Rinnai®

Tankless Water Heater Training Program

Product Knowledge / Installation Fundamentals

Level I/II

Click here to advance slides.

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The Evolution of Rinnai Tankless Water Heaters

Designation	Years of production	Generation and description	Other Notes
No specific letter designation	1999-2001	1st Generation non-condensing models	2402 and 2424 models only
"V" Series	2001-2006	2nd Generation non-condensing models	Initially called "Continuum" and "Integrity."
"VA" Series	2006-2010	3rd Generation non-condensing models	Most VA models are also known as "LS" (except the V53e)
	2011		R98LS and V53e models still maintain the VA designation.
"VB" Series	2010	4th Generation non-condensing models	Most VB models still maintain the "LS" designation (except the V53i)
	2011		**New for 2011** R75LS / R94LS models are now called RL75 / RL94. V53 models are now called RV53. These changes note the inclusion of isolation valves with the product (LS designation no longer used for VB models)
"VC" Series	**2012**	5th Generation non-condensing models	Additional Value Series units to include V65i/e and V75i/e (V53i not produced any longer)
"KA" Series	2009-2010	1st Generation condensing models	Also known as "HP" models (High Performance)
	2011		**New for 2011** RC series (80 and 98) now includes isolation valves with the product ("HP" designation no longer used)
"KB" Series	**2012**	2nd Generation condensing models	Re-design of product and models are now RU98i/e and RU80i/e

Current Water Heater Model Specifications

Detailed individual model specifications are available—contact your local Rinnai representative or 1-800-621-9419

Model Designation i=indoor models e=outdoor models	**Full Model Number**	**Minimum Btu's**	**Maximum Btu's**	**Minimum Activation Rate** (approx.)	**Maximum Flow Rate 35° Temp Rise**	**Maximum Flow Rate 50° Temp Rise**	**Efficiency % or EF Rating**
V53e	REU-VAM1620W	20.2 K – LP 19K - NG	120K	**0.6 GPM**	5.3 GPM	3.9 GPM	.82
V65i	REU-VC2025FFU	10.3K	152K	0.4 GPM	6.5 GPM	5.0 GPM	.82
V65e	REU-VC2025W						
V75i	REU-VC2528FFU	10.3K	180K	0.4 GPM	7.5 GPM	6.0 GPM	.82
V75e	REU-VC2528W						
RL75i	REU-VC2528FFUD	10.3K	180K	0.4 GPM	7.5 GPM	6.0 GPM	.82
RL75e	REU-VC2528WD						
RL94i	REU-VC2837FFUD	10.3K	199K	0.4 GPM	9.4 GPM	6.6 GPM	.82
RL94e	REU-VC2837WD						
RU80i	REU-KB2530FFUD	15.2K	157K	0.4 GPM	8.0 GPM	6.0 GPM	.96
RU80e	REU-KB2530WD		152K				
RU98i	REU-KB3237FFUD	15.2K	199K	0.4 GPM	9.8 GPM	7.6 GPM	.95
RU98e	REU-KB3237WD						

To remain the industry leader in tankless water heating, Rinnai is constantly improving our products- it is important to attend Rinnai installation and service training classes on a regular basis (preferably once per year)

PRODUCT FEATURES

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Rinnai Circ-Logic

Rinnai Circ-Logic (RCL) offers homeowners enhanced convenience and energy efficiency in home hot water recirculation systems with a dedicated return line. The RCL controls the on/off sequence and operational cycles of the recirculation pump through the programming of the tankless water heater's control board.
This feature is standard on Rinnai's Ultra and Luxury Series units.

The RCL has been designed to provide the homeowner with the ability to customize their recirculation systems based on such key variables as home size, length of recirculation loop, piping insulation, and the homeowner's comfort and efficiency preferences.

Economy Mode

The Economy mode operates as follows:

- Less energy consumed due to fewer pump cycles
- Assumes plumbing is insulated (minimal pipe heat loss)
- Pump cycles on every 31 to 79 minutes (see table).

Comfort Mode

The Comfort mode operates as follows:

- Higher energy consumption due to more pump cycles
- Assumes plumbing is not insulated resulting in higher pipe heat loss
- Pump cycles on every 15 to 39 minutes (see table).

See pump cycle tables provided in Installation Instructions and Owners Manual

Installation

Pump Requirements

Voltage: 120, 60 HZ

Amperage: less than 2 amps

NOTE: The Rinnai PC board will be damaged if amperage exceeds 2 Amps.

Check valve: An integral flow check (IFC) valve is required. See plumbing diagram.

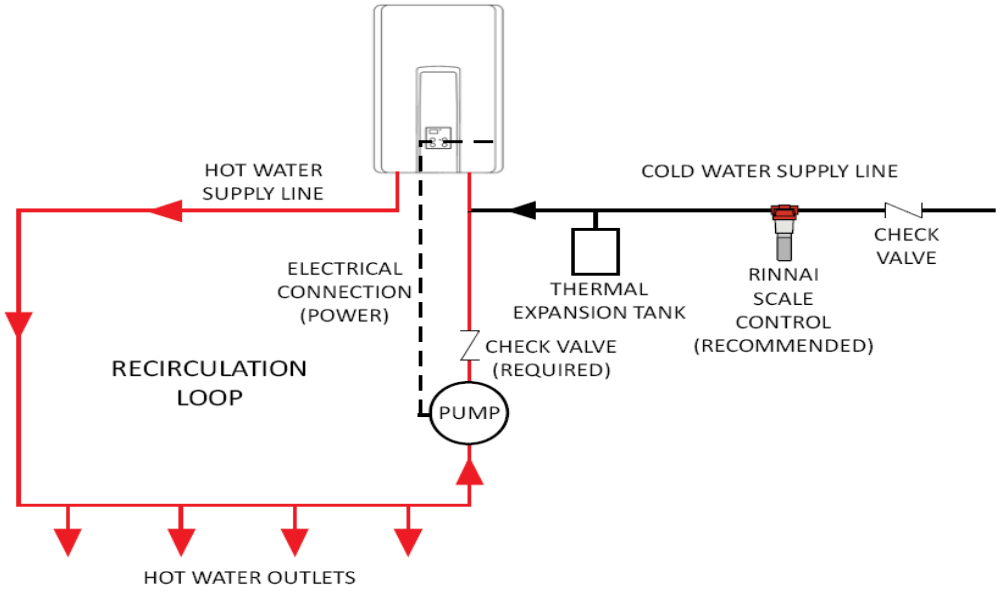
The pump should be sized for 2.5 GPM at the pressure loss through the tankless water heater and the supply and return plumbing in recirculation loop.

For more information on sizing the pump refer to "Pump Sizing for Circulation" in the Rinnai Hot Water System Design Manual.

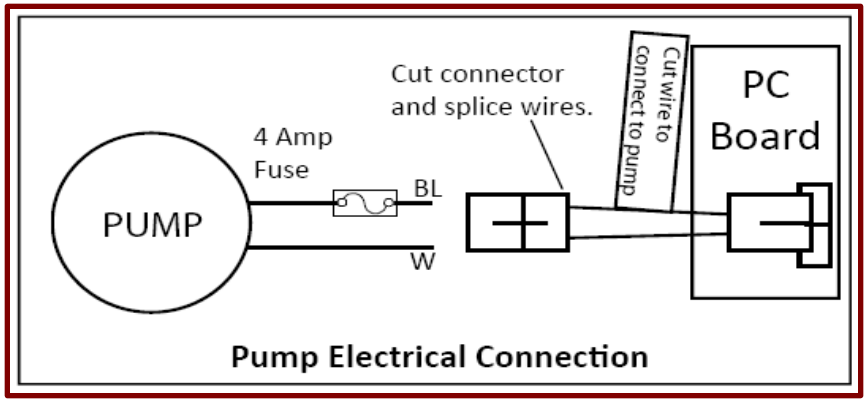
Note: Recirculation mode is for residential installations only, and cannot be used with the Bath Fill controller (BC-100V), an air handler, or with multiple Rinnai water heaters.

1. Turn off the electrical supply by unplugging the power cord or by turning off electrical power at breaker.

2. Install the recirculation pump on the return line according manufacturer installation instructions. Install a check valve in the return line as shown in the Plumbing Diagram if one is not integrated in the pump.



3. The wiring harness for the recirculation pump is bundled with the wiring harness from the PC board. The connector has a black and white wire with the Label "*Cut wire to connect to pump*". To connect to the pump, cut the connector, splice the wires and add a 4 Amp fuse to hot wire (black) to the pump. Connect the ground wire from the pump to a screw at base of water heater cabinet.
(Refer to the pump Electrical Connection Diagram. Follow Electrical Code and pump manufactures recommendations.)



Pump Electrical Connection

4. Adjust the (SW2) (bank of white) dip switches as follows:
Economy mode, Switch 4 ON Switch 8 OFF
Comfort mode, Switch 4 ON Switch 8 ON.

	Settings for SW2 (bank of white switches)	
	Switch 4	Switch 8
Economy Mode	ON	OFF
Comfort Mode	ON	ON

5. Connect power to the water heater. Press the power button on the controller. The pump and water heater will turn on to raise the recirculation loop temperature.

Sequence of Operation

Pump recirculation begins when the water heater is turned on. The Rinnai inlet and outlet thermistors measure the water temperature.

The water heater produces hot water at the temperature setting. If the inlet thermistor detects abnormal temperature then a diagnostic code **51** is generated and the pump will turn off.

When the return water temperature reaches 15˚ F (8.3˚ C) below the temperature setting the water heater and pump will turn off.

The cycle will restart at the approximate time interval in the table based on mode of operation and temperature thermistor readings

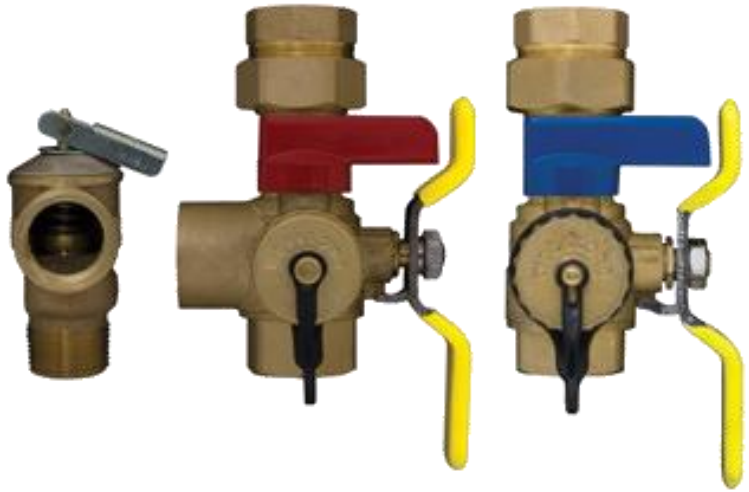
Note: The maximum Rinnai temperature setting while in recirculation mode is 140°F (60°C)

Rinnai Temperature Setting °F	Typical Pump ON Intervals* (minutes)	
	Economy Mode	Comfort Mode
140	31	15
135	31	15
130	31	15
125	31	15
120	31	15
115	35	18
110	42	21
108	45	22
106	49	24
104	54	27
102	60	30
100	68	34
98	79	39

* The pump will cycle on at these calculated intervals which are based on the temperature setting, insulation, and estimated heat loss in the system. The values for your installation may vary.

Tankless Valve Kit

- Rinnai recommends the use of a tankless valve kit when connecting the water lines to the water heater
- All RL94, RL75, RU98, and RU80 models now include Webstone Isolation Valve kits!
  - This kit includes hot and cold water shut-off valves, hot and cold water drain valves, and an ANSI approved PRV (pressure relief valve)
  - This kit meets all individual states' lead-free standards
- Use of this kit will assist in flushing the heat exchanger in areas where water quality issues exist, as well as improve overall product serviceability
- This kit is not included in the Value Series models.



Product Features

ONLY RINNAI STANDS BEHIND ITS TANKLESS WATER HEATERS WITH A LIMITED 5-YEAR EXTENDED LABOR WARRANTY!

RL / RU (Luxury/Ultra) Series Warranty (some restrictions apply):
Heat exchanger limited warranty
12 years residential; 3 years when used in certain recirculating systems; 10 years when used with a Rinnai hydronic furnace; 5 years in commercial applications.
All other parts: 5 years.

***Labor:** 5 years residential and 2 years commercial for Luxury/Ultra models when registered within 30 days of installation, 1 year all other applications. All products installed after March 31, 2011

Other models' warranty guidelines may vary.

For more warranty details, visit www.rinnai.us or call 1-800-621-9419.

Product Features

- Rinnai tankless water heaters have an industry leading activation rate of 0.4 gpm* and lower minimum gas input rate of 10,000 Btu
- This allows ignition for smaller amounts of water at higher incoming temperatures
- Water flow deactivation is less than 0.26 gpm* (exceptions: V53e model)
- Current non-condensing models are approved for mobile homes installations (Exception: R98LS)
- Whole house continuous hot water system when properly sized
- Non-condensing models have EF ratings of .82-.84
- Condensing models have EF ratings of .95 - .96
- Temperature controller for setting desired water temperatures
  - Output temperature can be adjusted to provide specific water temperatures for home, schools, nursing homes, hotels, etc.
  - Locking capability of controller for safety
- Space saving, compact size
- Very low noise (49 decibels)
- All parts are replaceable
- †Life expectancy up to 15 – 20 years

†Actual performance life will vary depending on water quality, usage rates, environmental conditions, and required maintenance scheduling. Refer to the maintenance section of the operators manual for further details.

*Model Dependent

Safety Devices

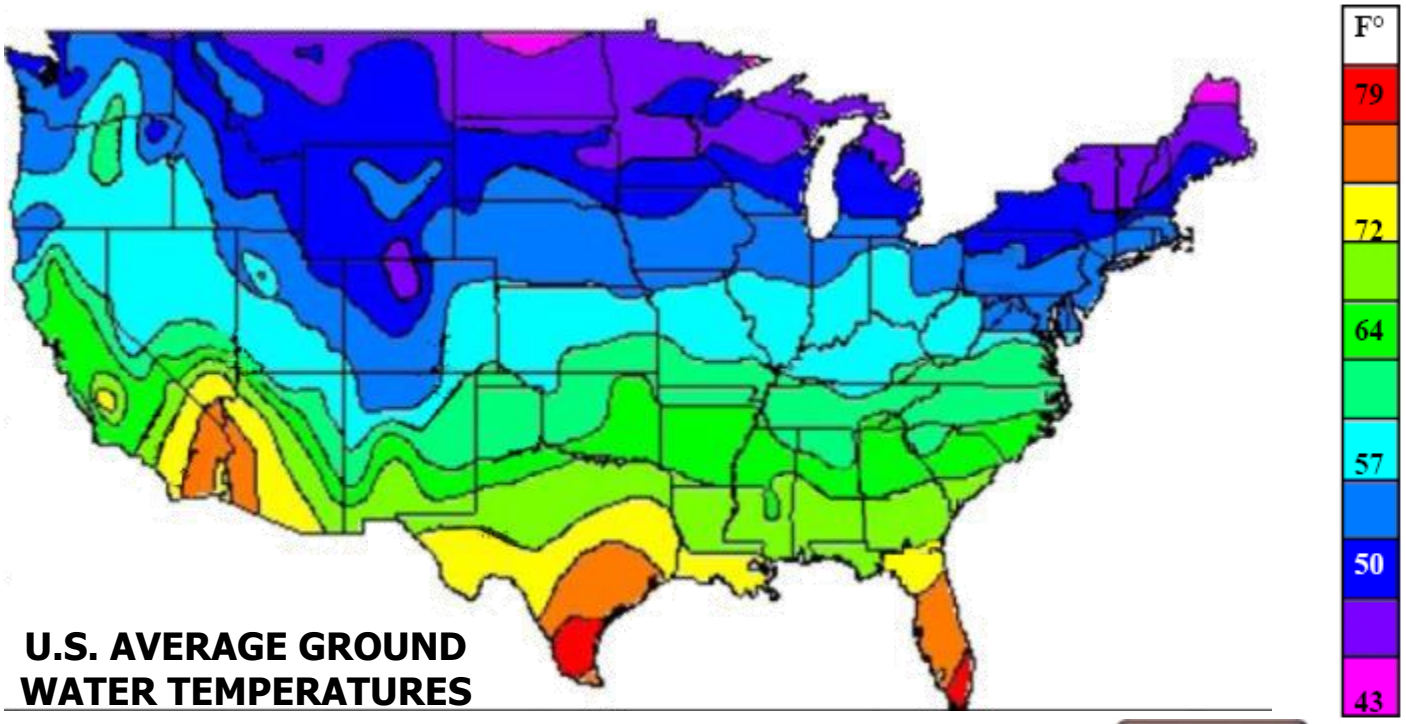
- Maintenance / diagnostic codes are displayed on the temperature controller, simplifying service calls
- Safe, low voltage temperature controllers
- Child safety lock on controller on current models
- Flame rod indicator(s) (validates and / or indicates flame failure)
- Over heat bi-metal sensor(s)
- Integrated boiling protection
- Heat exchanger thermal fuses
- Leak detection with Luxury and Ultra Series **internal** units
- Built-in freeze protection to -22º F for indoor units and -4º F for outdoor units (must have gas and electricity)
  - A drain down kit can be obtained to protect the unit from freezing in case of electrical failure or inadequate gas supply—non-condensing models only
- Combustion fan senses blocked intake or exhaust flue
- Direct electronic ignition (no standing pilot)
- PC Board is protected by a glass fuse (size will vary by model)

Tankless Water Heater Sizing and Sequence of Operation

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What is Delta T (ΔT)?

The difference of the incoming ground water and the tankless water heater's set point temperature is known as Delta T (ΔT). Delta T determines the flow rate of the tankless water heater.



U.S. AVERAGE GROUND WATER TEMPERATURES

EXAMPLE



Rinnai Tankless Water Heater's temperature at controller = 120˚

Subtract the incoming temperature from the water heater's set temperature for ΔT: 120˚ - 57˚ = 63˚ ΔT

Understanding Maximum Flow Rate

The tankless water heater's first priority is to provide the set point temperature to the user. Based on the ΔT, the tankless product may regulate flow to ensure it can provide the selected temperature.

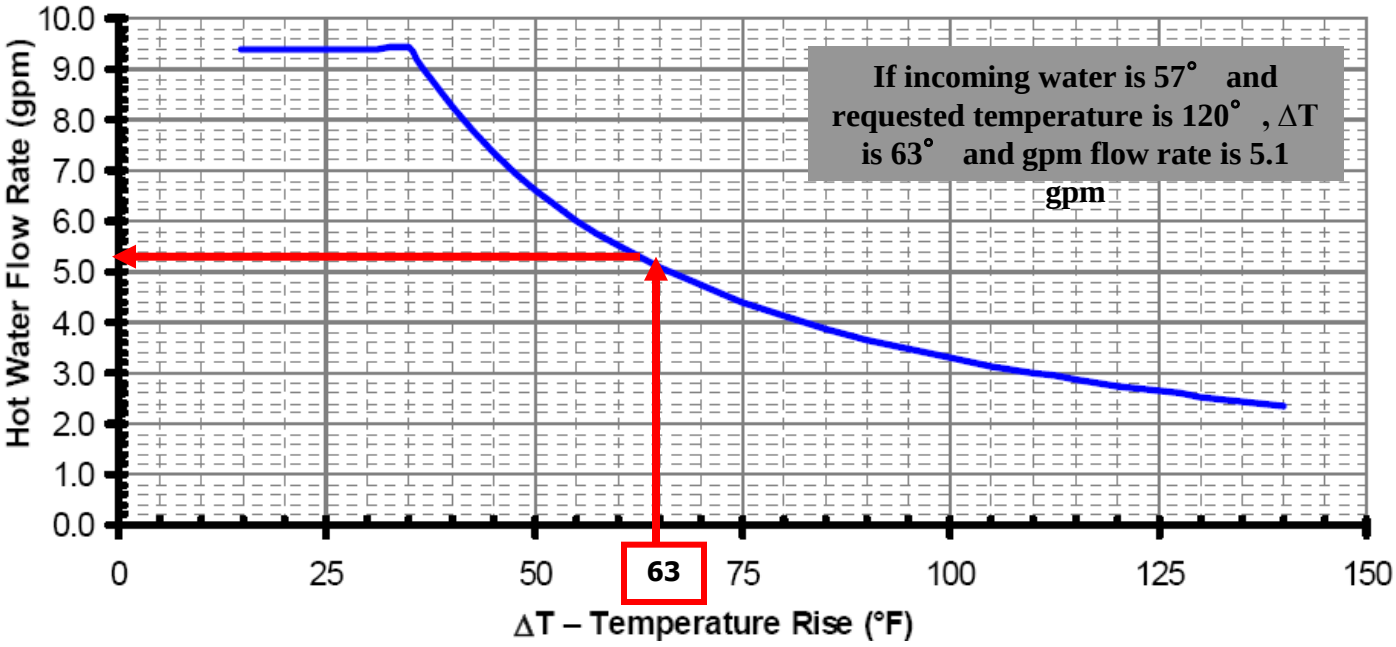
EXAMPLE (from previous page)

Incoming water = 57˚ Rinnai Set-Point temperature = 120˚

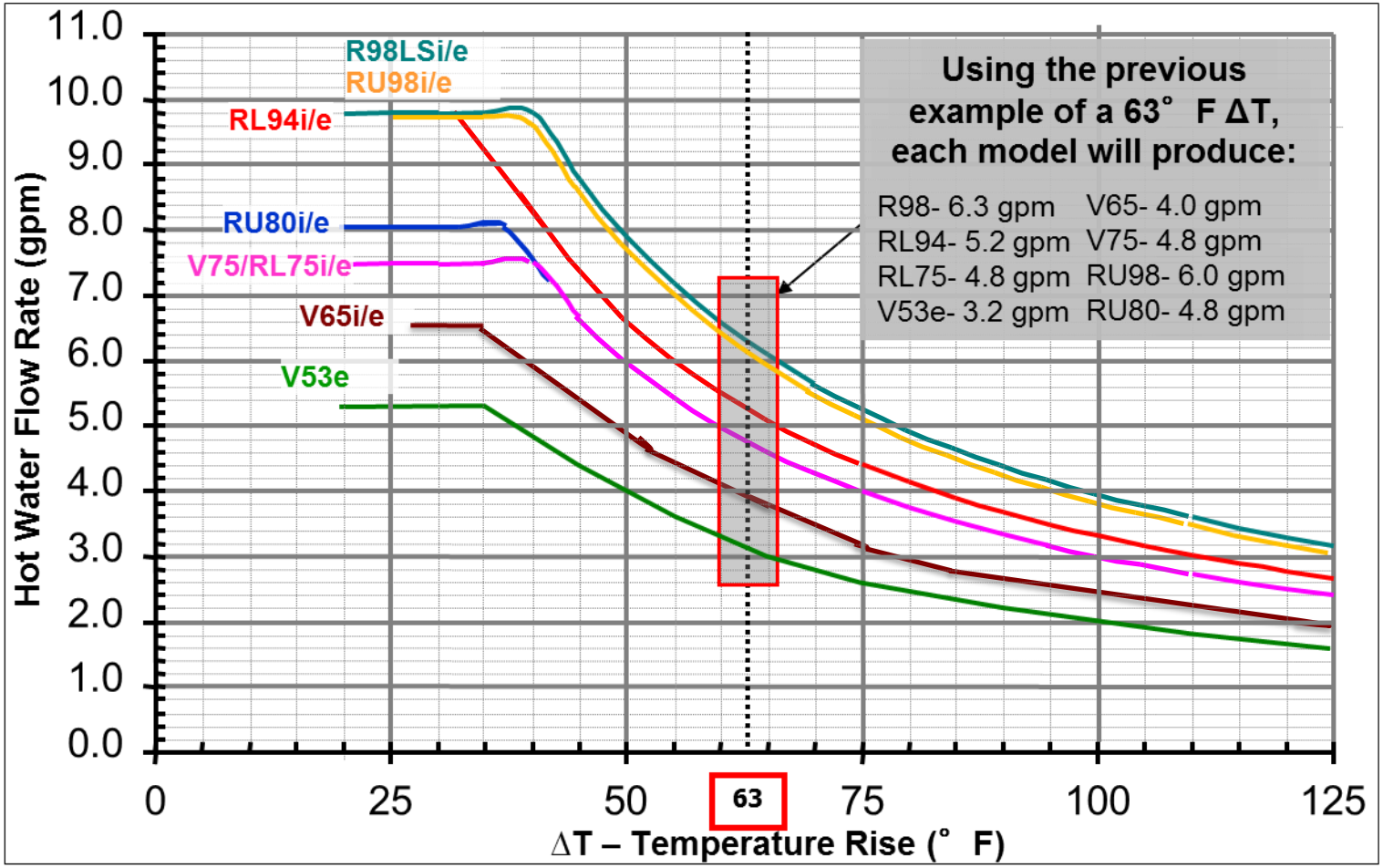
- **Subtract the incoming ground water temperature from the water heater's set temperature for ΔT 120˚ - 57˚ = 63**
- **The maximum GPM flow rate for any given ΔT can be found at the intersecting points along each model's specific flow curve**
- **A GPM flow test from the temperature controller can verify each unit's performance**

RL94e Flow Curve

Flow curves of each model are listed in each installation manual



Maximum Flow Rate by Model



Let's focus on just the RL94 and RL75 models-Rinnai's two main non-condensing products:

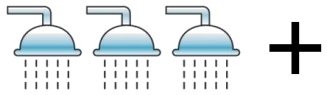
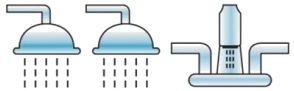
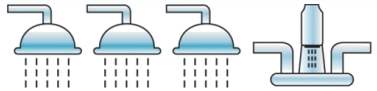
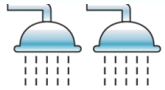
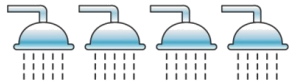
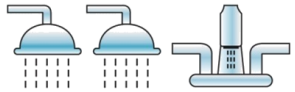
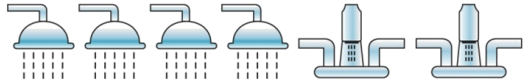
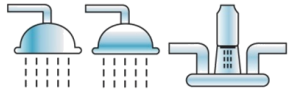
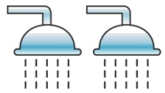
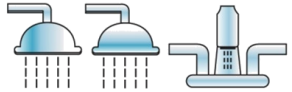
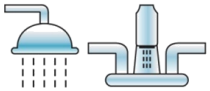
- **Note that when the ΔT is greater than 50° F the difference in flow rate is less the 1gpm. Therefore, in areas where the ground water is relatively cold, the RL75 is usually the model of choice for an average residential installation.**
- **In areas where the ground water is warmer, the RL94 will provide substantially more output than an RL75**

Whole-House Sizing Chart

To make things simpler, a basic sizing chart can be used based on ground water temperature. Please note the below factors as well:

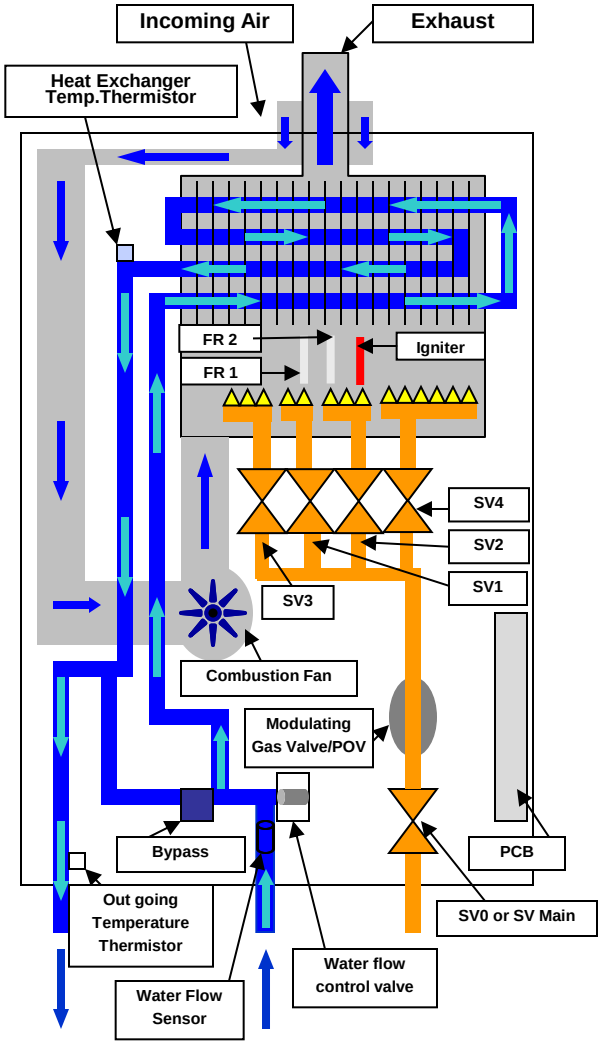
- Assumed Rinnai water heater set point at 120º F
- Assumed 50 psi – 80 psi inlet water pressure for maximum flow
- A residential washing machine or dishwasher is equivalent to one shower head
- Bathroom sink faucets assumed to be 2 gpm mixed flow rate or less
- Shower heads assumed to be 2.5 gpm mixed flow rate or less.
  - 2.5 gpm is a standard size for most residential shower heads
  - If multiple shower fixtures (i.e. body sprays, large rain heads, or tubs over 60 gallons in capacity) are used, please contact Rinnai's applications and sizing group

WHOLE HOUSE SIMULTANEOUS BATH USE

Ground Water Temperature		
Model	Summer Season: 70° F	Winter Season: 50° F
RU80i/e		
RU98i/e		
RL75i/e		
RL94i/e		
R98LSi/e		
(R)V53i		
(R)V53e		

