RINNAI

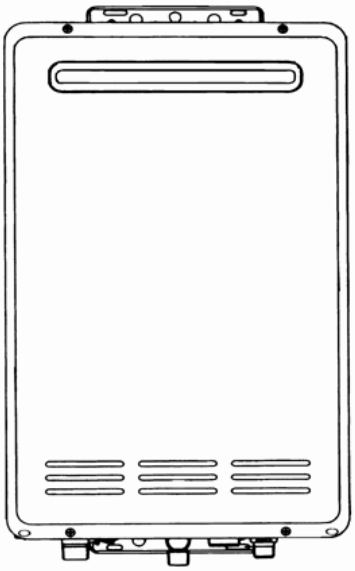
Continuum

Water Heater Model

REU-2424-W and REU-2424-C

General Use

SERVICE MANUAL



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Telephone number (800)621-9419

Key to Warning Symbols

Failure to comply with the following instructions may results in serious personal injury or damage to the appliance.

Be careful of possible electric shock. Wiring inside this appliance may potentially be at 120 volts.

Disconnect power supply to unit when carrying out the following service repairs.

Read Fault Diagnosis and Wiring Diagram carefully to avoid incorrect wiring.

Do not disassembly. Parts within can not be exchanged or diagnosed faulty.

Please follow instructions in chapters to ensure safe and appropriate service.

After completing the service and confirming that there are no water or gas leaks or incorrect wiring, test operation of the appliance. After confirming normal operation, explain what was serviced to the customer and the operating principles, if necessary.

The information in this manual was compiled by Rinnai 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 is 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**
BTU/H	**-**	**British thermal units**
PSI	**-**	**Pounds per square inch**
LED	**-**	**light emitting diode**
GPM	**-**	**gallons per minute**
mA	**-**	**milliamps**
W.C.	**-**	**inches of water column**
mm	**-**	**millimeters**
Nox	**-**	**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**
∅	**-**	**diameter**
Δ °F	**-**	**delta T or 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 Continuum refers to “Endless Hot Water”. The new Continuum series has been developed in response to the growing changes in the lifestyle of our customers, and the increasing diversification and sophistication of demand in the marketplace.

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

The Continuum model REU2424-W is delivered with the maximum hot water temperature output set at 120 °F without the remote control. The REU2424-C is delivered set at 140°F without the remote control. When using controllers you can adjust your hot water output from 96 – 120 °F using the “BC” and “BSC” controllers. The “MC” control will allow water temperature adjustments from 96 – 140 °F and the “MCC” control used with the commercial unit allows adjustments from 96 - 180°F. .

About the Continuum

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

Air inlets are situated in the front panel of the 2424 external unit. Air passes through the inlets and is drawn into the combustion chamber at the rear of the fan housing. The by-products of combustion on the external unit are expelled from the appliance through a flue outlet situated on the front of the appliance, at the top. The general layout of components can be seen in the cut-away diagram, see table of contents for page number. All components are supported within the unit’s casing, which is made from 0.8 mm coated steel.

The heat exchanger occupies the top section of the casing, and the burner is situated in a chamber formed from 0.8 mm aluminized steel, attached to the bottom of the heat exchanger. The copper tubing material used in the heat exchanger consist of, Phosphorus Dioxide Copper, (C1220P). The material used to solder the heat exchanger pipes is, Phosphorus Bronze Brazing, (main components are P, Ag, and Cu) (JIS No. BcuP-2). None of these materials contain lead.

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

Gas and water controls are situated at the bottom right of the appliance, directly under the manifold. The “O”ring material on the water and gas connections are made from EPDM, (Ethylene Propylene Diene) rubber.

The burner assembly is made up of (18) identical stainless steel Bunsen burners, secured by an aluminized steel framework. Each burner is capable of handling up to 10,000 BTU’s. An aluminum manifold with (18) integrally molded injectors supplies gas to the burners, and is attached to the front lower cover of the burner box.

2. Features

Installation

The lightweight, slim, compact design enables ease of installation, and improved appearance. The remote controls (where fitted) are connected to the appliance by (2) core non-polar cable, ensuring easy wiring and eliminating problems of mis-connections. Since the remotes use a 12 VDC digital signal, there's no-way you can cross up the wiring. You can connect the black wires at one terminal, black and white at another, and still not short the units out.

Low Noise Level

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

Safety

Varies 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 pipe-work at strategic locations throughout the appliance. The unit has a secondary freeze prevent device that will allow the unit to fire for three seconds, if the water temperature inside the appliance drops below 37 °F. This mode will heat the water inside the unit back up to 57 °F. The anti-frost devices should prevent the unit from freeze-ups down the –30 °F, in a no wind situation. This feature functions as long as the unit has power. See optional freeze protection in the owner's manual for power failure protection.

Economy

Direct ignition to the main burner eliminates wasteful pilot gas consumption. The combustion fan rpm is proportionally controlled with the gas consumption. This maintains high energy efficiency, as the gas consumption changes with increased or decreased water flows. The unit's AFUE rating is 82%.

Water Supply Control

The water supply capacity varies proportionally from 0.6 to 6.5 GPM's. A suitable volume of hot water can be supplied throughout all seasons by the water flow control device and water flow servomechanism. The Continuum 2424 and 2402 models will supply up to 6.5 GPM's, controlled by an automatic electro-mechanical water control flow device. Details pertaining to water flows can be found in the water flow charts in this manual.

Water Temperature Control

With an “MC” remote control connected, the hot water control range at the key pad is 96 – 140 °F. The “BC” and “BSC” key pads allow for adjustments between 96 – 120 °F. The “MCC” key pad allows the commercial unit to be adjusted from 140 – 180 ° F. The “MCC” key pad can be configured to deliver water temperatures from 96 - 140°F in low temperature applications. Contact Rinnai for details when using the commercial unit in temperature applications below 140°F . This allows the Continuum to be set to comply with various State codes pertaining to temperature control in homes, child care centers, and elderly care centers were the temperature can not excess a certain set point.

Over Temperature Control

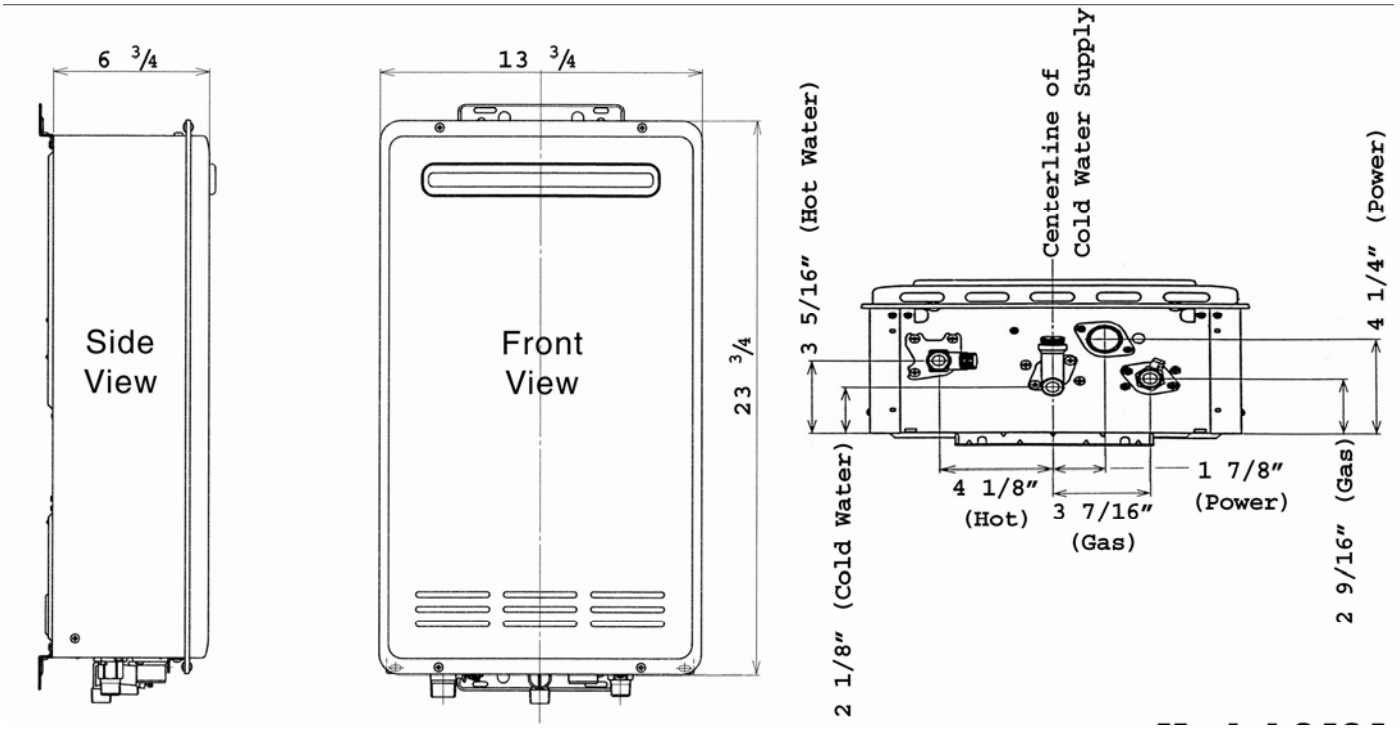
All Continuum models incorporate a device to prevent the hot water temperature from exceeding the pre-set temperature by more than 4 °F.

Temperature Locks

With the remote control(s) connected, the pre-set water temperature can only be altered between 96 – 110 °F while water is flowing. Also, if the remote control circuit fails while water is flowing, the unit defaults back to 100 °F. This prevents inadvertently increasing the temperature to a hazardous level, while someone is in the shower. This is an Anti-Scald feature.

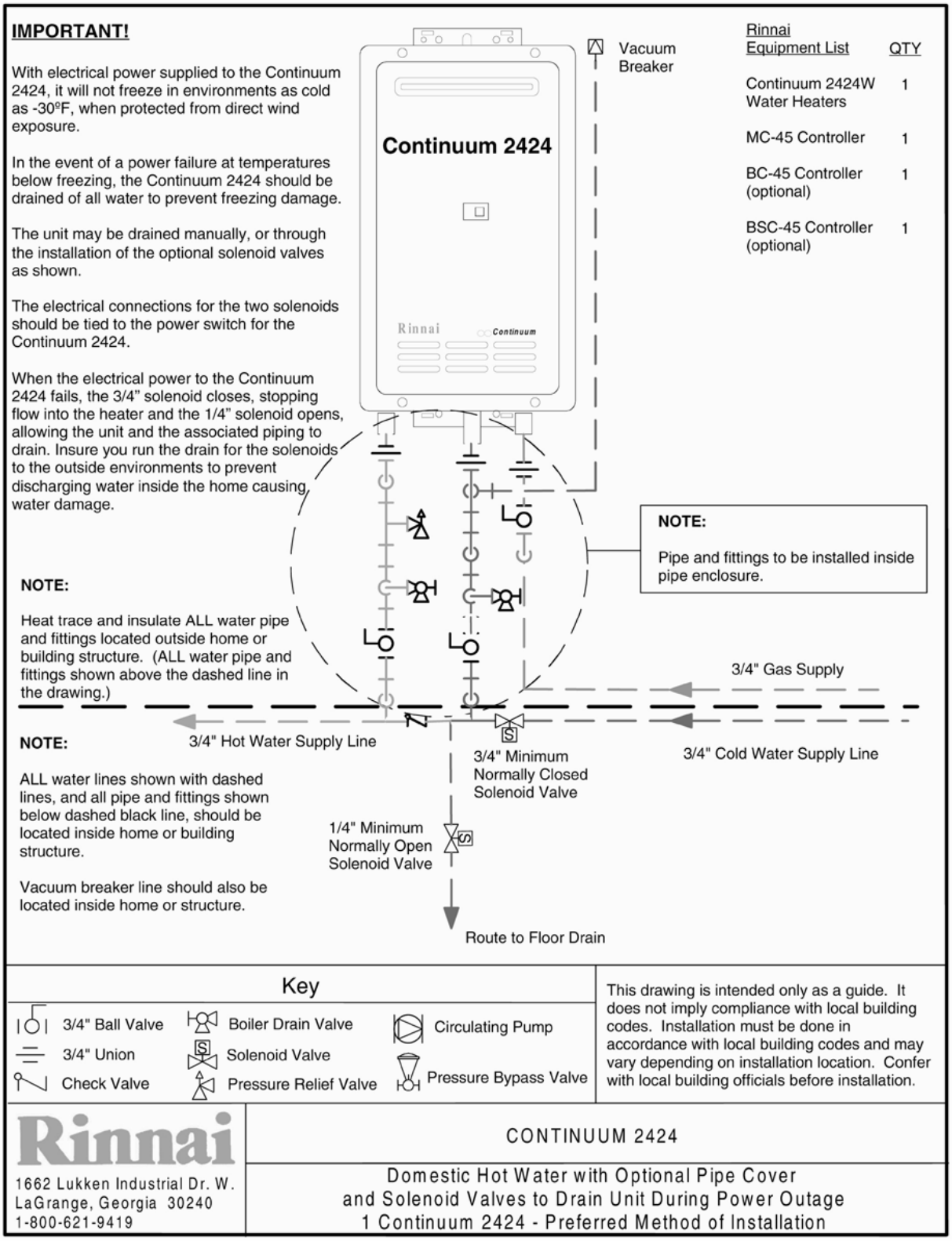
3. Dimensions

Note: All dimensions are in inches.



4. Installation

Recommended piping. .

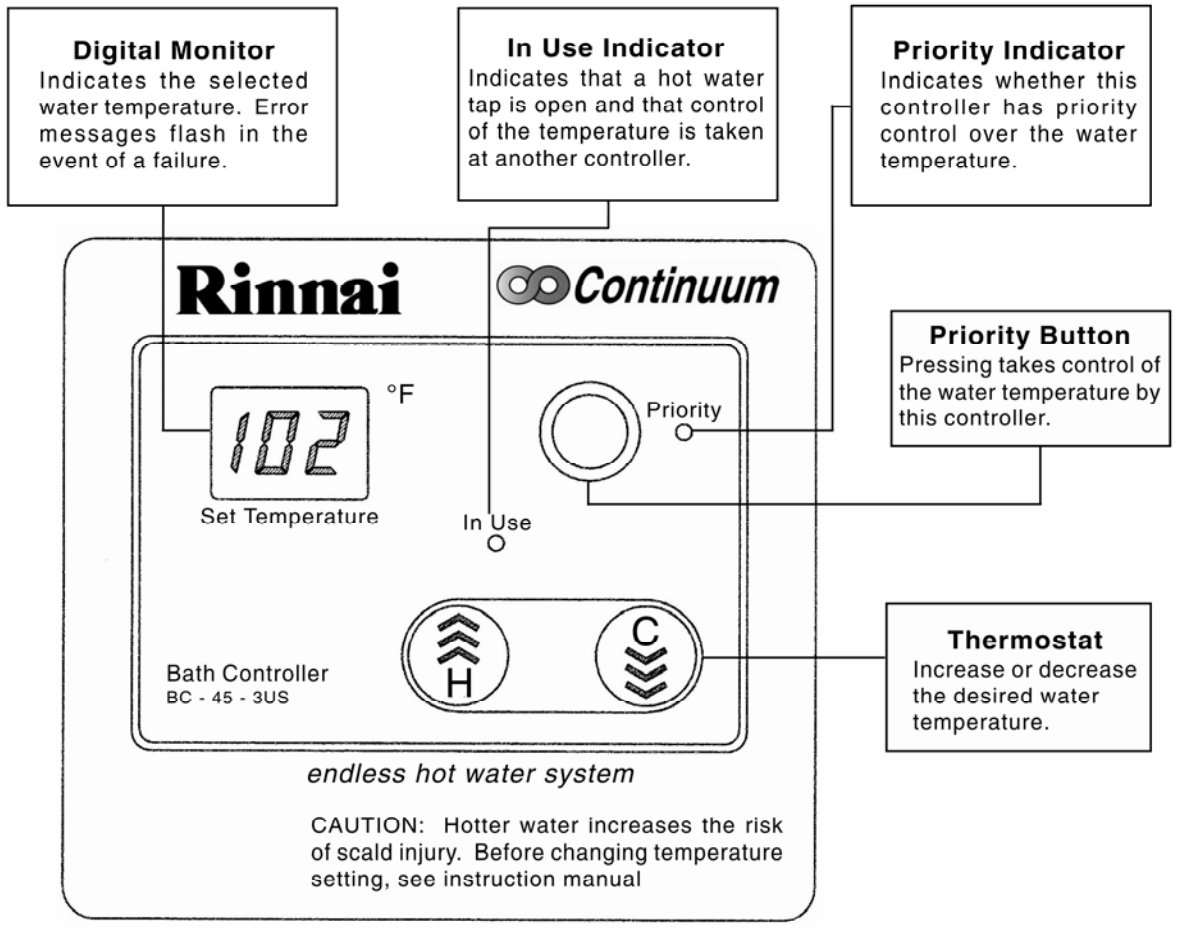


5. Remote Controls

The MC45-3US, BC45-3US, BSC45-3US , and the MCC45-3US remote key pads were specifically designed for use with the Continuum water heaters.

Features include:

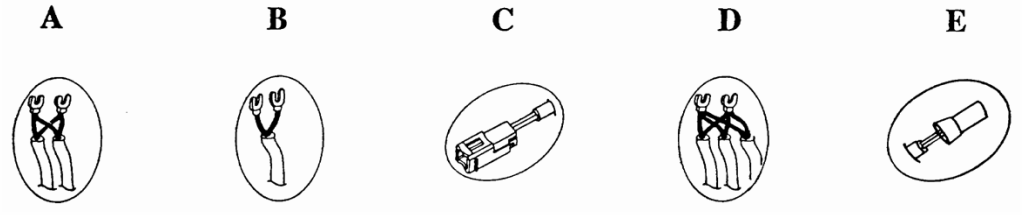
- Color coordination to allow immediate recognition of the temperature “hot” and “cold” buttons.
- Large LED display.
- Temperature adjustments in two degree increments from 96 – 116 °F, then one four degree increment from 116 – 120 °F on the BC,BSC and MC controllers. The “MC” controller has two additional ten degree increments, from 120 to 130, and 130 to 140 °F. The BC, BSC and MC controls are for domestic use. The MCC control allows the temperature to be adjusted from 96°F - 180°F , this control is used only on the REU-2424C commercial unit.
- Water temperature adjustment only in the range of 96 – 110 °F while hot water is flowing.
- Anti-Scald feature defaults unit back to 100 °F, if remote fails or becomes disconnected while water is flowing..
- Enhanced communication system between the remote controls, allowing priority temperature selection at each remote control.
- The remote offers self-diagnostics in the event of a fault with the unit, simplifying service calls.
- Flashes “LC” in the event of a liming condition. To reset the “LC” mode, power must be turned off to the unit and then reapplied.



