



PHANTOM Series

**High Efficiency Gas-Fired Hot Water
Direct Vent Condensing Boilers**

Multiple Boiler Installation Instructions

These instructions must be affixed on or adjacent to the boiler and retained for future reference.

Models:

- **PHNTM080**
- **PHNTM100**
- **PHNTM120**
- **PHNTM150**
- **PHNTM180**

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury, or loss of life. For assistance or additional information, consult a qualified installer, service agency or the gas supplier. This boiler requires a special venting system. Read these instructions carefully before installing.



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IMPORTANT INFORMATION - READ CAREFULLY

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



DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury or property damage.



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

NOTICE

Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.



WARNINGS FOR THE HOMEOWNER

FOLLOW ALL INSTRUCTIONS and warnings printed in this manual, the Installation & Operating Instructions Manual, the owner's manual and posted on the boiler.

MAINTAIN THE BOILER. To keep your boiler safe and efficient, have a service technician maintain this boiler as specified in Part XIII of the manual.

IF YOU ARE NOT QUALIFIED to install or service boilers, do not install or service this one.

THE BOILER MAY LEAK WATER at the end of its useful life. Be sure to protect walls, carpets, and valuables from water that could leak from the boiler.

PROTECT YOUR HOME IN FREEZING WEATHER. A power outage, safety lockout, or component failure will prevent your boiler from lighting. In winter, your pipes may freeze and cause extensive property damage. Do not leave the heating system unattended during cold weather unless alarms or other safeguards are in place to prevent such damage

DO NOT BLOCK AIR FLOW into or around the boiler. Insufficient air may cause the boiler to produce carbon monoxide or start a fire.

KEEP FLAMMABLE LIQUIDS AWAY from the boiler, including paint, solvents, and gasoline. The boiler may ignite the vapors from the liquids causing explosion or fire.

KEEP CHILDREN AND PETS away from hot surfaces of the boiler, boiler piping, vent piping and vent terminals.

CARBON MONOXIDE (CO) is an odorless, deadly gas that may be introduced into your home by any malfunctioning fuel-burning product or vent system failure. Consider installing CO alarms near bedrooms in all levels of the building to warn you and your family of potential CO exposure.



DANGER

Explosion Hazard. DO NOT store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.

If you smell gas vapors, DO NOT try to operate any appliance - DO NOT touch any electrical switch or use any phone in the building. Immediately, call the gas supplier from a remotely located phone. Follow the gas supplier's instructions or if the supplier is unavailable, contact the fire department.



WARNING

- **Asphyxiation Hazard.** This boiler requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.
- **Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life.** Read and understand the entire manual before attempting installation, start-up operation, or service. Installation and service must be performed only by an experienced, skilled, and knowledgeable installer or service agency.
- **This boiler must be properly vented.**
- **This boiler needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air.**
- **Asphyxiation Hazard.** The interior of the venting system must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed venting system is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.
- **Installation is not complete unless a safety relief valve is installed into the tapping located on left side of appliance or the supply piping. - See the Water Piping and Trim Section of this manual for details.**
- **This boiler is supplied with safety devices which may cause the boiler to shut down and not re-start without service.** If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.
- **Burn Hazard.** This boiler contains very hot water under high pressure. Do not unscrew any pipe fittings nor attempt to disconnect any components of this boiler without positively assuring the water is cool and has no pressure. Always wear protective clothing and equipment when installing, starting up or servicing this boiler to prevent scald injuries. Do not rely on the pressure and temperature gauges to determine the temperature and pressure of the boiler. This boiler contains components which become very hot when the boiler is operating. Do not touch any components unless they are cool.
- **Respiratory Hazard.** Boiler materials of construction, products of combustion and the fuel contain alumina, silica, heavy metals, carbon monoxide, nitrogen oxides, aldehydes and/or other toxic or harmful substances which can cause death or serious injury and which are known to the state of California to cause cancer, birth defects and other reproductive harm. Always use proper safety clothing, respirators and equipment when servicing or working nearby the appliance.
- **Failure to follow all instructions in the proper order can cause personal injury or death.** Read all instructions, including all those contained in component manufacturers manuals which are provided with the boiler before installing, starting up, operating, maintaining or servicing.
- **All cover plates, enclosures and guards must be in place at all times.**

Table of Contents

I.	Preface	4
II.	Venting Multiple Boilers	4
	A. Terminal Spacing	4
	B. Condensate Drain Line	5
III.	Gas Piping Multiple Boilers	10
IV.	System Piping Multiple Boilers	11
	A. General System Piping Precautions	11
V.	Wiring	14
	A. Multiple Boiler Wiring	14
VI.	Start-up and Checkout	18
VII.	Operation	18
	A. General Information	18
	B. Configuring The Control	18
	C. Changing Settings	27
	D. Enter Service Contact Information	27
	E. Boiler Status	29
	F. Staging Process	35
VIII.	Service and Maintenance	35
IX.	Troubleshooting	35

I Preface

These instructions are meant to provide information specific to multiple boiler (“Lead-Lag”) installations of the following models:

- PHNTM080
- PHNTM100
- PHNTM120
- PHNTM150
- PHNTM180

For larger Phantom models, refer to the instructions provided with that boiler for information on multiple installations. Boilers covered by these instructions apply to the above models where the complete model number ends in “C” (example: PHTM180HNT1SUC). Consult the factory before attempting multiple boiler installations where the above models have a different last letter.

These instructions cover only multiple boilers installations consisting solely of the above models. It is also generally recommended that all boilers on the installation be of the same size.



WARNING

These instructions provide supplemental information. Except where specifically stated, they do not replace the instructions in the manual provided with the boiler. Failure to follow all applicable instructions could result in property damage, personal injury, or loss of life.

II Venting Multiple Boilers



WARNING

- **Asphyxiation Hazard. Do not manifold (“common vent”) any portion of multiple boiler vent or intake systems. Doing so may result in unreliable operation, boiler damage, personal injury, or loss of life.**
- **Failure to maintain the proper clearances between adjacent terminals may result in aspiration of flue gas into the combustion air supply, resulting in unreliable operation, property damage, personal injury, or loss of life.**

The vent and air intake systems must exactly match one of the vent options described in Section VII of the Phantom 80-180 installation manual. Manifolding of either the vent or intake systems is prohibited.

A. Terminal Spacing

Spacing requirements between the terminals of adjacent boilers is as follows:

- Horizontal Fitting Terminals (Figures 2.1, 2.2) – A horizontal spacing of 36” between any vent terminal and any intake terminal is recommended; however, this spacing may be reduced to 12” if necessary (Figure 2.1). Maintain a minimum spacing between adjacent intake terminals of 4” as shown in Figure 2.2.
- Low Profile Terminals (Figure 2.3) – Maintain a minimum of 12” between the adjacent inlet and outlet openings as shown in Figure 2.3.
- Horizontal IpeX or Diversitech Concentric Terminals (Figure 2.4) – At their closest point adjacent “bells” must either be within 4” of each other OR greater than 24” apart as shown in Figure 2.4.
- Vertical Fitting Terminals (Figure 2.5) – Maintain at least 12” horizontally (center to center) between the exhaust terminal of one boiler and the intake terminal of another boiler as shown in Figure 2.5.
- Vertical IpeX, Diversitech, or Duravent PPs Concentric Terminals (Figure 2.6) – At their closest point adjacent “bells” must either be within 4” of each other OR greater than 24” apart as shown in Figure 2.6.

Refer to the installation manual supplied with the boiler for other important terminal clearances, such as distance above normal snow line.

B. Condensate Drain Line

Condensate drain lines from multiple boilers may be manifolded together. Size the condensate disposal system to carry the condensate rate per boiler shown in Table 2.7 multiplied by the number of boilers in the system.

