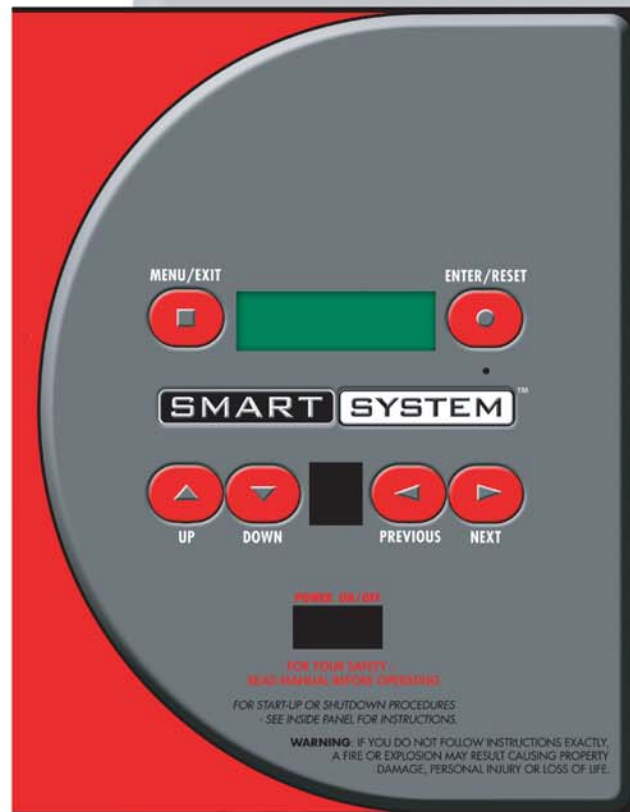


POWER-fin®

Service Manual

Models: 502, 752, 1002,
1302, 1501, 1701, and 2001

Up To 5:1 Turndown



Lochinvar®
High Efficiency Water Heaters, Boilers and Pool Heaters

WARNING

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

Save this manual for future reference.

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Hazard definitions

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

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.

NOTICE

NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

⚠ WARNING

Installer – Read all instructions, including this manual and the Power-fin Installation and Operation 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 the Power-fin User's Information Manual for your reference.

Have this appliance serviced/inspected by a qualified service technician at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE

When calling or writing about the appliance – Please have the appliance model and serial number from the appliance's rating plate.

Consider piping and installation when determining appliance location (see the Power-fin Installation and Operation Manual).

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

When servicing appliance –

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

Appliance operation –

- Do not block flow of combustion or ventilation air to the appliance.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this appliance if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

Appliance water –

- Thoroughly flush the system (without appliance connected) to remove sediment. The high-efficiency heat exchanger can be damaged by build-up or corrosion due to sediment.
- Do not use petroleum-based cleaning or sealing compounds in the appliance system. Gaskets and seals in the system may be damaged. This can result in substantial property damage.
- Do not use “homemade cures” or “appliance patent medicines”. Serious damage to the appliance, personnel, and/or property may result.

What is in this manual?

Service

The Power-fin display

- Display panel readout, buttons and their functions

Control module inputs

- Control module inputs and options

Control module outputs

- Control module outputs and options

General

- How the appliance operates
- How the control module operates
- Access modes -- user and installer
- Sequence of operation -- Domestic Hot Water (DHW)/space heating

Control panel menu access

- Accessing programming mode and locating menus
(See separate guides covering the PC and pocket PC interfaces)

Control panel parameter access

- Accessing and changing parameters from the display panel

Quick start information -- parameter table

- An index of available adjustments and readouts, where to access them and where to find detailed information.

Power-fin operation

- A: General
- B: Temperature Setting
- C: Data Logging
- D: Functions
- E: DHW Settings
- F: Outdoor Air Reset Curve
- G: Anti-cycling
- H: Control Modes
- I: Cascade
- J: Building Management System (BMS)
- K: Circulation Pumps
- L: Service Notification

Maintenance

- Service and maintenance schedules
- Address reported problems
- Inspect appliance area and appliance interior
- Clean condensate trap
- Check all piping for leaks
- Flue vent system and air piping
- Check water system
- Check expansion tank
- Check control settings
- Check igniter
- Check all appliance wiring
- Check flue gas passageways
- Flame inspection
- Inspect and clean burner
- General maintenance
- Checking manifold gas pressure
- Combustion analysis procedure
- Gas valve adjustment procedure
- Cleaning heat exchanger
- Review with owner

Troubleshooting

- Troubleshooting table - No display
- Checking temperature sensors
- Troubleshooting table - Noisy system
- Troubleshooting table - Fault messages displayed on Operator Interface

1 Service

The Power-fin display

- Hold 5 seconds to enter code Input Mode (Menu Mode)
- Press to move up one level in Menu Mode or to exit Menu Mode

MENU / EXIT

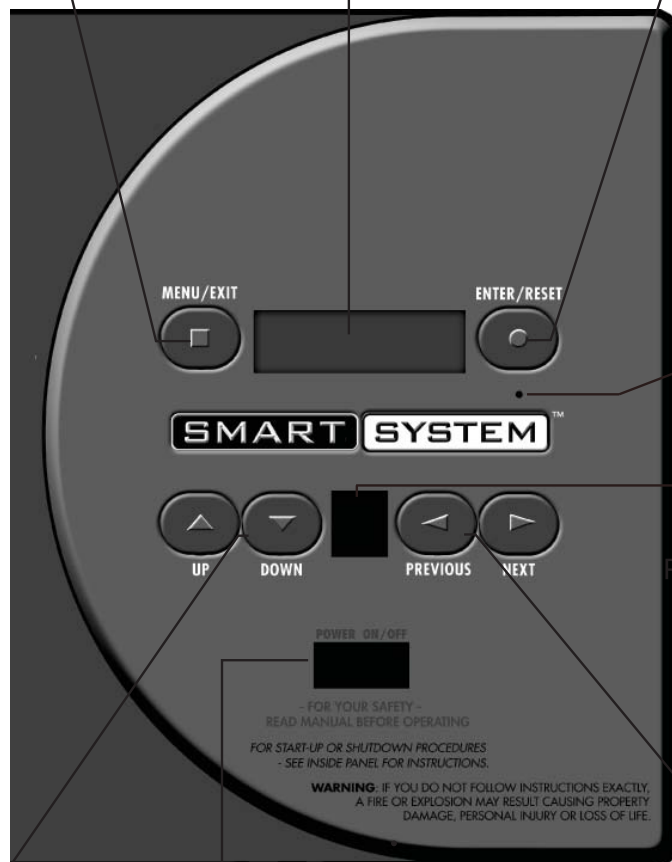


DISPLAY SCREEN



- Press to turn heater off or back on
- Press to select a menu item
- Press after parameter programming to store parameter data
- Press to exit Service Mode

ENTER / RESET

SERVICE
BUTTONPC / HANDHELD
CONNECTION
PORT

UP



DOWN

- Press to change boiler water temperature and/or tank water temperature set point during normal operation
- Press to change displayed data values in Menu Mode
- Press to navigate through menu listing in Menu Mode

POWER ON / OFF

- Press to turn unit ON or OFF.



PREVIOUS

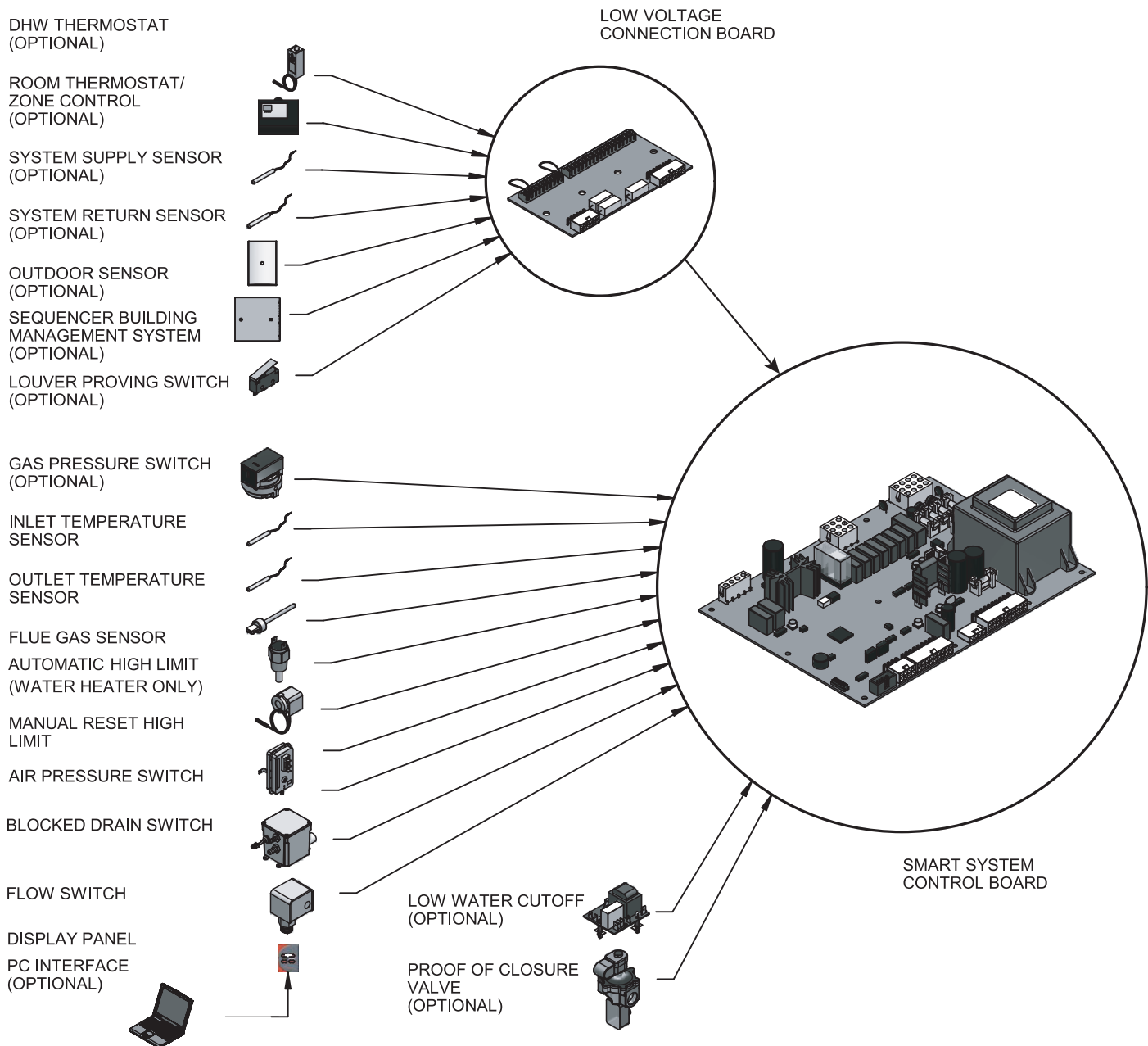


NEXT

- Press to toggle display during normal operation to show outlet and return temperatures, fan speed, flame signal, etc.
- Press to toggle between digits when entering access code or between hour, minutes, etc., when entering date and time

