<ORIGINAL>

MITSUBISHI ELECTRIC

Hot Water Heat Pump Unit

CAHV

CAHV-Z450YA-HPB(-BS)

For use with R290

Installation/Operation Manual

en

WT10863X02

Contents

1. Safety Precautions 4
1-1. General 4
1-2. Transportation 8
1-3. Installation 8
1-4. Pipe installation 9
1-5. Electrical wiring 10
1-6. Transportation and repairs 11
1-7. IMPORTANT 11
1-8. Using R290 refrigerant outdoor units 12
1-9. Before temporarily decommissioning 16
1-10. Before disposal 16
2. Selecting the Installation Site 17
2-1. Installation Conditions 17
2-1-1. Protection against wind exposure 17
2-1-2. Cold climate installation 17
2-2. Space Requirements 17
2-2-1. Individual unit installation 17
2-2-2. Multiple unit installation 19
2-3. Installation Restrictions 21
2-3-1. System configuration 21
2-3-2. Surrounding Conditions for Outdoor Units 23
2-4. Protective Zone 25
3. Unit Installation 29
3-1. Center of gravity 29
3-2. Installation on foundation 30
3-3. Installing the unit in a snow area 31
4. Refrigerant Charge 32
4-1. Vacuum Drying (Evacuation) 32
4-2. Refrigerant Charge 34
4-3. Actions to be taken in the event of refrigerant leakage 35
5. Water Pipe Installation 36
5-1. Piping System Schematic 36
5-2. Maintaining Water Quality 37
5-2-1. Water quality control 37
5-3. Installing the Strainer and Flow Switch 38
5-3-1. Strainer 38
5-3-2. Flow switch 38
5-4. Installing the External water temperature thermistor 39
5-5. Water Pipe Connection Ports 41
5-6. Connecting Pipes of Different Materials 42
5-7. Minimum Water Volume Requirements for Water Circuits 42
6. System Configurations 43
6-1. Schematics of Individual and Multiple Systems 43
6-1-1. Schematics of individual and multiple systems 43
6-1-2. Multiple system 43
6-1-3. Individual system with FTC connection 43
6-1-4. Multiple system with FTC connection 44
6-2. Switch Types and Default Settings 45
6-2-1. Switches on the PCB 45
6-2-2. Default dip switch settings 46
6-3. Configuring the Settings 47
6-3-1. Switch function table 47
6-3-2. Setting configuration procedures 48

Contents

6-3-3. LED and switches on the control board 49
6-3-4. System configuration procedures: Individual system 49
6-3-5. System configuration procedures: Multiple system 50
6-3-6. System configuration procedures: Individual system (with connection to FTC) 51
6-3-7. Multiple system with FTC connection 52
6-3-8. SWS1 settings 53
6-3-9. Re-initializing the system 54
6-3-10. Resetting the system 54
6-3-11. Priority order of the water-temp-setting-input-signal sources 55
6-3-12. Water-temperature setting 56

7. Electrical Wiring Installation 73
7-1. Power Supply, Breaker, and Cable Requirements 73
7-2. Schematics of a Unit and Its Terminal Blocks 74
7-3. Wire Knockout Hole and Conduit 75
7-4. Breaker Tag Installation 76
7-5. Electrical Wiring Diagram 77
7-6. External Input/Output 79

8. Troubleshooting 81
8-1. Diagnosing Problems with No Available Error Codes 81
8-2. Diagnosing Problems Using Error Codes 81
8-3. Calling for Service 85

9. Operating the Unit 86
9-1. Initial Operation 86
9-2. Daily Operation 86
9-3. Using Units in Cold Climates 87
9-4. Remote Controller Operation 88
9-4-1. Power ON/OFF 88
9-4-2. Setting the operation mode and temperature 89
9-4-3. Using the Weekly timer 90
9-4-4. Using the Period timer 91
9-4-5. Fan mode 92
9-4-6. Using power save 93
9-4-7. Setting the functions 96
9-4-8. Monitoring the operating status from the remote controller 97

10. Specifications 98
11. Maintenance 100
12. Safe handling of R290 102
12-1. Handing over to the user 102
12-2. Inspection and maintenance 102
12-3. Repair and service 102
12-3-1. Preparing repair and service work on the refrigerant circuit 102
12-4. Decommissioning 102
12-4-1. Temporarily decommissioning the unit 102
12-4-2. Permanently decommissioning the unit 102
12-5. Recycling and disposal 103
12-5-1. Disposing of the packaging 103
12-5-2. Disposing of the unit 103
12-5-3. Transportation of the unit for disposal 103

13. Disclaimer 104

1. Safety Precautions

- **Thoroughly read the following safety precautions prior to use.**
- **Observe these precautions carefully to ensure safety.**

⚠ WARNING	Describes precautions that must be observed to prevent danger of injury or death to the user.
⚠ CAUTION	Describes precautions that must be observed to prevent damage to the unit and/or limit the danger of injury or death to the user.
IMPORTANT	Indicates a risk of damage to the unit or other components in the system.

All electric work (from installation to disposal of units) must be performed by personnel certified by Mitsubishi Electric.

MEANINGS OF SYMBOLS DISPLAYED ON THE UNIT

	WARNING (Risk of fire)	This unit uses R290, a highly flammable refrigerant. If any refrigerant leaks or comes in contact with fire or a heated surface or environment, there is a risk of fire or explosion, and the installer and/or user is warned to take all possible safety precautions when handling the unit and R290, being sure to keep a safe distance at all times to any related fire or explosion and to notify the fire department immediately on becoming aware of such an outcome.
	Read the OPERATION MANUAL carefully before operation.	
	Service personnel are required to carefully read the OPERATION MANUAL and INSTALLATION MANUAL before operation.	
	Further information is available in the OPERATION MANUAL, INSTALLATION MANUAL, and the like.	

1-1. General

⚠ WARNING

The unit must only be installed/serviced/relocated/repaired/disposed, including any work undertaken on a related refrigerant circuit, by a competent electrician, with the requisite professional qualifications to install this unit and perform electrical works in your jurisdiction. Please contact your dealer for them. Failure to conduct electric work, deal with the refrigerant circuit(s) and install/service/relocate/repair/ uninstall or dispose the unit correctly in accordance with the foregoing and all laws and regulations may lead to prosecution, water leakage, electric shock or fire. Mitsubishi Electric does not accept responsibility for any direct, indirect, special or consequential loss, damage, liability or expense incurred or suffered which results from any works undertaken by an unqualified or third party installer, or any failure, claim, damage or deficiency caused to a unit by improper installation, servicing, relocation, repair, uninstallation, or disposing.

The work on refrigerant circuit can only be performed by certified or qualified personnel who are trained properly. Please contact your dealer for them.

For installation and relocation work, follow the instructions in the Installation/Operation Manual and use tools and pipe components specifically made for use with R290 refrigerant.

When installing the unit, use appropriate protective equipment and tools for safety.
Failure to do so could cause injuries.

Ventilate the space if refrigerant leaks into an enclosed area during operation. If refrigerant comes into contact with a flame, there is risk of fire or explosion.

In order to not invalidate unit warranty and maintain the correct and safe functioning of the unit, please use only parts and accessories recommended by Mitsubishi Electric, to be installed by a competent electrician with the requisite professional qualifications in your jurisdiction. We accept no liability for damage or expenses caused by the incorrect installation of the unit and/or third party accessories, parts or

components, which may result in water leakage, electric shock or fire.

A protective zone is defined for the area close around the product.
In the event of a refrigerant leak, it must be ensured that no one is endangered outdoors or in adjacent buildings and no refrigerant can get into the building.

When carrying out work on the refrigerant circuit or working in the protective zone, a competent electrician with the requisite professional qualifications must use only the specified and appropriate tools.

After installation has been completed, the installer must check for refrigerant leaks by using a professional leak detector tool. If refrigerant leaks into a space from the outdoor, machine room, or through indoor valves, and comes into contact with the flame of a heater, portable cooking range, sparks, static electricity or objects with high surface temperature (>370°C), a fire or explosion will occur. In case the leak detector detects the refrigerant leakage, all persons in close or adjacent vicinity of the leak must be immediately advised to move away to a safe distance in order for the area to be checked by a professional.

In the event of refrigerant leakage, to do as follows:
- Evacuate any people from the danger zone.
- When the refrigerant leak fault is detected and the fans are rotating, wait until the fans stop.
- Remove ignition sources from the danger zone.
- Do not operate the unit until repairs are completed.

Do not use refrigerant other than the type indicated in the manuals provided with the unit and on the nameplate.
- Doing so may cause the unit or pipes to burst, or result in explosion or fire during use, during repair, or at the time of disposal of the unit.
- It may also be in violation of applicable laws.
- MITSUBISHI ELECTRIC cannot be held responsible for malfunctions or accidents resulting from the use of the wrong type of refrigerant.

Do not install the unit in a place where large amounts of oil, steam, organic solvents, or corrosive gases, such as sulfur gas, hydrogen sulfide, or chlorine gas, are present or where acidic/alkaline solutions or sprays containing sulfur or siloxane are used frequently.
- These substances can compromise the performance of the unit or cause certain components of the unit to corrode, which can result in refrigerant leakage, water leakage, injury, electric shock, malfunctions, smoke, or fire.

Do not try to defeat the safety features of the unit or make unauthorized setting changes.
- Forcing the unit to operate by defeating the safety features of the devices such as the pressure switch or the temperature switch, making unauthorized changes to the switch settings, or using accessories other than the ones recommended by Mitsubishi Electric may result in smoke, fire, or explosion.

Do not turn off the breaker except for servicing.
- If the power supply to the unit is interrupted, the safety features (refrigerant sensor and fans) will stop, resulting in refrigerant accumulation and causing a fire and explosion.

To reduce the risk of fire or explosion, do not place flammable materials or use flammable sprays around the unit.

To reduce the risk of fire or explosion, do not use volatile or flammable substances as a heat carrier.

To reduce the risk of burns or electric shock, do not touch exposed pipes and wires.

To reduce the risk of shorting, current leakage, electric shock, malfunctions, smoke, or fire, do not splash water on electric parts.

Do not place a container filled with water on the unit.
- If water spills on the unit, it may result in shorting, current leakage, electric shock, malfunction, smoke, or fire.

To reduce the risk of electric shock, malfunctions, smoke or fire, do not operate the switches/buttons or touch other electrical parts with wet hands.

To reduce the risk of electric shock and injury from the fan or other rotating parts, stop the operation and turn off the main power before cleaning, maintaining, or inspecting the unit.

To reduce the risk of burns or frost bites, do not touch the refrigerant pipes or refrigerant circuit components with bare hands during and immediately after operation.

Before cleaning the unit, switch off the power. (Unplug the unit, if it is plugged in.)

To reduce the risk of injury, keep children away while installing, inspecting, or repairing the unit.

Children should be supervised to ensure that they do not play with the appliance.

This appliance is not intended for use by persons (including children) who lack experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Keep the space well ventilated. Refrigerant can displace air and cause oxygen starvation.
- If leaked refrigerant comes in contact with a heat source, toxic gas may be generated.

Always replace a fuse with one with the correct current rating.
- The use of improperly rated fuses or a substitution of fuses with steel or copper wire may result in fire or explosion.

If any abnormality (e.g., burning smell) is noticed, stop the operation, turn off the power switch, and consult your dealer.
- Continuing the operation may result in electric shock, malfunctions, or fire.

Properly install all required covers and panels on the terminal box and control box to keep moisture and dust out.
- Dust accumulation and water may result in electric shock, smoke, or fire.

Consult an authorized agency for the proper disposal of the unit.
- Refrigerant oil and refrigerant that may be left in the unit pose a risk of fire, explosion, or environmental pollution.

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.)

Do not pierce or burn.

In areas where temperature drops to freezing during the periods of non-use, blow the water out of the pipes or fill the pipes with anti-freeze solution.
- Not doing so may cause the water to freeze, resulting in refrigerant leakage and resultant fire and explosion.

In areas where temperature drops to freezing, use Anti-freeze mode and leave the main power turned on to prevent the water in the water circuit from freezing and damaging the unit or causing refrigerant leakage and resultant fire and explosion.

Use clean tap water.
- The use of acidic or alkaline water or water high in chlorine may corrode the unit or the pipes, causing refrigerant leakage and resultant fire and explosion.

In areas where temperature can drop low enough to cause the water in the pipes to freeze, operate the unit often enough to prevent the water from freezing.
- Frozen water in the water circuit may cause the water to freeze, resulting in refrigerant leakage and resultant fire and explosion.

Periodically inspect and clean the water circuit.
- Dirty water circuit may compromise the unit's performance or corrodes the unit or cause refrigerant leakage and resultant fire and explosion.

Ensure that the flow rate of the feed-water is within the permitted range.
- If the flow rate exceeds the permitted range, the unit may become damaged due to corrosion. Furniture may become wet due to water leaks.

Do not install the units or cylinders in or around underground, hollow, and enclosed space.
- If the refrigerant leaks, a fire or explosion may result.
- The unit must be stored where leaking refrigerant will not accumulate.

Be aware that refrigerants may not contain an odorant.

The maximum refrigerant amount in the unit is specified by IEC 60335-2-40.
- Refrigerant must not be charged beyond the maximum amount.

⚠ CAUTION

Do not operate the unit without panels and safety guards properly installed.

To reduce the risk of injury, do not sit, stand, or place objects on the unit.

Do not connect the water pipe from the unit directly to the potable water pipe. Use a cistern tank between them.
- Connecting these pipes directly may cause the water in the unit to migrate into the potable water and cause health problems.

To reduce the risk of adverse effects on plants and animals, do not place them where they are directly exposed to discharge air from the unit.

Do not install the unit on or over things that are vulnerable to water damage.
- Condensation may drip from the unit.

The model of heat pump unit described in this manual is not intended for use to preserve food, animals, plants, precision instruments, or art work.

To reduce the risk of injury, do not touch the heat exchanger fins or sharp edges of components with bare hands.

Always wear protective gears when touching electrical components on the unit.
- Several minutes after the power is switched off, residual voltage may still cause electric shock.

To reduce the risk of injury, do not insert fingers or foreign objects into air inlet/outlet grills.

Should not release refrigerant to air, the refrigerant should be collected in a cylinder.
- If the recovery is not required by national regulations, drain the refrigerant to the outside, it must be done safely.

Do not connect multiple units to other models with different refrigerants.

To prevent environmental pollution, dispose of brine in the unit and cleaning solutions according to the local regulations.

- It is punishable by law not to dispose of them according to the applicable laws.

The water heated by the heat pump is not suitable for use as drinking water or for cooking.
- It may cause health problems or degrade food.

1-2. Transportation

⚠ WARNING

Do not smoke during work and transportation.

Lift the unit by placing the slings at designated locations. Support the outdoor unit securely at four points to keep it from slipping and sliding.
- If the unit is not properly supported, it may fall and cause personal injury.

⚠ CAUTION

To reduce the risk of injury, do not carry the product by the PP bands that are used on some packages.

Observe the restrictions on the maximum weight that a person can lift, which are specified in local regulations.

1-3. Installation

⚠ WARNING

When the installer is performing brazing work, make sure that there are no hazardous or flammable materials nearby.
Make sure that there are no refrigerant leaks before performing the work.
If refrigerant leaks and accumulates, it may ignite.

Keep gas-burning appliances, electric heaters, and other fire sources (ignition sources) away from the location where installation, repair, and other outdoor unit work will be performed.
If refrigerant comes into contact with a flame, a fire or explosion will occur.

When carrying out work on the refrigerant circuit, take protective measures to prevent static discharges.

Do not install the unit where there is a risk of leaking flammable gas.
- If flammable gas accumulates around the unit, it may ignite and cause a fire or explosion.

Properly dispose of the packing materials.
- Plastic bags pose suffocation hazard to children.

The unit should be installed only by personnel certified by Mitsubishi Electric according to the instructions detailed in the Installation/Operation Manual.
- Improper installation may result in refrigerant leakage, water leakage, injury, electric shock, or fire.

Periodically check the installation base for damage.
- If the unit is left on a damaged base, it may fall and cause injury.

Remove packing materials from the unit before operating the unit. Note that some accessories may be taped to the unit. Properly install all accessories that are required.
- Failing to remove the packing materials or failing to install required accessories may result in refrigerant leakage, oxygen starvation, smoke, or fire.

Consult your dealer and take appropriate measures to safeguard against refrigerant leakage and resultant oxygen starvation. An installation of a refrigerant gas detector is mandatory.

Any additional parts must be installed by qualified personnel. Only use the parts specified by Mitsubishi Electric.

Take appropriate safety measures against wind gusts and earthquakes to prevent the unit from toppling over and causing injury.

Be sure to install the unit horizontally, using a level.
- If the unit is installed at an angle, it may fall and cause injury or cause water leakage.

The unit should be installed on a surface that is strong enough to support its weight.

As an anti-freeze, use ethylene glycol or propylene glycol diluted to the specified concentration.
- The use of other types of anti-freeze solution may cause corrosion and resultant water leakage. The use of flammable anti-freeze may cause fire or explosion.

Before turning on the power, perform vacuum drying and charge refrigerant.

It is strongly recommended to install breakers outside the protective zone.
However, if the laws and regulations of each country allow, it is also acceptable to install them inside the protective zone.
In both cases, installation personnel must always carry a leak detector.

⚠ CAUTION

All drainage work should be performed by the dealer or qualified personnel according to the instructions detailed in the Installation/Operation Manual.
- Improper drainage work may cause rain water or drain water to enter the buildings and damage the furnishings.

1-4. Pipe installation

⚠ WARNING

Pipe-work shall be protected from physical damage.

The installation of pipe-work shall be kept to a minimum.

The outlet piping of automatic air vent valves and pressure relief valves installed in machine rooms or indoors must always be installed outdoors. The outlet piping is considered part of a protective zone.

When drain piping is necessary, the condensate drain must not be connected to the waste water directly.

To prevent explosion, do not heat the unit with refrigerant gas in the refrigerant circuit.

Check for refrigerant leakage at the completion of installation.
- If leaked refrigerant comes in contact with a heat source, toxic gas may be generated.

Piping work should be performed by the dealer or qualified personnel according to the instructions detailed in the Installation/Operation Manual.
- Improper piping work may cause water resulting in refrigerant leakage and resultant fire and explosion.

Do not open the control box cover while charging refrigerant.
- If the refrigerant leaks, a fire or explosion may result.

⚠ CAUTION

Check that no substance other than the specified refrigerant (R290) is present in the refrigerant circuit.
- Infiltration of other substances may cause the pressure to rise abnormally high and cause the pipes to explode.

To keep the ceiling and floor from getting wet due to condensation, properly insulate the pipes.

1-5. Electrical wiring

⚠ WARNING

To reduce the risk of wire breakage, overheating, smoke, and fire, keep undue force from being applied to the wires.

Properly secure the cables in place and provide adequate slack in the cables so as not to stress the terminals.
- Improperly connected cables may break, overheat, and cause smoke or fire.

To reduce the risk of injury or electric shock, switch off the main power before performing electrical work.

All electric work must be performed by a qualified personnel according to the local regulations, standards, and the instructions detailed in the Installation/Operation Manual.
- Capacity shortage to the power supply circuit or improper installation may result in malfunction, electric shock, smoke, or fire.

To reduce the risk of electric shock, smoke, or fire, install an earth leakage breaker on the power supply to each unit.

Use properly rated breakers and fuses (an earth leakage breaker, local switch <a switch + fuse that meets local electrical codes>, or overcurrent breaker).
- The use of improperly rated breakers may result in electric shock, malfunction, smoke, or fire.

To reduce the risk of current leakage, overheating, smoke, or fire, use properly rated cables with adequate current carrying capacity.

Keep the unsheathed part of cables inside the terminal block.
- If unsheathed part of the cables come in contact with each other, electric shock, smoke, or fire may result.

Proper grounding must be provided by a qualified personnel. Do not connect the grounding wire to a gas pipe, water pipe, lightning rod, or telephone wire.
- Improper grounding may result in electric shock, smoke, fire, or malfunction due to electrical noise interference.

Tighten all terminal screws to the specified torque.
- Loose screws and contact failure may result in smoke or fire.

Only use standard power cables of sufficient capacity.
- Failure to do so may result in current leakage, overheating, smoke, or fire.

⚠ CAUTION

To reduce the risk of current leakage, wire breakage, smoke, or fire, keep the wiring out of contact with the refrigerant pipes and other parts, especially sharp edges.

To reduce the risk of electric shock, shorting, or malfunctions, keep wire pieces and sheath shavings out of the terminal block.

1-6. Transportation and repairs

⚠ WARNING

The unit should be moved, disassembled, or repaired only by qualified personnel. Do not alter or modify the unit.

- Improper repair or unauthorized modifications may result in refrigerant leakage, water leakage, injury, electric shock, or fire.

After disassembling the unit or making repairs, replace all components as they were.

- Failing to replace all components may result in injury, electric shock, or fire.

If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.

Do not open the control box cover while charging refrigerant.

- If the refrigerant leaks, a fire may result.

⚠ CAUTION

To reduce the risk of shorting, electric shock, fire, or malfunction, do not touch the circuit board with tools or with your hands, and do not allow dust to accumulate on the circuit board.

1-7. IMPORTANT

To avoid damage to the unit, use appropriate tools to install, inspect, or repair the unit.

To reduce the risk of malfunction, turn on the power at least 12 hours before starting operation, and keep the power constantly ON. This unit is equipped with refrigerant sensor and electrically powered safety measures. To be effective, the unit must be electrically powered at all times after installation, other than when servicing.

Should not release refrigerant to air, the refrigerant should be collected in a cylinder.

- If the recovery is not required by national regulations, drain the refrigerant to the outside, it must be done safely.

Do not unnecessarily change the switch settings or touch other parts in the refrigerant circuit.

- Doing so may change the operation mode or damage the unit.

To reduce the risk of malfunctions, use the unit within its operating range.

Do not switch on or off the main power in a cycle of shorter than 10 minutes.

- Short-cycling the compressor may damage the compressor.

To maintain optimum performance and reduce the risk of malfunction, keep the air pathway clear.

To ensure proper operation of the unit, periodically check for proper concentration of anti-freeze.

- Inadequate concentration of anti-freeze may compromise the performance of the unit or cause the unit to abnormally stop.

Take appropriate measures against electrical noise interference when installing the air conditioners in hospitals or facilities with radio communication capabilities.

- Inverter, high-frequency medical, or wireless communication equipment as well as power generators may cause the air conditioning system to malfunction. Air conditioning system may also adversely affect the operation of these types of equipment by creating electrical noise.

Check the water system, using a relevant manual as a reference.

- Using the system that does not meet the standards (including water quality and water flow rate) may cause the

water pipes to corrode.

To reduce the risk of power capacity shortage, always use a dedicated power supply circuit.

To reduce the risk of both the breaker on the product side and the upstream breaker from tripping and causing problems, split the power supply system or provide protection coordination between the earth leakage breaker and no-fuse breaker.

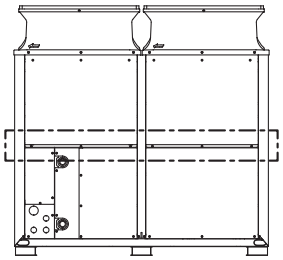
When servicing the refrigerant, open and close the check joint using two spanners, as there is the risk of refrigerant leakage due to damaged piping.

Please build the water circuit so that it is a closed system.
- Do not use water directly for showers or other applications.
- Do not allow other heat source water to mix with the water circuit.

Store the unit in a place large enough to allow clearance in the event of refrigerant leakage.
Comply with the national regulations of each country regarding storage.

Refrigerant R290 is highly flammable. Do not use a nakedflame type detector.

The following 6 screws securing the upper and lower panels are longer. Please ensure they are not mixed up during panel attachment or removal.



To protect the plate heat exchanger evacuate the system and collect refrigerant with the pump in the water circuit being operated.

1-8. Using R290 refrigerant outdoor units

⚠ CAUTION

Servicing shall be performed only as recommended by the manufacturer.

Do not use refrigerant other than R290 refrigerant. If another refrigerant is used, the chlorine will cause the oil to deteriorate.

Use the following tools specifically designed for use with R290 refrigerant. The following tools are necessary to use R290 refrigerant. Contact your nearest dealer for any questions. If incorrect tools are

used, a fire or explosion will occur.

Tools (for R290)	
Gauge manifold	Cutter/Reamer
Charge hose	Refrigerant cylinder
Charge valve	Adapter for refrigerant cylinder
Electronic refrigerant charging scale	Refrigerant recovery equipment
Leak detector	Refrigerant recovery cylinder
Vacuum pump	Electrical tools
Vacuum pump adapter	Fan

Be sure to use the correct tools. If dust, debris, or moisture enters the refrigerant lines, refrigeration oil deterioration may result.

Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the refrigerating systems, (1) to (5) shall be completed prior to conducting work on the systems.

(1) All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out.
Work in confined spaces shall be avoided. The area around the workspace shall be sectioned off. Ensure that the conditions within the area have been made safe by control of flammable material.

(2) The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

(3) If any hot work is to be conducted on the refrigeration equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.

(4) No person carrying out work in relation to a refrigeration system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

(5) Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer’s technical department for assistance.
The following checks shall be applied to installations using flammable refrigerants:
- The charge size is in accordance with the room size within which the refrigerant containing parts are installed.
- The ventilation machinery and outlets are operating adequately and are not obstructed.
- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
- Refrigeration pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being corroded.

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.
Initial safety checks shall include that:

- capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
- no live electrical components and wiring are exposed while charging, recovering or purging the system;
- there is continuity of earth bonding.

During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.

Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.
Ensure that the apparatus is mounted securely.
Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres.
Replacement parts shall be in accordance with the manufacturer's specifications.

Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use.
Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.
Replace components only with parts specified by the manufacturer. Other parts may result in the ignition of refrigerant in the atmosphere from a leak.

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or pumps.

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks.
A halide torch (or any other detector using a naked flame) shall not be used.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.)
Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.
Leak detection fluids are suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe work.
If a leak is suspected, all naked flames shall be removed/extinguished.
If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.
For appliances containing flammable refrigerants, oxygen free nitrogen (OFN) shall then be purged through the system both before and during the brazing process.

When breaking into the refrigerant circuit to make repairs – or for any other purpose conventional procedures shall be used. However, for flammable refrigerants it is important that best practice is followed since flammability is a consideration. The following procedure shall be adhered to:
- remove refrigerant
- purge the circuit with inert gas
- evacuate
- purge again with inert gas
- open the circuit by cutting.

The refrigerant charge shall be recovered into the correct recovery cylinders. For appliances containing flammable refrigerants, the system shall be "flushed" with OFN to render the unit safe. This process may need to be repeated several times.
Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, flushing shall be achieved by breaking the vacuum in the system with OFN and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum.
This process shall be repeated until no refrigerant is within the system. When the final OFN charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is absolutely vital if brazing operations on the pipe-work are to take place.
Ensure that the outlet for the vacuum pump is not close to any ignition sources and that ventilation is available.

In addition to conventional charging procedures, the following requirements shall be followed:
- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept upright.
- Ensure that the refrigeration system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigeration system.

Prior to recharging the system, it shall be pressure- tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its details. It is recommended as good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of reclaimed refrigerant. It is essential that electrical power is available before the task is commenced.

(1) Become familiar with the equipment and its operation.

(2) Isolate system electrically.

(3) Before attempting the procedure, ensure that:
- mechanical handling equipment is available, if required, for handling refrigerant cylinders;
- all personal protective equipment is available and being used correctly;
- the recovery process is supervised at all times by a competent person;
- recovery equipment and cylinders conform to the appropriate standards.

(4) If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.

(5) Make sure that cylinder is situated on the scales before recovery takes place.

(6) Start the recovery machine and operate in accordance with manufacturer’s instructions.

(7) Do not overfill cylinders. (No more than 80% volume liquid charge).

(8) Do not exceed the maximum working pressure of the cylinder, even temporarily.

(9) When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.

(10) Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and check.

Equipment shall be labelled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended as good practice that all refrigerants are removed safely. When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge are available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants including, when applicable, flammable refrigerants. In addition, a set of calibrated weighing scales shall be available

and in good working order.
Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.
The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders. If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers.
Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.

1-9. Before temporarily decommissioning

⚠ CAUTION

If there is a risk of frozen damage, drain the heating water from the unit.

1-10. Before disposal

⚠ CAUTION

The unit needs to be treated according to WEEE.
Be sure to observe the following.

Do not dispose of the unit with the household waste.

If the unit is disposed, hand in the unit to a collection center for waste electrical or electronic equipment or to a recycler authorised by manufacturer.

Dispose of the unit in an appropriate way according to the laws and ordinances of each country.

2. Selecting the Installation Site

2-1. Installation Conditions

Consult with the client to select an outdoor unit installation site that meets the following conditions:

- The unit is not subject to heat from other heat sources.
- The unit's noise will not be problematic.
- The unit's water can be properly drained.
- The space requirements are met. Refer to the following page(s) for detail. "Space Requirements" (p. 17)

2-1-1. Protection against wind exposure

A unit installed alone is susceptible to wind exposure, so choose a sheltered site (e.g., behind a structure).
If the wind consistently blows from one direction, position the unit so that the outlet is facing away from it.

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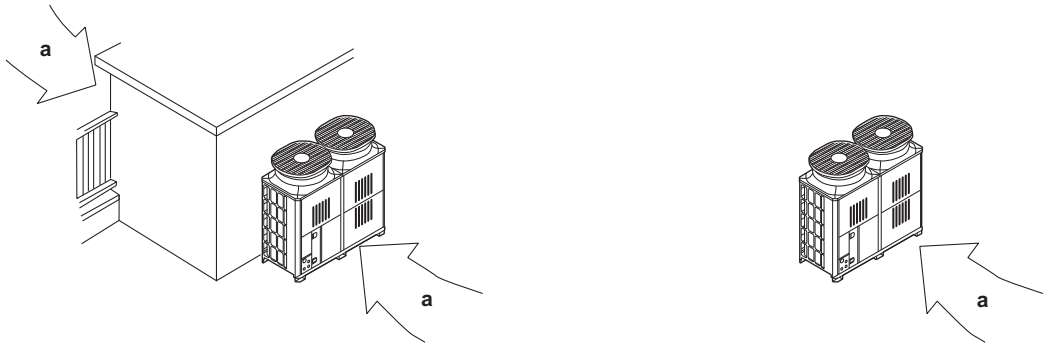


a Wind

2-1-2. Cold climate installation

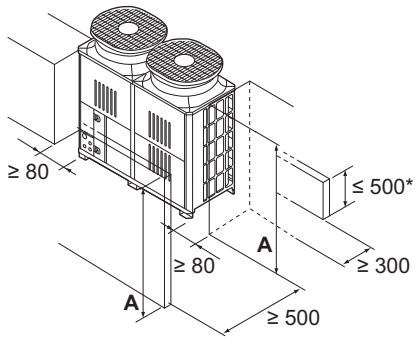
- Choose a sheltered site to minimize exposure to winds, rain, and snow, and to prevent possible damage or injury from falling icicles, particularly when installing on a roof.
- Install snow hoods on both the discharge and suction ducts if the units are exposed to rain, winds, or snow, or if the outdoor temperature can drop to -10°C or below. Use a snow net or snow fence as necessary.
- Install the units on a base approximately twice the height of the expected snowfall.
- If the units are operated continuously in freezing temperatures, install a base heater to prevent water at the unit bottom from freezing.

2-2. Space Requirements

2-2-1. Individual unit installation

[1] No walls surrounding the unit are taller than the unit height, and the wall behind the unit is no higher than 500 mm (* in the figure).