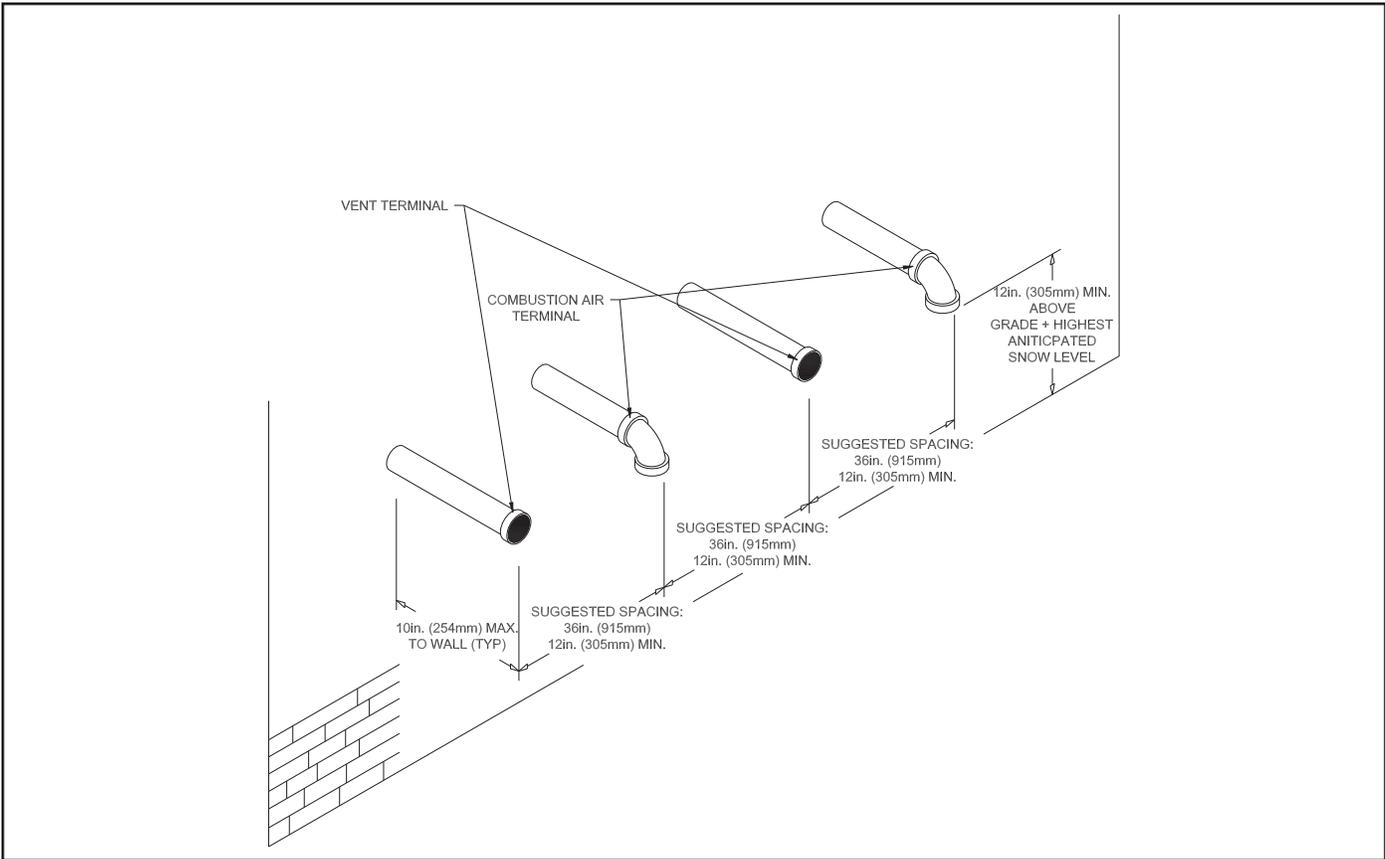


FIGURE 2.1: MULTIPLE BOILER HORIZONTAL CPVC/PVC DIRECT VENT

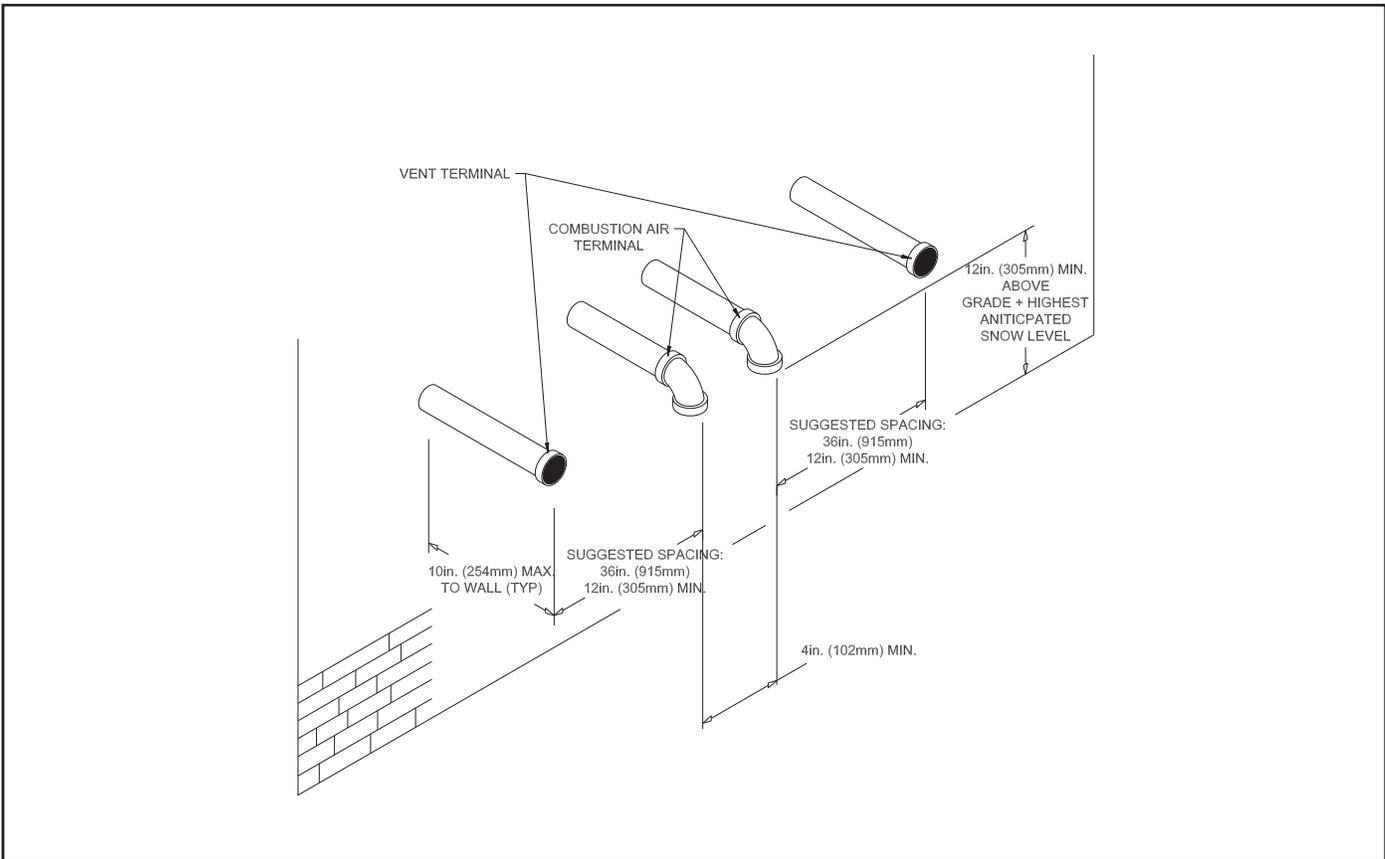


FIGURE 2.2: MULTIPLE BOILER HORIZONTAL CPVC/PVC DIRECT VENT ALTERNATE

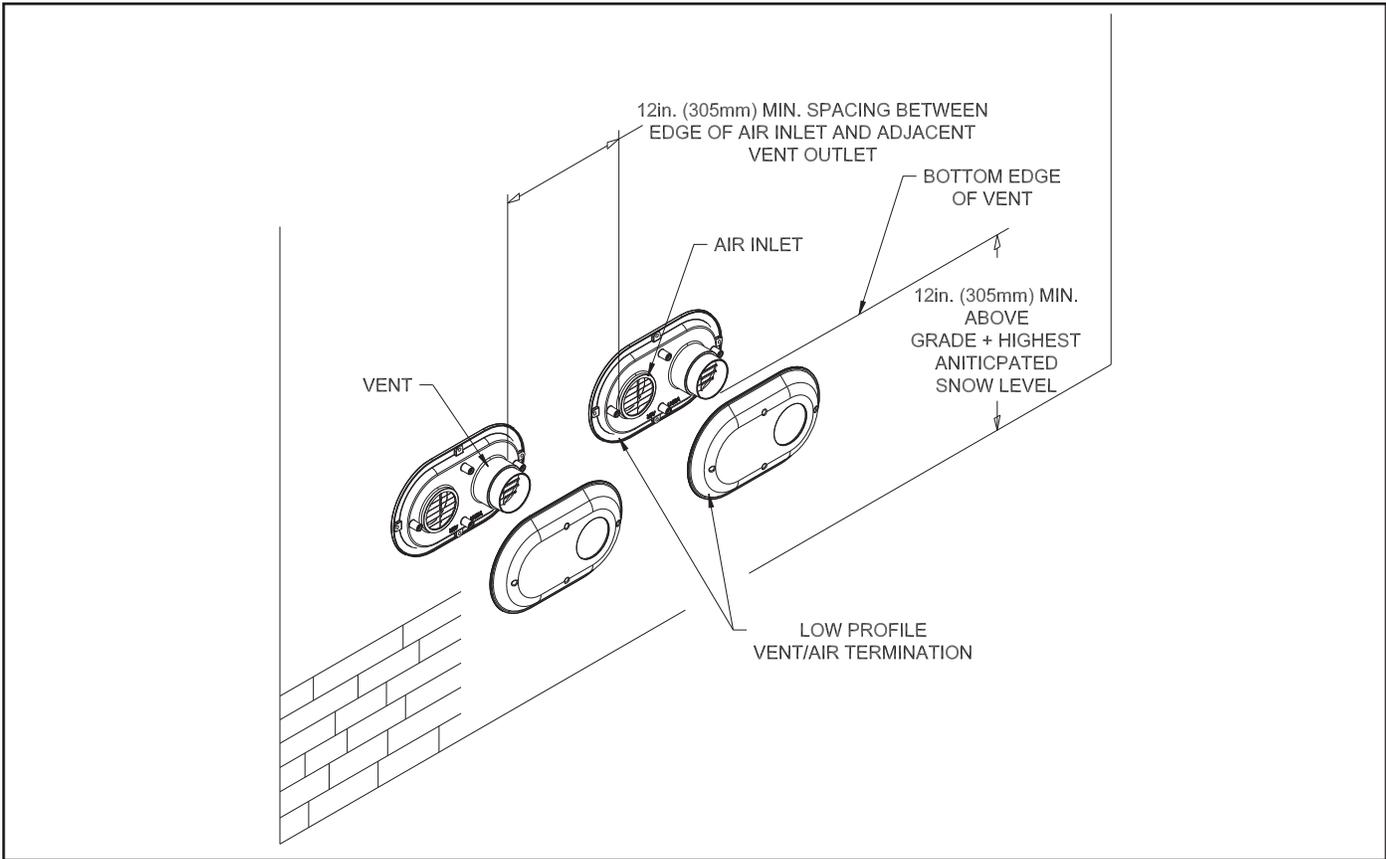


FIGURE 2.3: MULTIPLE BOILER HORIZONTAL VENTING WITH LOW PROFILE TERMINALS

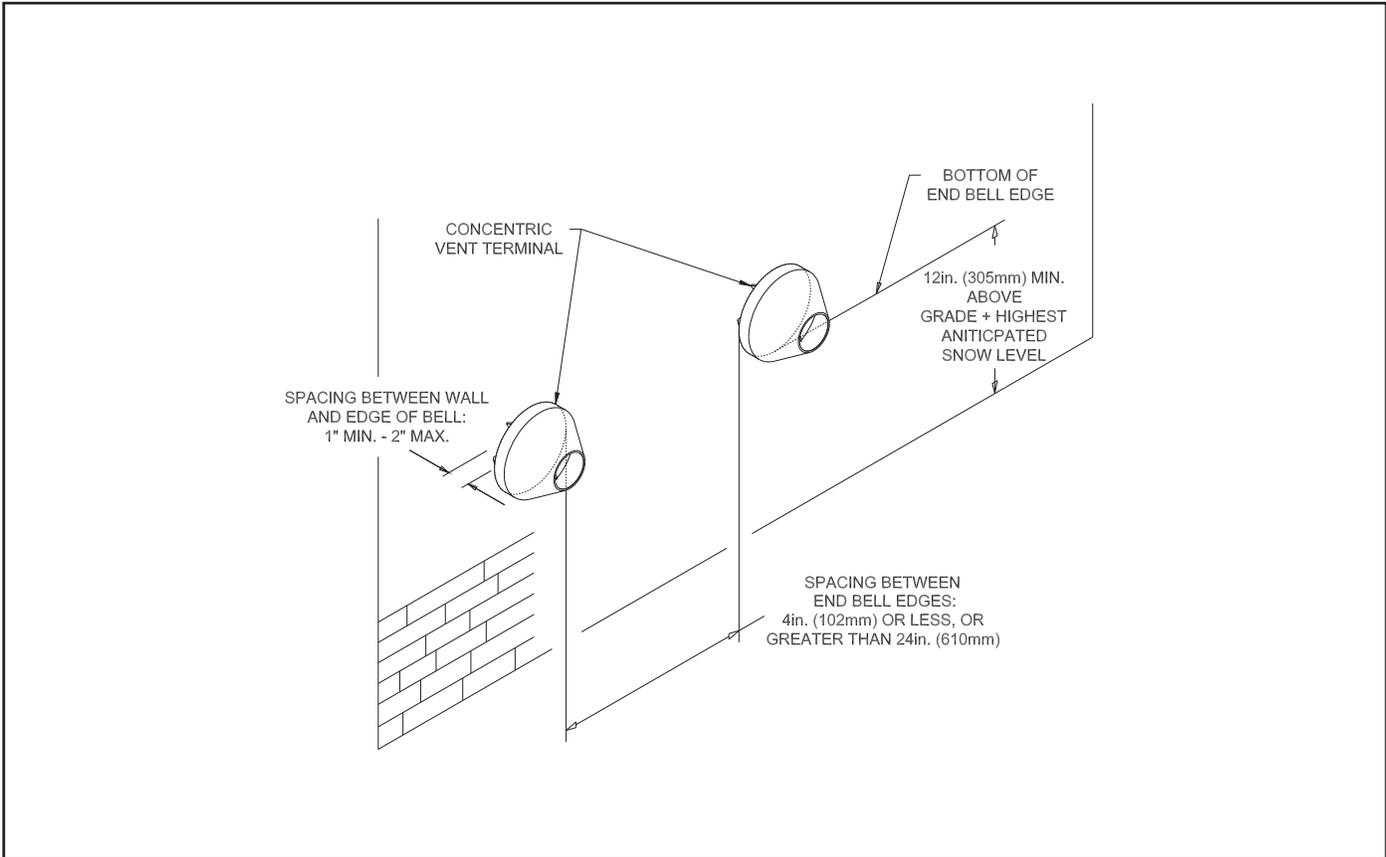


FIGURE 2.4: MULTIPLE BOILER HORIZONTAL VENTING WITH CONCENTRIC VENT TERMINALS

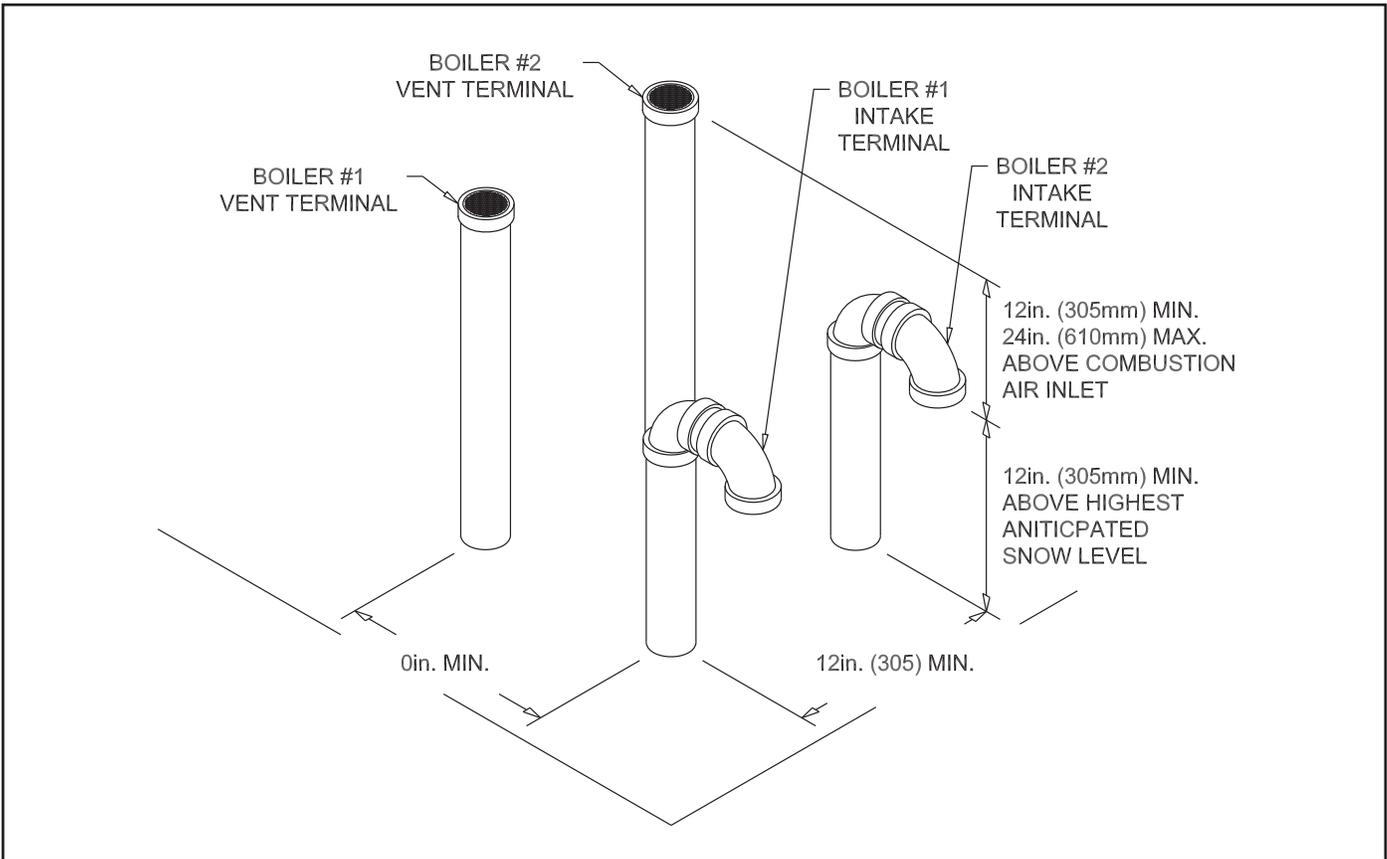


FIGURE 2.5: MULTIPLE BOILER VERTICAL CPVC/PVC DIRECT VENT

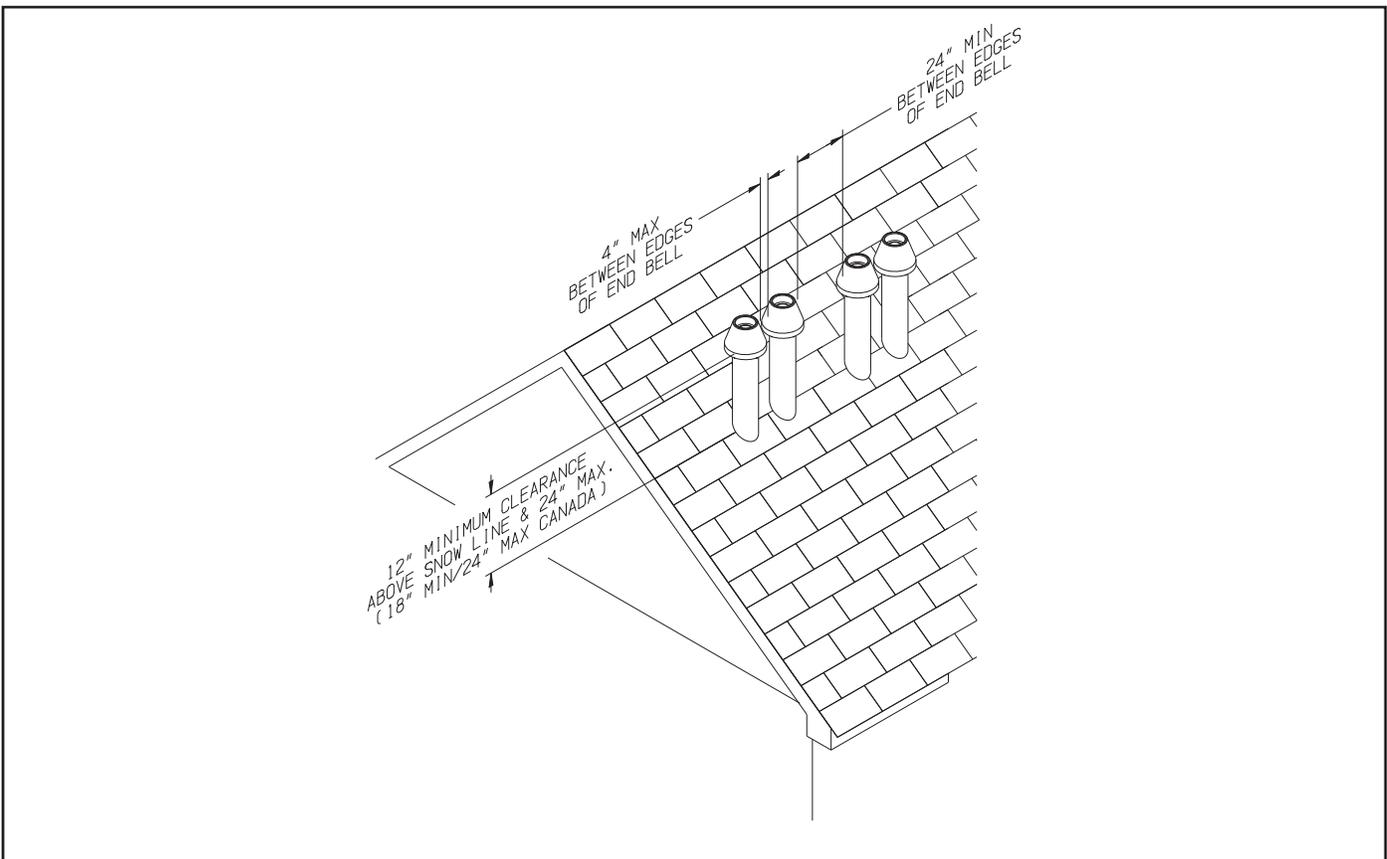


FIGURE 2.6: MULTIPLE BOILER VERTICAL VENTING WITH CONCENTRIC VENT TERMINALS

TABLE 2.7: MAXIMUM CONDENSATE FLOW

Boiler Model	*Maximum Condensate Flow, GPH
PHNTM080	0.9
PHNTM100	1.1
PHNTM120	1.4
PHNTM150	1.7
PHNTM180	2.1

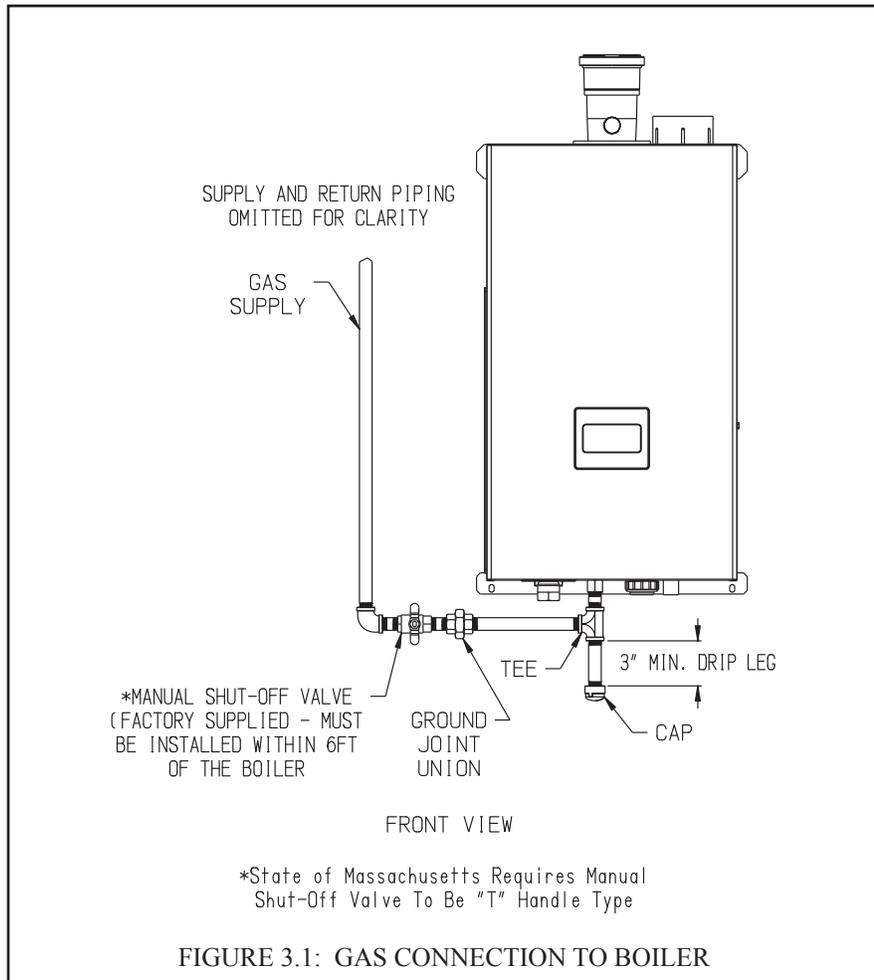
*Assumes 100% of water in fuel condenses

III Gas Piping Multiple Boilers

It is recommended that the gas piping of each individual boiler be installed as shown in Figure 3.1. When common gas piping is sized, insure it will have **adequate capacity for the combined input of the multiple boilers being installed**. Additional gas pressure regulators may need to be installed to properly regulate inlet gas pressure at the smallest individual boiler. Follow the instructions in Section VIII of the Phantom 080-180 Installation and Operating Instructions Manual for more detail on gas piping installation and hazards.