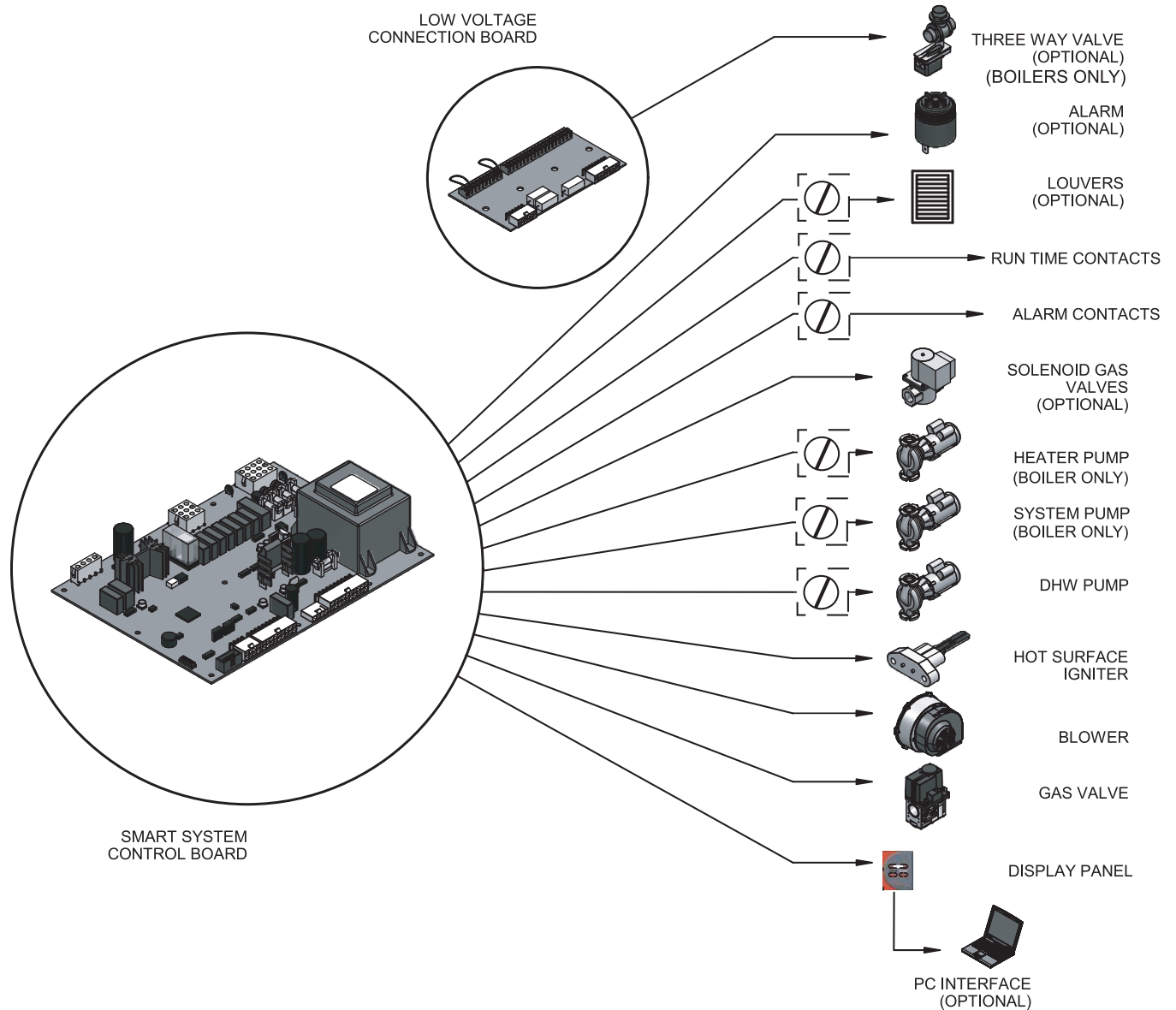
1 Service

Control inputs



1 Service *(continued)*

Control outputs



1 Service

General Operation

How the appliance operates

The Power-fin uses a copper-finned tube heat exchanger to transfer heat from the flue products to the water. An electronic control module monitors various inputs to initiate a call for heat. The blower provides both primary and secondary air to the burner and forces the flue products out of the combustion chamber and into the vent system. The control module regulates the blower speed (on B9 and M9 models) to control the firing rate of the appliance. The modulating gas valve monitors the amount of combustion air being pulled into the blower and regulates the amount of gas supplied, which then mixes with the combustion air and is supplied to the burner.

How the control module operates

The Power-fin control module receives input from appliance sensors. The control module activates and controls the blower and gas valve to regulate heat input and switches heater, DHW and system pumps on and off as needed. The user/installer programs the module to meet system needs by adjusting control parameters. These parameters set operating temperatures and heater operating modes. Appliance operation can be based on heater outlet water temperature, heater return water temperature, system supply temperature, system return temperature or tank temperature, depending on the parameter setting.

Sequence of operation

Table 1A shows control module normal sequences of operation for space heating and DHW operation. The combined operation sequence is for a typical application, programmed to provide DHW priority.

Access modes

User

The user can adjust space heating set point using the UP and DOWN buttons at any time during normal operation. By entering the USER code (0704), the user can also change temperature units, time and date, and night setback settings. In user mode, the following parameters can be viewed but not changed: Heater outlet water temperature in DHW mode; heater model number; software version; total operating hours, and total cycles.

Installer

Most parameters are available only to the installer, accessible only by entering the installer access code (5309).

Saving parameters

To save parameters and exit programming:

Press the ENTER/RESET button, then the MENU/EXIT button 3 times.

To keep parameter settings only for a current operating cycle:

Press the MENU/EXIT button 3 times after making all desired parameter changes.

To enter a parameter and continue programming:

Press the MENU/EXIT button 1 time to return to the parameter listings; press again to return to the menu listings. Remember to press the ENTER/RESET button when finished programming in order to save the changes made.

1 Service *(continued)*

Sequence of operation

Table 1A_Sequence of Operation - Space Heating and DHW

OPERATION	DISPLAY
1. The manual reset high limit must be closed before any action will take place.	HTR: Standby OUT: 123.8F(129)
2. Upon a call for heat the control turns on the appropriate pumps (system and boiler pumps for space heating; DHW pump for DHW call). The flow switch and low water cutoff (if equipped) must close.	HTR: Standby OUT: 123.8F(129)
3. <ul style="list-style-type: none"> • If the unit is equipped with a proof of closure valve, the proof of closure switch must be closed. The proof of closure valve is then energized. The gas pressure switch(es) (if equipped) must close. • If the contact for the louvers is closed, the louver proving, blocked drain switch, and auto reset high limit (water heater only) inputs must close. • If the air pressure switch is open, the prepurge cycle then begins by starting the combustion blower. Once started, the air pressure switch must close. 	HTR: Standby OUT: 123.8F(129)
4. After prepurge, the blower slows down and the hot surface igniter (HSI) is energized.	HTR: PREPURGE OUT: 123.9F(129)
5. Once the HSI is hot, the trial for ignition begins with the opening of the gas valve.	HTR: IGNITION OUT: 123.9F(129)
6. If the SMART SYSTEM control does not sense flame, it will lock out.	HTR: POSTPURGE, PREPURGE OUT: 123.9F(129)
7. If the SMART SYSTEM control senses flame at the end of the trial for ignition period, it will fire the burner to maintain the set point. On B9 and M9 models, the firing rate will modulate as required to hold the actual temperature at the set point. If the boiler lights due to a space heating call for heat, and the ramp delay function is active (default is disabled), the modulation will be held to a series of increasing limits after the burner has lit.	HTR: SH 20% RATE OUT: 124.8F(129)
8. If the space heating call for heat is active, and the DHW thermostat closes, the control will turn on the DHW pump, then turn off the boiler pump.(Boiler and DHW pump briefly overlap to ensure flow is maintained through the unit.) This will divert the hot water away from the heating zone(s) and send it to the DHW tank instead. The control will then modulate (B9 and M9 models only) to maintain the outlet temperature to the DHW boiler set point.	HTR: DHW 85% RATE OUT: 177.8(180)

1 Service

Sequence of operation















Table 1A_ (continued from previous page) Sequence of Operation - Space Heating and DHW

OPERATION	DISPLAY
9. If the DHW thermostat remains on for more than 30 minutes, and the space heating call for heat is also on, then the control will turn on the boiler pump, turn off the DHW pump and resume firing based on the space heating set point. (Boiler and DHW pump operation briefly overlap to ensure flow is maintained through the unit.) As long as both the space heating and DHW calls for heat remain active, the control will switch back and forth between the two modes until one of them is satisfied.	HTR: SH 41% RATE OUT: 123.0F(129)
10. Once both calls for heat are satisfied, the control will turn off the burner. The blower will remain on for the postpurge cycle. Any pumps that are running will continue to run for their respective pump delay times, then turn off.	HTR: POSTPURGE OUT: 127.4F(129)
11. Boiler pump off, system pump continues its delay if longer.	HTR: Standby OUT: 124.7F(129)
12. System pump off.	HTR: Standby OUT: 122.9F(129)

1 Service *(continued)*

Display panel menu access

Table 1B_ Use this procedure to access menus from the display panel














BUTTON	OPERATION	DISPLAY	COMMENTS
	ENTER/RES Press 1 time in normal operation	HTR:OFF OUT:123.0F	Heater turns off (this ensures uninterrupted programming)
	MENU/EXIT Hold for 5 seconds -- display will change	Enter Menu Code: 0000 ← flashing	Digit shown underlined at left will flash
	UP Press 9 times to change last digit in readout to "9"	Enter Menu Code: 000 <u>9</u>	Digit shown underlined at left will flash
	PREVIOUS Press 2 times to move to the second digit	Enter Menu Code: 00 <u>0</u> 9	Digit shown underlined at left will flash
	UP Press 3 times to change second digit in readout to "3"	Enter Menu Code: 0 <u>3</u> 09	Digit shown underlined at left will flash
	PREVIOUS Press 1 time to change to the first digit	Enter Menu Code: <u>0</u> 309	Digit shown underlined at left will flash
	UP Press 5 times to change first digit in readout to "5"	Enter Menu Code: <u>5</u> 309	Digit shown underlined at left will flash
If you enter a digit incorrectly, you can move to the digit by using the NEXT and PREVIOUS buttons as needed until the digit you want is flashing. Then use UP and/or DOWN buttons to change the value.			
	ENTER/RES Press to enter the code	Enter Menu Code: INSTALLER CODE	The words, "INSTALLER CODE" will flash while displayed
	After 2 seconds, display shows menus (press ENTER/RESET to select a menu)	>A General B Temp Settings	The caret symbol, ">" highlights the selectable line
If the code is entered incorrectly, the display will return to its previous mode. You will have to start over at step 1 to enter the code.			
	DOWN Press 1 time to highlight second listing	A General >B Temp Settings	The caret symbol, ">" highlights the selectable line
	DOWN Press 1 time to toggle menu listing	>C Data Logging D Functions	The menu toggles to the next two menu options
	DOWN Press 2 times to toggle menu listing	>E DHW Settings F Outdoor Reset	The menu toggles to the next two menu options
	DOWN Press 2 times to toggle menu listing	>G Anti-cycling H Control Modes	The menu toggles to the next two menu options
	DOWN Press 2 times to toggle menu listing	>I Circulation Pumps J Service Notification	The menu toggles to the next two menu options
To select a highlighted menu, press the ENTER/RESET button one time. The display will change to the first parameter under that menu, with the first characters flashing.			

Note: Not all menu listings shown above are available on water heaters.

1 Service

Display panel parameter access

Table 1C_ This is a typical example of accessing a parameter, shown for parameter K2, SH pump delay

BUTTON	OPERATION	DISPLAY	COMMENTS
<i>This example shows how to access parameter K2, SH pump delay. The first display shown is at the beginning of the menu listings, after entering the installer access code.</i>			
	-	Beginning of menu listings.	>A General B Temp Settings <i>The caret symbol, ">" highlights the selectable line</i>
	DOWN	Press 1 time to highlight second listing	>A General B Temp Settings <i>The caret symbol, ">" highlights the selectable line</i>
	DOWN	Press 1 time to toggle menu listing	>C Data Logging D Functions <i>The menu toggles to the next two menu options</i>
	DOWN	Press 2 times to toggle menu listing	>E DHW Settings F Heat Curve <i>The menu toggles to the next two menu options</i>
	DOWN	Press 2 times to toggle menu listing	>G Anti-Cycling H Control Modes <i>The menu toggles to the next two menu options</i>
	DOWN	Press 2 times to toggle menu listing	>I Cascade J BMS <i>The menu toggles to the next two menu options</i>
	DOWN	Press 2 times to toggle menu listing	>K Circ. Pump L Service Noti. <i>The menu toggles to the next two menu options</i>
	ENTER/RES	Press 1 time to list parameters	K1 SYS Pump Dely <i>K1 will flash</i>
	UP	Press 1 time to change parameter	K2 SH Pump Dely <i>K2 will flash</i>
	ENTER/RES	Press 1 time to select parameter	K2 SH Pump Dely 30 Seconds <i>K2 will stop flashing; parameter value will appear</i>
	UP (or DOWN)	Press to increase (or decrease) value	K2 SH Pump Dely 40 Seconds <i>Parameter will increase or decrease, depending on button pressed</i>
	ENTER/RES	Press 1 time to save (or press MENU/EXIT to continue)	K2 SH Pump Dely <i>K2 will flash</i>
	MENU/EXIT	Press 1 time to return to the main menu	> A General B Temp Settings
	MENU/EXIT	Press 1 time to return to normal operation	HTR:Pre-Purge OUT:123.7°F <i>This display example assumes a call for space heating is present</i>

