

PrecisionTemp – RV-500

Instantaneous Gas Water Heater Installation and Operating Instructions

The RV-500 is certified as a direct vent automatic instantaneous water heater designed to be installed in recreational vehicles or mobile homes. This appliance must be installed in accordance with local codes or in the absence of local codes the following applies:

Manufactured Home: Standard, Title 24 CFR, Part 3280

Recreational Vehicle: Standard ANSI A119.2/NFPA 501C-1987

Every water heater is inspected and tested before it leaves the factory. In order for this unit to operate safely and effectively, all installation instructions must be followed. Failure to comply with all installation and operating instructions will void the warranty. PrecisionTemp, Inc. will not be responsible for anything that is a result of non-compliance

FOR YOUR SAFETY **WHAT TO DO IF YOU SMELL GAS**

- Extinguish any open flame.
- Shut off the gas supply at the gas container or source
- Do not touch any electrical switch or use any phone or radio in the vehicle.
- Do not start the vehicle's engine or electrical generator.
- Contact the nearest gas supplier or qualified service technician for repairs.
- If you can not reach a gas supplier or qualified service technician, contact the nearest fire department.
- Do not turn on the gas supply until the gas leak(s) has been repaired.

FOR YOUR SAFETY

DO NOT STORE OR USE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE VICINITY OF THIS OR ANY OTHER APPLIANCE.

WARNING!

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Refer to the installation instructions and/or operating instructions provided with this appliance. A qualified installer service agency or the gas supplier must perform installation and service.

Keep this book with the water heater at all times. It contains instructions regarding installation, operation and maintenance of your water heater. If you need further information, contact your dealer, your nearest service center or PrecisionTemp Inc.

Please read these instructions thoroughly before starting your installation

Installation Instructions For The RV-500 Water Heater

The RV-500 water heater is designed to be installable and removable from the exterior of the vehicle. The mounting instructions are for the PrecisionTemp flush mount and surface access doors. No other door should be used. Doing so will void the warranty and cause the heater to malfunction and could cause damage or injury.

Please read these instructions before making any modification to the construction of your RV.

Selecting Installation Location

The water heater must not be installed in an area where the vent can be covered when any door or access panel on the coach is opened. The water heater should be located in an area where leakage will not result in damage to other items of, or in the structure. If such an area cannot be avoided, it is recommended that a suitable pan and drain be installed under the heater.

Install the heater as close to the gas supply as practical to minimize length of the gas line.

There must be a minimum of 8" of clearance between the vent cover and any other surface. Do not install where the vent is closer than one foot from any window or opening into the coach.

Although the RV-500 can be mounted with zero clearance around the sides, top and bottom, be sure that the installation does not interfere with any wiring, plumbing or cabinets inside the coach. Do not install the water heater or any other appliance where it can vent into an area covered by an awning, canopy or any other enclosure. For better support and ease of installation, install where the bottom of the heater case rests on a floor.

Installing Heater In The Side Wall Of A Coach

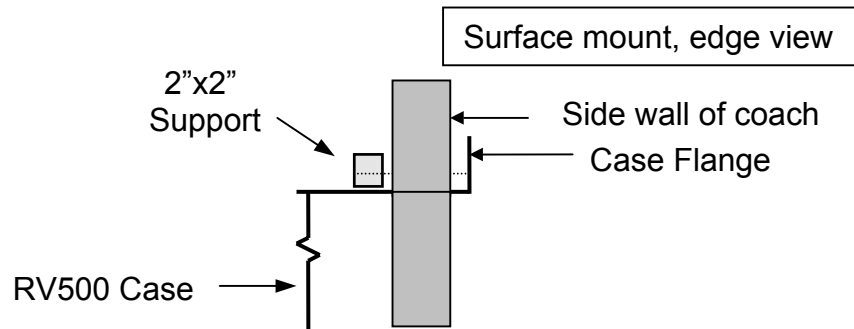
The RV-500 can be installed as a flush mount or a surface mount. The model RV-500 refers to the heater ordered with the flush mount door kit. The model RV-500-1 refers to the heater ordered with the surface mount door. The RV-500 *flush* mount can retrofit an Atwood ten gallon flush mount water heater without side wall modification regardless of side wall framing. If the side wall framing is steel or aluminum rather than wood framing and the original water heater is anything other than an Atwood ten gallon flush mount water heater, it is recommended that only the surface mount configuration be used unless done by the RV manufacturer or dealer.

