



MWH180

Service Manual



**Instantaneous Gas Water Heater
(Residential Indoor Unit)**

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1. General Outline of Appliance

1-1 Features

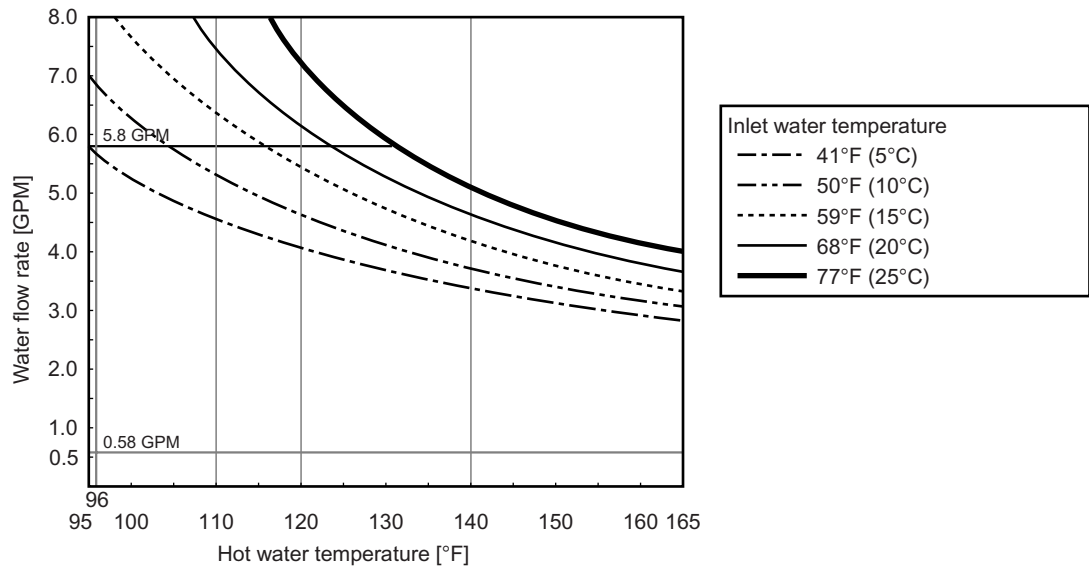
1. High-performance & high-capacity water heater features
 - Stable heating and supplying from 0.58 to 5.8 GPM with the proven temperature control method combining the feed forward, feedback and water flow control
 - Design to reduce water temperature drops to hold temperature variation upon re-feeding
 - Maximum flow rate of 5.8 GPM (22 L/min) allowing simultaneous hot water supply for the kitchen and shower
2. Environmentally-conscious and low NOx exhaust
 - The rich-lean design of the combustion burners allows the value of NOx to be as lower than 55 ppm or less
3. Self-diagnostic function
 - Detects the scale-clogging of the heat exchanger assembly (warning)
 - Detects the blocked exhaust system (alarming)
4. Improved reliability
 - The potted PCB (Printed Circuit Board) and connectors equipped with retainers have greatly improved the reliability of the electronic components.
5. Easier installation work
 - The slide-type wall hanging frame is provided so that the intake pipe and exhaust pipe can be aligned during the installation.
6. The PCB has a function to let the LED flash upon heater trouble and the remote controller has an error-display function.
7. With ultra-low power consumption, the optional remote controllers have highly visible display (equipped with a backlight). The main remote controller and the bath remote controller are different in design.

1-2 Specifications

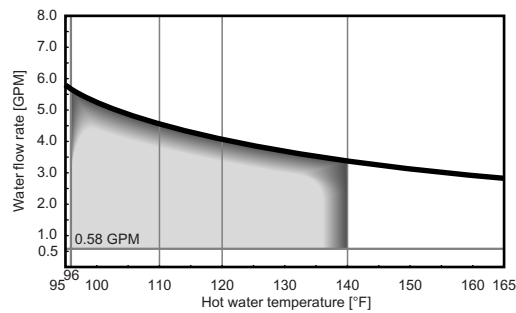
Type of appliance		Gas continuous flow water heater	
Model number		MWH-180	
Type of	Installation	Indoor only	
		Wall hanging	
	Hot water supply	End stop system	
	Exhaust system	Direct vent forced combustion (FF type)	
Power supply		Appliance AC120V 60Hz Remote controller DC12V (digital)	
Ignition system		Direct electronic ignition	
Outer panel material		Pre-Painted Galvanized Steel Sheet	
Hot water capacity (water temp. +25°C rise)		0.58 ~ 5.8 GPM	
Maximum hot water capacity (54°F rise)		5.8 GPM	
Maximum water supply pressure		150PSI (1.0MPa)	
Recommended minimum water supply pressure		15PSI (recommended 25-75 psi for maximum performance)	
Minimum operational water flow		0.58GPM (2.2L/min)	
Electrical consumption		Normal 61W	
		Standby Main/Bath remote controller on 3.7 W	
		Anti-frost heater operation 84W	
Connections	Gas	R3/4NPT	
	Water inlet	R3/4NPT	
	Hot water outlet	R3/4NPT	
Exhaust temperature		below 480°F	
Noise level		49dB	
NOx		55ppm Max.	
Safety devices		Flame failure - Flame rod, Over heat switch 212°F, Over heat limit 203°F	
		Thermal fuse for heat exchanger 363°F, Over current - fuse (5A)	
		Automatic frost protection, Combustion fan motor rpm check - PCB	
Dimensions		Height 24 1/32" (610mm) Width 13 25/32" (350mm) Depth 8 3/8" (210mm)	
Weight		43lbs. (20kg)	
Temperature Range		Main remote controller 96 - 140°F	
		Bath remote controller 96 - 140°F	
Available Default Temperatures (without remote controller)		110°F, 120°F, 140°F, 165°F (set by Dip switch on PCB)	
Gas consumption	Natural Gas	Maximum 180,000Btu/h (52.7kW)	Minimum (reference) 20,000Btu/h (6.0kW)
	Propane Gas	Maximum 180,000Btu/h (52.7kW)	Minimum (reference) 20,000Btu/h (6.0kW)
Remote controller (option)		CMR-2250 (P/N3748) Main control kitchen / laundry	
		YST-2250 (P/N3749) Bathroom control	
Remote controller cable (option)		Nonpolarized two core cable	
Clearance from combustibles		Top of heater 12" (30.5cm)	
		Front of heater 6" (15.2cm)	
		Sides of heater 2" (5.1cm)	
		Back of heater 0" (0cm)	
		Floor 12" (30.5cm)	
		Vent pipe 0" (0cm)	
Carton box dimensions		Height 31 1/2" (800mm) Width 15 7/8" (403mm) Depth 11 1/32" (280mm)	

1-3 Performance

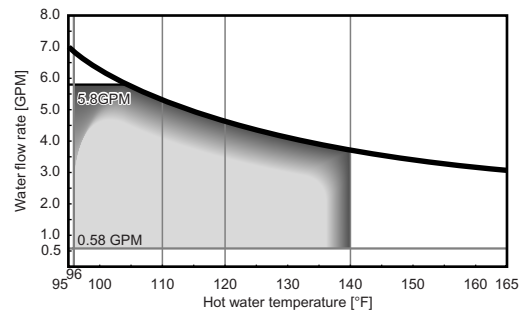
Performance-Capacity characteristic curves



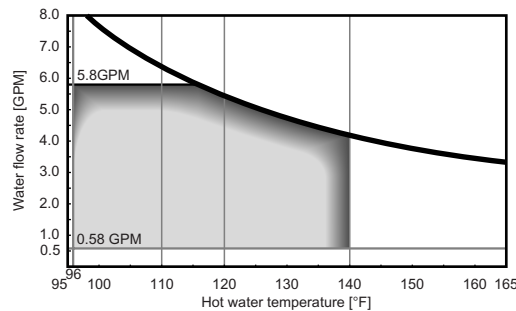
With water temperature 41°F (5°C) at inlet



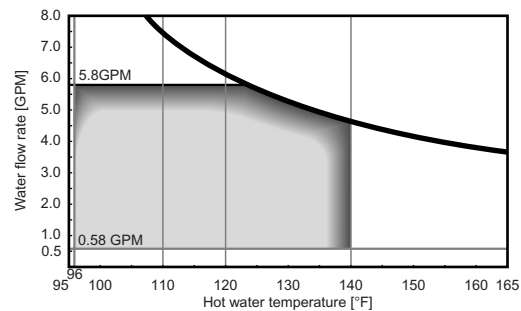
With water temperature 50°F (10°C) at inlet



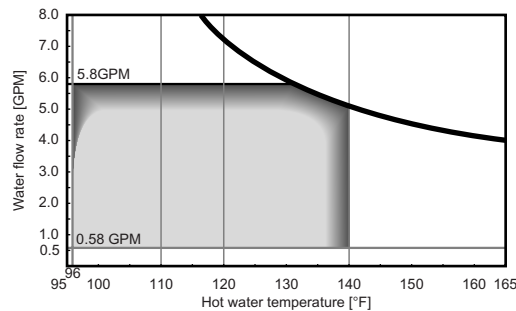
With water temperature 59°F (15°C) at inlet



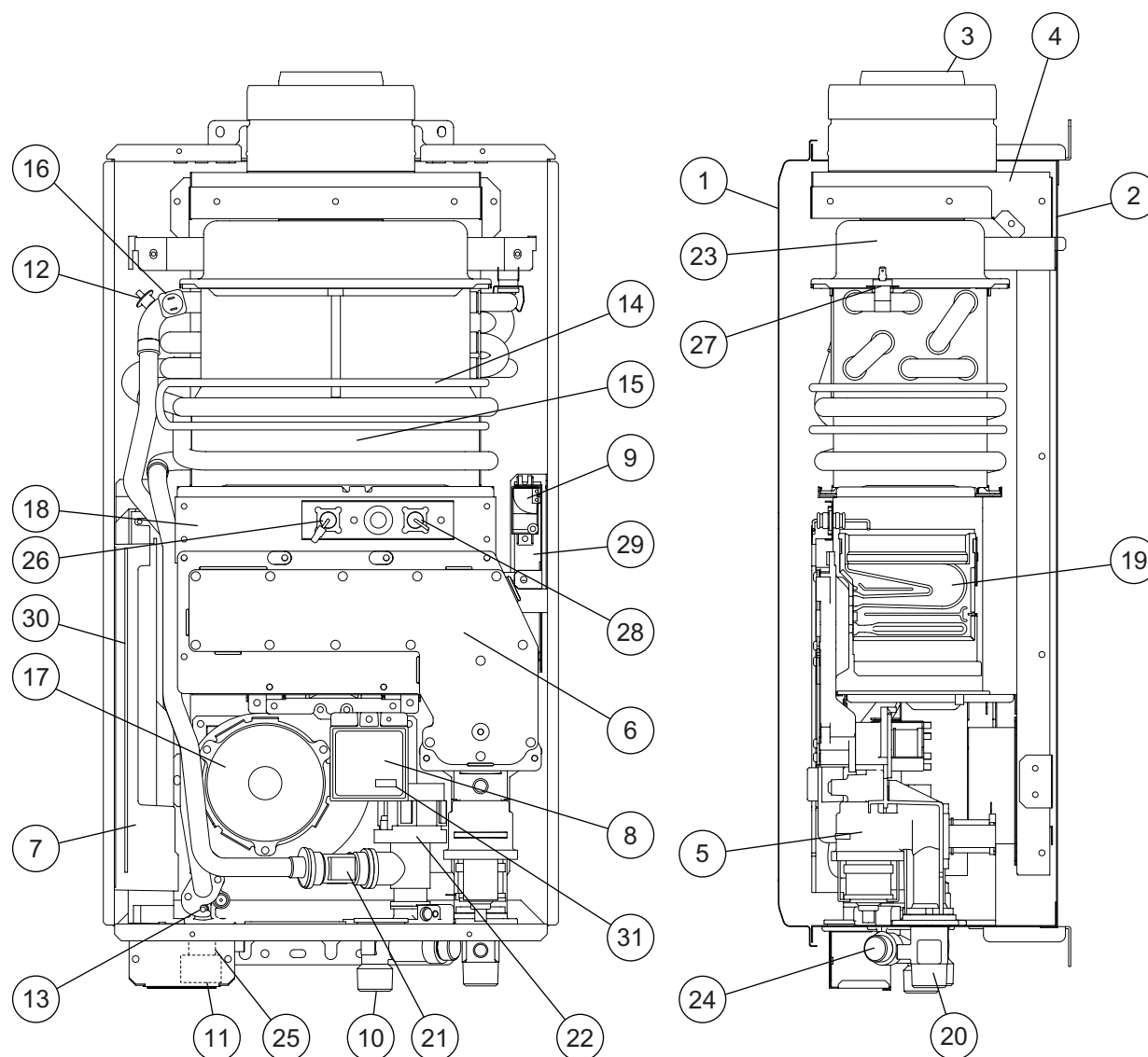
With water temperature 68°F (20°C) at inlet



With water temperature 77°F (25°C) at inlet



1-4 General Construction (Parts Names)

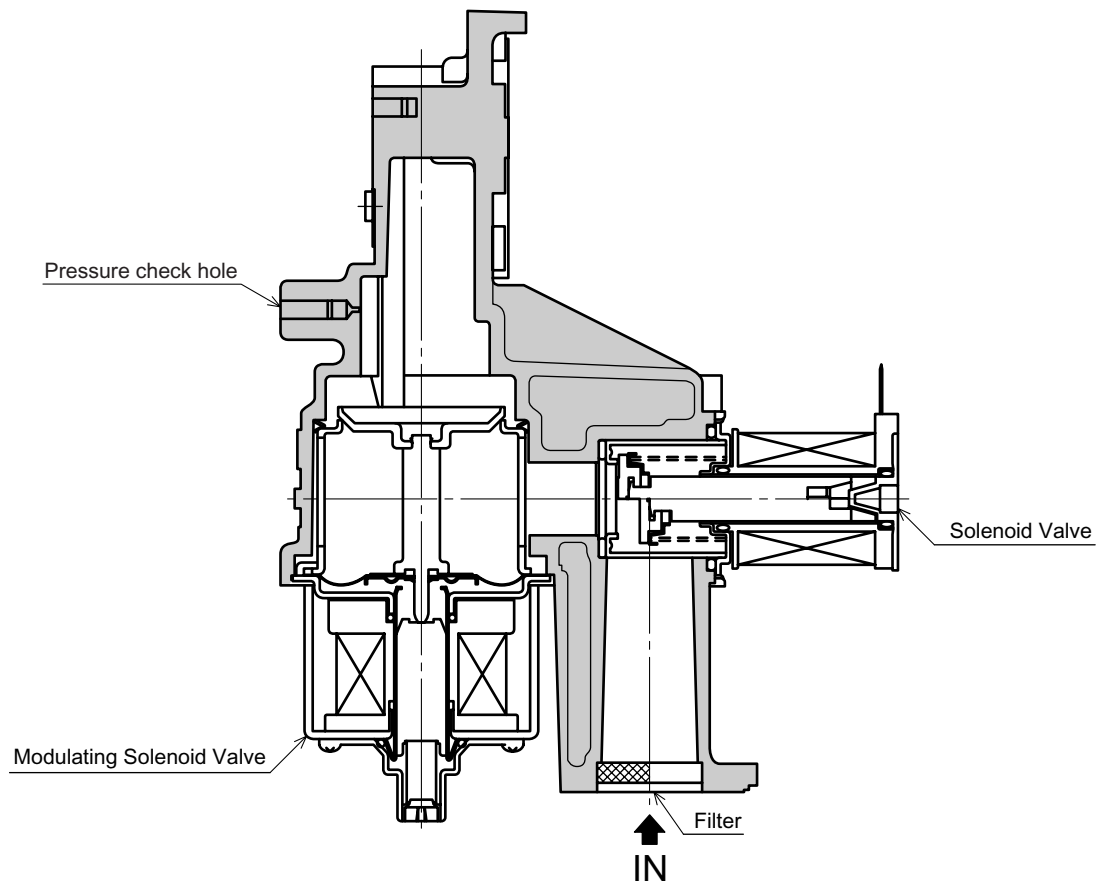
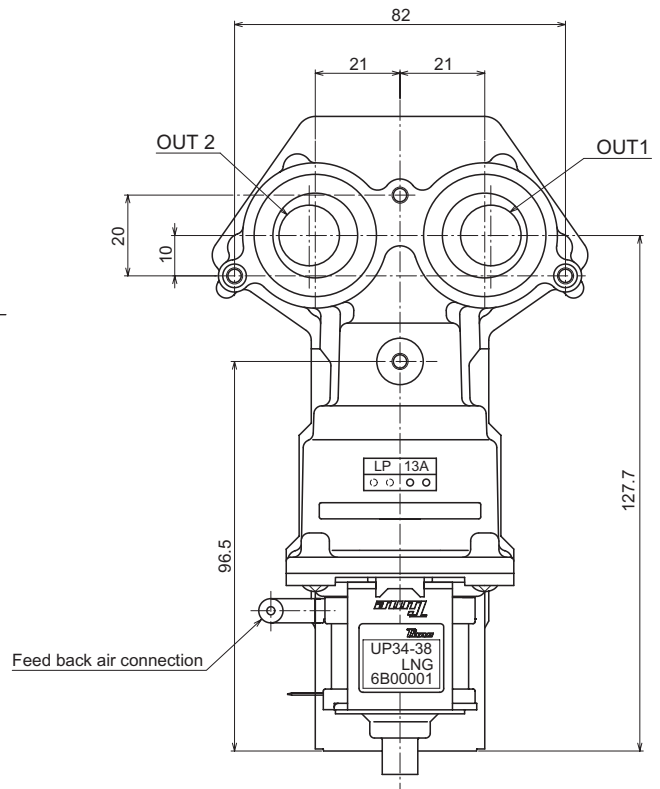
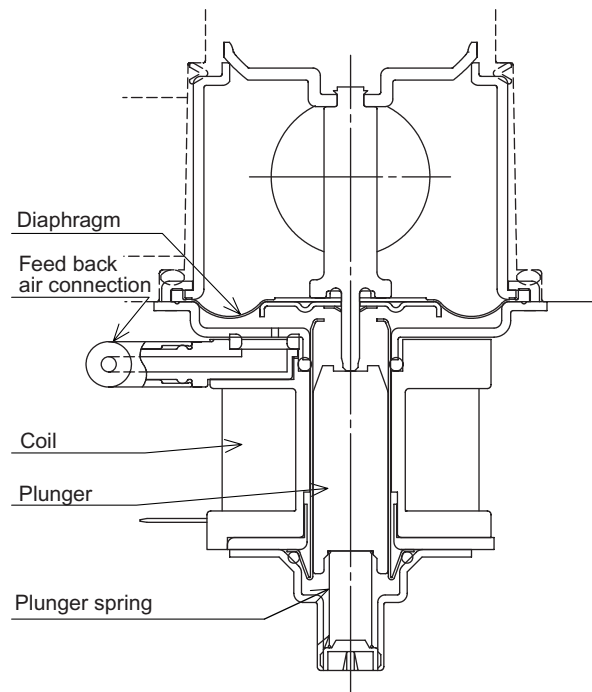


No.	Description	No.	Description	No.	Description
1	Front Panel	12	Heat Exchanger Thermistor	23	Exhaust Chamber
2	Casing Assembly	13	Outgoing Water Thermistor	24	Water Filter Assembly
3	Exhaust Gas Duct	14	Thermal Fuse Device	25	Drain Plug
4	Air Inlet Box Assembly	15	Heat Exchanger	26	Flame Rod
5	Modulation Valve Unit (Gas Control Assembly)	16	Over Heat Switch (bi-metal switch)	27	Frost Sensing Switch (bi-metal switch)
6	Manifold Assembly	17	Combustion Fan Motor Assembly	28	Electrode
7	PCB Unit	18	Combustion Chamber Assembly	29	Transformer(100V)
8	Surge Protector	19	Burner Assembly	30	Fuse(3.15A)
9	Igniter Transformer	20	Gas Inlet	31	Fuse(5A)
10	Water Inlet	21	Water Flow Sensor		
11	Hot Water Outlet	22	Water Flow Control Device		

1-5 Main Component Structures

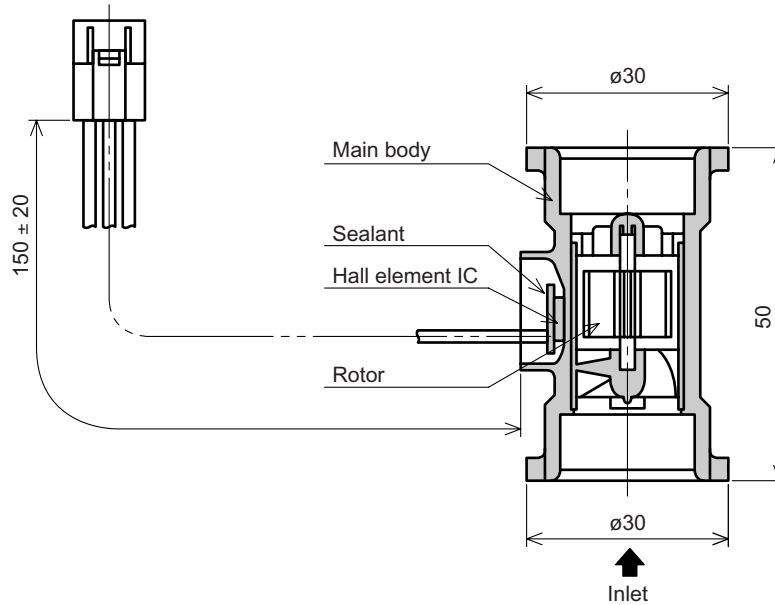
1. Gas flow control device

- Feeds the necessary amount of gas to heat water to a set temperature, based on the amount of water flowing in through the inlet measured by the water flow sensor and the water temperature calculation.
- When the thermistor detects the water temperature at the inlet, the temperature is compared with the setting. An electric current representing the temperature difference is transmitted to the PCB where the current is amplified and dispatched to the Modulating Solenoid Valve.
- An electromagnetic force caused by the current from the PCB pushes the plunger upward. <Upward force>
- Pressure received at the diaphragm due to internal pressure in the chamber of the Modulating Solenoid Valve pushes the plunger downward. <Downward force>
- The plunger stops moving and stays at a certain position when the Upward and Downward force are balanced.
- As the plunger remains at the position, the valve position of the Modulating Solenoid Valve linked to the plunger is determined. This determines a "clearance" between the valve body and the Modulating Solenoid Valve, establishing a necessary gas quantity. The required amount of gas is then supplied to the main burner.
- If the temperature of the heated water is lower or higher than the setting, the resistance of the hot water temperature detecting thermistor changes accordingly to automatically adjust the gas amount by changing greater or lower the current transmitted to the Modulating Solenoid Valve. This stabilizes the heated water temperature.
- When the gas supply pressure is changed, the receiving pressure of the diaphragm changes and also changes the clearance between the valve body and the Modulating Solenoid Valve. The gas is controlled to remain at a constant level.



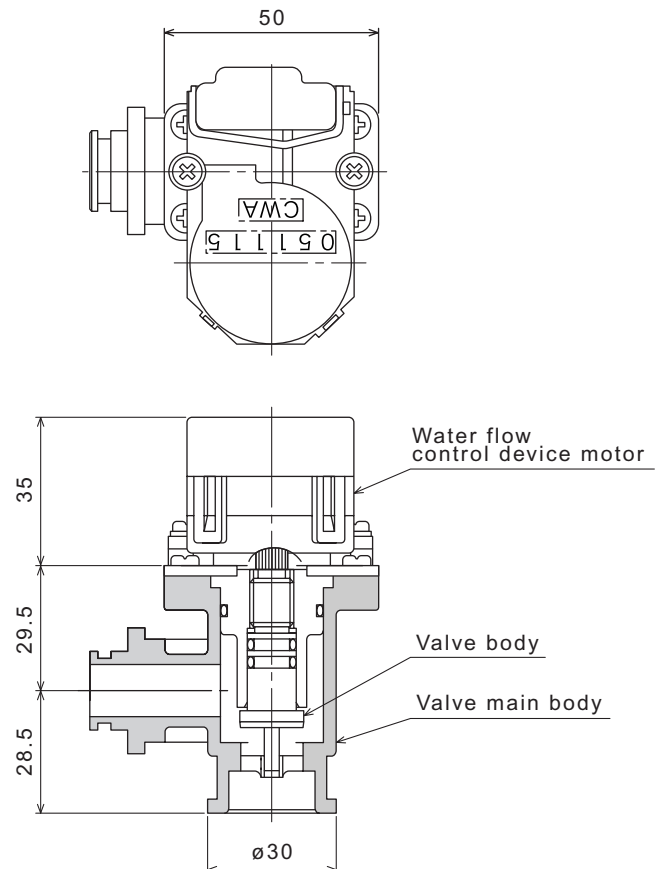
2. Water flow sensor

* Measures the water flow as its rotor (bladed wheel) spins with the passing water. The rotation of the rotor is detected by the sensor rotor (blade equipped with a magnet) of the wheel and the Hall element which calculates the water quantity.



3. Water flow control device

* When water flows more than water heater capacity, hot water temperature becomes lower than the setting. The water flow control device automatically reduces the water flow to prevent such temperature drops. If the water flow is greater than the heater capacity, a signal from the PCB activates the water flow control device's motor (stepping motor). In response to this operation, the valve body of the water flow control device also is operated to reduce the water flow by narrowing the water path. Water flow fluctuations are detected and transmitted to the PCB by the water flow sensor. When the appropriate level of water flow is reached, the PCB signals the motor to stop. Thus, the water flow remains at this level.



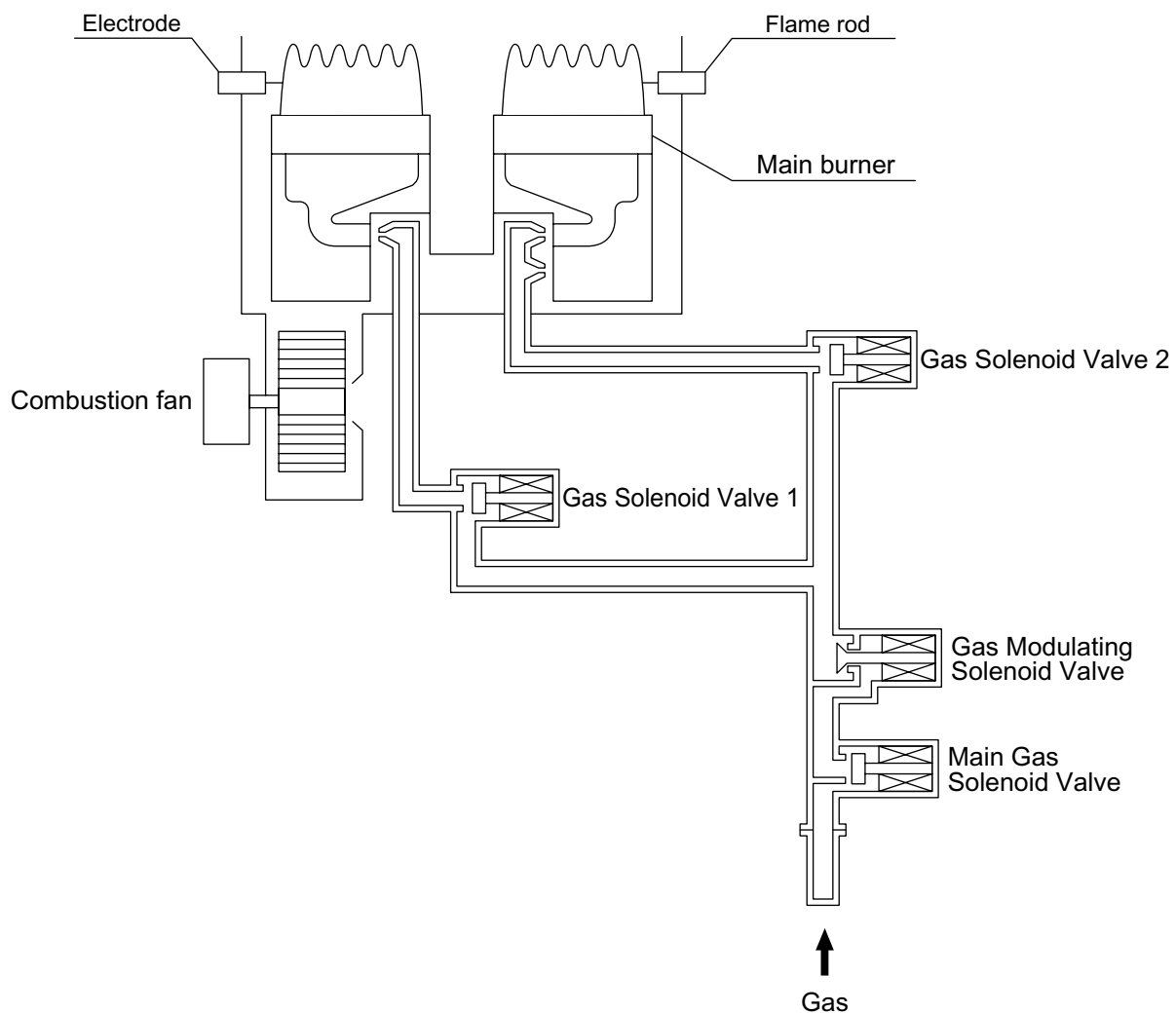
4. Combustion control of rich and lean burners

1) Ignition start

After the Main Gas Solenoid Valve, Gas Solenoid Valve 1, Gas Solenoid Valve 2 open respectively as required, the Gas Modulating Solenoid Valve, being held at the slow ignition position (with gas supply at a constant rate), operates to ignite rich burners and lean burners.