- Assumed mixed temperature on shower heads and bathroom faucets are set to 104º F

Sequence of Operation (VC)
(indoor RL Non-condensing model)



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 turns to allow correct air flow thru unit
- Spark igniter begins sparking and gas control valve opens to low fire rate
- When flame rods prove ignition spark igniter stops sparking

3. Normal Operation
- PCB monitors flame rods, fan motor frequency, flame characteristic, outlet water temperature, temperature set point, and water flow rate
- Gas valve assembly & fan speed modulate gas and air input to meet user demand
- If demand is very small, only SV1 will allow gas to burner, FR1 will monitor this minimum fire state
- If demand is large flame can develop across the entire burner
- Water is heated as it passes thru heat exchanger multiple times
- Heat exchanger strategically overheats water while the fixed or variable bypass cools to the set point temperature to provide higher flow rates
- Water flow control valve is adjusted, as needed

4. Shut-down Sequence
- PCB senses flow rate less than *0.26 gpm
- Gas control valve closes & water flow control valve resets to standby position
- Combustion fan runs for a short period of time at low speed

5. Standby Mode
- PCB monitors all components. Freeze protection is activated as needed

*Model dependent

INSTALLATION REQUIREMENTS

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Manufactured Home Installation

- **Modular Homes**
  - A modular, panelized, or precut home is built at a factory and then transported to the site and assembled. These types of construction fall under the regulation of the model building code enforced in the jurisdiction where the home is to be located.
    - **All Rinnai water heaters are approved for installation in modular, panelized, or precut homes**

- **Manufactured Homes (or Mobile Homes)**
  - The ANSI standard defines a manufactured home as a structure, transportable in one or more sections, which in the traveling mode, is eight body feet or more in width or forty body feet or more in length, or when erected on site, is 320 or more square feet.
    - **Rinnai R75/RL75, R94/RL94, and V53i/RV53i , V65, and V75 models with "VB" or "VC" in the full model number are approved by CSA for installation in manufactured or mobile homes**
    - **Rinnai V53e/RV53e models manufactured in April, 2010 or later are also approved by CSA for installation in manufactured or mobile homes**
    - At the time of this publication, all other Rinnai model water heaters are not approved for manufactured or mobile home installation. Contact Rinnai if needed for a current list of approved models.
  - Furthermore, the ANSI standard requires that all products for installation in manufactured homes be CSA certified with required labeling and instructions as well the ability to field convert gas type as necessary.
    - VB and VC models meet these requirements
    - Most models prior to the VB series were also gas type convertible, however only VB models are approved to this standard for installation in manufactured homes.
  - VB and VC models are also approved to retrofit into existing manufactured homes (local and state codes may apply)

Product Installation Key Points
(All current Rinnai models)

- Rinnai's tankless water heaters can be used in both residential and commercial applications
  - Exception: Value Series models are not to be used in commercial applications
- Units are available as either natural or propane gas
- Indoor models must be installed within the confines of a structure. This includes carports and crawlspaces. Outdoor models must be installed outside.
- Residential installations are potable water applications only in single family dwellings with a maximum water temperature setting of 140ºF
- Commercial installations are potable water applications for restaurants, schools, hotels, car washes, coin laundries, assisted living facilities, etc. Hydronic applications are also defined as commercial installations.
  - The MCC-91 commercial temperature controller (optional) allows a maximum water temperature setting of 160º F on V53, V65 and V75/RL75 models
  - The MCC-91 commercial temperature controller (optional) allows a maximum water temperature setting of 185º F on the RL94,RU80,RU98 and R98LS models

  DO NOT use these units in any application involving chemically treated water, (i.e. chlorinated pool water, hot tubs, etc,)

Installation Check-List
(All current models)

Attached to the front of every Rinnai water heater is an installation check list. It is important to review this list BEFORE the installation and again BEFORE commissioning the product to ensure proper operation. Below is an overview:

- ☑ Ensure the manual gas valve packaged with the water heater is installed in the gas supply line
- ☑ Ensure 120 Volts A.C. is connected to the unit, properly grounded, and that the circuit is turned on
- ☑ Verify the gas system is functioning correctly by connecting a manometer to the gas pressure test port on the unit. Operate all gas appliances in the facility at high fire. The inlet gas pressure on the unit **must not drop below** that listed on the unit's rating plate for the gas type being used.
- ☑ Make sure you have cleaned the COLD water inlet filter screen
- ☑ Inspect Hot (outlet) & Cold (inlet) water lines to ensure they have not been crossed & are leak free – *(Hot – Left) – (Cold – Center) – (Gas – Right)*
- ☑ Ensure the temperature controller is installed and functioning. Instruct the customer how to operate the temperature controller. Instructions are supplied in the Use & Care Manual. A typical water heater set point (water temperature) is 120º F.
- ☑ Explain to the customer the importance of never blocking the intake or exhaust venting. They should never store anything around the vent exhaust.
- ☑ Ensure the condensation drain is connected and drained per local code (condensing models only)

Installation Requirements
(All current models)

It is very important to ensure the following incoming sources are within specification:

- **Electricity –**
- A properly polarized and grounded 120 VAC, 60 Hz supply is required. Temperature controllers operate on 12 VDC only supplied by the water heater.

- **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) –**
- Vent components that are certified and listed with the water heater model must be installed to specifications and proper clearances must be maintained

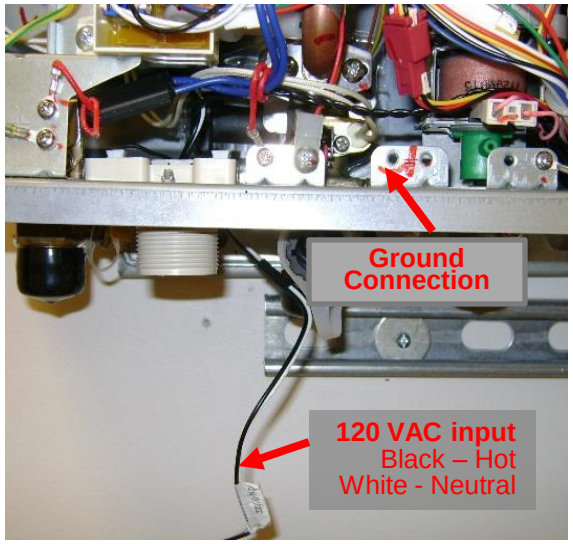
- **Code Adherence –**
- All national, state, and local codes must be followed

Installation Requirements
(All current models)

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ELECTRICAL REQUIREMENTS

Outdoor Models



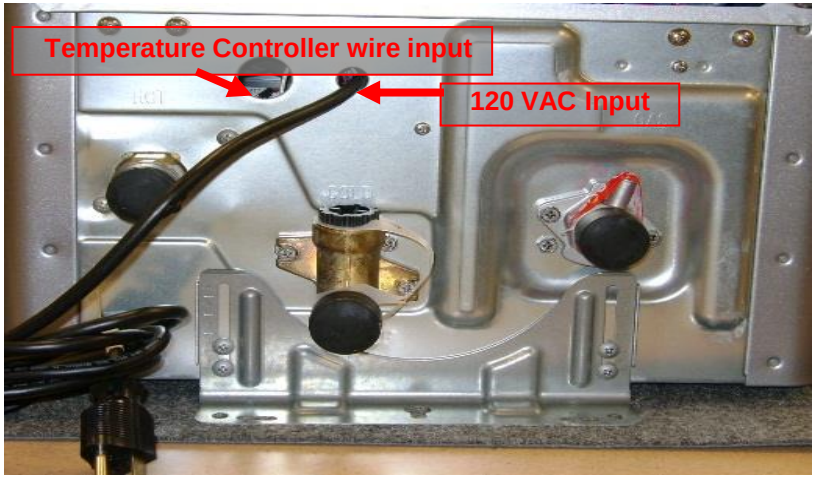
External units come with a hot and neutral wire and a ground connection point for direct connection to supply (i.e. circuit breaker box). Ensure supply is properly polarized and grounded 120 VAC.

Indoor Models



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

Entry point for electrical connections



Supply power should enter the water heater through the center opening at the bottom of the unit

Temperature controller wire should enter the water heater through the left opening at the bottom of the unit.

Important:
Observe all applicable electrical codes. Circuit must be well grounded to earth for proper operation of the water heater.

WATER REQUIREMENTS

- **WATER PRESSURE**
  - Minimum water pressure 20 psi (non-condensing models), 50 psi (condensing models)
  - Maximum water pressure 150 psi
  - Rinnai recommends 30-80 psi for optimum performance for non-condensing models
  - 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 REQUIRMENTS**
  - 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**
  - For proper operation, unit longevity, and warranty adherence, water quality cannot exceed the parameters set forth by the EPA's National Secondary Drinking Standard's Act:

DESCRIPTION	pH	TDS (Total Dissolved Solids)	Total Hardness	Aluminum	Chlorides	Copper	Iron	Manganese	Zinc
MAXIMUM LEVELS	6.5 to 8.5	Up to 500 mg/L	Up to 200 mg/L (11.7 gpg)	Up to 0.2 mg/L	Up to 250 mg/L	Up to 1.0 mg/L	Up to 0.3 mg/L	Up to 0.05 mg/L	Up to 5 mg/L

Gas Supply
(All current models)

- A manual gas control valve must be installed in the gas supply line prior to the unit
- An easy means of disconnection (such as a union) should be above the shut-off valve for future servicing of the water heater
- Supplied gas pressure must be within the limits shown on the rating plate or specification section listed for each product
- Tankless water heaters require a higher gas supply than tank water heaters. Consider the following:
  - An average 40 gallon gas-fired tank has a maximum input rating of approximately 45,000 Btu
  - A Rinnai tankless water heater has a maximum input rating of approximately 199,000 Btu
  - The variance in is 154,000 Btu's. Sizing of the gas supply system and meter capacity must be considered when increasing a structure's total Btu load
- Issues caused by insufficient gas supply:
  - Poor appliance operation and/or water heater diagnostic codes
  - Rumbling noises due to insufficient air/gas mixture
  - Summer installations sometimes operate correctly until winter appliances are operated—causing delayed performance issues
  - Testing gas pressure while all gas appliances are operating at full capacity can prevent such issues
- If any symptom exists suggesting a gas supply issue may be present, a gas manometer will be needed to verify incoming pressure. Rinnai tankless water heaters only need a single port manometer. Dual port or pressure differential manometers are not needed. Some common manometers are shown:



U-tube or Slack tube manometers



Digital manometers

Gas Supply Sizing Procedure – Example
(All current models)

Rinnai

The following example is known as the longest length method. A full explanation of NG and LPG pipe sizing can be found in the National Fuel Gas Code Manual

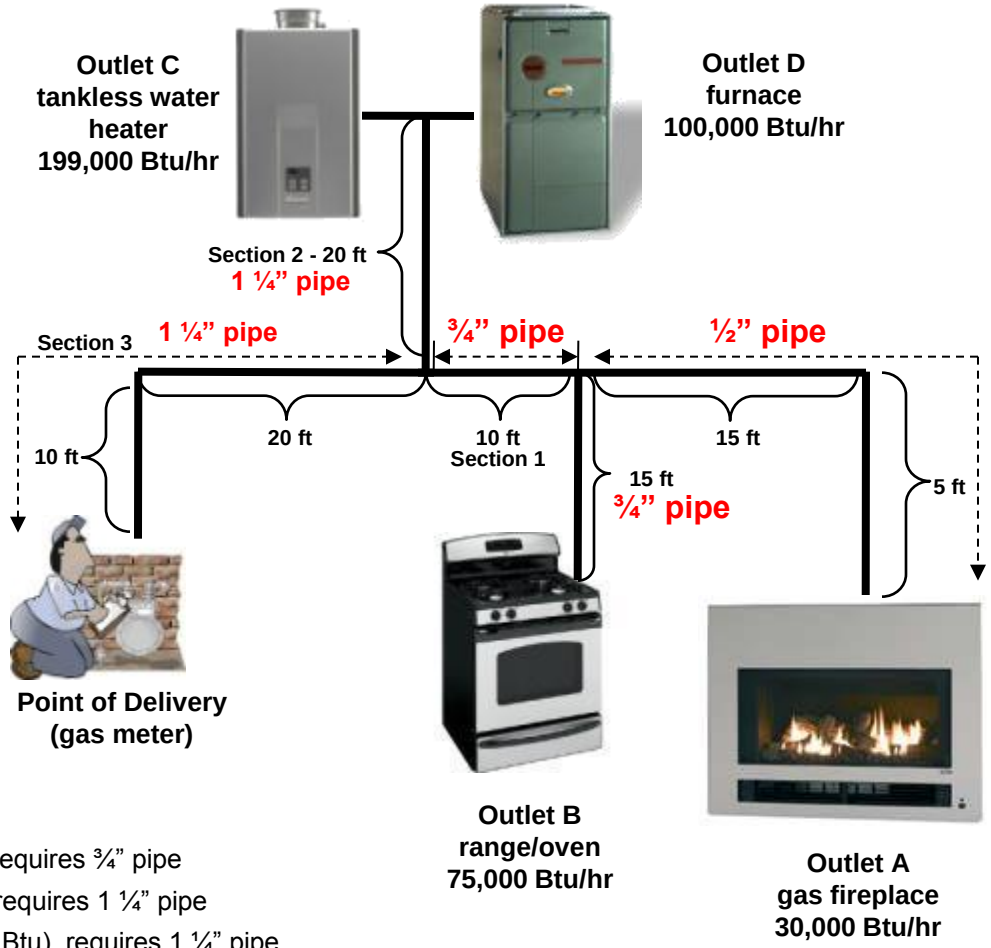
1. Determine the maximum gas (Btu) input for each appliance (see rating plate of appliance)
2. The total length of pipe from the point of delivery to the farthest appliance is 60 ft. **This is the only distance used** (longest length).
3. Refer to the appropriate table in the NFPA 54 manual. This will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

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

Pipe Size (in.)					
Nominal:	½	¾	1	1 ¼	1 ½
Length (ft)	Capacity in Cubic Feet of Gas per Hour (CFH=Btu/1000)				
10	172	360	678	1390	2090
20	118	247	466	957	1430
30	95	199	376	768	1150
40	81	170	320	657	985
50	72	151	284	583	873
60	65	137	257	528	791
70	60	126	237	486	728

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

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



Gas Supply Sizing Procedure

The following example is from a newly approved table in the NFPA 54 manual, which in some cases allows for smaller gas pipe sizing. Again using the longest length method.

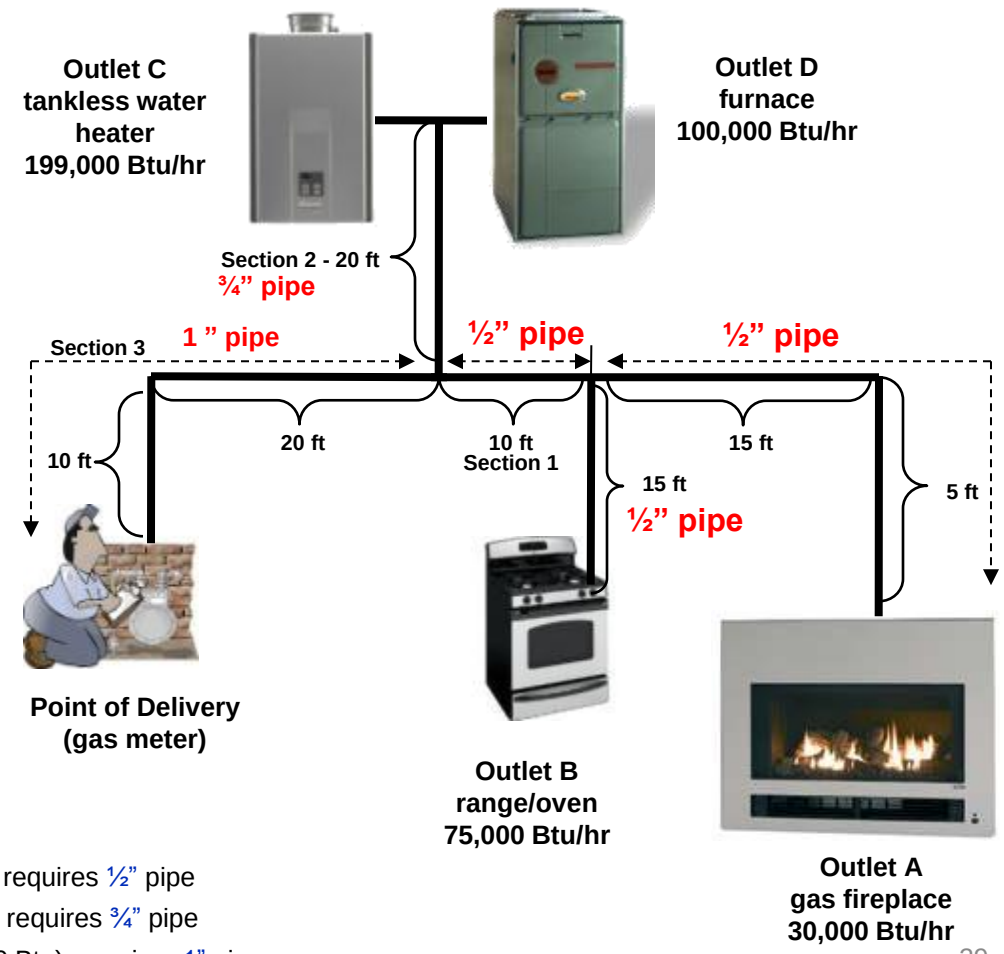
1. Determine the maximum gas (Btu) input for each appliance (see rating plate of appliance)
2. The total length of pipe from the point of delivery to the farthest appliance is 60 ft. **This is the only distance used** (longest length).
3. Refer to the appropriate table in the NFPA 54 manual. This will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

Schedule 40 Metallic Pipe, Natural Gas, less than 2 psi inlet pressure, 3.0" w.c. pressure drop, 0.60 specific gravity

Pipe Size (in.)					
Nominal:	½	¾	1	1 ¼	1 ½
Length (ft)	Capacity in Cubic Feet of Gas per Hour (CFH=Btu/1000)				
10	454	949	1,787	3,669	5,497
20	312	652	1,228	2,522	3,778
30	250	524	986	2,025	3,034
40	214	448	844	1,733	2,597
50	190	397	748	1,536	2,302
60	172	360	678	1,392	2,085
70	158	331	624	1,280	1,919

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

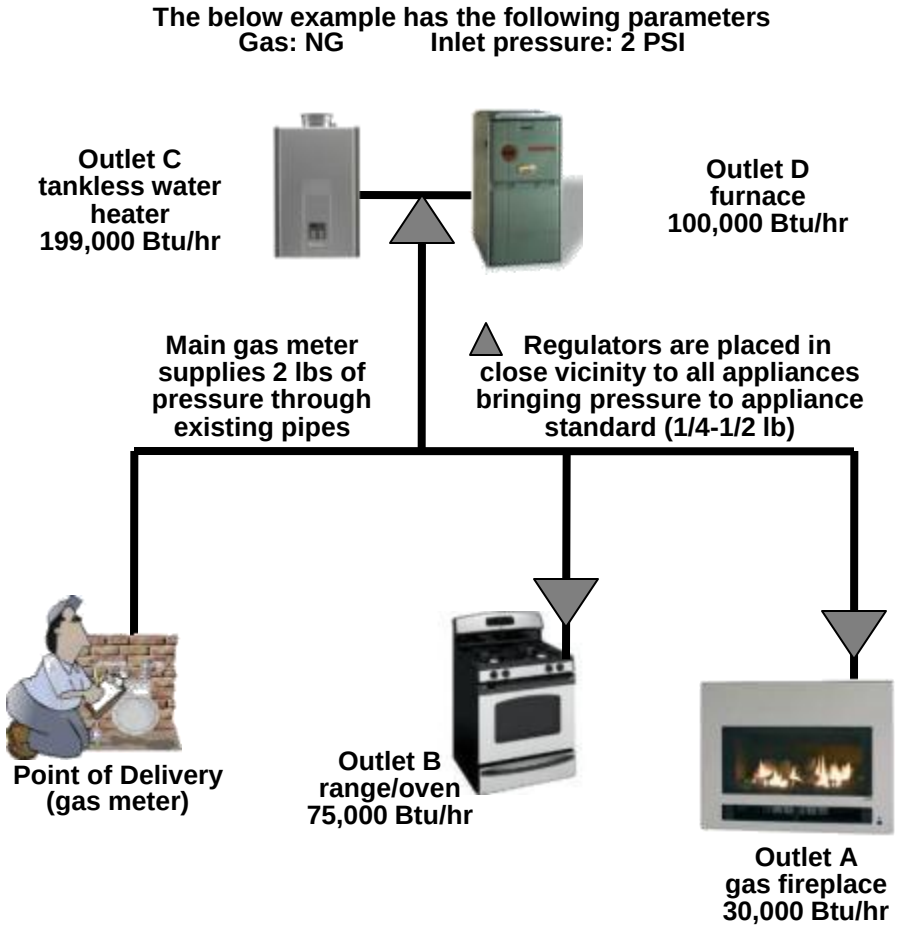
The below example Intended use is with initial supply pressure of 8"w.c. or greater.



Gas System – Two stage piping example
(All current models)

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

- Higher pressure (usually 2 lbs or approximately 56” w.c.) is supplied for a large portion of the supply system.
- Regulators are placed close to each appliance to reduce pressure to the appliance standard of ½ lb or approximately 7-14” w.c.
- This system overcomes volume inadequacies by raising the pressure. NOTE: Never apply high pressure (such as 2 lbs) to a household appliance unless stated by the manufacturer. All Rinnai tankless water heaters require no more than ½” lb inlet pressure (14” w.c.).
- Using the previous example, if the existing gas line did not meet the NFPA standard for ½ lbs pressure, the following two stage implementation could be an alternative
- 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

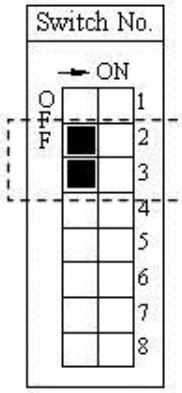
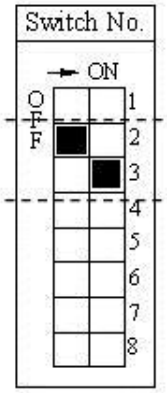
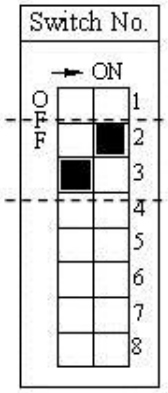
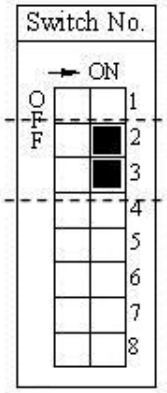


High Altitude Adjustments
(All current models)

Rinnai

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.
  (Output is affected by altitude DIP switch adjustments)

	0-2000 ft (0-610 m)	2001-5200 ft (610-1585 m)	5201-7700 ft (1585-2347 m)	7701-10200 ft (2347-3109 m)
Switch No. 2	OFF	OFF	ON	ON
Switch No. 3	OFF	ON	OFF	ON
				

VENTING REQUIREMENTS

- It is imperative to ensure proper vent guidelines are followed.
- Ensure non-condensing and condensing guidelines are understood.
- Do not mix vent parts or individual requirements between non-condensing and condensing models as dangerous safety conditions could occur!

! WARNING

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

Rinnai®

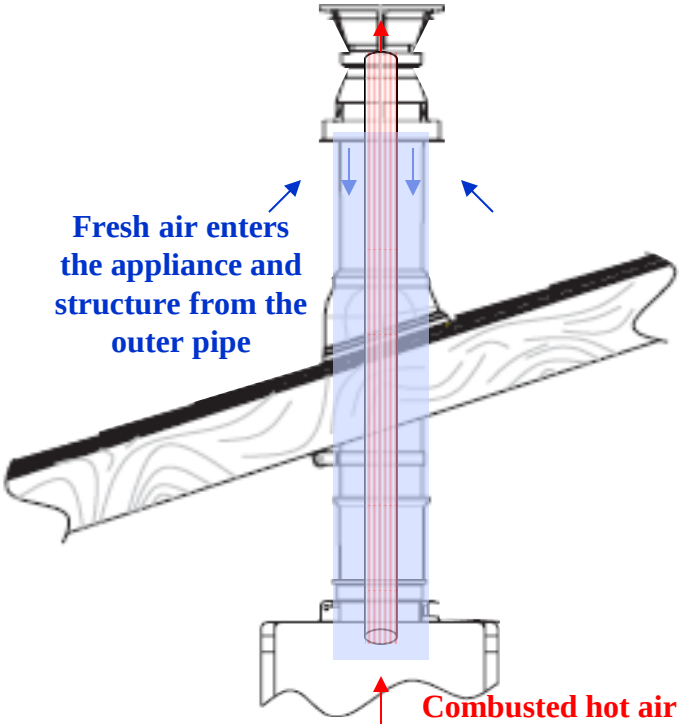
Intake / Exhaust Guidelines

For V65,V75/RL75, and RL94 indoor models only

- Rinnai tankless water heaters are direct vent appliances and therefore are certified and listed with the vent system. Only vent components that are certified and listed with the water heater model should be used. Refer to the following table:

Listed and Tested Vent Products for the V53, V65,V75, RL75 and RL94 indoor models	
Manufacturer	Product
Rinnai/Ubbink	Rolux Vent System (available through Rinnai-contact Rinnai for a detailed list of available components)
Heat-Fab	Saf-T Vent SC system
Metal-Fab	Corr/Guard Vent/Air Intake System

- The above listed models use a concentric venting system which allows zero clearance from combustibles.
  - These models are equipped with a female vent connection at the top of the water heater. Therefore, an appliance adaptor is NOT needed.
  - These models come equipped with an integrated condensation collector in the vent.



This is a balanced flue system. The incoming air keeps the pipe cool, allowing zero clearance for the venting system.

Indoor - Vent Length Calculator
(All current models)

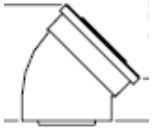
Rinnai

Elbow Length Calculator



= 6 Feet

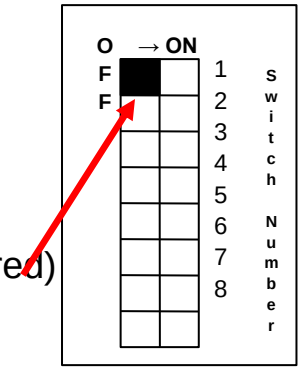
Each 90° pipe bend is equivalent to 6 feet of vent



= 3 Feet

Each 45° pipe bend is equivalent to 3 feet of vent

- Total equivalency cannot exceed 41 feet
- If the equivalency is greater than 21 feet, move DIP switch #1(bank of eight tan colored) to OFF
  (this switch is shipped in the ON position)



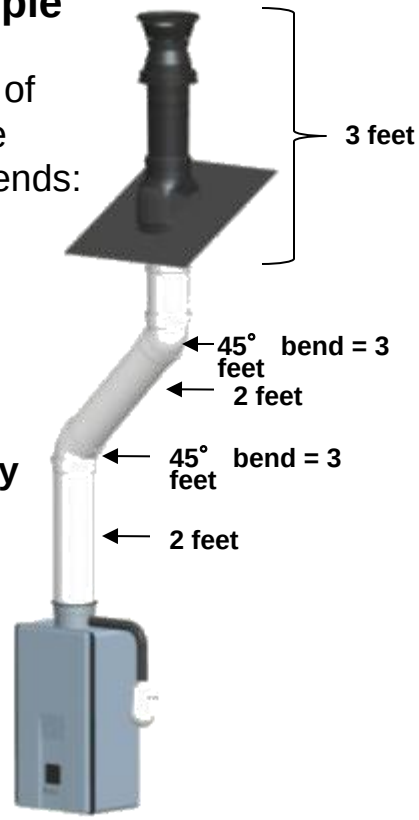
Vent Length Example

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



- Comply with all vent guidelines – refer to vent manufacturer and installation instructions.
- The R94/RL94 indoor model's maximum water flow capacity will be reduced by roughly 10% when DIP switch no. 1 is OFF.
- These images depict concentric venting. R98 models do not use concentric venting but use the same equivalency guidelines.

