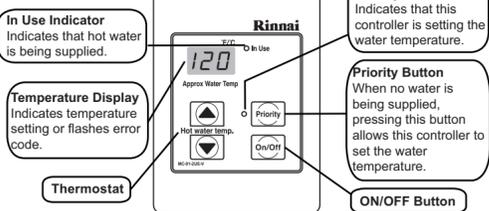


# Controller



**WARNING** Do not put SW2 and 3 in DIPSW2 (white switches) in on position. These settings are only for commercial applications and are not compatible with V94i, V94Xi, V75i and V65i.

## Diagnostic Use of the Controller

- To display the most recent diagnostic codes press and hold the "On/Off" button for 2 seconds on the MC-91 controller.
- To enter or exit the maintenance monitor information mode press and hold the down button for 2 seconds and without releasing it press the ON/OFF button.

No.	Data	Unit
01	Water flow rate	0.1 gal/min
02	Outgoing water temperature	Degrees Fahrenheit

## To Change the Temperature Scale (°F / °C)

With the water heater turned off, press and hold the ON/OFF button until the display changes to the other temperature scale (about 5 seconds).

## To Turn Off the Controller Sound (Mute)

To turn the sound off (mute), press and hold both the ▲ and ▼ thermostat buttons until a "beep" is heard (about 5 seconds).

## Locking the Controller

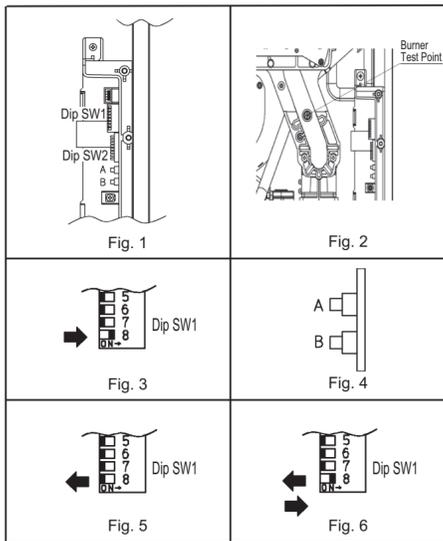
The MC-91-2 controller can be locked or unlocked by pressing the Priority button and the up button together for 5 seconds. A beep will sound confirming that the controller is locked. The display will alternately show "LOC", the temperature setting, and a diagnostic code if one has been activated. All of the controllers in the system are also locked.

To unlock the controller press the Priority button and the up button together for 5 seconds.

# Gas Pressure Setting

Ensure gas pressure check under Commissioning has been completed first! The regulator is electronically controlled and factory pre-set. Under normal circumstances it does not require adjustment during installation. Make adjustments only if the unit is not operating correctly and all other possible causes for incorrect operation have been eliminated.

- Turn OFF the gas supply.
- Turn OFF the water supply.
- Remove the front panel (four screws).
- Check the gas type using the data plate on the side of the unit. Confirm that the gas type switch is in the correct position (SW1 in DIPSW2 is ON for natural gas, NG, and OFF for propane gas, LPG.) Figure 1.
- Remove the screw and attach the manometer to the burner test point located on the gas control. Figure 2.
- Turn on the gas supply and the power supply.
- Flow water through the water heater at the maximum flow rate obtainable. (At least 3 gallons per minute is recommended. If there is not enough water flowing, the water heater could shut off or sustain damage due to overheating.)
- Move SW8 in DIPSW1 to ON. Figure 3.
- Push the PC board switch A for one second. Figure 4.
- Calibrate "Forced Low" combustion using switch A (up) and switch B (down).
- Move SW8 in DIPSW1 to OFF and then back to ON. Figure 6.
- Push the PC board switch B for one second. Figure 4.
- Calibrate "Forced High" combustion using switch A (up) and switch B (down).
- Move SW8 in DIPSW1 to OFF. Figure 5.
- Close hot water taps.
- Turn off gas supply and 120 V power supply.
- Remove manometer and re-install screws.
- Turn on the gas supply and 120 V power supply.
- Operate the unit and check for gas leaks.
- Install the front panel using four screws.



# Diagnostic Codes

## 03 Power interruption during Bath fill (Water will not flow when power returns)

- Turn off all hot water taps. Press ON/OFF twice.

