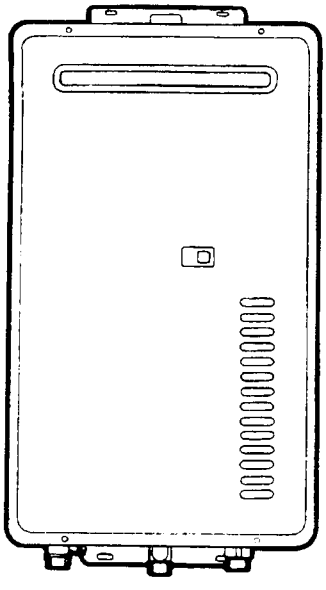
Rinnai

SERVICE MANUAL

INFINITY



REU-2406 W

Quality System

Quality Endorsed Company

ISO 9002 Lic 4983
Standards Australia

Head Office Certified

Distributed and Serviced in Australia under a Quality System certified as complying with ISO 9002 by Standards Australia Quality Assurance Services.

Rinnai Australia Pty Ltd
(Head Office)
10-11 Walker Street
Braeside Victoria 3195

The Australian Gas Association

Proudly a member of the AGA
All of our gas products are AGA tested and approved

June 1996
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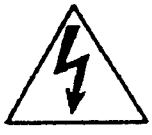


WARNING

ALL WIRING INSIDE THIS APPLIANCE MAY BE AT 240 VOLTS POTENTIAL.

ALL SERVICE WORK MUST BE CARRIED OUT BY AN AUTHORISED PERSON.

DO NOT TEST FOR GAS ESCAPES WITH AN OPEN FLAME.

This manual has been compiled by the Rinnai Australia Technical and Support Services Group. While many individuals have contributed to this publication, it will be successful only if you - the reader and customer - find it useful. We would like to extend an invitation to users of this manual to make contact with us, as your feedback and suggestions are valuable resources for us to include as improvements. Rinnai are constantly working toward supplying improved appliances as well as information, and specifications may be subject to alteration at any time.

Table of Contents

Glossary of Terms

This glossary of terms is provided to assist you in understanding some of the language used throughout this manual.

dB(A)	-	sound pressure level in decibels, "A" range
DC	-	direct current
AC	-	alternating current
WFCD	-	water flow control device
FB	-	feedback information
Hz	-	Hertz
IC	-	integrated circuit
kcal/h	-	kilocalorie per hour
kPa	-	kilopascals
LED	-	light emitting diode
L/min	-	Litres per minute
mA	-	milliamps
MJ/h	-	megajoule per hour
mm	-	millimetres
mmH_2O	-	millimetres of water (gauge pressure)
NO_x	-	oxides of nitrogen (NO & NO_2)
OHS	-	over heat switch
PCB	-	printed circuit board
CPU	-	central processing unit
POT	-	potentiometer
rpm	-	revolutions per minute
SV	-	solenoid valve
Ø	-	diameter
Δ°C	-	temperature rise above ambient
POV	-	modulating valve
TE	-	thermal efficiency
TH	-	thermistor
T_{IN}	-	temperature of incoming water
T_{OUT}	-	temperature of outgoing water

§ 1 Introduction

The REU-2406 is marketed as the Infinity 20. The brand name Infinity refers to "Endless Hot Water". The REU-2406 has been developed in response to the growing changes in the lifestyle of the end user, and the increasing diversification and sophistication of demand in the marketplace.

The REU-2406 model offers reduced cost, advanced safety features, and an option to connect one, two, or three remote temperature control pads, (Pre-March 1996 models - two controls only).

The REU-2406 model is delivered with the PCB set to ensure a maximum hot water temperature of 55°C with or without remote controls connected, (pre-March 1996 models were set to 50°C).

The REU-2406 is ideally suited for commercial situations as it is possible to obtain a maximum outgoing hot water temperature of 75°C or 85°C (without remote controls) by altering the positions of the dip switch - see page 11 for details.

About the REU-2406 Model

The front cover of the appliance is formed from 0.6 mm coated steel, secured to the main box assembly by 4 screws. Seals around the front cover and flue outlet prevent water from entering the appliance.

Air inlets are situated in the front panel. The general layout of components is shown on the cut-away diagram on page 8. All components are supported within a box formed from 0.8 mm coated steel.

The heat exchanger occupies the top section of the box, and the burner is situated in a chamber formed from 0.6 mm aluminised steel attached to the bottom of the heat exchanger.

The air for combustion is supplied by a fan which is connected to the burner box by a duct at the left hand side of the appliance.

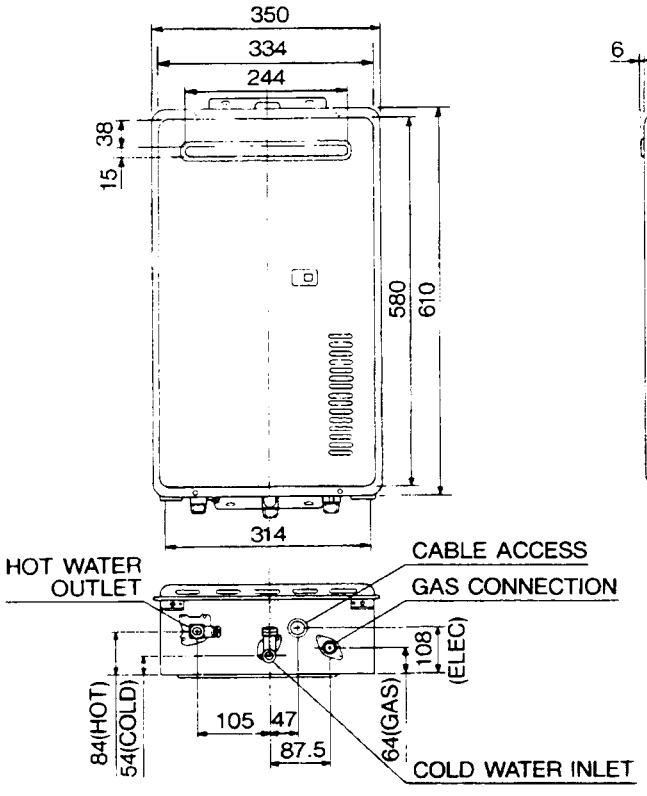
Gas and water controls are situated at the bottom right of the appliance, directly under the manifold. The products of combustion are expelled from the appliance through a stainless steel nozzle situated on the front of the appliance, at the top.

The burner assembly is made up of 18 identical stainless steel bunsen burners, secured by an aluminised steel framework. An aluminium manifold with 18 injectors supplies gas to the burners, and is attached to the front lower cover of the burner box.

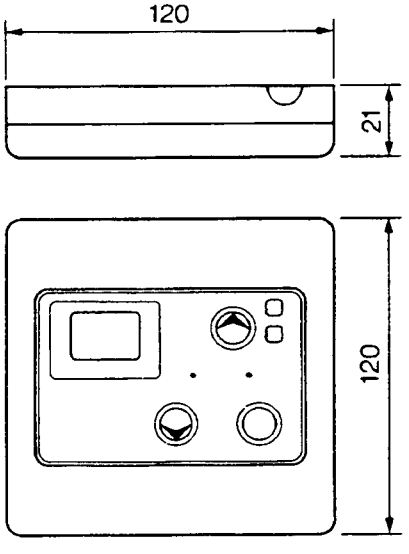
There is one thermistor, it is located near the outlet of the water heater.

Dimensions

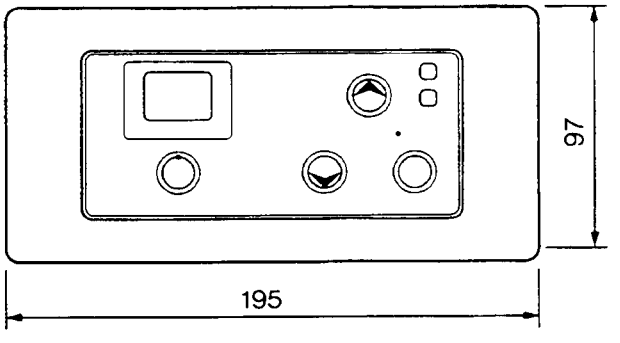
Note: All dimensions are in mm.



	A DIMENSION
HOT	42
COLD	49
GAS	42



Kitchen Control
MC-33-2A



Bath Control
BC-45-2A

Installation

The light weight, slim, compact form enables easier, improved appearance installations. The controls (where fitted) are connected to the main unit by 2 core non-polar cables, eliminating problems of misconnection.

Low Noise

The 49 dB(A) low noise design in the REU-2406 allows for installation in crowded or high density residential areas with minimum concern about noise complaints.

Safety

In the event of a malfunction, one or more of the various safety devices will operate. Depending on the fault, the Infinity 20 will be shut down by the Printed Circuit Board, or directly by individual safety devices. In winter, the automatically operated anti-frost protection heaters (AK model only) , ensure that the water in the appliance does not freeze.

Economy

Direct ignition to the main burner eliminates wasteful pilot gas consumption. The air gas ratio is always controlled to the most suitable level by the PCB, and as the water flow and gas consumption changes, combustion conditions are controlled, maintaining high efficiency.

Water Temperature Control

Sixteen different water temperatures can be selected between 37 °C and 75°C. The temperatures are: 37-38-39-40-41-42-43-44-45-46-47-48-50-55-60-75 °C. (The Infinity 20 is delivered pre-set to a maximum of 55°C.) The remote controls are easy to use with ultra-light touch operation buttons. The maximum temperature selectable on the bath-control is 50 °C (this is a safety feature).

Pre-set Maximum Temperature Limits

The Infinity 20 can be pre-set to supply water at a maximum temperature of 40 °C, 50°C, 55°C and 75°C, with remote controls connected. This means that the Infinity 20 can be set to comply with various State laws on temperature control in homes, child care centres, and elderly care centres. See page 11 for additional information. For commercial use, the Infinity 20 can be pre-set to 85 °C, (without controls only).

Over Temperature Protection

The Infinity 20 incorporates a device to prevent the hot water temperature exceeding the pre-set temperature by more than 3°C.

Temperature Locks

With the remote control(s) connected, the pre-set water temperature can only be changed between 37°C and 43°C whilst the hot water is flowing. This helps to avoid inadvertently increasing the temperature to a hazardous level whilst someone is in the shower. Whilst the water is flowing, the remote control(s) can be turned off, but not on again.

Third Remote Control

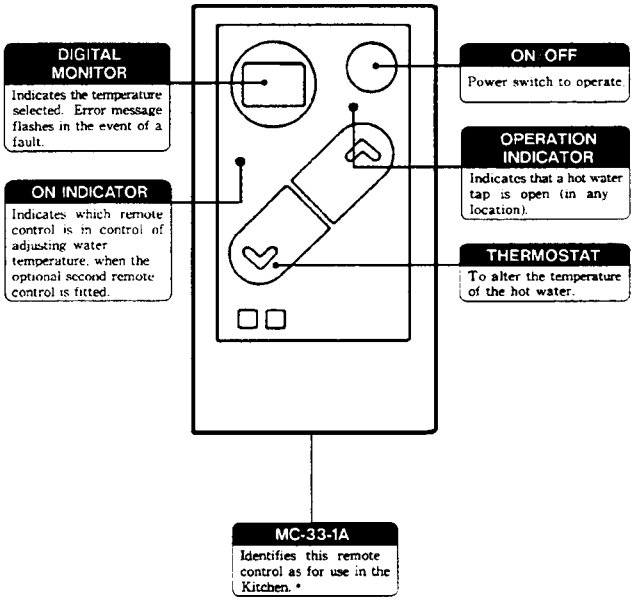
An optional third remote control is available for use in a second bathroom or ensuite for units produced from serial No. 96-03-XXXXXX

1. Up to March 1996

For the customer to receive the full benefit of the remote controls they must have the remote controls specified for the water heater. Two specifications of remote controls exist. The MC-33-1A and BC-45-1A remotes were specifically designed and manufactured to be connected with water heaters manufactured up to mid-March 1996. If they are connected to water heaters manufactured from mid-March 1996, the kitchen control will operate correctly, but the transfer functions on the bath control will differ from those shown in the customer's Operating Booklet.

For water heaters manufactured from mid-March 1996, the correct remote controls to use are the MC-33-2A and BC-45-2A.

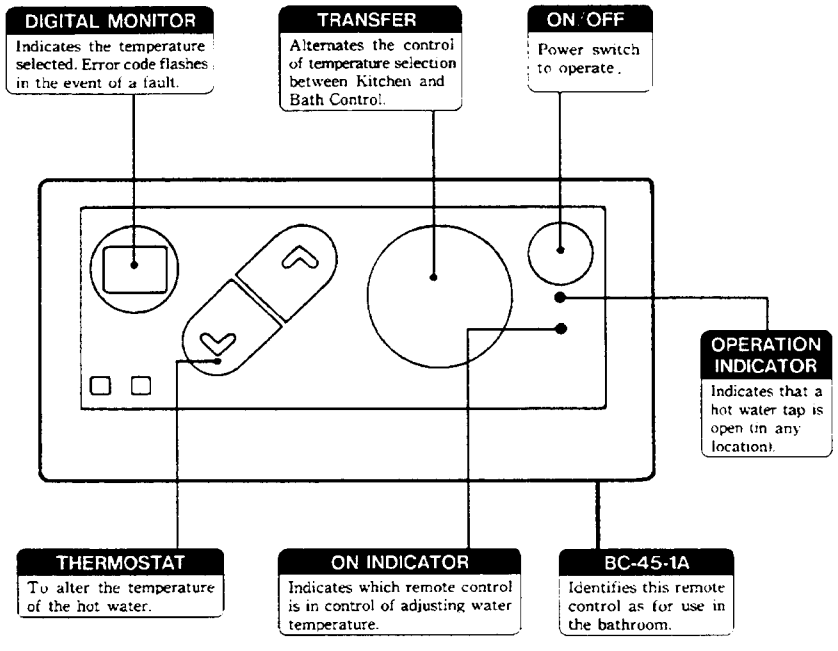
Kitchen Remote Control (Up to Mid-March 1996)



Bathroom Remote Control (Up to Mid-March 1996)

Only two remote controls can be fitted, and priority temperature can be switched between controls.

KC ⟷ BC



2. From March 1996

The MC-33-2A and BC-45-2A remotes were specifically designed for use with water heaters manufactured from mid-March 1996. Although they will operate if connected to water heaters manufactured up to mid-March 1996, the kitchen control will operate correctly but the transfer function on the bath control will not operate exactly as explained in the Customer's Operating Booklet.

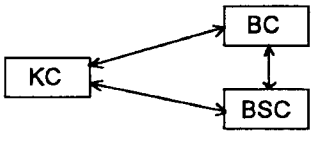
The new features which have been incorporated into these remote controls are:

* Colour coordinated to allow immediate recognition of the temperature "hotter" and "cooler" buttons.

* Larger LED display.

* Water temperature adjustment in the range of 37°C to 43°C whilst hot water is flowing.

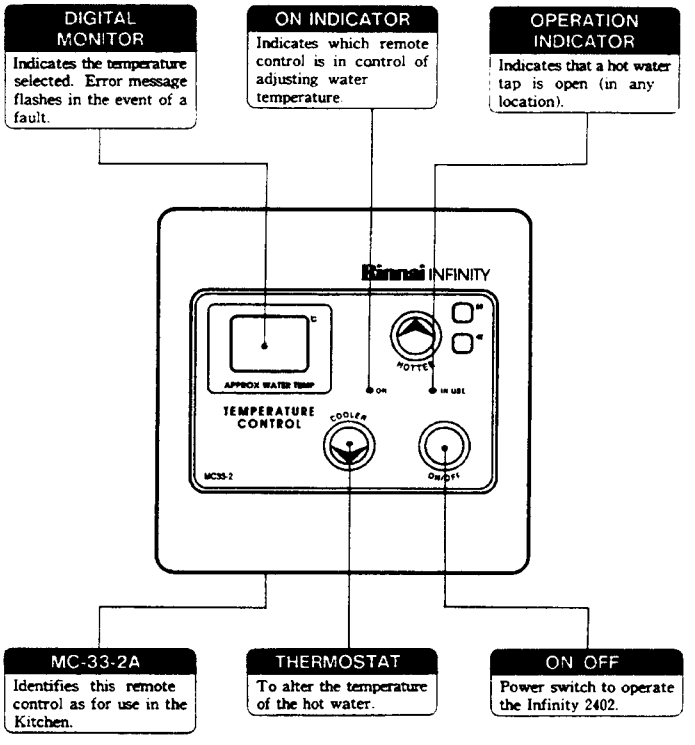
* Enhanced communication system between the remote controls, allowing priority temperature selection at each remote control.



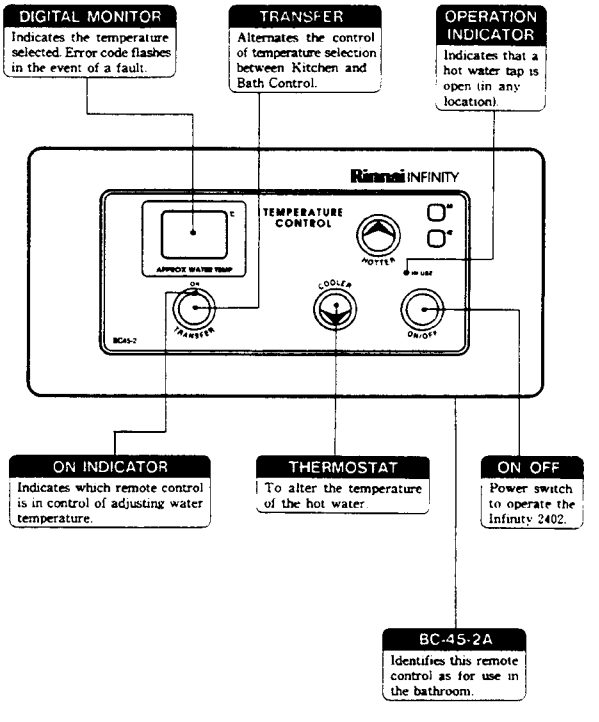
A third remote control identified as BSC-45-2A is available for use in a second bathroom or ensuite. Contact Rinnai for further details.

Different temperatures can be stored in the memory of each remote control.

Kitchen Remote Control (From Mid-March 1996)



Bathroom Remote Control (From Mid-March 1996)



Flame Failure

Situated to the right of the burner at the front, the flame rod monitors combustion, preventing any discharge of gas to the burner if there is no flame, by sending a signal to the PCB which in turn isolates the gas.

Remaining Flame Safety Device

Also referred to as an Over Heat Switch. This device is fitted to a bend section of the heat exchanger. If the flame remains on the burner after the tap is closed, and the water temperature inside the heat exchanger reaches 97°C, a DC 90 volt bi-metal cut-off switch isolates the gas to the solenoids.

No Water

Should the incoming water flow become restricted or stop, then t he water flow sensor will cease to send a magnetic pulse signal to the PCB, in turn isolating the flow of gas to the burner.

Fusible Link

Located in 7 positions covering the entire surface of the heat exchanger. If the heat exchanger burns out, or the temperature outside it reaches 129°C, the fusible link melts, breaking the electronic circuit. Current to the gas solenoid valve circuit is cut, and combustion stops, shutting down the unit.

Pressure Relief Valve

Located on the hot water outlet, this spring and valve seating type valve will, if the pressure inside the heat exchanger reaches 2100 kPa, release the built up pressure until 1500 kPa is maintained.

Combustion Fan Revolution Check

The combustion fan rpm are continually monitored by a magnetic pulse counter connected to the PCB. If the fan revolutions deviate from the speed required for complete combustion, a signal is sent to the PCB and the revolutions adjusted accordingly.

Automatic Frost Protection (Only on units specified AK)

When the outdoor temperature drops below 3.5°C, the frost sensing device is activated, and the anti-frost heaters prevent the water in the appliance from freezing. These anti-frost heaters remain ON until the outdoor temperature rises to 11.5°C. There are 5 anti-frost heaters located at various points in the main water flow area of the appliance. The anti-frost protection device w ill prevent freezing down to -20°C in a no wind situation, and -15°C in a windy situation.