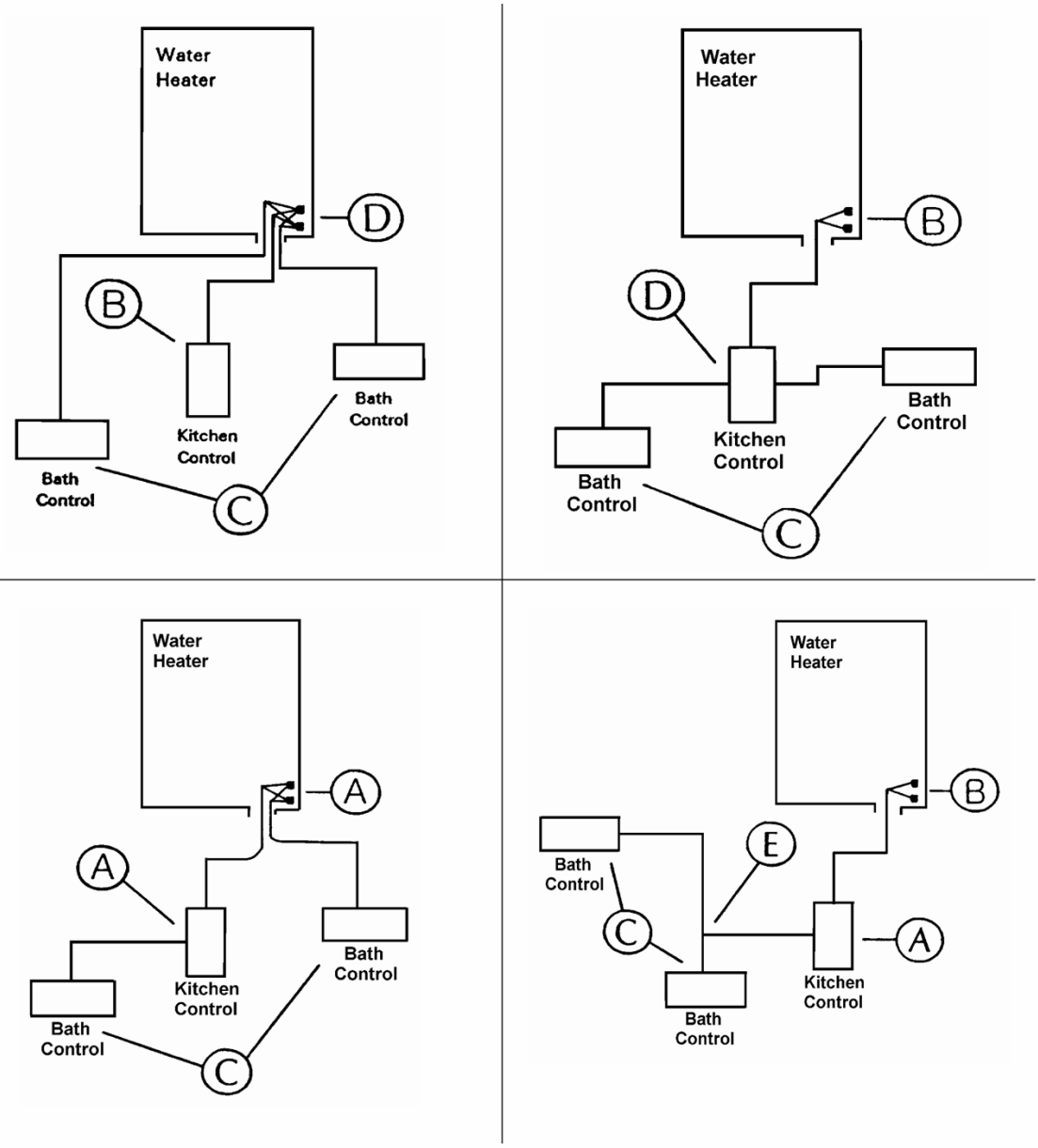
Suggested Connection Methods for Remotes

There must be at least one cable from the remote control(s) connected to the Continuum water heater. Power for the remote(s) is supplied from the PC board. On the front of the PCB, there are two screws labeled terminal, this is the 12VDC digital power supply for the remotes.

Connections



The following diagrams show methods of connection.



6. Safety Devices

Flame Failure

Situated to the right of the burner in the front of the combustion chamber, the flame rod monitors the combustion process. This sensor monitors the flame intensity, while the PCB compares this signal to the feed back signal from the combustion fan motor, water flow control, and gas flow through the POV valve. If any one of these feedback signals are incorrect, the unit will shut off, preventing discharge of gas to the burner.

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 to the burner after the tap is closed, and the water temperature inside the heat exchanger reaches 194 ° F a 12 volt DC bi-metal cut-off switch, will shut off the gas supply to the solenoids.

No Water

Should the incoming water flow become restricted or stop, the water flow sensor will cease to send a magnetic pulse signal to the PCB, in turn preventing gas to flow into the combustion chamber. If you have restricted flow, first check to ensure the inline water filter is not clogged up.

Thermal Fuse

Wrapped around the entire surface of the heat exchanger you will find a thermal fuse. This device activates in the event the heat exchanger burns out, or the temperature outside the heat exchanger reaches 279 °F. If the thermal fuse melts, it breaks an electronic circuit which in turn shuts off the power supply to the gas solenoids, shutting the unit off.

Combustion Fan Revolution Check

The combustion fan rpm's are continually monitored by a magnetic pulse generator 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 adjust accordingly. (If not the unit shuts down)

Automatic Frost Protection

When the temperature inside the appliance drops below 37 °F , the frost sensing device inside the appliance activates the anti-frost heaters, to prevent the water inside the unit from freezing. The anti-frost heaters remain ON until the temperature inside the appliance rises to 57 °F. There are four (16) watt anti-frost heaters located at various points throughout the main water flow area of the appliance. The unit also incorporates the ability to fire for (3) seconds in the event the anti-frost heaters can not keep the water temperature from dropping below 37 °F. This unique feature will heat the water in the lines inside the appliance back up to 57 °F**.** ***Both of the above features function as long as the unit has power.*** There is

an optional freeze protection system that can be added to the unit's piping, that will dump water out of the unit in the event of a power failure. See owner's manual for details on this system.

5 °F 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 5 °F 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.

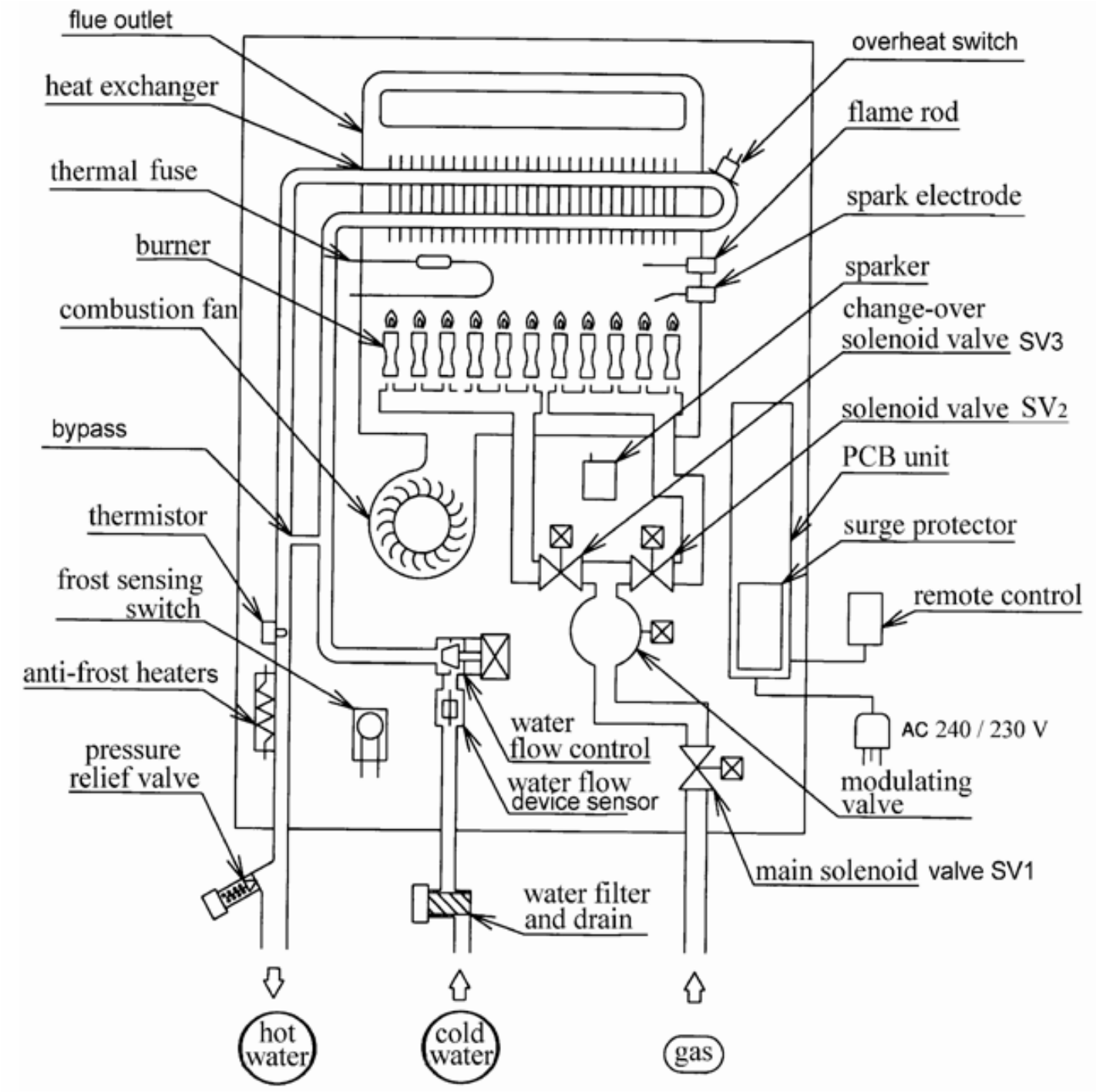
7. Specification

Type of appliance	Temperature controlled continuous flow gas hot water system	
Operation	With or without remote controls, mounted in Kitchen, bathroom, or laundry room	
Exhaust system	Forced combustion	
Rinnai model No.	REU-2424-W	REU-2424-WC
Minimum gas rate	19,000 BTU's	
Maximum gas rate	180,000 BTU's	
Hot water capacity	0.6 – 6.5 gals./min. unmixed @ 50°F rise 2.95 gals./min. unmixed @ 100°F rise	
Default temperature (without remote) Set using switches on PCB	108, 120, 130, 140, 150, 160, 170, or 180°F	
Temperature range (with remotes connected)	96 – 120 °F with the BC and BSC control(s) 96 – 140 °F with the MC control, 96°F - 180°F with the MCC control (2424C model only)	
Factory default temperature	REU-2424-W set at 120°F	REU-2424-WC set at 140°F
Approved gas types	Propane: Natural:	
Installation	External	
Dimensions	Height 13 ¾" Width 23 ¾" Depth 6 ¾"	
Weight	44 Lbs.	
Efficiency rating	82 %	
Noise level	49 dB (A)	
Connections	Gas supply ¾" MNPT Cold water inlet ¾" MNPT Hot water outlet ¾" MNPT	
Ignition system	Direct electronic ignition	
Electrical consumption	Normal 55 watts Standby 8 watts Anti-frost protection 80 watts	
Water temperature control	Simulation feedforward and feedback	
Water flow control	Water flow sensor and automatic electro-mechanical water flow control device	
Normal operating pressures (water)	20 – 174 PSI	
Power supply	Appliance 120 VAC, 60 Hz. Remote control(s) 12 VDC digital	
Safety devices	Flame failure – Flame rod Boiling protection 203 °F lockout thermistor (25 seconds) Remaining flame (OHS) 194 °F bi-metal switch Thermal fuse 279 °F Automatic frost protection – Bi-metal sensor & anti-frost heaters Combustion fan rpm check – Integrated circuit Over current – two 3 amp glass fuses	
Remote control(s)	MC-45-3US BC-45-3US BSC-45-3US	MCC-45-3US
Remote cable	Non polarized two-core cable	

8. Cut – away Diagram

REU2424

9. Schematic Diagram



10. Combustion Specifications

	Gas type	Firing rate	Measurement	REU-2424-W/WC
Input	Natural	Low fire High fire	BTU/H BTU/H	19,000 180,000
Input	Propane	Low fire High fire	BTU/H BTU/H	19,000 180,000
Gas consumption	Natural Propane	Low fire High fire	KW	5.93 52,3
Integral Injector size	Natural Propane		MM	Ø 1.7 mm (0.067") Ø 1.0 mm (0.039")
Manifold Gas Pressure	Natural	Low fire High fire	W.C.	0.43" 5.3"
Manifold Gas Pressure	Propane	Low fire High fire	W.C.	0.59" 8.7"
Damper	Natural Propane			NIL A
Burner type	Nat./L.P.			Bunsen burner
Dip switches	Contact Rinnai before setting or changing any switches			

Contact Rinnai for dip switch settings when changing PC board or setting up unit for special applications. Failure to set dip switches to the proper position, will result in damage to the unit, property damage, personal injury or death. <u>DO NOT</u> adjust dip switches unless you have written permission from Rinnai. Call 1(800)621-9419 to set-up a special training class pertaining to dip switch functions.

Maximum Capacity

Modulating Valve (mA)	Natural Propane	mA	147 229	147 229
Combustion Fan (Hz.)	Natural Propane	Hz.	264 272	264 272

Minimum Capacity

Modulating Valve (mA)	Natural Propane	mA	20 20	20 20
Combustion Fan (Hz.)	Natural Propane	Hz.	96 87	96 87

Slow Ignition

Modulating Valve (mA)	Natural Propane	mA	91 152	91 152
Combustion Fan (Hz.)	Natural Propane	Hz.	160 160	160 160

12. Water Flows

A simple calculation of the water flow rate, in gallons per minute, can be made using the chart on the next page, or simply using formula provided below. The chart on the following page indicates the water flow from the Continuum at various temperature rises up to a 140 degree rise.

a. How to read the charts:

The vertical plane indicates water flow in gallons per minute, and the horizontal plane indicates the temperature rise. The chart shows flow rates up to a 140 degree rise. Therefore, the water flow chart can be used to help you size your applications, if you know the temperature rise needed. The temperature rise is the difference between the temperature of the incoming water and the selected temperature at the remote control(s). Another name used in place of temperature rise, is delta T.

Select the appropriate temperature rise. Draw a vertical line up the graph from the selected temperature rise until it intersects the curve. The point at where these lines intersect indicates flow at that temperature rise.

b. How to calculate water flows:

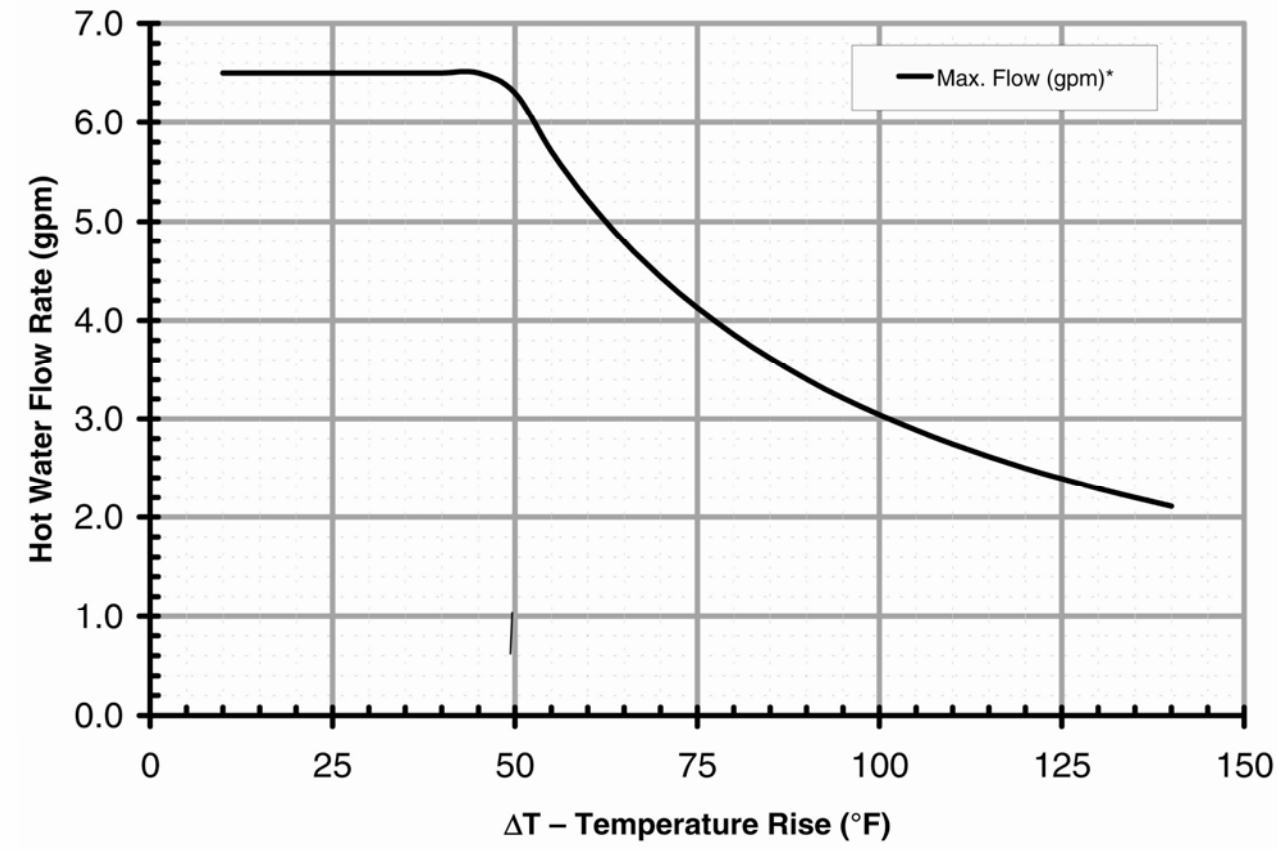
The following information is an outline of the formula required to measure accurately the flow rate in gallons per minute, as well as being the base for the chart on the next page. The most useful way in which this formula can be utilized, is to calculate the water flow rate where there is maximum gas input of 180,000 BTU's.

