

GENESIS

Installation & Service Manual Models: 400 - 2100

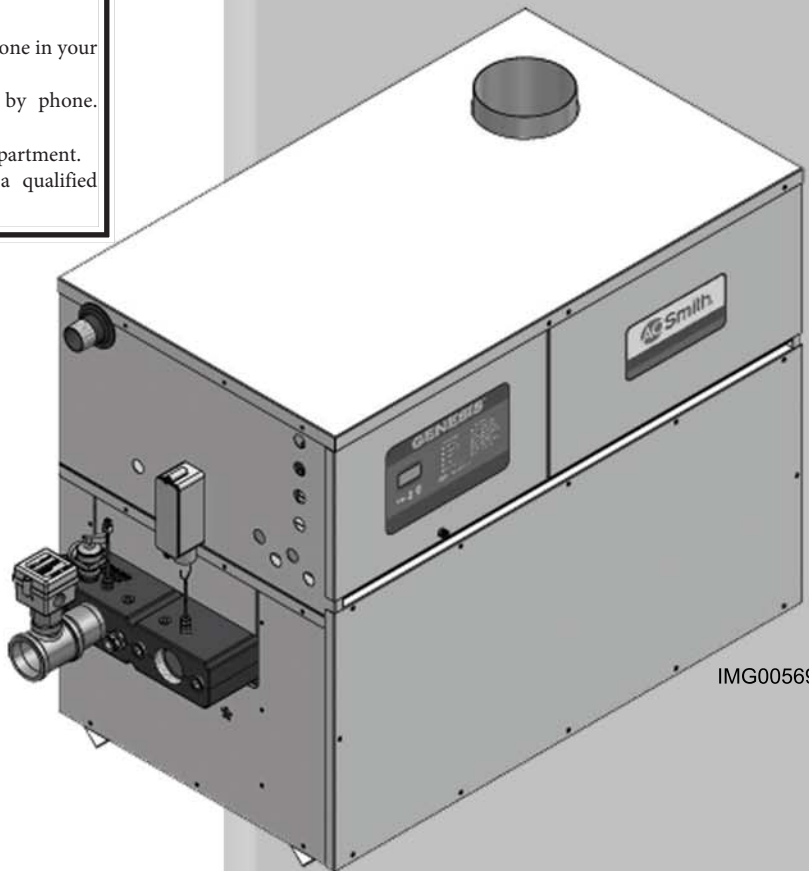
WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS**
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

FREE CERTIFIED FACTORY START-UP INCLUDED

Required for warranty activation and
assuring maximum operating performance

CALL 800-527-1953 TO ARRANGE START-UP.



IMG00569



AC Smith®

⚠ WARNING:

This manual supplies information for the installation, operation, and servicing of the appliance. It is strongly recommended that this manual and the Genesis Service Manual be reviewed completely before proceeding with an installation. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

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Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

Special instructions

NOTICE

This is a gas appliance and should be installed by a licensed electrician and/or certified gas supplier. Service must be performed by a qualified service installer, service agency or the gas supplier.

⚠ WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

This appliance **MUST NOT** be installed in any location where gasoline or flammable vapors are likely to be present, unless the installation is such to eliminate the probable ignition of gasoline or flammable vapors.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance or additional information, consult a qualified installer, service agency or the gas supplier.

■ Apply enough water to the combustion chamber lining to prevent airborne dust.

■ Remove the combustion chamber lining from the appliance and place it in a plastic bag for disposal.

• NIOSH stated First Aid:

Eye: Irrigate immediately.

Breathing: Fresh air.

⚠ WARNING

The combustion chamber insulation in this appliance contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)." Normal operating temperatures in this appliance are below the level to convert ceramic fibers to cristobalite. Abnormal operating conditions would have to be created to convert the ceramic fibers in this appliance to cristobalite.

The ceramic fiber material used in this appliance is an irritant; when handling or replacing the ceramic materials it is advisable that the installer follow these safety guidelines.

Checking equipment –

Upon receiving equipment, check for signs of shipping damage. Pay particular attention to parts accompanying the appliances which may show signs of being hit or otherwise being mishandled. Verify total number of pieces shown on packing slip with those actually received. In case there is damage or a shortage, immediately notify the carrier.

⚠ WARNING

Do not use this appliance if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

NOTICE

The ceramic fiber material used in this appliance is an irritant; when handling or replacing the ceramic materials it is advisable that the installer follow these safety guides.

REMOVAL OF COMBUSTION CHAMBER LINING OR BASE PANELS:

■ Avoid breathing dust and contact with skin and eyes.

- Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH website at <http://www.cdc.gov/niosh/homepage.html>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
- Wear long-sleeved, loose fitting clothing, gloves, and eye protection.

Warranty –

Factory warranty (in this manual) does not apply to units improperly installed or improperly operated.

Experience has shown that improper installation or system design, rather than faulty equipment, is the cause of most operating problems.

1. Excessive water hardness causing a lime/scale build-up in the copper tube is not the fault of the equipment and is not covered under the manufacturer's warranty (see Water Treatment and Water Chemistry).
2. Excessive pitting and erosion on the inside of the copper tube may be caused by too much water velocity through the tubes and is not covered by the manufacturer's warranty (see Hot Water Supply Boiler Flow Rates and Temperature Rise for flow requirements).

Please read before proceeding

Safety information

⚠ Owner warning –

The information contained in this manual is intended for use by qualified professional installers, service technicians, or gas suppliers.

NOTICE

Consult and follow all local Building and Fire Regulations and other Safety Codes that apply to this installation. Consult local gas utility company to authorize and inspect all gas and flue connections.

A gas appliance that draws combustion air from the equipment room where it is installed must have a supply of fresh air circulating around it during burner operation for proper gas combustion and proper venting.

⚠ WARNING

Should overheating occur or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the pump. Instead, shut off the gas supply at a location external to the appliance.

Prevention of freezing –

Heat exchangers and headers damaged by freezing are not covered by warranty.

See Section 7, Operating Information - Freeze Protection for more information.

Codes –

The equipment shall be installed in accordance with those installation regulations in force in the local area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made. In the absence of such requirements, the installation shall conform to the latest edition of the National Fuel Gas Code, ANSI Z223.1. Where required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, ASME CSD-1. All boilers conform to the latest edition of the ASME Boiler and Pressure Vessel Code, Section IV. Where required by the authority having jurisdiction, the installation must comply with the Canadian Gas Association Code, CAN/CGA-B149.1 and/or B149.2 and/or local codes. This appliance meets the safe lighting performance criteria with the gas manifold and control assembly provided, as specified in the ANSI standards for gas-fired hot water boilers, ANSI Z21.13.

⚠ WARNING

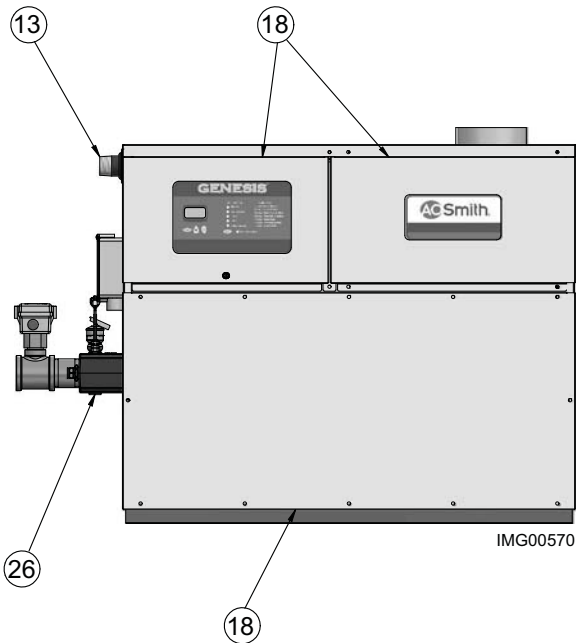
To minimize the possibility of serious personal injury, fire or damage to your unit, never violate the following safety rules.

1. This unit is only for use with the type of gas indicated on the rating plate.
2. If you smell gas
 - shut off gas supply
 - do not try to light any appliance
 - do not touch any electrical switch; do not use any phone in your building
 - immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions
 - if you cannot reach your gas supplier, call the fire department
3. Hot water supply boilers are heat producing appliances. To avoid damage or injury, do not store materials against the appliance or the vent-air intake system. Use proper care to avoid unnecessary contact (especially children) with the appliance and vent-air intake components.
4. Never cover your unit, lean anything against it, store trash or debris near it, stand on it or in any way block the flow of fresh air to your unit.
5. UNDER NO CIRCUMSTANCES MUST FLAMMABLE MATERIALS SUCH AS GASOLINE OR PAINT THINNER BE USED OR STORED IN THE VICINITY OF THIS APPLIANCE, VENT-AIR INTAKE SYSTEM OR ANY LOCATION FROM WHICH FUMES COULD REACH THE APPLIANCE OR VENT-AIR INTAKE SYSTEM.
6. Appliance surfaces become hot during operation. Be careful not to touch hot surfaces. Keep all adults, children, and animals away from operation of the hot unit. Severe burns can occur.
7. You must take adequate care to prevent scald injury when storing water at elevated temperatures for domestic use.
8. This unit must have an adequate supply of fresh air during operation for proper gas combustion and venting.
9. Make sure all exhaust venting is properly installed and maintained. Improper venting of this unit could lead to increased levels of carbon monoxide.
10. Do not use this hot water supply boiler if any part has been under water. Immediately call a qualified service technician to replace the appliance. The possible damage to a flooded hot water supply boiler can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.
11. Do not alter this unit in any way. Any change to this unit or its controls can be dangerous.

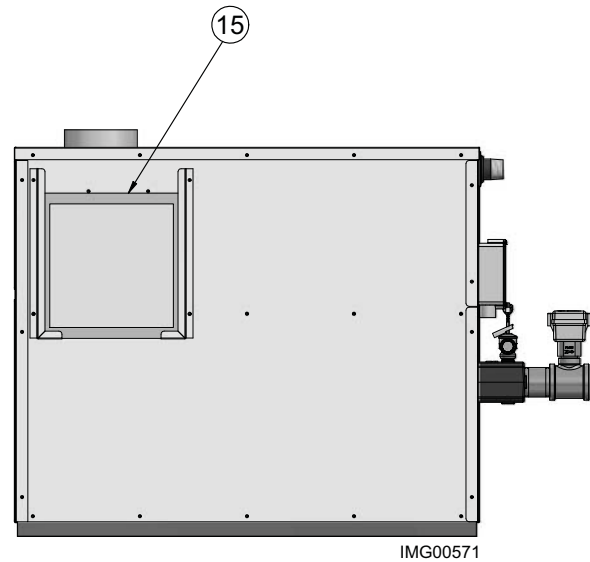
The Genesis - How it works...

- 1. Heat exchanger**
The heat exchanger allows system water to flow through specially designed tubes for maximum heat transfer. The glass lined headers and copper fined tubing are encased in a jacket that contains the combustion process.
- 2. Heat exchanger access cover**
The heat exchanger access cover is a galvanized steel door which allows access for service, maintenance, and removal of the heat exchanger from inside the combustion chamber.
- 3. Blower**
The blower pulls in and injects air into the individual burners along with gas from the gas manifold where the mix is burned inside the combustion chamber.
- 4. Gas valve**
The gas valves (reference) have a dual purpose; changing the gas supply pressure to manifold pressure, and the reference side of the gas valve is designed to allow chamber pressure to change the volume of gas through the valve and measured as net manifold pressure. This is not a design to compensate for gas supply pressure issues.
- 5. Tank temperature sensor (not shown)**
When connected, this sensor monitors tank temperature.
- 6. Outlet sensor**
This sensor monitors the outlet water temperature.
- 7. Inlet temperature sensor**
This sensor monitors inlet water temperature. If selected as the controlling sensor and a tank sensor is not connected, the appliance will maintain setpoint by adjusting the firing rate of the unit according to this sensor.
- 8. 2-Stage electronic temperature control**
The 2-stage electronic temperature control consists of a Liquid Crystal Display (LCD) for interactive prompting during programming and display of both sensed and assigned values. Programming is accomplished through the use of the three (3) programming buttons -- select, (+), and (-). This 2-stage electronic temperature control also controls the pump.
- 9. LED display board**
The LED display board displays the status of the unit. LED's are provided for prepurge, trial for ignition, Stage 1, Stage 2, ignition module status and alarm along with a RESET button for resetting the ignition module.
- 10. Burner**
The burner is a ported stainless steel construction which uses a gas air mix to operate at a fixed input. Banks of burners turn on or off to vary the firing rate.
- 11. Water outlet (system supply)**
The water outlet is a 2 or 2 1/2" (depending on model) pipe connection that supplies water to the tank with connections for a flow switch (see #25), a relief valve (see #22).
- 12. Water inlet (system return)**
The water inlet is a 2 or 2 1/2" (depending on model) pipe connection that receives water from the tank and delivers it to the heat exchanger.
- 13. Gas supply pipe**
The gas supply pipe on this appliance is 1 1/4 or 2" (depending on model) diameter NPT. Please reference the National Fuel Gas Code charts for connection details.
- 14. Hot surface ignition module**
The hot surface ignition module controls the blower(s), hot surface igniter and gas valves. A status LED is also provided for flash codes used for the purpose of troubleshooting the unit.
- 15. Air intake**
Fresh air for combustion is drawn through a filter provided at the air intake, located at either the rear or right side of the appliance.
- 16. Line voltage terminal strip**
The line voltage terminal strip provides a location to connect all of the line voltage (120 VAC) contact points to the unit.
- 17. Low voltage connection board(s)**
The low voltage connection board provides a location to connect all of the low voltage devices to the appliance. This is where most of the external safety controls are connected.
- 18. Front doors - upper and lower**
The front doors provide access to the gas train as well as the blower, burners and other key components for service and maintenance.
- 19. Hot surface igniter (HSI)**
The hot surface igniter is a device that is used to ignite the air/gas mixture as well as monitor the performance of the flame during operation. This device acts as a flame sense electrode.
- 20. Flame inspection window (sight glass)**
The flame inspection windows, located on either side of the appliance, allow for visual inspection of the burners and flame during operation.
- 21. Manual reset high limit sensor**
This device monitors the outlet water temperature to ensure safe operation. If the temperature exceeds its setting (field adjustable), it will break the control circuit, shutting the appliance down.
- 22. Relief valve**
The relief valve is a safety device that ensures the maximum pressure of the appliance is not exceeded. Hot water supply boilers operate on temperature and pressure and are shipped standard as 125 PSI and 210°F (98.9°C).
- 23. Power switch**
The power switch is used to engage and disengage power to the appliance on the 120 VAC circuit.
- 24. Air pressure switch**
The air pressure switch is a safety device which ensures proper blower operation. The air pressure switch is wired in series with the low voltage control circuit in such a way that if the fan does not engage or shuts down prematurely the device will break the control circuit and the unit will shut down.
- 25. Flow switch**
The flow switch is a safety device that ensures flow through the heat exchanger during operation. This appliance is low mass and should never be operated without flow. The flow switch makes contact when flow is detected and allows the unit to operate. If flow is discontinued during operation for any reason the flow switch will break the control circuit and the unit will shut down.
- 26. Drain port(s)**
The drain port(s) are located underneath the front header.
- 27. Manual shutoff valve (not shown)**
Manual valve used to isolate the unit from the gas supply.

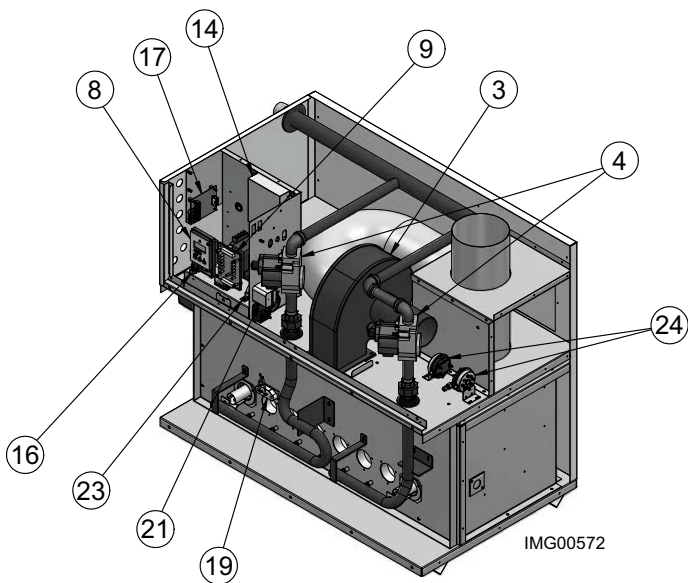
The Genesis - How it works...



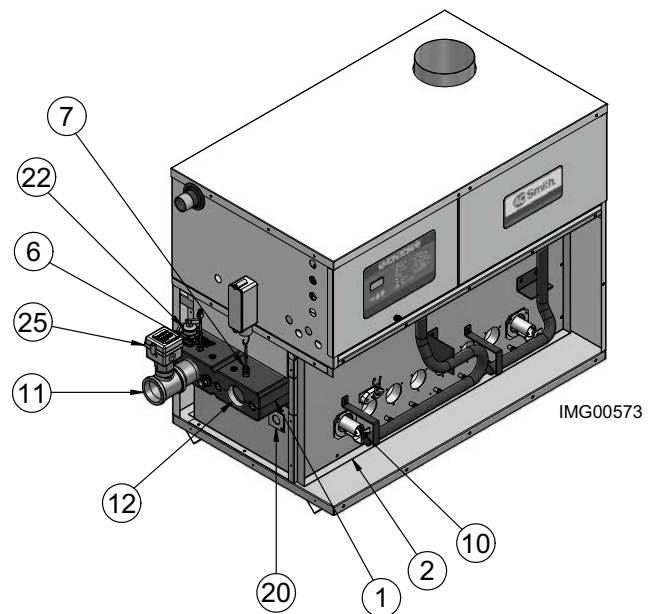
Models 400 - 750 Front View



Models 400 - 750 Rear View

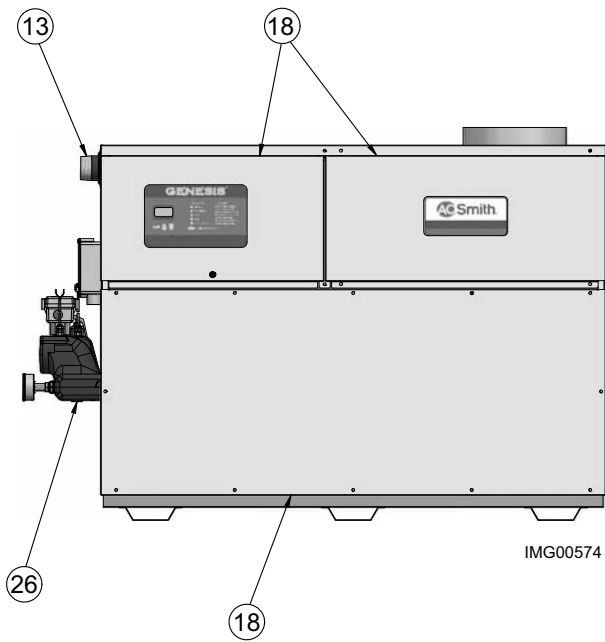


Models 400 - 750 Right Side (inside unit)

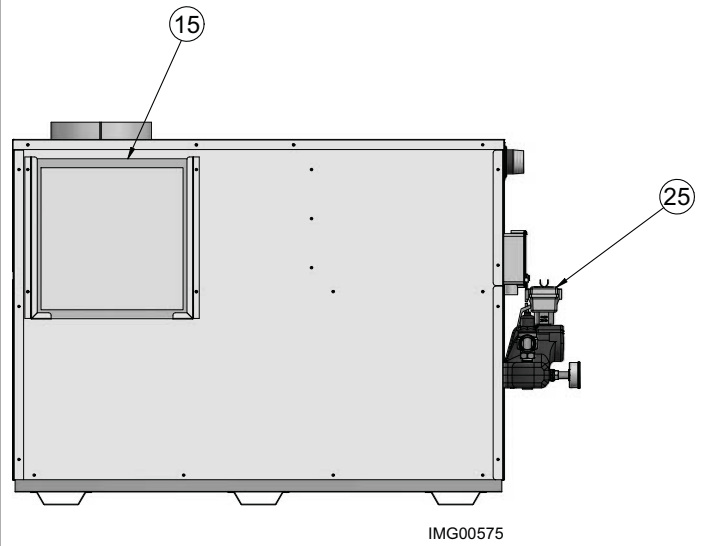


Models 400 - 750 Left Side (inside unit)

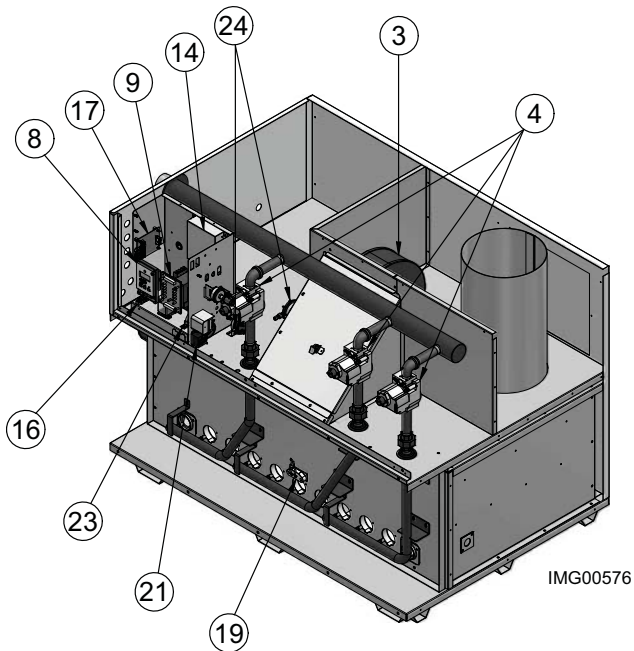
The Genesis - How it works... *(continued)*



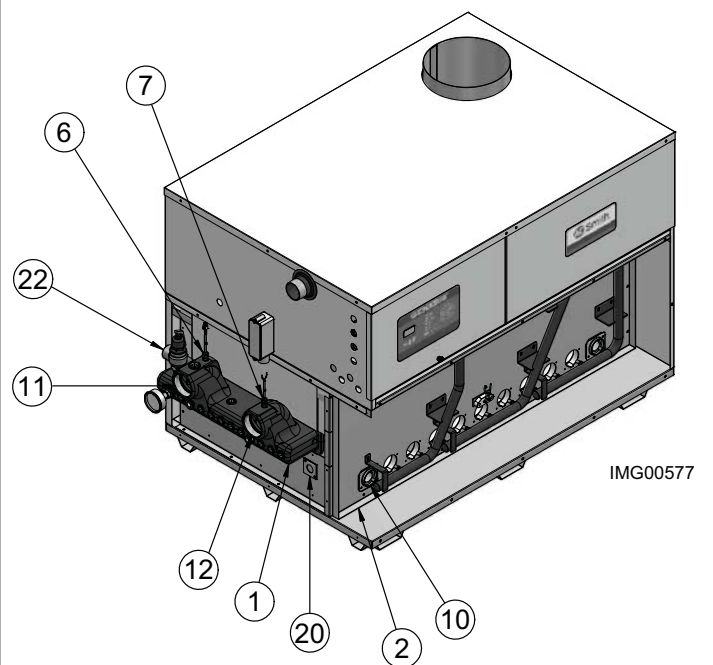
Models 1000 - 2100 Front View



Models 1000 - 2100 Rear View



Models 1000 - 2100 Right Side (inside unit)



Models 1000 - 2100 Left Side (inside unit)

Ratings



H



LOW LEAD CONTENT

Genesis Hot Water Supply Boiler Ratings				Other Specifications			
Model Number Note: N = Natural, P = Propane	Input MBH (Note 3)		GPH at 100°F Rise	Appliance Water Content Gallons	Water Connections	Gas Connections	Air / Vent Sizes (Note 2)
	Min	Max					
GWH0400(N,P)	250	399	412	1.6	2"	1-1/4"	6"
GWH0500(N,P)	250	500	515	1.7	2"	1-1/4"	6"
GWH0650(N,P)	350	650	670	2.0	2"	1-1/4"	8"
GWH0750(N,P)	400	750	773	2.1	2"	1-1/4"	8"
GWH1000(N,P)	360	990	1020	2.2	2-1/2"	2"	10"
GWH1250(N,P)	720	1260	1298	2.6	2-1/2"	2"	12"
GWH1450(N,P)	720	1440	1484	2.9	2-1/2"	2"	12"
GWH1800(N,P)	720	1800	1855	3.3	2-1/2"	2"	12"/14"
GWH2100(N,P)	990	2070	2133	3.6	2-1/2"	2"	12"/14"

NOTICE

Maximum allowed working pressure is located on the rating plate.

Notes:

1. The ratings are based on standard test procedures prescribed by the United States Department of Energy.
2. Genesis models require special gas venting. Use only the vent materials and methods specified in the Genesis Installation and Operation Manual.
3. The Genesis hot water supply boiler is orificed for operation up to 2000 feet altitude, and including up to 4,500 feet, with no field adjustments. The appliance will de-rate by 4% for each 1000 feet above sea level up to 4,500 feet. Consult the factory for installations above 4,500 feet elevation.

1 Determine unit location

Location of unit

This unit meets the safe lighting performance criteria with the gas manifold and control assembly provided, as specified in the ANSI standards for gas-fired units and ANSI Z21.13 - latest edition.

1. Maintain all clearances from combustible construction when locating appliance. See Clearances from Combustible Construction, this page.
2. Locate the appliance so that if water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the unit. The pan must not restrict combustion airflow. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this unit, or any of its components.
3. The appliance must be installed so that the ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, control replacement, etc.).
4. Appliances located in a residential garage and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit must be installed so that all burners and burner ignition devices have a minimum clearance of not less than 18" (46 cm) above the floor. The appliance must be located or protected so that it is not subject to physical damage by a moving vehicle.
5. **DO NOT** install this appliance in any location where gasoline or flammable vapors are likely to be present.
6. The appliance must be installed on a level floor.
7. Combustible floor installation:
 - a. Models 400 - 750 **require** an approved floor kit for installation on combustible flooring (reference Table 1A).
 - b. Models 1000 - 2100 are approved for installation on combustible flooring without a floor kit. **Note:** Concrete block over wood flooring is not considered non-combustible.
8. **DO NOT** install this appliance directly on carpeting or other combustible material.
9. Maintain required clearances from combustible surfaces, reference the *Indoor Clearances from Combustible Construction Section*, this page.
10. For outdoor models, you must install an optional vent cap. Instructions for mounting the vent cap are included in the venting section of this manual. Do not install outdoor models directly on the ground. You must install the outdoor unit on a concrete, brick, block, or other non-combustible pad. Outdoor models have additional special location and clearance requirements. See Outdoor Installation Venting, page 31. A wind proof cabinet protects the unit from weather.

Indoor clearances from combustible construction

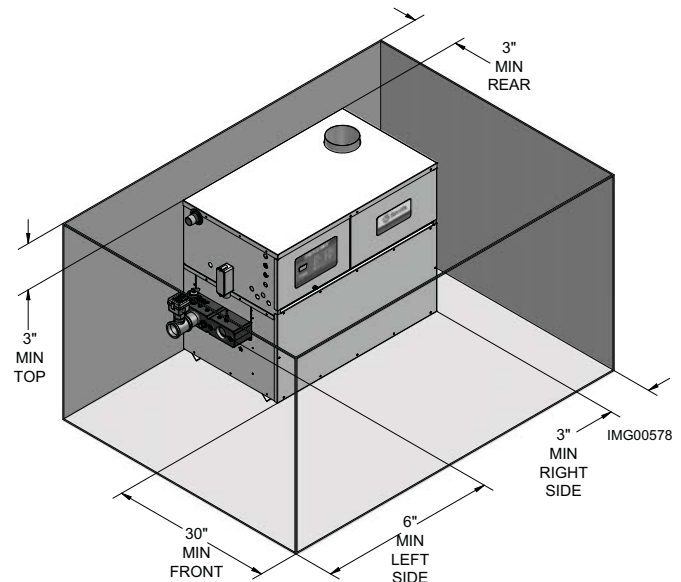
Maintain minimum specified clearances for adequate operation. Allow sufficient space for servicing pipe connections, pump and other auxiliary equipment, as well as the unit. See rating plate for specific service clearance requirements.

Right Side	3" (7.5 cm)
Rear	3" (7.5 cm) (3" min. from any surface)*
Left Side 6"	(15 cm) (24" (0.61 m) suggested for service)
Front	Alcove* (30" (0.76m) suggested for service)
Top	3" (7.5 cm)
Flue	1" (25.4 mm)
Vent Damper (if equipped)	6" (24" suggested for service)
Hot Water Pipes	1" (25.4 mm)

*An Alcove is a closet without a door. Thirty-six inches (36") to rear required for outdoor installation.

Note: No additional clearance is needed on the right side of the unit for the observation port. An observation port is located on both the right and left side of the unit.

Figure 1-1 Indoor clearances from combustible construction



NOTICE

Clearances from combustible construction are noted on the appliance rating plate.

TABLE - 1A
COMBUSTIBLE FLOOR KITS

Model	Kit Number
400	100131378
500	100131379
650	100131380
750	100131381

Freeze protection

Although these units are CSA International design-certified for outdoor installations, such installations are not recommended in areas where the danger of freezing exists. You must provide proper freeze protection for outdoor installations, units installed in unheated mechanical rooms or where temperatures may drop to the freezing point or lower. If freeze protection is not provided for the system, a low ambient temperature alarm is recommended for the mechanical room. Damage to the unit by freezing is non-warrantable.

1 Determine unit location

Anytime the temperature of any sensor drops below 34°F, the control turns on the pump contact.

Location

Locate indoor hot water supply boilers in a room having a temperature safely above freezing [32°F (0°C)].

⚠ CAUTION

A mechanical room operating under a negative draft pressure may experience a down draft in the flue of a hot water supply boiler when it is not firing. The cold outside air pulled down the flue may freeze a heat exchanger. This condition must be corrected to provide adequate freeze protection.

Outdoor installation

A snow screen should be installed to prevent snow and ice accumulation around the unit or its venting system.

Shut-down and draining

If for any reason, the unit is to be shut off, the following precautionary measures must be taken:

1. Shut off gas supply.
2. Shut off water supply.
3. Shut off electrical supply
4. Drain the unit completely. Remove one threaded plug or bulbwell from the inlet side of the front header and one from the outlet side of the front header on the heat exchanger. Blow all water out of the heat exchanger (see FIG.'s 1-2A and 1-2B).
5. Drain pump and piping.

Figure 1-2A_Drain the unit_Models 400 -750

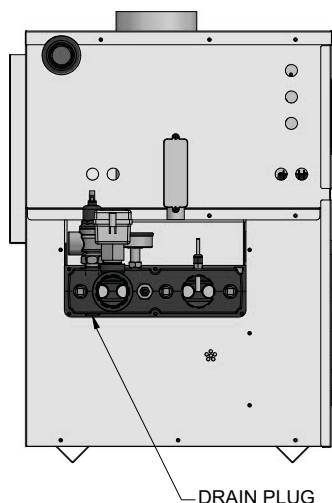
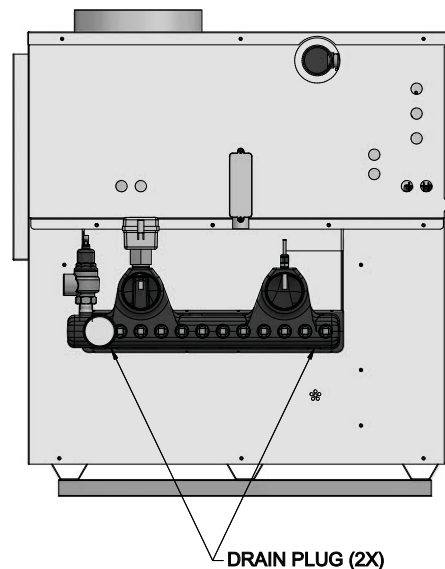


Figure 1-2B_Drain the unit_Models 1000 - 2100



Combustion and ventilation air

Provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1/ NFPA 54, or Clause 8.2, 8.3, or 8.4 of Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes.

