

Diagnostic Use of the Controller

DIPSW 2.

1. To display the most recent diagnostic codes press and hold the "On/Off" button for 2 seconds on the MC-91 controller.

2. 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 \blacktriangle and \blacktriangledown 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 Prioritv 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

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	Gas Inlet	Min./Max	Force	d Low	Force	d High		
	Inlet Max.	NAT.G	LPG	NAT.G	LPG	NAT.G	LPG		
C199e	150 PSI	4"W.C./ 10.5"W.C.	8"W.C./ 13.5"W.C.	0.46"W.C.	0.50"W.C.	3.0"W.C.	3.5"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.

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.

03

05

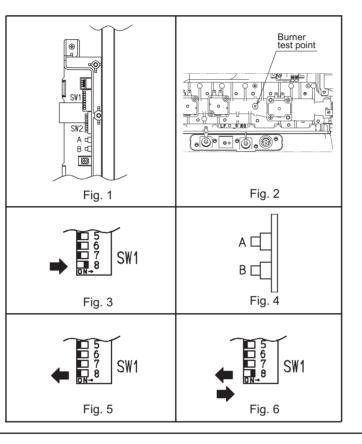
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- 1. Turn OFF the gas supply.
- 2. Turn OFF the water supply.
- 3. Remove the front panel (four screws).
- 4. Check the gas type using the data plate on the side of the unit. Confirm that the gas type switch is in the correct position (switch 1 of SW2 is ON for natural gas, NG, and OFF for propane gas, LPG.) Figure 1.
- 5. Remove the screw and attach the manometer to the burner test point located on the gas control. Figure 2.
- 6. Turn on the gas supply and the power supply.
- 7. 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.)
- 8. Move switch 8 of SW1 to ON. Figure 3.
- 9. Push the PC board switch A for one second. Figure 4. 10. Calibrate "Forced Low" combustion using switch A (up) and
- switch B (down). 11. Move switch 8 of SW1 to OFF and then back to ON. Figure 6.
- 12. Push the PC board switch B for one second. Figure 4.
- 13. Calibrate "Forced High" combustion using switch A (up) and switch B (down).
- 14. Move switch 8 of SW1 to OFF. Figure 5.
- 15. Close hot water taps.
- 16. Turn off gas supply and 120 V power supply.
- 17. Remove manometer and re-install screw.
- 18. Turn on the gas supply and 120 V power supply.
- 19. Operate the unit and check for gas leaks.
- 20. Install the front panel using four screws.



Diagnostic Codes

 O3 Power interruption during Bath fill (Water will not flow when power returns) Turn off all hot water taps. Press ON/OFF twice. 	 32 Outgoing Water Temperature Sensor 33 Heat Exchanger Outgoing Temperature Sensor 41 Outside Temperature Sensor 				
05 Bypass Servo • Replace bypass servo	 51 Inlet Water Temperature Sensor Check sensor wiring for damage. Measure resistance of sensor. Clean sensor of scale build-up. 				
 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. Burner Sensor (see code 31) 	 Replace sensor. 52 Modulating Solenoid Valve Signal Check modulating gas solenoid valve wiring harness for loose or damaged terminals. Measure resistance of valve coil. 				
 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. 	 57 Burner Contact a service provider. 58 Secondary Heat Exchanger There is scale build up in the secondary heat exchanger and it 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. 				
 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. 	 61 Combustion Fan Ensure fan will turn freely. Check wiring harness to motor for damaged and/or loose connections. Measure resistance of motor winding. 				
 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. 	 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. 				
 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. 	 70 PC Board Check PC board DIP switches for correct positons. Check the connection harness at the connection on the PC board. Replace PC board. 				
 Verify dip switches are set property. 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. 	71 Solenoid Valve Circuit • Replace the PC Board.				
 Oneck name rod for carbon band-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. 	 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. 				
14 Thermal FuseEnsure dip switch 5 in the second bank of dip switches(white) is in the off position.	 Measure micro amp output of sensor circuit with flame present. Replace the PC Board. 				
 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. 	 73 Burner Sensor Circuit Check sensor wiring and PC board for damage. Replace the PC Board. 				
 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. 	 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. 				
 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. 	 FF Maintenance Performed Indicates a service provider performed maintenance or repair. Enter this code by pressing up, down, and ON/OFF simultaneously. 				