2) During combustion

When a heating capacity higher than a certain level (approximately 95,000 BTU) is required, both Gas Solenoid Valve 1 and Gas Solenoid Valve 2 are opened to burn with rich and lean burners while the gas supply is controlled by the Gas Solenoid Valve. When the required heating capacity becomes lower than a certain level (approximately 110,000 BTU), the Gas Solenoid Valve 2 is closed while Gas Solenoid Valve 1 remains open to combust with 12 rich burners, with the gas supply controlled by the Gas Modulating Solenoid Valve.



1-6 Main Safety Devices

1. Water flow sensor (Boil-dry protection)

When the water flow sensor detects the flow rate set for starting ignition (ignition water flow) or higher, the water heater starts operation.

Ignition water flow: 0.71 GPM (2.7 L/min.)

Extinction water flow: 0.58 GPM (2.2 L/min.)

2. Flame rod (Flame failure detection)

Electric signals are transmitted to the flame detection circuit to confirm the normal combustion when the flame rod detects the rectification of normal combustion flame. Therefore, if the combustion of the burners is not normal, the signals are not sent via the flame rod. The gas control assemblies are closed without the signals and the error code "111" or "121" is displayed on the remote controllers. (Normal with 0.8 μ A or higher)

3. Thermal fuse (Over-temperature protection system)

The thermal fuse is placed around the heat exchanger assembly. If the ambient temperature inside the water heater becomes extremely high, the fuse will melt down to break the power circuit. In such a case, as no power is supplied to the gas control assemblies, the gas supply is stopped and the combustion is stopped.

(The system is activated to blow the fuse at 363°F [184°C].)

4. Over heat switch (residual)

Even if the heat exchanger assembly is over heated by no-water combustion, every gas path is closed to avoid risks. At this time, the error code "141" is displayed on the remote controllers.

(The switch is provided with a auto-restoration function and turns OFF at 212°F [100°C].)

5. Fan revolution detection device (Hall IC)

The device detects the fan revolution speed to control the air supply necessary for normal combustion. If the fan revolution is out of the preset standard range, the gas control assemblies are closed to stop the combustion before combustion failure occurs. In this case, the error code "611" is displayed on the remote controllers.

6. Anti-freeze system (Frost sensing switch and heater)

To prevent freezing in the hot water supply circuit, anti-frost heaters are provided at major points of water flow paths in the unit. The heaters are activated by the thermistors in the unit.

The 4 heaters, one located on the front side of heat exchanger is 48W, the water supply pipe is 16W, the connection of water inlet is 10W and the connection of hot water outlet is 10W. In order to keep the heat is the most vulnerable part of heat exchanger, the big capacity 48W heater is mounted.

(The system turns ON at 37°F [3°C] and OFF at 55°F [13°C].)

1-7 Scale Build Up Alarm

Summary

The temperature of residual hot water becomes higher as scale starts to build up inside the heat exchanger. The extent of scale build up is judged by monitoring the temperature of residual hot water. "LC", scale build up alarm, is indicated on the remote controller.

Flow chart (See page 50)

- 1) The set temperature by remote controller needs to be 120°F and over to activate the alarm.
- 2) The stability of the temperature of outgoing hot water is detected by the thermistor of the can body.
- 3) The temperature of residual hot water is detected by the thermistor of the can body when hot water flow is stopped. The criterion for judging scale build up varies depending on combustion capacity.
- 4) "LC" alarm and set temperature are indicated alternately on the remote controller.

Alarm specification

- * Hot water supply is available even if "LC" is indicated on the remote controller.
- * "LC" alarm can be reset by turning the power switch off and on.
- * No detection is possible in case remote controller is disconnected.
- * "LC" alarm is not memorized in the alarm history record.

Conditions for invalid detection

- * The thermistor of the can body is broken or short-circuited.
- * The alarm is in process.
- * During forced combustion by the dip switch.
- * The set temperature is under 120°F.

2. Installation and Related Work

2-1 INSTALLATION INSTRUCTIONS

- The cases shown below are classified by the degree of risk and damage.
Be sure to follow the instruction for your safety.

 Danger	"Danger" indicates that serious injuries or even death may result from the improper installation due to negligence of following the instructions.
 Warning	"Warning" indicates the possibility that serious injuries or even death may result from the improper installation due to negligence of following the instructions.
 Caution	"Caution" indicates the possibility that some injuries or material damage may result from the improper installation due to negligence of following the instructions.

Each mark indicates:

	General prohibited
	Never fail to do.
	Ground

 Danger
Never install the unit outdoors as it is exclusively for indoor use. Do not install it in the bathroom. Electric shock or leakage may result.

To the installers.

 Warning
• Read and understand the installation manual to carry out the installation as specified for proper and safe usage. • A competent dealer or plumber should perform the complete installation, including placement venting, plumbing, gas line, and electrical connection. Consumers should not try to install their own unit. • Make double sure that the unit runs in accordance with the check items of "trial run" standard after it is installed. (refer to Testing operation) • When installation of water heater and vent pipes, be sure to wear protective equipment to prevent injuries and burns.

Before installation.

Verification of the unit.

Warning

- Make sure the unit to be installed suits the intended use and application.
- Do not use any gas other than specified on the sticker.
- Do not operate with any power source (voltage/frequency) other than specified on the sticker.

 DIRECT VENT AUTOMATIC INSTANTANEOUS GAS WATER HEATER FOR INDOOR INSTALLATION NATURAL GAS / PROPANE GAS CHAUFFE-EAU INSTANTANÉE AUTOMATIQUE À ÉVENT DIRECT POUR INSTALLATION INTÉRIEUR. NAT / GPL		
MODEL : MWH-180	NATURAL GAS (Gaz Naturel)	PROPANE GAS (GPL)
MAX. INPUT Débit calorifique max.	180,000 Btu/h	180,000 Btu/h
MIN. INPUT Débit calorifique min.	20,000 Btu/h	20,000 Btu/h
GAS PRESSURE INLET MAX. Pression de gaz entrée max.	10.5 inches W.C. 10.5 pounces W.C.	14.0 inches W.C. 14.0 pounces W.C.
GAS PRESSURE INLET MIN. Pression de gaz entrée min.	4.0 inches W.C. 4.0 pounces W.C.	8.0 inches W.C. 8.0 pounces W.C.
GAS PRESSURE MANIFOLD MAX. Pression d'admission max.	2.4 inches W.C. 2.4 pounces W.C.	2.4 inches W.C. 2.4 pounces W.C.
GAS PRESSURE MANIFOLD MIN. Pression d'admission min.	0.4 inches W.C. 0.4 pounces W.C.	0.4 inches W.C. 0.4 pounces W.C.
ELECTRICAL RATING Régime nominal électrique	AC 120V – 60Hz	
MAX. WATER PRESSURE Pression d'eau max.	150 PSI	
Wiring Diagram inside Front Cover Schéma du câblage derrière le couvercle avant.		
Minimum clearances from combustible of non-combustible construction Dépassements minimums à assurer entre les parois de l'appareil et les constructions combustibles ou incombustibles		
Back: 0 inch	0 po arrière	
Front: 6 inches	6 po devant d'appareil	
Top: 12 inches	12 po dessus	
Side: 2 inches	2 po côtés	
FOR YOUR SAFETY Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. This water heater is required to have with a pressure relief valve. For safe operation of the water heater the relief valve must not be removed from its designated point of installation or plugged.		
POUR VOTRE SÉCURITÉ Ne pas entreposer ne utiliser d'essence ne d'autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil. Ce chauffe-eau doit être installer avec un soupape de décharge. Pour assurer le fonctionnement sécuritaire du chauffe-eau, ne pas retirer ni obturer cette soupape de décharge.		

20457662

ONLY FOR USE WITH

NATURAL GAS

REFER TO THE LOCAL GAS AUTHORITY FOR CONFIRMATION ON THE GAS TYPE, IF IN DOUBT.
DO NOT REMOVE THIS LABEL UNTIL THE APPLIANCE HAS BEEN INSTALLED AND TESTED.
Si vous ne savez pas le type de gaz, contactez le fournisseur de gaz ou les autorités locales.
Enlevez pas cette étiquette jusqu'à l'appareil a été installer et vérifié.

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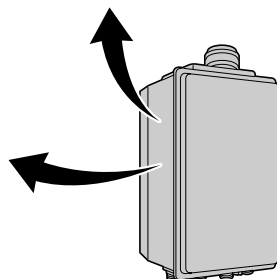
or

ONLY FOR USE WITH

PROPANE GAS

REFER TO THE LOCAL GAS AUTHORITY FOR CONFIRMATION ON THE GAS TYPE, IF IN DOUBT.
DO NOT REMOVE THIS LABEL UNTIL THE APPLIANCE HAS BEEN INSTALLED AND TESTED.
Si vous ne savez pas le type de gaz, contactez le fournisseur de gaz ou les autorités locales.
Enlevez pas cette étiquette jusqu'à l'appareil a été installer et vérifié.

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Location of the unit.

Decide where to install the unit by considering customer's request and venting length limitations.

Warning

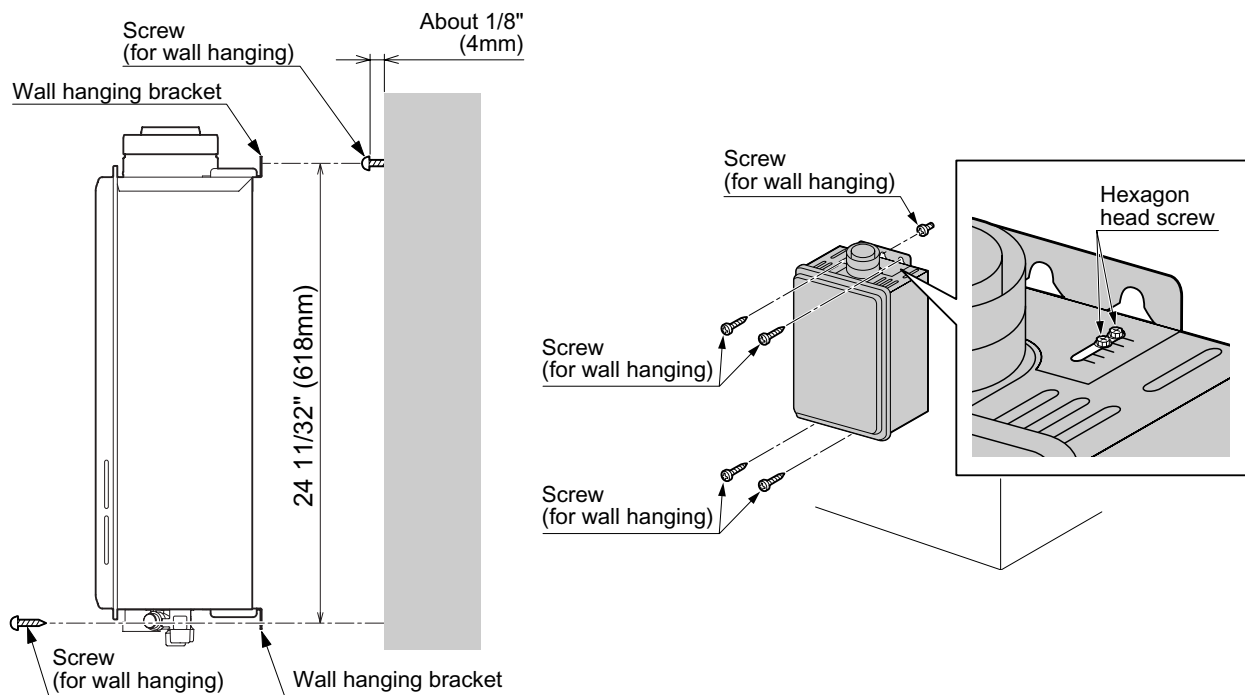
Ventilation

- Install the unit where there is enough space for ventilation.
- Use the designated vent terminal (option).
- Make sure the pipe termination is kept clear of snow.
- In principle, at time of replacing the unit, do not reuse vent pipe, termination, or fitting which has been used over one year.
However, if the components are made of SUS304 or a material having equal or better corrosion resistance, they can be reused.
Check for the holes, cracks, blockage, or gap in connections of the piping.
Reuse the components only after making sure there is no problem.
- Do not install the unit where flammables such as gasoline, benzene, and adhesive are handled.

Installation.

Caution

- Reinforce the wall if necessary as this unit weighs about 43lbs.
 - Make sure that there is adequate floor drainage to prevent flooding the floor.
1. Twist 1 screw (for wall hanging) into the wall leaving about 1/8" (4mm) length to hook on.
 2. Hook the center hole of the wall hanging bracket onto the screw and securely fix the unit with 4 screws.
 3. Adjust the clearance between the unit and the wall by loosening 8 hexagon head screws (upper and lower) and then securely fix the unit, so it is level.



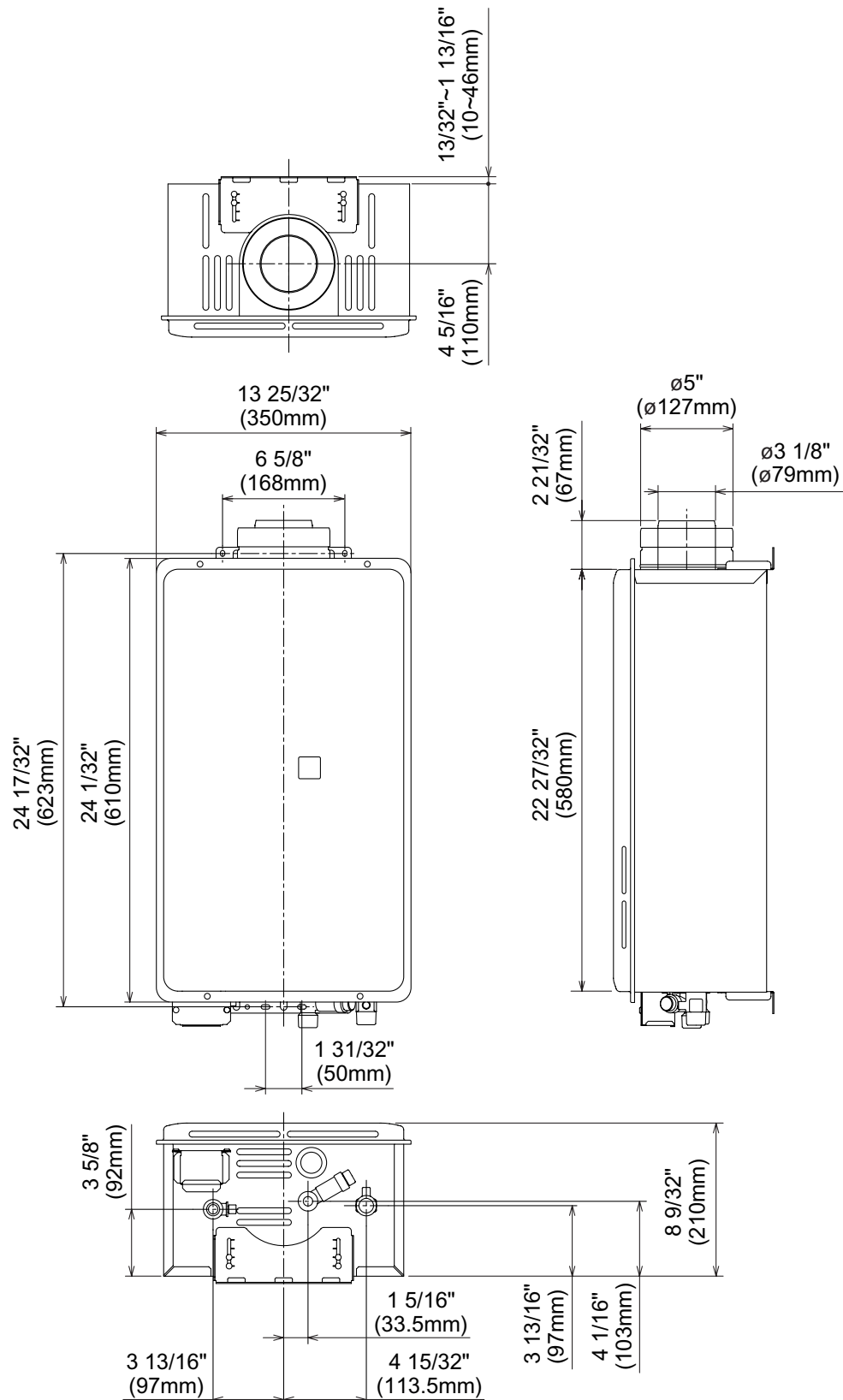
⚠ Caution

- Check if adjacent wall or ceiling is fire resistant and allows safe distance for fire prevention.
- This water heater is suitable for residential water (portable) heating only. Do not use this water heater for space heating, combination space heating/domestic water heating, or commercial water heating applications.
- MWH-180 is not suitable for use in pool or spa applications.
- Maintain proper space around the unit for proper servicing and operation. Minimum clearances from combustible materials are listed below.

Top of heater	12" (30.5cm)
Back of heater	0" (0cm)
Front of heater	6" (15.2cm)
Sides of heater	2" (5.1cm)
Floor	12" (30.5cm)
Vent pipe	0" (0cm)

- Secure enough space so that the inspection and repairs can be done easily.
- Secure space not only in front but also under the unit.
- Install the vent terminal in a place where sufficient ventilation can be secured.
- This unit is designed to be installed indoors using the proper vent piping to exhaust by-products of combustion to the outside environment.
Contact your dealer or MPI for proper vent kits.
- Do not install the unit over other combustion appliances such as gas cooking stove or a range.
Oil residue and dust in the air can adhere to the burner and the heat exchanger resulting in deformation, loss of efficiency, or damage to electronic components.
- Do not install the vent terminal near the outlets of the other appliances.
Install the air intake terminal away from the wind path as the wind may cause imperfect combustion.
- Keep the vent terminal away from the wall or the overhangs as far as possible even if it is noncombustible in order to prevent discoloration and staining caused by the exhaust gas.
- Do not install the unit where commercial chemicals are used.
Those chemicals are ammonium, sulfur, chloride, ethylene compound and acids which are used at beauty shop, laundry, factory and so forth.
- Do not install the unit over food or dishes.
- Installer must install a Pressure relief valve.
Pipe pressure relief to a drain or outside environment, or within 4" of the floor.
Pipe pressure relief discharge to a drain or outside environment.
- The appliance should be located in an area where leakage from the unit or connections will not result in damage to the area adjacent to the appliance or to lower floors of the structure. When such locations can not be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. The pan must not restrict combustion airflow.

2-2 DIMENSIONS



2-3 TEMPLATE OF L TERMINATION INSTALLATION

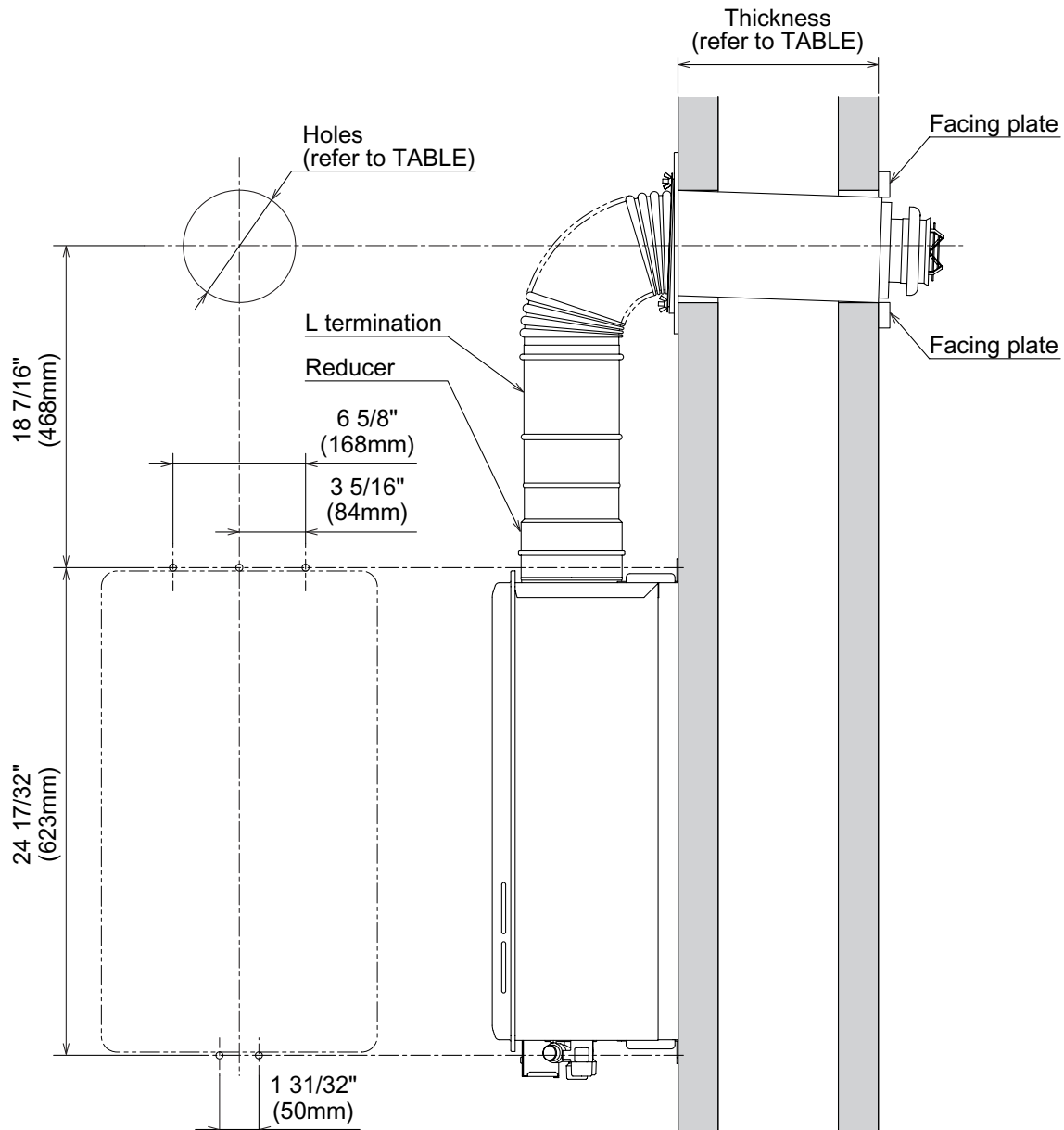


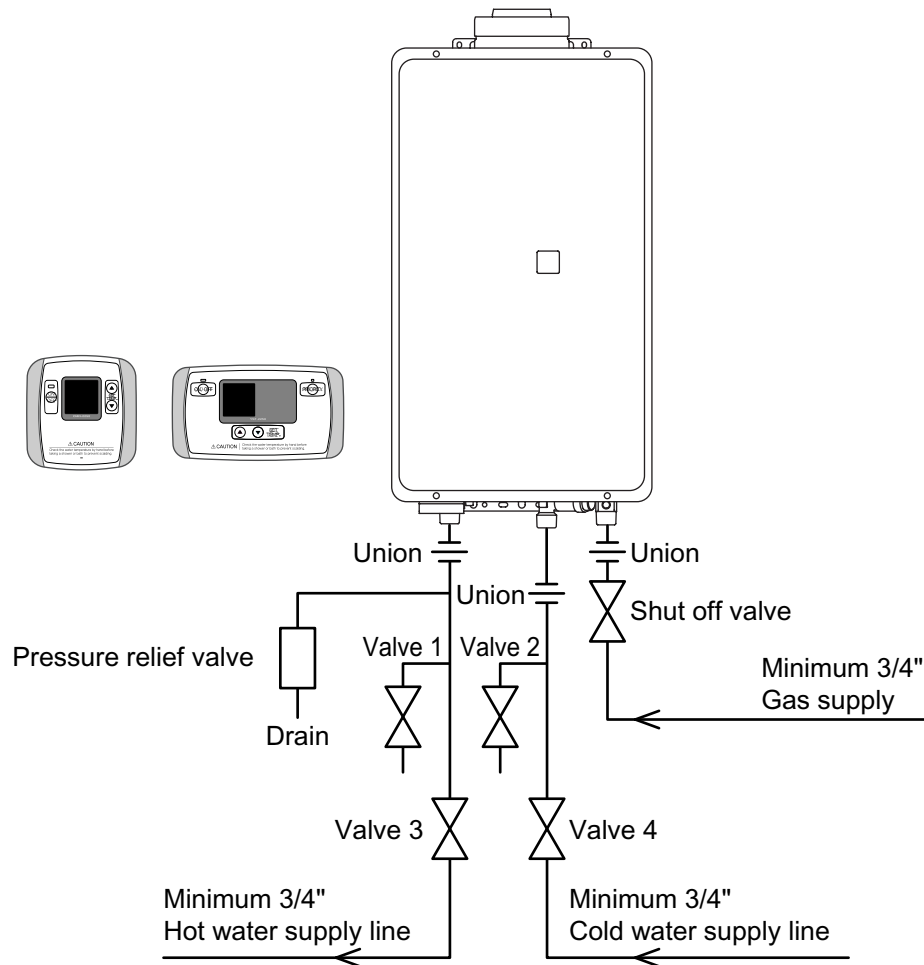
TABLE : Relationship between the range of wall thickness and the diameter of opening on the wall.

Model Number	MPI P/N	the range of wall thickness	the diameter of opening
FFT-7U-200	3810	3.9-9.8" (100-250mm)	ø5.7-5.9" (ø144-150mm)
FFT-7U-300	3811	9.8-17.7" (250-450mm)	ø5.8-5.9" (ø147-150mm)
FFT-7U-500	3812	17.7-25.6" (450-650mm)	ø6.1-6.9" (ø154-175mm)
FFT-7U(L)-200	3813	3.9-9.8" (100-250mm)	ø5.7-5.9" (ø144-150mm)
FFT-7U(L)-300	3814	9.8-17.7" (250-450mm)	ø5.8-5.9" (ø147-150mm)
FFT-7U(L)-500	3815	17.7-25.6" (450-650mm)	ø6.1-6.9" (ø154-175mm)

*The diameter of the wall opening does not need to be increased if the wall opening is pitched DOWNWARD towards the outside at a 2° (1/4 in/ft) pitch.

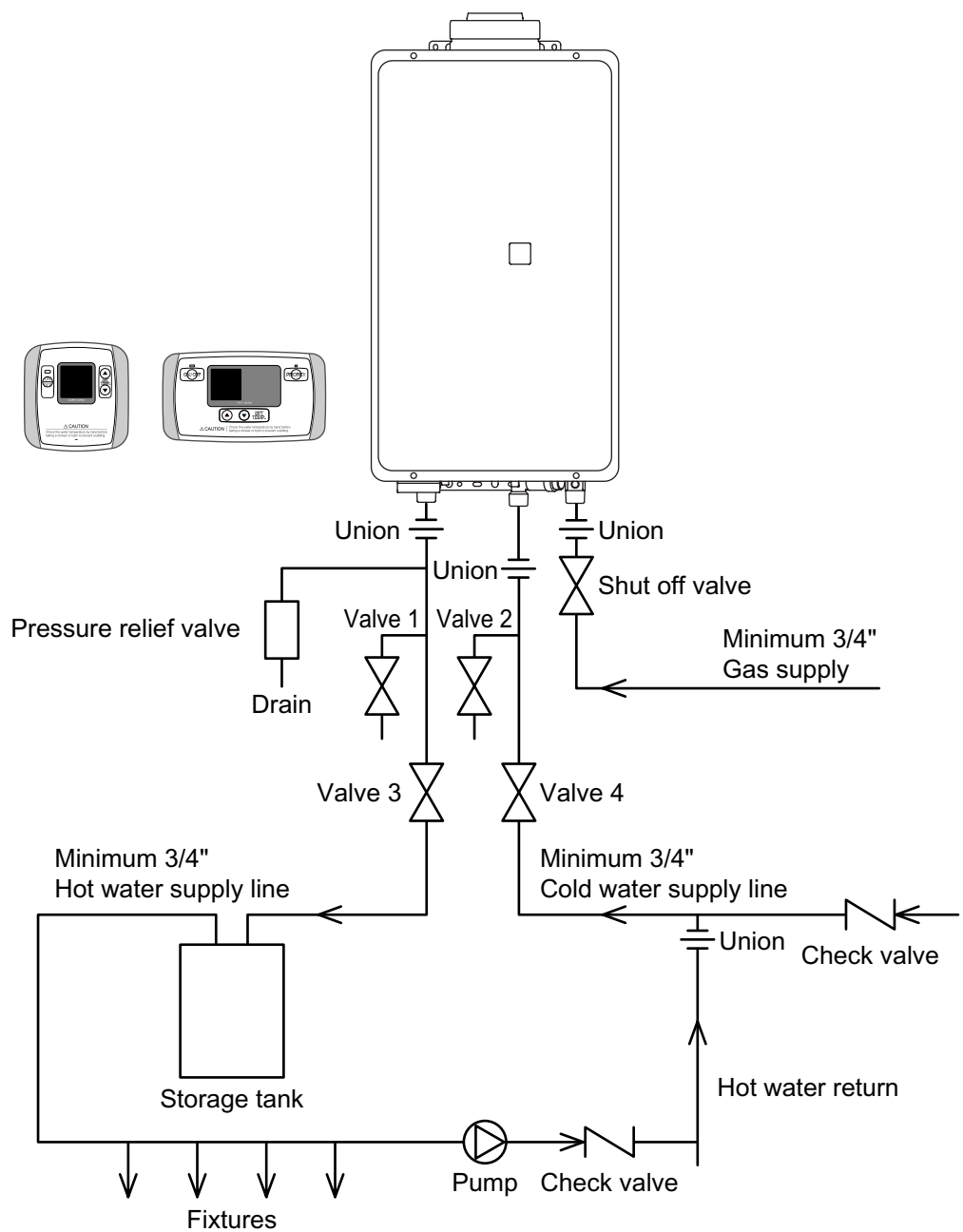
2-4 SUGGESTED PIPING-BASIC INSTALLATION

This drawing is intended only as a guide.
It does not imply compliance with local building codes.
Installation must be done in accordance with local building
codes and may vary depending on installation location.
Confer with local building officials before installation.



