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HC Series

Gas-Fired Stainless Steel Boilers and Water Heaters

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

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 neighbor's phone. Follow the gas supplier's instruction.
- 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.

Note: The installation must conform with one or more of the following, as applicable:

- 1) Local codes or, in the absence of local codes,
- 2) The *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 and/or CSA B149.1, *Natural Gas and Propane Installation Code*.

Note: This product must be installed and serviced by a professional service technician, qualified in hot water boiler and heater installation and maintenance. Improper installation and/or operation could create carbon monoxide gas in flue gases which could cause serious injury, property damage, or death. Improper installation and/or operation will void the warranty.

Warning: For proper operation of a spa or hot tub the following safety rules should be observed:

- Spa or hot tub water temperature should never exceed 104° F (40° C). A temperature of 100° F (38° C) is considered safe for an adult. Special caution is suggested for young children.
- Drinking alcoholic beverages before or during hot tub or spa use can cause drowsiness, which could lead to unconsciousness and subsequently resulting in drowning.
- Pregnant women should be cautious. Soaking in water above 102° F (39° C) can cause fetal damage during the first three months of pregnancy. Pregnant women should respect the 100° F (38° C) maximum rule.
- Before entering the spa or hot tub, the water temperature should be checked with an accurate thermometer. Spa or hot tub thermostats may have an inaccuracy, as high as 4° F in regulating the water temperature.
- Persons with medical history of heart disease, circulatory problems, diabetes or blood pressure should obtain their physician's advice before using spas or hot tubs.
- Persons taking medications, which induce drowsiness, should not use spas or hot tubs.

WARNING: Electrical Shock Hazard

Electrical shock can cause severe injury, death or property damage. Disconnect the power supply before beginning installation or changing the wiring to prevent electrical shock or damage to the equipment. It may be necessary to turn off more than one power supply disconnect. All electrical wiring is to be done in accordance with local codes, or in the absence of local codes, with: 1) The National Electrical Code ANSI/NFPA No. 70 - latest Edition, or 2) CSA STD. C22.1 "Canadian Electrical Code - Part 1." This appliance must be electrically grounded in accordance with these codes.

WARNING: Carbon Monoxide Hazard

Improper adjustment of the burners may lead to poor combustion quality, increasing the amount of carbon monoxide produced. Excessive carbon monoxide levels may lead to personal injury or death.

WARNING: Fire or Explosion Hazard

Improper configuration can cause fuel buildup and explosion. Improper user operation may result in property loss, severe physical injury, or death. Any changes to safety-related configuration parameters must only be done by experienced and/or licensed burner/boiler operators and mechanics. If any odor of gas is detected, or if the gas burner does not appear to be functioning in a normal manner, **close the main gas shutoff valve**. Do not shut off the power switch. Contact your heating contractor, gas company, or factory representative.

Warning:

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

Warning:

Do not bypass any of the instruments in the safety loop. Doing so may cause serious damage to the unit and its surroundings.

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HC SERIES GENERAL SPECIFICATIONS

Table 1: HC Series General Specifications

		HC 600	HC 1000	HC 1500	HC 2000	HC 2500
Input	BTU/hr	600,000	1,000,000	1,500,000	2,000,000	2,500,000
	kW	176	293	440	586	733
	BHP	236	393	590	785	983
Output	BTU/hr	570,000	950,000	1,425,000	1,900,000	2,375,000
	kW	167	278	418	557	696
	BHP	224	373	560	747	933
Boiler Eff. Full load	%	95	95	95	95	95
Electrical Rating	V/Ph/Hz	115/1/60	115/1/60	115/1/60	115/1/60	115/1/60
Heating Surface	Ft ²	67	105	172	200	229
Shipping Weight ¹ (approx.)	lbs	550	750	950	1,350	1,500
Water Content	USG	12	17	26	30	34
Minimum Water Flow Rate	USGPM	12	19	24	24	32
Inlet Gas Pressure ²	Inches WC	7 - 14				
Flue Duct Material	Stainless Steel (air tight, corrosion resistant)					
Max Working Pressure	PSIG	160				
Max Working Temp.	°F	210				
Min Inlet Water Temp.	°F	Any temperature above freezing point				
Min Service Clearance	Inches (cm)	Front 24" (61), Top (40), Side 0				

1. Dry weight of the unit.

2. Inlet gas pressures are standard values. Refer to submittal drawings for minimum requirements for different configuration.

HC SERIES GENERAL LAYOUT & DIMENSIONS

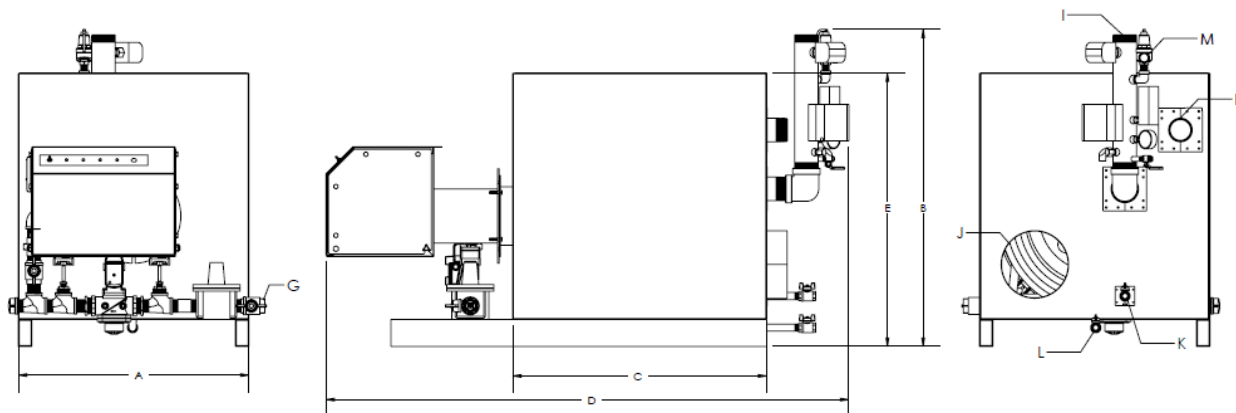


Figure 1: General layout of the HC series boilers

Table 2: HC series dimensions

Model	"A" in. (mm)	"B" in. (mm)	"C" in. (mm)	"D" in. (mm)	"E" in. (mm)
HC 600	35(890)	40.5(1,030)	20.5(521)	60(1,524)	40.5(1029)
HC 1000	35(890)	40.5(1,030)	26(661)	66(1,676)	40.5(1029)
HC 1500	35(890)	45(1,150)	35.6(905)	75.6(1,920)	40.5(1029)
HC 2000	35(890)	45(1,143)	37.75(959)	81.75(2,076)	40.5(1029)
HC 2500	35(890)	45(1,143)	44(1,118)	86(2,184)	40.5(1029)

Note: Depth of the unit may vary depending on the burner selected.

Model	Ø Gas Inlet "G" in.	Ø Water Inlet "H" in.	Ø Water Outlet "I" in.	Ø Flue Vent "J" in.	Ø Water Drain "K" in.	Ø Cond. Drain "L" in.
HC 600	1	2	2	7	¾	¾
HC 1000	1	2	2	9	¾	¾
HC 1500	2	2	2	10	¾	¾
HC 2000	2	3	3	10	¾	¾
HC 2500	2	3	3	12	¾	¾

SECTION 1: INTRODUCTION

1.1 Boiler/Water Heater Heat Exchanger

The H2O HC series is a gas-fired water tube boiler and water heater with nominal input rating ranging from 600,000 to 2,500,000 Btu/hr. Each unit consists of several stainless steel coiled tubes (SA-249 Type 316L), 1" diameter and 0.049" wall thickness. The coils are held parallel vertically by means of stainless steel ready rods and adjustment nut assemblies. The inlets and outlets of the coils are welded to the manifolds pipes of the boiler.



Figure 2: HC Series Boiler

The heat exchanger assembly consists of a ceramic refractory, insulation plate and support ring prevent hot gas escaping through the rear coil. The front hub and the front coil are connected and support a high performance gas burner. The weight of the burner is counter balanced by the heat exchanger.

The exact mechanism of heat exchange is an engineering phenomenon, involving combination of counter flow, condensation heat recovery, fouling factors, and two-phase conditions. The working of heat exchanger is a simple process. The gas burner ignites the gas and air mixture inside the combustion chamber (the central space of the four coils). The hot gas particles cool and condense as they pass through the gaps of the coils. The flue particles are gathered in the boiler chamber (space outside the coils and within the liners) and exit through the chimney. The water flows in the opposite direction of gas. Feed water enters the each coil at the perimeter of the heat exchanger. The water picks up heat gradually as it circulates through the coil tubes and exits at the center (near the central hubs). The counter flow design reduces the impact of thermal shock and increases the heat exchanger life. The flue condensate is drained through a fitting at the bottom right of the boiler.

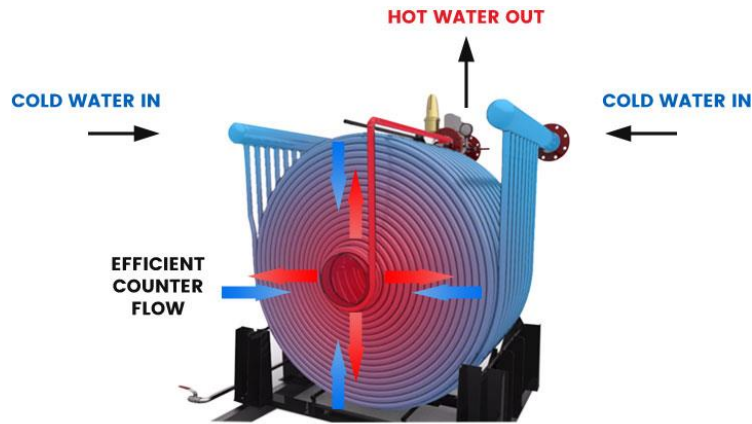


Figure 3: Patented radial pulse heat exchanger

Boiler's heat exchanger is designed for flue gas condensation, for a higher thermal efficiency. Flue condensation will occur if the temperature of the inlet water is below dew point, usually 120 degrees Fahrenheit. Because the flue condensate is a corrosive element, the internal structure of the boiler is constructed out of stainless steel 304/316L or better to offer the highest service life. Corrosion related failures are the typical problems which can be managed through a scheduled progressive inspection and maintenance program.

