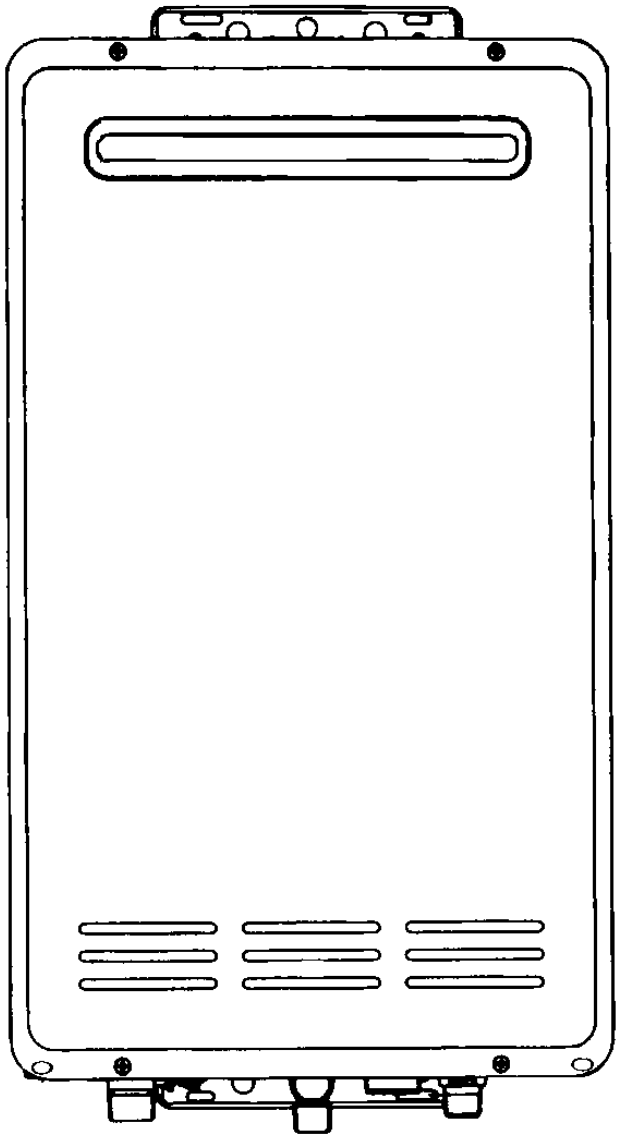
Rinnai

INFINITY REU-2425W

SERVICE MANUAL



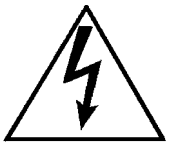
Rinnai High Capacity Continuous Flow Gas Hot Water System

The Australian Gas Association	All Rinnai products are certified by the Australian Gas Association as compliant to relevant Australian Standards.
Quality System™ Quality Endorsed Company ISO 9001 Lic 4983 SAI Global Head Office Certified Distributed and serviced in Australia under a Quality System certified as complying with ISO 9001 by SAI Global	Rinnai Australia Head Office is certified as complying with ISO 9001 by SAI Global.
TELARC REGISTERED SUPPLIER Quality Endorsed Company ISO 9001 Reg 415	Rinnai New Zealand has been certified to ISO 9001 Quality Assurance by Telarc.
Certified Product WaterMark AS3498 Lic W208 SAI Global	All Rinnai products are Certified to WaterMark by SAI Global. WaterMark certification is awarded to products and fittings complying with safety and water contamination standards.

Produced by Technical Services Department
February 2004 - Issue 2

Key to Warning Symbols

Failure to comply with the following instructions may result in serious personal injuiry or damage to the appliance.



Be careful of possible electric shock. Wiring inside this appliance may potentially be at 240 Volts.

Remove the plug from the source when carrying out any of the following activities.

Read Fault Diagnosis and Wiring Diagram carefully to avoid incorrect wiring

Do not disassemble. Parts within cannot be exchanged or diagnosed faulty.

Please follow instructions carefully to ensure safe and appropriate service.
After completing the service and confirming that there no gas leaks or incorrect wiring, test operation of unit according to the Customer Operating Instructions. After confirming normal operation, explain what was serviced to the customer and operation principles if necessary.

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

Table of Contents

Glossary of Terms and Symbols

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

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

1. Introduction

The brand name Infinity refers to “Endless Hot Water”. The Infinity 24 has been developed in response to the growing changes in the lifestyle of consumers, and the increasing diversification and sophistication of demand in the marketplace.

The Infinity series offers reduced cost, advanced safety features, and an option to connect one, two, or three remote control pads.

The Infinity 24 is delivered with the maximum hot water temperature of 50^{O}C, with or without remote controls connected.

About the Infinity

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

Air inlets are situated in the front panel. The general layout of components is shown on the cutaway diagram on page 9. 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 0.8 mm aluminised steel attached to the bottom of the heat exchanger.

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

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

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

There is one thermistor, it is located on the outgoing hot water supply tube, near the outlet of the heater.

2. Features

Installation

The light-weight, slim, and compact form enable easier, improved appearance installations. The remote controls (where fitted) are connected to the appliance by 2-core non-polar cable, ensuring easy wiring and eliminating misconnection problems.

Low Noise Level

Low noise level design enables these appliances to be installed in units, flats, townhouses, and other high density residential areas with little concern about noise disturbances.

Safety

Various safety devices controlled by a micro-computer ensure complete safety. Also, the anti-frost device (where fitted), automatically prevents the water inside the appliance from freezing by using small electrical ceramic heaters connected to the pipework at strategic locations.

Economy

Direct electronic ignition to the main burner eliminates wasteful pilot gas consumption. The combustion fan rpm is proportionally controlled with gas consumption. This maintains high energy efficiency as the gas consumption changes.

Water Supply Control

The water supply capacity varies proportionally from 2.7 L/min to 24 L/min. A suitable volume of hot water can be supplied throughout all seasons by the water flow control device and water flow servo mechanism. REU 2425W model will supply up to 24L/min, (maximum unmixed), controlled by an automatic electro-mechanical water flow device. See "Water Flows" on page 14 for precise details on water flow.

Water Temperature Control

With a remote control connected, the hot water control range is between 37°C and 50°C (in 12 steps). With or without a remote control connected the outgoing hot water temperature is fixed to 50°C maximum with no remote. This means that the Infinity Series can be set to comply with various State laws on temperature control in homes, child care centres, and elderly care centres. The maximum temperature selectable on the bath remote control is 50°C (this is a safety feature).

Over Temperature Protection

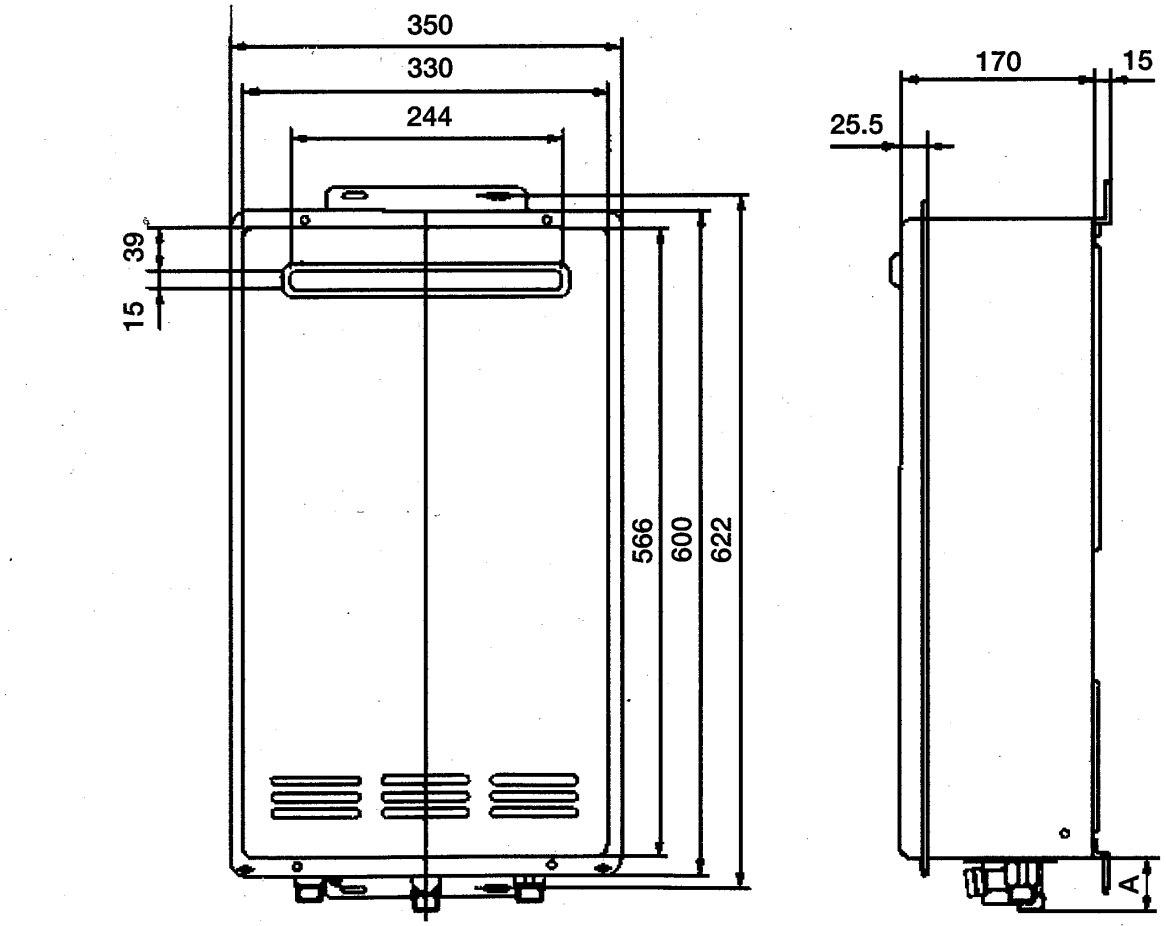
All Infinity models incorporate a device to prevent the hot water temperature exceeding the pre-set temperature by more than 3°C.

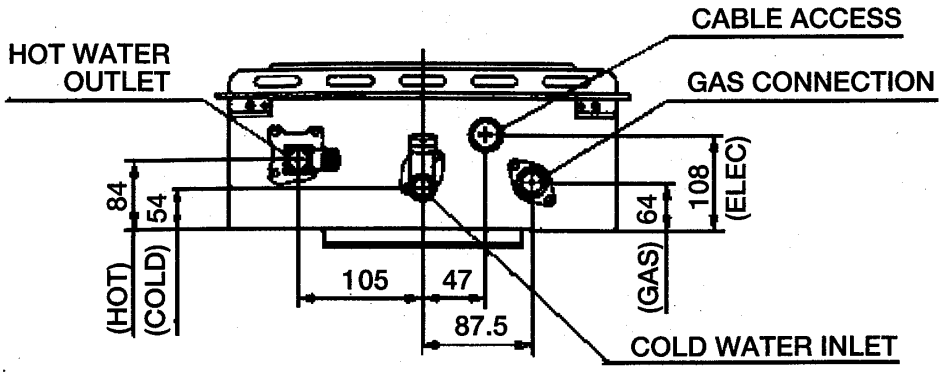
Temperature Locks

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

3. Dimensions

Note: All dimensions are in mm.





	A
GAS	41
COLD	49
HOT	42

4. Remote Controls

Remote Controls

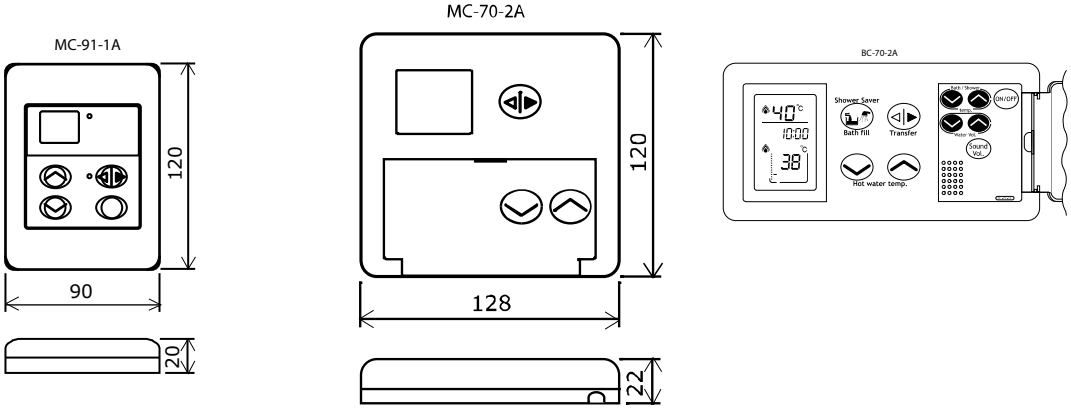
Remote Controllers are an optional extra. 'Universal' and 'Deluxe' Controllers can be fitted. Universal controllers allow temperature selection only. Deluxe controllers have temperature selection, bath-fill and voice prompting functions. For detailed information regarding controller operation refer to the 'How to use your water heater' booklet supplied with the appliance. Other manufacturers' controllers are NOT compatible with this appliance.

Universal Controller (Model: MC-91-1A)

Up to 3 Universal Controllers can be fitted to the appliance. They are normally installed in the areas where the majority of hot water is used, for example, the Kitchen, Bathroom, Ensuite and Laundry.

Deluxe Controllers (Models: MC-70-2A) and (BC-70-2A)

Deluxe Controllers have 'Kitchen' (MC-70-2A) and 'Bathroom' (BC-70-2A) versions. 'Kitchen' Controls are intended for the Kitchen or other convenient area where the majority of hot water is used. 'Bathroom' Controllers are intended to be fitted in the Bathroom or ensuite and allow the user to have a bath filled to the required level and temperature automatically.



Up to two ‘Deluxe” controllers can be connected as follows:

Kitchen	Bathroom
MC-70-2A	
MC-70-2A	BC-70-2A

If a Third controller is required, a ‘Unviersal’ controller can be included as follows:

Kitchen	Bathroom	Laundry
MC-70-2A	BC-70-2A	MC-91-1A

Positioning of Controllers

Controllers must be installed in shaded and clean locations. They should be fitted out of reach of children (suggested height from floor at least 1500mm). Controllers are water resistant, however, durability is improved when positioned outside the shower recess or at leat 400mm above the highest part of a sink, basin or bath.

DO NOT INSTALL THE CONTROLLERS

- NEAR A HEAT SOURCE, SUCH AS A COOK TOP, STOVE OR OVEN. HEAT, STEAM, SMOKE AND HOT OIL MAY CAUSE DAMAGE.
- IN DIRECT SUNLIGHT.
- OUTDOORS UNLESS AN ENCLOSURE IS PROVIDED WHICH PROTECTS THE CONTROLLER AGAINST SUNLIGHT AND DUST INGRESS.
- AGAINST A METAL WALL UNLESS THE WALL IS EARTHED IN ACCORDANCE WITH AS/NZ3000.

Remote Controller Connection

Remote controls operate at extra low voltage (12 Volts DC) which is supplied from the appliance. Controllers are supplied with 15 m of electrical cable. The cable wires for connection to the appliance are fitted with spade terminals.
Extension cables are available from Rinnai. Alternatively, a two core sheathed (double insulated) flex with minimum cross-sectional area of 0.5 mm² can be used. Maximum cable length is 50 m.
For connection refer to the "CONNECTING REMOTE CONTROL CABLES" section.

Water Heater and Controller installation configurations

If there is a label on the appliance casing that contains the text **"This appliance delivers water not exceeding 50°C",** local regulations may permit it's installation without a Temperature Limiting Device. Installations without a Temperature Limiting Device are shown in Diagram 1. If you are unsure about your local regulations contact your regulating authority or Rinnai.

If the appliance does not have this label, or your local regulations require installation with a Temperature Limiting Device then install the appliance in accordance with Diagram 2.

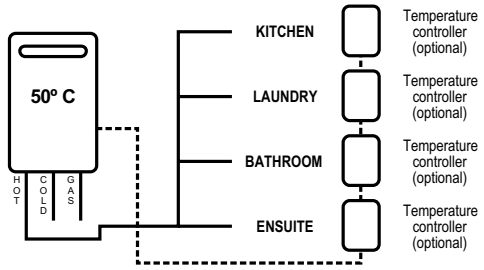


Diagram 1. 50º C Appliance

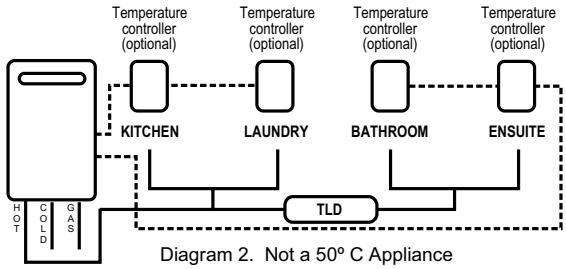


Diagram 2. Not a 50º C Appliance
Note: TLD = Temperature Limiting Device.

IMPORTANT: If the appliance is to deliver water primarily for the purposes of personal hygiene in an early childhood centre, primary or secondary school, nursing home or similar facility for young, aged, sick or disabled persons as defined in AS/NZ3500.4 a Temperature Limiting Device (TLD), such as a Tempering Valve, may be required even if the appliance is set to 50º C or less. For these types of applications contact Rinnai.

Connecting remote control cables

Do not attempt to connect the remote control cable terminals to the appliance with the power on.

RISK OF ELECTRICAL SHOCK

Connecting One or Two Controllers

1. Isolate the power supply.
2. Remove the front cover from the Appliance (4 screws) fig. 1.
3. Thread the cable(s) through the cable access hole at the base of the appliance.
4. Locate the terminals for controls, the position of which is marked on the Printed Circuit Board casing. Connect the spade connectors to the terminals on the P.C.B. (Fig. 2). Polarity is not important. Either wire colour can be connected to either terminal.
5. Replace cover of the Appliance. Ensure that the special screw is placed at the bottom right hand corner for earthing purposes.

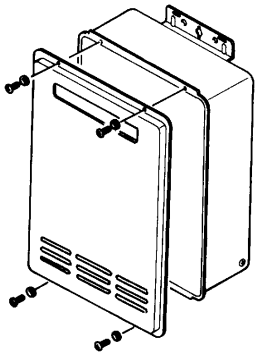
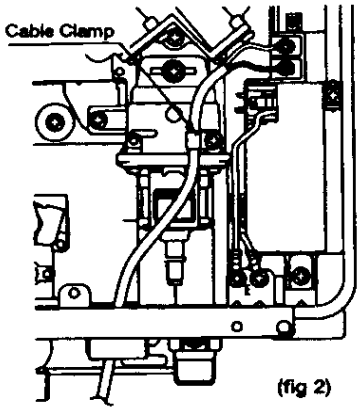


fig.1.

