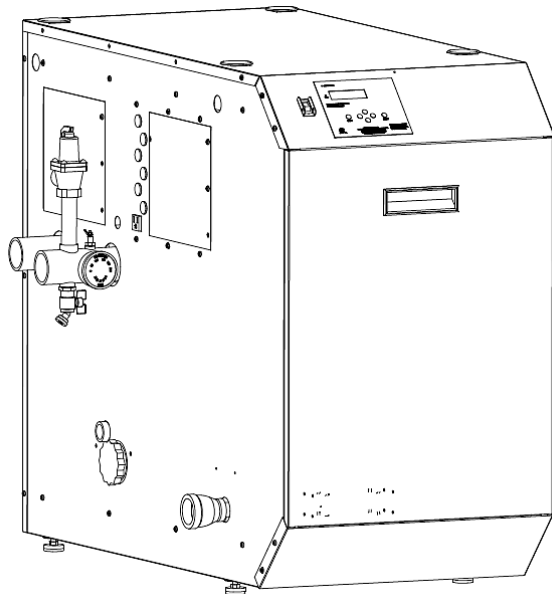




# Mod Con VWH



**INSTALLATION**

**START-UP**

**MAINTENANCE**

**PARTS**

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

**THIS MANUAL IS FOR USE WITH MOD CON BOILERS MANUFACTURED AFTER  
DECEMBER 1, 2012**



*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.

## **⚠ WARNING**

Improper installation, adjustment, alteration, service, or maintenance could void product warranty and cause property damage, 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.

The surfaces of these products contacted by consumable water contain less than 0.25% lead by weight, as required by the Safe Drinking Water Act, Section 1417.

**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

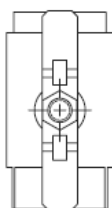
**WARNING: If you do not follow these instructions exactly, a fire or explosion may result, causing property damage, personal injury or loss of life.**

- |  |  |
|--|--|
| <p><b>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.</b></p> <p><b>B. BEFORE OPERATING</b> 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><b>WHAT TO DO IF YOU SMELL GAS</b></p> <ul style="list-style-type: none"> <li>• Do not try to light any appliance</li> <li>• Do not touch any electric switch; do not use any phone in your building</li> <li>• Immediately call your gas supplier from a neighbor's phone. Follow the gas suppliers' instructions.</li> </ul> | <ul style="list-style-type: none"> <li>• If you cannot reach your gas supplier, call the fire department.</li> </ul> <p><b>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.</b></p> <p><b>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.</b></p> |
|--|--|

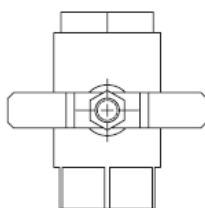
### OPERATING INSTRUCTIONS

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. STOP! Read the safety information above.</li> <li>2. Set the thermostat to lowest setting.</li> <li>3. Turn off all electric power to the appliance.</li> <li>4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.</li> </ol> | <ol style="list-style-type: none"> <li>5. Remove front cover.</li> <li>6. Turn gas shutoff valve to "off". Handle will be across the piping, do not force.</li> <li>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.</li> <li>8. Turn gas shutoff valve to "on". Handle will be in line with piping.</li> <li>9. Install Front Cover.</li> <li>10. Turn on all electric power to appliance.</li> <li>11. Set thermostat to desired setting.</li> <li>12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.</li> </ol> |
|---|---|

**GAS VALVE  
ON**



**GAS VALVE  
OFF**



### TO TURN OFF GAS TO APPLIANCE

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

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.

**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 combustible 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.

### ⚠ 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

## 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.

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 1 – 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 2 – 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  $\rightarrow M_f = \frac{\text{VWH Outlet Temp} - 40}{70}$

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

**Example:**

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

VWH Outlet Temp  $\rightarrow$  140°F

2 Storage Tanks (80 Gallons Each)  $\rightarrow$  Total Storage = 160 Gallons

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

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

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

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

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<sup>®</sup> 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.

**NOTE:** When using a system sensor, pipe insulation must be wrapped around it to improve temperature measurement accuracy and increase overall system efficiency.

**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.

**Integrated Venturi (500 Models) or Swirl Plate (850 Models)** – 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.

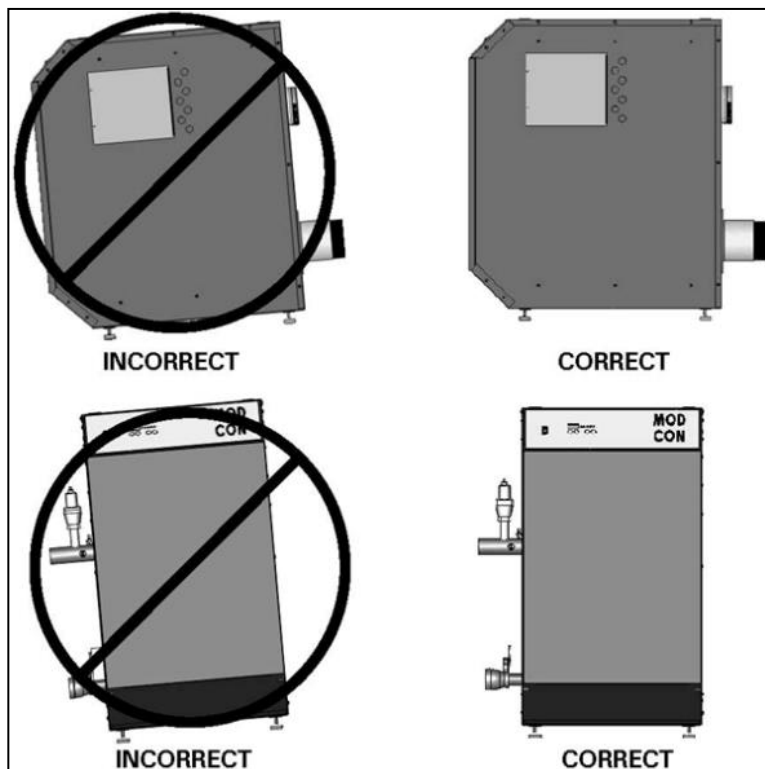
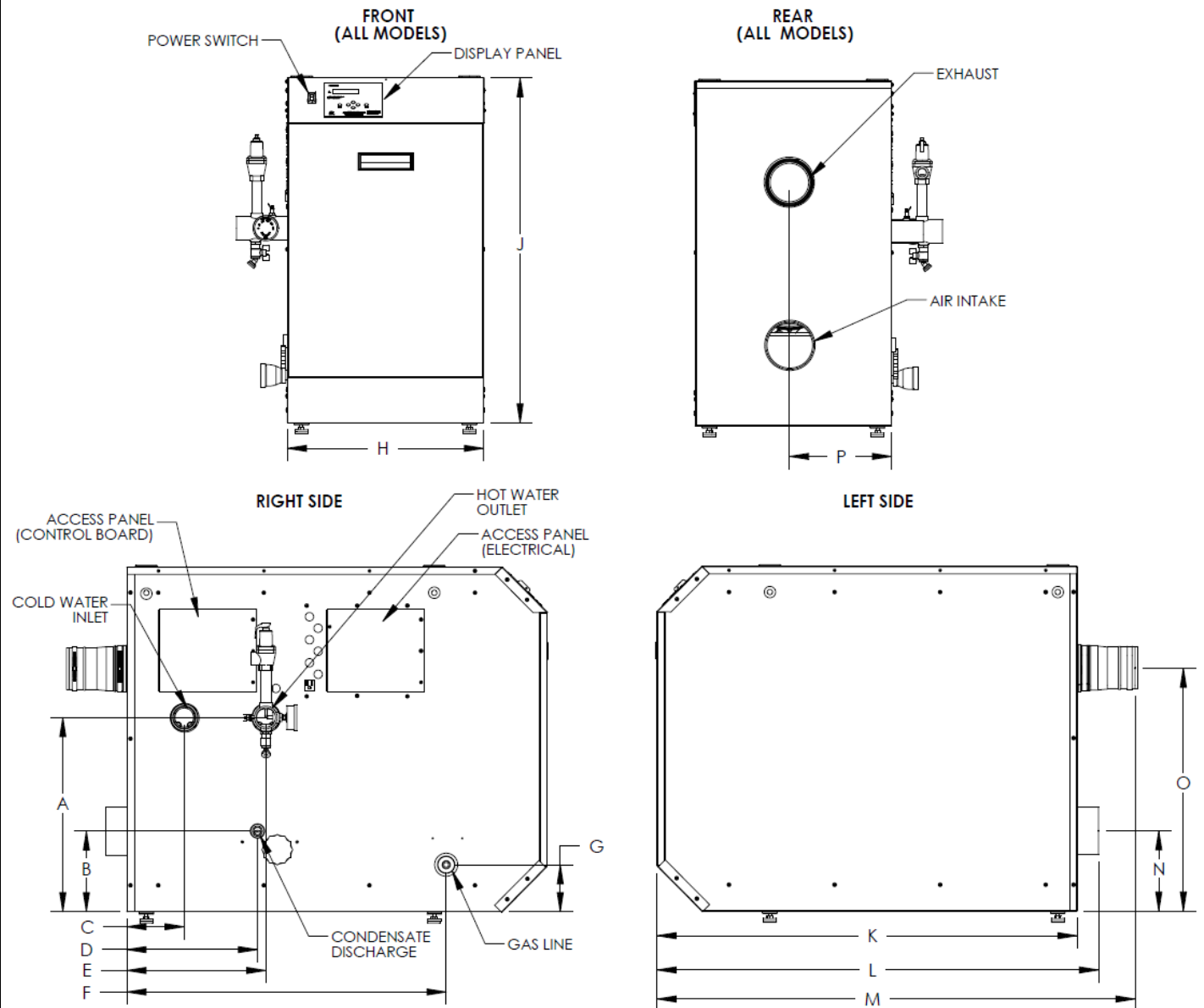


Figure 1 – Leveling



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.
MOD CON 500	100,000-500,000	470,000	409,000	94%	4.2	2"	1-1/2"	4"	505
MOD CON 850	170,000-850,000	799,000	695,000	94%	5.8	2"	2"	6"	580

LP-445-C  
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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**

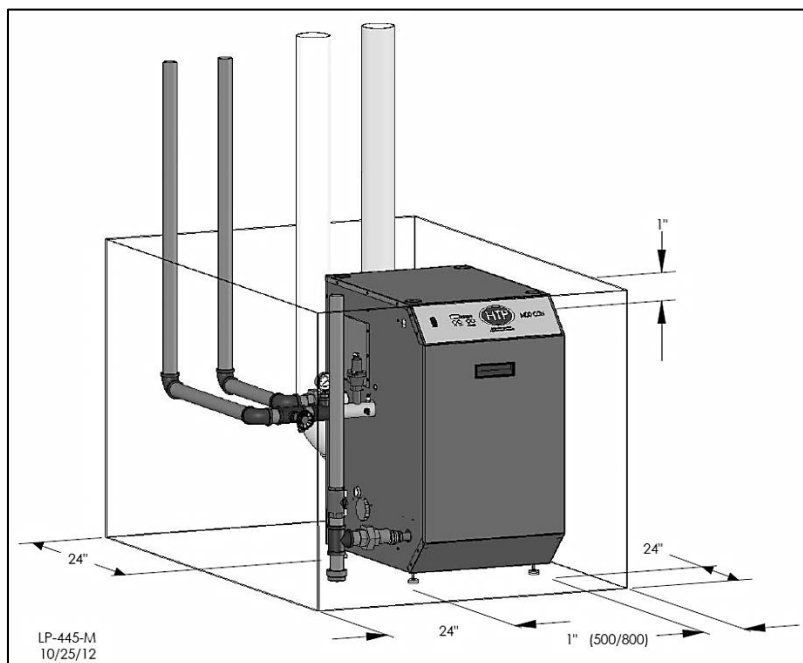
Space must be provided with combustion/ventilation air openings correctly sized for all appliances located in the same space as the boiler. The boiler venting cover must be securely fastened to prevent it from drawing air from the boiler room. This is particularly important if the boiler is in a room 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 PIPE**

### **⚠ WARNING**

Vents must be properly supported. The boiler exhaust and intake 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 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 3 in this section when considering exhaust vent and intake pipe termination.**

Exhaust vent and intake pipe must terminate near each other and may be vented vertically through the roof or out a side wall. Exhaust vent and intake piping methods are detailed in the Venting Section. Do not attempt installation using any other means. Be sure to locate the boiler so exhaust vent and intake piping can be routed through the building and properly terminated. The exhaust vent and intake 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 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 3 – 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**

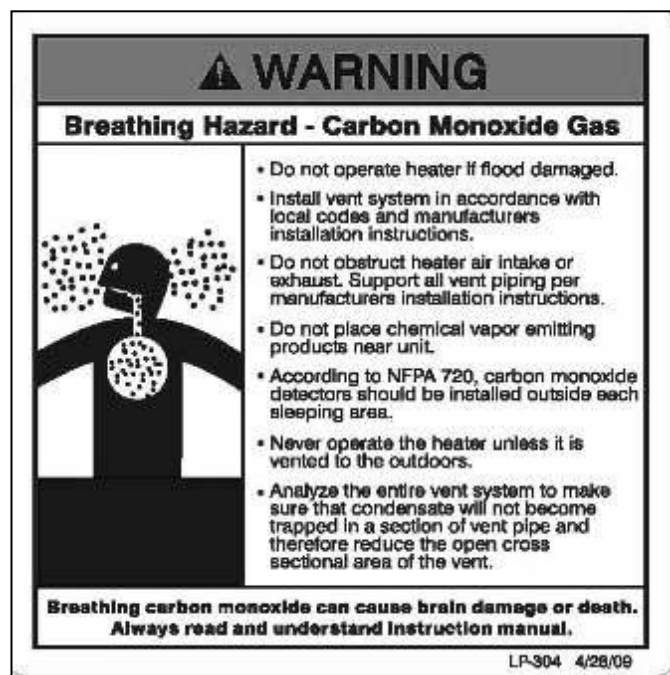
Do not install the boiler into a common vent with any other boiler. This will cause flue gas spillage or boiler malfunction, resulting in possible substantial property damage, severe personal injury, or death.

#### **⚠ 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  $\frac{3}{4}$ " 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.

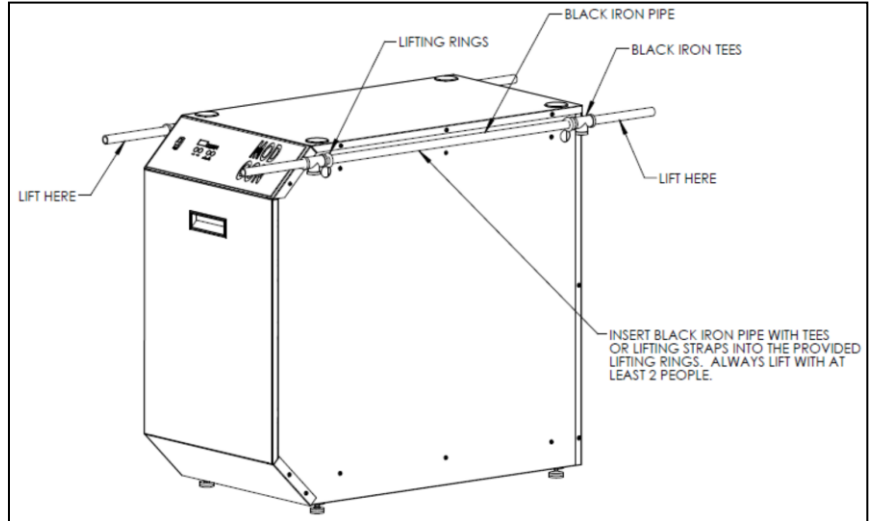


Figure 5 – Lifting the Mod Con

## **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**

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.**

## ⚠ 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.**



### 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.

#### HEATER WATER VOLUME

500 VWH	4.2 Gallons
850 VWH	5.8 Gallons

**Table 4**

2. The expansion tank must be located as shown in 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.

## ⚠ 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.

### D. CIRCULATOR PUMPS

## ⚠ 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 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. SCALDING**

### ⚠ 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**

### **⚠ 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 5**

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 5 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 500 boilers with a design of 30°F temperature rise, with each boiler having an individual flow rate of 33 gpm. To correctly size the manifold feeding these (5) Mod Con 500 boilers, you would need a pipe size of 4".

## **F. 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**

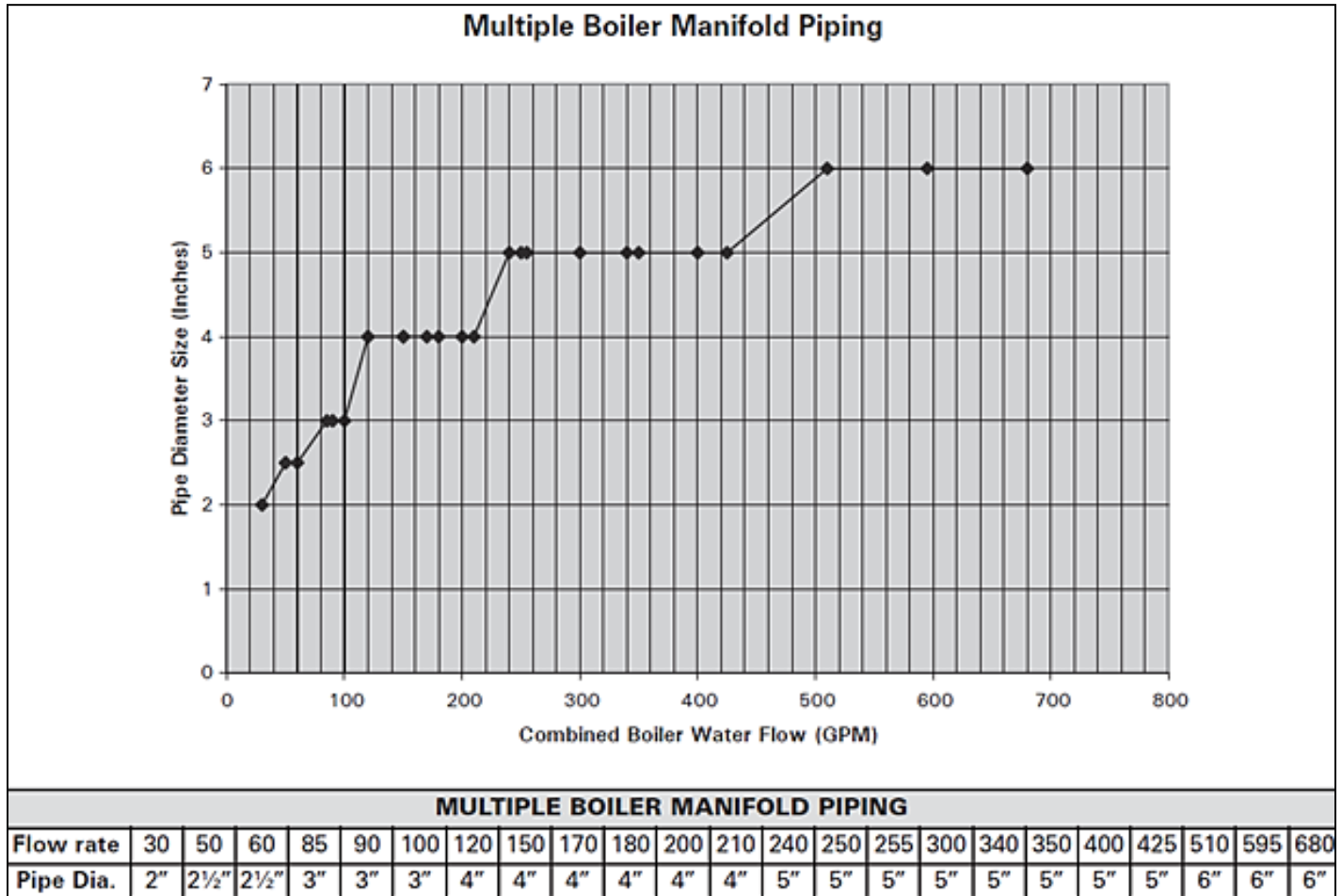
Water temperature above 140°F requires the circulator pump to run continuously and water hardness between 5 and 7 grains. Hardness above 7 grains will damage the heat exchanger and shorten the service life of the boiler.

In addition, the heat exchanger has a minimum total water volume that must be taken into account when sizing the circulator. Minimum flow rates are listed in the table below.

#### MINIMUM HEATER FLOW RATES

MODEL	MINIMUM FLOW (GPM)
MODCON500VWH	33
MODCON850VWH	54

**Table 6 – Minimum Flow Rates**



**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.

SYSTEM TEMPERATURE RISE CHART						
MODEL	20°Δt		25°Δt		30°Δt	
	Friction Feet	Flow GPM	Friction Feet	Flow GPM	Friction Feet	Flow GPM
MODCON500	19	50	11	40	8	33
MODCON850	35	85	26	65	18	54

**Table 8 – Temperature Rise Chart**

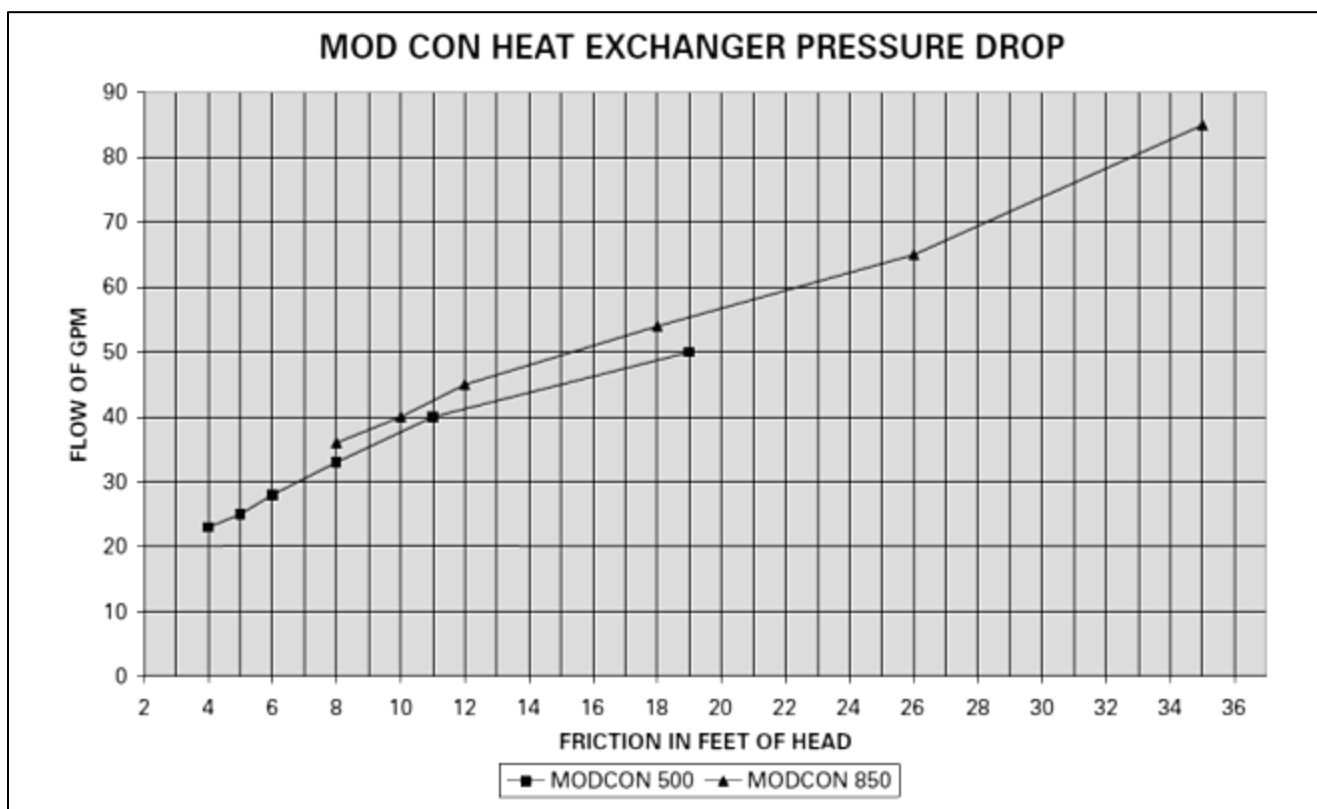


Table 9 – Mod Con Heat Exchanger Pressure Drop

## G. 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 7. 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:**

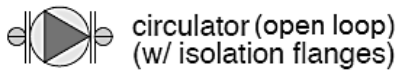
Field supplied: Recommended for unit serviceability. **DO NOT USE DIELECTRIC UNIONS!**  
**ONLY BRASS, COPPER, OR STAINLESS STEEL.**