19 Electrical Grounding

Check all components for electrical short.

- 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

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

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 and POV)	Gas valve	and Modulating so	olenoids:	(Set meter above 2K)

(3	(,
Wire color	Voltage	Resistance	Connector #	Pin #'s
(Main) Black - Pink	11 ~ 13 VDC	24 ~ 28 ohms	B1	3 - 4
(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	35 ~ 41 ohms	B4	4 - 5
(POV) Yellow - Yellow	2 ~ 15 VDC	67 ~ 81 ohms	D1	1 - 2

(M) Water F	low Control Device S	Servo or Geared Moto	or:	
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 Contro	l:			
Red - Pink	N/A	44 ~ 52 ohms	G1	12 - 13
White - Blue	N/A	44 ~ 52 011115	G1	10 - 11
(IG) Ignition System:				
Grey - Grey	110 ~ 130 VAC	N/A	C1	1 - 3
(FM) Combustion Far				
Red - Black	6 ~ 45 VDC	N/A	L2	5 - 6
White - Black	5 ~ 10 VDC	9.60 ~ 9.75 K ohms	L2	3 - 5
Yellow - Black	11 ~ 13 VDC	3.90 ~ 4.05 K ohms	L2	4 - 5
Set your meter to the h you should read betwe Fhermal Fuse / Overh	en 60 and 420 hertz.	ross the white and bla	ck wires at termi	nals 3 and 5
I nermai Fuse / Overn	eat Switch:			
Red - White	11 ~ 13 VDC	Below 1 ohms	B8 B7	B1 - G8

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 86°F = 6.4 ~ 7.8KΩ	140°F = 2.2 ~ 2.7KΩ 221°F = 0.6 ~ 0.8KΩ	
	113°F = 3.6 ~ 4.5KΩ		

Outgoing Water Thermisto

	mator.								
White - White	N/A	See example above	E6	2 - 3					
Blue - Blue	N/A	See example above	E6	4 - 5					
Heat Exchanger Temperature Thermistor:									
Pink - Pink	N/A	See example above	E5	4 - 7					
Inlet Thermistor:									
White - White	N/A	See example above	E9	4 - 9					
Remote Controls:									
Terminals J	10 ~ 13 VDC	1.5 ~ 3.0 K ohms	J	1 - 2					

ost Protection:

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

p Fuses:

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

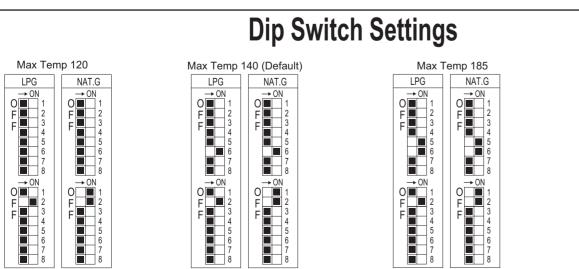
*Max Temp 185

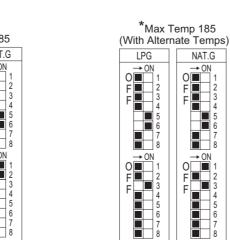
LPG

NAT.G

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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.

*Alternate Temperature Settings									
Fahrenheit °F	145	150	155	160	165	170	175	180	185
Celsius °C	63	66	68	71	74	77	79	82	85

25 Condensate Trap

Condensate trap is full. Check condensate trap and drain pipe for blockage

Replace condensate trap.

