G-Class Operators Manual Supplement

Important Supplementary Information

This supplementary information must be considered a part of the operator's manual. If the information included in this booklet are in conflict with information included in the owners manual the information in this booklet takes precedence.

!! IMPORTANT !!

The information included in this supplementary material is very important. Read and understand all of this information fully. If you require further explanation of the information contained in this manual contact your local dealer or contact the factory directly.

POLAR FURNACE

clean, simple heating with wood

Return Water Low Temperature Protection

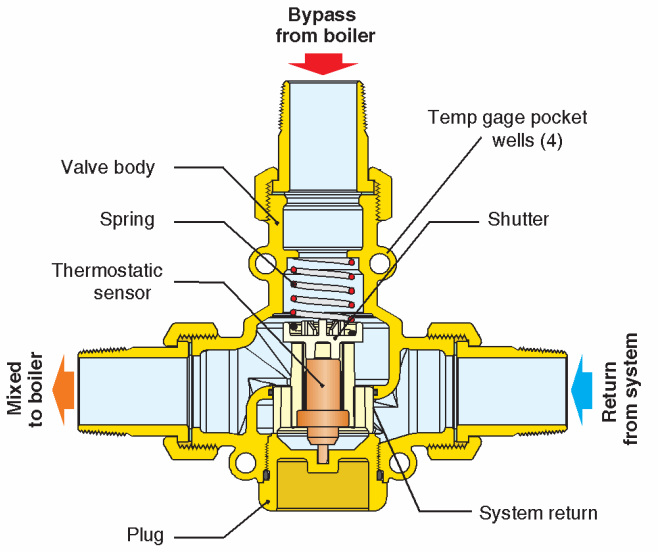
The G-Class heaters are designed as non condensing boilers. Condensation will occur inside the heater on surfaces that are cooler than 140F. If not stopped, this condensation will cause rapid corrosion and premature failure to occur. Warranty on the G-Class heater is cancelled if the return water temperature drops below the minimum temperature specified in the warranty. It is the responsibility of the installer to provide return water low temperature protection in the design of the heat distribution system. One way to prevent low return water temperature is to use a boiler protection valve also referred to as an anti-condensation valve. One boiler protection valve is shipped with each furnace.

Boiler Protection Valve Operating Principles

Inside an anti condensation valve is a thermostatic sensor cartridge (see diagram below) which responds to the temperature of the water flowing through the valve and moves to control the position of a shutter (see diagram below). This shutter regulates if the water pumped from the boiler bypasses the heating system and circulates back into the boiler to be heated further or flows towards the heating system to supply heat. The boiler protection valve has 3 modes of operation: Full Bypass Mode, Mixing Mode, and No Bypass Mode.

This port is teed into the water supply line of the primary distribution loop. All loads must be teed into primary distribution loop after this port.

This port is connected to the return water line of the primary distribution loop. No loads can be attached to the primary distribution loop between this port and the furnace



anti condensation valve / boiler protection valve cutaway view

This port is connected to the return water line of the primary distribution loop. All loads must be connected before this port in the primary distribution loop.

IMPORTANT NOTICE TO INSTALLER

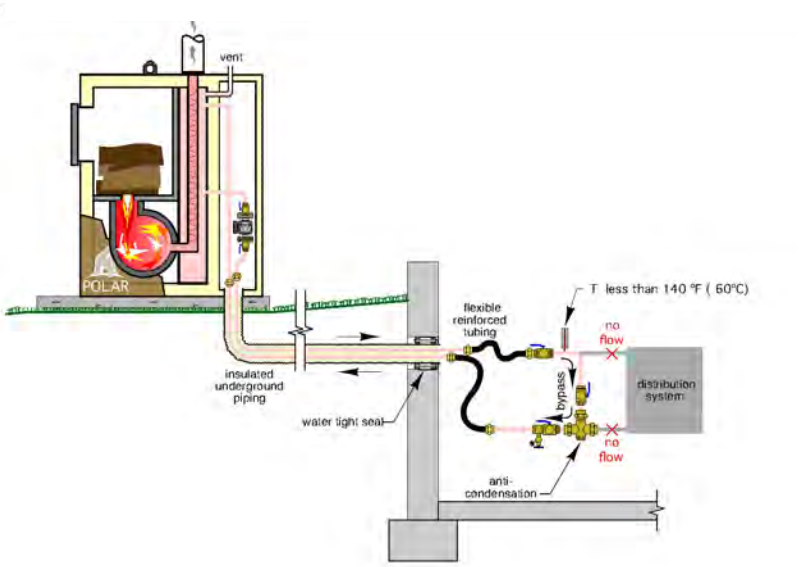
IT IS VERY IMPORTANT THE BOILER PROTECTION VALVE IS INSTALLED AT THE PROPER LOCATION ON THE PRIMARY DISTRIBUTION LOOP. IF AFTER READING THESE INSTRUCTIONS YOU ARE UNSURE OF EXACTLY WHERE OR HOW THIS VALVE SHOULD BE INSTALLED CONTACT YOUR LOCAL POLAR FURNACE DEALER OR THE FACTORY @ 204 626 3485 FOR FURTHER CLARIFICATION.

