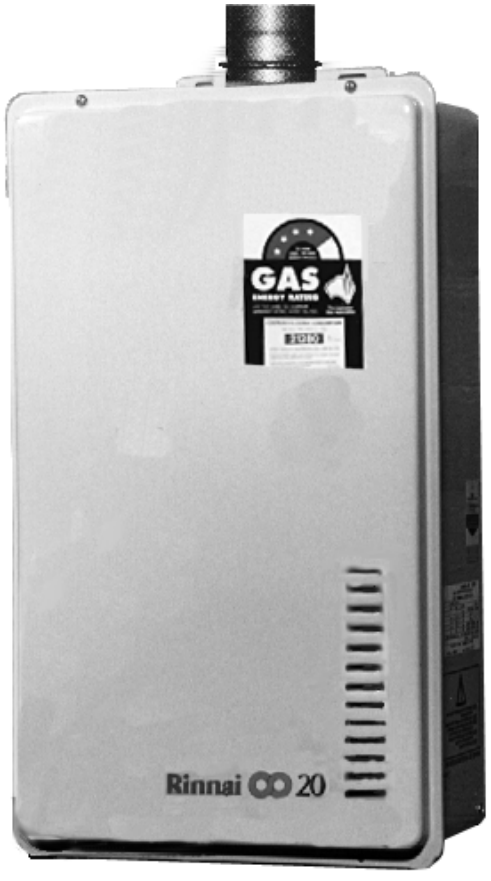
Rinnai INFINITY

Infinity 20 Internal
REU-2006FFU

SERVICE MANUAL



Infinity Compact Continuous Flow Gas Hot Water System

Proudly a member of The Australian Gas Association.
All of our products are AGA tested and approved.

The Australian
Gas Association

Quality System

Quality
Endorsed
Company

ISO 9002 Lic 4983
Standards Australia

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

Rinnai New Zealand has been certified to ISO 9001 Quality Assurance by Telarc.

TELARC
REGISTERED
SUPPLIER

Quality
Endorsed
Company

ISO 9001 Reg 415

Certified
Product

WaterMark

AS3498 Lic W208
Standards Australia

Certified to Australian Standard 3498 by Quality Assurance Services. Watermark certification is awarded to products with suitable fittings complying with safety and water contamination standards.

Comparative Energy Consumption tested to The Australian Gas Association requirements of Australian Gas Code AG 102. An energy rating of 5 stars refers to an efficiency of approximately 80%, that is, 80% of gas consumed is converted to useful heat.

THE MORE STARS THE MORE ENERGY EFFICIENT.
GAS
ENERGY RATING
USE THIS LABEL TO COMPARE DIFFERENT MODELS.
THE AUSTRALIAN GAS ASSOCIATION

ISO 9001	*Model for Quality Assurance in design/development, production, installation and servicing, aimed primarily at achieving customer satisfaction by preventing nonconformity at all stages from design through to servicing.*
ISO 9002	*Same as ISO 9001 but excluding design.*
AS 3498	*Authorisation requirements for plumbing products - water heaters and hot-water storage tanks, aimed at ensuring safe, quality products.*
AG 102	*Approval requirements for gas water heaters as set by The Australian Gas Association and Australian Liquefied Petroleum Gas Association Ltd, to ensure proper safety performance and quality levels are achieved.*

Feb 2000

WARNING

Failure to comply with these instructions may result in serious personal injury of damage to the appliance.

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 Rinnai Australia Customer Technical Services. 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.

SRV2006
Issue Nº2

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
Δ^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 REU-2006FFU has been developed in response to the growing changes in the lifestyle of the end user, and the increasing diversification and sophistication of demand in the marketplace.

The Infinity 20 (REU-2006FFU) offers advanced safety features, and an option to connect one, two, or three remote control pads for increased conrol. The Infinity 20 has been designed for internal installation, making it ideal for apartments or units.

The Infinity 20 is delivered with the maximum hot water temperature output set at 55^{o}C, with or without remote controls connected, although it is possible to achieve a maximum of 75^{o}C.

The front cover of each appliance in the new series is formed from 0.5 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 stainless steel nozzle situated on the upper front of the appliance.

The burner assembly is made up of 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, located on the outgoing hot water supply tube, near the outlet of the water heater, and another room temperature thermistor.

2. Features

Installation

The Infinity 20 is designed to be installed internally, hence requiring special Rinnai-approved flueing. Its light-weight, slim, and compact form enable easier installations improving appearance. 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. See "Safety Devices" on page 7 for further detail.

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 20 L/min. A suitable volume of hot water can be supplied throughout all seasons with the incorporation of the water flow control device and water flow servo mechanism. The REU-2006FFUwill supply up to 20 L/min (maximum unmixed), controlled by an automatic electro-mechanical water flow device. See 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 55°C (in 13 steps). With or without a remote control connected the outgoing hot water temperature can be fixed to a maximum of 40°C, 50°C, 55°C, 75°C. This means that the new 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 regulation safety feature).

Over Temperature Protection

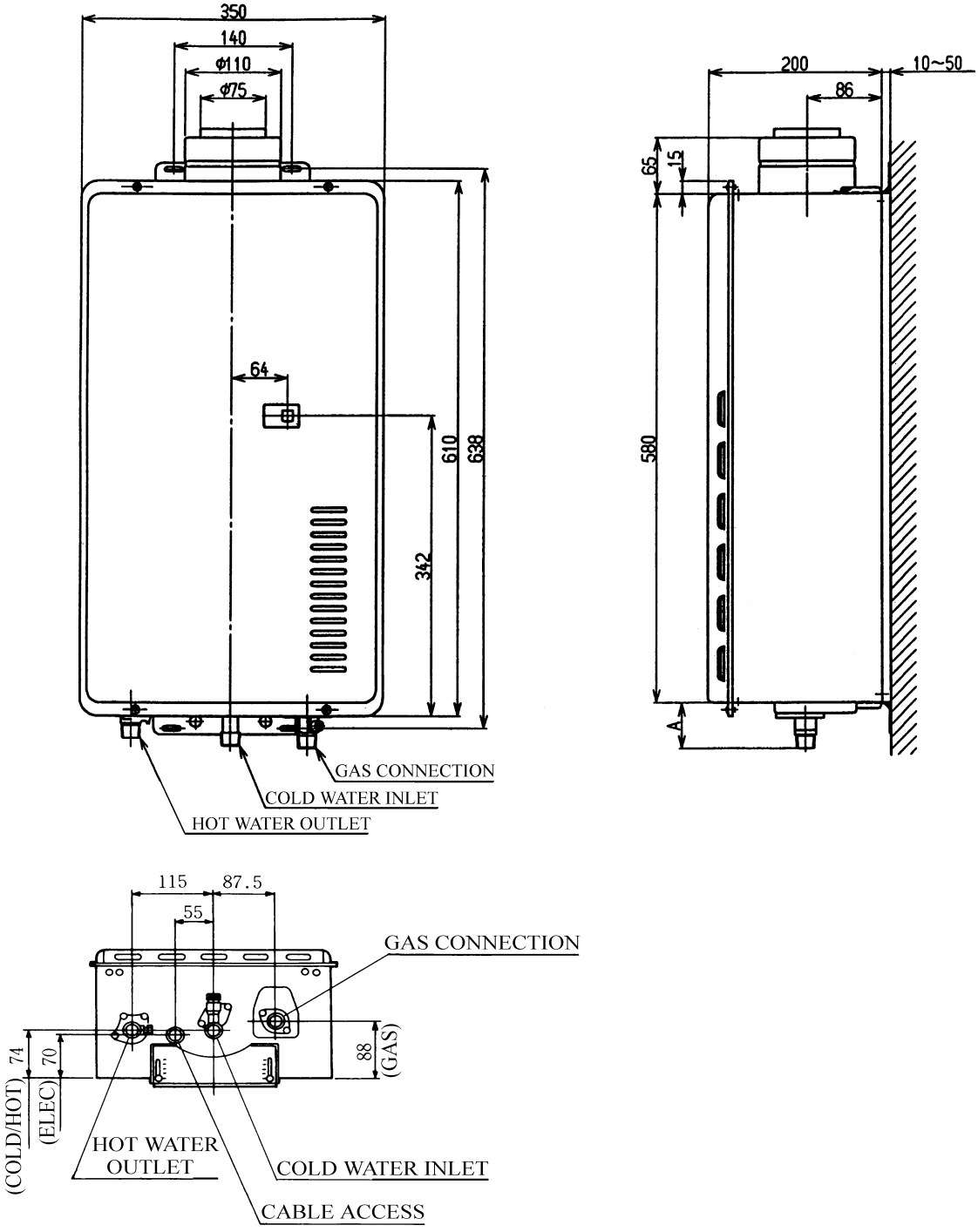
All Infinity models incorporate a device to prevent the hot water temperature exceeding the pre-set temperature by more than 3°C.

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 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.

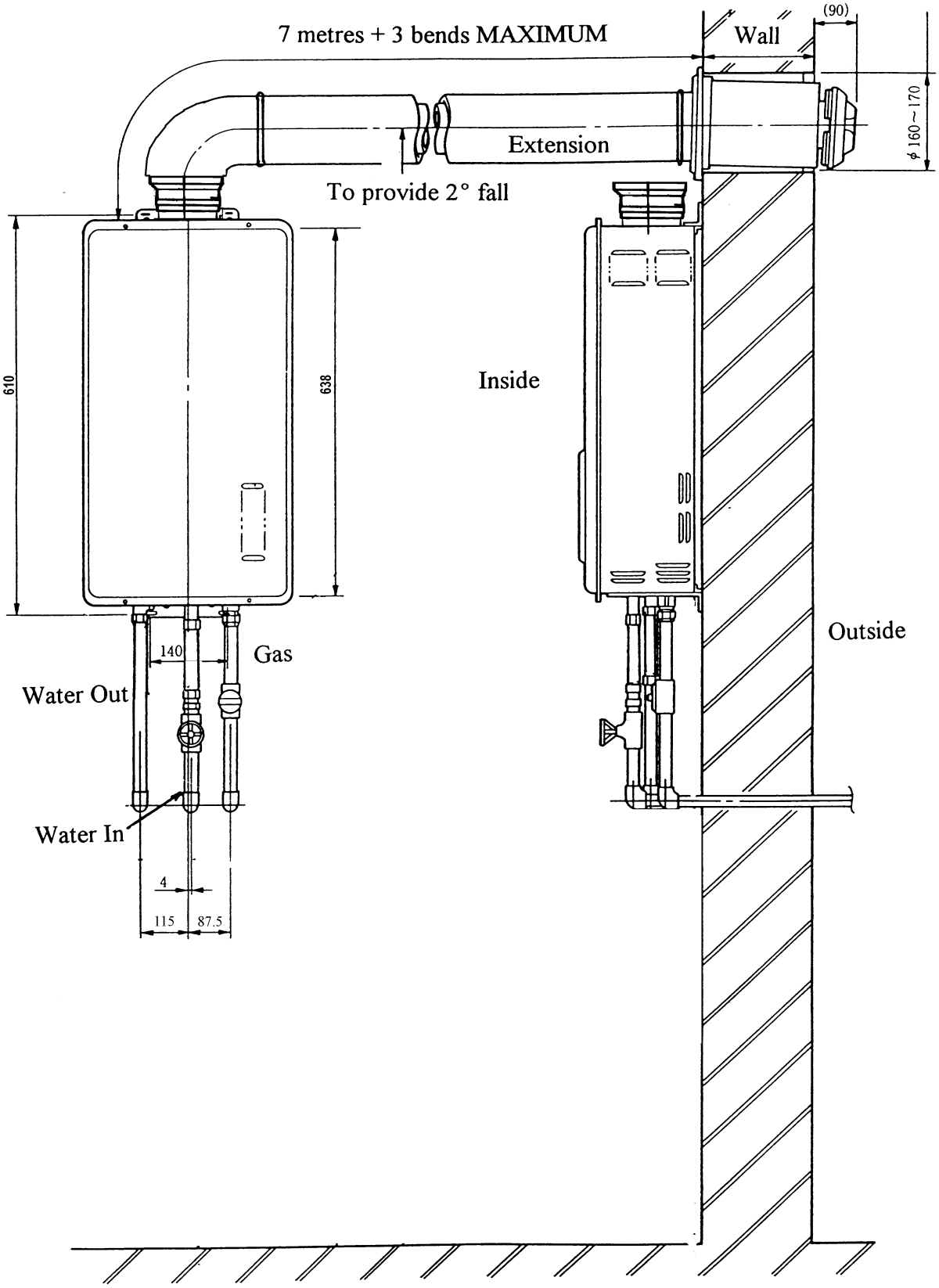
3. Dimensions

Note: All dimensions are in mm.



4. Installation

Note: All dimensions are in mm. Pipework will vary in each installation.



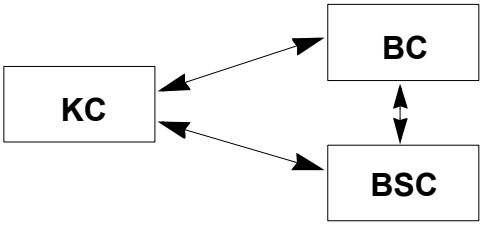
5. Remote Controls

The MC-33-3A and BC-45-3A remotes were specifically designed for use with the new series of Infinity water heaters introduced in 1998.

Features include:

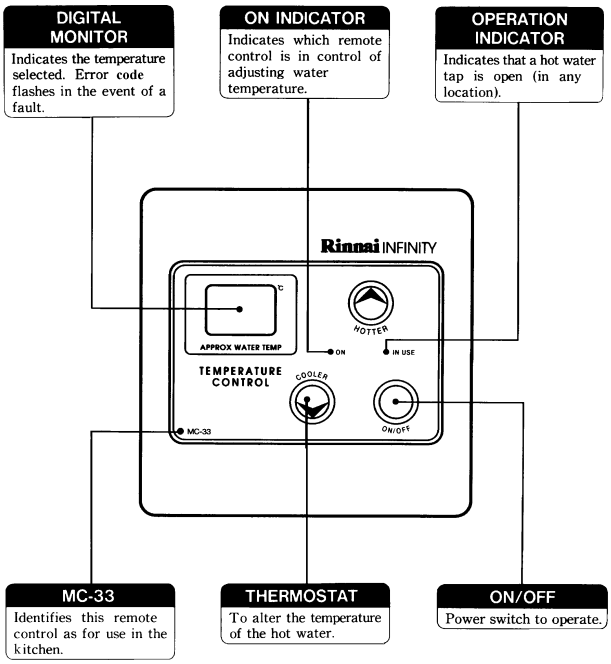
- Colour coordination to allow immediate recognition of the temperature "hotter" and "cooler" buttons.
- Larger LED display.
- Water temperature adjustment only in the range of 37°C to 43°C whilst hot water is flowing.
- Different temperatures can be stored in the memory of each remote control.

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

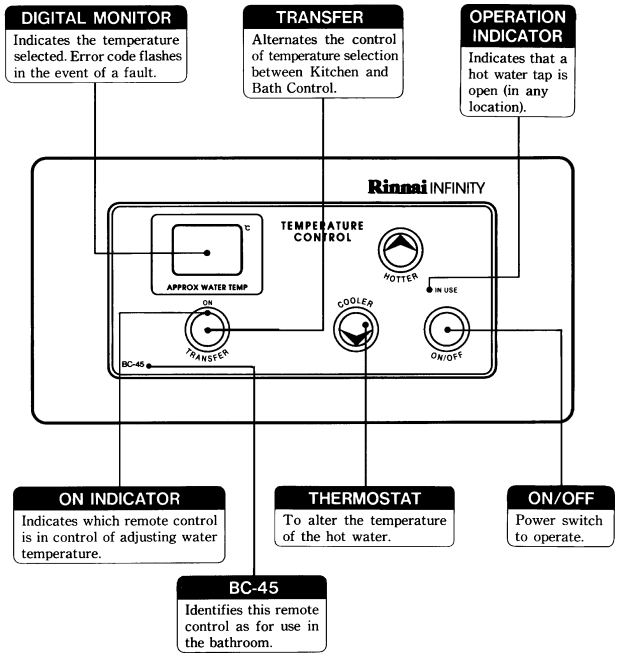


- A third remote control identified by model number BSC-45-3A is available for use in a second bathroom or ensuite. Contact Rinnai for further details.

Kitchen Remote Control



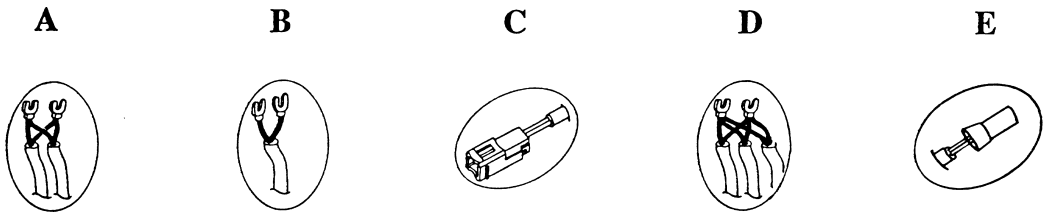
Bathroom Remote Control



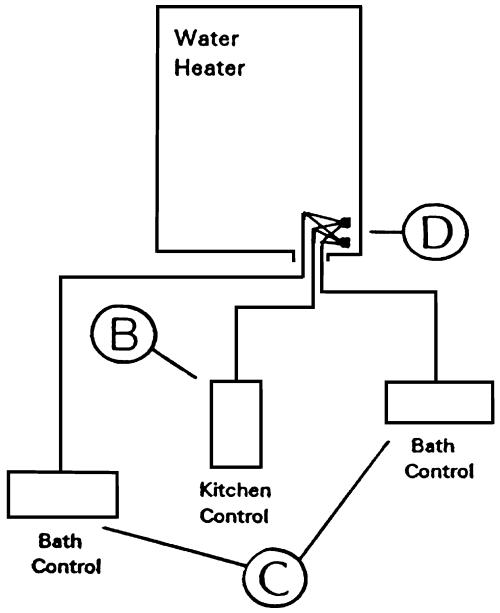
Suggested Connection Methods

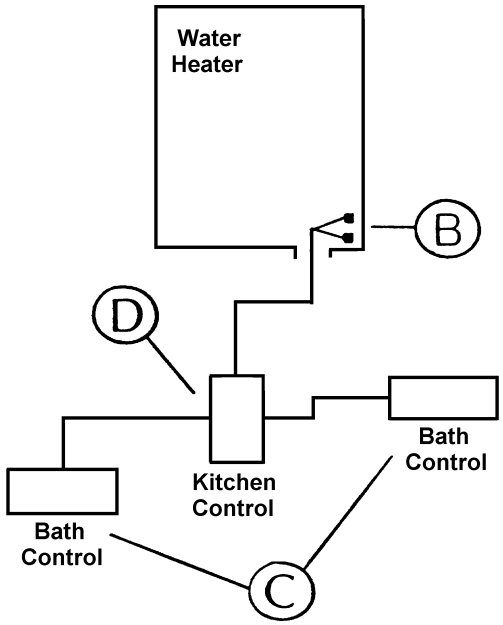
There must be at least on cable from any remote control connecting with the Infinity water heater.

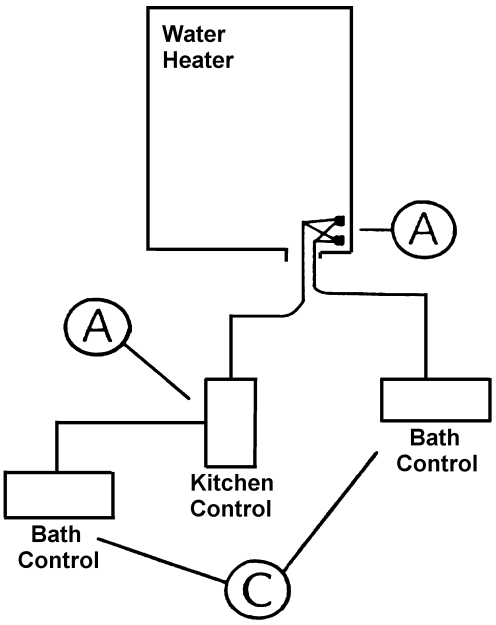
Connections

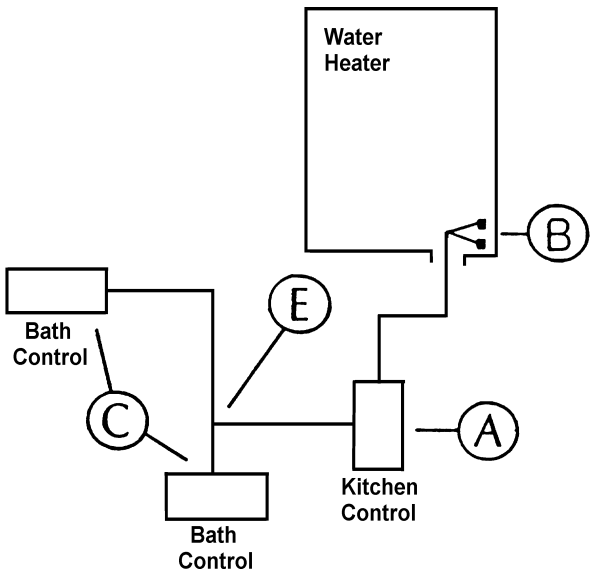


The following diagrams show methods of connection.









6. 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.

Remaining Flame Safety 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 90 V 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.

Fusible Link

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

Pressure Relief Valve

This spring and valve seating 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 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 (Option only)

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 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.