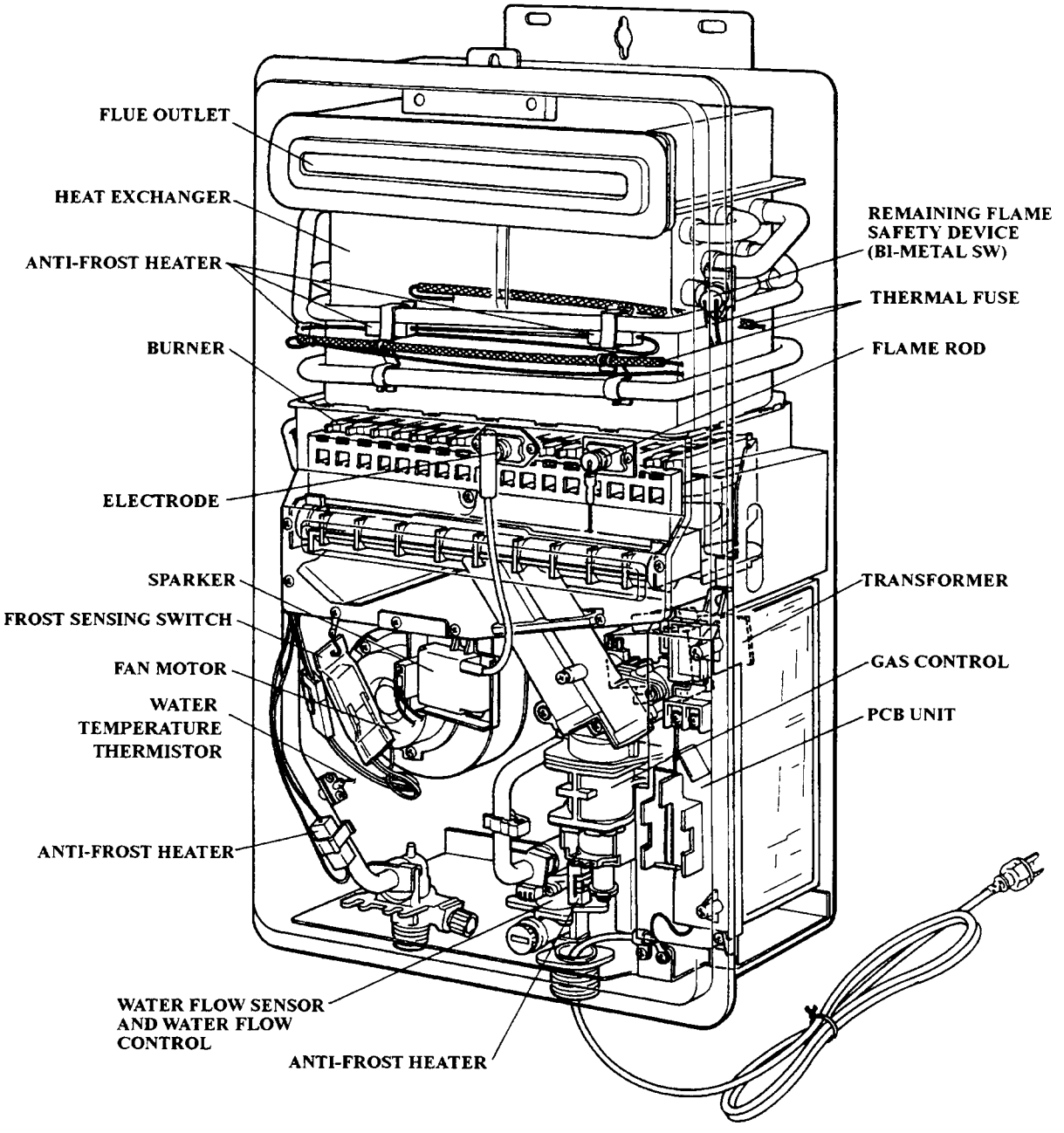
3°C Over Temperature Cut-Off

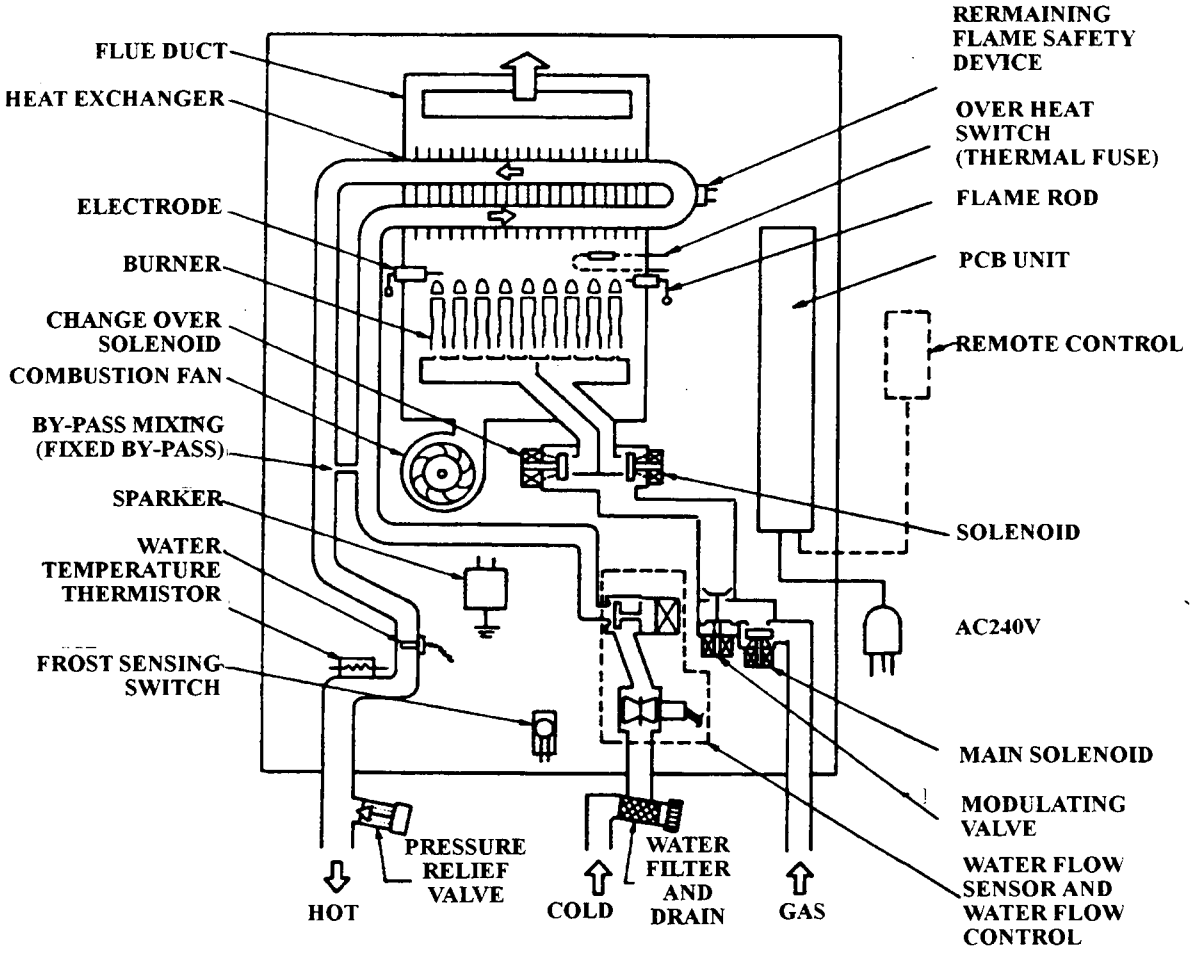
The temperature of the outgoing hot water is constantly monitored by the water temperature thermistor located near the outlet of the appliance. If the outgoing water temperature rises to more than 3 °C above the preset temperature, the burner will automatically go out. The burner will only ignite again once the outgoing hot water temperature falls below the preset temperature.

§ 6 Specification

Type of appliance	Temperature controlled continuous gas hot water system.
Operation	With or without remote controls, mounted in kitchen, bathroom, or ensuite.
Exhaust system	Forced Combustion
Rinnai model N°	REU-2406 W-A (Standard) REU-2406 W-AK (Anti-frost)
Installation	Externally mounted.
Dimensions	Width - 350 mm. Height - 610 mm. Depth - 170 mm.
Weight	19 kilograms.
Gas rate	Natural Gas - 188 MJ/h Propane Gas - 188 MJ/h
Connections	Gas supply - R ¾ / 20A. Cold water inlet - R ¾ / 20A. Hot water outlet - R ¾ / 20A.
Ignition system	Direct electronic ignition.
Minimum gas consumption	20 MJ/h, all gasses.
Electrical consumption	Normal - 55 Watts. Standby - 8 Watts. Automatic frost protection - 80 Watts.
Hot water capacity with remote	2.5 to 18 L/min
Hot water capacity mixed	2.5 to 24 L/min. [Raised 25°C]
Temperature range	37°C to 75°C in 16 steps, or preset at PCB to 55°C or 85°C
Water temperature control	Simulation feedforward and feedback.
Default temperature settings (without remote)	55°C, 85°C (Set by combination of switches on PCB)
Maximum temperature settings (remote connected)	40°C, 50°C, 55° C, 75°C (set by combination of switches on PCB)
Water flow control	Water flow sensor and water flow control device
Minimum operating pressure	10 kPa.
Nominal operating pressure	150 to 830 kPa.
Minimum operating water flow	2.5 L/min.
Power supply	Appliance - AC 240 Volts 50 Hz. Remote control - DC 12 Volts (Digital).
Safety devices	Flame failure - Flame rod. Boil dry - Water flow sensor. Remaining flame [OHS] - 97°C bi-metal strip. Fusible link - 129°C. Pressure relief valve - Opens-2100 kPa, closes-1500 kPa. Automatic frost protection - Bi-metal sensor & anti-frost heaters. Combustion fan rpm check - Integrated circuit system. Over Current - Glass fuse (3 Amp).
Remote control	MC-33-2A - Kitchen control. BC-45-2A - Bathroom control. BSC-45-2A - Ensuite or 2nd bathroom control

Cut-away Diagram




FLUE DUCT
HEAT EXCHANGER
ELECTRODE
BURNER
CHANGE OVER SOLENOID
COMBUSTION FAN
BY-PASS MIXING (FIXED BY-PASS)
SPARKER
WATER TEMPERATURE THERMISTOR
FROST SENSING SWITCH
RERMAINING FLAME SAFETY DEVICE
OVER HEAT SWITCH (THERMAL FUSE)
FLAME ROD
PCB UNIT
REMOTE CONTROL
SOLENOID
AC240V
MAIN SOLENOID
MODULATING VALVE
WATER FLOW SENSOR AND WATER FLOW CONTROL
PRESSURE RELIEF VALVE
WATER FILTER AND DRAIN
HOT
COLD
GAS

§ 9 Combustion Specification

		REU-2406 W External		
		L.P.G.	N.G.	T.G.*
Input	MJ/h	188	188	--
	kcal/h	45000	45000	--
Injector size (18 pieces) (mm)		Ø 1.0	Ø 1.7	--
Damper* (1 piece)		A	not used	--
Pressure (kPa)	LO	0.15	0.06	--
	HI	1.93	0.75	--
Burner type		LP.NG	LP.NG	--
Dip Switch positions		Prefer to page 11 ~ 13		
Maximum Capacity				
Modulating valve (mA)		222	152	--
Combustion fan (Hz)		135	130	--
Minimum Capacity				
Modulating valve (mA)		20	20	--
Combustion fan (Hz)		47	48	--
Slow Ignition				
POV (mA)		121	100	--
Fan (Hz)		80	80	--

* Indicated by an imprint on actual component.
* The REU-2406 W is not approved for use on Town Gas.

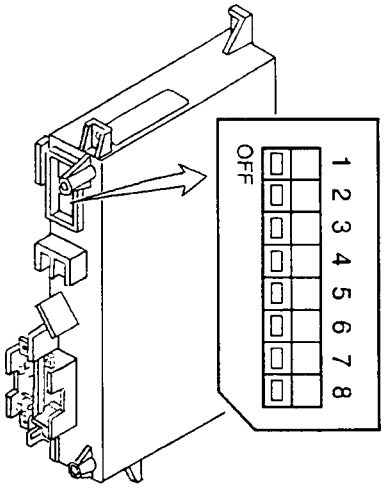
§ 10 Dip Switch Positions

Please do not adjust the DIP Switch Positions before reading this information.

Dip switches 1 ~ 8 are provided so that the water heater can be set to different opera ting configurations. In some instances such as nursing homes or even domestic situations, it may be necessary to limit the temperature of the hot water coming from the units.

The set-up configuration for the water heater differs depending on:

- Gas type
- Temperature limiting requirements



DIP Switches

1 & 2	:	Gas type (used only during conversion)
3	:	Do not alter (factory setting)
4	:	To select 85°C or 55°C default
5 & 6	:	Temperature control
7 & 8	:	Setting gas pressure

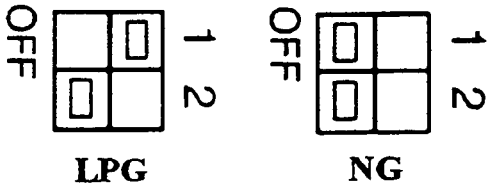
The REU-2406 model is delivered with the maximum hot water temperature limited to 55°C. The maximum temperature of hot water can be limited to 40 °C, 50°C, 55°C, or 75°C, when a remote control is connected.

A further maximum temperature of 85 ° C can be achieved only without a remote control connected, refer page 13 for details.

The REU-2406 model is normally supplied from Rinnai, with switches N ° 3 to N° 8 in the OFF position, and switches N° 1 and N° 2 in the ON or OFF position according to the required gas type.

① Gas type

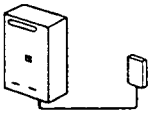
Only alter gas type positions when converting. For conversion instructions refer to page 42.

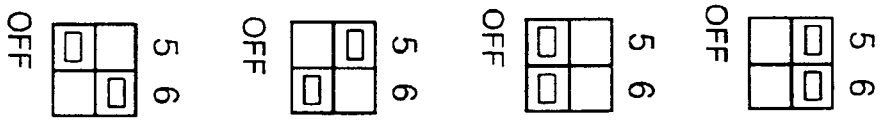


② Temperature limiting

There are different positions, depending on the temperature limit required and whether the remote controls are connected or not.

a) Pre-set maximum temperatures with the *remotes connected*





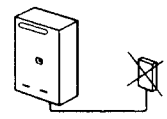
40°C	50°C	55°C	75°C	With Remote
55°C	55°C	55°C	55°C	Default temperature if remote is disconnected (SW4 OFF)
85°C	85°C	85°C	85°C	If remote disconnected (SW4 ON)

If dip switches 5 & 6 are set to any of the positions shown above and the remotes become disconnected, the outgoing water temperature will automatically default to be 55°C, or 85°C if switch No.4 is ON.

The 55°C default setting provides a safe default temperature if the remote controls become disconnected. Never leave switch No.4 in the ON position, in a domestic installation as 85°C is hazardous.

The REU-2406 model is delivered with the PCB set to ensure a maximum hot water temperature of 55°C with or without remote controls connected, (pre-March 1996 models were set to 50°C).

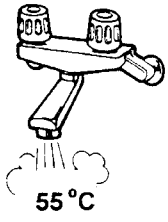
b) Pre-set temperatures with the *remotes <u>not</u> connected*

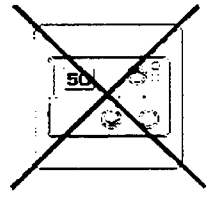


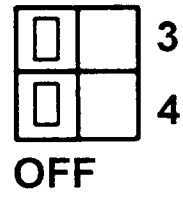
There are two (2) default outgoing hot water temperatures if the remote control(s) are not connected.

55°C Outgoing hot water temperature (without remote).

Disconnect the remote controls and ensure the PCB dip switch positions No.3 and No.4 are in the OFF position (far left).







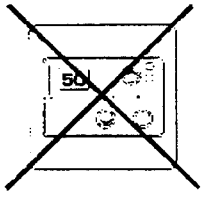
Step 1 **Step 2**

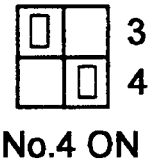
Note: Check to see whether the by-pass tube has not been squeezed or cut-off. If so, the unit is not suitable for use in the 55°C default mode. (Contact Rinnai Support Services for advice).

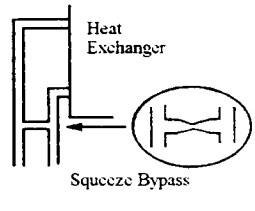
85°C Outgoing hot water temperature (without remote)

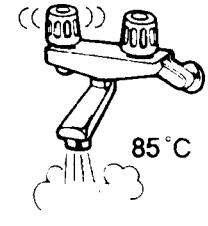
Note: Only available on units with serial No.96-03.xxxxxx or later.

85°C outgoing hot water can be achieved by placing dip switch No.4 to the ON position, squeezing by-pass tube to completely restrict the flow of water through it and disconnecting the remote controls.









Step 1 **Step 2** **Step 3**

The by-pass must be squeezed if the 85°C setting is selected in single point commercial installations. The tool used for squeezing refrigeration pipes is useful for this purpose, it is very difficult to squash the by-pass with grips.

Note: The remote control(s), if connected will override the 85 °C setting, and the maximum hot water temperature will revert back to 75°C. Condensation above the burner may occur at temperatures of 55°C or lower when the bypass is restricted.

§ 11 Water Flows

A simple calculation of the water flow rate, in litres per minute, can be made using the charts on the next page, or simply using the formula provided below. The charts on page 15 indicate the water flow from the Infinity 20 at various combinations of incoming water temperatures, and the selected temperature at the remote control.

a) How to read the charts:

The vertical plane indicates the selected temperature at the remote, and the horizontal plane indicates the flow of water in litres per minute. Remote control range is between 37 °C and 75°C, therefore the water flow charts only show the temperatures in that range. The temperature rise is the difference between the temperature of the incoming water and the selected temperature at the remote controls.

Select the appropriate chart depending on the incoming water temperature. Draw a horizontal line across the graph from the selected temperature at the remote until it intersects the curve. A t this point draw the line in the vertical direction. The water flow is indicated where the line intersects the bottom of the chart.

b) How to calculate water flows:

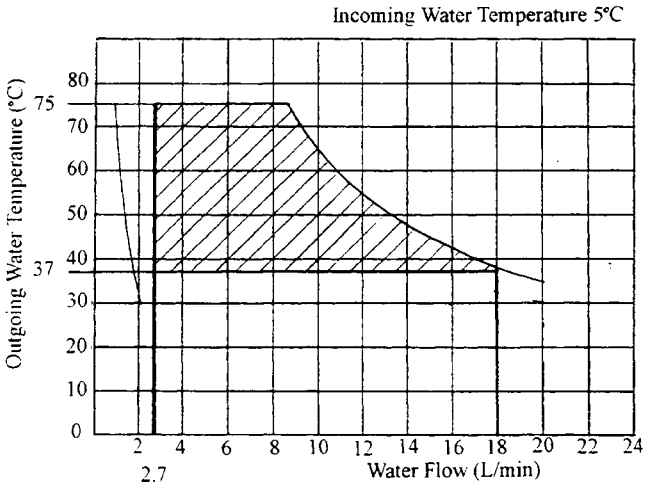
The following information is an outline of the formula required to measure accurately the flow rate in litres per minute, as well as being the base for the charts on the next page. The most useful way in which this formula can be utilised, is to calculate the water flow rate where there is maximum gas input of 188MJ/h.

Where:	Tin	=	Incoming water temperature.
	Tout	=	Outgoing water temperature as selected at the remote.
	IN	=	Gas input#.
	TE	=	Thermal efficiency*.
	Q	=	Water flow in litres per minute.