Provide properly-sized openings to the equipment room to assure adequate combustion air and proper ventilation when the unit is installed with conventional venting or sidewall venting.

Combustion air options

⚠ CAUTION

Under no circumstances should the equipment room ever be under a negative pressure. Particular care should be taken where exhaust fans, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit.

This unit has four combustion air options.

1. Outside Combustion Air, No Ducts

You can direct outside combustion air to this unit using either one or two permanent openings (see FIG. 1-3).

One Opening

The opening must have a minimum free area of one square inch per 3000 Btu input (7 cm² per kW). You must locate this opening within 12" (30 cm) of the top of the enclosure.

1 Determine unit location

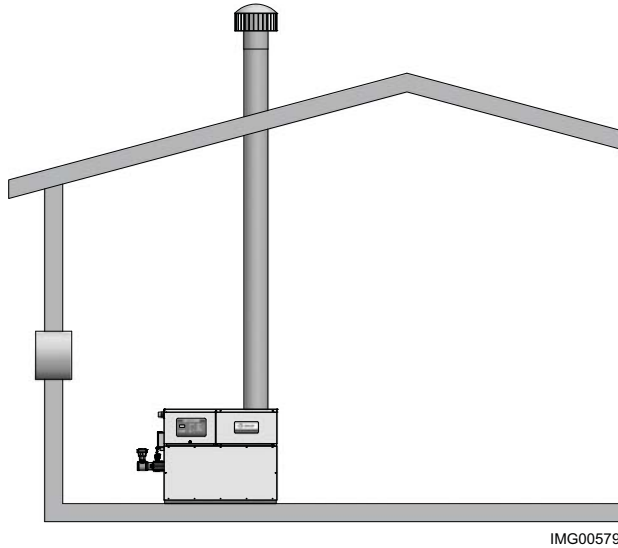


Figure 1-3_Outside Combustion Air - Single Opening

Two Openings

The combustion air opening must have a minimum free area of one square inch per 4000 Btu/hr input (5.5 cm² per kW). You must locate this opening within 12" (30 cm) of the bottom of the enclosure (see FIG. 1-4).

The ventilation air opening must have a minimum free area of one square inch per 4000 Btu/hr input (5.5 cm² per kW). You must locate this opening within 12" (30 cm) of the top of the enclosure.

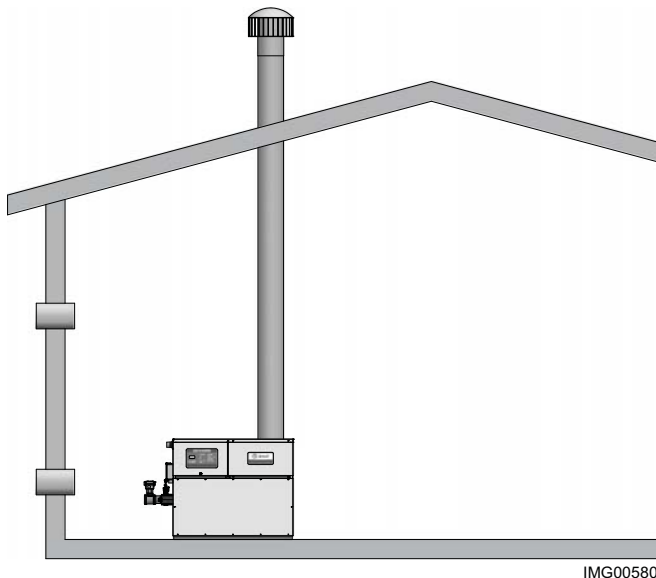


Figure 1-4_Outside Combustion Air - Two Openings

2. Outside Combustion Air, Using Ducts

You can direct outside combustion air to this unit using two air ducts to deliver the air to the equipment room (see FIG. 1-4).

Each of the two openings must have a minimum free area of one square inch per 2000 Btu input (11cm² per kW).

3. Combustion Air from Interior Space

You can direct combustion air to this unit using air from an adjoining interior space. You must provide two openings from the equipment room to the adjoining room (see FIG. 1-5).

Each of the two openings must have a net free area of one square inch per 1000 Btu input (22cm² per kW), but not less than 100 square inches (645cm²).

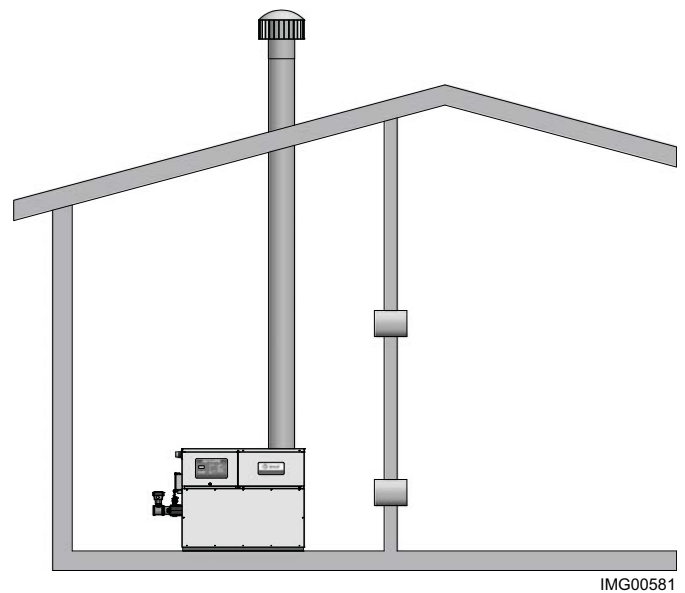


Figure 1-5_Combustion Air from Interior Space

1 Determine unit location

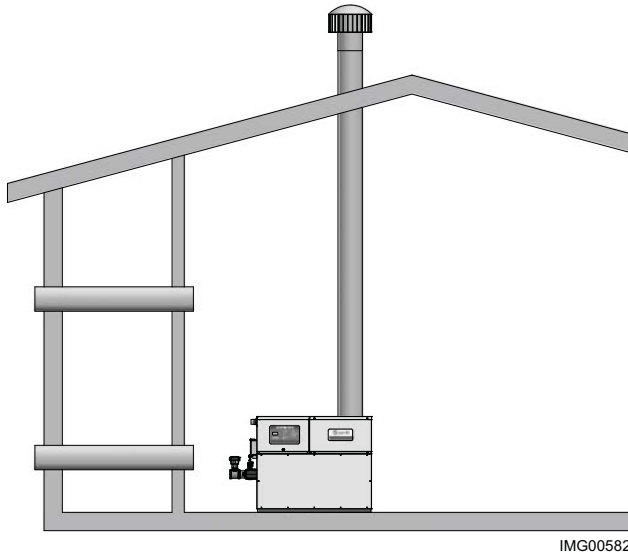


Figure 1-6_Outside Combustion Air Through Ducts

4. Outside Combustion Air - Using Direct Venting

With this option, you can connect combustion air vent piping directly to the unit. See the information under Direct Venting starting on page 27 for specific information regarding this option.

All dimensions are based on net free area in square inches. Metal louvers or screens reduce the free area of a combustion air opening a minimum of approximately 25%. Check with louver manufacturers for exact net free area of louvers. Where two openings are provided, one must be within 12" (30 cm) of the ceiling and one must be within 12" (30 cm) of the floor of the equipment room. Each opening must have a minimum net free area as specified in TABLE 1B. Single openings shall be installed within 12" (30 cm) of the ceiling.

⚠ CAUTION

The combustion air supply must be completely free of any flammable vapors that may ignite or chemical fumes which may be corrosive to the appliance. Common corrosive chemical fumes which must be avoided are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as Freon, trichlorethylene, perchlorethylene, chlorine, etc. These chemicals, when burned, form acids which quickly attack the heat exchanger finned tubes, headers, flue collectors, and the vent system. The result is improper combustion and a non-warrantable, premature unit failure.

TABLE - 1B
MINIMUM RECOMMENDED COMBUSTION
AIR SUPPLY TO EQUIPMENT ROOM

Model Number	*Outside Air from 2 Openings Directly from Outdoors		*Outside Air from 1 Opening Directly from Outdoors, in ²	Inside Air from 2 Ducts Delivered from Outdoors		Inside Air from 2 Ducts Delivered from Interior Space	
	Top Opening, in ²	Bottom Opening, in ²		Top Opening, in ²	Bottom Opening, in ²	Top Opening, in ²	Bottom Opening, in ²
400	100 (645 cm ²)	100 (645 cm ²)	133 (858 cm ²)	200 (1291 cm ²)	200 (1291 cm ²)	400 (2581 cm ²)	400 (2581 cm ²)
500	125 (806 cm ²)	125 (806 cm ²)	167 (1077 cm ²)	250 (1613 cm ²)	250 (1613 cm ²)	500 (3226 cm ²)	500 (3226 cm ²)
650	163 (1052 cm ²)	163 (1052 cm ²)	217 (1400 cm ²)	325 (2097 cm ²)	325 (2097 cm ²)	650 (4194 cm ²)	650 (4194 cm ²)
750	188 (1213 cm ²)	188 (1213 cm ²)	250 (1613 cm ²)	375 (2420 cm ²)	375 (2420 cm ²)	750 (4839 cm ²)	750 (4839 cm ²)
1000	248 (1600 cm ²)	248 (1600 cm ²)	330 (2129 cm ²)	495 (3194 cm ²)	495 (3194 cm ²)	990 (6388 cm ²)	990 (6388 cm ²)
1250	315 (2032cm ²)	315 (2032cm ²)	420 (2710 cm ²)	630 (4065 cm ²)	630 (4065 cm ²)	1260 (8130 cm ²)	1260 (8130 cm ²)
1450	360 (2323cm ²)	360 (2323cm ²)	480 (3097 cm ²)	720 (4646 cm ²)	720 (4646 cm ²)	1440 (9291 cm ²)	1440 (9291 cm ²)
1800	450 (2903cm ²)	450 (2903cm ²)	600 (3871 cm ²)	900 (5807 cm ²)	900 (5807 cm ²)	1800 (11614 cm ²)	1800 (11614 cm ²)
2100	518 (3342cm ²)	518 (3342cm ²)	690 (4452 cm ²)	1035 (6678 cm ²)	1035 (6678 cm ²)	2070 (13356 cm ²)	2070 (13356 cm ²)

*Outside air openings shall directly communicate with the outdoors. When combustion air is drawn from the outside through a duct, the net free area of each of the two openings must have twice (2 times) the free area required for Outside Air/2 Openings. The above requirements are for the hot water supply boiler only; additional gas fired appliances in the equipment room will require an increase in the net free area to supply adequate combustion air for all appliances.

1 Determine unit location *(continued)*

Exhaust fans

Any fan or equipment which exhausts air from the equipment room may deplete the combustion air supply and/or cause a down draft in the venting system. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be immediately corrected. If a fan is used to supply combustion air to the equipment room, the installer must make sure that it does not cause drafts which could lead to nuisance operational problems with the unit.

Vertical Vent/Air, Horizontal Vent/Air, and Direct Vent venting systems have specific requirements for combustion air ducts from the outside which are directly connected to the unit. See the requirements for combustion air duct in the venting section.

NOTICE

Use of filters having MERV (*Minimum Efficiency Reporting Value*) ratings higher than 4 is not recommended. Higher efficiency low-micron filters can limit combustion air leading to either nuisance problems or potential component damage if used over prolonged periods of time. Filters having a MERV rating of 5 to 6 may be used on a limited basis during the construction phase of a project provided they are replaced once filter loading becomes apparent. After the construction phase is completed, it is recommended that the filter be changed to a 4 or lower MERV disposable type filter.

Combustion air filter

This unit has a standard air filter located at the combustion air inlet. This filter helps ensure clean air is used for the combustion process. Check this filter every month and replace when it becomes dirty. The filter size on Models 400 - 750 is 12" x 12" x 1" (30.5cm x 30.5cm x 2.5cm) and 16" x 16" x 1" (40.6cm x 40.6cm x 2.5 cm) on Models 1000 - 2100. You can find these commercially available filters at any home center or HVAC supply store.

For convenience and flexibility, you can direct the combustion air inlet from either the back or right side of the unit. To arrange the combustion air inlet for side entry, follow the steps below:

1. Remove the metal panel from the unit's side wall (see FIG. 1-7).
2. Remove screws from the air filter/bracket assembly.
3. Move the filter/bracket assembly from the rear of unit to the side opening (see FIG. 1-8).
4. Attach filter/bracket assembly to the unit's side using the pre-drilled screw holes.
5. Attach the metal panel to the rear combustion air opening to seal it off.

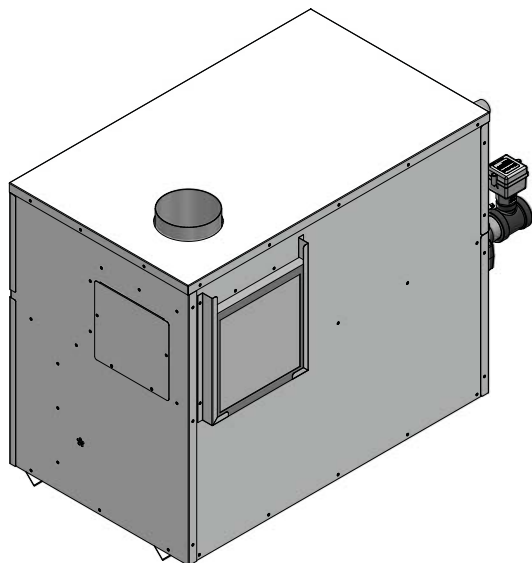


Figure 1-7 Metal Panel Covering Side Combustion Air Inlet

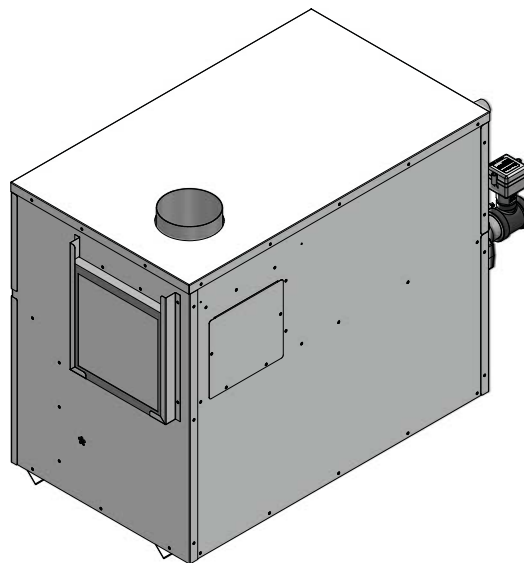


Figure 1-8 Moving Air Filter / Bracket Assembly from Rear of Unit to Side

NOTICE

During construction the air filter should be checked more frequently to ensure it does not become clogged with combustion dirt and debris.

CAUTION

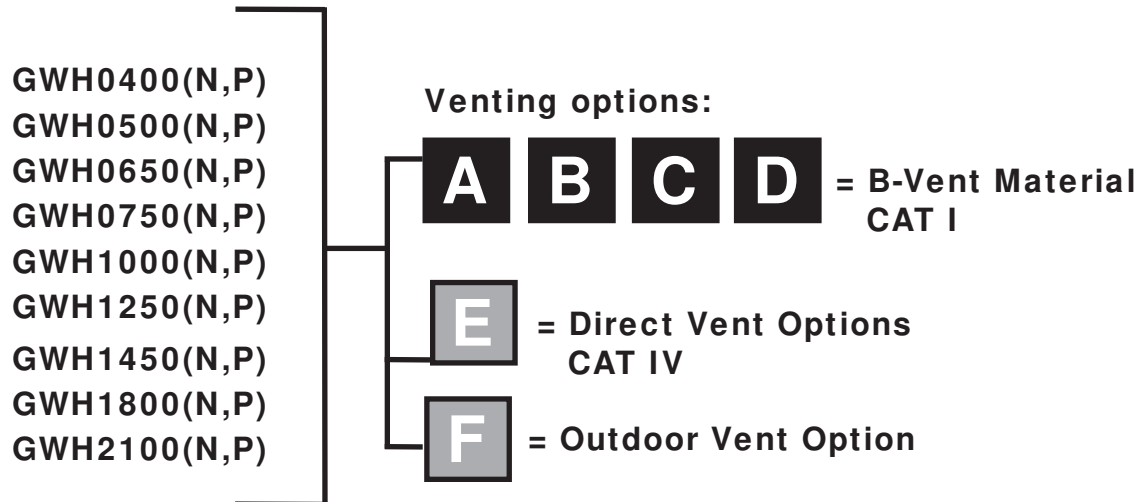
Sustained operation of an appliance with a clogged filter may result in nuisance operational problems, bad combustion, and non-warrantable component failures.

2 Venting

BEFORE YOU BEGIN

Identify your appliance's vent system:

This manual covers venting requirements for CAT I models and CAT IV vent materials. Be sure to correctly identify the type of vent system your appliance requires before proceeding.



⚠ DANGER

Failure to use correct venting materials can result in loss of life from flue gas spillage into working or living space.

Venting Category Definitions: (Reference National Fuel Gas Code ANSI Z223.1)

CAT I: Negative pressure non-condensing

An appliance that operates with a non-positive vent static pressure with a vent gas temperature that avoids excessive condensate production in the vent.

CAT IV: Positive pressure condensing

An appliance that operates with a positive vent static pressure with a vent gas temperature that may cause excessive condensate production in the vent.

CAT IV Flue pipe materials

The following manufacturers supply flue materials suitable for these models when installed as CAT IV. All materials are made with AL29-4C stainless steel.

Heat-Fab Inc., Saf-T CI Vent with AL29-4C stainless steel

Protech Systems Inc., Fas N Seal Vent with AL29-4C stainless steel

Metal-Fab Inc., Corr/Guard Vent with AL29-4C stainless steel

Or other listed Category IV vent systems suitable for a condensing, positive pressure, gas fired appliance.

A Category IV flue **MUST** have all vent joints and seams sealed gastight and have provisions for a drain to properly collect and dispose of condensate that may occur in the venting system.

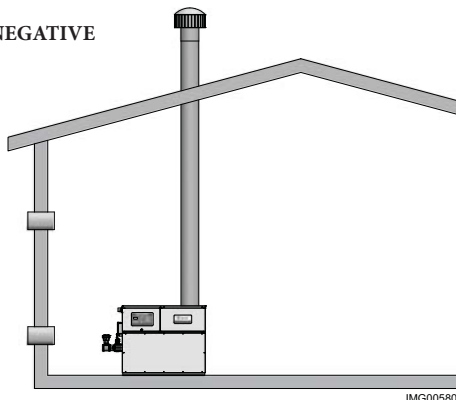
2 Venting *(continued)*

Vent system options: (Note: Installations shown below are representative, actual installations may vary from those shown.)

A

This option uses a vertical rooftop flue termination with air supplied from the equipment room - see page 17.

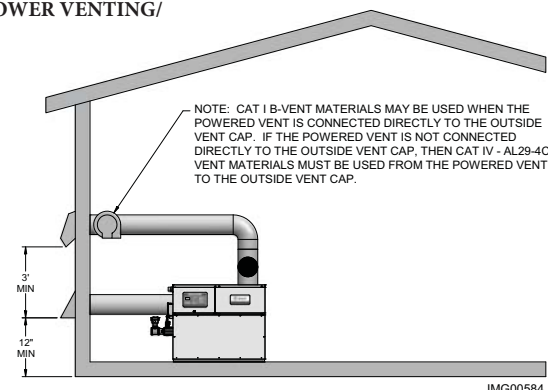
CONVENTIONAL NEGATIVE DRAFT VENTING



D

This option uses a powered vent assembly to exhaust the flue products out a sidewall with air supplied by a pipe from the sidewall - see page 26.

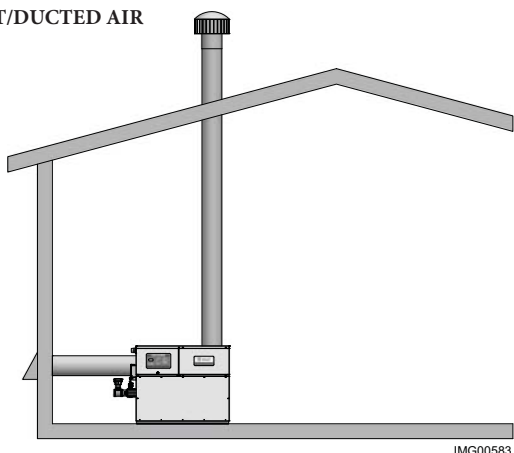
SIDEWALL/POWER VENTING/ DUCTED AIR



B

This option uses a vertical conventional vent for flue products with air supplied by a pipe from the sidewall or rooftop - see page 20.

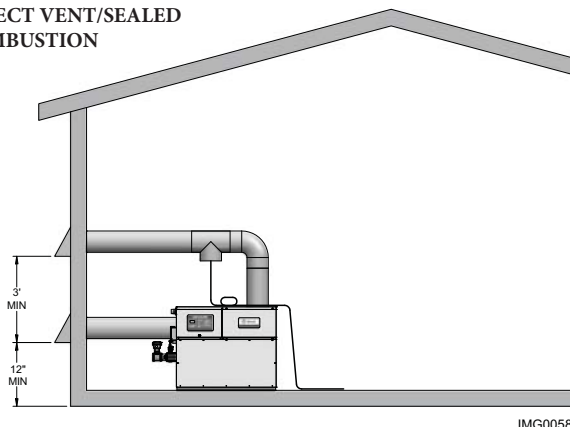
VERTICAL VENT/DUCTED AIR



E

This option uses a sealed AL29-4C flue and a separate combustion air pipe to the outdoors. This system terminates both the flue and combustion air inlet in the same pressure zone - see page 27.

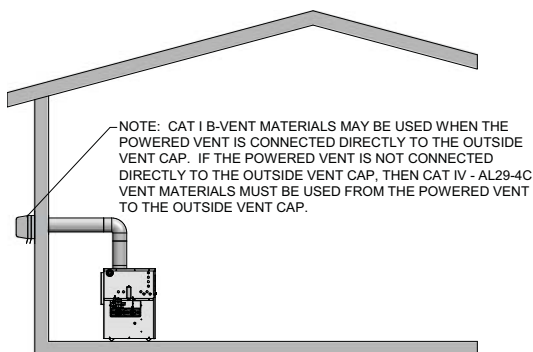
DIRECT VENT/SEALED COMBUSTION



C

This option uses a powered vent assembly to exhaust the flue products out a sidewall vent termination with air supplied from the equipment room - see page 23.

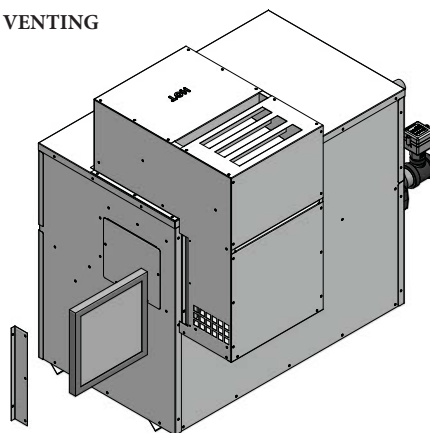
SIDEWALL/POWER VENTING



F

This option uses the installation of a special air inlet / vent cap on top of the unit - see page 31.

OUTDOOR VENTING



2 Venting

General information

You must supply adequate combustion and ventilation air to this unit. You must provide minimum clearances for the vent terminal from adjacent buildings, windows that open, and building openings. Follow all requirements set forth in the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CAN/CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment or applicable local building codes. Vent installations for connection to gas vents or chimneys must be in accordance with "Venting of Equipment" of the above-mentioned standards.

NOTICE

Examine the venting system at least once each year. Check all joints and vent pipe connections for tightness. Also check for corrosion or deterioration. If you find any problems, correct them at once.

Venting support

Support horizontal portions of the venting system to prevent sagging. Provide an upward slope of at least 1/4 inch per foot (21mm/m) on all horizontal runs from the unit to the vertical flue run or to the vent terminal on sidewall venting installations.

Do not use an existing chimney as a raceway if another appliance or fireplace is vented through the chimney. The weight of the venting system must not rest on the unit. Provide adequate support of the venting system. Follow all local and applicable codes. Secure and seal all vent connections. Follow the installation instructions from the vent material manufacturer.

Barometric damper location

Any venting system option that requires a barometric damper must adhere to the following directions for optimum performance. The preferred location for the barometric damper is in a tee or collar installed in the vertical pipe rising from the unit's flue outlet. The barometric damper **MUST NOT** be installed in a bull head tee installed on the unit's flue outlet. The tee or collar containing the barometric damper should be approximately three feet vertically above the connection to the unit's flue outlet. This location ensures that any positive velocity pressure from the unit's internal combustion fan is dissipated and the flue products are rising due to buoyancy generated from the temperature of the flue products. Adjust the weights on the damper to ensure that draft is maintained within the specified range.

TABLE - 2A
FLUE AND AIR INLET PIPE SIZES

MODEL	FLUE SIZE	AIR INLET SIZE	MODEL	FLUE SIZE	AIR INLET SIZE*
400	6"	6"	1000	10"	10"
500	6"	6"	1250	12"	12"
650	8"	8"	1450	12"	12"
750	8"	8"	1800	14"	12"
--	--	--	2100	14"	12"

*Minimum diameter for air inlet pipe. Installer may increase diameter one pipe size for ease of installation, if needed.

2 Venting *(continued)*

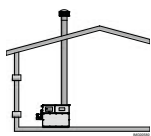
A

Conventional negative draft venting - see page 15.

NOTICE

Before installing a venting system, follow requirements found in the General Venting section.

This option uses Type-B double-wall flue outlet piping. The blower brings in combustion air. The buoyancy of the heated flue products cause them to rise up through the flue pipe. The flue outlet terminates at the rooftop.



Negative draft

The negative draft in a conventional vent installation must be within the range of 0.02 to 0.08 inches w.c. to ensure proper operation. Make all draft readings while the unit is in stable operation (approximately 2 to 5 minutes).

Connect the flue vent directly to the flue outlet opening on the top of the unit. No additional draft diverter or barometric damper is needed on single unit installations with a dedicated stack and a negative draft within the specified range of 0.02 to 0.08 inches w.c. If the draft in a dedicated stack for a single unit installation exceeds the maximum specified draft, you must install a barometric damper to control draft. Multiple unit installations with combined venting or common venting with other Category I negative draft appliances require each hot water supply boiler to have a barometric damper installed to regulate draft within the proper range.

Do not connect vent connectors serving appliances vented by natural draft (negative draft) to any portion of a mechanical draft system operating under positive pressure. Connecting to a positive pressure stack may cause flue products to be discharged into the living space causing serious health injury.

Flue outlet piping

With this venting option, you must use Type-B double-wall vent materials. Vent materials must be listed by a nationally-recognized test agency for use as vent materials. Make the connections from the unit vent to the outside stack as direct as possible with no reduction in diameter. Use the National Fuel Gas Code venting tables for double-wall vent to properly size all vent connectors and stacks. Follow the vent manufacturer's instructions when installing Type-B vents and accessories, such as firestop spacers, vent connectors, thimbles, caps, etc.

Provide adequate clearance to combustibles for the vent connector and firestop.

When planning the venting system, avoid possible contact with plumbing or electrical wiring inside walls, ceilings, and floors. Locate the unit as close as possible to a chimney or gas vent.

Avoid long horizontal runs of the vent pipe, 90° elbows, reductions and restrictions.

No additional draft diverter or barometric damper is required on single unit installations with a dedicated stack and a negative draft maintained between 0.02 to 0.08 inches w.c.

Common Venting Systems

You can combine the flue with the vent from any other negative draft, Category I appliance. Using common venting for multiple negative draft appliances requires you to install a barometric damper with each unit. This will regulate draft within the proper range. You must size the common vent and connectors from multiple units per the venting tables for Type-B double-wall vents in the latest edition of the National Fuel Gas Code, ANSI Z223.1 and/or CAN/CGA-B149 Installation Code.

Common venting systems may be too large when an existing unit is removed.

At the time of removal of an existing appliance, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused opening in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch. Make sure there is no blockage or restriction, leakage, corrosion and other unsafe conditions.
3. If possible, close all building doors and windows. Close all doors between the space in which the appliances remaining connected to the common venting system are located and other building spaces.

2 Venting

4. Turn on clothes dryers and any other appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan.
5. Close fireplace dampers.
6. Place in operation the unit being inspected. Follow the lighting instructions. Adjust thermostat so unit will operate continuously.
7. Test for spillage at the draft hood/relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
8. After making sure that each appliance remaining connected to the common venting system properly vents when tested as above, return doors, windows, exhaust fans, fireplace dampers and other gas burning appliances to their previous conditions of use.
9. Correct any improper operation of the common venting system so that the installation conforms to the latest edition of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1 Installation Code for Gas Burning Appliances and Equipment. When resizing any portion of the common venting system, resize to approach the minimum size as determined using the appropriate tables of the latest edition of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1 Installation Code for Gas Burning Appliances and Equipment.

Masonry chimney installations

A masonry chimney must be properly sized for the installation of a high efficiency gas-fired appliance. Venting of a high efficiency appliance into a cold or oversized masonry chimney can result in operational and safety problems. Exterior masonry chimneys, with one or more sides exposed to cold outdoor temperatures, are more likely to have venting problems. The temperature of the flue products from a high efficiency appliance may not be able to sufficiently heat the masonry structure of the chimney to generate proper draft. This will result in condensing of flue products, damage to the masonry flue/tile, insufficient draft and possible spillage of flue products into an occupied living space. Carefully inspect all chimney systems before installation.

WARNING

Do not vent this unit into a masonry chimney without a sealed stainless steel liner system. Any breaks, leaks, or damage to the masonry flue/tile will allow the flue products to leak from the chimney and into occupied living spaces. This could cause serious injury or death due to carbon monoxide poisoning and other harmful flue products.

NOTICE

Check with local code officials to determine code requirements or the advisability of using a masonry chimney with a sealed corrosion-resistant liner system.

Inspection of a masonry chimney

A masonry chimney must be carefully inspected to determine its suitability for the venting of flue products. A clay-tile-lined chimney must be structurally sound, straight and free of misaligned tile, gaps between liner sections, missing sections of liner or any signs of condensate drainage at the breaching or clean out. If there is any doubt about the condition of a masonry chimney, it must be relined with a properly-sized and approved chimney liner system. An unlined masonry chimney must not be used to vent flue products from this high-efficiency unit. An unlined chimney must be relined with an approved chimney liner system when a new appliance is being attached to it. Metallic liner systems (Type-B double-wall or flexible or rigid metallic liners) are recommended. Consult with local code officials to determine code requirements or the advisability of using or relining a masonry chimney.

Vertical vent termination clearances and location

The vent terminal should be vertical and exhaust outside the building at least 2 feet (0.61m) above the highest point of the roof within a 10 foot (3.05m) radius of the termination.

The vertical termination must be a minimum of 3 feet (0.91m) above the point of exit.

A vertical termination less than 10 feet (3.05m) from a parapet wall must be a minimum of 2 feet (0.61m) higher than the parapet wall.

Keep the vent cap clear of snow, ice, leaves, and debris to avoid blocking the flue.