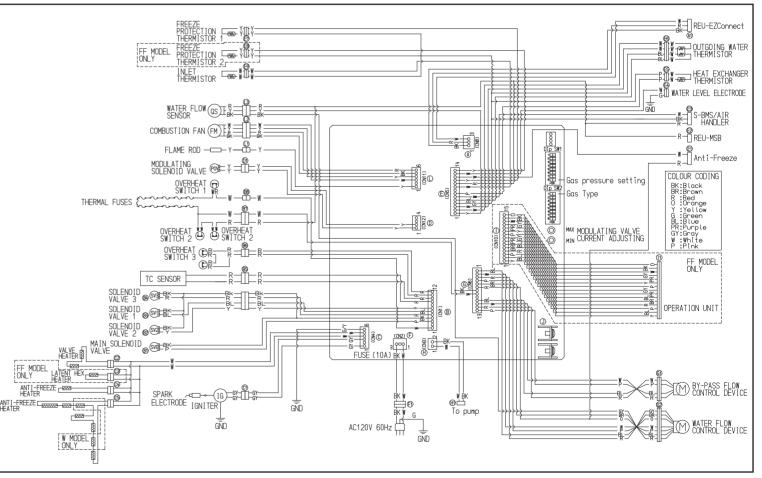
31 Burner Sensor

 Measure resistance of sensor Replace sensor.

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

• Clean inlet water supply filter.

Wire Diagram



High Altitude Installation Settings

Adjust switches 2 and 3 in the tan switches depending on your altitude according to the table below.

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

Top Bank of Dip Switches (tan in color)