CAUTION

If gas pressure in the building is above 1/2 psig (3.4 kPa), an additional gas pressure regulator is required. Using one additional regulator for multiple boilers may result in unsafe boiler operation. The additional regulator must be able to properly regulate gas pressure at the input of the smallest boiler. If the regulator cannot do this, two or more additional regulators are required. Consult regulator manufacturer and/or local gas supplier for instructions and equipment ratings.



IV System Piping Multiple Boilers

A. General System Piping Precautions



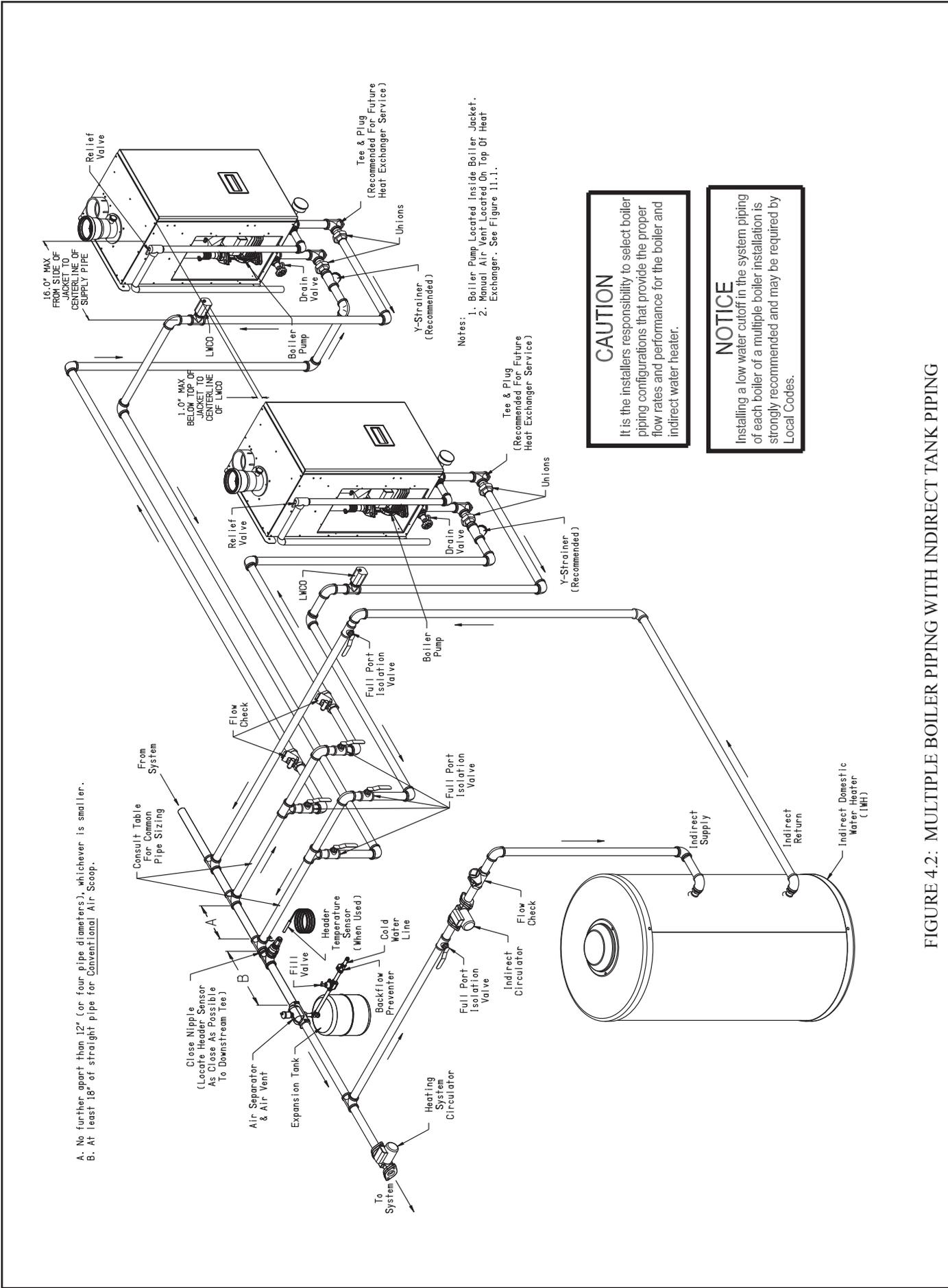
WARNING

- Failure to properly pipe boiler may result in improper operation and damage to boiler or structure.
- Install boiler so that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during boiler operation and service (circulator replacement, etc.).
- Oxygen contamination of boiler water will cause corrosion of iron and steel boiler components and can lead to boiler failure. Warranty does not cover problems caused by oxygen contamination of boiler water or scale (lime) build-up caused by frequent addition of water.

Follow the instructions in Section IX of the Phantom Series Installation and Operating Instructions Manual for installation of factory supplied piping, trim and individual near boiler piping design. See Table 4.1 and Figures 4.2 for piping recommendations.

Table 4.1: Multiple Boiler Water Manifold Sizing

Boiler Model	Number of Boilers						
	2	3	4	5	6	7	8
	Recommended Minimum Common Water Manifold Size (NPT)						
PHNTM080	1¼"	1½"	1½"	2"	2"	2"	2½"
PHNTM100	1¼"	1½"	2"	2"	2½"	2½"	2½"
PHNTM120	1½"	2"	2½"	3"	3"	3"	3"
PHNTM150	1½"	2"	2½"	3"	3"	3"	3"
PHNTM180	2"	2½"	2½"	3"	3½"	3½"	3½"



A. No further apart than 12" (or four pipe diameters), whichever is smaller.
 B. At least 18" of straight pipe for Conventional Air Scoop.

Notes:
 1. Boiler Pump Located Inside Boiler Jacket.
 2. Manual Air Vent Located On Top Of Heat Exchanger. See Figure 11.1.

CAUTION
 It is the installers responsibility to select boiler piping configurations that provide the proper flow rates and performance for the boiler and indirect water heater.

NOTICE
 Installing a low water cutoff in the system piping of each boiler of a multiple boiler installation is strongly recommended and may be required by Local Codes.

FIGURE 4.2: MULTIPLE BOILER PIPING WITH INDIRECT TANK PIPING

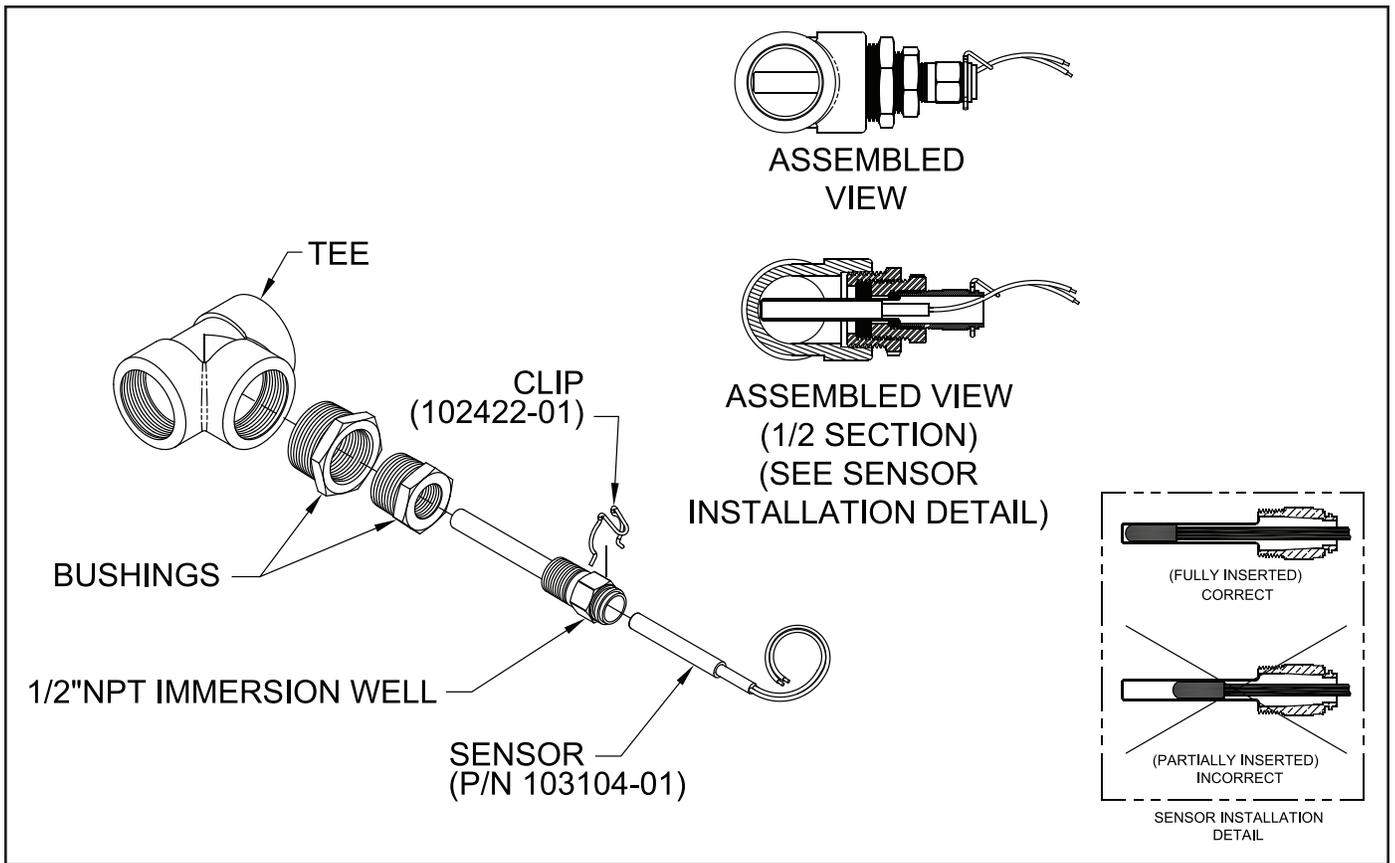


FIGURE 4.3: RECOMMENDED "IMMERSION" TYPE HEADER SENSOR INSTALLATION DETAIL

V. WIRING



DANGER

Positively assure all electrical connections are unpowered before attempting installation or service of electrical components or connections of the boiler or building. Lock out all electrical boxes with padlock once power is turned off.



WARNING

- **All wiring and grounding must be done in accordance with the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code /NFPA 70). In Canada, all wiring and grounding must be done in accordance with the Canadian Electrical Code, Part 1 (CSA C22.1 - latest edition).**
- **Failure to properly wire electrical connections to the boiler may result in serious physical harm.**
- **Electrical power may be supplied from more than one circuit. Make sure all power is off before attempting any electrical work.**
- **Each boiler must be protected with a properly sized over-current device.**
- **Never jump out or make inoperative any safety or operating controls.**
- **The wiring diagrams contained in this manual are for reference purposes only. Each boiler is shipped with a wiring diagram attached to the front door. Refer to this diagram and the wiring diagram of any controls used with the boiler. Read, understand and follow all wiring instructions supplied with the controls.**

A. MULTIPLE BOILER WIRING

Install over-current protection in accordance with the authority having jurisdiction or, in the absence of such requirements, follow the *National Electric Code*, NFPA 70, and/or *Canadian Electrical Code* Part 1, CSA C22.1. Do not provide overcurrent protection greater than 15 amperes. If this single 15A circuit is insufficient for the combined load of all boilers and pumps, provide additional 15A circuits and divide the boilers among them. Follow the instructions in Section X of the Phantom 80-180 Installation manual with the following exceptions:

One, and only one, of the boilers must be designated as the “Master”. This boiler manages demands for heat (and sometimes DHW). Any boiler can be designated as the Master, but field wiring to the Master is different from that for the other boilers (“Slaves”), so the Master must be chosen before the system is wired. Note that the “Master” boiler is not necessarily the same as the “Lead” boiler. (i.e. the first boiler to fire upon a call for heat).

See typical field wiring in Figure 5.1. Key points are:

- 1) System pump (s) must be connected to the Master. If this will result in a combined pump draw at the Master in excess of 6.3A, use an isolation relay between the Master’s system pump terminals and the pump(s). System pump terminals on Slaves are not used.
- 2) The heating thermostat is connected the “Heat T’Stat” (or Enviracon thermostat) terminals on the Master as shown. Heating thermostat connections on the Slaves are not used.
- 3) If an indirect water heater is used, connect the indirect water heater thermostat to the “DHW T’Stat” terminals on the Master. Also connect the indirect water heater pump to the “DHW Pump” terminals on the Master.

- 4) Header sensor P/N 103104-01 must be used in Phantom Multiple boiler applications. Install it in the system piping as shown in Figure 4.2 (also see Fig 4.3 for installation detail). Wire it to the Master boiler as shown in Figure 5.1. Observe the precautions against electrical noise that are described for sensor wiring in Part X of the boiler installation manual.
- 5) Outdoor Sensor – If used, wire to the Master as shown in Figure 5.1.
- 6) LWCO and/or external limits – In general, if low water cut-offs and/or external limits are required, separate ones must be provided for each boiler. Consult the authority having jurisdiction.
- 7) MODBUS Communication Wiring – The Master communicates with the Slaves using the MODBUS connections on the low voltage PCB. The simplest way to make these connections is using Ethernet (PC network) cables. Use the standard “straight through” cables for this and plug them into the Modbus receptacles as shown in Figure 5.1.

Alternatively, Modbus connections can also be made using the “A”, “B”, and “-V” screws terminals located directly above the Ethernet receptacles. To do this, connect all “A”, “B”, and “-V” terminals together as shown in Figure 5.2.