2 Venting *(continued)*

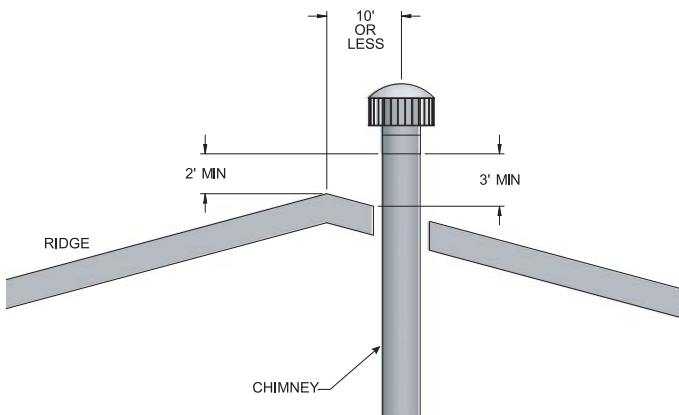


Figure 2-1_Vent Termination from Peaked Roof - 10 ft. or Less From Ridge

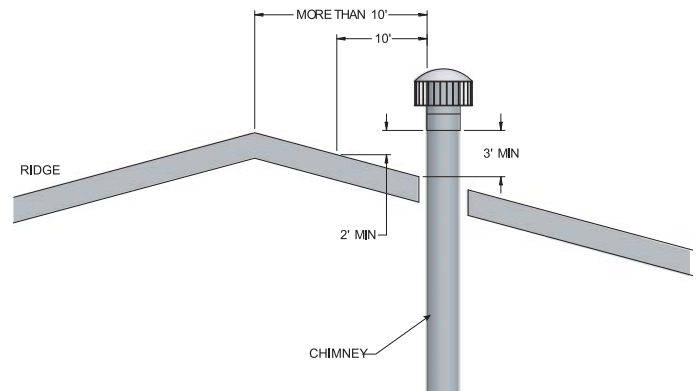


Figure 2-2_Vent Termination from Peaked Roof - 10 ft. or More From Ridge

NOTICE

Vent terminations are not shown in FIG.'s 2-1 thru 2-4. Make sure all vertical vents are installed with vent terminations recommended by the vent manufacturer.

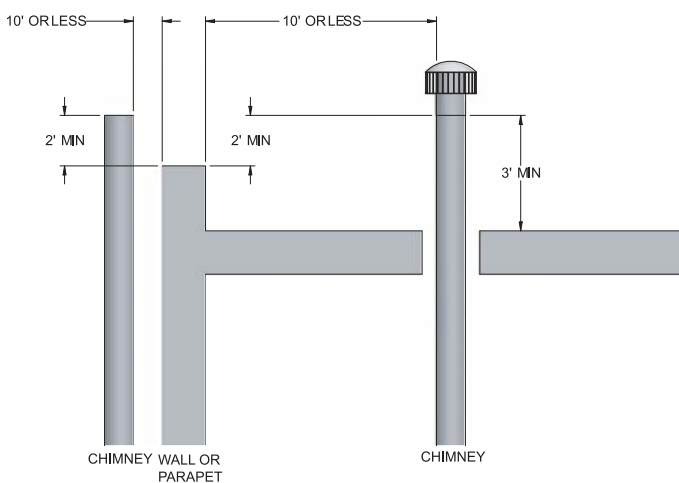


Figure 2-3_Vent Termination from Flat Roof - 10 ft. or Less From Parapet Wall

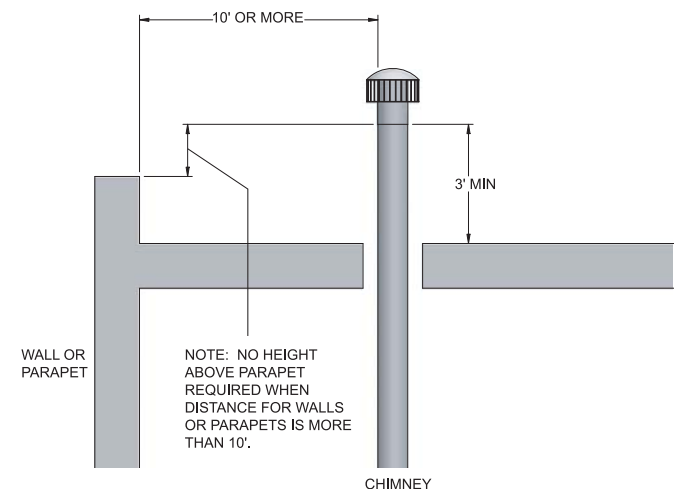


Figure 2-4_Vent Termination from Flat Roof - 10 ft. or More From Parapet Wall

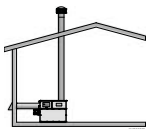
2 Venting

Vertical Vent/Ducted Air - see page 15.

B
NOTICE

Before installing a venting system, follow requirements found in the General Venting section.

The Vertical Vent/Ducted Air vent system is the same as the Conventional Negative Draft vent system, except it pulls combustion air from the outdoors through a separate air inlet pipe. Follow all requirements in the Conventional Negative Draft Venting section on page 17.



The Vertical Vent/Ducted Air vent system requires you to install two pipes directly to the unit; one vertical pipe with a rooftop termination for the flue products and one pipe for combustion air. For this venting option, you must purchase the DV box adapter from the appliance manufacturer. The DV box attaches to the air inlet of the unit. The pipe for combustion air attaches to the DV box (see FIG. 2-10 on page 29). Reference page 29 for a list of approved air intake materials.

Combustion air inlet piping

WARNING

Locate and install the combustion air inlet cap correctly. Failure to do so can allow the discharge of flue products to be drawn into the combustion process. This can result in incomplete combustion and potentially hazardous levels of carbon monoxide in the flue products. This will cause operational problems and the spillage of flue products. Spillage of flue products can cause personal injury or death due to carbon monoxide poisoning.

The sidewall or vertical rooftop Vent/Ducted Air combustion air supply system has specific material and installation requirements. The air inlet pipe connects directly to the unit to supply combustion air. In most installations, the combustion air inlet pipe will be a dedicated system with one air inlet pipe per unit. You can combine multiple air inlets if the guidelines in Combined Air Inlet Points, page 21 are followed. The air inlet pipe will be connected to a combustion air inlet cap as specified in this section.

For normal installations, this system uses a single-wall pipe to supply combustion air from outdoors directly to the unit.

In cold climates, use a Type-B double-wall vent pipe or an insulated single-wall pipe for combustion air. This will help prevent moisture in the cool incoming air from condensing and leaking from the inlet pipe.

Length of air inlet pipe

The installed length of air inlet pipe from the unit to the outside air inlet cap must not exceed 50 equivalent feet (15.2m). Subtract 5 feet (1.5m) of equivalent length for each 90° elbow. Subtract 2.5 feet (0.7m) of equivalent length for each 45° elbow.

Do not exceed the limits for the combustion air inlet piping lengths.

Sidewall air inlet

The sidewall air inlet cap is supplied in the Sidewall Air Inlet Kit. Order the kit from the appliance manufacturer. This sidewall cap supplies combustion air for a single unit only. See Table 2B, page 22, for kit numbers.

Locate the unit as close as possible to the sidewall where you will install the combustion air supply system.

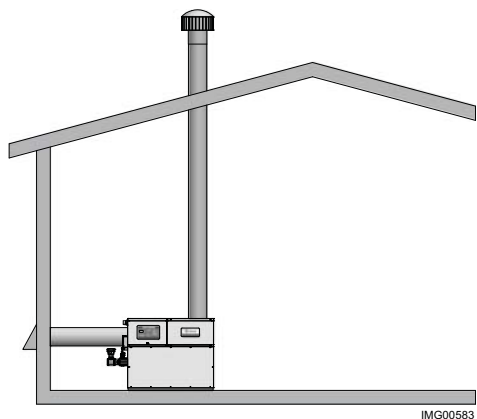


Figure 2-5_Sidewall Combustion Air Inlet

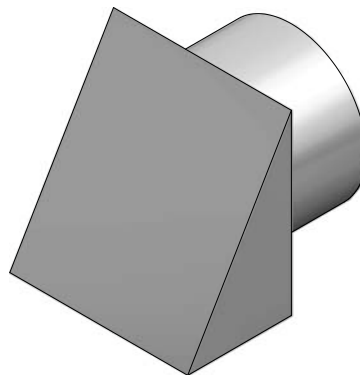


Figure 2-6_Air Inlet Cap for Sidewall Termination

2 Venting *(continued)*

To prevent recirculation of flue products from an adjacent vent cap into the combustion air inlet, follow all applicable clearance requirements in the latest edition of the National Fuel Gas Code and/or CAN/CGA-B149 Installation Code and instructions in the Installation and Operation Manual.

Clearances

You must install the combustion air inlet cap at least one foot (0.30m) above ground level and above normal snow levels.

The point of termination for the combustion air inlet cap must be at least 3 feet (0.91m) below the point of flue gas termination if it is located within 10 feet (3.05m) of the flue outlet. Make sure to properly install the air inlet cap assembly on the air inlet pipe.

Do not install the combustion air inlet cap closer than 10 feet (3.05m) from an inside corner of an L-shaped structure.

Vertical Rooftop Air Inlet

Use the vertical air inlet terminations available from the appliance manufacturer, recommended and/or supplied by the vent manufacturer, or use two 90° elbows as described on page 30.

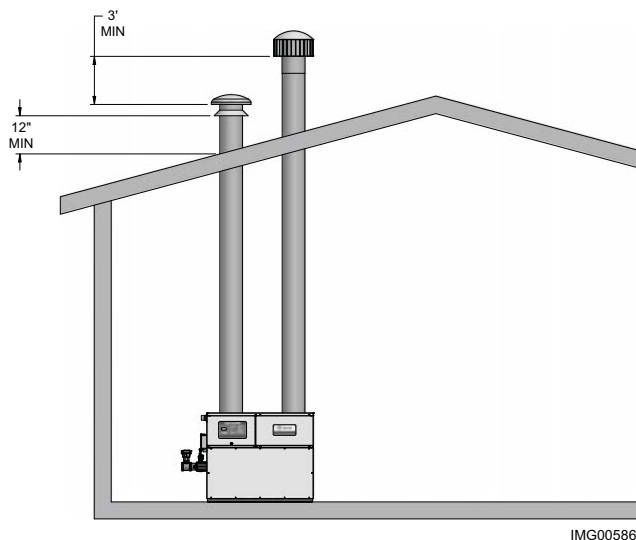


Figure 2-7_Rooftop Combustion Air Inlet

You must locate the air inlet termination elbow at least 12" (30cm) above the roof or above normal snow levels.

If the air inlet cap is within a 10-foot (3.05m) radius of the flue outlet, the point of termination for the combustion air inlet cap must be at least 3 feet (0.91m) below the point of flue gas termination (vent cap).

Do not install the combustion air inlet cap closer than 10 feet (3.05m) from an inside corner of an L-shaped structure.

Combined air inlet points

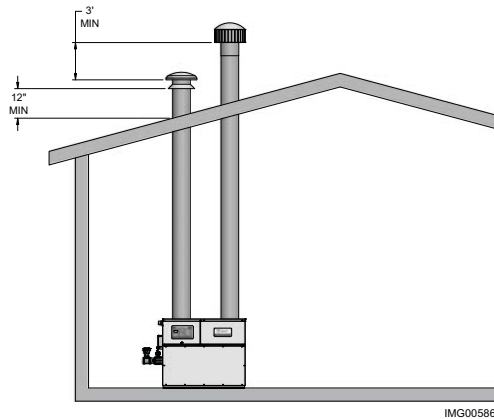
The air inlet pipes from multiple units can be combined to a single common connection if the common air inlet pipe has a cross sectional area equal to or larger than the total area of all air inlet pipes connected to the common air inlet pipe.

Example: Two 10" air inlet pipes (78.5 in² area each) have a total area of 157 in² and will require a 15" (176.7 in² area) common air inlet pipe.

The air inlet point for multiple unit air inlets must be provided with an exterior opening which has a free area equal to or greater than the total area of all air inlet pipes connected to the common air inlet. This exterior opening for combustion air must connect directly to the outdoors. The total length of the combined air inlet pipe must not exceed a maximum of 50 (15.2m) equivalent feet. Subtract 5 feet (1.5m) for each 90° elbow in the air inlet pipe. You must deduct the restriction in area provided by any screens, grills or louvers installed in the common air inlet point. These are common on the sidewall air inlet openings. Screens, grills or louvers installed in the common air inlet can reduce the free area of the opening from 25% to 75% based on the materials used.

You can terminate the combustion air pipe either horizontally with a sidewall air inlet or vertically with a rooftop air inlet. The installed length of air inlet pipe from the unit to the outside air inlet cap must not exceed 50 equivalent feet (15.2m).

2 Venting



⚠ WARNING

Only use a sidewall air inlet cap supplied by the appliance manufacturer or a rooftop air inlet cap supplied by either the vent or appliance manufacturer. Using any other air inlet cap for single unit installations or using a common air inlet cap for multiple units with insufficient free area and/or protections from wind and weather may result in operational problems and the spillage of flue products. Spillage of flue products can cause personal injury or death due to carbon monoxide poisoning.

For single unit installations with sidewall air inlet you must order the sidewall air inlet kit from the appliance manufacturer. The part number for each SVK kit is listed by unit size in Table 2B.

For single unit installations with rooftop air inlet (see FIG. 2-8), you must order the rooftop air inlet kit from the appliance manufacturer. The part number for each VDK kit is listed by unit size in Table 2B. Purchase the flue pipe, rooftop flue termination, and air inlet pipe locally.

Figure 2-8 Vertical Vent/Ducted Air Installation w/Rooftop Combustion Air Inlet

There is no vent kit for combined air supply systems for multiple units. Make sure the air inlet cap is properly sized. You must purchase this cap locally.

Venting of flue products

For venting flue products vertically to the outdoors, follow all requirements in the installation instructions for conventional venting in this manual.

Follow all clearance requirements in Vertical Vent Termination Clearances and Location on page 18.

A barometric damper is not required in the flue on Vertical Vent/Air installations if the draft is within the negative 0.02 to 0.08 inches w.c. required for proper operation. If the draft exceeds this range, install a barometric damper.

TABLE - 2B
VERTICAL VENT/AIR KITS

MODEL	HORIZONTAL KIT*	VERTICAL KIT*
400	100131407	100131398
500	100131407	100131398
650	100131408	100131399
750	100131408	100131399
1000	100131409	100131400
1250	100131410	100131401
1450	100131410	100131401
1800	100131410	100131401
2100	100131410	100131401

*The SVK kits include a DV box adapter and sidewall air inlet cap. The VDK kits include a DV box adapter and a rooftop air inlet cap.

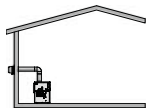
2 Venting *(continued)*

Sidewall venting - see page 15.

C**NOTICE**

Before installing a venting system, follow all requirements found in the General Venting section.

This option uses a powered vent assembly which pulls the flue products out of the stack. This fan generates a negative draft at the unit. Combustion air is drawn from the equipment room (see Combustion and Ventilation Air on 10).

**Sidewall with fan**

The sidewall fan can be mounted on the inside/outside (depending upon model) with a sidewall vent hood installed on the exterior wall. The sidewall fan and accessories are included in a venting kit provided by the appliance manufacturer. See Table 2C on page 25 for kit numbers.

The venting kit includes the sidewall fan, vent hood, tapered vent adapter, barometric damper (1000 - 2100 Models), proving switch and all necessary relays to interlock with the heaters control system. The tapered vent adapter reduces the vent size at the inlet to the fan. There should be no reduction in vent diameter from the unit's flue outlet to the sidewall fan. The barometric damper must be installed on the flue and adjusted to supply a negative draft within the range of 0.04 to 0.08 inches w.c. while unit is operating.

Flue outlet piping

With this venting option, you must use Type-B double-wall (or equivalent) vent materials. Vent materials must be listed by a nationally-recognized test agency for use as vent materials. Make the connections from the unit vent to the sidewall fan/cap as direct as possible with no reduction in diameter. Use the National Fuel Gas Code venting tables for double-wall vent to properly size all vent connectors and stacks. Follow the vent manufacturer's instructions when installing Type-B vents and accessories, such as firestop spacers, vent connectors, thimbles, caps, etc.

When planning the venting system, avoid possible contact with plumbing or electrical wiring inside walls.

The maximum installed length of sidewall vent pipe with an induced draft fan must not exceed 100 feet (30.5m). Subtract 5 feet (1.5m) for each 90° elbow. Subtract 2.5 feet (0.7m) for each 45° elbow.

Sidewall venting termination

The sidewall vent cap must be installed on an exterior sidewall. The sidewall fan/powered sidewall vent cap and accessories are included in a venting kit which is furnished by the appliance manufacturer in accordance with CSA International requirements. This venting kit includes the powered sidewall fan/cap, proving switch and all necessary relays to interlock with the heaters control system.

The sidewall fan/powered vent cap must be interlocked with the units control system to start the fan on a call for heat and prove fan operation before the hot water supply boiler fires. Plug-in and terminal strip connections are provided on the unit for easy connection of the factory supplied vent kit and control package for the sidewall vent fan. See the installation instructions provided with the vent kit.

Sidewall vent termination clearances and location

Locate the bottom of the vent terminal at least 12 inches (30cm) above grade and above normal snow levels. Locate the bottom of the vent terminal at least 7 feet (2.13m) above grade when located adjacent to public walkways. Do not terminate directly above a public walkway.

Do not terminate the venting system in a window well, stairwell, alcove, courtyard, or other recessed area. Do not terminate the venting system below grade.

Locate vent termination at least 3 feet (0.91m) from an inside corner of an L-shaped structure.

Provide a minimum clearance of 4 feet (1.2m) horizontally from electric meters, gas meters, regulators, and relief equipment. Never locate vent cap above or below electric meters, gas meters, regulators, and relief equipment unless a 4 foot (1.2m) horizontal clearance is maintained.

2 Venting

Terminate the venting system at least 3 feet (0.9m) above any forced air inlet within 10 feet (3.05m).

Terminate the venting system at least 4 feet (1.2m) below, 4 feet (1.2m) beside, or 1 foot (30cm) above any door, window, or gravity air inlet into any building.

Locate vent termination at least 8 feet (2.4m) horizontally from any combustion air intake located above the sidewall termination cap.

⚠ CAUTION

Units which are shut down or will not operate may experience freezing due to convective air flow in the flue pipe, through the air inlet, or from negative pressure in the equipment room. In cold climates, operate the pump continuously to help prevent freezing of unit water. Provide proper freeze protection. See Freeze Protection, page 44.

Sidewall venting without fan

For Models 400 - 750 which are approved for sidewall venting without an external power vent fan, you must install specific vent kits and venting materials (reference Table 2C on page 25 for kit numbers).

The following is a detailed explanation of Sidewall Venting Without an External Power Vent Fan installation requirements.

Flue outlet piping

Venting Guidelines

If using this venting option, a sealed AL29-4C venting system for flue products is required on all models of this appliance. This venting system operates with a positive pressure in the vent. The internal combustion air blower generates this positive pressure which operates the combustion process and also exhausts the flue products from the building.

This vent system has specific vent material and installation requirements. Only use listed sealed AL29-4C vent system materials. Follow all installation requirements. See Table 2A for proper pipe size for your unit. A list of sealed AL29-4C flue pipe manufacturers is located on page 14.

Seal all vent joints and seams gas-tight.

Drain tee installation

A drain tee must be installed in the vent pipe to collect and dispose of any condensate that may occur in the vent system. The drain tee must be installed as the first fitting after the horizontal ell on the top of the unit (see FIG. 2-9). Plastic drain tubing, sized per the vent manufacturer's instructions, shall be provided as a drain line from the tee. The drain tubing must have a trap provided by a 3" (7.6cm) diameter circular trap loop in the drain tubing. Prime the trap loop by pouring a small quantity of water into the drain hose before assembly to the vent. Secure the trap loop in position with nylon wire ties. Use caution not to collapse or restrict the condensate drain line with the nylon wire ties. The condensate drain must be routed to a suitable drain for disposal of condensate that may occur in the direct vent system. Refer to the condensate drain installation instructions as supplied by the manufacturer of the vent material.

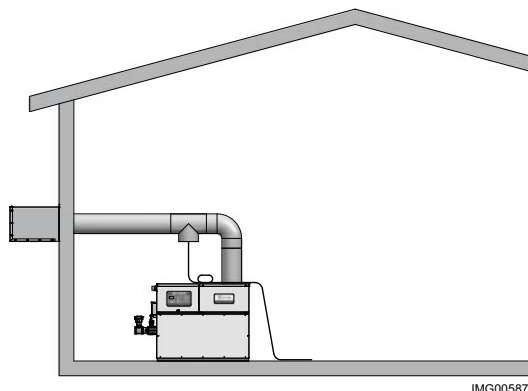


Figure 2-9 Sidewall Vent - Models 400 - 750 (Only)

2 Venting *(continued)*

⚠ WARNING

Do not combine the flue from this unit with the vent from any other appliance. Do not combine flues from multiple appliances into a common vent. The flue from this unit must be a dedicated stack.

Connect the flue vent directly to the flue outlet opening on the top of the unit. Make the connections from the unit vent to the outside stack as direct as possible with no reduction in diameter. Provide adequate clearance to combustibles for the vent connector and firestop. Follow the vent manufacturer's instructions when installing sealed AL29-4C vents and accessories, such as firestop spacers, vent connectors, thimbles, caps, etc.

Provide adequate clearance to combustibles for the vent connector and firestop.

When planning the venting system, avoid possible contact with plumbing or electrical wiring inside walls, ceilings, and floors.

Locate the unit as close as possible to chimney or gas vent. When a vent system is disconnected for any reason, the flue must be reassembled and resealed according to the vent manufacturer's instructions.

The installed length of flue from the unit to the outside point of termination must not exceed 50 equivalent feet (15.2m). Subtract 5 feet (1.5m) of equivalent length for each 90° elbow. Subtract 2.5 feet (0.7m) of equivalent length for each 45° elbow.

Sidewall vent termination clearances and location

Follow all sidewall venting termination information for clearances and location under Sidewall Vent Termination Clearances and Location on page 23.

TABLE - 2C
SIDEWALL VENT KITS

MODEL	KIT (W/POWER FAN ASSY.)	MAX. VENT LENGTH	VENT TERMINATION ONLY (MODELS 400 - 750)	MAX. VENT LENGTH
400	100131393	100 ft.	100131416	50 ft.
500	100131393	100 ft.	100131416	50 ft.
650	100131394	100 ft.	100131417	50 ft.
750	100131394	100 ft.	100131417	50 ft.
1000	100131395*	100 ft.	N/A	N/A
1250	100131396*	100 ft.	N/A	N/A
1450	100131396*	100 ft.	N/A	N/A
1800	100131397*	100 ft.	N/A	N/A
2100	100131397*	100 ft.	N/A	N/A

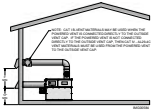
*These kits include a barometric damper.

2 Venting

Horizontal Vent/Ducted Air venting (Powered Venting) - see page 15.

D
NOTICE

Before installing a venting system, follow all requirements found in the General Venting section.



The Horizontal Vent/Ducted Air vent system is the same as the Sidewall Venting system, except it pulls combustion air from the outdoors through a sidewall air inlet. Follow all requirements in Sidewall Venting section on page 23.

The Horizontal Vent/Ducted Air vent system requires you to install two pipes directly to the unit; one pipe for flue products and one for combustion air. Install both pipes horizontally with a sidewall termination point. For this venting option, you must purchase the DV box accessory from the appliance manufacturer. The DV box attaches to the air inlet of the unit. The pipe for combustion air attaches to the DV box (see FIG. 2-10 on page 29). Reference page 29 for a list of approved air intake materials.

Make vent connection directly to the top of the unit. No additional draft diverter or barometric damper is required on single unit installations with a dedicated stack and a negative draft maintained between 0.04 to 0.08 inches w.c.

The Horizontal Vent/Ducted Air combustion air supply system has specific vent material and installation requirements. The air inlet pipe connects directly to the unit to supply combustion air. The combustion air inlet pipe is a dedicated system with one air inlet pipe per unit. You must connect the air inlet pipe to a combustion air inlet cap as specified in this section.

Combustion air supplied from outdoors must be free of contaminants (see the Combustion and Ventilation Air section on page 10).

You must order the Horizontal Vent/Ducted Air Vent Kit for sidewall installation from the appliance manufacturer. See Table 2D for kit numbers. Each kit includes a sidewall powered vent cap fan, proving switch, controls, combustion air inlet cap to supply air to a single unit, the transition adapter to attach the field supplied single wall air inlet pipe to the unit and installation instructions. Purchase flue pipe and air inlet pipe locally.

The sidewall air inlet cap supplied in the Horizontal Vent/Ducted Air Vent Kit is used to supply combustion air to a single hot water supply boiler. Combustion air supply pipes from multiple units can not be combined into a single air inlet pipe and inlet point.

WARNING

Only use the sidewall air inlet cap recommended by the appliance manufacturer. Using another sidewall air inlet cap may result in operational problems and the spillage of flue products. Spillage of flue products can cause personal injury or death due to carbon monoxide poisoning.

Venting of flue products

For venting flue products horizontally, follow all requirements in the installation instructions for sidewall venting.

Termination point for the flue products must follow the clearance requirements in the Sidewall Venting Termination section on page 23.

For proper operation, a barometric damper is provided for Horizontal Vent/Ducted Air installations. The damper will help to ensure a draft between negative 0.04 to 0.08 inches w.c.

TABLE - 2D
HORIZONTAL VENT/AIR KITS

MODEL	KIT	MODEL	KIT
400	100131402	1000	100131404*
500	100131402	1250	100131405*
650	100131403	1450	100131405*
750	100131403	1800	100131406*
--	--	2100	100131406*

*These kits include a barometric damper.

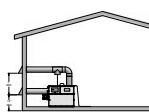
2 Venting *(continued)*



Direct Vent/Sealed Combustion - see page 15.

NOTICE

Before installing a venting system, follow all requirements found in the General Venting section.



This option uses sealed AL29-4C vent materials for the flue outlet piping and separate combustion air inlet piping. This system terminates both the flue and combustion air inlet in the same pressure zone. The flue outlet and combustion air intake may terminate at either a sidewall or the rooftop.

To use the optional Direct Vent system, you must install specific vent kits and venting materials. The following is a detailed explanation of Direct Vent installation requirements, including the components used and vent kit part numbers (reference Table 2E on page 28 for kit numbers).

Flue outlet piping

Venting Guidelines

If using this venting option, a sealed AL29-4C venting system for flue products is required on all models of this appliance. This venting system operates with a positive pressure in the vent. The internal combustion air blower generates this positive pressure which operates the combustion process and also exhausts the flue products from the building.

This vent system has specific vent material and installation requirements. Only use listed sealed AL29-4C vent system materials. Follow all installation requirements. See Table 2A, page 16 for proper pipe size for your unit.

Seal all vent joints and seams gas-tight.

Drain tee installation

A drain tee must be installed in the vent pipe to collect and dispose of any condensate that may occur in the vent system. The drain tee must be installed as the first fitting after the horizontal ell on the top of the unit (see FIG. 2-9 on page 24). Plastic drain tubing, sized per the vent manufacturer's instructions, shall be provided as a drain line from the tee. The drain tubing must have a trap provided by a 3" (7.6cm) diameter circular trap loop in the drain tubing. Prime the trap loop by pouring a small quantity of water into the drain hose before assembly to the vent. Secure the trap loop in position with nylon wire ties. Use caution not to collapse or restrict the condensate drain line with the nylon wire ties. The condensate drain must be routed to a suitable drain for disposal of condensate that may occur in the direct vent system. Refer to the condensate drain installation instructions as supplied by the manufacturer of the vent material.

⚠ WARNING

Do not combine the flue from this unit with the vent from any other appliance. Do not combine flues from multiple appliances into a common vent. The flue from this unit must be a dedicated stack.

Connect the flue vent directly to the flue outlet opening on the top of the unit. Make the connections from the unit vent to the outside stack as direct as possible with no reduction in diameter. Provide adequate clearance to combustibles for the vent connector and firestop. Follow the vent manufacturer's instructions when installing sealed AL29-4C vents and accessories, such as firestop spacers, vent connectors, thimbles, caps, etc.

Provide adequate clearance to combustibles for the vent connector and firestop.

When planning the venting system, avoid possible contact with plumbing or electrical wiring inside walls, ceilings, and floors. Locate the unit as close as possible to chimney or gas vent.

When a vent system is disconnected for any reason, the flue must be reassembled and resealed according to the vent manufacturer's instructions.

The installed length of flue from the unit to the outside point of termination must not exceed 50 equivalent feet (15.2m). Subtract 5 feet (1.5m) of equivalent length for each 90° elbow. Subtract 2.5 feet (0.7m) of equivalent length for each 45° elbow.

Vertical DV venting termination

You must use the vent termination recommended by the vent manufacturer for vertical direct vent terminations. Follow all vertical venting termination information for clearances and location under the Vertical Vent Termination Clearances and Location section on pages 18 - 19.

2 Venting

Masonry chimney installation

Do not use a standard masonry chimney to directly vent the combustion products from this unit.

To use a masonry chimney, the chimney must use a sealed, corrosion-resistant liner system. Sealed, corrosion-resistant liner systems (single-wall, double-wall, flexible, or rigid) must be rated for use with a high efficiency, positive pressure vent system.

Corrosion-resistant chimney liner systems are typically made from a high grade stainless steel such as AL29-4C. The liner must be properly sized and fully sealed throughout the entire length. Both the top and bottom of the masonry chimney must be capped and sealed to provide a dead air space around the liner.

⚠ WARNING

Do not vent this unit into a masonry chimney without a sealed stainless steel liner system. Any breaks, leaks, or damage to the masonry flue/tile will allow the positive-pressure flue products to leak from the chimney and into occupied living spaces. This could cause serious injury or death due to carbon monoxide poisoning and other harmful flue products.

NOTICE

Check with local code officials to determine code requirements or the advisability of using a masonry chimney with a sealed corrosion-resistant liner system.

Horizontal DV venting termination

Horizontal venting uses the unit's internal combustion air blower to force the flue products out of the horizontally-terminated flue.

You must purchase a horizontal direct vent kit from the appliance manufacturer to ensure proper operation. When installing the vent cap, the wall opening must provide an air space clearance of 2 inches (5.1cm) around the flue pipe. The diameter of the opening for installation of the sidewall cap will be 4 inches (10.2cm) larger (minimum) than the nominal diameter of the installed vent pipe to the horizontal vent cap.

Install the horizontal vent cap from the outside. Mount the vent cap to the wall using four screws or wall anchors. Seal under the screw heads with caulking. Install the Category IV vent pipe from the unit to the vent cap. See detailed instructions packed with the horizontal direct vent kit.

Horizontal Vent Termination Clearances and Location

Follow all sidewall venting termination information for clearances and location under Sidewall Vent Termination Clearances and Location, page 23.

TABLE - 2E
DIRECT VENT KITS

MODEL	HORIZONTAL KIT*	VERTICAL KIT*	MODEL	HORIZONTAL KIT*	VERTICAL KIT*
400	100131411	100131398	1000	100131413	100131400
500	100131411	100131398	1250	100131414	100131401
650	100131412	100131399	1450	100131414	100131401
750	100131412	100131399	1800	100131415	100131401
--	--	--	2100	100131415	100131401

*These kits include a DV box adapter, air inlet cap, and a sidewall vent termination. The VDK kits include a DV box adapter and an air inlet cap.

Combustion air inlet piping

The Direct Vent system requires the installation of a pipe to supply combustion air from the outdoors directly to the unit. Make sure the combustion air inlet is in the same pressure zone as the vent terminal.

In cold climates, use a Type-B double-wall vent pipe or an insulated single wall pipe for combustion air. This will help prevent moisture in the cool incoming air from condensing and leaking from the inlet pipe.

⚠ CAUTION

Units that are shut down or will not operate may experience freezing due to convective airflow in the air inlet pipe.

2 Venting *(continued)*

Length of air inlet pipe

The installed length of air inlet pipe from the unit to the outside air inlet cap must not exceed 50 equivalent feet (15.2m). Subtract 5 feet (1.5m) of equivalent length for each 90° elbow. Subtract 2.5 feet (0.7m) of equivalent length for each 45° elbow.

Do not exceed the limits for the combustion air inlet piping lengths.

