Rinnai

TROUBLESHOOTING

Water Heater

Error Codes





⚠ WARNING

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 product.

You MUST be a qualified service person before processing with these test instructions.

Before checking resistance readings turn off power to unit and then isolate each item to be checked from the circuit by unplugging it.

When setting gas pressures on one of these units, please check the complete model number you are troubleshooting. Gas pressures and dip switches can vary among models. Always check the rating plate for complete information and follow directions.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

If any of the original wire as supplied with the appliance must be replaced. It must be replaced with type 18 AWG wire or its equivalent.

Table of Contents

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Error Codes		Page #
02	No Burner Operation during Freeze Protection Mode	5
03	Power Interruption During Bath Fill - (Water will not flow when power returns)	9
05	Bypass Servo	10
07	Circulation Flow Rate has dropped below 2.1 gpm	11
10	Air Supply or Exhaust Blockage	12
11	No Ignition	15
12	Flame Failure	19
13	Combustion	23
14	Thermal Fuse or Overheat	25
16	Over Temperature Warning (Safety shutdown because unit is too hot	27
19	Electrical Grounding	28
25	Condensate Trap is Full	29
30	Flammable Vapors Detected	30
31	Burner Thermocouple	31
32	Outgoing Water Temperature Thermistor Fault .	32
33	Heat Exchanger Outgoing Thermistor	33
34	Combustion Air Temperature Thermistor (Internal units only)	34
35	Tank Temperature Sensor	35
38	Exhaust Gas Temperature Sensor or C.O Sensor	36
41	Freeze Protection Sensor for External Units	39
51	Inlet water Temperature Sensor	40
52	Modulating Solenoid Valve Signal Abnormal (POV)	41
54	High Exhaust Gas Temperature	42
57	Burner Overheat Bi-metal Switch	43
58	Secondary Heat Exchanger Sensor	44
61	Combustion Fan Motor	45
63	RUR Circulation Pump or RH-180 Flow Rate Dropped Below 1.3 GPM	46
65	Water Flow Servo	48
70	P.C. Board Fault	49
71	SV0, SV1, SV2 or SV3 Solenoid Valve Fault	50
72	Flame Sensing Device Fault	51

Table of Contents

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

73	Burner Thermocouple Fault	52
79	Water Leakage Detected	53
FE	Flammable Vapors Detected	54
FF	Indicates A Serviceman Has Serviced Product	55
Cold Water Sandwich Caused By Low		56
Cold Water Sandwich Caused By Faulty Fixture		58
LC, LCO-LC9	Scale Build Up In Heat Exchanger	59
No Code	Nothing Happens When Water Flow Is Activated	60
How to Retrieve Flow Rate and Temperature Output from Unit		61

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 02

No Burner Operation during Freeze Protection

WARNING: You must be qualified to service gas systems before proceeding.

1. Verify all gas valves on gas system are open feeding the proper gas pressure to said appliance.

2. Verify all air was properly purged from gas lines after installation.

3. Verify proper inlet gas pressures are being fed to appliance. Check appliances rating plate for proper pressures. This plate or label is located on the side of each unit. The minimum listed inlet pressure MUST be maintained with all gas appliances at the location firing on high fire. If the product is a condensing unit the front panel must be installed before testing inlet pressures.

4. Verify proper gas type; ensure the gas supply at this location matches that listed on said appliance.

5. Verify gas type dip switch on PC board is switch to proper gas type position.

6. Verify igniter is working. **WARNING:** Turn off gas valve feeding the appliance before preforming this test. Unplug igniter wire; hold the igniter wire with an insulated pair of pliers about a 1/4" from a piece of metal. Cycle the unit to ensure you see a spark when unit is cycling. If not, check ignition system for loose connections, damaged components or disconnected plugs back to PC board. If no spark is noted check the ignition board to verify it is getting the proper voltage from the PC board. See technical data sheet under the unit's front cover for proper voltage and connector numbers. Note; there will be no voltage present unless the unit is going through the ignition cycle.

7. Make sure the ceramic sparker electrode and flame rod(s) are tight in the mounting bracket. You should not be able to move the flame rod(s) are electrode with your finger if gasket is intact. If loose remove and clean the electrode and flame rod(s). Then, reinstall using new electrode/flame rod gasket. Ensure the components are tight once gasket has been replaced. Loose flame rod(s) or electrodes can lead to code 11's or 12's also.

8. Verify the proper flame rod wire is plugged into the proper flame rod. Some units have multiple flame rods. A quick check to verify correct wiring is to look at the stamped letter on the bracket at flame rod, sample a Y indicates yellow, R = red and B = blue

9. Look into view window on appliance to see if you ever see a flame in the burner box while the unit is going through the ignition cycle. If you do that indicates an issue in the flame rectification circuit. This could be a buildup of carbon or a white substance on flame rod, bad connection at flame rod, loose or damaged flame rod, bad PC board, gas valve or low inlet gas pressures. Before replacing the PC board or gas valve continue troubleshooting the steps below.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

10. **WARNING:** Turn off the electrical, gas and water supply before performing this inspection. Remove the igniter and flame rod assemblies and inspect them for carbon or a white substance build-up. Clean both components before re-installing them. If you removed just the igniter and flame rod assemblies, make sure you have a new flame rod/igniter gasket before removing these components. This gasket **MUST** be replaced if the seal is broken.

11. **WARNING:** Turn off the electrical, gas and water supply to the water heater on the following series product to perform this task, VA, VB, VC, KA, RH-180 and KCM units. Next; remove the burner manifold and inspect the orifices on the back side of this manifold for clogged or blocked orifices. Proceed with removing the burner assembly and inspect the chamber for insects or other debris. Clean out all debris found in the burner and air chambers. Also inspect the copper fins in heat exchanger for a build-up between the fins. Build-up or blockage between the heat exchanger fins will cause air flow restrictions, which will lead to code 10's. If build up is present, you will need an air compressor capable of delivering 120 psi of compressed air to blow out the burner and heat exchanger fins. If unable to clean the heat exchanger with compressed air, replace the heat exchanger. **CAUTION:** Always wear safety glasses and a mask when blowing out the burner.

12. If you note improper inlet gas pressures check to see if the gas system was properly sized. If sized properly you should see no more than a 0.3 inch pressure drop on natural gas with all gas appliances in the building firing on high fire. The allowable pressure drop for propane is 0.5 inches of water column. This pressure drop is based on the International Plumbing Code when operating on gas pressures up to 14" inches W.C. with black iron piping. There are a number of approved gas piping system out there, make sure you refer to the manufacture's or International Plumbing Code book for pressure drops on gas piping and pressures you are using for proper pressure drops allowed. If pressure drop exceeds that mentioned above for black iron gas systems, your system could be undersized, please recheck sizing. The issue could be in any of the following items; the gas system, gas piping, regulator, tank, utility supply, dirt or debris in gas system components, etc. Have the gas system checked by a professional gas technical or master plumber that deals with gas system sizing. Refer to the International Plumbing Code Book for proper gas system sizing for gas type, piping and pressures being used at this location.

13. Inspect vent system for loose joints, improper fittings, failure to meet clearances around vent terminal outside building. See venting instructions for clearance specifications. Failure to meet vent terminal clearances can lead to recirculation of combustion gases on all units, (with exception to the RH-180) causing incomplete combustion which will lead to carbon build up on flame rod. In addition; ensure vent length is within specifications and dip switch for vent lengths has been properly set.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

14. Verify that proper venting materials were used in this installation, see owner's manual or venting instructions for details on the proper type venting materials that should be used with your unit.

15. Verify proper altitude settings, see high altitude gas pressure setting procedure for dip switch and manifold gas pressure settings, found in owner's manual or technical date sheets behind unit's front cover.

16. On internal units inspect the plastic tube running from the bottom of the combustion chamber to the gas valve. If you find moisture in that tube, replace the gas valve. Also inspect the vent system to see where the condensate/moisture is coming from. The burner and heat exchanger fins should be inspected for excessive corrosion also. Signs of moisture could be a result of an improper venting or a leak inside the heat exchange.

17. Verify the condensate drain trap was used as recommended by Rinnai on non-condensing units at the vent terminal connection at the top of the water heaters (with exception to the RH-180). If the condensate drain line is not connected please install one per Rinnai venting instructions. If a condensate line is in use, inspect the vent connector on top of water heater to ensure it's not clogged up. In addition; check the condensate drain trap and line for blockage. If stopped up, remove vent pipe from unit and clean out all debris and/or build up from the trap or line.

18. Check that any two stage regulator used on the inlet gas feed is installed at least six foot away from appliance. Ensure when appliance shuts off the pressure from the two stage regulator doesn't exceed the maximum inlet pressure of the appliance, no bleed though being allowed. To verify this, connect your manometer up to the test port on the bottom of the water heater. The inlet gas pressures should never exceed 10 inches water column for natural gas or 13.5 inches on propane. If it does the regulator may be defective.

19. **WARNING:** Disconnect power supply to unit to perform this inspection. Inspect all wiring harnesses throughout unit for water or moisture in electrical connections. If any connections appear to be damp or wet dry them out and try to find out what is causing this.

20. If using an MSA or MSB system isolate the unit giving trouble from the system during troubleshooting. If unit operates when isolated the issue may be in the electronic staging system (MSA or MSB). The MSA or MSB system does not apply to the RH-180.

21. Other suggestions; **WARNING:** Turn off the electrical, gas and water supply to the water heater on the following series product to perform this task, VA, VB, VC, KA, RH-180 and KCM units.

a. Verify spark electrode is installed in the correct position.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

b. Verify all burner cassettes are in place in burner rack. Sometimes when contractors drop a unit the burners can shift and become dislodged. If you find the burners dislodged, loosen the burner bracket and reseat them.

c. Remove the four burners located under the flame rod and move them over to the high fire side of the burner tray. Move the four burners from the high fire side over under the flame rod. Sometimes condensate or debris can get down in the burners and cause turbulence inside the burner.

d. Condensate, debris or a malfunctioning mechanical component inside the gas valve may be preventing the valve from opening correctly once in a while. Replace gas valve.

e . Voltage output to gas valve from PC board could be incorrect or intermittent due to a bad component on PC board, replace PC board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 03

Power Interruption during Bath Fill

1. Turn off all hot water fixtures in building.
2. Press the ON/OFF button on the temperature controller twice.
3. This should reset the unit and code.
4. If code reappears after resetting unit three times, replace P.C. board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 05

Bypass Servo

All tankless water heaters, with exception to the RH-180

1. Turn off power supply to unit and then reapply power.

2. Turn on a tap and let unit fire up, if code 05 reappears, replace bypass valve.

RH-180 Code 05 Data:

1. Clean air filter.

2. Ensure the proper vent system and components were installed per Rinnai's recommended installation procedures. Approved vent material is 4" B-Vent.