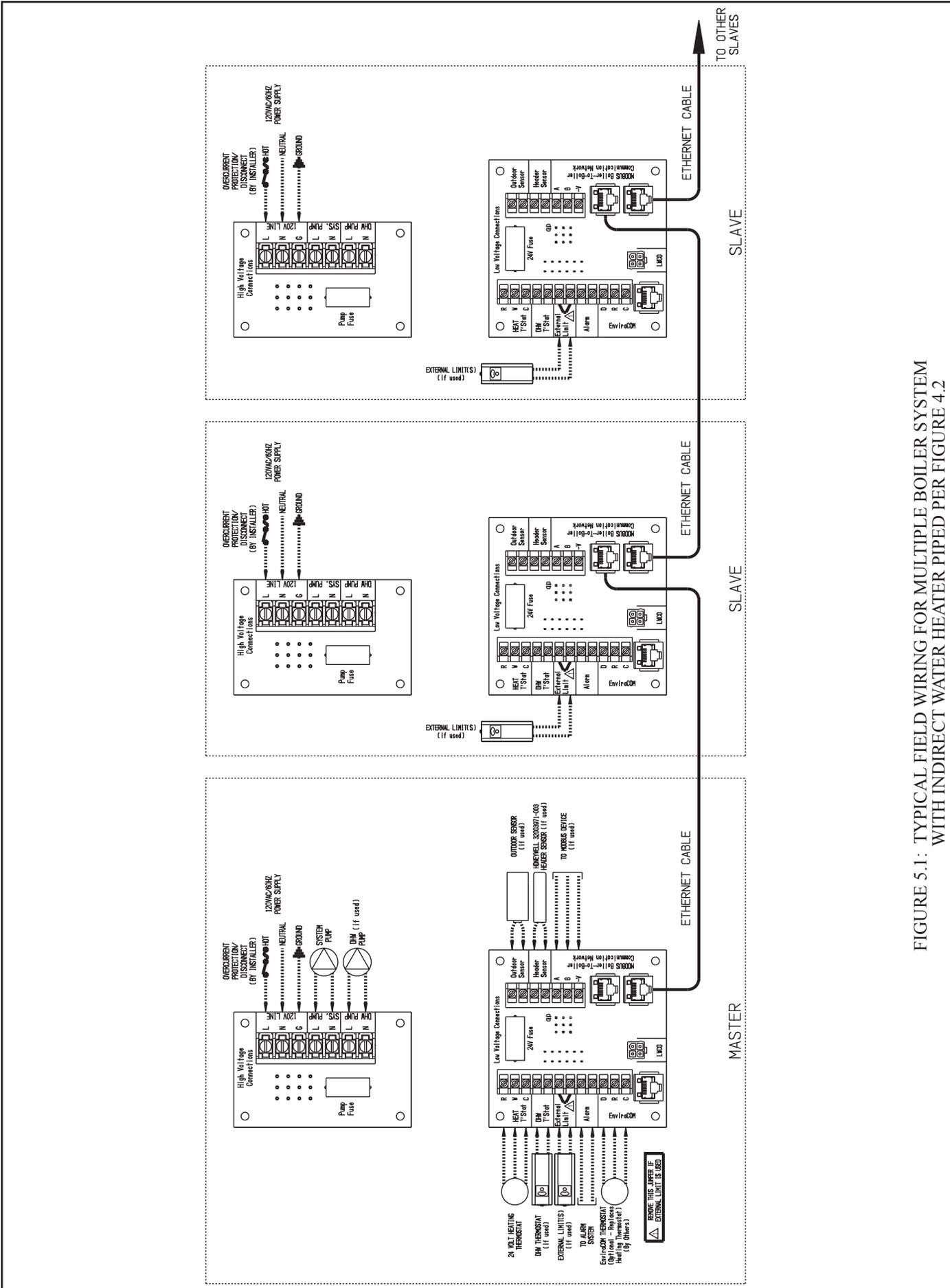


FIGURE 5.1: TYPICAL FIELD WIRING FOR MULTIPLE BOILER SYSTEM WITH INDIRECT WATER HEATER PIPED PER FIGURE 4.2

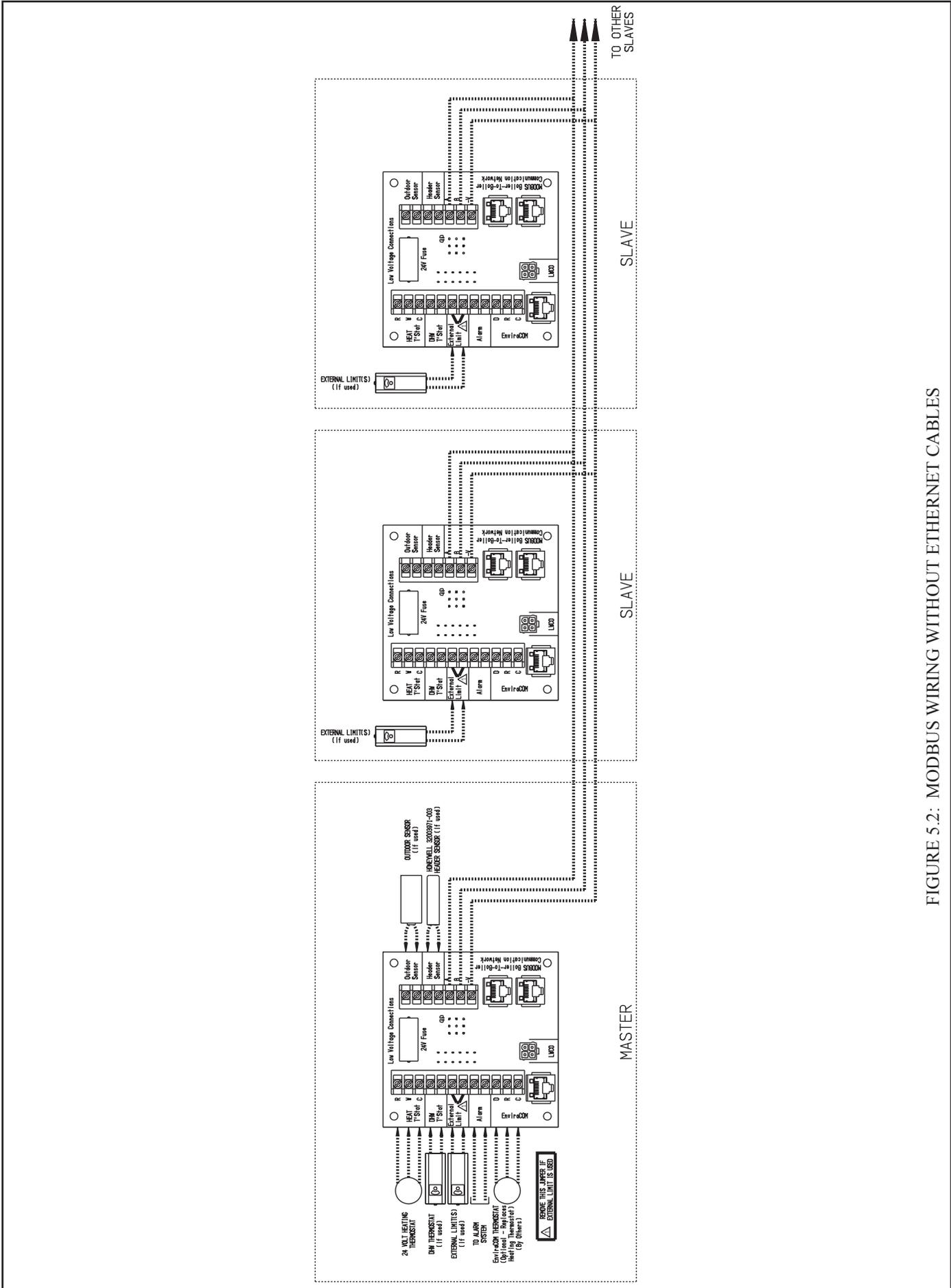


FIGURE 5.2: MODBUS WIRING WITHOUT ETHERNET CABLES

VI Start-up and Checkout

Refer to Section XI (Start-up and Checkout) in the Phantom 80-180 installation manual. Boilers are started, adjusted, and inspected as individual boilers. They are then configured to operate as a multiple boiler system in Section VII of this manual (Operation).

Because the slaves have no thermostats connected to them, it will be necessary to temporarily jump the DHW Thermostat terminals on each slave in order to fire it so that it can be checked out.

VII Operation

Information in this section supersedes that in Part XII (“Operation”) of the Phantom 80-180 Installation manual.

A. General Information

This boiler uses the microprocessor based Honeywell R7910B “boiler control” to manage all boiler functions including flame supervision and modulation. Two set point or “target” boiler supply temperatures are stored in the control’s memory; one for space heating (CH) and one for domestic hot water (DHW) production. If an outdoor temperature sensor is connected to the boiler, and enabled, the space heating supply set point will automatically shift downward as the outdoor temperature increases. For more information on this feature see the discussion on boiler water reset below.

The control modulates the boiler input by varying the fan speed. As the fan speed increases, so does the amount of gas drawn into the blower. As a result, a fairly constant air-fuel ratio is maintained across all inputs. The control determines the input needed by looking at both current and recent differences between the supply temperature and the set point temperature. As the supply temperature approaches the set point temperature, the fan will slow down and the input will drop. The minimum input is approximately 1/5 of maximum input.

This boiler control also monitors boiler return and flue temperatures. In addition, all other safety controls are connected into the R7910B. The R7910B uses inputs from all of these controls to either shut down the boiler when an unsafe condition exists or, in some cases, to correct the problem.

Up to 8 Phantoms may be piped and wired together as described earlier in this manual to create a multiple boiler (“Lead-lag”) system. When this is done, one boiler acts as the “Master”. The Master receives demands from loads shared by the boilers and determines firing order and rate for all boilers in the system. The exact manner in which this is done is described in Part F of this section.

Finally, the basic boiler control manages up to three pumps:

- Boiler Loop Pump (built into each boiler)
- DHW pump
- System pump

Refer to the Piping Section for the location of these pumps.

The touch screen display on this boiler has three basic functions:

- 1) To allow the professional HVAC technician to set-up this boiler so that it will work properly in the system to which it is connected.
- 2) To indicate the current status of the boiler and to provide information that will assist the professional HVAC technician in solving problems with the boiler and/or system.
- 3) To advise the homeowner if there is a problem requiring professional service.

A map of the basic menu structure is shown in Figure 7.0. In order to prevent unauthorized or accidental adjustments, access to menus, which change settings and boiler operation, is password protected. In general, if a menu is not touched for 255 seconds, the display backs up to the previous menu. Once the Home Screen is returned to, the password must be reentered in order to regain access to protected menus (this feature prevents the boiler from being permanently left in operation without password protection).

B. Configuring the Control

Use the Configuration Menu to provide the boiler with basic information about the type of system to which it is connected. On a new installation configure the boiler first and then go to the Settings Menu to set parameters such as target water temperatures. A map of the Configuration Menu structure is shown in Figure 7.1. To configure the boiler:

- 1) From the Home Screen (shown in Figure 7.0), press “MENU” to enter the Main Menu:
 - a) Press “CONFIGURE”
 - b) When prompted for a password, use the “+1” key to raise the password to “014”. Press SUBMIT, then NEXT (if you accidentally scroll past 014, press EXIT to return to the main menu and start over).
 - c) Review the Warning and press ACCEPT to continue to the Configuration Menu.

IMPORTANT

This boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases. This feature is equipped with an override which is provided primarily to permit the use of an external energy management system that serves the same function. THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:

- An external energy management system is installed that reduces the boiler water temperature as the heating load decreases.
- This boiler is not used for any space heating.
- This boiler is part of a modular or multiple boiler system having a total input of 300,000 BTU/hr or greater.

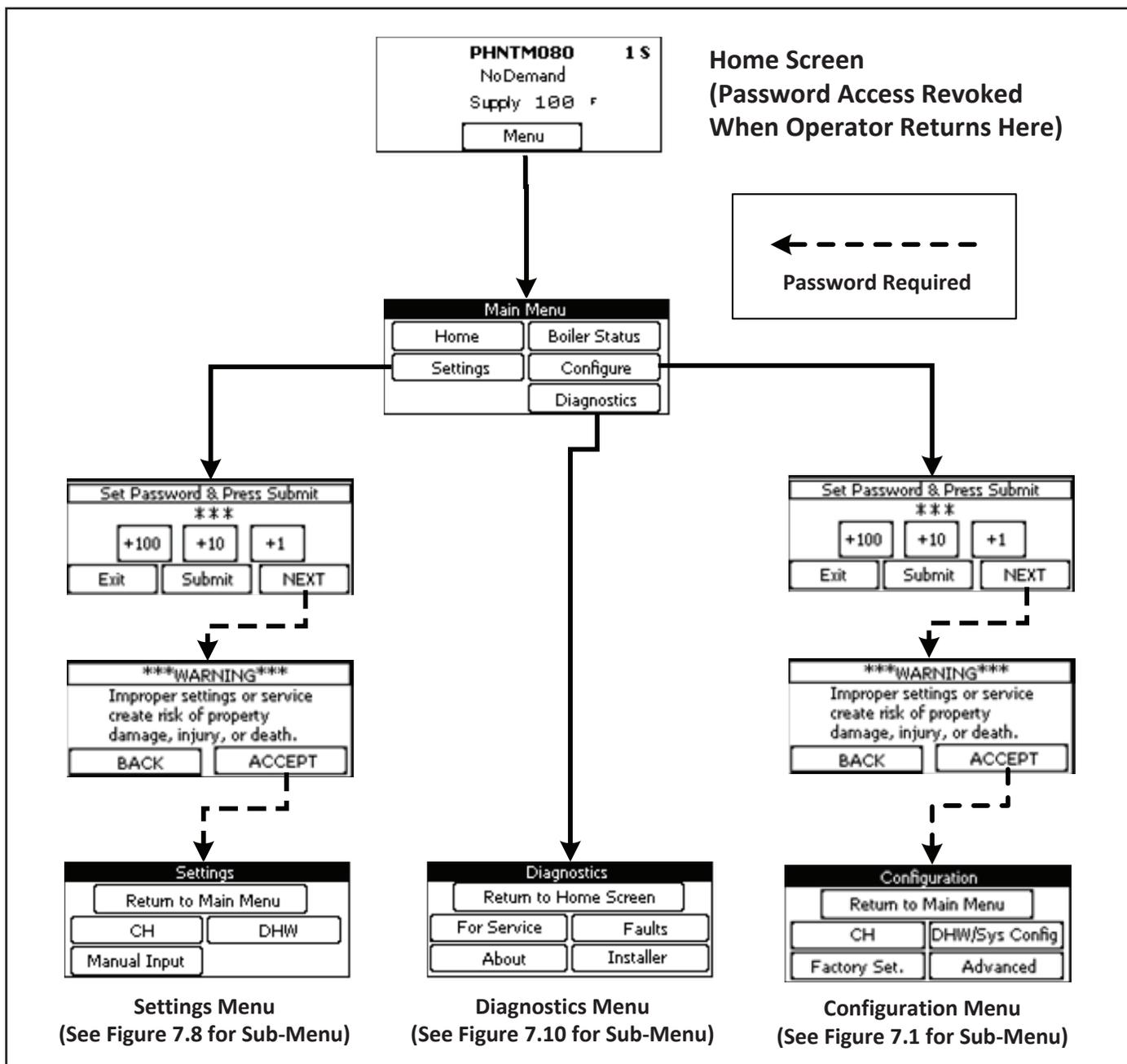
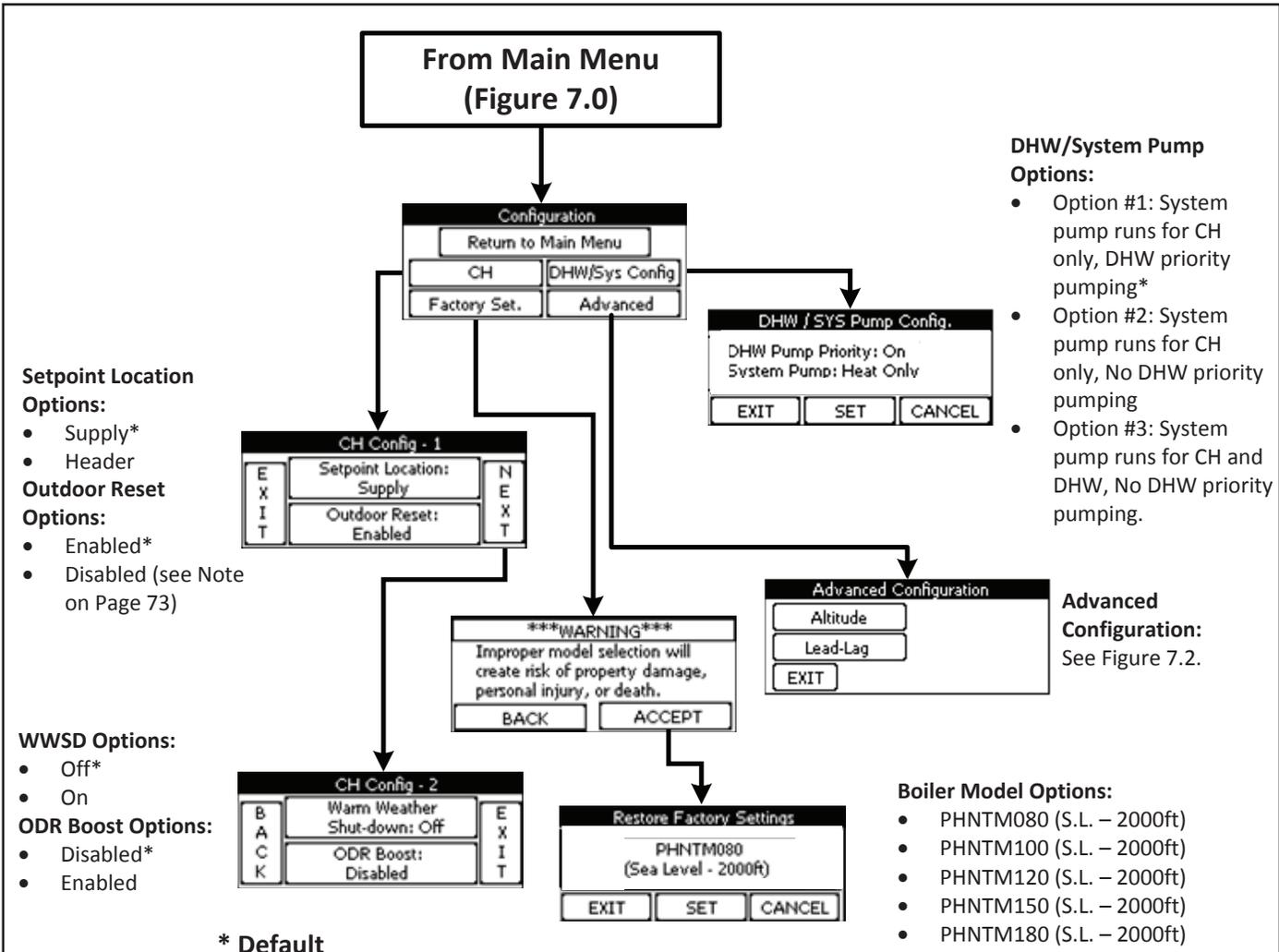


FIGURE 7.0: BASIC MENU STRUCTURE



HOW TO CHANGE OPTIONS

For Buttons with Two Options Like These:

- Pressing buttons toggles between two options.
- Change is effective as soon as new option appears on screen.