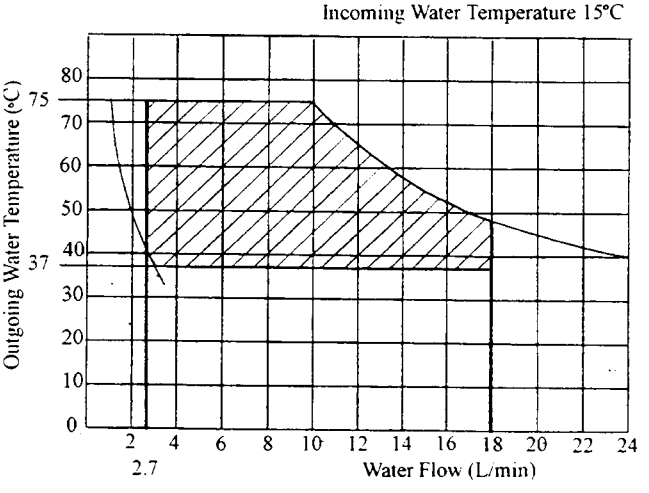
\# This is the maximum gas input converted from MJ/h into kilocalories. As 1 kilocalorie raises the temperature of 1 litre of water by 1 degree centigrade, the method of calcula tion is to multiply the input in MJ/h by 239.

* Thermal efficiency may be in the rang e of 78% to 90%, depending on the temperature rise and water flow. For the purpose of the following calculation we have assumed an efficiency of 80%.

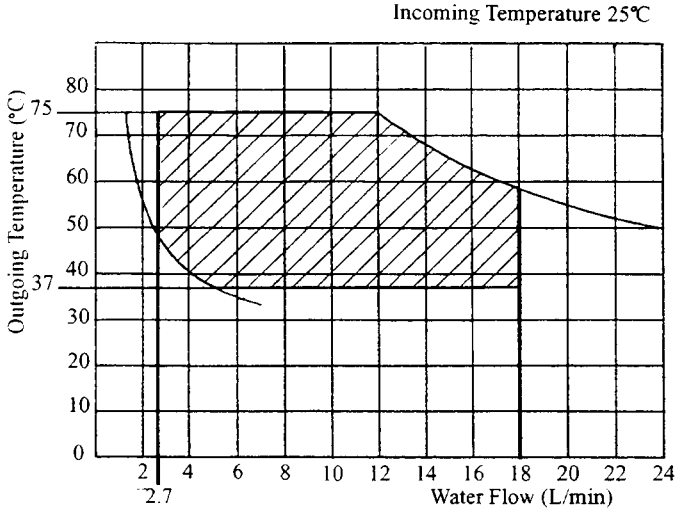
Example data			Calculation		
			Formula: IN x TE =(Tout - Tin) x 60 x Q		
Tin	=	15°C	45000 x 0.8	=	(60 - 15) x 60 x Q
			36000	=	45 x 60 x Q
Tout	=	60°C			
			$\frac{36000}{45}$	=	60 x Q
IN	=	45000 kcal/h			
TE	=	80%	800	=	60 x Q
Q	=	Water flow in litres per minute	$\frac{800}{60}$	=	Q
			13.3 L/min		



The chart opposite indicates that the water flow rate of the Infinity 20 will, at a preset temperature of 50°C and an **incoming water temperature of 5°C,** be 13 litres a minute.



The chart opposite indicates that the water flow rate of the Infinity 20 wi ll, at a preset temperature of 50°C and an **incoming water temperature of 15°C,** be 17 litres a minute.



The chart opposite indicates that the water flow rate of the Infinity 20 will, at a preset temperature of 50°C and an **incoming water temperature of 25°C,** be 18 litres a minute.

Output water temperature	Incoming + 15°C	Incoming + 25°C	Incoming + 30°C	Incoming + 35°C	Incoming + 45°C	Incoming + 55°C
Output water volume	with mixing 40 (L/min)	with mixing 24 (L/min)	with mixing 18 (L/min)	17.1 (L/min)	13.3 (L/min)	10.9 (L/min)

The most common unit used to calculate the energy required to heat water is the kilocalorie.

If the full gas rate is not required to provide the required water temperature rise, [ie - when the temperature selected at the remote controls is lower, or the incoming water temperature is higher]; the amount of gas that the water heater is going to use to carry out a specific heating task will change proportionally to these variables. The actual gas rate is based upon the following calculation.

Calculating The Gas Input

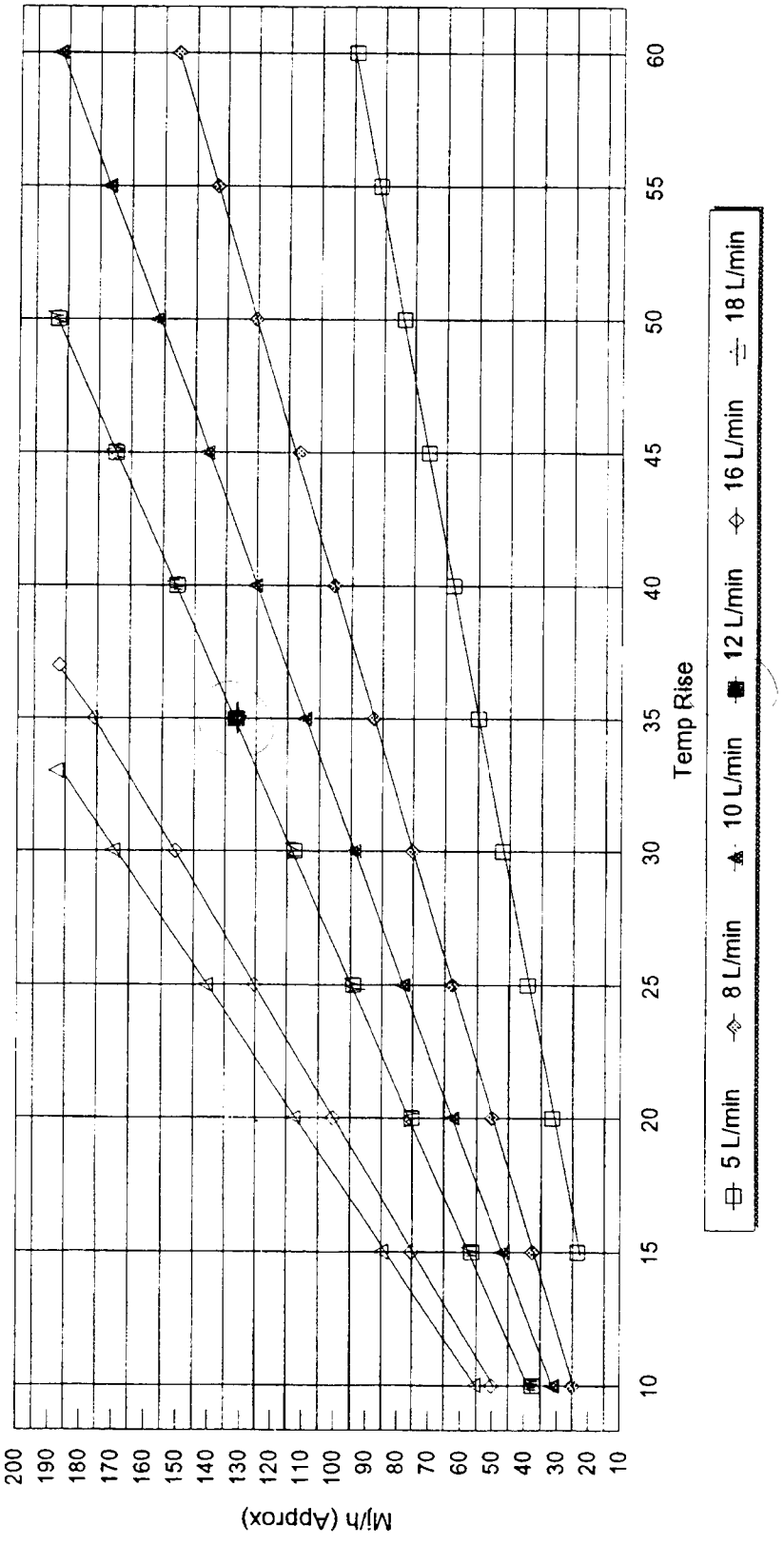
Formula: $\frac{(Tout - Tin) \times Q \times 60}{239 \times TE} = IN\ MJ/h$

See the previous page for an explanation of Tin, Tout, IN, TE and Q.

Example data			Calculation
Tin	=	15°C	$\frac{(60 - 15) \times 10 \times 60}{239 \times 0.8} = IN\ MJ/h$
Tout	=	60°C	
IN	=	Gas input in MJ/h	$\frac{45 \times 10 \times 60}{239 \times 0.8} = IN\ MJ/h$
TE	=	80%	$\frac{27000\ (Kcal/h)}{191.2} = IN\ MJ/h$
Q	=	10 L/min	
			141 MJ/h = IN

The Infinity 20 is able to modulate both the water and gas flows. The gas input varies depending on the water flow and incoming and outgoing water temperatures. The chart on the following page is an approximate guide to the gas input according to the various temperature rises and water flows.

To calculate the approximate gas input, first select the appropriate curve representing the water flow in litres/minute [L/min]. From the base line draw a vertical line at the point where the required temperature rise in °C is indicated. This can be calculated by subtracting the incoming water temperature from the selected temperature on the remote control. Draw a horizontal line from the point where the vertical line intersects the curve. The point where the horizontal line intersects the left hand vertical line (Gas Input), shows the approximate gas input in MJ/h



This chart is an approximate guide to the gas input according to various temperature rises and water flows. See previous page, last paragraph for the explanation on how to calculate approximate gas consumption in MJ/h.

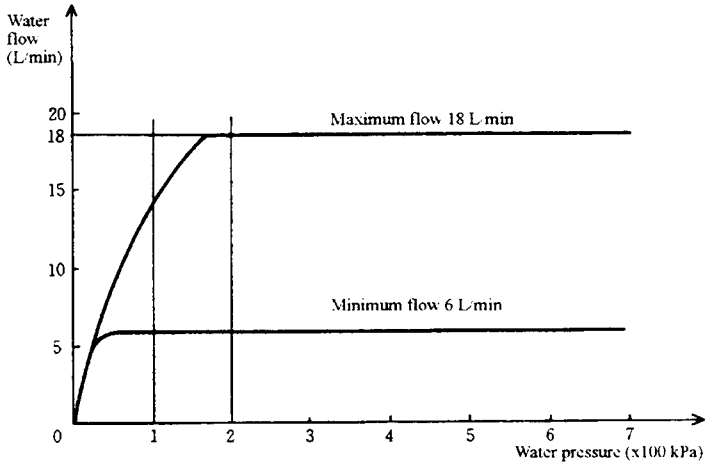
1. Mechanical Water Regulator

Rinnai's unique water regulator mechanism ensures the hot water is maintained with no noticeable change in the desired temperature level during use, even if water pressure drops due to another tap being turned on and increasing the demand.

The following graph shows the performance of the water regulator. The top line sho ws the performance when the electronic water flow control is open, the lower line when it is closed.

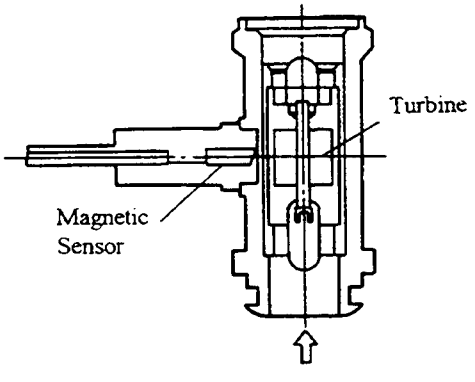
The bottom line shows that with the water flow control device closed, the maximum flow is 6 L/min. This maximum flow is reached at 50 kPa inlet pressure. The top line shows that with the electronic water flow control device open, the maximum flow is approximately 18 L/min. This maximum flow is reached at 150 kPa inlet pressure.

Note: Although the Infinity 20 will operate at very low water pressures, maximum performance is not reached unless the incoming pressure is 150 kPa or more.



2. Water Flow Sensor

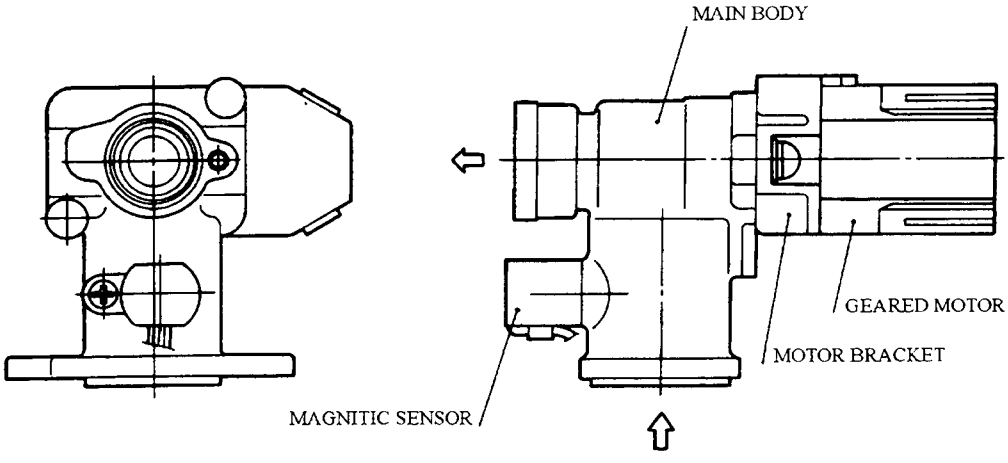
Water flow is detected by a turbine/magnetic pulse generating device. Water flows through the turbine/magnetic sensor providing information to the PCB by generating a pre-determined number of pulses in proportion to the water flow. These pulses are counted by the PCB - no pulse indicates no water flow. The frequency of the magnetic pulses increases as the water flow increases, this enables the PCB to calculate the exact water flow, and determine the water flow in litres/minute.

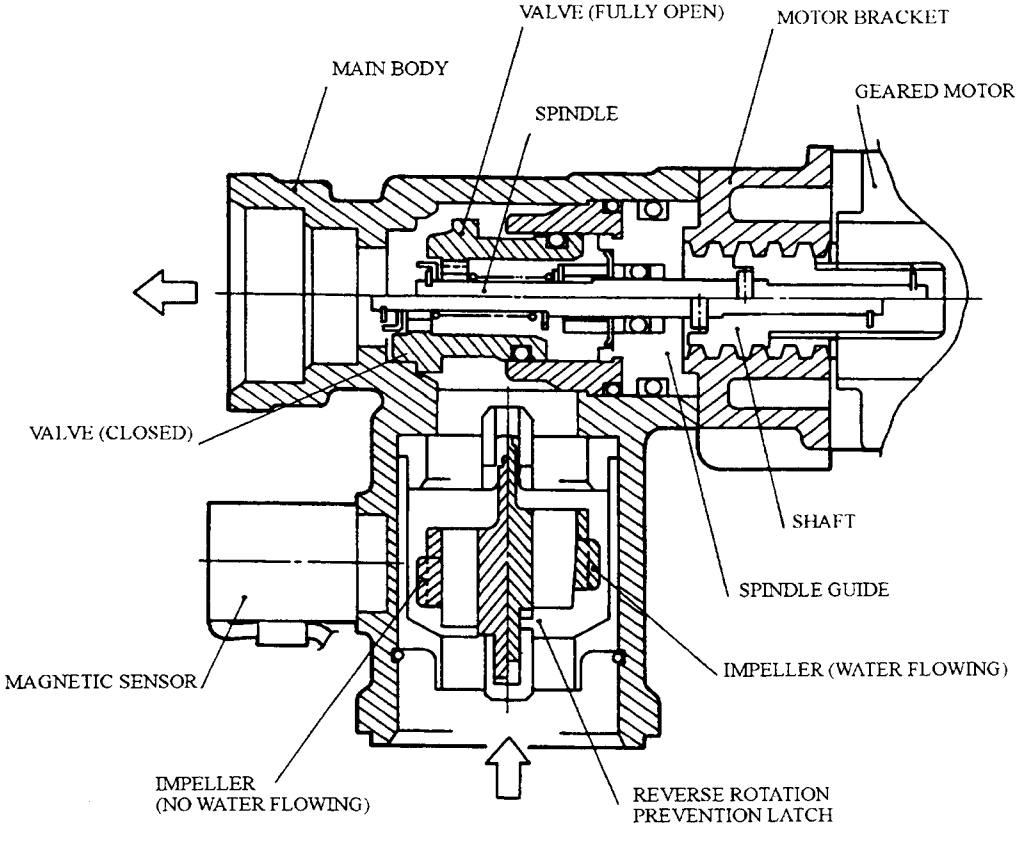


As soon as the required water flow is detected, the PCB activates the combustion fan. The combustion fan speed is monitored by a magnetic pulse sensor. The output from this sensor is processed by the PCB which opens the gas modulating valve to a degree proportional to the fan speed. See page 20 for further details on the combustion fan.

3. Water Flow Sensor and Water Flow Control Device

Water pressure to the appliance is controlled by a me chanical diaphragm, spring and valve system. The water flow control consists of a plug and barrel valve which is rotated by a motor to increase or decrea se the volume of water passing through the heat exchanger.



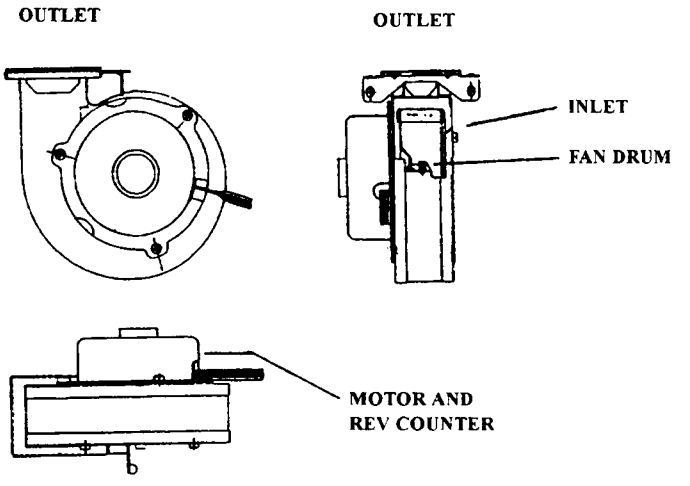


4. Preset Bypass

A pre-set volume of cold water is mixed with water heated in the heat exchanger. This increases the capacity of the appliance.

5. Combustion Fan

Air for combustion is supplied by a centrifugal fan driven by a DC motor. After a pre-purge period of 0.2 seconds, the fan speed is controlled by the PCB to provide the correct volume of air for combustion. The calculation for the fan speed is based upon incoming water temperature, water flow and the temperature selected on the remote controls.



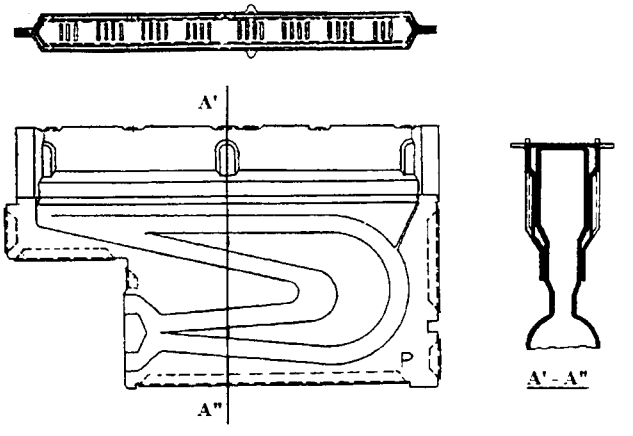
The actual speed of the motor is continuously monitored by a magnetic pulse sensor. This sensor emits 4 pulses per rotation of the fan. This is the fan feedback or confirmation data processed by the PCB and used for 2 operations.

1) The fan speed is constantly corrected to provide optimum combustion conditions.
2) To determine the opening degree of the modulating gas valve, so that the gas rate always matches the volume of air for combustion, as well as the input required to heat the water.

The reason for controlling the opening degree of the modulating gas valve based upon data from the combustion fan is that the gas valve is able to react much more quickly to a change in control signal than the combustion fan. Controlling the gas valve based upon data from the combustion fan means that combustion remains satisfactory, even if there are sudden changes in input conditions.