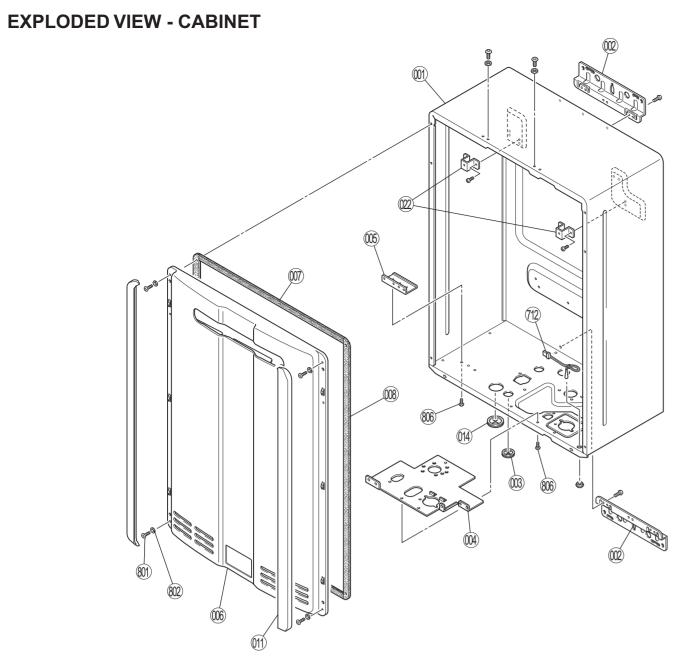




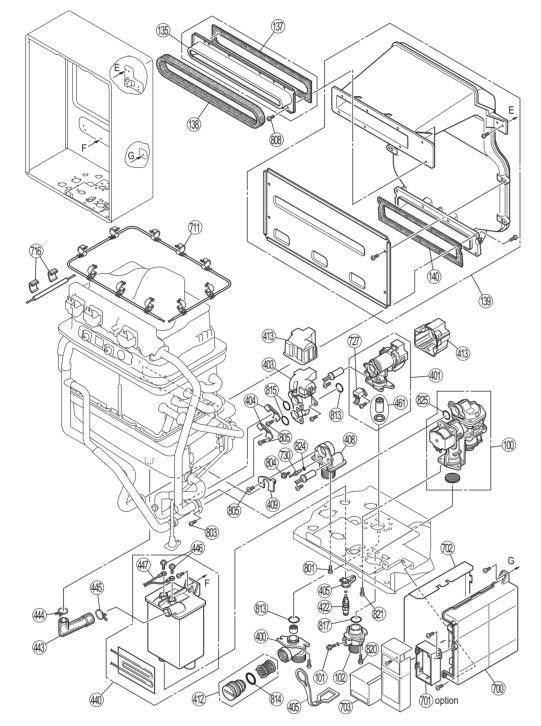


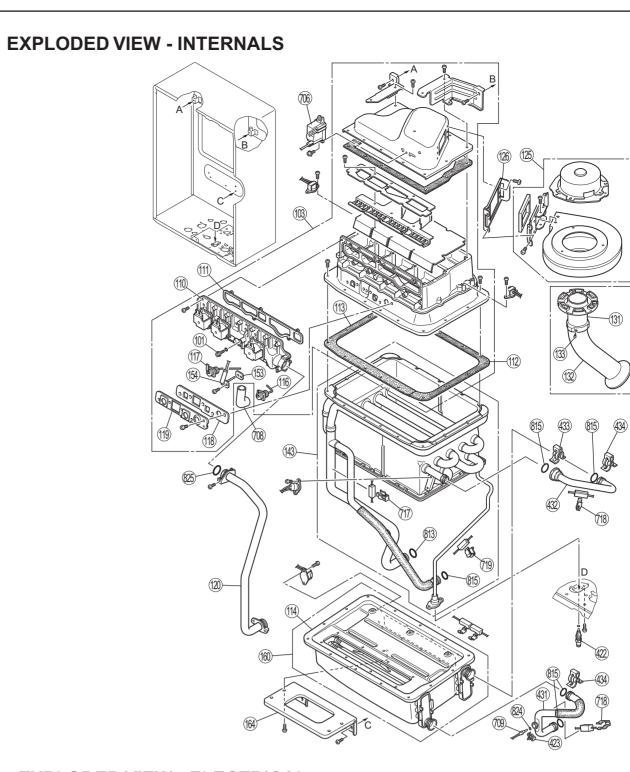
C199e (KB3237WDC-US)

U306-1982(00)