## 10 Air Supply or Exhaust Blockage

- Ensure approved venting materials are being used.
- Check that nothing is blocking the flue inlet or exhaust.
- Check all vent components for proper connections.
- Ensure vent length is within limits.
- Verify dip switches are set properly.
- Check fan for blockage.

## 11 No Ignition

- Check that the gas is turned on at the water heater, meter, or cylinder.
- If the system is propane, make sure that gas is in the tank.
- Ensure appliance is properly grounded.
- Ensure gas type and pressure is correct.
- Ensure gas line, meter, and/or regulator is sized properly.
- Bleed all air from gas lines.
- Verify dip switches are set properly.
- Ensure igniter is operational.
- Check igniter wiring harness for damage.
- Check gas solenoid valves for open or short circuits.
- Remove burner cover and ensure burners are properly seated.
- Remove burner plate; inspect burner surface for condensation/debris.
- Check the ground wire for the PC board.

## 12 No Flame

- Check that the gas is turned on at the water heater, meter, or cylinder.
- Check for obstructions in the flue outlet.
- If the system is propane, make sure that gas is in the tank.
- Ensure gas line, meter, and/or regulator is sized properly.
- Ensure gas type and pressure is correct.
- Bleed all air from gas lines.
- Ensure proper venting material was installed.
- Ensure condensation collar was installed properly.
- Ensure vent length is within limits.
- Verify dip switches are set properly.
- Check power supply for loose connections.
- Check power supply for proper voltage and voltage drops.
- Ensure flame rod wire is connected.
- Check flame rod for carbon build-up.
- Disconnect and reconnect all wiring harnesses on unit and PC board.
- Check for DC shorts at components.
- Check gas solenoid valves for open or short circuits.
- Remove burner plate; inspect burner surface for condensation/debris.

## 14 Thermal Fuse

- Ensure SW5 in DIPSW2(white) is in the off position.
- Check for restrictions in air flow around unit and vent terminal.
- Check gas type of unit and ensure it matches gas type being used.
- Check for low water flow in a circulating system causing short-cycling.
- Ensure dip switches are set to the proper position.
- Check for foreign materials in combustion chamber and exhaust piping.
- Check heat exchanger for cracks or separations.
- Check heat exchanger surface for hot spots which indicate blockage due to scale build-up. Refer to instructions in manual for flushing heat exchanger. Hard water must be treated to prevent scale build up or damage to the heat exchanger.
- Measure resistance of safety circuit.
- Ensure high fire and low fire manifold pressure is correct.
- Check for improper conversion of product.

## 16 Over Temperature Warning

- Check for restrictions in air flow around unit and vent terminal.
- Check for low water flow in a circulating system causing short-cycling.
- Check for foreign materials in combustion chamber and exhaust piping.
- Check for blockage in the heat exchanger.

## 19 Electrical Grounding

- Check all components for electrical short.

## 32 Outgoing Water Temperature Sensor

## 33 Heat Exchanger Outgoing Temperature Sensor

## 34 Combustion Air Temperature Sensor Fault

- Check for restrictions in air flow around unit and vent terminal.
- Check sensor wiring for damage.
- Measure resistance of sensor.
- Clean sensor of scale build up.
- Ensure fan blade is tight on motor shaft and is in good condition.
- Replace sensor.

## 51 Inlet Water Temperature Sensor

- Check sensor wiring for damage.
- Measure resistance of sensor.
- Clean sensor of scale build-up.
- Replace sensor.

## 52 Modulating Solenoid Valve Signal

- Check modulating gas solenoid valve wiring harness for loose or damaged terminals.
- Measure resistance of valve coil.

## 61 Combustion Fan

- Ensure fan will turn freely.
- Check wiring harness to motor for damaged and/or loose connections.
- Measure resistance of motor winding.

## 65 Water Flow Servo

- The water flow control valve has failed to close during the bath fill function. Immediately turn off the water and discontinue the bath fill function. Contact a licensed professional.

## 70 PC Board

- Check PC board DIP switches for correct positions.
- Check the connection harness at the connection on the PC board.
- Replace PC board.

## 71 Solenoid Valve Circuit

- Replace the PC Board.

## 72 Flame Sensing Device

- Verify flame rod is touching flame when unit fires.
- Check all wiring to flame rod.
- Remove flame rod; check for carbon build-up; clean with sand paper.
- Check inside burner chamber for any foreign material blocking flame at flame rod.
- Measure micro amp output of sensor circuit with flame present.
- Replace the PC Board.