6. Burner

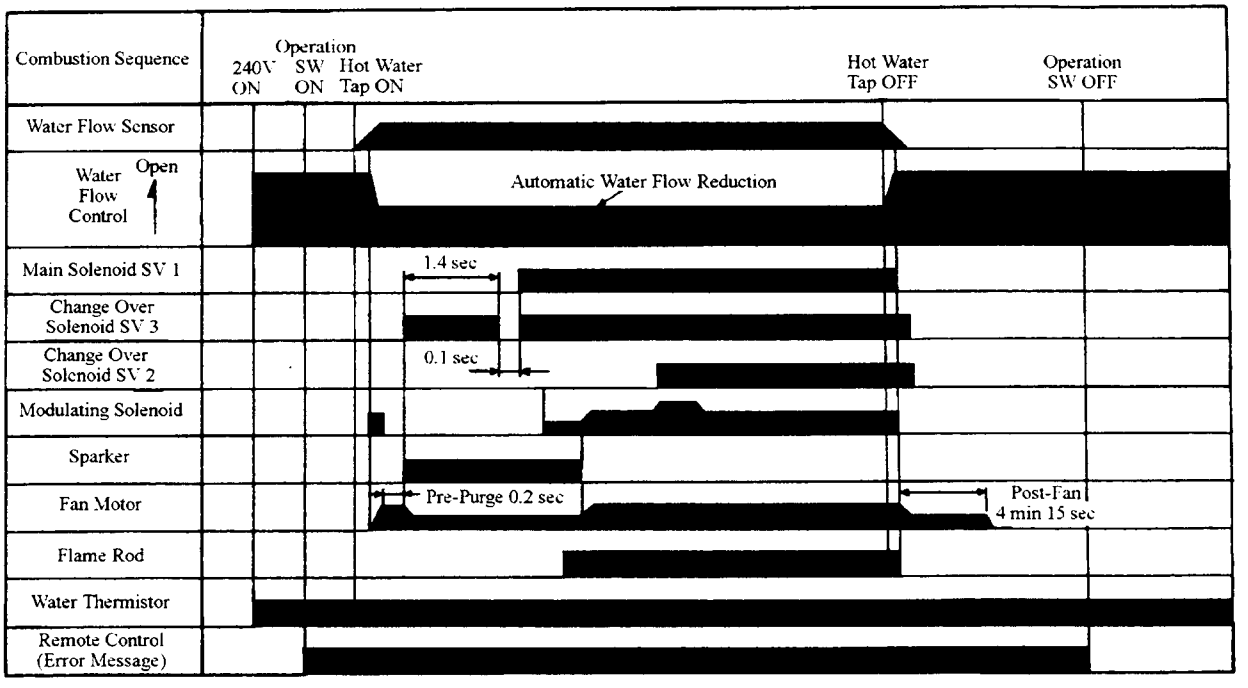
The burner assembly is made up of 18 identical stainless steel bunsen burners, secured by an aluminised steel framework. An aluminium manifold with 18 injectors supplies gas to the burners, and is attached to the front lower cover of the burner box.

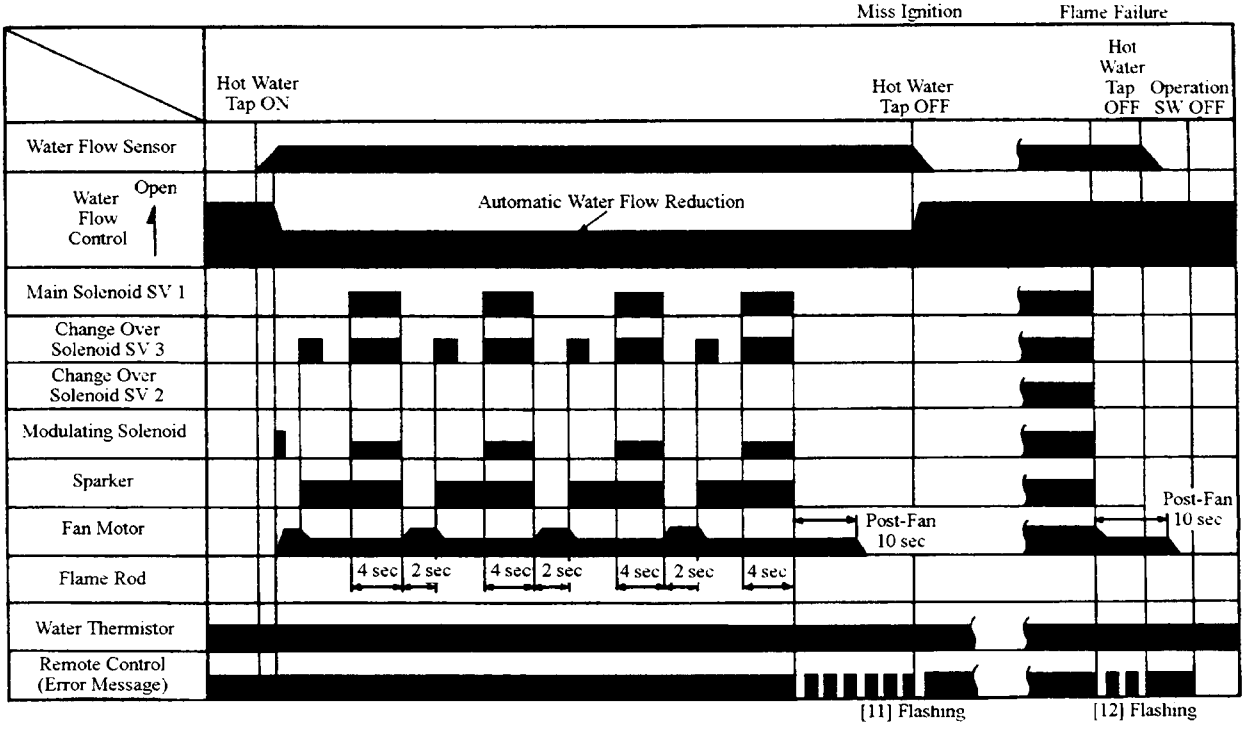


7. Changeover Solenoid Valve

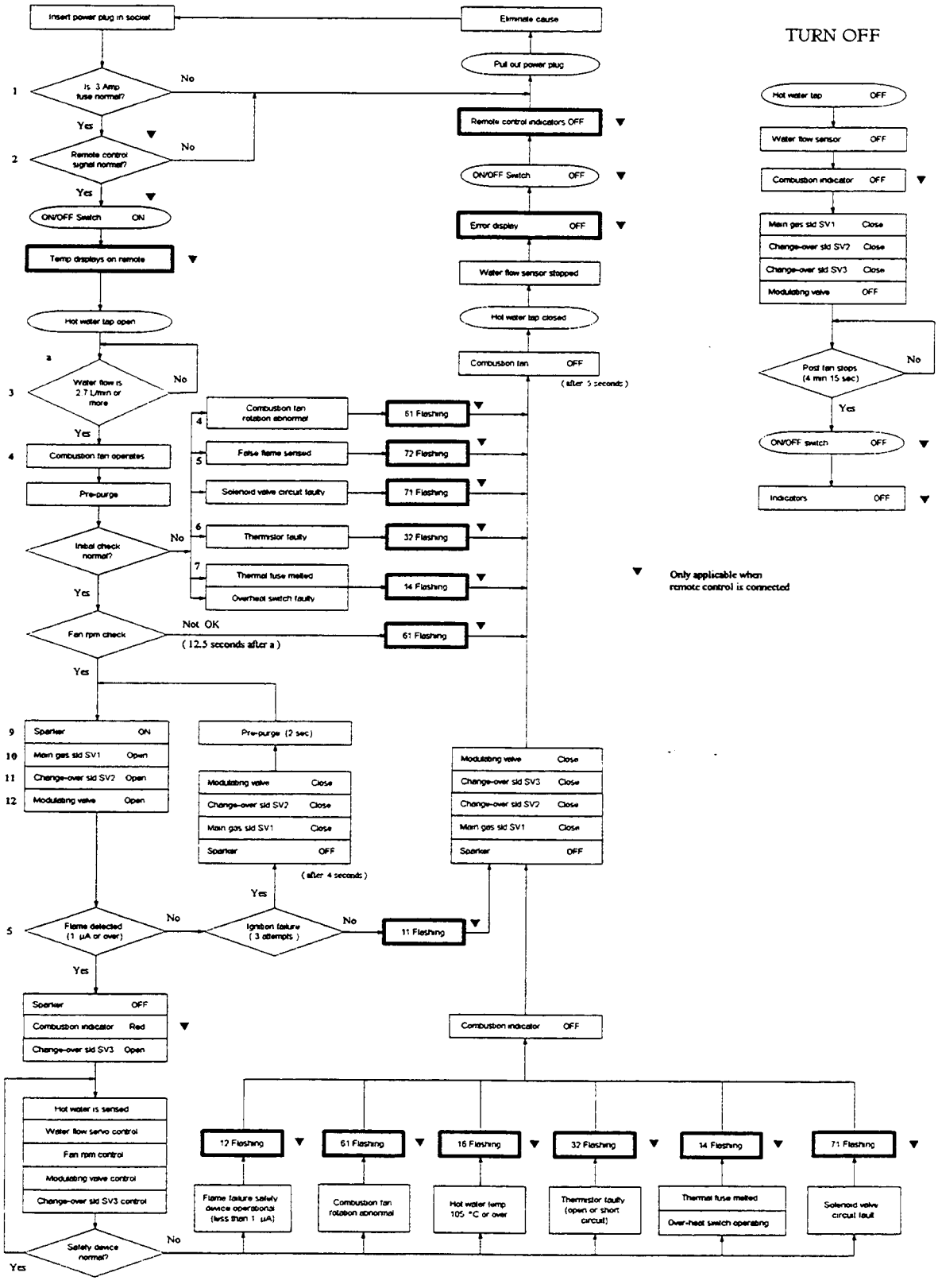
The changeover solenoid increases the flexibility of the re gulator/modulating valve by supplying gas to the right hand side of the burner only, [up to 40% input] or both sides of the burner, [40% input] + [40 - 100% input] through the tandem manifold.

§ 14 Time Chart





Operation Flow Principle



The preset temperature is selected at one of the remote controls (where fitted). Where no remote control is fitted, the default temperature is 55°C or 85°C depending on the position of dip switch No.4. (see page 13)

When the unit is first plugged into 240 Volts, the PCB assumes an incoming water temperature of 25°C, this prevents the appliance starting on HIGH, and producing very hot water the first time it is used.

The data used to determine the outgoing water temperature initially is incoming water flow, and the remote control pre-set temperature.

From the incoming water flow and remote control pre-set temperature data, the CPU is able to determine a suitable gas rate to kick the appliance off, once a hot water tap opens.

This calculation of temperature rise and water flow is called simulation feed forward information.

The water heater calulates incoming water temperature by subtracting the theoretical temperature rise from the outgoing hot water temperature, to establish the correct gas flow.

When a hot water tap is opened, water begins to flow through the appliance. The turbine in the water flow sensor begins to revolve. The revolution speed is proportional to the water flow. A sensor located inside the device relays information in the form of magnetic pulses to the main PCB to determine whether or not water is flowing, and also, the volume of water flowing. When a pre-determined water flow is sensed, the ignition sequence begins.

Incoming water pressure is regulated by a mechanical water regulator at all times.

The combustion fan pre-purges the combustion chamber. A rev counter on the combustion fan indicates the fan rpm to the main PCB. Once the pre-purge cycle is completed, the PCB controls the fan rpm by varying the DC voltage to the fan motor. This maintains the correct air/gas ratio throughout the time the water heater is in use, to ensure good combustion.

The gas is ignited by direct electronic spark and the flame is sensed by the flame rod. The opening degree of the modulating valve is determined by the combustion fan speed.

The changeover valve directs gas to one side or both sides of the burner. At the point where the changeover valve opens or closes the modulating valve is instantly re-adusted by the PCB to compensate for the change in the number of burners in use. From the information provided by the water flow sensor and the water temperature thermistor, the PCB determines how much gas is required to heat the water to the temperature selected on the remote control.

The PCB is programmed to provide the maximum volume of water possible at a given temperature rise. As the water flow from the tap is increased, the PCB increases the gas and air flow to the burner.

Once the maximum gas rate is reached the PCB begins to control the water flow through the appliance in order to maintain the preset temperature. This is achieved by the PCB turning the valve within the water flow control device by means of stepping motor.

The water flow control device operates at high water flows and/or high temperature rises. When the temperature rise is low, or the water flow is restricted by the hot water tap, then the device may not be required to operate. [See section on gas and water controls, page 18, for clarification].

Once hot water is flowing the water temperature thermistor senses the outgoing water temperature.

The PCB continually makes adjustments in order to maintain a constant temperature; [adjusting both the gas input and water flow where necessary.] It also continually monitors the combustion fan rpm adjusting the gas rate to match.

When the hot water tap is turned off the water flow sensor stops revolving, and the magnetic pulse ceases, indicating to the PCB that there is no water flowing, in turn the PCB closes the gas valves. The combustion fan continues to operate for 4 minutes 15 seconds. This is to provide quicker ignition when the tap is turned on and off in rapid succussion, as it removes the need for a pre-purge cycle, and allows the burner to re-light immediately a hot water tap is opened again.

The PCB stores data on the calculated incoming water temperature, ready for when the hot water is turned on again. The data is used to calculate the initial gas flow.

§ 17 Error Messages

Error messages are displayed as numbers flashing on the remote controls.

X = Does not operate

Error Code	Problem	Symptom	Main Solenoid Valve	Solenoid Valve	Changeover Solenoid Valve	Combustion Fan	Sparker
-	Water flow sensor faulty	Does not operate	X	X	X	X	X
71	Solenoid valve driving circuit faulty	Does not operate	X	X	X	X	X
72	Flame sensing device faulty	Does not operate	X	X	X	X	X
32	Short or faulty wiring in water temperature thermistor	Does not operate	X	X	X	X	X
-	Water flow control device faulty	Water flow is not controlled, water temperature incorrect	-	-	-	-	-
61	Combustion fan faulty	After 12.5 seconds operation	X	X	X	X	X
11	Sparker faulty	Stops without flame igniting	-	-	-	-	X
11	Main solenoid value faulty	Stops without flame igniting	X	-	-	-	-
11	Solenoid valve faulty	Stops without flame igniting	-	X	-	-	-
-	Changeover solenoid valve faulty	Incorrect water temperature	-	-	X	-	-
12	Flame sensing device faulty	Stops second time burner has been extinguised	X	X	X	X	X
16	Outgoiong water temperature abnormal	Operates, then stops	X	X	X	X	X
14	Remaining flame safety device operating	Operates, then stops	X	X	X	X	X
14	Thermal fuse faulty/blown	Operates, then stops	X	X	X	X	X

Notes

1. **Digital monitor does not illuminate when system is switched ON, or display drops out while appliance is operating.**
   - Check power supply to the appliance.
   - Switch system OFF, then switch ON again, and re-attempt ignition.
2. **Appliance operates however symptoms remain, with digital display dropping out and error coded message flashing.**
   - Isolate by potential faulty component using the flow charts on pages 37 through 41.

§ 18 Diagnostic Points

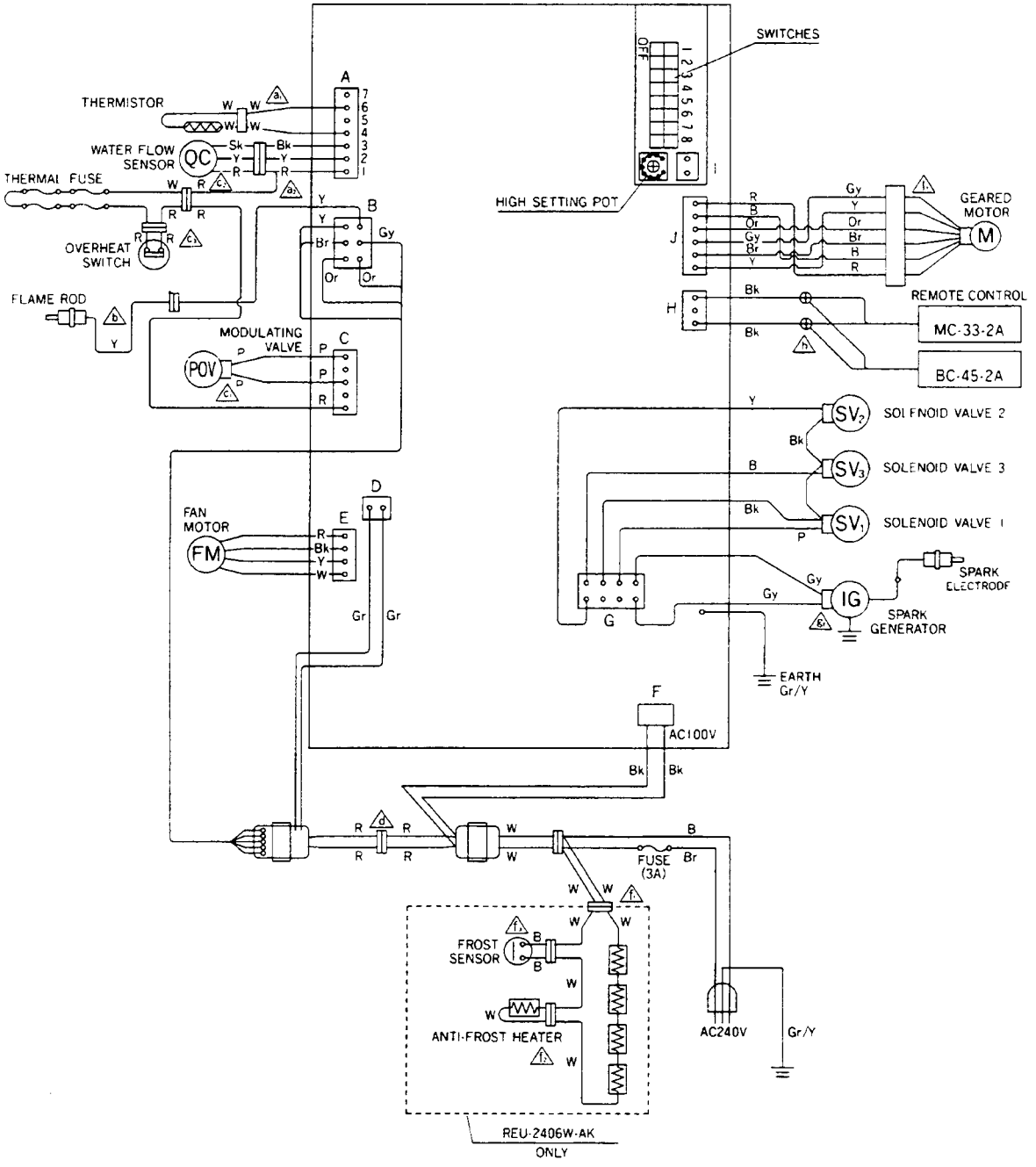
Flow chart is on page 22.
Wiring diagram is on page 27.

