Rinnai Condensing Tankless Water Heater Training Program
Level II
Installation Fundamentals
Rinnai SE+ and Commercial Series Condensing Water Heaters.

RU/RUC/RUR - SE+ Series.
RUS/RUCS - SE Series.
Commercial Series

Enhancing Lives By Changing The Way Water Is Heated
Rinnai Service and Support (800-621-9419)

- **CRC – Consumer Response Center** – general calls, consumer questions, etc.
  Available from 8 a.m. to 8 p.m. EST, Monday – Friday.

- **Parts Department – parts orders.**
  Available from 8 a.m. to 8 p.m. EST, Monday – Friday.

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

- **Technical Support Department** – technical issues related to the function and repair of Rinnai products.
  Available in the 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. **Technicians only, call 1-888-RINNAIS (888-746-6247)**

- **Engineering / Applications Department** – calls related to product use and applications including sizing.
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Rinnai America also provides the following websites for support:

- [www.rinnai.us](http://www.rinnai.us) – for installation manuals, product specifications and supporting documents. More technical information is available in the “Partner Portal” section of the website. Registration is required for access.

- [www.trainingevents.rinnai.us](http://www.trainingevents.rinnai.us) – to register for Rinnai product training live and online classes and videos. Service manuals, installation manuals and other technical documents are available under the “Resources” section of the site.
The Evolution of Rinnai Tankless Water Heaters

- **History of Rinnai Condensing** tankless water heaters in North America.

<table>
<thead>
<tr>
<th>Factory Model Designation</th>
<th>Years produced</th>
<th>Generation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>“KA” Series</strong></td>
<td>2009-2010</td>
<td>1st Generation condensing models</td>
<td>RC80HPi/e and RC98HPi/e models introduced. Isolation valve kit included and model designation changed to indicate this. Example: RC98HPi became the RC98i.</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>“KB” Series</strong></td>
<td>2012 to present</td>
<td>2nd Generation condensing models</td>
<td>All models underwent a major re-design and the model number designation changed. Example RUR98i/e, RUC98i, RU98e.</td>
</tr>
<tr>
<td><strong>“KCM” Series</strong></td>
<td>2015 to present</td>
<td>3rd Generation condensing. Residential ONLY</td>
<td>Using Proven technology Rinnai introduced a lower cost / lower flow option in the condensing water heater category. (i.e. RUCS75i / RUS75e)</td>
</tr>
<tr>
<td><strong>C199 Commercial Series</strong></td>
<td>2015 to present</td>
<td>Commercial ONLY version of the 2nd generation KB Series</td>
<td>Variation of the KB Series condensing water heaters adapted for commercial use ONLY.</td>
</tr>
</tbody>
</table>

**NOTE:** The KB models are for both residential and commercial applications. The KCM models are for residential applications ONLY. The C199 models are for commercial applications ONLY.

*Enhancing Lives By Changing The Way Water Is Heated*
## Specifications: SE+, SE and Commercial series.

<table>
<thead>
<tr>
<th>Model Designation</th>
<th>Full Model Number</th>
<th>Min Btu’s</th>
<th>Max Btu’s</th>
<th>Min Activation Flow Rate (approx.)</th>
<th>Max Flow Rate 35° Rise</th>
<th>Max Flow Rate 50° Rise</th>
<th>Max Flow Rate 70° Rise</th>
<th>UEF Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUCS65i</td>
<td>REU-KCM2025FFU-US</td>
<td>10.3K</td>
<td>130K</td>
<td>0.4 GPM</td>
<td>6.5 GPM</td>
<td>4.8 GPM</td>
<td>3.4 GPM</td>
<td>.90</td>
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<tr>
<td>RUS65e</td>
<td>REU-KCM2025W-US</td>
<td>10.3K</td>
<td>160K</td>
<td>0.4 GPM</td>
<td>7.5 GPM</td>
<td>5.8 GPM</td>
<td>4.2 GPM</td>
<td>.90</td>
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<tr>
<td>RUCS75i</td>
<td>REU-KCM2528FFU-US</td>
<td>10.3K</td>
<td>160K</td>
<td>0.4 GPM</td>
<td>7.5 GPM</td>
<td>5.8 GPM</td>
<td>4.2 GPM</td>
<td>.90</td>
</tr>
<tr>
<td>RUCS75e</td>
<td>REU-KCM2528W-US</td>
<td>10.3K</td>
<td>160K</td>
<td>0.4 GPM</td>
<td>7.5 GPM</td>
<td>5.8 GPM</td>
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<tr>
<td>RUC80i</td>
<td>REU-KBD2530FFUD-US</td>
<td>15.2K</td>
<td>152K</td>
<td>0.4 GPM</td>
<td>8.0 GPM</td>
<td>6.0 GPM</td>
<td>4.2 GPM</td>
<td>.92</td>
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<tr>
<td>RU80e</td>
<td>REU-KB2530WD-US</td>
<td>15.2K</td>
<td>180K</td>
<td>0.4 GPM</td>
<td>9.0 GPM</td>
<td>6.9 GPM</td>
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<td>RUC90i</td>
<td>REU-KBD2934FFUD-US</td>
<td>15.2K</td>
<td>199K</td>
<td>0.4 GPM</td>
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<tr>
<td>RU90e</td>
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<td>RUC98i</td>
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<tr>
<td>RU98e</td>
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<td>199K</td>
<td>0.4 GPM</td>
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<td>7.6 GPM</td>
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<tr>
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<td>199K</td>
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<td>5.4 GPM</td>
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<tr>
<td>RUR98e</td>
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<td>199K</td>
<td>0.4 GPM</td>
<td>9.8 GPM</td>
<td>7.6 GPM</td>
<td>5.4 GPM</td>
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<tr>
<td>C199i</td>
<td>REU-KBD3237FFUDC-US</td>
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<td>199K</td>
<td>0.4 GPM</td>
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<td>5.4 GPM</td>
<td>96% Thermal Efficiency</td>
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<tr>
<td>C199e</td>
<td>REU-KBD3237WDC-US</td>
<td>15.2K</td>
<td>199K</td>
<td>0.4 GPM</td>
<td>9.8 GPM</td>
<td>7.6 GPM</td>
<td>5.4 GPM</td>
<td>96% Thermal Efficiency</td>
</tr>
</tbody>
</table>
PRODUCT FEATURES
Product Features:

- Rinnai Condensing Tankless water heaters have an activation flow rate as low as 0.4 gallons per minute and a minimum gas input rate as low as 10,300 Btu.*

- A temperature controller is included with most models allowing specific water temperatures to be set.
  - The RUS/RUCS models do not come with a temperature controller. Water temperatures are set by dip switches – a temperature controller can be added.

  ➢ Maximum output temperature is 120°F in the factory default configuration for residential applications. This limit can be increased to 140°F if desired or allowed.
  ➢ Maximum output temperature is 140°F in the factory default configuration for the C199 commercial model. This limit can be increased to 185°F if desired.
  ➢ Temperature range for residential applications is 98°F to 140°F.
  ➢ Temperature range for commercial applications is 98°F to 185°F.
    - To obtain temperatures over 140°F (for commercial applications) a commercial temperature controller (MCC-91-2) will need to be connected. Max temperature setting for RUS/RUCS and RUR models is 140°F.
    - The C199 commercial ONLY model does not require the commercial controller (MCC-91-2) to obtain temperatures over 140°F.
  ➢ Temperature settings can be displayed in Celsius (RUS/RUCS models would require adding a MC-91-2 controller).

- Isolation valve kit is included (except RUS/RUCS models).
- All models are gas type convertible.
- Mobile and Modular home approved.
- All parts are replaceable.

* MODEL DEPENDENT
Product Features / Safety Devices:

- Child / function lock (must have a temperature controller connected).
- Flame rod(s).
- Over heat bi-metal sensor(s).
- Integrated boiling protection.
- Heat exchanger thermal fuse.
- Built-in freeze protection: Protection to -22°F for indoor units and -4°F for outdoor units (must have gas and electricity for full freeze protection).
- Combustion fan senses blocked intake or exhaust flue.
- Direct electronic ignition (no standing pilot).
- Grounded (shorted) component detection.
- Scale build-up detection.
- PC Board is protected by a glass fuse (fuse size will vary by model).
- Main components are monitored by the circuit board and will post an error code if a failure is detected.

Enhancing Lives By Changing The Way Water Is Heated
Product Features: Circ-Logic

- **Circ-Logic programming** (found on SE+ and HE+ models) offers a hot water circulation option for applications that have a water circulation system with a dedicated circulation return line.
  - HE and SE series units do not have Circ-Logic programming.
  - The RUR condensing model with ThermaCirc360™ can be used in applications that do not have a dedicated return line. This is explained later in the presentation.

- With Circ-Logic, the water heater has the ability to power an external circulation pump* and control the ON/OFF cycles of the pump.**

Circ-Logic has two modes of operation (controlled by dip switch settings on the main circuit board):

- **Comfort Mode**: Cycles the pump On and OFF based on a specific cycle. ** This mode can be used when higher loop temperatures are desired or with circulation loops that have high heat loss.

- **Economy Mode**: Cycles the pump half as often as in the Comfort mode. This mode can be used where lower loop temperatures are acceptable or where the loop is well insulated and has minimal heat loss.

These modes allow the consumer to customize their circulation system to suit their particular application as well as their comfort and efficiency preferences.

*For pump size and loop length limitations see the water heater installation manual or the Circ-Logic installation manual.
**For pump cycle times see tables provided in the water heater installation manual or the Circ Logic installation manual.
There are three basic methods of utilizing Circ-Logic.

1. **Internal Circ-Logic programming only.** With this method Circ-Logic will be active on a 24 hour per day basis. The pump ON/OFF cycles will be determined by the Economy or Comfort settings on the main circuit board and the water heater’s set temperature.

2. **Internal Circ-Logic programming in conjunction with a pump that incorporates a timer (Rinnai GTK15 kit).** With this method the timer will allow the pump to operate only during the specified time periods and the Circ-Logic programming will cycle the pump on and off during those periods.

3. **Internal Circ-Logic programming in conjunction with the Rinnai MC-195T timer controller.** Timers are incorporated into the MC-195T controller. The timer settings allow the pump to operate only during the specified time periods and the Circ-Logic programming will cycle the pump on and off during those periods.
   - The MC-195T has two separate timer programs plus the timers can be temporarily overridden if desired (the MC-195T timer/controller is for use only with a pump that has no timer).

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**NOTE:** The recirculation mode cannot be used with an air handler or with multiple Rinnai water heaters linked electronically. The maximum temperature setting while in the recirculation mode is 140°F (60°C).
Product Features: Circ-Logic

• The Rinnai GTK15 pump w/timer kit is designed to work in conjunction with the Rinnai Circ-Logic programming.
  ➢ The timer incorporated into the GTK15 pump allows the consumer to select what times of day the circulation system will be active.

• The MC-195T timer/controller incorporate two different timer functions plus has additional features to further enhance circulation system operation. (an external pump without a timer should be used when installing a MC-195T)
Product Features: RUR with ThermaCirc360™

- The Rinnai RUR98i and RUR98e (SE+ Series) condensing water heaters have a built-in circulation pump designed to work with the Circ-Logic programming. This combination is ThermaCirc360™.

- ThermaCirc360™ allows RUR model water heaters to be installed in applications with or without a dedicated circulation return line.
  - Applications that do not have a dedicated return line will require the installation of a thermal bypass valve in the plumbing. This valve will be included with the RUR water heater.

- Both indoor and outdoor RUR models will include a MC-195T Timer/Controller.
  - The MC-195T is necessary for proper operation of the RUR series water heater. (without the MC-195T timer/controller connected, the water heater will operate but Circ-Logic will be disabled).

Enhancing Lives By Changing The Way Water Is Heated
TANKLESS WATER HEATER SIZING AND SEQUENCE OF OPERATION
Sizing: What is Delta T?

Delta T (ΔT) is the difference between the incoming water temperature and the water heater’s set temperature. The maximum flow rate will depend on the Delta T.

EXAMPLE: A home located in the St. Louis MO area....

The average ground water temperature : 57°

Rinnai Tankless Water Heater’s set temperature : 120°

The difference is the Delta T (ΔT): 120° - 57° = 63°
Sizing: Maximum flow rate.