#### **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.

H. PIPING DIAGRAMS

# Piping Symbol Legend



circulator (open loop)  
(w/ isolation flanges)



thermostatic  
mixing valve



flow switch



pressure gauge



gate valve



pressure relief valve



globe valve



temperature /  
pressure gauge



ball valve



union



swing-check valve



vacuum breaker



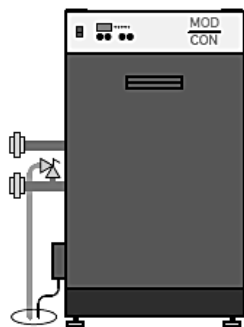
spring-loaded check valve



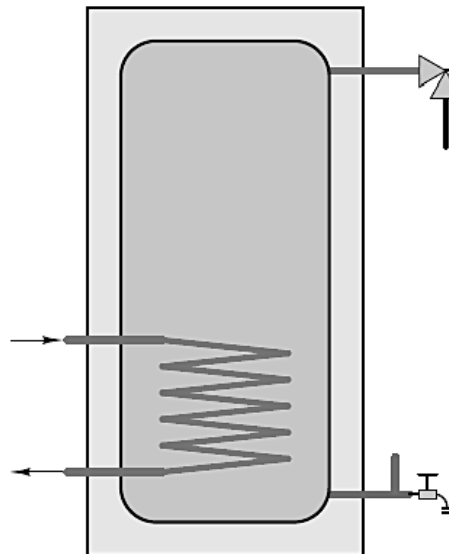
hose bib / boiler drain



diaphragm-type  
expansion tank  
(for potable water)



MOD CON VWH



SSU Storage Tank

Figure 6

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

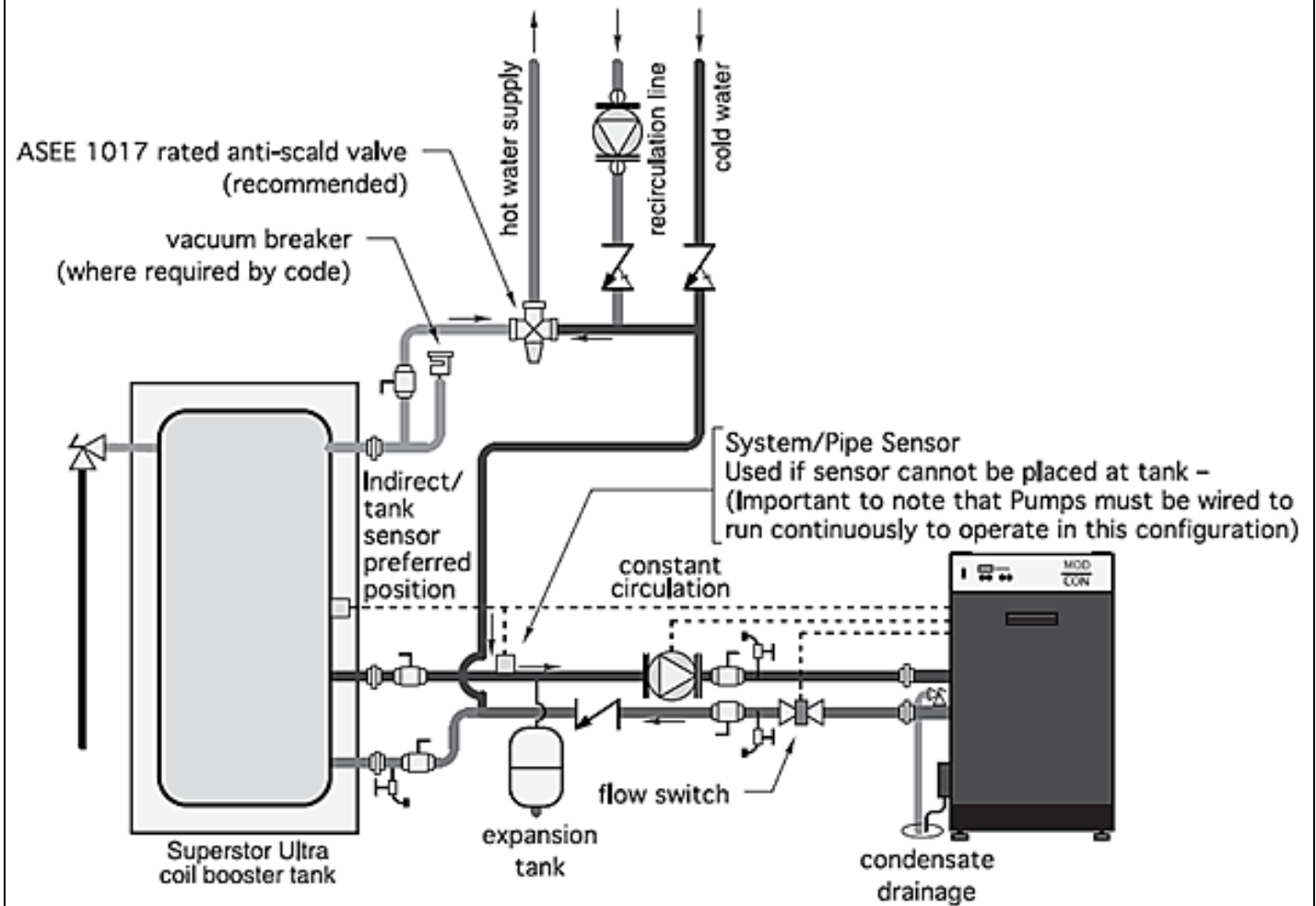


Figure 7

## 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 1/2".
5. The minimum pipe size for connecting the boiler is 2".
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)

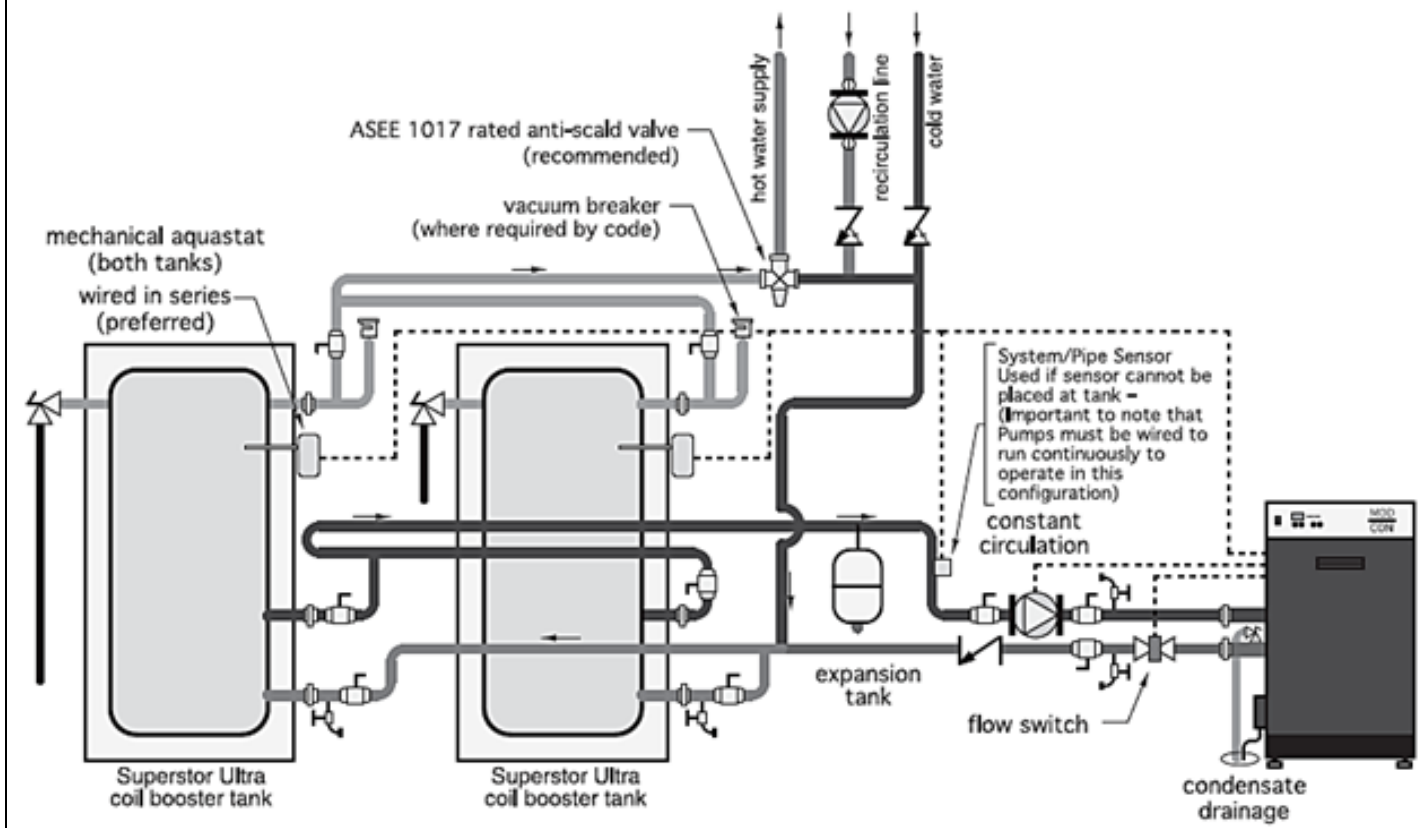
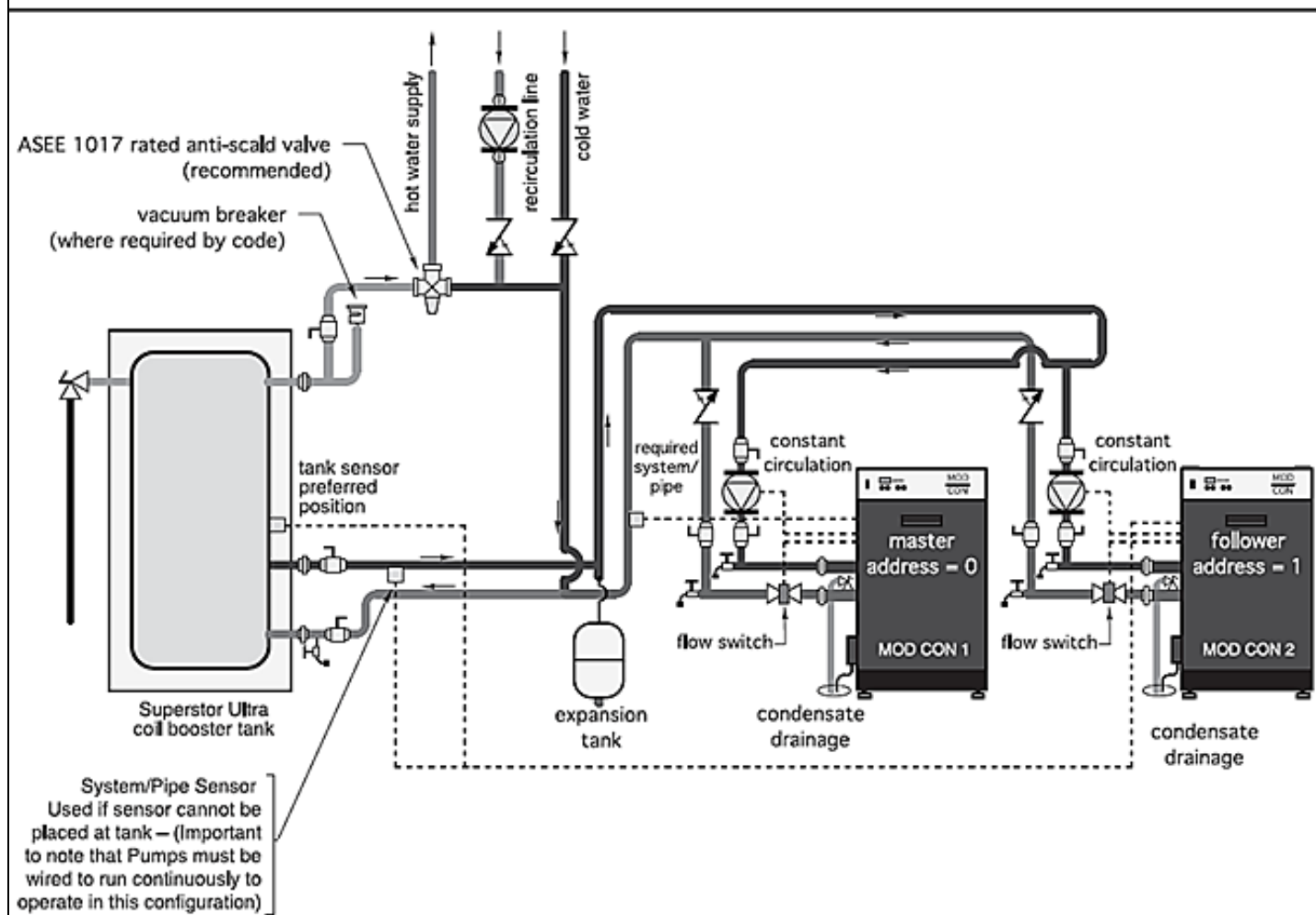


Figure 8

## 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 1/2".
5. The minimum pipe size for connecting the boiler is 2".
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)

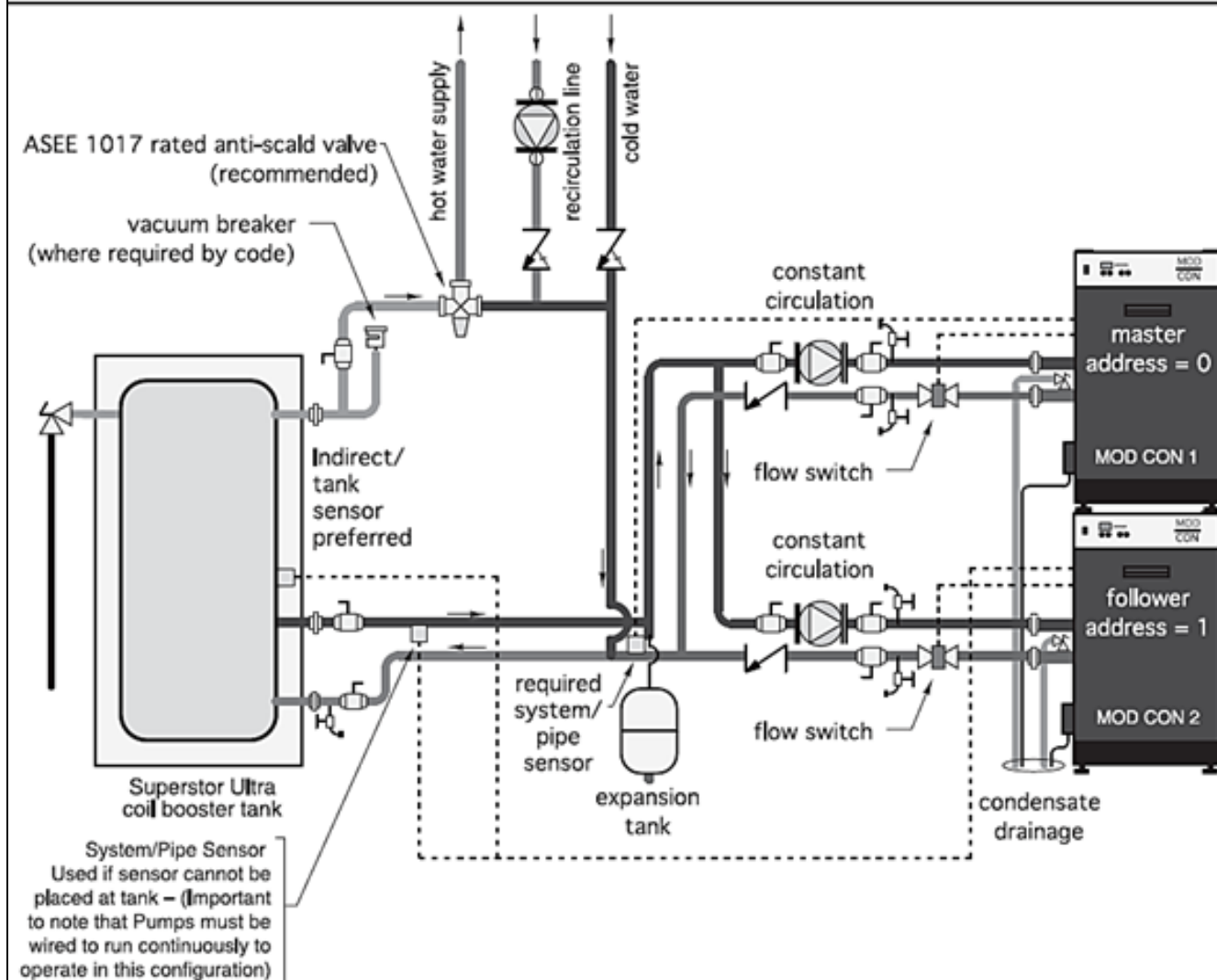


**Figure 9 NOTES:**

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 1/2".
5. The minimum pipe size for connecting the boiler is 2".
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 1/2".
5. The minimum pipe size for connecting the boiler is 2".
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)

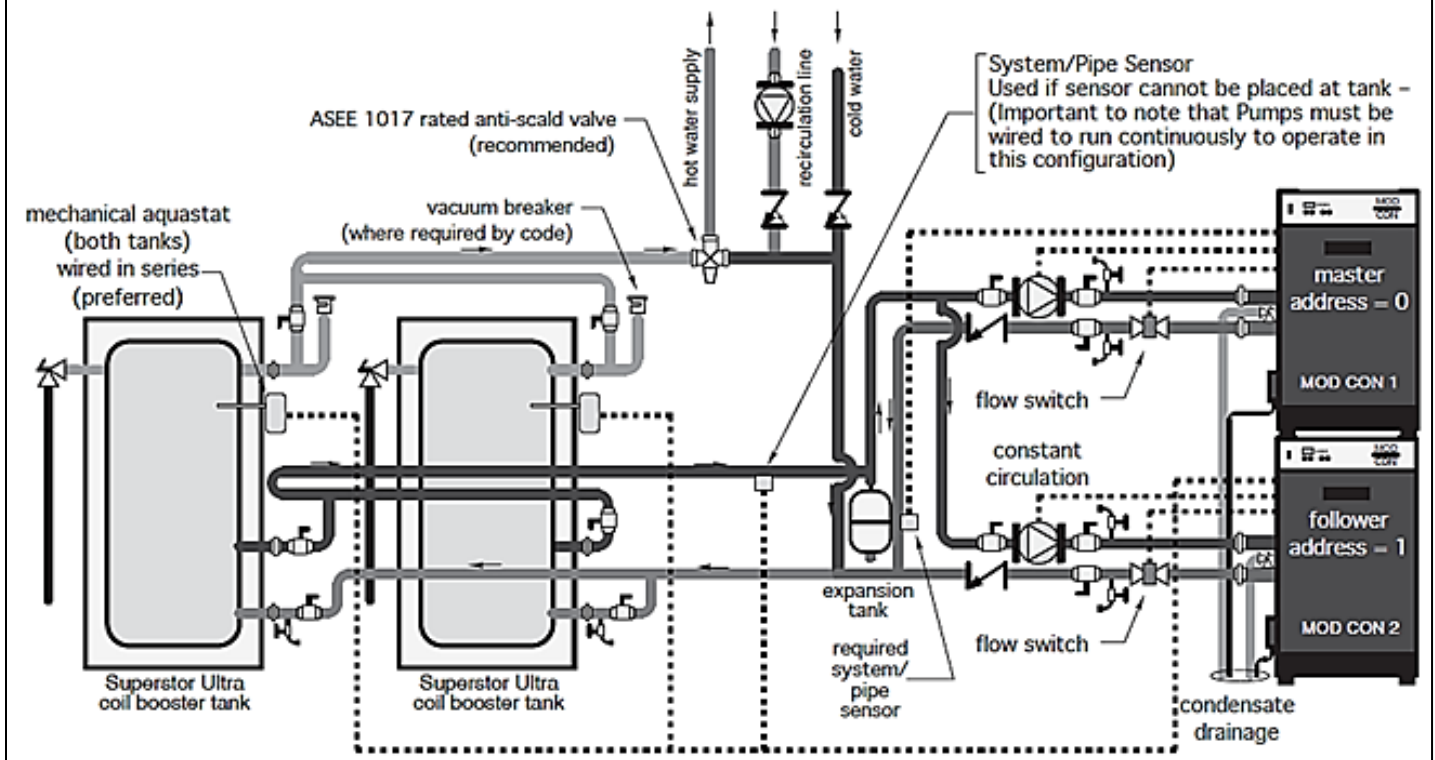


Figure 11

## 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 2".
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)

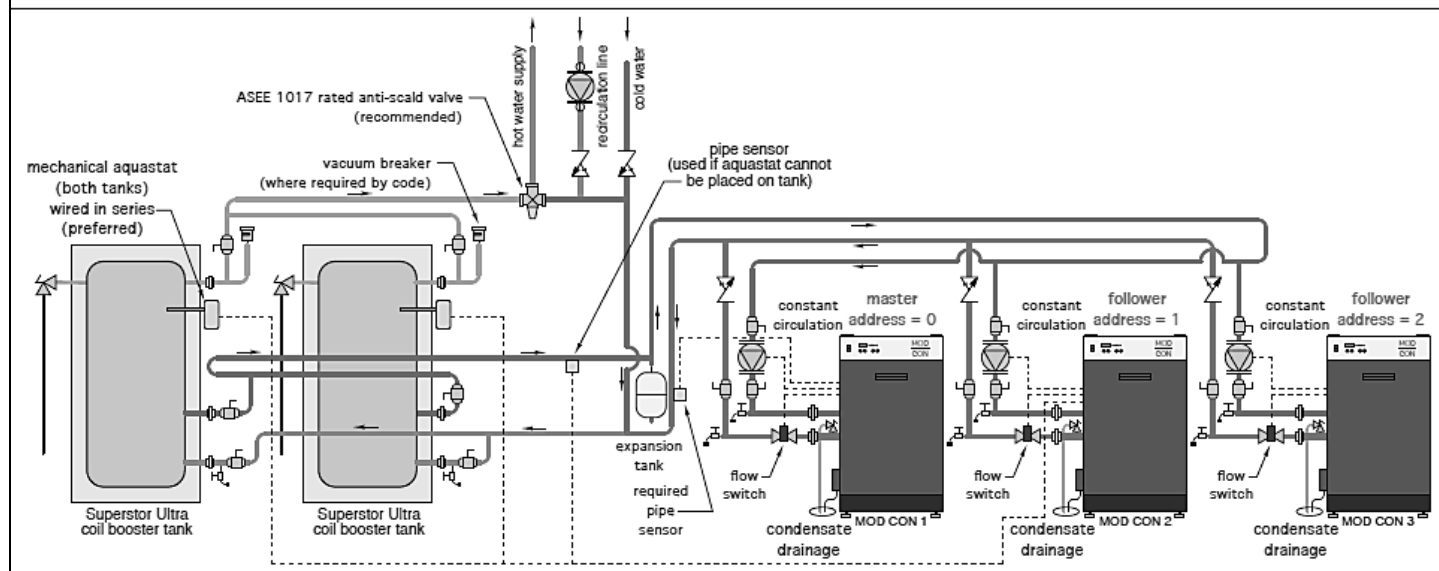


Figure 12

## 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 1/2".
5. The minimum pipe size for connecting the boiler is 2".
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 vent and intake piping complies with these instructions regarding vent system. Inspect finished exhaust vent and intake 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.

### **DANGER**

Exhaust vent and intake pipe 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.


**NOTE:** If exhaust vent pipe system passes through an unheated space, such as an alcove or attic, the space must be heated or the pipe must be insulated. The insulation must have an R value sufficient to prevent freezing of the condensate.

### **DANGER**

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

**⚠ 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

### **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 vent and intake 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 VENT AND INTAKE PIPE**

APPROVED EXHAUST VENT AND INTAKE PIPE MATERIAL			
Item	Material	Standards for Installation in:	
		United States	Canada
Exhaust vent or Intake 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	Certified for Category IV and direct vent appliance venting
	Stainless Steel AL29-4C	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 10

## **DANGER**

- The exhaust and intake 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 10. 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.

## **CAUTION**

High heat sources (sources generating heat 100°F / 37°C or greater, such as stove pipes, space heaters, etc.) may damage plastic components of the boiler as well as plastic vent pipe materials. Such damages ARE NOT covered by warranty. It is recommended to keep a minimum clearance of 8" from high heat sources. Observe heat source manufacturer instructions, as well as local, state, provincial, and national codes, laws, regulations and ordinances when installing this boiler and related components near high heat sources.