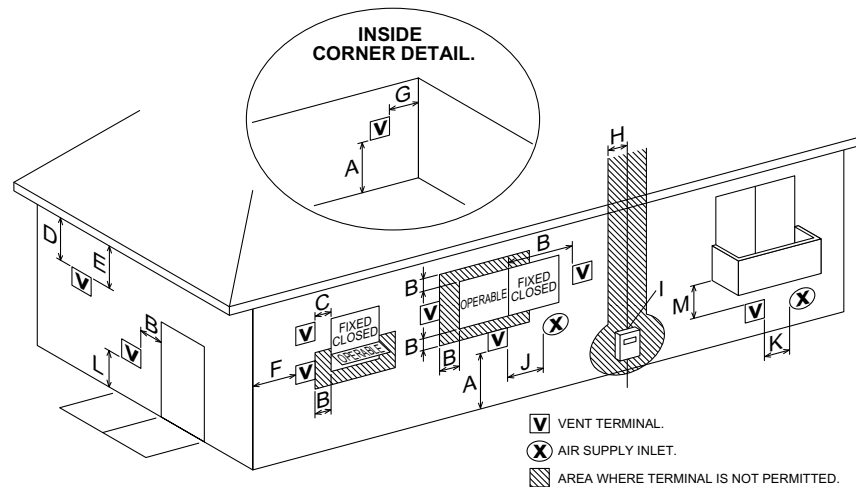
2-5 SUGGESTED PIPING-CIRCULATION SYSTEMS

This drawing is intended only as a guide.
It does not imply compliance with local building codes.
Installation must be done in accordance with local building
codes and may vary depending on installation location.
Confer with local building officials before installation.



2-6 VENT PIPE INSTALLATION

Vent Terminal Clearances.



		Canadian Installations ¹	US Installations ²
A=	Clearance above grade, veranda, porch, deck, or balcony.	12 inches (30cm)	12 inches (30cm)
B=	Clearance to window or door that may be opened.	6 inches (15cm) for appliances ≤ 10,000 Btuh (3kW), 12 inches (30cm) for appliances >10,000 Btuh (3kW) and ≤ 100,000 Btuh (30kW), 36 inches (91cm) for appliances >100,000 Btuh (30kW)	6 inches (15cm) for appliances ≤ 10,000 Btuh (3kW), 9 inches (23cm) for appliances >10,000 Btuh (3kW) and ≤ 50,000 Btuh (15kW), 12 inches (30cm) for appliances >50,000 Btuh (15kW)
C=	Clearance to window or door that may be opened.	*	*
D=	Clearance to permanently closed window.	*	*
E=	Clearance to unventilated soffit.	*	*
F=	Clearance to outside corner.	*	*
G=	Clearance to inside corner.	*	*
H=	Clearance to each side of center line extended above meter/regulator assembly.	3 feet (91cm) within a height 15 feet above the meter/regulator assembly.	*
I=	Clearance to service regulator vent outlet.	3 feet (1.83m)	*
J=	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance.	6 inches (15cm) for appliances ≤ 10,000 Btuh (3kW), 12 inches (30cm) for appliances >10,000 Btuh (3kW) and ≤ 100,000 Btuh (30kW), 36 inches (91cm) for appliances >100,000 Btuh (30kW)	6 inches (15cm) for appliances ≤ 10,000 Btuh (3kW), 9 inches (23cm) for appliances >10,000 Btuh (3kW) and ≤ 50,000 Btuh (15kW), 12 inches (30cm) for appliances >50,000 Btuh (15kW)
K=	Clearance to a mechanical air supply inlet.	6 feet (1.83m)	3 feet (91cm) above if within 10 feet (3m) horizontally.
L=	Clearance above paved sidewalk or paved driveway located on public property.	7 feet (2.13m) ³	*
M=	Clearance under veranda, porch deck, or balcony.	12 inches (30cm) ⁴	*

¹ In accordance with the current CSA B149.1 Natural Gas and Propane Installation Code.

² In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code.

³ A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

⁴ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

* For clearances not specified in ANSI Z223.1 / NFPA 54 or CSA-B149.1, one of the following shall be indicated :

a) A minimum clearance value determined by testing in accordance with section 2.20, or ;

b) A reference to the following footnote :

Note : Check local codes and ordinances.

- Use only designated vent terminal (sold separately).
- Install correctly in accordance with the installation manual attached.
- Select the correct switch position depending on the length of the vent pipe.
- Make sure that the proper distance, within the limitations, is determined between the unit and the termination of the vent pipe.
- Make sure the terminal of the vent pipe sticks out outdoors.
- Prevent the exhaust gas from flowing back indoors through the gap between the termination and the wall where the vent pipe penetrates.
- Make sure snow drift will not suffocate the vent terminal when it has been piled or fallen.
- Do not place hazardous materials near the end of the vent termination.
- Make sure to install the vent terminal at downward slope to prevent rain from entering inside.
- Some vapor or condensation may be generated from the vent terminal.
- Place the vent terminal where it is not affected by water splashing or falling off the roof eaves.
- A vent system that exits the structure through a sidewall shall terminate not less than 12" (30.5cm) above the ground.

Check local codes and ordinances which may require higher clearances.

- The termination of the vent system shall not be located in public traffic areas, such as walkways, unless the vent system is at least 7' (2.1m) above the ground.
- Terminate the system 6' (1.8m) from the combustion air intake of any appliance.
- Place the system at least 3' (0.9m) away from any other building opening, gas utility meter, service regulator or the like, or less distance if specified in the appliance's instructions.

And also ensure that positioning of the vent system complies with the requirements of AS5601/AG601 Clause 5.13.6.2/Fig. 5.3

- In case extension of the vent pipe is required, it shall be limited to the maximum of 41' (12.5m) based on the formula below.
However, the maximum height of the vent pipe is limited to 23 feet.
- Calculate D (distance) value according to the length of the vent pipe and the number of elbows.

$$D = L + (M_{90} \times 6) + (M_{45} \times 1.5)$$

D : Distance

L : Total extended length of straight vent pipe and adjustable vent pipe.

M₉₀: Number of 90° elbow

M₄₅: Number of 45° elbow

Note : Maximum number of M₉₀ is 3pcs. Maximum number of M₄₅ is 5pcs.
In case of combination use for M₉₀ and M₄₅, maximum total number is 5pcs.

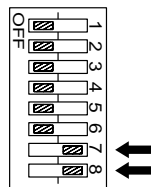
To prevent the vent/air intake piping from occurring condensation, the fan has following 4 type settings with 2 dip switches, No.7 & No.8 in each D value.

Both dip switch No.7 & No.8 ON is factory setting ; this is suitable for over 30 in D value.

- Depending upon the vent length, dip switch No.7 & No.8 on PCB may need to be adjusted to compensate fan speed. Read the following instructions to determine which position this switch should be placed in.
- In case D value is 30 and above, leave dip switch No.7 & No.8 (ON).
- In case D value is 21 and above, but less than 30, set dip switch No.7 OFF and leave dip switch No.8 (ON).
- In case D value is 15 and above, but less than 21, leave dip switch No.7 (ON) and set dip switch No.8 OFF.
- In case D value is less than 15, set both dip switch No.7 & No.8 OFF.
(Factory setting No.7 & No.8 ON.)

< Dip switch on PCB >

* No.1 dip switch is ON with Natural Gas and OFF with Propane Gas.

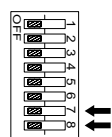


• Example #1 :

L termination

Reducer

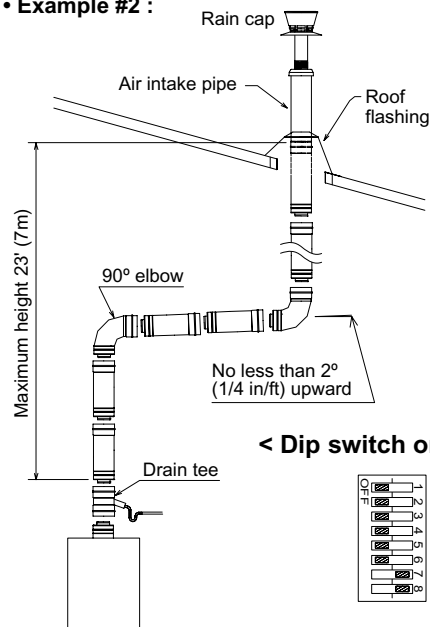
< Dip switch on PCB >



In case of L termination and reducer.
(Refer to Fig. 4-1)

$$D = 0' + (0 \times 6) + (0 \times 1.5) = 0$$

• Example #2 :



< Dip switch on PCB >

In case of 6 straight vents and 2-90° elbows.
(Refer to Fig. 7 right drawing.)

$$D = 18' + (2 \times 6) + (0 \times 1.5) = 30$$

Note :

- In case D value is longer than 41, the unit shall be relocated with vent length of less than 41'.
- In case vent pipe requires extension, use coaxial vent pipe and elbows and start from the vent terminal side.
- Install the vent pipe at slight decline toward the vent terminal.
- Install the vent pipe securely by using sling fittings to support the connected parts.
- Use fittings at 5' (1.5m) intervals. Do not use wire.
- When installing extended vent pipe :
Take special precaution to stay clear of combustible surfaces.
- In case of horizontal direct vent installation, be sure to use recommended vent terminal.
- In case of horizontal direct vent installation with recommended vent terminal, connect reducer between water heater and vent terminal.
- In case of other horizontal direct vent installation, connect reducer between pipe and vent terminal.

Warning :

- Failure to follow the installation instructions could cause FIRE, CARBON, MONOXIDE POISONING, or DEATH.
- Never change the position of any dip switch other than No.7 & No.8.
- Unauthorized alteration and use of the unit in a wrong setting may cause material damage, injury accident, scalding, or even death.
- Exceeding the maximum vent length is dangerous and may result in bad combustion.
- Be sure to connect the vent pipes in such a way so that no exhaust gas leaks when they are installed in a concealed area, such as the attic.

Caution :

- The edges of sheet metal parts may be sharp.
Always wear gloves and appropriate eye, foot, and other protections when handling these products.
- It is recommended that experienced professionals familiar with the operation and maintenance of heating appliances and vent / air intake system install this system.
These instructions are a guide to assist a professional installer.
- Before commencing installation, please read the installation instructions carefully.
- Failure to follow the installation instructions could cause not only the lower performance of appliance but also property damage or personal injury.
- Different manufactures have different joint systems and adhesives.
Do not mix pipe, fitting, or joining methods from different manufacturers.
- Examine all components for shipping damage prior to installation.

General installation requirements.

(1) Selecting installation site.

- A vent system that exits the structure through a sidewall or the like shall terminate not less than 12" (30.5cm) above the ground.
- The termination of the vent system shall be located above the snow line in geographical areas where snow accumulates.
- The termination of the vent system shall not be located in public traffic areas, such as walkways, unless the vent system is at least 7' (2.13m) above the ground.

And also ensure that positioning of the vent system complies with the requirements of AS5601/AG601 Clause 5.13.6.2/Fig. 5.3

Check local codes and ordinances which may require higher clearances.

(2) Clearance to combustibles and openings

Maintain clearances to openings as follows

- Terminate the system 6' (1.8m) from the combustion air intake of any appliance.
- Place the system at least 3' (0.9m) away from any other building opening, gas utility meter, service regulator or the like, or less distance if specified in the appliance's instructions.

Items of vent system.

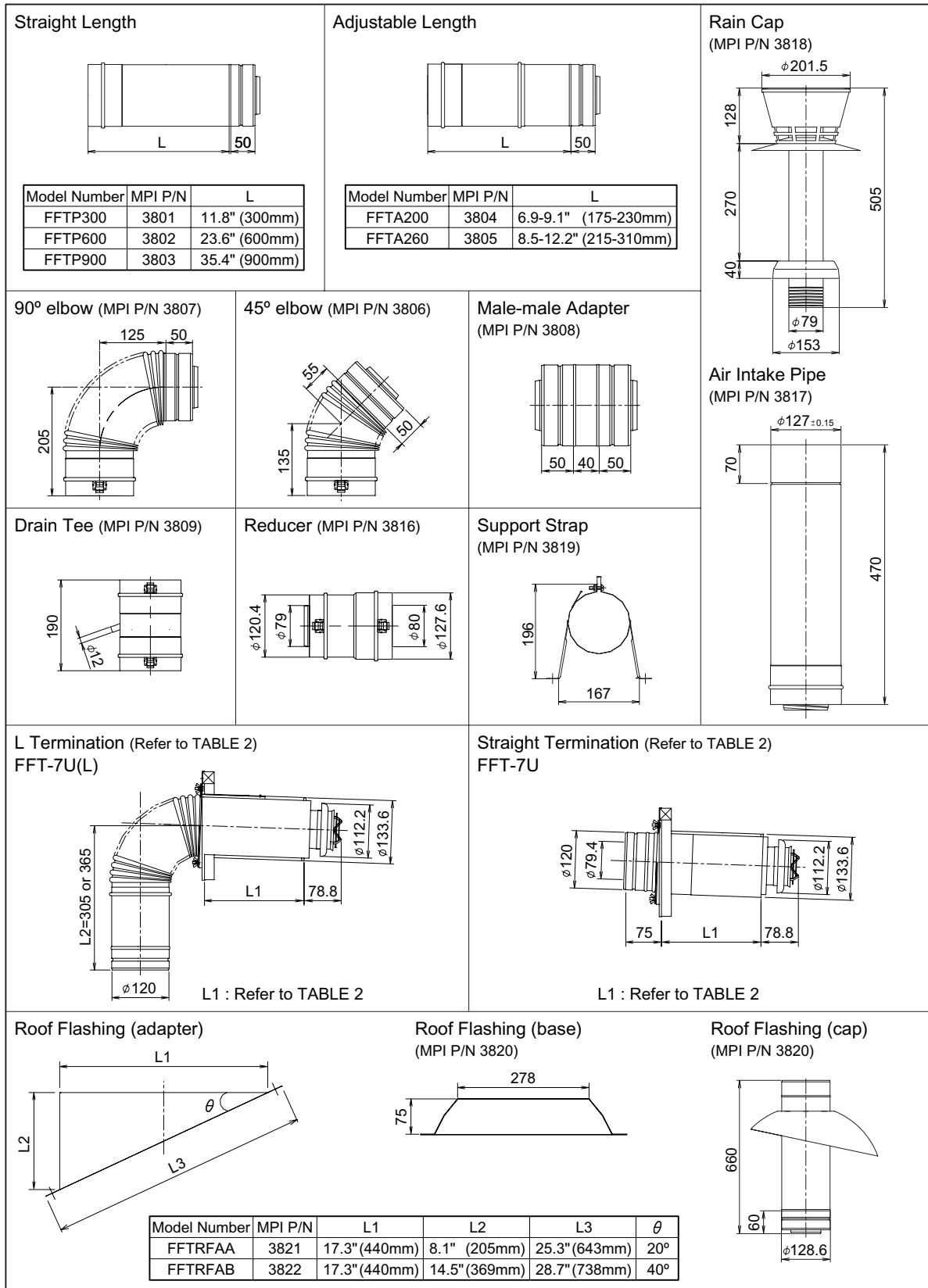
Items shown below in TABLE 1 are used for this vent system. The diameters of pipes are 3.1" (79mm) for inner vent pipe and 5" (127mm) for outer air intake pipe. The length of the items are shown in Fig. 1

TABLE 1 : Items

	Connection and detachment			Model Number	MPI P/N
Vent length *	Fig. 2	Straight	Length [300] 11.8"	FFTP300	3801
			Length [600] 24.01"	FFTP600	3802
			Length [900] 35.4"	FFTP900	3803
	Fig. 2	Adjustable	Adjustable Length [175-230] 6.9-9.1"	FFTA200	3804
			Adjustable Length [215-310] 8.5-12.2"	FFTA260	3805
	Fig. 2	Elbow	45° elbow	FFTEL45	3806
			90° elbow	FFTEL90	3807
	Fig. 2		Male-male Adapter	FFTMM	3808
Condensation drain	Fig. 4.4	Vertical	Drain Tee	FFTDTP	3809
Vent termination	Fig. 2	Horizontal	Straight Termination	FFT7U	Refer to TABLE 2
			L Termination	FFT7U(L)	
			Reducer	FFTRD	3816
	Fig. 3	Vertical	Air Intake Pipe	FFTAIP	3817
			Rain Cap	FFTRT	3818
Others		Support	Support Strap (2" clearance)	FFTSTR	3819
	Fig. 2,3	Roof Members	Roof Flashing	Base	3820
				Cap	
				Adapter A	3821
				Adapter B	3822

* The values enclosed by [] are effective length (unit : mm).

Effective length means the length of pipe when it is connected with other pipes.



(unit : mm)

< Fig. 1 The dimensions of items >

A vent system and components are the only vent system and components that have been approved by CSA to use with this unit.

U.L. Listed vent components of similar dimensions may be used.

All the air used for combustion shall be supplied from the outside and all the exhaust gas shall be discharged to the outside.

The minimum and maximum wall thickness required for installation:

Minimum 3.9" (10cm)

Maximum 25.6" (65cm)

The procedure of installation.

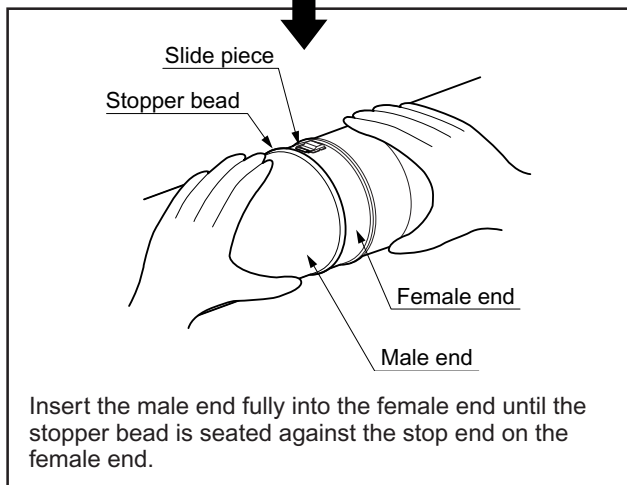
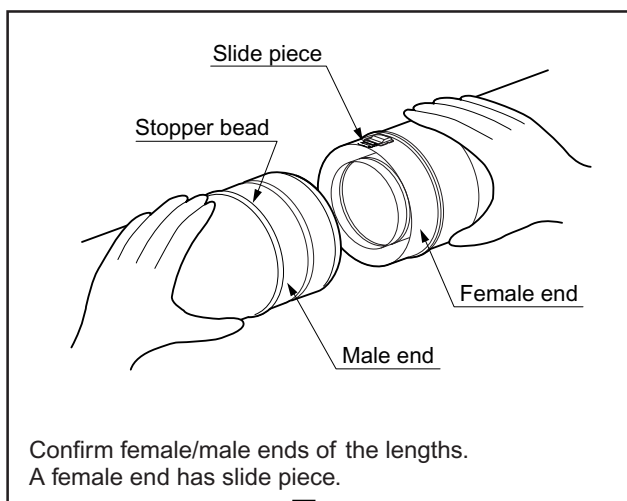
(1) Common procedure for vertical and horizontal installation.

- Joint connection and detachment method

Items in TABLE 1 shall be connected and detached by one of the following method (a),(b).

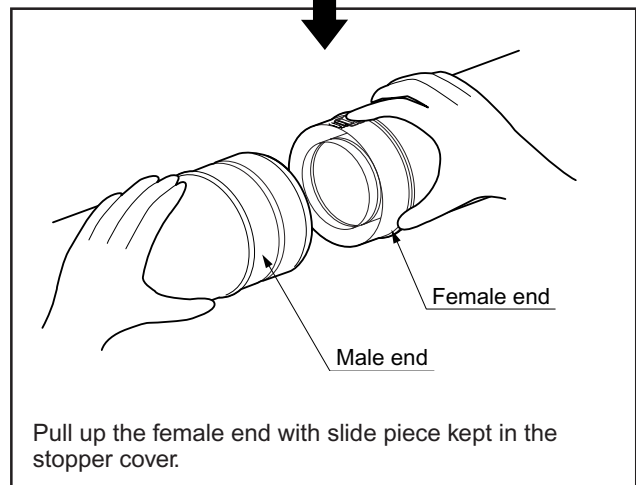
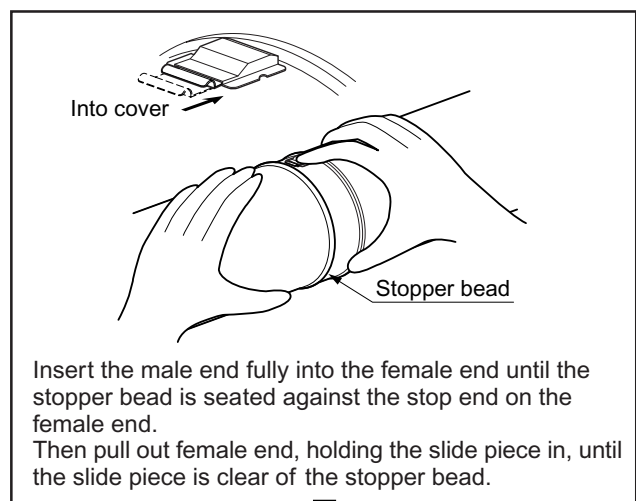
The column, Connection and detachment, in TABLE 1. indicates which method should be used. Vent pieces should not be cut.

(a) Mainly, method (a) is used for connection and detachment. It's for Horizontal terminations (straight termination and L termination), vent lengths, drain tee, and reducer.



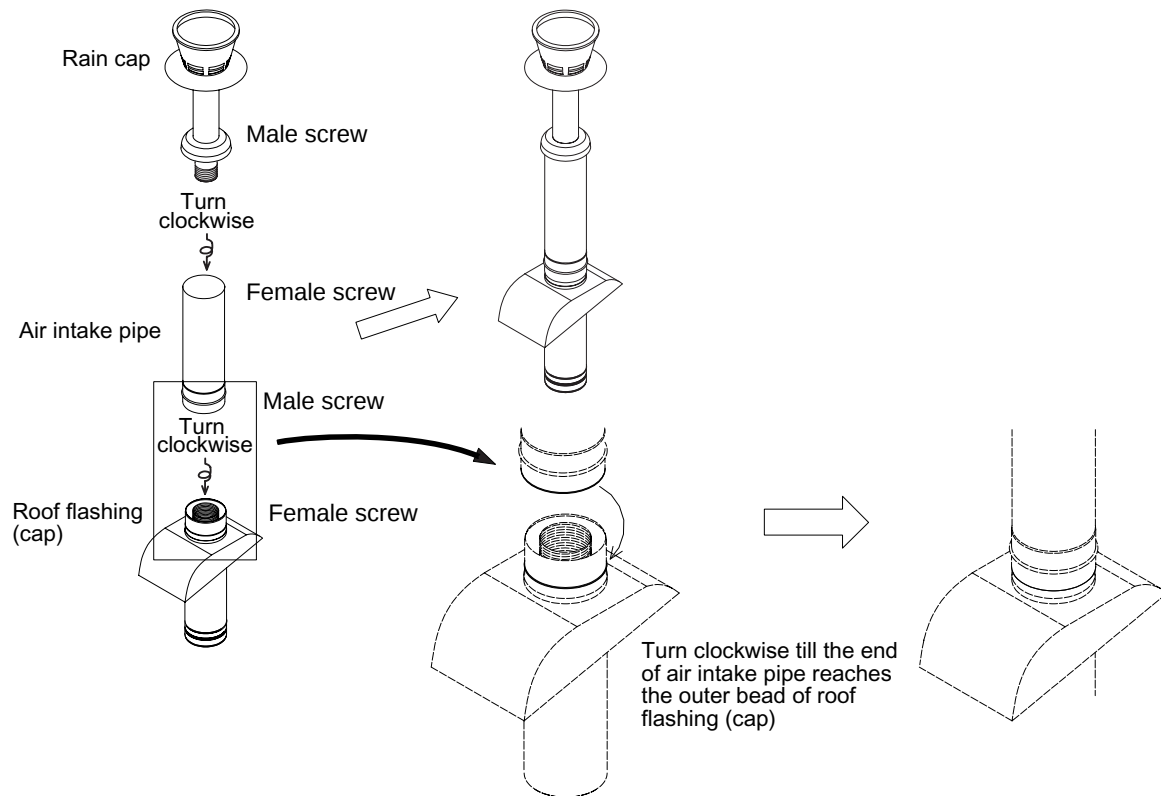
Connection

< Fig. 2 Joint connection and detachment method (a), (b) >



Disconnection

- (b) Rain cap, air intake pipe, and roof flashing (cap) shall be connected by turning the screw at each end of pipes clockwise as far as they will go, as shown in Fig. 3.
 When connecting between air intake pipe and roof flashing (cap), confirm that the end of air intake pipe reaches the outer bead of roof flashing (cap) because the screw section is hidden in outer pipe.
 When disconnecting them turn counterclockwise.



< Fig. 3 Joint connection and detachment method (b) >

- Adjustable lengths

Adjustable lengths are available to allow for installation where fixed-length sections do not produce the desired dimensions. Also adjustable lengths may be used to compensate for linear thermal expansion/contract between two fixed points.

As shown in Table1, 2 types of adjustable lengths are available according to the limits in which its effective length can be made longer and shorter.

- Elbows

45° and 90° elbow are available for changing the direction of the vent system.

The flexible section of each can be bent by hand for making small angle adjustment.

Do not bend repeatedly or extremely, because it may cause vent gas leaks.

- Drain tee

Connect the drain tee directly on to the appliance flue outlet as shown in Fig. 4-4.

Attach one end of a drain hose to the drain tee outlet, and the other end to a condensate drain so that any steam or condensed water will be handled properly.

The drain hose must be suitable for use with acidic effluent. Follow the appliance manufacturer's instructions, and all local and national codes for draining the condensate and acidic effluent.

Caution : Periodically check the terminal end to ensure it is not blocked or obstructed.

- Support

Support the vent system every 5' (1.5m).

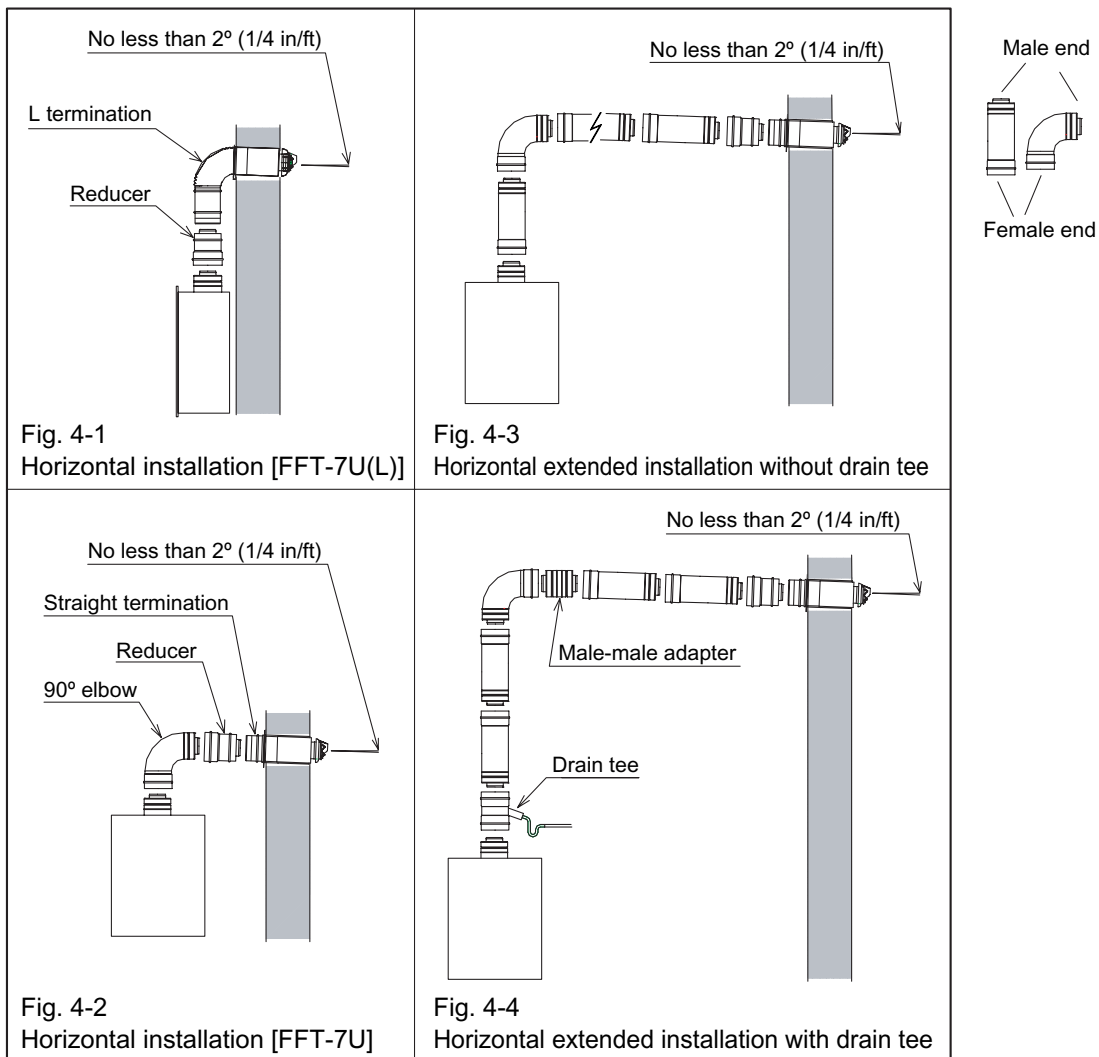
1) Secure the support to solid material using the screws provided with the support.

2) Loosen the nuts of the cylinder.

After inserting pipes, fasten the loosened nuts.

Use the pairs of nuts and bolts provided with the support.

(2) Detail of installation.