Surface Mount Installation

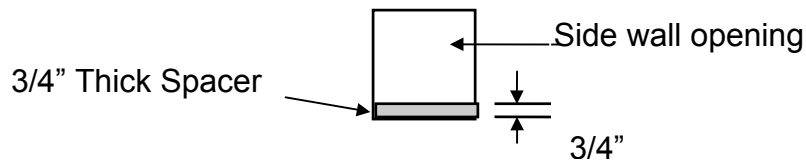
Surround the opening on the skin of the coach with four to six inches of masking tape to protect the skin of the side wall.

The rough opening for the RV-500-1 should be 13.75" wide x 14.375" high. This is about 2.75 inches taller than an Atwood six gallon tank heater. If the opening needs to be enlarged by cutting the internal side wall structural member, a 2"x2" wood support should be installed.

Do this on the inside of the side wall so that a screw would go through the screw hole on the RV-500-1 case flange, through the side wall and into the 2"x2" support sandwiching the side wall between the flange and the 2"x2" support.



Attach a 3/4" thick 2 x 2" wide wood spacer to the bottom of the cut out. This will center the flange of the RV-500 vertically in the opening. This applies if you are installing the RV-500 in either the flush or surface mount configuration.



Place the bottom of the back of the RV-500-1 on the bottom frame of the opening. Tilt the water heater back and feed the gas line through the gas line grommet. (Note: If there is no access from the inside of the coach to the back of the water heater compartment the water lines and electrical must be connected at this stage. Refer to those sections of this manual).

Push the RV-500-1 into the opening. Center the heater in the opening and start a screw in the top center hole.

Run the screw down but not tight. Apply silicone or other appropriate sealant under the RV-500 flange.

Push the unit into the opening to bed into the sealant. Now screw in the other three center screws.

Apply silicone or other appropriate sealant heavily in the corners and on the flange around the corner holes.

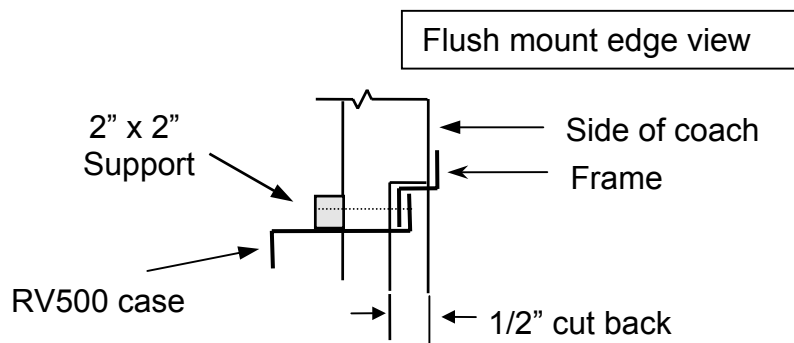
Place the corner pieces in the corner so the holes line up and put four screws in each corner.

Seal where the corner bracket meets the corner of the case. Remove excess sealant.

Flush Mount Installation

- Surround the opening on the skin of the coach with four to six inches of masking tape to protect the skin of the side wall.

- You are now going to mark the setback cut-out. Place the door frame over the opening. Center the frame on the skin. Use the inside edge of frame to draw a corner radius on each corner. Mark the .5" setback and remove the frame. Now check the markings to make sure they are 18.5" wide by 18.25" tall and adjust the markings to this dimension. **(Note: Do not cut the setback as a square! The rounded corners of the frame will not cover the square opening setback corner!)**
- Cut 0.5" deep on the lines with a circle skill saw being careful not to cut past the radius. Use a narrow chisel, a .125" drill bit, or router to cut around the radii.
- Use a wide wood chisel to cut 0.5" from the opening back to the cut you just made with the saw. Clean the radii out with a smaller chisel. Now place the frame in the opening and check to see that the flange part of the frame is flush with the skin of the coach. The side wall opening is now prepared to accept the door frame.
- The rough opening for the RV-500 case should be 13.75" wide x 14.375" high. If the opening needs to be altered and the internal side wall structural member is cut through, a 2 x 2 wood support should be installed on the inside of the side wall. Do this so that a screw would go through the screw hole on the RV-500 case flange, through the side wall and into the 2 x 2 support sandwiching the side wall between the flange and the 2 x 2 support.