### **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.

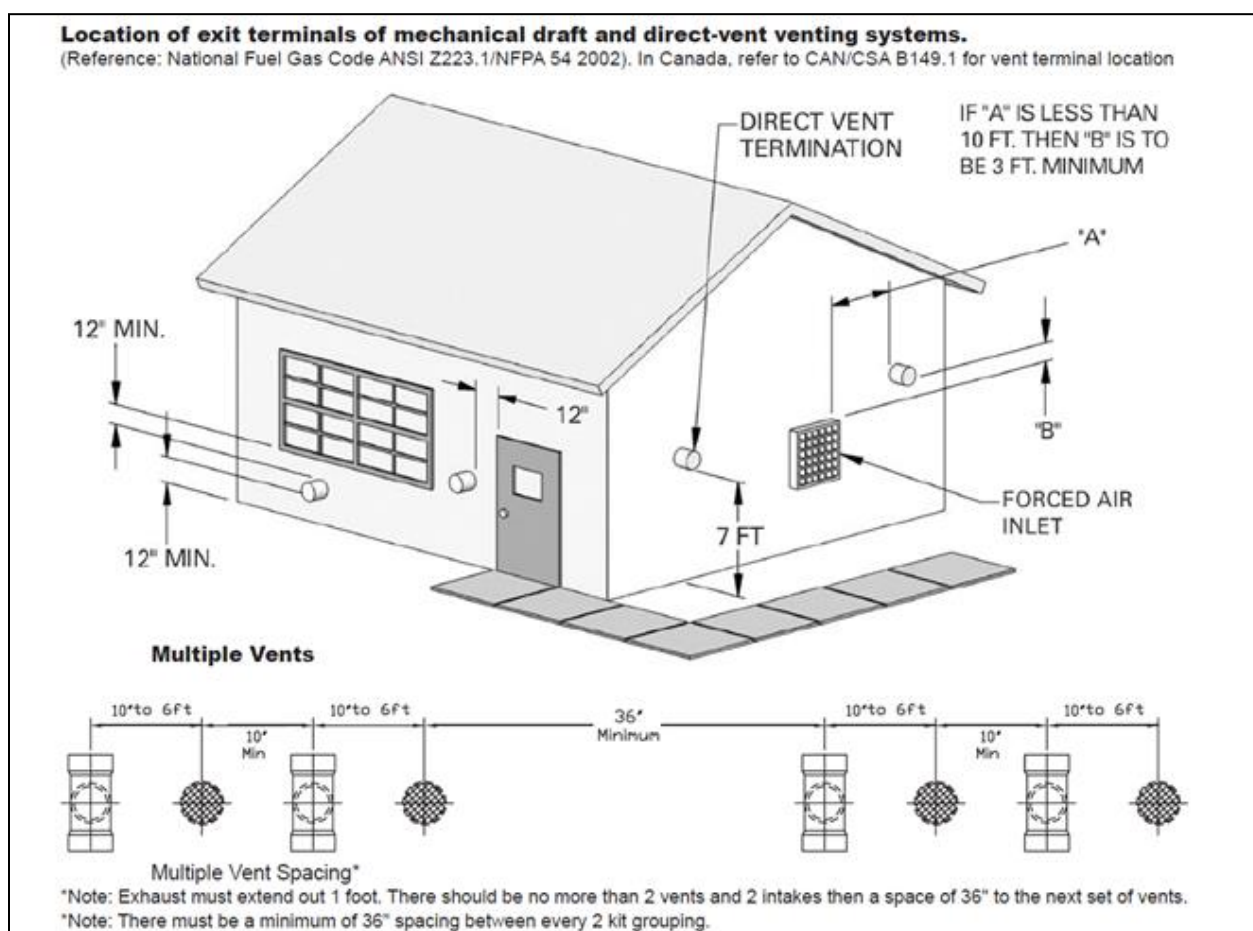


Figure 13

#### **D. EXHAUST VENT AND INTAKE PIPE LOCATION**

### **⚠ WARNING**

You must insert the provided exhaust and intake screens 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 intake pipe location:

- Provide 1 foot of clearance from the bottom of the intake pipe and the level of maximum snow accumulation. Snow removal may be necessary to maintain clearances.
- Do not locate the intake pipe in a parking area where machinery may damage the pipe.
- 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 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 11 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 11 – 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.

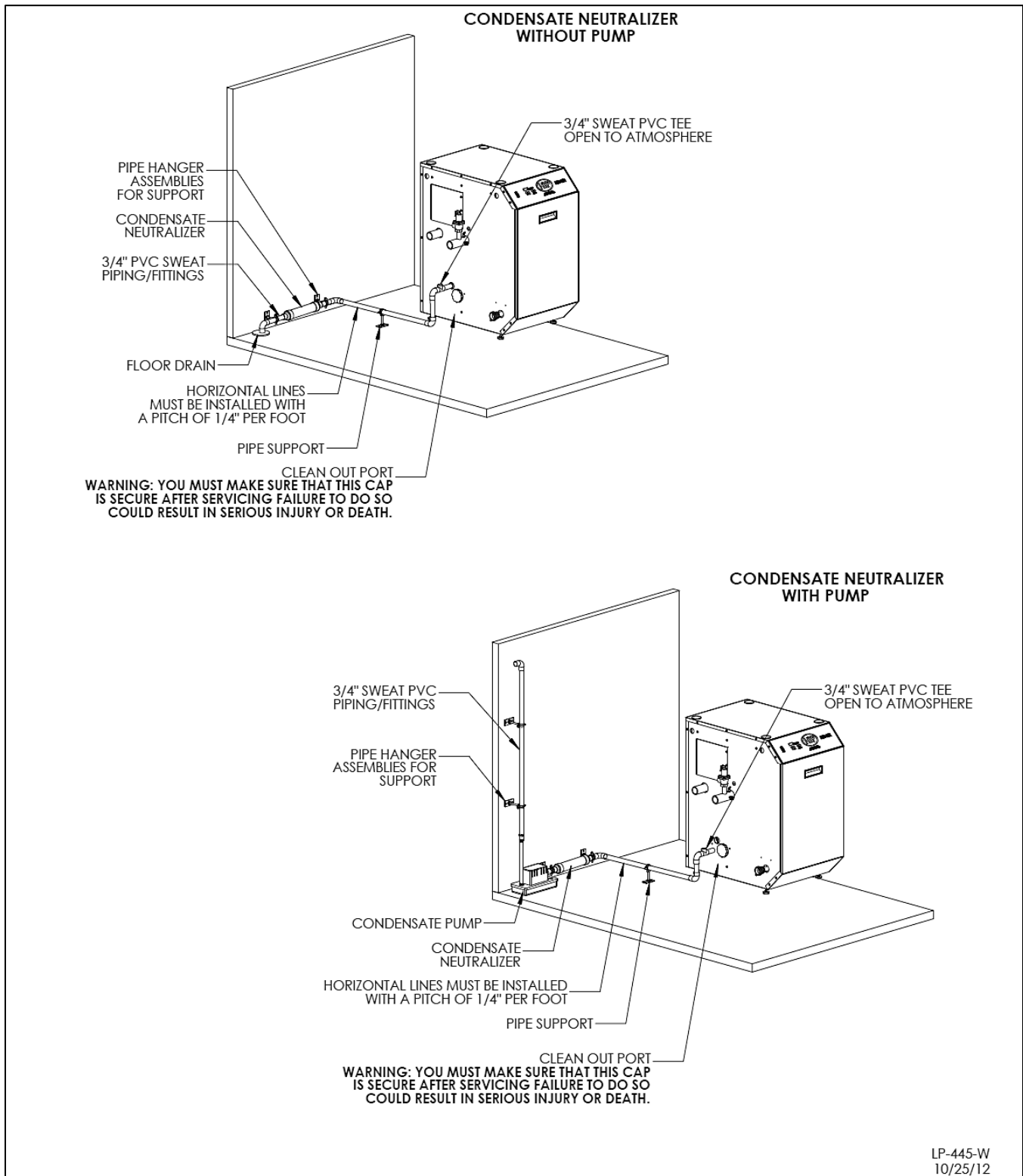
### 4. Condensate neutralization

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 PIPE SIZING**

1. The exhaust vent and intake pipe are 4" for the Mod Con 500 and 6" for the Mod Con 850.
2. The total equivalent length of exhaust vent and intake pipe should not exceed 200 feet.
  - a. The equivalent length of friction loss in elbows, tees, and other fittings are listed in Table 12.

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 12 – 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 Equivalent Length =  $(2 \times 3) + 10 = 16$  feet.

Further, if the intake pipe has two short 90° elbows, one 45° elbow, and 10 feet of PVC pipe, the following calculation applies: Intake Pipe Equivalent Length =  $(2 \times 3) + 1 + 10 = 17$  feet.

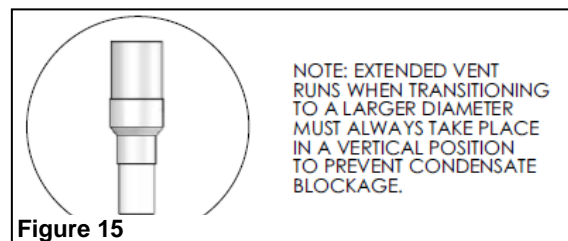
Therefore, total equivalent length equals 33 feet.

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

d. The minimum total equivalent length is 16 feet.

### **F. LONGER VENT RUNS**

The maximum total equivalent length can be extended by equally increasing the diameter of both the exhaust vent and intake pipes. However, the transitions should begin a minimum of 16 total equivalent feet from the boiler.



**Figure 15**

The maximum equivalent length for increased diameter vent pipes is 275 ft, which includes the 16 ft from the boiler with transition total of 259 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 13 – Vent Transition Fitting**

### **G. EXHAUST VENT AND INTAKE 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

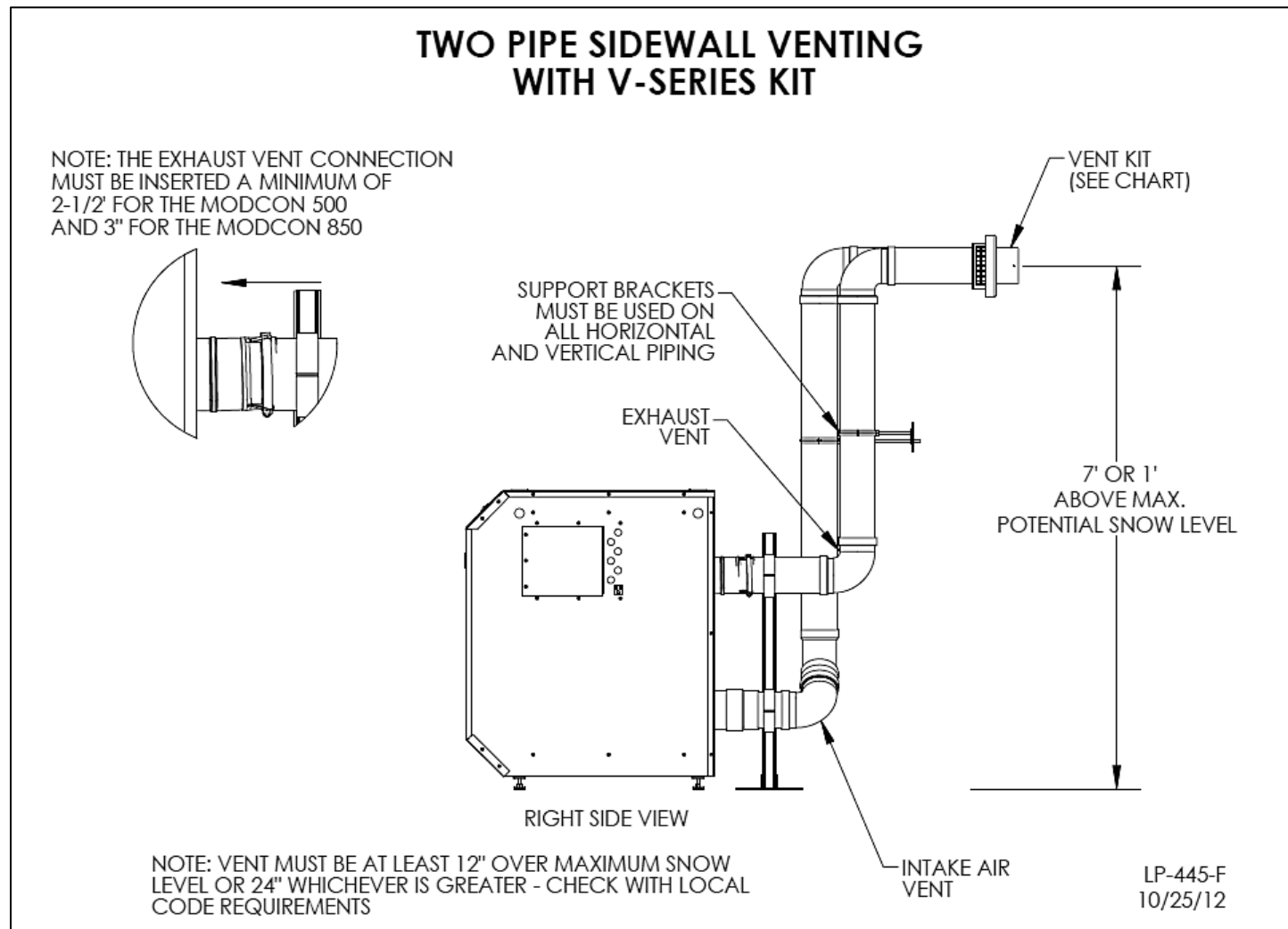
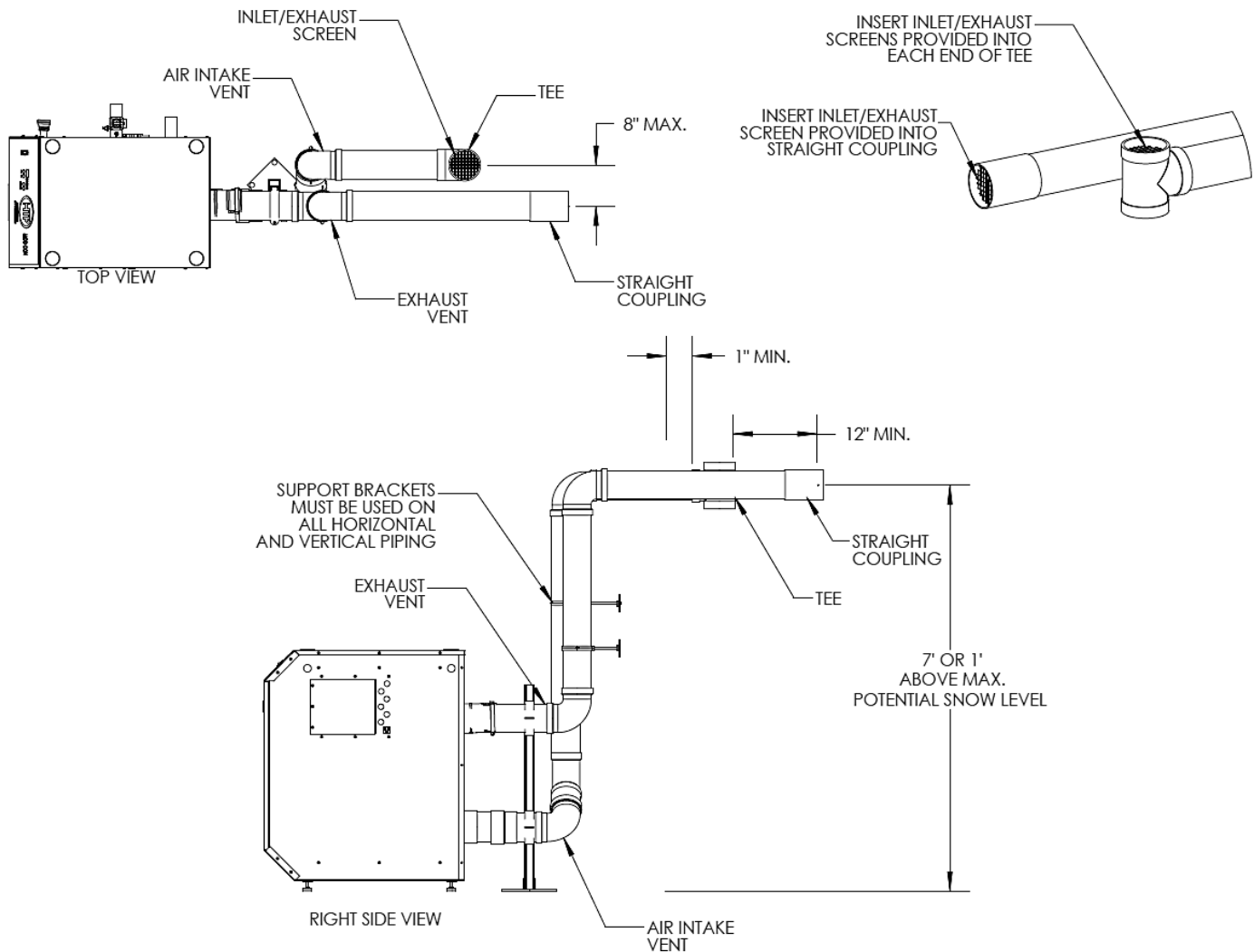


Figure 16 – Sidewall Venting Diagrams

### **⚠ WARNING**

All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of  $\frac{1}{4}$ " 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 500 models 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.

## TWO PIPE SIDEWALL VENTING W/TEE (INTAKE) AND COUPLING (EXHAUST)



NOTE: VENT MUST BE AT LEAST 12" OVER MAXIMUM SNOW LEVEL OR 24" WHICHEVER IS GREATER - CHECK WITH LOCAL CODE REQUIREMENTS

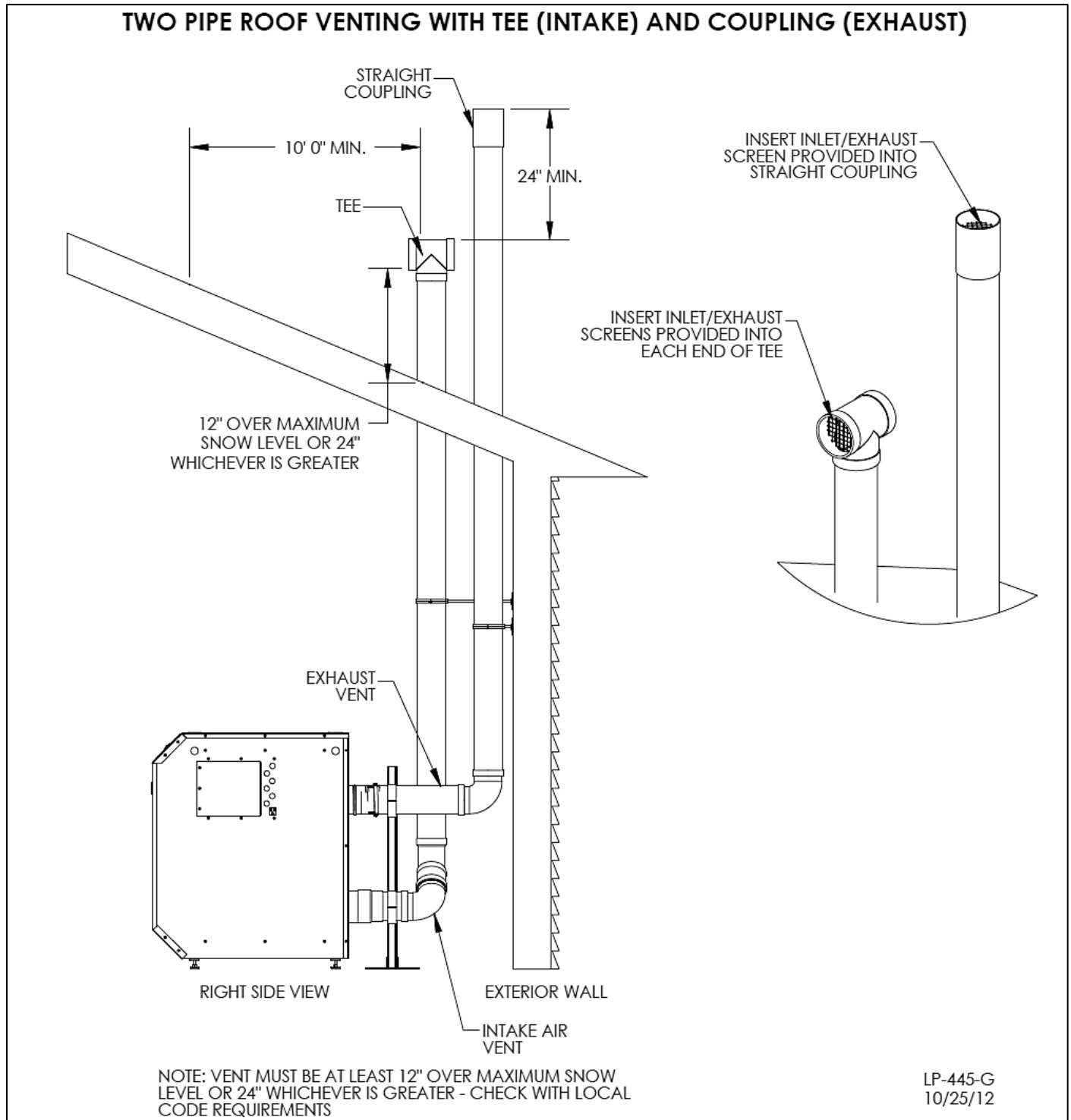
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Figure 17 – Sidewall Venting with Tee and Coupling

### **⚠ 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 500 models 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.

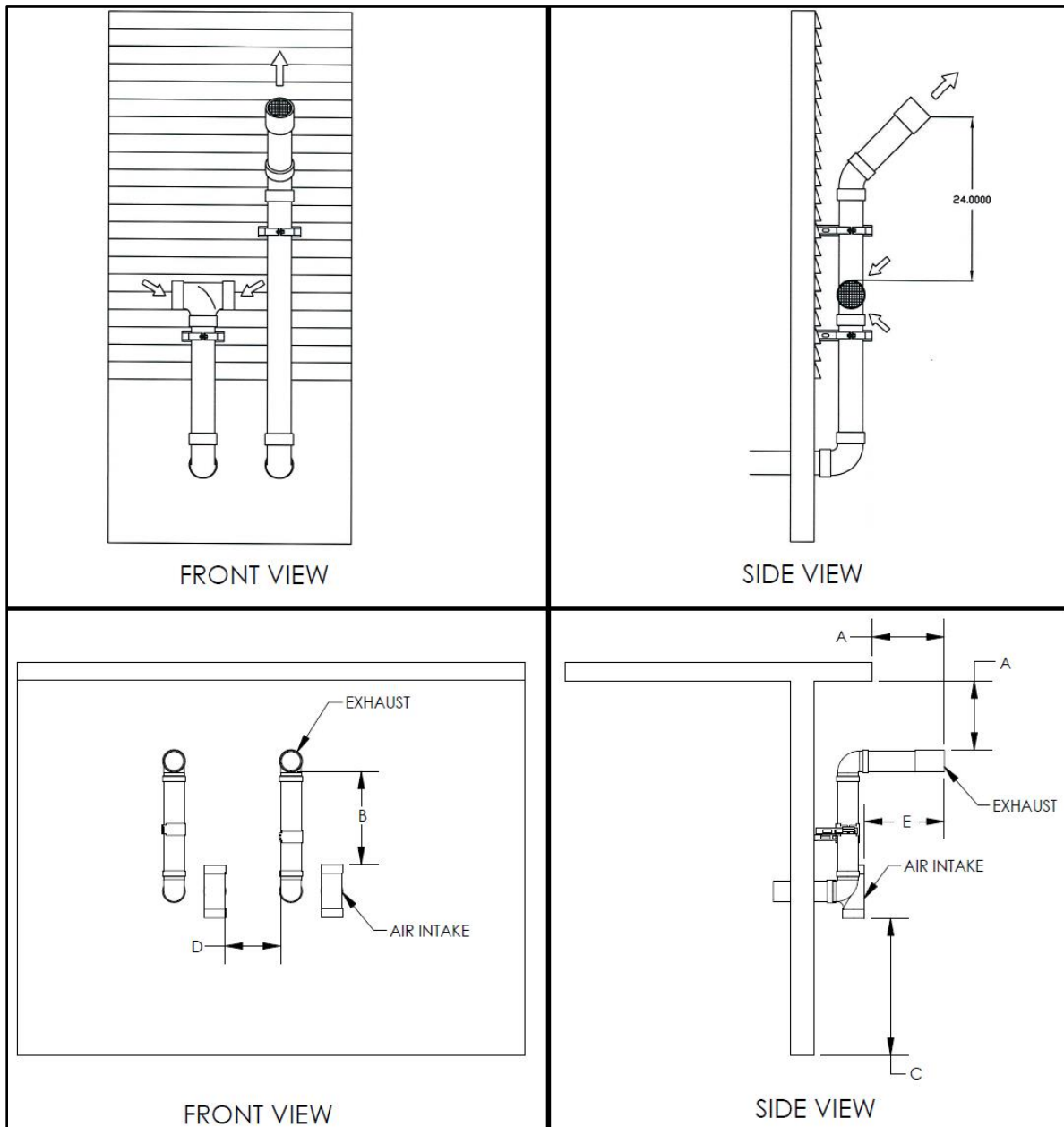
## J. VERTICAL VENTING DIAGRAMS



**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 500 models 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.