1 Service *(continued)*

Parameter table

Table 1D_ This table lists SMART SYSTEM control module parameters and where to access them

	MENU	SUB ITEM	DESCRIPTION	SEE PAGE	USER ACCESS		INSTALLER ACCESS	
					DISPLAY	MODIFY	DISPLAY	MODIFY
GENERAL	A	1	Heater Model	15	Yes	No	Yes	No
		2	User Code	15	Yes	Yes	Yes	Yes
		3	Date and Time	15	Yes	Yes	Yes	Yes
		4	Software Version	15	Yes	No	Yes	No
		5	Temperature Units	15	Yes	Yes	Yes	Yes
		6	Night Setback Temperature	15	Yes	Yes	Yes	Yes
		7	Night Setback Times	15	Yes	Yes	Yes	Yes
TEMPERATURE SETTING	B	1	SH Set Point User	15	Yes	Yes	Yes	Yes
		2	SH Minimum Set Point	15	No	No	Yes	Yes
		3	SH Maximum Set Point	15	No	No	Yes	Yes
		4	SH Offset	15	No	No	Yes	Yes
		5	SH Differential	15	No	No	Yes	Yes
DATA LOGGING	C	1	Hours Running SH	16	Yes	No	Yes	No
		2	Hours Running DHW	16	Yes	No	Yes	No
		3	Ignition Attempts	16	Yes	No	Yes	No
		4	Show Last 10 Errors	16	Yes	No	Yes	No
FUNCTIONS	D	1	Service Mode Delay	16	No	No	Yes	Yes
		2	Reset Last 10 Errors	16	No	No	Yes	Yes
DHW SETTINGS	E	1	DHW Tank Set Point	16	Yes	Yes	Yes	Yes
		2	DHW Boiler Set Point	16	Yes	Yes	Yes	Yes
		3	SH/DHW Switching Time	16	Yes	Yes	Yes	Yes
OUTDOOR AIR RESET	F	1	Minimum Air Temperature	16	No	No	Yes	Yes
		2	Maximum Air Temperature	16	No	No	Yes	Yes
		3	Maximum SH Set Point	17	No	No	Yes	Yes
		4	Minimum SH Set Point	17	No	No	Yes	Yes
		5	Outdoor Air Shutdown	17	Yes	Yes	Yes	Yes
		6	Outdoor Air Shutdown Differential	17	Yes	Yes	Yes	Yes
		7	Shift Reset Curve	17	No	No	Yes	Yes
		8	Boost Temperature	18	Yes	Yes	Yes	Yes
		9	Boost Time	18	Yes	Yes	Yes	Yes

1 Service

Parameter table *(continued)*

Table 1D_ *(continued from previous page)* This table lists SMART SYSTEM control module parameters and where to access them

	MENU	SUB ITEM	DESCRIPTION	SEE PAGE	USER ACCESS		INSTALLER ACCESS	
					DISPLAY	MODIFY	DISPLAY	MODIFY
ANTI-CYCLING	G	1	Anti-cycling Time	18	No	No	Yes	Yes
		2	Inlet Temperature Differential for Ending Anti-Cycling	18	No	No	Yes	Yes
		3	Ramp Delay On/Off	18	No	No	Yes	Yes
		4	Ramp Delay Settings (boiler only)	18	No	No	Yes	Yes
CONTROL MODES	H	1	SH Controlling Sensor (Outlet/ System, Inlet)	19	No	No	Yes	Yes
		2	Enable Input	19	No	No	Yes	Yes
		3	0-10V Building Management Input	19	No	No	Yes	Yes
		4	Cascade	19	No	No	Yes	Yes
CASCADE	I	1	Boiler Cascade Address	19	No	No	Yes	Yes
		2	Max. Cascade Set Point	20	No	No	Yes	Yes
		3	Cascade Offset	20	No	No	Yes	Yes
		4	Cascade Off-On Differential	20	No	No	Yes	Yes
BUILDING MANAGEMENT SYSTEM (BMS)	J	1	BMS Type	20	No	No	Yes	Yes
		2	Voltage at Minimum	20	No	No	Yes	Yes
		3	Voltage at Maximum	20	No	No	Yes	Yes
		4	Minimum Power	20	No	No	Yes	Yes
		5	Maximum Power	20	No	No	Yes	Yes
		6	Minimum Set Point	20	No	No	Yes	Yes
		7	Maximum Set Point	21	No	No	Yes	Yes
		8	Voltage at Start	21	No	No	Yes	Yes
		9	Voltage at Stop	21	No	No	Yes	Yes
CIRCULATION PUMPS	K	1	System Pump Delay	21	No	No	Yes	Yes
		2	SH Pump Delay	21	No	No	Yes	Yes
		3	DHW Pump Delay	21	No	No	Yes	Yes
SERVICE NOTIFICATION	L	1	Service Notification in Months	21	No	No	Yes	Yes
		2	Service Notification Running Hours	21	No	No	Yes	Yes
		3	Service Notification Boiler Cycles	21	No	No	Yes	Yes
		4	Reset Service Notification Counter	21	No	No	Yes	Yes
		5	Accept PPlug	21	No	No	Yes	Yes

1 Service *(continued)*

Viewable and changeable control parameters

CAUTION

Before changing parameters, note the settings so that the unit can be returned to its original operating parameters.

A: General

Heater model

The control will display “LOCHINVAR” as the model number because the same control is used on several models. This will be displayed when parameter **A1** has been accessed. This parameter is not changeable.

User code

The User Code allows the user to access and change a limited number of control parameters. The access code can be changed by the user or the installer to a code of their choosing. To change the code, parameter **A2** must be accessed. The default code is 0704. The code can be changed one digit at a time by using the arrow keys on the display.

Date and time

The control uses an internal clock for the night setback feature and for logging of events. For these features to work correctly, the clock must be set when the unit is first installed or any time the unit has been powered off for more than 30 days. To set the clock, parameter **A3** must be accessed. The date and time are displayed as “YY:MM:DD W hh:mm”. YY = year, MM = month, DD = date, W = day (1 = Monday, 2 = Tuesday, etc.), hh = hour (24 hour time; 2:00 PM = 14:00), mm = minutes.

NOTICE

The internal clock does not adjust for Daylight Savings Time and therefore, will require a manual adjustment.

Software version

The software version allows the user to view the software version in use by the control. This software controls the operation of the unit. When a new software version becomes available, the existing control can be replaced with a new control to update the software.

Temperature units

The control can be configured to display temperature in either °C or °F. This parameter can be changed by the user or the installer by accessing parameter **A5**. The default is °F.

Night setback temperature

Once the internal clock has been set correctly, the night setback feature can be used to program a lower water temperature set point for space heating or tank. This parameter can be changed by the user or the installer by accessing parameter **A6**. The temperature range for this parameter is 32°F (0°C) to 261°F (127°C). The feature is turned off with a setting of 32.0°F (0°C). The default value is 32.0°F (0°C).

Night setback times

If parameter **A6** is set to anything other than 32.0°F (0°C), the night setback feature becomes active. This will require start and stop times to be programmed for the days that reduced temperatures are required. These times can be changed by the user or the installer by accessing parameter **A7**. Each day of the week (Monday through Sunday) will have an on and off time.

Example: Monday ON: 22:30, Tuesday OFF: 6:45. If you wish to skip a day and have no night setback, leave the on and off times the same. The default times for each day will be 08:00 (OFF) and 18:00 (ON).

B: Temperature settings (boiler only)

SH Set point user

The SH set point user sets the water temperature set point for fixed operation or the maximum temperature set point when the outdoor air sensor is used. This parameter can be changed by the user or the installer by accessing parameter **B1**. The temperature range of this parameter is 60°F (15°C) to 230°F (110°C). The default value is 120°F (49°C).

SH Minimum set point

The SH minimum set point sets the minimum water temperature set point that can be used for space heating operation. The user or installer will not be able to program the control with a lower SH set point. This parameter can only be changed by the installer by accessing parameter **B2**. The temperature range of this parameter is 32°F (0°C) to 261°F (127°C). The default value is 70°F (21°C).

SH Maximum set point

The SH maximum set point sets the maximum water temperature set point that can be used for space heating. The user or installer will not be able to program the control with a higher SH set point. This parameter can only be changed by the installer by accessing parameter **B3**. The temperature range of this parameter is 32°F (0°C) to 261°F (127°C). The default value is 220°F (104°C).

SH Offset

The SH offset sets how many degrees above set point the temperature has to go before the unit will shut off. This parameter can only be changed by the installer by accessing parameter **B4**. The temperature range of this parameter is 0°F (0°C) to 54°F (30°C). The default value is 10°F (5°C).

SH Differential

The SH differential sets how many degrees below the turn off temperature the temperature has to go before the unit will turn on. This parameter can only be changed by the installer by accessing parameter **B5**. The temperature range of this parameter is 0°F (0°C) to 54°F (30°C). The default value is 20°F (11°C).

1 Service

C: Data logging

Hours running SH

The hours running SH parameter shows the total number of hours the unit has been in the SH firing position. This parameter can be viewed by the user and the installer by accessing parameter **C1**.

Hours running DHW

The hours running DHW parameter shows the total number of hours the unit has been in the DHW firing position. This parameter can be viewed by the user and the installer by accessing parameter **C2**.

Ignition attempts

The ignition attempts parameter shows the total number of times the unit has attempted to fire. This parameter can be viewed by the user and the installer by accessing parameter **C3**.

Show last 10 errors

The control will log the 10 most current errors with the date and time the error occurred. This parameter can be viewed by the user and the installer by accessing parameter **C4**.

D: Functions

Service mode delay

By pressing the pin button on the front of the display for five (5) seconds, the control will be placed in Service Mode. This will override all other heat demands. The Service Mode allows the installer to set the unit to either maximum firing rate or minimum firing rate for the purpose of combustion analysis. The delay sets the length of time the unit will stay in the Service Mode if no keys have been pressed before going back to its original state. This parameter can only be changed by the installer by accessing parameter **D1**. The time range of this parameter is 0 to 40 minutes. The default value is 20 minutes.

Reset last 10 errors

The reset last 10 errors parameter allows the error counter to be reset to 0. This parameter can only be cleared by the installer by accessing parameter **D2**. Once accessed, press the RESET key to clear the counter.

E: DHW settings

DHW tank set point

When a temperature sensor is installed in the DHW tank, the DHW tank set point sets the target temperature of the water in the tank. The user or installer can adjust this set point by accessing parameter **E1**. The temperature range of this parameter is 60°F (15°C) to 190°F (88°C). The default value is 120°F (49°C).

DHW boiler set point (boiler only)

When an indirect DHW call for heat becomes active, the control will use the DHW boiler set point to determine the firing rate of the unit based on the actual outlet water temperature. This parameter can be changed by the installer by accessing parameter **E2**. The temperature range of this parameter is 32°F (0°C) to 261°F (127°C). The default value is 180°F (82°C).

SH/DHW switching time (boiler only)

The SH/DHW switching time parameter sets the length of time the control will stay in DHW Mode when a space heating (SH) call has been received. After this time period has expired the control will revert to SH Mode. If a DHW call is still active the timer will reset. After the time period has expired the control will revert back to DHW Mode. This will continue until one of the demands has been satisfied. This parameter can be changed by the installer by accessing parameter **E3**. The time range of this parameter is 10 minutes to 240 minutes. The default value is 30 minutes.

F: Outdoor air reset (boiler only)

Outdoor air reset operation

When the outdoor air sensor is installed, the control will calculate the water temperature set point based on the outdoor air temperature. As the outdoor air temperature drops the water temperature set point increases. This feature allows the unit to be more efficient in periods of mild weather, see FIG. 1-1 on page 17.