The maximum flow rate for any given Delta T for a particular Rinnai water heater can be determined using the flow chart for that model. The maximum flow rate can be found where the Delta T intersects the flow curve.

➢ Example from the previous page: Set temperature = 120°, Water temperature = 57°, Delta T = 63°

Rinnai RUC98i flow curve illustrated here.

Maximum flow rates can vary as water temperatures fluctuate throughout the year.

- The installer will need to determine if these flow rates will be sufficient to meet the needs of the home or business. If not, a larger unit or multiple units may be required.

Enhancing Lives By Changing The Way Water Is Heated
Sizing: Maximum flow rate: Condensing models

Using the previous example of a 63°F ΔT, each model will produce:

- RUS/RUCS 65 – 3.8 gpm
- RUS/RUCS 75 – 4.6 gpm
- RU/RUC80 – 4.8 gpm
- RU/RUC90 – 5.6 gpm
- RU98 / C199 – 6.0 gpm

All models

Enhancing Lives By Changing The Way Water Is Heated
**Sequence of operation: Condensing models**

1. **Water flow begins:**
   - Water flow sensor sends pulses to the PCB.
   - When flow exceeds approximately *0.4 gpm the ignition sequence begins.

2. **Ignition Sequence:**
   - Combustion fan starts, drawing air in from the venting and through the unit.
   - Spark igniter begins sparking.
   - Gas control assembly opens to the low fire rate.
   - When the flame rod has proven flame the spark igniter stops sparking.

3. **Normal Operation:**
   - PCB monitors flame rods, TC Sensor, fan motor frequency, outlet water temperature, temperature set point, and water flow rate.
   - Gas valve assembly and fan speed modulate gas and air input to meet user demand.
   - If water flow demand is very small, only SV1 will allow gas to burner. The flame rod (FR) will monitor this minimum fire state.
   - If water flow demand is large, flame can develop across the entire burner.
   - Water is preheated in the secondary (latent) heat exchanger.
   - Water is heated further as it passes through the heat exchanger multiple times.
   - In certain circumstances the heat exchanger will overheat the water while the bypass tempers the water down to the set point temperature. This can provide for higher flow rates.
   - The water flow control valve will adjust as needed to maintain output temperature.
   - Due to the efficient combustion, condensation will form and drain into the condensate trap and through drain at the bottom of the unit.

4. **Shut-down Sequence:**
   - PCB senses flow rate less than 0.26 gpm.
   - Gas control valve closes & water flow control valve resets to a standby position.
   - Combustion fan will then run for a period of time to purge the combustion chamber.

5. **Standby Mode:**
   - PCB monitors all components.

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*Model Dependent*
TANKLESS WATER HEATER INSTALLATION
Installation: Key points.

- Rinnai SE+ model water heaters (RU, RUC and RUR) can be used in both residential and commercial applications.
  - The SE models (RUS, RUCS) are for residential applications only.
  - The C199 models are for commercial applications only.

- Rinnai tankless water heaters are manufactured in natural gas and propane versions.

- Indoor models must be installed within the confines of a structure and vented to the outside.

- Outdoor models must be installed outside where the exhaust can be vented directly from the front of the water heater.

- Residential installations are potable water applications in single family dwellings with a maximum water temperature setting of 140°F.

- Commercial installations are potable water applications for restaurants, schools, hotels, car washes, coin laundries, assisted living facilities, etc. with water temperatures up to 185°F.
  - For commercial applications requiring water temperatures over 140°F, an optional MCC-91 temperature controller allows a maximum water temperature setting up to 185°F.
  - The Commercial specific C199 models do not need the MCC-91-2 controller to achieve 185°F.

NOTE: The maximum operating temperature for the RUS/RUCS and RUR models is 140°F.
Installation: Key points.

- If the water heater is installed in an area where water leakage from the unit or the plumbing connections could result in water damage to the area surrounding the appliance or to floors or lower levels of the structure, it is recommended that a suitable drain pan be installed under the appliance. The drain pan must not restrict air flow.

- If the water heater is installed in a closed water supply system, such as one having a backflow preventer in the cold water supply line, means shall be provided to control thermal expansion.
  
  ➢ Water heaters utilizing a circulation system will require the installation of an expansion tank.

- DO NOT use Rinnai water heaters in applications such as a pool or spa heater that uses chemically treated water.
  
  ➢ The water heater is suitable for filling large tubs or whirlpool spa tubs with potable water.

- If the water heater is installed in an area that is known to have hard water or water that causes scale build-up, the water must be treated and may require more frequent service (flushing of the heat exchanger).
It is important to ensure the following incoming sources fall within specifications:

- **Electricity** –
  - A properly polarized and grounded 120 VAC, 60 Hz power supply is required (the temperature controller operates on 12 VDC. This voltage is supplied by the water heater main circuit board).

- **Water** –
  - Pipe sizing and incoming water pressure must meet each model’s requirements as stated in the installation manual and, water quality must meet the EPA’s National Secondary Drinking Standards.

- **Gas** –
  - Adequate gas pressure and volume (gas line sizing) must be verified for proper operation.

- **Venting (air)** –
  - Only the vent components that are certified and listed with the water heater can be used. The venting must be installed per specifications and proper clearances must be maintained.
  - All national, state, and local codes must be followed.
ELECTRICAL REQUIREMENTS

External units come with a hot and neutral wire and a ground connection point for direct connection to the electrical supply (i.e. circuit breaker box/local electrical disconnect). Ensure the supply is 120 VAC and is properly polarized and grounded.

Internal units come with a standard three-prong appliance cord. Ensure the receptacle is 120 VAC and is properly polarized and grounded.

Important:
Observe all applicable electrical codes. Circuit must be well grounded for proper operation.

Enhancing Lives By Changing The Way Water Is Heated
Installation: Water supply, Isolation valve kit.

- Rinnai recommends the use of an isolation valve kit when connecting the water lines to the water heater.

- All condensing models (except the RUS/RUCS Ultra series models) include an Isolation Valve kit in the shipping box.
  - This kit includes hot and cold water shut-off valves, hot and cold water drain valves, and an ANSI approved pressure relief valve.
  - This kit meets all individual states’ lead-free standards.

- Use of the kit allows flushing of the heat exchanger as well as aids in servicing and troubleshooting.

Enhancing Lives By Changing The Way Water Is Heated
Installation: Water supply.

• WATER PRESSURE
  • Minimum water pressure: 50 psi (or above is recommended for condensing models to achieve max flow).
  • Maximum water pressure 150 psi.
  • Rinnai recommends 60-80 psi for optimum performance for condensing models.
  • ANSI Code requires the addition of an approved pressure relief valve.
    ➢ Valve must be rated No-More than 150 psi and No-Less than the water heater’s maximum Btu input.

• INCOMING PIPING REQUIREMENTS
  • All performance data of Rinnai Water Heaters are based on systems plumbed with ¾” pipe (unless otherwise noted). Performance may vary with other pipe sizes.

• WATER QUALITY
  • Consideration of care for your water heater should include evaluation of water quality.
  • The water must be potable, free of corrosive chemicals, sand, dirt or other contaminants. It is up to the installer to ensure the water if free of elements that can affect or damage the heat exchanger. Water that contains chemicals exceeding the levels set forth in the install manual (see below) can effect and damage the heat exchanger. Replacement of the heat exchanger due to water quality is not covered under warranty.
  • The maximum levels (with the exception of total hardness and dissolved carbon dioxide) come from CFR, Title 40, Chapter 1 – EPA, Subchapter D, Part 143 - National Secondary Drinking Water Regulations.

<table>
<thead>
<tr>
<th></th>
<th>Total Hardness</th>
<th>Aluminum</th>
<th>Chlorides</th>
<th>Copper</th>
<th>Dissolved Carbon Dioxide (CO2)</th>
<th>Iron</th>
<th>Manganese</th>
<th>pH</th>
<th>TDS (Total Dissolved Solids)</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAXIMUM LEVELS</td>
<td>Up to 200 mg/L (11.7 gpg)</td>
<td>Up to 0.2 mg/L</td>
<td>Up to 250 mg/L</td>
<td>Up to 1.0 mg/L</td>
<td>Up to 15.0 mg/L or PPM</td>
<td>Up to 0.3 mg/L</td>
<td>Up to 0.05 mg/L</td>
<td>6.5 to 8.5</td>
<td>Up to 500 mg/L</td>
<td>Up to 5 mg/L</td>
</tr>
</tbody>
</table>

Enhancing Lives By Changing The Way Water Is Heated
Installation: Gas supply.

- An adequate gas supply is critical for proper operation of all Rinnai tankless water heaters.
- The supplied gas pressure must be within the limits shown on the rating plate or specification sheet for the selected water heater and the gas lines must be able to carry the volume of gas needed by the appliance.
- Tankless water heaters typically require a higher volume of gas than tank water heaters.
  - A 40 gallon gas-fired tank may have a maximum gas input rating of approximately 45,000 Btu.
  - A Rinnai tankless water heater can have a maximum gas input rating up to 199,000 Btu.
  - Replacing a 45,000 Btu tank water heater with a 199,000 Btu tankless water heater will increase the gas demand on the system by 154,000 Btu.
  - The gas line and the gas meter’s capacity, including the building’s total gas load, should be verified to ensure there is adequate capacity.

- An insufficient gas supply can result in:
  - Poor appliance operation and/or water heater shutdown due to fault codes.
  - Noisy operation due to an incorrect gas/air mixture.

- The gas supply should be tested with all appliances on that gas service operating at max capacity.

- If a symptom exists suggesting a gas supply issue may be a factor, a gas manometer will be needed to verify pressure.

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Installation: Gas supply.

- To verify or determine capacity, the NFPA 54 manual for gas line sizing should be consulted.
  - In NFPA 54, reference the chart that corresponds to your type of gas, type of pipe, inlet pressure requirements and specific gravity.
  - Determine the pipe length and the total gas load on that pipe.
  - From the chart determine the proper pipe sizing.
- In the example below we have a 199,000 Btu water heater with 50 feet of pipe from the gas source.
- Using the row marked for a 50 ft. pipe length, move across the row to find the sufficient Btu capacity.
- Based on a 199,000 Btu load, the min. pipe diameter is 1”

<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>
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<tbody>
<tr>
<td>Length (ft)</td>
<td>Capacity in Cubic Feet of Gas per Hour CFH=Btu/1000)</td>
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<td></td>
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<tr>
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<td>137</td>
<td>257</td>
<td>528</td>
<td>791</td>
</tr>
<tr>
<td>70</td>
<td>60</td>
<td>126</td>
<td>237</td>
<td>486</td>
<td>728</td>
</tr>
</tbody>
</table>

Schedule 40 Metallic Pipe, Natural Gas, less than 2 psi inlet pressure, 0.5” w.c. pressure drop, 0.60 specific gravity.

Any other appliance(s) on the same gas service will need to be figured into the gas line size calculation.

Enhancing Lives By Changing The Way Water Is Heated
Installation: Gas supply – two stage piping.

- If the gas supply is not adequate and resizing a gas supply line is not a feasible option, a two stage supply system may be used (depending on local code guidelines).

- In a two stage system, higher pressure gas (usually 2 lbs or approximately 56” w.c.) is supplied throughout the supply system.

- Increasing the system pressure can help overcome gas line sizing limitations (to a certain point).

- Regulators are then placed close to each appliance to reduce the supply pressure to within the appliance’s recommended range.

- Never exceed the manufacturers maximum supply pressure recommendations. All Rinnai tankless water heaters should be supplied with no more than ½” lb. inlet pressure (14” w.c.).

- Follow NFPA 54 guideline and all code requirements when sizing two stage systems.

- Two stage systems can be used in NG or LP applications—sizing values differ by gas type.

- Gas meter capacity must also be considered.

The below example has the following parameters:
- Gas: NG
- Inlet pressure: 2 PSI

Main gas meter supplies 2 lbs. of pressure through existing pipes

Regulators are installed in close vicinity to all appliances bringing pressure to appliance standard (1/4-1/2 lb)
### High Altitude Dip Switch Settings

- Proper gas volume and pressure must be supplied to the water heater at all times.
- All of Rinnai’s current non-condensing and condensing models do not require any manual gas valve adjustment to compensate for high altitude. Simply set DIP switches (SW1 bank-tan colored) on the PCB per the specific altitude to create the appropriate burn ratio for proper operation.
  - NOTE: The RUS/RUCS models are limited to 5400 feet altitude (use only dip switch #3 for those models).
  - Output is affected by altitude DIP switch adjustments.