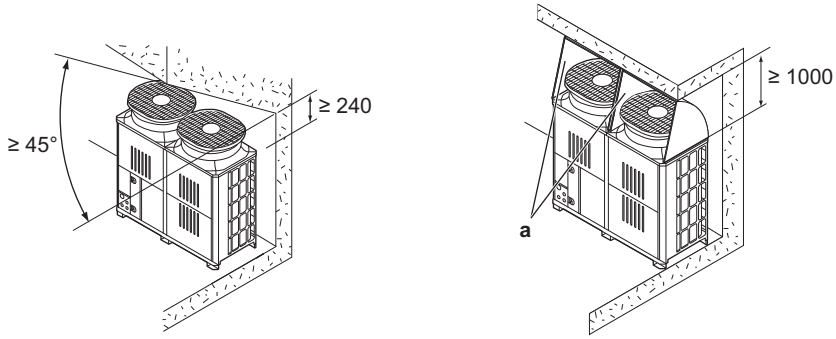
<Unit: mm>



A Unit height

[2] Required distance from the ceiling

<Unit: mm>



a Flow hood (not supplied)

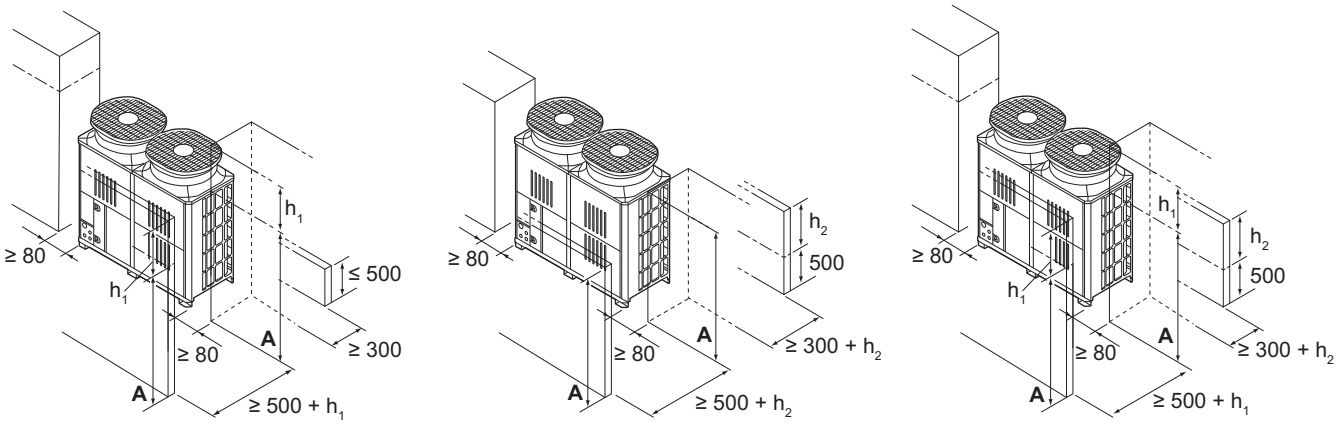
[3] One or more walls surrounding the unit are taller than the unit height, and there is a wall behind the unit.

If the wall(s) surrounding the unit are taller than the unit height, and/or the wall behind the unit is taller than 500 mm, the minimum space requirements will be increased by the amount indicated by h_1 and h_2 in the figures below.

h_1: Height difference between wall and unit

h_2: Wall height minus 500 mm

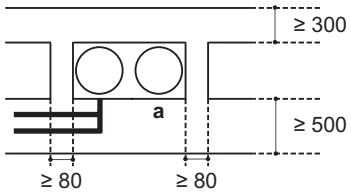
<Unit: mm>



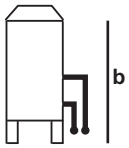
A Unit height

[4] Water piping

Top view



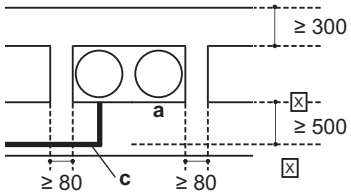
Side view



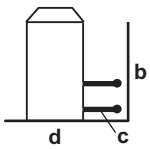
<Unit: mm>

a Front
b Wall

Top view



Side view



<Unit: mm>

a Front
b Wall
c Water pipe
d Foundation

Water pipe must be routed at least 500 mm from the unit, if it is not possible to install the unit on a raised foundation. (See x in the figure.)

2-2-2. Multiple unit installation

-Leave sufficient space for air passage and as a walkway between units as shown below.

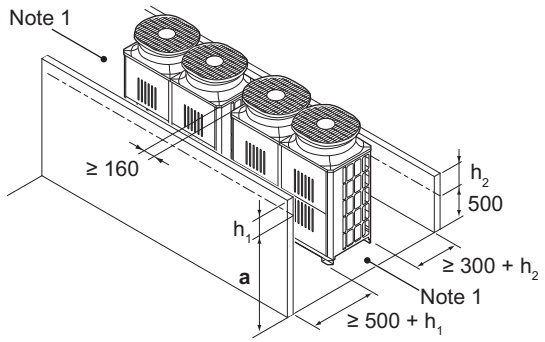
Note 1: Leave both sides of each group of units open.

Note 2: Leave one side of each group of units open.

If the wall(s) surrounding the unit are taller than the unit height, the minimum space requirements will be increased by the amount that the wall exceeds the unit height.

[1] Units installed side-by-side

<Unit: mm>

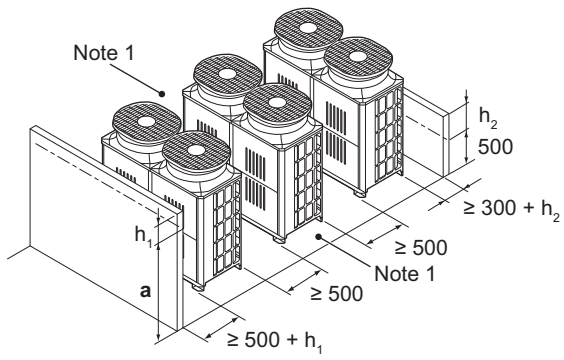


a Unit height

[2] Units installed face-to-face

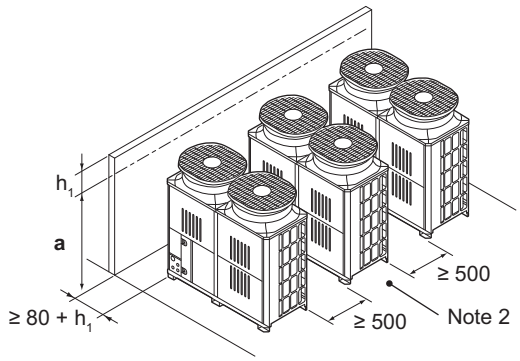
♦ Walls in the back and the front

<Unit: mm>



♦ Wall on one side

<Unit: mm>

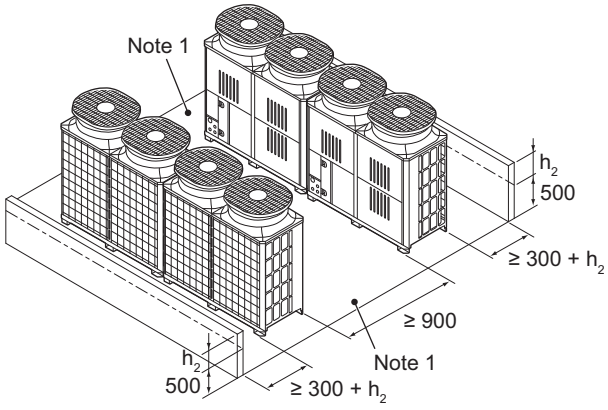


a Unit height

[3] Combination of face-to-face and side-by-side installations

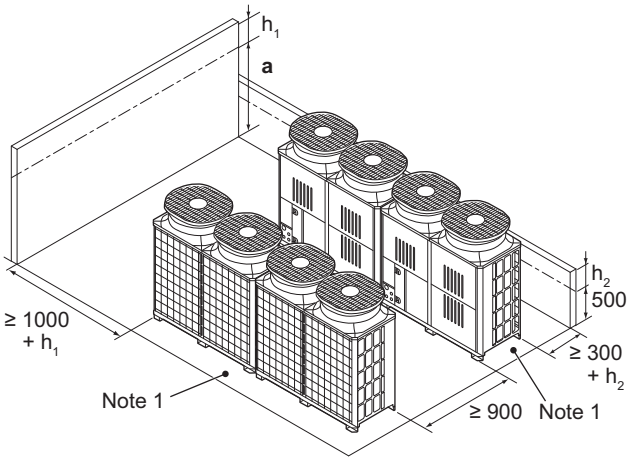
♦ Walls in the back and the front

<Unit: mm>



♦ A wall on one side and either in the front or the back of a given group of unit

<Unit: mm>

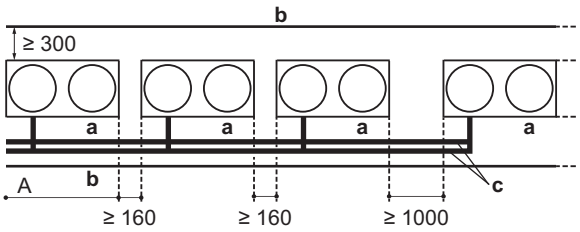


a Unit height

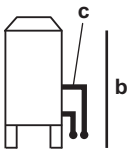
[4] Water piping

(1) Units installed side-by-side

Top view



Side view



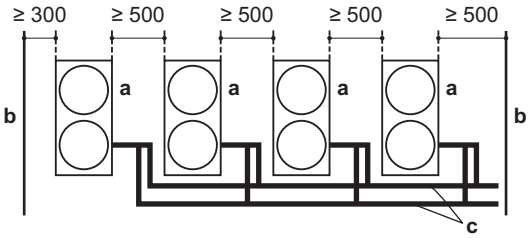
<Unit: mm>

a Front
b Wall
c Water pipe

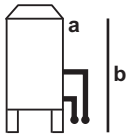
If the product width (labeled A in the figure) times the number of units that are installed side by side exceeds 6 m, leave a space of 1000 mm between each block, which is defined as a group of units that fits within 6 m.

(2) Units installed face-to-face

Top view



Side view



<Unit: mm>

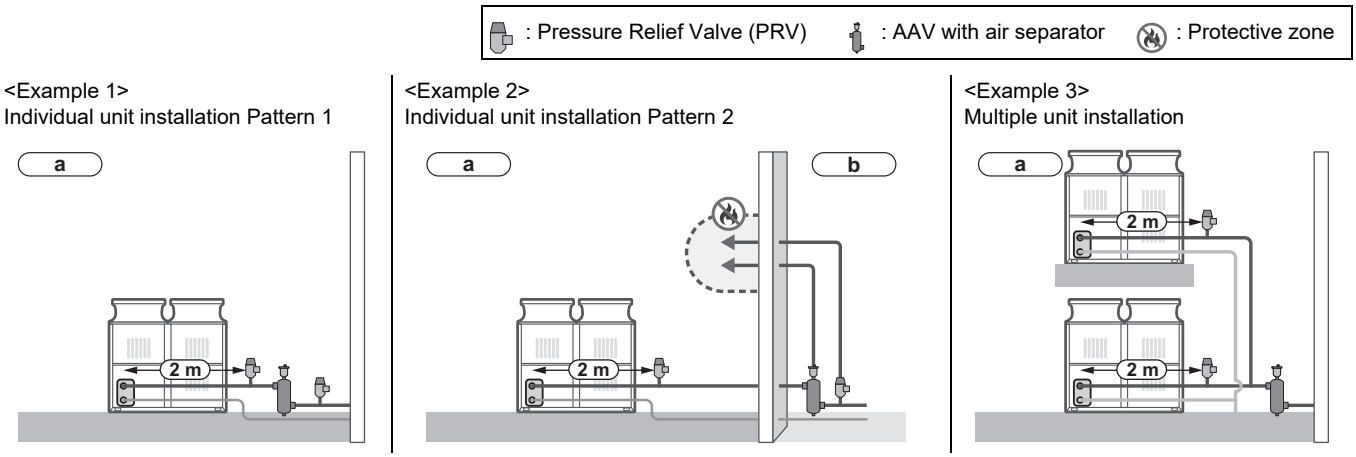
a Front
b Wall
c Water pipe

2-3. Installation Restrictions

To prevent ignition of the refrigerant, follow these instructions[*1] during installation.

*1: Established based on the Mitsubishi Electric's Risk Assessment Standards.

2-3-1. System configuration



a Outside
b Machine room

In order to ensure that the safety measures function properly in the event of a refrigerant leakage, Pressure Relief Valve (PRV) and Automatic Air vent Valve with Air Separator (AAV with air separator) must be installed as defined. Mitsubishi Electric strongly recommends that these be installed outdoors to reduce the risk of ignition with the leakage. In that case, they must be located inside the protective zone around the unit, as these open components may discharge flammable refrigerant. Make sure to follow the points below;

<PRV>

All the conditions below must be followed;

1) At least two PRVs that remain opened must be installed in the whole system. (It is acceptable for a greater number of them to be installed.)

2) One of the two PRVs must be located within 2 m of the unit.
One efficiently discharges refrigerant outdoors while the other regulates the water pressure, in the event of rapid refrigerant leakage from the water heat exchanger.

<AAV with air separator>

The condition below must be followed;

1) At least one AAV with an air separator must be installed in the whole system. It efficiently discharges refrigerant outdoors in the event of slow refrigerant leakage from the water heat exchanger.

- It is also acceptable to install an AAV with air separator equipped with a PRV. However, in this case, it must be installed within 2 m of the unit.

The PRV installed within 2 m of the unit and the AAV with air separator must comply with the following specifications;

<PRV>

Regarding the unit installation;

1) Individual unit installation: Discharge capacity must be ≥2,700 NL/min.
2) Multiple unit installation: Each unit must be equipped with a PRV installed within 2 m of the unit (each PRV must be ≥2,700 NL/min.).

Regarding the operating pressure;

1) The PRV must be set at the appropriate point so that it operates first in the event of the refrigerant leakage.
2) The operating pressure of the PRV must be set to the lowest value. Proper consideration of head difference and pressure loss is required to ensure correct operation.

<AAV with air separator>

Regarding the unit installation;

1) Individual unit installation;
- Discharge capacity must be ≥90 NL/min.
- Gas-liquid separation efficiency must be ≥90% at maximum water flow rate of 7 m^3/h.

2) Multiple unit installation;
- Discharge capacity must be ≥90 NL/min.
- When installing it on the combined piping system, the gas-liquid separation efficiency must be ≥90% at the water flow rate of (7 × number of units) m^3/h.
- When installing it on the pipe of each unit, the gas-liquid separation efficiency must be ≥90% at the maximum water flow rate of 7 m^3/h.

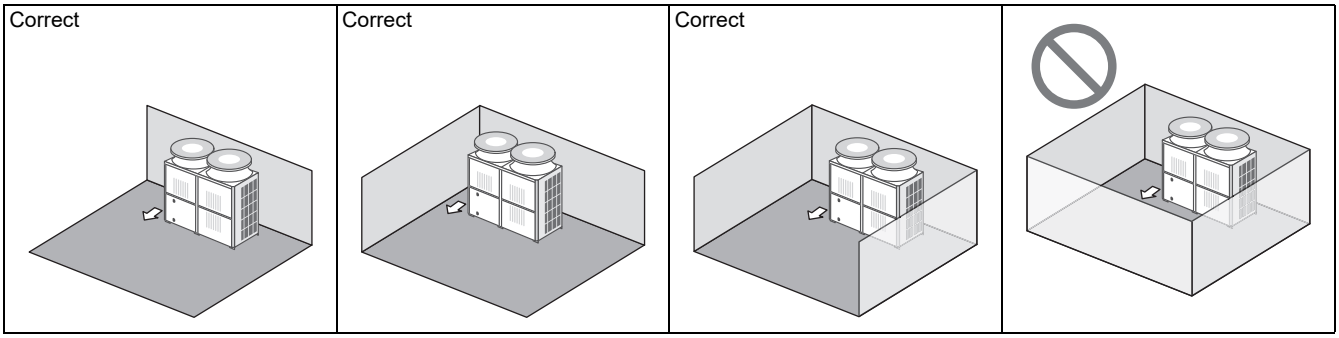
Even when PRVs and AAVs with air separator are installed indoors unavoidably, any leaked refrigerant must always be discharged outdoors. Make sure to follow the points below;

1) If it is necessary to discharge from indoor PRVs or AAVs with air separator, the outlet piping must always be led outdoors because the indoor discharge is not permitted. The protective zone rule also applies to the discharge destination; therefore, no ignition sources should exist at that location. Refer to "Protective Zone" (page 25).
2) When the primary side is isolated from the secondary side by an indirect heat exchanger or a tank with coil, the restrictions above do not apply to the secondary side.

In addition to the above, if there is any mechanism that releases gas throughout the entire system, it is not recommended to leave it open. If it is to be left open, ensure that the outlet piping is led outdoors. In case of heat exchanger failure, a small amount of flammable refrigerant could leak inside the building from it.

2-3-2. Surrounding Conditions for Outdoor Units

Install outdoor units in a place where at least one of the four sides is open or in a sufficiently large space without depressions.



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If you unavoidably install a unit in a space where all four sides are blocked or there are depressions, confirm that one of these situations below ([1] or [2]) is satisfied.

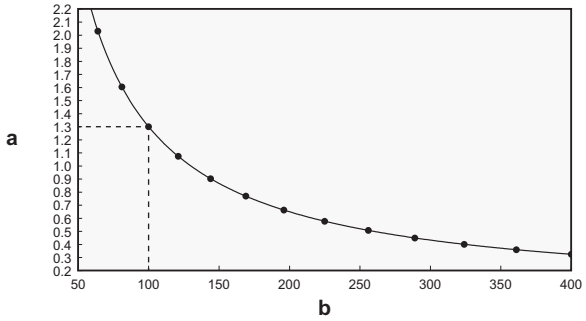
[1] Secure sufficient installation space and follow the restriction of the possible installation height regarding ignition sources.

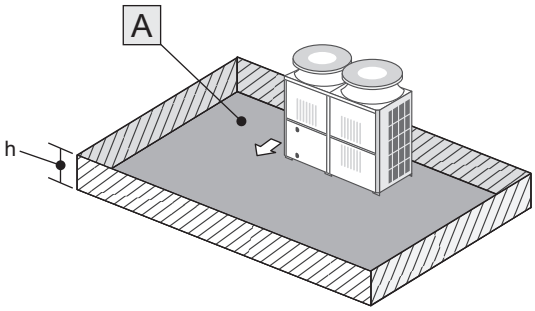
Based on the size of the installation area A (X-axis), find the possible installation height of h (Y-axis) in which ignition sources must not exist (refer to the graph below). Make sure any ignition source must not be placed below h.

However, when h is higher than the height of parapet *1, h can be equivalent to the height of parapet.

*1: Definition of parapet: a low protective wall along the edge of a roof, bridge, or balcony

e.g., When A is 100 m^2, any ignition source cannot be installed below h 1.3 m. (the dotted line on the graph below)



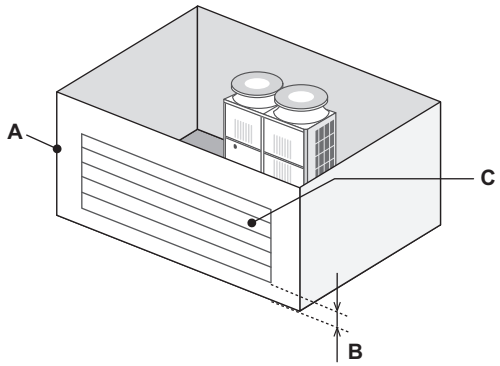


a The possible installation height of ignition sources h (m)

b The installation area A (m^2)

[2] Create an appropriate ventilation open area.

The ventilation open area refers to those that meet all of the following conditions: it starts at a height of 0.125m or less from the ground (condition **B**), the vertical length of the sides is at least 80% of longitudinal direction of the wall on which it is placed (**A**), and the area must occupy more than 75% of the total area of the wall (condition **C**).
If one side of the walls out of four sides satisfies that, the installation rules of Fig. 6 are applied, and when 2 sides/ 3 sides of the walls satisfy that, that of Fig. 5/4 are applied.



A Longitudinal direction
B Height from the ground to an opening ≤ 0.125 m
C Opening:
- Must occupy 80% of the longitudinal side of a space.
- Must have an opening ratio of 75% or higher.

(Example: space with a louver)

NOTE

- These countermeasures ([1] or [2]) are for keeping safety not for specification guarantee.
- In addition to the restriction of ignition sources, people are not allowed to enter the installation area where four surfaces are closed.
  In case qualified personnel enter for maintenance/removal, refer to "Safety Precautions" (p. 4)

2-4. Protective Zone

In the event of a refrigerant leakage, it must be ensured that no one is endangered outdoors or in adjacent buildings, and no refrigerant can get into the building. For this purpose, safety-relevant protective zone are specified below.

- There must not be any building openings, entrance to the basement, grooves, or into the wastewater system in this area.
- The protective zone must not extend to adjacent buildings or public traffic areas.
- Ignition sources must not be present in this area, either permanently or for a short period of time.
- When the unit is installed in an open area (e.g., on the ground), prepare a fence around the unit so that people cannot enter easily.
  The unit is not accessible to the general public.
- When the unit is installed on the roof, make sure to lock the entrance so that only authorized personnel can enter.

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Protective zone

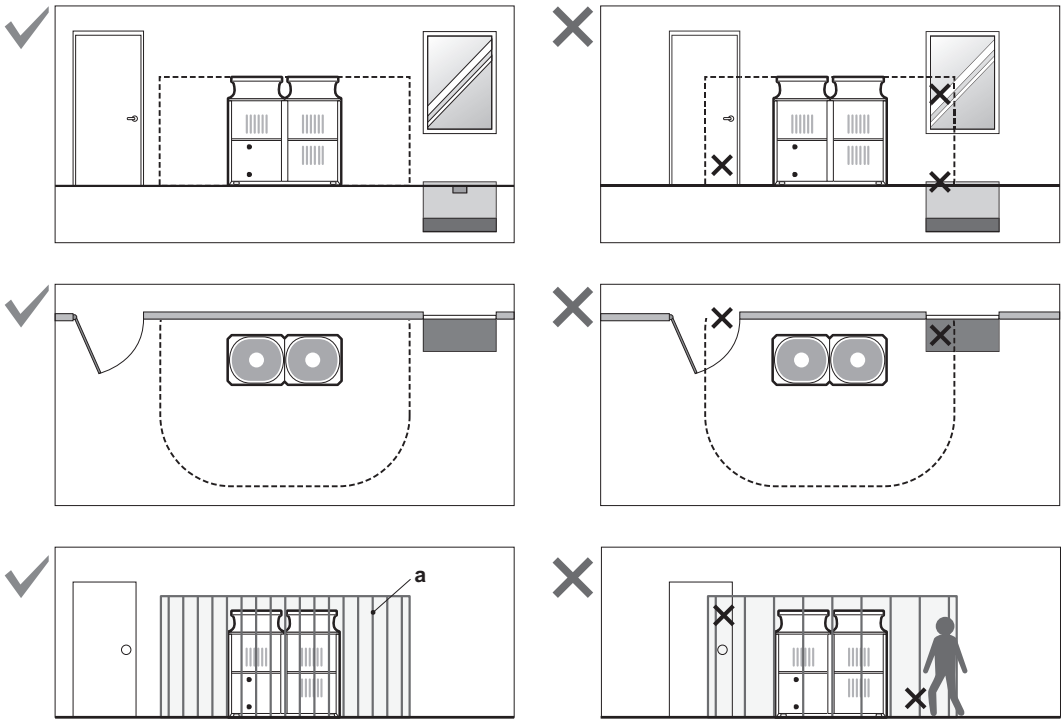


Fig. 1

a fence

NOTE

- In case qualified personnel enter for maintenance/removal. Refer to "Safety Precautions" (page 4).

Specific dimensions of the protective zone are specified for each installation condition.
Refer to the figures for each case.

An object is considered to indicate the presence of a surface (or wall) when all of the following criteria are met:

- Its height is greater than 0.125 m and its width exceeds that of the unit.
- The opening ratio is less than 75%.
- It is within 5 m of the nearest side of the product enclosure.

[1] When installed in a location with an open around (Fig2, Fig3)

Define the protective zone as follows:

- 2 m around of the unit

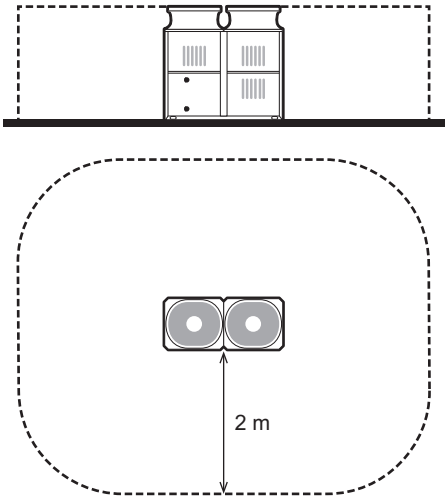


Fig. 2

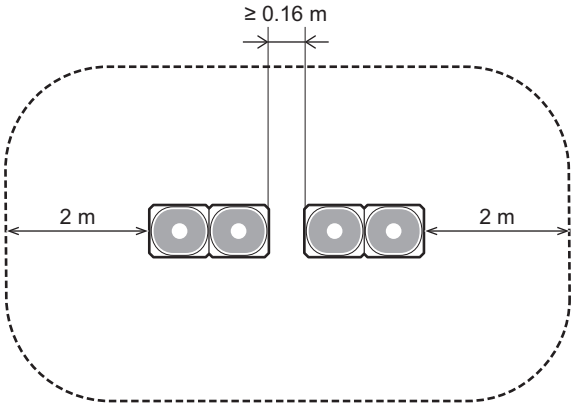


Fig. 3

[2] When installed in a location with 3 surfaces opened

- The open side distance from the unit x_l and x_r must be above 2 m.
- Calculate the forward distance y_{f1} and backward distance y_b to the unit with the table below.

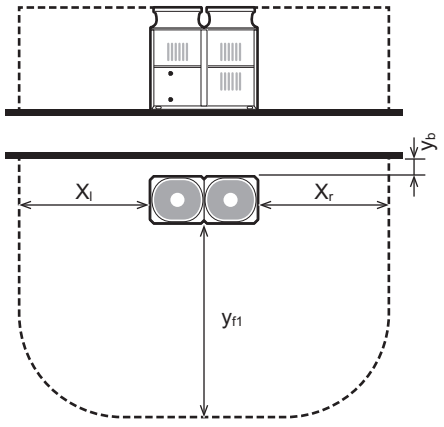


Fig. 4

(Unit: m)

y_b	y_{f1}
0.3	3.2
1.0	2.5
2.0	2.0
3.0	2.0

[3] When installed in a location with 2 surfaces opened (where the distance between one side of the unit and the wall is 0.3 m or more but less than 5 m)

- The open side distance from the unit x_l must be above 2 m.
- The forward distance from the unit y_{f2} must follow the table below. It depends on the distance l, which is defined by the smaller of the distances between x_r and y_b.

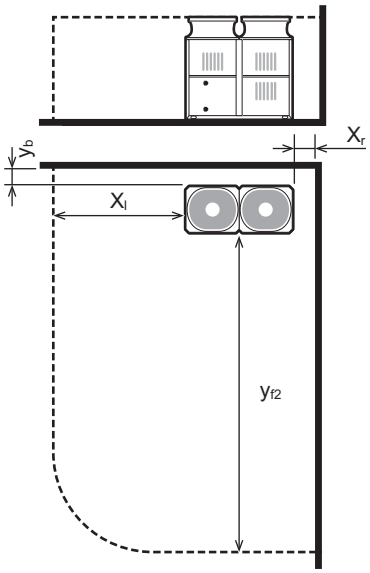


Fig. 5

(Unit: m)

l = min. (x_r, y_b)	y_{f2}
0.3	5.0
1.0	3.4
2.0	2.0
3.0	2.0

en

[4] When installed in a location where only the front opened

- The backward distance from the unit y_b must be above 0.3 m.
- The forward distance y_{f3} must follow the table below depending on the total side distance $x_l + x_r$.

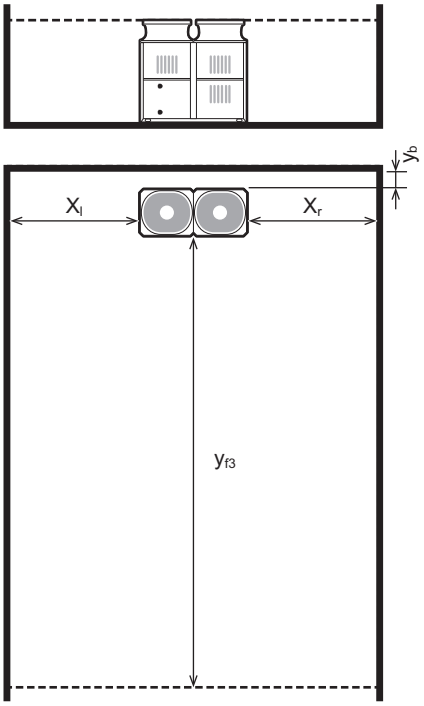


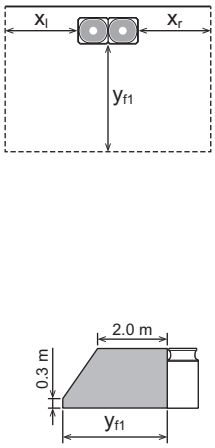
Fig. 6

(Unit: m)

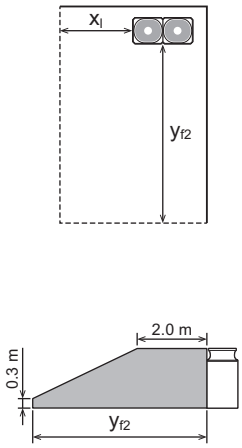
$x_l + x_r$	y_{f3}
2.0	12.0
4.0	7.5
6.0	5.3
8.0	4.0
10.0	3.1

Protective zone (Side view)

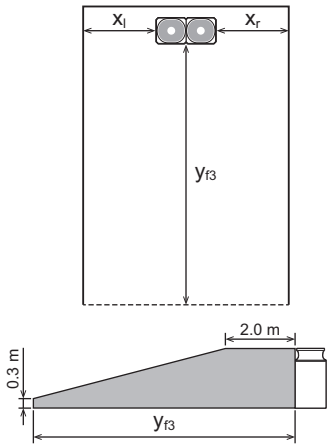
3 surfaces opened



2 surfaces opened



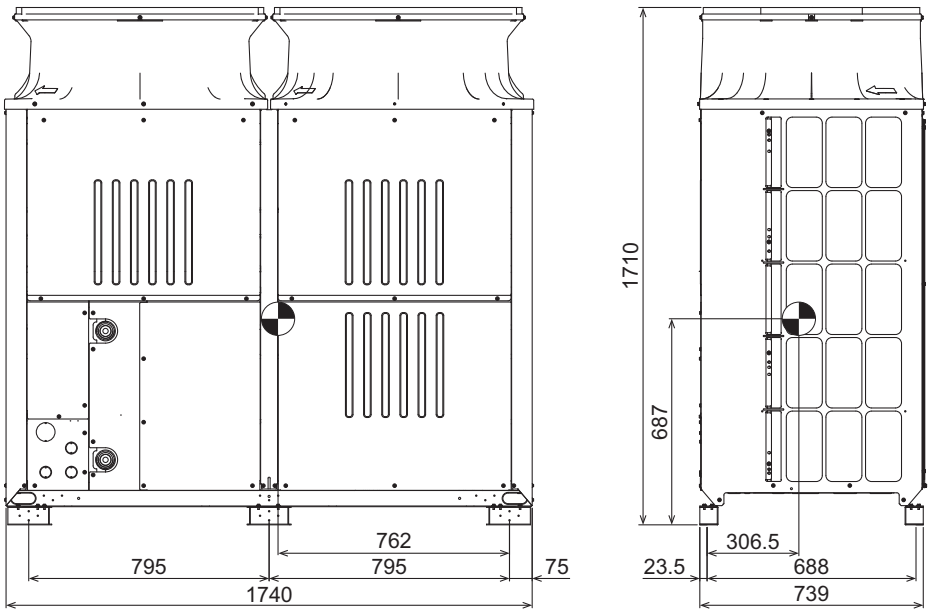
1 surface opened



3. Unit Installation

3-1. Center of gravity

Unit: mm



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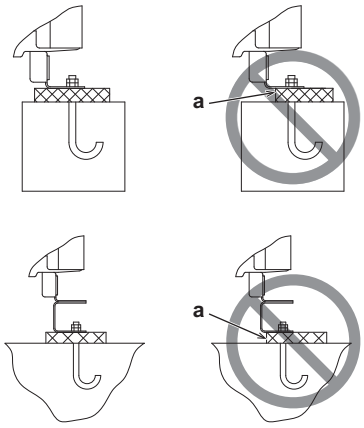
3-2. Installation on foundation

Units must be properly installed by personnel certified by Mitsubishi Electric, following the installation instructions. Improper installation can cause the unit to topple or fall, leading to serious injuries. For safety measures against earthquakes and strong winds, consult local specialists.