Vent Clearances – ANSI Standards

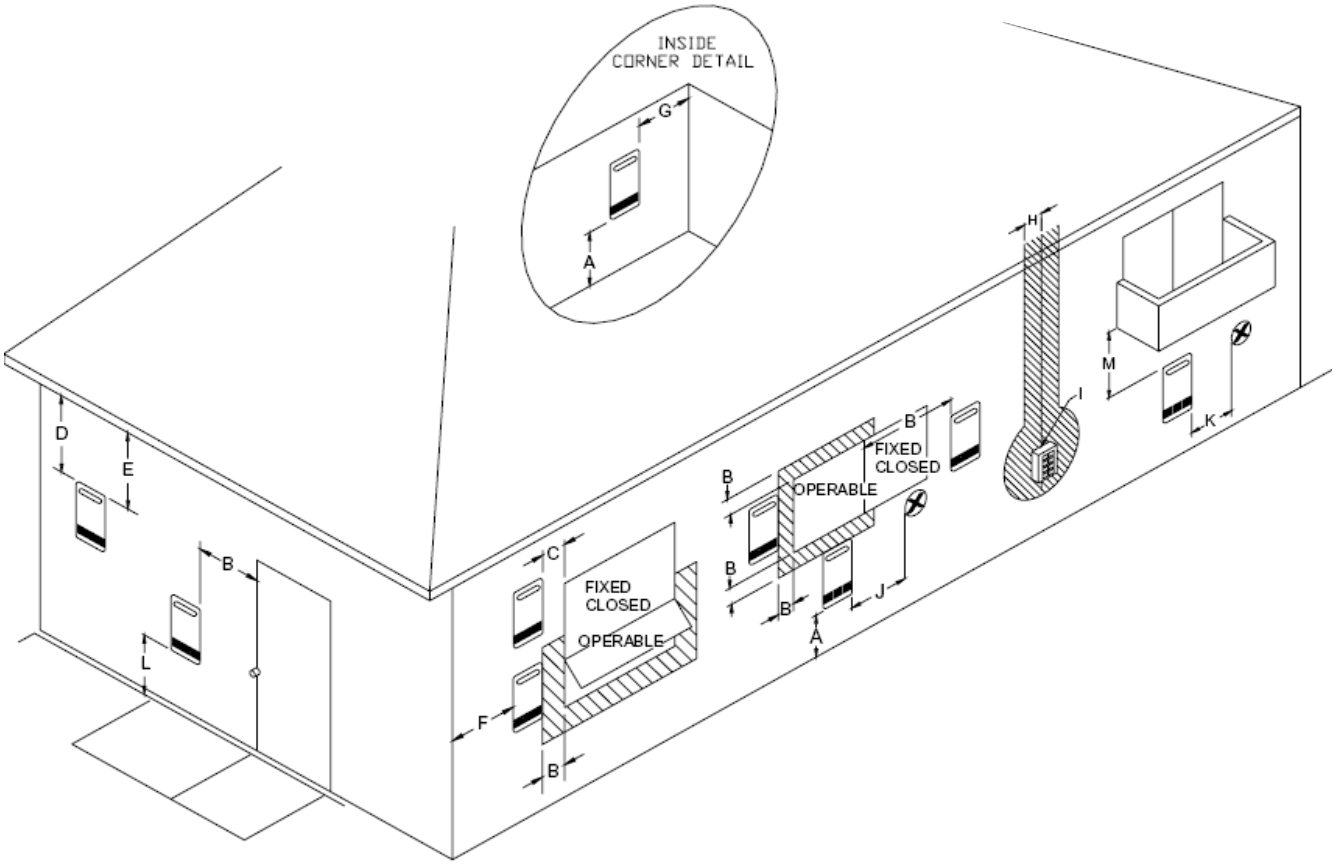
(for all Rinnai Water Heaters)

Rinnai

AIR SUPPLY INLET

VENT TERMINAL

AREA WHERE TERMINAL IS NOT PERMITTTED



See Chart on the following page for the ANSI recommended clearance of each corresponding letter

Vent Clearances (for all Rinnai Water Heaters)

View Structure on previous page

Ref	Description	U.S. Specifications	Canadian Specifications
A	Clearance above grade, veranda, porch, deck or balcony	12 inches (30 cm)	12” (30 cm)
B	Clearance to window or door that maybe opened	12 inches (30 cm)	36” (91 cm)
C	Clearance to permanently closed window	*	*
D	Vertical clearance to ventilated soffit, located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	*	*
E	Clearance to unvented soffit	*	*
F	Clearance to outside corner	*	*
G	Clearance to inside corner	*	*
H	Clearance to side of center line extended above meter / regulator assembly	*	3 feet (91 cm) within a height 15 feet (5 m) above the meter / regulator assembly
I	Clearance to service regulator vent outlet	*	36 inches (91 cm)
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	12 inches (30 cm)	36 inches (91 cm)
K	Clearance to a mechanical air supply inlet	3 feet (91 cm) above if within 10 feet (3 m) horizontally	6 feet (2 m)
L	Clearance above paved sidewalk or paved driveway located on the public property	*	7 feet (2.25 m) ①
M	Clearance under veranda, porch, deck, or balcony	*	12 inches (30 cm) ②

ANSI Z223.1

① A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

② Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor.

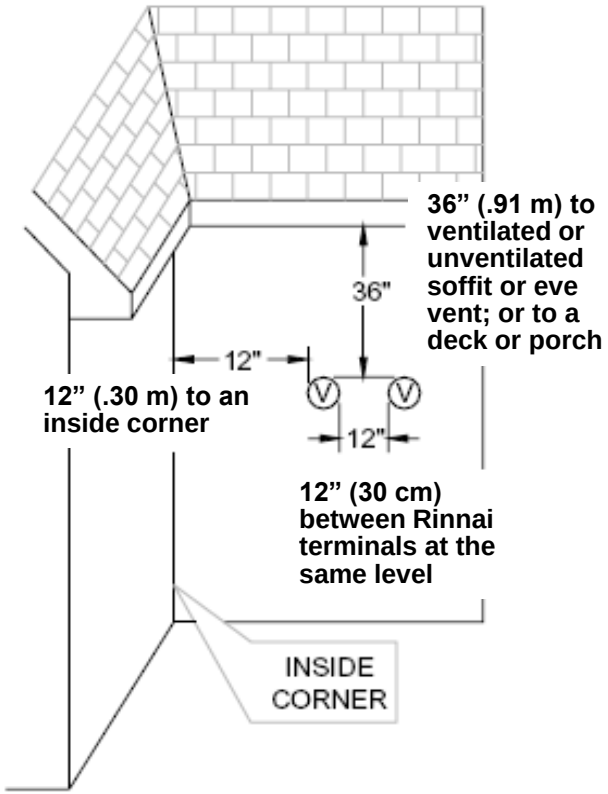
***** For clearances not specified in ANSI Z223. 1/NFPA 54 or CSAB149.1, clearances are in accordance with local installation codes and the requirements of the gas supplier.

Rinnai Vent Termination Requirements

(for all Rinnai Water Heaters)

Rinnai

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

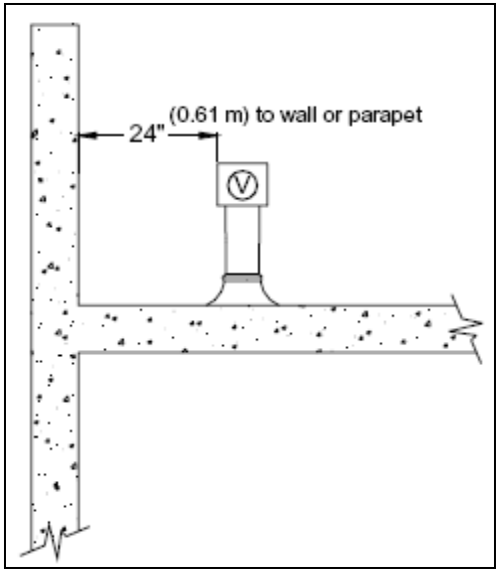


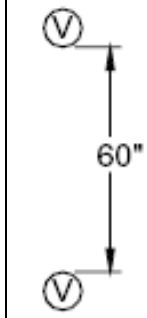
36” (.91 m) to ventilated or unventilated soffit or eve vent; or to a deck or porch

12” (.30 m) to an inside corner

12” (30 cm) between Rinnai terminals at the same level

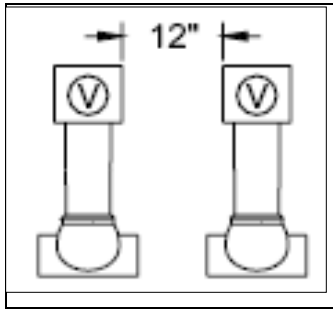
The above clearances also apply to external models.



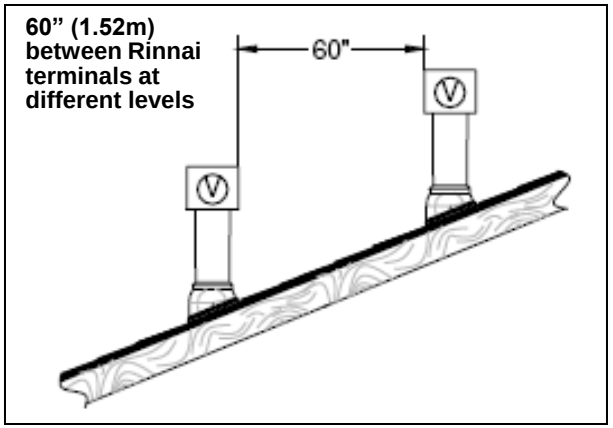


60” (1.52m) vertically between Rinnai terminals (Also applies to external models)

NOTE: It is acceptable to be within 60” vertically if a horizontal clearance of 12” is maintained



12” (30 cm) between Rinnai terminals at the same level



60” (1.52m) between Rinnai terminals at different levels

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

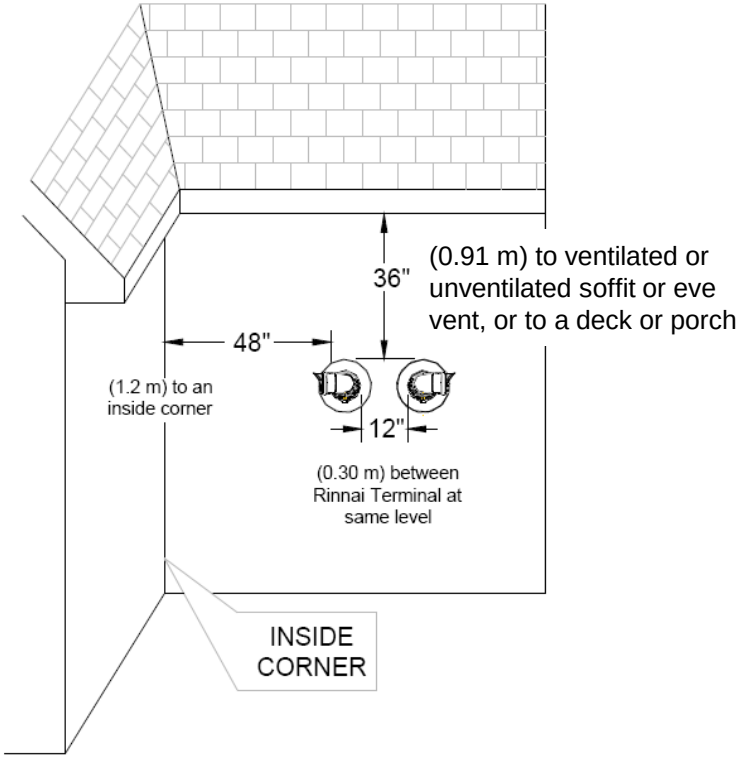
Rinnai Termination Diverter

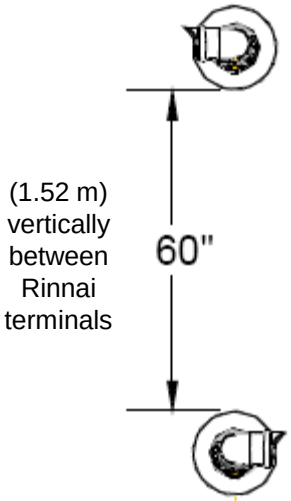
(for all Rinnai Water Heaters)

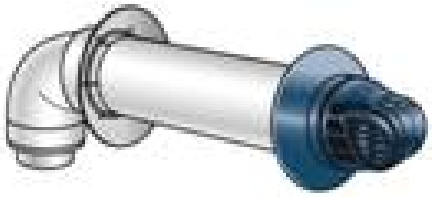
Rinnai has developed the termination diverter kit to redirect the vent plume to the sides (left or right). These diverter kits are available for non-condensing or condensing water heaters and condensing boilers.

They are designed to be used when the termination is less than four feet from an opposing structure. Some local, state and provincial codes specifically state a direct (perpendicular) termination cannot be used if an opposing structure is less than four feet.

Ensure the following clearances are followed:







The condensing diverter kit consists of the above components.

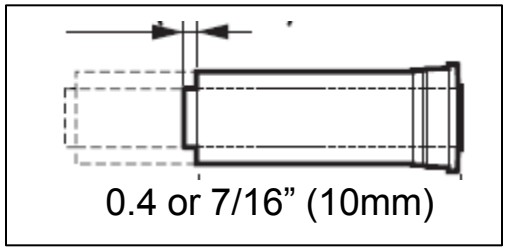


The non-condensing diverter kit consists of the above components.
NOTE: The termination elbow protrudes a little farther from the structure than the condensing kit. This is due to warmer exhaust temperatures

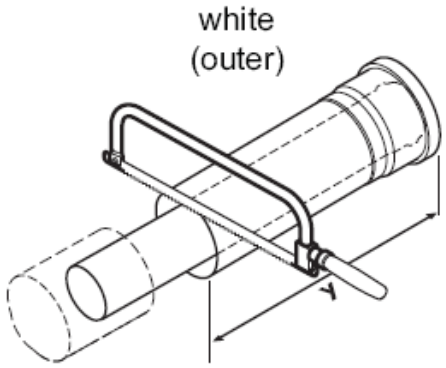
Cutting Ubbink Vent Pipe

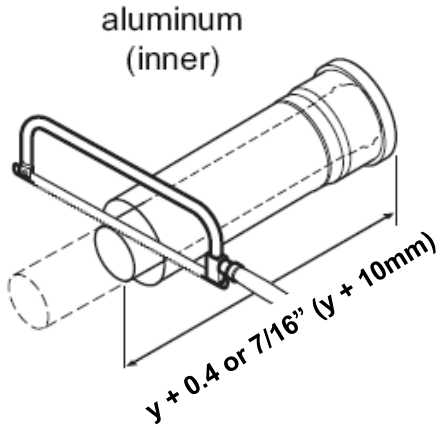
Improper installation of vent system and components, or failure to follow all installation instructions, can result in property damage or serious injury.

- Certain applications require the vent pipe to be shortened to fit the application
- Shortening of Vent Pipe Extensions –
  - The aluminum inside pipe should always extend 0.4 or 7/16” (10 mm) beyond the white outside of the male end of the vent extension.
- Always cut the male end of the vent pipe extension. Do not attempt to cut the female end.



Overall length = length of the outer pipe + 0.4 or 7/16”





- Ubbink also offers a telescopic vent extension that requires no cutting. This can reduce install time and prevent possible vent sealing issues.

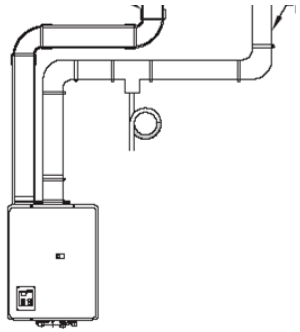


Telescopic vent effective length is 2.2” – 12”

Draining Vent Condensation
(Non-condensing models only)

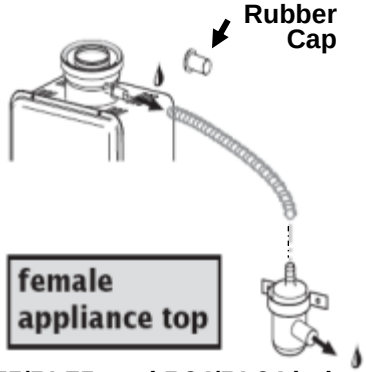
- Condensation occurs when the water created in the combustion process cools below the dew point. As this water vapor condenses, it combines with other combustion by-products to form an acid solution. The resultant acid will collect and eventually destroy the joints and seams of any vent system not designed and or installed to properly drain the condensate solution.
- Condensate formation can occur in mid and high efficiency direct vent appliances.
  - Even though many Rinnai tankless water heaters are referred to as “non-condensing” models, condensation can still occur in the vent system
  - Space provisions must be made to properly drain and dispose of the condensate.
  - The condensate drain trap must contain a minimum of 3” of water.
  - Dispose of condensate per local codes.

Rinnai products with a male appliance top require a discharge adapter



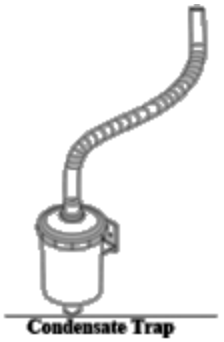
R98 LSi models

Rinnai products with a female appliance top have an integrated condensate collector. Removal of the rubber cap is required to connect the collector.



(R)V53i, R75/RL75, and R94/RL94 indoor models

Rinnai now offers a self priming condensate trap that does not require periodic priming



Part No.: 222053

Vent Termination

For V65i, V75i/RL75i, and RL94 indoor models only

Rinnai

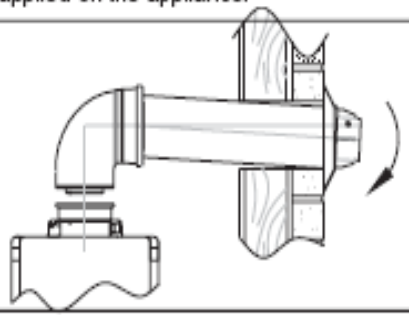
The diagrams illustrate the correct way to address condensation with Rinnai concentric vented water heaters ,V65, V75/RL75, RL94 indoor models only)

- The integrated condensate collector MUST BE used on all vertical vent terminations and on any horizontal vent termination where the vertical run exceeds 5 feet or two or more elbows exist.
- If the condensate collector is used in a horizontal vent termination, the exhaust venting MUST BE sloped 1/4" per foot towards the water heater.
- If no condensate collector is used in a horizontal vent termination the exhaust venting MUST BE sloped 1/4" per foot towards the exhaust terminal.
- The condensation trap MUST contain at least 3” of water

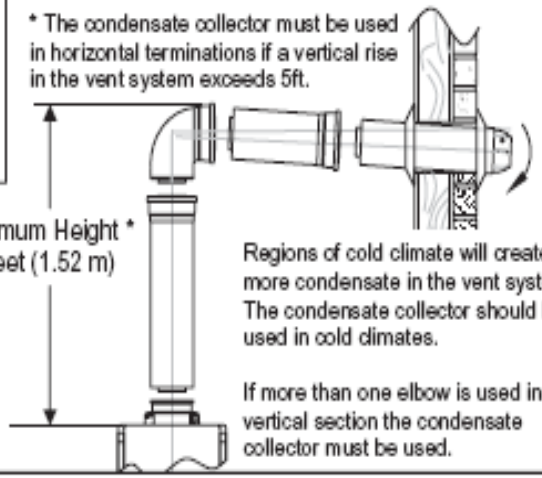
Horizontal Termination without using the Condensate Collector

⚠ WARNING

If the condensate collector is not used, the drain pipe must be capped to prevent exhaust gases and condensate from entering the building. The cap is supplied on the appliance.



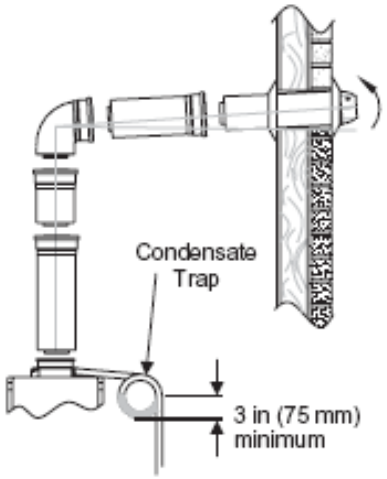
* The condensate collector must be used in horizontal terminations if a vertical rise in the vent system exceeds 5ft.



Regions of cold climate will create more condensate in the vent system. The condensate collector should be used in cold climates.

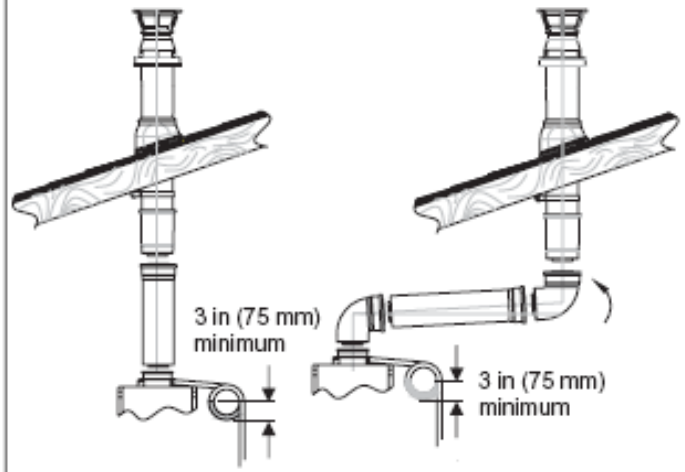
If more than one elbow is used in the vertical section the condensate collector must be used.

Horizontal Termination using the Condensate Collector



Vertical Termination

(condensate collector must be used in all installations)



Intake / Exhaust Guidelines

(For all Ubbink Pipe – aluminum or PP-s types)



Do not combine vent components from different manufacturers



The vent system must vent directly to the outside of the building with proper termination clearances



- Only the black portion of the vertical termination should be exposed to the exterior.
- No Ubbink pipe joints should be exposed to the outside



Do not connect the venting system with an existing vent or chimney



Do not use Class-B vent



Ubbink offers a paintable “snorkel” kit that will in many cases allow for a low structure termination while protecting all joints. This accessory is available for non-condensing or condensing models—the part number is different for each—ensure the correct part is used!

- Vent diameter must not be reduced
- Do not common vent with the vent pipe of any other water heater or appliance

Temperature Controllers
(for all current Rinnai Water Heaters)

Temperature Control guidelines are identical for non-condensing and condensing models



MC-91 **(temp range 98˚ -140˚)**
MCC-91*(temp range 98˚ -185˚)
***for commercial / hydronic use only**



MC-100



BC-100

All current Rinnai models will accept up to four temperature controllers installed in parallel in any combination (Exception: only one MC-100 per unit and/or one BC-100 per unit)

MC-91/MCC-91 Temperature Controls
(For all current Rinnai Water Heaters)

Rinnai

TEMPERATURE INDICATION

Indicates the selected water temperature. Diagnostic Codes flash if operator intervention is required.

THERMOSTAT

Increases or decreases the desired water temperature

MODEL NUMBER



IN USE INDICATOR

Indicates that the unit is in operation

PRIORITY BUTTON & INDICATOR

When multiple controllers are installed, the priority button allows each to individually set temperature output of the water heater. The priority indicator reports which controller has control.

ON/OFF BUTTON

MC-100/BC-100 Temperature Controllers
(For all current Rinnai Water Heaters)

MC-100 and BC-100 controllers have the same features and the MC-91 plus these additional benefits:

MC-100



IN USE INDICATOR

Flame indicates unit is in operation

FUNCTION

Sets time and sound volume

CALL BUTTON

Pages (by beeping) all other temperature controllers installed on the same water heater

TIME DISPLAY

Also available on BC-100

BATH FILL AND WATER VOLUME BUTTONS**

Bath fill allows a specific volume and temperature of water to be programmed to fill a tub. Once that amount of water is delivered, water heater will stop hot water deliver.

- "Bath" will show on the BC-100 and MC-100 when in use (see MC-100 picture).
- The fill amount and remaining fill volume will be displayed as well



BC-100

POWER SAVER

Turns display off after extended non-use to save energy

The MC-100 also has an extended diagnostic menu to aid in servicing. Contact Rinnai technical support for additional information.

*Bath fill feature allows temperature adjustments from 98º F to 120º F. The BC-100 monitors flow through one water heater.

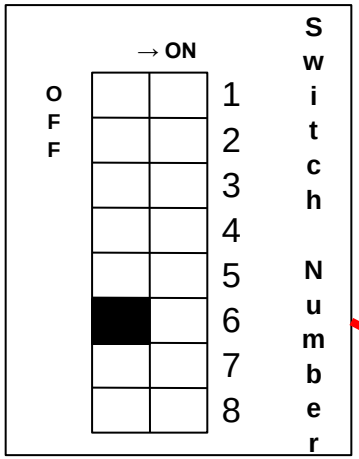
<u>DO NOT</u> use this feature in applications with two or more water heaters. Do not use with single handled fixtures. Use only hot water when using the BC-100 controller.

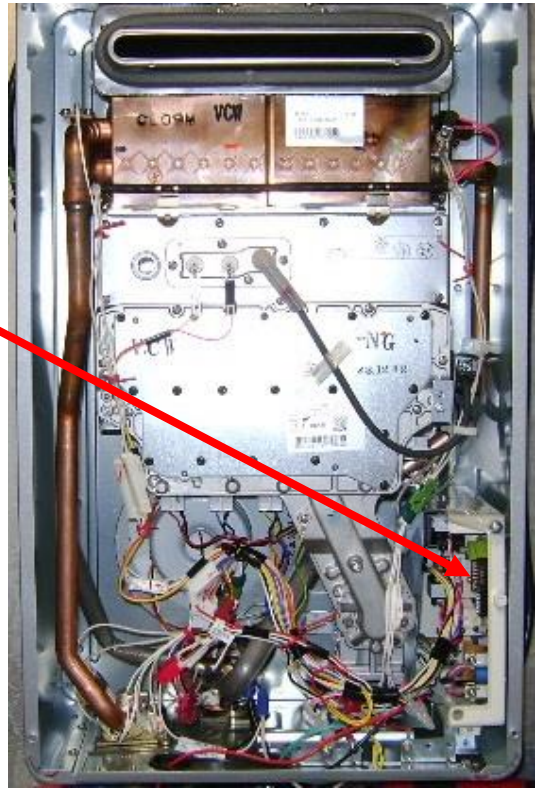
Temperature Controller Range
(for all current Rinnai Water Heaters)

- **All water heaters* manufactured July, 2008 or after have the following temperature adjustment features:**

- **Maximum default production temperature setting of 120º F (49º C)**
  - Meets requirements of various local codes
  - Enhances safety of users, especially children and the elderly
  - Temperatures between 125 – 140º (52º - 60ºC) are available by setting DIP switch 6 to the ON position in the SW1 bank of 8 (tan colored) DIP switches

*The V53e does not default at a max of 120˚ F with an MC-91 (or similar controller). These models will always max at 140˚ F. DIP switch 6 is allocated for another use.





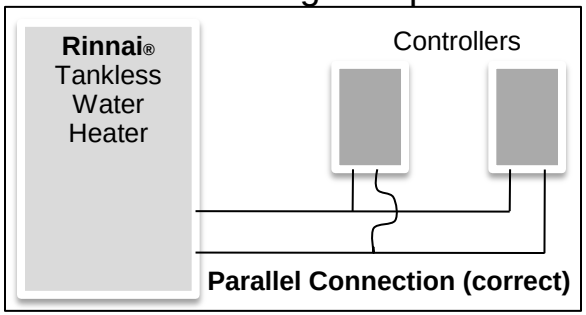
Temperature Controller Installation
(for all current Rinnai Water Heaters)

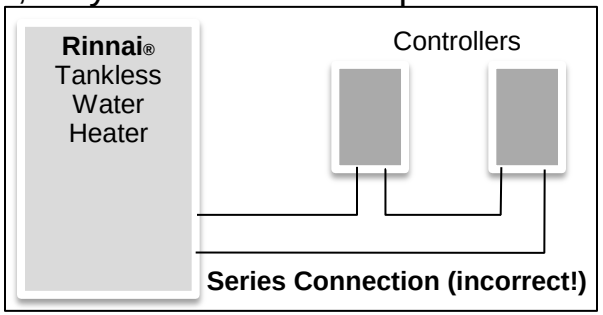
Temperature controller connection



*The connection for temperature controllers for the V53e is located on the bottom of the cabinet

- Refer to owner's / installation manual of each model for specific installation instructions
- Controller wires are to be connected to the unit where indicated . Wires are not polarity sensitive.
- Indoor models come with a temperature controller integrated into the front cover and its wiring already connected.
- Outdoor models come with an independent temperature controller to be installed remotely.
- Controllers operate on 12 VDC supplied from the PCB and should never be connected to supply voltage (120 VAC)
- Controllers can be located anywhere in the structure protected from heat, direct sunlight, water, and small children
- Standard thermostat wire can be used to connect the controller to the water heater if needed
- When connecting multiple controllers, they must be wired in parallel:





Temperature Controller - Guidelines

(For all current Rinnai Water Heaters)

The below table indicates current model controller compatibility and temperature ranges.

	WATER HEATER Model #	Shipped with MC-91 to be installed remote from unit	Shipped with MC-91 factory installed in front cover of unit**	Temperature with no remote	Temperature range when installed with MC-91, MC-100, BC-100	Temperature range when installed with MCC-91*
Indoor	RL75i/V75i, V65i		✓	Default - 120° F 140° F can be achieved by adjusting DIP switches (see install manual)	98°-140° F	98°-160° F
Indoor	RL94i, R98LSi, RU80i, RU98i		✓			98°-185° F
Outdoor	RL75e/V75e	✓				98°-160° F
Outdoor	RL94e, R98LSe, RU80e, RU98e	✓				98°-185° F
Outdoor	V53e	V53 models are not shipped with a temperature controller. They do have an error code display and can accept controllers				98°-160° F See note below

***commercial applications only**

- Controllers can be installed virtually anywhere within a structure (i.e. kitchen, laundry, master and/or secondary bath)
- Up to four temperature controllers can be installed for each water heater.
- All units require the installation of one MCC-91 controller to achieve commercial-level temperatures. All other controllers installed on the same water heater will then be able to achieve commercial level temperatures as well.
- An MCC-91 controller is not required where commercial application temperatures do not exceed 140˚ F
- The MCC-91 controller can be installed for additional commercial applications that require temperatures up to 185˚ F such as commercial kitchens and hydronic applications
- Value series units are not approved for commercial use but can use an MCC-91 controller for hydronic applications

Temperature Controller – Adjustments and Troubleshooting

(For all product prior to VC and KB series Rinnai Water Heaters)



MC-91-1US

Standard with all new units

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

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

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

To mute the audible beep:

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

All temperature controllers also provide the following diagnostic capabilities:

To display water flow (GPM) through water heater:

Press ▲, hold for 2 seconds, and simultaneously press On/Off

To display outlet water temperature:

Press ▼, hold for 2 seconds, and simultaneously press On/Off

To display previous maintenance codes:

Press On/Off, hold for 2 seconds, and simultaneously press ▲

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

Controller Changes

- MC-91-1 and MCC-91-1 changing to MC-91-2 and MCC-91-2
  - MC-91-2/MCC-91-2 controllers are backwards compatible
- An additional table of temperature increments is available ("alternate temperature settings")
  - For commercial applications ONLY
  - Intended to provide additional increments between 140° F and 185° F
  - These can only be accessed with the new "-2" controllers
- Controller now has locking function and increased diagnostics capability.
- Controller in interior units can NOT be removed and used as a remote control.
  - Relocation kits no longer necessary

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

Rinnai



MC-91-2US

Standard with all VC and KB series units

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

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

To Lock the controller on a set temperature:

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

To mute the audible beep:

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

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

To display previous maintenance codes:

Press On/Off, hold for 2 seconds, and simultaneously press ▲

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

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

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

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

New Alternate Temperature Settings

Rinnai

Temperature Settings Available (Fahrenheit °F)															
RL75i, RL75e RL94i, RL94e	98	100	102	104	106	108	110	115	120	125 *	130 *	135 *	140 *	150 **	160 **	185**
Celsius °C	37	38	39	40	41	42	43	46	49	52	54	57	60	66	71	85

A different range of temperature setting is available by setting switches 2 and 3 of the SW2 dip switch (white switches) to on. The table below shows the settings available with the MC-91-2 and MCC-91-2.