EXAMPLE:

BTU's ÷ ΔT x 500 = GPM's
GPM's = (180,000 BTU's x .82 efficiency rating) ÷ ΔT x 500
GPM's = 147,600 ÷(Requested water temperature – incoming water temperature) x 500
GPM's = 147,600 ÷ (120 °F requested – 65 °F incoming) x 500
GPM's = 147,600 ÷ (55 °F delta T x 500)
GPM's = 147,600 ÷ 27,500
GPM's = 5.367

Unmixed Water Flows for REU-2424

The chart below can be used to determine water flow rates in “gallons per minute” at a given temperature rise. In order to figure flow rates, you need the following information; requested water temperature and inlet water temperature Next, subtract the inlet water temperature from the requested temperature to get your delta T or temperature rise. Then, locate your temperature rise at the bottom of the chart. Follow that line vertically until it intersects with the flow rate line to the right. This indicates the flow rate at your temperature rise.

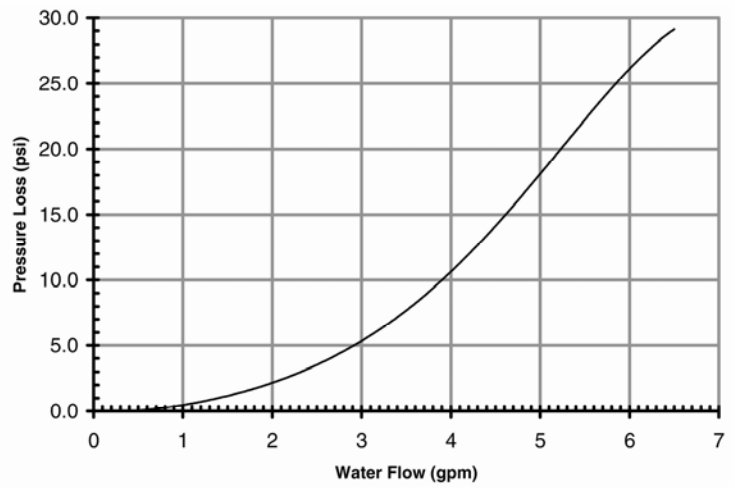


12. Main Components

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 graph shows that maximum flow is approximately 6.5 gallons per minute for the Continuum. This maximum flow is reached at 29 PSI inlet pressure respectively.

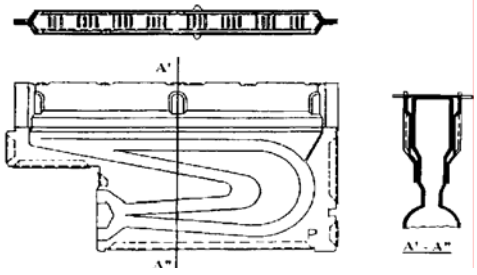


2. Preset Bypass

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

3. Burner

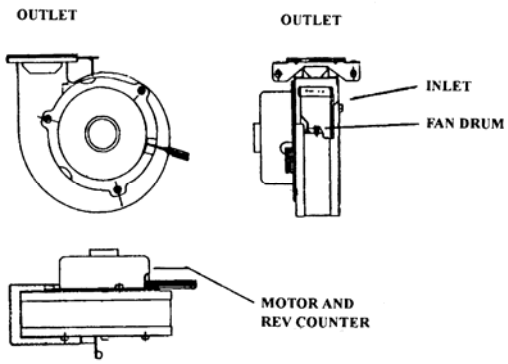
The burner assembly is made up of 18 identical stainless steel Bunsen burners, secured by an aluminized steel framework. An aluminum manifold with 18 integral injectors supplies gas to the burners, and is attached to the front lower cover of the burner box and Change Over Solenoid.



4. Changeover Solenoid Valve

The changeover solenoid increases the flexibility of the regulator/modulating valve by supplying gas to the right hand size of the burner only, (up to 40% of the total BTU load) or both sides of the burner from 40 to 100% of the total BTU load, through the tandem manifold.

5. Combustion Fan



Air for the 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.

1. The fan speed is constantly correcting 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.

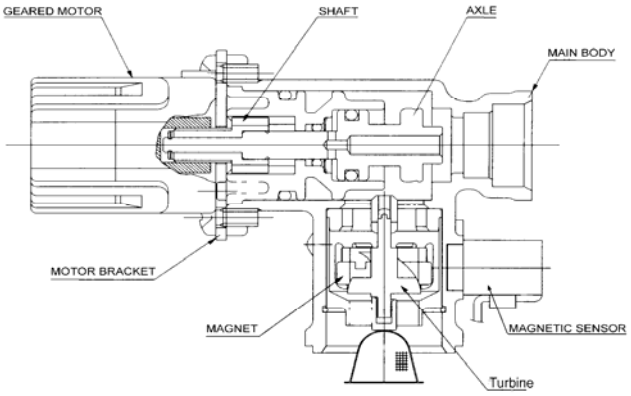
The reason for controlling the opening degree of the modulating gas valve based upon data from the combustion fan is that, the gas valve is able to react much more quickly to a change in control signal than the combustion fan is. Controlling the gas valve based upon data from the combustion fan means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

1. Water Flow Sensor and Water Flow Control device

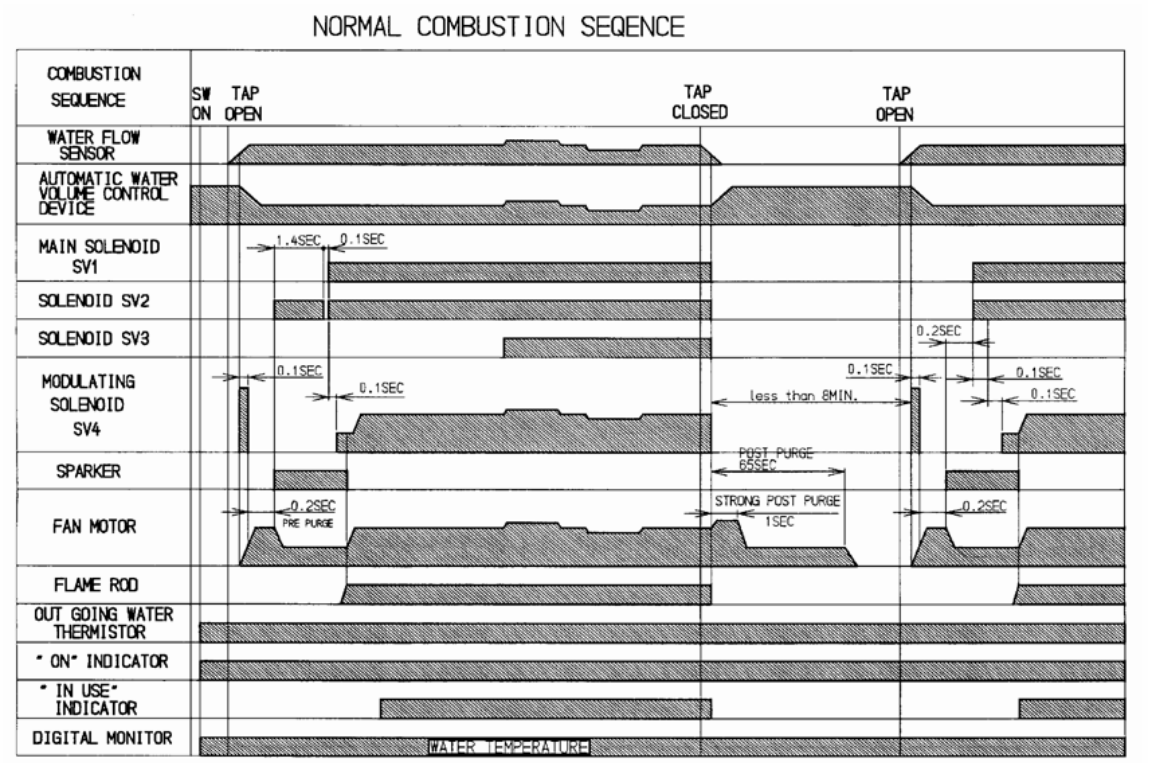
Water flow is detected by a turbine/magnetic pulse generating device. Water flows through the turbine/magnetic sensor providing information to the PCB by generating a pre-determined number of pulses in proportion to the water flow. These pulses are counted by the PCB – no pulse indicates no water flow.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

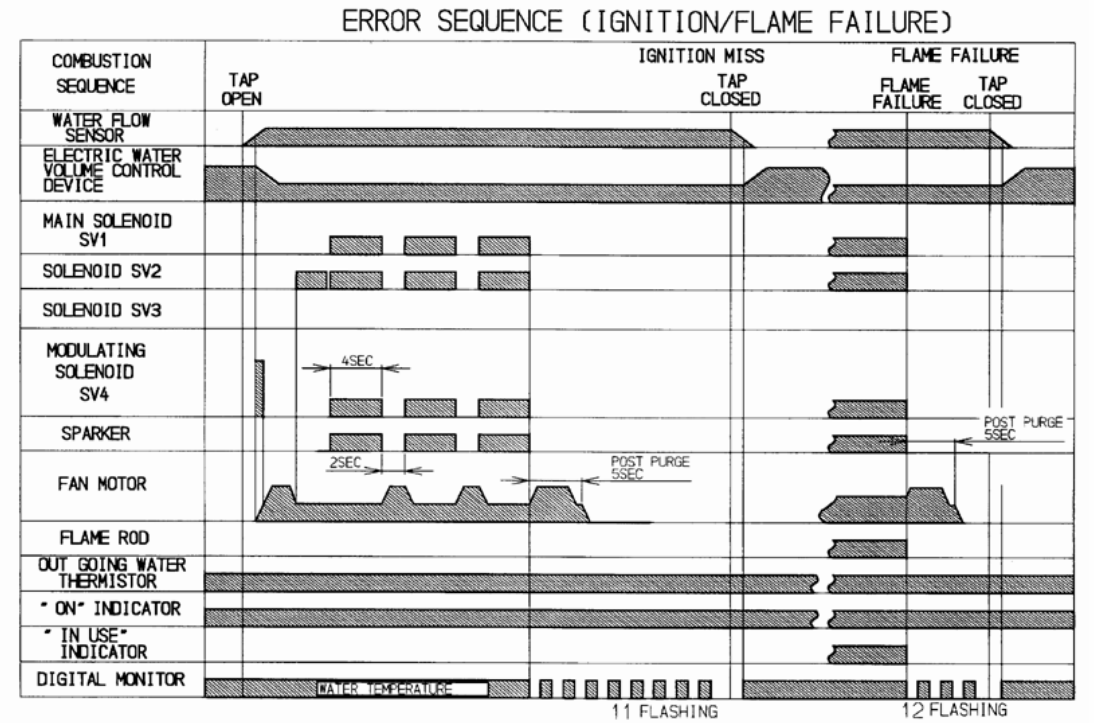
REU-2424 units have an automatic water flow control device.



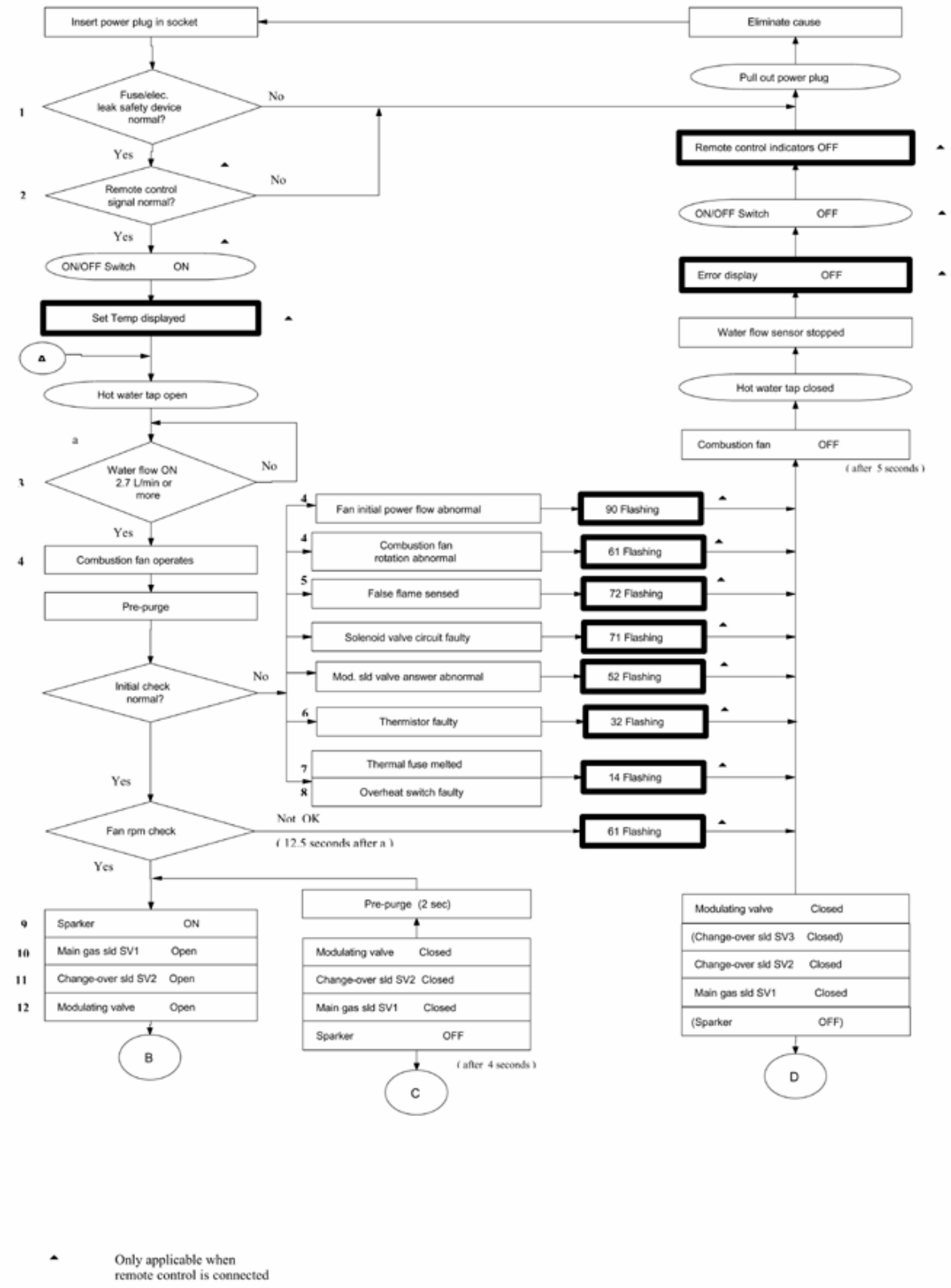
13. Time Charts (External Unit)



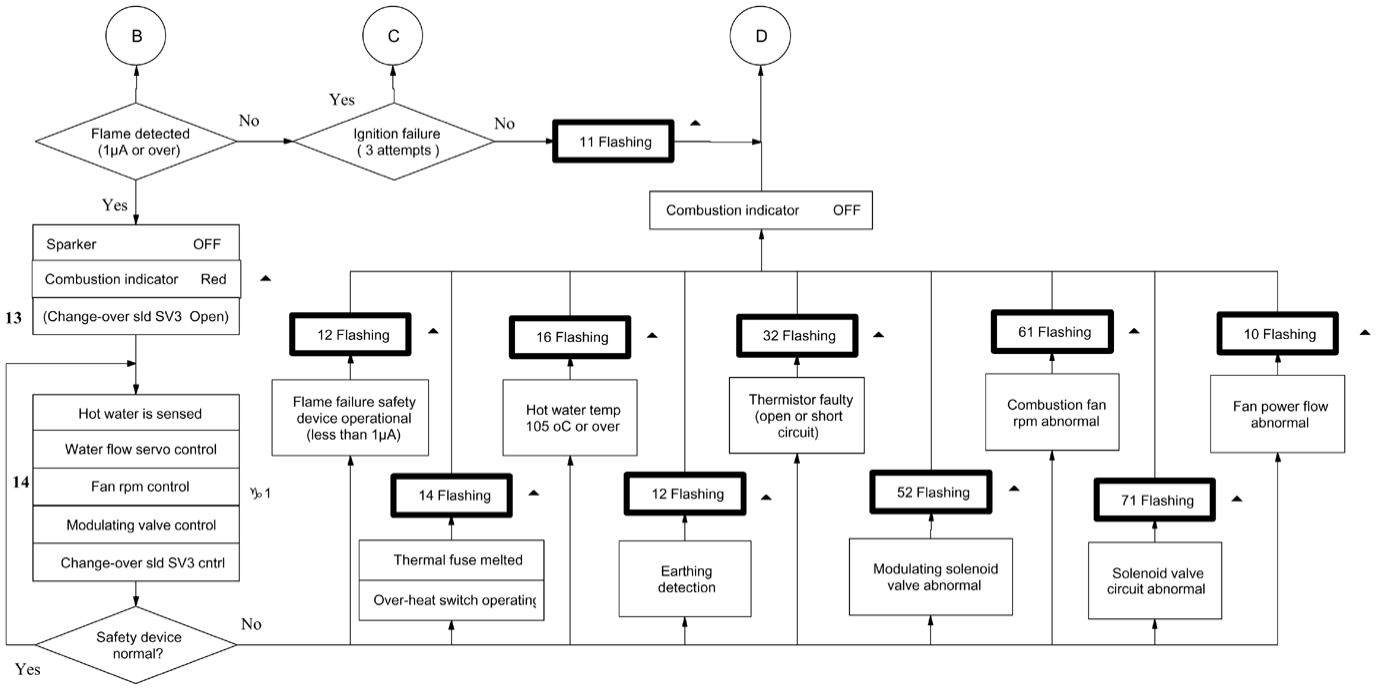
Error Sequence (Ignition / Flame Failure)



14. Operation Flow Principle



▲ Only applicable when remote control is connected


B
C
D
Flame detected (1μA or over)
No
Yes
Ignition failure (3 attempts)
Yes
No
11 Flashing
Combustion indicator OFF
Yes
Sparker OFF
Combustion indicator Red
13
(Change-over sld SV3 Open)
12 Flashing
Flame failure safety device operational (less than 1μA)
16 Flashing
Hot water temp 105 oC or over
32 Flashing
Thermistor faulty (open or short circuit)
61 Flashing
Combustion fan rpm abnormal
10 Flashing
Fan power flow abnormal
Hot water is sensed
Water flow servo control
14
Fan rpm control
Modulating valve control
Change-over sld SV3 cntrl
14 Flashing
Thermal fuse melted
Over-heat switch operating
12 Flashing
Earthing detection
52 Flashing
Modulating solenoid valve abnormal
71 Flashing
Solenoid valve circuit abnormal
Safety device normal?
No
Yes

15. Operation Principles

The preset temperature is selected at one of the remotes controls (where fitted). Where no remote control is fitted , the default temperature can be set at 108, 120, 130, 140, 150, 160, 170, or 180 °F. To select one of the above temperatures as your default setting, you **MUST** obtain written permission and training from Rinnai.

When the unit is first plugged into 120 volts, The PCB assumes an incoming water temperature of 77 °F, this prevents the appliance from starting in “High fire”, 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.

The 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 heater 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 predetermined 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.