Minimum air temperature

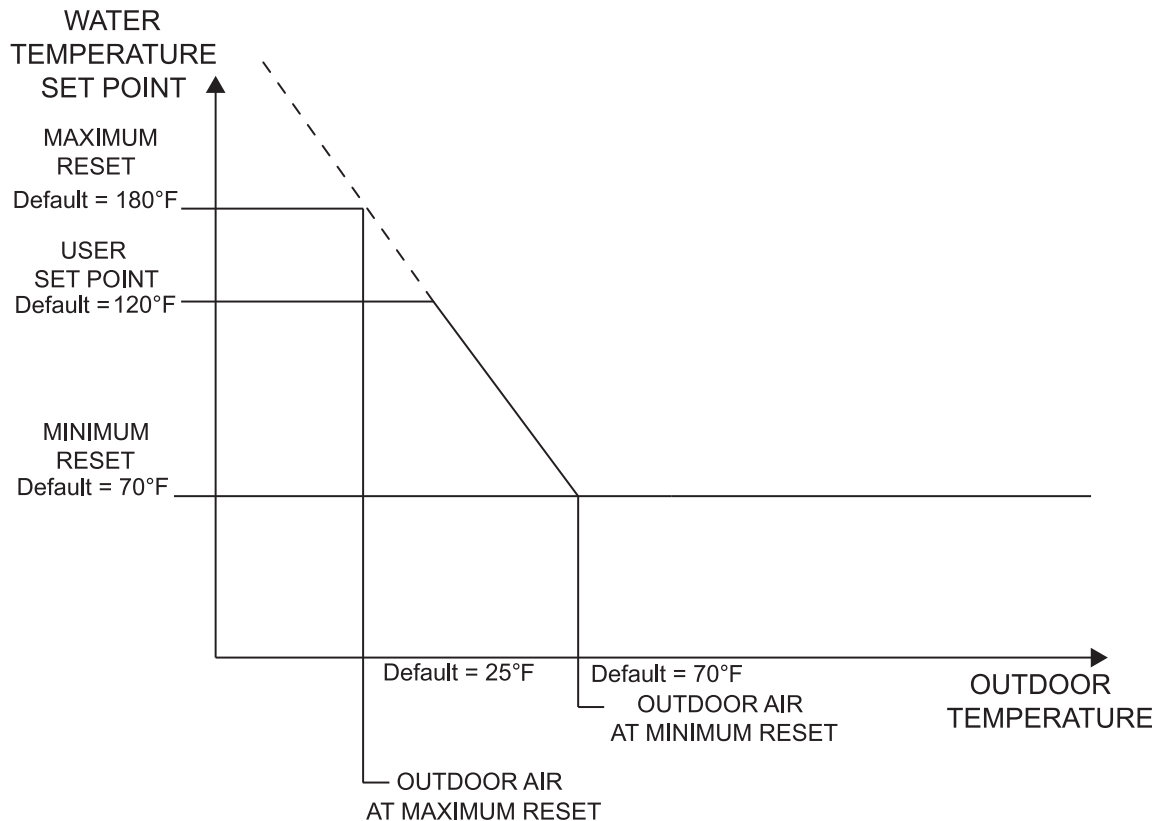
When the outdoor air temperature drops to this point, the water temperature will be at its maximum setting (FIG. 1-1). The water temperature will be limited by the user set point. This parameter can be changed by the installer by accessing parameter **F1**. The temperature range of this parameter is -22°F (-30°C) to 86°F (30°C). The default value is 25°F (-4°C).

Maximum air temperature

When the outdoor air temperature rises to or above this point, the water temperature will be at its minimum setting (FIG. 1-1). This parameter can be changed by the installer by accessing parameter **F2**. The temperature range of this parameter is -22°F (-30°C) to 86°F (30°C). The default value is 70°F (21°C).

1 Service *(continued)*

Figure 1-1_ Outdoor Air Reset Curve



Maximum SH set point

When the outdoor temperature drops to its minimum setting (F1) the water temperature will be at this point, if the SH set point is set higher (FIG. 1-1). This parameter can be changed by the installer by accessing parameter **F3**. The temperature range of this parameter is 32°F (0°C) to 248°F (120°C). The default value is 180°F (82°C).

Minimum SH set point

When the outdoor temperature rises to or above its maximum setting (F2) the water temperature will be at this point (FIG. 1-1). This parameter can be changed by the installer by accessing parameter **F4**. The temperature range of this parameter is 32°F (0°C) to 248°F (120°C). The default value is 70°F (21°C).

Outdoor air shutdown

When the outdoor temperature rises above this point, the control will block all SH demands (DHW demands will still be active). This parameter can be changed by the user or the installer by accessing parameter **F5**. The temperature range of this parameter is 32°F (0°C) to 122°F (50°C). The default value is 80°F (27°C).

Outdoor air shutdown differential

The outdoor air shutdown differential parameter is the number of degrees below parameter F5 the outdoor air temperature must go before the unit will respond to a SH demand. This parameter can be changed by the user or the installer by accessing parameter **F6**. The temperature range of this parameter is 0°F (0°C) to 90°F (50°C). The default value is 10°F (5°C).

Shift reset curve

The shift reset curve parameter shifts the actual set point above the calculated set point the number of degrees in this parameter. This parameter can be changed by the installer by accessing parameter **F7**. The temperature range of this parameter is -27°F (-15°C) to 27°F (15°C). The default value is 0°F (0°C). This feature will be active if this parameter is set to anything other than 0°F (0°C).

1 Service

Boost temperature

If a SH demand lasts longer than the programmed time delay setting (F9) and there have been no DHW demands, the control will increase the water temperature set point by the amount in this parameter. If the SH demand continues through another time period, the set point will be increased again. This will continue until either the SH demand ends, a maximum of 20 increases has occurred, or the maximum set point has been reached. Once the SH demand has been satisfied the set point will revert back to its calculated setting. The boost temperature can be changed by the installer by accessing parameter **F8**. The temperature range of this parameter is 0°F (0°C) to 45°F (25°C). The default value is 0°F (0°C). This feature will be active if this parameter is set to anything other than 0°F (0°C).

Boost time

The boost time parameter sets the amount of time that must elapse with a SH demand before the water temperature set point will be increased. This parameter can be changed by the installer by accessing parameter **F9**. The time range for this parameter is 1 minute to 250 minutes. The default value is 20 minutes.

G: Anti-cycling

Anti-cycling time

Once a SH demand has been satisfied, a set amount of time must elapse before the control will respond to a new SH demand. The control will block the new heat demand and anti-cycling will be shown in the display until the time has elapsed or the water temperature drops below parameter G2. This parameter can be changed by the installer by accessing parameter **G1**. The time range for this parameter is 0 minutes to 40 minutes. The default value is 1 minute.

Inlet temperature differential for ending anti-cycling

The control will bypass the anti-cycling time if the water temperature drops too quickly. The control will use the water temperature the unit was at when it shut off as the starting point. If the temperature drops below the temperature parameter the control will abort anti-cycling and allow the unit to fire. This parameter can be changed by the installer by accessing parameter **G2**. The temperature range of this parameter is 0°F (0°C) to 54°F (30°C). The default value is 10°F (5°C).

Ramp delay on/off (M9 boilers only)

When the ramp delay on/off parameter is active, the ramp delay limits the boiler firing rate when a SH cycle has started. There are six (6) limiting steps used to limit temperature overshoot and short cycles, see FIG. 1-2 on page 19 of this manual. This feature can be turned on or off depending on the installation. This parameter can be changed by the installer by accessing parameter **G3**. The control range of this parameter is 0 = Off, 1 = Ramp Up Only, and 2 = Ramp Up and Ramp Down. The default value is 0.

Ramp delay settings (M9 boilers only)

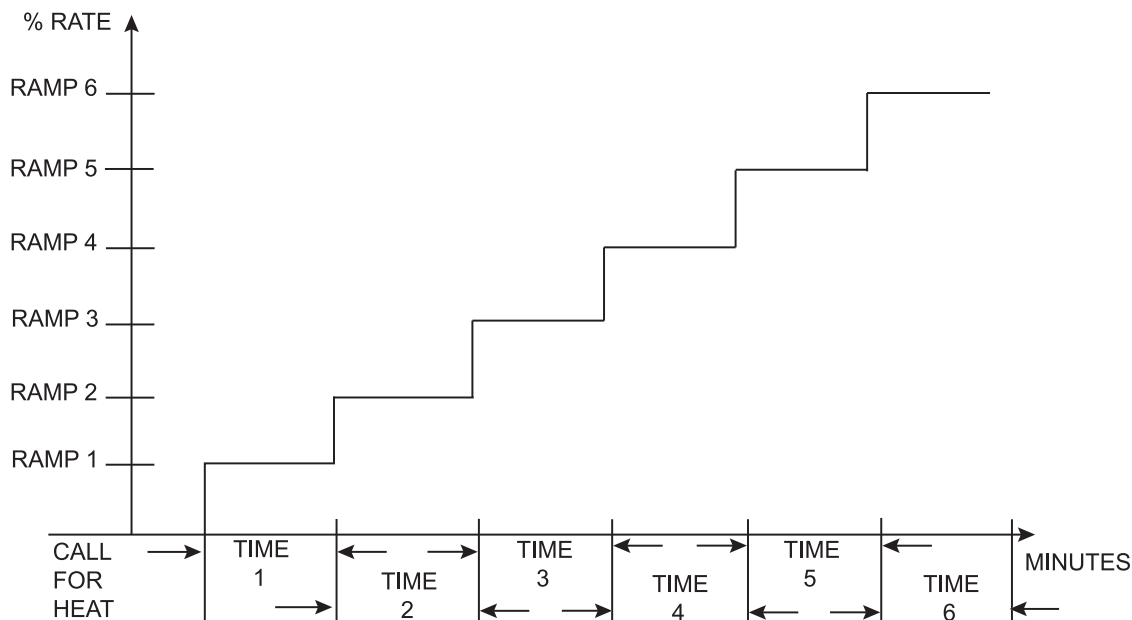
When ramp delay is active, there are up to six (6) limiting steps, as described above in *Ramp Delay On/Off*. Each step has its own time period and modulation limit. The installer can adjust these settings by accessing parameter **G4**. The settings for each step are displayed as follows:

G4 Ramp n
mm minutes ppp.p%

Where n is the number of the step, mm is the length of time in that step, and ppp.p is the maximum modulation allowed during that step. Upon selecting this parameter, the ramp number n will be flashing. Use the UP and DOWN keys to select the step you wish to adjust. Use the NEXT and PREVIOUS keys to select the setting you wish to adjust. Use the UP and DOWN keys to adjust the value of each setting. NOTE THAT THE MODULATION LIMIT IN STEP 6 WILL APPLY THROUGHOUT THE ENTIRE CALL FOR HEAT. If 100% modulation is required, the modulation limit in step 6 must be 100%. The default values are 2 minutes at 50% for step 1, 1 minute at 80% for step 2, and 1 minute at 100% for steps 3 through 6.

1 Service *(continued)*

Figure 1-2_Ramp Delay Interval



H: Control modes

SH controlling sensor (boiler only)

The SH controlling sensor parameter selects the sensor the control will use to regulate the boiler firing rate. This parameter is adjustable by the installer by accessing parameter **H1**. The sensor selections are as follows: The outlet sensor regulates the firing rate based on the outlet water temperature of the unit and the inlet sensor regulates the firing rate based on the inlet water temperature of the unit. If the outlet sensor is selected, and the optional system supply sensor is connected, the control will regulate the firing rate based on the system sensor temperature. If the inlet sensor is selected, and the optional system return sensor is connected, the control will regulate the firing rate based on the system return sensor. The default sensor is the Outlet Sensor.

Enable input

The boiler or water heater can receive a call for heat in two different ways. First, an external contact (like a tank thermostat) or sensor (like a tank sensor) can generate a call for heat. Second, the 0-10Vdc voltage from a BMS can be used to generate the call for heat, as well as provide the set point or modulation level. On boilers, the external contact is connected to the Enable input on the low voltage connection board. On water heaters, the external contact is connected to the Tank Thermostat input on the low voltage connection board. When a tank sensor is connected, the Tank Thermostat input is not used. When the call for heat comes from an external contact or tank sensor, the enable input must be set to active. When the call for heat comes from the 0-10Vdc input, the enable input must be set to inactive. This setting is adjustable by the installer by accessing parameter **H2**. The default setting is active.

0-10V building management input (BMS)

When the building management input is enabled, the control modulates the unit (B9 or M9 only) or the cascade based on the voltage on the 0-10V input on the connection board. The 0-10V input may control either the modulation of the unit(s), or the set point. This setting is adjustable by the installer by accessing parameter **H3**. The default value is Inactive. See menu *Section J* to adjust the parameters that control the BMS operation.

