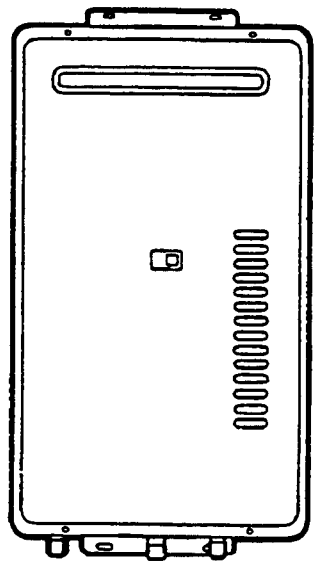
Rinnai

24 Litre Series

REU-2402W
REU-2402FFU

SERVICE MANUAL

INFINITY



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The Australian Gas Association

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

1st print January 1994
2nd print April 1996 (updated)
3rd print November 1996 (updated)

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.

Please REGISTER your details with our Support Services Department on tel: (03) 9586 7904 or fax: (03) 9586 7905, and we will ensure you are kept up to date with changes to specifications as well as receiving new model information as it becomes available.

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§ 1 INTRODUCTION

The REU-2402 W and REU-2402 FFU are part of a range of compact continuous flow water heaters designed and produced by Rinnai. The main features of this model are: compact size, high efficiency, remote temperature control, reduced noise, and the ability to prevent "the cold water sandwich effect".

Conventional water heaters supply water at high temperatures; this means that the pipe work in the house is also very hot. Hot pipes lose more heat than cooler pipes. With the Infinity 2402, the water in the house pipes can be kept much cooler, reducing heat loss and thus effectively saving energy.

The aim of this manual is to provide an operational reference **specifically** concerning the Infinity REU-2402 W and REU-2402 FFU water heaters. A glossary of abbreviations is provided on page 5, to assist you in understanding some of the terms used throughout this manual. Further information about this product is contained in the customers operation information booklet.

FEATURES

1. Q Function

These models each incorporate a high-tech mixing valve and high-tech electronic water flow control distribution device to minimise "the cold water sandwich effect" when a hot tap is repeatedly opened and closed. This is referred to as the "Q Function" throughout this manual.

2. Convenience

Wide proportional temperature control of the hot water from 2.7 to 24 litres per minute, ensures hot water at a suitable temperature is selectable throughout all seasons. Control of the water temperature while on the rise to a particular preset temperature with the feedforward and feedback control system prevents overheated water being supplied when the water heater is turned ON and OFF repeatedly. As a result of the adoption of the electronic water flow control distribution device; these units can be used in areas with low water pressure.

3. Installation

The light weight, slim, compact form enables easier, improved appearance installations. The main unit and controls are connected by 2 non-polar cables, eliminating problems of misconnection. Cable installation is simple.

4. Low Noise

Incorporation of the 49 dB(A) low noise design in the Infinity 2402 allows for installation in crowded or high density residential areas with minimum concern about noise complaints.

5. Safety

In the event of a malfunction, one or more of the various safety devices will operate. Depending on the fault, the Infinity 2402 will be shut down by the Printed Circuit Board (PCB), or directly by individual safety devices. In winter, the automatically operated anti-frost protection heaters (W-AK model only), ensure that the water in the appliance does not freeze. An over temperature shut-off sensing device and temperature lock help to prevent scalding whilst the hot water is flowing.

6. 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.

7. Water Temperature Control

The water temperature can be selected in 16 steps from 37°C to 75°C. The temperatures are 37-38-39-40-41-42-43-44-45-46-47-48-50-55-60-75°C. (The Infinity 2402 is delivered pre-set to a maximum of 55°C.) The remote controls are easy to use with ultra-light touch operation buttons. See point 9 for information on fixed upper limit temperatures. The maximum temperature selectable on the bath control is 50°C.

8. Cold Water Sandwich Prevention Device

This device monitors the temperature of water in the heat exchanger, and at the outlet of the water heater for 8 minutes after the burner extinguishers. If a tap is turned back on during this time, this device mixes the pre-heated water in the heat exchanger with cold water, before the main burner ignites. This means that the temperature of water at the tap does not vary by more than 3°C when the hot water tap is turned off and on repeatedly.

9. Pre-set Temperature Limits

The Infinity 2402 can be pre-set to supply water at a maximum temperature of 40°C, 50°C, 55°C and 75°C, with or without remote controls. This means that the Infinity 2402 can be set to comply with various State laws on temperature control in homes, child care centres, and elderly care centres. See page 10 for additional information.

10. Over Temperature Protection

The Infinity 2402 incorporates a device to prevent the hot water temperature exceeding the pre-set temperature by more than 3°C.

11. Temperature Locks

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. The Infinity 2402 can be turned off, but not on again whilst the water is flowing.

12. Third Remote Control

An optional third remote control is available for use in a second bathroom or ensuite.

§ 2 ABOUT THE 2402 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 of the externally mounted Infinity 2402 prevent water from entering the appliance.

Air inlets are situated in the front panel of the externally mounted Infinity 2402. In the case of the internally mounted Infinity 2402, air for combustion is drawn from outside the building, and combustion products discharged outside the building through a co-axial flue system. The general layout of components is shown on the cut-away diagram on page 11. 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 by the combustion fan.

The burner assembly is made up of 18 identical stainless steel bunsen burners, secured by an aluminised steel framework. A 2 chamber aluminium manifold with 18 injectors supplies gas to the burners, and is attached to the front lower cover of the burner box.

There are three water temperature thermistors - one fitted within the electronic water flow control device, checking the incoming water temperature - part of the feedforward information; another fitted to the outlet of the heat exchanger, checking the temperature of the water as it leaves the heat exchanger; and a third situated at the outlet of the unit, checking the outgoing water temperature. The Infinity 2402 relies on feedforward and feedback information to operate effectively. See page 17 for further explanation about how this control function operates. The internally mounted Infinity 2402 has an additional thermistor checking combustion air temperature.

§ 3 GLOSSARY of ABBREVIATIONS

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

dB(A)	-	sound pressure level in decibels, "A" range.
AC	-	alternating current.
DC	-	direct current.
EWFCD	-	electronic water flow control device.
FB	-	feedback information.
FF	-	feedforward information.
Hz	-	Hertz.
IC	-	integrated circuit.
kcal/h	-	kilocalorie per hour.
kPa	-	kilopascals.
L/min	-	Litres per minute.
LED	-	light emitting diode.
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.
TE	-	thermal efficiency.
TIN	-	temperature of incoming water.
TOUT	-	temperature of outgoing water.
WDC	-	water distribution control device

Flame Failure

Situated on the left of the burner at the front, the flame rods monitor normal 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.

Boiling Protection

The heat exchanger outlet water temperature thermistor continually monitors the temperature of the water flowing from the heat exchanger. Should the temperature of the water at this point reach 105°C then a signal will be sent to the PCB to shut off the solenoids and isolate the gas.

No Water

Should the incoming water flow become restricted or stop, then the 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 152°C (129°C FFU), 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 (Used only on units specified K)

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 will prevent freezing down to -20°C in a no wind situation, and -15°C in a windy situation. (Not used on the internally mounted Infinity 2402.)

3°C Over Temperature Cut-Off

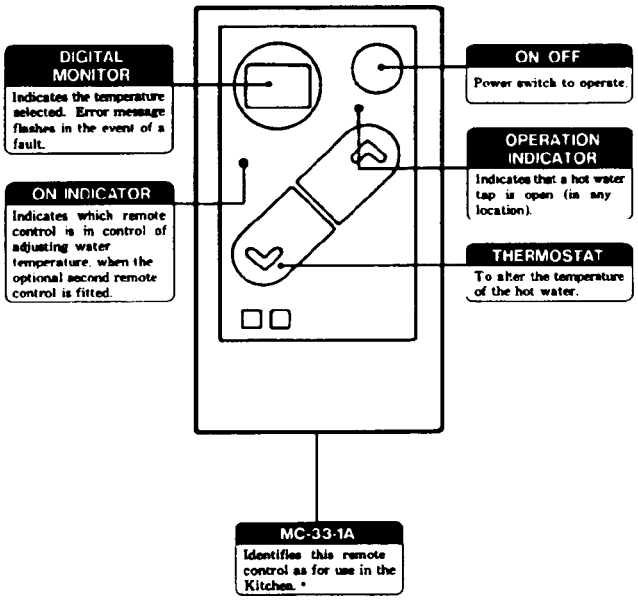
The temperature of the outgoing hot water is constantly monitored by the outgoing water temperature thermistor. If the outgoing water temperature rises to more than 3°C above the preset temperature, the burner will automatically go out. The burner will ignite again once the outgoing hot water temperature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

1. Design

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 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 memory functions on the bath control will differ from those shown in the customer's Operating Booklet (for detailed information, contact Rinnai).

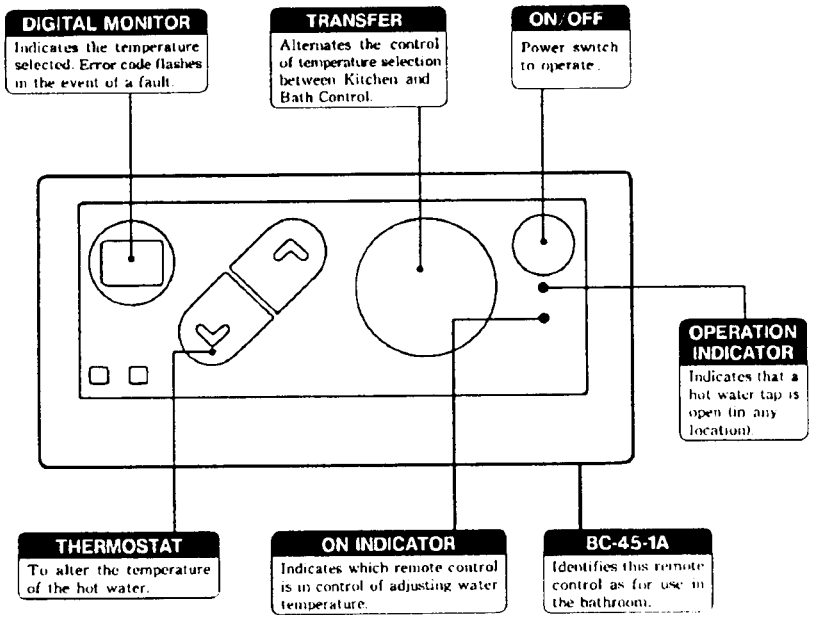
For water heaters manufactured from mid-March 1996, the correct remote controls to use are the MC-33-2A and BC-45-2A (see page 7).

Kitchen Remote Control (Up to Mid-March 1996)



This remote control is also suitable for installation in laundry areas

Bathroom Remote Control (Up to Mid-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 not operate exactly as explained in the Customer's Operating Booklet. (For detailed information, contact Rinnai.)

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

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

* Larger LED display.

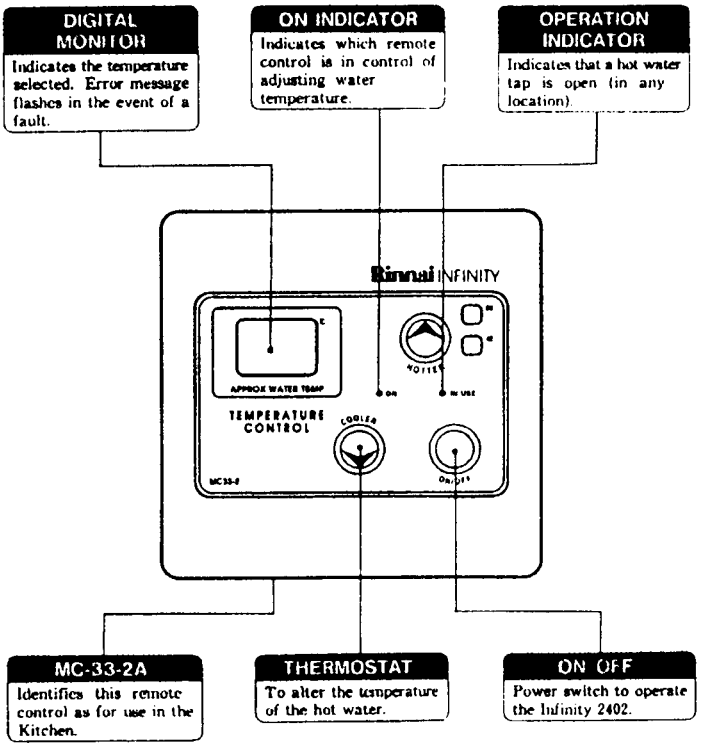
* Water temperature adjustment in the range of 37°C to 43°C whilst hot water is flowing.

* 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.

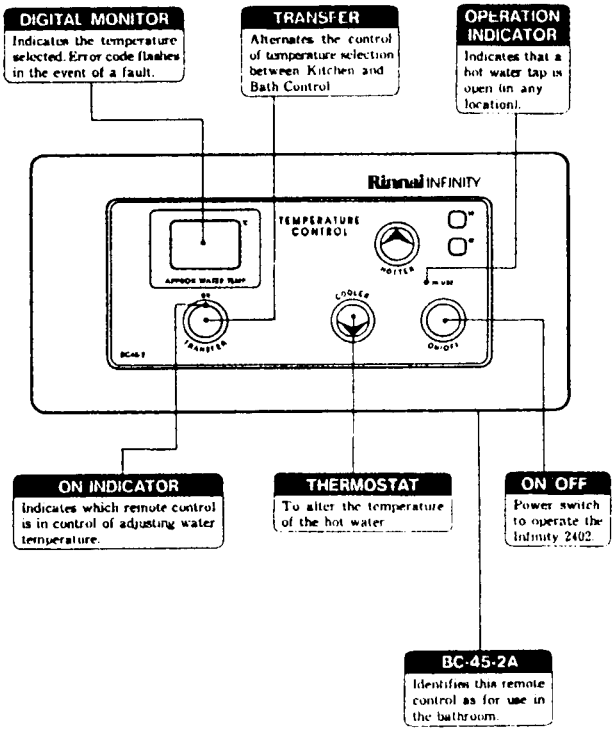
Different temperatures can be stored in the memory of each remote control.

Kitchen Remote Control (From Mid-March 1996)



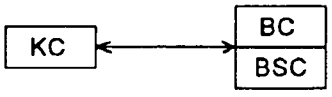
This remote control is also suitable for installation in laundry areas.

Bathroom Remote Control (From Mid-March 1996)

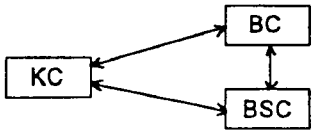


2. Communication between remotes

The transfer button enables the customer to select and lock a preferred temperature at either bathroom remote control. The communication network for each specification remote control differs. A complete explanation is provided in the Customer's Operating Booklet, but a summarised illustration is shown here.



Up to Mid-March 1996



From Mid-March 1996

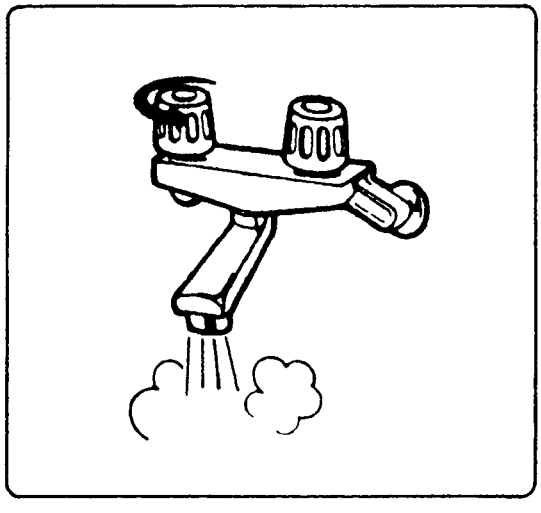
Priority temperature selection is now available at each remote.

Note: Each remote control now has its own separate system memory.

3. Safety

While the hot water tap is open the following safety features apply.

- Temperature selection cannot be transferred between remotes.
- Water temperature cannot be adjusted while hot water tap is open. (Up to mid-March 1996)
- Water temperature can only be adjusted between 37°C and 43°C. (From mid-March 1996)
- The Kitchen and Bath Control cannot be turned ON.



The temperature of outgoing hot water is constantly monitored by a built-in sensor. If the temperature of the outgoing hot water rises to more than 3°C above the selected temperature shown on the Digital Monitor of the remote control, the burner will automatically go out. The red operation lamp will also go out. The burner will ignite again once the outgoing hot water temperature falls to that shown on the Digital Monitor.

§ 6 SPECIFICATION

Type of appliance	Temperature controlled continuous gas hot water system.	
Operation	Remote control, mounted in kitchen, bathroom, or ensuite.	
Exhaust system	Forced Flue.	
Rinnai Australia model N°	REU-2402 W-A (Standard) REU-2402 W-AK (Anti-frost)	REU-2402 FFU-A (Standard) Anti-frost - not available.
Installation	Externally mounted.	Internally mounted.
Dimensions	Width - 350 mm. Height - 610 mm. Depth - 185 mm.	Width - 370 mm. Height - 680 mm. Depth - 200 mm.
Weight	22 kilograms.	25 kilograms.
Gas rating	Natural Gas - 188 MJ/h Propane Gas - 188 MJ/h Towns Gas - 183 MJ/h	Natural Gas - 188 MJ/h Propane Gas - 188 MJ/h Not approved for TG
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	2.7 to 24 L/min. [Raised 25°C]	
Temperature range	37°C to 75°C in 16 steps.	
Water temperature control	Feedforward and feedback (Modulating control).	
Default temperature settings	40°C, 50°C, 55°C, 75°C (Set by combination of switches on PCB)	
Water flow control	Electronic water flow control distribution device (2.7~24 L/min)	
Minimum operating pressure	10 kPa.	
Nominal operating pressure	150 to 830 kPa.	
Minimum operating water flow	2.7 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. Over temperature - 105°C lockout thermistor. Fusible link - 152°C (W-A). 129°C (FFU-A). 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 - Optional 3rd control (Ensuite).	
Cable	UC-25C-20A - (20 Metres). Non-polarised.	

§ 7 COMBUSTION SPECIFICATION

ITEM		REU-2402 W External			REU-2402 FFU Internal		
		L.P.G.	N.G.	T.G.	L.P.G.	N.G.	T.G.
INPUT	MJ/h	188	188	183	188	188	※
	kcal/h	45000	45000	43500	45000	45000	※
Injector size (18 pieces) (mm)		Ø1.0	Ø1.7	Ø3.1	Ø1.0	Ø1.8	※
Damper* (1 piece)		C	C	E	B	A	※
Pressure (kPa)	LO	0.13	0.06	0.04	0.18	0.07	※
	HI	2.00	0.70	0.37	2.06	0.68	※
Burner type		LP.NG	LP.NG	TG	LP.NG	LP.NG	※
Dip Switch positions		Prefer to page 8 ~ 10					
Maximum Capacity							
Modulating valve (mA)		216	135	104	226	134	※
Combustion fan (Hz)		122	113	120	147	139	※
Minimum Capacity							
Modulating valve (mA)		20	20	20	20	20	※
Combustion fan (Hz)		42	45	50	43	45	※
Slow Ignition							
Fully open POV (mA)		115	85	44	164	107	※
Half open POV (mA)		115	85	44	164	107	※
Fan (Hz)		65	65	67	90	90	※

* Indicated by an imprint on actual component.
※ The REU-2402 FFU-A is not approved for use on Town Gas.

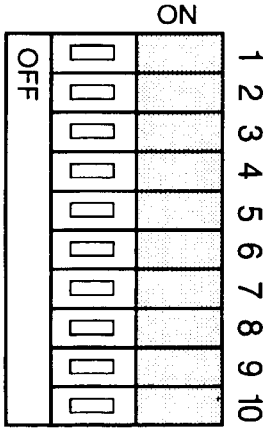
§ 8 DIP SWITCH POSITIONS

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 up in different operating configurations. The set-up configuration for the water heater differs depending on:

* Gas type
* Flue type (FFU Only)
* Outgoing water temperature limiting requirements

Dip switches



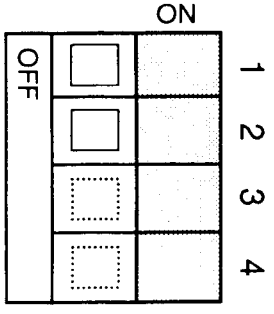
1 & 2	:	Gas type
3	:	Not used
4	:	Flue length (FFU only)
5 ~ 8	:	Temperature control **
9 & 10	:	Gas pressure

** The maximum temperature of hot water can be limited to 40°C, 50°C, 55°C, or 75°C, using these switches in various combinations. (See page 10, Nº. ③) In some instances such as nursing homes or even domestic situations, you may be asked to limit the temperature of the hot water produced by the units. In which case use this as reference.

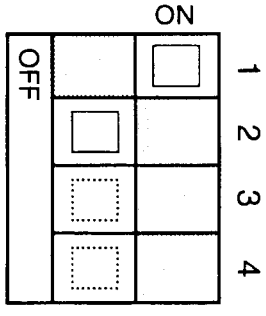
The individual switch position functions are fully explained on the following pages.

① **Gas type**

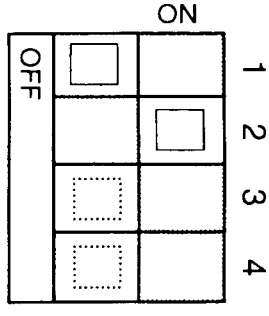
Only alter gas type positions when conversion is required. For conversion instructions refer to page 57.



Natural Gas



Propane/LPG



Town Gas

② Flue type (FFU only)

Do not alter this switch position on the external model - REU-2402 W-A(K).

To help prevent condensation in the flue, the combustion fan has two settings. Dip switch number 4 controls the combustion fan speed. This switch position will determine the fan speed to compensate for back pressure when using extended flues. Switch number 4 is normally set to the "ON" position; this is suitable for direct flueing using a mushroom flue and 90° L Bend.

When installing the FFU model using an extended flue, you will need to decide which position switch №.4 should be in. The following formula must be used to determine the position. To calculate when to turn the switch "OFF", use the following formula to calculate "D".

$D = L + (M \times 2)$

L = Length of flue in metres.
M = Number of bends.

When D is 7 or more, turn switch number 4 to the "OFF" position.
When 45° bends are used, calculate using the following formula:

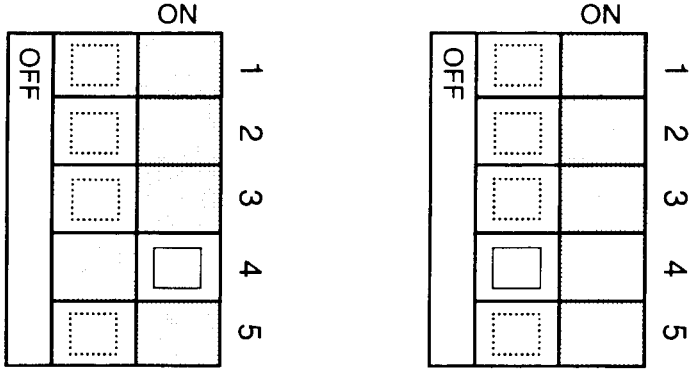
$D = L + (M \times 0.5)$

Examples: 2 metres of flue, and 2 x 90° bends
$D = 2 + (2 \times 2)$, → $D = 2 + 4$, → $D = 6$ ➜ switch 4 to "ON".

3 metres of flue, and 2 x 90° bends
$D = 3 + (2 \times 2)$, → $D = 3 + 4$, → $D = 7$ ➜ switch 4 to "OFF".

If D is greater than 13, the flue is too long or there are too many bends.

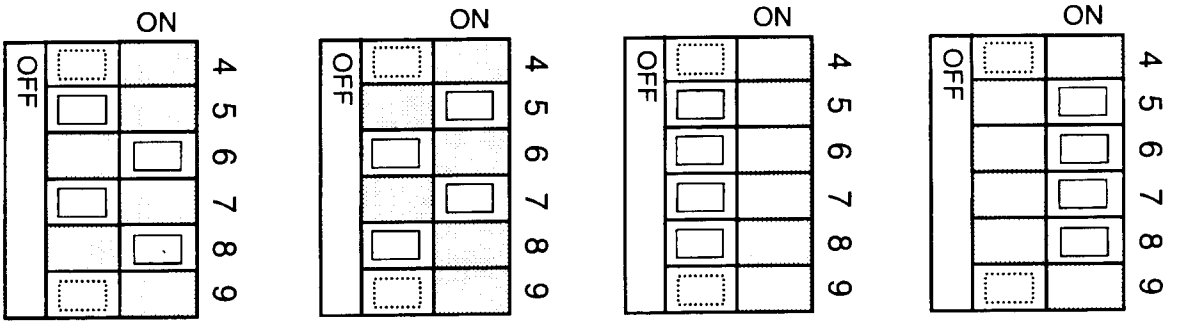
Do not alter switch position before checking position requirement using the above formula.



③ Temperature limiting

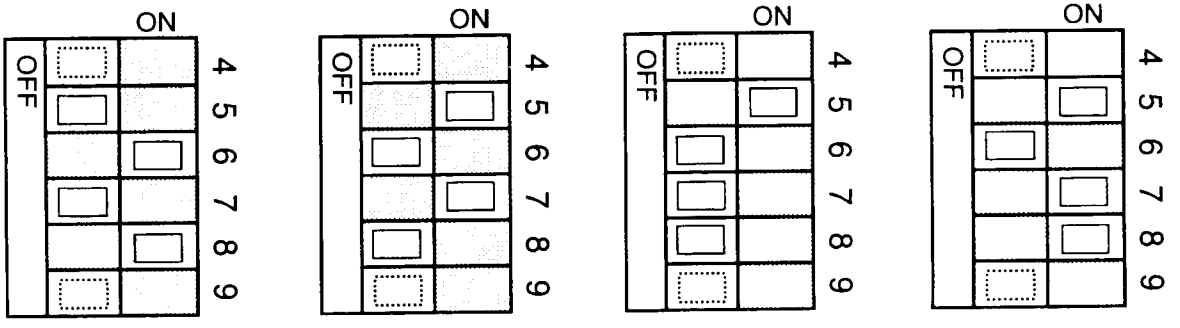
There are various positions, depending on the temperature limit required, and whether the remotes are connected or not.

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



If the remote controls are connected later with the switches in these positions, the maximum temperature which can be selected on the control will be the same as those indicated above.

b) Pre-set temperatures with the *remotes connected*



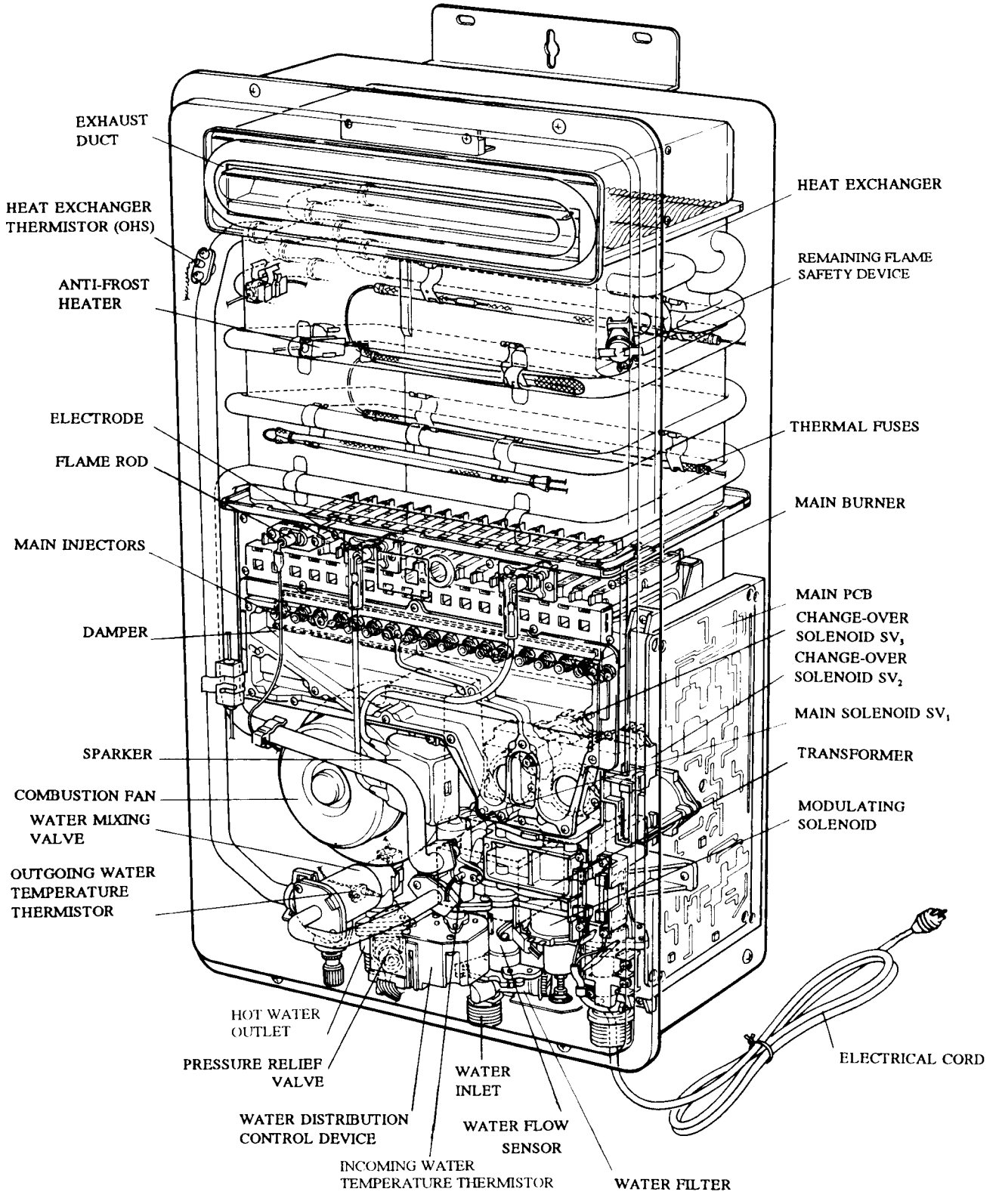
With remote	40°C	50°C	55°C	75°C
Default temp. if remote is disconnected	40°C	50°C	50°C**	50°C**

** These settings provide a safe default temperature if the remote controls become disconnected. If there is a particular reason for needing to set the default higher, please contact Rinnai Technical Services Department for further information.