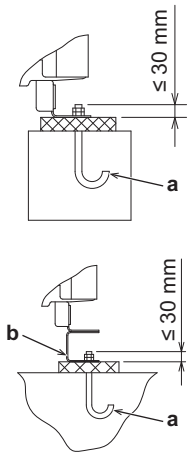
Install the unit on a foundation made of concrete or iron that can withstand its weight, and secure it with bolts. Ensure the foundation properly supports all corners of the installation legs as shown in the figures below. If the corners of the legs are not properly supported, the legs may bend. Build a foundation by considering the routes for drainage, piping, and wiring.



a Leg corner is not properly seated.

To prevent noise, pipe damage, and refrigerant gas leakage caused by vibrations from the unit being transmitted to floors and walls, take appropriate vibration control measures (e.g., rubber pads that cover the entire width of the legs).

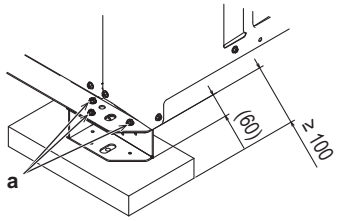
The projecting length of the anchor bolt must be 30 mm or less. The unit cannot be installed using hole-in anchor bolts unless brackets support the corners.



a M10 anchor bolt (not supplied)
b Detachable leg

The legs of the unit (two each in the front and back) can be detached by loosening the three screws on each leg. Repaint the finish coat if damaged. When installing units without using the detachable legs and routing pipes and wires underneath the unit, ensure the foundation does not block the piping access holes. To route the pipes under the unit, the foundation height must be at least 100 mm.

(Unit: mm)



a Unscrew to detach legs

3-3. Installing the unit in a snow area

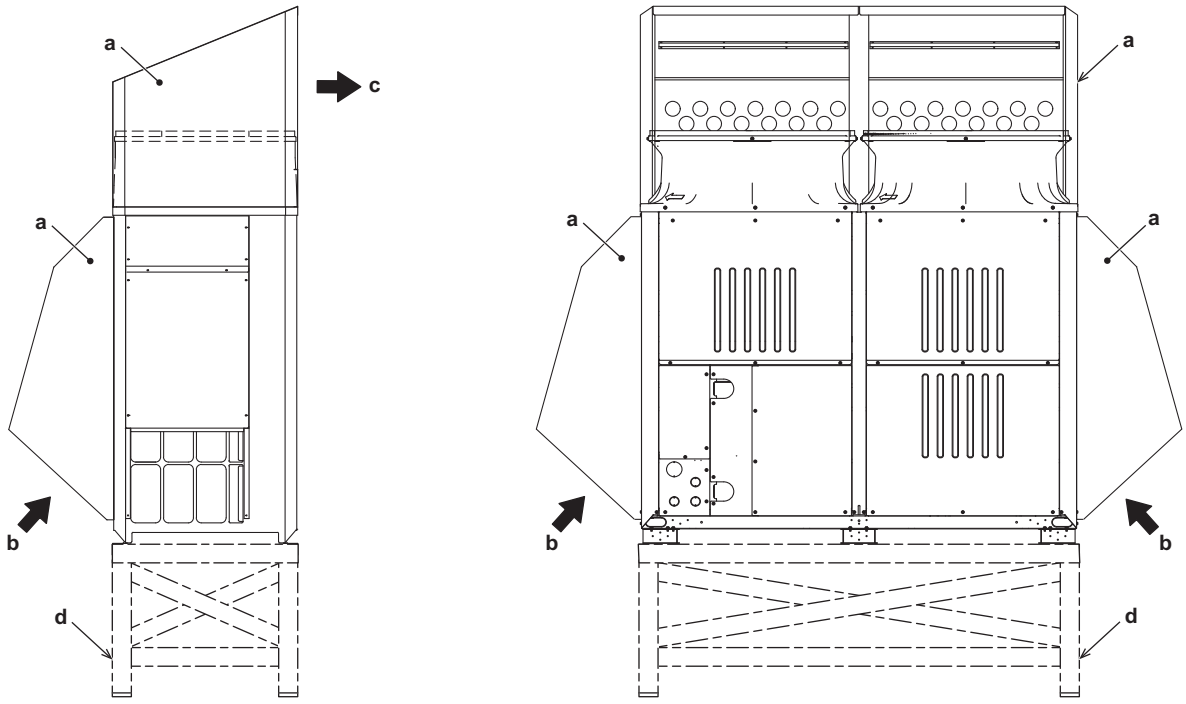
In snowy areas, sufficient protection against snow and winds should be provided to ensure proper operation.
Even in other areas, appropriate measures should be taken to minimize the effects of winds and snow to ensure normal operation.
To ensure proper operation, install a field-supplied outlet/inlet duct if the unit is directly exposed to wind, rain, or snow and is operated in the cooling mode with the outside air temperature of -10ºC or below.

NOTE

- Install the unit on a base approximately twice as high as the expected snowfall. The base must be made of angle steel or something to let snow and wind slip through the structure. The base width must not exceed the unit size, otherwise snow will accumulate on the base.
- Install the unit so that the outlet/inlet faces away from the wind.

en

CAHV-Z450YA-HPB (-BS)



a Snow hood
b Inlet
c Outlet
d Raised base

NOTE

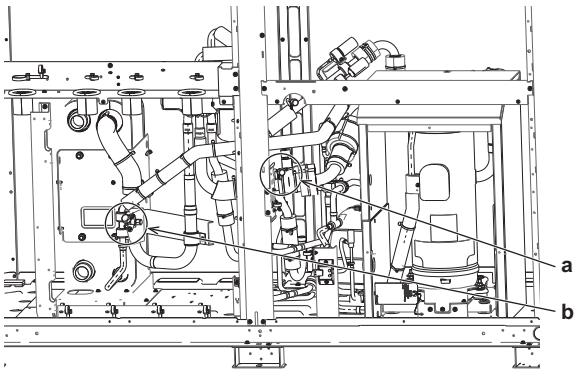
- Install the unit so that the outlet/inlet faces away from the wind. Secure enough space around the unit to avoid a short cycle.
- Do not install the unit in a place where snow may fall from the roof. Also, remove the snow on the unit before it accumulates.
- Refer to the figure above when installing the base on site.

4. Refrigerant Charge

4-1. Vacuum Drying (Evacuation)

[1] Prior to vacuum drying

Release inert gas charged in the unit from the check joint on the low-pressure side.
For vacuum drying, use the low-pressure check joint and refrigerant service valve.
The refrigerant service valve is set the low-pressure side when shipping from the factory.
The check joint and valve of the unit is 7/16-20 UNF.
Do not evacuate after the unit turns on the power since LEV will close in the unit.
Once the LEV closes, the evacuating takes more time.



a Low-pressure check joint
b Refrigerant service valve
(At the factory shipment, the valve is set to the low-pressure side)

[2] Vacuum pump

To prevent the vacuum pump oil from flowing into the refrigerant circuit during power OFF or power failure, use a vacuum pump with a reverse-flow check valve.
A reverse-flow check valve may also be added to the vacuum pump currently in use.
Also, use a vacuum pump compatible with A3 refrigerant.

[3] Standard of vacuum degree

Use a vacuum pump that attains 0.5 Torr (65Pa) or lower degree of vacuum after 5 minutes of operation, and connect it directly to the vacuum gauge. Use a pump well-maintained with an appropriate lubricant. A poorly maintained vacuum pump may not be able to attain the desired degree of vacuum.

[4] Required precision of vacuum gauge

Use a vacuum gauge that registers a vacuum degree of 2 Torr (266 Pa).
Do not use a commonly used gauge manifold because it cannot register a vacuum degree of 2 Torr (266 Pa).

[5] Evacuation time

- After the degree of vacuum has reached 2 Torr (266 Pa), evacuate for an additional 1 hour. (A thorough vacuum drying removes moisture in the pipes.) When the outdoor temperature drops below 1°C (or when the saturation pressure drops below 656 Pa), continue vacuum drying for another 1 hour after the vacuum degree has reached the saturated vapor pressure of the water (ice) at the outdoor temperature. When performing vacuum drying at a low outdoor temperature, use a vacuum gauge appropriate for the temperature range.

Degree of vacuum (reference)

Outdoor temp.	-20°C (-4°F)	-15°C (5°F)	-10°C (14°F)	-5°C (23°F)	0°C (32°F)
Degree of vacuum	0.77 Torr (103 Pa)	1.24 Torr (165 Pa)	1.95 Torr (260 Pa)	3.01 Torr (402 Pa)	4.58 Torr (611 Pa)

- Degrees of vacuum shown above are obtained based on the saturated vapor pressure of ice.
- In a system using water heat exchangers, circulate water to prevent the water in the heat exchangers from freezing during vacuum drying.

- Verify that the vacuum degree has not risen by more than 1 Torr (130 Pa) 1 hour after evacuation. A rise by less than 1 Torr (130 Pa) is acceptable.
- If the vacuum is lost by more than 1 Torr (130 Pa), conduct evacuation, following the instructions in section 7. Special vacuum drying.

[6] Procedures for stopping vacuum pump

To prevent the reverse flow of vacuum pump oil, open the relief valve on the vacuum pump side, or draw in air by loosening the charge hose, and then stop the operation.
The same procedures should be followed when stopping a vacuum pump with a reverse-flow check valve.

[7] Special vacuum drying

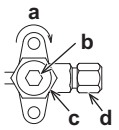
- When 2 Torr (266 Pa) or lower degree of vacuum cannot be attained after 3 hours of evacuation, it is likely that

water has penetrated the system or there is a leakage.

- If water infiltrates the system, break the vacuum with nitrogen. Pressurize the system with nitrogen gas to 0.5 kgf/cm^{2}G (0.05 MPa) and evacuate again. Repeat this cycle of pressurizing and evacuation either until the degree of vacuum below 2 Torr (266 Pa) is attained or until the pressure stops rising.
- Only use nitrogen gas for vacuum breaking. (The use of oxygen may result in an explosion.)

[8] Notes

- Evacuating the system only from the high-pressure side may damage the compressor.
- When dry-vacuuming and recovering refrigerant, let the water circulate to keep the plate heat exchanger from freezing.
- If power is accidentally turned on before vacuuming and refrigerant charge, evacuate not only from the low-pressure check joint and the refrigerant service valve but also from the high-pressure check joint.
- Do not purge the air using refrigerant. Use a vacuum pump to evacuate the system.
  Residual gas in the refrigerant lines will cause bursting of the pipes or an explosion.
- After the unit has been run once, the pressure of the refrigerant service valve may reverse depending on the four-way valve. Do not use the refrigerant service valve except for initial commissioning.
- Tighten the valve/valve cap with your hands as far as they go, and then turn them further by approximately 30 to 45 degrees.
  - Tightening the valve/valve cap too hard may damage the screw head, which may render the screw unable to be tightened.
- Close the refrigerant service valve immediately after the completion of maintenance work.
  The refrigerant service valve must be closed at all times during operation.

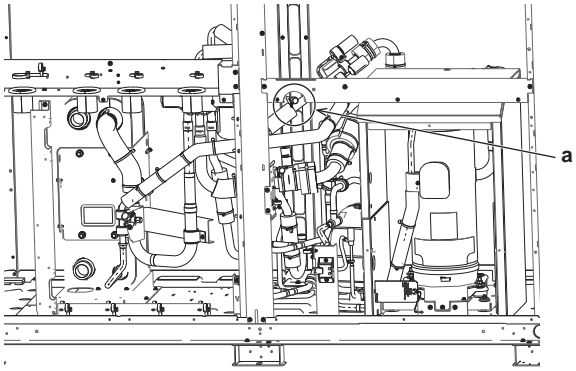


a Turn to close.
b Valve tightening torque 6.0±10%N · m
c Valve cap tightening torque 15.0±10%N · m
d Tightening torque for the parts to be connected to the equipment on site 12.7±2N · m

4-2. Refrigerant Charge

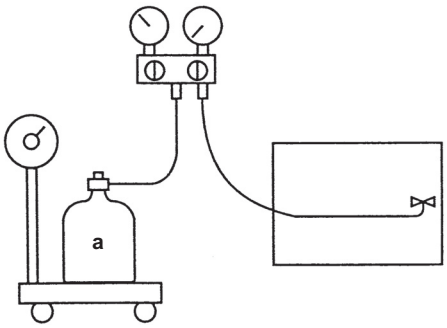
[1] Refrigerant charge

Charge 4.8 kg of R290 refrigerant only from the high-pressure check joint.
Use a scale with a maximum error of ±30 g that has been calibrated at least once per year.
R290 refrigerant must not be charged beyond 4.94 kg required by IEC 60335-2-40.
Be aware that the refrigerant may not contain an odorant.
Draw out the refrigerant from the cylinder in the liquid phase.

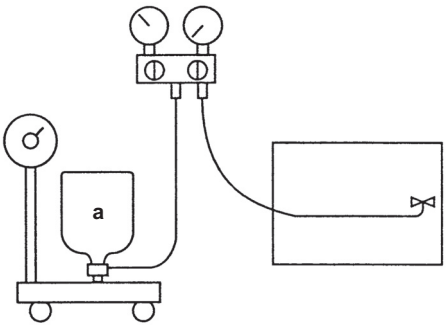


a High-pressure check joint

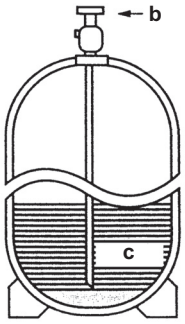
Cylinder with a siphon

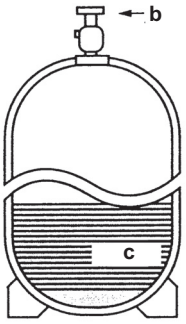


Cylinder without a siphon



Refrigerant charging in the liquid state





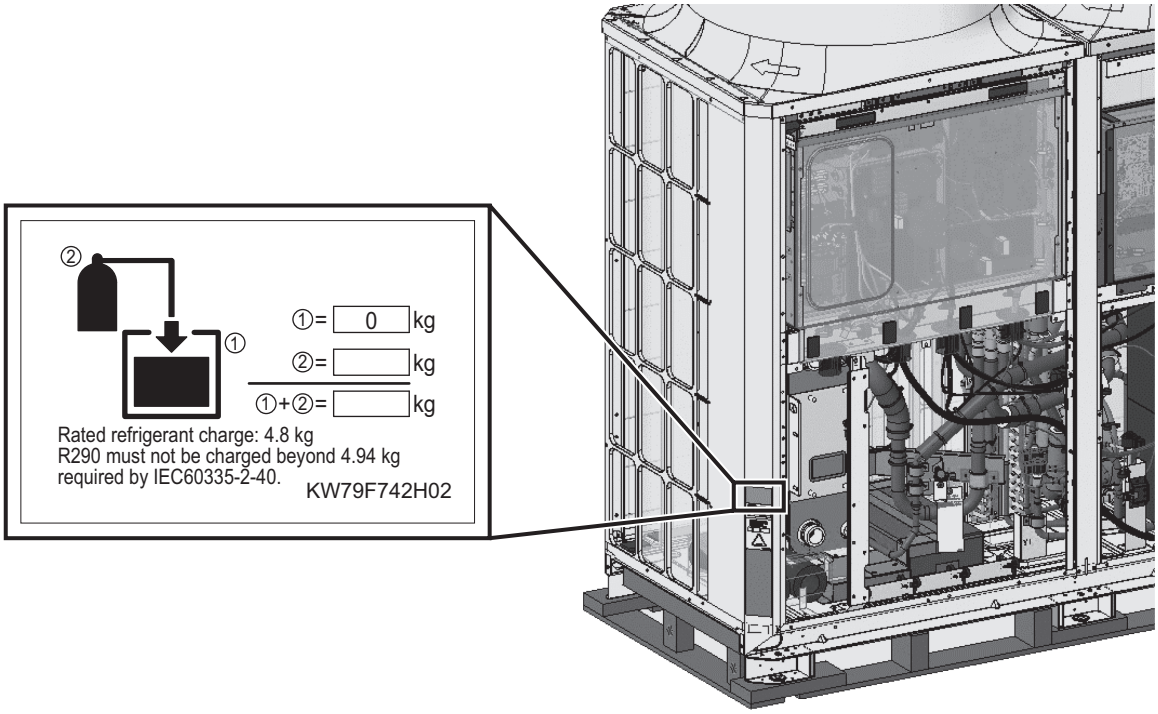
a Cylinder
b Valve
c liquid

[2] Record of Refrigerant Charge on Label

After charging the refrigerant, record on the label both the actual charged amount ② and the resulting total refrigerant amount ① + ②.

The amount of factory-charged refrigerant ① is 0 kg.

Use a permanent marker so that the entry will not be easily erased.



[3] Notes

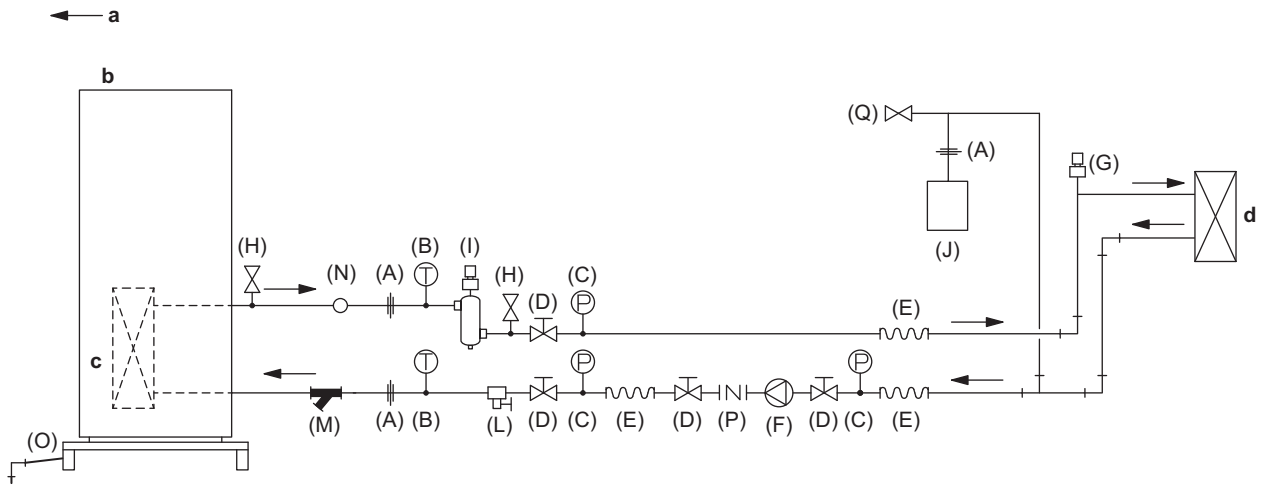
When using a cylinder with a siphon, refrigerant is charged in the liquid state without the need for turning it upside down. Check the type of the cylinder on the label before use.

4-3. Actions to be taken in the event of refrigerant leakage

- Evacuate any people from the danger zone.
- Do not turn the switch ON/OFF or plug/unplug any device.
  Do not use any devices that may have ignition source.
- Prepare the fire extinguishers or other fire prevention equipment for use.
- When the refrigerant leak fault is detected and the fans are rotating, wait until the fans stop.
- Ventilate the area around the unit.
- Remove ignition sources from the danger zone.
- Do not operate the unit until repairs are completed.

5. Water Pipe Installation

5-1. Piping System Schematic



a Water flow direction
b Outdoor unit
c Water heat exchanger
d AC units, floor heater, etc.

(A)	Union joints/flange joints	Allows for equipment replacement
(B)	Thermistor	For performance check and unit operation monitoring
(C)	Water pressure gauge	For operation status monitoring (recommended)
(D)	Valve	Allows for replacement/cleaning of flow adjuster
(E)	Flexible joint	Reduces the noise and vibration from the pump from being transmitted (recommended)
(F)	Pump	Must be large enough to accommodate the total water pressure loss and capable of supplying sufficient water to the unit
(G)	Automatic air vent valve (AAV)	To be installed where air tends to accumulate
(H)	Pressure relief valve (PRV)	For addressing a refrigerant leak from water heat exchanger and regulating water pressure. The PRVs are to be field-supplied. Refer to the following page(s). "System configuration" (p. 21)
(I)	AAV with air separator	For addressing a refrigerant leak from water heat exchanger. The AAV with air separator is to be field-supplied. Refer to the following page(s). "System configuration" (p. 21)
(J)	Closed expansion tank	Accommodates expanded water supplies
(K)	Water pipe	Use pipes designed for easy air purging, and ensure proper insulation. Ensure that gaps between water pipe and the unit are filled. (e.g. Racking)
(L)	Drain valve	For draining water for servicing
(M)	Strainer	To be installed near the unit to keep debris from entering the water heat exchanger
(N)	Flow switch	Ensures sufficient water flow
(O)	Drain pipe	Install the drain pipe at a downward slope between 1/100 and 1/200. To keep drain water from freezing, install the pipes at a downward angle and minimize horizontal sections. For cold climate installation, take an appropriate measure (e.g., drain heater) to prevent the drain water from freezing.
(P)	Check valve	Prevents water backflow
(Q)	Safety valve	To be installed near the closed expansion tank

5-2. Maintaining Water Quality

5-2-1. Water quality control

Poor-quality circulating water can corrode or scale up the water heat exchanger and compromises its performance. Proper water quality control and regular water treatment are required. During installation, remove debris (e.g., welding and sealant fragments, rust) out of the pipes.

Water circulation systems with open heat storage tanks are particularly prone to corrosion.

When using an open heat storage tank, install a water-to-water heat exchanger, and use a closed-loop circuit on the hot water heat pump unit side. When using a water supply tank, minimize air exposure, and maintain dissolved oxygen levels in the water at or below 1 mg/ℓ.

(1) Water quality standard

Item			Lower mid-range temp. water system Water Temp. ≤ 60ºC		Higher mid-range temp. water system Water Temp. > 60ºC		Corrosive tendency	Scale-forming tendency
			Circulating water	Make-up water	Circulating water	Make-up water		
Standard	pH	(25°C)	7.0 – 8.0	7.0 – 8.0	7.0 – 8.0	7.0 – 8.0	○	○
	Electrical conductivity	(mS/m) (25°C)	≤ 30	≤ 30	≤ 30	≤ 30	○	○
		(μs/cm) (25°C)	≤ 300	≤ 300	≤ 300	≤ 300		
	Chloride ion	(mg Cl^-/ℓ)	≤ 50	≤ 50	30	≤ 30	○	
	Sulfate ion	(mg $SO4^{2-}$/ℓ)	≤ 50	≤ 50	≤ 30	≤ 30	○	
	Acid consumption	(pH4.8) (mg $CaCO_3$/ℓ)	≤ 50	≤ 50	≤ 50	≤ 50		○
	Total hardness	(mg $CaCO_3$/ℓ)	≤ 70	≤ 70	≤ 70	≤ 70		○
	Calcium hardness	(mg $CaCO_3$/ℓ)	≤ 50	≤ 50	≤ 50	≤ 50		○
	Ionic silica	(mg SiO_2/ℓ)	≤ 30	≤ 30	≤ 30	≤ 30		○
Reference	Iron	(mg Fe/ℓ)	≤ 1.0	≤ 0.3	≤ 1.0	≤ 0.3	○	○
	Copper	(mg Cu/ℓ)	≤ 1.0	≤ 0.1	≤ 1.0	≤ 0.1	○	
	Sulfide ion	(mg S^{2-}/ℓ)	Undetectable	Undetectable	Undetectable	Undetectable	○	
	Ammonium ion	(mg NH_4^+/ℓ)	≤ 0.3	≤ 0.1	≤ 0.1	≤ 0.1	○	
	Residual chlorine	(mg Cl/ℓ)	≤ 0.25	≤ 0.3	≤ 0.1	≤ 0.3	○	
	Free carbon dioxide	(mg CO_2/ℓ)	≤ 0.4	≤ 4.0	≤ 0.4	≤ 4.0	○	
	Ryznar stability index		–	–	–	–	○	○

Reference: Guideline of Water Quality for Refrigeration and Air Conditioning Equipment. (JRA GL02E-1994)

(2) Consult a water quality control specialist before using anti-corrosive solutions.

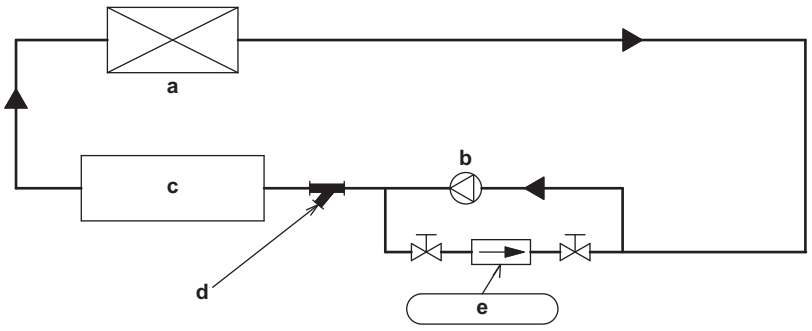
(3) Before replacing the hot water heat pump unit (or only the heat exchanger), analyze the water quality to see if the water is the problem.

Note that corrosion can suddenly occur in water systems with no obvious signs of corrosion. If improving the water quality solves the problem, there is no need to replace the unit.

(4) Debris Removal

Debris and corrosive substances in water can damage or corrode the heat exchanger surface. Install a 20 mesh or finer strainer at the inlet of the unit.

Consider installing a settlement tank or a bypass strainer capable of handling two to three percent of the circulating water to remove debris from the water system.



a Air-conditioning unit
b Water pump
c Heat pump unit
d 20 mesh or finer strainer
e Bypass strainer

5-3. Installing the Strainer and Flow Switch

5-3-1. Strainer

Install an optional strainer near the unit in the inlet water pipe to keep the heat exchanger from clogging and corrosion.

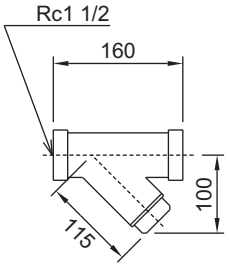
Operating the units with a clogged strainer may cause the units to make an abnormal stop.

Install the strainer for easy cleaning access, and advise the user to clean it regularly.

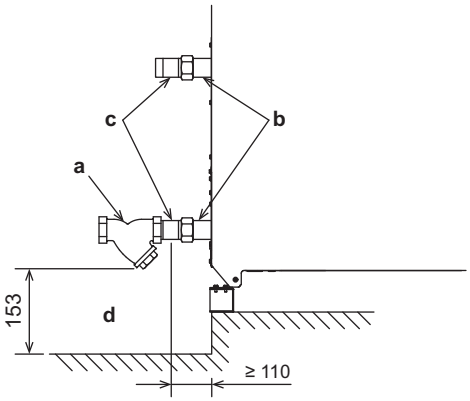
Consider the installation angle, insulation thickness, and maintenance access space.

- Y-strainer dimensions

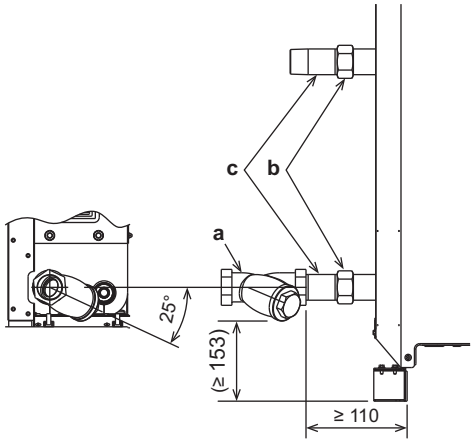
<Unit: mm>



- Space required around the Y-strainer for screwing it in



Example 1



Example 2

a Y-strainer (Option: YS-40A)
b Pipe
c Pipes (not supplied)
d Y-strainer maintenance access space

5-3-2. Flow switch

Install a flow switch (not supplied) in the water pipe, and connect the flow switch to the contact point on the unit.

The water volume range of the unit is 4.0 - 7.0 m^3/h.

5-4. Installing the External water temperature thermistor

[1] Required parts for installing an external-water temperature thermistor TW-TH16

1) External-water temperature thermistor
2) Cable for connecting between the sensor and the unit *1
3) Cable terminal for connecting to the sensor and the unit terminal block *1
(Terminals for M4 screws × 4) *1
*1: 1) and 2) are field-supplied.

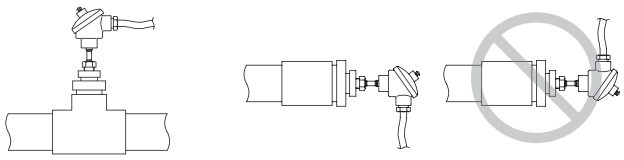
Cable specifications

Size	2-core, 1.25 mm^2 or larger
Type	CVVS or CPEVS
Length	20 m

en

[2] Installing an external-water temperature thermistor

As shown in the figures below, install the sensor at the merged part of water pipes or the load-side tank.
The sensor can be installed in either the vertical or the horizontal position. When installing the sensor in the horizontal position, make sure to place the cable-access-hole side down.

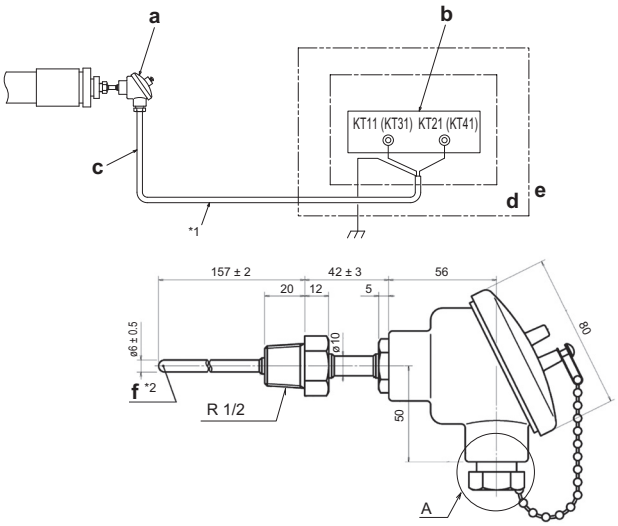


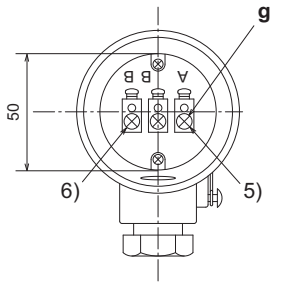
Vertical installation **Horizontal installation**

[3] Wiring for an external-water temperature thermistor

As shown in the figures below, connect the cable to the external-water temperature thermistor and the terminal block in the unit control box.

Unit: mm





Terminal block on the sensor

a External water temperature thermistor
b Terminal block in the control box on the unit
c Sensor wire
d Control box
e Unit
f Sensor
g 3 - M4 screw (Screw for cable terminal installation)
*1:Install the sensor cable at least 5 cm away from the power cable to which 100 V or higher voltage is applied.
*2:Sensor properties
Resistance: R = 15 KΩ ± 3% (0 °C)
B-constant: 3460 K

On the unit side, connect the sensor cable to the terminals T1 and T2 in the terminal block 18P in the unit sub box.

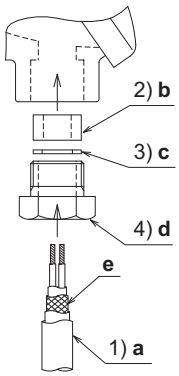
Connect the shielded cable to the ground terminal.

On the sensor side, as shown in the figure below, run the cable through 4), 3), and 2), attach the field-supplied terminals for M4 screws to the cable, and then connect the terminals to the screws 5) and 6) (terminal A and B).

Cut the shielded cable and leave it unconnected. (On the unit side, the shielded cable should be connected to the ground terminal already.)

Tighten the tightening screw 4), and caulk the gap between the tightening screw 4) and cable 1) to prevent water leakage.

*1: In a multiple module connection system, install the temperature thermistor where the cold/hot water from each module is sufficiently mixed to provide a representative temperature.
*2: The temperature thermistor must be installed on a pipe between the outlet of the unit and the entrance to the load-side system.