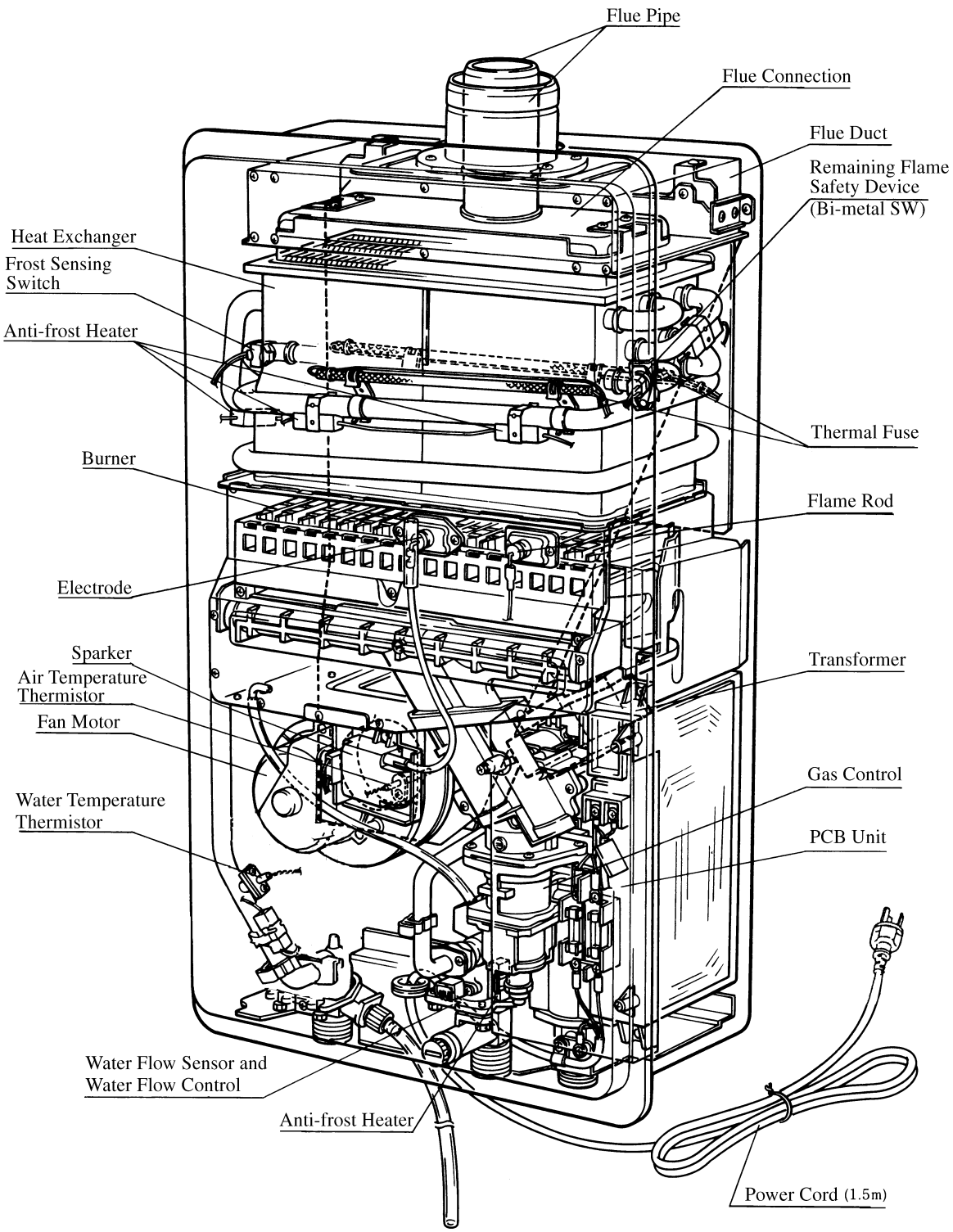
3°C Over Temperature Cut-off

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 rises to more than 3°C above the preset temperature, the burner will automatically go out. The burner will only ignite again once the outgoing hot water temperature falls below the preset temperature.

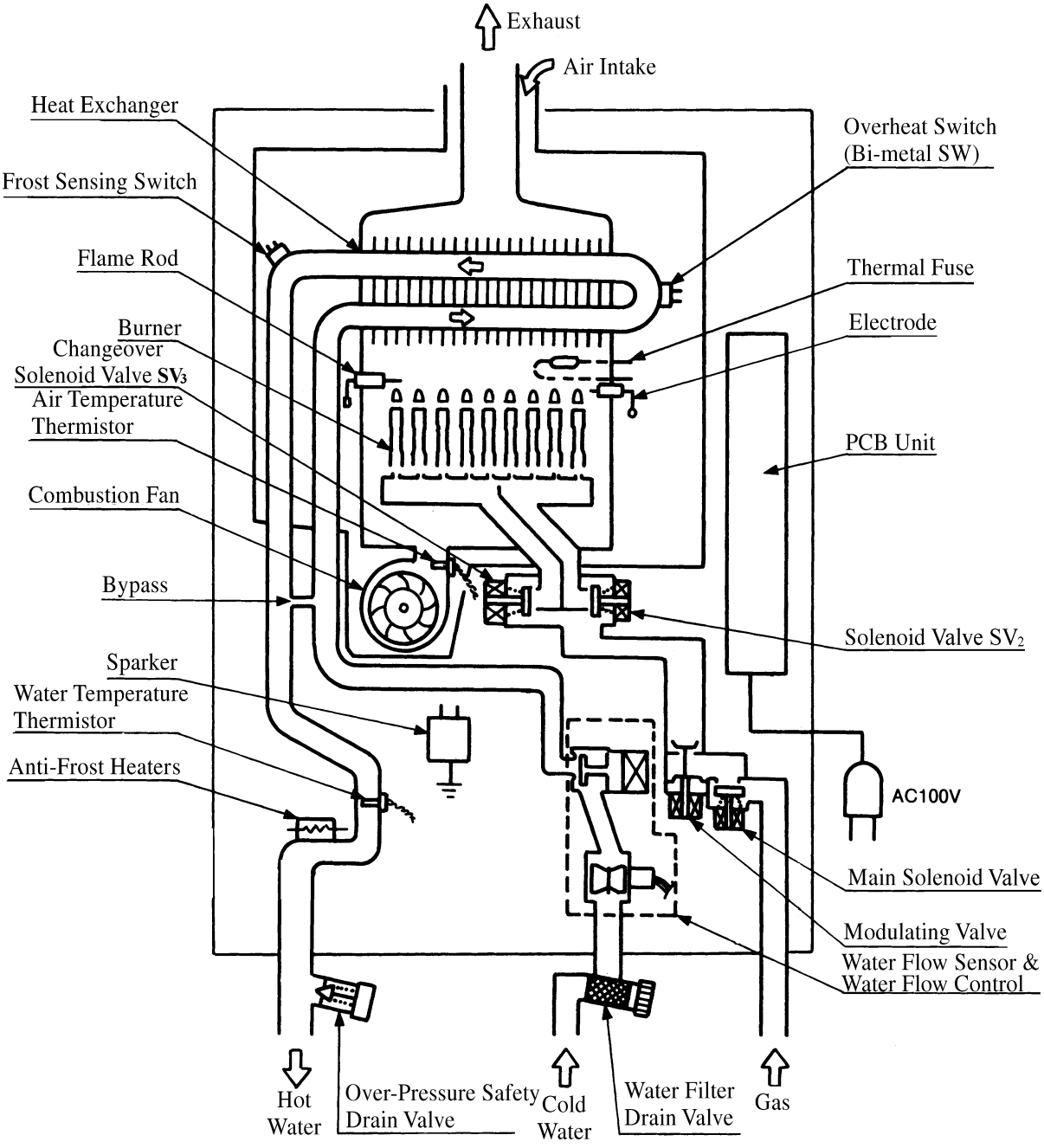
7. Specification Overview

Type of Appliance	Temperature controlled continuous gas hot water system
Operation	With or without remote controls
Exhaust System	Forced flue (FF)
Rinnai Model Number	REU-2006FFU
Maximum Gas Rate	NG: 159 MJ/h; LPG: 160MJ/h
Water Flow (L/min)	Minimum: 2.7 (25^{o} rise); unmixed:18; mixed: 20
Default Temperature Settings (with or without remote)	40, 50, 55, 75^{o}C
Temp. Range (with remote)	37 to 55^{o}C in 13 steps
Approved Gas Types	Natural; Propane (New Zealand only - LPG)
Installation	Internally mounted
Dimensions	Width: 350 mm; Height: 610 mm; Depth: 200 mm
Weight	20 kilograms
Efficiency	80%
Noise Level	50 dB(A)
Connections	Gas (right); Cold (centre); Hot (left): R 3/4 / 20A
Ignition System	Direct electronic ignition, continuous spark
Gas Consumption (High/Low)	160 / 20 MJ/h
Electrical Consumption (Watt)	Normal: 64; Standby: 6; Automatic frost protection: 112
Water Temperature Control	Simulation feedforward and feedback
Water Flow Control	Water flow sensor and automatic water flow control device
Operating Pressure	Minimum: 200 kPa; Nominal: 200 to 830 kPa
Power Supply	Appliance: AC 230.240 V 50Hz Remote Control: DC 12V (digital)
Safety Devices	Flame failure: flame rod
	Boiling protection: 95^{o}C hot wtaer output thermistor (25 secs)
	Boil dry: water flow sensor
	Remaining flame[OHS]: 97^{o}C bi-metal; 152^{o}C thermal fuse
	Fusible link: 129^{o}C
	Pressure relief valve: opens - 2100 kPa, closes - 1500 kPa
	Auto. frost protection: bi-metal sensor & anti-frost heaters
	Combustion fan rpm check: integrated circuit system
	Over current: glass fuse (3 Amp)
Remote Control	Kitchen: MC-33-3A; Bath: BC-45-3A; 2nd Bath: BSC-45-3A
Remote Control Cable	12 Volt, non-polarised two-core cable

8. Cut-away Diagram



9. Schematic Diagram



10. Combustion Specification

		REU-2006FFU		
		Natural Gas	**Propane (Australia)**	**LPG (NZ)**
Input	MJ/h	160	160	160
	kcal/h	38000	38000	38000
Injector Size (mm)	mm	1.6	0.95	0.95
Damper Marking		B	E	E
Primary Pressure	kPa	1.13	2.8	2.8
Secondary Pressure - Low	kPa	0.069	0.157	0.167
- High	kPa	0.62	1.80	1.76
Burner Type		LP	LP	LP
Dip Switch Positions		Refer to page 12.		
Maximum Capacity				
Modulating Valve (POV)	mA	125/125	220/215	204/206
Combustion Fan	Hz	152/127	148/128	152/145
Minimum Capacity				
Modulating Valve (POV)	mA	22/20	24/20	25/20
Combustion Fan	Hz	63/55	62/55	62/55
Slow Ignition				
Modulating Valve (POV)	mA	96/92	157/138	155/145
Combustion Fan	Hz	110/100	110/100	110/100

11. Dip Switch Positions

Please do not adjust the dip switch positions before reading this information.

Dip switches 1 ~ 8 are provided so that the water heater can be set to different 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
- Temperature limiting requirements

Dip Switches explained

1 & 2: Gas type (used only during conversion)
3 & 4: Fixed hot water temperature *without* remote control connected
5 & 6: Upper limit hot water temperature *with* remote control connected
7 & 8: Combustion control
Note: switch 4 to 6 is for the newer PCB (see page 13 for settings). To select the temperature with or without remote connected.

The REU-2006FFU model is delivered with the maximum hot water temperature limited to 55°C by default. The maximum temperature of hot water can be limited to 40°C, 50°C, 55°C, or 75°C.

Dip Switch Settings for the Older PCB

Gas Type

1	OFF	LPG (NZ only)	ON	Natural Gas	OFF	Propane (Aust. only)
2	OFF		OFF		ON	

Fixed Hot Water Temperature *without* Remote Control Connected

3	OFF	55°C	OFF	40°C	ON	50°C	ON	75°C
4	OFF		ON		OFF		ON	

Upper Limit Hot Water Temperature *with* Remote Control Connected

5	OFF	55°C	OFF	40°C	ON	50°C	ON	75°C
6	OFF		ON		OFF		ON	

Combustion Control

7	OFF	Normal	ON	Forced Low	OFF	Forced High
8	OFF		OFF		ON	

Dip switches 3 and 4 should be set to provide a maximum hot water temperature of 40°C, 50°C or 55°C if a remote is connected to ensure a safe default temperature in case the remotes become disconnected.

Dip Switch Settings for the newer PCB

No.	Model	Carried out from	Gas Type	Serial No.
1	REU-2006FFU-A-NC	6.7.99	NG	99.07.100653~
2	REU-2006FFU-A-NC	6.7.99	LPG	99.07.100161~
3	REU-2006FFFU-ZK-2C	Yet to be carried out *	NG	From July production
4	REU-2006FFU-ZK-2C	Yet tobe carried out *	LPG	From July production

** "Yet to be carried out" means none have been produced since the modificaiton of the PCB.*

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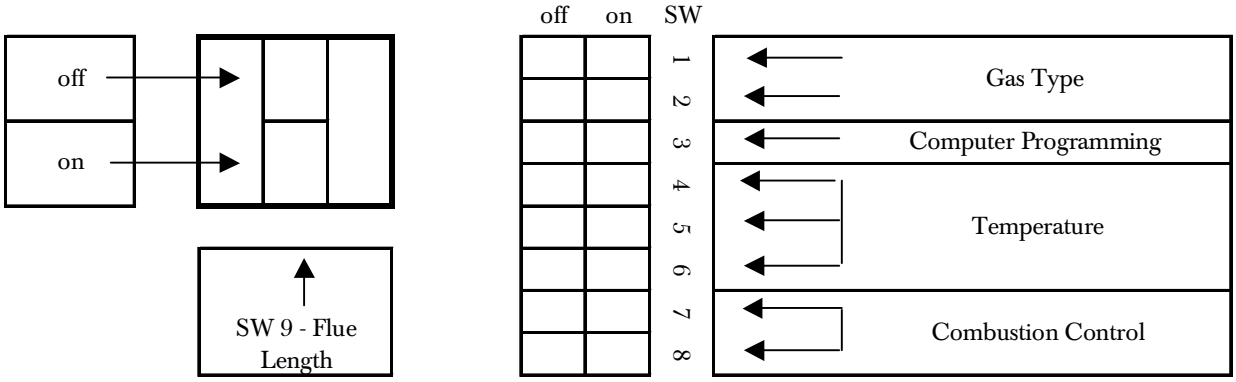
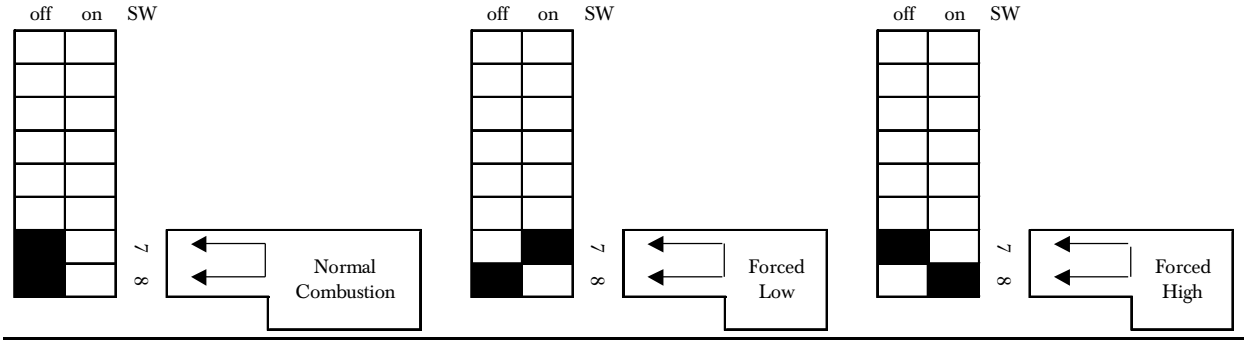
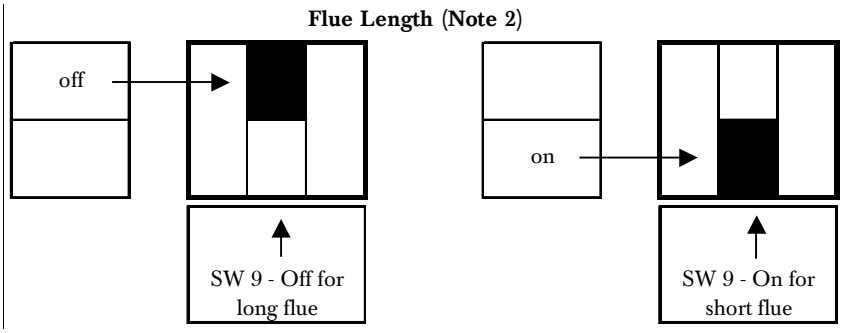
Dip Switches explained



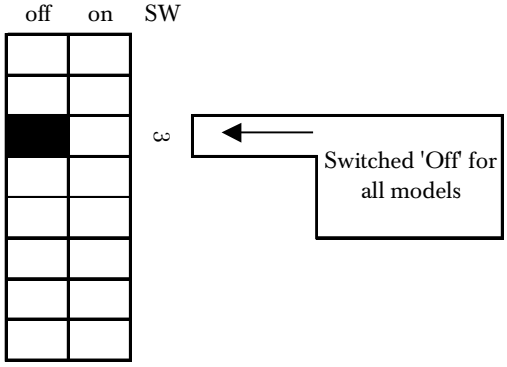
Combustion Control

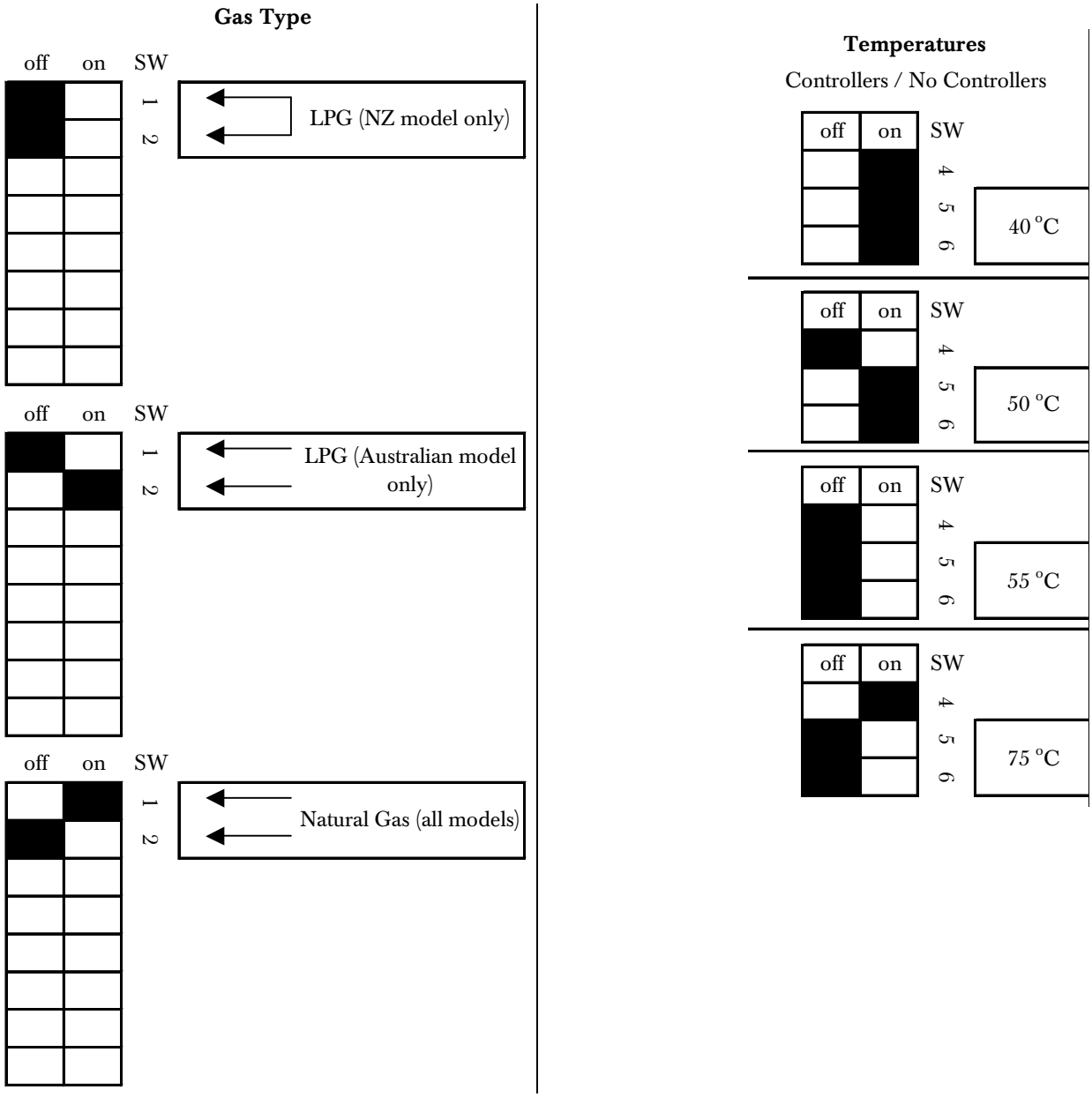


Flue Length (Note 2)



Computer Programming (Sw No.3)





Notes:

a) Black squares indicate the position of switches.
b) Position of switch 9 must be determined from the calculation in the Installation Instructions or Service Manual.

Flue Length

9	OFF	Long	ON	Short

To help prevent condensation in the flue, the combustion fan has two settings. Dip switch number 9 controls the combustion fan speed. This switch position will determine the fan speed to compensate for back pressure when using extended flues. Switch number 9 is normally set to the "OFF" position; this is suitable for direct flueing using a mushrrom flue and 90° L bend.

When installing the FFU model using an extended flue, you will need to decide which position switch No. 9 should be in. The following formula must be used to determine the position. To calculate when to turn the switch "ON", use the following formula to calculate "D".

D = L + (M x 2)

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

When D is 7 or more, turn switch number 9 to the "OFF" psoition.