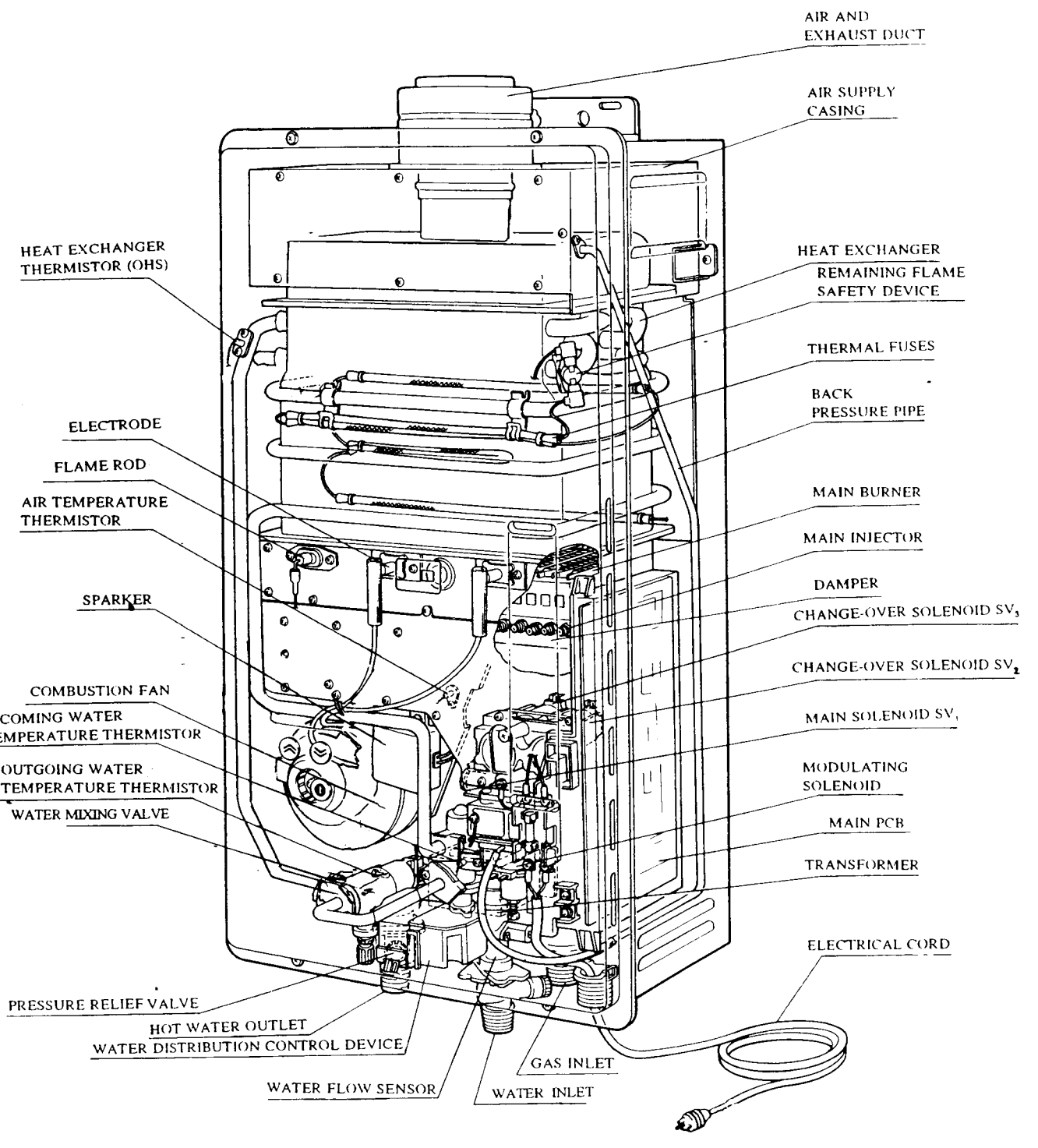
** **If switch No. 5 is placed in the "OFF" position, the default temperature if remotes become disconnected will be 55°C.**

§ 9 CUT- AWAY DIAGRAM

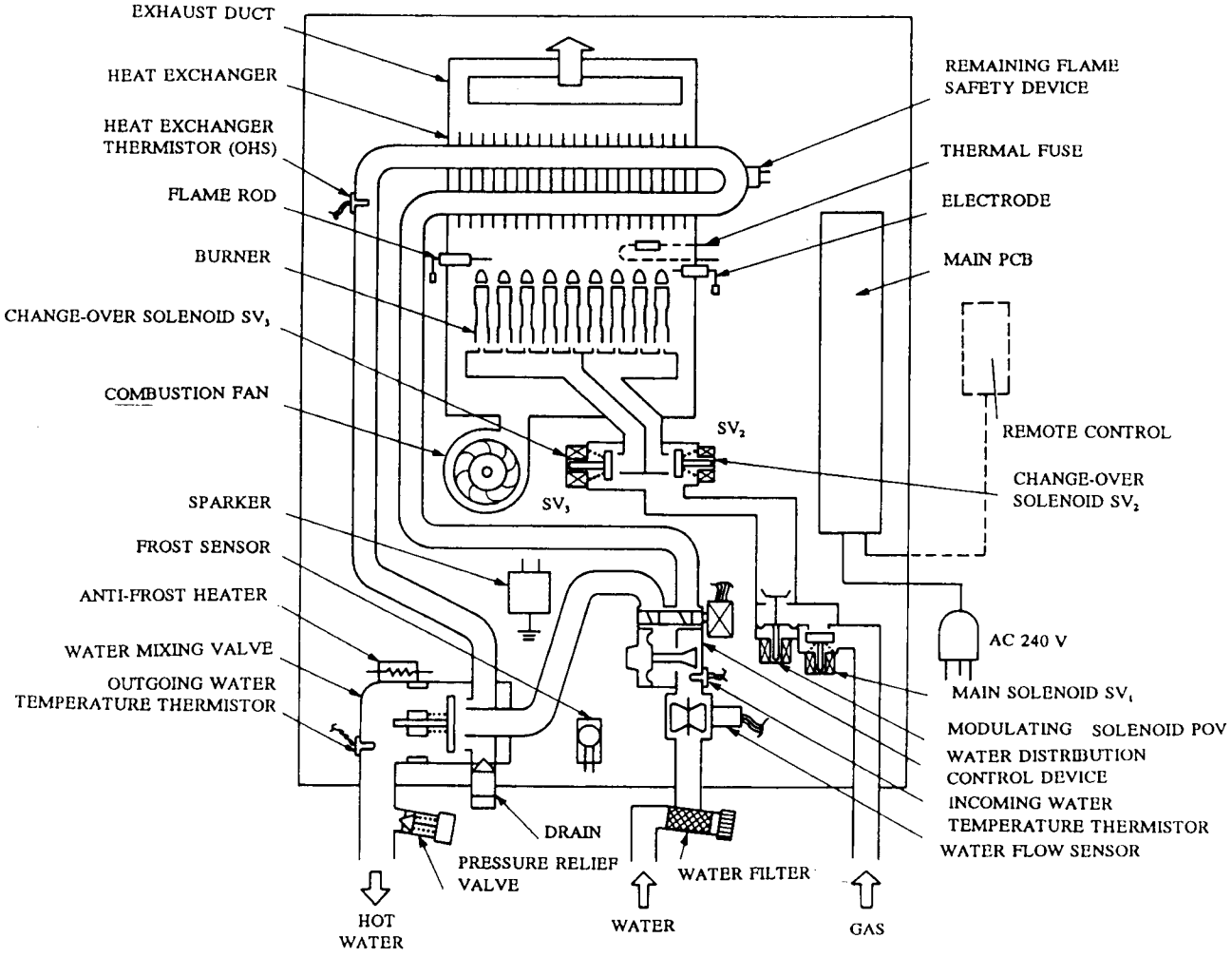
REU-2402 W (EXTERNAL)

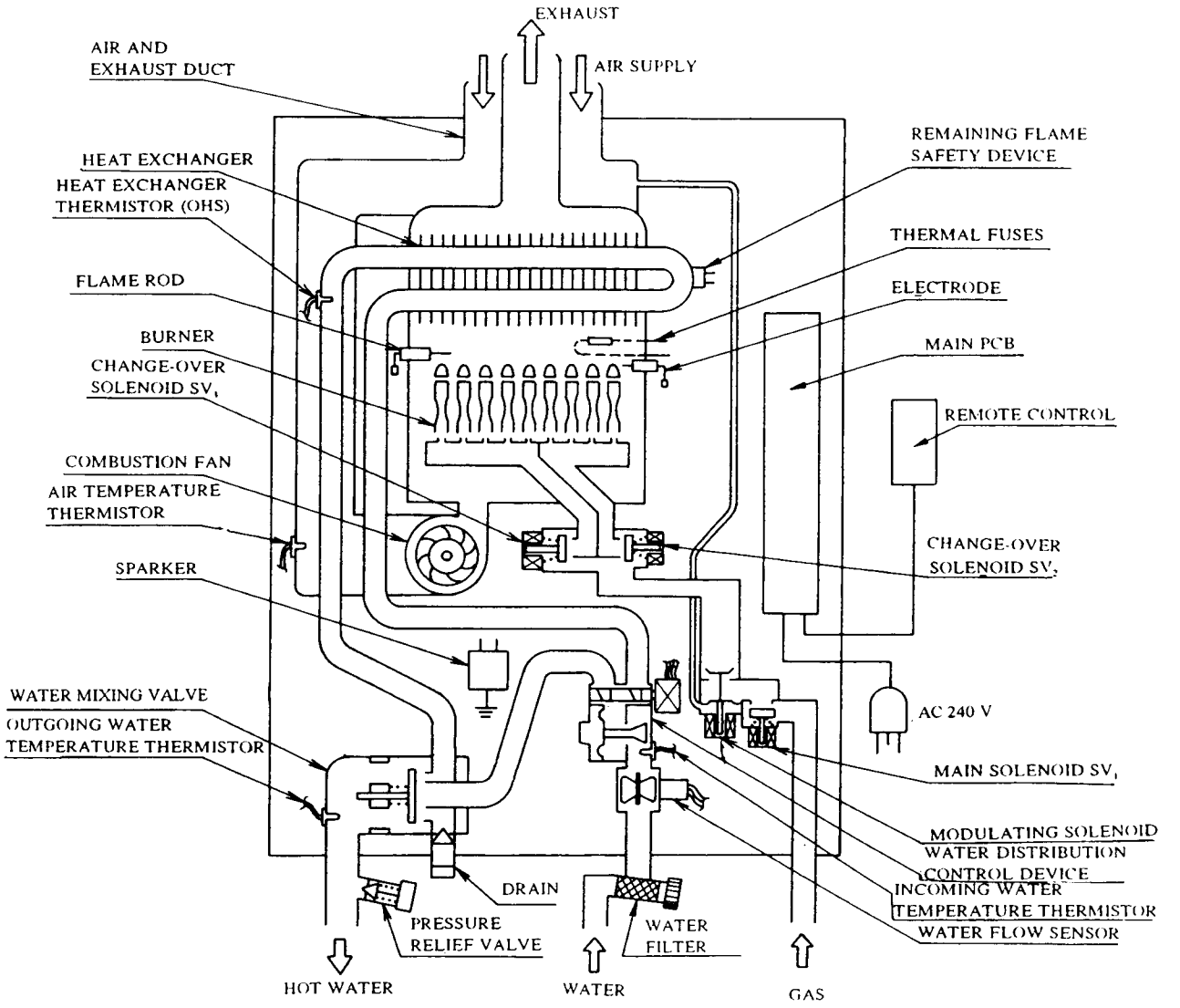


REU-2402 FFU (INTERNAL)

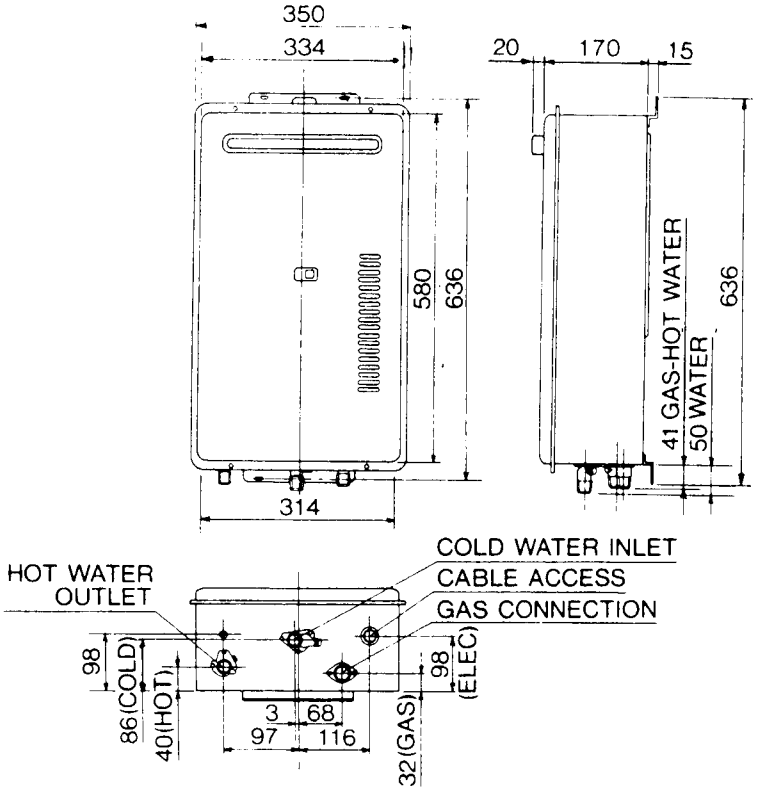


REU-2402 W (EXTERNAL)

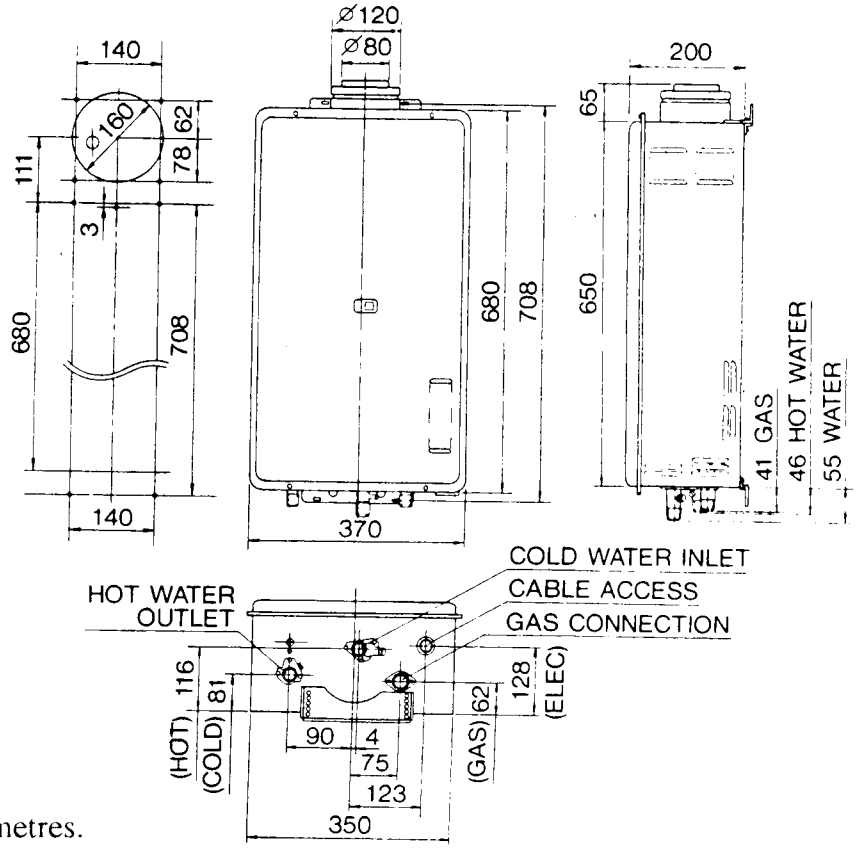



EXHAUST
AIR AND
EXHAUST DUCT
AIR SUPPLY
REMAINING FLAME
SAFETY DEVICE
HEAT EXCHANGER
HEAT EXCHANGER
THERMISTOR (OHS)
THERMAL FUSES
FLAME ROD
ELECTRODE
BURNER
MAIN PCB
CHANGE-OVER
SOLENOID SV1
REMOTE CONTROL
COMBUSTION FAN
AIR TEMPERATURE
THERMISTOR
CHANGE-OVER
SOLENOID SV2
SPARKER
WATER MIXING VALVE
AC 240 V
OUTGOING WATER
TEMPERATURE THERMISTOR
MAIN SOLENOID SV3
MODULATING SOLENOID
WATER DISTRIBUTION
CONTROL DEVICE
INCOMING WATER
TEMPERATURE THERMISTOR
WATER FLOW SENSOR
DRAIN
PRESSURE
RELIEF VALVE
WATER
FILTER
HOT WATER
WATER
GAS

REU-2402 W (EXTERNAL)

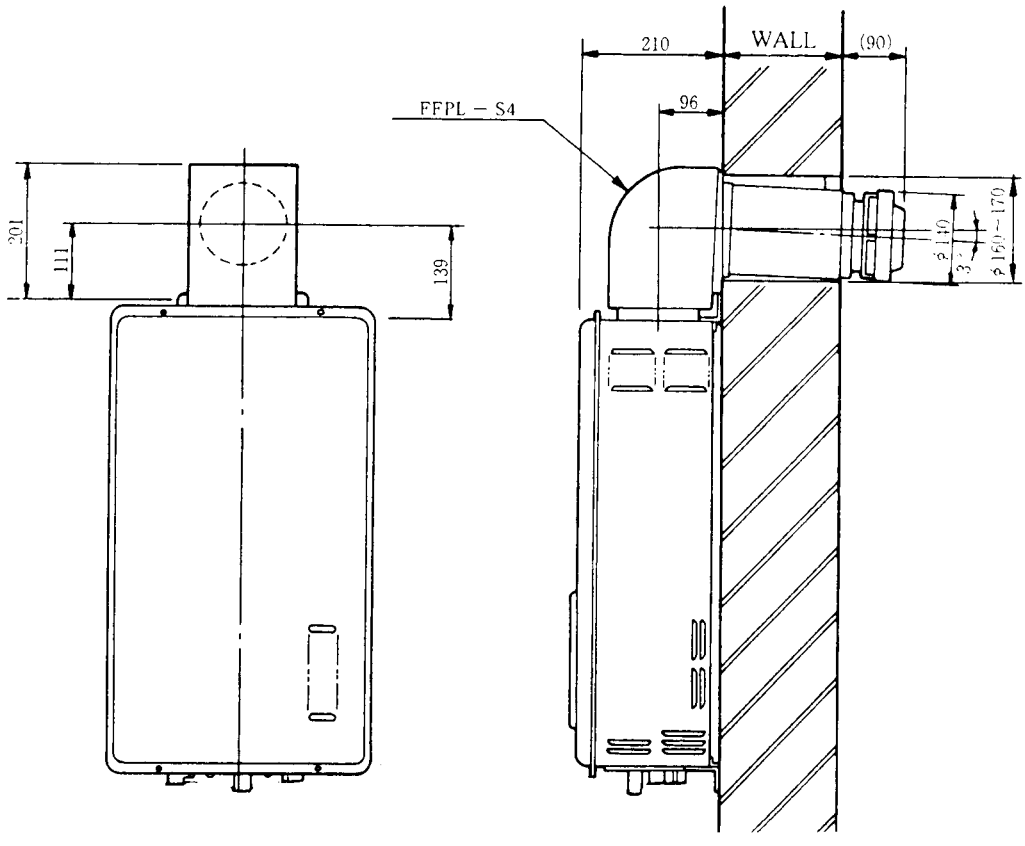


REU-2402 FFU (INTERNAL)

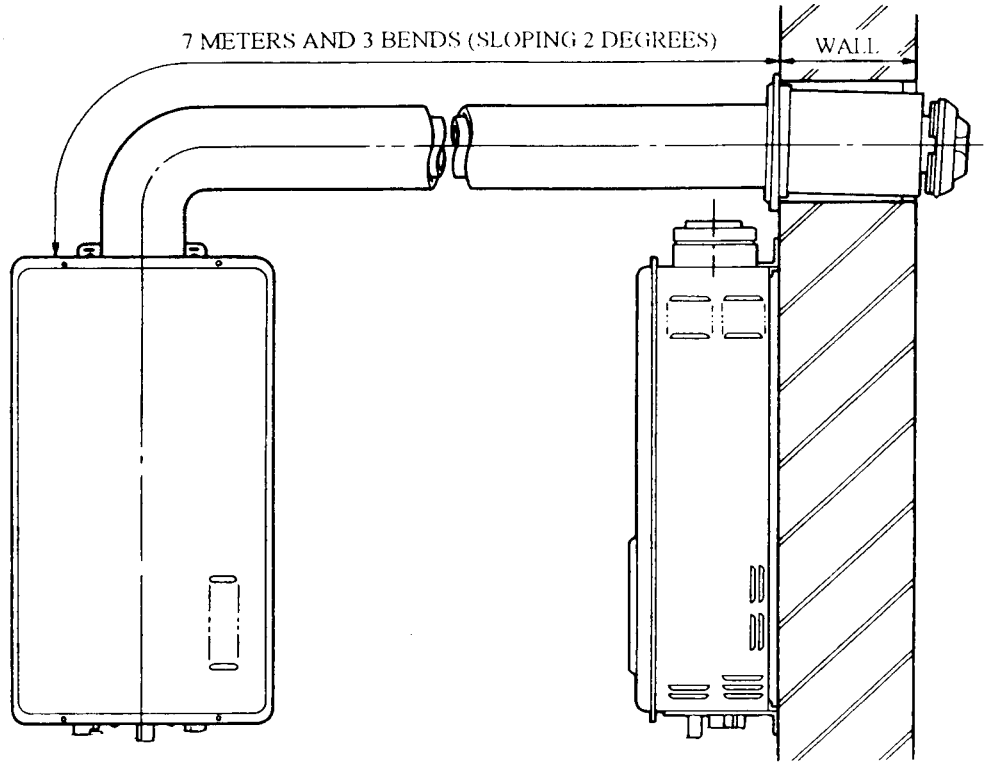


All dimensions are in millimetres.

REU-2402 FFU **Direct fluing installation**



REU-2402 FFU **Extension fluing installation**



§ 13 FEEDFORWARD AND FEEDBACK

The CPU on the PCB monitors incoming water temperature, (0.01 second data sampling), incoming water flow, outgoing water temperature and the pre-set temperature to modulate the required gas input and air/gas ratio to ensure optimum control of the outgoing water temperature and water flow. While the gas input is constantly monitored to maintain hot water capacity, the water flow servo (by-pass mixing device), controls outgoing hot water conditions and drives the water distribution control device in accordance with pre-programmed conditions, to guarantee outgoing hot water at the pre-set temperature.

a) Feedforward Information

This is the information which the water heater uses to calculate the required parameters to give the temperature selected on the remote control. The data used is
a) Incoming water temperature
b) Water flow
c) Selected pre-set temperature at the remote control

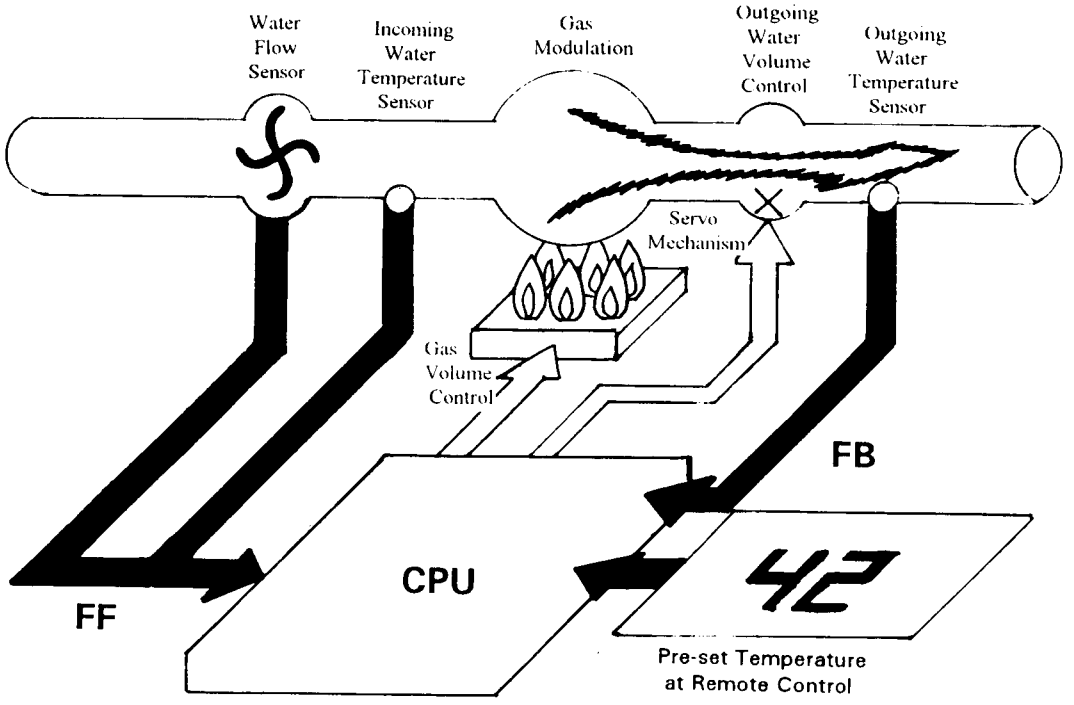
This data is continually monitored by the PCB and adjustments are made to maintain the temperature selecte on the remote control.

b) Feedback Information

This information is provided by the outgoing water temperature thermistor. The PCB checks the temperature selected on the remote control against the temperature indicated by the outgoing water temperature thermistor, and makes adjustments to the gas rate or water flow as required to maintain the temperature selected on the remote control.

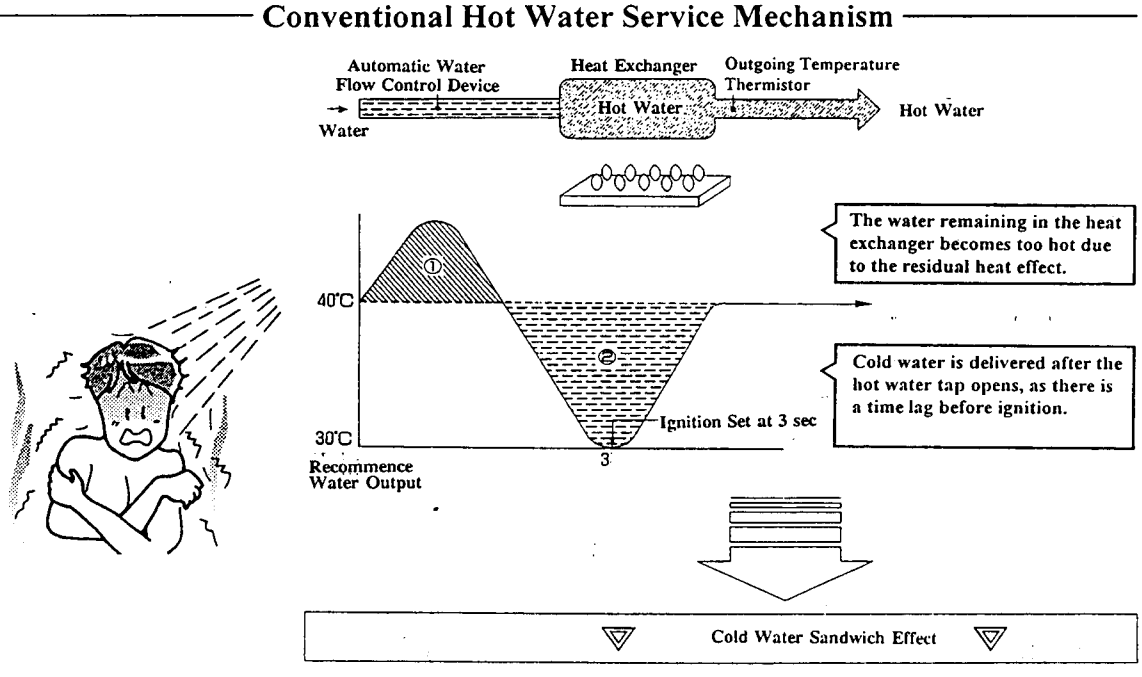
The temperature of the water discharged from the heat exchanger is maintained above 60°C. This is to prevent condensation inside the heat exchanger. A thermistor located near the outlet of the heat exchanger monitors the water temperature of the water at the point of discharge from the heat exchanger.

The schematic diagram below indicates those components which are incorporated into the feedforward and feedback system.



What is the Cold Water Sandwich effect ?

When combustion in the water heater stops after the shower (or other tap) has been turned off, the hot water remaining inside the heat exchanger absorbs the residual heat of the heat exchanger and becomes hotter. The next time a tap is turned on, that water flows out first. Due to the time lag between the new flow of water and burner ignition, first "hot" then "cold" water flows before water temperature stabilises. This is known as the "Cold Water Sandwich".



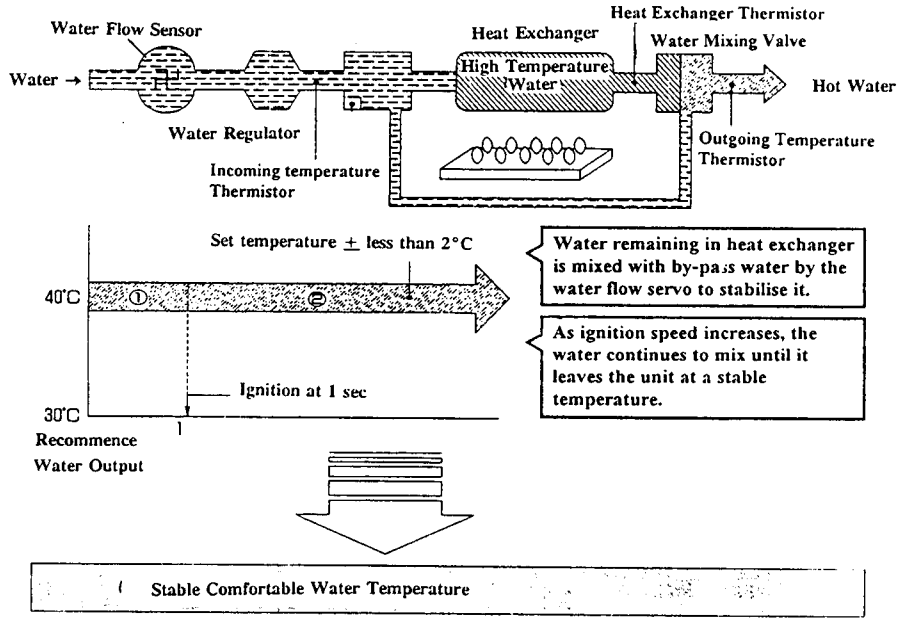
Eliminating the Cold Water Sandwich

Once the shower tap has been turned off and combustion stops, the outgoing water thermistor and the heat exchanger outlet thermistor take over constant supervision of data collection about the hot water temperature as it changes continuously due to residual heat in the heat exchanger.

When the hot water is drawn on again, the electronic water flow control device stepping motor uses that data to adjust the heat exchanger water flow and the bypass water flow to the optimum levels to provide a supply of hot water at the correct temperature (pre-set temperature). So, the next time a tap is used, hot water flows at the pre-set temperature as the water stored in the heat exchanger and water from the bypass mix together.