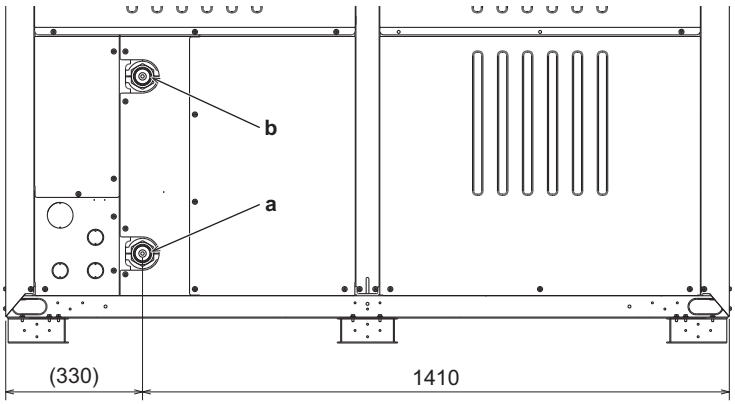


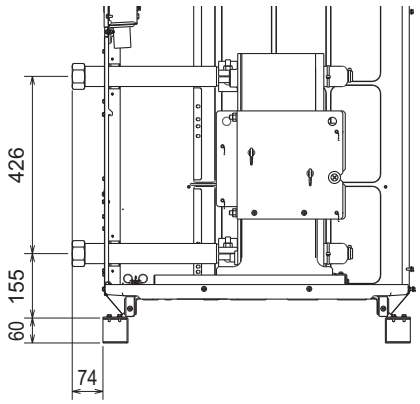
a Cable (field-supplied)
b Watertight sealing rubber (Inner diameter ø11)
c Washer (Inner diameter ø12)
d Tightening screw (Inner diameter ø15)
e Shielded cable (cut)

Enlarged view of area A: Cable installation

5-5. Water Pipe Connection Ports

<Unit: mm>

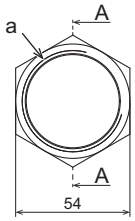


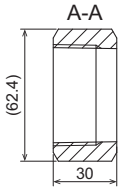


With assembly of accessories.

a Water inlet (1-1/2B socket)
b Water outlet (1-1/2B socket)

(1) Water pipe connection specification



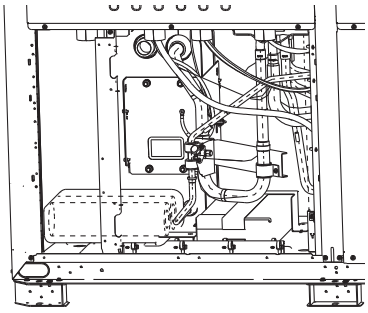


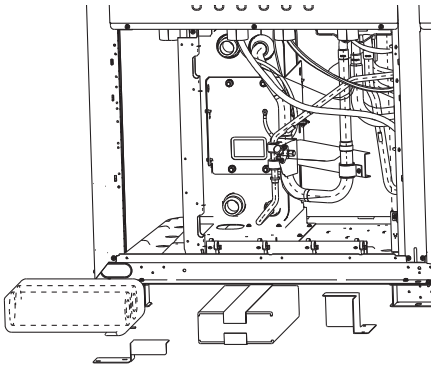
Recommended tightening torque: 150 N·m
a Rc1-1/2B

1) Open the bottom left panel of the unit and take the following parts out of the unit:

- A cardboard carton containing water pipes
- An insulation pipe
- Two types of fixing brackets for the cardboard carton
- Four securing screws for the bracket

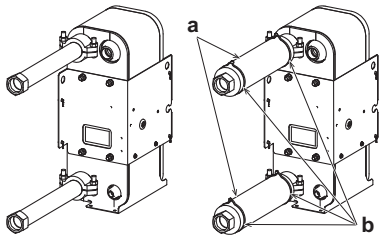
After removing the two types of fixing brackets and the four securing screws, dispose of them.





2) Take the water pipes and the pipe covers out of the cardboard carton and connect them to the plate heat exchanger using housing joints.

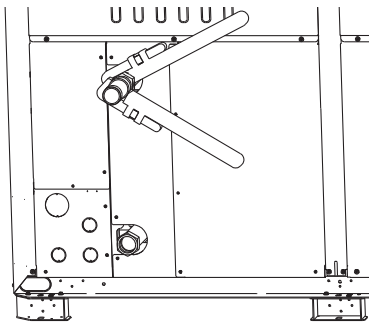
- Apply silicone spray to the rubber rings on the housing joints.
  Failure to do so may cause the rubber rings to twist, leading to breakage and a water leak.
- Recommended tightening torque for the housing joint bolt: 49 N · m



a Pipe cover
b Band (not supplied)

3) Close the bottom left panel to complete the installation of the supplied pipes.
Connect the field pipes using two pipe wrenches as shown in the figure at right.

- Recommended tightening torque for the pipe: 150 N · m ±10%
- After connecting the field pipes, provide piping supports to prevent them from sagging under their own weight.



5-6. Connecting Pipes of Different Materials

The contact surface of different types of metals will corrode. Install an insulating material between pipes of different materials to keep them out of direct contact.

5-7. Minimum Water Volume Requirements for Water Circuits

(1) Required water volume

Insufficient water in the water circuit may shorten unit operation time, cause drastic temperature fluctuations, or impair defrost function during heating. Refer to the table below for minimum water volume requirements. If the pipe is too short to hold sufficient water, install a cushion tank to ensure sufficient water volume.

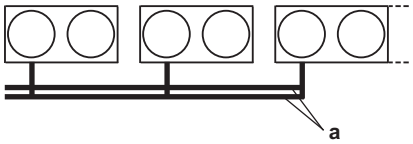
Model	Min. water volume (ℓ)
CAHV-Z450YA-HPB(-BS)	525

Minimum water volume requirement for units that are installed in series under the condition with the outlet water temperature of 55ºC or higher: 360 × number of units.

(Ex. 360 × 3 = 1080 ℓ)

Up to 7 units can be installed within the same water circuit.

a Water pipe



(2) Calculating the necessary water volume for water circuits

Calculation formula

(Necessary amount of water in the water circuit) = (water capacity of water pipes) + (water capacity of heat source unit) + (water capacity of load-side unit)

Water capacity of water per meter (ℓ/m)

Pipe size					
3/4B (20A)	1B (25A)	1 1/4B (32A)	1 1/2B (40A)	2B (50A)	2 1/2B (65A)
0.37 (ℓ/m)	0.60 (ℓ/m)	0.99 (ℓ/m)	1.36 (ℓ/m)	2.20 (ℓ/m)	3.62 (ℓ/m)

Water capacity of heat source unit (ℓ)

CAHV-Z450YA-HPB(-BS)
4.4

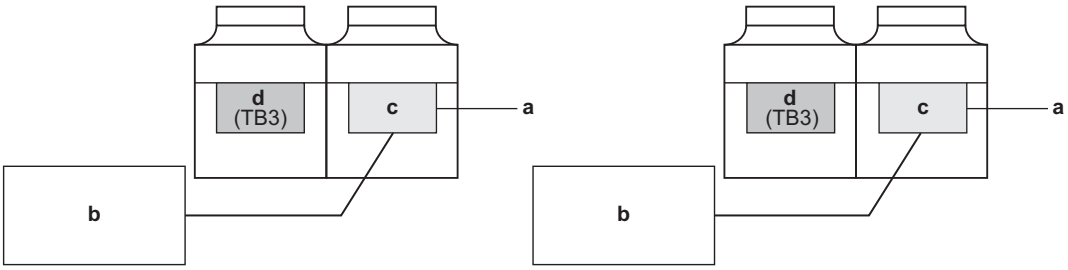
(3) Inlet/Outlet pipe fitting size

Model	Inlet	Outlet
CAHV-Z450YA-HPB(-BS)	40A, Rc 1-1/2B	40A, Rc 1-1/2B

6. System Configurations

6-1. Schematics of Individual and Multiple Systems

6-1-1. Schematics of individual and multiple systems

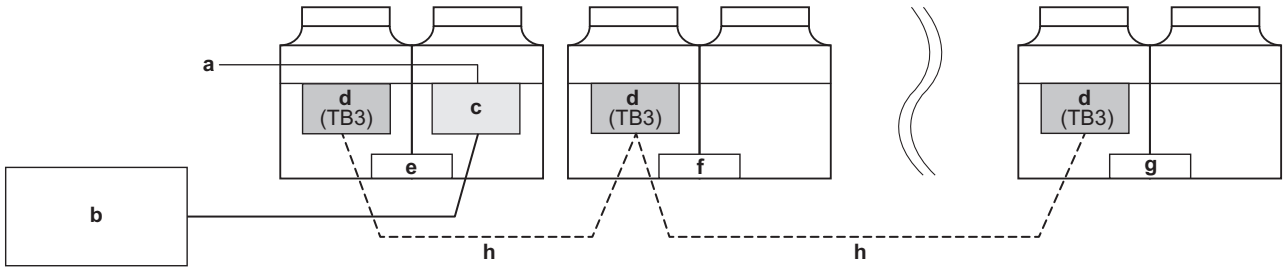


a External water temp. thermistor
b Dry contact switch/relay or remote controller (not supplied)
c Sub control box
d PCB

6-1-2. Multiple system

For 2 ~ 7 units

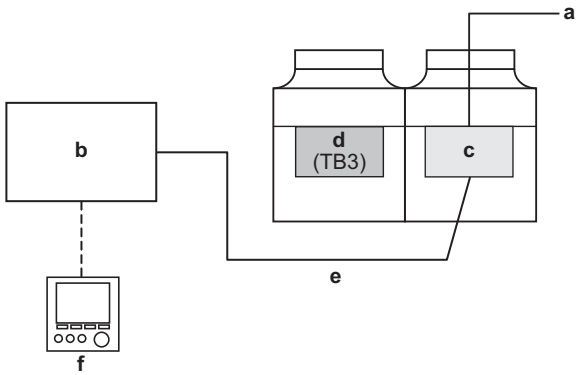
Consists of one main unit that connects to an external water temp. thermistor and a dry contact switch/relay, and up to 6 sub units that are operated collectively



a External water temp. thermistor
b Dry contact switch/relay or remote controller (not supplied)
c Sub control box
d PCB
e Main unit
f Sub unit
g Sub unit(s)
h Inter-unit wiring (M-NET)

6-1-3. Individual system with FTC connection

Each unit connects to a primary FTC unit.

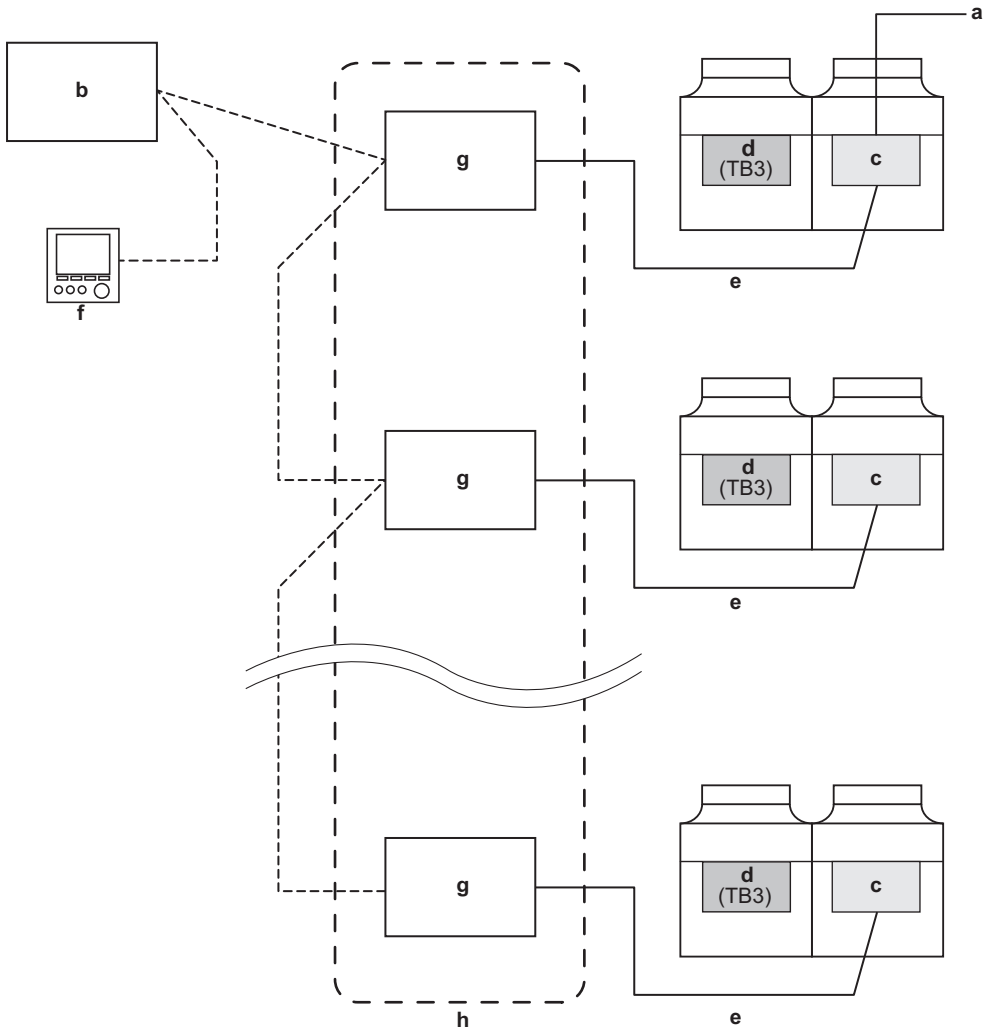


a External water temp. thermistor
b FTC (Primary)
c Sub control box
d PCB
e Outdoor unit
f Main RC

See the FTC manual for information about FTC.

6-1-4. Multiple system with FTC connection
For 2 ~ 6 units

Consists of one main FTC that connects to the main remote controller, and up to six units, each with connection to a secondary FTC. The unit connected to an external temp. thermistor is the main unit.



a External water temp. thermistor
b FTC (Primary)
c Sub control box
d PCB
e Outdoor unit
f Main RC
g FTC (Secondary)
h Max. six secondary FTCs

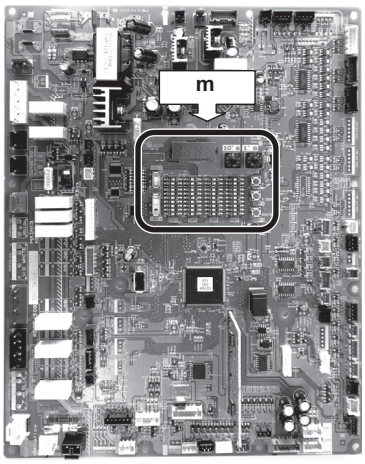
See the FTC manual for information about FTC.

6-2. Switch Types and Default Settings

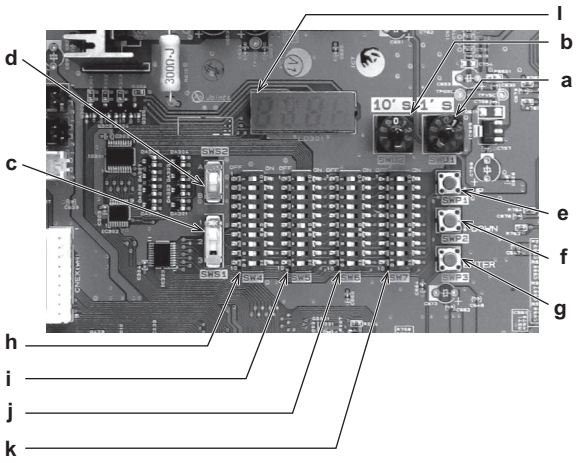
6-2-1. Switches on the PCB

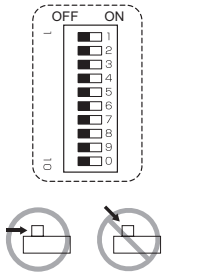
Dip switches (SW4-SW7)
Push switches (SWP1-SWP3)
Rotary switches (SWU1, SWU2)
Slide switches (SWS1, SWS2)

Switches on the PCB



Enlarged view





Slide (not push down) the dip switches.

	Switch	Function	Default
a	Rotary switch (SWU1)	Sets the ones place of the unit address (multiple system)	1
b	Rotary switch (SWU2)	Sets the tens place of the unit address (multiple system)	0
c	Slide switch (SWS1)	Used to select Remote, OFF, or LOCAL. (Switch positions and corresponding functions depend on the system configuration.)	REMOTE
d	Slide switch (SWS2)	Not used	A
e	Push switch (SWP1)	Switches the display between the item code and the current value for a specific item, or increases the current value	-
f	Push switch (SWP2)	Switches the display between the item code and the current value for a specific item, or decreases the current value	-
g	Push switch (SWP3)	Advances the item code or saves the change	-
h	Dip switches (SW4)	Sets the LED display contents	
i	Dip switches (SW5)	Sets the LED display contents	
j	Dip switches (SW6)	Sets the LED display contents	
k	Dip switches (SW7)	Sets the LED display contents	
l	-	LED display	
m	-	Switches	

6-2-2. Default dip switch settings

SW		Function		Circuit board (Default)	OFF	ON	Setting timing
SW 4	1 2 3 4 5 6	Model setting	Sets the model	Depends on the unit	-		Upon reset
	7	External static pressure option	Selects the fan's operating mode from Normal or External static pressure mode	OFF	Disable	Enable	
	8 9 10	Model setting	Sets the model	Depends on the unit	-		
SW 5	1	Freeze-up protection	Starts the pump to prevent water pipe freeze-up	OFF	Outdoor temp. ≤ 1°C Water temp. ≤ 13°C	Same as when set to OFF	Upon reset
	2	Scheduled operation display	Turns on and off the remote display when the units are scheduled to stop	OFF	Leaves the display on	Turns off the display	Upon reset
	3	Model setting	Sets the model	OFF	-		Upon reset
	4	Model setting	Sets the model	OFF	-		Upon reset
	5	Recovery conditions after forced stoppage	Selects the thermistor used to determine if the water outlet temp. meets the recovery conditions	OFF	External thermistor	Built-in thermistor	Upon reset
	6	Power supply option to the communication circuit	Switches between supplying or not supplying power to the communication circuit	ON	Does not supply power	Supplies power	Any time
	7	Remote water-temp. setting	Enables or disables the water temp. to be set using external analog signals from a remote location	OFF	Disabled	Enabled	Upon reset
	8	Water temp. control option	Selects the thermistor to be used to control water temp.	OFF	Built-in thermistor	External thermistor	Upon reset
	9	Individual/Multiple system	Selects between individual and multiple systems	OFF	Individual system	Multiple system	Upon reset
	10	Display mode 7	Used to set or view the settings when performing a test run or changing system configuration	OFF	-		Any time
SW 6	1	Remote reset	Enables or disables an error to be reset remotely	ON	Disabled	Enabled	Upon reset
	2	Auto recovery after power failure	Automatic recovery of operation after power failure (in the mode before power failure)	ON	Displays an alarm	Automatically restores operation	Upon reset
	3	Water temp. control	Switches between inlet- and outlet-water-temp-based control.	OFF	Outlet	Inlet	Upon reset
	4	Pump-thermistor interlock	Interlocks or does not interlock the operation of pump with external thermistor (Effective only when SW5-8 is set to ON)	OFF	Pump operates when turned on, regardless of Thermo-ON/OFF status	Pump operation is interlocked with Thermo-ON/OFF status	Upon reset
	5	Display mode 1	Used to set or view the settings when performing a test run or changing system configuration	OFF	Changes the 7-segment LED display mode		Any time
	6	Display mode 2		OFF	Same as above		Any time
	7	Display mode 3		OFF	Same as above		Any time
	8	Display mode 4		OFF	Same as above		Any time
	9	Display mode 5		OFF	Same as above		Any time
	10	Display mode 6		OFF	Same as above		Any time

-: Do not change the settings.

6-3. Configuring the Settings

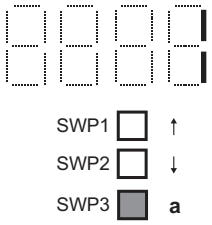
6-3-1. Switch function table

SW5 and SW6 settings				Setting Item	Item Code	Default	Notes
SW5-1	SW6-8	SW6-9	SW6-10				
OFF	OFF	ON	OFF	Current time	1		
				Max. peak-demand capacity	2	100%	
				Peak-demand control start time	3	13:00	
				Peak-demand control end time	4	13:00	
				Enable/disable schedule	5	0	Set to "1" to enable
				ON-time 1 (schedule mode w/o remote signal input)	6	0:00	
				OFF-time 1 (schedule mode w/o remote signal input)	7	0:00	
				ON-time 2 (schedule mode w/o remote signal input)	8	0:00	
				OFF-time 2 (schedule mode w/o remote signal input)	9	0:00	
				ON-time 3 (schedule mode w/o remote signal input)	18	0:00	
				OFF-time 3 (schedule mode w/o remote signal input)	19	0:00	
				Temp. settings D, E for analog input	11 13	D = 45ºC; E = 65ºC	When SW5-7 is set to ON
				Temp. setting A (Heating mode)	11	45ºC	Range 24-75
				Temp. setting B (Hot water mode)	13	65ºC	Range 24-75
				Remote water temp. input signal type	21	0	0: 4-20 mA; 1: 0-10 V; 2: 1-5 V; 3: 2-10 V
				Temp. settings C1, C2, C3, C4, C5, C6 for Heating ECO mode	22-27	C1 = 34ºC; C2 = -7ºC C3 = 24ºC; C4 = 12ºC C5 = 30ºC; C6 = 2ºC	
				Water temp./Capacity control	1051	0	0: Water temp. input 4-20 mA 1: Capacity control input 4-20 mA 2: Water temp. input IT terminal 3: Capacity control input IT terminal
				Drain heater/Defrost signal	1056	0	Selects between drain heater output and defrost output for IO board (CN513 5-7) output.
				TWL1	1057	40	Water temp. 1 for emergency signal 1
				TAL1	1058	-10	Outdoor temp. 1 for emergency signal 1
OFF	ON	OFF	OFF	Thermo differential 2	1016	2.0	Range 0-8
				Multiple System Thermo-ON/OFF prohibition period	1020	1	Range 1-5
				Outdoor temp. input source	1080	0	0: Outdoor temp. thermistor (TH9) 1: IT terminal
				Control sensor selection (Target temp. A)	1215	(TH) 14	Selectable from TH14 or TH15
				Control sensor selection (Target temp. B)	1216	(TH) 14	Selectable from TH14 or TH15
				Control sensor selection (Target temp. C)	1217	(TH) 14	Selectable from TH14 or TH15
				Pre-set temp. selection 1 (ON-time 1-OFF-time 1)	1218	1 (A)	A = 1; B = 2; C = 3
				Pre-set temp. selection 2 (ON-time 2-OFF-time 2)	1219	1 (A)	A = 1; B = 2; C = 3
				Pre-set temp. selection 3 (ON-time 3-OFF-time 3)	1220	1 (A)	A = 1; B = 2; C = 3

6-3-2. Setting configuration procedures

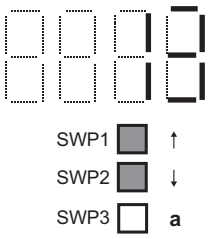
Use push switches SWP1, SWP2, and SWP3 to change or view the current settings on the circuit board.

1.



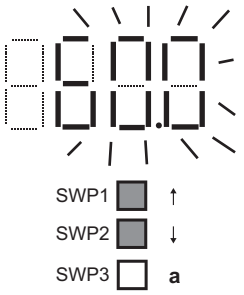
Normally, the LED shows an item code. (“1” in the left figure)
Press SWP3 to advance the item code to the desired code.

2.



Press SWP1 or SWP2 to display the current setting for the selected item code. ("13" in the left figure)

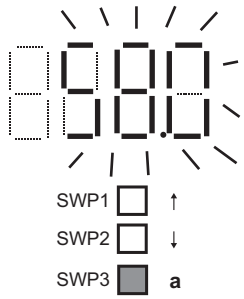
3.



Current setting will blink. (“60.0” in the left figure)
To change the setting, press SWP1 to increase and SWP2 to decrease the value while the LED is blinking.

- Some settings cannot be changed.
- Press and hold to fast-forward.

4.

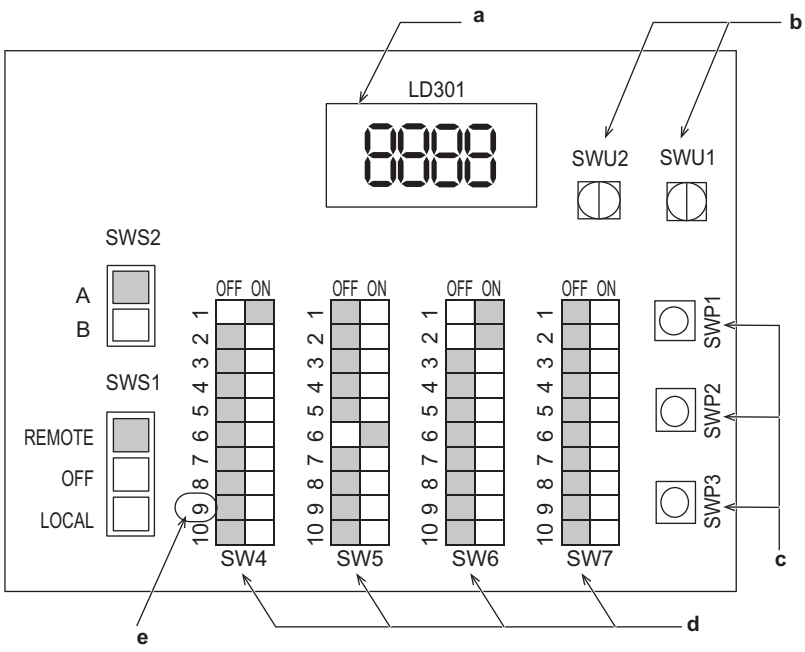


To save the change, press SWP3 while the item code is blinking. The LED will stop blinking and the change will be saved.

- If SWP3 is not pressed within one minute, the change will not be saved, and the LED will display the item code.
- If no buttons are pressed within one minute, the LED will automatically stop blinking, and an item code will stay lit.
- To change the values of other items, repeat the steps above.

a Enter

6-3-3. LED and switches on the control board



a LD301
b Rotary switches SWU1, SWU2: Use SWU1 to set the ones place of the address and use SWU2 to set the tens place.
c Push switches SWP1, SWP2, SWP3
d Dip switches SW4, SW5, SW6, SW7
e (Dip switch name example: SW4-9)

6-3-4. System configuration procedures: Individual system

(1) Set the dip switches on the control board for the items below.

- Water temp. control based on external water temp.
- Water temp. control based on inlet water temp.

Refer to the following page(s) for detail. "Default dip switch settings" (p. 46)

(2) Switch on the power to the unit.

[EEEE] will appear on LD301.

(3) Set the values for individual item codes as necessary.

1) Press SWP1, SWP2, or SWP3. [EEEE] will disappear and [101] will appear on LD301.
2) Press SWP3 to toggle through and select an item code.
([101]→[102]→[105]→[107]→[108]→Back to [101])
3) Press SWP1 to increase and SWP2 to decrease the value.
4) Press SWP3 to save the change.

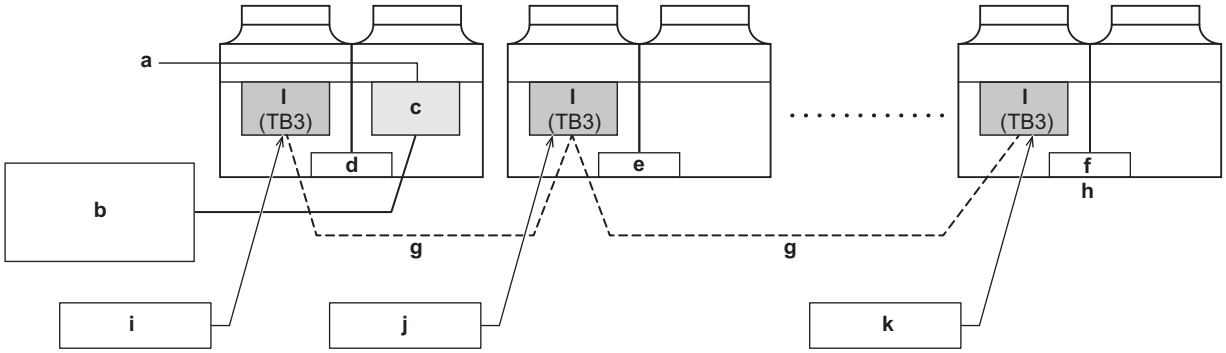
(4) Perform an initial setup on the main unit

1) Set SW7-1, -2, -3, and -4 to ON.
[EEEE][*1] will appear on LD301.
2) Press and hold SWP3 for one second.
While the system is starting up, [9999] will appear on LD301.
3) Set SW7-1, -2, -3, and -4 to OFF.
The step above completes the initial setup, and the settings for clock, peak-demand control, schedule, and thermistor, etc. can now be set.

*1: If the start-up process has already been completed, [FFFF] will appear.

6-3-5. System configuration procedures: Multiple system
For 2 ~ 7 units

(1) Schematic of a multiple system



a External water temp. thermistor
b Dry contact switch/relay or remote controller (not supplied)
c Sub control box
d Main unit
e Sub unit
f Sub unit(s)
g M-NET lines
h "n"th unit
i SW5-8: ON, SW5-9: ON, Address: 1
j SW5-9: ON, Address: 2
k SW5-9: ON, Address: 1 + n
l PCB

(2) Set the switches on the main unit

1) Ensure that the address of the main unit is set to "1."
2) Set SW5-8 to ON. (external water temp. thermistor)
3) Set SW5-9 to ON. (multiple unit control)

Refer to the following page(s) for detail. "Default dip switch settings" (p. 46)

(3) Set the switches on all sub units

1) Set SW5-9 to ON. (multiple unit control)
2) Set the ones place of the address with SWU1 and tens place with SWU2. Assign sequential addresses to all sub units starting with 2.

(4) Switch on the power to the unit.

Check for proper wiring, and switch on the power to all units.
The following codes will appear on LD301.
- [EEEE] on the main unit
- [9999] on the sub units

(5) Set the values with the switches on the control board.

1) Press SWP1, 2, or 3.
[EEEE] will disappear, and an item code ([101]) will appear on LD301.
2) Press SWP3 to toggle through and select an item code.
[101]→[102]→[105]→[107]→[108]→Back to [101]
3) Press SWP1 to increase and SWP2 to decrease the value.
4) Press SWP3 to save the change.

Set the item [107] setting (total number of main and sub units in the system) when connecting multiple units to a system.
Leave the item [108] setting (secondary FTC unit group) to the default setting = 0.

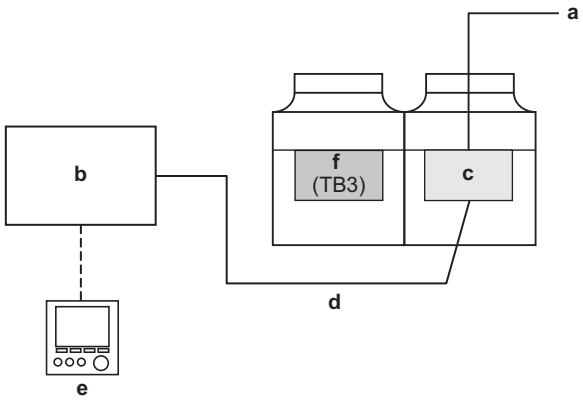
(6) Perform an initial setup on the main unit

1) Set SW7-1, -2, -3, and -4 to ON.
[EEEE][*1] will appear on LD301.
2) Press and hold SWP3 for one second.
While the system is starting up, [9999] will appear on LD301.
3) Set SW7-1, -2, -3, and -4 to OFF.
The step above completes the initial setup, and the settings for clock, peak-demand control, schedule, and thermistor, etc. can now be set.

*1: If the start-up process has already been completed, [FFFF] will appear.

6-3-6. System configuration procedures: Individual system (with connection to FTC)

(1) Schematic of an individual system with FTC connection



a External water temp. thermistor
b FTC (Primary)
c Sub control box
d Outdoor unit
e Main RC
f PCB

The unit connects to a primary FTC unit.

(2) Set the switches on the control board

Set SW6-1 on the primary FTC board to ON.