## 79 Water leakage detected

- Turn off water supply and contact licensed professional.

## LC# Scale Build-up in Heat Exchanger (when checking maintenance code history "00" is substituted for "LC")

- LC0-LC9 indicates that there is scale build up in the heat exchanger and that the heat exchanger needs to be flushed to prevent damage. Refer to the flushing instructions in the manual. Hard water must be treated to prevent scale build up or damage to the heat exchanger.
- To operate the water heater temporarily until the heat exchanger can be flushed, push the On/Off button on the temperature controller 5 times. Repeated LC# codes will eventually lock out the water heater.

## FF Maintenance Performed

- Indicates a service provider performed maintenance or repair. Enter this code by pressing up, down, and ON/OFF simultaneously.

## No Code (Nothing happens when water flow is activated.)

- Clean inlet water supply filter.
- On new installations ensure hot and cold water lines are not reversed.
- Verify you have at least the minimum flow rate required to fire unit.
- Check for cold to hot cross over. Isolate circulating system if present.
- Turn off cold water to the unit, open pressure relief valve; if water continues to flow, there is bleed over in your plumbing.
- Verify turbine spins freely.
- Measure the resistance of the water flow control sensor.
- If the display is blank and clicking is coming from the unit, disconnect the water flow servo motor (GY, BR, O, W, P, BL, R). If the display comes on then replace the water flow servo motor.

# Gas Pressure Setting

NOTE: For additional installation and commissioning information refer to the Operation and Installation Manual.

**WARNING** This appliance must be installed, serviced and removed by a trained and qualified person. During pressure testing of the consumer piping, ensure gas valve is turned off before unit is shut off. Failure to do so may result in serious injury to yourself or damage to the unit.

## APPLIANCE OPERATING PRESSURES

	Water Inlet Max.	Gas Inlet Min./Max.		Forced Low		Forced High	
		NAT.G	LPG	NAT.G	LPG	NAT.G	LPG
V94i / V94Xi	Short flue length 150 PSI	4"W.C. (10.5"W.C.)	8"W.C. (13.5"W.C.)	0.61"W.C. (1.55"W.C.)	0.87"W.C. (2.26"W.C.)	3.0"W.C. (7.92"W.C.)	4.8"W.C. (12.50"W.C.)
	Long flue length			0.61"W.C.	0.95"W.C.	2.3"W.C.	3.7"W.C.
V75i	Short flue length 150 PSI	4"W.C. (10.5"W.C.)	8"W.C. (13.5"W.C.)	0.61"W.C. (1.55"W.C.)	0.87"W.C. (2.26"W.C.)	2.5"W.C. (6.35"W.C.)	3.9"W.C. (9.91"W.C.)
	Long flue length			0.61"W.C.	0.95"W.C.	2.3"W.C.	3.7"W.C.
V65i	Short flue length 150 PSI	4"W.C. (10.5"W.C.)	8"W.C. (13.5"W.C.)	0.61"W.C. (1.55"W.C.)	0.87"W.C. (2.26"W.C.)	1.97"W.C. (5.00"W.C.)	2.74"W.C. (6.96"W.C.)
	Long flue length			0.61"W.C.	0.95"W.C.	2.04"W.C.	2.93"W.C.

## Commissioning

With all gas appliances in operation at maximum gas rate, the flowing inlet pressure at the incoming test point on the Rinnai water heater should read 4" W.C. - 10.5" W.C. on natural gas and 8" W.C. - 13.5 W.C. on propane gas. If the pressure is lower, the gas supply is inadequate and the unit will not operate to specification. Check the gas meter regulator and pipework for correct operation/sizing and correct as required.

# Troubleshooting

## Important Safety Notes

There are a number of (live) tests that are required when fault finding this product. Extreme care should be used at all times to avoid contact with energized components inside the water heater. Only trained and qualified service technicians should attempt to repair this product. Before checking for resistance readings, disconnect the power source to the unit and isolate the item from the circuit (unplug it).