- Horizontal installation.

Horizontal installation can consist of only horizontal termination (straight termination or L termination), reducer, and 90° elbow. If the distance between an inner wall and the center of the appliance flue outlet is under 5.7" (146mm), use L termination [FFT-7U(L)] and reducer as shown in Fig. 4-1. Otherwise, use straight termination [FFT-7U] and reducer as shown in Fig. 4-2.

A continuously DOWNWARD slope of no less than 2° (1/4 in/ft) is maintained in the horizontal portion.

- Horizontal extended installation.

Horizontal extended installation means installation on an internal wall apart from the appliance. It can consist of straight termination, reducer, straight lengths, adjustable lengths, and elbows as shown in Fig. 4-3. If vent system has vertically installed lengths longer than 5' (1.5m), or has 3 elbows, install drain tee direct on the appliance flue outlet and male-male adapter before horizontal lengths as shown in Fig. 4-4. The directions of lengths are different between Fig. 4-3 and Fig. 4-4.

A continuously DOWNWARD slope of no less than 2° (1/4 in/ft) is maintained in the horizontal portion toward the outside.

TABLE 2 : Relationship between the range of wall thickness and the diameter of opening on the wall.

Model Number	MPI P/N	the range of wall thickness	the diameter of opening
FFT-7U-200	3810	3.9-9.8" (100-250mm)	ø5.7-5.9" (ø144-150mm)
FFT-7U-300	3811	9.8-17.7" (250-450mm)	ø5.8-5.9" (ø147-150mm)
FFT-7U-500	3812	17.7-25.6" (450-650mm)	ø6.1-6.9" (ø154-175mm)
FFT-7U(L)-200	3813	3.9-9.8" (100-250mm)	ø5.7-5.9" (ø144-150mm)
FFT-7U(L)-300	3814	9.8-17.7" (250-450mm)	ø5.8-5.9" (ø147-150mm)
FFT-7U(L)-500	3815	17.7-25.6" (450-650mm)	ø6.1-6.9" (ø154-175mm)

*The diameter of the wall opening does not need to be increased if the wall opening is pitched DOWNWARD towards the outside at a 2° (1/4 in/ft) pitch.

Horizontal installation (See Fig. 5).

The horizontal termination (straight termination and L termination) consists of two parts (sleeve and termination itself).

Separate them before installation.

1. Check the location of appliance and the path for the vent system.
2. Check wall thickness where the vent system passes through, and select suitable horizontal termination according to TABLE 2. Cut the opening for the sleeve with the diameter in TABLE 2. (Cover the flue outlet to avoid debris from entering the appliance)
3. Adjust the length of the sleeve so that the end of the sleeve protrudes about 0.2" (5mm) from the wall. Then fasten the sleeve with the screw provided.

*Remember a stamped letter on the sleeve.

4. When the opening is too large, twist the packing provided around the end of the sleeve after peeling off backing paper from the packing.
5. Insert the sleeve to the wall and fasten with 4 screws provided. Use plugs provided if needed.

*Ensure the UP label on sleeve plate is at the top.

*If it isn't easy to insert the sleeve because the packing doesn't fit the wall, press down the packing during insertion.

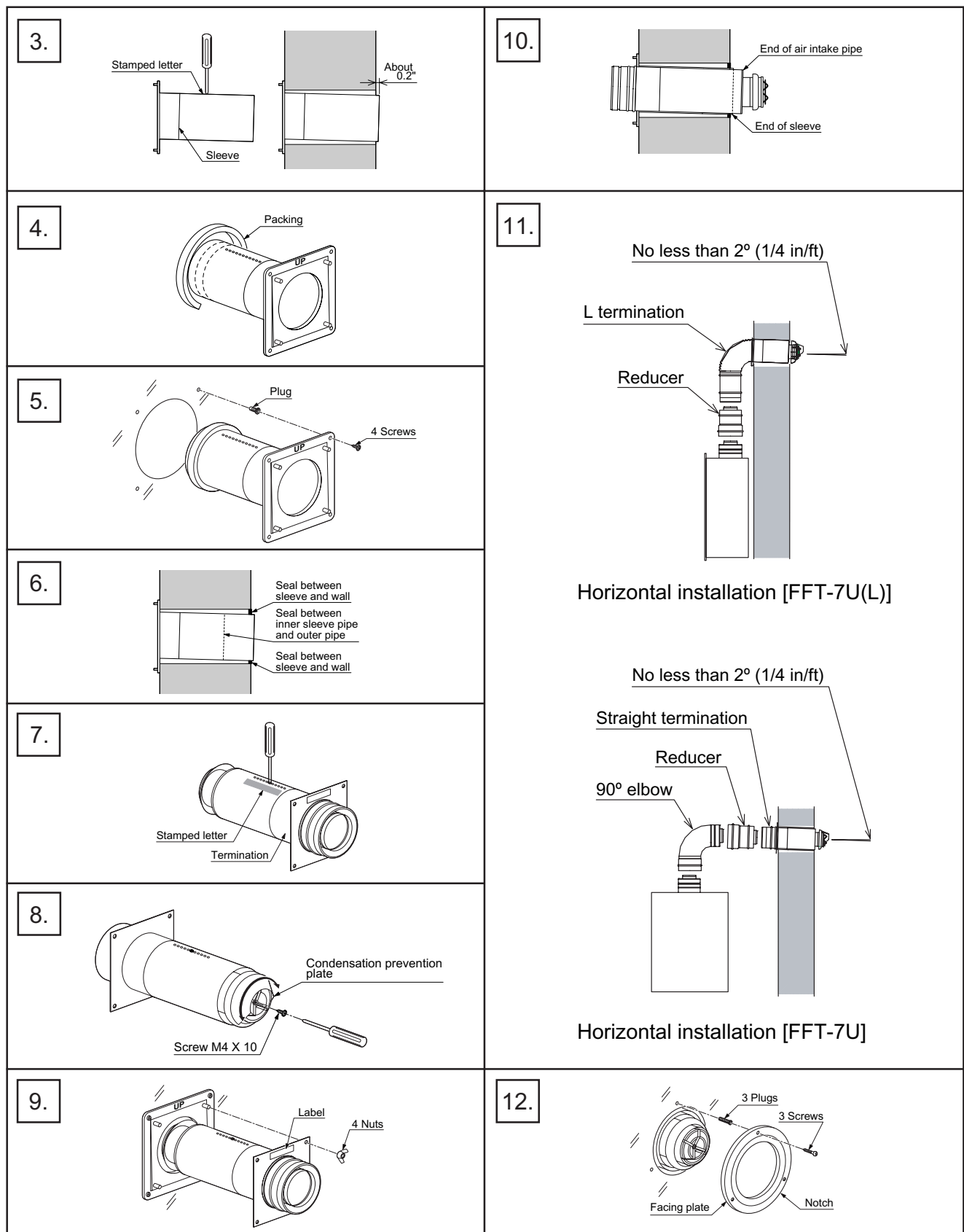
6. Seal between the end of the sleeve and wall, and between the end of inner sleeve pipe and outer pipe.
7. Adjust the length of the termination by fastening it at the stamped number same as that in 2.
8. Fasten the condensation prevention plate with the screw provided. (In case of L termination or straight termination with reducer and elbow without additional straight length, put this plate without fail.)
9. Insert the termination into the sleeve from inside wall so that 4 studs on sleeve plate are inserted into each 4 holes on termination plate and fasten the termination to the sleeve with the 4 nuts provided.

*Ensure that the label on the termination is at the top.

10. Ensure that the end of air intake pipe protrudes about 0.4" (10mm) from the sleeve.
11. If using straight termination, connect reducer on appliance flue outlet, and 90° elbow between reducer and termination.
If using L termination, connect reducer on appliance flue outlet and slide the adjustable part or the termination to fit it to the flue outlet.
Make sure that a continuously DOWNWARD slope of no less than 2° (1/4 in/ft) is maintained in the horizontal portion.
Refer to Fig 4-1 & 4-2.
12. Attach facing plate for outer wall as required.

*Drill 3 pilot holes in the outer wall first. Then insert plugs to the holes and fasten the facing plate to the wall with 3 screws provided. Locate the notch of the facing plate at the bottom of the plate.

*Seal between the facing plate and the wall. Do not seal the notch.



< Fig. 5 Detail of horizontal installation >

Maximum vent length	
Number of 90° elbow	Maximum vent length
3	23' (7.0m)
2	29' (8.8m)
1	35' (10.7m)

Unless a drain tee is used, the maximum vertical height of the vent system can not exceed 5' (1.5m).

Horizontal extended installation (See Fig. 6).

The straight termination consists of 2 parts (sleeve and termination itself). Separate them before installation.

1. Check the location of appliance and the path for the vent system. And calculate the required number and combination of items (see the dimensions of items in Fig.1).
2. Check wall thickness where the vent system passes through, and select suitable horizontal termination according to TABLE 2. Cut the opening for the sleeve with the diameter in TABLE 2. (Cover the flue outlet to avoid debris from entering the appliance)

3. Adjust the length of the sleeve so that the end of the sleeve protrudes about 0.2" (5mm) from the wall. Then fasten the sleeve with the screw provided.

*Remember a stamped letter on the sleeve.

4. When the opening is too large, twist the packing provided around the end of the sleeve after peeling off backing paper from the packing.

5. Insert the sleeve to the wall and fasten with 4 screws provided. Use plugs provided if needed.

*Ensure the UP label on sleeve plate is at the top.

*If it isn't easy to insert the sleeve because the packing doesn't fit the wall, press down the packing during insertion.

6. Seal between the end of the sleeve and wall, and between the end of inner sleeve pipe and outer pipe.

7. Adjust the length of the termination by fastening it at the stamped number same as that in 2.

8. Fasten the condensation prevention plate with the screw provided if this plate is needed.

9. Insert the termination into the sleeve from inside wall so that 4 studs on sleeve plate are inserted into each 4 holes on termination plate and fasten the termination to the sleeve with the 4 nuts provided.

*Ensure that the label on the termination is at the top.

10. Ensure that the end of air Intake pipe protrudes about 0.4" (10mm) from the sleeve.

11. Install the vent system from the appliance to straight termination with using straight lengths, adjustable lengths, and elbows. If vent system have vertically installed lengths longer than 5' (1.5m), or have 3 elbows, install drain tee directly on the appliance flue outlet and male-male adapter before horizontal lengths.

Make sure that a continuously DOWNWARD slope of no less than 2° (1/4 in/ft) is maintained in the horizontal portion.

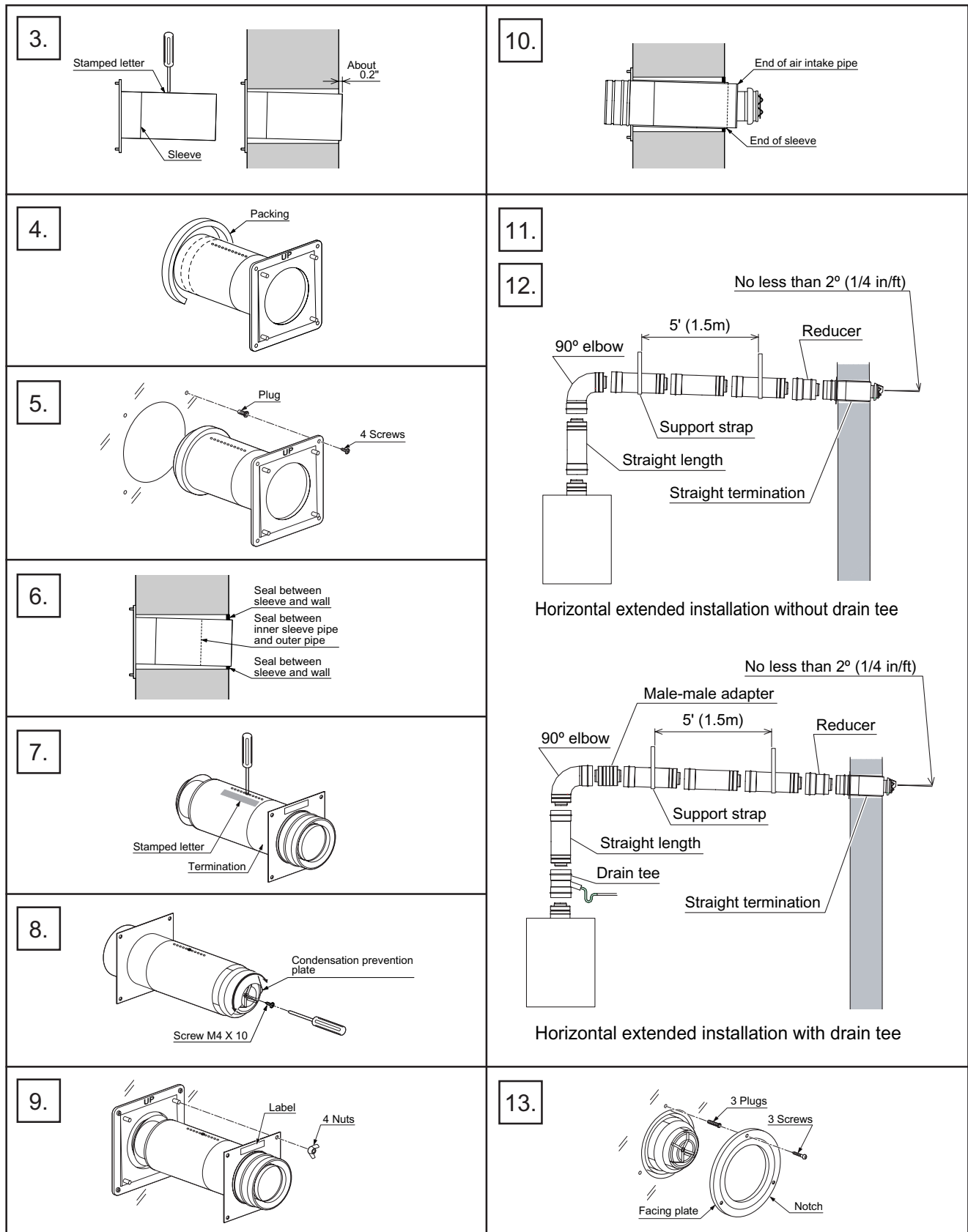
Refer to Fig 4-3 & 4-4.

12. Support the vent system every 5' (1.5m) with support straps.

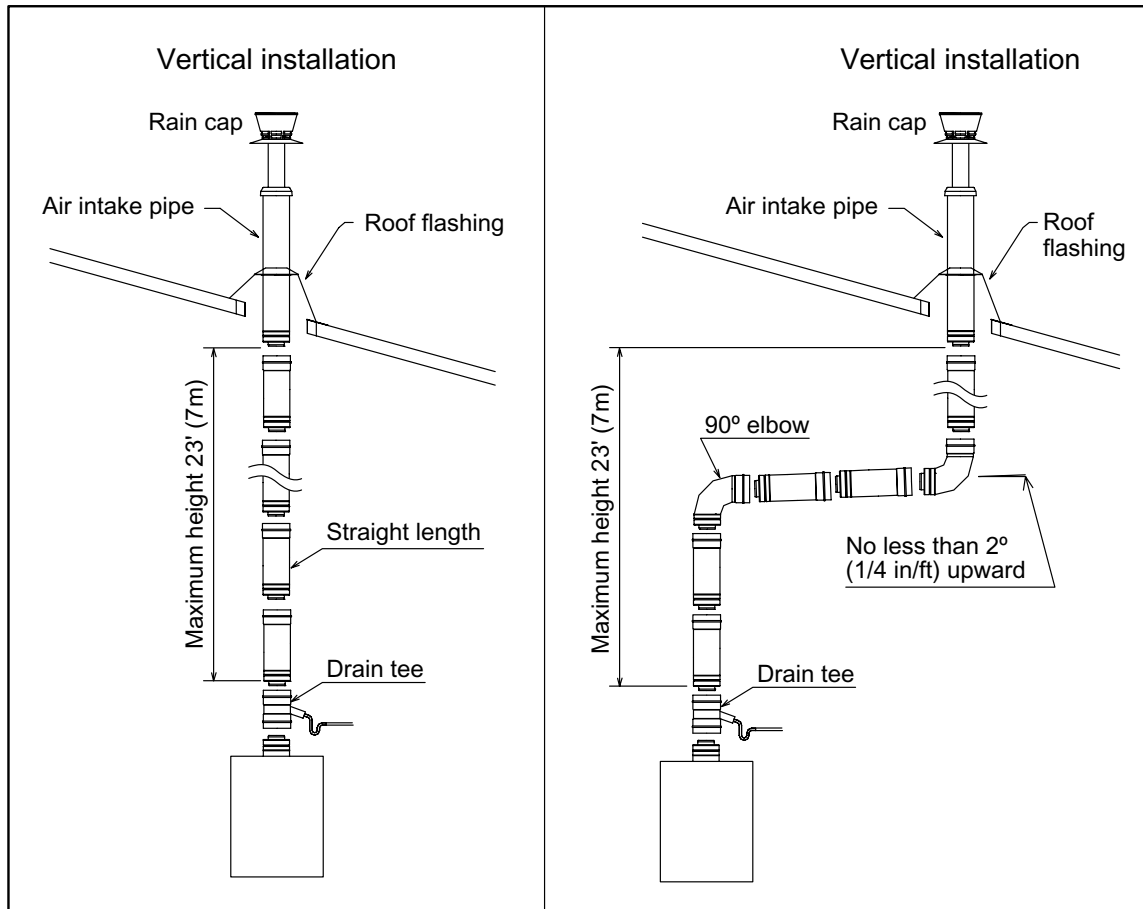
13. Attach facing plate for outer wall as required.

*Drill 3 pilot holes in the outer wall first. Then insert plugs to the holes and fasten the facing plate to the wall with 3 screws provided. Locate the notch of the facing plate at the bottom of the plate.

*Seal between the facing plate and the wall. Do not seal the notch.



< Fig. 6 Detail of horizontal extended installation >



< Fig. 7 Vertical installation >

Vertical installation.

Vertical installation means installation of vent terminal on flat or angled roofs. It consists of rain cap, reducer, straight lengths, adjustable lengths, and elbows as shown in Fig. 7 install drain tee directly on the appliance flue outlet.

A continuously UPWARD slope of no less than 2° (1/4 in/ft) should be maintained in the horizontal portion. A typical installation is shown in Fig. 7.

It shall be limited to the maximum height 23' (7m).

Refer to Vent Pipe Installation, for maximum total length of vent pipe.

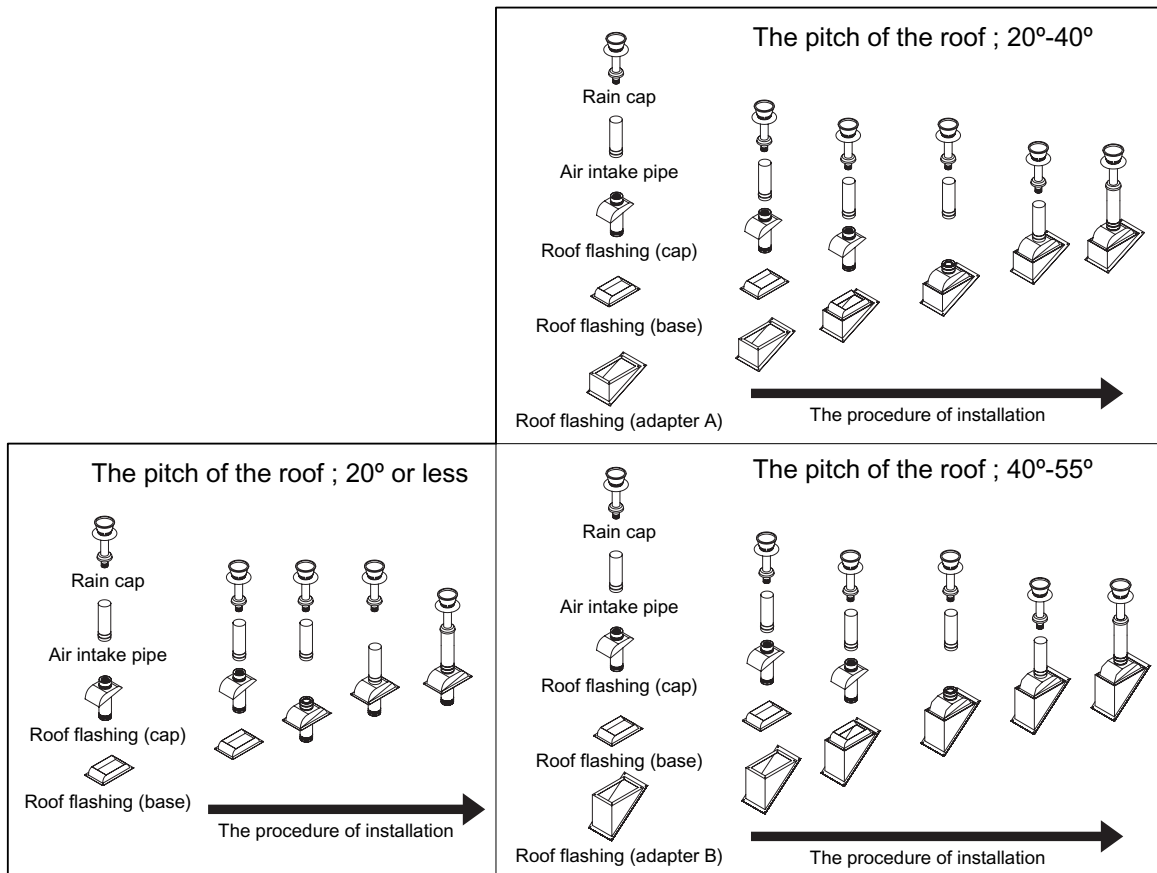
Vertical installation (See Fig. 7).

1. Check the location of appliance and the path for the vent system. And calculate the required number and combination of items (see the dimensions of items in Fig.1) of the vent system. Check the pitch of roof where the vent system passes through.
2. Cut 5.3" (135mm) diameter openings(or suitable 'oval' for pitched roof) in each floor, ceiling, and the roof where the vent system passes through.
3. Connect drain tee to the appliance flue outlet.
4. Install the vent system from the appliance to roof by using straight lengths, adjustable lengths, and elbows.

Make sure that a continuously UPWARD slope of no less than 2° (1/4 in/ft) is maintained in the horizontal portion.

Refer to Fig. 7.

5. Support the vent system every 5' (1.5m) with support straps.
6. Once the vent system reaches under the roof, set the parts of roof flashing. The parts required and the connecting order of them depend on the pitch of the roof shown in Fig. 8.
7. Fasten the bottom part of roof flashing (cap) or (adapter) to roof with screws, nails or so on.
If the 4 holes at the 4 corners of the part is larger than screws or nails, insert the 4 washers provided with the part.
8. If roof flashing (adapter) is used, connect roof flashing (base) to roof flashing (adapter) with the bolts provided with the part.
9. Connect the pipe of roof flashing (cap) to vent system.
Adjust the angle of roof flashing (cap) so as to make the pipe of roof flashing (cap) vertical.
10. Seal between the parts of roof flashing and roof.



< Fig. 8 Detail of vertical installation >

2-7 GAS LINE SIZING CHARTS

Maximum **Natural Gas** Delivery Capacity in Cubic Feet per Hour (0.60 Specific Gravity, 0.5" WC Pressure Drop)

PipeSize	Length in Feet											
	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	125'	
1/2"	174	119	96	82	73	66	61	56	53	50	44	
3/4"	363	249	200	171	152	138	127	118	111	104	93	
1"	684	470	377	323	286	259	239	222	208	197	174	
1 1/4"	1404	965	775	663	588	532	490	456	428	404	358	
1 1/2"	2103	1445	1161	993	880	798	734	683	641	605	536	
2"	4050	2784	2235	1913	1696	1536	1413	1315	1234	1165	1033	
2 1/2"	6455	4437	3563	3049	2703	2449	2253	2096	1966	1857	1646	
3"	11,412	7843	6299	5391	4778	4329	3983	3705	3476	3284	2910	
3 1/2"	16,709	11,484	9222	7893	6995	6338	5831	5425	5090	4808	4261	
4"	23,277	15,998	12,847	10,995	9745	8830	8123	7557	7091	6698	5936	

Contact the Gas Supplier for Btu/Cubic Ft. of the Supplied Gas.
1000 Btu/Cubic Ft. is a Typical Value.

Maximum **Liquified Petroleum** (Undiluted) Delivery Capacity in Thousands of Btuh (0.5" WC Pressure Drop)

PipeSize	Length in Feet													
	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	125'	150'	200'	
1/2"	275	189	152	129	114	103	96	89	83	78	69	63	55	
3/4"	567	393	315	267	237	217	196	185	173	162	146	132	112	
1"	1071	732	590	504	448	409	378	346	322	307	275	252	213	
1 1/4"	2205	1496	1212	1039	913	834	771	724	677	630	567	511	440	
1 1/2"	3307	2299	1858	1559	1417	1275	1181	1086	1023	976	866	787	675	
2"	6221	4331	3465	2992	2646	2394	2205	2047	1921	1811	1606	1496	1260	

** For reference only. Please consult gas pipe manufacturer for actual pipe capacities.

Maximum Capacity of Flex TracPipe in Cubic Feet per Hour of **Natural Gas** (0.60 Specific Gravity, 0.5" WC Pressure Drop)

PipeSize	Length in Feet											
	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	150'	200'
3/4"	206	147	121	105	94	86	80	75	71	67	55	48
1"	383	269	218	188	168	153	141	132	125	118	94	82
1 1/4"	614	418	334	284	251	227	209	194	181	171	137	116
1 1/2"	1261	888	723	625	559	509	471	440	415	393	320	277
2"	2934	2078	1698	1472	1317	1203	1114	1042	983	933	762	661

Maximum Capacity of Flex TracPipe in Thousands of Btuh **Liquified Petroleum** (0.5" WC Pressure Drop)

PipeSize	Length in Feet											
	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	150'	200'
3/4"	325	232	191	166	149	136	126	118	112	106	87	76
1"	605	425	344	297	265	241	222	208	197	186	143	129
1 1/4"	971	661	528	449	397	359	330	307	286	270	217	183
1 1/2"	1993	1404	1143	988	884	805	745	696	656	621	506	438
2"	4638	3285	2684	2327	2082	1902	1761	1647	1554	1475	1205	1045

** For reference only. Please consult gas pipe manufacturer for actual pipe capacities. TracPipe is a registered trademark of Omega Flex.

Maximum Capacity of Gas Flex Connectors in Cubic Feet per Hour of **Natural Gas** (0.60 Specific Gravity, 0.5" WC Pressure Drop)

PipeSize	Length in Inches					
	12"	24"	36"	48"	60"	72"
1/2"	180	150	125	106	93	86
3/4"	-	290	255	215	197	173
1"	-	581	512	442	397	347
1 1/4"	-	1470	1200	1130	960	930

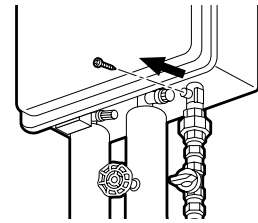
Maximum Capacity of Gas Flex Connectors in Thousands of Btuh **Liquified Petroleum** (0.5" WC Pressure Drop)

PipeSize	Length in Inches					
	12"	24"	36"	48"	60"	72"
1/2"	288	240	200	169	149	137
3/4"	-	465	409	344	315	278
1"	-	930	825	708	638	556
1 1/4"	-	2352	1920	1808	1536	1488

** For reference only. Please consult gas pipe manufacturer for actual pipe capacities.

2-8 GAS PIPING

- Install the manual gas control valve in the gas inlet connection of MWH-180.
- A union should be used to connect the unit and the gas pipe.
- Check the gas type and the gas inlet pressure before connecting.
- Remove the screw from the test plug before checking the gas inlet pressure.
Connect the manometer to the plug with the silicon tube and measure the gas inlet pressure.
- The maximum and minimum gas inlet pressures are as follows.
 - < Natural Gas supply pressure >
 - Min. 4" W.C. (102mmH₂O)
 - Max. 10.5" W.C. (267mmH₂O)
 - < Propane Gas supply pressure >
 - Min. 8" W.C. (203mmH₂O)
 - Max. 14" W.C. (356mmH₂O)
- Put the screw back in the test plug and fasten tightly.
- Make sure to conduct gas leakage test before operating MWH-180.



2-9 WATER PIPING

- Install a manual water control valve in the water inlet connection of MWH-180.
- A union should be used on both the hot and cold water supply lines for connection.
- Use soldering materials or piping that will not cause any deterioration of potable water.
NO LEAD!
- Purge the water lines to remove all debris and air.
- Make sure both the hot and cold water supply lines are connected correctly.
- A filter is placed at the water supply inlet to remove debris.
Clean the filter regularly.
Do not operate the unit without the filter in place.
In areas of heavy debris, such as with some wells, install a whole house water filter in line before the unit.
- 15 PSI or higher water pressure is required to operate MHW-180.

2-10 PRESSURE RELIEF VALVE

- Install an approved pressure relief valve with every gas water heater installation.
- The pressure relief valve shall conform to the following requirements.
Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems ANSI Z21, 22. This pressure relief valve shall activate with the pressure of 150PSI.
- The pressure relief valve shall be installed in the outgoing hot water supply line according to the manufacturer's instruction.
- No valves or shut off device shall be placed between the relief valve and the unit.
The discharge from the pressure relief valve shall be piped to the ground or into the drain system to prevent possible burns to humans or animals. Hot water discharged from the relief valve may cause severe scalding instantly and even death.
- Do not cap the relief valve and do not install any depressurizer or restriction device in the relief line.
- Manually operate the pressure relief valve at least once a year to check if it functions properly.