(3) Switch on the power to the unit.

Check for proper wiring, and switch on the power to all units.
[EEEE]*1 will appear on LD301.

(4) Set the values with the switches on the control board.

1) Press SWP1, 2, or 3.
[EEEE] will disappear, and an item code ([101]) will appear on LD301.
2) Press SWP3 to toggle through and select an item code. [101]→[102]→[105]→[107]→[108]→Back to [101]
3) Press SWP1 to increase and SWP2 to decrease the value.
4) Press SWP3 to save the change.
Leave the item [107] setting (number of units in the system) to the default setting = 1.
Leave the item [108] setting (secondary FTC unit group) to the default setting = 0.

(5) Perform an initial setup

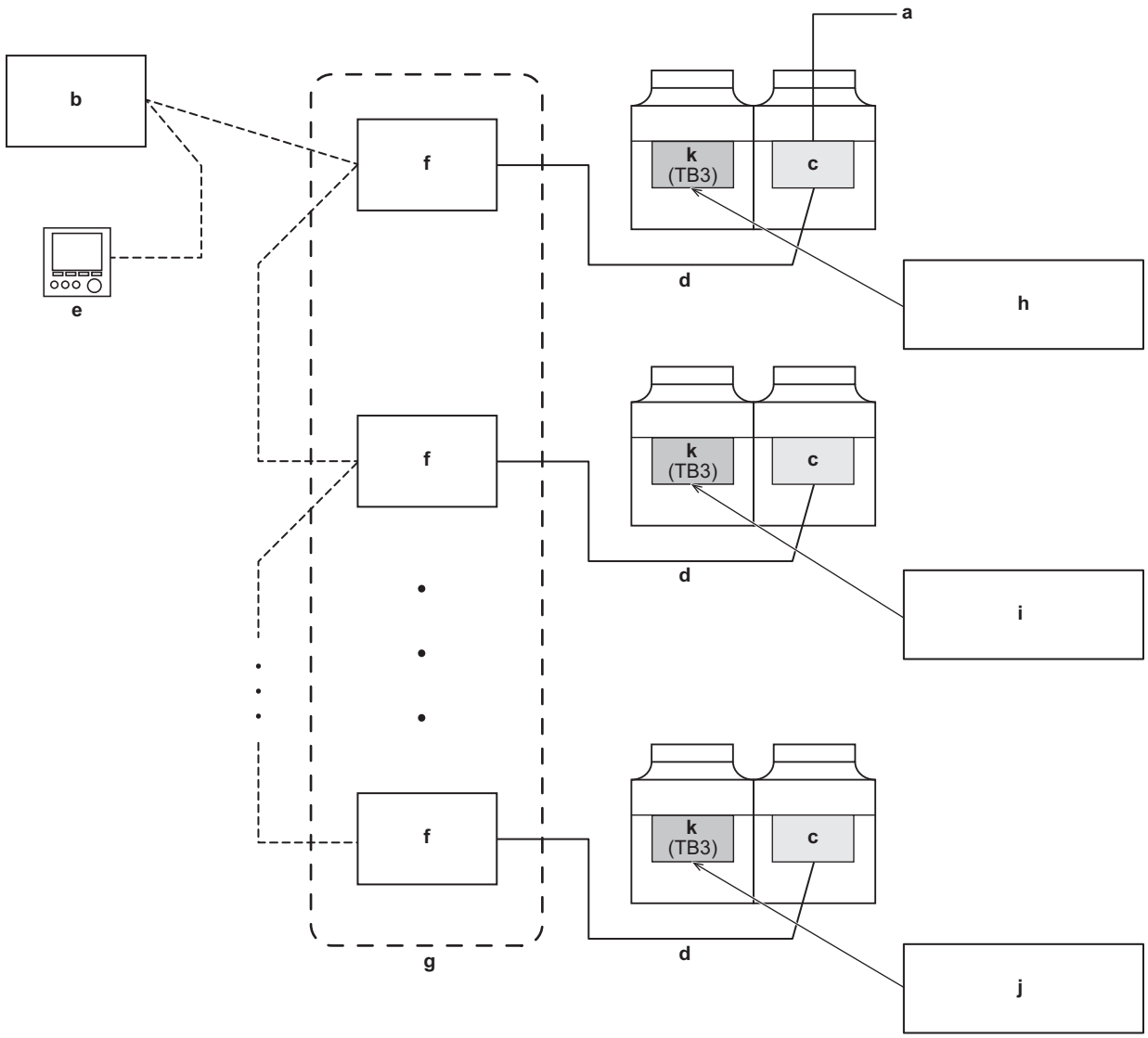
1) Set SW7-1, -2, -3, and -4 to ON.
[EEEE]*1 will appear on LD301.
2) Press and hold SWP3 for one second.
While the system is starting up, [9999] will appear on LD301.
3) Set SW7-1, -2, -3, and -4 to OFF.
The step above completes the initial setup, and the settings for clock, peak-demand control, schedule, and thermistor, etc. can now be set.

*1: If the start-up process has already been completed, [FFFF] will appear.
Refer to the FTC manual for detail.

en

6-3-7. Multiple system with FTC connection
For 2 ~ 6 units

(1) Schematic of a multiple system with FTC connection



a External water temp. thermistor
b FTC (Primary)
c Sub control box
d Outdoor unit
e Main RC
f FTC (Secondary)
g Max. six sub units
h Address: 1 secondary FTC unit group: 1
i Address: 1 secondary FTC unit group: 2
j Address: 1 secondary FTC unit group: 6
k PCB

- The main unit is the unit with connection to an external water temp. thermistor.
- Each unit connects to a secondary FTC unit.

(2) Set the switches on all units

1) Make sure the address of the main unit is set to “1.”

2) Set SW5-8 to ON. (external water temp. thermistor)

Refer to the following page(s) for detail. "Default dip switch settings" (p. 46)

3) Set SW6-1 on both the primary and secondary FTC boards to ON.

(3) Switch on the power to the unit.

Check for proper wiring, and switch on the power to all units.
[EEEE][*1] will appear on LD301 of the main unit

(4) Set the values with the switches on the control board.

1) Press SWP1, 2, or 3.
[EEEE] will disappear, and an item code ([101]) will appear on LD301.
2) Press SWP3 to toggle through and select an item code.
[101]→[102]→[105]→[107]→[108]→Back to [101]
3) Press SWP1 to increase and SWP2 to decrease the value.
4) Press SWP3 to save the change.
Leave the item [107] setting (number of units in the system) to the default setting =1
Set the item [108] setting (secondary FTC unit group) when connecting multiple units to a system.

(5) Perform an initial setup on the unit

1) Set SW7-1, -2, -3, and -4 to ON.
[EEEE][*1] will appear on LD301.
2) Press and hold SWP3 for one second.
While the system is starting up, [9999] will appear on LD301.
3) Set SW7-1, -2, -3, and -4 to OFF.
The step above completes the initial setup, and the settings for clock, peak-demand control, schedule, and thermistor, etc. can now be set.

*1: If the start-up process has already been completed, [FFFF] will appear.
Refer to the FTC manual for detail.

6-3-8. SWS1 settings

(1) Individual system

SWS1 Setting	Unit operation
REMOTE	Follows the input signal fed through a dry contact interface or controllers
OFF	Ignores the input signal
LOCAL	ON

(2) Multiple system

SWS1 Setting		Unit operation	
Main unit	Sub unit	Main unit	Sub unit
REMOTE	REMOTE	Follows the input signal fed through a dry contact interface or controllers	Follows the input signal from the main unit
	OFF		Ignores the input signal
	LOCAL		Follows the input signal from the main unit
OFF	REMOTE	Ignores the input signal	Ignores the input signal
	OFF		
	LOCAL		
LOCAL	REMOTE	ON	Follows the input signal from the main unit
	OFF		Ignores the input signal
	LOCAL		Follows the input signal from the main unit

6-3-9. Re-initializing the system

Changing the settings for the items below requires system re-initialization.

- SW5-8 (use or non-use of external water temp. thermistor) (Applicable only to multiple systems)
- SW5-9 (multiple unit control)
- SW6-3 (water temp. control method)
- System setting [107] (total number of units in the system)
- SWU1 and SWU2 (unit address)
- System setting [108] (secondary FTC unit group)

Steps

1) Set SW7-1, 2, 3, 4 to ON.
[FFFF] will appear on LD301.
2) Press and hold SPW3 for 3 seconds.
While the system is starting up, [EEEE] will appear on LD301.
3) Press and hold SPW3 for one second.
[9999] will appear on LD301.
4) Set SW7-1, 2, 3, 4 to OFF.

6-3-10.Resetting the system

Follow the steps below to reset the system or an error.
Note that errors must be reset on the main unit.
When an error on the main unit is reset, all sub units will stop.

Steps

1) Set SW7-1, 2, 3, 4 to ON.
[FFFF] will appear on LD301.
2) Press and hold SWP3 for one second.
While the system is starting up, [9999] will appear on LD301.
3) Set SW7-1, 2, 3, 4 to OFF.

6-3-11.Priority order of the water-temp-setting-input-signal sources

Water temperature can be controlled by signals from different types of input sources. The setting for the item with higher priority will override the settings for the items with lower priorities. Water temperature will be controlled based on the temperature setting in the "Target water temperature" column.

Priority 1	Priority 2	Priority 3		Priority 4			Priority 5	Target water temp.	Active sensor when SW5-8 is ON(*1)
Analog input (SW 5-7)	Schedule setting from control board	SWS1 / RC	Schedule type (RC)	Dry contact (*2) Anti-freeze	Dry contact (*2) Hot water	Dry contact (*2) Heating ECO	Remote controller / Input from centralized controller AE-C400 or BMS		
ON	ON	SWS1:LOCAL	-	-	-	-	-	Temp. setting for analog signal input	TH14
		SWS1: REMOTE Dry contact: ON	In time	-	-	-	-	Temp. setting for analog signal input	TH14
			After-hours	ON	-	-	-	25°C	-
				OFF	-	-	-	Stop	-
		SWS1: REMOTE Dry contact: Stop	-	ON	-	-	-	25°C	-
				OFF	-	-	-	Stop	-
	OFF	SWS1: LOCAL Operation command: ON	-	ON	-	-	-	25°C	-
				OFF	-	-	Anti-freeze	25°C	-
					-	-	Heating	Temp. setting for analog signal input	TH14
		SWS1: REMOTE Operation command: OFF	-	ON	-	-	-	25°C	-
				OFF	-	-	Anti-freeze	Stop	-
					-	-	Heating	Stop	-
OFF	ON	SWS1: LOCAL	-	-	-	-	-	Selectable from temp. settings A through C by scheduled operation of the control board	Selectable fromTH14 or TH15
		SWS1: REMOTE Dry contact: ON	In time	-	-	-	-	Selectable from temp. settings A through C by scheduled operation of the control board	Selectable fromTH14 or TH15
			After-hours	ON	-	-	-	25°C	-
				OFF	-	-	-	Stop	-
		SWS1: REMOTE Dry contact: Stop	-	ON	-	-	-	25°C	-
				OFF	-	-	-	Stop	-
	OFF	SWS1: LOCAL Operation command: ON	-	ON	-	-	-	25°C	-
				OFF	ON	-	-	Temp. setting B (Hot water mode)	Selectable fromTH14 or TH15
					OFF	ON	-	Temp. setting C (Heating ECO mode)	Selectable fromTH14 or TH15
						OFF	Heating	Temp. setting A (Heating mode)	Selectable fromTH14 or TH15
							Hot water	Temp. setting B (Hot water mode)	Selectable fromTH14 or TH15
							Heating ECO	Temp. setting C (Heating ECO mode)	Selectable fromTH14 or TH15
							Anti-freeze	25°C	-
		SWS1: REMOTE Operation command: OFF	-	ON	-	-	-	25°C	-
				OFF	ON	-	-	Stop	-
					OFF	ON	-	Stop	-
						OFF	Heating	Stop	-
							Hot water	Stop	-
							Heating ECO	Stop	-
							Anti-freeze	Stop	-

*1:When SW5-8 is set to OFF, water temp. will be controlled by the built-in thermistor TH11 on the unit.
*2:Priority is given in the order of Anti-freeze, Hot water, and Heating ECO.

IMPORTANT

- When the outlet water temp. setting is below 35°C or the inlet water temp. setting is below 30°C, the target water temp. may be overridden to the lower limit shown in the specifications from the perspective of the unit protection. Refer to the following page(s). "Specifications" (p. 98)
- The Thermo-ON/OFF control follows the overridden target.
- Set the target water temp. within the upper and lower limits shown in the specifications.

6-3-12.Water-temperature setting

[1] Setting the individual water temp. for item codes 11, 13, and 22-27

Steps

Step 0

Set SWS1 to OFF.

Set SWS1 to OFF with the local switch.

The settings for items 22 through 27 cannot be changed unless SWS1 is set to OFF (except from the optional remote controller).

Step 1

Select the outdoor temp. input source.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	ON	OFF	OFF

Settable item	Item Code	Initial value	Unit	Limits and increments			Notes	Setting change from optional remote controller
				Increments	Lower limit	Upper limit		
Outdoor temp. input source	1080	0		1	0	1		No

0: Outdoor temp. thermistor (TH9)

1: IT terminal

Step 2

Set SW5 and SW6 as follows.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	OFF	ON	OFF

Step 3

Press SWP3 to select an item code.

Step 4

Press SWP1 to increase and SWP2 to decrease the value.

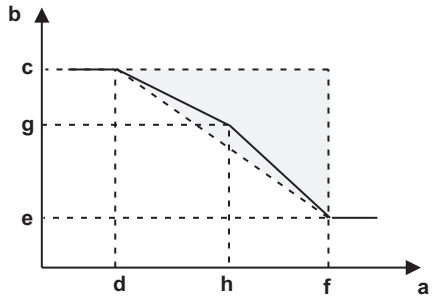
Settable item	Item Code	Initial value	Unit	Setting	Limits		Setting change from optional remote controller
				Increments	Lower limit	Upper limit	
Water temp. setting A (Heating mode)	11	45	°C	0.1°C	24	75	Yes
Water temp. setting B (Hot water mode)	13	65	°C	0.1°C	24	75	Yes
Heating ECO/Water temp. setting C1 *1	22	34	°C	0.1°C	24	75	No
Heating ECO/Outdoor temp. setting C2 *1	23	-7	°C	0.1°C	-25	50	No
Heating ECO/Water temp. setting C3 *1	24	24	°C	0.1°C	24	75	No
Heating ECO/Outdoor temp. setting C4 *1	25	12	°C	0.1°C	-25	50	No
Heating ECO/Water temp. setting C5 *1	26	30	°C	0.1°C	24	75	No
Heating ECO/Outdoor temp. setting C6 *1	27	2	°C	0.1°C	-25	50	No

*1:Need not be set when only a single water temp. setting is used

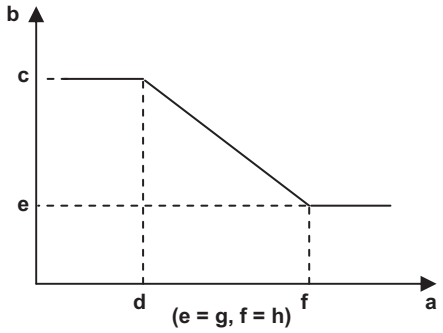
When a signal through a dry contact is used to switch between the Heating, Hot water, and Heating ECO modes, the water temp. setting will be as shown in the figures below.

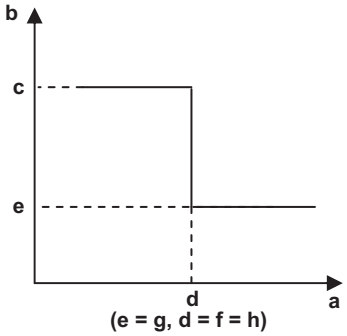
The ranges for water temp. settings A, B, C1, and C3 are shown in the figures below.

Setting ranges for water temp. settings A, B, C1-C6



a Outdoor temp.
b Water temp.
c Water temp. setting C1
d Outdoor temp. setting C2
e Water temp. setting C3
f Outdoor temp. setting C4
g Water temp. setting C5
h Outdoor temp. setting C6





Water temp. control	Lower limit	Upper limit
Outlet-water-temp-based control	24.0°C	75.0°C
Inlet-water-temp-based control	24.0°C	70.0°C

Step 5

Press SWP3 to save the change.

The LED will stop blinking and stay lit. Then, an item code will appear on the LED.

If SWP3 is not pressed within one minute, the change will not be saved, and an item code will appear on the LED.

[2] Scheduled operation

Three sets of start/end times can be set for a day.

A single mode (pre-set temp.) can be selected for each period.

Refer to the following page(s) for detail. "Setting the temperatures for different operation periods" (p. 62)

The function is valid only when SWS1 is set to "REMOTE."

Steps

Step 0

Set SWS1 to OFF.

Set SWS1 to OFF with the local switch.

Settings cannot be changed unless SWS1 is set to OFF (except from the optional remote controller).

Step 1

Set SW5 and SW6 as follows.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	OFF	ON	OFF

Step 2

Press SWP3 to select an item code.

Set item code 5 to 1, and set the times for item codes 1, 6 through 9, 18, and 19 as necessary.

Step 3

Press SWP1 to increase and SWP2 to decrease the value.

Settable item	Item Code	Initial value	Unit	Limits and increments		
				Increments	Lower limit	Upper limit
Current time	1	0000	Hour: minute	1 min.	0000	2359
Enable or disable schedule (ON/OFF)	5	0	Enable: 1 Disable: 0	1	0	1
Start time 1	6	0000	Hour: minute	1 min.	0000	2359
End time 1	7	0000	Hour: minute	1 min.	0000	2359
Start time 2	8	0000	Hour: minute	1 min.	0000	2359
End time 2	9	0000	Hour: minute	1 min.	0000	2359
Start time 3	18	0000	Hour: minute	1 min.	0000	2359
End time 3	19	0000	Hour: minute	1 min.	0000	2359

Step 4

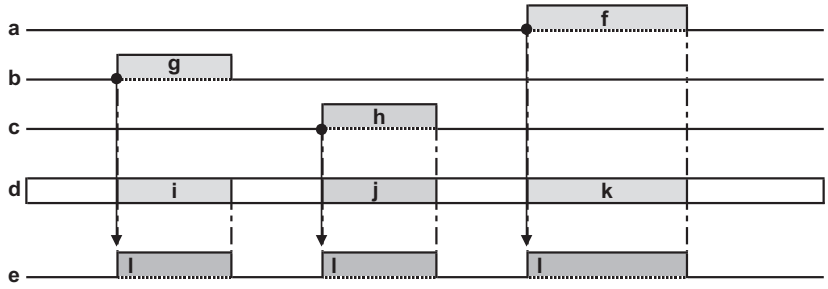
Press SWP3 to save the change.

The LED will stop blinking and stay lit. Then, an item code will appear on the LED.

If SWP3 is not pressed within one minute, the change will not be saved, and the LED will display the item code.

Note: Setting code 5 to "1" will lock the remote controller's schedule function.

(1) Effective/ineffective settings for overlapping and non-overlapping periods
[No overlapping periods]



a Period 1
b Period 2
c Period 3
d Set temp.
e Operation command signal
f Period 1
g Period 2
h Period 3
i Item code 1219 setting
j Item code 1220 setting
k Item code 1218 setting
l ON

en

[Overlapping periods 1 and 2](Period 2 setting will be ineffective.)

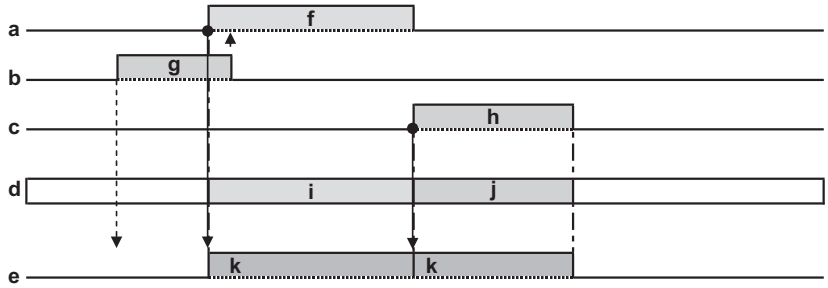
Note:

If two or more operation periods overlap, the settings for the period with a smaller number will be effective.

If End time 1 and Start time 3 are set to the same value, the setting for Start time 3 will be ineffective.

Set Start time 3 to a time at least one minute after End time 1.

Note that once the compressor stops at End time 1, the restart delay function will keep the compressor from restarting for three minutes.

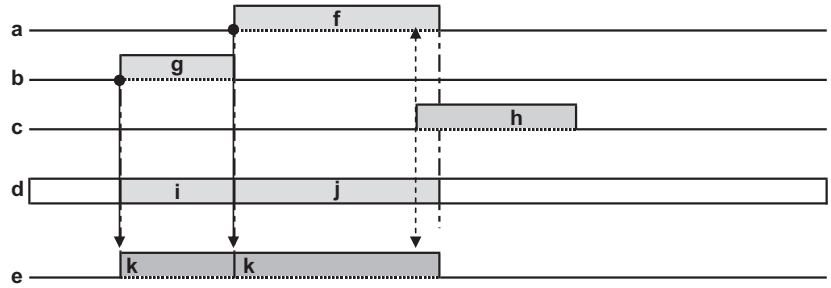


a Period 1
b Period 2
c Period 3
d Set temp.
e Operation command signal
f Period 1
g Period 2
h Period 3
i Item code 1218 setting
j Item code 1220 setting
k ON

[Overlapping periods 1 and 3](Period 3 setting will be ineffective.)

Note:

Refer to the following page(s) for detail. "[Overlapping periods 1 and 2](Period 2 setting will be ineffective.)" (p. 59)

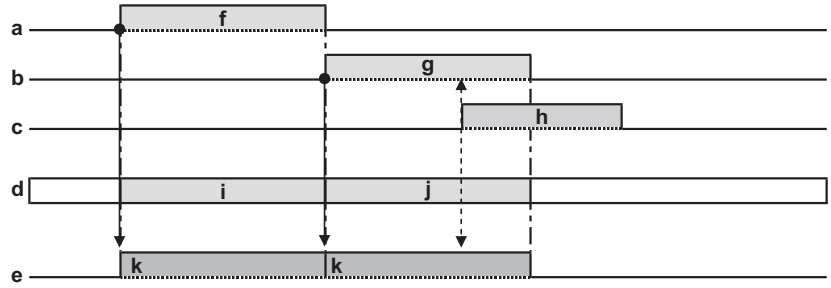


a Period 1
b Period 2
c Period 3
d Set temp.
e Operation command signal
f Period 1
g Period 2
h Period 3
i Item code 1218 setting
j Item code 1219 setting
k ON

[Overlapping periods 2 and 3](Period 3 setting will be ineffective.)

Note:

Refer to the following page(s) for detail. "[Overlapping periods 1 and 2](Period 2 setting will be ineffective.)" (p. 59)

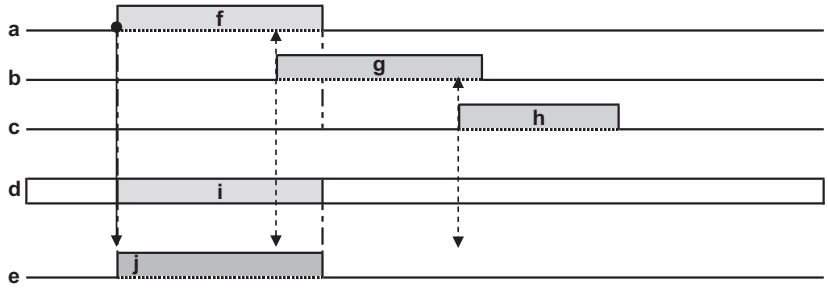


a Period 1
b Period 2
c Period 3
d Set temp.
e Operation command signal
f Period 1
g Period 2
h Period 3
i Item code 1218 setting
j Item code 1219 setting
k ON

[Overlapping periods 1 and 2, and 2 and 3](Period 2 and 3 settings will be ineffective.)

Note:

Refer to the following page(s) for detail. "[Overlapping periods 1 and 2](Period 2 setting will be ineffective.)" (p. 59)



a Period 1
b Period 2
c Period 3
d Set temp.
e Operation command signal
f Period 1
g Period 2
h Period 3
i Item code 1218 setting
j ON

[3] Setting the temperatures for different operation periods

Steps

Step 0

Set SWS1 to OFF.

Set SWS1 to OFF with the local switch.

Settings cannot be changed unless SWS1 is set to OFF (except from the optional remote controller).

Step 1

Set SW5 and SW6 as follows.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	ON	OFF	OFF

Step 2

Press SWP3 to select an item code (1215-1220), and set the temperature for each item.

Step 3

Press SWP1 to increase and SWP2 to decrease the value.

Settable item	Item Code	Initial value	Unit	Limits and increments			Setting change from optional remote controller
				Increments	Lower limit	Upper limit	
Pre-set temp. A (Heating)	1215	14	TH	1	14	15	No
Pre-set temp. B (Hot Water)	1216	14	TH	1	14	15	No
Pre-set temp. C (Heating ECO)	1217	14	TH	1	14	15	No
Start/End time 1 (ON/OFF) water temp. setting *1	1218	1		1	1	3	No
Start/End time 2 (ON/OFF) water temp. setting *2	1219	1		1	1	3	No
Start/End time 3 (ON/OFF) water temp. setting *3	1220	1		1	1	3	No

*1:Pre-set temp. A (Heating)
*2:Pre-set temp. B (Hot Water)
*3:Pre-set temp. C (Heating ECO)

Step 4

Press SWP3 to save the change.

The LED will stop blinking and stay lit. Then, an item code will appear on the LED.

If SWP3 is not pressed within one minute, the change will not be saved, and the LED will display the item code.

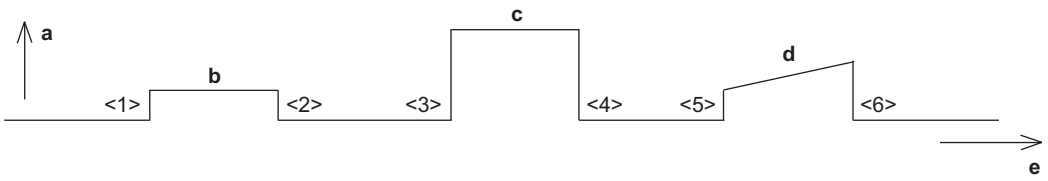
Temp. settings for periods 1, 2, and 3 are selectable from pre-set temp. A, B, or C.

Item code 1218: Period 1
Item code 1219: Period 2
Item code 1220: Period 3
Item code 1215: Pre-set temp. A (Item code 11: Heating)
Item code 1216: Pre-set temp. B (Item code 13: Hot Water)
Item code 1217: Pre-set temp. C (Item codes: 22-27: Heating ECO)

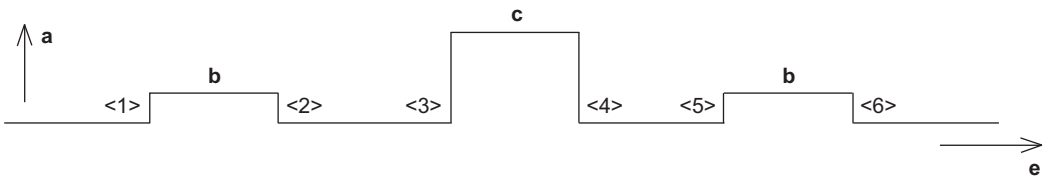
Temp. settings for each period

	Item code 1218-1220	Item code 1215-1217	Ex. 1	Ex. 2	Ex. 3
<1> <2>	Start time 1 End time 1	Operation 1 (Select pre-set temp. from A, B, or C)	Heating	Heating	Hot Water
<3> <4>	Start time 2 End time 2	Operation 2 (Select pre-set temp. from A, B, or C)	Hot Water	Hot Water	Heating ECO
<5> <6>	Start time 3 End time 3	Operation 3 (Select pre-set temp. from A, B, or C)	Heating ECO	Heating	Hot Water

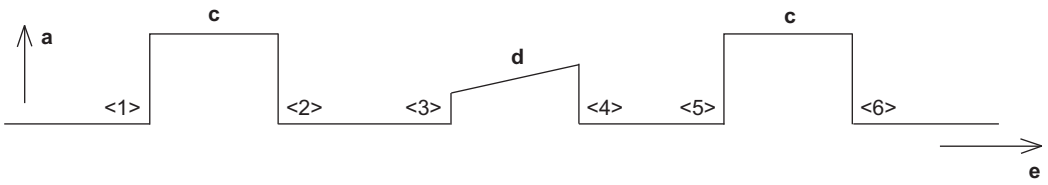
Ex. 1



Ex. 2



Ex. 3



a Temperature
b Heating
c Hot Water
d Heating ECO
e Time

[4] Peak-demand control

The peak-demand control function controls the maximum compressor frequency and the number of units in operation during high loads according to the peak demand control signal.

Individual system	Multiple system
Max.	Compressor frequency

Steps

(1) Setting the maximum frequency setting

Step 0

Set SWS1 to OFF.

Set SWS1 to OFF with the local switch.

Settings cannot be changed unless SWS1 is set to OFF (except from the optional remote controller).

Step 1

Set SW5 and SW6 as follows.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	OFF	ON	OFF

Step 2

Press SWP3 to select item code 2, 3, or 4.

Step 3

Press SWP1 to increase and SWP2 to decrease the value.

Settable item	Item Code	Initial value	Unit	Limits and increments			Setting change from optional remote controller
				Increments	Lower limit	Upper limit	
Max. frequency ratio	2	100	%	5%	0	100	Yes
Peak-demand control start time	3	1300	Hour: minute	1	0000	2359	No
Peak-demand control end time	4	1300	Hour: minute	1	0000	2359	No

---

Step 4

Press SWP3 to save the change.

The LED will stop blinking and stay lit. Then, an item code will appear on the LED.

If SWP3 is not pressed within one minute, the change will not be saved, and the LED will display the item code.

- When the peak-demand control contact is ON, units will operate at the max. capacity set in the steps above.

[5] Setting the total number of units for a multiple system

Step 0

Set SWS1 to OFF.

Set SWS1 to OFF with the local switch.

Settings cannot be changed unless SWS1 is set to OFF.

Step 1

Set SW5 and SW6 as follows to select the type of external inputs.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	ON	ON	ON

Step 2

Press SWP3 to select item code 107.

Step 3

Press SWP1 to increase and SWP2 to decrease the value.

Item Code	Increments	Lower limit	Upper limit	Initial value
107	1	1	7	1

*1:Including the main unit. Applicable only to the main unit.

Step 4

Press SWP3 to save the change.

The LED will stop blinking and stay lit. Then, an item code will appear on the LED.

If SWP3 is not pressed within one minute, the change will not be saved, and the LED will display the item code.

Step 5

Turn the power back on to re-initialize the system.

Refer to the following page(s) for detail."Re-initializing the system" (p. 54)

The new setting will not be saved unless re-initialization is performed.

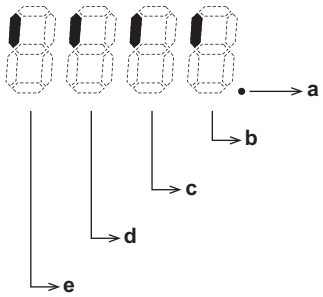
Setting the unit addresses

Refer to the following page(s) for detail. "System configuration procedures: Multiple system" (p. 50)

[6] Selecting the item to display on the LED

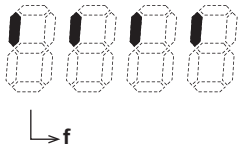
SW5	SW6						Display content
10	5	6	7	8	9	10	
OFF	OFF	OFF	ON	OFF	OFF	OFF	Displays operation mode 1
OFF	OFF	ON	ON	OFF	OFF	OFF	Displays operation mode 2
OFF	ON	ON	OFF	OFF	OFF	OFF	Displays the current water temp.
OFF	ON	OFF	OFF	OFF	OFF	OFF	Displays the water-temp. setting
OFF	OFF	OFF	OFF	OFF	OFF	OFF	Displays the high and low refrigerant pressures

Operation mode 1



a Lights up when the operation command signal is ON
Lights off when the operation command signal is OFF
b A: Compressor in operation
S: Compressor is stopped.
c S: Fan is forced to operate.
-: Function is disabled.
d d: Demand control is enabled
-: Function is disabled.
e Displays the operation mode
H: Water heating operation
F: Pump in freeze-up protection operation

Operation mode 2



f Displays the system control mode
S: Multiple system control
A: Individual system control

[7] Selecting the remote water temp. setting input signal type

The following four external analog input signals can be used to set water temperatures by setting SW5-7.
"0": 4-20 mA
"1": 0-10 V
"2": 1-5 V
"3": 2-10 V

Steps

Step 1

Set SW501-1, SW501-2, SW5, and SW6 as follows.