3. Inspect vent system for obstructions.

4. Verify you maintained the proper clearance around the vent termination.

5. **CAUTION:** Turn off power supply to unit. Remove fan motor and inspect fan wheel and housing for any type restriction. Re-install fan, after installation reapply power to unit and test for proper operation.

6. **WARNING:** Turn off the electrical, gas and water supply to the water heater. Next; remove the burner manifold and inspect the orifices on the back side of this manifold for clogged or blocked orifices. Proceed with removing the burner assembly and inspect the chamber for insects or other debris. Clean out all debris found in the burner and air chambers. Also inspect the copper fins in heat exchanger for a build-up between the fins. Build-up or blockage between the heat exchanger fins will cause air flow restrictions, which will lead to code 05 or 10. If build up is present, you will need an air compressor capable of delivering 120 psi of compressed air to blow out the burner and heat exchanger fins. If unable to clean the heat exchanger with compressed air, replace the heat exchanger. **CAUTION:** Always wear safety glasses and a mask when blowing out the burner.

7. Proceed to the code 10 troubleshooting details if the items above did not clear the code 05.

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Code 07

Circulation Flow Rate below 2.1 gpm

1. Verify unit has power.
2. Verify your water supply is turn on and your have at least 30 psi feeding the unit.
3. Check to see if pump is operational.
4. Check pump wiring harness for loose, damaged or broken connections.
5. Drain tank, check to ensure inlet water filter is not clogged.
6. Flush heat exchanger to ensure it is not clogged with scale build-up.

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Code 10

Air Supply or Exhaust Blockage

1. Inspect the entire vent system inside/outside the installation site. Check for clearance issues, ensure proper venting materials were used, ensure all sections are properly seated, joints are sealed and cannot be pulled apart, etc.

NOTICE: Please note: Rinnai offers several different types of venting materials across our line of tankless and tank/tankless water heaters. It is important to ensure the proper vent materials were used on your unit. ***You MUST refer to owner's manual of the product being serviced for the approved venting materials allowed for your specific water heater.***

2. Next; Perform this test only if the unit is coding out while onsite. Remove the vent system from the top of the water heater. Fire the product and see if the unit will operate without the vent system connected. If so, this is an indication the issue is in the vent system and not the unit. **WARNING:** Never leave a unit operating with the vent system disconnected. The test mentioned above is only that, a test, reconnect vent immediately after performing this test. Ensure the front cover is installed on product before performing this test.

3. Verify each vent section for proper installation.

a. If using concentric or common vent materials this may require disassembling each section of venting to inspect for proper installation and depth. Mark each concentric or common vent joint with a marker before disassembling. This will allow you to determine the proper depth when the vent sections are disassembled. Make sure to use the lubricant supplied by Rinnai when assembling the concentric or common vent sections. **WARNING:** Failure to use the lubricant may result in improperly sealed joints, which will lead to code 10 or exhaust gas leakage.

Rinnai/Ubbink concentric venting with an aluminum inter pipe and white PVC outer shell for the intake air is approved for use with all Rinnai non-condensing tankless water heaters with exception to the RH-180, see below for approved venting for the RH-180 water heaters.

Rinnai/Ubbink concentric venting with a polypropylene (PP) inter pipe and common vent pipe are approved for use with all condensing water heaters. The exhaust portion of the system is a special material made from Polypropylene (PP) piping.

b. PVC/CPVC solid core piping can be used to vent Rinnai condensing tankless water heaters.

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Ensure all joints were properly glued and seated. Inspect system for damage, cracked or melted sections.

c. 4" B-Vent venting materials ***ONLY*** are approved for the RH-180 tank/tankless water heater. Follow the vent manufacturer's instructions for proper installation. Follow vent manufacturer's instructions to ensure proper installation of the vent system.

4. Verify dip switch for vent lengths were set to the proper position for your application. First determine total vent length. See owner's manual for your specific water heater to determine the length of any 90 degree elbows or forty fives that are being used in the vent system. **Example;** a vent system using concentric venting materials with two ninety degree elbows, one forty five degree elbow and ten foot of straight pipe would be calculated as twenty five foot of total vent length. In concentric venting a 90 degree elbow counts as six foot, a 45 degree as three foot.

5. If installer sprayed a foam sealant around the vent pipe penetration through the wall, check to ensure this material did not collapse the intake pipe. Look down vent pipe with a flash light. If you can't see that section of venting material remove it from the wall and inspect it.

6. Check for debris in vent system. Disconnect joints looking for water, condensation, insects or other items.

7. Verify all vent terminations meet Rinnai's recommendation from another vent termination on the same wall or roof. If multiple Rinnai's are installed at the location, see owner's manual or venting instructions for the vent materials being used for the proper clearances between vent terminations for details.

8. Verify vent terminals are installed with the proper clearance from overhangs, grade, obstructions, walls, porches, etc. See venting instructions for proper clearance requirements.

9. **CAUTION:** Turn off power supply to unit. Remove fan motor and inspect fan wheel, housing, and air duct for any type restriction. Re-install fan, after installation reapply power to unit and test for proper operation.

10. **WARNING:** Turn off the electrical, gas and water supply to the water heater on the following series product to perform this task, VA, VB, VC , KA, RH-180 and KCM. Next; remove the burner manifold and inspect the orifices on the back side of this manifold for clogged or blocked orifices. Proceed with

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removing the burner assembly and inspect the chamber for insects or other debris. Clean out all debris found in the burner and air chambers. Also inspect the copper fins in heat exchanger for a build-up between the fins. Build-up or blockage between the heat exchanger fins will cause air flow restrictions, which will lead to code 10's. If build up is present, you will need an air compressor capable of delivering 120 psi of compressed air to blow out the burner and heat exchanger fins. If unable to clean the heat exchanger with compressed air, replace the heat exchanger. **CAUTION:** Always wear safety glasses and a mask when blowing out the burner.

WARNING: You must be qualified to service gas systems before proceeding with the following items listed below. See data sheet on the rear of front panel or owner's manual for information on gas pressures, dip switch settings, and burner sensor resistance readings mention below.

11. Verify low and high fire manifold gas pressures are set correctly. Some model units have a burner sensor if the manifold pressures are not properly set the temperature range for this senor may be too low causing a code 10.

12. Verify the manifold gas pressures and dip switches were properly set for your altitude.

WARNING: Disconnect the electrical supply and turn off the gas supply to the appliance before replacing items listed below.

13. Other items that could cause code 10's;
    a. Bad fan motor bearing
    b. Bad wiring harness to fan motor from PC board
    c. Bad PC board
    d. Improper dip switch settings

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Code 11

No Ignition

WARNING: You must be qualified to service gas systems before proceeding.

1. Verify all gas valves on gas system are open feeding the proper gas pressure to said appliance.

2. Verify all air was properly purged from gas lines after installation.

3. Verify proper inlet gas pressures are being fed to appliance. Check appliances rating plate for proper pressures. This plate or label is located on the side of each unit. The minimum listed inlet pressure MUST be maintained with all gas appliances at the location firing on high fire. If the product is a condensing unit the front panel must be installed before testing inlet pressures.

4. Verify proper gas type; ensure the gas supply at this location matches that listed on said appliance.

5. Verify gas type dip switch on PC board is switch to proper gas type position.

6. Verify igniter is working. **WARNING:** Turn off gas valve feeding the appliance before preforming this test. Unplug igniter wire; hold the igniter wire with an insulated pair of pliers about a 1/4" from a piece of metal. Cycle the unit to ensure you see a spark when unit is cycling. If not, check ignition system for loose connections, damaged components or disconnected plugs back to PC board. If no spark is noted check the ignition board to verify it is getting the proper voltage from the PC board. See technical data sheet under the unit's front cover for proper voltage and connector numbers. Note; there will be no voltage present unless the unit is going through the ignition cycle.

7. Make sure the ceramic sparker electrode is tight in its mounting bracket. You should not be able to move it with your finger if gasket is intact. If loose remove and clean the electrode and flame rod. Reinstall using new electrode/flame rod gasket and ensure it is tight when the installation is finished. If the electrode is loose the tip can drop down and touch the burners creating a short or no spark. A loose flame rod is called a floating flame rod and will result in code 11’s or 12's.

8. Verify the proper flame rod wire is plugged into the proper flame rod. Some units have multiple flame rods. A quick check to verify correct wiring is to look at the stamped letter on the bracket at flame rod, sample a Y indicates yellow, R = red and B = blue

9. Verify the flame rod is tight in its mounting bracket. You should not be able to move it with your finger if gasket is intact. If loose remove it and clean flame rod and igniter. Inspect flame rod for cracks

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before re-installing it. Re-install using new gasket and ensure it is tight when installation is finished. A loose flame rod is called a floating flame rod and will result in code 11's.

10. Look into view window on appliance to see if you ever see a flame in the burner box while the unit is going through the ignition cycle. If you do that indicates an issue in the flame rectification circuit. This could be a buildup of carbon or a white substance on flame rod, bad connection at flame rod, loose or damaged flame rod, bad PC board, gas valve or low inlet gas pressures. Before replacing the PC board or gas valve continue troubleshooting the steps below.

11. **WARNING:** Turn off the electrical, gas and water supply before performing this inspection. Remove the igniter and flame rod assemblies and inspect them for carbon or a white substance build-up. Clean both components before re-installing them. If you removed just the igniter and flame rod assemblies, make sure you have a new flame rod/igniter gasket before removing these components. This gasket **MUST** be replaced if the seal is broken.