1.2 Control System

The boiler/water heater control module consists of an "Individual Boiler/Water Heater Control Module", or the "BMS" (Building Management System) signal input module as an option.

With the "Individual Boiler/Water Heater Control Module", the unit's operation is governed by the desired outlet (hot water) temperature. Using a digital, high precision temperature controller, the owner will identify the required hot water temperature. A temperature sensor installed on the boiler/water heater outlet manifold continuously measures the outlet water temperature. A servomotor controlling the gas butterfly valve and the air damper allows for throttling of the air/gas mixture flowing into the burner. For as long as the set temperature is above that of the outlet water, the boiler/water heater operates at maximum output capacity.

1.3 Safety Features

Each H2O BOILER HC series boiler and water heater is equipped with a number of safety features.

- **Low Water Cut Off Switch:** One "McDonnell & Miller" low water cut off switch is installed on the outlet manifold. It prevents the burner from firing when water level drops. When water reaches the LWCO position, the burner will fire.
- **Flame Sensor:** Every Burner type is equipped with an Ultraviolet flame detector or a flame probe sensor. This is connected to the burner controller, and is installed inside the

burner head. At any time after the main gas valve is opened, if flame is not detected for a period longer than 4 seconds, the burner controller will be deactivated and the main gas valve will immediately close.

- **High Temperature Limit:** Each unit is equipped with a “Honeywell” high temperature limit switch. If outlet water temperature exceeds the temperature set on this switch, switch will open and the burner controller will be deactivated and the gas valve will immediately close.
- **Air Pressure Switches:** Every Burner type is equipped with a low air pressure switch is installed on the air inlet of the blower and measures air pressure entering the burner. If the combustion air pressure drops by more than 20% below the nominal air pressure (minimum pressure of 0.4” wc) for any reason such as air inlet obstruction or exhaust obstruction, the burner controller will be deactivated and the main gas valve will immediately close.
- **Relief Valve:** A safety relief valve with prescribed nominal pipe size of 3/4" to 1 1/4" valve inlet/outlet, at 150 psig relief pressure, is installed on the water outlet manifold and supplied as standard equipment. When the boiler or water heater is used in heating applications having working pressures in the range 40–160 psig, an appropriate pressure relief valve should be installed.
- **Gas Pressure Switch:** One manual reset low gas pressure switch is installed on the gas train in between the gas pressure regulator and the first safety shut off valve. If the line pressure drops below 7” wc, the switch will open and the unit will immediately shut down. One high gas pressure switch is also installed. If the gas manifold pressure increases above the pressure on the boiler label, the switch will open and the unit will immediately shut down. High and Low pressure switches can be also installed directly on the available ports of the safety shut-off gas valve. Refer to figure 6 for a typical gas train configuration.
- **Flow Switch:** One Flow switch is installed on the outlet manifold. Flow switch has a very important role. Flow switch is a part of the safety loop, and during normal operation of the boiler, it will be in close position. When flow rate of the water drops below the minimum required flow rate, Flow switch will open and stop the burner immediately. When water flow rate reaches the minimum flow rate for the specific boiler, Flow switch will close up and burner will automatically restart.

Notes: Flow switch installation

- Additional flow switch is to be installed on the inlet piping of the boiler (by user).
- Flow switch’s paddle length is sized according to the manufacturer’s instruction for the intended pipe size.
- Contact H2O BOILER for installation instruction of the Flow switch.

1.4 Gas Lines

1.4.1 Pilot Gas Line

Referring to Figure 5, gas from the main supply line flows at the maximum pressure of 14" wc, through the manual valve into the pilot line. From the pressure regulator it will then flow through the safety shut off valves into the burner. The pilot pressure regulator is adjusted such that gas flows within 2" – 5" wc pressure into the first safety shut off valve. If pilot flame is not established within 5 seconds of the ignition trial time, the flame safeguard will shut off the pilot safety gas valve(s).

The pilot flame will ignite the air/gas mixture flowing through the burner within 5 seconds of the mixture flowing into the burner. In some burner models, a direct ignition system is being used which eliminates the need for pilot gas train.

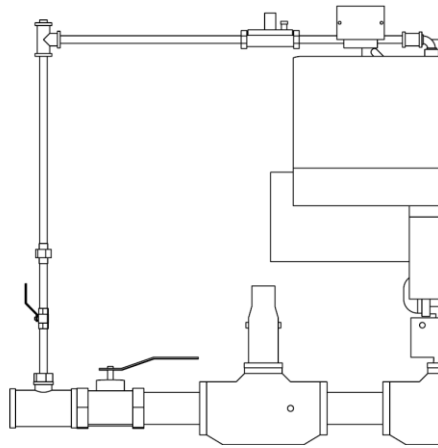


Figure 4: Pilot gas train

1.4.2 Main Gas Line

Referring to Figure 6, gas from the main supply line flows at a maximum pressure of 14" wc, through the manual gas valve into the main gas line. From the pressure regulator it will then flow through the two safety shut off valves, into the second manual shut off valve. Finally gas flows through the gas adjustment butterfly valve into the burner where it is ignited by the pilot flame. The pressure regulator is adjusted such that the manifold gas pressure remains within 0.2 – 3.0" wc. Signals from the temperature controller are sent to the servomotor, which controls the opening of the butterfly valve and the air damper. Subsequently, the valve and damper are proportionately closed or opened in order to decrease or increase the air/gas mixture flow into the burner.

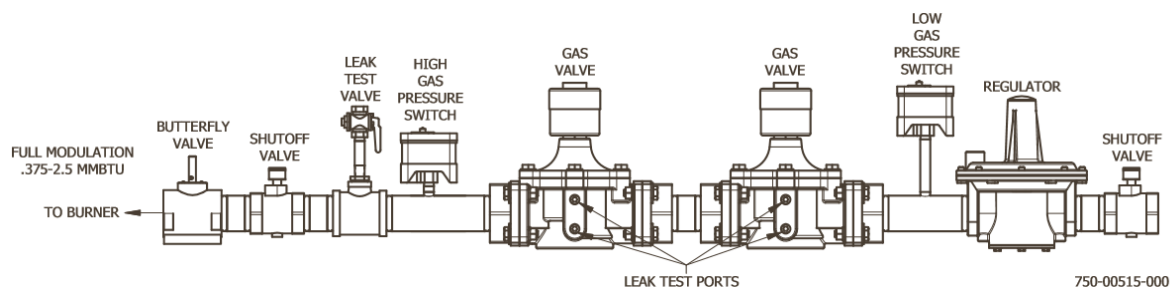


Figure 5: Main burner gas train

1.4.3 Gas Manifold and Control Assembly Tests

Safe operation and all performance criteria of all H2O BOILER products, incorporating the installed gas manifold and control assembly, are proven before delivery when the products are factory tested in accordance with the ANSI Z21.13- CSA 4.9- 2017 standards for Gas-fired hot water boilers and ANSI Z21.10.3-2015-CSA 4.3-2015 for Gas-fired water heaters, circulating or instantaneous.

1.4.4 Code Compliance

In Canada, boiler installation must conform to the requirements identified in the CGA Codes CAN1-B149-1 or CAN1-B149-2 for gas burning appliances, CSA Codes B51 for boiler, pressure vessel, and pressure piping, and/or all applicable local codes. All electrical connections are to be made in accordance with the requirements of CSA C22.1, Canadian Electrical Code, Part 1, and/or all applicable local codes.

In the United States of America, the installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1-latest edition. All electrical wiring must be carried out in accordance with the National Electrical Code ANSI/NFPA No.70-latest edition, and any additional state or local code requirements. If an external power source is used, the unit must be electrically grounded in accordance with the requirements of the authority having jurisdiction. In the absence of such authority, the boiler must be electrically grounded in accordance with the National Electrical Code ANSI/NFPA No. 70-latest edition.

The plumbing and condensate disposal must be carried out in accordance with the local plumbing codes.

« Cet appareil doit être installé selon les règlements locaux, ou en l'absence de tels règlements, selon le *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, ou les, *Code d'installation du gaz naturel et du propane*, CSA B149.1. »

NOTES:

- *Air and gas flow rates are factory adjusted for optimum combustion quality. Note that these settings may vary slightly at different site conditions (calorific value of gas, duct length, elevation, etc.)*
- *After installation is completed, using a gas analyzer, the CO and O₂ contents of the exhaust gases should be re-checked to ensure their compliance with those achieved at the factory and reflected in the test report provided to your local H2O BOILER representative.*
- *IF adjustments to the factory settings of air and gas flows are made, ensure that the manifold gas pressure does not exceed the pressure specified on the boiler label.*

WARNING:

Exceeding the maximum allowable gas manifold pressure could result in over-firing of the unit and may cause permanent damage to the unit.

1.5 Freeze Protection and Storage

In either an open or a closed loop configuration, the boiler must be isolated before draining. Due to the radial geometry of the unit, it can only be drained by forced air method. The operator can connect the forced air through the 3/8" air vent on the manifold and the drain connection on the 3/8" connection on the other manifold.