Flow Chart N°	Measurement Point		Normal Value	Component
	Con N°	Wire Colour		
1	d	Red - Red	AC 90 ~ 110 V	3 Amp Fuse
2	h	Black - Black	DC 11 ~ 13 V	Remote Control
3	a_2	Red - Black	DC 11 ~ 13 V	Water Flow Sensor
		Yellow - Black	DC 2 ~ 10 V	
4	E	White - Black	DC 2 ~ 7 V	Combustion Fan Motor Sensor
	I	Checkpin	75 ~ 135 Hz	
5	b	Yellow - body earth	AC 40 ~ 150 V (over DC 1μA)	Flame Rod
6	a_1	White - White	Thermistor resistance value Temp Resistance 15 °C 11.4 ~ 14 kΩ 30 °C 6.4 ~ 7.8 kΩ 45 °C 3.6 ~ 4.5 kΩ 75 °C 1.4 ~ 1.8 kΩ	Thermistor
7	c_2	White - Red	Below 1 Ω	Thermal Fuse
8	c_3	Red - Red	Below 1 Ω	Over-heat Safety Mechanism
9	G_1	Grey - Grey	AC 90 ~ 110 V	Sparker
10	G	Pink - Black	DC 80 ~ 100 V 0.9 ~ 1.3 kΩ	Main Solenoid Valve
11	G	Yellow - Black	DC 80 ~ 100 V 1.3 ~ 1.9 kΩ	Solenoid Valve (SV_2)
12	c_1	Pink - Pink	DC 0.5 ~ 25 V 65 ~ 90 Ω	Modulating Valve
13	G	Blue - Black	DC 80 ~ 100 V 1.5 ~ 1.9 Ω	Solenoid Valve (SV_3)
14	I_1	Red - Blue	DC 11 ~ 13 V 10 ~ 13 Ω	Water Flow Servo
		Orange - Grey	DC 11 ~ 13 V	

TRANSFORMER VOLTAGES AND RESISTANCES

Connector	Wire Colour	Normal Value
d	Red - Red	AC 90 ~ 110 V 15 ~ 21 Ω
D	Green - Green	AC 16 ~ 20 V 6 ~ 10 Ω
B	Orange - Orange	AC 13 ~ 30 V 1.4 ~ 1.8 Ω
B	Brown - Grey	AC 30 ~ 50 V 6 ~ 10 Ω
B	Yellow - Grey	AC 180 ~ 220 V 0.4 ~ 0.6 kΩ

W:	White	Bk:	Black	Br:	Brown	R:	Red	B:	Blue
Y:	Yellow	P:	Pink	Or:	Orange	Gr:	Green	Gy:	Grey



Before carrying out checks marked ※, remove power cord from wall plug.
Wiring diagram is on page 27.

Appliance fails to operate (even remote control fails to operates).

1. Is the fuse blown?

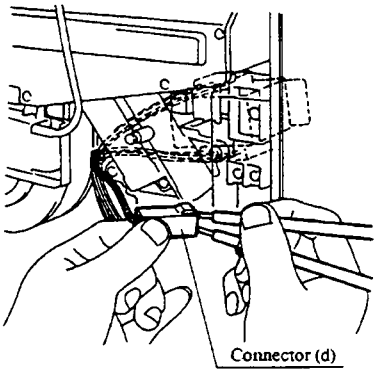
Fuses are located in plastic holders in the main harness, on the lower right hand side of the appliance

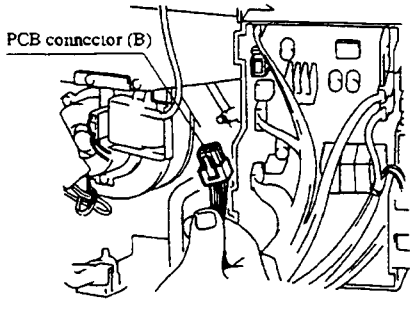
Check fuse.

① Remove 240V plug from socket.
② ※ Measure resistance to check the electric fuse (3A).

Normal: less than 1 Ω
If normal, check 2 below.
Faulty: Replace fuse (3A).
If it blows again, investigate cause of short-circuit.

2. Is the main transformer normal?





Check the transformer.

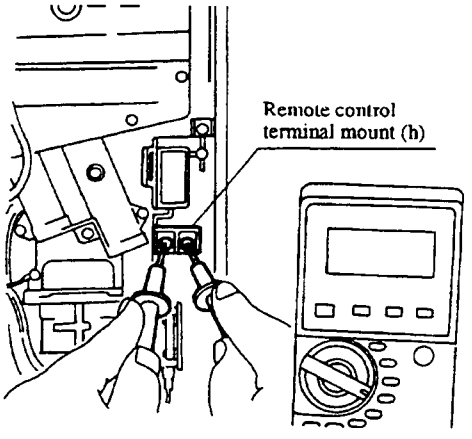
① Measure the voltage at connector d, red - red.
Normal: AC 90 ~ 110 V
If normal, check ② below.
Faulty: Check for AC 220 ~ 260 volts at TR1, white - white.

② Check voltages below at PCB connector B.
Normal: orange - orange
AC 13 ~ 30 V
brown - grey
AC 30 ~ 50 V
yellow - grey
AC 180 ~ 220 V
If normal, check ③ on next page.
Faulty: Replace the transformer.

Refer to diagram on bottom of previous page.

③ Check the voltage at PCB connector D, green - green.
Normal: AC 16 ~ 20 V
If normal, check 3 below.
Faulty: Replace the transformer.
Note: The transformer voltage above applies to the appliance in a standby, non-functioning state.

3. Is the remote control normal?

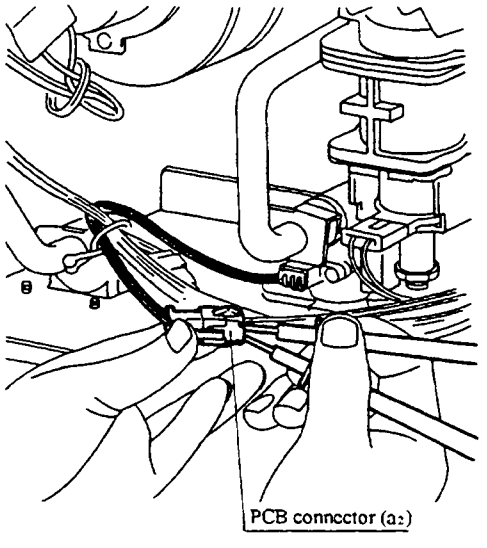


Check voltage between the two remote control cable conductors.

① Check the voltage between the terminals on the remote control terminal mount H.
Normal: DC 11 ~ 13 V
If normal, check for an open circuit or short before relacing the remote control.
Faulty: Replace the PCB.

No combustion (despite remote control indication).

1. Is the water flow sensor normal?

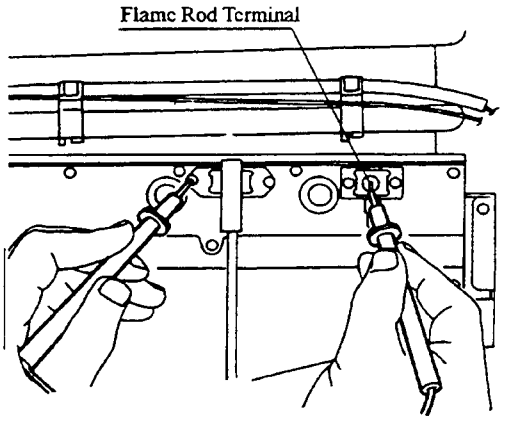


Check the water flow sensor.

① Check the voltage at PCB connector a_2, red - black.
Normal: DC 11 ~ 13 V
If normal, check ② below.
Faulty: Replace the PCB.

② Check the voltage at PCB connector a_2, yellow - black.
Normal: DC 2 ~ 10 V
If normal, check item 2 on next page.
Faulty: Replace the water flow sensor.

2. Is the flame rod normal? Error "72" is displayed.

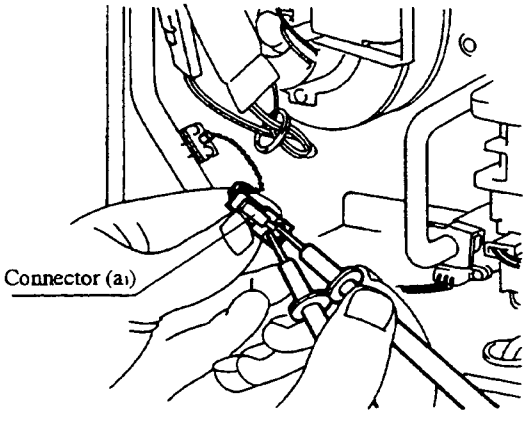


Check the flame rod.

①※ Detach the flame rod terminal b and re-attempt operation.
("72" display)
Check 3 below.
(no "72" display)
Inspect for electrical current leak from the flame rod.

Measure resistance between the flame rod terminal b and the appliance earth.
Normal: 1MΩ or more
If normal, replace the PCB. unit.
Faulty: Replace the flame rod.

3. Is the water temperature thermistor normal? Error "32" is displayed.

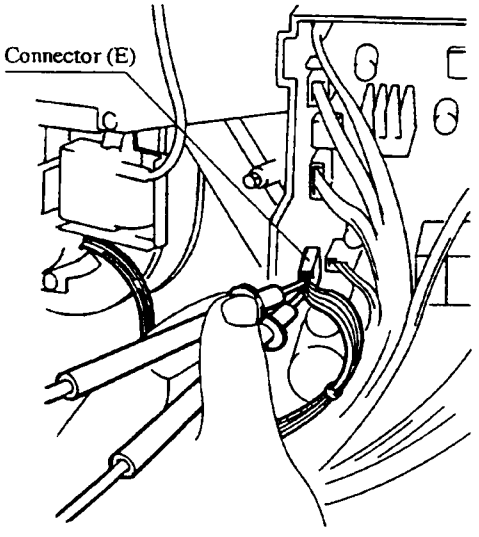


If error "32" is displayed, check the water temperature thermistor.

① ※Disconnect connector a_1 and measure resistance of white - white.

Resistance >1mΩ= open circuit
Resistance <1Ω= short circuit
Normal: check 4 on next page.
Faulty: replace the water temperature thermistor.

4. Is the combustion fan normal? Error "61" displayed.



Check the motor.

If error "61" is displayed, inspect the combustion fan.

① Measure the voltage at the connector E black - red.
Normal: DC 6 ~ 40 V (Fan on)
DC 0 V (Fan off)
If normal, check ②.
Faulty: Replace the PCB Unit.

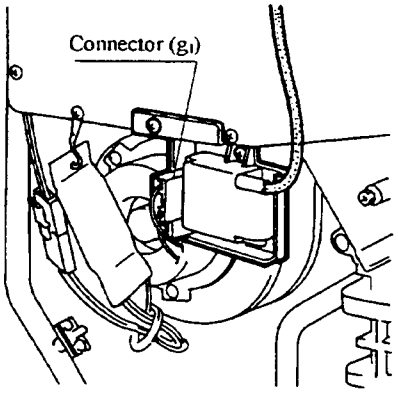
②※ Disconnect connector E, and measure resistance at black (+) - red (COM) .
Normal: 3.9 ~ 4.9 kΩ
If normal, check the fan revolution sensor, see 5 below.
Faulty: Replace the combustion fan.

Check the fan revolution sensor.

① Measure the voltage at connector E black - yellow.
Normal: DC 11 ~ 13 V
If normal, check ② below.
Faulty: Replace the PCB unit.

② Measure the voltage at connector E black - white.
Normal: DC 2 ~ 7 V.
If normal, check item 5 below.
Faulty: Replace the combustion fan.

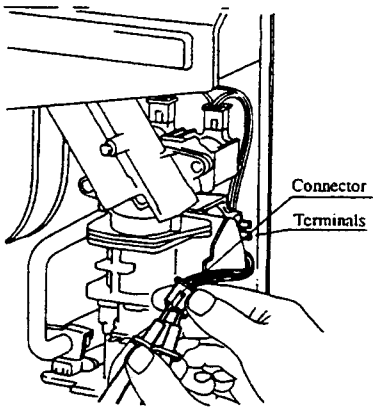
5. Is the sparker operating normally? Error "11" displayed.



① Measure the voltage at connector g_1 grey - grey.
Normal: AC 90 ~ 100 V.
If normal, check ② below.
Faulty: Replace the PCB unit.

②※ Disconnect connector g_1, and measure the resistance between the two sparker terminals.
Normal: > 1MΩ
If there is no spark, adjust or replace the electrode.
Faulty: Replace the sparker.

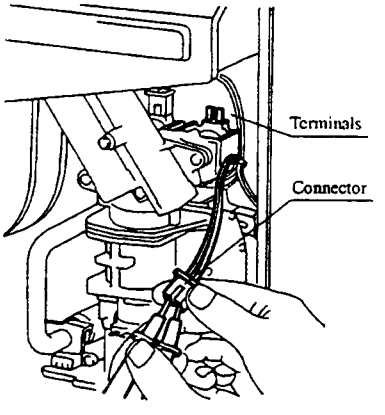
6. Is main gas solenoid Valve (SV_1) operating normally? Error "11" is displayed.



① ※Disconnect the main gas solenoid valve connector and measure pink - black resistance at the solenoid terminals.
Normal: 0.9 ~ 1.3 kΩ
If normal, check ② below.
Faulty: Replace the main gas solenoid valve.

② Measure voltage at pink - black voltage on the main gas solenoid valve connector.
Normal: DC 80 ~ 100 V
If normal, proceed to 7.
Faulty: Replace the PCB unit.

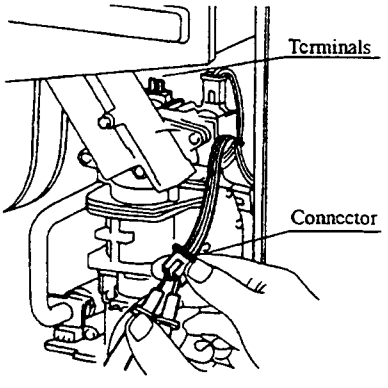
7. Is the change over solenoid (SV_2) operating normally? Error message "11" is displayed.



① ※Disconnect the change over solenoid (SV2) connector, and measure yellow - black resistance at the solenoid terminals.
Normal: 1.3 ~ 1.9 kΩ
If normal, check ② below.
Faulty: Replace the change over solenoid (SV_2).

② Measure voltage at change over solenoid (SV2) yellow -black connector.
Normal: DC 80 ~ 100 V.
If normal, check 8 below.
Faulty: Replace the PCB unit.

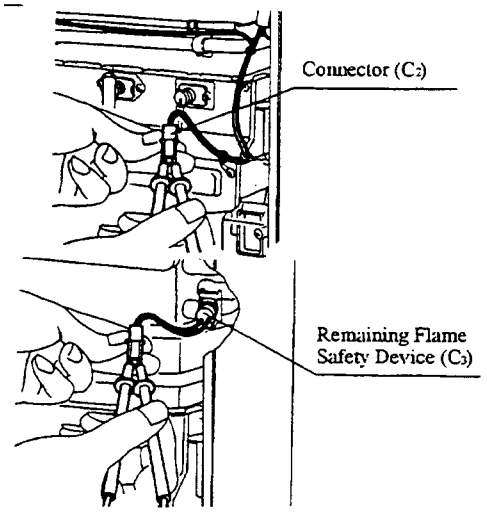
8. Is the change over solenoid (SV3) normal?



① ※ Disconnect the change over solenoid (SV_3) connector, and measure blue - black resistance at the solenoid terminals.
Normal: 1.5 ~ 1.9 kΩ
If normal, check ② below.
Faulty: Replace the change over solenoid (SV_3).

② Measure the voltage at change over solenoid (SV_3) blue -black connector.
Normal: DC 80 ~ 100 V.
If normal, check 9 below.
Faulty: Replace the PCB unit.

9. Are the safety devices operating normally? Error "14" displayed.



Check the thermal fuse

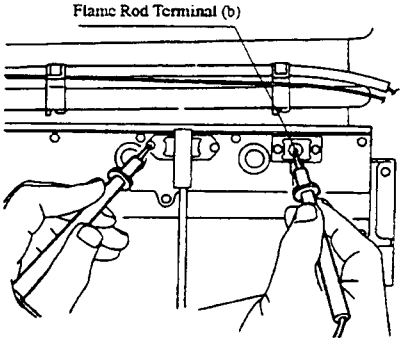
① ※Disconnect connector C_2, and measure the resistance between the red wires.
Normal: Less than 1 Ω
If normal, replace the PCB unit.
Faulty: Check the appliance for damage, if there is nothing abnormal replace the thermal fuse.

Check the remaining flame safety device.

② Measure resistance between the two terminals C_3.
Normal: Less than 1 Ω
If normal, replace the PCB unit.
Faulty: Replace the remaining flame safety device.

Combustion stops due to flame failure.

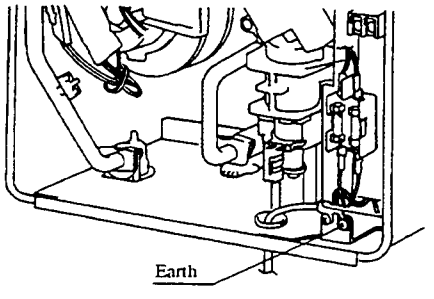
1. Is the flame rod functioning normally? Error "12" displayed.



① Measure the voltage between the flame rod terminal b and the appliance earth.
Normal: AC 40 ~ 150 V.
If normal, check ② below.
Faulty: Replace the PCB unit.

② Check that the flame rod attachment is not loose.
Normal: replace the PCB unit.
Faulty: secure the flame rod bracket.

2. Is the earth lead wire normal?

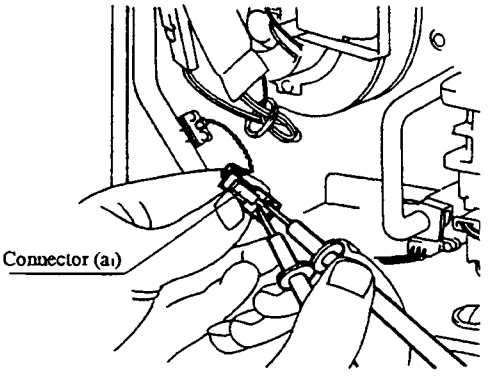


① Check for defective earth terminal, or an open circuit or short. If normal, investigate other possible causes for the flame failure. (Is the gas cock open? Is the filter mesh blocked? Is the gas turned ON at the meter?)

Faulty: secure the earth.

Unable to adjust hot water temperature.

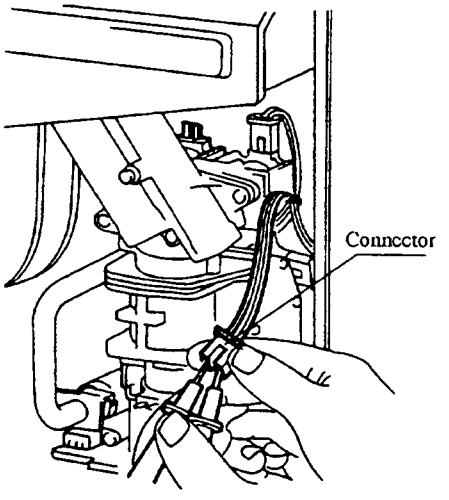
1. Is the water temperature thermistor operating normally? Error "32" displayed.



1. Disconnect the connector a_1 and measure the resistance between the white wires.

See diagnostic points, page 26 for temperatures at various resitances.
Normal: proceed to 2.
Faulty: replace the thermistor.

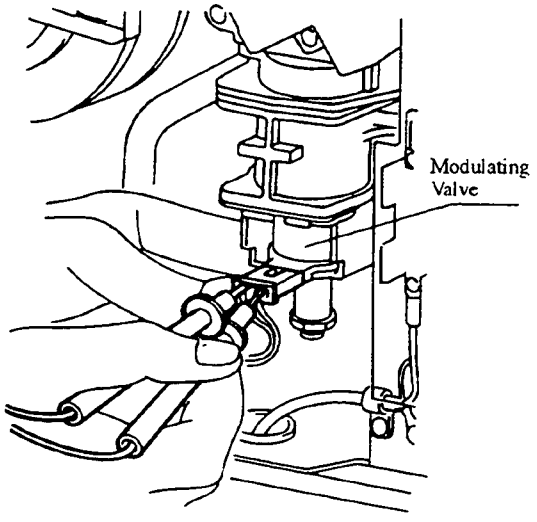
2. Is the change over solenoid (SV_3) normal?



① ※ Disconnect the change over solenoid (SV_3) connector, and measure blue - black resistance.
Normal: 950 ~ 1420 kΩ
If normal, proceed to ②.
Faulty: Replace the change over solenoid (SV_3).

② Measure the voltage at change over solenoid (SV_3) blue -black connector.
Normal: DC 80 ~ 100 V.
If normal, check item 3 below.
Faulty: Replace the PCB unit.

