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Rinnai Service and Support (800-621-9419)

Rinnai America’s phone support structure consists of the following departments:

- Customer Care Group
  - CRC – Consumer Response Center – Fielding general calls, consumer questions, etc.
    - Available in office from 8 a.m. to 8 p.m. EST, Monday – Friday
  - Parts Department – Fielding parts orders
    - Available in office from 8 a.m. to 5 p.m. EST, Monday – Friday

- Warranty Department – Fielding warranty claim issues
  - Available in office from 8 a.m. to 5 p.m. EST, Monday – Friday

- Technical Support Department – Fielding technical issues related to the function of all Rinnai Products
  - Available in office from 8 a.m. to 8 p.m. EST, Monday – Friday AND 24/7/365 on call support for technicians who are at the service location. Please call 1-888-RINNAI (1-888-746-2441).

- Engineering / Applications Department – Fielding issues related to product applications including sizing
  - Available in office from 8 a.m. to 5 p.m. EST.

Rinnai America also provides the following web site for support:

- www.rinnai.us – for all product, sales, and service information. Of Note—a comprehensive documents library is available at the sales/service link. Website registration is required for access.
UNIT DI SASSEMBLY

ASSEMBLY

It is important to note that all components within Rinnai tankless water heaters are field replaceable while installed.

All major replacement parts are accompanied with replacement procedures.

The following procedures are for VB series product.

Other Rinnai models may vary in design and application requirements.

Please refer to each model's install guide and service documentation for specific model information.

PLEASE STAY WITH THE PRESENTATION WHEN DI SASSEMBLING

Primary Service Tools

For service, troubleshooting, and component replacement, the following primary service tools will be needed (other tools could be needed on occasion)

- #2 Phillips Head Screw Drivers
- Small Phillips Head Screw Drivers
- U-Tube Manometer
- 3/16" Allen Wrench
- Multimeter (Volt/Ohm Meter)

Front Panel Removal-VB Models

To remove front cover of VB models, press the top and bottom of each side cover piece and pull the piece away from the product.

- Remove the four Phillips head screws securing the cover.

Press the top and bottom of each side cover piece (with thumbs) and pull the piece away from the product.
Front Panel Information

The inside cover of every Rinnai tankless water heater* contains a model specific wiring diagram and technical data sheet. The technical data sheet contains a parts diagram with part numbers and various service information including:

- Error code information
- DIP Switch/Gas Pressure settings
- Electrical Component Values
- Venting information
- Temperature controller information

*Continuum/Integrity models only had a wiring diagram in the front cover

Indoor Control Panel-VB Models

1. The controller mounting plate will slide up and unhook from the igniter mounting plate.
2. The controller mounting plate can then be moved after disconnecting controller wiring from terminals for control.

Manifold and Site Glass Plate

1. Ensure unit is isolated from power.
2. There are two flame rods—note the flame rod with the yellow wire is on the right and red wire is on the left with the igniter in the middle.
3. The color coding is engraved on the manifold and the site glass plate for clarity.
Sparker Electrode & Flame Rods

1. Ensure unit is isolated from power.
2. Unplug sparker by pulling down on black wire.
3. Unplug flame rods by pulling down on yellow and red wires.
4. If needed, the electrode holder can be removed with three screws for inspection—it is preferred not to remove this and remove the manifold, site glass plate, and burner assembly for full inspection of entire burner area.
5. Upon reinstallation, the wires must point downward (6 o'clock position) in order for correct inner orientation of electrodes.
6. Make certain gasket (packing) remains intact. If not, a new manufacturer supplied gasket must be installed.

Heat Exchanger Thermistor, Overheat Bimetal, and Thermal Fuse

1. Ensure unit is isolated from water & power.
2. To remove the heat exchanger thermistor, remove two screws and pull out thermistor. Upon reinstall, ensure o-ring is intact and on thermistor.
3. To unplug the heat exchanger thermistor, release the Molex connector in wiring harness beside PC board.
4. The overheat bimetal opens the safety circuit at 207°F. The switch will automatically reset once the temperature drops below the activation point.
5. The thermal fuses will open at 264°F. This is a “one shot” device and must be replaced if open. This component wraps around the heat exchanger. To replace, the heat exchanger must be removed. Ensure no wires are pinched upon reassembly. Tip: Pinched or grounded wires contacting ground can cause an immediate error code 12.
6. To unplug the thermal fuse harness, follow the white wires on the right side of the unit to two Molex connectors.

Overheat Safety Protection

The Rinnai Safety “Line of Defense”

Multiple layers of technology ensure safe operation

- An LC warning code will post on the temperature controller (unit will continue to operate)
- If the heat exchanger thermistor detects unusually slow heat dissipation after the flame stops...
  - The flame will turn off until the temperature decreases (no code is posted)
  - The safety circuit is broken and a code 14 will post on the controller
- If the outlet thermistor detects 60°F over the temperature set point...
  - The flame will turn off until the temperature decreases (no code is posted)
  - The safety circuit is broken and a code 14 will post on the controller
- If the overheat bimetal detects 207°F...
  - The flame will turn off until the temperature decreases (no code is posted)
- If the heat exchanger thermistor detects a boiling condition (approx. 210°F)...
  - The safety circuit is broken and a code 14 will post on the controller
- If the thermal fuse detects 264°F...
  - The safety circuit is broken and a code 14 will post on the controller
1. When the activation temperature is reached, freeze protection sensors allow incoming voltage to supply five or eight (depending on unit) ceramic heaters located at the water inlet and outlet assemblies, the inlet and outlet heat exchanger pipes, and directly across the front of the heat exchanger. See adjacent table for activation temperature.

2. The sensor on the indoor model is located next to heat exchanger thermistor.

3. The outdoor model sensor is located in the bottom of the unit.

4. Ceramic heater connections are in the bottom left corner of the unit (2 or 3 Molex connectors depending on model).

5. Additionally, if the outlet and heat exchanger thermistors detect freezing water, non-condensing units will fire in a “non flow” state for three seconds periodically until warmer temperatures are maintained. Condensing models will not do this due to the amount of water in both heat exchangers—instead, they are equipped with additional ceramic heaters.