2-11 ELECTRICAL CONNECTION

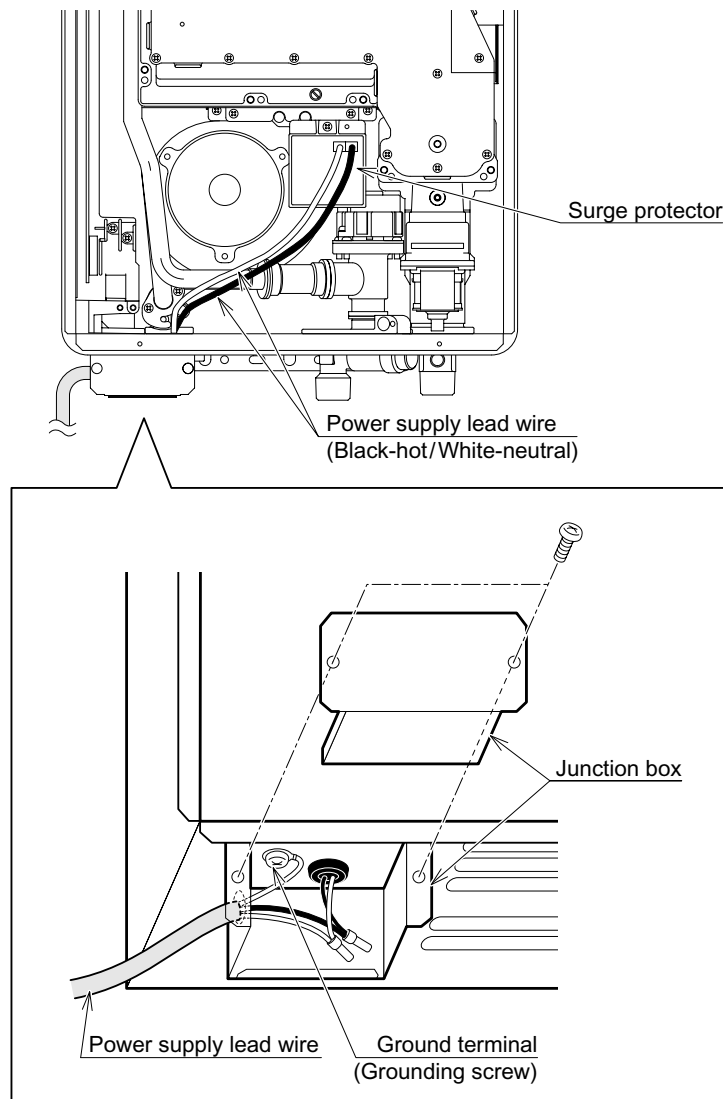
Warning

MWH-180 must be electrically grounded in accordance with local codes or in the absence of local codes with the most recent edition of the National Electrical Code, ANSI/NFPA 70. In Canada, all electrical wiring to the MWH-180 should be in accordance with local codes and the Canadian Electrical Codes, CSA C22.1 Part 1. Do not rely on the gas or water piping to ground the metal parts of the water heater.

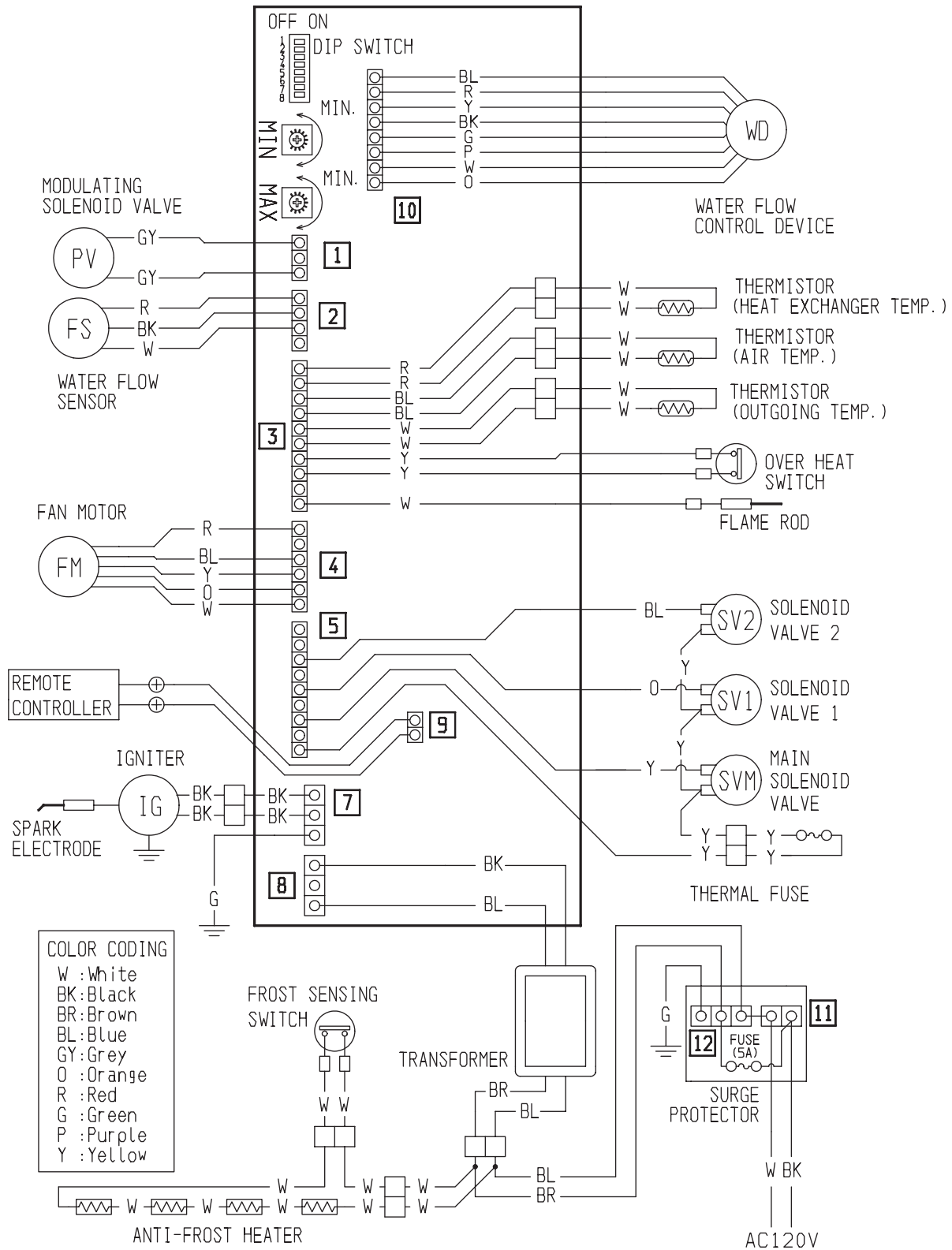
Caution

- Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.
Verify proper operation after servicing.
Field wiring to be performed at time of appliance installation.
- Completely turn off the power before starting the work.
Do not turn the power on until the electric wiring is finished and all work is completed.
Otherwise electric shock or personal injury may result.

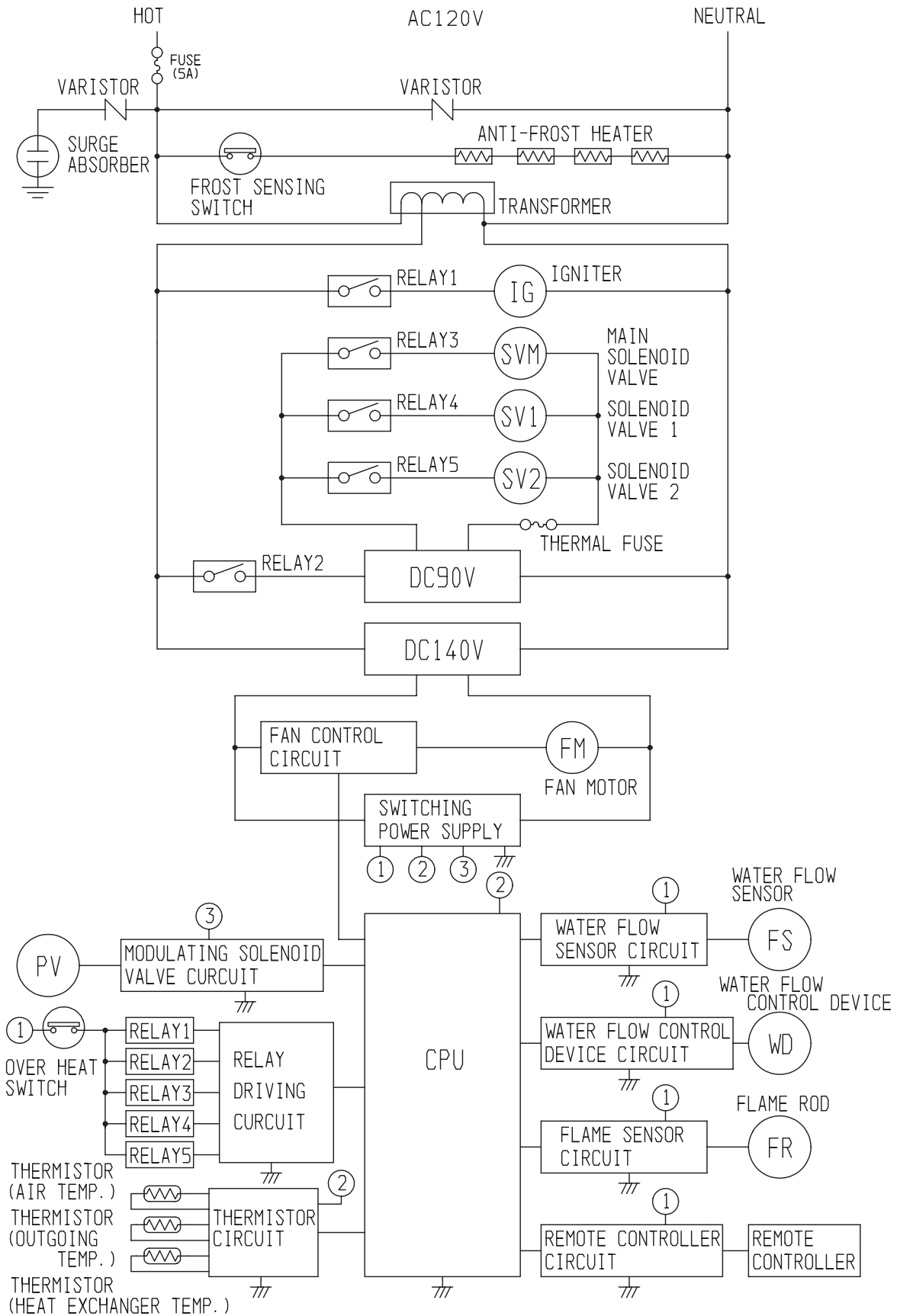
- MWH-180 requires 120V AC at 60Hz.
Disconnect the power supply if the unit is not in use for a long time.
- Remove residual water in the unit when the power supply is off because the freeze prevention in the unit will not activate, resulting in possible freezing damage.
- Do not let the power cord contact the gas piping.
- The grounding screw is located in the junction box attached to the outside of bottom plate.
- To prevent electrical shock, provide a ground with resistance less than 100Ω. An electrician should do this work.



2-12 WIRING DIAGRAM



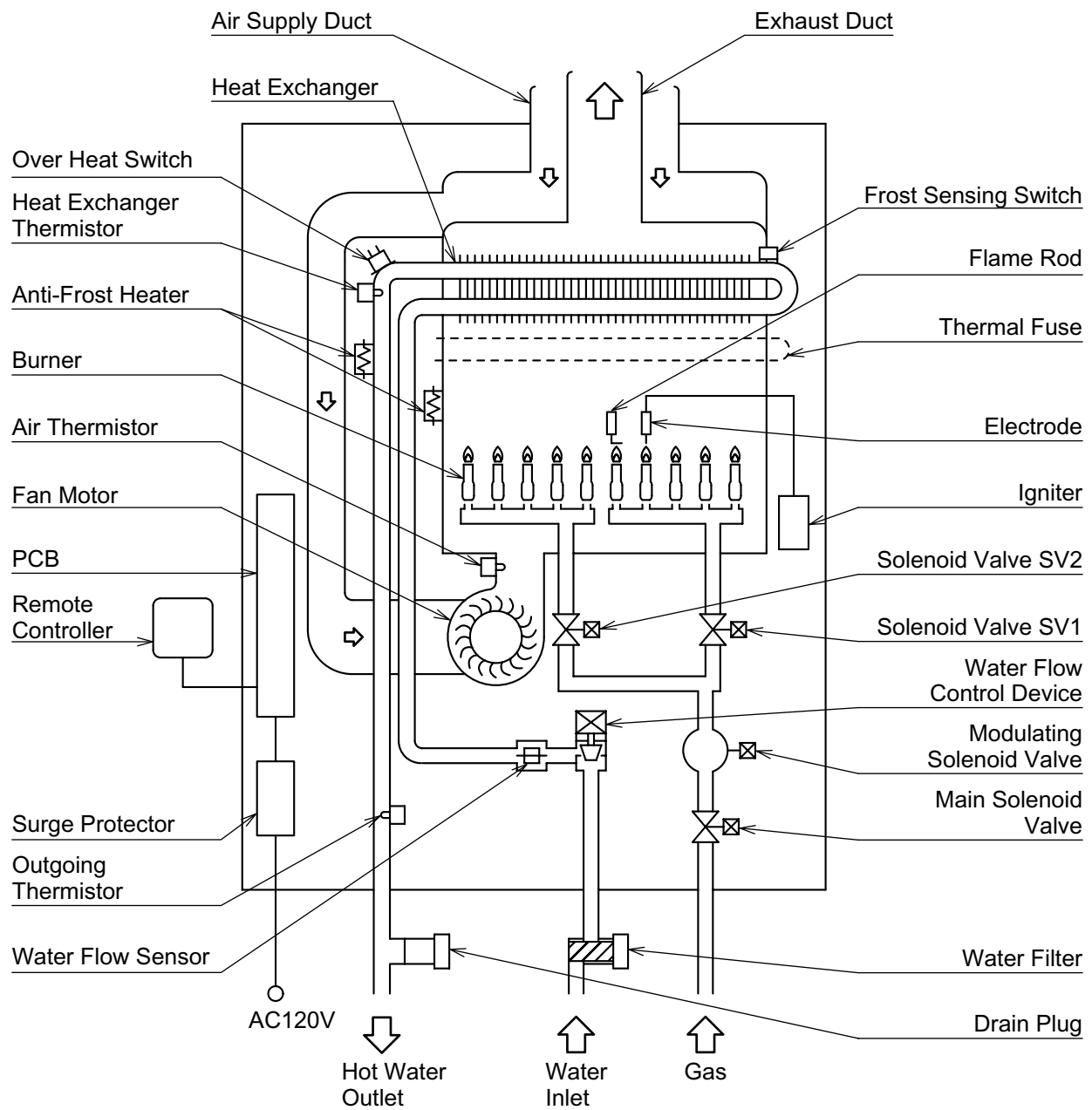
IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE
MUST BE REPLACED. IT MUST BE REPLACED WITH A WIRE OF AT LEAST
A 194°F TEMPERATURE RATING AND NUMBER 18AWG OR ITS EQUIVALENT.



2-13 DIAGNOSTIC POINTS

Component	Measurement Point		Normal Value	Notes
	Comp. No.	Wire Color		
Surge Protector	12	Brown-Blue	AC108~132V	
Water Flow Control Device	10	Blue-Red	DC11~13V	Power Supplied to Unit
		Black-White	55~65Ω	
		Green-White	55~65Ω	
		Purple-White	55~65Ω	
		Orange-White	55~65Ω	
Water Flow Sensor	2	Red-Black	DC11~13V	Power Supplied to Unit
		White-Black	DC5~7V or DC0~1V	Power Supplied to Unit
Modulating Solenoid Valve	1	Gray-Gray	DC2~12V	Flame Condition
			65~77 Ω	
Remote Controller	9	Black-Black	DC11~13V	Power Supplied to Unit
Fan Motor	4	Red-Blue	DC155~165V	Power Supplied to Unit
		Yellow-Blue	DC14~16V	Revolving Condition
		Orange-Blue	DC2~6V	Revolving Condition
		White-Blue	DC8~12V	Revolving Condition
Flame Rod	3	White-Green	AC50~150V	After Ignition
		White-Flame Rod	DC1~20μA	Flame Condition
Over Heat Switch	3	Yellow-Yellow	Below 1Ω	
Igniter	7	Black-Black	AC90~110V	Igniting Condition
Thermal Fuse	5	Yellow-Yellow	Below 1Ω	
Main Solenoid Valve	5	Yellow-Yellow	DC80~100V	Flame Condition
			1.4~1.6kΩ	
Solenoid Valve 1	5	Yellow-Orange	DC80~100V	Flame Condition
			1.55~1.75kΩ	
Solenoid Valve 2	5	Yellow-Blue	DC80~100V	Flame Condition
			1.5~1.7kΩ	
Outgoing Thermistor	3	White-White	40° F 19~21k Ω	
Air Thermistor	3	White-White	80° F 7.5~8.5kΩ	
Heat Exchanger Thermistor	3	White-White	120° F 3.3~3.9kΩ	
			160° F 1.7~1.9kΩ	
Transformer				
Primary	C	Brown-Blue	AC108~132V 45~55Ω	
Secondary	C	Black-Blue	AC90~110V 43~53Ω	

2-14 SCHEMATIC DIAGRAM



2-15 WIRING REMOTE CONTROLLER

The Main remote controller model is CMR-2250. (P/N 3748)

The Bath remote controller model is YST-2250. (P/N 3749)

These controllers are to be fitted in the following locations:

Main remote controller - kitchen or laundry.

Bath remote controller - bathroom.

Only one of each type of controllers can be connected to one MWH-180 water heater.
(i.e. Installations with two CMR-2250 or two YST-2250 will not function properly.)

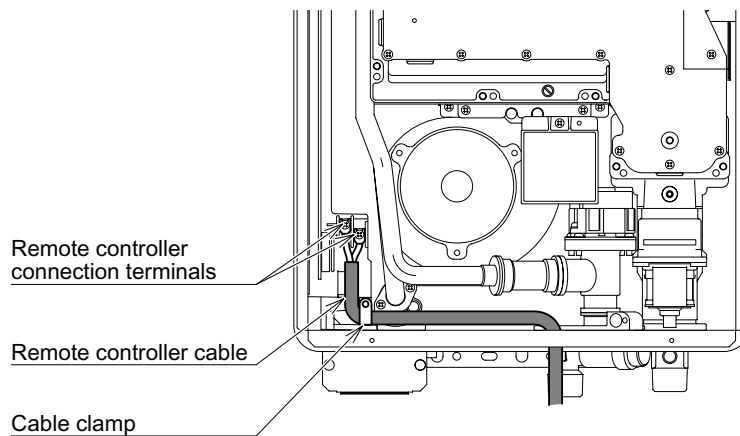
The remote controllers can be wired in parallel only depending on the distance from MWH-180 to the remote controllers.

Be sure to peel the protective film off the surface of the remote controller after the installation.
The surface is covered with a film to prevent scratches during installation.

Caution

The appliance should always be disconnected from the power supply before REMOTE CONTROLLERS are connected.

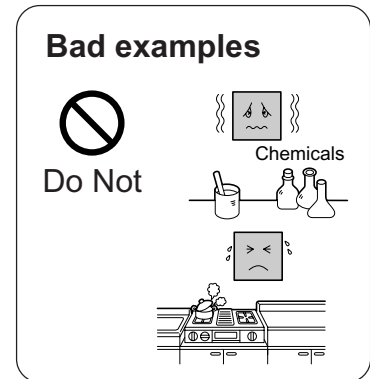
- Connect the cord to the terminal block of water heater.
As remote controller cables are nonpolarized, they do not have specific plus and minus.
Be sure not to touch other electronic components with the screwdriver.
- Replace the front panel of MWH-180.



2-16 MAIN REMOTE CONTROLLER CMR-2250 (P/N 3748)

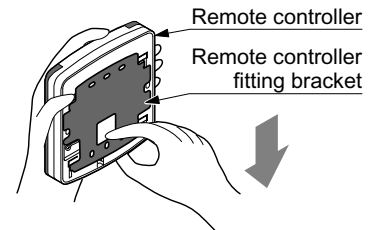
1) Safety precautions on Main remote controller installation.

- Connect remote controller cable after heater is unplugged.
- Never install Main remote controller above a combustion appliance like hot plate or a kitchen range. The heat will cause electrical component problems, or deform the exterior.
- Install Main remote controller out of the reach of steam, water drop, spray of water from tea kettle, or electrical pot.
- Do not put Main remote controller in direct sunshine.
- It is convenient to install it where it will be used most frequently.
- Do not install Main remote controller at the place where any commercial chemicals like ammonia, sulfur, chlorine, ethylenic compound and acids etc are used.
- The remote controller cables carry low voltage, 12VDC digital.



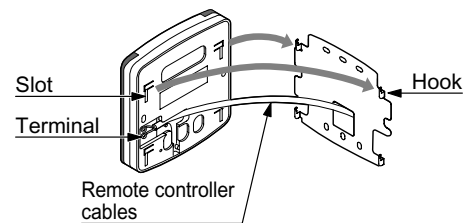
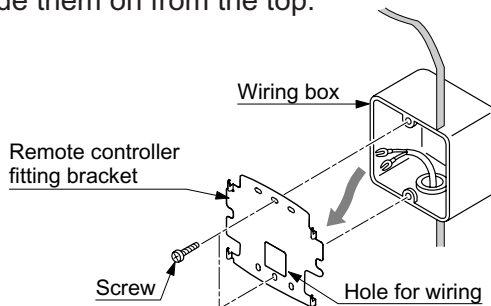
2) Installation of Main remote controller.

- Detach the fitting bracket from Main remote controller by sliding it down.
- Attach the fitting plate to wall.
- Install conduit inside of wall in advance and secure the wiring box.
- Pass remote controller cables through conduit. Then pass the cables through the hole of the fitting bracket and pull them out.
- Attach the fitting bracket with screws adjusting the screw hole to the wiring box.
- Connect the remote controller cables to the terminal for the remote controller of PCB.



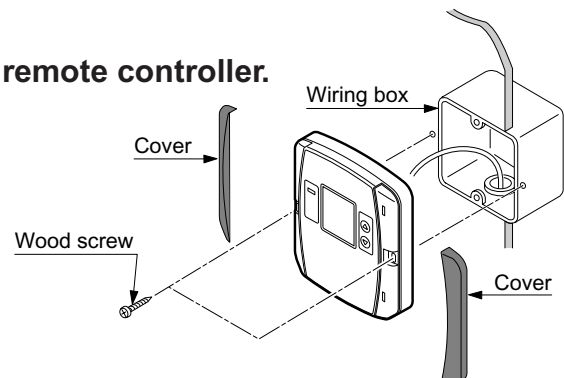
In case of installing of the fitting bracket for remote controller.

Align the slots of Main remote controller's back to 4 hooks on the fitting bracket. Then slide them on from the top.



In case you are not using the fitting bracket of the remote controller.

Detach right-and-left covers of the remote controller and fix them to the wall directly with wood screws. Then attach the covers again. (You can detach the slot covers by catching the bottom corner's slot with nail.)



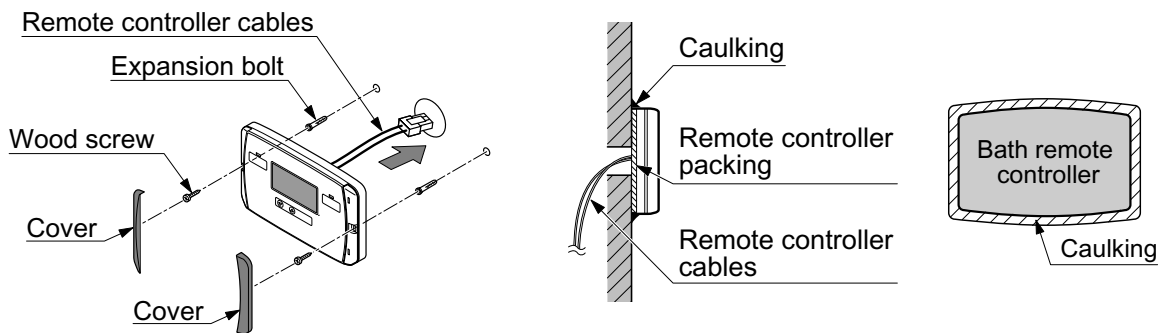
2-17 BATH REMOTE CONTROLLER YST-2250 (P/N 3749)

1) Safety precautions on Bath remote controller installation.

- Before remote controller installation, check the hole position considering wall stud location.
- **Note** : Do not dismantle the remote controller due to water-proof design.
- Do not install remote controller where water will contact the remote controller directly.
- The remote controller cables carry low voltage, 12VDC digital.

2) Installation of Bath remote controller.

- Drill a hole (more than dia about 1/2" (12mm)) in a wall for the remote controller cables.
- After passing the remote controller cables through the hole, remove the packing's back paper of remote controller. Then attach the remote controller to the wall.
- Detach both end covers of remote controller and fix the remote controller to the wall with wood screws(2 pcs) in the screw holes provided. (You can detach the covers with catching the bottom corner's slot with nail.) Do not tighten the screws excessively, as the screw hole may be damaged. In case of mounting the remote controller on tile, cement or mortar, use an expansion bolt.
- Reattach the cover and caulk with silicone around surrounding of the remote controller.



In case of use of store-bought cables.

- The remote controller cable can be extended up to 100' (30m) by splicing the cable and using 18 gauge wire to extend the cable to the appropriate length.
- Cut the connector of the remote controller lead wire and cut remote controller lead wire and store-bought cables' coating in 0.2" (5mm) length.
- Insert the end of remote controller cables to clamping connector and caulk using a caulking tool.
- Caulk the store-bought cables inserted in the clamping connector using the caulking tool.

2-18 TESTING OPERATION

- Follow the steps below, to ensure the MWH-180 has been properly installed.

Preparation for testing operation.

1. Fully open the water supply main valve.
2. Flush out the water supply piping to clean out any installation debris, clean out filter.
3. Turn on power to unit and open gas supply valve.

Testing operation.

1. Operate the unit according to “ **Remote controller operation** ” in the instruction manual.
2. Make sure the unit operates normally.
 - Does the burner ignite and shut off properly? Check the combustion lamp.
The burner may not ignite at first until the air in the gas supply pipe is driven out.
Repeat the procedure until it ignites.
 - Is temperature setting workable?
Check if the temperature can be adjusted as desired.

Procedure after testing operation.

- If the residence is not ready for habitation or the unit will not be used for an extended time, the residual water in the unit and the pipe may freeze and damage the unit, or the residual water in the heat exchanger may deteriorate.
Be sure to remove the water in the unit and the pipe. Refer to the instruction manual.
1. Close the gas supply main valve.
 2. Close the water supply main valve
 3. Take off the water filter (drain stopper), drain the valve, and remove the water.
Take this procedure when the unit cools down after the testing operation.
 4. Disconnect the power, or turn off the power supply.
 5. Open the faucet and shower faucet (if any) and remove the water.
 6. Leave the unit in this condition until ready to use.

Explanation to customers.

Fill out the warranty form with the customer and send to it MPI.

Explain the “ **How to use the unit** ” section of this instructional manual to the customer.

3. Service and Maintenance

3-1 Operation Principles

[Before operation]

- When ON/OFF Button (Power switch) on the Main remote controller or Bath remote controller is turned ON, the ON indicator illuminates (in the case of operation with a remote controller). Gas is supplied to the Gas Solenoid Valve.