Connecting the air inlet pipe to the unit

Connect the air inlet piping directly to the unit by attaching it to the DV box adapter. The DV box adapter is included in the direct vent kits. The combustion air inlet area of the unit is located at the right rear corner of the unit. This unit uses a simple air filter to ensure clean air is used for the combustion process. Attach the DV box adapter over the air filter (see FIG. 2-10). Align screw holes on the DV box adapter with the screw holes surrounding the air filter hanger. Insert sheet metal screws and tighten firmly.

For venting versatility, you can move the air filter assembly and DV box adapter to the right side of the unit. Remove the metal panel on the unit's right side (see FIG. 2-11). Remove the filter/bracket assembly from the rear of the unit. Attach the filter/bracket assembly and DV box adapter to the right side opening using the pre-drilled screw holes. Make sure you attach the metal panel to the rear combustion air opening of the unit.

The DV box adapter has an air inlet pipe mounting ring. Connect combustion air inlet piping to the direct vent box mounting ring.

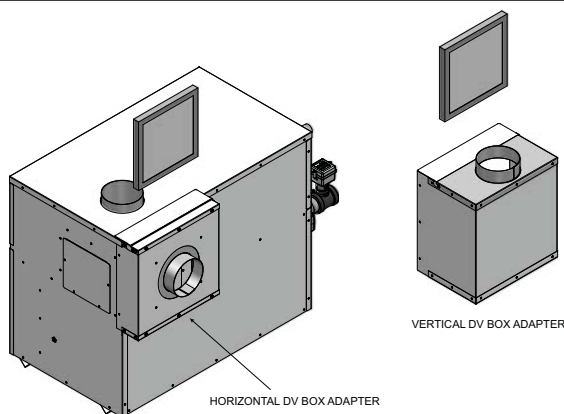


Figure 2-10_Attaching DV Box Adapter to Unit

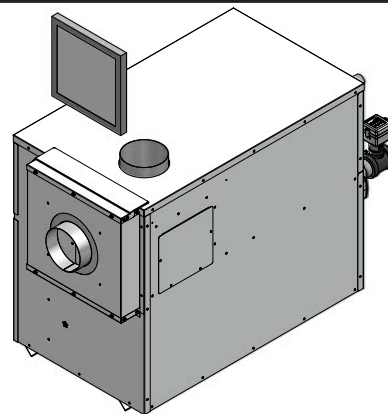


Figure 2-11_Moving Air Filter Assembly & DV Box Adapter

Air inlet piping materials

The air inlet pipe(s) must be sealed. Select air inlet pipe material from the following specified materials.

- PVC, CPVC, or ABS*
- Dryer vent or sealed flexible duct (not recommended for rooftop air inlet)
- Galvanized steel vent pipe with joints and seams sealed as specified below
- Type-B double-wall vent with joints and seams sealed as specified below.

* Plastic pipe may require an adapter (not provided) to transition between the air inlet connection on the unit and the plastic air inlet pipe.

⚠ WARNING

Use only vent or air intake materials specified in this manual. Follow vent pipe manufacturer's instructions. Failure to do so can result in property damage, personal injury, or death. Mixing of venting materials will void the warranty and certification of this unit.

Sealing Type-B double-wall vent pipe or galvanized vent pipe

Follow the steps below to properly seal Type-B double-wall vent pipe or galvanized vent pipe.

1. Seal all joints and seams of the air inlet pipe using either aluminum foil duct tape meeting UL Standard 723 or 181 A-P or a high quality UL Listed silicon sealant such as those manufactured by Dow Corning or General Electric.
2. On horizontal runs, do not install vent pipe with seams pointing down. Position vent pipe so that the seams are on the top side of the vent pipe.
3. Secure all joints with a minimum of three sheet metal screws or pop rivets. Apply aluminum foil duct tape or silicone sealant to all screws or rivets installed in the vent pipe.
4. Ensure that the air inlet pipes are properly supported.

Sealing PVC, CPVC, ABS, dryer vent, and flex duct vent pipe

1. Clean the PVC, CPVC, or ABS air inlet pipe using the pipe manufacturer's recommended solvents. Seal the pipe joints using standard commercial pipe cement.

2 Venting

- For PVC, CPVC, ABS, dryer vent, or flex duct air inlet piping, use a silicone sealant to ensure a proper seal at the unit inlet and the air inlet cap.
- For Dryer vent or flex duct, also use a screw-type clamp to attach the inlet vent material to the unit inlet and the air inlet cap. Properly sealing the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.
- Ensure that the air inlet pipes are properly supported.

⚠ WARNING

Properly seal all joints and seams in the inlet vent piping system. Failure to do so may result in flue gas recirculation, spillage of flue products, and carbon monoxide emissions. Carbon monoxide poisoning can cause severe personal injury or death.

Vertical and sidewall combustion air inlet

NOTICE

To prevent recirculation of flue products into the combustion air inlet, follow all instructions in this section.

⚠ WARNING

Locate and install the combustion air inlet termination correctly. Failure to do so can allow the discharge of flue products to be drawn into the combustion process. This can result in incomplete combustion and potentially hazardous levels of carbon monoxide in the flue products. This will cause operational problems and the spillage of flue products. Spillage of flue products can cause personal injury or death due to carbon monoxide poisoning.

You must locate the combustion air cap and the flue gas outlet on the same rooftop surface (vertical direct vent system) or sidewall surface (horizontal direct vent system) and in the same pressure zone as the vent termination. Follow all clearance requirements listed on this page.

Purchase and assemble the combustion air inlet cap to protect the air inlet from wind and weather.

Alternatively, assemble the combustion air inlet cap for vertical rooftop air inlet from items purchased locally. The air inlet cap consists of two 90° elbows installed to the air inlet pipe (see FIG. 2-12). Install the first 90° elbow on the rooftop at the highest vertical point of the air inlet pipe. Install the second 90° elbow on the horizontal outlet of the first elbow. The outlet of the second 90° elbow will be pointing down. You may use a 90° elbow and a 90° straight elbow to make this assembly. If you use a straight piece of pipe between the two 90° elbows, it should not exceed 6" (51mm) in length.

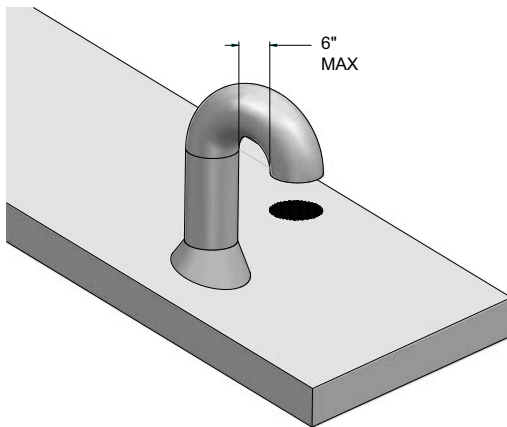


Figure 2-12_Vertical Rooftop Air Inlet

For horizontal direct vent termination of combustion air, you must use the termination cap from the appliance manufacturer. The sidewall air inlet cap is available as part of a direct vent kit. See Table 2E, page 28 for Horizontal Direct Vent Kits.

Vertical Combustion Air Inlet Clearances

You must locate the air inlet termination elbow at least 12" (30cm) above the roof or above normal snow levels.

If the air inlet cap is within a 10-foot (3.05m) radius of the flue outlet, the point of termination for the combustion air inlet cap must be at least 3 feet (0.91m) below the point of flue gas termination (vent cap).

Do not install the combustion air inlet cap closer than 10 feet (3.05m) from an inside corner of an L-shaped structure.

Horizontal combustion air inlet clearances

You must locate the horizontal air inlet termination point at least 12" (30cm) above grade and above normal snow levels.

If the air inlet cap is within a 10-foot (3.05m) radius of the flue outlet, the point of termination for the combustion air inlet cap must be at least 3 feet (0.91m) below the point of flue gas termination (vent cap). Do not install the horizontal combustion air inlet cap above the flue outlet.

Do not install the combustion air inlet cap closer than 10 feet (3.05m) from an inside corner of an L-shaped structure.

Multiple sidewall direct vent installations

You must locate the horizontal air inlet termination points at least 12" (30cm) above grade and above normal snow levels. The combustion air inlet caps for multiple appliance installations must maintain the same minimum clearance from the closest flue vent cap as specified in single appliance installations. You may install multiple flue outlet caps side-by-side and multiple combustion air inlet caps side-by-side, but the air inlet must always be at least 3 feet (0.91m) horizontally and 3 feet (0.91m) below the closest flue outlet. Do not install combustion air inlet caps above the flue outlets.

Maintain all clearances and installation requirements for multiple appliance installations.

2 Venting *(continued)*

F Outdoor installation - see page 15.

NOTICE

Before installing a venting system, follow all requirements found in the General Venting section.

Units are self-venting and can be used outdoors when installed with the optional outdoor cap. This cap mounts directly to the top of the unit and covers the flue outlet and combustion air inlet openings. No additional vent piping is required.

WARNING

Only install outdoor models outdoors and only use the vent cap supplied by the appliance manufacturer. Personal injury or product damage may result if any other cap is used or if an outdoor model is used indoors. Properly install all covers, doors and jacket panels to ensure proper operation and prevent a hazardous condition.

Combustion air supply must be free of contaminants (see Combustion and Ventilation Air, page 10). To prevent recirculation of the flue products into the combustion air inlet, follow all instructions in this section.

Outdoor vent/air inlet location

Keep venting areas free of obstructions. Keep area clean and free of combustible and flammable materials. Maintain a minimum clearance of 3" (76mm) to combustible surfaces and a minimum of 36" (915mm) clearance to the air inlet. To avoid a blocked air inlet or blocked flue condition, keep the outdoor cap air inlet, flue outlet and drain slot clear of snow, ice, leaves, debris, etc.

Do not install outdoor models directly on the ground. You must install the outdoor unit on a concrete, brick, block, or other non-combustible pad.

Do not locate unit so that high winds can deflect off of adjacent walls, buildings or shrubbery causing recirculation. Recirculation of flue products may cause operational problems, bad combustion or damage to controls. Locate unit at least 3 feet (0.91m) from any wall or vertical surface to prevent wind conditions from affecting performance.

Multiple unit outdoor installations require 48" (1.22m) clearance between each vent cap. Locate outdoor cap at least 48" (1.22m) below and 48" (1.22m) horizontally from any window, door, walkway or gravity air intake.

Locate unit at least 10 feet (3.05m) away from any forced air inlet.

Locate unit at least 3 feet (0.91m) outside any overhang.

Clearances around outdoor installations can change with time. Do not allow the growth of trees, shrubs or other plants to obstruct the proper operation of the outdoor vent system.

Do not install in locations where rain from building runoff drains will spill onto the unit.

Flue gas condensate can freeze on exterior walls or on the vent cap. Frozen condensate on the vent cap can result in a blocked flue condition. Some discoloration to exterior building or unit surfaces can be expected. Adjacent brick or masonry surfaces should be protected with a rust resistant sheet metal plate.

The outdoor vent cap kit

The optional outdoor vent cap kit is available from the appliance manufacturer. The outdoor cap part numbers are listed by model number. See Table 2F for kit numbers.

Install the outdoor vent cap on the rear of the unit. Complete installation instructions are included with the outdoor vent cap kit.

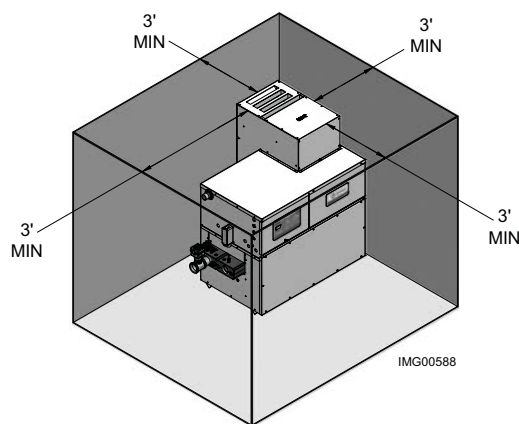


Figure 2-13_ Outdoor vent cap installed

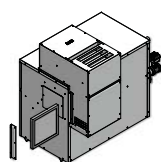


TABLE - 2F OUTDOOR VENT CAP KITS			
MODEL	KIT* WITH PUMP COVER	MODEL	KIT* WITH PUMP COVER
400	100131387	1000	100131389
500	100131387	1250	100131390
650	100131388	1450	100131391
750	100131388	1800	100131392
--	--	2100	100131392

*These kits include an outdoor vent cap and gasket.

3 Gas connections

Connecting to gas supply

Verify that the appliance is supplied with the type of gas specified on the rating plate. This appliance is configured for operation up to 4,500 feet altitude. Consult factory for installations above 4,500 feet elevation.

Inlet gas pressure: Measured at the inlet pressure tap on the appliance gas manifold. The pressure tap is located upstream of the combination gas valve(s) (FIG. 3-3 on page 34).

See Table 3A for maximum and minimum inlet pressures. Do not exceed the maximum. Minimum inlet pressure is for the purpose of input adjustment.

TABLE 3A INLET GAS PRESSURE				
MODEL	NATURAL		LP	
	Max. w.c.	Min. w.c.	Max. w.c.	Min. w.c.
400 - 2100	14.0	4.5	14.0	8.0

Manifold pressure: The gas regulator on the unit's combination gas valve is adjustable to supply proper manifold pressure for normal operation. See the Genesis Service Manual for net manifold pressure settings.

If you must adjust regulator pressure, follow the instructions under Gas Manifold Pressure Adjustment in the Genesis Service Manual. Do not increase regulator pressure beyond specified pressure setting.

Gas pressure test

1. The appliance must be disconnected from the gas supply piping system during any pressure testing of that system at a test pressure in excess of 1/2 PSIG (3.5 kPa).
2. The appliance must be isolated from the gas supply piping system by closing a manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.5 kPa).
3. The appliance and its gas connection must be leak tested before placing it in operation.

Gas piping

To safely operate this unit, you must properly size the gas supply piping. See Tables 3B through 3D for piping and fitting requirements. Gas pipe size may be larger than heater connection.

For ease of service, install a union.

Install a manual main gas shutoff valve, outside of the unit gas connection within six feet of the unit in accordance with the requirements of the National Fuel Gas Code, ANSI Z223.1.

You must provide a sediment trap (drip leg) in the inlet of the gas connection to the unit.

NOTICE

It is the installer's responsibility to supply the sediment trap (drip leg).

CAUTION

Do not block access to the electrical cover plate when installing the sediment trap. The sediment trap must be a minimum of 12 inches from the appliance.

The combination gas valves have an integral vent limiting device and do not require venting to atmosphere, outside the building. The unit will not operate properly if the reference hose is removed or a vent to atmosphere is installed.

Optional gas controls may require routing of bleeds and vents to the atmosphere, outside the building when required by local codes.

Gas connection

All gas connections must be made with pipe joint compound resistant to the action of liquefied petroleum (L.P.) and natural gases. All piping must comply with local codes and ordinances. Piping installations must comply with approved standards and practices.

1. Make sure gas line is a separate line direct from the meter unless the existing gas line is of sufficient capacity. Verify pipe size with your gas supplier.

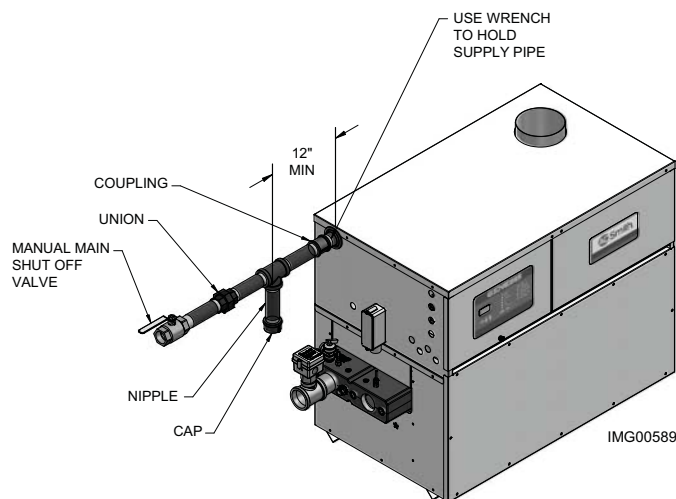


Figure 3-1_Gas Line Connection

NOTICE

If an inline high gas pressure regulator is used, it MUST BE of the lockup type and be located a minimum of 10 feet from the appliance. Failure to do so may result in insufficient gas volume supplied to the appliance.

3 Gas connections *(continued)*

- Use new, properly threaded black iron pipe free from chips. If you use tubing, make sure the ends are cut square, deburred and clean. Make all tubing bends smooth and without deformation. Avoid flexible gas connections. Internal diameter of flexible lines may not provide unit with proper volume of gas.
- Install a manual main gas shutoff valve at the unit's gas inlet, outside of the unit.
- Run pipe or tubing to the unit's gas inlet. If you use tubing, obtain a tube to pipe coupling to connect the tubing to the unit's gas inlet.
- Install a sediment trap in the supply line to the unit's gas inlet (see FIG. 3-1).
- Apply a moderate amount of good quality pipe compound (do not use Teflon tape) to pipe only, leaving two end threads bare.
- Remove seal over gas inlet to unit.
- Connect gas pipe to inlet of unit. Use wrench to support gas manifold on the unit.
- For L.P. gas, consult your L.P. gas supplier for expert installation.
- Ensure that all air is completely bled from the gas line before starting the ignition sequence. Start up without properly bleeding air from the gas line may require multiple reset functions of the ignition control module to achieve proper ignition.

WARNING

Do not have any open flame in proximity to the gas line when bleeding air from the gas line. Gas may be present.

Gas train and controls

NOTICE

The gas train and controls assembly provided on this unit have been tested under the applicable American National Standard to meet minimum safety and performance criteria such as safe lighting, combustion and safety shutdown operation.

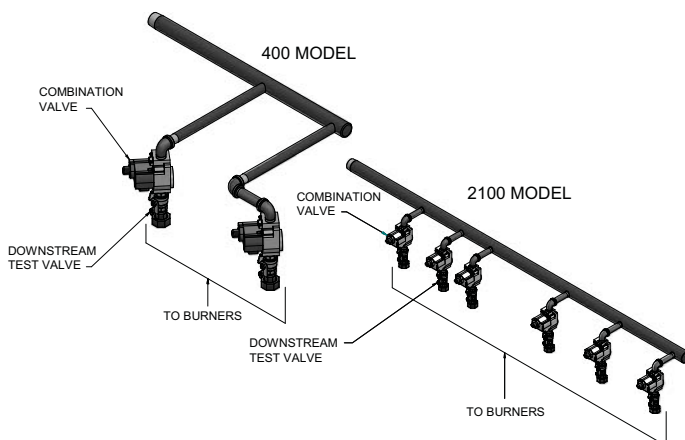


Figure 3-2 Typical Hot Water Supply Boiler Gas Train Drawing

TABLE 3B
SUGGESTED GAS PIPE SIZE FOR
SINGLE UNIT INSTALLATIONS

MODEL	Distance from Meter (in feet)				
	0 - 50	51 - 100	101 - 200	201 - 300	301 - 500
400	1 1/4"	1 1/4"	1 1/2"	2"	2"
500	1 1/4"	1 1/2"	2"	2"	2 1/2"
650	1 1/2"	2"	2"	2 1/2"	2 1/2"
750	1 1/2"	2"	2"	2 1/2"	3"
1000	2"	2"	2 1/2"	2 1/2"	3"
1250	2"	2 1/2"	2 1/2"	3"	3"
1450	2 1/2"	2 1/2"	3"	3"	3 1/2"
1800	2 1/2"	3"	3"	3 1/2"	3 1/2"
2100	2 1/2"	3"	3"	3 1/2"	4"

For each elbow or tee, add equivalent straight pipe to total length from Table 3C.

TABLE - 3C
FITTINGS TO EQUIVALENT STRAIGHT PIPE

Diameter Pipe (inches)	3/4	1	1 1/4	1 1/2	2	3	4	5
Equivalent length of Straight Pipe (feet)	2	2	3	4	5	10	14	20

Combination gas valves

These units fire in multiple stages of burner input. Each stage of burner operation has a combination gas valve(s) to cycle the gas supply on and off and regulate gas to the burners. Each combination valve consists of a gas regulator and two valve seats to meet the requirements for redundant gas valves. The valve has a gas control knob that must remain in the open position at all times when the unit is in service. The gas control valve has pressure taps located on the inlet and discharge sides of the valve. Manifold pressure is adjusted using the regulator located on the valve. A manifold gas pressure tap for each burner stick is located on the discharge side of the valve.

The manifold pressure is preset at the factory and adjustment is not usually required. If you must adjust regulator pressure, follow the instructions in the Genesis Service Manual.

Venting of combination gas valves

The combination gas valve/regulator used on all units is equipped with an integral vent limiting orifice per ANSI Z21.78. The vent limiter ensures that the volume of gas emitted from the valve in the event of a failed gas diaphragm does not exceed the maximum safe leakage rate allowed by agency requirements.

3 Gas connections

Combination gas valve/regulators equipped with integral vent limiters are not required to have vent or relief lines piped to the outdoors. The termination of the vent limited opening on the combination gas valve/regulator complies with the safety code requirements of CSD-1, CF-190(a) as shipped from the appliance manufacturer without the installation of additional vent lines.

Checking gas supply pressure

Use the following procedure to check gas supply pressure.

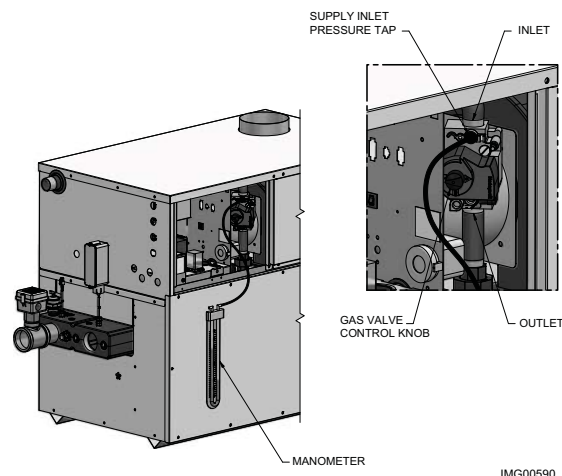
1. Turn the main power switch to the "OFF" position.
2. Turn gas valve knobs to the "OFF" position.
3. Shut off gas supply at the field-installed manual gas cock in the gas piping to the unit. If fuel supply is L.P. gas, shut off gas supply at the tank.
4. Remove the 1/8" hex plug, located on the "inlet" side of the gas valve. You may also use a tapping on the field-installed main manual gas cock or gas piping. Install a fitting in the inlet pressure tapping suitable to connect to a manometer or magnehelic gauge. Range of scale should be 14" w.c. or greater to check inlet pressure.
5. Turn on gas supply at the manual gas cock, turn on L.P. gas at the tank if required.
6. Turn the power switch to the "ON" position.
7. Turn the gas valve knobs to the "ON" position. Set the electronic temperature control or thermostat to call for heat.
8. Observe the gas supply pressure as all burners are firing. Ensure that inlet pressure is within the specified range. See Connecting To Gas Supply, page 32 for minimum and maximum gas supply pressures.
9. If gas pressure is out of range, contact gas utility, gas supplier, qualified installer or service agency to determine necessary steps to provide proper gas pressure to the control.
10. If gas supply pressure is within normal range, turn the power switch to the "OFF" position.
11. Turn gas valve knobs to the "OFF" position.
12. Shut off gas supply at the manual gas cock in the gas piping to the unit. If fuel supply is L.P. gas, shut off gas supply at the tank.

13. Remove the manometer and related fitting from the "inlet" side of the gas valve, replace 1/8" hex plug in gas valve and tighten.
14. Turn on gas supply at the manual valve, turn on L.P. gas at the tank if required.
15. Turn the power switch to the "ON" position.
16. Turn the gas valve knob to the "ON" position.
17. Set the electronic temperature control or thermostat to call for heat.

⚠ WARNING

After completing any testing on the gas system, leak test all gas connections. Apply a soap/water solution to all gas connections while main burners are operating. Bubbles forming indicate a leak. Repair all leaks at once. Do not operate this unit with a leak in the gas train, valves or related piping.

Check burner performance by cycling the system while you observe burner response. Burners should ignite promptly. Flame pattern should be stable, see Burner Flames in the Genesis Service Manual. Turn system off and allow burners to cool, then cycle burners again to ensure proper ignition and flame characteristics.



IMG00590

Figure 3-3 Measuring Gas Supply Pressure at Combination Gas Valve

TABLE - 3D
GAS PIPING SIZE CHART

Nominal Iron Pipe Size Inches	Length of Pipe in Straight Feet														Maximum Capacity of Pipe in Thousands of Btu/hr per hour for gas pressures of 14 Inches Water Column (0.5 PSIG) or less and a pressure drop of 0.5 Inch Water Column (Based on NAT GAS, 1025 Btu/hr per Cubic Foot of Gas and 0.60 Specific Gravity)
	10	20	30	40	50	60	70	80	90	100	125	150	175	200	
3/4	369	256	205	174	155	141	128	121	113	106	95	86	79	74	
1	697	477	384	328	292	267	246	256	210	200	179	164	149	138	
1 1/4	1,400	974	789	677	595	543	502	472	441	410	369	333	308	287	
1 1/2	2,150	1,500	1,210	1,020	923	830	769	707	666	636	564	513	472	441	
2	4,100	2,820	2,260	1,950	1,720	1,560	1,440	1,330	1,250	1,180	1,100	974	871	820	
2 1/2	6,460	4,460	3,610	3,100	2,720	2,460	2,310	2,100	2,000	1,900	1,700	1,540	1,400	1,300	
3	11,200	7,900	6,400	5,400	4,870	4,410	4,000	3,800	3,540	3,300	3,000	2,720	2,500	2,340	
4	23,500	16,100	13,100	11,100	10,000	9,000	8,300	7,690	7,380	6,870	6,150	5,640	5,130	4,720	

4 Water connections

Inlet and outlet connections

For ease of service, install unions on the water inlet and water outlet of the unit. The connection to the unit marked “Inlet” on the header should be used for return from the system. The connection on the header marked “Outlet” is to be connected to the supply side of the system.

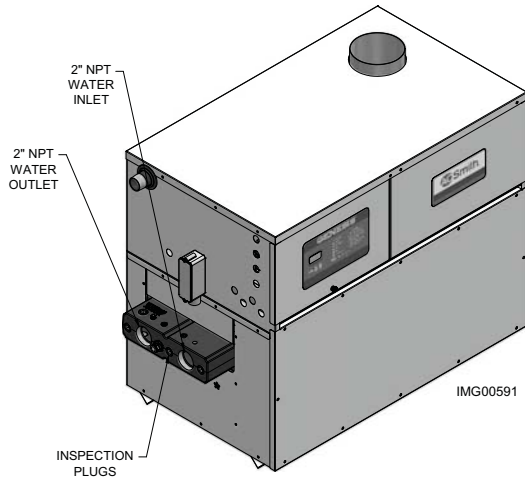


Figure 4-1_Water Connections - Models 400 - 750

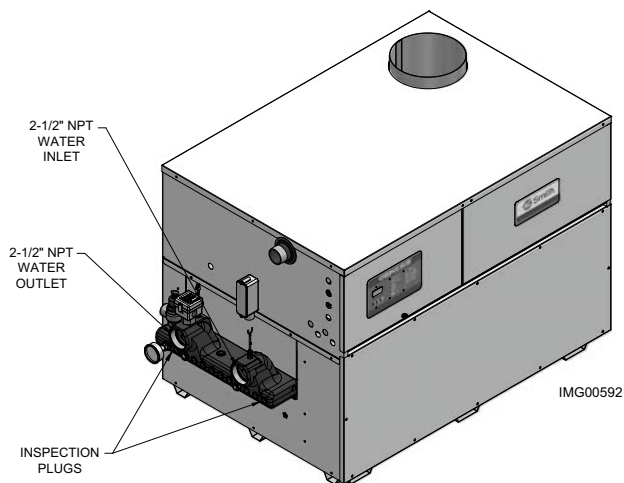


Figure 4-2_Water Connections - Models 1000 - 2100

Initial set-up of maximum water flow

On initial start-up of the Genesis, the maximum water flow to the heat exchanger must be checked and manually limited with a valve or bypass before normal operation begins.

⚠ CAUTION

An appliance allowed to operate at return temperatures below the specified minimum setting may experience problems with the operating controls, safety switches, obstruction of the flue gas passages on the heat exchanger, incomplete combustion and possible flue gas spillage. Sustained operation at lower than specified water temperatures (140°F) may cause hazardous conditions that may result in personal injury or non-warrantable damage to the appliance.

Water flow switch

A water flow switch is factory installed in the outlet on all hot water supply boilers. The flow switch must prove water flow before a trial for ignition can begin. The flow switch requires a minimum flow of 15 - 18 GPM on Models 400 - 750 and 26 GPM on Models 1000 - 2100 to make the flow switch and start burner operation. A water flow switch meets most code requirements for a low water cutoff device on hot water supply boilers requiring forced circulation for operation.

Low water cutoff (if equipped)

If this unit is installed above radiation level, a low water cutoff device must be installed at the time of hot water supply boiler installation. An electronic low water cutoff is available as a factory supplied option on all models. The low water cutoff should be inspected every 6 months.

Relief valve

This unit is supplied with a safety relief valve(s) sized in accordance with ASME Boiler and Pressure Vessel Code, Section IV (“Rules for Construction of Heating Boilers”). The relief valve(s) is installed in the vertical position and mounted in the hot water outlet. No valve is to be placed between the relief valve and the unit. To prevent water damage, the discharge from the relief valve shall be piped to a suitable floor drain for disposal when relief occurs. No reducing couplings or other restrictions shall be installed in the discharge line. The discharge line shall allow complete drainage of the valve and line. Relief valves should be manually operated at least once a year.

⚠ CAUTION

Avoid contact with hot discharge water.

4 Water connections

Hot water supply boiler installations Piping of the hot water supply boiler system

Before beginning the installation, consult local codes for specific plumbing requirements. The installation should provide unions and valves at the inlet and outlet of the hot water supply boiler so it can be isolated for service. An air separation device must be supplied in the installation piping to eliminate trapped air in the system. Locate a system air vent at the highest point in the system. The system must also have a properly sized expansion tank installed. Typically, an air charged diaphragm-type expansion tank is used. The expansion tank must be installed close to the hot water supply boiler and on the suction side of the system pump to ensure proper operation.

CAUTION

The hot water supply boiler system should not be operated at less than 12 PSIG.

Hot water piping must be supported by suitable hangers or floor stands, **NOT** by the hot water supply boiler. Copper pipe systems will be subject to considerable expansion and contraction. Rigid pipe hangers could allow the pipe to slide in the hanger resulting in noise transmitted into the system. Padding is recommended on rigid hangers installed with a copper system. The hot water supply boiler pressure relief valve must be piped to a suitable floor drain.

Water connections

Models 400 - 750 have 2" NPT inlet and outlet connections and Models 1000 - 2100 have 2 1/2" NPT inlet and outlet connections.

CAUTION

Field installed reducing bushings must not be used.

Any reduction in pipe size may decrease flow resulting in high water temperatures, noise, flashing to steam, and non-warrantable heat exchanger damage.

It is important to guarantee that adequate flow is provided to properly dissipate heat from the unit and also ensure that flow through the unit does not exceed the maximum recommended flow rate of 55 GPM for Models 400 - 750 and 90 GPM for Models 1000 - 2100 for a hot water supply boiler equipped with a copper heat exchanger.

Circulator pump requirements

This is a low mass, high efficiency hot water supply boiler which must have adequate flow for quiet, efficient operation. Pump selection is critical to achieve proper operation. A pump should be selected to achieve proper system design water temperature rise. Two heat exchanger head-loss charts (FIG.'s 4-3 and 4-4) are provided to assist in proper pump selection. A System Temperature Rise Chart (Table 4B on page 37) is also provided. This table provides GPM and hot water supply boiler head-loss at various temperature rises for each model based on Btu/hr input. Temperature rise is the difference in hot water supply boiler inlet temperature and hot water supply boiler outlet temperature while the hot water supply boiler is firing.