	SW501-1	SW501-2
4-20 mA	ON	ON
0-10 V	OFF	OFF
1-5 V	OFF	ON
2-10 V	OFF	OFF

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	OFF	ON	OFF

Step 2

Press SWP3 to select item code 21.

Step 3

Press SWP1 or SWP2 to select the input signal type.

Settable item	Item Code	Initial value *1	Limits and increments			Setting change from optional remote controller
			Increments	Lower limit	Upper limit	
Water temp. setting input signal type	21	0	1	0	3	No

*1:0: 4-20 mA, 1: 0-10 V, 2: 1-5 V, 3: 2-10 V

Step 4

Press SWP3 to save the change.

The LED will stop blinking and stay lit. Then, an item code will appear on the LED.
If SWP3 is not pressed within one minute, the change will not be saved, and the LED will display the item code.

[8] Setting the water temperature using analog signal input

For how to set the settings, refer to the following section."Selecting the remote water temp. setting input signal type" (p. 67)

When SW5-7 is set to ON (enable external input), target water temp. will be determined based on the pre-set temp. A and B and the type of analog input signal.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	OFF	ON	OFF

Settable item	Item Code	Initial value	Unit	Limits and increments			Note	Setting change from optional remote controller
				Increments	Lower limit	Upper limit		
Analog input signal	1051	0		1	0	3		No

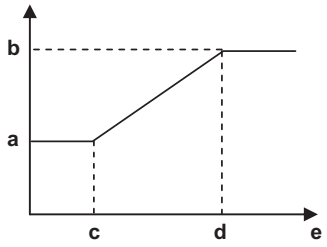
0: Water temp. input analog
1: Capacity control input 4-20 mA
2: Water temp. input IT terminal
3: Capacity control input IT terminal

(1) Input signal type 0 (4-20 mA)

- External analog input signal of 5.9 mA: Pre-set temp. A (Item code 11)
- External analog input signal of 18.3 mA: Pre-set temp. B (Item code 13)
- External analog input signal of between 5.9 and 18.3 mA: Pre-set temp. will be linearly interpolated.

  Pre-set temp. = (B - A) * (Input current - 5.9 mA)/12.4 mA + A

  Change of 0.12 mA or less is not recognized.



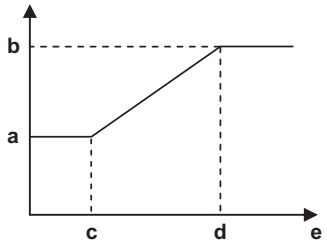
a Pre-set temp. A
b Pre-set temp. B
c 5.9 mA
d 18.3 mA
e Input current

(2) Input signal type 1 (0-10 V)

- External analog input signal of 1.0 V: Pre-set temp. A (Item code 11)
- External analog input signal of 9.1 V: Pre-set temp. B (Item code 13)
- External analog input signal of between 1.0 and 9.1 V: Pre-set temp. will be linearly interpolated.

  Pre-set temp. = (B - A) * (Input voltage - 1.0 V)/8.1 V + A

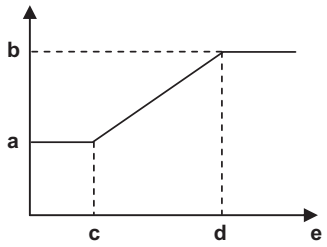
  Change of 59 mV or less is not recognized.



a Pre-set temp. A
b Pre-set temp. B
c 1.0 V
d 9.1 V
e Input voltage

(3) Input signal type 2 (1-5 V)

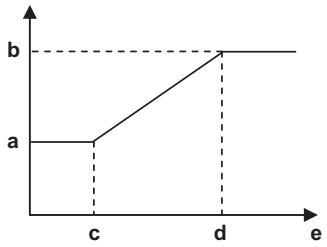
- External analog input signal of 1.5 V: Pre-set temp. A (Item code 11)
- External analog input signal of 4.5 V: Pre-set temp. B (Item code 13)
- External analog input signal of between 1.5 and 4.5 V: Pre-set temp. will be linearly interpolated.
  Pre-set temp. = (B - A) * (Input voltage - 1.5 V)/3.0 V + A
  Change of 29 mV or less is not recognized.



a Pre-set temp. A
b Pre-set temp. B
c 1.5 V
d 4.5 V
e Input voltage

(4) Input signal type 3 (2-10 V)

- External analog input signal of 2.9 V: Pre-set temp. A (Item code 11)
- External analog input signal of 9.1 V: Pre-set temp. B (Item code 13)
- External analog input signal of between 2.9 and 9.1 V: Pre-set temp. will be linearly interpolated.
  Pre-set temp. = (B - A) * (Input voltage - 2.9 V)/6.2 V + A
  Change of 59 mV or less is not recognized.



a Pre-set temp. A
b Pre-set temp. B
c 2.9 V
d 9.1 V
e Input voltage

[9] Setting the capacity control ratio using analog signal input

For how to set the settings, refer to the following section."Selecting the remote water temp. setting input signal type" (p. 67)

(Set item code 1051 instead of 21.)

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	OFF	ON	OFF

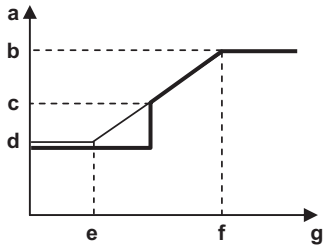
Settable item	Item Code	Initial value	Unit	Limits and increments			Note	Setting change from optional remote controller
				Increments	Lower limit	Upper limit		
Analog signal input	1051	0		1	0	3		No

0: Water temp. input analog
1: Capacity control input 4-20 mA
2: Water temp. input IT terminal
3: Capacity control input IT terminal

When SW5-7 is set to ON (Enable external input), the capacity control ratio will be determined based on the type of analog input signal.

(1) Input signal type 0 (4-20 mA)

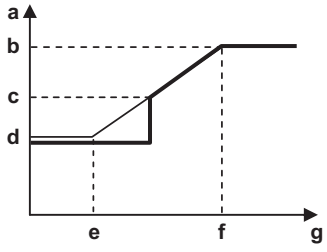
- External analog input signal of 5.9 mA: 0%
- External analog input signal of 18.3 mA: 100%
- External analog input signal of between 5.9 and 18.3 mA: Percentage will be linearly interpolated.
  Pre-set temp. = 100% * (Input current - 5.9 mA)/12.4 mA
  Change of 0.12 mA or less is not recognized.



a Load ratio
b 100%
c *%
d 0%
e 5.9 mA
f 18.3 mA
g Input current

(2) Input signal type 1 (0-10 V)

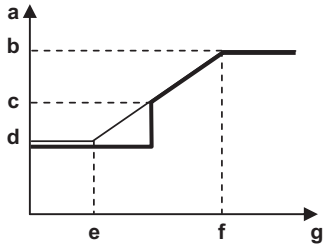
- External analog input signal of 1.0 V: 0%
- External analog input signal of 9.1 V: 100%
- External analog input signal of between 1.0 and 9.1 V: Percentage will be linearly interpolated.
  Pre-set temp. = 100% * (Input voltage - 1.0)/8.1 V
  Change of 59 mV or less is not recognized.



a Load ratio
b 100%
c *%
d 0%
e 1.0 V
f 9.1 V
g Input voltage

(3) Input signal type 2 (1-5 V)

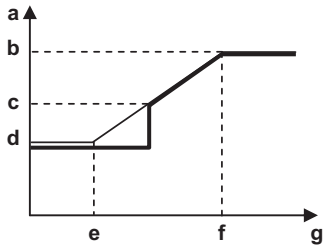
- External analog input signal of 1.5 V: 0%
- External analog input signal of 4.5 V: 100%
- External analog input signal of between 1.5 and 4.5 V: Percentage will be linearly interpolated.
  Pre-set temp. = 100% * (Input voltage - 1.5)/3.0 V
  Change of 29 mV or less is not recognized.



a Load ratio
b 100%
c *%
d 0%
e 1.5 V
f 4.5 V
g Input voltage

(4) Input signal type 3 (2-10 V)

- External analog input signal of 2.9 V: 0%
- External analog input signal of 9.1 V: 100%
- External analog input signal of between 2.9 and 9.1 V: Percentage will be linearly interpolated.
  Pre-set temp. = 100% * (Input voltage - 2.9 V)/6.2 V
  Change of 59 mV or less is not recognized.



a Load ratio
b 100%
c *%
d 0%
e 2.9 V
f 9.1 V
g Input voltage

* %: Compressor will stop when the compressor frequency drops below the low frequency limit, depending on the outside and water temperatures.

[10] Setting the booster heater 1 operation conditions

Set the booster heater 1 trigger temperatures for item codes 1057 and 1058 (TWL1 and TAL1).

Booster heater 1 start conditions

(1) Individual system

Operation command signal is ON, and at least one of the following two conditions is met.

1) Water temp. control is set to OFF, water temp. drops below TWL1, and outdoor temp. drops below TAL1.
2) Water temp. control is set to ON, external water temp. thermistor reading drops below TWL1, and outdoor temp. drops below TAL1.

(2) Multiple system

Operation command signal is ON, and the following conditions are met.
External water temp. thermistor readings (TH14 and TH15) drop below TWL1, and the reading of the outdoor temp. thermistor connected to the main unit drops below TWL1.

Booster heater 1 stop conditions

Operation command signal is OFF, or both of the following conditions are met.

1) Water temp. is at or above TWL1+2°C, or outdoor temp. is at or above TAL1+2°C.
2) External water temp. thermistor readings (TH14 and TH15) are at or above TWL1+2°C, or the reading of the outdoor temp. thermistor (TH9) connected to the main unit exceeds TAL1+2°C.

Steps

Step 1

Set SW5 and SW6 as follows to select the outdoor temp. input source.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	ON	OFF	OFF

Settable item	Item Code	Initial value	Unit	Limits and increments			Note	Setting change from optional remote controller
				Increments	Lower limit	Upper limit		
Outdoor temp. input source	1080	0		1	0	1		No

0: Outdoor temp. thermistor (TH9)
1: IT terminal

Step 2

Set SW5 and SW6 as follows to select the output temp. input source.

SW5	SW6					
10	5	6	7	8	9	10
OFF	OFF	OFF	OFF	OFF	ON	OFF

Settable item	Item Code	Initial value	Unit	Limits and increments			Setting change from optional remote controller
				Increments	Lower limit	Upper limit	
Booster heater 1 trigger water temp. (TWL1)	1057	40	°C	0.1	0	75	No
Booster heater 1 trigger outdoor temp. (TAL1)	1058	-10	°C	0.1	-30	50	No

Step 3

Press SWP3 to save the change.

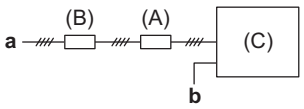
The LED will stop blinking and stay lit.
Then, an item code will appear on the LED.
If SWP3 is not pressed within one minute, the change will not be saved, and an item code will appear on the LED.

7. Electrical Wiring Installation

7-1. Power Supply, Breaker, and Cable Requirements

Wiring schematic

a 3N~380–415 V
L1, L2, L3, N
b PE (Protective Earth)



(A) Current breaking switch
(B) Earth leakage breaker (ELB)
(C) Outdoor unit

Wire size, switch capacity, and system impedance

Model	Min. wire size (mm^2)			ELB	Local switch (A)		Overcurrent breaker (A)	Max. permissive system impedance
	Main	Branch	Ground		Capacity	Fuse		
CAHV-Z450YA-HPB	14	-	14	50 A 100 mA 0.1 sec. or less	50	50	50	0.15 Ω

en

To minimize the risk of electrical leakage, electric shock, noise interference, malfunction, overheating, smoke, or fire, electrical work must be conducted only by a certified electrician, following all relevant local wiring regulations and the instructions detailed below and in this manual. Consider the ambient conditions, and consult the power company as necessary.

Power supply

- This equipment complies with IEC 61000-3-12, provided the short-circuit power S_{SC} at the interface point is greater than or equal to the S_{SC} value (MVA) of 3.93.
  Ensure the equipment is connected only to a power supply with a short-circuit power S_{SC} greater than or equal to this value.

- Ensure each unit has its own dedicated power supply and is individually wired.
- Connect this device to a power supply system that has a maximum permissible system impedance at the user's supply interface point as shown in the table.
- Maintain a power supply voltage drop of no more than 10%. The table provides the minimum wire size for use with a metal conduit. If voltage drop is a problem, consider increasing the wire size.

Breaker/ground

- Only use properly rated breakers and fuses, including an earth leakage breaker, a local switch (switch + fuse), or an overcurrent breaker that matches the unit capacity, leakage current limit, and current breaking threshold.
- Use breakers with at least 3.0 mm contact separation in each pole.
- When using an earth leakage breaker without an overcurrent breaker, combine it with a local switch and a molded case circuit breaker.
- Install an earth leakage breaker for each unit's power supply.
- For INV circuits, use a Mitsubishi Electric NV-S series earth leakage breaker or its equivalent.
- A large electric current due to malfunction or faulty wiring can trigger the earthleakage breakers on both the unit side and the upstream side of the power supply. Either separate the power supply system or coordinate breaker protection to provide higher protection.
- Some installation sites may require an additional earth leakage breaker for the inverter.
- Provide proper grounding, avoiding connections to gas pipes, water pipes, lightning rods, or telephone wires.

Cable/connector

- Only use standard power supply cable of sufficient capacity.
- For outdoor use, power supply cables should be no lighter than polychloroprene sheathed flexible cord (design 60245 IEC57).
- Include some slack in the power supply cable.
- Replace the power supply cable immediately if damaged.
- Grounding wire should be longer than the power supply cable.
- Use specified cables and avoid straining terminal connections.
- Tighten all terminal screws to the specified torque.

Misc.

Avoid installing a phase advancing capacitor on the motor as it could cause damage and potentially start a fire.

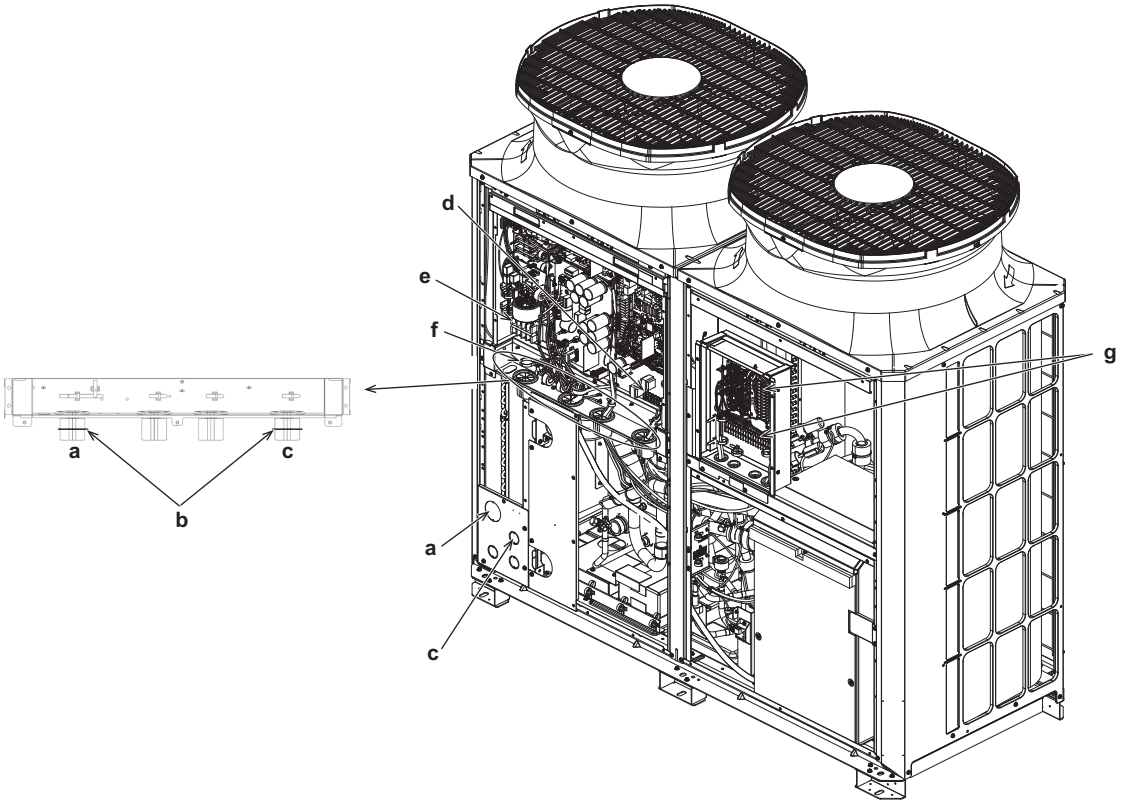
[1] Control cable specifications

Remote controller cable	Size	0.3 - 1.25 mm^2 (Max. 200 m)
	Recommended cable	CVV
M-NET cable between units *1	Size	Min. 1.25 mm^2
	Recommended cable	Shielded CVVS, CPEVS, or MVVS cable (Max. 200 m)
External input wire size *2	Size	Min. 0.3 mm^2
	Recommended cable	Shielded CVVS, CPEVS or MVVS cable
External output wire size *2	Size	1.25 mm^2
	Recommended cable	Shielded CVVS, CPEVS or MVVS cable

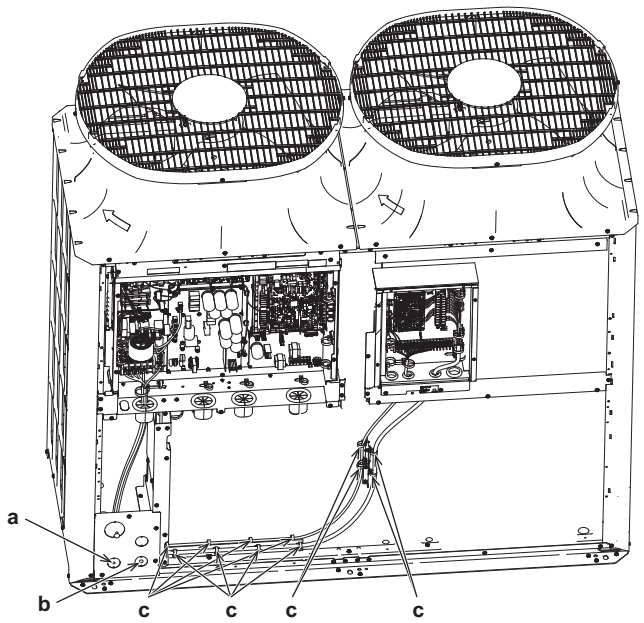
*1:Use a CVVS or CPEVS cable if a source of noise interference is nearby.
*2:With at least 1-mm-thick supplementary insulation

7-2. Schematics of a Unit and Its Terminal Blocks

Front panels of the control box are removable by unscrewing the four screws and pulling the panels forward and down.



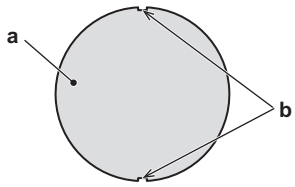
a Power wire
b Fasten with cable ties
c Transmission cable
d Transmission terminal block
e Power supply terminal block (TB1)
(Power supply cables larger than 25 mm^2 are not connectable to TB1. Use a pull box to connect them.)
f Cable tie
g Control terminal block (TB5,TB6)



a < 24 V
b > 100 V
c Cable tie

7-3. Wire Knockout Hole and Conduit

- Punch out the wire knockout hole at the bottom of the front panel with a hammer.
- Consider using a conduit if damage to wires by animals is a concern.
- If not using a conduit, deburr the knockout hole, and wrap the wires with protective tape.
- If damage from animals is a concern, use a conduit tube to narrow the opening.

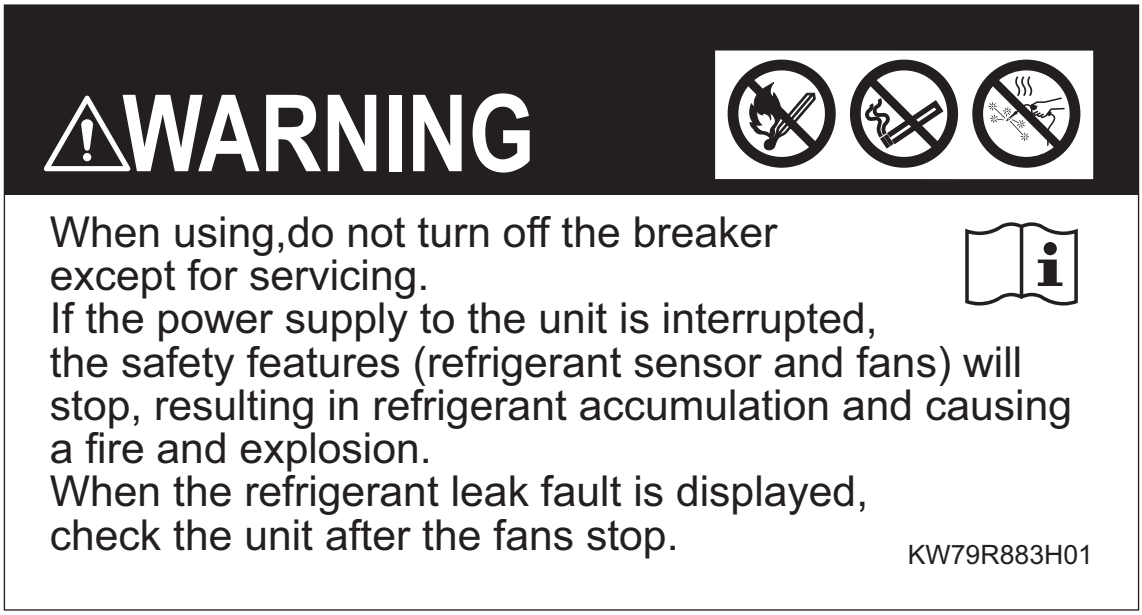


a Knockout hole
b Burr

7-4. Breaker Tag Installation

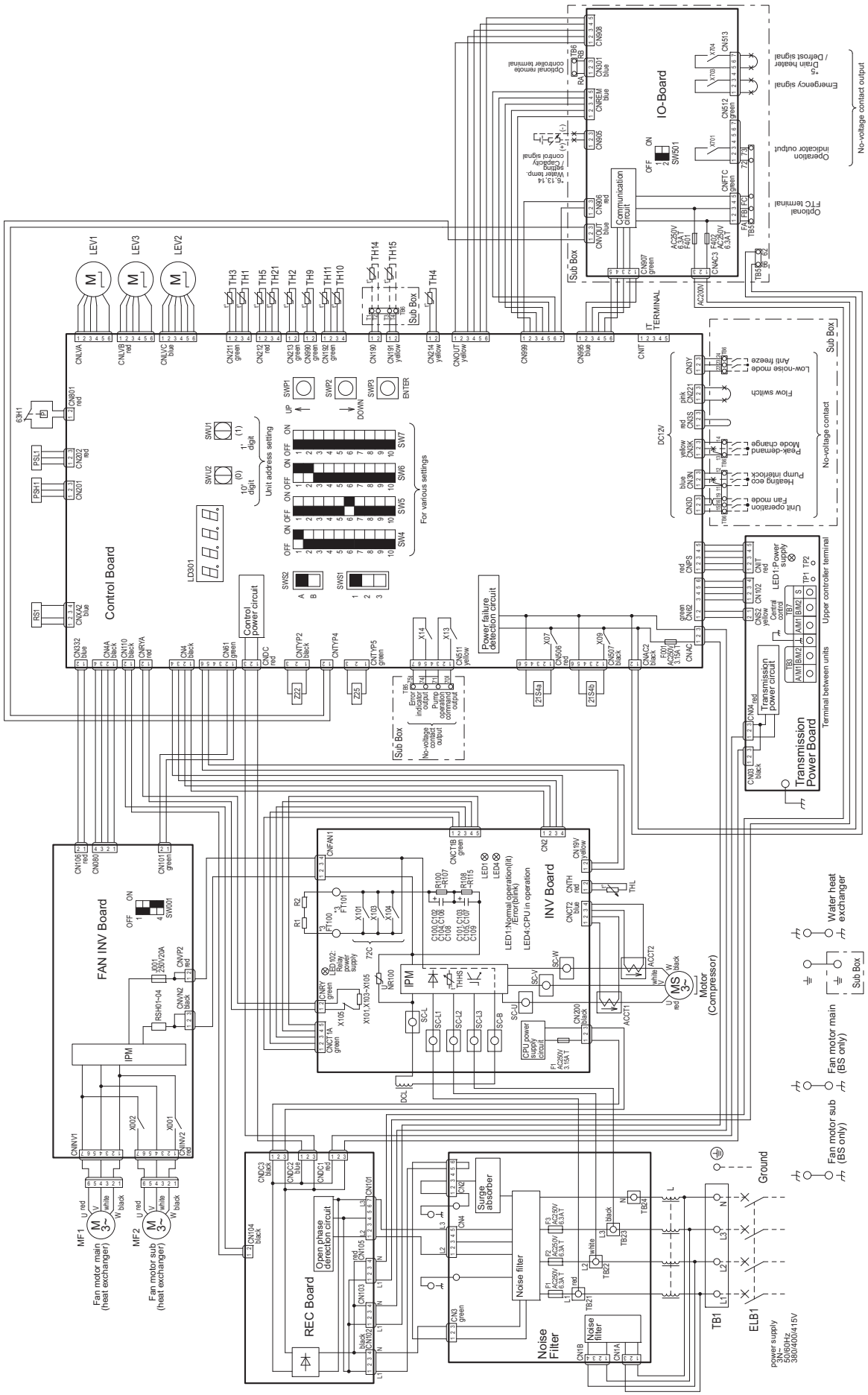
Do not turn off the breaker except for servicing.

- This unit is equipped with the refrigerant sensor and electrically powered safety measures.
- To be effective, the unit must be electrically powered at all times after installation, other than when servicing.
- To prevent the power from being switched off, attach the provided the caution tag to the local breaker to alert personnel.



7-5. Electrical Wiring Diagram

CAHV-Z450YA-HPB (-BS)



The specification of the product is for the improvement a previous notice and might change.

Note 1. The broken lines indicate the optional parts,field-supplied parts,and field work.
2. Dashed lines indicate Sub box.
3. Faston terminals have a locking function.
Press the tab in the middle of the terminals to remove them.
Check that the terminals are securely locked in place after insertion.
4. The symbols of the field connecting terminals are as follows.
○: Terminal block ×: Connection by cutting the short circuit wire
5. Selects either Drain heater signal or Defrost signal by SW5 and SW6 settings.
(Item code 1056)
6. Selects either Water temp. setting or Capacity control input signal by SW5 and SW6 settings. (Item code 1051)
7. Make sure to connect a pump interlock contact.
A short-circuit may cause abnormal stop or malfunctions.
8. The preset temp. setting can be switched from the no-voltage contact or by setting time ranges.
9. The method of input signal of operation can choose one of optional remote controller or no-voltage input.
10. Leave a space of at least 5 cm between the low voltage external wiring (no-voltage contact input and remote controller wiring) and wiring of 100V or greater. Do not place them in the same conduit tube or cabtyre cable as this will damage the circuit board.
11. When cabtyre cable is used for the control cable wiring, use a separate cabtyre cable for the following wiring.
Using the same cabtyre cable may cause malfunctions and damage to the unit.
(a) Optional remote controller wiring
(b) No-voltage contact input wiring
(c) No-voltage contact output wiring
(d) Remote water temp. setting
12. Use a contact that takes 12VDC 1mA for no-voltage contact input.
13. Need to selects either Water temp. setting input signal.
Set the SW501 as shown in the table below.