(SV1, SV2, SV3, SV4 and POV) Gas valve and Modulating solenoids: (Set meter above 2K)

Wire color	Voltage	Resistance	Connector #	Pin #'s
(Main) Black - Grey	11 ~ 13 VDC	24 ~ 28 ohms	D1	B3 - B4
(SV1) Black - Blue	11 ~ 13 VDC	36 ~ 42 ohms	B3	4 - 6
(SV2) Black - Yellow	11 ~ 13 VDC	36 ~ 42 ohms	B2	4 - 7
(SV3) Black - Red	11 ~ 13 VDC	36 ~ 42 ohms	B4	4 - 5
(SV4) Black - Orange	11 ~ 13 VDC	35 ~ 41 ohms	B1	4 - 8
(POV) Pink - Pink	2 ~ 15 VDC	67 ~ 81 ohms	D1	1 - 2

## (M) Water Flow Control Device Servo or Geared Motor:

Red - Pink	N/A	44 ~ 52 ohms	G2	3 - 4
White - Blue	N/A	44 ~ 52 ohms	G2	1 - 2
Grey - Brown	N/A	N/A	G2	5 - 7
Grey - Orange	N/A	N/A	G2	6 - 7

NOTE: The grey wire listed above turns to black at G connector on the PCB.

## (QS) Water Flow Sensor:

Black - Red	11 ~ 13 VDC	N/A	L3	E10 - G7
Yellow - Black	4 ~ 7 VDC	N/A	L3	E1 - G7

## By-pass Flow Control:

Red - Pink	N/A		G1	12 - 13
White - Blue	N/A	44 ~ 52 ohms	G1	10 - 11

## (IG) Ignition System:

Grey - Grey	110 ~ 130 VAC	N/A	C1	1 - 3
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## (FM) Combustion Fan Motor:

Red - Black	6 ~ 45 VDC	N/A	L2	5 - 6
White - Black	5 ~ 10 VDC	N/A	L2	3 - 5
Yellow - Black	11 ~ 13 VDC	N/A	L2	4 - 5

Set your meter to the hertz scale. Reading across the white and black wires at terminals 3 and 5 you should read between 60 and 420 hertz.

## Thermal Fuse / Overheat Switch:

White - White	11 ~ 13 VDC	Below 1 ohms	B8 B7	B1 - E10
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## Flame Rod:

Place one lead of your meter to the flame rod and the other to ground. With the unit running you should read between 5-150 VAC. Set your meter to the μ amp scale and series your meter in line with the flame rod. You should read 1 μ amp or greater for proper flame circuit. In the event of low flame circuit remove the flame rod and check for carbon or damage.

## Heat Exchanger, Outgoing Water Temperature and Inlet Thermistors:

Check all thermistors by inserting meter leads into each end of the thermistor plug. Set your meter to the 20 K scale and read resistance. Applying heat to the thermistor bulb should decrease the resistance. Applying ice to the thermistor bulb should increase the resistance. See below for examples of typical temperatures and resistance readings.

Example: 59°F = 11.4 ~ 14KΩ 140°F = 2.2 ~ 2.7KΩ  
86°F = 6.4 ~ 7.8KΩ 221°F = 0.6 ~ 0.8KΩ  
113°F = 3.6 ~ 4.5KΩ

## Outgoing Water Thermistor:

White - White	N/A	See example above	E5	2 - 3
Blue - Blue	N/A	See example above	E5	4 - 5

## Heat Exchanger Temperature Thermistor:

Pink - Pink	N/A	See example above	E4	4 - 7
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## Inlet Thermistor:

White - White	N/A	See example above	E7	4 - 9
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## Remote Controls:

Terminals J	10 ~ 13 VDC	1.5 ~ 3.0 K ohms	J	1 - 2
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## Frost Protection:

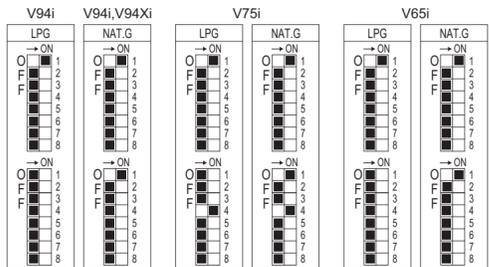
This unit has frost protection heaters mounted at different points to protect the water heater from freezing. All of them should show a positive resistance reading.

## Amp Fuses:

This unit has one inline (10) amp glass fuse. Remove the fuse and check continuity through it. If you have continuity through the fuse then it is good. Otherwise the fuse is blown and must be replaced.

# Dip Switches Settings

Adjust SW2 and 3 in DIPSW1 (upper side) depending on your altitude according to the table below.