When 450 bends are used, calculate using the following formula:

D = L + (M x 2)

Examples:

2 metres of flue, and 2 x 90° bends
D = 2 + (2 x 2), → D = 2 + 4, → D = 6 ⇒ Dip Switch 9 "ON"

3 metres of flue, and 2 x 90° bends
D = 3 + (2 x 2), → D = 3 + 4, → D = 7 ⇒ Dip Switch 9 "OFF"

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

Do not alter dip switches before checking posistion requirement using the above formula.

12. 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.

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 160MJ/h or 188MJ/h depending on the model.

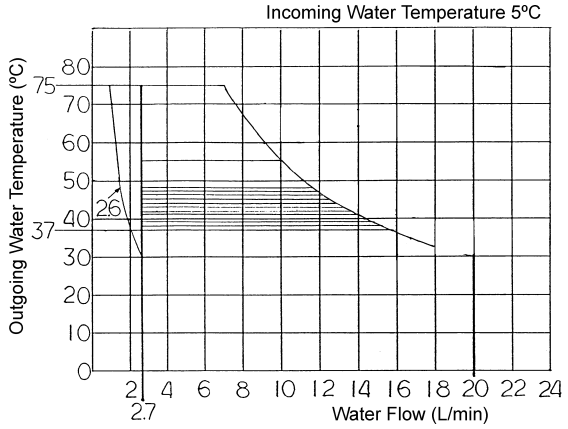
Where:
- T_{IN} = Incoming water temperature.
- T_{OUT} = Outgoing water temperature as selected at the remote.
- IN = Gas input#.
- TE = Thermal efficiency*.
- Q = Water flow in litres per minute.

\# 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%.

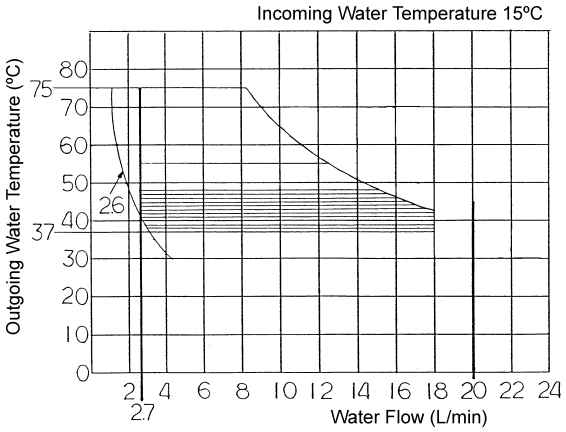
Example Data	Calculation
TIN = 15° C TOUT = 60° C IN = 45000kcal/h TE = 80% Q = Water flow in Litres per minute	$IN \times TE = (T_{OUT} - T_{IN}) \times 60 \times Q$ $4500 \times 0.8 = (60 - 15) \times 60 \times Q$ $36000 = 45 \times 60 \times Q$ $\frac{36000}{45} = 60 \times Q$ $800 = 60 \times Q$ $\frac{800}{60} = Q$ 13.3 L/min

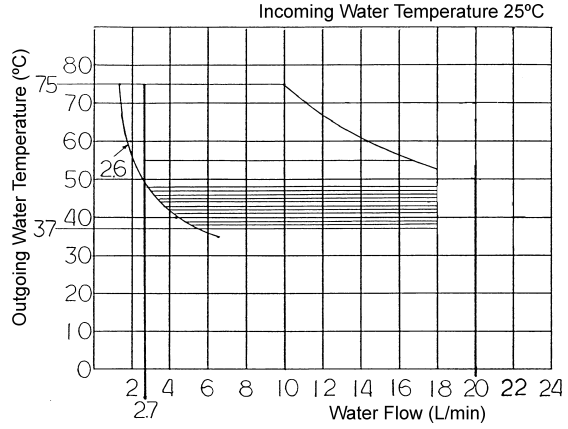
Unmixed Water Flows



The chart opposite indicates that the water flow rate of the REU-2006FFU will, at a preset temperature of 50° C and an *incoming water temperature of 5° C*, be 11 litres per minute.

The chart opposite indicates that the water flow rate of the REU-2006FFU will, at a preset temperature of 50° C and an *incoming water temperature of 15° C*, be 11 litres per minute.





The chart opposite indicates that the water flow rate of the REU-2006FFU will, at a preset temperature of 50° C and an *incoming water temperature of 25° C*, be 11 litres per minute.

Mixed Water Flows for the REU-2006FFU

Ouput water temperature	Incoming +15° C	Incoming +25° C	Incoming +30° C	Incoming +35° C	Incoming +45° C	Incoming +55° C
Output water volme	with mixing 40 L/min	with mixing 40 L/min	with mixing 40 L/min	17.1 L/min	13.3 L/min	10.9 L/min

13. 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 Gas Input

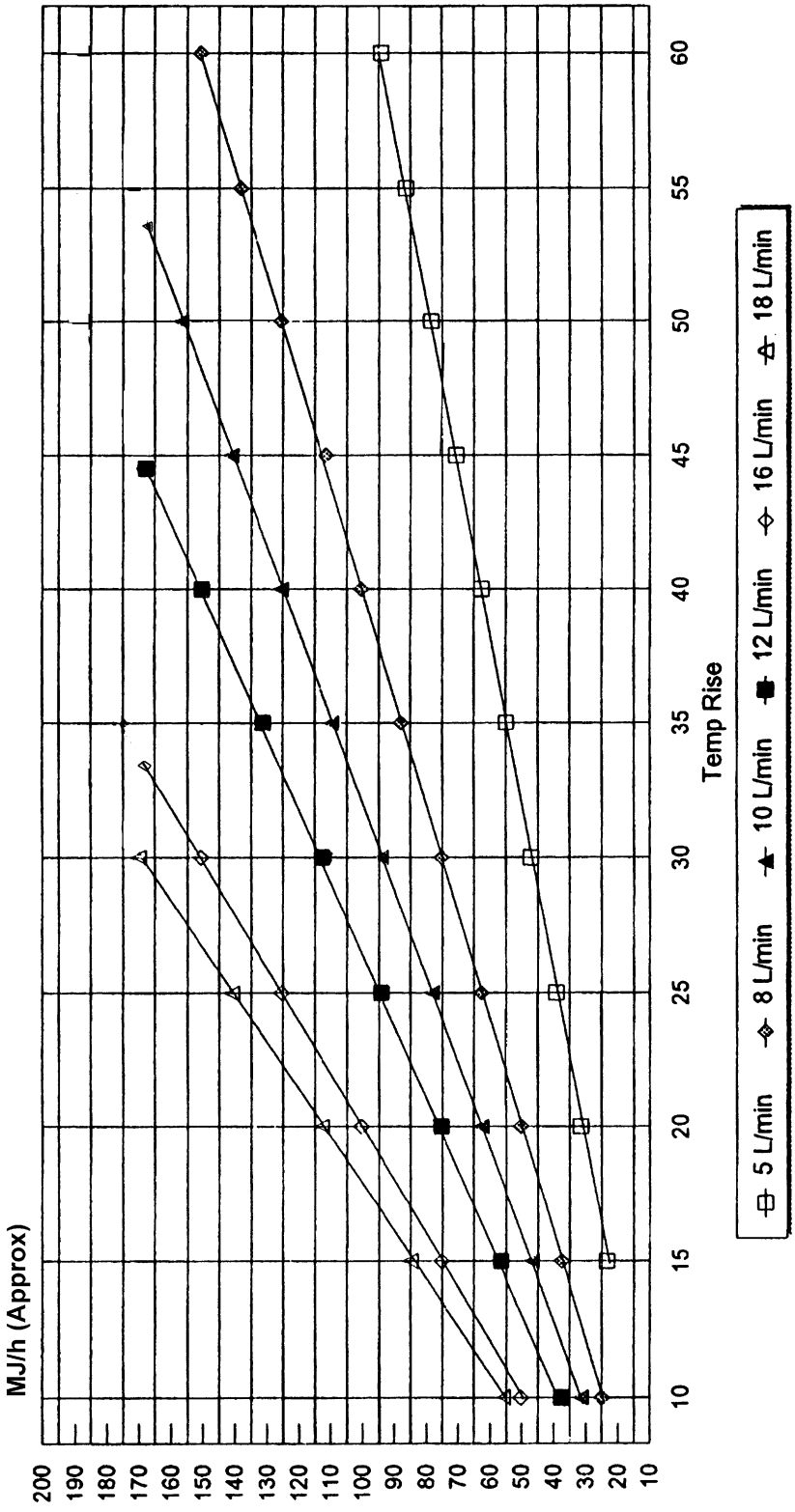
Formula: $\frac{(T_{OUT} - T_{IN}) \times Q \times 60}{239 \times TE} = IN\ MJ/h$

See previous page for an explanation of TIN, TOUT, IN, TE and Q.

Example data	**Calculation**
T_{IN}=15°C T_{OUT}=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 is able to control 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 degrees celcius (°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 gide 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

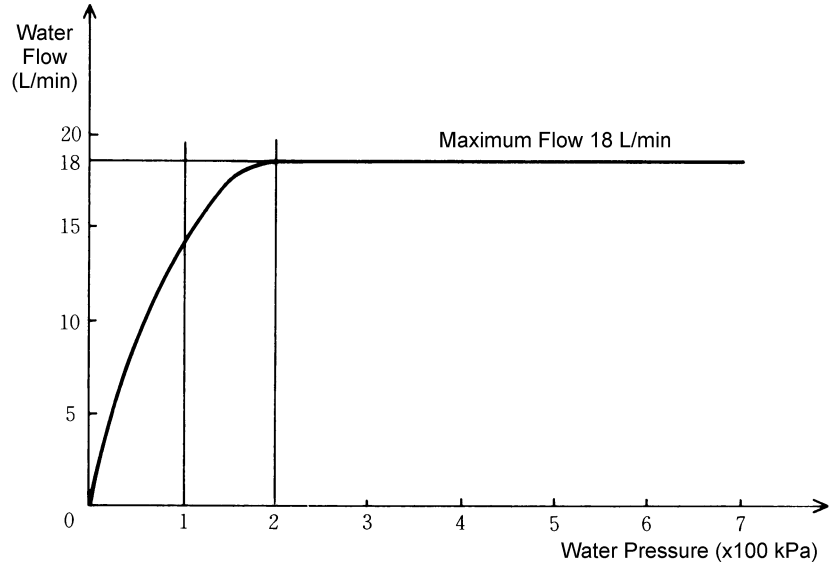
14. Main Components

14.1 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 graph shows that the maximum flow is approximately 20 L/min for the 2006. This maximum flow is reached at 130 kPa and 290 kPa inlet pressure respectively.

Note: Although the 2006 will operate at very low water pressures, maximum performance is not reached unless the incoming pressure is 130 kPa or more.

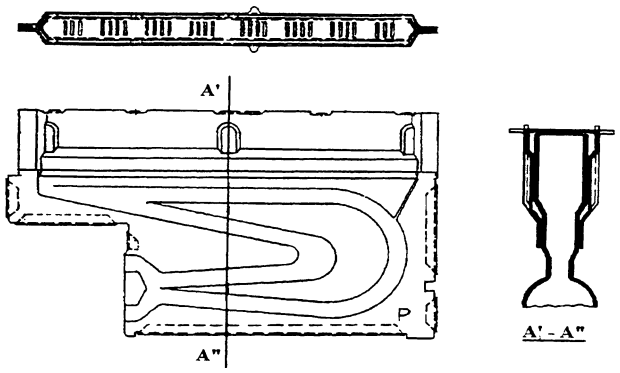


14.2 Preset Bypass

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

14.3 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.

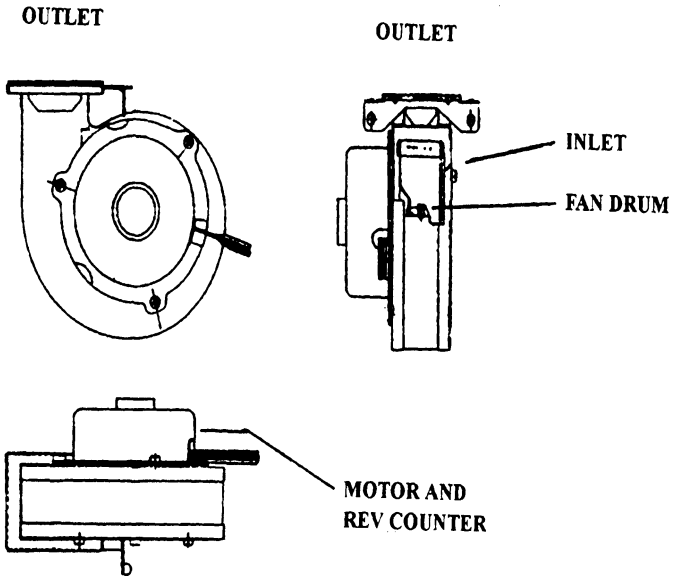


14.4 Changeover Solenoid Valve

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% input] through the tandem manifold.

14.5 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.



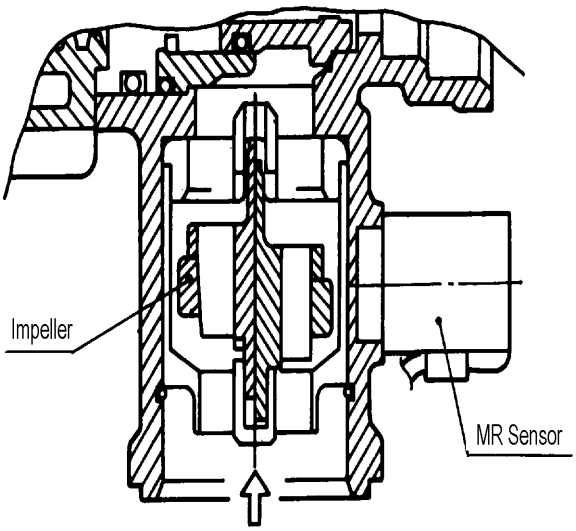
The actual speed of the motor is continuously monitored by a magnetic pulse sensor. This sensor emits 4 pulses per rotation of the fan. This is the fan feedback or confirmation data processed by the PCB and used for 2 operations.

1. The fan speed is constantly crected 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.

14.6 Water Flow Sensor



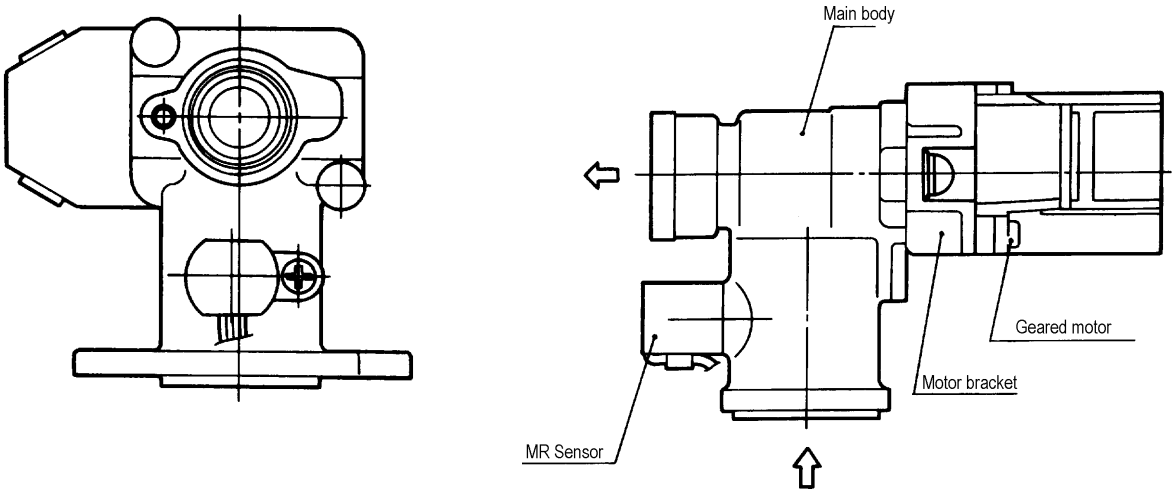
Water flow is detected by a turbine/magnetic pulse generating device. Water flows through the turbine/magnetic sensor providing information to the PCB by generating a pre-determined number of pulses in proportion to the water flow. These pulses are counted by the PCB - no pulse indicates no water flow.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

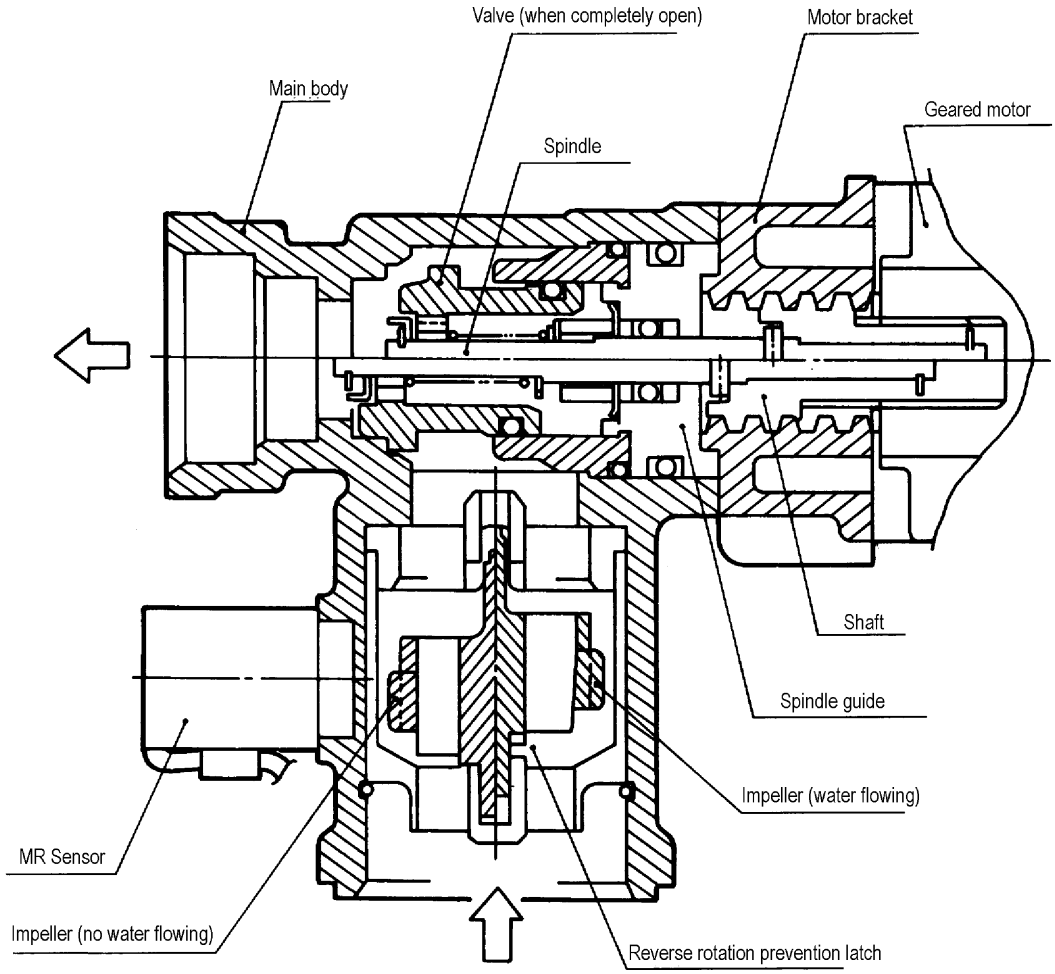
As soon as the required water flow is detected, the PCB activates the combustion fan. The combustion fan speed is monitored by a magnetic pulse sensor. The output from this sensor is processed by the PCB which opens the gas modulating valve to a degree proportional to the fan speed. See above for further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

14.7 Water Flow Sensor and Water Flow Control Device

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.

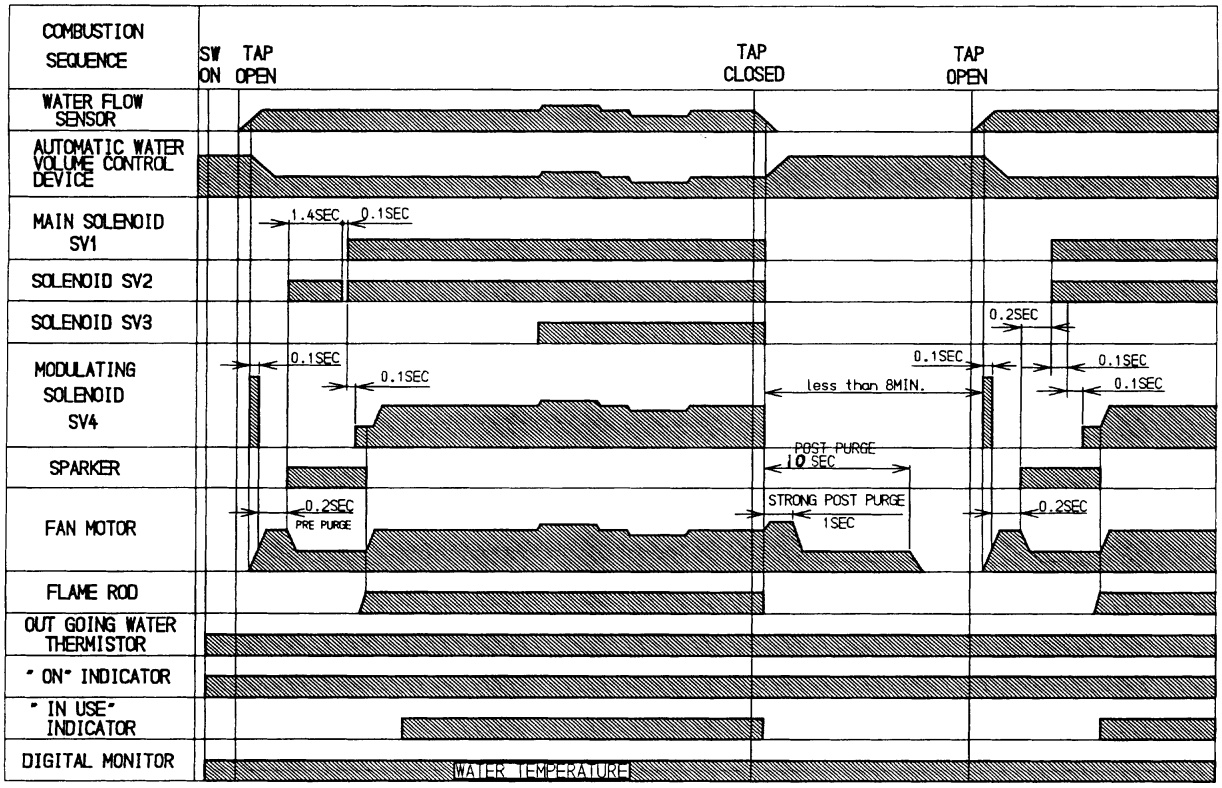
The REU-2006 has an automatic water flow control device.