For Buttons with Three or More Options Like This:

- Pressing large button cycles through all available options.
- Press SET to save change
- To restore original option before SET is pressed, press CANCEL or EXIT.

FIGURE 7.1: CONFIGURATION MENU

- d) Press **ADVANCED**, then **LEAD-LAG** to enter the lead lag configuration menu
- e) Verify that all boilers are powered and all Modbus cables are connected. Also make sure that the header sensor is connected to the Master. Press **NEXT**.
- f) Press the button marked **ENABLE LEAD-LAG** in order to enable lead-lag.
- g) Press **NEXT**.
- h) On the Master (see Figure 5.1) boiler only – Press the button marked **ENABLE MASTER** in order to enable the Master. If the Master is successfully enabled, the screen will look like that in Figure 7.2. If there is no header sensor connected to this boiler, or if there is a problem with the header sensor, an error message will appear on this screen.
- i) Press **NEXT**
- j) Use the **+1** key to assign the boiler an address between 1 and 8. Each boiler must have a unique address. Order in which the boilers are addressed is not important. Press **SET** to save the address.



CAUTION

Enabling more than one master or assigning the same address to more than one boiler will cause erratic operation.

- 2) Repeat the above steps for each boiler (skip (h) for all slaves). When complete return all boilers to their home screen. The boilers lead lag status (“M” for Master and “S” for Slave) will appear in the upper right corner of this screen, along with the address (Figure 7.3). Verify that:
 - a) Master boiler has an “M” on this screen
 - b) All other boilers show an “S” in this location.
 - c) Each boiler shows a unique address between 1 and 8.
 - d) Navigate to the Master’s Staging Status Screen (Figures 7.4 & 7.11b). Verify that this screen shows the address of all boilers in the system.

If the above conditions are not met, return to Step 1 and resolve before proceeding further.

- 3) On the Master only, Press the **CH** Button to access central heating options (re-enter password if necessary). These include:
 - a) **Outdoor Reset** - Determines whether or not the outdoor reset function is enabled when the boiler is responding to a call for heat. Choices include:
 - **Outdoor Reset Enabled** - When the boiler is responding to a call for heat, the target water temperature will adjust downward (within certain limits) as the outdoor temperature increases. The graph in Figure 7.9 shows how the target water temperature changes with outdoor temperature. Figure 7.9 shows the default reset curve; the “ends” of this curve can be changed in the Settings Menu.
 - **Outdoor Reset Disabled** - When the boiler is responding to a call for heat, the target water temperature is fixed regardless of what the outdoor temperature is. This fixed set point can be changed in the Settings Menu. Outdoor reset function should not be disabled unless at least one of the conditions listed in the “IMPORTANT” box on page 19 is met.
 - b) If outdoor reset is enabled, press the **NEXT** key to access two more options related to outdoor reset only. Otherwise, press the **EXIT** button to return the Configuration Menu and skip to Step 4.
 - c) **Warm Weather Shutdown (WWSD)** - Determines how the boiler responds to a call from the heating thermostat if the outdoor temperature is “warm”.
 - **WWSD Disabled** - The boiler will always respond to a call for heat regardless of the outdoor temperature.
 - **WWSD Enabled** - When the outdoor temperature is above the WWSD Outdoor Temperature setting, the boiler will ignore a call for space heat (CH) from the thermostat.
 - d) **ODR Boost** - Determines if the boiler automatically increases the target temperature above that determined by the reset curve when it encounters a long call for space heat:
 - 1) **ODR Boost Disabled** (Generally Recommended) - When responding to a call for heat, the target water temperature is determined solely by the outdoor temperature.
 - 2) **ODR Boost Enabled** - When a call for heat first appears, the target water temperature is determined by the reset curve. If the call for heat lasts for 30 minutes, this target temperature is increased by 10°F. The target temperature is then increased in 10°F increments at 30 minute intervals until one of the following happens:
 - The call for heat ends.
 - The target water temperature is at the top of the reset curve (180°F in the example shown in Figure 7.9)
 - e) Press **EXIT** to return to the Configuration Menu.

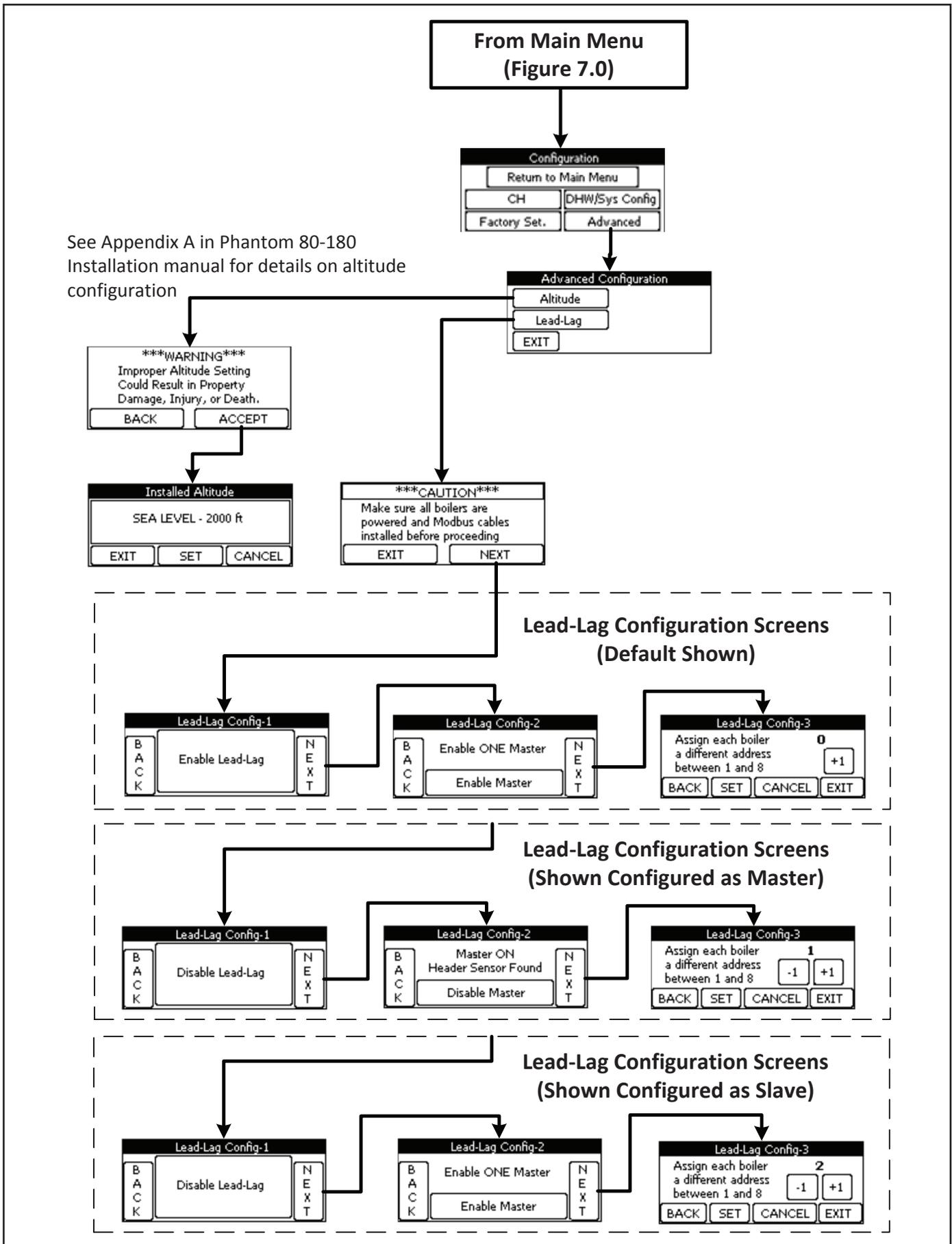


FIGURE 7.2: ADVANCED CONFIGURATION MENU

- 4) If the system is installed with an indirect water heater which sends a DHW demand directly to the Master boiler, press the DHW button on the Configuration menu to configure the pump and DHW priority operation. If this is a heat only installation, or if the indirect water heater is controlled by an external zoning panel, skip to Step 5.

There are three possible DHW configurations. Each of these options is described below and also summarized in Table 7.7. In all three cases, this boiler is intended to accept a DHW demand generated by a thermostat mounted in the indirect water heater, such as a Honeywell L4006A or L4080B, with this device set to the desired potable water temperature. The “DHW target temperature” is therefore the boiler supply temperature required during a call for DHW.



WARNING

Burn Hazard. Water temperatures over 125°F can cause personal injury or death due to scalding. Children Disabled, and Elderly are at most risk of being scalded. This boiler is not designed to directly control domestic water temperature.

- Use only the thermostat recommended by the indirect water heater manufacture to control the DHW temperature.
- Adjust the thermostat set point in accordance with the indirect water heater manufacturer’s instructions.
- Install scald protection devices as required by the indirect water heater manufacturer or local codes.
- Do not attempt to wire a DHW sensor into the boiler control.

Option #1 (DEFAULT): System Pump Used for CH Only, DHW Priority Pumping – An example of this system is shown in Figure 7.5. When this option is selected, the system operates as follows:

- a) Boiler pump runs on any boiler receiving a lead-lad demand.
- b) DHW pump circulates water through the portion of the system loop shared by the indirect water heater loop.
- c) The system pump is used only to circulate water through the heating (CH) zone/s.
- d) The system pump is not allowed to operate while the boiler is responding to a call for DHW (this strategy permits the entire output of all boilers to be directed to the indirect water heater and, in some cases, is also needed to protect some types of radiation from excessive temperatures).

Option #2: System Pump Used for CH Only, No DHW Priority Pumping – An example of this system is shown in Figure 7.5. The only difference between Option #2 and Option #1 is that Option #2 permits the system circulator to operate at the same time as the DHW pump when there is a call for both heat and DHW.

Option #3: System Pump Used for Both CH and DHW, No DHW Priority Pumping – An example of this system is shown in Figure 7.6. When this option is selected, the system operates as follows:

- a) Boiler pump runs on any boiler receiving a lead-lad demand.
 - b) DHW circulates water only as far as a set of closely spaced tees in the system loop.
 - c) The system pump is required to circulate water for either a space heating or DHW demand.
 - d) A fourth pump (controlled by an installer supplied relay) is required to circulate water through the radiation.
- To change the DHW configuration, press the large button containing the description repeatedly until the desired description is reached. When the selection is changed, this button will flash. When the desired configuration is reached, press SET to select it. When this change is accepted by the control, the button will stop flashing. Press EXIT to Return to the Configuration Menu



CAUTION

Radiant heating systems generally require much lower boiler supply temperatures than those required for a DHW demand. Such systems can be damaged by excessive water temperatures. Do not select Option #2 or Option #3 unless one of the following is true:

- The heating system can accept a water temperature greater than or equal to the DHW target temperature.
- An external control, such as a thermostatic mixing valve, is used to limit the temperature of the water entering the heating system.
- Option #3 is used and there is a field-supplied control system that will force off the CH pump/s during a call for DHW.

DHW Priority – This multiple boiler system is capable of regulating only one target boiler water temperature at any given time. This means that priority must be given to either the CH or DHW target temperature. For this reason, the system gives priority to the DHW demand for the first 60 minutes during which both calls for CH and DHW continuously exist. If there are still simultaneous calls for DHW and CH at the end of this time, the system will attempt to maintain the target CH temperature and operate the pump/s needed to satisfy the call for heat. The system will once again give priority to the DHW temperature when either of the following events occur:

- The call for CH ends.
- The call for DHW is removed and then restored.

Regardless of the DHW option selected, the target water temperature will always change from that for DHW to CH if the simultaneous demand exceeds 60 min.

! WARNING

Asphyxiation Hazard. Boiler type is factory set and must match the boiler model. Only change the boiler type setting if you are installing a new or replacement control. The boiler type setting determines minimum and maximum blower speeds. Incorrect boiler type can cause hazardous burner conditions and improper operation that may result in property loss, physical injury or death.

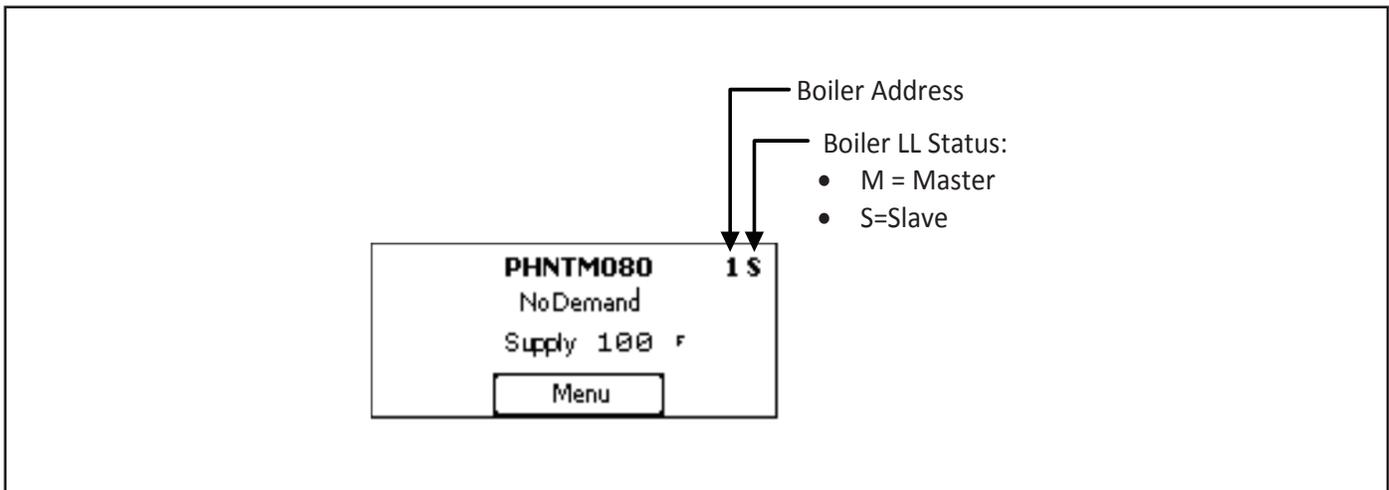


FIGURE 7.3: LEAD-LAG HOME SCREEN

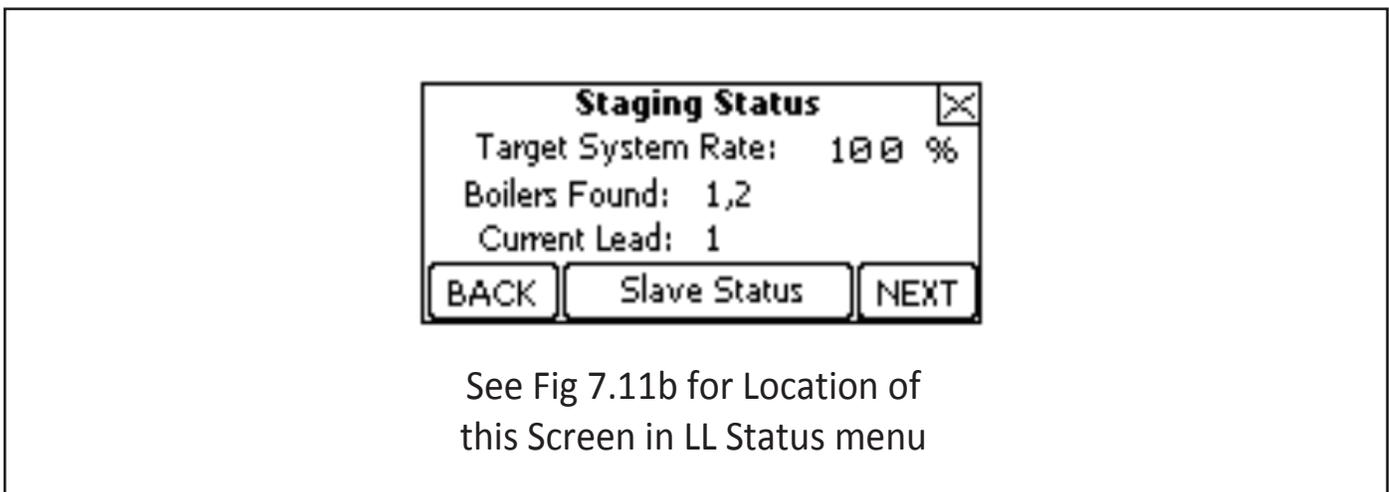


FIGURE 7.4: LEAD-LAG STAGING SCREEN

- 5) Pressing the **ADVANCED** button on the configuration menu takes the user to the Advanced Configuration menu. This menu allows the user to access rarely needed configuration options. These include:

FACTORY SET - This button allows the user to restore all factory configuration and setting options. This function can be used to restore all factory settings if a large number of settings are suspect or if the original control is replaced by one that is programed for use on another size Phantom. Pressing this button brings up the screen shown in Figure 7.8. Press the model number button until the desired model number is reached. When the selection is changed, this button will flash. When the desired model is reached, press **SET** to select it. When this change is accepted by the control, the button will stop flashing. Press **EXIT** to Return to the Advanced Configuration Menu. If factory settings are restored, the set-up process described in this section must be repeated.