12. **WARNING:** Turn off the electrical, gas and water supply to the water heater on the following series product to perform this task, VA, VB, VC, KA, RH-180 and KCM units. Next; remove the burner manifold and inspect the orifices on the back side of this manifold for clogged or blocked orifices. Proceed with removing the burner assembly and inspect the chamber for insects or other debris. Clean out all debris found in the burner and air chambers. Also inspect the copper fins in heat exchanger for a build-up between the fins. Build-up or blockage between the heat exchanger fins will cause air flow restrictions, which will lead to code 10's. If build up is present, you will need an air compressor capable of delivering 120 psi of compressed air to blow out the burner and heat exchanger fins. If unable to clean the heat exchanger with compressed air, replace the heat exchanger. **CAUTION:** Always wear safety glasses and a mask when blowing out the burner.

13. If you note improper inlet gas pressures check to see if the gas system was properly sized. If sized properly you should see no more than a 0.3 inch pressure drop on natural gas with all gas appliances in the building firing on high fire. The allowable pressure drop for propane is 0.5 inches of water column. This pressure drop is based on the International Plumbing Code when operating on gas pressures up to 14" inches W.C. with black iron piping. There are a number of approved gas piping system out there, make sure you refer to the manufacture's or International Plumbing Code book for pressure drops on gas piping and pressures you are using for proper pressure drops allowed. If pressure drop excesses that mentioned above for black iron gas systems, your system could be undersized, please recheck sizing. The issue could be in any of the following items; the gas system, gas piping, regulator, tank size,

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utility supply, dirt or debris in gas system components, etc. Have the gas system checked by a professional gas technical or master plumber that deals with gas system sizing. Refer to the International Plumbing Code Book for proper gas system sizing for gas type, piping and pressures being used at this location.

14. Inspect vent system for loose joints, improper fittings, failure to meet clearances around vent terminal outside building. See venting instructions for clearance specifications. Failure to meet vent terminal clearances can lead to recirculation of combustion gases on all units, (with exception to the RH-180) causing incomplete combustion which will lead to carbon build up on flame rod. In addition; ensure vent length is within specifications and dip switch for vent lengths has been properly set.

15. Verify that proper venting materials were used in this installation, see owner's manual or venting instructions for details on the proper type venting materials that should be used with your unit.

16. Verify proper altitude settings, see high altitude gas pressure setting procedure for dip switch and manifold gas pressure settings, found in owner's manual or technical data sheets behind unit's front cover.

17. On internal units inspect the plastic tube running from the bottom of the combustion chamber to the gas valve. If you find moisture in that tube, replace the gas valve. Also inspect the vent system to see where the condensate/moisture is coming from. The burner and heat exchanger fins should be inspected for excessive corrosion also. Signs of moisture could be a result of an improper venting or a leak inside the heat exchange.

18. Verify the condensate drain trap was used as recommended by Rinnai on non-condensing units at the vent terminal connection at the top of the water heaters (with exception to the RH-180). If the condensate drain line is not connected please install one per Rinnai venting instructions. If a condensate line is in use, inspect the vent connector on top of water heater to ensure it's not clogged. In addition; check the condensate drain trap and line for blockage. If stopped up, remove vent pipe from unit and clean out all debris and/or build up from the trap or line.

19. Ensure any two stage regulators used on the inlet gas feed are at least six foot from the inlet gas feed to the appliance. Ensure when appliance shuts off the pressure from the two stage regulator doesn't exceed the maximum inlet pressure of the appliance, no bleed though being allowed. To verify this, connect

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your manometer up to the test port on the bottom of the water heater. The inlet gas pressures should never exceed 10 inches water column for natural gas or 13.5 inches on propane. If it does the regulator may be defective.

20. **WARNING:** Disconnect power supply to unit to perform this inspection. Inspect all wiring harnesses throughout unit for water or moisture in electrical connections. If any connections appear to be damp or wet dry them out and try to find out what is causing this.

21. If using an MSA or MSB system isolate the unit giving trouble from the system during troubleshooting. If unit operates when isolated the issue may be in the electronic staging system (MSA or MSB). The MSA and MSB's do not work with the RH-180 water heater.

22. Other suggestions; **WARNING:** Turn off the electrical, gas and water supply to the water heater on the following series product to perform this task, VA, VB, VC, KA, RH-180 and KCM units.

a. Verify spark electrode is installed in the correct position.

b. Verify all burner cassettes are in place in burner rack. Sometimes when contractors drop a unit the burners can shift and become dislodged. If you find the burners dislodged, loosen the burner bracket and reseat them.

c. Remove the four burners located under the flame rod and move them over to the high fire side of the burner tray. Move the four burners from the high fire side over under the flame rod. Sometimes condensate or debris can get down in the burners and cause turbulence inside the burner.

d. Condensate, debris or a malfunctioning mechanical component inside the gas valve may be preventing the valve from opening correctly once in a while. Replace gas valve.

e . Voltage output to gas valve from PC board could be incorrect or intermittent due to a bad component on PC board, replace PC board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 12

Flame Failure

NOTE; before troubleshooting your code 12 first determine what type code 12 is present. Look into the view window while the appliance is going through the ignition cycle to see if you ever see a visible flame. The reason for this is; there are two types of code 12's. The most common code 12 is called a flame failure, meaning the appliance did sense a flame at one point. In other words you could see a visible flame in the burner box during the ignition cycle and/or during operation. The other is called an immediate code 12 and/or no flame was ever noted in the burner box. If you note a flame even for a few seconds follow steps below. If no flame was ever noted proceed to the last item listed in these instructions called, "Immediate code 12 or no flame visible in burner box".

WARNING: You must be qualified to service gas systems before proceeding with the following items listed below.

1. Verify proper inlet gas pressures are being fed to appliance. Check appliance rating plate for proper pressures. This plate or label is located on the side of each unit. The minimum listed inlet pressure MUST be maintained with all gas appliances at the location firing on high fire.

2. If you note improper inlet gas pressures check to see if the gas system was properly sized. If sized properly you should see no more than a 0.3 inch pressure drop on natural gas with all gas appliances in the building firing on high fire. The allowable pressure drop for propane is 0.5 inches of water column. This pressure drop is based on the International Plumbing Code when operating on gas pressures up to 14" inches W.C. with black iron piping. There are a number of approved gas piping system out there, make sure you refer to the manufacture's or International Plumbing Code book for pressure drops on gas piping and pressures you are using for proper pressure drops allowed. If pressure drop excesses that mentioned above for black iron gas systems, your system could be undersized, please recheck sizing. The issue could be in any of the following items; the gas system, gas piping, regulator, tank, utility supply, dirt or debris in gas system components, etc. Have the gas system checked by a professional gas technical or master plumber that deals with gas system sizing. Refer to the International Plumbing Code Book for proper gas system sizing for gas type, piping and pressures being used at this location.

3. Verify manifold gas pressures. You will need the gas pressure setting procedure for the model number appliance you are working on. This information is normally found in a plastic holder on the back side of the front panel, called technical data sheet. If procedure is not available, contact Rinnai tech services for data. Verify correct dip switch settings before adjusting/checking gas pressures. Dip switch settings can be found in the gas pressure setting procedure. If in altitudes above two thousand

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

foot in elevation refer to high altitude settings and pressures.

Next; connect your manometer to the gas valve test port. Fire the unit up ensuring you have maximum water flow through the water heater per the gas pressure setting procedure recommendation. You can use the unit's key pad to check the flow rate. Then; place the unit into forced low fire and follow the gas pressure setting procedure to adjust the low fire gas pressure. Next place the unit into forced high fire per gas pressure setting procedure. Adjust high fire pressure per instructions.

CAUTION: Verify all vent connections are properly seated per manufacturer's venting instructions.

4. Inspect vent system for loose joints, improper fittings, failure to meet proper clearances around vent terminal outside building. See venting instructions for clearance specifications. Failure to meet vent terminal clearances can lead to recirculation of combustion gases (with exception to the RH-180) causing incomplete combustion which will lead to code 12. In addition; ensure vent length is within specifications and dip switch for vent lengths has been properly set.

5. Ensure the proper venting materials were used on the unit, see venting instructions for detail information pertaining to the vent system used. If using Rinnai's concentric vent or common vent system verify each vent component is fully engaged into top of water heater and at each joint. You may need to separate each connection to check for proper connection. Mark each vent connection with a marker before pulling it apart to check depth once separated. Failure to have this joint fully engaged could result in code 12's during to recirculation of combustion gases.

6. Make sure the flame rod is tight in its mounting bracket. You should not be able to move it with your finger if the gasket is intact. If you remove the flame rod it is very important to note the orientation before removal. After removing it, clean it before re-installing. Re-install the flame rod in the same orientation as it was before removal. You MUST replace the flame rod/igniter gasket before reassembly. Note; a loose flame rod is called a floating flame rod and will result in code 12's. Flame rods should never have to be replaced unless the white ceramic is cracked or broken or the flame rod is damaged.

8. Inspect flame rod wires for loose or damaged wires or connectors at the flame rod and PC board.

9. Inspect flame rod silicone protective sleeve for cracks or heat damage. If cracked or has heat damage the spark could possibly seek a grounding source other than the intended target though the igniter, replace the sleeve.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

10. A properly grounded circuit is critical. Check to ensure all ground connections are intact, free of corrosion, tight at each joint or connection and the polarity of the circuit is correct. If unsure contact a Licensed Electrician to inspect and/or correct any issue with the circuit.

WARNING: Turn off the electrical, gas and water supply to the water heater on the following series product to perform this task, VA, VB, VC, KA, RH-180 and KCM units.

11. Pull the unit's burner and inspect for debris and/or condensate around the burner located at flame rod position. Clean all burners using 120 psi of compressed air. Blow out combustion chamber and copper fins in heat changer while inside the burner box. If you are unable to clean out the debris between the copper fins in the heat exchanger, replace heat exchanger. Note the copper surface where the burner box and heat exchanger meet. If that surface appears black from heat stress that's a good indication the fins inside the heat exchanger are clogged with debris. If you have heat damage on the surface of the heat exchanger, replace the heat exchanger.