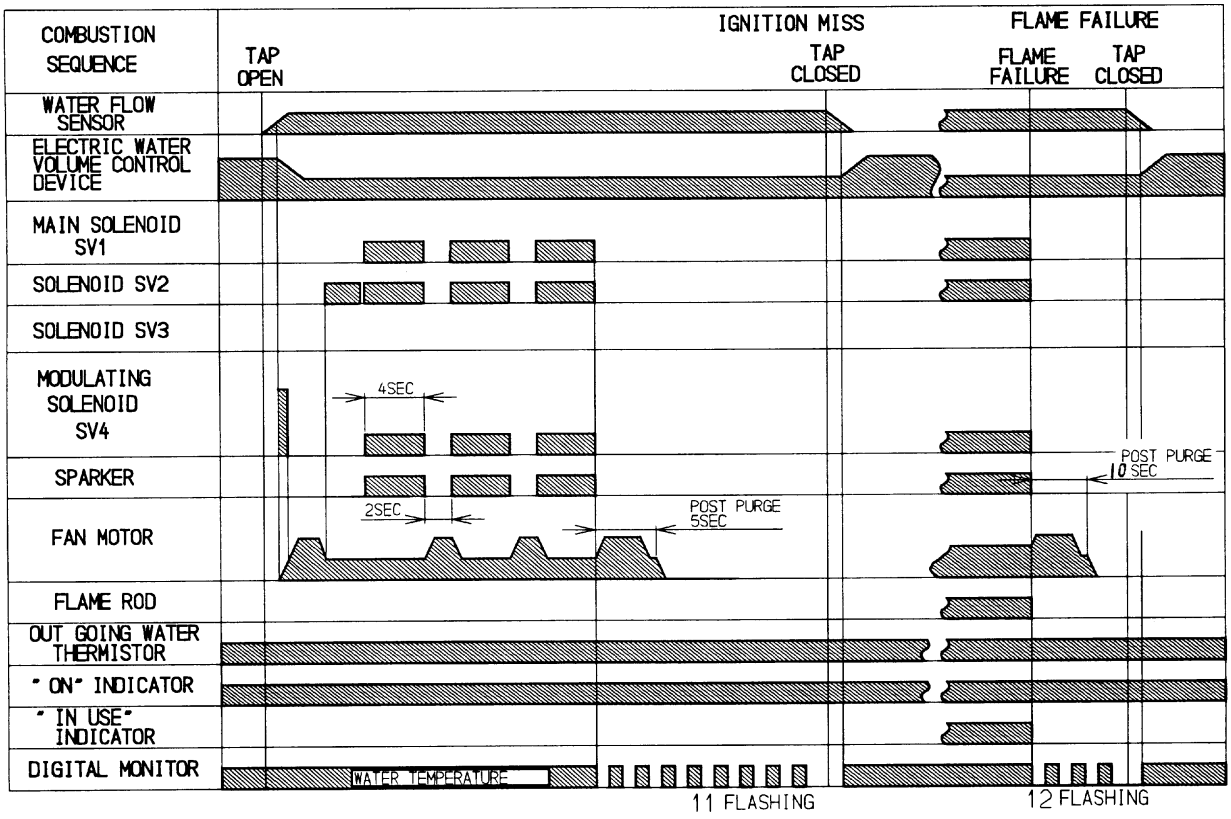


15. Time Charts

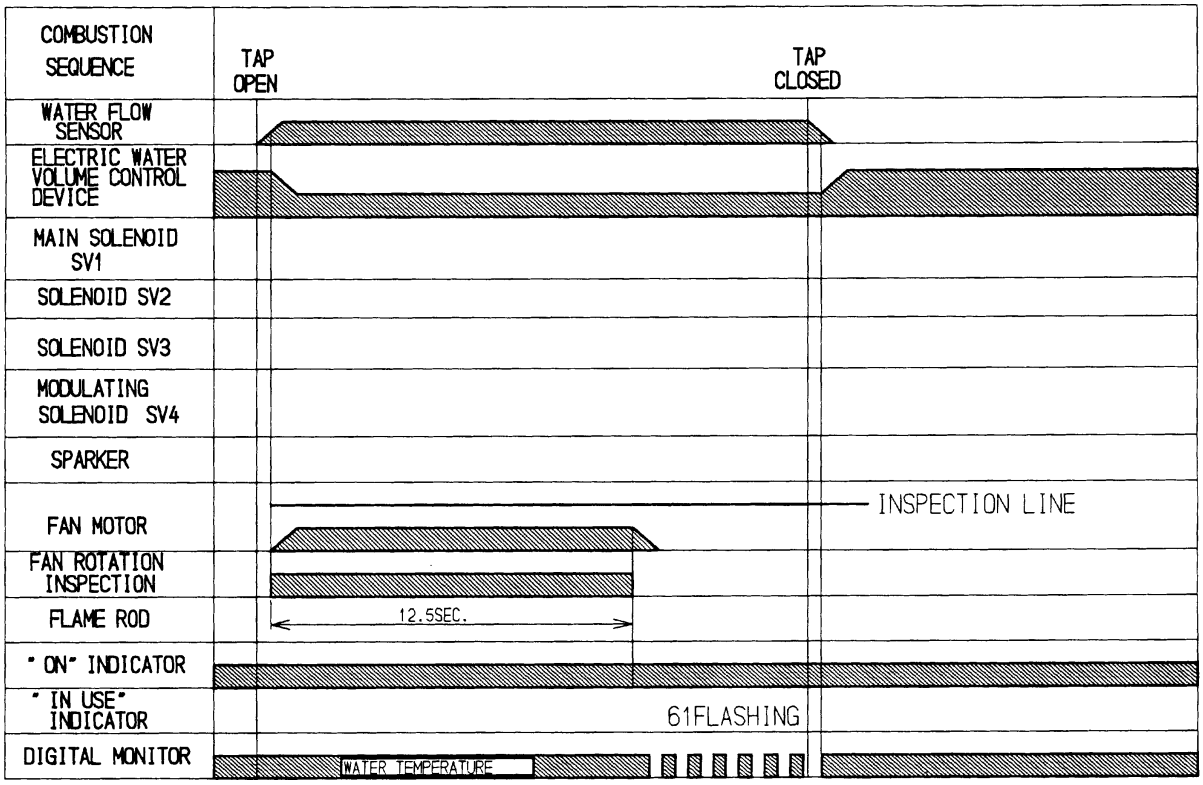
During Normal Combustion



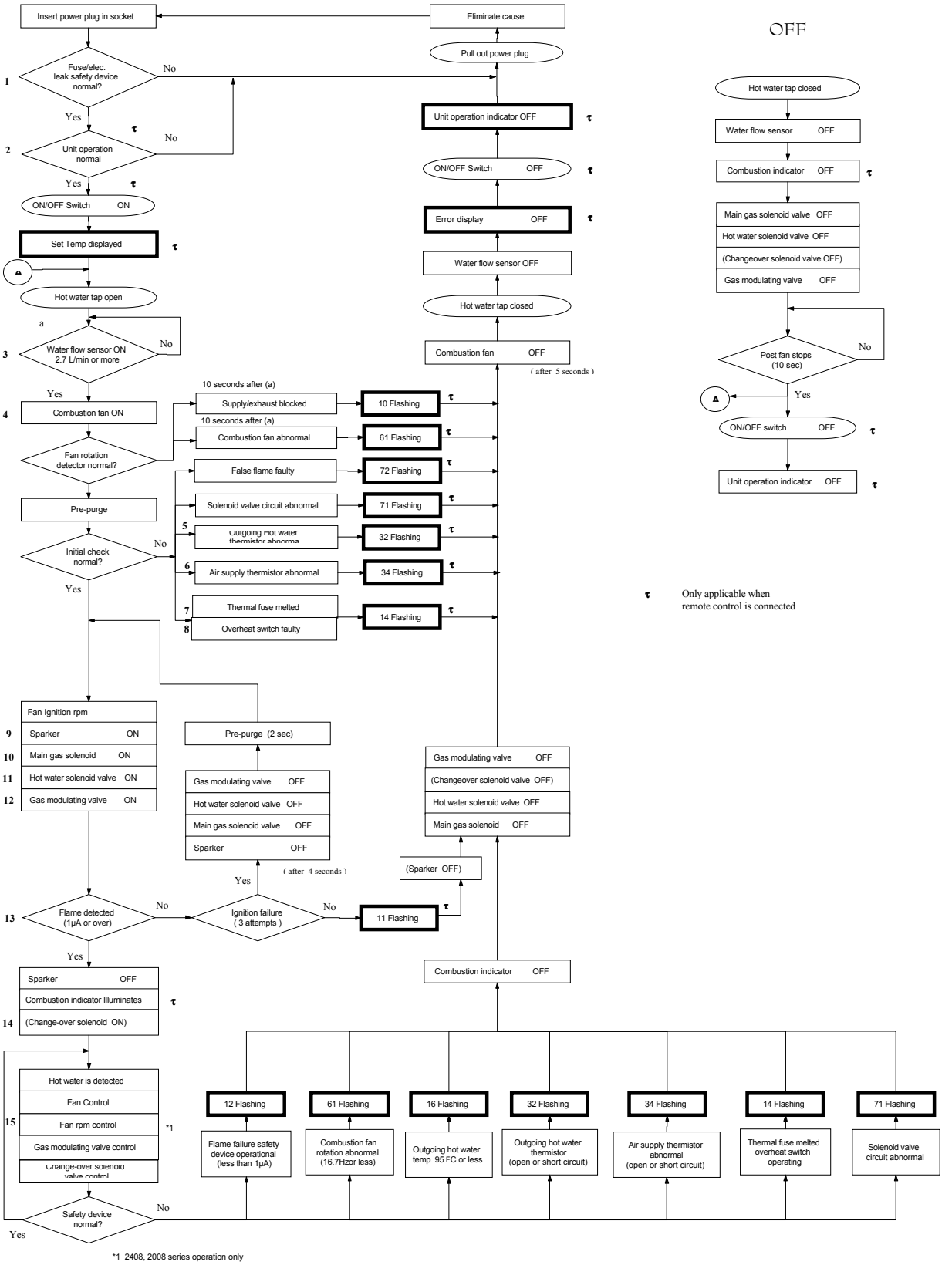
Misignition / Sudden Misfire



Unsatisfactory Pre-purge (Water supply closed etc)



16. Operation Flow Principle



*1 2408, 2008 series operation only

17. Operation Principles

The preset temperature is selected at one of the remote controls (where fitted). Where no remote control is fitted, the default temperature is 40°C, 43°C, 50°C, 55°C, 60°C, 65°C, 75°C depending on the position of dip switch numbers 3 to 6 (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 18, 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 continually makes adjustments in order to maintain a constant temperature; [adjusting both the gas input and water flow where necessary.] It also continually monitors the combustion fan rpm adjusting the gas rate to match.

When the hot water tap is turned off, the water flow sensor stops revolving, and the magnetic pulse ceases, indicating to the PCB that there is no water flowing, in turn the PCB closes the gas valves. The combustion fan continues to operate for 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.

18. Error Messages

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

X *= Does not operate*

Error Code	Problem	Symptom	Main Solenoid Valve	Solenoid Valve	Changeover Solenoid Valve	Combustion Fan	Sparker
-	Water flow sensor faulty	Does not operate	X	X	X	X	X
71	Solenoid valve driving circuit faulty	Does not operate	X	X	X	X	X
72	Flame sensing device faulty	Does not operate	X	X	X	X	X
32	Short or faulty wiring in water temperature thermistor	Does not operate	X	X	X	X	X
-	Water flow control device faulty	Water flow is not controlled, water temperature incorrect	-	-	-	-	-
61	Combustion fan faulty	After 12.5 seconds operation	X	X	X	X	X
11	Sparker faulty	Stops without flame igniting	-	-	-	-	X
11	Main solenoid value faulty	Stops without flame igniting	X	-	-	-	-
11	Solenoid valve faulty	Stops without flame igniting	-	X	-	-	-
-	Changeover solenoid valve faulty	Incorrect water temperature	-	-	X	-	-
12	Flame sensing device faulty	Stops second time burner has been extinguised	X	X	X	X	X
16	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. Diagnostic Points

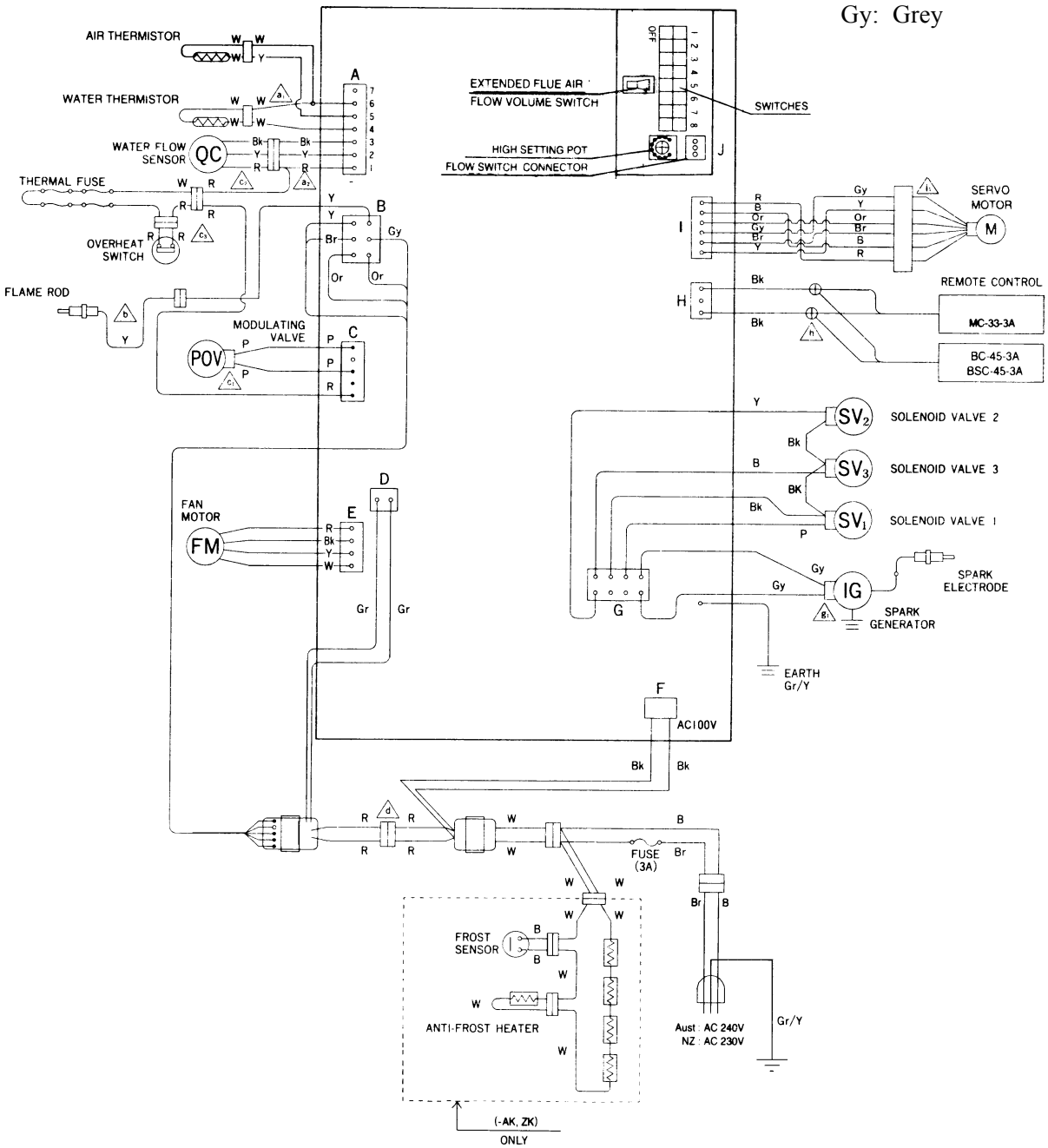
Flow chart is on page 23.
Wiring diagram is on page 29.

Flow Chart No.	Measurement Point		Normal Value	Component
	CN	Wire Colour		
1	d	red - red	AC 90~110 V	Electrical Fuse
2	h	black - black	DC 11~13 V	Remote Controls
3	a_2	red - black	DC 11~13 V	Water Flow Sensor
		yellow - black	DC 2~10 V	
4	E	white - black	DC 2~7 V	Combustion Fan Motor
	J	checkpin	55~170 Hz	
5	a_1	white - white	Thermistor resistance 15°C 11.4~14 kΩ 30°C 6.4~7.8 kΩ 45°C 3.6~4.5 kΩ 75°C 1.4~1.8 kΩ	Water Temperature Thermistor
6	a_1	white - white	Thermistor resistance 15°C 11.4~14 kΩ 30°C 6.4~7.8 kΩ 45°C 3.6~4.5 kΩ 75°C 1.4~1.8 kΩ	Air Temperature Thermistor
7	c_2	white - red	Less than 1 Ω	Thermal Fuse
8	c_3	red - red	Less than 1 Ω	Over Heat Switch
9	g_1	grey - grey	AC 90~110 V	Sparker
10	G	pink - black	DC 80~100 V 0.9~1.3 kΩ	Main Gas Solenoid Valve
11	G	yellow - black	DC 80~100 V 1.3~1.9 kΩ	Hot Water Supply Solenoid Valve
12	c_1	pink - pink	DC 0.5~25 V 65~90 Ω	Gas Modulating Valve
13	b	yellow - earth	AC 40~150 V (Over DC 1uA)	Flame Rod
14	G	blue - black	DC 80~100 V 1.5~1.9 kΩ	Changeover Solenoid Vlave
15	I_1	red - blue	DC 11~13 V 10~30 Ω	Water Flow Servo
		orange - grey	DC 11~13 V	

CN	Wire Colour	Normal Value (Electrical Pressure / Resistance
d	red - red	AC 90~110 V 15~21 Ω
D	green - green	AC 16~20 V 6~10 Ω
B	orange - orange	AC 13~30 V 1.4~1.8 Ω
B	brown - grey	AC 30~50 V 6~10 Ω
B	yellow - grey	AC 180~220 V 1.4~0.6 kΩ

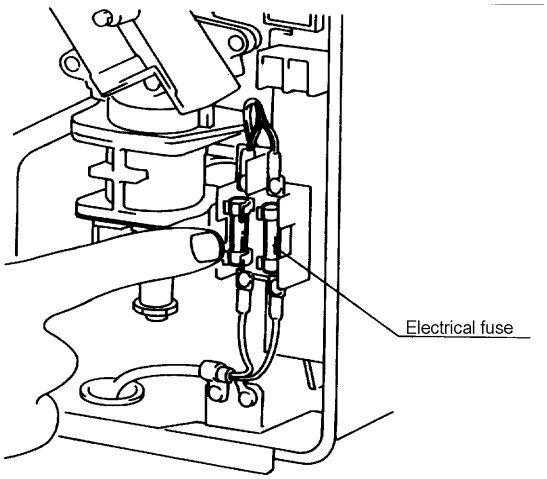
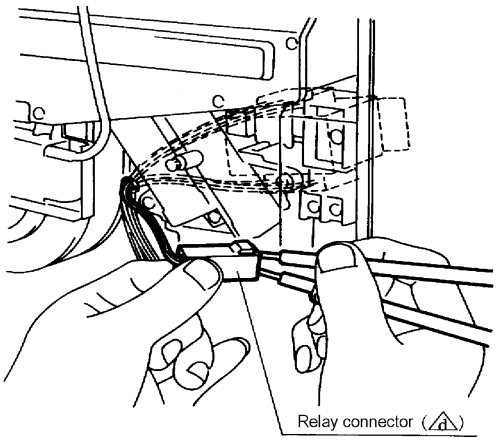
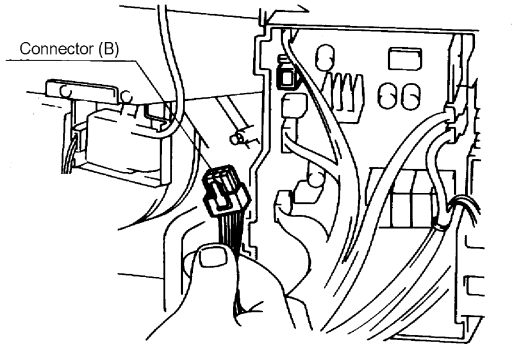
20. Wiring Diagram

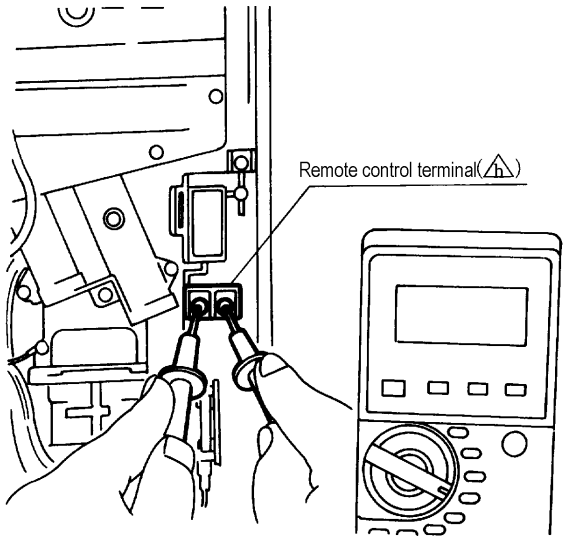
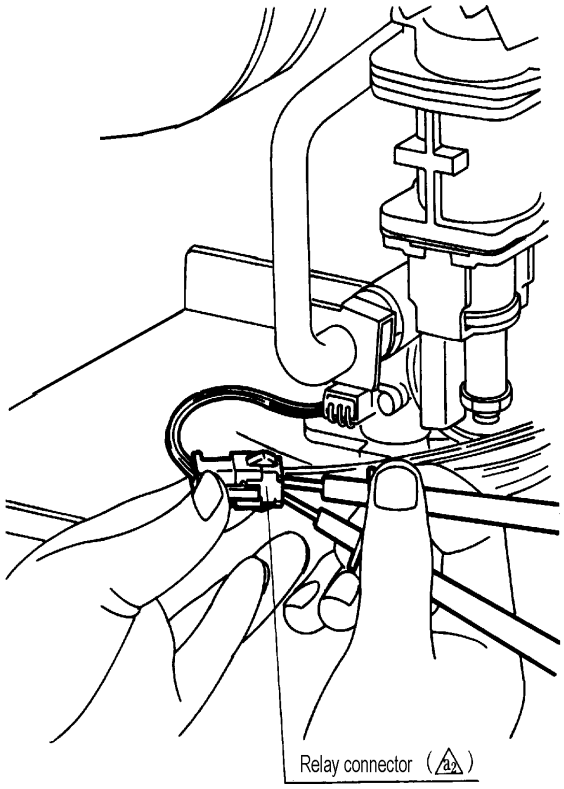
COLOUR CODING
W: White
Bk: Black
Br: Brown
R: Red
B: Blue
Y: Yellow
P: Pink
Or: Orange
Gr: Green
Gy: Grey



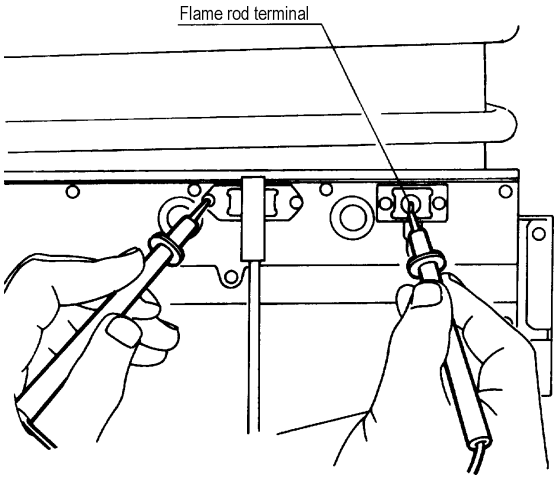
21. Fault Diagnosis

Wiring diagram is on page 29.

Appliance will not operate (main control PCB not displayed)	
1) Is the electrical fuse broken?	
	Electrical fuse short circuit check a. Disconnect the power from the power point. b. Check for electrical fuse (3A) short circuits with a multimeter ***Normal:*** less than 1 Ω If normal, go to 2). ***Faulty:*** Replace the electrical fuse (3A) Check for any shorts if it switches off.
2) Is the transformer normal?	
 	Transformer check. a. Measure the voltage in between the red wires of the relay connector (d). ***Normal:*** AC90 ~ 110 V If normal, go to b. ***Faulty:*** Check whether AC 90 ~ 110 V is flowing between the electrical fuse terminal and the water flow control unit. b. Measure the voltages with connector (B) on top of the main panel. ***Normal:*** orange -orange AC 13 ~ 30 V brown - grey AC 30 ~ 50 V yellow - grey AC 180 ~ 220 V If normal, go to c. ***Faulty:*** Replace the thermistor.

Refer to diagram on bottom of previous page.	c. Measure voltage between green - green of connector (D) on the top of the main panel. ***Normal:*** AC 16 ~ 20 V If normal, go to 3). ***Faulty:*** Replace the transformer. **Caution:** Transformer voltages are measured when the unit is in standby.
3) Is the control PCB normal?	
	Voltage check between 2 core cables of the remote control. a. Measure the voltage between terminals at the remote control terminal (h). ***Normal:*** DC 11 ~ 13 V If normal, check for broken cables or shorts and replace the remote control. ***Faulty:*** Replace the water flow control.
Combustion doesn't occur (control PCB displayed)	
1) Is the water flow sensor normal?	
	a. Measure the voltage between red and black of the relay connector (a_2). ***Normal:*** DC 11 ~ 13 V If normal, go to b. ***Faulty:*** Replace water flow control. b. Measure the voltage between yellow and black of the relay connector (a_2) ***Normal:*** DC 2 ~ 10 V If normal, go to 2). ***Faulty:*** Replace the water flow sensor.

2) Fault display “72” is displayed

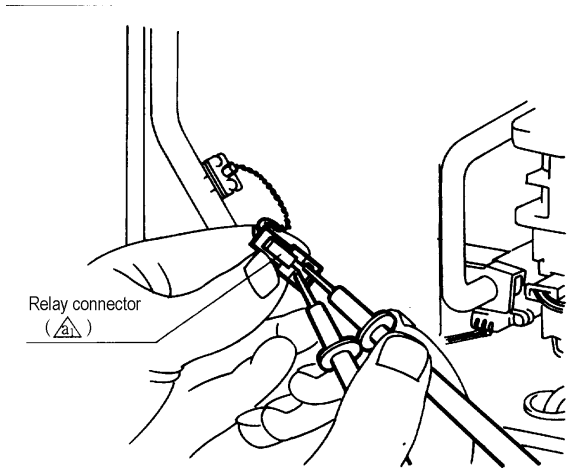


Checking the flame rod.

a. Detach the flame rod terminal (b), turn it on and repair.
(“72” is displayed)
Proceed to check item 3) below.
(“72” is not displayed)
Check for electrical leaks from the flame rod.

Measure resistance between flame rod terminal (b) and fuselage earth.
Normal: At least 1 MS
If normal, replace the water flow control.
Faulty: Replace the flame rod.

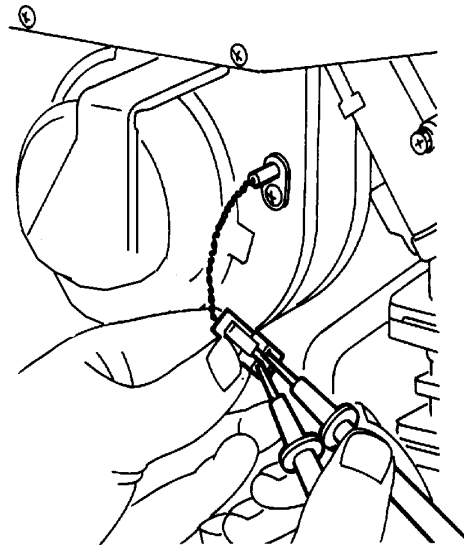
3) Is the water temperature thermistor normal?



If fault display displays “32”, check the water temperature thermistor.

a. Detach the relay connector (a_1), and measure the resistance between white and white.
When disconnection occurs: resistance is at least 1MS.
When short has occurred: resistance is below 1S.
If normal, go to 4).
If there is an error, replace the water temperature thermistor.

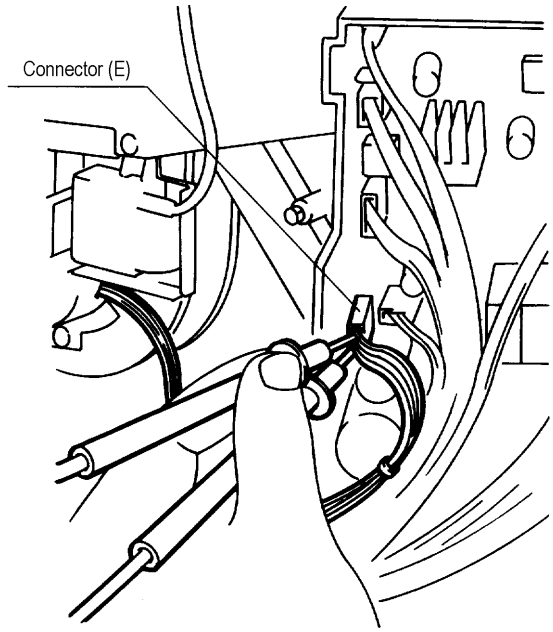
4) Is the air temperature thermistor normal?



If fault display “34”, check the air temperature thermistor.

a. Detach the relay connector (a_3) measure the resistance between white and white.
When disconnection occurs: resistance is at least 1 MS.
When short occurs: resistance is less than 1S.
If normal, go to 5.
If error occurs, replace air temperature thermistor.

5) Is the combustion fan normal?



Checking the motor

If fault display displays "61", check the combustion fan.

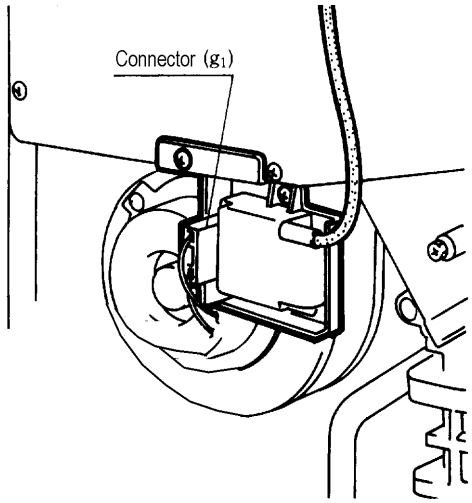
a. Measure the voltage between black and red of the connector (E).
Normal: DC 6 ~ 40 V (when fan is ON)
DC 0 V (when fan is OFF)
If normal, go to b.
Faulty: Replace the water flow control

Checking the rotation sensor section

b. Measure the voltage between black and yellow of the connector (E).
Normal: DC 11 ~ 13 V
If normal, go to b.
Faulty: Replace the water flow control.

c. Measure the voltage between black and white of the connector (E).
Normal: DC 2 ~ 7 V
If normal, go to 6).
Faulty: Replace the combustion fan.

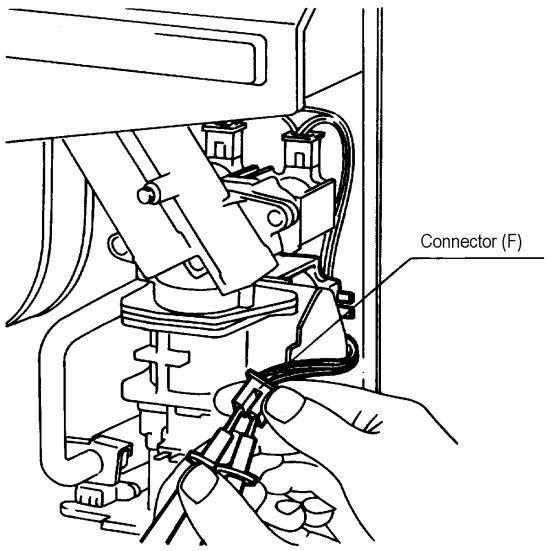
6) Is the sparker normal?



a. Measure the voltage between grey and grey of connector (g_1).
Normal: AC 90 ~ 110 V
If normal, go to b.
Faulty: Replace the water flow control.

b. Detach connector (g_1) and measure the resistance between both terminals of the sparker.
Normal: At least 1 MΩ.
If it is not sparking, adjust or replace the ignition plug.
Faulty: Replace the sparker.

7) Is the main gas solenoid valve (SV_1) normal?

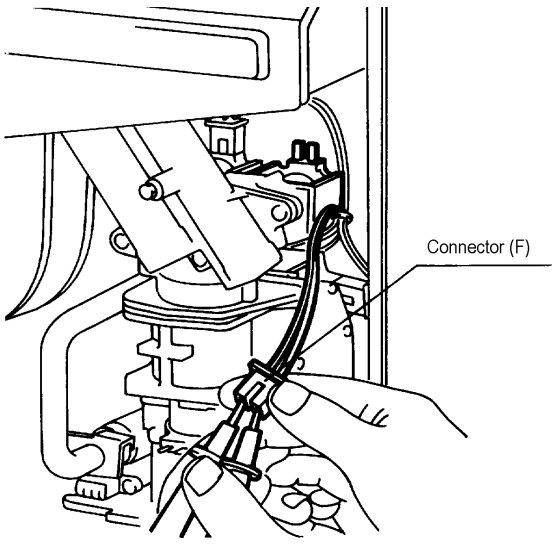


If fault display displays "11", check the main gas solenoid valve.

a. Detach the connector on the main gas solenoid valve, and measure the resistance between pink and black.
Normal: 0.9 ~ 1.3 kS.
If normal, go to b.
Faulty: Replace the main gas solenoid valve.

b. Measure the voltage between pink and black of the connector from the main gas solenoid valve.
Normal: DC 80 ~ 100 V
If normal, go to 8).
Faulty: Replace water flow control

8) Is the hot water supply solenoid valve (SV_2) normal?

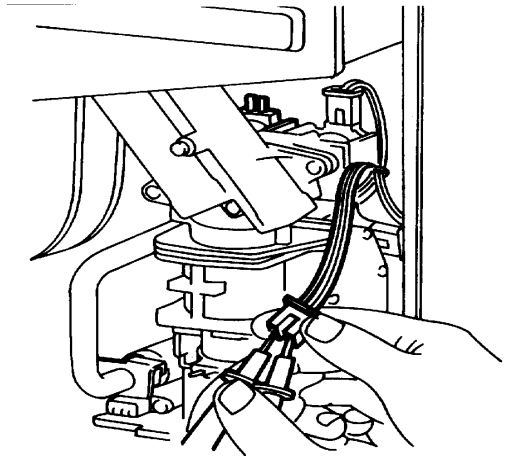


If fault display displays "11", check the hot water supply solenoid valve.

a. Detach the hot water supply solenoid connector, and measure the resistance between yellow and black.
Normal: 1.3 ~ 1.9 kS
If normal, go to b.
Faulty: Replace the hot water supply solenoid valve.

b. Measure the voltage between yellow and black of the connector from the hot water supply solenoid valve.
Normal: DC 80 ~ 100 V
If normal, go to 9).
Faulty: Replace the water flow control.

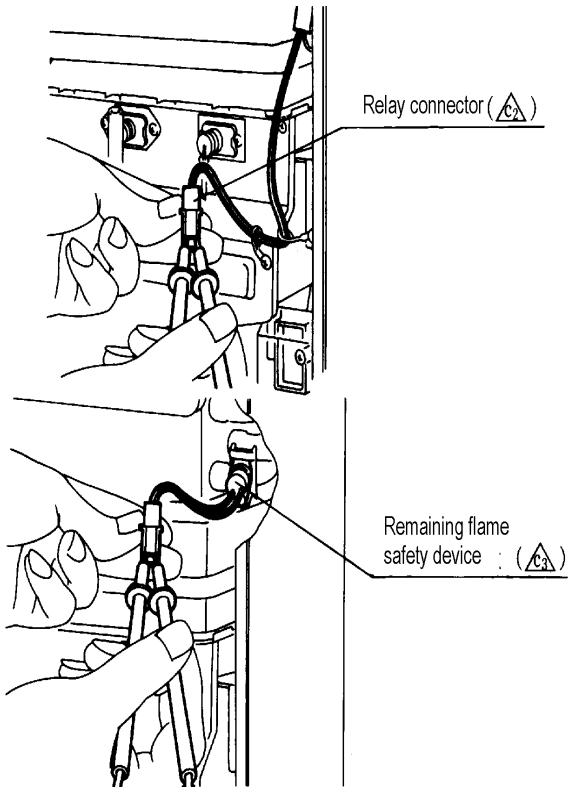
9) Is the changeover solenoid valve (SV_3) normal?



a. Detach the connector on the changeover solenoid valve, and measure the resistance between blue and black.
Normal: 1.5 ~ 1.9 kS.
If normal, go to b.
Faulty: Replace the changeover solenoid valve.

b. Measure the voltage between blue and black of the connector on the changeover solenoid valve.
Normal: DC 80 ~ 100 V
If normal, go to 10).
Faulty: Replace the water flow control.

10) Is the safety device panel?



If fault display displays "14", check the following points.

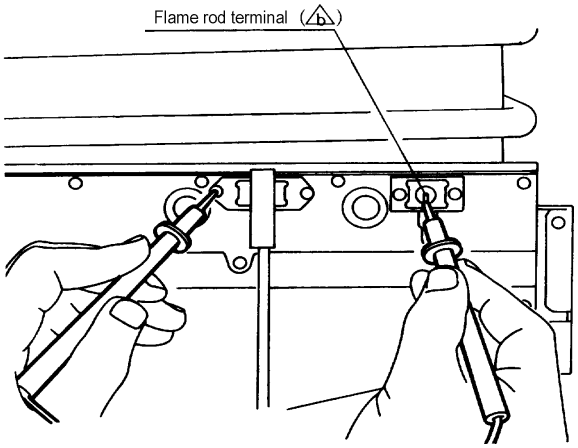
a. Check the thermal fuse.
Detach relay connector (c_2) and measure the resistance between red and white.
Normal: Less than 1S
If normal, go to b.
Faulty: After checking for any damage to the appliance and, if there are no other errors, replace the thermal fuse.

b. Check the overheat prevention device (bi-metal switch). Measure the resistance between both terminals of the bi-metal switch (c_3).
Normal: Less than 1S.
If normal, go to c.
Faulty: Replace the remaining flame safety device.

c. Check harnesses.
Self-check operates if the earth is connected to the main body for harness tearability (especially water flow sensor, modulating valve remote control cable etc,.
Check harnesses within the appliance.
Replace the water flow control unit if above steps a~ c are normal.

Combustion occurs but flame fails

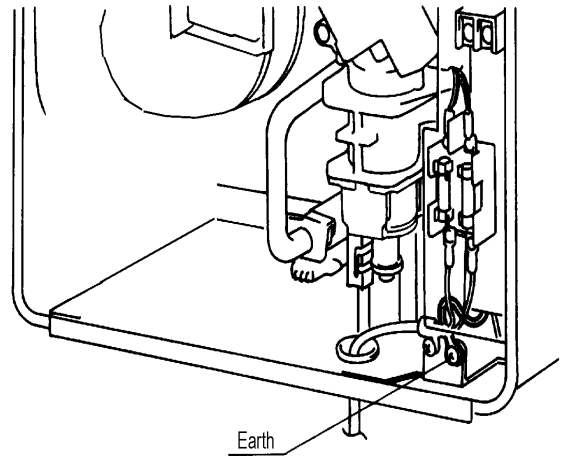
1) Is the flame rod normal?



a. Measure the voltage between the flame rod terminal (b) and the appliance earth.
Normal: AC 40 ~ 150 V
If normal, go to b.
Faulty: Replace the water flow control.

b. Check whether the flame rod is loose.
If normal, replace the water flow control.
If faulty, adjust the flame rod so it is not loose.

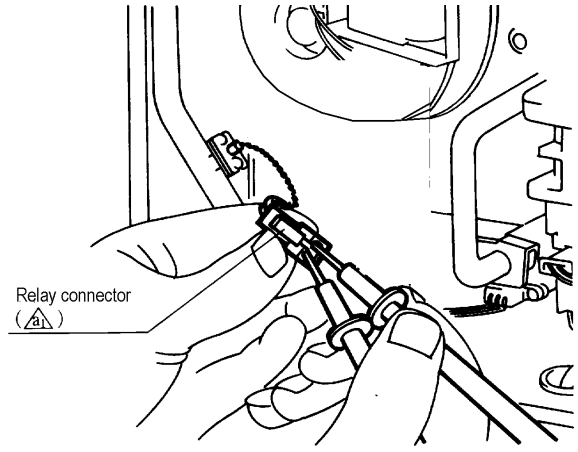
2) Is the earth lead wire normal?



a. 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)
If faulty, reconnect the earth lead wire.

Hot water supply temperature cannot be adjusted

1) Is the water temperature thermistor normal?

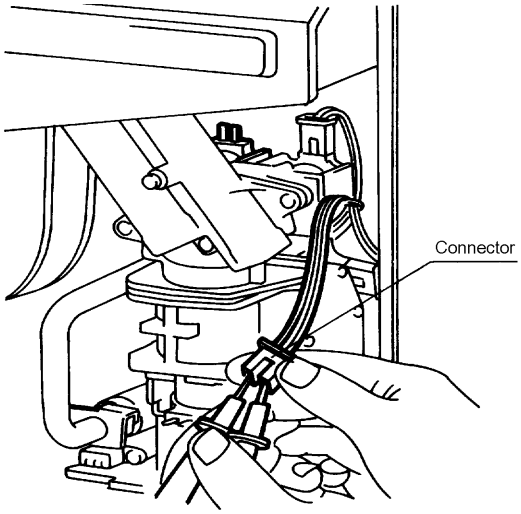


a. Detach relay connector (a_1) and measure the resistance between white and white.

***Normal (*Standards)**

Temperature: 15°C, 30°C, 45°C, 75°C
Resistance: 12.3, 7.0, 4.1, 1.6. [kS]
If normal, go to 2).
Faulty: Replace water temperature thermistor.