Boiler Protection Valve – Operating Modes

The boiler protection valve has 3 modes of operation: Full Bypass Mode, Mixing Mode, and No Bypass Mode.

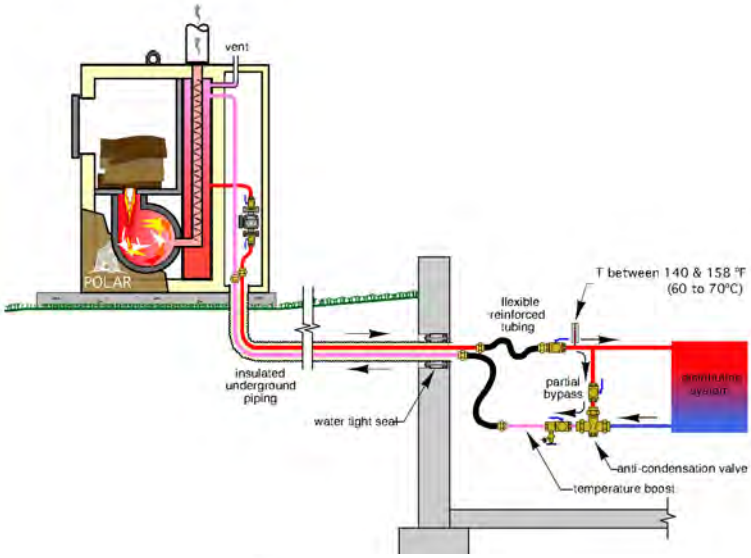
Full Bypass Mode

At boiler startup, the anti condensation valve circulates the full flow from the boiler back to the boiler without passing through the load side of the system. This insures the boiler comes up to temperature as quickly as possible to stop any condensation from occurring as quickly as possible.



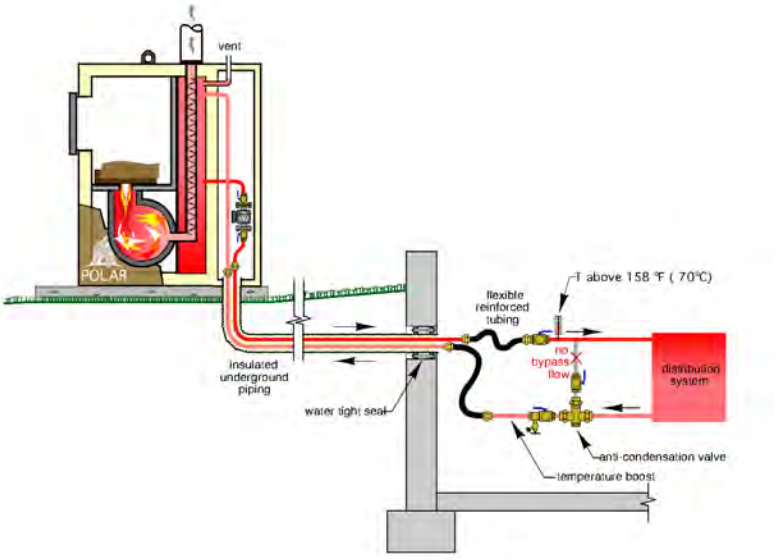
Mixing Mode

When the bypass flow temperature from the boiler is higher than the setting of the boiler protection valve, the system return port starts opening allowing cool water from the system to mix with the bypass flow and circulate through the boiler. The valve continuously regulates and mixes the proper amount of flow from the bypass and the system so that the water returning to the boiler is at no time cooler than the boiler protection valve set point.