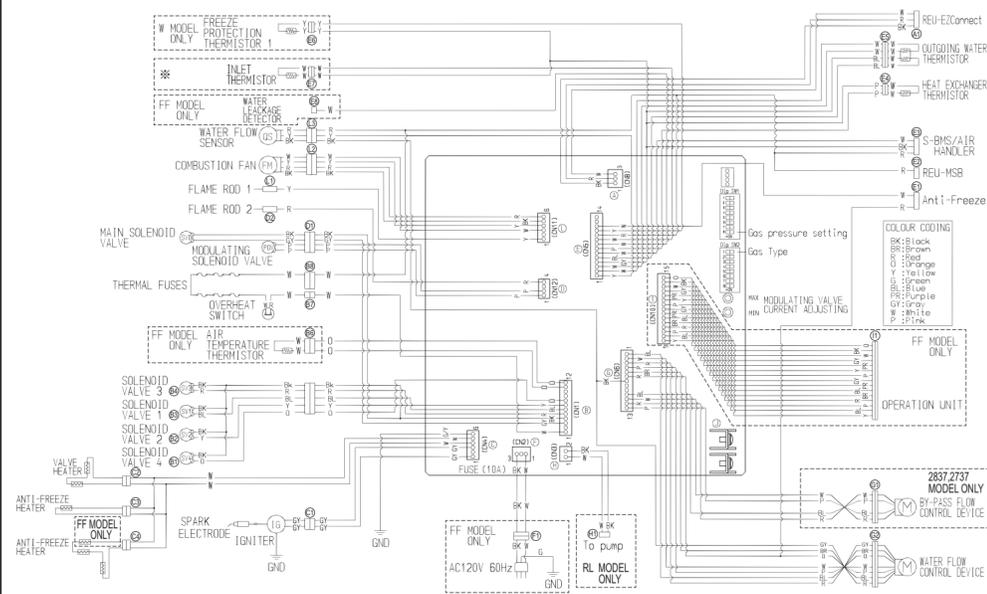
## WARNING

DO NOT adjust the other dip switches unless specifically instructed to do so. Incorrect Dip Switch Settings can cause the Rinnai water heater to operate in an unsafe condition and may damage the water heater and void the warranty.

SW No.	NOTES								
2	High Altitude	Off	Level 0 0-2000 ft (0-610 m)	Off	Level 1 2001-5200 ft (610-1585 m)	On	Level 2 5201-7700 ft (1585-2347 m)	On	Level 3 7701-10200 ft (2347-3109 m)
3		Off		On		On			

# Wire Diagram

※ Refer to [EXPLODED VIEW - ELECTRICAL] of technical data sheet

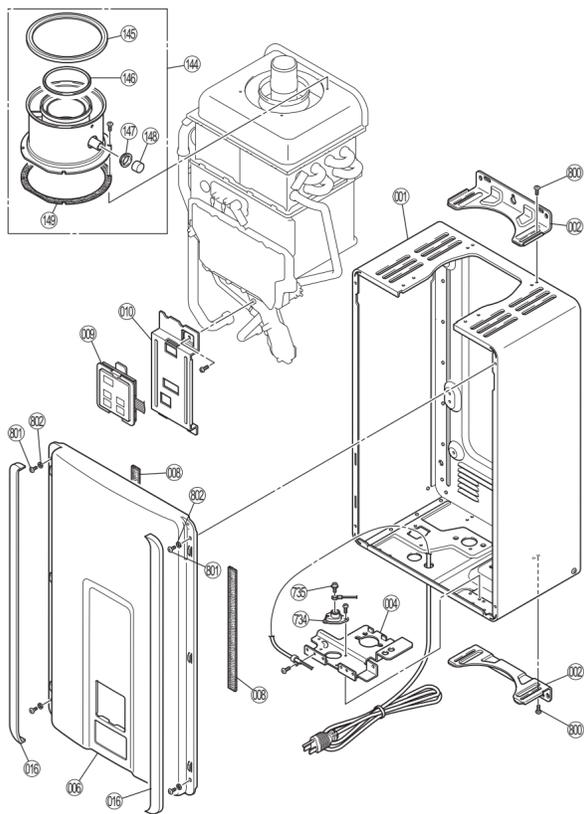


V65i (VC2025FFU-US)  
V75i (VC2528FFU-US)  
V94Xi (VC2737FFU-US)  
V94i (VC2837FFU-US)