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 key pads.

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 valve 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 during or after ignition	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
12	Faulty ground	Does not operate	X	X	X	X	X
90	Fan (air) failure	Does not operate	X	X	X	X	X
10	Fan current abnormal	Operates, then stops	X	X	X	X	X
52	Modulating Solenoid valve signal abnormal	Operates, then stops	X	X	X	X	X

Notes

1. **Digital monitor does not illuminate, (key pads) when system is switched ON, or display drops out while the appliance is in operation.**

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

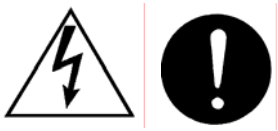
2. **Appliance operates however symptoms remain, with digital display dropping out and error code message is flashing.**

   - Isolate potentially faulty components using the component analysis table on page #41 through #45.

17. Diagnostic Points

Flow Chart is on page #22

Wiring Diagram is on page #28



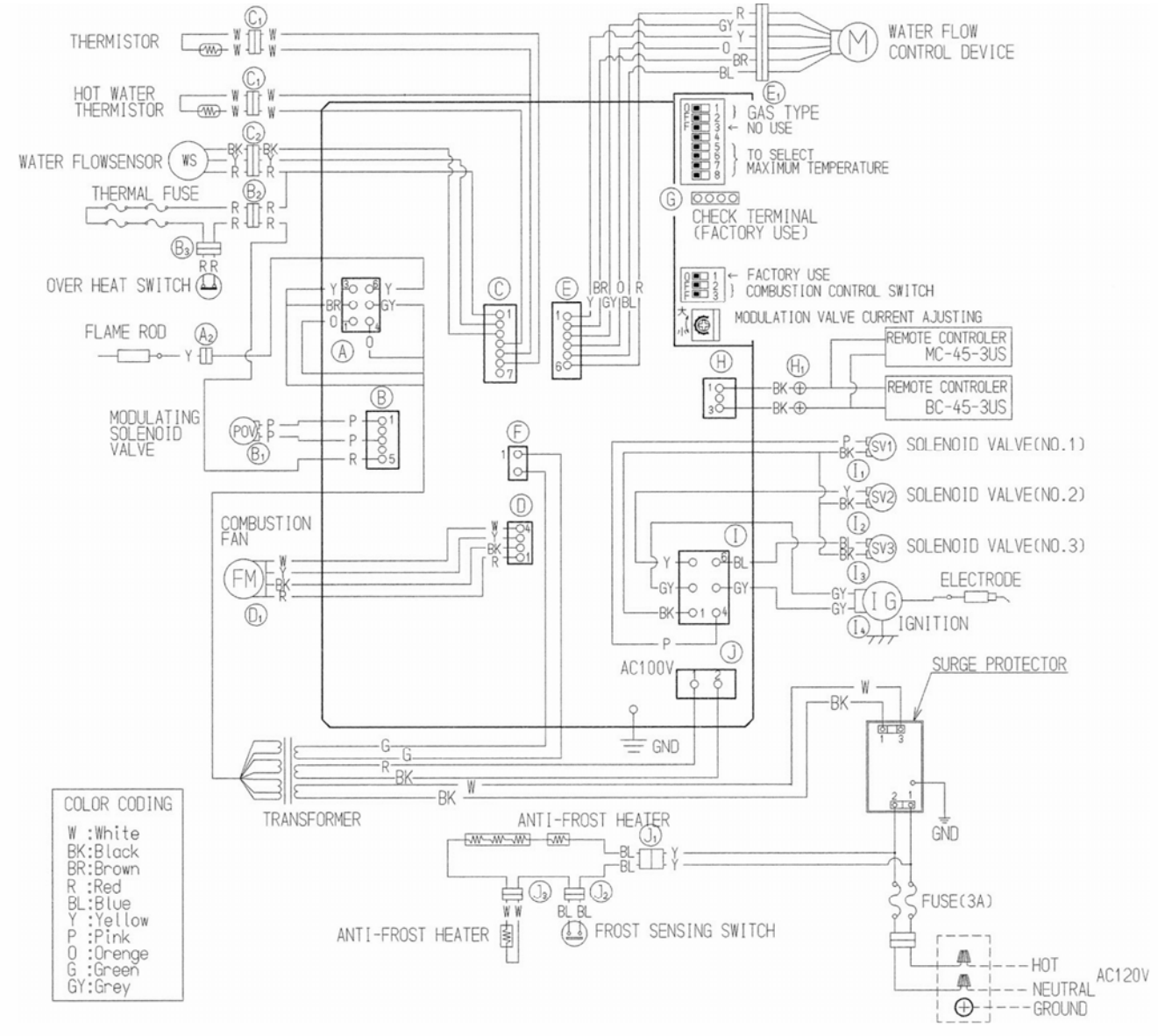
Flow Chart N°.	Measurement Point		Normal Value	Component
	Con. N°.	Wire Color		
1	N/A	Brown ~ Blue	100 ~ 128 VAC	Surge Protector
2	H_1	Black ~ White	10 ~ 13 VDC	Remote Control
3	C_2	Red ~ Black	11 ~ 13 VDC	Water Flow Sensor
		Yellow ~ Black	2 ~ 10 VDC	
4	D	White ~ Black	2 ~ 9 VDC	Combustion Fan Motor
	D	Red ~ Yellow	60 ~ 350 Hz.	
5	A_2	Yellow ~ Ground	100 ~ 160 VAC (over 1μ amp)	Flame Rod
6	C_1	White ~ White	Temperature resistance 59 °F = 11.4 ~ 14 KΩ 86 °F = 6.4 ~ 7.8 KΩ 113 °F = 3.6 ~ 4.5 KΩ 140 °F = 2.2 ~ 2.7 KΩ 221 °F = 0.6 ~ 0.8 Ω	Thermistor
7	B_2	Red ~ Red	Below 1Ω	Thermal Fuse
8	B_3	Red ~ Red	Below 1Ω	Over-heat Switch
9	I	Grey ~ Grey	90 ~ 110 VAC	Sparker
10	I_1	Pink ~ Black	80 ~ 100 VDC 0.9 ~ 1.3 KΩ	Solenoid Valve (SV1)
11	I_2	Yellow ~ Black	80 ~ 100 VDC 1.3 ~ 1.9 KΩ	Solenoid Valve (SV2)
12	B_1	Pink ~ Pink	0.5 ~ 25 VDC 60 ~ 100 Ω	Modulating Valve (POV)
13	I_3	Blue ~ Black	80 ~ 100 VDC 1.3 ~ 1.9 KΩ	Solenoid Valve (SV3)
14	E_1	Red ~ Blue	11 ~ 13 VDC	Stepping Motor
		Orange ~ Grey		

Transformer Voltage and Resistances

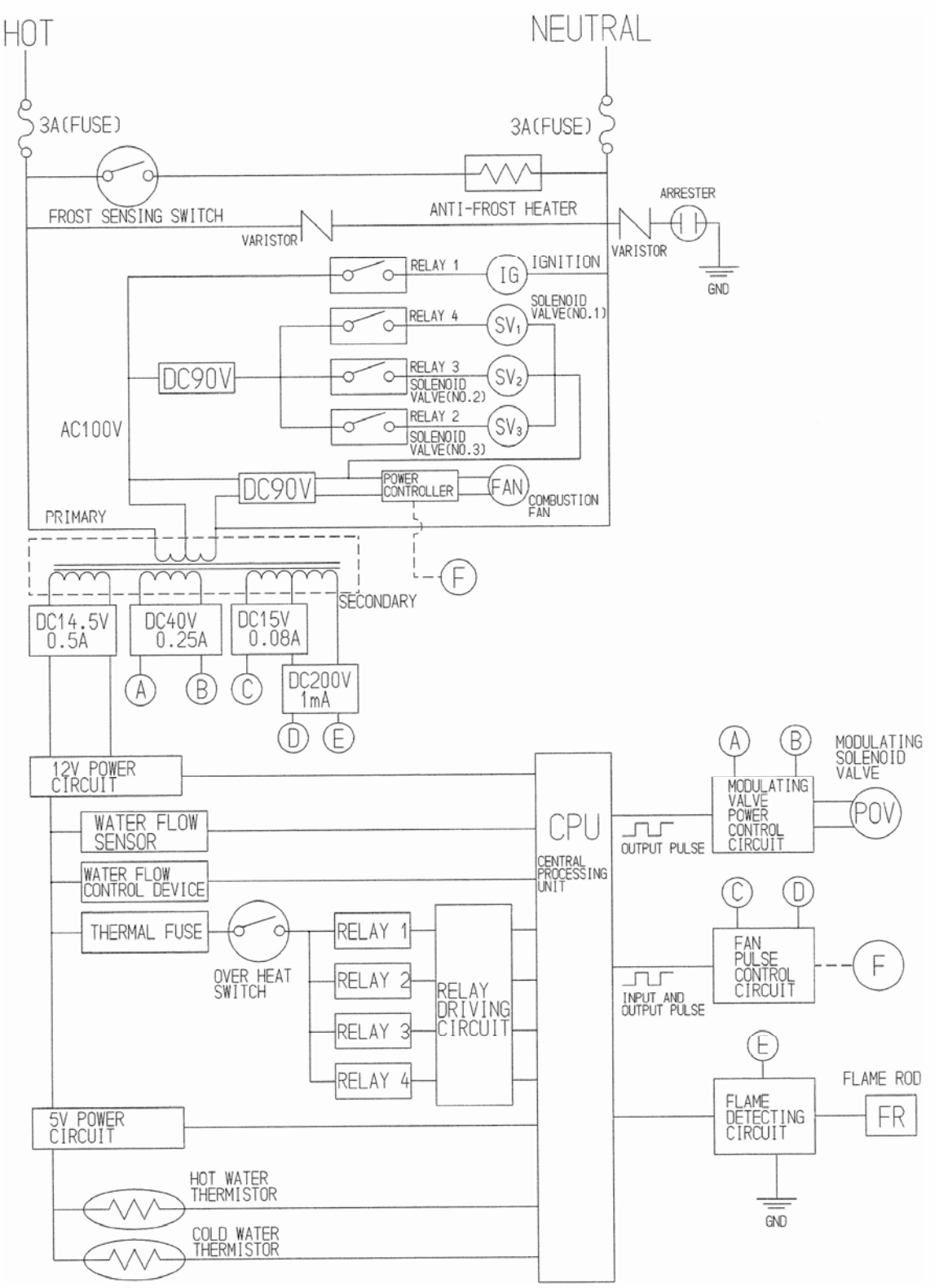
Connector	Wire Color	Normal Valve
J	Black ~ Red	90 ~ 110 VAC 19 ~ 24 Ω
F	Green ~ Green	16 ~ 20 VAC 3.5 ~ 4 Ω
A	Orange ~ Orange	13 ~ 30 VAC 1.0 ~ 1.4 Ω
A	Brown ~ Grey	30 ~ 50 VAC 3.2 ~ 3.7 Ω
A	Yellow ~ Grey	180 ~ 220 VAC 237 ~ 260 Ω
Surge Protector	Black ~ White	110 ~ 125 VAC 21 ~ 26 Ω

18. Wiring Diagram

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



18. Block Diagram

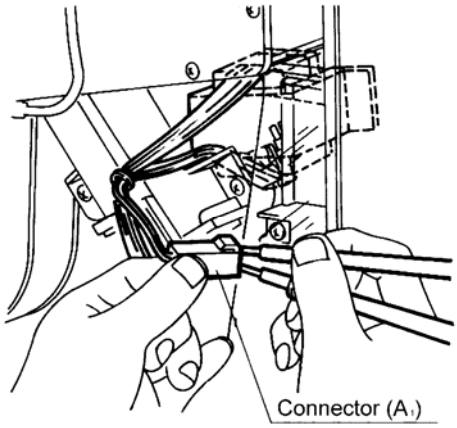


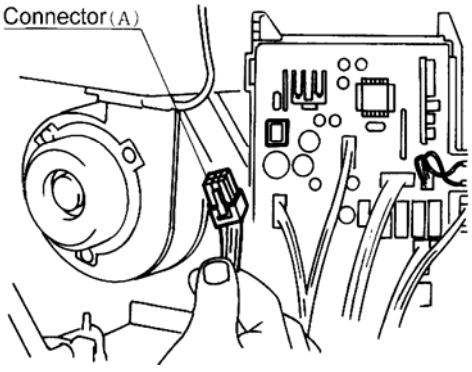
19. Fault Diagnosis

Before carrying out checks marked with a # sign, disconnect power source.
Wiring diagram is on page #28

<table>
<tr><th colspan="2">Appliance fails to operate (even remote control fails to operate).</th></tr>
<tr><td colspan="2">1) Is the fuse blown</td></tr>
<tr><td>Fuses are located in plastic holders in the main harness, on the lower right hand side of the appliance.</td><td>Check fuse.

a. Disconnect unit from power supply.
b. # Measure resistance to check the electric fuse (3 amp)

Normal: less than 1Ω
If normal, proceed to check item 2 below.
Faulty: Replace 3 amp grass fuse. If the fuse blows again, investigate cause of short circuit.</td></tr>
<tr><td colspan="2">2) Is the main transformer normal ?</td></tr>
<tr><td> 


</td><td>Check the transformer.

a. Measure the voltage and/or resistance at connector J, black ~ red wires.

Normal: 90 ~ 120 VAC
19 ~ 24 Ω resistance

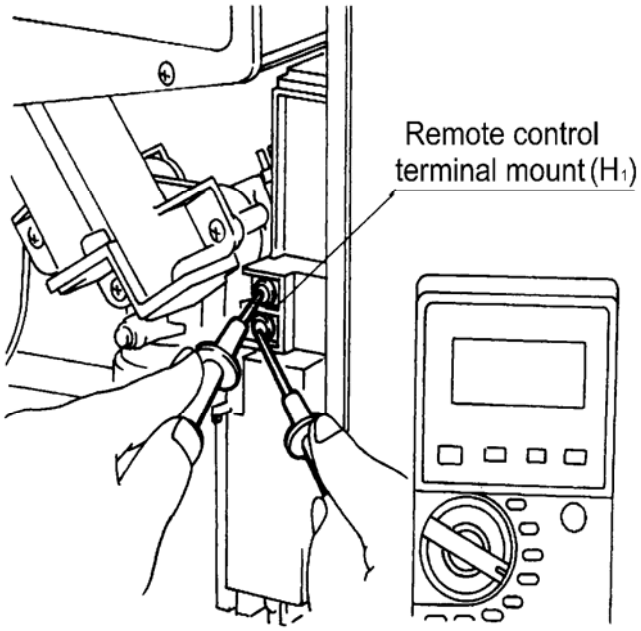
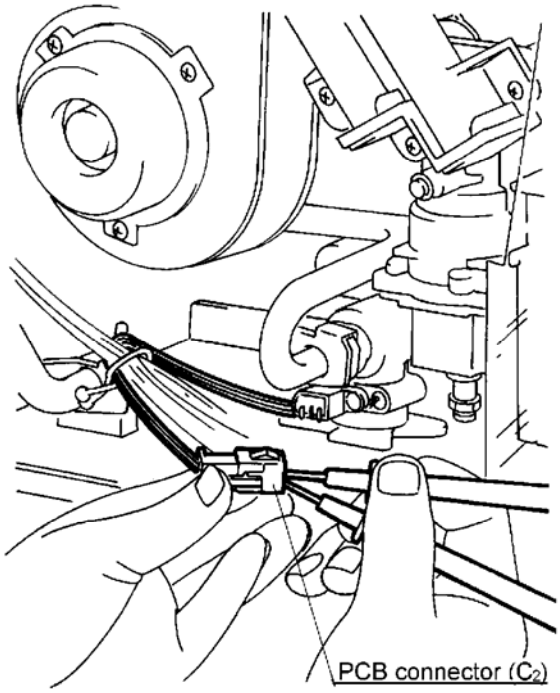
Faulty: Check for 120 – 125 VAC at the surge protector, black ~ white wires.
Resistance reading 21 ~ 26 Ω

b. Check voltages below at upper PCB connector A.
Normal: Orange ~ Orange = 13 ~ 30 VAC
1.0 ~ 1.4 Ω

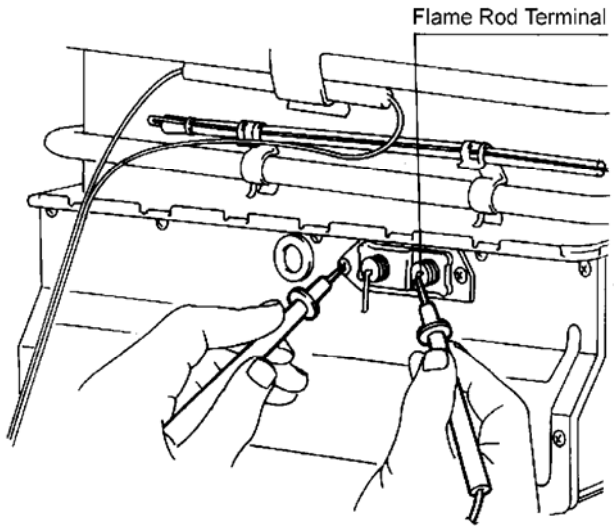
Brown ~ Grey = 30 ~ 50 VAC
3.2 ~ 3.7 Ω

Yellow ~ Grey = 180 ~ 220 VAC
237 ~ 260 Ω

If normal, check item 3 on next page.
Faulty: Replace the transformer.</td></tr>
</table>

Refer to diagram on bottom of Previous page.	c. Check the voltage at the center PCB connector F, green ~ green wires. *Normal:* 16 ~ 20 VAC or 3.5 ~ 4 Ω If normal, check item 3 below. *Faulty:* Replace the transformer. *Note:* The transformer voltage above applies to the appliance in a standby, non-functional state.
3) Is the remote control normal ?	
	Check voltage between the two remote control cable connectors. a. Check the voltage between terminals on the remote control terminal mount H_1. *Normal:* 10 ~ 13 VDC If normal, check for an open circuit or short before replacing the remote control. *Faulty:* Replace PCB.
No combustion (despite remote control indication)	
1) Is the water flow sensor normal ?	
	Check the water flow sensor. a. Check the voltage at PCB connector C_2, red and black wires. *Normal:* 11 ~ 13 VDC or 7.4 ~ 7.8K Ω If normal, check (b) below. *Faulty:* Replace the PCB. b. Check the voltage at PCB connector C_2, yellow and black wires. *Normal:* 2 ~ 10 VDC or 940 ~ 980K Ω. If normal, proceed to check item 2 on next page. *Faulty:* Replace the water flow sensor.