Cascade

The boiler or water heater is part of a group of units sequenced together. The designated Leader unit determines the total output needed from the group based on the set point and controlling sensor reading. It assigns portions of the output to itself (Leader) and the Member units. When Cascade is active, each boiler in the group requires a unique address (see menu *Section I* below). This setting is adjustable by the installer by accessing parameter **H4**. The default value is Inactive.

I: Cascade

Boiler cascade address

The boiler designated as the Leader needs to be programmed with address 0. All the Member boilers require addresses from 1 to 7, and the addresses must be different for each Member. The addresses can be in any order, regardless of the order in which the units are wired together. This parameter is adjustable by the installer by accessing parameter **I1**. The outdoor air (if used) and system supply sensor must be connected to the Leader boiler. The default address is 1.

1 Service

Max. cascade set point

This parameter determines the set point used by the individual boilers in a Cascade. When a boiler is commanded to fire by the Leader boiler, it will attempt to achieve this temperature at its outlet. The Leader boiler will limit the modulation of the last boiler to fire in order to hold the temperature at the system supply sensor to the user set point. If any of the boiler outlet temperatures reach the max. cascade set point, the boiler will then modulate down on its own in order to keep its outlet temperature within the max. cascade set point. Therefore, this parameter can be used to limit the outlet temperatures of all the boilers in a Cascade. Note that this parameter does not apply when the boiler is heating an indirect DHW tank. This parameter is adjustable by the installer by accessing parameter **I2**. The temperature range for this parameter is 32°F (0°C) - 261°F (127°C). The default max. cascade set point is 185°F (85°C).

Cascade offset (boilers only)

This parameter determines how much the temperature must go above set point before the lead boiler will turn off. This parameter can be adjusted by the installer by accessing parameter **I3**. The temperature range for this parameter is 0°F (0°C) - 54°F (30°C). The default value is 9.9°F (5°C).

Cascade off-on differential (boilers only)

This parameter determines how much the temperature must go below the turn off temperature (Set point + Offset) before the lead boiler turns on. This parameter can be adjusted by the installer by accessing parameter **I4**. The temperature range for this parameter is 0°F (0°C) - 54°F (30°C). The default value is 19.8°F (11°C).

J: Building Management System (BMS)

BMS type

When the unit or cascade is controlled by the 0-10V BMS input, the voltage signal can control either the modulation rate (power) (B9 or M9 only) or the set point. This parameter may be adjusted by the installer by accessing parameter **J1**. The default value is Power.

Voltage at minimum

This setting determines the voltage at which the external signal begins to increase either the modulation or the set point. Below this voltage, the modulation or set point will be at their minimum values. This parameter can be adjusted by the installer by accessing parameter **J2**. The range for this parameter is 0V - (J3 - 0.1V). The default value is 2V.

Voltage at maximum

This setting determines the voltage at which the external signal forces either the modulation or the set point to their maximum value. This parameter, along with the previous parameter, determines how much the modulation or set point changes as the BMS input voltage changes. The modulation or set point will change in proportion to the change in voltage between the minimum and maximum voltage settings. This parameter may be adjusted by the installer by accessing parameter **J3**. The range for this parameter is (J2 + 0.1V) - 10V. The default setting is 10V.

Minimum power

This setting determines the modulation of the unit (B9 or M9 only) or cascade when the BMS input voltage is at or below the Voltage at Minimum setting. This parameter is active only when the BMS type is set to Power. On heaters with F9 firing controls, this function does not apply. On heaters with B9 firing controls, this parameter should not be less than 50%. On heaters with M9 firing controls, this parameter can be as low as 20%. When the cascade function is also active, this parameter may be as low as the minimum firing rate of the individual heaters divided by the number of heaters in the cascade. This parameter may be adjusted by the installer by accessing parameter **J4**. The range for this parameter is 0 - 100%. The default value is 20%.

Maximum power

This setting determines the modulation of the unit (B9 or M9 only) or cascade when the BMS input voltage is at or above the Voltage at Maximum setting. This parameter is only active when the BMS type is set to Power. This parameter can be adjusted by the installer by accessing parameter **J5**. The range for this parameter is 0 - 100%. The default value is 100%.

Minimum set point

This setting determines the set point used by the unit or cascade when the BMS voltage is at or below the Voltage at Minimum setting. This parameter is only active when the BMS type is set to Set Point. This parameter can be adjusted by the installer by accessing parameter **J6**. The temperature range for this parameter is 32°F (0°C) - 248°F (120°C). The default value is 70°F (21°C).

1 Service *(continued)*

Maximum set point

This setting determines the set point used by the unit or cascade when the BMS voltage is at or above the Voltage at Maximum setting. This parameter is only active when the BMS type is set to Set Point. This parameter can be adjusted by the installer by accessing parameter **J7**. The temperature range for this parameter is 32°F (0°C) - 248°F (120°C). The default value is 190°F (88°C) for water heaters, and 220°F (104°C) for boilers.

Voltage at start

When the Enable input is set to Inactive, this parameter determines the BMS input voltage at which the unit or cascade is enabled. When the unit is disabled, the unit will become enabled when the BMS input voltage rises up to or above this value. This parameter may be adjusted by the installer by accessing parameter **J8**. The range for this parameter is (**J9** + 0.1V) - 10V. The default value is 1V.

Voltage at stop

When the Enable input is set to Inactive, this parameter determines the BMS input voltage at which the unit or cascade is disabled. When the unit is enabled, the unit will become disabled when the BMS input voltage drops down to or below this value. This parameter may be adjusted by the installer by accessing parameter **J9**. The range for this parameter is 0V - (**J8** - 0.1V). The default value is 0.5V.

K: Circulation pumps

System pump delay (boiler only)

The system pump delay parameter sets the length of time the system pump (if connected) will run after a SH demand has been satisfied. This parameter is adjustable by the installer by accessing parameter **K1**. The time range for this parameter is 1 minute to 40 minutes. The default time is 30 seconds.

SH pump delay (boiler only)

The SH pump delay parameter sets the length of time the boiler pump will run after a SH demand has been satisfied. This parameter is adjustable by the installer by accessing parameter **K2**. The time range for this parameter is 1 minute to 40 minutes. The default time is 30 seconds.

DHW pump delay

The DHW pump delay parameter sets the length of time the DHW pump (if connected) will run after a DHW demand has been satisfied. This parameter is adjustable by the installer by accessing parameter **K3**. The time range for this parameter is 1 minute to 40 minutes. The default time is 30 seconds.

L: Service Notification

Service notification in months

When the boiler control determines that a scheduled service is due based on days of installation, the boiler display will alternate the standard boiler display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by the installer by accessing parameter **L1**. The time range for this parameter is 0 months to 36 months. The default time is 12 months.

Service notification running hours

When the boiler control determines that a scheduled service is due based on the hours of actual operation, the boiler display will alternate the standard boiler display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by the installer by accessing parameter **L2**. The time range for this parameter is 0 hours to 100,000 hours. The default time is 10,000 hours.

Service notification boiler cycles

When the boiler control determines that a scheduled service is due based on the number of boiler cycles, the boiler display will alternate the standard boiler display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by the installer by accessing parameter **L3**. The range for this parameter is 0 cycles to 100,000 cycles. The default is 10,000 cycles.

Reset service notification counter

Once servicing has been completed, the service notification counter should be reset. This parameter can be reset by the installer by accessing parameter **L4**. Once accessed, press the RESET key to reset the service notification counter.

Accept PPlug

After replacing a control board, the new control will require the installer to verify the model in which it is installed. As soon as the power is turned on, the screen will display "Wrong ID Plg". Look behind the control panel at the connector plugged into X5 on the control board. Note the number written on the connector. Access parameter **L5**. That number should appear after the word "Setting:" on the bottom line. If this number matches the number on the connector, press "Enter".

2 Maintenance

Maintenance and annual startup

Table 2A_ Service and Maintenance Schedules

Service technician (see the following pages for instructions)		Owner maintenance (see the Power-fin User's Information Manual for instructions)	
ANNUAL START-UP	General: <ul style="list-style-type: none">• Address reported problems• Inspect interior; clean and vacuum if necessary;• Inspect condensate system and flush with fresh water• Check for leaks (water, gas, flue, condensate)• Examine venting system• Check system water pressure/system piping/expansion tank• Check control settings• Check igniter• Check wiring and connections• Check flue gas passageways• Flame inspection (stable, uniform)• Inspect and clean the burner• Check manifold gas pressure• Perform start-up checkout and performance verification per Section 7 in the Power-fin Installation and Operation Manual. If combustion or performance indicate need: <ul style="list-style-type: none">• Clean heat exchanger• Remove and clean burner using compressed air only• Clean the blower wheel	Daily	<ul style="list-style-type: none">• Check appliance area• Check pressure/temperature gauge
	Monthly	<ul style="list-style-type: none">• Check vent piping• Check air piping• Check relief valve• Check condensate drain system	
	Periodically	<ul style="list-style-type: none">• Test low water cutoff (if used)• Reset button (low water cutoff)	
	Every 6 months	<ul style="list-style-type: none">• Check appliance piping (gas and water) for leaks• Operate relief valve	
	End of season months	<ul style="list-style-type: none">• Shut appliance down (unless boiler used for domestic hot water)	

2 Maintenance *(continued)*

⚠ WARNING

Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the appliance. Failure to perform the service and maintenance could result in damage to the appliance or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠ WARNING

The appliance should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the appliance designated in Table 2A and explained on the following pages must be performed to assure maximum appliance efficiency and reliability. Failure to service and maintain the appliance and system could result in equipment failure.

⚠ WARNING

Electrical shock hazard – Turn off power to the appliance before any service operation on the appliance except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect appliance area

1. Verify that appliance area is free of any combustible materials, gasoline and other flammable vapors and liquids.

Inspect appliance interior

1. Remove the outer access panels and inspect the interior of the appliance.
2. Vacuum any sediment from inside the appliance and components. Remove any obstructions.

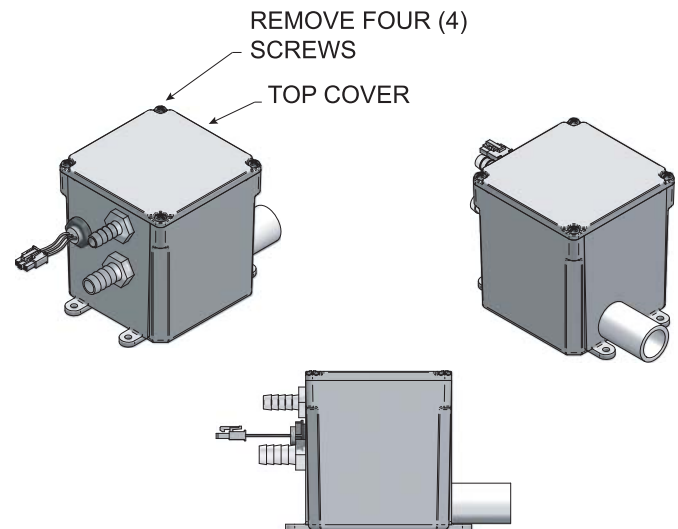
Inspect condensate system

1. Inspect the condensate drain line, condensate PVC fittings, and condensate trap on an annual basis.

Flush condensate trap with water

1. Remove the four (4) screws securing the top cover to the condensate trap and remove the cover (reference FIG. 2-1).
2. Locate the plastic ball inside the float tube. Verify there is nothing under the ball causing it to not seat properly.
3. If necessary, flush with fresh water until the water begins to pour out of the drain.
4. Replace the top cover on the condensate trap.
5. Replace the four (4) screws removed in Step 1.

Figure 2-1_ Condensate Trap



Check all piping for leaks

⚠ WARNING

Eliminate all system or appliance leaks. Continual fresh makeup water will reduce appliance life. Minerals can build up in sections, reducing heat transfer, overheating heat exchanger, and causing heat exchanger failure. Leaking water may also cause severe property damage.

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using the procedure found in *Section 3 - Gas Connections* of the Power-fin Installation and Operation Manual.

2 Maintenance

Flue vent system and air piping

1. Check for gastight seal at every connection, seam of air piping, and vent piping periodically inspected by a qualified service agency.