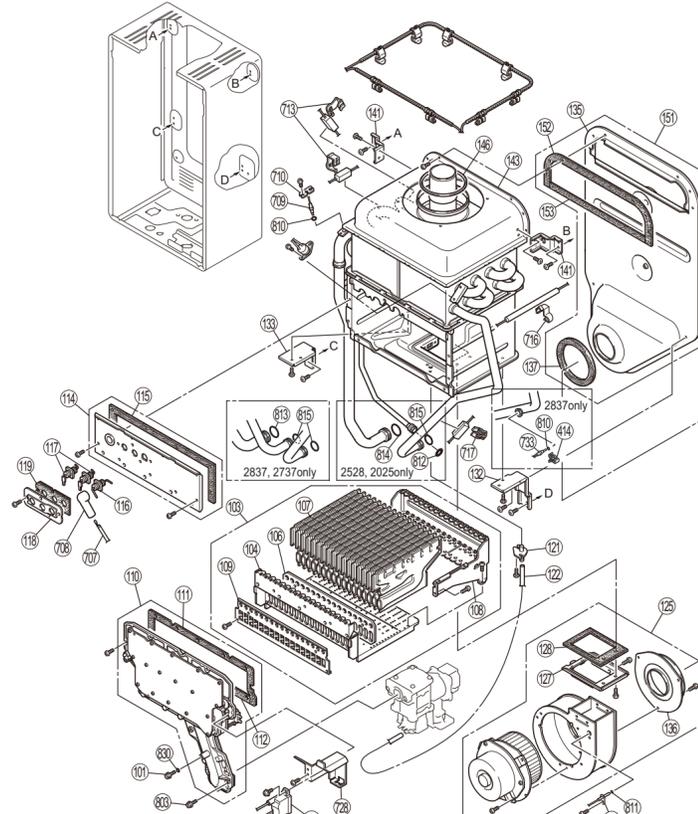


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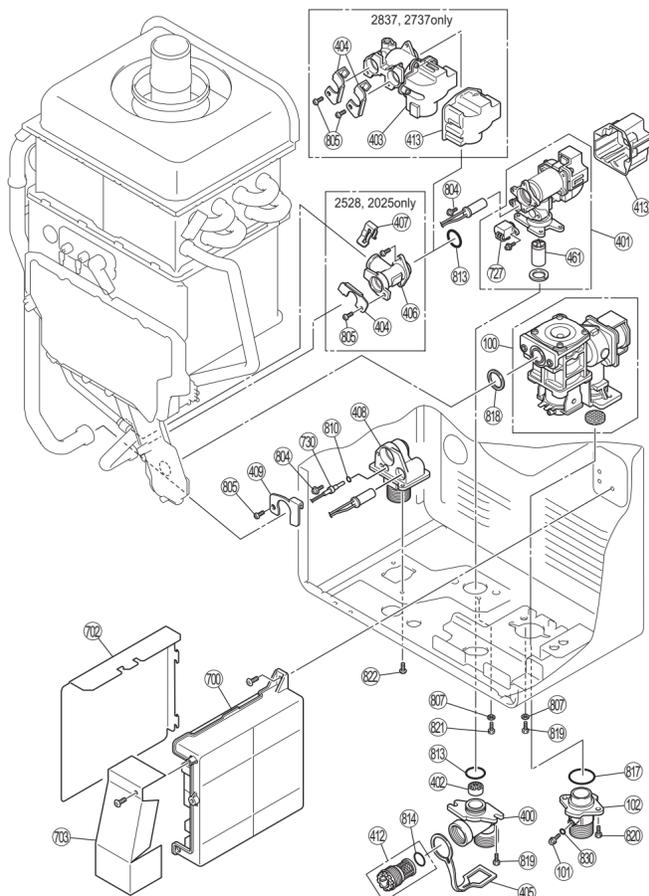
**EXPLODED VIEW - CABINET**