For short term storage, the operator can add antifreeze to protect the boiler against freezing condition. In this case, the boiler or water heater does not need to be drained. The antifreeze must be compatible with hydronic heating systems.

1.6 Water Treatment

All heat exchanger coils are constructed from high grade stainless steel. Therefore, high oxygen content in the feed water should not result in any corrosion inside the coils. Since water flow through coils is in turbulent mode, and they are continuously expanding and contracting; the operation of the unit is to a large extent self-cleaning. Therefore, other potential minerals that may exist in water should not have any adverse effect (on the tubes). However, if it is wished to supply soft water to the boiler or water heater, then a sodium-based ion-exchanger may be used. Note that "soft water" is defined as one having less than 0.12° British, or 0.17° US hardness level. Consult a local water treatment consultant to determine if water treatment is required.

NOTES:

- *Boiler/water heater can be used in both closed loop and open loop (one pass) operations.*
- *In the commonwealth of Massachusetts the installation shall be carried out by a licensed gas fitter/plumber and comply with 48CMR*

SECTION 2: INSTALLATION

2.1 Water Heater/ Boiler Package

Upon the receiving and unpacking of the equipment, check for any sign of damages, hit or dents. Pay special attention to the gas train parts and safety devices installed. Verify total number of pieces being shipped with the packing slip. All safety devices will be installed at the factory.

Warning:

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

Each unit is supplied with:

- Burner/ Blower.
- Inlet and outlet manifolds.
- High temperature cut off switch with manual reset.
- Operating temperature controller.
- Pressure relief valve.
- Fully assembled gas train.
- One Temperature sensor installed on the outlet manifold
- Condensates drain kit.
- Flame sensor (inside burner).
- Flue gas connection.
- Pressure-Pressure/temperature gauge.
- All Safety features as described in **Section 1.3.**

Please contact H2O BOILER if items listed above are missing. Please be familiar with major parts of the boiler before operating. Always exercise caution when transporting. Instructions provided are only general guides, and are not substitute for common sense and sound safe practices.

2.2 Removal of Existing Boiler

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

- Seal any unused openings in the common venting system.
- Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance 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. Close fireplace dampers.
- Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
- 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.
- After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous condition of use.”
- Any improper operation of the common venting system should be corrected so the installation conforms to the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/or the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Chapter 13 of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/or the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1.

2.3 Clearance from Combustible Material

Table 3: Clearances from combustible material

MODELS	TOP	FRONT	FLUE	BACK	L, SIDE	R, SIDE	FLOOR
ALL	40"	40"	1"	24"	24"	24"	Non-Combustible

Note:

Refer to appliance rating plate for specified clearances for combustible material.

Note:

Indicated clearances are minimum values; leave enough space for burner removal and cleaning of the heat exchanger.

2.4 Location

Notes:

- *Never install directly on carpet.*
- *For other than a direct vent appliance, the appliance must be located as close as practicable to a chimney or gas vent.*
- *The appliance should be located in an area where leakage of the tank or connections will not result in damage to the area adjacent to the appliance or to lower floors of the structure. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. The pan must not restrict combustion air flow.*

- This boiler/water heater is for indoor installation only.
- For service access to the Burner control box, condensate drain “U” trap, and gas train, refer to the clearances indicated on the boiler/water heater rating plate. Note that some jurisdictions may have their own clearance requirements. In such cases refer to all applicable local codes.
- The boiler/water heater can be placed in a basement or utility room. It should not be placed in an unconditioned area where the unit and condensation could be subject to freezing temperatures.
- For reduced installation cost, locate the boiler/water heater as close to an outside wall as possible.
- Flue gases can be vented out directly through a wall, or in case of retrofit installation, the flue gas duct can be extended into the existing chimney.
- Keep boiler/water heater area clear and free from combustible materials, gasoline, flammable vapors and liquids.
- Ensure that inlet to the blower is kept clear of any obstruction so that combustion air can flow freely through to the air intake blower.
- A resilient pad to separate the boiler/water heater from floor when the appliance is installed directly on carpeting, the appliance shall be installed on a metal or wood panel extending beyond the full width and depth of the appliance by at least 3 in (76.2 mm) in any direction or, if the appliance is installed in an alcove or closet, the entire floor shall be covered by the panel. The panel must be strong enough to carry the weight of the heater when full of water.

2.5 Relief Valve piping

A pressure relief valve is supplied as standard equipment. The relief valve is extra protection against damage that could be caused by excessive water pressure. Either, mal-functioning of controls, or creation of steam pockets due to water stagnation in some parts of the coils, may cause such excessive pressure. This latter condition could arise if one or both coils are not properly purged.

The pressure relief valve should be connected to a suitable water drain. The drain pipe **MUST** pitch down from the valve and its internal diameter should not be less than that of the relief valve. The end of the drain line should not cause any restriction to the water flow, and should be protected from freezing. There should not be any valve of any type installed between the pressure relief valve and the end of the drain line. Similarly, there should not be any instrument installed anywhere along the length of the drain valve, between the relief valve and the end of the drain line. The relief valve is installed in vertical position and should remain in that position at all times.

2.6 Water Connection

Note:

If a water heater is installed in a closed water supply system, such as one having a backflow preventer in the cold water supply line, means shall be provided to control thermal expansion. Contact the water supplier or local plumbing inspector on how to control this situation.

All pre-installation work has been completed at the factory. Two water manifolds (inlet and outlet headers) are provided with the unit.

Cold-water inlet and hot water outlet connections are clearly marked on the respective manifolds of the boiler/water heater. The cold water supply line (in one pass applications), or return water (in closed loop applications) should be connected to the cold water inlet of the unit. The hot water supply line should be connected to the hot water outlet of the boiler. Both manifolds have 3" stainless steel flange, ANSI 150 lbs inlet/outlet connections.

For further information on methods of connecting supply and return water piping to boilers/water heaters consult available installation and piping guides developed according to local plumbing codes.

2.6.1 Potable water heater connection

In the case where water heater is being used for water (potable) heating and space heating:

- The piping and components connected to the water heater for the space heating application shall be suitable for use with potable water.
- Toxic chemical, such as used for boiler treatment, shall not be introduced into the potable water used for space heating.
- A water heater that will be used to supply potable water shall not be connected to any heating system or component(s) previously used with a non-potable water heating appliance.
- Water heaters for combination water/space heating cannot be used in space heating application only.

2.6.2 Piping Arrangement

Typical flow arrangements for primary and secondary water piping are shown in Figures 6 – 10 below.

Single Boiler

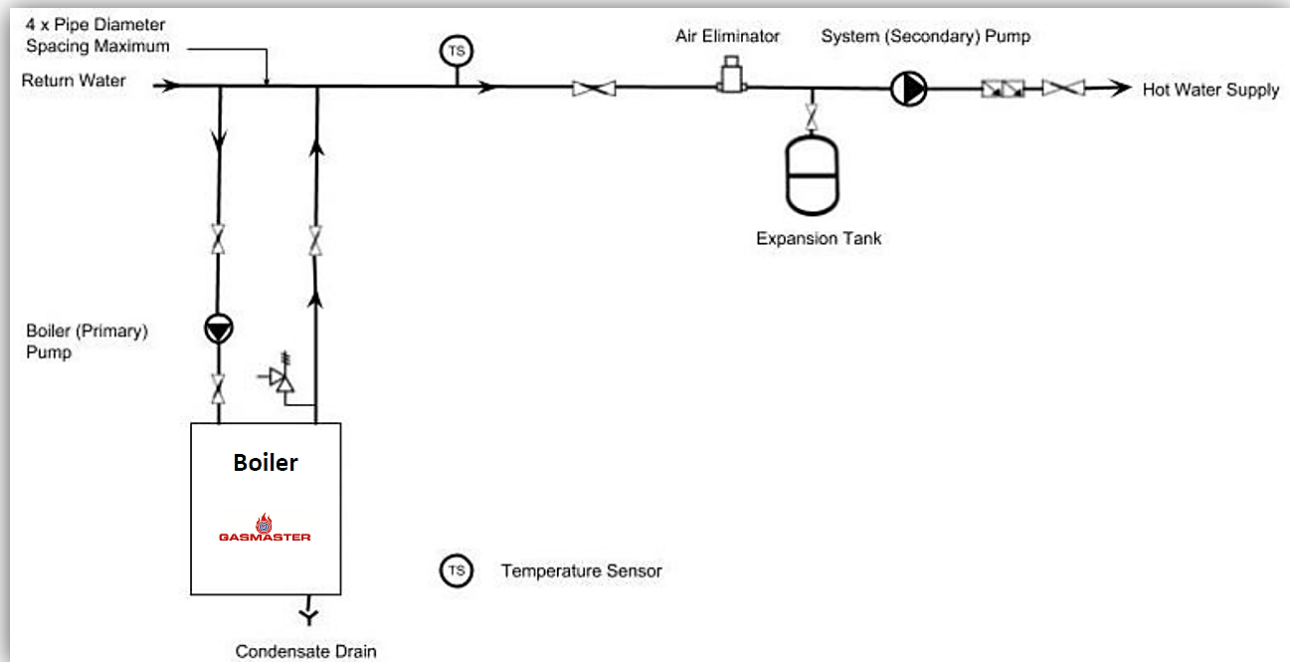


Figure 6: Primary/Secondary Piping for Condensing Boilers (Single)