- Place sealant on the back of the door frame and push it into opening.
- Put flush door adapter ring over back of heater and bring forward to the mounting flanges.
- Slide the RV-500 and adapter ring into door frame already mounted into opening.
- Tilt the water heater back and feed the gas line through the gas line grommet. **(Note: If there is no access from the inside of the coach to the back of the water heater compartment the water lines and electrical must be connected at this stage. Refer to those sections of this manual).**
- Push the RV-500 into the opening. Center the heater in the opening and start a screw in the top center hole.
- Run the screw down but not tight. Back the screw off enough to put silicone or other appropriate sealant on the frame under the RV-500 flange.

- Put the door onto the frame and adjust the frame so the door screw threads align with the screw catch.
- Remove the door and tighten the top center screw
- Apply silicone or other appropriate sealant under the RV-500 flange. Push unit into opening to bed into the sealant.
- Now screw in the other three center screws. Apply silicone or other appropriate sealant heavily in the corners and completely around the flange. Remove excess sealant.

Connecting Gas Supply

The gas line should be of approved type and size with a 3/8" female flare nut. If the gas line is very long or has numerous bends in it, it should not be less than 5/16" ID or performance of the water heater will suffer. The maximum inlet gas pressure must not exceed 13 water column inches.

Some standards may require a manual gas shut off valve in the gas line external to the water heater. The water heater must be isolated from the gas supply system during any pressure testing of that system at test pressures equal to or in excess of 1/2 PSIG.

To Connect A Gas Line:

1. Remove foil insulation and set aside until gas line connection is complete.

NOTE: The gas line can be routed into the case through the grommet in the back or through the side of the case. If the gas line is to be brought into the side of the case, the positions of the knockout plug in the side of the case and the sealing grommet in the back of the case should be reversed. Both of these devices will snap in and out.

Never operate heater with either of these holes left open. The gas inlet fitting on the top of the gas solenoid valve must be repositioned to point to the side of the case. To do so, support the gas valve and back-up with a wrench, turn the gas fitting 1/4 turn clock-wise taking care not to damage the threads. Caution: Turning the gas-fitting counter clock-wise may cause the seal to leak.

2. Route gas line through sealing grommet (back or side) of heater case. Take care not to damage wiring.
3. Screw gas line fitting onto the flare fitting of the gas valve by hand and then tighten with a basin wrench or crow's foot.
4. Turn on gas supply and check for leaks using a soapy solution on the joint. Never use a flame to check for leaks. Be sure that sealing grommet is intact. If it became torn or distorted through the installation, fill cup on back of grommet with silicone caulk (RTV) to seal against any possible leaks.

Warning: This flare fitting is a dry seal. Pipe dope should never be used on this fitting.

5. Replace the foil insulation taking care that it is secured to the Velcro attachment points.

Connecting The Electrical Supply

The water heater is designed for 12 VDC negative ground. Never connect to 115 VAC. The power leads are on the back of the heater and should be connected directly to the breaker panel of the coach, extending the wires if necessary. Red is positive (+) and black is negative (-).

If the leads need to be extended or any wiring is extended or replaced inside the heater, use a minimum of 18 gauge wire with a temperature rating of 105°C. It is suggested that the heater be connected to a switch or breaker rated at 2 amps.

Never connect heater to a power converter without a battery in line. Doing so could damage your heater and void the warranty. Be sure that the heater is connected to a "filtered" (pure DC) circuit of the converter. To test whether the circuit is pure DC, take a voltage reading using a multimeter set on the AC voltage scale. If the reading is more than 1/2 volt, the circuit is not DC voltage and should not be used. (See the tag on red and black power wire on the back of heater)

Connecting The Water Supply And Hot Water Outlet

The water connections are on the back of the heater. They are marked "Cold" inlet and "Hot" outlet. The Hot water is on the bottom and cold water is on the top. This is reverse of most tank heaters.

The standard fitting is 1/2" NPT. Piping and components connected to the heater shall be suitable for use with potable water. The heater shall not be connected to any system or component(s) previously used with a non-potable appliance. When tightening water connections to the water line, be sure to back up the fittings with a wrench as to not damage the copper water tubing. Re-tighten the compressions nuts on the water fittings.

With the power and gas supply to the heater turned off, pressurize the water system, purge it of all air and check for leaks. Also, verify that the rotor in the flow meter is rotating counterclockwise while a water hot water tap is turned on. If it is not rotating counterclockwise the hot and cold water lines have been installed backwards.