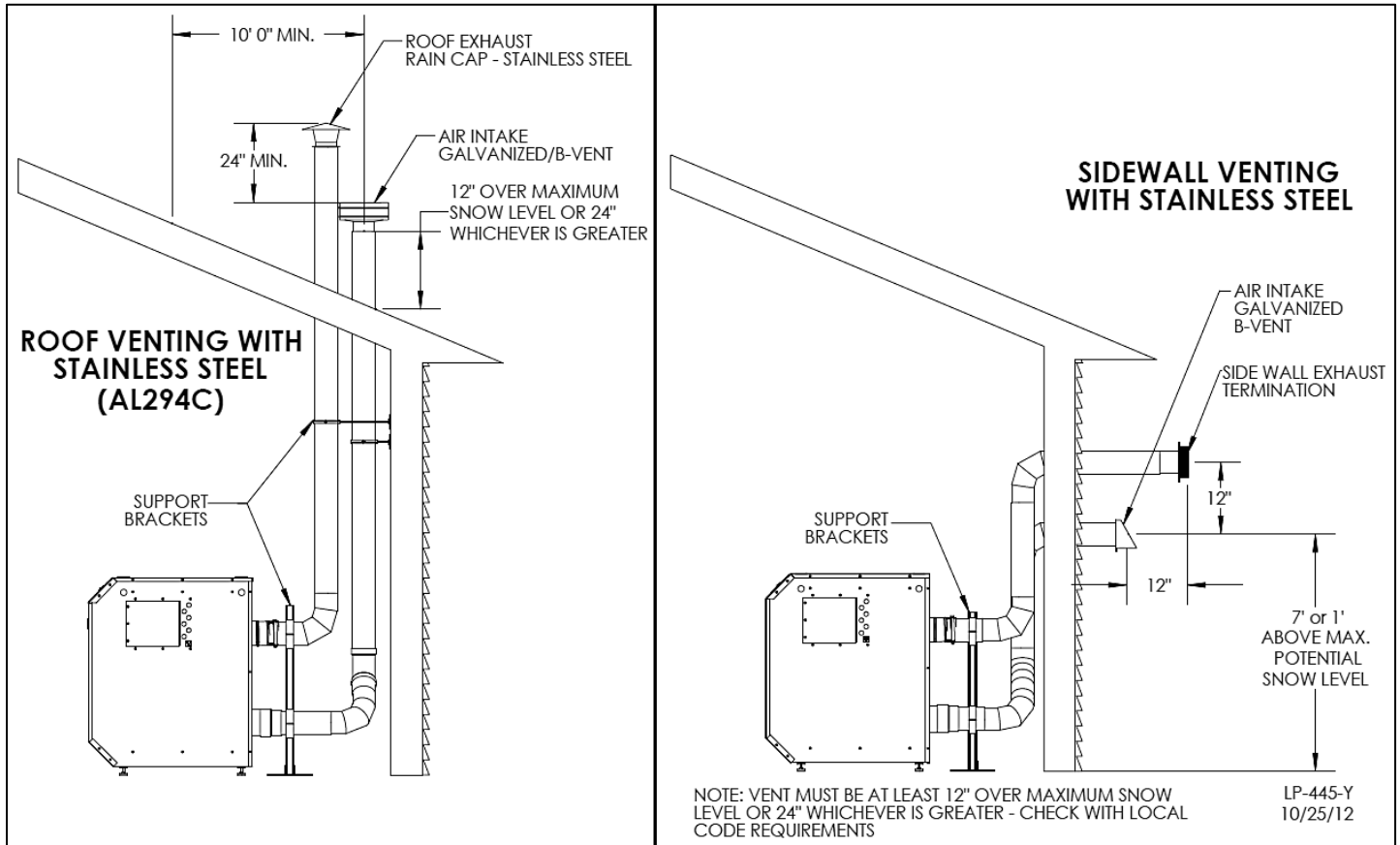
**Figure 19 – Horizontal Venting - NOTE: Drawing is meant to demonstrate system venting ONLY.**

**NOTES:**

- A. For every 1" of overhang, the exhaust vent must be located 1" vertical below overhang (overhang means top of building structure and not two adjacent walls [corner of building]).
- B. Typical installations require 12" minimum separation between bottom of exhaust outlet and top of air intake.
- C. Maintain 12" minimum clearance above highest anticipated snow level or grade (whichever is greater).
- D. Minimum 12" between vents when installing multiple vents.
- E. 12" minimum beyond air intake.

**⚠ 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 appliance to allow drainage of condensate. When placing support brackets on vent piping, the first bracket must be within 1 foot of the appliance and the balance at 4 foot intervals on the vent pipe. Boiler venting must be readily accessible for visual inspection for the first three feet from the boiler.



**Figure 20 – 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  $\frac{1}{4}$ " 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 500 models 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.

## **K. ROOM AIR, INDOOR COMBUSTION, AND VENTILATION AIR INSTALLATION REQUIREMENTS**

When using an indoor combustion air installation, the mechanical room **MUST** be provided with properly sized openings, and/or be of sufficient volume to assure adequate combustion air and proper ventilation for all gas fired appliances in the mechanical room to assure adequate combustion air and proper ventilation. The requirements shown here are for the boiler only. Additional gas fired appliances in the mechanical room will require an increase in the net free area and/or volume to supply adequate combustion air for all appliances. This must be done in accordance with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1.

This boiler can be vented using mechanical room air only for combustion. No combustion air openings are needed when the boiler is installed in a space with a volume **NO LESS** than 50 cubic feet per 1,000 BTU/hr of all installed gas fired appliances and the building **MUST NOT BE** of "Tight Construction".

**TIGHT CONSTRUCTION:** A building with less than .4 ACH (air changes per hour). For buildings of "Tight Construction", provide air openings into the building from the outside.

Indoor and outdoor combustion air may be combined by applying a ratio of available volume to required volume times the required outdoor air opening(s) size(s). This must be done in accordance with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1.

1. If air is taken directly from outside the building with no duct, provide two permanent openings to the mechanical room each with a net free area of one square inch per 4000 BTU/hr input. See Figure 21.
2. If combustion and ventilation air is taken from the outdoors using a duct to deliver the air to the mechanical room, each of the two openings should be sized based on a minimum free area of one square inch per 2000 BTU/hr input. See Figure 22.
3. If air is taken from another interior space combined with the mechanical room:
  - a. Two spaces on same story: Each of the two openings specified should have a net free area of one square inch for each 1000 BTU/hr input, but not less than 100 square inches.
  - b. Two spaces on different stories: One or more openings should have a net free area of two square inches per 1000 BTU/hr.

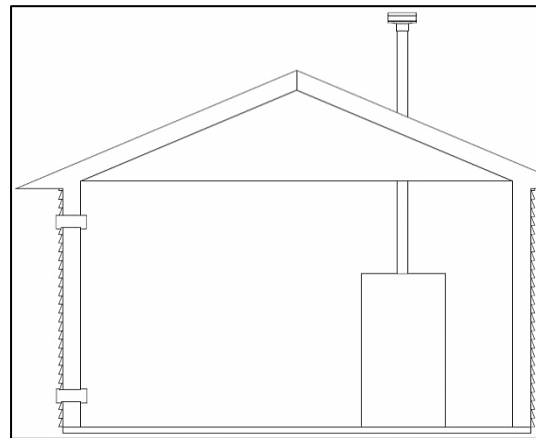
See Figure 23 for reference.

4. If a single combustion air opening is provided to bring combustion air in directly from the outdoors, the opening must be sized based on a minimum free area of one square inch per 3000 BTU/hr. This opening must be located within 12" of the top of the enclosure. See Figure 24.

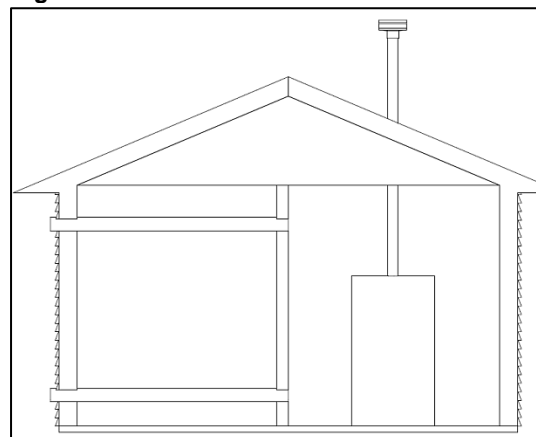
Combustion air requirements are based on the latest edition of the National Fuel Gas Code, NFPA 54 / ANSI Z223.1, CGA Standard CAN/CSA B149.1 in Canada. Check all local code requirements for combustion air.

All dimensions based on net free area in square inches. Metal louvers or screens reduce the free area of a combustion air opening a minimum of approximately 25%. Check with louver manufacturers for exact net free area of louvers.

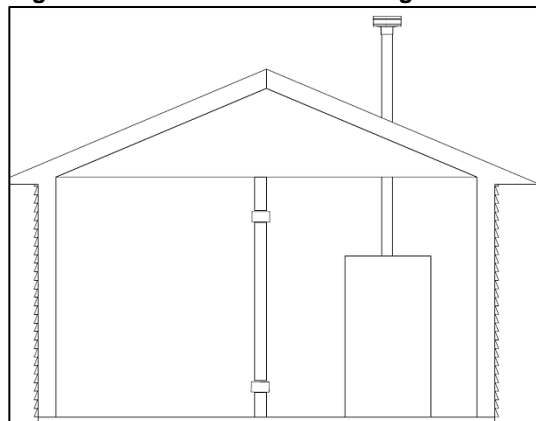
Where two openings are provided, one must be within 12" of the ceiling, and one must be within 12" of the floor of the mechanical room. Each opening must have a net free area as specified in Table 14. Single openings shall commence within 12" of the ceiling. The minimum dimension of air openings should not be less than 3".



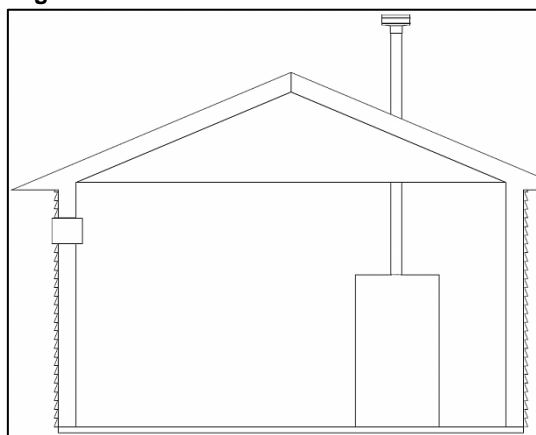
**Figure 21 – Combustion Air From Outdoors**



**Figure 22 – Combustion Air Through Ductwork**



**Figure 23 – Combustion Air From Indoors**



**Figure 24 – Combustion Air From Outdoors – Single Opening**



## ⚠ CAUTION

Under no circumstances should the mechanical room ever be under negative pressure. Particular care should be taken where exhaust fans, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit. Failure to follow these instructions could result in property damage or personal injury.

Combustion air supply must be completely free of any flammable vapors that may ignite, or chemical fumes which may be corrosive to the boiler. See Table 1 for a list of combustion air contaminants. These chemicals, when burned, form acids which quickly attack the stainless steel heat exchanger, headers, flue connectors, and the vent system. The result is improper combustion and premature boiler failure. Such failure IS NOT covered under warranty.

**EXHAUST FANS:** Any fan or appliance which exhausts air from the mechanical room may deplete the combustion air supply and/or cause a downdraft in the venting system. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be corrected immediately.

MINIMUM RECOMMENDED COMBUSTION AIR SUPPLY TO MECHANICAL ROOM								
MODEL	FIGURE 21		FIGURE 22		FIGURE 23			FIGURE 24
	*Outside Air from 2 Openings Directly from Outdoors <sup>1</sup>		*Outside Air from 2 Ducts Delivered from Outdoors <sup>1</sup>		Inside Air from 2 Ducts Delivered from Interior Space <sup>2</sup>			*Outside Air from 1 Opening Directly from Outdoors, in <sup>2</sup> <sub>1</sub>
	Top Opening, in <sup>2</sup>	Bottom Opening, in <sup>2</sup>	Top Opening, in <sup>2</sup>	Bottom Opening, in <sup>2</sup>	Same Story		Different Stories Total Opening, in <sup>2</sup>	
MODCON500	125	125	250	250	500	500	1000	170
MODCON850	215	215	425	425	850	850	1700	285

**Table 14 – Indoor Combustion Air Sizing**

The above requirements are for the boiler only; additional gas fired appliances in the mechanical room will require an increase in the net free area and/or volume to supply adequate combustion air for all appliances.

No combustion air openings are needed when the boiler is installed in a space with a volume NO LESS than 50 cubic feet per 1,000 BTU/hr of all installed gas fired appliances. Buildings MUST NOT be of "Tight Construction".

<sup>1</sup>Outside air openings shall communicate with the outdoors.

<sup>2</sup>Combined interior space must be 50 cubic feet per 1,000 BTU/hr input. Buildings MUST NOT be of "Tight Construction".

## PART 6 – GAS PIPING

### ⚠ DANGER

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

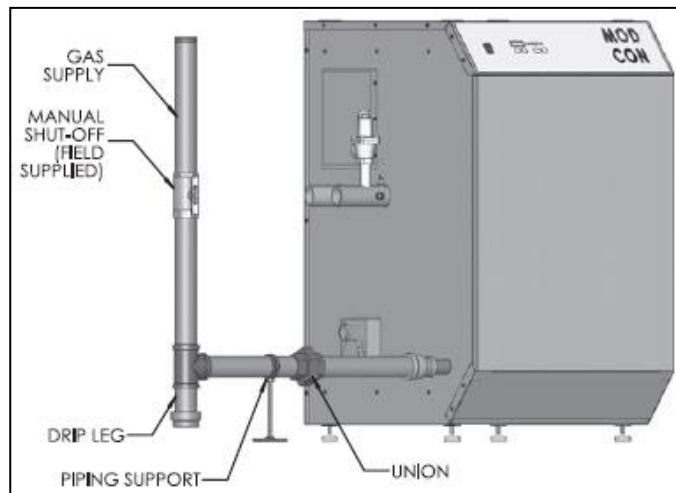
#### A. GAS CONNECTION

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 Mod Con 500 boilers ONLY. Field conversions ARE NOT ALLOWED on the Mod Con 850. A properly calibrated combustion analyzer must be used to verify proper combustion. Failure to follow all above information could result in property damage, serious injury, or death.



**Figure 25 – 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 1-1/2" 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

#### 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.

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## ⚠ 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 15 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.

<b>NATURAL GAS SUPPLY PIPING CAPACITY CHART</b>								
(0.6 specific gravity gas; 0.5" WC pressure drop) *Schedule 40 iron pipe size in nominal inches								
<b>MODEL</b>	<b>1 BOILER</b>	<b>2 BOILERS</b>	<b>3 BOILERS</b>	<b>4 BOILERS</b>	<b>5 BOILERS</b>	<b>6 BOILERS</b>	<b>7 BOILERS</b>	<b>8 BOILERS</b>
CUBIC FT. HR.	500	1000	1500	2000	2500	3000	3500	4000
MODCON 500 @ 100' OF PIPE	1 ½"	2"	2 ½"	3"	3"	3"	4"	4"
MODCON 500 @ 250' OF PIPE	2"	2 ½"	3"	3"	4"	4"	4"	4"
<b>MODEL</b>	<b>1 BOILER</b>	<b>2 BOILERS</b>	<b>3 BOILERS</b>	<b>4 BOILERS</b>	<b>5 BOILERS</b>	<b>6 BOILERS</b>	<b>7 BOILERS</b>	<b>8 BOILERS</b>
CUBIC FT. HR.	850	1700	2550	3400	4250	5100	5950	6800
MODCON 850 @ 100' OF PIPE	2"	2 ½"	3"	4"	4"	4"	4"	5"
MODCON 850 @ 250' OF PIPE	2 ½"	3"	4"	4"	5"	5"	5"	5"

**Table 15 – 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:

1. **IMPORTANT!** Before you connect to the inlet pressure, shut off the gas and electrical power to unit.
2. Loosen the pressure tap with a small screwdriver. Refer to Figures 26 and 27 for locations.
3. 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.
4. Turn on the gas and power up the unit.
5. 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.
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**

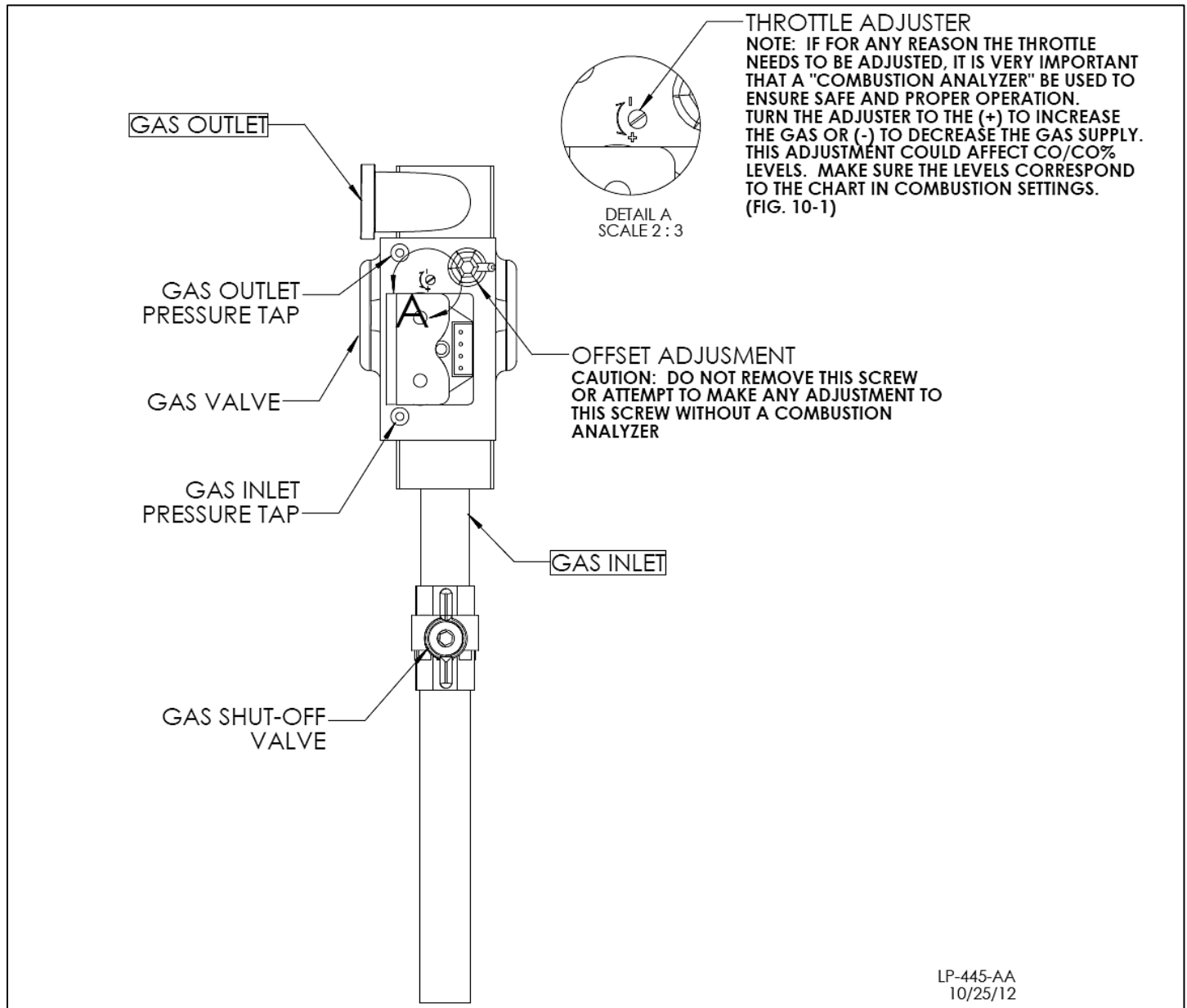
Ensure the pressure tap screw is properly tightened to prevent gas leaks. Failure to do so could cause substantial property damage, severe personal injury, or death.

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 26 – Mod Con 500 Gas Valve**

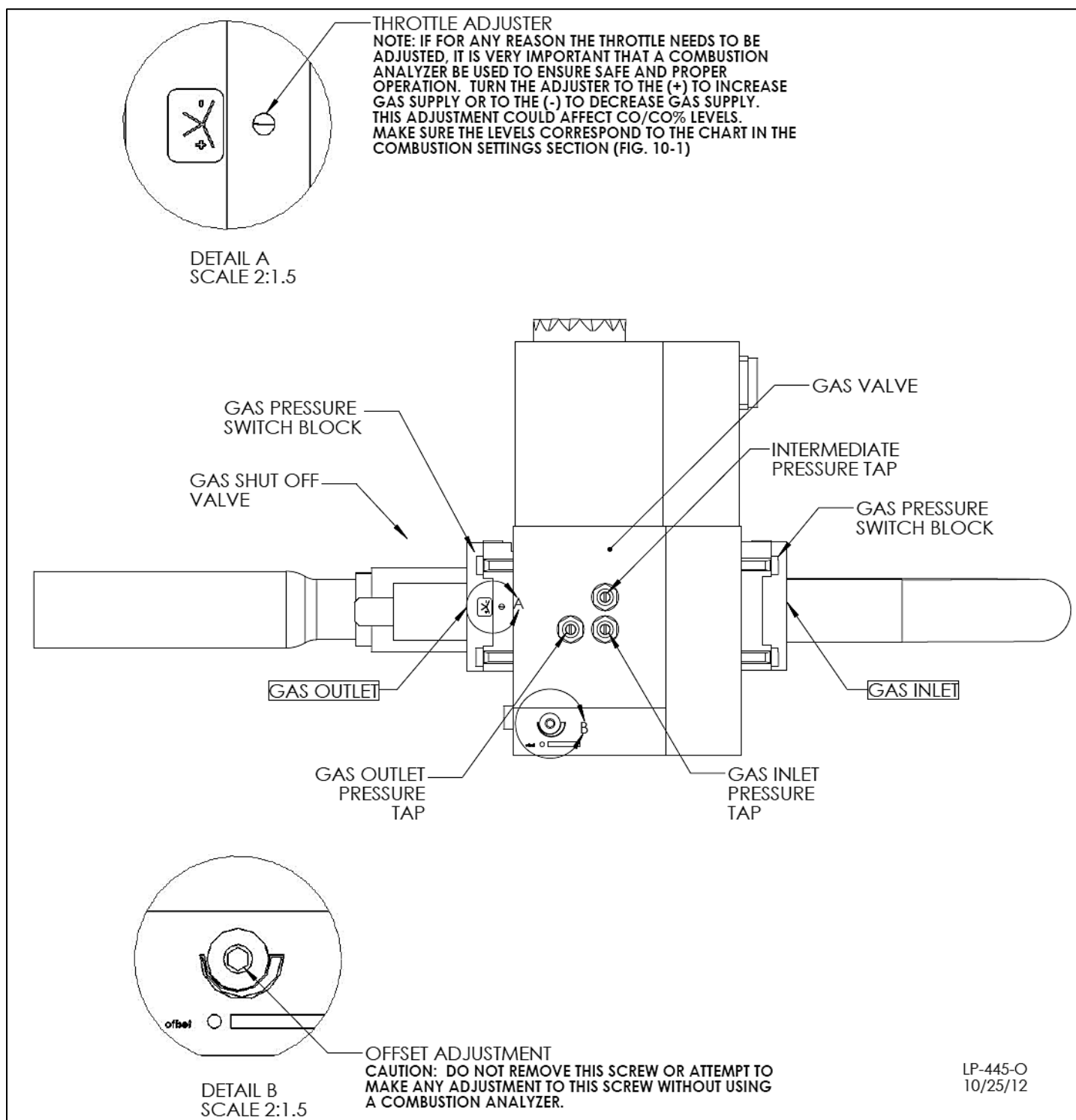


Figure 27 – Mod Con 850 Gas Valve

## ⚠ 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 CO<sub>2</sub> 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 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 29 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 29.