Single Boiler w/ Storage Tank

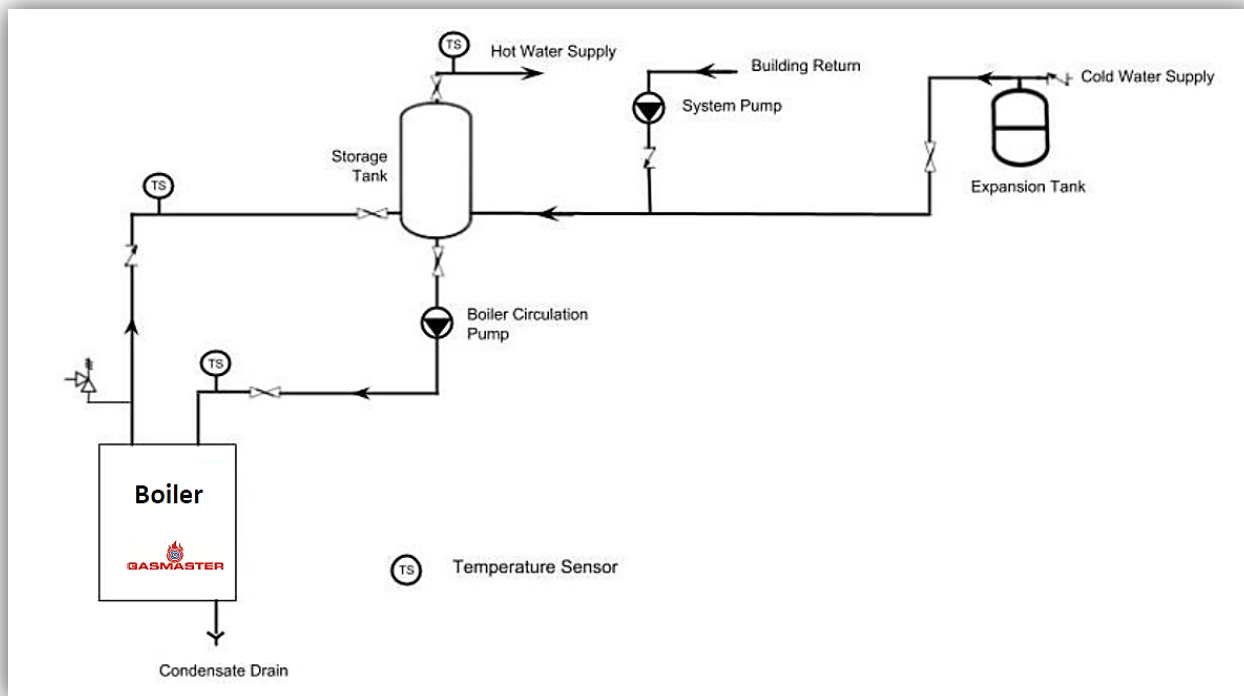


Figure 7: Primary/Secondary Piping for Condensing Boilers (Single with storage tank)

Multiple Boilers

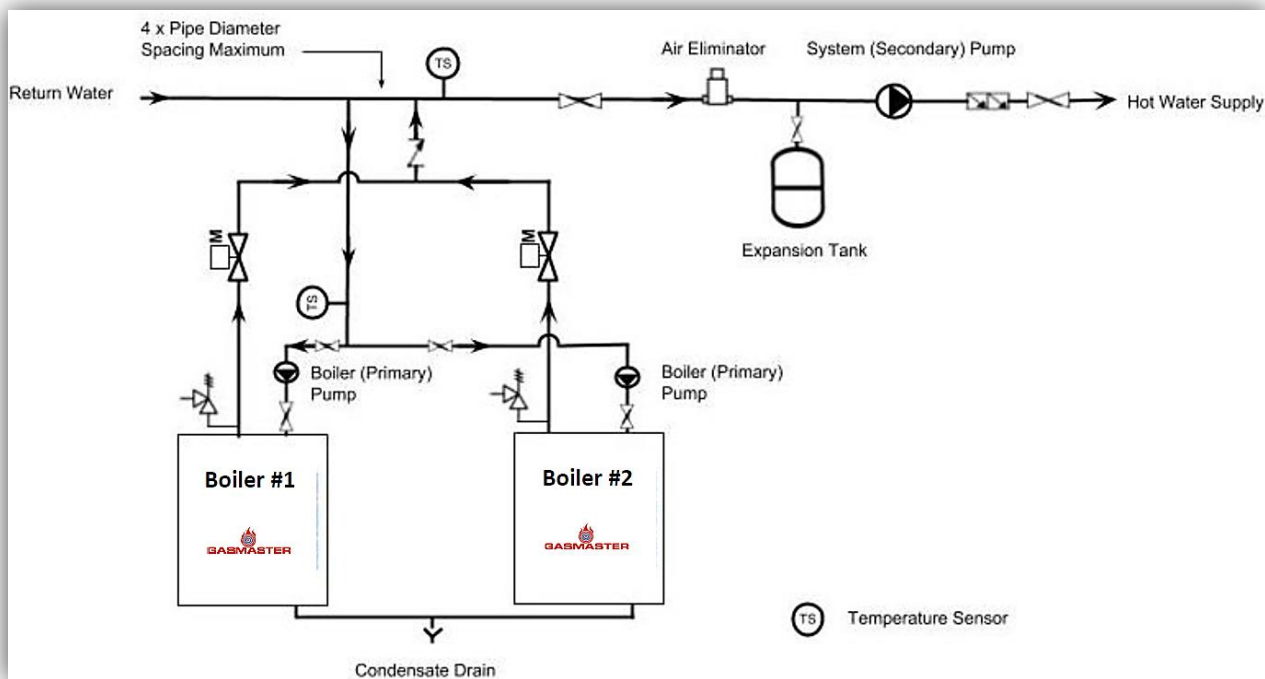


Figure 8: Primary/Secondary Piping for Condensing Boilers (Multiple)

Variable Flow Arrangements (Primary Only)

Single Boiler

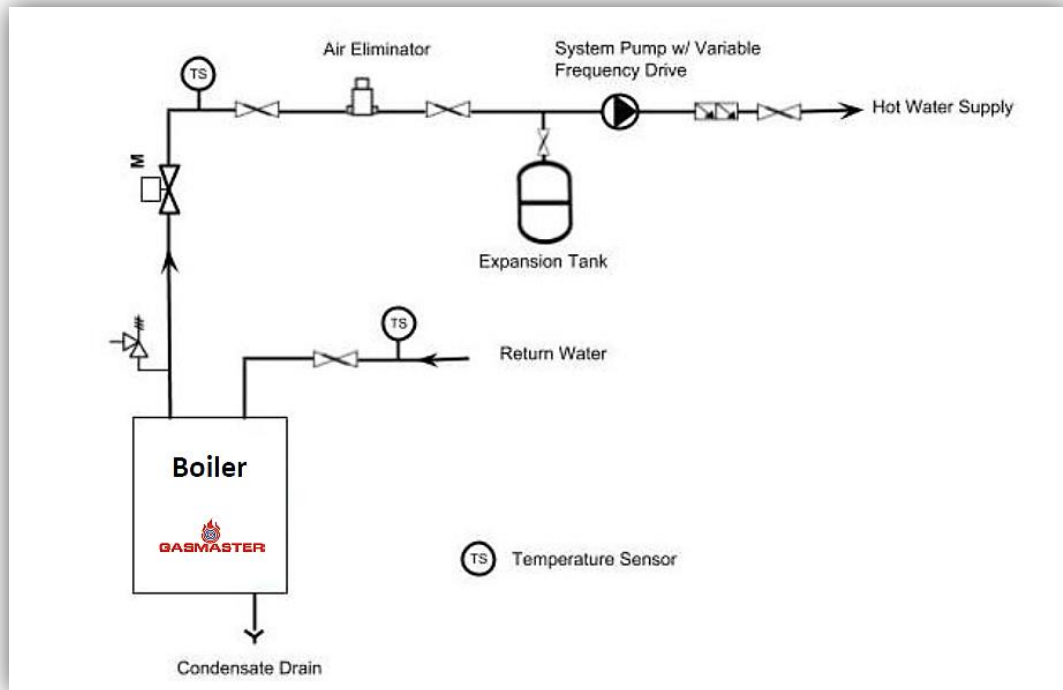


Figure 9: Primary Only Variable Flow (Single)

Multiple Boilers

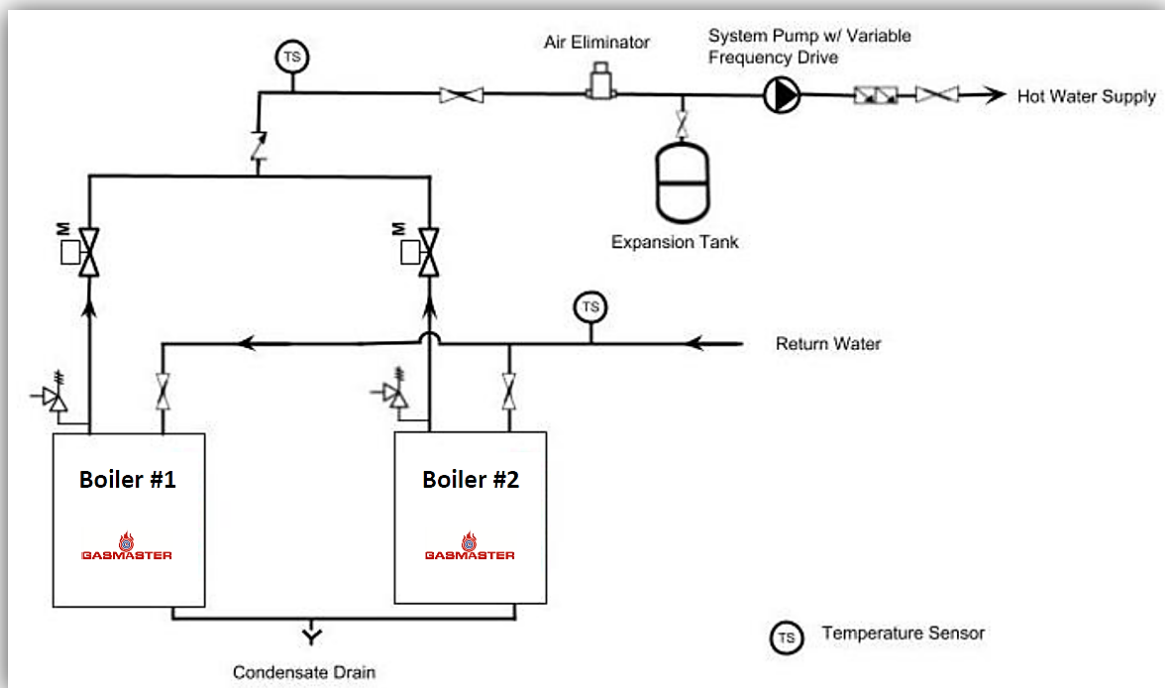


Figure 10: Primary Only Variable Flow (Multiple)

2.7 Condensate Line

Connect 3/4" ABS tubing from the condensate drain "U" trap, directly to the floor drain. Notice that the line **MUST** be pitched downward towards the floor drain to avoid traps. **DO NOT** install any valve of any type, or any other instrument between the condensate drain "U" trap and the end of the condensate line.