Note: There is no need for a bypass kit when installing the RV-500. It is recommended any bypass kit be removed. If a bypass kit is installed the valve must be in the off position or the heater will not operate properly. If the coach is going to be used in freezing conditions, it is suggested that a drain valve be installed at the hot water outlet connection to drain the heater while transporting in freezing conditions.

Recommendations For Water System Installation

In order to realize all of the temperature control features of your water heater and to extend the life of the water system, observe the following recommendations:

- Be sure all water strainers and aerators are removed and cleaned.
- Any water flow restricter located on the inlet of the showerhead should be removed. Failure to remove this could effect the performance of the temperature control.

- Keep hot water lines as short as possible and no larger than 1/2" ID to conserve water and accelerate the delivery of hot water.
- Install a water strainer into the water line preceding the water heater to keep particulate matter out of the system.
- Always have a water pressure reducer in place when using city pressure water.
- It is strongly recommended that an accumulator tank be installed in the cold water line. This maintains a constant flow of hot water when using the pump, enhances the operation of your water heater and extends the pump life.

Operating Instructions

The RV-500 is now ready to operate. Follow this procedure to operate the water heater:

1. Pressurize the water system by turning on pump or city water pressure.
2. Purge all air from system by turning on the taps until a steady stream of water flows from the taps. Turn off taps.
3. Turn on the 12 VDC power supply. A green LED should now be flashing on the front of the electronics drawer. (Front cover must be opened to observe LED). This indicates normal operation. Close front cover.
4. Turn on the propane supply at tank and the manual gas valve if installed in system.

Heater will remain dormant until a water tap is opened and the heater senses a water flow of at least 0.4 GPM.

5. Turn on hot water tap. The heater will fire up within two seconds and hot water will flow from the tap in the time that it takes to get through the plumbing from the heater to the tap. Hot water delivery will continue as long as the water is flowing. (Note: You may have to turn the water on and off several times to bleed the air from the LPG line before the water heater fires up.) If the heater fails to light after several ignition attempts, turn the power to the unit off, wait 5 seconds and turn the power on again.
6. Close the hot water tap and the heater will shut off.

NOTE: When using an "on/off" button on a shower head or an outside washdown box, always turn off the hot and cold water valves when finished. Not doing so will result in cold water bleeding into the hot water system and causing the water heater not to ignite. Cold water or alternating warm and cold water will result.

The RV-500 is designed to give a continuous flow of hot water as long as required and maintain the approximate set temperature through all flow rates within the capacity of the heater (85°F temperature rise per GPM). The heater will not fire at very low flows; i.e., under 0.4 GPM.

It is recommended that even when dry camping, take a real shower and leave the water running as you would at home. You won't run out of hot water and you won't have to waste

water waiting for the cold water to purge from the water line every time the water is turned back on. RV showerheads are designed to drip when turned off and will allow the hot water line to be filled with cold water.

WARNING: Always turn off the 12-volt power supply to the heater during any fueling operations. Operating this water heater or any other ignition source during fueling could cause a fire or explosion, which could result in serious injury or death.

NOTE: Should overheating occur or the gas supply fails to shut off, turn off gas valve at the supply tank. Immediately call a qualified service technician.

Do not use this appliance if any part has been under water. Immediately contact a qualified service technician to inspect the appliance and replace any part of the control system and any gas control, which has been under water.

Changing Temperature Setting

The temperature on your water heater has been factory set to approximately 115°F. It is not recommended that you change this setting. Doing so could result in dangerously hot temperatures that could result in severe injury. If it is necessary to change the setting it can be done as follows:

Open access door of heater. Pull the steel electronic drawer out about one inch. The adjustment screw is located on a small blue block at the lower right corner of the electronics board (R6), just inside the drawer.

A small blade screwdriver should be used. To decrease temperature, turn screw counterclockwise. To increase temperature, turn screw clockwise. Check the water temperature and adjust as necessary.

Use a voltmeter with the black lead in Black test point and the red lead in Blue test point adjust the screw in R6 to read 1.57 vdc on the voltmeter. This will set the temperature control at 115° F.

Routine Maintenance

All faucet aerators and showerhead screens should be cleaned regularly.

It is recommended that the RV-500 be inspected by a qualified service technician at least once a year. Particular attention should be paid to the following:

1. Be sure that the air inlet openings and flue area are clear of any debris or obstructions, (leaves, bug nests, spider webs, etc.)
2. Check that heater mounting is still secure to the coach and there are no areas for potential water leaks.
3. Open the cover of the heater and inspect for debris or obstructions under the burner or in flue hood.