#### **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

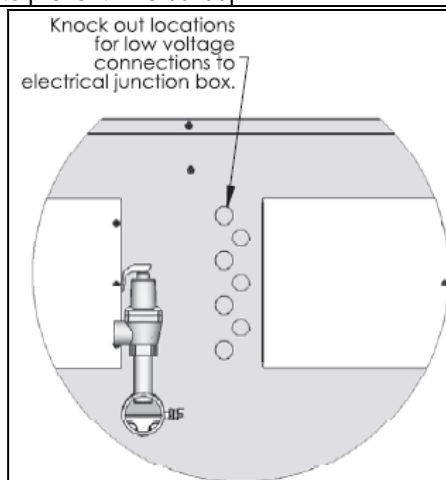


Figure 28

each tank and wire them in series to provide temperature control of the tanks. (See Piping Diagrams in Part 4 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 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**

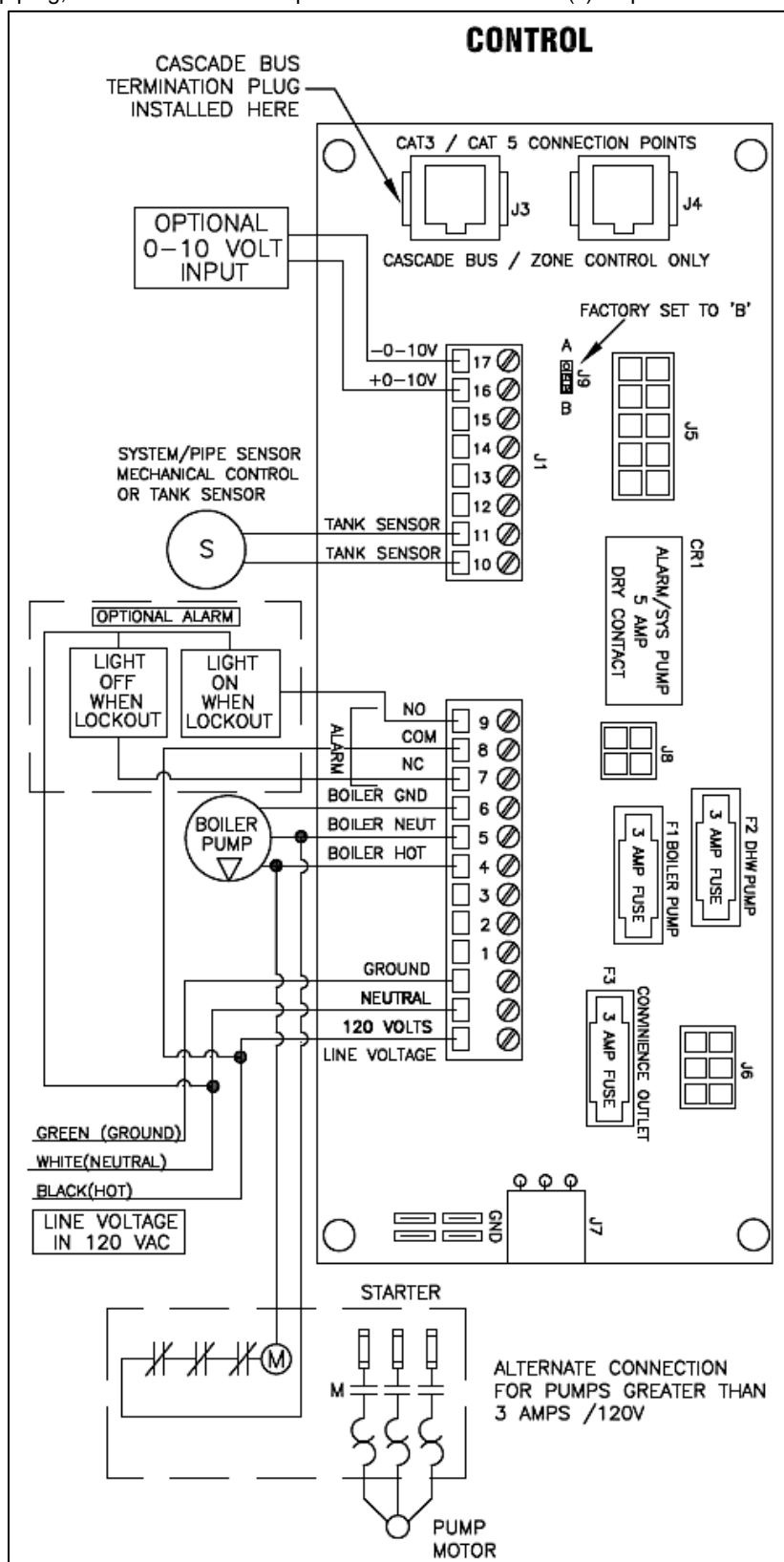
**NOTE:** A termination plug is included in the CAT 3 / CAT 5 Bus Connection Point, labeled J3 in Figure 29. **DO NOT REMOVE THIS PLUG!** Doing so will affect boiler operation and void warranty.

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 29). 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 29 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



**Figure 29 - Mod Con VWH Control**

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 29 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.

#### **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 28. Connect all low voltage field devices in the low voltage terminal strip located in the electrical junction box (shown in Figure 29).

#### **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 29. 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 29. 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 29.

#### **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 31 and 32 for Cascade Bus Termination Plug installation detail.

**NOTE:** It is important that the termination plug in multiple boilers (cascaded units) be installed as depicted in Figure 31. Leave the plug installed in the J3 port on the Master boiler. Remove the plug on intermediate Follower boilers. Move the plug to the J4 port on the final Follower boiler.

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.

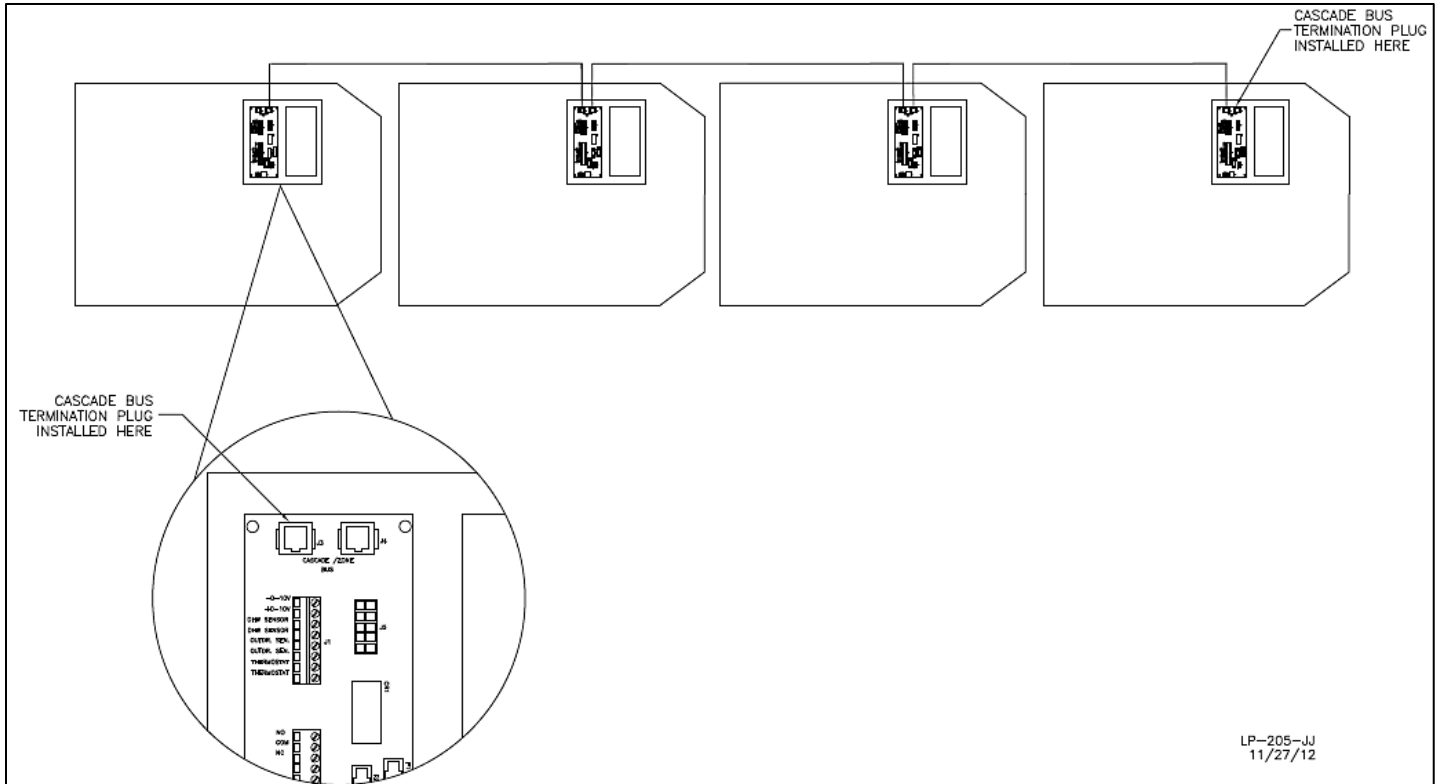


Figure 30 – LP-205-JJ

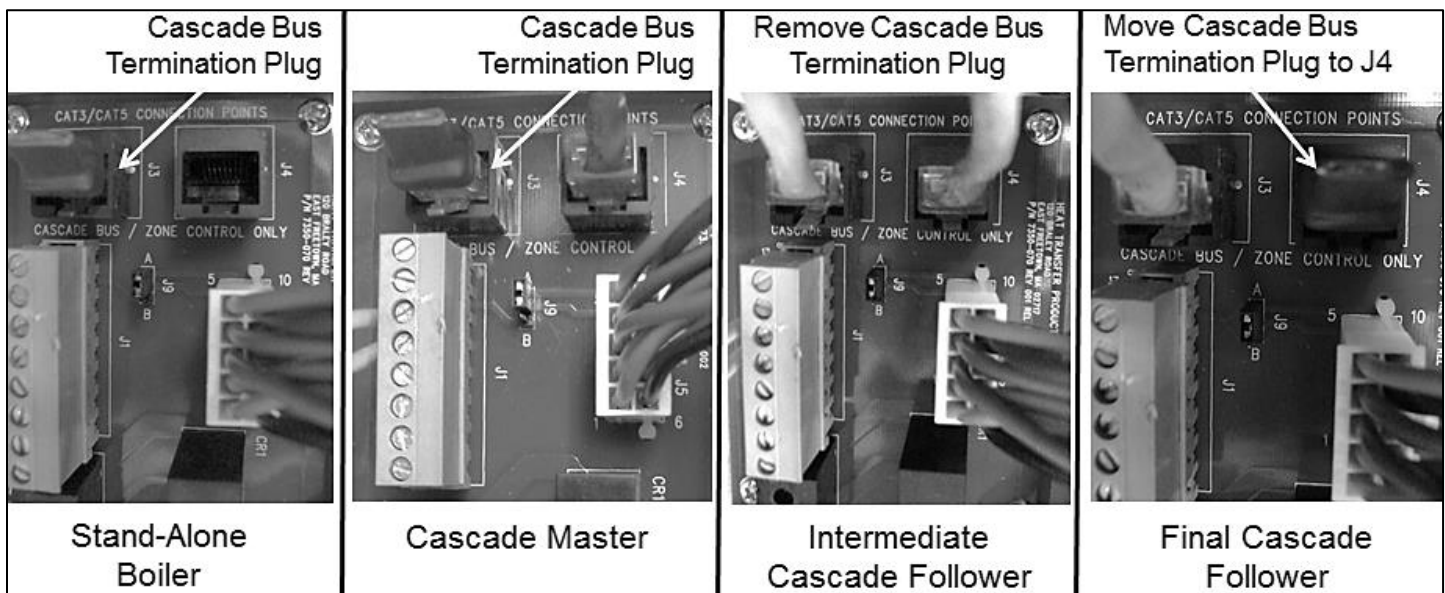


Figure 31 – Cascade Resistor Plug Installation Detail

### **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 positive going DC signal input is used, connect to marked terminals.

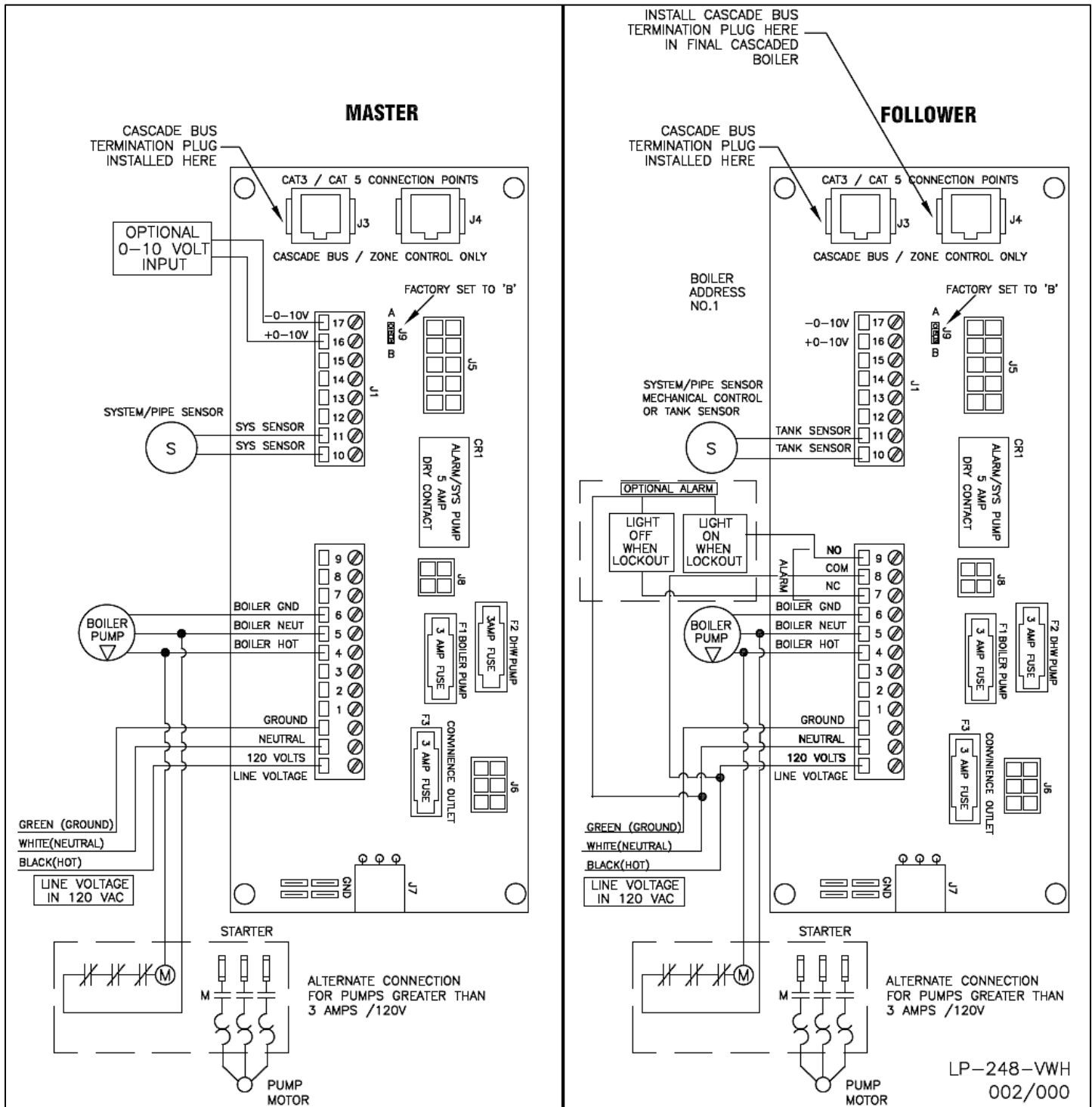
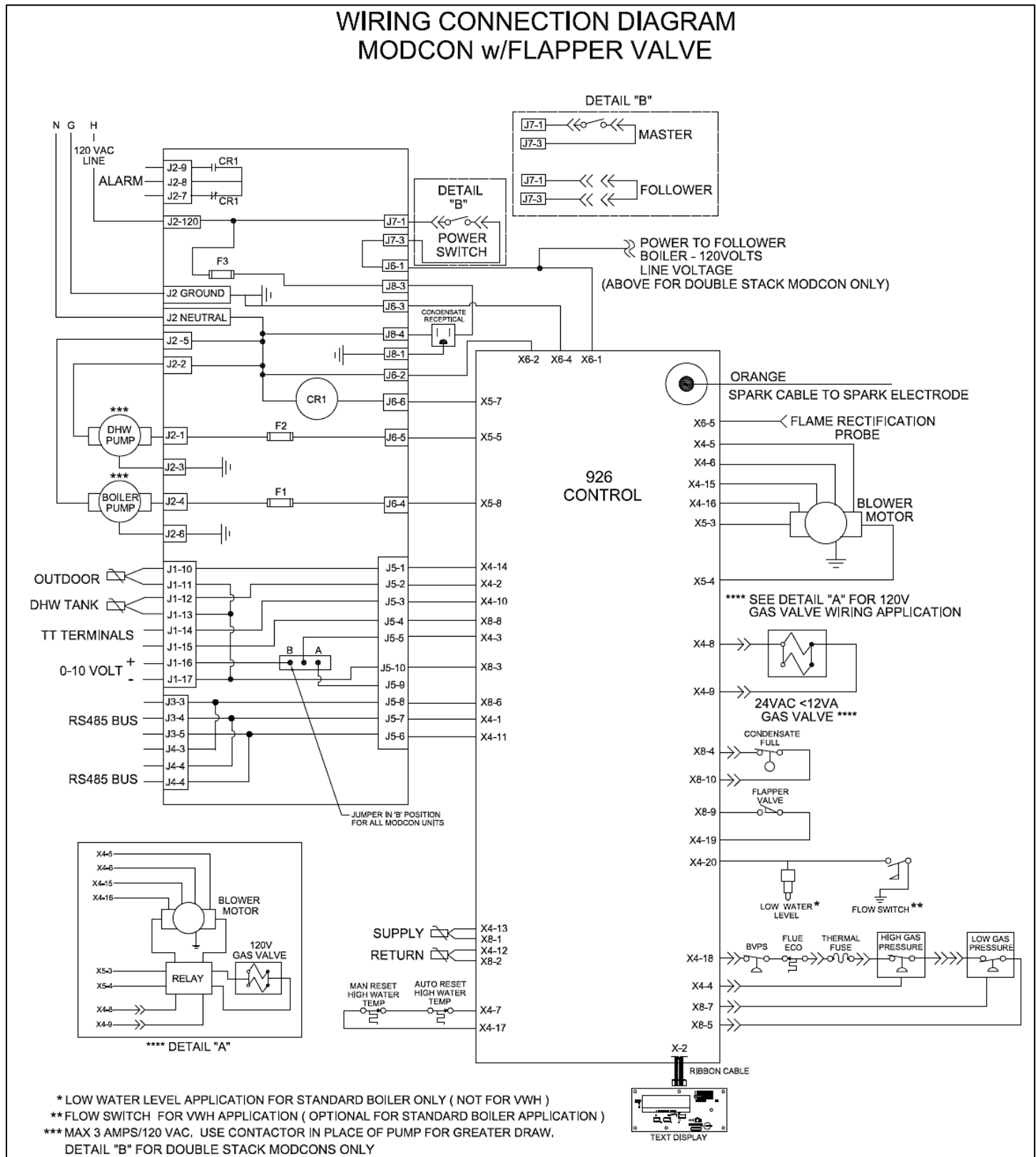


Figure 32 – Mod Con VWH Cascade Master and Follower

**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 32 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 33 – Mod Con Internal Connection Diagram – LP-428-K**

## PART 8 – START-UP PREPARATION

### A. CHECK / CONTROL WATER CHEMISTRY

#### CAUTION

Chemical imbalance of your water can cause severe damage to your 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.**

To assure extended service life, 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 heater system. Damage to elastomer seals and gaskets in the system could occur, resulting in substantial property damage.

#### **Sodium less than 20 mGL**

#### **Water pH between 6.0 and 8.0**

1. Maintain heater 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.

#### **Hardness less than 7 grains**

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

#### **Chlorine concentration less than 100 ppm**

1. Using chlorinated fresh water should be acceptable since drinking water chlorine levels are typically less than 5 ppm.

2. Do not connect the heater to directly heat a swimming pool or spa water.

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

#### ⚠ WARNING

PROPANE HEATERS 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 heater is a high efficiency condensing heater. 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 (7450-212).

2. The heater is equipped with a ¾ female socket weld fitting connection that must be piped to a local drain. It is very important that the condensate line is sloped downward away from the heater to a suitable inside drain. If the condensate outlet on the appliance 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 HEATER**

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

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

### **⚠ WARNING**

Ensure the heater is full of water before firing the burner. Failure to do so will damage the heater. 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 exhaust vent and intake piping for signs of deterioration from corrosion, physical damage or sagging. Verify exhaust vent and intake piping are intact and correctly installed per Venting Section, (Part 5) and local code.

#### **E. SETTING UP A SINGLE HEATER**

When power is applied to the heater, the control first completes a power-up systems check. During this time the combustion fan may run. The display will initially show the current heater 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 heater 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 minus the tank differential temperature, 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 heater first turns on the pump (if it is not wired to run continuously). Once the pump is running, the control will display LOW WATER FLOW 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 heater. (NOTE: This step may happen very rapidly. If flow is adequate, LOW WATER FLOW may never display.)

Once flow through the heater is adequate, the control will measure the supply temperature. If it is below the set point temperature minus the ignition differential set point, 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. 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 heater 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 heater is part of a cascaded system the operation is somewhat different. The control of each heater in a cascaded system completes its own power up system check as described above. One of the heaters in the cascade system is designated as the master heater. After the master heater completes its power up sequence, it checks the communication bus to see if any other heaters are present. If other heaters are present, the master control determines these follower heater addresses. The master heater control will

recheck the bus every few seconds as long as it is powered up to update the status of the connected heaters. The control in the master heater processes all heat demands and dictates which of the follower heaters should light and what firing rate the followers should try to achieve.

When the master heater receives a demand for heat, it determines which heater is first in the firing sequence and sends that heater a command to begin a demand sequence. That heater will then begin a demand sequence as described above. Once the heater ignites, the master heater control will increase the firing rate command to that heater until the system sensor temperature is at the tank set point temperature plus the supply offset temperature (installer #4), or that heater is at high firing rate. If the command from the master heater control gets to the high firing rate of the follower heater, but the system sensor is below the required temperature, the master heater control will then tell the next heater in the firing sequence to begin its demand sequence. The master heater control will then begin to ramp up the firing rate command of that heater. This process will continue while there is a demand until all heaters 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 heaters 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, the demand is complete, and the master heater control will extinguish all heaters that may be lit. If the demand decreases, the firing rate command and amount of heaters lit will decrease exactly opposite as described above.

Whenever the master heater control needs to fire a follower heater, it sends a firing rate command to that heater. The follower heater 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 heater 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 heaters firing at less than their maximum firing rate.

### **G. LOCKOUT CONDITION**

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

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

### **H. CASCADE SYSTEM PROGRAMMING**

1. If the heater is used alone, skip this section.

2. Programming the Master Heater:

- a. Make sure there is no demand for heat being supplied to the heater.
- b. Apply power to the heater.
- c. Enter the system setting program navigation following instructions in Part 10 of this manual.
- d. Verify that cascade address function 15 is set to 0. This makes the master heater address 0. NOTE: The Master Heater MUST be addressed as 0.
- e. Change Cascade Mode function 23 to 926 Boilers. This makes it the master heater.
- f. Exit the installer menu.

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

3. Programming Follower Heaters:

#### **NOTE: READ THE NOTES BELOW BEFORE PROGRAMMING FOLLOWER HEATERS**

- The heater addressed as 1 will share its alarm output with the master heater.
  - It is recommended but not necessary to address heaters in the order that they are wired.
  - No two heaters 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 heater
  - b. Apply power to the follower heater you are working on.
  - c. Enter system settings following instructions in Part 10 of this manual
  - d. Set cascade address parameter 15 to 1 for the first follower, 2 for the second follower, etc. depending on which heater you are programming based on the above notes.
  - e. Change "CASCADE MODE" parameter to "926 BOILERS". This makes the heater a follower heater and enables all data to be transferred between heaters as needed for the system to function to full capability.

f. Exit system menu.

**NOTE:** The temperature set point of the follower must match the master heater 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 heater 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 heater 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 heater.
- 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 heater) 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 heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and to replace any part of the control system and any gas control that has been damaged.

5. The heater shall be installed so the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during heater 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.

### **WARNING**

If you discover any evidence of a gas leak, shut down the heater at once. Find the leak source with a bubble test and repair immediately. Do not start the heater again until the leak is repaired. Failure to comply could result in substantial property damage, severe personal injury, or death.

### **A. CONTROL OVERVIEW**

The control is one of the primary safety devices of the heater. It monitors the safety sensors of the heater to assure safe and efficient operation.

The control has many features associated with system design. This section addresses programming features, including Heater Settings / System Settings / Maintenance Settings and System Diagnostics, to help in customizing your control. It is important to fully understand control capabilities before customization, as its factory defaults may already fit your system design and not require any adjustment at all.

### **B. NAVIGATION OF THE DISPLAY**

The display includes a two line backlit LCD readout to provide informative messages about the operation of the heater. Many operating parameters can be viewed and adjusted by using the six buttons on the display. The function of each button is described below.

**RESET** – The RESET button has two functions.

- Resets any lockout error code
- Returns the user to the default display screen.