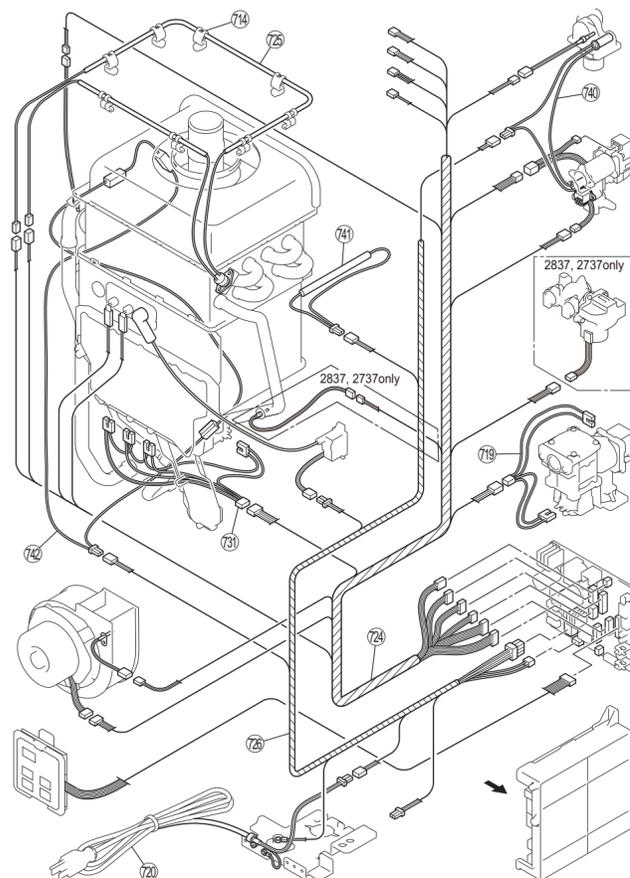
**EXPLODED VIEW - INTERNALS**



**EXPLODED VIEW - INTERNALS**



**EXPLODED VIEW - ELECTRICAL**



Item Description	Part Number	V94i			Item Description	Part Number	V94i			Item Description	Part Number	V94i		
		VC2837	VC2737	VC2528			VC2837	VC2737	VC2528			VC2837	VC2737	VC2528
001 MAIN BODY	109000289	1	1	1	141 HEAT EXCHANGER BRACKET	109000269				717 HEATER CLIP	AU100-721	1	1	1
002 WALL BRACKET	109000259	2	2	2	143 HEAT EXCHANGER ASSEMBLY	107000101			1	719 MAIN SOLENOID HARNESS	105000162	1	1	1
004 CONNECTION REINFORCEMENT	109000261	1	1	1	143 HEAT EXCHANGER ASSEMBLY	107000099	1			720 POWER CORD ASSEMBLY	CP-90580	1	1	1
006 FRONT PANEL	109000295	1	1	1	144 FLUE CONNECTION ASSEMBLY	108000068	1	1	1	724 SENSOR HARNESS-3	105000165			1
008 FRONT PANEL PACKING	U245-3185-2	2	2	2	145 INLET SEAL	109000239	1	1	1	724 SENSOR HARNESS-1	105000163	1		
009 TEMPERATURE CONTROL	105000188	1	1	1	146 O-RING	108000018	2	2	2	725 FUSE HARNESS	105000167	1	1	1
010 TEMPERATURE CONTROL PLATE	109000263	1	1	1	147 PIPE SEAL	109000170	1	1	1	726 POWER SUPPLY HARNESS	105000184	1	1	1
016 SCREW COVER	109000294	2	2	2	148 CAP	109000171	1	1	1	727 WATER FLOW SENSOR	105000176	1	1	1
100 GAS CONTROL ASSEMBLY	106000085	1	1	1	149 PACKING	109000240	1	1	1	728 IGNITOR BRACKET	109000272	1	1	1
101 TEST PORT SET SCREW	C10D-5	2	2	2	151 AIR INLET ASSEMBLY	108000069	1	1	1	730 TWIN THERMISTOR	105000108	1	1	1
102 3/4 GAS INLET	106000065	1	1	1	152 DUCT PACKING UPPER	108000070	1	1	1	731 SOLENOID HARNESS	105000168	1	1	1
103 BURNER UNIT ASSY (LPG)	106000072	1	1	1	153 DUCT PACKING LOWER	108000071	1	1	1	732 INLET AIR THERMISTOR	105000029	1	1	1
103 BURNER UNIT ASSY (NG)	106000073	1	1	1	400 WATER INLET	H73-501-2	1	1	1	733 THERMISTOR	H111-650	1		
104 BURNER CASE FRONT PANEL	106000074	1	1	1	401 WATER FLOW SERVO & SENSOR	107000090	1	1	1	734 SENSOR BRACKET	109000273	1	1	1
106 PACKING	109000264	1	1	1	402 RECTIFIER	M8D1-15	1	1	1	735 SCREW	109000279	1	1	1
107 BURNERS	106000054	17	17	17	403 BY-PASS SERVO ASSEMBLY	107000091	1			740 HEATER	105000154	1	1	1
108 BURNER CASE BACK PANEL	106000075	1	1	1	404 PIPE BRACKET	AH69-310	2	1	1	741 HEATER	105000169	1	1	1
109 DAMPER(LPG)	106000076	1	1	1	405 PLUG BAND	109000018	1	1	1	742 HEATER	105000171	1	1	1