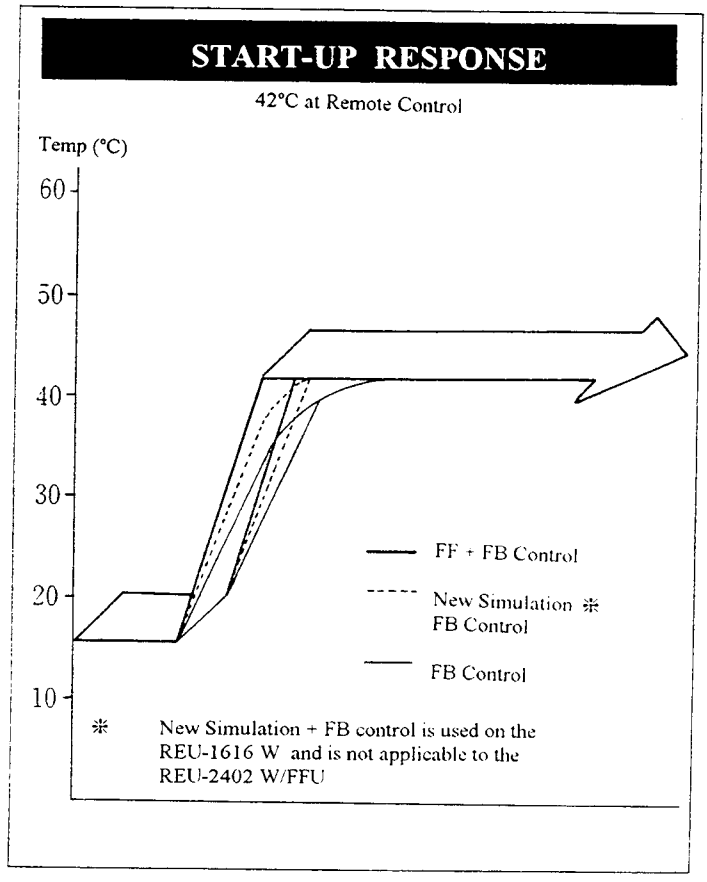
A diagram on the following page explains this schematically.

WDC Mechanism on Hot Water Services with Q Function



Quick start-up

The pre-set temperature is achieved more rapidly because ignition occurs in one third of the time taken by conventional systems.



Getting Maximum Benefit from the water heater

The 'Q' in 'Q-Function' comes from Quality.

Thanks to the 'Q-Function' one of the largest drawbacks in instantaneous water heaters, the so called cold water sandwich, which caused hot and lukewarm flushes of water with intermittent use, has been almost completely eliminated. Now hot water is supplied at the pre-set temperature whenever it is required, with no noticeable temperature change.

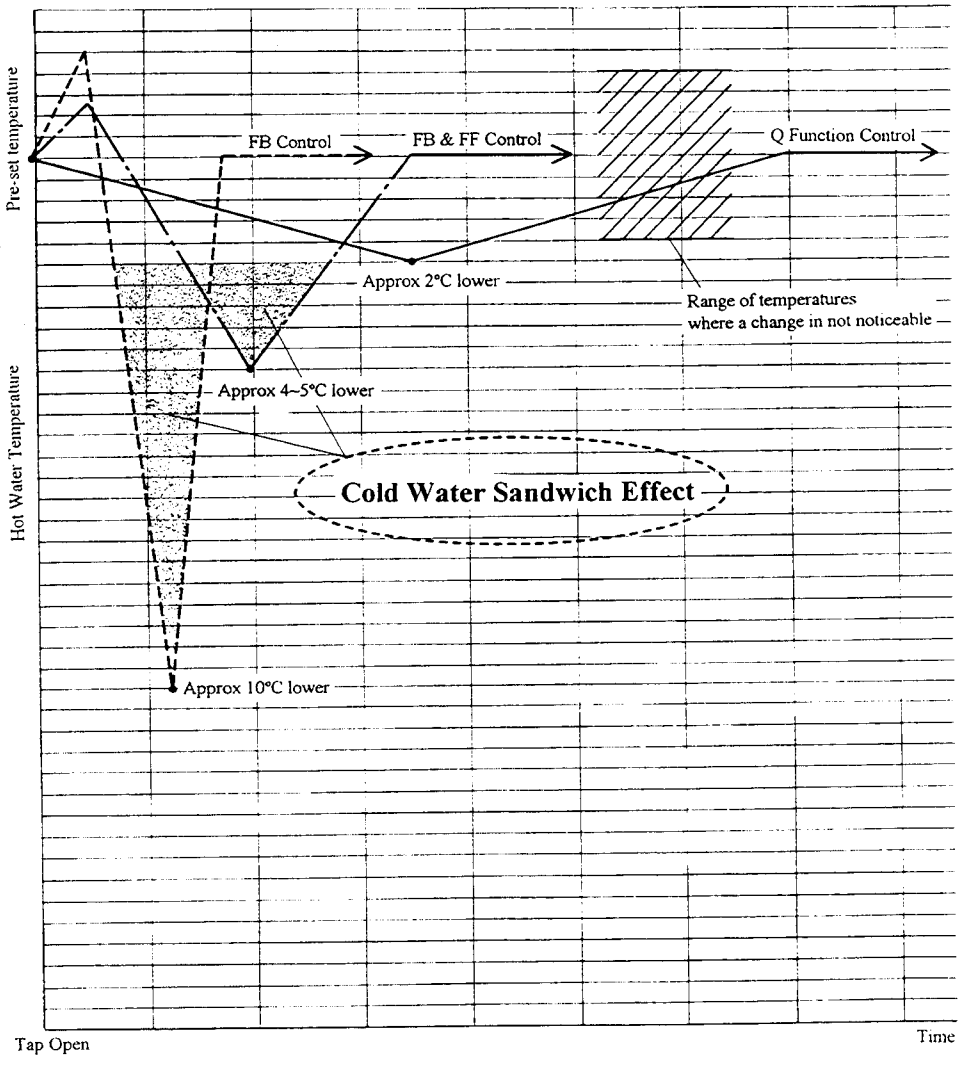
The Q Function.

[Definition] enables an ongoing and stable hot water supply during use (particularly in the shower).

[Features] ensures a maximum temperature fluctuation range within ±3°C during actual use. In actual use, temperature will fluctuate within only ±3°C, if stopped and restarted up to 5 mins later.

Hot water characteristics differ depending on control method

This graph below shows the difference in heat up response time between conventional control systems; improved feedforward and feedback control systems; and the new improved `Q' function system.



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 indicate the water flow from the Infinity 24 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. At 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:

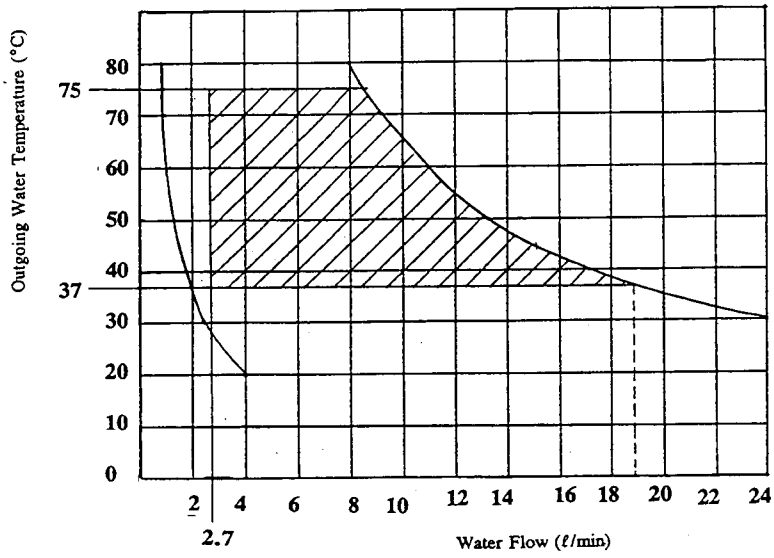
The following information is an outline of the formula required to measure accurately the flow rate in litres per minute, as well as being the base for the charts on the next page. The most useful way in which this formula can be utilised, is to calculate the water flow rate where there is maximum gas 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 calculation is to multiply the input in MJ/h by 239.

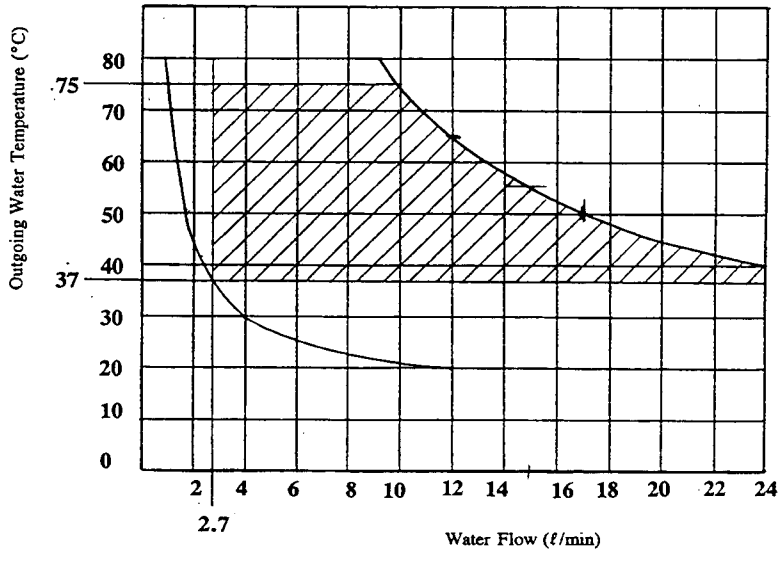
* Thermal efficiency may be in the range of 78% to 90%, depending on the temperature rise and water flow. For the purpose of the following calculation we have assumed an efficiency of 80%.

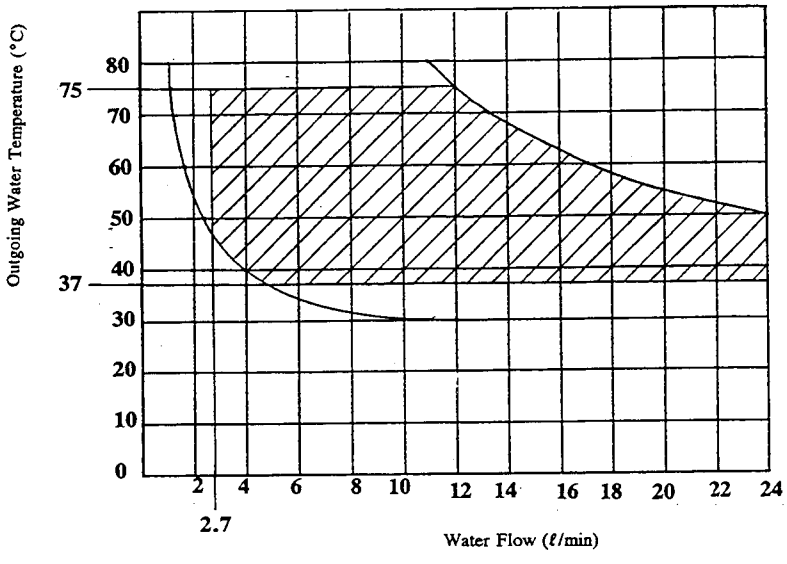
Example data			Calculation		
			Formula: IN x TE =(Tout - Tin) x 60 x Q		
Tin	=	15°C	45000 x 0.8	=	(60 - 15) x 60 x Q
			36000	=	45 x 60 x Q
Tout	=	60°C			
			36000 / 45	=	60 x Q
IN	=	45000 kcal/h			
TE	=	80%	800	=	60 x Q
Q	=	Water flow in litres per minute	800 / 60	=	Q
			13.3 L/min		



The chart opposite indicates that the water flow rate of the Infinity 24 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 24 will, 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 24 will, at a preset temperature of 50°C and an **incoming water temperature of 25°C,** be 24 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)	24 (L/min)	20 (L/min)	17.1 (L/min)	13.3 (L/min)	10.9 (L/min)

§ 16 GAS CONSUMPTION

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

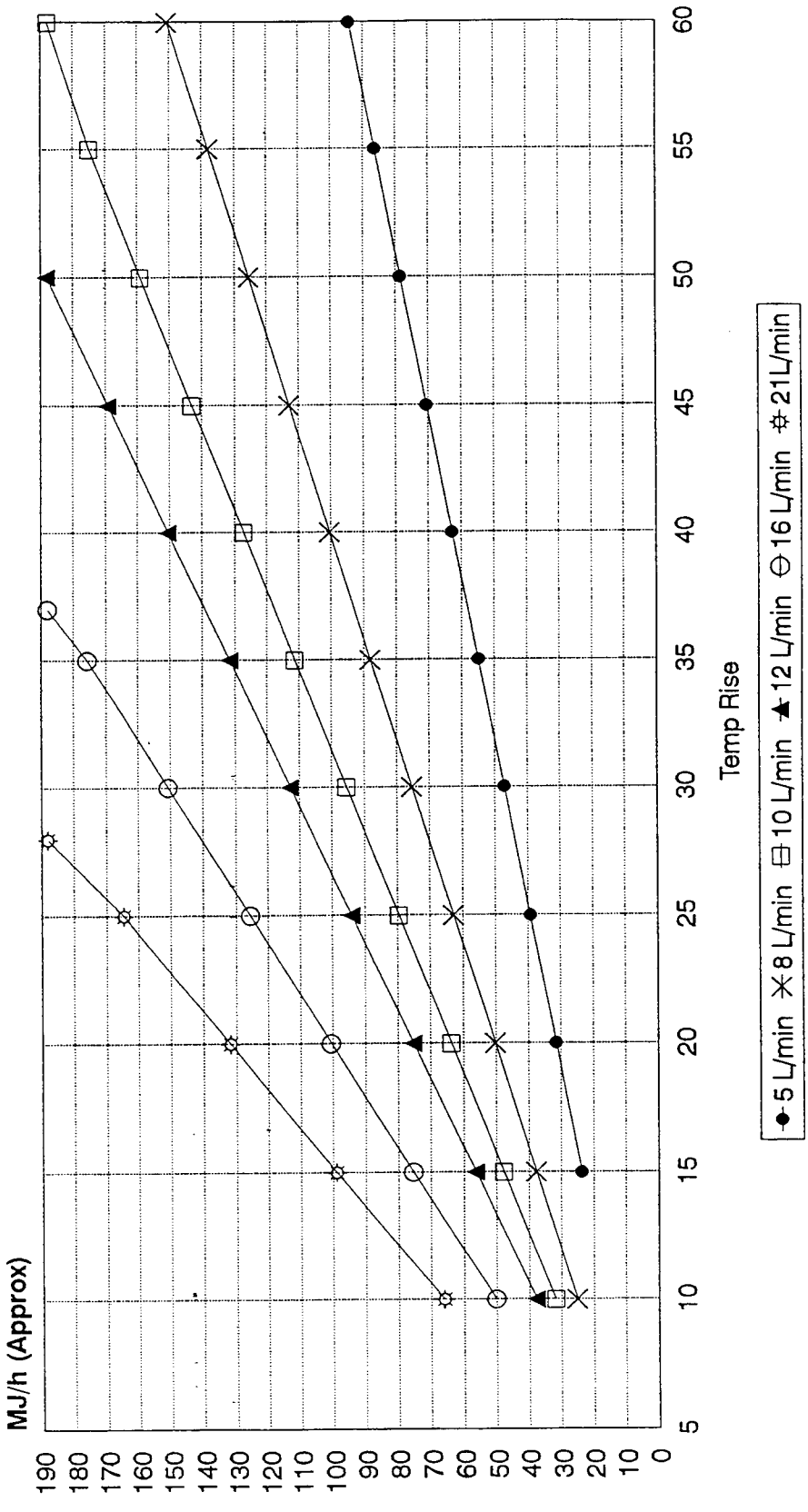
Formula: $\frac{(Tout - Tin) \times Q \times 60}{239 \times TE} = IN\ MJ/h$

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

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

The Infinity 24 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.

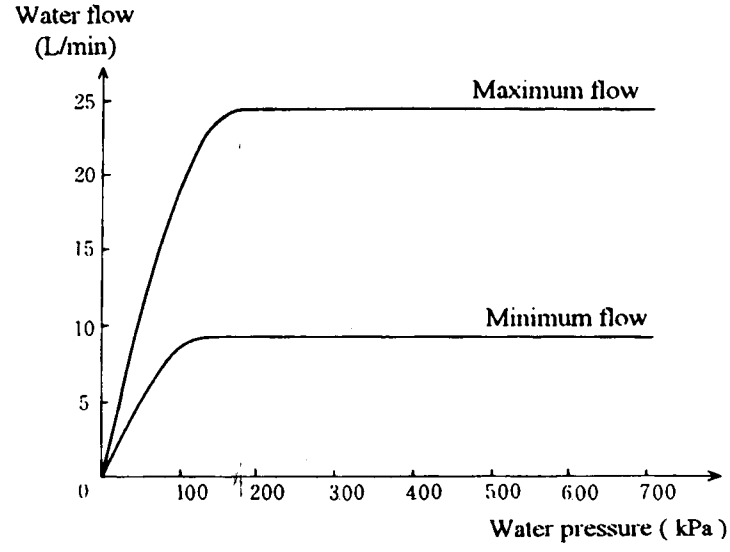
1. Mechanical Water Regulator

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 shows the performance when the electronic water flow control is open, the lower line when it is closed.

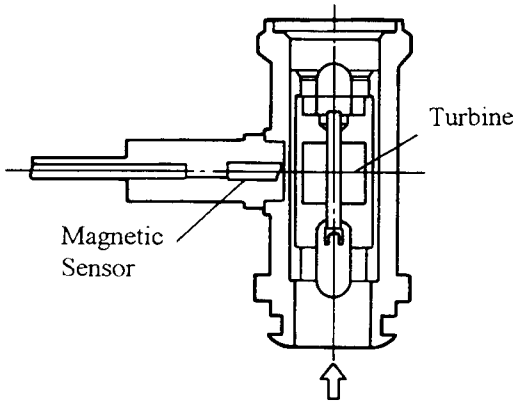
The bottom line shows that with the electronic water flow control device closed, the maximum flow is 9 L/min. This maximum flow is reached at 100 kPa inlet pressure. The top line shows that with the electronic water flow control device open, the maximum flow is approximately 24 L/min. This maximum flow is reached at 150 kPa inlet pressure.

Note: Although the Infinity 24 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

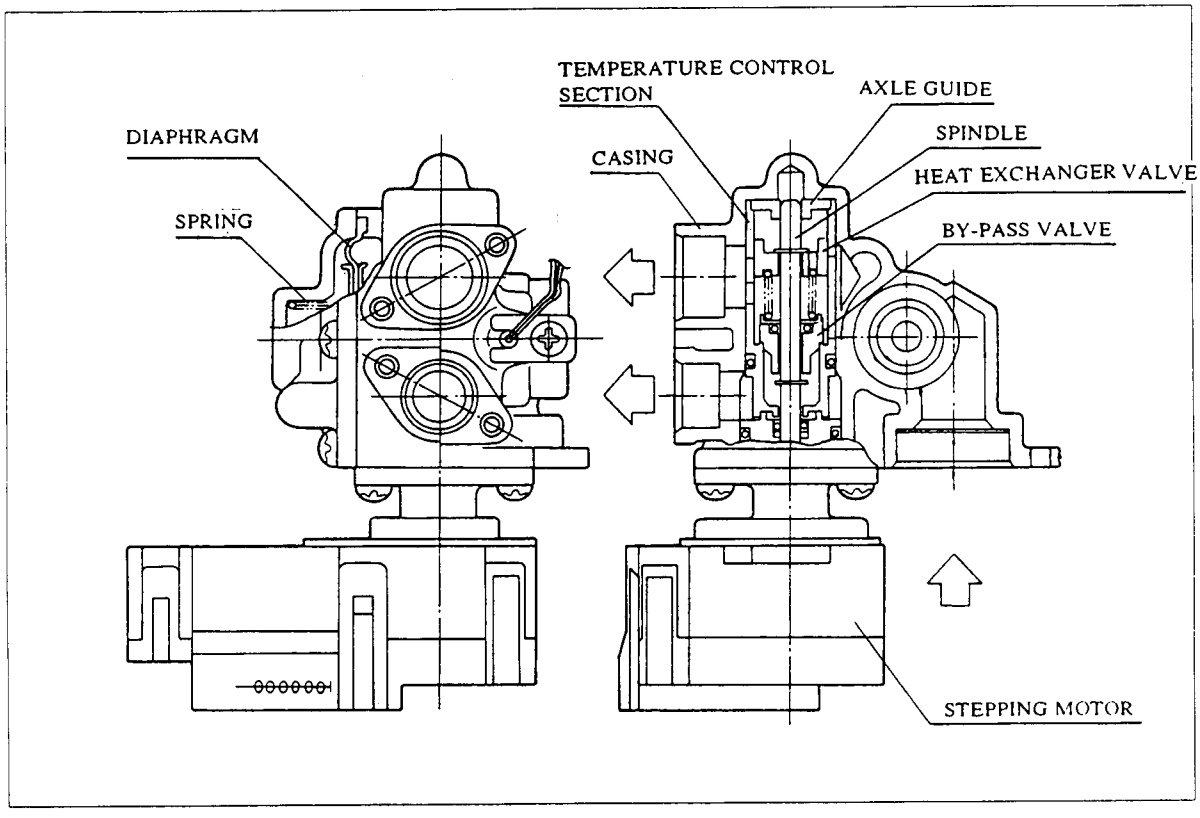
Water flow is detected by a turbine/magnetic pulse generating device. Water flows through the turbine/magnetic sensor providing information to the PCB by generating a pre-determined number of pulses in proportion to the water flow. These pulses are counted by the PCB - no pulse indicates no water flow. 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 28 for further details on the combustion fan.

3. Electronic Water Flow Control Device

Water pressure to the appliance is controlled by a mechanical 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 decrease the volume of water passing through the heat exchanger.



4. Water Flow Servo [Water Distribution Control Device] Q-function

To provide the correct outlet water temperature, the water from the heat exchanger is mixed with cold water. The distributor consists of a motorised (servo) valve connected between the heat exchanger outlet, the cold water inlet, and the hot water outlet; this is controlled by the PCB. The water distribution control device is also controlled by the cold water sandwich prevention device, otherwise referred to as the Q function, so that the hot water temperature remains constant when the tap is turned off and on repeatedly.

Water at 60°C from the heat exchanger is mixed with cold water by the by-pass system when the preset temperature selected at the remote controls is less than 60°C.

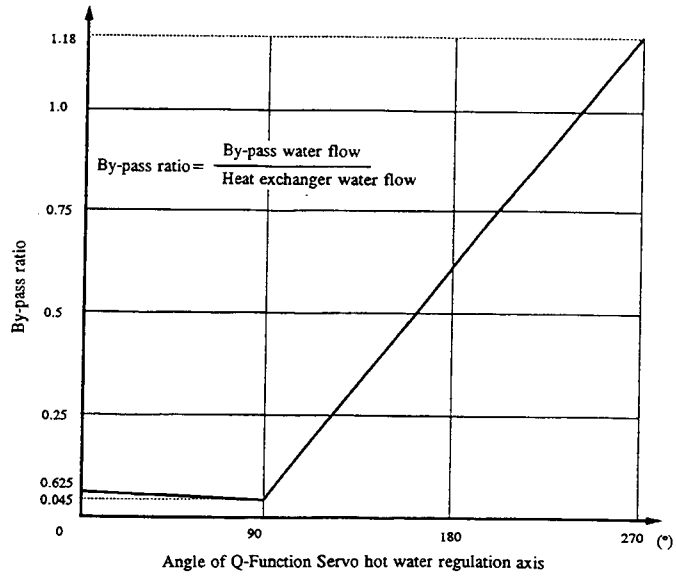
The water flow through the heat exchanger is dependent on the incoming and outgoing water temperatures. The PCB controls the settings of the water flow control valve to provide the correct flow for the conditions at any given time.

The water flow control device is controlled by a stepping motor which positions the valve in response to instructions from the PCB

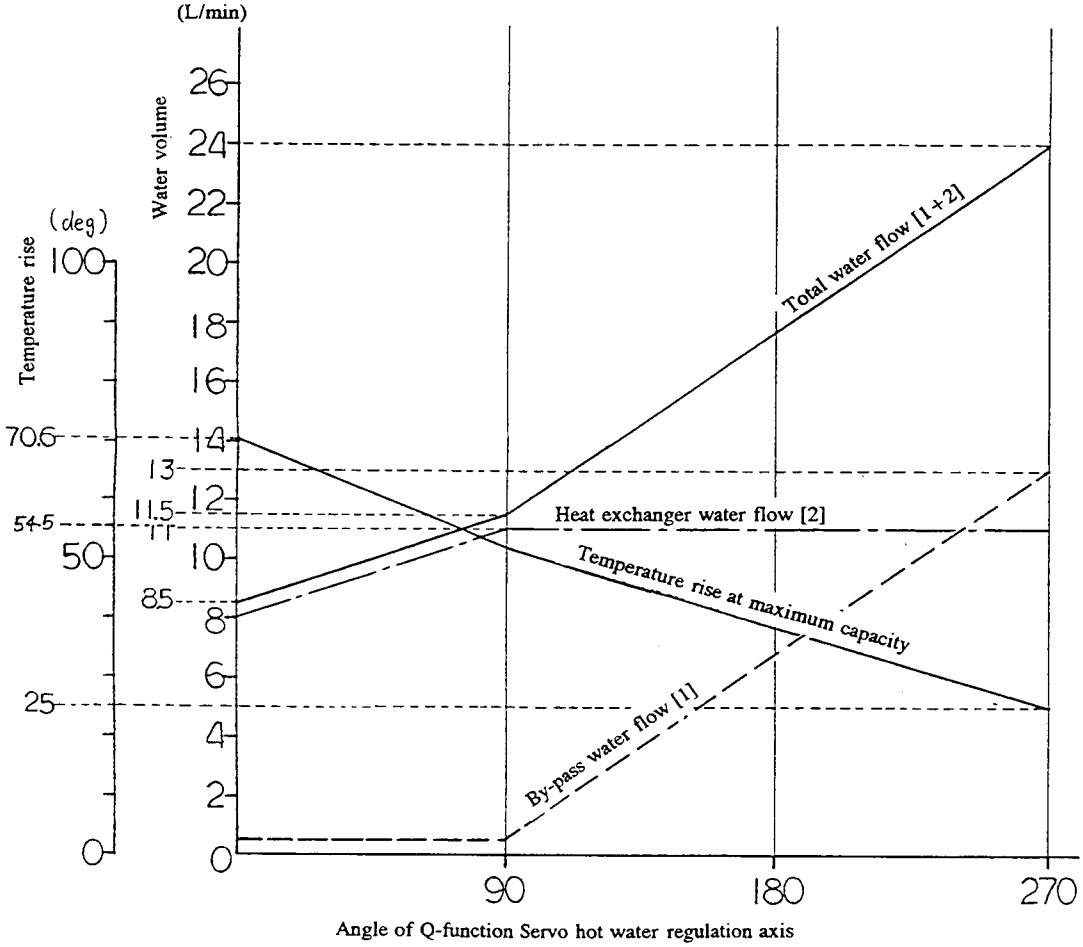
The principle of the Q-Function operation is that the maximum water flow through the heat exchanger (W_{HEX}[L/min]) is fixed at 11.0 L/min. The water flowing through the by-pass (W_{BY}[L/min]) is used for mixing with the water that has passed through the heat exchanger, to achieve higher water flows than 11.0 L/min.

This system (in conjunction with the gas modulating valve) enables maximum control over the temperature of the outgoing water, up to the maximum capacity (24 L/min). At flows over 11.0 L/min, the heat exchanger outlet and by-pass water are mixed (W_{BY} + W_{HEX}).

The graph to the right shows the relationship between the servo opening angle and the ratio of by-pass water to heat exchanger water, e.g. when the servo is open 180°, the ratio between the by-pass water and heat exchanger outlet is 0.7. Looking at the graph below; at 180° opening, the flow through the heat exchanger is 11 L/min, and through the by-pass it is 7 L/min, giving a total of 18 L/min, at a ratio of 0.7.



Even when the tap is closed the servo is pre-positioned to give the maximum water flow. This is achieved by monitoring the heat exchanger temperature, the pre-set temperature, and the incoming water temperature for 8 minutes after the tap is closed. The servo is operated by a stepping motor. The opening angle of the by-pass servo is monitored by the PCB based on data from the stepping motor.



5. Combustion Fan

The air for combustion is supplied by a centrifugal fan driven by a DC motor. After a pre-purge period of 1 second, 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 gas valves, 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 gas valves based upon data from the combustion fan is that the gas valves are able to react much more quickly to a change in control signal than the combustion fan. Controlling the gas valves 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. A 2 chamber aluminium manifold with 18 injectors supplies gas to the burners, and is attached to the front lower cover of the burner box.

7. Electronic Regulator/Modulating Valve

Gas is controlled by a composite regulator/modulating valve, double block safety and changeover valve. This modulating solenoid is electronically controlled depending on the incoming water temperature, water flow and outgoing water temperature and is related to the combustion fan speed.