NOTE: Adequate incoming power and gas are required for freeze protection to operate correctly!

---

### Freeze Protection- VB Models

1. **VB - LS indoor series** have 8 ceramic heaters
2. These models also will fire with no water flow if the thermistors sense temperatures approaching freezing conditions.

3. **IMPORTANT:** Please note the differences in fuse capacity for all models:
   - VB – LS Indoor models now require a 5 amp fuse
   - VB – LS Outdoor models still require a 3 amp fuse*
   - All previous non-condensing models require a 3 amp fuse*
   - Condensing models require a 7 amp fuse

*Some older non-condensing models were equipped with two fuses.

---

### Combustion Fan-VB

1. Ensure unit is isolated from power. NOTE: Component damage is possible!
2. The spark igniter must be removed before the fan can come free of the unit. Note the two machine screws.
3. Remove the two housing screws.
4. Remove rubber bellow (internal unit only)
5. Unplug SV4 and fan motor wiring harness plug
6. Disconnect air inlet thermistor (internal unit only) and remove fan assembly.
7. The combustion fan mounting bracket has an extended tab to prevent misalignment of the fan tab when reinstalling fan assembly.
**Manifold Plate Removal**

1. Ensure unit is isolated from power.
2. Unplug SV3 and SV4 connections.
3. Remove 3 screws at gas valve assembly.
4. Move electrode sparker wire.
5. Remove 6 screws on perimeter of manifold.
6. Ensure gaskets are intact upon reinstall.
7. Front plate can be removed for inspection of gas delivery paths (rare). See below.

**Note:** The 3 hex head screws connecting manifold to gas valve, important to re-install in same location.

---

**Manifold-A Closer Look**

Follow the gas flow

32 Gas Orifices

When sparking, only SV1 and SV2 will open on the manifold. This allows gas only to the area of the burner where the spark electrode and flame rods. Once an adequate flame is established on the flame rods, SV3 and SV4 will open as needed based on demand.

**This is a gas type specific part. If replacing (or converting), ensure this part matches the appropriate gas type.**

---

**Site Glass Plate and Burner Box Removal**

1. Ensure unit is isolated from water & power.
2. Remove manifold plate.
3. Remove 8 screws on perimeter of site glass plate.
4. Remove 2 screws on burner box.
5. Pull burner away from unit.
6. Ensure gasket / packing is intact upon reinstall.

**Note:** If a symptom indicative of a dirty flame rod is present, it is recommended to remove the site glass plate and burner for additional inspection instead of the electrode holder. This will also ensure the fiber gasket at the electrode holder does not become damaged during removal.

Site glass plate reversed – picture from the inside of the manifold plate
Burner Box Inspection

16 stainless steel burners can be individually removed for inspection and cleaning. A mildly abrasive wire brush and/or compressed air pressure can be used to clean the burner.

Burner Sensor Operation

Indoor models only (VB series)

- The burner sensor is a negative temperature coefficient resistor measuring the flame temperature.
- It works only in the 4th and 6th stages of combustion due to the burner sensor’s location on the right side of the burner.
- The flue block system does not change dramatically with this sensor. Basically it is the same as VA models.
- However, the burner sensor will detect combustion that is extremely inadequate. If this is detected, a code 10 will display.
- If the burner sensor does not detect a temperature between 194°F and 1,202°F (during the 4th and 6th stages of flame), a code 10 will occur.
- If a code 10 occurs, first verify air passageways are free— including the vent system, fan assembly, burner assembly and heat exchanger fins— remember, any issue that can restrict fan frequency can cause an error code 10.
- After verifying all air passageways are clear, ensure gas pressure is correct, all solenoids are opening correctly, and the burner sensor is positioned correctly.
- Contact Rinnai Technical Support as needed at 1-888-RINNAI (888-746-6247).

Gas Valve Assembly Removal

1. Ensure unit is isolated from power and gas supply.
2. If needed, remove manifold plate.
3. Remove 4 screws around gas inlet. Two of the screws are longer to accommodate the inlet fixture.
4. Disconnect all solenoid plugs from valve assembly. Note solenoid wire color assignments.
5. Indoor units: Remove clear tube from bottom of assembly. **NOTE:** If an indoor heat exchanger is replaced due to leaking, inspect this tube for water. If signs of water in this tube are present, replace gas valve.
6. Upon reinstallation, ensure O-ring is intact with ribbed side facing manifold, gas inlet is positioned correctly, and proper manifold gas pressure is verified.
7. To properly adjust the manifold pressure, a manometer must first be connected, and the unit set in a forced low and high fire setting.
**Water Outlet Fixture & Thermistor**

1. Ensure unit is isolated from water & power.
3. Remove pan-head screw holding outlet thermistor.
4. Ensure thermistor o-ring is intact and on thermistor upon reinstall. Ensure thermistor is clean.

**Water Inlet Fixture & Water Flow Control Assembly Removal**

1. Ensure unit is isolated from water & power.
2. Remove 2 screws securing inlet fixture. Pull fixture away from unit. Ensure fixture o-ring is intact.
3. Remove 2 screws surrounding inlet fixture.
4. If needed, remove screw(s) from heat exchanger outlet retainer(s). Rotate retainer to release. Pull copper heat exchanger inlet(s) away from fixture. Ensure o-rings stay intact. **NOTE:** Model will determine if variable bypass valve is in flow control assembly. If so, there will be two copper heat exchanger inlets.
5. If needed, unplug ceramic anti-frost heater, flow sensor, and flow control plug(s).

**Water Flow Control / Bypass Valve Assembly Overview**

1. To separate water flow servo from bypass valve, remove 2 screws on bypass valve. Upon reinstall, ensure o-ring is intact and bypass orientation is correct. Bypass is model dependent.
2. To remove turbine from assembly, remove retaining clip. **CAUTION:** Turbine is fragile, contact Rinnai Technical Support if needed for guidance!
3. To disassemble turbine, remove top cap. Impeller will come free of housing. Reinstall is unique to correct position.
4. To remove flow sensor (and ceramic heater) from assembly, remove the non-ferrous screws in front of assembly.
**Water Flow Bypass—A Closer Look**

Model number will determine what type of bypass is used. Ensure the correct heat exchanger part number is selected if replacing.