NOTE:

To ensure proper flow of condensate, it is recommended to install a "drain vent" of approximately 1 foot height at 0.5-1 foot downstream of the U trap.

2.8 Gas Line Connections

The installation must conform with one or more of the following, as applicable:

- Local codes or, in the absence of local codes, the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 and/or CSA B149.1, *Natural Gas and Propane Installation Code*.
- The *Manufactured Home Construction and Safety Standard*, Title 24 CFR, Part 3280 and/or CSA Z240 MH Series, *Manufactured Homes*.
- Local codes or, in the absence of local codes, *Recreational Vehicles*, NFPA 1192 and/or CAN/CSA-Z240 RV Series.

Review the instructions below before any installation:

- The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of ½ psi (3.5 kPa).
- The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than ½ psi (3.5 kPa).
- The appliance and its gas connection must be leak tested before placing the appliance in operation.
- Install gas line for the appliance according to applicable codes.

The gas train comprises a pressure regulator, low gas pressure switch, solenoid valve, and the main gas valve Figure 6. Gas pressure at the inlet to the pressure regulator should always remain in the 7" – 14" wc range. If higher pressures are present, consult the local gas company or gas installation codes for installing the appropriate gas pressure regulator. Gas line from the meter to the boiler/water heater should be of adequate size to prevent undue pressure drop. A manual shut off valve should be installed in the gas line upstream of the pressure regulator, so that the control

instruments (main gas valve, boiler/water heater gas regulator, and low gas pressure switch) could be easily isolated and removed, whenever necessary. The valve should be clearly marked, located outside the unit's housing, readily visible and accessible for turning on and off. If the unit is to be installed in, under, or directly attached to a pool, or spa, structure, the said manual valve should be located outside the structure.

NOTE:

Inlet gas pressure upstream of the unit must always remain within the 7" – 14" WC range. The maximum inlet gas pressure must not exceed the value specified by the manufacturer and that the minimum value listed is for the purposes of input adjustment.

2.9 Electrical connection

If an external electrical source is utilized, the appliance, when installed, must be electrically grounded in accordance with local codes or, in the absence of local codes, with the *National Electrical Code*, ANSI/NFPA 70 and/or the CSA C22.1, *Canadian Electrical Code, Part 1*.

CAUTION:

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

2.10 Vent Connection

For US and Canadian installations, vent termination must be in accordance and not less than those specified in the current ANSI Z223.1/NFPA 54 *National Fuel Gas Code* or CSA B149.1, *Natural Gas and Propane Installation Codes*, as applicable.

Warning:

*Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenylsulfone) in non-metallic venting systems is prohibited.
Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.*

Provisions for adequate combustion and ventilation air in accordance with one of the following:

- The *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 (Current Edition);
- *CSA B149.1, Natural Gas and Propane Installation Code* (Current Edition); or
- Applicable provisions of the local building code.

2.10.1 Suggested Single wall Vent system

It is recommended to install prefabricated factory-made vent parts each designed to be assembled with the other without requiring field fabrication.

Table 4 Suggested Venting System

Manufacturer	Vent Part Model	Material/Rigid Vent	Listed
Heat-Fab Inc.	Saf-T Vent System	Stainless Steel, (AL-29-4C), corrosion resistance for use with Class II, III and IV gas boilers – ANSI Z21.13	UL 1738 and ULC 636 Type BH special gas vent
NovaFlex, Z-FLEX	Z-Vent	Stainless Steel, (AL-29-4C), corrosion resistance for use with Class II, III and IV gas boilers – ANSI Z21.13	UL 1738 and ULC 636 Type BH special gas vent
DuraVent	FasNSeal	Stainless Steel, (AL-29-4C), corrosion resistance for use with Class II, III and IV gas boilers	UL 1738 and ULC 636 Type BH special gas vent

Refer to Guide line below for vent terminal termination

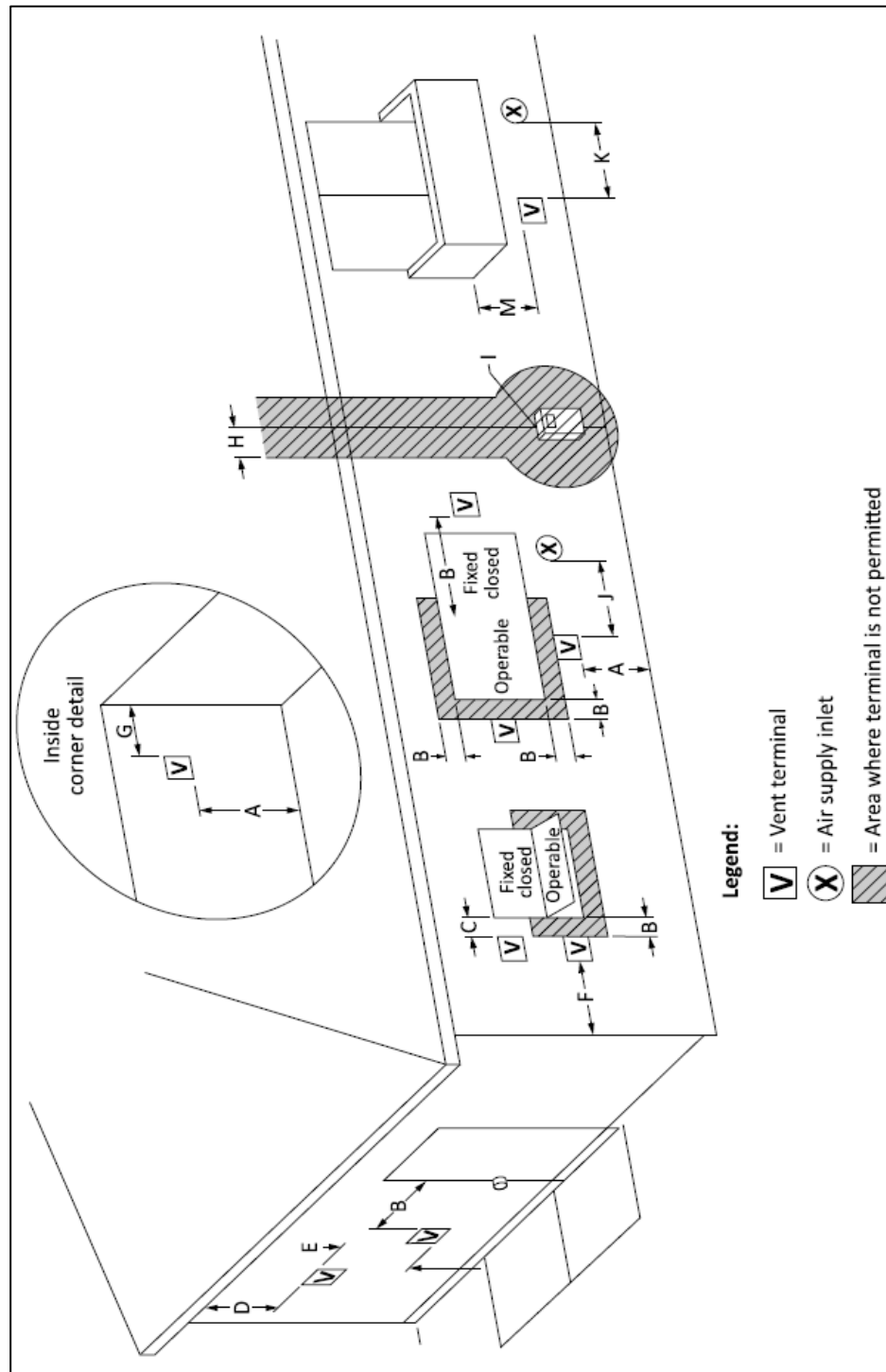


Figure 11: Vent Terminal Termination

Table 5: Vent Termination Guide Line

		Canadian installation (note 1)	US installation (note 2)
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm) (Note 7)
B =	Clearance to window or door that may opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
C =	Clearance to permanently close window	See note 4	See note 4
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal	See note 4	See note 4
E =	Clearance to unventilated soffit	See note 4	See note 4
F =	clearance to outside corner	See note 4	See note 4
G =	Clearance to inside corner	See note 4	See note 4
H =	Clearance to each side of center line extended above meter/ regulator assembly	See note 4	See note 4
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	See note 4
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13) See note 5	7 ft (2.13 m)
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm) See note 6	See note 4

Notes:

1. In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code.
2. In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code.
3. For clearances not specified in ANSI Z223.1/ NFPA 54 or CSA-B149.1. Clearance in accordance with local installation codes and the requirements of the gas supplier
4. "Clearance in accordance with local installation codes and the requirements of the gas supplier."
5. A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
6. Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
7. Value is the minimum from the average snow line, refer to local codes for more specific requirements.

The vent for this appliance shall not terminate:

- Over public walkways; or
- Near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage; or
- Where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Vent termination should be in accordance with all applicable local codes. In addition, the following conditions must be satisfied:

- Distances from adjacent public walkways, buildings, windows and building openings, should be consistent with the National Fuel Gas Code, ANSI Z223.1.
- Minimum clearance of 4 feet (1.22 m) horizontally and in no case above or below, unless a 4-foot (1.22 m) horizontal distance is maintained from electric meters, gas meters, regulators and relief equipment.

For other than a direct vent appliance,

- The appliance must be located as close as practicable to a chimney or gas vent.
- The appliance should be located in an area where leakage of the tank or connections will not result in damage to the area adjacent to the appliance or to lower floors of the structure.
- When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. The pan must not restrict combustion air flow.
- The duct should be corrosion resistant, air tight and short as possible. A condensate drain is highly recommended for long duct or single wall vent. The condensate drain pipe should pipe the condensate to appropriate drain. The combustion gases can be exhausted either directly through the wall, or through a chimney (in case of retrofit applications). If venting directly through a wall, allow at least a 5% rising slope of horizontal duct immediately after the exhaust outlet on the boiler. Vent installation should be done by professional contractor and in accordance to local building code and/or CSA B149.1 or ANSI Z223.1.

2.10.2 Vent Sizing

When determining the equivalent vent lengths, use the following table. Shown vent diameter in Table 1 has been selected based on total of 100 feet equivalent length of air intake plus vent.

Table 6: Vent fittings equivalent length

Fitting	Equivalent Lengths
90 deg. Elbow	3'
45 deg. Elbow	2'
Condensate Tee	2'
Vent Cap	3'

NOTES:

- *The exhaust venting system must meet the requirements of type BH, category II or IV boilers (i.e. corrosion resistant, water and air-tight).*
- *The exhaust duct outlet to the atmosphere MUST be wind protected by an approved wind cap.*

Periodically inspect the vent duct for pin holes or cracks. Maintaining gas tight seal is very necessary and important. Please apply appropriate condensate sealant (Mill-Pac) on these openings.

2.11 General Instructions

- The boiler/water heater and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system, at test pressures in excess of 0.5 psig. The unit must be isolated from the gas supply piping system by closing its individual manual shutoff valve, during any pressure testing of the gas supply piping system at test pressures equal or less than 0.5 psig.
- The boiler/water heater should be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation or service.
- The boiler/water heater and its gas connection must be leak tested, before placing the boiler in operation.
- The boiler/water heater when installed must be electrically grounded and bonded in accordance with the local codes or in the absence of such codes, in accordance with the National Electrical Code, ANSI/NFPA 70.
- The boiler/water heater should be located in an area where leakage of the tank, or connections, will not result in damage to the area adjacent to the appliance or to the structure. When such locations cannot be avoided, it is recommended that a suitable drain pan, that drains adequately be installed under the boiler. The pan must not restrict air- flow.
- The boiler should always be purged of natural gases before starting up. The operator should also investigate and identify the cause of any trip before attempting to relight the boiler.

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SECTION 3: OPERATION

All units are factory assembled with Low Water Cut Off, ASME pressure relief valves (HV stamp), pressure gauges, high temperature limit cut off, gas pressure switch, air pressure switch, drain valves and vent valves. Flame sensors provided are either flame rod or UV sensor.

In addition to standard controls and safety devices provided with the boiler, compliance with ASME CSD.1, IRI and FM codes and requirements are available.

3.1 Sequence of Operation

3.1.1 Safety Loop

A) Components

Referring to section 1.3, for a description, and Figure 13, Control System Schematic, the safety loop includes the following components:

- *High temperature cut off switch*
- *Operating temperature switch*
- *Low water cut off switch*
- *Low gas pressure switch*
- *Air Pressure Switches*
- *Flow Switch*

WARNING:

Do not bypass any of the instruments in the safety loop. Doing so may cause serious damage to the unit and its surroundings.

B) Remote Enable/Disable

Every boiler/water heater is fully tested at the factory prior to shipment. When the unit is tested at the factory, a “jumper” is placed between terminals identified as “Remote Enable/Disable” (see Figure 13). If BMS is used, this jumper should be replaced by wires from the BMS. In the absence of a BMS, the operation of the unit is governed by the Siemens temperature controller.

3.1.2 Pre-Purge

- Once the blower starts operating, the air pressure switch will close. This switch has been factory adjusted such that when the blower reaches its minimum frequency it will close.

- When the air pressure switch is closed and safety loop is satisfied, pre-purge will start.
- Blower continues to run at its maximum frequency for a period identified as the purge time.

3.1.3 Pilot Flame

- After completion of the pre-purge period, the burner controller sends the required voltage to the ignition rod, and 120V to the two, pilot safety shut off valves. The valves open simultaneously with the activation of the ignition rod. Upon pilot ignition, and after the flame is detected by the sensor, the ignition rod will be deactivated.
- If after 5 seconds activation of the flame rod and opening of the gas valves, pilot flame is not established and detected by the flame sensor, the gas valves will immediately shut down and the boiler/water heater goes into the “lock-out” mode. The unit will not re-start until the burner controller is manually reset.

3.1.4 Main Flame

- Once pilot flame is established burner controller will send 120V to the two main safety shut off valves. From these valves, gas flows into the gas butterfly valve.
- Air supplied by the blower flows through to the burner head where it mixes with gas and the air/gas mixture is ignited.
- The pilot safety shut of valves will open five seconds after the main safety valves are closed. If at any time during the operation flame (pilot or main) is not detected the boiler/water heater will immediately shut down and will not restart until the burner controller is manually reset.

NOTES:

- *Air and gas flow rates are factory adjusted for optimum combustion quality. Note that these settings may vary slightly at different site conditions (calorific value of gas, duct length, etc.).*
- *After installation is completed, using a gas analyzer, the CO and O₂ contents of the exhaust gases should be re-checked to ensure their compliance with those achieved at the factory and reflected in the test report provided to your local H2O Boiler representative.*
- *IF adjustments to the factory settings of air and gas flows are made, ensure that the manifold gas pressure does not exceed the pressure specified on the boiler label.*

WARNING:

Exceeding the maximum allowable gas manifold pressure could result in over-firing of the unit and may cause permanent damage to the unit.

3.1.5 Continuous Operation

The unit continues to operate at low fire for as long as the outlet (discharge) temperature remains higher than the desired temperature- with respect to the differentials -, and lower than the maximum operating temperature; both being set on the temperature controller. The temperature sensor installed on the outlet manifold continuously measures the discharge water temperature. Signals from this sensor are sent to the temperature controller. As soon as the discharge water reaches the desired temperature (set on the controller by the owner), the process is reversed and the input is decreased so that discharge water remains at constant temperature. This throttle (load tracking) process continuously takes place through increase or decrease in the air/gas mixture (opening/closing of the butterfly valve and air damper), thereby ensuring water is always supplied at ± 1 °C of the desired operating (discharge) temperature.

If the outlet water temperature reaches the maximum operating temperature, the boiler/water heater will shut down and goes into the standby mode. The unit will automatically re-start when the water temperature drops below the operating set point minus the differential temperature.

NOTE:

If as a result of mal-functioning of the temperature controller the discharge water temperature increases above that of the high limit temperature switch, the unit will automatically shut down and will not re-start until said switch is manually re-set.

3.2 PRE-COMMISSIONING

Water connections (Return and Supply Lines)

- Purge air from the piping system, and from the boiler/water heater. To purge the unit, run water through the open coils for at least 5 minutes. The coils are now completely purged.

Gas Connections

- All pipe connections should be carried out in strict compliance with all applicable local codes.
- Selection of the gas regulator model and size should be carried out in accordance with the design requirements.
- Conduct a complete leak test on the unit's gas train, and associated components.
- Measure the static pressure upstream of the unit to ensure it is within the prescribed range of 7" - 14" wc.

Vent Connection

- Installation must be carried out in accordance to all applicable local codes and factory guidelines.
- When required, a proper drain should be installed on the vent.

Condensate Line Connection

- Inspect the condensate line and ensure it is installed in accordance with the factory guidelines.

Power Connection

- Inspect all wiring connections to the unit and ensure they comply with all applicable local codes.
- Ensure that the appropriate power supply has been connected to the unit (please refer to the electrical rating on the unit's nameplate).
- Ensure the temporary jumpers have been removed from the unit's control panel.
- If applicable, ensure the external control connections have been wired.

NOTE:

*Start-up and commissioning **MUST** be carried out by a GMI qualified technician.*

WARNING:

Ensure the manual gas valve is closed prior to power being supplied to the boiler/water heater

3.3 Commissioning

- Purge heat exchanger coils in accordance with the procedure outlined in paragraph I of section 3.2.
- Measure and meter the flow rate through the unit to be at least at the minimum of flow rates indicated in Table 1.
- Connect (plug in) the power supply to the proper outlet. Turn the “ON/OFF” switch to the “ON” position.
- After the system has undergone the sequence of events described in Section 3.1 above and when the two safety shut off valves in the main gas line are opened, the unit will be in regular operating mode.
- The Dungs air pressure switch installed on the side of the burner/ blower has been factory set at 0.3” wc.
- The boiler should be purged of any combustible gases before starting.
- **Test Points**
 - Measure gas line pressure upstream of the gas pressure regulator to ensure it is within the specified range of 7” – 14” wc.
 - Measure the gas manifold pressure at the test point located adjacent to the burner’s gas inlet connection port; ensure it is within the specified range on the burner label.

WARNING:

The gas manifold pressure should not exceed the maximum value shown on the unit’s nameplate.

3.4 Boiler Capacity and recovery rate

Determining What Boiler Capacity You Need

To determine the correct H2O BOILER for your application, follow these simple steps:

- Locate the temperature difference (ΔT) required by your system at the top of the table.
- Moving down the chart, select the GPM flow rate closest to that you require.
- From that point, select the boilers appropriate for your chart position from the column on the left.
- The pressure drop (PSI) is also shown in Table 7 based on the selected flow rate.

Note: This chart provides approximate values for estimation purposes; conditional safety factors and application specifics may affect boiler requirements.

Table 7: HC Series boiler capacity selection (safety factor of 25% already included)

HC Model		Temperature Difference (°F)											
		20	30	40	50	60	70	80	90	100	110	120	130
600	Flow (GPM)	43	29	21	17	14	12	11	10	9			
	Press. Drop (PSI)	1	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1			
1000	Flow (GPM)	71	47	36	29	24	20	18	16	14			
	Press. Drop (PSI)	1	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1			
1500	Flow (GPM)	107	71	53	43	36	31	27	24	21	20		
	Press. Drop (PSI)	1	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1		
2000	Flow (GPM)	143	95	71	57	47	41	36	32	29	26	24	
	Press. Drop (PSI)	1.1	0.6	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	
2500	Flow (GPM)	178	119	89	71	59	51	45	40	36	32	30	27
	Press. Drop (PSI)	1.3	1	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1

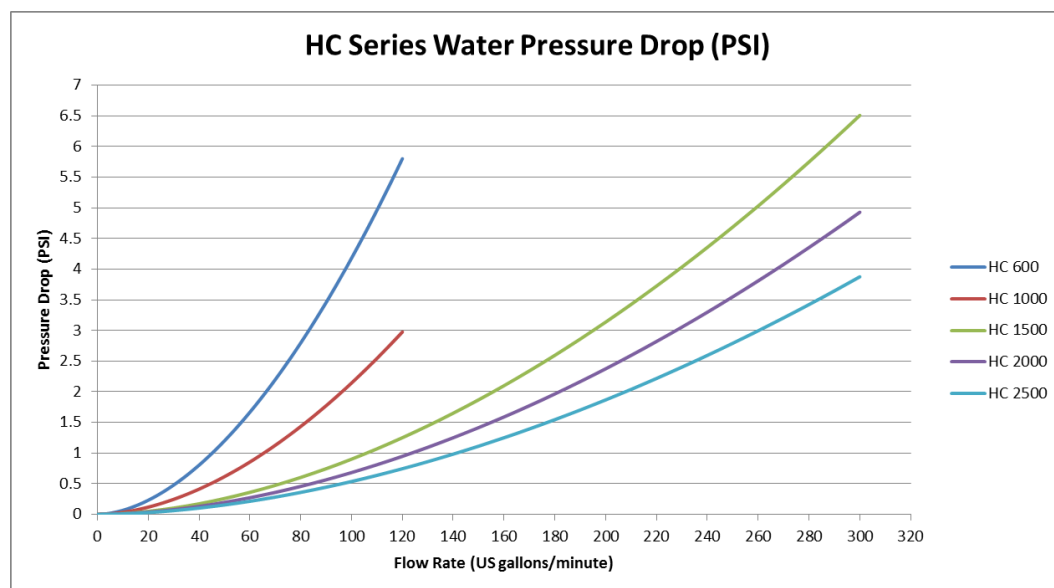


Figure 12: HC Series Water Pressure Drop

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SECTION 4: MAINTENANCE

The H2O BOILER HC Series units require the following maintenance duties performed to ensure long and problem free service life. Failure to perform the maintenance duties described in this manual and unit component literature may result in severe damage to the unit and/or the mechanical system.

4.1 Maintenance Schedule

The unit owner and/or operator is required to follow the maintenance schedule below.

Monthly	<ul style="list-style-type: none"> • Check unit gas piping • Check unit ventilation stack • Check unit air piping (if applicable) • Check unit pressure relief valves • Check unit condensate drain system
Every six months	<ul style="list-style-type: none"> • Use a combustion analyser to check combustion performance
Annually or end of heating season	<ul style="list-style-type: none"> • Shutdown the unit • Perform annual maintenance procedure • Perform commissioning start-up (for year round usage)

4.2 General Procedure

The following maintenance procedure is required to be performed annually and prior to every cold unit start.

- **Address existing problems**
 - Address any existing problems reported by the owner, building operator and resolve before proceeding with the maintenance service.
- **Inspect mechanical room**
 - Before proceeding work on the unit, remove all combustible or flammable materials within the minimum clearances to combustibles.
 - Clean up the unit area. If the unit draws combustion air directly from the mechanical room, remove any unnecessary items that may obstruct or contaminate combustion air.
- **Inspect Boiler Casing**
 - Inspect the sheet metal covering the insulation for any sign of rust or corrosion. If necessary, contact your service person to clean the sheet metal panels.

- **Clean up condensate drain**
 - Inspect the condensate drain system including the drain line, vent line, fittings and condensate trap.
 - Ensure there are no restrictions.
- **Inspect all piping**
 - Inspect all gas and water piping and check for leaks.
 - Fix the leaks if found.
- **Inspect ventilation system**
 - Inspect the entire ventilation system for air and flue gas. Check for obstruction, corrosion and leakage. Fix any leakages on fittings or from corrosion.
 - Check the duct and draft hood to ensure there is no restrictions or signs of rust.
 - Inspect all flue gas passageways, including the inner surface of the heat exchanger for any sign of rust or corrosion.
- **Inspect pressure relief valve**
- **Inspect burner system (IMPORTANT – Dual Fuel Option)**
 - Remove the top cover by undoing the fasteners securing the cover.
 - Remove the burner pilot, UV flame sensor and the flame observation port.
 - Check for calcification on the surfaces of the pilot and flame sensor.
 - Clean the glass on the flame observation port.
 - Replace the components if determined unserviceable.
 - Check for any piping/orifice blockages.
 - Inspect the central plate and the burner for any sign of damage or corrosion.
- **Inspect electronic wiring**
 - Inspect the unit wiring and ensure the leads are securely attached and free of deterioration.
- **Inspect control settings**
 - Check the unit settings are matching the operator's requirements.
 - Any other unit components may have user-specific settings as well. Inspect the settings and maintain consistency (*if applicable*).
- **Initiate unit start-up**
 - Follow the instructions in Section 3: Operation, start the unit.
 - Continuously monitor unit operating temperature and pressure as the post start-up maintenance duties are performed.

4.3 Service Notes

- H2O BOILER boilers and water heaters have been designed and developed based on a unique patented technology. When operated properly, the products will provide the owner with years of trouble free performance. To benefit for many years, from the unique performance characteristics of these boilers and water heaters, it is recommended to have your boiler/water heater inspected by a qualified service person at least once every year.
- Ensure that air intake and exhaust ducts are always free of any debris and restrictions. This will allow the electric motor to operate under normal loads, as well as allowing for a clean combustion process. Do not store anything against the boiler and ensure that the boiler is kept in a clean environment. Do not store any combustible material, flammable liquid, or vapor, in the vicinity of the boiler.
- Should overheating occur or the gas supply fails to shut off, turn off the manual gas control valve.
- Label all wires prior to disconnection when servicing the controls. Wiring errors can cause improper and dangerous operation.
- Verify proper operation after each service (refer to the start-up report).

4.2 Troubleshooting

Fault	Cause	Corrective Action
<ul style="list-style-type: none"> ◆ Blower does not start 	<ul style="list-style-type: none"> ◆ Power not supplied to the unit. ◆ Safety loop open. ◆ None of the above 	<ul style="list-style-type: none"> ◆ Ensure power switch is on. ◆ Check both fuses on the power and the supply sides. ◆ Ensure BMS (if connected) calls for heat. ◆ Ensure high temperature limit switch is closed. ◆ Ensure operating temperature switch is closed. ◆ Ensure low gas pressure switch are closed. ◆ See burner catalogue for burner controller trouble shooting.
<ul style="list-style-type: none"> ◆ Unit does not start 	<ul style="list-style-type: none"> ◆ Blower does not run. ◆ Air pressure switch installed on the housing is open. ◆ Gas pressure switch is open. ◆ No ignition. 	<ul style="list-style-type: none"> ◆ See above ◆ Adjust switch. ◆ Replace switch (if defective). ◆ Adjust the switch. ◆ Replace switch (if defective). ◆ See burner catalogue for burner controller trouble shooting
<ul style="list-style-type: none"> ◆ Pilot flame failure 	<ul style="list-style-type: none"> ◆ Pilot gas valve not opened ◆ No ignition 	<ul style="list-style-type: none"> ◆ Check the electrical connections to ensure they are all securely connected (see the schematic wiring diagram for terminals). ◆ Check the two safety shut off valves. Replace if defective. ◆ Check the electrical connections to ensure they are all securely connected (see burner catalogue) for terminals. <p>Measure gas pressure and air pressure in the pilot burner at the available test port. Ensure it is within the specified 2"-5" wc. If pressure is not available check both safety shut off valves and the pressure regulator. Replace any defective component, if necessary.</p>
<ul style="list-style-type: none"> ◆ Main flame failure 	<ul style="list-style-type: none"> ◆ Main gas valve not opened. ◆ Insufficient gas pressure 	<ul style="list-style-type: none"> ◆ Check the electrical connections to ensure they are all securely connected. ◆ Check the two, safety shut off valves. Replace if defective. ◆ Check gas pressure at the inlet test port of the first safety shut off valve. It should be within the specified 7-14" wc range. Adjust the pressure regulator to obtain the required pressure. If problem persists, replace the valve. Repeat process for the second safety shut off valve.

	<ul style="list-style-type: none"> ◆ Unit out of adjustment ◆ Insufficient draft 	<ul style="list-style-type: none"> ◆ Check the gas manifold pressure to ensure it complies with the value given in the factory test report. If required, re-adjust the boiler/water (see factory test report for the adjustment values). ◆ Check the vent system to ensure it is not clogged.
◆ Unit fails at frequent intervals (excessive cycling)	<ul style="list-style-type: none"> ◆ Operating temperature is set too low. ◆ Break in controls wiring. ◆ Unit is over-sized 	<ul style="list-style-type: none"> ◆ Check the setting on operating temperature switch to ensure it is set at desire temperature. ◆ If applicable, check the differential adjustment on the operating temperature switch. ◆ Check all connections to and from the wiring block located immediately below the blower. ◆ Check the maximum heat requirement with the engineer and ensure the unit is of the appropriate size.
◆ Unclean combustion	<ul style="list-style-type: none"> ◆ Insufficient air in the mechanical room ◆ Unit out of adjustment 	<ul style="list-style-type: none"> ◆ Check all the louvers and air openings in the mechanical room to ensure they are free of any obstructions and there is sufficient inflow of fresh air into the room. ◆ Using a gas analyzer re-adjust the air and gas settings.
◆ Air bubble sound in the unit.	<ul style="list-style-type: none"> ◆ Poor water circulation in one or both coils ◆ Foreign material in one or both coils. ◆ Steam pockets in one or both coils. 	<ul style="list-style-type: none"> ◆ Completely purge each coil. ◆ Drain each coil with pressurized air and re-purge. ◆ Check water flow rate to ensure it complies with the required minimum flow rate.
◆ Gas Odor	<ul style="list-style-type: none"> ◆ Leak in piping. ◆ Exhaust gas leakage 	<ul style="list-style-type: none"> ◆ Using a gas detector, check all the connections (inlet and outlet) of all instruments on the gas line. Repair as required. ◆ Check the vent system to ensure there are no cracks or other openings (holes cut for insertion of thermocouples during the start-up). Repair if required.

Technical Data

Control System Schematic

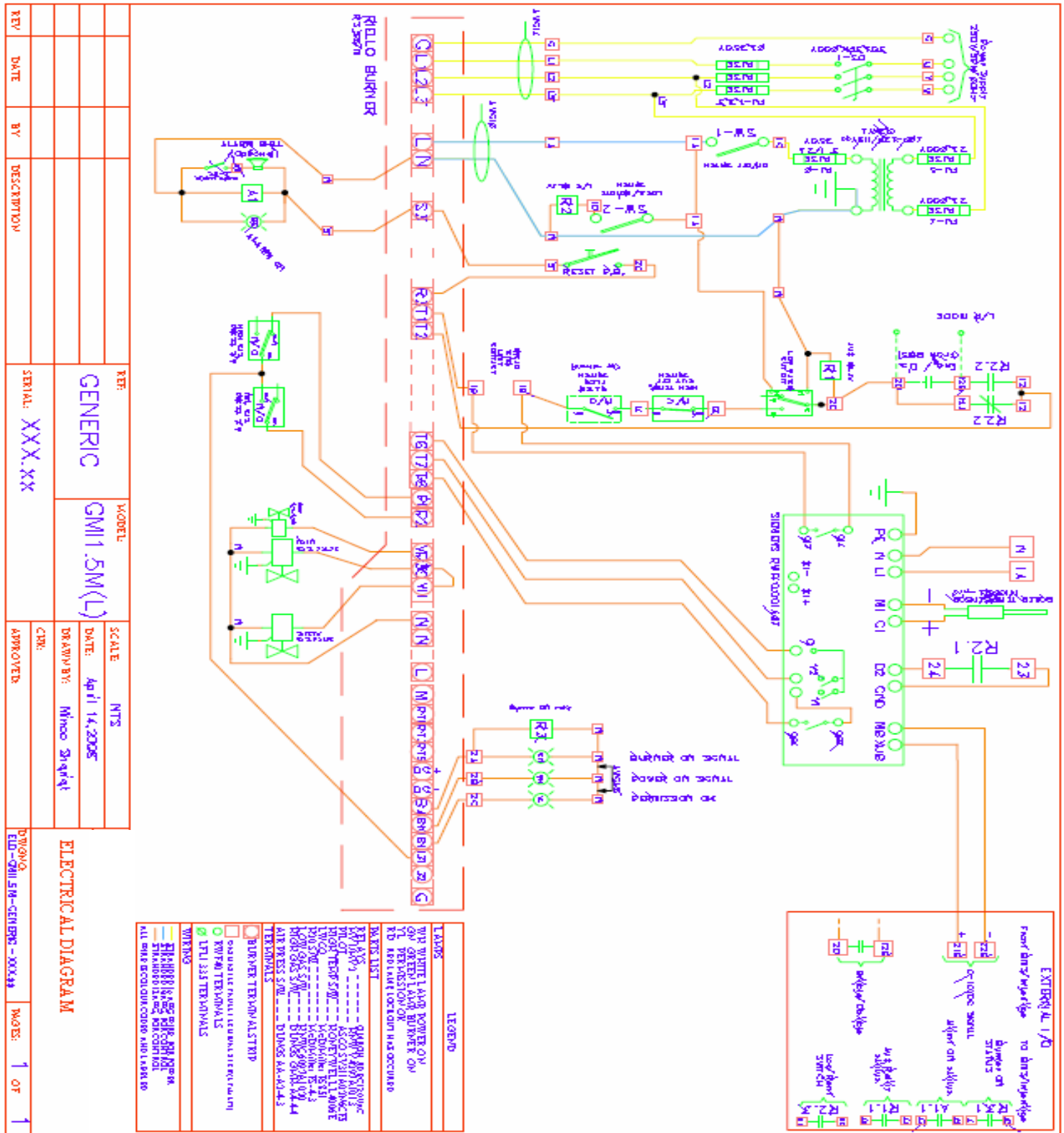


Figure 13: Control system schematic

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Reports

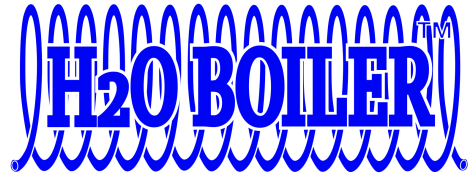
FIELD START UP REPORT

SERIAL NO. _____ MODEL _____ Type of Appliance _____ Label Date _____

Installation Address _____

Installer Name _____ Phone# _____ Type of Installation _____ (hotel, school, etc)

ELEC./CONTROL SECTION		GAS SECTION	
ALL WIRES TIGHT <input type="checkbox"/>		GAS TRAIN TIGHT <input type="checkbox"/>	
RATED VOLTAGE _____		MAIN GAS VALVE TIGHTNESS TEST <input type="checkbox"/>	
ACTUAL VOLTAGE _____		TYPE OF FUEL : NAT. GAS <input type="checkbox"/> PROPANE <input type="checkbox"/> MAX INPUT(MBH) _____	
RATED F.L.A. _____		HIGH _____ LOW _____	
ACTUAL F.L.A. _____		INLET GAS _____ "w.c. off _____ "w.c. run _____ "w.c. run _____	
TRIAL FOR IGNITION _____ Sec.		MANIFOLD GAS _____ "w.c. _____ "w.c. _____	
IGNITION TYPE _____		BLOWER SPEED _____ RPM _____ RPM	
PRE PURGE _____ Sec.		NET STACK TEMPERATURE _____ F _____ F	
PROOF OF LOW FIRE START <input type="checkbox"/>		MAIN FLAME SIGNAL _____ V _____ V	
SAFETY LOOP WORKS PROPERLY <input type="checkbox"/>		BURNER MIXER POSITION _____	
OPER. TEMP SET POINT IS CONTROLLED BY _____		MEG VALVE CURRENT _____ (mA) _____ (mA)	
SET POINT IS _____ F		PILOT GAS PRESSURE _____ "w.c. _____	
OPERATIONAL TEMPERATURE IS SET ON _____ F		PILOT FLAME SIGNAL _____ V _____	
DIFFERENTIAL IS SET ON _____ F		GAS ANALYZER PRINTOUT REPORT # _____ (Attached)	
HIGH TEMPERATURE LIMIT IS SET ON _____ F		WATER INLET TEMP _____ F WATER OUTLET TEMP _____ F	
		APPROX STACK LENGTH _____ Ft (Horizontal) _____ Ft (Vertical) _____	
		DRAFT _____ "w.c. (measured where stack exits boiler)	
		Total cycles _____ Total hours _____ (For 7800 series)	
CONTROL/SAFETY DEVICES Ok		OTHER OPTIONAL DEVICES Ok	
HIGH TEMP. LIMIT <input type="checkbox"/>		AIR(AIR/GAS) PRESSURE SWITCH <input type="checkbox"/>	(LISTED) <input type="checkbox"/>
OPER. TEMP CONTROL <input type="checkbox"/>		BLOCKED VENT PRESS. SWITCH <input type="checkbox"/>	<input type="checkbox"/>
LOW WATER CUT OFF <input type="checkbox"/>		PRESSURE RELIEF VALVE <input type="checkbox"/>	<input type="checkbox"/>
FLOW SWITCH <input type="checkbox"/>		ALARM BELL <input type="checkbox"/>	<input type="checkbox"/>
LOW GAS PRESSURE SWITCH <input type="checkbox"/>		PRESSURE GAUGE <input type="checkbox"/>	<input type="checkbox"/>
HIGH GAS PRESSURE SWITCH <input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Mechanical Contractor:		COMMENTS :	
Start up company:	TEL: _____ DATE: _____		
Start up Technician:	TEL: _____ DATE: _____		
Signature:	TEL: _____ DATE: _____		



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