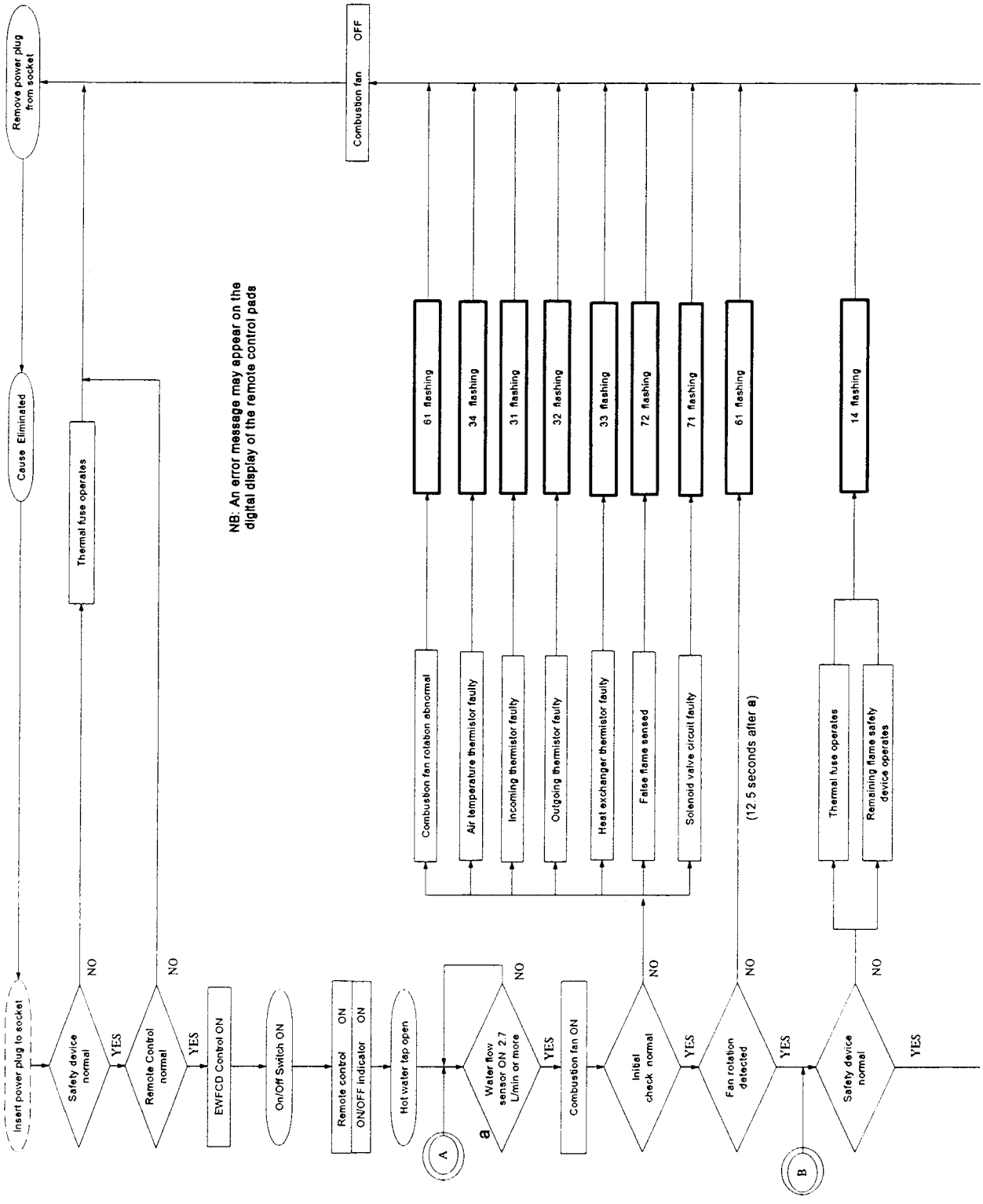
When the water flow and/or selected water temperature changes, then the system will adjust the gas flow to the burner automatically in proportion to the water flow, between 20 and 188 MJ/h, ensuring that the outgoing water temperature remains at the temperature selected at the remote controls. Schematic diagrams on page 13 and 14 show the basic layout of the gas piping system. Maximum gas rate is pre-determined, and the appliance cannot be overloaded. In summary, the 3 main functions of the electronic regulator/modulating valve are:

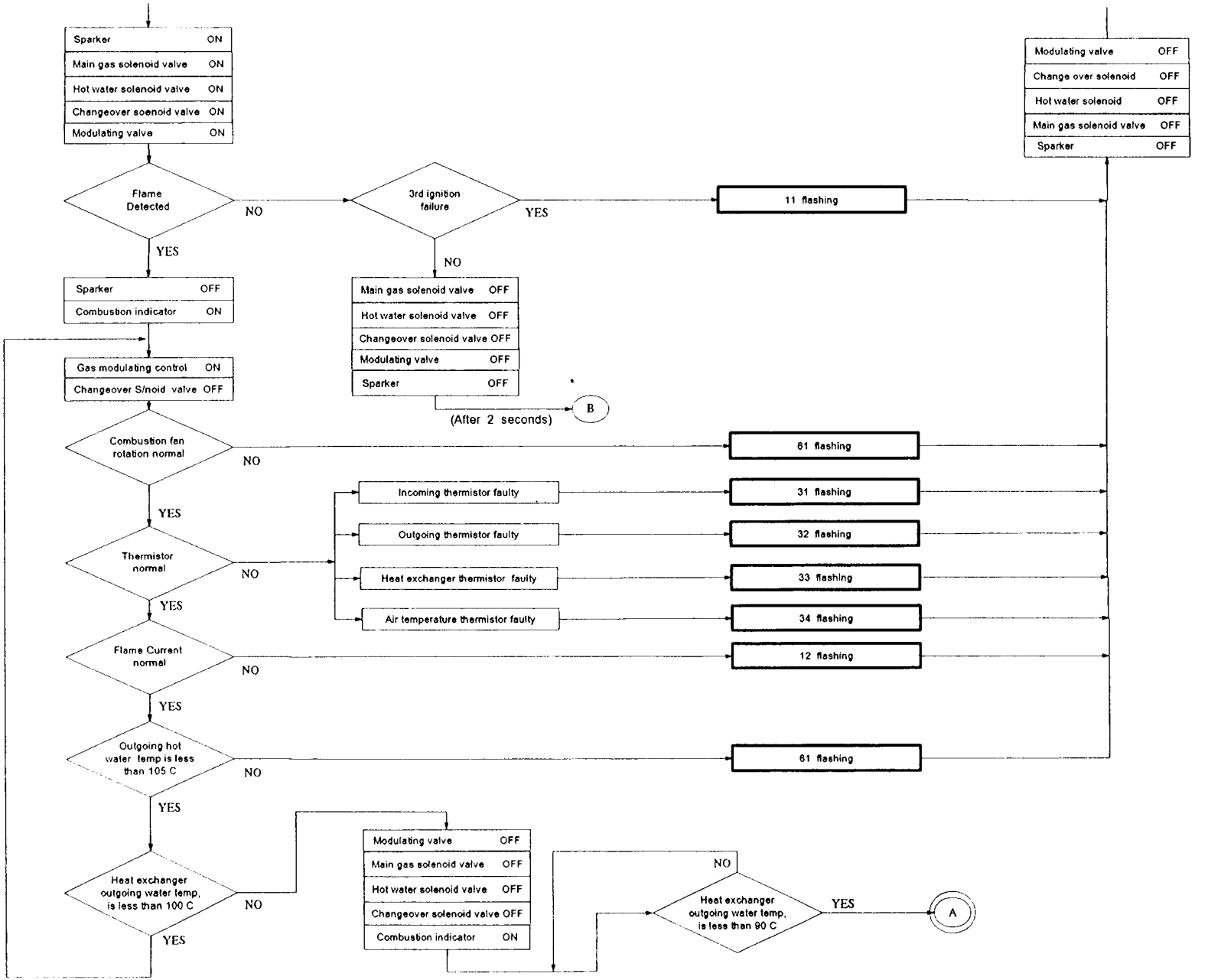
1) To regulate incoming gas pressure.
2) To direct gas to one manifold only, or both manifolds.
3) To modulate gas flow from 20 to 188 MJ/h by the combination of change-over and modulating valve positions.

8. Changeover Solenoid Valve

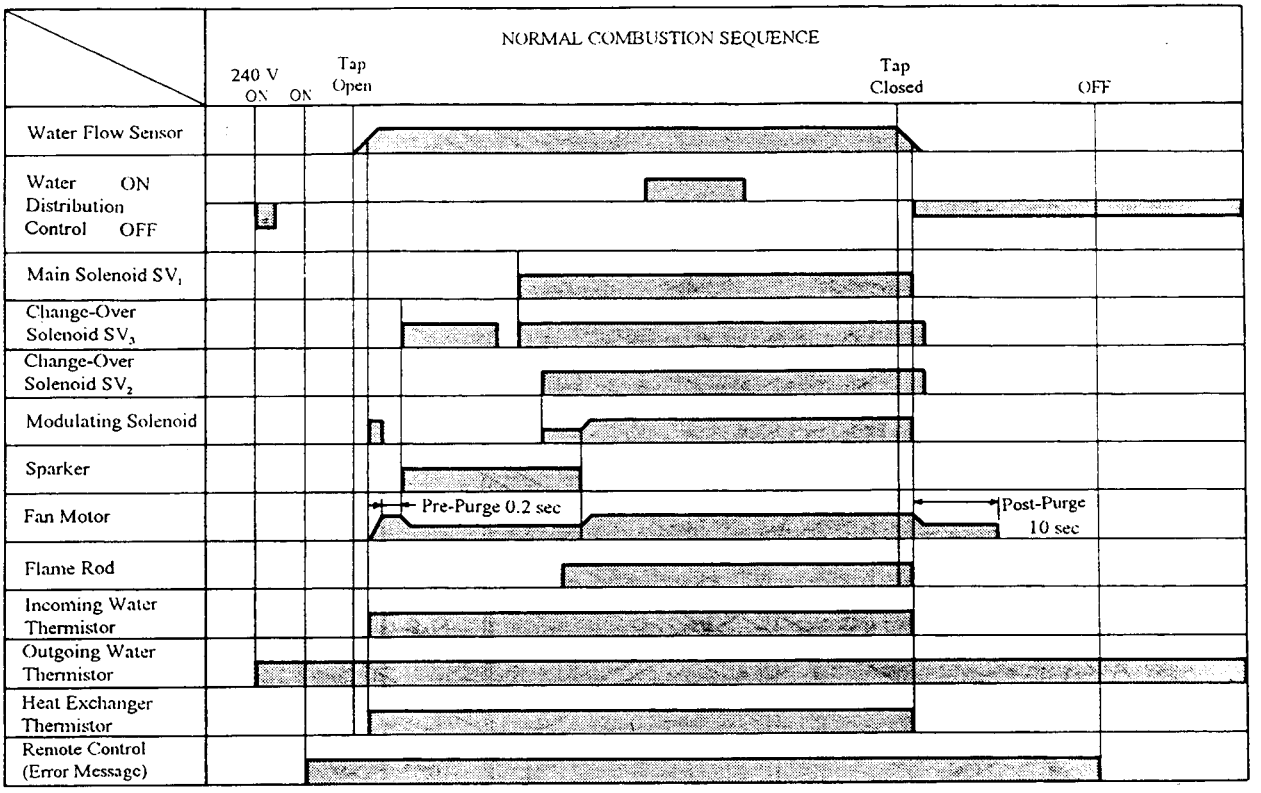
The changeover solenoid increases the flexibility of the regulator/modulating valve by supplying gas to the right hand side of the burner only, [up to 40% input] or both sides of the burner, [40% input] + [40 - 100% input] through the tandem manifold.

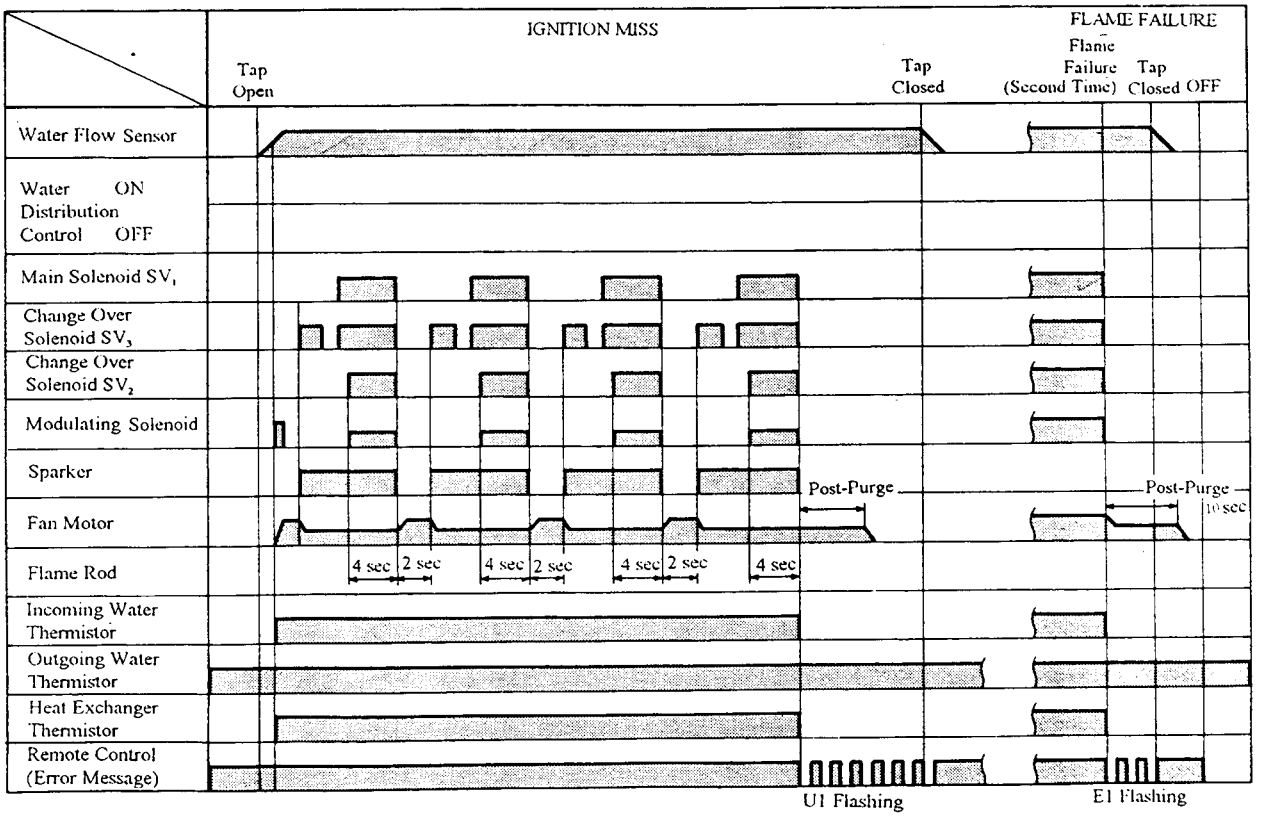
REU-2402 W (EXTERNAL) and REU-2402 FFU (INTERNAL)

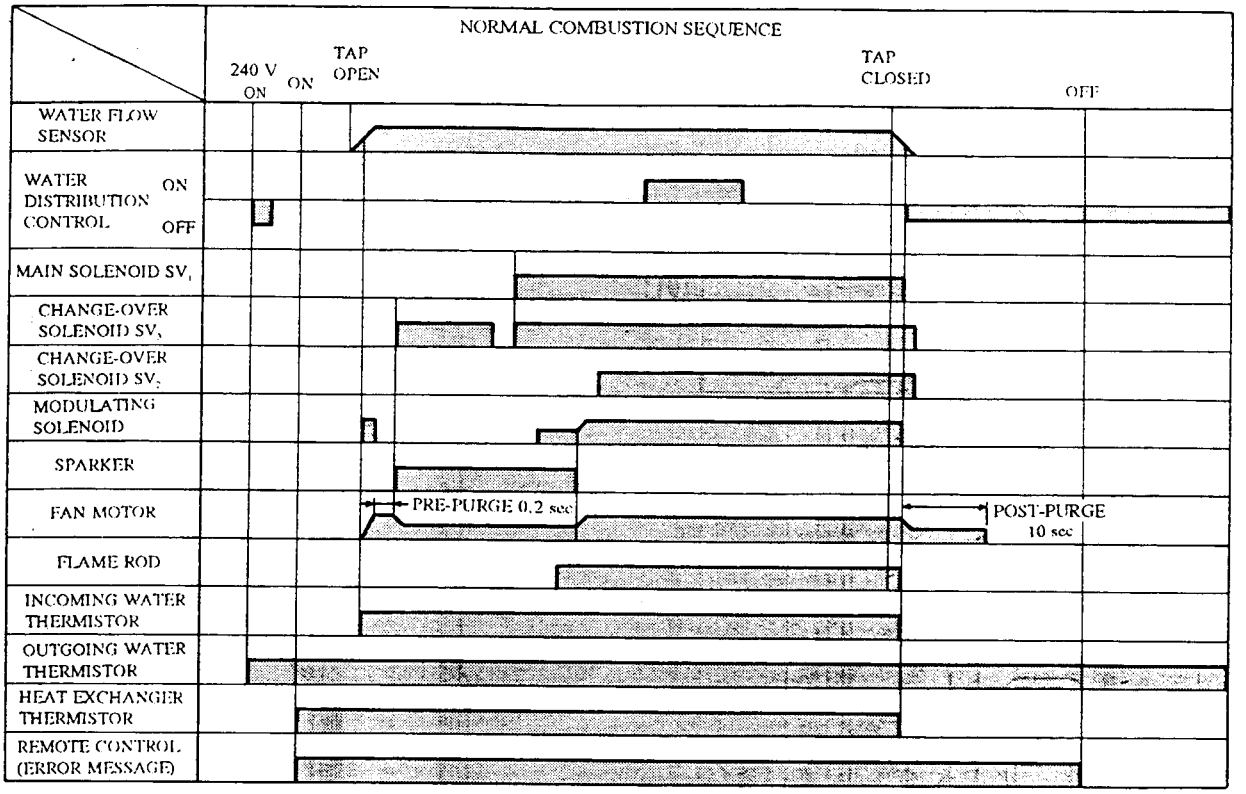


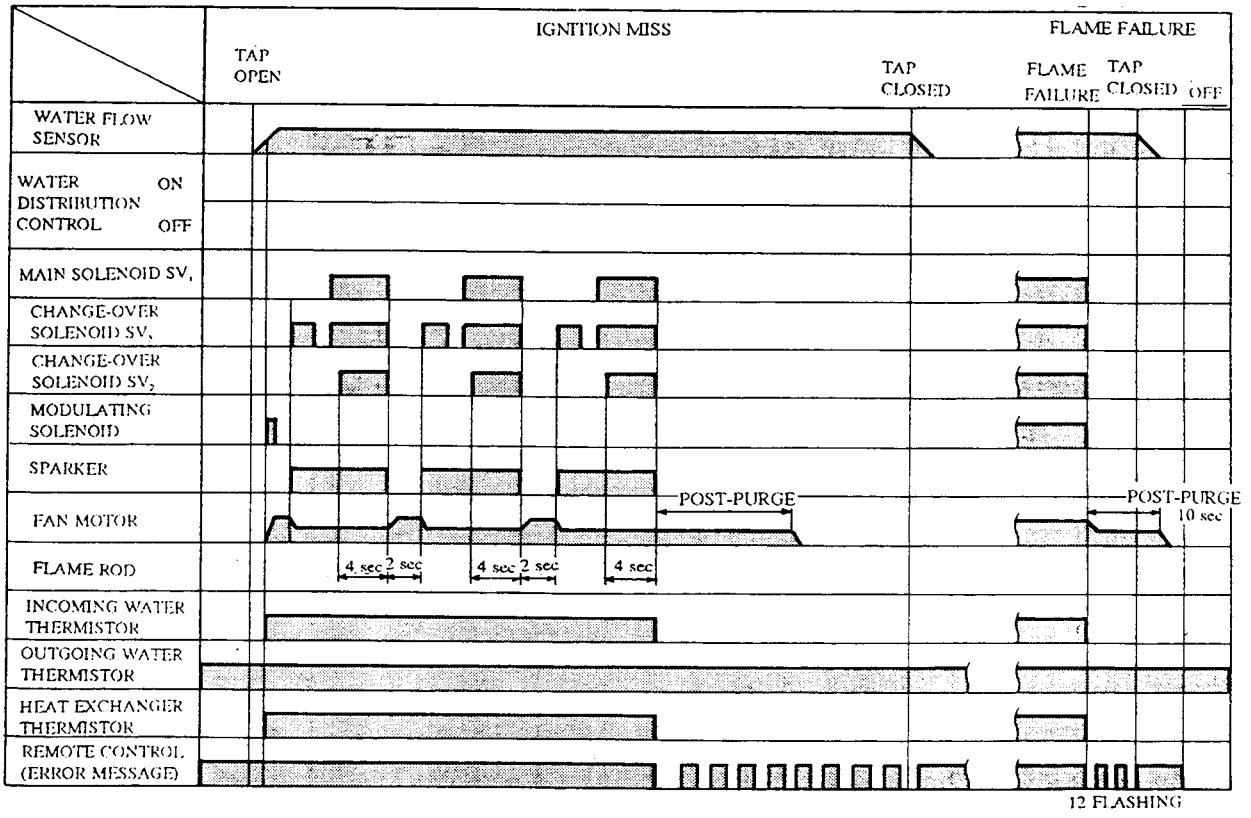


REU-2402 W (EXTERNAL)






NORMAL COMBUSTION SEQUENCE
240 V ON
ON
TAP OPEN
TAP CLOSED
OFF
WATER FLOW SENSOR
WATER DISTRIBUTION CONTROL ON OFF
MAIN SOLENOID SV1
CHANGE-OVER SOLENOID SV1
CHANGE-OVER SOLENOID SV2
MODULATING SOLENOID
SPARKER
FAN MOTOR
PRE-PURGE 0.2 sec
POST-PURGE 10 sec
FLAME ROD
INCOMING WATER THERMISTOR
OUTGOING WATER THERMISTOR
HEAT EXCHANGER THERMISTOR
REMOTE CONTROL (ERROR MESSAGE)


IGNITION MISS
FLAME FAILURE
TAP OPEN
TAP CLOSED
FLAME FAILURE
TAP CLOSED
OFF
WATER FLOW SENSOR
WATER DISTRIBUTION CONTROL ON OFF
MAIN SOLENOID SV1
CHANGE-OVER SOLENOID SV1
CHANGE-OVER SOLENOID SV2
MODULATING SOLENOID
SPARKER
FAN MOTOR
POST-PURGE
POST-PURGE 10 sec
FLAME ROD
4 sec
2 sec
4 sec
2 sec
4 sec
INCOMING WATER THERMISTOR
OUTGOING WATER THERMISTOR
HEAT EXCHANGER THERMISTOR
REMOTE CONTROL (ERROR MESSAGE)
12 FLASHING

§ 20 OPERATION PRINCIPLE

The preset temperature is selected at one of the remote controls [where fitted]. Where no remote control is fitted, the temperature can be preset on the PCB see page 10, temperature limiting settings. 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 PCB. This enables the PCB to determine whether or not water is flowing, and also, the volume of water flowing.

Incoming water pressure is regulated by a mechanical water regulator at all times. The incoming water temperature is measured by the incoming water temperature thermistor. When the pre-determined water flow is sensed, the ignition sequence begins.

The combustion fan pre-purges the combustion chamber. A rev counter on the combustion fan indicates the fan rpm to the 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 burner is ignited by direct electronic spark and the flame is sensed by the flame rod. The opening degree of the modulating valve and change over valve is determined by the combustion fan speed, see page 28 - combustion fan. The changeover valve directs gas to one or both manifolds. This increases the flexibility of the modulating valve.

At the point where the changeover valve opens or closes the modulating valve is instantly re-adjusted by the PCB to compensate for the change in the number of manifolds in use. From the information provided by the water flow sensor and the incoming water temperature thermistor, the PCB determines how much gas is required to heat the water to the temperature selected on the remote control. This calculation of temperature rise and water flow is called "feedforward" information.

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 a stepping motor, and by the water flow servo.

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.

The PCB continually makes adjustments in order to maintain a constant temperature; [adjusting both the gas input, water flow and the water mixing, 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.

After the water is turned off, the PCB continues to monitor the temperature of the incoming water, the water in the heat exchanger and the water temperature at the outlet for 8 minutes. The PCB pre-positions the Water Flow Servo device so that it is in the correct position to supply hot water at the pre-set temperature, before the gas ignites. If a tap is turned on during this period, the water heater uses the residual hot water in the heat exchanger and mixes it with cold water to provide hot water at the pre-set temperature before the gas ignites. This overcomes the "cold water sandwich effect" which is normally experienced when turning a water heater off, then on again.

§ 21 FAULT FINDING PROCEDURE

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

× = Does not operate

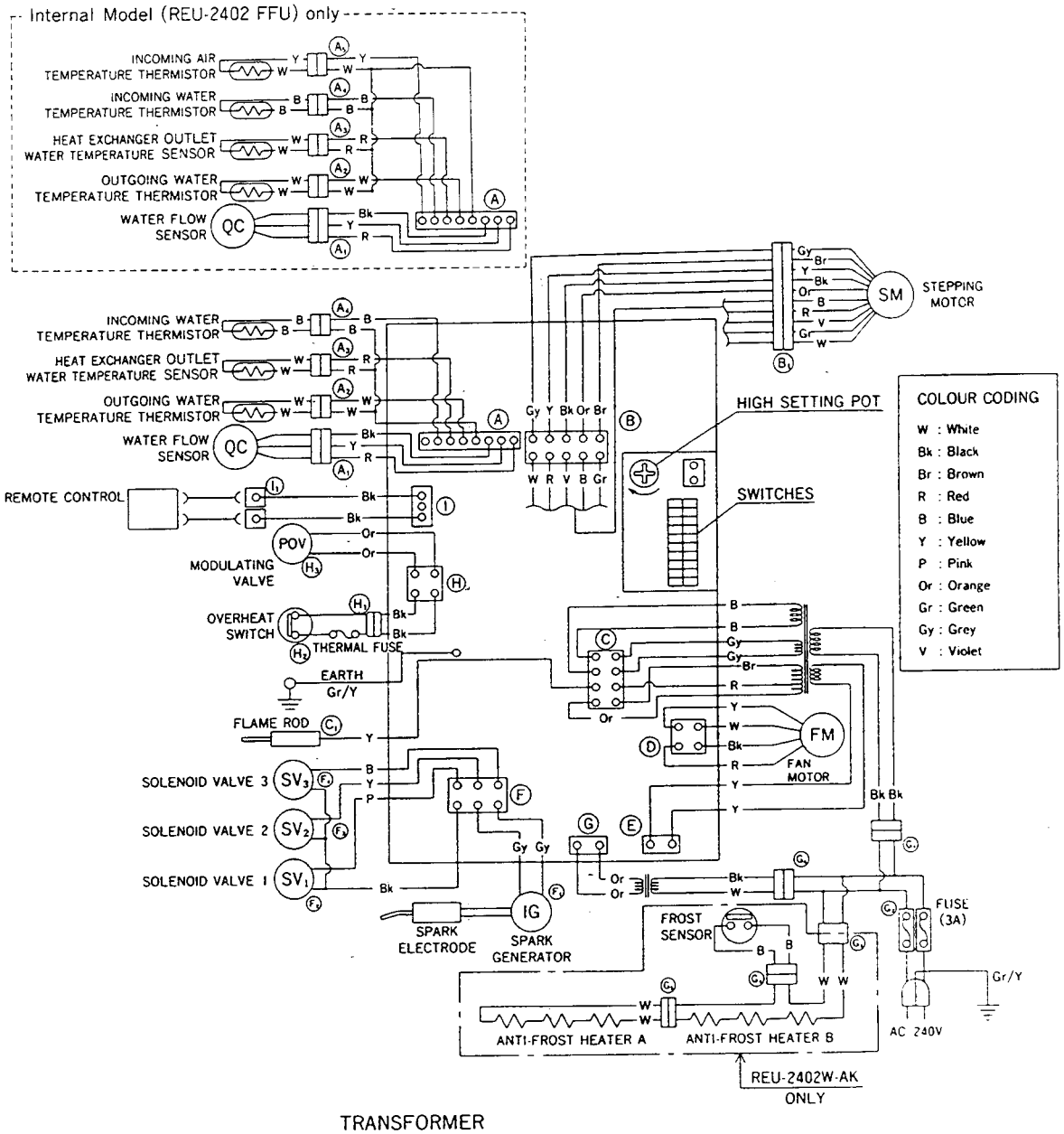
Error Code	Fault Description	Symptom	Main Solenoid Valve	Solenoid Valve	Changeover Solenoid Valve	Combustion Fan	Sparker
-	Water Flow Sensor Faulty	No operation	×	×	×	×	×
71	Solenoid Valve Driving Circuit Faulty	No operation	×	×	×	×	×
72	Flame Sensing Device Faulty	No operation	×	×	×	×	×
31	Short / Faulty Wire in Incoming Water Temperature Thermistor	No operation	×	×	×	×	×
32	Short / Faulty Wire in Outgoing Water Temperature Thermistor	No operation	×	×	×	×	×
33	Short / Faulty Wire in Heat Exchanger Outlet Thermistor	No operation	×	×	×	×	×
-	Electronic Water Flow Control Device Faulty	Water flow not controlled,water temperature incorrect	-	-	-	-	-
61	Combustion Fan Faulty	Operation stops after 12.5 sec	×	×	×	×	×
11	Sparker Faulty	Stops without flame igniting	-	-	-	-	×
11	Main Solenoid Valve Faulty	Stops without flame igniting	×	-	-	-	-
11	Solenoid Valve Faulty	Stops without flame igniting	-	×	-	-	-
-	Changeover Solenoid Valve Faulty	Incorrect water temperature	-	-	×	-	-
12	Flame Sensing Device Faulty	Stops second time burner extinguishes	×	×	×	×	×
16	Outgoing Water Temperature Abnormal	Operation ceases	×	×	×	×	×
14	Remaining Flame Safety Device Faulty	Operation ceases	×	×	×	×	×
14	Thermal Fuse Faulty / Blown	Operation ceases	×	×	×	×	×

Notes

1. **Pre-set temperature flashing.**
   - Check electronic water flow control device, see page 56.
2. **Digital monitor does not illuminate when system is switched ON, or the display drops out while the appliance is operating.**
   - Check power supply to the appliance.
   - Switch system OFF, then switch ON again, and re-attempt ignition.
3. **Error coded message flashing.**
   - Refer to table above.
3. **Appliance operates, however symptoms remain, with digital display dropping out and error coded message flashing.**
   - Isolate potential faulty component using the tables on pages 40 to 47.