⚠ WARNING

Venting system must be sealed gastight to prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

⚠ WARNING

Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the boiler relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 PSI).
3. Watch the system pressure as the boiler heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly press push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

⚠ WARNING

Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the appliance until a new relief valve has been installed.

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools. Tanks may be open, closed, diaphragm or bladder type. See *Section 4 - Water Connections* of the Power-fin Installation and Operation Manual for suggested best location of expansion tanks and air eliminators.

Check relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read *Section 4 - Water Connections* of the Power-fin Installation and Operation Manual before proceeding further.

2. After following the above warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

2 Maintenance *(continued)*

Inspect/replace hot surface igniter

1. Turn off main electrical power to the appliance.
2. Turn off main manual gas shutoff to the appliance.
3. Carefully pull back the insulation flaps to expose the burner mounting flange.
4. Locate the hot surface igniter. Disconnect the two power leads to the hot surface igniter.
5. Loosen and remove the two wing nuts that mount the igniter.
6. Lift the igniter vertically out of the burner mounting flange. Use care, do not hit or break the silicon carbide igniter. Do not contaminate the igniter by handling with oily or dirty hands.
7. Check the replacement igniter for cracks or damage before installing.
8. Ensure that the fiber gasket used to seal the base of the igniter to the burner flange is reinstalled to seal the base of the replacement igniter.
9. Carefully insert the igniter into the mounting point on the burner flange and position on the mounting studs.
10. Reinstall the two wing nuts and tighten by hand only. Over tightening the wing nuts may break the ceramic mounting flange.
11. Ensure that the igniter gasket is properly installed and seals the point of contact between the igniter and burner mounting flange.
12. Reconnect the power leads to the igniter.
13. Replace the insulation blanket flaps.
14. Turn on main gas supply and main power.
15. Test fire the appliance to ensure proper operation.

Check all wiring

1. Inspect all wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Set the SMART SYSTEM control module display to Parameter Mode and check all settings. See Section 1 of this manual. Adjust settings if necessary. See Section 1 of this manual for adjustment procedures.
2. Check settings of external limit controls (if any) and adjust if necessary.

Perform start-up and checks

1. Start appliance and perform checks and tests specified in *Section 7 - Start-up* of the Power-fin Installation and Operation Manual.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

Check burner flame

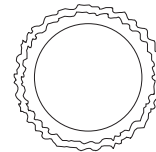
Visually check main burner flames at each start-up after long shutdown periods or at least every six months. A burner viewport is located on the burner mounting flange.



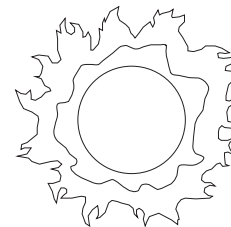
WARNING

The area around the burner viewport is hot and direct contact could result in burns.

Figure 2-2 *Flame Pattern Illustration*



NORMAL BURNER FLAME



ABNORMAL BURNER FLAME

Normal Flame: A normal flame at 100% of burner input is blue, with slight yellow tips, a well defined flame and no flame lifting.

Yellow Tip: Yellow tipping can be caused by blockage or partial obstruction of air flow to the burner.

Yellow Flames: Yellow flames can be caused by blockage of primary air flow to the burner or excessive gas input. This condition **MUST** be corrected immediately.

Lifting Flames: Lifting flames can be caused by over firing the burner, excessive primary air or high draft.

If improper flame is observed, examine the venting system, ensure proper gas supply and adequate supply of combustion and ventilation air.

2 Maintenance

Check flue gas passageways

Any sign of soot around the inner jacket, outer jacket, flue pipe connections, burner or in the areas between the fins on the copper heat exchanger indicates a need for cleaning. The following cleaning procedure must only be performed by a qualified serviceman or installer. Proper service is required to maintain safe operation. Properly installed and adjusted units seldom need flue cleaning.

NOTICE

All gaskets/sealants on disassembled components or jacket panels must be replaced with new gaskets/sealants on reassembly. Gasket and sealant kits are available from your distributor.

⚠ CAUTION

When a Category IV vent system is disconnected for any reason, the flue must be reassembled and resealed according to the vent manufacturer's instructions.

Inspect and clean burner

The burner should be removed for inspection and cleaned on an annual basis. An appliance installed in a dust or dirt contaminated environment may require cleaning of the burner on a 3 to 6 month schedule or more often, based on severity of the contamination. The fan assisted combustion process may force airborne dust and dirt contaminants, contained in the combustion air, into the burner. With sustained operation, non-combustible contaminants may reduce burner port area, reduce burner input or cause non-warrantable damage to the burner.

Use extreme care when operating an appliance for temporary heat during new construction. Airborne contaminants such as dust, dirt, concrete dust or drywall dust can be drawn into the burner with the combustion air and block the burner port area. An external combustion air filter is provided with the appliance. This filter helps ensure clean air is used for the combustion process. Check this filter every month and replace when it becomes dirty. The burner of an appliance used for temporary heat without a combustion air filter installed will probably require a thorough cleaning before the unit is placed into normal service.

Access to the burner will require the following steps:

1. Turn off main electrical power to the appliance.
2. Turn off main manual gas shutoff to the appliance.
3. Remove the front outer control panel covers. Slide out the inner control panel to increase service clearances and carefully remove the multi-pin wiring connectors on the back of the control panel. Remove the screws along the front and rear edge of the top outer jacket panel to remove top. Remove the control panel to allow access to the components in the top of the appliance.
4. Remove the sensing tubes from the low air pressure switch to the combustion air blower.
5. Disconnect the wiring connections on the top of the combustion air blower.
6. Remove the six (6) hex head bolts attaching the gas/air venturi to the inlet of the combustion air blower.
7. Remove the four (4) nuts holding the combustion air blower to the top of the burner and remove the combustion air blower assembly.
8. Use care when removing the combustion air blower assembly to prevent damage to the venturi and burner gaskets.
9. Disconnect the power wires to the hot surface igniter.
10. Remove the hot surface igniter. The hot surface igniter is fragile. Use care to prevent impact damage to the silicone carbide igniter surface when removing the igniter.
11. Remove the eight (8) nuts holding the burner to the heat exchanger.
12. The burner can now be lifted vertically out of the heat exchanger chamber.
13. Use care when removing the burner to prevent damage to the woven burner port surface or gaskets on removal.
14. Remove any visible dust or dirt blockage from the surface of the burner with a vacuum. Compressed air may also be blown across the burner surface to clean the "pores" of the woven burner port material.
15. Reassemble in reverse order.

2 Maintenance *(continued)*

Checking manifold gas pressure

The gas manifold pressure tap for F9 models is located on the downstream test valve in the manifold assembly (FIG. 2-3). For B9/M9 models the gas manifold pressure tap is located on the venturi connection of the gas manifold assembly (FIG. 2-4). The manifold gas pressure tap can be accessed by removing the upper left access panel on the front of the appliance.

Follow the steps below when checking manifold gas pressure:

1. Turn the appliance power switch to the "OFF" position.
2. Loosen the thumbscrew on the upper left access panel. Remove the upper left access panel.
3. Remove the screws along the front and rear edge of the top outer jacket panel. Disconnect the 2-pin connector hanging from the top panel cover inside the unit. Remove the top outer jacket panel.
4. On F9 models remove the 1/8" hex plug from the tap on the downstream test valve. Install a fitting in the tap to connect a manometer to read manifold gas pressure. Place the tubing of the manometer over the fitting.

On B9/M9 models, loosen the set screw on the venturi connection of the gas manifold assembly one full turn from inside the pressure tap to read manifold gas pressure. Place the tubing of the manometer over the the tap once the set screw is loosened.

5. Turn the appliance power switch to the "ON" position.
6. Place the appliance into the active position by pressing the ENTER/RESET button on the display board (see page 5) until **HTR:Standby** appears in the display window.
7. Locate the pinhole button below the ENTER/RESET button (see page 5). Press the button once and hold for five (5) seconds to place the appliance into Service Mode. In Service Mode the appliance will fire and operate at 100% of rate.
8. As the appliance comes on and fires, record the inches of water column of displacement on both sides of the manometer. The sum of these two readings will be the gas manifold pressure. Reference Table 2B - Gas Manifold Pressure Chart for the proper measurement.
9. This is a reference pressure only and is not field adjustable. An appliance supplied with the required minimum gas supply pressure will operate at the correct manifold gas pressure.

Figure 2-3_Gas Train Assembly F9

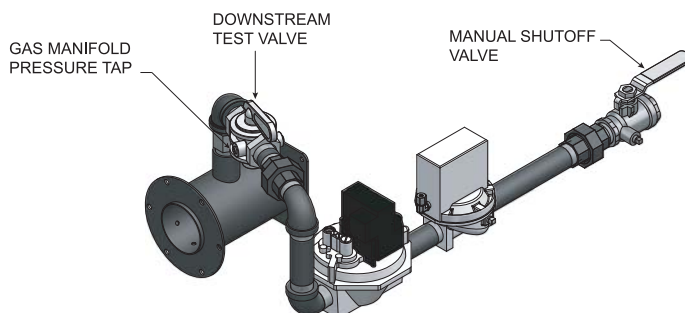


Figure 2-4_Gas Train Assembly B9/M9

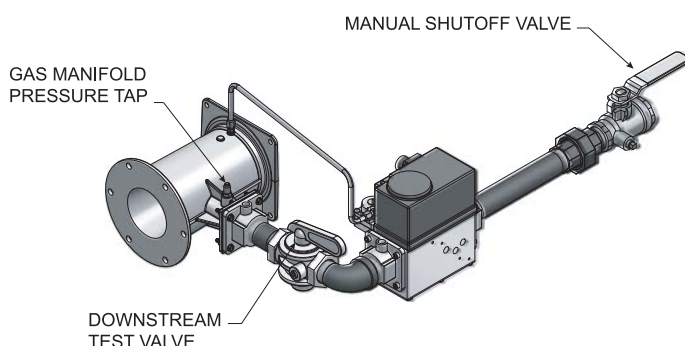


Table 2B_Gas Manifold Pressure Chart

Firing Control / Model No.	Natural Gas Water Column (w.c.)	LP Gas Water Column (w.c.)
F9: 502 - 1302	+3.2	+10.0
B9: 1501	-4.5 to -5.4	-3.2 to -3.8
B9: 1701	-5.9 to -6.4	-3.4 to -4.0
B9: 2001	-3.5 to -4.0	-1.7 to -2.4
M9: 502	-6.7 to -7.2	-7.9 to -8.4
M9: 752	-3.0 to -3.5	-4.0 to -4.5
M9: 1002	- 6.1 to -6.6	-8.4 to 8.9
M9: 1302	-6.5 to -7.0	-9.0 to -9.5
M9: 1501	-3.9 to -4.6	-2.1 to -2.6
M9: 1701	-4.9 to -5.9	-2.1 to -2.6
M9: 2001	-3.9 to -4.6	-2.1 to -2.6

2 Maintenance

10. Once the gas manifold pressure has been checked, press the ENTER/RESET button on the display board to take the appliance out of Service Mode. The appliance will go to shutdown and the display will show **HTR:OFF**.
11. Turn the appliance power switch to the "OFF" position.
12. Remove the manometer and related fitting(s) from the connection tap and replace the 1/8" hex plug (on F9 models only).
13. Replace the top jacket panel and reconnect the 2-pin connector hanging from the top panel cover.
14. Replace the upper left access panel.
15. Turn the appliance power switch to the "ON" position.
16. Press the ENTER/RESET button on the display board until **HTR:Standby** appears in the display window.
8. If the combustion is not within the specified range, reference the Troubleshooting Chart below for possible causes and corrective actions.

Table 2D_Combustion Troubleshooting Chart

Possible Cause	Corrective Action
Vent / Air Intake Length or Obstruction	<ul style="list-style-type: none"> - Refer to Section 2 - <i>Venting</i> in the Power-fin Installation and Operation Manual for the proper venting and air intake methods. - Check for obstructions in the vent / air intake terminals.
Gas Supply Pressure	<ul style="list-style-type: none"> - Refer to Section 3 - <i>Gas Connections</i> in the Power-fin Installation and Operation Manual for the proper gas supply for the Power-fin.
Dirty / Damaged Burner	<ul style="list-style-type: none"> - Refer to page 26 of this manual for burner removal and cleaning procedures. - Replace burner if necessary.
Gas Valve Adjustment	<ul style="list-style-type: none"> - Refer to page 29 of this manual for the gas valve adjustment procedure.