	SW501-1	SW501-2
4~20mA	ON	ON
0~10V	OFF	OFF
1~ 5V	OFF	ON
2~10V	OFF	OFF

14. Use a 4-20mA signal output device with insulation.
Feeding 30mA or more current may damage the circuit board.

Symbol explanation

Symbol	Explanation	
ACCT1, 2	AC current sensor	
DCL	DC reactor	
F1 (INV Board)	Fuse	
J001 (FAN INV Board)		
LEV1, 3	Linear expansion valve	Pressure control, Refrigerant flow rate control
LEV2		HIC bypass, Refrigerant flow rate control in HIC circuit
MF1, 2	Motor	Fan
MS		Compressor
63H1	Pressure switch	High pressure protection
PSH1	Pressure sensor	High pressure
PSL1		Low pressure
R1, 2	Electrical resistance	
21S4a, b	4-way valve	Cooling/Heating switching
TH1	Thermistor	Discharge pipe temp.
TH2		Suction pipe temp.
TH3		Compressor shell bottom temp.
TH4, 5		Air heat exchanger outlet pipe temp.
TH9		Outdoor temp.
TH10		Inlet water temp.
TH11		Outlet water temp.
TH21		Water heat exchanger outlet pipe temp. (refrigerant side)
THHS		IPM temp.
THL		DC reactor temp.
TH14, 15	External Thermistor (optional)	Water temp.
RS1	Refrigerant sensor	Leakage from refrigerant pipe
Z22, 25	Function setting connector	
72C	Electromagnetic relay (Inverter main circuit)	
ELB1	Earth leakage breaker (field-supplied)	

7-6. External Input/Output

Available signals for local controllers

Input

Dry contact		ON (Close)	OFF (Open)	Terminal block/ connector
(a) UNIT OPERATION	ON/OFF	Unit will start when water temp. drops below the pre-set temp.	Unit will stop except when in the Anti-Freeze mode.	TB6 15-16
(b) HEATING ECO	Heating ECO/ Heating	Unit will start when water temp. drops below water temp. setting C. (Heating ECO mode)	Unit will start when water temp. drops below water temp. setting A. (Heating mode)	CN3N 1-2
(c) MODE CHANGE	Hot water/Heating	Unit will operate when water temp. drops below water temp. setting B.	Unit will start when water temp. drops below water temp. setting A. (Heating)	TB6 13-14
(d) ANTI FREEZE	ON/OFF	Unit will operate in the Anti-Freeze mode (target temp. 25ºC) when the contact status of unit operation (item (a)) is Stop, or the ON/OFF button on the remote controller is off.	Unit will operate based on the status of the unit operation contact (item (a)) or the ON/OFF command from the remote controller.	TB6 22-24
(e) LOW-NOISE MODE	ON/OFF	Unit will operate in the Low-noise mode and below the max. capacity for low noise.	Unit will operate at the max. capacity.	TB6 22-23
(f) FAN MODE	Forced/Normal	Fan will stay in operation after the compressor has stopped (incl. when the operating status is Stop).	Fan will stop when compressor stops.	TB6 15-19
(g) FLOW SWITCH	Normal/Error	Unit is allowed to operate.	Unit will not operate.	CN221 1-3
(h) PUMP INTERLOCK	Normal/Error	Unit is allowed to operate.	Unit will not operate.	TB6 11-12
(i) PEAK-DEMAND CONTROL	ON/OFF	Unit will operate at or below the max. capacity for peak-demand control.	Unit will operate at the max. capacity.	CN3K 1-2
Analog				Terminal block/ connector
Input type		Action		
(j) WATER TEMP. SETTING/CAPACITY CONTROL		Settable by using external analog input to CN905 on IO board. Available analog inputs: 4-20 mA, 1-5 V, 0-10 V, or 2-10 V.		CN905 2-3
(k) EXTERNAL WATER TEMP. THERMISTOR (TH14/Optional)		-		TB6 T1-T2
(l) EXTERNAL WATER TEMP. THERMISTOR (TH15/Optional)		-		TB6 T3-T4

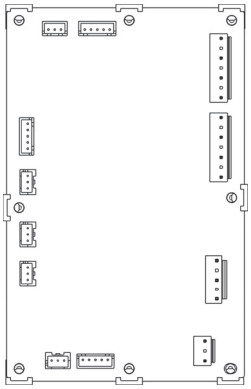
Output

Contact type		Conditions in which the contact closes (turns on)	Conditions in which the contact opens (turns off)	Terminal block/ connector
(m) ERROR INDICATOR	Close/Open	Unit has stopped abnormally.	During normal operation	TB5 74-75
(n) OPERATION INDICATOR	Close/Open	Unit operation contact (item (a)) or the ON/OFF button on the remote controller is ON.	Unit operation contact (item (a)) or the ON/OFF button on the remote controller is OFF.	TB5 72-73
(o) PUMP OPERATION COMMAND	Close/Open	(1) When SW5-8 is set to ON Pump will operate based on Thermo-ON/OFF status. (2) When SW5-8 is set to OFF Pump will operate based on the status of the unit operation contact or the ON/OFF button on the remote controller.	All conditions other than the ones at left	TB5 70-71
(p) EMERGENCY SIGNAL	Close/Open	Water temp. below booster heater operation water temp. (TWL1 value) (Item code 1057) and outdoor temp. (TAL1 value) (Item code 1058).	Water temp.≥ TWL1 + 2ºC or Outdoor temp.≥ TAL1 + 2ºC	CN513 1-3
(q) DRAIN HEATER SIGNAL/ DEFROST SIGNAL	Close/Open	Item code 1056 set to "1": Defrost signal Item code 1056 set to "0": Drain heater signal Outdoor temp. ≤ 1ºC, Outdoor temp. ≤ 3ºC after having once dropped below 1°C, or 1°C ≤ Outdoor temp. ≤ 8°C during defrost cycle	-	CN513 5-7

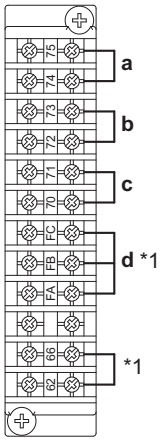
RC/M-NET

REMOTE CONTROLLER	PAR-W31MAA	TB6 RA-RB
M-NET	Transmission line	TB3 A/M1-B/M2
Centralized controller	AE-C400E, EW-C50E	TB7 A/M1-B/M2
Internal/external A-control signal Flow temp. controller	Flow temp. controller (FTC) PAC-IF071B-E PAC-IF072B-E PAC-IF073B-E PAC-SIF051B-E	TB5 FA-FB-FC

[1] IO board



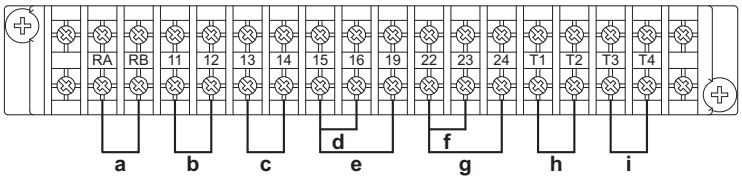
[2] TB5



a Error indicator output
b Operation indicator output
c Pump operation command output
d Optional FTC terminal
Refer to the FTC manual for detail.
*1:CAUTION: High voltage

Outdoor unit	FA	FB	FC
FTC control board	S1	S2	S3

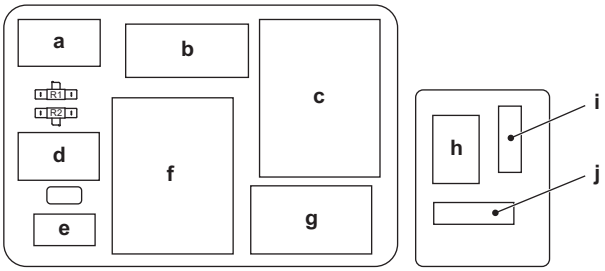
[3] TB6



a Optional remote controller terminal
b Pump interlock
c Mode change
d Unit operation
e Fan mode
f Low-noise mode
g Anti-freeze
h External water temp. thermistor (option) TH14
i External water temp. thermistor (option) TH15

Wire color
Heating ECO: Black
Demand: Brown
Flow switch: White

[4] Inside the control box (front view)



a Rec board
b Fan INV board
c Control board
d Noise filter
e TB1
f INV board
g Transmission power board
h IO board
i TB5
j TB6

[5] Display setting

Control board display	Control board SW setting *1	
Pre-set water temp.	SW6-5: ON	SW6-6: OFF
Current water temp. *2	SW6-5: ON	SW6-6: ON
High pressure/Low pressure	SW5-10: OFF	SW6-8: OFF
	SW6-5: OFF	SW6-9: OFF
	SW6-6: OFF	SW6-10: OFF
	SW6-7: OFF	

*1:Select an item to be displayed by setting the switches.
*2:The current water temperature will be displayed according to the selection on the pre-set water temperature display option.

8. Troubleshooting

Troubleshooting must be performed only by Mitsubishi Electric certified personnel.

8-1. Diagnosing Problems with No Available Error Codes

Resolve the issue causing the unit to stop before resuming operation to prevent possible damage to the unit.

Problem	Symptom		Cause	Solution
Unit does not operate.	Fuse in the control box is intact.	Power lamp on the circuit board is not lit.	Main power is off.	Turn on the power.
		Power lamp on the circuit board is lit.	Pump interlock circuit is disconnected.	Connect the circuit.
			Flow switch is disconnected.	Connect the switch.
	Blown fuse in the control box	Improper circuit resistance or ground resistance	Short circuit or ground fault	Resolve the cause, and replace the fuse.
	Automatic Start/ Stop thermistor trip	Water temp. too high	-	Normal
		Water temp. too low	Automatic Start/Stop thermistor set too low	Increase the setting.
Unit operates, but water temp. does not change.	Water temp. too low	Normal water inlet/ outlet temp. differential	Water-heating load too high	Increase the number of outdoor units.
			Refrigerant shortage due to a leak	Check for and repair any leakage, evaculate the system, and recharge the refrigerant.
		Water inlet/outlet temp. differential too small	LEV fault	Replace the LEV.
			Compressor fault	Replace the compressor.
			High pressure too high, or low pressure too low	Operate the units within the specified pressure range.
	Water temp. too high		Low water flow	Increase the flow rate.
			Problem with external devices	Repair the devices.

8-2. Diagnosing Problems Using Error Codes

If a problem occurs, refer to the table below for troubleshooting before calling for service.

A: Errors resettable regardless of switch settings
B: Errors resettable when the remote reset setting on the unit is set to Enable (default)
Errors non-resettable when the remote reset setting on the unit is set to Disable
C: Errors non-resettable
-: Errors auto-canceled when the cause is removed

Error code *1 (PCB *2)	Preliminary error code	Error (preliminary) detail code	Error type	Cause (Installation/Setting error) (Component problems)	Error reset	
					Unit (PCB)	Remote controller
					SWS1	Operation SW
A000	-	-	Unreset errors *4	Some errors have not been reset.	-	-
4106 A-P0	-	-	Power failure *2	Power failure occurred while the operation switch is on.	A	A
2501 AFSA	-	-	Water supply interruption (Flow switch trip)	Water flow rate dropped below the flow switch threshold. Water supply interruption Open-circuited flow switch Broken flow switch wiring	B	B
1302 AHP1	-	-	High-pressure fault	Water supply interruption LEV fault High-pressure sensor fault	B	B
1502 AdSH	-	-	Compressor flooding	Fan motor fault/broken fan motor wiring Low-pressure sensor fault Compressor shell bottom temp. thermistor fault High-pressure sensor fault Discharge pipe temp. thermistor fault LEV fault	B	B
1505	1605	-	Low-pressure fault	Outdoor temp. below the operating range Clogged air heat exchanger outlet pipe temp. due to sudden frosting or heavy snow Low-pressure sensor fault Air heat exchanger outlet pipe temp. thermistor fault Suction pipe temp. thermistor fault LEV fault Fan motor fault/broken fan motor wiring Refrigerant shortage (refrigerant leak)	B	B

Error code *1 (PCB *2)	Preliminary error code	Error (preliminary) detail code	Error type	Cause (Installation/Setting error) (Component problems)	Error reset	
					Unit (PCB)	Remote controller
					SWS1	Operation SW
1103	-	-	Compressor shell bottom temp. fault	Outdoor temp. above the operating range Excessive oil flow Compressor shell bottom temp. thermistor fault LEV fault	B	B
Thermistor fault (5101, 5102, 5103, 5104, 5105, 5109, 5116, 5111, 5114, 5115, 5121)						
5101	-	-	Discharge pipe temp. thermistor fault (TH1)	Broken or short-circuited thermistor wiring	B	B
5102	-	-	Suction pipe temp. thermistor fault (TH2)	Same as above	B	B
5103	-	-	Compressor shell bottom temp. thermistor fault (TH3)	Same as above	B	B
5104	-	-	Air heat exchanger outlet pipe temp. thermistor fault (TH4)	Same as above	B	B
5105	-	-	Air heat exchanger outlet pipe temp. thermistor fault (TH5)	Same as above	B	B
5109	-	-	Outdoor temp. thermistor fault (TH9)	Same as above	B	B
5116	-	-	Inlet water temp. thermistor fault (TH10)	Same as above	B	B
5111	-	-	Outlet water temp. thermistor fault (TH11)	Same as above	B	B
5114	-	-	External water temp. thermistor fault (TH14)	Same as above	B	B
5115	-	-	External water temp. thermistor fault (TH15)	Same as above	B	B
5121	-	-	Water heat exchanger outlet pipe temp. thermistor fault (TH21)	Same as above	B	B
5201	-	-	High-pressure sensor fault	Broken or short-circuited pressure sensor wiring	B	B
5202	-	-	Low-pressure sensor fault	Same as above	B	B
5501	-	-	Refrigerant sensor fault (RS1)	Broken or short-circuited sensor wiring Leakage from refrigerant pipe	B	B
7113	-	(12) (14) (15) (16) (56) (66)	Model setting error	Resistor Z22, 24, 25, or 26 fault	B	B
7117	-	(12) (14) (15) (16) (56) (66)	Model setting error (open)	Resistor Z22, 24, 25, or 26 fault (open)	B	B
4102 A471	-	-	Open phase	Power supply fault Open phase Voltage drop Circuit board fault Wiring fault	B	B
4106 (255)	-	-	Power supply fault	Transmission power supply PCB fault	-	-
1102 AC61	1202	-	(Discharge temp. ≥ 110ºC for 30s while compressor is in operation) Brief discharge temp. rise to ≥ 115ºC while the compressor is in operation	No water Sudden change in water temp. (≥ 5 K/min.) Pump fault High-pressure sensor fault LEV fault (main circuit, injection) Refrigerant shortage (refrigerant leak)	B	B
1503	-	-	Heat exchanger freeze-up *5	Drop in water flow or water supply interruption during defrost cycle Water temp. drop during defrost cycle Four-way valve switching fault	B	B
1510	-	(01)	Refrigerant leak	Leakage from refrigerant pipe Sensitization due to gas exposure containing hydrogen sulfide, chlorine, or siloxane.	-	-
	-	(02)	Refrigerant leak	Fan board fault, occurring together with 1510 (01).	-	-
INV fault **Electric current related errors during operation (101, 107, 106, 104, 105, 137, 121, 128, 122)**						
4250 4255 4256 *6	4350 4355 4356	(101)	IPM error	INV board fault Compressor ground fault Compressor coil fault IPM error (loose terminal screws, cracking) Fan motor fault Fan board fault	B	B
		(107)	Overcurrent during operation (effective value)	Inter-phase voltage drop (≤ 180)	B	B
		(106)	Momentary overcurrent during operation	INV board fault Compressor ground fault Compressor coil fault IPM error (loose terminal screws, cracking) Fan motor fault Fan board fault	B	B
		(104)	Short-circuited IPM/ground fault during operation		B	B
		(105)	Overcurrent due to short-circuit during operation		B	B

Error code *1 (PCB *2)	Preliminary error code	Error (preliminary) detail code	Error type	Cause (Installation/Setting error) (Component problems)	Error reset	
					Unit (PCB)	Remote controller
					SWS1	Operation SW
4255 4256 *6	4355 4356	(137)	Step-out fault	Motor desynchronization Fan motor fault Fan board fault	B	B
4250	4350	(121) (128)	DCL overcurrent (H/W)	DCL overcurrent INV board fault Compressor ground fault Compressor coil fault	B	B
4250	4350	(122)	DCL overcurrent (S/W)		B	B
INV fault **Electric current related errors during operation (101, 107 ,106)**						
4250 4255 4256 *6	4350 4355 4356	(101)	IPM error	INV board fault Compressor ground fault Compressor coil fault IPM error (loose terminal screws, cracking) Fan motor fault Fan board fault	B	B
		(107)	Overcurrent at start-up (effective value)	INV board fault Compressor ground fault Compressor coil fault IPM error (loose terminal screws, cracking) Fan motor fault Fan board fault	B	B
		(106)	Momentary overcurrent at start-up		B	B
INV fault **Voltage related problems during operation (108, 109, 110, 111, 112)**						
4220 4225 4226 *6	4320 4325 4326	(108)	Bus voltage drop protection (S/W)	(Momentary) power failure Power supply voltage drop (interphase voltage ≤ 248 V) Voltage drop INV board fault 72C fault Noise filter coil (L) fault Wiring fault between noise filter board and INV board Wiring fault between fan board and INV board Resistor (R1, R2) fault	B	B
4220	4320	(109)	Bus voltage rise protection (S/W)	Incorrect power supply voltage INV board fault	B	B
4220	4320	(110)	Bus voltage error (H/W)	VDC error INV board fault	B	B
4220 4225 4226 *6	4320 4325 4326	(111) (112)	Logic error	Malfunction due to noise interference Faulty grounding Improper transmission wiring and external wiring installation (Use of non-shielded cable) Low-voltage signal wire and high-voltage wire in contact (Signal and power wires in the same conduit) INV board fault Fan board fault	B	B
4220 4225 4226 *6	4320 4325 4326	(131)	Voltage fault at start up (Bus voltage drop protection at start up (detected by the main unit))	Voltage drop INV board fault 72C fault Noise filter coil (L) fault Wiring fault between noise filter board and INV board Wiring fault between fan board and INV board Resistor (R1, R2) fault	B	B
4220	4320	(129)	Control power supply fault	Control power supply fault INV board, main control board fault Broken wiring between INV and main control boards Contact fault	B	B
4220	4320	(123)	Voltage boost control error	Voltage drop Poor installation condition INV board fault Compressor ground fault	B	B
4230 4235 4236 *6	4330 4335 4336		Heatsink fault (Heatsink overheat protection)	Power supply voltage drop (interphase voltage ≤ 180 V) Clogged heatsink cooling air passage Fan motor fault INV and fan board fault THHS sensor fault IPM error (loose terminal screws, cracking)	B	B
4230	4320	(126)	DCL temp. fault	Above 150ºC Contact or connector fault (CNTH) INV board fault	B	B

en

Error code *1 (PCB *2)	Preliminary error code	Error (preliminary) detail code	Error type	Cause (Installation/Setting error) (Component problems)	Error reset	
					Unit (PCB)	Remote controller
					SWS1	Operation SW
4240 4245 4246 *6	4320 4325 4326	-	Overload protection	Short-cycling (reduced air flow) Clogged heatsink cooling air passage Power supply voltage drop (interphase voltage ≤ 180 V) THHS sensor fault Fan motor fault Current sensor fault Compressor fault INV and fan board fault	B	B
5301	4301	(115)	ACCT sensor fault	INV board fault Compressor ground fault and IPM error	B	B
		(117)	ACCT sensor/circuit fault	Poor INV board CNCT2 contact (ACCT) ACCT sensor fault	B	B
		(119)	Open-circuited IPM/loose ACCT sensor	ACCT sensor (CNCT2) disconnection ACCT sensor fault Broken compressor wiring INV circuit fault (IPM error etc.)	B	B
		(120)	Wiring fault	Wrong ACCT sensor phase Wrong ACCT sensor orientation	B	B
5110	1214	(01) (05) (06)	THHS sensor/circuit fault	THHS sensor contact fault THHS sensor fault INV board fault	B	B
5301	4300	(127)	DCL electric current circuit fault	Contact fault between CNCT1A and CNCT1B INV board fault	B	B
5305 5306 *6	4305 4306	(135)	Current sensor fault	Fan board fault Fan motor fault	B	B
		(136)	Current sensor/circuit fault	Fan board fault	B	B
5120	1248	(01)	THL sensor/circuit fault	THL sensor contact fault (CNTH) THL sensor fault INV board fault	B	B
0403	4300 4305 4306	(01) (05) (06)	Serial communication error	Communication error between control board and INV board (noise interference, broken wiring)	B	B
-	-	-	IPM system error	INV board switch setting error Loose wiring or connectors on IPM-driven power supply circuit INV board fault	B	B
Remote controller error (incl. remote controller wiring fault)(6830, 7109 ,6831 ,6832 ,6834)						
6830	-	-	Address overlap	Duplicate addresses	C	C
7109	-	-	Non-consecutive address, system error	Address setting error (non-consecutive address)	C	C
6831	-	-	Remote controller signal reception error 1	Remote controller cable disconnection Broken wiring Broken remote controller wiring Main control board communication circuit fault	-	-
6832	-	-	Remote controller signal transmission error	Communication error due to noise interference Main control board communication circuit fault	-	-
6834	-	-	Remote controller signal reception error 2	Same as above	-	-
Multiple system error (7105, 7130, 7102)						
7105	-	-	Address setting error	Address setting error (non-consecutive address)	C	C
7130	-	-	Incompatible unit combination	Incompatible units in the same system	C	C
7102	-	-	Connected unit setting error	The number of connected unit setting is incorrect (main unit)	C	C
6500	-	-	Communication error between main and sub units		-	-
6600	-	-	Transmission line power supply PCB fault	Communication error due to noise interference	C	C
6602 6603 6606 6607 6608			Communication error between main and sub units (Simple multiple unit control mode) *3	Broken transmission power supply circuit board wiring Transmission power supply PCB communication circuit fault	-	-
0100	2-digit code *7 *8		FTC error		C	C

*1: Parenthesized codes in the Error code column are detail codes.
*2: Error codes will appear in the PCB's 4-digit digital display.
Power failure will be detected as an error only when the Automatic recovery after power failure setting on the unit is set to Disable. (Default: Enable)
*3: Depending on the system configuration, unit may stop abnormally when the communication error lasts for 10 minutes.
Reset the error by setting SWS1 on the PCB of the unit or the remote operation switch.
*4: This error code will appear when multiple errors occur that are reset in different ways and when one or more of these errors have not been reset.
*5: Before resetting this error, resolve its causes to prevent possible damage to the heat exchanger.
*6: Last digit 5: MF2 (Top left fan motor when seen from front)

Last digit 6: MF2 (Top right fan motor when seen from front)

*7: Refer to the FTC installation manual.

*8: Operable only from the main remote controller connected to FTC

8-3. Calling for Service

If the issue persists, please contact your dealer or service provider along with the necessary information.

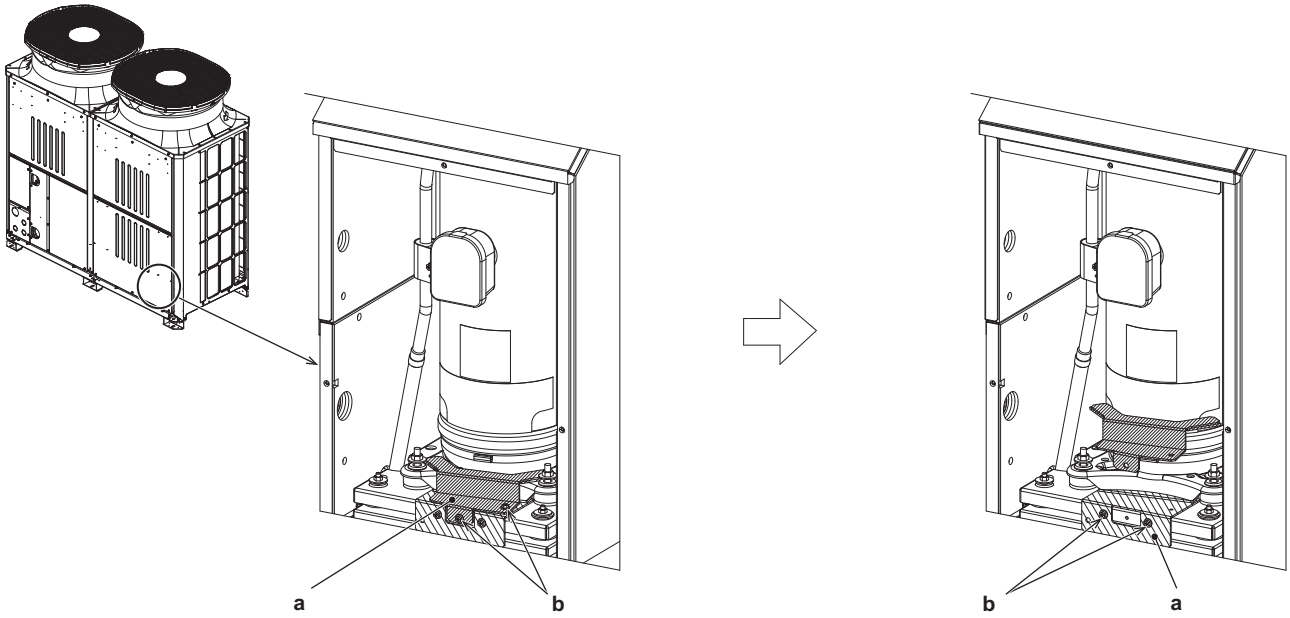
- Model name
  Indicated on the lower left of the unit (Starts with CAHV)
- Serial number
  Ex: 75W00001
- Error code
- Nature of the problem in detail

en

9. Operating the Unit

9-1. Initial Operation

1) Ensure the unit ON/OFF switch on the local control panel is turned off.
2) Remove the metal plates from the compressor by unscrewing the four screws (circled in the figure).



a Shipping bracket
b Unscrew to remove the brackets

3) Turn on the main power. Perform an initial setup. The compressor will not be activated until the initial setup is completed. Refer to the following page(s) for detail. "Setting configuration procedures" (p. 48)
4) Keep the main power turned on for at least 12 hours to heat the compressor.
5) Turn on the unit ON/OFF switch on the control panel.

IMPORTANT
- The refrigerant sensor is not activated before the initial setup is completed. Complete the initial setup promptly.

9-2. Daily Operation

[1] Daily Operation

To start an operation

Switch on the unit ON/OFF switch on the local control panel, or press the ON/OFF button on the remote controller. Refer to the following pages for how to use the remote controller.

The unit described in this manual features a circuit that protects the compressor from short-cycling. Once the compressor stops, it will not restart for up to 10 minutes. If the unit does not start when the ON/OFF switch is turned on, leave the switch turned on. The unit will automatically start within 10 minutes.

To stop an operation

Switch off the unit ON/OFF switch on the control panel, or press the ON/OFF button on the remote controller.

IMPORTANT
- Keep the main power turned on throughout the operating season, in which the unit is stopped for three days or shorter (e.g., during the night and on weekends).
- Keep the power constantly ON. This unit is equipped with the refrigerant sensor and electrically powered safety measures. To be effective, the unit must be electrically powered at all times after installation, other than when servicing.

9-3. Using Units in Cold Climates

[1] Using units in cold climates

In sub-freezing conditions, take measures to prevent water in the water circuit from freezing, bursting pipes, and damaging water leaks.

- Remove any snow off the unit before turning on the unit.
- Operate the unit frequently enough to reduce the chance of water freeze-ups.
- Blow the water out of the pipes, or fill them with anti-freeze before a long period of non-operation.
- Ensure that the water circuit has an anti-freeze feature, and keep the main power turned on.
- If the water circulation circuit is connected to a separate circuit from the unit, keep its power on as well.
- Starting the unit with the outlet water temperature outside the specified range may result in an abnormal stop.
- When the outside air temperature is low, use auxiliary heat sources such as heaters to ensure that the water temperature at the startup of the unit is equal to or above the lower limit of the specified outlet water temperature range.

9-4. Remote Controller Operation

Button functions

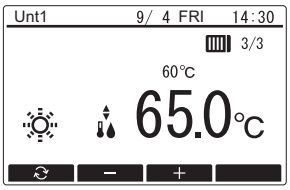
: Returns to the menu screen

: Saves the settings

: Returns to the previous screen

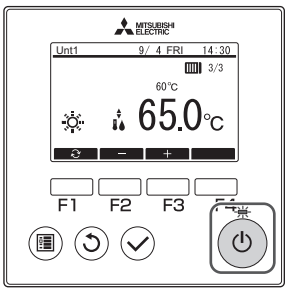
: Turns on/off the power

Main screen



Refer to the FTC installation manual for how to use the main remote controller with connection to FTC.

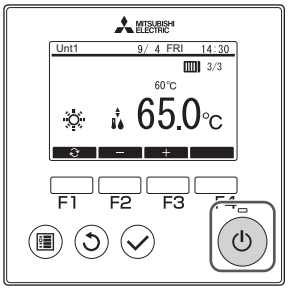
9-4-1. Power ON/OFF



To start

Press [⏻].

The LED above [⏻] will light up in green, and operation will start.



To stop

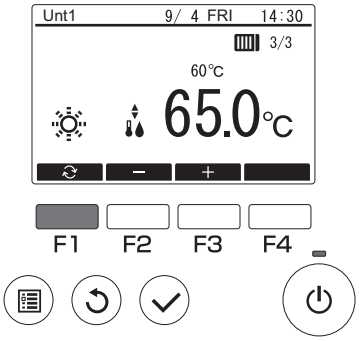
Press [⏻].

Press [F3] on the confirmation screen.

[⏻] will light off, and the operation will stop.

9-4-2. Setting the operation mode and temperature

[1] Operation mode



Press [F1] to select the operation mode from Heating, Heating ECO, Hot water and Anti-Freeze.
Each press advances the mode.

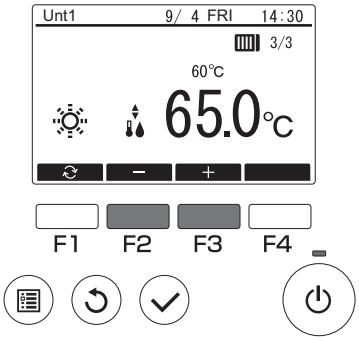

Heating


Heating ECO


Hot water


Anti-Freeze

[2] Temperature



Press [F2] to decrease the temperature, and [F3] to increase.

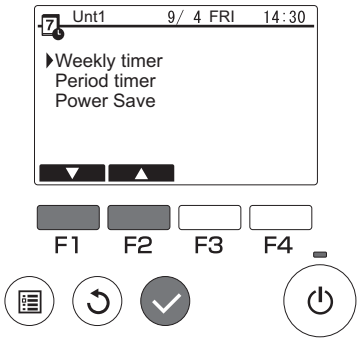
en

9-4-3. Using the Weekly timer

Use the Weekly timer to set the ON/OFF schedule, operation mode, and temperature for each day of the week.
Weekly timer will be disabled when the schedule function is disabled and when the period timer is enabled.
Weekly timer may not be executed under certain system configurations.

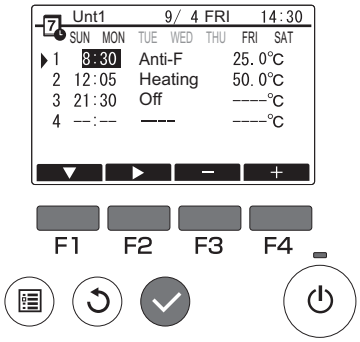
Steps

Step 1



Press [▤].
Press [F3] to select [7].
Press [⊘].
On the Schedule menu, press [⊘] to select Weekly timer.

Step 2

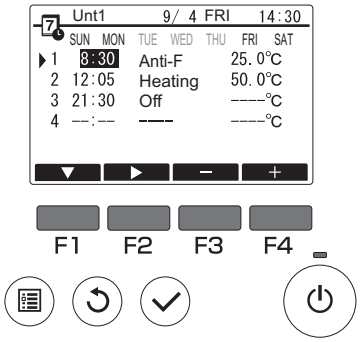


Weekly timer screen will appear.

To view the settings:
Press [F1] or [F2] to view the settings for each day.
Press [F4] to see the next page.

To change the settings:
Press [F1] or [F2] to toggle through the days. Press [F3] select a day, and press [⊘].
Multiple days are selectable by repeating the steps above.

Step 3



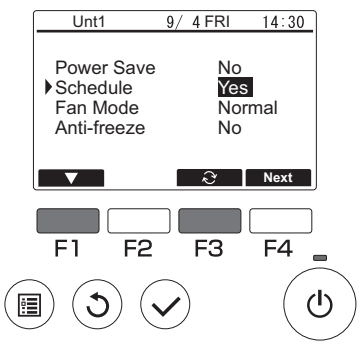
Pattern setting screen will appear.
Press [F1] to select a pattern to be set.
Press [F2] to select the item to change its settings.
Press [F3] or [F4] to change the setting for the selected item.

1) Time
Set in 5-minute increments.
Hold down the button to fast-forward.

2) Operation selection mode or Off
Available options vary with the connected unit.
Connected unit will operate unless set to Off.

3) Temperature
Settable in 0.5°C increments
Press [⊘] to save the change.

Step 4



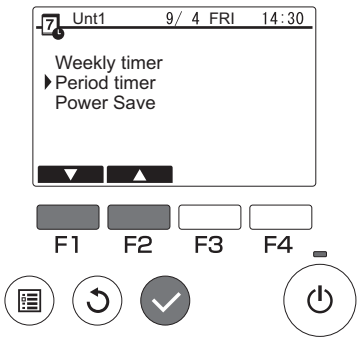
To enable schedule
Return to the main screen, and press [F4].
Press [F1] to move the cursor to Schedule.
Operation setting screen will appear.
Press [F3] to select Yes.

9-4-4. Using the Period timer

Use the Period timer to set the daily operation schedule (ON/OFF, operation mode, temperature) for specific periods.
If the periods 1 and 2 overlap, only period 1 will be valid.
Weekly timer will be disabled when the Schedule function is disabled:
When the Schedule function is disabled from the centralized controller or the connected unit, Schedule settings cannot be made from the remote controller.

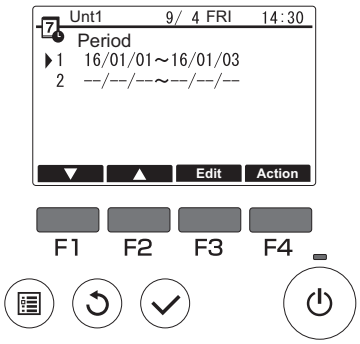
Steps

Step 1



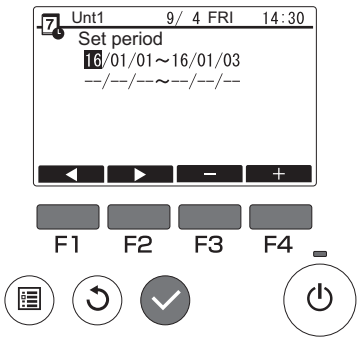
From the Schedule menu press [F1] or [F2] to select Period timer, and press [⊛].
Refer to the following page(s) for detail. "Using the Weekly timer" (p. 90)

Step 2



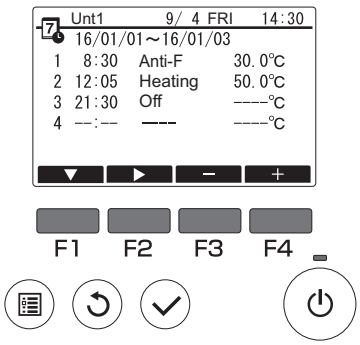
Pre-set periods will appear, if any.

Step 3



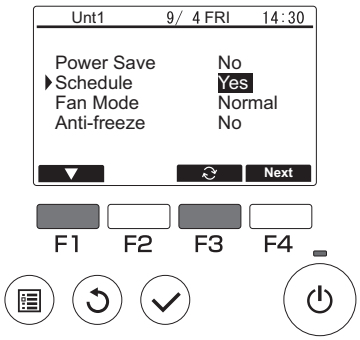
To select a period
Press [F1] or [F2] to select a period to set, and press [F3].
Press [F1] or [F2] to select the year, month, or date.
Press [F3] or [F4] to change the year, month, or date.
Press [⊛] to save the setting.

Step 4



To set the operation
Press [F1] or [F2] to select a period to set, and press [F4].
Operation pattern setting screen will appear.
Set the time, mode, and temp.
(Select an item with [F1] and [F2]. Change the value with [F3] and [F4].)
Press [⊘] to save the change.