Example: The hot water supply boiler inlet temperature is 140°F (60°C) and the hot water supply boiler outlet temperature is 160°F (71.1°C). This means that there is a 20°F (11.1°C) temperature rise across the hot water supply boiler.

Figure 4-3_Pressure Drop Chart - Models 400 - 750

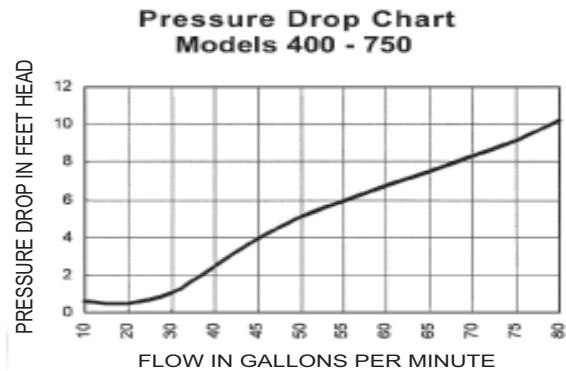
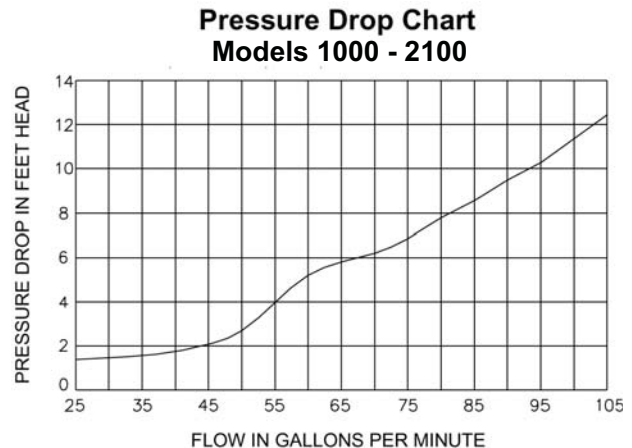


Figure 4-4_Pressure Drop Chart - Models 1000 - 2100



Circulator pump specifications

1. Maximum operating pressure for the pump must exceed system operating pressure.
2. Maximum water temperature should not exceed the nameplate rating.
3. A properly sized expansion tank must be installed near the hot water supply boiler.

Circulator pump operation

The hot water supply boiler pump must run when the unit is firing. Separate supply circuits can be provided or the two circuits (pump and controls) can be combined for connection to one circuit, properly sized for both.

Pump delay operation

A pump delay operation feature is provided. The hot water supply boiler's circulating pump will cycle on at each call for heat, before the unit fires and will continue to run as long as the call for heat is active. After the call for heat, the unit will shut down and the pump will continue to run for a period of time to remove the residual heat from the heat exchanger.

4 Water connections *(continued)*

Pump minimum delta T (ΔT)

A pump minimum ΔT feature is provided in addition to the pump delay. After a call for heat, the unit will shut down and the pump will continue to run as long as the ΔT is above the preset value. The minimum ΔT can be set to ON, 1 to 20°F or OFF. If set to ON, the pump will run continuously whether or not there is a call for heat. If set to a value of 1 to 20°F, the pump will run until the ΔT drops below the set value plus the pump delay time. Factory default is 5°F. If set to OFF, the pump will run for 30 seconds after the call for heat.

Maximum delta T (ΔT)

A maximum ΔT feature is provided. If enabled, this will allow the controller to monitor the hot water supply boiler's ΔT to allow it to display a Max ΔT error and enable the alarm circuit should the programmed value be exceeded. The maximum ΔT can be set to a value from 80°F to 20°F or OFF. If set to OFF it will disable this feature. This can be useful to alert the user to either poor flow or hard water issues. Factory default is OFF.

Pump installation and maintenance

For installation and maintenance information on the circulator pump, refer to the pump manufacturer's instructions provided in the instruction package.

Hot water supply boiler flow rate

⚠ CAUTION

The maximum flow rate for Models 400 - 750 is 55 GPM and 90 GPM on Models 1000 - 2100. Do not exceed the maximum flow rate of the hot water supply boiler.

If higher flow rates are required through the hot water supply boiler, an optional Cupro-Nickel heat exchanger is available. When using a Cupro-Nickel heat exchanger, GPM can be increased by 30 percent. Consult the factory for specific application requirements.

Flow rate can be determined by measuring the temperature rise through the hot water supply boiler.

Minimum water temperatures

Inlet water temperatures below the specified minimum of 140°F (60°C) can excessively cool the products of combustion resulting in condensation on the heat exchanger. Condensation on the heat exchanger can cause operational problems, bad combustion, sooting, flue gas spillage and reduced service life of the related components.

⚠ CAUTION

A hot water supply boiler allowed to operate at set point temperatures below the specified minimum settings may experience operational problems with the operating controls and safety switches, obstruction of the flue gas passages on the heat exchanger, incomplete combustion and possible flue gas spillage. Operation at lower than specified water temperatures may cause hazardous conditions that result in non-warrantable damage to the appliance.

TABLE - 4A
MAXIMUM FLOW FOR HEATING HOT WATER SUPPLY BOILER

The maximum flow rate through the hot water supply boiler with a copper heat exchanger must not exceed the following:

Model	Maximum Flow
400 - 750	55 GPM
1000 - 2100	90 GPM

If higher flow rates are required through the hot water supply boiler, an optional Cupro-Nickel heat exchanger is available. Consult the factory for specific application requirements.

Low system water volume

System run time is very important to the overall operating efficiency of the unit. Short cycling of the unit creates problems with condensation in the vent stack, condensation on the heat exchanger, system temperature spikes, and mechanical component failures. To prevent short cycling of the hot water supply boiler, it is important to limit the cycles to six or fewer per hour.

TABLE - 4B
ACCEPTABLE TEMPERATURE RISE

Model	Min Δ °F	Max Δ °F
400	12	18
500	15	20
650	20	25
750	23	30
1000	19	25
1250	24	30
1450	27	35
1800	34	40
2100	39	42

Typical hot water supply boiler installations

General plumbing rules:

1. Check all local codes.
2. For serviceability of the hot water supply boiler, always install unions.
3. Always pipe pressure relief valve to an open drain.
4. Locate system air vents at highest point of system.
5. Support all water piping.

5 Electrical connections

Connecting to electrical supply

This unit is wired for 120 VAC service. The unit, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or in the absence of such requirements, with the latest edition of the National Electrical Code ANSI/NFPA No. 70. When the unit is installed in Canada, it must conform to the CAE C22.1, Canadian Electrical Code, Part 1 and/or local Electrical Codes.

1. Use only Type-T wire [63°F (35°C) rise] on all wiring between the unit and field-installed devices.
2. Enclose line voltage wire exterior to the unit in approved conduit or approved metal-clad cable.
3. The pump must run continuously when the unit is being fired (hot water supply boilers must use the pump delay if the pump is to be cycled. See Freeze Protection, page 44 when cycling the pump). Hot water supply boilers use the pump delay as standard in accordance with ASHRAE 90.1 requirements.
4. To avoid serious damage, do not energize the unit until the system is filled with water.
5. Provide the unit with proper overload protection.

NOTICE

Do not block access to the electrical cover plate when installing electrical conduit.

⚠ WARNING

ELECTRICAL SHOCK HAZARD – For your safety, turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

Installation must comply with:

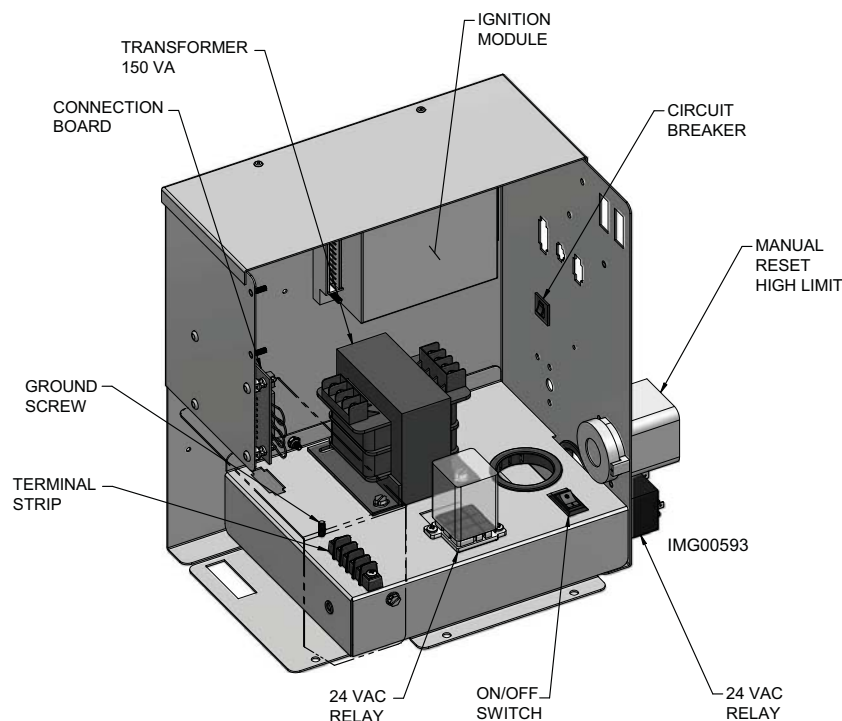
1. National Electrical Code and any other national, state, provincial, local codes, or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

TABLE - 5A
AMP DRAW DATA

Model	Controls	Blower	Pump FLA*	Approximate Total Amps @ 120 VAC
400	3.6	2.7	5.8	12.1
500	3.6	2.7	5.8	12.1
650	5.4	3.4	5.8	14.6
750	5.4	3.4	5.8	14.6
1000	7.3	3.2	7.4	17.9
1250	7.3	3.2	7.4	17.9
1450	7.3	6.7	7.4	21.4
1800	7.3	6.7	7.4	21.4
2100	7.3	6.7	7.4	21.4

*Standard Pump Supplied with HWSBs

Figure 5-1_ Control panel location



5 Electrical connections

Line voltage connections

1. Connect 120 VAC power wiring to the line voltage terminal strip in the junction box, as shown in FIG. 5-2.
2. Provide and install a fused disconnect or service switch (15 AMP recommended) as required by the code (see FIG. 5-2).
3. To activate a system pump, wire as shown in FIG. 5-2. If the motor is larger than 1 HP, you must install a contactor.

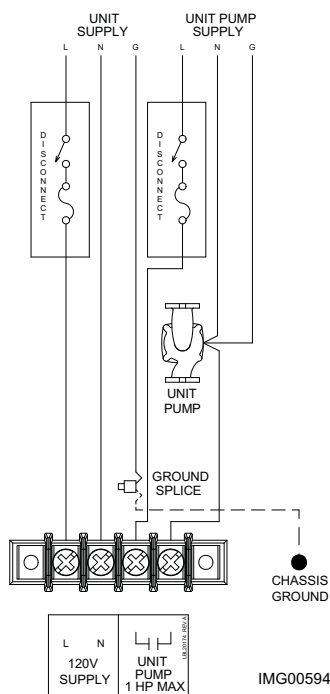


Figure 5-2_Line Voltage Field Wiring Connections

Low voltage connections

1. Route all low voltage wires through the knockouts on the left side of the heater, as shown in FIG. 5-3.
2. Connect low voltage wiring to the low voltage connection board, reference the connection diagram on pages 66 and 67 of this manual.

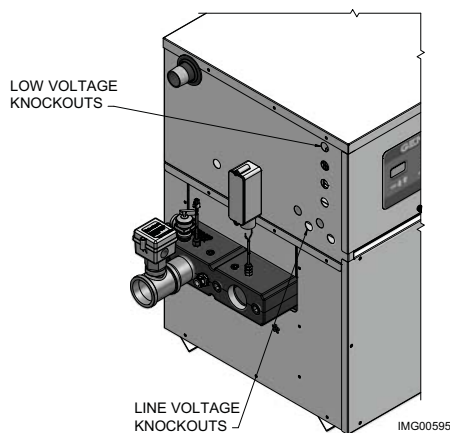


Figure 5-3_Routing Field Wiring

External EMS connection to terminal strip for stage firing control of burners

This unit is equipped with a factory installed terminal strip for connection of an energy management system (EMS) to the burner stages. The EMS terminal strip is located in the unit's control panel. Ensure that all wiring used for connection to this terminal strip is properly sized per the recommendations in TABLE 5A. When connecting an EMS to this terminal strip to sequence on each stage of burner operation, the unit's electronic control should be set to Sequencer Mode 3 to act as an additional high limit control. This will prevent problems between the setpoints of the EMS and the hot water supply boiler's internal controller.

Terminal strip connection options *(reference figures on page 40)*

Figure 5-4 shows the position of jumpers as shipped from the factory for stand-alone operation of hot water supply boilers.

Figure 5-5 shows connections to the terminal strip for Remote ON/OFF control of the hot water supply boiler. The 1C-1NO jumper must be removed when making these wiring connections. This remote ON/OFF control will provide an Enable/Disable signal to the unit and allow the unit to operate based on the stage setpoints, until the remote ON/OFF signal is cancelled.

Figure 5-6 shows the connections necessary to operate the unit as a two-stage (High/Low Fire) hot water supply boiler from an Energy Management System (EMS). For use with EMS, the controller should be set to Mode 3 and the Boil Max adjusted to the desired setting to allow the controller to act as an upper limit while the EMS controls the actual setpoint temperature.

Figure 5-7 shows the Continuous and Intermittent terminals. External safety devices connected to these terminals will function to protect the unit. Devices connected to the Intermittent terminals (B1 and B2) are monitored only when there is an active Call for Heat. Devices connected to the Continuous terminals (A1 and A2) are monitored continuously and will activate an alarm (if the unit is equipped with the alarm option) anytime the safety device senses an abnormal condition.

Figure 5-8 shows the wiring of a tank sensor. A tank sensor must be wired to the low voltage terminal strip in order for the pump delay to function properly.

5 Electrical connections

Figure 5-4 Stand-alone operation

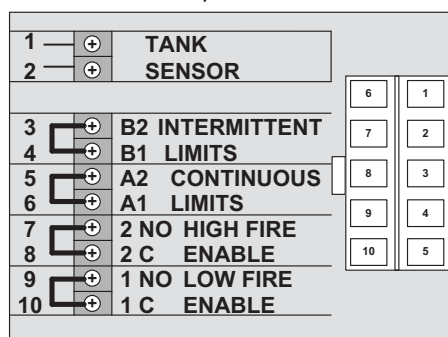


Figure 5-8 Remote sensor for pump delay

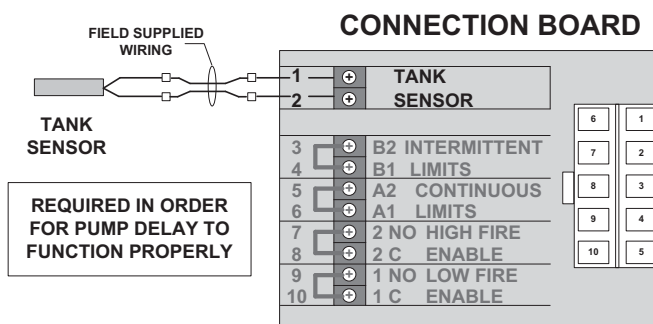


Figure 5-5 Remote on/off hot water supply boiler

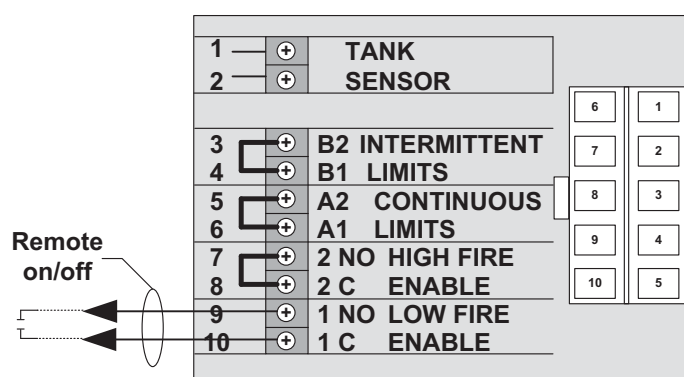


Figure 5-6 Two-stage (high/low fire) hot water supply boiler

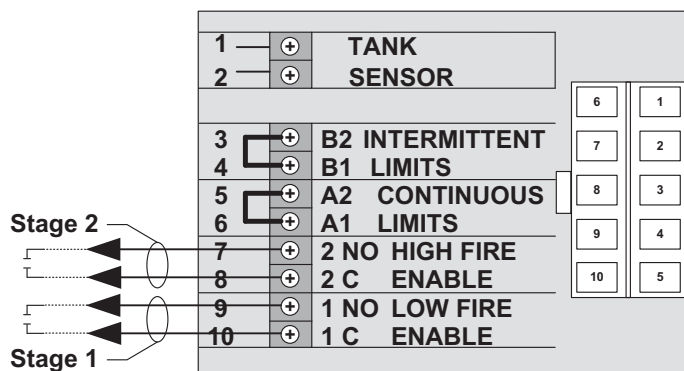
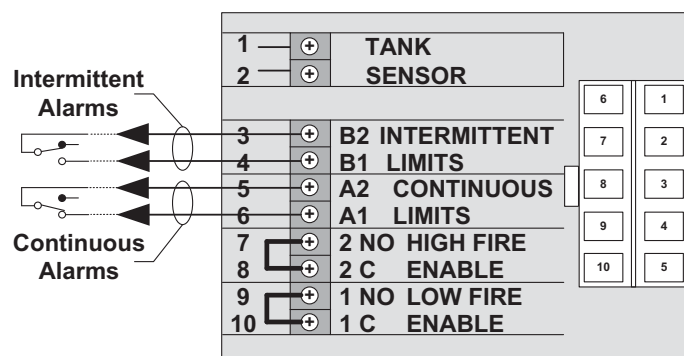


Figure 5-7 Field installation safety devices



Remote mounting of a sensor

To mount remote sensor, follow the guidelines below. Take care to correctly wire sensors to the unit. Erratic temperature readings can be caused by poor wiring practices. Twist the wires between the unit and the remote sensor. Turn wires at least three or four turns per linear foot of wiring. This provides common mode rejection of some types of electrical interferences.

1. Do not route temperature sensor wiring with building power wiring.
2. Do not locate temperature sensor wiring next to control contactors.
3. Do not locate temperature sensor wiring near electric motors.
4. Do not locate temperature sensor wiring near welding equipment.
5. Make sure good mechanical connections are made to the sensor, any interconnecting wiring and the controller.
6. Do not mount sensor with leadwire end pointing up in an area where condensation can occur.
7. Use shielded wiring to connect the sensor to the control when the possibility of an electrically noisy environment exists. Shielded cable is recommended on all cable runs of more than 25 feet in length.

NOTICE

Ground the cable shield at the connection to the hot water supply boiler temperature control only. Do not ground the shielded cable at the sensor end.

To maintain temperature accuracy, sensor wires should be at least 18 AWG, see Table 5B.

TABLE 5B
Remote Wire Connection

Wire Gauge	Max. Allowable Length
12 GA	100 FT
14 GA	75 FT
16 GA	50 FT
18 GA	30 FT

6 Start-up

Filling hot water supply boiler

1. Close the system's drain valve by turning the handle clockwise.
2. Open a nearby hot water faucet to permit the air to escape.
3. Fully open the cold water inlet pipe valve allowing the hot water supply boiler and piping to be filled.
4. Close the hot water faucet as water starts to flow.
5. The hot water supply boiler is ready to be operated.

Check for gas leaks

WARNING

Before starting the unit, and during initial operation, smell near the floor and around the unit for gas odorant or any unusual odor. Remove the front access panel and smell the interior of the hot water supply boiler enclosure. Do not proceed with startup if there is any indication of a gas leak. Use an approved leak detection solution. Repair any leaks at once.

WARNING

Propane hot water supply boilers only – Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

Check thermostat circuit(s)

1. Disconnect the two external wires connected to the enable terminals on the connection board.
2. Connect a voltmeter across these two incoming wires. Close each thermostat and relay in the external circuit one at a time and check the voltmeter reading across the incoming wires.
3. There should NEVER be a voltage reading.
4. If a voltage does occur under any condition, check and correct the external wiring.
5. Once the external thermostat circuit wiring is checked and corrected if necessary, reconnect the external thermostat circuit wires to the connection board. Allow the unit to cycle.

Check vent and air piping

Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

Placing the unit in operation

Hot water supply boiler operational checks

1. Turn the hot water supply boiler main power switch to the "ON" position.
2. Verify operation of the electronic controller.
3. Program the electronic controller to desired settings.
4. Push the reset for the low water cutoff (if equipped).
5. Ensure that maximum flow to the unit does not exceed 55 GPM on Models 400 - 750 and 90 GPM on Models 1000 - 2100. Verify by checking temperature rise while burner is firing at 100% of rated input.
6. Install a manometer on the gas supply to the hot water supply boiler and verify minimum gas supply pressure as the burner fires at 100% of rated input.
7. Verify operation of safeties as necessary (low water cutoff, high limit, gas pressure, etc.).
8. Verify that all adjustable points in the electronic controller are set as required.
9. Once the unit analysis is complete, test the safety shutoff device by turning the manual shutoff valve to the OFF position and ensuring that the unit shuts down and registers an alarm. Open the manual shutoff valve and reset the control.
10. Place the hot water supply boiler back into normal operation.

Hot water supply boiler operation

11. Hot water supply boiler should begin the start-up process for the sequence of operation.
12. The unit will ignite at the proper ignition speed and will stage to meet the system demand.
13. Ensure that inlet water temperature does not fall below the specified minimum for the unit.
14. Based on tank demand, hot water supply boilers may run for an extended period of time at a reduced rate of input to maximize efficiency.
15. As tank demand is satisfied, the burner will cycle off and the combustion air blower will run for a post purge operation before the unit shuts down.

6 Start-up

Start the hot water supply boiler

Read and follow the Lighting Instructions in FIG. 6-1, on page 43.

If hot water supply boiler does not start correctly

1. Check for loose connections or service switch off?
2. Is external limit control (if used) open? Is water temperature above 200°F (93.3°C)?
3. Is thermostat set below tank temperature?
4. Is gas turned on at meter or unit?
5. Is incoming gas pressure less than 4.5" water column?

If none of the above corrects the problem, refer to the Troubleshooting Section of the Genesis Service Manual.

WARNING

The venting system must be installed so that it will prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

Set hot water supply boiler temperature

To activate the Adjust Menu:

1. Press in and hold all three (3) programming buttons (Select, +, and -) for three (3) seconds. The LCD screen will change from the "View" Menu to the "Adjust" Menu.
2. Press the SELECT key until Target 1 appears, then use the + and - keys to adjust the target to the desired setting.
3. Press the SELECT key to advance to Diff 1 and then use the + and - keys to adjust to the desired setting.
4. Repeat Steps 1 thru 3 above to set Target 2 and Diff 2.

6 Start-up *(continued)*

Figure 6-1_Lighting Instructions

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

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

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

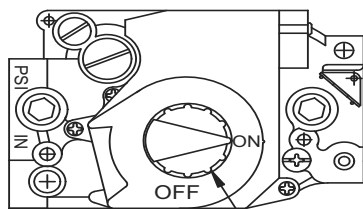
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the knob will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

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

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Turn off all electric power to the appliance.
3. Open control access panel.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.



GAS CONTROL KNOB
SHOWN IN THE "ON" POSITION

5. Push in gas control knob slightly and turn clockwise to "OFF."



NOTE: On the 36C valve, knob cannot be turned to "OFF" unless knob is pushed in slightly. Do not force.

6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step".

7. Turn gas control knob counterclockwise to "ON."



8. Replace control access panel.
9. Turn on all electric power to the appliance.
10. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Turn off all electric power to the appliance if service is to be performed.

2. Open control access panel.

3. Push in gas control knob slightly and turn clockwise to "OFF". Do not force.



4. Replace control access panel.

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7 Operating information

General

How the appliance operates

The Genesis uses a copper finned tube heat exchanger to transfer heat from the flue products to the water. An electronic controller initiates a call for heat and an ignition module monitor controls blower and gas valve operation. The blower provides both primary and secondary air to the burner and forces the flue products out of the combustion chamber and into the vent system. On models equipped with two speed blowers, the controls change blower speed and firing stages, based upon the heat demand. Gas valves regulate the amount of gas supplied for the firing stages, which is mixed with the combustion air supplied to the burner.

NOTICE

If an inline high gas pressure regulator is used, it **MUST BE** of the lockup type and be located a minimum of 10 feet from the appliance. Failure to do so may result in insufficient gas volume supplied to the appliance.

NOTICE

If a pressure drop of more than 2" water column occurs between Standby (static) Mode and Operating (dynamic) Mode, a gas volume problem exists. Contact the gas utility, gas supplier, qualified installer, or service agency to determine the necessary steps to provide the proper gas volume to the appliance.

How the control module operates

The electronic controller and ignition module receive inputs from appliance sensors and external devices. The electronic controller controls pump operation and regulates heat input by activating the ignition module which controls the blower and gas valve. The user programs the controller to meet system needs by adjusting control parameters. These parameters set operating temperatures and appliance operating modes. Hot water supply boiler operation can be based on a tank sensor or an external sequencer device.

Protection features

Max Delta T – (factory default is off)

A maximum ΔT feature is provided. If enabled, this will allow the controller to monitor the hot water supply boiler's ΔT to allow it to display a Max ΔT error and enable the alarm circuit should the programmed value be exceeded. The maximum ΔT can be set to a value from 80°F to 20°F or OFF. If set to OFF it will disable this feature. This can be useful to alert the user to either poor flow or hard water issues. Factory default is OFF.

Freeze protection

The controller monitors the inlet and outlet sensor. If either sensor drops below 45°F (7.2°C), the pump will turn on to circulate water through the heat exchanger.

⚠ CAUTION

This feature does not eliminate the possibility of freezing. The installer must still use recognized design, installation and maintenance practices to prevent freeze potential of the appliance and system.

High limit operation – manual reset

When outlet temperature exceeds either 200°F or 210°F allowed by local codes, a the high limit will trip. The appliance will shut down until water cools down and the RESET button on the high limit is pressed.

Monitor external limits

Connections are provided on the connection board for external limits. The unit will shutdown and operation will be inhibited whenever any of these limits open. Louver proving switch is one example.

Optional Run-time and alarm outputs

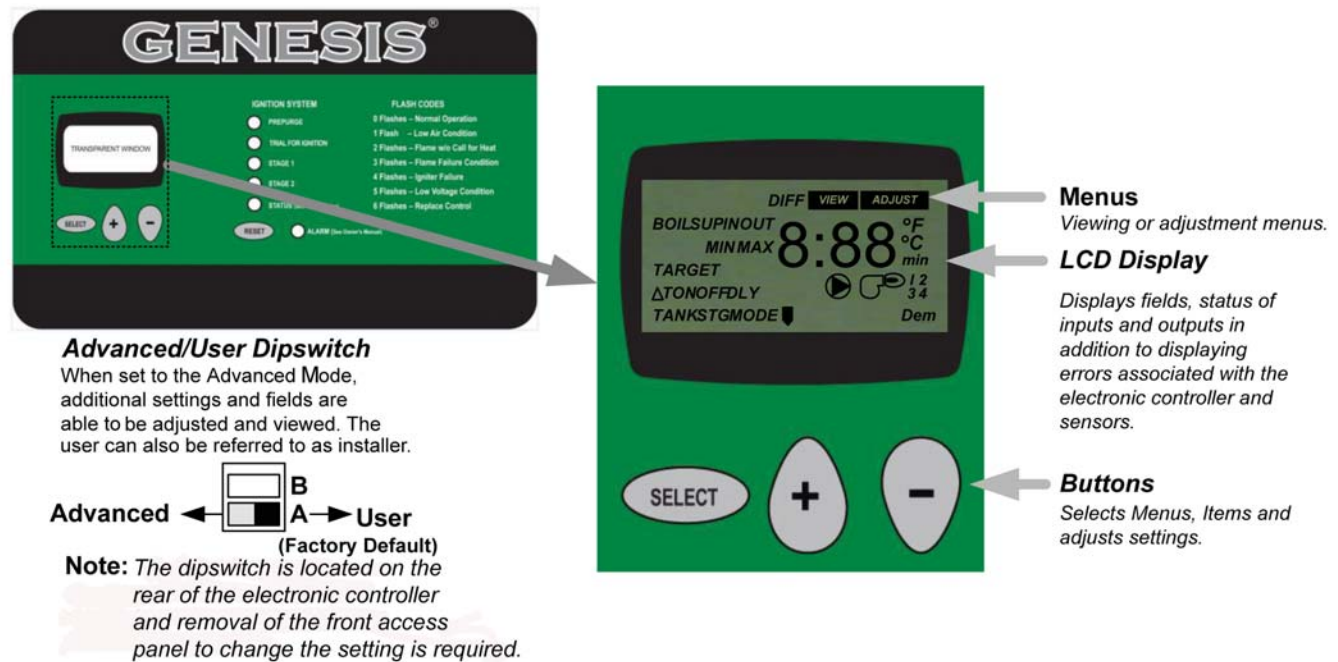
If ordered, dry contacts for indicating appliance is running or fault conditions exist with either the electronic controller or ignition module that either require attention or are inhibiting operation of the unit.

7 Operating information *(continued)*

User interface

The electronic controller has a Liquid Crystal Display (LCD) to supply information. The LCD allows for setup and monitoring of the unit. Three (3) buttons ("Select", "+" & "-") are provided for selecting and adjusting settings.

Figure 7-1_ User Interface Screen



Menus

All of the items displayed by the electronic controller are organized into two (2) menus. These menus are listed on the upper right-hand side of the display (Menu Field). The default menu for the controller is the **View** Menu. While in the **View** Menu, the VIEW segment is displayed. To select the **Adjust** Menu, press and hold all three (3) buttons for 3 seconds simultaneously. The display then advances to the **Adjust** Menu and the ADJUST segment is turned on in the display. The display will automatically revert back to the **View** Menu after 20 seconds of keypad inactivity. Once in a menu, there will be a group of items that can be viewed within that menu.

Select

The abbreviated name of the selected item will be displayed in the item field of the display. To view the next available item, press and release the SELECT button. Once you have reached the last available item in a menu, pressing and releasing the Select button will return the display to the first item in the selected menu.

Adjust

To make an adjustment to a setting in the control, begin by selecting the **Adjust** Menu by pressing and holding all three (3) buttons simultaneously and then select the desired item using the SELECT button. Finally, use the + or - button to make the adjustment.



WARNING

Return water temperatures must not be less than 140°F.

Figure 7-2_ Symbol Descriptions



Pump

Displays when the boiler pump is in operation.



°F, °C

Units of measurement.



Burner

Displays when Stage 1 or 2 is turned on.



Pointer

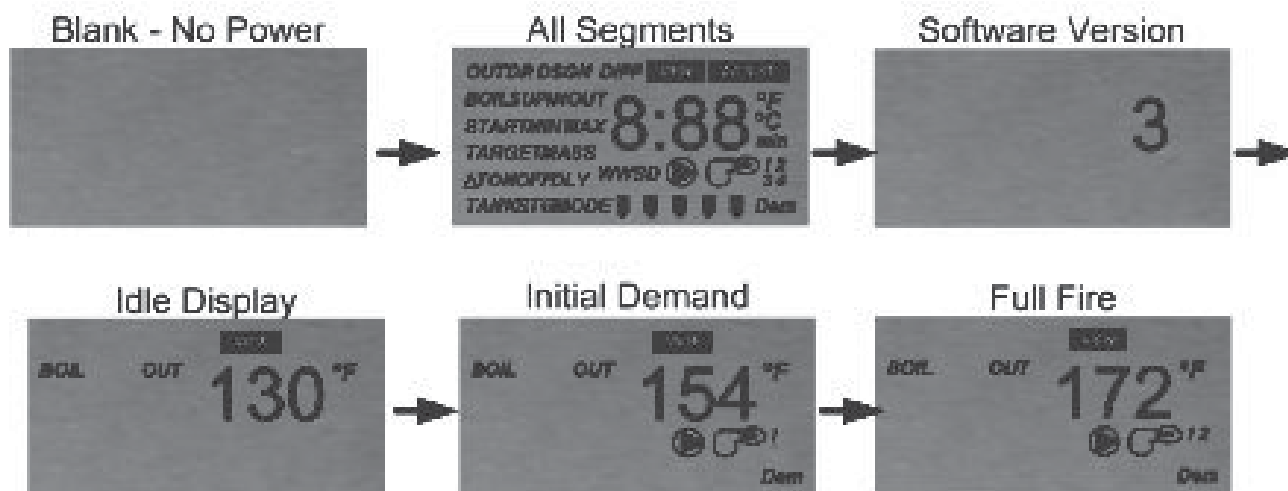
Indicates a setpoint is either being displayed or adjusted.