Combustion analysis procedure

1. Turn the appliance power switch to the "OFF" position.
2. Remove the flue temperature sensor from the flue pipe.
Note: Combustion measurements will be made at this point.
3. Turn the appliance power switch to the "ON" position.
4. Place the appliance into the active position by pressing the ENTER/RESET button on the display board (see page 5) until **HTR:Standby** appears in the display window.
5. Locate the pinhole button below the ENTER/RESET button. Press the button once and hold for 5 seconds to place the appliance into Service Mode. In Service Mode the appliance will fire and operate at 100% of rate.
6. Insert the probe from a combustion analyzer into the hole left by the removal of the flue temperature sensor.
7. Compare the combustion measurement to the values listed in Table 2C.
9. Once the combustion analysis is complete, press the ENTER/RESET button on the display board to take the appliance out of Service Mode. The appliance will go to shutdown and the display will show **HTR:OFF**.
10. Turn the appliance power switch to the "OFF" position.
11. Replace the flue temperature sensor into the flue pipe.
12. Turn the appliance power switch to the "ON" position.
13. Press the ENTER/RESET button on the display board until **HTR:Standby** appears in the display window.

Table 2C_Combustion Measurements

Firing Control / Model No.	Natural Gas CO ₂ (%)	LP Gas CO ₂ (%)
F9: 502 - 1302	7.9 to 8.4	9.0 to 9.5
B9: 1501 - 2001	8.0 to 8.5	9.0 to 9.5
M9: 502 - 1302	8.2 to 8.7	9.0 to 9.5
M9: 1501 - 1701	8.6 to 9.1	9.6 to 10.1
M9: 2001	7.6 to 8.2	8.6 to 9.2

⚠ WARNING

You must replace the flue temperature sensor to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

2 Maintenance *(continued)*

Gas valve adjustment procedure

1. Turn the appliance power switch to the “OFF” position.
2. Loosen the thumbscrew on the upper left access panel. Remove the upper left access panel.
3. Remove the screws along the front and rear edge of the top outer jacket panel. Disconnect the 2-pin connector hanging from the top panel cover inside the unit. Remove the top outer jacket panel.
4. Follow the Combustion Analysis Procedure on page 28 of this manual to measure combustion.
5. With the appliance operating in the Service Mode, locate the throttle adjustment screw on the gas valve. See FIG. 2-5 for F9 models and FIG. 2-6 for B9/M9 models. Using a screwdriver (F9) or Allen wrench (B9/M9) turn the throttle adjustment screw a 1/4 turn counterclockwise to increase CO₂ levels and a 1/4 turn clockwise to decrease CO₂ levels.
6. After one adjustment of the valve, measure the combustion.
7. If the combustion is still not within the specified range, repeat the procedure. This procedure **SHOULD NOT** be performed more than four (4) times. If after four (4) adjustments the combustion is still not within the specified range, revisit the possible causes in Table 2D on page 28 of this manual.
8. Once the combustion analysis is complete, press the ENTER/RESET button on the display board to take the appliance out of Service Mode. The appliance will go to shutdown and the display will show **HTR : OFF**.
9. Turn the appliance power switch to the “OFF” position.
10. Replace the flue temperature sensor into the flue pipe.
11. Replace the top jacket panel and reconnect the 2-pin connector hanging from the top panel cover.
12. Replace the upper left access panel.
13. Turn the appliance power switch to the “ON” position.
14. Press the ENTER/RESET button on the display board until **HTR : Standby** appears in the display window.

⚠ WARNING

Overfire and underfire hazards! Possible fire, explosion, overheating, and component failure. Do not attempt to adjust firing rate of the boiler or water heater. The firing rate must be adjusted only by factory trained personnel.

Figure 2-5_Throttle Adjustment Screw - F9 Model

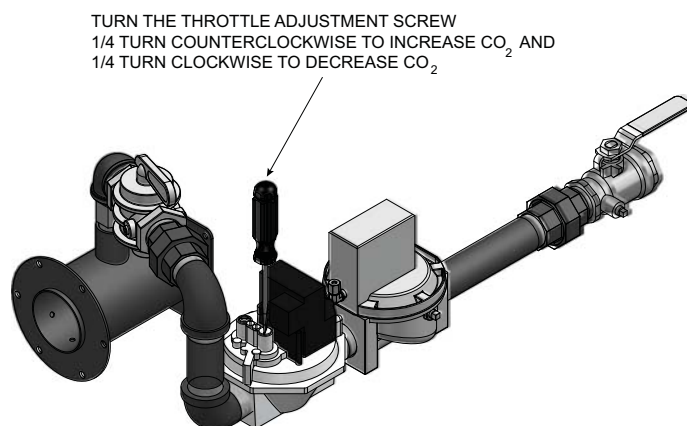
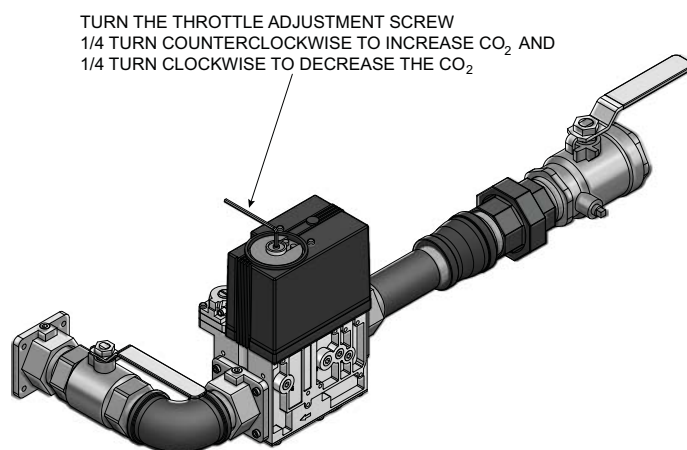


Figure 2-6_Throttle Adjustment Screw - B9/M9 Models



2 Maintenance

Inspect and clean the heat exchanger

1. Turn off all power to the appliance.
2. Turn off main gas to appliance.
3. Remove the front outer jacket panel.
4. Remove the inner jacket panel (see FIG. 2-7).
5. Check the heat exchanger surface for soot. If soot is present, the heat exchanger must be cleaned and the problem corrected.
6. Remove the burner as described in the *Inspect and Clean Burner* section of this manual.
7. Check the “V” baffles on the heat exchanger. Remove and clean if necessary.
8. Remove soot from the heat exchanger with a stiff bristle brush. Use a vacuum to remove loose soot from surfaces and inner chamber.
9. The heat exchanger can be removed by disconnecting all water piping to the heat exchanger, removing the screws holding the heat exchanger to the top of the inner jacket and sliding the heat exchanger towards the front of the appliance. Once the heat exchanger is removed, a garden hose can be used to wash the tubes to ensure that all soot is removed from the heat exchanger surfaces. *Note: Do not wet the insulation blankets on the inside of the outer jacket panels.*
10. Ensure that any soot present on the burner is removed. See *Inspect and Clean Burner* section.
11. Carefully reinstall the heat exchanger and “V” baffles if removed from the appliance.
12. Reinstall the inner jacket panel, burner, manifolds, wires, and hoses. Use new gasket material to ensure a proper air seal.
13. Reassemble all gas and water piping. Test for gas leaks.

NOTICE

Upon completion of any testing on the gas system, leak test all gas connections with a soap and water solution while main burners are operating. Do not spray soap and water solution on the SMART SYSTEM control module housing. The use of an excessive amount of soap and water solution can damage the control. Immediately repair any leak found in the gas train or related components. Do not operate an appliance with a leak in the gas train, valves, or related piping.

14. Reassemble outer jacket panels.
15. Cycle unit and check for proper operation.

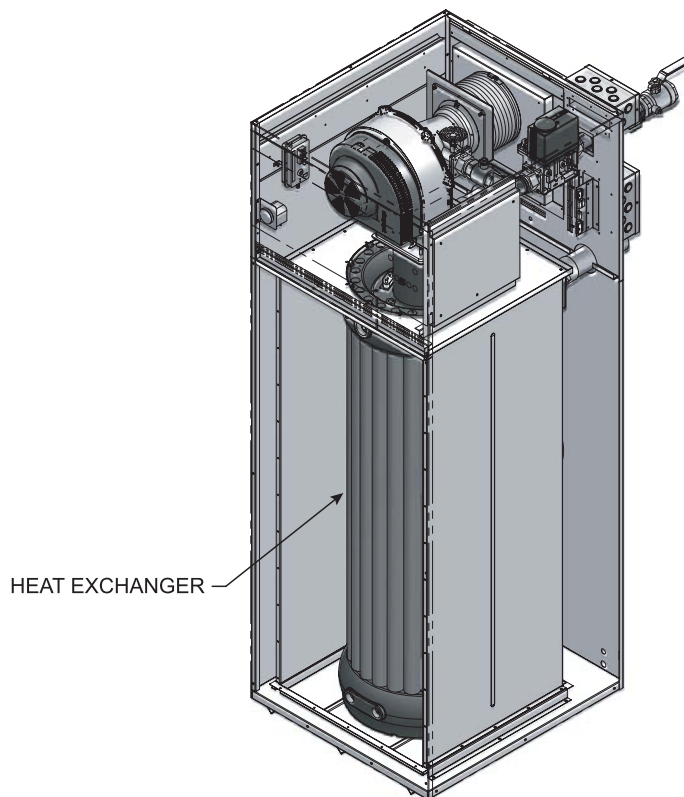


Figure 2-7 Location of the Heat Exchanger Inside Jacket

Review with owner

1. Review the Power-fin User's Information Manual with the owner.
2. Emphasize the need to perform the maintenance schedule specified in the Power-fin User's Information Manual (and in this manual as well).
3. Remind the owner of the need to call a licensed contractor should the appliance or system exhibit any unusual behavior.
4. Remind the owner to follow the proper shutdown procedure and to schedule an annual start-up at the beginning of the next heating season.

Oiled bearing circulators

Inspect the pump every six (6) months and oil as necessary. Use SAE 30 non-detergent oil or lubricant specified by the pump manufacturer.

3 Troubleshooting

⚠ WARNING

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Always disconnect power to the appliance before servicing. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING

Never jumper (bypass) any device except for momentary testing as outlined in the Troubleshooting chart. Severe personal injury, death, or substantial property damage can result.

Before troubleshooting:

- Have the following items:
 - Voltmeter that can check 120 VAC, 24 VAC, and 12 VDC.
 - Continuity checker.
 - Contact thermometer.
- Check for 120 VAC (minimum 102 VAC to maximum 132 VAC) to appliance.
- Make sure thermostat is calling for heat and contacts (including appropriate zone controls) are closed. Check for 24 VAC between thermostat wire nuts and ground.
- Make sure all external limit controls are installed and operating.

Check the following:

- Wire connectors to control module are securely plugged in at the module and originating control.
- Gas pressures:

Refer to Section 3 - Gas Connections of the Power-fin Installation and Operation Manual for detailed information concerning the gas supply.

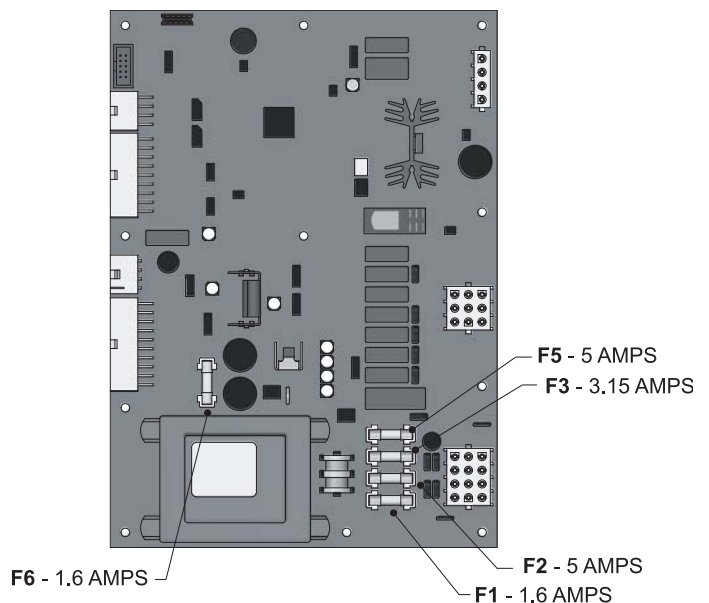
Check control module fuses

NOTICE

ALWAYS check control module fuses before replacing control module or any major components (blower, etc.). If one of these fuses is blown, it can prevent the control module or other components from operating.