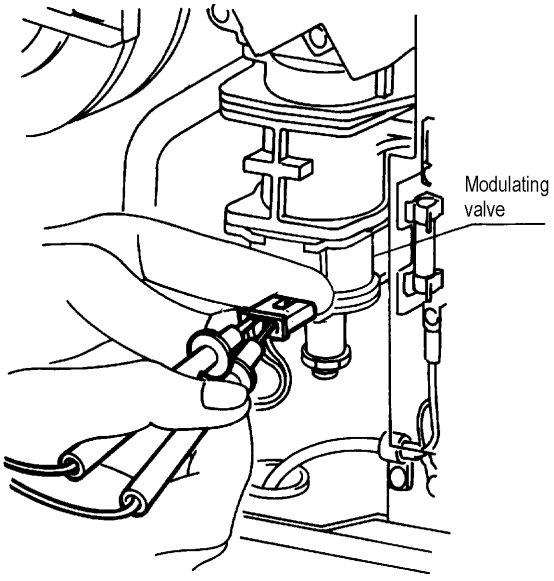
2) Is the changeover solenoid valve (SV_3) normal?



a. Detach the changeover solenoid valve, and measure the resistance between blue and black.
Normal: 950 ~ 1420 Ω.
If normal, go to b.
Faulty: Replace the changeover solenoid valve.

b. Measure the voltage between the blue and black on the changeover solenoid connector.
Normal: DC 80 ~ 100 V
If normal, go to 3).
Faulty: Replace the water flow control unit.

3) Is the modulating valve normal?

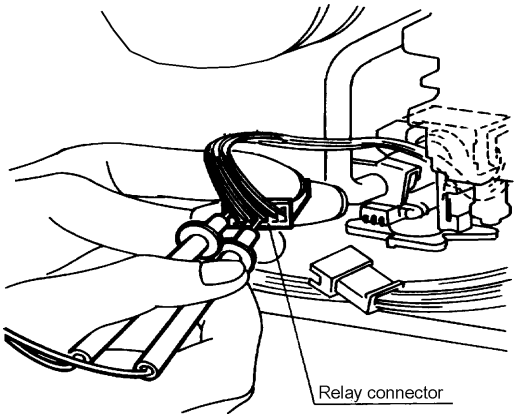


a. Detach quick connector on the modulating valve and measure the resistance between both terminals.
Normal: 65 ~ 90Ω
If normal, go to b.
Faulty: Replace the modulating valve.

b. Measure the voltage between the orange and orange quick connectors on the modulating valve.
Normal: DC 0.5 ~ 25 V
If normal, go to c.
Faulty: Replace water flow control.

c. Check the gas secondary pressure change when the remote control temperature has been modified from 35 to 75°C.
Normal: If the secondary pressure changes, go to 4).
Faulty: Replace the modulating valve.

4) Is the water flow servo normal?



a. Detach the relay connector and measure the resistance between red and blue on the water flow servo side.
Normal: 10 ~ 30Ω
If normal, go to b.
Faulty: Replace the water flow servo with water flow sensor.

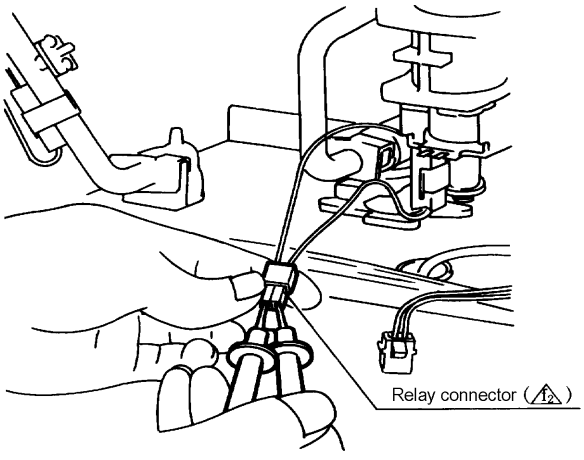
b. Detach the relay connector and measure the voltage between orange (+) and grey(-) on the water flow control side.
Normal: DC 11 ~ 13 V
If normal, go to c.
Faulty: Replace the water flow control.

c. Leaving the relay connector (I_1) connected (no water flow, water servo open), measure the voltage between brown and grey.
Normal: DC 4 ~ 6 V
Faulty: Change water flow servo with sensor.

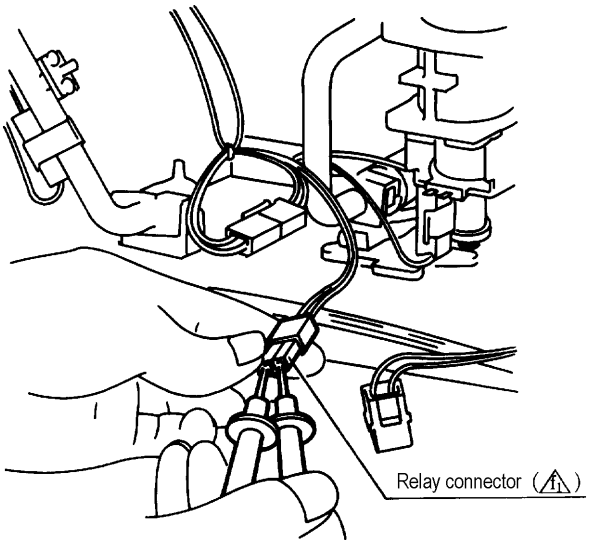
d. Leaving the relay connector (I_1) connected (no water flow, water servo open), measure the voltage between yellow and grey.
Normal: Less than DC 0.5 V
Faulty: Change water flow servo with sensor.

The freeze prevention heater does not activate

1) Is the freeze prevention heater normal?

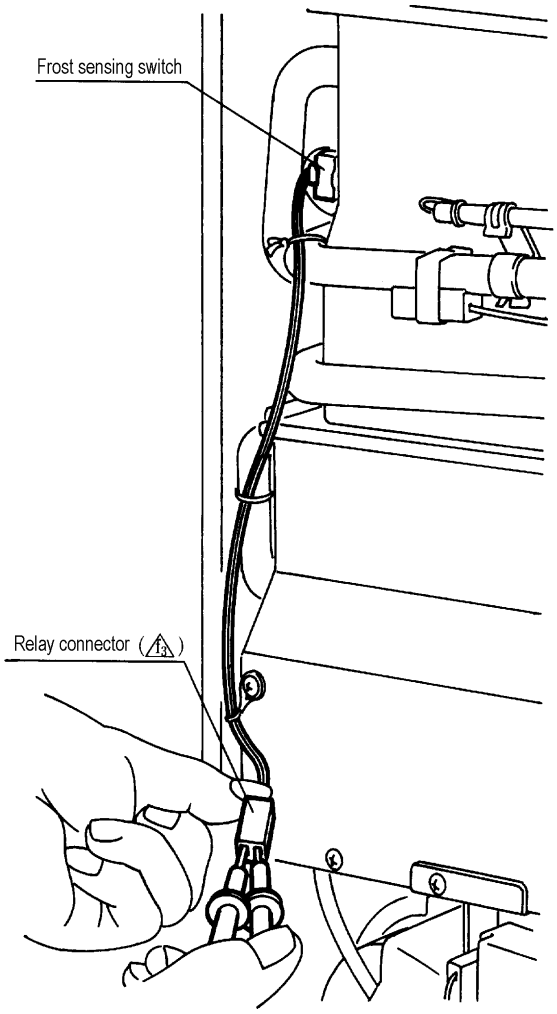


a. Detach the relay connector (f_2) and measure the resistance between blue and blue on the heater side.
Normal: 625Ω
If normal, go to b.
Faulty: Replace freeze prevention heater D (assy).



b. Detach relay connector (f_1) and measure the resistance between blue and blue on the heater side.
Normal: 104S
If normal, go to 2).
Faulty: Replace freeze prevention heater (assy)

2) Is the frost sensing switch normal?



a. Detach the relay connector (f_2) and measure the resistance between white and white.
*Measure at room temperature of 7 ± 3°C.**
Normal: Less than 1 S
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 etc.*

22. 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.	***** Disconnect and measure resistance to confirm if fuse is blown. Normal< 1 MS	Is fuse blown?	Yes	Go to A - 4 and replace fuse.	
				No	Go to A - 5.	
	4. Check for short circuits.	i) Measure the resistance of each solenoid valve. ***** Remove connector G from the PCB before measuring. Pink - Black 0.9 ~ 1.3 kS Yellow - Black 1.3 ~ 1.9 kS Blue - Black 1.5 ~ 1.9 kS	Are values within those specified at left? N.B. Measure after checking that there areno broken wires or shorts.	Yes	Go to A-5-ii)	
				No	Replace faulty solenoid valves.	3
		ii) Measure the sparker resistance. ***** Disconnect the sparker connector g_1 and measure the resistance between both terminals.	Is resistance> 1MS?	Yes	Go to A-4-iii)	
				No	Replace sparker	4
		iii) Check wiring	Are there any shorts?	Yes	Rectify/ Replace	5
				No	Replace PCB	6
	5. Check 240V-100V transformer.	i) Measure voltage between red-red connector d.	AC 90~110 V	Yes	Go to A-5-ii)	
				No	Replace PCB.	7

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair No
		ii) Measure voltage at connectors b, d with appliance on "standby". Green-Green AC16 ~ 20 V Orange-Orange AC13 ~ 30 V Brown-Grey AC30 ~ 50 V Yellow-Grey AC180 ~ 220 V	Are values within those specified at left?	Yes	Go to A-6.	
				No	Replace transformer.	8
	6. Check the remote control.	Measure voltage between control terminals at h.	DC11 ~ 13 V.	Yes	Check cable for shorts/ broken wires; replace remote control.	9
				No	Replace PCB.	10
B. Digital monitor lights up, but there is no combustion.	**1.** Check water flow sensor.	i) Measure voltage between red-black at connector a2.	DC11 ~ 13 V.	Yes	Go to B-1-ii)	
				No	Replace PCB	11
		ii) Measure voltage btween yellow-black at connector a_2.	DC2 ~ 10 V.	Yes	Go to B-ii).	
				No	Replace water flow sensor.	12
Error code "72" displayed	**2.** Check flame rod.	* Measure resistance between flame rod terminal (b) and earth.	Resistance > 1MS?	Yes	Replace PCB.	13
				No	Replace flame rod.	14
Error code "32" displayed	**3.** Check outgoing water temperature thermistor.	* Disconnect and measure resistance of connector a_1. Open circuit:>1MS Short circuit: <1S	Are values as shown at left?	Yes	Replace thermistor.	15
				No	Go to B-4.	
Error code "34" displayed	**4.** Check air temperature thermistor.	* Disconnect and measure resistance of connector a_1. Open circuit:>1MS Short circuit: <1S	Are values as shown at left?	Yes	Replace thermistor.	16
				No	Thermistor	
Error code "61" displayed	5. Check combustion fan.	i) Check motor. Measure voltage between black-red at connector E.	DC6 ~ 40 V (Fan ON) DC 0 V (Fan OFF)	Yes	Go to B-5-ii).	
				No	Replace PCB.	17

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair No
		ii) * Disconnect connector E from PCB; measure resistance between black (+) -red (COM)	Is resistance between 3.9K~4.9KS	Yes	Go to B-5-iii).	
				No	Replace combustion fan	18
		iii) Check rotation sensor. Measure resistance between black-white at connector E.	DC11 ~ 13V	Yes	Go to B-5-iv).	
				No	Replace PCB.	19
		iv) Measure resistance between black-white at connector E.	DC2 ~ 7 V.	Yes	Go to B-6.	
				No	Replace combustion fan	20
Error code "11" diaplayed	**6.** Check sparker.	i) Measure voltage between grey-grey at connector g_1.	AC90~110 V.	Yes	Go to B-6-ii).	
				No	Replace PCB.	21
		ii) * Disconnect connector g_1; measure resistance between terminals.	Is resistance > 1MS?	Yes	Go to B-6-iii).	
				No	Replace sparker.	22
		iii) Confirm spark.	Sparking?	Yes	Go to B-7.	
				No	Adjust/replace electrode..	23
	7. Check main gas solenoid valve (SV_1).	i) * Disconnect main solenoid connector G from PCB. Measure resistance between pink-black.	0.9 ~ 1.3kS?	Yes	Go to B-7-ii).	
				No	Replace main solenoid (SV_1).	24
		ii) Measure voltage between pink-black main solenoid connector.	DC80~100V	Yes	Go to B-8.	
				No	Replace PCB.	25
	8. Check solenoid valve (SV_2).	i) * Disconnect solenoid connector G from PCB; measure resistance between yellow-black.	1.3 ~ 1.9kS?	Yes	Go to B-8-ii).	
				No	Replace solenoid (SV_2).	26
		ii) Measure voltage between yellow-black solenoid connector.	DC80~100V	Yes	Go to B-9.	
				No	Replace PCB.	27

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair No
	9. Check changeover solenoid valve (SV_3).	i) * Disconnect changeover solenoid connector G from PCB; measure resistance between blue-black.	1.5~1.9kΩ?	Yes	Go to B-9-ii).	
				No	Replace solenoid (SV_3).	28
		ii) Measure resistance between blue-black on solenoid connector.	DC80~100V	Yes	Go to B-10.	
				No	Replace PCB.	29
Error code "14" displayed	**10.** Check thermal fuse.	* Disconnect connector c_2; measure resistance between white-red.	Resistance value < 1Ω?	Yes	Go to B-11.	
				No	Replace thermal fuse.	30
	11. Check overheat switch (bi-metal)	* Disconnect OHS fastener terminal; measure resistance between terminals.	Resistance value < 1Ω?	Yes	Replace PCB.	31
				No	Replace remaining flame safety device (bi-metal SW).	32
C. Combustion occurs but flame fails. Error code "12" displayed	**1.** Check flame rod.	i) Measure voltage between flame rod terminal b and appliance earth.	AC40~150V	Yes	Go to C-1-ii).	
				No	Replace PCB.	33
		ii) Confirm the flame rod isn't loose.	Is it secure?	Yes	Go to C-2.	
				No	Adjust flame rod.	34
	2. Check earth lead.	Check for short/ open circuits, and bad earth lead connection (to round terminals)	Are connections OK?	Yes	Check other causes for flame failure.	35
				No	Adjust/replace earth lead.	36
D. Cannot adjust water temperature.	**1.** Check outgoing thermistor.	Disconnect connector a_1; measure resistance between white-white. See "Diagnostic Points" on page 27, for temperature at various resistances.	Resistance values match table on page 27?	Yes	Go to D-2.	
				No	Replace thermistor.	37

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair No
	2. Check changeover solenoid.	i) * Disconnect solenoid connector G from PCB; measure resistance between blue-black.	1.5~1.9kΩ.	Yes	Go to D-2-ii).	
				No	Replace solenoid (SV_3).	38
		ii) Measure voltage between blue-black solenoid (SV_3) connector.	DC80~100V	Yes	Go to D-3.	
				No	Replace PCB.	39
	3. Check modulating valve.	i) * Disconnect modulating valve terminal; measure resistance between terminals.	65 ~ 90 Ω?	Yes	Go to D-3-ii).	
				No	Replace modulating valve	40
		ii) Disconnect modulating valve terminal; measure voltage between both terminals.	DC0.5~25V	Yes	Go to D-3-iii).	
				No	Replace PCB.	41
		iii) Check gas secondary voltage when the temperature set on the remote controls changes between 37~75°C.	Are there secondary voltage changes?	Yes	Go to D-4.	
				No	Replace modulating valve.	42
	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.	43
		ii) Measure voltage between orange (+) - grey (-) water flow servo connector I_1.	DC11~13V	Yes	Go to -4-iii).	
				No	Replace PCB.	44
		iii) Measure voltage between brown-grey water flow servo connector I_1 (when water not flowing).	DC4 ~ 6V	Yes	Go to D-4-iv).	
				No	Replace water flow servo with sensor.	45
		iv) Measure voltage between yellow-grey water flow servo connector I_1 (when water not flowing).	< DC 0.5V	Yes	Normal	
				No	Replace water flow servo with sensor.	46

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair No
E. Anti-frost heater does not work.	**1.** Check anti-frost heater.	i) * Disconnect connector f_2; measure resistance between blue-blue.	600~650S?	Yes	Go to E-1-ii).	
				No	Replace anti-frost heater (assy).	47
		ii) * Disconnect connectors f_1 and f_2; measure resistance between white-white. (Short circuit connector f_3 and measure).	96~112S?	Yes	Go to E-2.	
				No	Replace anti-frost B (assy).	48
	2. Check frost sensing switch.	* Disconnect connector f3; measure resistance between white-white. Room temperature < $7^{\pm 3}$oC.	Is resistance < 1S?	Yes	Check wiring.	
				No	Replace frost sensing switch.	49

23. Gas Conversion

1. Remove outer cover, 4 screws. (see diagram 1)
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. Remove combustion chamber cover, 11 screws. (see diagram 2)
10. Remove manifold, 5 screws. (see diagram 3)
11. Remove damper (3 screws). (see diagram 4)
12. Replace the burner unit (2 screws). (see diagram 4)
13. Remove 18 injectors.
14. Fit new injectors (18) (see diagram 4)
15. Fit Damper. (Natural Gas marked “B” / Propane Damper marked “E”).
16. Refit manifold, check “O” rings are correctly positioned.
17. Refit combustion chamber cover. Attach flame sensor and sparker lead.
18. Connect appliance to gas, water, and electricity.
19. Follow gas pressure setting procedure, (see next page).
20. Check for gas escapes with soapy water.
21. Disconnect appliance from services (if in workshop).
22. Replace front cover, star washer must be on bottom right hand screw.

Diagram 1.

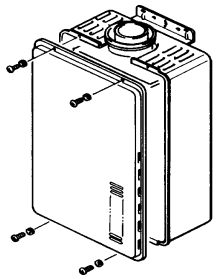


Diagram 2.

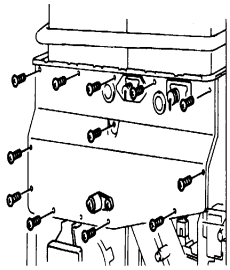


Diagram 3.

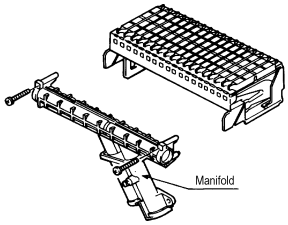


Diagram 4.

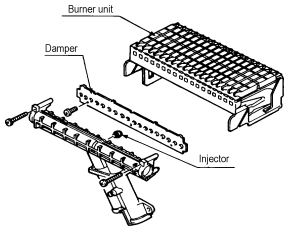


Diagram 5

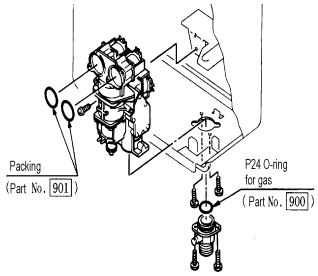
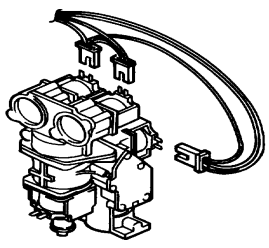
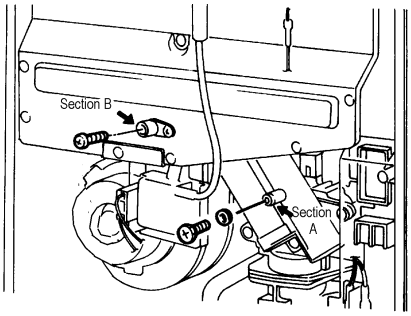


Diagram 6

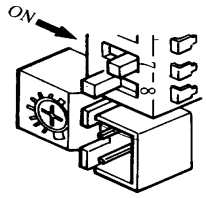


24. Gas Pressure Setting Procedure

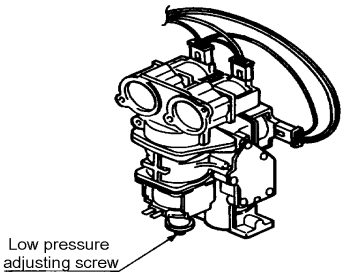
1) Check gas type switch is in correct position (see page 12).



2) Remove concealed pressure point screws from manifold, and remove concealed pressure point screws from combustion chamber.
3) Attach pressure gauge to pressure test points. (check pressures of sections A and B with manometer)
Turn power on. (connect to power)
4) Press ON switch on the main PCB.
5) Set No. 7 switch to ON. Remove plug in base of heater for access to regulator screw. Adjust regulator screw on modulating valve.

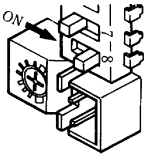


Pressure Setting Low
NG 0.06 kPa
PROP 0.16 kPa
LPG (NZ) 0.17 kPa

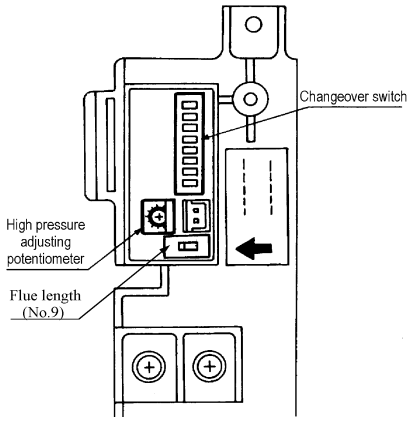


6) Switch No.7 “OFF” and switch No. 8 “ON”. Adjust pressure by POT on PCB. when completed, switch No. 8 to “OFF”.

Pressure Setting High
NG 0.62 kPa
PROP 1.80 kPa
LPG (NZ) 1.76 kPa



7) Return switch No. 7 and No. 8 switches to the “OFF” position.
8) Turn heater off.
9) Remove gauge, replace screw.
10) Replace plug in base.