7 Operating information

Powering up the control

When the unit is turned on, the controller will power up and turn on all segments in the display for two (2) seconds. The software version is then displayed for two (2) seconds before the controller enters into the Normal Operating Mode.

Figure 7-3_Powering Up the Controller



Modes of operation (Mode)

The controller allows for two (2) modes of operation. Mode 2 for standalone operation and Mode 3 for external sequenced operation. The mode of operation is selected using the MODE item in the *Adjust* menu.

Mode 2 – Standalone Operation

This is the default mode that allows the electronic controller to stage the unit ON and OFF to control water temperature.

Figure 7-4_Standalone Operation

Stand Alone Operation

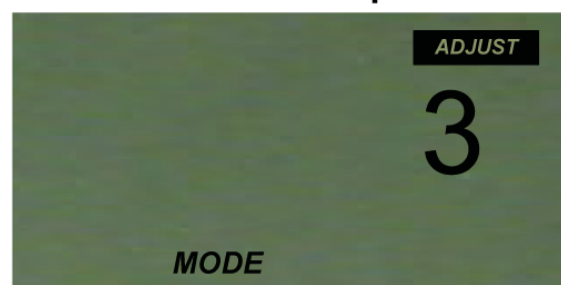


Mode 3 – External Sequencer Operation

This mode allows for the use of an external Building Management System (BMS) or sequencer to be used to control water temperature. The mode of operation is selected using the MODE item in the *Adjust* Menu.

Figure 7-5_External Sequencer

External Sequencer



7 Operating information *(continued)*

View menus

Depending on the Mode and Access Level selected (User or Advanced), the following items may be view while the electronic controller is powered up:

Errors

Error and warning messages.

BOIL OUT

Outlet water temperature.

BOIL IN

Inlet water temperature.

BOIL ΔT

Difference between sensed values of the outlet and inlet temperature sensors.

TANK

Tank water temperature.

BOIL ON

Accumulated run time of hot water supply boiler up to 999 hours, then resets and repeats.

ADJUSTment menus

Depending on the Mode and Access Level (User or Advanced), several adjustable parameter settings are provided to control the operation of the unit.

MODE

Select 2 for standalone hot water supply boiler operation or 3 for an externally sequenced (or controlled by an external Building Management System) hot water supply boiler operation. Selection is either 2 or 3.

BOIL MAX (Advanced dipswitch position)

Maximum hot water supply boiler target temperature. Selection is from 70° to 190°F. Factory default is 190°F.

Setpoint TARGET 1

Stage 1 setpoint target temperature. Selection is from 70°F to Boil Max. Factory default is 125°F.

DIFF 1

Stage 1 differential. Selection is from 2° to 42°F. Factory default is 2°F.

Setpoint TARGET 2

Stage 2 setpoint target temperature. Selection is from 70°F to Boil Max. Factory default is 123°F.

DIFF 2

Stage 2 differential. Selection is from 2° to 42°F. Factory default is 2°F.

STG DLY (Advanced dipswitch position)

Delay between stages. Selection is from 0:00 to 5:00 minutes in 10 second increments. Factory default is 30 seconds.

ΔT MIN (Advanced dipswitch position)

Determines when the pump will stop purging heat from the heat exchanger. Selection is from ON (for continuous pump mode), 1 to 20°F or OFF (when set to OFF, pump will run for 30 seconds after unit shuts off). Factory default is 5°F.

ΔT MAX (Advanced dipswitch position)

Determines when to generate a delta T MAX error code. Selection is from 20°F to 80°F or OFF (to disable delta T max function). Factory default is OFF.

Units

Allows for selection between Fahrenheit and Celsius. Selection is either C° or F°. Factory default is °F.

Error and warnings

Depending upon the Mode and parameter settings the following error and/or warning messages may appear in the electronic controller display when a fault condition is sensed by the controller.

E01 “Err”

Electronic controller’s EEPROM read an error during power up.

E02 “Err”

Freeze protection is in progress, pump may be running to prevent damage to the appliance.

BOIL OUT “SHr”

Hot water supply boiler outlet sensor may be shorted.

BOIL OUT “OPn”

Hot water supply boiler outlet sensor may be open.

BOIL IN “SHr”

Hot water supply boiler inlet sensor may be shorted.

BOIL IN “OPn”

Hot water supply boiler inlet sensor may be open.

TANK “SHr”

Tank sensor may be shorted.

TANK “OPn”

Tank heater inlet sensor may be open.

ΔT MAX

If set, the maximum delta T was exceeded.

7 Operating information

Figure 7-6_View Menu - Mode 2

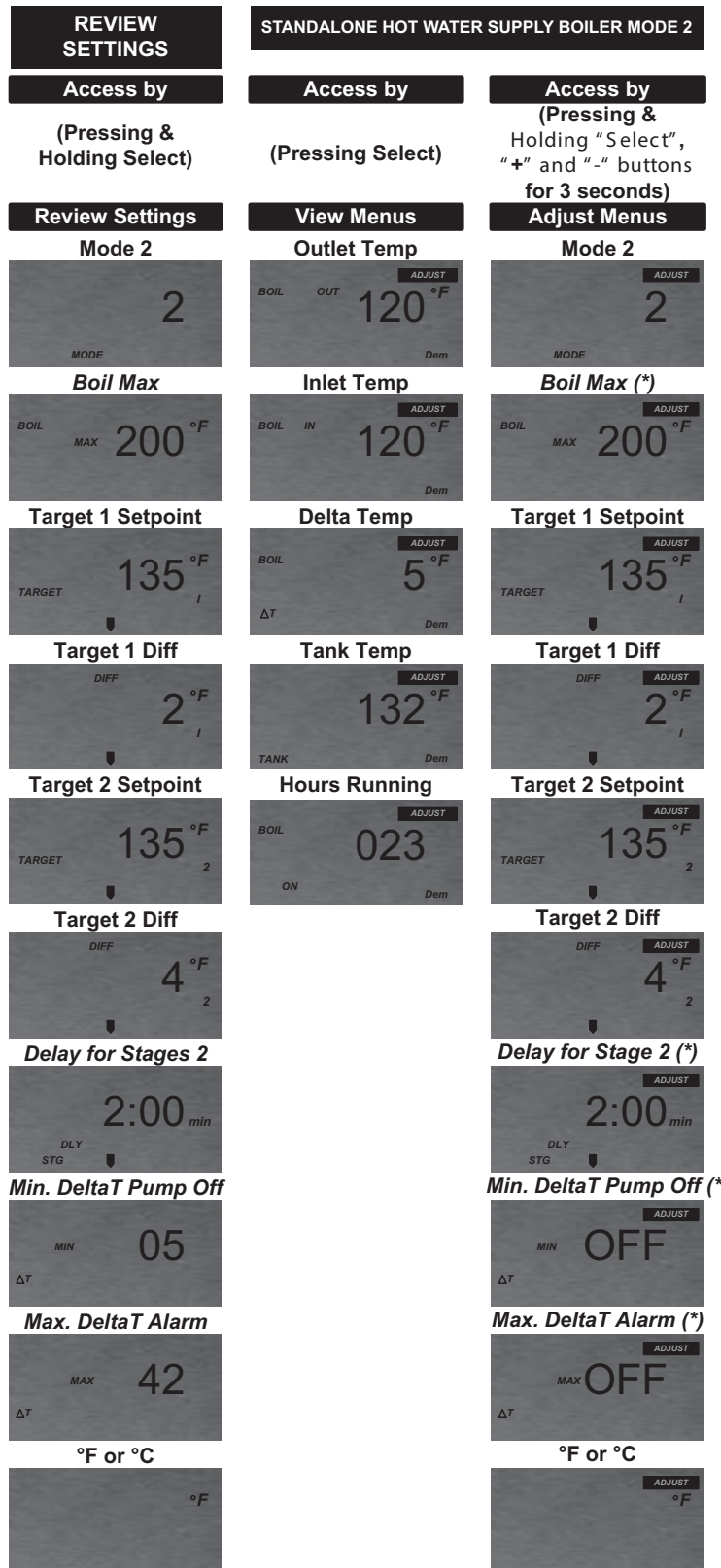
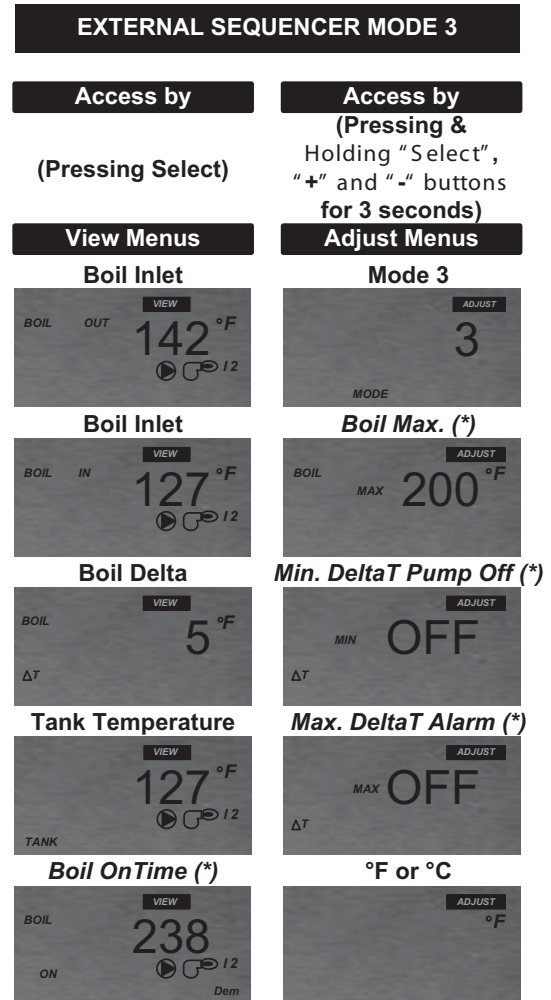


Figure 7-7_View Menu - Mode 3

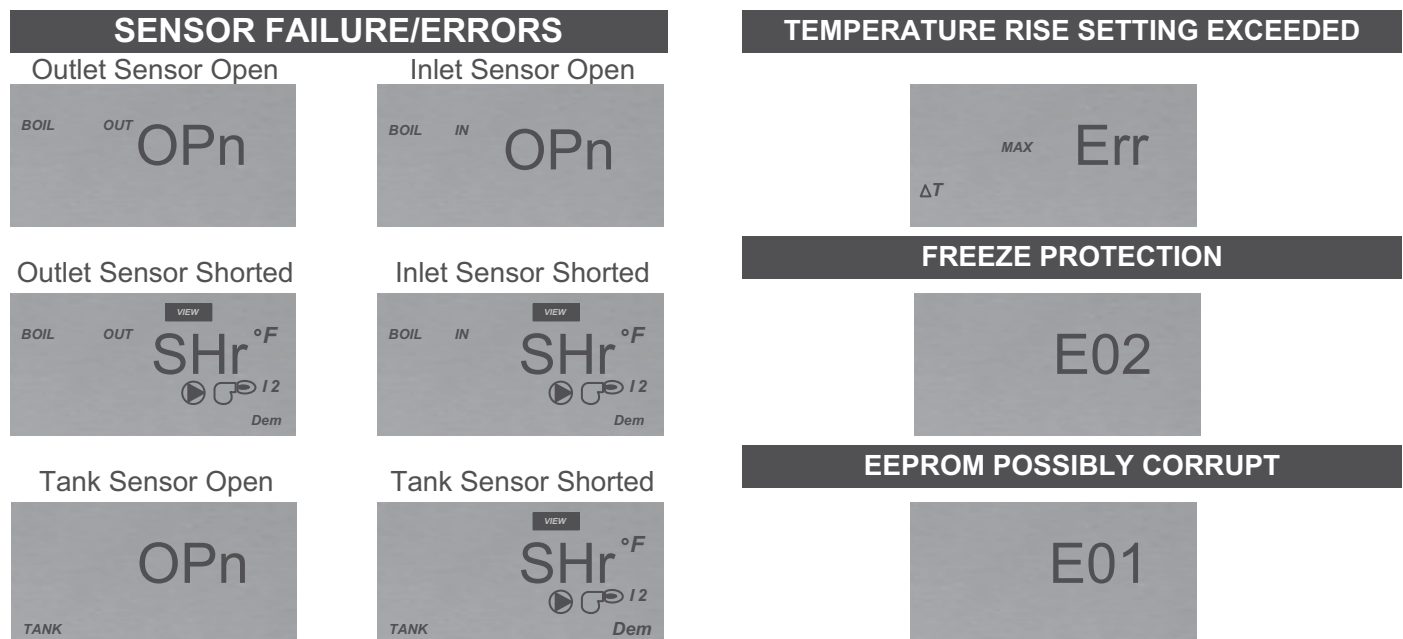


7 Operating information *(continued)*

Access menus

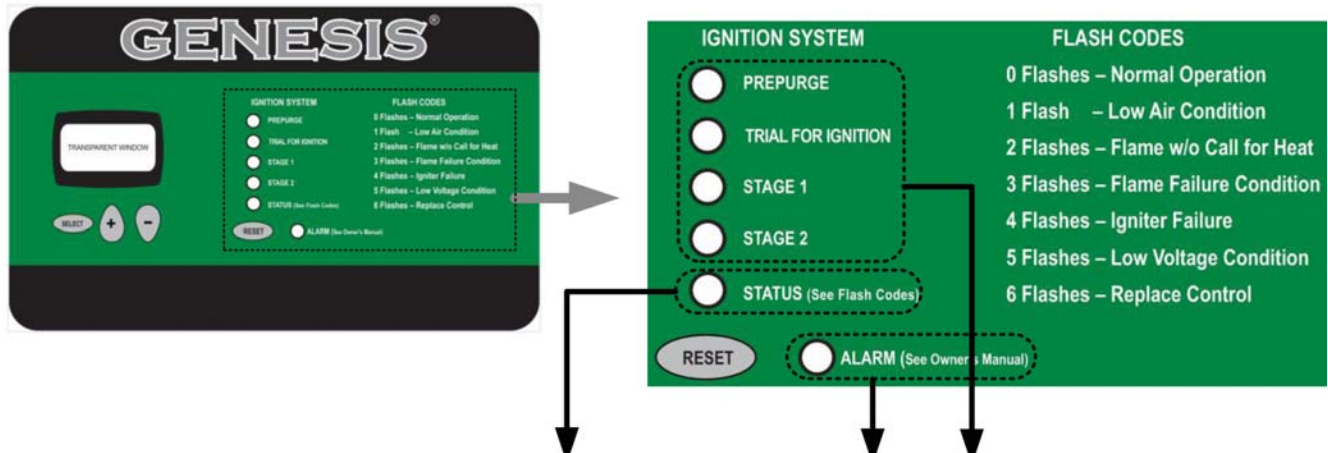
TABLE - 7A ACCESSING MENUS	
VIEW MENU	ADJUST MENU
Press and release SELECT button to advance View Menus.	Press all three (3) buttons (Select, + and -) for three (3) seconds to enter Adjustment Menus.

Figure 7-8_Error Messages



7 Operating information

Figure 7-9_LED Diagnostic Codes



Status LED Diagnostic Codes	
Code Sequence	Condition
Constant ON	System OK, no faults present.
Constant OFF	Possible control fault, check power; LED may be defective, do not replace control if all operational sequences function properly, see Troubleshooting Guide.
One Flash	Low Air, check air pressure switch and hoses to pressure sensing points, fan, venting and sealing of pressurized chamber. Note: Brief flashing normal on fan start-up proving.
Two Flashes	Flame without call for heat, check for a gas valve stuck in the open position, air, venting, burners and the combustion process. Fan will remain on.
Three Flashes	Lockout due to flame failure, push the reset button on the diagnostic panel after correcting ignition problem. Initial heater start up without properly bleeding air from the gas line may require multiple reset functions to achieve proper ignition.
Four Flashes	Igniter failure, igniter will not maintain a minimum 2.75 amp current draw, caused by low voltage, bad wiring/continuity, high resistance or igniter failure.
Five Flashes	Power supply problem, check for low supply voltage or transformer output less than 18 VAC.
Six Flashes	Replace ignition module, internal fault.

Status LED Diagnostic Codes	
Code Sequence	Condition Lights
Prepurge	Operation for combustion air fan before ignition on stages 1 and 2.
Trial for Ignition	Hot surface igniter preparing to light burners.
Stage 1 ON	Burners for stage 1 operating.
Stage 2 ON	Burners for stage 2 operating.
Status	Remote status light for ignition module.
Alarm	Indicates flame failure on the ignition module and will indicate additional alarms if the alarm of any failure option is purchased.

7 Operating information *(continued)*

Hot surface ignition system

Hot Surface Igniter and Ignition Control Module The 399,999 - 750,000 Btu/hr models have one ignition module and one hot surface igniter. The 990,000 - 2,070,000 Btu/hr models have two ignition modules and two hot surface igniters.

Figure 7-10_Hot Surface Igniter

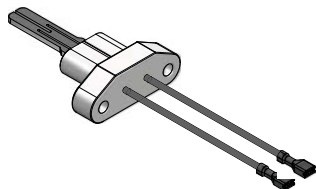
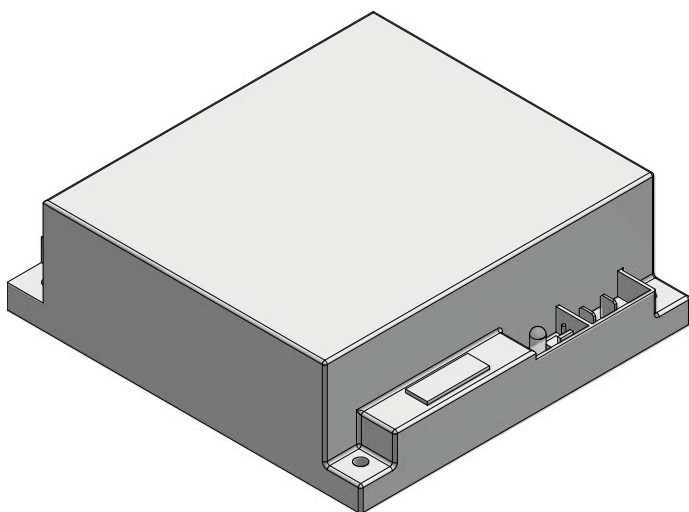


Figure 7-11_Hot Surface Ignition Control Module



Hot surface ignition control module

Ignition module lockout functions

The ignition module may lockout in either a hard-lockout condition, requiring pushing of the RESET button to recycle the control, or a soft-lockout condition which may recycle after an approximate five-minute waiting period. This soft-lockout condition is intended to allow self-correcting faults to correct themselves and permit normal operation. A typical hard-lockout fault is a flame failure condition. An ignition module that is in a hard-lockout condition may only be reset by pushing the RESET button next to the ignition control or the "RESET" button on the diagnostic panel on the left end of the unit. Upon a flame failure, the RESET button is only active after the control module has completed its post-purge cycle. Turning main power "OFF" and then "ON" or cycling the thermostat will not reset a hard-lockout condition. Wait five seconds after turning on main power before pushing the RESET button when the ignition module is in a hard lockout. The ignition module will go into a soft lockout if conditions of low air, low voltage or low hot surface igniter current are present.

A soft-lockout condition will operate the combustion air fans for the post purge cycle and then the ignition module will pause for approximately five minutes. At the end of this timed pause, the ignition module will attempt a new trial for ignition sequence. If the soft-lockout fault condition has subsided or has been corrected at the end of the timed pause, main burner ignition should be achieved with the resumption of the normal trial for ignition sequence. If the control sensed fault is not corrected, the ignition module will continue in the soft-lockout condition. If the electronic thermostat opens during the soft-lockout period, the ignition module will exit soft lockout and wait for a new call for heat from the thermostat. A soft-lockout condition may also be reset by manually cycling the thermostat or turning the main power switch "OFF" and then "ON" after the control sensed fault has been corrected.

Diagnostic status indication

The ignition module has an LED which indicates the status of the safety circuits. A remote Ignition Module Status indicating light is wired from the ignition module Status LED and mounted on the front diagnostic panel. The flashing operation of this light indicates the diagnostic status of the ignition control module. The status LED, mounted on the ignition module flashes a code sequence from the Ignition Module to indicate the status of the ignition process. See FIG. 7-9 for the flashing diagnostic status codes as signaled by the ignition module.

8 Domestic water heater application

This section contains specific instructions for those appliances used to supply domestic hot water. All warnings, cautions, notes and instructions in the general installation and operation sections apply to these instructions. Hot water supply boilers are designed for installation with a storage tank.

A circulating pump **MUST** be installed in the piping assembly to the storage tank and valves used to control water velocity through the appliance. Proper water velocity is important for correct operation of your hot water supply boiler. The operation of the circulating pump, proper sizing of the piping between the tank and heater and the control of water velocity, as explained in this section, are important for correct operation of your hot water supply boiler.

NOTICE

To ensure proper velocity through the heat exchanger, it is necessary to regulate the temperature rise across the heat exchanger from inlet to outlet. This must be done on initial installation and periodically rechecked. With the correct temperature rise across the heat exchanger when the hot water supply boiler is firing at 100% of rated input, you may be assured of the proper velocity in the tubes. This will yield long life and economical operation from your hot water supply boiler.

Excessive lime/scale build-up in the heat exchanger tubes is a result of restricted flow and too little velocity in the tubes. Excessive pitting or erosion in the tube is caused by high water flow and too much velocity through the tubes. Care should be taken to measure temperature rise and maintain velocity as follows:

Initial set-up of maximum water flow

On initial start-up of the Genesis the maximum water flow through the heat exchanger must be manually set before normal operation begins.

TABLE - 8A
MAXIMUM WATER FLOW

⚠ CAUTION: The maximum flow rate through a Genesis hot water supply boiler with a copper heat exchanger must be set to provide and not exceed the following flow:

Model	Maximum Flow
400 - 750	55 GPM
1000 - 2100	90 GPM

If higher flow rates are required through the hot water supply boiler, an optional Cupro Nickel heat exchanger is available. Consult the factory for specific application requirements.

The heat exchanger is capable of operating within the design flow rates required for the hot water supply boiler, storage tank(s), and connecting piping. Erosion of the finned copper tubes may occur if the flow rate exceeds the maximum allowable flow rate through the hot water supply boiler. The maximum flow rate through the hot water supply boiler must be adjusted. Maximum flow on Models 400 - 750 is 55 GPM and 90 GPM on Models 1000 - 2100. Flow rate can be determined by measuring the temperature rise through the hot water supply boiler when it is firing at full rate input.

TABLE - 8B
TEMPERATURE RISE AT FULL RATE FIRE
55 AND 90 GPM FLOW

Model	Temperature Rise
400	12°F (6.7°C)
500	15°F (8.3°C)
650	20°F (11.1°C)
750	23°F (12.8°C)
1000	19°F (10.6°C)
1250	24°F (13.3°C)
1450	27°F (15°C)
1800	34°F (18.9°C)
2100	39°F (21.7°C)

1. The pump must run continuously when the burner is firing.
2. With the pump running and the burner in the hot water supply boiler in the off cycle, the inlet water temperature and outlet water temperature readings on the Operator Interface should read approximately the same temperatures. Water Temperature Rise on the Operator Interface should read near zero.
3. Turn the hot water supply boiler on and allow time for the temperature to stabilize. Check the water temperature rise in the Operator Interface when the burner is firing at 100% of rated input.
4. Compare the water temperature rise in the Operator Interface with the required temperature rise. Should adjustment be needed, proceed as follows.

8 Domestic water heater application *(continued)*

If the temperature rise is too high, the water velocity is too low, adjust as follows:

1. Check for restrictions in the outlet of the hot water supply boiler.
2. Be sure all valves are open between the hot water supply boiler and the storage tank. Ensure that all ball valves are fully ported.
3. Check the pump to be sure it is running properly and that the pump motor is running in the proper direction.
4. Check diameter and length of the piping between the storage tank and hot water supply boiler against the head capacity of the circulating pump.
5. Be sure the pipes between the hot water supply boiler and storage tank are not less than 2 or 2 1/2 inch (63.5mm) diameter (depending on model). To increase flow and decrease temperature rise, increase the piping to 3 inch (76.2mm) diameter (depending on model) to decrease head loss in the piping to the storage tank.
6. Common manifold piping for multiple unit installations will require larger minimum pipe sizes and tank circulating tappings to ensure proper flow.

If the temperature rise is too low, the water velocity is too high, adjust as follows:

1. Temperature rise can be increased by slowly closing the field-installed ball valve in the outlet piping from the hot water supply boiler to the storage tank to achieve the proper temperature rise.
2. Sustained high water velocity and low temperature rise may result in pitting or erosion of the copper tubes in the heat exchanger. This is a non-warrantable failure. Temperature rise must be properly adjusted to achieve the specified flow rate.
3. Once temperature rise has been properly set, return to normal operation.

⚠ CAUTION

Temperature rise cannot be adjusted when the burner is firing at less than 100% of rated input.

Water chemistry

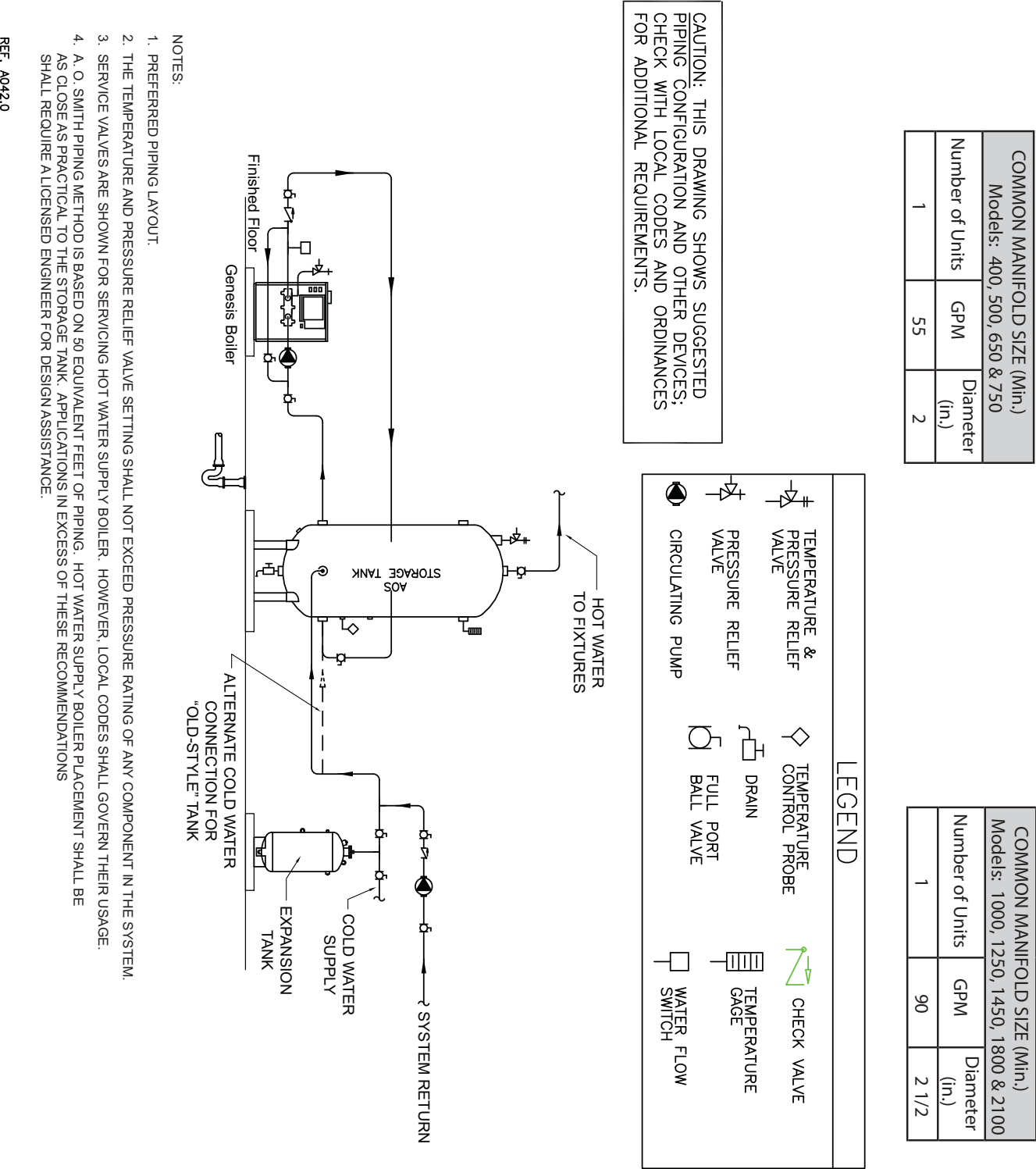
NOTICE

Water temperature rise and maximum flow data is based on heating potable water with a hardness of 5 to 25 grains per gallon and total dissolved solids not exceeding 350 ppm.

The required temperature rise and the standard circulating pump are sized based on the heating of potable water with a hardness of 5 to 25 grains per gallon and a total dissolved solids not exceeding 350 ppm. Consult the manufacturer when heating potable water exceeding these specifications. Heating of high hardness and/or high total dissolved solids water may require a larger circulating pump, an optional Cupro Nickel heat exchanger and a revised temperature rise specification based on the water chemistry of the water to be heated. Water with a hardness of less than 5 grains per gallon will usually have a pH which can be aggressive and corrosive causing non-warrantable damage to the heater, pump, and associated piping. Corrosion due to water chemistry generally shows up first in the hot water system because heated water increases the rate of corrosive chemical reactions.

8 Domestic water heater application

Figure 8-1_Typical Water Heater Application Piping with Storage Tank



8 Domestic water heater application (continued)


Figure 8-2_Single Water Heater Application Piping with Two Storage Tanks


COMMON MANIFOLD SIZE (Min.)		
Models: 400, 500, 650 & 750		
Number of Units	GPM	Diameter (in.)
1	55	2


COMMON MANIFOLD SIZE (Min.)		
Models: 1000, 1250, 1450, 1800 & 2100		
Number of Units	GPM	Diameter (in.)
1	90	2 1/2


CAUTION: THIS DRAWING SHOWS SUGGESTED PIPING CONFIGURATION AND OTHER DEVICES; CHECK WITH LOCAL CODES AND ORDINANCES FOR ADDITIONAL REQUIREMENTS.