ENTER MENU CODE 000
------------------------

**ENTER** – The ENTER key is used to enter the parameter programming mode. To enter this mode, hold down the ENTER key for more than 4 seconds. The readout will change to:

One of the zeroes will be blinking. Use the ▲▼ arrow keys to change the blinking digit to the correct value. Use the ◀▶ arrow keys to select the next digit to change and again use the ▼▲ keys to change the value. Repeat until the correct code is entered. Press the **ENTER** key to accept the code entered. If the code is correct, the readout will change to the appropriate screen. If the programming code is not accepted, the readout will continue to display as shown above.



The **ENTER** key is also used to enable a function for editing. After the user navigates to the desired function, the user would hold down the **ENTER** key for one second. When the **ENTER** key is released, the function value will begin to blink. The function can now be changed using the **▼ ▲ ARROW** keys. After the new value is displayed, the user then presses the **ENTER** key for 1 second to lock the new value of the function in. The value will then stop blinking.

**LEFT AND RIGHT ARROW KEYS** – **◀ ▶** are used to navigate between the default display, status display, analog and cascade displays if they are enabled. The **◀ ▶** keys are also used in programming modes to change between the programmable functions. It is recommended you use the Menu Maps in the back of this manual and the detailed menu instructions printed in this section to help in menu navigation.

**UP AND DOWN ARROW KEYS** – **▼ ▲** are used to navigate between the various functions displayed in the menu. After the function is enabled for editing by pushing the **ENTER** key, the **▼ ▲** keys are used to adjust the function upward or downward to the desired value.

### **C. OPERATING INSTRUCTIONS**

Before operating the unit, it is important to remove the cover and verify that the gas line and water lines are connected to heater and fully purged. If you smell gas, STOP; Follow the safety instructions listed in the first part of this section. If you do not smell gas, follow the next steps.

1. Turn down the thermostats before applying power to the heater. If 0–10 volt or other inputs are used, make sure that they are set so there is no call for heat while programming.
2. Turn on the power to the heater or heaters if a cascade system used.
3. Next, check the heater settings. Adjustment and factory defaults are outlined within this section. If a cascade system is used, it is important that all the heaters have the same heater settings.
4. Next, check the system settings. Adjustments and factory defaults are outlined within this section. If a cascade system is used, it is important that the Master Heater is programmed with the correct system settings.
5. Create a demand on the heater or heaters if a cascade system is used. The user can monitor system functions when the heaters are operational.
6. If the heaters fail to start, refer to the troubleshooting section in the back of this manual.

### **D. PROGRAMMING HEATER SETTINGS**

#### **Heater Setting Program Access**

Note: Programming the heater control is not possible when the heater is firing. Make sure any input which can create a demand on the heater, such as the tank thermostat, is turned off, so the heater will remain idle to allow programming.

SCREEN	DESCRIPTION
ENTER MENU CODE 000	To access the heater setting program, press and hold the <b>ENTER</b> Key for 4 seconds, until the display shows the screen at left.
ENTER MENU CODE 600	Using the arrow keys, log in the <b>Heater Menu Access Code “600”</b> . To confirm the code, press <b>ENTER</b> to access <b>Heater Setting Program</b> navigation menu.

**Table 16 – Programming Screens**

#### **Heater Setting Program Navigation**

Once the code is confirmed, the user can now start to set **the Heater Settings**. Use the arrow keys on the display to navigate through the **Heater Setting Program**. A blinking setting indicates it can be changed. To change a setting, press the **ENTER** Key. Heater settings can be increased by pressing the **UP ARROW ▲** and decreased by pressing the **DOWN ARROW ▼** on the display. When done, press **ENTER**. Setting will stop blinking and you can move on to next setting. Press **RESET** to exit programming and store settings. Listed below are the heater settings that can be programmed into the control.

SCREEN	DESCRIPTION
IGNITION DIFF SET 7 °F	<b>Function:</b> Allows the user to adjust the ignition differential set point from 1°F to 36°F (Factory Default 7°F). Degrees below set point must be equal to or below tank differentials.
TANK SETPOINT 120 °F	<b>Function:</b> Adjusts the tank set point from 59°F to 180°F (Factory Default 120°F).
TANK DIFF SETPOINT 7 °F	<b>Function:</b> Adjusts the tank differential set point from 1°F to 18°F (Factory Default 7°F). Degrees below set point where demand starts.

TEMP DISPLAY C OR F °F	<b>Function:</b> Adjusts the temperature measurement in F = Fahrenheit to C = Celsius (Default is Fahrenheit).
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Table 17 – Heater Setting Program Navigation

**Clock Settings**

(NOTE: The clock will reset if the heater is powered off for more than a week.)

SCREEN	DESCRIPTION
CLOCK MODE (12/24) 08/28/2009 Fr 9:42A	<b>Function:</b> Changes the clock from 12 hour mode (8:45 PM) to 24 hour mode (20:45). To change to 24 hour mode, press the <b>ENTER</b> key. The letter (A or P) after the time will blink. Press the up or down arrow key once and the letter will disappear. Press the <b>ENTER</b> key to save the new setting.
CLOCK HOUR 08/28/2009 Fr 10:01A	<b>Function:</b> Allows the user to adjust the hour setting.
CLOCK MINUTE 08/28/2009 Fr 10:01A	<b>Function:</b> Adjusts the minute setting.
CLOCK DAY OF WEEK 08/28/2009 Fr 10:01A	<b>Function:</b> Adjusts the day of week.
CLOCK DATE MODE 08/28/2009 Fr 10:01A	<b>Function:</b> Allows the user to switch to European date format (2009/08/28) from US format (08/28/2009).
CLOCK YEAR 08/28/2009 Fr 10:01A	<b>Function:</b> Adjusts the year setting.
CLOCK MONTH 08/28/2009 Fr 10:01A	<b>Function:</b> Adjusts the month setting.
CLOCK DATE 08/28/2009 Fr 10:01A	The clock is set.

Table 18 – Clock Setting Screens

**NOTE:** The internal clock does not adjust for daylight savings time, and requires manual adjustment.**E. PROGRAMMING THE SYSTEM SETTING****System Setting Program Access**

Note: Programming the heater control is not possible when the heater is firing. Make sure any input which can create a demand on the heater, such as the tank thermostat, is turned off, so the heater will remain idle to allow programming.

SCREEN	DESCRIPTION
ENTER MENU CODE 000	To access the heater setting program, press and hold the <b>ENTER</b> Key for 4 seconds, until the display shows the screen at left.
ENTER MENU CODE 925	Using the arrow keys on the display, log in your <b>System Menu Access Code “925”</b> . To confirm code, press <b>ENTER</b> to access system setting program navigation menu.

Table 19 – System Setting Access

**F. SYSTEM SETTING PROGRAM NAVIGATION**

Once the **System Menu Access Code** is confirmed, the user can begin to set the system setting menu. Use the ◀ ▶ arrow keys on the display to navigate through the system setting program. To change a setting, press **ENTER**. System settings can be **increased** by pressing the **UP ARROW** and **decreased** by pressing the **DOWN ARROW** on the display. When done, press **ENTER**. Setting will stop blinking and you can move on to next setting. Press **RESET** to exit programming and store settings. Listed below are the heater settings that can be programmed into the control.

SCREEN	DESCRIPTION
<b>Function 1</b>	<b>Factory Program Mode</b>
MODE VWH MODE 1	This screen indicates that the control is configured correctly for a volume water heater. Do not change this screen.
<b>Function 3</b>	<b>DHW Tank Max Temp</b>
DHW TANK MAX TEMP 180 °F 3	This is the maximum temperature that can be selected in heater settings for the DHW tank. Factory Default is 180°F. (Range: 95°F to 180°F)
<b>Function 4</b>	<b>Burner Off Differential</b>
BURNER OFF DIFF 20 °F 4	This is the amount of degrees above tank set point that the burner will maintain its outlet water temperature while there is a demand for heat. Factory Default is 20°F. (Range: 1°F to 45°F)

<b>Function 6</b>	<b>VWH Post Pump Time</b>
VWH POST PUMP TIME 0 MINUTES 6	The heater pump has the ability to post purge energy from the heater to the tank after the set point has been achieved. Please note that running the pump for a time greater than 5 minutes may cause tank energy to be released back to the heat exchanger. Factory Default of 0 Minutes. (Range: 0 – 10 minutes)
<b>Function 7</b>	<b>Warm Weather Shutoff</b>
WARM WEATHER OFF 68 °F 7	Not applicable on this product.
<b>Function 8</b>	<b>Min Outdoor Temp</b>
MIN OUTDOOR TEMP 5 °F 8	Not applicable on this product.
<b>Function 9</b>	<b>Max Supply Temp</b>
MAX SUPPLY TEMP 190 °F 9	Not applicable on this product.
<b>Function 10</b>	<b>Max Outdoor Temp</b>
MAX OUTDOOR TEMP 68 °F 10	Not applicable on this product.
<b>Function 11</b>	<b>Min Supply Temp</b>
MIN SUPPLY TEMP 95 °F 11	Not applicable on this product.
<b>Function 12</b>	<b>Min Heater Temp</b>
MIN HEATER TEMP 68 °F 12	Not applicable on this product.
<b>Function 13</b>	<b>CH Post Pump Time</b>
CH POST PUMP TIME 0 MINUTES 13	Not applicable on this product.
<b>Function 14</b>	<b>DHW Priority</b>
DHW PRIORITY 30 MINUTES 14	Not applicable on this product.
<b>Function 15</b>	<b>Cascade Address</b>
CASCADE ADDRESS 0 15	Bus addressing heaters (maximum heaters allowed 8 in a cascade system). Master Heater address is 0 and Following Heaters are addressed 1 thru 7. Default: 0 (Range: 0 – 8). NOTE: DO NOT USE ADDRESS 8.
<b>Function 16</b>	<b>Optional Inputs</b>
OPTIONAL INPUT RETURN SEN 16	Allows the user to select from optional inputs to control or monitor the system. Default: RETURN (Range: Off / Booster Board / 0-10 Volt / DHW Sensor / Return Sen).
<b>Function 17</b>	<b>0-10 Volt Function</b>
0-10 VOLT FUNCTION TEMPERATURE 17	Allows the user to control heater modulation through temperature control. Factory Default = Temperature (Temperature only on VWH).
<b>Function 18</b>	<b>Step Modulation Mode</b>
STEP MODULATE MODE ON 18	Not applicable on this product.
<b>Function 19</b>	<b>Heater DHW Temp</b>
HEATER SUPPLY DHW 180°F 19	Not applicable on this product.
<b>Function 20</b>	<b>Water Safety Input</b>
WATER SAFETY INPUT WATER PRESSURE 20	The user can select various water safety inputs used in the heater system. Default: Flow Switch (Range: None / Low Water Cut off / Flow Switch / Water Pressure).
<b>Function 21</b>	<b>Error Outdoor Sensor</b>
ERROR OUTD SENSOR OFF 21	Not applicable on this product.
<b>Function 22</b>	<b>Adjust Heater Output %</b>
ADJ HEATER OUTPUT 100% 22	Allows the user to adjust the heater output down from 100% to 50%. Factory Default: 100%. (Range: 100% – 50%)
<b>Function 23</b>	<b>Cascade Mode</b>
CASCADE MODE VISION 3 23	Allows the user to select cascade mode. Factory Default: Vision 3 (Range: 926 Heaters / Vision 3).
<b>Function 24</b>	<b>Cascade Rotation</b>
CASCADE ROTATION 48 HOURS 24	Sets the amount of hours before the first heater in the cascade firing rotation will be changed. NOTE: If this parameter is set to 0, the firing order of the heaters will not rotate. Default: 48 hours (Range: 0 – 240 hours).
<b>Function 25</b>	<b>Cascade DHW Mode</b>
NOT USED NOT USED 25	Not applicable on this product.
<b>Function 26</b>	<b>System Freeze Protect</b>
SYS FREEZE PROT PROTECT OFF 26	<b>NOTE:</b> This parameter is only present if the heater is a cascade master. Allows the user to set the freeze protection when a system pump is used. Factory Default: OFF. Selection of temperature activates freeze protection. (Range: OFF, -40°F – 104°F).

<b>Function 27</b>	<b>Error System Sensor</b>
ERROR SYSTEM SENS ON 27	Allows the user to set the control to display an error message if the system sensor is open or shorted. NOTE: This error does not stop the heater (or heaters) from running. Factory Default: ON (Range: ON / OFF).
<b>Function 28</b>	<b>Freeze Protection</b>
FREEZE PROTECTION ON 28	Allows the user to set freeze protection on the heater. Factory Default: ON (Range: ON / OFF).
<b>Function 29</b>	<b>DHW Modulation Mode</b>
DHW MODULATE MODE NORMAL MOD 29	Not applicable on this product.
<b>Function 30</b>	<b>Extra Heater Mode</b>
EXTRA HEATER MODE OFF 30	Allows for a non HTP heater to be controlled when the cascade output has risen above the percent of the cascade firing rate set in this parameter. Factory Default: Off (Range: 50% - 100%).
<b>Function 31</b>	<b>System Sensor Mode</b>
SYSTEM SENSOR MODE OFF 31	Suppresses the 'NO FOLLOWER' message on the display if the heater is used as a cascade master heater with no follower heaters connected. Factory Default: OFF (Range: ON / OFF).
<b>Function 32</b>	<b>Service Schedule</b>
SERVICE SCHEDULE OFF 32	Allows the user to select a service date or time based on the heater run hours to program the heater maintenance schedule. Factory Default: OFF (Range: Date or Run Hours). NOTE: Without setting this function, Functions 33/34/35/36 will not display.

Table 20 – System Setting Menu Screens

**NOTE:** For the following functions, you must have your maintenance function turned on.

To change these functions, press **ENTER**. The left most digit will begin to blink. Use the up ▲ or down ▼ arrows to change the digit. Use the ◀ ▶ arrow keys to switch between digits. When you've made your selection, press **ENTER** again.

SCREEN	DESCRIPTION
<b>Function 33</b>	<b>Year</b>
SERVICE SCHEDULE YEAR 00/00/2000 33	Allows the user to set the year of the next service reminder.
	<b>Hours</b>
SERVICE SCHEDULE 10000's 000000h 33	Allows the user to set the left two digits of the amount of run hours before next service reminder.
<b>Function 34</b>	<b>Month</b>
SERVICE SCHEDULE MONTH 00/00/2000 34	If the date function was selected, this function allows the user to program the month. If you selected the run hour function, you will need to program 10,000 hours, if required.
	<b>Hours</b>
SERVICE SCHEDULE 10000's 000000 34	Allows the user to set the two middle digits of the amount of run hours for the next service reminder.
<b>Function 35</b>	<b>Day</b>
SERVICE SCHEDULE DAY 00/00/2000 35	Allows the user to set the day of next service reminder.
	<b>Hours</b>
SERVICE SCHEDULE 10000's 000000 35	Allows the user to set the 2 right digits of the amount of run hours for the next service reminder.
<b>Function 36</b>	<b>Telephone</b>
TELEPHONE # 000 000 0000 36	Allows the user to input a telephone number that will be displayed when maintenance is required.

Table 21 - Maintenance Reminder Function Screens

### **G. RESETTING THE MAINTENANCE SCHEDULE**

When the system control flashes MAINTENANCE REQUIRED, it is advisable that you call for service. After the service is performed, reset the schedule for the next required service by using the following steps.

Press **ENTER** on the display for 3 seconds. The Menu code will appear as 000. This does not change. Press **ENTER** again. SERVICE SCHEDULE RESET will be displayed. Using the right arrow key ▶ scroll to the selection of year or hours. Select enter to reset the mode you are in. Use the up ▲ or down ▼ arrow key for each adjustment then select **ENTER** when reset is complete.

## PART 10 – START-UP PROCEDURES FOR THE INSTALLER

### A. HEATER CONTROL STATUS MENU

The heater control also has the ability to review the status of the system. To access the status screens, simply press the right arrow ►. Once the first value is displayed, press the up arrow ▲ or down arrow ▼ to access additional information. At any point you may press the RESET button to exit the status screen.

SCREEN	DESCRIPTION
SUPPLY SEN 180°F RETURN SEN 150°F	This screen is displayed after pressing the ► key as described above. This shows the actual temperature that the supply and return sensors are measuring. NOTE: If the heater is configured to use a 0 – 10 volt input, the return sensor is disabled and the second line of the display will be blank.
Press the ▼ key once.	
NA NA SUPPLY SEN 122°F	The actual temperature measured by the supply sensor is displayed on the bottom.
Press the ▼ key once.	
0-10 SIGNL ON *	Shows if 0 – 10 volt is enabled.
Press the ▼ key once. (This screen will appear only when set in Master Heater mode).	
CAS SET 190 °F SYSTEM 112 °F	This screen displays the cascade set point (maximum 190°F) on the top line. The system sensor value reading is on the second line. The control will cascade the heaters up to this set point depending on demand.
Press the ▼ key once.	
TANK SET 120 °F RET / TANK OFF	This screen displays the current tank temperature set point on the top line. The actual temperature measured by the tank or return line sensor (HTP 7250P-325) is displayed on the bottom line. If a mechanical aquastat is used in place of the recommended sensor, the second line will display 'OFF' in place of the temperature if the aquastat measures close to its set temperature, or 'ON' in place of the temperature if the aquastat temperature is too low.
Press the ▼ key once.	
NA 11 °F FLUE 95 °F	The second line displays the current flue temperature of the heater.
Press the ▼ key once.	
FLAME 0.0uA FAN SPEED 3497 RPM	This screen displays the heater flame current on the top line. The second line displays the fan speed in the heater.
Press the ▼ key once.	
0-10 V 0.0 V *	The top line displays the voltage on the optional input. This voltage is only relevant if an external 0-10 volt signal is being used to control the heater.
Press the ▼ key once.	
BUS COMM NO CONN	This display shows the status of the communication bus between multiple heaters. If the heater is in a single heater configuration, the display will show 'NO CONN'. If the heater is used in a multiple coiler configuration, is the Master Heater, and other heaters are connected to the communication bus and powered, this screen will show the address of each heater connected to the bus.
Press the ▼ key once.	
POWER ON 0H CH ON 0H	The top line of this display indicates the amount of hours the heater has had power applied to it over its life. The second line is not applicable.
Press the ▼ key once.	
VWH ON 0H GOOD IGNIT 1X	The top line of this display indicates the amount of hours the burner has been on for hot water demand in the life of the heater. The second line indicates how many times the burner has successfully ignited in the life of the heater.
Press the ▼ key once.	
SYS CH ON 0h SYS VWH ON 0h	The top line is not applicable. The second line registers system pump hours on cascade master ONLY.

**Table 22 - Heater Control Status Menu Screens**

The following 10 screens display the last ten heater lockout faults. The faults are displayed from most recent to oldest by depressing the ▼ key.

SCREEN	DESCRIPTION
Press the ▼ key once.	
FAULT HISTORY 1 07/27/2009 Mo 5:19A	This screen displays the last lockout fault of the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the actual fault encountered. The bottom line displays the date and time the fault occurred.
Press the ▼ key once.	
FAULT HISTORY 2 08/28/2009 Fr 5:19A	This screen displays the second oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the actual fault encountered. The bottom line will display the date and time that the fault occurred.
Press the ▼ key once.	
FAULT HISTORY 3 08/28/2009 Fr 5:19A	This screen displays the third oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the actual fault encountered if one has occurred. The bottom line displays the date and time a fault occurred.

Press the ▼ key once.		
FAULT HISTORY	4	This screen displays the fourth oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the fault encountered. The bottom line displays the date and time the fault occurred.
08/28/2009	Fr 5:19A	
Press the ▼ key once.		
FAULT HISTORY	5	This screen displays the fifth oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the fault encountered. The bottom line displays the date and time the fault occurred.
08/28/2009	Fr 5:19A	
Press the ▼ key once.		
FAULT HISTORY	6	This screen displays the sixth oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the fault encountered. The bottom line displays the date and time the fault occurred.
08/28/2009	Fr 5:19A	
Press the ▼ key once.		
FAULT HISTORY	7	This screen displays the seventh oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the fault encountered. The bottom line displays the date and time the fault occurred.
08/28/2009	Fr 5:19A	
Press the ▼ key once.		
FAULT HISTORY	8	This screen displays the eighth oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the fault encountered. The bottom line displays the date and time the fault occurred.
08/28/2009	Fr 5:19A	
Press the ▼ key once.		
FAULT HISTORY	9	This screen displays the ninth oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the fault encountered. The bottom line displays the date and time the fault occurred.
08/28/2009	Fr 5:19A	
Press the ▼ key once.		
FAULT HISTORY	10	This screen displays the tenth oldest lockout fault that occurred in the heater controller. The top line will alternate between the words 'FAULT HISTORY' and the fault encountered. The bottom line displays the date and time the fault occurred.
08/28/2009	Fr 5:19A	

**Table 23 – Heater Fault Screens****B. CASCADE MENU**

This menu is accessed by pressing the ◀ key from the default menu or the ▶ key from the status menu.

SCREEN	DESCRIPTION
CASCADE MASTER READY SYS PUMP OFF	This screen tells the user that the heater is configured as a Cascade Master Heater and that the cascade system is ready to accept a demand for heat. The second line indicates the status of the system pump output of the cascade system. This screen will alternate with the default screen every 5 seconds or it can be accessed by pressing the ◀ key from the default screen.
CASCADE NO FOLLOWER SYS PUMP OFF	This screen is displayed when the heater is configured as a Master Heater and there are no connected follower heaters, or the follower heaters are not powered. The second line indicates status of the cascade system pump output. This screen will alternate with the default screen every 5 seconds or it can be accessed by pressing the ◀ key from the default screen.
CASCADE NO SENSOR SYS PUMP OFF	This screen is displayed when the heater is configured as a Master Heater and there is no system temperature sensor connected or the system sensor is defective. The cascade system will still function in this situation with reduced efficiency. All heaters will run simultaneously rather than in a staged fashion. The second line indicates the status of the system pump output of the cascade system. This screen will alternate with the default screen every 5 seconds or it can be accessed by pressing the ◀ key from the default screen.
CASCADE VWH 0123 567 SYS PUMP ON 12:47P	This screen shows information about cascade status. The VWH in the center of the top line shows that the cascade demand is coming from the tank sensor or thermostat. You may also see 0-10 if the demand is from a 0-10 volt input. The following numbers show which heater addresses are currently communicating to the master. If a heater address is not used or communicating, the number will not show on the display. In the example above, heater address #4 is not communicating. When a heater in the system is firing, its address number will alternate with a '.' to signify it is firing. The bottom line shows the status of the system pump output contacts.
Press the ▼ key once.	
CASCADE PWR 100% PRESENT 01234567	This screen shows the overall cascade power output. The range of this value is the number of heaters communicating with the Master x 100. For example, if 8 heaters are connected and communicating, the maximum cascade power is 800%. The second line shows which heater addresses are communicating with the Master.
Press the ▼ key once.	
CASCADE SYST 118°F CASCADE SET 190°F	This screen shows the current system temperature sensor reading on the top line and the cascade system temperature setting on the bottom.
Press the ▼ key once.	
HEATER 0 100% HEATER 1 56%	This screen shows the current cascade power demand output on a per connected heater basis for heaters addressed as 0 and 1. In the screen above, heater 0 is being commanded to fire at 100% and heater 1 at 56%. If this were a 2 heater system, the 'CASCADE PWR' screen above would read 156%.

Press the ▼ key once.		
HEATER 2	0%	This screen shows the current cascade power demand output on a per connected heater basis for heaters addressed as 2 and 3.
HEATER 3	0%	
Press the ▼ key once.		
HEATER 4	0%	This screen shows the current cascade power demand output on a per connected heater basis for heaters addressed as 4 and 5.
HEATER 5	0%	
Press the ▼ key once.		
HEATER 6	0%	This screen shows the current cascade power demand output on a per connected heater basis for heaters addressed as 6 and 7.
HEATER 7	0%	

Table 24 – Cascade Menu

**C. HEATER TEST MODE**

This function is intended to simplify the gas adjustment. Listed in Table 25. are the recommended combustion settings for the gas type selected to run the heaters. Automatic modulation does not take place when the controller is in test mode. However, the heaters will modulate down if the program set point is reached while running in test mode. It is recommended you have the largest load possible to create a heat demand so the test mode operation will not be interrupted. To enter test mode, press the ▲ and ▼ arrow keys simultaneously. **NOTE:** The heater will automatically exit test mode after 20 minutes of operation.

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 <sub>2</sub> %)	8 ½ - 9 ½%	8 ½ - 9 ½%	9 ½ - 10 ½%	9 ½ - 10 ½%

Table 25 – Combustion Settings on All Models

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

Table 26 – Fan Speeds

**PART 11 – TROUBLESHOOTING****A. HEATER ERROR CODE**

If any of the sensors detect an abnormal condition, or an internal component fails during the operation of the heater, the display may show an error message and error code. This message and 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 a condition that the controller has evaluated as not safe to restart the heater. In this case, the heater control will be locked out, the red FAULT light will be lit, and the message "LOCKOUT" will be displayed on the readout on the lower line.