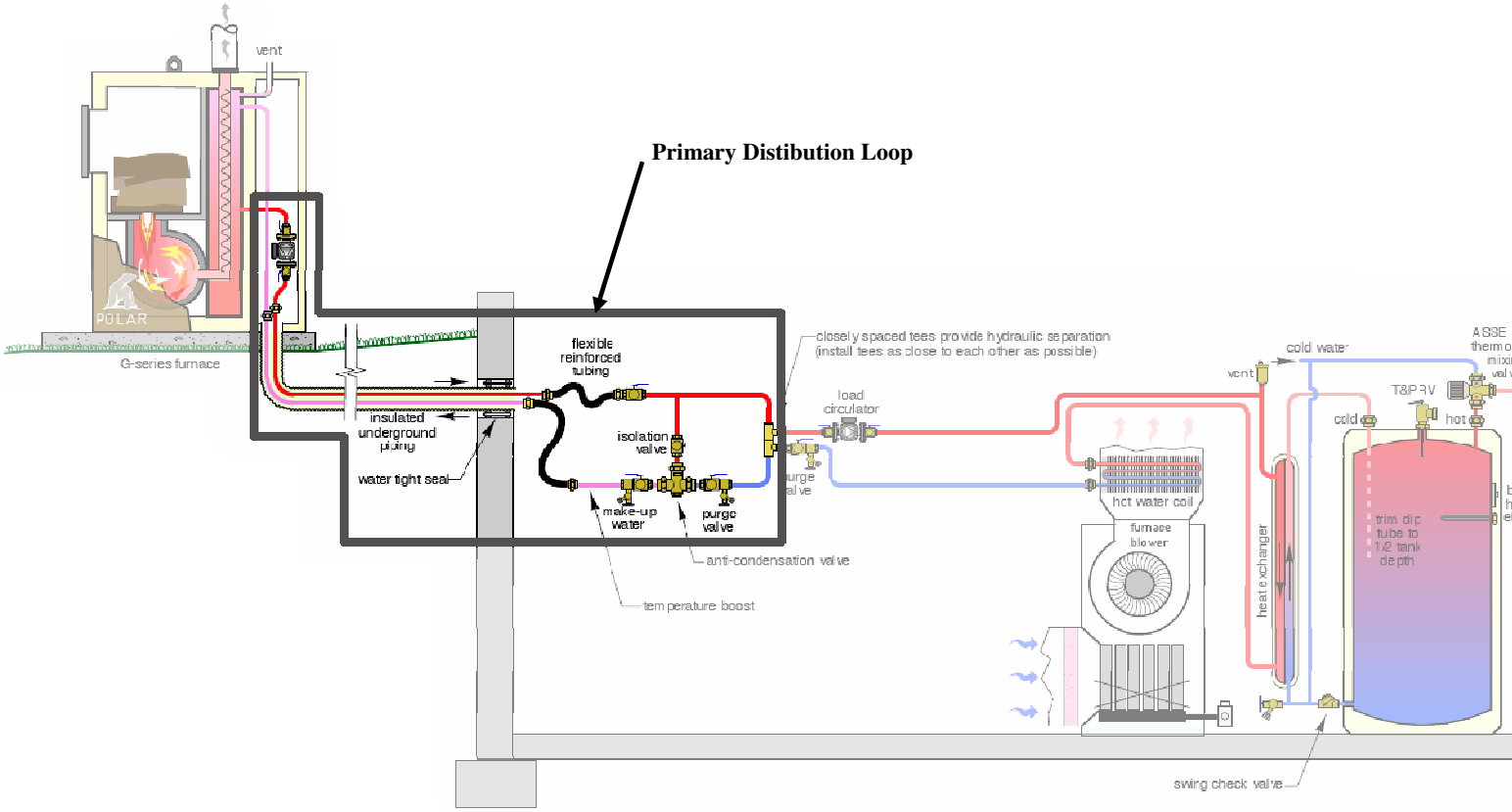
No Bypass Mode

Whenever the bypass flow temperature from the boiler is higher than the setting of the boiler protection valve set point plus an additional 18F, the system return port is fully open and the bypass flow is completely closed and no mixing occurs.



Primary Distribution Loop

The primary distribution loop is the portion of the system which delivers heat from the furnace to the application. The primary distribution loop consists of a water supply line, water return line, pump, and boiler protection valve. The primary loop piping and pump must be sized properly in order to insure the required minimum flow through the furnace is achieved. Failure to design the primary loop properly can cause low flows, high supply/return differential, and stratification in the boiler water jacket. These will cause the furnace to not supply enough heat, not operate properly, and fail prematurely. **There should be no loads connected in series on the primary distribution loop. All loads should be connected parallel to the primary distribution loop.**



Minimum Pipe and Pump Size

The primary loop supply and return lines must be at least 1" pipe. Pipe smaller than 1" must not be used for any portion of the primary loop. The pump used on the primary loop must be a Grundfos 26-99 or equivalent pump. If the primary loop total linear length is greater than 200 feet a larger pump and/or larger pipe diameter may be required to achieve minimum flow.