Item	Connector N°	Wire Colour	Value (Normal Value)	Error Code	Notes
Glass Fuse (3 Amp)	G_2	black - white	AC 90 ~ 110 V		
Transformer	G_1	black - black	AC 90 ~ 110 V		Voltage measurement on primary windings
	C	orange - red	AC 100 ~ 150 V		Voltage measurement on secondary windings
		blue - blue	AC 30 ~ 50 V		
		brown - brown	AC 11 ~ 16 V		
		grey - grey	AC 21 ~ 28 V		
	E	yellow - yellow	AC 11 ~ 16 V		
Remote Control	I_1	black - black	DC 11 ~ 13 V		
Water Flow Sensor	A_1	red - black	DC 11 ~ 13 V		
		yellow - black	DC 0 ~ 12 V (pulse)		
Stepping Motor (EWCFD)	B_1	green - yellow - orange - black - brown	DC 15 ~ 26 V		Reference values DC 16 V (ON) DC 24 V (OFF)
		white - yellow - orange	90 ~ 130 Ω		
		grey - black - brown	90 ~ 130 Ω		
		red - green	DC 11 ~ 13 V		
		violet - green	DC 0 ~ 0.4 V DC 4 ~ 6 V		Fully open limiter (ON) Fully open limiter (OFF)
		blue - green	DC 0 ~ 0.4 V DC 4 ~ 6 V		Fully closed limiter (ON) Fully closed limiter (OFF)
Combustion Fan	D	black - red	DC 6 ~ 50 V	61	
		black - yellow	DC 11 ~ 13 V	61	
		black - white	DC 0 ~ 12 V (pulse)	61	
Incoming Thermistor	A_4	blue - blue		31	
Outgoing Thermistor	A_2	white - white		32	
Heat Exchanger Thermistor	A_3	white - white		33	
Air Temperature Thermistor	A_5	white - yellow		34	
Flame Rod	C_1	yellow - appliance earth	AC 100 ~ 150 V	11	Flame sensed
				72	Flame not sensed
Thermal Fuse	H_1	black - black		14	
Remaining Flame Safety Device	H_2	black - black	under 1 Ω	14	
Spark Generator	F_1	grey - grey	AC 90 ~ 110 V		
Main Gas Solenoid Valve	F	pink - black	DC 80 ~ 100 V 610 ~ 810 Ω	11	
Solenoid Valve 2	F	yellow - black	DC 80 ~ 100 V 950 ~ 1420 Ω	11	
Changeover Solenoid Valve	F	blue - black	DC 80 ~ 100 V 950 ~ 1420 Ω		
Modulating Valve	H_3	orange - orange	DC 0.5 ~ 25 V 69 ~ 89 Ω		

REU-2402 W (EXTERNAL) and REU-2402 FFU (INTERNAL)

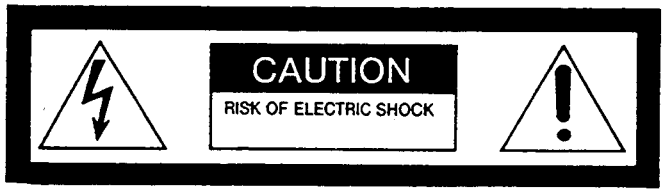


TRANSFORMER
NORMAL READINGS

G1	Bk — Bk	AC216 - 264V 28 - 36Ω
C	Or — R	AC190 - 240V 300 - 370Ω
C	B — B	AC25 - 50V 5.0 - 7.4Ω
C	Br — R	AC10 - 16V 0.9 - 1.8Ω
C	Gy — Gy	AC20 - 28V 1.2 - 2.2Ω
E	Y — Y	AC10 - 16V 3 - 5Ω

G4	Bk — W	AC216 - 264V 66 - 82Ω
G	Or — Or	AC90 - 110V 18 - 22Ω

§ 24 ELECTRICAL COMPONENT ANALYSIS



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

NATURE OF FAULT	EXAMINATION POINT	DIAGNOSTIC POINT	VALUES	Y/N	ACTION	REPAIR N°
A. Display monitor does not light, even after having switched unit on at remote control.	① Is the power cord connected to 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~ 260 V	Yes	Go to A - ③	
				No	Check power supply circuit. Check breakers/fuses.	2
	③ Check insulation resistances. **✻Unplug power cord before measuring.**	1) Disconnect main solenoid valve connector F from PCB. Measure the insulation resistance between Black - Earth Pink - Earth	> 1 M Ω	Yes	Go to A - ③ - 2	
				No	Replace main solenoid valve.	3
		2) Disconnect main solenoid valve connector F from PCB. Measure the insulation resistance between Yellow - Earth.	> 1 M Ω	Yes	Go to A - ③ - 3	
				No	Replace solenoid valve 2.	4
		3) Disconnect main solenoid valve connector F from PCB. Measure the insulation resistance between blue - earth.	> 1 M Ω	Yes	Go to A - ③ - 4	
				No	Replace change over solenoid valve.	5
		4) Disconnect the thermal fuse at H1. Measure the connector insulation resistance between: Black - Earth. (Connect the two terminals of the remaining flame safety device and measure.)	> 1 M Ω	Yes	Go to A - ③ - 5	
				No	Replace thermal fuse.	6

NATURE OF FAULT	EXAMINATION POINT	DIAGNOSTIC POINT	VALUES	Y/N	ACTION	REPAIR N°
		5) Disconnect the remaining flame safety device festoon terminals, and measure the insulation resistance between each device terminal and earth.	>1 M Ω	Yes	Go to A - ③ - 6	
				No	Replace remaining flame safety device.	7
		6) Disconnect the igniter sparker connector and measure the insulation resistance between each grey terminal and earth.	>1 M Ω	Yes	Go to A - ③ - 7	
				No	Replace sparker.	8
		7) Disconnect the transformer connector, and measure the insulation resistance between black and earth.	>1 M Ω	Yes	Go to A - ③ - 8	
				No	Replace transformer.	9
		8) Disconnect the frost sensing switch connector, and measure the insulation resistance between blue and earth.	>1 M Ω	Yes	Go to A - ③ - 9	
				No	Replace frost sensing switch.	10
		9) Disconnect the anti-frost heater connector, and measure the insulation resistance between white and earth.	>1 M Ω	Yes	Go to A - ④	
				No	Replace anti-frost heater.	11
	④ Check 3 Amp electrical fuses.	※ Disconnect and measure resistance, to confirm whether fuse is blown. Normally less than 1 M Ω.	Is fuse blown?	Yes	Go to A - ⑤ and replace fuse.	
				No	Check A - ⑥	
	⑥ Check for short-circuits.	1) Measure the resistance of each solenoid valve. ※ Remove connectors before measuring. **Do not pull on wires, pull on connectors.**	Are values as specified? (N.B. Confirm after checking that there are no broken wires or shorts in any harness.) Pink - Black 610~810 Ω. Yellow - Black 950~1420 Ω. Blue - Black 950~1420 Ω.	Yes	Go to A - ⑤ - 2	
				No	Replace solenoid valves.	12

NATURE OF FAULT	EXAMINATION POINT	DIAGNOSTIC POINT	VALUES	Y/N	ACTION	REPAIR N°
		2) Measure the sparker. ※ Disconnect sparker connector and measure the resistance between grey terminals.	>1 M Ω	Yes	Go to A - ⑤ - 3	
				No	Replace sparker.	13
		3) Check wiring.	Are there any shorts?	Yes	Rectify or replace.	14
				No	Replace PCB	15
	⑥ Check transformer.	1) Measure the voltage between the black and the black on connector G_1	AC 230-260 V	Yes	Go to A - ⑥ - 2	
				No	Replace PCB.	16
		2) Measure the voltage at connectors C and E. Measure with appliance on "standby".	Are voltages as specified? Orange - Red AC 190~50 V Blue - Blue AC 25~50 V Brown - Red AC 10~16 V Grey-grey AC 20~28 V Yellow-yellow AC 10~16 V	Yes	Go to A - ⑦	
				No	Replace transformer.	17
	⑦ Check remote control.	Measure voltage between the remote control terminals at I_1.	DC 11~13 V	Yes	After checking the cable for shorts and broken wires, replace the remote control.	18
				No	Replace PCB	19
B. Digital monitor lights up, but combustion does not commence.	① Check water flow sensor.	1) Measure voltage between red and black of connector.	DC 11-13 V	Yes	Go to B - ① - 2	
				No	Replace PCB.	20
		2) Measure voltage between yellow and black of connector.	DC 2-10 V	Yes	Go to B - ②	
				No	Replace water flow sensor.	21
Error code "72" displayed on digital monitor.	② Check flame rod.	※ Measure resistance between flame rod terminal C1 and earth.	>1 M Ω	Yes	Replace PCB.	22
				No	Replace flame rod.	23
Error code "31" displayed on digital monitor.	③ Check incoming water temperature thermistor.	※ Disconnect connector A_4 and measure resistance.	Open circuit: >1 M Ω Short circuit: <1 Ω.	Yes	Replace incoming water temperature thermistor.	24
				No	Go to B - ⑤	

NATURE OF FAULT	EXAMINATION POINT	DIAGNOSTIC POINT	VALUES	Y/N	ACTION	REPAIR N°
Error code "32" displayed on digital monitor.	④ Check outgoing water temperature thermistor.	※ Disconnect connector A_2 and measure resistance.	Open circuit: >1 M Ω Short circuit: <1 Ω.	Yes	Replace outgoing water temperature thermistor.	25
				No	Go to B - ⑤	
Error code "33" displayed on digital monitor.	⑤ Check heat exchanger outlet thermistor.	※ Disconnect connector A_3 and measure resistance.	Open circuit: >1 M Ω Short circuit: <1 Ω.	Yes	Replace heat exchanger outlet thermistor.	26
				No	Check B - ⑥	
(FFU ONLY) Error code "34" displayed on digital monitor.	Check air temperature thermistor	※ Disconnect connector A_5 and measure resistance.	Open Circuit: >1 M Ω Short Circuit: < 1 Ω	Yes	Replace air temperature thermistor.	26
				No	Go to B - ⑥	
Error code "61" displayed.	⑥ Check combustion fan.	1) Check motor. Measure voltage between black and red at connector D.	**DC 6 - 40 V (Fan ON)** **DC 0 V (Fan OFF)**	Yes	Go to B - ⑥ - 2	
				No	Replace PCB.	27
		2) ※Remove connector D from PCB and measure resistance between black (+) and red.	3.9 ~ 4.9 kΩ (W) 4.2 ~ 5.2 kΩ (FFU)	Yes	Check B - 6. - 3	
				No	Replace combustion fan.	28
		3) Check combustion fan. Measure voltage between black and yellow at connector D.	DC 11~13 V	Yes	Go to B - ⑥ - 4	
				No	Replace PCB.	29
		4) Measure voltage between black and white of connector D.	DC 2-10 V	Yes	Go to B - ⑦	
				No	Replace combustion fan.	30
Error code "11" displayed on digital monitor.	⑦ Check igniter.	1) Measure voltage between grey and grey of connector F (sparker on).	AC 90~110 V	Yes	Go to B - ⑦ - 2	
				No	Replace PCB.	31
		2) Remove connector F and measure the resistance between grey terminals.	>1 M Ω	Yes	Go to B - ⑦ - 3	
				No	Replace igniter.	32
		3) Check if unit is sparking.	Is the igniter sparking?	Yes	Go to B - ⑧	
				No	Adjust or replace Electrode.	33

NATURE OF FAULT	EXAMINATION POINT	DIAGNOSTIC POINT	VALUES	Y/N	ACTION	REPAIR N°
	⑧ Check main gas solenoid valve. (SV_1)	1) ✻Disconnect the gas solenoid valve connector F from the PCB, and measure resistance between pink and black.	610~810 Ω	Yes	Go to B - ⑧ -	
				No	Replace main gas solenoid valve.	34
		2) Measure voltage between pink and black of connector F. (SV_1)	DC 80-100 V	Yes	Go to B - ⑨	
				No	Replace PCB.	35
	⑨ Check SV_2.	1) ✻Disconnect solenoid valve connector F from PCB. Measure resistance between yellow and black.	950~1420 Ω	Yes	Go to B - ⑨ - 2	
				No	Replace hot water solenoid valve.	36
		2) Measure voltage between yellow and black of SV_2 connector F.	DC 80-100 V	Yes	Go to B - (10)	
				No	Replace PCB	37
	(10) Check change over solenoid valve. (SV_3)	1) ✻Disconnect solenoid valve connector F from PCB and measure resistance between blue and black.	950-1420 Ω	Yes	Go to B - (10) - 2	
				No	Replace change over solenoid valve.	38
		2) Measure the voltage between the blue and black of connector F.	DC 80-100 V	Yes	Go to B - (11)	
				No	Replace PCB	39
Error code "14" displayed	(11) Check thermal fuse.	✻Disconnect connector H_1 and measure resistance between black and black.	< 1 Ω	Yes	Go to B - (12)	
				No	Replace thermal fuse.	40
	(12) Check remaining flame safety device.	✻Disconnect remaining flame safety device Festoon terminals, and measure resistance between them.	< 1 Ω	Yes	Replace PCB	41
				No	Replace remaining flame safety device.	42
C. Combustion occurs, but there is flame failure. **Error code "11" displayed digital monitor.**	① Check flame rod.	1) Measure the voltage between flame rod terminal C1 and appliance earth.	AC 40-150 V	Yes	Go to C - ① - 2	
				No	Replace PCB	43
		2) Confirm flame rod bracket is not loose.	Is it secure?	Yes	Go to C - ②	
				No	Replace flame rod.	44

NATURE OF FAULT	EXAMINATION POINT	DIAGNOSTIC POINT	VALUES	Y/N	ACTION	REPAIR N°
	② Check earth wire.	Check earth wire connections (to round terminals), broken wires, short circuits.	Is it OK?	Yes	Check for other causes of flame failure.	45
				No	Replace or adjust earth wire.	46
D. Cannot adjust water temperature.	① Check incoming water temperature thermistor.	✻Disconnect connector A_4 and measure resistance between blue and blue.	(T°C) R(KΩ) 0 23.0 5 18.3 10 15.0 15 12.3 20 10.1 30 7.0 45 4.1 55 2.9	Yes	Go to D - ②	
				No	Replace incoming water temperature thermistor.	47
	② Check outgoing water temperature thermistor.	✻Disconnect connector A_2 and measure resistance between white and white.	(T°C) R(KΩ) 15 12.3 30 7.0 45 4.1 75 1.6	Yes	Go to D - ③	
				No	Replace outgoing water temperature thermistor.	48
	③ Check change over solenoid valve. (SV_3)	1) ✻Disconnect change over solenoid value connector F from PCB, and measure the resistance between blue and the black.	950-1420 Ω	Yes	Go to D - ③ - 2	
				No	Replace change over solenoid valve.	49
		2) Measure the voltage between blue and black wire of change over solenoid valve SV_3 at connector F.	DC 80~100 V	Yes	Check D - ④	
				No	Replace PCB	50
	④ Check modulating valve.	1. ✻Disconnect modulating valve terminals and measure resistance between them.	69~89 Ω	Yes	Go to D - ④ - 2	
				No	Replace modulating valve.	51

NATURE OF FAULT	EXAMINATION POINT	DIAGNOSTIC POINT	VALUES	Y/N	ACTION	REPAIR N°
		2. Measure the voltage between the two terminals (still disconnected).	DC 0.5~25 V	Yes	Go to D - ④ - 3	
				No	Replace PCB	52
		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 - ⑤	
				No	Replace modulating valve.	53
	⑤ Check electronic water flow control device.	1) ※Measure the resistance between white and yellow of connector B_1.	90-130 Ω	Yes	Go to D - ⑤ - 2	
				No	Replace electronic water flow control device.	54
		2) ※Measure the resistance between white and orange of connector B_1.	90-130 Ω	Yes	Go to D - ⑤ - 3	
				No	Replace electronic water flow control device.	55
		3) ※Measure resistance between grey and black of connector B_1.	90-130 Ω	Yes	Go to D - ⑤ - 4	
				No	Replace electronic water flow control device.	56
		4) ※Measure resistance between grey and brown of connector B_1.	90-130 Ω	Yes	Go to D - ⑤ - 5	
				No	Replace electronic water flow control device.	57
		5) Measure voltage between green and yellow of connector B_1.	DC 15-26 V	Yes	Go to D - ⑤ - 6	
				No	Replace PCB	58
		6) Measure voltage between green and orange of connector B_1.	DC 15-26 V	Yes	Got to D - ⑤ - 7	
				No	Replace PCB.	59
		7) Measure voltage between green and black of connector B_1.	DC 15-26 V	Yes	Go to D - ⑤ - 8	
				No	Replace PCB.	60

NATURE OF FAULT	EXAMINATION POINT	DIAGNOSTIC POINT	VALUES	Y/N	ACTION	REPAIR N°
		8) Measure voltage between green and brown of connector B_1.	DC 15-26 V	Yes	Go to D - ⑤ - 7	
				No	Replace PCB.	61
		9) Measure voltage between red and green of connector B_1.	DC 11~13 V	Yes	Go to D - ⑤ - 10	
				No	Replace PCB.	62
		10) Measure voltage between purple and green of connector B_1.	Fully open limiter ON DC 0~0.4 V fully open limiter OFF DC 4~6 V	Yes	Go to D - ⑤ - 11	
				No	Replace PCB.	63
		11) Measure voltage between blue and green of connector B_1	Fully open limiter ON DC 0~0.4 V full open limiter OFF DC 4~6 V	Yes	Replace electronic water flow control device.	64
				No	Replace PCB.	65
E. Anti-frost heater does not operate. (W ONLY)	① Check anti-frost heater.	1) ✻Disconnect connector G_5 and measure resistance between white and white.	47-57 Ω	Yes	Go to E - ① - 2	
				No	Replace anti frost heater assembly A.	66
		2) ✻Disconnect connector G_3 and measure resistance between white and white (short circuit connector G_4 before measuring).	47~57 Ω	Yes	Go to E - ②	
				No	Replace anti-frost heater assembly B.	67
	② Check frost sensing switch.	✻Disconnect connector G_4 measure the resistance between blue and blue. Atmospheric temperature less than 4±3°C.	< 1Ω	Yes	Check wiring	68
				No	Replace frost sensing switch.	69

- Before carrying out checks marked *, remove power cord from wall socket.

Appliance fails to operate (Remote control display fails to operate).

1. Check electrical supply.

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

① Power cord unplugged - plug in.

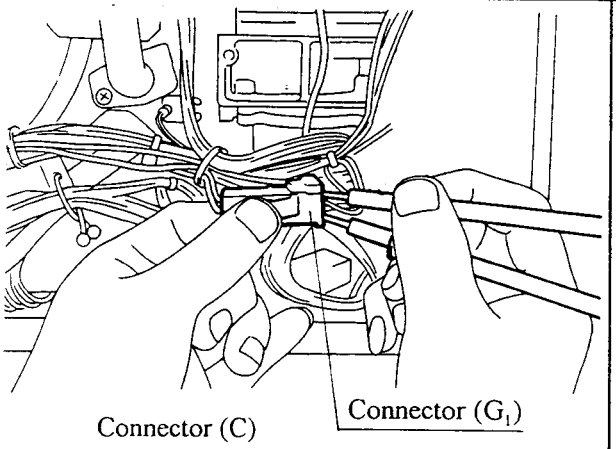
② No 240 V to wall socket -

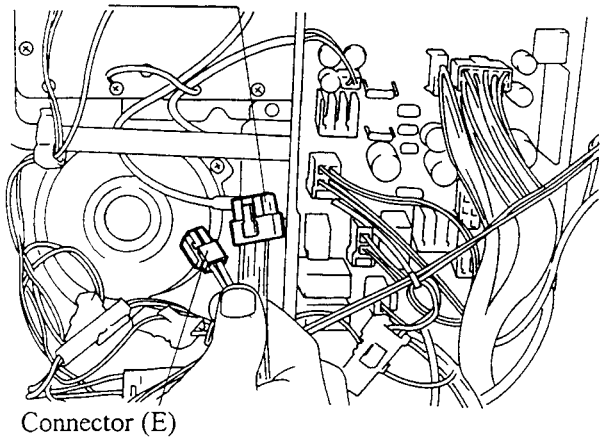
- Power failure - wait for power to be restored.
- Building supply disconnected - investigate cause.

③ Fuse blown - check fuse.

* Normal: less than 1 Ω. If normal check next step.
Faulty or blows again, check for shorts.

2. Is the transformer operating normally ?





Check the transformer.

① Measure the voltage between the black wires of connector G_1.

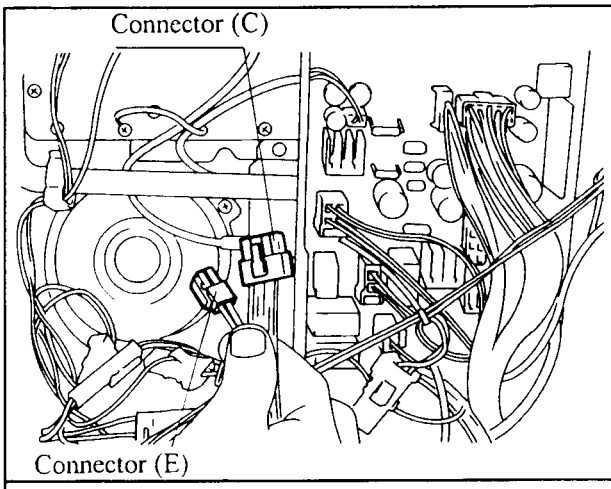
Normal: AC 90 ~ 110 V. If normal proceed to ②.
Faulty: check that the voltage between the terminals of the PCB fuse G_2 is AC 90 - 110 V.

② Measure the following voltages at PCB connector C.

Normal:

Orange - Red	AC 190-240 V
Blue - Blue	AC 25-50 V
Brown - Red	AC 10-16 V
Grey - Grey	AC 20-28 V

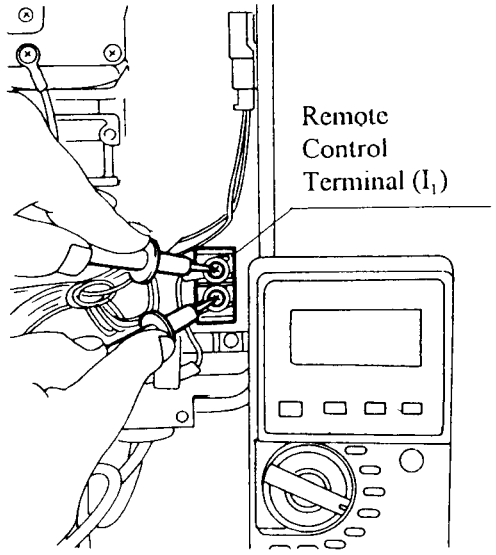
If normal; proceed to ③.
Faulty: replace transformer.



③ Measure the voltage between the yellow wires of PCB connector E.
Normal: AC 10 - 16 V. If normal proceed to 3.
Faulty: replace transformer.

NB: Voltages quoted above are all measurements for when the appliance is not operating, and is in standby mode.

3. Is the remote control faulty ?



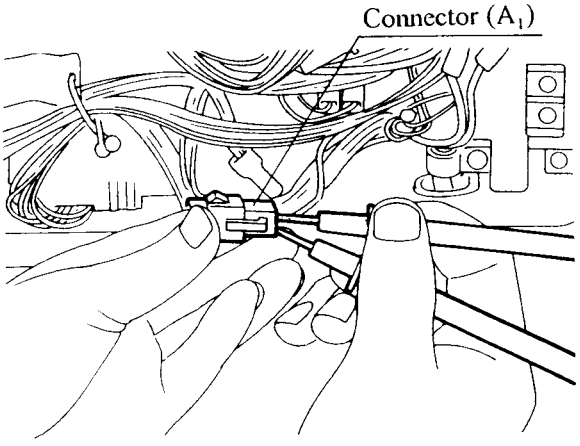
Measure the voltage between remote control connections.

① Measure the voltage between the two terminals at the remote control terminal on main PCB.

Normal: DC 11 - 13 V. If normal, check there are no faults in the wires, correct specification wire has been used, and that there are no shorts, then replace the remote control.
Faulty: replace PCB unit.

Combustion Failure (Remote control operating).

1. Is the water flow sensor functioning normally ?



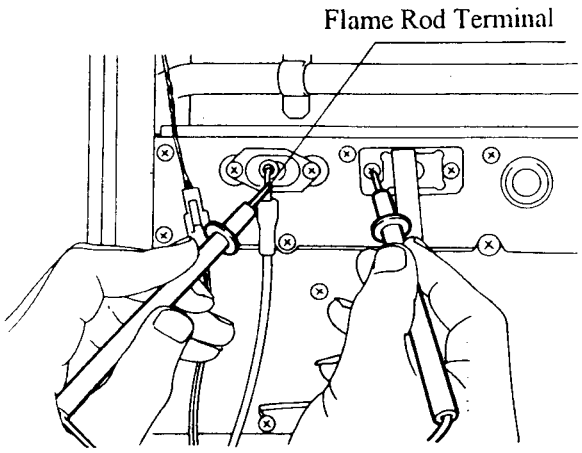
① Measure the voltage between the red and black wires of PCB connector A_1.

Normal: DC 11 - 13 V. If normal proceed to ②.
Faulty: replace PCB.

② Measure the voltage between the yellow and black wires of PCB connector A_1.

Normal: DC 2 - 10 V. If normal, proceed to 2.
Faulty: replace water flow sensor.

2. Error message "72" is displayed on Remote Control.



Check the flame rod.

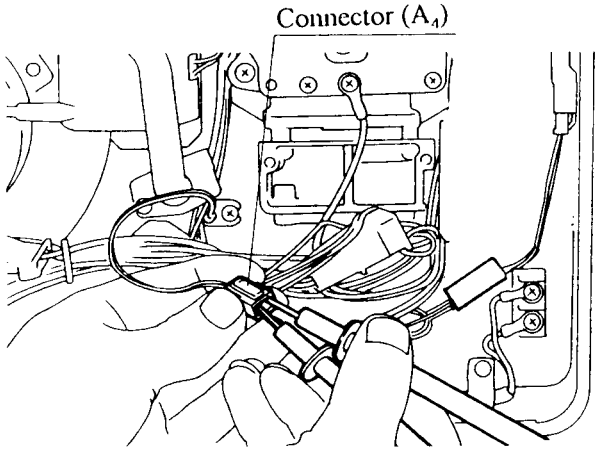
① Remove flame rod terminal C, and attempt to restart the appliance.

If message "72" is displayed again, go to 3.
If message "72" is not displayed; check there is no current leakage from the flame rod.

* Measure the resistance between flame rod terminal C_1 and the appliance earth.

Normal: greater than 1 M Ω. If normal, replace PCB.
Faulty: replace flame rod.

3. Is the incoming water temperature thermistor operating normally ?
Error message "31" is displayed.



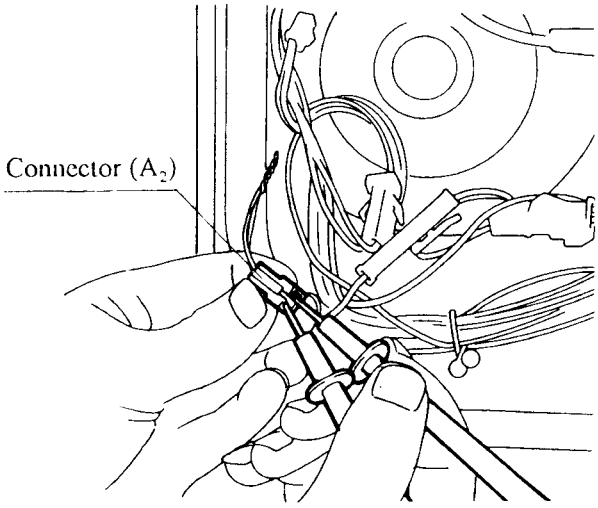
If error message "31" is displayed, check the incoming water temperature thermistor.

① *Disconnect connector A_4 and measure the resistance between the two blue wires.

Faulty: resistance greater than 1 M Ω.
Short: resistance less than 1 Ω.

If normal proceed to 4.
Faulty: replace thermistor.

4. Is the outgoing water temperature thermistor operating normally ?
Error message "32" is displayed.



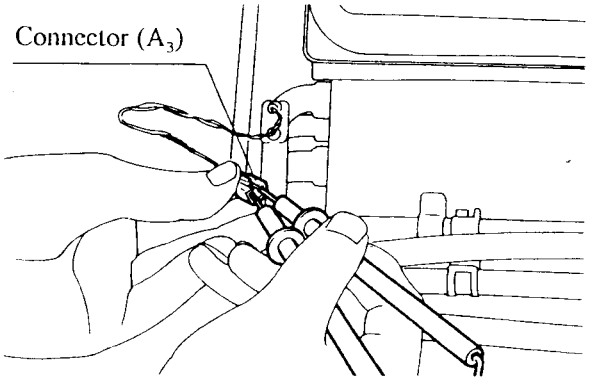
If error message "32" is displayed, check the outgoing water temperature thermistor.

① * Disconnect connector A_2, and measure the resistance between the two white wires.

Faulty: resistance greater than 1 M Ω.
Short: resistance less than 1 Ω.

If normal, proceed to 5.
Faulty: replace the outgoing water temperature thermistor.

5. Is heat exchanger outlet thermistor operating normally ? Error message "33" is displayed.



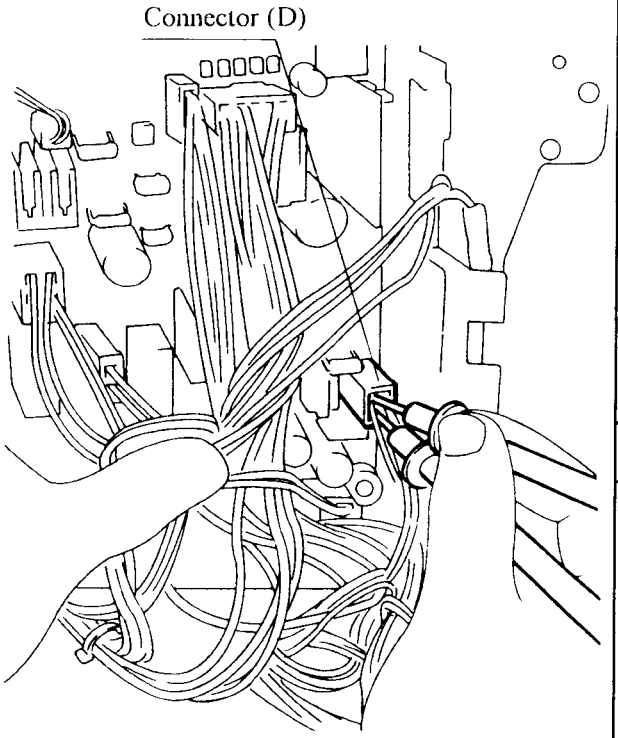
If error message "33" is displayed, check the heat exchanger outlet thermistor.

① * Disconnect connector A_3, and measure the resistance between the two white wires.

Faulty: resistance greater than 1 M Ω.
Short: resistance less and 1 Ω

If normal, proceed to 6.
Faulty: replace the heat exchanger outlet thermistor.

6. Is the combustion fan operating normally ? Error message "61" is displayed.



If error message "61" is displayed, check the combustion fan motor.

① Check the voltage at connector D between the black and red wires.
Normal:
DC 6 ~ 40 V (Fan ON)
DC 0 V (Fan OFF)
If normal proceed to ②.
Faulty: replace PCB.

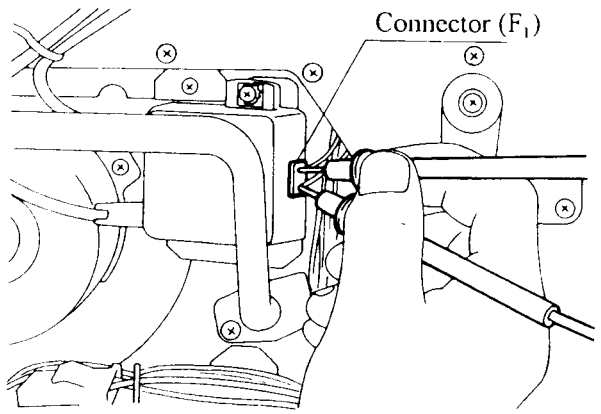
② * Remove connector D from the PCB and measure the resistance between the black (+) and the red (com).
Normal: 3.9 - 4.9 kΩ. If normal check the rotation sensor as below.
Faulty: replace combustion fan.

Check the rotation sensor

① Measure the voltage between the black and yellow wires of connector D.
Normal: DC 11 ~ 13 V. If normal proceed to ②.
Faulty: replace PCB.

② Measure the voltage between the black and white wires of connector D.
Normal: DC 2 ~ 10 V. If normal proceed to 7.
Faulty: replace combustion fan.

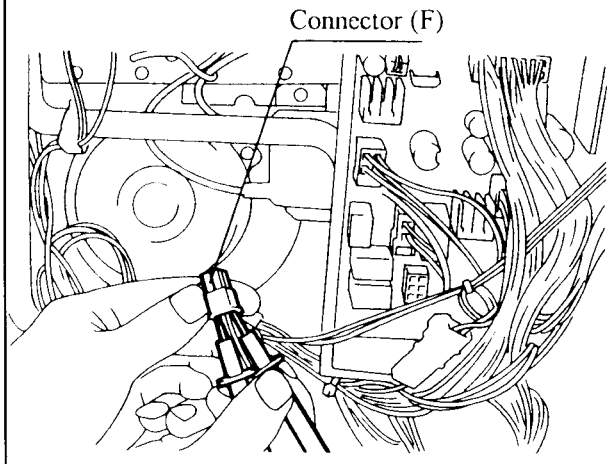
7. Is the sparker operating normally ?