<table>
<thead>
<tr>
<th>Altitude Range</th>
<th>Switch No. 2</th>
<th>Switch No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2000 ft (0-610 m)</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>2001-5200 ft (610-1585 m)</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>5201-7700 ft (1585-2347 m)</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>7701-10200 ft (2347-3109 m)</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

### Diagram

![DIP Switch Diagram](image.png)

**Enhancing Lives By Changing The Way Water Is Heated**
VENTING REQUIREMENTS

• Follow proper vent installation guidelines.

• Do not mix venting components between non-condensing and condensing models or between different manufacturers or vent system types as dangerous conditions could occur!

! WARNING

Improper installation of vent system components, or failure to follow installation instructions, could result in property damage or serious injury or death!
Rinnai condensing water heaters have several separate vent system options (model and application dependent).

The venting options include:

- Concentric Vent Systems.

- Two pipe PVC/CPVC or Polypropylene Vent Systems (utilizing 3” or 4” piping for both intake/exhaust).

- Common Vent system for multiple unit installation (for both intake/exhaust piping).

- Common Vent system for multiple unit installations (for the exhaust piping and utilizing room air for combustion ---- C199 commercial models ONLY).
Installation: Venting options.

• Rinnai tankless water heaters are certified and listed with the vent system.
  ➢ You must use ONLY the vent components that are certified and listed with the water heater.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Listed and Tested Vent Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ubbink * (available from Rinnai)</td>
<td>Rolux Condensing Vent System</td>
</tr>
<tr>
<td>Centrotherm</td>
<td>Innoflue Vent System</td>
</tr>
<tr>
<td>Heat-Fab *</td>
<td>Saf-T Vent SC System</td>
</tr>
<tr>
<td>Metal-fab *</td>
<td>Corr/Guard Vent/Air Intake System</td>
</tr>
<tr>
<td>Ipex</td>
<td>Concentric &amp; Low Profile Terminations</td>
</tr>
<tr>
<td>M&amp;G Dura Vent</td>
<td>Venting, Concentric &amp; Two Pipe Terminations</td>
</tr>
<tr>
<td>Royal</td>
<td>Concentric and Low Profile Terminations</td>
</tr>
<tr>
<td>Various Manufacturers</td>
<td>PVC / CPVC piping.</td>
</tr>
</tbody>
</table>

* Concentric venting
Installation: Concentric Venting.

- **Operation of a concentric vent system.**
  - Fresh air enters the appliance through the outer part of the pipe.
  - Exhaust gasses exit the appliance through the center part of the pipe.

This is a balanced flue system. The incoming air keeps the outer pipe cool which allows for the zero clearance.

NOTE: Rinnai condensing water heaters have a built-in condensate trap to collect any condensation draining into the unit from the vent system.
To utilize the Rinnai/Ubbink concentric vent system, the PVC exhaust adapter ring must be removed prior to connecting the vent pipe. (remainder of procedure listed on the next slide)

➢ The Intake Cap must remain in place.

Note: The same procedure is to be used for Centrotherm twin pipe venting with the Centrotherm adapter.

**NOTICE**
- Prior to the installation of the vent system, the unit must be properly adjusted for the venting configuration selected for the application.
- Any issues resulting from improper installation will not be covered by warranty.
- Ducted outside air is mandatory for all twin pipe configurations.

*Enhancing Lives By Changing The Way Water Is Heated*
Installation: Concentric Venting.

1. Remove fastener from concentric flue connection.

2. Remove exhaust adapter ring.

3. Install the concentric vent pipe. Ensure it is properly seated.

4. Secure the vent pipe to the unit with a screw.

Enhancing Lives By Changing The Way Water Is Heated
Installation: Concentric Venting.

- When using the Rinnai/Ubbink concentric venting, the maximum equivalent vent length is from **41 to 65 equivalent feet** (model and/or gas type dependent).
- When calculating the equivalent vent length, each 90° elbow is equal to 6 feet and each 45° is equal to 3 feet.
  
  $= 6$ Feet
  
  $= 3$ Feet

- If the vent length equivalency is greater than 21 feet, move DIP switch #1 on the PCB (in the upper group of switches) to the OFF position.
  (this switch is shipped in the ON position)

- Comply with all vent guidelines – refer to the vent manufacturer installation instructions.

**Vent Length Example**

Add the total length of all vent pipe and the equivalency of all bends:

- 3’ (termination)
- +3’ (bend)
- +2’ (extension)
- +3’ (bend)
- +2’ (extension)

13 foot equivalency

In this example, DIP switch #1 would remain in the ON position.

Enhancing Lives By Changing The Way Water Is Heated
Installation: Concentric Venting guidelines.

Slope the venting ¼” per foot toward the appliance according to the vent manufacturer’s installation instructions. Dispose of condensate per local code.

Slope any horizontal venting toward the water heater per the venting manufacturer’s installation instructions to ensure proper condensate flow through the venting.

- Rinnai / Ubbink PP-s venting for condensing water heaters require a ¼” per foot slope

- Since there is an integrated condensation trap inside the water heater, no condensation collector in the vent system is needed.

Enhancing Lives By Changing The Way Water Is Heated
Installation: Concentric Venting.

Ubbink Condensing water heater vent components available through Rinnai distributors.

<table>
<thead>
<tr>
<th>CONDENSING, (PP) POLYPROPYLENE VENT COMPONENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Discharge Termination Part No.: 184162PP</td>
</tr>
<tr>
<td>Roof Termination Extension Kit Part No.: 185344PP</td>
</tr>
<tr>
<td>12&quot; Termination Kit Part No.: 223176PP</td>
</tr>
<tr>
<td>45 Degree Elbow Part No.: 224077PP</td>
</tr>
<tr>
<td>90 Degree Elbow Part No.: 224078PP</td>
</tr>
<tr>
<td>21&quot; Horizontal Termination Diverter Kit Part No.: 223186PP</td>
</tr>
<tr>
<td>21&quot; Condensing Termination Kit Part No.: 223177PP</td>
</tr>
<tr>
<td>Vent Pipe Extension</td>
</tr>
<tr>
<td>Rubber Wall Plate Part No.: 710342(White) Part No.: 710602 (Black)</td>
</tr>
</tbody>
</table>

Enhancing Lives By Changing The Way Water Is Heated
Installation: Concentric Venting.

Ubbink Condensing water heater vent components available through Rinnai distributors.

Thimble
Part No.: 224045
*Fits 2x4 or 2x6 Wall Construction

Vent Support Bracket
Part No.: 224049

Condensing Raised Horizontal Termination Kit “Snorkel”
Part No.: 224047PP

Horizontal—Flashing Panel
Part No.: 102000012

Roof Flashing

<table>
<thead>
<tr>
<th>Roof Pitch</th>
<th>Part No. for Shingle Roofs</th>
<th>Part No. for Tile Roofs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/12 to 6/12</td>
<td>189950</td>
<td>50171949</td>
</tr>
<tr>
<td>6/12 to 12/12</td>
<td>189951</td>
<td>50171961</td>
</tr>
<tr>
<td>8/12 to 16/12</td>
<td>189952</td>
<td>50171954</td>
</tr>
</tbody>
</table>

Universal Bug Guard
Part No.: 224042

Pipe Clamp
Part No.: 169044

Roof Flashing—Flat
Part No.: 146141

Flashing for Metal Roof
Part No.: 242141

Kit Includes:
14.2” Vent Extension, Qty 3-90° Elbow, 19.5” Vent pipe extension, Special wall terminal, Cover.

Enhancing Lives By Changing The Way Water Is Heated
Installation: Rinnai/Ubbink concentric vent identification.

When selecting Rinnai/Ubbink polypropylene (PP-s) concentric venting for condensing models, ensure the proper vent material is used. DO NOT use the concentric venting designed for non-condensing models.

- The shipping box for the Rinnai/Ubbink polypropylene (PP-s) venting will have an asterisk on the part number label and the label description will read “Condensing”.
- Each Rinnai/Ubbink PP-s condensing vent component will have an orange/green warning label on the outer/intake pipe and an orange/black label on the inner/exhaust pipe (inside label may be difficult to see).

Labeling on shipping box.

<table>
<thead>
<tr>
<th>Product description</th>
<th>Asterisk for condensing venting</th>
</tr>
</thead>
</table>

Warning label on each individual vent piece.

- Outside pipe
- Inside pipe

Enhancing Lives By Changing The Way Water Is Heated
Installation: Two pipe PVC/CPVC venting (direct vent).

1. Remove fastener from intake connection.
2. Remove the intake cap.
3. Install the intake pipe. Ensure it is properly seated.
4. Secure the intake pipe to the unit with the supplied screw (in the box).
5. Install the exhaust pipe. Ensure it is properly seated.
6. Secure the exhaust pipe to the unit with the supplied screw (in the box).

Twin Pipe PVC / CPVC Configuration.

Intake Cap to be removed and discarded for the twin pipe venting configuration.

Enhancing Lives By Changing The Way Water Is Heated
**Installation:** Two pipe PVC/CPVC venting approved materials.

- If the Twin Pipe venting option is chosen, PVC/CPVC must meet the following standards.

<table>
<thead>
<tr>
<th>Item</th>
<th>Material</th>
<th>Standard for Installation in North America</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>United States</td>
</tr>
<tr>
<td>Exhaust vent or combustion air intake pipe and fittings</td>
<td>PVC Schedule 40</td>
<td>ANSI/ASTM D1785</td>
</tr>
<tr>
<td></td>
<td>PVC-DWV</td>
<td>ANSI/ASTM D2665</td>
</tr>
<tr>
<td></td>
<td>CPVC schedule 40</td>
<td>ANSI/ASTM F441</td>
</tr>
<tr>
<td>Combustion air intake pipe and fittings</td>
<td>ABS schedule 40</td>
<td>ANSI/ATSM D2661</td>
</tr>
<tr>
<td>PVC pipe cement &amp; primer</td>
<td>PVC</td>
<td>ANSI/ASTM D2564</td>
</tr>
<tr>
<td></td>
<td>CPVC</td>
<td>ANSI/ASTM F493</td>
</tr>
<tr>
<td>IPEX bird screens (purchased separately)</td>
<td>Polyethylene</td>
<td>3” Vent screen: IPEX part# 196051, 4” Vent Screen: IPEX part# 196052 (screens are friction fit inside termination fitting bells)</td>
</tr>
</tbody>
</table>

**Certified Vent and Air Piping Materials**

- Thermoplastic vent pipe must be certified to ULC S636. Intake Pipe may be of any material listed (left).

Refer to the vent manufacturer’s installation instructions for proper assembly of vent components.

- Ubbink concentric *non-condensing* venting is NOT approved for use with Rinnai condensing water heaters. (Ubbink *non-condensing* venting uses an aluminum inner exhaust pipe. The Ubbink *condensing* venting uses a polypropylene inner exhaust pipe.)*

- Ensure the differences between non-condensing and condensing vent installation guidelines are understood.

- DO NOT mix vent parts or the individual installation requirements between different vent manufacturers or types.
Installation: Two pipe PVC/CPVC maximum vent lengths.

NOTE: Vent lengths greater than 41 equivalent feet apply to condensing water heaters ONLY!

Maximum equivalent vent lengths may be specific to the water heater model, the type of vent material, the gas type of the water heater and the diameter of the vent pipe. When performing vent length calculations it is important to follow the guidelines for your particular model.

<table>
<thead>
<tr>
<th>Vent Type</th>
<th>Maximum equivalent length.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentric venting.</td>
<td>Equivalent lengths of 41 to 65 feet depending on model and gas type.</td>
</tr>
<tr>
<td>3” PVC/CPVC/Polypropylene*</td>
<td>Equivalent lengths of 41 to 65 feet depending on model and gas type.</td>
</tr>
<tr>
<td>4” PVC/CPVC/Polypropylene*</td>
<td>Equivalent lengths of 65 to 100 feet depending on model and gas type.</td>
</tr>
<tr>
<td>Two Pipe PP (Centrotherm)</td>
<td>Equivalent lengths up to 41 feet.</td>
</tr>
</tbody>
</table>

* NOTE: When calculating equivalent lengths for PVC/CPVC/Polypropylene two pipe venting, refer to your specific model’s Installation and Operation manual for the equivalent lengths for 90° or 45° elbows as this length can vary. The approved terminations also have length equivalencies based on the manufacturer and configuration. See the installation manual for specifics.