Heat Exchanger Sizing

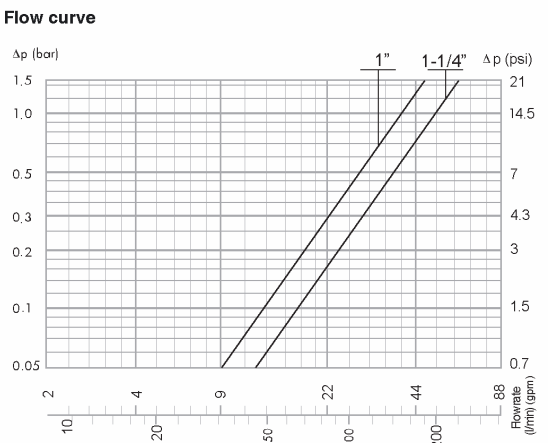
Polar Furnace recommends that a heat exchanger is used to separate the outdoor "open" system from the indoor "closed" system. If a heat exchanger is installed between the primary distribution loop and the load part of the system insure a properly sized heat exchanger is used.

Minimum Flow and Flow Testing

The minimum allowable flow through the G2 and G3 models is 9 gpm. Low flow is the root cause of many installation issues including problems with not enough or no heat delivered to buildings, condensation in the fire chamber and flues, and rapid corrosion in the furnace fire chamber. After finishing the entire installation always complete a flow test. The flow must be measured as close to the return port of the furnace as possible. With the pump on it should take no more than 33 seconds to fill a 5 gallon pail. Faster filling time is better. If it takes longer than 33 seconds changes must be made to the primary loop to insure the minimum required flow is achieved.

One Boiler Protection Valve is shipped with each furnace

One boiler protection valve with 1" NPT connectors is shipped with each G-Class furnace and will work for almost all applications. A larger 1.25" version of the valve is available for those installations requiring higher flow and/or lower pressure drop through the valve.