12. On internal units inspect the plastic tube running from the bottom of the combustion chamber to the gas valve. If you find moisture in that tube replace gas valve. Also inspect the vent system to see where the condensate is coming from. It could be a venting issue or leak inside the heat exchange combustion box area.

13. Ensure the condensate drain trap was used as recommended by Rinnai on the vent terminal connection at the top of the water heater on non-condensing products (with exception to the RH-180) If the condensate drain line is not connected please install one per Rinnai venting instructions. If a condensate line is in use, inspect the vent connector on top of water heater to ensure it's not clogged up. If clogged up remove vent pipe from unit and clean out all debris or build up in the trap or drain lines.

14. Inspect fan blower wheel for debris and/or insects. **WARNING:** turn off power to unit before unplugging fan motor or plugging it back up. Failure to do so can short out fan motor. If insects or debris are found in the fan housing or burner assembly, inspect the entire intake air chamber to include the vent system and air box chamber.

15. Check that any two stage regulator used on the inlet gas feed is installed at least six foot away from appliance. Ensure when appliance shuts off the pressure from the two stage regulator doesn't exceed the maximum inlet pressure of the appliance, no bleed though being allowed. To verify this, connect your manometer up to the test port on the bottom of the water heater. The inlet gas pressures should

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

never exceed 10 inches water column for natural gas or 13.5 inches on propane. If it does the regulator may be defective.

16. Inspect all wiring harnesses throughout unit for water or moisture in electrical connections. If any connections appear to be damp or wet dry them out and try to find out what is causing this. This can cause a short circuit which will lead to code 12.

17. If any MSA or MSB system is in use isolate the unit from that system and see if it operates without going to a code 12. A short circuit within those systems can cause a code 12. MSA and MSB's do not apply to the RH-180.

18. See below for other suggestions:

a. Remove the four burners located under the flame rod and move them over to the high fire side of the burner tray. Move the four burners from the high fire side over under the flame rod. Sometimes condensate or debris can get down in the burners and cause turbulence inside the burner.

b. Condensate, debris or a malfunctioning mechanical component inside the gas valve may be preventing the valve from opening correctly once in a while. Replace gas valve.

c. Voltage output to gas valve from PC board could be incorrect or intermittent due to a bad component on PC board, replace PC board.

Immediate code 12 or 19 no flame visible in burner box;

This code appears when you first turn on the water supply. The water heater will go straight into a code 12 or 19 depending on model number of water heater. In all other codes including most code 12's the unit will try to fire three times. That will not occur on the immediate code 12. The fan motor may try to come on but immediately goes into a code.

An immediate code 12 or 19 is an indication of a short circuit within the appliance. Could be a short in a wiring harness, water flow control or bypass valve or any other component within the DC circuit. One way to track this down is to unplug one component at a time and try to cycle the unit on. If you unplug any component and the unit cycles three times after unplugging it, the short is in that device.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 13

Combustion

1. Verify 4" B-Vent venting materials were used and installed per manufacturer's requirements.

2. Inspect the entire vent system inside/outside the installation site. Check for clearance issues, ensure proper venting materials were used, ensure all sections are properly seated, joints are sealed and cannot be pulled apart, etc.

3. Verify space water heater is installed has the proper amount of combustion air for all gas appliances installed in that space. Leave a door open and see if the unit will operate, if so, you may have to recalculate the combustion air requirements based on the installation site.

4. Verify dip switches were properly set per your altitude, see technical data sheet on rear of front panel for details. See technical data sheet behind unit's front cover or owner's manual for proper settings.

Altitude	Switch No. 2	Switch No. 3
0-2000 ft (0-610 m)	OFF	OFF
2001-5400 ft (610-1646 m)	OFF	ON

WARNING: before proceeding you must be qualified to service gas systems before performing task listed below.

5. Verify the inlet gas supply maintains that listed below with all gas appliances at the site firing on high fire.

6. Verify unit's force low and high fire pressures were properly set, see data below.

Gas Inlet Min/Max		Forced Low		Forced High	
Nat G.	LPG	Nat. G	LPG	Nat. G	LPG
4" W.C. / 10.5"W.C	8" W.C. / 13.5"W.C	1.10" W.C.	1.23" W.C.	2.8" W.C.	3.0" W .C.

7. **CAUTION:** Turn off power supply to unit. Remove fan motor and inspect fan wheel, housing, and air duct for any type restriction. Re-install fan, after installation reapply power to unit and test for proper operation.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

8. **WARNING:** Turn off the electrical, gas and water supply to the water heater. Next; remove the burner manifold and inspect the orifices on the back side of this manifold for clogged or blocked orifices. Proceed with removing the burner assembly and inspect the chamber for insects or other debris. Clean out all debris found in the burner and air chambers. Also inspect the copper fins in heat exchanger for a build-up

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 14

Thermal Fuse or Overheat

Inspect the internal components inside the water heater's casing especially around the heat exchanger where the copper section meets up with the combustion box. You are looking for discoloration of the heat exchanger surface in that area, will appear black.

Note; Code 14 is an indication of overheating and should be taken seriously. There are two components (bi-metal switches & thermo-fuses) within the product that will cause a code 14. The overheat bi-metal safety switch is mounted on the heat exchanger either on the top right or left front of that component, the thermo-fuses wrapped around the heat exchanger. The bi-metal switch in most cases will reset itself after cooling down once tripped. After the bi-metal switch resets the unit will operate again. If the fault that caused it to trip is not corrected it will trip again once the temperature range for that switch is exceeded. The thermo-fuses on the other hand are a one shot device, meaning once blown they must be replaced. This will require removing the heat exchanger at which point you need to perform a detailed inspection of all items listed below.

1. Verify dip switch #5 in the SW2 bank of dip switches is in the "OFF" position. If in the "ON" position this will cause a code 14 as this switch is used to de-energize the gas valve circuit. This applies only to the VC, and KB models, it does not apply to V, VA, VB or KA products.

2. Verify the unit is connected to the proper gas type; see rating plate for gas type of unit.

3. Check to ensure this unit has ever been converted from one gas type to another? If it was converted verify conversion was performed per manufacturer's specifications. See conversion procedure for the model number unit at your location.

4. Verify proper clearances were maintained around unit and vent terminals.

5. Inspect the safety circuit wiring harness for loose connectors, damage or broken wires.

6. Ohm out safety circuit to determine if the bi- switch is open or if the issue is a blown thermo- fuse.

7. Verify all dip switches are set per manufacturer' recommendations, contact Rinnai for details on proper settings if you need assistance.

8. **WARNING:** You must be qualified to service gas systems before proceeding. Verify force low and high fire manifold gas pressures, check using a manometer. Procedure for checking these pressures can be found on the back side of the front cover. If you need assistance contact Rinnai technical services

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

24/7 for details on now to check these pressures. You must have a manometer to check gas pressures.

9. Check system operation to see if the water heater is continuously short cycling. If so, heat from short cycling can transfer into the copper heat exchange and trip the bi-metal switch. Investigate to see what is causing the short cycling such as aqua-stats with a low delta T. Increase set point of aqua-stat by at least twenty degrees lower than the water heater's set point. This will normally stop the unit from short cycling.

WARNING: Turn off the electrical, gas and water supply to the water heater before proceeding.

10. Inspect burner manifold, burner assembly and heat exchanger copper fins for debris build-up or blockage. If you find debris build-up inside the heat exchanger that has led to a code 14, replace the heat exchanger.

11. Inspect the front, sides and back of the heat exchanger surface for cracks, separations, discoloration or damage of any kind. If you find any of the above mentioned items replace the heat exchanger.

12. Inspect all components inside the water heater cabinet for signs of excessive heat damage. Take note of the copper surface of the heater exchange where the combustion box and copper meet for discoloration. If discoloration (black) surface is noted replace heat exchange. This indicates a blockage or debris build up between the copper fins inside the heat exchange.

13. Verify venting is within vent clearance specifications and lengths per manufactures' recommendation.

14. If code 14 still appears after performing the above inspections, replace PC board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 16

Over Temperature Warning

1. Check for low flow in circulation system causing short cycling.

WARNING: Turn off the electrical, gas and water supply to the water heater before proceeding.

2. Check for foreign materials in combustion chamber and/or exhaust piping.

3. Check for blockage in the heat exchanger fins.

4. Clean out heat exchanger fins or replace heat exchanger.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 19

Electrical Grounding

This code appears when you first turn on the water supply. The water heater will go straight into a code 12 or 19 depending on model number of water heater. In all other codes including most code 12's the unit will try to fire three times. That will not occur on the immediate code 12 or 19. The fan motor may try to come on but immediately goes into the code.

The immediate code 12 or 19 is an indication of a short circuit within the appliance. Could be a short in a wiring harness, water flow control or bypass valve or any other component within the DC circuit. One way to track this down is to unplug one component at a time and try to cycle the unit on. If you unplug any component and the unit cycles three times after unplugging it, the short is in that device.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 25

Condensate Trap is Full

1. Inspect condensate drain line for blockage.

2. Inspect condensate trap and tank inside cabinet for blockage.

3. Ensure condensate line has an air gap between the unit and drain line. An air gap is required to allow proper drainage.

4. Check sensor wiring harness for loose, broken or damaged connections from sensor back to PC board.

5. If condensate tank is draining and the unit is still throwing a code 25, replace condensate tank with sensor.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 30

Flammable Vapors Detected

1**. WARNING:** Leave the space or room the water heater is installed in until safety personal has identified the area as safe and all flammable vapors have been removed and eliminated.

WARNING: You **MUST** be qualified to service gas appliances before proceeding with the flowing inspection and checks. Disconnect the power supply to the unit.

2. Remove the front panel and inspect the flammable vapor sensor, (FV) wiring harness for loose, damaged or broken wires or connectors. Check from the sensor back to the P.C. board.

3. Verify FV sensor is properly mounted and is not damaged.

4. Once you are 100% sure no flammable vapors are present, turn the power and gas back on to the appliance. Open a tap and allow the unit to fire up and check the following voltages output listed in chart below. If the FE code reappears and you are 100% sure no flammable vapors are present, replace the FV sensor.