New settings

Alternate Temperature Settings Available (Fahrenheit °F)																
RL75i, RL75e RL94i, RL94e	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185
Celsius °C	43	46	49	52	54	57	60	63	66	68	71	74	77	79	82	85

MC-91-2

MCC-91-2

⚠ WARNING

MC-91-1, MCC-91-1, MC-100V-1, and BC-100V-1 controllers are not compatible with Alternate Temperature Settings. Alternate Temperature Settings are for commercial applications only.

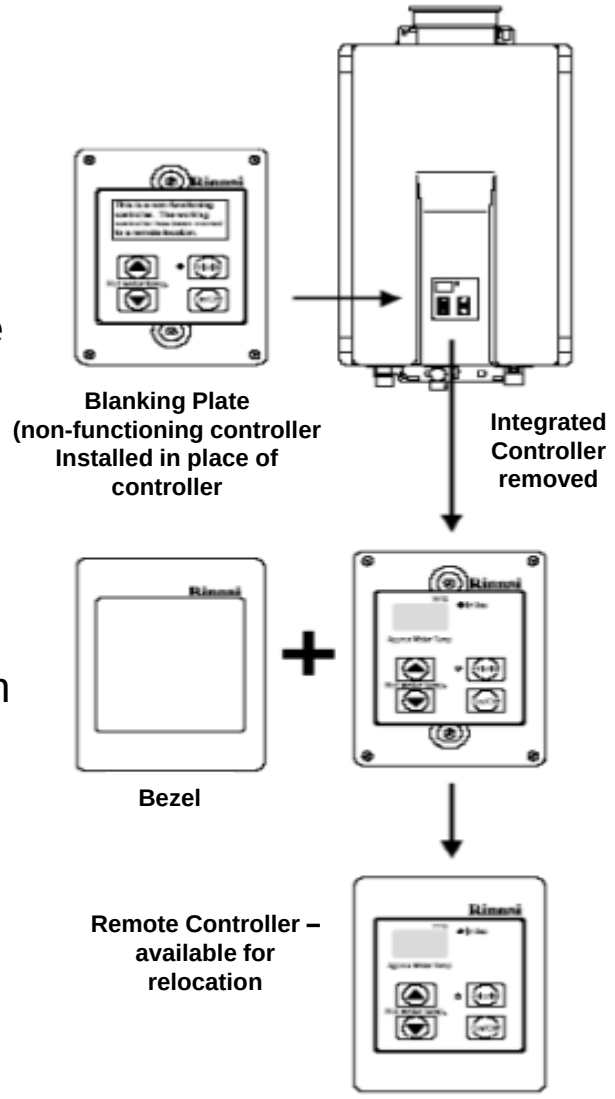
DO NOT use the MC-91-1, MCC-91-1, MC-100V-1, or BC-100V-1 controllers when dip switches 2 and 3 (bank of 6) are in the ON position.

Note: SW2 bank of dip switches (white) on some units will have a bank of 8

Temperature Controller - MC-91 Relocation Kit
(Not used for VC or KB series Water Heaters)

If an indoor water heater (with the MC-91 integrated in the front cover) is placed in an inaccessible location, like an attic or crawl space, the installer could use this kit to remove the MC-91 from the front panel and relocate it to a remote location.

- This kit fills the hole left after relocating the working controller
- The working MC-91 controller assembly lacks an outer trim piece (bezel) and so requires that the bezel that comes with the kit be snapped on to make it look like a complete unit.
- Accessory part number: MC-91-1US-S-RK



WARRANTY

&

MAINTENANCE

Rinnai®

Warranty-All Models*

Residential			Commercial		
Heat Exchanger	Parts	**Labor	Heat Exchanger	Parts	**Labor
12 or 10 (model dependent)	5	5	5	5	2

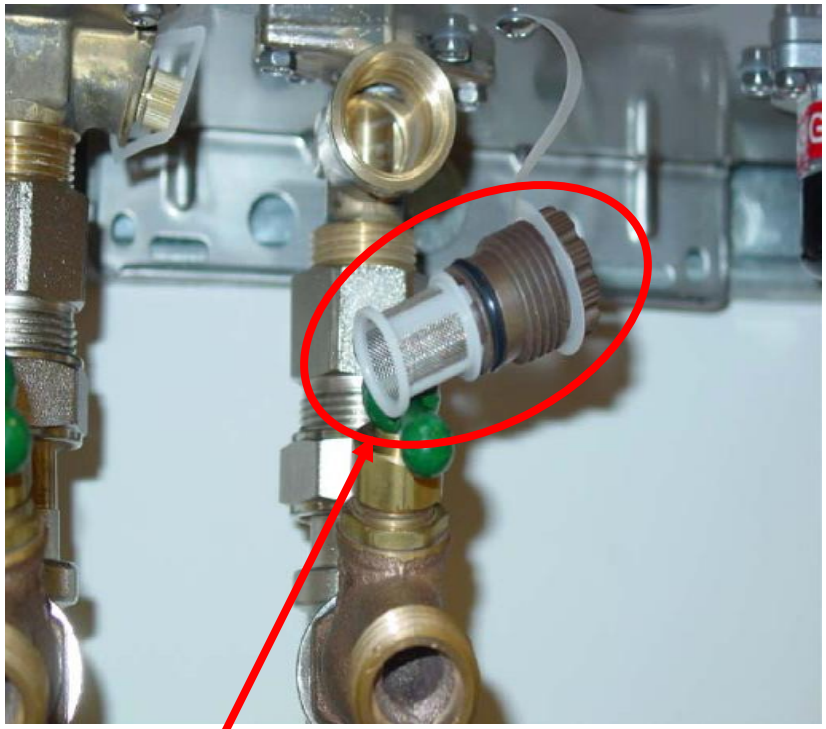
V53e, V65i/e, and V75i/e models have a 10 year heat exchanger ***and 1 year Labor warranty* / all other models have a 12 year heat exchanger warranty. Previous model warranties may vary *See Owner's manual for complete warranty guidelines

KEY POINTS OF LIMITED WARRANTY COVERAGE (all models)

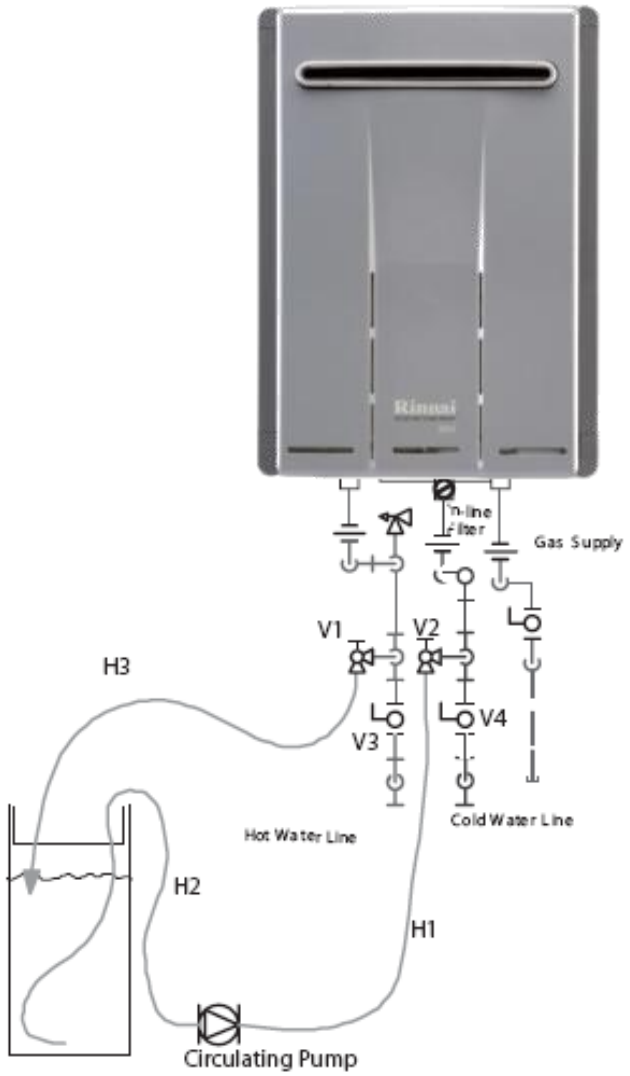
- **Labor: 5 years residential / 2 years commercial for RL / RU / R98LS models when registered within 30 days of installation, 1 year all other applications and models, *** Heat exchanger warranty increased from 10 to 12 years if a isolation valve kit is installed on Value series.
- 3-year heat exchanger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

Maintenance – Inlet Water Filter
(All Rinnai Models)

- Rinnai recommends that the inlet water filter be cleaned before the initial operation of a new unit.
- 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.
- See filter location in picture at right.
- The filter assembly should be hand tightened only.



Maintenance – Service Flush Procedure
(All Rinnai Models)



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
2. Close the shutoff valves on both the hot and cold water lines (V3 and V4)
3. Connect pump outlet hose (H1) to the cold water line at service valve V2
4. Connect drain hose (H3) to service valve V1
5. Pour approximately 4 gallons of virgin food grade white vinegar or citric acid into pail
6. Place the drain hose (H3) and the hose (H2) to the pump inlet into the cleaning solution
7. Open both service valves (V1 and V2) on the hot and cold water lines
8. Operate the pump and allow the cleaning solution to circulate through the water heater for at least 45 minutes
9. Turn off the pump
10. Rinse the cleaning solution from the water heater by:
    a. Remove the free end of the drain hose (H3) from the pail and place in a suitable drain
    b. Close service valve, V2, and open shutoff valve, V4. Do not open shutoff valve, V3.
    c. Allow water to flow through the water heater for 5 minutes
    d. Close service valve, V1, and open shutoff valve, V3
11. Disconnect all hoses
12. Remove the in-line filter at the cold water inlet and clean out any residue
    a. Place the filter back into the unit
13. Restore electrical power to the water heater

Maintenance Codes
(All Rinnai Models)

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

NOTE: THE BELOW IS A PARTIAL LIST OF CODES—SEE THE INSTALLATION MANUAL FOR A COMPLETE LIST

ERROR	FAULT	REMEDY
02	No burner operation during freeze protection mode	- Service Call
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 - Ensure condensation collar was installed correctly - Verify DIP switches are set properly - Check fan for blockage
11	No Ignition	- Check that the gas is turned on at the water heater, gas meter, or cylinder - Ensure gas type and pressure is correct - Bleed all air from gas lines - Ensure gas line, meter, and / or regulator is sized properly - Verify DIP switches are set properly - Ensure appliance is properly grounded - Remove burner cover and ensure all burners are properly sealed and seated - Remove burner plate and inspect burner surface for condensation or debris - Check for obstructions in the flue outlet - Ensure proper Rinnai venting material was installed and vent length is within limits - Check power supply for loose connections and ensure proper voltage and voltage drops - Ensure flame rod wire is connected - Check flame rod for carbon build up - Check all components for electrical short - The above is an abbreviated list—see the installation manual for more information
12	Flame Failure	

(Continued on next page)

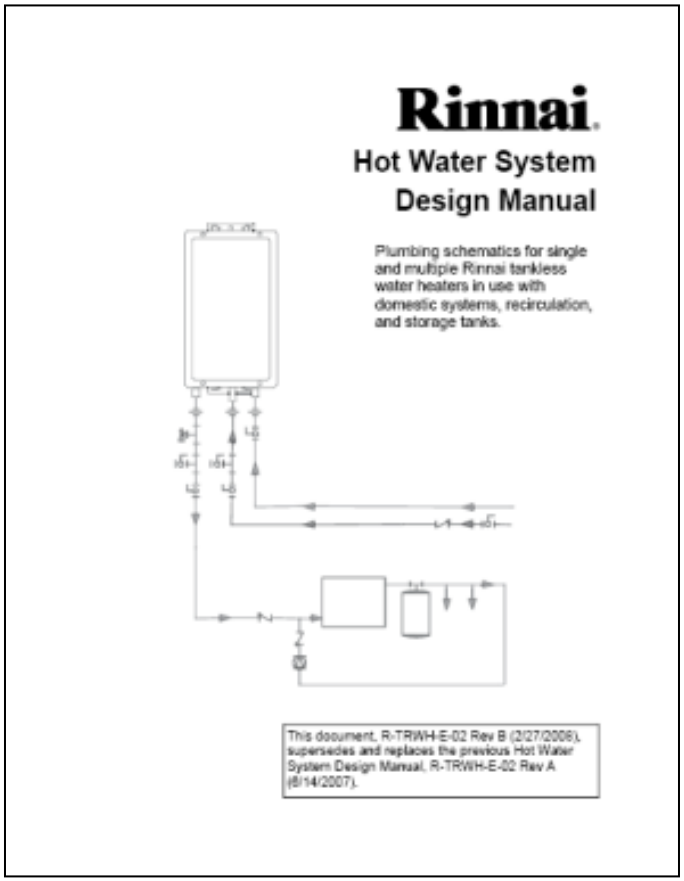
Maintenance Codes - continued
(All Rinnai Models)

ERROR	FAULT	REMEDY
14	Thermal Fuse	- Check gas type of unit and ensure it matches gas type being used - Check for low water flow in a circulating system causing short cycling - Ensure DIP switches are set to the proper position - Check heat exchanger for cracks and/or separations - Check heat exchanger for blockage due to scale build up. Refer to flushing instructions. - Measure resistance of safety circuit - Ensure high fire and low fire manifold pressure is correct - Check for improper conversion of product - The above is an abbreviated list—see the installation manual for more information
25	Condensation Trap Error (Condensing models only)	– The condensation container is full – Ensure container can drain water adequately – Ensure that the condensate drain line does not have a drain loop
31	Burner Sensor Faulty	– Check sensor wiring for damage – Measure resistance of sensor – Clean sensor of scale build-up – Replace Sensor
32	Outgoing Water Thermistor Faulty	
33	Heat Exchanger Outgoing Thermistor Faulty	
34	Combustion Air Thermistor Faulty	
52	Modulating Solenoid Valve Signal Abnormal	– Check modulating gas solenoid wire harness for loose or damaged terminals – Measure resistance of valve coil
61	Combustion Fan Failure	– Ensure fan will turn freely – Check wiring harness to motor for damaged and/or loose connections – Measure resistance of motor windings
LC (00)	Scale Build-up in Heat Exchanger (“00” is substituted for “LC” in diagnostic code history)	- Flush heat exchanger. Refer to instructions in manual. - Replace heat exchanger
No Code	Nothing happens when water flow is activated.	- Clean inlet water supply filter - On new installations, ensure hot and cold water lines are not reversed - Check for crossover - Ensure turbine spins freely - Measure the resistance of the water flow control sensor - Ensure minimum flow rate to fire unit is present - The above is an abbreviated list—see the installation manual for more information

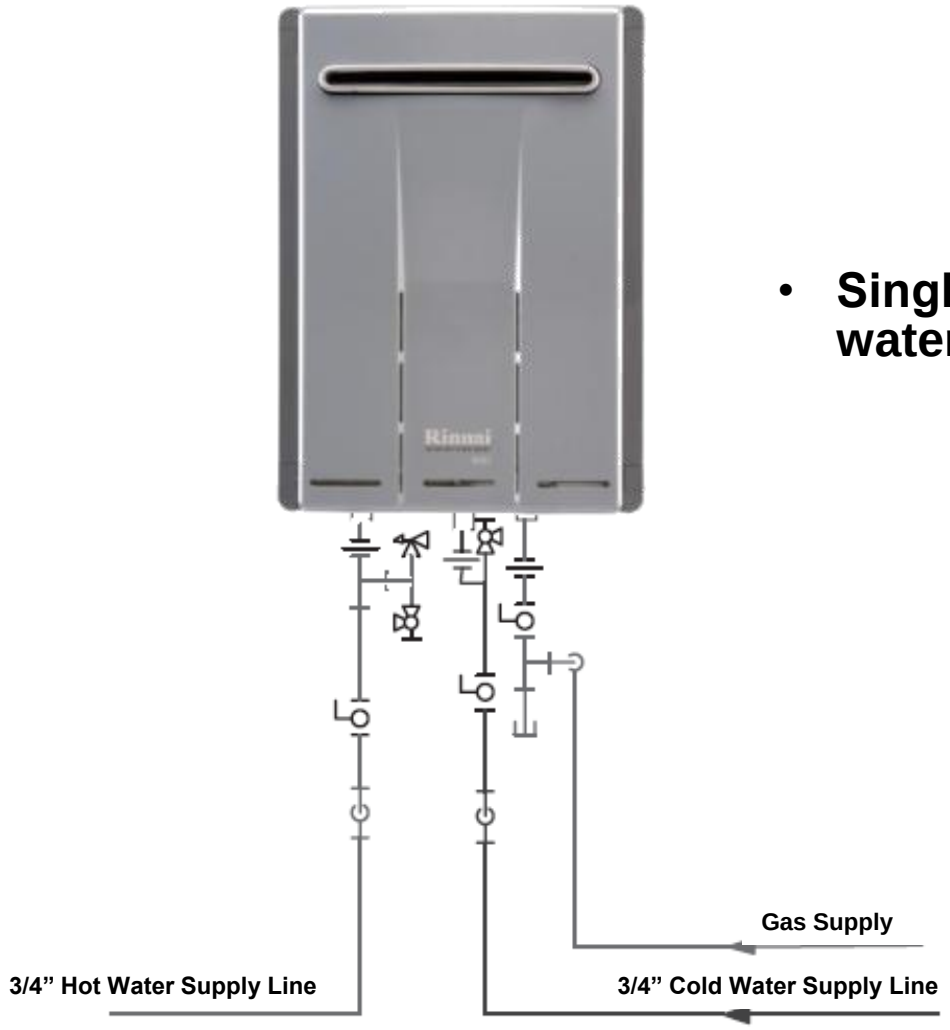
VARIOUS INSTALLATION DRAWINGS

Rinnai's Engineering / Application department is available for assistance in sizing residential and commercial projects. Please call 1-800-621-9419.

- DO NOT use the following drawings for piping systems. These are only intended to be used as examples, and may not include all the components needed for all applications.
- For additional drawings and sizing information please review the Rinnai Hot Water System Design Manual available or Rinnai's sizing calculators available at www.rinnai.us or by calling 1-800-621-9419.
- It is the engineer / contractors responsibility to ensure that installation is in accordance with all local and state building codes. Confer with your local building officials before installation.



Piping – Standard Installation

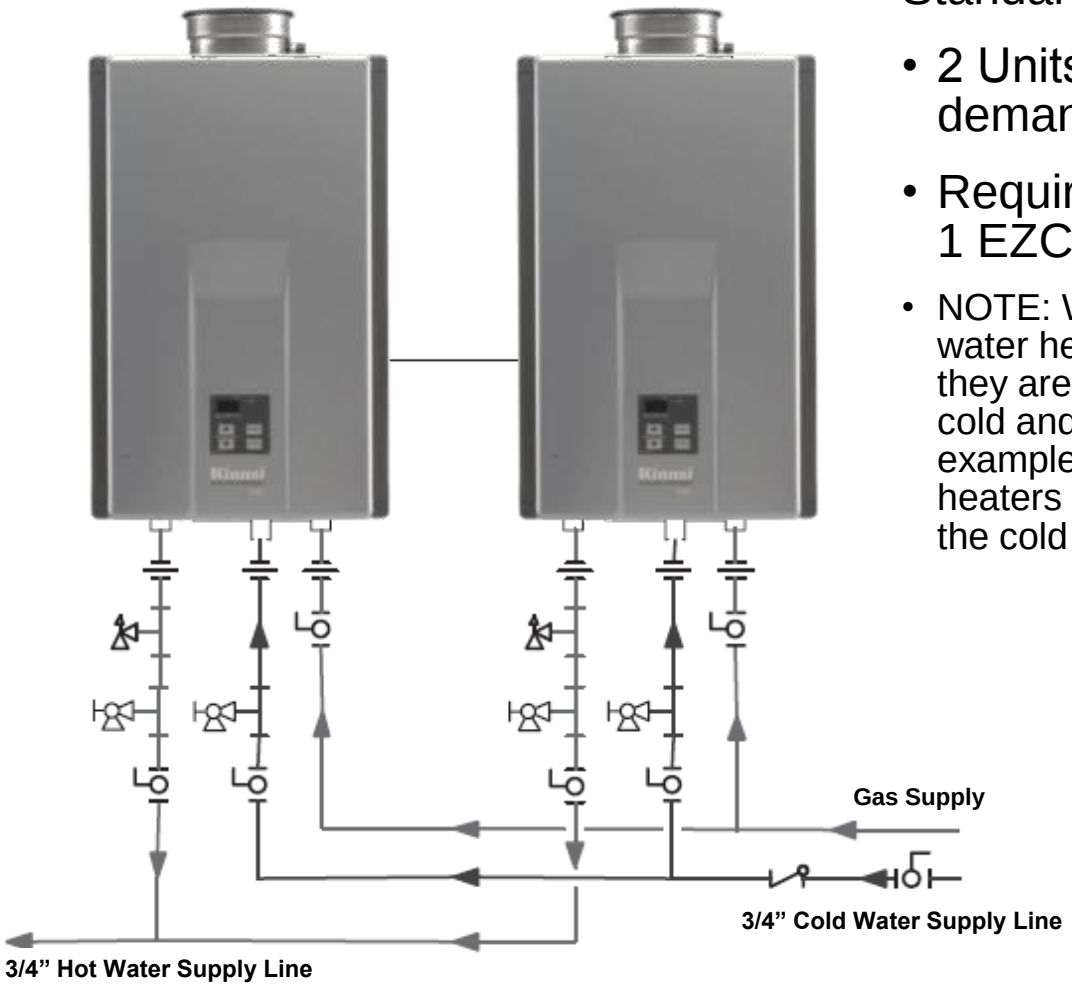


Standard Installation

- **Single Unit based on structure’s hot water demand (bathrooms / fixtures)**

Example Drawing Only

Piping – Multi Unit Application

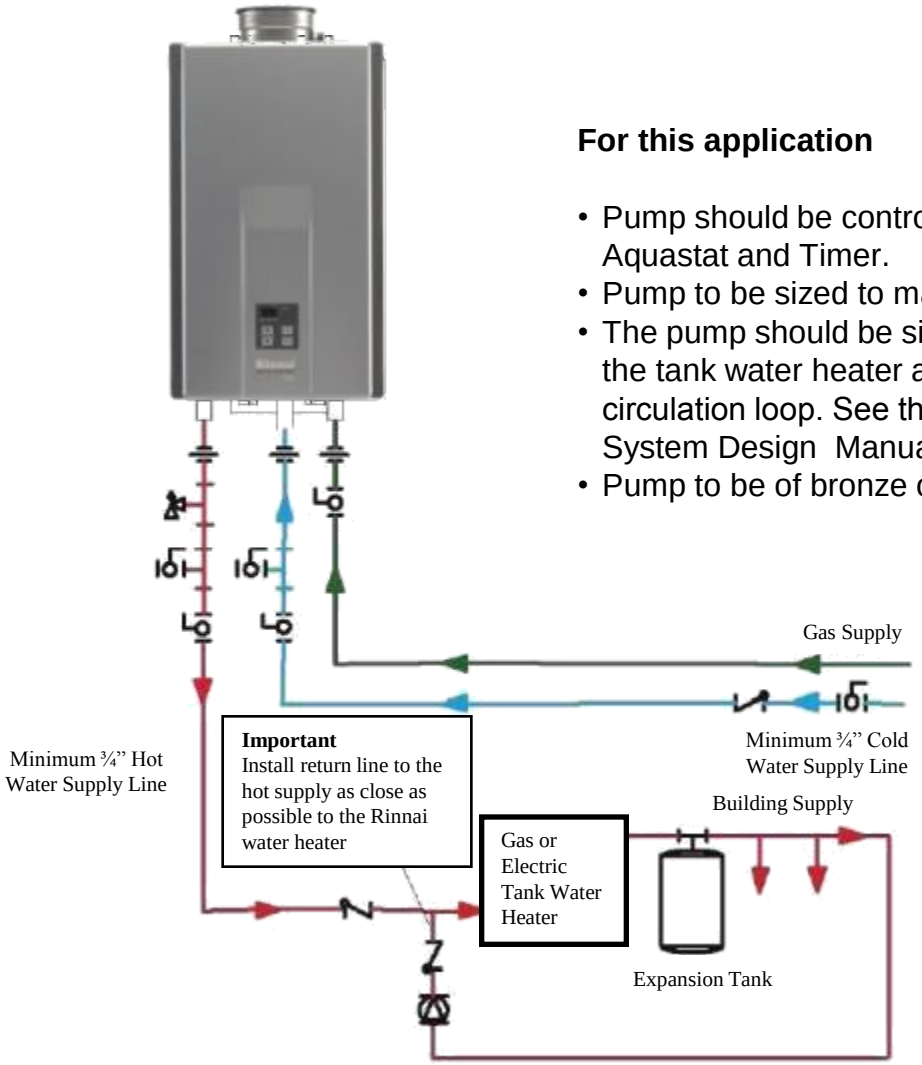


Standard Installation

- 2 Units based on structure’s hot water demand (bathrooms / fixtures)
- Required accessories:
  1 EZConnect® Cable (preferred)
- NOTE: When using two or more Rinnai tankless water heaters in the same plumbing system, they are always to be piped in parallel (common cold and common hot lines)—as shown in this example. Never pipe Rinnai tankless water heaters in series (hot outlet of one unit enters the cold inlet of another).

Example Drawing Only

Recommended Piping-Recirculation



For this application

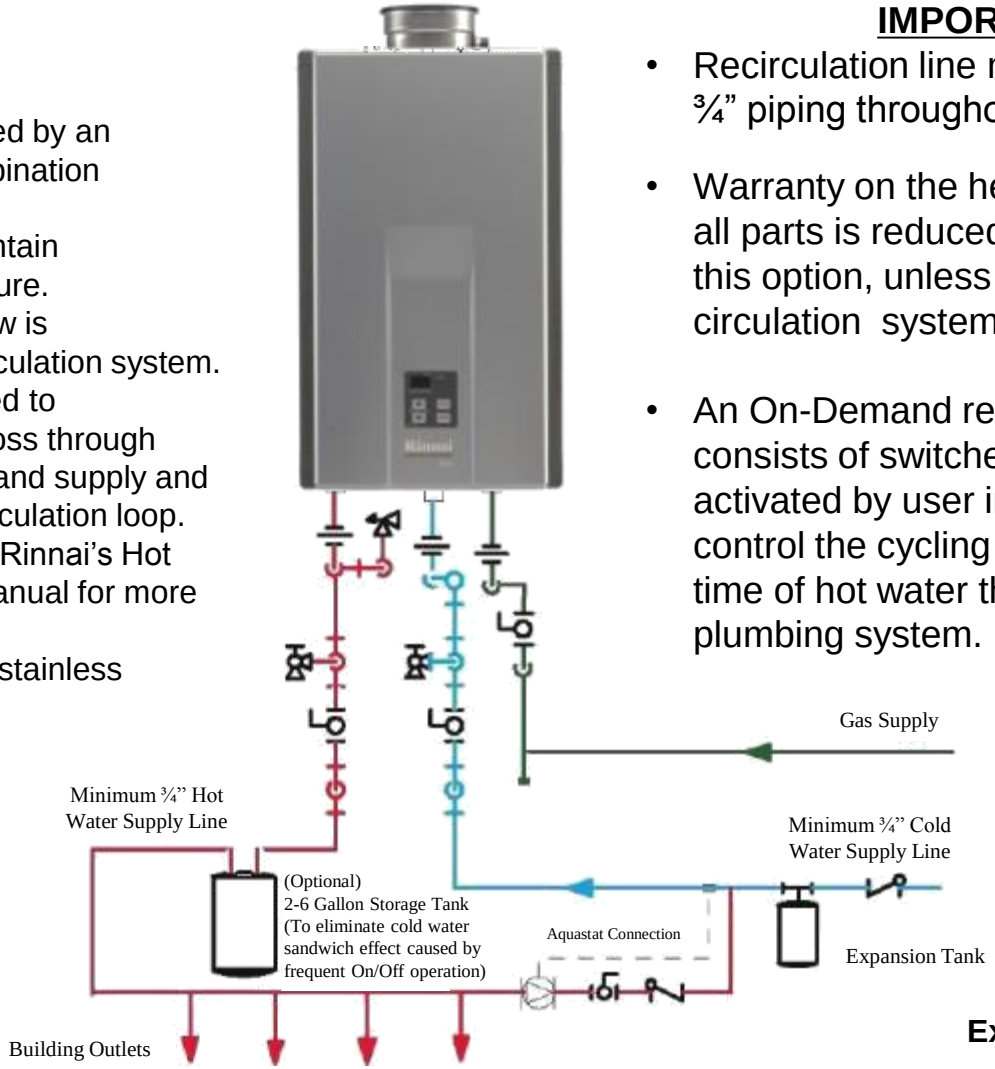
- Pump should be controlled by an Aquastat, Timer, or combination Aquastat and Timer.
- Pump to be sized to maintain circulation loop temperature.
- The pump should be sized to overcome the pressure loss through the tank water heater and supply and return plumbing in the circulation loop. See the latest release of Rinnai's Hot Water System Design Manual for more information.
- Pump to be of bronze or stainless construction.