The Heater will not start until a qualified technician has repaired the heater and pressed the RESET button for more than 1 second. If there is an error message displayed on the readout, and the message "LOCKOUT" is not displayed and the FAULT light is not lit, then the message is the result of a temporary condition and will disappear when the problem corrects itself.

**IMPORTANT NOTE:** If you see error messages on your display readout, call a technician immediately, since the message may indicate a more serious problem will occur soon.

**B. HEATER ERROR**

When an error condition occurs, the controller will display a description and code on the display readout. These error messages and their recommended corrective actions are described in Section D.

**C. HEATER FAULT**

1. When a fault condition occurs, the controller will illuminate the red "FAULT" indication light and display a fault message in the screen. The alarm output will also activate. Most fault conditions cause the CH pump to run in an attempt to cool the heater.

2. Note the fault message displayed and refer to Part D in this section for an explanation of the message 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 reoccurrence of fault message.

## **WARNING**

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

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

## **DANGER**

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

- There is no pressure in the heater. (Pull the release on the relief valve. Do not depend on the pressure gauge reading.
- The heater water is not hot.
- The electrical power is disconnected.

## **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 proper 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 heater damage. Instead, shut off the gas supply to the heater at the gas service valve.

### **D. USER INTERFACE DISPLAY**

#### **Cascade Control FAULT Codes**

SCREEN	DESCRIPTION	POSSIBLE REMEDY
<b>Fault Code E03 System Sensor Failure</b>		
SYS SUPPLY SENSOR PUMP OFF E03	This screen shows that there is a problem with the system sensor circuit. The circuit could be open or shorted. Possible reasons for this error are: There is no system sensor connected to the Master Heater. The system sensor is faulty. There is a short circuit in the system sensor wiring; possibly from a staple placed through the wire, or damage to the wire causing both conductors to touch. The system sensor wiring is open due to defect or damage.	Disconnect the system sensor from the wiring and measure the resistance of it. Compare the measured resistance to the table in this manual to see if it corresponds to the temperature of the sensor. If the resistance does not agree with the sensor, replace the sensor. If the sensor is OK, disconnect the sensor wiring from both the heater and the sensor and check continuity using an ohmmeter. Repair or replace as necessary. If this error is present, all heaters in the cascaded group will run and ignite simultaneously when there is a heat demand. Each heater will modulate to maintain set point temperature on its own supply sensor. This code will reset automatically when repair is complete. This code will not display if system setting function ERROR SYSTEM SENS is set to OFF.
<b>Fault Code TT Temperature Blocking TT Demand</b>		
TEMPER BLOCKING PUMP ON TT	This screen shows that there is a demand on the heater, the pump is powered on, and the temperature of the water at the supply sensor is too high for the heater to ignite. This occurs because the water temperature measured by the supply sensor is higher than the tank temperature – ignition diff setting. This message will stay present until the water temperature measured by the supply sensor is less than the tank temperature – ignition diff setting.	
<b>Fault Code FLU</b>		
HIGH FLUE PRESS FLU PUMP ON	This display indicates that there is excessive flue pressure. This code resets automatically after the high pressure condition is resolved. The second line indicates the status of the pump.	1. Assure that the flue is not blocked. 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 heater.
<b>WARNING:</b> Do not use jumper to remedy an FLU error. Faulty switch <b>MUST</b> be replaced. Failure to do so could result in serious injury or death.		



Fault Code LOU		
24 VOLT LOW PUMP ON LOU	This display indicates that the 24 volt power supply on the control is damaged or overloaded. This code resets automatically if it is the result of an overload and that overload condition is removed. The second line indicates the status of the pump. Note that while 24 volt power is low, the pump output will be on.	<ol style="list-style-type: none"> <li>1. Check line voltage. It must be between 100 and 128 volts.</li> <li>2. If available, connect 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 no greater than 250. Use this as a troubleshooting guide as you follow the steps below.</li> <li>3. Remove the 10 pin Molex connector from customer connection board. If the message clears, then the problem is with the external sensor wiring. Examine the external sensor wiring for shorts to the ground, repairing as necessary. If the message is still present and the heater is so equipped, disconnect the UL 353 low water cut-off to see if the message clears. Replace the faulty part. Check the low voltage wire harness in heater for shorts to ground.</li> <li>4. If a message only occurs when the burner tries to light, check the gas valve for excessive current draw.</li> <li>5. If a message is present with the low voltage harness disconnected from the 926 control board, replace the 926 control board.</li> </ol>
Fault Code F00		
WATER HIGH TEMP PUMP ON F00	This display indicates if the water in the heater has overheated. This code indicates a serious safety issue and the heater will not restart until it cools sufficiently and a technician repairs the cause of overheating and pushes the RESET button on the display. This is a serious situation and is indicated by the red light on the display illuminating and the word LOCKOUT flashing on the display. During this lockout fault, the pump will be on as indicated on the second line in an effort to cool the heater down.	<ol style="list-style-type: none"> <li>1. Check circulator pump operation</li> <li>2. If the circulator pump is running, be sure that there is water in the system and that the water is moving through the system as intended. Be sure that all correct ball valves and or zone valves are open or closed as intended.</li> <li>3. Observe the temperature/pressure gauge. If the water is not too hot and this message is displayed, check the wiring to the water ECO sensor and repair if necessary. If the wiring is ok and this code is still present and the water is not excessively hot, replace the ECO sensor.</li> </ol>
Fault Code F01		
FLUE TEMP/WAT LV F01 PUMP ON	This display indicates that the flue temperature limit switch of the heater has tripped or that the water level in the heater is low (this will only occur if the optional UL353 LWCO is installed). This code indicates a serious safety issue. The heater will not restart until the flue cools down sufficiently or the water level is restored. A technician must repair the cause of the problem and push the RESET button first on the low water cut-off control box, then on the display. This situation is indicated by the red light on the display and the word LOCKOUT flashing on the display. During this lockout fault, the pump will be on as indicated on the second line of the display.	<ol style="list-style-type: none"> <li>1. If the heater 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 the LWCO. The LED should change to green. Press the reset button on the front panel of the heater to reset the heater control.</li> <li>2. Check the flue for obstructions or any sign of damage, especially signs of excessive heat. Repair as necessary. Push the red reset button on the flue temperature switch located on the flue inside the rear access door of the heater. NOTE: The switch temperature must be less than 90°F to reset. Press the reset button on the display. Run the heater and check the flue temperature by using both an external thermometer in the flue pipe and the flue temperature display in the status screens. If the flue temperature is within specs and the switch trips, replace the switch. If the flue temperature is excessive, check and adjust combustion controls on the heater. If the problem persists, inspect the target wall in the combustion chamber and replace it if cracked or damaged.</li> </ol>
Fault Code F02		
SUPPLY SENSOR F02 PUMP ON	This display indicates that the supply temperature sensor of the heater has failed. This code indicates a serious safety issue and the heater will not restart until the sensor is replaced by a technician and he pushes the RESET button on the display. This situation is indicated by the red light on the display and the flashing word LOCKOUT. During this lockout fault, the pump will be on as indicated on the second line of the display.	<ol style="list-style-type: none"> <li>1. Check the electrical connection to the thermistor on the outlet manifold. Verify 5 VDC by checking in Molex connector. If there is no 5 VDC, check the harness. If harness is OK, replace control. NOTE: The heater will reset automatically. Verify thermistor values by referencing chart in this manual.</li> <li>2. Replace thermistor if necessary.</li> </ol>
Fault Code F03		
RETURN SENSOR F03 PUMP ON	This display indicates that the return temperature sensor of the heater has failed. This code indicates a serious safety issue and the heater will not restart until the sensor is replaced by a technician and he pushes the RESET button on the display. This situation is indicated by the red light on the display and the word LOCKOUT flashing on the display. During this lockout fault, the pump will be on as indicated on the second line of the display.	<ol style="list-style-type: none"> <li>1. Check circulator pump operation.</li> <li>2. Assure that there is adequate flow through the heater by accessing the status menu and assuring that there is less than a 50°F rise from the return thermistor to the supply thermistor.</li> <li>3. Troubleshoot thermistor by following steps in <b>F02</b>.</li> </ol>

Fault Code F04		
FLUE SENSOR F04 PUMP ON	This display indicates that the flue temperature sensor of the heater has failed. This is a serious safety issue. The heater will not restart until the sensor is replaced by a technician and he pushes the RESET button on the display. This situation is indicated by the red light and the flashing word LOCKOUT on the display. During this lockout fault, the pump will be on as indicated on the second line of the display.	Inspect the flue sensor for physical damage or corrosion and replace it if necessary. Check the electrical connection to the flue sensor and repair as necessary. Measure the resistance of the sensor and refer to the chart in Table 28 of this manual. The temperature on the chart should be close to the same as the temperature in the flue. If not, replace the flue sensor.
Fault Code F05		
SUPPLY TEMP HIGH F05 PUMP ON	This display indicates that the supply temperature of the heater is excessive. If accompanied by the red FAULT light and LOCKOUT flashing on the display, this code indicates that the temperature on the supply sensor has exceeded 230°F and a serious safety issue exists. The heater will not restart until the cause of the excessive temperature is repaired by a technician and he pushes the RESET button on the display. If the FAULT light is not illuminated and this message is displayed, then the supply temperature of the heater is at or above 210°F. The message will clear automatically when the temperature drops below 194°F. During the time that this message or lockout fault is displayed, the pump will be on as indicated on the second line.	<ol style="list-style-type: none"> <li>1. Check circulator pump operation.</li> <li>2. Assure that there is adequate flow through the heater by accessing the status menu and assuring that there is less than a 50°F rise from the return thermistor to the supply thermistor.</li> <li>3. Check the direction of flow off the heater circulator. (See Piping Details in this manual.)</li> <li>4. Troubleshoot the thermistor by following steps in <b>F02</b>.</li> </ol>
Fault Code F06		
RETURN TEMP HIGH F06 PUMP ON	This display indicates that the return temperature of the heater is excessive. If accompanied by the red FAULT light and LOCKOUT flashing on the display, this code indicates that the temperature on the return sensor has exceeded 230°F and a serious safety issue exists. The heater will not restart until the cause of the excessive temperature is repaired by a technician and he pushes the RESET button on the display. If the red FAULT light is not illuminated and this message is displayed, then the return temperature of the heater is at or above 210°F. The message will clear automatically when the temperature drops below 194° F. During the time that this message or lockout fault is displayed, the pump will be on as indicated on the second line.	<ol style="list-style-type: none"> <li>1. Check circulator pump operation.</li> <li>2. Assure that there is adequate flow through the heater by accessing the status menu and assuring that there is less than a 50°F rise from the return thermistor to the supply thermistor.</li> <li>3. Check the direction of flow on heater circulator. (See Piping Details in this manual.)</li> <li>4. Troubleshoot thermistor by following steps in <b>F02</b>.</li> </ol>
Fault Code F09		
NO FLAME ON IGN F09 PUMP ON	The heater tried to ignite four times during one heat call and failed. The red FAULT light and LOCKOUT will flash on the display. This code indicates a serious safety issue. The heater will not restart until the cause of ignition failure is repaired by a technician and he pushes the RESET button on the display. During this lockout fault, the pump will remain on as indicated on the second line of the display.	<ol style="list-style-type: none"> <li>1. Watch the igniter through the observation window provided.</li> <li>2. If there is no spark, check the spark electrode for the proper .196" (5.0 mm ± 1mm) gap. See Figure 34.</li> <li>3. Remove any corrosion from the spark electrode and flame rectifier probe.</li> <li>4. If there is a spark but no flame, check the gas supply to the heater.</li> <li>5. If there is a flame, check the flame sensor.</li> <li>6. Check any flue blockage or condensate blocks.</li> </ol>

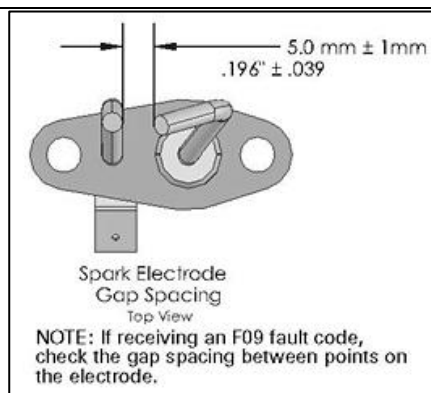


Figure 34

**Fault Code F10**

FLAME LOSS F10	<p>The flame was lost while the heater was firing 3 times during 1 demand call. The red light will display and the word LOCKOUT will flash. This code indicates a serious safety issue. The heater will not restart until the cause of flame loss is determined by a technician and he pushes the RESET button on the display. During this lockout fault, the pump will be on as indicated on the second line of the display.</p>	<ol style="list-style-type: none"> <li>1. Monitor the gas pressure to the unit while in operation.</li> <li>2. Assure that the flame is stable when lit.</li> <li>3. Check to see if the display readout changes from "GAS VALVE ON" to "RUN" within a few seconds after the heater ignites.</li> <li>4. Check the FLAME signal on the status display. It should be above 1.0 when the heater is firing.</li> <li>5. If the signal reads less than 1 microampere, clean the flame rectifier and spark probe.</li> <li>6. If the problem persists and the "FLAME" signal is still less than 1.0, replace the flame probe and spark igniter probe.</li> <li>7. The flame signal should be steady after the heater has been firing for 1 minute and is normally at 5.0 to 9.0. If the flame signal is not steady, disassemble the burner door and check the burner and its sealing gaskets.</li> </ol>
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**Fault Code F11**

FALSE FLAME SIG F11 PUMP ON	<p>There is flame when the control is not telling the heater to run. The red light will display and the word LOCKOUT will flash. This code indicates a serious safety issue. The heater will not restart until the cause is determined by a technician and he pushes the RESET button on the display. During this lockout fault, the pump will be on as indicated on the second line of the display.</p>	<ol style="list-style-type: none"> <li>1. Look into window. If there is flame, turn the gas off to the unit at the service valve and replace the gas valve.</li> <li>2. If the flame signal on the status menu is greater than 1.0 when the burner is not lit, replace the spark ignitor and the flame rectification probe.</li> <li>3. If the flame signal is not present after turning off the gas supply, check the gas valve electrical connection.</li> <li>4. Check for condensate backup. Repair condensate system as necessary. If condensate has partially filled the combustion chamber, the refractory wall may be damaged and should be replaced.</li> <li>5. Turn the gas on at the service valve after corrective action is taken.</li> <li>6. If the refractory wall falls against the rectifier probe, it may conduct the signal to ground, giving a false reading.</li> </ol>
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**Fault Code F13**

FAN SPEED ERROR F13 PUMP ON	<p>The fan is not running at the speed that the control has commanded it to run at. The fan speed had been more than 30% faster or slower than the commanded speed for more than 10 seconds. The red light will display and the word LOCKOUT will flash. This code indicates a serious safety issue and the heater will not restart until the cause is determined by a technician and he pushes the RESET button on the display. During this lockout fault, the pump will be on as indicated on the second line.</p>	<ol style="list-style-type: none"> <li>1. Check the combustion air fan wiring.</li> <li>2. Measure the DC voltage from the red fan wire to ground while it is connected to the fan. It should be between 24 to 40 volts. If it is lower than 24 volts, check for excessive external loads connected to the heater sensor terminals. Disconnect the 5 pin plug from the fan and check the voltage on the red wire again. If it is now between 24-40 volts, replace the fan. If it is still below 24 volts replace the heater control board.</li> </ol>
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**Fault Code F15**

APS OPEN F15	Flapper valve feedback stuck open.	<ol style="list-style-type: none"> <li>1. Check flue system for obstructions.</li> <li>2. Check proper communication between boilers.</li> <li>3. Check operation of flapper valve.</li> <li>4. Check wiring between valve and controller.</li> <li>5. Replace valve-flapper.</li> </ol>
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<b>Fault Code F16</b>		
APS CLOSED F16	Flapper valve stuck closed.	<ol style="list-style-type: none"> <li>1. Check flue system for obstructions.</li> <li>2. Check proper communication between boilers.</li> <li>3. Check operation of flapper valve.</li> <li>4. Check wiring between valve and controller.</li> <li>5. Replace valve-flapper.</li> </ol>
<b>Fault Code F20</b>		
CONDENSATE FULL F20 PUMP ON	The condensate trap is full. The red light will display and the word LOCKOUT will flash. This code indicates a serious safety issue. The heater will not restart until the cause is determined by a technician and he pushes the RESET button on the display. During this lockout fault, the pump will be off as indicated on the second line of the display.	<ol style="list-style-type: none"> <li>1. Check condensate lines for obstructions.</li> <li>2. Check float switch in condensate reservoir.</li> <li>3. Check wiring from condensate reservoir to 926 control and repair as necessary.</li> </ol>
<b>Fault Code F31</b>		
PROGRAM ERROR F31	There was an error while programming the control and the memory is corrupt. The heater control will not function in this state and the pump will be off as indicated on the bottom line. This error only occurs if a technician is programming the control and the programming function fails. The only way to recover from this error is to reprogram the control. If this error occurs at any time other than when a technician is servicing the heater, the control has failed and must be replaced by a qualified technician.	The control must be re-programmed. If programming does not solve problem, the control must be replaced.
<b>Fault Code PP</b>		
CONTROL PROGRAMED PP	The control has been programmed by a technician or the factory. After programming, the control is left in a locked out mode.	Press the RESET key for at least 1 second to begin use of the control.
<b>Fault Code FL</b>		
LOW WATER FLOW FL PUMP OFF	This display indicates that there is low water flow in the heater. This code will display on VWH products only. This code resets automatically when water flow is high enough for the heater to run safely. The second line indicates the status of the pump. The pump should always be on when this code is displayed. When there is a demand, the control will start the pump, wait for the flow switch to indicate flow then try to ignite the heater. This display occurs after the pump is energized for several seconds and the flow is still too low.	<ol style="list-style-type: none"> <li>1. Check to see if heater pump is functioning. Repair as necessary.</li> <li>2. Be sure water is flowing in the system. Check for valves that should be open, plugged filter screens, etc.</li> <li>3. Check the flow switch and wiring. Repair as necessary.</li> </ol>
<b>The following blocking codes will block operation until the control determines the situation safe for heater operation.</b>		
<b>Blocking Code E07</b>		
FLUE TEMP HIGH E07 PUMP OFF TIME	This display indicates that the flue sensor temperature is excessive and above 210°F. When this code is displayed, the heater will not respond to a demand for heat. When the flue temperature decreases below 194°F, the display will return to normal and allow the heater to respond for a demand to heat. The bottom line indicates the status of the pump. The pump will remain off when this error is displayed.	Check the flue for obstructions or any sign of damage, especially signs of excessive heat. Repair as necessary. Run the heater and check the flue temperature with an external thermometer. If the flue temperature on the thermometer does not agree with the flue temperature displayed in the status menu, inspect the wiring to the flue temperature sensor in the heater and repair as necessary. If the wiring is intact, replace the flue sensor. If the flue temperature is excessive on the status menu and the test thermometer reads the same, check and adjust combustion controls on the heater. If the problem persists, inspect the target wall in the combustion chamber and replace it if cracked or damaged.
<b>Blocking Code E16</b>		
COMMON FLUE BLOCK E16	Common flue blocking or flapper valve feedback failure.	<ol style="list-style-type: none"> <li>1. Check flue system for obstructions.</li> <li>2. Check proper communication between boilers.</li> <li>3. Check operation of flapper valve.</li> <li>4. Check wiring between valve and controller.</li> <li>5. Replace valve-flapper.</li> </ol>
<b>Blocking Code E19</b>		
LINE VOLTAGE PUMP OFF E19	This display indicates that the line voltage frequency is out of range. This could happen if the heater is being powered from a small gasoline powered generator that is not functioning correctly or overloaded.	Inspect power wiring to heater and repair as necessary. If connected to line voltage, notify the power company. If connected to an alternate power source such as generator or inverter, make sure the line voltage frequency supplied by the device is 60 Hz.

Table 27 – Heater Error and Fault Codes

Outdoor Sensor (7250P-319)		Supply Temperature Sensor (7250P-324)	
		Heater Sensor (7250P-667)	Indirect Sensor (7250P-325)
Outside Temperature (°F)	Resistance (ohms)	Outside Temperature (°F)	Resistance (ohms)
-22	171800	32	32550
-13	129800	41	25340
-4	98930	50	19870
5	76020	59	15700
14	58880	68	12490
23	45950	77	10000
32	36130	86	8059
41	28600	95	6535
50	22800	104	5330
59	18300	113	4372
68	14770	122	3605
77	12000	131	2989
86	9804	140	2490
95	8054	149	2084
104	6652	158	1753
113	5522	167	1481
		176	1256
		185	1070
		194	915
		203	786
		212	667

Table 28 – Resistance Tables

## PART 12 – MAINTENANCE

### A. MAINTENANCE PROCEDURES

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 heater. The installer must also inform the owner that a lack of proper care and maintenance of the heater may result in a hazardous condition.

### WARNING

BEFORE EACH HEATING SEASON a trained and qualified service technician should perform the inspections as per the heater inspection and maintenance schedule in the back of the manual. Failure to do so could result in death or serious injury.

### 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.

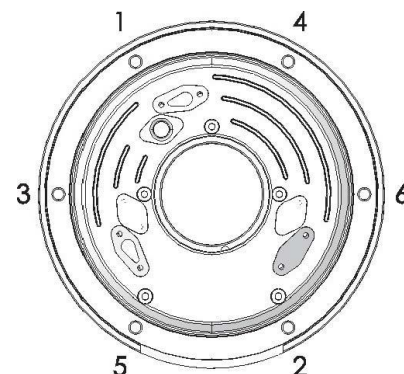
## **B. COMBUSTION CHAMBER COIL CLEANING INSTRUCTIONS FOR HEATER**

\*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 Heater by using the following steps:

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



**Figure 35 – Heat Exchanger Detail**

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.

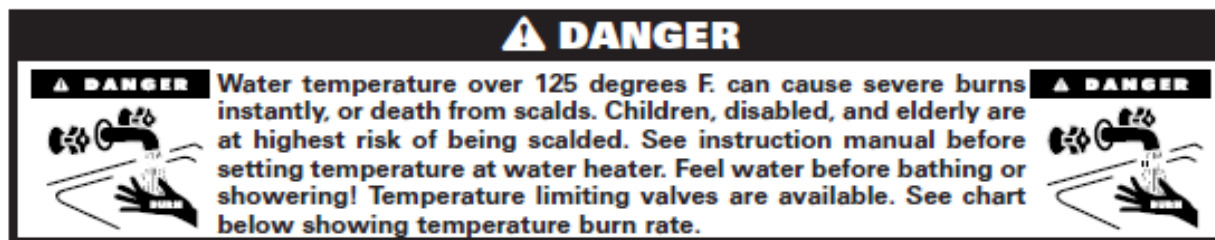
4. Spray the coils with clear water, making sure to confine the spray to the area being cleaned (Try to avoid getting the back ceramic wall of the unit wet). Flush the combustion chamber with fresh water until it runs clear from the condensate. At this point, the heater should be ready to be re-assembled.

- Inspect gaskets.
- Re-install the burner assembly
- Replace and tighten the (6) 10MM nuts to the burner plate using staggered tightening sequence. (See detail)
- Re-connect all wiring connections
- Inspect the gas valve to assure the O-ring is in place.
- Replace the (4) screws on the aluminum connector on the gas valve. Turn the gas back on. (IMPORTANT: CHECK FOR GAS LEAKS!)
- Turn the Heater power back on and create a demand on the heater. When heater is lit, observe condensate flow from the heater. Be sure the heater is operating properly.
- Re-connect the condensate piping to the outside condensate connection.

## **WARNING**

Do not use solvents to clean any of the burner components. The components could be damaged, resulting in unreliable or unsafe operation. Failure to do so could result in death or serious injury.