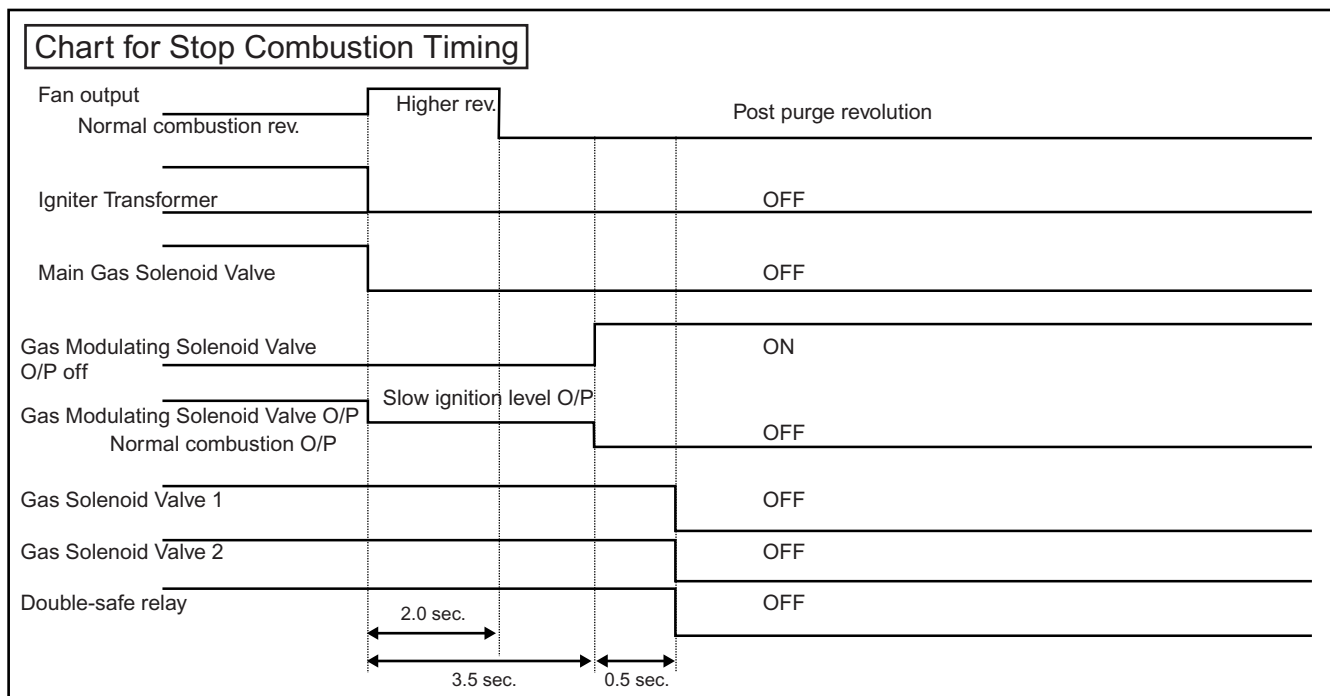
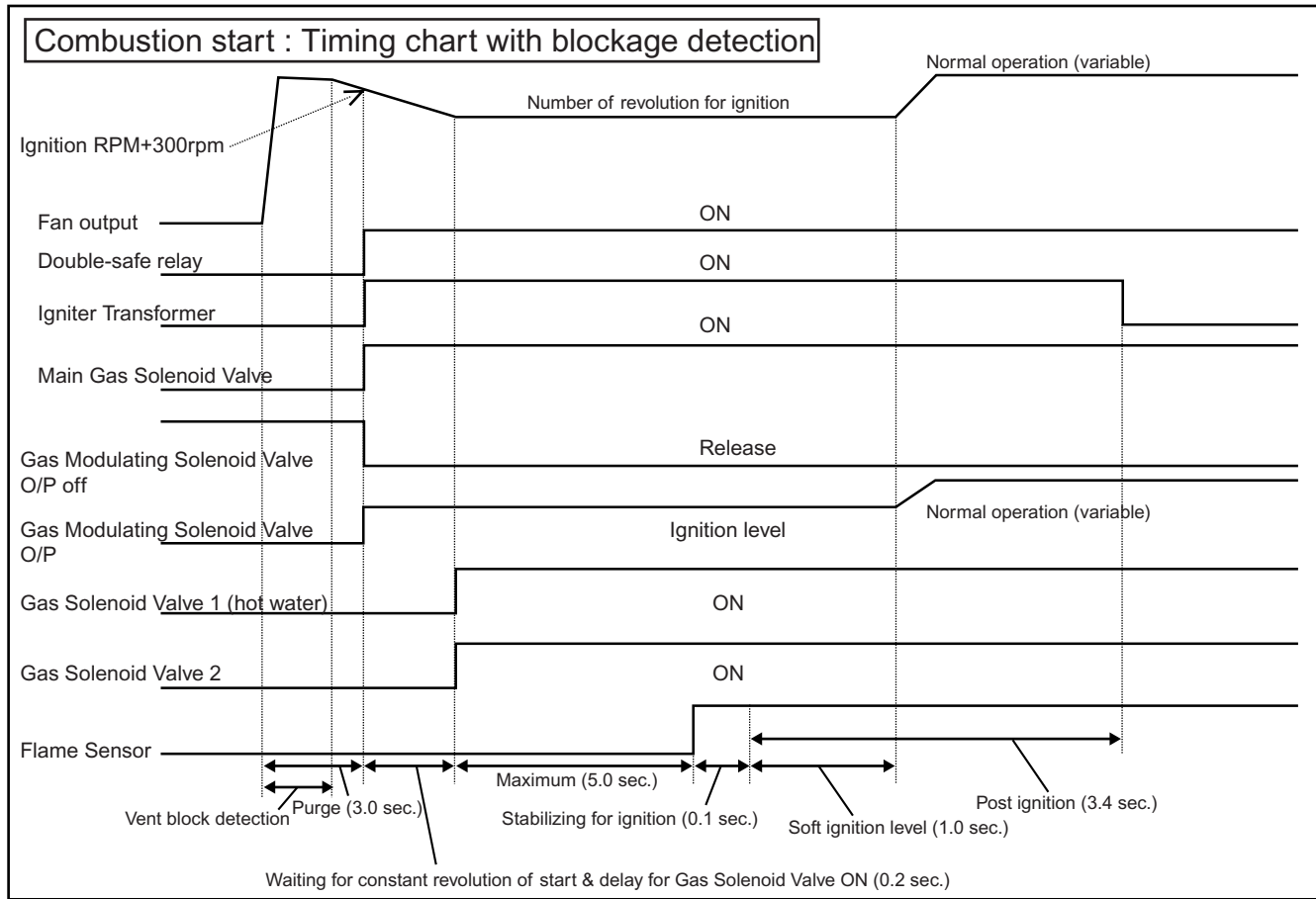
[During operation (when hot water is supplied)]

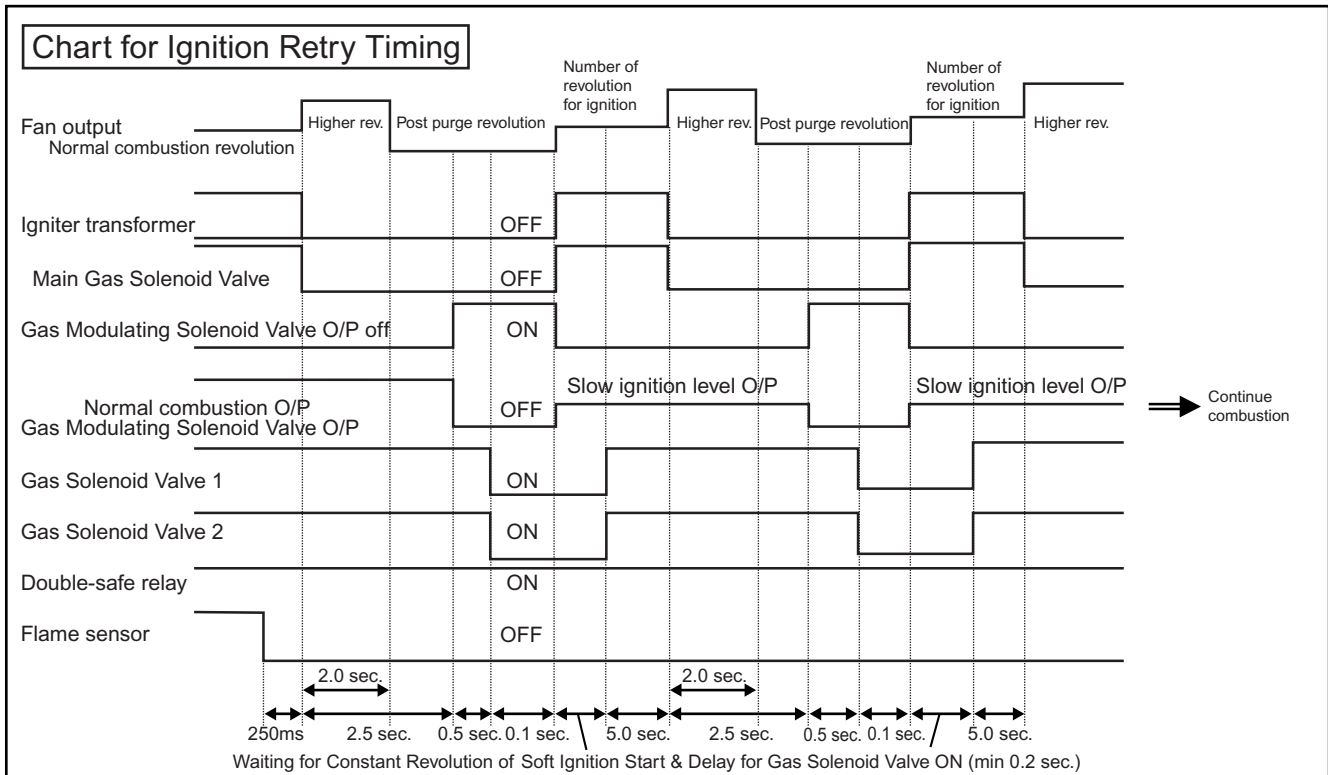
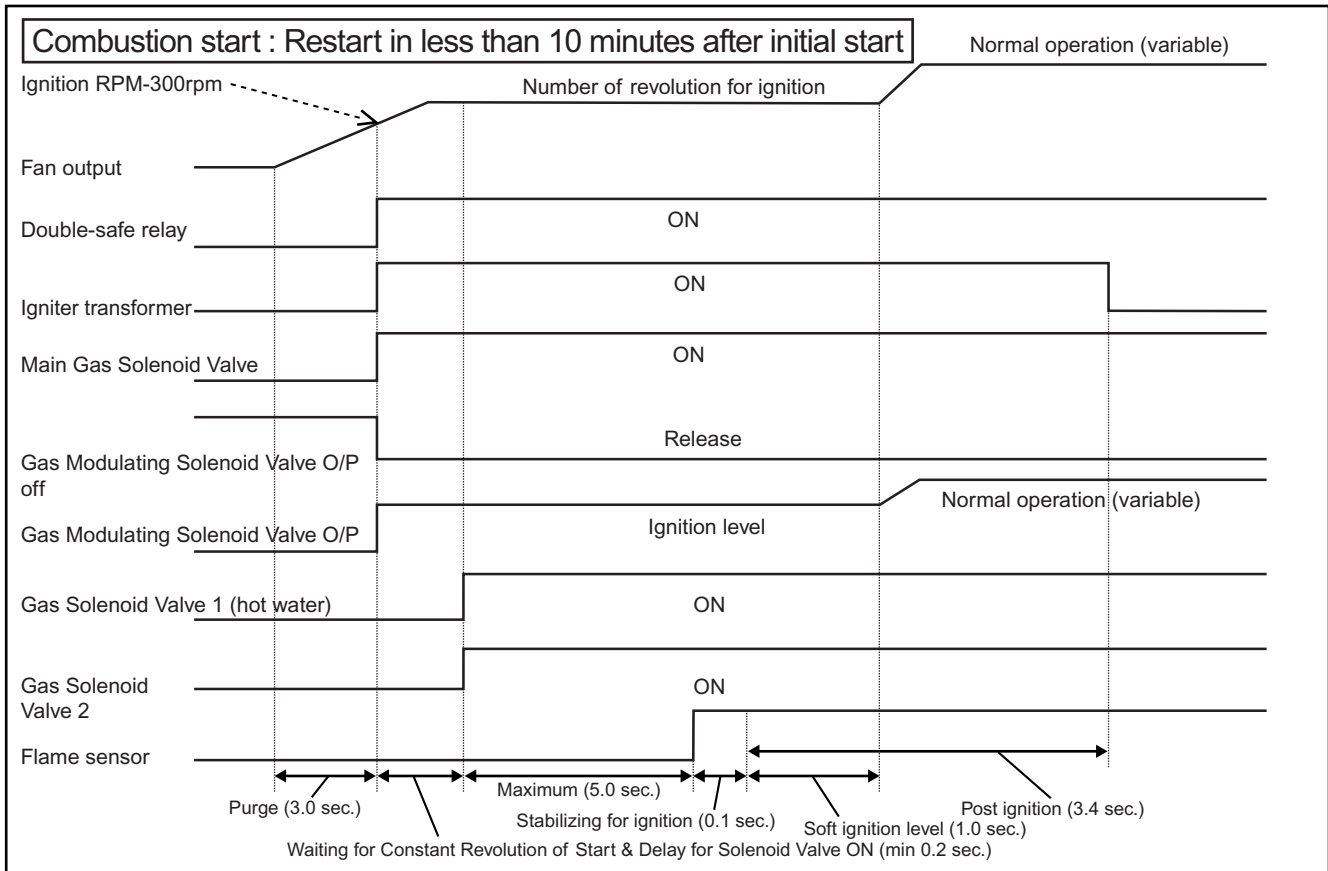
- When the hot water supply faucet is opened, water flows through the water flow control device and water flow sensor into the heat exchanger assembly. The water heated by the heat exchanger assembly passes through the Outgoing Water Thermistor to go to a hot water outlet. At this time, the water flow sensor detects water flow. Then the PCB starts the combustion fan, activating the electrode. The Main Gas Solenoid Valve, Gas Solenoid Valve 1 and Gas Solenoid Valve 2 are opened simultaneously when the spark is emitted by the electrode.
- The gas supply is set at the slow ignition level by the Gas Modulating Solenoid Valve and goes to main burners. When all the main burners are ignited, the flame rod detects the flame condition, the Flame Logo Indicator lights and the sparking is stopped.
- The PCB, detects the water flow rate based on the signal from the water flow sensor, calculates the energy required to heat the water up to the set temperature, and adjusts the opening position of the gas flow control device and the combustion fan rpm. After this, PCB maintains the combustion to keep the water at the set temperature by checking with the Outgoing Water Thermistor, While controlling the combustion fan rpm and gas supplied by the Gas Modulating Solenoid Valve. (Feedforward feedback control)

[Operation stop]

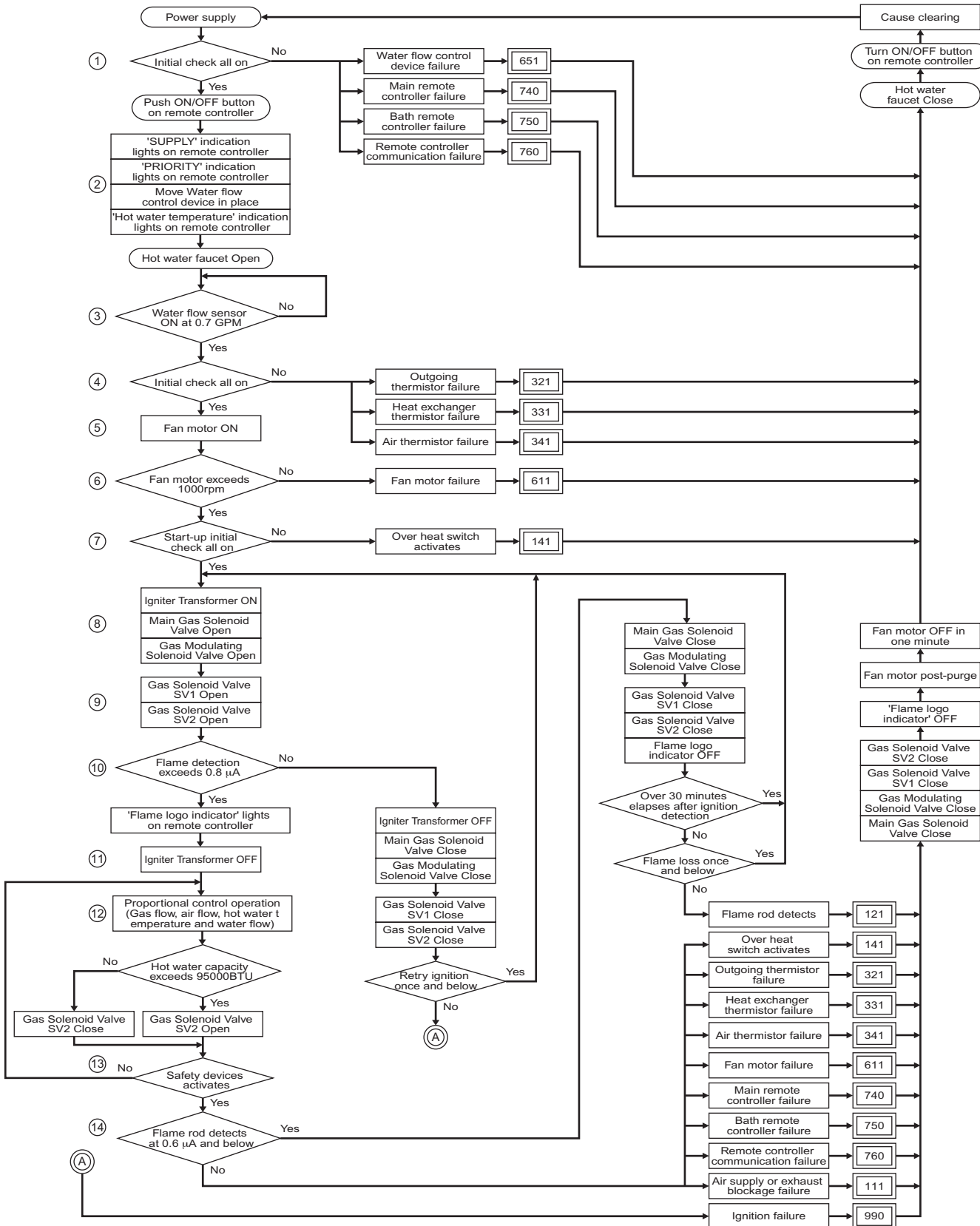
- When the hot water faucet is closed, the water flow sensor detects no water flow. In response to this, PCB closes the Main Gas Solenoid Valve, the Gas Solenoid Valve 1 and Gas Solenoid Valve 2 and the combustion fan stops after running for 65 seconds. (Post purge)

3-2 Time Charts





3-3 Flow Charts



3-4 Fault Findings and Error Code

ERROR CODE

ERROR CODE	CONDITION OF COMBUSTION INDICATOR ON PCB	NUMBER OF FLASHING	PHENOMENON	SYMPTOM	POSSIBLE CAUSE	CHECK METHOD	CORRECT VALUE	Refer Figure
-	NOT FLASHING	-	NOTHING STARTS AND REMOTE'S DISPLAY DOES NOT INDICATE ANY FAULT		FUSE BLOWS	CHECK THE CONTINUITY OF FUSE ON PCB	0 ohm	Fig.1
					120V/100V STEP-DOWN AUTO TRANSFORMER DEFECT	CHECK FOR AC100V BETWEEN BLACK AND BLUE AT CONNECTOR (8)		
			NOTHING STARTS, ONLY REMOTE'S DISPLAY INDICATES SWITCH ON		WATER INLET FILTER IS BLOCKED.	VISUAL CHECK AND CLEAN CAREFULLY OR REPLACE.		See fwg
	WATER FLOW SENSOR DEFECT OR JAMMED	VISUAL CHECK. AS NEXT STEP, PULL OUT CONNECTOR(2), CHECK IGNITION WHEN CONNECTION WITH WHITE PIN OF WATER FLOW SENSOR AND UNUSED PIN.(*)			Fig.2			
000	NOT FLASHING	-	POWER RECOVERY DETECTION ([000] indication can be referred only in calling mode as the record of power failure.)					
001	FLASHING	6	POWER FAILURE DETECTION	COMBUSTION STOPS, THEN FLASHING	POWER FAILURE DURING COMBUSTION	CLOSE HOT WATER FAUCET AND AGAIN OPEN FAUCET.		
111		1	IGNITION FAILURE	NO IGNITION, THEN COMBUSTION INDICATOR STARTS FLASHING AFTER 15 SEC.	IGNITER DEFECT	CHECK AC VOLTAGE BETWEEN BLACK AND BLACK AT CONNECTOR (7) IN IGNITION	AC100V	Fig.3
					BROKEN INSULATOR IN IGNITER TERMINAL	VISUAL CHECK OF IGNITER TERMINAL		
					THERMAL FUSE IS ACTIVATED. (FUSE WIRE IS DISCONNECTED)	CHECK THE CONTINUITY IN TRANSMISSION CONNECTOR.(YELLOW) FOR FUSE SIDE	0 ohm	Fig.4
					GAS SOLENOID VALVE ASSY DEFECT	CHECK FOR DC90V AT CONNECTOR (5) IN IGNITION OR CHECK FOR CONTINUITY IN MAIN SOLENOID VALVE, SOLENOID VALVE 1&2 RESPECTIVELY.	DC90V Table 1	Fig.5
					MODULATING SOLENOID VALVE DEFECT	CHECK FOR DC 3.2-9.5 V CONNECTOR (1) WITHOUT PULLING OUT THE PLUG ON	DC 3.2-9.5V	Fig.6
					LOSS OF GAS SUPPLY	CHECK GAS INLET PRESSURE		
				IGNITES, THEN LED STARTS FLASHING AFTER 15 SECS.	FLAME ROD INSULATOR FAILURE, OR SHORT-CIRCUITED	VISUAL CHECK OF FLAME ROD INSULATION		
					EARTH CABLE	CHECK FOR DISCONNECTION OR LOOSE CONNECTIONS AT TERMINAL.		
					NOZZLE OF MANIFOLD	VISUAL CHECK OF INJECTOR BLOCKAGE		
121		3	FLAME FAILURE DURING COMBUSTION	FLAME FAILURE DURING COMBUSTION	INSUFFICIENT GAS PRESSURE SETTING (MODULATING SOLENOID VALVE)	CHECK MANIFOLD PRESSURE.	Table 2	
					LOSS OF GAS SUPPLY	CHECK GAS INLET PRESSURE	Table 2	
141		4	OVER HEAT SWITCH ON	COMBUSTION STOPS AND COMBUSTION INDICATOR STARTS FLASHING	OVER HEAT SWITCH DEFECT AND IS ACTIVATED.	CHECK THE CONTINUITY BETWEEN THE TERMINALS OF THE SWITCH	0 ohm	Fig.7
321		5	OUTGOING THERMISTOR WIRE BREAKAGE	COMBUSTION INDICATOR FLASHES IMMEDIATELY	WIRE BREAKAGE	CHECK THE RESISTANCE AT CONNECTOR (3)	Table 3	Fig.8
331		10	HEAT EX. THERMISTOR WIRE BREAKAGE					
341		11	AIR THERMISTOR WIRE BREAKAGE					
611		7	FAN MOTOR FAILURE BREAKING	NO IGNITION, COMBUSTION INDICATOR STARTS FLASHING AFTER 10 SECS.	FAN MOTOR DETECT	REPLACE FAN MOTOR.		
					WIRE BREAKAGE FOR FAN MOTOR FUSE(3A)	REPLACE FAN MOTOR AND FAN MOTOR FUSE AT SAME TIME.		
651		9	WATER FLOW CONTROL DEVICE FAILURE	COMBUSTION INDICATOR FLASHES IMMEDIATELY	WATER FLOW CONTROL DEVICE DEFECT	REPLACE WATER FLOW CONTROL DEVICE.		
721	2	FALSE FLAME DETECTION	COMBUSTION INDICATOR FLASHES IMMEDIATELY	FLAME ROD INSULATOR DEFECT	VISUAL CHECK OF FLAME ROD INSULATION			
740 750	NOT FLASHING	-	NOTHING OPERATES AND THE ERROR CODE DISPLAYS IN 1 MINUTE.		PCB DEFECT	TURN OFF AND ON. IF NOT RECOVERY, REPLACE PCB.		
740		8	COMMUNICATION FAILURE WITH MAIN REMOTE CONTROLLER	NO COMBUSTION OR COMBUSTION STOPS, COMBUSTION INDICATOR FLASHES IMMEDIATELY	WIRE BREAKAGE OF REMOTE CONTROLLER CABLE, SHORT-CIRCUITED	VISUAL CHECK OF WIRE AND REMOTE CONTROL CONNECTIONS		
750			COMMUNICATION FAILURE WITH BATHROOM REMOTE CONTROLLER		REMOTE CONTROLLER FAILURE	WHEN OPENING HOT WATER FAUCET WITHOUT CONNECTING REMOTE CONTROLLER, IF NORMAL COMBUSTION STARTS, REPLACE REMOTE CONTROLLER.		
760			COMMUNICATION FAILURE					
990		12	AIR SUPPLY OR EXHAUST BLOCKAGE FAILURE	COMBUSTION STOPS AND COMBUSTION INDICATOR STARTS FLASHING	VENT TOP IS BLOCKED.	VISUAL CHECK OF VENT TOP. IF BLOCKAGE, TAKE OUT.		
LC	LIGHTING	-	SCAL BUILDUP (IN HEAT EXCHANGER) FAILURE	COMBUSTION CONTINUES.HOWEVER LC SHOWS ON REMOTE CONTROLLER	SCALE BUILDS UP IN HEAT EXCHANGER	REMOVE SCALE BY USING SCALE REMOVER.		
-	LIGHTING	-	HOT WATER TEMPERATURE CAN NOT BE REACHED PRESET TEMPERATURE		THERMISTOR DEFECT	CHECK RESISTANCE AT CONNECTOR (3).	Table 3	Fig.8
					MODULATING SOLENOID VALVE	CHECK MANIFOLD PRESSURE.	Table 2	
					PRESSURE OF GAS SUPPLY	CHECK INLET GAS SUPPLY(SUFFICIENT PRESSURE AT MAX. COMBUSTION).	Table 2	
					REMOTE CONTROLLER DEFECT	OPERATE WATER HEATER WITHOUT REMOTE CONTROLLER AND CHECK HOTWATER TEMPERATURE AT 42°C, 60°C, 75°C.		
					WATER INLET FILTER IS BLOCKED.	VISUAL CHECK AND CLEAN.		See fwg

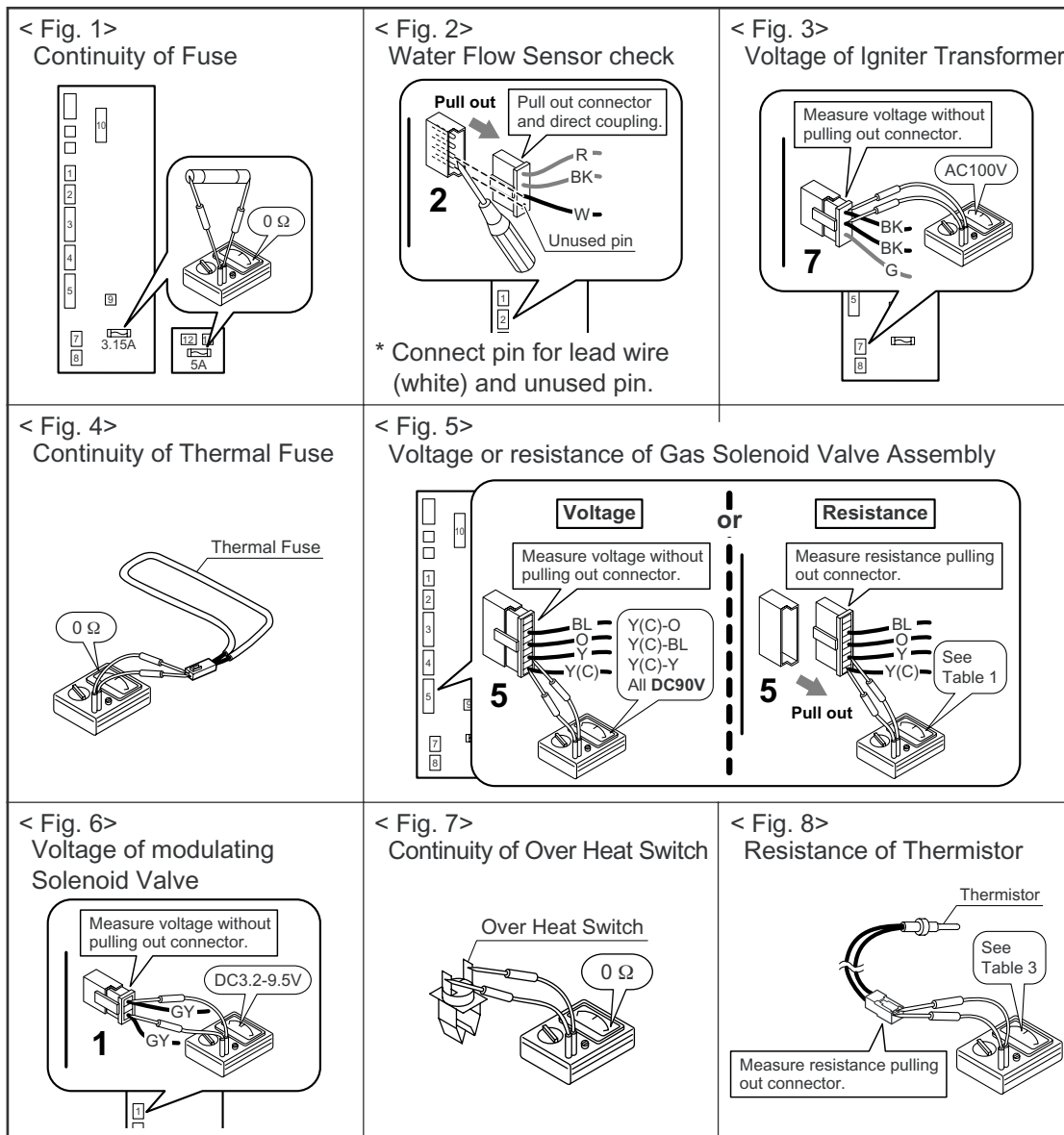
* CHECKING METHOD OF FAULTS

In case of using circuit tester;
Connector No.1,3,4,5,6,7,8 on PCB can check fault by measure voltage with tester in inserting connector.

* Water filter

There are some symptoms such as ignition failure or firstly smooth ignition and later ignition failure.
Possible reason are that water filter does not turn off securely (after water filter cleaning, water filter does not turn off to the end securely) and foreign matter passes through without stopping in water filter, water flow control device or water flow sensor are blocked with foreign matter.

Fault findings



< Table 1 >
Resistance of Gas Solenoid Valve Assembly

Lead wire	Resistance (kΩ)
Y(C)-O Solenoid Valve	Approximately 1.6
Y(C)-BL Solenoid Valve	Approximately 1.6
Y(C)-Y Main solenoid Valve	Approximately 1.5

< Table 2 >
Gas pressure (in W.C.)