ALTITUDE – Allows the boiler to be configured for Altitudes above 2000ft. See Appendix A of the Phantom 80-180 installation manual for additional details. Each boiler in a lead lag system installed above 2000ft must be individually configured for the installed altitude.

LEAD-LAG – This Menu allows the user to enable or disable the ability of the boiler to operate as part of a multiple boiler (Lead-Lag”) System. See Steps 1 and 2 of this Section for details on the use of this Menu. The Lead Lag menu is not visible if the standard “005” password was entered when the configuration menu was entered.

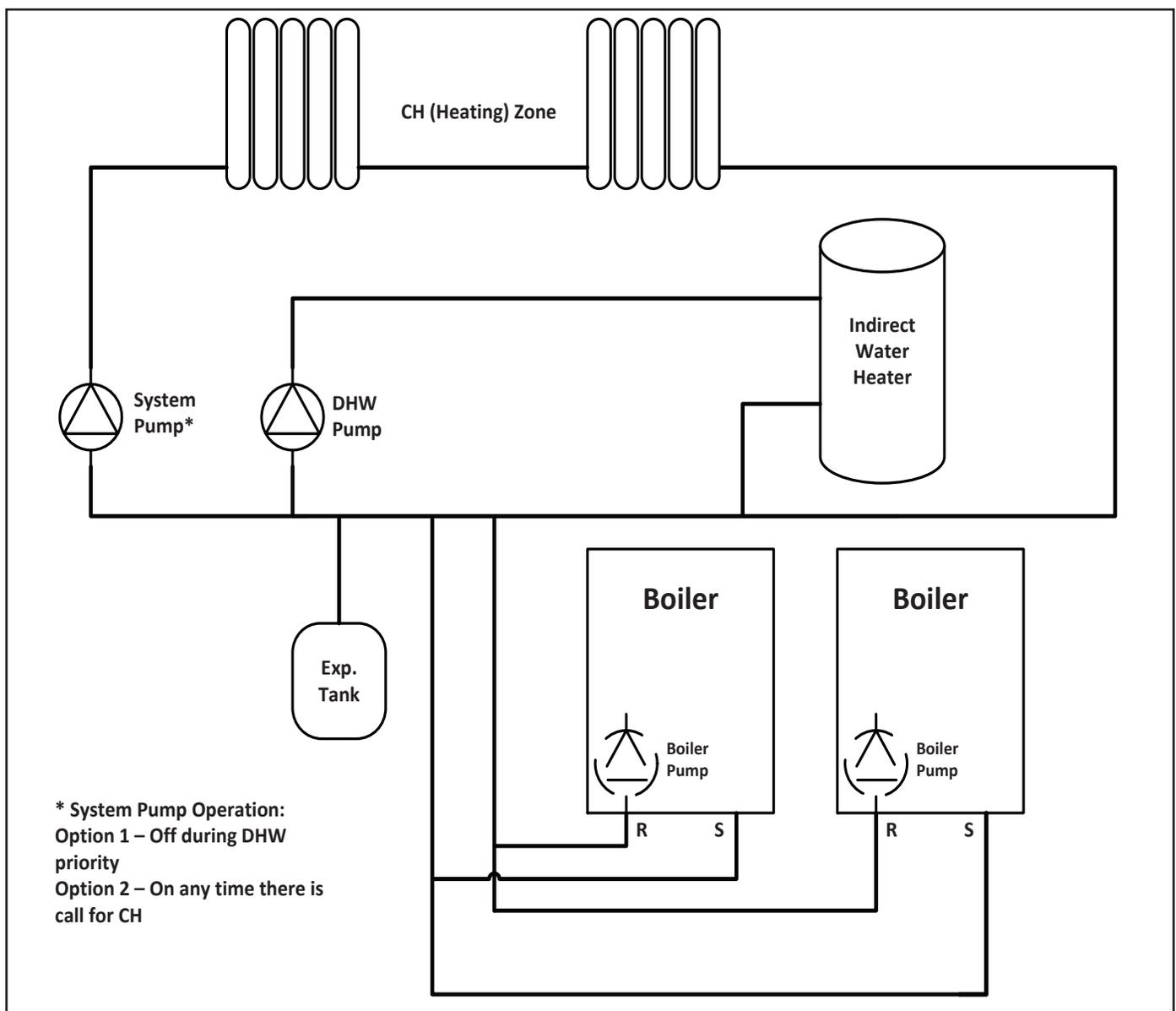


FIGURE 7.5: DHW PIPING OPTIONS #1 & #2

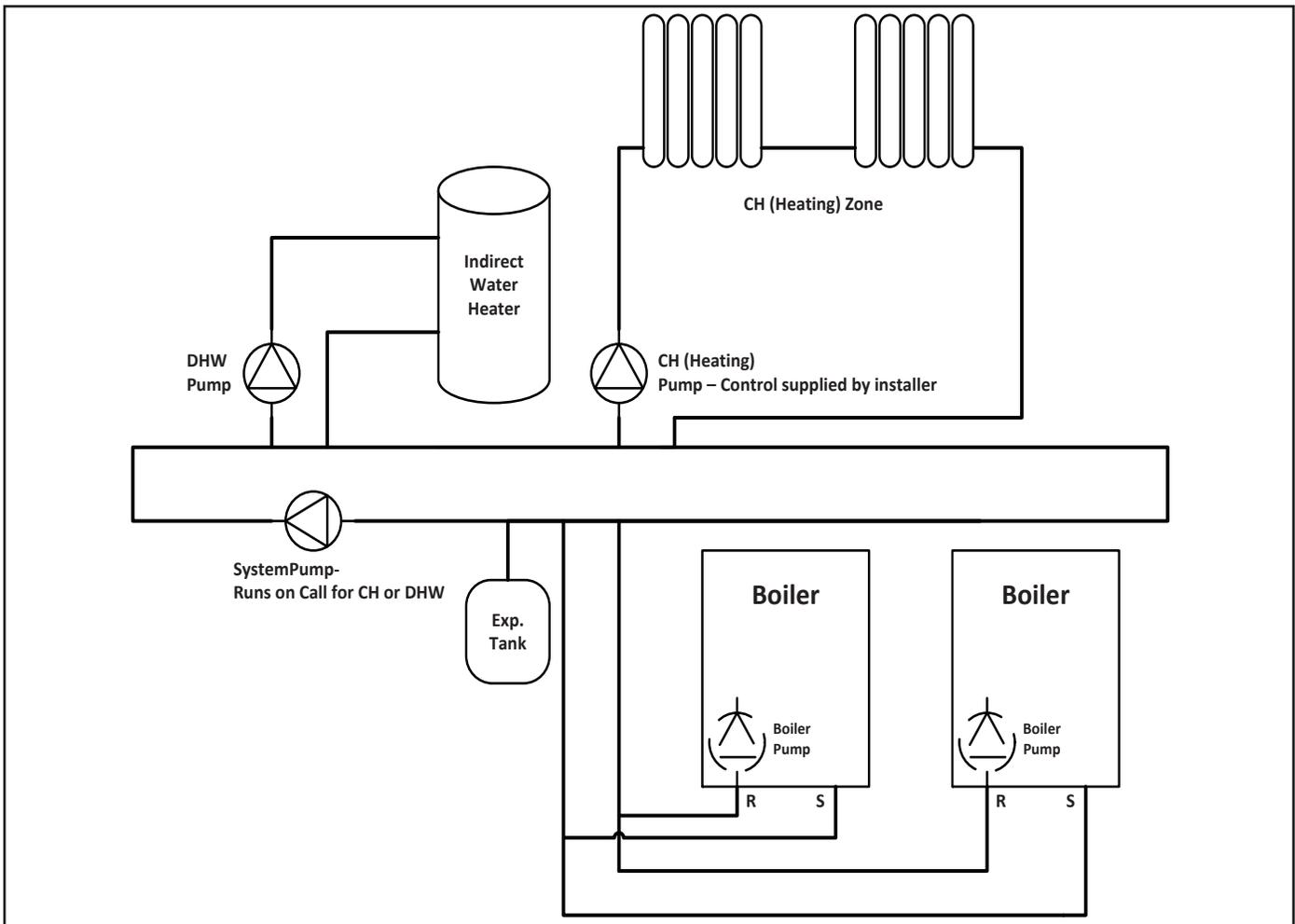


FIGURE 7.6: DHW PIPING OPTION #3

Table 7.7: Summary of Target Temp and Pump Behavior

DHW Option #	Description	Status of:	Demands				
			None	CH Only	DHW Only	CH+DHW (<60 min)	CH+DHW (>60 min)
1	System Pump used for CH only (Fig. 7.5). DHW priority pumping.	Boiler Pump*	OFF	ON	ON	ON	ON
		DHW Pump	OFF	OFF	ON	ON	OFF
		System Pump	OFF	ON	OFF	OFF	ON
		Target Temp	NONE	CH	DHW	DHW	CH
2	System Pump used for CH only (Fig. 7.5). No DHW priority pumping.	Boiler Pump*	OFF	ON	ON	ON	ON
		DHW Pump	OFF	OFF	ON	ON	ON
		System Pump	OFF	ON	OFF	ON	ON
		Target Temp	NONE	CH	DHW	DHW	CH
3	System Pump used for both CH and DHW (Fig. 7.6).	Boiler Pump*	OFF	ON	ON	ON	ON
		DHW Pump	OFF	OFF	ON	ON	OFF
		System Pump	OFF	ON	ON	ON	ON
		Target Temp	NONE	CH	DHW	DHW	CH
4	Options for Add-on Combi Module used on PHNTM150-180. See Combi Module installation instructions for operation.						
5							

* Behavior of lead boiler pump shown. Operation of other boiler pumps dependent on staging.

C. Changing Settings

Use the Settings Menu to change temperature set points and to temporarily lock the boiler in high or low fire. On a new installation configure all boilers first, then go to the Settings Menu. Most settings adjustments are made on the Master only. A map of the Settings Menu structure is shown in Figure 7.8.

To change settings:

- 1) From the Home Screen (shown in Figure 12.0) , press “MENU” to enter the Main Menu:
 - a) Press “SETTINGS”
 - b) When prompted for a password, use the “+1” key to raise the password to “005” or “014”. Press SUBMIT, then NEXT (if you accidentally scroll past 014, press EXIT to return to the main menu and start over).
 - c) Review the Warning and press ACCEPT to continue to the Settings Menu.

Note: If you go from the Configurations Menu to the Settings Menu without returning to the Home Screen, you will not have to reenter a password.

- 2) CH Settings – CH adjustments are made on the Master only (this menu is not even visible on slaves). Press CH to change the target supply water temperature setting.
 - a) If outdoor reset is disabled, only one CH set point exists. The multiple boiler system will always attempt to maintain this temperature at the header sensor during a call for CH. To change the setting, touch the button containing the current setting. Adjust the temperature using the “+” and “-” arrows shown and press SET to save the change (also see “How to Change Settings” in Figure 7.8).
 - b) If outdoor reset is enabled, there are a total of four settings that can be changed (also see Figures 7.8 and 7.9):
 - **Max Header Set point** - This is the maximum permissible header set point temperature, regardless of how low the outdoor temperature is.
 - **Min Header Set point** - This is the minimum permissible header set point, regardless of how high the outdoor temperature is.
 - **Max Outdoor Temp** - At or above this setting, header set point is equal to the “Min Header Set point”.
 - **Min Outdoor Temp** - At or below this setting, header set point is equal to the “Max Header Set point”.Pressing the GRAPH button on either the CH Outdoor Reset -1 or CH Outdoor Reset -2 screen allows any of the above four outdoor reset settings to be changed while viewing the other three. This graph is for reference only - it does not scale with changes to the ODR settings.
 - c) If Warm Weather Shut-Down (WWSD) is enabled, a NEXT button will be present on the CH-Outdoor Reset - 2 screen. This screen allows the user to set the **WWSD Outdoor Temperature**. This is the outdoor temperature above which the multiple boiler system will ignore a call for heat from the thermostat.
- 3) DHW Settings – In the applications covered by this manual DHW adjustments are made on the Master only (this menu is not even visible on slaves). From the Settings Menu, press the DHW button to change the set point temperature when the multiple boiler system is responding to a call for DHW. The “DHW Set point” is the set point at the header sensor during a call for DHW. Control of the potable water temperature is accomplished using the thermostat on the storage type indirect water heater.
- 4) Manual Input - From the Settings menu, press the MANUAL INPUT button to temporarily lock the boiler into either high or low fire (Figure 7.8). This menu is normally used during the performance of combustion tests. Restore automatic operation by pressing the AUTO FIRE Button. If AUTO FIRE is not pressed, the boiler will remain in manual input until one the following occurs:
 - 12 minutes and 45 seconds passes with no touch screen activity
 - The user returns to the Home Screen

Note: The DHW thermostat must be temporarily jumped on slaves in order to manually fire slaves.

D. Enter Service Contact Information

If desired, the technician can enter contact information so that the owner knows who to contact for future service. To do this:

- 1) From the Main Menu, press the DIAGNOSTICS button.

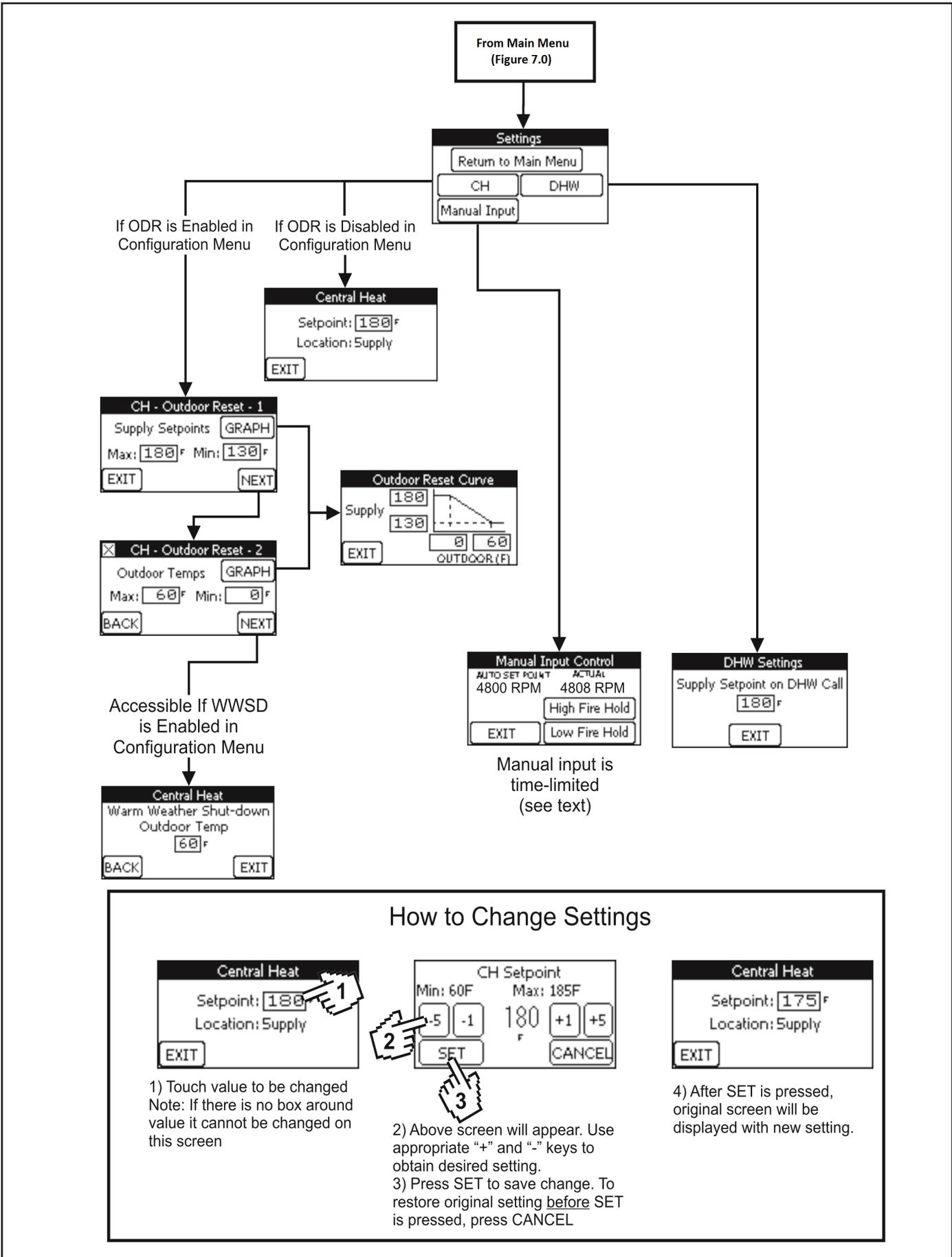


FIGURE 7.8a: MASTER SETTINGS MENU

- 2) From the Diagnostic Menu, press either the INSTALLER or MORE button (only one will be visible depending on whether you are “logged in”).
 - a) If prompted for a password, use the “+1” key to raise the password to “005” or “014”. Press SUBMIT, then NEXT (if you accidentally scroll past 014, press EXIT to return to the main menu and start over).
 - b) Review the Warning and press ACCEPT to continue.
- 3) Press ENTER CONTACT.
- 4) Touch the top blank field to enter the first line. When you do this, the keyboard shown in Figure 7.10 will appear. Use the up and down arrows to access additional characters. After entering the first line, press the return key to temporarily save the line.
- 5) Repeat Step 4 for the remaining two lines.
- 6) Press SET to permanently save all three lines into the memory of the display.