- For PVC/CPVC and Polypropylene venting keep the intake and exhaust pipe lengths as equal as possible.
- When installing a two-pipe PVC / CPVC / Polypropylene vent system, the vent material type and termination configuration may result in slightly different equivalent lengths for the intake and exhaust pipes.
  ➢ The total equivalent length is calculated from the longer of the intake or exhaust piping. The equivalent lengths of intake and exhaust are not added together.
Installation: Two pipe PVC/CPVC venting (direct vent).

Horizontal twin pipe vent termination examples - these vent configurations must use outside air for combustion.

This configuration requires the use of the IPEX or Royal concentric vent termination.

Refer to the water heater’s operation and installation manual for each termination’s equivalent length and specific clearances.
Installation: Two pipe PVC/CPVC venting (direct vent).

Vertical twin pipe vent termination examples – these vent configurations must use outside air for combustion.

3” or 4” PVC/CPVC with IPEX Concentric Vertical Termination.

3” or 4” PVC/CPVC Standard Upside down “U” Vertical Termination.

3” or 4” PVC/CPVC Tee Vertical Termination.

Refer to the water heater’s operation and installation manual for each termination’s equivalent length and specific clearances.
Installation: Two pipe PVC/CPVC venting (direct vent).

Horizontal twin pipe low profile vent termination example - this vent configuration must use outside air for combustion.

Refer to the water heater’s operation and installation manual for each termination’s equivalent length and specific clearances.

Enhancing Lives By Changing The Way Water Is Heated

3” IPEX or Royal or 4” IPEX PVC/CPVC Low Profile Horizontal Termination.
The PVC/CPVC connections are sized for 3” diameter pipe. The vent size can be increased to 4” with field supplied adapters. When installing 4” PVC/CPVC, the adapters should be placed as close to the water heater cabinet vent connections as possible.
### Vent Components and Assigned Equivalent Lengths:
The following fittings and accessories (by others) are certified for use with Rinnai condensing water heaters.

<table>
<thead>
<tr>
<th>OEM</th>
<th>OEM# or Cert.</th>
<th>Product Description</th>
<th>Diagram</th>
<th>Equivalent Lengths (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPEX (purchased separately)</td>
<td>196006 / 197009 (3 inch) 196021 / 197021 (4 inch) (System 636)</td>
<td>PVC / CPVC FGV Concentric Vent Kit w/vent screen</td>
<td><img src="image" alt="Diagram" /></td>
<td>20</td>
</tr>
<tr>
<td>Royal (purchased separately)</td>
<td>52CVKGVS6503</td>
<td>Concentric Vent Termination Kit</td>
<td><img src="image" alt="Diagram" /></td>
<td>5</td>
</tr>
<tr>
<td>IPEX (Purchased separately)</td>
<td>196985 (3 inch) 196986 (4 inch) (System 636)</td>
<td>Low Profile Termination Kit</td>
<td><img src="image" alt="Diagram" /></td>
<td>5</td>
</tr>
<tr>
<td>Royal (purchased separately)</td>
<td>52SWVKGVS6503</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Supplied PVC / CPVC Sch. 40 Fittings or Approved Equal</td>
<td>Comply with CAN/CGA B149.1 &amp; ULC-S636</td>
<td>3” and 4” Sch. 40 (solid core) PVC/CPVC TEE w/vent screen</td>
<td><img src="image" alt="Diagram" /></td>
<td>5</td>
</tr>
<tr>
<td>Field Supplied PVC / CPVC Sch. 40 Fittings or Approved Equal</td>
<td>Comply with CAN/CGA B149.1 &amp; ULC-S636</td>
<td>3” and 4” Sch. 40 (solid core) PVC/CPVC 90º EL w/vent screen</td>
<td><img src="image" alt="Diagram" /></td>
<td>5</td>
</tr>
</tbody>
</table>
## Installation: Venting (direct vent)

<table>
<thead>
<tr>
<th>OEM</th>
<th>OEM# or Cert.</th>
<th>Product Description</th>
<th>Diagram</th>
<th>Equivalent Lengths (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Supplied PVC / CPVC Sch. 40 Fittings or Approved Equal</td>
<td>Comply with CAN/CGA B149.1 &amp; ULC-S636</td>
<td>3” and 4” Sch. 40 (solid core) PVC/CPVC 45° EL w/vent screen</td>
<td><img src="image1.png" alt="Diagram" /></td>
<td>2.5</td>
</tr>
<tr>
<td>*IPEX (Purchased separately)</td>
<td>196051 (3 inch) 196052 (4 inch)</td>
<td>Friction fit vent screen (3” and 4”’)</td>
<td><img src="image2.png" alt="Diagram" /></td>
<td>0</td>
</tr>
<tr>
<td>Metal-Fab (Purchased separately) – For use ONLY with Metal-Fab Vent</td>
<td>3CGVRHK3 (2x4 wall) 3CGVRHK4 (2x6 wall)</td>
<td>5” outer diameter Concentric Vent kit with transition adapter, elbow and horizontal termination</td>
<td><img src="image3.png" alt="Diagram" /></td>
<td>22 (termination alone = 16)</td>
</tr>
<tr>
<td>Field Supplied PVC / CPVC Sch. 40 Fittings or Approved Equal</td>
<td>Comply with CAN/CGA B149.1 &amp; ULC-S636</td>
<td>3” and 4” Sch. 40 (solid core) PVC/CPVC Snorkel vent w/vent screen (2 x 90° or 2 x 90° + 1 x 45° EL)</td>
<td><img src="image4.png" alt="Diagram" /></td>
<td>15</td>
</tr>
</tbody>
</table>

*Vent screens are not ULC S636 Certified.
There are two common vent options for the commercial C199i models.

1. **Option 1**: Direct Common vent.
2. **Option 2**: Common Vent with room air for combustion (must terminate vertically).

**Option 1**
- Vertical exhaust termination and horizontal fresh air intake.

**Option 2**
- Vertical exhaust termination with room air for combustion (must terminate vertically).
Installation: Common vent for C199 models ONLY.

- **NOTE:** Utilizing room air for combustion is allowed **ONLY** for C199 common vent applications with vertical terminations. This vent configuration is **NOT** allowed for single unit installations.
Installation: Condensate drain.

Each Rinnai Condensing Tankless water heater has a condensate trap and drain outlet on the bottom of the unit. A drain line must be connected to each water heater.

- Condensate piping shall be CPVC or PVC material and shall not be smaller than the drain connection on the appliance.

- Components of the condensate drainage shall be CPVC or PVC material. All components shall be selected for the pressure and temperature rating of the installation.

- Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with an approved method as dictated by local codes.

- Condensate must be disposed of according to local codes.

- Condensate drain line must have an air gap installed in it to allow proper drainage. Provisions must be made to collect and drain off any condensate spillage due to blocked or clogged drain lines to prevent damage to the structure.

Enhancing Lives By Changing The Way Water Is Heated
Temperature Controllers
Temperature Controllers:

MC-91-2 / MCC-91-2*
*for commercial use

MC-195T

All current Rinnai models will accept up to four temperature controllers wired in parallel.

NOTE: Only one MC-195T per unit.

Enhancing Lives By Changing The Way Water Is Heated
Temperature Controllers: MC-91-2 / MCC-91-2

**TEMPERATURE INDICATION**
Indicates the selected water temperature. Fault codes and diagnostic functions will be displayed here.

**THERMOSTAT**
Increases or decreases the desired water temperature. Used in conjunction with other buttons for auxiliary functions.

**MODEL NUMBER**
The model number will indicate if the controller is a standard or commercial version.

**IN USE INDICATOR**
Indicates if the water heater is in operation.

**PRIORITY BUTTON & INDICATOR**
When multiple controllers are installed, the priority button is used to select which controller is setting the output temperature. The priority indicator reports which controller has control.

**ON/OFF BUTTON**
Turns the water heater ON and OFF. Power will still be applied to the unit when OFF and diagnostic functions are still operable. Also used in conjunction with other buttons for auxiliary functions.

---

*Enhancing Lives By Changing The Way Water Is Heated*
Temperature Controllers: MC-91-2 / MCC-91-2

- Current production condensing water heaters utilize the MC-91-2 and MCC-91-2 controllers (The MC-91-2 and MCC-91-2 replaced the MC-91-1 and MCC-91-1 controllers).
  - Any water heater originally equipped with a MC-91-1/MCC-91-1 controller is compatible with the MC-91-2/MCC-91-2 controller.
  - The MC-91-2 controllers have additional functions (compared to the MC-91-1 controller).

- An alternate table of temperature settings are available for commercial applications.
  - These alternate temperature settings are intended to provide additional temperature increments between 140°F and 185°F for commercial applications. These can only be accessed with the “-2” controllers.

- Temperature options without a controller.
  - The default temperature setting for units installed without a controller is 120°F. However the temperature setting can be adjusted to 140°F by setting dip switch #5 in DIPSW1 (upper set of switches) to the ON position (if a controller is connected, switch #5 has no effect on temperature).
## Temperature controllers: Temperature ranges.

<table>
<thead>
<tr>
<th>Standard Temperature Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fahrenheit F°</td>
</tr>
<tr>
<td>Celsius C°</td>
</tr>
</tbody>
</table>

* Default maximum temperature is 120°F. Temperature settings of 125°F to 140°F are available by setting switch #6 to the ON position on DIPSW1 (upper set of switches).

** Temperatures above 140°F will require the use of a MCC-91-2 controller on most models.

** NOTE: The C199 commercial model does not require the MCC-91-2 controller for temperatures above 140°F.

If multiple controllers are connected to one water heater, all controllers will display the same set temperature.

<table>
<thead>
<tr>
<th>Alternate Temperature Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fahrenheit F°</td>
</tr>
<tr>
<td>Celsius C°</td>
</tr>
</tbody>
</table>

*Alternate temperature settings:* Alternate settings are primarily for commercial applications.

To access these alternate settings, dip switches #2 and #3 should be in the ON position on DIPSW2 (lower set of switches).

**NOTE:** When alternate temperature settings are used, the minimum temperature setting will be 110°F.

**NOTE:** The maximum set temperature for the RUS/RUCS and RUR98 water heaters is 140°F. (Installing a MCC-91-2 controller will NOT allow settings above 140°F).

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C199i & C199e: (temperature options)

- The C199 models will come with the MC-91-2 temperature controller (built-in on the C199i indoor model).

  - Indoor models will have a default maximum temperature setting of 140°F (DIPSW1, switch #5 will be OFF and #6 will be ON).

  - Outdoor models will have a default maximum temperature setting of 120°F WITHOUT the controller connected (DIPSW1, switch #5 will be OFF and #6 will be ON).

  - The temperature can be increased to 140°F WITHOUT the controller by setting #5 to ON and #6 to OFF.
C199i & C199e: (temperature options)

- To increase the temperature setting above 140°F on the indoor model:
  - Both SW5 and SW6 in DIPSW1 must be set to the ON position.

- To increase the temperature setting above 140°F on the outdoor model:
  - The included MC-91-2 controller **MUST** be connected and both SW5 and SW6 in DIPSW1 must be in the ON position.
MC-91-2 Controller (Indoor Models):

• The factory installed MC-91-2 controllers on indoor models are specific to an indoor model and cannot be relocated or used on an outdoor model.

• These controllers are identical in function to the wall mounted MC-91-2 controllers but are connected to the main circuit board by a 15 conductor wire harness.

• Additional controllers, or the controller for an outdoor model, are connected to the circuit board by two wires. The extra wire needed for remote mounted controllers is to be field supplied.
MC-195T Timer/Controller:

- The MC-195T Timer / Temperature controller is for use only with the Rinnai Luxury and Ultra series tankless water heaters equipped with Circ-Logic™ programming (standard equipment with the RUR model water heaters).
- The MC-195T timer controls when the Circ-Logic™ function is ON or OFF.
- The Circ-Logic™ programming controls actual pump operation.