① Measure the voltage between the two grey wires at connector F.
Normal: AC 90 - 110 V. If normal proceed to ②.
Faulty: replace PCB.

② * Remove connector F_1, and measure the resistance between the two sparker terminals.
Normal: greater than 1 M Ω. If not sparking, adjust or replace the electrode.
Faulty: replace sparker.

8. Is the main gas solenoid valve (SV_1) operating normally ? Error message "11" is displayed.

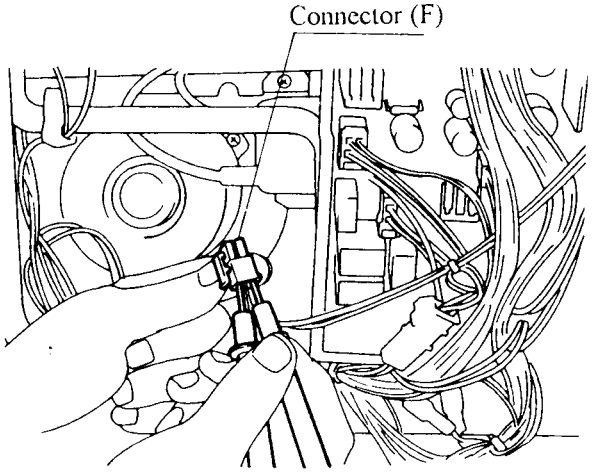


If error message "11" is displayed, check the primary gas solenoid valve.

① Remove connector F from the PCB and measure the resistance between the pink and the black wires.
Normal: 610 - 810 Ω. If normal, proceed to ②.
Faulty: replace main gas solenoid valve.

② Measure the voltage between the black and pink wires of connector F.
Normal: DC 80 ~ 100 V. If normal, proceed to 9.
Faulty: replace PCB.

9. Is solenoid valve SV_2 operating normally ? Error message "11" is displayed.

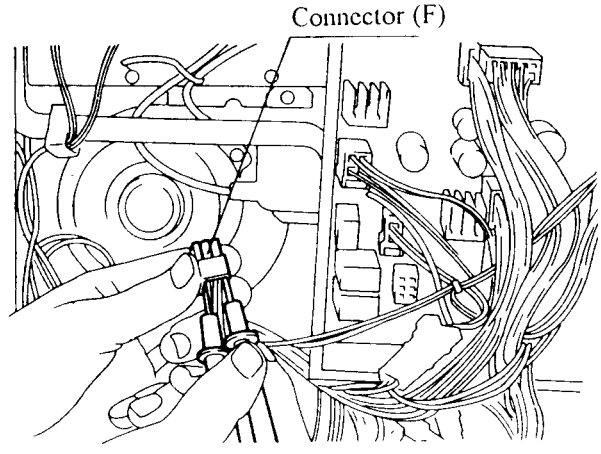


If error message "11" is displayed check solenoid valve SV_2.

① * Remove connector F from the PCB, and measure the resistance between the yellow and black wires.
Normal: 950 Ω - 1420 Ω. If normal proceed to step ②.
Faulty: replace solenoid valve SV_2.

② Measure the voltage between the yellow and black wires of connector F.
Normal: DC 80 - 100 V. If normal, proceed to 10.
Faulty: replace PCB.

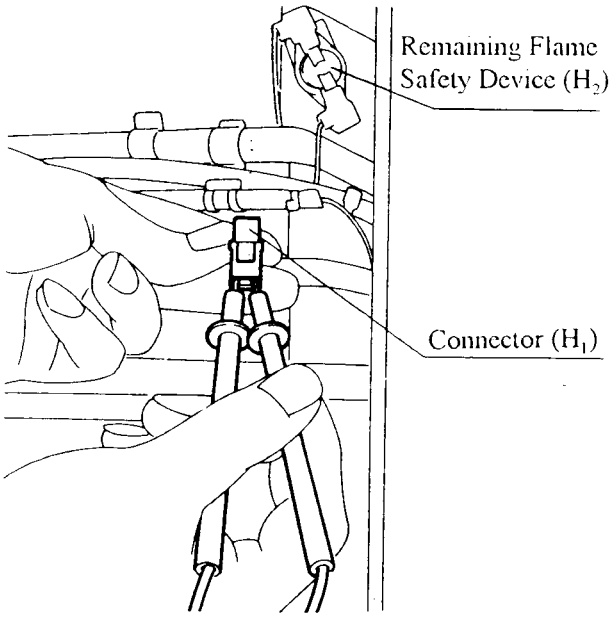
10. Is the change-over solenoid valve (SV_3) operating normally ?



① * Remove connector F from the PCB and measure the resistance between the blue and wires.
Normal: 950 - 1420 Ω. If normal proceed to ②.
Faulty: replace change over solenoid valve SV_3.

② Measure the voltage between the blue and the black wires of connector F.
Normal: DC 80 - 100 V. If normal, proceed to 11.
Faulty: replace PCB.

11. Is the remaining flame safety device operating normally ?

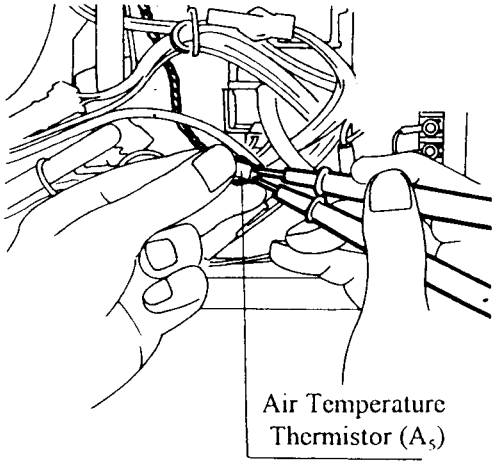


Check the thermal fuse.

① * Disconnect connector H_1, and measure the resistance between the two black wires.
Normal: less than 1 Ω. If normal, replace the PCB.
Faulty: after checking the appliance for damage, there is nothing abnormal, replace the thermal fuse.

② * Measure the resistance between the two terminals of the remaining flame safety device H_2.
Normal: less than 1 Ω. If normal, replace PCB.
Faulty: replace remaining flame safety device.

12. Is the Air Temperature Thermistor normal ? (FFU ONLY) Error "34" is displayed.

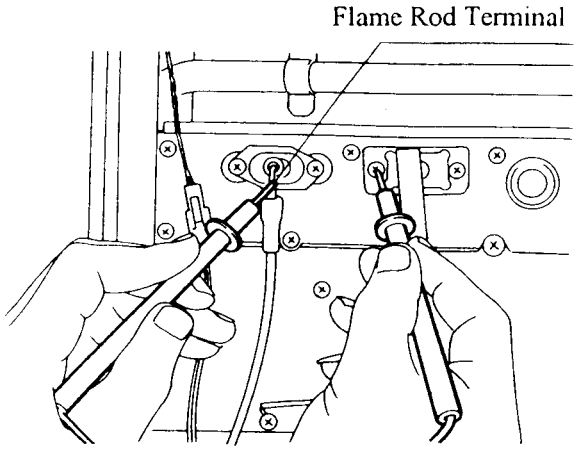


If error code "34" is displayed, check the air temperature thermistor.

① * Disconnect connector A_5 and measure the white - yellow resistance.
Faulty: > 1 MΩ
Short: < 1 MΩ
Normal: replace the PCB unit
Faulty: replace the air temperature thermistor

Combustion occurs, but flame extinguishes during operation.

1. Is the flame rod functioning normally ?



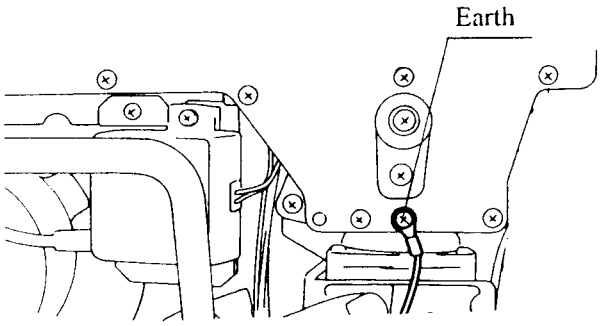
① Measure the voltage between flame rod terminal C_1, and the appliance earth.

Normal: AC 40 - 150 V. If normal, proceed to ②.
Faulty: replace PCB.

② Check that the flame rod is securely attached.

Normal: replace PCB.
Faulty: attach securely.

2. Is the earth lead secure ?

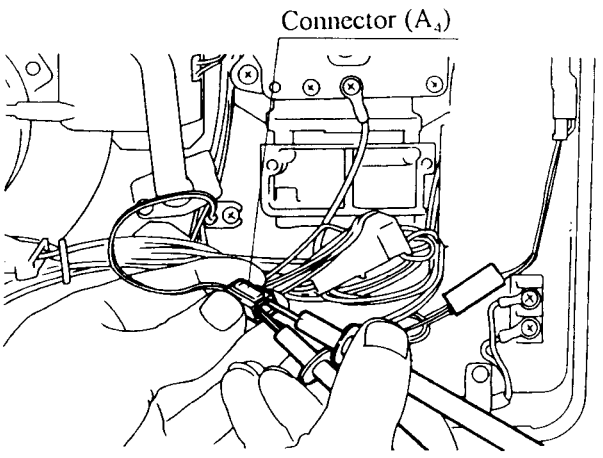


① Check that the earth lead is properly attached (terminal is properly attached), also check for shorts or faults in the wires.

If OK, check for other causes of the flame being extinguished, (Gas not turned on, filter blocked, etc.)
Faulty: re-attach the earth lead.

Unable to adjust hot water temperature.

1. Is the incoming temperature thermistor operating normally ?



① * Disconnect connector A_4, and measure the resistance between the two blue wires.

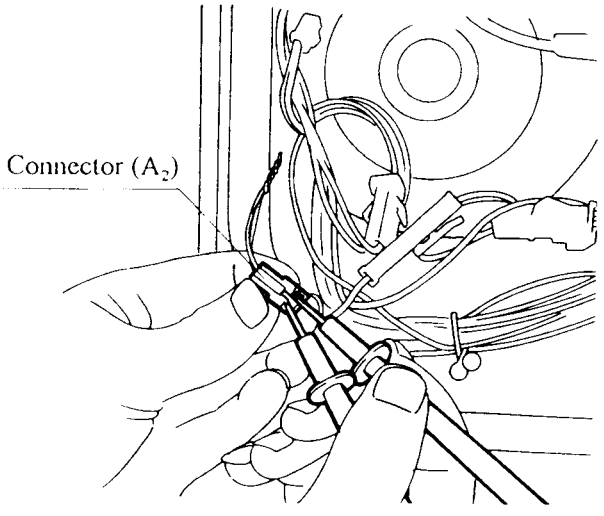
Normal (standard)

Temp (°C)	0	5	10	15
Resistance (kΩ)	23.0	18.3	15.0	12.3

Temp (°C)	20	30	45	55
Resistance (kΩ)	10.1	7.0	4.1	2.9

Normal: proceed to 2.
Faulty: replace incoming water temperature thermistor.

2. Is the outgoing water temperature thermistor operating normally ?



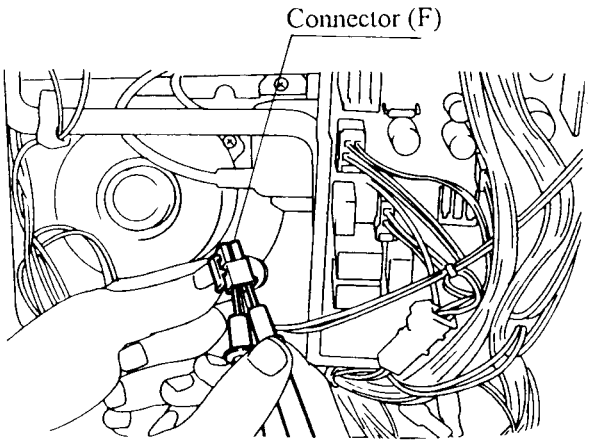
① * Disconnect connector A_2, and measure the resistance between the two white wires.

Normal (standard)

Temp (°C)	15	30	45	75
Resistance (kΩ)	12.3	7.0	4.1	1.6

Normal: proceed to 3.
Faulty: replace outgoing water temperature thermistor.

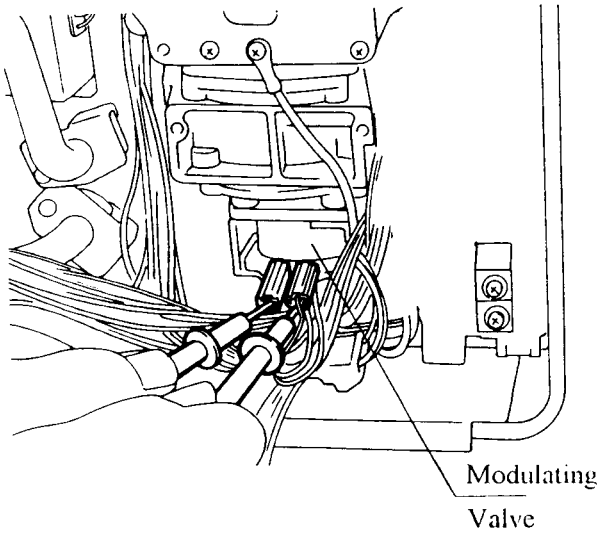
3. Is the changeover solenoid valve operating normally ?



① * Disconnect solenoid valve connector F and measure the resistance between the blue and black wires.
Normal: 950 - 1420 Ω. If normal, proceed to ②.
Faulty: replace changeover solenoid valve.

② Measure the voltage between the blue and the black wires of connector F.
Normal: DC 80 - 100 V. If normal, proceed to 4.
Faulty: replace PCB.

4. Is the modulating valve operating normally ?

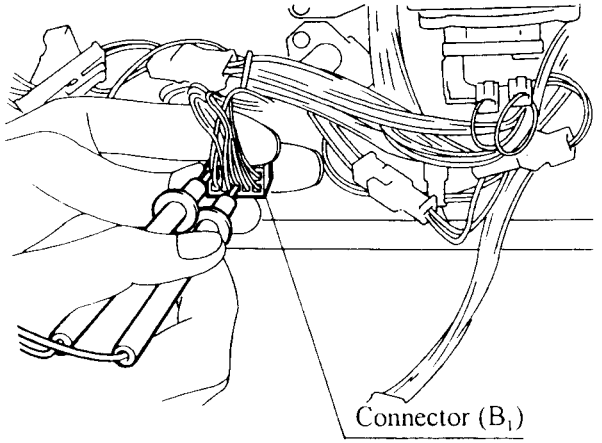


① * Remove the terminals from the modulating valve (**do not pull on the wires**), and measure the resistance between the two terminals.
Normal: 69 ~ 89 Ω. If normal, proceed to ②.
Faulty: replace modulating valve.

② Measure the voltage between the two orange wires of the modulating valve terminals.
Normal: DC 0.5 - 25 V. If normal, proceed to ③. Faulty: replace PCB.

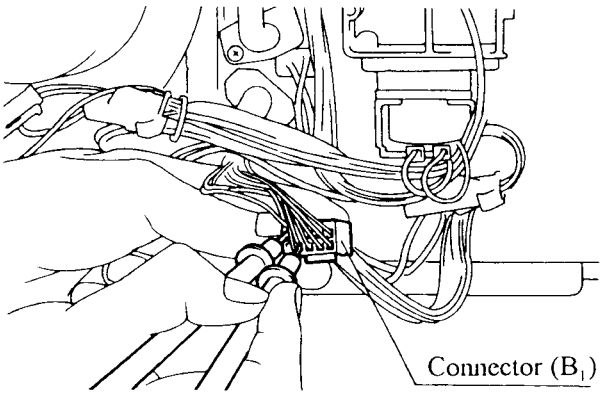
③ Check the change in the secondary gas pressure when the remote control temperature setting is changed from 37°C to 75°C.
Normal: if the secondary pressure changes proceed to 5.
Does not change: replace modulating valve.

5. Is the electronic water flow control device operating normally ?



① * Measure the resistance between the white and yellow of PCB connector B_1.
Normal: 90 - 130 Ω. If normal, proceed to ②.
Faulty: replace electronic water flow control device.

② * Measure the resistance between the white and orange of PCB connector B_1.
Normal: 90 - 130 Ω. If normal, proceed to ③.
Faulty: replace electronic water flow control device.



③ * Measure the resistance between the grey and black of PCB connector B_1.

Normal: 90 - 130 Ω. If normal, proceed to ④.
Faulty: replace electronic water flow control device.

④ * Measure the resistance between the grey and brown of PCB connector B_1.

Normal: 90 - 130 Ω. If normal, proceed to ⑤.
Faulty: replace electronic water flow control device.

⑤ Measure the voltage between the green and yellow of PCB connector B_1.

Normal: DC 15 - 26 V. If normal, proceed to ⑥.
Faulty: replace PCB.

⑥ Measure the voltage between the green and orange of PCB connector B_1.

Normal: DC 15 - 26 V. If normal, proceed to ⑦.
Faulty: replace PCB.

⑦ Measure the voltage between the green and black of PCB connector B_1.

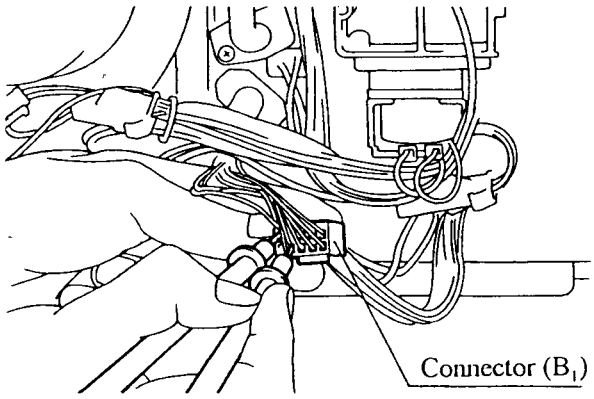
Normal: AC - DC 15 - 26 V. If normal, proceed to ⑧.
Faulty: replace PCB.

⑧ Measure the voltage between the green and brown of PCB connector B_1.

Normal: AC - DC 15 - 26 V. If normal, proceed to ⑨.
Faulty: replace PCB.

⑨ Measure the voltage between the red and green of PCB connector B_1.

Normal: DC 11 - 13 V. If normal, proceed to (10).
Faulty: replace PCB.

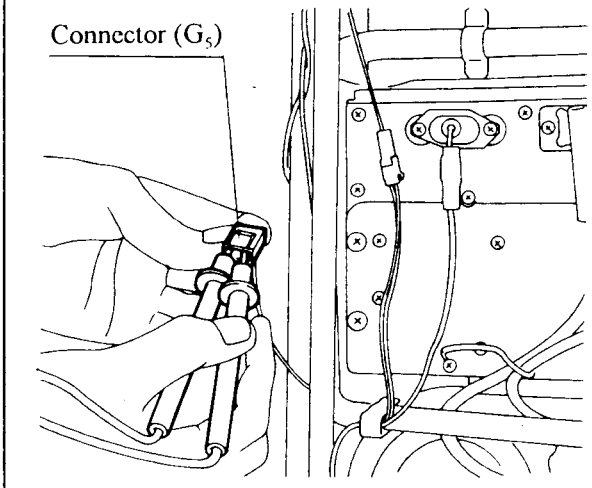


(10) Measure the voltage between the purple and green of PCB connector B_1.
Normal:
DC 0 - 0.4 V (Fully open limiter "ON")
DC 4 - 6 V (Fully Open limiter "OFF")
If normal, proceed to (11).
Faulty: replace PCB.

(11) Measure the voltage between the blue and green of PCB connector B_1.
Normal:
DC 0 - 0.4 V (Fully open limiter "ON")
DC 4 - 6 V (Fully open limiter "OFF")
If normal, replace electronic water flow control device.
Faulty: replace PCB.

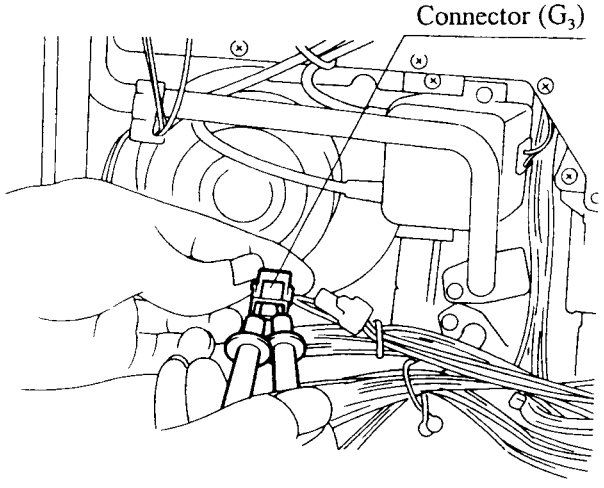
Anti-Frost heater does not operate.

1. Is the anti-frost heater circuit OK ?



① * Disconnect PCB connector G_5 and measure the resistance between the white and white wires.

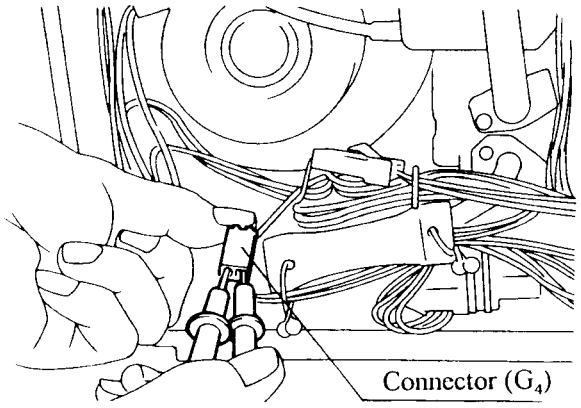
Normal: 47 - 50 Ω. If normal, proceed to ②.
Faulty: replace anti-frost heater A harness.



② * Remove PCB connector G_3 and measure the resistance between the white and the white.

Normal: 47 - 57 Ω. If normal, proceed to 2.
Faulty: replace anti-frost heater B assembly.

2. Is the frost temperature sensing switch operating normally ?



(1) * Disconnect PCB connector G_4, and measure the resistance between blue and blue. (Measure at 4±3°C.)

Normal: less than 1 Ω. If normal, check the wiring (AC 100 V circuit.)
Faulty: replace frost temperature sensing switch.

§ 25 GAS CONVERSION PROCEDURE

Refer to page 10 for detailed combustion specification. The Infinity 2402 Internal unit is not approved for use on Town Gas.

1) Disconnect Electrical Supply.

2) Remove front panel (4 screws).

3) Remove manifold (8 screws).

4) Exchange main injectors x 18.

   For conversion from NG to LP or LP to NG on REU-2402FFU Only: Exchange damper.

   For conversion to Town Gas from NG or LP (*W Only*)): Exchange damper, burner and gas control. (Contact Rinnai Australia for details.)

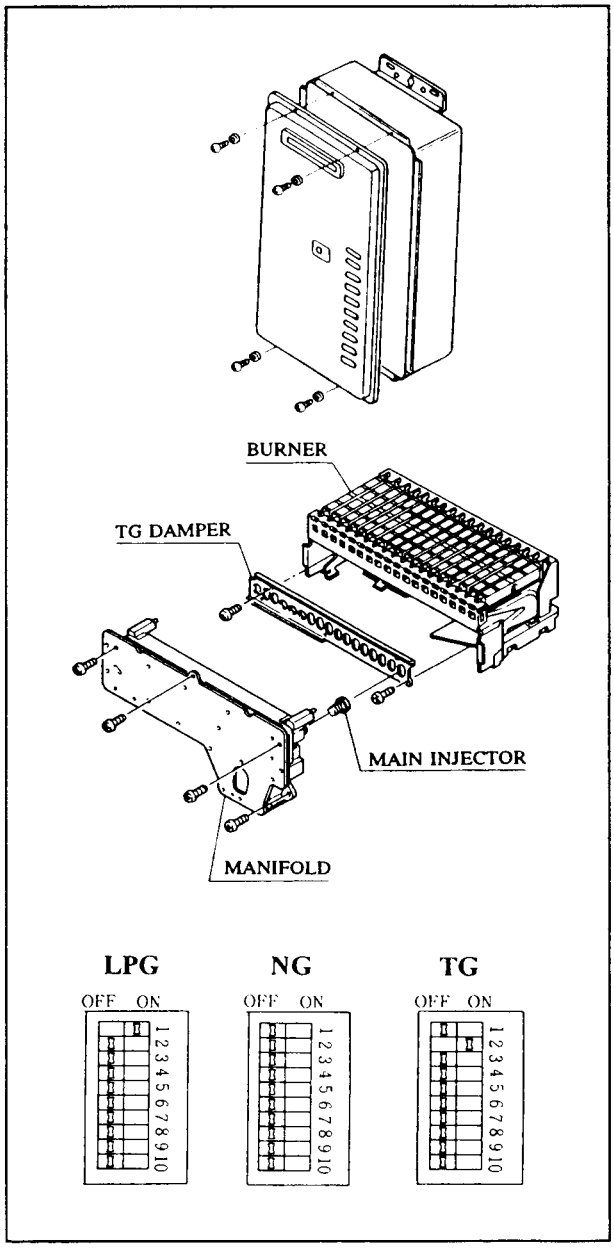
   For conversion to NG or LP from Town Gas (*W Only*): Exchange damper. (No need to change burner and gas control.)

5) Replace manifold (8 screws).

6) Remove plastic cover. Position gas selection switches to the correct position. See diagram opposite.

7) Remove pressure point screw and attach pressure gauge.

8) Connect electrical supply. **Take care with connections, 240 V.**



9) **Pressure Adjustment *with water flowing*.**

1. **LOW**

a. Place N° 9 switch to ON position.

b. Remove plug in base of unit for access to regulator screw. Adjust regulator screw.

	W	FFU
LPG	0.13 kPa	0.18kPa
NG	0.06 kPa	0.07kPa
TG	0.04 kPa	------

c. Place N° 9 switch to OFF position.

2. **HIGH**

a. Place N° 10 switch to ON position.

b. Adjust HI potentiometer on PCB.

	W	FFU
LPG	2.00 kPa	2.06kPa
NG	0.70 kPa	0.68kPa
TG	0.37 kPa	------

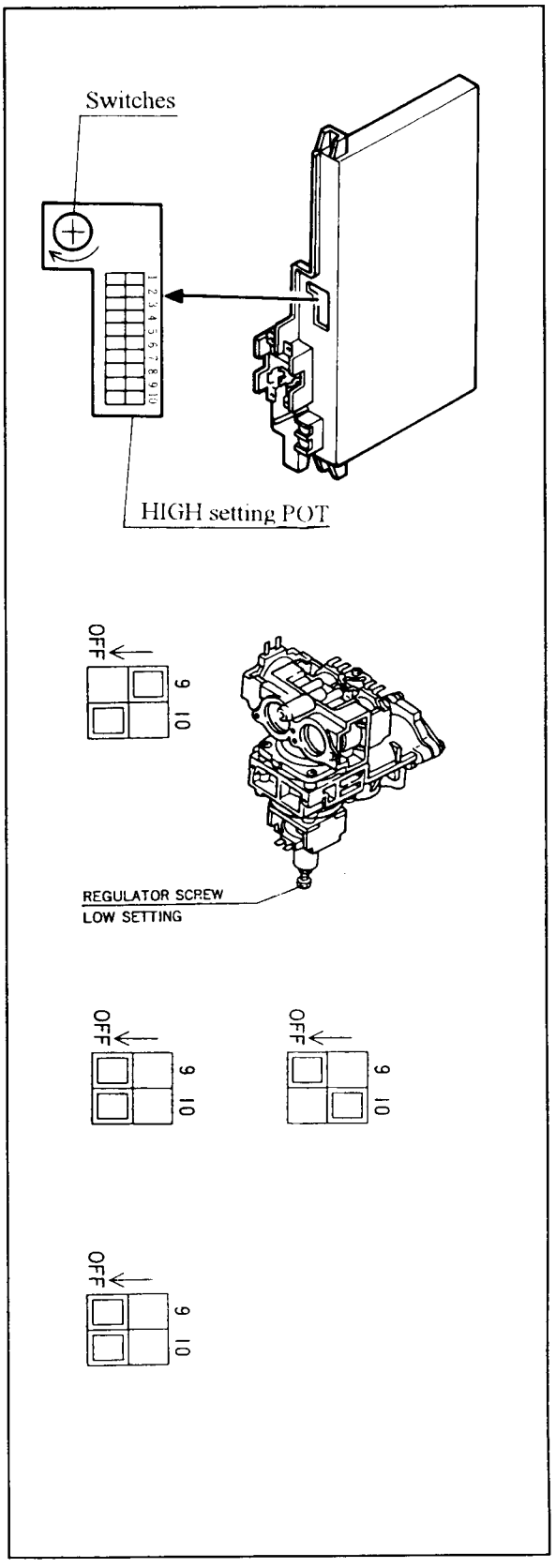
c. Place N° 10 switch to OFF position.

d. Turn unit OFF.

10) Remove pressure gauge and replace test point screw. Replace plastic cover.
Replace plug in base.

11) Check for gas escapes.

12) Replace front panel (4 screws).



§ 26 DISMANTLING FOR SERVICE

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

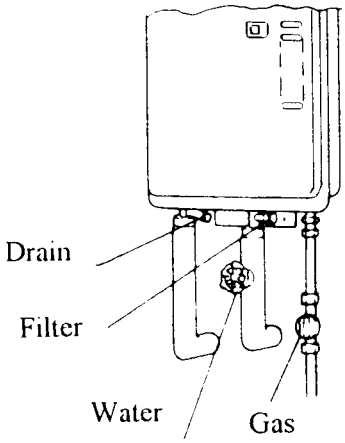
eg. - Isolate gas supply.
- Disconnect electrical supply from wall socket.
- Isolate the water supply.
- Drain **All** water from the appliance.

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.

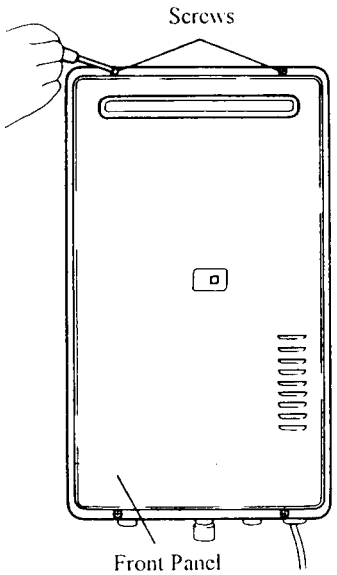
The following diagram may be of assistance.