<table>
<thead>
<tr>
<th>ELECTRONIC BYPASS</th>
<th>FIXED BYPASS</th>
<th>NO BYPASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>R85 / C85</td>
<td>R42 / R53</td>
<td>C42 / C53</td>
</tr>
<tr>
<td>R94LS / R94L</td>
<td>R70 / V53</td>
<td>R97 / V75</td>
</tr>
<tr>
<td>R50LS / R63LS /</td>
<td>R50LS / R63LS/</td>
<td>R95LS / R95L</td>
</tr>
<tr>
<td>R98 / C98 / R98L</td>
<td>REU-2424W(C)</td>
<td></td>
</tr>
<tr>
<td>RC80 / RU80</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sample representations only—individual component characteristics will vary between model.

**Heat Exchanger Removal**

Common to indoor or outdoor units

1. Ensure unit is isolated from water & power.
2. Remove the combustion fan.
3. Disconnect safety circuit, heat exchanger thermistor, anti-frost circuit, and spark module.
4. Separate the copper pipes from the inlet and outlet fixtures by removing machine screws and stainless steel clips. Models with a variable bypass will have two copper pipes at the inlet fixture. Models with a fixed bypass will have one.
5. Remove three screws connecting manifold to gas valve.
6. Remove clear tube at bottom of gas valve. (Indoor models only)
7. Remove two screws connecting PCB to heat exchanger and cabinet.
8. Remove three screws behind fan.
9. Continue to outdoor or indoor unit’s specific instructions.

**Outdoor Heat Exchanger Removal**

See previous slide/page for initial steps

1. Remove two screws at top of heat exchanger.
2. Remove the four screws securing the flue outlet to the heat exchanger.
3. Heat exchanger should pull free from cabinet.
4. Transfer to new heat exchanger:
   - thermal fuse
   - overheat bimetal
   - heat exchanger thermistor
   - anti-frost circuit
   - spark module
Indoor Heat Exchanger Removal

See page: “Heat Exchanger Removal: Common to indoor or outdoor units” for initial steps

1. Remove one screw at bottom of air inlet box.
2. Remove four screws behind (on sides of) heat exchanger.
3. Heat exchanger should pull free from unit.
4. Remove nine screws from air inlet box cover.
5. Remove four screws at back of heat exchanger (pull upward).
6. Remove four screws from exhaust bracket. Bracket should pull free from heat exchanger.
7. Remove four screws from back of air inlet box.
8. Transfer to new heat exchanger:
   - thermal fuse
   - anti-frost circuit
   - heat exchanger thermistor
   - overheat bimetal
   - spark module

Reasons for Heat Exchanger Failure

When all installation guidelines are followed, the heat exchanger should last for many years. Primary reasons heat exchangers fail:

- **Freezing damage**
  - Rinnai indoor water heaters have internal protection when outside temps are as cold as -22°F (-30°C). Outdoors when outdoor temps are as cold as -4°F (-20°C) provided adequate power and gas supplies are present. Employ the optional drain down configuration if needed.

- **Condensation from incorrect venting**
  - High efficiency appliances create condensation. Incorrect venting not only can cause operational issues and shortened vent life, but the highly acidic condensation will corrode water heater components including the heat exchanger.

- **Internal scaling from poor water quality**
  - Inadequate water quality creates internal insulation issues which can affect performance and eventually deteriorate the copper tubing. Higher operating temperatures can exasperate this condition. Ensure the water quality meets the National Secondary Drinking Standards Act (EPA Guidelines).

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Water Flow Control Assembly Troubleshooting

**TROUBLESHOOTING TIP**

A clicking sound from inside the water heater accompanied by a temperature controller with no display or sporadic flashing temperature (not an error code) on the display is indicative of a water flow control issue.

To troubleshoot:

- Unplug the water flow control wiring harness—the only harness with a blue and red wire.
- If the clicking noise stops and the temperature controller returns to a steady temperature display, the water flow control valve may need to be replaced—contact Rinnai technical support at 1-888-746-6247 with the full model (REU-VBXXXXXX) and serial number for additional information.
Surge Protector Review

**SURGE PROTECTOR DISCONNECTION**

1. Disconnect power from the unit.
2. Disconnect the bottom & top Molex connectors.
3. Disconnect the yellow/green ground wire from the surge protector to frame.
4. If applicable, remove the center connector containing red and brown wires (if using optional drain down kit surge protector).

![Surge protector diagram](image)

**120V to PCB (output)**

**120V from source (input)**

Optional Drain Down Surge Protector

- **12 VDC output to temperature controller**
- **120 VAC output**
- **120 VAC at these lugs** (For optional drain down solenoids ONLY! Not for incoming power or remotes!)

- **Optional connection for PCB drain down signal**
- **120 VAC input voltage**

![Optional Drain Down Surge Protector](image)

*NOTE: Connecting the temperature controller to the surge protector connection lugs will destroy it—this is not a warranty claim!*

PCB Disconnection and Removal

1. Disconnect the power from the unit & disconnect surge protector connections.
2. If needed, remove the two screws at the top and bottom of PCB casing.
3. Remove ground wires from PCB and surge protector to frame.
4. Pull the PCB up and out. Take care not to stress any connections.
5. When the PCB is in raised position, disconnect all connections.

Most PCB connections are uniquely keyed to their individual plug.

If the PCB is replaced, DIP switches and gas pressure must be verified.

Some PCB’s do not have the white bank of six DIP switches as gas type and model information is preprogrammed into the board—this was the case primarily for LS/VA units.

All outdoor models prior to LS Series came with this style surge protector. This surge protector is available as an accessory individually or as part of a drain down kit.