Connecting Three Controllers

1. Isolate the power supply.
2. Remove the front cover from the Appliance (4 screws) fig.1.
3. Cut the spade connectors from 2 of the controller cables to be connected to the appliance (4 spade connectors should be cut off) and discard. Connect the wires from these two cables and terminate into two new spade connectors as shown in fig.3. Spade connectors are available from your local electrical component retailer.
4. Located the terminals for controls, the position of which is marked on the Printed Circuit Board casing. Connect the 4 spade connectors to the terminals on the P.C.B. (Fig. 2). Polarity is not important. Either wire colour can be connected to either terminal.
5. Replace cover of the Appliance. Ensure that the special screw is placed at the bottom right hand corner for earthing purposes.



(fig 2)

MC-91A Controller Programming

Is there a label on the appliance casing that contains the text.

"THIS APPLIANCE DELIVERS WATER NOT EXCEEDING 50° C

IF YES:No further action required.

IF NO: You will need to program Kitchen controller to enable selection of temperatures higher than 50º C.

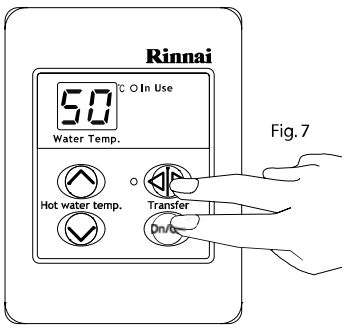


Fig.7

STEP 1:

For the controller in the KITCHEN only, press and hold the 'Transfer' and 'On/Off' buttons simultaneously (see Fig 7.) until a 'beep' is heard (approximately 5 seconds).

STEP 2:

When the controller fitted in the KITCHEN is switched on, it should be possible to select temperatures higher than 50º C. If not, repeat Step 1.

Note:

- If the kitchen controller is replaced, repeat STEP 1 above for the replacement controller.
- If the kitchen controller is swapped with another controller (for example, the controller fitted in a bathroom), repeat STEP 1 for the controller moved from the kitchen to the bathroom. Then perform STEP 1 for the controller moved from the bathroom to the kitchen.

5. Safety Devices

Flame Failure

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

Over Heat Protection Device

Also referred to as an Over Heat Switch. This device is fitted to a bend section at the inlet to 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 12 volt bi-metal cut-off switch isolates the gas to the solenoids.

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.

Thermal Fuse

Wrapped around the entire surface of the heat exchanger, if the heat exchanger burns out, or the temperature outside it reaches 129◦C, the thermal fuse melts, breaking the electronic circuit. Current to the gas solenoid valve circuit is cut, and combustion stops, shutting down the unit.

Pressure Relief Valve

This spring and seat type valve located on the hot water outlet will release the built up pressure if the pressure inside the heat exchanger reaches 2100 kPa until 1500 kPa is maintained.

Combustion Fan Revolution Check

The combustion fan rpm is 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. (If not the unit shuts down)

Automatic Frost Protection

When the outdoor temperature drops and the temperature inside the appliance goes 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 temperature inside the appliance rises to 11.5◦C. There are 5 x 16 Watt 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.

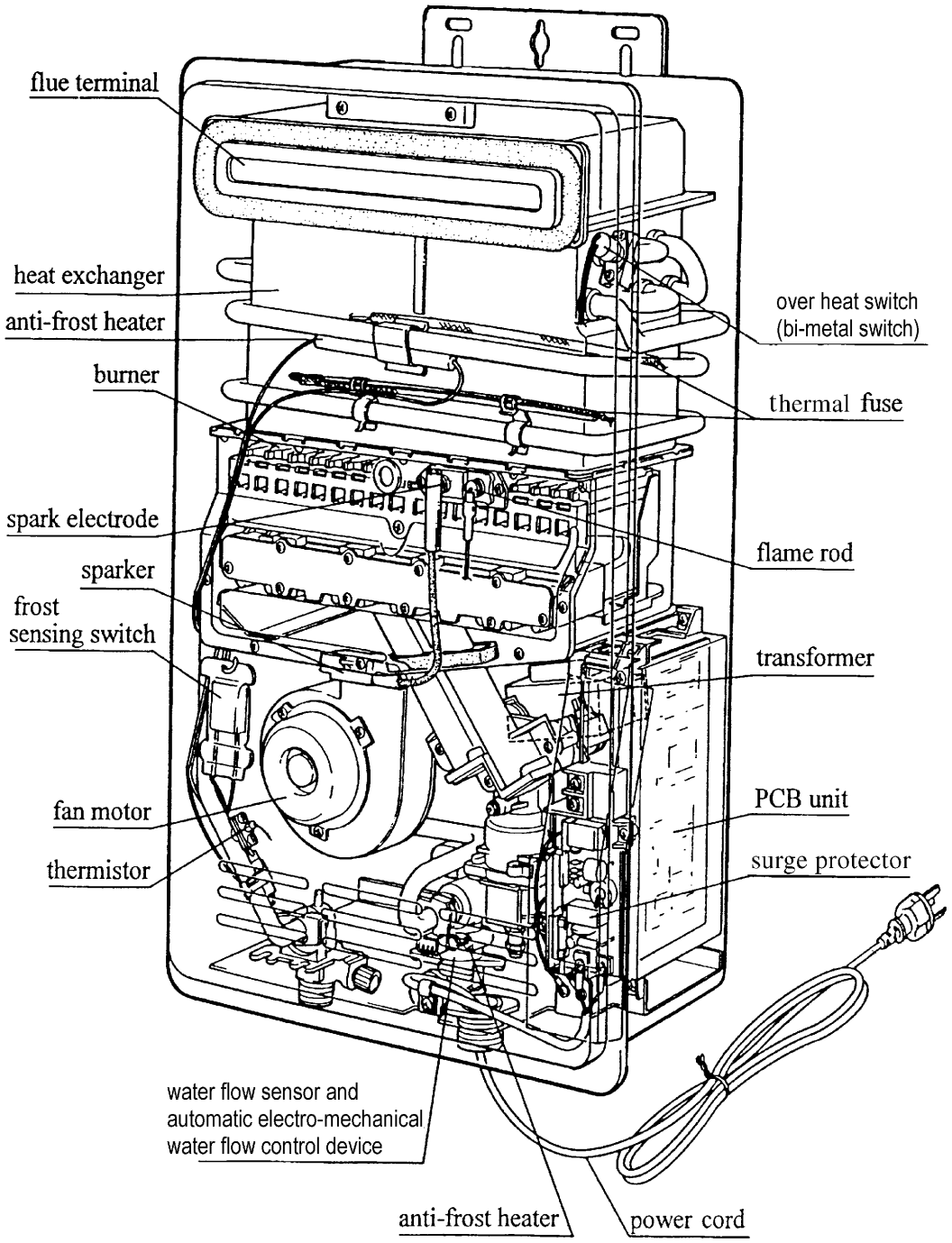
3°C Over Temperature Cut-Off

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

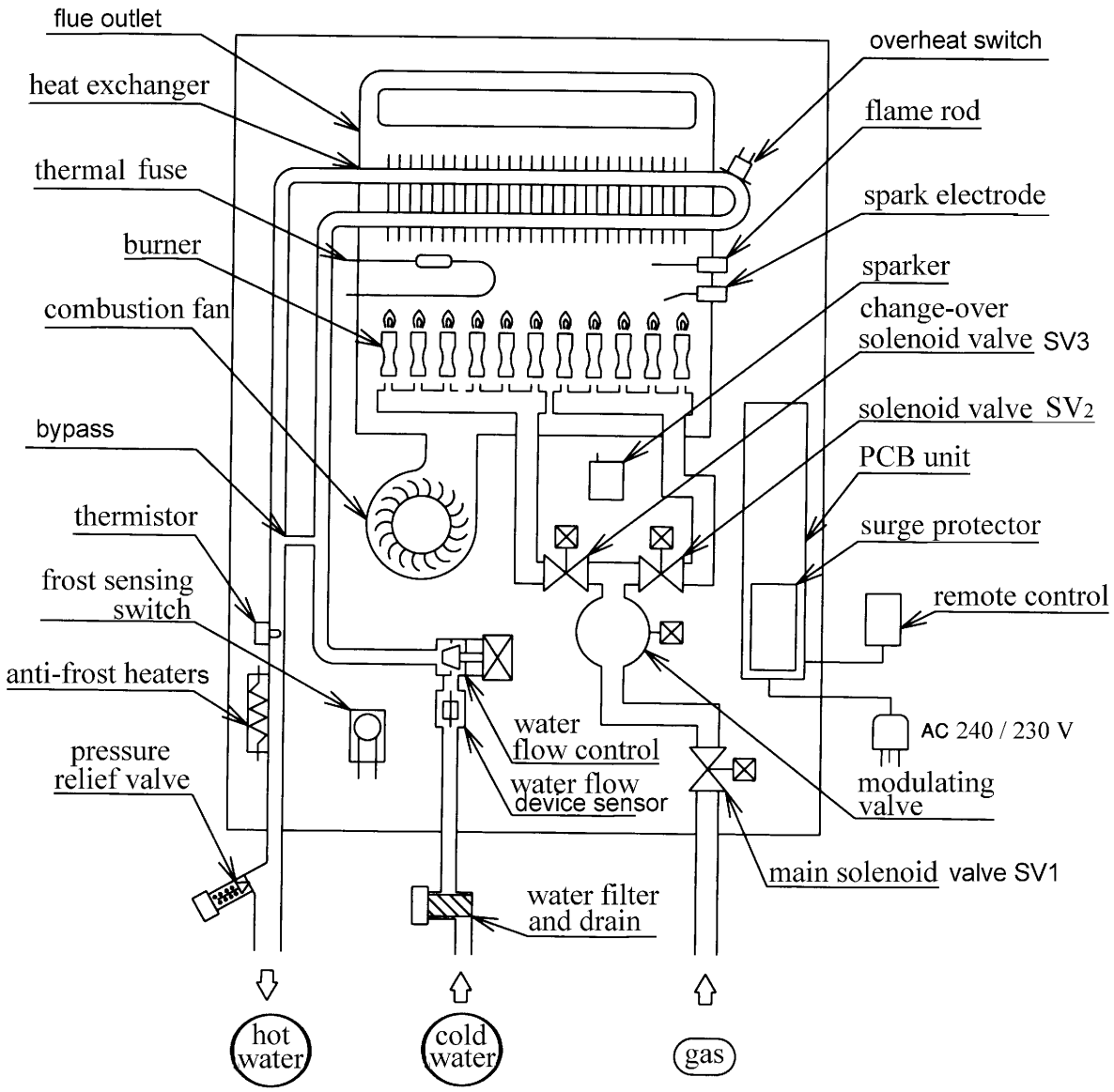
6. Specification

Rinnai Model No.	REU-2425W	
Type of appliance	Temperature controlled continuous flow gas hot water system.	
Operation	With or without remote controls, mounted in kitchen, bathroom, or ensuite.	
Exhaust system	Forced combustion	
Installation	Externally mounted	
Maximum gas rate	188 MJ/h	
Minimum gas rate	21 MJ/h	
Output (Kw)	41.7	
Efficiency rating	80%	
Hot water capacity, unmixed	2.7 to 24 L/min	
Hot water capacity, mixed (25° C rise)	2.7 to 24 L/min	
Default temperature (without remote) (Set using switches on PCB)	50°C (40,43,50,55,60,65,75° C)	
Maximum temperature ceilings (remote connected)	50°C (set by combination of switches on PCB) Other temp.settings than 50°C avail. from alternative PCB	
Temperature range (with remote)	37 to 50° C in 13 steps	
Approved gas types	Natural; Propane	
Dimensions	Width - 350 mm Height - 600 mm Depth- 170 mm	
Weight	18 kilograms.	
Noise level	49 dB(A)	
Connections	Gas supply- R : / 20mm Cold water inlet- R : / 20mm Hot water outlet- R : / 20mm	
Ignition system	Direct electronic ignition	
Electrical consumption (Watts)	Normal - Standby - Anti frost protection -	55 8 80
Water temperature control	Simulation feedforward and feedback.	
Water flow control	Water flow sensor & automatic electro-mechanical water flow control device	
Minimum operating pressure	200 kPa	
Nominal operating pressure	200 ~ 1200 kPa	
Power supply	Appliance- AC240 Volts 50 Hz. Remote control- DC12 Volts (Digital)	
Safety devices	Flame failure- Flame rod.	
	Boiling protection- 105° C lockout thermistor (25 seconds)	
	Remaining flame [OHS]- 97° C bi-metal switch	
	Thermal fuse- 129° C	
	Pressure relief valve- Opens-2100kPa, closes-1500 kPa	
	Automatic frost protection- Bi-metal sensor & anti-frost heaters	
	Combustion fan rpm check- Integrated circuit system	
	Over current- Glass fuse (5 Amp).	
Remote control	MC-91-1A- Universal control	
	MC-70-2A- Kitchen control	
	BC-70-2A- Bathroom control	
Remote control cable	Non polarised two-core cable	

7. Cut-away Diagram



8. Schematic Diagram



9. Combustion Specification

				REU-2425W
Input	NG/Propane LPG #	HI	MJ/h	188
		LO		21
Gas Consumption	NG/Propane LPG #	HI	kW	52.3 (50)
		LO		5.93
Integral Injector size (18)	NG		mm	∅ 1.7
	Propane/LPG #			∅ 1.0
Damper (1 piece)	NG			NIL
	Propane/LPG #			A
Pressure	NG	HI	kPa	0.90
		LO		0.08
	Propane/LPG #	HI	kPA	2.26 (1.90)
		LO		0.17 (0.15)
Burner type				NG/ Propane Common
Dip Switch positions				Refer to page 12

Note: LPG values specified in brackets are for New Zealand.

10. Dip Switch Positions

Please do not adjust the DIP Switch Positions before reading this information.
The dip switches are provided so that the water heater can be set to different operating configurations. In some instances such as nursing homes or even domestic situations, it may be necessary to limit the temperature of the hot water coming from the units.
The set-up configuration for the water heater differs depending on:

- Gas type
- Maximum water flow select
- Temperature limiting requirements
- Alternate type

DIP Switches explained

Top switch settings 1 ~ 8

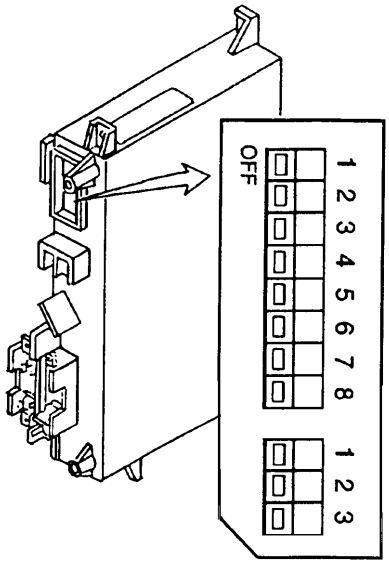
1: Gas type (used only during conversion)
2: To select maximum water flow volume

4 to 8: To select the temperature with or without remote connected.

Bottom switch settings 1 ~ 3

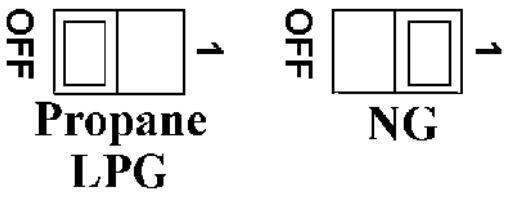
1: Factory use (To select the capacity of appliance)
2 & 3: Combustion control

The Infinity REU-2425W model delivers maximum hot water temperature limited to 50◦C, however alternative PCB for the other maximum temperature of hot 40◦C, 43◦C, 50◦C, 55◦C, 60◦C, 65◦C, or 75◦C available.

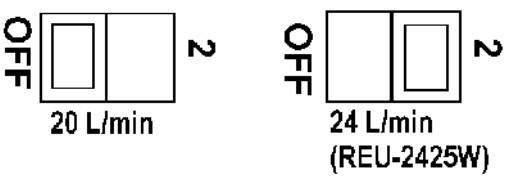


1. Gas Type

Only alter gas type positions when converting. For conversion instructions refer to page 39.



2. Maximum Water Flow Select

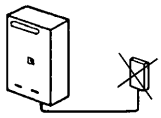


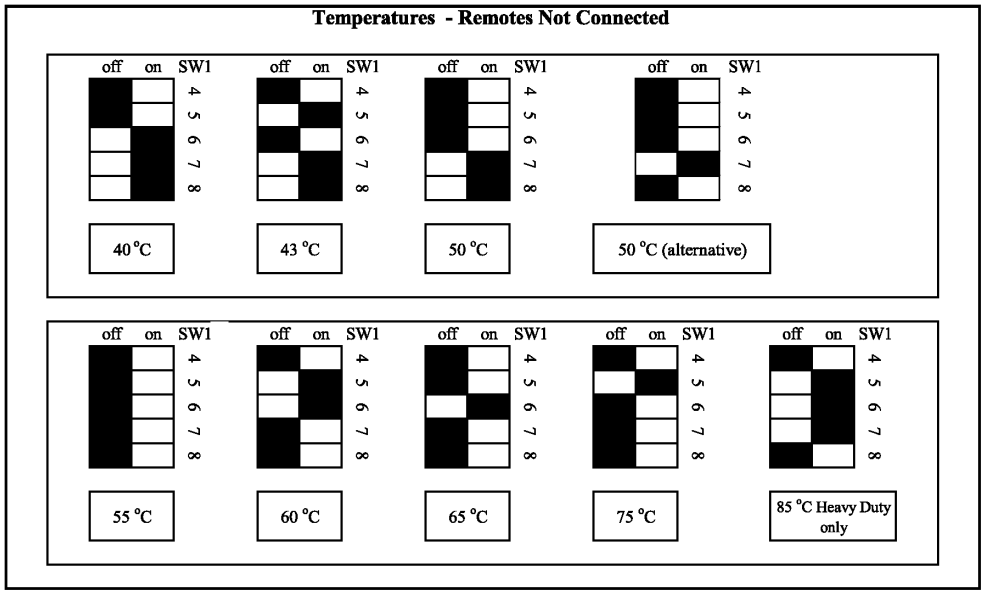
3. Temperature Limiting

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

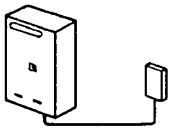
Dip Switch Settings for Alternative PCB

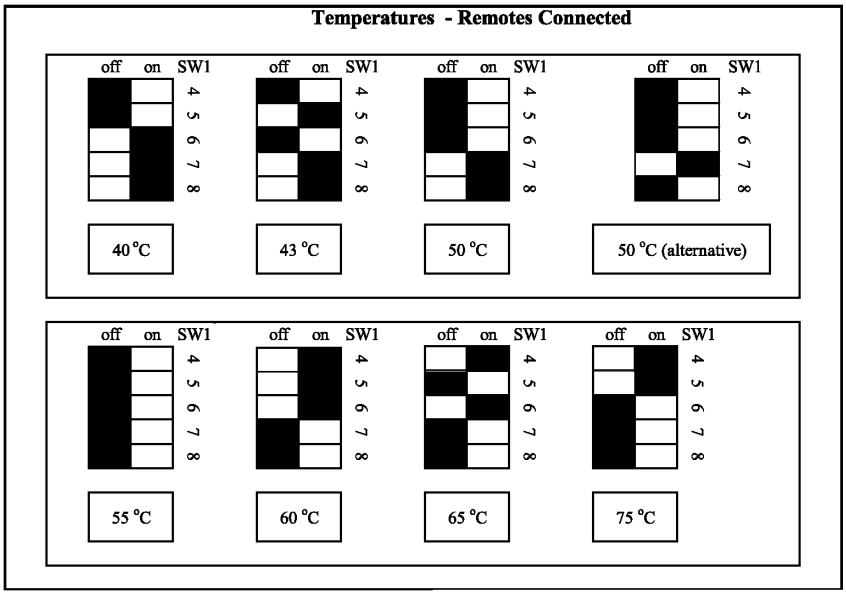
a. Fixed hot water temperature "without" remote connected





Upper limit hot water temperature "with" remote connected





Note:
a) The black squares indicate the position of switches.
b) It will be noted that some dip switch configurations are the same for a given temperature whether controllers are connected or not. These similarities are not mistakes.