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

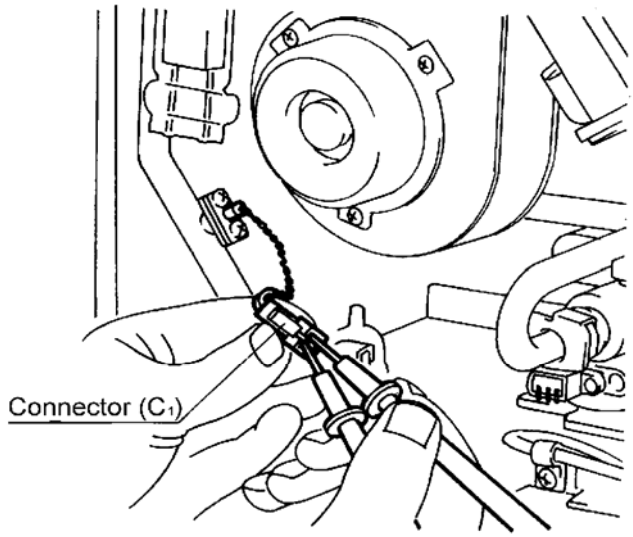


Checking the flame rod.

a. # Detach the flame rod terminal A_2, and re-attempt operation.
("72 is displayed)
Proceed to check item 3 below.
(no "72" displayed)
Inspect flame rod wiring for current leak and inspect flame rod for carbon build-up.

Measure resistance between the 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.

3) Is the water temperature thermistor normal ?

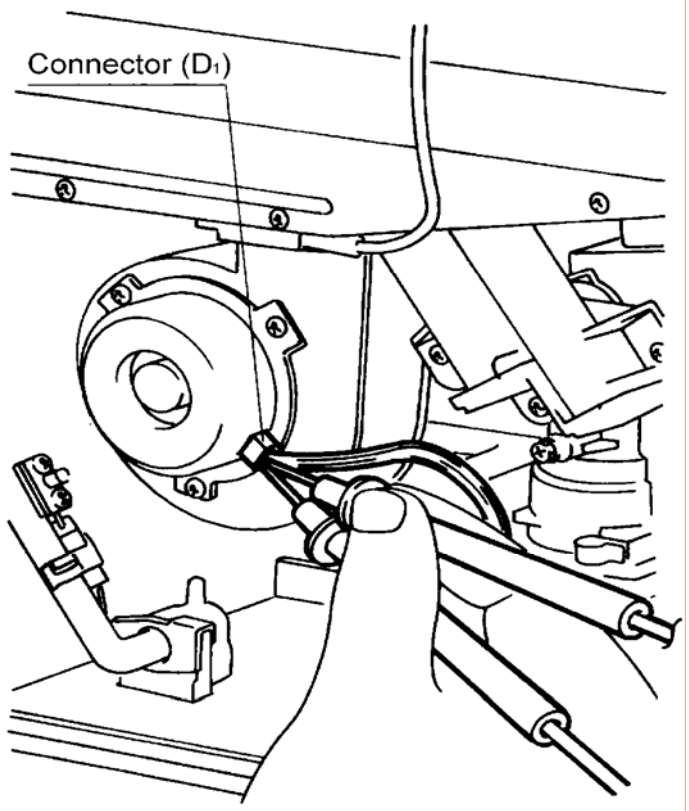


If error "32" is displayed, check the water temperature thermistor.

a. # Disconnect connector C_1, and measure resistance of the white ~ white wires.

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

4) Is the combustion fan normal ?



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

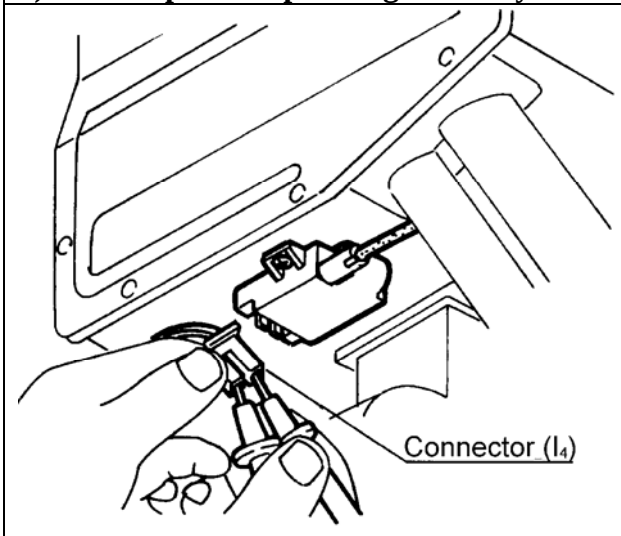
a. Measure voltage at connector D_1. Black and red wires.
Normal: 6 ~ 40 VDC (Fan on)
0 VDC (Fan off)
If normal, check item b below.
Faulty: Replace the PCB unit.

Fan revolution sensor check.

b. Measure voltage at connector D_1, black and yellow wires.
Normal: 11 ~ 13 VDC or 2 ~ 2.3 KΩ
If normal, check item b below.
Faulty: Replace the PCB unit.

c. Measure voltage at connector D_1, black and white wires.
Normal: 2 ~ 9 VDC or 7.8 ~ 8.1 KΩ
If normal, proceed to check item 5 below.
Faulty: Replace the combustion fan motor.

5) Is the sparker operating normally ?

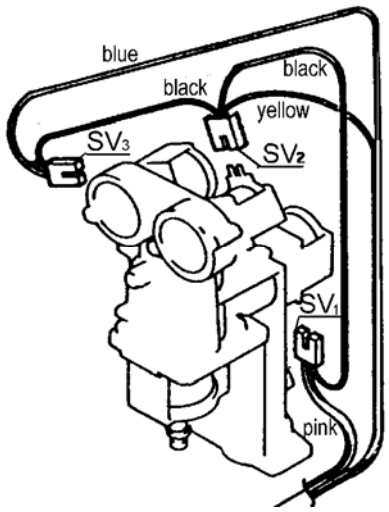


Check the sparker module.

a. Measure voltage at connector I_4, grey and grey wires.
Normal: 90 ~ 110 VDC
0 VDC (when fan is off)
If normal, check b below.
Faulty: Replace the PCB unit.

b. # Disconnect connector I_4, and measure the resistance between the two sparker terminals.
Normal: > 1 MΩ
If there is no spark, adjust or replace the electrode. The sparker gap should be $^3/_{16}$" to $^1/_4$" .
Faulty: Replace the sparker.

6) Is the main gas solenoid valve (SV1) operating normally ?

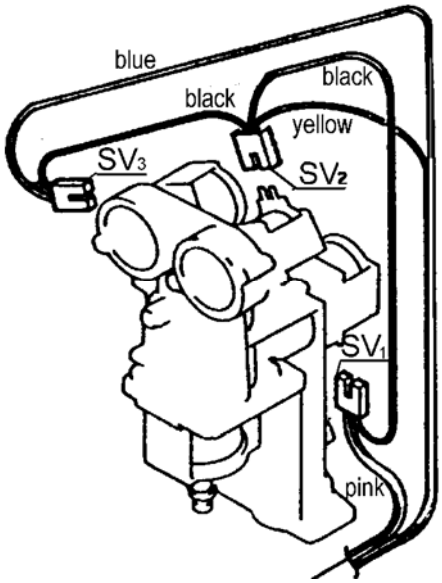


If error "11" is displayed, check the main gas solenoid valve.

a. # Disconnect the main gas solenoid valve (SV1) connector and measure the resistance at the solenoid terminals.
Normal: 1 ~ 1.6 KΩ
If normal, check b below.
Faulty: Replace the main gas solenoid valve.

b. Measure voltage at the main gas solenoid (SV2) Yellow and black wires.
Normal: 80 ~ 100 VDC
If normal, proceed to check item 7 below.
Faulty: Replace PCB unit.

7) Is the change over solenoid (SV2) operating normally ?

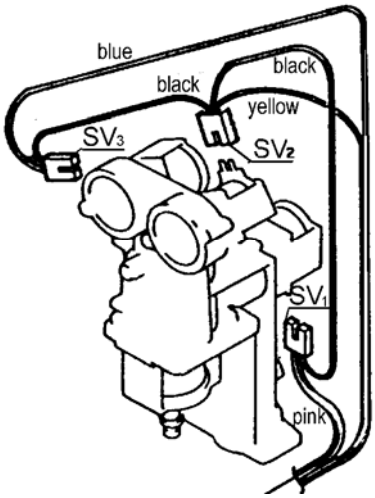


If error "11" is displayed, check the change over solenoid (SV2).

a. # Disconnect the change over solenoid (SV2) connector, and measure resistance at the solenoid terminals.
Normal: 1.3 ~ 1.9 KΩ
If normal, check b below.
Faulty: Replace the change over solenoid (SV2).

b. Measure voltage at the change over solenoid (SV3) blue ~ black wires.
Normal: 80 ~ 100 VDC
If normal, check 9 below.
Faulty: Replace PCB unit.

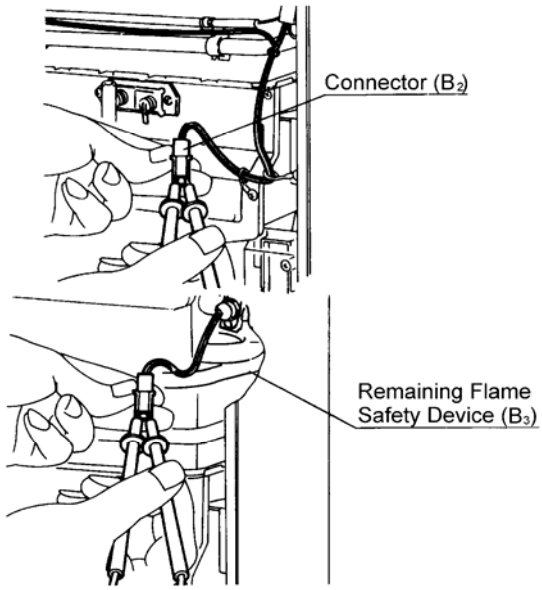
8) Is the change over solenoid (SV3) operating normally ?



a. # Disconnect the changeover solenoid (SV3) connector, and measure the resistance at the solenoid terminals.
Normal: 1.3 – 1.9 KΩ
If normal, check b below.
Faulty: Replace the changeover solenoid (SV3).

b. Measure the voltage at the changeover solenoid (SV3), blue – black wires.
Normal: 80 – 100 VDC
If normal, check 9, on next page.
Faulty: Replace the PCB unit.

Are the safety devices operating normally ?



Check the thermal fuse.

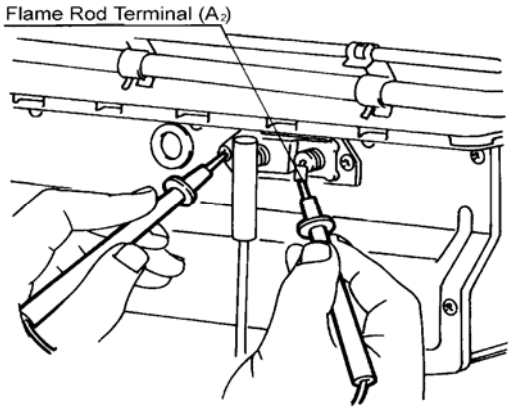
a. # Disconnect connector B_2, and measure the resistance between the red – red wires.
Normal: Less than 1Ω
If normal, replace the PCB unit.
Faulty: Check the appliance for damage. If there is nothing abnormal, replace the thermal fuse.

Check the remaining flame safety device

b. Measure resistance between the two terminals B_3.
Normal: 100 – 160 VAC
If normal, replace the PCB unit.
Faulty: Replace the remaining flame safety device.

Combustion stops due to flame failure

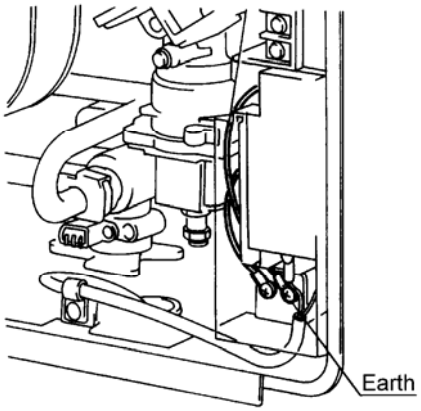
1) Is the flame rod functioning normally ?



a. Measure the voltage between the flame rod terminal A_2 and the appliance earth.
Normal: 100 – 160 VAC.
If normal, check b below.
Faulty: Replace the PCB unit.

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

2) Is the earth lead wire connected ?

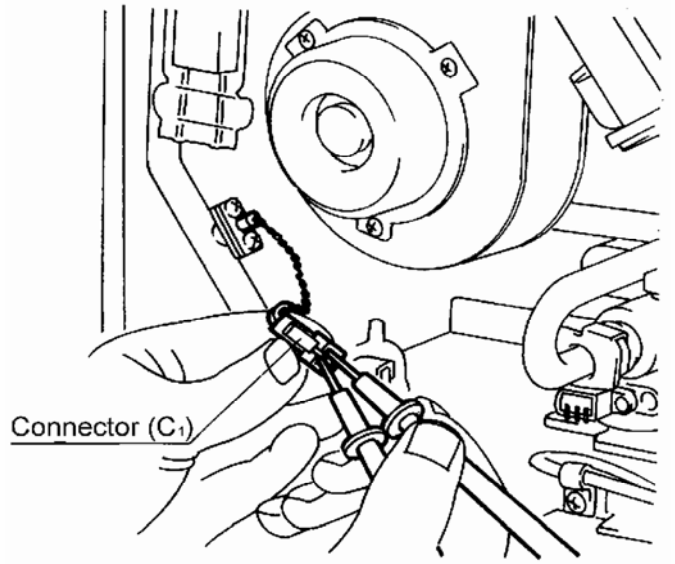


a. Check for defective earth terminal, or an open circuit or short. If normal, investigate other possible causes for the flame failure.
(Eg. Is the gas cock open ? Is the filter mesh blocked ?)

Faulty: Ensure unit is properly grounded. Check ground circuit outside home at service pole. There should be an eight foot ground rod driven in the earth and a copper lead tied to the service meter. Ensure connection on ground rod is tight.

Unable to adjust hot water temperature

1) Is the water temperature thermistor operating normally ?

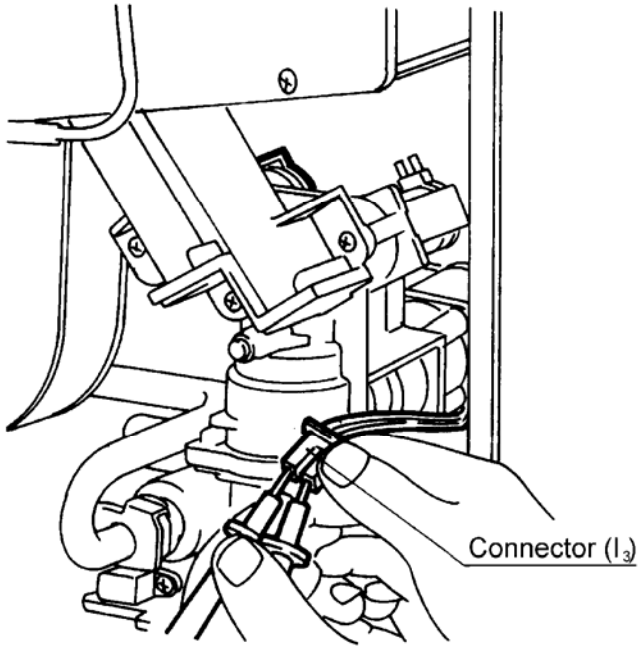


a. # Disconnect the connector C_1, and measure the resistance between the white wires, see below for resistance readings.

Thermistor resistance valves:
59 ºF = 11.4 ~ 14 KΩ
86 ºF = 6.4 ~ 7.8 KΩ
113 ºF = 3.6 ~ 4.5 KΩ
140 ºF = 2.2 ~ 2.7 KΩ
221 ºF = 0.6 ~ 0.8 Ω

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

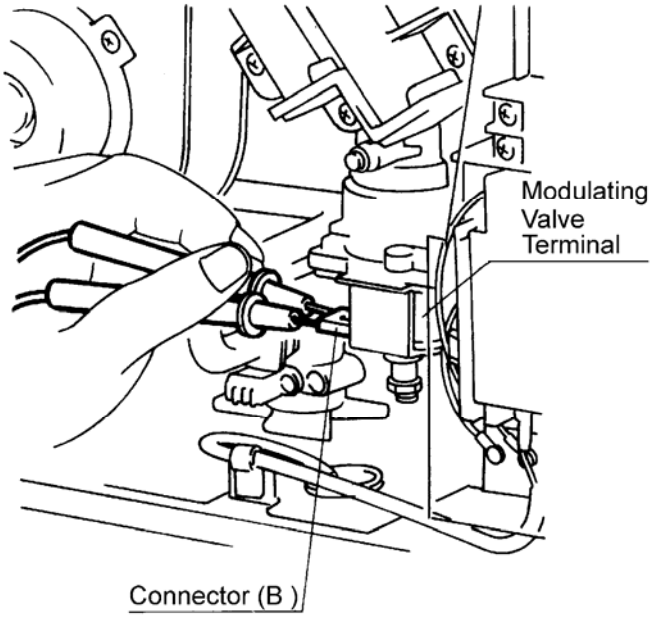
2) Is the change over solenoid (SV3) normal ?



a. # Disconnect the changeover solenoid (SV3) connector, and measure resistance at the solenoid terminals.
Normal: 1.3 ~ 1.9 KΩ
If normal, proceed to b.
Faulty: Replace the changeover solenoid (SV3).

b. Measure the voltage at the changeover solenoid (SV3) blue ~ black wires.
Normal: 80 ~ 100 VDC
If normal, proceed to check item 3, on next page.
Faulty: Replace the PCB unit.

3) Is the modulating valve operating normally ?

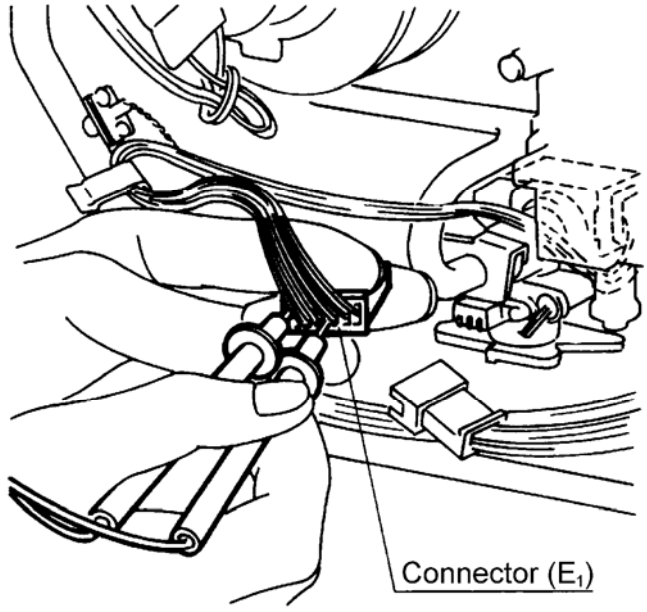


a. # Disconnect the modulating valve festoon terminals and measure the resistance at the terminals.
Normal: 60 ~ 100 Ω
If normal, check b.
Faulty: Replace modulating valve.

b. Re-connect terminal and measure the pink ~ pink voltage at the modulating valve festoon terminal.
Normal: 0.5 ~ 25 VDC
If normal, check c below.
Faulty: Replace the PCB unit.

c. Investigate the change in the manifold gas pressure, when the remote control pre-set temperature is altered from 96 ~ 140 ºF.
Normal: If the manifold pressure changes, proceed to check item 4 below. **DO NOT** adjust manifold pressures.
Faulty: Replace modulating valve.