*excluding some 2424W models*
Accessory Wiring

Note the harnesses that are for future accessory use:

1. EZConnect: connects two tankless products in a manifold
2. MSA or MSB: Connects up to five tankless products in a manifold
3. Air Handler Control Switch or Simple Building Management System interface (VB and condensing models only-coming soon)
4. Freeze Protection Drain kit: Connects to accessory surge protector used with solenoid valves in kit.

Product Reassembly

Key Points of reassembly

- Reassemble in opposite order of disassembly
- Ensure all screws are placed in the correct location and NOT over tightened
- Ensure all connections are correct (solenoid valves, etc.)
- Do not place covers on units

Note: Do not apply power until the product is inspected by the instructor!

WARRANTY GUIDELINES
**Warranty-All Models**

<table>
<thead>
<tr>
<th>Residential</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Exchanger</td>
<td>Parts <strong>Labor</strong></td>
</tr>
<tr>
<td><strong>12 or 10</strong> <strong>(miles away)</strong></td>
<td>5</td>
</tr>
</tbody>
</table>

**KEY POINTS OF LIMITED WARRANTY COVERAGE (ALL MODELS)**

- **Labor**: 5 years residential / 2 years commercial for RL / RU / R98LS models when registered within 30 days of installation. 1 year all other applications and models. **Heat exchanger warranty increased from 10 to 12 years if isolation valve kit is installed on Value series.**
- 3-year heat exchanger and parts warranty when water heater is installed in a circulation loop or system or in a series where all water flows through the water heater, and where an on-demand system is not incorporated.
- If a Rinnai water heater in a commercial application, the commercial warranty will apply. Exception: V53, V65, and V75 models are not approved for commercial applications.
- If a Rinnai tankless water heater is in conjunction with a Rinnai Hydronic Furnace, the heat exchanger is warranted for 10 years and all other parts are warranted for 5 years from date of purchase of the Rinnai water heater. Temperature setting exceeds 160ºF (71ºC). Heat Exchanger coverage is reduced to 5 years from date of purchase if the Rinnai water heater temperature setting exceeds 160ºF (71ºC). Heat Exchanger coverage is reduced to 5 years from date of purchase if the Rinnai water heater temperature setting exceeds 160ºF (71ºC).
- Warranty covers any defects in materials or workmanship when the product is installed and operated according to Rinnai written installation instructions.
- Warranty applies only to products that are installed per local and/or state codes. Improper installation may void the warranty.
- Warranty does not cover failure due to accident, abuse, misuse, alteration, misapplication, force majeure, improper installation, maintenance, or service, and/or water quality, water usage, or freeze damage.
- Warranty does not cover production or component failures where the water supply does not meet the National Secondary Drinking Water Regulations.

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**ELECTRICAL REQUIREMENTS AND TROUBLESHOOTING**

**Electrical Diagnostic Points**

Verifying electrical values of individual components is not common but when necessary, must be conducted correctly and safely. Verifying incoming supply voltage is the most common metering need in the field—especially during installation.

**Key points when troubleshooting electrical values:**

- Ensure volt meter probes are solidly contacting metal.
- Apply probes to the back of Molex connections when possible, to prevent possible damage to connection points.
- Know your meter and how to set it for each type of measurement.
- **Ω** = Ohms or resistance
- **VDC** or **V-** = DC voltage
- **VAC** or **V~** = AC voltage
- Always set meter to next highest value from range (as listed in manual).
- When measuring resistance, ensure the component is disconnected from the circuit AND power is removed.
- When measuring a solenoid’s resistance, place the meter probes on the solenoid’s lugs (connection points) with the wires disconnected from.
- A correct resistance reading from a solenoid or transformer coil is not a guarantee that the component is good as the windings can open under load. An incorrect value is a very good indication that the component is bad though.

For metering values, reference Rinnai’s Tankless Water Heater Service Manual (pt. #100000098)—the “Electrical Diagnostic Points” section (model dependent) or each unit’s technical data sheet in the front cover.

ENSURE YOU ARE READING THE CORRECT PAGE!
Electrical Diagnostic Points

LAB EXERCISE

1. Measure Incoming Voltage
   a. At receptacle or extension cord
   b. At bottom of surge protector
   c. At top of surge protector
2. Measure Continuity of Safety Circuit
   a. At thermal fuse connections
3. Measure Resistance of Solenoids
   a. Measure SV4
   b. Measure POV
4. Measure Resistance of Heat Exchanger Thermistor
   a. While measuring, squeeze bulb and watch value change inversely to temperature
   NOTE: Although this is rarely done in the field, this validates the accuracy of the component.

For component-level wiring diagrams, reference Rinnai's Tankless Water Heater Service Manual (pt. #100000098)—(model dependent) or each unit's front cover.

ENSURE YOU ARE READING THE CORRECT PAGE!

KEY POINTS
- On VB Model diagrams (as shown), note the etched-out sections indicating unique components for specific models
- Ensure all DIP Switches are set correctly for the model in question (see DIP switch section in the Service Manual)
- The Anti-frost portion of the circuit is independent from the PCB.

Current Available Temperature Controllers

MC-91
MC-100
MCC-91
MCC-100*
BC-100

*for commercial / hydronic use only

All current Rinnai models will accept up to four temperature controllers installed in parallel in any combination (perception: only one MC-100 per unit and/or one BC-100 per unit)
Temperature Controller Range
(for all current Rinnai Water Heaters)

• All water heaters* manufactured July, 2008 or after have the following temperature adjustment features:
  • Maximum default production temperature setting of 120º F (49º C)
  • Meets requirements of various local codes
  • Enhances safety of users, especially children and the elderly
  • Temperatures between 125 – 140º (52º - 60ºC) are available by setting DIP switch 6 to the ON position in the SW1 bank of 8 DIP switches

*The V53i/e nor the R98LS does not default at a max of 120 ºF with an MC-91 (or similar controller). These models will always max at 140 ºF. DIP switch 6 is allocated for another use.