Example Drawing Only

Optional Piping-Recirculation

For this application

- Pump should be controlled by an Aquastat, Timer, or combination Aquastat and Timer.
- Pump to be sized to maintain circulation loop temperature.
- A minimum of 3 GPM flow is recommended for the circulation system.
- The pump should be sized to overcome the pressure loss through the Rinnai, storage tank and supply and return plumbing in the circulation loop. See the latest release of Rinnai's Hot Water System Design Manual for more information.
- Pump to be of bronze or stainless construction.



Example Drawing Only

IMPORTANT

- Recirculation line must be a minimum ¾" piping throughout
- Warranty on the heat exchanger and all parts is reduced to three years with this option, unless an on demand circulation system is installed.
- An On-Demand recirculation system consists of switches or motion sensors activated by user intervention to control the cycling time and circulation time of hot water throughout the plumbing system.

Circulation System

For this application:

Pump should be controlled by an Aquastat. Timer or Combination Aquastat and Timer.

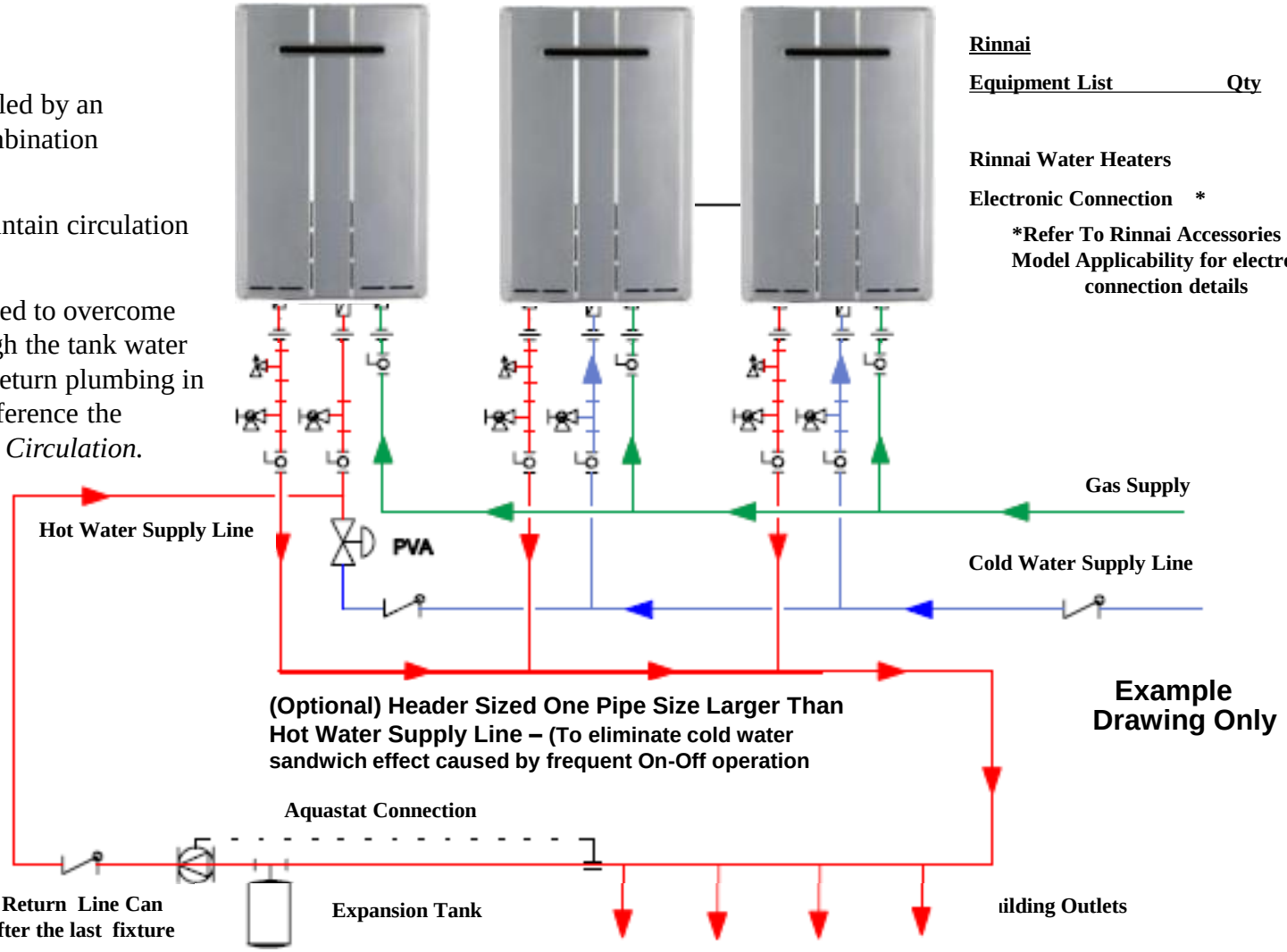
Pump to be sized to maintain circulation loop temperature.

The pump should be sized to overcome the pressure loss through the tank water heater, and supply and return plumbing in the circulation loop. Reference the section *Pump Sizing for Circulation.*

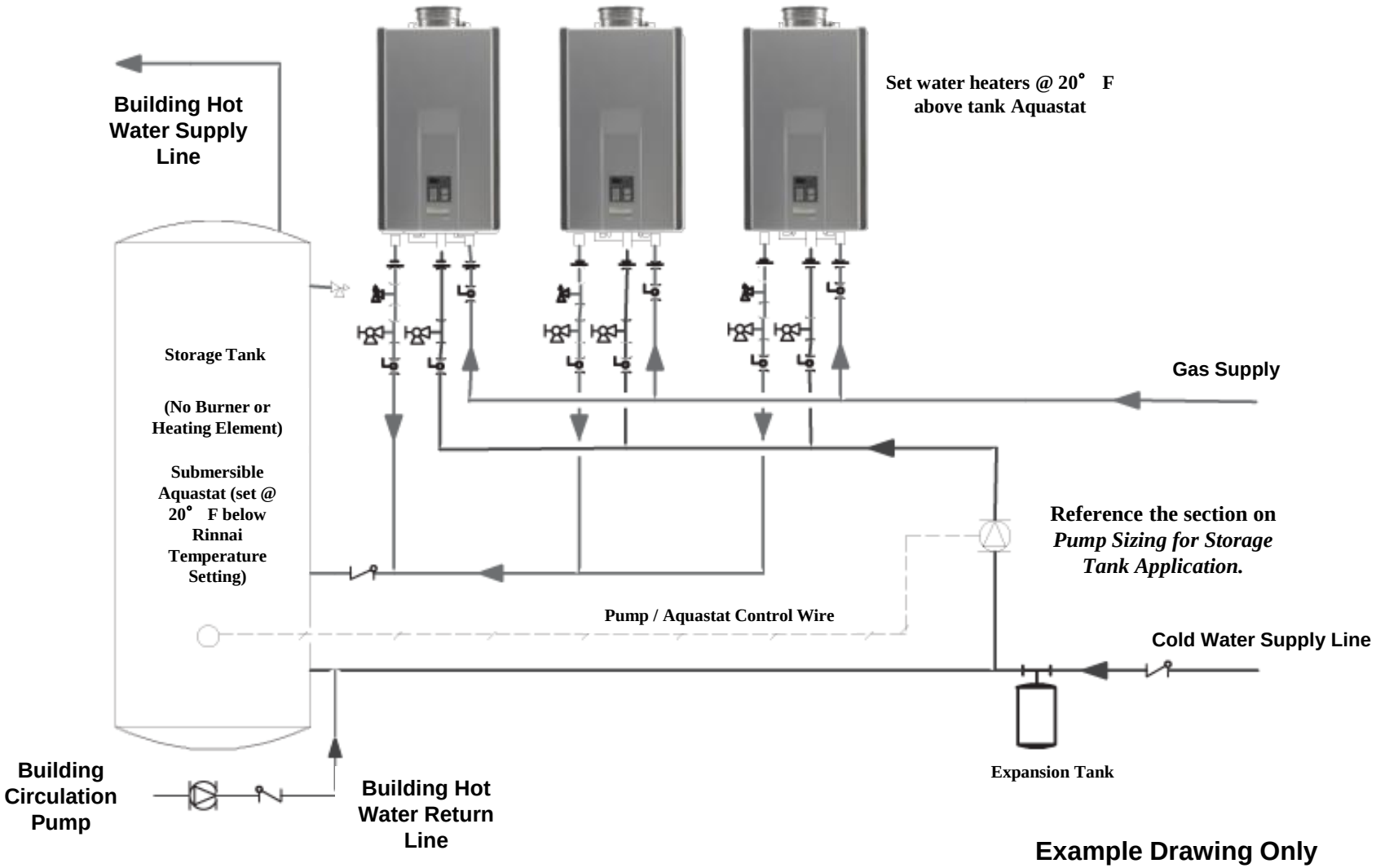
Pump to be of bronze of stainless construction.

PVA to be kept on factory default setting

Circulation Unit should not be connected electronically



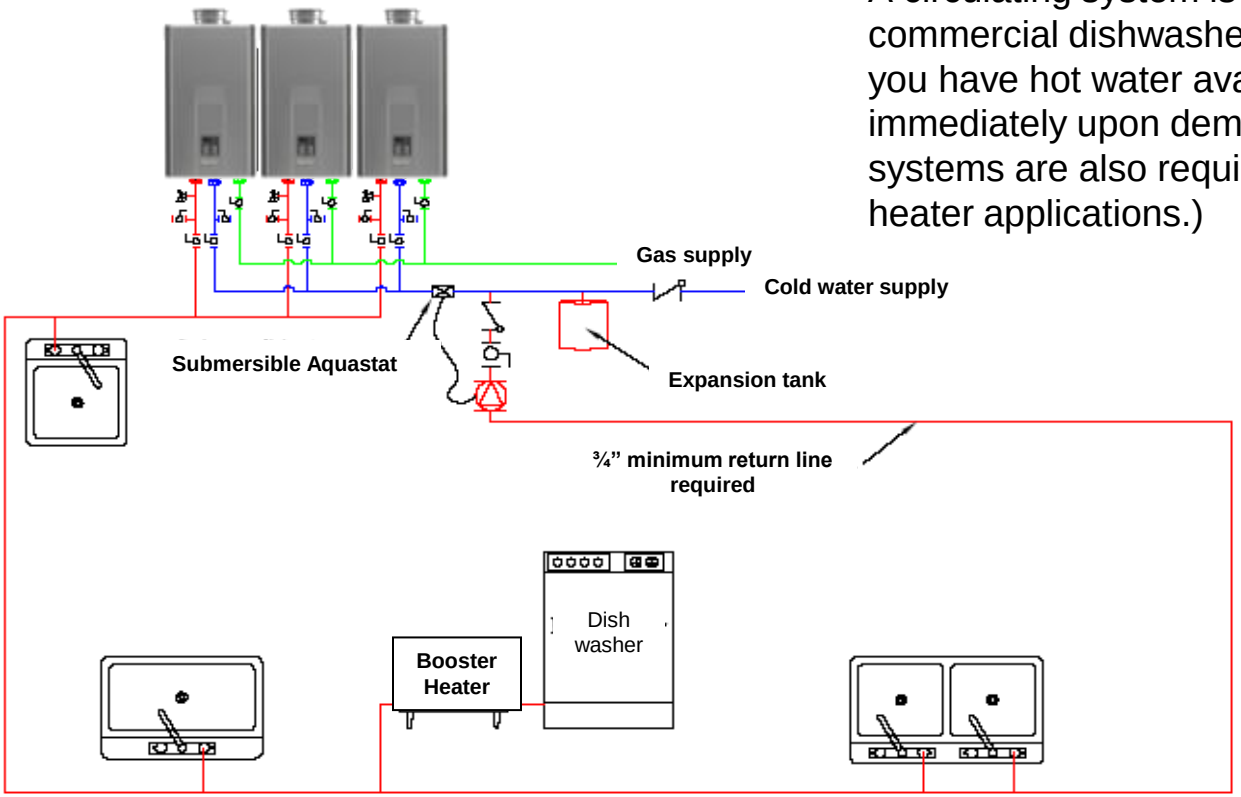
Backup Storage / Circulation



Example Drawing Only

Commercial Dishwasher Installations

Typically, in applications involving commercial dishwashers, two or more tankless water heaters are needed. Contact Rinnai's Engineering / Applications department for proper sizing in all commercial dishwasher applications. (Have the dishwasher model number available). Below is one of many commercial dishwasher applications.



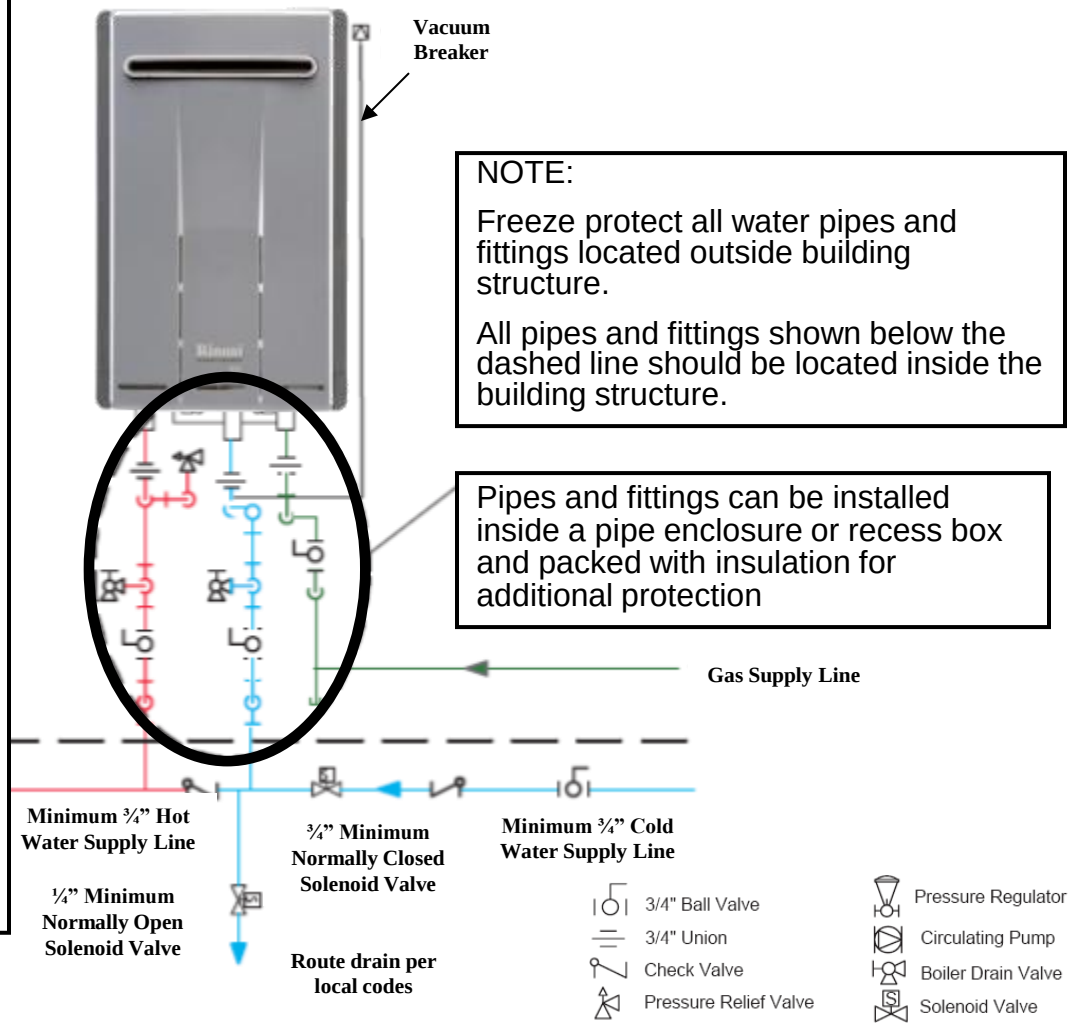
- A circulating system is required in all commercial dishwasher applications to ensure you have hot water available at the dishwasher immediately upon demand. (Circulating systems are also required in similar tank water heater applications.)

- DO NOT use a tankless water heater as a booster heater for commercial dishwashers. When using a tankless water heater in conjunction with a hot water sanitizing type dishwasher, a booster heater recommended by the dishwasher manufacturer must be used.

Auto Drain Down / Freeze Protection

(For non-condensing models only)

- With electrical power and an adequate gas supply to the Rinnai water heater, it will not freeze in environments as cold as -22º F (indoor models) or -4º F (outdoor models), when protected from direct wind exposure.
- In the event of a power failure at temperatures below freezing, the water heater should be drained of all water to prevent freezing damage.
- The unit may be drained manually or with the installation of optional solenoids as shown.
- An optional drain down kit is offered consisting of:
  - 1-3/4” normally closed solenoid valve
  - 1-1/4” normally open solenoid valve
  - 1 Vacuum breaker
  - A special surge protector for connection of the two solenoids valves. Connection at this point ensures the solenoids will drain the unit under various potential freezing scenarios.



Example Drawing Only

Rinnai Condensing Water Heater Installation Differences

The following highlights the differences of condensing models as compared to non-condensing models.

Please read each model's installation manual that comes with each product.

Failure to comply with each model's accompanying guidelines could void the warranty.

Rinnai®

Condensing Model Product Features

Similarities and differences compared to Rinnai's non-condensing products

DIFFERENCES

- Energy Factor rating as high as .96 (model dependent)
- Higher EF ratings could allow for additional rebate and tax incentives
- Integrated condensation trap—no need to address condensation in the vent system
  - Draining direct to a drain system is permitted (check local codes-neutralizer may be required)
- Listed vent systems are different than Rinnai's non-condensing water heaters
  - Ubbink PP-s venting is economical and easy to install
  - Ubbink PP-s has a plastic outer (intake) pipe and a flame-retardant polypropylene inner (exhaust) pipe
- Stainless steel secondary (latent) heat exchanger (primary heat exchanger is copper)

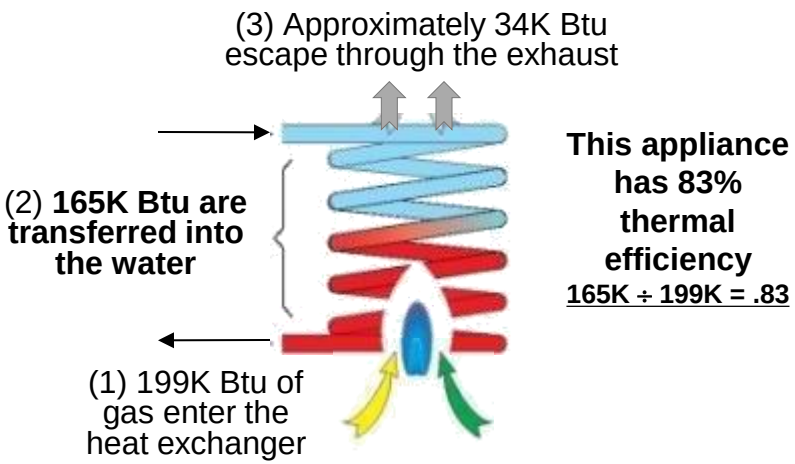
SIMILARITIES

- Energy Star Qualified—Eligible for various utility and tax incentives
  - Industry leading activation rate of 0.4 gpm and lower minimum gas input rate of 10,000 Btu
  - This allows ignition for smaller amounts of water at higher incoming temperatures
  - Water flow deactivation is less than 0.26 gpm
- Current Rinnai temperature controllers are used with the condensing series
  - Diagnostic codes are displayed on the controller—simplifying service issues
- Venting clearances and equivalencies are similar to Rinnai's non-condensing water heaters
- Rinnai condensing water heaters are approved for installations up to 10,200 feet
  - The same altitude setting procedures exist for condensing models
- Whole House continuous hot water system when properly sized

Condensing Technology

Rinnai

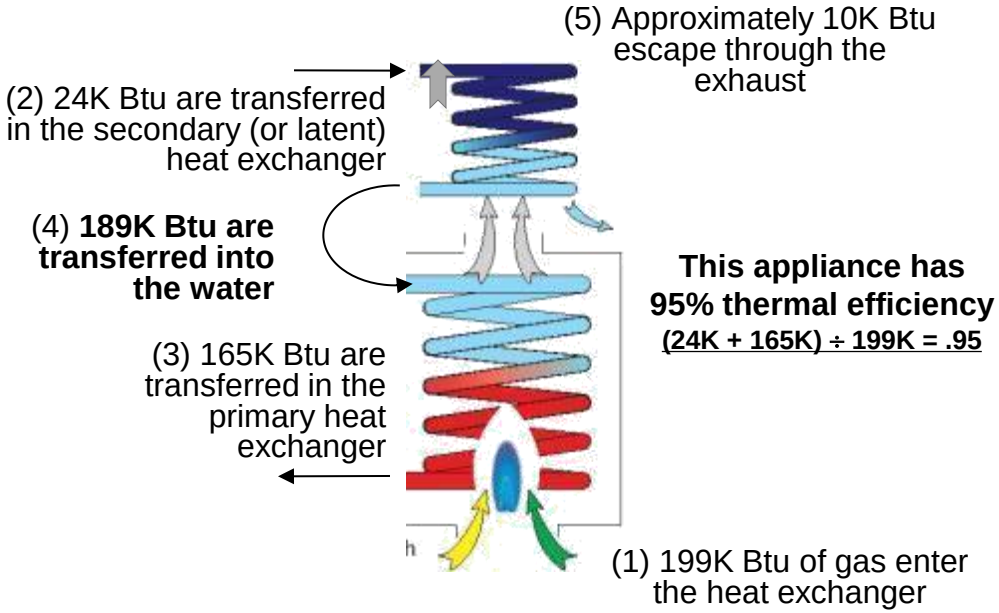
Non-condensing Water Heater



- Condensing appliances capture the extra heat (or latent heat) before it escapes into the vent system and transfers it, in the case of a water heater, into the water being heated.
- Condensation occurs when the water created in the combustion process cools below the dew point. As this water vapor condenses, it combines with other combustion by-products to form an acid solution. Condensing appliances are designed to properly drain this condensation.

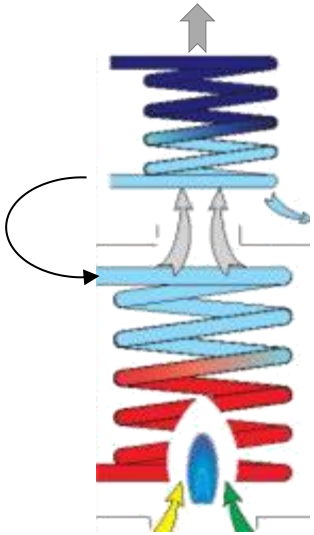
- When vented combustion occurs, there will always be some level of heat loss in the form of exhaust exiting through the vent system.
- Thermal efficiency of a gas-fired appliance is measured by how much heat is actually transferred to the heating medium (water, air, etc) and how much is lost through the vent system.

Condensing Water Heater



Condensing Technology

KB Condensing Units



The RU98 and RU80 /KB series Condensing Units now have a down-fired ceramic burner (with a downward-burning flame)
This allows condensation to drain from the bottom of the heat exchanger, providing greater longevity.

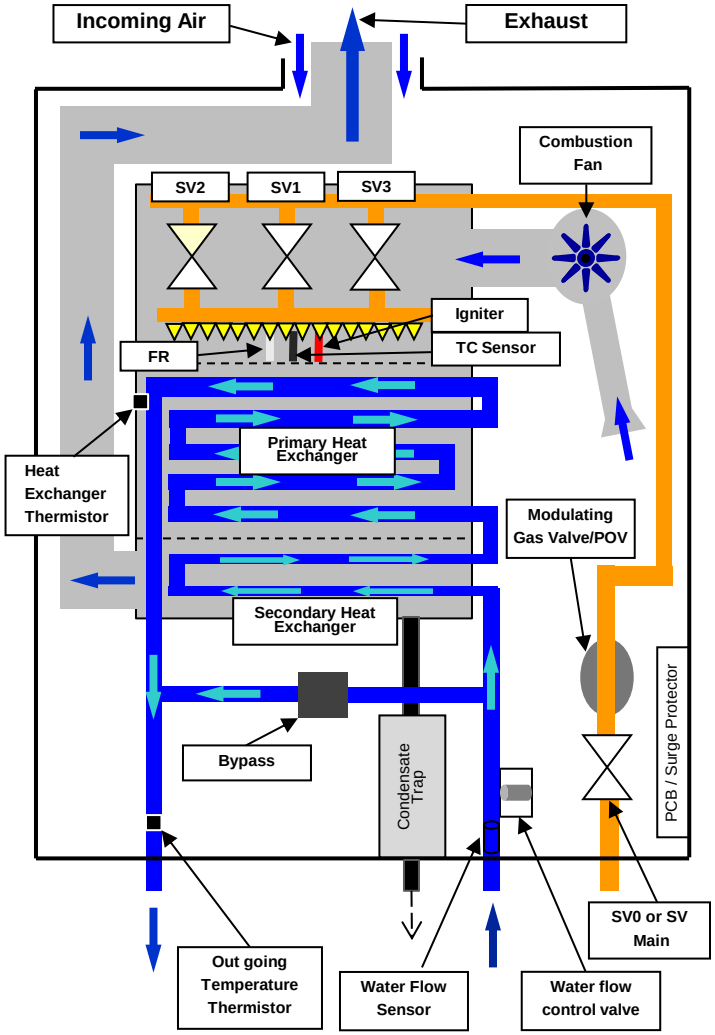
Condensate will drain down from secondary HEX, protecting primary HEX and burner.

Condensate will drain down from secondary HEX, protecting primary HEX and burner.





Sequence of Operation
(indoor KB condensing unit)



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 turns to allow correct air flow thru unit
- Spark igniter begins sparking
- Gas control assembly opens to low fire rate
- When flame rod (FR) proves ignition, spark igniter stops sparking

3. Normal Operation
- Gas valve assembly & fan speed modulate gas and air input to meet user demand
- PCB monitors flame rod, TC Sensor, flame characteristic, fan motor frequency, outlet water temperature, temperature set point, and water flow rate
- If demand is very small, only SV1 will allow gas to burner. The flame rod (FR) will monitor this minimum fire state
- If demand is large, flame can develop across the entire burner
- Water is preheated in the secondary (latent) heat exchanger
- Water is heated as it passes through the heat exchanger multiple times
- Heat exchanger strategically overheats water while the variable bypass cools to the set point temperature to provide higher flow rates
- Condensation is drained through the condensation trap and to a drain
- Water flow control valve is adjusted, as needed

4. Shut-down Sequence
- PCB senses flow rate less than 0.26 gpm
- Gas control valve closes & water flow control valve resets to standby position
- Combustion fan runs for a short period of time at low speed

5. Standby Mode
- PCB monitors all components. Freeze protection is activated as needed

Intake / Exhaust Guidelines
(For condensing models only)

- Refer to the vent pipe manufacturers' instructions for component assembly instructions.

- Rinnai indoor condensing water heaters are direct vent water heaters and therefore are certified and listed with the vent system. Only vent components that are certified and listed with the water heater model should be used.
  Refer to the table below:

Listed and Tested Vent Products for the R80i and R98i		
Manufacturer	**Product**	**Description**
Rinnai/Ubbink	Rolux **Condensing** Vent System	Polypropylene (PP-s)
Centrotherm	InnoFlue Vent System	Single wall 3"PP-s
Selkirk / Heat-Fab	Saf-T Vent SC system	AL29-4C Stainless Steel
Metal-Fab	Corr/Guard Vent/Air Intake System	

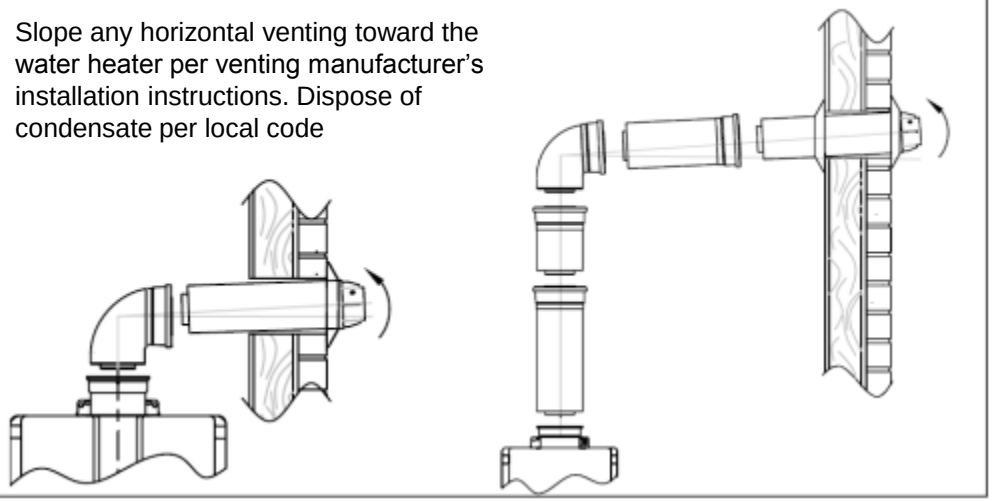
- The above listed vent systems use gaskets to ensure all seals are secure—no gluing or cure time is required
- Schedule 40 PVC/CPVC venting **is not** approved and should **never** be used on exhaust with Rinnai condensing water heaters
- Ubbink aluminum concentric venting is not approved for use with Rinnai condensing water heaters
  - Ensure non-condensing and condensing guidelines are understood
  - Do not mix vent parts or individual requirements between non-condensing and condensing models as dangerous safety conditions could occur!