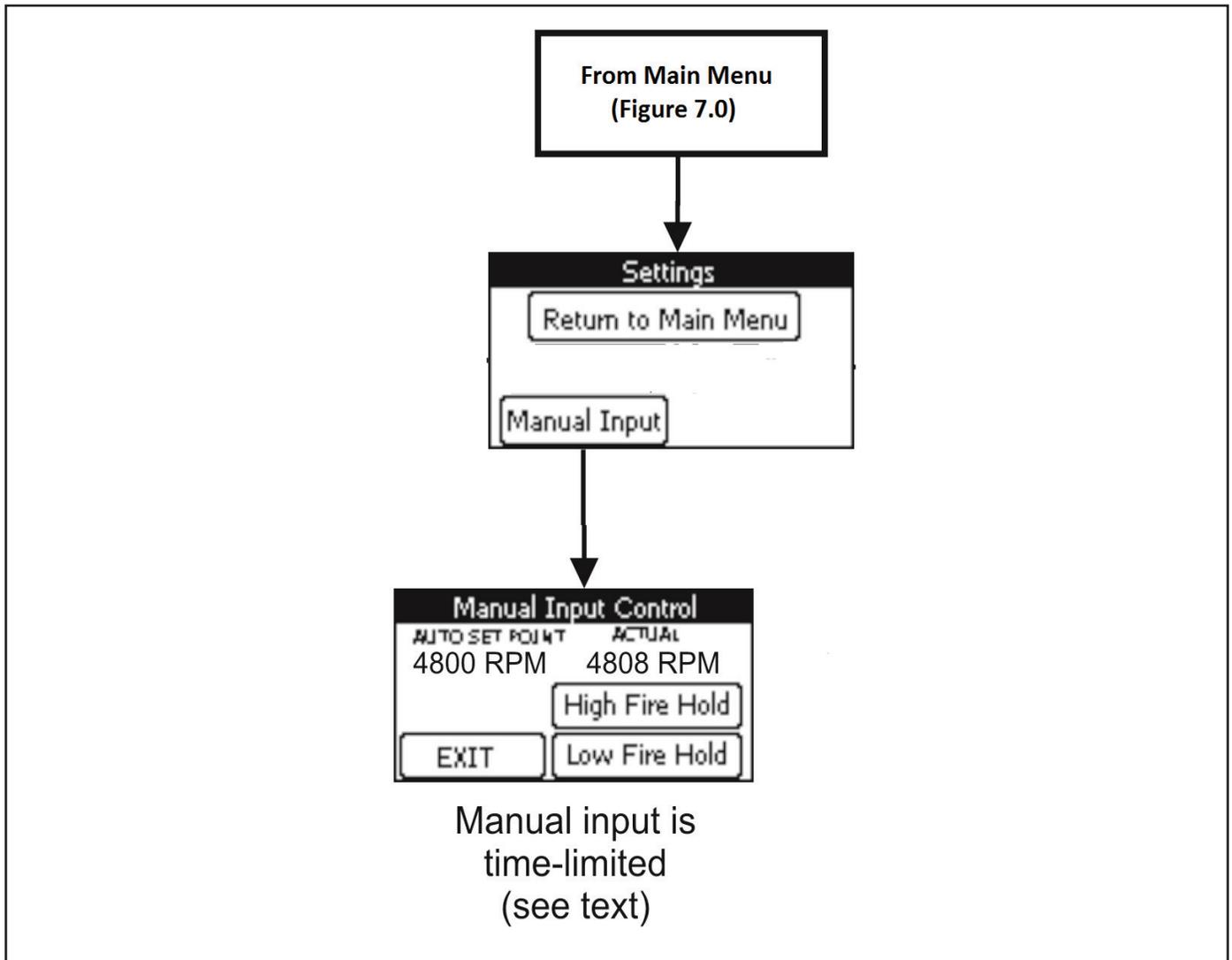


FIGURE 7.8b: SLAVE SETTINGS MENU

E. Boiler Status

The following screens provide the user with information about the current boiler status:

- Home Screen (Figure 7.3) – This is the default screen shown on the boiler. It allows the user to see basic information about the boiler at a glance.
- Boiler Status Menu (Figure 7.11a) – Allows the user to see more detailed information about the operation of the boiler itself.
- Master Status Menu (Figure 7.11b) – This menu is visible on the Master boiler only. It provides detailed information about the operation of the multiple boiler system.

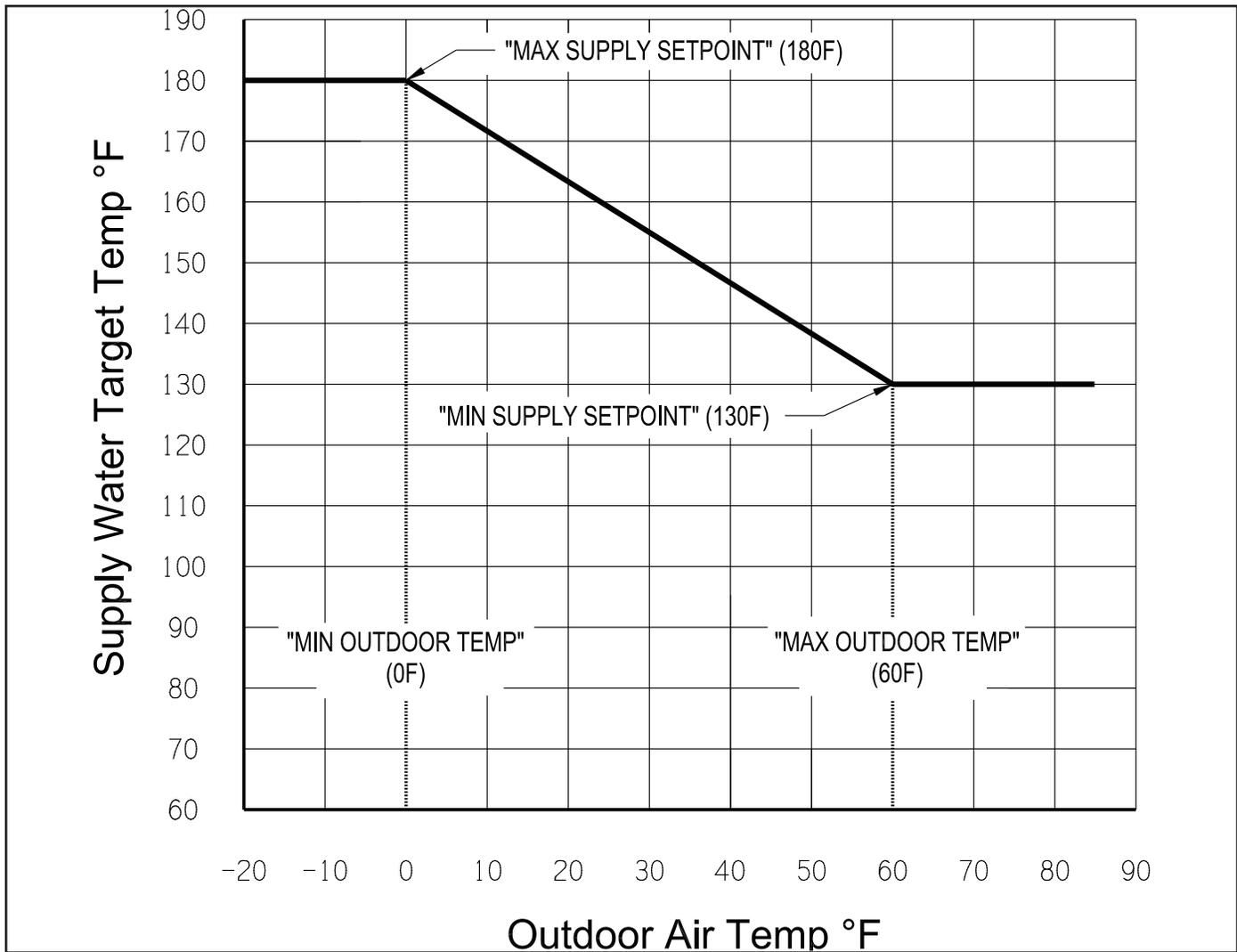
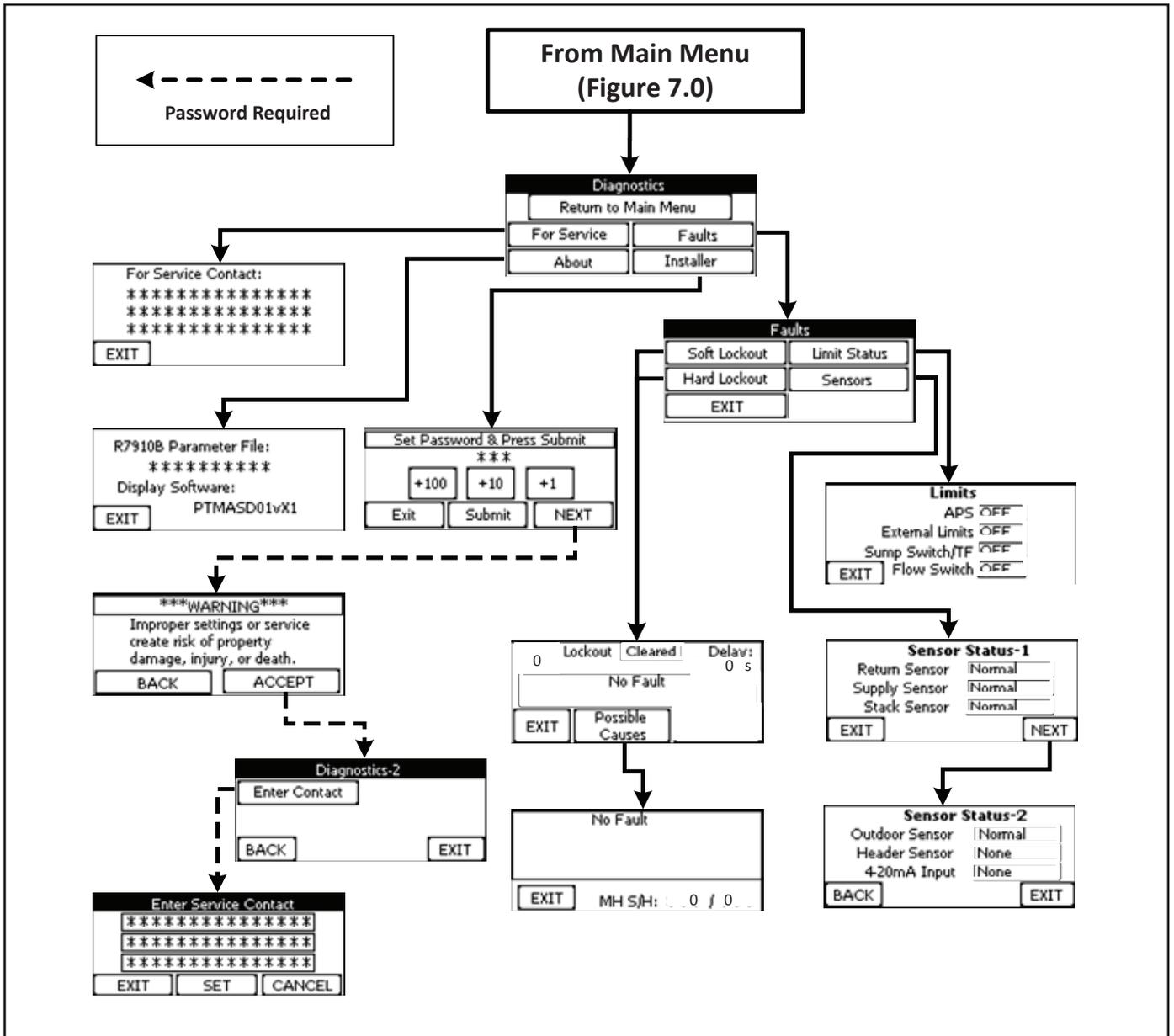


FIGURE 7.9: OUTDOOR RESET CURVE (DEFAULT SETTINGS SHOWN)

Specific information available on these screens is as follows:

1) Home Screen

- a) Current Demand –The demand to which the boiler is currently responding. If more than one demand is present, the Current Demands shown will be the one having the highest priority. Typical Current Demands include:
 - **Lead-Lag** – Boiler is either responding, or is available to respond, to a call from the Master. Normally, this status will be shown on the Home Screen of all Slave boilers in the system, regardless of whether the boiler is actually being called upon to fire.
 - **No Master Demand** (Master Home Screen only) - The Master boiler is not receiving a demand of any type. This status should not be seen on the Home screen of any boiler in a multiple boiler system if it is configured and operating correctly.
 - **Master: Central Heat** (Master Home Screen Only) – The Master boiler is receiving a call for space heat.
 - **Master: Domestic HW** - The Master boiler is receiving a call for domestic hot water.
 - **Frost Protection** - The boiler supply, or header, temperature fell below 45°F and the boiler is responding to prevent freeze damage to itself.
 - **Master: CH Off on WWSD** (Master Home Screen only) - The warm weather shut down option has been selected in the Configuration Menu and the outside air temperature has exceeded the setting at which this function causes the multiple boiler system to ignore calls for space heating.
 - **Other Current Demands**, such as “Central Heat” and “Domestic HW” are possible but should never be seen in the multiple boiler applications covered by this manual. Most likely causes of the demands include connection of a thermostat to a slave, or improper configuration of the boiler for lead lag operation.
- b) Active Fault (visible only when there is a problem) - Reverse flashes to indicate certain problems with the boiler or the system. Touching this indicator takes the users to the Diagnostic Menu. See Section XIV for more information.



How to Enter Service Contact Info.

- 1) Touch field to be changed
- 2) Screen below will appear. Use appropriate keys to enter first line.
- 3) Press SET to permanently save all three fields

Enter Service Contact

EXIT SET CANCEL

Use Arrows for More Chars.

W . E .