**MC-195T-US**

- Dual Timer Programs.
- Override Function.
- Function Lock.
- Power Saving feature.
- Clock.
- Combustion and Circulation indicators.

**NOTE:** In order for Circ-Logic to function on the RUR model, the MC-195T controller will need to be connected.
Maximum default temperature setting for residential models is 120°F (49°C).

- This limit meets the requirements of various local building codes.
- Enhances the safety of users.
- Temperature settings between 125°F and 140°F (52°C - 60°C) are available by setting DIP switch #6 to the ON position in the DIPSW1 bank of 8 DIP switches.

NOTE: The RUS/RUCS models do not come with a temperature controller - temperatures above 120°F are obtained by dip switch settings.

Commercial C199 models can achieve higher temperatures utilizing the standard MC-91-2 controller and dip switch settings.
Temperature controllers: Installation.

- Refer to operation / installation manual of each model for specific installation instructions.
- Separate or additional controllers are to be connected to the “terminals for controls” located on the PC Board.
- Controllers operate on 12 VDC which is supplied from the main PCB. Do not connect a controller to a 120 VAC power supply.
- Controllers should be located in the interior of a structure and protected from heat, direct sunlight and water.
- Two-core, non-polarized wire (min. 22 AWG) can be used to connect the controller to the water heater. The maximum wire length with 1 wired controller is 328 ft. (100 m). This distance will be reduced with additional controllers (see installation manual).

- Additional controllers must all be wired in parallel.
Temperature Controller (Adjustments and Diagnostics):

Auxiliary functions for the MC-91-2 series controllers.

- **To change from Fahrenheit to Celsius:** With the controller turned off, press and hold the ON/OFF button for approximately 5 seconds. The display will switch to the opposite temperature scale. Repeating the procedure will switch the display back to the original setting.

- **Locking the controller:** Press the Priority button and the UP arrow (in that order) at the same time for approximately 5 seconds. A beep will sound confirming the lock. The display will alternately show “LOC” and the temperature setting. Error codes will display if needed. All controllers in the system will also lock. To unlock, repeat the procedure.

- **Muting the controller:** Press the UP and Down arrows together for approximately 5 seconds. The controller will beep once the mute function has been activated. Repeat the procedure to reactivate the beep.
The MC-91-2 temperature controllers provide the following diagnostic capabilities:

- **To display the error code history:** Press and hold the ON/OFF button. After 2 seconds, simultaneously press the UP arrow then let go of both buttons. The error code history will be displayed with the most recent recorded error code being displayed first. To exit the error code history, repeat the procedure.

- **To enter the maintenance information mode:** Press and hold the Down arrow. After 2 seconds, simultaneously press the ON/OFF button then let go of both buttons. An “01” will be displayed briefly followed by the water flow rate (in GPM). To select the next information mode, press the up arrow. An “02” will be displayed followed by the water heater output temperature (in Fahrenheit). Continue to press the up or down arrow to scroll through the remaining information modes *. To exit the information mode, repeat the procedure.

* The remaining info modes are explained on the next page.
To enter the maintenance monitor display mode:
Press and hold the DOWN arrow. After two seconds press the ON/OFF button at the same time. Then let go of 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.

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

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.
WARRANTY & MAINTENANCE
Warranty & Maintenance: See manual for full details.

<table>
<thead>
<tr>
<th>Item</th>
<th>Residential Applications</th>
<th>Both residential water heating and space heating applications</th>
<th>Commercial Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other parts and components</td>
<td>5 years [1]</td>
<td>5 years [1]</td>
<td>5 years [1]</td>
</tr>
</tbody>
</table>

[1] Period of coverage is reduced to 3 years from date of purchase when used as a circulating water heater within a hot water circulation loop where the water heater is in series with a circulation system and where all circulating water flows through the water heater and where no controls such as a timer, aquastat (or combination) or on-demand system are utilized.

• **Note:** See the installation manual for your particular model for specific warranty details.

[2] The Rinnai Limited Warranty for a heat exchanger used in a circulation system which is controlled through an aquastat / thermostat or timer or an on-demand system is 12 years for residential applications and 5 years for commercial applications (6 years for the C199 models).

[3] Period of coverage is reduced to 5 years from date of purchase if the Rinnai water heater temperature setting exceeds 160°F (71°C).

[4] Labor coverage is extended to 5 years in residential applications and 2 years in commercial applications if the product is registered within 30 days (registration not required in California and Quebec) and/or if the other conditions above in the Residential and Commercial applications are satisfied.

➢ Value series and RUS/RUCS models installed in a commercial application will have no warranty. C199 models installed in a residential application will have no warranty.

➢ 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 doesn’t cover failure due to accident, abuse, misuse, alteration, misapplication, force majeure, improper installation, maintenance, or service, inadequate water quality, scale buildup, or freeze damage. See each product’s installation manual for more specific information.

➢ There is no warranty coverage on product installed in a closed loop application commonly associated with space heating only applications.

➢ This warranty does not cover any product used in an application that uses chemically treated water such as a pool or spa heater.

➢ This limited warranty does not apply to any product whose serial number or manufacture date has been defaced.

➢ The integrated controller on indoor models has a 1 year warranty on parts.
• Rinnai recommends that the inlet water filter be cleaned before the initial operation of a new unit and periodically thereafter.

• Before removing the inlet filter, ensure that the water supply has been turned off, and all pressure in the hot water system has been drained off by opening a hot water tap to ensure no water is flowing.

• The filter is located in the cold water supply connection fitting. See filter location example picture at right.

• The filter assembly should be hand tightened only.

Enhancing Lives By Changing The Way Water Is Heated
**Maintenance: General instructions**

- **The appliance must be inspected annually by a licensed professional. Repairs and maintenance shall be performed by a licensed professional. The licensed professional must verify proper operation after servicing.**

**Cleaning:**
- It is important that control compartments, burners and circulating air passageways of the appliance are kept clean.

  **Clean as follows:**
  1. Turn off and disconnect electrical power. Allow unit to cool.
  2. Close the water shutoff valves. Remove and clean the water inlet filter.
  3. Remove the front panel by removing trim strips and 4 screws.
  4. Use pressurized air to remove dust from the main compartment. Do not use a wet cloth or spray cleaners on the burner. Do not use volatile substances such as benzene and thinners. They may ignite or fade the paint.
  5. Use a soft dry cloth to wipe the cabinet.

**Vent System:**
- The vent system should be inspected at least annually for blockages or damage. If the vent is blocked contact a licensed professional.

**Motors:**
- Motors are permanently lubricated and do not require periodic lubrication. However you must keep the fan motor free of dust and dirt by cleaning annually.

**Temperature Controller:**
- Use a soft damp cloth to clean the temperature controller. Do not use solvents.

**Snow Accumulation:**
- Keep the area around the flue terminal free of snow and ice. The appliance will not function properly if the intake air or exhaust is blocked or partially blocked by obstructions.

**Coastal Installations:**
- Installations located near coastal areas may require additional maintenance due to corrosive airborne sea salt.
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 conditioning 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, Disconnect from MSA, MSB, or E-Z connect cables from unit (if applicable).
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. Reconnect power to unit and allow Water flow servo and Water flow by-pass time to reset to start position, approximately 10-15 seconds. Disconnect power again before flushing.
8. Open both service valves (V1 and V2) on the hot and cold water lines
9. Operate the pump and allow the cleaning solution to circulate through the water heater for at least 45 minutes
10. Turn off the pump
11. Rinse the cleaning solution from the water heater by:
   a. Remove the free end of the drain hose (H3) from the pail and place in a suitable drain
   c. Allow water to flow through the water heater for 5 minutes
   d. Close service valve, V1 and shutoff valve V4.
12. Disconnect all hoses
13. Remove the in-line filter at the cold water inlet and clean out any residue
   a. Place the filter back into the unit.
15. Reconnect MSA, MSB or E-Z Connect cable (if applicable). Restore electrical power to the water heater.
A fault code will flash on the temperature controller when a fault is detected. The unit may stop operating (code dependent). Not all codes are applicable to all models. See the owners manual or tech sheet for codes specific to your particular model water heater.

<table>
<thead>
<tr>
<th>ERROR</th>
<th>FAULT</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>No burner operation during freeze protection mode</td>
<td>- Service Call</td>
</tr>
<tr>
<td>03</td>
<td>Power interruption during Bath Fill</td>
<td>- Turn off all hot water tap. Disable bath fill, turn unit OFF then back ON.</td>
</tr>
<tr>
<td>05</td>
<td>Bypass Servo failure</td>
<td>- Replace bypass servo.</td>
</tr>
</tbody>
</table>
| 10    | Air supply or Exhaust Blockage                                       | - Ensure Rinnai approved venting materials are being used.  
- Check that nothing is blocking the flue inlet or exhaust.  
- Check all vent components for proper connections.  
- Ensure vent length is well within limits.  
- Check Burner Sensor / TC sensor or air temperature thermistor (indoor non-condensing models.  
- Verify DIP switches are set properly .  
- Check fan or burners for blockage .  |
| 11    | No Ignition                                                          | - Check that the gas is turned on at the water heater, gas meter, or cylinder.  
- If the system is Propane, ensure the tank has adequate quantity.  
- Ensure the appliance and circuit board is grounded properly.  
- Ensure gas type and gas pressure is correct.  
- Ensure gas line, gas meter and /or regulator is sized properly.  
- Bleed all air from the gas lines.  
- Verify dip switches are set correctly.  
- Ensure the igniter electrode is operational.  
- Check gas solenoid valves for open or short circuits.  
- Remove burner cover to ensure burners are properly seated.  
- Remove burner plate and inspect burner surface for condensation / debris.  |