## **C. CLEANING WATER SIDE OF HEAT EXCHANGER**

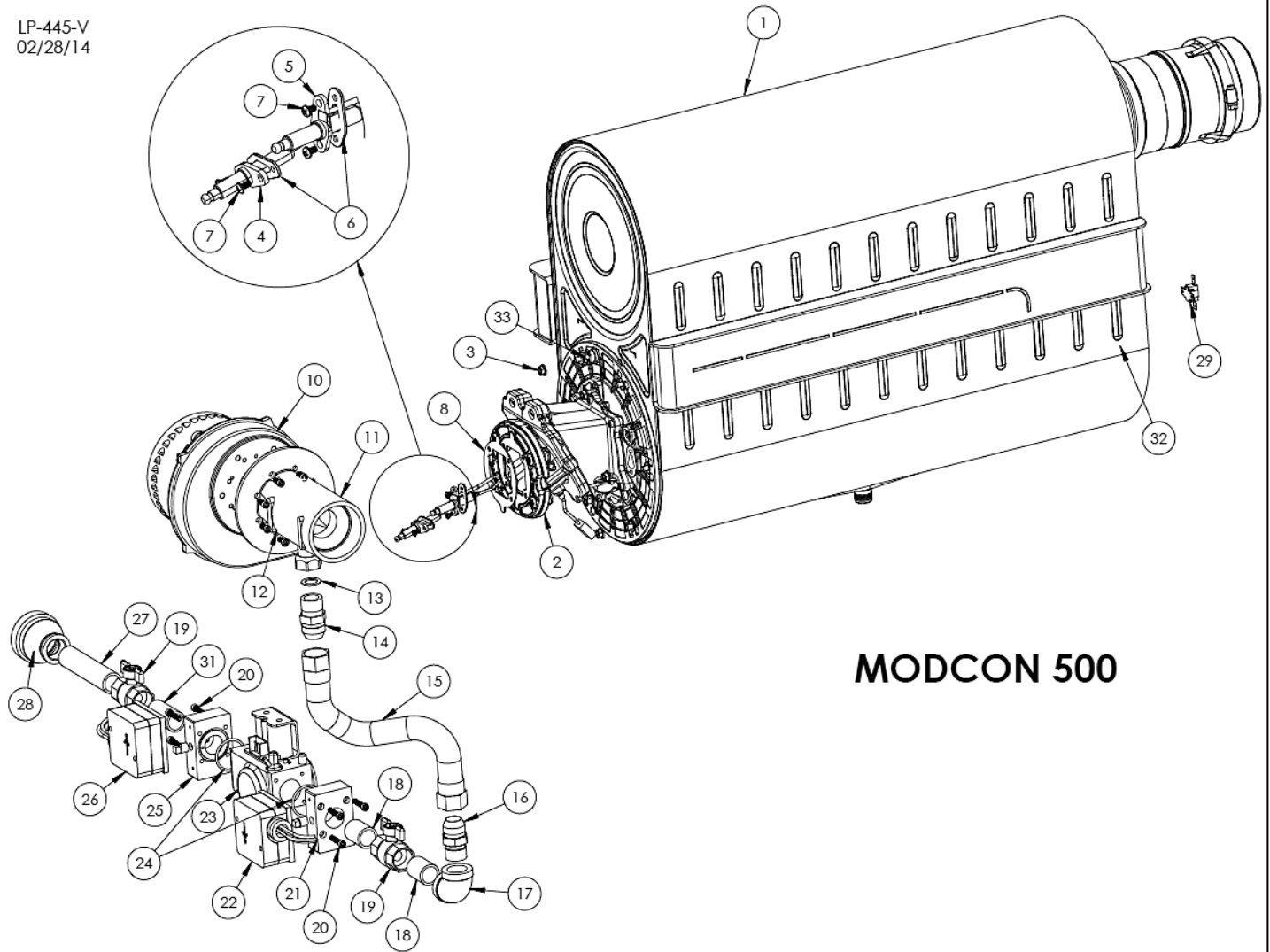


1. Make sure power is turned off to the heater. Run water through the hot water system to assure it is below room temperature.

2. Close isolation valves on the return and supply connections to the heaters as shown in 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.

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

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## MODCON 500

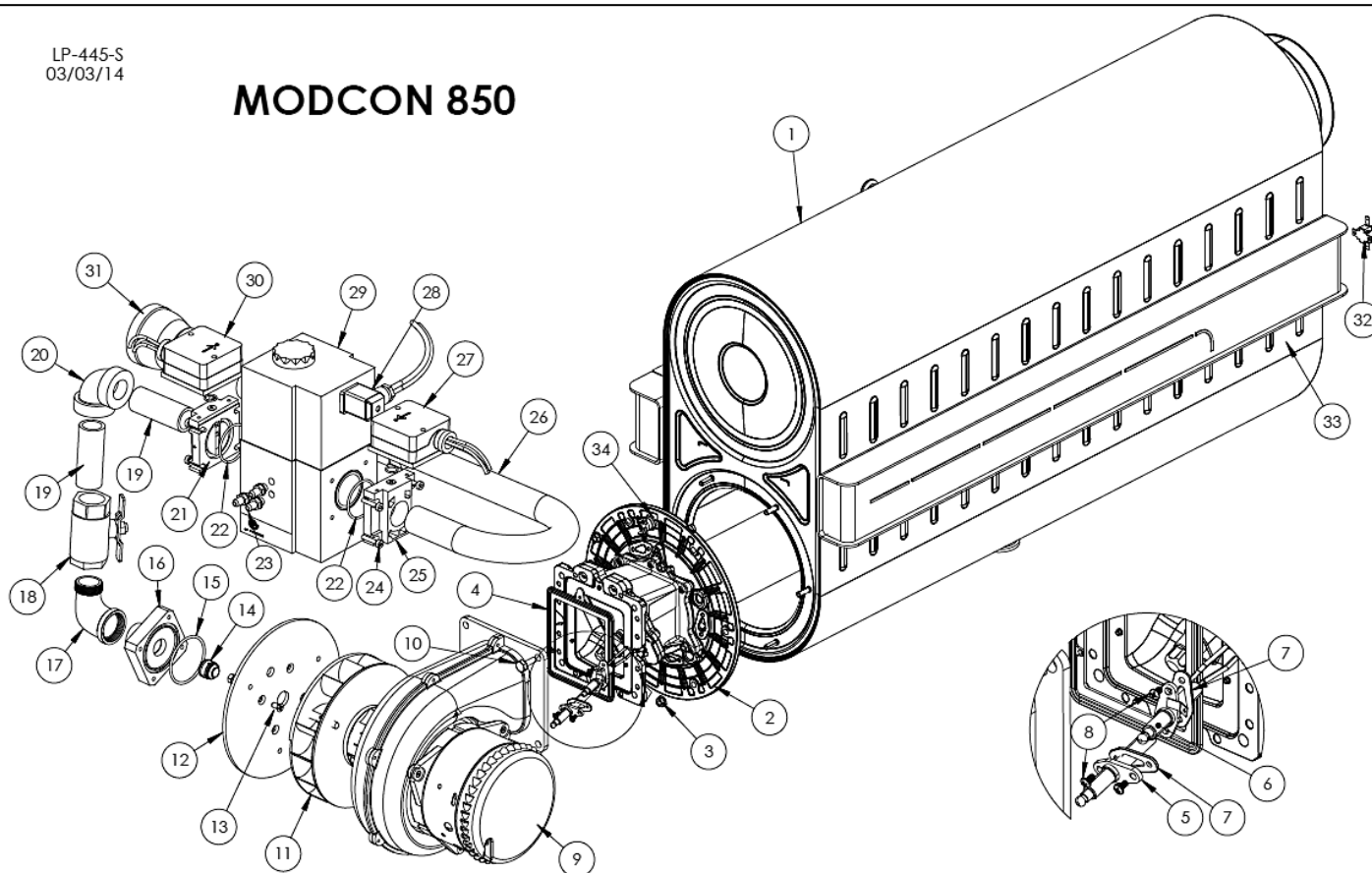
Item #	Replacement Part #	Description
1	7350P-006	500,000 BTU MODCON MODULE
2	7350P-442	BURNER ASSEMBLY (BURNER DOOR, FLAPPER VALVE, BURNER, BURNER GASKET)
3	7500P-067	M6 NUT - BURNER DOOR
4	7350P-023	FLAME RECTIFICATION PROBE (w/GASKET)
5	7350P-266	SPARK ELECTRODE (w/GASKET)
6	7250P-005	GASKET - PROBE/ELECTRODE
7	7250P-069	M4 X 8MM S.S. SCREW - PROBES
8	7350P-274	GASKET - BLOWER TO FLAPPER VALVE
9	7250P-206	M5 X 12MM ALLEN CAP SCREW - BLOWER (NOT SHOWN)
10	7350P-159	COMBUSTION BLOWER
11	7350P-630	AIR/GAS MIXER ASSEMBLY
12	7250P-478	M5 X 12MM ALLEN CAP SCREW- AIR/GAS MIXER
13	7450P-115	WASHER - AIR/GAS MIXER
14	7450P-138	3/4 FLARE X 3/4 BSPP FITTING
15	7600P-152	3/4 FLARE FLEX HOSE
16	7450P-143	3/4 FLARE X 3/4 NPT ADAPTER

Item #	Replacement Part #	Description
17	7350P-083	3/4 NPT ELBOW
18	7350P-101	3/4 NPT X CLOSE NIPPLE - ZINC PHOSPHATE COATED
19	7350P-079	3/4 GAS BALL VALVE
20	7250P-061	M5 X 25MM S.S. SOCKET CAP SCREW - SWITCH BLOCK
21	7350P-075	GAS PRESSURE SWITCH BLOCK (LEFT)
22	7350P-035	HIGH PRESSURE GAS SWITCH w/O-RING (OPTIONAL)
23	7350P-033	GAS VALVE
24	7350P-077	SILICONE O-RING #127 - SWITCH BLOCK
25	7350P-076	GAS PRESSURE SWITCH BLOCK (RIGHT)
26	7350P-036	LOW PRESSURE GAS SWITCH w/O-RING (OPTIONAL)
27	7350P-081	3/4 X 4-1/2" NIPPLE - ZINC PHOSPHATE COATED
28	7350P-110	3/4" X 1-1/2" NPT REDUCING COUPLING BLACK IRON
29	7350P-626	THERMAL FUSE
30	7350P-078	1/8-27 NPT PLUG - SWITCH BLOCK
31	7350P-102	2" NPT NIPPLE
32	7250P-162	CERAMIC REFRACTORY (LOCATED INSIDE END OF MODULE)
33	7450P-085	TEMPERATURE LIMIT SWITCH

Figure 36

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03/03/14

## MODCON 850

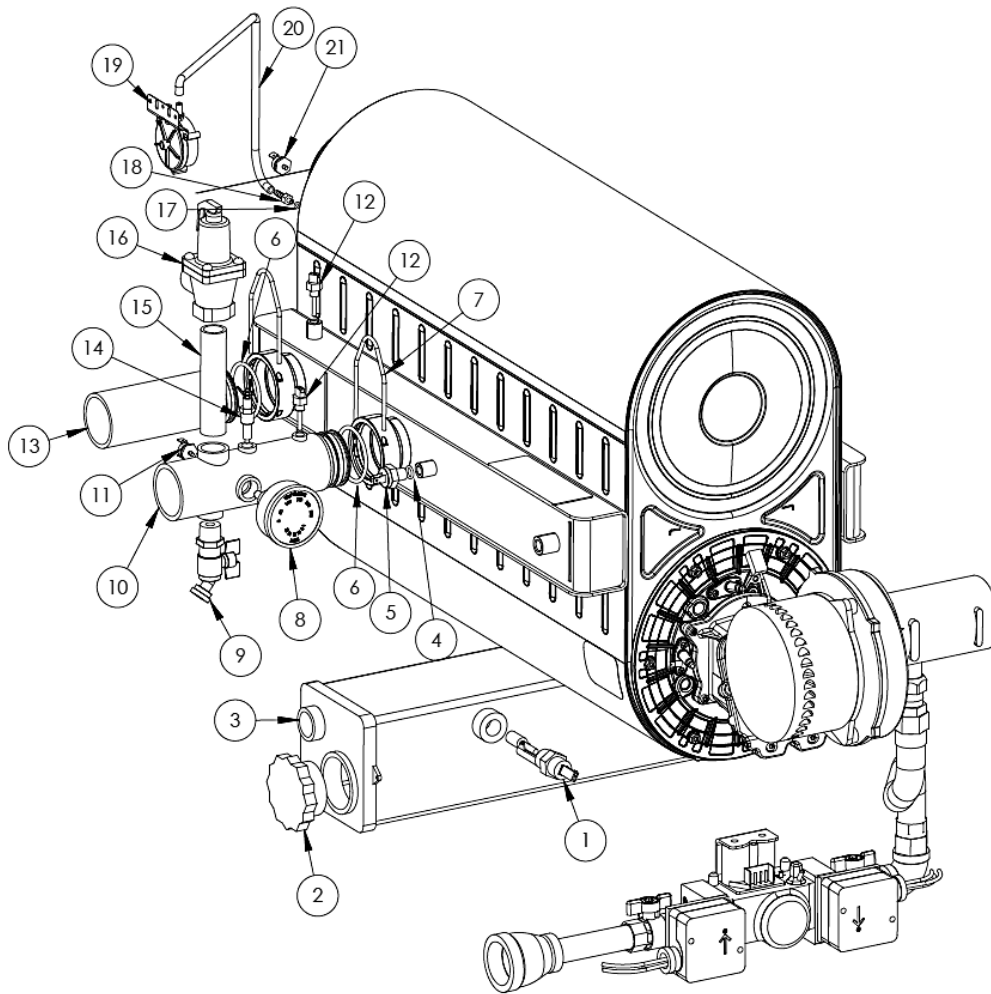


Item #	Replacement Part #	Description
1	7350P-007	850,000 BTU MODCON MODULE
2	7350P-443	BURNER ASSEMBLY (BURNER DOOR, FLAPPER VALVE, BURNER, BURNER GASKET)
3	7500P-067	M6 NUT - BURNER DOOR
4	7350P-064	GASKET - BLOWER TO FLAPPER VALVE
5	7350P-023	FLAME RECTIFICATION PROBE (w/GASKET)
6	7350P-266	SPARK ELECTRODE (w/GASKET)
7	7250P-005	GASKET - PROBE/ELECTRODE
8	7250P-069	M4 X 8MM CHEESE HEAD PHILLIPS SCREWS - PROBE/ELECTRODE
9	7350P-238	COMBUSTION BLOWER
10	7350P-093	M8 X 20MM HEX HEAD BOLT - BLOWER
11	7350P-034-11	SWIRL PLATE
12	N/A	MOUNTING PLATE
13	N/A	M6 X 24MM FLAT HEAD SCREW - ADAPTER FLANGE
14	N/A	O-RING - BLOWER ADAPTER FLANGE
15	7350P-034-4	12MM GAS INJECTOR
16	7350P-034-2	BLOWER ADAPTER FLANGE (includes O-RING, SCREWS)
17	7350P-096	1" M X 1" F STREET ELBOW - ZINC PHOSPHATE COATED

Item #	Replacement Part #	Description
18	7350P-099	1" GAS BALL VALVE
19	7350P-098	1" NPT X 3" NIPPLE - ZINC PHOSPHATE COATED
20	7350P-095	1" NPT 90 DEGREE ELBOW
21	7350P-034-3	MAXIMUM FLOW RESTRICTOR FLANGE
22	N/A	O-RING - FLANGES
23	7350P-034-6	AIR ADJUSTMENT PORTS
24	N/A	M6 X 25MM SCREWS - FLANGE
25	7350P-034-5	1" NPT FLANGE
26	7350P-082	GAS PIPE ASSY w/SHUT-OFF - 1-1/4 IPS X 1 IPS
27	7350P-036	LOW PRESSURE GAS SWITCH w/O-RING (OPTIONAL)
28	7350P-034-8	HIRSCHMAN CONNECTOR
29	7350P-034	GAS VALVE (includes O-ring, Screws)
30	7350P-035	HIGH PRESSURE GAS SWITCH w/O-RING (OPTIONAL)
31	7350P-109	1-1/4" - 2" REDUCING COUPLING
32	7350P-626	THERMAL FUSE
33	7250P-162	CERAMIC REFRACTORY (LOCATED INSIDE END OF MODULE)
34	7450P-085	TEMPERATURE LIMIT SWITCH

Figure 37

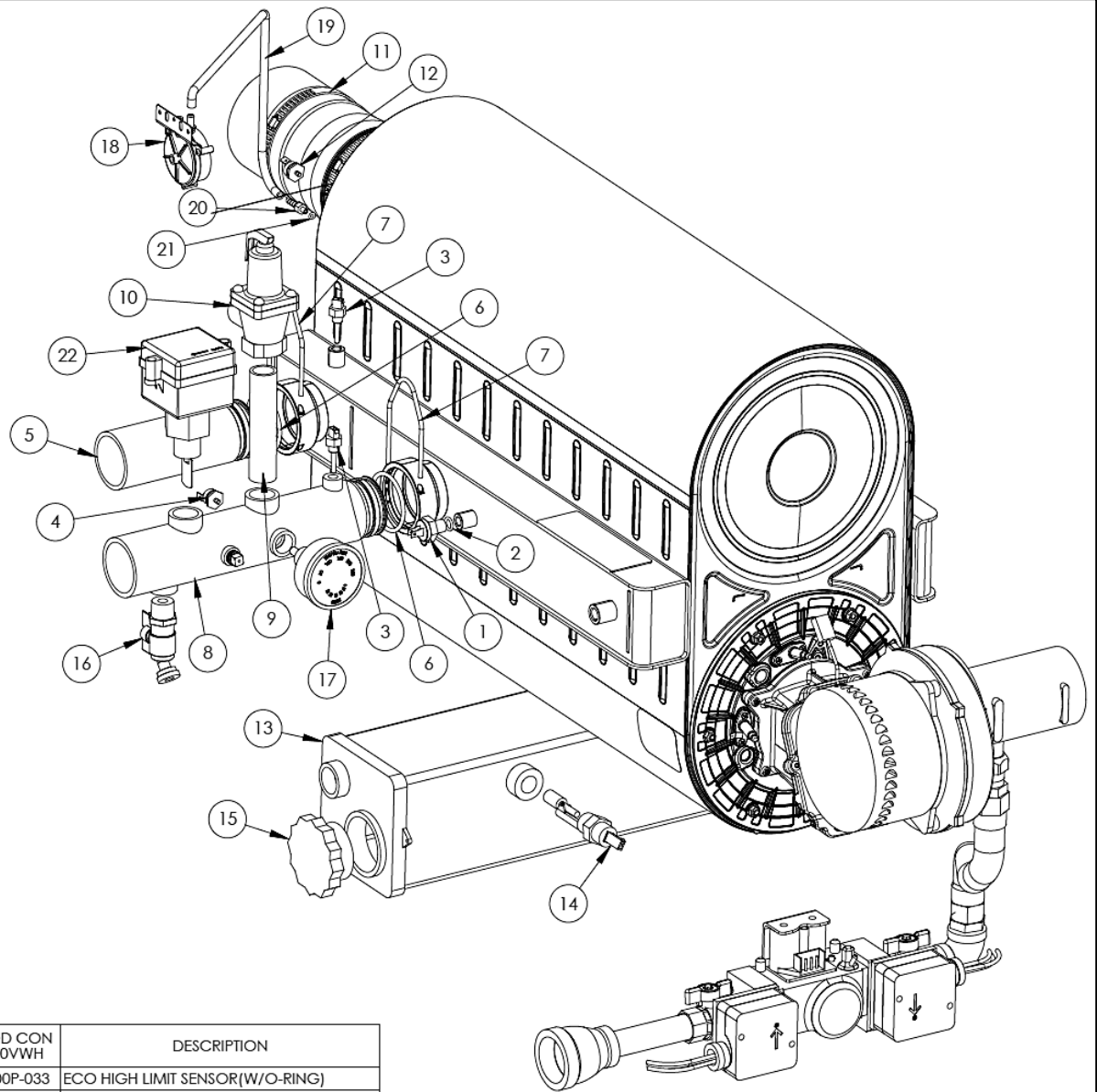




Item#	ModCon500	ModCon850	Description
1	7350P-167	7350P-167	CONDENSATE OVERFLOW SWITCH
2	7350P-113	7350P-113	2" PVC PLUG
3	7350P-613	7350P-613	CONDENSATE OVERFLOW SWITCH
4	7500P-100	7500P-100	O-RING - ECO HIGH LIMIT SENSOR
5	7500P-033	7500P-033	ECO HIGH LIMIT SENSOR (w/O-RING)
6	7350P-072	7350P-072	O-RING - INLET/OUTLET NIPPLE
7	7350P-015	7350P-015	INLET/OUTLET NIPPLE CLIP
8	7250P-499	7250P-499	TEMP/PRESSURE GAUGE 200 PSI
9	7350P-327	7350P-327	SHUT-OFF DRAIN
10	7350P-318	7350P-318	OUTLET NIPPLE (w/O-RING)
11	7500P-002	7500P-002	ECO SWITCH - 190 DEG.
12	7250P-667	7250P-667	THERMISTOR
13	7350P-004	7350P-004	INLET NIPPLE
14	7350P-089	7350P-089	LOW WATER CUT-OFF PROBE
15	SN1018	SN1018	3/4" NPT X 3" NIPPLE - BRASS
16	7350P-065	7350P-065	150# RELIEF VALVE - 3/4" NPT
17	7250P-152	7250P-152	SILICONE O-RING 2-007 - BARBED FITTING
18	7250P-154	7250P-154	S.S. BARBED FITTING - 1/4 HOSE X 10-32
19	7250P-150	7250P-150	BLOCKED VENT PRESSURE SWITCH
20	7000P-805	7000P-805	PLASTIC TUBING 3/16 ID X 5/16 OD X 12"
21	7250P-739	7250P-729	FLUE ECO SWITCH - 160 DEG.
22	7350P-219	7350P-220	VENT ADAPTER

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Figure 38



ITEM	MOD CON 500VWH	MOD CON 850VWH	DESCRIPTION
1	7500P-033	7500P-033	ECO HIGH LIMIT SENSOR(W/O-RING)
2	7500P-100	7500P-100	O-RING-ECO HIGH LIMIT SENSOR
3	7450P-280	7450P-280	SENSOR, NTC
4	7500P-002	7500P-002	ECO SWITCH-190 DEGREES
5	7350P-004	7350P-004	2" INLET /NIPPLE (w/O-RING)
6	7350P-072	7350P-072	O-RING- INLET/OUTLET NIPPLE
7	7350P-015	7350P-015	2" INLET NIPPLE CLIP
8	7350P-002	7350P-002	2" OUTLET NIPPLE (w/O-RING)
9	SN1018	SN1018	3/4"NPT X 3" NIPPLE - BRASS
10	7350P-065	7350P-065	150# RELIEF VALVE=3/4" NPT
11	7350P-219	7350P-220	VENT ADAPTER
12	7250P-739	7250P-739	FLUE ECO SWITCH - 160 DEGREES
13	7350P-613	7350P-613	CONDENSATE COLLECTOR ASSEMBLY
14	7350P-167	7350P-167	CONDENSATE OVERFLOW SWITCH
15	7350P-113	7350P-113	2" PVC PLUG
16	7350P-327	7350P-327	DRAIN VALVE
17	7250P-499	7250P-499	TEMP/PRESSURE GAUGE
18	7250P-160	7250P-160	PRESSURE SWITCH
19	7000P-805	7000P-805	PLASTIC TUBING 3/16 ID X 5/16 OD X 12"
20	7250P-154	7250P-154	S.S. BARBED FITTING 1/4 HOSE X 10-32
21	7250P-152	7250P-152	O-RING, SILICONE 2-007 - BARBED FITTING
22	7350P-605	7350P-605	FLOW SWITCH KIT FOR MOD CON VWH

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01/23/13

Figure 39

## 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 (12 – 15 PSI)	_____ PSI			
	Add water to prime condensate cup				
	Percentage of glycol in system (0-50%)	_____ %			
	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 electrical connections	Ensure all electrical connections of line voltage (pumps, etc.) and low voltage circuits (system sensor, outdoor sensor, etc.) are properly wired.				
4) Check combustion	Check and adjust (if necessary) carbon dioxide content	_____ % CO2	High Fire	_____ % CO2	Low Fire
	Check and adjust (if necessary) carbon monoxide content	_____ ppm CO	High Fire	_____ ppm CO	Low Fire
5) Convert the boiler fuel type	If necessary, convert the heater to the proper gas type				
<b>Mod Con 500 Models ONLY</b>	Locate the stickers in the appropriate locations on the heater				
	Verify combustion settings after gas conversion, Carbon Dioxide	_____ % CO2	High Fire	_____ % CO2	Low Fire
	Verify combustion settings after gas conversion, Carbon Monoxide	_____ ppm CO	High Fire	_____ ppm CO	Low Fire
6) Record ionization current	Check uA reading at on the status menu (see start-up section)	_____ uA	High Fire	_____ uA	Low Fire
7) Verify system operation with indirect water heater sensor	Verify safety and operation of the indirect water heater, record settings	DHW Setpoint	_____	DHW Differential	_____
8) Verify system operation with indirect water heater aquastat	Turn up aquastat on storage tank to verify wiring connections. Boiler should fire.				
9) Mixing Valve	Ensure thermostatic mixing valve is properly supported and installed.				
Notes:					

Table 29

## 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			
PIPING		1 <sup>st</sup> YEAR	2 <sup>nd</sup> YEAR	3 <sup>rd</sup> YEAR	4 <sup>th</sup> YEAR*
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 exhaust and intake 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/CO <sub>2</sub> Levels	Check CO and CO <sub>2</sub> 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 30 - \*Continue annual maintenance beyond the 4<sup>th</sup> 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.

## MAINTENANCE NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

### 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.