Connector on PCB	Part Name	Wire Color	Pin #	Voltage (DC)
D1	Flammable Vapor Sensor	Red—Black	(D) 1—6	1.9 to 2.1 VDC
		White—Yellow	(D) 3 –43	25.5 to 39.5 mVDC

5. Replace P.C. board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 31

Burner Thercouple

1. **WARNING:** You must be qualified to service gas systems before proceeding. Check low/high fire manifold pressures for proper settings. See gas pressure setting procedure located under the front cover of unit in the technical data sheet. In addition, can be found in the product's service manual. Set manifold pressures per instructions for your altitude.

2. Verify all dip switches are set to the proper position on the PC board. See technical data sheet for proper settings at your altitude.

3. Measure milli-volt (mV) reading of burner thermocouple. The thermocouple milli-volt range should be between 20 to 27 mV under normal combustion. If the reading exceeds 30 milli-volts or is less than 8 milli volts the unit will go into a code 31.

If the thermocouple mV output is above 30 mV during combustion that indicates the unit may be over fired. **WARNING:** You must be qualified to service gas systems before proceeding. Verify your high fire manifold pressures. If gas pressures are found to be within specifications, remove burner manifold and burners. Check for blockage between heat exchanger fins. If clogged clean all debris from fins or replace heat exchanger.

If the thermocouple reading is below 8 mV during combustion that indicates low gas pressure or low Btu gas content. In other words; the thermocouple is not seeing a high enough temperature inside the combustion chamber due to pressures or gas issues. Verify your forced low fire gas pressure. If pressure is found to be within specifications, contact Rinnai tech support for assistance.

4. Replace thermocouple.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 32

Outgoing Water Temperature Thermistor Fault

1. Check thermistor wiring harness for loose, broken or damaged connections from thermistor back to PC board.

2. CAUTION: Turn off water supply to the water heater and drain system down before proceeding. With no water left in hot water supply lines remove the thermistor and check for scale build up on thermistor. Clean off any substance found on this component. Proceed to item #3 below.

3. With water supply still isolated and thermistor removed from unit, check resistance readings of this component using a volt/ohm meter capable of reading 20K ohms. Set meter to proper setting for checking 20K ohms and insert meter leads into each end of the thermistor plug. Then apply heat to the thermistor bulb. You will notice the thermistor resistance reading start to drop when heat is applied. A simple way to apply heat is to place the thermistor bulb between your thumb and another finger and apply pressure. The heat from your body will cause the resistance reading to decrease. If the thermistor reading starts to decrease with heat applied normally that indicates the component is functioning properly. The resistance reading will increase if ice is placed against the bulb.

Typical resistance values are:
11.4 – 14K ohms at 59 degrees ^{o}F
6.4 – 7.7K ohms at 86 ^{o}F
3.6 – 4.5K ohms at 113^{o}F
2.2 – 2.7K at 140 ^{o}F
0.6 – 0.8K at 221 ^{o}F.

If thermistor readings are correct re-install this component ensuring the small O-ring is still intact in thermistor well before installation. Place a small amount of grease or lubricant on the O-ring to prevent damaging it during installation. Turn water supply back on and check for leaks around this component. Next re-fire the unit to see if you still get a code 32. If so, replace the thermistor.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 33

Heat Exchanger Outgoing Thermistor

1. Check thermistor wiring harness for loose, broken or damaged connections from thermistor back to PC board.

2. CAUTION: Turn off water supply to the water heater and drain system down before proceeding. With no water left in hot water supply lines remove the thermistor and check for scale build up on thermistor. Clean off any substance found on this component. Proceed to item #3 below.

3. With water supply still isolated and thermistor removed from unit, check resistance readings of this component using a volt/ohm meter capable of reading 20K ohms. Set meter to proper setting for checking 20K ohms and insert meter leads into each end of the thermistor plug. Then apply heat to the thermistor bulb. You will notice the thermistor resistance reading start to drop when heat is applied. A simple way to apply heat is to place the thermistor bulb between your thumb and another finger and apply pressure. The heat from your body will cause the resistance reading to decrease. If the thermistor reading starts to decrease with heat applied normally that indicates the component is functioning properly. The resistance reading will increase if ice is placed against the bulb.

Typical resistance values are:
11.4 – 14K ohms at 59 degrees ^{o}F
6.4 – 7.7K ohms at 86 ^{o}F
3.6 – 4.5K ohms at 113^{o}F
2.2 – 2.7K at 140 ^{o}F
0.6 – 0.8K at 221 ^{o}F.

If thermistor readings are correct re-install this component ensuring the small O-ring is still intact in thermistor well before installation. Place a small amount of grease or lubricant on the O-ring to prevent damaging it during installation. Turn water supply back on and check for leaks around this component. Next re-fire the unit to see if you still get a code 33. If so, replace the thermistor.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 34

Combustion Air Temperature Thermistor

1. Check thermistor wiring harness for loose, broken or damaged connections at thermistor/PC board.

2. Remove thermistor from fan motor housing, check resistance readings using a volt/ohm meter capable of reading 20K ohms. Insert meter leads into each end of the thermistor plug. Then apply heat to the thermistor bulb. The thermistor resistance reading will start to drop when heat is applied. Apply heat to the thermistor bulb by placing it between your thumb and another finger. The heat will cause the resistance reading to decrease. If the reading decreases with heat applied the thermistor is functioning properly. The resistance reading will increase if ice is placed against the bulb. Typical resistance values are 11.4 – 14K ohms at 59 degrees ^{o}F, 6.4 – 7.7K ohms at 86 ^{o}F, 3.6 – 4.5K ohms at 113^{o}F, 2.2 – 2.7K at 140 ^{o}F or 0.6 – 0.8K at 221 ^{o}F.

3. Verify the unit is connected to the proper gas type; see rating plate for gas type of unit.

4. Check to ensure this unit has ever been converted from one gas type to another? If it was converted verify conversion was performed per manufacturer's specifications. See conversion procedure for the model number unit at your location.

5. Verify proper clearances were maintained around unit and vent terminals.

6. Verify all dip switches are set per manufacturer' recommendations, contact Rinnai for details on proper settings if you need assistance.

7**. WARNING:** You must be qualified to service gas systems before proceeding. Verify force low and high fire manifold gas pressures, check using a manometer. Procedure for checking these pressures can be found on the back side of the front cover. If you need assistance contact Rinnai technical services 24/7 for details on now to check these pressures. You must have a manometer to check operating gas pressures.

8. **WARNING:** Turn off the electrical, gas and water supply to the water heater before proceeding. Inspect burner manifold, burner assembly and heat exchanger copper fins for debris build-up or blockage.
9. Verify venting is within clearance specifications and lengths per manufactures' recommendation.
10. If code 34 still appears after performing the above inspections, replace thermistor.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 35

Tank Temperature Sensor

1. Check tank temperature sensor wiring harness for loose, broken or damaged connections from thermistor back to PC board.

2. **CAUTION:** Turn off water supply to the water heater and drain system down before proceeding. With the water supply isolated, remove the thermistor from the unit. Check resistance readings of this component using a volt/ohm meter capable of reading 20K ohms. Set meter to proper setting for checking 20K ohms and insert meter leads into each end of the thermistor plug. Then apply heat to the thermistor bulb. You will notice the thermistor resistance reading start to drop when heat is applied. A simple way to apply heat is to place the thermistor bulb between your thumb and another finger and apply pressure. The heat from your body will cause the resistance reading to decrease. If the thermistor reading starts to decrease with heat applied normally that indicates the component is functioning properly. The resistance reading will increase if ice is placed against the bulb.

Typical resistance values are:

11.4 – 14K ohms at 59 degrees ^{o}F

6.4 – 7.8K ohms at 86 ^{o}F

3.6 – 4.5K ohms at 113^{o}F

2.2 – 2.7K at 140 ^{o}F

0.6 – 0.8K at 221 ^{o}F.

If thermistor readings are correct re-install this component ensuring the small O-ring is still intact in thermistor well before installation. Place a small amount of grease or lubricant on the O-ring to prevent damaging it during installation. Turn water supply back on and check for leaks around this component. Next re-fire the unit to see if you still get a code 33. If so, replace the thermistor.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 38

Condensing & RH-180 Water Heaters

Code 38 - Condensing Water Heaters - Exhaust Gas Temperature Sensor

1. Check “Exhaust Gas Temperature Sensor” wiring harness for loose, broken or damaged connections at the sensor and PC board.

2. Remove sensor and check resistance readings of this component using a volt/ohm meter capable of reading 20K ohms. Set meter to proper setting, insert meter leads into each end of the sensor plug behind the wires. Then apply heat to the thermistor bulb. You will notice the thermistor resistance reading start to drop when heat is applied. A simple way to apply heat is to place the thermistor bulb between your thumb and another finger and apply pressure. The heat from your body will cause the resistance reading to decrease. If the thermistor reading starts to decrease with heat applied normally that indicates the component is functioning properly. The resistance reading will increase if ice is placed against the bulb. Typical resistance values are 11.8 – 13.3K ohms at 59 degrees ^{o}F, 6.7 – 7.4K ohms at 86 ^{o}F, 3.9 – 4.3K ohms at 113^{o}F, 2.4 – 2.7K at 140 ^{o}F or 0.66 – 0.76K at 221 ^{o}F.

If sensor readings are correct re-install this component into the exhaust port. Next re-fire the unit to see if you still get a code 38. If so, proceed to item #3 below.

3. Verify the unit is connected to the proper gas type; see rating plate for gas type of unit.

4. Check to ensure this unit has ever been converted from one gas type to another? If it was converted verify conversion was performed per manufacturer’s specifications. See conversion procedure for the model number unit at your location.

5. Verify proper clearances were maintained around unit and vent terminals.

6. Verify all set up procedures were followed during installation per manufacturer’ recommendations, contact Rinnai for details on proper settings if you need assistance.

7**. WARNING:** You must be qualified to service gas systems before proceeding. Verify force low and high fire manifold gas pressures, check using a manometer. Procedure for checking these pressures can be found on the back side of the front cover. If you need assistance contact Rinnai technical services 24/7 for details on now to check these pressures. You must have a manometer to check operating gas pressures.