(Continued on next page)
### Maintenance: Fault Codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Possible Causes and Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Flame Failure</td>
<td>- Check that the gas is turned on at the water heater, meter or cylinder.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for obstructions in the flue outlet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- If the system is propane, ensure the tank has adequate quantity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure the gas line, meter and / or regulator is sized properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure gas type and pressure is correct.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Bleed all air from the gas line.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure proper venting material was installed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure condensation collar was installed correctly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure vent length is within limits.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Verify dip switches are set properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check power supply for loose connections, proper voltage and voltage drops.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check flame rod for carbon buildup.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for DC shorts at components (VB / KA models and prior).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check gas solenoid valves for open or short circuits.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Remove burner plate, inspect burner surface for condensation / debris.</td>
</tr>
<tr>
<td>14</td>
<td>Thermal Fuse</td>
<td>- Check for restrictions in air flow around unit and vent terminal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check gas type of unit and ensure it matches gas type being used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for low water flow in a circulating system causing short-cycling.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure dip switches are set properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for foreign materials in combustion chamber and exhaust piping.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check heat exchanger for cracks or separations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check heat exchanger surface for hot spots which indicates heat stress to the HEX.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Measure resistance of safety circuit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure high fire and low fire manifold pressure is correct.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for improper gas type conversion of product.</td>
</tr>
<tr>
<td>16</td>
<td>Over Temperature Warning</td>
<td>- Check for restrictions in air flow around the vent terminal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for low water flow in a circulating system causing short cycling.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for foreign materials in the combustion chamber and exhaust piping.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for blockage in the heat exchanger.</td>
</tr>
<tr>
<td>19</td>
<td>Electrical grounding</td>
<td>- Check components for an electrical short (VC / KB models and newer).</td>
</tr>
<tr>
<td>25</td>
<td>Condensation Trap Error (Condensing models only)</td>
<td>- Ensure the condensate trap is draining properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure drain lines connected to the trap are not blocked, ensure external condensate pump is operating (if equipped), ensure a secondary trap is not installed outside the unit.</td>
</tr>
</tbody>
</table>
### Maintenance: Fault Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Recommended Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Burner Sensor</td>
<td>- Check sensor wiring for damage or disconnection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Measure resistance of sensor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Clean sensor of scale build-up.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Replace Sensor.</td>
</tr>
<tr>
<td>32</td>
<td>Outgoing Water Thermistor Faulty</td>
<td>Code 38 applies to the RUS/RUCS models only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Code 41 will allow the water heater to continue operating. Freezeprotection heaters will go into a default heating mode.</td>
</tr>
<tr>
<td>33</td>
<td>Heat Exchanger Outgoing Thermistor Faulty</td>
<td>Code 51 will allow the water heater to continue operating but Circ-Logic will be disabled.</td>
</tr>
<tr>
<td>34</td>
<td>Combustion Air Thermistor Faulty</td>
<td>- Check modulating gas solenoid wire harness for loose or damaged terminals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Measure resistance of valve coil.</td>
</tr>
<tr>
<td>38</td>
<td>Exhaust Gas Temperature Sensor Faulty</td>
<td>- Check for scale buildup and/or excessive heat to primary / secondary heat exchangers.</td>
</tr>
<tr>
<td>41</td>
<td>Outside Temperature Sensor Faulty</td>
<td>- Check burner area of heat exchanger for excessive heat or heat damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check continuity through both Overheat switches #2 and associated wiring.</td>
</tr>
<tr>
<td>51</td>
<td>Inlet Water Temperature Sensor Faulty</td>
<td>- Check for scale buildup or heat damage to the secondary heat exchanger.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check for continuity through the Overheat Switch #3 and associated wiring.</td>
</tr>
<tr>
<td>52</td>
<td>Modulating Solenoid Valve Signal Abnormal</td>
<td>- Check modulating gas solenoid wire harness for loose or damaged terminals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Measure resistance of valve coil.</td>
</tr>
<tr>
<td>54</td>
<td>High Exhaust Gas Temperature (RUS/RUCS Models Only)</td>
<td>- Check burner area of heat exchanger for excessive heat or heat damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check continuity through both Overheat switches #2 and associated wiring.</td>
</tr>
<tr>
<td>57</td>
<td>Burner overheat</td>
<td>- Ensure fan will turn freely.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check wiring harness to motor for damaged and/or loose connections.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Measure resistance of motor windings.</td>
</tr>
<tr>
<td>58</td>
<td>Secondary Heat Exchanger overheat</td>
<td>- Ensure isolation valves are open and inlet filter screen is not obstructed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure unit is set up properly for the application (dedicated or crossover mode).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure dedicated return line is not blocked or has a closed valve.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure Air is purged from piping and return line.</td>
</tr>
<tr>
<td>61</td>
<td>Combustion Fan</td>
<td>- The water flow control valve has failed to close during the bath fill mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Damage to the water flow control valve or wiring / no feedback signal from valve to main circuit board.</td>
</tr>
<tr>
<td>63</td>
<td>Circulation Pump</td>
<td>- Ensure isolation valves are open and inlet filter screen is not obstructed.</td>
</tr>
<tr>
<td>65</td>
<td>Water Flow Servo</td>
<td>- Ensure unit is set up properly for the application (dedicated or crossover mode).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure dedicated return line is not blocked or has a closed valve.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ensure Air is purged from piping and return line.</td>
</tr>
</tbody>
</table>

*Enhancing Lives By Changing The Way Water Is Heated*

(Continued on next page)
### Maintenance: Fault Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Component</th>
<th>Action(s)</th>
</tr>
</thead>
</table>
| 70   | PC Board  | - Check the PC Board DIP switches for correct position.  
     |           | - Check the wiring harness connections at the PC Board  
     |           | - Replace the PC Board. |
| 71   | Solenoid Valve circuit | - Replace the PC Board. |
| 72   | Flame sensing device circuit | - Replace the PC Board. |
| 73   | Burner Sensor Circuit | - Replace the PC Board. |
| 79   | Water leak detected | - Turn off water supply  
     |           | - Determine and correct source of the water leak. |
| LC (00)** | Scale Build-up in Heat Exchanger (“00” is substituted for “LC” in diagnostic code history) | - LC1 ~ LC9 indicates there is possible scale buildup in the heat exchange. Refer to instructions in manual.  
     |           | - Replace heat exchanger in extreme cases of scale buildup or internal clogging.  
     |           | - To operate the water heater temporarily, push the ON/OFF button on the temperature controller 5 times. **Repeated LC codes will eventually lock out the water heater. |
| FF   | Maintenance Performed | - Indicates a service provider performed maintenance or repair and flagged this action.  
     |           | - Enter this code in the history by pressing and holding the UP, then Down and then ON/OFF buttons. The buttons must be pushed in that order. |
| NO Code | Unit does not operate or post an error code when water flow is initiated. | - Check/clean inlet water supply filter  
     |           | - Ensure the minimum activation water flow rate is met.  
     |           | - Ensure hot and cold water lines are not reversed / cross connected.  
     |           | - Ensure there is not a crossover / cross connection somewhere in the building plumbing or a plumbing fixture.  
     |           | - Check to ensure the water flow turbine is not clogged / damaged.  
     |           | - Measure voltage to and from the water flow sensor  
     |           | - Measure the water flow sensor resistances. |

** After an LC code is temporary cleared the unit will operate for 70 hours before shutting down again with the next LC code (LC-0 through LC-9). After service is performed (flushing) the LC code sequence will need to be reset to. This is accomplished by pressing the “A” and “B” test switches at the same time for approximately 5 seconds. The unit will return to normal operation and the LC# count will return to “0”.

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Freeze Protection
Freeze Protection Operation

The freeze protection system on the RU/RUC and C199 model water heaters consists of electrically powered ceramic heater elements installed on several pipes and fittings inside the water heater cabinet.

➢ Heater activation is triggered by the outside air temperature thermistor (thermistor #1) and/or the intake air temperature thermistor (thermistor #2).
  ❖ Thermistor #1 (indoor and outdoor models) measures the air temperature outside of the water heater cabinet.
  ❖ Thermistor #2 (indoor models only) measures the air temperature coming into the cabinet through the vent system.

➢ Heaters are turned on when thermistor #1 or #2 detects air temperatures below 39°F.
  ❖ The main circuit board will cycle the heaters On and Off on a specific cycle based on the air temperature.

NOTE: Adequate incoming power is required for the freeze protection system to operate correctly!
Freeze Protection Operation

The freeze protection system on the RUS/RUCS model water heaters consists of electrically powered ceramic heater elements installed on several pipes and fittings inside the water heater.

➢ Heater activation is triggered by the outside air temperature thermistor (on outdoor models) and by the internal air temperature thermistor OR exhaust gas temperature sensor (on indoor models).

❖ The thermistor on outdoor models measures the air temperature outside of the water heater cabinet.

❖ The thermistor on indoor models measures the air temperature inside the cabinet. The Exhaust gas temperature sensor is primarily an overheat safety but can trigger freeze protection when the water heater is not in operation.

➢ Heaters are turned on when thermistors/sensor detects air temperatures below 39°F to 35°F (model dependent).

❖ The main circuit board will cycle the heaters On and Off on a specific cycle based on the temperature reading.

NOTE: Adequate incoming power is required for the freeze protection system to operate correctly!
Multiple Unit Installations
Why is multi-unit control technology needed?

In the example shown here, if multiple units are NOT installed with a multi-unit control system (MSB), it could take in excess of 2.0 GPM total water flow to fire a single unit (5 units X 0.4 GPM [activation flow rate for each unit] = 2.0 GPM).

Additionally, with a total water flow of only 1.5 GPM through the system, this flow would be divided evenly among all five water heaters (assuming the plumbing is equal for each unit). The flow through each unit would be only 0.3 GPM (1.5 GPM ÷ 5 units = 0.3 GPM per unit). This is below the minimum activation flow rate for a single water heater. Under this circumstance none of the water heaters would fire.

The solution is to use Rinnai’s MSB Technology (or EZ-Connect if connecting only two water heaters).

This technology allows multiple water heaters to communicate with each other and operate as one. Only the number of water heaters necessary to satisfy the water flow demand would be operated.
The main component of Rinnai’s MSB technology is the MSB circuit board. This board can be used to link up to 5 water heaters. The board is mounted inside one water heater and is connected to other units by a wire harness. The basic MSB-M kit contains all parts needed to link two water heaters. Additional wire harnesses will be needed for additional water heaters.

Accessories: MSB control board.

Cable linking the MSB to the primary water heater.

Cables linking the MSB to other water heaters.
Each MSB board can link up to 5 water heaters.

UP to 5 MSB boards can be linked together for a total of 25 water heaters operating as one system.

Dip switches on the MSB board will allow the installer to select how many units (attached to each MSB board) are in a standby mode with their water control valves open (and ready to fire) thus allowing quicker response to a water flow demand.

Depending on which model water heater is used, a MSB system could have an operating range of 10,000 Btu to as great as 4.9 million Btu. Or, in terms of flow rate: 0.4 GPM to 245 GPM!
Accessories: EZ-Connect cable.

When connecting only two water heaters, a MSB board is not necessary. An EZConnect cable can be used. It connects to a special harness on the primary water heater and to the PCB on the secondary unit (see pictures). Three or more water heaters will require the use of an MSB system.

For KB series water heaters: Dip Switch #7 in the SW1 bank (top 8 switches) can be used to configure one or both water heaters to be in the ready mode and ready to operate (when water flow is detected).

<table>
<thead>
<tr>
<th>Dip Sw 7 ON</th>
<th>1 unit ready (allows for faster activation and delivery of hot water at low flow rates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dip Sw 7 OFF (default setting)</td>
<td>Both units ready (allows for quicker delivery of hot water at higher flow rates that require both units to operate)</td>
</tr>
</tbody>
</table>

NOTE: This Dip Switch will not affect systems operating with an MSA / MSB board.
• The EZ-Connect and MSB technology will rotate operation between units within a group and between groups in order to equally distribute operating hours among all units in the system.

• In a MSB or EZ-Connect configuration, the temperature controller connected to the primary or #1 water heater will control the temperature output on ALL units in the system.
  - Temperature controllers connected to other units in the system will display the set temperature but cannot be used to change temperature settings.
  - Temperature controllers connected to other units in the system will display fault codes specific to that particular unit only and can be used for diagnostic purposes for that unit.
  - Units that do not have a temperature controller will operate at the set temperature of the primary unit but fault codes will not be displayed and no diagnostic functions can be performed.
  - If multiple groups of water heaters (Multiple linked MSB systems) are installed, the temperature controller on the #1 unit in the primary MSB system will control the set temperature of all units in any secondary MSB system(s).
  - If temperatures above 140⁰ are required a MCC-91 temperature controller will need to be connected to the #1 unit in the Primary MSB system (if multiple systems are used). Temperatures above 140⁰ will be available from all units in the system.

• Only VA, VB, VC, KA and KB series water heaters are compatible with the EZ-Connect and MSB technology. The RUR98 units are not compatible.
  - V series water heaters were originally designed to use the MSA multi unit system but can be adapted to work with the MSB system through the use of an adapter cable.
  - The V models are not compatible with an EZ-Connect cable.
  - Some smaller water heater models (V53e, RV53e, R63e) are not compatible with MSB, MSA or EZ-Connect technology. If necessary they can be linked mechanically through the use of a PVA valve. Contact Rinnai for more information (Note, It is not common for these smaller units to be linked together).
• When multiple water heaters are operating, the system will attempt to supply equal water flow through each unit.

• The default setting for a MSB board is for the first three units in each group to be in a “ready” condition and ready to operate when water flow is initiated. Any remaining units connected to that MSB board will be held in a “Off” condition with their water flow servo valves closed. These units will be operated as needed when water flow demand increases.
  ➢ If desired, dip switches on the MSB board can be set so that only one or two units in each group are in a “ready” condition.

• If a MSB board is configured with more than one “ready” unit when water flow is initiated AND the total flow rate is too low to activate all “ready” units, the MSB board will place some “ready” units in the “Off” condition (by closing their water flow servo valve) directing all water flow through the remaining units until there is sufficient water flow to fire the other unit(s).

• When the flow through the operational unit(s) in a MSB group reaches approximately 90% of its capacity (determined by Delta T) the MSB board will bring on additional unit(s) to assist with the water flow demands.

• When water flow is decreased through a system, each water heater will continue to operate until the flow rate through an individual unit drops below 0.7 GPM. That unit will then be placed in an “Off” condition and water flow distributed to the remaining units.
Accessories: MSB multi-system operation.

- The EZ-Connect and MSB technology will take a unit out of operation if a fault code is detected (by closing the water flow servo valve of the unit with the fault).
- There are several LED lights on the MSB board that will give basic status information about the water heaters connected to the board.