11. Water Flows

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

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 50◦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.

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.

Formula: $IN \times TE = ({}^{T}OUT - {}^{T}IN) \times 60 \times Q$

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

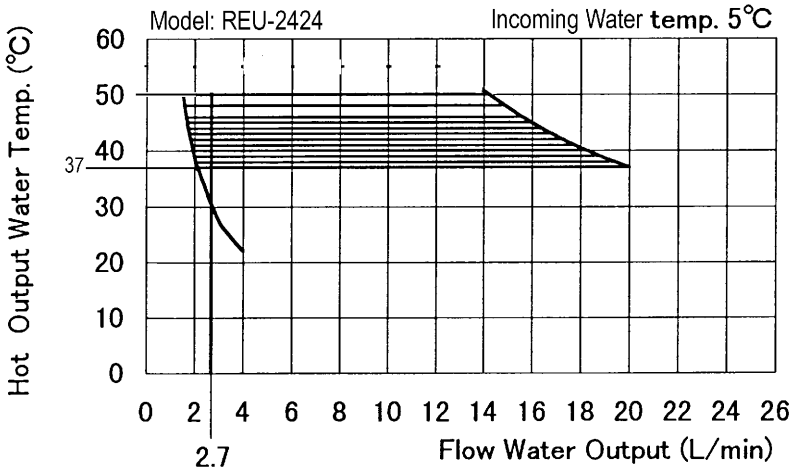
\# This is the maximum gas input converted from MJ/h into kilocalories. As 1 kilocalorie raises the temperature of 1 litre of water by 1 degree centigrade, the method of calculation is to multiply the input in MJ/h by 239.

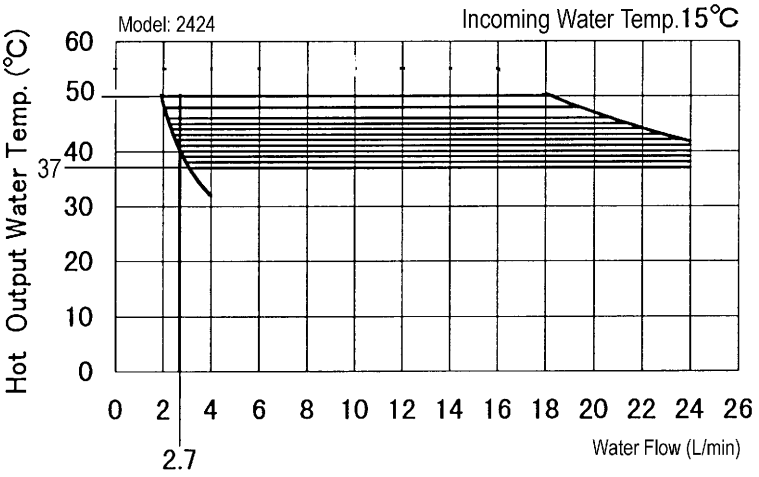
* Thermal efficiency may be in the range of 78% to 90%, depending on the temperature rise and water flow. For the purpose of the following calculation we have assumed an efficiency of 80%.

Example Data	Calculation
TIN =15° C TOUT = 60◦C IN = 45000kcal/h TE = 80% Q = Water flow in Litres per minute	$IN \times TE = ({}^{T}_{OUT} - {}^{T}_{IN}) \times 60 \times Q$ $45000 \times 0.8 = (60 - 15) \times 60 \times Q$ $36000 = 45 \times 60 \times Q$ $\frac{36000}{45} = 60 \times Q$ $800 = 60 \times Q$ $\frac{800}{60} = Q$ 13.3 L/min

Unmixed Water Flows for the REU-2425W

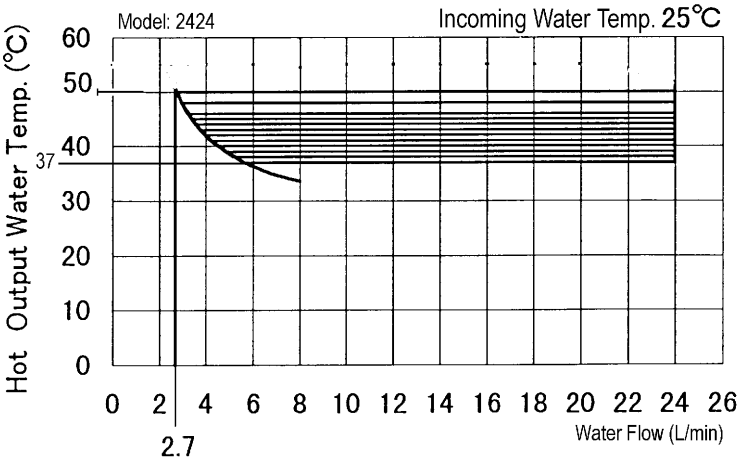
The chart opposite indicates that the water flow rate of the REU-2425W will, at a preset temperature of 50◦C and an *incoming water temperature of 5◦C*, be 14 litres per minute.





The chart opposite indicates that the water flow rate of the REU-2425W will, at a preset temperature of 50◦C and an *incoming water temperature of 15◦C*, be 18 litres per minute.

The chart opposite indicates that the water flow rate of the REU-2425W will, at a preset temperature of 50◦C and an *incoming water temperature of 25◦C*, be 24 litres per minute.



Mixed Water Flows

Output water temp.	Incoming +15◦C	Incoming +25◦C	Incoming +30◦C	Incoming +35◦C	Incoming +45◦C	Incoming +50◦C
Output water vol.	with mixing 40 L/min	with mixing 24 L/min	with mixing 18 L/min	17.1 L/min	13.3 L/min	11.9 L/min

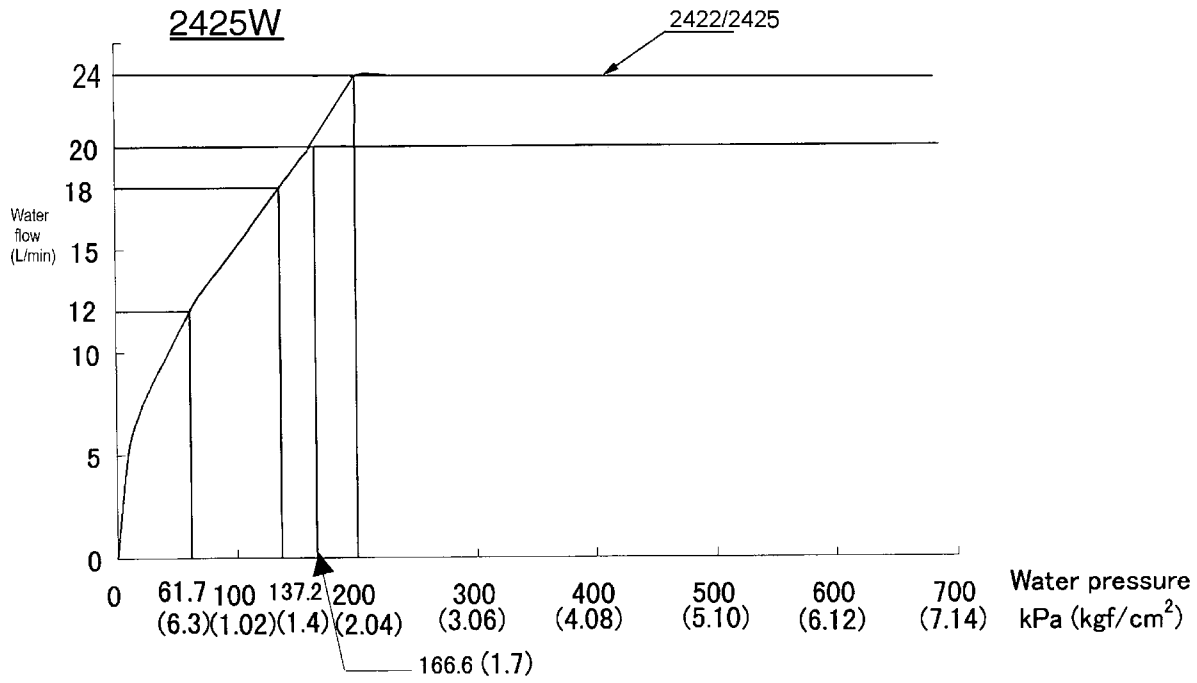
12. Main Components

1. Mechanical Water Regulator

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

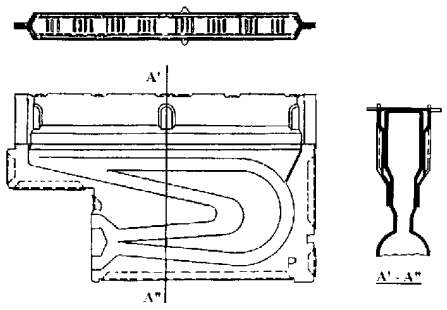
The following graphs show that the maximum flow is approximately 24 L/min for the 2425. This maximum flow is reached at 200 kPa inlet pressure respectively.

Note: Although the 2425W model operates at very low water pressures, maximum performance is not reached unless the incoming pressure is 200 kPa or more.



2. Preset Bypass

A preset volume of cold water is mixed with water heated in the heat exchanger.



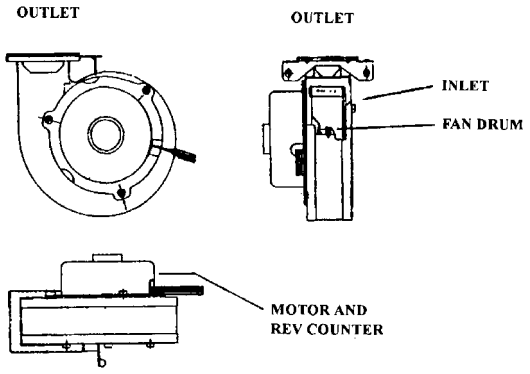
3. Burner

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

4. 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%] through the tandem manifold.

5. Combustion Fan



Air for combustion is supplied by a centrifugal fan driven by a DC motor. After a pre-purge period of 0.2 seconds, the fan speed is controlled by the PCB to provide the correct volume of air for combustion. The calculation for the fan speed is based upon incoming water temperature, water flow and the temperature selected on the remote controls.
The actual speed of the motor is continuously monitored by a magnetic pulse sensor.
This sensor emits 4 pulses per rotation of the fan.
This is the fan feedback or confirmation data processed by the PCB and used for 2 operations.

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

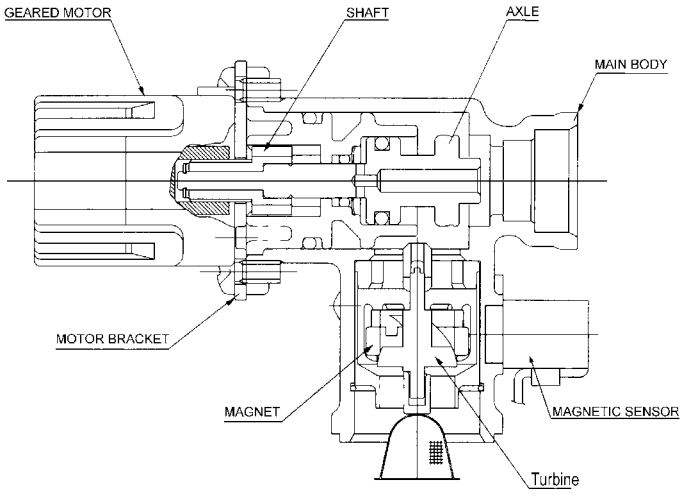
The reason for controlling the opening degree of the modulating gas valve based upon data from the combustion fan is that the gas valve is able to react much more quickly to a change in control signal than the combustion fan. Controlling the gas valve based upon data from the combustion fan means that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

6. Water Flow Sensor and Water Flow Control device:

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 above for further details on the combustion fan.

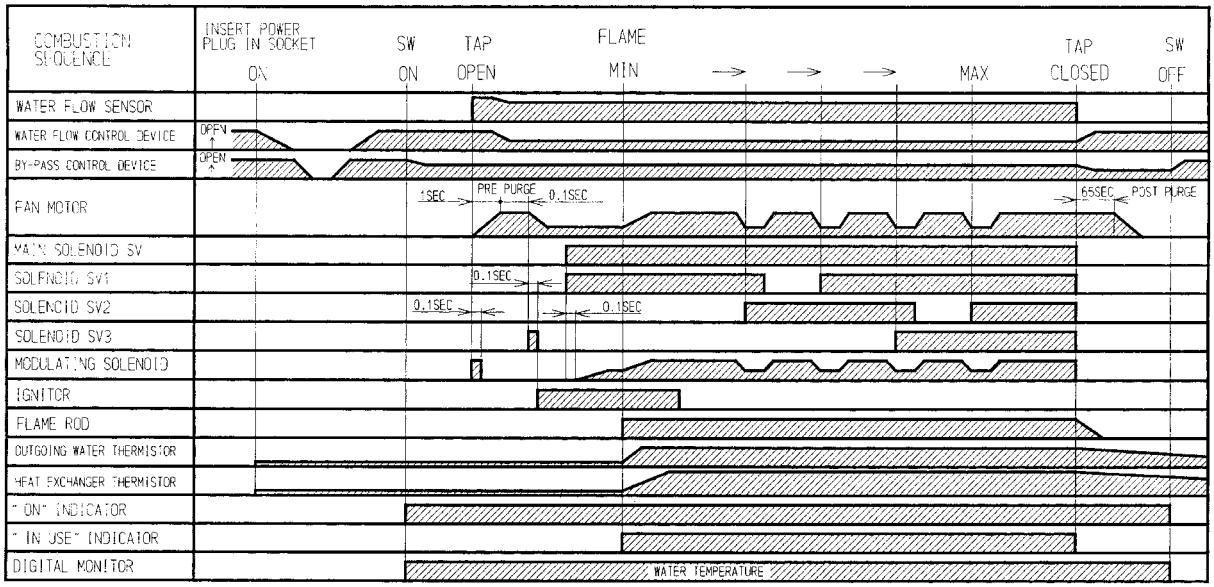
The water flow control consists of a plug and barrel valve which is rotated by a motor to increase or decrease the volume of water passing through the heat exchanger.

Water flow control device.

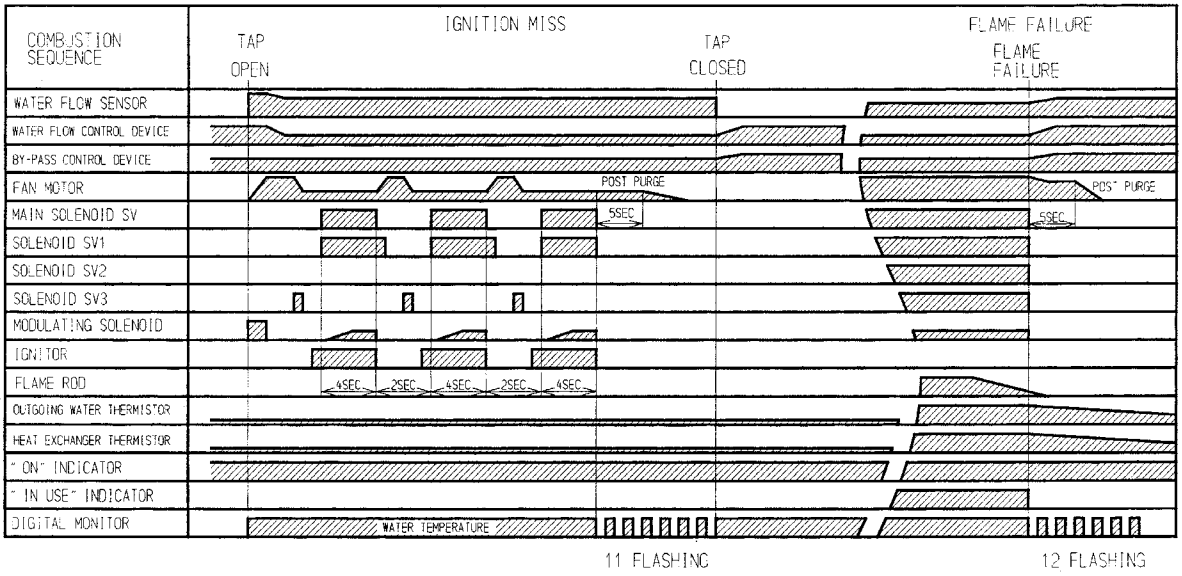


13. Time Charts

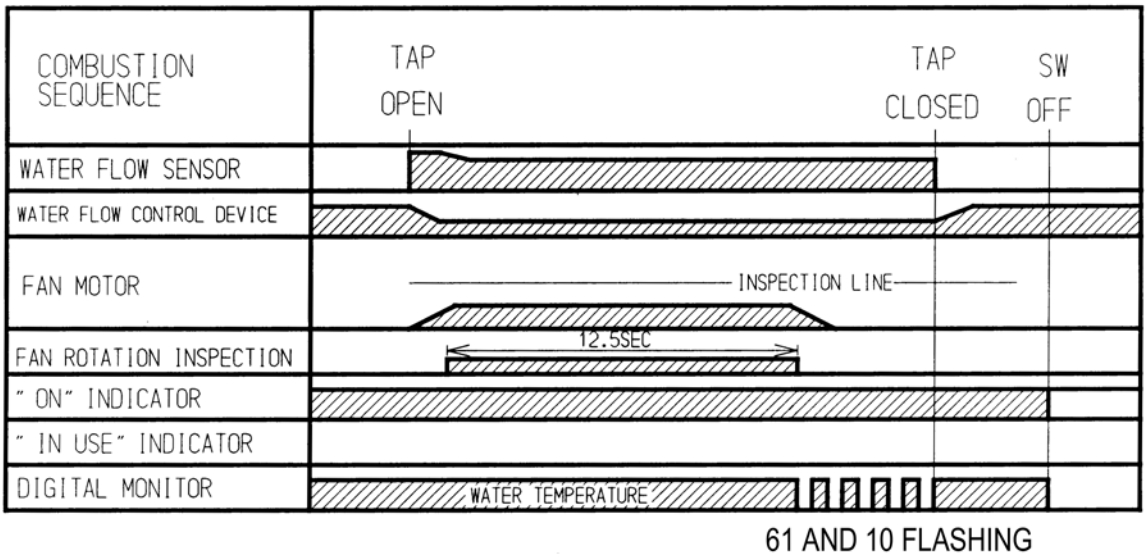
Normal Combustion Sequence



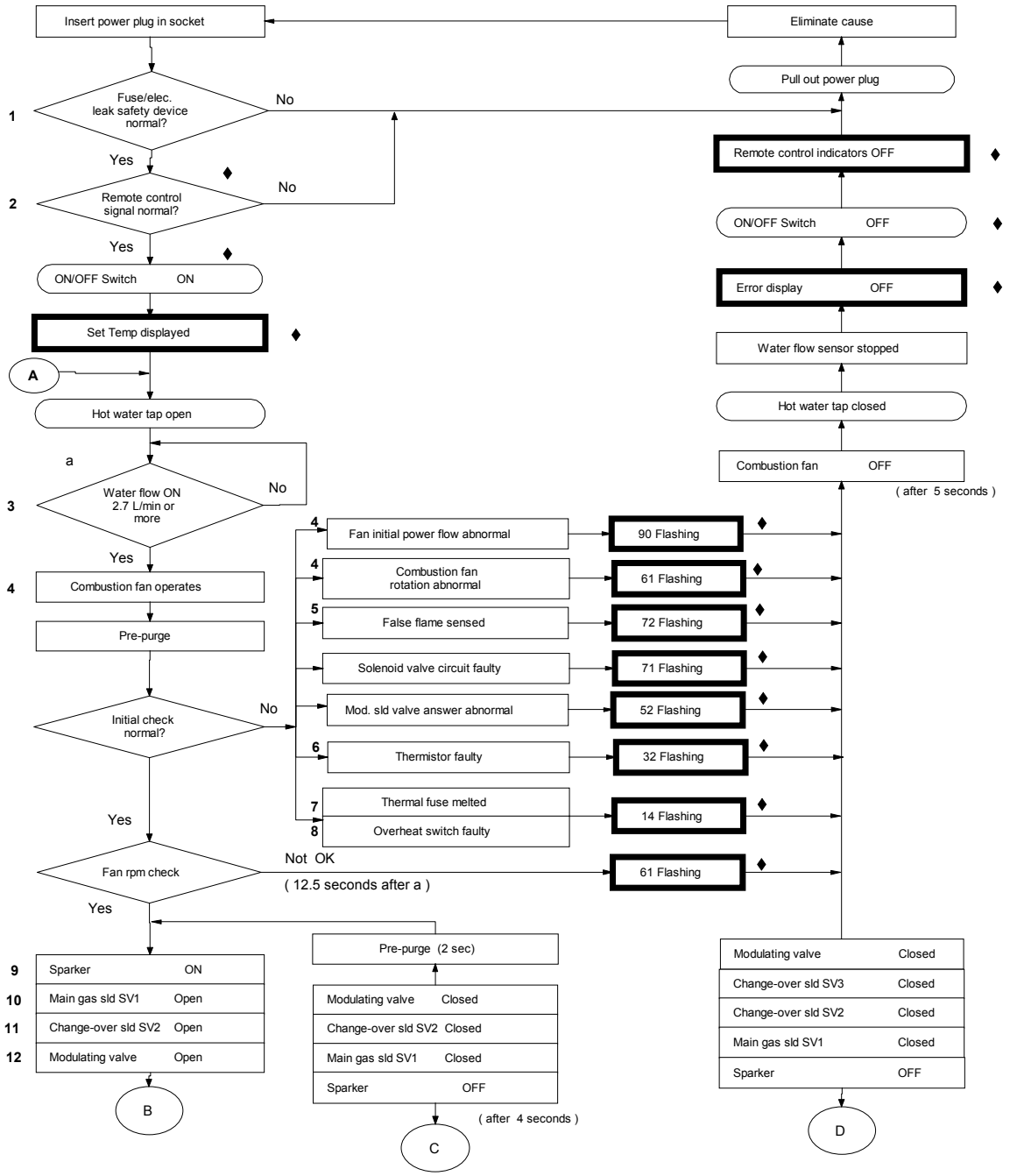
Error Sequence (Ignition / Flame Failure)



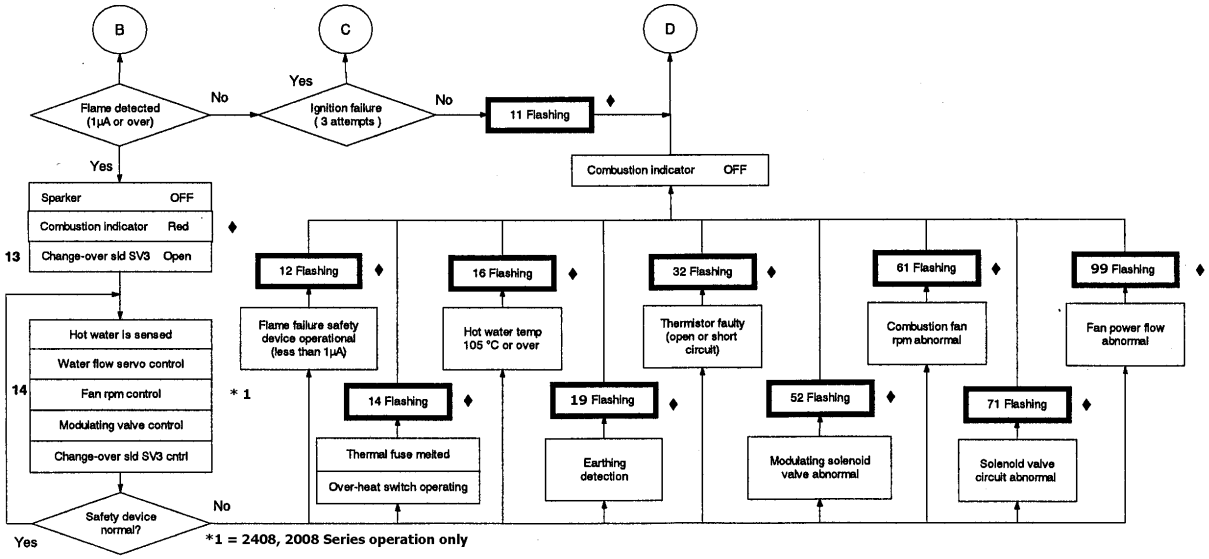
Pre-purge Defect Sequence



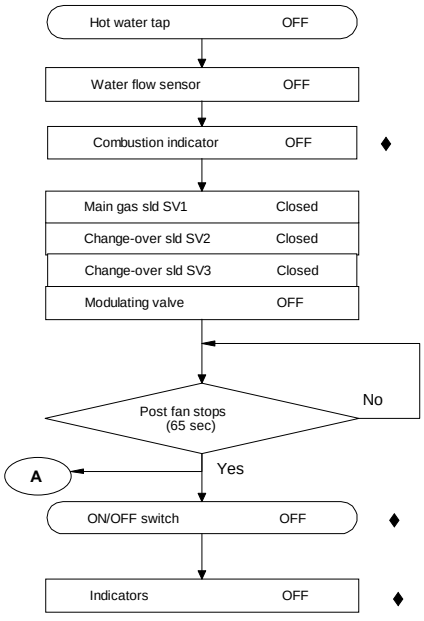
14. Operation Flow Principle



♦ Only applicable when remote control is connected



TURN OFF



♦ Only applicable when remote control is connected

15. Operation Principles

The preset temperature is selected at one of the remote controls (where fitted). Where no remote control is fitted, the default temperature (Heavy Duty only) depending on the position of dip switch numbers 4 to 8 (see page 12).

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

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

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

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

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

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

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

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

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

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

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

The water flow control device operates at high water flows and/or high temperature rises. When the temperature rise is low, or the water flow is restricted by the hot water tap, then the device may not be required to operate. [See section on “Main Components” on page 16, for clarification].

There is no direct connection between the mechanical water flow control device with water flow sensor and the PCB, therefore, there could be occasions when the input required to heat the water exceeds the capacity of the appliance, and water at a temperature lower than that requested on the remote control is output. In this case, manually reducing the water flow at the tap will increase the temperature.
Once hot water is flowing the water temperature thermistor senses the outgoing water temperature.

The PCB is continually adjusting both the gas input and water flow to maintain a constant temperature. It also continually monitors the combustion fan rpm adjusting the gas rate to match.

When the hot water tap is turned off, the water flow sensor stops revolving, and the magnetic pulse ceases, indicating to the PCB that there is no water flowing, in turn the PCB closes the gas valves. The combustion fan continues to operate for 65 seconds. This is to provide quicker ignition when the tap is turned on and off in rapid succession, as it removes the need for a pre-purge cycle, and allows the burner to re-light immediately when a hot water tap is opened again.

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

16. Error Messages

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

X = *Does not operate*

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

Notes

1. Digital monitor does not illuminate when system is switched ON, or display drops out while appliance is operating.

- •Check power supply to the appliance.
- •Switch system OFF, the switch ON again, and re-attempt ignition.

2. Appliance operates however symptoms remain, with digital display dropping out and error coded message flashing.

- •Isolate potentially faulty component using the component analysis table on page 40.

17. Diagnostic Points

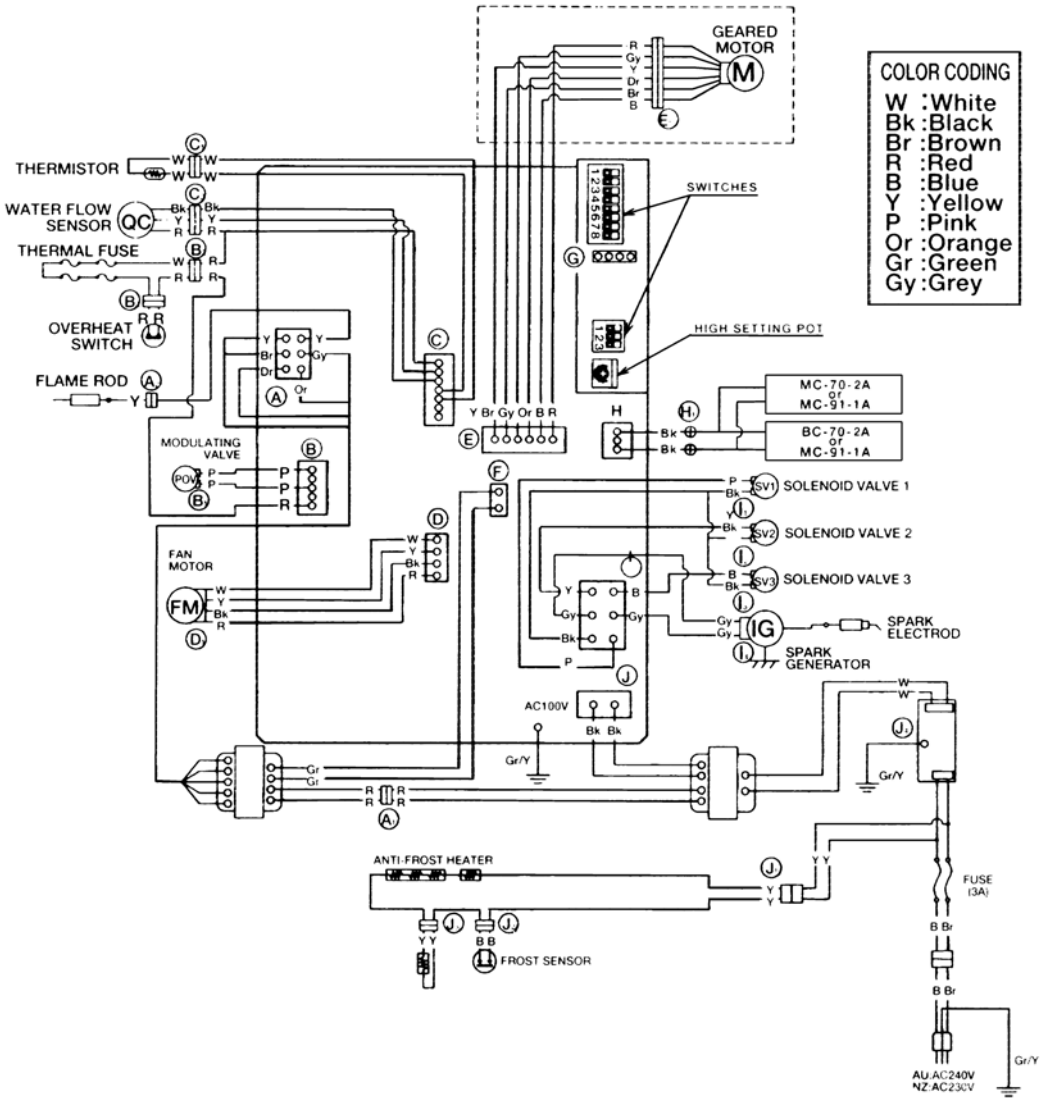
Flow chart is on page 19.
Wiring diagram is on page 25.

Flow Chart No.	Measurement Point		Normal Value	Component
	CN	Wire Colour		
1	J_4	brown-blue	AC 207~264 V	Surge Protector
2	H_1	black - white	DC 10~13 V	Remote Controls
3	C_2	red - black	DC 11~13 V	Water Flow Sensor
		yellow - black	DC 2~10 V	
4	D	white - black	DC 2~9 V	Combustion Fan Motor
	G	red - yellow	60~350 Hz	
5	A_2	yellow - body earth	AC 100 ~ 160 V (over DC μ 1A	Flame rod
6	C_1	white - white	Thermistor resistance value Temp resistance 15° C 11.4~14 kΩ 30° C 6.4~7.8 kΩ	Thermistor
7	B_2	red - red	Below 1 Ω	Thermal Fuse
8	B_3	red - red	Below 1 Ω	Over Heat Switch
9	I_1	grey - grey	AC 90~110 V	Sparker
10	I_1	pink - black	DC 80~100 V 0.9~1.3 kΩ	Solenoid Valve (SV_2)
11	I_2	yellow - black	DC 80~100 V 1.3~1.9 kΩ	Solenoid Valve (SV_2)
12	B_1	pink - pink	DC 0.5~25 V 60~100 Ω	Modulating Valve
13	I	blue - black	DC 80~100 V 1.3~1.9 kΩ	Solenoid Valve (SV_3)
14	E_1	red - blue	DC 11~13 V	Stepping motor
		orange - grey		

Transformer Voltages and Resistances

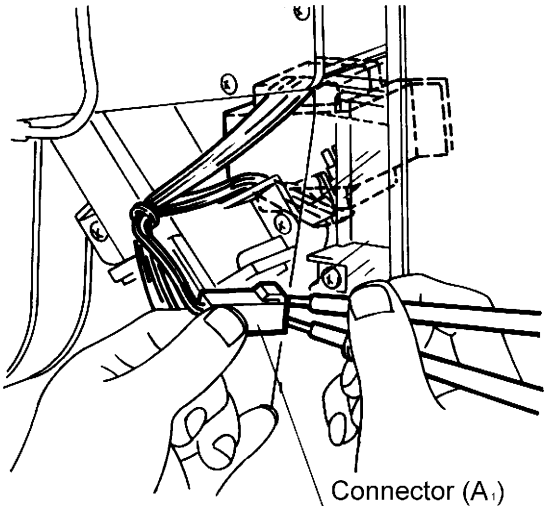
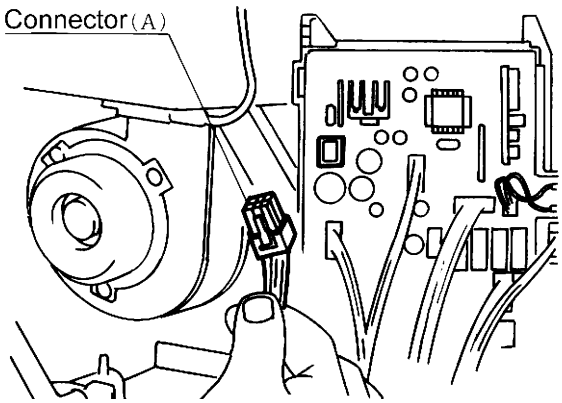
CN	Wire Colour	Normal Value
A	red - red	**AC 90~110 V**
F	green - green	**AC 16~20 V**
A	orange - orange	**AC 13~30 V**
A	brown - grey	**AC 30~50 V**
A	yellow - grey	**AC 180~220 V**

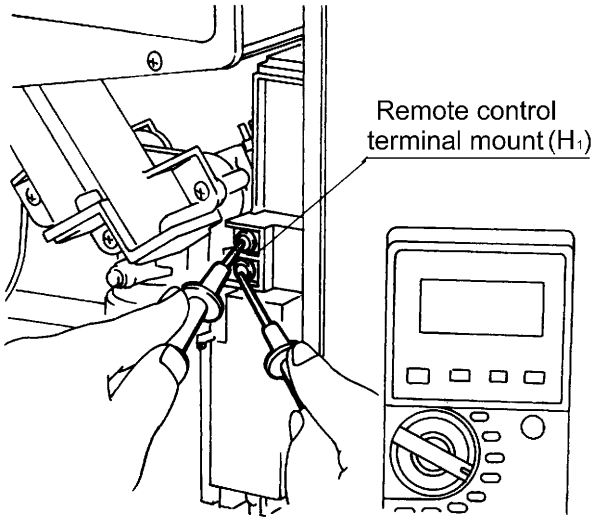
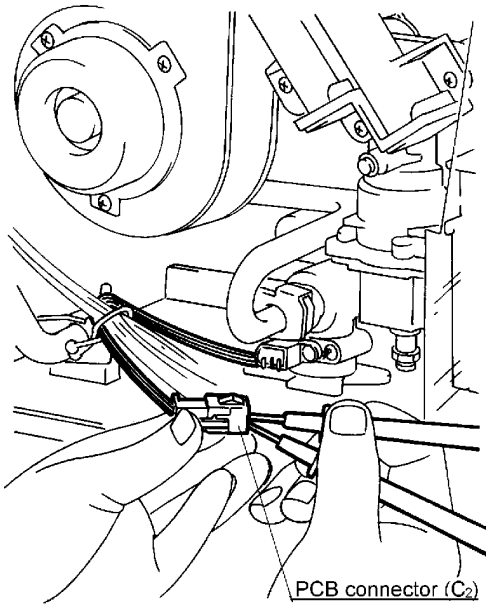
18. Wiring Diagram



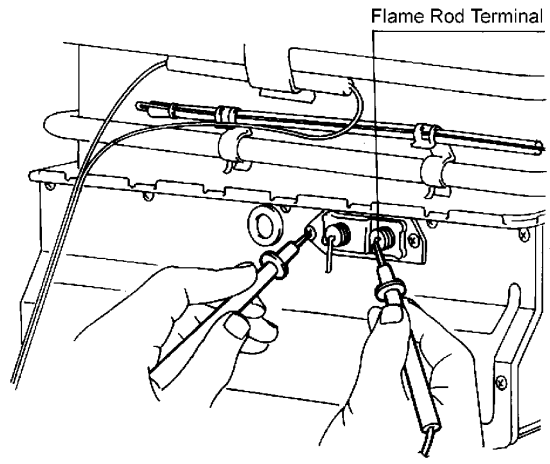
19. Fault Diagnosis

Before carrying out checks marked #, remove power cord from wall plug.
Wiring diagram is on page 25.

Appliance will to operate (even remote control fails to operate)	
1) Is the fuse blown?	
Fuses are located in plastic holders in the main harness, on the lower right hand side of the appliance	Check fuse a. Remove 240V plug from socket. b. # Measure resistance to check the electric fuse (3A). ***Normal:*** less than 1Ω If normal, proceed to check item 2) below. ***Faulty:*** Replace fuse (5A) If it blows again, investigate cause of short circuit.
2) Is the main transformer normal?	
 	Check the transformer c. Measure the voltage in between the red wires of the relay connector (A_1). ***Normal:*** AC90 ~ 110 V / 15 ~ 21Ω If normal, check (d) below. ***Faulty:*** Check for AC 90 ~ 110 V on the PCB terminal J black ~ black d. Check voltages below at upper PCB connector A. ***Normal:*** orange -orange AC 13 ~ 30V / 1.4 ~ 1.8Ω brown - grey AC 30 ~ 50V / 6 ~10Ω yellow - grey AC 180 ~ 220V / 0.4 ~ 0.6Ω If normal, check 3 at top of next page. ***Faulty:*** Replace the transformer.

Refer to diagram on bottom of previous page.	e. Check the voltage at centre PCB connector F, green~green. ***Normal:*** AC 16 ~ 20V If normal, check item 3) below. ***Faulty:*** Replace the transformer. **Note:** Transformer voltage above applies to the appliance in a standby, non-functioning state.
3) Is the remote control normal?	
	Check voltage between the two remote control cable conductors. f. Check the voltage between terminals on the remote control terminal mount (H_1). ***Normal:*** DC 10 ~ 13V If normal, check for open circuit or shorts before replacing the remote control. ***Faulty:*** Replace PCB.
No combustion (despite remote control indication)	
4) Is the water flow sensor normal?	
	g. Measure the voltage between red and black of the relay connector (a_2). ***Normal:*** DC 11 ~ 13V If normal, go to (h). ***Faulty:*** Replace water flow control. h. Measure the voltage between yellow and black of the relay connector (a_2) ***Normal:*** DC 2 ~ 10V If normal, go to 2). ***Faulty:*** Replace the water flow sensor.

5) Is the flame rod normal? Error "72" is displayed

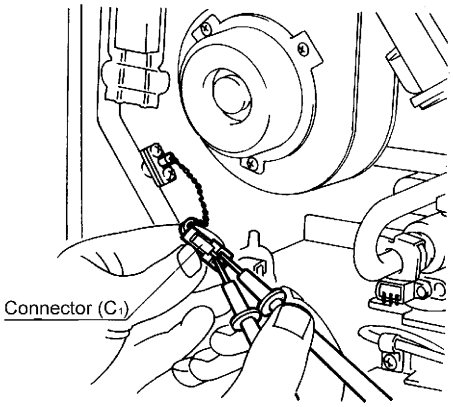


Checking the flame rod.

i. # Detach the flame rod terminal A_2, and re-attempt operation.
("72" is displayed)
Proceed to check item 3) below.
("72" is not displayed)
Inspect for electrical current leak from the flame rod.

Measure resistance between flame rod terminal A_2 and the appliance earth.
Normal: 1 MΩ or more
If normal, replace the PCB unit.
Faulty: Replace the flame rod.

6) Is the water temperature thermistor normal?

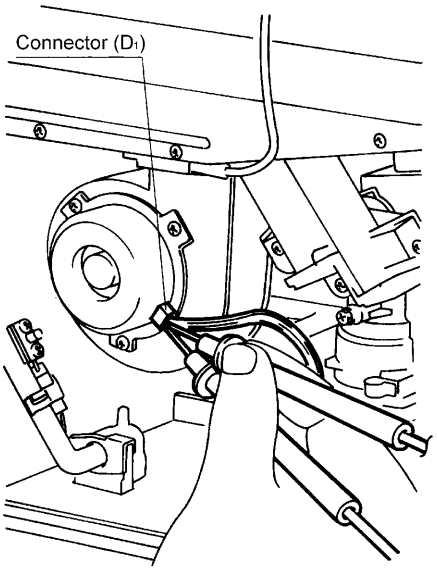


If error "32" is displayed, check the water temperature thermistor.

j. # Disconnect connector C_1, and measure the resistance of white and white.

Resistance > 1MΩ = open circuit.
Resistance < below 1Ω = short circuit.
Normal: proceed to check item 4) on next page.
Faulty: replace the water temperature thermistor.

7) Is the combustion fan normal?



Motor check
If error "61" is displayed, check combustion fan.

k. Measure the voltage at the connector (D_1) black ~ red

Normal: DC 6~40V (fan on)
DC 0V (fan off)
If normal, go (1)
Faulty: Replace the PCB unit

Fan Revolution Sensor Check

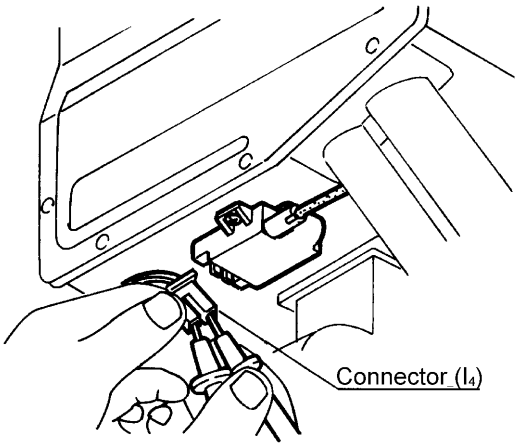
l. Measure the voltage at connector D_1, black ~ yellow

Normal: DC11~13V
If normal, go (m) below
Faulty: Replace the PCB unit

m. Measure the voltage at connector D_1, black ~ white

Normal: DC2~9V
If normal, proceed to check item 5) below
Faulty: Replace the combustion fan.

8) Is the sparker operating normally?



Checking the motor

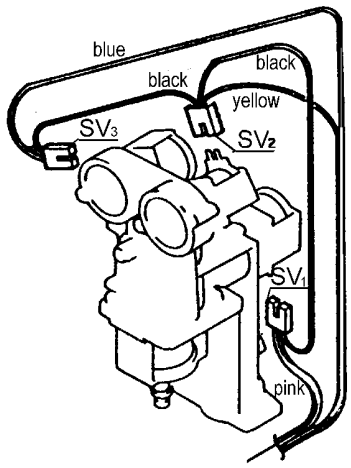
n. Measure the voltage at connector I_4. grey ~ grey

Normal: DC 90 ~ 110 V
DC 0 V (when fan is OFF)
If normal, check (o) below.
Faulty: Replace the PCB unit

o. # Disconnect I_4, and measure the resistance between sparker terminals

Normal: >1MΩ
If there is no spark, adjust or replace the electrode.
Faulty: Replace the sparker.

9) Is main gas solenoid valve (SV_1) normal?



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

p. # Disconnect the main gas solenoid valve (SV_1), connector and measure the resistance at the solenoid terminals. **Normal:** 0.9 ~ 1.3 kΩ

If normal, check (q) below.

Faulty: Replace the main gas solenoid valve.

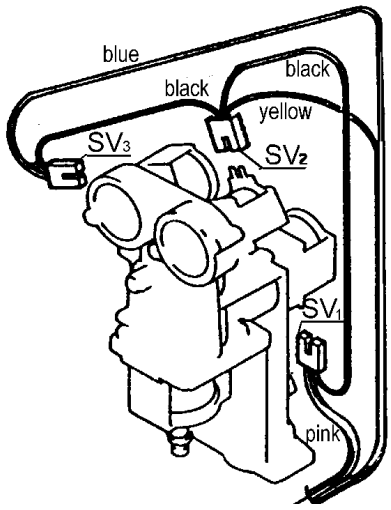
q. Measure voltage main gas solenoid valve (SV_2) pink ~ black connector.

Normal: DC80~100V

If normal, proceed to check item 7) below.

Faulty: Replace the PCB unit.

10) Is the change over solenoid (SV_2) operating normally?



If error "11" is displayed, check the change over solenoid valve (SV_2).

r. # Disconnect the main gas solenoid valve (SV_2) connector, and measure the resistance at the solenoid terminals.

Normal: 1.3 ~ 1.9 kΩ .

If normal, check (s) below.

Faulty: Replace the change over solenoid valve (SV_2).

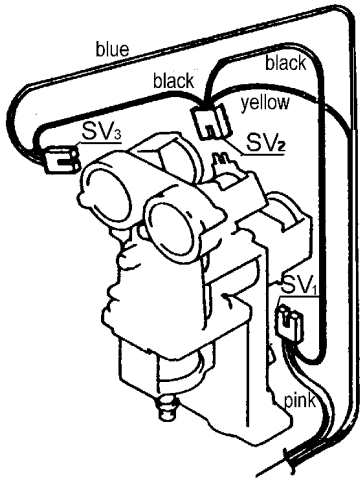
s. Measure voltage at change over solenoid valve (SV_3) blue ~ black connector.

Normal: DC 80 ~ 100V

If normal, check item 8) below.

Faulty: Replace the PCB unit

11) Is the change over solenoid valve (SV_3) normal?



t. # Disconnect the change over solenoid valve (SV_3) connector, and measure the resistance at the solenoid terminals.

Normal: 1.3 ~ 1.9 kΩ

If normal, check (u) below.

Faulty: Replace the change over solenoid valve (SV_3).

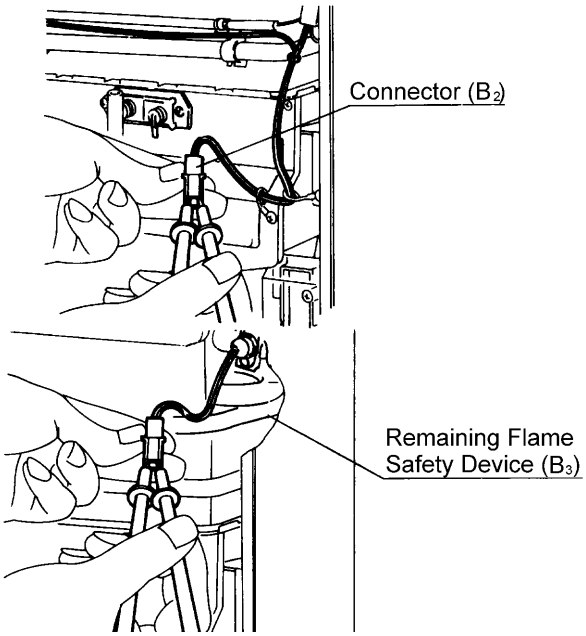
u. Measure the voltage at changeover solenoid valve (SV_3) blue ~ black connector.

Normal: DC 80 ~ 100V

If normal, check item 9).

Faulty: Replace the PCB unit.

12) Are the safety devices operating normally?



Check the thermal fuse.

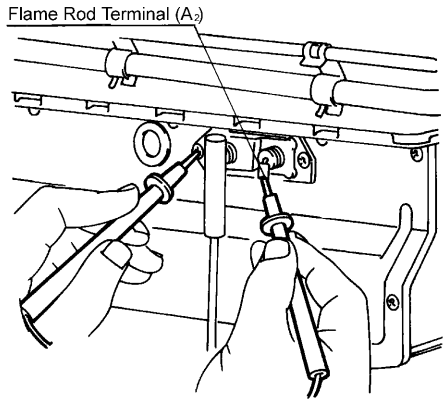
v. # Disconnect connector B_2 and measure the resistance between red ~ red.
Normal: less than 1Ω.
If normal, replace the PCB unit.
Faulty: Check the appliance for damage. If there is nothing abnormal, replace the thermal fuse.

Check the remaining flame safety device.

w. Measure resistance between the two terminals B_3.
Normal: less than 1Ω
If normal, replace the PCB unit.
Faulty: Replace the remaining flame safety device.

Combustion stops due to flame failure

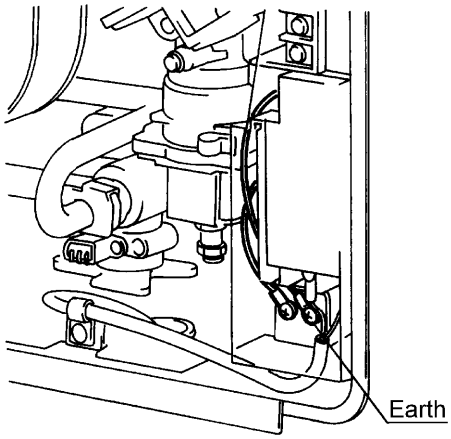
13) Is the flame rod functioning normally?



x. Measure the voltage between the flame rod terminal (A_2) and the appliance earth.
Normal: AC 100 ~ 160V
If normal, check (y) below.
Faulty: Replace the PCB unit.

y. Check that the flame rod attachment is not loose.
Normal: Replace the PCB unit
Faulty: Secure the flame rod brackets.

14) Is the earth lead wire normal?

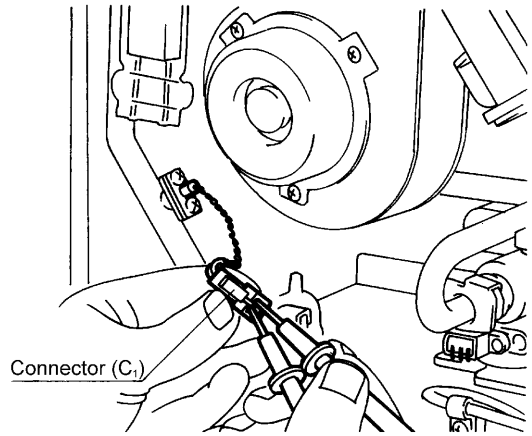


z. Check whether the earth lead wire has come loose (disconnection from round terminal) or if any shorts have occurred.
If normal, check for any other causes for flame failure (eg. gas valve is open, blocked filter, etc)

Faulty: Secure the earth.

Unable to adjust hot water temperature

15) Is the water temperature thermistor normal?

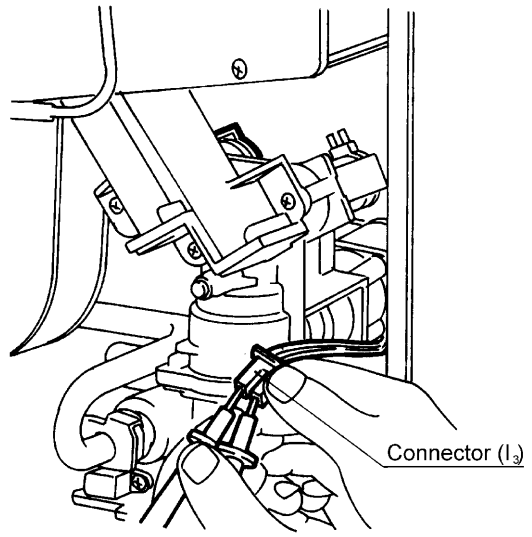


aa. Disconnect the connector (C_1) and measure the resistance between white wires.

See diagnostic points, for temperature at various resistance.

Normal: Proceed to check item 2) below
Faulty: Replace water temperature thermistor.

16) Is the changeover solenoid valve (SV_3) normal?



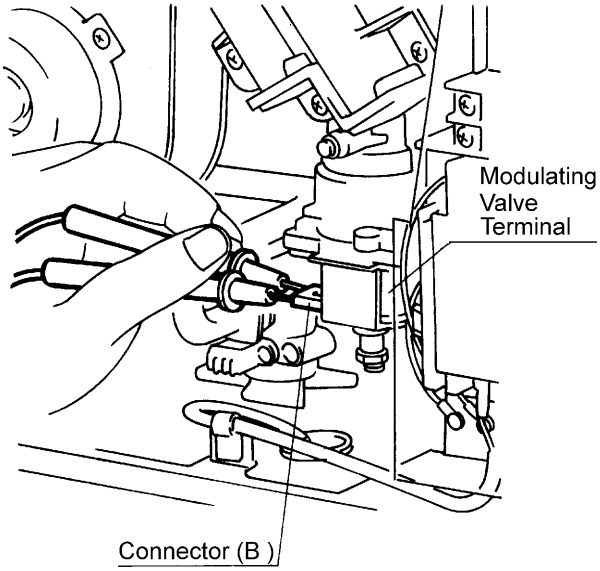
ab. # Disconnect the changeover solenoid valve (SV_3) connector, and measure the resistance between the solenoid terminals.

Normal: 1.3 ~ 1.9 kΩ.
If normal, go to (ac).
Faulty: Replace the changeover solenoid valve (SV_3).

ac. Measure the voltage at the changeover solenoid (SV3) blue ~ black connector.

Normal: DC 80 ~ 100V
If normal, go to item 3) on the next page.
Faulty: Replace the PCB unit.

17) Is the modulating valve operating normal?

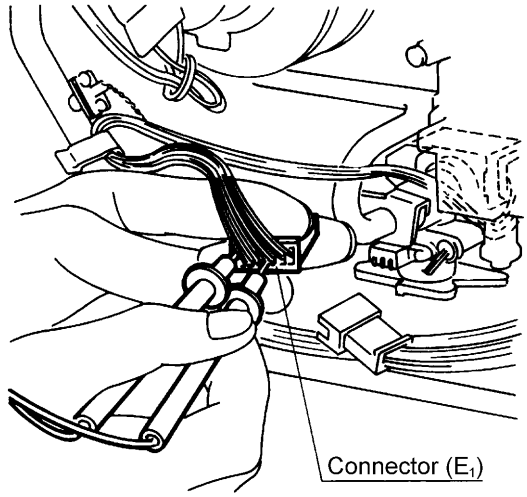


ad. # Disconnect the modulating valve festoon terminals and measure the resistance at the terminals.
Normal: 60 ~ 100Ω
If normal, go to (ae).
Faulty: Replace the modulating valve.

ae. Re-connect terminal and measure the pink ~ pink voltage at the modulating valve festoon terminal.
Normal: DC 0.5 ~ 25 V
If normal, go to (af) below.
Faulty: Replace PCB unit.

af. Investigate the change in gas secondary pressure when the remote control preset temperature is altered from 37 to 75◦C.
Normal: If the secondary pressure changes, proceed to check item 4) below.
Faulty: Replace the modulating valve.

18) Is the water flow servo normal? (2008/2408)



ag. # Disconnect connector and measure the red ~ blue resistance on the water flow servo side.
Normal: 10 ~ 30Ω
If normal, go to (ah).
Faulty: Replace the water flow servo with water flow sensor.

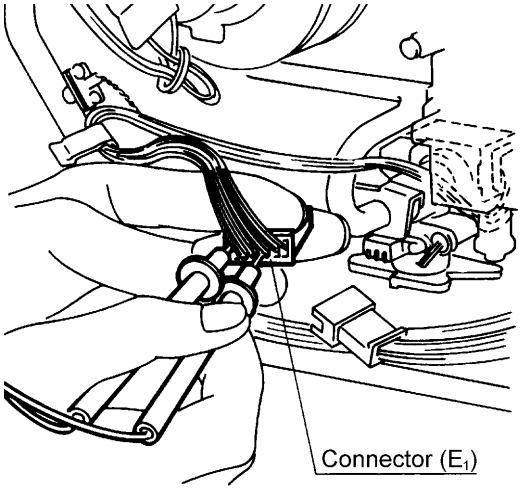
ah. Disconnect connector, and measure the voltage between orange (+) and grey(-) on the water flow control side.
Normal: DC 11 ~ 13 V
If normal, go to (ai).
Faulty: Replace the PCB unit.

ai. With connector (E_1) connected (do not turn water ON... wait for the water flow servo to return to fully open), measure the voltage between brown and grey.
Normal: DC 4 ~ 6V
Faulty: Change water flow servo with sensor.

aj. Leaving the relay connector (E_1) connected (do not turn water ON... wait for the water flow servo to return to fully open), measure the voltage between yellow and grey.
Normal: Less than DC 0.5 V
Faulty: Change water flow servo with sensor.

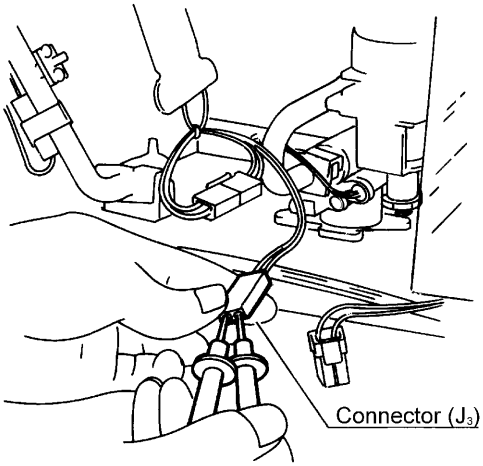
Anti frost heater does not operate

19) Are the ceramic anti-frost heaters OK?



ak. # Disconnect connector (J_3) and measure the blue and blue resistance on the water control heater side.

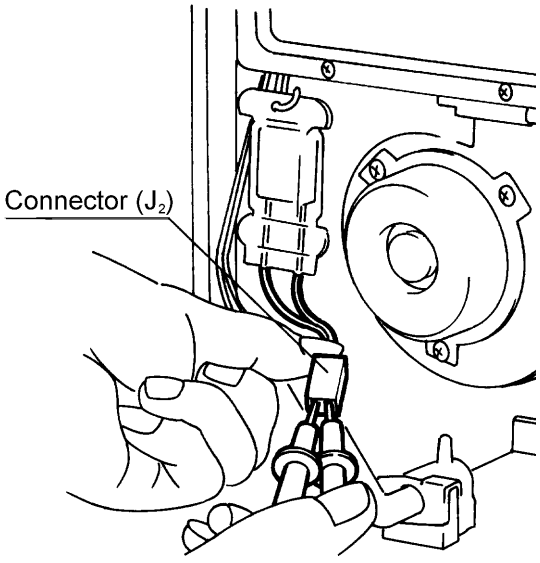
Normal: 950~1050Ω
(If normal, go to (al).
Faulty: Replace the water control heater.



al. # Disconnect connector (J_3) and measure the resistance between blue and blue on the heater exchanger's heater side.

Normal: 135 ~ 175Ω
If normal, go to item 2) below.
Faulty: Replace anti-frost heater (assy)

20) Is the frost sensing switch normal?



am. # Detach connector (J_2) and measure the resistance between blue and blue.
*Measure at room temperature of 4± 3◦ C.**

Normal: Less than 1Ω
if normal, check the wiring (AC100V circuit)
Faulty: Replace the frost sensing switch.

** Where the low room temperature cannot be achieved, please cool with iced water or cold water below 4◦ C.*

20. Electrical Component Analysis

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

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair No
A. The ON indicator does not light up after switching the unit on.	**1.** Is the power cord plugged in?	Inspect visually	Is it plugged in?	Yes	Go to A - 2.	
				No	Plug in cord	1
	2. Is supply voltage correct?	Measure voltage at power point.	AC 240 V (NZ 230 V)	Yes	Go to A - 3.	
				No	Check power supply circuit. Check fuses.	2
	3. Check 3 Amp electrical fuses.	*Inspect visually	Is the surge protector indicator lit up	Yes	Go to A - 5	
				No	Go to A - 6	
	4. Check 3 Amp electrical fuses.	* Disconnect and measure resistance to confirm if fuse is blown. Normal< 1 MΩ	Is fuse blown?	Yes	Go to A - 5 and replace fuse.	
				No	Go to A - 6.	
	5. Check for short circuits.	i) Measure the resistance of each solenoid valve. * Remove connector I from the PCB before measuring. Pink - Black 0.9 ~ 1.3 kΩ Yellow - Black 1.3 ~ 1.9 kΩ Blue - Black 1.5 ~ 1.9 kΩ	Are values within those specified at left? N.B. Measure after checking that there are no broken wires or shorts.	Yes	Go to A - 6 - 2)	
				No	Replace faulty solenoid valves.	
		ii) Measure the sparker resistance. * Disconnect the sparker connector I_4 and measure the resistance between both terminals.	Is resistance > 1MΩ	Yes	Go to A - 5-iii)	
				No	Replace sparker	4
		iii) Check wiring	Are there any shorts?	Yes	Rectify/Replace	5
				No	Replace PCB	6
	6. Check 240V-100V transformer.	i) Measure voltage between red-red A_1 connector.	AC 90~110 V	Yes	Go to A - 6 - ii)	
				No	Replace PCB.	
		ii) Measure voltage at connectors A, F with appliance on “standby”. A, Green-Green AC16 ~ 20 V F, Orange-Orange AC13 ~ 30 V F, Brown-Grey AC30 ~ 50 V F, Yellow (LH)-Grey AC180 ~ 220 V	Are values within those specified at left?	Yes	Go to A - 7.	
				No	Replace 240V transformer.	8
	7. Check the remote control (where connected).	Measure voltage between the control terminals at H_1.	DC10 ~ 13 V.	Yes	Check cable for shorts/ broken wires; replace remote control.	9
				No	Replace PCB.	10

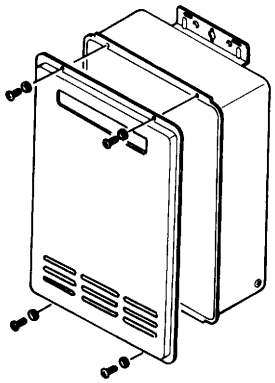
Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair No
B. Digital monitor lights up, but combustion does not commence. (When remotes are connected)	**1.** Check water flow sensor.	i) Measure voltage between red-black at connector C_2	DC11 ~ 13 V.	Yes	Go to B - 1 - ii)	
				No	Replace PCB	11
		ii) Measure voltage between yellow-black at connector C_2	DC2 ~ 10 V	Yes	Go to B - 4 - ii).	
				No	Replace water flow sensor.	12
Error code "72" displayed on digital monitor	**2.** Check flame rod.	* Measure resistance between flame rod terminal A_2 and earth.	Resistance > 1MΩ	Yes	Replace PCB.	13
				No	Replace flame rod.	14
Error code "32" displayed	**3.** Check outgoing water temperature thermistor.	* Disconnect connector C_1 and measure resistance of resistance Open circuit:>1MΩ Short circuit: <1Ω	Are values as shown at left?	Yes	Replace water temp. thermistor.	15
				No	Go to B - 4.	
Error code "61" displayed on digital monitor	**4.** Check combustion fan.	i) Check motor. Measure voltage between black-red at connector D_1.	DC6 ~ 40 V (Fan ON) DC 0 V (Fan OFF)	Yes	Go to B - 4 - ii).	
				No	Replace PCB.	16
		ii) Check rotation sensor. Measure voltage between black-yellow at connector D_1.	DC11 ~ 13V	Yes	Go to B - 4 - iii).	
				No	Replace combustion fan.	18
		iii) Measure voltage between black-white of connector D_1.	DC2 ~ 9V.	Yes	Go to B - 5.	
				No	Replace PCB	19
Error code "11" displayed on digital monitor	**5.** Check sparker.	i) Measure voltage btwn grey-grey at connector I_4 (sparker ON)	AC90~110 V.	Yes	Go to B - 5 - ii).	
				No	Replace PCB.	20
		ii) * Remove connector I_4; measure resistance btwn sparker terminals.	Is resistance > 1MΩ	Yes	Go to B - 5 - iii).	
				No	Replace sparker.	21
		iii) Check if unit is sparking.	Is the sparker sparking?	Yes	Go to B - 6.	
				No	Adjust/replace electrode.	22
	6. Check main gas solenoid valve (SV_1).	i) * Disconnect main sld connector I from PCB. Measure resistance btwn pink-blk.	0.9 ~ 1.3kΩ	Yes	Go to B - 6 - ii).	
				No	Replace main solenoid (SV_1).	23
		ii) Measure voltage between pink-black of SV_1 connector.	DC80~100V	Yes	Go to B - 7.	
				No	Replace PCB.	24
	7. Check solenoid valve (SV_2).	i) * Disconnect connector I from PCB; measure resistance between yellow-black.	1.3 ~ 1.9kΩ	Yes	Go to B - 7 - ii).	
				No	Replace (SV_2).	25
		ii) Measure voltage between yellow-black of SV_2 connector.	DC80~100V	Yes	Go to B - 8.	
				No	Replace PCB.	26
Error code "11" displayed on digital monitor	**8.** Check change over solenoid valve (SV_3).	i) * Disconnect connector I from PCB; measure resistance between blue-black.	1.3~1.9kS	Yes	Go to B - 8 - ii).	
				No	Replace (SV_3).	27
		ii) Measure the voltage between blue-black of SV_3 connector.	DC80~100V	Yes	Go to B - 9.	
				No	Replace PCB.	28

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair N°
Error code "14" displayed	**9.** Check thermal fuse.	* Disconnect connector B_2; measure resistance between red-red.	Resistance value < 1Ω	Yes	Go to B - 10.	
				No	Replace thermal fuse.	29
	10. Check overheat switch (remaining flame) switch (bi-metal)	* Disconnect OHS (remaining flame) sw. (Bi-metal sw.) festoon terminals; measure resistance btwn terminals.	Is Resistance < 1Ω	Yes	Go to B - 10.	30
				No	Replace remaining flame safety device (bi-metal SW).	31
C. Combustion occurs but flame fails. Error code "12" displayed	**1.** Check flame rod.	i) Measure voltage btwn flame rod terminal A_2 and appliance earth	AC100~160V	Yes	Go to C - 1 - ii).	
				No	Replace PCB.	32
		ii) Check flame bracket is not loose.	Is it secure?	Yes	Go to C - 1 - 2.	
				No	Replace/Rectify.	33
	2. Check earth lead.	Check for faulty earth connections (to round terminals) for broken wires or short circuits	Are connections OK?	Yes	Check other causes for flame failure.	34
				No	Adjust/replace earth lead.	36
D. Can not adjust water temperature.	**1.** Check water temperature thermistor.	Disconnect connector C_2; measure resistance between white-white. See page 24, for temp. at various resistance.	Resistance values match table on page 24?	Yes	Go to D - 2.	
				No	Replace water temperature thermistor.	36
	2. Check changeover solenoid valve (SV_3)	i) * Disconnect sld connector I from PCB; measure resistance between blue-black.	1.3~1.9kΩ.	Yes	Go to D - 2 - ii).	
				No	Replace (SV_3).	37
		ii) Measure voltage between blue-black wire of change over (SV_3) at connector I_3.	DC80~100V	Yes	Go to D - 3.	
				No	Replace PCB.	39
	3. Check modulating valve.	i) * Disconnect modulating valve festoon terminal; measure resistance solenoid terminals.	60 ~ 100Ω	Yes	Go to D - 3 - ii).	
				No	Replace modulating valve	39
		ii) Measure the voltage between the two harness terminals (still disconnected)	DC0.5~25V	Yes	Go to D - 3 - iii).	
				No	Replace PCB.	40
		iii) Check whether the secondary gas pressure alters when remote control temperature alters 37~75° C.	Does secondary voltage change?	Yes	Go to D - 4.	
				No	Replace modulating valve.	41
D. Can not adjust water temperature.	**4.** Check water flow servo.	i) Measure resistance between red-blue water flow servo connector I_1.	10 ~ 30 Ω	Yes	Go to D - 4 - ii).	
				No	Replace water flow servo with sensor.	42
		ii) Measure voltage between orange (+) - grey (-) water flow servo connector I_1.	DC11~13V	Yes	Go to D - 4 - iii).	
				No	Replace PCB.	43
		iii) Measure voltage between brown-grey water flow servo connector I_1 (don't turn water ON).	DC4 ~ 6V	Yes	Go to D - 4 - iv).	
				No	Replace water flow servo with sensor.	44
		iv) Measure voltage between yellow-grey water flow servo connector I_1 (don't turn water ON).	Is voltage < DC 0.5V	Yes	Normal	
				No	Replace water flow servo with sensor.	45

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair N°
E. Anti-frost heater does not work.	**1.** Check anti-frost heater.	i) * Disconnect connector J_3; measure resistance between blue-blue (water valve)	950~1050 Ω	Yes	Go to E - 1 - ii).	
				No	Replace anti-frost heater (assy).	46
		ii) * Disconnect connectors J_3; measure resistance between blue-blue. (heat exchanger).	135~170 Ω	Yes	Go to E - 2.	
				No	Replace anti-frost B (assy).	47
	2. Check frost sensing switch.	Disconnect connector f_3; measure the resistance between blue-blue. Atmospheric temperature less than 4±3 °C.	Is resistance < 1 Ω	Yes	Check wiring.	
				No	Replace frost sensing switch.	48

21. Gas Conversion

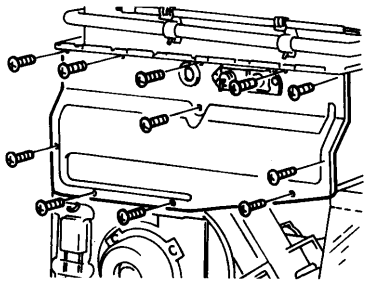
1. Remove outer cover, 4 screws.



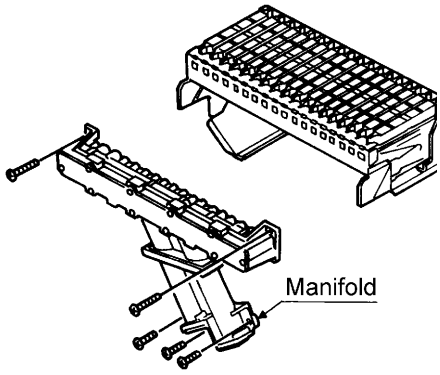
2. Delete “gas type marking” from the combustion chamber cover and replace with “new gas type”.

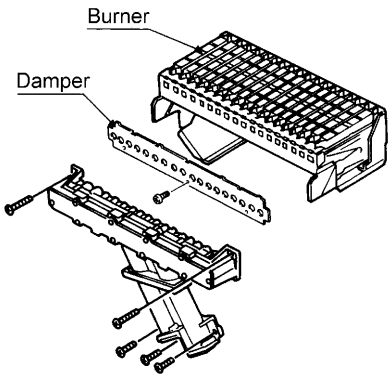
(Use a black marking pen).

3. Delete gas type from small paper sticker on bottom edge of inner casing.
4. Replace small gas label on gas inlet.
5. Replace large gas label on top of appliance.
6. Place “new” very small gas label (indicating new gas type) over existing one on data plate.
7. Complete details on conversion sticker, place sticker on the inside front cover.
8. Remove PCB protective plastic cover.
9. Disconnect flame sensor and sparker lead.
10. Remove combustion chamber cover, 11 screws.
11. Remove manifold, 5 screws.



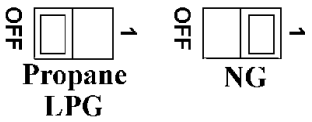
12. Fit or remove damper assembly (3 screws) depending on gas type. Note: Damper is only used on LPG models.
13. Fit new manifold, ensuring no wires are trapped. Check “O” rings are correctly positioned.
14. Refit combustion chamber cover. Attach flame sensor and sparker lead.
15. Connect appliance to gas, water, and electricity.
16. Follow gas pressure setting procedure, (see next page).
17. Check for gas escapes with soapy water.
18. Disconnect appliance from services (if in workshop).
19. Replace front cover, star washer must be on bottom right hand screw.





22. Gas Pressure Setting Procedure

Position gas selection switches to the correct position. (see diagram opposite).



Remove pressure point screw and attach pressure gauge.

Turn water ON.

Adjust pressure

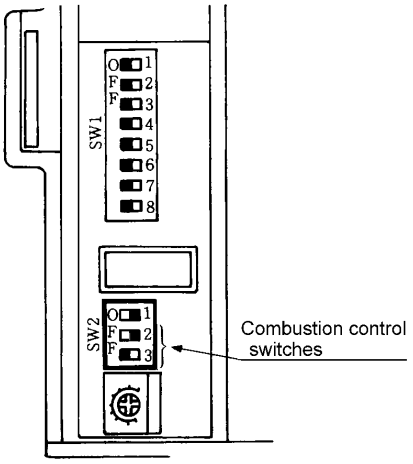
1) Low

a. Position No. 2 of the bottom set of dip switches to ON.

b. Remove the plug in the base of the appliance for access to the regulator screw (modulating valve).

Unlock screw and adjust to:

- Natural - 0.8 kPa
- Propane - 0.17 kPa
- LPG (NZ) - 0.15 kPa

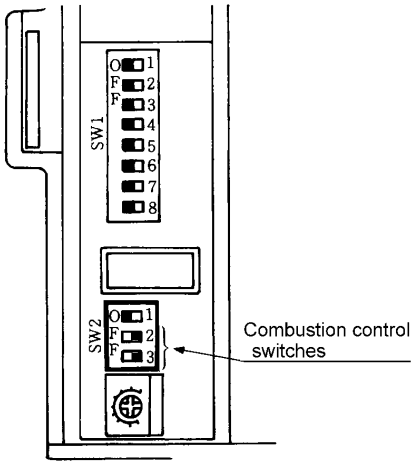


c. Lock regulator screw (modulating valve).

2) High

d. Position No. 3 of the bottom set of dip switches to the ON position (leaving No.2 ON).

e. The HI potentiometer on the PCB, adjust the pressure to:
Natural - 0.90 kPa
Propane - 2.26 kPa
LPG (NZ) 1.90 kPa



f. Position switch No.2 and No.3 of the bottom set of dip switches to the “OFF” position.

g. Turn water OFF. Replace plug in base.

h. Replace protective plastic cover over PCB.

23. Dismantling for service

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

e.g. - Isolate gas supply.

- Disconnect electrical supply from wall socket.

- Isolate the water supply.

- Drain All water from the appliance

Item ***Page***

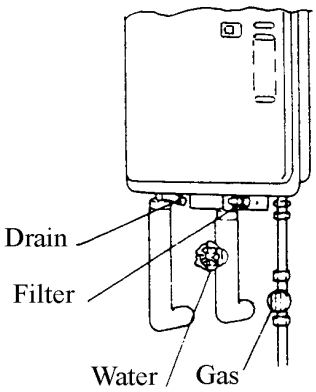
Unless otherwise stated, reassembly is the reverse of dismantling

IMPORTANT

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

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

The following diagram may be of assistance.

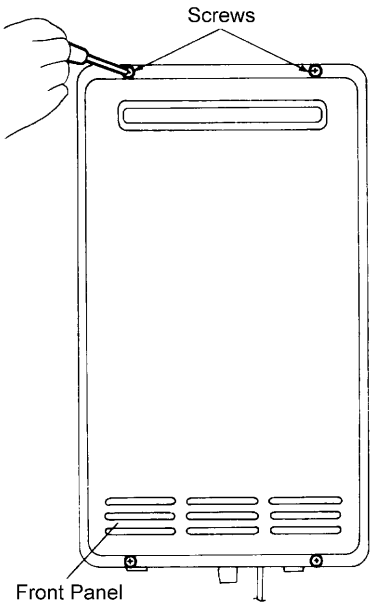


3) Removal of Front Panel

CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

a. Remove the four (4) screws holding the panel in place. (phillips driver)

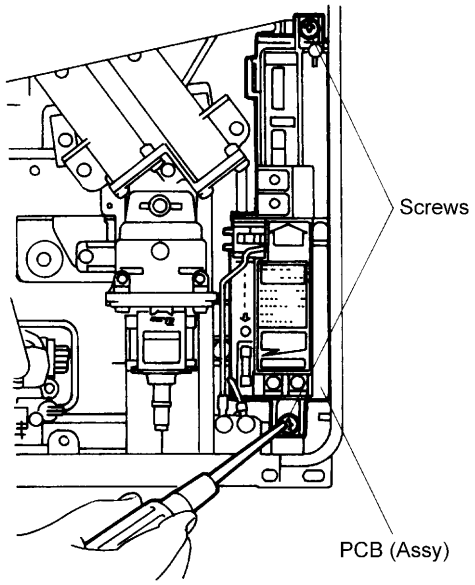


4) Removal of PCB

CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

a. Remove the 2 screws on the P.C.B. and pull out towards you. (phillips driver)



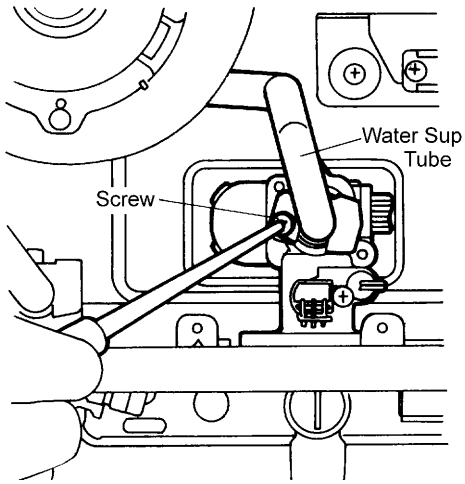
5) Removal of Water Flow Sensor with Water Flow Servo

CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

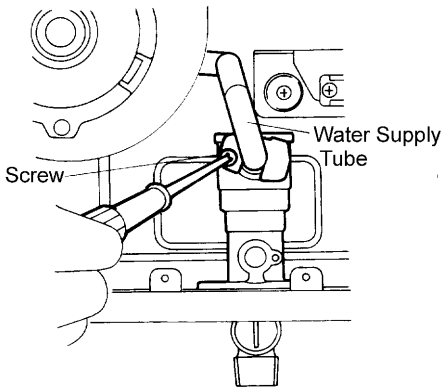
- Isolate Water Supply.

b. 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. (phillips driver)



c. Remove four (4) screws from the water supply connection and remove connection.

Handle O-ring carefully. (phillips driver)



d. Disconnect electrical connectors and remove water flow sensor from control assembly.

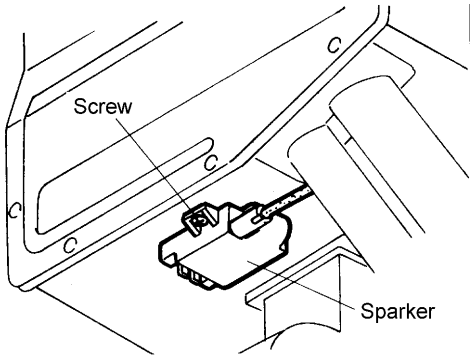
6) Removal of Sparker

CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

a. Remove one (1) screw that secures sparker to the attachment plate to remove sparker. (phillips driver).

b. Disconnect high tension lead connector.



7) Removal of Combustion Fan

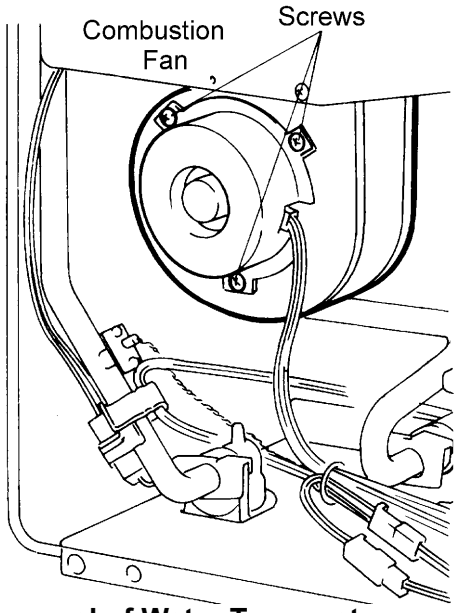
CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

a. Detach the sparker, refer to section 4.

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

(phillips driver).



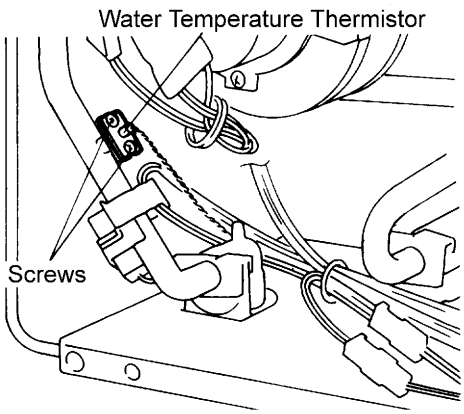
8) Removal of Water Temperature Thermistor

CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

- Isolate Water Supply.

a. Remove the two (2) screws that secure the thermistor in place to remove the water temperature thermistor. (phillips driver).

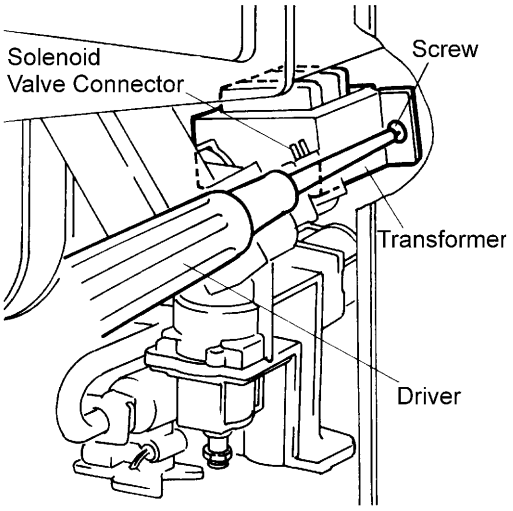


9) Removal of Transformer

CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

a. Remove the PCB unit; refer to section 2.
b. Remove the sparker; refer to section 4.
c. Remove one solenoid valve connector.
d. Remove two (2) fixing screws to release the transformer (phillips driver)
e. Disconnect connectors.

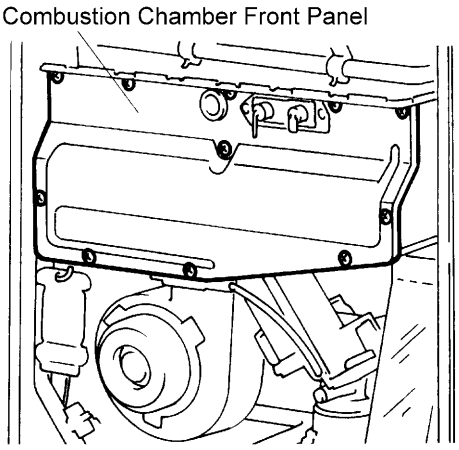


10) Removal of Manifold and Burner

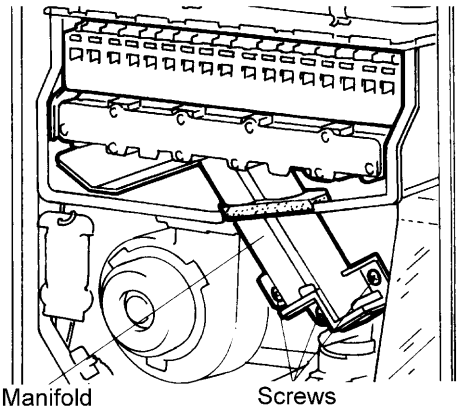
CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

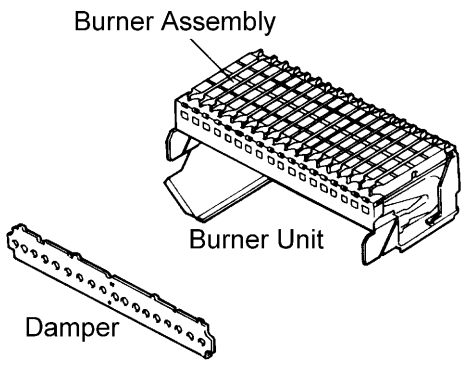
a. Remove the sparker, refer section 4.(1 screw)
b. Remove eleven (11) screws that hold the combustion chamber front panel in place and remove the panel (phillips driver)



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



d. Pull burner unit forward to remove (hand)



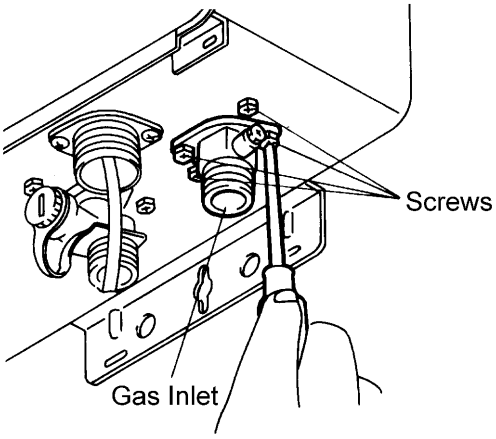
11) Removal of Gas Control

CAUTION

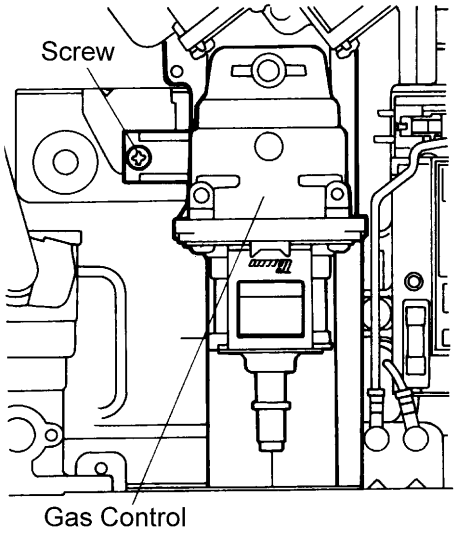
- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

a. Remove the manifold (5 screws), refer section 8a,b,c.

b. Remove the four (4) screws that hold the gas connection and gas control in place. Remove the gas connection. Handle O-ring carefully. (phillips driver)



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



12) Removal of Heat Exchanger

CAUTION

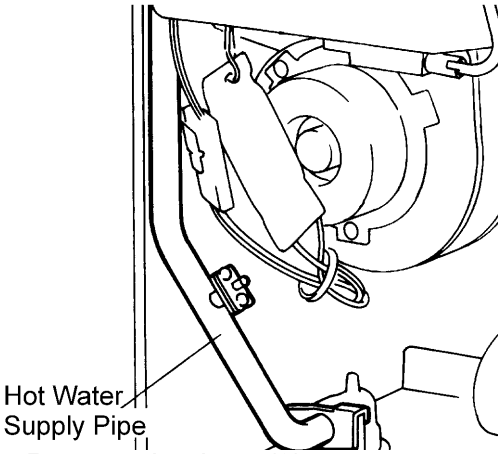
- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

- Isolate Water Supply.
- Drain All Water

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

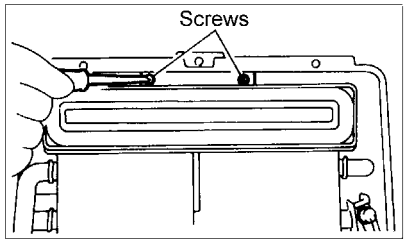
b. Remove the heat exchanger water. connection pipe; refer to section 3-a.

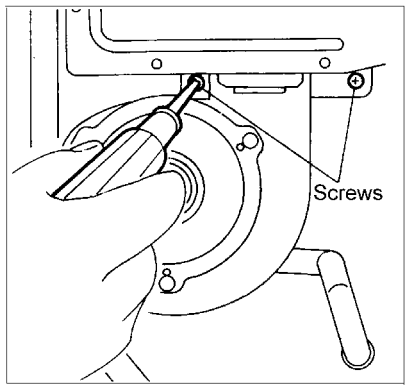
c. Remove one (1) screw from the outlet connection clip, to pull out the hot water supply connection pipe towards yourself. (Handle O-ring carefully)



d. Remove the three (3) screws securing the manifold to the gas control.

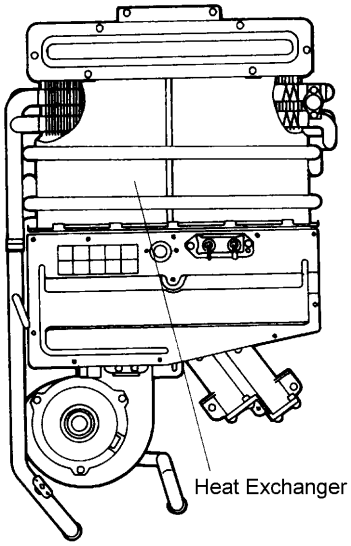
e. Remove four (4) screws that secure the heat exchanger unit in place.





f. Remove all electrical connectors, including the thermistor.

g. Pull out the heat exchanger unit towards yourself.



13) Removal of Thermal Fuse

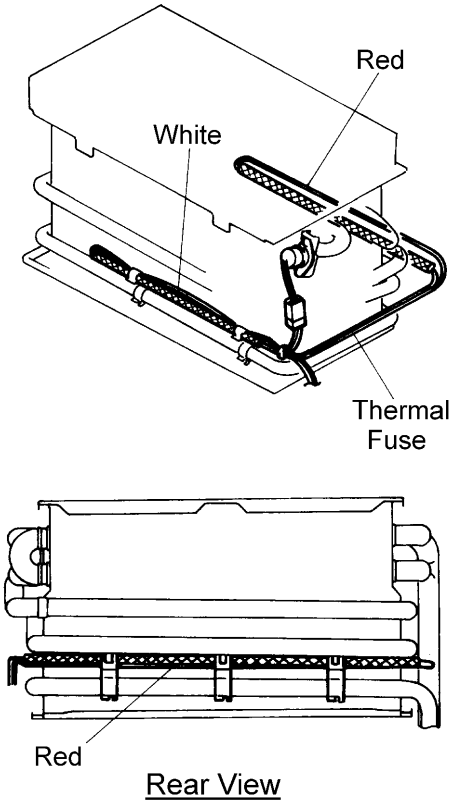
CAUTION

- 240 volt potential exposure. Isolate the appliance and reconfirm with a neon screwdriver or multimeter.

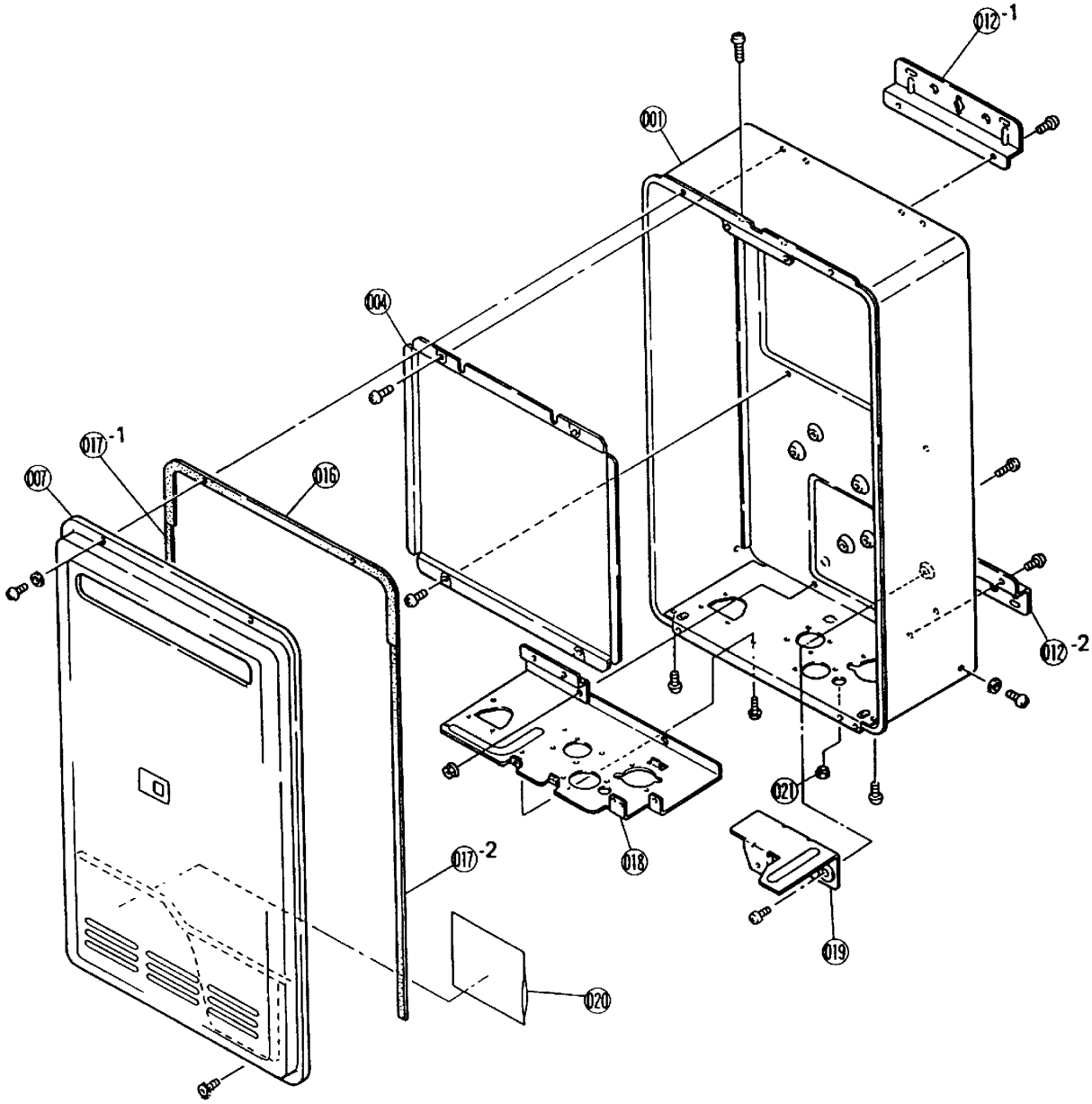
h. Remove the heat exchanger unit; refer to section 10.