Temperature Controllers
Installation Requirements

Installation (recommended in the SW1 bank of 8 DIP switches)

• Controller wires are to be connected to the unit where labeled “Terminals for Controls.” Wires are not polarity sensitive.
• Indoor LS models come with a temperature controller integrated into the front cover and its wiring already connected. MC-91 relocation kit available as an accessory.
• Outdoor LS units come with an independent temperature controller to be installed remotely.
• Controllers operate on 12 VDC and should never be connected to supply voltage (120 VAC).
• Controllers can be located anywhere in the structure protected from heat, direct sunlight, water, and small children.
• Standard thermostat wire can be used to connect the controller to the water heater if needed.
• Each unit will accept up to four controllers. They must be wired in parallel.
• The connection for temperature controllers for the R63LSe and V53e are located on the bottom of the cabinet.

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

To change the display from ºF to ºC or ºC to ºF:

With the controller off press and hold (g) 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

To display outlet water temperature:

Press hold for 2 seconds, and simultaneously press

To display previous maintenance codes:

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

To change the display from °F to °C or °C to °F:
With the controller off press and hold for approximately 5 seconds.

To Lock the controller on a set temperature:
Press and hold the TOGETHER for 5 seconds

To mute the audible beep:
Press and hold the TOGETHER 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 , hold for 2 seconds, and simultaneously press

- To enter or exit the maintenance monitor information mode, press and hold for 2 seconds.

- To display various diagnostic information press the or arrows. Ex: “01” which will then display water flow rate or “02” which will then display outgoing water temperature.

- To Lock the controller on a set temperature:
  To enter or exit the maintenance monitor information mode, press and hold for 2 seconds and simultaneously press

- To display various diagnostic information press the or arrows. Ex: “01” which will then display water flow rate or “02” which will then display outgoing water temperature.

NOTE: The MC-91-2 also has an extended diagnostic menu to aid in servicing.

Maintenance Monitor
(VC and KB series Rinnai Water Heaters)

To enter or exit the maintenance monitor information mode, press and hold for 2 seconds.

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

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

45 Series Controller
Standard with all “Continuum” and “Integrity” water heaters

For other remote specifications, see owner’s manual of specific model.

45 Series temperature controllers also provide the following diagnostic capabilities:

- To display water flow (GPM) through water heater:
  Press , hold for 2 seconds, and simultaneously press

- To display outlet water temperature:
  Press , hold for 2 seconds, and simultaneously press

- To display previous maintenance codes:
  Press , hold for 2 seconds, and simultaneously press
MAINTENANCE CODE DIAGNOSTICS

Maintenance Diagnostic Codes
(Condensing and Non-condensing models)

A 2-digit maintenance code will flash on the temperature controller when a fault occurs. The unit will stop operating. Resetting water flow or power will clear the code. See owner's manual for a full detailed list of all codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Power interruption during bath setup (water will not flow when power restored)</td>
<td>Turn off hot water. Press ON/OFF button.</td>
</tr>
<tr>
<td>01</td>
<td>Condensing/Non-condensing</td>
<td>Check that terminal is closing the fan only or exhaust. Check that any components in the power connection.</td>
</tr>
<tr>
<td>15</td>
<td>Air Supply to Exhaust Breather</td>
<td>Ensure approved warning messages are being taken. Ensure the exhaust bend is not restricted. Check the fan. Check for gas leaks.</td>
</tr>
<tr>
<td>11</td>
<td>No Ignition (heater not turning on)</td>
<td>Check that the gas is turned on at the water heater. Gas, water, or ignition of the unit is properly. Ensure the water is not restricted. Ensure gas supply is not restricted.</td>
</tr>
</tbody>
</table>

(Continued on next page)
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.

LC code reset for VC and KB model units

- FF – To enter this maintenance flag code in history, press the up, down, and ON/OFF simultaneously
WATER REQUIREMENTS, MAINTENANCE AND TROUBLESHOOTING

Troubleshooting Water Flow Issues

- Cold water search is when a tankless water heater is turned on, off, and on again in a short period of time.
- Due to the 3-5 second activation time, this causes a cold slug of water to travel down the hot water pipe.
- Crossover is when cold water is introduced into the hot water line after the water heater.
- When this happens, it can ‘overtake’ the flow from the tankless water heater, thus causing the temperature at the output to scale back.
- If strong enough, the crossover can cause the unit to turn off altogether for a brief moment.
- Crossover can occur in single handled mixing valves, washing machine connections, anywhere there is hot and cold introduced at a single point.
- Pressure regulated and scald prevention fixtures can also cause intermittent flow issues.
- Clogged water filters, sink aerators, filtration systems, etc. can also cause flow issues.
- All of the above are common factors of tankless water heaters—understanding the basic technology and various ways to alleviate such issues is important for consumer satisfaction.

Troubleshooting tip: If after isolating the appliance from the plumbing system and gpm flow and output temperature are verified through the controller’s diagnostic tests, the unit is likely performing to manufacturer’s specifications.

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Troubleshooting tip: If after isolating the appliance from the plumbing system and gpm flow and output temperature are verified through the controller’s diagnostic tests, the unit is likely performing to manufacturer’s specifications.

Maintenance—Service Flush Procedure

1. Disconnect electrical power to the water heater
2. Close the shutoff valves on both the hot and cold water lines (V3 and V4)
3. Connect pump outlet hose (H1) to the cold water line at service valve V2
4. Connect drain hose (H3) to service valve V1
5. Pour approximately 4 gallons of virgin food grade white vinegar or citric acid into pail
6. Place the drain hose (H3) and the hose (H2) to the pump inlet into the cleaning solution
7. Open both service valves (V1 and V2) on the hot and cold water lines
8. Operate the pump and allow the cleaning solution to circulate through the water heater for at least 30 minutes
9. Turn off the pump
10. Rinse the cleaning solution from the water heater by:
   a. Remove the free end of the drain hose (H3) from the pail
   b. Close service valve V1, and open shutoff valve V3. Do not open shutoff valve V3.
   c. Allow water to flow through the water heater for 5 minutes
   d. Close service valve V1, and open shutoff valve V3
11. Disconnect all hoses
12. Remove the in-line filter at the cold water inlet and clean out any residue
   a. Place the filter back into the unit
13. Restore electrical power to the water heater