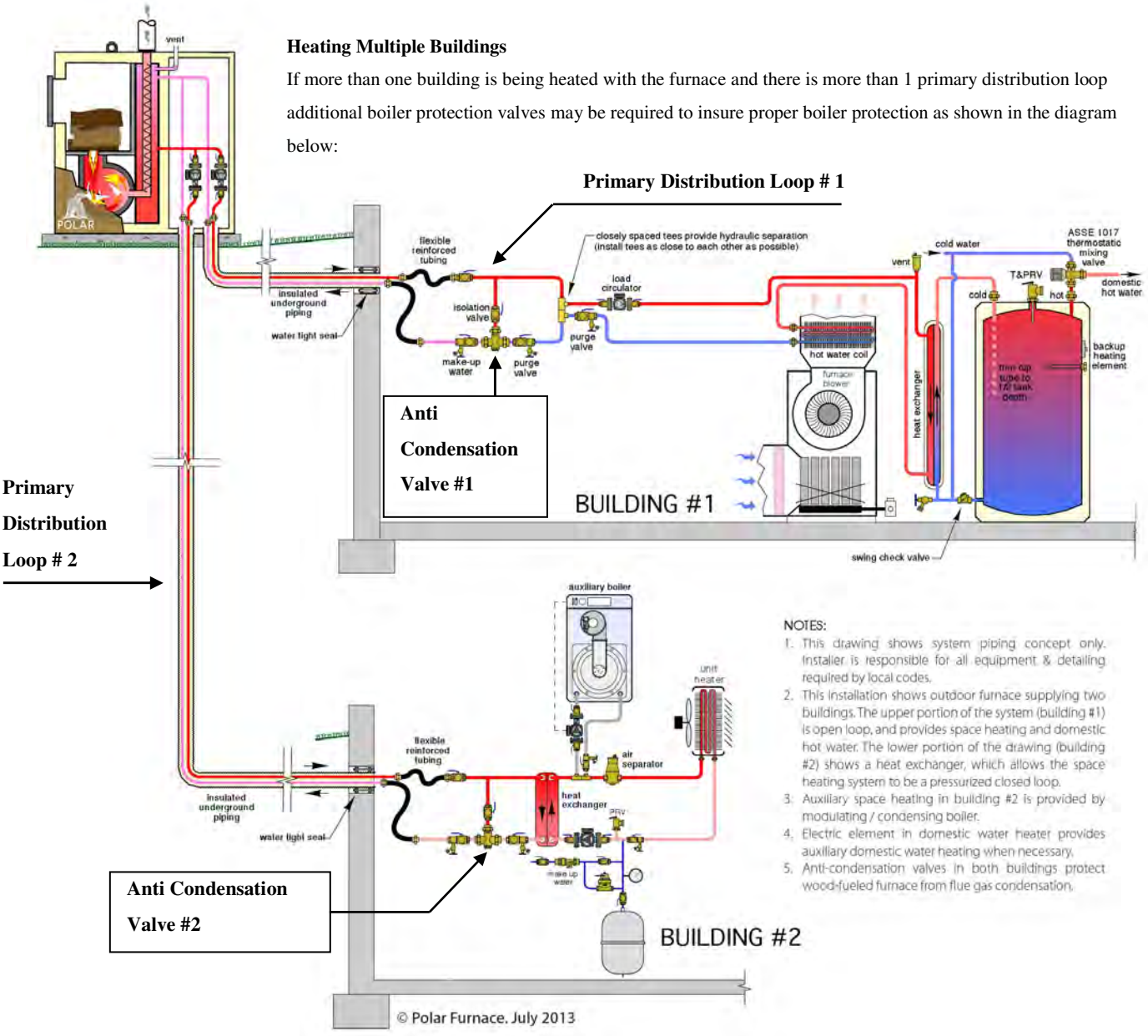


Anti Condensation Valve Installation Guidelines

The boiler protection valve should be located inside the building (or buildings) heated by the G-Class heater. The valve should be installed with isolation valves on each of the three ports. This allows for the valve to be easily serviced without having to drain large portions of the distributions system.

Heating Multiple Buildings

If more than one building is being heated with the furnace and there is more than 1 primary distribution loop additional boiler protection valves may be required to insure proper boiler protection as shown in the diagram below:

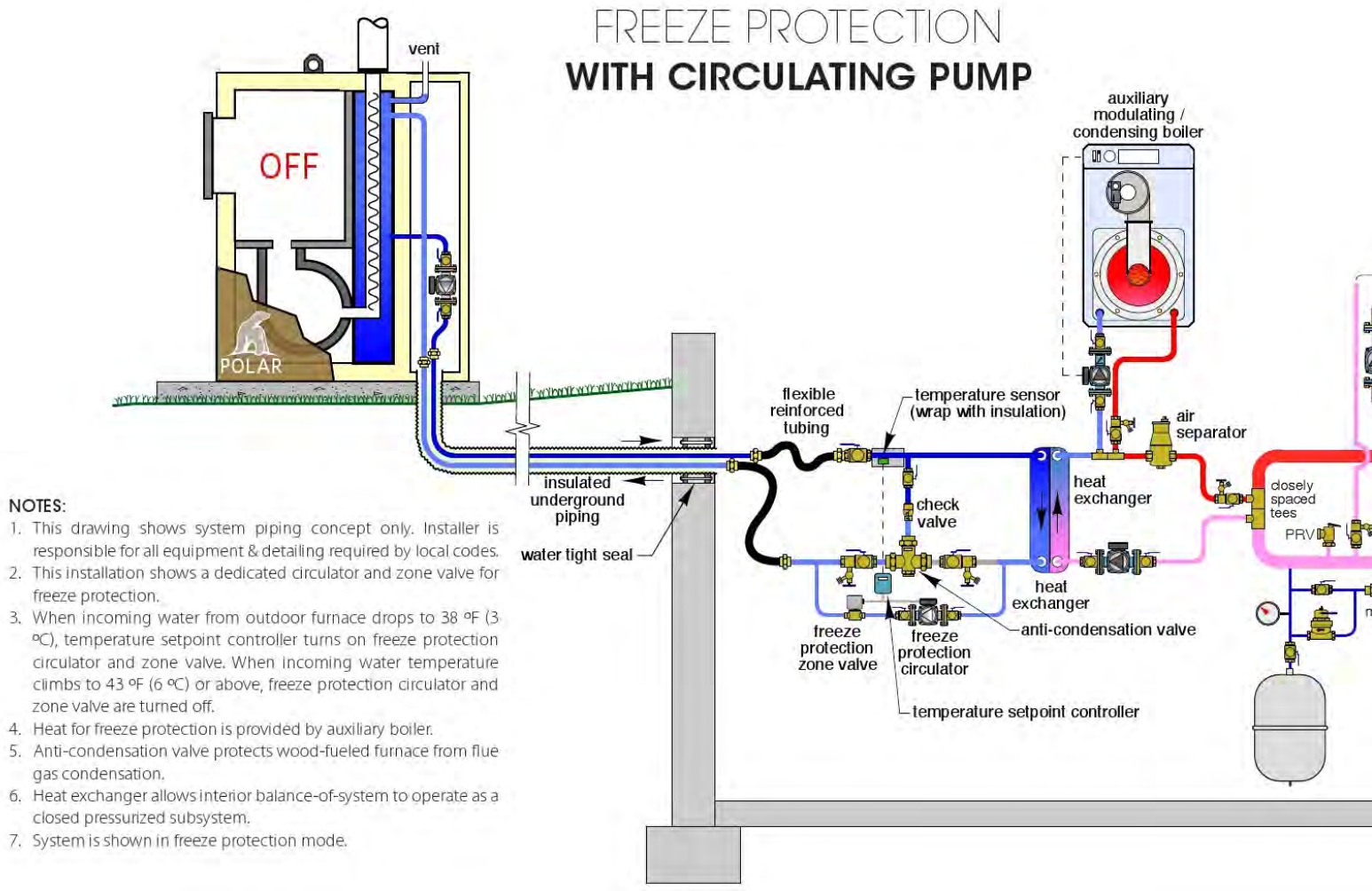


Outdoor Furnace Freeze Protection

In installations where glycol is not used a freeze protection pump is needed to transfer heat from the system or load side of the boiler protection valve to the outdoor furnace side of the boiler protection valve. Review the Freeze Protection diagram below. The outdoor furnace is out of wood or switched OFF. The back up heater inside the house is firing to provide backup heat. The boiler protection valve stops the flow in the primary distribution loop from flowing through the heat exchanger and the entire flow is bypassing through the bypass port of the boiler protection valve.

Freeze Protection Circuit Function

When the temperature setpoint controller senses that the water returning from the furnace has dropped to 38F(3C) it opens the zone valve and switches the freeze protection pump ON. This causes water to flow through the heat exchanger were it picks up some heat from the inside loop which is being heated by the backup boiler. The freeze protection pump remains ON until the setpoint controller senses that the temperature of the water returning from the furnace has increased to 43F(6C).



Chimney Installation

The Chimney is a very important factor in the successful operation of the G-Class heater. A good chimney will provide a continuous and dependable draft to insure proper operation of the heater. If your furnace is installed indoors a good continuous draft is especially important to pull the exhaust gases out of the building. The entire chimney exhaust system must be designed to prevent possible soot-up, insufficient draft, and condensation. Chimneys that are too large in diameter, are insufficiently insulated, or have bends are very prone to problems with draft and creosote related problems. Incorrect chimney installation will void the warranty.

Chimney Requirements

The heater must be connected to a factory-built chimney that must be designed for solid fuel appliances, must be 6" diameter, and must be UL-103 or ULC-S629 listed. Chimney that does not meet these requirements MUST NOT be used for any part of the chimney system. Never use black stove pipe or uninsulated double wall chimney pipe for any part of the chimney system. The chimney connection on the G-Class heater will work best with the Security Chimney ASHT+ 6" chimney system. Other chimney systems can be used but follow the chimney installation instructions for making a connection. If a short piece of stove pipe is used to make the connection the stove pipe must be as short as possible and must be insulated using suitable blanket insulation. At the connection between the boiler and the factory-built chimney a dripless adaptor must be used. The top of the chimney must be at least 3 feet above the top of the roof penetration and at least 2 feet above any portion of the roof within 10 feet measured horizontally.

Always follow the chimney manufacturer's installation instructions when installing and supporting a chimney. All chimneys and connections must conform to all applicable standards and local codes. No other appliance should be connected to the chimney unless allowed by the local code authority. Consult your local inspector for chimney requirements and install the heater in accordance with all applicable codes.

Chimney Draft

When measuring draft insure there is a fire in the fire chamber and fan has been on for at least 10 minutes and the water temperature in boiler is above 160 F. This insures the chimney is at proper operating temperature. Breech draft is the draft near the connection point to the furnace and should be measured within 6" from the top roof panel of the heater. Minimum breech draft is .02" water column. Maximum breech draft is .14" water column. Strong winds blowing across the top of a chimney (especially a chimney which has a strong natural draft like very tall chimneys) can cause the G-Class heater to continue firing when the fan has switched off. This can cause the furnace to overheat. If there is excessively high draft or an irregular draft a draft regulator must be used.

Draft Regulator

If the breech draft exceeds .12" water column a draft regulator must be installed. The diameter of the draft regulator used must be equal to or larger than that of the chimney connector and should be installed as close as possible to the boiler. If one draft regulator is not sufficient to bring the draft below .10" water column a second draft regulator may be required. After installing a draft regulator the draft must always be measured on the boiler side of the draft regulator. The draft regulator adjustment should be made with a vacuum gauge if possible. If the damper is adjusted during warm weather an adjustment may be required during cold weather.

Off Cycle Draft

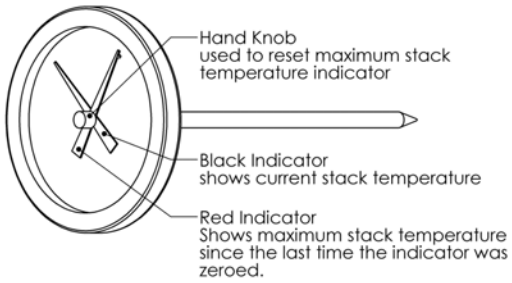
A slight but measurable draft during the off cycle is required. The draft must persist for at least 20 minutes after the fan has switched off. A draft during the off cycle moves a very small amount of fresh air through the heater which evacuates moisture laden air from the primary fire chamber. In some conditions a reverse draft or back draft may occur during the off cycle. This may be the case if the boiler is installed near a very tall building or near a high hill or if the chimney is improperly installed and/or terminates on the side of a building. A back draft must be remedied and stopped. If a back draft is suspected consult with your dealer or local HVAC professional to determine a possible solution. Lack of a draft and/or back drafting during the off cycle will cause water condensating and accumulating inside the primary air delivery channels during the off cycle.