LEGEND


TEMPERATURE & PRESSURE RELIEF VALVE


TEMPERATURE CONTROL PROBE


CHECK VALVE


PRESSURE RELIEF VALVE

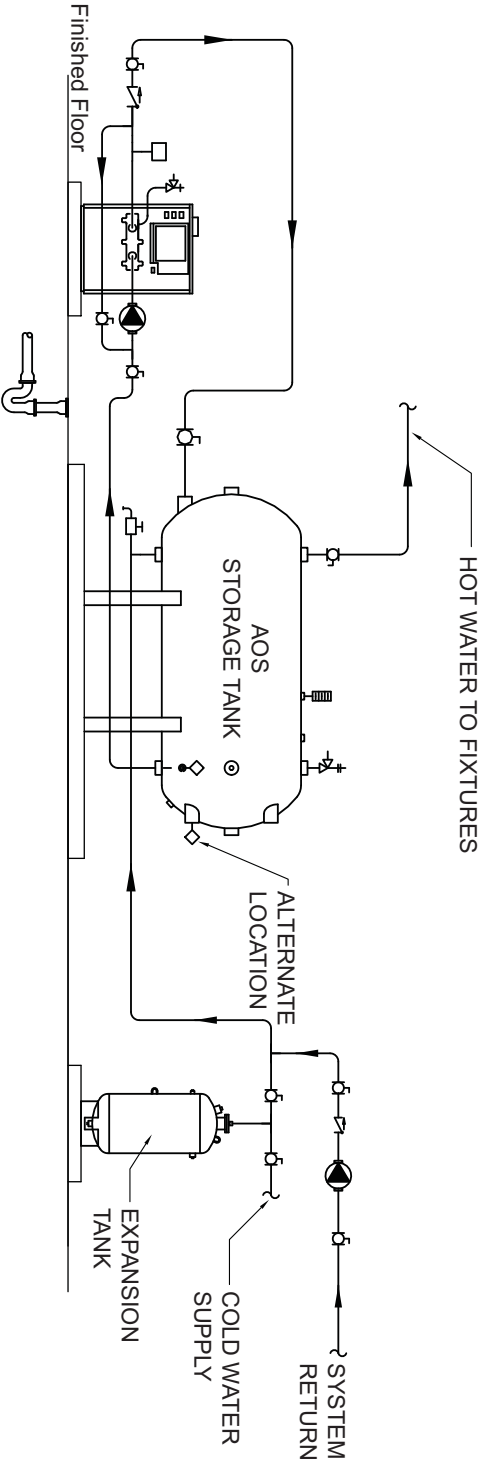
DRAIN

TEMPERATURE GAGE

CIRCULATING PUMP

FULL PORT BALL VALVE

WATER FLOW

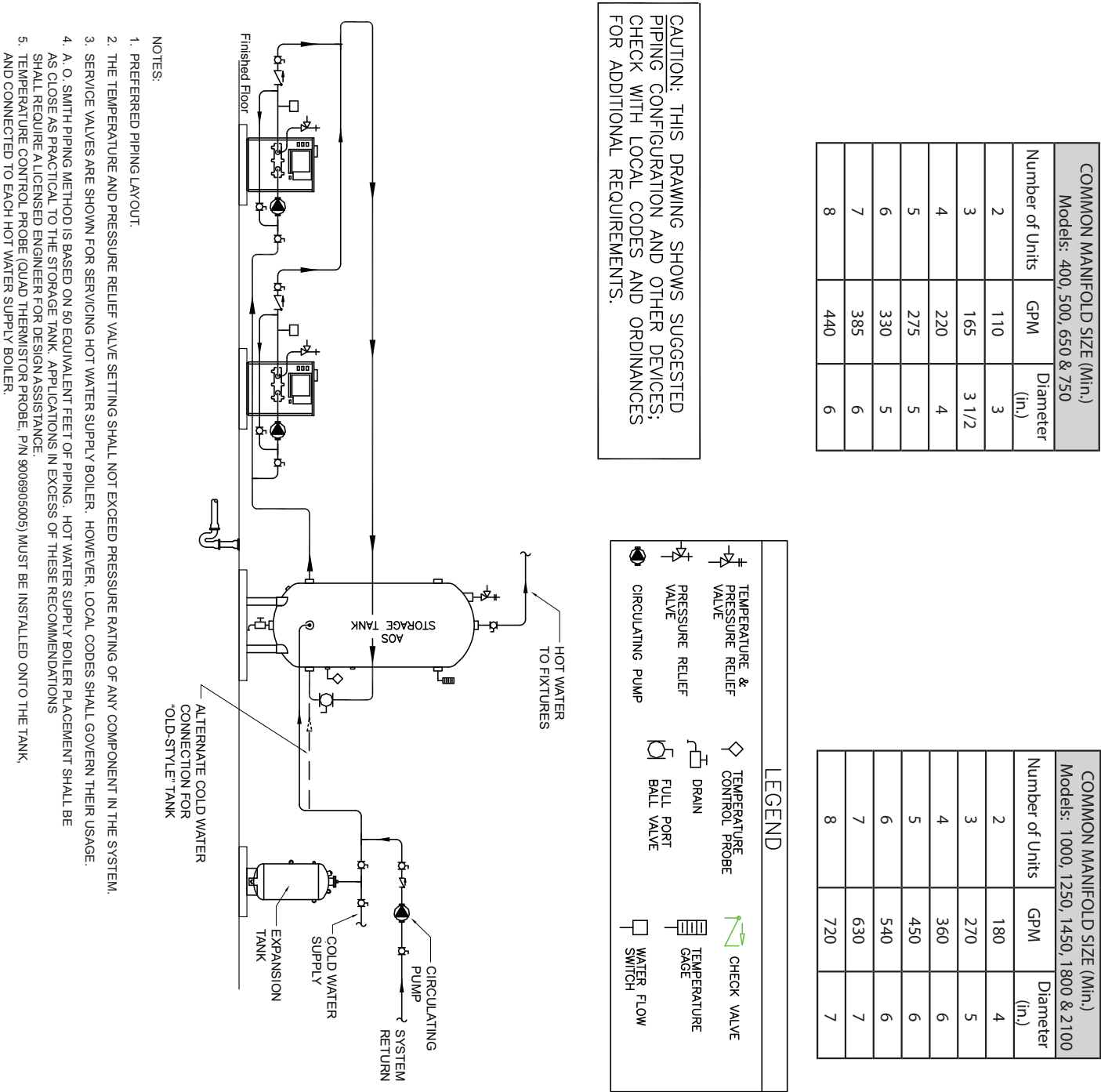


- NOTES:
1. PREFERRED PIPING LAYOUT.
 2. THE TEMPERATURE AND PRESSURE RELIEF VALVE SETTING SHALL NOT EXCEED PRESSURE RATING OF ANY COMPONENT IN THE SYSTEM.
 3. SERVICE VALVES ARE SHOWN FOR SERVICING HOT WATER SUPPLY BOILER. HOWEVER, LOCAL CODES SHALL GOVERN THEIR USAGE.
 4. A. O. SMITH PIPING METHOD IS BASED ON 50 EQUIVALENT FEET OF PIPING. HOT WATER SUPPLY BOILER PLACEMENT SHALL BE AS CLOSE AS PRACTICAL TO THE STORAGE TANK. APPLICATIONS IN EXCESS OF THESE RECOMMENDATIONS SHALL REQUIRE A LICENSED ENGINEER FOR DESIGN ASSISTANCE.

REF. A042.1

8 Domestic water heater application

Figure 8-3_Multiple Water Heater Application Piping with a Single Storage Tank



NOTICE

Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

8 Domestic water heater application *(continued)*


Figure 8-4_Multiple Water Heater Application Piping with Multiple Storage Tanks


COMMON MANIFOLD SIZE (Min.) Models: 400, 500, 650 & 750		
Number of Units	GPM	Diameter (in.)
2	110	3
3	165	3 1/2
4	220	4
5	275	5
6	330	5
7	385	6
8	440	6


COMMON MANIFOLD SIZE (Min.) Models: 1000, 1250, 1450, 1800 & 2100		
Number of Units	GPM	Diameter (in.)
2	180	4
3	270	5
4	360	6
5	450	6
6	540	6
7	630	7
8	720	7


CAUTION: THIS DRAWING SHOWS SUGGESTED PIPING CONFIGURATION AND OTHER DEVICES; CHECK WITH LOCAL CODES AND ORDINANCES FOR ADDITIONAL REQUIREMENTS.


LEGEND


TEMPERATURE & PRESSURE RELIEF VALVE


TEMPERATURE CONTROL PROBE


CHECK VALVE


PRESSURE RELIEF VALVE

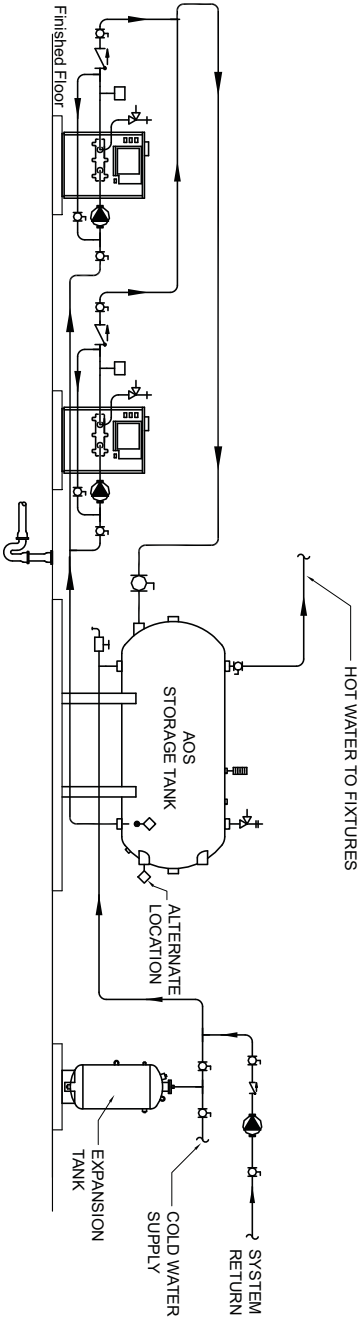
DRAIN

TEMPERATURE GAGE

CIRCULATING PUMP

FULL PORT BALL VALVE

WATER FLOW SWITCH



- NOTES:
1. PREFERRED PIPING LAYOUT.
 2. THE TEMPERATURE AND PRESSURE RELIEF VALVE SETTING SHALL NOT EXCEED PRESSURE RATING OF ANY COMPONENT IN THE SYSTEM.
 3. SERVICE VALVES ARE SHOWN FOR SERVICING HOT WATER SUPPLY BOILER. HOWEVER, LOCAL CODES SHALL GOVERN THEIR USAGE.
 4. A. O. SMITH PIPING METHOD IS BASED ON 50 EQUIVALENT FEET OF PIPING. HOT WATER SUPPLY BOILER PLACEMENT SHALL BE AS CLOSE AS PRACTICAL TO THE STORAGE TANK. APPLICATIONS IN EXCESS OF THESE RECOMMENDATIONS SHALL REQUIRE A LICENSED ENGINEER FOR DESIGN ASSISTANCE.
 5. TEMPERATURE CONTROL PROBE (QUAD THERMISTOR PROBE, P/N 9006905005) MUST BE INSTALLED ONTO THE TANK, AND CONNECTED TO EACH HOT WATER SUPPLY BOILER.

NOTICE

Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

8 Domestic water heater application

TABLE 8C

COMMON WATER MANIFOLD SIZE FOR MULTIPLE HOT WATER SUPPLY BOILER INSTALLATIONS

Pipe sizing chart provides minimum pipe size for common manifold piping to ensure adequate flow.

Number of Hot Water Supply Boilers	Common Manifold Size (Min.) Models	
	400 - 750	1000 - 2100
1	2"	2 1/2"
2	3"	4"
3	3 1/2"	5"
4	4"	6"
5	5"	6"
6	5"	6"
7	6"	7"
8	6"	7"

Pump operation

1. The hot water supply boiler must have a properly sized circulating pump. This pump is sized to circulate water between the heater and the storage tank only.
2. The pump is sized to the heater input and water chemistry specifications noted in the Water Chemistry section on page 53.
3. The diameter and length of the piping installed between the storage tank(s) and hot water supply boiler must be properly sized based on the capacity of the circulating pump.
4. The pump must run continuously when the water heater is energized. This is the standard operating system for a hot water supply boiler.

A pump delay control function with an all bronze pump is installed as standard equipment on all hot water supply boiler systems. The pump will operate only while there is a "Call for Heat" and for a timed period after the water temperature setpoint is satisfied to remove any residual heat from the combustion chamber.

5. Lubricate pump to manufacturer's recommendations. Pump damage due to inadequate lubrication is non-warrantable.

The tank sensor must be installed in the tapping provided in the lower 25% of the storage tank to achieve proper operation. As shipped from the factory, the tank sensor is in the literature package shipped with the unit. Placing the sensor in the tapping provided on the storage tank will improve temperature response and prevent short cycles of operation.

The standard circulating pump on this hot water supply boiler is sized based on installation of a single storage tank and heater in close proximity. If the number of fittings and straight pipe exceeds the specified maximum equivalent number of straight feet for a specified diameter of pipe, non-warrantable operational problems may be experienced.

400 - 750 Models

1/4 HP, 120 VAC, 5.8 Amps

1000 - 2100 Models

1/2 HP, 120 VAC, 7.4 Amps

The standard pump selection is based on the following pipe and fittings from the hot water supply boiler to the storage tank:

6 - 90° elbows

2 - ball valves

2 - unions

1 - cold water tee

Not more than 45 feet of straight pipe.

For every elbow and tee in excess of those shown above, DEDUCT 6.5 FEET from the maximum allowable straight pipe in the heater to tank circulating loop.

NOTICE

The factory supplied pump allows enough feet of head to accommodate pressure drop of the unit and up to approximately 45 equivalent feet of piping with some limited reserve. If additional lengths of piping are required, it may be necessary to upgrade the factory pump. Please refer to the pressure drop curves in *Section 4* of this manual for the respective model's heat exchanger to determine pump requirements.

NOTICE

The factory supplied pump will accommodate pressure drop of the unit plus up to approximately 45 equivalent feet of piping with some limited amount of reserve capacity. If additional lengths of piping are required beyond 45 equivalent feet, it may be necessary to either upsize the piping or upgrade from the factory pump. Consult the respective pressure drop charts in *Section 4* of this manual for respective units.

TABLE 8D

MINIMUM PUMP PERFORMANCE

Based on heating potable water with a hardness of 5 to 25 grains per gallon and total dissolved solids not exceeding 350 ppm. See *Water Chemistry* section on page 53.

Model	GPM	Ft. Hd.
400 - 750	55	10
1000 - 2100	90	15

When installing multiple hot water supply boilers and/or multiple storage tanks, the diameter of the inter-connecting pipe and all fittings must be increased. An increase in pipe diameter will decrease head loss in the system piping and ensure proper flow. Proper pipe size between the heater and storage tank **MUST** be maintained to ensure that the standard pump supplied on the hot water supply boiler will maintain desired flow.

8 Domestic water heater application *(continued)*

Thermostat adjustment procedure

1. Press all three (3) buttons (SELECT, +, -) simultaneously and hold for three (3) seconds. The Adjust menu will appear in the controller display.
2. Press and release the SELECT key to step through all available settings.
3. Setpoint Targets 1 & 2 and DIFFs 1 & 2 need to be set to the desired settings.
4. To access all settings, the Advanced/User dipswitch should be set to the "Advanced" position.
5. Once setpoints are adjusted, the dipswitch may be set back to the User position if desired.
6. After all adjustments have been made, allow 10 seconds for the controller to revert back to its operating mode.

Note: The unit will not run while the controller is in Adjust Mode.

Minimum water temperatures (domestic hot water use)

Domestic water temperatures:

This high efficiency hot water supply boiler should be operated at a temperature setting high enough to prevent condensing of the products of combustion on the unit's heat exchanger or in the attached venting system. Use extreme caution when storing water at elevated temperatures. A water temperature setting maintained above the dew point of the products of gas combustion should prevent condensate formation and ensure proper performance of the venting system. The manufacturer recommends the use of a properly sized thermostatic mixing valve to supply domestic hot water at temperatures less than 140°F (60°C). Storing the water at a higher temperature and thermostatically mixing the water will increase the available quantity of mixed hot water, greatly reducing the possibility of condensate formation on the heat exchanger or in the venting system and help prevent the growth of water borne bacteria.

NOTICE

Adequate care **MUST** be taken to prevent a potential scald injury when storing water at elevated temperatures for domestic use.

Inlet water temperatures below the specified minimum recommendations can excessively cool the products of combustion resulting in condensation on the heat exchanger. Condensation on the heat exchanger can cause operational problems, bad combustion, sooting, flue gas spillage and reduced service life of the related components.

CAUTION

An appliance allowed to operate at return temperatures below the specified minimum setting may experience problems with the operating controls, safety switches, obstruction of the flue gas passages on the heat exchanger, incomplete combustion, and possible flue gas spillage. Sustained operation at lower than specified water temperatures may cause hazardous conditions that may result in personal injury or non-warrantable damage to the appliance.

The maximum temperature setpoint that can be programmed into the control module from the Operator Interface for water heater operation is 190°F (88°C). The control is factory pre-set at approximately 120°F (49°C). Facilities with small children or invalids may require 120°F (49°C) or a lower temperature setting to reduce risk of scald injury. Some states may require a lower temperature setting. Check with your gas supplier for local requirements governing the temperature setting. Remember, no water heating system will provide exact temperature at all times. Allow a few days of operation at this setting to determine the correct temperature setting consistent with your needs.

NOTICE

1. This hot water supply boiler, when set at the lower temperature setting, is not capable of producing hot water of sufficient temperature for sanitizing purposes.

2. Higher stored water temperature increases the ability of the hot water supply boiler to supply desired quantities of hot water, however remember hotter water increases the risk of scald injury.

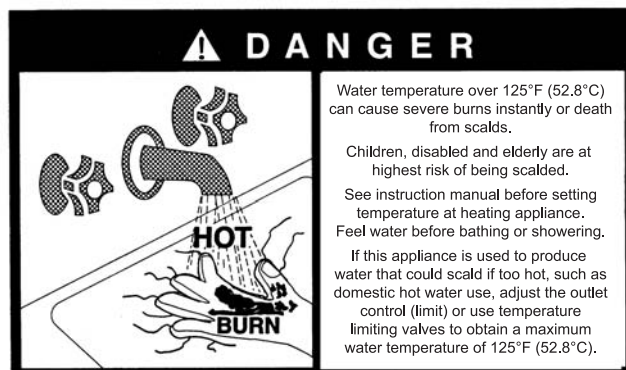


Figure 8-5_Danger Warning

8 Domestic water heater application

Location of Cold Water Supply Piping Connections

Incorrect piping of the cold water supply to the system may result in excessive low temperature operation causing condensate formation on the primary heat exchanger and operational problems. The cold water supply piping must be installed in the discharge piping from the heater to the storage tank. This allows the cold water to be tempered in the storage tank before entering the heater. See typical installation drawings provided in this manual for correct piping (FIG.'s 8-1 thru 8-4). Higher water temperatures reduce the volume of condensate formed.

CAUTION

Setting the temperature selector to higher settings provides hotter water, which increases the risk of scald injury.

WARNING

Should overheating occur or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the pump. Instead, shut off the gas supply at a location external to the appliance.

Optional adjustable auxiliary high water temperature limit control

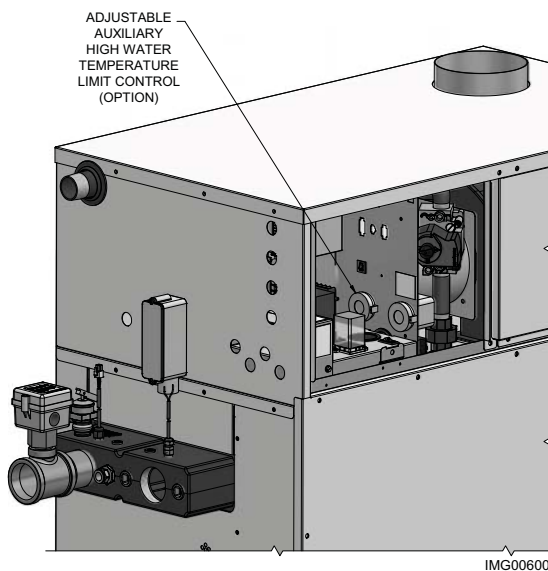


Figure 8-6 Adjustable Auxiliary High Water Temperature Limit Control

A high limit control is located on the inside of the left front panel, as shown in FIG. 8-6. The setting of this control knob limits maximum discharge water temperature. The hot water supply boiler temperature limit control is adjustable up to a maximum setting of 210°F (99°C). This hot water supply boiler also includes a fixed high water temperature limit control set to 200° (93.3°C).

NOTICE

The high limit control will not reset until the water temperature has dropped below the setpoint of the high limit.

Thermal expansion

A relief valve that discharges periodically may be due to thermal expansion in a closed system. A hot water supply boiler installed in a closed system, such as one with a backflow preventer or check valve installed in the cold water supply, shall be provided with means to control expansion. Contact the water supplier or local plumbing inspector on how to correct this situation. Never plug or cap the relief valve discharge.

Cathodic protection

Hydrogen gas can be produced in a hot water system that has not been used for a long period of time (generally two weeks or more). Hydrogen gas is extremely flammable. To prevent the possibility of injury under these conditions, we recommend the hot water faucet be open for several minutes at the kitchen sink before you use any electrical appliance which is connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipe as the hot water begins to flow. There should be no smoking or open flames near the faucet at the time it is open.

9 Maintenance

Maintenance and annual startup

Table 9A_Service and Maintenance Schedules

Service technician (see the following pages for instructions)		Owner maintenance (see the Genesis User's Information Manual for instructions)	
ANNUAL START-UP	General: <ul style="list-style-type: none"> • Address reported problems • Inspect interior; clean and vacuum if necessary; • Check for leaks (water, gas, flue, condensate) • Examine venting system • Check system water pressure/system piping/expansion tank • Check control settings • Check igniter • Check wiring and connections • Check flue gas passageways • Flame inspection (stable, uniform) • Inspect and clean the burner • Check manifold gas pressure • Perform start-up checkout and performance verification per Section 6 in the Genesis Installation and Operation Manual. If combustion or performance indicate need: <ul style="list-style-type: none"> • Clean heat exchanger with a stiff bristle brush • Remove and clean burners using water. Dry before re-assembling. • Clean the blower wheel with a brush and vacuum. Do not let dirt from cleaning get pulled into the blower. 		
	Daily	<ul style="list-style-type: none"> • Check appliance area • Check pressure/temperature gauge 	
	Monthly	<ul style="list-style-type: none"> • Check vent piping • Check air piping • Check relief valve • Replace combustion air filter Note: More frequent replacement may be necessary in dirty environments.	
	Periodically	<ul style="list-style-type: none"> • Test low water cutoff (if used) • Reset button (low water cutoff) 	
	Every 6 months	<ul style="list-style-type: none"> • Check appliance piping (gas and water) for leaks • Operate relief valve 	

9 Maintenance

⚠ WARNING

Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the appliance. Failure to perform the service and maintenance could result in damage to the appliance or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠ WARNING

The appliance should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the appliance designated in Table 9A and explained on the following pages must be performed to assure maximum appliance efficiency and reliability. Failure to service and maintain the appliance and system could result in equipment failure.

⚠ WARNING

Electrical shock hazard – Turn off power to the appliance before any service operation on the appliance except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect appliance area

1. Verify that appliance area is free of any combustible materials, gasoline and other flammable vapors and liquids.

Inspect appliance interior

1. Remove the outer access panels and inspect the interior of the appliance.
2. Vacuum any sediment from inside the appliance and components. Remove any obstructions.

Check all piping for leaks

⚠ WARNING

Eliminate all system or appliance leaks. Minerals can build up in sections, reducing heat transfer, overheating heat exchanger, and causing heat exchanger failure. Leaking water may also cause severe property damage.

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using the procedure found in *Section 3 - Gas Connections* of the Genesis Installation and Operation Manual.

Flue vent system and air piping

1. Check for gastight seal at every connection, seam of air piping, and vent piping periodically inspected by a qualified service agency.

⚠ WARNING

Venting system must be sealed gastight to prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 PSI).
3. Watch the system pressure as the unit heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly press push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools. Tanks may be open, closed, diaphragm or bladder type. See *Section 4 - Water Connections* of the Genesis Installation and Operation Manual for suggested best location of expansion tanks and air eliminators.

9 Maintenance *(continued)*

Check relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read *Section 4 - Water Connections* of the Genesis Installation and Operation Manual before proceeding further.

⚠ WARNING

Safety relief valves should be re-inspected **AT LEAST ONCE EVERY THREE YEARS**, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the hot water supply boiler relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING

Following installation, the valve lever must be operated **AT LEAST ONCE A YEAR** to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the appliance until a new relief valve has been installed.

2. After following the above warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

Inspect/replace hot surface igniter

This unit uses a proven control module and a hot surface igniter. The control module is not repairable. Any modification or repairs will invalidate the warranty.

⚠ WARNING

Do not attempt to repair a faulty hot surface igniter or control module. Any modification or repairs may create hazardous conditions that result in property damage, personal injury, fire, explosion and/or toxic gases.

A faulty hot surface igniter or control module must be replaced with an identical part. A specification igniter and control module for this specific unit is available from your local distributor. **Do not use general purpose field replacement control modules or igniters.**

Ignition system checkout

1. Turn off gas supply to unit.
2. Turn electric power on.
3. Adjust the setpoint targets on the temperature control to a setting above water temperature or to the highest safe setting.
4. The igniter will cycle on trial for ignition.
5. The ignition module will lock out and turn the alarm light on.
6. Adjust the Stage Differential and Boil Max to the desired | settings.
7. Turn on gas supply.
8. Press the RESET button on the panel to reset the ignition module.
9. If ignition system fails to operate properly, repair work must be performed by a qualified service person or installer.

Check all wiring

Inspect all wiring, making sure wires are in good condition and securely attached.

Check control settings

Press and hold the SELECT key, the controller will display the current settings. When the Advanced/User switch is set to User, only a limited group of settings will be shown. Changing the dipswitch to the Advanced position will show all of the available settings when the SELECT key is held down. In order to review and adjust the settings, all three (3) keys (SELECT, +, -) must be held down for three (3) seconds to enter the Adjust Mode. The position of the Advanced/User dipswitch will also affect how many items are allowed to be adjusted.

9 Maintenance

Perform start-up and checks

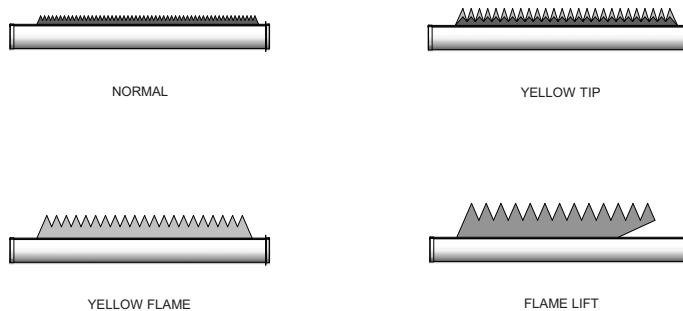
1. Start appliance and perform checks and tests specified in *Section 6 - Start-up* of the Genesis Installation and Operation Manual.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

Check burner flame

Visually check main burner flames at each start-up after long shutdown periods or at least every six months. A burner viewport is located on the burner mounting flange.

⚠ WARNING The area around the burner viewport is hot and direct contact could result in burns.

Figure 9-1_Flame Pattern Illustration



Normal Flame: A normal flame at 100% of burner input is blue, with slight yellow tips, a well defined flame and no flame lifting.

Yellow Tip: Yellow tipping can be caused by blockage or partial obstruction of air flow to the burner.

Yellow Flames: Yellow flames can be caused by blockage of primary air flow to the burner or excessive gas input. This condition **MUST** be corrected immediately.

Lifting Flames: Lifting flames can be caused by over firing the burner, excessive primary air or high draft.

If improper flame is observed, examine the venting system, ensure proper gas supply and adequate supply of combustion and ventilation air.

Check flue gas passageways

Any sign of soot around the inner jacket, outer jacket, flue pipe connections, burner or in the areas between the fins on the copper heat exchanger indicates a need for cleaning. The following cleaning procedure must only be performed by a qualified serviceman or installer. Proper service is required to maintain safe operation. Properly installed and adjusted units seldom need flue cleaning.

NOTICE

All gaskets/sealants on disassembled components or jacket panels must be replaced with new gaskets/sealants on reassembly. Gasket and sealant kits are available from your distributor.

⚠ CAUTION

When a Category IV vent system is disconnected for any reason, the flue must be reassembled and resealed according to the vent manufacturer's instructions.

Inspect and clean burner

1. Turn off main power to unit.
2. Turn off main manual gas shutoff to unit.
3. Remove the front outer jacket panels.
4. Disconnect manifold from gas train using union(s) just below each gas valve(s).
5. Remove mounting screws from manifold mounting brackets. Pull the manifold/orifice assembly away from burners. Repeat for each manifold assembly.
6. Remove two mounting screws from burner and slide burner out toward front of unit. Use caution to prevent damage to burners, refractory, hot surface igniter or wiring.
7. Remove soot from burners with a stiff bristle brush.

Dirt may be removed from burner ports by rinsing the burner thoroughly with water. Drain and dry burners before re-installing. Damaged burners must be replaced.

When installed in a dusty and dirty location, the burners may require cleaning on a 3 to 6 month schedule or as needed, based on severity of contamination. Contaminants can be drawn in with the combustion air. Non combustible particulate matter such as dust, dirt, concrete dust or dry wall dust can block burner ports and cause non-warrantable failure. The standard inlet air filter will help eliminate dust and dirt from entering the unit. Use extreme care when operating a unit for temporary heat during new construction. The burners could require a thorough cleaning before the unit is placed in service.

Access to the burners will require the following steps:

1. Turn off main electrical power to the appliance.
2. Turn off main manual gas shutoff to the appliance.
3. Remove the upper and lower outer front access doors.
4. Disconnect the manifold(s) from the gas train using the union(s) just below each gas valve.
5. Disconnect the wiring to the hot surface igniter(s) and ground.
6. Disconnect burner pressure line at burner.
7. Remove the screws from the manifold mounting bracket(s) and remove the manifold(s).
8. Remove the screws from the burner mounting flanges and slide the burner(s) out toward the front of the unit. Use caution to prevent damage to the burners, refractory, hot surface igniter, and wiring.
9. Remove soot from the burners with a stiff bristle brush. Dirt may be removed from the burner ports by rinsing the burner thoroughly with water. Drain and dry burners before re-installing. Damaged burners must be replaced.
10. Reassemble in reverse order.

9 Maintenance *(continued)*

NOTICE

When installed in a dusty and dirty location, the burners may require cleaning on a 3 to 6 month schedule or as needed, based on the severity of contamination. Contaminants can be drawn in with the combustion air. Non-combustible particulate matter such as dust, dirt, concrete dust, or drywall dust can block burner ports and cause non-warrantable failure. The standard inlet air filter will help eliminate dust and dirt from entering the unit.

NOTICE

While burners are removed, check the heat exchanger surface for sooting. If present, the heat exchanger must be cleaned. Reference the *Heat Exchanger Cleaning* procedures in this manual.

Checking combustion air pressure

The combustion air fans are factory pre-set and should not require adjustment in most cases. Follow the steps in the *Checking / Adjusting Combustion Air Pressure* Section to adjust the fan if a continuous Low Air status code occurs.

NOTICE

On the 400 - 750 models, the air shutter is adjusted to the side of the fan as depicted in FIG. 9-2. On the 1000 - 2100 models, the air shutter is adjusted by sliding the arm located on the front of the air box as depicted in FIG. 9-3.

Check for proper installation and draft in the venting system prior to any adjustments. Correct as needed.