109 DAMPER (NG)	106000077	1	1	1	406 FIXED BYPASS	107000103	1	1	1	800 TRUSS SCREW	CP-30580-2	8	8	8
110 MANIFOLD ASSEMBLY (LPG)	106000078	1	1	1	407 CLIP	109000278	1	1	1	801 TRUSS SCREW	CP-30580	4	4	4
110 MANIFOLD ASSEMBLY (NG)	106000079	1	1	1	408 HOT WATER OUTLET (3/4 NPT)	107000104				802 NYLON WASHER	AU33-184X01	4	4	4
111 COMB CHAMBER PACKING UPPER	106000080	1	1	1	408 HOT WATER OUTLET (3/4 NPT)	107000092	1			803 SCREW	109000280	2	2	2
112 COMB CHAMBER PACKING LOWER	106000081	1	1	1	409 STOP BRACKET	U211-322	1			804 SCREW	U217-449	2	2	2
114 COMB CHAMBER FRONT PANEL	106000082	1	1	1	409 STOP BRACKET	AU162-1876		1	1	805 SCREW	CP-20883-410UK	3	2	2
115 COMB CHAMBER PACKING - 2	106000083	1	1	1	412 FILTER ASSEMBLY	H98-510-S	1	1	1	807 PLASTIC WASHER	AU48-174	2	2	2
116 ELECTRODE	105000179	1	1	1	413 COVER	107000093	2	1	1	810 O-RING	M10B-2-4	3	2	2
117 FLAME ROD	105000093	2	2	2	414 CLIP	105000090	1			811 O-RING	M10B-2-3	1	1	1
118 ELECTRODE BRACKET	105000156	1	1	1	461 WATER FLOW TURBINE	107000088	1	1	1	812 O-RING	M10B-2-10		1	1
119 ELECTRODE PACKING	105000157	1	1	1	700 PC BOARD	105000160			1	813 O-RING	M10B-2-18	3	2	2
121 BACK PRESSURE CONNECTOR	U242-312	1	1	1	700 PC BOARD	105000158	1			814 O-RING	M10B-2-16	1	2	2
122 TUBE G	109000198	1	1	1	702 COVER	109000247	1	1	1	815 O-RING	M10B-2-14	2	1	1
125 FAN MOTOR ASSEMBLY	108000061	1	1	1	703 EC COVER	109000248	1	1	1	817 O-RING	M10B-1-24	1	1	1
127 FAN CONNECTING BRACKET	108000062	1	1	1	706 IGNITOR	105000180	1	1	1	818 PACKING	109000181	1	1	1
128 FAN CONNECTING BRACKET PACKIN	108000063	1	1	1	707 HIGH TENSION CORD	BH38-710-240	1	1	1	819 HEXAGON HEAD SCREW	ZQAA0512UK	3	3	3
132 HEAT EXCHANGER BRACKET	109000265	1	1	1	708 ELECTRODE SLEEVE	AU206-218	1	1	1	820 HEXAGON HEAD SCREW	ZQAA0514UK	2	2	2
133 HEAT EXCHANGER BRACKET	109000266	1	1	1	709 THERMISTOR	105000114	1	1	1	821 HEXAGON HEAD SCREW	ZQAA0508UK	1	1	1
135 AIR INLET	108000064	1	1	1	710 RETAINER (THERMISTOR)	CP-90172	1	1	1	822 SCREW	CP-30580	2	2	2
136 FAN BRACKET	109000267	1	1	1	713 HEATER CLIP	109000270	2	2	2	830 O-RING	M10B-13-4	2	2	2
137 SEAL PACKING	109000268	1	1	1	714 FUSE HOLDER	U250-670X01	8	8	8	888 MANUAL	100000258	1	1	1
					716 HEATER CLIP	109000271	2	2	2	889 TECH SHEET	100000260	1	1	1