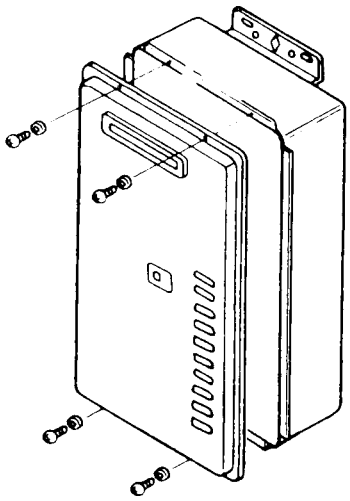
1) Removal of the FRONT PANEL

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.

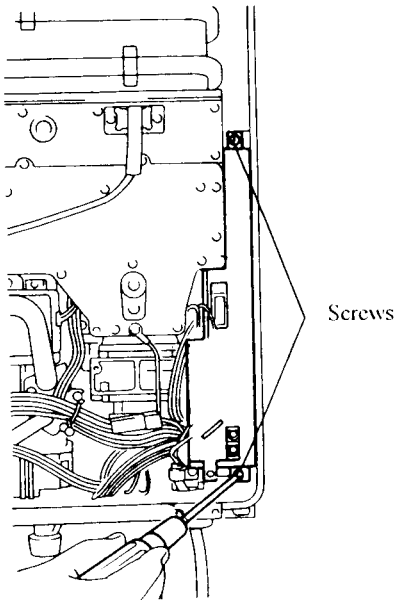


b. Remove front panel by shifting forward.



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.

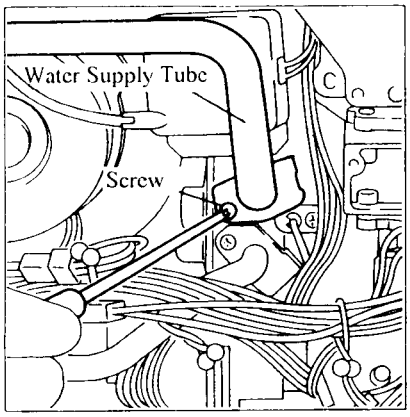


a. Remove the two (2) screws holding the PCB in place, and pull the PCB towards yourself and out of appliance. [+ Driver.]

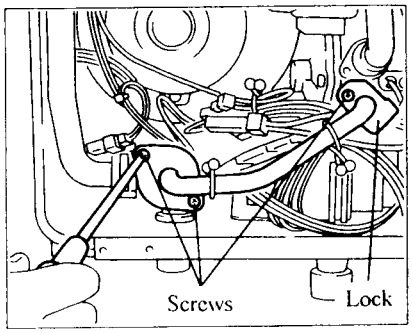
3) Removal of the ELECTRONIC WATER FLOW CONTROL DEVICE.

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

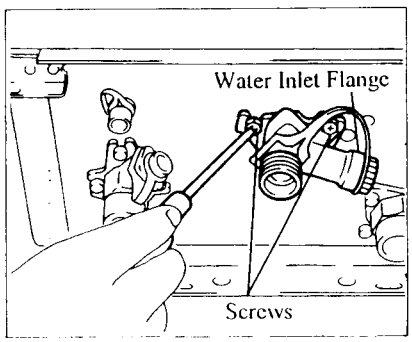
a. Remove one (1) screw from the heat exchanger water supply pipe to release the metal lock. Pull the pipe towards yourself to release. Handle O-ring carefully. [⊕ Driver]



b. Remove the three (3) screws that secure the by-pass pipe and metal lock in place. Pull the by-pass pipe towards yourself and remove from the appliance. (Handle O-ring carefully.) [⊕ Driver, hand.]



c. Remove the four (4) screws that secure the water supply connection in place; remove connection. Handle carefully.[⊕ Driver]

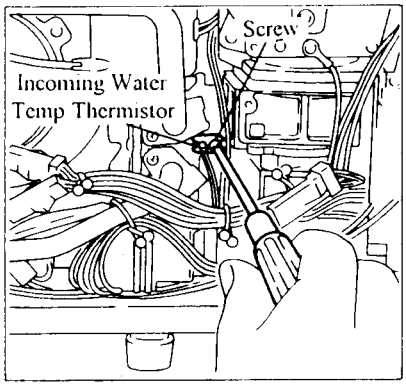


4) Removal of the WATER FLOW SENSOR.

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

a. Remove the electronic water flow control device; (refer to section 3).

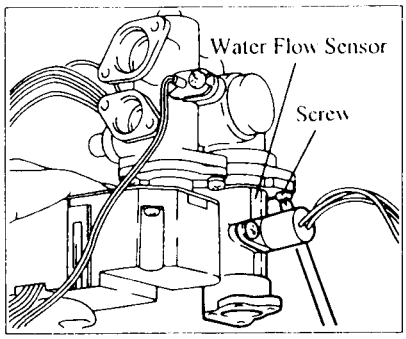
b. Remove two (2) fixing screws to remove water flow sensor. [⊕ Driver, hand.]



5) Removal of the INCOMING WATER TEMPERATURE THERMISTOR.

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

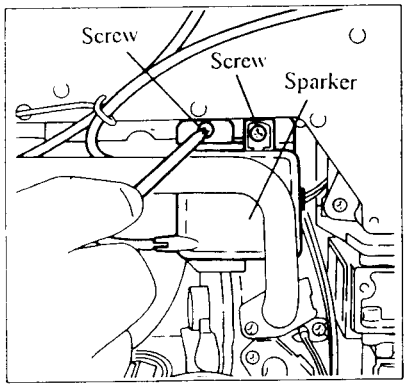
a. Remove one (1) screw that secures the thermistor in place. [⊕ Driver, hand.]



6) 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.]

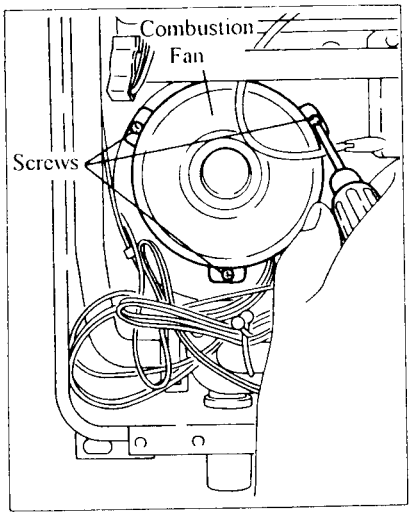


b. Remove one (1) screw that secures the sparker to the attachment plate to remove sparker. [⊕ Driver, hand.]

7) Removal of the COMBUSTION FAN.

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

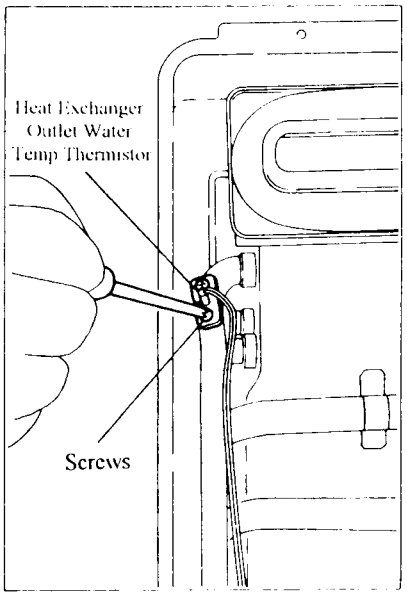
a. Remove the three (3) screws that secure the fan in place, and pull the fan towards yourself to remove it. [⊕ Driver, hand.]



8) Removal of the HEAT EXCHANGER OUTLET THERMISTOR.

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

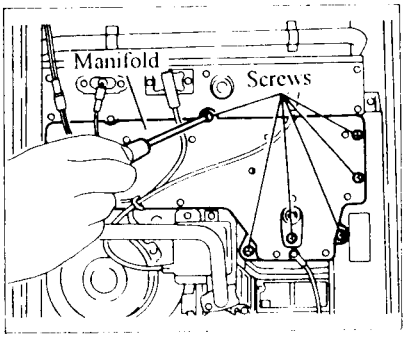
a. Remove two (2) screws that secure the thermistor in place. [⊕ Driver, hand.]



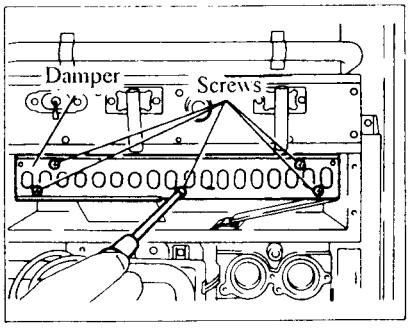
9) Removal of the BURNER AND MANIFOLD.

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

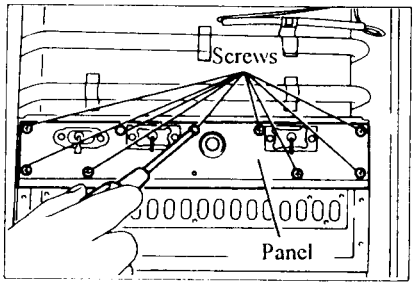
a. Remove eight (8) screws that secure the manifold in place and pull out the manifold. [⊕ Driver.]



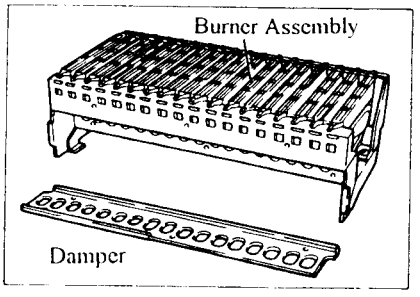
b. Remove the five (5) screws that hold the damper in place and remove it. [⊕ Driver.]



c. Remove the nine (9) screws that hold the combustion chamber front panel in place and remove the panel. [⊕ Driver.]



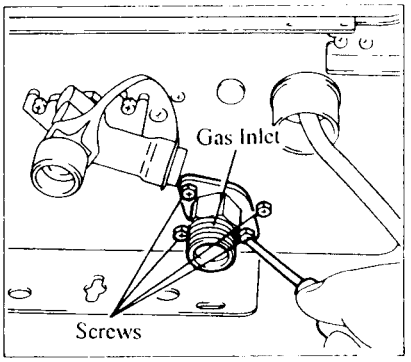
d. Pull burner assembly forward to remove. [hand.]



10) 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 four (4) screws that hold that gas connection in place. (Handle O-ring carefully.) [⊕ Driver, hand.]

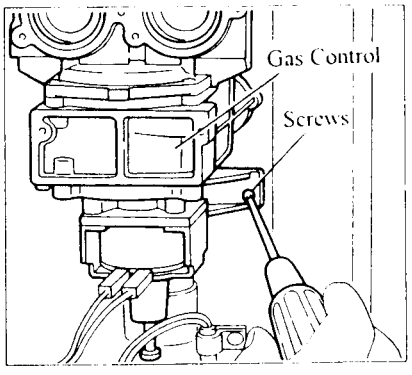


b. Remove the manifold; refer to section 9)a.

c. Remove the PCB; refer to section 2.

d. Remove the electronic water flow control device; refer to section 3.

e. Remove the screw that holds the gas control assembly in place and pull out the gas control.



11) Removal of the HEAT EXCHANGER UNIT.

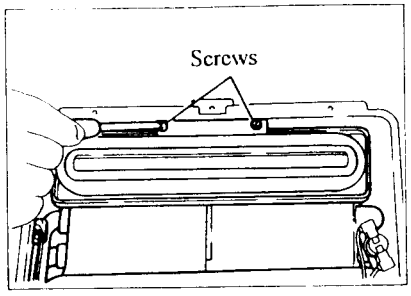
CAUTION: 240 Volt exposure. Isolate the electrical, water and gas supplies to the appliance, reconfirm with a neon screwdriver or multimeter.

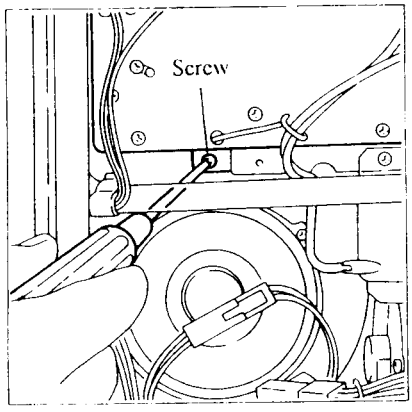
a. Remove the heat exchanger water supply connecting pipe; refer to 3)a.

b. Remove the hot water supply pipe; refer to 3.

c. Remove the igniter attachment plate; refer to 6) a.

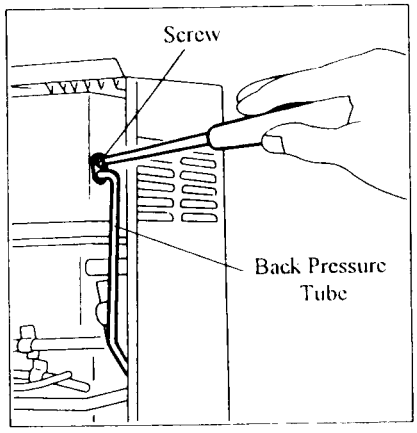
d. Remove the four (4) screws from the heat exchanger unit, to pull out the assembly. [⊕ Driver, hand.] (The following diagrams show W model.)

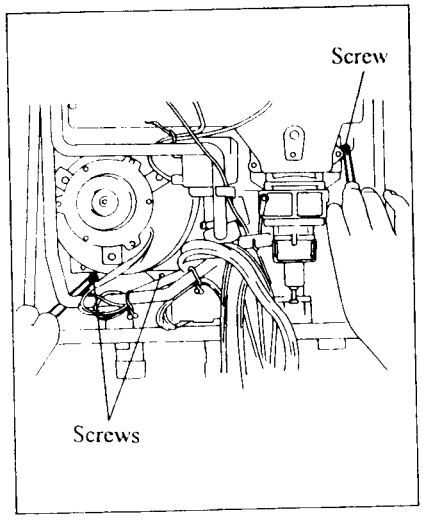


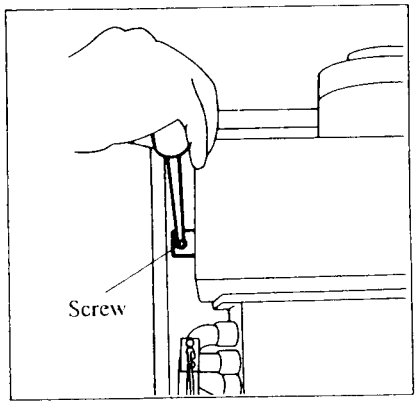


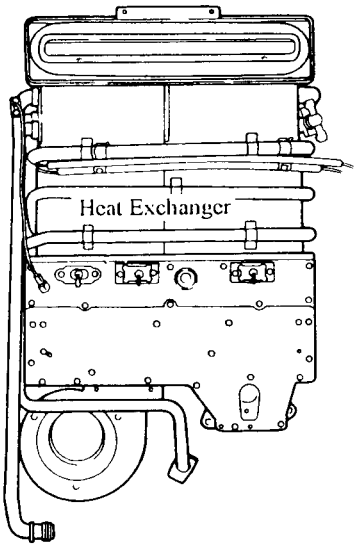
(The following diagrams show FFU model.)

e. Remove one (1) screw to release flue back pressure pipe. [⊕ Driver.]









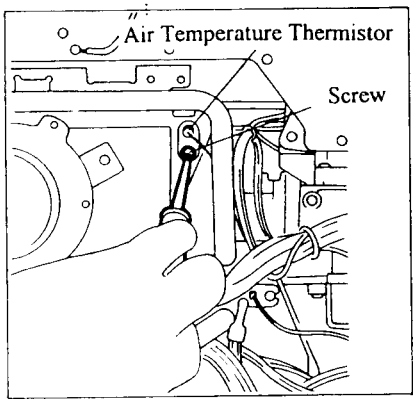
f. Remove the five (5) securing screws of the heat exchanger/flue to pull out the assembly. [⊕ Driver, hand.]

12) Removal of INCOMING AIR TEMPERATURE THERMISTOR (FFU).

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

a. Remove the igniter; refer to section 6) b.

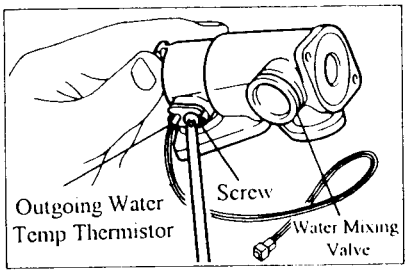
b. Remove the two (2) screws that secure the thermistor to release.



13) Removal of the OUTGOING WATER TEMPERATURE THERMISTOR.

a. Remove the mixing valve; refer to section 15.

b. Remove the screw release thermistor. [⊕ Driver, hand.]

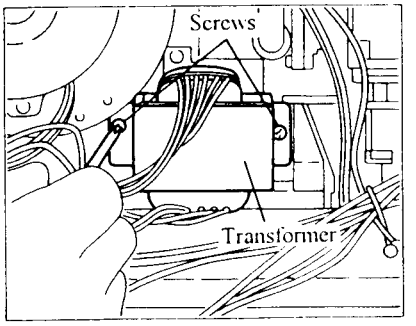


14) Removal of the TRANSFORMER.

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

a. Remove the electronic water flow control device, refer to section 3.

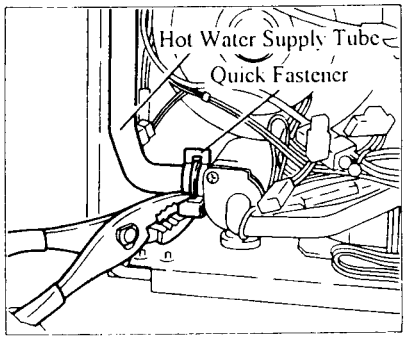
b. Remove two (2) fixing screws to release the transformer. [⊕ Driver, hand.]



15) Removal of the WATER BY-PASS MIXING VALVE.

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

a. Remove the water drain plug. Remove the four (4) screws that hold the hot water supply connection in place and remove the connection. (Handle O-ring carefully.) [⊕ Driver, hand.]



b. Remove quick-fastener and detach hot water connecting pipe. (Pliers.)

c. Remove water by-pass pipe; refer to section 3) b.

§ 27 PARTS LIST - 2402 W

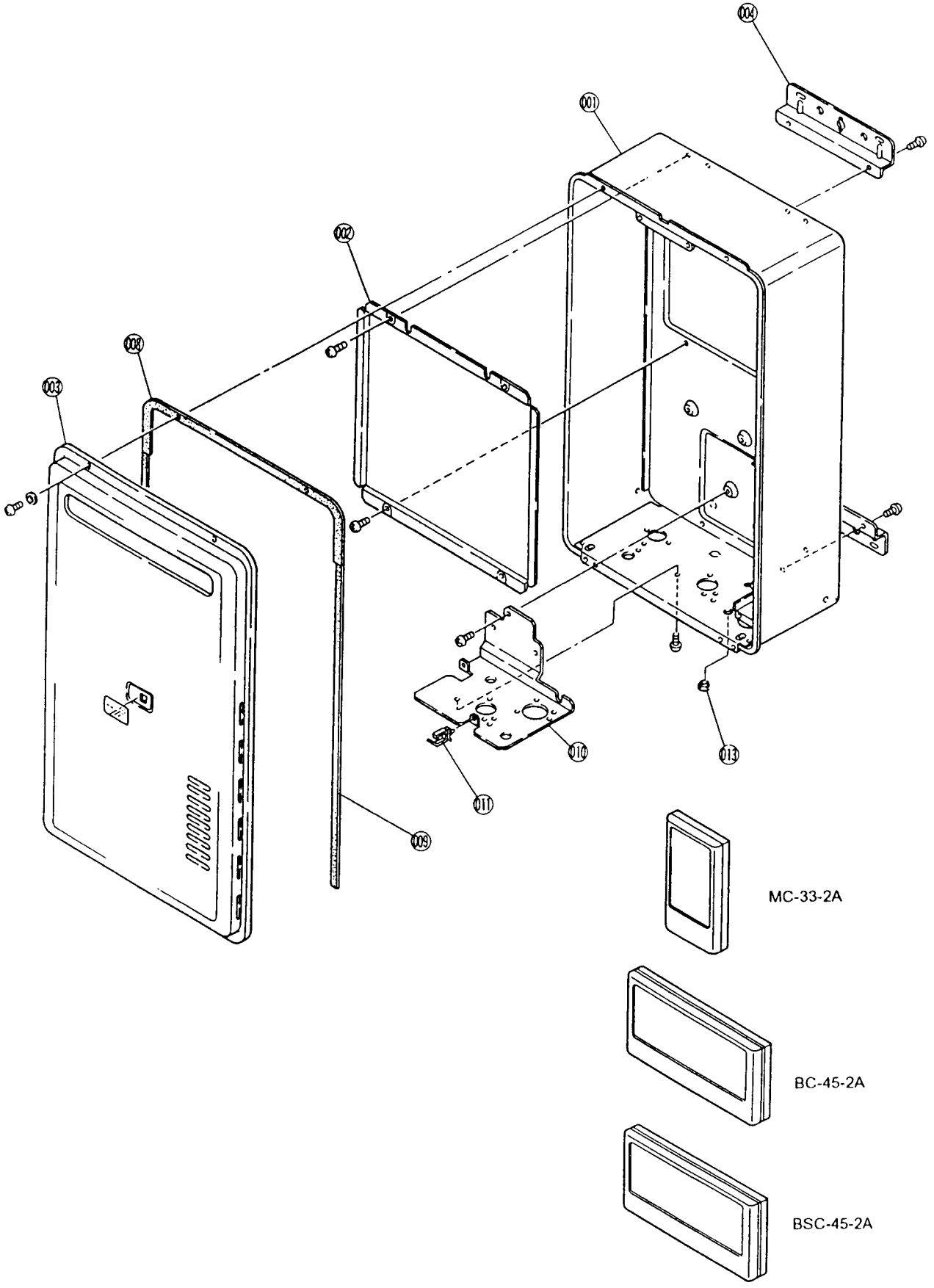
No	Part Name	RNZ Part No	RA Part No	QTY
001	Main body - standard		92071125	1
001	Main body - rustproof	3570	92071125	
002	Heat shield			1
003	Front panel assembly - standard		92071133	1
003	Front panel assembly - rustproof	3571	92071133	1
004	Wall mounting bracket F		92071323	2
008	Main Body Packing A	3572	92073345	1
009	Main Body Packing Side	3567	92063361	2
010	Gas control bracket			1
011	Cable clamp (locking wire saddle)			1
013	Rubber plug			1
014	Cable Plug/Connections Inlet			1
100	3/4" Gas Connection	3836	92075092	1
101	Filter	3563	92075100	1
102	Gas Control supply tube	3581	92071356	1
103	Gas Control Assembly (LP,NG)	3582	92071349	1
103	Gas Control Assembly (TG)		92074988	1
104	Manifold Assembly	3583	92071141	1
105	Main Injector - NG	3814	92071158	18
105	Main Injector - LPG	3558	92071364	18
105	Main Injector - TG		92074962	18
106	Damper (NG, LPG)		92074939	1
106	Damper (TG)		92071471	1
107	Burner Unit Assembly A (TG)		92071166	1
107	Burner Unit Assembly B (NG,LPG)		92071620	1
108	Burner Front Bracket			1
109	Distribution Panel			1
110	Inclined Panel			1
111	Burner Case Lower Panel			1
112	Horizontal Bunsen Burner (TG)		92063411	18
112	Horizontal Bunsen Burner (NG,LPG)	3584		18

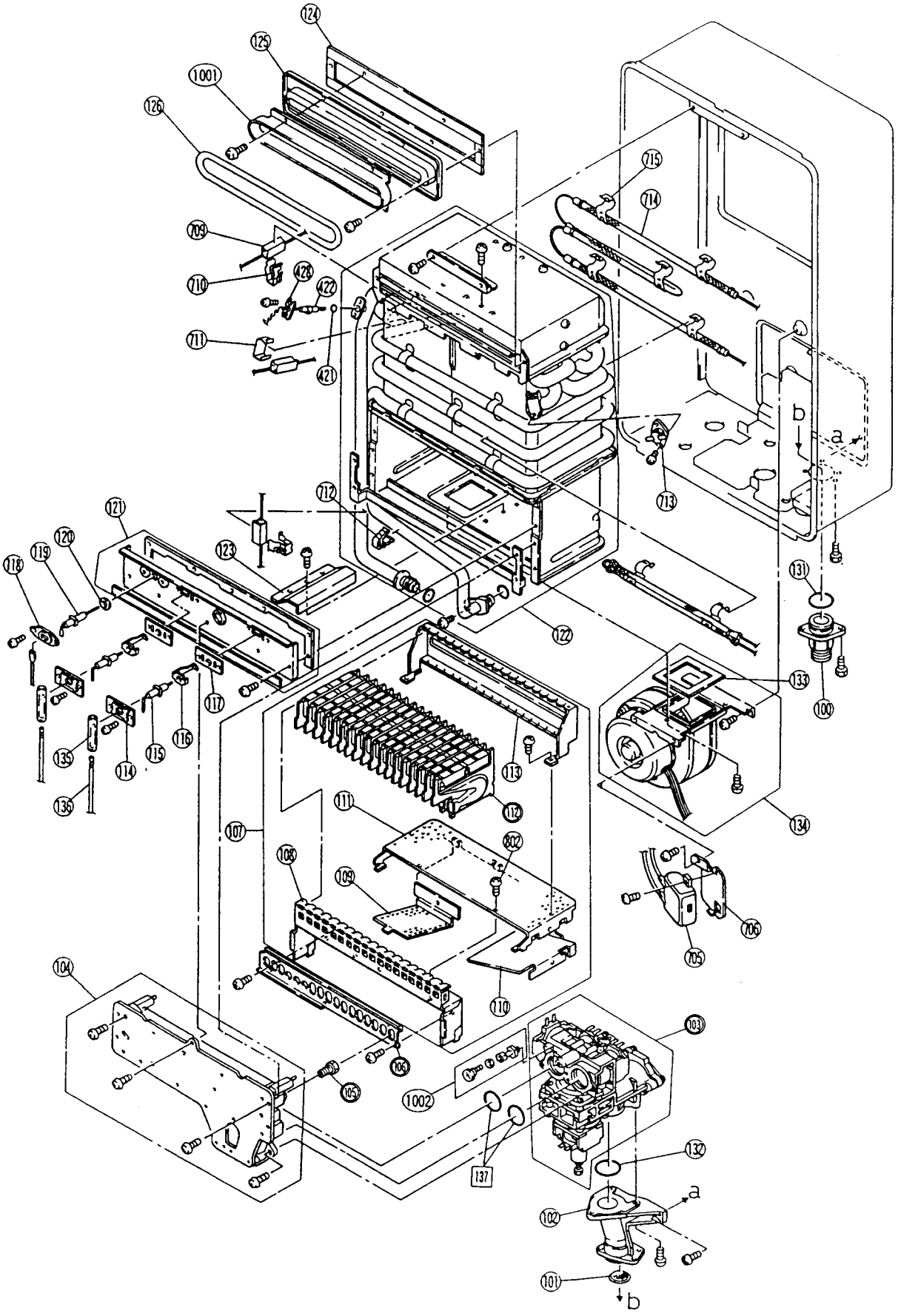
No	Part Name	RNZ Part No	RA Part No	QTY
113	Burner Case Rear Panel			1
114	U-electrode Bracket			1
115	Electrode	3978	92071190	2
116	Ignition Striker			2
117	U-Electrode Packing	3586		2
118	Flame rod Bracket			1
119	Flame rod	3606	92071208	1
120	Flame Rod Packing	3607		1
121	Combustion Chamber Front Panel			1
122	Heat Exchanger Complete Assy	3587	92071174	1
123	Combustion Chamber Bottom Panel Support			1
124	Flue Packing			1
125	Flue Assembly			1
126	Front Panel Seal Packing			1
131	Gas Inlet O Ring	3559	92071380	1
132	Gas Connection Tube O Ring	3615	92071398	1
133	Fan Connection Packing	3617		1
134	Fan Motor Assembly	3618	92071232	1
135	Electrode Sleeve			2
136	High Tension Cord C		92075118	2
137	Gas Manifold O Rings	3619	92075126	2
400	3/4" Water Inlet Fitting C		92075167	1
401	Plug Band L			1
402	Water Filter Assembly	3839	92062280	1
403	Water Filter Plug	3609		1
404	Water Rectifier	3560		1
405	Water Flow Sensor Assembly	3979	92071257	1
406	Electric Water Flow Control Device	3980	92071240	1
407	Quick Fastener	3561		1
408	Mixing Valve assembly	3669	92071406	1
409	Water Bypass Pipe Assembly	3961		1
410	3/4" Hot Water Outlet Fitting B		92075175	1
411	Pressure Relief Plug Band			1

No	Part Name	RNZ Part No	RA Part No	QTY
412	Pressure Relief Valve Assembly B	3870	92071273	1
413	Drain Valve Band A			1
414	Drain valve	3962		1
415	Water Filter O ring	1106	92063551	1
416	Water Inlet/Outlet O ring	3013	92071182	1
417	Water Flow Sensor O ring	3964	92071414	1
418	HX inlet connection O ring	3965	92071422	1
419	HX outlet bypass O ring	3826	92062207	1
420	Bypass/mixing Valve O ring	1070	92071430	2
421	Thermistor use O ring	3832	92062249	3
422	Incoming Water Temperature Thermistor	3966	92071216	
422	Heat Exchanger Outlet Water Temperature Thermistor	3966	92071216	
422	Outgoing Water Temperature Thermister	3966	92071216	
423	Themistor clip			2
425	Bypass Relief Valve O ring A	1063	92071448	1
426	Bypass Relief Valve O ring B	3562	92071455	1
427	Pressure Relief Valve O ring	3849	92062348	1
428	Large Clip (M.X. Thermistor)			1
429	Harness B	3967		1
430	Harness Assembly A	3968		1
431	Harness C	3969		1
432	Orifice			
700	P.C.B. Unit Assembly	3970	92071281	1
701	Fuse			2
702	P.C.B. Lid	3565		1
703	P.C.B. Cover	3568		1
704	Power Supply Cord			1
705	Electronic Sparker	3971	92071307	1
706	Sparker Attachment Plate			1
707	Transformer Cover			1
708	Transformer Assembly small (100V)	3972	92071299	1
709	Anti-Frost Heater A Assembly	3973	92071224	1
710	Heater Fixing Clip			2

No	Part Name	RNZ Part No	RA Part No	QTY
711	Heater Fixing Clip			1
712	Harness Clamp			1
713	Overheat Switch (97°C OFF)	3830	92062405	1
714	Thermal Fuse and Harness	3974	92071315	1
715	"F" Fixing Band A			7
716	Heater Fixing Clip			2
717	Anti-Frost Heater B Assembly	3975	92075183	1
718	Frost Sensing Switch	3976	92069079	1
719	Purse Lock			4
720	Heater Fixing Clip			1
722	Set of O Rings		92071463	15
1001	Flue Wind Restrictor			
1002	Pressure Test Point and Test Point Screw		92068907	1
1003	Transformer Mounting Bracket A			
1004	Transformer Mounting Bracket B			
1005	Transformer Large (240-100V)	3977	9201372	1
1006	Transformer Cover			
1007	Fuse Cover			
	Kitchen remote control (Pre March 1996)	MC-33-1A	92072495	1
	Kitchen remote control (Post March 1996)	MC-33-2A	92078583	1
	Main bathroom remote control (Pre March 1996)	BC-45-1A	92072503	1
	Main bathroom remote control (Post March 1996)	BC-45-2A	92078591	1
	Second bathroom remote control (Pre March 1996)	BSC-45-1A(UC)	DBSC45A	1
	Second bathroom remote control (Post March 1996)	BSC-45-2A	WBSC03	1