For proper operation, unit longevity, and warranty adherence, water supply to the water heater must meet National Secondary Drinking Water Regulations. In areas with hard water, a water softener or other treatment may be needed. A periodic flushing procedure may also be required. Below is the proper flushing procedure:

1. Disconnect electrical power to the water heater
2. Close the shutoff valves on both the hot and cold water lines (V3 and V4)
3. Connect pump outlet hose (H1) to the cold water line at service valve V2
4. Connect drain hose (H3) to service valve V1
5. Pour approximately 4 gallons of virgin food grade white vinegar or citric acid into pail
6. Place the drain hose (H3) and the hose (H2) to the pump inlet into the cleaning solution
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   b. Close service valve V1, and open shutoff valve V3. Do not open shutoff valve V3.
   c. Allow water to flow through the water heater for 5 minutes
   d. Close service valve V1, and open shutoff valve V3
11. Disconnect all hoses
12. Remove the in-line filter at the cold water inlet and clean out any residue
   a. Place the filter back into the unit
13. Restore electrical power to the water heater
**Maintenance—Water Quality**

**Study Highlights:**
- Hard water can lead to as much as a 45% loss of efficiency in (gas tank-type) water heaters.
- Each five grains per gallon of hardness causes an 8% loss in efficiency and an 8% increase in cost when using 100 gallons of hot water per day in a gas storage tank water heater. (On 30 gpg hard water, that’s a 45% less efficient than with softened water.)
- Indoor tankless gas water heaters operated on softened water maintained the original factory efficiency rating over a 10-year lifetime.
- Softened water saves 34% of costs compared to operating on 20 gpg and saves 47% compared to operation on 30 gpg hard water.

**Remember….the incoming water maximum hardness threshold for Rinnai Tankless water heaters is 11.7gpg—so the above values are extreme—but they do exist in some areas.

- The moral of the story: Know the hardness levels in your area, perform the recommended flushing procedure as needed, and recommend the use of a water softener if needed as well.


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**Gas Requirements, Maintenance and Troubleshooting**

**Gas Supply Sizing Procedure—Example**

(All current models)

1. Determine the maximum gas (Btu) input for each appliance (see rating plate of appliance).
2. The total length of piping from point of delivery to the farthest appliance is 60 ft. This is the only distance used (longest length).
3. Refer to the appropriate table in the NFPA 54 manual. This will depend on type of pipe, type of gas, inlet pressure, pressure drop, and specific gravity. See below example:

<table>
<thead>
<tr>
<th>Pipe Size (in.)</th>
<th>Nominal: ½</th>
<th>¾</th>
<th>1</th>
<th>1 ¼</th>
<th>1 ½</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (ft)</td>
<td>10</td>
<td>172</td>
<td>360</td>
<td>678</td>
<td>1390</td>
</tr>
<tr>
<td>Capacity in Cubic Feet of Gas per Hour (CFH=Btu/1000)</td>
<td>20</td>
<td>118</td>
<td>247</td>
<td>466</td>
<td>957</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>95</td>
<td>199</td>
<td>376</td>
<td>768</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>81</td>
<td>170</td>
<td>320</td>
<td>657</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>72</td>
<td>151</td>
<td>284</td>
<td>583</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>65</td>
<td>137</td>
<td>257</td>
<td>528</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>60</td>
<td>126</td>
<td>237</td>
<td>486</td>
</tr>
</tbody>
</table>

4. Using the row marked 60 ft in the above excerpt from Table 6.2.(b):
   a) Outlet A, supplying 30 cfh (30,000 Btu), requires ½" pipe
   b) Outlet B, supplying 75 cfh (75,000 Btu), requires ¾" pipe
   c) Section 1, supplying outlets A and B, or 105 cfh (105,000 Btu), requires ¾" pipe
   d) Section 2, supplying outlets C and D, or 299 cfh (299,000 Btu), requires 1 ¼" pipe
   e) Section 3, supplying outlets A, B, C, and D, or 404 cfh (404,000 Btu), requires 1 ¼" pipe.

The following example is known as the longest length method. A full explanation of NG and LPG pipe sizing can be found in the National Fuel Gas Code Manual.
1. Determine the maximum gas (Btu) input for each appliance (see rating plate of appliance).

2. The total length of pipe plus the point of delivery is the total length. This is the only distance used (longest length).

3. Refer to the appropriate table in the NFPA 54 manual. This will depend on type of pipe, type of gas, inlet pressure, pressure drop, and specific gravity. See below example:

4. Using the row marked 60 ft in the above excerpt from table 6.2(c):
   a) Outlet A, supplying 30 cfh (30,000 Btu), requires ½" pipe
   b) Outlet B, supplying 75 cfh (75,000 Btu), requires ½" pipe
   c) Section 1, supplying outlets A and B, or 105 cfh (105,000 Btu), requires ½" pipe
   d) Section 2, supplying outlets C and D, or 299 cfh (299,000 Btu), requires ¾" pipe
   e) Section 3, supplying outlets A, B, C, and D, or 404 cfh (404,000 Btu), requires 1" pipe.

Gas System—Two stage piping Example
(All current models)

If resizing gas supply lines is not a feasible option, a two stage supply system may be used depending on local code guidelines. Two stage systems operate in the following manner:

• Higher pressure (usually 2 lbs or approximately 56" w.c.) is supplied for a large portion of the supply system.
• Regulators are placed close to each appliance to reduce pressure to the appliance standard of ½ lb or approximately 7-14" w.c.
• This system overcomes volume inadequacies by raising the pressure. NOTE: Never apply high pressure (such as 2 lbs) to a household appliance unless stated by the manufacturer.

