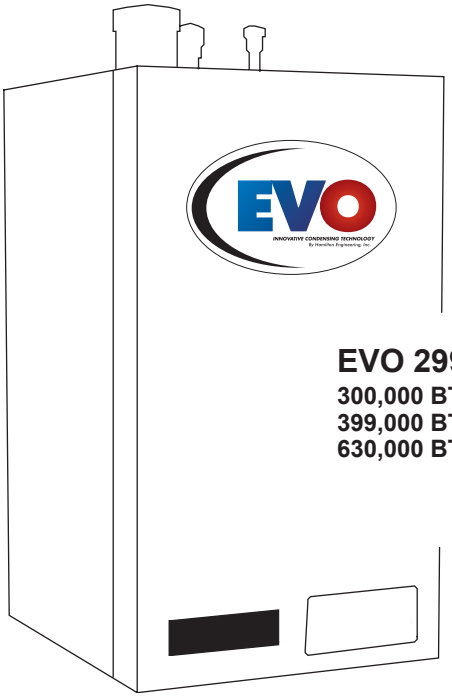
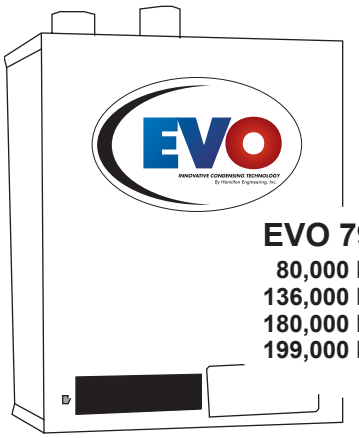
Installing, Operating & Maintaining
EVO 79–599 HIGH EFFICIENCY WATER HEATERS AND HEATING BOILERS



EVO 299–599
300,000 BTU/hr
399,000 BTU/hr
630,000 BTU/hr



EVO 79–199.1
80,000 BTU/hr
136,000 BTU/hr
180,000 BTU/hr
199,000 BTU/hr

⚠ WARNING

If the information in this manual 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 neighbor's phone. Follow the gas supplier instructions. If you can not reach your gas supplier, call the fire department.

UL 795-2011/CSA3.4
ANSI Z21.13-2014/CSA 4.9-2014
UL 795-2011/CSA 3.4
SCAQMD 1146.2

New York	Massachusetts	SCAQMD	CEC Listed
MEA 425-05-E	C1-0319-441	Compliant Rule1146.2	California Energy Commission

⚠ WARNING

These appliances MUST be installed by a properly licensed individual in the City and State which the unit is being installed. All start up adjustments and subsequent service work must be done by a similarly licensed contractor or a factory trained service individual. Failure to comply could result in loss of warranty and or severe personal injury, death and or substantial property damage. ***These instructions are required to be kept with the appliance on the left side, in the pocket provided.***

USING THIS MANUAL

Throughout this manual you will see these special attention boxes similar to this one, which are intended to supplement the instructions and make special notice of potential hazards. These categories are in the judgement of Hamilton Engineering, Inc.

⚠ DANGER

Indicates a condition or hazard which <u>MAY</u> cause severe personal injury, death, or major property damage.

⚠ WARNING

Indicates a condition or hazard which <u>MAY</u> cause severe personal injury, death, or major property damage.

⚠ CAUTION

Indicates a condition or hazard which <u>MAY</u> cause severe personal injury, death, or major property damage.

⚠ WARNING

- THE VENT SYSTEM IS RATED AND DESIGNED TO BE 2 PIPE SEALED COMBUSTION ONLY, PVC SCH 40 OR CPVC SCH 40 OR 80 OR AL 29-4C STAINLESS VENTING FOR ALL MODELS. A FACTORY ENGINEERED VENTING SYSTEM MAY ALLOW FOR EXCEPTIONS; CONSULT FACTORY FOR DETAILS.
- THIS HEATER INSTALLATION MUST CONFORM TO THE LATEST EDITION OF THE "NATIONAL FUEL GAS CODE" ANSI Z223.1 NFPA 54 AND/OR CAN/CGAB149 INSTALLATION CODES. STATE AND LOCAL CODES MIGHT ALSO APPLY TO INSTALLATION.
- WHERE REQUIRED BY THE AUTHORITY HAVING JURISDICTION, THE INSTALLATION MUST CONFORM TO THE STANDARDS FOR CONTROLS AND SAFETY DEVICES FOR AUTOMATICALLY FIRED HEATERS, ANSI/ASME HEATER AND PRESSURE VESSEL CODE, SECTION IV, ALONG WITH CSD-1.
- THE HEATER, GAS PIPING, WATER PIPING, VENTING AND ELECTRICAL MUST BE INSTALLED BY TRAINED & QUALIFIED PERSONNEL FAMILIAR WITH INSTALLATION PRACTICES, LOCAL CODE, AND LICENSING REQUIREMENTS.
- IF THE INFORMATION IN THESE INSTRUCTIONS ARE 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.

TABLE OF CONTENTS

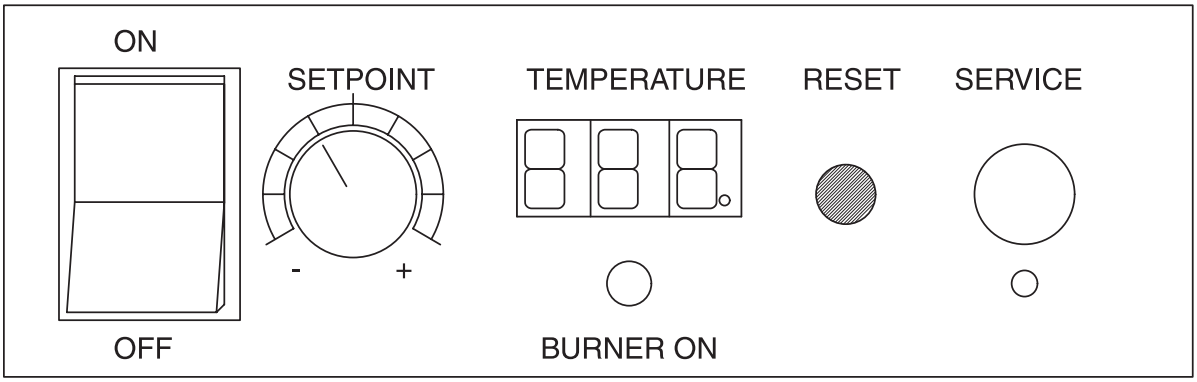
PART 1. GENERAL INFORMATION

A. HOW IT OPERATES

The EVO product line is an extremely high efficiency water heating product, requiring special venting and condensate removal precautions. All high efficiency condensing appliances will require more maintenance (cleaning) than their non-condensing counterparts. Failure to do so may result in damage to the appliance that is not covered under warranty. Failure to follow all of the instructions contained in this manual may also cause premature product failure that may not be covered under warranty.

This appliance has built-in freeze protection, automatically activating the circulation pump when the internal water temperature drops below 41°F. If the internal water temperature drops to 37°F, a burn cycle will be initiated and will shut down as soon as the supply water temperature has reached 50°F. *Power and gas must be left on for this function to operate.*

The appliance's primary controller (FMT 914) operates all functions of needed control and safety. It contains sophisticated logic that allows it to operate at very precise temperatures while minimizing burner on/off cycling. When multiple units are operated as a Cascade to handle a common load, the control logic contains the ability to control all of the units as efficiently as one. *Cascade operation is a factory-installed and programmed option, requiring a field wiring connection between appliances for operation.*



Looking at the controls on the front of the appliance,

1) POWER on/off switch
2) SETPOINT knob, temperature control (and fan speed control knob during service mode)
3) TEMPERATURE setpoint display
   a. Temperature in °F, corresponding to the SETPOINT knob
   b. Display will always read temperature setpoint unless there is a fault code displayed.
   c. Cascade indicator light, found in the lower right hand corner of the Temperature display. This dot will be flashing when this appliance is part of a properly-connected, commonly-controlled group of EVO products and reading temperature sensors.
   d. Display code, not flashing indicates a Soft Lockout
   e. When this display is flashing a code, the appliance is in a Hard Lockout and the reset must be pushed to re-start the appliance.
4) Green indicating light labeled BURNER ON; when lit, the burner is firing.
5) RESET button, used as described in 3e above, as well as to view sensors and set altitude (see pages 46 & 64 respectively for details).
6) SERVICE port, used for connecting a computer to the appliance to download the service fault history, as well as factory setting of control board parameters. There is a service button located just below the service port that must be pressed with a pointed object to get to the service mode.

A number of parameters must be programmed at the factory to provide proper operation and temperature control, including:

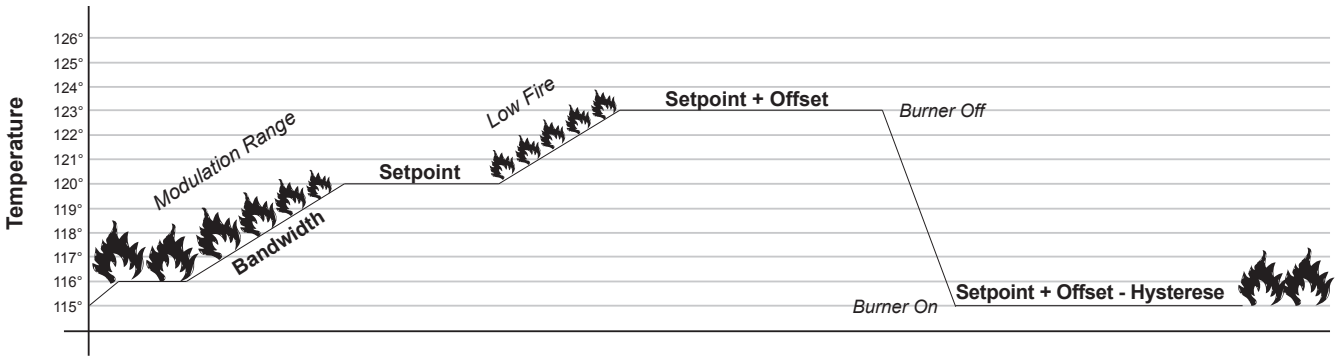
- Controlling Sensor: Setpoint, Offset, Hysterese and Bandwidth.
    - Controlling sensor is the inlet sensor for a stand alone water heater, outlet sensor for a stand alone boiler or the remote 10k thermistor for either water heater or boiler any time one is connected. Connection is automatically detected and control shifted to the remote sensor from the internal sensor by the EVO Controller when a 10k sensor is connected to the appropriate terminals.
- Secondary Sensor: Setpoint Outlet and Offset.
    - **Setpoint:** desired operating water temperature (this is set by the end user)
    - **Offset:** amount the temperature is allowed to go above Setpoint before finally shutting off
    - **Hysterese:** amount the temperature is allowed to drop under Setpoint plus offset before the appliance turns on
    - **Bandwidth:** the range over which flame modulation occurs (this only takes place below Setpoint)

EXAMPLE: Water Heater Control

Controlling sensor

All of the following parameters are controlled by either a storage tank temperature sensor or the inlet temperature sensor:

- **Setpoint** = Target Temperature (120°F) Low fire only above this point
- **Offset** = Off Setpoint (3) = 123°F off
- **Hysterese** = On Setpoint (8) (120 + 3 - 8 = 115°F)
- **Bandwidth** = Modulation range (4) (120 - 4 = 116°F, modulation begins)



The heater turns on at 115°F and when the temperature reaches 116°F the flame will begin to modulate down (approximately 25% of the modulation range per degree F of increase in this example) at 120°F, it will be at low fire and will remain there unless the temperature drops below 120°F and it will modulate back up. If it continues to increase, it will shut down at 123°F.

Outlet sensor

Its purpose is twofold: first stage as a high limit and second as a sensor for computing ΔT. Default water heater settings are as follows:

- **Setpoint** = start of modulation (185°F)
- **Offset** = Off Setpoint (5°F) (185 + 5 = 190°F off)

There is a fixed ***Manual Reset High Limit*** at 198°F (155°F and 210°F also available) on water heaters and heating boilers.

B. EVO CONTROLS

The following is an overview of the EVO controls. More detailed descriptions of EVO configurations can be found in LIT91110 - FMT-914 Control Configurations.

Control Sensors - Control of the EVO will require the use of appropriate internal and external control sensors (all 10k ohm):

- **Flow** - this is the internal leaving water from the heater/boiler.
- **Return** - this is the internal entering water to the heater/boiler.
- **External** - this is the storage tank sensor on water heaters and the common loop/low loss header sensor on boilers.
- **Indirect Sensor** - this is the Domestic Hot Water tank sensor on a heating boiler application only.
- **Outdoor** - the is the sensor to be mounted outdoors for temperature reset control on a heating boiler application only.

Pump Control - All water heaters and boilers are designed to operate with their own individual pump that will be controlled, on/off, by the EVO controller. The controller runs the pump for a fixed period of time after the end of a burn cycle and uses the combustion air fan as the cooling medium to ONLY cool the heat exchanger. This is accomplished by monitoring the inlet and outlet water temperature sensors and running the fan until they are within a pre-set range.

Cascade Control - When multiple units are operated as a Cascade system to handle a common load, the EVO controller contains the ability to control up to 8 burners as efficiently as one.

Common Venting - When units are installed as a Cascade system and a factory-supplied common venting manifold is used, the software contained in the controller provides for accurate, fail-safe control of all units in the Cascade while using a single air supply and single exhaust, for up to (8) burners. In addition to this software, hardware that is standard in each unit, makes venting of multiple units in a positive pressure venting system a reality.

Control of firing rate - The EVO controller contains sophisticated logic that allows it to operate at very precise temperatures while minimizing burner on/off cycling. Whether the temperature setpoint is manually set, sent via BMS as 0 – 10 VDC signal, or calculated via the outdoor reset function, precise temperatures are the standard. The difference between the temperature set-point and the water temperature sensed at the control sensor and how quickly the temperature is moving to or away from that desired water temperature are the basis for the control response.

Domestic Water Heating (DHW) - This controller is the only one of it's kind in use in North America that contains separate software for DHW and Central Heating. Safeties, control response and other operational considerations are unique to DHW applications, including concerns of scaling due to poor water conditions. The EVO controller was designed from the ground up with this application in mind.

It is recommended to use an external sensor located in the storage tank for control in DHW applications. If an external temperature sensor is not used, the EVO will be controlled by its own inlet (Return) sensor and ***the water heater pump must run constantly.***

B. EVO CONTROLS CONT.

Central Heating - The EVO controller has many built-in functions for precise control in Central Heating applications. The controller can operate on its own internal Flow (outlet) sensor, however the preferred method is to use an External Sensor connected to the Lead Boiler. If the External Sensor is not employed, the boiler(s) will need to have a constant flow of water so that the internal sensors can accurately detect the loop temperature.

When the External sensor is installed in the main building loop or a Hamilton System Separator (low loss header), the boiler system operates at peak efficiency, reducing short-cycling and maintaining a constant loop temperature. The External Sensor must be installed in a location that has good water flow - avoid positions where the sensor will be located in stagnant flow areas or in the near boiler piping. *See LIT91110 - FMT-914 Control Configurations for suggested locations.*

In a Central Heating application, the EVO controller can utilize an outdoor thermistor for outdoor reset (without the need for an external controller), remote setpoint control from a BMS or external controller (0 - 10 VDC), and indirect DHW priority. See below for additional details on these features.

Outdoor Reset - The EVO controller will automatically operate while in the Central Heating mode, utilizing Outdoor Reset. When a 10K ohm thermistor is connected to the EVO, the controller will automatically change the temperature setpoint to a calculated value based on the programmed outdoor reset curve. The setpoint selected by the outdoor reset curve can be shifted (parallel shift) up to 36°F above or below by adjusting the temperature control knob on the display.

BMS 0 - 10VDC control - The range of 0 – 10 volts corresponds directly to the temperature range imbedded in the control software. Factory default for heating boilers is 50°F – 194°F. With the standard parameter sets, the following would be true:

0 - 0.9 volts = boiler(s) off
1 volt = 50°F
4 volts = 98°F
7 volts = 146°F
10 volts = 194°F
(each volt = 16°F)

Voltage can be sent in any value between 1 and 10 and the temperature set point will be the exact value that corresponds to that voltage. Below 1 volt, there will be considered no heat demand.

Note: If another type of heat demand device is connected to the EVO, such as a room thermostat (or the jumper wire factory shipped in place), the controller will revert to that as it's control point when the voltage is less than 1. If the 0–10 VDC signal is lost from the external source, such as a BMS, the control will revert to its maximum set point if there is a jumper or other closed thermostat connected to the "Room Thermostat" terminals. If this is not desired and heat with some form of control is desired, a relay may be used. The relay coil can be energized from the control source (i.e. BMS) and the common and NC contacts from the relay can be connected to the room thermostat terminals and an outdoor air sensor connected to the appropriate point on the EVO terminal strip. If power is ever lost from the control source, the relay will de-energize and close the room thermostat terminals, thus activating the outdoor reset (see above for control).

B. EVO CONTROLS CONT.

Further notes to the use of 0–10 VDC as a control:

- Room thermostat jumper must be removed—if it is not, it will fire based on setpoint when there is less than 1 volt
- Red dial must remain in the maximum position (all the way to the right) If it is not turned all the way to the right, it's corresponding setpoint becomes the maximum the 0–10 volt signal will go to, regardless of the voltage supplied.
- 0 VDC–0.9 VDC results in no call for heat
- 1 VDC results in minimum set point, this should always be programmed to the minimum water temperature desired when using a BMS system.
- 10 VDC results in maximum set point, this should always be programmed to the maximum water temperature desired when using a BMS system. Voltage can be sent in any value between 1 and 10 and the temperature set point will be the exact value that corresponds to that voltage. Below 1 volt, there will be considered no heat demand.

Production of Indirect Domestic Hot Water - this controller can also provide for control of split loads, Central Heating and Domestic Hot Water, via an additional pump or diverting valve with priority for DHW, a user selectable option. It can also control the system pump or signal to a zone controller, if required. *See LIT91110 - FMT-914 Control Configurations for suggested piping diagrams and details.*

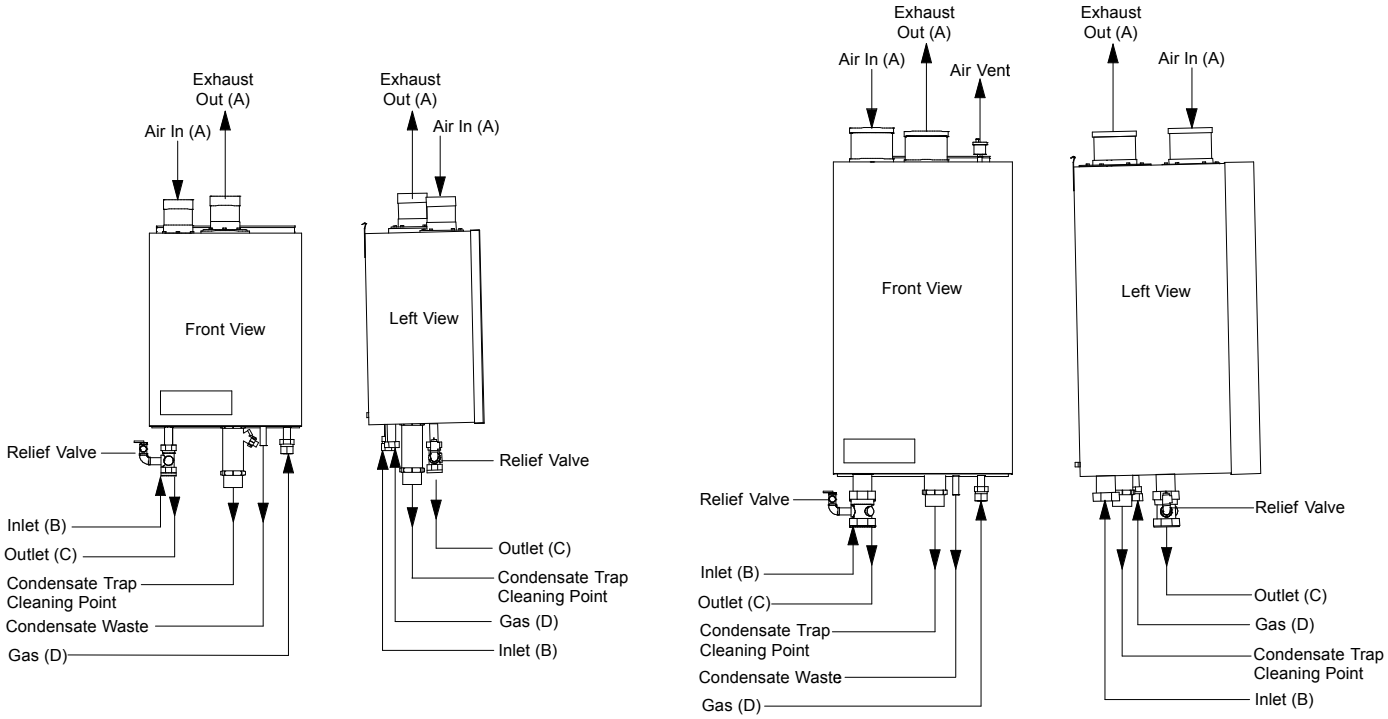
The EVO control system offers the ability to automatically provide DHW from a stand alone or group of Cascaded Heating Boilers. To do this properly, a 10k ohm thermistor or aquastat, which senses the DHW tank water temperature, must be connected to the appropriate terminals on the EVO.

The default control parameters provide priority for DHW production. On a call for heat from the DHW tank, the EVO will:

- Switch on if there is no current heat demand
- Drop power to the system pumps, if energized through relay and EVO controller
- Energize indirect DHW pump or 3-way valve
- Change boiler water temperature setpoint to preset parameter

When the DHW load is satisfied, the indirect DHW pump will run for an additional minute (the boiler will be off) as a cool down cycle, then the boiler will resume the state and water temperature it was at prior to the DHW call for heat.

C. EVO DIMENSIONS



(TABLE 1-1) EVO DIMENSIONS

Model	Width	Height	Depth	A	B	C	D
79–199.1	16"	20.5"	12"	3"	1"	1"	0.75"
299	19"	33"	19"	4"	1.5"	1.5"	0.75"
399	19"	33"	19"	4"	2"	2"	0.75"
599	19"	35"	26.5"	5"	2"	2"	1"

(TABLE 1-2) EVO INFORMATION

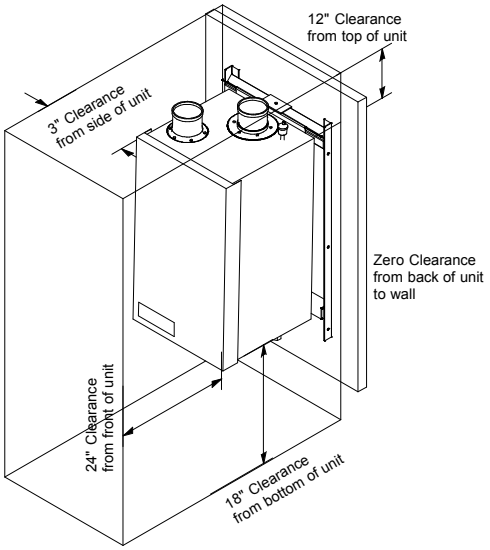
Model	Input BTU/hr	Water Heater* Output BTU/hr	Boiler** Output BTU/hr	GPH Recovery @ 100˚FΔT	GPH Recovery @ 80˚FΔT	GPH Recovery @ 60˚FΔT	Water Flow Rate & Pressure Drop DWH†	Heating	Shipping Weight
HW 79	80,000	up to 77,600	up to 76,000	93	116	155	6.6@19.9'	4.4@7.9'	66 lbs
HW 129	136,000	up to 132,890	up to 130,150	160	199.1	265	6.6@19.9'	4.4@7.9'	66 lbs
HW 179	180,000	up to 174,829	up to 171,224	210	262	349	9.9@21.'	6.6@7.9'	75 lbs
HW 199.1	199,999	up to 193,999	up to 189,999	233	291	388	9.9@21.8'	6.6@7.9'	75 lbs
HW 299	300,000	up to 291,000	up to 285,000	360	450	600	16.5@22.9'	11.0@9.3'	172 lbs
HW 399	399,999	up to 387,999	up to 379,999	466	582	776	26.4@20.3'	17.6@8.5'	204 lbs
HW 599	630,000	up to 611,100	up to 598,500	734	917	1223	39.6@23.6'	26.4@9.4'	260 lbs

*At 97% thermal efficiency with 86ºF incoming water to heat exchanger
**At 95% thermal efficiency with 140ºF incoming water to heat exchanger

RECOMMENDED SERVICE CLEARANCES

(FIGURE 1-2) EVO CLEARANCES

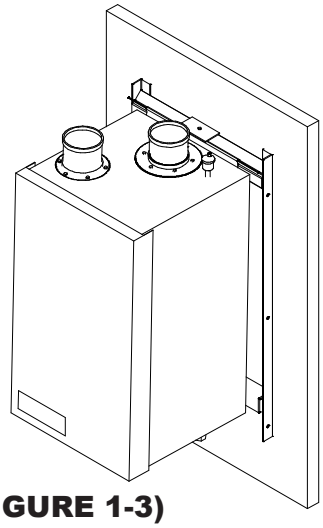
(NOTE: The EVO is rated at zero clearance to combustibles.)



D. PRE INSTALLATION REQUIREMENTS

The EVO models 299–599 are designed to be installed using a factory designed and supplied rack or frame (see Figure 1-3 for details). Models 79–199.1 may also be installed using an optional wall bracket. If the wall bracket is used, ***care must be exercised to insure that the wall structure is sufficient to support the weight of the connected load*** (see weights in Table 1-2, pg.9). Consult factory for details of wall mount bracket. It can be installed in alcoves, basements, and utility rooms, as well as standard equipment rooms. Choose a location for your EVO, centralized to the piping system, along with consideration for Electrical (Part 2), Gas Connection (Part 3), Venting (Part 4), and Condensate Drain (Part 4, Section F) **and temperature (Min/Max Ambient 33–105°F, Max Air Intake 120°F).**

The EVO heat exchanger must be level as installed, and the mounting surface must be designed to support the weight (see previous page, Table 1-2 for weights). Be sure the appliance is adequately secured to the mounting surface.



(FIGURE 1-3)
EVO MOUNTING DETAIL

The front cover is secured by a threaded screw and two clasp style latches; it can only be installed one way. ***When removing the front cover of the EVO unit, you must make sure all electric power to the appliance is turned off***. Then remove the screw at the bottom of the panel, undo the latches and remove the cover (see Figure 1-4 on the next page).

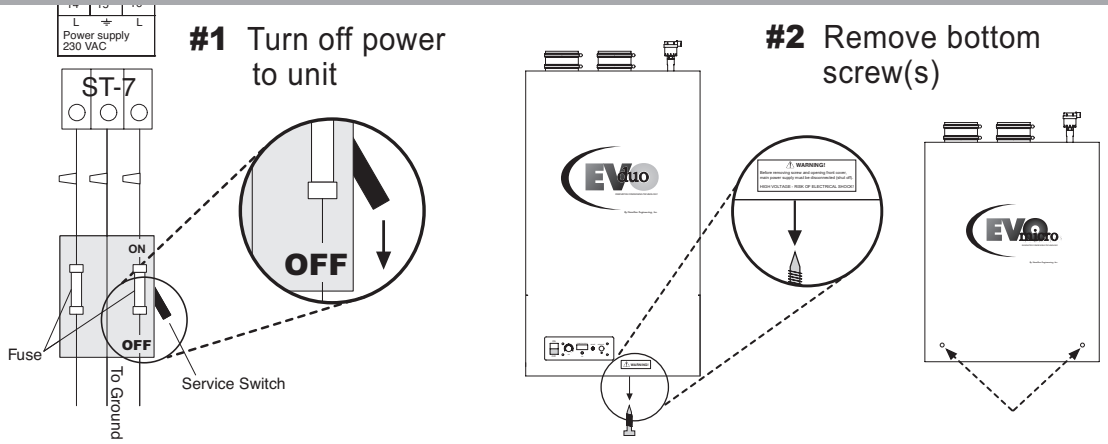
If the EVO is set up for liquefied petroleum (LP) gas, some geographic areas follow the Uniform Mechanical Code, section 304.6, “Liquefied petroleum gas burning appliances shall not be installed in a pit, basement or similar location where heavier-than-air gas might collect. Appliances so fueled shall not be installed in a below grade under-floor space or basement ***unless such location is provided with an approved means for removal of unburned gas***.”

Note: A water chemistry analysis should be performed prior to any installation. If the water quality exceeds any of the following levels, then a water chemistry analysis must be performed:

- ***Water hardness can be no more than 12 grains (205 ppm or mg/l)***
- ***TDS (total dissolved solids) can be no more than 450 ppm or mg/l***
- ***PH - below 6.5 or above 7.5***

For total combined hardness over 15 grains (250 ppm or mg/l) or longer pipe lengths, contact Hamilton Engineering for correct pump sizing. Combined, the hardness and TDS can be no more than 450 ppm. Our internal term for this is the TCH (Total Combined Hardness).

D. PRE INSTALLATION REQUIREMENTS CONT.



(FIGURE 1-4) HOW TO REMOVE THE FRONT COVER

The EVO is certified as an indoor appliance. Do not install outdoors or in unconditioned spaces where it will be exposed to temperatures above or below specified min/max ambient temperatures. This includes all related piping and components. If the EVO is subjected to flood water or submersed in water, the EVO must be replaced.

NOTICE

Condensation Removal: This is a condensing, high efficiency appliance, therefore condensation removal must be addressed to avoid damage to surrounding area or appliance. See Part 4, Section F for Condensate Requirements (pg.28).

E. PRESSURE RELIEF VALVE

WARNING

Do not, under any circumstances, thread a cap or plug into the relief valve! Explosion, severe personal injury, death, or major property damage may result.

This unit is supplied with a relief valve sized in accordance with ANSI/ASME Heater and Pressure Vessel Code, Section IV. The relief valve is installed near the hot water outlet. If the valve supplied is replaced, the pressure rating of the valve must not exceed the listed working pressure of this appliance, and must be rated to the proper BTU/hr capacity of the water heater. ***Do not, under any circumstances, thread a cap or plug into the relief valve! Explosion, serious injury or death may result!*** To prevent water damage, the relief valve piping must be directed to the floor or an open drain, but not connected directly. There must be a 6” space between the outlet of relief valve piping and drain or floor. Do not hook up to drain system directly without an air gap. Protect from freezing. Place no other valve between the relief valve and the unit. Do not install any reducing couplings or other restrictions in the discharge line. The discharge line must allow complete drainage of the valve and line. Manually operate the relief valve at least once a year.

Also, care must be exercised when choosing the location of this appliance, where leakage from the relief valve, leakage from related piping, or leakage from the tank or connections, will not result in damage to the surrounding areas, or to the lower floors of the building. A water heating appliance should always be located in an area with a floor drain or installed in a drain pan suitable for water heating appliances. Under no circumstances, shall Hamilton Engineering, Inc. be held liable for any such water damage whatsoever.

PART 2. ELECTRICAL

A. ELECTRICAL CONNECTION / REQUIREMENTS

The electrical connection for the EVO is on the bottom of the unit. There is a 1/2" knockout location for an electrical connection for the heater's incoming power connection. All electrical wiring must be performed by a qualified licensed electrician in accordance with National Electrical Code ANSI/NFPA and/or the Canadian Electrical Code, Part 1 CSA C22.1, or to any applicable local codes and standards. For your convenience, all the points for electrical connections needed to operate the EVO are labeled.

Note: Always check electrical ground to known earth ground; if less than 0.5 ohms, ground is sufficient (meter MUST be on lowest setting).

We recommend a simplified test, differing from one looking for building earth ground issues, it is our intent to use this test as an indicator of equipment room (boiler or water heater) electrical grounding issues, or equipment bonding issues, not prove the earth ground to the building.

Take an Ohm meter and place one lead on a known earth ground (not the ground wire on the boiler), and place the other lead on either 1) The near boiler system piping, 2) The boiler heat exchanger, or 3) The boiler cabinet.

If any of those readings exceed 0.5 Ohms, then it is a good indicator that there may be sufficient stray current flowing through the water in the piping system to accelerate or amplify conditions that can cause pump, boiler or piping issues in the not too distant future.

If any readings are over 0.5 ohms, an electrician should be brought in to correct the problem.

The electrical requirements are for standard 208–240 volts, 50/60 Hz 15 Amp service. This unit is wired with #18 awg and internally fused for no more than 3.15 Amps. When the unit is first powered on, there is a self-setting of the electronics for 50 Hz or 60 Hz. At every power up, the electronics will take a couple of seconds to compare the pulses of the power to the pulses of the crystal, which is built into the electronics. Then all time-related functions are correct no matter the power source.

The standard supplied pumps are all 208–240 VAC, 60 cycle and are to be wired to terminals indicated on the appliance. In 50 cycle applications, other pumps may need to be supplied, depending on water conditions. With the 914 controller there is an ability to program a custom pump delay time, or to use a continuous (no time out) setting. The factory default is a 1 minute delay to turn off after completing a burn cycle.

B. INTERNAL WIRING CONNECTION

⚠ CAUTION

The incoming power shall be connected directly to the labeled, intended connection points only. Failure to do so may result in an electrical short and the control board will have to be replaced!

⚠ DANGER

IT IS EXTREMELY IMPORTANT THAT THIS UNIT BE PROPERLY GROUNDED! IT IS VERY IMPORTANT THAT THE BUILDING GROUND IS INSPECTED BY A QUALIFIED ELECTRICIAN PRIOR TO MAKING THIS CONNECTION!

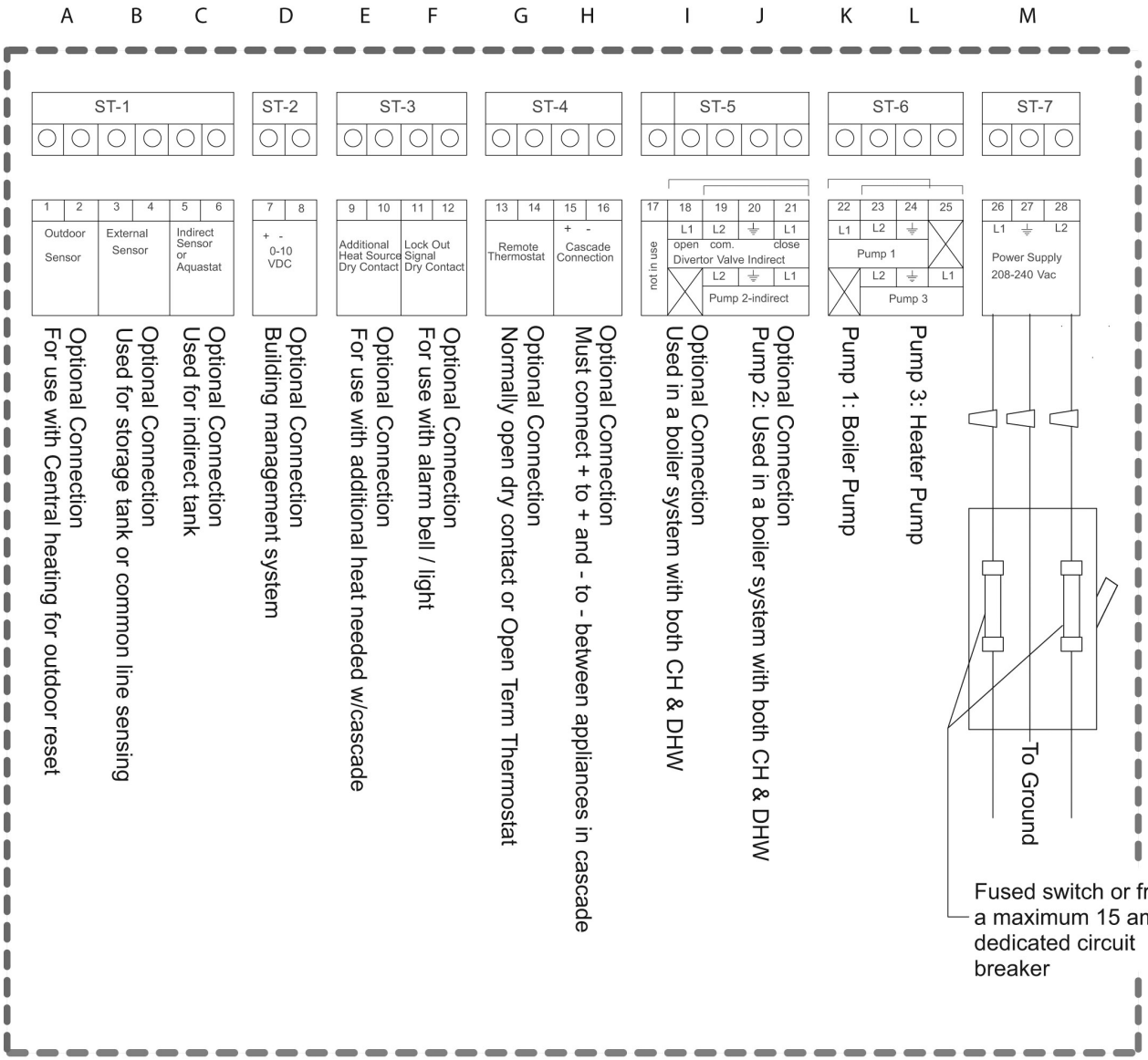
Failure to confirm proper grounding and the absence of stray voltage may result in premature component failure. See start up and commissioning documents (LIT91111 - Start Up Checklist) for details.

Terminal 27 in the electrical compartment must be connected to the building ground system.

The incoming 208–240 volt single phase power supply is connected to terminals 26 through 28.

It is important that the electrical power is not turned on at this time. Double check all connections and then turn the power on. The display that is provided with the EVO should now be reading the Setpoint temperature.

Note: See Start-Up Procedures (Part 6, page 38) to change the temperature setting or run the appliance.



(FIGURE 2-1) FIELD WIRING CONNECTIONS

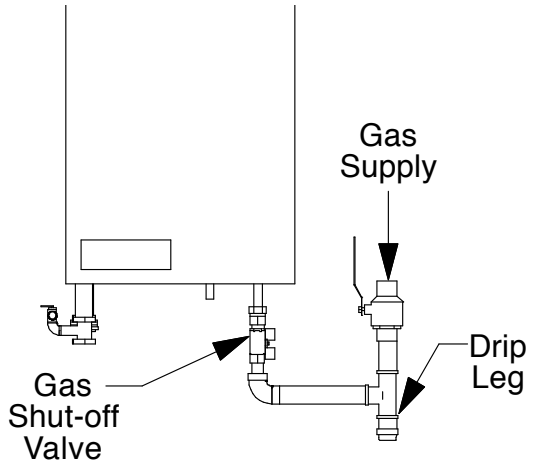
A. Outdoor Sensor - outdoor air sensor, set point will adjust based on outdoor air temperature (not needed if 0-10 VDC output is connected)
B. External sensor connection - system temperature sensor, senses water temp in a storage tank or a heating loop.
C. Indirect Tank Sensor - Sensor for indirect DHW. An aquastat may also be connected here.
D. 0–10 VDC - connect a 0–10 VDC output here to vary set point temperature.
E. Additional Heat Source - dry contacts that will close a thermostat on an extra heater/boiler if the cascade system is at 100% of capacity.
F. Lock Out Signal - alarm bell or light may be connected here to indicate that the boiler is a hard lockout.
G. Remote Thermostat - normally jumped. A room thermostat may be connected here to enable/disable the heater/boiler.
H. Cascade Connection - communication cables get connected here and “daisy chained” to all heaters/boilers in a cascade. This is polarity sensitive.
I. 3-Way Diverter Valve - Used in a boiler system with both Heating and Indirect Hot Water.
J. P2 - Pump for indirect. Used in a boiler system with both Heating and Indirect Hot Water.
K. P1 - Wire to primary pump for boilers.
L. P3 - Wire to primary pump for heaters or system pump for boilers.
M. Power Supply - connect 208–240 VAC single phase power supply here.

PART 3. GAS CONNECTION

A. GAS CONNECTION

Failure to follow all precautions could result in fire, explosion or death!

The gas supply shall have a maximum inlet pressure of less than 14" water column (1/2 PSI) (3.44 kPa), and a minimum of 4" water column. The entire piping system, gas meter and regulator must be sized properly to prevent pressure drop greater than 1" as stated in the National Fuel Gas Code. This information is listed on the rating plate. **It is very important that you are connected to the type of gas as noted on the rating plate**, “LP” for liquefied petroleum, propane gas or “Nat” for natural or city gas. All gas connections must be approved by the local gas supplier, or utility in addition to the governing authority, prior to turning the gas supply on. It is mandatory that a drip leg be fabricated, as per the National Fuel Gas code. Once all the inspections have been performed, the piping must be leak tested. It is recommended that a soapy solution be used to detect leaks. Bubbles will appear on the pipe to indicate a leak is present. If the leak test requirement is a higher test pressure than the maximum inlet pressure, you must isolate the EVO from the gas line. In order to do this, you must shut the gas off using factory and field-installed gas cocks (following the lighting instructions in Part 6, Section B, Page 38.) This will prevent high pressure from reaching the valve. Failure to do so may damage the gas valve. In the event the gas valve is exposed to a pressure greater than 14" water column, the gas valve must be replaced.



(FIGURE 3-1) EVO GAS CONNECTION

Never use an open flame (match, lighter, etc.) to check gas connections.

B. GAS PIPING

The gas piping must be sized for the proper flow and length of pipe, to avoid pressure drop. Both the gas meter and the gas regulator must be properly sized for the total gas load. If you experience a pressure drop greater than 1" WC, the meter, regulator or gas line is undersized or in need of service. You can attach a manometer to port 3 of the gas valve (see Figures 3-2 and 3-3 on the following page). Alternatively, you can attach the manometer to the incoming gas drip leg, by removing the cap and installing the manometer. The gas pressure must remain between 4" and 14" during stand-by (static) mode and while in operating (dynamic) mode. **If an in-line regulator is used, it must be a minimum of 10 equivalent feet from the EVO. It is very important that the gas line is properly purged by the gas supplier or utility. Failure to properly purge the lines or improper line sizing, will result in ignition failure.** This problem is especially noticeable in NEW LP installations and also in empty tank situations. This can also occur when a utility company shuts off service to an area to provide maintenance to their lines. This gas valve must not be replaced with a conventional gas valve under any circumstances. As an additional safety feature, this gas valve is easily de-coupled from the fan inlet.

Refer to the following tables to size the supply piping to minimize pressure drop between meter or regulator and unit.

C. GAS TABLES

(TABLE 3-1) NATURAL GAS SUPPLY PIPING

Nominal Iron Pipe Size (in.)	Internal Diameter (inches)	Length of Pipe (Feet) 10	20	30	40	50	60	70	80	90	100	125	150	200	BTUs per HR x 1,000
3/4	0.824	363	249	200	171	152	138	127	118	111	104	93	84	72 }	
1	1.049	684	470	377	323	286	259	239	222	208	197	174	158	135 }	
1-1/4	1.380	1,404	965	775	663	588	532	490	456	428	404	358	324	278 }	
1-1/2	1.610	2,103	1,445	1,161	993	880	798	734	683	641	605	536	486	419 }	
2	2.067	4,050	2,784	2,235	1,913	1,696	1,536	1,413	1,315	1,234	1,165	1,033	936	801 }	

(Based on 0.60 specific gravity for natural gas at 0.5" WC pressure drop; DOE standard is 1100 BTU per cubic foot of natural gas.)

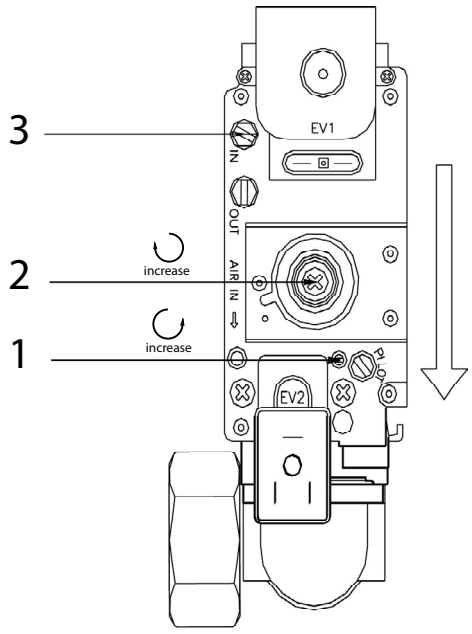
1 Run the gas supply line in accordance with all applicable codes.

2. Locate and install manual shut off valves in accordance with state and local requirements.

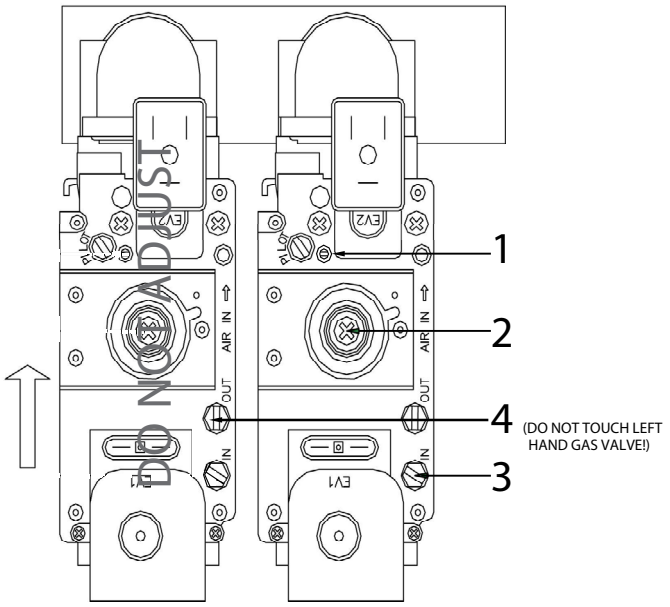
(TABLE 3-2) PROPANE SUPPLY PIPING (Based on 11" WC supply pressure)

Nominal Iron Pipe Size (in.)	Internal Diameter (inches)	Length of Pipe (Feet) 10	20	30	40	50	60	70	80	90	100	125	150	200	BTUs per HR x 1,000
3/4	0.824	567	393	315	267	237	217	196	185	173	162	146	132	112 }	
1	1.049	1,071	732	590	504	448	409	378	346	322	307	275	352	213 }	
1-1/4	1.380	2,205	1,496	1,212	1,039	913	834	771	724	677	630	567	511	440 }	
1-1/2	1.610	3,307	2,299	1,858	1,559	1,417	1,275	1,181	1,086	1,023	976	866	787	675 }	
2	2.067	6,221	4,331	3,465	2,992	2,646	2,394	2,205	2,047	1,921	1,811	1,606	1,496	1,260}	

D. GAS VALVE SETUP



(FIGURE 3-2) EVO MODELS 79–399



(FIGURE 3-3) EVO MODEL 599

Please see Part 6 - Start-Up Procedures on page 38 before continuing!

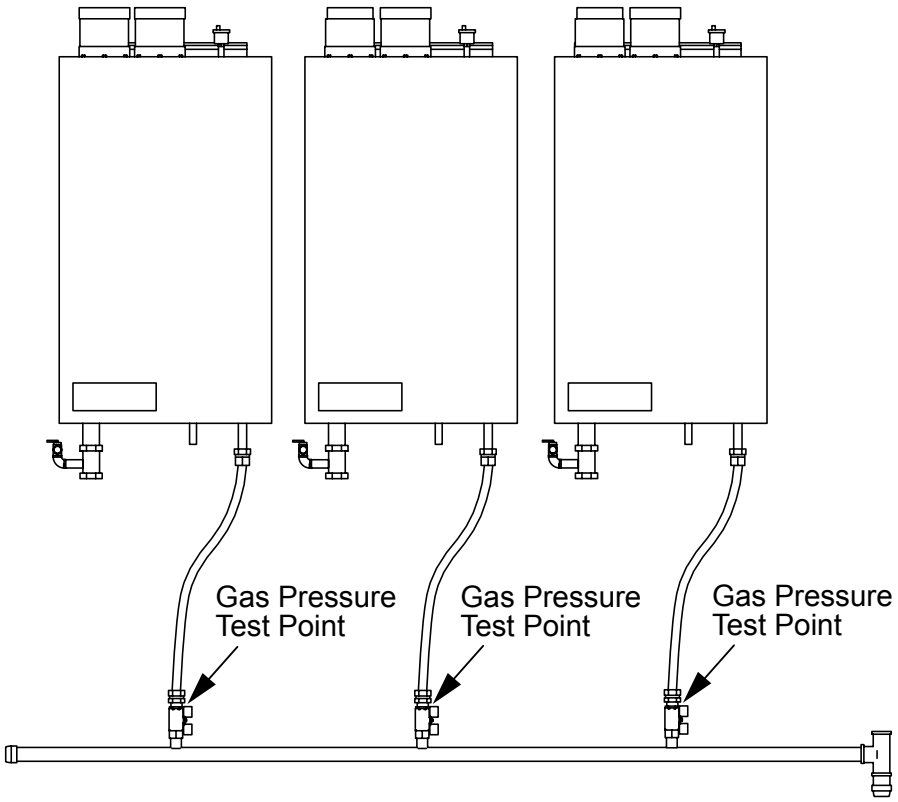
Proper gas volume and pressure is critical to the operation of any high efficiency appliance. There are three types of measurements that must be taken to provide the data to insure product performance:

- Lock-up pressure (pressure in gas piping at appliance inlet with no load) may not exceed 14" wc. at any time!
- Minimum load at ignition of a single unit in a multiple unit rack
- Maximum load – all appliances on at full fire that are being tested and any other gas fired equipment on the same gas supply.

How and where to measure:

- All gas pressure tests must be taken at the gas manifold inlet, external to the EVO (see diagram).
- Gas pressure for minimum load should be measured the moment after the gas valve opens on a single EVO, and recorded.
- Gas pressure for maximum load shall be measured with all units on at full fire and all other connected loads on that gas supply running
- Gas pressure drop shall not exceed 1" wc. between minimum load and maximum load as described above.

(FIGURE 3-4) GAS PRESSURE TESTING POINTS



(TABLE 3-3) COMBUSTION & FUEL RELATED ADJUSTMENT TABLE

	Natural Gas CO_2		Natural Gas CO ppm	LP Gas CO_2		LP Gas CO ppm
	Cover On	Cover Off	Approximate, do not use for setup!	Cover On	Cover Off	Approximate, do not use for setup!
LOW FIRE	8.5%	8.3%	Less than 10	9.6%	9.4%	Less than 15
HIGH FIRE	8.8%	8.6%	Less than 110	10.0%	9.8%	Less than 120

Please note: All adjustments must be made with the appliance door off, which will lower the CO_2 reading 0.2%. See tables above for specific readings.

When checking or replacing a gas valve, the CO_2 percentage in the flue gas is the preferred measuring method to insure proper combustion and firing rate. CO is used as the (temporary) alternate.

Changing incoming air temperature may vary the CO_2 setting slightly (~0.2–0.6%) after initial set up. This is not cause for concern or reason to set up again. After one year of operation, set up is required again.

If your appliance will be operated in an area that has inlet air temperature variations greater than 80ºF, please use the following table in adjusting your CO_2 for optimum performance.

(TABLE 3-4) CO_2 ADJUSTMENT TABLE

Inlet air ΔT variation	Setup at minimum incoming air temperature	Setup at maximum incoming air temperature
80ºF	Reduce CO_2 0.2%	Increase CO_2 0.2%
100ºF	Reduce CO_2 0.3%	Increase CO_2 0.3%
120ºF	Reduce CO_2 0.4%	Increase CO_2 0.4%

E. SETTING THE MAXIMUM LOAD

A means of sampling the leaving flue gas is built into the vent connector on top of the appliance. Remove the rubber plug for testing and replace when testing is completed. This plug MUST be in place during normal operation.

• Press the service button with a pointed object and set the temperature knob on the maximum fan speed as shown by model in the table below *(RPM = display * 100, ex. 060 = 5951–6050).*

If necessary, turn the adjusting slot [1], which sets the high fire performance, either counterclockwise to increase the CO_2 percentage or clockwise to reduce the CO_2 percentage, as shown in Figures 3-2 and 3-3, page 15. Appropriate CO_2 percentages are shown in Table 3-3 above.

(TABLE 3-5) FAN SPEED REQUIREMENTS

Last 4 digits of serial number		HWD 79, HWH 79, HWH 79.8	
First Week	Last Week	Maximum rpm	Minimum rpm
02--08	current	6400	1856

Last 4 digits of serial number		HWD 129, HWH 129, HWH 129.8	
First Week	Last Week	Maximum rpm	Minimum rpm
49-06	07-14	5900	1947
52-14	current	6000	1740

Last 7 digits of serial number		HWD 179, HWH 179, HWH 179.8	
First Week	Last Week	Maximum rpm^	Minimum rpm
009-43-07	023-48-07	5800	1856
009-43-07	008-48-07	5600	1680
024-11-08	current	5600	1736

Last 4 digits of serial number		HWD 199, HWD 199.1, HWH 199, HWH 199.1, HWH 199.8	
First Week	Last Week	Maximum rpm	Minimum rpm
49--06	current	6500	1755

Last 4 digits of serial number		HWD 299	
First Week	Last Week	Maximum rpm	Minimum rpm
02--08	current	6300	1575

Last 4 digits of serial number		HWD 399	
First Week	Last Week	Maximum rpm	Minimum rpm
24--05	current	6200	1798

Last 4 digits of serial number		HWD 599	
First Week	Last Week	Maximum rpm	Minimum rpm
24--05	current	5700	1596

Do not forget to place the knob, labeled with "Setpoint," at the proper temperature value when done.

F. SETTING THE MINIMUM LOAD

Set the minimum load once the maximum load has been set, turn the knob until the minimum RPM setting has been reached. In order to set or adjust the minimum load, turn the screw [2] for the minimum setting (first remove the protective cap). Turn the screw clockwise to increase or counter clockwise to decrease the CO_2 percentage. On the HW 599, you only are allowed to set the gas valve at the right side; the left gas valve is set by the manufacturer. *See Section H, page 19 for special instructions on replacing both gas valves in a model 599.*

- If the measuring process takes more than 40 minutes, the appliance will return to the automatic mode. If so required, press the Service button another time.
- When you are done setting the valve, press the Service button again to return to normal run mode

Please do not forget to replace the protective cap on the gas valve!

G. GAS CONVERSION

If the appliance is to be converted in the field for using Propane (LPG), the following steps must be taken:

- Turn screw [1] clockwise (Figure 3-2, page 15) ¾ of a full turn (270°) on models HW 79/199.1, ¾ of one turn (270°) on models HW 199.1/299 and 1 full turn (360°) on model HW399
- On model HW599 (Figure 3-3, page 15) turn screw on left hand valve closed (clockwise) and turn right valve 1-¾ of a full turn clockwise.
- Run the appliance. If the burner does not ignite after four starting efforts, turn the screw [1] one half turn back (180°) (counter clockwise).
- After conversion, follow the steps in Sections E and F for setting the maximum and minimum loads, using the LP gas values shown in Table 3-3, page 17.

H. GAS VALVE MAINTENANCE/REPLACEMENT

1) When checking or replacing a gas valve, the CO_2 percentage in the flue gas is the preferred measuring method to insure proper combustion and firing rate. CO is used as the alternate.
2) Gas valve replacement for the HW 599:

The left hand gas valve (which is normally factory-set and sealed and must not be adjusted) must be set up to factory specifications before any combustion related adjustments can be performed on the right hand valve. An electronic manometer must be used, as it will be set to a scale of 0.01" WC.

The adjustment screw [1] (see Figure 3-3, page 15) normally used for setting maximum flow rate must be turned counterclockwise until it begins to click when turned. The screw will not fall out, but will be fully retracted at this point. this is for Natural Gas, for LP gas, close the left hand valve (clockwise) until it is closed down.

The digital manometer must now be connected to the outlet pressure tapping [4] on the left hand valve only (marked do not adjust in Figure 3-3 page 15), and the appliance fired. It must be placed in the service mode and held at the minimum firing rate (1653 rpm fan speed). With the appliance firing at this rate, adjust the offset (minimum firing rate) screw [2] to a pressure of “0” +/- .0.01" WC. ***Be sure the manometer has been zeroed out prior to making this setting.***

Once this operation is complete, you may follow the instructions for setting the minimum and maximum firing rate as shown in Sections G and H, ***for the right hand gas valve only.***

⚠ WARNING

Failure to follow all precautions could result in fire, explosion, or death!

⚠ DANGER

It is extremely important to follow these venting instructions carefully. Failure to do so can cause severe personal injury, death or substantial property damage.

PART 4. VENTING

A. APPROVED VENTING MATERIALS

All vent pipe materials and fittings must comply with the following:			
Item	**Material**	**Standards for installation in:**	
		United States	**Canada**
Vent pipe and fittings	AL 29-4C Stainless	ANSI/ASTM UL1738	UL1738
	PVC schedule 40*	ANSI/ASTM D1785	CPVC and PVC venting must be ULC-S636 Certified. IPEX is an approved vent manufacturer in Canada supplying vent material listed to ULC-S636.
	CPVC schedule 40	ANSI/ASTM F441	
	Polypropylene	ULC-S636	ULC-S636
Pipe cement & primer	PVC	ANSI/ASTM D2564	IPEX System 636 Cements & Primers
	CPVC	ANSI/ASTM F493	
NOTICE: DO NOT USE CELLULAR (FOAM) CORE PIPE			

Please note: Venting system may contain one or more of the above materials.

The EVO is a direct vent appliance. The EVO is listed as a Category IV. Condensing Appliance. (The EVO Venting is rated at Zero Clearance to combustibles.)

⚠ SPECIAL VENTING SYSTEM DESIGN NOTES

The EVO efficiency testing and ratings are based on a sealed, two pipe vent system; however, many other vent configurations are available as factory engineered solutions. Please contact the factory if exceptions are required for your installation.

⚠ DANGER

It is extremely important to follow these venting instructions carefully. Failure to do so can cause severe personal injury, death or substantial property damage.

⚠ WARNING

This vent system will operate with a positive pressure in the vent pipe. Do not connect vent connectors serving appliances by natural draft into any portion of mechanical draft systems operating under pressure.

Note: For concrete construction or to meet certain fire codes, exhaust and inlet piping at the wall penetration to the EVO must be CPVC Schedule 40 or 80 or stainless. The balance from the penetrated wall to the outside may be PVC Schedule 40 or 80.

Note: If return water temps exceed 130ºF, use of PVC is NOT recommended, even though product is approved as such. Contact Hamilton Engineering at 800.968.5530 for further clarification.

B. VENTING THE EVO

(TABLE 4-1) VENTING SPECIFICATIONS

Model	Vent Diameter	Standard Vent Type	Optional Vent Type	Minimum Combined Vent Length	Maximum Combined Length
HW 79	3"	Plastic	Stainless	6' + (2) 90º elbows	250'
HW 129	3"	Plastic	Stainless	6' + (2) 90º elbows	200'
HW 179	3"	Plastic	Stainless	6' + (2) 90º elbows	160'
HW 199.1	3"	Plastic	Stainless	6' + (2) 90º elbows	90'
HW 299	4"	Plastic	Stainless	6' + (2) 90º elbows	225'
HW 399	4"	Plastic	Stainless	6' + (2) 90º elbows	180'
HW 599	5"	Stainless	Plastic - 6"*	6' + (2) 90º elbows	200'

**The use of 6" PVC will require the purchase of a special adapter from Hamilton Engineering, Inc.*

(TABLE 4-2) EQUIVALENT FEET

Fittings or Piping	Equivalent Feet
90 degree elbow	5'
45 degree elbow	3'
Coupling	0
Air inlet elbow	6'
Exhaust coupling	1'

The inlet and exhaust pipes on the top of the cabinet should be the diameter and material indicated in the Venting Specifications Table above. It is very important that you plan the location properly to eliminate long pipe runs and excessive fittings. Inlet pipe size must not be reduced. *Do not combine the inlet air or exhaust with any other inlet or exhaust pipe including either to an additional similar appliance, unless you have purchased an engineered Common Venting System from Hamilton Engineering, Inc.* The joints must be properly cleaned, primed and cemented if plastic, and sealed per the manufacturer's instructions if stainless. The piping must also be properly supported as per Local and National Standard Plumbing Codes. It is important that the piping must be clean and free from burrs, debris, ragged ends and particles of PVC (if applicable).

B. VENTING THE EVO CONT.

Exhaust piping should be sloped back to the connection on the EVO, at least 1/4” per foot to remove additional condensate that forms within the pipe. The total combined length of pipe (intake piping plus exhaust piping added together) including elbow allowances intake and exhaust should not exceed the length shown in the vent table. The minimum combined vent length should not be less than a combined length of 6’ plus two 90° elbows. Choose your vent termination locations carefully. You must also make certain that exhaust gas does not re-circulate back into the intake pipe. You must place them in an open area and follow the following guidelines:

⚠ NOTICE

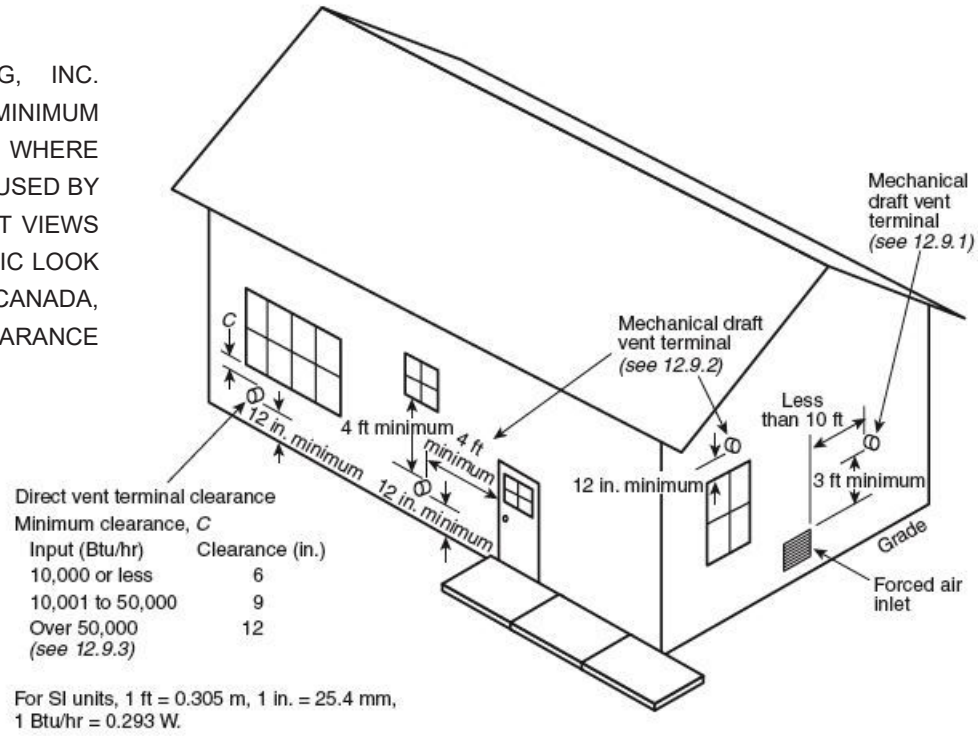
The following are code restrictions for the location of the flue gas vent terminal. Compliance to these requirements doesn’t insure a satisfactory installation; good common sense must also be applied. It is important to make sure that exhaust gases are not recirculated into the inlet air of the EVO. If there is any doubt, contact the factory BEFORE installing.

1) Never vent into a walkway, patio area, alley or otherwise public area less than 7' from the ground. (See detail below references Fig. A.12.9 in the National Fuel Gas Code 2009 “Exit Terminals of Mechanical Draft and Direct-Venting Systems;” see Figure 4-1, pg.23)
2) Never vent over or under a window or a doorway where the exhaust plume or condensation liquid will cause obtrusive or dangerous conditions. (Refer to National Fuel Gas Code, CAN B149).
3) Never install a heat saver or similar product to capture waste heat from exhaust.
4) Always have a vent location at least 12" above maximum snow level.
5) Always have vent a minimum of 24" above ground level, away from shrubs and bushes.
6) Follow local gas codes in your region or refer to National Fuel Gas Code, Can B149.
7) Always have at least 36" distance from an inside corner of the outside walls.
8) Maintain at least 48" clearance to electric, gas meters, windows, exhaust fans, chimneys, inlets or mechanical vents.
9) **VERY IMPORTANT!** The inlet air connection must be connected to outside air and should be located no closer than 8" and no further than 24" to the exhaust.
10) *Always* place screens in all openings in intake and exhaust to prevent foreign matter from entering the EVO.
11) The vent intake and exhaust must be properly cleaned and glued if plastic, and sealed per the manufacturer’s directions if stainless for a pressure tight joint. Several methods for venting the EVO can be found in Figures 4-2 through 4-6 of this section. Use these layouts as guidelines: certain site conditions such as multiple roof lines/pitches may require venting modifications (consult Hamilton Engineering, Inc.).

B. VENTING THE EVO CONT.

***IMPORTANT NOTE**

HAMILTON ENGINEERING, INC. RECOMMENDS A MINIMUM CLEARANCE OF 4 FEET WHERE THE EXHAUST PLUME CAUSED BY THE UNIT MAY OBSTRUCT VIEWS OR AFFECT THE COSMETIC LOOK OF THE BUILDING. IN CANADA, THERE IS A MINIMUM CLEARANCE OF 10 FEET.



* REFERENCE: THE NATIONAL FUEL GAS CODE 2009 EDITION

Through-the-Wall Vent Termination

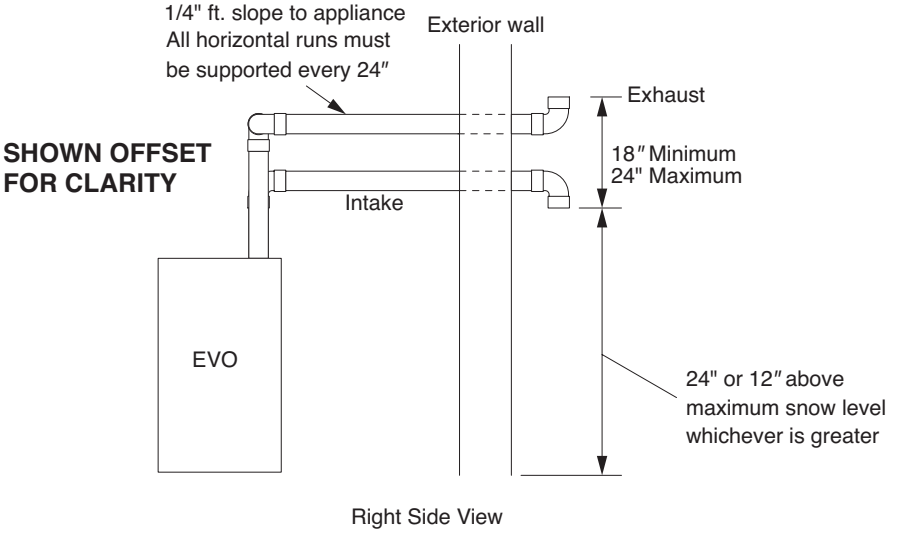
1) A through-the-wall mechanical draft venting system shall terminate at least 3 ft (0.9 m) above any forced air inlet located within 10 ft (3 m).
   Exception No. 1: This provision shall not apply to the combustion air intake of a direct vent appliance.
   Exception No. 2: This provision shall not apply to the separation of the integral outdoor air inlet and flue gas discharge of listed outdoor appliances.

2) A through-the-wall mechanical draft venting system of other than direct vent type shall terminate at least 4 ft (1.2 m) below, 4 ft (1.2 m) horizontally from, or 1 ft (300 mm) above any door, operable window, or gravity air inlet into any building. The bottom of the vent terminal shall be located at least 12 in. (300 mm) above finished ground level.

3) The through-the-wall vent terminal of a direct vent appliance with an input of 10,000 Btu/hr (3 kW) or less shall be located at least 6 in. (150 mm) from any air opening into a building, an appliance with an input over 10,000 Btu/hr (3 kW) but not over 50,000 Btu/hr (14.7 kW) shall be installed with a 9 in. (230 mm) vent termination clearance, and an appliance with an input over 50,000 Btu/hr (14.7 kW) shall have at least a 12 in. (300 mm) vent termination clearance. The bottom of the vent terminal and the air intake shall be located at least 12 in. (300 mm) above finished ground level.

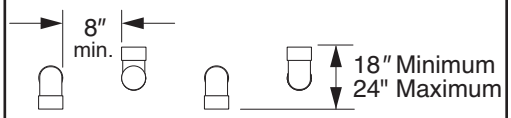
(FIGURE 4-2) SIDEWALL VENT WITH DOWN ELBOW (INTAKE) & UP ELBOW (EXHAUST)

PLEASE NOTE:
Exhaust must not terminate beneath an overhang!



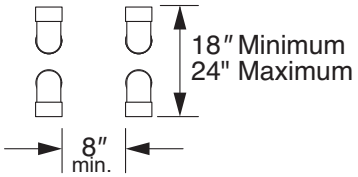
Right Side View

VENTING FOR MULTIPLE UNITS, with vents all on same horizontal plane, spaced at least 8 inches apart, and at level of highest unit.



Front Elevation

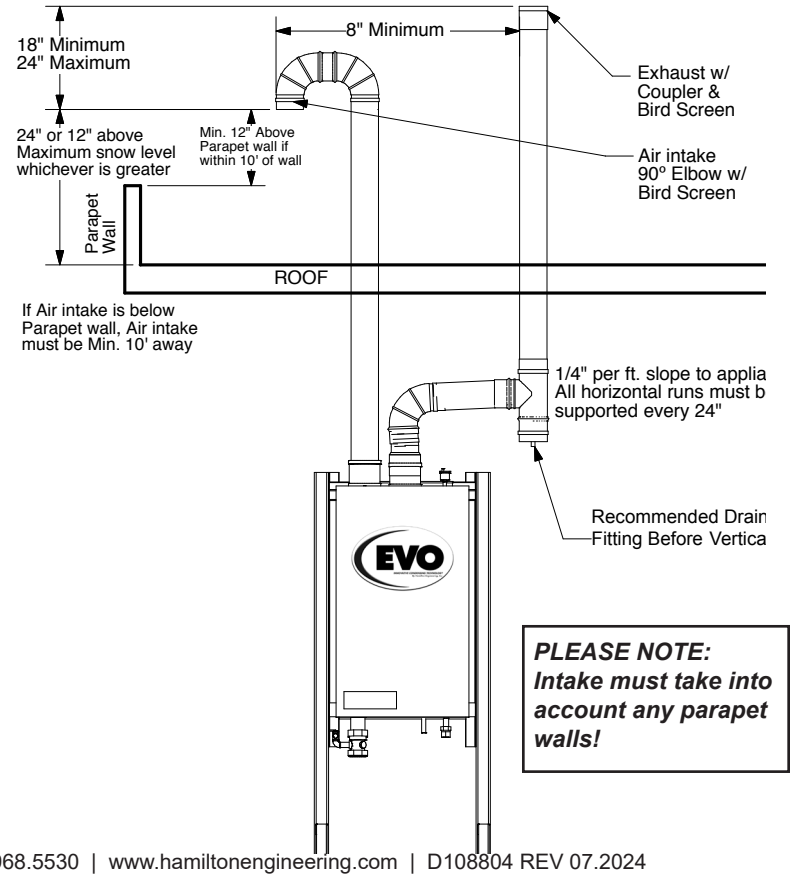
- OR -



Front Elevation
(Multiple Vents)

**IMPORTANT NOTE: All vent pipes must be glued, properly supported and the exhaust must be pitched a minimum of a 1/4" per foot back to the heater (to allow drainage of condensate). All stainless venting must be sealed at each joint per manufacturer's instructions.

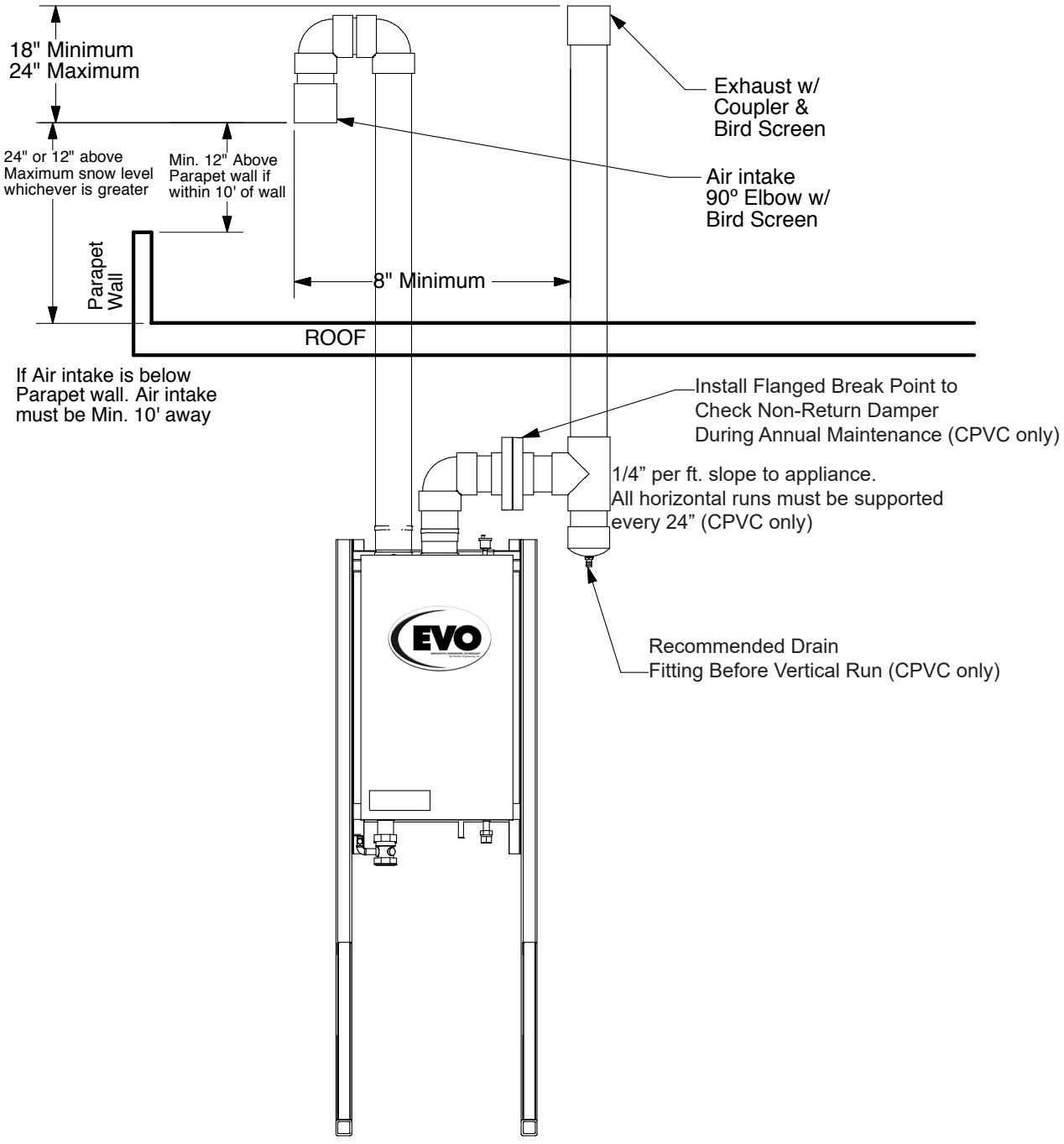
(FIGURE 4-3) VERTICAL VENT WITH DOUBLE ELBOW (INTAKE) & COUPLING (EXHAUST)



PLEASE NOTE:
Intake must take into account any parapet walls!

**IMPORTANT NOTE: All vent pipes must be glued, properly supported and the exhaust must be pitched a minimum of a 1/4" per foot back to the heater (to allow drainage of condensate). All stainless venting must be sealed at each joint per manufacturer's instructions.

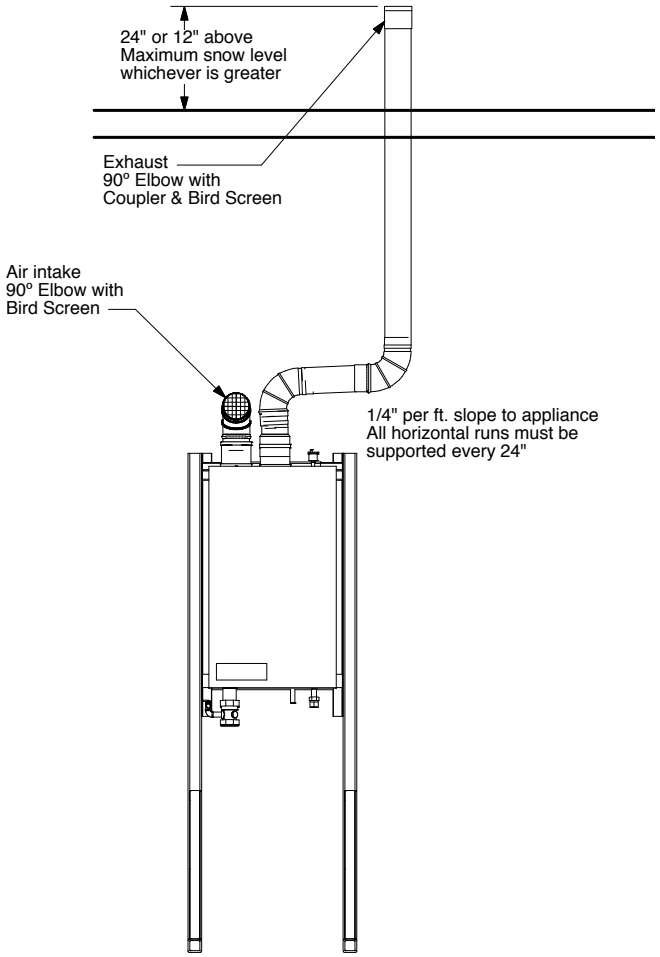
(FIGURE 4-4) VERTICAL VENT WITH PVC/CPVC



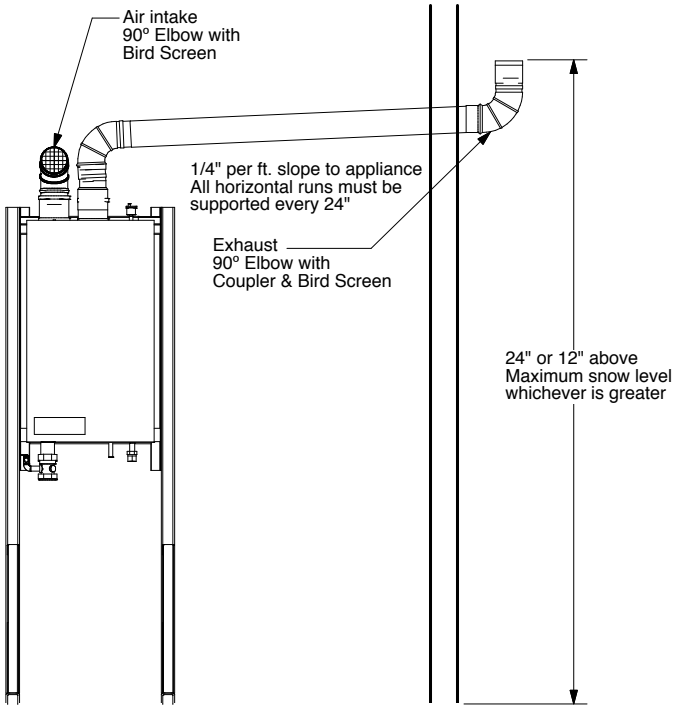
DIAGRAMS FOR ROOM AIR VENTING TERMINATION

If you're using room air, your unit should be set up this way:

(FIGURE 4-5) VERTICAL TERMINATION



(FIGURE 4-6) SIDEWALL TERMINATION



As long as the boiler room remains under a positive pressure under all operating conditions of the building, this is a perfectly acceptable option. Generally, all this requires is an external free air source; typically just two properly sized openings to the outdoors. Installations done in this manner must comply with ANSI Z223.1, NFPA 54 - National Fuel Gas Code 2009 section 9.3, and any specific local codes that may require additional combustion air be provided. For more information, see Technical Bulletin - TB 003. This would be our preferred alternate to our standard manual specifications.

Note: Stated efficiencies are based on ducted air; using room air may effect efficiency.

⚠ CAUTION

Flue Gas will condense as it exits the vent termination. This condensate can freeze on exterior building surfaces which may cause discoloration of these surfaces. Consideration should be given to the plume of condensation that exits the exhaust which may affect the cosmetic appearance of the building.

C. INLET AIR VENT

You may use the same material as used for exhaust or any material that is the same diameter that provides a pressure tight connection. THIS IS ONLY FOR INLET AIR, NOT FOR EXHAUST PIPING!

The air inlet must be a minimum of 12" vertically above the maximum snow level. It is very important that there are no other vents, chimneys or air inlets in any direction for at least 48".

All venting must be properly supported. The EVO is not intended to support any venting whatsoever. All piping, glue, solvents, cleaners, fittings and components, must conform to ASTM (American Society for Testing and Materials), and ANSI (American National Standards Institute).

D. VENTING RUNS THAT EXCEED MAXIMUM COMBINED LENGTH

If the combined venting length of a heater's exhaust/inlet air system exceeds the Maximum Combined Length called out in Table 4-1, Page 21, contact Hamilton Engineering, Inc. for an engineered venting calculation. Do not proceed without calling Hamilton Engineering, Inc. at 800.968.5530 or 734.419.0200.

VENT CALCULATION EXAMPLE: Installation requires the following material for both inlet and exhaust piping for the EVO HW 199.1 (maximum combined equivalent length is 100 feet).

Required: 6 Pcs. 90° elbow (6 x 5 = 30 equivalent feet)	= 30 equivalent feet
Required: 20' of Plastic PVC Pipe (20 x 1 = 20 equivalent feet)	= 20 equivalent feet
Required: Inlet air in vertical termination (2) 90° elbows + bird screen)	= 11 equivalent feet
Required: Exhaust coupling	= 1 equivalent foot
Total Friction Loss in equivalent feet	**= 62 equivalent feet**

THIS VENT SYSTEM IS OK!

⚠ DANGER

The EVO is not intended to be common vented with any other existing appliance! Multiple EVO products may be common vented, only if using an engineered system by Hamilton Engineering, Inc.

E. HEATER REMOVAL FROM AN EXISTING COMMON VENT SYSTEM

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

1. Seal any unused openings in the common venting system. The EVO venting is NOT to be combined with this older venting system!
2. Visually inspect the venting system for proper size and horizontal pitch to determine if there is blockage, leakage, corrosion or other deficiencies that could cause an unsafe condition.

E. HEATER REMOVAL FROM AN EXISTING COMMON VENT SYSTEM CONT.

3. If practical, close all building doors, windows and all doors between the space in which the appliance remains connected to the common venting system and other spaces in the building. Turn on clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, at maximum speed. Do not operate a summer exhaust fan. Close all fireplace dampers.
4. Place the appliance being inspected in operation. Follow the lighting instructions. Adjust the thermostat so the appliance will operate continuously.
5. 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.
6. After it has been determined that each appliance remaining connected to common venting system properly vents when tested as outlined, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous condition of use.
7. Any improper operation of the common venting system should be corrected so the installation con forms with the National Fuel Gas Code, ANSI Z223.1. 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 Appendix G in the National Fuel Gas Code, ANSI Z 223.1

⚠ WARNING

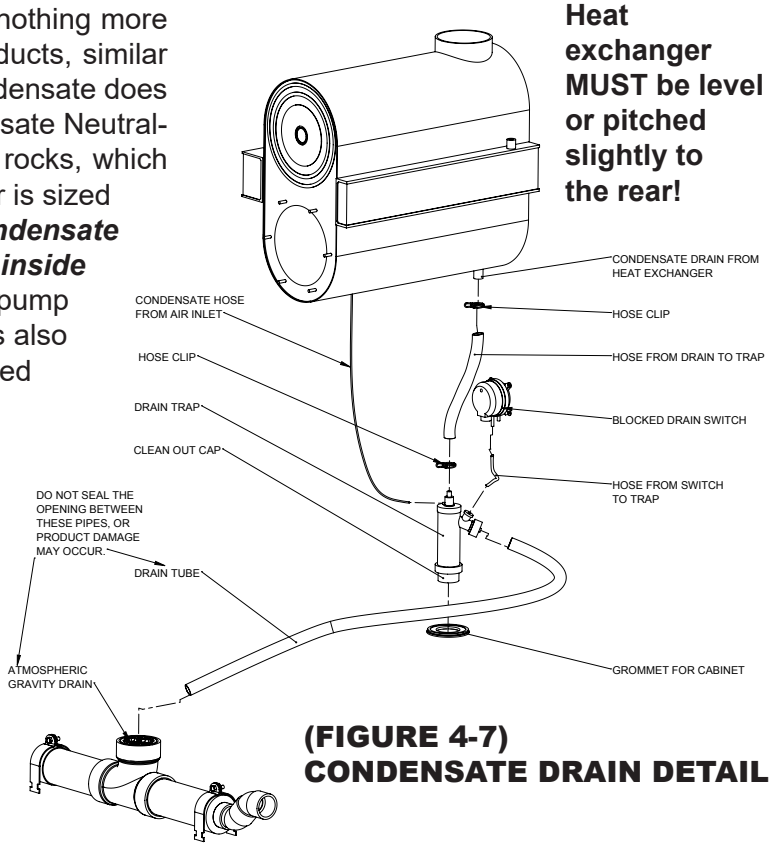
In a common vent system, DO NOT POWER THE UNIT OFF! Equipment damage may occur. To disable operation, turn off gas, NOT power. If you have any questions, please call Hamilton Engineering Technical Support at 800.968.5530.

F. CONDENSATE REQUIREMENTS

This is a condensing high efficiency appliance, therefore this unit has a condensate removal system. Condensate is nothing more than water vapor derived from the combustion products, similar to an automobile when it is initially started. This condensate does have a low pH and should be treated with a Condensate Neutralizer Filter. This filter contains either lime or marble rocks, which will neutralize the condensate. The outlet of the filter is sized for 1.5" PVC pipe. ***It is very important that the condensate line is sloped away from and down to a suitable inside drain.*** A condensate neutralizer and a condensate pump kit are available from Hamilton Engineering, Inc. It is also very important that the condensate line is not exposed to freezing temperatures, or any other type of blockage. Plastic tubing or PVC pipe should be the only materials used for the condensate line. Steel, brass, copper or others will be subject to corrosion and deterioration. A second vent may be necessary to prevent condensate line vacuum lock if a long horizontal run is used. The EVO appliance has an automatic safety device that will shut it down in the event of a condensate drain blockage. Please test annually.

Maximum volume of condensate produced is 11 gallons per hour per 1,000,000 BTU of gas burned.

NOTE: Heat exchanger MUST be level or pitched slightly to the rear!



(FIGURE 4-7)
CONDENSATE DRAIN DETAIL

PART 5. PIPING

A. HYDRONIC HEATING BOILER PIPING

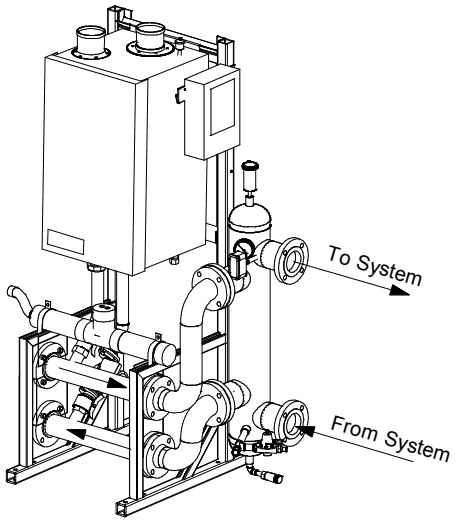
The EVO is designed to function in a closed loop (minimum) 12 PSI System. Never let the EVO operate without a minimum of 10 PSI water pressure, this assures that the EVO heat exchanger can be completely purged of air, failure to do so could cause damage. It is important to note that the EVO Boiler is flow dependent for proper efficiency and life expectancy; therefore, primary-secondary piping or use of a low loss header design is always recommended, as shown in the Figure 5-1 below. Each EVO Heating Boiler System should have an Air Eliminator, in addition to the heat exchanger mounted air vent, which will remove air from the Hydronic System. Always follow good piping practices. Observe minimum 1" clearance to combustibles around all uninsulated hot water pipes, or when openings around pipes are not protected by non-combustible materials. On an EVO installed above the level of the highest heat transfer device, some state and local codes require a low water cut off device at the time of installation by the installer. A water flow switch is provided as standard and will take the place of a low water cut-off. If the EVO supplies hot water to heating coils in air handler units, flow control valves or other devices must be installed to prevent gravity circulation of boiler water in the coils during the cooling cycle.

Basic piping connection steps are listed below. A drawing, specific to your application can be obtained from your distributor or Hamilton Engineering, Inc., which will guide you through proper installation of the EVO.

1) Pipe properly, in accordance with generally accepted piping principals or Hamilton Engineering specific documents.
2) Connect system return to the pipe entering the EVO closest to the back.
3) Connect system supply to the pipe leaving the EVO containing the Relief Valve.
4) Install Drain Valve on system supply.

Note: the EVO can not be drained of water without purging the unit with air pressure, 15 PSI minimum. The system's air vent must be closed during this process.

(FIGURE 5-1) BOILER PIPING



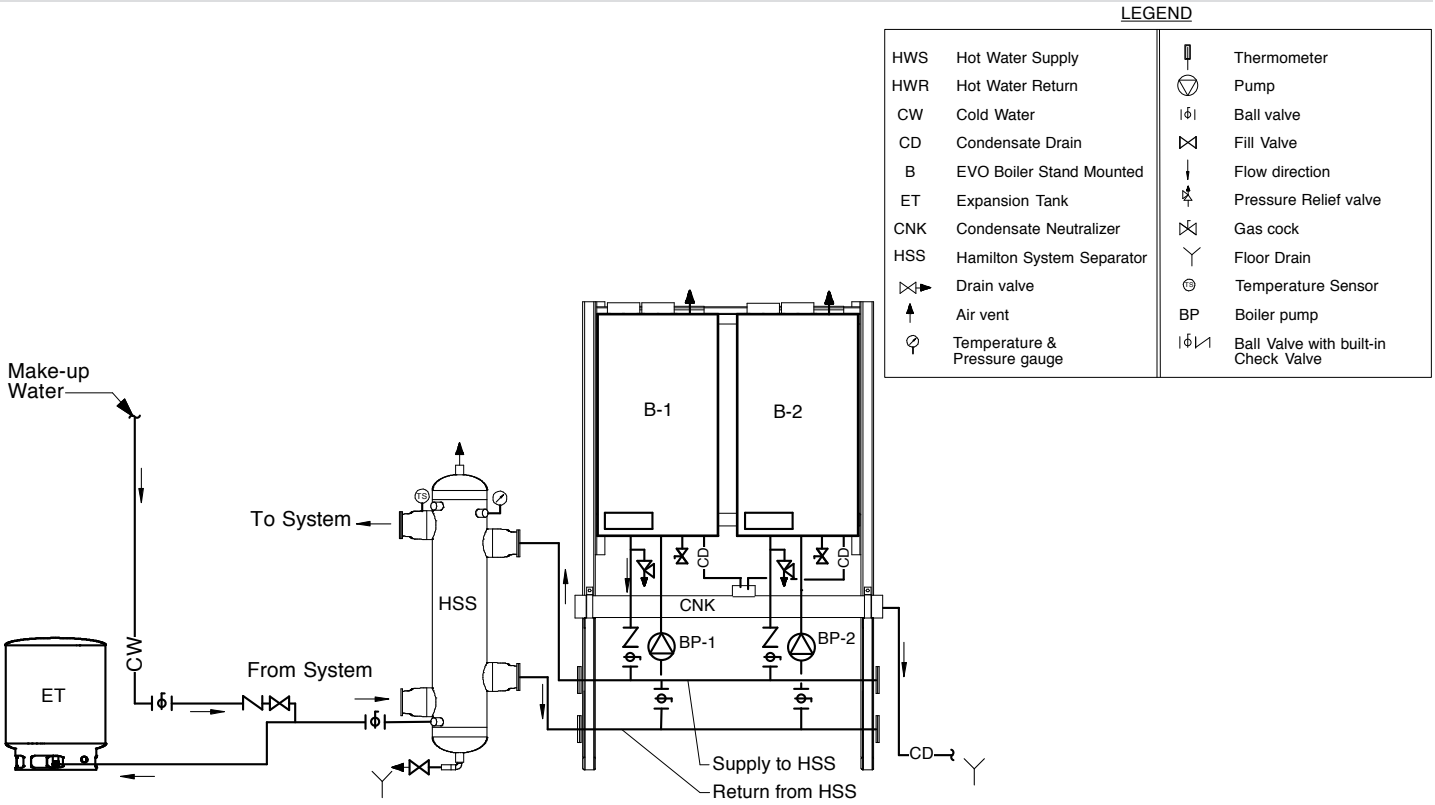
(TABLE 5-1) BOILER PIPING

Model	Boiler Only GPM ΔP	Design ΔT		Pump Supplied	Minimum Manifold Pipe Size			
					Single	Double	Triple	Quad
HW 79	4.4 @ 7.9'	34.6º F	19.2º C	PMP 90302	1"	1"	1"	1.5"
HW 129	4.4 @ 7.9'	58.9º F	32.7º C	PMP 90302	1"	1"	1"	1.5"
HW 179	6.6 @ 7.9'	53.7º F	29.8º C	PMP 90302	1"	1"	1.5"	1.5"
HW 199.1	6.6 @ 7.9'	57.6º F	32.0º C	PMP 90302	1"	1"	1.5"	1.5"
HW 299	11 @ 9.3'	51.8º F	28.8º C	PMP 90304	1.5"	1.5"	2"	2"
HW 399	17.6 @ 8.5'	43.2º F	24.0º C	PMP 90304	1.5"	2"	2"	2.5"
HW 599	26.4 @ 9.4'	45.3º F	25.2º C	PMP 90310	1.5"	2"	2.5"	3"

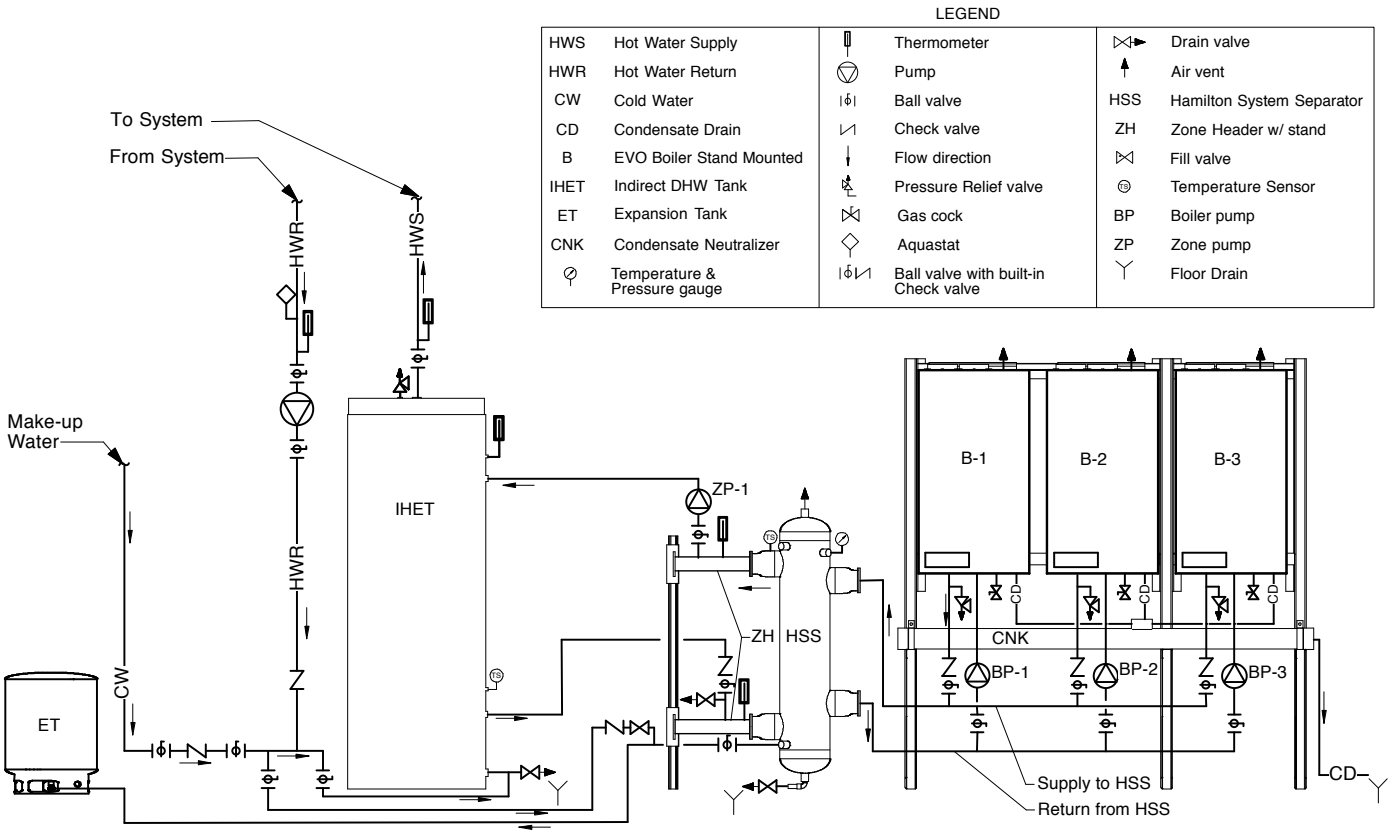
Note: Flow rates shown above are for clean, closed loop systems.

B. BOILER SCHEMATIC DRAWINGS

Two boiler schematic to Hamilton System Separator



Three boiler schematic to Hamilton System Separator with one zone for indirect hot water tank



IMPORTANT NOTE: The above are representative drawings; must conform to local codes. Consult factory for Custom System Solutions.

C. FILL & PURGE HEATING SYSTEM

1) Attach hose to balance and purge hose connector and run to drain.
2) Close the other side of the balance and purge valve.
3) Open first zone balance and purge valve, so as to let the water flow out of the hose. If zone valves are used, open zone valves one at a time, manually. (NOTE: please check manufacturer's instructions prior to opening valves manually, so as not to damage the valve.)
4) Manually operate fill valve regulator. When water runs out of hose, connected to the balance and purge valve, in steady stream (with no air bubbles), close balance and purge valve to stop the water from flowing. Disconnect hose and connect to next zone to be purged.
5) Repeat procedure for additional zones (one at a time).

Upon completion, make sure that the fill valve is in automatic position and each zone balance and purge valve is in the open position and zone valves are positioned for automatic operation.

NOTE: Installations that incorporate Standing Iron Radiators and systems with manual high point vents: Follow the above procedure, then starting with nearest manual air vent, open vent until water flows out; close vent. Repeat procedure, working your way toward furthest air vent. It may be necessary to install a basket strainer or filtration in an older hydronic system where larger amounts of sediment may be present. Periodic cleaning of the strainer may be necessary.

For boiler water and/or odd water systems, please make note of these additional guidelines:

- ***Thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by build-up or corrosion due to sediment.***
- ***Do not use petroleum-based cleaning or sealing compounds in the boiler system. Gaskets and seals in the system may be damaged. This can result in substantial property damage.***
- ***Do not use 'homemade cures' or 'boiler patent medicines'. Serious damage to the boiler, personnel, and/or property may result.***
- ***Continual fresh make-up water will reduce boiler life. Mineral buildup in the heat exchanger reduces heat transfer, overheats the stainless steel heat exchanger, and causes failure. Addition of oxygen carried in by makeup water can cause internal corrosion in system components. Leaks in boiler or piping must be repaired at once to prevent makeup water.***

D. REMOVING AIR FROM THE HEAT EXCHANGER

The EVO 299–599 (it is not necessary on an EVO 79–199.1) has an automatic air vent on the top of the appliance and the air vent cap must be loosened to allow trapped air to escape when the appliance is initially filled and put into operation. If this air vent should start to leak, there are two possible solutions:

a. Close the cap—the air vent is not needed anymore after the heat exchanger has been purged of air. This air vent MUST be operable if the appliance is drained and refilled.
b. Replace the air vent. When replacing the air vent, the water must be shut off and pressure released first.

E. WATER HEATING PIPING

1) Use only the pipe sizes shown and a pump meeting the listed specifications in the following tables:

   *Note: Individual Appliance Piping pressure drop used in the tables is based on 20 feet of straight pipe, 6 elbows, 2 tees, 2 full port ball valves and 2 unions.

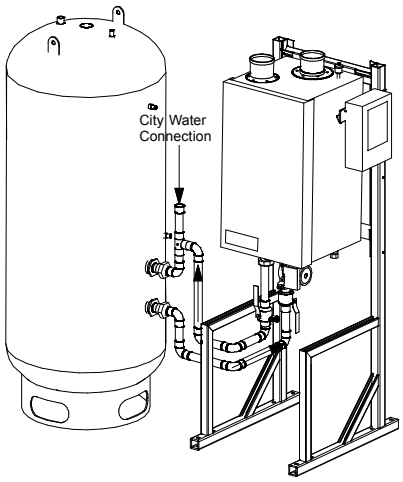
2) The city cold water supply to the water heating system should be connected between the heater outlet and the storage tank or the storage tank directly. This will help minimize unnecessary short cycling due to small hot water draws. Higher efficiency can be obtained through use of our optional CWIS™ - Cold Water Injection System in any Hamilton Storage Tank.

3) Isolation valves should be installed on each heater and on the cold and hot water system connections.

Upon completion of piping, fill and properly purge of all air. Open all valves and start circulating pump. Consult Hamilton Engineering for specific piping diagrams for your application at 800.968.5530.

NOTE: Minimum pump selection is based on piping sizes shown above and water hardness not to exceed 15 grains per gallon and total maximum equivalent piping length of 60 feet.

(FIGURE 5-2) HEATER PIPING



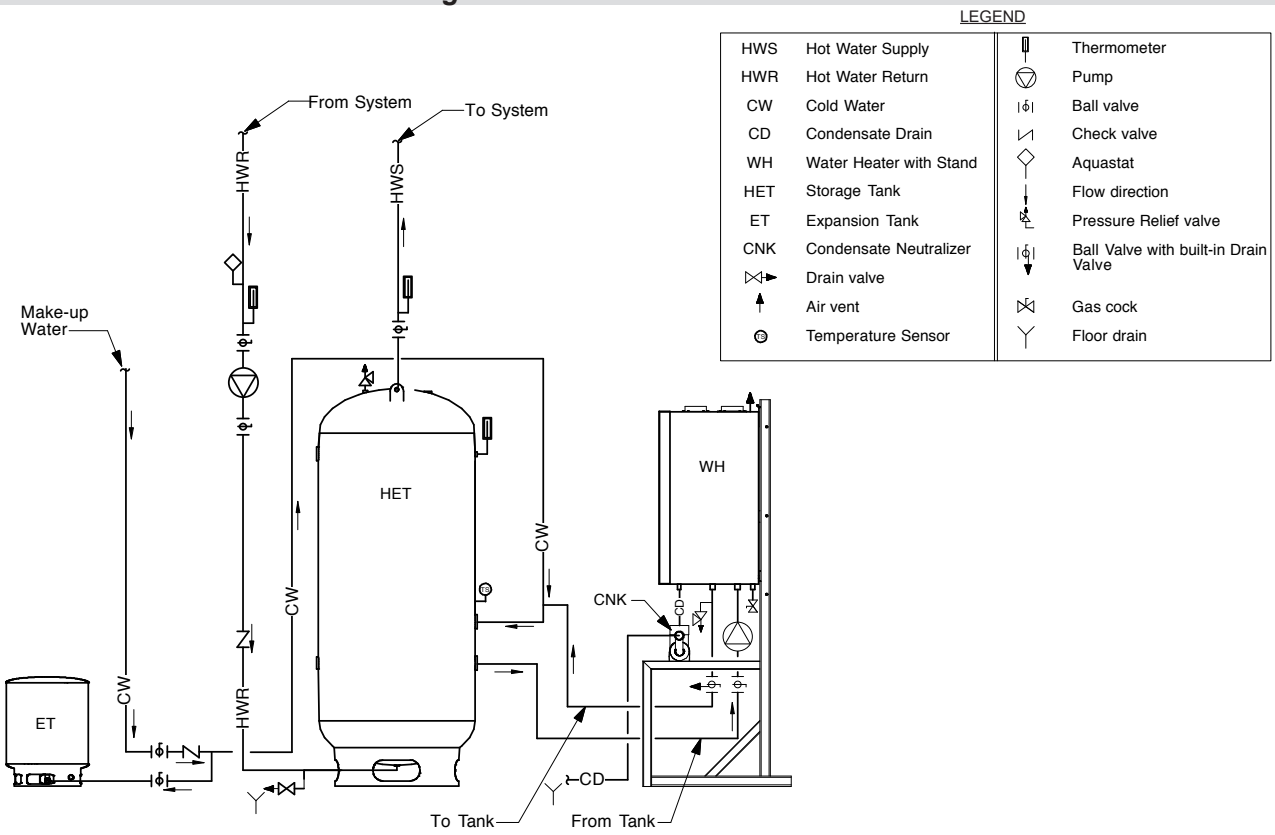
(TABLE 5-2) WATER HEATER PIPING

Model	GPM ΔP*	Design ΔT		Pump Supplied	Minimum Manifold Pipe Size			
					Single	Double	Triple	Quad
HW 79	6.6 @ 19.9’	23.5º F	13.1º C	PMP 90305	1”	1.5”	1.5”	2”
HW 129	6.6 @ 19.9’	40.1º F	22.2º C	PMP 90305	1”	1.5”	1.5”	2”
HW 179	9.9 @ 21.8’	36.6º F	20.3º C	PMP 90305	1”	1.5”	1.5”	2”
HW 199.1	9.9 @ 21.8’	39.2º F	21.8º C	PMP 90305	1”	1.5”	1.5”	2”
HW 299	16.5 @ 22.9’	35.3º F	19.6º C	PMP 90307	1.5”	2”	2”	2.5”
HW 399	26.4 @ 20.3’	29.4º F	16.3º C	PMP 90309	2”	2”	2.5”	3”
HW 599	39.6 @ 23.6’	30.9º F	17.1º C	PMP 90309	2”	2.5”	3”	4”

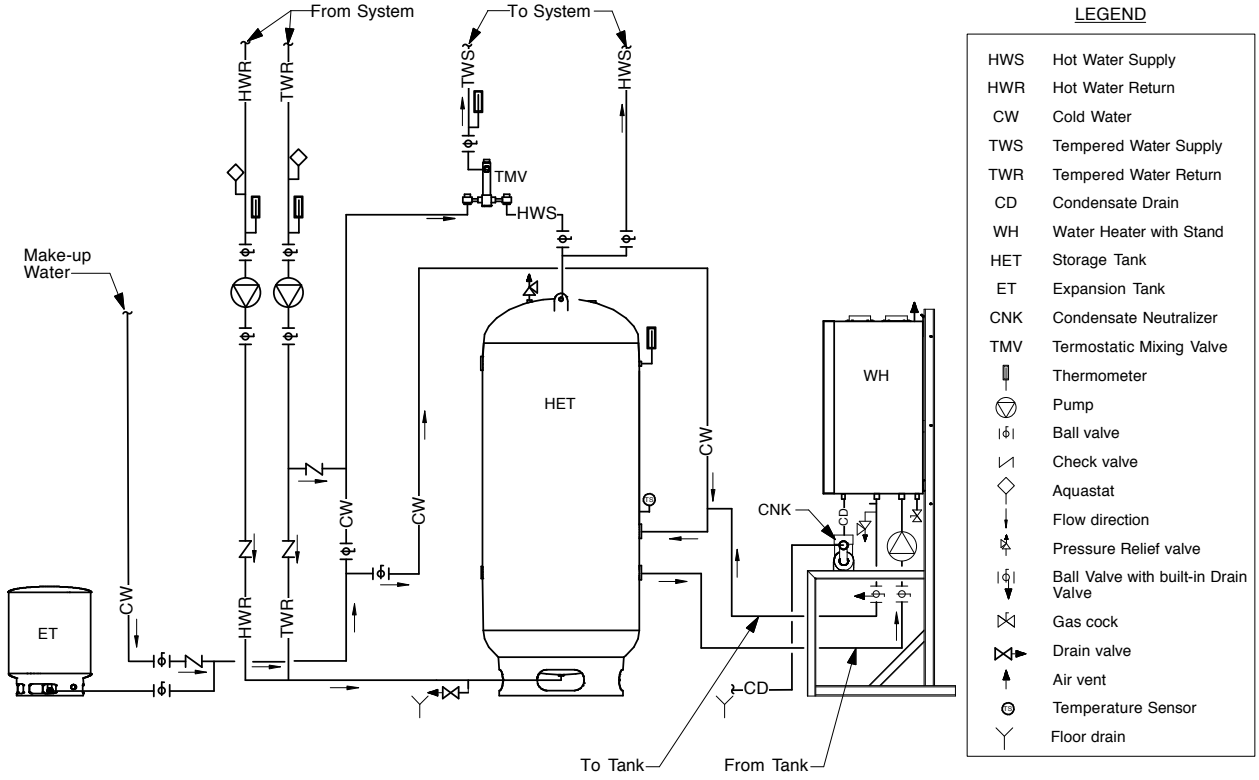
*Water heater and piping as described above.

F. WATER HEATING SCHEMATIC DRAWINGS

One water heater schematic to single tank



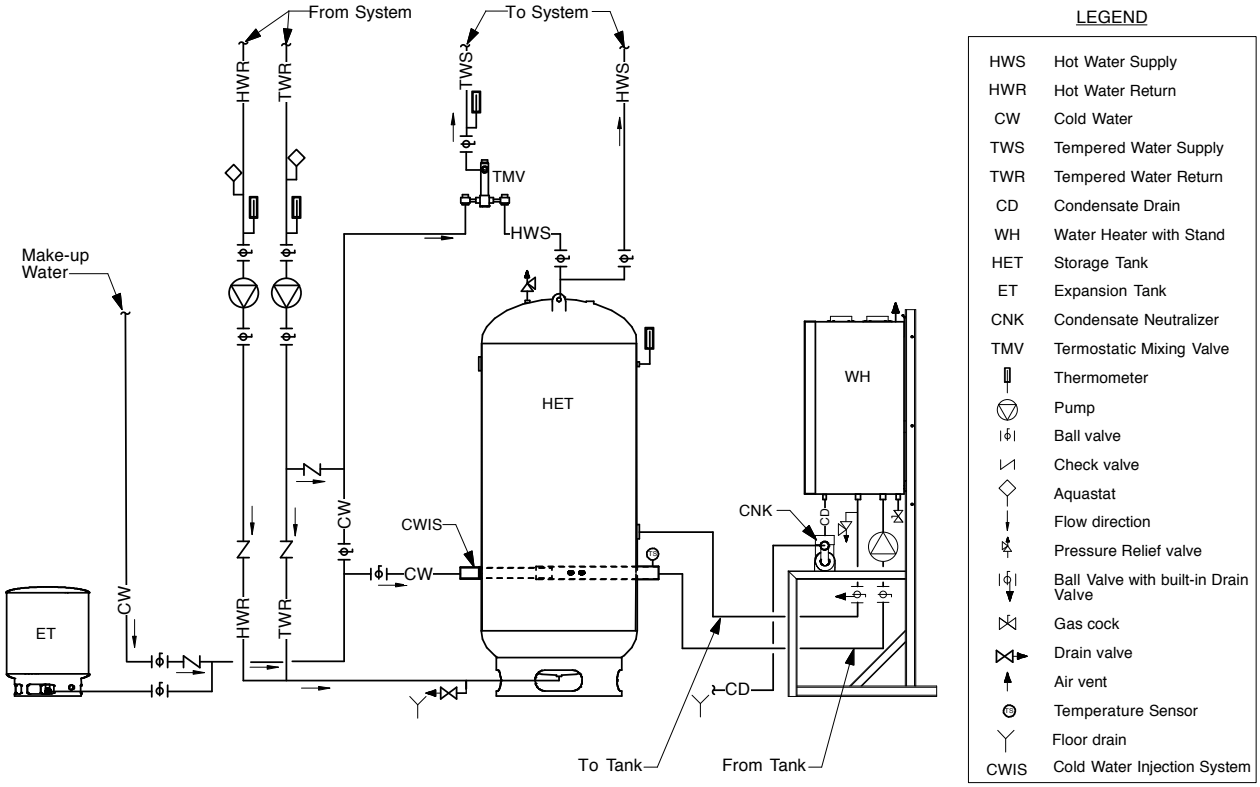
One water heater schematic to single tank with mixing valves



IMPORTANT NOTE: The above are representative drawings; must conform to local codes. Consult factory for Custom System Solutions.

F. WATER HEATING SCHEMATIC DRAWINGS CONT.

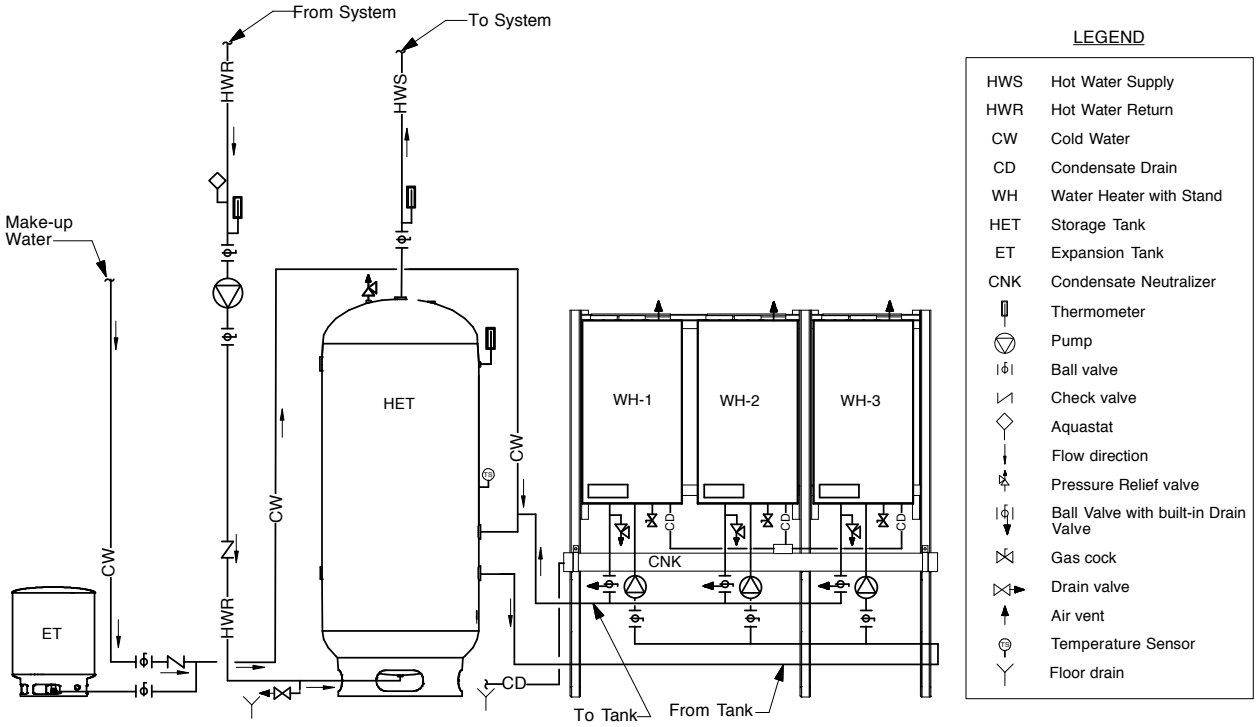
One water heater schematic to single tank with mixing valve and CWIS™



LEGEND

HWS	Hot Water Supply
HWR	Hot Water Return
CW	Cold Water
TWS	Tempered Water Supply
TWR	Tempered Water Return
CD	Condensate Drain
WH	Water Heater with Stand
HET	Storage Tank
ET	Expansion Tank
CNK	Condensate Neutralizer
TMV	Termostatic Mixing Valve
	Thermometer
	Pump
	Ball valve
	Check valve
	Aquastat
	Flow direction
	Pressure Relief valve
	Ball Valve with built-in Drain Valve
	Gas cock
	Drain valve
	Air vent
	Temperature Sensor
	Floor drain
CWIS	Cold Water Injection System

Three water heater schematic to single tank



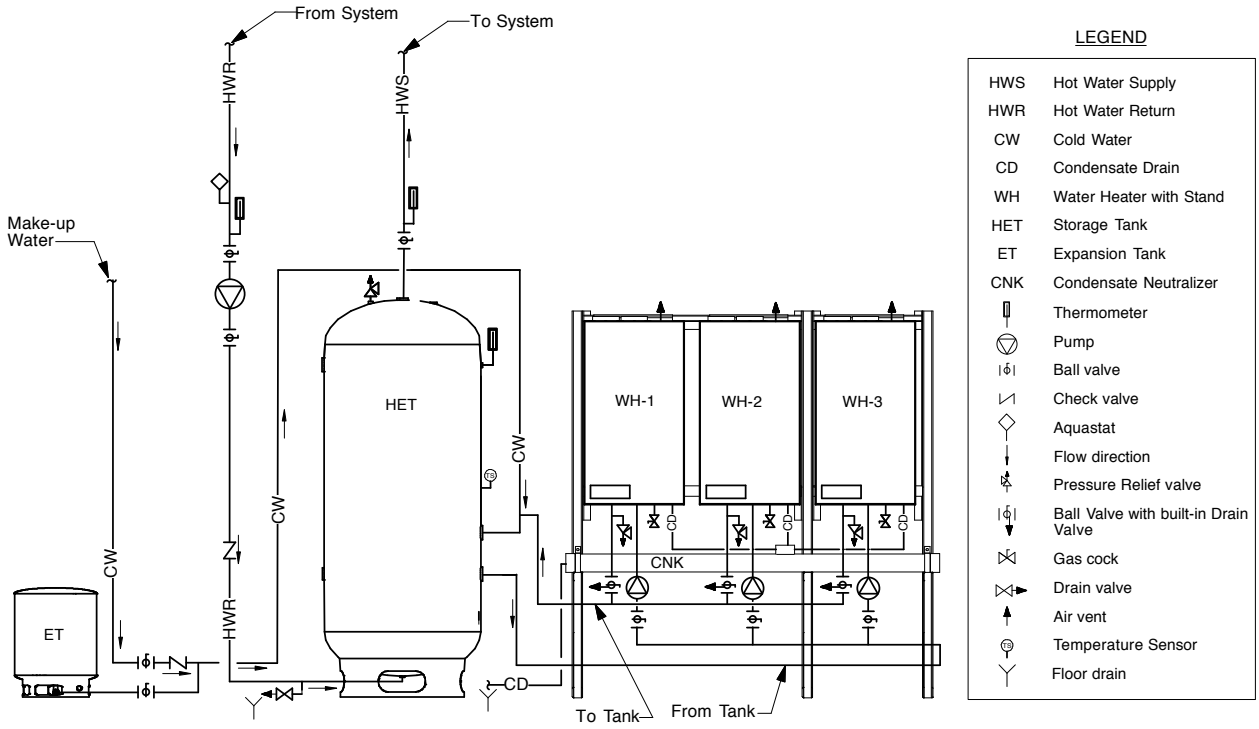
LEGEND

HWS	Hot Water Supply
HWR	Hot Water Return
CW	Cold Water
CD	Condensate Drain
WH	Water Heater with Stand
HET	Storage Tank
ET	Expansion Tank
CNK	Condensate Neutralizer
	Thermometer
	Pump
	Ball valve
	Check valve
	Aquastat
	Flow direction
	Pressure Relief valve
	Ball Valve with built-in Drain Valve
	Gas cock
	Drain valve
	Air vent
	Temperature Sensor
	Floor drain

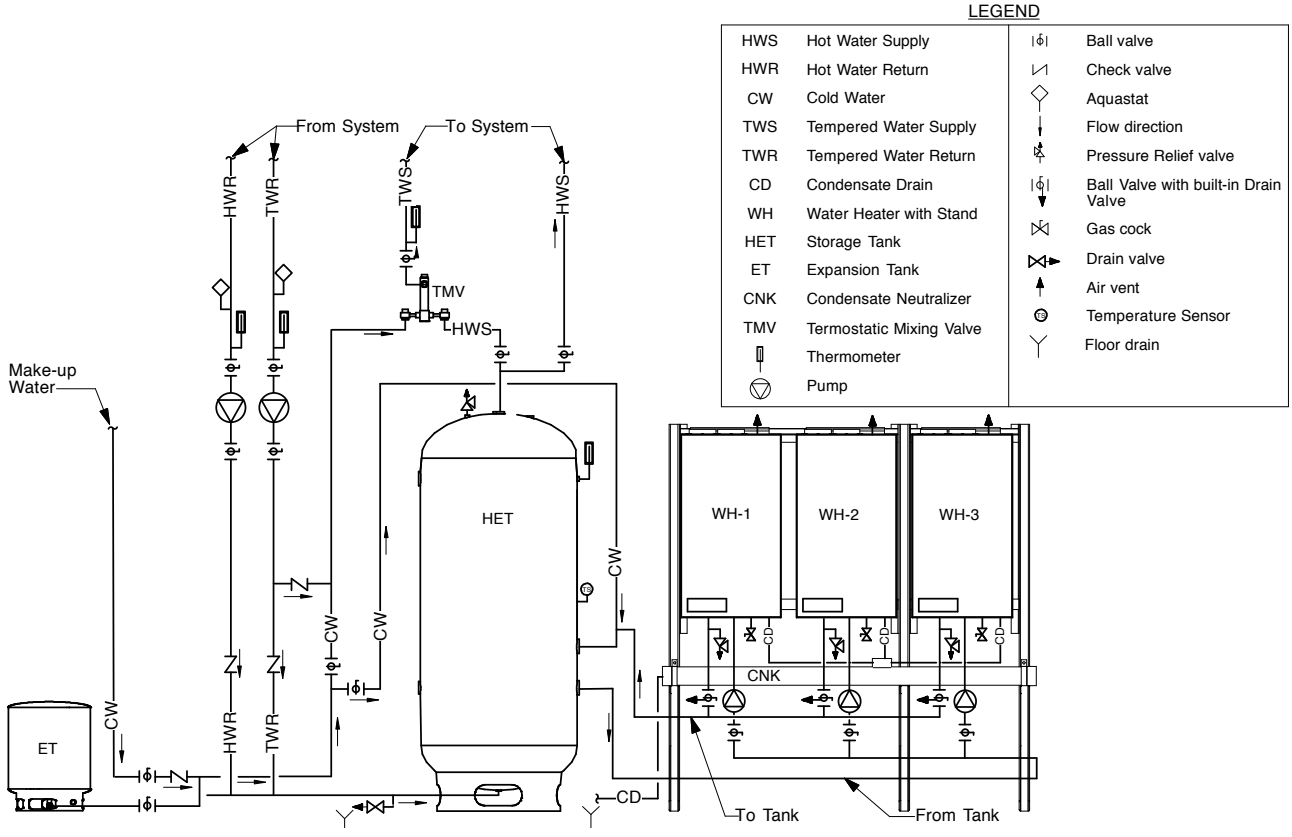
IMPORTANT NOTE: The above are representative drawings; must conform to local codes. Consult factory for Custom System Solutions.

F. WATER HEATING SCHEMATIC DRAWINGS CONT.

Three water heater schematic to single tank



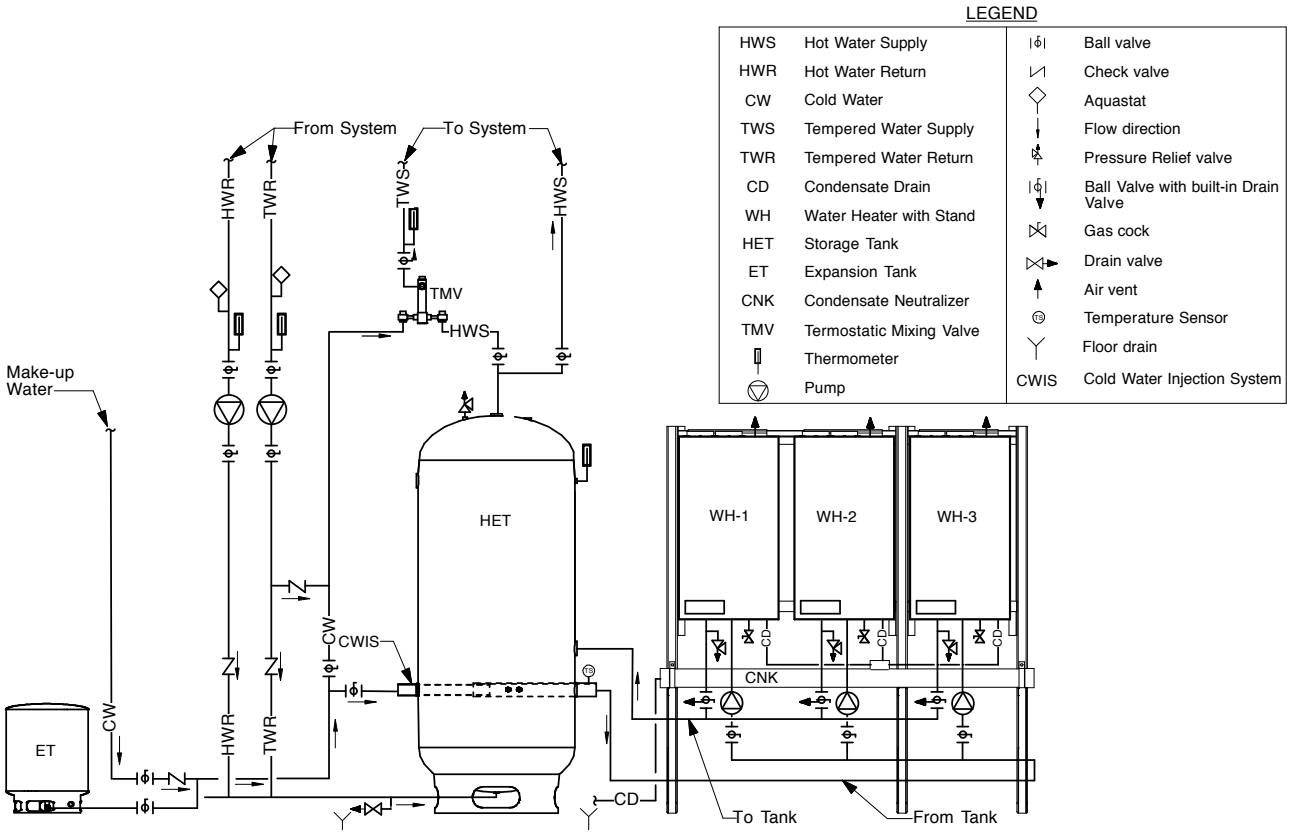
Three water heater schematic to single tank with mixing valve



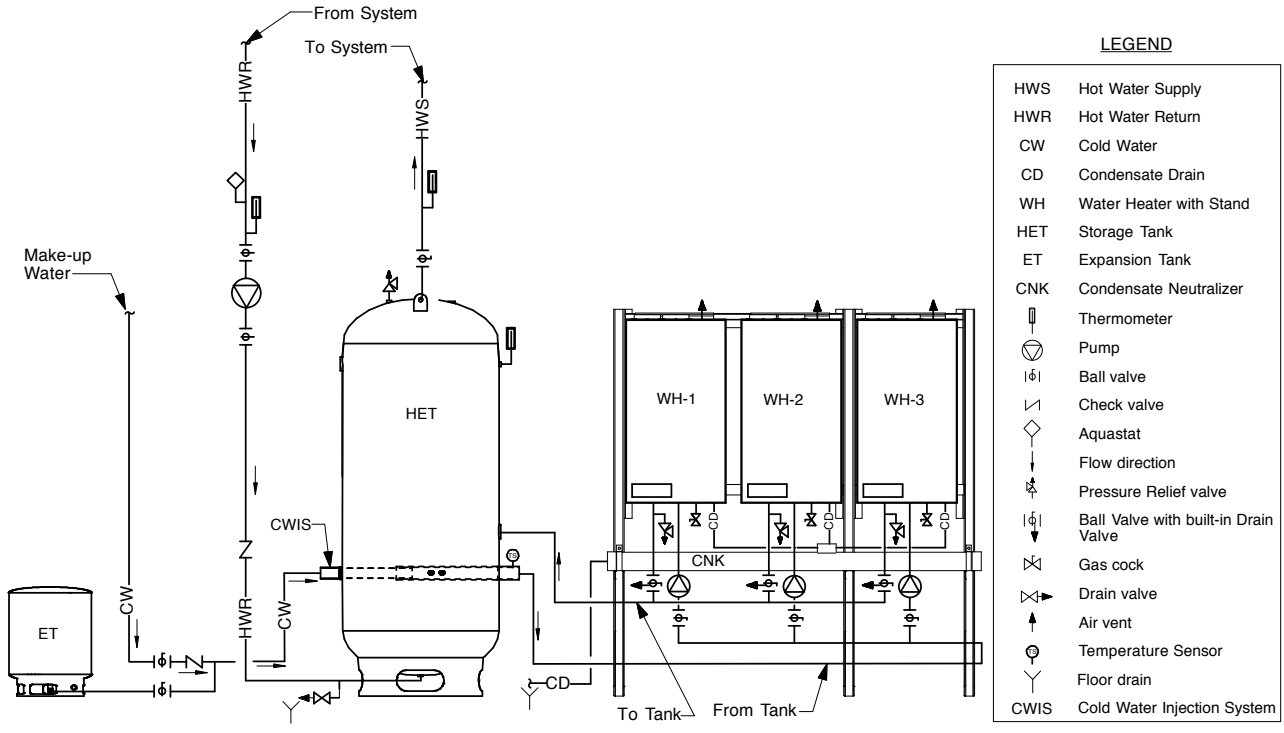
IMPORTANT NOTE: The above are representative drawings; must conform to local codes. Consult factory for Custom System Solutions.

F. WATER HEATING SCHEMATIC DRAWINGS CONT.

Three water heater schematic to single tank with mixing valve and CWIS™



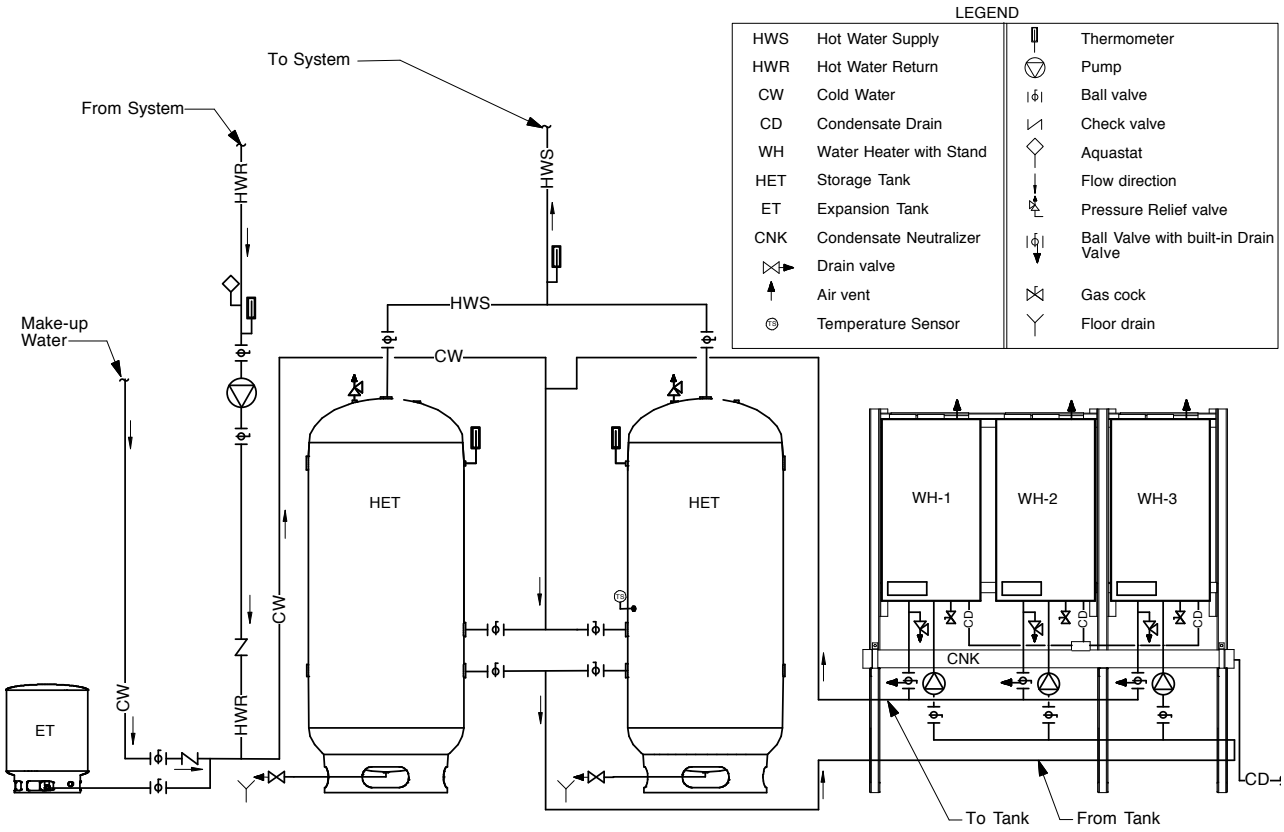
Three water heater schematic to single tank with CWIS™



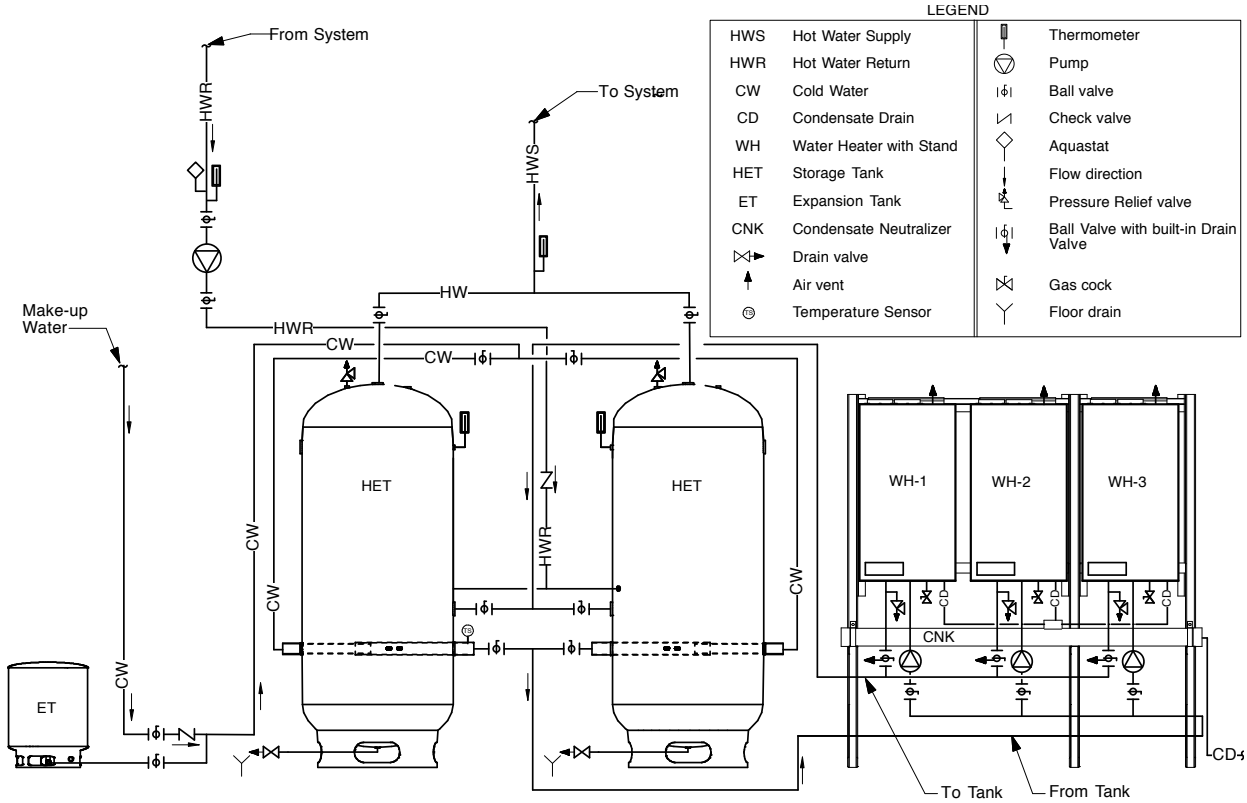
IMPORTANT NOTE: The above are representative drawings; must conform to local codes. Consult factory for Custom System Solutions.

F. WATER HEATING SCHEMATIC DRAWINGS CONT.

Three water heater schematic to two tanks



Three water heater schematic to two tanks with CWIS™



IMPORTANT NOTE: The above are representative drawings; must conform to local codes. Consult factory for Custom System Solutions.

PART 6. START-UP PROCEDURES

A. ITEMS TO BE CHECKED BEFORE LIGHTING THE EVO

It is recommended that you read the General Information Section (Part 1, Page 4-5) to get a better understanding of how the EVO operates before you start the unit and use LIT91111 (Start-Up Checklist) as a check and to document and confirm all conditions are correct. All EVO start ups should be conducted by properly qualified professionals.

1. Make sure that you follow the lighting instructions before running the EVO.
2. Check and make sure the circulating pump is running, and that the Flow Switch is operating correctly.
3. Make sure that the Gas is turned on outside the bottom of the cabinet of the EVO.
4. Double check to be sure the temperature setting is correct.
5. Make sure the unit is properly grounded and the electrical wiring meets the requirements of the Electrical section (Part 2, Page 12–13).
6. Make sure that no valves are placed between the relief valve and the appliance. The relief valve must be installed in such a manner that the discharge will be conducted to a suitable place for disposal when relief occurs. Ensure that no reducing coupling or other restriction is installed in the discharge line, and that the discharge line is installed to allow complete drainage of both the valve and the line.
7. Turn on the power to the EVO. The Setpoint Temperature of the EVO will appear in the display at this time. If a fault code appears, correct the fault before operating. The EVO will now run its pre-purge and ignition cycles, then begin heating, which will be indicated by the green “BURNER ON” light.

⚠ WARNING

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

B. LIGHTING INSTRUCTIONS

FOR YOUR OWN SAFETY, READ BEFORE OPERATING!

1. This appliance does not have a pilot light. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
2. 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.

   WHAT TO DO IF YOU SMELL GAS
   - Do not try to light any appliance.
   - Do not touch any electric switch; do not use any phone in your building.
   - Immediately call your gas supplier from a neighbor’s phone. Follow the gas suppliers’ instructions.
   - If you cannot reach your gas supplier, call the fire department.
3. Turn on gas shutoff valve (located outside the cabinet on the bottom of the appliance) so that the handle is aligned with the gas pipe. If the handle 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.

B. LIGHTING INSTRUCTIONS CONT.

4. 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.
5. The EVO Heater shall be installed so the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, condensate trap, control replacement, etc.).

C. OPERATING INSTRUCTIONS

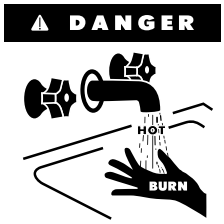
1. STOP! Make sure you have read the safety information above.
2. Turn off all electric power to the appliance.
3. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
4. Turn gas shutoff valve clockwise to “off” The handle will be horizontal; do not force it.
5. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow the instructions from Section B: Lighting Instructions in the safety information. If you don’t smell gas, go to the next step.
6. Turn the gas shutoff valve counter clockwise to “on” The handle will be vertical.
7. Turn on all electric power to appliance.
8. Set the thermostat to the desired setting.
9. If the appliance will not operate, follow the instructions “To Turn Off Gas To Appliance” (Part 7, Section F, page 46 and call your service technician or gas supplier.

D. ADJUSTING THE TEMPERATURE ON THE EVO DISPLAY

The red knob labeled Setpoint is used to set the desired operating water temperature. On a boiler, this will be based on the leaving water temperature. On a water heater it will be based either on a connected external (storage tank) sensor, or, if there is none connected, it will operate based on the incoming water temperature. There are no temperature markings on the knob itself, as the range of this knob is factory-set at 50–159°F for water heaters and 50–192°F for boilers. Other special ranges are available by contacting the factory. Any movement of the knob will be immediately indicated on the temperature display when the appliance is powered on.
If other temperature settings are required, contact Hamilton Engineering, Inc. This is the only function able to be set by the end-user; all others are set by a special computer program at the factory, or while in service mode. The display can show either °F or °C as factory-set. Display will indicate “0” when temperature setpoint is reached.

E. SEQUENCE OF OPERATION

⚠ DANGER



Water temperature over 125ºF can cause severe burns instantly, or death from scalds. Children, the disabled, and the elderly are at highest risk of being scalded. See instruction manual before setting temperature at water heater. Feel water before bathing or showering! Temperature limiting valves are available.

1. When power is first applied to the control, the control display will read the temperature Setpoint. The control will initially run through a self-diagnostic routine and then go into its operating mode. If there is no call for heat, the system will go into an idle state.
2. If the thermostat is calling for heat, the control module will determine if the water temperature is below the programmed set point value minus the switching differential. It will then initiate a heating cycle.
3. The control then performs selected system diagnostic checks. If all checks are successfully passed, a pre-purge cycle is initiated (the blower will be on maximum speed).
4. When the pre-purge period is complete, power is applied to the spark ignitor for 4.5 seconds. Approximately 1/2 second later, flame is verified. If a flame is not verified during the trial-for-ignition, the gas valve is immediately closed and the control will return to Step 3. After four trials, if a flame is not verified, the control will go into a lockout mode. If a flame is confirmed, the control enters the heating mode. The firing rate will be based on the control's proprietary algorithm.
5. When water temperature reaches the temperature set point value, the burner will be at minimum firing rate. If, when firing at minimum rate, it reaches 3°F over temperature setpoint, the gas valve closes and the control enters a post-purge state (the blower will be on maximum speed). At any time if an external thermostat is being used and becomes satisfied, the gas valve will be closed immediately and display will read "0".
6. When the post-purge is complete, the control enters an idle state while continuing to monitor temperature and the state of other system devices. If a call-for-heat is received, the control will automatically return to Step 2 in sequence and repeat the entire operating cycle.
7. Built in freeze protection: all models will automatically turn the pump on if the heat exchanger reaches 41°F and the burner if it reaches 37°F, it will turn off at 50°F.
   Note: power must be left on for this protection to function.

During the idle state and heat state, if the control detects an improper operating state from external devices, such as the high-limit switch, the control will illuminate an error code in the display.

PART 7. SERVICING

A. SERVICING THE EVO

1. Shut off the power supply to the appliance (See Figure 1-4, Page 11).
2. Remove the front cover security screw(s).
3. Undo the two latches at the bottom of the cover (if applicable).
4. Remove the cover.

B. PLACING THE EVO INTO NORMAL OPERATION

1. Replace the front cover in the normal position.
2. Close the latches on the bottom of the cabinet (if applicable).
3. Replace the security screw(s).
4. Turn on the power supply to the appliance.

C. SOFT LOCKOUT CODES

(TABLE 7-1) FMT 914 SOFT LOCKOUT CODES

DESCRIPTION	DISPLAY CODE	WILL AUTOMATICALLY RESET WHEN:
Low water cut off (if equipped) opened	A1	The water level is restored
Outlet temperature too high	A2	Outlet temp decreases sufficiently
Return temperature higher than setpoint	A3	The temp decreases sufficiently
Indirect DHW temperature too high	A4	DHW temp decreases sufficiently
Too many ON - OFF cycles	A5	After control keeps appliance off for two minutes
Fan speed too high	A6	Fan speed is OK within 1 minute. If not, it will become a Hard Lock Out
Fan speed too low	A7	Fan speed is OK within 1 minute. If not, it will become a Hard Lock Out
Anti-scale setting exceeded (HWD models only)	A8	The temp is less than the setting
False flame signal	C1	No flame is measured

If the appliance is shut down for any reason other than the operating setpoint, a Soft Lockout Code is displayed in the Temperature Display. If the Code is not flashing, the codes reference the above information.
Note: F1 will equal improper gas pressure on a CSD-1 equipped model.

D. HARD LOCKOUT CODES

(TABLE 7-2) FMT 914 HARD LOCKOUT CODES

DESCRIPTION	DISPLAY CODE	ACTION TO RESET
Flame signal without flame	F0	Reset button
Additional safeties, X1 pins 2 & 11	F1	Reset safety then reset button
Burner door or back wall high limit	F2	Reset burner door high limit, then reset button
Wrong fan speed indicated	F4	Reset button
No flame after 4 trials for ignition	F5	Reset button
Flame lost (4 times) during a burn cycle	F6	Reset button
Outlet sensor short/interrupted	E0	Reset button
Inlet sensor short/interrupted	E2	Reset button
Anti-scale setting exceeded 3 times during single burn cycle	E6	Reset button
Parameters programmed	PP	Reset button
Parameter programming error	PE	Reset button
FMT 914 burner controller is out of order	nc	Re-program / Disconnect power
Water flow switch, pressure switch, or the High Limit opened	H1	Reset button
No lag control is communicating in Cascade	nc. (with dot)	Restore RS-485 Wiring

If the appliance is shut down for any reason other than the operating setpoint and there is a Fault Code displayed in the Temperature Display and the display *is flashing* a Code, the code references the above information.

D. HARD LOCKOUT CODES

IN MANY CASES, A "HARD LOCKOUT" WILL INDICATE THAT THERE IS SOMETHING WRONG WITH THE APPLIANCE, THAT SHOULD BE SERVICED OR REPAIRED.

EXAMPLE:
If there is a loss of flow due to an air bubble passing through the appliance (sensed via the water flow switch), the appliance will shut down and display a temporary fault (H1). When flow resumes and the reset button pushed, the control board will perform a pre-start diagnostic and then resume a burn cycle.

(TABLE 7-3) REFERENCE OF SOLUTIONS FOR HARD LOCKOUT CODES

MEANING OF LOCKOUT	DISPLAY CODE	POSSIBLE CAUSE OF LOCKOUT
Short circuit in flame signal (ionization) circuit	F0	18, 35 61
Additional safety open	F1	10, 11, 12, 28, 29, 72, 73
High limit switch on the back of the heat exchanger or on the burner door is open	F2	74, 75
Wrong fan speed	F4	7, 8, 9, 39, 40, 41
No flame after 4 ignition attempts	F5	10, 11, 12, 16, 18, 25, 35
Flame lost (4 times) during a single burn cycle	F6	10, 12, 16, 22, 25, 26, 44, 61, 66
Outlet sensor shorted or interrupted	E0	46, 71
Inlet sensor shorted or interrupted	E2	46,71
Too many anti-scale lockouts	E6	4, 5, 28, 29, 72, 73
Water flow switch, high limit temperature or pressure switch has opened	H1	4, 5, 21, 22, 23, 29, 30, 42, 67, 68, 72
Parameter programmed	PP	Press reset button
Parameter programming error	PE	Program again (Com1 or Com2)
Burner control is not functioning correctly	nc	Reprogram
No communication within the Cascade control system	nc. (with dot)	Bus cable not correctly wired or wrong COM port
Burnt fuse	(no display)	13

Beside the above lockouts, there are several faults or complaints the display is unable to convey.

(TABLE 7-4) ADDITIONAL COMPLAINTS FOR HARD LOCKOUTS

	COMPLAINT	CAUSE OF FAULT
a.	The building is not warming up or water is not getting hot, but appliance is working	31, 45, 53, 54
b.	Noisy ignition	16, 35
c.	Room thermostat or external thermostat demanding heat, but appliance is not firing	1, 42, 52
d.	Appliance is very noisy during operation	29, 66, 73
e.	Tops of radiators are insufficiently hot	5, 55
f.	Temperature of the DHW is far too hot	51, 57
g.	Fault after replacement of the burner control	60

E. FAULT CAUSES

The numbers given in Tables 7-3 and 7-4 match with those in the following table to give the reason for the fault.

(TABLE 7-5) FAULT CAUSES

1.	Room thermostat connected incorrectly or faulty
4.	Pump not running or partially clogged
5.	Water pressure in the system too low (heat exchanger/radiator air bound)
7.	Fan speed control wiring not connected (unplugged)
8.	Fan blades are fouled - check for lint or dirt build-up on blades
9.	Fan is defective
10.	Manual gas valve under heater not open
11.	Gas pressure is too low
12.	Gas pipe diameter is too small
13.	Fuse blown—replace with 3.15 amp only
16.	Gas valve setting for low fire is incorrect (the offset setting)
18.	Ignition cable incorrectly connected
21.	Power supply to the pump connected incorrectly
22.	Condensate trap is plugged or drain line is blocked
23.	Air bubble in heat exchanger—open air vent cap
25.	Too much resistance in the flue system, or flue system has been restricted
26.	Flue system incorrectly installed, allowing re-circulation of flue gas
28.	Water piping shut off valve partially closed
29.	Heat exchanger blocked (insufficient water circulation)
30.	High-limit thermostat defective (contacts corroded)
31.	Maximum load is too high
35.	Ignition electrode porcelain is cracked or spark gaps are incorrect
39.	Moisture in the fan and/or the fan connection or faulty fan
40.	Fan wiring plug for speed control (PWM) signal not connected or faulty fan
41.	Fan power supply plug is not connected
42.	Damaged connecting cable to high limit sensor
44.	The built-in non-return valve in the flue is partially blocked
45.	Leak in hot water piping
46.	Sensor defective; compare ohm reading to actual temp (see Figure 7-1 on page 46)
51.	Parameter(s) in the installer program entered incorrectly
52.	Room thermostat (or common thermostat) connected to an incorrect connector strip port
53.	Pulse with program in the installer menu incorrectly programmed, or steps are too long
54.	Clock program of the dock thermostat should start earlier in the morning
57.	Priority sensor (S3) not placed correctly, or is defective
60.	Cable harness connectors incorrectly mounted on the PCB
61.	Gas valve is defective or there is moisture on the control board
63.	Incorrect parameters or values outside the range of the program have been entered
66.	Gas valve not correctly adjusted at maximum load

(TABLE 7-5) FAULT CAUSES (CONTINUED)

67.	Venting system has too much resistance (possibly partially blocked)
68.	Pressure switch is defective
71.	Wiring to sensor is disconnected or incorrectly connected
72.	Insufficient flow through the boiler
73.	Heat exchanger is beginning to accumulate scale
74.	Heat exchanger back wall high limit is open
75.	Burner door high limit is open, reset high limit

The numbers given in Tables 7-3 and 7-4 match with those in the following table to troubleshoot.

(TABLE 7-6) TROUBLESHOOTING THE FAULT

1.	Check room thermostat connections
4.	Try to loosen the pump spindle, replace the pump drive, or clean impeller
5.	Check available city water pressure—water heater must be over 15 PSI. Boiler closed loop heater system must have at least 12 PSI from fill valve. Check operation of expansion tank.
7.	Remove and reconnect the wiring harness, being sure that the plus lines up properly and latches when fully inserted
8.	Clean the fan blades
9.	Replace the fan - *see notes below under 13*
10.	Open gas valve
11.	Check line, gas meter, and pressure to heater inlet (it must be at least 4 inches WC). Make a pressure drop test and calculation, as required.
12.	Change gas lines. If a flexible connector is used, it must be rated for the BTU capacity of the appliance. ***CONNECTORS PURCHASED AT HOME CENTERS WILL NOT WORK!***
13.	Replace fuse. Check the pump.
16.	See pages 14-15
18.	Check cable and cap for shorting to ground, overheating, and cut or worn cable casing. Check spark ignitor porcelain for cracks. Check for 1/8" gap at the tips.
21.	Check pump wiring and correct
22.	Open the condensate trap clean out (underneath the appliance in the center) by unscrewing the cap. Keep a jug on hand to catch the water drained. Look through the drained material for contaminants. If there are alot, remove the burner unit from the appliance, and pour some water in the heat exchanger to rinse out the drain line (see Part 8, Section C). Eliminate water traps in the drain hose.
23.	Bleed all air from not only the appliance itself, but the entire system. If working on a closed loop heating system, take care not to run the pumps if there is no water; establish an uninterrupted water flow.
25.	Check the inlet air and flue lines for blockage, inspect non-return damper.
26.	Check the inlet and flue system starting at the appliance outlet, confirm venting terminations
28.	Check all shut off valves and check valves. Be sure they are fully open.

(TABLE 7-6) TROUBLESHOOTING THE FAULT (CONTINUED)

29.	First check that the pump is circulating like it should, and that there are no obstacles between the appliance and the tank (or in any of the inlet/outlet piping). If the appliance is still making a 'popping' noise, the heat exchanger will need to be acid cleaned to remove accumulated scale. ***DO NOT RUN THE APPLIANCE UNTIL THIS IS DONE!***
30.	Replace the high-limit thermostat by unscrewing it from the brass nut; no draining is needed (do not remove the brass nut)
31.	Go over the Fan RPM settings as outlined in Table 3-5 on page 17–18
35.	Replace. Or when bending, take care: bend near the burner plate, or there may be risk of cracking
39.	Remove the connection and blow dry using a hair dryer or compressed air
40.	Plug in speed control wire, replace fan.
41.	Check the plugs and fit into one another correctly
42.	Check cables for possible damage or entrapment, and replace as required
44.	Check the seal of the heat exchanger on the flue gas casing, and replace as required. Fit a new rotary lip seal. Lift the flue gas tube and inspect the Non-Return Valve from the top
45.	Check the piping and repair any leaks
46.	Disconnect leads from sensor and place an OHM meter across both terminals on the sensor. Compare to Figure 7-1 on page 46. If it does not match, replace.
51.	Contact Hamilton Engineering for assistance at 800.968.5530
52.	Check the type of room thermostat and contact Hamilton Engineering for assistance at 800.968.5530
53.	Contact Hamilton Engineering for assistance at 800.968.5530
54.	Change the "wake-up" times of the clock thermostat
57.	Check the sensor on the storage tank or in the common piping
60.	It may occur that the 18-pin FMT 914 plug moved up one pin too far—this may cause a fault in the communication between the wiring and the pins. Check both the left and the right-hand side of the plugs to ensure they are placed correctly
61.	A defective gas valve usually has one of the two causes: the electric coils are defective, or an internal defect to the gas valve. In either case, it is recommended to replace the entire gas valve
63.	Contact Hamilton Engineering for assistance at 800.968.5530
66.	Re-adjust the gas valve per the instructions on pages 17-18
67.	Check the venting system completely for blockage
68.	Replace the pressure switch
71.	Check the wiring and correct
72.	Check the entire system including the pump for blockage and scaling
73.	For descaling, see the special instructions. Contact Hamilton Engineering for assistance at 800.968.5530
74.	Remove leads on burner door high limit and check them for an open circuit; if it's open, the back wall high limit is bad
75.	Reset burner door high limit with button between the two leads; open combustion chamber and check back side of burner door

F. TO TURN OFF GAS TO THE APPLIANCE

1) Set the thermostat to lowest setting.
2) Turn off power switch on front of unit.
3) Turn off all electric power to the appliance if service is to be performed.
4) Turn gas shutoff valve clockwise to “off.” Handle will be horizontal. Do not force.

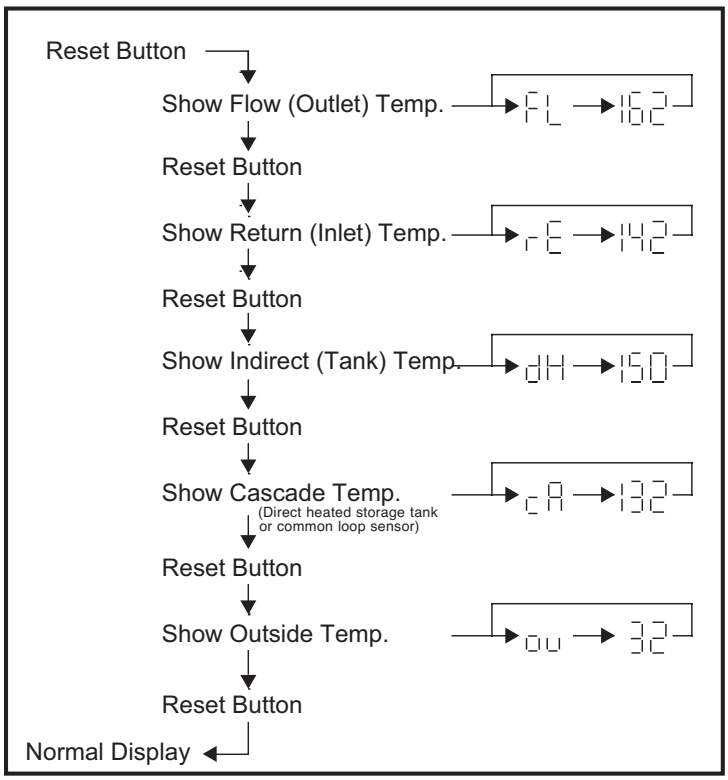
G. PUMP & WIRING CONTROL

The FMT 914 control board has an on-board relay for controlling the circulating pump. On a call for heat, the pump will start, allowing the water flow switch circuit to be made and the pre-start diagnostic to continue. After the call for heat has been satisfied, the pump will continue to run for the factory programmed period of time (3 minutes) and then shut off. For water heating applications an external temperature sensor must be mounted in the water storage tank or the pump must be wired to run continuously. For heating applications the call for heat must come from an external source (room thermostat etc.). In both applications if a continuous pump operation is desired, it may be specially factory programmed for that or the pump should be wired directly to an external power supply.

The only restriction is the amount of pump electrical load that can be connected. The maximum wattage externally connected loads can draw is 650 watts. All standard pumps as supplied by Hamilton Engineering draw 550 watts or less.

The EVO control system has the ability to control up to three (3) pumps, or two (2) pumps and a diverting valve. For details see EVO Configurations Manual (LIT91110) or contact Hamilton Engineering at 800.968.5530.

H. TEMPERATURE SENSOR READING INSTRUCTIONS



(FIGURE 7-1) TEMPERATURE SENSOR READING INSTRUCTIONS

I. EVO SENSOR RESISTANCE TABLE

(TABLE 7-7) EVO SENSOR RESISTANCE TABLE

TEMPERATURE (ºF)	RESISTANCE (OHM)	TEMPERATURE (ºC)	RESISTANCE (OHM)
32	32550	0	32550
41	25340	5	25340
50	19870	10	19870
59	15700	15	15700
68	12490	20	12490
77	10000	25	10000
86	8059	30	8059
95	6535	35	6535
104	5330	40	5330
113	4372	45	4372
122	3605	50	3605
131	2989	55	2989
140	2490	60	2490
149	2084	65	2084
158	1753	70	1753
167	1481	75	1481
176	1256	80	1256
185	1070	85	1070
194	915	90	915
203	786	95	786

PART 8. MAINTENANCE

A. MAINTENANCE PROCEDURES

All high efficiency condensing appliances will require more regular maintenance (cleaning) than their non-condensing counterparts. Failure to do so may result in damage to the appliance that is not covered under warranty. Failure to follow all of the instructions contained in this manual may also cause premature product failure that may not be covered under warranty.

Periodic maintenance should be performed at least once a year by a qualified service technician to ensure that all the equipment is in safe, efficient operation. ***Failure to do so may eliminate warranty coverage***. In the first year of operation, it is highly recommended that inspections of all connection points and the combustion chamber be done at three month intervals, any signs of fouling or leaks must be thoroughly investigated immediately as failure to do so may void warranty. Assuming no cause for excessive fouling is found, then the period of months from initial start up that it was found that cleaning was required, shall become the required future minimum cleaning interval, but at no time should it exceed 12 months. The owner MUST make necessary arrangements with a qualified heating contractor for proper maintenance of the heater. Installer must also inform the owner that the lack of proper care and maintenance of the heater may result in a hazardous condition and lack of warranty coverage. The installer should discuss the contents of the User's Information Manual with the owner.

B. ANNUAL INSPECTION *(See LIT91179 Maintenance Checklist for required tools and materials)*

An inspection should cover, at a minimum, the following areas:

- Download and review operating hour data and fault history
- Inspect all fittings, controls and connections for leaks, damage, or fouling
- Fire side:
  - Heat exchanger
  - Burner and ignitor
  - Burner door and rear wall insulation
- Drain system components:
  - Hoses & clamps
  - Trap assembly
  - Condensate neutralizer
- Test all safeties and operating controls
- Water side temperature rise (ΔT) test

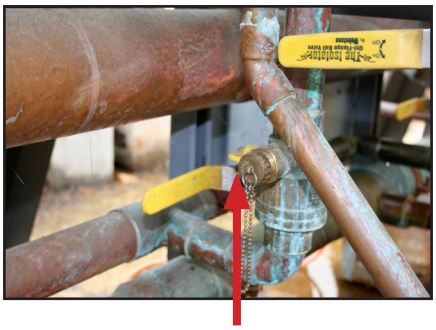
DATA DOWNLOAD

Always retrieve fault history and power on hours from the control board first, using your laptop or PDA and the SIT cable and software. Be sure to use the proper version software and communication cable, then save the file and name appropriately for future reference. Should the servicing contractor not have the proper software, cables, and training to do this, have them contact the factory or their local distributor.

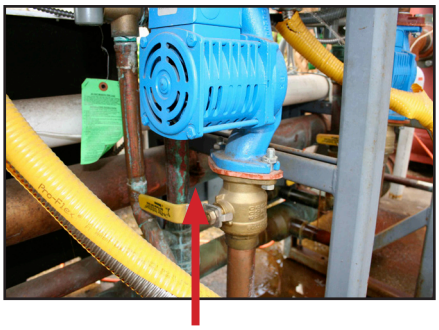
INSPECTION AND CLEANING *(photos illustrating each step follow sets of instructions)*

Caution: Before removing the door of the appliance, switch off the electrical power supply to it.

- Remove the front cover and check the sensors, flow switch, all pipes, lines and connections, and the heat exchanger (top, bottom) for traces of water and water leakage.
- Inspect the top of the casing and/or the top of the appliance for water leakage or traces of water from the air supply pipe or the air vent (if applicable).
- Inspect the flow switch; the appliance must first be drained by closing the inlet and outlet valves on each appliance. Then, by opening the drain on the ball valve and the relief valve, the appliance will drain.



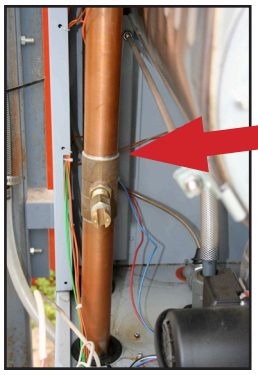
Isolation and drain valve appliance outlet



Isolation valve for pump & appliance outlet

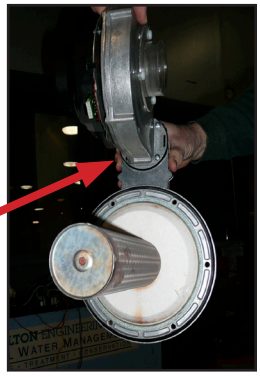
Relief valve - check operation and open to drain unit

B. ANNUAL INSPECTION CONT.



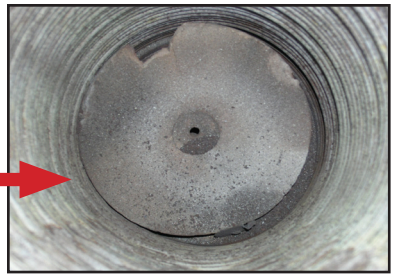
FLOW SWITCH:

Check paddle for fouling and free movement by spring!



Complete burner, door & fan assembly removed for inspection

- Dismantle the burner unit: remove the (6) 6mm nuts (with a 10mm socket), the ignition cable, the power and speed control plugs, and the ground wire from the fan, and remove the burner/fan unit from the heat exchanger and cabinet.
- After the burner door is removed, it should be thoroughly inspected before being put back into service. There are two gaskets on the burner door; the first is the inner rope gasket, which is permanently affixed to the burner door. If this gasket is completely compressed (having no sealing ability), the door must be replaced. The second gasket is on the perimeter and is made of rubber; this gasket is easily replaced, and comes as a standard part of a maintenance kit (and should always be replaced during the annual maintenance procedure. ***Note: Over-tightening the M6 nuts may cause the threaded rods on the front of the heat exchanger to break! If excess resistance is encountered when installing a M6 nut, discard that nut and use one of the spares shipped with the unit. The maximum torque for assembling a burner door nut is 3.7 ft-lb or 44.4 in-lb. Use a torque wrench suitable for this torque range to tighten the nuts.***
- Remove and inspect the rear fiberboard. If any resistance is encountered with the removal of the screw securing the fiberboard in place, do not exert undo force; break the fiberboard out to provide access to the screw. Apply penetrating oil to the screw, let it sit, then remove. See photos below for details. Replace only after cleaning procedure. Use a new fiberboard if moisture has fouled it or if there is any physical damage preventing it from protecting the rear wall, such as cracks or warping. Warped fiberboards will allow the back wall to overheat, this could lead to a breach of the back wall. This will also cause a loss of efficiency and a rise in stack temperature. ***Note: Failure to replace front and rear fiberboard when damaged may result in irreparable damage to the appliance!***



Both of these must be replaced!

B. ANNUAL INSPECTION CONT.

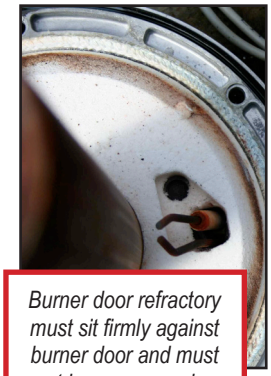
- Check the fire side of the heat exchanger: only clean loose residue from the heat exchanger coil, use a vacuum cleaner and nylon brush, and do not push the residue between the openings of the coils if at all possible, as this may impede the flow of the products of combustion.

- Use inspection mirror to check all heat passage spaces between coils, and using a short, thin putty knife or strip of stainless steel, remove all debris. ***These passages MUST be free and clear for proper heat transfer to occur.*** Rinse well all loose debris that was pushed down to the bottom of the condensate collection tray.

- It is recommended to only use clear water to rinse any remaining residue away—the water will automatically flow to the condensate drain point.

- ***If surface or coil gap fouling still exists after the above measures have been taken, the heat exchanger requires additional cleaning.*** Use a non-acid based cleaning solution, such as Fernox F3, to thoroughly soak the remaining residue. Brush clean and then completely rinse all residue and cleaning solution down the condensate drain assembly. Repeat if necessary.

(See complete cleaning instructions on page 53–55)



*Burner door refractory must sit firmly against burner door and must not have any cracks, water damage, or gouges. If any of these exist, it **MUST** be replaced.*

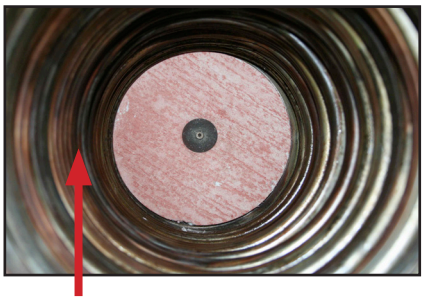
- Check the distance from the electrode to the burner; there should be a 3/8" gap in between the two. If the existing electrode pins must be adjusted for proper gap, caution must be exercised, as they will likely be brittle from exposure to the flame; try to bend them as close to the burner door insulation as possible using two pair of pliers; one to support the rod, and one to bend with. New electrodes will be less susceptible to breakage during adjustment. The metal surface of the electrodes should also be carefully cleaned with emery cloth.

  Note: Do not make any adjustments or cleaning with the electrode still mounted to the burner door, as damage to refractory may result!

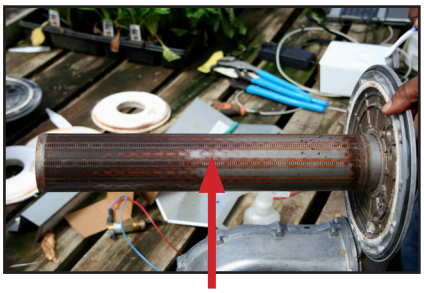
- Dismantle the air gas mixing plate or chamber on the suction side of the fan and check for fouling. If required, clean the fan blade wheel and the air gas mixing box.

- Reassemble the burner chamber, making sure there is no moisture on any of the fireside components.

Cleaned heat exchanger - prior to rear wall installation



Cleaned heat exchanger - after rear wall installation



Burner & door assembly - prior to fiberboard installation

B. ANNUAL INSPECTION CONT.

TESTING

The following steps require the power supply be turned back on; extreme caution must be exercised when performing service with the power supply on and the door off.

- When turning the appliance back on, listen for significant noises from the fan and pump. Also, inspect for leaks at the pump connections.
- Press the reset button from the home screen to access the sensor readings, and record each reading, making sure that all sensors and thermometers are reading the same, with the heat off.
- Fire the appliance on maximum output for 5 minutes, in order to check the ΔT from the inlet sensor to the outlet sensor.
  - If the ΔT reading is out of design range by more than 10% or there is an E6 error on the display, refer to coil cleaning instructions below. Record ΔT to track any increases from one year to the next.

Model	BTU/hr. Input	Minimum Hydronic Flow	ΔP at Minimum Flow Rate - ft. of head
HWH 79	80,000	2.23	3.3
HWD 79	80,000		
HWH 129	136,300	3.64	3.5
HWD 129	136,300		
HWH 179	186,600	5.06	3.3
HWD 179	186,600		
HWH 199.1	199,999	5.63	3.5
HWD 199.1	199,999		
HWH 299	300,000	8.45	4.9
HWD 299	300,000		
HWH 399	399,999	11.31	3.5
HWD 399	399,999		
HWH 599	630,000	17.74	4.9
HWD 599	630,000		
HWH 1499	1,500,000	42.13	5.2
HWD 1499	1,500,000		
HWH 1999	1,999,999	58.45	5.2
HWD 1999	1,999,999		

Hydronic Pipe Size	Design ΔT Hydronic @ 95% efficiency °F	°C
1"	34.6	19.2
1"	58.9	32.7
1"	53.7	29.8
1"	57.6	32.0
1.5"	51.8	28.8
1.5"	43.2	24.0
1.5"	45.3	25.2
2.5"	46.3	25.7
2.5"	46.3	25.7

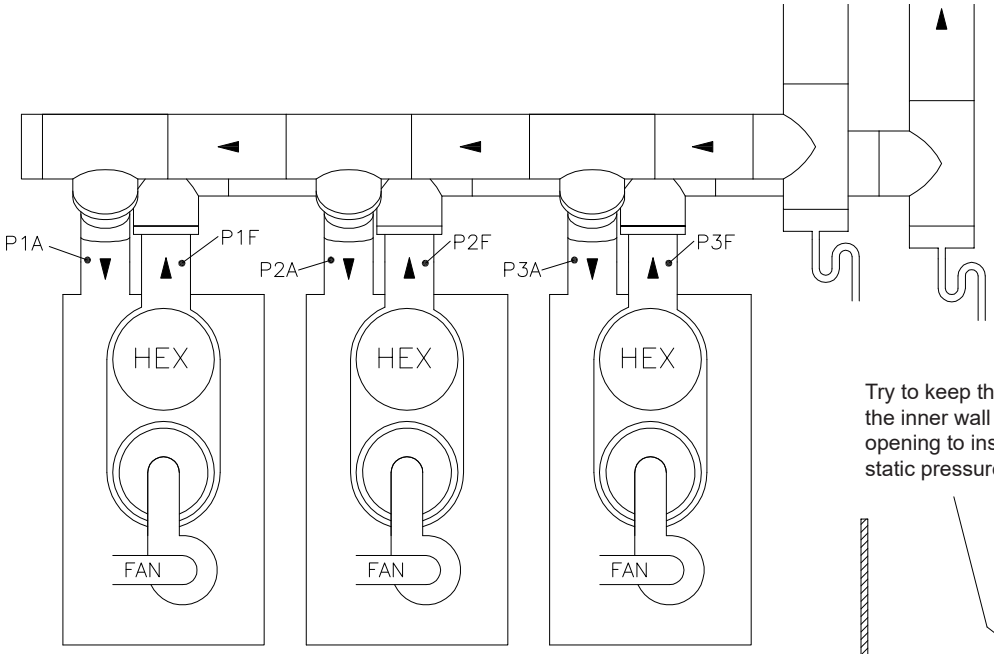
DHW Pipe Size	Design ΔT DHW @ 97% efficiency °F	°C
1"		
	23.5	13.1
1"		
	40.1	22.2
1"		
	36.6	20.3
1"		
	39.2	21.8
1.5"		
	35.3	19.6
2"		
	29.4	16.3
2"		
	30.9	17.1
2.5"		
	31.5	17.5
2.5"		
	31.5	17.5

- Fire the appliance on maximum output, and measure and adjust the CO_2 percentage as required.
- Fire the appliance on minimum output, and measure and adjust the CO_2 percentage as required.
- If there are an unusual number of F5 or F6 faults or if combustion is off significantly, gas supply pressure must be verified at static (no load) and full building load conditions.
- See Table 3-3, Page 17 for specific settings.
- Inspect intake and exhaust screens at the termination point for signs of contamination (i.e. leaves, twigs, etc).
- A differential pressure (ΔP) reading should be taken across the exhaust and inlet air connection points of each appliance to confirm that it is below the maximum shown below.

NOTE: The inlet air pressure should be negative.

MODEL	AIR PRESSURE (ΔP)	MODEL	AIR PRESSURE (ΔP)
HW79	< .4" wc	**HW299**	< .7" wc
HW129	< .6" wc	**HW399**	< 1" wc
HW179	< .96" wc	**HW599**	< .86" wc
HW199.1	< .68" wc	**HWH 1499-1999**	< .8" wc

B. ANNUAL INSPECTION CONT.



P (1, 2, 3) A
These will be negative pressures relative to atmosphere

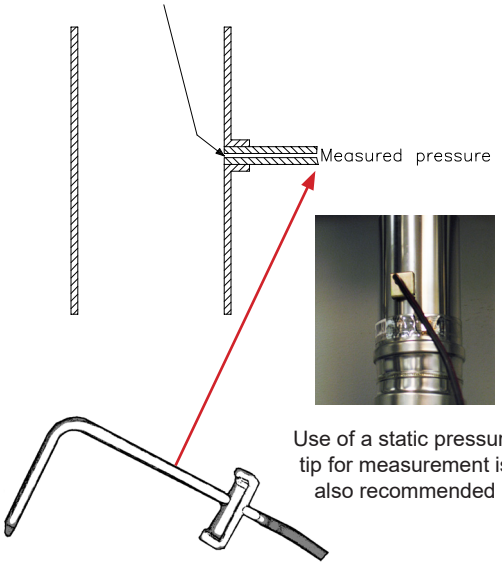
P (1, 2, 3) F
These will be positive pressures relative to atmosphere

Example
P1A = -0.32” wc
P1F = 0.4” wc
Then the total pressure drop is:
ΔP total = -(P1A) + P1F = -0.32 + 0.4 = 0.72” wc

Calculations are done with:
- All boilers at high fire
- Water temperature 160/180ºF (gives the hottest flue gasses)
- All readings must be taken with boiler front cover installed

Doing the measurements under these conditions will give the most accurate results. There may be minor differences between appliances.

Try to keep the measuring hose flat with the inner wall of the pipe. Use a small opening to insure you are measuring static pressure and not velocity pressure



Use of a static pressure tip for measurement is also recommended

- A pH test must be performed at the exit point of the condensate neutralizer with litmus paper to test for acidity. pH level should be within 6.6–7.0. If the pH is less than 6.6, replace neutralizing medium.
- Checking the minimum and maximum settings on the display must be performed as a final check.
- All findings and concerns should be discussed with the appliance owner after the inspection is complete.

C. CONDENSATE TRAP CLEANING INSTRUCTIONS

The condensate trap and entire drain system attached to it (above the neutralizer) should be cleaned at least once every year.

1) Turn off the power to the EVO.

2) Place a bucket under the condensate trap. Use caution when removing the clean-out cap, as the trap is full of condensate and it may be hot.

3) Remove the condensate clean-out cap, and be sure the bucket is under the open drain trap assembly to catch the debris and water.

4) Rinse out the clean-out cap in a sink to remove any dirt or buildup that may have accumulated.

5) Condensate drain assembly should now be checked for non-restricted flow throughout the entire assembly.

6) Reinstall the clean-out cap on the condensate trap.

7) Turn on the power to the EVO.

8) Make sure the hose from the condensate trap is not submerged too far into the neutralizer, there should be an air gap between the highest level of condensate and the outlet hose from the trap.

9) Monitor the condensate drain until flow has been established.

D. COMBUSTION CHAMBER COIL CLEANING INSTRUCTIONS*

Before beginning this procedure, you must have the following items on hand:

- Nylon brush - **DO NOT use brass, stainless or steel brushes.**
- Water
- Vacuum cleaner
- Fernox F3 Cleaner
- Fernox F1 Inhibitor Protector (boilers only)
- Fernox DS 40
- Towel for clean up and plastic sheeting to protect electronics.

NOTE: If electronics do get wet, DO NOT turn on power to appliance until they have been thoroughly dried, as component failure may result.

FIRE SIDE CLEANING

1) Shut down the EVO by using the following steps:
   a. Turn off the power, close the gas valve, and shut down the unit. Wait for the unit to be cool to the touch.
   b. Remove the clean-out cap and place drain bucket according to the directions above.
   c. Remove the Molex plugs from the fan.
   d. Remove the (6) 6mm nuts from the burner plate assembly to access the coils.
   e. Pull the entire burner plate assembly towards you and remove rear target wall.

2) Vacuum first and then use the nylon brush to scrub coils to remove any buildup. Vacuum the debris from the coils.

3) Using a spray bottle filled with water or a hose under low pressure to avoid water spraying on electronics (be sure to cover them to protect against water damage), spray the coils liberally, making sure the water penetrates and funnels down through the condensate hose. If the condensate hose is blocked, try to knock any debris loose with a small screwdriver. Replace hose if not completely clean.

4) ***If surface or coil gap fouling still exists after the above measures have been taken, the heat exchanger requires additional cleaning.*** Use a non-acid based cleaning solution, such as Fernox F3, to thoroughly soak the remaining residue. Brush clean and then completely rinse all residue and cleaning solution down the condensate drain assembly. It may take several applications of the F3, followed by a rinsing, to completely clean the coil surfaces. Use a spray bottle for **each** (F3 and clear water). Repeat if necessary.

5) Be sure that water is flowing freely through the bottom casing of the heat exchanger and the drain is not plugged. At this point, the EVO should be ready to power back up.

6) Before powering up the EVO follow the steps below:
   a. Re-install the burner assembly and rear target wall (fiberboard insulation)
   b. Replace the (6) 6mm nuts to the burner plate, following appropriate tightening pattern and torque.
   c. Re-connect the Molex plugs.
   d. Re-set system thermostats.
   e. Replace the clean-out cap.
   f. Turn the EVO back on** and monitor the condensate drain until flow has been established.
   g. Re-connect the condensate hose to the outside connection.

D. COMBUSTION CHAMBER COIL CLEANING INSTRUCTIONS*

WATER SIDE CLEANING (de-scaling kit is required for this process, please consult factory)

1) Shut down the EVO and clean by using the following steps for heaters:

   a. Turn off the power, close the gas valve, and shut down the unit. Wait for the unit to be cool to the touch.
   b. For water heaters, close both inlet and outlet water valves to isolate the appliance.
   c. Open the drain valve to let out all the water from the appliance, and circulate Fernox DS 40 Cleaner in reverse of normal flow, to flush out any build up that may have occurred in the coils. ***Note: Fernox DS 40 is a heat activated de-scaling solution. It must be heated to 160º–180ºF to clean efficiently. Follow Fernox instructions to ensure a fully clean heat exchanger.***
   d. Flush with water to eliminate any of Fernox DS 40 Cleaner that may have been left behind.
   e. Close the drain valve and open the inlet and outlet water valves to put the appliance back online.

2) Shut down the EVO and clean by using the following steps for boilers:

   a. Turn off the power, close the gas valve, and shut down the unit. Wait for the unit to be cool to the touch
   b. At the chemical injection point first add the appropriate number of bottles of Fernox DS 40 Cleaner to the system, based on total system water volume. Follow the cleaning instructions on the bottle.
   c. Open the drain valve to let out all the water from the appliance, and circulate Fernox DS 40 Cleaner in reverse of normal flow, to flush out any build up that may have occurred in the coils. ***Note: Fernox DS 40 is a heat activated de-scaling solution. It must be heated to 160º–180ºF to clean efficiently. Follow Fernox instructions to ensure a fully clean heat exchanger.***
   d. Flush the system of all the Fernox DS 40.
   e. After the system has been flushed, add the Fernox F1 Inhibitor Protector (for closed-loop boiler applications only) to the system at the chemical injection point and leave in the system. One bottle of Fernox F1 treats approximately 26 gallons of water. Please follow instructions on the bottle for specific mixing ratios.

Detailed instructions on Water Side Cleaning can be found in LIT91195 Water Side Cleaning Procedure, available on our website.

*****NOTE: When firing up the boiler for the first few times you may experience some fluttering of the gas burner that may result in a flame lockout. This is normal and will require you to re-cycle the unit until this clears up. This is caused by water still present in the combustion chamber.***

After all cleaning has been done, it is recommended that a combustion analysis and testing, as shown on page 51, be completed. See LIT91111 (Start-Up Checklist) & LIT91133 (Cascade Start-Up Procedures) for details.

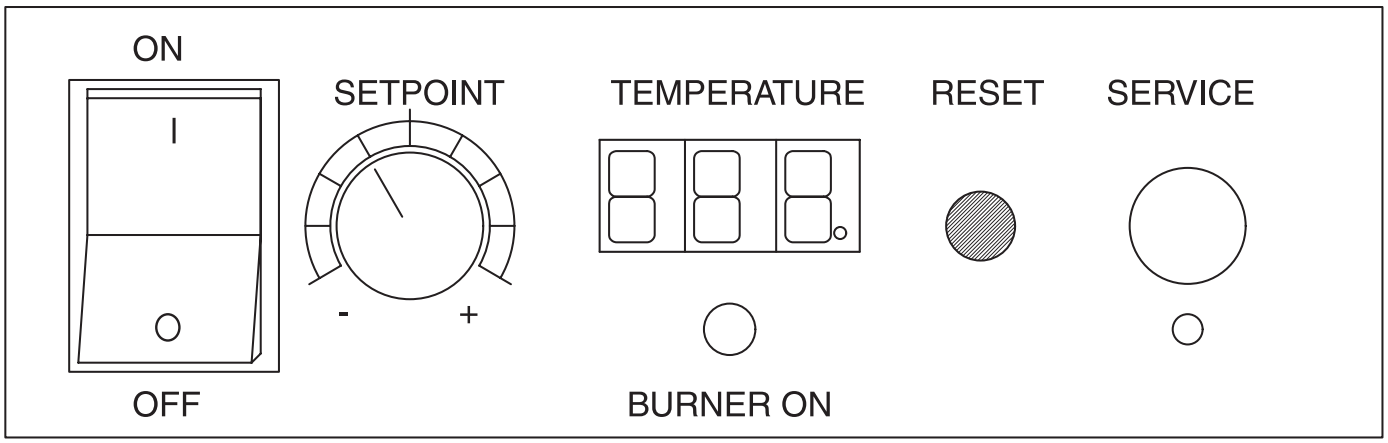
E. EVO CONTROLS

⚠ DANGER

It is extremely important that you check for leaks when reconnecting the gas valve and make sure the exhaust vent is no longer blocked. Failure to do so may result in severe personal injury or death.

The following components are found on the control panel on the front of the appliance.

(FIGURE 8-3) EVO CONTROL PANEL



Looking at the controls on the front of the appliance,

1) POWER on/off switch
2) SETPOINT knob, temperature control (and fan speed control knob during service mode)
3) TEMPERATURE setpoint display
   a. Temperature in °F, corresponding to the SETPOINT knob
   b. Display will always read temperature setpoint unless there is a fault code displayed.
   c. Cascade indicator light, found in the lower right hand corner of the Temperature display. This dot will be flashing when this appliance is part of a properly-connected, commonly-controlled group of EVO products and reading temperature sensors.
   d. Display code, not flashing indicates a Soft Lockout
   e. When this display is flashing a code, the appliance is in a Hard Lockout and the reset must be pushed to re-start the appliance.
4) Green indicating light labeled BURNER ON; when this is light is on, the burner is firing.
5) RESET button, used as described in 3e above, as well as to view sensors and set altitude (see pages 46 & 64 respectively for details).
6) SERVICE port, used for connecting a computer to the appliance to download the service fault history, as well as factory setting of control board parameters. There is a service button located just below the service port that must be pressed with a pointed object to get to the service mode.

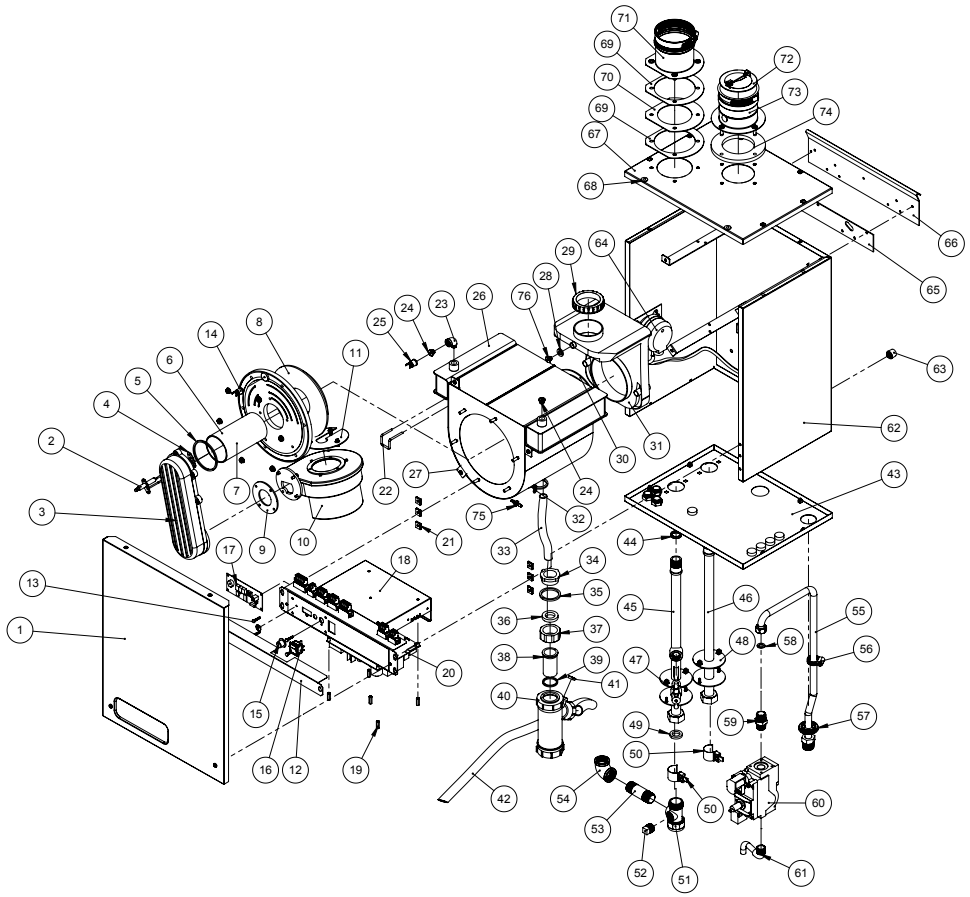
F. COIL ANTI-SCALING PREVENTION FEATURE

The EVO controller (FMT 914) contains sophisticated software that enables it to monitor the rate of temperature rise through the heat exchanger. By doing this, it greatly reduces the possibility of heat exchanger failure due to scaling or fouling. A set of parameters are programmed in at the factory, to provide a design temperature rise (ΔT) setting on each size unit that is fixed. The Anti-Scale is based on an increase over the design ΔT through the heat exchanger. This Anti-Scale is determined using the inlet and outlet sensors, even if a tank thermistor is being used. If the Anti-Scale setting is reached, the unit will display A8, shut down and not re-fire until it has cooled. After the first three times this condition is reached in the FMT 914 reset life cycle (reset life cycle is the time between factory service history downloads), the FMT 914 control will go into hard Lockout, display E6, and have to be manually reset. After it has been reset, it will fire again, but at a maximum of 50% of rated input in an attempt to prevent further damage but still provide some hot water. Once the heat exchanger has been acid cleaned contact the factory for instructions on resetting the unit for full rated BTU input.

Typical causes for repeated E6 indications at start up are air trapped in the heat exchanger (be sure air vent cap is loose) or contaminates lodging in the piping or heat exchanger during installation, both of these causes can generally be cleared by isolating the hot water system and flushing water at full city pressure through the drain valve or relief valve on the heater outlet.

Please note: Scale monitoring feature only available on HWD (water heater) models.

G. EVO HW 79-199.1 PARTS BREAKDOWN



NO. ON DRAWING	PART DESCRIPTION	PART NUMBER
1	Panel Front Door Assembly HW79-199.1	JKD 94100
2	Pilot Spark Electrode Assembly HW79-599 Knurled	PLT 94318 A
3	Burner Air/Gas Mixer Inlet HW79-399	D112959
4	Gasket for Electrode HW79-599 *(only needed on PLT 74318)*	GKT 74018
5	Gasket Down Tube/Burner HW79-599	D104184
6	Burner HW179-199.1 - 70mm x 137mm	D112964
	Burner HW79-129 - 70mm x 105mm	D113712
7	Burner Door w/rope and EPDM gasket HW79-599	D105611
8	Burner Door Insulation HW79-599	D105632
9	Gasket Gas/Air Inlet Pipe & Fan-38mm, HW129	GKT 74053
	Gasket Gas/Air Inlet pipe & fan-42mm, HW199.1	D112956
	Gasket Gas/Air Inlet pipe & fan HW179, 299-399	D106935
	Gasket Gas/Air Inlet pipe & fan-HW79	CF
10	Fan RG 128e HW79-199.1	D115947
11	Venturi HW79-199.1	D112963
12	Cover Protective Assembly HW79-199.1	JKC 94100
13	Pan Head Screw 10-16 x 1/2 Thread Forming	D105142
14	Limit Temperature Switch Burner Door HW79-599	D106936
15	Cap Front Panel Bushing & Program Port	D108572
16	On/Off Switch HW79-1999	D108302
17	Display Assembly HW79-599	RLY 74061
18	Electronics/Display Drawer Assembly, HW79-199.1	PAN 94100 B
19	Nylon M3x19mm Female Threaded Hex Standoff	D104901
20	Control Board HW79-1999	D113634
21	U Clips, Wrapper HW79-199.1, Side Panel HW299-599	D104898

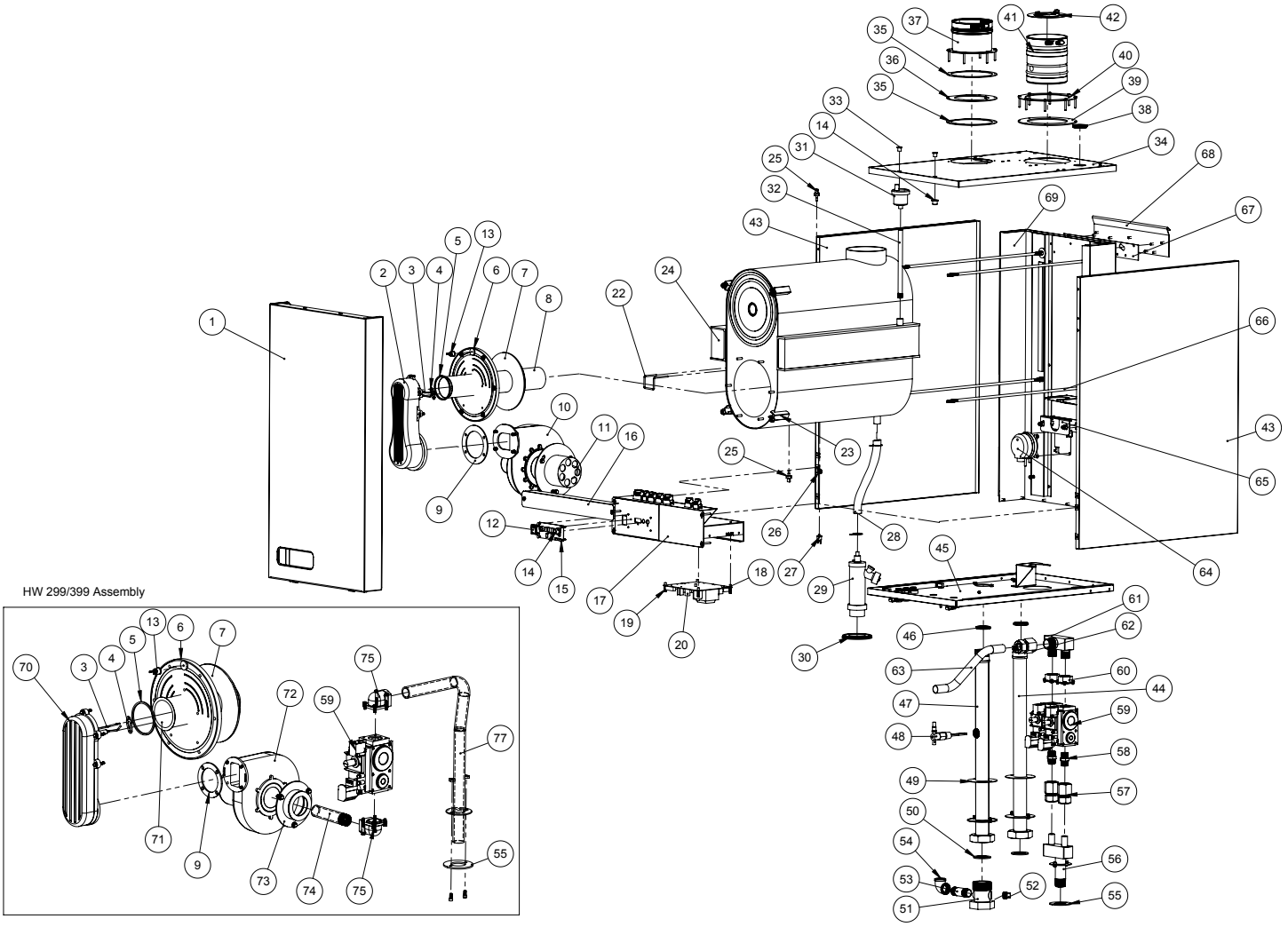
G. EVO HW 79-199.1 PARTS BREAKDOWN (CONTINUED)

NO. ON DRAWING	PART DESCRIPTION	PART NUMBER
22	Fork Clip HW79-199.1 Arms	D113887
23	Elbow 1/8"in x 1/8" out for HW79-199.1 High Limit	D113420
24	Bushing SS Hi Limit HW79-199.1 G1/8"	D121450
25	Hi Limit HW79-1999, 210˚F	D110573
	Hi Limit HW79-1999, 198˚F	D113464
26	Heat Exchanger HW79-129 - ASME H-Stamp	HEX 74161
	Heat Exchanger HW179-199.1 - ASME H-Stamp	D113421
27	Hex Hold Down Clip HW79-199.1	D113427
28	Gasket Flue Bushing HW79-199.1	D113003
29	Flue Outlet Gasket (60 DIA) HW9-199.1	D112965
30	Gasket for flue outlet pipe, HW79-199.1	D113002
31	Flue Outlet Pipe, 7HW9-199.1	D113004
32	Clamp Spring Double Wire 24mm	D107930
33	Lower Condensate Drain Hose Assembly HW79-199.1	CDK 94200
34	Reducing Ring HW79-199.1	D113474
35	Sealing Gasket HW79-199.1 Condensate	D113471
36	Gasket Siphon HW79-199.1 5/8ID Hose	D108917
37	Nut 1.25 HW79-199.1	D113473
38	Tube 1.25 HW79-199.1	D113472
39	Washer Slip Joint 1.25 HW79-199.1	D113475
40	Condensate Drain Assembly. HW79-199.1	CDK 94114
41	Adapter 21mm Air Inlet Hose	D104207
42	Drain Hose Condensate Trap to Condensate Manifold	D111421
43	Bottom Plate HW79-129 - Sheet Metal Only	D112469
	Bottom Plate HW79-129 - Complete Bottom Assembly	JKB 94100
	Bottom Plate HW179-199.1 - Sheet Metal Only	D109217
	Bottom Plate HW179-199.1 - Complete Bottom Assembly	D113476
44	O-ring SS HW79-199.1 Arms	D113632
45	Arm Outlet Assembly HW79-199.1	D113360
46	Arm Inlet Assembly HW79-199.1	D113359
47	Switch Flow V-10/flat paddle, HW79-199.1	D115692
48	Gasket Outer for Fast connect arms HW79-199.1	D113358
49	EPDM Gasket for Arm HW79-199.1	D113094
50	Sensor Inlet/Outlet NTC for HW79-199.1	D113633
51	Tee Br Outlet Arm 1" HW79-199.1 Includes items 52, 53 & 54	OBSOLETE
52	Plug Brass - 1/2"	D30035
53	Nipple Brass - 3/4" X 3"	D10861
54	Elbow Brass 90˚ 3/4"	D11029
55	Tube Gas HW79-199.1 Inlet	GAS 94001
56	Hose Clamp 7/16 to 25/32"	D113423
57	Grommet Air Vent Tube	D104189
58	Gasket nylon for HW79-199.1 gas valve	D113424

G. EVO HW 79-199.1 PARTS BREAKDOWN (CONTINUED)

NO. ON DRAWING	PART DESCRIPTION	PART NUMBER
59	Nipple Ftg BSPT Male x NPT Male 1/2" HW79-599	D104271
60	Valve Gas HW79-599	D108737
61	Tube Gas HW79-129 Outlet	GAS 74002
	Tube Gas HW179-199.1 Outlet	GAS 74003
62	Cabinet HW79-199.1 - Sheet Metal Only	D113721
	Cabinet HW79-129 - Complete w/insulation & Brackets	JKR 94100.1
	Cabinet HW179-199.1 - Complete w/insulation & Brackets	JKR 94100
63	Plastic feet for HW79-199.1	MSC 74083
64	Switch P Condensate HW79-599	D113636
65	Hanger Bracket Spacer HW79-599	D103748
66	Hanger Bracket HW79-599	D103747
67	Top Plate HW79-199.1 3+1, H-Stamp Sheet Metal Only	D113548
	Top Plate HW79-199.1 3+1, H-Stamp Complete w/Intake & Exhaust Connections	JKT 94100 A
68	Front Panel Pin Guide Bushings, HW79-199.1	D113719
69	Gasket Air Inlet connection HW79-199.1	D113547
70	Flange Condensate Air Inlet with Nipple HW79-199	D113720
71	Flue Air Inlet Pipe HW79-199.1	D113545
72	Valve Non-Return HW79-199.1	VAL 74096 C
73	Flue Gas Outlet Assembly HW79-199.1	VAL 94100 A
74	Flange Flue Gas Outlet HW79-199.1	D113546
75	Barb Straight for Hex Condensate Drain Hose HW79-199.1	D113641
76	Bushing SS Hi Limit G1/4"-M5	D121451
Not Shown	Valve Relief P 50# .75x.75	D112960
Not Shown	Valve Relief P 125# .75	D110095
Not Shown	Flue Gas Analyzer port plug 79-599	GKT 74093
Not Shown	Hose Condensate Air Intake/PS Drain Hose	D104205
Not Shown	Bracket Pressure Switch Mount HW79-199.1	D113725
Not Shown	Fuse 250V-3.15A	D113609
Not Shown	Nut for Burner Door HW79-1999	D105680
Not Shown	Fiberboard Back Wall, 16mm	FIB 74902
Not Shown	Kit Maintenance Heat Exchanger 16mm Knurled	MNT 94309B

H. EVO HW 299-599 PARTS BREAKDOWN



NO. ON DRAWING	PART DESCRIPTION	PART NUMBER
1	Panel Front Door Assembly HW299-399	D115969
	Panel Front Door Assembly HW599	JKD 94102
2	Burner Air/Gas Mixer Inlet HW599	D105610
3	Pilot Spark Electrode Assembly HW79-599 Knurled	PLT 94318 A
4	Gasket for Electrode HW79-599 *(only needed on PLT 74318)*	GKT 74018
5	Gasket Down Tube/Burner HW79- 599	D104184
6	Burner Door w/rope and EPDM gasket HW79-599	D105611
7	Burner Door Insulation HW79-599	D105632
8	Burner HW599 - 70mm x 395mm	D105609
9	Gasket Fan HW599	D104185
	Gasket Gas/Air Inlet pipe & fan HW179, 299-399	D106935
10	Fan, RG 175, HW599	D113735
11	Venturi HW599	D105629
12	On/Off Switch HW79-1999	D108302
13	Limit Temperature Switch, Burner Door HW79-599	D106936
14	Cap Front Panel Bushing & Program Port	D108572
15	Plastic stand-off for Display Panel HW79-1999	D113640
16	Plate Protection Boiler Control HW299-599	JKC 94101

H. EVO HW 299-599 PARTS BREAKDOWN (CONTINUED)

NO. ON DRAWING	PART DESCRIPTION	PART NUMBER
17	Electronics/Display Drawer Assembly, HW299-599	PAN 94101 A
18	Spacer Unthreaded, 4-40 ID x 1/4"OD x5/16"	D104899
19	Nylon 6-32 1/4x3/4 Female thread Hex Standoff	C/F
20	Control Board HW79-1999	D113634
22	Fork Clip HW599 Arms	D108335
	Fork Clip HW299 Arms	D113886
	Fork Clip HW399 Arms	D113885
23	Hold Down Heat Exchanger HW299-599	D106928
24	Heat Exchanger HW299 - ASME H-Stamp	D113732
	Heat Exchanger HW399 - ASME H stamp	D113693
	Heat Exchanger HW599 - ASME H Stamp	D105679
25	Stainless Inlet/Outlet Sensor HW79-1999	D113612
26	Bushing SS Hi Limit G1/4"-M5	D121451
27	Hi Limit HW79-1999, 210˚F	D110573
	Hi Limit HW79-1999, 198˚F	D113464
28	Drain Hose Lower HW599	CDK 94202
	Drain Hose Lower HW299-399	CDK 94201
29	Condensate Drain Assembly HW299-599	CDK 94097
30	Grommet Cabinet/Condensate Clean-out - HW299-599	GKT 74044
31	Vent Air 1/8 Automatic HW299-599	D104903
32	Tube Air Vent HW299-599	D108337
33	Plastic bushing Front Panel Mount HW299-599	D119494
34	Plate Top HW599 - Sheet Metal Only	D107647
	Plate Top HW299-399 - Sheet Metal Only	D100567
	Plate Top HW599 - Complete Assembly	D110440
	Plate Top HW299-399 - Complete Assembly	D118981
35	Gasket HW299-599 Air Inlet connection	D104186
36	Flange Condensate Air Inlet with Nipple HW599	D109372
	Flange Condense with Nipple HW299-399	D113156
37	Air Inlet Connection HW599	D109371
	Air Inlet Connection HW299-399	D113155
38	Grommet Air Vent Tube HW299-599	D104189
39	Gasket Silicon Flue gas outlet HW599	D104188
	Gasket Silicon Flue gas outlet HW299-399	D113103
40	Flue Gas Outlet Flange HW599	D109123
	Flue Gas Outlet Flange HW299-399	D114072
41	Flue Gas Outlet HW599 Assembly	VNT 94102 A
	Flue Gas Outlet HW299-399 Assembly	VNT 94101 A

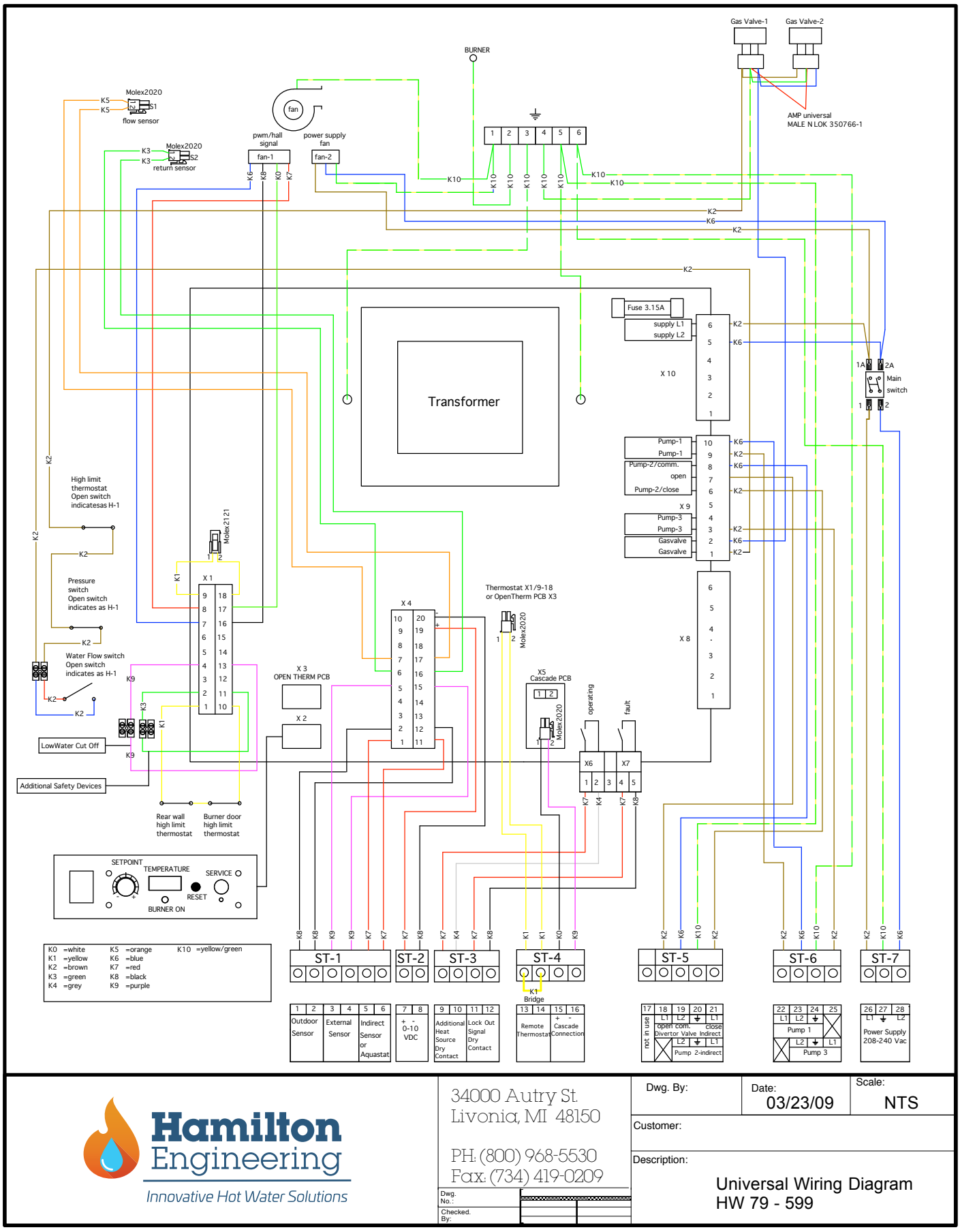
H. EVO HW 299-599 PARTS BREAKDOWN (CONTINUED)

NO. ON DRAWING	PART DESCRIPTION	PART NUMBER
42	Valve Non-Return HW599	D104923
	Valve Non-Return HW299-399	D113615
43	Panel Side HW299-399 Left Side	D117663
	Panel Side HW299-399 Right Side	D117661
	Panel Side HW599 Left Side	D109597
	Panel Side HW599 Right Side	D109598
44	Arm Inlet HW599	ARM 74599 I
	Arm Inlet HW399	ARM 74399 I
	Arm Inlet HW299	ARM 74299 I
45	Plate Bottom HW599 - Sheet Metal Only	D114529
	Plate Bottom HW299-399 - Sheet Metal Only	D113884
	Plate Bottom HW599 - Complete Assembly	D114529
	Plate Bottom HW299-399 - Complete Assembly	JKB 94102 B
46	O-ring SS HW299 Arms	D114528
	O-ring SS HW399 Arms	D113610
	O-ring SS HW599 Arms	D104578
47	Arm Outlet HW599	ARM 74599 O
	Arm Outlet HW399	ARM 74399 O
	Arm Outlet HW299	ARM 74299 O
48	Switch Flow V-10/flat paddle, HW299	D113361
	Switch Flow V-10/flat paddle, HW399-599	D114073
49	Gasket Outer for Fast Connect Arms HW299-599	D104191
50	EPDM Gasket for Arm, HW399-599	D108297
	EPDM Gasket for Arm, HW399-599	D113741
51	Tee Br Outlet Arm 1 1/2" HW299 Includes items 52, 53 & 54	ARM 94101
	Tee Br Outlet Arm 2" HW399-599 Includes items 52, 53 & 54	ARM 94102
52	Plug Brass - 1/2"	D30035
53	Nipple Brass - 3/4" X 3"	D10861
54	Elbow Brass 90˚ 3/4"	D11029
55	Gasket, Gas Inlet Manifold mt. plate to cabnt HW299-599	D113692
56	Manifold Gas 599 Inlet	D105002
57	Fitting 3/4" comp. x 1/2" MPT, HW599 GV Inlet	D104275
58	Nipple Ftg BSPT Male x NPT Male 1/2" HW79-599	D104271
59	Valve Gas HW79-599	D108737
60	3/4 Straight. Flange, 0-rings & screws-VAL 74050	D104922
61	Manifold Gas HW599 Outlet	GAS 74091 A
62	Fitting 1" Comp. x 1" FPT, HW599 Outlet	D104272

H. EVO HW 299-599 PARTS BREAKDOWN (CONTINUED)

NO. ON DRAWING	PART DESCRIPTION	PART NUMBER
63	Tube Gas HW599 Outlet	D111660
64	Switch P Condensate HW79-599	D113636
65	Gas Valve Mount Bracket Lower HW599	D103750
66	Heat Ex. Hold Down Rods HW599 25.125" Long	D108299
	Heat Ex. Hold Down Rods HW399 17" Long	D110848
	Heat Ex. Hold Down Rods HW299 12.812" Long	D114161
67	Hanger Bracket Space HW79-599	D103748
68	Hanger Bracket HW79-599	D103747
69	Panel Rear HW599	C/F
	Panel Rear HW299-399	C/F
70	Burner Air/Gas Mixer Inlet HW79-399	D112959
71	Burner HW299 - 70mm x 210mm	D113711
	Burner HW399 - 70mm x 296mm	D113050
72	Fan RG 148 HW299-399	D113734
73	Venturi HW299	D113733
	Venturi HW399	D113051
74	Tube Gas HW299-399 Outlet	D114865
75	3/4" 90˚ Flange, O-ring, screws - VAL 74050	D114078
Not Shown	Valve Relief P 50# .75x.75	D112960
Not Shown	Valve Relief P 125# .75	D110095
Not Shown	Gas Valve Mount Bracket Upper HW599	C/F
Not Shown	O-Ring RG175 Fan HW599	D107282
Not Shown	Flue Gas Analyzer port plug HW79-599	GKT 74093
Not Shown	U Clips, Wrapper 79-199.1, Side Panel HW299-599	D104898
Not Shown	Insulation Side Panel HW599	D108690
Not Shown	Insulation Side Panel HW299-399	D114074
Not Shown	Hose Condensate Air Intake/PS Drain Hose	D104205
Not Shown	Drain Hose Condensate Trap to Condensate Manifold	D111421
Not Shown	Adapter 21mm Air Inlet Hose	D104207
Not Shown	Bracket Pressure Switch Mount HW299-599	D113725
Not Shown	Insulation Front Panel HW599	D114533
Not Shown	Insulation Front Panel HW299-399	D113052
Not Shown	Fuse 250V-3.15A	D113609
Not Shown	Nut for Burner Door HW79-1999	D105680
Not Shown	Fiberboard Back Wall, 16mm	FIB 74117
Not Shown	Kit Maintenance Heat Exchanger 16mm Knurled	MNT 94309 B
Not Shown	Hi Limit rear Wall 299-1999	HLC 74500

C/F = Consult Factory



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Dwg. By:	Date: 03/23/09	Scale: NTS
Customer:		
Description: Universal Wiring Diagram HW 79 - 599		
Dwg. No.:		
Checked. By:		

PART 9. SPECIAL INSTALLATION REQUIREMENTS

A. INSTALLATION REQUIREMENTS - MASSACHUSETTS

Requirements for installation – Commonwealth of Massachusetts
For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. INSTALLATION OF CARBON MONOXIDE DETECTORS. At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors

   a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.

   b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

2. APPROVED CARBON MONOXIDE DETECTORS. Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

3. SIGNAGE. A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, “GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS”.

4. INSPECTION. The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

(b) EXEMPTIONS: The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:

1. The equipment listed in Chapter 10 entitled “Equipment Not Required To Be Vented” in the most current edition of NFPA 54 as adopted by the Board; and

2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

B. INSTALLATION AT HIGH ALTITUDES

This appliance is equipped with an automatic combustion characteristic adjustment system, provided the installed elevation above sea level is entered into the operating control (FMT 914) when the height is greater than 2,000 feet and less than or equal to 9,000 feet. To enter the operating elevation:

- Press the ***reset button*** continuously for 3 seconds, the appliance shows the adjusted altitude of the appliance (0 = sea level). Each time the ***service button*** is pressed, the value increases by 100 feet (20 through 90 = 2,000 through 9,000 feet). After reaching the maximum value, the counter returns to the minimum value (example: when the value is 90 and the service button is pressed, the new value will be 20). When the right altitude has been set (example: 53 = 5,300 feet of elevation above sea level), press the ***reset button*** for one second and the value will be programmed. The factory default is 20 (which equals 2,000 feet), and there is no need to adjust below that. ***See Figure 8-3 on page 56 for the button locations.***
- The adjusted altitude entered is internally converted to an offset on top of the maximum fan speed.
- ***By adjusting the combustion characteristics as described above, there is no de-rate required at altitudes up to 9,000 feet. For elevations in excess of 9,000 feet or gas BTU content levels below 950 BTU/cubic foot, consult the factory at 734.419.0200 or 800.968.5530 for adjustments and de-rating information.***

PART 10. WARRANTY INFORMATION

A. WARRANTY CONTACT INFORMATION

Hamilton Engineering, Inc. warrants each EVO™ Water Heater and Boiler to be free from defects in material and workmanship according to terms, conditions and time periods. *Unless otherwise noted, these warranties commence on the date of installation.* ***If required periodic maintenance is not performed, warranty coverage may be voided.***

Warranty information specific to each model can be found on our website ***www.hamiltonengineering.com***, requested via email at ***info@hamiltonengineering.com***, or in our printed Product Catalogs.

If you have any questions or comments, please contact us at 800.968.5530. If you need emergency technical support after hours, we are available 24 hours a day, 7 days a week by calling this number.

Please keep the following information on hand when calling about warranty information:

Model: _____ Serial #: _____

Installer Name: _____ Phone #: _____ Install Date: _____