<table>
<thead>
<tr>
<th>LED Status</th>
<th>Water Heater Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED On Solid</td>
<td>Water heater is operating OR the unit is in a “Ready” condition and will operate when water flow is initiated. (water flow servo valve is open)</td>
</tr>
<tr>
<td>LED Flashing Slow (1.2 sec. On / 0.5 sec. Off)</td>
<td>Unit is in the “OFF” condition and will not operate until the water flow demand is increased. (water flow servo valve is closed)</td>
</tr>
<tr>
<td>LED Flashing Fast (0.5 sec. On / 0.5 sec. Off)</td>
<td>A fault code has been detected at this unit. (To reset fault code power to the MSA/MSB or the particular unit will need to be cycled Off then back On)</td>
</tr>
<tr>
<td>LED Off</td>
<td>No unit detected / connected at this connection.</td>
</tr>
</tbody>
</table>

Connection points for multiple MSB boards. This LED will be illuminated solid if connections are correct.

The primary water heater for this MSB board will be connected here.

Dip switches for configuring number of units “Ready” and also the number of MSB boards in use.

Water heater status LED’s
**Accessories:** MSB component compatibility.

Refer to the table below to ensure the correct components are selected for each system configuration.

| NO. OF UNITS | 2* | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|--------------|----|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| **Parts Needed** | MSB components are compatible with all VA, VB, VC, KA and KB models. For V series, see note**
| EZConnect ® cable | 1 | | | | | | | | | | | | | | | | | | | | | | |
| MSB-M | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | | | | |
| MSB-C1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| MSB-C2 | 1 | 2 | 3 | 4 |
| MSB-C3 | **V-series products will accept the MSB technology. However, substitute the MSB-C3 cable for any MSB-C1 cable and Connector A cable.**

**NOTE:** V-series products will not accept EZ-Connect (except R98/C98 V-Series)

*EZConnect is the preferred method of linking only two units; however, an MSB system is capable of operating two units.*

**NOTE:** V-series products will accept MSB parts.

This is an overview only. Please refer to the MSB/EZConnect installation instructions for more detail on cable connections and dip switch configurations.
NOTE:
• If 6 or more water heaters are used in an MSB system, at least three water heaters should be used in each sub system (3-water heaters per MSB-M).
• Normally, although not required, you would have the highest quantity sub-system assigned as the first (or primary) MSB and closest to the cold water supply.
• EZConnect® and MSB systems cannot be used together.
• Refer to the table below for recommended grouping of units:

<table>
<thead>
<tr>
<th>NO. OF UNITS</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended</td>
<td>3,3</td>
<td>4,3</td>
<td>4,4</td>
<td>5,4</td>
<td>5,5</td>
<td>4,4,3</td>
<td>4,4,4</td>
<td>5,4,4</td>
<td>5,5,4</td>
<td>5,5,5</td>
</tr>
<tr>
<td>banking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NO. OF UNITS</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended</td>
<td>4,4,4</td>
<td>5,4,4</td>
<td>5,5,4</td>
<td>5,5,5</td>
<td>5,5,5</td>
<td>5,4,4</td>
<td>5,5,4</td>
<td>5,5,5</td>
<td>5,5,5</td>
<td>5,5,5</td>
</tr>
<tr>
<td>banking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• For proper operation it is not recommended that different models be connected together. Combining different models can result in lower performance due to the different output ratings of each model.
Accessories: MSB multi-system components.

1. MSB-M Kit
   1a. MSB-M Board
   1b. Connector A (18 inches)
   1c. Connector B
       (MSB-C1 cable—9.8 ft.)
   1d. HP mounting bracket
       (this bracket must be used to connect the MSB-M board to the HP condensing unit’s cabinet (see instructions)
   1e. Misc. hardware

2. MSB-C1 Kit
   2a. MSB-C1 cable
   2b. Wire ties

3. MSB-C2
   3a. MSB-C2 cable (26.2 ft.)
   3b. 2 each terminal connectors

4. MSB-C3 cable—9.8 ft.
   (for V series product only—note additional single red cable)

NOTE: It is recommended to space the water heaters 2 inches apart. If additional spacing is used, these cables may not be long enough to reach the farthest units. Contact Rinnai Engineering if needed.
The next section of the presentation concentrates on Rinnai RUR98i/e model specific information and will not necessarily cover features and functions common to other Rinnai Condensing Tankless Water Heaters.
Simply put, the RUR98i/e is a Rinnai Ultra Series Condensing Tankless water heater that incorporates a circulation pump into the water heater cabinet.

This pump, in conjunction with Rinnai Circ-Logic programming on the main PC Board allows consumers to introduce hot water circulation into their plumbing system.

Two RUR models are available.

- RUR98i, indoor model (shown here).
- RUR98e, outdoor model.

Both RUR models are available in Natural Gas or Propane versions.
• Some homes have a dedicated circulation return line but the majority do not.
  ➢ The Rinnai RUR Ultra Series water heaters are designed and equipped to provide hot water circulation in homes WITH or WITHOUT a dedicated circulation return line.
• From the factory, the water heater is configured for plumbing systems that have a dedicated circulation return line (dip switches will need to be set).
• Plumbing systems that do not have a dedicated return line will require the installation of a thermal bypass valve (which will be included with the water heater).

The purpose and operation of this valve will be explained in more detail later in the presentation.
Both indoor and outdoor RUR models will include a MC-195T timer / controller.

- The MC-195T timer / controller allows the user to set the time(s) and duration of circulation system operation.
- The Circ-Logic programming will control pump operation during active circulation periods.
- The MC-195T controller is necessary for proper operation of RUR water heaters. (If the MC-195T is not connected, the unit will provide hot water but the circulation system will not operate.)

**NOTE:** Indoor RUR98i models do not have a temperature controller installed into the water heater front cover. The included MC-195T Timer/Controller will need to be installed separately and wired to the water heater (for both indoor and outdoor models).
Condensing Models: RUR model circulation modes.

• There are two circulation modes for the RUR models.

  1. Dedicated Mode:
     ➢ The Dedicated Mode requires a dedicated circulation return line in the plumbing system. The water heater will be shipped configured for the Dedicated Mode.

  2. Cross Over Mode:
     ➢ The Cross Over Mode is optional for applications that do not have a dedicated circulation return line. Utilizing the water heater in this mode requires installation of a thermal bypass valve and a simple reconfiguration of the water heater.
       • The thermal bypass valve will be included with the water heater. The procedure to reconfigure the water heater for the Cross Over Mode will be explained in a later slide.

  Note: In either mode there are dip switch settings that must be set in order for the circulation system to operate correctly.
A dedicated circulation return line usually is installed during the initial construction of a building but in some cases, depending on the building design and construction method, it might be possible to add one at a later date.

- The return line normally will be routed from the fixtures located the farthest plumbing length from the water heater back to the cold water supply line.
- The maximum circulation pipe length (total length of the hot water supply line plus the dedicated return line) is 400 ft for ¾” pipe and 100 ft for ½” pipe.

When the pump is operating, hot water will be pumped through the hot water supply lines and back to the water heater through the return line creating a circulation loop.

After the water in the circulation loop is heated, hot water will be available to the fixtures with minimal delay. This saves time and reduces water waste.

CONDENSING MODELS: RUR model dedicated mode.
Condensing Models: RUR model dedicated mode.

• In the Dedicated Mode, pump operation intervals are based on dip switch settings, the selected operating temperature and the return water temperature.
  ➢ Circulation can be selected to operate in the Comfort Mode or the Economy Mode.
  ➢ Once operating, the internal pump turns off based on the water temperature being returned to the water heater (as detected by the water inlet thermistor).
    ❖ When the return water temperature reaches approximately 12.6°F (7°C) below the set temperature, the pump will turn off.
  ➢ The dip switch settings and water set temperature determine how long the pump will stay off.
    ❖ Pump off intervals can vary from 18 to 62 minutes in the Economy mode or from 9 to 31 minutes in the Comfort mode.
  ➢ When the pump stops, the internal timer will begin and the pump will not restart until the end of the time interval (unless the set temperature is raised or power to the water heater is disconnected and reapplied).
  ➢ The included MC-195T Timer/Controller is then used to program the time(s) of day the circulation system will be active.

Enhancing Lives By Changing The Way Water Is Heated
Condensing Models: RUR model dedicated mode.

- Dip switches #4, #7 and #8 in the second, or lower, group of switches (DIPSW 2) will be utilized to configure the water heater to the desired mode.

<table>
<thead>
<tr>
<th>Setting options for the Dedicated Mode:</th>
<th>Temperature Setting °F</th>
<th>Typical Pump OFF Time intervals (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Economy</td>
<td>Comfort</td>
</tr>
<tr>
<td>140</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>135</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>130</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>125</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>120</td>
<td>28</td>
<td>14</td>
</tr>
<tr>
<td>115</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td>110</td>
<td>38</td>
<td>19</td>
</tr>
<tr>
<td>108</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>106</td>
<td>44</td>
<td>22</td>
</tr>
<tr>
<td>104</td>
<td>48</td>
<td>24</td>
</tr>
<tr>
<td>102</td>
<td>52</td>
<td>26</td>
</tr>
<tr>
<td>100</td>
<td>56</td>
<td>28</td>
</tr>
<tr>
<td>98</td>
<td>62</td>
<td>31</td>
</tr>
</tbody>
</table>

* If switches 4, 7 and 8 are off, circulation will not operate regardless of the MC195T controller settings.
Condensing Models: RUR model crossover mode.

- If a structure does not have a dedicated return line, circulation can be accomplished through the use of a thermal bypass valve.
  - The thermal bypass valve will be installed between the hot and cold lines of the fixture that is furthest from the water heater (in terms of plumbing length). The cold water line is then used as the return portion of the circulation loop.
  - The maximum circulation pipe length (total length of the hot water supply line plus the section of the cold water supply line being used as the return portion of the loop) is 400ft for ¾” pipe and 100ft for ½” pipe.

When the pump is operating, hot water will be pumped through the hot water supply line, through the bypass valve and into the cold water lines. Once hot water reaches the bypass valve it will close stopping hot water flow (the valve closes at 98°F, +/- 5°F).

After the water in the circulation loop is heated, hot water will be available to the fixtures with minimal delay. This saves time and reduces water waste.

NOTE: Some plumbing fittings omitted for clarity.

NOTE: Since the cold water supply line is used in lieu of a dedicated return line, pump operation will push warm water into the cold side of the fixtures. This may result in the brief delivery of warm water from the fixture when cold water is used.

Enhancing Lives By Changing The Way Water Is Heated
Condensing Models: RUR model crossover mode.

- In the Cross Over Mode, pump operation intervals will be based on dip switch settings ONLY. The water heater set temperature and the return water temperature have no bearing on pump operation.
  - Circulation can be selected to operate in the Comfort Mode or the Economy Mode.
  - These settings determine how often the pump will start and how long the pump will operate.
    - Water flow through the cross over valve stops (the valve closes) when hot water flowing through the valve reaches 98°F (+/- 5°F). The water heater’s inlet water temperature thermistor is not utilized. **Pump cycles are based on time ONLY.**
    - The pump will continue to operate until the end of the ON time interval and will restart at the beginning of the next (length of pump ON and OFF periods vary based on dip switch settings only).
  - The included MC-195T Timer/Controller is then used to program the time(s) of day the circulation system will be active.

Enhancing Lives By Changing The Way Water Is Heated
Since, in the crossover mode, the pump is operated only on time, certain dip switch settings are selected based on the length of the plumbing lines and the time intervals needed or desired to provide adequate hot water circulation.

- The chart below is used as a guideline to determine if your plumbing system is considered to have a “Short” or “Long” circulation loop.

<table>
<thead>
<tr>
<th>Pipe diameter</th>
<th>Short Loop</th>
<th>Long Loop</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾”</td>
<td>Up to 200 ft.</td>
<td>From 201 to 400 ft.</td>
</tr>
<tr>
<td>½”</td>
<td>Up to 50 ft.</td>
<td>From 51 to 100 ft.</td>
</tr>
</tbody>
</table>
Condensing Models: RUR model crossover mode.

- The Chart below outlines the pump ON and OFF intervals based on the Long or Short Loop settings combined with the Comfort or Economy mode settings.
  - The loop length setting determines how long the pump will stay ON.
  - The Economy or Comfort mode settings determine how long the pump will stay OFF.