8. **WARNING:** Turn off the electrical, gas and water supply to the water heater. Inspect burner manifold, burner assembly and heat exchanger copper fins for debris build-up or blockage.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

9. Verify venting is within vent clearance specifications and lengths per manufactures' recommendation.

10. If code 38 still appears after performing the above inspections, replace sensor.

Code 38 for RH-180 Water Heaters — CO Sensor

1. Verify 4" B-Vent venting materials were used and installed per manufacturer's requirements.

2. Inspect the entire vent system inside/outside the installation site. Check for clearance issues, ensure proper venting materials were used, ensure all sections are properly seated, joints are sealed and can not be pulled apart, etc.

3. Verify space water heater is installed in has the proper amount of combustion air for all gas appliances installed in that space. Leave a door open and see if the unit will operate, if so, you may have to recalculate the combustion air requirements based on the installation site.

4. Verify dip switches were properly set per your altitude, see technical data sheet on rear of front panel for details. See technical data sheet behind unit's front cover or owner's manual for proper settings.

Altitude	Switch No. 2	Switch No. 3
0-2000 ft (0-610 m)	OFF	OFF
2001-5400 ft (610-1646 m)	OFF	ON

WARNING: before proceeding you must be qualified to service gas systems before performing task listed below.

5. Verify the inlet gas supply maintains that listed below with all gas appliances at the site firing on high fire.

Gas Inlet Min/Max		Forced Low		Forced High	
Nat G.	LPG	Nat. G	LPG	Nat. G	LPG
4" W.C. / 10.5"W.C	8" W.C. / 13.5"W.C	1.10" W.C.	1.23" W.C.	2.8" W.C.	3.0" W .C.

6. Verify unit's force low and high fire pressures were properly set, see settings below.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

7. **CAUTION:** Turn off power supply to unit. Remove fan motor and inspect fan wheel, housing, and air duct for any type restriction. Re-install fan, after installation reapply power to unit and test for proper operation.

8. **WARNING:** Turn off the electrical, gas and water supply to the water heater. Next; remove the burner manifold and inspect the orifices on the back side of this manifold for clogged or blocked orifices. Proceed with removing the burner assembly and inspect the chamber for insects or other debris. Clean out all debris found in the burner and air chambers. Also inspect the copper fins in heat exchanger for a build-up between the fins. Build-up or blockage between the heat exchanger fins will cause air flow restrictions. If build up is present, you will need an air compressor capable of delivering 120 psi of compressed air to blow out the burner and heat exchanger fins. If unable to clean the heat exchanger with compressed air, replace the heat exchanger. **CAUTION:** Always wear safety glasses and a mask when blowing out the burner.

9. Review items listed under code 05 regarding the RH-180 water heater.

10. Review items listed under code 10 regarding the RH-180 water heater.

11. Check voltage to CO sensor based on chart below.

Connector on PCB	Part Name	Wire colors	Pin #'s	Status	Voltage (DC)
C1	CO Sensor	Red—Black	1—5	Normal	1.9 to 2.1 VDC
				During combustion	2.5—3.– VDC

12. Before replacing CO sensor ventilate room and allow fresh air into the space. Then turn off the power supply to the unit and back on. Wait thirty minutes and try firing the unit again. If after checking all of the items listed in this document fails to reset the 13 error code replace the CO sensor and P.C. board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 41

Freeze Protection Sensor (External Units)

NOTE: If the KB water heater's freeze protection sensor/thermistor is unplugged/cut/shorted, it will not allow the water heater to fire up but will show a code 41.

If the VC water heater's freeze protection sensor/thermistor is unplugged/cut/shorted, it will allow the water heater to fire up. At which point it will flash a code 41 alternating between the code 41 and the set point temperature.

1. Check sensor wiring harness for loose, broken or damaged connections from sensor back to PC board.

2. Ensure sensor is open to outside air and not covered with insulation.

3. Check the resistance readings of this component using a volt/ohm meter capable of reading 20K ohms. Set meter to proper setting for checking 20K ohms and insert meter leads into each end of the sensor plug. Then apply heat to the sensor bulb. You will notice the sensor resistance reading start to drop when heat is applied. A simple way to apply heat is to place the sensor bulb between your thumb and another finger and apply pressure. The heat from your body will cause the resistance reading to decrease. If the sensor reading starts to decrease with heat applied normally that indicates the component is functioning properly. The resistance reading will increase if ice is placed against the bulb.

Typical resistance values are:
11.4 – 14K ohms at 59 degrees ^{o}F
6.4 – 7.7K ohms at 86 ^{o}F
3.6 – 4.5K ohms at 113^{o}F
2.2 – 2.7K at 140 ^{o}F
0.6 – 0.8K at 221 ^{o}F.

If the outside air temperature thermistor (on outdoor models only) is open or disconnected the unit will continue to operate and flash a code 41. The display will alternate between the set point temperature and the code 41. Since the thermistor is used basically to activate the freeze protection, there's no need for it not to allow the unit to operate. Once the issue causing the code is cleared the error code will disappear.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 51

Inlet Water Temperature Sernsor

1. Check sensor wiring harness for loose, broken or damaged connections from sensor back to PC board.

2. CAUTION: Turn off water supply to the water heater and drain system down before proceeding With no water left in hot water supply lines remove the sensor and check it for scale build up. Clean off any substance found on this component. Proceed to item #3 below.

3. With water supply still isolated and sensor removed from unit, check the resistance readings of this component using a volt/ohm meter capable of reading 20K ohms. Set meter to proper setting for checking 20K ohms and insert meter leads into each end of the sensor plug. Then apply heat to the sensor bulb. You will notice the sensor resistance reading start to drop when heat is applied. A simple way to apply heat is to place the sensor bulb between your thumb and another finger and apply pressure. The heat from your body will cause the resistance reading to decrease. If the sensor reading starts to decrease with heat applied normally that indicates the component is functioning properly. The resistance reading will increase if ice is placed against the bulb.

Typical resistance values are:
11.4 – 14K ohms at 59 degrees ^{o}F
6.4 – 7.7K ohms at 86 ^{o}F
3.6 – 4.5K ohms at 113^{o}F
2.2 – 2.7K at 140 ^{o}F
0.6 – 0.8K at 221 ^{o}F.

If sensor readings are correct re-install this component ensuring the small O-ring is still intact in sensor well before installation. Place a small amount of grease or lubricant on the O-ring to prevent damaging it during installation. Turn water supply back on and check for leaks around this component. Next re-fire the unit to see if you still get a code 51. If so, replace the sensor.

Note: If the inlet water temperature thermistor is open or disconnected the unit will continue to operate and flash a code 51. The display will alternate between the set point temperature and the code 51. Since the inlet water temperature thermistor is used basically to activate the circulation pump when the circ-logic is enabled, there's no need for it not to allow the unit to operate. Once the issue causing the code is cleared the error code will disappear.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 52

Modulating Solenoid Valve Signal Abnormal (POV)

WARNING: Disconnect power supply before processing with item 1 below.

1. Check wiring harness for loose, broken or damaged connections from POV valve back to PC board.

2. Unplug POV valve, using a volt/ohm meter and check resistance readings across the POV coil on the gas valve. The proper resistance reading for this coil can be found in the Tech Data Sheet found on the back side of the unit's front panel or in the Rinnai Water Heater Service Manual for that model unit. If you find the coil to be open replace the gas valve. If resistance reading is found to be within specification, proceed to item #3 below.

Note: Resistance readings can vary from meter to meter based on the meter's accuracy range and battery life. A weak battery can affect readings; replace your battery if in doubt before performing service. In addition; make sure you have you meter set to the correct resistance (ohm) setting and the component being checked is isolated from the unit's circuit and power supply.

3. Check voltage to the POV valve while unit is trying to fire. If you have the proper voltage but keep getting an error code proceed to the next item.

4. **WARNING:** Disconnect power supply to unit before proceeding with this task. If code 52 still appears after performing the above inspection replace the PC board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 54

High Exhaust Gas Temperature

Error code 54 — "High Exhaust Gas Temperature". If the exhaust temperature exceeds 163°F the water heater will reduce it's input Btu firing rate. If after 120 seconds the exhaust gas temperature remains above 163°F, the unit will shut down and flash a code 54.

1. Check around vent termination to ensure clearances were met.

2. Check for restrictions in vent system intake and exhaust ports.

3. Verify venting is within vent clearance specifications and lengths per manufactures' recommendation.

4. Ensure unit was installed on gas type that matches rating plate gas type.

5. W**ARNING:** You must be qualified to service gas systems before proceeding. Verify force low and high fire manifold gas pressures, check using a manometer. Procedure for checking these pressures can be found on the back side of the front cover. If you need assistance contact Rinnai technical services 24/7 for details on how to check these pressures. You must have a manometer to check operating gas pressures.

6. **WARNING:** Turn off the electrical, gas and water supply to the water heater before proceeding. Check heat exchanger surface for hot spots. If hot spots are found, this indicates blockage inside the heat exchanger due to scale build up. Flush heat exchanger with three gallons of vinegar per flushing instructions found in owner's manual. If heat exchanger shows signs of damage from poor maintenance of the appliance, replace the heat exchanger.

7. If scale build-up caused the code 54, treat the inlet water supply to prevent future issues.

8. Check for fan air leakage (leakage between air intake and combustion chamber).

9. If code 54 still appears after performing the above inspections, replace the P.C. board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 57

Burner Overheat Bi-metal Switch

A code 57 will appear when one of the two bi-metals opens on the rear of the burner assembly. The code 57 will appear regardless to whether or not the unit is in operation. To reset this code you must correct the problem with the bi-metal switch first. Then, turn the power off to the appliance and then back on. This is called a hard reset.

1. Check burner overheat bi-metal switch wiring harness for loose, broken or damaged connections from sensor back to PC board.

2. Verity unit is connected to the proper type gas. Example; if a natural gas unit should be connected to natural gas.

3. **WARNING:** You must be qualified to service gas systems before proceeding. Verify low/high fire manifold pressures are set properly. See gas pressure setting procedures for pressure setting at your elevation.

4. If unit was ever converted from one gas type to another, verify the conversion process was performed per the manufacturer's instructions and all pressures and dip switches were properly set to match the gas type unit was converted too.