4) Is the water flow servo normal ?

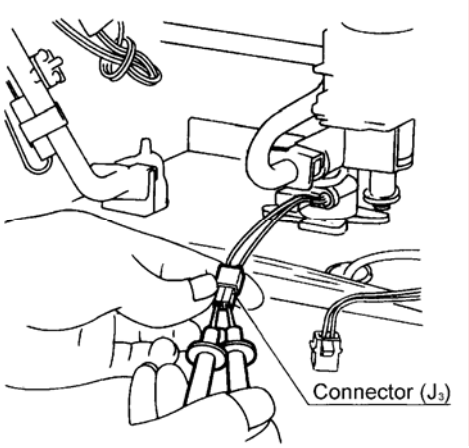
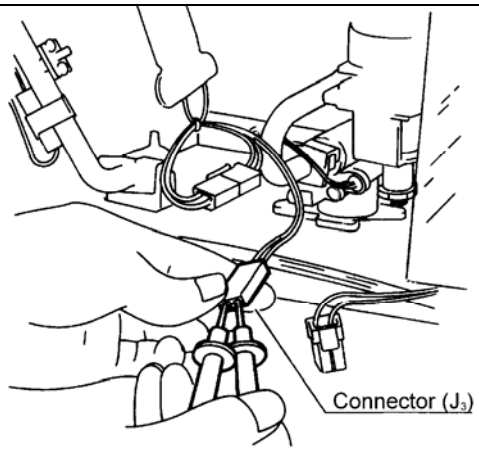
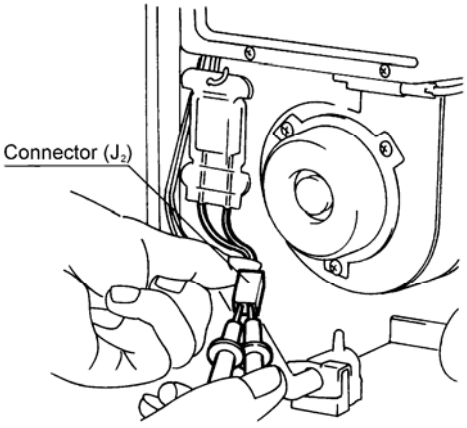


a. # Disconnect connector E_1 and measure the resistance of the water flow servo, red ~ blue wires.
Normal: 10 ~ 30Ω
If normal, proceed to b.
Faulty: Replace the water flow servo and sensor.

b. Disconnect connector E_1, and measure the voltage on the PCB unit side, were the orange (+), and grey (-) wires connect to the board.
Normal: 11 ~ 13 VDC
If normal, proceed to c.
Faulty: Replace the PCB unit.

c. With connector E_1, connected (do not turn water ON … wait for the water flow servo to return to fully open), measure the voltage at the brown ~ grey wires.
Normal: 4 ~ 6 VDC
Faulty: Replace the water flow servo and sensor.

d. With connector E_1, connected (do not turn water ON… wait for the water flow servo to return to fully open), measure the voltage at the yellow ~ grey wires.
Normal: Less than 0.5 VDC
Faulty: Replace water flow servo and sensor.

Anti-frost heaters do not operate	
1) Are the ceramic anti-frost heaters OK ?	
	a. # Disconnect connector J_3, and measure the resistance of the heater mounted in the water flow control valve, these are yellow wires. See connector in picture to the left. *Normal:* 950 ~ 1050 KΩ If normal, proceed to b. *Faulty:* Replace the water flow control heater.
	b. # Disconnect connector J_3, at the connector shown in the second picture to the left, these are yellow wires. *Normal:* 135 ~ 175Ω If normal, proceed to check item 2 below. *Faulty:* Replace defective anti frost heater assembly.
2) Is the frost sensor switch operating normally ?	
	a. # Disconnect connector J_2, and measure the resistance through this switch, measure when atmospheric temperature is 39 ºF + or – 3 ºF. See drawing to right for location of switch. These are blue wires to this switch. *Normal:* Less than 1Ω If normal, check wiring harness for defects. (100 volts AC) *Faulty:* Replace the frost sensing switch. # If the atmospheric temperature is too high, cool the switch with ice.

20. Electrical Component Analysis

- Before starting inspect, recheck wiring harness and double check that all connections are tight.
- Before carrying out checks marked #, disconnect power supply to unit.

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair Nº
A. The LED on the remote control does not light up, when the system is powered up	1. Do you have voltage to the unit?	Inspect visually	Do you have 120 VAC at the power supply?	Yes	Go to A – (1)	
				No	Plug in cord	1
	2. Is supply voltage correct?	Measure voltage at power point.	120 VAC	Yes	Go to A – (3)	
				No	Check power supply circuit. Check fuses.	2
	3. Check surge protector.	Inspect visually	Do you have 120 volts AC across the white and black wires at the surge protector?	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 < than 1MΩ	Is fuse blown.	Yes	Go to A – (5) and replace fuse.	
				No	Go to A – (6)	
	5. Check for short circuits.	1. Measure resistance of each solenoid valve. # Remove connector I from the PCB before measuring . Pink ~ Black (SV1) 0.9 ~ 1.3 KΩ Yellow ~ Black (SV2) 1.3 ~ 1.9 KΩ Blue ~ Black (SV3) 1.3 ~ 1.9 KΩ	Are valves within those specified at left? # Measure after checking that there are no broken wires or shorts.	Yes	Go to A – (6) - 2	
				No	Replace faulty solenoid valves.	3
		2.Measure the resistance. # Disconnect sparker connector I_4 and measure the resistance between both terminals.	Is resistance >1MΩ ?	Yes	Go to A (5-3)	4
				No	Replace sparker.	
		3. Check wiring.	Are there any shorts ?	Yes	Rectify/ Replace	5
				No	Replace PCB	6
	6. Check to ensure you have 120 VAC across both terminals feeding the surge protector.	1. Measure voltage at the blue and brown wires, and the black and white wires.	100 ~ 120 VAC	Yes	Go to A (6-2)	
				No	Replace PCB	

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair N°
		2. Measure the voltage at connector A, F with appliance on standby **F** – Green ~ Green 16 ~ 20 VAC **A** – Orange ~ Orange 13 ~ 30 VAC **A** – Brown ~ Grey 30 ~ 50 VAC **A** – Yellow ~ Grey 180 ~ 240 VAC	Are valves within those specified at left.	Yes	Go to A – (7)	
				No	Replace transformer	8
	7. Check remote(s) (where connected).	Measure voltage between remote control terminals at H_1	10 ~ 13 VDC Digital	Yes	Check cable for shorts or broken wires. Replace remote control	9
				No	Replace PCB.	10
B. Digital monitor lights up, but combustion does not commence. (When remotes are connected).	1. Check water flow sensor.	1. Measure voltage between red ~ black of connector C_2.	11 ~ 13 VDC	Yes	Go to B–1-2	
				No	Replace PCB	11
		2. Measure voltage between yellow ~ black at connector C_2.	2 ~ 10 VDC	Yes	Go to B - 2	
				No	Replace water flow sensor.	12
Error code “72” displayed on the 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 on digital monitor.	3. Check outgoing water temperature thermistor.	# Disconnect connector C_1 and measure resistance. Open circuit: > 1MΩ Short circuit: <1Ω	Are values as shown at left.	Yes	Replace water temperature thermistor.	15
				No	Go to B-4	
Error code “61” displayed on digital monitor	4. Check combustion fan.	1. Check motor. Measure voltage between black ~ red at connector D_1.	6 ~ 40 VDC (Fan on) 0 VDC (Fan off)	Yes	Go to B–5-2	
				No	Replace PCB	16
		2. Check fan rotation sensor. Measure voltage between black ~ yellow at connector D_1.	11 ~ 13 VDC	Yes	Go to B-4-4	
				No	Replace PCB	18
		3. Measure voltage between black ~ white of connector D_1.	2 ~ 9 VDC	Yes	Go to B-5	
				No	Replace fan	19

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair N°
Error code "11" displayed on digital monitor.	. Check sparker.	1. Measure voltage between grey ~ grey of connector I_4 (sparker)	90 ~ 110 VAC	Yes	Go to B-5-2	
				No	Replace PCB	20
		2. # Remove connector I_4 and measure the resistance between sparker terminals.	Is the resistance >1MΩ	Yes	Go to B-5-3	
				No	Replace sparker.	21
		3. 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 (SV1)	1. # Disconnect the main solenoid valve connector I from the PCB, and measure resistance between pink ~ black (SV1)	0.9 ~ 1.3KΩ	Yes	Go to B-6-2	
				No	Replace main solenoid valve (SV1)	23
		2. Measure voltage between pink ~ black of SV1 connector.	80 ~ 100 VDC	Yes	Go to B-7	
				No	Replace PCB	24
	7. Check solenoid valve (SV2)	1. # Disconnect connector I from the PCB. Measure resistance between yellow ~ black (SV2)	1.3 ~ 1.9KΩ	Yes	Go to B-7-2	
				No	Replace (SV2)	25
		2. Measure voltage between yellow ~ black of SV2 connector.	80 ~ 100 VDC	Yes	Go to B-8	
				No	Replace PCB	26
	8. Check changeover solenoid valve (SV3)	1. #Disconnect connector I from PCB. And measure resistance between blue ~ black (SV3)	1.3 ~ 1.9KΩ	Yes	Go to B-8-2	
				No	Replace (SV3)	27
		2. Measure the voltage between blue ~ black of SV3 connector.	80 ~ 100 VDC	Yes	Go to B9	
				No	Replace PCB	28
Error code "14" displayed on digital monitor	9. Check thermal fuse	1. #Disconnect connector B_2 and measure resistance between red ~ red	Is resistance <1Ω?	Yes	Go to B-10	
				No	Replace thermal fuse	29
	10. Check overheat (remaining flame) bi-metal switch.	2. #Disconnect OHS (remaining flame) bi-metal switch festoon terminal B_3 and measure resistance between terminal on switch.	Is resistance <1Ω?	Yes	Replace PCB	30
				No	Replace remaining flame bi-metal switch	31

Nature of Fault	Examination Point	Diagnostic	Values	Y/N	Action	Repair N°.
C. Combustion occurs, but flame fails. Error code "12" Displayed on digital monitor.	1. Check flame rod	1. Measure the voltage between flame rod terminal A_2 and appliance ground.	80 ~ 160 VAC	Yes	Go to C-1-2	
				No	Replace PCB	32
		2. Check to ensure flame rod bracket is not loose.	Is it secure?	Yes	Go to C-2	
				No	Replace/rectify	33
	2. Check ground wire.	Check for faulty ground wire connections at unit, receptacle, and ground rod to home, and broken or shorted wires.	Are connections OK?	Yes	Check for other causes of flame failure.	34
				No	Replace or repair grounding circuit to unit.	35
D. Cannot adjust water temperature.	1. Check hot water thermistor.	# Disconnect connector C_1 and measure the resistance between white ~ white. See diagnostic points on page #37 for temperature at various resistance.	Resistance values match table on page #37.	Yes	Go to D – 2	
				No	Replace water temperature thermistor.	36
	2. Check changeover solenoid valve (SV3)	1. # Disconnect solenoid connector I from PCB and measure the resistance between blue ~ black.	1.3 ~ 1.9KΩ	Yes	Go to D-2-2	
				No	Replace (SV3)	37
		2. Measure voltage between blue ~ black wire of the changeover solenoid valve (SV3) at connector I_3.	80 ~ 100VDC	Yes	Go to D-3	
				No	Replace PCB	38
	3. Check modulating valve.	1. #Disconnect modulating valveB_1 festoon terminal and measure resistance at solenoid terminals.	60 ~ 100Ω	Yes	Go to D-3-2	
				No	Replace modulating valve	39
		2. Measure the voltage between the two harness terminals at B_1.	0.5 ~ 25VDC	Yes	Go to D-3-3	
				No	Replace PCB	40
		3. Check whether the manifold pressure alters when remote control temperature is altered between 96° ~ 140°F.	Does the manifold pressure change?	Yes	Go to D-4	
				No	Replace modulating valve (POV)	41
	4. Check water flow servo	1. #Measure resistance between red ~ blue wires of the water flow servo connector E_1.	10 ~ 30Ω	Yes	Go to D-4-2	
				No	Replace water flow servo sensor.	42

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action	Repair Nº
		2. Measure voltage between orange (+) and grey (-) of the water flow servo connector E_1.	11 ~ 13 VDC	Yes	Go to 4-3	
				No	Replace PCB	43
		3. Measure voltage between brown ~ grey of water flow servo connector E_1. (Do not turn water on).	4 ~ 6 VDC	Yes	Go to D-4-4	
				No	Replace water flow servo sensor.	44
		4. Measure voltage between yellow ~ grey of the water flow servo connector E_1. (Do not turn water on)	0.5 VDC	Yes	Normal	
				No	Replace water flow servo sensor.	45
E. Anti-frost heater does not work.	1. Check anti-frost heater.	1. #Disconnect connector J_3 and measure resistance between yellow ~ yellow wires.	950 ~ 1050Ω	Yes	Go to E-1-2	
				No	Replace Anti-frost heater located in the water valve.	46
		2. #Disconnect connector J_1 and measure resistance between yellow ~ yellow wires.	135 ~ 200Ω	Yes	Go to E-2	
				No	Replace anti-frost heater that is defective.	47
	2. Check frost sensing switch.	#Disconnect connector F_3 and measure the resistance between blue ~ blue wires leading into this switch. Check this switch at temperatures below 37°F. You can place an ice cube against the switch to activate it.	Is resistance <1Ω after applying ice to this switch for five minutes?	Yes	Check wiring	
				No	Replace Anti-frost sensing switch.	48

22. Gas Pressure Setting Procedure

CONTINUUM 2424-W and WC units only!

All settings/adjustments must be performed by a qualified Service Technician.

1. Turn unit off at power source, remove the gas pressure test port plug. Connect manometer to this port See figure #2 for location of the test port plug.

2. The plastic cover over the front of the PC board has to be removed. Locate the three dip switches, labeled "SW2" on the PC board. See figure #1 for location of the combustion control switches.

3. ***CAUTION:*** **When setting the gas pressure, a water tap must be open to allow water flow at a maximum flow rate. Turn on the hot water tap at the tub, shower and kitchen to ensure you have proper flow**. Make sure water is draining out of the tub and sink before returning outside to set the gas pressure. This will prevent overflowing that could cause water damage inside the home.

4. To adjust the ***"Low"*** fire pressure, set combustion control dip switch #2 to the ***"ON"*** position, (see figure #1 for location of combustion control switches.) This will put the unit into forced low fire. Check the pressure reading on your manometer. If the pressure needs adjusting, remove the rubber plug from the bottom of the casing right under the regulator, to access the regulator adjustment screw. Loosen the regulator screw lock nut and adjust the pressure to the correct setting. Below are the proper pressures for ***"Low"*** fire, per gas type being used.

Propane	0.59" W.C.	Low fire rate of 19,000 BTU's
Natural	0.43" W.C.	Low fire rate of 19,000 BTU's

5. To adjust the ***"High"*** fire pressure, set combustion control dip switches #2 and #3 to the ***"ON"*** position, (see figure #1 for location of the combustion control switches), this will put the unit into forced high fire. Check the pressure reading on your manometer. If the pressure needs adjusting, adjust it by turning the high pressure ***"Pot"*** just below the ***"SW2"*** dip switches. See figure #1 for location of "high pressure setting pot". Below are the proper pressures for ***"High"*** fire, per gas type being used. **Dip switches #2 and #3 (combustion control switches), MUST be returned to the "Off" position, before processing. If you fail to reset these switches, the unit will operate in forced high fire and could cause property damage, personal injury, scalding or death.**

Propane	**8.7" W.C.**	**High fire rate of 180,000 BTU's**
Natural	**5.3" W.C.**	**High fire rate of 180,000 BTU's**

6. This completes the gas pressure setting procedure. Verify both low and high fire pressures by following steps 1-5 above. ***Once you have verified the pressures, reset dip switches #2 and #3 at "SW2" on the PC board to the "OFF" position, see figure #1 for location of these switches. They are called "combustion control switches". Failure to reset these dip switches will lock the unit in a high fire mode, which could cause damage to the unit or a possible fire.***

7. Remove the manometer connection. Reinstall the pressure port plug, check for gas leaks around test port with a leak solution.

8. Reinstall the plastic cover over the PC board.

9. Reinstall the front cover and place the unit back into operation.

10. Verify you are getting the proper water temperature, as set on the controller at your outlets. If controllers are not being used the output temperature should be 120°F.

Figure #1

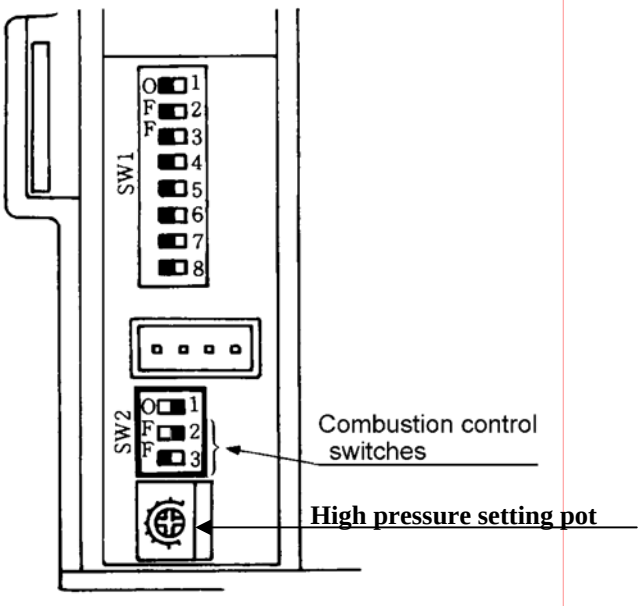
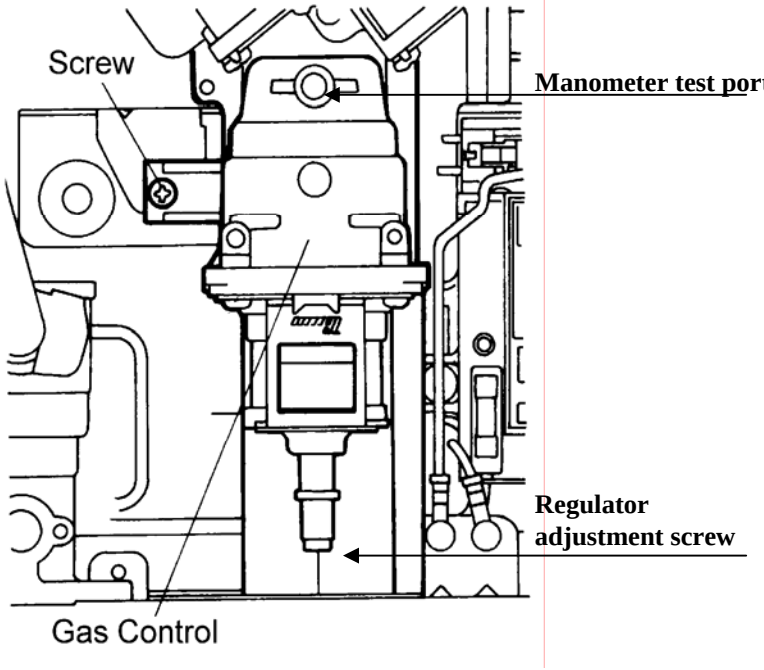


Figure #2



23. Dismantling for Service

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

Eg. Isolate gas supply.
Disconnect electrical supply to unit.
Drain ALL water from appliance.