Intake / Exhaust Guidelines
(For condensing models only)

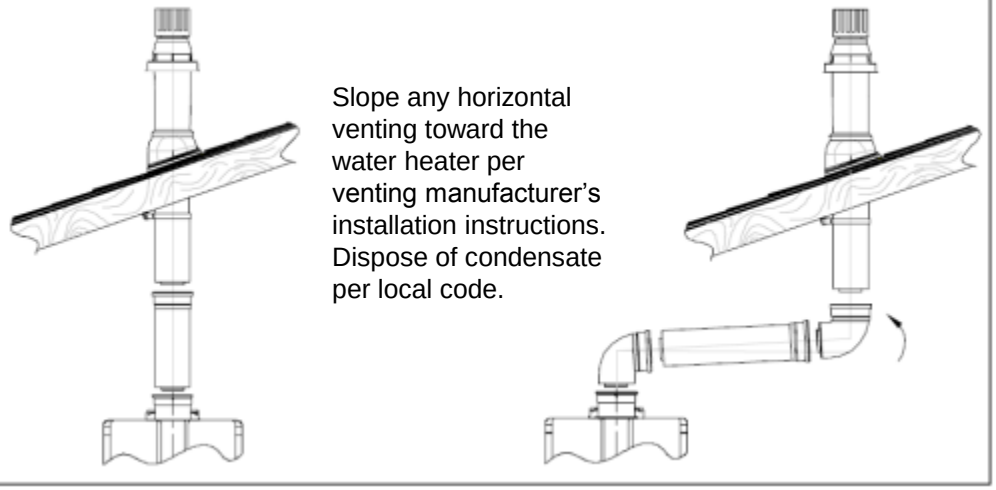
Rinnai

Horizontal Termination

Slope any horizontal venting toward the water heater per venting manufacturer's installation instructions. Dispose of condensate per local code



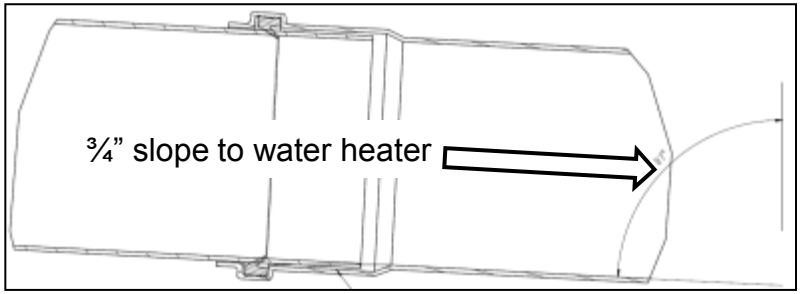
Vertical Termination



Slope any horizontal venting toward the water heater per venting 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

- Rinnai / Ubbink PP-s venting for condensing water heaters require a ¾" per foot slope



¾" slope toward water heater when using Ubbink PP-s condensing to ensure proper flow through venting joints

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

Condensing Concentric Venting Parts
(For Condensing models only)

When purchasing or using Rinnai/Ubbink venting, ensure the proper type is used

- **Rinnai/Ubbink polypropylene (PP-s) venting will have a green "Condensing" label on each package**
- **Each Rinnai/Ubbink PP-s condensing vent component will have an orange Warning Label on every inside and outside piece**



Condensing label on the packaging

Inside pipe- Exhaust



Warning label on each individual vent piece

Outside pipe- Intake



Centrotherm InnoFlue® 2 Pipe System

Rinnai has certified the Centrotherm InnoFlue (single wall) venting system as an optional venting system for the following condensing water heater models:

RC80HPi, RC80i (KA2530FFUD-US)	RU80i (KB2530FFUD-US)
RC98HPi, RC98i (KA3237FFUD-US)	RU98i (KB3237FFUD-US)

When installing the Centrotherm 2 pipe system:

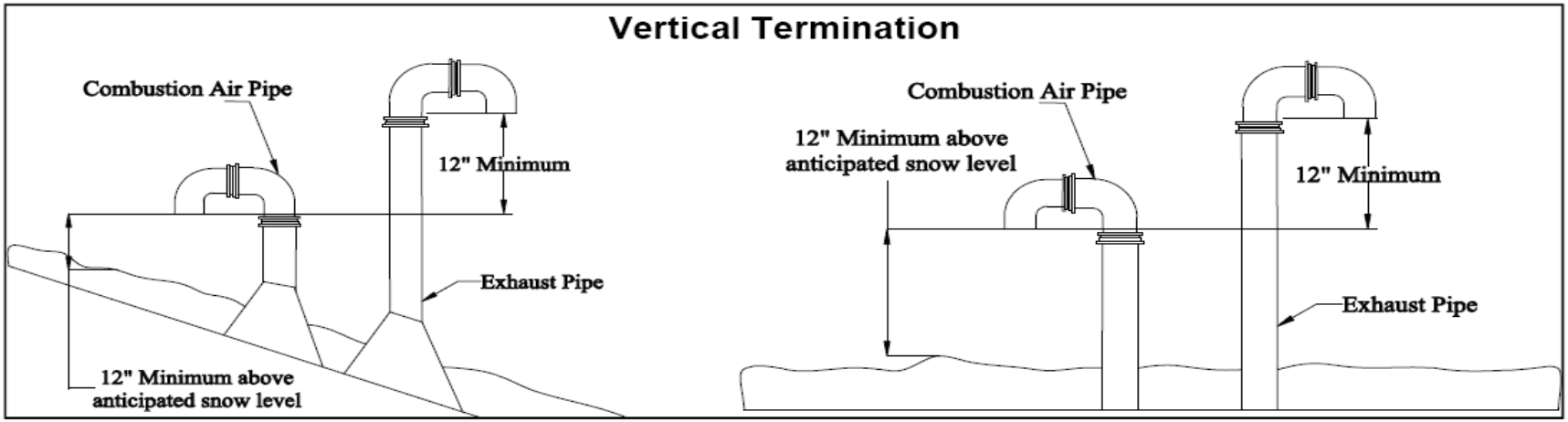
- Comply with the exhaust clearances found in the Rinnai Operation and Installation Manual.
- Only one appliance can be attached to the vent system.
- Install the system in according to the Centrotherm installation instructions.
- Use the 3"/5" concentric to twin pipe adaptor and 3" diameter venting.
- The vent termination and air intake must be in the same pressure zone.
- Do not exceed maximum straight vent length with number of elbows as shown in the tables on the next page.
- Maintain the clearances shown in the figures below.

⚠ WARNING **DO NOT use PVC on the exhaust venting. PVC is allowed on the intake only.**

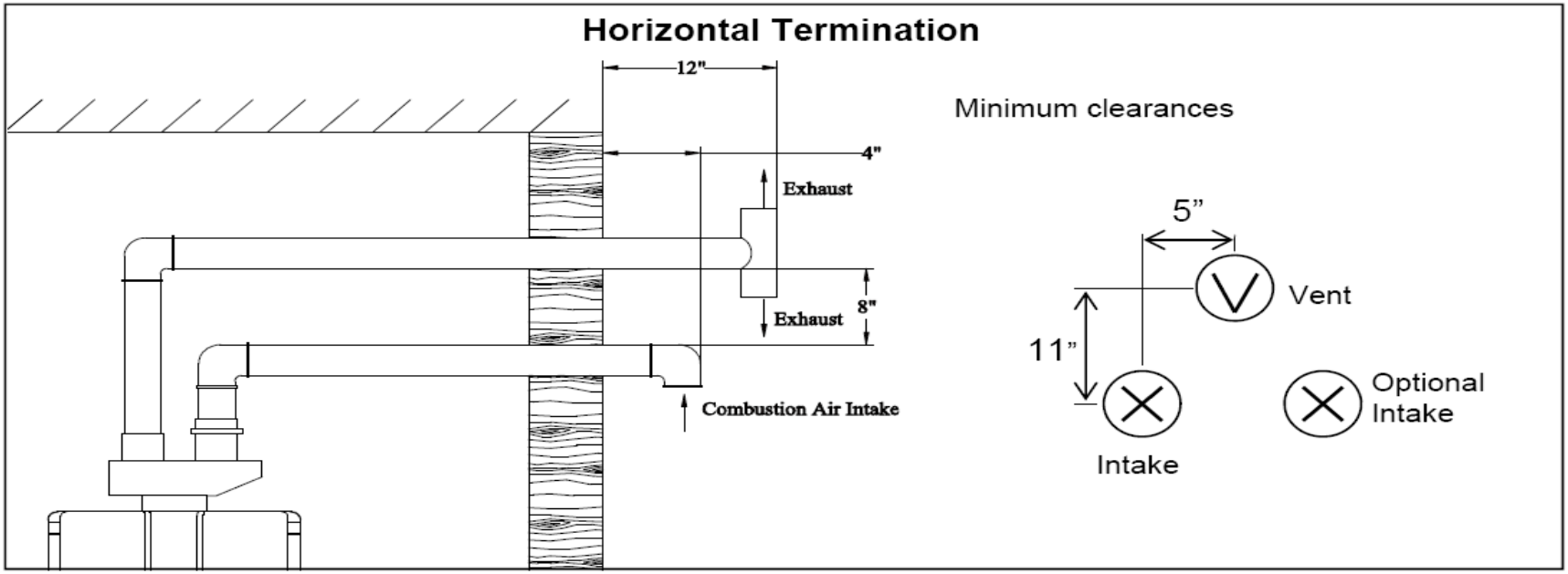
Clearances for InnoFlue® 2 Pipe System

Rinnai

Vertical Termination



Horizontal Termination



Vent Length Tables

Rinnai

Maximum Straight Vent Length

There are two types of elbows, short radius and long radius.

1. Refer to correct table for your type of elbow (long/short) to find the maximum straight vent length.
2. Count the number of elbows in your venting excluding the termination/intake.
3. Refer to the third column. If required based on vent length, move switch #1 in the tan dip switches to off.

Vent length using short radius elbow
(Intake is the short UV protected 90° elbow)

Number of 90° Short Radius Elbows	Maximum Straight Vent Length	Switch #1 in the tan DIP switches If length is greater than:
0	42 ft (12.80 m)	18 ft (5.49 m) move switch #1 to OFF
1	27 ft (8.23 m)	3 ft (0.91 m) move switch #1 to OFF
2	12 ft (3.66 m)	move switch #1 to OFF for any length

Vent length using long radius elbow
(Intake is the long UV protected 90° elbow)

Number of 90° Long Radius Elbows	Maximum Straight Vent Length	Switch #1 in the tan DIP switches If length is greater than:
0	45 ft (13.72 m)	21 ft (6.40 m) move switch #1 to OFF
1	39 ft (11.89 m)	15 ft (4.57 m) move switch #1 to OFF
2	33 ft (10.06 m)	9 ft (2.74 m) move switch #1 to OFF
3	27 ft (8.23 m)	3 ft (0.91 m) move switch #1 to OFF
4	21 ft (6.40 m)	move switch #1 to OFF for any length
5	15 ft (4.57 m)	
6	9 ft (2.74 m)	
7	3 ft (0.91 m)	

Vent Pitch

- Horizontal vent configurations must be pitched towards the appliance and at an angle of no less than 3˚ or 5/8”/ft. (5.6cm/m)
- Male ends of all components must point towards the appliance to assure free condensate flow to the condensate drain of the appliance.

Reminder… InnoFlue® can be installed at zero-clearance to combustible materials.

Install a Support Bracket at any directional changes such as Elbows or Tee sections as needed.

Vent Terminations

- Horizontal terminations should go straight through wall. Vent cannot extend more than 12” (30cm) from the wall exterior.
- Termination Tee’s, 45˚ , or 90˚ elbows may be used to direct flue gases in desired directions.
- All outside piping must be the UV-rated PP-s (Black piping)
- Install Bird Screens into any exterior vent or air intake opening

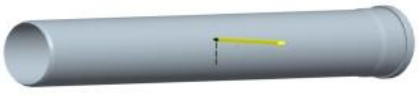
Installation

- Gaskets are factory installed in all InnoFlue® components. If a gasket is missing or damaged, it must be replaced by a correctly-sized Centrotherm supplied gasket

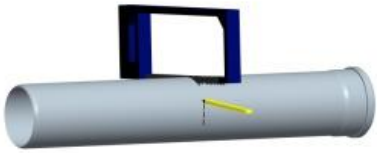
- **CAUTION**: leaking gaskets can cause the formation of dangerous carbon monoxide or property damage due to condensate leaks!

- When measuring vent length required, ensure to include the depth of the female socket to the total length required.

- When field cutting InnoFlue® vent lengths, use a hack saw and miter box to create a perpendicular, clean cut, ensuring to deburr cut, so that any damage to gasket is avoided.



Measure



Cut

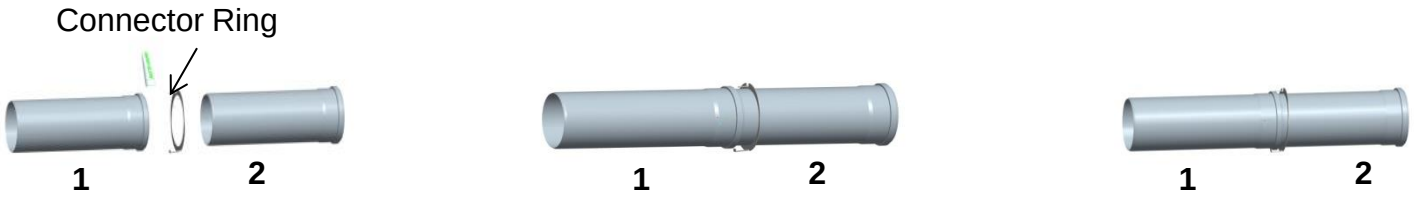


Deburr

Installation

Joint Connections

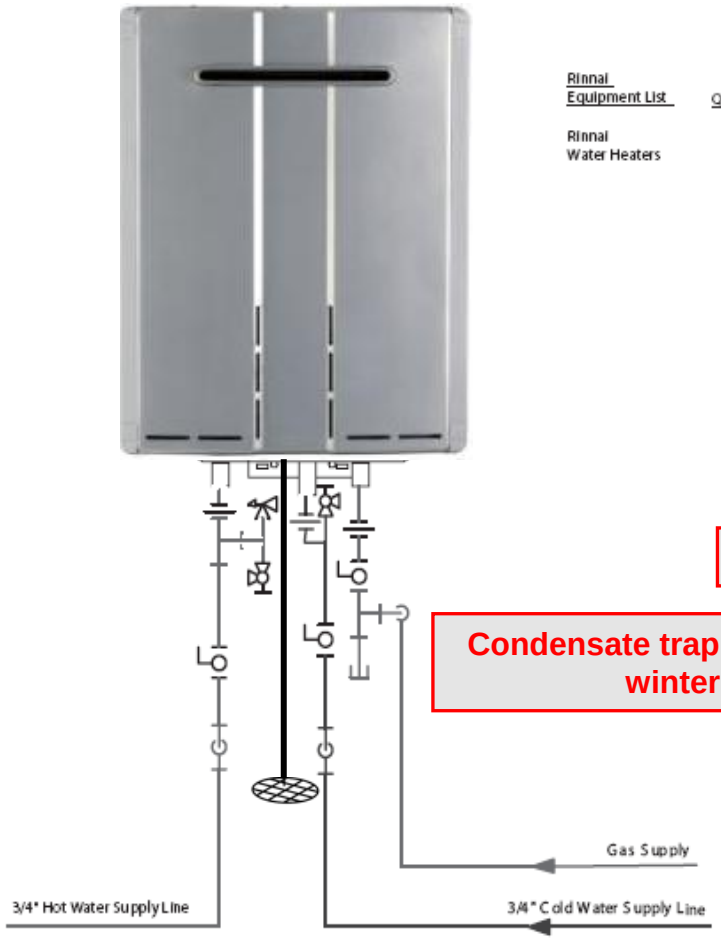
- Place Centrocerin, a water based lubricant on the gasket of component 1 for ease of assembly.
- Slip a Connector Ring over male end of component 2 so that that it can grip the gasket bead of component 1.



- Push and twist male end until it bottoms out in component 1.
- Clip the Connector Ring onto gasket bead to secure the two components to each other.
- Install support brackets for horizontal venting onto solid ceiling joist or surfaces to avoid future movement or sagging. Space supports no more than 39” (1m) apart.
- Install support brackets for vertical, wall mounted vent configuration. space brackets no more than 78” (2m) apart.

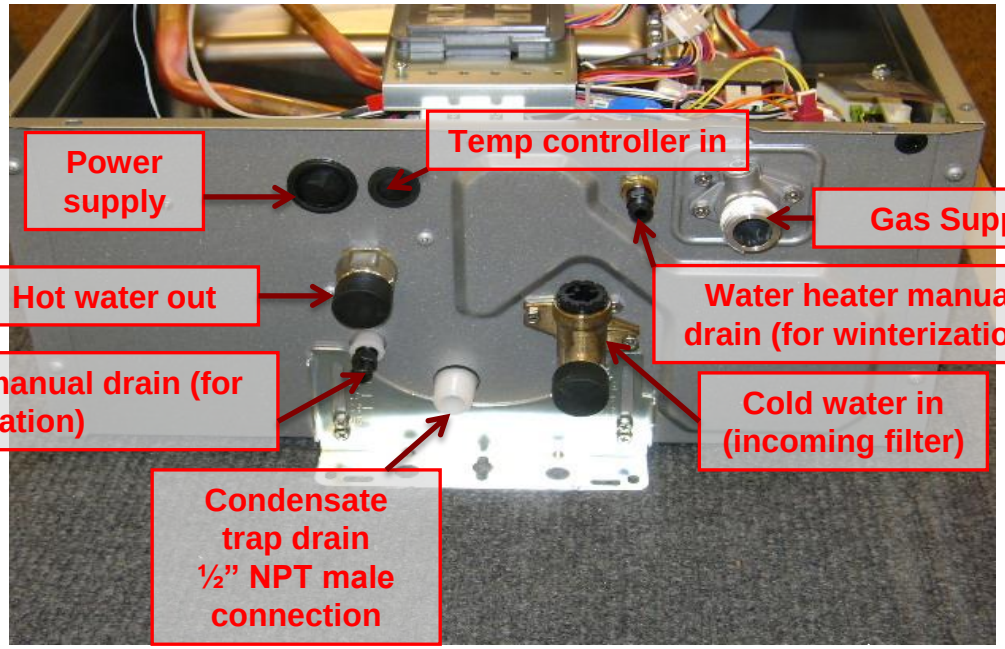
Piping – Standard Installation
(For KB series Condensing models only)

Rinnai



Standard Installation

- **Single Unit based on structure's hot water demand (bathrooms / fixtures)**



Rinnai Condensing Water Heater FAQ

1. **Can the condensing product be used for hydronic heating?**
   - Condensing products are certified and tested to ANSI Z21.10.3/CSA 4.3. This is the same standard as our non-condensing product. Therefore, only open-loop hydronic applications are permitted (check local codes too). Contact Rinnai Engineering for more details (1-800-621-9419)

2. **Is a neutralizer or neutralizing agent required for the condensation?**
   - This will depend on local code. Third-party neutralizers are readily available at Rinnai distributors and supply houses.

3. **Is the integrated condensation trap freeze protected**
   - Yes, there are heating elements on this trap (power must be applied). There is also a drain plug for quick and easy draining (for winter storage).

4. **Does the condensation trap require priming?**
   - No, in most cases normal operation will self-prime the trap (approximately 9-11 minutes)

5. **What is the temperature of the exhaust?**
   - Exhaust gases are approximately 120˚ F-135˚ F depending on incoming water temperature, demand, etc

6. **What is the maximum temperature limit of Ubbink PP-s?**
   - Ubbink PP-s has a maximum temperature in excess of 230˚ F. This is superior to PVC's max limit of only 156˚ F.

Rinnai Condensing Water Heater FAQ

7. What are the input parameters to ensure the condensing tankless water heater is truly condensing (high efficiency operation)?

- Under most circumstances this product will be operating in a condensing state. However, the exhaust will not condense as easily and efficiency will decrease as incoming temperatures surpass 100˚ F.
- If the unit has heavy scale build-up in the heat exchanger, the unit may not condense—ensure proper water quality is maintained

8. Is PVC or CPVC venting permitted?

- No, PVC and CPVC require twice the amount of piping (for intake and exhaust), priming and gluing, and long cure times (which sometimes aren't followed—creating a potentially dangerous environment).
- If poor water quality exists and the heat exchanger begins to scale, flue gas temperatures could exceed the maximum allowable temperatures of PVC/CPVC.
- Under most circumstances, Rinnai/Ubbink concentric PP-s condensing vent material will be more economical and easier to install

9. Why do condensing tankless water heaters use a different type of Ubbink venting than Rinnai's non-condensing water heaters

- Because of large amounts of condensation in the vent system (due to high efficiency), aluminum exhaust piping—the type used for non-condensing products—could break down over time
- Because the exhaust gas temperatures on non-condensing products are much higher than the condensing products, polypropylene (PP-s) venting—the type used for condensing products—could melt

10. What size and type of piping should be used to drain the condensation from the water heater?

- It is the responsibility of the plumbing contractor, engineer, installer, etc. to size water pipe. If in question, please refer to local codes and common design practices.

MANUFACTURER ACCESSORIES

Rinnai®

Condensation Neutralizer Kit

Features and Benefits

- Raises pH before discharging condensate into drain
- Clear Capsule – Easy to identify need for new media
- **For Condensing Boilers and Condensing Water Heaters**
- Can mount vertically and horizontally
- Fast and simple installation
- Refillable – Easy and inexpensive
- Capacity 1.6 Gallons/Hour (6.06 liters/hour)



P/N 804000074



P/N 809000114

Installation (Neutralizer)

! WARNING

- "Risk of damage to appliance". The neutralization kit inlet and discharge must be at a lower elevation than the condensate drain from appliance.
- **Do Not** allow exhaust flue gases to vent through the neutralization kit. All condensate drains must have a trap to prevent flue gas leakage. Flue gas leakage can cause injury or death from carbon monoxide.
- Connection to the appliance and neutralization kit must be installed to ensure that no condensate backflow into the appliance can occur.

The inlet has a center connection port and the outlet connection is off center. Mount the neutralization capsule on the wall or floor securing it with the provided brackets. When mounting capsule in the horizontal position rotate the tube so the outlet is at its highest point (Figure 1 and 2). When mounting in the vertical position ensure the outlet is at a higher elevation than the inlet (Figure 3). The preferred mounting method is in the horizontal position.

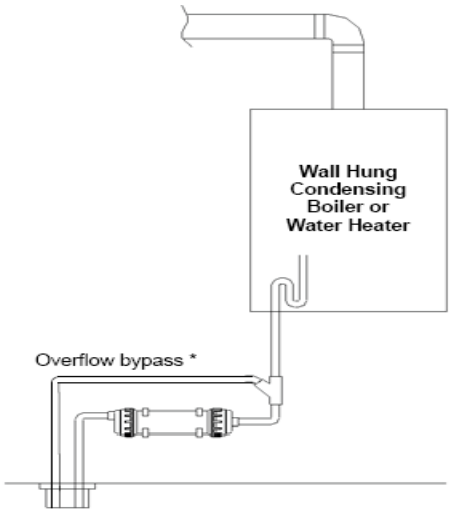


Figure 1.

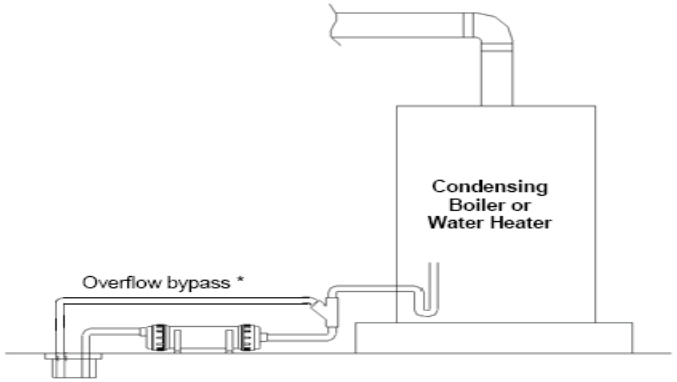


Figure 2.

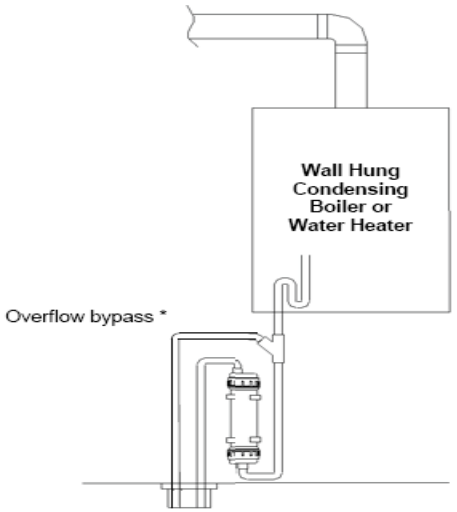


Figure 3.

Installation (Neutralizer)

- Connections to the appliance and neutralization kit must be installed to ensure that no condensate backflow can occur.
- Connect corrosion resistant piping and secure it to the floor or wall to prevent movement. Do not route the condensate line through any area that is exposed to freezing temperatures. If traffic poses a risk, install some protection to prevent movement and/or damage
- Ensure the condensate will flow freely from the appliance drain into the capsule then to the drain.
- The end of the condensate drain pipe should be open to the atmosphere, not under water or other substances.
- Access to the discharge is necessary for proper maintenance in order to check the effectiveness of the neutralizing media, using pH test strips.

NOTE: IF there is no gravity drain available, Install a condensate removal pump designed for use on condensing boilers and furnaces. The condensate pump must be equipped with an over flow switch to prevent the appliance from running should a failure occur.

Check with your local water authority for regulations regarding discharge of treated condensate to the drain or sewer system.

Scale Control System

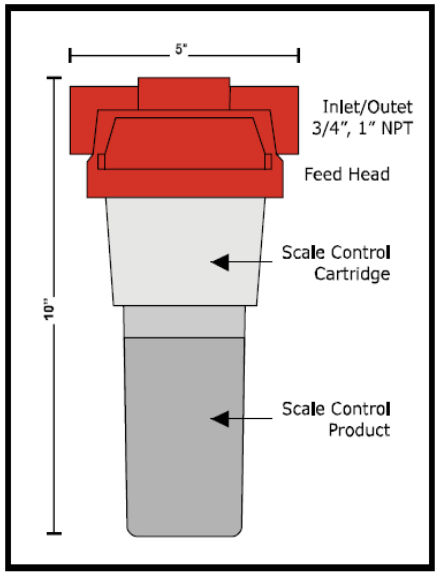
Rinnai's Scale Control System is a unique product providing excellent lime scale prevention and corrosion control for tankless water haters. The scale control conditions the water resulting in consistent scale control prevention and corrosion control for predictable periods of time. The system works in the following ways:

- **Keep scale causing minerals in solution, inhibiting lime scale formation.**
- **Changes the shape of the precipitated lime scale preventing accumulation.**
- **Coats wetted surfaces with a micro-thin layer that acts as a corrosion buffer.**
- **Helps soften and remove existing lime scale over time.**

Part Numbers:

103000022	Scale Control Water Heater Only ¾" Feed
103000023	Scale Control Whole Home ¾" Feed
103000024	Scale Control Whole Home 1" Feed
103000025	Scale Control Refill Water Heater Only
103000026	Scale Control Refill Whole Home





Installation (Scale Control)

Prior to Installing the Scale Control System

- The installation must be on the cold water supply line prior to the water heater. For the whole home / light commercial system the installation must be on the incoming water supply line for the home or building.
- Install the system where the housing is in an accessible location for changing the cartridge. Allow a 1 inch space under the cartridge housing in order to remove it from the head.
- **DO NOT install sideways or upside down. The system must be installed with the cartridge directly below the feed head.**
- **DO NOT install the scale control system within a recirculation loop.**
- **DO NOT install the Rinnai Scale Control System where it is exposed to direct sunlight. If installed outdoors, ensure the system is covered or insulated from exposure to direct sunlight and / or to protect it from freezing.**
- Installation of a by-pass system is recommended for easier maintenance.