25. Dismantling for service

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

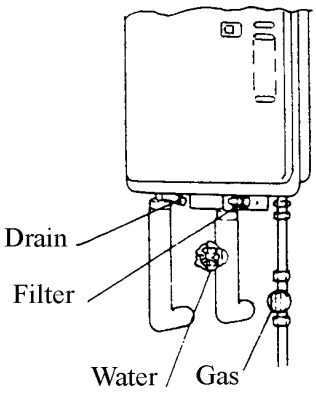
Unless otherwise stated, re-assembly is the reverse of dismantling

IMPORTANT

For some areas of dismatling 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.

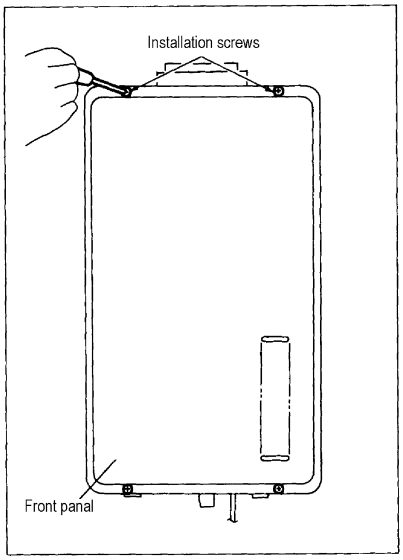
The following diagram may be of assistance.



1) Removal of Front Panel

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

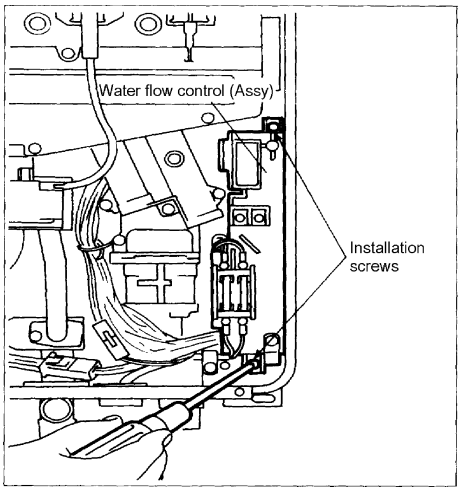
a. Remove the four (4) screws holding the panel in place. (phillips driver)



2) Removal of Water Flow Control

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

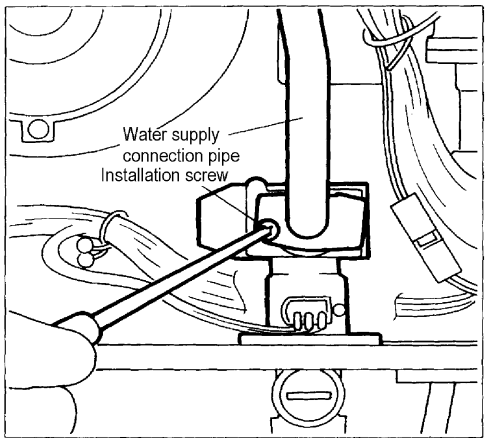
a. Remove the 2 screws on the water flow control and pull out towards you. (phillips driver)



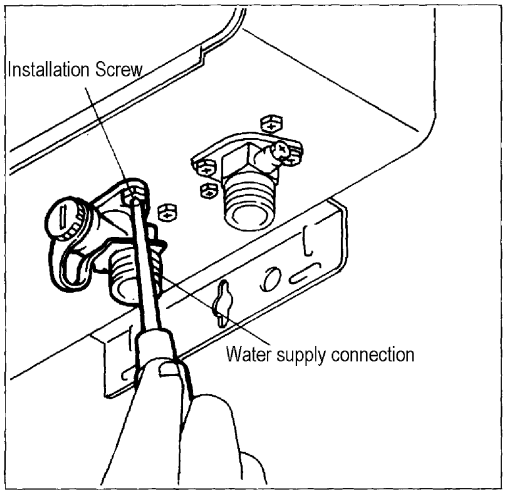
3) Removal of Water Flow Sensor with Water Flow Servo

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove the screw from the water supply connection pipe on the heat exchanger, remove the metal lock and pull the water supply connection pipe out towards you. Handle O-ring carefully. (phillips driver)



b. Remove four (4) screws from the water supply connection and pull out the water supply connection.
Handle O-ring carefully. (phillips driver)

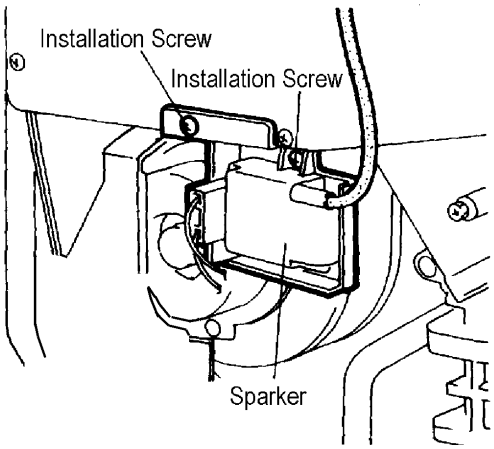


4) Removal of Sparker

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove one (1) screw from the sparker panel and pull out the sparker. (phillips driver).

b. Remove one (1) screw from the sparker and detach the sparker (phillips driver)

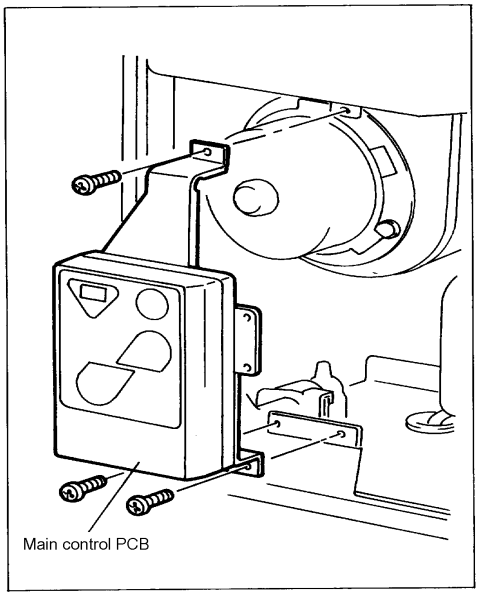


5) Removal of Combustion Fan

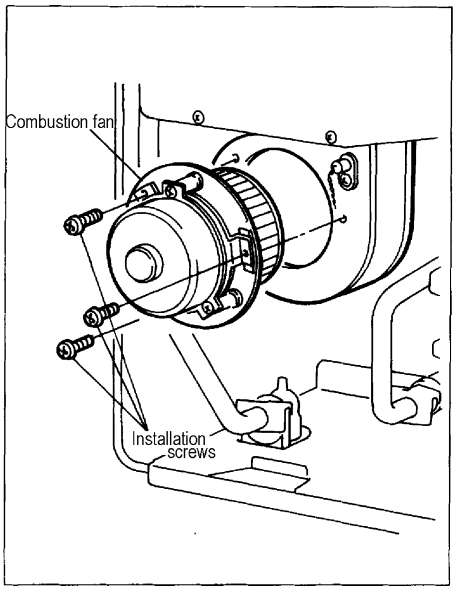
CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Detach the sparker, refer to section 4.

b. Remove the three (3) screws from the main control PCB and pull towards you. (phillips driver)



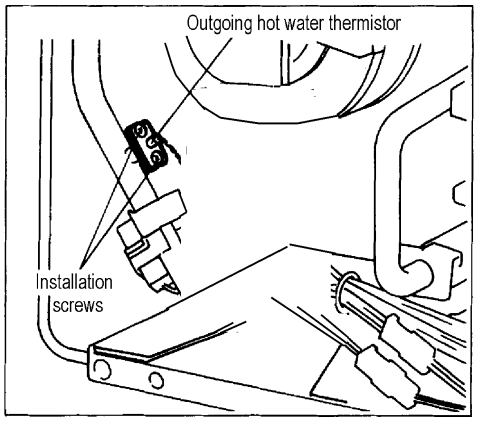
c. Remove the three (3) screws from the combustion fan and pull towards you. (phillips driver)



6) Removal of Water Temperature Thermistor

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove the two (2) screws from the outgoing hot water thermistor and detach the outgoing hot water thermistor.

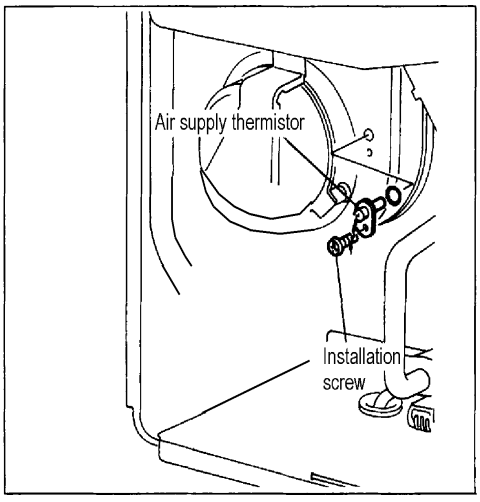


7) Removal of Air Supply Thermistor

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Detach the sparker, refer to section 4.

b. Remove the screw on the air supply thermistor and detach the air supply thermistor (phillips driver)



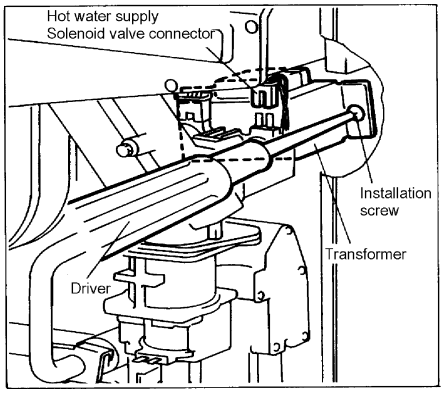
8) Removal of Transformer

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Detach the water flow control (Assy), refer to section 2.

b. Pull out the connector on the hot water supply solenoid valve.

c. Remove the two (2) screws on the transformer and detach the transformer.

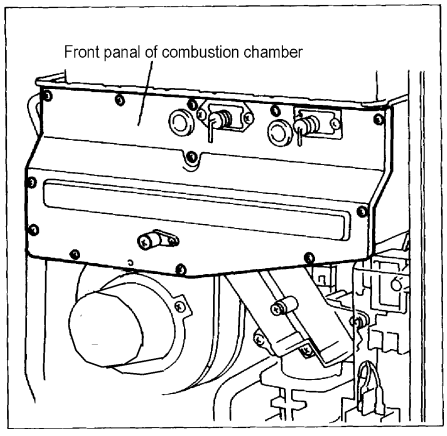


9) Removal of Manifold and Burner

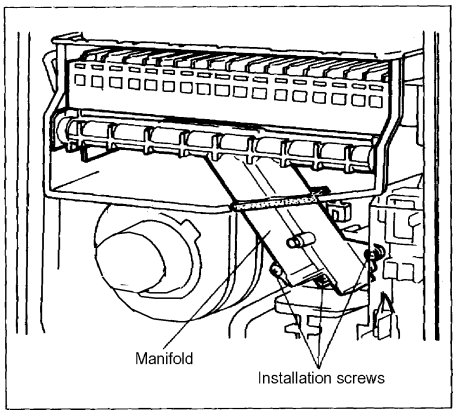
CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Detach the sparker, refer section 4.
(1 screw)

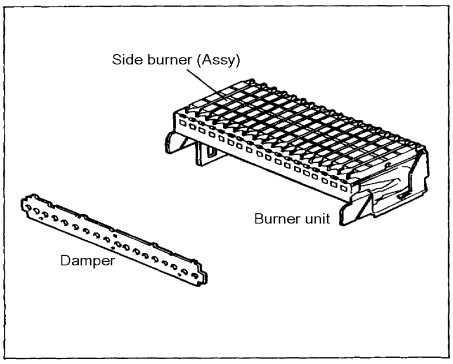
b. Detach the front panel of the combustion chamber.
(12 screws)



c. Remove the manifold (5 screws)



d. Pull the burner unit out.

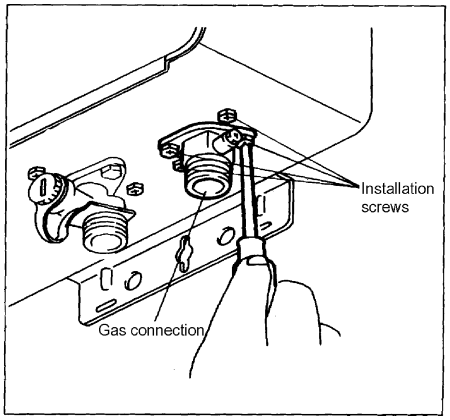


10) Removal of Gas Control

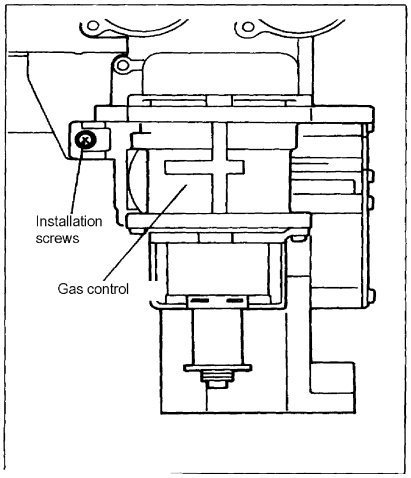
CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove the manifold, refer section 9.

b. Remove the four (4) screws from the gas connection and pull out the gas connection.
Handle O-ring carefully. (phillips driver)



c. Remove the screw from the gas control (assy) and pull out the gas control.



11) Removal of Heat Exchanger

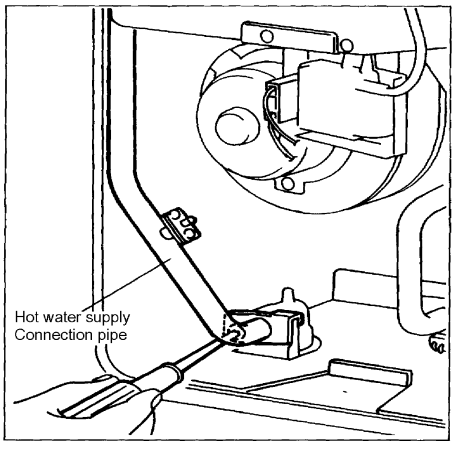
CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Pull the water flow unit towards you, refer section 2.1

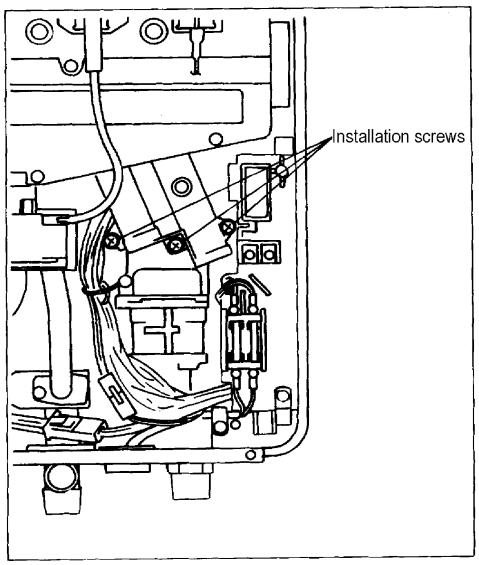
b. Pull out the water supply connection pipe on the heat exchanger, refer section 3.1.

c. Detach the main control PCB, refer section 5.2.

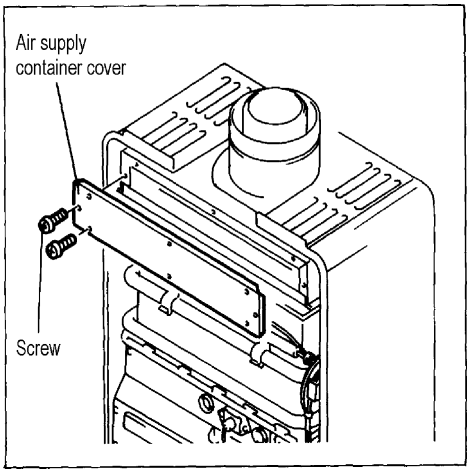
d. Remove the screw from the hot water supply connection pipe on the heat exchanger and pull the hot water supply connection pipe towards you.
Handle O-ring carefully. (phillips driver)



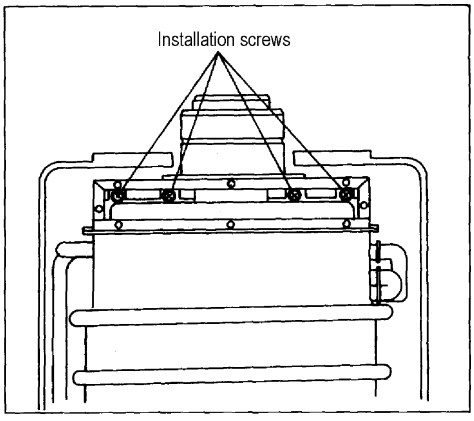
e. Detach the three (3) screws on the manifold. (phillips driver)



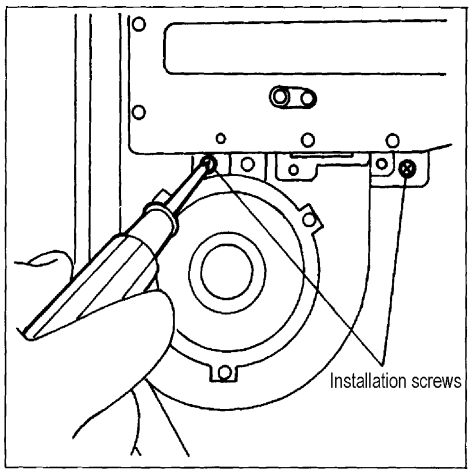
f. Detach the air supply container cover (8 screws).



g. Detach the screws found within the exhaust pipe set.

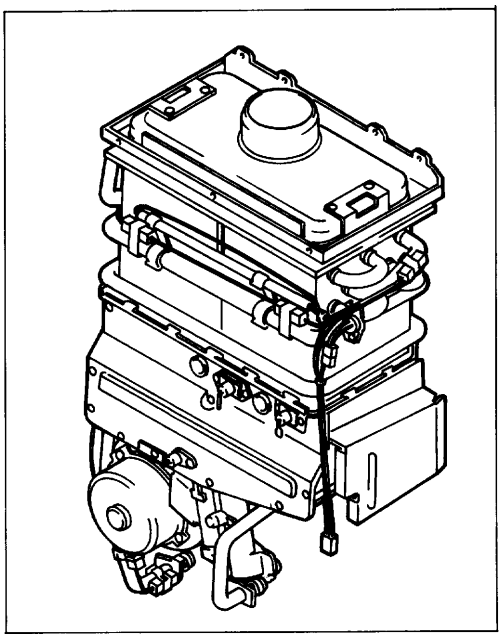


h. Detach the 2 screws on the heat exchanger unit.



i. Remove the connectors on the various harness.

j. Slide the heat exchanger unit downwards, and pull towards you.

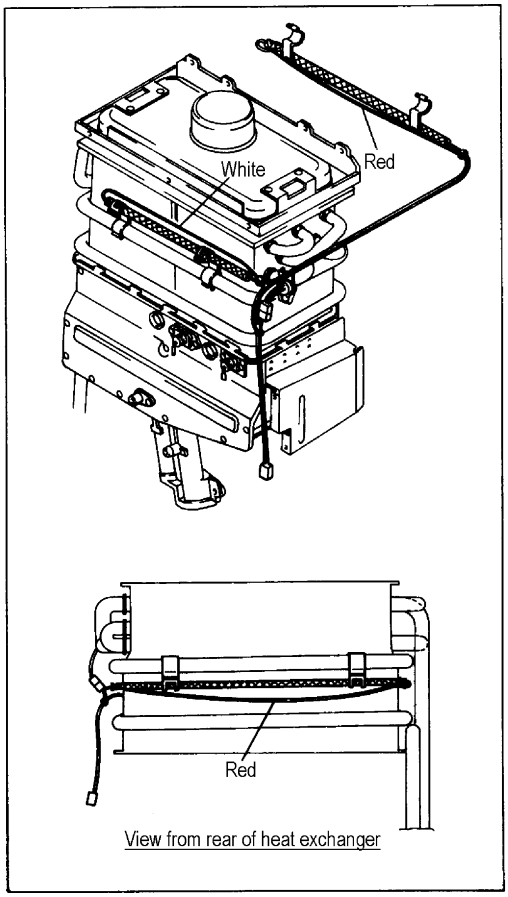


12) Removal of Thermal Fuse

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Pull the heat exchanger unit towards you, refer section 11.1 ~ 11.10

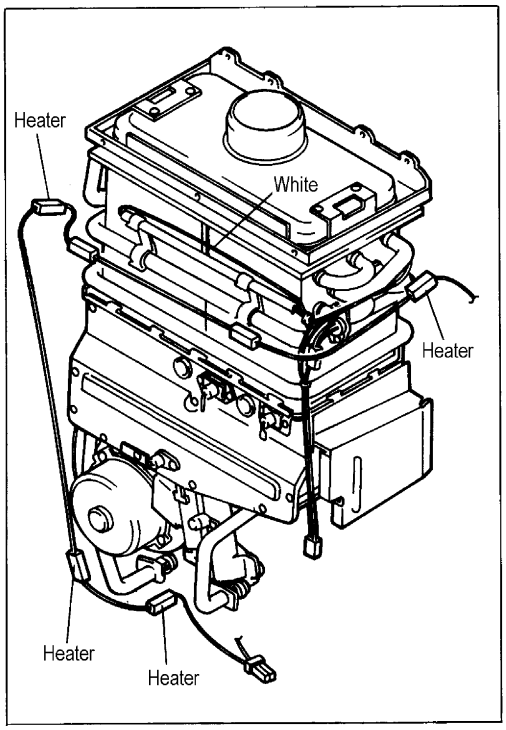
b. Detach the thermal fuse. After removing the thermal fuse, replace it as shown in the diagram below.