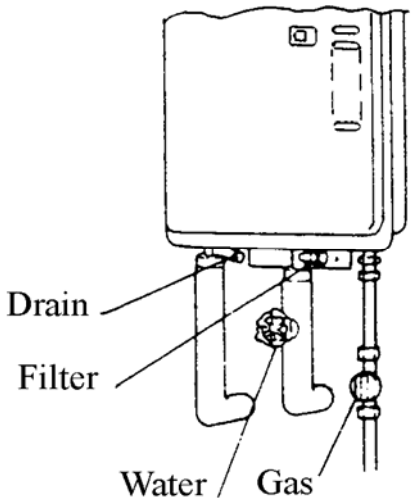
Re-assembly in the reverse order of dismantling, unless stated otherwise.

IMPORTANT

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

- Isolate gas supply.
- Disconnect electrical supply.
- Isolate water supply.
- Drain all water from the appliance.

The following diagram may be of assistance.

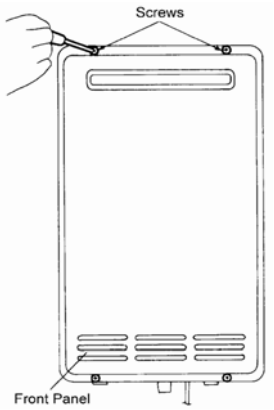


1. Removal of the Front Panel

CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

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

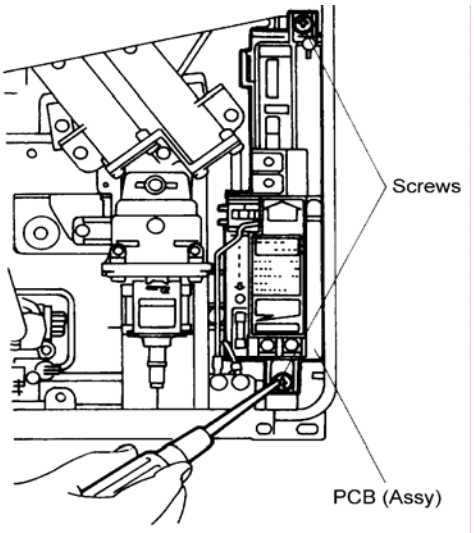


3. Removal of Water Flow Control

CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

a. Remove the two (2) screws holding the PCB in place with a Phillips screw driver, then pull the PCB out of the appliance.
Disconnect all connectors.

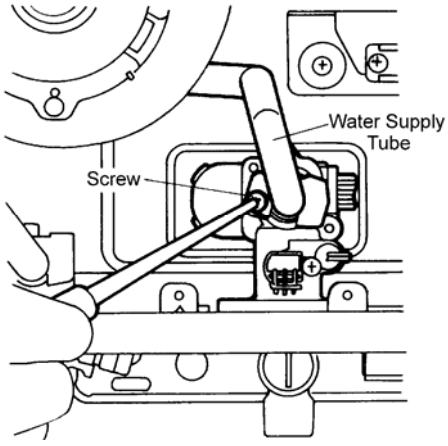


3. Removal of the Water Flow Sensor and Water Flow Control

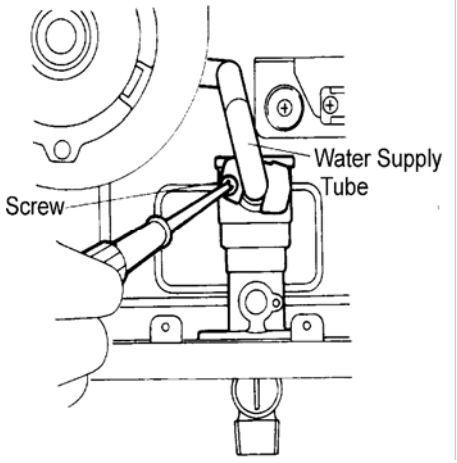
CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

a. Remove one (1) screw from the heat exchanger water supply pipe to release the metal lock, with a Phillips screw driver. Pull the pipe towards yourself to release it. Handle "O"ring carefully.



b. Remove four (4) Phillips screws that secure the water supply connection in place, remove connection. Handle "O" ring carefully.



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

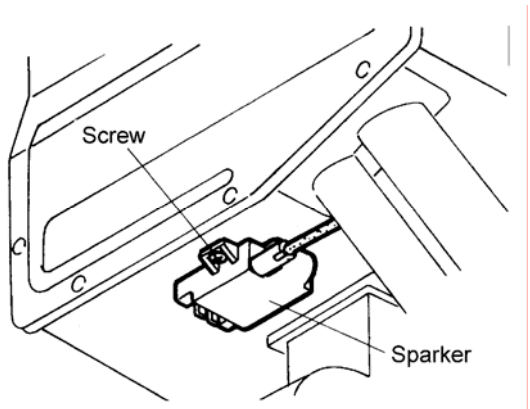
4. Removal of Sparker Module:

CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

a. Remove one (1) Phillips screw that secures the sparker module to the unit casing.

b. Disconnect high tension lead and connector.



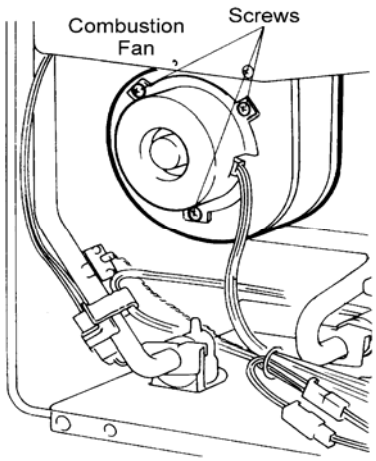
5. Removal of the Combustion Fan:

CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

a. Remove the sparker, refer to section 4.

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

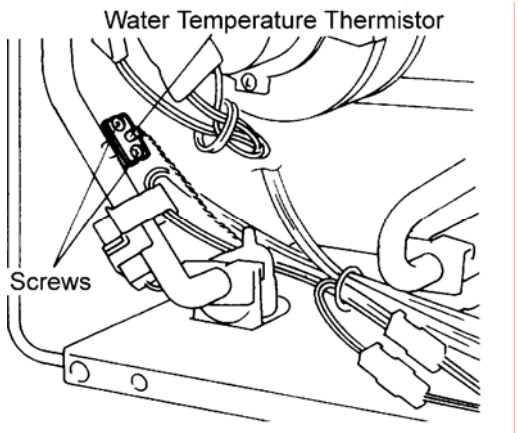


6. Removal of the Water Temperature Thermistor:

CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

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

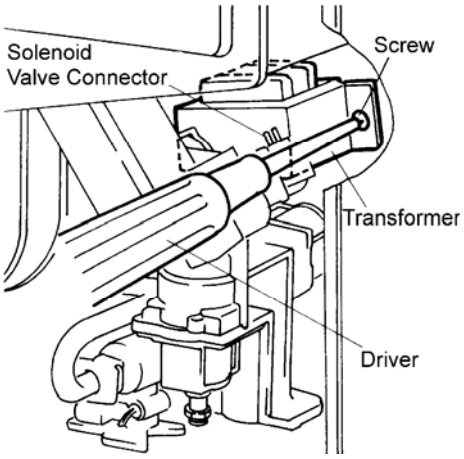


7. Removal of Transformer:

CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

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.
e. Disconnect wiring harness connectors to transformer and pull out towards you.

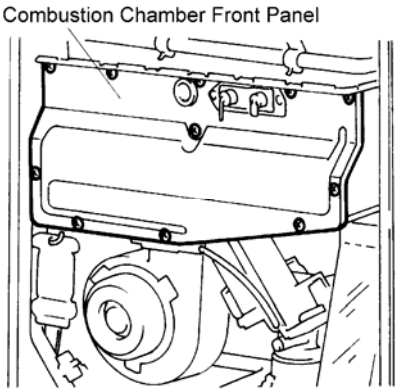


8. Removal of Manifold and Burner:

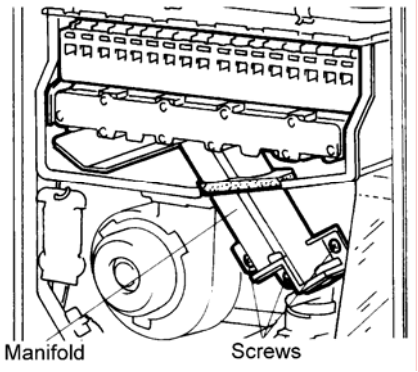
CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

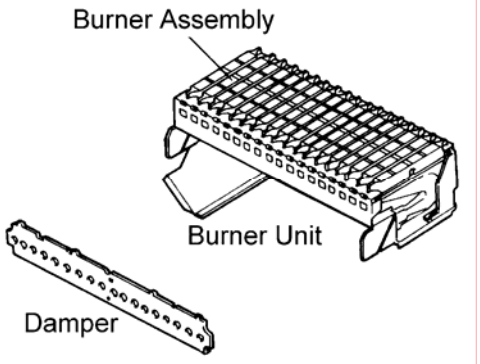
a. Remove the sparker, refer to section 4.
b. Remove eleven (11) phillips screws that hold the combustion chamber front panel in place and remove the panel.



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



d. Grip the burner and pull it out with your hand.

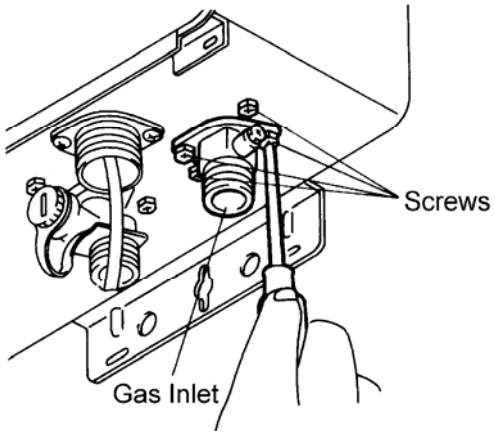


9. Removal of the Gas Valve Assembly:

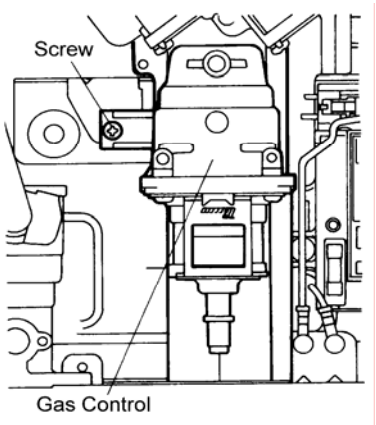
CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

a. Remove the manifold, refer to section 8-a,b,c.
b. Remove the four (4) phillips screws that hold the gas connection and gas control in place. Handle the "O"ring with care.



c. Remove one (1) screw that holds the gas control in place. Disconnect connectors from solenoids, and pull gas valve assembly out of unit.



10. Removal of Heat Exchanger:

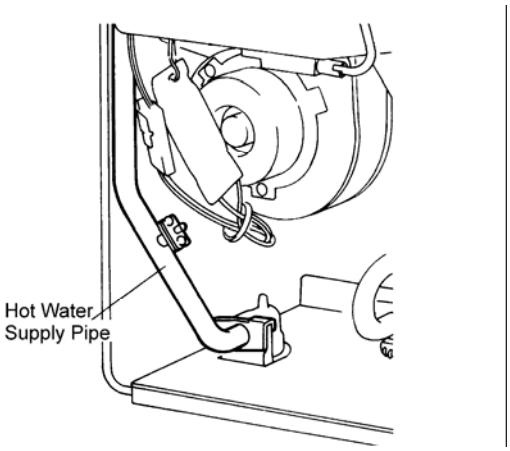
CAUTION

120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

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

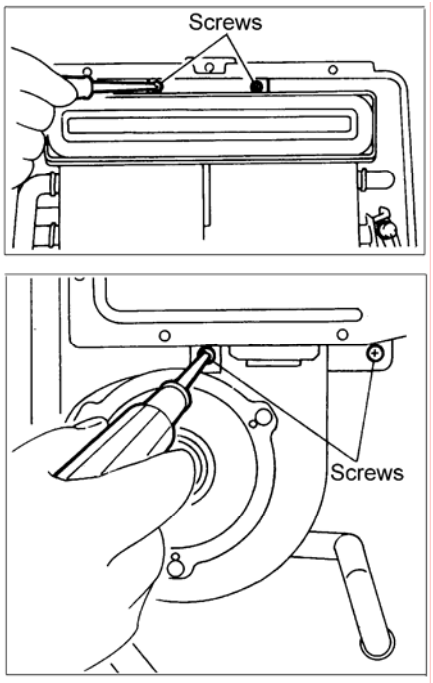
b. Remove the heat exchanger water connection pipe, refer to section 3-a.

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



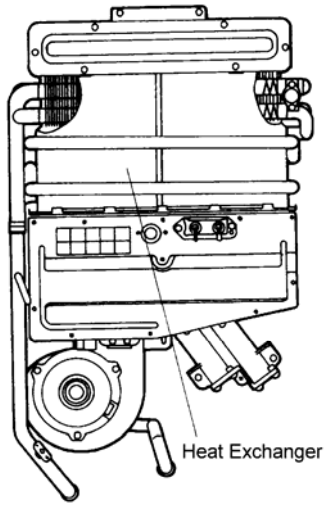
d. Remove the three (3) screws securing the manifold to the gas control.

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



f. Remove all electrical connectors including the thermistor.

g. Pull the heat exchanger assembly out of the unit.



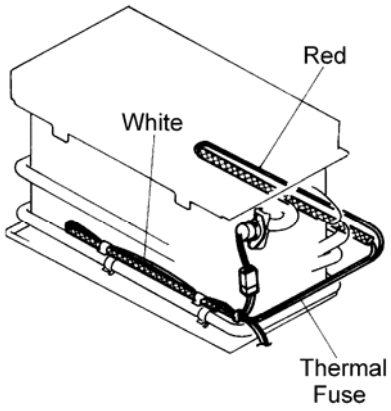
11. **Removal of Thermal Fuse:**

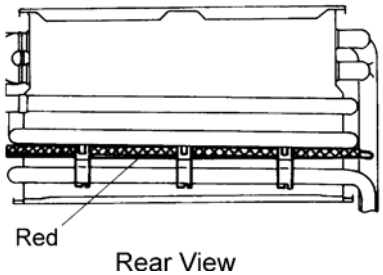
CAUTION
120 volt potential exposure. Isolate the appliance and reconfirm power has been disconnected using a multi-meter.

a. The REU 2424 has two thermal fuses labeled as white and red in the pictures below.

b. Disconnect and remove the thermal fuse.

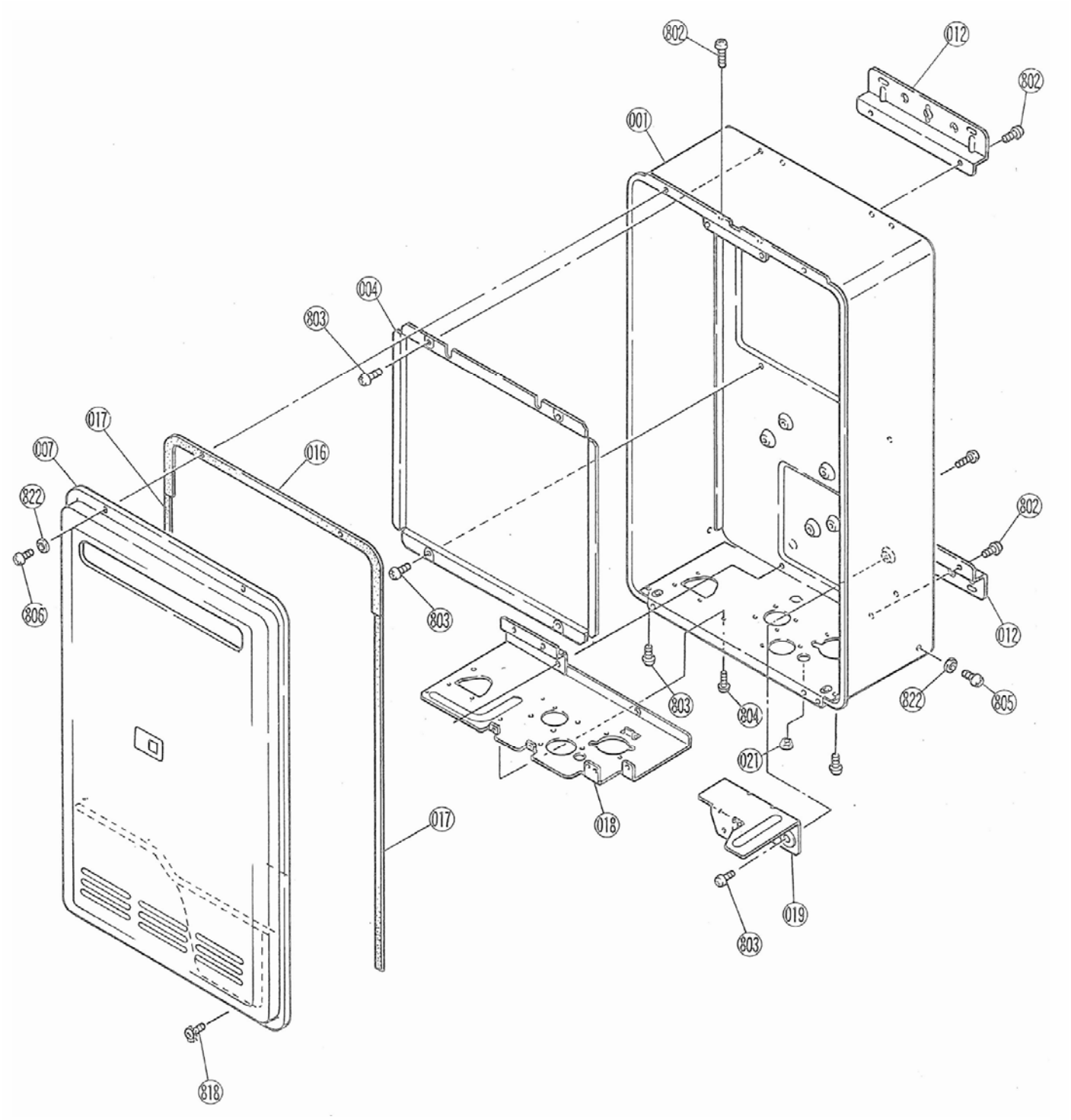
* Fit the fuse as shown below.