3. Is the modulating valve operating normally?

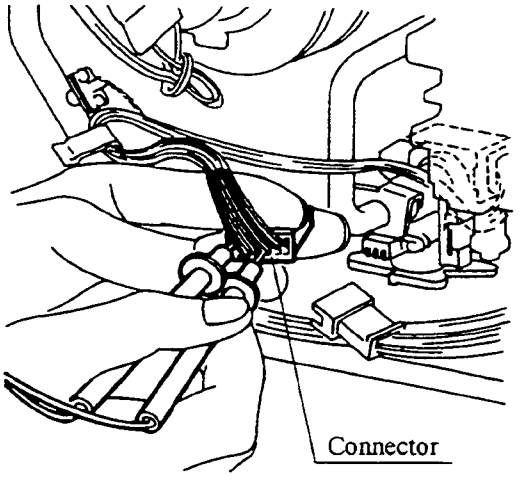


① ※Remove the modulating valve festoon terminal and measure the resistance at the terminals.
Normal: 65 ~ 90 Ω
If normal, check ② .
Faulty: Replace modulating valve.

② Re-connect terminal and measure the pink - pink voltage for the modulating valve festoon terminal.
Normal: DC 0.5 ~ 25 V.
If normal, check ③ below.

③ Investigate the change in gas secondary pressure when the remote control pre-set temperature is altered from 37 ~ 75°C.
Normal: If the secondary pressure changes, check 4 below.
Faulty: Replace modulating valve.

4. Is the water flow servo normal?



① ※ Disconnect connector, and measure the red - blue resistance on the water flow servo side.
Normal: 10 ~ 30 Ω
If normal, proceed to ②.
Faulty: Replace the water flow servo sensor.

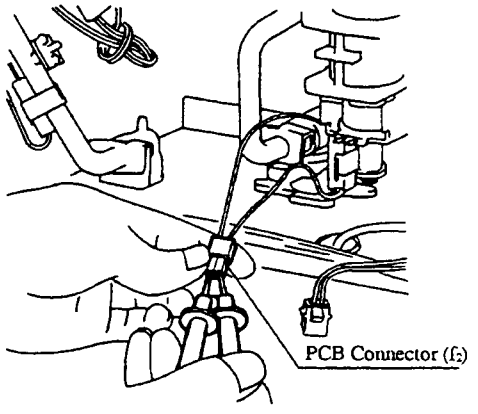
② Disconnect connector, and measure the orange (+) - grey (-) voltage on the PCB unit side.
Normal: DC 11 ~ 13 V
If normal, proceed to ③.
Faulty: Replace the PCB unit.

③ With connector, connected (do not turn water ON... wait for the water flow servo to return to fully open), measure the brown - grey voltage at brown - grey.
Normal: DC 4 ~ 6 V
Faulty: Replace the water flow servo sensor.

③ With connector, connected (do not turn water ON ... wait for the water flow servo to return to fully open), measure the yellow - grey voltage at yellow - grey.
Normal: less than DC 0.5 V
Faulty: Replace the water flow servo sensor.

Anti-frost heater does not operate.

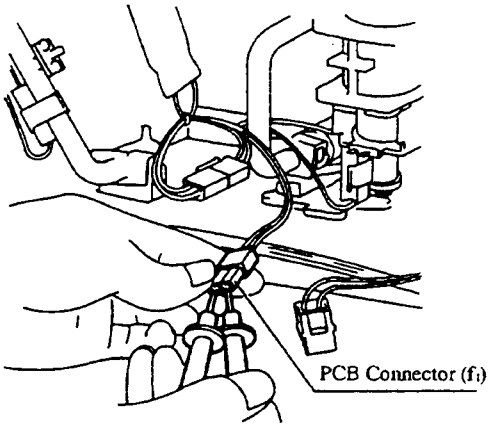
1. Are the ceramic anti-frost heaters ok?



① ※Disconnect connector f_2, and measure the resistance white - white resistance on the heater side.

Normal: 145 Ω
If normal, proceed to 2.

Faulty: Replace the anti-frost heater B assembly.

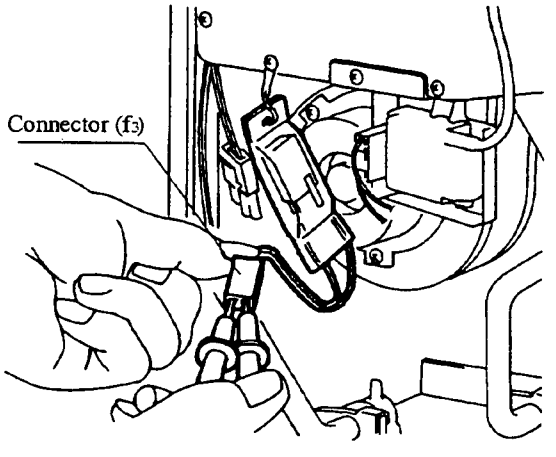


② ※Disconnect connector f_1.
Bridge connector f_2 and connector f_3

Normal: 600 Ω
If normal, proceed to 2.

Faulty: Replace anti-frost heater A assembly.

2. Is the temperature sensing switch operating normally?



① ※Disconnect connector f_3, and measure blue - blue resistance. (perform the measurement when atmospheric temperature is less than 3.5°C.)

Normal: Less than 1Ω
If normal, check the wiring (AC100 V) circuit.

Faulty: Replace the temperature sensing switch.

If the atmospheric temperature is too high, cool the switch with ice.

§ 21 Electricial Component Analysis

- ***Before starting inspection, re-check wiring harnesses and double check that all connections are tight.***
- ***Before carrying out checks marked ※, remove power cord from wall plug.***

Nature Of fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair N°
A. ON indicator does not glow after having switched system on at remote control.	① Is the power cord plugged into the power point?	Inspect visually.	Is plug in or not?	Yes	Go to A - ②	
				No	Plug in cord.	1
	② Is supply voltage correct?	Measure voltage at power point.	AC 230-260V	Yes	Go to A - ③	
				No	Check power supply circuit. Check fuses.	2
	③ Check 3 Amp electrical fuses.	※ Disconnect and measure resistance, to confirm if fuse is blown. Normally < than 1 M Ω	Is fuse blown?	Yes	Go to A - ④ and replace fuse.	
				No	Check A - ⑤	
	④ Check for short-circuits.	1) Measure the resistance of each solenoid valve. ※ Remove connector G from the PCB before measuring. Pink - Black 0.9 ~ 1.3 kΩ Yellow - Black 1.3 ~ 1.9 kΩ Blue - Black 1.5 ~ 1.9 kΩ	Are values within those specified at left? N.B. Confirm after checking that there are no broken wires or shorts in any harness.	Yes	Go to A - ⑤ - 2	
				No	Replace gas control assembly	3
		2) Measure the sparker resistance. ※ Disconnect sparker connector g, and measure the resistance between both terminals.	> 1 M Ω	Yes	Go to A - ④ - 3	
				No	Replace sparker.	4
		3) Check wiring.	Are there any shorts?	Yes	Rectify/replace.	5
				No	Replace PCB.	6
	⑤ Check transformer. 240 V-100 V.	1) Measure the voltage between red and red d connector.	AC 90 ~ 110 V	Yes	Go to A - ⑤ - 2	
				No	Replace PCB.	7
		2) Measure the voltage at connector B, D. Measure values with appliance on "standby". Green - Green AC 16 ~ 20 V Orange - Orange AC 13 ~ 30 V Brown - Grey AC 30 ~ 50 V Yellow (LH) - Grey AC 180 ~ 220 V	Are valves within those specified at left?	Yes	Go to A - ⑥	
				No	Replace 240 V transformer.	8

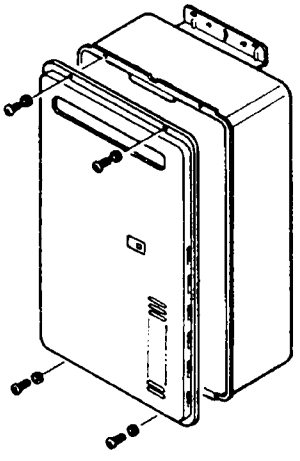
Nature of Fault	Examination Point	Diagnotic Point	Values	Y/N	Action	Repair N°
	⑮ Check remote control (where connected).	Measure voltage between the remote control terminals at H.	DC 11 ~ 13 V	Yes	After checking cable for shorts and broken wires, replace the remote control.	9
				No	Replace PCB	10
B. Digital monitor lights up, but combustion does not commence.	① Check water flow sensor.	1) Measure voltage between red and black of connector a_2.	DC 11 ~ 13 V	Yes	Go to B - ① - 2	
				No	Replace PCB.	11
		2) Measure voltage between yellow and black of connector a_2.	DC 2 ~ 10 V	Yes	Go to B - ②	
				No	Replace water flow sensor.	12
Error code "72" displayed on digital monitor.	② Check flame rod.	※ Measure resistance between flame rod terminal b and earth.	>1 M Ω	Yes	Replace PCB.	13
				No	Replace flame rod.	14
Error code "32" displayed on digital monitor.	③ Check outgoing water temperature thermistor.	Disconnect connector a_1 and measure resistance. Open circuit: > 1MΩ Short circuit: < 1Ω	Are values as shown on left?	Yes	Replace water temperature thermistor.	15
				No	Go to B - ④	
Error code "61" displayed on digital monitor.	④ Check combustion fan.	1) Check motor. Measure voltage between black and red at connector E.	DC 6 ~ 40 V (Fan ON) DC 0 V (Fan OFF)	Yes	Go to B - ④ - 2	
				No	Replace PCB.	16
		2) ※Remove connector E from PCB, and measure resistance between black (+) and red (COM).	3.9 ~ 4.9 kΩ	Yes	Go to B - ④ - 3	
				No	Replace combustion fan.	17
		3) Check combustion fan. Measure voltage between black and yellow at connector E.	DC 11 ~ 13 V	Yes	Go to B - ④ - 4	
				No	Replace PCB.	18
		4) Measure voltage between black and white of connector E.	DC 2 ~ 7 V	Yes	Go to B - ⑤	
				No	Replace combustion fan.	19
Error code "11" displayed on digital monitor.	⑤ Check sparker.	1) Measure voltage between grey and grey of connector g_1 (sparker on)	AC 90 ~ 110 V	Yes	Go to B - ⑤ - 2	
				No	Replace PCB.	20
		2) Remove connector g and measure the resistance between sparker terminals.	>1 MΩ	Yes	Go to B - ⑤ - 3	
				No	Replace sparker	21
		3) Check if unit is sparking.	Is the sparker sparking?	Yes	Go to B - ⑯	
				No	Adjust or replace electrode.	22

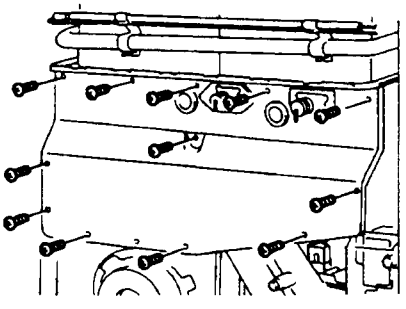
Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair N°
Error code "11" displayed on digital monitor.	⑥ Check main gas solenoid valve (SV_1).	1) ※Disconnect the gas solenoid valve connector G from the PCB, and measure resistance between pink and black.	0.9 ~ 1.3 KΩ	Yes	Go to B - ⑥ - 2	
				No	Replace main gas solenoid valve. (SV_1)	23
		2) Measure voltage between pink and black of SV_1 connector.	DC 80 ~ 100 V	Yes	Go to B - ⑦	
				No	Replace PCB.	24
	⑦ Check solenoid valve (SV_2).	1) ※Disconnect connector G from PCB. Measure resistance between yellow and black.	1.3 ~ 1.9 k Ω	Yes	Go to B - ⑦ - 2	
				No	Replace (SV_2)	25
		2) Measure voltage between yellow and black of SV_2 connector.	DC 80 ~ 100 V	Yes	Go to B - ⑧	
				No	Replace PCB.	26
	⑧ Check change over solenoid valve. (SV3).	1) ※Disconnect connector g from PCB and measure resistance between blue and black.	1.5 ~ 1.9 k Ω	Yes	Go to B - ⑧ - 2	
				No	Replace (SV_3)	27
		2) Measure the voltage bewteen the blue and black of connector.	DC 80 - 100 V	Yes	Go to B - ⑨	
				No	Replace PCB.	28
Error code "14" displayed on digital monitor.	⑨ Check thermal fuse.	※Disconnect connector C_2 and measure resistance between white and red.	< 1Ω	Yes	Go to B - ⑩	
				No	Replace thermal fuse.	29
	⑩ Check over heat switch (Bi-metal switch).	※Disconnect over heat switch (Bi-metal switch) festoon terminals, and measure resistance between them.	< 1Ω	Yes	Replace PCB.	30
				No	Replace remaining flame safety device. (Bi-metal SW)	31
C. Combustion occurs, flame fails. Error code "12" displayed on digital monitor.	① Check flame rod.	1) Measure the voltage between flame rod terminal b and appliance earth.	AC 40 ~ 150 V	Yes	Go to C - ① - 2	
				No	Replace PCB.	32
		2) Check flame rod bracket is not loose.	Is it secure?	Yes	Go to C - ②	
				No	Replace rectify	33
	② Check earth wire.	Check earth wire connections for (to round terminals), broken wires, short circuits.	Is it OK?	Yes	Check for other causes of flame failure.	34
				No	Replace or adjust earth wire.	35

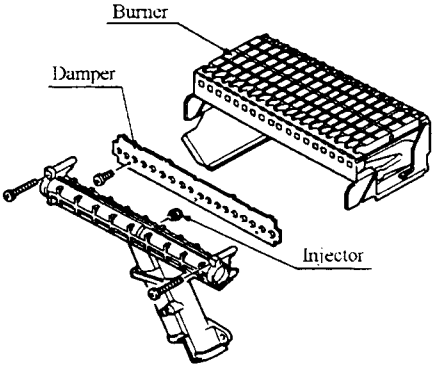
Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair N°
D. Cannot adjust water temperature.	① Check water temperature thermistor.	Disconnect connector (a_1) and measure the resistance between white and white. See diagnostic points, page 26 for temperatures at various resistances.	Resistance values as left?	Yes	Go to D - ②	
				No	Replace water temperature thermistor.	36
	② Check change over solenoid valve (SV_3).	1) ※Disconnect solenoid connector G from PCB, and measure the resistance between blue and the black.	1.5 ~ 1.9 KΩ	Yes	Go to D - ② - 2	
				No	Replace SV_3	37
		2) Measure the voltage between blue and black wire of change over solenoid valve SV3 at connector g.	DC 80 ~ 100 V	Yes	Check D - ③	
				No	Replace PCB.	38
	③ Check modulating valve.	1. ※Disconnect modulating valve terminals and measure resistance between them.	65 ~ 90 Ω	Yes	Go to D - ③ - 2	
				No	Replace modulating valve.	39
		2. Measure the voltage between the two harness terminals C_1 (still disconnected).	DC 0.5 ~ 25 V	Yes	Go to D ③ - 3	
				No	Replace PCB.	40
		3. Check whether the secondary gas pressure alters when the remote control temperature is changed between 37 and 75°C.	Does the secondary pressure change?	Yes	Go to D - ④	
				No	Replace modulating valve.	41
	④ Check water flow servo.	1) Measure resistance between red - blue of water flow servo connector j.	10 ~ 13 Ω	Yes	Go to D - ④ - 2	
				No	Replace water flow servo	42
		2) Measure voltage between orange (+) - grey (-) of water flow servo connector j.	DC 11 ~ 13 V	Yes	Go to D - ④ - 3	
				No	Replace PCB	43
		3) Measure voltage between brown - grey of water flow servo connector j (Do not turn water on.)	DC 4 ~ 6 V	Yes	Go to D - ④ - 4	
				No	Replace water flow servo	44
		4) Measure voltage between yellow - grey of water flow servo connector (J). (Do not turn water on.)	< DC 0.5 V	Yes	Normal	
				No	Replace water flow servo	45

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair N°
E. Anti-frost heater does not operate.	① Check anti-frost heater.	※Disconnect connector f_1 and measure resistance between white and white.	75 ~ 138 Ω	Yes	Go to E - ②	
				No	Replace anti-frost heater assembly B.	47
	② Check frost sensing switch.	Disconnect connector f_3 measure the resistance between blue and blue. Atmospheric temperature less than 3.5°C.	< 1 Ω	Yes	Check wiring	48
				No	Replace frost sensing switch.	49

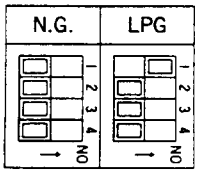
1. Remove outer cover, 4 screws.
2. Delete "gas type marking" from the combustion chamber cover and replace with "new gas type". (Use a black marking pen)
3. Delete gas type from small paper sticker on bottom edge of inner casing.
4. Replace small gas label on gas inlet.
5. Replace large gas label on top of appliance.
6. Place "new" very small gas label (indicating new gas type) over "old one" on Data Plate.
7. Complete details on conversion sticker, place sticker on the inside front cover.
8. Remove PCB protective plastic cover.
9. Remove combustion chamber cover, 12 screws and one earth screw.
10. Remove manifold, 5 screws.
11. Fit or remove damper assembly (2 screws), depending on gas type. Note: Damper is only used on LPG models.
12. Remove 18 injectors.
13. Fit new injectors.
14. Refit manifold. Check "O" rings are correctly positioned.
15. Refit combustion chamber cover. Attach earth lead to the bottom right hand screw, marked " E". Ensure no wires become trapped.
16. Follow gas pressure setting procedure, (see next page).
17. Check for gas escapes with soapy water.
18. Replace front cover, star washer must be on bottom right hand screw.







1. Check gas type switch is in correct position.

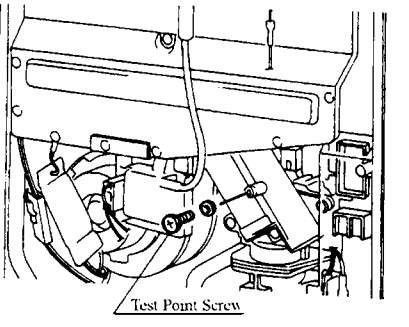


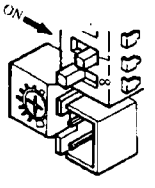
2. Attach pressure gauge to pressure test point. Turn heater on.
3. Set No.7 switch to ON. Remove plug in base of heater for access to regulator screw. Adjust regulator screw on modulating valve.

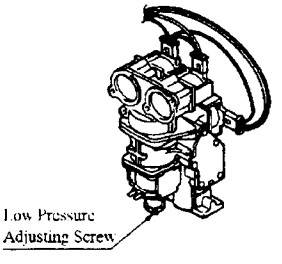
Pressure Setting Low

NG	0.06	kPa
LPG	0.15	kPa

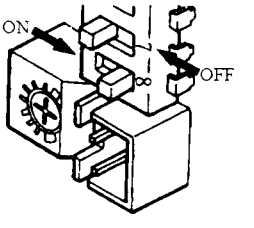
Lock Regulator Screw.







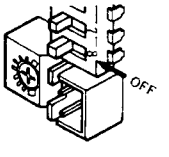
4. Switch No.7 "OFF" and switch No.8 "ON".

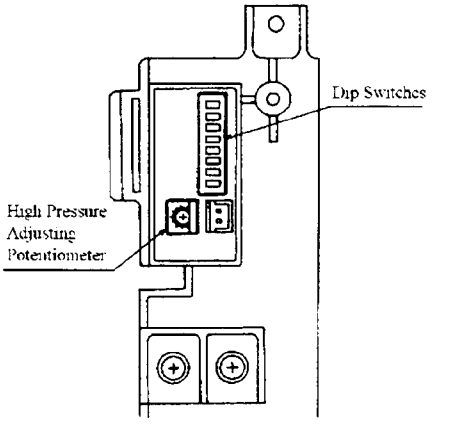


5. Adjust pressure by POT on P.C.B. When completed, switch No.8 to "OFF".

Pressure Setting High

NG	0.75	kPa
LPG	1.93	kPa





6. Turn heater off.
7. Remove gauge, replace screw.
8. Replace plug in base.

NOTE: Before proceeding with dismantling, be sure to follow the CAUTION instructions before each explanation.

eg. - Isolate gas supply.
- Disconnect electrical supply from wall socket.
- Isolate the water supply.
- Drain **All** water from the appliance.