Figure 9-2 *Adjusting air shutter - 400 - 750 Models*

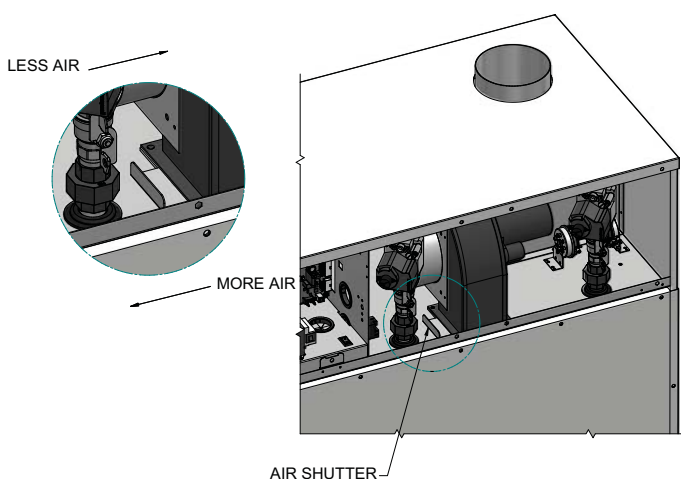
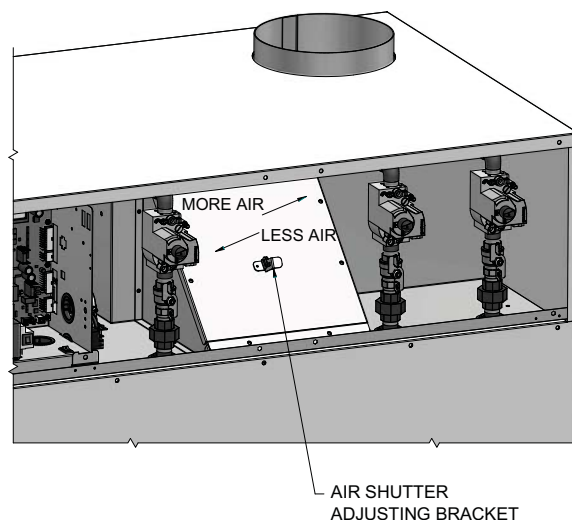


Figure 9-3 *Adjusting air shutter - 1000 - 2100 Models*



Adjusting combustion air pressure

The following is a recommended method for setting the combustion air pressure. The following pressure settings are for installations up to 4000 feet altitude. Contact the factory for high altitude air pressure settings.

Upon removal of the upper front doors, locate the capped tee in the pressure tubing that connects between the inner top and the gas valves. Remove this cap and connect a hose from the tee to a manometer.

For 400 - 750 models (reference FIG. 9-2)

1. The combustion air chamber pressure for these models is typically 1.2 - 1.3 inches water column when the fan is at high speed.
2. If adjustment is necessary, slightly loosen the nuts connecting the fan to the inner top.
3. Adjust the air shutter located underneath the fan assembly to obtain the desired chamber pressure. Slide the shutter inward to decrease the chamber pressure or outward to increase the chamber pressure.

For 1000 - 2100 models (reference FIG. 9-3)

1. The combustion air chamber pressure for these models is typically 1.2 - 1.3 inches water column when the fan is at high speed.
2. If adjustment is necessary, slightly loosen the nut located on the air shutter arm.
3. Adjust the air shutter arm to obtain the desired chamber pressure. Slide the arm inward to decrease the chamber pressure or outward to increase the chamber pressure.

9 Maintenance

All models

- Once the adjustment procedure is complete, tighten all connections, disconnect the manometer, and replace the cap at the tee.
- Check all connections and test fire the unit.
- Replace all panels.

Checking manifold gas pressure

The gas regulator on the combination gas valve is adjustable to supply the proper manifold pressure for normal operation. The gas valves are factory pre-set and should not need adjusting in most cases. Gas manifold pressures are listed in Table 9B.

Gas manifold pressures may be checked with the use of a manometer. Follow the steps in the *Checking Combustion Air Pressure Section* prior to checking the manifold pressures.

- Turn the appliance power switch to the "OFF" position.
- Remove the upper outer access panels.
- Remove the 1/8" hex plug from the downstream side of the gas valve (see FIG. 9-4). Install a fitting in the tap and connect a hose from the tap to a manometer.
- Connect a hose from the tee used to measure the combustion air pressure to the other side of the manometer.
- Turn the appliance power switch to the "ON" position.
- With the unit at high fire, check and record the manifold pressure of the valve. The manifold pressure will be the sum of the two pressure readings (reference Table 9B).
- Repeat this process with each gas valve.

⚠ WARNING

Overfire and underfire hazards! Possible fire, explosion, overheating, and component failure. Do not attempt to adjust firing rate of the appliance. The firing rate must be adjusted only by factory trained personnel.

If you must adjust the gas valve regulator pressure, follow the steps below:

- Remove the cap covering the manifold pressure adjustment screw (see FIG. 9-4). **Note:** Once the cap is removed, the pressure shown on the manometer will change and the unit may turn off.
- Make a slight adjustment to the manifold pressure adjustment screw. Turning the screw clockwise increases manifold pressure and counterclockwise decreases manifold pressure.

- Replace the cap and check the manifold pressure. **Note:** Allow the unit to re-light if necessary.
- Repeat the steps above to match the manifold pressures from Table 9B.
- Once the adjustment procedure is complete, turn off the appliance, disconnect the manometer, replace and tighten all connections, and replace all panels.
- Turn on the appliance and test fire the unit.
- Repeat this process with each gas valve.

Figure 9-4_Measuring manifold gas pressure

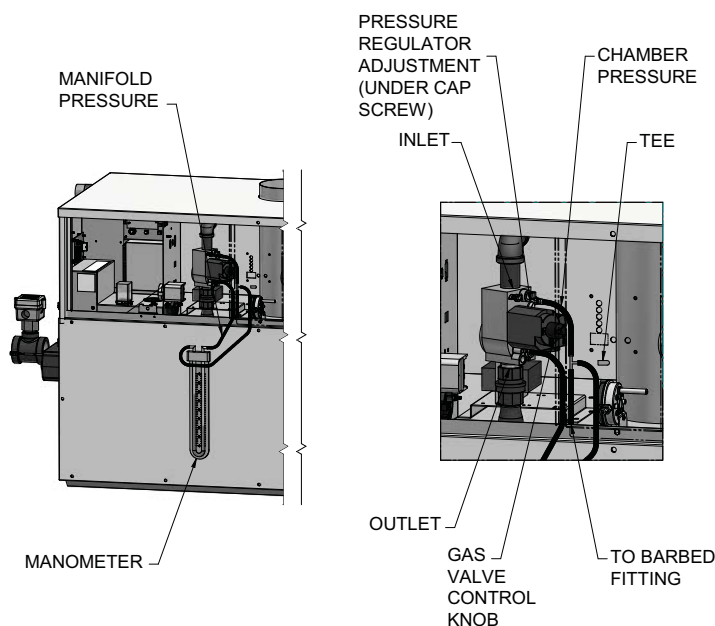


TABLE 9B
Net Manifold Pressure
Regulator Pressure Less
Front Chamber Pressure

MODEL	Nat. Gas	LP
400 - 750	1.8" w.c.	4.6" w.c.
1000 - 2100	1.2" w.c.	4.6" w.c.

9 Maintenance *(continued)*

Inspect and clean the heat exchanger

1. While burners are removed, check the heat exchanger surface for sooting. If present, heat exchanger must be cleaned and problem corrected. Proceed as follows.
2. Remove gas manifold(s)/orifice assemblies as described in steps 1 through 5 in Inspect and Clean Burner, page 64.
3. Disconnect wiring from the hot surface igniter and hose from the burner pressure tap.
4. Remove inner jacket panel mounting screws and slide door assembly out toward front of the unit. Use caution to prevent damage to the refractory and hot surface igniter.
5. Check “V” baffles and frame runners along front and back edges of heat exchanger. Remove and clean if necessary.
6. Remove soot from heat exchanger with a stiff bristle brush. Use a vacuum to remove loose soot from surfaces and inner chamber.
7. The heat exchanger can be removed by sliding towards the front of the unit. Once the heat exchanger is removed from the unit, a garden hose can be used to wash the tubes to ensure that all soot is removed from the heat exchanger surfaces. Note: Do not wet the unit's refractory.
8. Ensure that all burner ports are cleaned to remove any soot. See Inspect and Clean Burner, page 64.
9. Carefully reinstall the heat exchanger, “V” baffles, and frame runners if removed from the unit. Note: Make sure frame runners seal securely where they contact the front and rear compartment refractory.
10. Carefully reinstall inner jacket panels, burners, manifolds, wires and hoses. Use new gasket material to ensure a proper air seal.
11. Reassemble all gas and water piping. Test for gas leaks.

NOTICE

Upon completion of any testing on the gas system, leak test all gas connections with a soap and water solution while main burners are operating. Do not spray soap and water solution on the control module housing. The use of an excessive amount of soap and water solution can damage the control. Immediately repair any leak found in the gas train or related components. Do not operate an appliance with a leak in the gas train, valves, or related piping.

12. Reassemble outer jacket panels.
13. Cycle unit and check for proper operation.

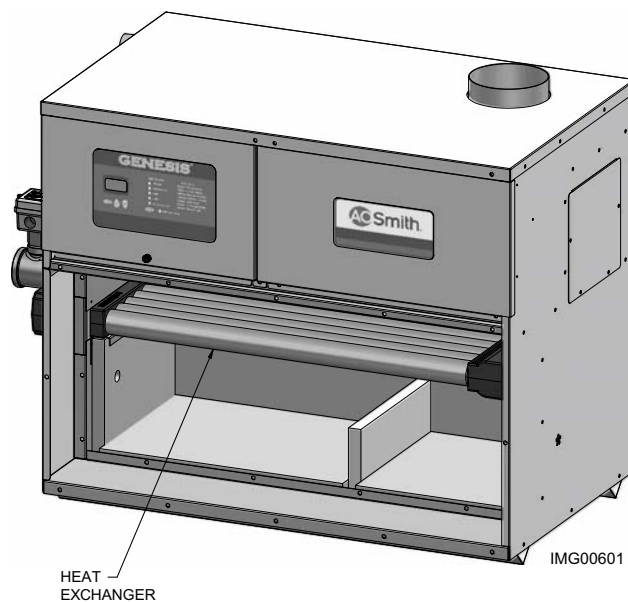


Figure 9-5 Location of the Heat Exchanger Inside Jacket

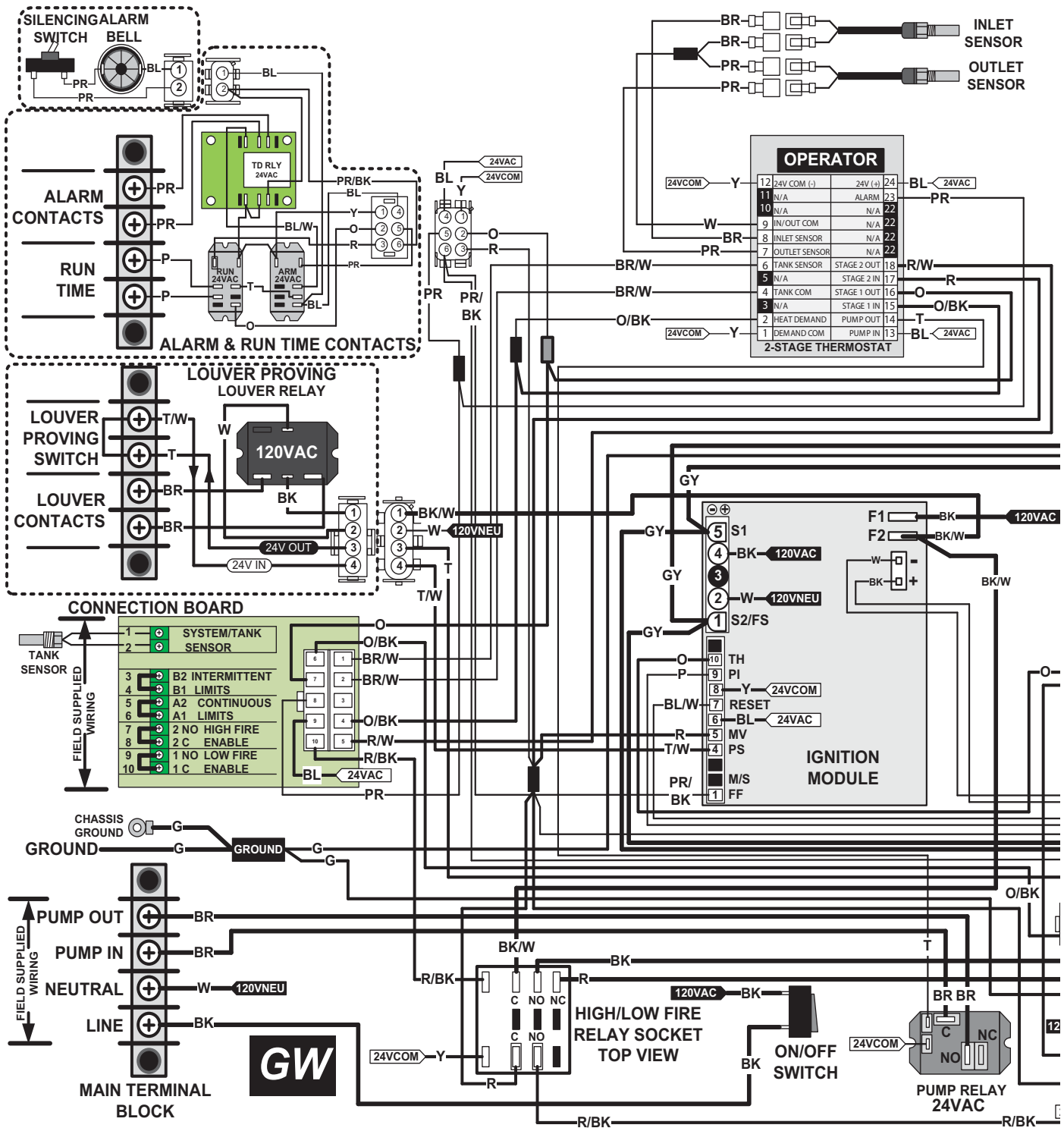
Review with owner

1. Emphasize the need to perform the maintenance schedule specified in this section.
2. Remind the owner of the need to call a licensed contractor should the appliance or system exhibit any unusual behavior.
3. Remind the owner to follow the proper shutdown procedure and to schedule an annual start-up at the beginning of the next heating season.

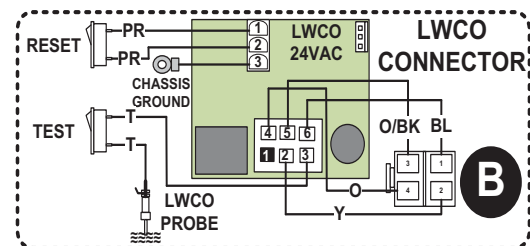
Oiled bearing circulators

Inspect the pump every six (6) months and oil as necessary. Use SAE 30 non-detergent oil or lubricant specified by the pump manufacturer.

10 Connection diagram



10 Connection diagram (continued)



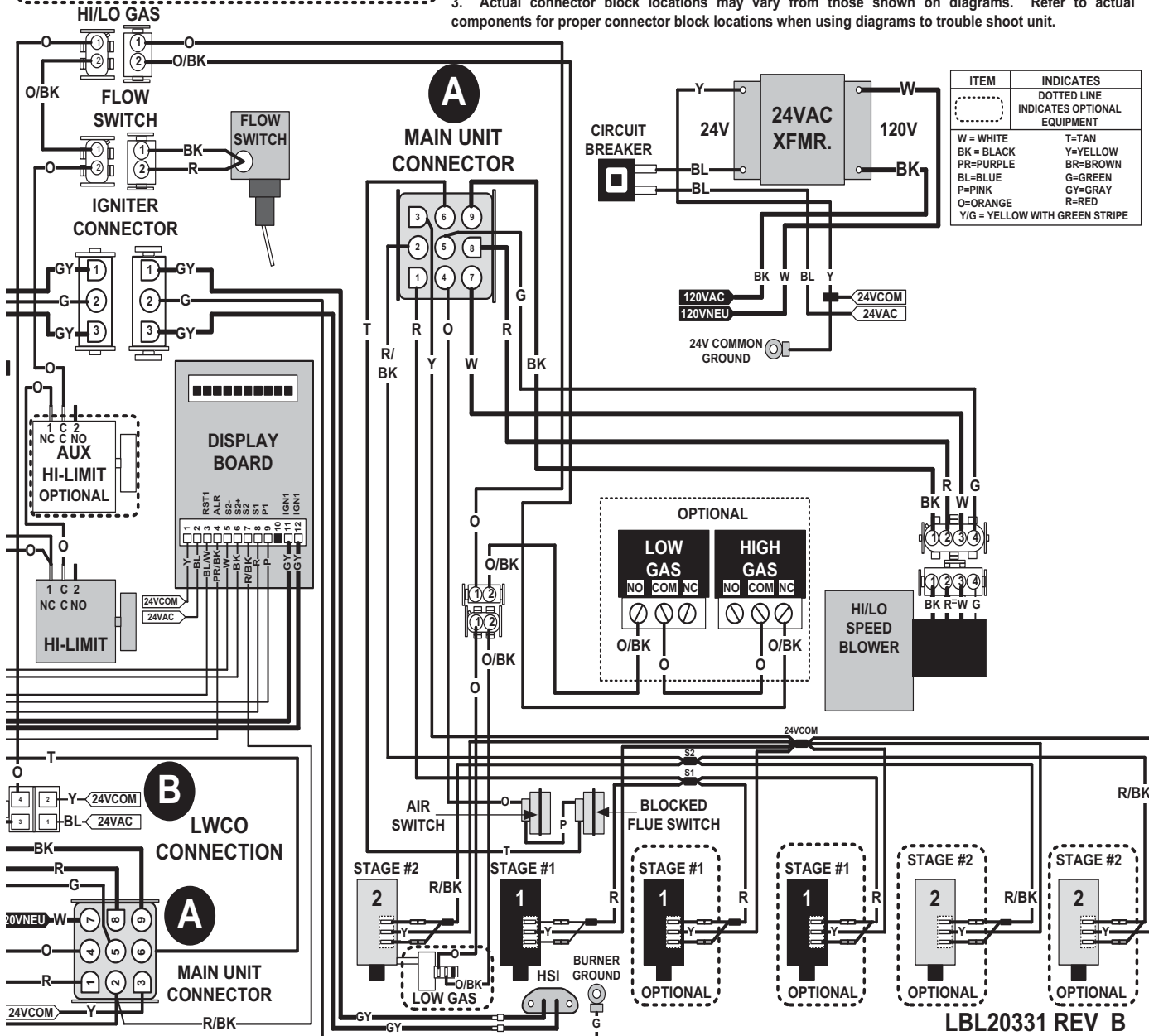
⚠ DANGER

TO PREVENT ELECTRICAL SHOCK

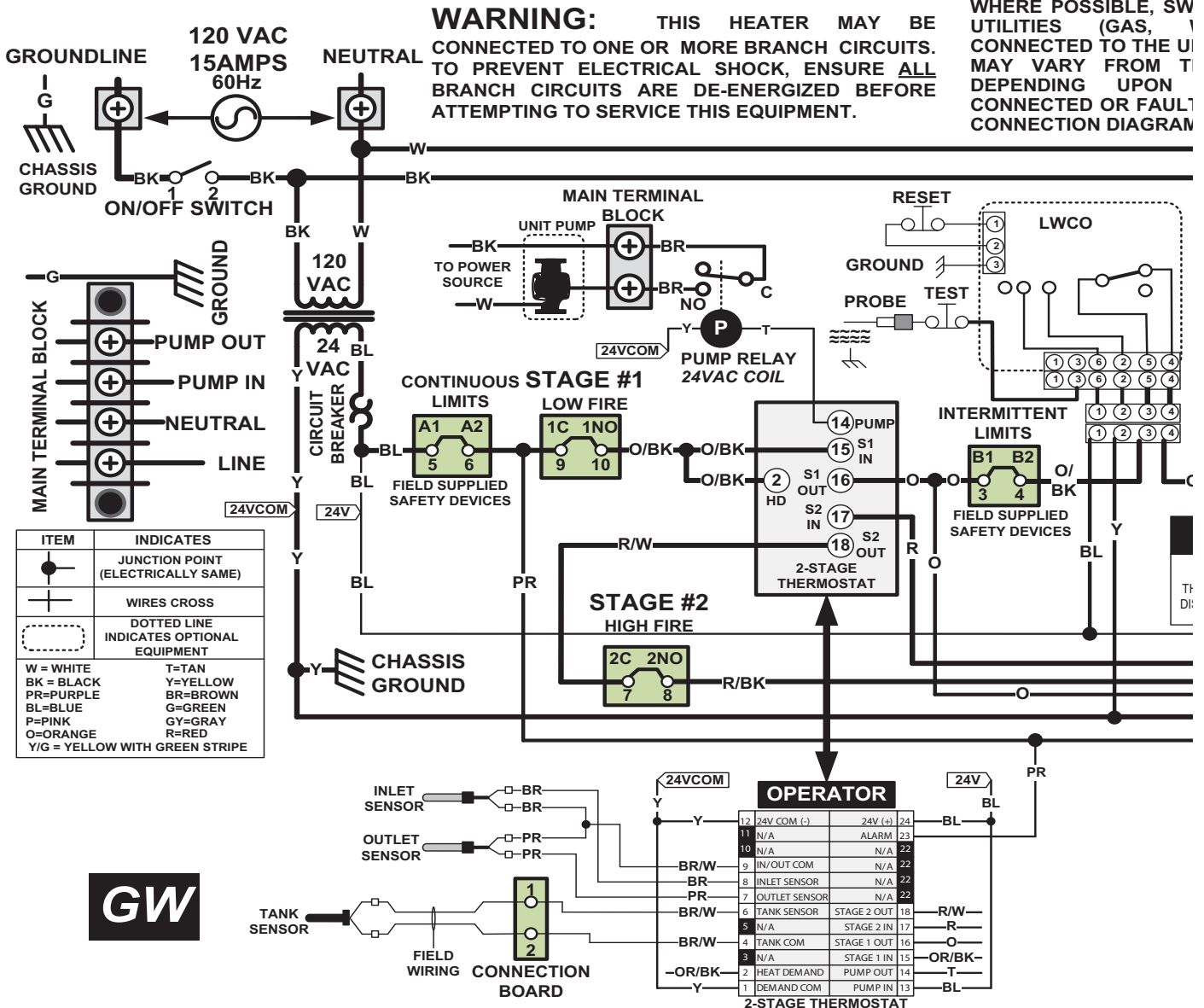
THIS HEATER MAY BE CONNECTED TO MORE THAN ONE BRANCH CIRCUIT. MORE THAN ONE DISCONNECT SWITCH MAY BE REQUIRED TO DE-ENERGIZE THE EQUIPMENT FOR SERVICING.

Notes:

1. All wiring must be installed in accordance with: local, state, provincial and national code requirements per either N.E.C. in USA or C.S.A. in Canada.
2. If any original equipment wire as supplied with the appliance must be replaced, it must be replaced with wire having same wire gauge (AWG) and rated for a minimum of 105°C
3. Actual connector block locations may vary from those shown on diagrams. Refer to actual components for proper connector block locations when using diagrams to trouble shoot unit.

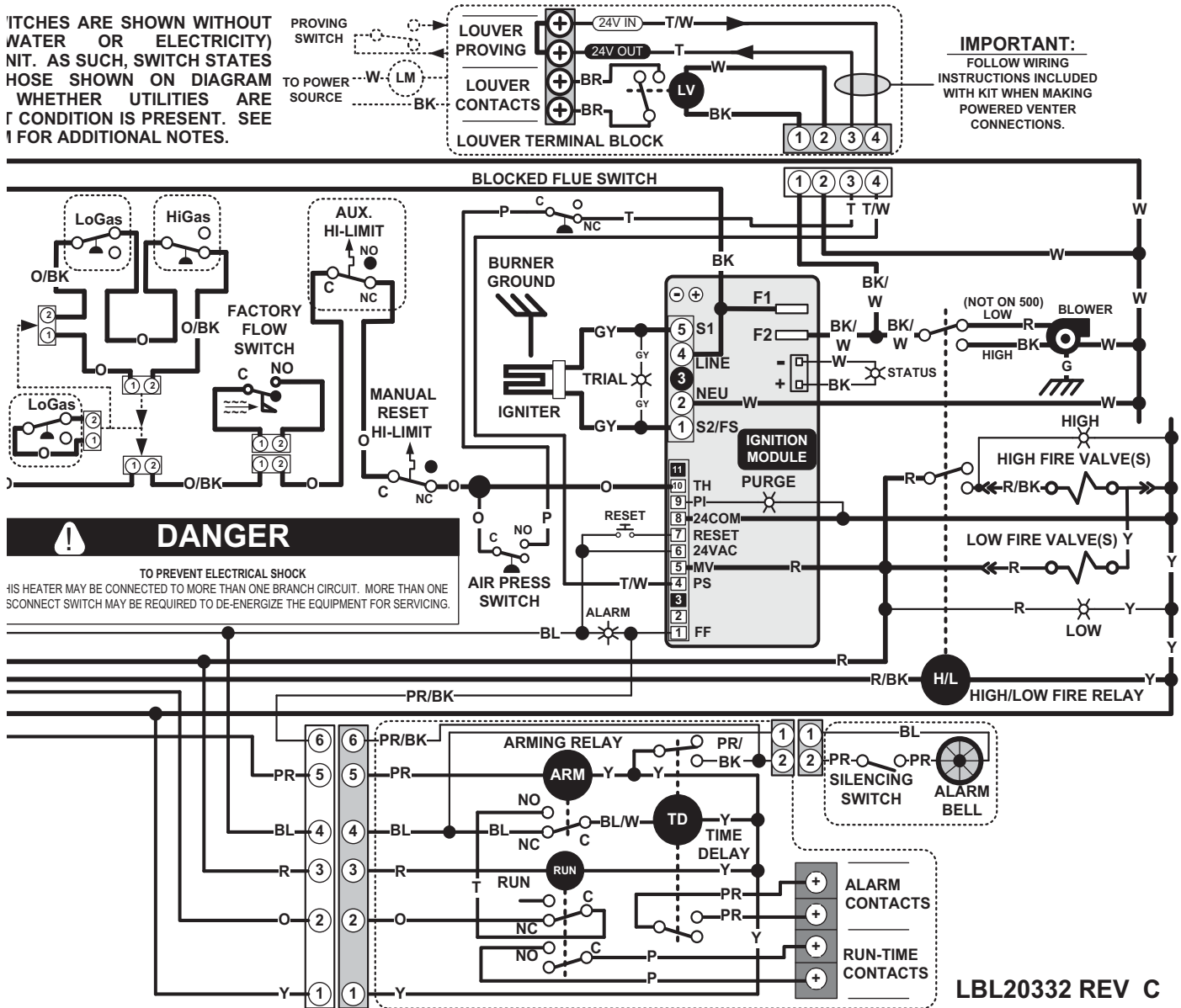


11 Ladder diagram



11 Ladder diagram (continued)

ITCHES ARE SHOWN WITHOUT
WATER OR ELECTRICITY,
NIT. AS SUCH, SWITCH STATES
HOSE SHOWN ON DIAGRAM
WHETHER UTILITIES ARE
IN CONDITION IS PRESENT. SEE
1 FOR ADDITIONAL NOTES.



LBL20332 REV C

Notes

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12 Warranty

LIMITED WARRANTY

A. O. Smith Corporation, the warrantor, extends the following LIMITED WARRANTY to the owner of this hot water supply boiler:

1. If within FIVE years after initial installation of the hot water supply boiler, a heat exchanger or gas burner shall prove upon examination by the warrantor to be defective in material or workmanship, the warrantor, at his option will exchange or repair such part or portion.
 - a. This warranty is extended to the owner for all other parts or portion during the FIRST year following initial installation of this hot water supply boiler.
 - b. The warranty on the repair or replacement of the part or portion will be limited to the unexpired term of the original warranty.

2. CONDITIONS AND EXCEPTIONS

This warranty shall apply only when the hot water supply boiler is installed in accordance with local plumbing and building codes, ordinances and regulations, the printed instructions provided with it and good industry practices. In addition, a pressure relief valve, certified by C.S.A. and approved by the American Society of Mechanical Engineers, must have been installed and fresh water used for filling and make-up purposes.

a. This warranty shall apply only when the hot water supply boiler is used:

- (1) with inlet water temperature 140°F (60°C) and above and outlet water temperatures not exceeding the maximum setting of its operative and/or high limit control;
- (2) at water pressure not exceeding the working pressure shown on the hot water supply boiler;
- (3) when filled with water, free to circulate at all times and with the heat exchanger free of damaging scale deposits;
- (4) in a non-corrosive and non-contaminated atmosphere;
- (5) in the United States, its territories or possessions, and Canada;
- (6) at a water velocity flow rate not exceeding or below the hot water supply boiler's designed rates;

b. Any accident to the hot water supply boiler, any misuse, abuse (including freezing) or alteration of it, any operation of it in a modified form, or any attempt to repair leaks in the heat exchanger will void this warranty.

3. SERVICE AND REPAIR EXPENSE

Under this limited warranty the warrantor will provide only a replacement part. The owner is responsible for all other costs. Such costs may include but are not limited to:

- a. Labor charges for service, removal, repair, or reinstallation of the component part;
- b. Shipping, delivery, handling, and administrative charges for forwarding the replacement part from the nearest distributor and returning the claimed defective part to such distributor.
- c. All cost necessary or incidental for any material and/or permits required for installation of the replacement.

4. LIMITATIONS ON IMPLIED WARRANTIES

Implied warranties, including any warranty of merchantability imposed on the sale of this hot water supply boiler under state or provincial law are limited to one (1) year duration for the hot water supply boiler or any of its parts. Some states and provinces do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

5. CLAIM PROCEDURE

Any claim under this warranty should be initiated with the dealer who sold the hot water supply boiler, or with any other dealer handling the warrantor's products. If this is not practicable, the owner should contact:

U.S. Customers

A. O. Smith Corporation
500 Tennessee Waltz Parkway
Ashland City, TN
Telephone: 800 527-1953

Canadian Customers

A. O. Smith Enterprises Ltd.
P. O. Box, 310 - 768 Erie Street
Stratford, Ontario N5A 6T3
Telephone: 800-265-8520

- a. The warrantor will only honor replacement with identical or similar parts thereof which are manufactured or distributed by the warrantor.
- b. Dealer replacements are made subject to in-warranty validation by warrantor.

6. DISCLAIMERS

NO OTHER EXPRESS WARRANTY HAS BEEN OR WILL BE MADE ON BEHALF OF THE WARRANTOR WITH RESPECT TO THE MERCHANTABILITY OF THE HOT WATER SUPPLY BOILER OR THE INSTALLATION, OPERATION, REPAIR OR REPLACEMENT OF THE HOT WATER SUPPLY BOILER. THE WARRANTOR SHALL NOT BE RESPONSIBLE FOR WATER DAMAGE, LOSS OF USE OF THE UNIT, INCONVENIENCE, LOSS OR DAMAGE TO PERSONAL PROPERTY, OR OTHER CONSEQUENTIAL DAMAGE. THE WARRANTOR SHALL NOT BE LIABLE BY VIRTUE OF THIS WARRANTY OR OTHERWISE FOR DAMAGE TO ANY PERSONS OR PROPERTY, WHETHER DIRECT OR INDIRECT, AND WHETHER ARISING IN CONTRACT OR TORT.

- a. Some states and provinces do not allow the exclusion or limitation of the incidental or consequential damage, so the above limitations or exclusions may not apply to you.
- b. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state or province to province.

Fill in the following for your own reference. Keep it. Registration is not a condition of warranty. The model and serial number are found on the hot water supply boiler's rating plate.

Owner _____

Installation Address _____

City and State _____ Zip Code _____

Date Installed _____ Model No. _____ Serial No. _____

Dealer's Name _____ Phone No. _____

Dealer's Address _____

FILL IN WARRANTY AND KEEP FOR FUTURE REFERENCE



Revision Notes: Revision A (ECO #C12846) initial release.

Revision B (ECO #C13498) edits made to the setpoint default on page 47, edits made to FIG. 7-6 and 7-7 on page 48 along with the addition of new revisions of LBL20331 and LBL20332.

Revision C (C# 500001030) reflects the update of Table 4B on page 37, as well as the addition of the factory startup label on the manual cover.

Revision D (PCP# 3000006580 / CN# 500006678) reflects a change from all instances of "water heater" to "hot water supply boiler," and references to ANSI Z21.13. SAP material numbers have been updated.