A	B	C	D	E	F	G	H
I	J	↑	↓	ES	CL	ES	↓

Enter Service Contact

W . E . COYOTE HTG

PHOENIX AZ

123 456 7890

EXIT SET CANCEL

Use UP and DOWN Arrows for More

Exit Screen without Saving

Clear Entire Field

Backspace

Temporarily Save Field and Exit

FIGURE 7.10: DIAGNOSTICS MENU

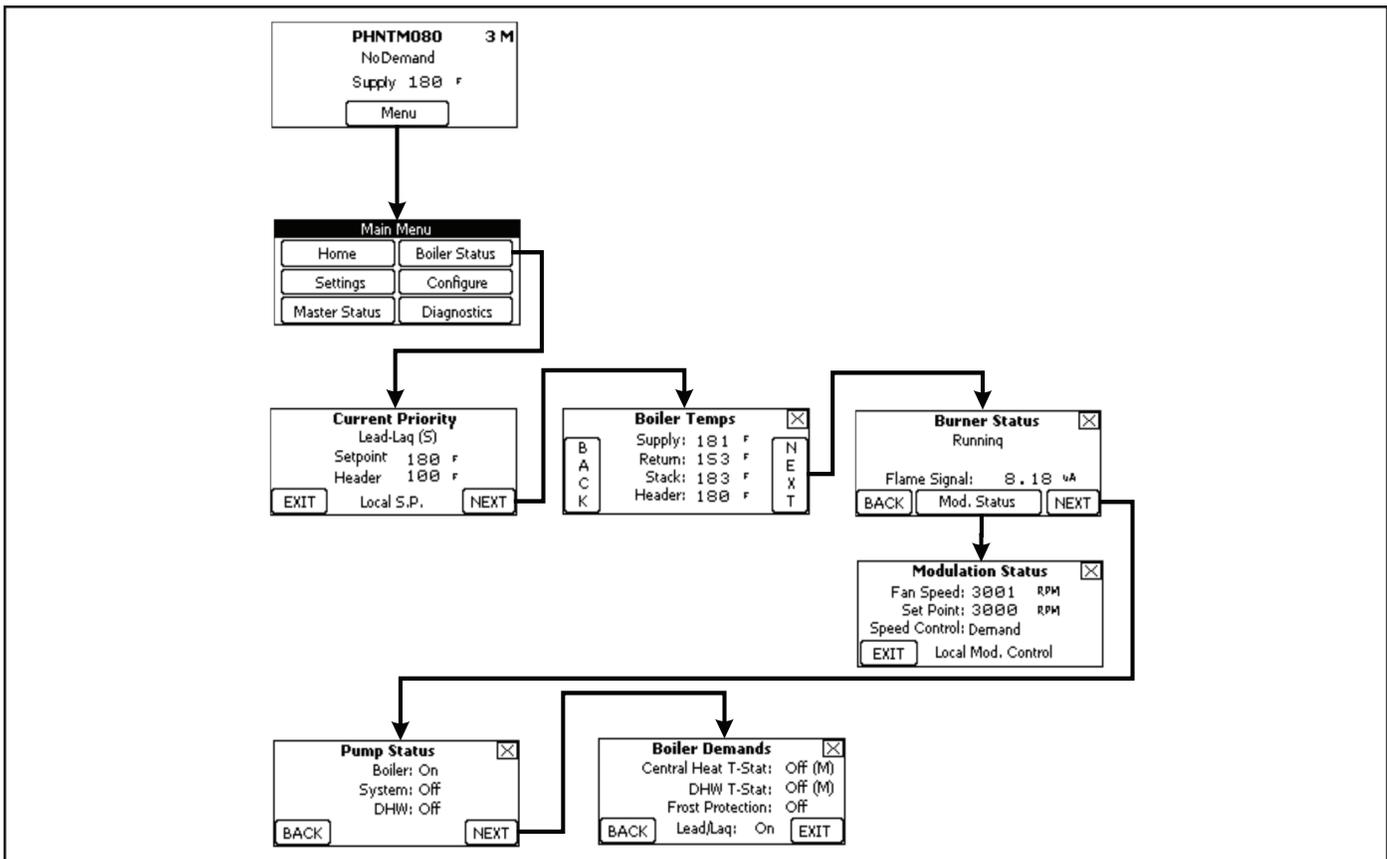


FIGURE 7.11a: BOILER STATUS MENU

- c) Supply - Current temperature at the boiler’s supply sensor.
- d) Lead Lag Status – Either “M” for Master or “S” for slave. Shown in the upper right corner.
- e) Boiler Address – A number from 1 to 8. Shown in the upper right corner.

2) Boiler Status Menu (Figure 7.11a):

a) Current Priority Screen

- **Current Demand** – This is the highest priority demand currently present at the boiler. Normally it reads “Lead-Lag (S)” in the multiple boiler applications covered by this manual (regardless of whether the boiler is the Master or a Slave). This is also true, regardless of whether the boiler is actually receiving a demand to fire.
- **Header Temperature** - (Visible on Master Only) - The water temperature at the header sensor location.

b) Boiler Temperatures Screen:

- **Supply** - Current water temperature at boiler supply sensor.
- **Return** - Current water temperature at boiler return sensor.
- **Stack** - Current flue gas temperature near boiler vent connection.
- **Header** - Current header sensor temperature (Master Only).

c) Burner Status Screen:

- **Burner Status** - Indicates what the burner system is currently doing. Typical Burner Status include:
 - i. **Standby** - Burner is not needed because there is no call for heat or the target temperature has been reached.
 - ii. **Standby Delay** - Burner is needed, but is being temporarily held off (generally due to a soft lockout - see Diagnostics section).
 - iii. **Safe Start-up** - Control is checking flame circuit before initiating ignition sequence.
 - iv. **Drive Purge** - Waiting for blower to reach pre-purge speed.
 - v. **Prepurge** - Allowing the blower to clear any residual gas/flue gas from the combustion chamber (10 s).
 - vi. **Drive Light-off** - Waiting for blower to prove that it is at the proper ignition fan speed.
 - vii. **Pre-ignition test** - Test the safety relay and verify that downstream contacts are off.
 - viii. **Pre-ignition** - Energize igniter with gas valve off to make sure that there is no “false flame” signal.
 - ix. **Direct ignition** - With the igniter energized, open the gas valve and check for the presence of a flame. Nominal trial for ignition period is 4s.

- x. **Running** - Burner is firing.
 - xi. **Post-Purge** - Blower is running after the burner shuts off to clear the combustion chamber of residual gasses. Post
 - xii. purge time is 30s.
 - xiii. **Lockout** - Boiler is in a hard lockout (see Diagnostic Section).
 - **Active Fault** (visible only when there is a problem) - Reverse flashes to indicate a problem with the boiler or the system. Touching this indicator takes the user to the Diagnostic Menu. See Section XIV for more information.
 - **Hold Delay (Visible only during soft lockout)** - Indicates remaining time before next ignition sequence.
 - **Flame Signal** - Indicates the strength of the flame signal in DC micro-amps.
- d) Modulation Status Screen:
- **Fan Speed** - Current actual fan speed in RPM
 - **Set point** - Current target fan speed in RPM
 - **Speed Control** - Indicates the function currently controlling fan speed (and therefore firing rate). Typical possibilities include:
 - i. **Off** - Blower is off.
 - ii. **Burner system** - The blower speed is being determined by that needed for pre-purge, ignition, or post purge.
 - iii. **Demand** - Fan speed is being determined by the “PID” function in the Master. This function regulates the fan speed based on a combination of past and present differences between the target water temperature and the actual water temperature.
 - iv. **Supply Limit** - The supply temperature is above 185°F and the input is being limited to reduce the likelihood of high limit activation.
 - v. **Delta-T limit** - The temperature rise across the boiler has exceeded approximately 54°F and the input is being limited to reduce the likelihood of a soft lockout.
 - vi. **Stack Limit** - The flue temperature is above 200°F and the input is being limited to reduce the likelihood of a hard lockout.
 - vii. **Min Mod** - The input is not allowed to go lower because the minimum allowable fan speed has been reached.
 - viii. **Manual** - The boiler is set in manual input mode (see Settings Menu).
 - **Modulation Source** - Should always read “Local Mod. Control” in the applications covered by this manual.
- e) Pump Status:
- **Boiler** - Indicates whether the boiler pump is currently powered.
 - **System** - Indicates whether the system pump is currently powered.
 - **DHW** - Indicates whether the DHW pump is currently powered.
- f) Boiler Demands:
- **Central Heat T’Stat** - Indicates whether the boiler is seeing a call for space heat from that boiler’s thermostat connection.
 - **DHW T’ Stat** - Indicates whether the boiler is seeing a call from a domestic hot water thermostat connected to that boiler.
 - **Frost Protection** - Indicates whether the boiler is seeing a call for frost protection. This demand should never be present unless the boiler supply, or header, temperature is at or below 45°F.
 - **Lead/Lag** – Indicates whether the boiler is receiving a demand from the Master.
- 3) Master Status Menu (Figure 7.11b):
- a) Current Master Priority Screen
- Current Demand –The demand to which the multiple boiler system is currently responding. If more than one demand is present, the Current Demands shown will be the one having the highest priority. Typical Current Demands include:
 - i. **No Demand** - The Master boiler is not receiving a demand of any type.
 - ii. **Central Heat** – The Master boiler is receiving a call for space heat.
 - iii. **Domestic HW** - The Master boiler is receiving a call for domestic hot water.
 - iv. **CH Off on Warm Weather** - The warm weather shut down option has been selected in the Configuration Menu and the outside air temperature has exceeded the setting at which this function causes the multiple boiler system to ignore calls for space heating.
 - Set point – The temperature that the Master is currently trying to achieve at the set point location (normally at the header sensor).
 - Actual temperature at the set point location. Normally this will be the header, but it could also be the supply sensor on the lead boiler if there is a problem with the header sensor.

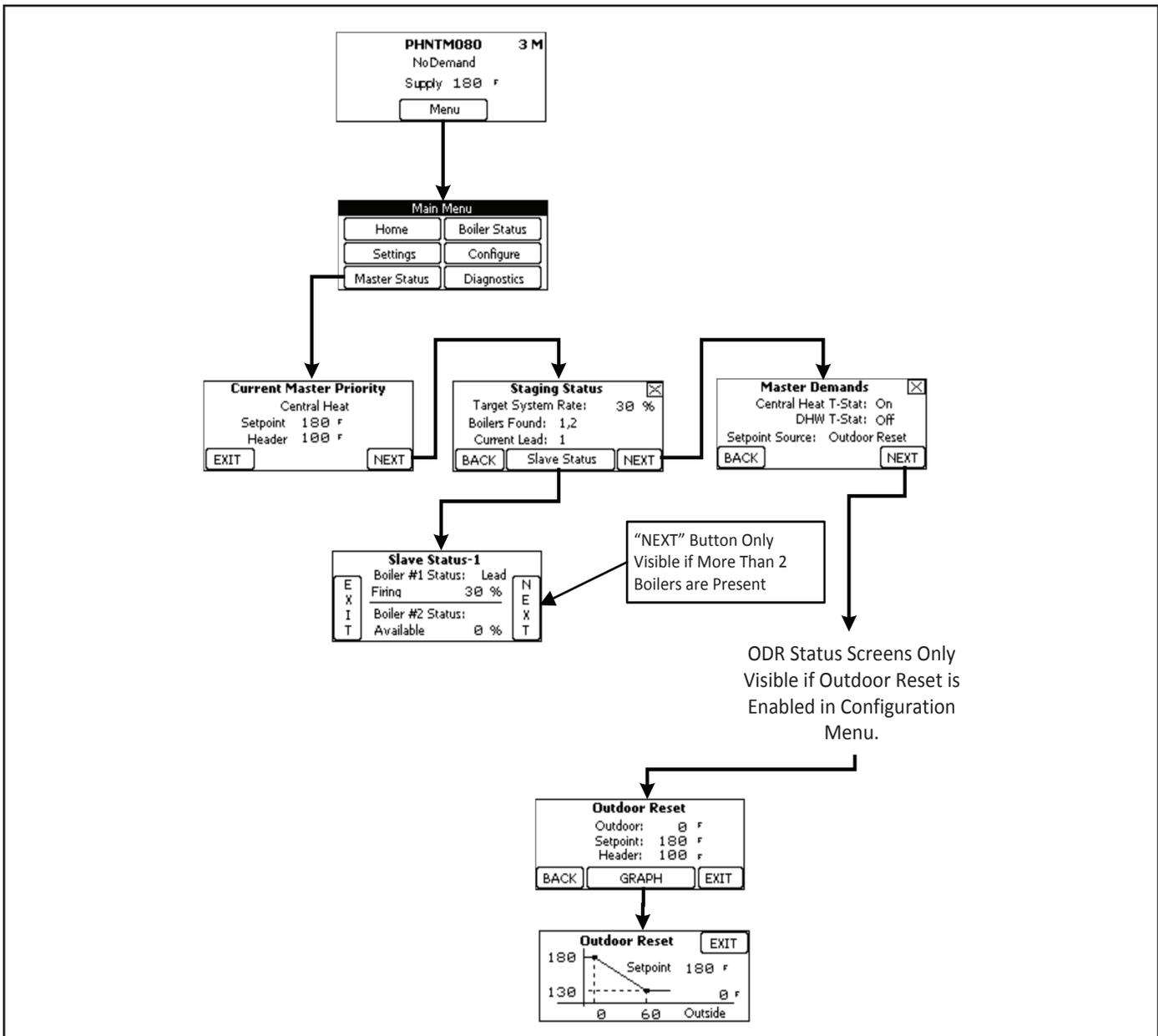


FIGURE 7.11b: MASTER STATUS MENU

- b) Staging Status – Provides general picture of the multiple boilers in the system:
- **Target system rate** – This is the firing rate (expressed as target fan speed divided by maximum fan speed) that is used by any boilers which are firing.
 - **Boilers Found** – This shows the Modbus address of all Slave boilers that have been found by the Master. Since the Master itself is also a slave, the address of the Master will also be shown here.
 - **Current Lead Boiler** – Shows the address of the current Lead boiler (the first boiler to start, and the last boiler to stop in response to a demand). The lead boiler automatically rotates to the next higher address when either of the following occur:
 - i. The lead boiler has been so for 24 hours of operation
 - ii. There is a fault with the lead boiler.
- c) **Slave Status** – The following information is available for each Slave:
- **Boiler status:** Typical status include:
 - i. **Available** – Boiler is available to respond to a call from the master.
 - ii. **Add Stage** – The boiler is currently in the process of starting, but has not yet fired.
 - iii. **Firing** – Boiler is firing in response to a call from the Master.
 - iv. **On Leave** – Boiler is responding to a demand other than the Master and is therefore unable to respond to the Master (this will not normally occur in the applications covered by this manual).
 - v. **Disabled** – Boiler is in a lockout condition and is therefore unavailable to the Master.

- vi. **Recovering** – Boiler is attempting to return to the “Available” state (for example, this state is shown when the slave is in post purge or powered down).
- **Lead** – Lead boiler is shown.
- **%** - If the boiler is firing in response to a call from the Master, this is the percentage of maximum fan speed at which the boiler is operating. Normally this value will wither be zero or equal to the Target System Rate.
- d) **Master Demands** - Shows the current status of the thermostats connected to the Master. This screen also identifies the source of the set point value currently in use by the Master.
- e) **Outdoor Reset Screens** (only visible when outdoor reset has been enabled in Configuration Menu):
 - **Outdoor** - Current temperature at outdoor sensor.
 - **Setpoint** - Current CH set point obtained from outdoor reset curve (Figure 7.9).
 - **Supply (or Header) Temperature** - The actual water temperature at the current set point location (either the boiler supply or header, depending on the demand and what set point location was selected in the Configuration Menu).
- f) **Outdoor Reset Graph** - Shows all outdoor reset curve settings, the current outdoor temperature, and set point.
Note: this graph is for reference only and does not scale.

F. Staging Process

The Master uses the following basic rules to add, drop, and modulate Slaves:

- 1) If the header temperature is at least 5 degrees below set point, the Master will initiate a call for the lead boiler to fire. The master will direct the lead boiler to operate at an input corresponding to 70% of maximum fan speed or less.
- 2) The Master decides when to add the next boiler based on a combination of time and the set point error (i.e. the difference between current and set point temperature). In general, either of the following requirements must be met to add another boiler:
 - The error must be at least 5F below set point with all previous stage(s) operating at 70% of max input for at least 3 minutes. OR:
 - The previous stage(s) has been operating at 70% of max fan speed continuously for 20 minutes.
 Once the next stage has been added, the target input is divided evenly among all stages. For example, if one boiler is operating at 70% of full input, and the next stage is added, the target rate of both boilers will be 35% immediately after the second boiler is added.
- 3) The fan speed of each boiler is limited to 70% of maximum until all boilers are firing.
- 4) Once all boilers are firing, they are permitted to operate at higher fan speeds. All boilers operate at same fan speed with this speed determined by the Master using a “PID” algorithm. This algorithm is similar to that used to control modulation on a single boiler and is based on the size, duration, and rate of change of the set-point error.
- 5) If the output of all operating boilers exceeds the current heating load, they will modulate down together until either the heating load is matched or the minimum fan speed is reached. Once all operating boilers are at their minimum fan speed, the Master will drop one stage if either of the following is true:
 - The header temperature has been at least 5F above the set point temperature for at least one minute. OR:
 - All operating boilers have been at their minimum fan speed for 20 minutes.
- 6) Boilers are added in order of their address. For example, if the current lead boiler is 2, the next boiler to come on will be 3. If a boiler fails to respond to a demand from the Master after 2:45s, the Master will transfer the demand to the boiler at the next higher address. Boilers are dropped in the reverse order.
- 7) The Master boiler is also a Slave and sends demands to itself using the same rules as it does for any other boiler. If the Master enters a hard lockout, it will attempt to continue managing the multiple boiler system while keeping itself in the disabled state.

VIII Service and Maintenance

Refer to Section XIII of the Phantom 080-180 installation manual provided with the boiler for service and maintenance instructions.

IX Troubleshooting

Refer to Section XIV of the Phantom 080-180 installation manual provided with the boiler for troubleshooting instructions.



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Rev 0, 05/15