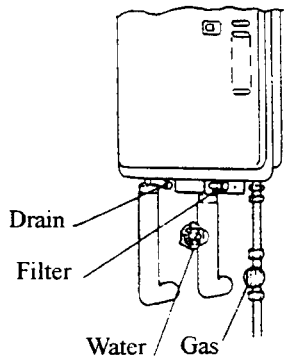
Unless otherwise stated, re-assembly is the reverse of dismantling.

IMPORTANT

For some areas of dismantling you may need to isolate any or all of the following:

* Isolate gas supply.
* Disconnect electrical supply from wall socket.
* Isolate water supply.
* Drain **all** water from appliance.

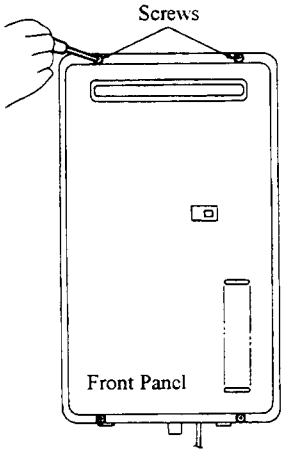
The following diagram may be of assistance.



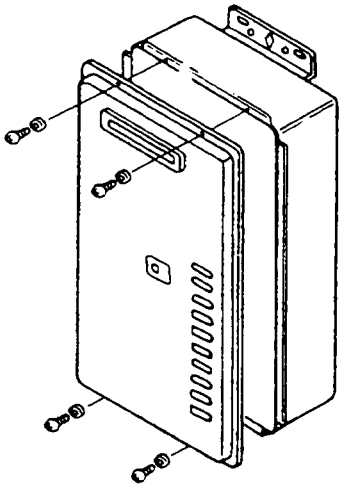
1) Removal of the FRONT PANEL

CAUTION: 240 Volt exposure. Isolate the electrical supply to the appliance and reconfirm with a neon screwdriver or multimeter.

a. Remove the four (4) screws holding the panel in place.[⊕ driver.]

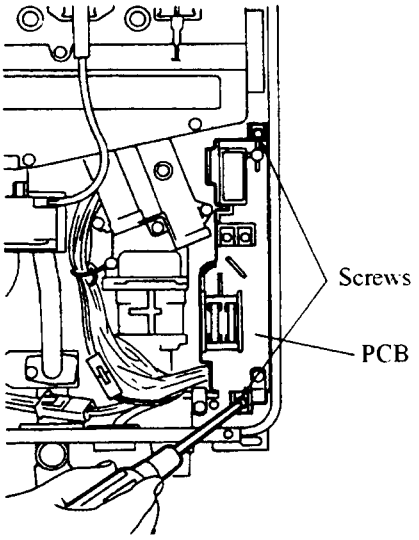


b. Remove front panel by shifting forward.



2) Removal of the PCB UNIT.

CAUTION: 240 Volt exposure. Isolate the electrical and gas supplies to the appliance, reconfirm with a neon screwdriver or multimeter.

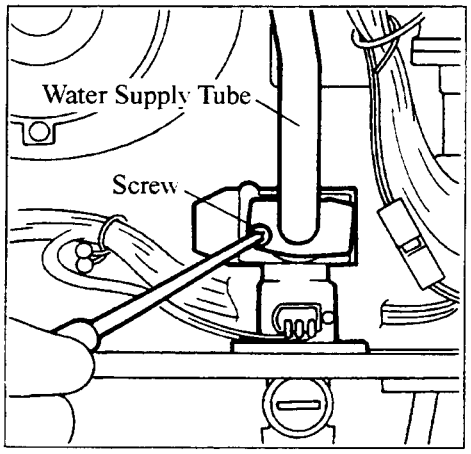


a. Remove the two (2) screws holding the PCB in place, and pull the PCB towards yourself and out of appliance. [⊕ driver.] Disconnect all connectors.

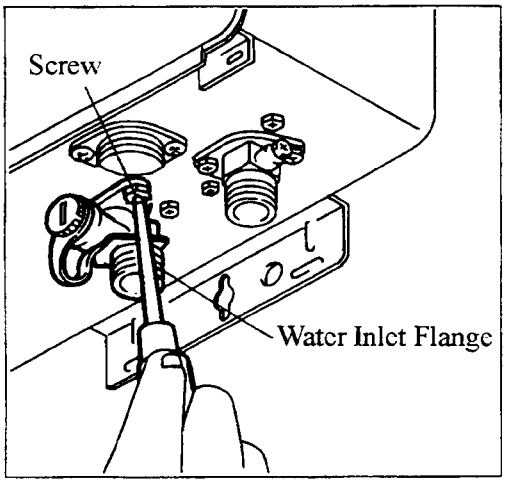
3) Removal of the WATER FLOW SENSOR and WATER FLOW CONTROL.

CAUTION: 240 Volt exposure. Isolate the electrical and water supplies to the appliance, reconfirm with a neon screwdriver or multimeter.

a. Remove one (1) screw from the heat exchanger water supply pipe to release the metal lock. Pull the pipe towards yourself to release. Handle O-ring carefully. [⊕ driver, hand.]



b. Remove the four (4) screws that secure the water supply connection in place; remove connection. Handle O-ring carefully. [⊕ driver, hand.]

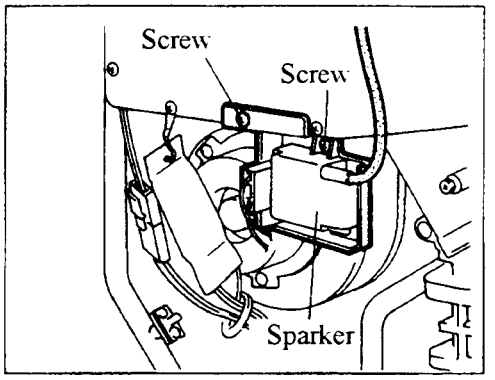


c. Disconnect electrical connectors and remove water flow from control assembly.

4) Removal of the SPARKER.

CAUTION: 240 Volt exposure. Isolate the electrical supply to the appliance and reconfirm with a neon screwdriver or multimeter.

a. Remove one (1) screw from the sparker attachment plate, and remove the attachment plate.[⊕ driver, hand.]



b. Remove one (1) screw that secures the sparker to the attachment plate to remove sparker. [⊕ driver, hand.]

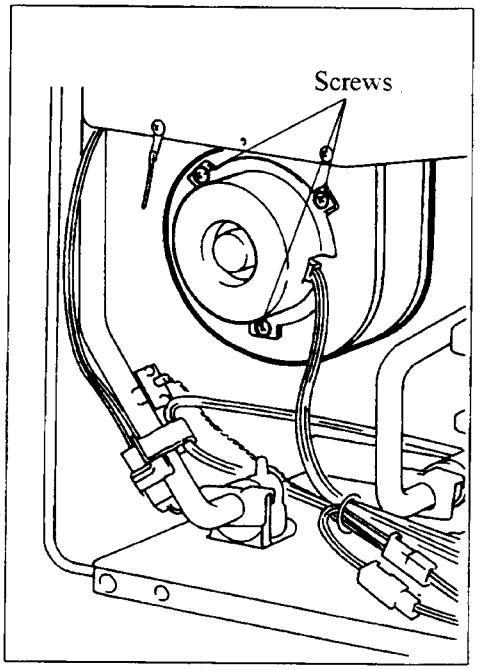
c. Disconnect High Tension lead and connector.

5) Removal of the COMBUSTION FAN.

CAUTION: 240 Volt exposure. Isolate the electrical supply to the appliance and reconfirm with a neon screwdriver or multimeter.

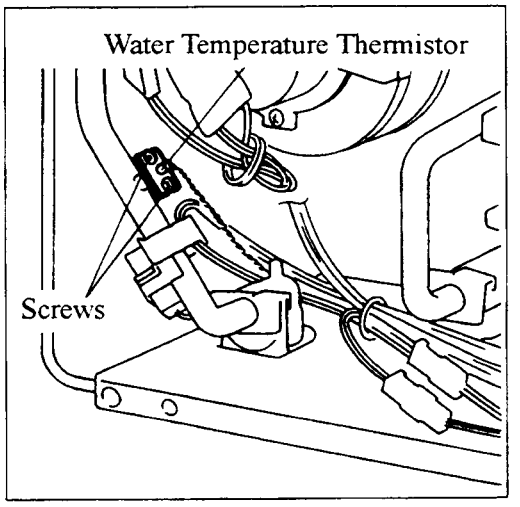
a. Remove the sparker; refer to section 4.

b. Remove the three (3) screws that secure the fan in place, disconnect connector and pull the fan towards yourself to remove it.[⊕ driver.]



6) Removal of the WATER TEMPERATURE THERMISTOR.

a. Remove the two (2) screws that secure the thermistor in place to remove the water temperature thermistor. [⊕ driver.] Take care not to loose 'O' ring.



7) Removal of the TRANSFORMER.

CAUTION: 240 Volt exposure. Isolate the electrical and water supplies to the appliance, reconfirm with a neon screwdriver or multimeter.

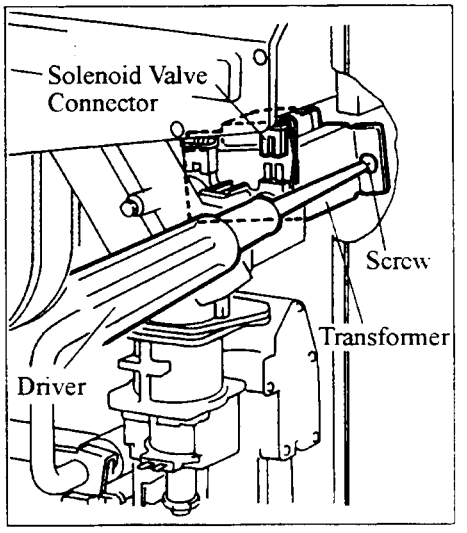
a. Remove the PCB unit; refer to section 2.

b. Remove the sparker; refer to section 4.

c. Remove one solenoid valve connector.

d. Remove two (2) fixing screws to release the transformer. [⊕ driver.]

e. Disconnect connectors.

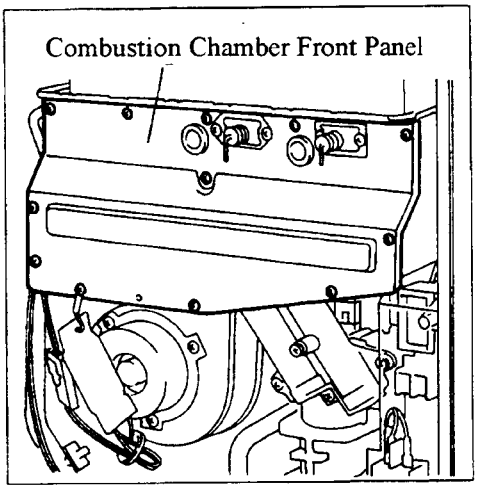


8) Removal of the BURNER AND MANIFOLD.

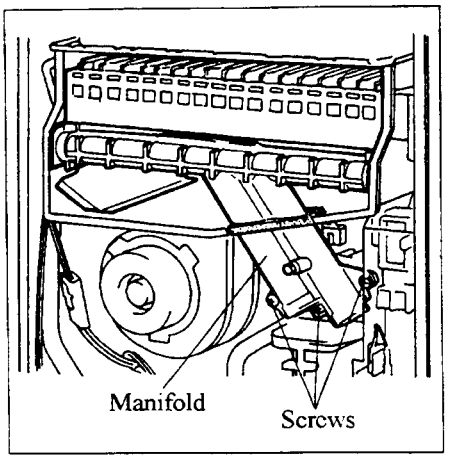
CAUTION: 240 Volt exposure. Isolate the electrical and gas supplies to the appliance, reconfirm with a neon screwdriver or multimeter.

a. Remove the sparker; refer to section 4. Disconnect electrode and flame rod.

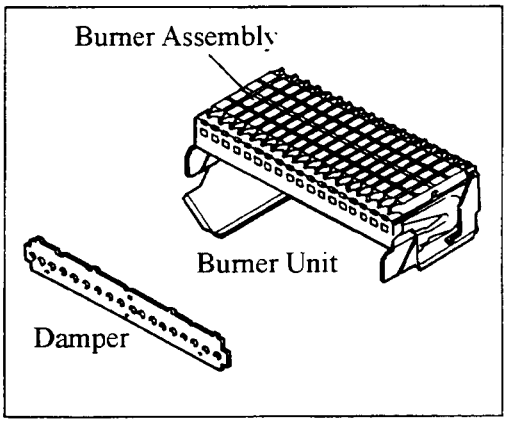
b. Remove twelve (12) screws that hold the combustion chamber front panel in place and remove the panel. [⊕ driver.]



c. Remove five (5) screws that secure the manifold in place and pull out the manifold. [⊕ driver.]



d. Pull burner unit forward to remove. [Hand.]



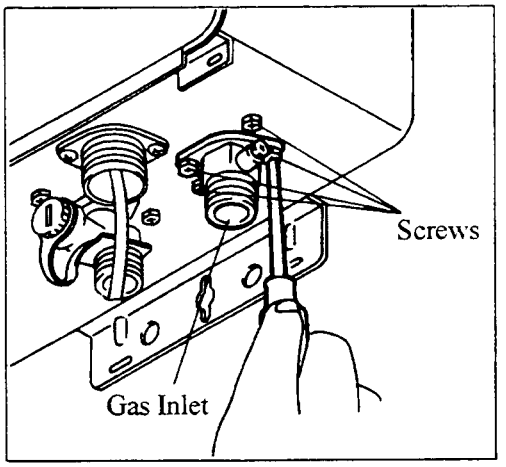
Don't forget to replace earth when re-assembling.

9) Removal of the GAS CONTROL.

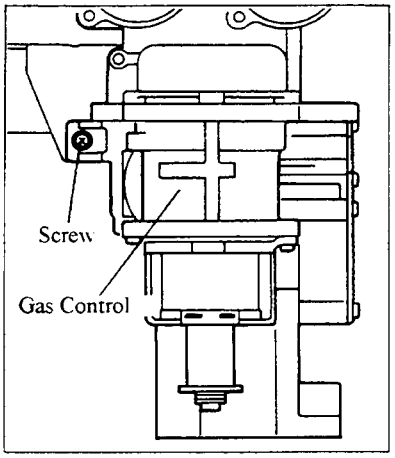
CAUTION: 240 Volt exposure. Isolate the electrical and gas supplies to the appliance, reconfirm with a neon screwdriver or multimeter.

a. Remove the manifold; refer to section 8) a, b and c.

b. Remove the four (4) screws that hold the gas connection in place. **(Handle O-ring carefully)** [⊕ driver.]



c. Remove one (1) screw that holds the gas control in place, disconnect connectors, pull out the gas control.



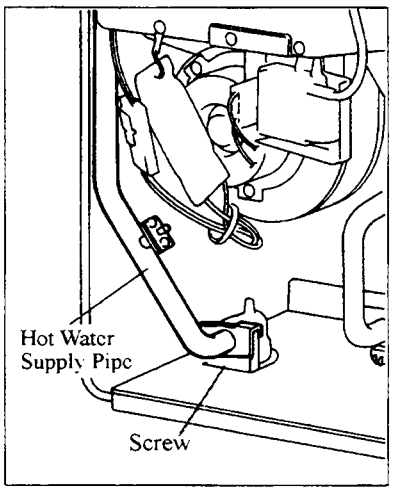
10) Removal of the HEAT EXCHANGER UNIT.

CAUTION: 240 Volt exposure. Isolate the electrical, water and gas supplies to the appliance, reconfirm with a neon screwdriver or multimeter.

a. Remove PCB unit; refer to section 2) a.

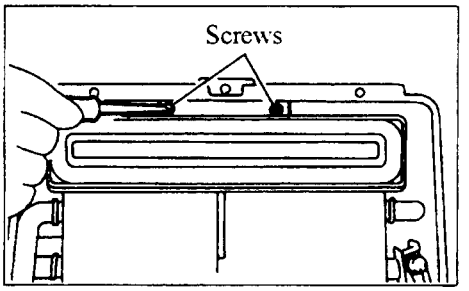
b. Remove the heat exchanger water connection; refer to section 3)a.

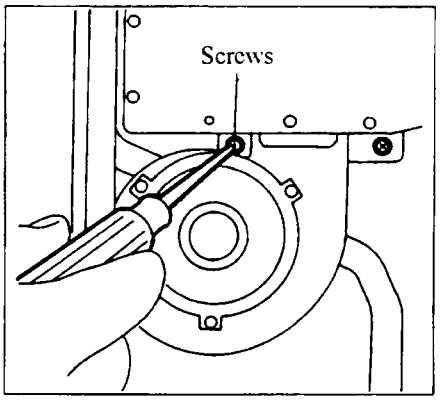
c. Remove one (1) screw from the outlet connection clip, to pull out the hot water supply connecting pipe towards yourself. (Handle O-ring carefully.)[⊕ driver, hand.]



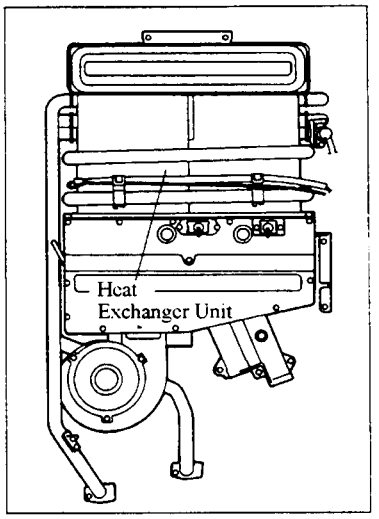
d. Remove the sparker; refer to section 4) a.

e. Remove the four (4) screws that secure the heat exchanger unit in place.





f. Pull out the heat exchanger unit towards yourself.



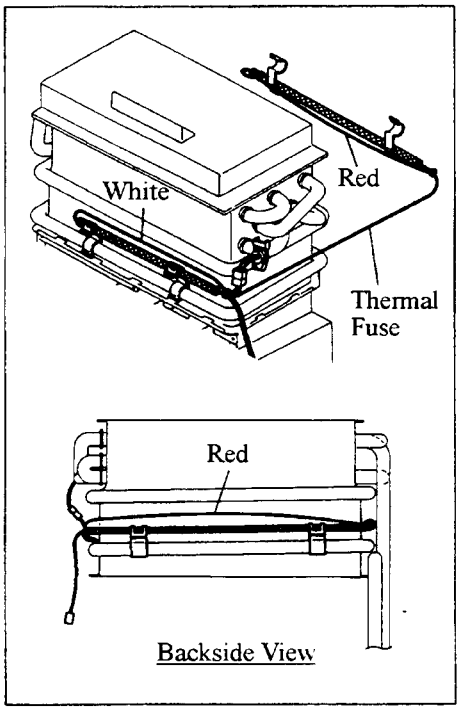
11) Removal of the THERMAL FUSE.