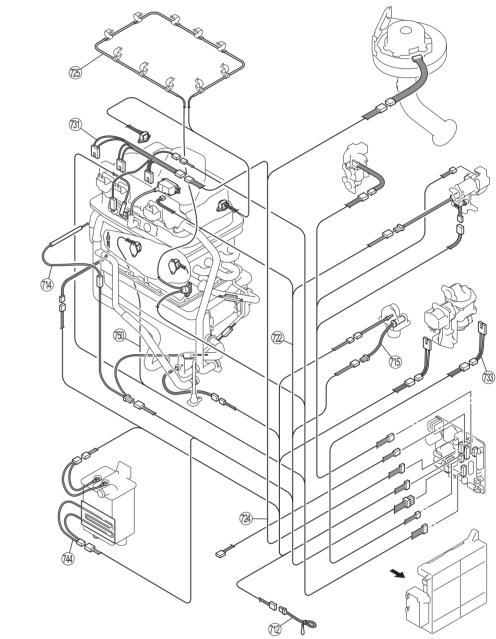


EXPLODED VIEW - INTERNALS





EXPLODED VIEW - ELECTRICAL



Item	Description	Part Number	Qty	ltem	Description	Part Number	Qty	ltem	Description	Part Number	Qty
001	Main Body	109000224	1	143	Heat Exchanger Assembly	107000147	1	714	Anti Frost Heater 120V	105000153	1
002	Wall Bracket	BU195-121	2	153	Burner Sensor Gasket	109000241	1	715	Valve Heater 120V	105000154	1
003	Rubber Bushing-A	CF79-41020-A	1	154	Burner Thermistor	105000147	1	716	Anti Frost Heater Clip	CF29-742	2
004	Connection Reinforcement Panel	109000225	1	160	Secondary Heat Exchanger	107000089	1	717	Anti Frost Heater Clip A	AU124-618	1
005	Reinforcement Panel	109000226	1	164	Secondary Heat Exchanger Bracket	109000242	1	718	Anti Frost Heater Clip	U250-625	2
006	Front Panel	109000228	1	400	Water Inlet 3/4" NPT	H73-501-2	1	719	Anti Frost Heater Clip	109000251	1
007	Gasket - Top and Bottom	109000120	2	401	Water Flow Servo & Sensor Assemb	107000090	1	722	IG Anti Frost Harness	105000172	1
008	Gasket - Side	109000121	2	402	Rectifier	107000105	1	724	Sensor Harness-2	105000174	1
011	Screw Cover	109000230	2	403	Bypass Flow Assembly	107000091	1	725	Thermal Fuse Harness Assembly	105000175	1
014	Rubber Bushing	U245-125	1	404	Stop Bracket	AH69-310	2	727	Water Flow Sensor	105000176	1
022	Attachment Bracket	109000274	2	405	Plug Band	109000018	1	730	Twin Thermistor	105000108	1
100	Gas Controller Assembly	106000064	1	408	Hot Water Outlet 3/4" NPT	107000092	1	731	Solenoid Connection Harness	105000177	1
101	Test Port Set Screw	C10D-5	2	409	Stop Bracket	U211-322X01	1	733	Connection Harness	105000178	1
102	Gas Connection 3/4" NPT	106000065	1	412	Water Filter Assembly	H98-510-S	1	744	Condensate Trap Harness	105000106	1
103	Burner Unit Assembly-LPG	106000103	1	413	Servo Cover	107000093	2	750	Over Heat Switch Harness	105000199	1
103	Burner Unit Assembly-NG	106000104	1	422	Drain Plug	107000058	2	801	Screw	109000178	6
110	Manifold Assembly-LPG	106000066	1	423	Clip	105000090	2	802	Washer	AU33-184X01	4
110	Manifold Assembly-NG	106000067	1	431	Connecting Pipe - Inlet	107000094	1	803	Screw	109000179	2
111	Gasket	109000232	1	432	Connecting Pipe - HEX	107000148	1	804	Screw	U217-449	1
112	Gasket	109000233	1	433	Clip	109000132	1	805	Screw	CP-20883-410UK	3
113	Gasket	109000234	1	434	Clip	109000244	2	806	Screw	ZBA0408UK	3
114	Gasket	109000235	2	440	Condensate Trap	109000245	1	808	Screw	109000255	8
116	Electrode	105000145	1	443	Condensate Drain Tube	109000246	1	813	O-ring	M10B-2-18	3
117	Flame Rod	105000146	1	444	Band	109000137	1	814	O-ring	M10B-2-16	1
118	Electrode Packing	109000236	1	445	Band	109000138	1	815	O-ring	M10B-2-14	7
119	Electrode Holder	109000237	1	446	Screw	109000155	2	817	O-ring	M10B-1-24	1
120	Gas Pipe Assy	106000084	1	447	Connection Harness	105000105	1	820	Screw	ZQAA0514UK	4
125	Fan Motor All Assembly	108000052	1	461	Water Flow Turbine	107000088	1	821	Screw	ZQAA0512UK	1
126	Fan Bracket	108000053	1		PC Board	105000201	1		O-ring	M10B-2-4	3
131	Noise Filter A	108000054	1	701	Anti Frost Unit	BU195-1873-2	1	825	O-ring	109000252	2
132	Noise Filter B	108000055	1	702	PC Board Cover Side	109000247	1	888	Tech Sheet	100000383	1
133	Filter Rivet	109000427	1		PC Board Cover Front	109000426	1	889	Manual	100000380	1
135	Flue Outlet Assembly	108000045	1	706	Ignitor	106000068	1	900	Front Panel Label	109000468	1
137	Gasket	108000046	1	708	Electrode Sleeve	109000249	1				
138	Gasket	AH24-653-6	1	709	Thermistor	H111-650	2				
139	Exhaust Duct Assembly	108000057	1	711	Thermal Fuse Clip	109000250	10				
	Gasket	109000238	1	712	Frost Sensing Thermistor Assembly	105000150	1				