4. Visually inspect wiring. Be sure there is no chafing of the insulation. Be sure that the direct spark ignition (yellow) wire is secured to the electrode under the burner and that the connector is not touching anything.
5. Check gasket on front lip of electronics drawer to be sure that it still seals when drawer is shut. Check that all case sealing grommets are secure and not leaking.
6. Check for soot around the flue. Soot is a sign of incomplete combustion and a qualified service technician should be notified to correct the problem.
7. The pressure relief valve should be manually activated at least once a year by moving the lever on the top of the valve 90°. Never perform this operation while the burner is operating. Water will flow freely from the valve and could cause scalding.

Never plug the pressure relief valve. If the valve is actuating too frequently, contact PrecisionTemp.

Winter Operation and Winterizing Water Heater

It is not recommended that you operate water systems in the winter. Any freezing of the water heater or other plumbing components can cause severe damage that is not covered by warranty.

However, if it is necessary to operate the RV- 500 under freezing conditions, the power and gas supply to the unit should not be turned off. As long as the power and gas are on, the unit will ignite to protect the heat exchanger as the water temperature approaches freezing.

For extended cold temperature use contact PrecisionTemp regarding our optional freeze protection package.

Under no circumstances, however, should you travel under freezing conditions without first draining water from the unit. To drain the system:

1. Turn off water pump and the power and gas to the heater. Open the pressure relief valve by lifting the handle to a 90° position from the normal position.
2. Open drain valve that was installed at hot water outlet fitting of heater.
3. Open at least one hot and cold water tap in the coach. This should drain the system.

Before storing the system for the winter, the plumbing system must be winterized. This can be done by either of the following methods:

1. All water should be drained from the system. To do this, open one tap at a time, using compressed air to purge the system of all water.
2. Recommendations of your coach manufacturer should be followed. Since the RV-500 has no storage tank, there is no need for a water heater bypass kit. It holds less than one pint of anti-freeze. The water system can be filled with RV, non-toxic anti-freeze. When you see the anti-freeze coming from the hot water tap, the heater is protected.

Troubleshooting

The RV-500 is equipped with self-diagnostics. In the event the red LED is flashing please refer to the Service Codes section.

Most problems are easily remedied by consulting the trouble-shooting guide. If problems still persist, contact PrecisionTemp or an authorized service center. Only a qualified technician should do any work involving the gas system.

Heater Does Not Come On When The Water Turns On. Green LED Not Flashing.

1. Be sure all electrical connectors are secure and the polarity is correct. (Red wire to positive terminal) of RV electrical panel.
2. Be sure power is on and panel breaker is not blown.
3. Check electrical contacts in electronics drawer. Be sure the connector with red and black power wire is plugged into board. Using a voltmeter, check for 12Volts on this connector.
4. The fusible link in this wire might be blown. Replace power cord.
5. Be sure there is a battery in the system. Never connect the heater directly to a power converter. Some converters have circuits that are not pure DC. (See the tag on red and black power wire on the back of heater)

Green LED Flashing But Heater Does Not Come On When Water Flows

Be sure that no water-mixing valve has been left in the on position, using the showerhead as a shut off. This will permit water to bypass the water heater and bleed cold water into the hot water system. Always turn off both hot and cold water valves after using. Be sure that the bypass valve at the water connections is in the "off" position.

Heater Does Not Come On When The Water Turns On. Red LED Is Flashing Three Flash Series.

The T-Mid thermister (pair of yellow wires going to heat exchanger) is not connected or defective. Be sure wiring harness connectors are secure and that wires are not chaffed. Be sure connector is secure on electronics board. If these are secure, re-power unit. If the red LED still flashes, contact factory for replacement thermister probe

Green LED Is Flashing But There Is No Ignition When Water Is On.

1. Be sure the gas valve at the tank is "On" and there is gas in the tank.
2. Be sure that gas is turned on and water flow is at least 0.4 gallon/minute.
3. Check that yellow ignition wire is clipped to the spark electrode terminal and is not touching anything else. Align so that it is not in contact with anything but the terminal.

4. With water running, check that the paddle wheel in the flow meter is turning counter-clockwise. This can be visually observed with the access door open by looking through the clear window of the flow meter.

If it is not turning with the water flowing, there is an obstruction in the flow meter. Remove the clear cover of the flow meter by firmly pushing on the cover and turning counterclockwise (approximately 1/8" turn) to remove the plastic cover. Remove the paddle, taking care not to lose the "O" ring seal and the pin that the paddle rotates on. Remove any debris and re-assemble by reversing the procedure.