§ 28 EXPLODED DIAGRAM - 2402 W




124
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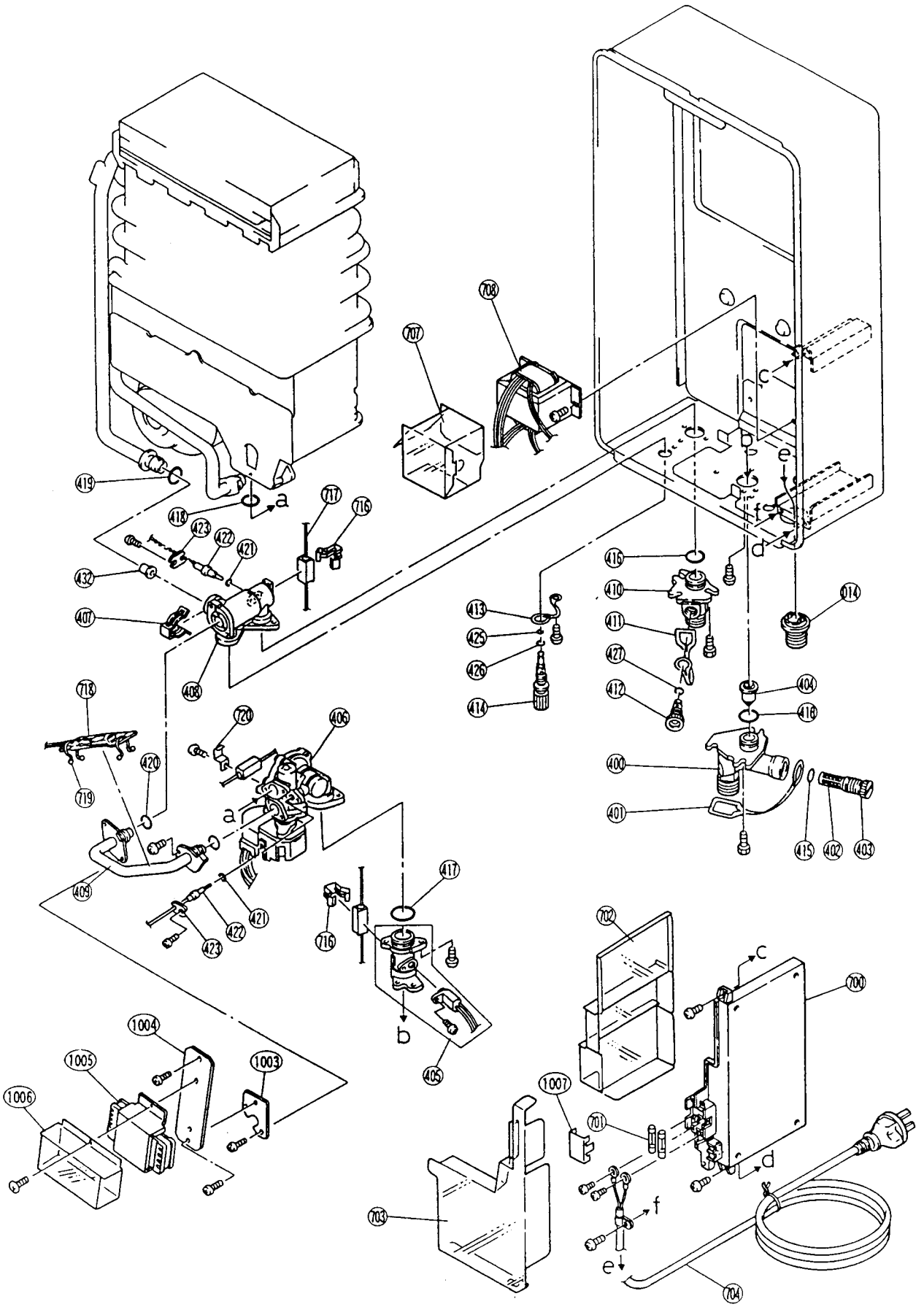

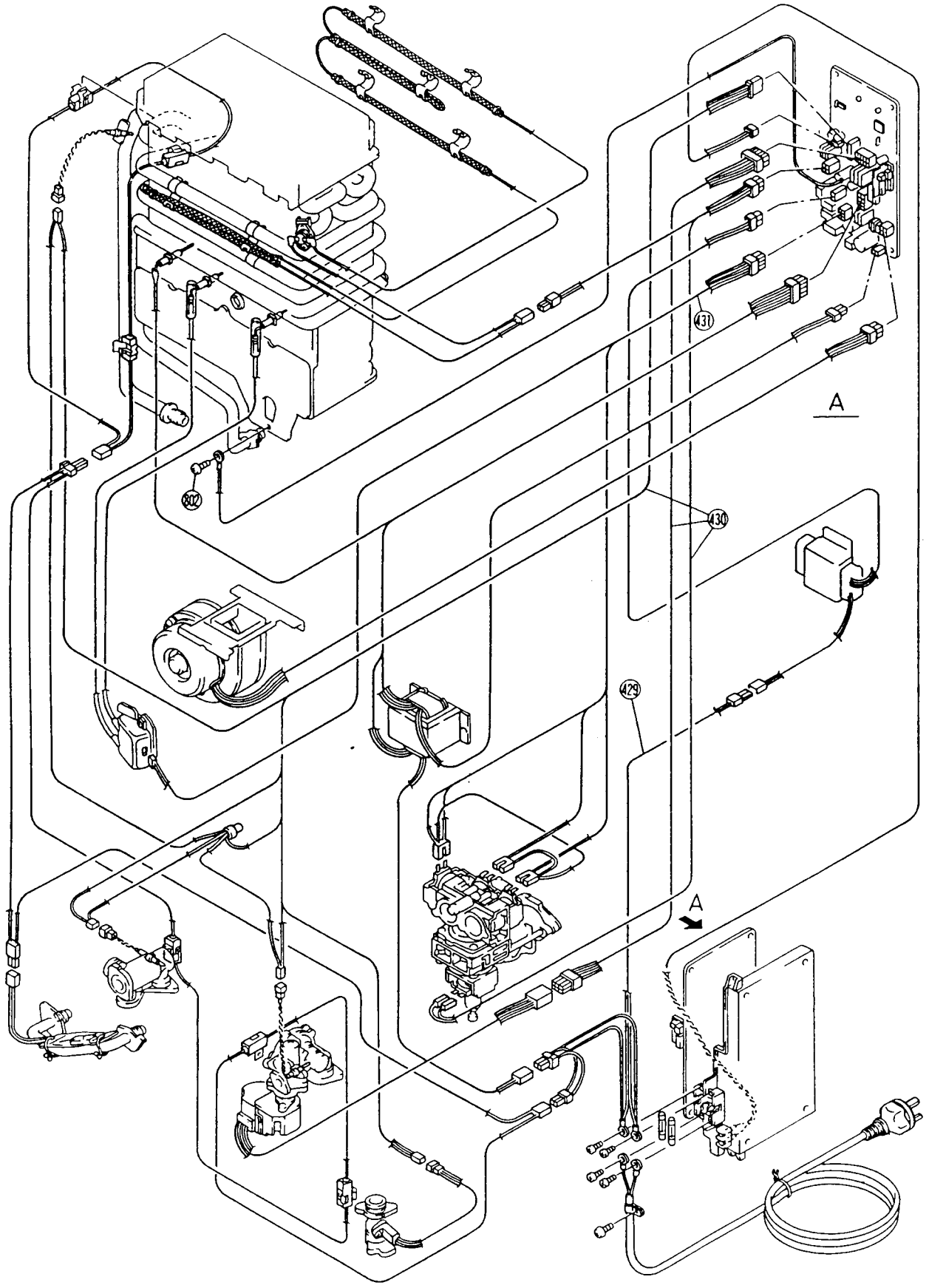
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429
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§ 29 PARTS LIST - 2402 FFU

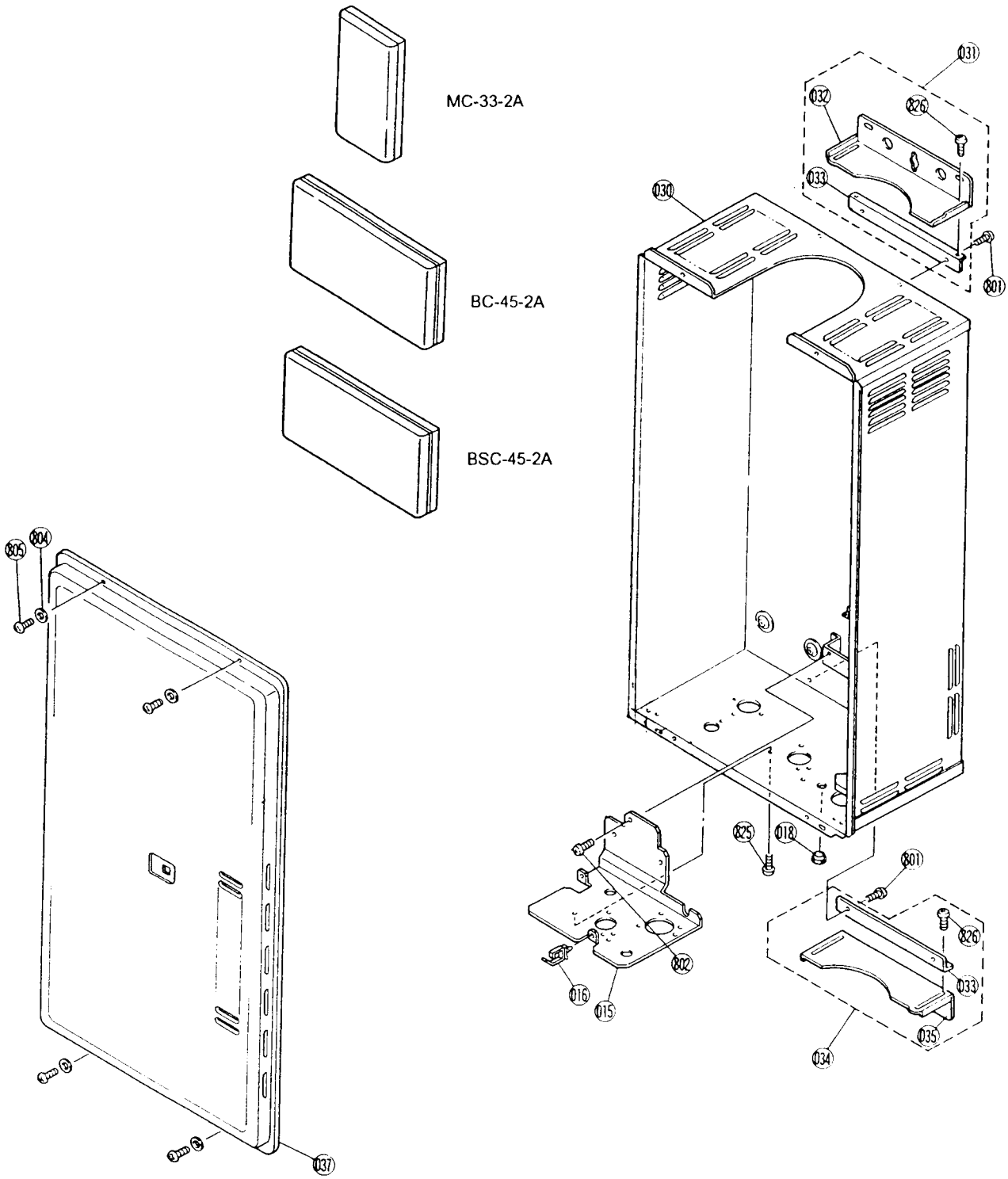
No	Part Name	RNZ Part No	RA Part No	QTY
015	Pipe Supporting Panel			1
016	Locking Wire Saddle			1
018	Rubber Plug			1
030	Main Body (assembly)	3960	92075076	1
031	Top Wall Bracket (assembly)			1
034	Bottom Wall Bracket (assembly)			1
036	Cable Connection			1
037	Front Panel	3963	92075084	1
100	3/4" Gas Connection	3836	92075092	1
101	Filter	3563	92075100	1
102	Gas Control Supply Tube			1
104	Manifold (Assembly)		92071141	1
105	Main Injector - NG	3993	92071158	18
105	Main Injector - LPG	3558	92071158	18
106	Damper (NG, LPG)		92074939	
107	Burner Assembly B (NG, LPG)		92071620	
108	Burner Front Bracket			1
110	Inclined Panel			1
111	Burner Case Lower Panel T			1
112	Horizontal Bunsen/ Burner NG, LPG	3584		18
113	Burner Case Rear Panel			1
114	U-Electrode Bracket			2
115	Electrode	3978	92071190	2
116	Ignition Striker			2
117	U-Electrode Packing	3586		2
118	Flame rod Bracket			1
119	Flame Rod	3606	92071208	1
120	Flame Rod Packing	3607		1
121	Com/Chamber Front Panel Assy			1
123	Com/Chamber Bottom Support			1
131	Gas Inlet O Ring	3559	9207380	1
132	Gas Connection Tube O Ring	3615	92071298	1
135	Electrode Sleeve			2

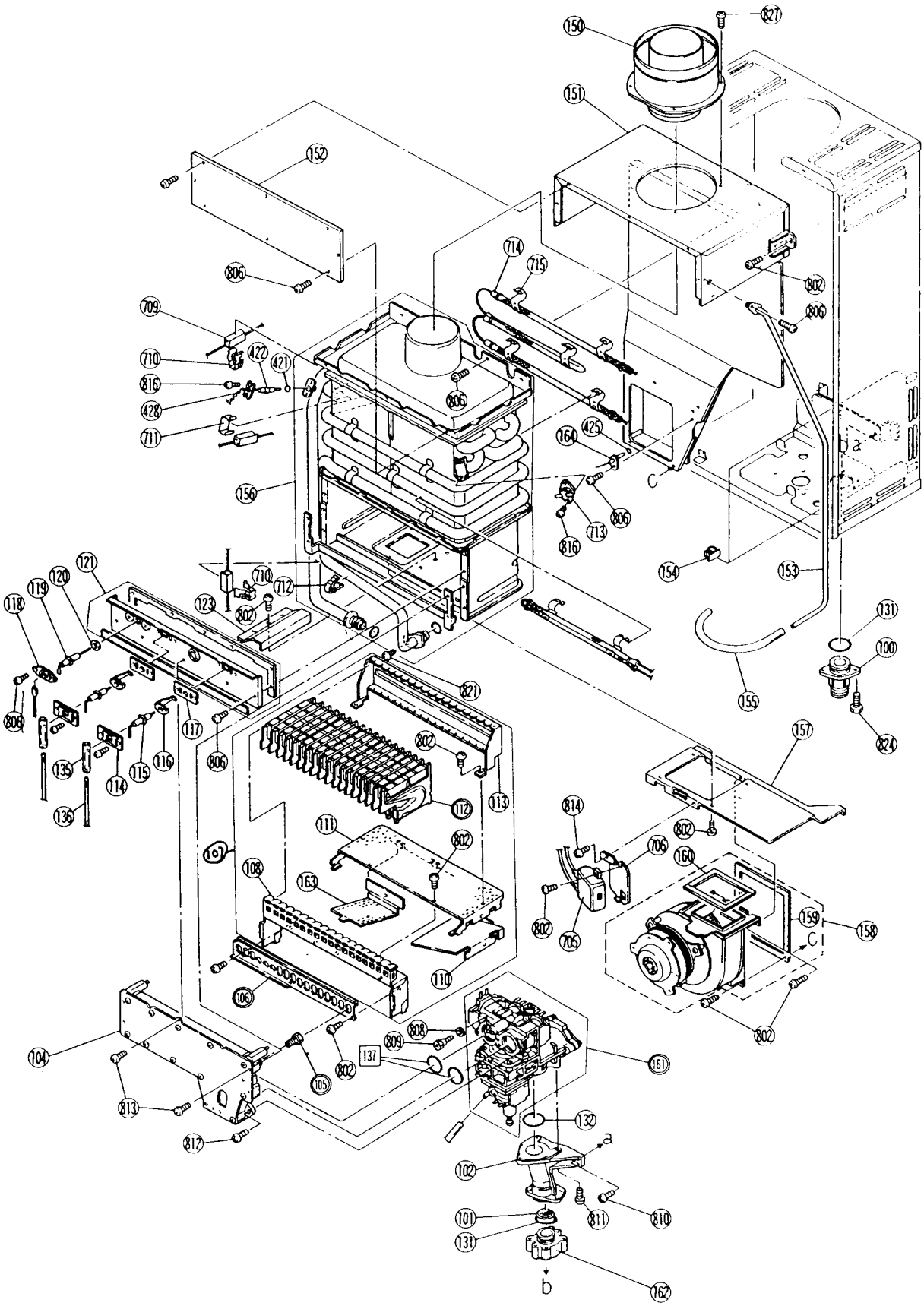
No	Part Name	RJ Part No	RA Part No	QTY
136	High Tension Cord C		92075118	2
137	Gas Manifold O Rings	3619	92075136	2
150	Flue Outlet (Assembly)			1
151	Air Supply Bracket (Assembly)			1
152	Air Supply Panel Lid			1
153	Back Pressure Pipe	3981		1
154	CK Clamp			3
155	Air Pressure Tube	3982		1
156	Heat Exchanger Complete Assembly A	3983	92075134	1
157	Combustion Chamber Bracket			1
158	Fan Motor (Complete Assembly)	3984	92075142	1
159	Air Inlet Packing			1
160	Fan Connection Packing			1
161	Gas Control Assembly (NG, LPG)	3985	92071349	1
162	Gas Connection Adaptor			1
163	Distribution Panel			1
164	Incoming Air Temperature Thermistor	3986	92075159	1
400	3/4" Water Inlet Fitting C		92075167	1
401	Plug Band L			1
402	Water Filter Assembly	3839	92062280	1
403	Water Filter Plug	3609		1
404	Water Rectifier	3560		1
405	Water Flow Sensor Assembly	3979	92071257	1
406	Electronic Water Flow Control Device	3980	92071240	1
407	Quick Fastener	3561		1
408	Mixing Valve Assembly	3669	92071406	1
409	Water Bypass Pipe Assembly	3961		1
410	3/4" Hot Water Outlet Fitting B		92075175	1
411	Pressure relief Plug Band			1
412	Pressure Relief Valve Assembly B	3870	92071273	1
413	Drain Valve Band A			1
414	Drain Valve	3962		1
415	Water Filter O Ring	1106	92063551	1
416	Water Inlet/Outlet O Ring	3013	92071182	1

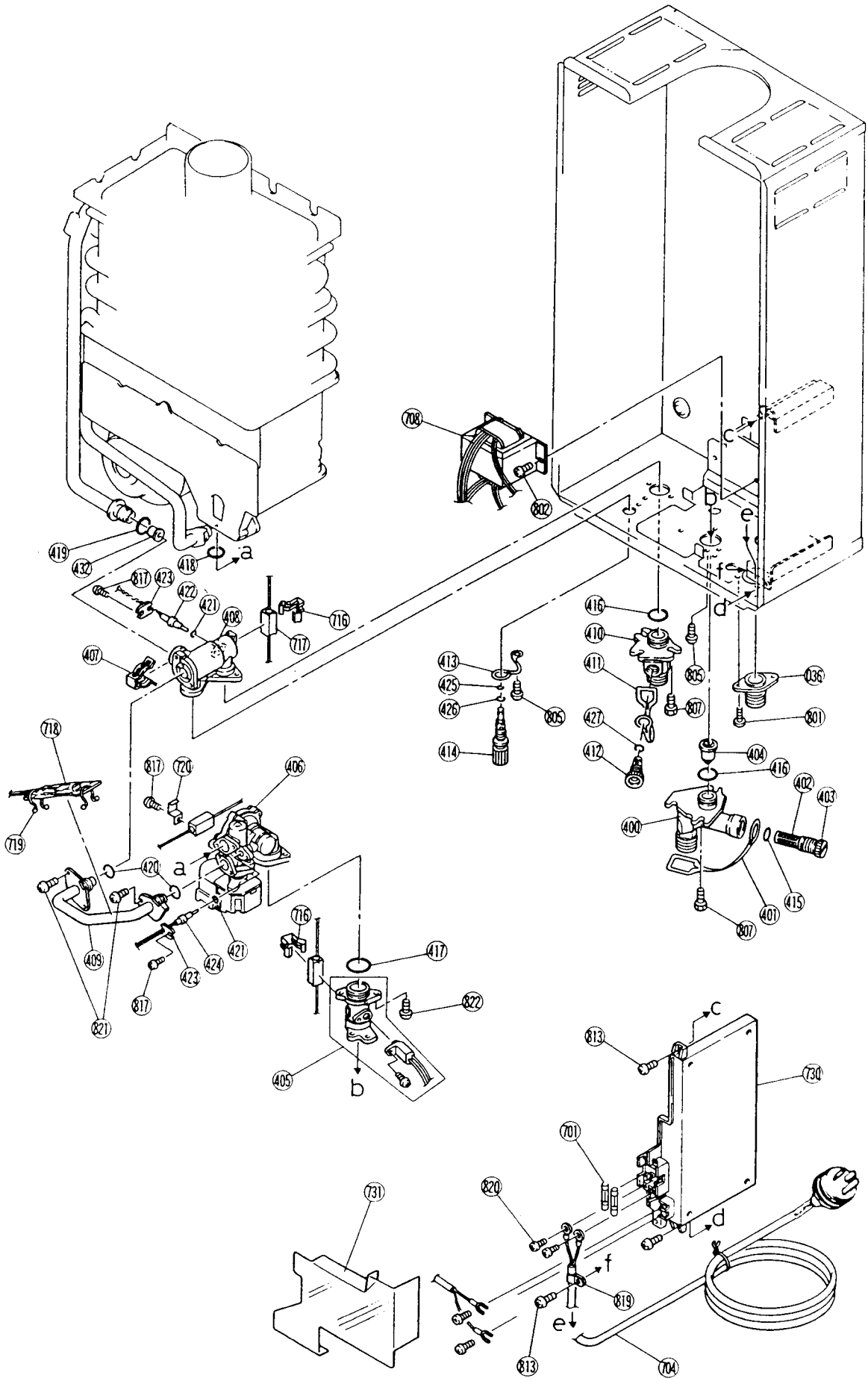
No	Part Name	RNZ Part No	RA Part No	QTY
417	Water Flow Sensor O Ring	3964	92071414	1
418	HX Inlet Connection O Ring	3965	92071422	1
419	HX Outlet Bypass O Ring	3826	92062207	1
420	Bypass/Mixing Valve O Ring	1070	92071430	2
421	Thermistor Use O Ring	3832	92062249	3
422	Incoming Water Temperature Thermistor			2
422	Heat Exchanger Outlet Water Temperature Thermistor	3966		2
422	Outgoing Water Temperature Thermistor			2
423	Thermistor Clip			2
424	Incoming Water Temperature Thermistor	3845	92071265	1
425	Relief Valve/Thermistor O Ring A	1063	92071448	1
426	Bypass Relief Valve O Ring B	3562	92071455	1
427	Pressure Relief Valve O Ring	3849	92063348	
428	Clip Large (M.X. Thermistor)			1
429	Harness B	3967		1
431	Harness C	3969		1
432	Orifice	3987		1
433	Harness A Assembly	3988		1
701	Fuse			2
704	Power Supply Cord			1
705	Electronic Sparker	3971	92071307	1
706	Sparker Attachment Plate			1
708	Transformer Assembly (100V)	3989	92071299	1
709	Anti-Frost Heater A Assembly	3973	92071224	1
710	Heater Fixing Clip			2
711	Heater Fixing Clip			1
712	Harness Clamp			1
713	Overheat Switch (97°C OFF)	3830	92062405	1
714	Thermal Fuse and Harness	3974	92071315	1
715	"F" Fixing Band A			7
716	Heater Fixing Clip			2
717	Anti-Frost Heater B Assy	3975	92075183	1

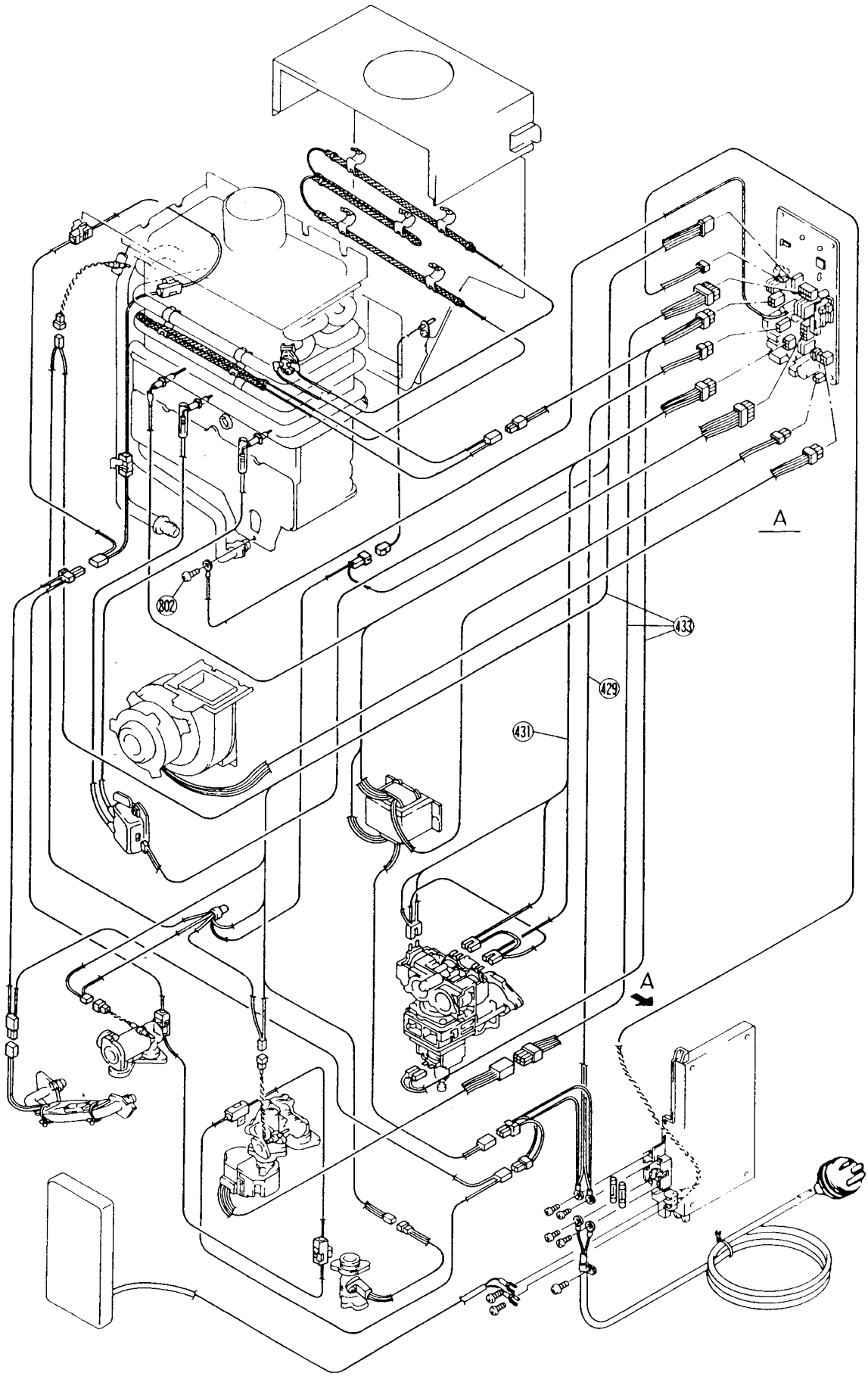
No	Part Name	RNZ Part No	RA Part No	QTY
718	Frost Sensing Switch	3976	92069079	1
719	Purse Lock			4
720	Heater Fixing Clip			1
721	Transformer (240-100V)	3990	92075209	1
722	Set of O Rings		92071463	15
730	P.C.B. Unit (Assembly)	3991	92075191	1
731	P.C.B. Cover	3992		1
	Kitchen Remote Control (Pre March 1996)	MC-33-1A	92072495	1
	Kitchen Remote Control (Post March 1996)	MC-33-2A	92078583	1
	Main Bathroom Remote Control (Pre March 1996)	BC-45-1A	92072503	1
	Main Bathroom Remote Control (Post March 1996)	BC-45-2A	92078591	1
	Second Bathroom Remote Control (Pre March 1996)	BSC-45-1A(UC)	DBSC45A	1
	Second Bathroom Remote Control (Post March 1996)	BSC-45-2A	WBSC03	1

§ 30 EXPLODED DIAGRAM - 2402 FFU









SERVICE CONTRACT POINTS

Rinnai AUSTRALIA PTY. LTD. A.C.N. 005 138 769

Head Office:		10-11 Walker Street, Braeside, VIC 3195.
		Tel: (03) 9580 7811. Fax: (03) 9580 8098.
	Sales	Tel: (03) 9586 7977. Fax: (03) 9587 0107.
	Service/Spare Parts	Tel: (03) 9586 7948. Fax: (03) 9580 7747.
	24 hr Hot Water	Tel: (1800) 632 386.
N.S.W. Branch:		62 Elizabeth Street, Wetherill Park, NSW, 2164.
		Tel: (02) 9609 2111. Fax: (02) 9609 5260.
	Sales	Tel: (02) 9609 2888.
	Service	Tel: (02) 9609 2600.
	24 hr Hot Water	Tel: (02) 9729 0468.
S.A. Branch:		140 Days Road, Ferryden Park, SA 5010.
		Tel: (08) 8345 0292. Fax: (08) 8345 4760.
	24 hr Hot Water	Tel: (018) 81 4379.
W.A. Branch:		18 Belgravia Street, Belmont, WA 6104.
		Tel: (09) 478 3355. Fax: (09) 277 2531.
	24 hr Hot Water	Tel: (09) 401 2562 North.
		Tel: (09) 457 1909 South.
QLD Branch:		6 Curban Street, Underwood, QLD 4119.
		Tel: (07) 3341 8777. Fax: (07) 3341 8868.
A.C.T.		**Rinnai Southern (Bird & Stirling Agencies Pty. Ltd.)**
		3 Lithgow Street, Fyshwick, ACT 2609.
		Tel: (06) 280 4833. Fax: (06) 280 6561.

Rinnai NEW ZEALAND LTD.

Head Office:		691 Mt. Albert Road, Royal Oak, Auckland.
		P.O. Box 24-068.
		Tel: (09) 625 4285. Fax: (09) 624 3018.
	24 hr Hot Water	Tel: (0800) 746 624. (0800 Rinnai)