NOTES

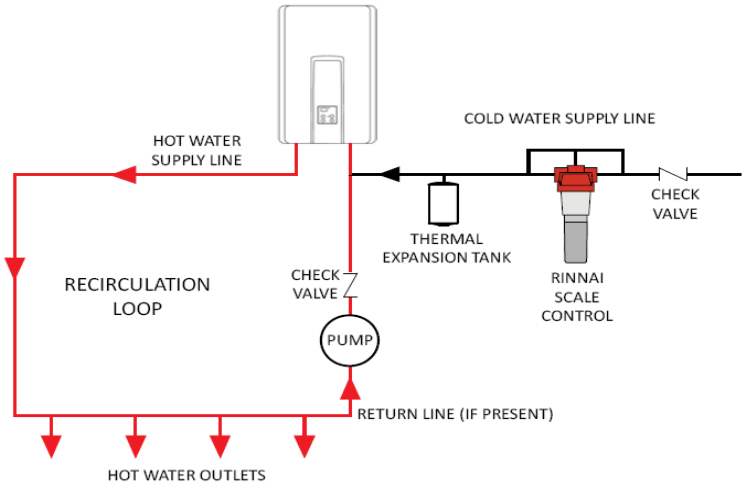
INSTALL THE RINNAI SCALE CONTROL SYSTEM

⇒ ON COLD WATER SUPPLY LINE PRIOR TO WATER HEATER

⇒ OUTSIDE THE RECIRCULATION LOOP (IF PRESENT)

⇒ IN AN UPRIGHT VERTICAL POSITION

EXAMPLE OF PIPING FOR THE RINNAI SCALE CONTROL SYSTEM

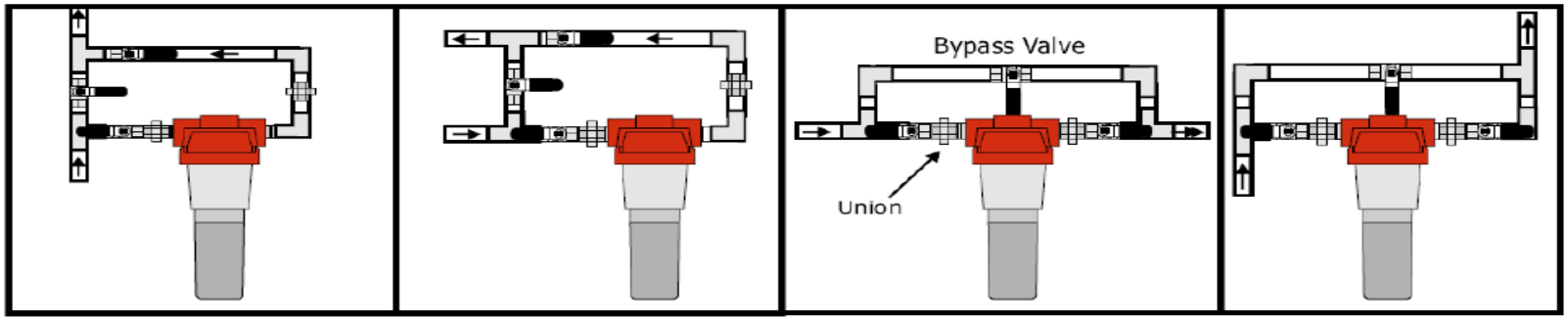


Installation (Scale Control)

Installation

1. Turn off water supply.
2. Use Teflon tape and/or pipe dope on male threaded fittings prior to connecting to system. Do not over tighten.
3. If using sweat fittings, protect the system from excessive heat.
4. Use a back up wrench next to the system if compression fittings are used.
5. The use of a bypass is recommended. See configurations below.

Bypass Configurations



6. Install the mounting bracket and attach the head unit. Determine the flow direction of the water line and match it up with the flow direction of the system. IN and OUT are identified on top of unit. If needed, remove and reverse the mounting bracket for right side inlet port configuration.
7. Insert cartridge into head unit by lining up the “ears” of the cartridge with notches in head unit. Push up until cartridge stops, then turn clockwise until the cartridge stops turning (approximately 1.5”).
8. If a bypass is used, make sure the bypass is in a closed position.
9. Once installation is complete, turn supply water on and allow water to flow. Purge air from supply line and then check for leaks.

Recess / Pipe Cover Compatibility Parts List

Rinnai

The below chart shows applicable part numbers for each model:

PIPE COVER / RECESS BOX COMPATIBILITY		
Model	**Pipe Cover Boxes**	**Recess Boxes**
V53e	PC-20-W	RGB-20U
V65e and V75e	PCD03-EWV	**RGB-25U-C**
R75LSe / RL75e	PCD03-SM2	RGB-25U or RGB-25U-MSAL MSAL=Moisture Seal Aluminum
R94LSe / RL94e		
R98LSe or R98LSe ASME	PC-32-S	RGB-32-W
RC80e	PCD07-SM Bottom plate sold separately-PCD07-SM-BP	RGB-CWTH
RC98e		
RL75e and RL94e (VA,VB,**VC**)	PCD03-SM2	**RGB-25U-C**
RU80e or RU98e (**KB** series)	PCD07-SM	**RGB-CTWH-2**
V65i and V75i	PCD03-EWV	Not Applicable
R75LSi / RL75i	PCD03-SM2 (use PCD03-SM for 2009 models or earlier)	
R94LSi / RL94i		
R98LSi or R98LSi ASME	PC-32-S	
RC80i / RU80i	PCD07-SM Bottom plate sold separately-PCD07-SM-BP	
RC98i / RU98i		

PIPE COVER BOXES

- Pipe Cover boxes mount underneath indoor or outdoor units to cover visible pipes and valves, increasing security and allowing for possible insulation of pipes.
- Pipe cover boxes connect to the bottom of indoor or outdoor water heaters, providing an aesthetically pleasing cover for incoming piping and electrical connections
- Pipe cover boxes also provide additional security and allow insulation of incoming plumbing inside the box
- Ensure the correct model box is ordered for each model water heater (color and design should be considered)



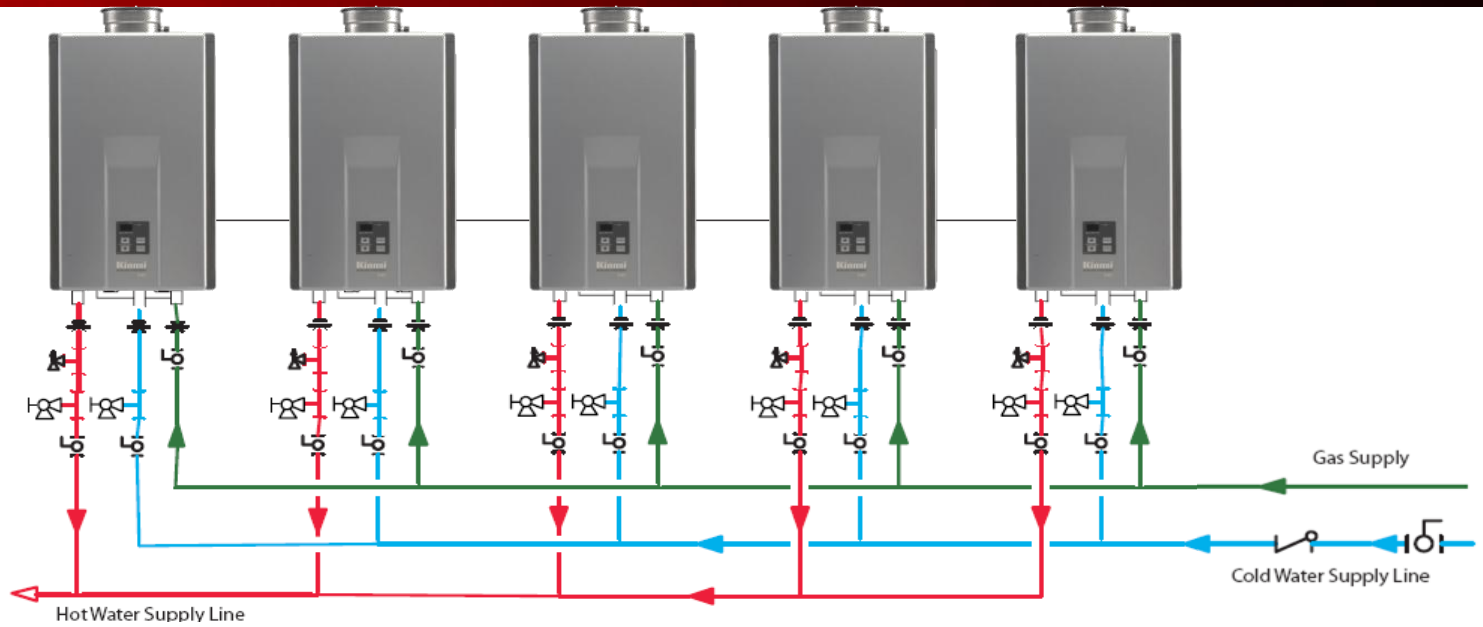
RECESS BOXES

- Recess boxes allow outdoor units to be installed recessed into an exterior wall.
- A universal recess box for each model size is offered.
- A moisture seal-aluminum recess box is offered for some models. This is a flanged recess box designed for new builds to allow a water tight seal within the enclosure.
- Due to its width, the R98LSe and condensing product recess boxes must be installed below a load bearing header. See installation instructions for details.
- A retrofit kit is available to allow the installation of a newer water heater in an older RGB25 recess box.



Rinnai's new MSB technology

Why is a multi-unit control technology needed?



If the above system of VB product did not use a multi-control system, it could take in excess of 2.0 gpm to fire any single unit (5 units multiplied by a 0.4 gpm activation rate).
Example: If 1.5 gpm were flowing, this would divide evenly through all five units (remember, with no control system, ALL flow control valves are open). 1.5 gpm ÷ 5 units = 0.3 gpm (less than each unit's activation rate).

- Couldn't pressure activation or regulator valves overcome this issue—turning on consecutive units based on incoming pressure changes? Yes, but…
  - The cost of such valves—including the labor to install them—could be prohibitive to many applications;
  - And, such a system would always fire the water heaters in the same order—meaning that, over time, unit #1 would have more usage than unit #5
  - Furthermore, if one product experiences a diagnostic code, cold water would pass through it—diluting the overall temperature at the output(s). This would occur until the disabled unit was reset.
- The solution: Rinnai's MSB and EZConnect® technology….

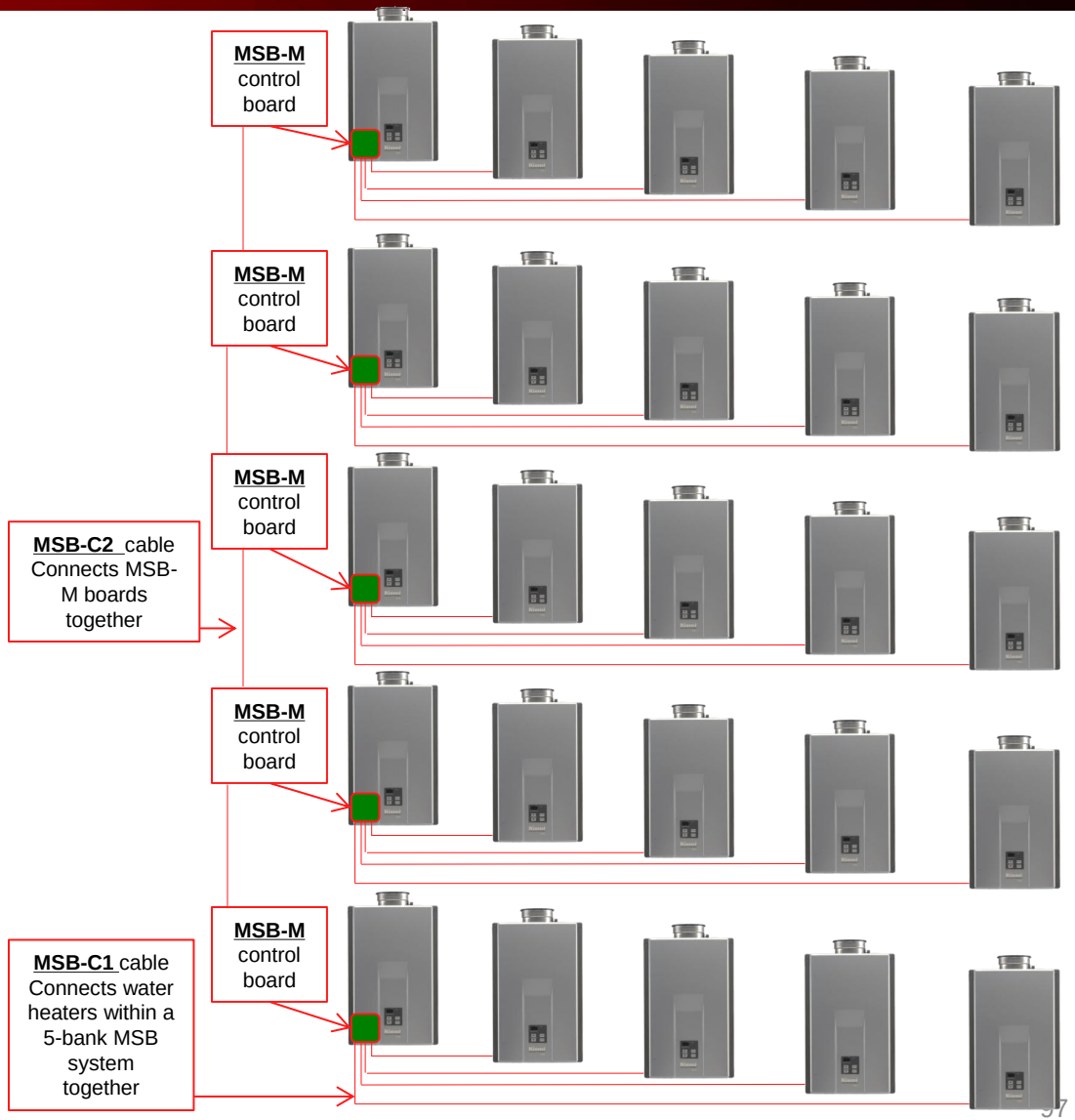
Rinnai's new MSB technology

Rinnai's improved upon its previous MSA technology with the release of the MSB platform.

Each MSB-M board will connect up to 5 water heaters. However, now up to 5 MSB-M boards can be connected together with communication cables—now as many as 25 water heaters will operate as a single system!

Furthermore, dip switches will allow the installer to select how many units are in standby with their water control valves open (ready to fire)—thus allowing quicker response time when demand increases.

Depending on which model water heater is used, an MSB system could have an operating range of 10,000 to as great as 5.9 million Btu and anywhere in between. Or, in terms of flow rate: 0.4 gpm to 245 gpm and anywhere in between!



MSB Compatibility Parts List

Part selection is important! Refer to the table below to ensure that the correct parts are selected for each system.

NOTE: V-series products will accept MSB parts—see the note below. This would likely only be performed for retrofit applications.

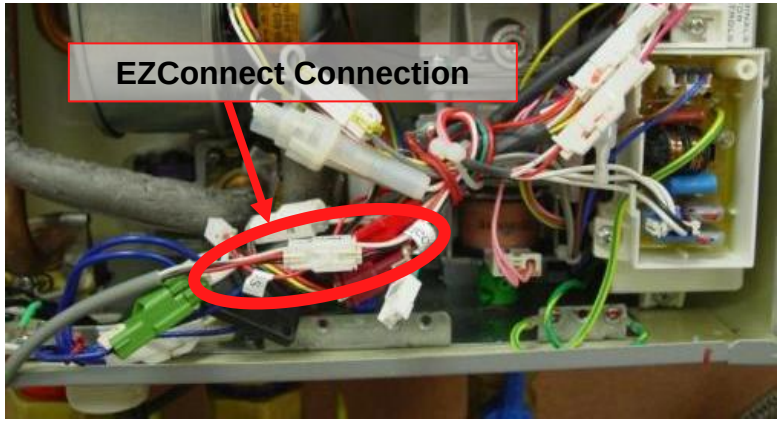
NO. OF UNITS	2*	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Part Needed	The following components are compatible for all VA, VB, and KA (HP) products. For V series, see note at MSB-C3																							
EZConnect ® cable	1																							
MSB-M		1			2					3					4					5				
MSB-C1		1	2	3	2	3	4	5	6	5	6	7	8	9	8	9	10	11	12	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 V-Series products will not accept EZConnect either (except R98/C98 V-Series)																							

*EZConnect is the preferred (and least expensive) method for operating two units together; however, an MSB system is capable of operating only two units

NOTE: This is an overview only. Please refer to the MSB/EZConnect installation instructions OR the expanded edition of MSB training for more detail.

EZConnect® – Connecting two units

When connecting only two LS/HP Series model water heaters, an MSA or MSB board is not necessary. An EZConnect cable can be used connecting to a special harness on the primary unit and the PCB on the secondary unit (see pictures). Three or more of these models will require the MSA / MSB components.





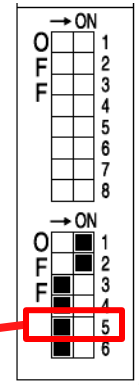
NOTE: With any EZConnect configuration,

- The temperature controller connected to the primary or #1 unit will control temperature on both units in the system. The temperature controller on the other unit in the system will only display (not change) the temperature. They will also display individual diagnostic codes.
- All units manufactured after July, 2008 : When installed in an MSA / MSB or EZConnect setup and needing temperatures higher than 140˚ F only one MCC-91 controller is required—Installed on the primary unit. All other units will follow the primary unit's temperature without the purchase of the MCC-91 controller.

New for 94/75 Series VB units: Dip Switch 5 in the bank of 6 will control whether one or both units are ready to fire when in standby:

Dip Sw 5 ON	1 unit in standby (allow for quicker activation for flow rates within the capacity of a single unit)
Dip Sw 5 OFF (default)	2 units in standby (allows for quicker delivery temperature for flow rates requiring both units)

NOTE: This Dip Switch will not affect systems operating with an MSA / MSB board



EZConnect standby setting

APPENDIX A
INSTALLATION EXAMPLES

Rinnai®

2008 HGTV Green Home





Show Village Home





Commercial Application-Public School

Middle School Cafeteria





- 4 – R94LSi replace 1 – 85 gallon – 399,900 btu tank serving:
  - Hobart CRS66A dish washer w/ pre-rinse
  - (1) triple pot sink, (4) single pot sinks, (1) single pot sink w/ pre-rinse, (3) hand sinks, (1) mop sink, (1) service faucet, & (1) res washer

Commercial Application-Hotels

Rinnai

National Hotel Chain

- **6 – R94LSe Rinnai units supplying 125° F water needs for this 88 room hotel**
- **2 – R94LSe Rinnai units with storage supplying 140° F water to the commercial laundry equipment**

<u>Benefits:</u>

- **Space Savings – exterior application**
- **Energy Savings**
- **Redundancy**
- **Zoned systems and temperatures**



Commercial Application-Hotels

Rinnai

National Hotel Chain



22 – R94LSi Rinnai units 105 room hotel and convention center with commercial laundry and full service kitchen



Commercial Application-Restaurant

National Full Service Restaurant





90 Gallon 500,000 btu tank water heater replaced with 5 – R94LSi Rinnai units horizontally vented using snorkel kits.

APPENDIX B

MSB Multi-Unit Controller



Rinnai®

Rinnai's Multi-unit controller technology

An EZConnect® cable or MSA/MSB controller ensures each unit is firing at the same rate during operation and electronically balances the flow rate through each unit.
In addition, this technology sequences or rotates between units to prevent one unit from being overworked.

History of Rinnai's Multi-unit Controllers	
VA, VB, VC, KA and KB Products*	1-EZConnect cable or MSA-2M technology and moving forward MSB technology
V Series products	MSA-2M technology and moving forward MSB technology (some components will vary)
2424/2402	Original MSA-M Technology
*NOTE	Some smaller models (RV53, R63, etc) may not accept MSA /MSB components. These units are seldom operated in tandem—if so, PVA valves can be used. Contact Rinnai if needed for more information.

The following features have not changed from MSA to MSB technology:

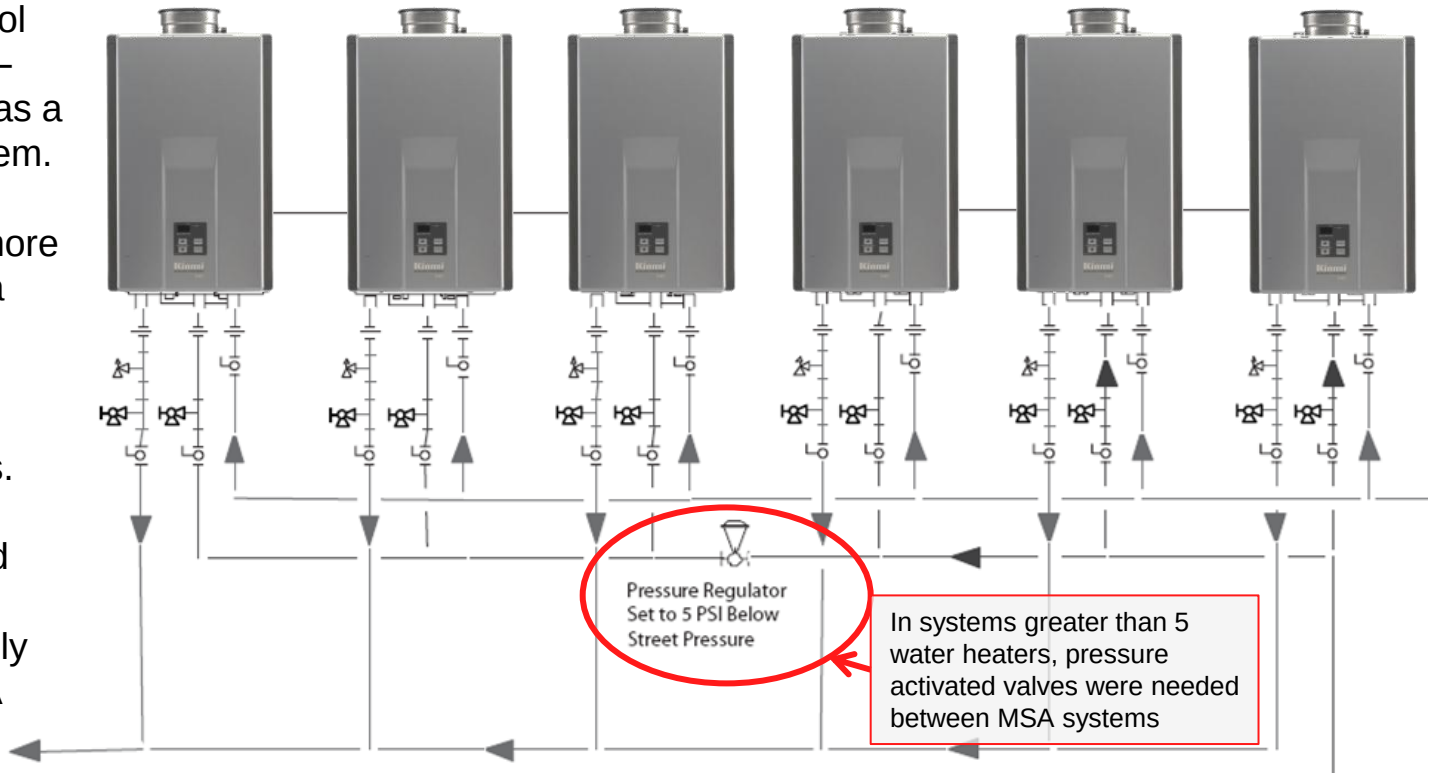
- With any MSA/MSB or EZConnect configuration, the temperature controller connected to the primary or #1 unit will control temperature on ALL units in the system.
  - Temp controllers on other units in the system will only display (not change) the temperature. They will also display individual diagnostic codes—therefore it is recommended to ensure temperature controllers are connected to all units.
  - Additionally, if multiple MSB systems are used together (6 or more units), the controller in the first unit of the Master MSB will control the entire system.
  - Water heaters that do not have a temperature controller will operate at the temp setting of this first unit.
- All units manufactured after July, 2008 installed in an MSA / MSB or EZConnect setup and needing temperatures higher than 140˚ F will only require an MCC-91 controller installed on the primary unit.
  - All other units will follow the primary unit's temperature without the purchase of the MCC-91 controller.
- For proper operation, it is not recommended that different models be connected together. Combining different models may result in lower performance.

MSA vs. MSB

Rinnai's previous MSA technology could control up to 5 water heaters—allowing them to work as a single modulating system.

For applications with more than 5 water heaters, a pressure activation or regulating valve would have to be placed in between MSA systems. This was an effective method from a demand perspective; however, cyclic rotation could only occur within each MSA system.

Previous MSA Technology



So in the example here, the 3-unit system on the right would ALWAYS operate to full capacity before the 3-unit system on the left would engage.

Furthermore, the previous MSA system always had no less than three water heaters in standby (ready to fire with the water flow control valve opened). For smaller flow rates, the time to ignition could be a bit longer due to the MSA system closing any control valves that were opened but not needed.

MSA vs. MSB

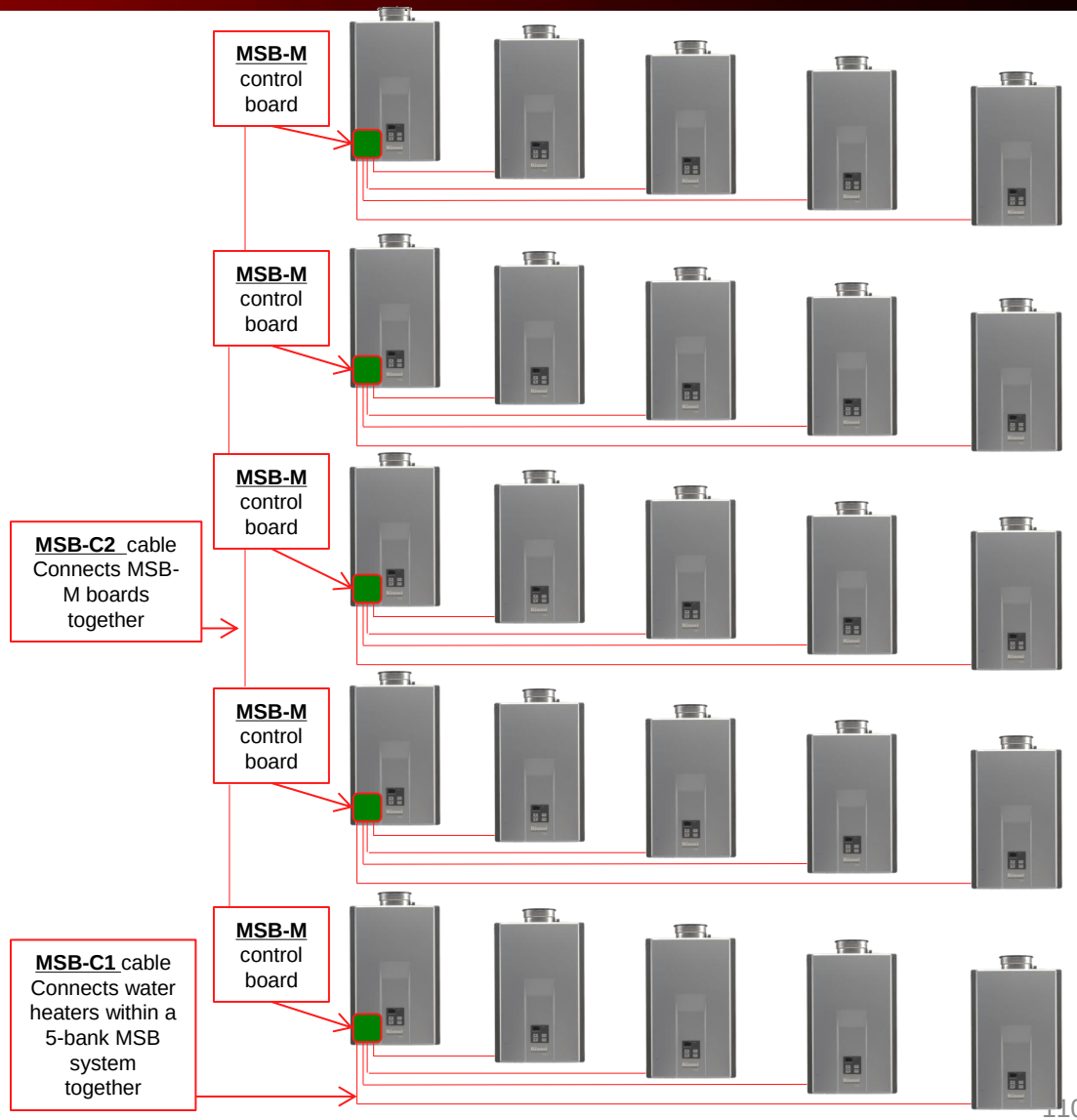
Current MSB Technology

Rinnai's improved upon its MSA technology with the release of the MSB platform.

Each MSB-M board will connect up to 5 water heaters. However, now up to 5 MSB-M boards can be connected together with communication cables—now as many as 25 water heaters will operate as a single system!

Furthermore, dip switches will allow the installer to select how many units are in standby with their water control valves open (ready to fire)—thus allowing quicker response time when demand increases.

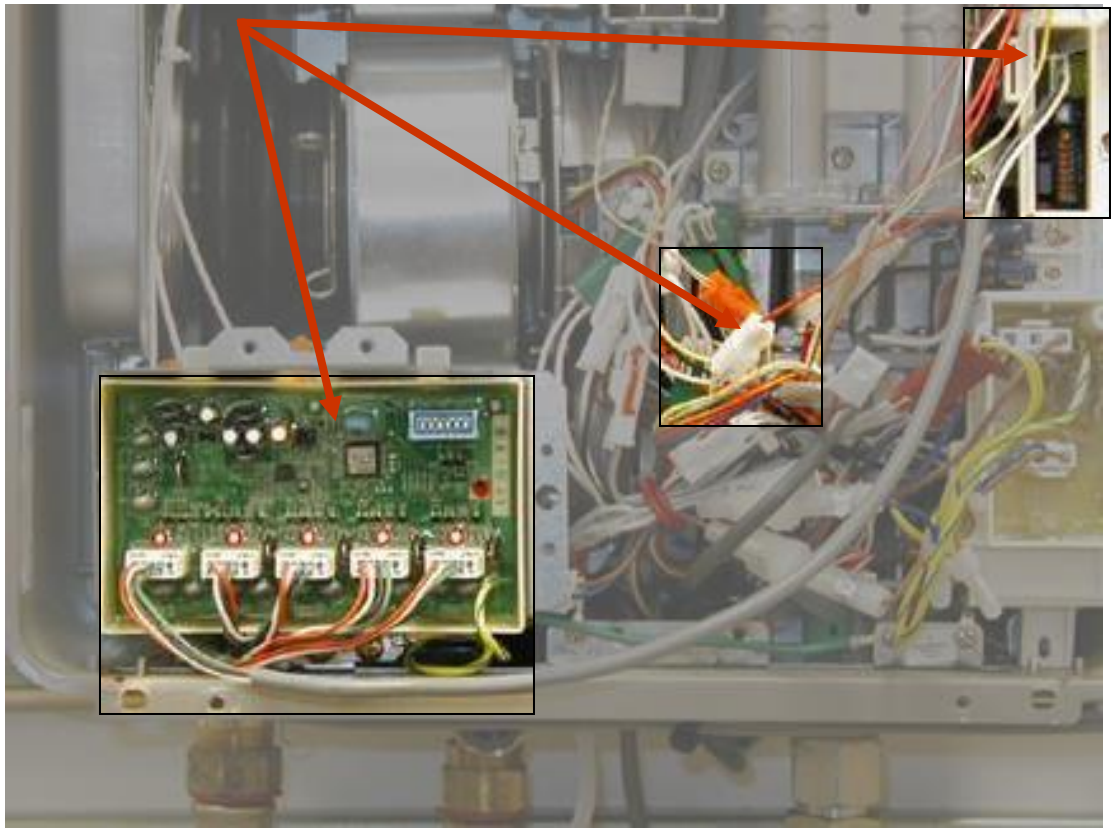
Depending on which model water heater is used, an MSB system could have an operating range of 10,000 to as great as 5.9 million Btu and anywhere in between. Or, in terms of flow rate: 0.4 gpm to 245 gpm and anywhere in between!