Gas Supply Sizing Procedure—Troubleshooting

• Issues caused by insufficient gas supply:
  • Poor appliance operation
  • Tankless water heater error codes
  • Rumbling noises due to insufficient air/gas mixture (this will also happen with incorrect venting)
  • Summer installations sometimes operate correctly until winter appliances are operated—thus causing delayed performance issues. Testing gas pressure while all gas appliances are operating at full capacity can prevent such issues.
  • If any symptom exists suggesting a gas supply issue may be present, a gas manometer will be needed to verify incoming pressure. Rinnai tankless water heaters only need a single port manometer. Dual port or pressure differential manometers are not needed. Various manometers are shown:
### Setting Gas Pressure at the Manifold

**For all current models prior to VC and KB series product**

- Gas pressures at the manifold must be verified when:
  - The PCB has been replaced.
  - The gas valve has been replaced.
  - The unit's gas type is converted.

Every gas valve and PCB are equipped with full replacement instructions outlining the gas pressure settings.

Instructions are also in the Tankless Water Heater Service Manual (pt. #100000098) or each unit's technical data sheet found on the inside of the front cover.

- Due to the modulating gas valve, the unit must be forced into low and high fire and pressures must be set at each point. This ensures all points of modulation are set correctly.

- The gas valve setting procedure for each model must be followed.

#### Manifold Gas Pressure Settings

<table>
<thead>
<tr>
<th>Model</th>
<th>Adjustment Point(s)</th>
<th>Low Fire Setting</th>
<th>High Fire Setting</th>
<th>Low/High Fire Dip Switches (7 &amp; 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC &amp; KB</td>
<td>Low fire adjustment</td>
<td>4.9 (47)</td>
<td>6.9 (62)</td>
<td>7 &amp; 8</td>
</tr>
<tr>
<td></td>
<td>High fire adjustment</td>
<td>6.9 (62)</td>
<td>9.0 (87)</td>
<td>7 &amp; 8</td>
</tr>
</tbody>
</table>

#### Setting Gas Pressure at the Manifold

**For VC and KB series product**

- The procedure can be found on Technical Data Sheet located inside front cover of unit.

- The VC and KB models adjustments are both electronic, no mechanical adjustment of gas valve.
NON-CONDENSING MODELS
VENTING

**WARNING**
Improper installation of vent system and components, or failure to follow all installation instructions, can result in property damage or injury.

Rinnai's installation instructions are intended to complement those of the venting manufacturer. Please review Rinnai's Level II Installation Fundamentals Presentation as needed for more detailed venting guidelines.

### Vent Length Calculator
**All current models**

<table>
<thead>
<tr>
<th>Elbow Length Calculator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each 90° bend = 6 Feet</td>
</tr>
<tr>
<td>Each 45° bend = 3 Feet</td>
</tr>
</tbody>
</table>

- Total equivalency cannot exceed 41 feet
- If the equivalency is greater than 21 feet, move DIP switch #1 (bank of eight) to OFF (this switch is shipped in the ON position)
- Comply with all vent guidelines – refer to vent manufacturer and installation instructions.
- The RL94 maximum water flow capacity will be reduced by roughly 10% when DIP switch no. 1 is OFF.
- These images depict concentric venting. R98 models do not use concentric venting but use the same equivalency guidelines.

### Vent Termination
**For V53i, V65i, V75i/RL75i and RL94 indoor models only**

- The diagrams illustrate the correct way to address condensation with Rinnai concentric vented water heaters, V53, V65, V75/RL75, RL94 indoor models only.
- The integrated condensate collector MUST BE used on all vertical vent terminations and on any horizontal vent termination where the vertical run exceeds 5 feet or two or more elbows exist.
- If the condensate collector is used in a horizontal vent termination, the exhaust venting MUST BE sloped 1/4" per foot towards the water heater.
- If no condensate collector is used in a horizontal vent termination the exhaust venting MUST BE sloped 1/4" per foot towards the exhaust terminal.
- The condensation trap MUST contain at least 3" of water
Rinnai Vent Termination Requirements
For all Rinnai Water Heaters

- Avoid terminations near a dryer vent
- Avoid terminations near commercial cooking exhaust
- Comply with local and state codes as required

- 36" (.91 m) to vented or unvented soffit or eve
- 12" (.30 m) to an inside corner
- 12" (30 cm) between Rinnai terminals at the same level
- 60" (1.52 m) between Rinnai terminals at different levels
- 60" (1.52 m) vertically between Rinnai terminals (Also applies to external models)

V Vent terminal represents concentric vent terminal or R98 LS series exhaust vent only or external exhaust where applicable

TROUBLESHOOTING SUMMARY
WHEN TROUBLESHOOTING IT IS IMPORTANT TO REMEMBER....

- REMEMBER ALL RESOURCES AVAILABLE TO YOU!!
  - Rinnai documentation (Tech Service Manual, Installation Manuals, Tech Data Sheets)
  - Rinnai Support
  - Technical Support and Engineering Phone Support (1-888-746-6247)
  - Local Support (Sales representatives, distributors, etc.)
  - Rinnai Websites

- REMEMBER THE QUALITY OF THE PRODUCT!!
  - Rinnai’s Quality Control is second to none
    - Every Rinnai Product is fired and operated before leaving the factory
    - If it is a new install, realize the improbability of a manufacturing issue

- REMEMBER THE BASICS!!
  - Make certain all input parameters are good... water, gas, electricity, and air (venting)
  - If after isolating the appliance from the plumbing system and gpm flow and output temperature are verified through the controller’s diagnostic tests, the unit is likely performing to manufacturer’s specifications

General Trouble Shooting Summary
This is a general guide and not intended as an official troubleshooting procedure—contact Rinnai technical support if needed.

- Verify incoming pressure
- Verify clean burner area
- Confirm the information... have you witnessed the symptom? is your meter or manometer connected/setup correctly? are the meter probes making good contact?

- Verify correct venting
- Verify pressure/pipe size
- Verify all wiring/harnesses (check all harnesses for damage—i.e. water, corrosion, shorts/opens?)

- Verify input power
- Verify flow (with unit isolated)
- Verify grounding

- Verify clean fan
- Verify air
- Verify all wing harnesses

- Verify DC power
- Verify grounding
- Verify flow (with unit isolated)

- Verify incoming water temperature
- Verify pressure/pipe size
- Verify application

If SERVICE OR INSTALLATION assistance is needed in diagnosing the operation of the product, contact Rinnai technical support at 1-888-RINNAI.