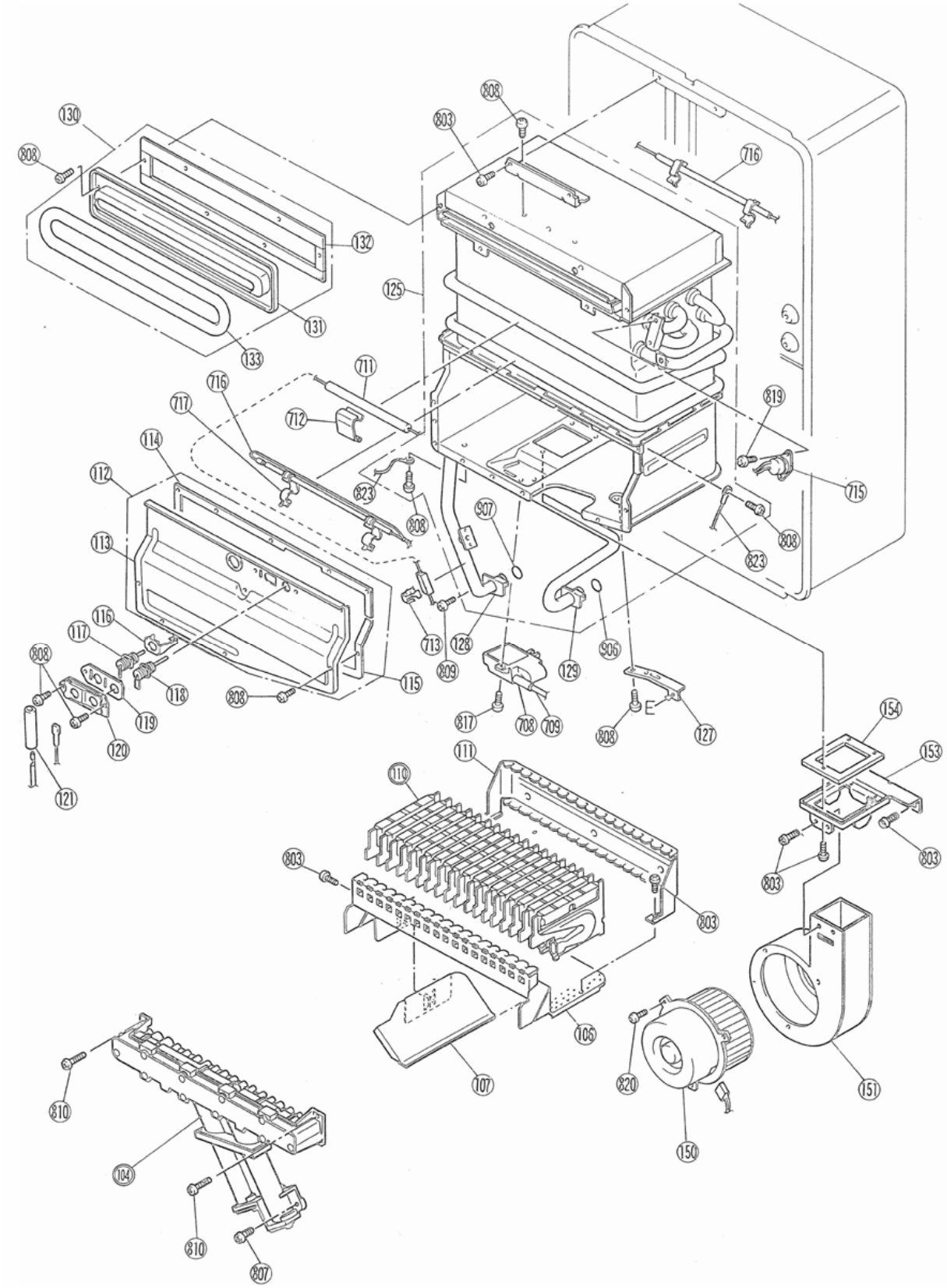


Rear View

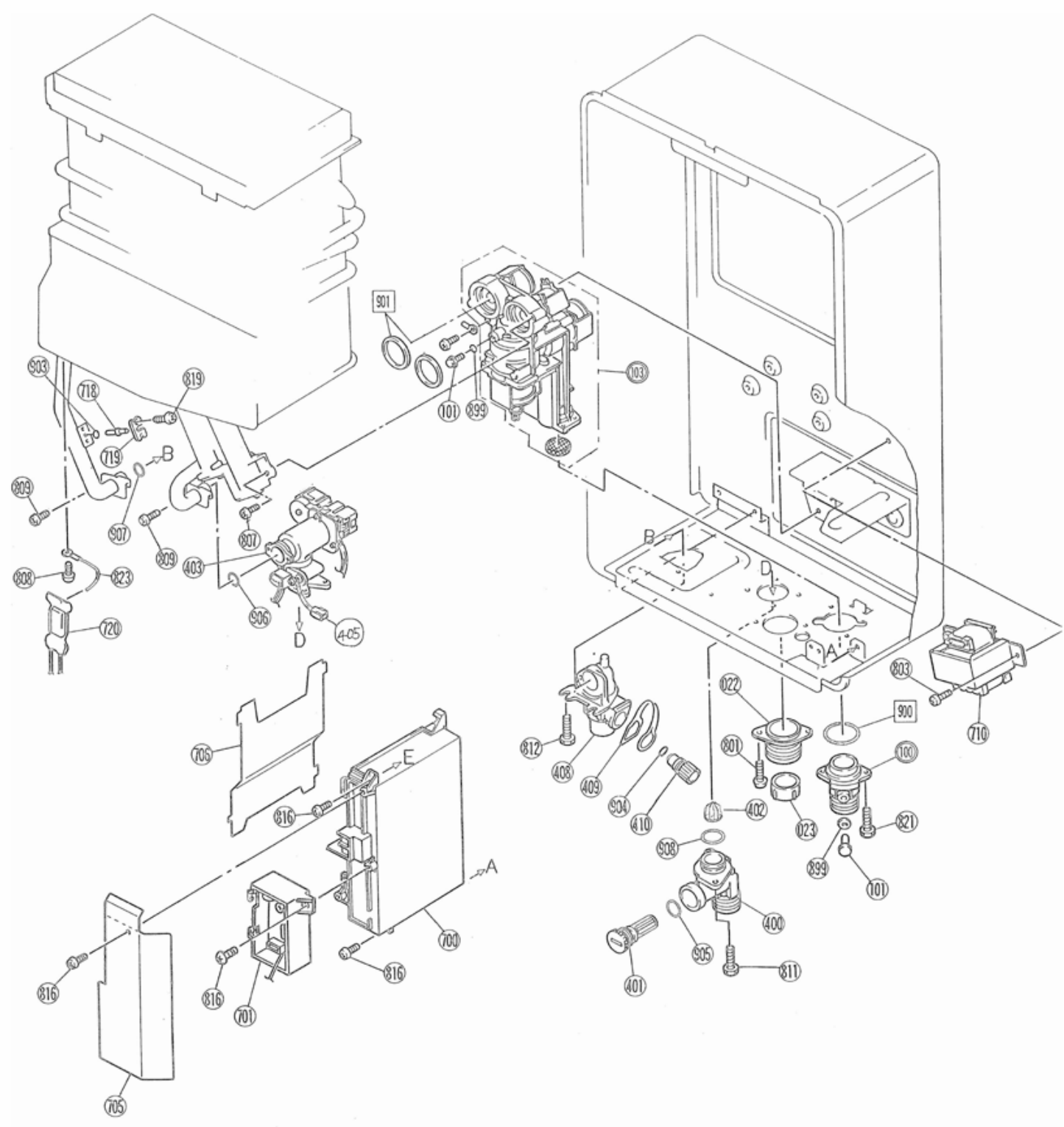
24. Exploded Diagram (Cabinet)



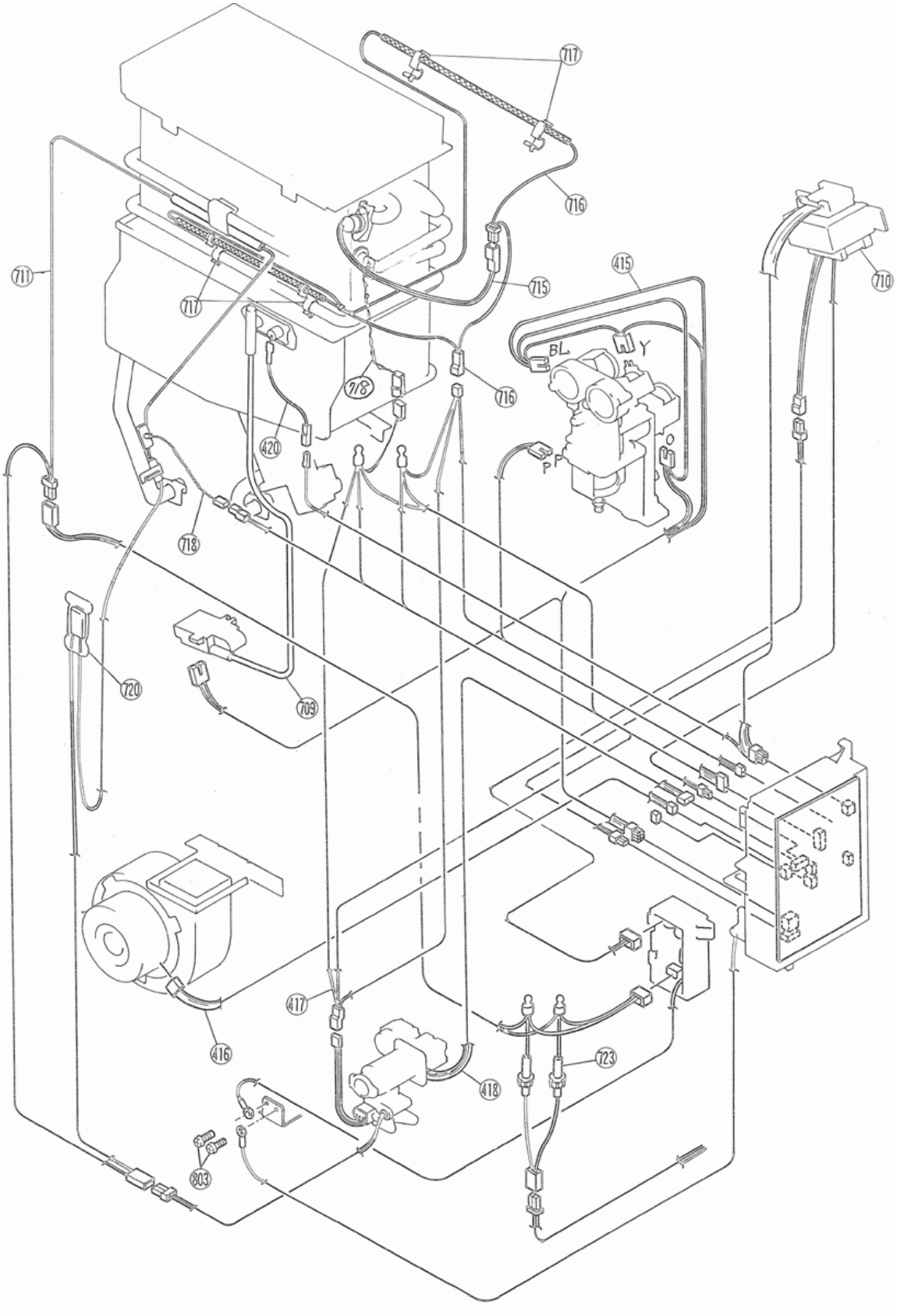
Exploded View - Internals



Exploded View - Internals



Exploded View - Electrical



25. Parts List

Number	Description	Part Number	Quantity
001	Casing Assembly	DU195-100-2	1
004	Heat Protection Plate	BU155-110	1
007	Front Panel Assembly	DU195-1615-2	1
012	Wall Installation Bracket	BU195-121	2
016	Front Panel Packing	BU195-167	1
017	Front Panel Packing - Side	AU115-163	2
018	Connection Reinforcement Panel	BU169-120	1
019	Gas Control Bracket	BU169-125	1
022	Cable Connection	BU56-602-N	1
023	Cable Seal Packing	AU169-126	1
100	Gas Connection (3/4" NPT)B	CU195-211-2	1
101	Test Point Screw	C10D-5	2
103	Gas Control Assembly	C36E-30-S	1
104	Manifold Assembly - A (LPG)	CU195-200-A	1
104	Manifold Assembly - B (Nat)	CU195-200-B	1
106	Burner Case Front	DU195-255	1
107	Sound Proofing Panel	CU169-257	1
110	Side Type Sleeve Burner Assembly	B3A1-4	18
111	Burner Case Back Panel	CU169-256	1
112	Comb. Chamber Front Panel (Complete Assembly)	CU195-920	1
113	Comb, Chamber Front Panel (Assy)	CU195-310	1
114	Upper Packing - Comb. Chamber	BU195-315	1
115	Lower Packing - Comb. Chamber	BU195-316	1

Parts List Cont…

Number	Description	Part Number	Quantity
116	Ignition target	AU168-325	1
117	Electrode	AU168-321	1
118	Flame Rod	AU168-322	1
119	Electrode Packing	AU195-312	1
120	Electrode Holder	AH43-262	1
121	Electrode Sleeve	AU102-681	1
125	Heat Exchanger Complete Assy	DU195-1867	1
127	PCB Bracket	AU195-330	1
128	Stop Bracket A	AU195-321	1
129	Stop Bracket B	AU195-322	1
130	Flue Outlet (Assy)	BU169-470	1
131	Flue Outlet	BU169-471	1
132	Flue Outlet Packing	BU169-472	1
133	Flue Outlet Packing A	AU155-111-1	1
150	Blower Motor Assy	BU195-565	1
151	Fan Casing Assy A	BU169-552	1
153	Fan Connection	BU169-555	1
154	Fan Connection Packing	AU169-656	1
400	Water Inlet (3/4” NPT) B	H73-511	1
401	Water Filter Assy	H73-501-2	1
402	Rectifier	M8D1-11	1
403	Water Flow Servo & Sensor	M8E-4-4	1
405	120V Anti-Frost Heater	BU195-1878	1
408	Hot Water Outlet (3/4”NPT) C	BU132-363-C	1

Parts List Cont…

Number	Description	Part Number	Quantity
409	Plug Band B	AU142-445	1
410	Drain	AU142-444	1
415	Modulating Solenoid Valve Harness	BU195-601	1
416	Fan Motor Harness	BU195-602	1
417	Sensor Harness	BU195-1877	1
418	Water Flow Servo Harness	BU195-604	1
420	Flame Rod Harness	BU195-605	1
700	PCB	CU195-1870	1
701	Surge Protector	BBF9-630	1
705	PCB Front Cover	BU168-707	1
706	PCB Side Cover	BU195-507	1
708	Ignitor	EI-144	1
709	High Tension Cord	BH38-710-200	1
710	Transformer	ET-259	1
711	120V Anti-Frost Heater B	BU195-1879	1
712	Anti-Frost Heater Clip	AU195-675	2
713	Anti-Frost Heater Clip	AU100-721	3
715	Over Heat Switch	BU129-824-2	1
716	Thermal Fuse Harness	CU195-610-2	1
717	Thermal Fuse Clips	CP-80531	6
718	Thermistor	BH45-650	2
719	Thermistor Clip	CP-90172	2
720	Frost Sensing Switch	BU189-530	1
723	3 Amp Fuse Harness	BU195-1630	1

Parts List Cont…

Number	Description	Part Number	Quantity
801	Screw	ZBA041OUK	–
802	Screw	ZBA051OUK	–
803	Screw	ZEAB0408SZ	–
804	Screw	ZBA0408UK	–
805	Screw	ZBD0408UK	–
806	Screw	ZAD0408UK	–
807	Screw	CP-21478-412	–
808	Screw	ZEA0408UK	–
809	Screw	ZAA0408UK	–
810	Screw	ZBA0412UK	–
811	Screw	ZAG0512UK	–
812	Screw	ZBA0512UK	–
816	Screw	ZEDB0408SZ	–
817	Screw	CP-80452	–
819	Screw	ZEAB0406UK	–
820	Screw	ZIAA0410SZ	–
821	Screw	ZAG0514UK	–
822	Washer	CF83-41430	–
823	Tie backs	CP-90331	–
899	“O” Ring (S4)	M10B-13-4	2
900	“O” Ring (P24)	M10B-1-24	1
901	Packing	C36F8-1	2
903	“O” Ring (P4)	MIOB-2-4	1
904	“O” Ring (P7)	MIOB-2-7	1

Parts List Cont…

Number	Description	Part Number	Quantity
905	"O" Ring (P16)	M10B-2-16	1
906	"O" Ring (P12.5)	M10B-2-12.5	1
907	"O" Ring (P14)	M10B-2-14	1
908	"O" Ring (P18)	M10B-2-18	1
	Manual 3/4" gas control value	BU195-1865	1
	Kitchen remote control kit	MC-45-3US	1
	Bathroom Remote Control kit	BC-45-3US	1
	2nd Bathroom Remote Control kit	BSC-45-3US	1
	View Window Sticker	AU195-1680-2	1
	Continuum Label	BU195-1882X01	1
	Model Number Label	AU195-1881	1
	Wiring Diagram	CU195-1887	1
	Manifold Seal	AU169-206X02	1
	Rating Plate (NG)	CU195-1889-1X03	1
	Rating Plate (LP)	CU195-1889-2X03	1
	Warning Label	CU195-1886X01	1
	Warning Repair Label	AU195-1890	1
	Gas Type Label (NG)	CP-71201X01	1
	Gas Type Label (LP)	CP-71571X01	1
	Gas Type Label (Bottom of Unit - NG)	CP-71070	1
	Gas Type Label (Bottom of Unit - LP)	CP-71572	1

Notes: