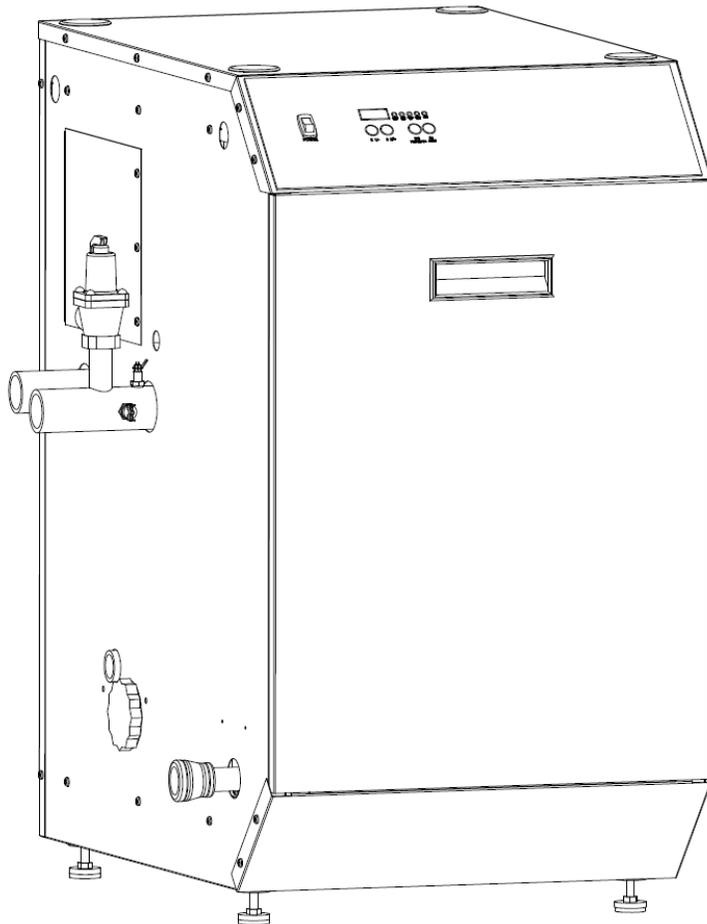




Mod Con VWH



INSTALLATION

START-UP

MAINTENANCE

PARTS

**VWH Models
300 / 500 / 850
LP / HL / LPHL**



Heat Exchanger Bears the ASME "H" Stamp

⚠ DANGER

This manual must only be used by a qualified heating installer/service technician. Read all instructions in this manual before installing. Perform steps in the order given. Failure to comply could result in substantial property damage, severe personal injury, or death.

NOTICE: HTP reserves the right to make product changes or updates without notice and will not be held liable for typographical errors in literature.

NOTE TO CONSUMER: PLEASE KEEP ALL INSTRUCTIONS FOR FUTURE REFERENCE.

⚠ WARNING

IF THE INFORMATION IN THIS MANUAL IS NOT FOLLOWED EXACTLY, A FIRE OR EXPLOSION MAY RESULT, CAUSING PROPERTY DAMAGE, PERSONAL INJURY, OR LOSS OF LIFE. DO NOT STORE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE VICINITY OF THIS OR ANY OTHER APPLIANCE.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch.
- Do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department. Installation and service must be provided by a qualified installer, service agency, or the gas supplier.

FOR YOUR SAFETY READ BEFORE OPERATING

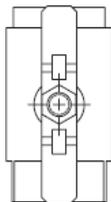
WARNING: If you do not follow these instructions exactly, a fire or explosion may result, causing property damage, personal injury or loss of life.

- | | |
|--|--|
| <p>A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do <u>not</u> try to light the burner by hand.</p> <p>B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.</p> <p>WHAT TO DO IF YOU SMELL GAS</p> <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • If you cannot reach your gas supplier, call the fire department. <p>C. Use only your hand to turn the gas control knob. Never use tools. 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.</p> <p>D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.</p> |
|--|--|

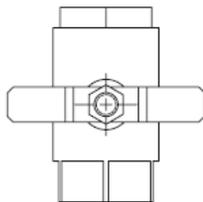
OPERATING INSTRUCTIONS

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. STOP! Read the safety information above. 2. Set the thermostat to lowest setting. 3. Turn off all electric power to the appliance. 4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand. | <ol style="list-style-type: none"> 5. Remove front cover. 6. Turn gas shutoff valve to "off". Handle will be across the piping, do not force. 7. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to next step. 8. Turn gas shutoff valve to "on". Handle will be in line with piping. 9. Install Front Cover. 10. Turn on all electric power to appliance. 11. Set thermostat to desired setting. 12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier. |
|---|---|

GAS VALVE
ON



GAS VALVE
OFF



TO TURN OFF GAS TO APPLIANCE

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Set the thermostat to lowest setting. 2. Turn off all electric power to the appliance if service is to be performed. 3. Remove Front Cover. | <ol style="list-style-type: none"> 4. Turn gas shutoff valve to "off". Handle will be across the piping. Do not force. 5. Install Front Cover. |
|--|--|

LP-175 Rev. 4 3-11-08

SPECIAL ATTENTION BOXES

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

DANGER

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

WARNING

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

CAUTION

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

CAUTION

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

FOREWORD

This manual is intended to be used in conjunction with other literature provided with the appliance. This includes all related control information. It is important that this manual, all other documents included with this system, and additional publications including the National Fuel Gas Code, ANSI Z223.1-2002, be reviewed in their entirety before beginning any work.

Installation should be made in accordance with the regulations of the Authority Having Jurisdiction, local code authorities, and utility companies which pertain to this type of water heating equipment.

Authority Having Jurisdiction (AHJ) – The Authority Having Jurisdiction may be a federal, state, local government, or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department or health department, building official or electrical inspector, or *others having statutory authority*. In some circumstances, the property owner or his/her agent assumes the role, and at government installations, the commanding officer or departmental official may be the AHJ.

NOTE: HTP, Inc. reserves the right to modify product technical specifications and components without prior notice.

FOR THE INSTALLER

DANGER

This manual must only be used by a qualified heating installer/service technician. Read all instructions in this manual before installing. Perform steps in the order given. Failure to comply could result in substantial property damage, severe personal injury, or death.

This appliance must be installed by qualified and licensed personnel. The installer should be guided by the instructions furnished with the boiler, and with local codes and utility company requirements. In the absence of local codes, preference should be given to the National Fuel Gas Code, ANSI Z223.1-2002.

INSTALLATIONS MUST COMPLY WITH:

Authority Having Jurisdiction, local, state, provincial, and national codes, laws, regulations and ordinances.

The latest version of the National Fuel Gas Code, ANSI Z223.1, from American Gas Association Laboratories, 8501 East Pleasant Valley Road, Cleveland, OH 44131.

In Canada – CGA No. B149 (latest version), from Canadian Gas Association Laboratories, 55 Scarsdale Road, Don Mills, Ontario, Canada M3B 2R3. Also, Canadian Electrical Code C 22.1, from Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

Code for the installation of Heat Producing Appliances (latest version), from American Insurance Association, 85 John Street, New York, NY 11038.

The latest version of the National Electrical Code, NFPA No. 70.

NOTE: The gas manifold and controls met safe lighting and other performance criteria when the boiler underwent tests specified in ANSI Z21.13 – latest edition.

⚠ WARNING

The hydronic supply and return connections of these products are for installation in closed loop systems ONLY! Use of this product in any manner other than described in this manual may result in premature product failure, substantial property damage, severe personal injury, or death. Damage or failure of this product (or the system in which it is installed) due to unauthorized use **IS NOT COVERED BY WARRANTY.**

NOTICE

The CSD-1 ASME Code, Section CW-400 requires that hot water heating and supply boilers have a) a UL 353 temperature control device, b) at least one (1) temperature-actuated control to shut off the fuel supply when system water reaches a preset operating temperature, c) a high temperature limit control that prevents the water temperature from exceeding the maximum allowable temperature by causing a safety shutdown and lockout, and d) its own sensing element and operating switch.

The temperature control system integrated into the 926 control provided with this heating appliance complies with the requirements of CSD-1 Section CW-400 as a temperature operation control. The control monitors the temperature difference between the inlet and the outlet sensor, which is affected by boiler water flow. If this temperature difference exceeds 55°F (typically because of low water flow or very low heat load), the control will reduce the maximum fan speed. If the temperature difference exceeds 60°F, the control will effectively sense there is little or no water flow or heat load and shut the boiler down. The controller will restart automatically once the temperature difference has dropped below 55°F and the minimum off time (anti-cycle time) has expired. In addition, if the control senses that the outlet water temperature has reached 210°F, the boiler is put into a hard lockout and requires manual reset to restart.

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PART 1 – GENERAL SAFETY INFORMATION

A. PRECAUTIONS

This appliance is for indoor installations only. Clearance to combustibles materials: 0” top, bottom, sides and back. Front must have room for service, 24” recommended. (A combustible door or removable panel is acceptable front clearance.) This appliance has been approved for closet installation. Do not install this appliance directly on carpeting. This appliance may be installed on combustible flooring. For use with Category IV vent systems only.

 WARNING
INSTALLER – Read all instructions in this manual before installing. Perform steps in the order given.
USER – This manual is for use only by a qualified heating installer/service technician. Refer to user’s information manual for your reference. Have this boiler serviced/inspected by a qualified service technician annually.
FAILURE TO ADHERE TO THE GUIDELINES ON THIS PAGE AND HAVE THIS BOILER SERVICED/INSPECTED ANNUALLY CAN RESULT IN SUBSTANTIAL PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.

WARNING

DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN SUBMERGED IN WATER. Immediately call a qualified service technician. The appliance **MUST BE** replaced if it has been submerged. Attempting to operate an appliance that has been submerged could create numerous harmful conditions, such as a potential gas leakage causing a fire and/or explosion, or the release of mold, bacteria, or other harmful particulates into the air. Operating a previously submerged appliance could result in property damage, severe personal injury, or death.

NOTE: Appliance damage due to flood or submersion is considered an Act of God, and IS NOT covered under product warranty.

NOTE: If the boiler is exposed to the following, do not operate until all corrective steps have been made by a qualified serviceman:

- FIRE
- DAMAGE
- WATER

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

B. IMPROPER COMBUSTION

WARNING

Do not obstruct the flow of combustion and ventilating air. Adequate air must be provided for safe operation. Failure to keep the vent and combustion air intake clear of ice, snow, or other debris could result in property damage, serious personal injury, or death.

C. GAS

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

D. WHEN SERVICING THE BOILER

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow boiler to cool before servicing.

E. BOILER WATER

- Do not use petroleum-based cleaning or sealing compounds in a boiler system. These products may damage gaskets and seals in the system. This can result in substantial property damage.
- Do not use "homemade cures" or "boiler patent medicines". Substantial property damage, damage to boiler, and/or serious personal injury may result.

CAUTION

You must not have a direct connection of the potable water system into the heat exchanger. This could cause flow issues, short cycling, and an increase of mineral build-up in the unit. This system is designed to have incoming potable water flow through the storage tank first, then through the heat exchanger. **FAILURE TO PIPE THE UNIT PROPERLY WILL VOID THE WARRANTY.**

NOTE: Damages resulting from incorrect installation or from use of products not approved by HTP, Inc. ARE NOT covered by warranty.

PART 2 – BEFORE YOU START

CAUTION

VWH units must be connected to a storage tank. Failure to connect the VWH to a storage tank **WILL VOID** the warranty.

VWH Recovery Ratings with Storage Tanks and 40°F Inlet Temperature

Mod Con 300 VWH				
Outlet Temperature	Recovery Gallons Per Hour	First Hour Rating With 80 Gallon	First Hour Rating With 119 Gallon	First Hour Rating With 175 Gallon
80°	846	906	935	971
90°	677	737	766	802
100°	564	624	653	689
110°	483	543	572	608
120°	423	483	512	548
130°	376	436	465	501
140°	338	398	427	463
150°	308	368	397	433
160°	282	342	371	407
170°	260	320	349	385
180°	242	302	331	367

Table 1 – Mod Con 300 VWH Recovery Ratings with Storage Tanks and 40°F Inlet Temperature

Mod Con 500 VWH				
Outlet Temperature	Recovery Gallons Per Hour	First Hour Rating With 80 Gallon	First Hour Rating With 119 Gallon	First Hour Rating With 175 Gallon
80°	1,410	1,470	1,499	1,535
90°	1,128	1,188	1,217	1,253
100°	940	1,000	1,029	1,065
110°	806	866	895	931
120°	705	765	794	830
130°	627	687	716	752
140°	564	624	653	689
150°	513	573	602	638
160°	470	530	559	595
170°	434	494	523	559
180°	403	463	492	528

Table 2 – Mod Con 500 VWH Recovery Ratings with Storage Tanks and 40°F Inlet Temperature

Mod Con 850 VWH				
Outlet Temperature	Recovery Gallons Per Hour	First Hour Rating With 80 Gallon	First Hour Rating With 119 Gallon	First Hour Rating With 175 Gallon
80°	2,397	2,457	2,486	2,522
90°	1,918	1,978	2,007	2,043
100°	1,598	1,658	1,687	1,723
110°	1,370	1,430	1,459	1,495
120°	1,199	1,259	1,288	1,324
130°	1,065	1,125	1,154	1,190
140°	959	1,019	1,048	1,084
150°	872	932	961	997
160°	799	859	888	924
170°	738	798	827	863
180°	685	745	774	810

Table 3 – Mod Con 850 VWH Recovery Ratings with Storage Tanks and 40°F Inlet Temperature

Min Tank Size (gal.) = Required Flow (GPM) x 10

Mixing Factor → $M_f = \frac{\text{VWH Outlet Temp} - 40}{70}$

First Hour Rating = $\left[\frac{\text{Total VWH Output} \times \text{VWH Efficiency} + .75 \times \text{Total Storage}}{(\text{VWH Outlet Temp} - 40)} \right] \times M_f \times 8.31$

Example:

2 MOD CON VWH 500 → Total Output = 1,000,000 BTU @ 94% Efficiency

VWH Outlet Temp → 140°F

2 Storage Tanks (80 Gallons Each) → Total Storage = 160 Gallons

$$\text{Mixing factor} \rightarrow M_f = \frac{140 - 40}{70} = 1.43$$

$$\text{First Hour Rating} = \left[\frac{1,000,000 \times .94}{(140 - 40) \times 8.31} + .75 \times 160 \right] \times 1.43$$

$$\text{First Hour Rating} = \left[\frac{940,000 + 120}{831} \right] \times 1.43$$

$$\text{First Hour Rating} = [1,131 + 120] \times 1.43$$

$$\text{First Hour Rating} = [1,251] \times 1.43$$

First Hour Rating = 1789 Gallons

A. WHAT'S IN THE BOX

Also included with the boiler:

- Pressure and Temperature Gauge
- Pressure Relief Valve
- Intake PVC Tee with Screens
- Exhaust PVC Coupling with Screens
- Supply and Return Thermistors
- Flow Switch and Fitting
- Wiring Harness
- System/Pipe Sensor
- Installation Manual
- Warranty
- CSD-1 Form
- H-3 Data Sheet

B. HOW BOILER OPERATES

Mod Con VWH[®] condensing technology intelligently delivers large volumes of hot water while maximizing efficiency by measuring data from the connected storage tank. Outlined below are the features of the system and how they operate:

Stainless Steel Heat Exchanger - The highly efficient stainless steel heat exchanger is designed to use the cold return water from the system and extract the last bit of heat before it is exhausted.

Modulating Combustion System - The combustion system will modulate the output of the burner during operation to match the system demand and achieve the control set point while in operation. The set point can change by internal or external signals which enhance the overall performance of the system.

Control – The integrated control system monitors the system and regulates fan speed to control boiler output. This allows the boiler to deliver only the amount of heat energy required and nothing more.

The control can regulate the output of multiple boilers through its cascade system function. The cascade system is capable of connecting up to eight boilers together in such a way that they function as one boiler system. This allows for greater turn down ratios and provides systematic control of the multiple boilers in an installation to minimize downtime and maximize efficiency.

The cascade system works by establishing one boiler as the master and the other connected boilers as followers. The master boiler requires a cascade system sensor and a cascade pump in addition to its own boiler pump. Each of the follower boilers has an individual pump.

System Display and Operational LED Light Indicators – The display allows the user to change the system parameters and monitor system outputs.

Gas Valve – Senses suction from the blower, allowing gas to flow only if powered and combustion air is flowing.

All Metal Integrated Venturi – Controls air and gas flow into the burner.

Burner – Constructed of high grade stainless steel, the burner uses premixed air and gas fuel to provide a wide range of firing rates.

Spark Ignition – The burner is ignited by applying high voltage through the system spark electrode. This causes the spark from the electrode to ignite mixed gas from the burner.

Supply Water Temperature Sensor – This sensor monitors the boiler outlet water temperature (System Supply). The control adjusts the boiler firing rate so the supply temperature will match the boiler set point.

Return Water Temperature Sensor – This sensor monitors the boiler return water temperature (System Return).

Temperature and Pressure Gauge – Allows the user to monitor system temperature and pressure.

Electrical field connections with terminal strips – The electrical cover allows easy access to the line voltage and low voltage terminals strips which are clearly marked to facilitate wiring of the boiler.

Condensation Collection System – This boiler is a high efficiency appliance, therefore the boiler will produce condensate. The collection system has a float switch which monitors the condensation level and prevents condensation from backing up into the combustion system. Inside the collection system there is a built in trap which seals the combustion system from the connected drain. This condensate should be neutralized to avoid damage to the drainage system or piping.

Flow Protection – The supplied flow switch is designed to protect the boiler in the event of low flow conditions. The boiler control will also monitor flow through the heat exchanger by monitoring the return and supply sensor and will shut down the burner before overheating occurs.

System Pipe Sensor – This sensor is designed to be used in a cascade system. When placed on the supply line feeding the storage tank, the system pipe sensor measures the temperature of return water and communicates with the control system to modulate the firing rate of the connected boilers.

Indirect Tank Sensor (optional) – Monitors storage tank temperature.

C. OPTIONAL EQUIPMENT

Below is a list of optional equipment available from HTP:

- Indirect Tank Sensor (Part # 7250P-325)
- 4" Stainless Steel Outside Termination Vent Kit (V2000)
- 6" Stainless Steel Outside Termination Vent Kit (V3000)
- High and Low Gas Pressure Switch Kit with Manual Reset (Part # 7350P-600)
- U.L. 353 Compliant Low Water Cut-Off Interface Kit with Manual Reset (Part # 7350P-601)
- Alarm System (Part # 7350P-602) (to monitor any failure)
- PC Connection Kit (Part # 7250P-320)
- Condensate Neutralizer (Part # 7350P-611)
- Caster Kit (Part # 7350P-604)

These additional options may be purchased through your HTP distributor.

PART 3 – PREPARE BOILER LOCATION

CAUTION

Carefully consider installation when determining boiler location. Please read the entire manual before attempting installation. Failure to properly take factors such as boiler venting, piping, condensate removal, and wiring into account before installation could result in wasted time, money, and possible property damage and personal injury.

A. BEFORE LOCATING THE BOILER

⚠ WARNING

Incorrect ambient conditions can lead to damage to the heating system and put safe operation at risk. Ensure that the boiler installation location adheres to the information included in this manual. Failure to do so could result in property damage, serious personal injury, or death.

CAUTION

Failure of boiler or components due to incorrect operating conditions IS NOT covered by product warranty.

1. Installation Area (Mechanical Room) Operating Conditions

- Ensure ambient temperatures are higher than 32°F/0°C and lower than 104°F/40°C.
- Prevent the air from becoming contaminated by the products, places, and conditions listed in this manual, Part 3, Section F.
- Avoid continuously high levels of humidity
- Never close existing ventilation openings

CAUTION

The service life of the boiler's exposed metallic surfaces, such as the casing, as well as internal surfaces, such as the heat exchanger, are directly influenced by proximity to damp and salty marine environments. In such areas, higher concentration levels of chlorides from sea spray coupled with relative humidity can lead to degradation of the heat exchanger and other boiler components. In these environments, boilers must not be installed using direct vent systems which draw outdoor air for combustion. Such boilers must be installed using room air for combustion. Indoor air will have a much lower relative humidity and, hence, potential corrosion will be minimized.

⚠ WARNING

This boiler is certified for indoor installations only. Do not install the boiler outdoors. Failure to install this boiler indoors could result in substantial property damage, severe personal injury, or death.

2. Check for nearby connections to:

- System water piping
- Venting connections
- Gas supply piping
- Electrical power
- Condensate drain

3. Check area around boiler. Remove any combustible materials, gasoline, and other flammable liquids.

⚠ WARNING

Failure to keep boiler area clear and free of combustible materials, liquids, and vapors can result in substantial property damage, severe personal injury, or death.

4. Gas control system components must be protected from dripping water during operation and service.

5. If the boiler is to replace an existing boiler, check for and correct any existing system problems, such as:

- System leaks
- Location that could cause the system and boiler to freeze and leak.
- Incorrectly-sized expansion tank

6. Clean and flush system when reinstalling a boiler.

NOTE: When installing in a zero clearance location, it may not be possible to read or view some product labeling. It is recommended to make note of the boiler model and serial number.

B. LEVELING AND DIMENSIONS

⚠ CAUTION

In order for the condensate to properly flow out of the collection system, the area where you locate the boiler must be level. The boiler comes equipped with leveling feet. Should you find the floor beneath the boiler is uneven, adjust the leveling feet with a wrench.

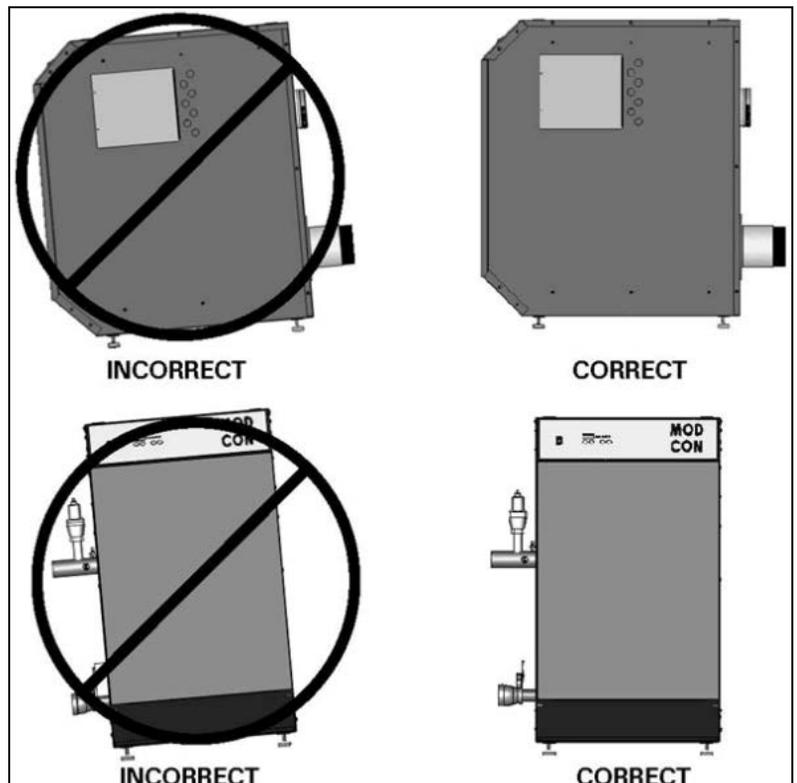
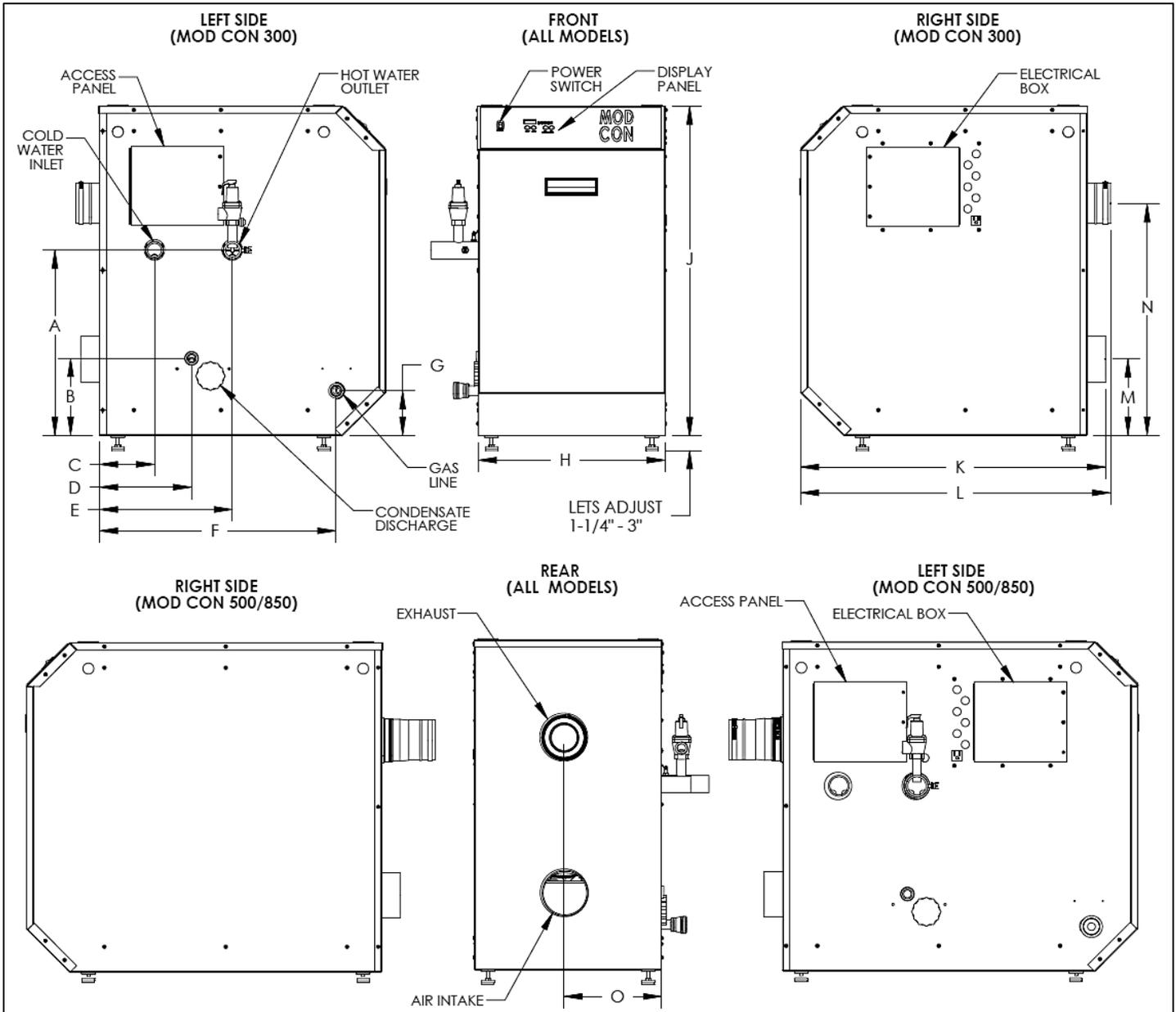


Figure 1 – Leveling



MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	O
MOD CON 300	20"	10-1/4"	6-1/4"	10-1/4"	14-1/2"	26"	5-1/8"	20-1/2"	36"	33-1/2"	36"	8-1/4"	25-1/2"	10-1/2"
MOD CON 500	20"	14-3/4"	6-1/4"	13-1/4"	14-1/2"	33-1/4"	5-1/8"	20-1/2"	36"	40"	43"	8-1/4"	25-1/2"	10-1/2"
MOD CON 850	20"	20"	6-1/4"	16-1/4"	18-3/4"	43-1/2"	20"	20-1/2"	36"	68-3/4"	70-3/4"	8-1/4"	25-1/2"	10-1/2"

NOTE: ALL DIMENSIONS ARE APPROXIMATE AND HEIGHTS DO NOT INCLUDE ADJUSTABLE LEGS.

MODEL	BTU/HR INPUT LOW FIRE	Gross Output BTU/hr	Net I=B=R BTU/hr	Thermal Efficiency	Boiler Water	Supply/Return Connection	Gas Conn.	Vent Dia.	Ship. Wt.	High Fan Speed	Low Fan Speed	Fan Speed at Ignition
MOD CON 300	60,000-301,000	283,000	245,000	94%	2.9	1-1/2"	1-1/4"	4"	410	5500	1250	3000
MOD CON 500	100,000-500,000	470,000	409,000	94%	4.2	2"	1-1/2"	4"	505	6930	1250	3000
MOD CON 850	170,000-850,000	799,000	695,000	94%	5.8	2"	2"	6"	580	5400	1500	3000

LP-205-C
03/15/12

Figure 2 – Dimensions and Specifications

C. CLEARANCES FOR SERVICE ACCESS

See Figure 3 for recommended service clearances. If you do not provide the minimum clearances shown, it might not be possible to service the boiler without removing it from the space.

⚠ WARNING

Space must be provided with combustion/ventilation air openings correctly sized for all appliances located in the same space as the boiler. The boiler venting cover must be securely fastened to prevent it from drawing air from the boiler room. This is particularly important if the boiler is in a room with other appliances. Failure to comply with the above warnings could result in substantial property damage, severe personal injury, or death.

D. RESIDENTIAL GARAGE INSTALLATION

PRECAUTIONS

If the boiler is located in a residential garage, per ANSI Z223.1:

- Mount the bottom of the boiler a minimum of 18" above the floor of the garage, to ensure the burner and ignition devices are well off the floor.
- Locate or protect the boiler so it cannot be damaged by a moving vehicle.

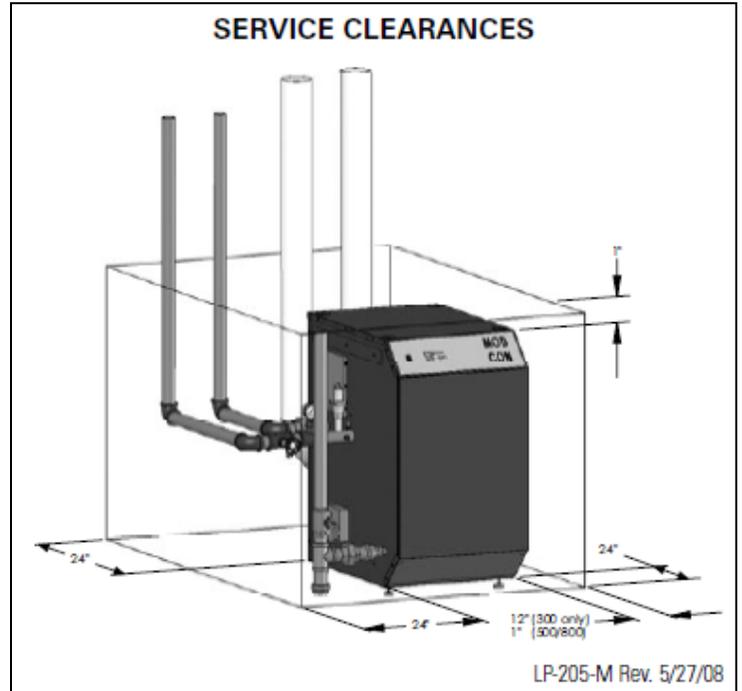


Figure 3 - Clearances

CAUTION

Check with your local Authority Having Jurisdiction for requirements when installing boiler in a garage. Please read the entire manual before attempting installation. Failure to properly take factors such as boiler venting, piping, condensate removal, and wiring into account before installation could result in wasted time, money, and possible property damage and personal injury.

E. EXHAUST VENT AND INTAKE AIR VENT

⚠ WARNING

Vents must be properly supported. The boiler intake and exhaust connections are not designed to carry heavy weight. Vent support brackets must be within 1' of the boiler and the balance at 4' intervals. Venting must be readily accessible for visual inspection for the first 3' from the boiler.

The boiler is rated ANSI Z21.13 Category IV (pressurized vent, likely to form condensate in the vent), and requires a special vent system designed for pressurized venting.

You must also install air intake piping from outdoors to the boiler flue adaptor. The resultant installation is categorized as direct vent (sealed combustion). **Note: To prevent combustion air contamination, see Table 4 in this section when considering exhaust vent and intake air vent termination.**

Intake and exhaust vents must terminate near each other and may be vented vertically through the roof or out a side wall. Intake and exhaust venting methods are detailed in the Venting Section. Do not attempt installation using any other means. Be sure to locate the boiler so intake and exhaust vent piping can be routed through the building and properly terminated. The air intake and exhaust vent piping lengths, routing and termination method must all comply with methods and limits given in the venting section.

F. PREVENT COMBUSTION AIR CONTAMINATION

Install intake piping for the boiler as described in the Venting section. Do not terminate exhaust in locations that can allow contamination of intake air.

⚠ WARNING

You must pipe outside air to the boiler intake. Ensure that the intake air will not contain any of the contaminants below. For example, do not pipe intake vent near a swimming pool. Avoid areas subject to exhaust fumes from laundry facilities. These areas always contain contaminants. Contaminated air will damage the boiler, resulting in possible substantial property damage, severe personal injury, or death.

PRODUCTS TO AVOID	AREAS LIKELY TO HAVE CONTAMINANTS
Spray cans containing fluorocarbons	Dry cleaning/laundry areas and establishments
Permanent wave solutions	Swimming pools
Chlorinated waxes/cleaners	Metal fabrication plants
Chlorine-based swimming pool chemicals	Beauty shops
Calcium chloride used for thawing	Refrigeration repair shops
Sodium chloride used for water softening	Photo processing plants
Refrigerant leaks	Auto body shops
Paint or varnish removers	Plastic manufacturing plants
Hydrochloric or Muriatic acid	Furniture refinishing areas and establishments
Cements and glues	New building construction
Antistatic fabric softeners used in clothes dryers	Remodeling areas
Chlorine-type bleaches, laundry detergents, and cleaning solvents	Garages and workshops
Adhesives used to fasten building products	

Table 4 – Contaminants

NOTE: DAMAGE TO THE BOILER CAUSED BY EXPOSURE TO CORROSIVE VAPORS IS NOT COVERED BY WARRANTY.
 (Refer to the limited warranty for complete terms and conditions).

G. REMOVING A BOILER FROM A COMMON VENT SYSTEM

⚠ DANGER

Do not install the boiler into a common vent with any other boiler. This will cause flue gas spillage or boiler malfunction, resulting in possible substantial property damage, severe personal injury, or death.

⚠ DANGER

Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

When removing an existing boiler, the following steps must be followed.

1. Seal any unused openings in the common 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.
3. If practical, close all building doors, windows and all doors between 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 in operation the appliance being inspected. 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 conforms to 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.

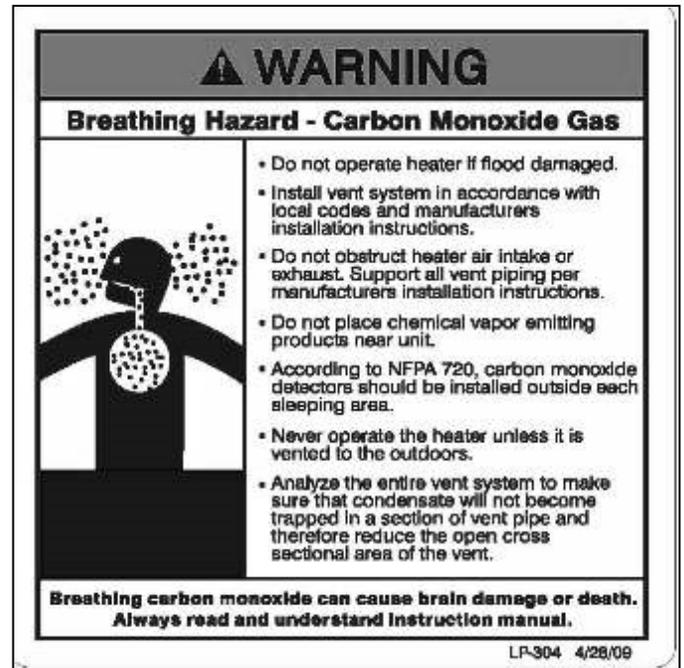


Figure 4 – CO Warning Label

H. UNCRATING AND MOVING BOILER

⚠ WARNING

Uncrating Boiler – Any claims for damage in shipment must be filed immediately against the transportation company by the consignee.

CAUTION

Cold Weather Handling – If boiler has been stored in a very cold location (below 0°F) before installation, handle with care until the plastic components come to room temperature.

Remove all sides of the shipping crate in order to allow the boiler to be lifted into its installation location. Pick the boiler up by the lift rings to avoid damage to the boiler enclosure. Use either a solid ¾" diameter black iron pipe or lifting straps to lift the boiler off of its shipping crate. The boiler is very heavy. At least two individuals are needed to handle the boiler properly. If the location is not level, adjust the boiler's leveling feet to ensure a level boiler and proper flow of condensate. If surface flooring is rough, care should be taken not to catch the leveling feet and damage the boiler when sliding it into position.

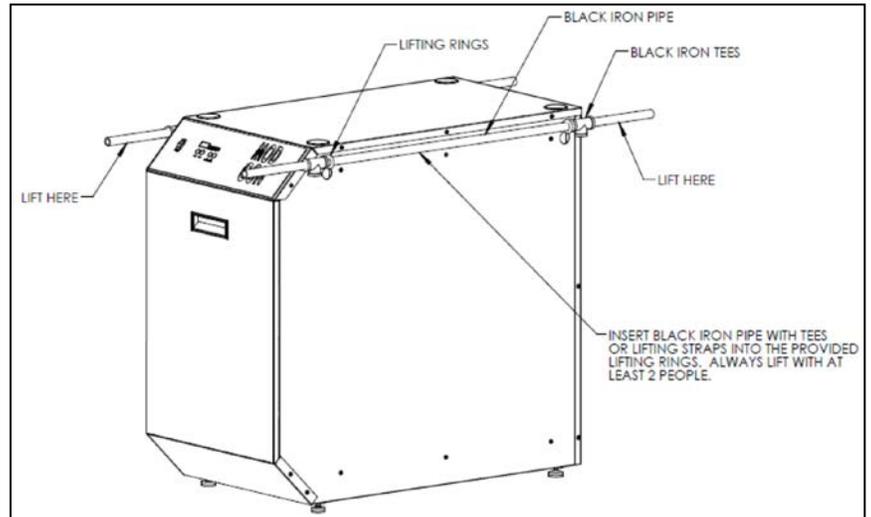


Figure 5 – Lifting the Mod Con

PART 4 – BOILER PIPING

⚠ WARNING

Failure to follow the instructions in this section WILL VOID the warranty and may result in property damage, serious injury, or death.

CAUTION

Never use dielectric unions or galvanized steel fittings when connecting to a stainless steel storage tank or boiler. Failure to follow this instruction can lead to premature failure of the boiler system. Such failures ARE NOT covered by warranty.

Plumbing of this product should only be done by a qualified, licensed plumber in accordance with all local plumbing codes. The boiler is designed to be connected to a storage tank to supply domestic hot water. HTP offers 80/119/175 gallon size storage tanks in either Stainless Steel or Glass lined construction. These storage tanks will be directly connected to the Boiler supply and return connection.

A. GENERAL PIPING INFORMATION

CAUTION

The building piping system must meet or exceed the piping requirements in this manual.

CAUTION

The control module uses temperature sensors to provide both high limit protection and modulating temperature control. The control module also provides low water protection by sensing the water level in the heat exchanger. Some codes/jurisdictions may require additional external controls.

CAUTION

Use two wrenches when tightening water piping at the appliance. Use one wrench to prevent the appliance return or supply line from turning. Failure to prevent piping connections from turning could cause damage to appliance components.

B. RELIEF VALVE

⚠ DANGER

⚠ DANGER



Water temperature over 125 degrees F. can cause severe burns instantly, or death from scalds. Children, disabled, and 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. See chart below showing temperature burn rate.

⚠ DANGER



Connect discharge piping to a safe disposal location according to the following guidelines.

⚠ WARNING

To avoid water damage or scalding due to relief valve operation:

- Discharge line must be connected to relief valve outlet and run to a safe place of disposal.
- Terminate the discharge line in a manner that will prevent possibility of severe burns or property damage should the relief valve discharge.
- Discharge line must be as short as possible and the same size as the valve discharge connection throughout its entire length.
- Discharge line must pitch downward from the valve and terminate at least 6" above the floor drain, making discharge clearly visible.
- Discharge line shall terminate plain, not threaded, with a material serviceable for temperatures of 375°F or greater.
- Do not pipe discharge to any location where freezing could occur.
- No shutoff valve may be installed between the relief valve and boiler or in the discharge line. Do not plug or place any obstruction in the discharge line.
- Test the operation of the relief valve after filling and pressurizing the system by lifting the lever. Make sure the valve discharges freely. If the valve fails to operate correctly, replace it with a new relief valve.
- Test relief valve at least once annually to ensure the waterway is clear. If valve does not operate, turn the boiler "off" **and call a plumber immediately.**
- Take care whenever operating relief valve to avoid scalding injury or property damage.
- For boilers installed with only a pressure relief valve, the separate storage vessel must have a temperature and pressure relief valve installed. This relief valve shall comply with *Relief Valves for Hot Water Supply Systems, ANSI Z21.22 CSA4.4.*

FAILURE TO COMPLY WITH THE ABOVE GUIDELINES COULD RESULT IN FAILURE OF RELIEF VALVE OPERATION, RESULTING IN POSSIBILITY OF SUBSTANTIAL PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.

C. SYSTEM WATER PIPING METHODS

EXPANSION TANK AND MAKE-UP WATER

1. Ensure that the expansion tank is sized to correctly handle boiler and system water volume and temperature.

BOILER WATER VOLUME	
300 VWH	2.9 Gallons
500 VWH	4.2 Gallons
850 VWH	5.8 Gallons

Table 5

2. The expansion tank must be located as shown in Part 4, Section H, Piping Diagrams, or following recognized design methods. See expansion tank manufacturer's instructions for details. Always install an expansion tank designed for potable water systems.

D. CIRCULATOR PUMPS

⚠ CAUTION

DO NOT install automatic air vents on closed type expansion tank systems. Air must remain in the system and return to the tank to provide an air cushion. An automatic air vent would cause air to leave the system, resulting in improper operation of the expansion tank.

⚠ CAUTION

DO NOT use the boiler circulator in any location other than the ones shown in this manual. The boiler circulator location is selected to ensure adequate flow through the boiler. Failure to comply with this caution could result in unreliable performance and nuisance shutdowns from insufficient flow.

The boiler is designed to be connected to a storage tank to supply domestic hot water. HTP offers storage tanks that are 80/119/175 gallon size storage tanks constructed in either stainless steel or glass-lined construction. These storage tanks connect directly to the boiler supply and return connections. Connect the cold water supply to both the storage bottom port and the supply side of the Mod Con VWH (shown in Piping details, this section). It is important that you install a flow check on the supply line of Mod Con VWH before you connect the feed line to the storage tank. This will allow the cold feed to flow through the storage tank first. It is recommended that you install shut off valves on the cold feed line for ease of future service. If there is a back flow preventer or any type of no return valve in the system, you must install an additional tee for a suitable potable hot water expansion tank. Connect the Storage tank return line to the return connection located on the Mod Con VWH (shown in Section H, Piping Diagrams). Then connect your hot water outlet located on the storage tank to your hot water plumbing lines.

⚠ WARNING

Never use dielectric unions or galvanized steel fittings when connecting to a stainless steel storage tank or boiler.

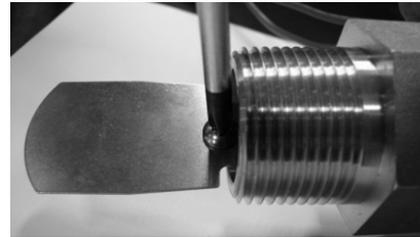
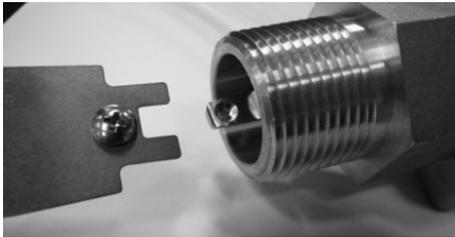
⚠ WARNING

When raising tank temperature, you increase the risk of scalding. Use a water tempering or mixing valve and extreme caution. Consult codes for conformance.

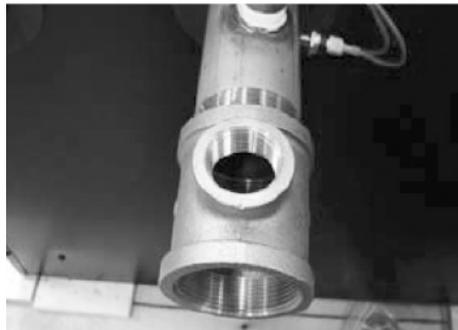
E. INSTALLATION OF THE FLOW SWITCH

NOTE: If you are converting the boiler to a VWH, you will follow steps 1 – 9. If you have purchased a factory VWH, you will only need to follow steps 1 – 3 and 8.

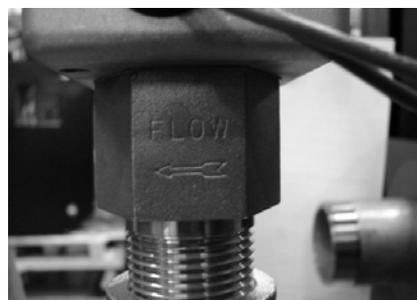
1. Attach flow paddle as shown.



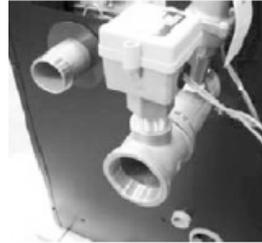
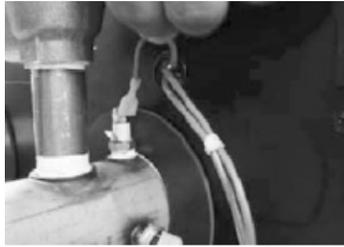
2. Thread brass tee onto outlet nipple using pipe dope.



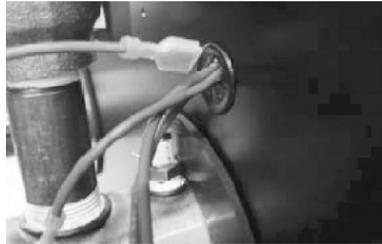
3. Thread flow switch into tee using pipe dope, **making certain the FLOW arrow points in the correct direction.**



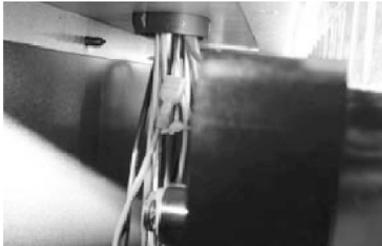
4. Disconnect red wire on the low water cut off probe and connect it to the red wire from the wire harness (included in kit).



5. Feed green ground wire into boiler through the wire access.



6. From the front of the boiler, feed the ground wire up into the control box.



7. Once into the control box, attach the green ground to the ground bus connection.



8. Connect red wire from flow switch to boiler wire harness.



9. When installation is complete, power up the boiler and use the control to access installer parameter #20 and change the default value to 2 (see Part 11 in this manual). When done, create a demand and observe boiler function to verify the installation is working properly.

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

F. SCALDING

⚠ WARNING

When raising tank temperature, you increase the risk of scalding. Please use a water tempering or mixing valve and extreme caution when raising tank temperature to lessen the chance of scalds. Consult codes for conformance.

This water boiler can deliver scalding water at any faucet in the system. Be careful whenever using hot water to avoid scalding injury. Certain appliances such as dishwashers and automatic clothes washers may require increased water temperature. By setting the thermostat on this water boiler to obtain the increased water temperature required by these appliances, you may create the potential for scald injury.

APPROXIMATE TIME / TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 ½ to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 ½ seconds
155°F	About 1 second

Table 6

To protect against injury, the installer should install a mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch supply lines. Such valves are available from your local plumbing supplier.

To protect against injury, the installer should install a mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch supply lines. Such valves are available from your local plumbing supplier.

Table 6 details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

The table below represents the combined flow rates and pipe sizes when using multiple boilers to design the manifold system for the primary circuit. To size, simply add up the number of boilers and the required flow rates for the system design temperature. Example: (5) Mod Con 300 boilers with a design of 30°F temperature rise, with each boiler having an individual flow rate of 20 gpm. To correctly size the manifold feeding these (5) Mod Con 300 boilers, you would need a pipe size of 3".

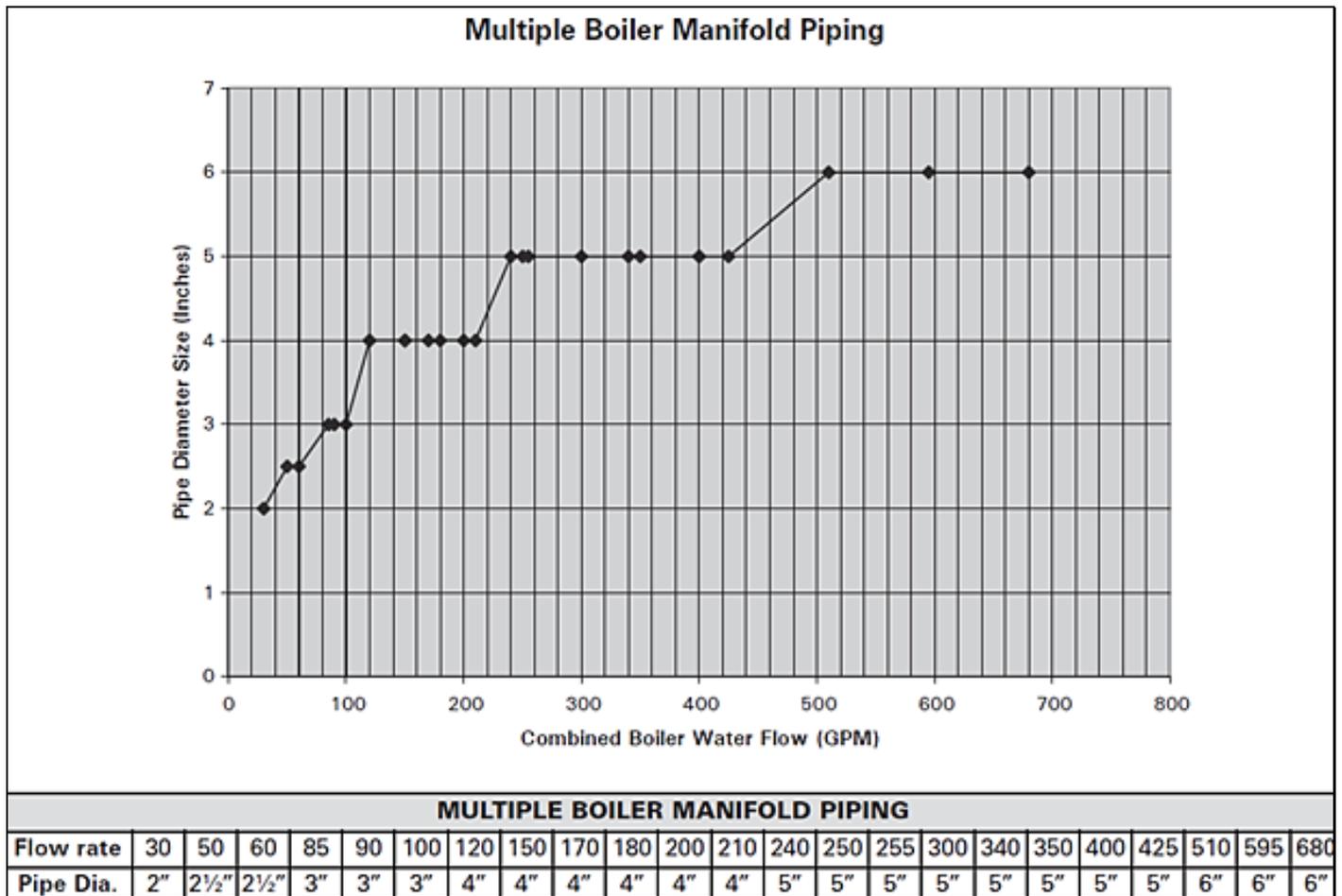


Table 7 – Multiple Boiler Manifold Piping

The table below represents the various system design temperature rise through the Mod Con along with the respective flow and friction loss which will aid in circulator selection.

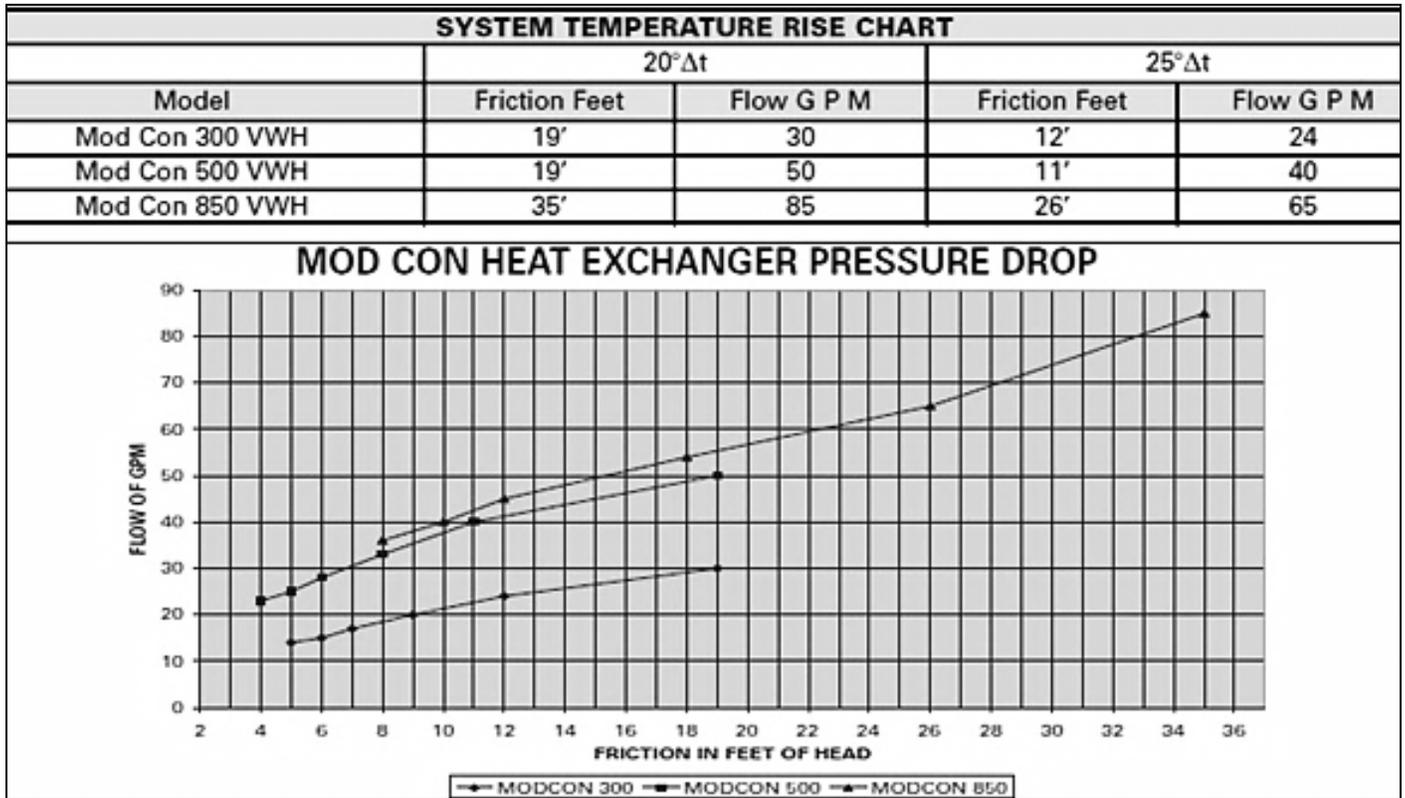


Table 8 – Mod Con Heat Exchanger Pressure Drop

G. HIGH VELOCITY CIRCULATOR PUMP

Every VWH system requires special attention to pump size in order to overcome the pressure drop through the boiler and its related piping. All circulators installed on the VWH system must be designed for a potable water system.

CAUTION

Water temperature above 140°F requires the circulator pump to run continuously and water hardness between 5 and 7 grains. Hardness above 7 grains will damage the heat exchanger and shorten the service life of the boiler.

H. WATER CHEMISTRY

CAUTION

Chemical imbalance of your water can cause severe damage to your water heater and associated equipment, and may also affect efficiency. You may have to have your water quality professionally analyzed to determine whether you need to install a water softener. It is important that the water chemistry on both the domestic hot water and central heating sides are checked before installing the heater, as water quality will affect the reliability of the system.

Outlined below are those water quality parameters which need to be met in order for the system to operate efficiently for many years. **Failure of a heat exchanger due to lime scale build-up on the heating surface, low pH or other imbalance IS NOT covered by the warranty.**

Water Hardness

Water hardness is mainly due to the presence of calcium and magnesium salts dissolved in the water. The concentration of these salts is expressed in mg/L, ppm or grains per gallon, as a measure of relative hardness of water. Grains per gallon is the common reference measurement used in the U.S. water heater industry. Hardness expressed as mg/L or ppm may be divided by 17.1 to convert to grains per gallon. Water may be classified as very soft, slightly hard, moderately hard, or hard based on its hardness number. The minerals in the water precipitate out when the water is heated and cause accelerated lime and scale accumulation on a heat transfer surface.

If the hardness of the water exceeds the maximum level of 7 grains per gallon, water should be softened to a hardness level no lower than 5 grains per gallon. Water softened as low as 0 to 1 grain per gallon may be under-saturated with respect to calcium carbonate, resulting in water that is aggressive and corrosive.

pH of Water

pH is a measure of relative acidity, neutrality or alkalinity. Dissolved minerals and gases affect water pH. The pH scale ranges from 0 to 14. Water with a pH of 7.0 is considered neutral. Water with a pH lower than 7 is considered acidic. Water pH higher than 7 is considered alkaline. A neutral pH (around 7) is desirable for most potable water applications. **Corrosion damage and heater failures resulting from water pH levels of lower than 6 or higher than 8 ARE NOT covered by the warranty.** The ideal pH range for water used in a storage tank or a water heater system is 7.2 to 7.8.

Total Dissolved Solids

Total Dissolved Solids (TDS) is a measurement of all minerals and solids dissolved in a water sample. The concentration of total dissolved solids is usually expressed in parts per million (ppm).

Water with a high TDS concentration will greatly accelerate lime and scale formation in the hot water system. Most high TDS concentrations precipitate out of the water when heated. This can generate a scale accumulation on the heat transfer surface that will greatly reduce the service life of a water heater. This scale accumulation can also impede the ability of the heat exchanger to transfer heat into the water. A heat exchanger damaged or blocked by lime/scale accumulation must be replaced.

The manufacturer of the water heater has no control of water quality, especially TDS levels in your system. Total dissolved solids in excess of 2,000 ppm will accelerate lime and scale formation in the heat exchanger. Heat exchanger failure due to total dissolved solids in excess of 2,000 ppm is a non-warrantable condition. **Failure of a water heater due to lime scale build up on the heating surface IS NOT covered by the warranty.**

Hardness: 7 grains

Chloride levels: 100 ppm

pH levels: 6-8

TDS: 2000 ppm

Sodium: 20 mGL

***NOTE:** It is recommended you clean heat exchanger at least once a year to prevent lime scale buildup. Follow the maintenance procedure to clean the heat exchanger in the Maintenance Section (Part 12 of this manual).

Piping components

Water heating system piping:

Water boiler system piping **MUST** be sized per technical pipe requirements listed in Table 9. Reducing pipe size can restrict flow rate through the boiler, causing inadvertent short cycling and poor system performance.

Check valves:

Field supplied. Check valves are recommended for installation as shown in Piping Details.

Water boiler isolation valves:

Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the water boiler.

Anti-scald mixing valve:

Field supplied. A thermostatic mixing valve is recommended when storing domestic hot water above 115°F.

Unions:

Field supplied: Recommended for unit serviceability. **DO NOT USE DIELECTRIC UNIONS!
ONLY BRASS, COPPER, OR STAINLESS STEEL.**

Pressure relief valve:

Factory supplied on VWH. The pressure relief valve is sized to ASME specifications. Storage tank may require additional relief valves depending on local codes.

I. PIPING DIAGRAMS

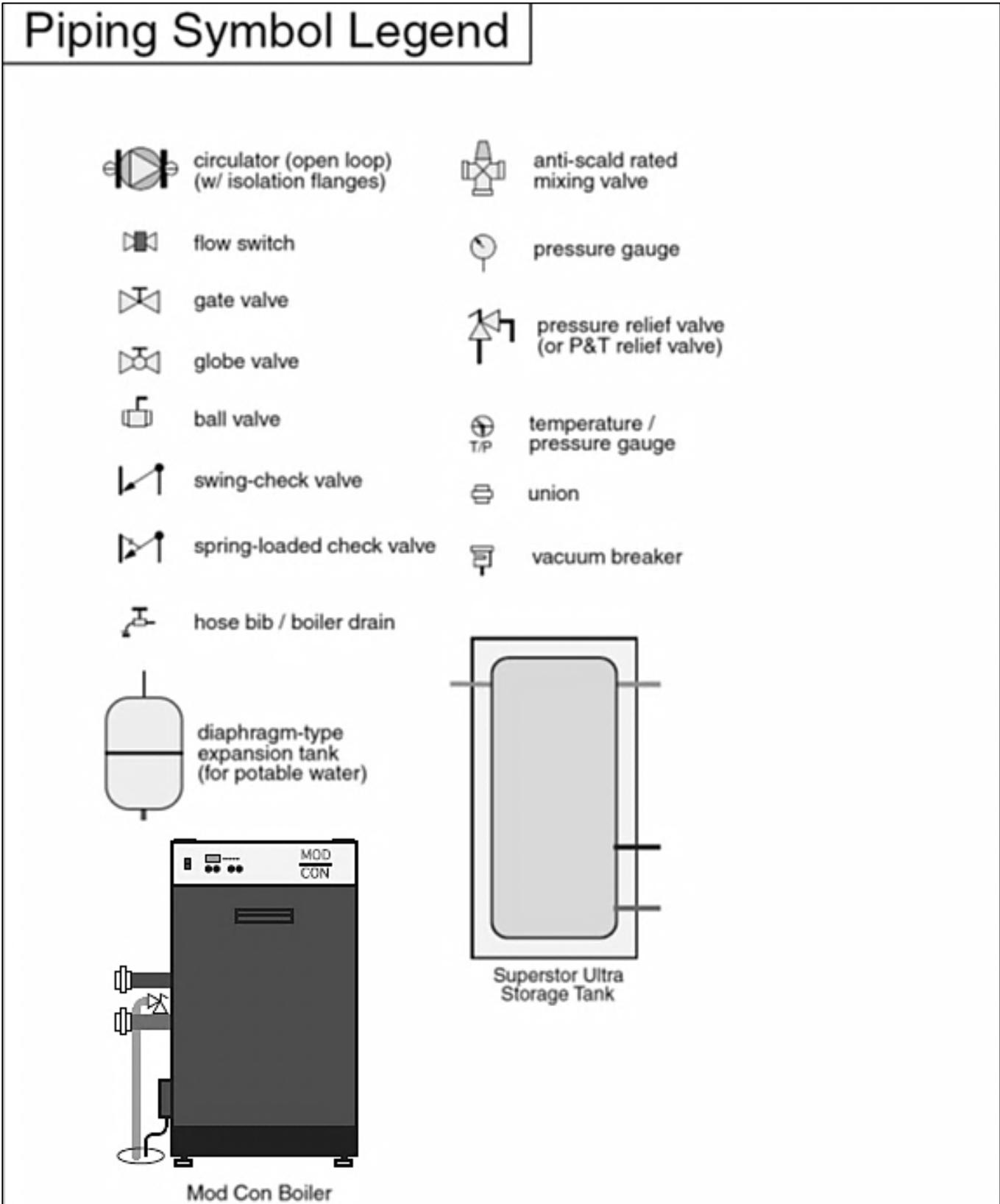


Figure 6

Volume Water Heating using MOD CON boiler (1 boiler supplying 1 storage tank)

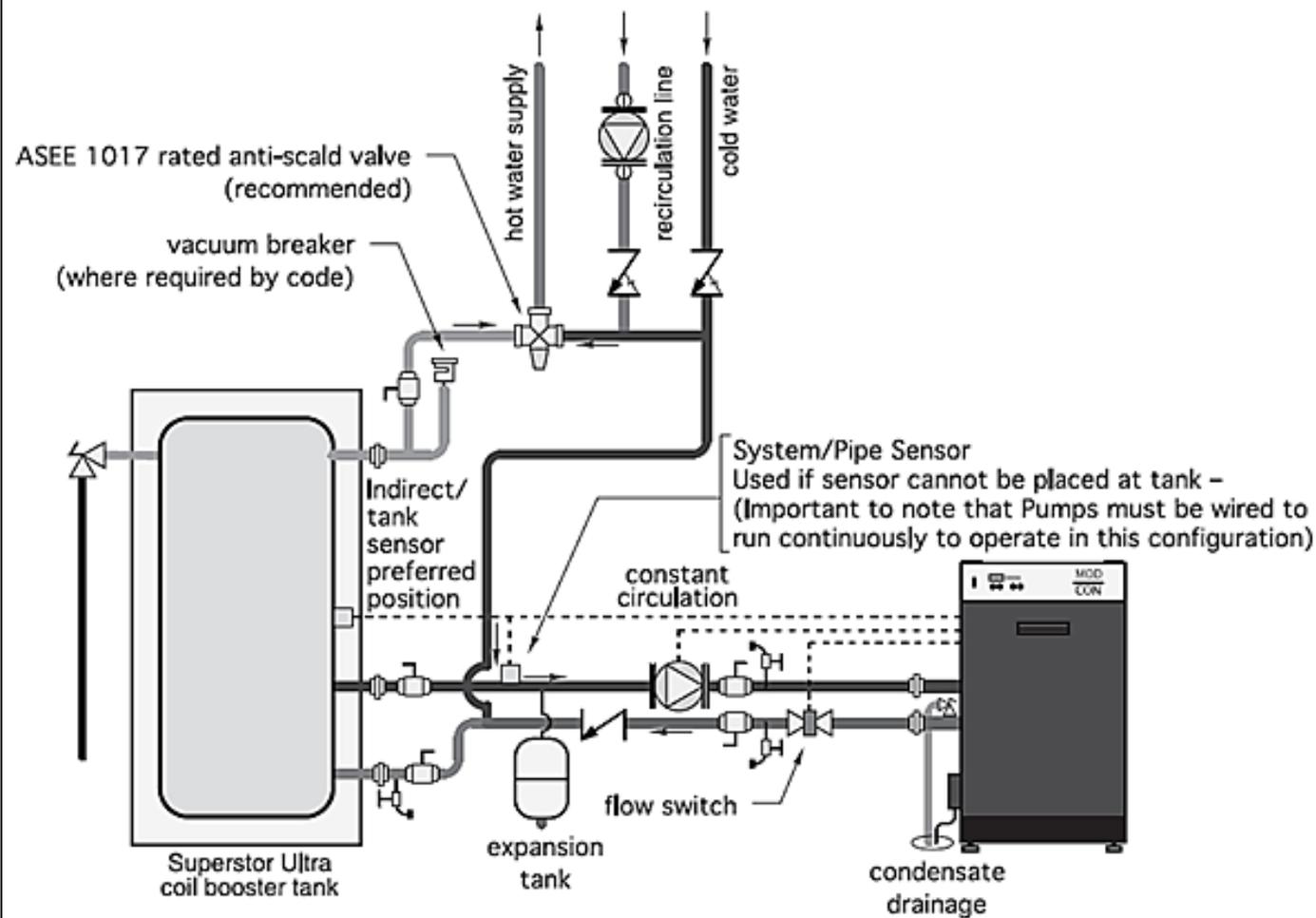


Figure 7

NOTES:

1. This drawing is meant to demonstrate system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. Boiler circulator(s) must be rated for open loop applications. Do not use cast-iron circulators.
3. Boiler circulator(s) operate continuously.
4. The minimum pipe size for connecting to a water storage tank is 1 ½".
5. The minimum pipe size for connecting the boiler is 1 ½" for the Mod Con 300 VWH and 2" for the 500 and 850 models.
6. All pumps are shown with isolation flanges or full port ball valves for isolation. The alternative is standard flanges with full port ball valves and a separate flow check valve.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators and check valves.
8. Install a vacuum relief valve in accordance with local code requirements.
9. Multiple boilers and storage tanks shall be installed with reverse return piping (as shown).
10. **Mixing valves are recommended on all tanks if hot water temperature is above 119°F.**
11. Expansion tank must be rated for use with potable water.
12. Use either indirect/tank sensor or system/pipe sensor mounted on common return to the boiler.
13. Aquastat or system/pipe sensor connects to DHW sensor input on boiler.

Volume Water Heating using MOD CON boiler (1 boiler supplying 2 storage tanks)

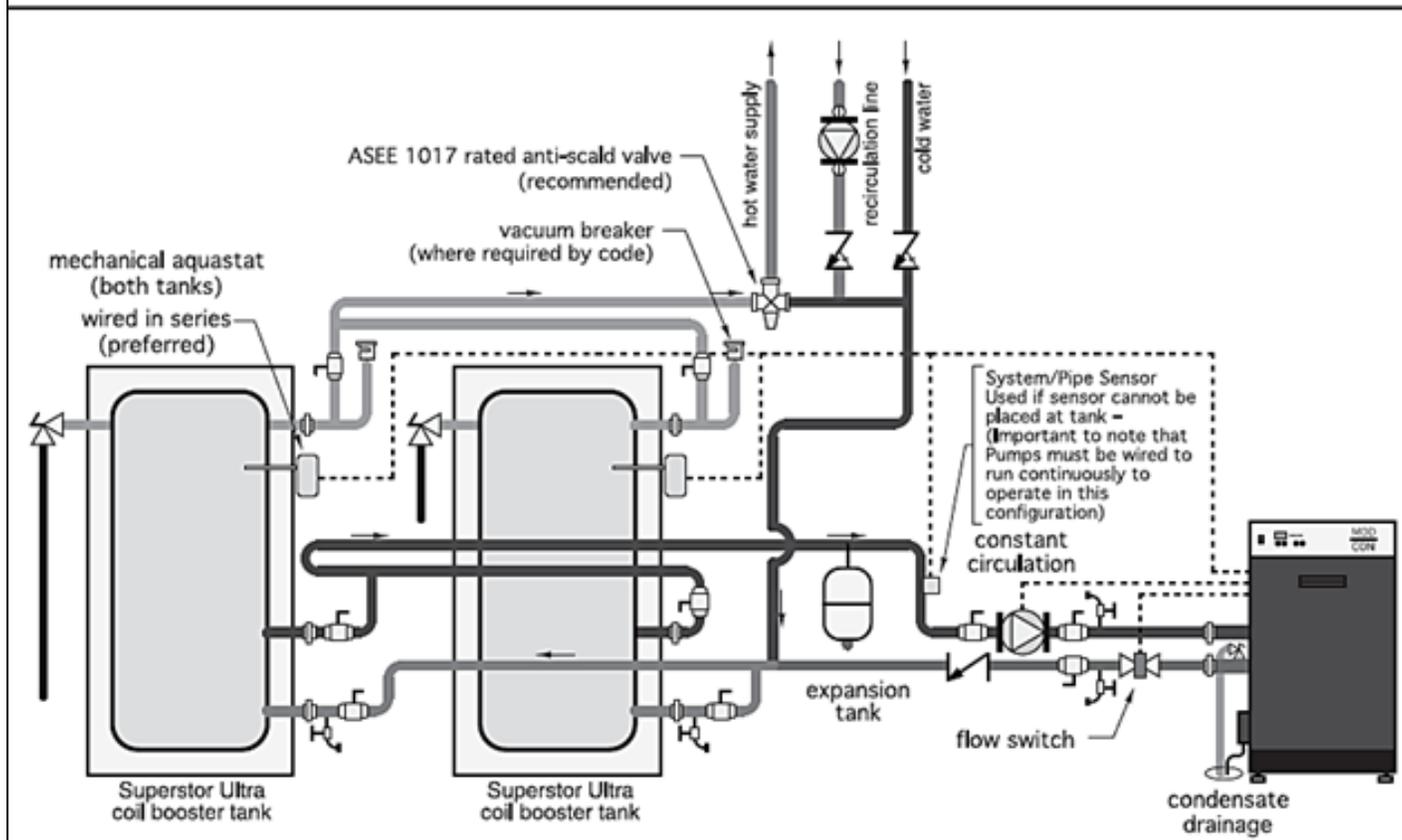


Figure 8

NOTES:

1. This drawing is meant to demonstrate system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. Boiler circulator(s) must be rated for open loop applications. Do not use cast-iron circulators.
3. Boiler circulator(s) operate continuously.
4. The minimum pipe size for connecting to a water storage tank is 1 ½".
5. The minimum pipe size for connecting the boiler is 1 ½" for the Mod Con 300 VWH and 2" for the 500 and 850 models.
6. All pumps are shown with isolation flanges or full port ball valves for isolation. The alternative is standard flanges with full port ball valves and a separate flow check valve.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators and check valves.
8. Install a vacuum relief valve in accordance with local code requirements.
9. Multiple boilers and storage tanks shall be installed with reverse return piping (as shown).
10. **Mixing valves are recommended on all tanks if hot water temperature is above 119°F.**
11. Expansion tank must be rated for use with potable water.
12. Use either indirect/tank sensor or system/pipe sensor mounted on common return to the boiler.
13. Aquastat or system/pipe sensor connects to DHW sensor input on boiler.

Volume Water Heating using MOD CON boiler (2 boilers supplying 1 storage tank)

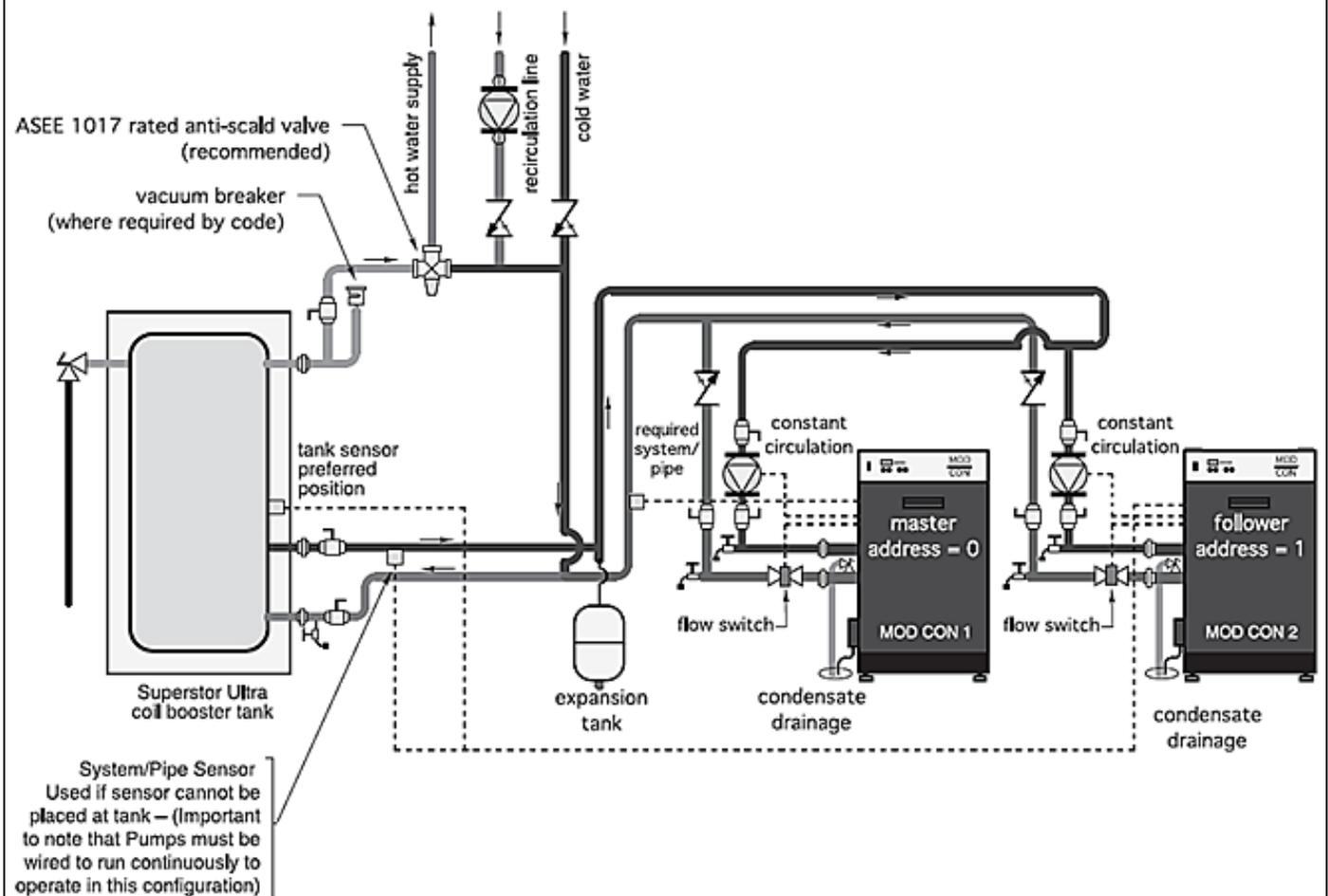


Figure 9 NOTES:

1. This drawing is meant to demonstrate system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. Boiler circulator(s) must be rated for open loop applications. Do not use cast-iron circulators.
3. Boiler circulator(s) operate continuously.
4. The minimum pipe size for connecting to a water storage tank is 1 ½".
5. The minimum pipe size for connecting the boiler is 1 ½" for the Mod Con 300 VWH and 2" for the 500 and 850 models.
6. All pumps are shown with isolation flanges or full port ball valves for isolation. The alternative is standard flanges with full port ball valves and a separate flow check valve.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators and check valves.
8. Install a vacuum relief valve in accordance with local code requirements.
9. Multiple boilers and storage tanks shall be installed with reverse return piping (as shown).
10. **Mixing valves are recommended on all tanks if hot water temperature is above 119°F.**
11. Expansion tank must be rated for use with potable water.
12. Use either indirect/tank sensor or system/pipe sensor mounted on common return to the boiler.
13. Wire the tank or system/pipe sensor connected to the DHW sensor terminals on the follower boiler addressed as #1.
14. The system/pipe sensor must be placed on common piping to the tank, as close to the tank as possible.
15. The system/pipe sensor is wired to the system sensor terminals on the master boiler.

Volume Water Heating using MOD CON boiler (2 boilers supplying 1 storage tank)

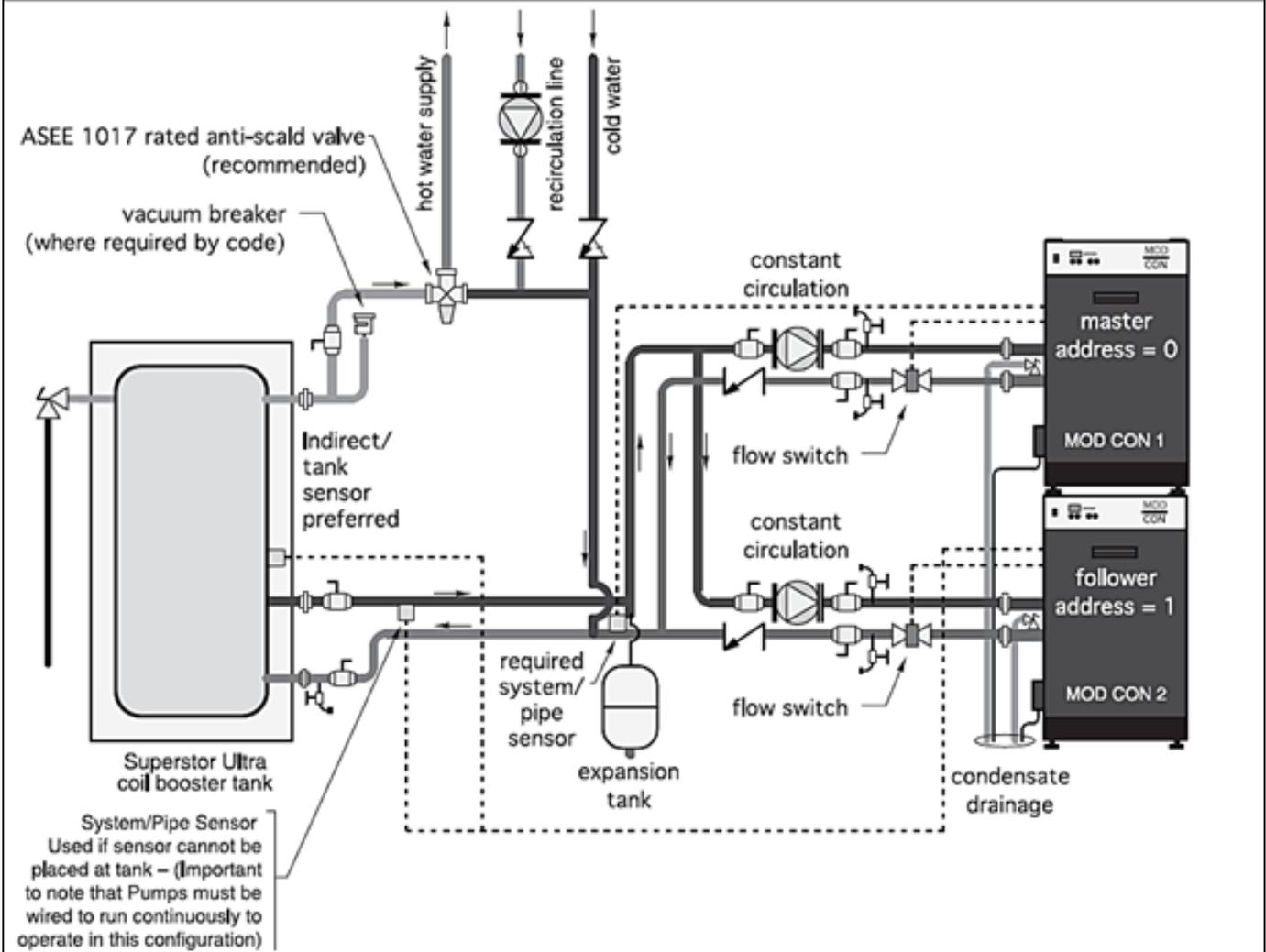


Figure 10 NOTES:

1. This drawing is meant to demonstrate system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. Boiler circulator(s) must be rated for open loop applications. Do not use cast-iron circulators.
3. Boiler circulator(s) operate continuously.
4. The minimum pipe size for connecting to a water storage tank is 1 ½".
5. The minimum pipe size for connecting the boiler is 1 ½" for the Mod Con 300 VWH and 2" for the 500 and 850 models.
6. All pumps are shown with isolation flanges or full port ball valves for isolation. The alternative is standard flanges with full port ball valves and a separate flow check valve.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators and check valves.
8. Install a vacuum relief valve in accordance with local code requirements.
9. Multiple boilers and storage tanks shall be installed with reverse return piping (as shown).
10. **Mixing valves are recommended on all tanks if hot water temperature is above 119°F.**
11. Expansion tank must be rated for use with potable water.
12. Use either indirect/tank sensor or system/pipe sensor mounted on common return to the boiler.
13. Wire the tank or system/pipe sensor connected to the DHW sensor terminals on the follower boiler addressed as #1.
14. The system/pipe sensor must be placed on common piping to the tank, as close to the tank as possible.
15. The system/pipe sensor is wired to the system sensor terminals on the master boiler.

Volume Water Heating using MOD CON boilers (2 boilers supplying 2 storage tanks)

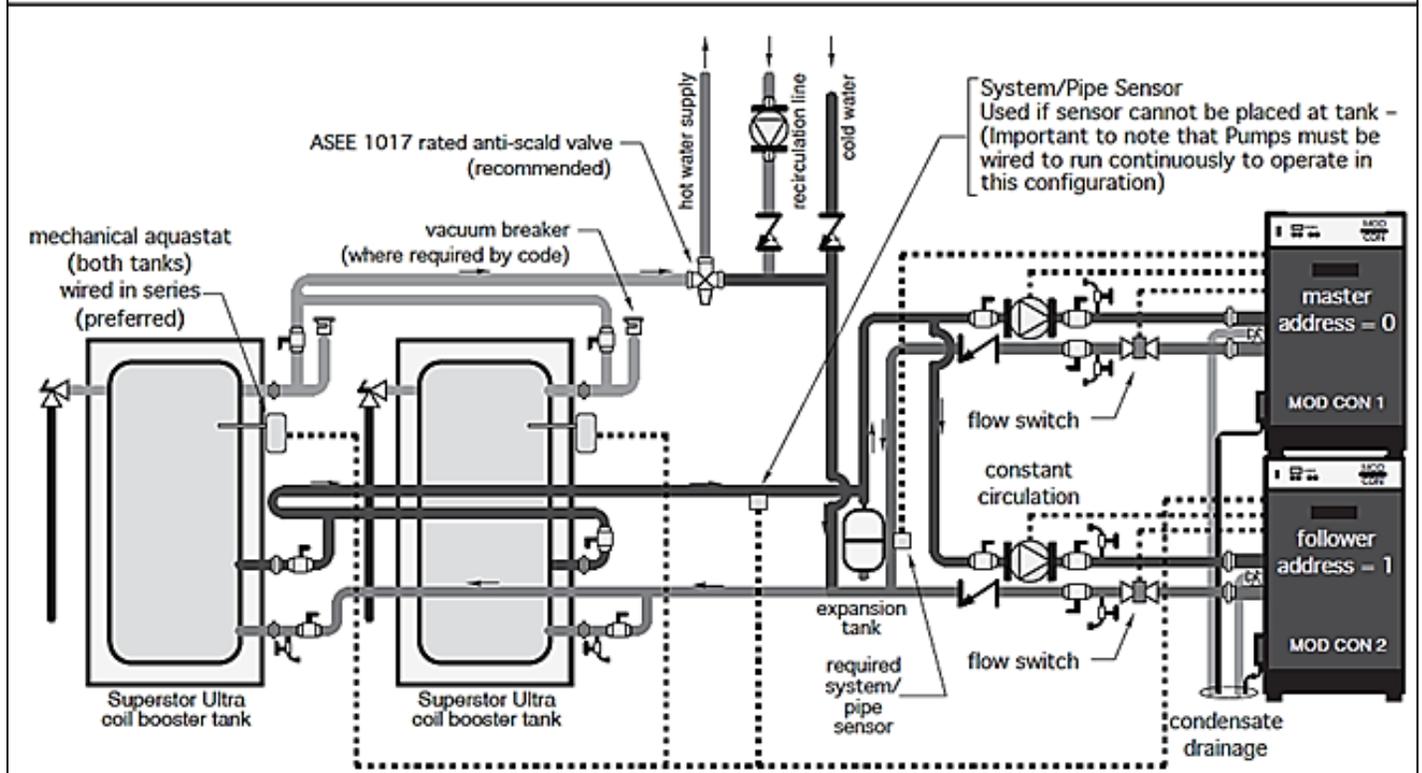


Figure 11

NOTES:

1. This drawing is meant to demonstrate system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. Boiler circulator(s) must be rated for open loop applications. Do not use cast-iron circulators.
3. Boiler circulator(s) operate continuously.
4. The minimum pipe size for connecting to a water storage tank is 1 1/2".
5. The minimum pipe size for connecting the boiler is 1 1/2" for the Mod Con 300 VWH and 2" for the 500 and 850 models.
6. All pumps are shown with isolation flanges or full port ball valves for isolation. The alternative is standard flanges with full port ball valves and a separate flow check valve.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators and check valves.
8. Install a vacuum relief valve in accordance with local code requirements.
9. Multiple boilers and storage tanks shall be installed with reverse return piping (as shown).
10. **Mixing valves are recommended on all tanks if hot water temperature is above 119°F.**
11. Expansion tank must be rated for use with potable water.
12. Use either indirect/tank sensor or system/pipe sensor mounted on common return to the boiler.
13. Wire the tank or system/pipe sensor connected to the DHW sensor terminals on the follower boiler addressed as #1.
14. The system/pipe sensor must be placed on common piping to the tank, as close to the tank as possible.
15. The system/pipe sensor is wired to the system sensor terminals on the master boiler.

Volume Water Heating using MOD CON boiler (3 boilers supplying 2 storage tanks)

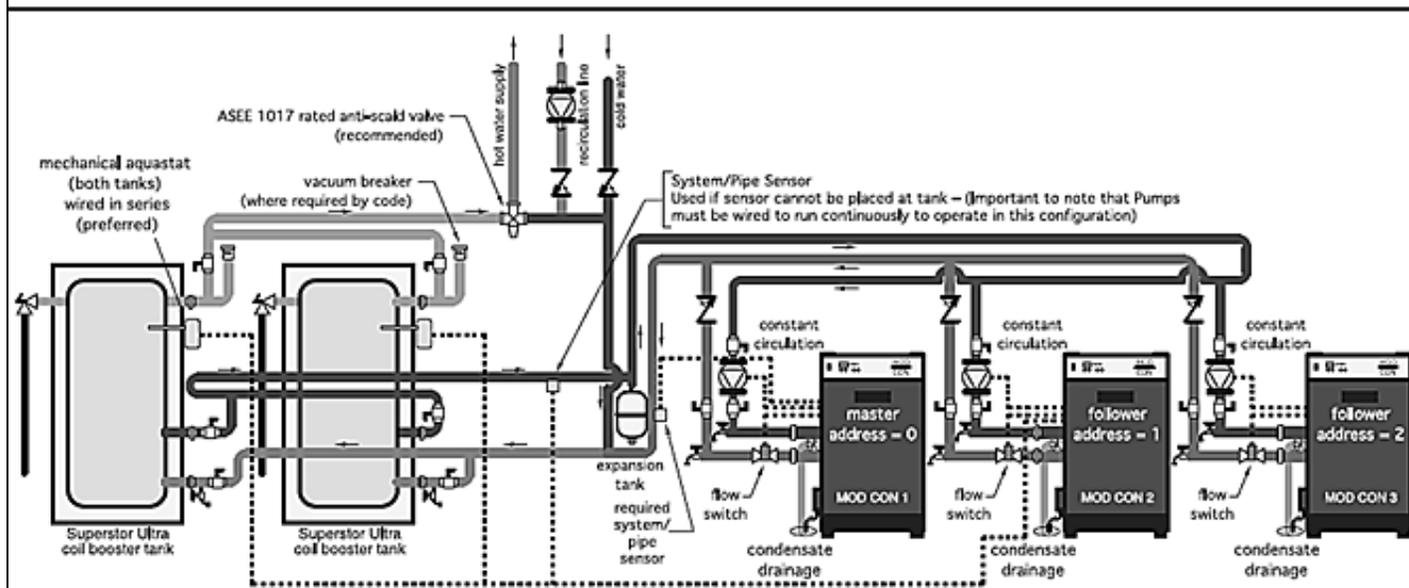


Figure 12

NOTES:

1. This drawing is meant to demonstrate system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. Boiler circulator(s) must be rated for open loop applications. Do not use cast-iron circulators.
3. Boiler circulator(s) operate continuously.
4. The minimum pipe size for connecting to a water storage tank is 1 ½".
5. The minimum pipe size for connecting the boiler is 1 ½" for the Mod Con 300 VWH and 2" for the 500 and 850 models.
6. All pumps are shown with isolation flanges or full port ball valves for isolation. The alternative is standard flanges with full port ball valves and a separate flow check valve.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators and check valves.
8. Install a vacuum relief valve in accordance with local code requirements.
9. Multiple boilers and storage tanks shall be installed with reverse return piping (as shown).
10. **Mixing valves are recommended on all tanks if hot water temperature is above 119°F.**
11. Expansion tank must be rated for use with potable water.
12. Use either indirect/tank sensor or system/pipe sensor mounted on common return to the boiler.
13. Wire the tank or system/pipe sensor connected to the DHW sensor terminals on the follower boiler addressed as #1.
14. The system/pipe sensor must be placed on common piping to the tank, as close to the tank as possible.
15. The system/pipe sensor is wired to the system sensor terminals on the master boiler.

PART 5 – VENTING, COMBUSTION AIR AND CONDENSATE REMOVAL

⚠ DANGER

The boiler must be vented as detailed in this Venting Section. Ensure exhaust and intake piping complies with these instructions regarding vent system. Inspect finished combustion air intake and exhaust piping thoroughly to ensure all joints are well secured, airtight, and comply with all applicable code requirements, as well as with the instructions provided in this manual. Failure to properly install the vent system will result in property damage, severe personal injury, or death.

A. GENERAL

⚠ DANGER

This boiler is certified as a "Category IV" appliance, and requires a special venting system. The vent system will operate with a positive pressure in the pipe. Exhaust gases must be piped directly outdoors using the vent materials and rules outlined in these instructions. Do not connect vent connectors serving appliances vented by natural draft into any portion of mechanical draft systems operating under positive pressure. Follow the venting instructions below carefully. Failure to do so will result in substantial property damage, severe personal injury, or death.

1. Installation should be made in accordance with the regulations of the Authority Having Jurisdiction, local code authorities, and utility companies which pertain to this type of water heating equipment.

2. Install the venting system in accordance with these instructions and with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, CAN/CGA B149, and/or applicable provisions of local building codes.

3. This boiler must be vented with materials, components, and systems listed and approved for Category IV boilers.

⚠ WARNING

Breathing Hazard - Carbon Monoxide Gas



- Do not operate heater if flood damaged.
- Install vent system in accordance with local codes and manufacturers installation instructions.
- Do not obstruct heater air intake or exhaust. Support all vent piping per manufacturers installation instructions.
- Do not place chemical vapor emitting products near unit.
- According to NFPA 720, carbon monoxide detectors should be installed outside each sleeping area.
- Never operate the heater unless it is vented to the outdoors.
- Analyze the entire vent system to make sure that condensate will not become trapped in a section of vent pipe and therefore reduce the open cross sectional area of the vent.

Breathing carbon monoxide can cause brain damage or death. Always read and understand instruction manual.

LP-304 4/28/09

⚠ DANGER

Exhaust and intake air pipes are to be piped separately. This boiler cannot share a common exhaust or intake with multiple appliances. Failure to follow this instruction will result in substantial property damage, severe personal injury, or death.

NOTE: To avoid contamination often contained in indoor air, it is best to pipe all intake combustion air directly to the outdoors.

⚠ DANGER

Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

⚠ WARNING

Improper seating of vent pipe gaskets can cause eventual gasket failure and exhaust gas leakage. Ensure the exhaust vent pipe is properly beveled and seated before insertion into the flue adapter. Failure to do so could result in property damage, severe personal injury, or death.

⚠ DANGER

Due to the extreme flammability of most glues, cements, solvents, and primers used to join plastic exhaust and intake air pipes, explosive solvent vapors must be cleared from all vent piping before start-up. Avoid using excess cement or primer, as this may pool in the vent pipes. Vent assemblies should be allowed to cure for a period of at least 8 hours before powering a connected appliance. Failure to follow these instructions will result in substantial property damage, severe personal injury, or death. It is the installers' responsibility to understand the hazards associated with explosive solvents and take the necessary precautions to avoid these risks.

B. APPROVED MATERIALS FOR EXHAUST AND INTAKE AIR VENTS

APPROVED EXHAUST VENTING AND AIR INLET MATERIAL			
Item	Material	Standards for Installation in:	
		United States	Canada
Exhaust vent or air inlet pipe and fittings	PVC schedule 40/80	ANSI/ASTM D1785	PP, CPVC, and PVC venting must be ULC-S636 Certified. IPEX is an approved manufacturer in Canada, supplying vent material listed to ULC-S636.
	PVC-DWV*	ANSI/ASTM D2665*	
	CPVC schedule 40/80	ANSI/ASTM F441	
	Polypropylene	ULCS636	
	Stainless Steel AL29-4C	Certified for Category IV and direct vent appliance venting	Certified for Category IV and direct vent appliance venting
Pipe cement/primer	PVC	ANSI/ASTM D2564	IPEX System 636 Cements & Primers
	CPVC	ANSI/ASTM F493	

Table 9

DANGER

- The air inlet and exhaust components installed with this boiler must be used for near boiler piping BEFORE transitioning to the approved materials listed above. DO NOT REMOVE these installed components. Doing so WILL VOID boiler warranty.
- PVC/CPVC pipe and fittings of the same diameter are considered interchangeable.
- Do NOT use Foam Core Pipe in any portion of the exhaust piping from this boiler.
- DO NOT connect PVC/CPVC to PP without an approved vent connector.
- When installing AL29-4C vent piping, install a PVC-to-stainless adapter at the boiler vent connection, and at the termination when using an HTP PVC termination kit. DO NOT mix AL-29-4C piping from different manufacturers unless using adapters specifically designed for the purpose by the manufacturer.
- *PVC-DWV for air intake applications ONLY.

Failure to follow these directions will result in substantial property damage, severe personal injury, or death.

WARNING

DO NOT mix components from different venting systems without proper adapters. The vent system could fail, causing leakage of flue products into the living space. Use only the approved pipe and fitting materials, primer and cement, and adapters specifically designed for the material used, as listed in Table 9. Failure to do so could result in property damage, severe personal injury, or death.

WARNING

Exhaust vent adaptors are not designed as load-bearing devices, and must not be used to support exhaust vent piping. All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of ¼" per foot back to the boiler to allow drainage of condensate. Failure to properly support vent piping and follow the information in this statement could result in product damage, severe personal injury, or death.

WARNING

For closet and alcove installations: CPVC, polypropylene, or stainless steel venting material MUST BE USED. Failure to follow this statement could result in product damage, severe personal injury, or death.

NOTE: The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

C. REQUIREMENTS FOR INSTALLATION IN CANADA

1. Installations must be made with a vent pipe system certified to ULC-S636. IPEX is an approved vent manufacturer in Canada supplying vent material listed to ULC-S636. Additionally you may use AL29-4C stainless steel venting to comply with Canadian requirements.

2. The first three (3) feet of vent pipe from the boiler flue outlet must be readily accessible for visual inspection.

3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe / fittings.

Cellular foam core piping may be used on air inlet piping **only**.

DANGER

Use only venting materials approved for use with Category IV appliances installed in accordance with the National Fuel Code. The following materials are approved for use as vent pipe for this boiler. Failure to use approved materials could result in substantial property damage, severe personal injury, or death.

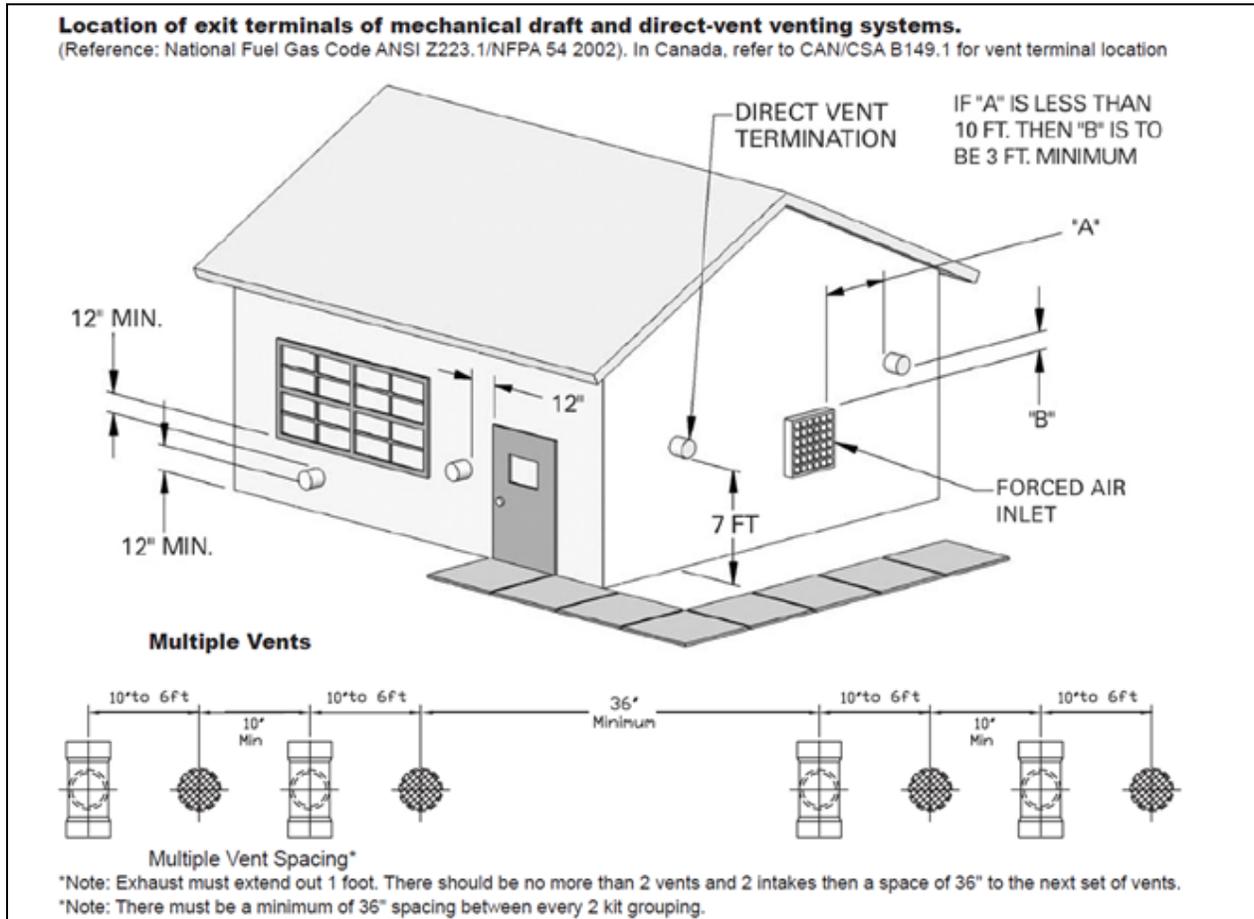


Figure 13

D. EXHAUST VENT AND INTAKE AIR VENT PIPE LOCATION

⚠ WARNING

You must insert the provided intake and exhaust screen at your vent termination to prevent blockage caused by debris or birds.

NOTE: SEE ADDITIONAL REQUIREMENTS FOR MASSACHUSETTS IN THE BACK OF THIS MANUAL.

1. Determine exhaust vent location:

- Total length of vent may not exceed the limits specified in the Venting Section, Part 6.
- The vent piping for this boiler is approved for zero clearance to combustible construction.
- See Venting Details within this section of clearances for location of exit terminals of direct-vent venting systems.
- Avoid terminating exhaust vents near shrubs, air conditioners or other objects that will obstruct the exhaust stream.
- The flue products coming from the exhaust vent will create a large plume when the boiler is in operation. Avoid venting in areas that will affect neighboring buildings or be considered objectionable.
- The boiler vent system shall terminate at least 3 feet (0.9 m) above any forced air intake located within 10 ft (3 m). **NOTE:** This does not apply to the combustion air intake of a direct-vent appliance.
- Provide a minimum of 1 foot distance from any door, operable window, or gravity intake into any building.
- Provide a minimum of 1 foot clearance from the bottom of the exhaust above the expected snow accumulation level. Snow removal may be necessary to maintain clearance.
- Provide 4 feet horizontal clearance from electrical meters, gas meters, gas regulators, relief equipment, exhaust fans and inlets. In no case shall the exit terminal be above or below the aforementioned equipment unless the 4 foot horizontal distance is maintained.
- Do not locate the boiler exhaust over public walkways where condensate could drip and/or freeze and create a nuisance or hazard.
- When adjacent to a public walkway, locate exit terminals at least 7 feet above grade.
- To prevent icicles from forming, do not locate the exhaust directly under roof overhangs.
- Provide 6 feet of clearance from the inside corner of vertical walls, chimneys, etc., as well as horizontal corners created by roof overhangs.

NOTE: In Canada, follow CAN/CGA B149.1-M95 where natural gas fired appliances are used, and CAN/CGA B149.2-M95 where propane fired appliances are used.

2. Determine air intake vent location:

- Provide 1 foot of clearance from the bottom of the intake vent and the level of maximum snow accumulation. Snow removal may be necessary to maintain clearances.
- Do not locate the intake air vent in a parking area where machinery may damage the vent.
- Follow required minimum clearances located in Figure 13.

NOTE: Due to potential moisture build-up, sidewall venting may not be the preferred venting option. To save time and cost, carefully consider venting installation and location.

⚠ WARNING

The building owner is responsible for keeping the exhaust and air intake terminations free of snow, ice, or other potential blockages, as well as scheduling routine maintenance. Failure to keep the vent piping terminations clear and properly maintain the boiler could result in property damage, severe personal injury, or death.

⚠ WARNING

For each floor containing bedroom(s), a carbon monoxide detector and alarm shall be placed in the living area outside the bedrooms, as well as in the room that houses the boiler. Detectors and alarms shall comply with NFPA 720 (latest edition). Failure to comply with requirements for detectors and alarms could result in property damage, severe personal injury, or death.

3. Determine location of condensate piping:

This boiler is a high efficiency appliance, and therefore produces condensate: a by-product of the combustion process. A condensate collection system with an internal float switch monitors the condensate level to prevent it from backing up into the combustion system. There is a 3/4" sweat connection provided to connect the outlet of the collection system to a drain or condensate pump (See Table 10 for approved condensate piping material).

APPROVED PLASTIC CONDENSATE PIPING MATERIAL		
MATERIAL	STANDARDS FOR INSTALLATION IN:	
	UNITED STATES	CANADA
PVC SCHEDULE 40 / 80	ANSI/ASTM D1785	ULC S636

Table 10 – Approved Plastic Condensate Piping Material

NOTE: Check with your local gas company to determine if combustion condensate disposal is permitted in your area. In the state of Massachusetts, condensate must be neutralized before entering a drain.

4. Condensate neutralization

Condensate from the boiler is slightly acidic with a pH of 3.2 - 4.5. To avoid long term damage to the drainage system and to meet local code requirements, HTP recommends neutralizing the condensate with a Condensate Neutralizer Kit (Part # 7350P-611). The neutralizer kit connects to the drain system and contains marble chips that neutralize the pH level of the water vapor. The neutralizer kit should be checked annually and the marble chips replenished if necessary. When replacing the marble chips, take care to ensure chips are no smaller than 1/2" to avoid blockage in condensate piping (refer to Figure 14 for piping of the condensate neutralizer.)

CAUTION

It is very important that the condensate piping be no smaller than 3/4". You must use a tee at the condensate connection with a branch vertically up and open to the atmosphere, so as not to cause a vacuum that could obstruct the flow of condensate from the boiler. To prevent sagging and maintain pitch, condensate piping should be supported with pipe supports.

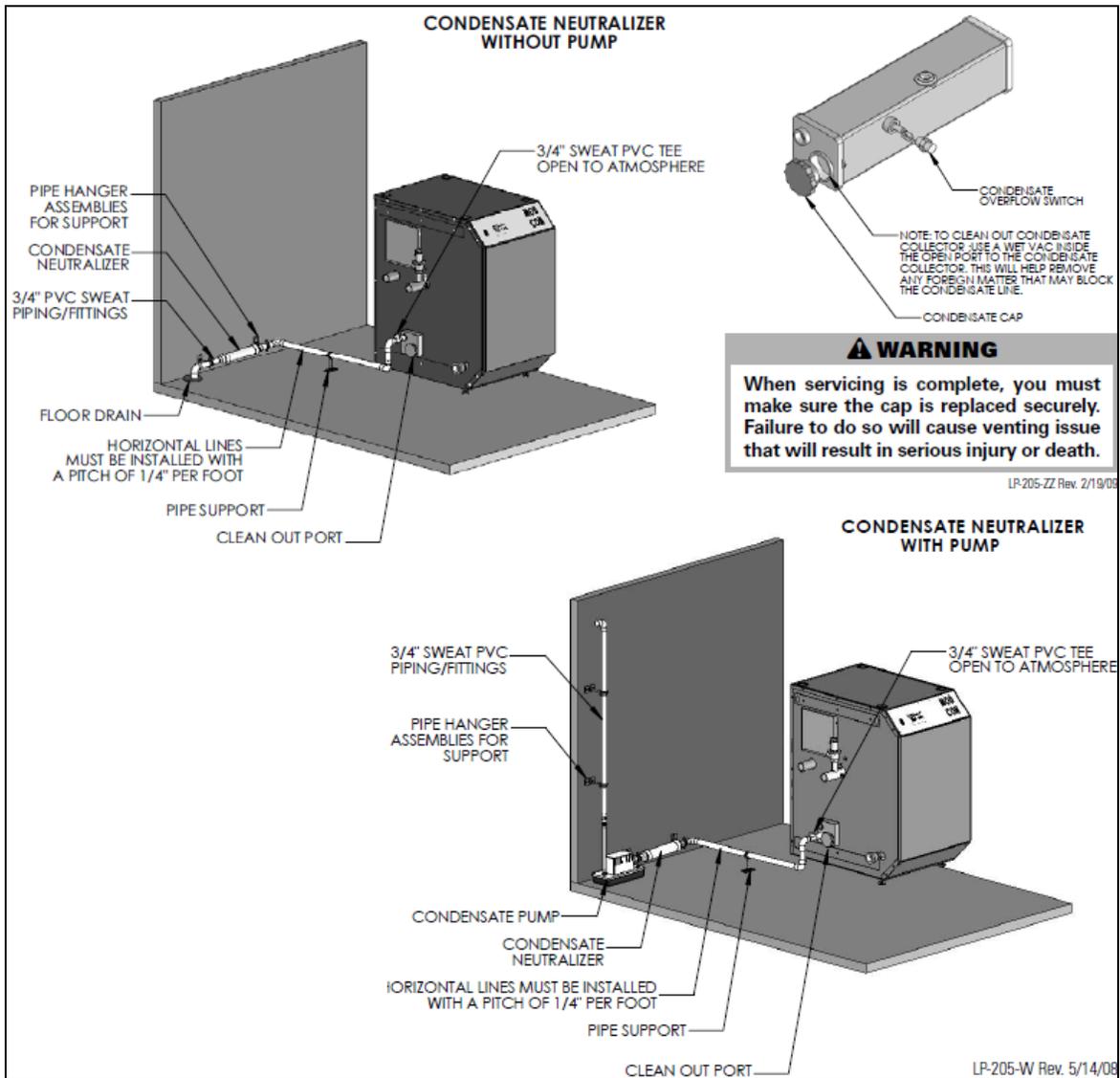


Figure 14 – Condensate Piping NOTE: Blow water into the condensate collector to remove any foreign matter that may block the line.

NOTES:

1. Condensate line must be pitched at least 1/4" per foot to properly drain. If this cannot be done, or a very long length of condensate hose is used, you must increase the condensate line to a minimum of 1" ID and place a tee in the line after the condensate neutralizer to properly reduce vacuum lock in the drain line.
2. Plastic pipe should be the only material used for the condensate line. Steel, brass, copper, or other materials will be subject to corrosion or deterioration.
3. NEVER install condensate lines outside. It is very important that the condensate line is not exposed to freezing temperatures or any type of blockage. Damages due to frozen or blocked condensate lines ARE NOT covered by warranty.
4. Support of the condensate line may be necessary to avoid blockage of the condensate flow.

CAUTION

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate freezes in the line, or if line is obstructed in any other manner, condensate can exit from boiler tee, resulting in potential water damage to property.

CAUTION

When installing a condensate pump, select one approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage.

E. EXHAUST VENT AND INTAKE AIR VENT SIZING

1. The exhaust vent and intake air vent pipes are 4" for the Mod Con 300 and 500 and 6" for the Mod Con 850.

2. The total combined equivalent length of exhaust vent and intake air pipe should not exceed 200 feet.
 a. The equivalent length of friction loss in elbows, tees, and other fittings are listed in Table 11.

FRICTION LOSS EQUIVALENT FOR STAINLESS OR PLASTIC PIPING AND FITTINGS			
FITTING DESCRIPTION	4"	6"	8"
90° elbow short radius	3'	3'	3'
90° elbow long radius	2'	2'	2'
45° elbow	1'	1'	1'
Coupling	0'	0'	0'
Tee (intake only)	0'	0'	0'
V Series Vent Kit	1'	1'	1'
AL20 4C Vent Terminal	1'	1'	1'
Pipe (All Materials)	1'	1'	1'

Table 11 – Friction Loss in Equivalent Feet - *Friction loss for long radius elbow is 1' less.

b. For example: If the exhaust vent has two short 90° elbows and 10 feet of PVC pipe we will calculate: Exhaust Vent Pipe Equivalent Length = (2x3) + 10 = 16 feet.

Further, if the intake air vent pipe has two short 90° elbows, one 45° elbow, and 10 feet of PVC pipe, the following calculation applies: Intake Air Equivalent Length = (2x3) + 1 + 10 = 17 feet.

Therefore, total combined equivalent length equals 33 feet.

c. The intake air vent pipe and the exhaust vent are intended to penetrate the same wall or roof of the building.

d. The minimum combined equivalent length is 32 combined equivalent feet – 16 ft intake and 16 ft. exhaust.

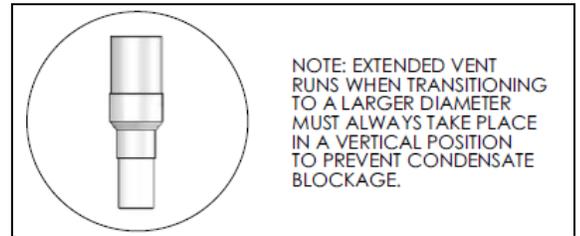


Figure 15

F. LONGER VENT RUNS

The maximum combined equivalent length can be extended by equally increasing the diameter of both the exhaust and intake air vent pipes. However, the transitions should begin a minimum of 32 combined equivalent feet from the boiler equally on both the intake and exhaust.

The maximum equivalent length for increased diameter vent pipes is 275 feet, which includes the combined 32 feet from the boiler, 16 ft. (inlet) + 16 ft. (exhaust) = 32 ft. combined with transition total of 245 ft. upsize piping for longer vent runs.

VENT TRANSITION FITTING		
SIZE	REDUCING COUPLING	FINAL VENT SIZE
4" Venting	6" x 4"	6"
6" Venting	8" x 6"	8"

Table 12 – Vent Transition Fitting

G. EXHAUST VENT AND INTAKE AIR PIPE INSTALLATION

⚠ WARNING

All joints of positive pressure vent systems must be sealed completely to prevent leakage of flue products into living space.

1. Use only solid PVC or CPVC pipe, or a Polypropylene vent system, approved for use with Category IV boilers.
 FOAM CORE PIPING IS NOT APPROVED FOR EXHAUST APPLICATIONS. Foam core piping may be used on air inlet piping **only**.
2. Remove all burrs and debris from joints and fittings.
3. When using PVC or CPVC pipe, all joints must be properly cleaned, primed, and cemented. Use only cement and primer approved for use with the pipe material. Cement must conform to ASTM D2564 for PVC and ASTM F493 for CPVC pipe. **NOTE: DO NOT CEMENT POLYPROPYLENE PIPE.**
4. Ensure the vent is located where it will not be exposed to prevailing winds.
5. In all roof venting applications, exhaust discharge must point away from the pitch of the roof.

6. To prevent water leakage, install adequate roof flashing where the pipe enters the roof.
7. Do not locate vent over public walkways, driveways, or parking lots. Condensate could drip and freeze, resulting in a slip hazard or damage to vehicles and machinery.
8. Due to potential moisture build-up, sidewall venting may not be the preferred venting option. To save time and cost, carefully consider venting installation and location.
9. Horizontal lengths of exhaust vent must slope back towards the appliance not less than ¼" per foot to allow condensate to drain from the vent pipe.
10. The exhaust vent must terminate where vapors cannot make accidental contact with people or pets, or damage shrubs or plants.
11. In vacant chimney applications, install and seal a rain cap over existing chimney openings.
12. All piping must be fully supported. Use pipe hangers at a minimum of 4 foot intervals to prevent sagging of the pipe where condensate may form.
13. Do not use the appliance to support any piping.
14. A screened straight coupling is provided with the appliance for use as an outside exhaust termination.
15. A screened inlet air tee is provided with the appliance to be used as an outside intake termination.

H. BOILER REMOVAL FROM A COMMON VENT SYSTEM

When removing an existing boiler, the following steps must be followed.

1. Seal any unused openings in the common 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.
3. If practical, close all building doors, windows and all doors between 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 in operation the appliance being inspected. 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 conforms to 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.

NOTE: For Canadian Installations, it is required that Non Metallic Vent Installations conform to ULC S636. Where plastic venting is not allowed, HTP recommends AL294C Stainless Steel Venting be used for Exhaust venting installations and "B" vent for intake air.

I. SIDEWALL VENTING DIAGRAMS

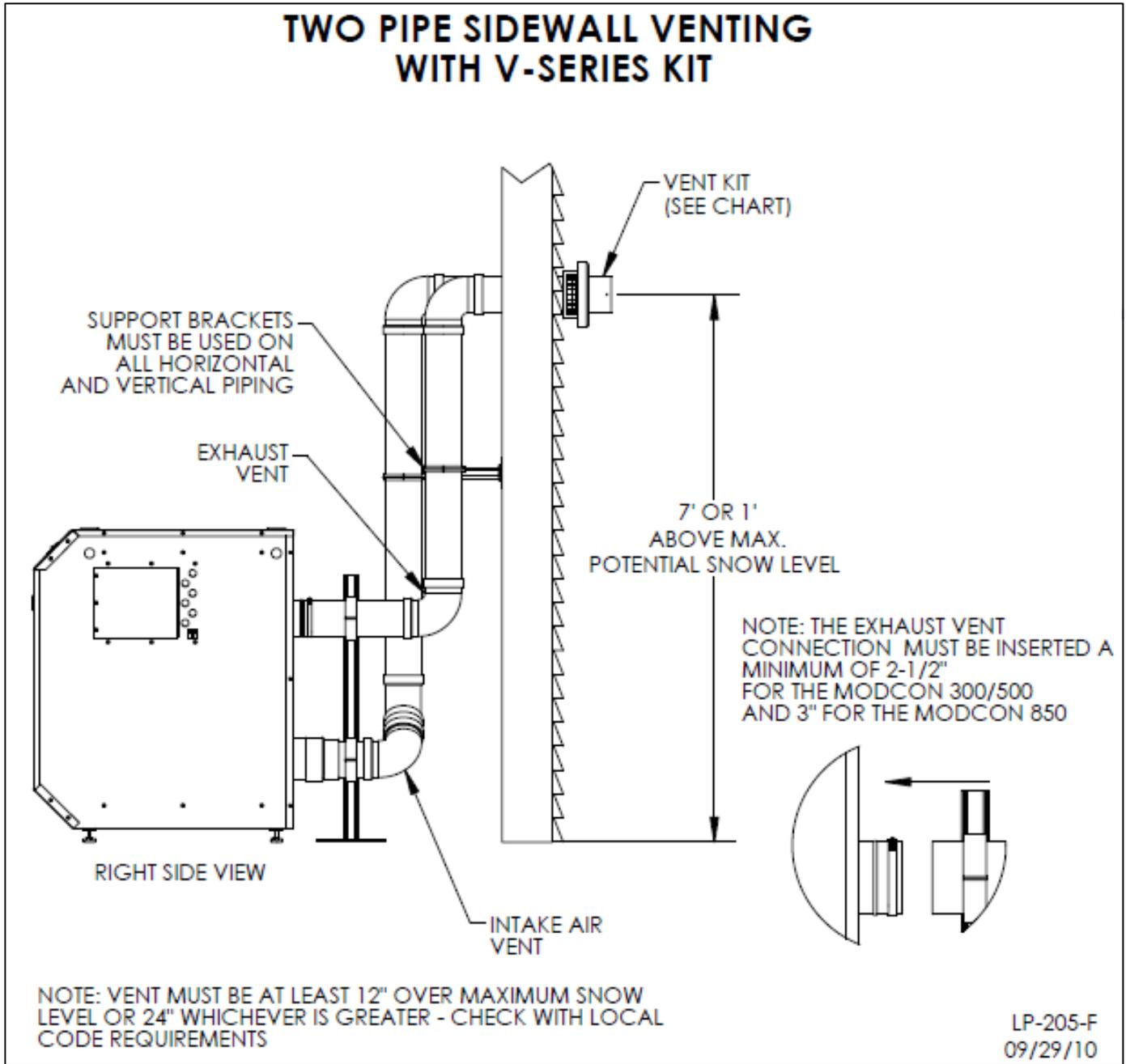


Figure 16 – Sidewall Venting Diagrams

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of 1/4" per foot back to the boiler to allow drainage of condensate. Exhaust connection insertion depth should be a minimum of 2 1/2" for models 300/500 and 3" for 850. When placing support brackets on vent piping, the first bracket must be within 1' of the appliance and the balance at 4' intervals on the vent pipe. Boiler venting must be readily accessible for visual inspection for the first three feet from the boiler.

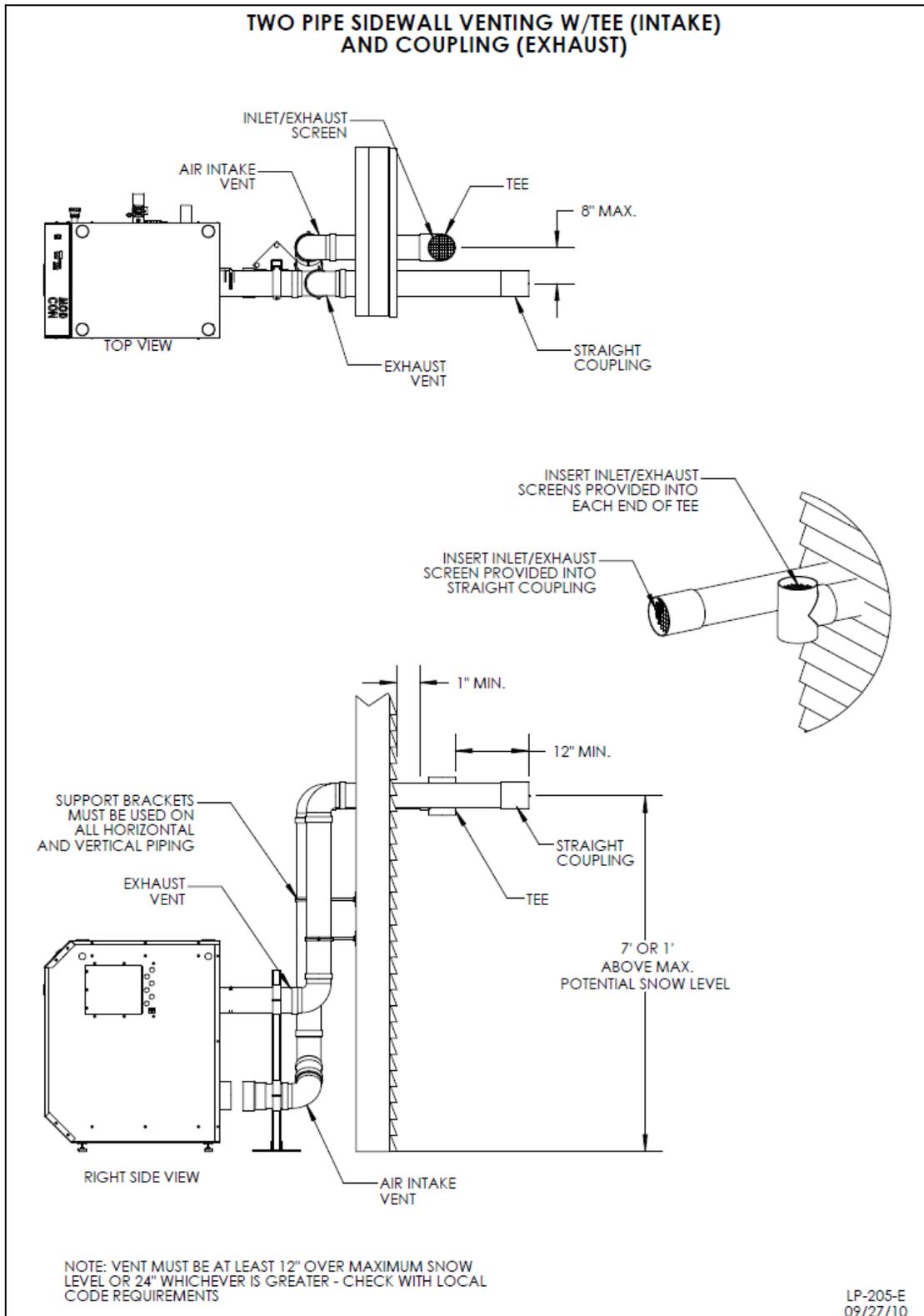


Figure 17 – Sidewall Venting with Tee and Coupling

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of $\frac{1}{4}$ " per foot back to the boiler to allow drainage of condensate. Exhaust connection insertion depth should be a minimum of 2 $\frac{1}{2}$ " for models 300/500 and 3" for 850. When placing support brackets on vent piping, the first bracket must be within 1' of the appliance and the balance at 4' intervals on the vent pipe. Boiler venting must be readily accessible for visual inspection for the first three feet from the boiler.

J. VERTICAL VENTING DIAGRAMS

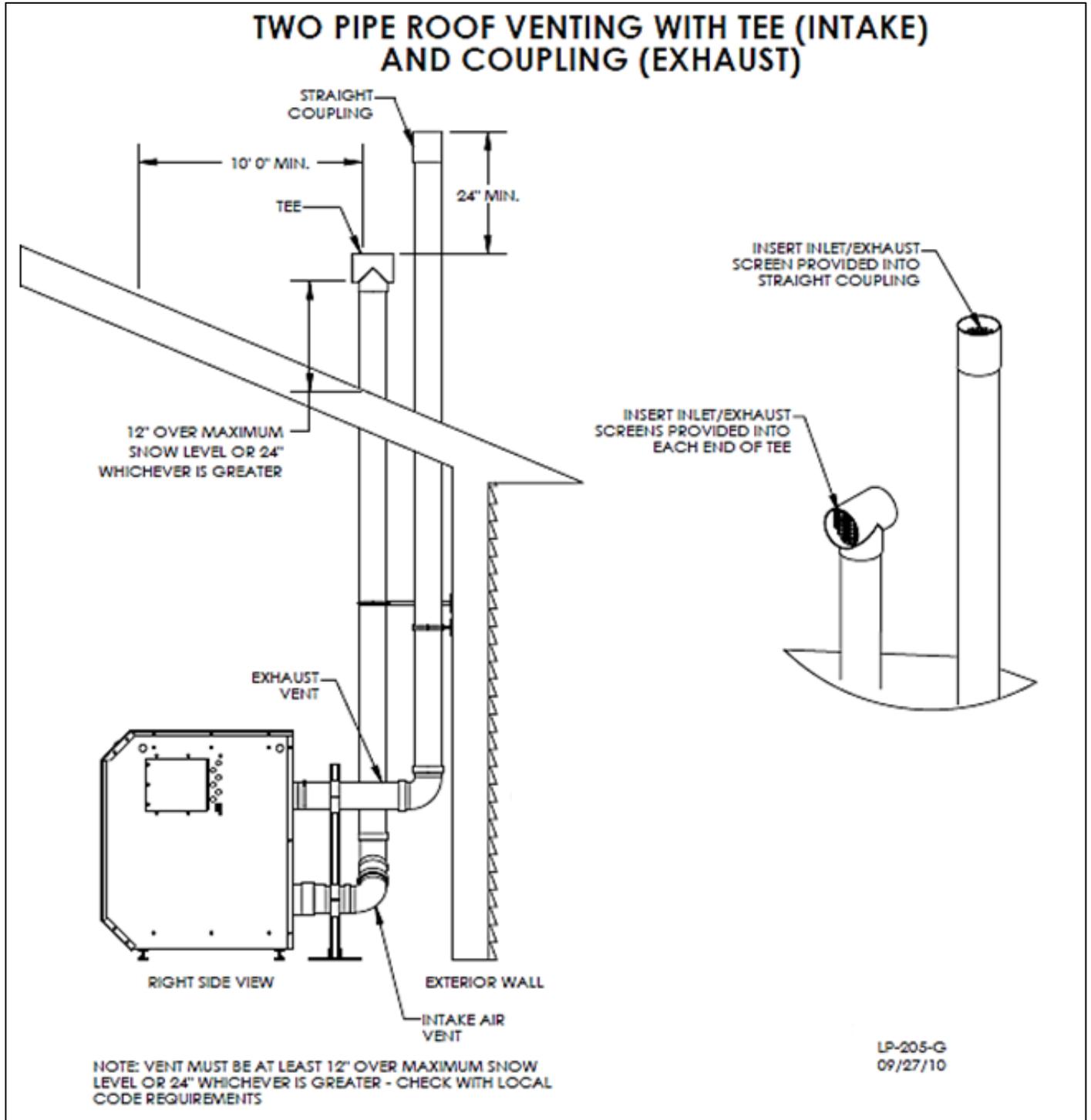


Figure 18 – Two Pipe Roof Venting with Tee and Coupling

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of $\frac{1}{4}$ " per foot back to the boiler to allow drainage of condensate. Exhaust connection insertion depth should be a minimum of $2\frac{1}{2}$ " for models 300/500 and 3" for 850. When placing support brackets on vent piping, the first bracket must be within 1' of the appliance and the balance at 4' intervals on the vent pipe. Boiler venting must be readily accessible for visual inspection for the first three feet from the boiler.

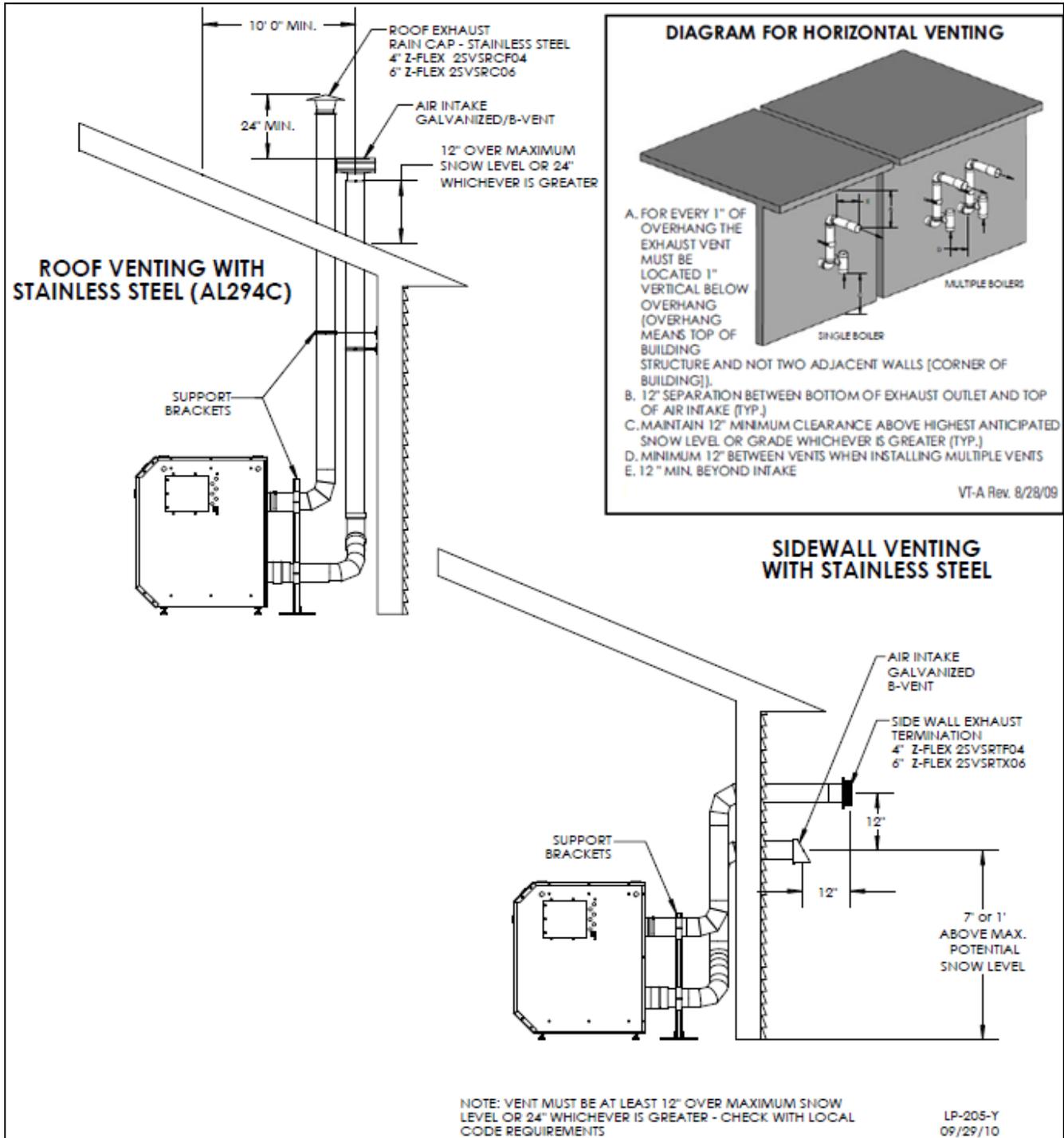


Figure 19 – Roof and Sidewall Venting with Stainless Steel

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of 1/4" per foot back to the boiler to allow drainage of condensate. Exhaust connection insertion depth should be a minimum of 2 1/2" for models 300/500 and 3" for 850. When placing support brackets on vent piping, the first bracket must be within 1' of the appliance and the balance at 4' intervals on the vent pipe. Boiler venting must be readily accessible for visual inspection for the first three feet from the boiler.

⚠ WARNING

Take extra precaution to adequately support the weight of vent pipes terminating through the roof. Failure to properly support roof terminated vent piping could result in property damage, serious personal injury, or death due to flue gas leakage.

PART 6 – GAS PIPING

⚠ DANGER

FAILURE TO FOLLOW ALL PRECAUTIONS IN THIS SECTION COULD RESULT IN FIRE, EXPLOSION, OR DEATH!

A. GAS CONNECTION

The gas supply shall have a maximum inlet pressure of less than 14" w.c. (3.5 kPa), and a minimum of 3.5" w.c. (.87 kPa). The entire piping system, gas meter and regulator must be sized properly to prevent pressure drop greater than 0.5" (.12 kPa) as stated in the National Fuel Gas Code. This information is listed on the rating label.

⚠ DANGER

It is very important that you are connected to the type of gas noted on the rating plate. "LP" for liquefied petroleum, propane gas, or "NAT" for natural or city gas. You must not do a gas conversion without an approved gas conversion kit. Prior to turning the gas on, all gas connections must be approved by the local gas supplier or utility, in addition to the governing authority.

A gas conversion kit comes with the boiler. Follow the included instructions carefully. Failure to follow gas conversion instructions could result in property damage, serious injury, or death.

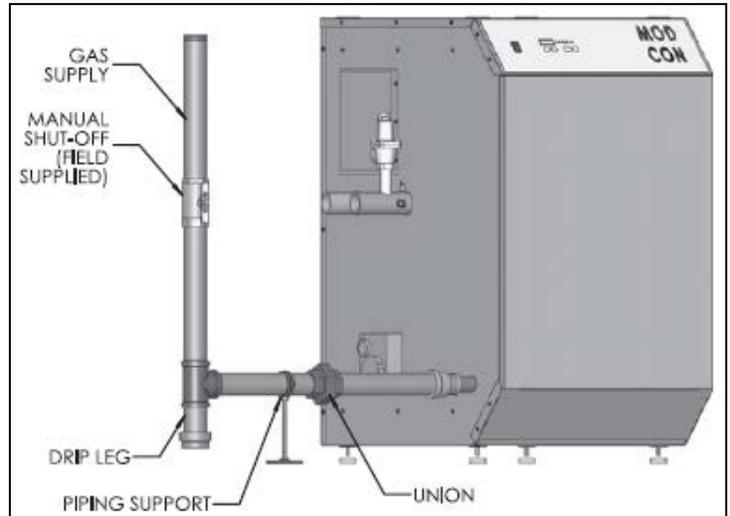


Figure 20 – Gas Connection

⚠ WARNING

Do not attempt to support the weight of gas piping with the boiler or its accessories. The gas valve and blower will not support the weight of the piping. Failure to follow this warning could result in substantial property damage, severe personal injury, or death.

The gas connection on the boiler is 1-1/4" for the Mod Con 300, 1-1/2" for the Mod Con 500, and 2" for the Mod Con 850. It is mandatory that this fitting is used for connection to a field fabricated drip leg as shown in the illustration above per the National Fuel Gas Code. You must ensure that the entire gas line to the connection at the boiler is no smaller than the unit supplied connection.

Once all inspections have been performed, the piping must be leak tested. If the leak test requirement is at a higher test pressure than the maximum inlet pressure, you must isolate the boiler from the gas line. To do this, shut the gas off using factory and field-installed gas cocks. Failure to do so may damage the gas valve. In the event the gas valve is exposed to a pressure greater than 1/2 PSI, 14" w.c. (3.5 kPa), the gas valve must be replaced. Never use an open flame (match, lighter, etc.) to check gas connections.

B. GAS PIPING

1. Run the gas supply line in accordance with all applicable codes.
2. Locate and install manual shutoff valves in accordance with state and local requirements.
3. In Canada, the Manual Shutoff must be identified by the installing contractor.
4. It is important to support gas piping as the unit is not designed to structurally support a large amount of weight.
5. Purge all gas lines thoroughly to avoid start up issues with air in the lines.
6. Sealing compound must be approved for gas connections. Care must be taken when applying compound to prevent blockage or obstruction of gas flow which may affect the operation of the unit.

⚠ WARNING

Failure to apply pipe sealing compound as detailed above could result in substantial property damage, severe personal injury, or death.

CAUTION

CSA / UL listed flexible gas connections can be used when installing the boiler. Flexible gas connections have different capacities and must be sized correctly for the connected boiler firing rates. Consult with the flex line supplier to assure the line size is adequate for the job. Follow local codes for proper installation and service requirements.

⚠ WARNING

Never use an open flame (match or lighter) to check for gas leaks. Use a soapy solution to test connection. Failure to use a soapy solution test or check gas connection for leaks could result in substantial property damage, severe personal injury, or death.

CAUTION

Use a two-wrench method when tightening gas piping near the boiler and its piping connection: One wrench to prevent the boiler gas line connection from turning; the second to tighten the adjacent piping. Failure to support the boiler gas piping connection could damage the boiler beyond repair. Such damage IS NOT covered by warranty.

C. GAS TABLE

Refer to Table 13 to size the supply piping to minimize pressure drop between the meter or regulator and unit.

Maximum capacity of pipe in cubic feet of gas per hour for gas pressures of .5 w.c. or less and a pressure drop of .3 inch w.c.

NATURAL GAS SUPPLY PIPING CAPACITY CHART								
(0.6 specific gravity gas; 0.5" WC pressure drop)								
*Schedule 40 iron pipe size in nominal inch size								
Boiler Model	1 Boiler	2 Boilers	3 Boilers	4 Boilers	5 Boilers	6 Boilers	7 Boilers	8 Boilers
Cubic Ft. Hr.	300	600	900	1200	1500	1800	2100	2400
ModCon 300 VWH @ 100' of pipe	1 1/4"	1 1/2"	2"	2 1/2"	2 1/2"	2 1/2"	3"	3"
ModCon 300 VWH @ 250' of pipe	1 1/2"	2"	2 1/2"	3"	3"	3"	4"	4"
Boiler Model	1 Boiler	2 Boilers	3 Boilers	4 Boilers	5 Boilers	6 Boilers	7 Boilers	8 Boilers
Cubic Ft. Hr.	500	1000	1500	2000	2500	3000	3500	4000
ModCon 500 VWH @ 100' of pipe	1 1/2"	2"	2 1/2"	3"	3"	3"	4"	4"
ModCon 500 VWH @ 250' of pipe	2"	2 1/2"	3"	3"	4"	4"	4"	4"
Boiler Model	1 Boiler	2 Boilers	3 Boilers	4 Boilers	5 Boilers	6 Boilers	7 Boilers	8 Boilers
Cubic Ft. Hr.	850	1700	2550	3400	4250	5100	5950	6800
ModCon 850 VWH @ 100' of pipe	2"	2 1/2"	3"	4"	4"	4"	4"	5"
ModCon 850 VWH @ 250' of pipe	2 1/2"	3"	4"	4"	5"	5"	5"	5"

Table 13 – Gas Supply Piping Size Chart for Mod Con Boilers

D. CHECK INLET GAS PRESSURE

The gas valve is equipped with an inlet gas pressure tap that can be used to measure the gas pressure to the unit. To check gas pressure, perform the steps listed below:

- IMPORTANT!** Before you connect to the inlet pressure, shut off the gas and electrical power to unit.
- Loosen the pressure tap with a small screwdriver. Refer to Figures 21 and 22 for locations.
- Each unit is equipped with a needle valve that will accept a 5/16 ID hose to connect to a digital manometer or liquid gauge to measure incoming pressure from 0-35" w.c.
- Turn on the gas and power up the unit.
- Put the unit into manual service mode (details on service mode are in the back of this manual). In service mode, monitor pressure to assure it does not drop below 1 inch from its idle reading. If gas pressure is out of range, or pressure drop is excessive, contact the gas utility, gas supplier, qualified installer, or service agency to determine the correct action needed to provide proper gas pressure to the unit. If gas pressure is within normal range, proceed to Step 6.
- Exit Service mode, then turn power off and shut off the gas supply at the manual gas valve before disconnecting the hose from the gas monitoring device. Tighten the screw on the pressure tap, turn gas on, and check for leaks with a soapy solution. If a leak is present, bubbles will appear on the pipe.

⚠ WARNING

Ensure the pressure tap screw is properly tightened to prevent gas leaks. Failure to do so could cause substantial property damage, severe personal injury, or death.

The gas piping must be sized for the proper flow and length of pipe to avoid pressure drop. The gas meter and regulator must be properly sized for the total gas load. If you experience a pressure drop greater than 1" w.c. (.87 kPa), the meter, regulator or gas line may be undersized or in need of service. You can attach a manometer to the incoming gas drip leg after removing the cap. The gas pressure must remain between 3.5" (.87 kPa) and 14" (3.5 kPa) 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 feet from the boiler. 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 empty tank situations. This situation 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.

⚠ WARNING

DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure and requires no field adjustment. Attempts by the installer to adjust or measure the gas valve outlet pressure could result in damage to the valve and cause substantial property damage, severe personal injury, or death.

E. GAS VALVE

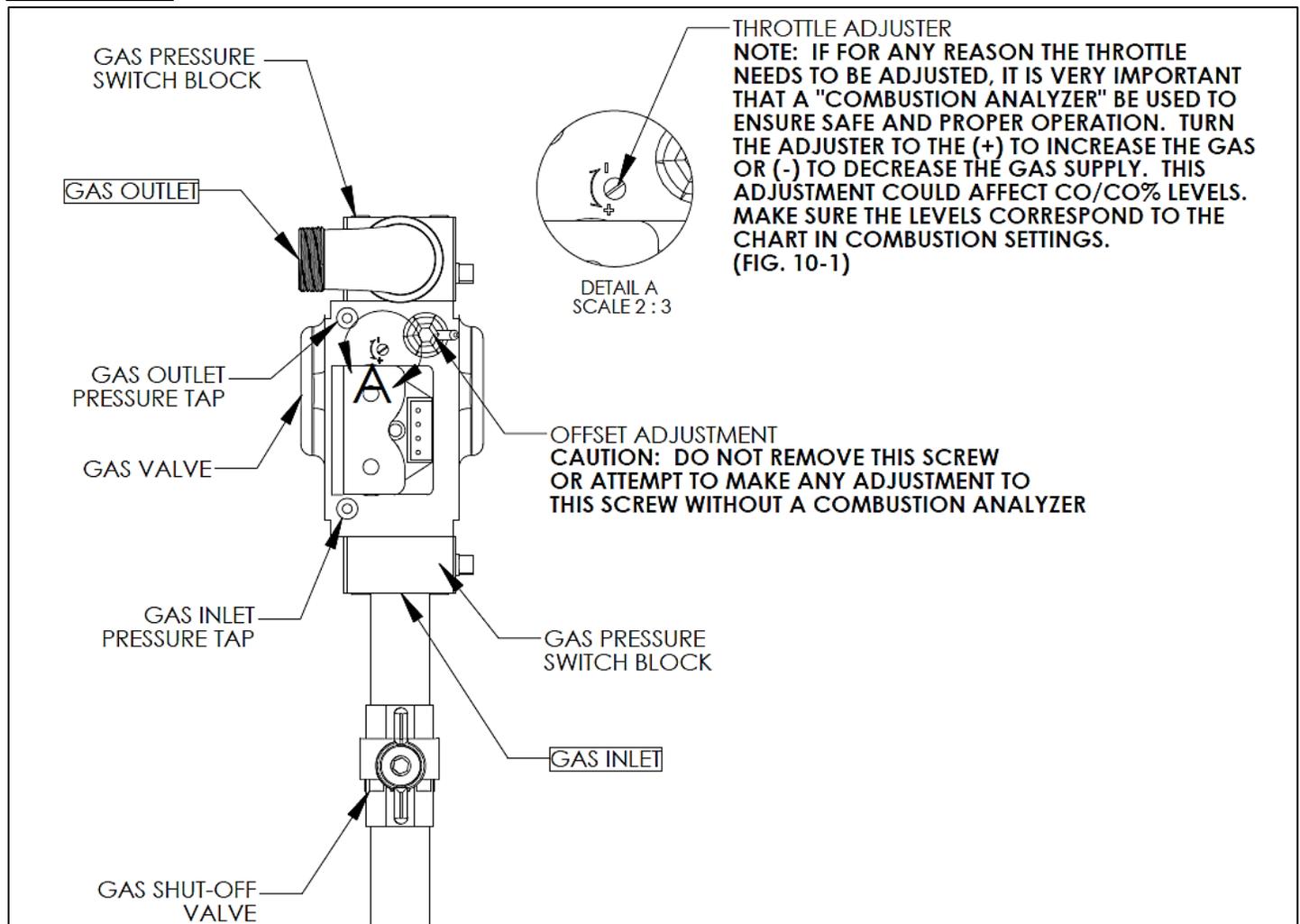


Figure 21 – Mod Con 300 / 500 Gas Valve

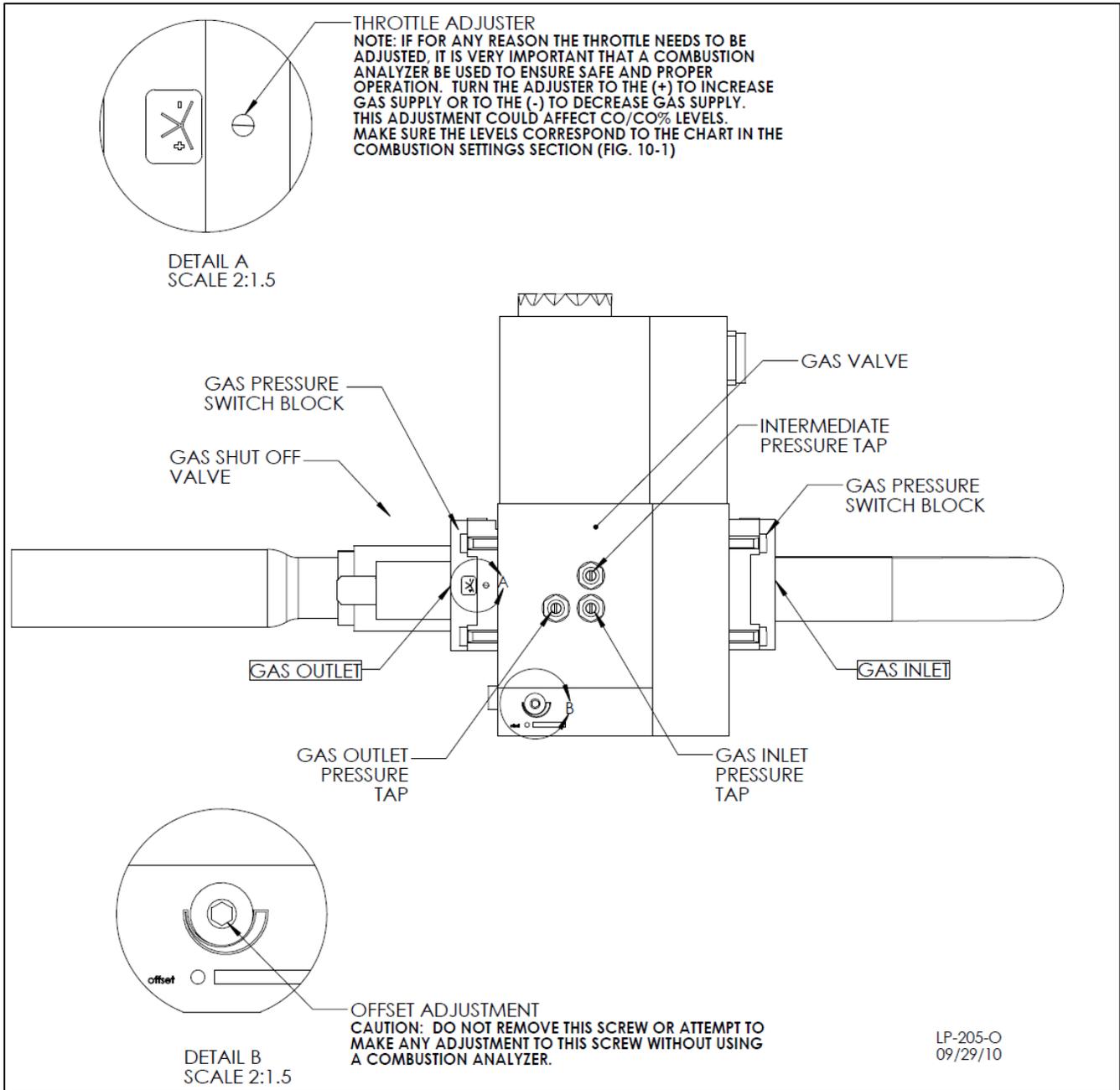


Figure 22 – Mod Con 850 Gas Valve

⚠ DANGER

Do not do a gas conversion on this boiler without an officially approved conversion kit and instructions supplied by HTP. Failure to use a conversion kit when converting the boiler to fire on Natural or LP gas will result in extremely dangerous burner operation, leading to fire, explosion, severe injury or death.

⚠ WARNING

Strain on the gas valve and fittings may result in vibration, premature component failure and gas leakage, and result in fire, explosion, property damage, severe personal injury, or death.

⚠ WARNING

Adjustments to the throttle screw or offset may only be made by a qualified gas technician using a calibrated combustion analyzer capable of measuring CO₂ and CO. Failure to follow this instruction could result in fire, explosion, property damage, severe personal injury, or death.

PART 7 – FIELD WIRING

⚠ WARNING

To avoid electrical shock, turn off all power to the appliance prior to opening an electrical box within the unit. Ensure the power remains off while any wiring connections are being made. Failure to follow these instructions could result in component or product failure, serious injury, or death. Such product failure IS NOT covered by warranty.

⚠ WARNING

ELECTRICAL SHOCK HAZARD - Turn off electrical power supply at service entrance panel before making any electrical connections. Failure to do so can result in severe personal injury or death.

CAUTION

Wiring must be N.E.C. Class 1. If original wiring supplied with the boiler must be replaced, use only UL Listed TEW 105° C wire or equivalent. Boiler must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – Latest Edition.

⚠ CAUTION

In order to ease future servicing and maintenance, it is advised to label all wires. Wiring errors can cause improper and dangerous operation. Failure to follow these instructions could result in property damage or personal injury.

A. INSTALLATION MUST COMPLY WITH:

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

B. FIELD WIRING TERMINATIONS

All connections made to the boiler in the field are done inside the electrical junction box located on the side of the unit. The electrical junction box is located on the right side of the Mod Con 300, and the left side of both the Mod Con 500 and 850. Multiple knockout locations are available to route field wires into and out of the electrical junction box.

C. FIELD WIRING CONSIDERATIONS

CAUTION

Check water chemistry section for acceptable levels. If water chemistry is acceptable, pumps may be wired directly to pump terminals. If water chemistry levels are too high, you must wire pumps to line voltage to run continuously to prevent lime buildup.

Pumps

The Mod Con VWH application requires a circulator pump for each boiler. Circulator pumps can be wired directly to the controller as shown in Figure 24 or wired directly to line voltage for continuous operation. Only wire the circulator pump to the controller if a tank sensor or mechanical control can be mounted to the storage tank, otherwise circulator pumps must be wired to run continuously.

The circulator pump wired to the boiler control will have a default program of a 5 minute post purge to provide stabilization and post cleaning of the heat exchanger. The boiler control is capable of supplying 120 volts at up to 3 amps to run the circulator pump. If using a larger circulator pump requiring more than 3 amps or higher voltage, an external motor starter, sized appropriately for the pump motor, must be used. This starter should have a 120 VAC coil. If a starter with a 120 VAC coil is used, it can be wired directly to the appropriate pump terminals as shown in Figure 24.

Tank and Sensor Connections

When the Mod Con VWH is used in a single boiler installation, it is recommended to use a sensor (7250P-325) placed in a well in the storage tank for best temperature control. If multiple tanks are used in the installation, it is recommended to put a mechanical aquastat in each tank and wire them in series to provide temperature control of the tanks. (See Piping Diagrams in Part 4, Section I for reference.) The control in the Mod Con VWH will read either the temperature of the tank sensor or the status of the aquastats, and cause the boiler to run until the water temperature of the tank(s) meets the desired set point.

If a sensor or aquastat cannot be placed directly in the tank, then one sensor should be used on the pipe carrying water from the tank(s) to the boiler. To minimize temperature loss in the piping, this sensor should be placed as close to the tank(s) as possible. The

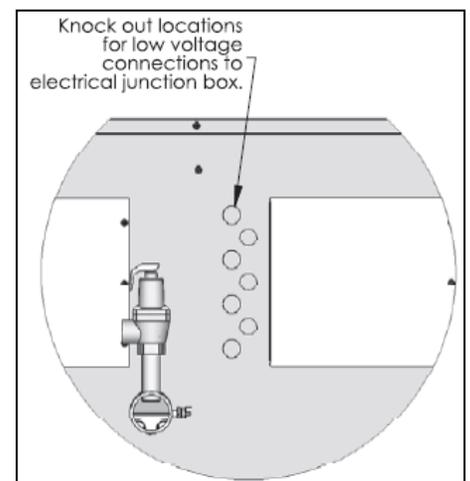


Figure 23

use of a pipe sensor will be somewhat less accurate than using a sensor in the tank, and has the disadvantage of requiring the boiler pump(s) to run continuously so the sensor is always measuring the tank water temperature.

In a multiple Mod Con VWH installation, where the boilers are connected for cascade operation, a system sensor is needed in addition to the tank or pipe sensor described above. The system sensor is mounted on the common pipe to the tank(s) from the boilers as close to the tank(s) as possible. The purpose of this sensor is to serve as feedback to the control and provide it with the aggregate temperature of all firing boilers. The master boiler control will then fire the boilers in cascade sequence to maintain the water temperature in this pipe and provide correct tank heating.

The electrical junction box has separate, clearly marked terminal strips for line voltage and low voltage wiring. Special jacks are provided for trouble-free cascade system wiring using standard CAT3 or CAT5 patch cables.

D. LINE VOLTAGE WIRING

NOTE: A termination plug is included in the CAT 3 / CAT 5 Bus Connection Point, labeled J3 in Figure 24. DO NOT REMOVE THIS PLUG! Doing so will affect boiler operation and void warranty.

Connect the incoming power wiring to the line voltage terminal strip in the electrical junction box at terminals LINE 120V, Neutral, and Ground (shown in Figure 24). A line voltage fused disconnect switch may be required to be externally mounted and connected according to local wiring codes.

If the pump used for the boiler operates at 120 volts and less than 3 amps is required, it may be connected directly to the terminals marked BOILER HOT, BOILER NEUT, and BOILER GRD. If the pump operates at a voltage other than 120 volts and/or requires more than 3 amps, an external motor starter must be used to operate the pump. If the starter is equipped with a 120 volt coil, the coil connections may be connected directly to the terminals marked BOILER HOT and BOILER NEUT. Refer to Figure 24 for a representative drawing of this configuration. If a motor starter is used, it should be selected, installed, and wired in compliance with all local electrical codes and requirements. In the absence of such codes or requirements, the National Electrical Code (NFPA 70) should be followed.

E. ALARM CONNECTIONS

The Mod Con control includes a dry contact alarm output. This is an SPDT circuit, rated at 5 amps at 120 volts. This contact can be used to activate an alarm light or bell, or notify a building management system if the boiler goes into a lockout condition. The circuit between the ALARM COM and NC terminals is closed during normal operation and the circuit between ALARM COM and NO is open during normal operation. The connections depicted in Figure 24 show two 120 volt lights connected to the alarm terminals. One light will be on when the boiler is in normal mode and the other light will turn on when the boiler is in lockout mode.

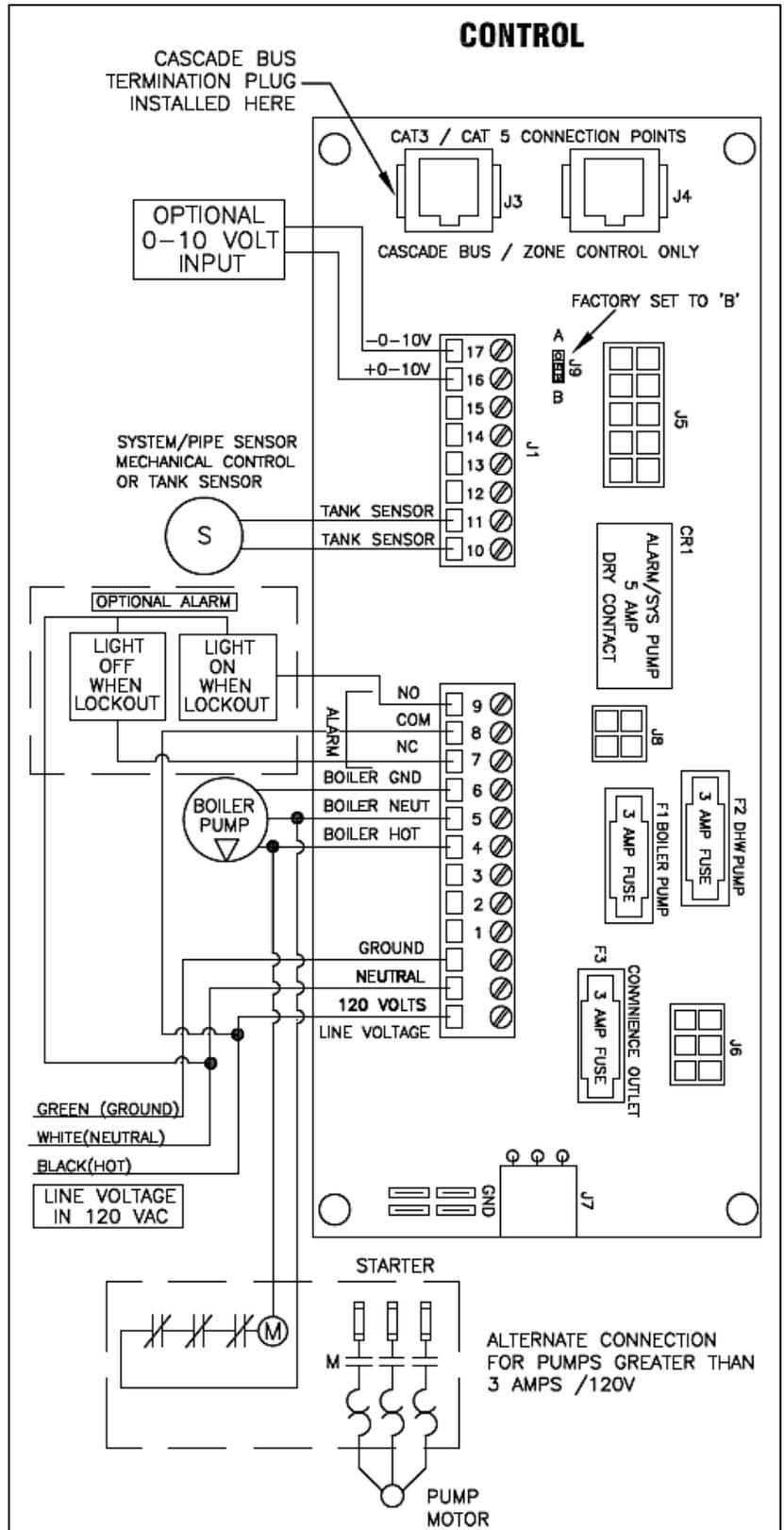


Figure 24 - Mod Con VWH Control

F. LOW VOLTAGE CONNECTIONS FOR STANDARD BOILER

All low voltage cables should enter the electrical junction box through the provided knock out holes shown in Figure 23. Connect all low voltage field devices in the low voltage terminal strip located in the electrical junction box (shown in Figure 24).

G. TANK SENSOR OR MECHANICAL CONTROL

Connect the tank sensor or mechanical controls to the TANK SENSOR terminals of the low voltage terminal strip shown in Figure 24. The control will automatically determine which type of sensor is connected and will operate accordingly. Caution should be used to ensure that neither of these terminals becomes connected to ground.

H. SYSTEM / PIPE SENSOR

The system/pipe sensor can be used to control the temperature of the storage tank when a tank sensor or mechanical control cannot be mounted. The system/pipe sensor must be wired into the terminals of the low voltage terminal strip as shown in Figure 24. It is important to note that when a system/pipe sensor is used, the circulating pump must be wired to operate continuously. Failure to do so will short cycle the boiler.

The system/pipe sensor can also be used in a cascade system when the sensor is placed on the supply line of multiple boilers that feed the storage tank. This will control the temperature and modulate the firing rate of the connected boilers. The system/pipe sensor would then be wired into the master boiler terminals on the low voltage strip as shown in Figure 24.

I. OPTIONAL HIGH GAS PRESSURE SWITCH

1. If an optional high gas pressure switch is used, it should be installed on the outlet side of the gas valve. This is normally closed and will open if the pressure goes above 1.5" w.c. on the outlet side.

2. Locate the two pigtailed hanging from the electrical box inside of the boiler cabinet. Remove and discard the jumper plug from one of the unused pigtailed.

3. Connect the high gas pressure switch to the pigtail that you removed the jumper plug from.

J. OPTIONAL LOW GAS PRESSURE SWITCH

1. If an optional low gas pressure switch is used, it should be installed on the inlet side of the gas valve. This is normally closed and will open if the pressure goes below 1" w.c. on the inlet side.

2. Locate the two pigtailed hanging from the electrical box inside of the boiler cabinet. Remove and discard the jumper plug from one of the unused pigtailed.

3. Connect the low gas pressure switch to the pigtail that you removed the jumper plug from.

K. FLOW SWITCH

This VWH boiler requires the use of a flow switch. The flow switch kit 7350P-605 or 7350P-606 comes packaged with detailed installation instructions which should be read and followed to ensure a functional system.

L. WIRING OF THE CASCADE SYSTEM COMMUNICATION BUS

1. A Cascade Bus Termination Plug has been installed on the customer connection board of this boiler. The purpose of this plug is to stabilize communication between multiple boilers and reduce electrical "noise". See Figures 26 and 27 for Cascade Bus Termination Plug installation detail.

2. Use standard CAT3 or CAT5 computer network patch cables to connect the communication bus between each of the boilers. These cables are readily available at any office supply, computer, electronic, department or discount home supply store in varying lengths. If you possess the skills you can also construct custom length cables.

3. It is recommended to use the shortest length cable that will reach between the boilers and create a neat installation. Do not run unprotected cables across the floor where they may become wet or damaged. Avoid running communication cables parallel and close to or against high voltage (120 volt or greater) wiring. HTP recommends that the maximum length of communication bus cables not exceed 200 feet.

4. Route the communication cables through one of the knockouts in the cabinet.

5. Connect the boilers in a daisy chain configuration as shown below. It is best to wire the boilers using the shortest wire runs rather than trying to wire them in the order that they are addressed. The communication bus jacks on the customer connection panel are interchangeable so you can use either one or both in any order to connect the cable.

If you have connected the boilers to each other properly, there will be no open communication connection ports.

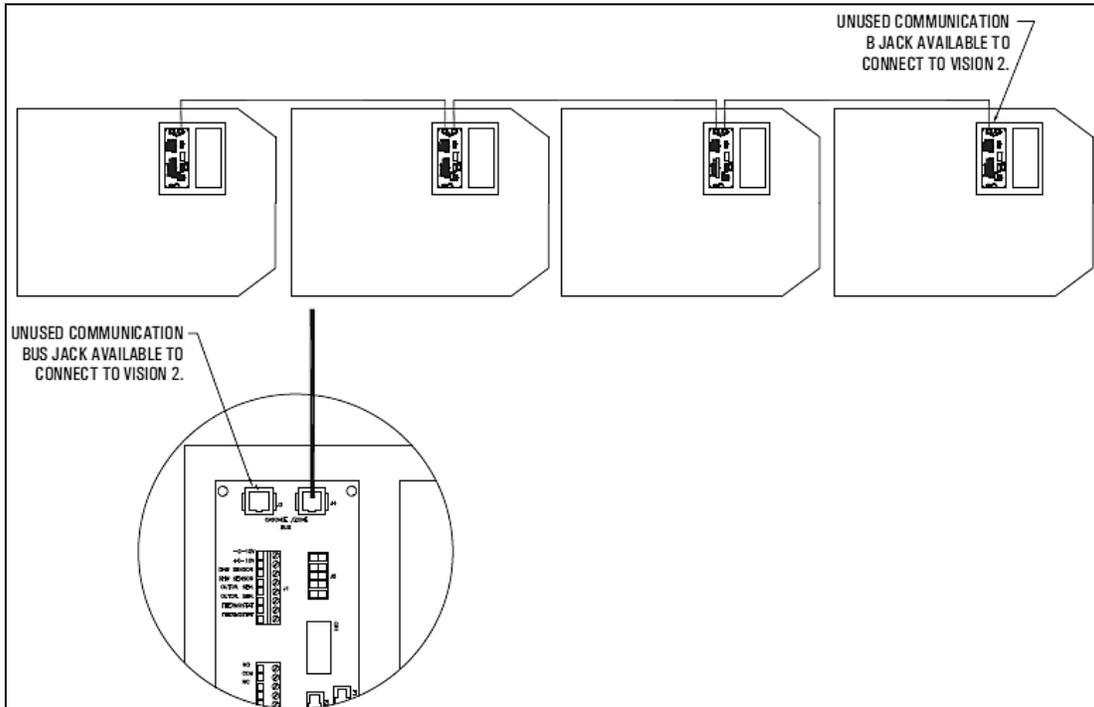


Figure 25 – LP-205-JJ

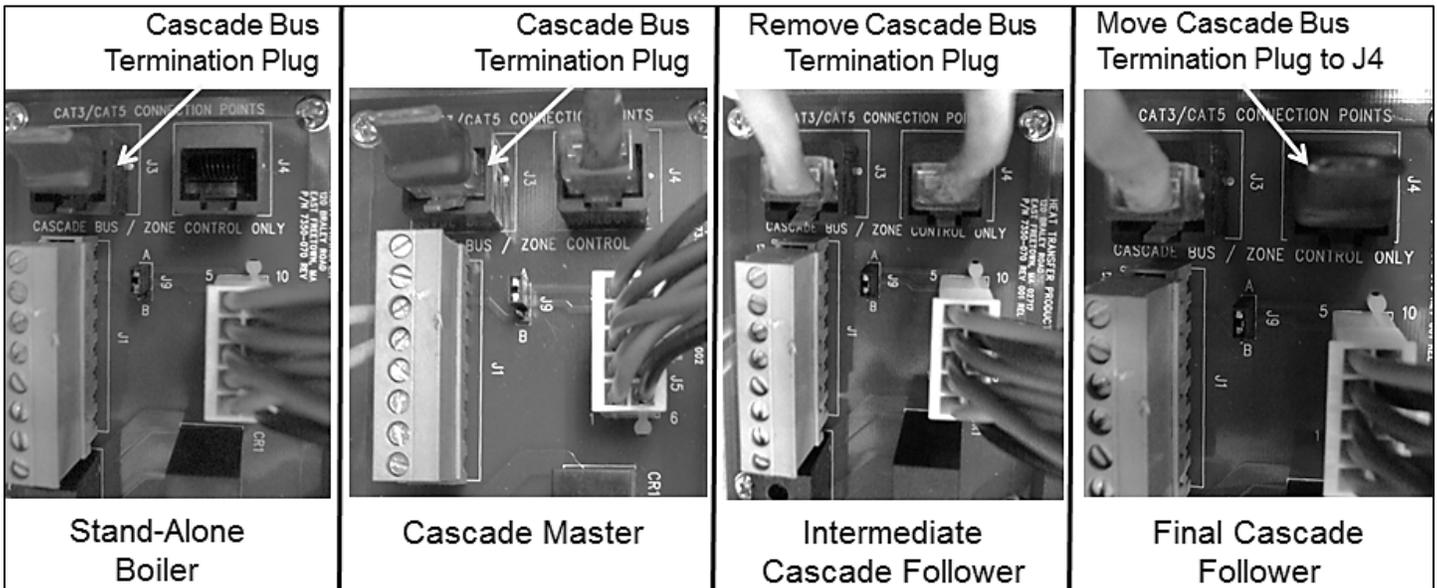


Figure 26 – Cascade Resistor Plug Installation Detail

M. VWH CASCADE MASTER PUMP AND SENSOR WIRING

1. Place the cascade master overlay sticker onto the field connection board on the boiler designated as the cascade master.
2. If it is desired to have the boiler control the boiler pump, connect the boiler pump to the BOILER HOT, BOILER NEUT, and BOILER GND terminals.
3. Connect the system sensor to the terminals marked SYS SENSOR.
4. Do not connect anything to the OUTDOOR SENS or THERMOSTAT terminals.
5. If 0-10 volt input is used, connect to marked terminals.

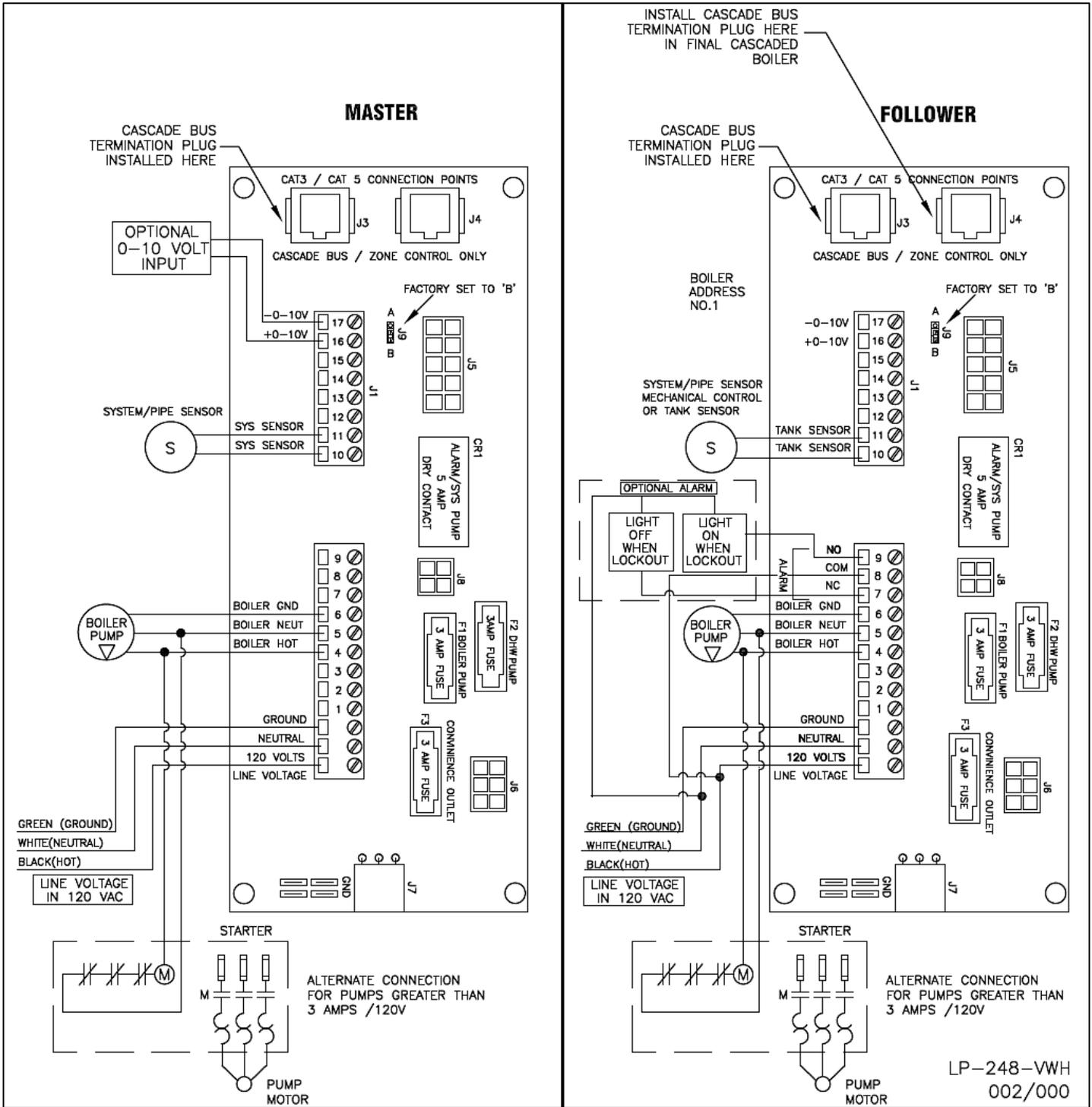


Figure 27 – Mod Con VWH Cascade Master and Follower

N. VWH CASCADE FOLLOWER PUMP AND SENSOR WIRING

1. If it is desired to have the boiler control the boiler pump, connect the boiler pump to the BOILER HOT, BOILER NEUT, and BOILER GND terminals.
2. Connect the tank sensor(s) or return sensor to the terminals marked TANK SENSOR on the follower boiler addressed as 1. There are no connections to these terminals on other follower boilers in the system.
3. Do not connect anything to the OUTDOOR SENS, 0-10V, or THERMOSTAT terminals.
4. If it is desired to monitor the boiler system to detect a lockout condition, a dry contact alarm relay is provided. Please see Figure 27 for wiring suggestions for this relay. Note that the alarm output of the boiler addressed as 1 will be active for lockout alarms on boiler 1 as well as on the master boiler.

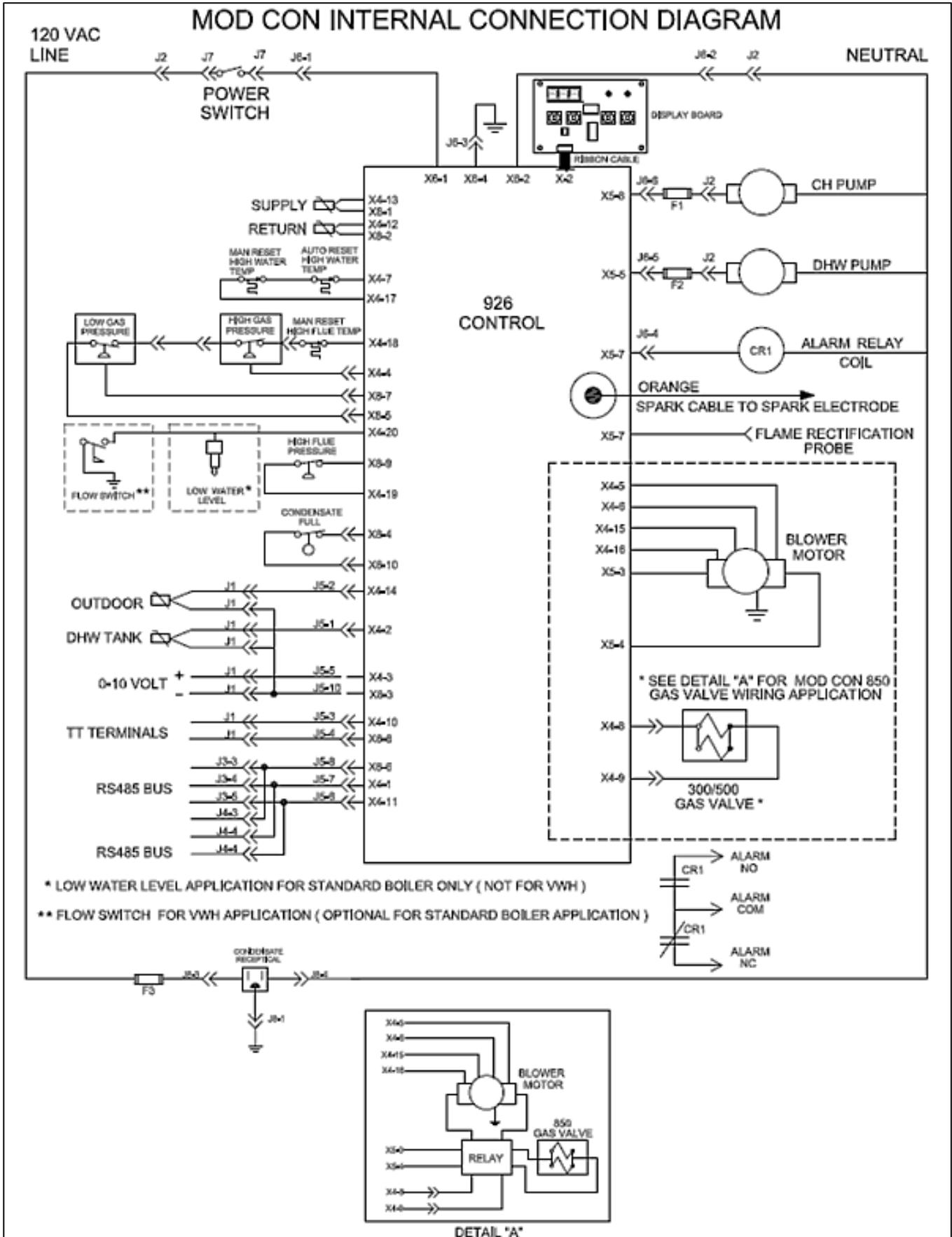


Figure 28 – Mod Con Internal Connection Diagram – LP-255

PART 8 – START-UP PREPARATION

A. CHECK / CONTROL WATER CHEMISTRY

It is recommended that you test your water quality prior to installation. Listed below are some guidelines.

WARNING

Do not use petroleum-based cleaning or sealing compounds in the boiler system. Damage to elastomer seals and gaskets in the system could occur, resulting in substantial property damage.

CAUTION

Chemical imbalance of your water can cause severe damage to your water heater and associated equipment, and may also affect efficiency. You may have to have your water quality professionally analyzed to determine whether you need to install a water softener. It is important that the water chemistry on both the domestic hot water and central heating sides are checked before installing the heater, as water quality will affect the reliability of the system. Outlined below are those water quality parameters which need to be met in order for the system to operate efficiently for many years. **Failure of a heat exchanger due to lime scale build-up on the heating surface, low pH or other imbalance IS NOT covered by the warranty.**

Water Hardness

Water hardness is mainly due to the presence of calcium and magnesium salts dissolved in the water. The concentration of these salts is expressed in mg/L, ppm or grains per gallon, as a measure of relative hardness of water. Grains per gallon is the common reference measurement used in the U.S. water heater industry. Hardness expressed as mg/L or ppm may be divided by 17.1 to convert to grains per gallon. Water may be classified as very soft, slightly hard, moderately hard, or hard based on its hardness number. The minerals in the water precipitate out when the water is heated and cause accelerated lime and scale accumulation on a heat transfer surface.

If the hardness of the water exceeds the maximum level of 7 grains per gallon, water should be softened to a hardness level no lower than 5 grains per gallon. Water softened as low as 0 to 1 grain per gallon may be under-saturated with respect to calcium carbonate, resulting in water that is aggressive and corrosive.

Consult local water treatment companies for unusually hard water areas (above 7 grains hardness).

pH of Water

pH is a measure of relative acidity, neutrality or alkalinity. Dissolved minerals and gases affect water pH. The pH scale ranges from 0 to 14. Water with a pH of 7.0 is considered neutral. Water with a pH lower than 7 is considered acidic. Water pH higher than 7 is considered alkaline. A neutral pH (around 7) is desirable for most potable water applications. **Corrosion damage and heater failures resulting from water pH levels of lower than 6 or higher than 8 ARE NOT covered by the warranty.** The ideal pH range for water used in a storage tank or a water heater system is 7.2 to 7.8.

1. Maintain boiler water pH between 6.0 and 8.0. Check with litmus paper or have it chemically analyzed by a water treatment company.

2. If the pH differs from above, consult local water treatment company for treatment needed.

Total Dissolved Solids

Total Dissolved Solids (TDS) is a measurement of all minerals and solids dissolved in a water sample. The concentration of total dissolved solids is usually expressed in parts per million (ppm).

Water with a high TDS concentration will greatly accelerate lime and scale formation in the hot water system. Most high TDS concentrations precipitate out of the water when heated. This can generate a scale accumulation on the heat transfer surface that will greatly reduce the service life of a water heater. This scale accumulation can also impede the ability of the heat exchanger to transfer heat into the water. A heat exchanger damaged or blocked by lime/scale accumulation must be replaced.

The manufacturer of the water heater has no control of water quality, especially TDS levels in your system. Total dissolved solids in excess of 2,000 ppm will accelerate lime and scale formation in the heat exchanger. Heat exchanger failure due to total dissolved solids in excess of 2,000 ppm is a non-warrantable condition. **Failure of a water heater due to lime scale build up on the heating surface IS NOT covered by the warranty.**

1. Do not connect the boiler to directly heat a swimming pool or spa water.

2. Do not fill boiler or operate with water containing chlorine in excess of 100 ppm.

Hardness: 7 grains

Chloride levels: 100 ppm

pH levels: 6-8

TDS: 2000 ppm

Sodium: 20 mGL

B. CHECK FOR GAS LEAKS

⚠ WARNING

Before starting the boiler, and during initial operation, smell near the floor and around the boiler for gas odorant or any unusual odor. Remove boiler front door and smell interior of boiler enclosure. Do not proceed with startup if there is any indication of a gas leak. Repair any leaks at once.

⚠ WARNING

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

C. CONDENSATE REMOVAL

1. The boiler is a high efficiency condensing boiler. Therefore, the unit has a condensate drain. Condensate fluid is nothing more than water vapor, derived from combustion products, similar to that produced by an automobile when it is initially started.

Condensation is slightly acidic (typically with a pH of 3 to 5) and must be piped with the correct materials. Never pipe the condensate using steel, copper, brass or other materials that will be subject to corrosion. Plastic PVC or CPVC pipe are the only approved materials.

A condensate neutralizer, if required by local authorities, can be made up of lime crystals, marble or phosphate chips that will neutralize the condensate. This may be done by the installer or you may purchase a condensate neutralizer from HTP (7350-025).

2. The boiler is equipped with a ¾ FPT connection that must be piped to a local drain. It is very important that the condensate line is sloped downward away from the boiler to a suitable inside drain. If the condensate outlet on the boiler is lower than the drain, you must use a condensate removal pump, available from HTP (554200). This pump is equipped with two leads that can be connected to an alarm or another type of warning device to alert the user of a condensate overflow, which, if not corrected, could cause property damage.

3. If a long horizontal run is used, it may be necessary to create a vent in the horizontal run to prevent a vacuum lock in the condensate line.

4. Do not expose the condensate to freezing temperatures.

5. It is very important you support the condensation line to assure proper drainage.

D. FINAL CHECKS BEFORE STARTING BOILER

1. Read Startup Procedures within this manual for proper steps to start boiler. (See Startup Report to record steps for future reference.)

2. Verify the boiler and system are full of water and all system components are correctly set for operation.

⚠ WARNING

Ensure the boiler is full of water before firing the burner. Failure to do so will damage the boiler. Such damage IS NOT covered by warranty, and could result in property damage, severe personal injury, or death.

3. Fill condensate trap with water.

4. Verify electrical connections are correct and securely attached.

5. Inspect intake piping and exhaust piping for signs of deterioration from corrosion, physical damage or sagging. Verify intake piping and exhaust piping are intact and correctly installed per Venting Section and local code.

E. SETTING UP A SINGLE BOILER

When power is applied to the boiler, the control first completes a power-up systems check. During this time the combustion fan may run. The display will initially show the current boiler outlet temperature. If a fault is detected during the power-up test, the control will display the appropriate fault code. Otherwise, the display will continue to show the boiler outlet temperature and stand-by, waiting for a demand for hot water. If the temperature of the tank sensor falls below the tank set point **[dd]** minus the tank differential temperature **[dh]**, a demand for hot water is generated by the control.

When a demand for hot water is received, the control begins the following demand sequence. The boiler first turns on the pump (if it is not wired to run continuously). Once the pump is running, the control will display FL and wait for the water flow in the system to increase to an acceptable level determined by the flow switch on the outside of the boiler. (NOTE: This step may happen very rapidly. If flow is adequate, FL may never display.)

Once flow through the boiler is adequate, the control will measure the supply temperature. If it is below the set point temperature $\{dd\}$ minus the supply hysteresis $\{sh\}$, the control will ignite the burner. After the burner is lit, the control modulates the firing rate to control the supply water temperature at the set point temperature plus the supply offset temperature $\{Installer \#4\}$ above the tank set point temperature $\{dd\}$. When the tank temperature is equal to the tank set point temperature, the control will extinguish the burner and run the combustion fan to purge gasses from the combustion chamber. In addition, the pump will run for a pump post purge interval. The control will then be in standby, waiting to process the next demand for heat.

During this process, the control will extinguish the burner if it senses a dangerous or unsafe condition. If the control determines that a dangerous or unsafe condition has occurred, the control may lock out the boiler and prevent it from igniting until a maintenance person diagnoses the problem, repairs it, and resets the control. In the event that the control goes into lockout, it will show a diagnostic code on the display, illuminate the LED fault indicator, and close the alarm relay contacts to aid in recognition of the condition, diagnosis, and repair.

F. SETTING UP A CASCADED SYSTEM

If the boiler is part of a cascaded system the operation is somewhat different. The control of each boiler in a cascaded system completes its own power up system check as described above. One of the boilers in the cascade system is designated as the master boiler. After the master boiler completes its power up sequence, it checks the communication bus to see if any other boilers are present. If other boilers are present, the master control determines these follower boiler addresses. The master boiler control will recheck the bus every few seconds as long as it is powered up to update the status of the connected boilers. The control in the master boiler processes all heat demands and dictates which of the follower boilers should light and what firing rate the followers should try to achieve.

When the master boiler receives a demand for heat, it determines which boiler is first in the firing sequence and sends that boiler a command to begin a demand sequence. That boiler will then begin a demand sequence as described above. Once the boiler ignites, the master boiler control will increase the firing rate command to that boiler until the system sensor temperature is at the tank set point temperature plus the supply offset temperature $\{Installer \#4\}$, or that boiler is at high firing rate. If the command from the master boiler control gets to the high firing rate of the follower boiler, but the system sensor is below the required temperature, the master boiler control will then tell the next boiler in the firing sequence to begin its demand sequence. The master boiler control will then begin to ramp up the firing rate command of that boiler. This process will continue while there is a demand until all boilers in the cascade system are at high fire or the desired temperature of the system sensor is reached. If the system sensor temperature reaches tank set point and $\{Installer \#4\}$ before all boilers are at high fire, the master control will modulate the cascade command signal to maintain the system sensor at tank set point and $\{Installer \#4\}$ until the demand is complete. When the tank temperature is equal to the set point temperature $\{dd\}$, the demand is complete, and the master boiler control will extinguish all boilers that may be lit. If the demand decreases, the firing rate command and amount of boilers lit will decrease exactly opposite as described above.

Whenever the master boiler control needs to fire a follower boiler, it sends a firing rate command to that boiler. The follower boiler will respond to the command until its supply sensor temperature gets to be 5°F above the tank set point temperature plus the supply offset temperature $\{Installer \#4\}$, at which point the individual boiler will modulate on its own so as not to overheat. As a result, it is not uncommon to see the cascade output at maximum but individual boilers firing at less than their maximum firing rate.

G. LOCKOUT CONDITION

If any boilers, including the master boiler in the cascade system, are in a lockout condition, the master control will recognize the lockout condition and skip over the boiler in the firing sequence. Each boiler in the cascade system is responsible for its own safety functions. So, if any individual boiler control senses an unsafe condition, it will extinguish the burner and, if necessary, go to a lockout condition. In this way, every boiler in the system has its individual safety controls intact and operational, even if the firing of the boiler is under control of the master boiler.

In the event that the system sensor fails, all boilers in the system will ignite simultaneously when there is a demand, and each boiler will individually regulate firing rates to maintain the master set point temperature (tank set point plus $\{Installer \#4\}$) at the individual supply sensors built into the boiler. If this should happen, the master boiler will display an **E03** fault code, indicating that the supply sensor has failed.

H. CASCADE SYSTEM PROGRAMMING

1. If the boiler is used alone, skip this section.
2. Programming the Master Boiler:
 - a. Make sure there is no demand for heat being supplied to the boiler.
 - b. Apply power to the boiler.
 - c. Enter the installer menu following instructions in Part 10 of this manual.

- d. Verify that parameter 15 is set to 0. This makes the master boiler address 0. NOTE: The Master Boiler MUST be addressed as 0.
- e. Change parameter 23 from 0 to 1.
- f. Exit the installer menu.

NOTE: The temperature set point of the master must match the follower boiler set point in order for the system to operate properly.
3. Programming Follower Boilers:

NOTE: READ THE NOTES BELOW BEFORE PROGRAMMING FOLLOWER BOILERS

- The boiler addressed as 1 will share its alarm output with the master boiler.
 - It is recommended but not necessary to address boilers in the order that they are wired.
 - No two boilers can have the same address.
 - It is not required to use all consecutive address numbers.
- a. Make sure there is no demand for heat being supplied to the master boiler
 - b. Apply power to the follower boiler you are working on.
 - c. Enter system settings following instructions in part 11 of this manual
 - d. Set cascade address parameter 15 to 1 for the first follower, 2 for the second follower, etc. depending on which boiler you are programming based on the above notes.
 - e. Set parameter 23 to 1.
 - f. Exit system menu.

NOTE: The temperature set point of the follower must match the master boiler set point in order for the system to operate properly.

PART 9 – START-UP PROCEDURE

WARNING

FOR YOUR OWN SAFETY READ BEFORE OPERATING

1. This boiler does not have pilot. 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 boiler 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 boiler.
 - 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.
 - Turn off gas shutoff valve (located outside of the boiler) so that the handle is crosswise to the gas pipe. If the handle will not turn by hand, don't try to force or repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
4. Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control that has been damaged.
 5. The boiler shall be installed so the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during boiler operation and service (circulator replacement, condensate trap, control replacement, etc.)

Failure to follow these instructions could result in property damage, serious personal injury, or death.

A. OPERATING INSTRUCTIONS

Remove boiler cover. If you smell gas, **STOP**. Follow listed safety instructions. If you do not smell gas, follow the next steps.

1. Turn on all electrical power to the boiler.
2. If desired, adjust the temperature set point of the boiler. The factory default setting is 119°F. If changes are necessary, follow "Adjusting the Set Point" in this section.
3. On the initial start-up of this boiler, you may note a lock-out code of **F01**. This is a low gas pressure switch lock-out from the factory-installed low inlet gas pressure switch (located on the left in the 500 and on the right in the 850). You will also see a yellow LED illuminated under the cover of the inlet gas pressure switch. Once the gas is turned on, reset the gas pressure switch by **FIRMLY**

pressing on top of the plastic cover over the red reset button. You will note that the yellow LED has gone out. Press and hold the **[S4]** key on the control panel for 4 seconds to begin normal operation.

4. If the tank water temperature is below the tank set point temperature (tank differential temperature) the boiler will ignite.
5. If the appliance fails to start, refer to Troubleshooting, Part 11.

B. ADJUSTING THE OPERATING SET POINTS OF THE VWH DISPLAY

To adjust the temperature set point, differential values, and display units of the VWH boiler, press the **[S3/Program]** key for three seconds until you see **[Sh]** and an alternating value of 7°F. Use the **[S1/-]** key or **[S2/+]** key on the display to either increase or decrease the setting of each parameter. Use **[S3]** to advance to each parameter listed in the chart below. Pressing **[S3]** when you are at the last parameter on the chart will return the display to normal operation. If you missed a parameter or want to make further changes, simply press and hold **[S3]** for 3 seconds to reenter the programming mode.

SET POINT ADJUSTMENT			
Function	Display	Default Setting	Range of Adjustment
Supply Sensor Differential	sh	7°F	1 – 45°F
Temperature Set Point	dd	119°F	80°F / 185°F
Tank Sensor Differential	dh	7°F	1 – 45°F
Measurement Units	t	Fahrenheit to Celsius	F or C

Table 14 – Set Point Adjustment

Settings when using a Tank or Pipe Sensor

Parameter **[t]** should be set to F for Fahrenheit temperatures or C for Celsius temperatures.

Parameter **[dd]** should be set to the desired tank temperature. If you are using 0-10 volt control, parameter **[dd]** should be set to the tank temperature corresponding to the 10 volt input signal.

Parameters **[sh]** and **[dh]** should both be set to the number of degrees below the desired tank temperature that you want the VWH boiler(s) to start firing at.

Settings when using a Mechanical Tank or Pipe Sensor

The mechanical sensor should be set to the desired tank temperature.

Parameter **[t]** should be set to F for Fahrenheit temperatures or C for Celsius temperatures.

Parameter **[dd]** should also be set to the desired tank temperature.

Parameter **[sh]** should be set to the number of degrees below the desired temperature that you want the VWH boiler(s) to begin firing at. This is useful if you desire a greater differential temperature than is designed in to the mechanical control.

Note: Parameter **[dh]** is not active when using a mechanical tank or pipe sensor.

C. STATUS MENU

Installers are also able to check the current status of the VWH parameters by pressing **[S4/Reset]** for 3 seconds. Once activated, the display will show d1 alternating value of the actual outlet temperature. Actual values are displayed for each function. To view the next value, simply press **[S4]**.

Listed below are the values which can be displayed. These values cannot be changed. To exit this menu, press **[S3]** to resume normal operation.

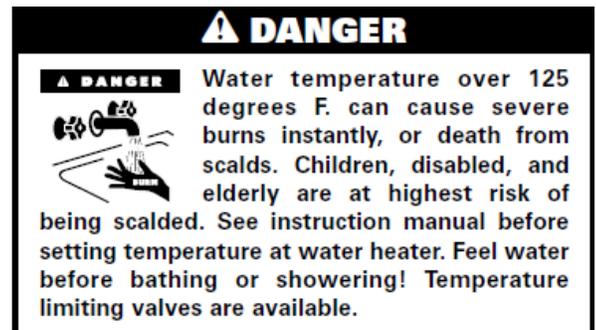
Function – Value

To toggle between values press **[S1]** to go down and **[S4]** to go up. The first function you will see is:

[d1] — Actual temperature from outlet sensor

[d2] — Actual temperature from inlet sensor

[d3] — If using a standard mechanical control, the control will display **0** for closed and **1** for open. If the tank sensor is connected to a storage tank, it will measure the actual temperature.



|d4| — Not used.

|d5| — Not used.

|d6| — Actual fan speed multiplied by 10 (Example: If fan speed displayed is |410| RPM x 10 = 4100 actual fan speed)

|d7| — Actual ionization current read from flame rectification probe

|d8| — 0 (not used).

|d9| — Circulator pump - Off = |0|, On = |1|.

|d10| — Actual status of bus communication |co| = connected, |nc| = not connected

|d11| — Storage tank set point

|d12| — Power on hours in thousands (display will not read until 100 hrs). Example: Display number x 1000 = Power on hours.

|d13| — Not used.

|d14| — Total running hours of boilers in thousands (display will not read until 100 hrs.)

|d15| — Passed ignition attempts in thousands (display will not read until 100 ignition attempts).
Example: Display number x 1000 = ignition attempts. Display showing 12.3 x 1000 = 12300 ignition attempts.

|d16| — This function only becomes active when boiler is set as the Master. It allows the user to monitor the system pump connected to the Master Boiler (0 = Off, 1 = On) in a multiple boiler installation. Each boiler firing output percentage is displayed.

|P0| - Master Boiler - Alternating (0-100 Percentage firing rate)

|P1| - Follower Boiler #1 – Alternating (0-100 Percentage firing rate)

|P2| - Follower Boiler #2 – Alternating (0-100 Percentage firing rate)

|P3| - Follower Boiler #3 – Alternating (0-100 Percentage firing rate)

|P4| - Follower Boiler #4 – Alternating (0-100 Percentage firing rate)

|P5| - Follower Boiler #5 – Alternating (0-100 Percentage firing rate)

|P6| - Follower Boiler #6 – Alternating (0-100 Percentage firing rate)

|P7| - Follower Boiler #7 – Alternating (0-100 Percentage firing rate)

NOTE: If you toggle beyond parameters of connected boilers, the display will go into the next function value.

D. TEST MODE

This function is intended to simplify the gas valve adjustment. Listed below are the recommended limits on each VWH boiler and combustion settings. Automatic modulation does not take place when the controller is in test mode, only temperature limitation based on the VWH boiler central heating set point. The user can increase or decrease the fan speed by pressing either |S1/-| or |S2/+|.

To activate test mode, press the |S2/+| and |S3/Program| keys together for 1 second. Once activated, you will see in the display |Ser| and the actual fan speed. The measurement of the combustion levels should always be taken at the highest and lowest fan speeds. After 20 minutes, test mode stops automatically. To exit test mode, press |S1/-| and |S2/+| together for 1 second.

COMBUSTION SETTINGS ON ALL MODELS				
Fan Speed	Natural Gas		Propane LP	
	low	high	low	High
Carbon Monoxide (CO%)	0 – 20 ppm	70 – 135 ppm	0 – 20 ppm	80 – 150 ppm
Carbon Dioxide (CO ₂ %)	8 ½ - 9 ½%	8 ½ - 9 ½%	9 ½ - 10 ½%	9 ½ - 10 ½%

Table 15 – Combustion Settings on All Models

MOD CON FAN SPEEDS			
MODEL	IGNITION	MIN	MAX
300	3000	1250	5500
500	3000	1250	6930
850	3000	1500	5400

Table 16 – Fan Speeds

PART 10 – START-UP PROCEDURES FOR THE INSTALLER

A. PROGRAMMING FOR THE INSTALLER

This section describes each parameter the installer can access to customize the settings of the VWH boiler for a particular installation. These system limits should not be changed by the user. For future reference, it is important to document your settings within this manual after you program the system parameters.

B. PROGRAM ACCESS

To start, press and hold **[S3]** and **[S4]** simultaneously for three seconds. You will notice the display change to **[000]**. Then, press and hold **[S1]** until you see **[925]**. (If you go past **[925]**, you can use **[S2]** to decrease the number.) This is the pass code. To confirm that the pass code is correct, press and hold the **[S3]** key for 1 second. If the pass code is entered incorrectly, the controller program function will cancel and return to normal operation. If the code is entered correctly, the control will switch off the gas valve and purge fan while showing a solid **---** in the display. The display will then show a **[1]** alternating to **[dd]**. This first function verifies that the control is configured as a VWH boiler.

C. PROGRAM NAVIGATION

Next you will have to press the **[S3]** key to move through each function. To increase or decrease a value, you will need to press either **[S1]** or **[S2]** to change the default values. If there is no key action for 1 minute, the display returns to normal operation. Changes are effective immediately but not directly stored until the **[S4]** key is pressed down for 3 seconds then the new values are stored. Listed below are the varieties of functions the installer can program.

CAUTION

The boiler cannot be programmed while there is a call for heat.

DEFAULT FUNCTION	VALUE	DESCRIPTION
1	[dd]	N/A (no change allowed)
2	149°F	N/A (no change allowed)
3	180°F	Allows the installer to set the maximum domestic water heater delivery temperature. Range: 95°F to 185°F
4	20°F	Offset temperature / number of degrees above the tank set point that will control the boiler output. Ex: Storage tank is set at 120°F with 20°F offset boiler supply will be 140°F. Range: 1°F to 39°F.
5	7°F	Allows the installer to change the differential temperature (dh) Range: 1°F to 18°F
6	5 min.	Changes the circulator post purge time once the sensor is satisfied. (NOTE: Post purge time should be set no greater than 5 minutes.) Range: 0 to 10 minutes
7	68°F	N/A (no change required)
8	5°F	N/A (no change required)
9	180°F	N/A (no change required)
10	68°F	N/A (no change required)
11	95°F	N/A (no change required)
12	68°F	N/A (no change required)
13	0 min.	N/A (no change required)
14	30 min.	N/A (no change required)
15	0	Bus address (Cascade 8 Boiler Max) (0 = master 1 – 7 = follower) NOTE: Never address boiler with number 8. Range: 0 to 8.
16	0	Allows the installer to connect a 0-10 volt directly from Building Management System. To activate, change value to 2. WARNING: Values 1 and 3 are not to be programmed into the board. Range: 0 - 3.
17	0	N/A (no change required)
18	1	N/A (no change required)
19	180°F	N/A (no change required)

20	2	Flow switch. Do not change. 0 = none, 1 = water pressure switch, 2 = flow switch, 3 = low water cut-off
21	0	N/A (no change required)
22	100%	This parameter can be adjusted to lower the maximum boiler output. Default = 100%. Ex: 500 boiler setting at 80% will go to 400,000 BTU/hr max rather than 500,000 BTU/hr. Range: 50 – 100%.
23	0	Cascade configuration (Default 0). Leave as 0 if this is a standalone unit or if the unit is cascaded using the Vision 3 module. Change this to 1 if the appliance is part of a cascaded system not using the Vision 3 module.
24	24	This parameter is used to set how many power on hours will go by before the priority appliance will be rotated in the cascade system. Range: 0 - 240
25	0	N/A, must be at 0.
26	---	---
27	0	Parameter set on 0 then E03 will be displayed if system sensor fails. Parameter set on 1, no code will be displayed if system sensor fails. 0 = E03 , 1 = no code displayed.
28	0	Parameter set on 0 = Frost protection active. Parameter set on 1 = Frost protection disabled.
29	0	N/A (no change required)
30	0	Parameter set on 0 = There will be no extra boiler on the Cascade Master. Parameter greater than 0 = Percentage of the cascade output that will turn on the auxiliary boiler.
31	0	N/A (do not change)

Table 17

CONTROL PROGRAM REFERENCE CHART					
FUNCTION	DEFAULT SETTING	PROGRAMMED SETTING	FUNCTION	DEFAULT SETTING	PROGRAMMED SETTING
1	de	No change allowed	17	0	
2	149°F	No change allowed	18	1	
3	160°F		19	185°F	
4	36°F	No change allowed	20	3	
5	7°F		21	0	
6	0 Min.		22	100%	
7	68°F		23	0	
8	5°F		24	24 hrs.	
9	180°F		25	0	
10	68°F		26	---	
11	95°F		27	0	
12	68°F		28	0	
13	0 Min.		29	0	
14	30 Min.		30	0	
15	0		31	N/A	
16	0				

Table 18

PART 11 – TROUBLESHOOTING

A. VWH ERROR CODE

If any of the sensors detect an abnormal condition or an internal component fails during the operation of the VWH boiler, the display may show an error code. This code may be the result of a temporary condition, in which case the display will revert to its normal readout when the condition is corrected, or it may be the result of a condition that the controller has evaluated as not safe to restart the boiler. In this case, the boiler control will be locked out, requiring the maintenance person to manually reset the control by pressing the **S4/RESET** key for more than 1 second. Typically, if the display has a code beginning with F followed by 2 numbers, the VWH boiler is locked out. If the display has a 3 letter code, the fault is the result of a temporary condition.

B. BOILER ERROR

When an error condition occurs, the controller will display an error code on the display module. These error codes and several suggested corrective actions are included in Table 19.

C. BOILER FAULT

1. When a fault condition occurs, the controller will illuminate the red “fault” indication light and display a fault code. The alarm output will also be activated. Most fault conditions will also cause the CH pump to run in an attempt to cool the boiler.
2. Note the fault code and refer to Table 20 for an explanation of the fault code along with several suggestions for corrective actions.
3. Press the reset key to clear the fault and resume operation. Be sure to observe the operation of the unit for a period of time to assure correct operation and no recurrence of fault codes.

⚠ WARNING

When servicing or replacing any components of this boiler, be certain that:

- The gas is off.
- All electrical power is disconnected.

⚠ DANGER

When servicing or replacing components that are in direct contact with the boiler water, be certain that:

- There is no pressure in the boiler. (Pull the release on the relief valve. Do not rely on the pressure gauge reading.
- The boiler water is not hot.
- The electrical power is off.

⚠ WARNING

DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN SUBMERGED IN WATER. Immediately call a qualified service technician. The appliance **MUST BE** replaced if it has been submerged. Attempting to operate an appliance that has been submerged could create numerous harmful conditions, such as a potential gas leakage causing a fire and/or explosion, or the release of mold, bacteria, or other harmful particulates into the air. Operating a previously submerged appliance could result in property damage, severe personal injury, or death.

NOTE: Appliance damage due to flood or submersion is considered an Act of God, and IS NOT covered under product warranty.

⚠ CAUTION

This appliance has wire function labels on all internal wiring. Observe the position of each wire before removing it. Wiring errors may cause improper and dangerous operation. Verify operation after servicing.

⚠ CAUTION

If overheating occurs, or the gas supply fails to shut off, do not turn off electrical power to the circulating pump. This may aggravate the problem and increase the likelihood of boiler damage. Instead, shut off the gas supply to the boiler at the gas service valve.

926 CONTROL BOARD ERROR CODES

CODE	DESCRIPTION	CORRECTIVE ACTION
E19	Line voltage frequency out of range.	Inspect power wiring to appliance and repair as necessary. If connected to line voltage, notify power company. If connected to an alternate power source, such as a generator or inverter, make sure line voltage frequency supplied by the device is 60 Hz. No reset is necessary, as this blocking code clears automatically after the problem has been corrected.
FLU	Blocked Vent Pressure Switch	1. Check the flue vent to be sure it is not blocked or damaged. 2. Check the switch wiring by applying a jumper in place of the switch. If the code clears with the jumper in place, REPLACE the flue switch and connect the wires to the new switch BEFORE running the boiler. WARNING: Do not use jumper to remedy this error. Faulty switches MUST be replaced. Failure to do so could result in serious injury or death.
LEO	Water Level in Boiler is Low	1. Check boiler feed water system to be sure it is supplying make-up water to the boiler system. 2. Be sure all air is bled from system. 3. Check for leaks in boiler and system piping and repair as necessary. 4. Inspect low level switch and wiring for damage and repair if necessary.
LOU	24 Volt Low	1. Check line voltage. Must be between 100 – 128 volts. 2. If available, connect a PC and, using HTP service software, check the 24v supply display in the lower left corner of the screen. The number displayed here must be greater than 128 and should be greater than 250. Use this as a troubleshooting guide as you follow the steps below. 3. Remove 10 pin Molex connector from customer connection board. If LOU clears, then the problem is with external sensor wiring. Examine external sensor wiring for shorts to ground, repairing as necessary. If LOU code is still present and the heater is so equipped, disconnect high gas pressure switch, then low gas pressure switch, then UL 353 low water cutoff in this order, one at a time, to see if LOU code clears. Replace faulty part. Check low voltage wire harness in heater for shorts to ground. 4. If LOU only occurs when burner tries to light, check gas valve for excessive current draw. 5. If LOU is present with the low voltage harness disconnected from the 926 control board, replace the 926 control board.

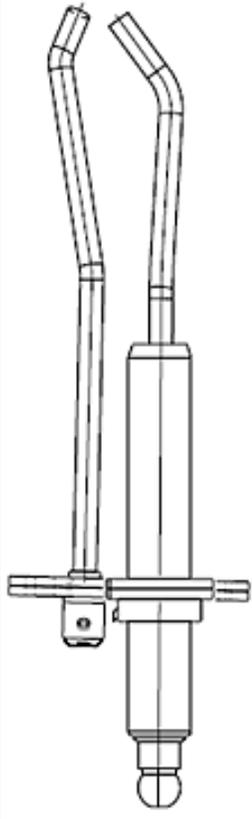
E03	System sensor failure (Cascade Master only)	<ol style="list-style-type: none"> 1. Check wiring to system sensor. Repair as necessary. 2. Check sensor resistance. Compare to the resistance table in this manual. Replace if not correct.
FL	Low water flow (Users with optional flow switch only).	<ol style="list-style-type: none"> 1. Check to see if boiler circulator is functioning. Repair as necessary. 2. Be sure water is flowing in the system. Check for valves that should be open, plugged filter screens, etc. 3. Check flow switch and wiring. Repair as necessary.

Table 19

926 Control Board FAULT		
Codes	Description	Remedy
F00	High temperature limit exceeded	<ol style="list-style-type: none"> 1. Check circulation pump operation. 2. Assure that there is adequate flow through the boiler by accessing the status menu and assuring that there is less than a 50°F rise from the return thermistor to the supply thermistor. 3. Check thermistor reading on supply thermistor. Replace switch if faulty. 4. Disconnect the two wires from the thermostat terminals and connect the wires together. Depress the S4/Reset button. If the fault clears, the problem is outside the boiler.
F01	ECO circuit 2 Vent temperature High Gas Pressure (if equipped) Low gas pressure (if equipped) Low level (if equipped with UL353 LWCO)	<ol style="list-style-type: none"> 1. If the boiler is equipped with High and/or Low gas pressure switches, examine the yellow LED lights on each switch. If lit, correct the gas supply problem associated with the switch. Then, reset the switch by pressing on the cover of the switch over the red button. Pressing the button requires a firm push. Finally, press the RESET button on the front panel of the boiler to reset the boiler control. 2. If the boiler has a UL353 LWCO, check to see if the red LED on the LWCO control box is illuminated. If so, correct the low water condition and press the reset button on the LWCO control box to reset it. The LED should change to green. Finally, press the reset button on the front panel of the boiler to reset the boiler control. 3. Check the flue for obstructions or any sign of damage, especially signs of excessive heat. Repair as necessary. Push red reset button on flue temperature switch located on the flue inside the rear access door of the boiler. NOTE: Switch temperature must be less than 90°F to reset. Run the boiler and check the flue temperature. If the flue temperature is within specs and the switch trips, replace the switch. If the flue temperature is excessive, check and adjust the combustion controls on the boiler. If problem persists, inspect the target wall in the combustion chamber and replace it if cracked or damaged.
F02	Interrupted or shorted supply (outlet) thermistor.	<ol style="list-style-type: none"> 1. Check the electrical connection to the appropriate thermistor. Verify 5 VDC by checking in Molex connector. If not 5 VDC, check harness. If harness is OK, replace control. NOTE: Boiler will reset automatically. Verify thermistor values by referencing chart in this manual. 2. If connection is okay, replace thermistor.
F03	Interrupted or shorted return (inlet) thermistor.	
F05	Supply (outlet) temperature sensor exceeds 230°F.	<ol style="list-style-type: none"> 1. Check circulation pump operation. 2. Assure there is adequate flow through the boiler by accessing the status menu and assuring that there is less than a 50°F rise from the return thermistor to the supply thermistor. 3. Check direction of flow on boiler circulator (see PIPING DETAILS in this manual). 4. Troubleshoot thermistor by following steps in F02.
F06	Return (inlet) temperature sensor exceeds 230°F.	
F09	No flame detected – Boiler will make three attempts at ignition before the control goes into this lockout condition.	<ol style="list-style-type: none"> 1. Watch the igniter through the observation window provided. 2. If there is no spark, check the spark electrode for the proper ¼" gap. 3. Remove any corrosion from the spark electrode and flame rectifier probe. 4. If there is a spark but no flame, check the gas supply to the boiler. 5. If there is a flame, check the flame sensor. 6. Check any flue blockage or condensate blocks.
F10	Loss of flame signal – The heater will relight 4 times before the control goes into this lockout condition. Will reset in 1 hour.	<ol style="list-style-type: none"> 1. Monitor the gas pressure to the unit while in operation. 2. Assure that the flame is stable when lit. 3. Check to see if the green light on the display module is out while the heater is running. 4. If the green light doesn't come on or goes off during operation check the flame signal on the status menu. 5. If the signal reads less than 1 microampere, clean the flame rectifier probe. 6. If the flame rectifier probe continues to read low, replace it. 7. Check the stability of the flame rectification signal. If the signal is unstable, you may need to replace the burner gasket.
F11	False flame signal – The boiler will lock out if it senses a flame signal when there should be none present.	<ol style="list-style-type: none"> 1. Look into window. If there is flame, turn the gas off to the unit at the service valve and replace gas valve. 2. If the flame signal is present and there is no flame, replace the flame rectification probe. 3. If the flame signal is not present after turning off the gas supply, check the gas valve electrical connection. 4. Remove the gas valve and check for obstruction in the valve seat or replace the gas valve. 5. Turn the gas on at the service valve after corrective action is taken. 6. Check for condensate backup. Condensate backup can damage the refractory wall. If the wall falls against the rectifier probe, it may conduct the signal to ground, giving a false reading.
F13	Combustion fan speed incorrect – The boiler will lock out if it senses that the fan speed is less than 70% or greater than 130% of expected rate for more than 60 seconds.	<ol style="list-style-type: none"> 1. Check the combustion air fan wiring. 2. Check the 24 VAC signal by measuring from any connected safety to ground. A low voltage situation may cause a "false" error code. 2. Replace the combustion air fan. 3. Replace the control board.

F20	Condensate cup is full	1. Check condensate lines for obstructions. 2. Check float switch in condensate reservoir. 3. Check wiring from condensate reservoir to 926 control and repair as necessary.
pp	Parameters programmed	Press [S4] reset for at least 1 second.
F31	Program parameter error	Control must be re-programmed. If programming does not solve problem, control must be replaced.

Table 20



NOTE: If receiving an F09 fault code, check the gap spacing between points on the electrode by holding two quarters together and sliding them through the gap. There should be a slight resistance.

Resistance Table

System/Pipe Sensor Temperature Sensor 7250P-324
Boiler Sensor (7250P-667) Indirect/Tank Sensor (7250P-325)

Water Temperature (°F)	Resistance (ohms)
32	32550
41	25340
50	19870
59	15700
68	12490
77	10000
86	8059
95	6535
104	5330
113	4372
122	3605
131	2989
140	2490
149	2084
158	1753
167	1481
176	1256
185	1070
194	915
203	786
212	667

Figure 29

PART 12 – MAINTENANCE

CAUTION

In unusually dirty or dusty conditions, care must be taken to keep appliance cabinet door in place at all times. Failure to do so VOIDS WARRANTY!

⚠ WARNING

Allowing the appliance to operate with a dirty combustion chamber will hurt operation. Failure to clean the heat exchanger as needed by the installation location could result in appliance failure, property damage, personal injury, or death. Such product failures ARE NOT covered under warranty.

The appliance requires minimal periodic maintenance under normal conditions. However, in unusually dirty or dusty conditions, periodic vacuuming of the cover to maintain visibility of the display and indicators is recommended.

A. MAINTENANCE PROCEDURES

Periodic maintenance should be performed once a year by a qualified service technician to assure that all equipment is operating safely and efficiently. The owner should make necessary arrangements with a qualified heating contractor for periodic 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.

⚠ WARNING

The combustion chamber insulation in this product contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)."

- Avoid breathing dust and contact with skin and eyes.
- Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on job site conditions. Current NIOSH recommendations can be found on the NIOSH website: <http://www.cdc.gov/niosh/homepage.html>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
- Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent dust.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- **Eye:** Irrigate immediately.
- **Breathing:** Fresh air.

B. COMBUSTION CHAMBER COIL CLEANING INSTRUCTIONS FOR HEATER

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

- a nylon, stainless steel, or brass brush (not steel)
- gloves and eye protection

1. Shut down the boiler by using the following steps:
 - a. Close the gas valve, shut down the unit, and wait for the unit to be cool to the touch.
 - b. Disconnect the condensate piping from the outside connection, (not from the boiler side), so flow from condensate reservoir can be observed.
 - c. Disconnect electrical connections from the gas valve, spark electrode and flame rectification probe and combustion blower.
 - d. Remove the (4) screws on the aluminum $\frac{3}{4}$ " NPT connector on the right side of the gas valve.
 - e. Disconnect the wiring connected to the combustion blower motor.
 - f. Remove the (6) 10MM nuts from the burner plate assembly.

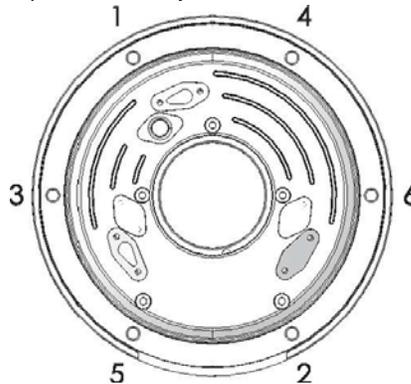


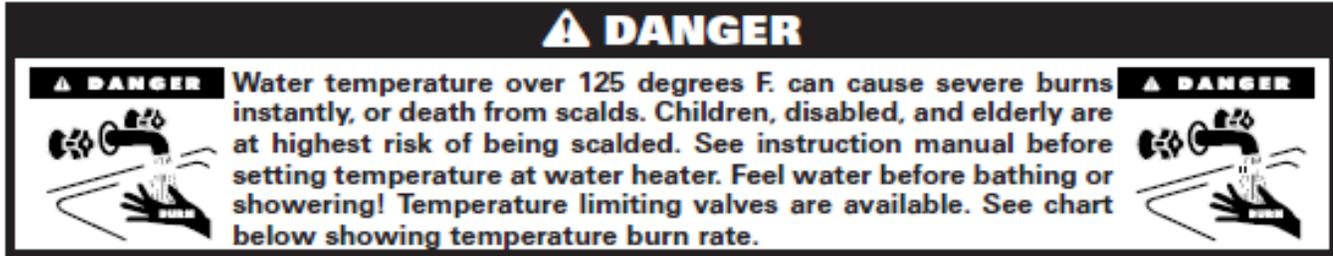
Figure 30

- g. Pull the entire burner plate assembly with blower still attached towards you, while removing or pushing aside any wiring to allow the removal of the assembly.

2. Using a spray bottle filled with tap water, spray liberally on the coils. If the condensate system is blocked, use a vacuum to clear.
3. Use the nylon, stainless steel or brass brush (do not use steel) and scrub coils to remove any buildup. Then vacuum the debris from the coils.
4. Spray the coils with clear water, making sure to confine the spray to the area being cleaned (Try to avoid getting the back ceramic wall of the unit wet). Flush the combustion chamber with fresh water until it runs clear from the condensate. At this point, the heater should be ready to be re-assembled.
 - a. Inspect gaskets.
 - b. Re-install the burner assembly.
 - c. Replace and tighten the (6) 10 mm nuts to the burner plate using staggered tightening sequence (see detail).
 - d. Re-connect all wiring connections.
 - e. Inspect the gas valve to assure the O-ring is in place.

- f. Replace the (4) screws on the aluminum connector on the gas valve. Turn the gas back on. **(IMPORTANT: CHECK FOR GAS LEAKS BEFORE TURNING THE APPLIANCE ON!)**
- g. Turn the boiler power back on and create a demand on the boiler. When boiler is lit, observe condensate flow from the boiler. Be sure the boiler is operating properly.
- h. Re-connect the condensate piping to the outside condensate connection.

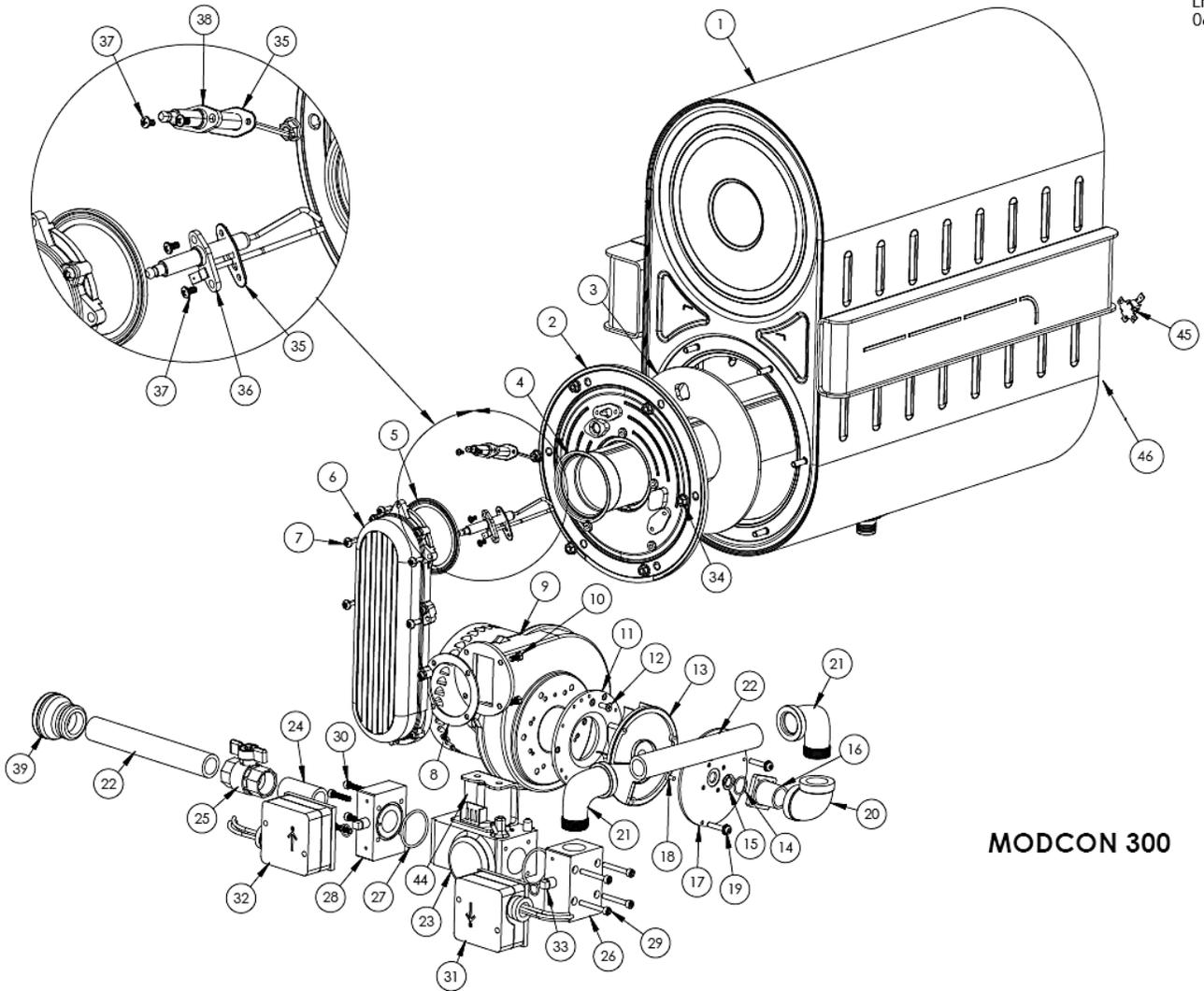
C. CLEANING WATER SIDE OF HEAT EXCHANGER



1. Make sure power is turned off to the boiler. Run water through the hot water system to assure it is below room temperature.
2. Close isolation valves on the return and supply connections to the heaters as shown in the piping diagrams within this manual. Slowly open the ball valves and release pressure into a bucket. Once pressure is released, connect a hose to the water line to flush the heater. Scale removing solution may be used, but must be approved for use with stainless steel and FDA approved for use in a potable water system.

NOTE: USE OF CLEANERS THAT ARE INCOMPATIBLE WITH STAINLESS STEEL AND NOT FDA-APPROVED WILL VOID THE BOILER WARRANTY.

3. Thoroughly flush the heat exchanger before commissioning the unit back in service.



MODCON 300

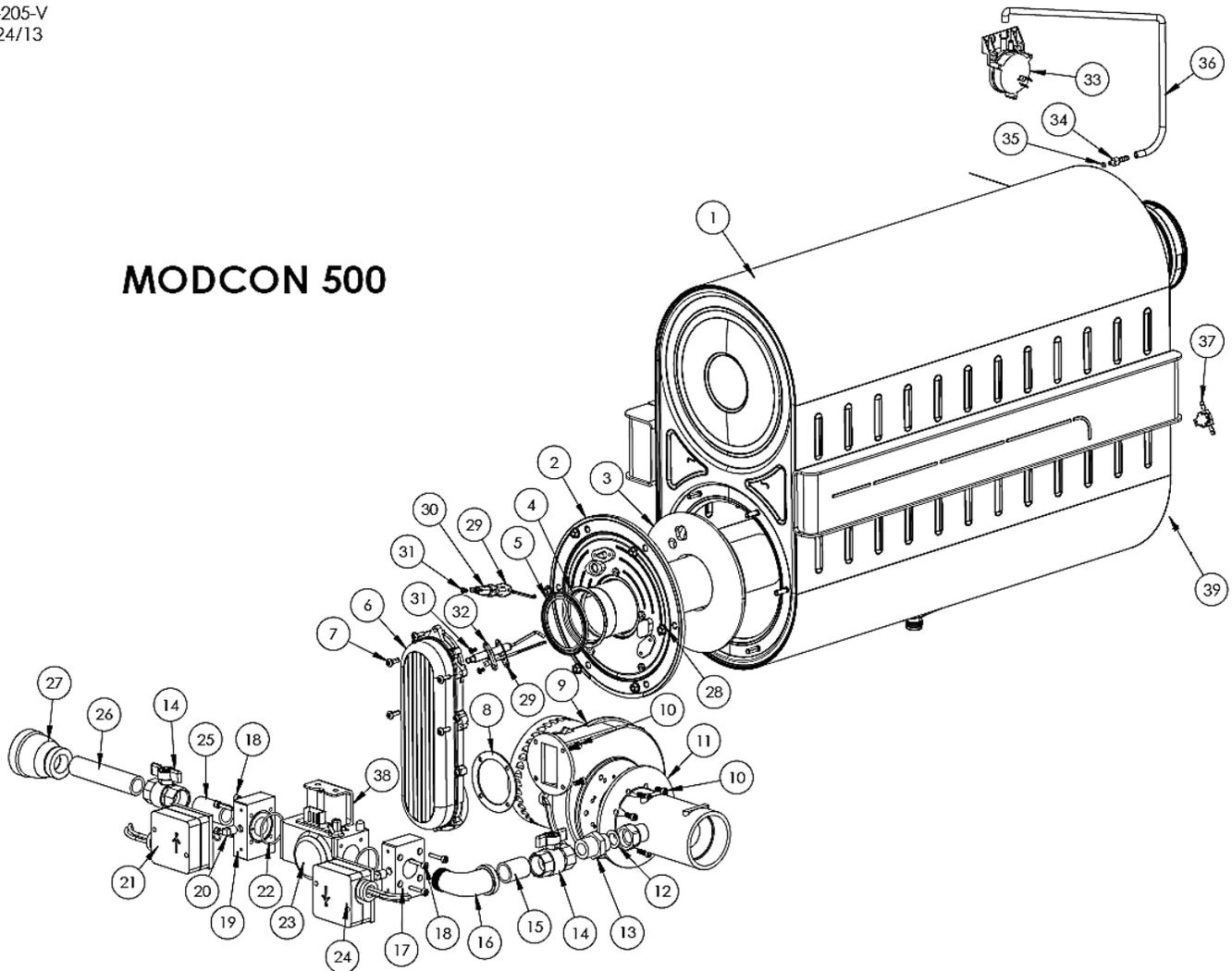
Item No	Replacement Part #	Description
1	7350P-005	300,000 BTU MOD CON MODULE
2	7350P-016	BURNER DOOR
3	7350P-018	BURNER DOOR REFRACTORY
4	7350P-031	BURNER - GCFI
5	7500P-074	BURNER MOUNTING GASKET
6	7250P-687	AIR CHANNEL
7	7250P-206	M5 X 14MM TORX SCREWS - AIR CHANNEL
8	7500P-075	GASKET - AIR CHANNEL/BLOWER
9	7350P-159	COMBUSTION BLOWER
10	7350P-119	M5 X 12MM HEX HEAD SCREW
11	7250P-711	FAN ADAPTER PLATE
12	N/A	M5 X 8MM FLAT HEAD PHILLIPS SCREW
13	7250P-712	SWIRL PLATE 16MM
14	7350P-121-3	GAS INJECTOR PLATE O-RING
15	7350P-121-4	GAS INJECTOR
16	7350P-121-2	3/4" NPT ADAPTER
17	7350P-121-1	GAS INJECTOR PLATE
18	7350P-121-5	M4 X 10MM FLAT HEAD SLOTTED SCREW
19	7350P-617	M4 X 35MM SCREW
20	7350P-083	3/4" NPT ELBOW, SCH. 40
21	7350P-084	3/4" M x 3/4" F NPT STREET ELBOW
22	7350P-074	3/4" NPT X 7" NIPPLE - PHOSPHATE COATED
23	7350P-033	GAS VALVE

Item No	Replacement Part #	Description
24	7350P-102	3/4"NPT x 2" NIPPLE - PHOSPHATE COATED
25	7350P-079	3/4" GAS BALL VALVE
26	7350P-091	GAS PRESSURE SWITCH BLOCK - RIGHT
27	7350P-077	SILICONE O-RING #127 - GAS PRESSURE SWITCH BLOCK TO GAS VALVE
28	7350P-075	GAS PRESSURE SWITCH BLOCK - LEFT
29	7350P-111	10-32 X 1-1/2" SS SOCKET CAP SCREW - PRESSURE SWITCH BLOCK
30	7250P-061	M5 X 25MM SOCKET HEAD CAP SCREW
31	7350P-035	HIGH PRESSURE GAS SWITCH w/O-RING (OPTIONAL)
32	7350P-036	LOW PRESSURE GAS SWITCH w/O-RING (OPTIONAL)
33	7350P-078	1/8-27" NPT PLUG - GAS PRESSURE SWITCH BLOCK
34	7500P-067	NUT M6 - BURNER DOOR
35	7250P-005	GASKET - PROBE/ELECTRODE
36	7350P-020	SPARK ELECTRODE
37	7250P-069	M4 X 8MM CHEESE HEAD PHILLIPS
38	7350P-022	FLAME RECTIFICATION PROBE (w/GASKET)
39	7350P-122	3/4" X 1-1/4" NPT REDUCING COUPLING BLK. IRON
40	7250P-152	SILICONE O-RING 2-007 - BARBED FITTING
41	7250P-154	S.S. BARBED FITTING 1/4 HOSE X 10-32 (w/O-RING)
42	7250P-150	BLOCKED VENT PRESSURE SWITCH
43	7000P-805	PLASTIC TUBING 3/16" ID X 5/16" OD X 12"
44	7350P-627	24VAC GAS VALVE COIL KIT
45	7350P-626	THERMAL FUSE
46	7250P-162	CERAMIC REFRACTORY (LOCATED INSIDE END OF MODULE)

Figure 31

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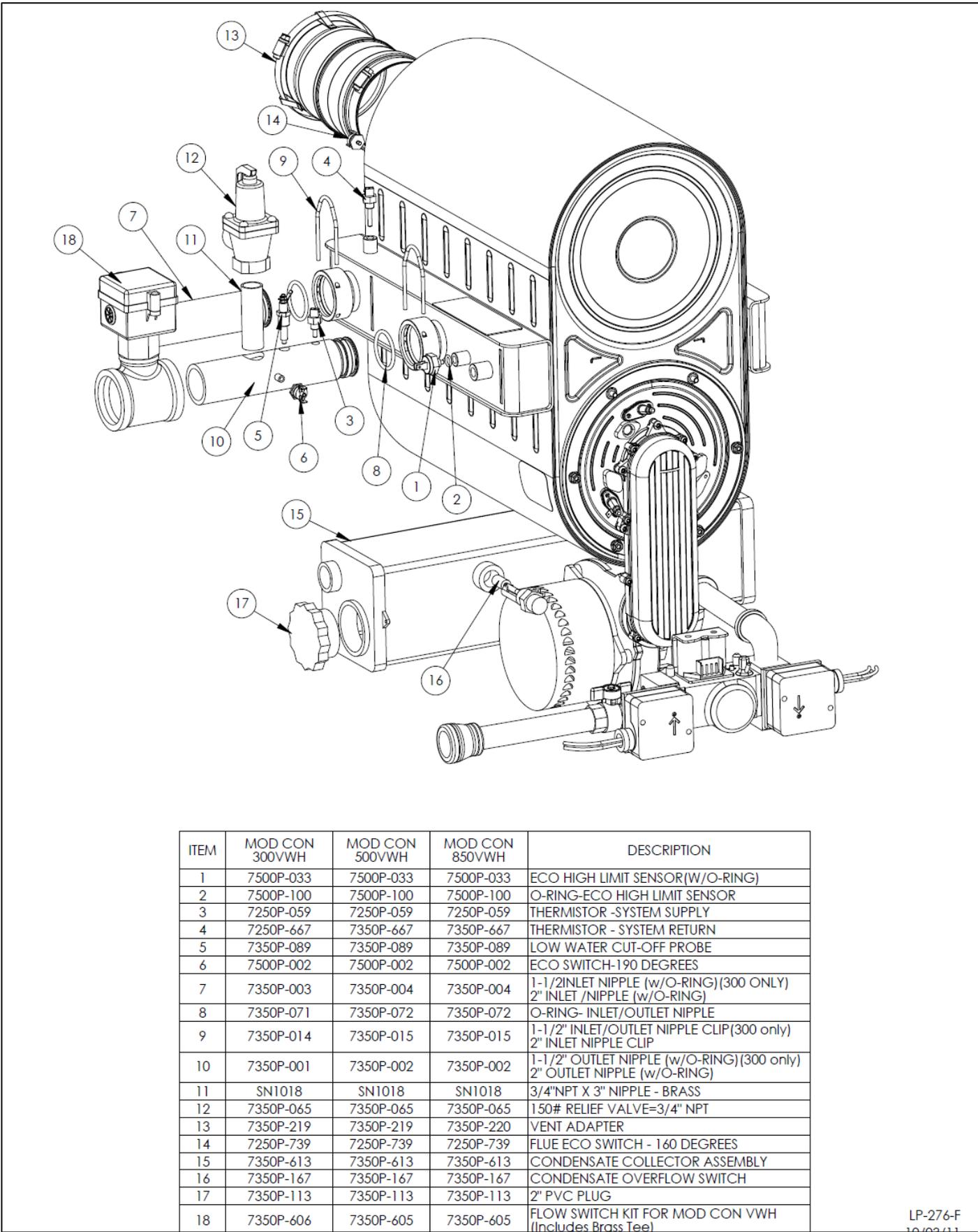
MODCON 500



Item No	Replacement Part #	Description
1	7350P-006	500,000 BTU MODCON MODULE
2	7350P-016	BURNER DOOR
3	7350P-018	BURNER DOOR REFRACTORY
4	7350P-031	BURNER - GCFI
5	7500P-074	BURNER MOUNTING GASKET
6	7250P-687	AIR CHANNEL
7	7250P-206	M5 X 14MM TORX SCREWS - AIR CHANNEL
8	7500P-075	GASKET - AIR CHANNEL/BLOWER
9	7350P-159	COMBUSTION BLOWER
10	7250P-478	M5 X 12MM ALLEN CAP SCREW - BLOWER
11	7350P-630	AIR/GAS MIXER ASSEMBLY
12	7450P-115	WASHER - AIR/GAS MIXER
13	7450P-119	3/4 NPT X 3/4 BSPP ADAPTER
14	7350P-079	3/4" GAS BALL VALVE
15	7350P-101	3/4 NPT X CLOSE NIPPLE - PHOSPHATE COATED
16	7350P-084	3/4 M X 3/4 NPT STREET ELBOW
17	7350P-075	GAS PRESSURE SWITCH BLOCK (LEFT)
18	7250P-061	M5 X 25MM SS SOCKET CAP SCREWS - SWITCH BLOCK
19	7350P-076	GAS PRESSURE SWITCH BLOCK (RIGHT)
20	7350P-078	1/8-27 NPT PLUG - SWITCH BLOCK

Item No	Replacement Part #	Description
21	7350P-036	LOW PRESSURE GAS SWITCH w/O-RING (OPTIONAL)
22	7350P-077	SILICONE O-RING #127 - SWITCH BLOCK
23	7350P-033	GAS VALVE
24	7350P-035	HIGH PRESSURE GAS SWITCH w/O-RING (OPTIONAL)
25	7350P-102	3/4" NPT X 2" NIPPLE - PHOSPHATE COATED
26	7350P-081	3/4" NPT X 4-1/2" NIPPLE - PHOSPHATE COATED
27	7350P-110	3/4" X 1-1/2" NPT REDUCING COUPLING BLACK IRON
28	7500P-067	M6 NUT - BURNER DOOR
29	7250P-005	GASKET - PROBE/ELECTRODE
30	7350P-022	FLAME RECTIFICATION PROBE (w/GASKET)
31	7250P-069	M4 X 8MM S.S. SCREW - PROBES
32	7350P-020	SPARK ELECTRODE (w/GASKET)
33	7250P-150	BLOCKED VENT PRESSURE SWITCH
34	7250P-154	S.S. BARBED FITTING 1/4 HOSE X 10-32
35	7250P-152	SILICONE O-RING 2-007 - BARBED FITTING
36	7000P-805	PLASTIC TUBING 3/16" ID X 5/16" OD X 12" LONG
37	7350P-626	THERMAL FUSE
38	7350P-627	24 VAC GAS VALVE COIL KIT
39	7250P-162	CERAMIC REFRACTORY (LOCATED INSIDE END OF MODULE)

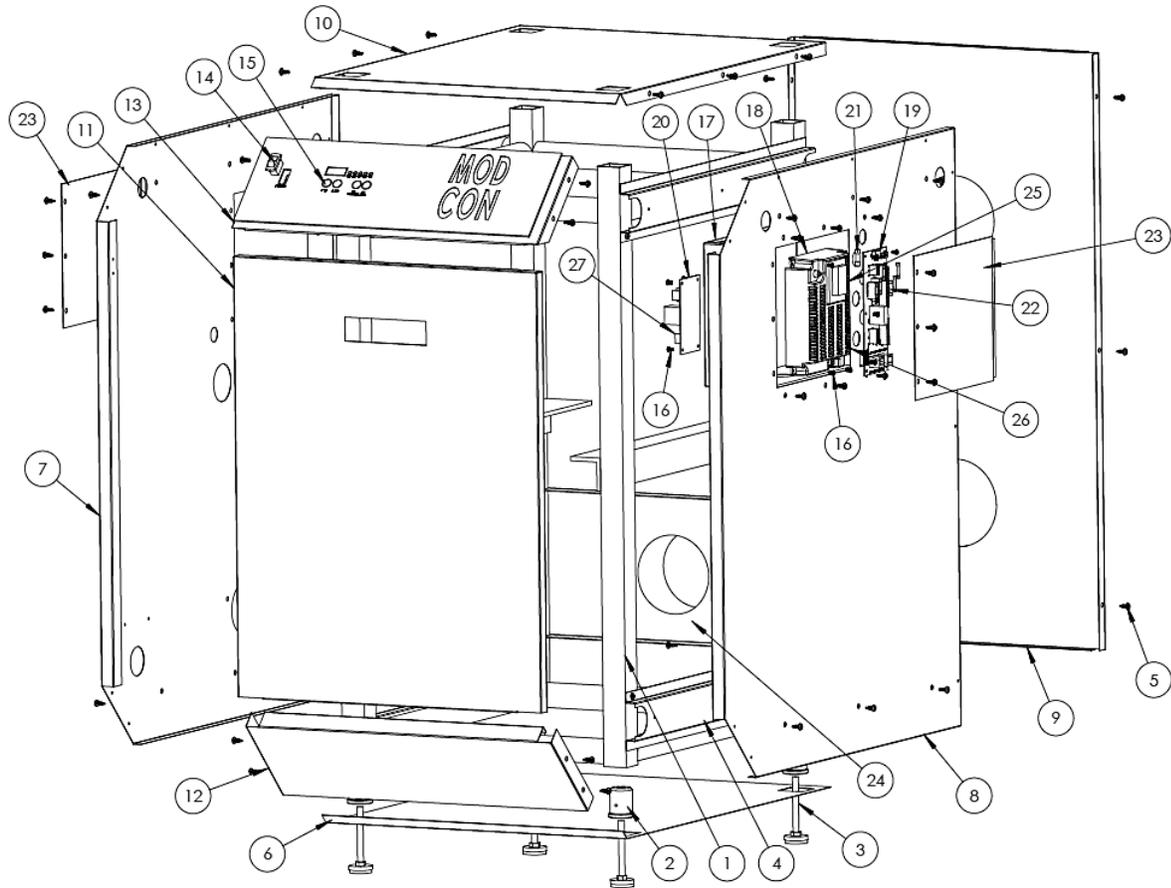
Figure 32



ITEM	MOD CON 300VWH	MOD CON 500VWH	MOD CON 850VWH	DESCRIPTION
1	7500P-033	7500P-033	7500P-033	ECO HIGH LIMIT SENSOR(W/O-RING)
2	7500P-100	7500P-100	7500P-100	O-RING-ECO HIGH LIMIT SENSOR
3	7250P-059	7250P-059	7250P-059	THERMISTOR -SYSTEM SUPPLY
4	7250P-667	7350P-667	7350P-667	THERMISTOR - SYSTEM RETURN
5	7350P-089	7350P-089	7350P-089	LOW WATER CUT-OFF PROBE
6	7500P-002	7500P-002	7500P-002	ECO SWITCH-190 DEGREES
7	7350P-003	7350P-004	7350P-004	1-1/2"INLET NIPPLE (w/O-RING)(300 ONLY) 2" INLET /NIPPLE (w/O-RING)
8	7350P-071	7350P-072	7350P-072	O-RING- INLET/OUTLET NIPPLE
9	7350P-014	7350P-015	7350P-015	1-1/2" INLET/OUTLET NIPPLE CLIP (300 only) 2" INLET NIPPLE CLIP
10	7350P-001	7350P-002	7350P-002	1-1/2" OUTLET NIPPLE (w/O-RING)(300 only) 2" OUTLET NIPPLE (w/O-RING)
11	SN1018	SN1018	SN1018	3/4"NPT X 3" NIPPLE - BRASS
12	7350P-065	7350P-065	7350P-065	150# RELIEF VALVE=3/4" NPT
13	7350P-219	7350P-219	7350P-220	VENT ADAPTER
14	7250P-739	7250P-739	7250P-739	FLUE ECO SWITCH - 160 DEGREES
15	7350P-613	7350P-613	7350P-613	CONDENSATE COLLECTOR ASSEMBLY
16	7350P-167	7350P-167	7350P-167	CONDENSATE OVERFLOW SWITCH
17	7350P-113	7350P-113	7350P-113	2" PVC PLUG
18	7350P-606	7350P-605	7350P-605	FLOW SWITCH KIT FOR MOD CON VWH (Includes Brass Tee)

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Figure 34



Item No	MOD CON 300	MOD CON 500	MOD CON 850	Description
1	7350P-039	7350P-040	7350P-041	MOD CON FRAME
2	7350P-092	7250P-092	7350P-092	LEVELING FOOT SUPPORT
3	7250P-673	7250P-673	7250P-673	LEVELING FEET KIT
4	7350P-067	7250P-068	7250P-069	JACKET MOUNTING BRACKET
5	7350P-063	7350P-063	7350P-063	#10 x 1/2" SELF TAPPING SCREW
6	7350P-059	7350P-060	7350P-061	JACKET - BOTTOM (w/SCREWS)
7	7350P-053	7350P-055	7350P-057	JACKET - LEFT SIDE (w/SCREWS)
8	7350P-054	7350P-056	7350P-058	JACKET - RIGHT SIDE (w/SCREWS)
9	7350P-049	7350P-049	7350P-126	JACKET - REAR (w/SCREWS)
10	7350P-050	7350P-051	7350P-052	JACKET - TOP (w/SCREWS)
11	7350P-047	7350P-047	7350P-047	JACKET - FRONT (w/SCREWS)
12	7350P-048	7350P-048	7350P-048	JACKET - LOWER FRONT (w/SCREWS)
13	7350P-046	7350P-046	7350P-046	JACKET - UPPER FRONT (w/MOD CON LABEL, SCREWS)
14	7500P-087	7500P-087	7500P-087	POWER SWITCH
15	7350P-009	7350P-009	7350P-009	926 DISPLAY PANEL w/RIBBON CABLE
16	7500P-115	7500P-115	7500P-115	6-32 X 1/4" PAN HEAD SCREW - ELECTRONIC BOARDS
17	7350P-042	7350P-042	7350P-042	ELECTRICAL BOX
18	7350P-008	7350P-008	7350P-008	926 CONTROL BOARD
19	7350P-070	7350P-070	7350P-070	FIELD CONNECTION BOARD
20	7250P-580	N/A	7250P-580	RELAY BOARD - 399M/MODCON850
21	7250P-378	7250P-378	7250P-378	FUSE - CONTROL BOARD - 6.3 AMPS
22	7350P-129	7350P-129	7350P-129	FUSE - CONNECTION BOARD - 3.15 AMPS
23	7350P-062	7350P-062	7350P-062	ELECTRICAL BOX/ACCESS PANEL COVER
24	7350P-103	7350P-103	7350P-104	AIR INLET BRACKET
25	7350P-025	7350P-026	7350P-043	120V WIRING HARNESS (LOCATION)
26	7350P-139	7350P-140	7350P-138	LOW VOLTAGE WIRING HARNESS (LOCATION)
27	N/A	N/A	7350P-012	BLOWER WIRING HARNESS (LOCATION)

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Figure 35

BOILER START-UP REPORT

LIGHT OFF ACTIVITIES		DATE COMPLETED _____			
1) Fill the heating system	Check all piping and gas connections, verify all are tight				
	Pressurize system	_____ PSI			
	Add water to prime condensate cup				
	Verify near heater piping is properly supported				
2) Check gas pipe	Leak test using locally approved methods (consult jurisdictional code book)				
	Check incoming gas pressure (3.5" to 14" W.C.)	_____ in w.c.	Static		
	What is the "drop" on light off (No more than 1" W.C.)?	_____ in w.c.	Dynamic		
3) Check combustion	Check and adjust (if necessary) carbon dioxide content	_____ % CO ₂	High Fire	_____ % CO ₂	Low Fire
	Check and adjust (if necessary) carbon monoxide content	_____ ppm CO	High Fire	_____ ppm CO	Low Fire
4) Verify system operation	Turn up aquastat on storage tank to verify wiring connections				
5) Record ionization current	Check uA reading at d7 on the status menu (see start-up section)	_____ uA	High Fire	_____ uA	Low Fire
6) Indirect water heater	Verify safety and operation of the indirect water heater, record settings	_____ de	_____ dh		
7) Convert the heater	If necessary, convert the heater to the proper gas type				
	Locate the stickers in the appropriate locations on the heater				
	Verify combustion settings after gas conversion, Carbon Dioxide	_____ % CO ₂	High Fire	_____ % CO ₂	Low Fire
	Verify combustion settings after gas conversion, Carbon Monoxide	_____ ppm CO	High Fire	_____ ppm CO	Low Fire
	Mail in the conversion registration				
8) System Setting	Verify system settings	_____ de	_____ dh		
	Check mixing valve				
Notes:					

Table 21

MAINTENANCE REPORT

CAUTION

In unusually dirty or dusty conditions, care must be taken to keep boiler cabinet door in place at all times. Failure to do so VOIDS WARRANTY!

WARNING

Allowing the boiler to operate with a dirty combustion chamber will hurt operation. Failure to clean the heat exchanger as needed by the installation location could result in boiler failure, property damage, personal injury, or death. Such product failures ARE NOT covered under warranty.

The boiler requires minimal periodic maintenance under normal conditions. However, in unusually dirty or dusty conditions, periodic vacuuming of the cover to maintain visibility of the display and indicators is recommended.

Periodic maintenance should be performed once a year by a qualified service technician to assure that all the equipment is operating safely and efficiently. The owner should make necessary arrangements with a qualified heating contractor for periodic maintenance of the boiler. Installer must also inform the owner that the lack of proper care and maintenance of the boiler may result in a hazardous condition.

INSPECTION ACTIVITIES		DATE LAST COMPLETED			
		1 st YEAR	2 nd YEAR	3 rd YEAR	4 th YEAR*
PIPING					
Near heater piping	Check heater and system piping for any sign of leakage; make sure they are properly supported.				
Vent	Check condition of all vent pipes and joints. Check for any obstructions at intake and exhaust termination points. Check clearances (see Venting Section for further details).				
Gas	Check Gas piping, test for leaks and signs of aging. Make sure all pipes are properly supported.				
SYSTEM					
Visual	Do a full visual inspection of all system components.				
Functional	Test all functions of the system (Heat, Safeties)				
Temperatures	Verify safe settings on heater or Anti-Scald Valve				
Temperatures	Verify programmed temperature settings				
ELECTRICAL					
Connections	Check wire connections. Make sure they are tight.				
Smoke and CO detector	Verify devices are installed and working properly. Change batteries if necessary.				
Circuit Breakers	Check to see that the circuit breaker is clearly labeled. Exercise circuit breaker.				
Switch and Plug	Verify ON/OFF switch and convenience plug are both functional				
CHAMBER/BURNER					
Combustion Chamber	Check burner tube and combustion chamber coils. Clean according to maintenance section of manual. Vacuum combustion chamber. Replace any gaskets that show signs of damage.				
Spark Electrode	Clean. Set gap at 1/4".				
Flame Probe	Clean. Check ionization in uA (d7 on status menu in Start-up Procedures). Record high fire and low fire.				
CONDENSATE					
Neutralizer	Check condensate neutralizer. Replace if necessary.				
Condensate hose	Disconnect condensate hose. Clean out dirt. Fill with water to level of outlet and re-install. (NOTE: Verify the flow of condensate, making sure that the hose is properly connected during final inspection.)				
GAS					
Pressure	Measure incoming gas pressure (3.5" to 14" W.C.)				
Pressure Drop	Measure drop in pressure on light off (no more than 1" W.C.)				
Check gas pipe for leaks	Check piping for leaks. Verify that all are properly supported.				
COMBUSTION					
CO/CO2 Levels	Check CO and CO ₂ levels in Exhaust (See Start-up Procedures for ranges). Record at high and low fire.				
SAFETIES					
ECO (Energy Cut Out)	Check continuity on Flue and Water ECO. Replace if corroded.				
Flow Switch	Activate heating call and monitor system to ensure flow switch and pump are operating correctly.				
Thermistors	Check wiring. Verify through ohms reading.				
FINAL INSPECTION					
Check list	Verify that you have completed entire check list. WARNING: FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY OR DEATH.				
Homeowner	Review what you have done with the homeowner.				

Table 22 - *Continue annual maintenance beyond the 4th year as required.

ADDITIONAL INSTALLATION REQUIREMENTS FOR THE COMMONWEALTH OF MASSACHUSETTS

In the Commonwealth of Massachusetts, the installer or service agent shall be a plumber or gas fitter licensed by the Commonwealth.

When installed in the Commonwealth of Massachusetts or where applicable state codes may apply; the unit shall be installed with a CO detector per the requirements listed below.

5.08: Modifications to NFPA-54, Chapter 10

(1) Revise NFPA-54 section 10.5.4.2 by adding a second exception as follows:

Existing chimneys shall be permitted to have their use continued when a gas conversion burner is installed, and shall be equipped with a manually reset device that will automatically shut off the gas to the burner in the event of a sustained back-draft.

(2) Revise 10.8.3 by adding the following additional requirements:

(a) 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 service 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 cannot 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.

(c) MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM PROVIDED. When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components; and
2. A complete parts list for the venting system design or venting system.

(d) MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED. When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

(e) A copy of all installation instructions for all Product Approval side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

HTP CUSTOMER INSTALLATION RECORD FORM

The following form should be completed by the installer for you to keep as a record of the installation in case of a warranty claim. After reading the important notes at the bottom of the page, please also sign this document.

Customer's Name:	
Installation Address:	
Date of Installation:	
Installer's Code/Name:	
Product Serial Number(s):	
Comments:	
Installer's Phone Number:	
Signed by Installer:	
Signed by Customer:	

IMPORTANT NOTES:

Customer: Please only sign after the installer has reviewed the installation, safety, proper operation and maintenance of the system. In the case that the system has any problems, please call the installer. If you are unable to make contact, please contact your HTP Sales Representative.

Distributor/Dealer: Please insert contact details.