<table>
<thead>
<tr>
<th>Typical Intervals (minutes)</th>
<th>Short Loop Mode</th>
<th>Long Loop Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump ON</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Economy Mode</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Pump OFF</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Comfort Mode</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

- The settings for short or long loop should be based on the length of plumbing in the structure.
- The settings for economy or comfort mode should be based on the temperature setting, pipe insulation and estimated heat loss in the system.
**Condensing Models:** RUR model crossover mode.

- Dip switches #4, #7 and #8 in the second or lower group of switches (DIPSW 2) will be utilized to configure the water heater to the desired mode.

<table>
<thead>
<tr>
<th>Setting options for the Cross Over Mode:</th>
<th>SW #4 in DIPSW2</th>
<th>SW #7 in DIPSW2</th>
<th>SW #8 in DIPSW2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump OFF* (no circulation)</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Cross Over Short Loop Economy Mode</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Cross Over Short Loop Comfort Mode</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Cross Over Long Loop Economy Mode</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Cross Over Long Loop Comfort Mode</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

*If switches 4, 7 and 8 are all off, circulation will not operate regardless of the MC195T controller settings.*
Condensing Models: RUR model crossover mode.

• To use the water heater in a Cross Over Mode it must first be reconfigured.
  ➢ In addition to dip switch settings, the reconfiguration process requires removing the bypass plug assembly from the hot water outlet fitting, removing the bypass plug from the cap and replacing it with the bypass filter. The bypass filter is included with the water heater and attached to the interior of the water heater cabinet.
  ➢ The bypass plug/filter is accessed from the bottom of the water heater.
Condensing Models: RUR model crossover mode.

- As previously mentioned, in the Cross Over mode the thermal bypass valve closes once hot water is detected at the valve. Closure of the valve stops the circulation flow preventing water over 98°F (+/- 5°F) from being pumped into the cold water lines.

  ➢ Because the valve is mechanically operated, there is no signal indicating the valve has closed. As a result, the integral pump in the RUR unit will continue to operate until the “ON” time period has elapsed.

  ➢ **Installation of the bypass filter is necessary in the Cross Over Mode to prevent the circulation pump from dead heading.** This filter allows water to circulate internally through the heat exchanger when the pump is operating and the thermal bypass valve is closed.

NOTE: Even when the thermal bypass valve is open, pump output is greater than the flow through the valve. Excess pump output will circulate through the heat exchanger.
Condensing Models: RUR model temperature range.

• The temperature range for the RUR98 is........
  ➢ 98°F to 140°F in the Dedicated Mode.
  ➢ 120°F to 140°F in the Cross Over Mode.
    ▪ For temperature settings above 120°F, dip switch #6 in DIPSW1 (upper set of switches) will need to be in the ON position.

• The RUR98 is approved for residential and commercial applications but the maximum operating temperature is limited to 140°F (Connecting a MCC-91-2 commercial temperature controller will NOT allow an RUR model to be set at temperatures above 140°F).

• Only one thermal bypass valve can be installed per water heater.
• Do not electronically manifold multiple units together (with MSB or EZ Connect wiring).
• The RUR98 is not permitted for installation in hydronic heating applications of any type.

Enhancing Lives By Changing The Way Water Is Heated
• Incorporation of the circulation pump required several physical changes to the water heater. These changes include the addition of manual water drains plus the relocation of water pipe connections as compared to other RU models. Exact dimensions can be found in the install manual or specification sheet.

➢ For servicing or winterization, disconnecting the hot and cold water supply lines will not completely drain an RUR model water heater. There are four manual drains that will need to be opened. These include the condensate trap, circulation pump, check valve and the water drain.
Component identification and water flow description.
Condensing Models: RUR model component identification.

- Hot Water Outlet Pipe
- Pump Outlet Pipe
- Pump Outlet
- Pump Inlet
- Circulation Return Pipe
- Crossover Mode Pump Bypass Pipe
- Internal Check Valve
- Hot Water Outlet – Bypass filter/plug Assembly
- Cold Water Inlet
Condensing Models: RUR model water flow – dedicated mode.

Default configuration with bypass plug installed in hot water outlet fitting assembly.

1. The pump pushes water through the pump outlet pipe into the internal check valve assembly.
2. The internal check valve directs pump flow into the water flow servo valve which controls water flow into the heat exchanger.
3. Hot water flow from the heat exchanger is directed into the plumbing system through the hot water outlet/bypass plug assembly.
4. Circulation return water enters the water heater via the cold water inlet/check valve assembly and is directed into the circulation return pipe back to the circulation pump.
5. Once the circulation return water reaches 12.6°F (7°C) below the set point the pump will turn off.
1. In the Crossover Mode, pump output and flow through the heat exchanger will be the same as in the Dedicated mode. The difference will be related to the flow out of the water heater into the plumbing.

2. The thermal bypass valve allows only 0.8 GPM flow so only 0.8 GPM will flow out of the water heater and return via the circulation return pipe.

3. Any pump output that does not flow into the plumbing and through the thermal bypass valve will be recirculated internally via the pump bypass pipe. The bypass filter must be installed to allow this flow.

4. After the thermal bypass valve closes all water flow will be circulated internally.

**Installation of the bypass filter in the hot water outlet fitting is necessary in order to prevent the pump from dead heading.**
Condensing Models: Circulation with RUR models.

Maximum pipe length (Hot Water Supply Lines + Dedicated Return Line).
¾” – 400 ft.
½” – 100 ft.

Circulation Pump built into the water heater cabinet.

Example Drawing Only

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Dedicated Mode Plumbing Diagram
Condensing Models: Circulation with RUR models.

Cross Over Method Plumbing Diagram

Maximum pipe length (Hot Water Supply Lines + Dedicated Return Line).
¾” – 400 ft.
½” – 100 ft.

Example Drawing Only

Enhancing Lives By Changing The Way Water Is Heated
MANUFACTURER ACCESSORIES
Accessories: Control-R™, Wi-Fi

Consumer Features
- Unit Registration
- Temperature Control
- Fault Codes
- Maintenance Modes
- Remote Monitoring
- Power On/Off
- Circulation
  - Sensors
  - Push Buttons

Dealer Features
- Unit Registration
- Device Manager
  - Error History
  - Maintenance Modes
- Alerts
  - Error Codes & Troubleshooting
- Remote Monitoring
- Dealer Tools
- Profile/Settings

*Enhancing Lives By Changing The Way Water Is Heated*
Accessories: Condensate neutralizer. For condensing boilers and water heaters.

- Neutralizers raise the pH level of the condensate prior to disposal to prevent possible damage to plumbing and may be required by local building codes.
  - Check with local authorities for the condensate disposal requirements in your area.

- **Rinnai has two condensate neutralizers available.**
  - P/N 804000074 – for single unit applications (includes media).
    - 1.6 Gallon/hour capacity
    - Clear housing to easily see when media refill is needed (refill P/N 809000114).
  - P/N 103000067 – for multiple unit/commercial applications (includes media).
    - 45 Gallon/hour capacity (4.8 gallon tank).
      - Can handle up to a 7 million Btu appliance (35 tankless units operating at max Btu).
    - Tank and lid are made from polypropylene.
    - Weight 45 lbs.
    - Media refill P/N 103000068.

**NOTE:** If no gravity drain is available, install a condensate removal pump may need to be installed. The condensate pump must be equipped with an overflow switch to prevent the appliance from running should a failure occur.
This switch is intended to be installed in a Rinnai tankless water heater when connected to one of the following products or systems..........

- The switch can be used when a Rinnai tankless water heater is used in conjunction with a Rinnai or other branded hydronic air handler. The switch provides for domestic hot water priority and will turn the air handler off during high domestic hot water demands and allow it to come back on when the demand is reduced.

- The switch can also be used to connect a Rinnai water heater to a simple building management system. The switch will signal the building management system if an fault code causes the water heater to shut down (it indicates only that a water heater is not operating, not what the actual fault code is).

The switch is a volt-free Normally Open (NO) / Normally Closed (NC) switch.

P/N 103000037
Accessories: ScaleCutter Water Conditioning System.

Southeastern Filtration’s “ScaleCutter Water Conditioning System”.

- Rinnai offers Southeast Filtration’s “ScaleCutter Water Conditioning System” as an accessory if the water heater is installed in an area that is known to have hard water or that causes scale build-up in the heat exchanger.

- The ScaleCutter water conditioning system offers scale prevention and corrosion control by feeding a blend of control compounds into the cold water supply.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>103000038</td>
<td>Southeastern Filtration ScaleCutter System ¾” Feed</td>
</tr>
<tr>
<td>103000039</td>
<td>ScaleCutter Refill</td>
</tr>
</tbody>
</table>
• Accessories:
  ➢ Pipe cover boxes.
    ▪ Pipe cover boxes mount underneath the water heater to enclose visible pipes.
    ▪ This allows for a cleaner looking installation as well as provides increased security and weather protection (insulation can be installed inside the cover is desired).
    ▪ Pipe covers are available for all models.

  ➢ Recess boxes.
    ▪ Recess boxes allow outdoor models to be installed recessed into an exterior wall.
    ▪ The recess box encloses the water heater and the associated piping.
    ▪ This allows for a cleaner looking installation as well as provides increased security and weather protection.
Additional Rinnai Water Heating Options
RH180 Hybrid Tank/Tankless Water Heater:

- Combination of a storage tank and a tankless water heater into one appliance.
- Piping configuration is the same as tank water heaters.
- Standard water line and tank connections.
- Can use ½” gas lines (in most cases).
- Uses 4” B-Vent and can be common vented with a furnace.
- Multiple safeties and diagnostic functions.
- Circulation compatible.

- Provides increased hot water capacity over most standard tanks.
- 110 gallon First Hour Rating.
- UEF rating of 0.66.
- Heat loss from tank is minimized due to 2” of insulation and no burner or exhaust flue.
- Tank recovery approximately 15 minutes (starting from a cold tank).
- 5 different temperature settings.

Enhancing Lives By Changing The Way Water Is Heated
Condensing Boilers:

- Three product lines, 10 models.
- Ultra-High efficiency (95%+ AFUE).
- Ultra-Low NOx emissions – SCAQMD approved.
- Six models have domestic hot water capability built in (Combi and Q-Premier models). Domestic hot water is also available on the Solo series models (with optional 3-way diverter valve kit).
- Models from 50K Btu up to 205K Btu.
- Models available in Natural Gas or Propane but can be converted.
- Domestic hot water priority.
- Plumbing kit (Low Loss Header) included (except E50C).
- Ultra-Low Noise levels.
Commercial Applications
Commercial Tankless Water Heater: C199

- Rinnai now offers a commercial ONLY version of our condensing tankless water heater.
  - Available in indoor and outdoor versions.
  - Available for Natural Gas or Propane.
  - 96% thermal efficiency.
  - Multiple venting options available.
  - 98°F to 185°F temperature output capability.
  - Available pre-assembled onto rack systems (see next page).
Tankless Rack Systems: TRS

• Rinnai also offers pre-assembled rack systems for commercial applications. These racks have multiple water heaters mounted with the header pipes for gas and water pre-installed.

• Rack systems are available for indoor and outdoor models (The C199 model water heaters will be standard on the TRS systems).

• In-line and back-to-back systems are available in various configurations.

• Multiple racks can be linked together to meet system demands.

• Common vent systems are also available for indoor rack systems.

4 unit back to back system shown. Other configurations available.

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Tankless Rack Systems: Common Venting

Other common vent configurations are available.
Commercial Hybrid: Demand Duo™.

- Rinnai offers a commercial hybrid tank/tankless water heater system.

**Demand Duo™**

- Combines a 199K Btu High Efficiency C199 condensing water heater with a 119 gallon storage tank.
- 96% thermal efficiency.
- Designed to replace existing commercial tank water heaters – similar connection locations.
- Better hot water performance than HE/SE tanks – more hot water at consistent temperatures.
- Flexible venting options – concentric, two-pipe PVC/CPVC, room air.
- Serviceable – all parts are replaceable.
- System assembled with approved UL listed components.

*Enhancing Lives By Changing The Way Water Is Heated*
This concludes the Rinnai Condensing Tankless Water Heater Training Program

Level II - Installation Fundamentals