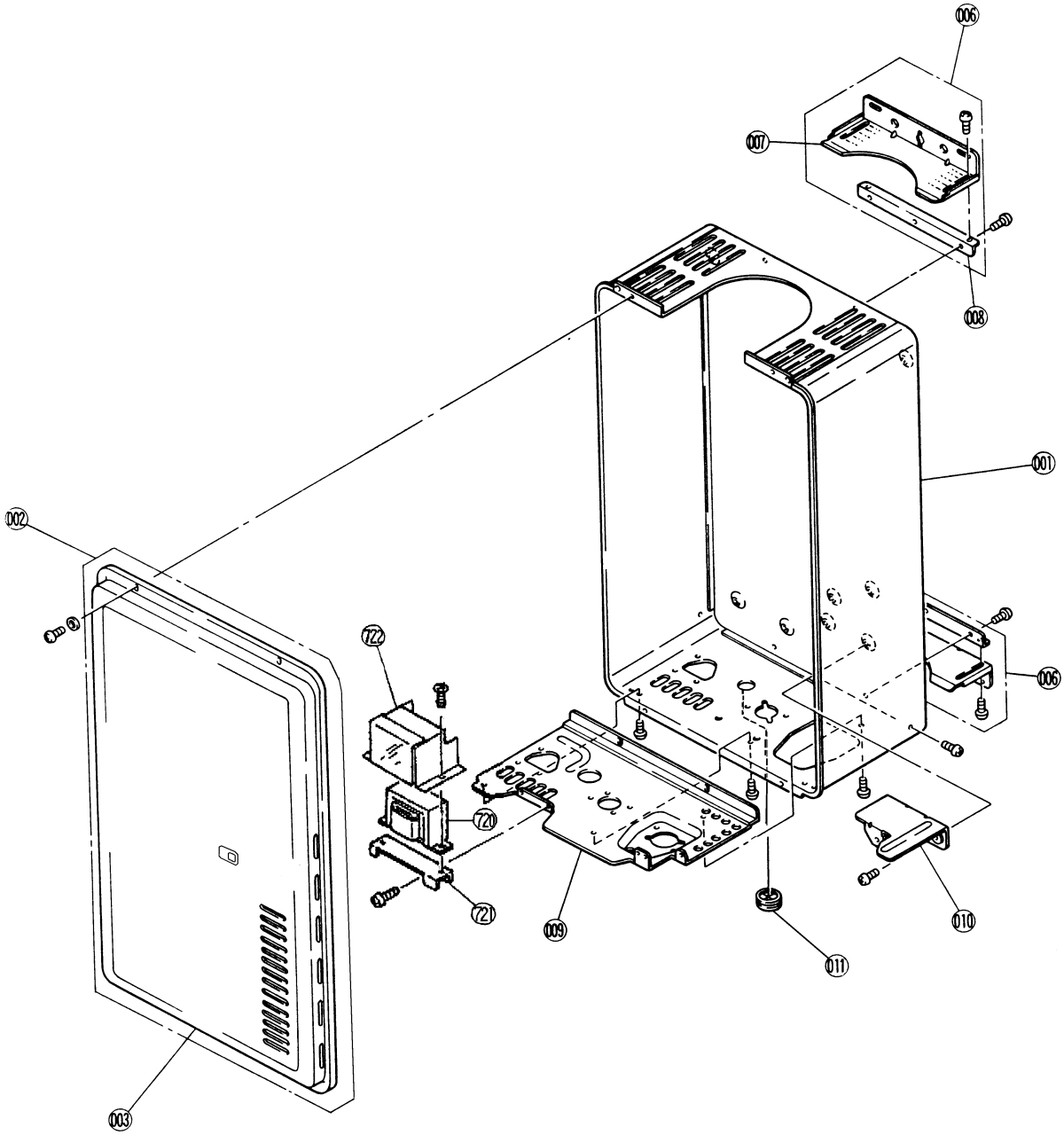
13) Removal of Anti-Frost Device

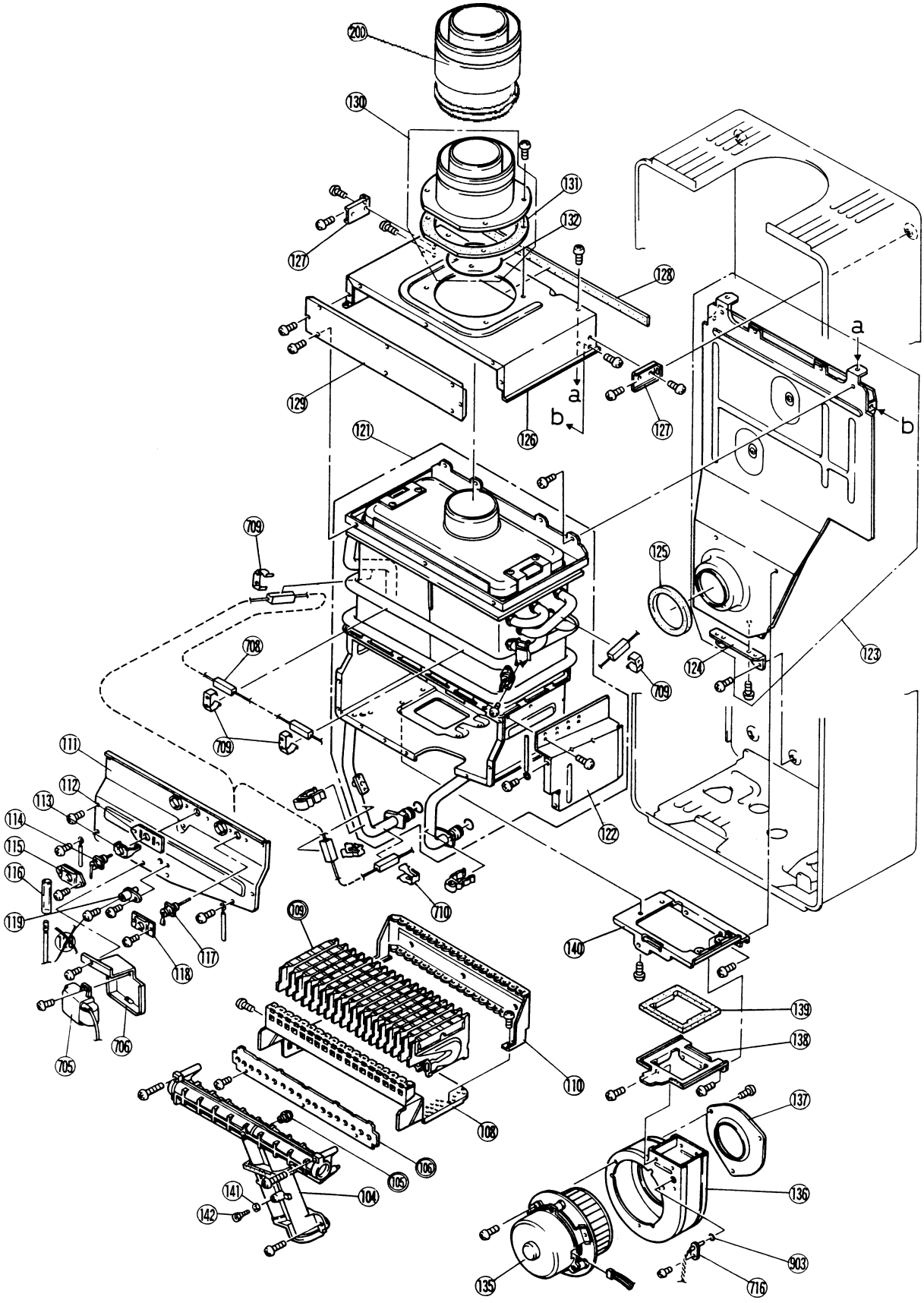
a. Pull out the heat exchanger unit, refer section 11.1 ~ 11.10.

b. Detach the freeze prevention device.



26. Exploded Diagram




200
130
131
132
127
128
129
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a
b
121
709
708
125
124
123
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710
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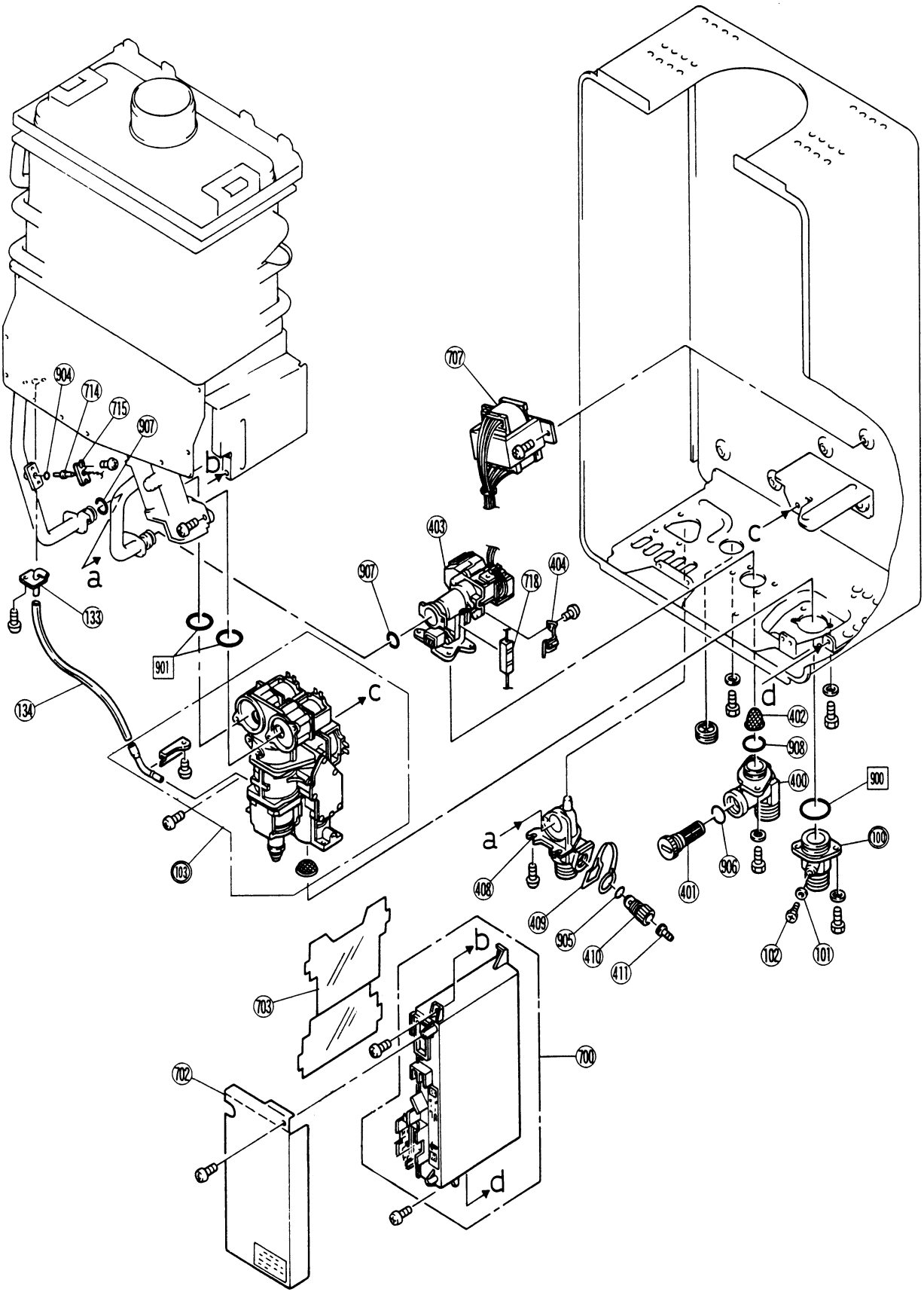
904
714
715
907
b
a
133
134
901
103
c
907
403
718
404
707
c
d
402
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906
401
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409
905
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703
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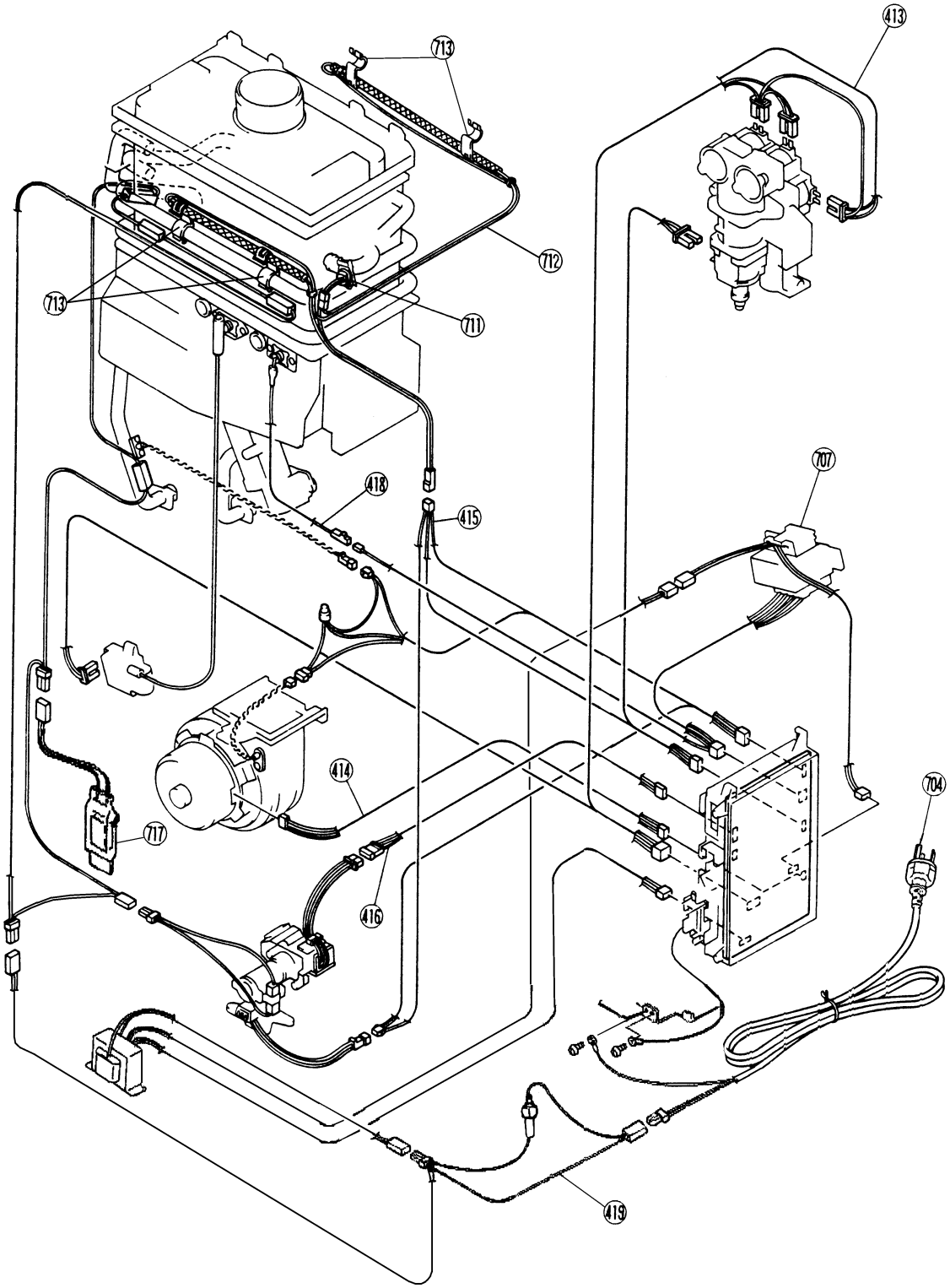
700
702
d


713
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27. Parts List

No	Part Name	RA Part No	RNZ Part No	QTY
001	Main Body Assembly - Standard			1
001	Main Body Assembly - Salt Resistant		3044	1
004	Heat Shield			1
007	Front Panel Assembly - Standard	920881561		1
007	Front Panel Assembly - Salt Resistant		3047	1
012	Wall Bracket			2
016	Front Panel Packing			1
017	Front Panel Packing - Side		3768	2
018	Connection Reinforcement Panel			1
019	Gas Control Bracket			1
020	Installation Sheet Storage Pouch			1
021	Rubber Plug			1
022	Cable Connection		3896	1
023	Cable Seal Packing			1
100	R¾ / 20 Gas Connection	92081587	3074	1
101	Test Point Screw			2
103	Gas Control Assembly	92081595	3083	1
104	Manifold (Assembly) - NG		3125	1
104	Manifold (Assembly) - LPG		3089	1
105	Damper (LPG, Propane Gas)	92071364	3136	1
	[Damper not required for Natural Gas]			1
106	Burner Case Front			1
107	Sound Proofing Panel			1
110	Burners (Front)		3393	18
111	Burner Case Back Panel			1
112	Comb. Chamber Front Panel (Complete Assy)			1
113	Combustion Chamber Front Panel (Assy)			1
114	Combustion Chamber Packing - Top	92081629	3396	1
115	Combustion Chamber Packing - Bottom	92081637	3397	1
116	Ignition Target			1
117	Flame Rod	92072891	3018	1
118	Flame Rod Bracket			1
119	Air Pressure Test Point	92044577		1
121	Heat Exchanger Complete Assy B	92048131	2645	1

No	Part Name	RA Part No	RNZ Part No	QTY
122	Draining Panel			1
123	Air Supply Plate Assy			1
124	Air Supply Plate Bracket			1
125	Air Plate Inlet Packing		2662	1
126	Flue Duct			1
127	Air Supply Plate Fixing			2
128	Anti-Vibration Packing		2663	1
129	Air Supply Duct Cover			1
130	Flue Outlet Assembly		2664	1
131	Flange Packing		2665	1
132	O-Ring P75		2666	1
133	Back Pressure Tube Assy		2667	1
134	Back Pressure Tube	92071570	3982	1
135	Fan Motor Assembly	92066976	2668	1
136	Fan Casing Assy			1
137	U-Bellmouth			1
138	Fan Bracket			1
139	Fan Bracket Packing		2669	1
140	Fan . Combustion Chamber Bracket			1
141	Pressure Point Packing		9995	1
142	Pressure Test Point Screw	92068907	9994	1
200	ø110 Flue Adaptor		2680	1
400	R¾ / 20 Water Inlet Connection	92081702	3059	1
401	Water Inlet Filter (Assy)	92062280	3839	1
402	Water Rectifier	92072701	3048	1
403	Water Flow Servo & Sensor (Assy)	92073568	3058	1
404	Anti-frost Heater Fixing Plate		2038	1
408	R¾ / 20 Water Outlet Connection	92081744	3055	1
409	Pressure Relief Valve Band			1
410	Pressure Relief Valve C	92081751	3626	1
411	Valve Hose End			1
413	Solenoid Valve Harness		3070	1
414	Fan Motor Harness		3034	1
415	Sensor Motor Harness		2686	1
416	Water Flow Servo Harness		3071	1

No	Part Name	RA Part No	RNZ Part No	QTY
418	Flame Rod Harness		2691	1
419	Power Supply Harness		2692	1
700	PCB (Assy)	92072586	2693	1
702	EC Cover		3041	1
703	PCB Cover		3040	1
704	Power Supply Cord		2695	1
705	Sparker	92072776	2851	1
706	Sparker Installation Bracket			1
707	Transformer Assembly	92072768	3043	1
708	240V Anti-frost Heater L Assy		2035	1
709	Heater Bracket D		2034	1
710	Heater Bracket		2032	1
711	Over Heat Switch	92072750	3045	1
712	Thermal Fuse and Harness	92072651	2856	1
713	“F” Fixing Band A		2869	4
714	Thermistor	92073675	3029	1
715	Thermistor Clip - Large		3882	1
716	Air Temperature Thermistor	92071380	3986	1
717	Frost Sensing Switch	92069079	3976	1
718	240V Anti-frost Heater M Assy	92063593	3854	1
720	Transformer Assy (240 ~ 100 V)	92072735	3061	1
721	Transformer Bracket			1
722	Transformer Cover		3067	1
900	“O” Ring (P24)	92081926	3559	1
901	Packing	92075126	3619	2
903	“O” Ring (P3)	92071448	2974	1
904	“O” Ring (P4)	92062249	3832	1
905	“O” Ring (P7)	92062348	3849	1
906	“O” Ring (P12)	92063551	1106	1
907	“O” Ring (P14)	92062207	3826	1
908	“O” Ring (P18)	92071182	3627	1

SERVICE CONTACT POINTS

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	Service	Tel: (03) 9271 6699 Fax: (03) 9271 6688
	Spare Parts	Tel: (03) 9271 6600 Fax: (03) 9271 6688
	Sales	Tel: (03) 9271 6666 Fax: (03) 9271 6611
	Emergency Hot Water	Tel: (1800) 632 386
		10-11 Walker Street, Braeside, VIC 3195
		Tel: (03) 9271 6625 Fax: (03) 9271 6622
New South Wales:	**Service**	Tel: (02) 9609 2600 Fax: (02) 9729 0467
	Sales	Tel: (02) 9609 2888 Fax: (02) 9609 5260
	Emergency Hot Water	Tel: (02) 9729 0468
		62 Elizabeth Street, Wetherill Park, NSW 2164
		Tel: (02) 9609 2111 Fax: (02) 9609 5260
South Australia:	**Service**	Tel: (08) 8345 0292 Fax: (08) 8345 4760
	Emergency Hot Water	Tel: (08) 8345 5185
		140 Days Road, Ferryden Park, SA 5010
Western Australia:	**Service**	Tel: (08) 9478 3355 Fax: (08) 9277 2531
	Emergency Hot Water	Tel: (08) 9324 4145
		18 Belgravia Street, Belmont, WA 6104
Queensland:	**Service**	Tel: (07) 3209 4622 Fax: (07) 3209 4722
	Emergency Hot Water	Tel: 1800 255 266.
		1/6 Booran Drive, Logan Central, QLD 4114
Tasmania:		**Contact Rinnai Melbourne on:**
	Service	Tel: (03) 9271 6699 Fax: (03) 9271 6688
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