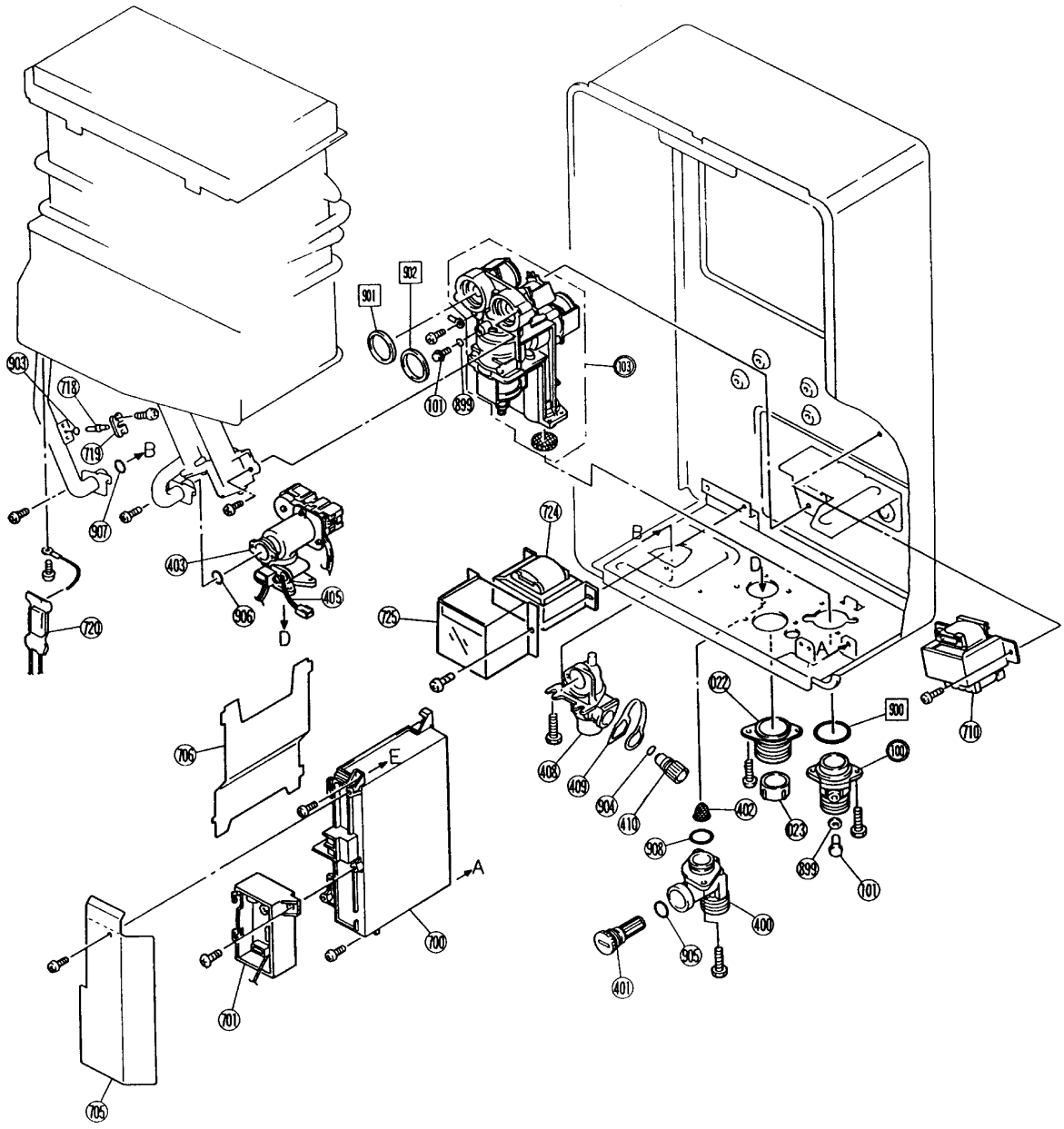
i. Disconnect and remove the thermal fuse (phillips head).

* Fit the fuse as shown below



24. Exploded Diagram

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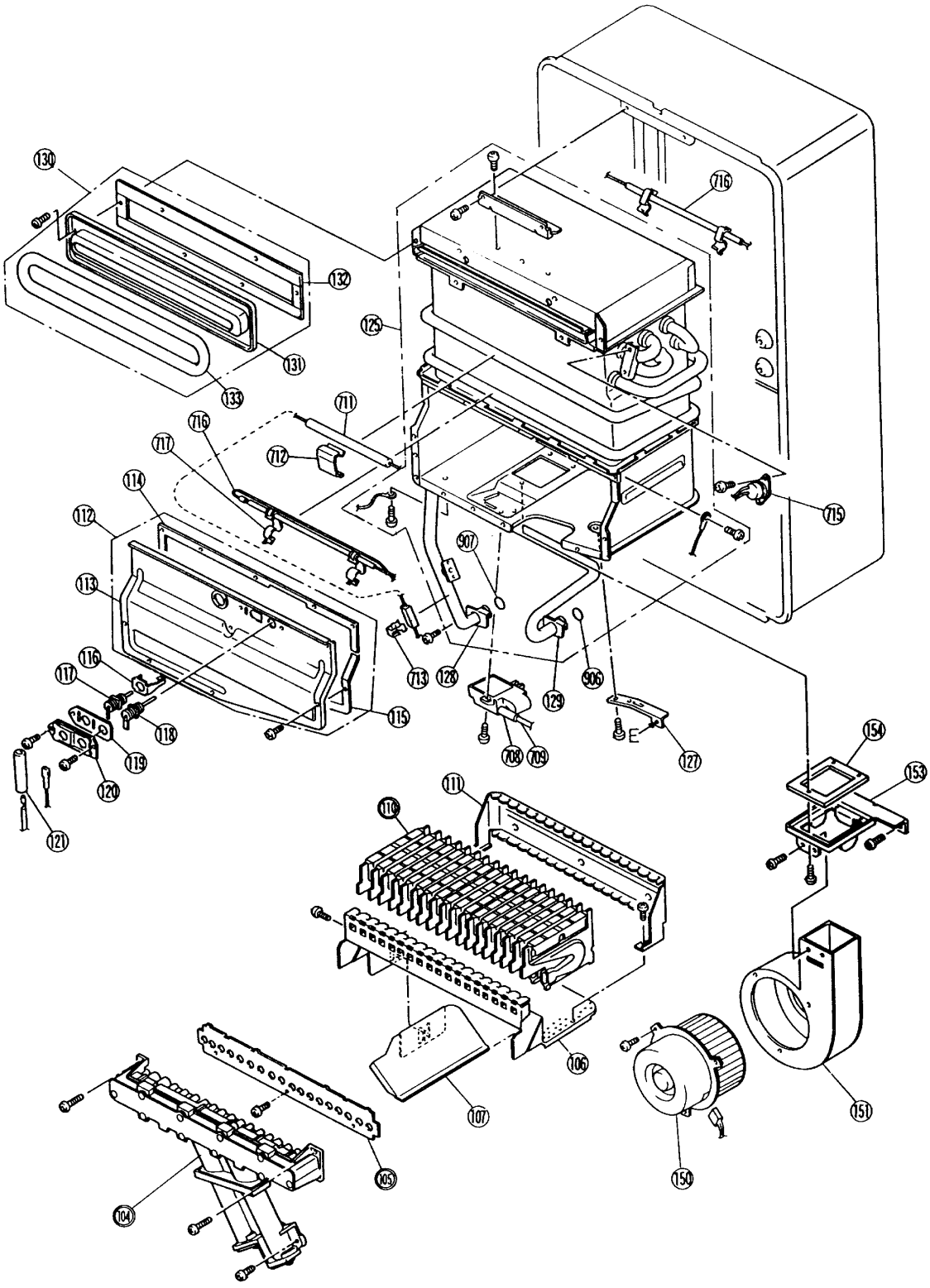
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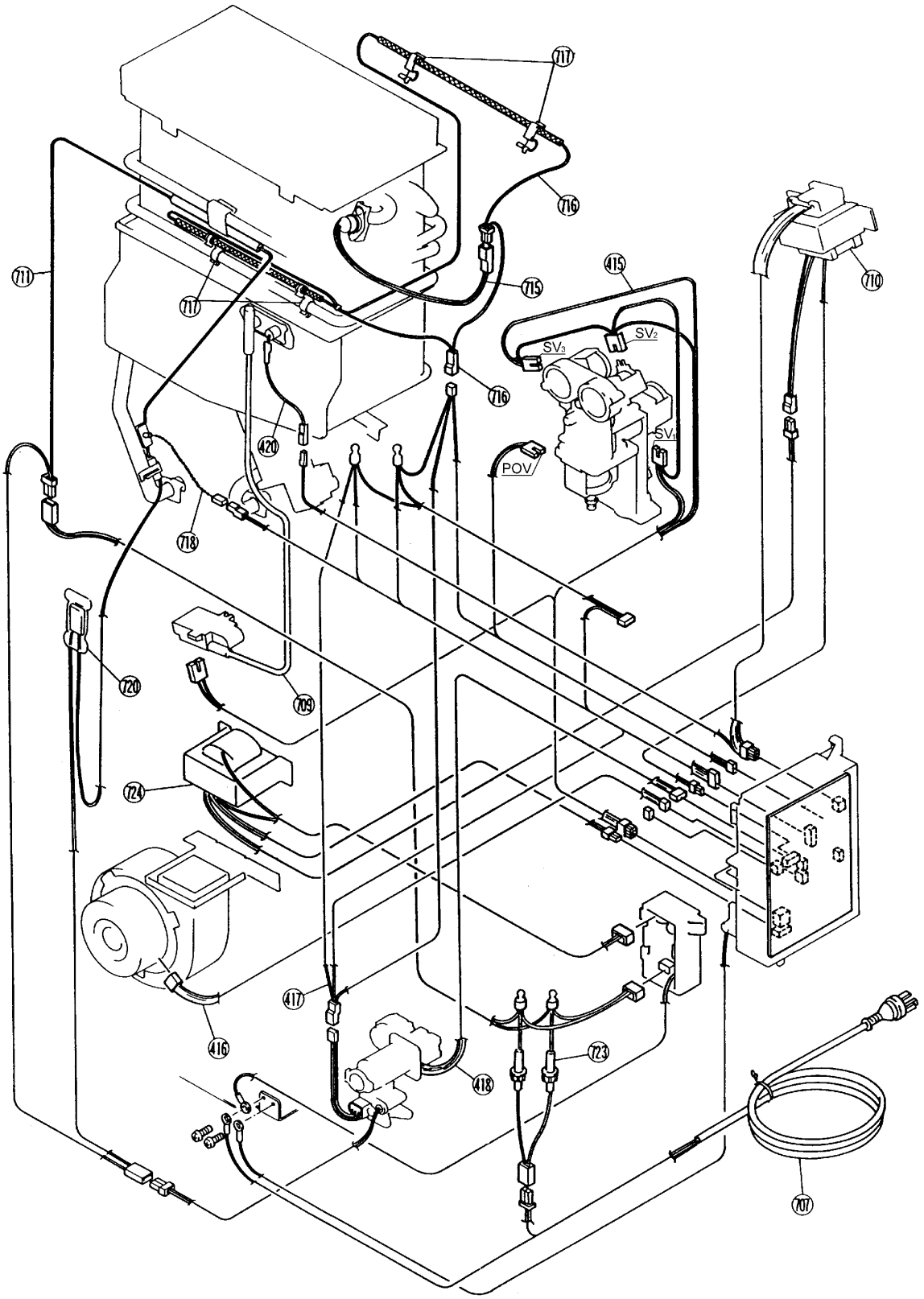
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21. Parts List

No.	Part Name	RJ Drawing No	RA Part No	Qty
001	BODY Assy, Main - Standard	DU195-100	92088616	1
001	BODY Assy, Main - Salt Resistant			1
004	SHIELD, Heat Insulation	BU155-110	92073329	1
007	PANEL Assy, Front - Standard	CU195-165-6-4	92088582	1
012	BRACKET, Wall Mounting	BU195-121		2
016	SEAL PACKING, Panel	BU195-167	92086909	1
017	GASKET - Side, Main Body	AU115-163	92063361	2
018	PANEL, Connection Reinforcement	BU169-1511		1
019	GASKET, Gas Control	BU169-125		1
021	GASKET, Blind	AU105-113		
022	PLUG, Rubber	BU56-602-N	92073352	1
023	SKIRT, Cable	AU169-126		1
100	CONNECTION, Gas R3/4	CU195-211	92081587	1
101	SCREW, Test Point	C10D-5		2
103	CONTROL Assy, Gas	C36E-16	92081595	1
104	MANIFOLD Assy - 1.70 NG	CU195-200-G	92074977	1
104	MANIFOLD Assy - NG	CU195-200-G	92074970	1
105	DAMPER, Prop.G/LPG	BU195-258	92071364	1
106	BURNER CASE, Front	DU195-255		1
107	PANEL, Sound Insulation	CU169-257		1
110	BURNER, Front	B3A1-4	92073451	1
111	BACK PANEL, Burner Case	CU169-256		1
112	FRONT PANEL, Comp.Assy, Comb.Chamber	DU195-311		1
114	GASKET, Comb. Chamber - Top	BU195-315	92081629	1
115	GASKET, Comb. Chamber - Bottom	BU195-316	92081637	1
116	TARGET, Ignition	AU168-325	92073469	1
117	ELECTRODE	AU168-321	92072917	1
118	ELECTRODE, Flame Rod Electrode	AU168-322	92072891	1
119	GASKET, Electrode	AU168-312	92095629	1
120	CLIP, Electrode retainer	AH43-262		1
121	SLEEVE, Electrode	AU102-681	90164856	1
125	HEAT EXCHANGER, Comp.Assy	DU195-906	92081660	1
127	BRACKET, PCB	AU195-330		1
128	O-RING, Heat Exchanger Outlet	AU195-321		1
129	O-RING, Heat Exchanger Inlet	AU195-322		1
130	FLUE Assy	BU169-470	92081678	1
131	TERMINAL, Flue	BU169-471		1
132	GASKET, Flue Front Terminal	BU169-472	92073485	1
133	PACKING, Flue Front Panel Seal	AU155-111	92073493	1
150	MOTOR Assy, Fan	BU195-565	92081686	1
151	CASING, Fan	BU169-552	92073519	1
153	CONNECTION, Fan	BU169-555	92073527	1
154	GASKET, Fan Connection	AU169-556	92073535	1
400	CONNECTION-B, R3/4 Water Inlet	H73-501	92089044	1
402	FILTER, Water Flow Valve	M8D1-11	92072701	1
403	SERVO Assy, Water Flow Sensing	M8E-4-3	92085406	1
403	HEATER, Water Valve	BU195-1635	92082437	1
408	RETAINER, Pressure Relief Valve Plug	BU132-362	92081744	1
409	PLUG, Rubber	AU129-526		1
410	VALVE, Pressure Relief	BU129-520-C	92081751	1
415	HARNESS - Wire, Modulating Solenoid Valve	BU129-520	92081769	1
416	HARNESS - Wire, Fan Motor	BU195-602		1
417	HARNESS - Wire, Sensor	BU195-603	92081777	18
418	HARNESS - Wire, Water Flow Servo	BU195-604	92081785	1
420	HARNESS - Wire, Flame Rod	AU195-605		1

No.	Part Name	RJ Drawing No	RA Part No	Qty
700	PCB Assy	CU195-1633	92088624	1
701	ARRESTOR, Surge	BU195-1643	92081801	1
705	COVER, PCB Front	BU168-707		1
706	COVER, Control	BU195-507		
707	POWER CORD	CP90491T	92089051	1
708	SPARKER	E1-144	92072776	1
709	LEAD HT	BH38-710	92063585	1
710	TRANSFORMER, Assy	ET150-1	92081835	1
711	HEATER-B Assy, Anti Frost (AK only)	BU195-1637	92081843	1
712	BRACKET, Heater (AK only)	AU195-675	92086123	1
713	BRACKET, Heater (AK only)	AU100-721	92076123	1
715	SWITCH, Overheat	BU129-821	92081850	1
716	FUSE, Thermal	CU195-610	92081868	1
717	HARNESS, Thermal Fuse	CP80531		1
718	THERMISTOR	BH45-650	92073675	1
719	CLIP-LARGE, Thermistor Retainer	CP90172	92086388	1
723	HARNESS - Wire, 3 Amp Fuse Harness	BU195-163		1
724	TRANSFORMER, Assy (240-100V)	ET160A-1	92081918	1
725	COVER, Transformer	BU168-1533		1
801	SCREW, FT	ZBA0410UK		1
802	SCREW	ZB10510UK		
803	SCREW, Tapping	ZFAB0408SZ		1
804	SCREW, FT	ZBA0408UK		1
805	SCREW, Truss Tapping	ZBD0408UK		1
806	SCREW	ZAD0408UK	92087535	1
807	SCREW	CP-21478-412		1
808	SCREW. Tapping	ZAA0408UK		1
809	SCREW	ZAA0408UK		1
810	SCREW, Truss FT	ZBA0412UK		1
811	SCREW, FT	ZQAA0512UK		1
812	SCREW, Truss FT	ZBA0512UK		1
816	SCREW	ZEDB0408SZ		3
818	SCREW	ZHDC0408TK		1
819	SCREW, Tapping	ZEAB0406UK		1
820	SCREW, FT	ZIAA0408SZ		1
821	SCREW, Hexagon Head	ZAG0514UK		1
822	WASHER, Nylon	CF83-41430		1
823	CLIP, Electrode	CP-90331		1
899	O-RING	12A03	90195165	2
900	O-RING	OR1AP24NP	92081926	1
901	MANIFOLD O-Ring Gas	C36F8-1	92075126	1
903	O-RING	M10B-2-4		1
904	O-RING	M10B-2-7	92043231	1
905	O-RING	M10B-2-12	92063551	1
906	O-RING	M10B-2-12.5	92071422	1
907	O-RING	M10B-2-14	92062207	1
908	O-RING	M10B-2-18	92071182	1

Notes

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Western Australia	(08) 9324 4145
Queensland	1800 255 655

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