Step 5



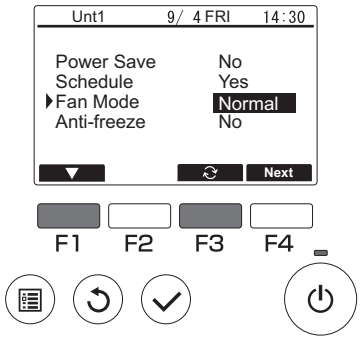
To enable schedule
Refer to the following section. "Using the Weekly timer" (p. 90)

9-4-5. Fan mode

- The following two fan modes are available.
  Normal: Fan stops when compressor stops.
  Snow: Fan keeps operating after compressor has stopped to keep snow off the unit.

Steps

Step 1



Press [F4] on the Menu screen.
Operation setting screen will appear.
Press [F1] to select Fan mode.
Press [F3] to select Normal or Snow.

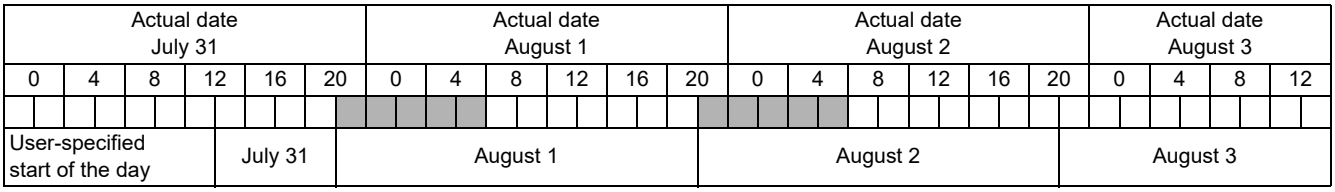
9-4-6. Using power save

Power save is a function that regulates the compressor's rotation count and reduces power consumption during high load on a daily schedule, during specific time periods, or based on the regulated unit capacity.

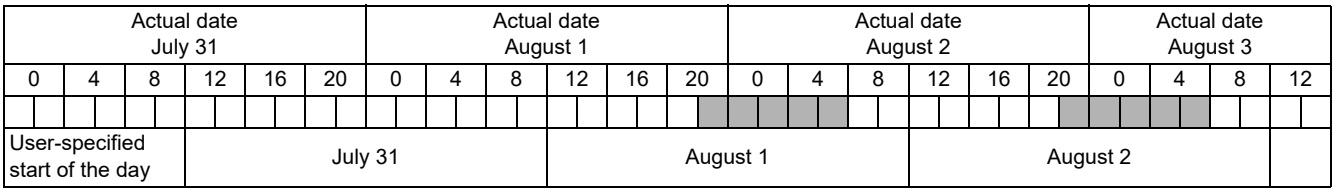
Definition of a Day in using power save

Each Day starts with the time specified by the user. No periods can be specified that spans the Day. Refer to "Unit Setting" in the Remote controller Installation Manual for detail.

Ex. 1: When the start of the day is specified as 22:00 on August 1 and 2, and the power save period is set to the period between 22:00 and 8:00



Ex. 2: When the start of the day is specified as 22:00 on August 1 and 2, and the power save period is set to the period between 22:00 and 8:00



Shaded areas in the figure show when power save is enabled.

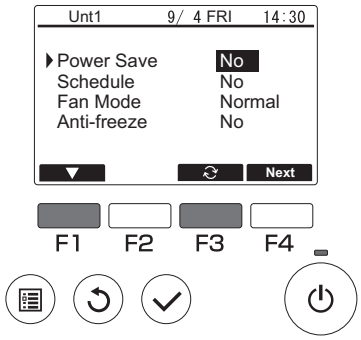
Power save will be disabled when a system controller is connected to the system or when power save is disabled.

Using demand control on the connected units

(1) Using the demand control (contact point) of the connected units without using power save on the remote controller

Steps

Step 1



Press [F4] on the Menu screen.
Press [F1] to access power save.
Press [F3] to select No.

- Do not set the power save settings on the remote controller.
- Some items may not be available for selection.
- Refer to the Instruction Book of the connected units for details on demand control.

(2) Using both the demand control (contact point) of the connected units and power save on the remote controller

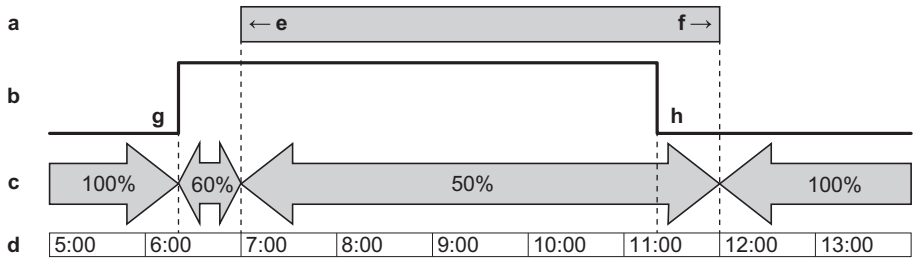
The system will be controlled based on the lower of the following: demand control setting and power save control capacity.

If the contact-ON time and the power save start time are set to different times, whichever the earlier will be valid. Refer to the table below.

Control values for using power save and demand control

Period	Power save value	Demand control value	Actual control target capacity
12:00-6:30	– (100%)	– (100%)	100%
6:30-7:00	– (100%)	60%	60%
7:00-11:30	50%	60%	50%
11:30-12:00	50%	– (100%)	50%

Ex, When power save is enabled between 7:00 and 12:00 at the control capacity of 50%, and the contact for the connected unit is on (capacity setting of 60%)

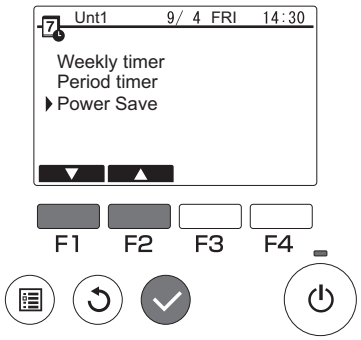


a Power save time period setting
b Unit contact input
c Max. capacity of the unit
d Time
e Power save starts
f Power save ends
g Contact ON
h Contact OFF

- While the contact is on or power save is enabled, the maximum capacity will be limited to whichever is the lower between the power save and demand control settings.
- While the contact is off and power save is disabled, units will operate at 100% capacity.
- Units will operate at up to 100% capacity during non-power-saving periods.

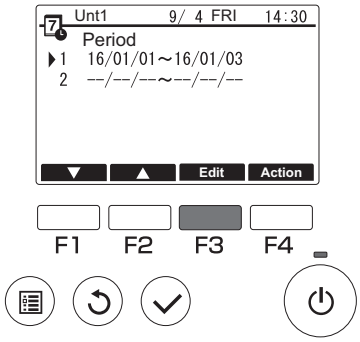
Steps

Step 1



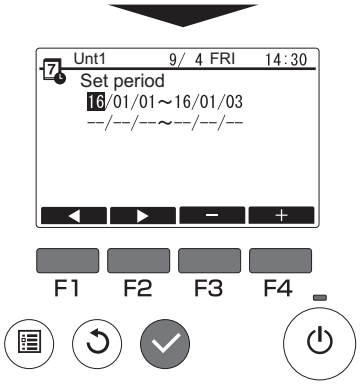
From the Menu screen, select Schedule, then power save.
Press [⊙].

Step 2



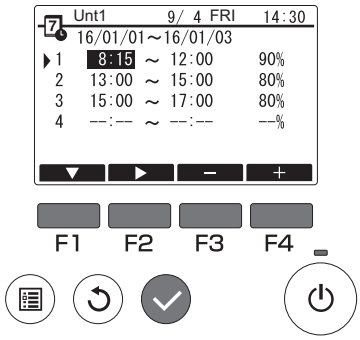
Two different periods can be set by specifying the start and end dates.

- If the dates specified in periods 1 and 2 overlap, only the dates specified in period 1 will be valid.



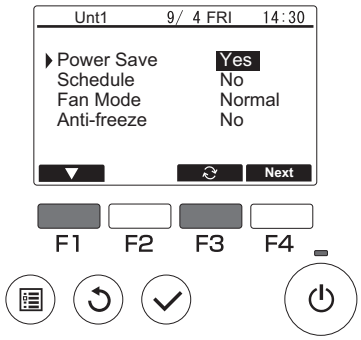
Refer to Step 3 of the section on using the period timer for how to set the periods.
Refer to the following page(s) for detail. "Using the Period timer" (p. 91)

Step 3



Refer to Step 4 of the section on using the period timer for how to set the power save start/end time and the demand control value.
Refer to the following page(s) for detail. "Using the Period timer" (p. 91)
Press [⊘] to save the change.

Step 4



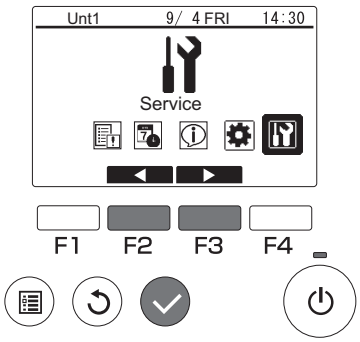
Refer to Step 4 of the section on using the weekly timer for how to enable power save.
Refer to the following page(s) for detail. "Using the Weekly timer" (p. 90)

9-4-7. Setting the functions

Set the functions for each connected unit from the remote controller as necessary.
Record any changes made to the functions of the connected units to allow for proper management.

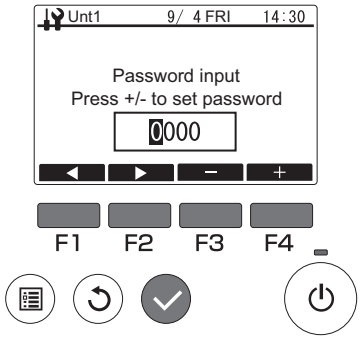
Steps

Step 1



From the Menu screen, select Service, and press [⊘].

Step 2

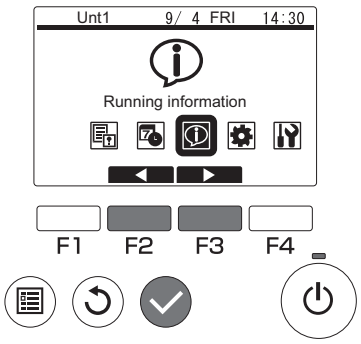


A password screen will appear.
Enter the current maintenance password (a 4-digit number), and press [⊘] to access the Service menu.

9-4-8. Monitoring the operating status from the remote controller

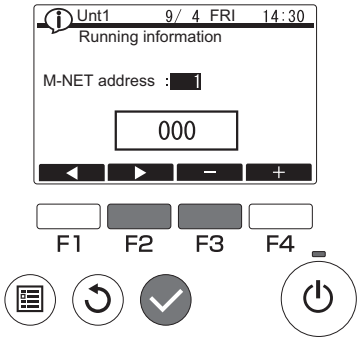
Steps

Step 1



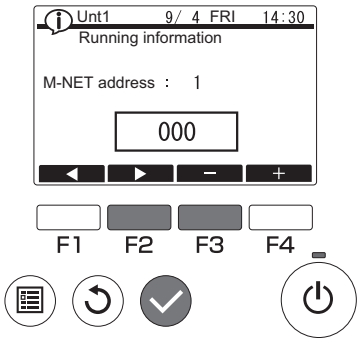
From the Menu screen, select Running information, and press [⊘].

Step 2

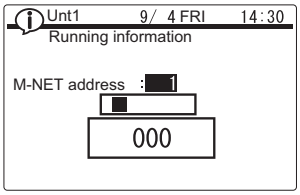


Set the M-NET address with [F2] and [F3], and press [⊘].

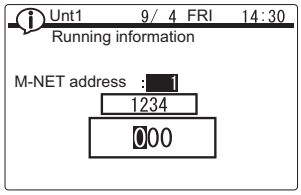
Step 3



Enter a 3-digit running inf. number, and press [⊘].



The setting-inf.-send screen will appear.



If sent successfully, the running inf. will appear on the screen.
Press [↺] to return to the screen shown in Step 2.
Set other M-NET address and running inf. number in the same way.

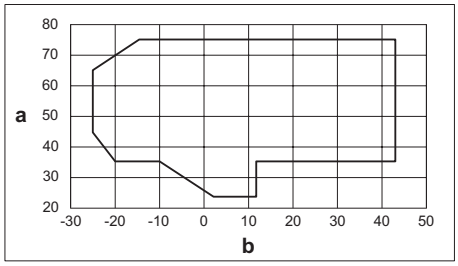
en

10.Specifications

Model			CAHV-Z450YA-HPB (-BS)
Power source			3-phase 4-wire 380-400-415 V 50/60 Hz
Capacity (EN14511) *1		kW	40.0
	Power input	kW	12.62
	Current input	A	21.3-20.2-19.5
	COP		3.17
	SCOP Low/Medium		4.12/3.25
	Water flow rate	m^3/h	6.88
Maximum current input		A	45.6
Water pressure drop		kPa	10.2
Temp. range *2	Outlet water temp.	°C	24 ~ 75
	Outdoor temp.	°C	-25 ~ 43
Circulating water volume range *3		m^3/h	4.0 ~ 7.0
Sound pressure level (measured in an anechoic room) at 1m *4		dB (A)	65 *1
		dB (A)	72 *5
Water pipe diameter and type	Inlet		40A, Rc 1-1/2B
	Outlet		40A, Rc 1-1/2B
External finish			Acrylic painted steel sheet <Munsell 5Y 8/1 or similar>
External dimensions H × W × D		mm	1710 × 1750 × 740
Net weight		kg	363
Design pressure	R290	MPa	3.85
	Water	MPa	1.0
Drawing number	Wiring		KW94R794
	External appearance		KW94R768
Heat exchanger	Water side		Stainless steel plate and copper brazing
	Air side		Plate fins and copper tubes
Compressor	Type		Inverter scroll hermetic compressor
	Manufacturer		MITSUBISHI ELECTRIC CORPORATION
	Starting method		Inverter
	Motor output	kW	10.8
	Lubricant		PZ46M
Fan	Air flow rate	m^3/min	150 × 2
		L/s	2500 × 2
		cfm	5297 × 2
	External static pressure	Pa	10, 40 *6
	Type and quantity		Propeller fan × 2
	Control and driving mechanism		Inverter control, direct driven by motor
	Motor output	kW	0.92 × 2
HIC (Heat inter-changer) circuit			Copper pipe
Protection devices	High pressure		High-pressure sensor and switch set at 3.85 MPa
	Inverter circuit		Overheat and overcurrent protection
	Compressor		Overheat protection
	Fan motor		Thermal switch
	Refrigerant sensor		Refrigerant leakage protection
Defrosting method			Auto-defrost mode (Reversed refrigerant cycle)
Refrigerant	Type and factory charge *7		R290, 4.8 kg
	GWP *8		3
	Flow and temp. control		LEV and HIC circuit

*1: Under normal heating conditions at the outdoor temp. of 7 °CDB / 6 °CWB, the outlet water temp. of 45 °C, and the inlet water temp. of 40 °C.

*2:



a Outlet water temp. (°C)
b Outdoor temp. (°C)

- Keep inlet water temp. of 19 °C or higher during the unit operation

*3: The unit can operate at the water volume range of 1.5 - 4.0 m^3/h if the water volume exceeds 4.0 m^3/h during defrost cycle.
The defrost signal is output from the terminal block of the unit.
*4: SPL is the value measured in an anechoic room at 1 m away from the unit and 1.5 m above the floor.
*5: Under conditions with maximum compressor frequency and fan rotated speed.
*6: External static pressure mode.
*7: The unit is not charged with R290 refrigerant when shipping from the factory.
*8: IPCC 4th assessment report.

- Due to continuing improvements, specifications may be subject to change without notice.
- Do not use steel pipes as water pipes.
- Keep the water circulated at all times. Blow the water out of the pipes if the unit will not be used for an extended period of time.
- Do not use ground water or well water.
- The water circuit must be a closed circuit.

Unit converter

Kcal = kW × 860
BTU/h = kW × 3,412
cfm = m^3/min × 35.31
Lb = kg/0.4536

11.Maintenance

The table below details regular inspection and preventive maintenance, including inspection items, methods, criteria, and schedules.

Parts			Regular inspection			Preventive maintenance
Component parts	Parts		Item	Method/tool	Criteria <Reference>	Item
Refrigerant circuit	Compressor		• Sound and vibration at start-up, during operation, during compressor stoppage • Insulation resistance • Terminals, wiring	Visual, auditory, tactile 500 VDC ohmmeter Screwdriver, visual	• No abnormal sound and vibration • ≥ 1 MΩ • No loose terminals and wiring contacts	• Replace if abnormal sound or vibration was detected • Replace if “insulation resistance ≤ 1 MΩ” • Retighten terminals and reconnect connectors
	Linear expansion valve		• Operation • Operating sound (pressure)	Tactile Auditory and tactile By turning ON/OFF the unit	• Normal refrigerant circulation • Normal operating sound and temp. change	• Replace if stuck
	Refrigerant system	Inner piping	• Sympathetic vibration, contact, corrosion of inner piping • Sympathetic vibration, capillary tubes in contact	Visual Visual	• No abnormal sympathetic vibration, sound, and corrosion • No abnormal sympathetic vibration and contact wear	• Replace or repair if pipes are severely corroded or worn • Replace if “insulation resistance ≤ 1 MΩ” • Paint any corroded surface.
		Solenoid valve, four-way valve	• Operation, insulation • Corrosion, noise	500 VDC ohmmeter Visual, auditory	• Insulation resistance ≥1 MΩ • No abnormal sound and corrosion	
		Container	• Corrosion of accumulator or oil separator	Visual	• No corrosion	
	Protection device	High-pressure switch	• Operating pressure, refrigerant leak, insulation resistance	Pressure gauge	• Operates at the set value • Measured value within the specified range	• Replace regularly
		Fusible plug	• Swollen soluble metal	Visual	• Soluble metal in the normal position	
	Heat exchanger	Air	• Clogging, damage • Refrigerant leak	Visual Refrigerant leak detector	• No clogging and damage • No leaks	• Clean air inlet if clogged • Repair or replace heat exchanger if leaking
		Water	• Water volume, temp. • Refrigerant leak • Drain water in the heat exchanger or pipes	• Thermometer, flowmeter, differential pressure gauge • Refrigerant leak detector	• Tolerance • No refrigerant leaks • Proper nstallation	• Adjust valve and valve operation settings • Repair or replace heat exchanger if leaking • Install a drain valve
Electrical/ Electronic parts	Fan motor		• Noise • Insulation resistance	Auditory 500 VDC ohmmeter	• No abnormal sound • Insulation resistance ≥1 MΩ	• Replace bearing if making loud noise • Replace motor if insulation is eroded
	Switch (incl. FFB and ELB)	Solenoid switch Overcurrent relay Auxiliary relay	• Operation and appearance • Contact	Visual	• No deformation • Normal operation, no deformation • No deformation and discoloration	• Replace switches if malfunctioning, deformed, or discolored
	Fuse		• Appearance	Visual	• No deformation and discoloration	• Replace fuse if blown
	Control box (incl. inverter) Electrolytic capacitor		• Insulation resistance • Dust on circuit board • Terminals, connectors • Appearance of electrolytic capacitor	500 VDC ohmmeter Visual Screwdriver, visual Visual	• Insulation resistance ≥1 MΩ • No dust • All connectors properly connected • No liquid leaks and deformation	• Clean dust with a brush • Replace circuit board if malfunctioning • Re-tighten terminals and reconnect connectors • Replace electrolytic capacitor if leaking. (Note4)
	Smoothing capacitor		• Capacitance, insulation resistance	Electrostatic meter, 500 VDC ohmmeter	• Insulation resistance ≥ specified value	• Replace regularly
	Electric box (incl. circuit board)		• Insulation resistance of circuit, appearance of capacitor • Terminals, connectors • Self-diagnosis mode, appearance	500 VDC ohmmeter Visual Visual	• Insulation resistance ≥1 MΩ • All connectors properly connected • No errors appear on the display.	• Replace circuit board if malfunctioning • Re-tighten terminals and reconnect connectors • Replace circuit board if leaking
	Pressure sensor, thermistor		• Open- or short-circuit, appearance	Tester, visual	• Within the specified value, no discoloration	• Replace if short-circuited or disconnected
	SW power source		• Output voltage	Tester	• Within the specified range	• Replace SW if voltage is abnormal
	Refrigerant sensor		• Burial • Refrigerant leak	• Visual • Refrigerant leak detector	• No burial • No leaks	• Replace regularly • Replace if malfunctioning
Structural parts	Decorative part		• Grime and damage	Visual	• No dirt, damage, and deformation	• Wash panels with neutral detergent, and paint the surface
	Frame, bottom plate		• Rust, insulation material • Peeling coating	Visual	• No rust and insulation damage	• Repair frame or bottom plate if insulation is torn. • Paint the surface
	Propeller fan		• Vibration, appearance	Visual	• No propeller runout and catching	• Replace if propeller runout or balance problem exists
	Drain pan		• Clogging • Peeling paint	Visual	• No clogging • No rust and holes	• Clean drain pan, and check for tilt. • Touch up paint
	Guard panel		• Peeling coating	Visual	• No rust	• Paint the surface
External parts	Remote controller switch		• Controllability	Visual	• Display follows the commands.	• Replace if the display does not follow the commands or wrong display appears
	Central control system		• Controllability • Loose terminal, wiring contact • Insulation resistance	• Visual • 500 VDC ohmmeter	• Display follows the commands • No loose contacts • > 1 MΩ	• Re-tighten terminals and reconnect connectors • Replace if “resistance < 1MΩ”
	Flow switch		• Controllability • Water leak • Insulation resistance	• Visual • 500 VDC ohmmeter	• Display follows the commands • No water leaks • >1 MΩ	• Replace
	Phase-advance capacitor Elapsed time integrator Ammeter		• Insulation resistance	• 500 VDC ohmmeter	• >1 MΩ	• Replace if “resistance < 1MΩ”
Water circuit	Strainer		• Clogging	• Visual	• No stain and clogging	• Clean
	Water pipe		• Water leak • Presence of air • Open air vent valve	• Visual • Sensory	• No water leaks • No abnormal sound	• Re-tighten terminals and reconnect connectors • Release air, or replace and adjust valve
	Flow regulating valve		• Water temp. difference (flow rate)	• Thermistor	• Proper temp. difference range	• Replace and adjust
	Pump		• Vibration • Insulation resistance • Water leak • Loose terminal, wiring contact • Strainer	• Visual, audibility, tactile • 500 VDC ohmmeter • Visual	• No abnormal sound • > 1 MΩ • No water leaks • No loose contacts • No clogging	• Replace • Re-tighten terminals and reconnect connectors • Reconnect wiring • Clean strainer
	Pressure gauge		• Displayed value	• Visual	• Correct display	• Replace if wrong values are displayed
	Thermistor		• Displayed value	• Surface thermistor	• Correct display	• Replace if wrong values are displayed
	Water		• Water quality	• Water quality analysis	• Water quality standards	• Improve water quality

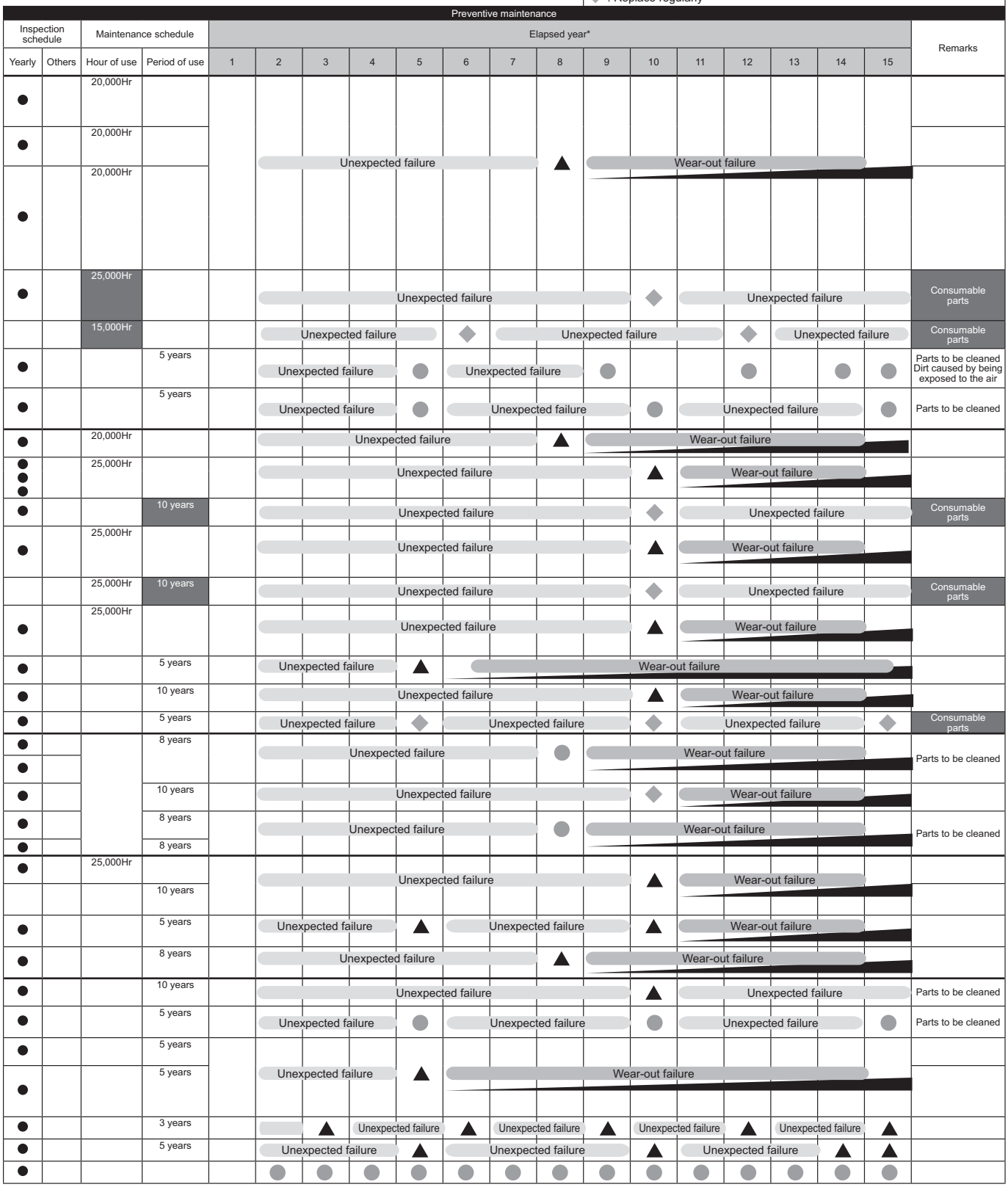
Note1) Unexpected failure is a sudden and unpredictable failure that occurs randomly before parts or device reaches its lifespan. It is difficult to apply technical measures, leaving applying statistical measures as the only solution.

Note2) Elapsed year refers to the time period in which a given product has been used for 10 hours a day and 2500 hours a year without frequent start-stops.

Note3) shows that the likelihood of wear-out and failure increases over time.

Note4) If the compressor or fans have accumulated more than 25,000 operating hours or have been in service for 10 years, please consider replacing any circuit boards that contain electrolytic capacitors.

Nomenclature
- ● : Annual
- ● : Clean or adjust as needed
- ▲ : Replace or repair as needed
- ◆ : Replace regularly



12.Safe handling of R290

12-1. Handing over to the user

Explain the following items to the end user.

- How the unit operates.
- The particular risks, the protective zone and rules of conduct that are associated with R290 refrigerant.
- How the unit is avoided from frozen damage when stopping the unit.
- Ask a dealer or an authorized technician to carry out work on the unit.
- Keep the Installation/Operation Manual so that don't lose them.
- Recommend that regular maintenance be performed.
  Ask a dealer to perform it.

12-2. Inspection and maintenance

Refer to the Service Handbook for maintenance.

12-3. Repair and service

Repairs must be carried out in accordance with the Service Handbook.

12-3-1.Preparing repair and service work on the refrigerant circuit

- Work on the refrigerant circuit with flammable refrigerant in safety group A3 may only be carried out by authorised contractors. These contractors must be trained in accordance with EN 378 Part 4 or IEC 60335-2-40 Annex HH.
- Work on electrical equipment may only be carried out by a qualified electrician.
- Use only spare parts authorized by the manufacturer.

⚠ WARNING

Do not fill the unit with more refrigerant than the specified amount.

- **Failure to follow this instruction may result in unit failure or fire hazard.**

12-4. Decommissioning

12-4-1.Temporarily decommissioning the unit

- Switch off all of the isolators to which the unit is connected in the building.
- Disconnect the unit from the power supply.
- If there is a risk of frost damage, drain the heating water from the unit.

12-4-2.Permanently decommissioning the unit

Have a authorised contractor permanently decommission the unit.

12-5. Recycling and disposal

12-5-1.Disposing of the packaging

The competent person who installed the unit is responsible for the disposal of the packaging.
Dispose of the packaging correctly.
Observe all relevant regulations.

12-5-2.Disposing of the unit

Do not dispose of the unit with the household waste.
According to the laws and ordinances of each country, hand in the unit to a collection center for waste electrical or electronic equipment or to a authorized recycler.

⚠ WARNING

Refrigerant must be recovered and disposed properly only by an authorised competent person.

12-5-3.Transportation of the unit for disposal

⚠ WARNING

Be sure to observe the following safety requirements when transporting the unit.

(1) Do not use a source of ignition during transportation, which includes: naked flames, sparks, static electricity, objects with high surface temperature (>370°C).
Do not smoke.
Do not use the electric devices, heater, lights, etc.

(2) Vehicles with ventilation in the cargo area should be used.
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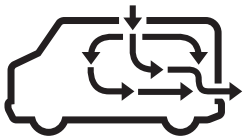
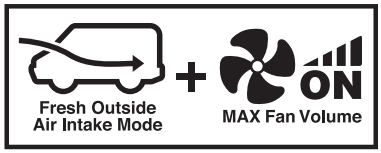


If vehicles are not equipped with a special ventilation system, fresh outside air intake mode and MAX fan volume operation are mandatory.



(3) Be sure to carry the R290 detector and keep it working properly.

(4) Do not open the packaging of the unit that is charged with R290 during delivery.
CAHV-Z450YA-HPB(-BS) is not charged with R290 refrigerant when shipping from factory.

13.Disclaimer

All electrical works to be undertaken to install/service/relocate/repair this unit (together the "Works") must be performed by a competent electrical technician, who must either hold an industry standard qualification recognized in the professional electrical industry or recognized by Mitsubishi Electric (a "Professional Installer"). The Professional Installer shall use his/her own judgment and skill in conformance with the applicable unit instructions, and in compliance with all Mitsubishi Electric manuals and instructions, laws, statutory requirements, regulations and guidance applicable to the unit (together the "Standards"), to install the unit and perform the Works. Mitsubishi Electric does not accept liability for any direct, indirect, special or consequential loss, damage or expense incurred or suffered that results from, or is connected to, any Works undertaken by the Professional Installer or any failure, claim, damage or latent deficiency caused by improper installation of the unit by the Professional Installer, or the Professional Installer failing to conform to the Standards. Please note that any inability by the Professional Installer to exercise competent workmanship in undertaking the Works may result in an electric shock or fire, for which the Professional Installer shall be solely responsible. Mitsubishi Electric's instruction manuals, guides and any other documents related to the installation and initiation of the unit must not be taken, in any way, as overriding: (i) any statutory obligations and, (ii) where the user is a consumer, the consumer's mandatory legal rights in his/her respective jurisdiction.

This product is designed and intended for use in the residential, commercial and light-industrial environment.

The product at hand is based on the following EU regulations:

- Low Voltage Directive 2014/35/EU
- Electromagnetic Compatibility Directive 2014/30/EU
- Pressure Equipment Directive 2014/68/EU
- Machinery Directive 2006/42/EC
- Restriction of Hazardous Substances 2011/65/EU
- Energy-related Products 2009/125/EC
  (with Regulation No. 811/2013, 813/2013, 327/2011)

Please be sure to put the contact address/telephone number on this manual before handing it to the customer.

MITSUBISHI ELECTRIC CORPORATION

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