Stack Temperature

Stack temperature is an important factor in the proper function of a chimney. The chimney maximum stack temperature must never exceed 400F. If the chimney exceeds 400F consult with your local dealer or with the factory on how to decrease the maximum stack temperature. The stack temperature must always increase to over 275F during every burn cycle. If the stack temperature fails to exceed 275F during each burn cycle consult with your local dealer or with the factory to increase the stack temperature.

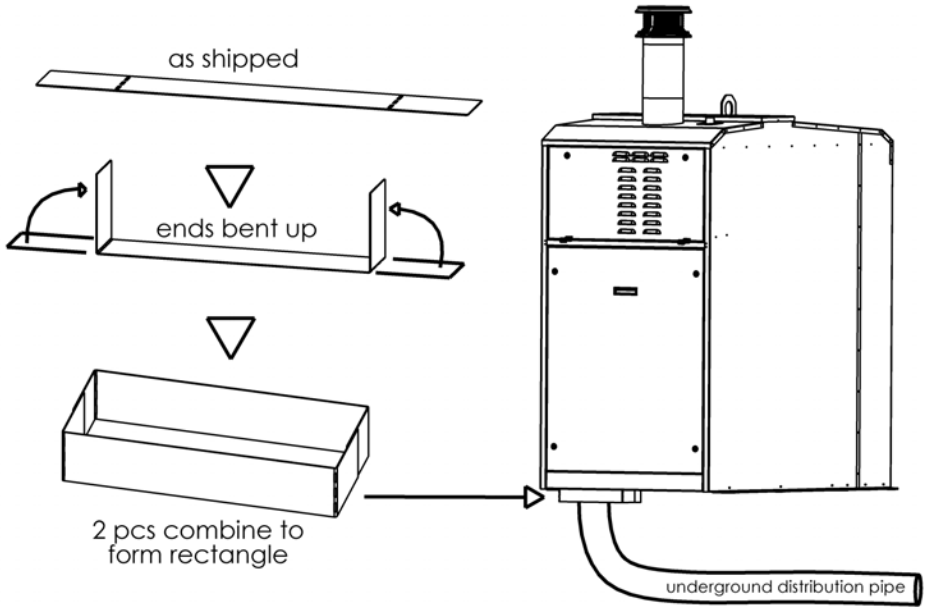
Stack Temperature Gauge

A stack temperature gauge is shipped with each G-Class furnace. This gauge must be installed in the chimney within 4" from the point at which the chimney penetrates the rear roof panel. The gauge is installed by sliding it into a small hole drilled through the chimney wall. The stack temperature gauge has a red temperature indicator which shows the maximum temperature measured since the last time the max temperature dial was turned counterclockwise until it contacted the black current temperature indicator.



Notice: Always turn the hand knob very carefully. Only turn the hand knob counterclockwise until the red maximum temperature indicator gently touches the black current temperature indicator.

Distribution Pipe Finishing Duct



4 flat pieces are shipped inside each furnace (see "as shipped" in diagram below). The pieces are bent by hand into a u shape as shown in the diagram below. 2 pieces combine to form a rectangle. There are 4 flat pieces which can be used to form 2 rectangles. These pipe duct rectangles fit into the 2 knockouts located at the rear of the furnace and can be used as a form for pouring grouting and/or insulation around the distribution pipes to finish the connection from the furnace bottom to the furnace pad. Use is optional, different installers use different techniques for finishing the connection. Finished connection must be mouse and rodent proof.

Fan - Maintenance

At least every 3 months or as often as is required to insure trouble free operation the main suction fan as well as the fan housing at the rear of the furnace needs to be removed and cleaned.

CAUTION: Before removing/servicing the fan, disconnect power to the heater. Ensure that there is no wood burning in the primary fire chamber and that the fan blade has cooled adequately.

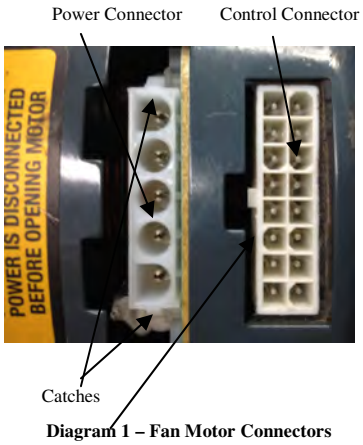


Diagram 1 – Fan Motor Connectors

Removing the Fan Assembly

Carefully unplug the rear power connector **first** (see diagram1). Next unplug the front control connector from the side of the motor.