If SERVICE OR INSTALLATION assistance is needed in diagnosing the operation of the product, contact Rinnai technical support at 1-888-RINNAI.
Appendix A

VC Non-Condensing Water Heater

Component Review

The following reviews differences of the VC series to previous VB series water heaters.

Please refer to each model's install guide and service documentation for specific model information.

Indoor Control Panel and Igniter Removal

1. To remove remote control bracket, remove screw and lift up from bottom of cabinet.
2. Note the 15 wire ribbon harness, which plugs into PCB. (Controller in VC series internal unit cannot be removed and installed remotely, relocation kit no longer necessary)
3. Unplug sparker wire from electrode and remove screw to remove igniter mounting plate from manifold.

Sparker Electrode & Flame Rods

If removed for inspection and cleaning ensure gasket (packing) remains intact. If not, a new manufacturer supplied gasket must be installed.
Heat Exchanger Thermistor, Overheat Bimetal and Thermal Fuse

1. Heat exchanger thermistor is now located on top left corner of Heat Exchanger.
2. Overheat Bimetal is now located on upper right side of Heat Exchanger.
3. Thermal fuse circuit.

Temperatures to activate overheat switch and thermistors have not changed.

Freeze Protection—VC models

- Indoor VC models
  - Heat Exchanger: 10°F
  - Air Inlet: 5°F
- Outdoor VC models
  - Outside Air Thermistor: 10°F
  - Heat Exchanger: 5°F

Units will fire momentarily if Heat Exchanger Thermistor senses below 37.4°F.

Combustion Fan Removal

1. Ensure unit is isolated from power. NOTE: Component damage is possible!
2. Unplug SV1, SV2, and SV3 connections & fan motor wiring harness.
3. Remove the four screws attaching fan motor and squirrel cage to housing.

Note: On Internal units there is no longer a rubber bellows due to the Air Inlet Assembly, it is now in rear of heat exchanger.
Manifold Plate Removal

1. Remove 6 screws on perimeter of manifold.
2. Remove 2 screws at gas valve assembly.
3. Ensure gasket is intact upon reinstall.
4. Front plate can be removed for inspection of gas delivery paths (rare)

Site Glass Plate and Burner Box Removal

1. Remove 7 screws on site glass plate.
2. Remove the clips securing Thermal fuse circuit to heat exchanger and site glass plate.
3. Ensure gasket/packing is intact upon reinstall.
4. Remove 2 screws holding burner in place in heat exchanger (rear of burner box)
5. Pull burner away from unit, use caution and protect your hands from sharp edges and ensure not to damage heat shield.

Gas Valve Assembly Removal

1. Ensure unit is isolated from power and gas supply.
2. If needed, remove manifold plate.
3. Remove 3 screws around gas inlet. Two of the screws are longer to accommodate the inlet fixture.
4. Disconnect both solenoid plugs from valve assembly. Note solenoid wire color assignments.
5. Upon reinstall, ensure O-ring is intact with ribbed side facing manifold; gas inlet is positioned correctly, and the proper manifold gas pressure is verified.
6. To properly adjust the manifold pressure, a manometer must be connected, and the unit set in a forced low fire setting.

Notes:
- The gas valve consists of the SVO (main) and POV (modulating) solenoid valves only, SV1, SV2, SV3, and SV4 are attached to manifold.
- The gas inlet and manifold ports no longer have a 3/16 Allen inset, but now has a special Phillips screw with O-ring in port; Hot Rod set screw: P/N C10D-5 & O-ring: P/N M10B-13-4
Heat Exchanger Removal
Common to indoor or outdoor units

1. Manifold and burner assembly has been removed previously.
2. Disconnect safety circuit, heat exchanger thermistor, anti-frost circuit, and spark module.
3. Separate the copper pipes from the inlet and outlet fixtures by removing machine screws and stainless steel clips. Models with a variable bypass will have two copper pipes at the inlet fixture.
4. Models with a fixed bypass will have a clip attaching copper tube to fixture.
5. Remove clear tube at bottom of gas valve. (Indoor models only)
6. Continue to outdoor or indoor unit’s specific instructions

Outdoor Heat Exchanger Removal

See previous slide/page for initial steps
1. Remove two screws at top of heat exchanger.
2. Remove the six screws securing the flue outlet to the heat exchanger.
3. Remove two screws on heat exchanger brackets attaching hex to rear of cabinet.
4. Heat exchanger should pull free from cabinet.
5. Transfer to new heat exchanger:
   • thermal fuse
   • overheat bimetal
   • heat exchanger thermistor
   • Incoming water thermistor
   • anti-frost circuit
   • Flue outlet

Indoor Heat Exchanger Removal

See page: “Heat Exchanger Removal: Common to indoor or outdoor units” for initial steps
1. Remove four screws on top brackets(on sides of) heat exchanger.
2. Remove four screws on bottom brackets on heat exchanger.
3. Heat exchanger and air inlet box should pull free from unit.

Note: The air box for interior units now in rear of heat exchanger instead of on left side as in previous model product.
Indoor Heat Exchanger Removal

1. Remove six screws on top left and right side attaching hex to air inlet box.
2. Remove two screws on lower brackets of hex attaching Hex to air inlet box.
3. Air inlet box should pull free from heat exchanger.
4. Remove four screws from fan bracket housing. Housing should pull free from heat exchanger.
5. Remove four screws from flue connection assembly and remove.
6. Transfer to new heat exchanger:
   1. thermal fuse circuit
   2. overheat bimetal
   3. heat exchanger thermistor
   4. incoming water thermistor
   5. Anti-frost circuit
   6. Flue connection assembly

VC Series Units

1. Leak detector on interior units only.
2. Outside Air Thermistor on exterior units only.
3. Inlet water Thermistor.
4. Clip for fixed bypass line to heat exchanger.

This concludes Rinnai's Tankless Water Heater Training Program
Product Knowledge / Installation Fundamentals
Level I/II

Advance the next slide to test your knowledge.