5**. WARNING:** Disconnect power supply to unit before proceeding with this task. Replace sensor.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 58

Secondary Heat Exchanger Sensor

A code 58 will appear when one of the two bi-metals opens on the secondary heat exchanger opens. These bi-metals are located on the rear of the secondary heat exchanger where the air box connects to the heat exchanger. The code 58 will appear regardless to whether or not the unit is in operation. To reset this code you must correct the problem with the bi-metal switch first. Then you have to turn the power off to the appliance and then back on. This is called a hard reset.

1. Check sensor wiring harness for loose, broken or damaged connections from sensor back to PC board.

2. This code indicates a scale build-up inside the secondary heat exchanger and it needs to be flushed to prevent damage. Refer to flushing instructions in the owner manual. Hard water must be treated to prevent scales build-up or damage to the heat exchanger will occur.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 61

Combustion Fan Motor

WARNING: Before servicing fan motor turn off power supply to the unit. Never attempt to plug up or unplug motor while power is supplied to product. Failure to follow this procedure could lead to damaged components including the fan motor.

1. Check wiring harness for loose, broken or damaged connections from fan motor back to PC board.

2. Remove fan motor with power supply to product turned off. Inspect blower wheel to ensure it turns freely.

3. Check fan housing for debris that could prevent the fan wheel from turning.

4. Measure fan motor winding resistance, see technical data sheet behind front cover or in service manual for proper resistance readings. If windings are open replace motor.

5. If motor windings are within specifications and fan motor turns freely, replace PC board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 63 for RUR Water Heater

Circulation Issues

1. Verity dip switches were set to the proper position for the type circulation system in use, cross- over or dedicated circulation. See owner's manual for details.

2. Ensure cold inlet and hot water outlet valves are open to plumbing system.

3. Purge air from circulation line by opening fixture furthest and/or highest from unit during pump operation.

4. Open bleeder valve installed below water heater and allow all air out of plumbing system. **CAUTION:** system is pressurized; place bucket under valve to catch water being released.

5. If application is using a cross-over valve inspect/clean pump filter.

6. Clean/inspect the inlet water filter.

7. If installed on a dedicated return, ensure line does not exceed maximum length allowed for your piping size, see manual for details.

8. Turn off the water supply. In the dedicated mode ensure the plug was installed in the filter housing on the circulation side of the water heater.

9. Isolate the plumbing system with the valve kit hot/cold water feed line. Connect a 50' to 100' hose up to the water heater valve kit. Place one end of the hose on the cold water connection threads and the other end to the hot water connection threads. You will need an adapter sold at your local hardware store to adapt the male end of the hose to a female thread. The hose being connected to the water heater is creating an independent circulation loop, which isolates the home's loop. Next; open the valve on the valve kit allowing water to flow into the hose. Bleed all air from the hose with the pump drain or pressure relief valve, be sure to have a bucket to catch all water being released. Now power the system up and allow the pump to cycle on. If this system operates without throwing a code 63, your have air or a leak in your home's plumbing system. Close the valve kit drain valve and disconnect your hose. Open the cold and hot water feed lines back up and proceed to the test below or properly bleed to plumbing system on the structure.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

10. In the event you continue to get a code 63 check the plumbing system for leaks. First ensure all hot and cold water fixtures are not in use. Next; place a pressure gauge on a hose connection outside the structure. Open that fixture to pressurize the gauge. Check to ensure you have no leaks at the gauge. Go to the water meter or well and shut off the main water feed to the building. Go back to the gauge on the hose connection and ensure the building is holding pressure. If the pressure bleeds down, this indicates you have a leak in your plumbing system. The reason for the code 63 is, when the circulation pump comes on, it is drawing a higher flow rate than the leak, which in turn sucks air into the system.

RH-180 Water Heater Code 63

Circulation Flow Rate below 1.3 GPM

1. Next, using the temperature controller see if unit is producing flow. To display the recovery flow rate in gallons per minute through the unit, press the “UP” button for 3 seconds, followed by the “ON/OFF” button. The display will display a number, that number is your flow rate. Example 5 = 0.5 gpm, 21 – 2.1 gpm. If the flow rate is below 1.3 gpm perform the following checks;

a. Bleed all air from the system tank and pump.
b. Clean the inlet water filter.
C. Verify you have the proper water supply to the appliance at a flow rate of six gallons plus.
d. Verify you have 30 to 50 psi of inlet water pressure to the appliance.
e. If application is using a cross over valve inspect and clean pump filter on unit.
f. If installed on a dedicated circulation return line, inspect return line to ensure check valves are functional and you have no restrictions in this line.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 65

Water Flow Servo

1. Check wiring harness to the water flow servo for loose, broken or damaged connections from that servo valve back to PC board.

2. Turn off the power to the water hater and then reapply, see if code resets.

3. The water flow servo valve has failed to close during the bath fill function. Immediately turn off the water flow and discontinue the bath fill function.

4. **WARNING:** Turn off the electrical, gas and water supply to the water heater before proceeding. Replace water flow control servo.

NOTE: If the water flow servo motor is disconnected when the unit tries to cycle the product will post a code 65. This will shut the unit down until the WFSV motor is plugged back in and the power is turned off and then on again.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 70

P.C Board Fault

WARNING: Turn off the electrical, gas and water supply to the water heater before proceeding.

1. Check all wiring harnesses at the connection to the PC board to ensure they are not loose, broken or damaged.

2. Check all dip switches to ensure they are set to the proper position.

3. Replace PC board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 71

SV0, SV1, SV2 or SV3 Solenoid Valve Fault

WARNING: Turn off the electrical, gas and water supply to the water heater before proceeding.

1. Check wiring harnesses to SV0, SV1, SV2, SV3 and SV4 for loose, broken or damaged connections from gas valve solenoids back to PC board.

2. Check for moisture in plastic tubing on internal units from bottom of combustion box back to gas valve. If moisture is found in this tube replace gas valve. In addition; remove burner manifold and burner assembly to determine what is causing the moisture. Look for a leaking heat exchanger or condensation coming from the vent system.

If the heat exchanger is leaking replace it and any other components damaged due to that leak.

If the moisture is caused by condensation running back into the unit from the vent system make provisions to stop this by installing a condensate drain line at the top of said unit.

3. Check voltage to SVO and SV1 while unit is trying to fire. If you have proper voltage but keep getting an error code proceed to item 4 below.

4. Measure the resistance of SV0, SV1, SV2, SV3 and SV4 if any of the solenoid valves are found to be open, meaning having no resistance replace the gas valve and burner manifold with the new solenoids. Proper resistance values can be found in the technical data sheet under the unit’s front cover.

5. If you are still getting a code 71 replace the gas control valve. You may get a good resistance reading upon unplugging the wires, however under load it could open or you may have a mechanical problem inside the valve that won't allow the valve open.

6. Replace PC board

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 72

Flame Sensing Device Fault

WARNING: Turn off the electrical, gas and water supply to the water heater before proceeding.

1. Check wiring harnesses to flame rods for broken or damaged connections from flame rod back to PC board.

2. Ensure flame rod is touching flame when unit fires.

3. Remove flame rod and check for carbon build-up. Clean flame rod as necessary and replace flame rod gasket. .

4. Check inside burner for debris build up that may be shorting out flame rod. If debris on the burner is touching flame rod this could cause a short circuit and throw a code 72.

5. Measure micro amp output from flame rod, should maintain a minimum of 1 micro amp.

6. Replace flame rod, flame rod gasket and PC board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 73

Burner Thermocouple Fault

1. Check wiring harness at burner thermocouple back to PC board for loose, broken or damaged wiring or connections.

2. Verify all dip settings are set to the proper altitude per the tech sheet found under the front panel of your unit. This information can also be found in the product's service manual.

3. **WARNING:** You must be qualified to service gas systems before proceeding. Confirm low/high fire manifold gas pressures are set to factory specification per altitude unit is installed at. Manifold gas pressure settings and directions can be found on the tech sheet under front panel of the unit or in the service manual.

4. Replace burner thermocouple. If code reappears after replacing this component replace PC board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code 79

Water Leakage Detected

1. Check wiring harness at leak detector for loose, broken or damaged wiring or connections.

2. Check the heat exchanger and all piping inside the unit for leaks.

3. If no leaks are found inspect inside of cabinet for signs of water pooling on bottom pan of water heater. Wipe or blow out any water found in cabinet. Dry off leak sensor and restart unit.

4. If no water is found in cabinet unplug sensor and fire water heater. If unit operates with sensor unplugged replace sensor and screw.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code FE

Flammable Vapors Detected

1. **WARNING:** Leave the space or room the water heater is installed in until safety personal has identified the area as safe and all flammable vapors have been removed and eliminated.

2. Remove the front panel and inspect the flammable vapor sensor, (FV) wiring harness for loose, damaged or broken wires or connectors. Check from the sensor back to the P.C. board.

3. Verify FV sensor is properly mounted and is not damaged.

4. Once you are 100% sure no flammable vapors are present, turn the power and gas back on to the appliance. Open a tap and allow the unit to fire up and check the following voltages output listed in chart below. If the FE code reappears and you are 100% sure no flammable vapors are present, replace the FV sensor.

Connector on PCB	Part Name	Wire Color	Pin #	Voltage (DC)
D1	Flammable Vapor Sensor	Red—Black	(D) 1—6	1.9 to 2.1 VDC
		White—Yellow	(D) 3 –43	25.5 to 39.5 mVDC

5. Replace P.C. board.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code FF

Maintenance has been performed

This code indicates a service provider performed maintenance or repair. The serviceman will enter the following code FF after making repairs to the product. That flags the system indicating all codes after the FF took place after his repairs were made.

You can enter the FF code by; pressing the up, down and ON/OFF buttons simultaneously. ***This hard reset procedure that is not in owners/installation manual or technical data sheets***.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Cold Water Sandwich caused by Low Flow

1. Open fixture and record flow rate using the water heater's temperature control pad.

2. Shut off hot/cold water feed lines to the water heater, remove inlet water filter and check for debris, clean if necessary. Re-install filter, turn on water supply. Open the same tap again and recheck your flow rate to see if it increased. If flow rate is less than one gpm remove the restrictor and clean the strainer in that fixture. You should have at least one gpm of flow at all fixtures. Otherwise; pressure drops in the plumbing system due to improperly sized plumbing can cause the flow rate to drop below the minimum flow rate requirement of the unit. This will cause the unit to cycle on/off causing a cold water sandwich.