MSA – 2M Connections

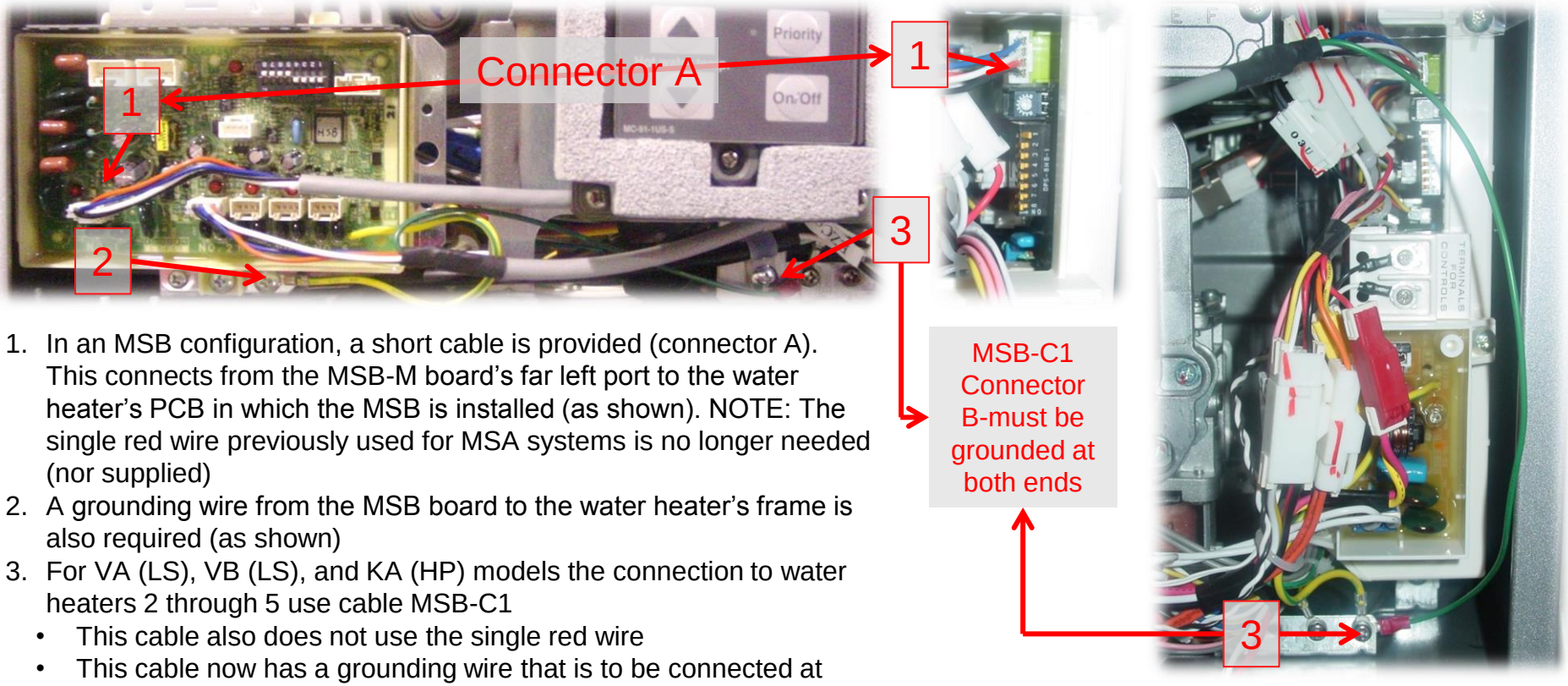
Previous MSA - 2M Master Board / MSA-2S wiring harness connections

In an MSA configuration, a special harness (MSA-2S cable) connects to the MSA controller board (left arrow), a single red wire (middle arrow), and each unit's PCB (right arrow). A grounding cable from the MSA board to the water heater's frame is also required



MSB – M: Connections within a 5-unit subsystem

MSB-M Master Board / MSB-C1 or C3 wiring harness connections



1. In an MSB configuration, a short cable is provided (connector A). This connects from the MSB-M board's far left port to the water heater's PCB in which the MSB is installed (as shown). NOTE: The single red wire previously used for MSA systems is no longer needed (nor supplied)
2. A grounding wire from the MSB board to the water heater's frame is also required (as shown)
3. For VA (LS), VB (LS), and KA (HP) models the connection to water heaters 2 through 5 use cable MSB-C1
   - This cable also does not use the single red wire
   - This cable now has a grounding wire that is to be connected at both ends (to both water heaters)—as shown
4. If an MSB-M is used with a V-series model, the single red wire connection is still required. Therefore a separate cable is available—MSB-C3

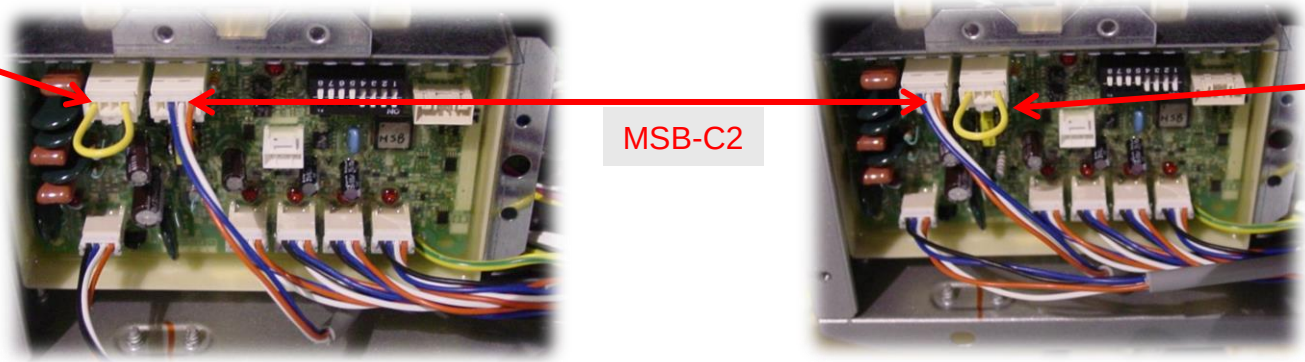
MSB – M: Connections between a subsystem

MSB-M Master Board / MSB-C2 wiring harness connections

- For applications with more than 5-Rinnai water heaters, an MSB-C2 cable can connect MSB-M boards together—allowing the entire system to work as one.
- Two yellow terminal cables are provided with each MSB-C2 kit. These are to be installed on the first and last MSB-M boards in the series
- The first MSB-M board in the system should have the yellow terminal cable seated in the top left port
- The last MSB-M board in the system should have the yellow terminal cable seated in the top right port
- See the following examples:

  - For 6 though 10 units using 2-MSB-M boards, ensure the yellow terminal cable is installed as follows

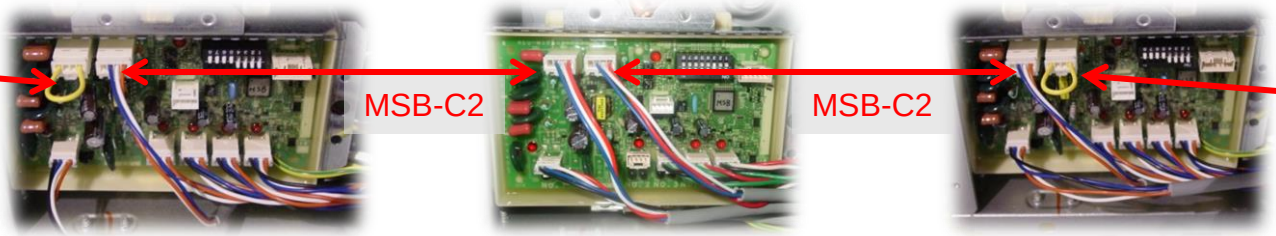
Yellow terminal to be installed in the top left port on the first MSB-M board NOTE: THIS IS THE MASTER MSB



Yellow terminal to be installed in the top right port on the last MSB-M board

  - For systems using 3, 4 or 5-MSB-M boards, ensure the yellow terminal cable is installed as follows

Yellow terminal to be installed in the top left port on the first MSB-M board

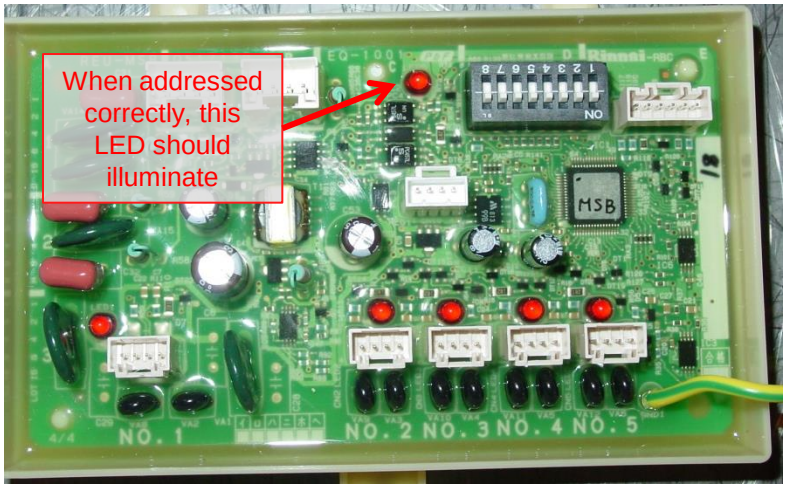


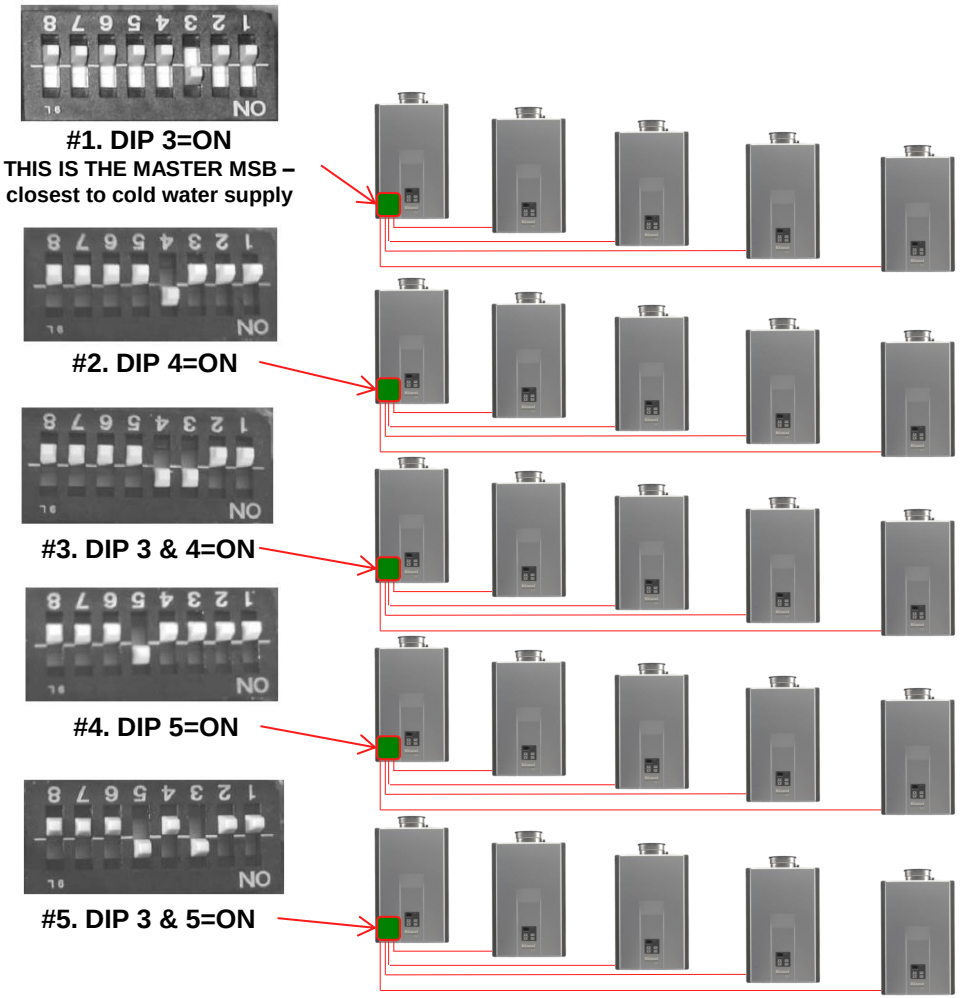
Yellow terminal to be installed in the top right port on the last MSB-M board

MSB – M: DIP Switch Settings

MSB-M Master Board / MSB-C2 wiring harness connections

- No DIP switch settings are needed on the water heaters' PCB's.
- However, each MSB has DIP switches that should be set for the following reasons
  - Addressing each MSB within a system—when set correctly the LED light on each MSB should illuminate (shown here)
  - To assign how many units should be "ready-to-fire" upon initial water flow—this will be dependent on the application's needs (next slide)

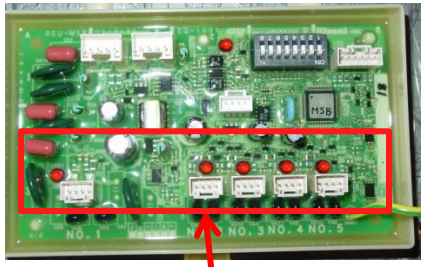




MSB – M: DIP Switch Settings

When multiple water heaters are operating, they will attempt to supply equal amounts of hot water.

- By default, three water heaters will be in standby (or a “ready-to-fire” state)—meaning that the water flow control valves of three units are open. Those units will fire immediately on initial water flow demand.
- Once the MSB system determines water flow demand, only the necessary number of water heaters will fire to meet that demand. Water heaters not firing will close their valves.
- Each MSB-C1 cable has an LED indicator to report the status of each water heater:



LED Status indicator

LED State	Unit status with no flow established by MSA/MSB	Unit status after MSA/MSB establishes flow
LED On Solid	Water flow control valve is open. Unit is in standby and will be among the first to fire.	Unit is fired and running.
LED Flashing Slow	Water flow control valve is closed/ unit is not in standby.	
LED Flashing Fast	Error detected at this unit (Error will not reset until power at MSA/MSB or this unit is recycled).	
LED Off	No unit detected at this plug	

- As the default setting, 3 units will open their servo valves until flow demand is determined. This can be altered between 1 and 3 units dependent on the application’s needs
  - The more units in standby, the quicker delivery temperature for higher flow rates
  - The fewer units in standby, the quicker activation for lower flow rates
  - If fewer than 3 units in standby is desired, refer to the Dip SW setting chart below



DIP 1 & 2 OFF
3-units in standby (default)



DIP 1 ONLY ON
2-units in standby



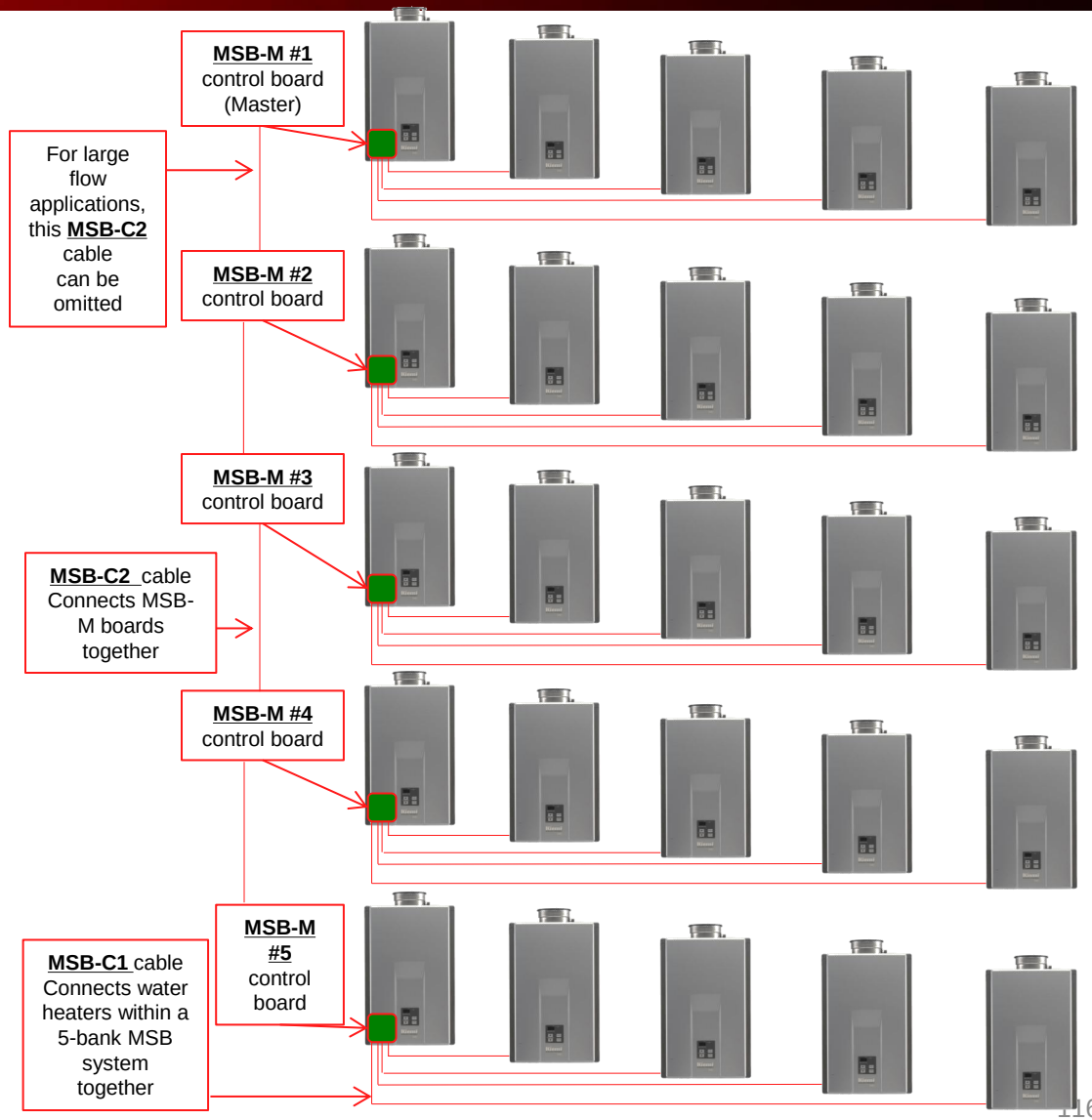
DIP 1 & 2 ON
1-unit in standby

- When installation is completed, do a test run for all units.
- The temperature setting for all water heaters in the system is controlled by the temperature controller connected to the water heater with the Master MSB Board. Temperature controllers connected to the other units will provide maintenance codes for their respective units.

MSB: Basic Operation

So based on the previous recommendation, operation would work as follows:

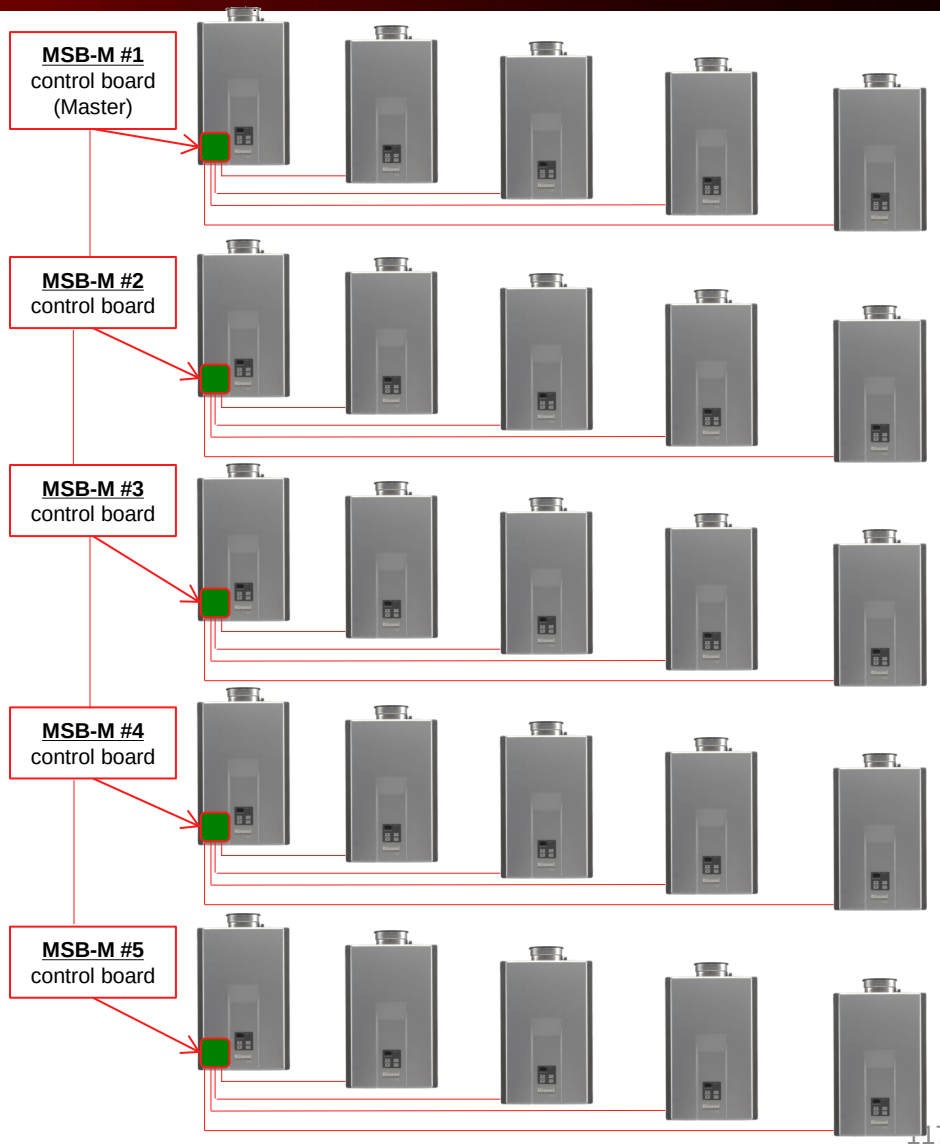
- When water flow starts, the first three units of the Master MSB #1 will pass water through them. ALL other water heaters in the system will have their flow control valves closed—not allowing water flow initially
  - If water flow is less than 1.2 gpm (3 units X 0.4 gpm activation), 1 or 2 of the active units will close their valves (depending on total flow rate)
  - Otherwise, the MSB system will determine demand and quickly commission as many units as needed
    - Once subsystem #1 is at about 90% of its capacity, subsystem #2 will begin to commission its units. The number of units commissioned will be based on the increase in demand.
    - This sequence will continue in the same manner
- NOTE: If an application requires a large amount of flow very quickly at startup, the MSB-C2 cable between subsystems 1 & 2 can be omitted.
  - This will allow 6 units to be in standby (3 each from the first two subsystems)
  - This will also require a 0.8 gpm minimum activation



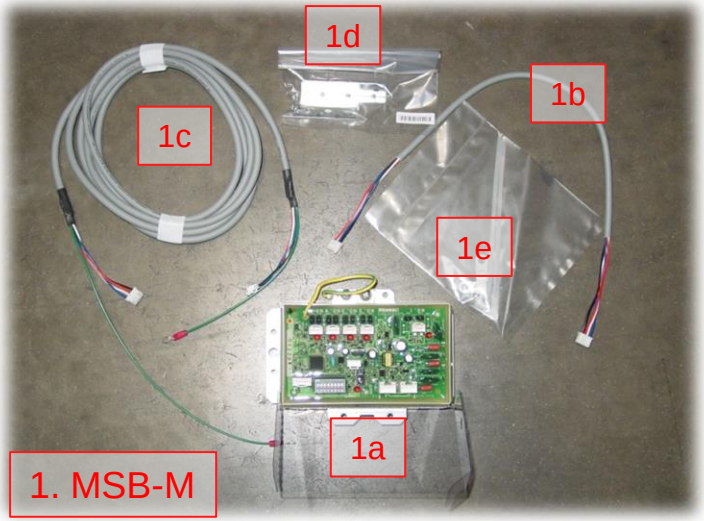
MSB: Rotation

The order in which each water heater operates is occasionally rotated to ensure equal usage among the entire system.

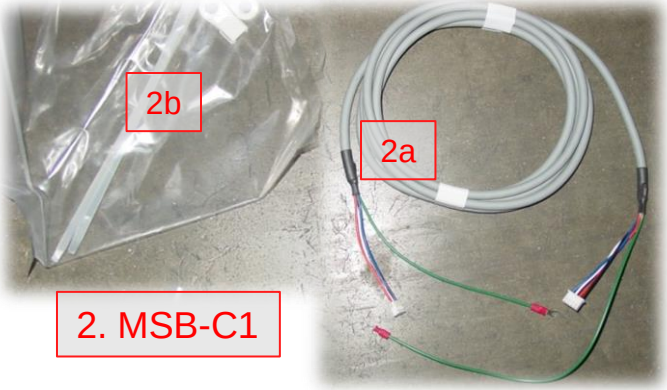
- When power is first applied, the Master MSB is designated as the “parent subsystem.” All other MSB subsystems are designated as “branches.”
- Every 24 hours the parent subsystem will rotate to the next branch.
  - So MSB #2 would become the parent after the first 24 hours
  - NOTE: this is 24 hours of applied power—not operation time
  - IMPORTANT: If the master MSB is set for 3-units in standby (via its DIP settings), this will transfer to each subsystem when it becomes the parent. So, in this example, MSB #2 would then have three units in standby.
- If a subsystem is not operating at full capacity—meaning one or more units are not needed—a rotation sequence will also occur WITHIN that subsystem moving in a counterclockwise fashion
  - NOTE: this works in the same fashion as the previous MSA system. If needed, refer to TB-54 for additional information



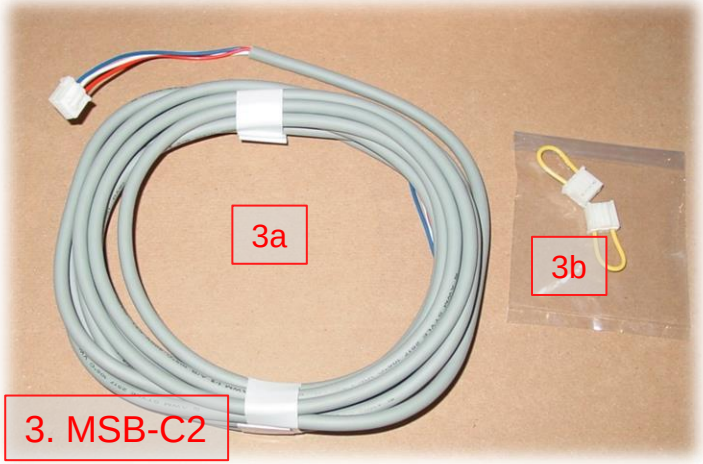
MSB Parts Overview



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

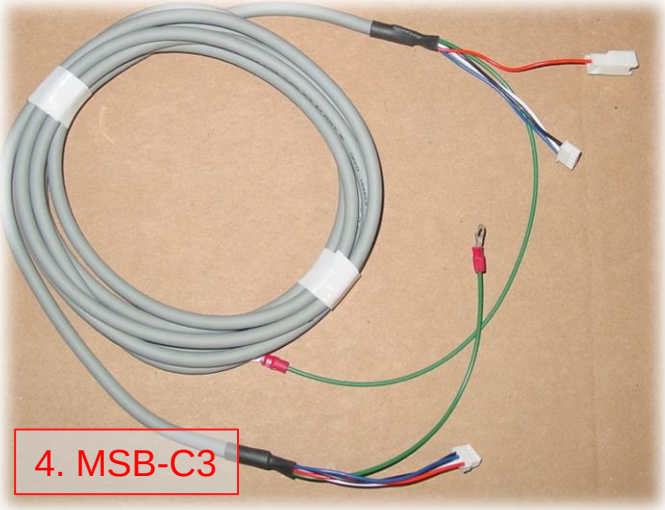


2. MSB-C1 Kit
   - 2a. MSB-C1 cable
   - 2b. Wire ties



3. MSB-C2
   - 3a. MSB-C2 cable (13.1 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.

This concludes Rinnai's

Tankless Water Heater Training Program
Product Knowledge / Installation Fundamentals
Level I/II

Advance the next slide to test your knowledge.

Rinnai®

Tankless Water Heater PK-Install

Question 1 of 25

Point Value: 10

Rinnai Tankless Water Heaters have an industry leading _____ gpm activation rate.

- 0.6
- 0.8
- .08
- 0.4

PROPERTIES

On passing, 'Finish' button:	Goes to Next Slide
On failing, 'Finish' button:	Goes to Next Slide
Allow user to leave quiz:	After user has completed quiz
User may view slides after quiz:	At any time
User may attempt quiz:	Unlimited times

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