Gas type	Gas supply pressure	Manifold pressure	
		Maximum	Minimum
Propane Gas	8-14	2.4	0.4
Natural Gas	4-10.5	2.4	0.4

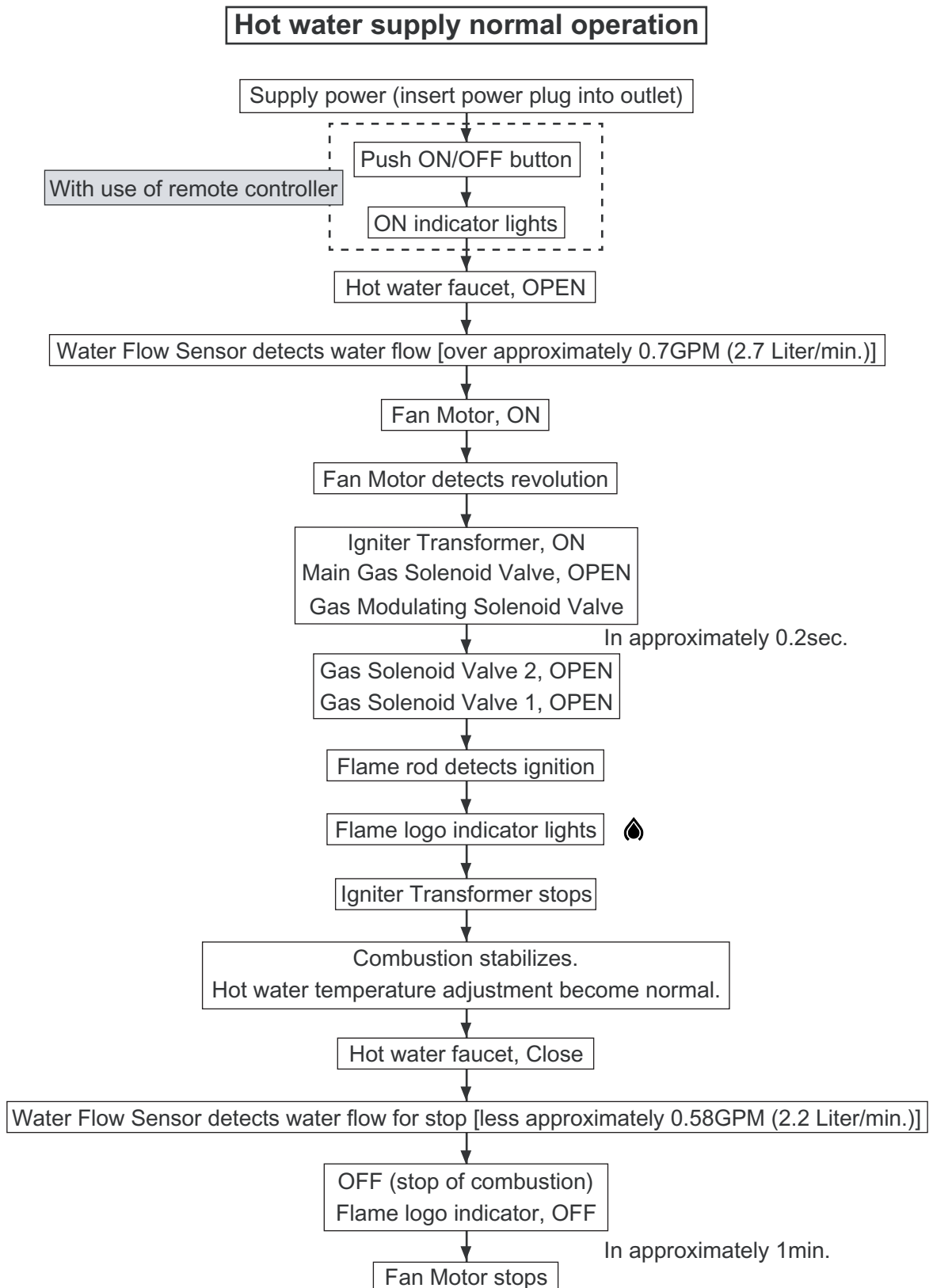
< Table 3 >
Resistance of Thermistor

Temperature (C°)	Resistance (kΩ)
10	Approximately 15.8
20	Approximately 10.4
35	Approximately 5.9
40	Approximately 4.9
50	Approximately 3.5

Abbr. of color :

Y = Yellow R = Red G = Green
O = Orange BK = Black GY = Gray
BL = Blue W = White

Operational flow chart



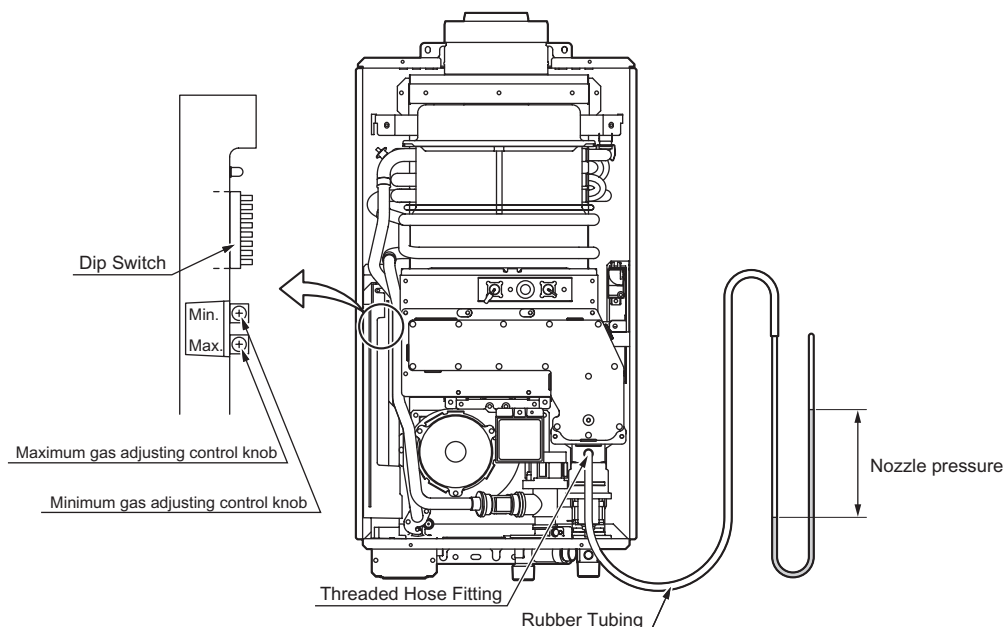
3-5 Gas Setting Procedure

1. Preparation

- (1) Make sure the appliance is not in operation. Then, remove the screw from the pressure check inlet.
- (2) Connect the hose of the manometer to the pressure check hole. <See page 56>

2. Adjusting nozzle pressure settings <Minimum pressure should be set before setting the maximum pressure.>

- (1) Make sure that "Dip Switch" No. 1 is set to the position for the appropriate gas type.
- (2) After igniting for combustion by opening the hot water supply valve, set "Dip Switch" No. 5 to ON position to set the combustion at a minimum capacity level. By turning the Minimum gas adjusting control knob under the "Dip Switch," set the gas amount for the minimum capacity level. Then, set the "Dip Switch" No. 5 to OFF.
- (3) With the combustion going on, set "Dip Switch" No. 6 to ON position to set the combustion at a maximum capacity level. At this time, a substantial amount of water should be supplied. (To prevent water from boiling, as the maximum capacity is forced, if the water temperature is high, the heated water may reach boiling point.)
- (4) Set the gas amount for the maximum capacity level by turning the Maximum gas adjusting control knob under the Minimum gas adjusting control knob. Then, set "Dip Switch" No. 6 to OFF.
- (5) Shut the hot water supply valve. Open the valve again for combustion. Repeat the steps (2) to (4) to check that the settings are correct.
- (6) Shut the hot water supply valve to stop combustion. Disconnect the rubber hose of the manometer from the pressure check hole. Seal the hole by installing and tightening the screw. After tightening the screw, make sure there is no gas leak.

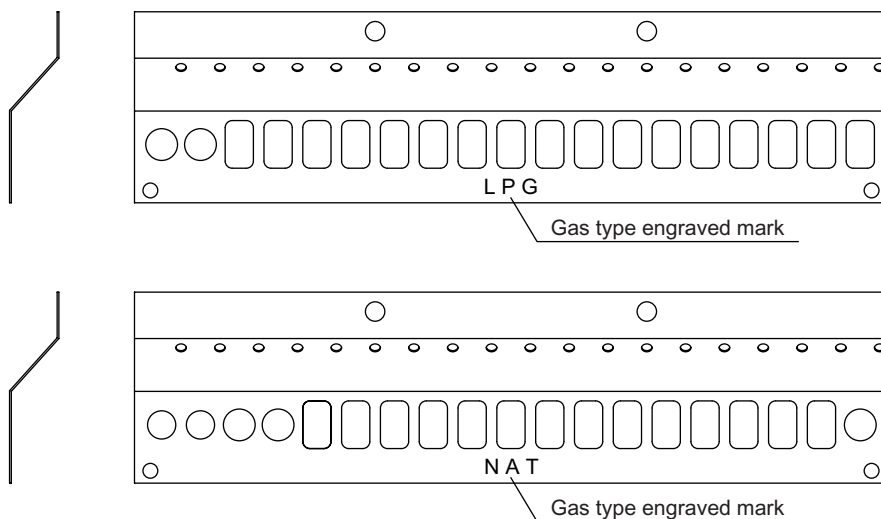


3-6 Combustion Specification, Various Combination Setting

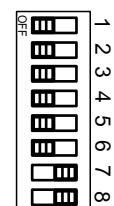
COMBUSTION SPECIFICATIONS

Gas type	Gas consumption Btu/h		Nozzle diameter of manifold (mm)		Gas type dip(c/o) switch
	Maximum	Minimum (reference)	Rich [Top side]	Lean [bottom side]	
LPG	180,000	20,000	ø1.00 ×19 pcs	ø1.20 ×18 pcs	DipSw.No.1:OFF
Natural Gas	180,000	20,000	ø1.35 ×19 pcs	ø1.65 ×18 pcs	DipSw.No.1:ON

Damper



Initial setting of Dip Switch No. 1
(Factory setting for shipping)



[LPG]



[Natural Gas]

• Switching gas type

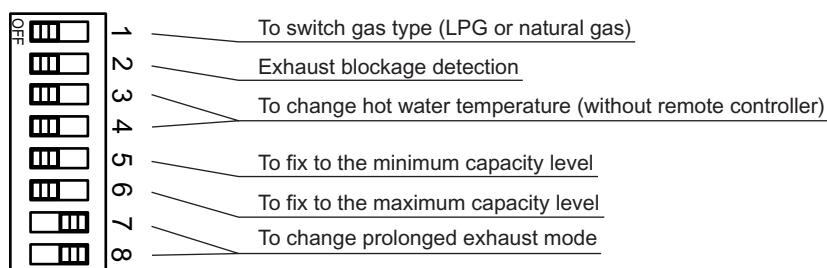
Dip SW settingfor gas type	Applicable gas type
No. 1	
OFF	LPG
ON	Natural Gas

* Setting change can be done with power ON or OFF.

Comfort Dip Switch Setting Pattern(Various Combination Setting)

<Dip Switch>

(The illustrated switch settings show the factory settings for the LPG as the gas type.)



- Changing hot water temperature (when the remote controller is not connected, the hot water temperature setting can be changed by selecting one of these settings.)

Dip SW settings for different temperature		Temperature [°F] (°C)
No. 3	No. 4	
OFF	OFF	120(49)
ON	OFF	165(74)
OFF	ON	110(43)
ON	ON	140(60)

* Setting change after the power is turned on is ineffective.

* The system recognizes the settings and makes them effective before power is turned on.

* When the remote controller is connected, the Dip SW settings become ineffective.

- Changing combustion capacity level

Dip SW settings for different combustion capacity		Capacity Level
No. 5	No. 6	
OFF	OFF	Default
ON	OFF	Locked at minimum capacity level
OFF	ON	Locked at maximum capacity level
ON	ON	Not applicable

* ON settings before the power is turned on is ineffective.

* By detecting setting changes, the system validates the changed settings.

* If the water is not supplied for 5 minutes continuously, the settings become ineffective.

- Manifold gas pressure by exhaust mode of vent pipe

		Exhaust mode			
		short 1	short 2	Long 1	Long 2
Dip SW Settings for different exhaust mode	No. 7	OFF	ON	OFF	ON
	No. 8	OFF	OFF	ON	ON
LPG	Minimum [in W.C]	*	*	*	*
	Maximum [in W.C]	*	*	*	*
Natural Gas	Minimum [in W.C]	*	*	*	*
	Maximum [in W.C]	*	*	*	*

* Setting change after the power is turned on is effective.

* By detecting setting changes, the system validates the changed settings.

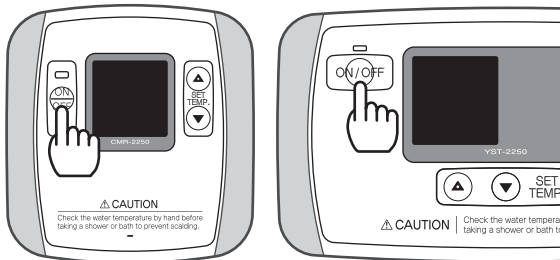
Refer to page 21 Installation and Operating instruction, for setting of exhaust mode of vent pipe.

3-7 Remote Controllers Special Features

How to adjust the brightness of the remote controller display

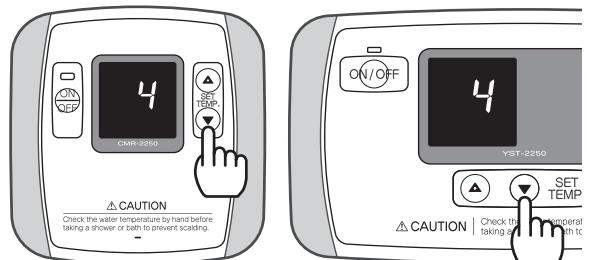
The brightness of each of the main remote controller (CMR-2250), bathroom remote controller (YST-2250), can be adjusted.

1. Turn off the operation switch.



Press the operation switch to turn it off.

2. Press and hold the adjustment switch for approximately five seconds.



The current settings appear.

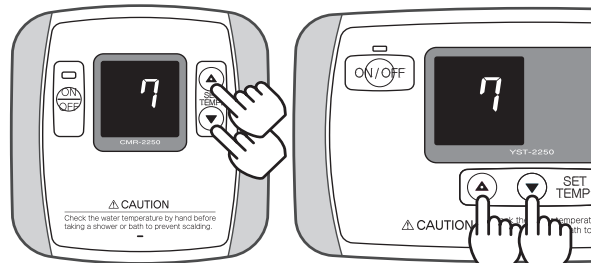
3. Press the adjustment switch.

The brightness can be adjusted to any of seven levels.

The higher the number, the brighter the display.

If no data are changed within a period of approximately 20 seconds, the current settings remain active.

The settings can also be determined by pressing the operation switch.



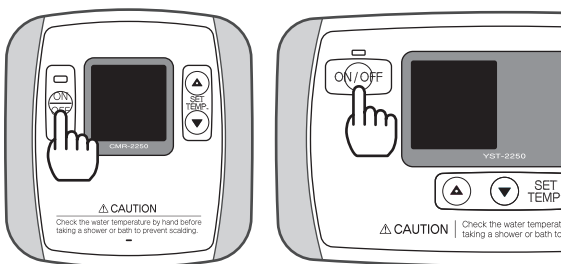
Note

- The settings for the main remote controller and bath remote controller can be adjusted individually.
- The brightness of the remote controller display is set to level "4", by default, at the time of shipping.

How to set energy-saving mode

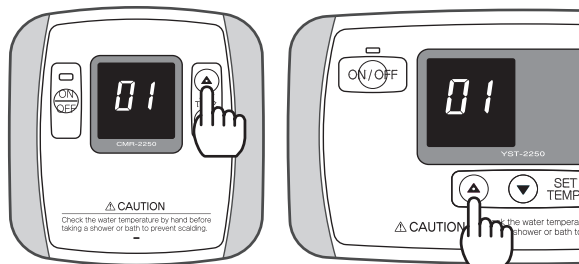
The main remote controller (CMR-2250), bathroom remote controller (YST-2250), can be set energy-saving mode if no operation is carried out within a specified period. In energy-saving mode, the display becomes dim.

1. Turn off the operation switch.



Press the operation switch to turn it off.

2. Press and hold the adjustment switch for approximately five seconds.



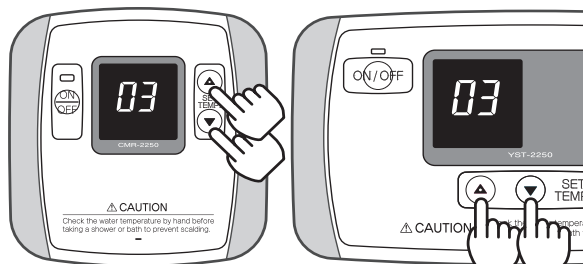
The current settings appear.

3. Press the adjustment switch.

Energy-saving mode is activated or deactivated according to the table below.

If no data are changed within a period of approximately 20 seconds, the current settings remain active.

The settings can also be determined by pressing the operation switch.

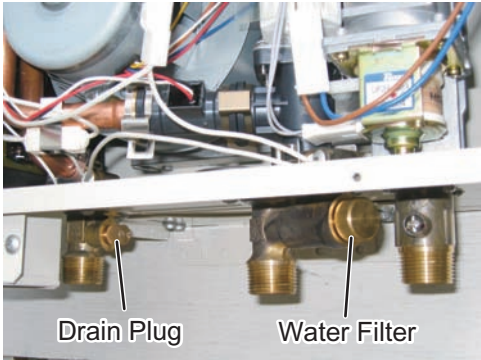
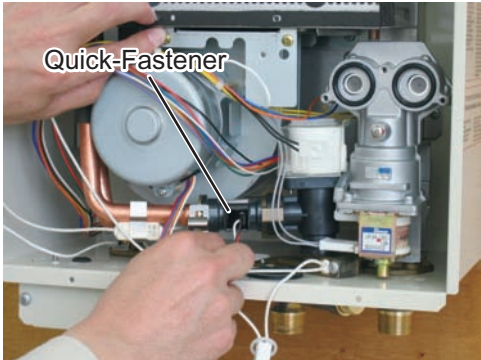
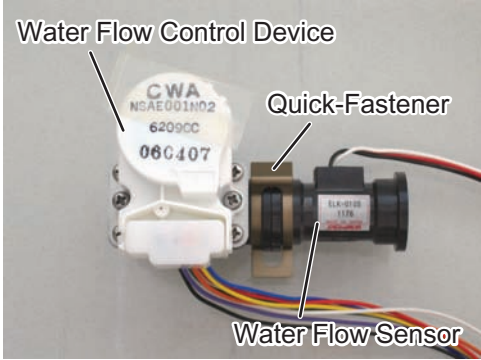


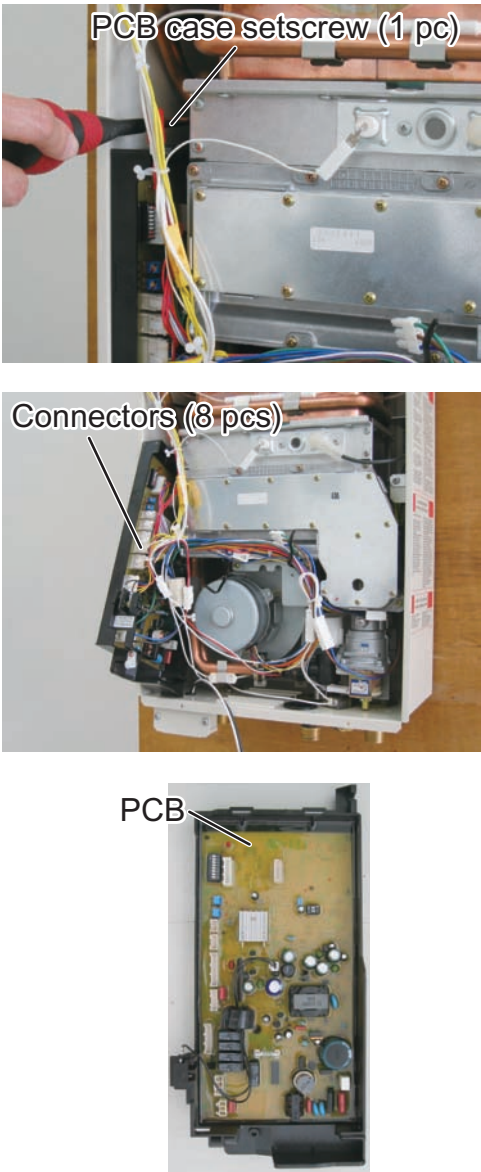
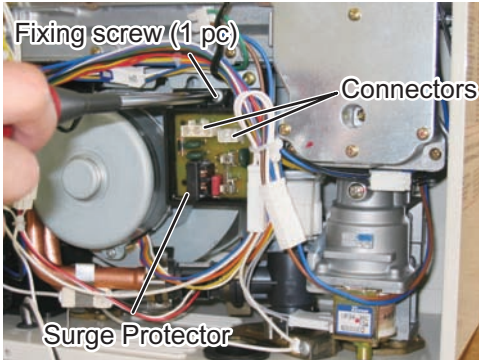
Note

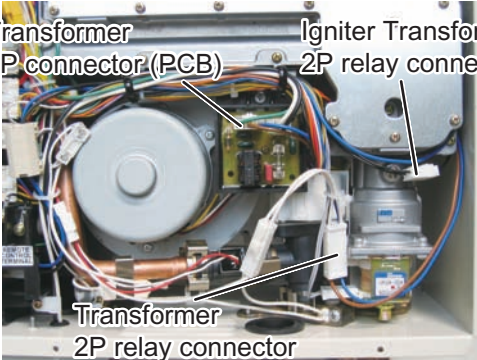
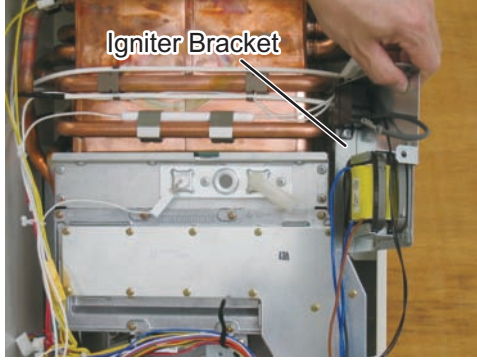
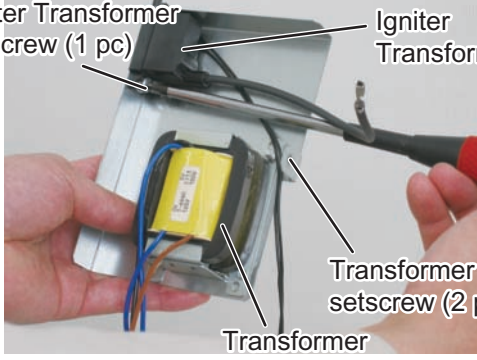
- The settings for the main remote controller and bathroom remote controller can be adjusted individually.
- Energy-saving mode is set to level "01", by default, at the time of shipping.

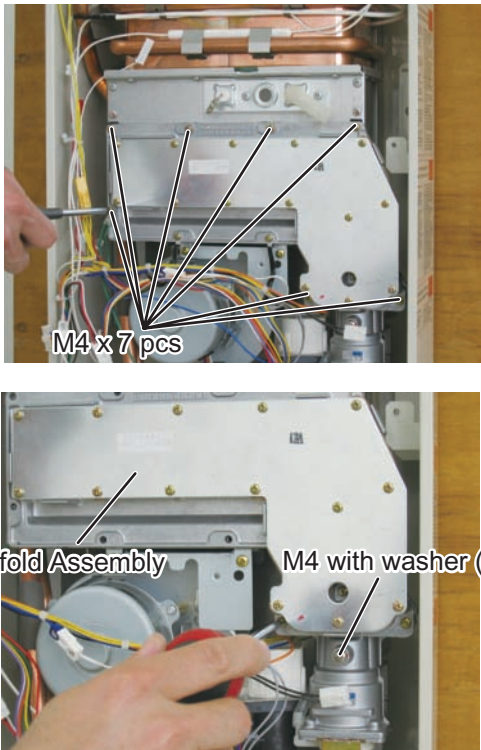
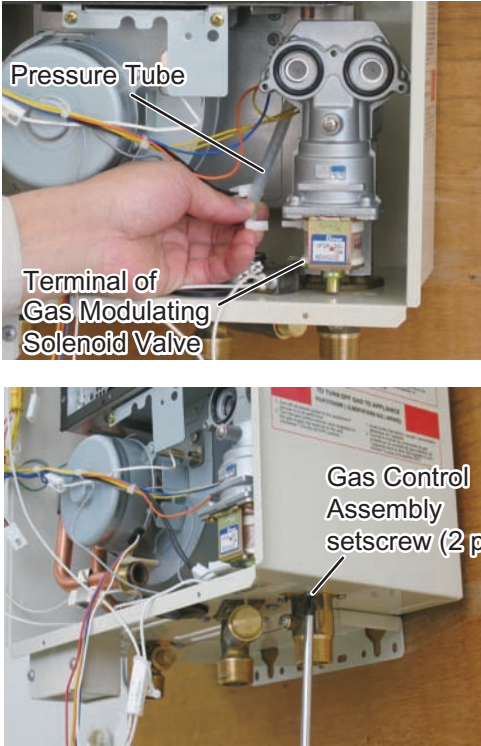
Setting	Meaning
01	If no data are adjusted with a period of approximately 25 seconds, the display becomes dim.
02	If no data are adjusted with a period of approximately 25 seconds, the display becomes more dim.
03	The display always remains bright.
04	The display always remains dim.

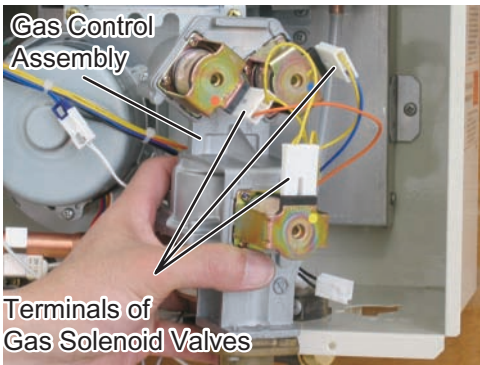
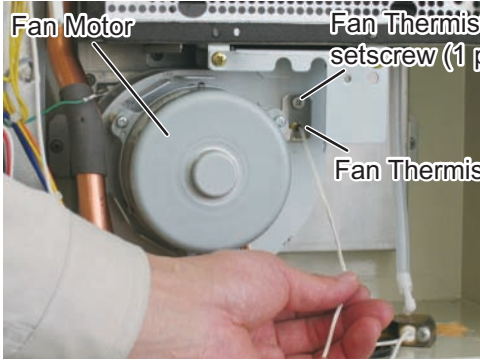
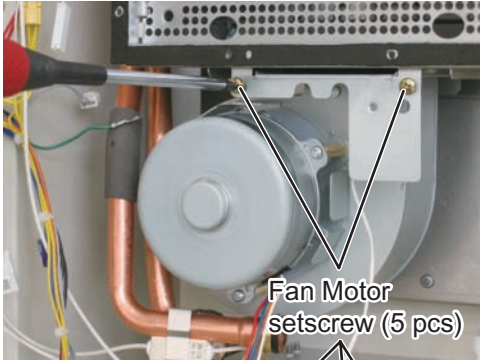
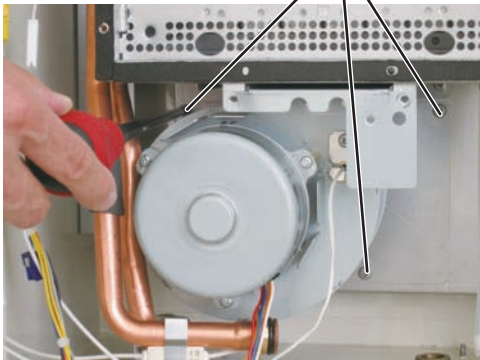
3-8 Disassembling/Assembling Parts

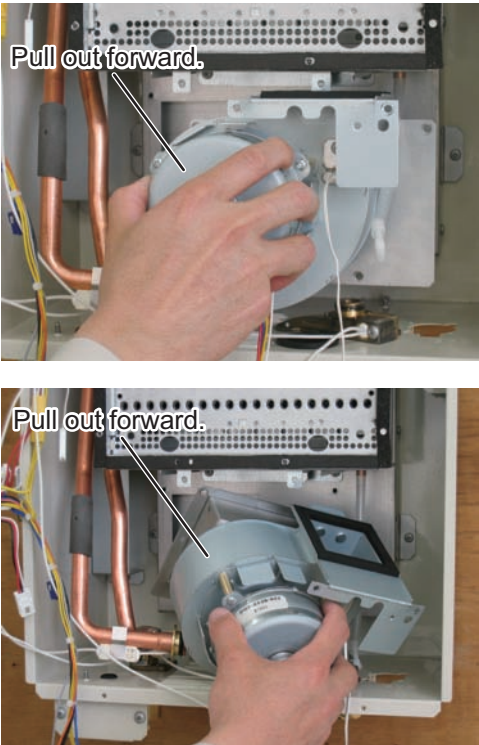
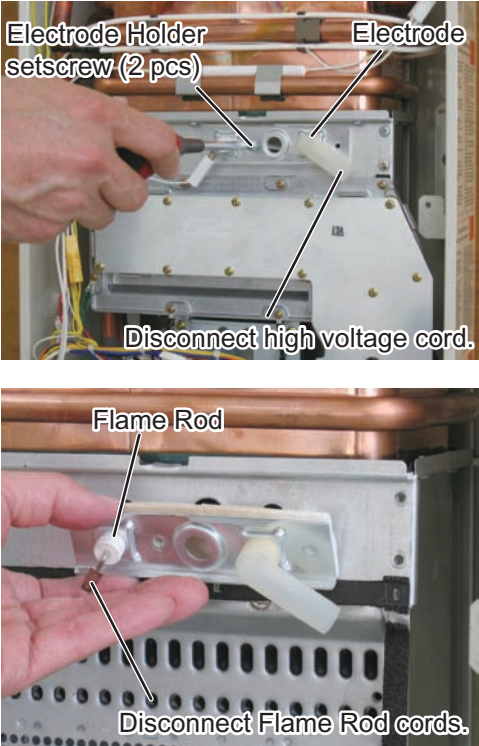
Procedure	Illustration
[1] Removing Water Flow Control Device and Water Flow Sensor (1) Drain water and turn off the power. (2) Disconnect Water Flow Control Device 8PIN connector (on PCB side) and Water Flow Sensor 3PIN relay connector. (3) Remove the two Quick-Fasteners and take out Water Flow Control Device and Water Flow Sensor. (4) Remove the Quick-Fastener.	 Drain Plug Water Filter  Quick-Fastener  Water Flow Control Device Quick-Fastener Water Flow Sensor