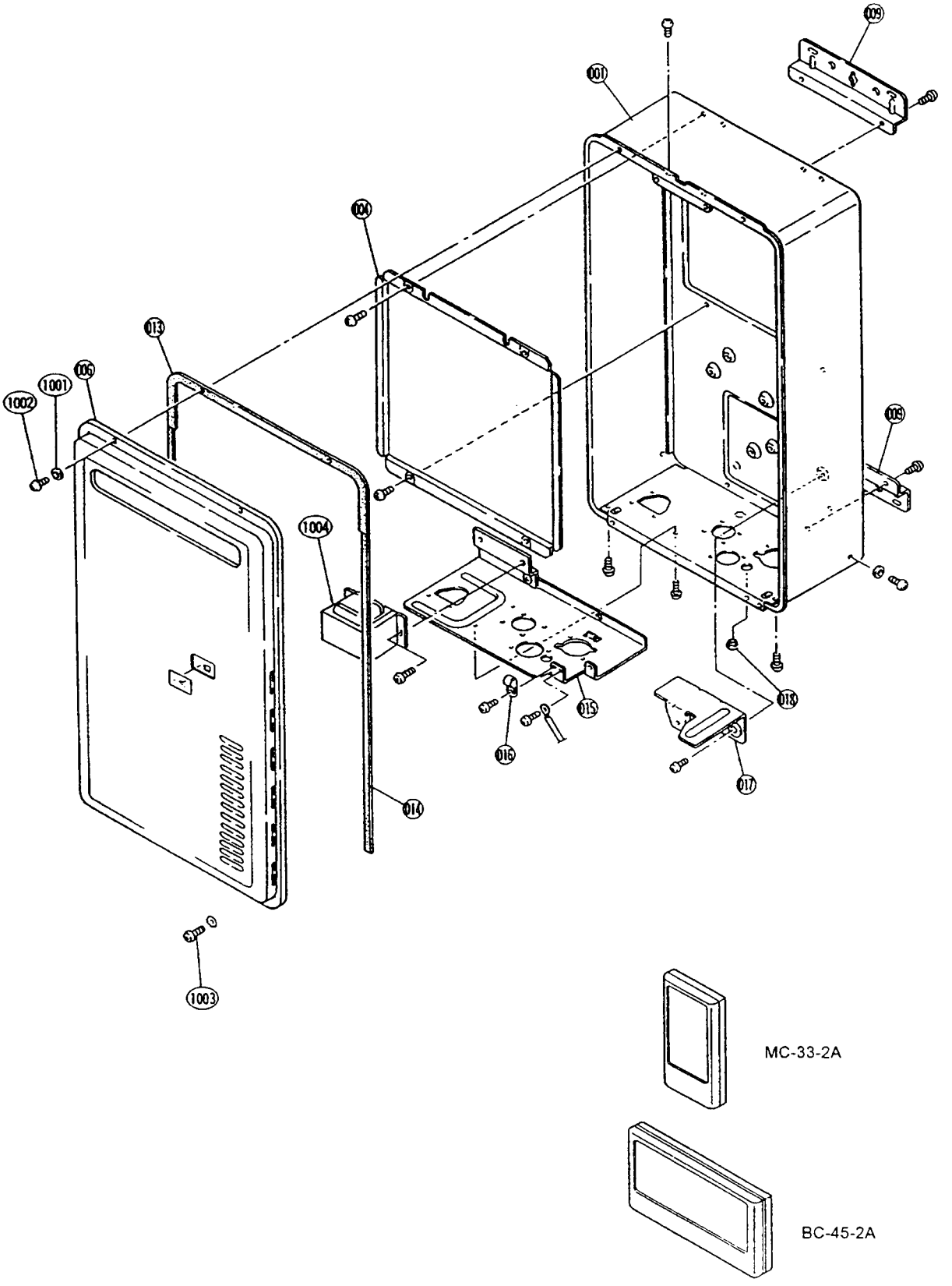
CAUTION: 240 Volt exposure. Isolate the electrical and gas supplies to the appliance, reconfirm with a neon screwdriver or multimeter.

a. Remove the heat exchanger unit; refer to section 10) a, b, c, d, e and g.

b. Disconnect and remove the thermal fuse. [⊕ driver, hand.]

* Fit the fuse as shown below.

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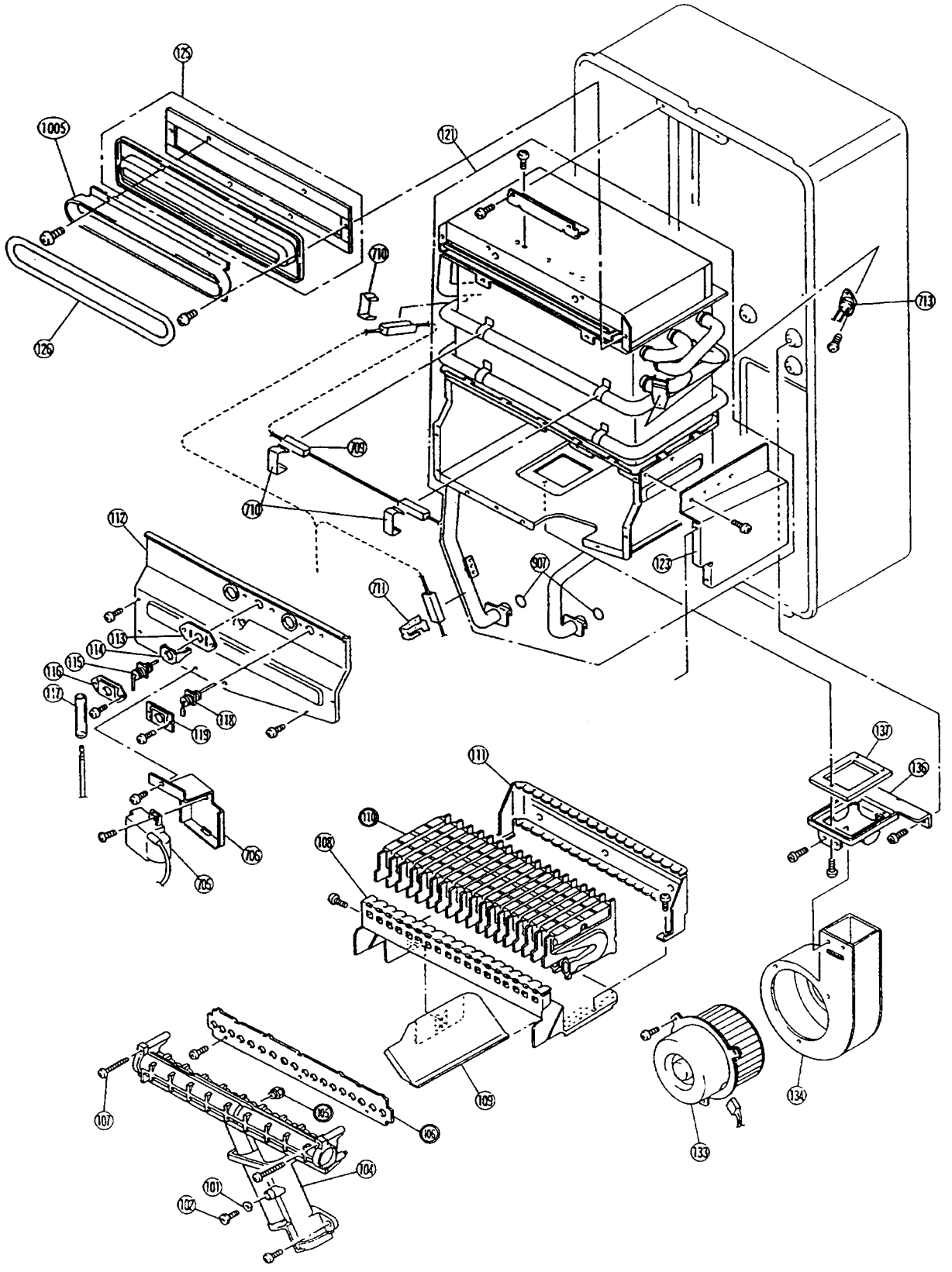
MC-33-2A
BC-45-2A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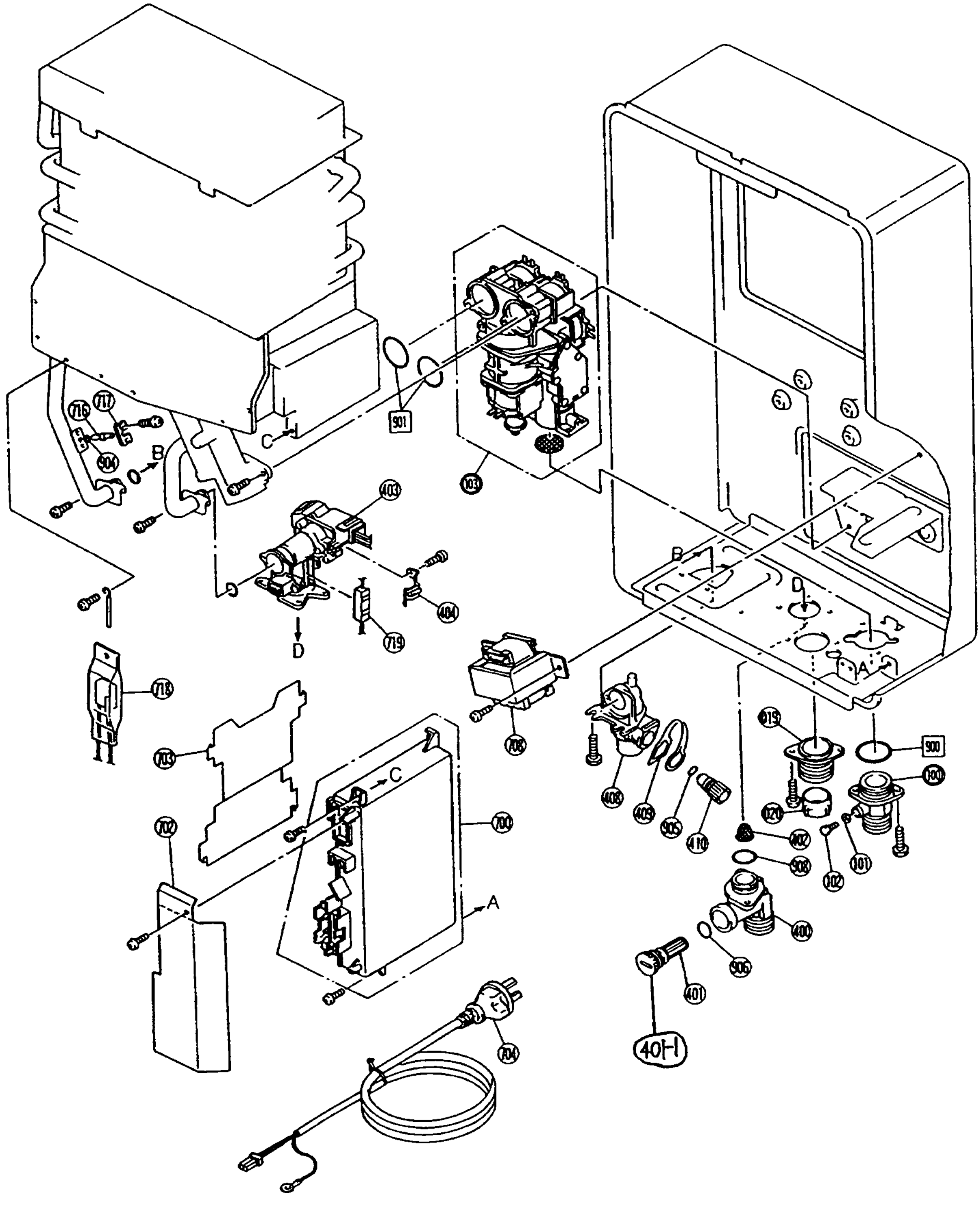
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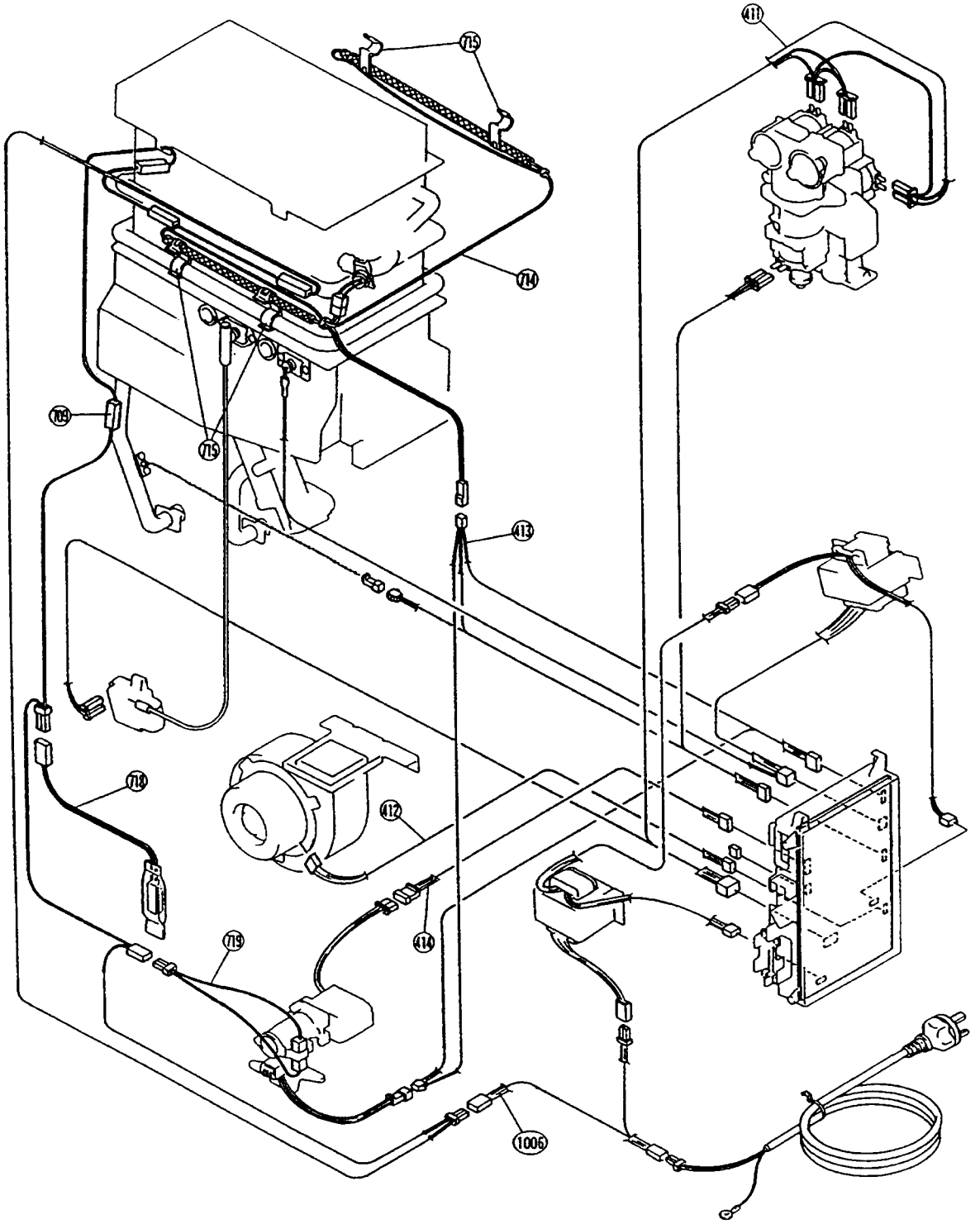
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No	Part Name	RA Part No	RNZ Part No	QTY
001	Main body assembly - Standard			1
001	Main body assembly - Salt Resistant	92073311	3051	1
004	Heat shield	92073329		1
006	Front panel assembly - Standard			1
006	Front panel assembly - Salt Resistant	92073337	3052	1
009	Wall bracket F	92071323		2
009	Wall bracket D			2
013	Main body packing A	92073345	3572	1
014	Main body packing - Side	92063361	3567	2
015	Reinforcement panel			1
016	Nylon clamp C			1
017	Gas control bracket			1
018	Rubber plug			1
019	Cable entry			1
020	Cable seal packing			1
100	R¾/20 Gas connection	92073360	3836	1
101	Test point packing		9994	1
102	Test point screw	92068907	9995	1
103	Gas control assembly	92073386		1
103	Gas control assembly - NG, LPG	92073394	3053	1
104	Manifold	92073733		1
105	Injector A - NG (1.7 mm)	92062397	3814	18
105	Injector A - LPG (1.0 mm)	92072008	3558	18
106	Damper (LP only) (marked "A")	92073428	3054	1
107	FT screw			2
108	Burner box front	92073436		1
109	Sound proofing panel			1
110	Burner assembly - LP, NG	92073451	3014	18
111	Burner box back panel			1
112	Combustion chamber front panel assembly			1
113	Electrode packing	92072909	3017	1

No	Part Name	RA Part No	RNZ Part No	QTY
115	Electrode	92072917	3016	1
116	Electrode clip			1
117	Electrode sleeve			1
118	Flame rod	92072891	3018	1
119	Flame rod clip			1
121	Heat exchanger complete assembly			1
123	PCB water deflector			1
125	Exhaust outlet (with packing)	92073485	3056	1
126	Front panel seal packing	92073493	2031	1
133	Fan and motor assembly	92073501		1
134	Fan casing assembly	92073519		1
136	Fan bracket	92073527		1
137	Fan bracket seal	92073535		1
400	$R^3/_4$/20 Cold water connection B		3059	1
401	Water filter assembly	92062280	3839	1
402	Water rectifier	92075100	3057	1
403	Electronic water flow control device	92073568	3058	1
404	Anti-frost heater clip		2038	1
408	$R^3/_4$/20 Hot water connection B		3055	1
409	Pressure relief valve band			1
410	Pressure relief valve assembly B	92071273	3870	1
411	Solenoid valve harness	92073592	3070	1
412	Fan motor harness	92073600	3034	1
413	Sensor harness	92043618	3035	1
414	Water flow sensor harness	92073626	3071	1
700	PCB unit assembly	92073634	2030	1
702	PCB front cover		3041	1

No	Part Name	RA Part No	RNZ Part No	QTY
703	PCB cover		3040	1
704	Power supply cord	90161894	4182	1
705	Spark generator		3042	1
706	Ignitor bracket			1
708	Transformer assembly (240 V-100 V)	92072768	3043	1
709	Anti-frost heater L assembly	92073659	2035	1
710	Anti-frost heater clip D		2034	3
711	Anti-frost heater clip		2032	1
713	Remaining flame safety device	92072750	3045	1
714	Thermal fuse harness	92073667	3072	1
715	Thermal fuse clip			4
716	Thermistor	92073675	3029	1
717	Thermistor clip		3882	1
718	Frost sensing switch C	92069079	3976	1
719	Anti-frost heater M assembly	92063593	2037	1
900	"O" Ring (P24) (gas)		3559	1
901	Packing (gas)	92075126	3077	2
904	"O" Ring (P4) (water)	92062249	3832	1
905	"O" Ring (P7) (water)	92062348	3849	1
906	"O" Ring (P12) (water)	92063351	1106	1
907	"O" Ring (P14) (water)	92062207	3826	2
908	"O" Ring (P18) (water)	92072818	3013	1
1001	Resin washer			6
1002	Small phillips screw			3
1003	Small phillips screw with washer			1
1004	Transformer assembly	92072735	3061	1
1005	Wind shield			1
1006	Electric harness			1
	Kitchen remote control	92078583	BC-33-2A	1
	Bathroom remote control	92078591	BC-45-2A	1
	2nd Bathroom remote control	WBSCO3	BSC-45-2A	1

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	Emergency Hot Water	Tel: (1800) 632 386
		10-11 Walker Street, Braeside, VIC 3195
		Tel: (03) 9271 6625 Fax: (03) 9271 6622
New South Wales:	Service	Tel: (02) 9609 2600 Fax: (02) 9729 0467
	Sales	Tel: (02) 9609 2888 Fax: (02) 9609 5260
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		Tel: (02) 9609 2111 Fax: (02) 9609 5260
South Australia:	Service	Tel: (08) 8345 0292 Fax: (08) 8345 4760
	Emergency Hot Water	Tel: (018) 81 4379
		140 Days Road, Ferryden Park, SA 5010
Western Australia:	Service	Tel: (08) 9478 3355 Fax: (08) 9277 2531
	Emergency Hot Water	Tel: (08) 9401 2562 North
		Tel: (08) 9457 1909 South
		18 Belgravia Street, Belmont, WA 6104
Queensland:	Service	Tel: (07) 3209 4622 Fax: (07) 3209 4722
		1/6 Booran Drive, Logan Central, QLD 4114
A.C.T.:	Service	Tel (06) 6280 4833 Fax: (06) 6280 6561
	Emergency Hot Water	Tel: (02) 9729 0468
		Rinnai Southern (Bird & Stirling Agencies Pty. Ltd.)
		3 Lithgow Street, Fyshwick, ACT 2609
Tasmania:		Contact Rinnai Melbourne on:
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