3. Cold water sandwiches can be created by numerous items such as;

a. Improperly installed, faulty, or flapping check valves. Swing check vales should be installed with the hex cap horizontal, facing upwards.

b. Debris in fan motor blower wheel causing the unit to ramp up/down in Btu's due to cycling.

c. Clogged inlet water filter causing restricted water flow. Always clean filter on all service calls.

d. Inlet gas pressure changing due to under sized meters, regulators, gas lines, tanks, etc. Must ensure gas system is sized properly. Check inlet gas pressure while the unit is operating look ing for inlet gas pressures surging up and down. This would indicate an issue with the gas supply.

e. Inlet water pressure fluctuating causing the unit to cycling on/off on low flows. Can be caused by fluctuating water supplies due to improperly sized plumbing systems, well system problems, and utility water systems fluctuating.

f. MSA system cycling especially if unit #1 has a clogged filter or restricted flow for whatever reason. If unit #1 is creating the issue, may have to install a PVA valve to resolve.

g. Faulty valve diaphragm can cause a fixture to bleed over. Could be a fixture up or down stream from area experiencing sandwich.

h. Standard use of water in a plumbing system without circulation when customer turns hot water off and someone else comes up behind them with a few minutes and uses hot water. Water in plumbing system can still be hot, but when the last person using hot water turned off the fixture the water heater cycled off. When the next person opened the tap, the water

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

heater had to re-fire, allowing some cold water back into the system. Demand systems – each time a demand system calls for hot water the water heater cycles on. If the consumer does not leave the tap open the water heater cycles off. Then when the water is turned back on within a few minutes of the demand system cycling, and cold water sandwich is created.

j. Loose or bad electrical connection inside the water heater or power supply to product. Power supply could be dropping out momentarily due to a component heating up, loose wiring connections, etc.

k. Low flow shower heads especially in area with high ground water temperatures.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Cold Water Sandwich caused by faulty fixture

1. Have customer explain issue.

2. Turn off hot water ball valve on the Rinnai valve kit at the water heater. This should shut off the water flow to all hot water fixtures at the location. Turn on a hot water fixture to check and see if any water continues to flow at that fixture. After roughly two minutes all residual water in the system should bleed down to no flow at your fixtures. If water continues to flow at any flow rate you have a faulty fixture, check valve, or a cross over in the plumbing system. Locate faulty fixture and correct the bleed over.

3. Ask the customer if the location has a circulating system. If so; isolate to circulation loop from the plumbing system by means of a shut off valve in the return loop. We are trying to ensure water is not bypassing the water heater through a faulty check valve in the return loop. After shutting off the ball valve in the circulating loop, all water flow should stop. If not, you may still have a faulty fixture.

4. Proceed to all fixtures with single handle levers, shut off the cold water ball valve at each fixture one at a time. Check flow after shutting off the cold water line at each fixture. If water flow stops during this process, go back to the last fixture turned off and open the cold water ball valve. If flow starts back that fixture has a bad diaphragm in it. You can either replace the faulty fixture insert or install a check valve in the hot water feed to prevent cold water from back feeding.

5. If location has a mixing valve isolate mixing valve, turn off the cold water feed to that device. If the water temperature reaches temperature and continues to maintain temperature with the mixing valve isolated, the problem is in the mixing valve.

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

Code LC, LCO—LC9

Scale build-up in Heat Exchanger (when checking maintenance code history. “00” is substituted for “LC”)

1. Flush heat exchanger per recommended flushing procedure found in unit’s owner’s manual.
2. NOTE; the LC, LC0 – LC9 codes are the only codes that will allow a unit to continue to operate. The display will alternate between the LC codes and the temperature setting. The controller will continue to beep.
3. On older product you can reset the LC code by turning off the power and then turning it back on.
4. On newer product there is a shutdown feature built into the product to prevent damage caused by the unit scaling up. See reset function for these units below:



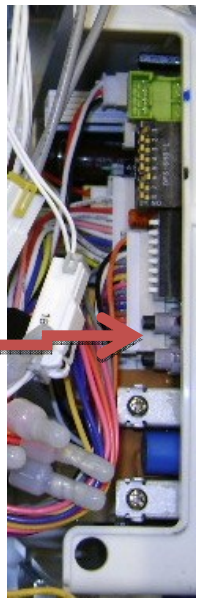
- LC, 00, or LC0 – LC9 indicates that there is a scale build-up in the heat exchanger and that it needs to be flushed to prevent damage. Refer to the flushing instructions in the owner’s manual. Hard water must be treated to prevent scale build-up or damage to the heat exchanger. **The above codes will lock the unit out requiring a reset function, see below how to reset.**

- To operate the water heater **temporarily** until the heat exchanger can be flushed, push the on/off button on temperature controller 5 times. *(unit will operate for 70hrs and lock out with another LC code)* **Example: LC2**

After temporarily reset, controller will cycle between set temperature and LC#

After flushing unit, the procedure to reset LC codes:
- Push the two switches (A & B) on PCB at the same time for 5 seconds.
- Unit will return to normal operation and LC# count returns to 0.

This hard reset procedure is not in owners/installation manual or tech sheet.



WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

No Code

1. Clean water inlet filter to water heater.

2. On new installations ensure the hot/cold water lines are not reversed.

3. Ensure you have the minimum flow rate required to fire the unit.

4. Ensure water flow control turbine spins freely.

5. Measure the resistance of the water flow control sensor, see technical data sheet behind front cover of unit for proper readings.

6. Check for bleed overs, isolate unit from building by turning off hot water line to building. Next isolate the circulation system if present. Open your pressure relief valve; if water is flowing, there is a bleed over in your plumbing system.

How to Retrieve Flow Rate and Temperature Output from Unit

Temperature Controller – Adjustments and Troubleshooting
(For all product prior to VC and KB series Rinnai Water Heaters)

Rinnai



MC-91-1US
Standard with all new units

For other remote specifications, see owner's manual or specific model.

To change the display from °F to °C or °C to °F:

With the controller off press and hold On/Off for approximately 5 seconds.

To mute the audible beep:

Press and hold the ▲ and ▼ until an audible beep is heard (approximately 5 seconds).

All temperature controllers also provide the following diagnostic capabilities:

To display water flow (GPM) through water heater:
Press ▲, hold for 2 seconds, and simultaneously press On/Off

To display outlet water temperature:
Press ▼, hold for 2 seconds, and simultaneously press On/Off

To display previous maintenance codes:
Press On/Off, hold for 2 seconds, and simultaneously press ▲

NOTE: The MC-100 also has an extended diagnostic menu to aid in servicing. Contact Rinnai for more details.

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Temperature Controller – Adjustments and Troubleshooting
(VC and KB series Rinnai Water Heaters)

Rinnai



MC-91-2US
Standard with all VC and KB series units

To change the display from °F to °C or °C to °F:

With the controller off press and hold On/Off for approximately 5 seconds.

To Lock the controller on a set temperature:

Press and hold the Priority and ▲ together for 5 seconds a beep will sound confirming the controller is locked. The Display will alternately show "LOC" and set temperature.

To mute the audible beep:

Press and hold the ▲ and ▼ until an audible beep is heard (approximately 5 seconds).

MC-91-2US controllers also provide the following diagnostic capabilities:

To display previous maintenance codes:
Press On/Off, hold for 2 seconds, and simultaneously press ▲

To enter or exit the maintenance monitor information mode, press and hold ▼ for 2 seconds and simultaneous press On/Off

To display various diagnostic information press the up or down arrows. Ex: "01" which will then display water flow rate or "02" which will then display outgoing water temperature.

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

NOTE: The MC-91-2 also has an extended diagnostic menu to aid in servicing. Contact Rinnai for more details.

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WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

NOTES:

WARNING: Turn off power, water and gas supplies to the appliance before removing or installing any parts. You MUST be a qualified and/or licensed technician to service this appliance.

To enter the maintenance monitor display mode:

Press and **hold** the DOWN arrow, in two seconds press the ON/OFF button at the same time. Release both buttons. First "01" will be displayed followed by a display of the flow rate in GPM. Pressing the UP arrow will change the display to "02" followed by the output water temperature and so on.

Code	Reading	Units	Description / Notes
01	Water Flow in GPM.	0.1 GPM	GPM Through WH (decimal not shown).
02	WH Outlet Temperature.	Deg. F	Output Water Temperature.
03	Hours of Operation.	X100	Total Combustion Hours.
04	Combustion cycles.	X100	Total Combustion Cycles.
05	Fan Frequency.	Hertz	Fan Motor Hertz (if operating).
06	System Controllers.	# of controllers	Add together for total # controllers connected to unit.
07	Water Flow Servo Position.*	*	*See notes.
08	Inlet Water Temperature.	Deg. F	Calculated Inlet Water Temperature.
09	Fan Current.	10 mA	Fan Current Draw (if operating).
10	Total Bath Fill Volume.	Gallons	Volume of Water During Bath Fill Mode.
11	HEX Temperature.	Deg. F	Heat exchanger output water temp
12	Bypass Servo Position.	Degrees	Degrees of opening (if equipped)
13	Burner Thermistor Temperature	Deg. F	(if equipped)
14	Intake Air Temperature.	Deg. F	(indoor non-condensing models only)
15	Thermal Fuse	Deg. F	
16	Thermocouple Value	mV	(condensing models only)
17	Freeze Protection Temperature 1.	Deg. F	Temperature reading of freeze protection sensors.
18	Freeze Protection Temperature 2.	Deg. F	
19	Pump Hours	X100	Total pump operation hours (RUR98 models only)
20	Pump Cycles	X100	Total pump operation times (RUR98 models only)

Note: Not all diagnostic functions will be available on all models. If a water heater does not have a particular function that number will be skipped when scrolling through the menu.

***Water flow servo position.**

- **If the controller reads 1, the servo is open.**
- **If the controller reads 2, the servo is closed.**
- **If the controller reads 0, the servo is partially open.**

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51

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