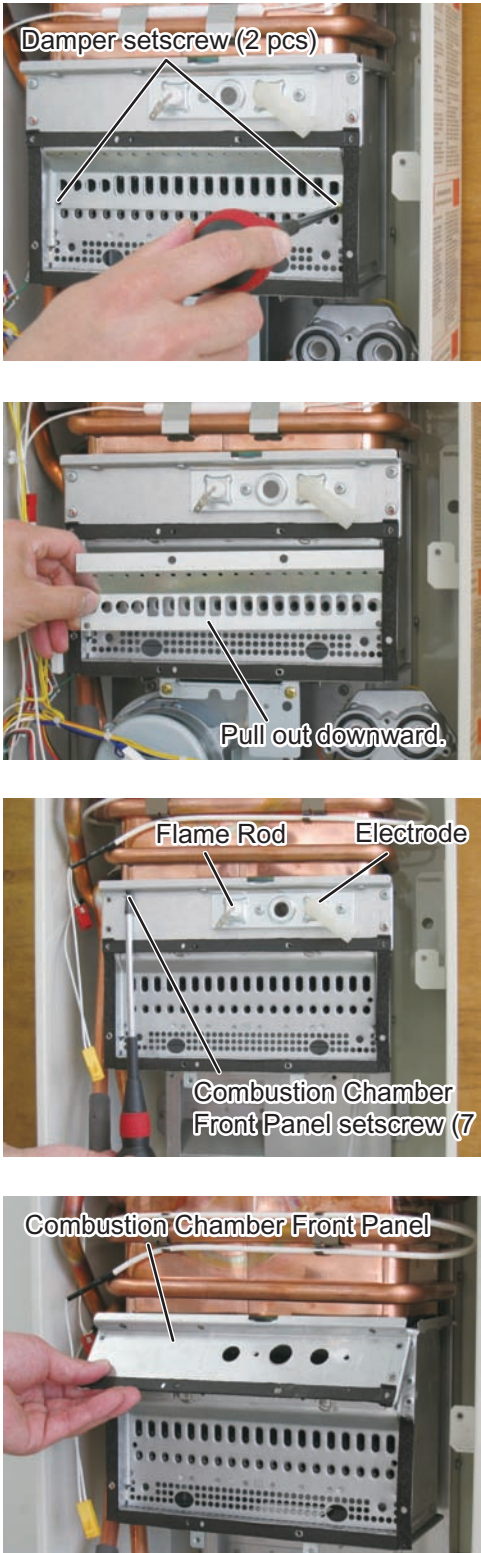
Procedure	Illustration
[2] Removing PCB (1) Remove the set screw (1 pc) fixing the PCB case and pull the case out. (2) Disconnect the Connectors (8 pcs) from the electrical PCB. (3) If remote controllers are connected, disconnect the remote controller cables.	 PCB case setscrew (1 pc) Connectors (8 pcs) PCB
[3] Removing Surge Protector (1) Disconnect Connectors (2 pcs). (2) Remove the Fixing screw (1 pc). (3) Remove the Surge Protector.	 Fixing screw (1 pc) Connectors Surge Protector

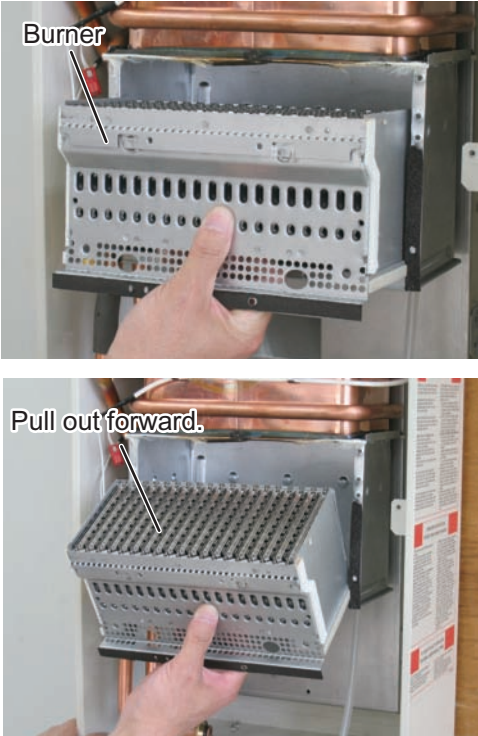
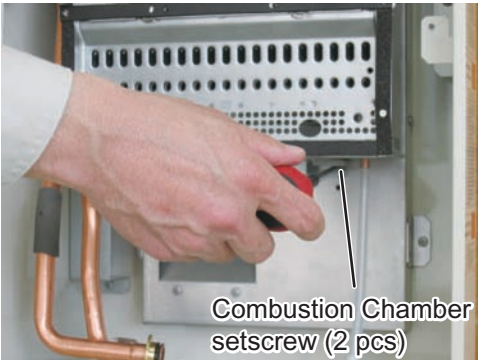
Procedure	Illustration
[4] Removing Igniter Transformer and Transformer (1) Remove the set screw (1 pc) installing the Igniter Bracket. (2) Disconnect the Igniter Transformer 2P relay connector, high-voltage cord, Transformer 2P relay connector, and Transformer 3P connector (on PCB side). (3) Pull out the Igniter Transformer and Transformer with the Igniter Bracket as one unit. (4) Remove the set screw (1 pc) retaining the Igniter Transformer, and set screws (2 pc) retaining the Transformer.	 Igniter Bracket setscrew (1 pc)  Transformer 3P connector (PCB) Igniter Transformer 2P relay connector Transformer 2P relay connector  Igniter Bracket  Igniter Transformer setscrew (1 pc) Igniter Transformer Transformer setscrew (2 pcs) Transformer

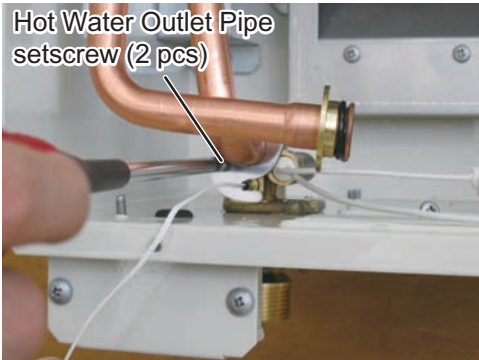
Procedure	Illustration
[5] Removing Manifold Assembly (1) Remove the set screws fixing the Manifold Assembly (M4 x 7 pcs, M4 w/ washer x 3 pcs).	 M4 x 7 pcs Manifold Assembly M4 with washer (3 pcs)
[6] Removing Gas Control Assembly (1) Remove Manifold Assembly. (See [5].) (2) Remove Terminals of Gas Modulating Solenoid Valve. (3) Remove the Pressure Tube. (4) Remove two set screws, one on right side in front and the another on left side at the rear, fixing the Gas Control Assembly. (5) Remove plug (1 pc) from the gas pressure check hole.	 Pressure Tube Terminal of Gas Modulating Solenoid Valve Gas Control Assembly setscrew (2 pcs)

Procedure	Illustration
(6) Pull the Gas Control Assembly out and disconnect the terminals (3 pcs) of the Gas Solenoid Valves, and remove them as one unit.	 Gas Control Assembly Terminals of Gas Solenoid Valves
[7] Removing Fan Motor (1) Remove Water Control Device and Water Flow Sensor. (See [1].) (2) Remove Manifold Assembly and Gas Control Assembly. (See [5] [6].) (3) Remove the set screw (1 pc) fixing the fan Thermistor. (4) Remove the set screws (5 pcs) fixing the Fan Motor to pull it out forward.	 Fan Motor Fan Thermistor set screw (1 pc) Fan Thermistor  Fan Motor set screw (5 pcs) 

Procedure	Illustration
	
[8] Removing Electrode and Flame Rod [Electrode] (1) Disconnect high voltage cord. (2) Remove set screws (2 pcs) fixing the Electrode Holder to pull the Holder out. [Flame rod] (1) Disconnect Flame Rod cords. (2) Remove set screws (2 pcs) fixing the Electrode Holder to pull the Holder out.	

Procedure	Illustration
[9] Removing Burner (1) Remove Manifold Assembly. (See [5].) (2) Disconnect cords from Flame Rod. (3) Disconnect high voltage cord from the Electrode. (4) Remove set screws (2 pcs) fixing the Damper and pull the Damper out downward. (5) Remove Electrode and Flame Rod. (See [8].) (6) Remove set screws (7 pcs) fixing the Combustion Chamber Front Panel.	 Damper setscrew (2 pcs) Pull out downward. Flame Rod Electrode Combustion Chamber Front Panel setscrew (7 pcs) Combustion Chamber Front Panel

Procedure	Illustration
(7) Pull out the Burner forward.	 The illustration consists of two photographs. The top photograph shows a hand pulling a metal burner assembly forward from its housing. A label 'Burner' with an arrow points to the assembly. The bottom photograph shows the burner assembly further extended, with a label 'Pull out forward.' and an arrow indicating the direction of movement.
[10] Removing Heat Exchanger Assembly (1) Remove Fan Motor. (See [7].) (2) Remove Burner. (See [9].) (3) Remove Pressure Tube. (4) Remove set screws (2 pcs) fixing the Combustion Chamber.	 The photograph shows a hand using a red-handled screwdriver to remove a set screw from the bottom of the combustion chamber. A label 'Combustion Chamber setscrew (2 pcs)' with an arrow points to the screw being removed.

Procedure	Illustration
(5) Disconnect the following connectors: • Thermal Fuse (front) 2P connector (1 pc) • Anti-frost Heater 2P relay connector (1 pc) • Heat Exchanger Thermistor 2P relay connector (1 pc) • High limit terminal (2 pcs) and other connected items. (6) Remove set screws (2 pcs) retaining the Hot Water Outlet Pipe. (7) Remove set screws (2 pcs) retaining the Heat Exchanger Assembly. (8) Pull the Heat Exchanger Assembly downward to take it out. Note: If any gaskets or seals are damaged or torn during disassembling, they must be replaced.	 Hot Water Outlet Pipe setscrew (2 pcs)  Heat Exchanger Assembly setscrew (2 pcs)  Pull out Heat Exchanger Assembly downward.

Thermal Fuse installation condition



3-9 Procedure for Flushing Water Heater

If "LC" is displayed on the remote controllers a few times, flush the heat exchanger assembly of the water heater following the steps described below.

1. Disconnect the power supply to the water heater from the electrical outlet.
2. Close both the water inlet valve (valve 4) and water outlet valve (valve 3).
3. Gradually open the relief valve to release the residual pressure inside the unit. After the pressure release, securely close the relief valve again.
4. Connect an appropriate circulation pump in valve 1 and 2 which is located in the upper of valve 3 and 4 (See Fig. 1). At this time, make sure that the pump outlet (discharge) side is connected to the water inlet side (valve 2) of the unit.
5. Prepare approximately 2 gallons of cleaning liquid by mixing 1.5 gallons of specified cleaning agent such as CLR and 0.5 gallon of water.
6. Turn on the power to start the pump and circulate the liquid for 45 minutes. (For several minutes after the circulation start, carbon dioxide gas may come out from the hose connected to the water outlet because of the dissolution of scale contents.)
7. Turn off the power of the pump.
8. After closing valve 2, disconnect the hose connected to the water inlet. Place the end of the hose connected to the water outlet into an empty bucket. (See Fig. 2)
9. Open the valve 4 gradually to flush off the cleaning liquid remaining in the water circuit of the water heater by supplying water at least for 5 minutes. At that time, be sure to close the valve 3.
10. Shut off the water valve 1 and 4, disconnect the hose connected to the valve 1.
11. Check the water inlet filter (Fig. 3) for clogging. If clogged, remove the foreign substance. After cleaning the filter, install it again.
12. Open both water valve 3 and 4.
13. Restore power to the water heater.

Note

- Be sure the area is well ventilated as opening windows and doors.
- Be sure to wear rubber gloves.
- If the specified cleaning agent comes into contact with skin or eyes, flush area with cool water immediately for 15 min. Call physician if irritation continues.
- If swallowed, do not induce vomiting; drink a glass of water followed with milk. Call a physician immediately.

Fig. 1

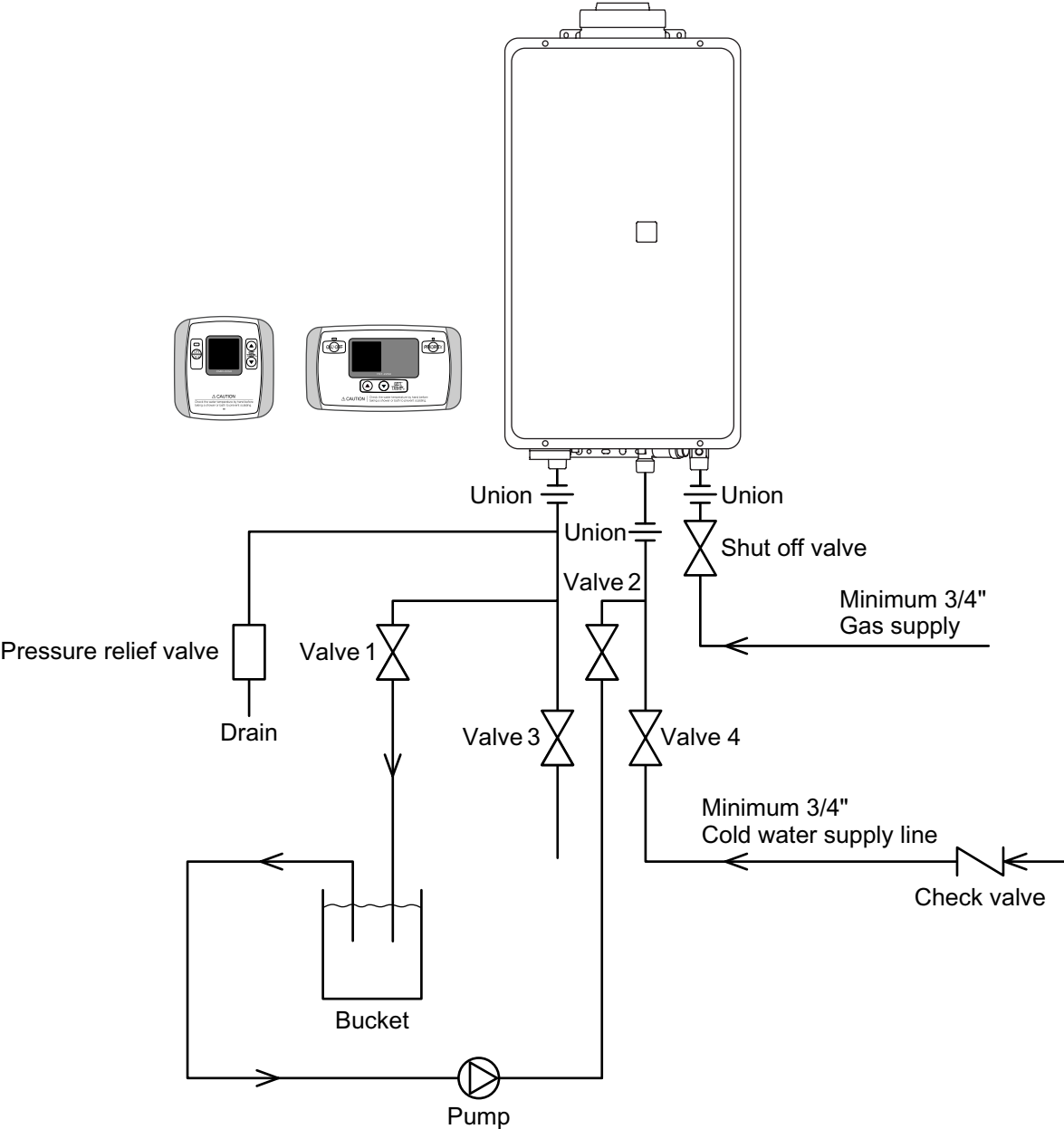
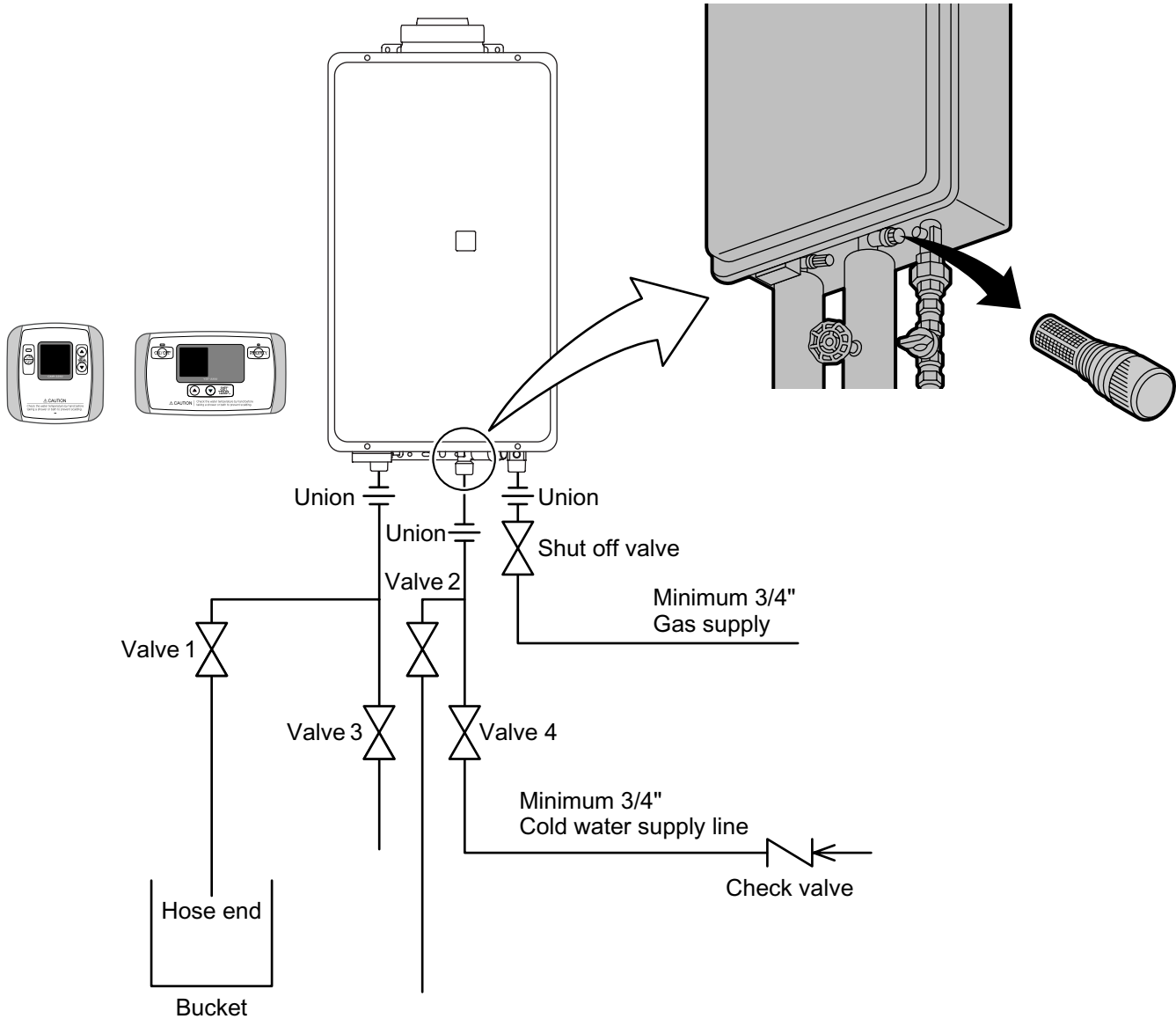
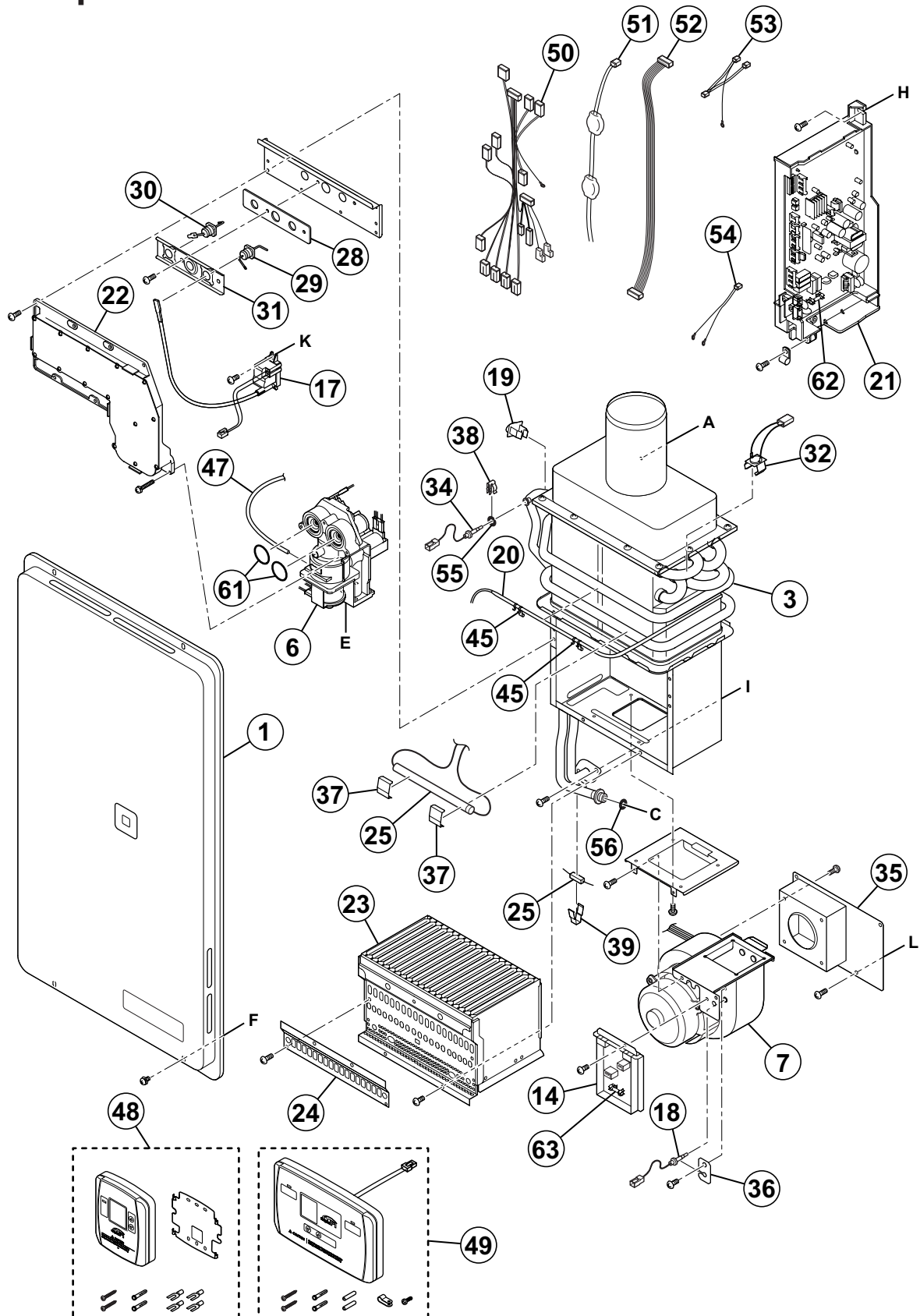


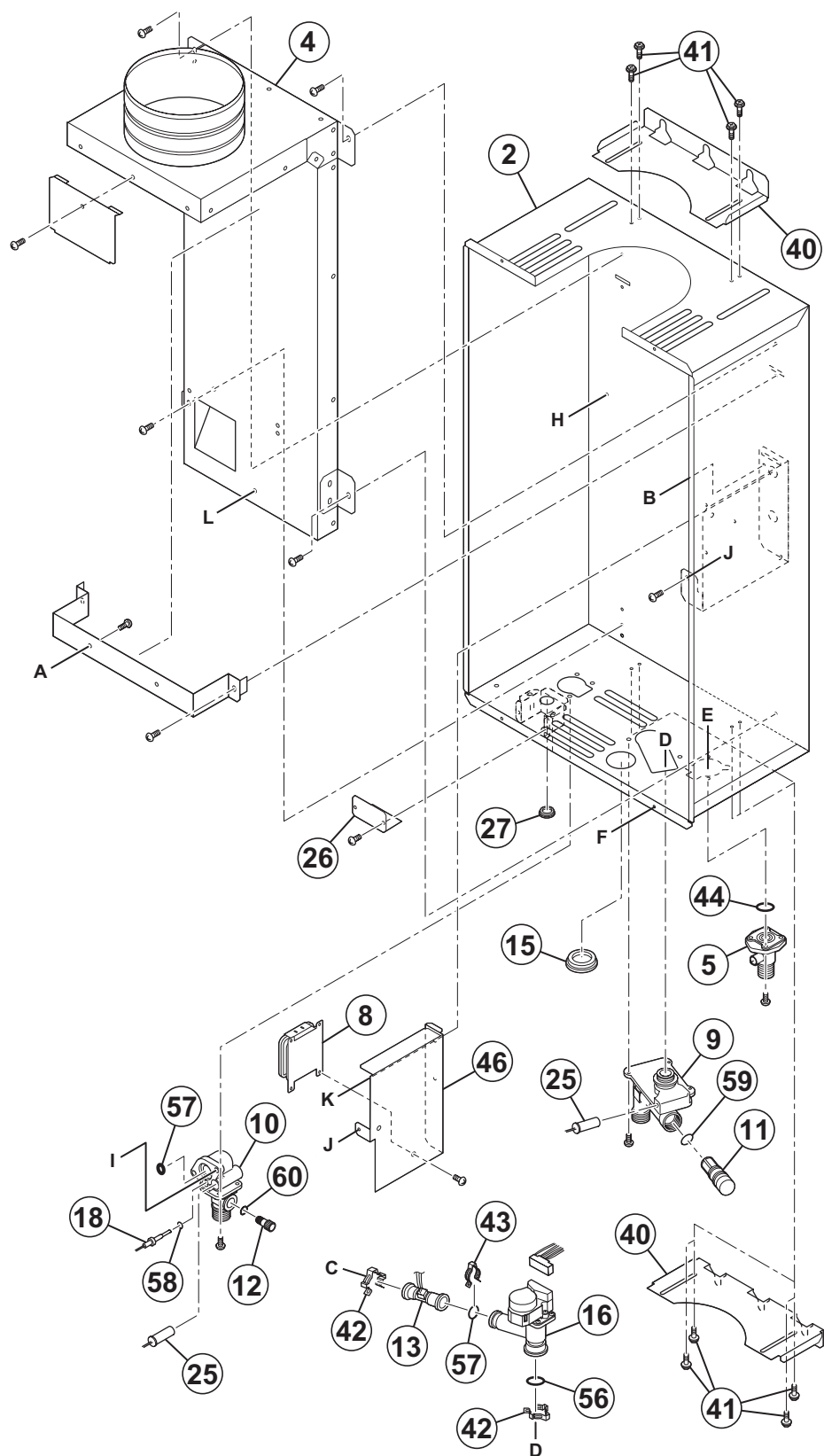
Fig.2

Fig.3



3-10 Exploded View





3-11 Parts List

Number	MPI P/N	Description	Number	MPI P/N	Description
1	3701	Front Panel	34	3734	Heat Exchanger Thermistor
2	3702	Casing Assembly	35	3735	Air Inlet Adapter
3	3703	Heat Exchanger Assembly	36	3736	Thermistor Holder
4	3704	Air Inlet Box Assembly	37	3737	Anti-Frost Heater Clip A
5	3705	Gas Connection	38	3738	Thermistor Clip
6	3706	Gas Control Assembly	39	3739	Anti-Frost Heater Clip B
7	3707	Fan Motor Assembly	40	3740	Wall Hanging Bracket
8	3708	Transformer	41	3741	Hexagon Head Screw
9	3709	Water Inlet	42	3742	Quick-Fastener 16A
10	3710	Hot Water Outlet	43	3743	Quick-Fastener 16C
11	3711	Water Filter	44	3744	Rubber Packing
12	3712	Drain Plug	45	3745	Thermal Fuse Clip
13	3713	Water Flow Sensor	46	3746	Igniter Bracket
14	3714	Surge Protector	47	3747	Pressure Tube
15	3715	Cable Inlet	48	3748	Main Remote Controller CMR-2250
16	3716	Water Flow Control Device Assembly	49	3749	Bath Remote Controller YST-2250
17	3717	Igniter Transformer	50	3750	Harness
18	3718	Thermistor	51	3751	Power Supply Lead Wire
19	3719	Over Heat Switch	52	3752	Water Flow Control Device Lead Wire
20	3720	Thermal Fuse	53	3753	Heater Lead Wire
21	3721-1	PCB (Propane Gas)	54	3754	Terminal Block Lead Wire
	3721-2	PCB (Natural Gas)	55	3755	O-ring P4 Fluorine
22	3722-1	Manifold Assembly (Propane Gas)	56	3756	O-ring P16 EPDM
	3722-2	Manifold Assembly (Natural Gas)	57	3757	O-ring P15 EPDM
23	3723	Burner	58	3758	O-ring P4 EPDM
24	3724-1	Damper (Propane Gas)	59	3759	O-ring P12 EPDM
	3724-2	Damper (Natural Gas)	60	3760	O-ring P8 EPDM
25	3725	Anti-Frost Heater Assembly	61	3761	O-ring P24 NBR
26	3726	Junction Box Cover	62	3762	PCB Fuse
27	3727	Cable Inlet	63	3763	Surge Protector Fuse
28	3728	Electrode Packing			
29	3729	Electrode			
30	3730	Flame Rod			
31	3731	Electrode Holder			
32	3732	Frost Sensing Switch			