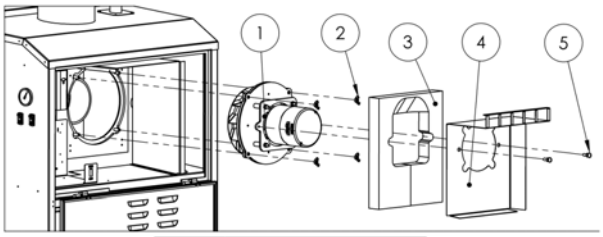
Note: Both Connectors have catches (diagram 1) which must be released before the plug can be unplugged. The rear power connector has a release on both ends of the connector. The release on the front control connector is on the back side of the connector and hidden from view.

Once unplugged, thread both cables back into the electrical controls area.

Next, remove the thumb screw(s) (diagram 2 – item# 5) (earlier revisions have none or one thumb screw) securing the cooling shroud in place and remove the fan cooling shroud (diagram 2 – item# 4) and the fan insulation (diagram 2 – item# 3)

Next, remove the 4 wing nuts (diagram 2 – item# 2) mounting the fan assembly to the heater. Finally, pull the fan assembly straight back to remove from the heater.

IMPORTANT: DO NOT DISASSEMBLE THE FAN ASSEMBLY FURTHER THAN SHOWN IN DIAGRAM 2 - ITEM 1. LEAVE THE BLADE ATTACHED TO THE MOTOR DURING CLEANING.



ITEM	DESCRIPTION
1	Fan Assembly
2	3/8" wing nut (x4)
3	fan insulation
4	cooling shroud
5	thumb screw(x2)

Diagram 2 – Fan Removal

Cleaning the Fan Assembly

Gently clean the fan blade using a stiff brush. A wire brush works well**. NEVER USE WATER WHEN CLEANING THE FAN BLADE. NEVER USE A CHISEL OR HAMMER OR ANY OTHER TOOL THAT COULD GOUGE BEND OR DAMGE THE FAN BLADE.** Remove as much of the ash from the fan blade as possible. Using a thin screwdriver or similar tool, remove any buildup between the fan blade and the mounting plate. All fan blade surfaces must be cleaned thoroughly to ensure the blade is well balanced when placed back into the heater. Clean the walls and bottom of the fan housing and remove all ash and dust before reinstalling the fan assembly.

Fan – Troubleshooting

	Fan Problem experienced	Cause of Problem	Trouble Shooting/Corrective Measures
1	the fan is make a loud noise	-Fan is contacting inside surface of furnace	-remove and adjust fan blade on shaft to give more clearance to surface being contacted
2	the fan/furnace is vibrating/shaking	-fan has buildup of dust on one side of the fan making it unbalanced -condensation from chimney is dripping from chimney onto fan in the off cycle causing the fan to become unbalanced	-remove and clean fan assembly and fan housing -see corrective measures listed under problem #4
3	Fan fails to start turning when controller calls for heat	- fan or fan housing has a lot of ash/dust buildup keeping fan from rotating - motor has failed - motor control has failed -other electrical control component has failed	-remove fan and clean fan assembly and fan housing -ask licensed electrician to check cables and connectors -ask dealer or factory for assistance in locating failed electrical component
4	There is water or wet sludge at the bottom of the fan housing	-condensation is occurring inside the fan housing and/or chimney extension	- use only prefabricated insulated chimney extension -insure fan insulation is installed behind the fan air cooling shroud -insure chimney base insulation underneath the rear roof panel is in place - insure proper combustion -burn well seasoned dry wood only
5	Ash/dust building up on fan and in fan housing very quickly and needs to cleaned much more frequently than every 3 months to run without problems	-uninsulated chimney causing condensation to drip from chimney down onto fan and into fan housing -temperature in chimney too low -wet wood is burned causing poor combustion, low stack temperatures, and condensation in stack.	-insure only prefabricated insulated chimney is used to extent chimney - see corrective measures listed under problem #4 -adjust damper/fan settings to increase stack temperature above 280F -burn well seasoned wood only
6	There is a heavy buildup of creosote on fan that is very difficult to remove	-creosote indicates improper combustion	-modify air damper settings to achieve proper combustion -burn well seasoned wood only **Note: creosote (dark black hard substance that is difficult to remove) should never occur on the heat exchanger tubes or on the fan or in the fan housing. A creosote buildup in these areas indicates the furnace is not working properly and it must be adjusted to burn properly. Consult with your dealer or the factory to correct this as soon as possible.**

END OF SUPPLEMENTAL INFORMATION