To secure the window, line up the guides, firmly push to seat and turn clockwise.

5. Check flame site hole to see if igniter is sparking from the probe to the burner. Bend ignition wire to adjust to proper gap or contact PrecisionTemp or your nearest authorized service representative.

There Is No Ignition. Red LED Is Flashing A Series Of Seven Flashes.

The ignition has locked out. Check for these possible causes:

1. Locate the high temperature switch (two light blue wires) at the upper right hand of the heat exchanger. Push the reset button in the center of the switch.
2. Check that the yellow ignition wire is clipped to the spark electrode terminal and is not touching anything else. Check that there are no cuts or breaks in the yellow wire. Align it so that it is not in contact with anything but the terminal.
3. Excessively high or turbulent winds may cause the burner to extinguish. Adjust the position of the vehicle relative to the prevailing wind.

Heater Turns On But Temperature Fluctuates Erratically.

1. Hot and cold water lines are reversed on back of heater. If the flow meter rotor is not rotating counterclockwise, pipes are connected in reverse. Be sure hot water is connected to bottom fitting and cold to the top fitting.
2. May be caused by excessive restriction at the water outlets, showerheads, aerators or water strainers. These should be cleaned and the any showerhead flow restrictor removed as defined in "Recommendations for Water System Installation"
3. The *VariFlame* gas modulating valve is out of calibration. Consult PrecisionTemp.

Heater Does Not Ignite When Water Is Turned On

The gas flow may be too low due to an improper gas line diameter (under 3/8 inch outside diameter). The gas line may be excessively long (over 20 feet) or the on/off solenoid at the tank (if you have one) may have an orifice that is too small (under 3/16th of an inch).

Heater Comes On But Rapidly Cycles On And Off.

1. Water flow is too low. Increase flow at a tap. Clean all aerators and shower head screens.
2. Water pump is not functioning properly. Repair or replace pump.
3. If the heater cycles as the pump cycles, a pressure accumulator tank is needed in the water system. If you have an accumulator tank, check to see if it has become filled with water. If it has, drain it so that it contains air only.
4. Air is in the water line. Bleed air by turning on all water taps.

Heater Ignites But Water Temperature Is Too Low

1. Check thermostat setting. See "Changing The Temperature Setting"
2. The water flow may be so high as to exceed the capacity of the heater particularly if your supply water is very cold. Slow the water flow.
3. The heater may be subjected to excessively strong winds, cutting the efficiency. Shield from wind or change the location of the unit.
4. The gas pressure may be too low. Check the regulator pressure. The LPG pressure should be 11 water column inches, (WCI) while the heater is running. A gas-testing gauge should be installed on the manifold tap so that it may be read while heater is running. If it is too low, turn up the gas regulator to the proper pressure. Be sure the gas flow control valve is in full "on" position. This should only be done by a qualified technician.
5. The gas flow may be too low due to improper gas line diameter (under 3/8 inch outside diameter). The gas line may be excessively long (over 20-30 feet) or the on/off solenoid

at the tank (if you have one) may have an orifice that is too small (under 3/16th of an inch).

6. Check the heater for an airflow obstruction and clean.
7. Check the two conductor, black and white wire to the modulating valve. It should be securely plugged in to the control board terminal.

Water Temperature Is Too Hot Or No Temperature Control.

1. The thermostat is set too high. See "Changing The Temperature setting."
2. Fuel tank regulator is set too high. Have the regulator checked by a qualified technician.
3. Be sure that the hot and cold water lines are not reversed on the heater hook-ups. The unit will not function properly and water could become extremely hot.
4. If water temperature reaches 165°F, the high temperature limit switch (ECO) will trip, shutting the heater down. Locate the high temperature switch (two light blue wires) at the upper right hand of the heat exchanger. Push the reset button in the center of the switch.

Low Heat Rise. Excessive Water Flow Is Required To Trigger Water Heater

If you find that your heater requires excessive flow to activate it (over 1/2 gallon per minute), it is likely that you have cold water bleeding into the hot water side of your water system. Check that valves and faucets are closed when not in use. If there is an on/off button on your showerhead, always turn the water valves off after the shower to prevent cold water from bleeding into the hot water system. This will keep the heater from functioning properly.

If any problem persists, contact an authorized service center or PrecisionTemp.