- Turn OFF the power to the appliance at the external line switch.
- Remove front access cover.
- Inspect fuses F1, F2, F3, F5, and F6, see FIG. 3-1 below.

Figure 3-1_Control Module Fuses



- The appliance is shipped with three (3) spare fuses in a plastic bag attached to the control panel.
- If necessary, replace open fuse (F1 and F6 are 1.6 amps, F3 is 3.15 amps, F2 and F5 are 5 amps).

Note: Fuses F1 - F6 are all slow blow fuses.

⚠ WARNING

Do not jumper fuse or replace with any fuse except as specified. Failure to comply could result in severe personal injury, death, or substantial property damage.

- Install front access cover after fuse inspection.
- Restore power to the appliance at the external line switch and verify boiler/water heater operation (*Section 7 - Start-up* in the Power-fin Installation and Operation Manual) after completing boiler/water heater service.

3 Troubleshooting

Table 3A Troubleshooting Chart - No Display

FAULT	CAUSE	CORRECTIVE ACTION
No Display	- No 120 VAC supplied to unit.	<ul style="list-style-type: none"> • Check external line switch, fuse, or breaker. • Check position of ON/OFF switch. Turn switch to the ON position. • Check 120 VAC through the ON/OFF switch. No voltage through switch, replace switch.
	- Bad wiring connection.	<ul style="list-style-type: none"> • Check wiring harness connection between the display board and the main control board. Connect the harness at both points.
	- Blown fuse.	<ul style="list-style-type: none"> • Replace fuse F6 on the main control board, see FIG. 3-1 on page 31 of this manual.
	- Bad display board.	<ul style="list-style-type: none"> • Replace board.
	- Bad main control board.	<ul style="list-style-type: none"> • Replace main control board.
No Burner Operation	- Main control board temperature set point satisfied.	<ul style="list-style-type: none"> • Review temperature setting.
	- Remote thermostat satisfied.	<ul style="list-style-type: none"> • Review remote thermostat setting.
	- Outside air temperature above Warm Weather Shutdown (WWSD) set point for main control board.	<ul style="list-style-type: none"> • Check location of outside air sensor. Check resistance of outdoor air sensor and compare to Table 3D on page 33 of this manual.
	- Unit locked out on fault.	<ul style="list-style-type: none"> • Consult display for specific fault. Refer to fault descriptions on pages 35 - 42 of this manual for corrective actions.
Unit Does Not Modulate Above 50%	- Ramp delay active.	<ul style="list-style-type: none"> • Check ramp delay parameter settings. Optional PC software required.
		<ul style="list-style-type: none"> • Turn ramp delay feature off. See page 18 of this manual for instructions on how to turn this feature off.
	- Boiler controlled by BMS.	<ul style="list-style-type: none"> • Check BMS parameter settings. Optional PC software required.

3 Troubleshooting *(continued)*

Checking temperature sensors

The appliance temperature sensors (inlet water, outlet water, system water, tank water, flue, and outdoor air) are all resistance type devices. The following tables show the correct values for the sensors at various temperatures. Use an ohmmeter to read the resistance of the sensor at a known temperature. If the resistance of the sensor does not closely match its corresponding table, replace the sensor.

Table 3B Inlet/Outlet/System/Tank Sensor Resistance vs. Temperature

Temperature	Resistance	Temperature	Resistance
50	18,780	158	1,990
68	12,263	176	1,458
86	8,194	194	1,084
104	5,592	212	817
122	3,893		
140	2,760		

Table 3C Flue Temperature Sensor Resistance vs. Temperature

Temperature	Resistance	Temperature	Resistance
68	125,500	158	16,870
77	100,000	176	12,000
86	80,220	194	8,674
104	52,590	212	6,369
122	35,270	230	4,744
140	24,160	248	3,581

Table 3D Outdoor Air Sensor Resistance vs. Temperature

Temperature	Resistance	Temperature	Resistance
-50	490,813	20	46,218
-40	336,606	30	34,558
-30	234,196	40	26,099
-20	165,180	50	19,900
-10	118,018	60	15,311
0	85,362	70	11,883
10	62,465	80	9,299

3 Troubleshooting

Table 3E Troubleshooting Chart - Noisy System

FAULT	CAUSE	CORRECTIVE ACTION
Noisy Operation	- Gas supply problem.	• Refer to <i>Section 3 - Gas Connections</i> of the Power-fin Installation and Operation Manual for detailed information concerning the gas supply.
	- Gas/air mixture problem.	• Refer to the <i>Checking Manifold Gas Pressure and Combustion Analysis Procedure</i> on pages 27 and 28 of this manual for the proper settings. Verify that the vent/air intake lengths do not exceed the maximum listed in the <i>Venting</i> section of the Power-fin Installation and Operation Manual.
	- Dirty/damaged burner.	• Refer to page 26 in this manual for the burner removal and inspection procedure. Clean or replace the burner as necessary.
	- Low water flow through the heat exchanger.	• Refer to <i>Section 4 - Water Connections</i> of the Power-fin Installation and Operation Manual for minimum flow rates. Verify that the appliance is piped in a primary/secondary fashion and that the appliance and system pump are running on a call for heat.
	- Air in the piping system.	• Properly purge all air from the piping system.
	- Low system water pressure.	• Verify system pressure is a minimum of 12 PSI.
No Pump Operation - Boiler Pump System Pump or DHW Pump	- Faulty pump.	• Replace pump.
	- Internal fault on control board.	• Replace main control board. Note: Make sure the pump horse power (hp) does not exceed 1 hp.
Relief Valve Opening	- System pressure exceeds relief valve setting.	• Lower the system pressure below the rating of the supplied relief valve or replace the standard relief valve with a higher rated valve up to the maximum pressure of the heat exchanger.
	- Improperly sized expansion tank.	• Install properly sized expansion tank.
	- Outlet water temperature in excess of 210°.	• Check set point of temperature control. • Check temperature rise across heat exchanger. Refer to the temperature rise chart in <i>Section 4 - Water Connections</i> of the Power-fin Installation and Operation Manual.

3 Troubleshooting *(continued)*

Table 3F Troubleshooting Chart - Fault Messages Displayed on Operator Interface

FAULT	DESCRIPTION	CORRECTIVE ACTION
Gas Pressure SW (Will require a manual reset once the condition has been corrected.)	Either the optional manual reset low gas pressure switch or the optional manual reset high gas pressure switch tripped.	<ul style="list-style-type: none"> Reset the pressure switches. Measure the supply gas pressure to determine cause of failure. Refer to <i>Section 3 - Gas Connections</i> of the Power-fin Installation and Operation Manual for detailed information concerning the gas supply. Correct the supply gas pressure if necessary.
Flow Switch/ LWCO (Lockout will reset automatically after 5 minutes or may be reset immediately once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	Either the flow switch or the optional low water cutoff is not making.	<ul style="list-style-type: none"> Check pump operation on a call for heat. Check for closed valves or obstructions in the water piping. Verify system is full of water and all air has been purged from the system.
Blocked Drain SW (Lockout will reset automatically after 5 minutes or may be reset immediately once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset)	The blocked drain switch has detected excessive condensate build up inside the unit.	<ul style="list-style-type: none"> Check condensate tube from unit to floor drain for proper installation and obstructions. Inspect condensate trap for blockage. Clean if necessary. Check for loose wiring connection at wire harness plug. Bad blocked drain switch. Replace switch.
Flame Sequence (Will require a manual reset once the condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	The flame detector circuit is seeing a flame signal while no flame is present.	<ul style="list-style-type: none"> Check supply voltage for proper polarity. Check external wiring for voltage feedback. Check the internal wiring for bad connections. Replace main control board.
Anti-cycling	The main control board has received a call for heat too quickly after the previous call for heat has ended.	<ul style="list-style-type: none"> The control board will release the call for heat after a set time period. The control board will release the call for heat if the outlet temperature drops too quickly.

3 Troubleshooting

Table 3F (continued from previous page) *Troubleshooting Chart - Fault Messages Displayed on Operator Interface*

FAULT	DESCRIPTION	CORRECTIVE ACTION
No Flame Ign (Will require a manual reset. Press the RESET button on the SMART SYSTEM display to reset.)	The unit has failed to prove main burner flame upon ignition.	<ul style="list-style-type: none"> Inspect igniter and associated wiring for damage and connection. Reference page 25 of this manual for removal and cleaning procedure. Replace if necessary. Check for proper electrical grounding of unit. Check incoming supply gas pressure. Refer to <i>Section 3 - Gas Connections</i> in the Power-fin Installation and Operation Manual for detailed information concerning the gas supply. Verify that the tube from the gas valve to the air inlet is connected and is not damaged. Verify that the vent/air intake pipes are correctly installed and that there are no obstructions. Inspect the burner. Reference page 26 of this manual for removal and cleaning procedures. Replace if necessary. Refer to the <i>Checking Manifold Gas Pressure and Combustion Analysis Procedure</i> on pages 27 and 28 of this manual for the proper settings. Check for 120 VAC to the gas valve during the ignition attempt. If no voltage is present, check the wiring between the gas valve and the main control board. Replace the wiring or the main control board as necessary.
HSI Current Low (Will require a manual reset once the condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	Amp draw of the hot surface igniter did not meet the minimum requirement of 2.6 amps.	<ul style="list-style-type: none"> Measure the amp draw of the hot surface igniter during the trial for ignition stage. If less than 2.6 amps replace the hot surface igniter. If more than 2.6 amps replace the control module.
Flame CKT Error	The main control board has detected an internal fault.	<ul style="list-style-type: none"> Replace the main control board.

3 Troubleshooting *(continued)*

Table 3F (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Operator Interface

FAULT	DESCRIPTION	CORRECTIVE ACTION
<p>No Flame Running</p> <p>(Will require a manual reset once the condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)</p>	<p>The unit was running and lost the flame signal.</p>	<ul style="list-style-type: none"> • Inspect igniter and associated wiring for damage and connection. Reference page 25 of this manual for removal and cleaning procedure. Replace if necessary. • Check for proper electrical grounding of unit. • Check incoming supply gas pressure. Refer to <i>Section 3 - Gas Connections</i> of the Power-fin Installation and Operation Manual for detailed information concerning the gas supply. • Verify that the tube from the gas valve to the air inlet is connected and is not damaged. • Verify that the vent/air intake pipes are installed correctly and there are no obstructions. • Refer to the <i>Checking Manifold Gas Pressure and Combustion Analysis Procedure</i> on pages 27 and 28 of this manual for the proper settings. • Inspect the burner. Reference page 26 of this manual for removal and cleaning procedures. Replace if necessary. • Replace the main control board.
<p>Auto Reset High Limit</p>	<p>The outlet water temperature has exceeded the fixed setting of the automatic reset high limit.</p>	<ul style="list-style-type: none"> • Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the appliance is piped properly into the heating system. Refer to <i>Section 4 - Water Connections</i> of the Power-fin Installation and Operation Manual for the proper piping methods for the Power-fin. • Check 120 VAC to boiler pump motor on a call for heat. If voltage is not present, check wiring back to the main control board. Replace the main control board if necessary. • If 120 VAC is present on a call for heat and the pump is not operating, replace the pump. • If the system pump is a variable speed pump, ensure that the system flow is not less than the boiler flow. • Check temperature setting of the main control board. • Check resistance of water sensors and compare to Table 3B on page 33 of this manual. Replace sensor if necessary. • Replace high limit.

3 Troubleshooting

Table 3F (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Operator Interface

FAULT	DESCRIPTION	CORRECTIVE ACTION
Manual Reset High Limit (Will require a manual reset once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	The outlet water temperature has exceeded the setting of the adjustable high limit.	<ul style="list-style-type: none"> • Verify setting of adjustable high limit. • Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the appliance is piped properly into the system. Refer to <i>Section 4 - Water Connections</i> of the Power-fin Installation and Operation Manual for proper piping methods for the Power-fin. • Check 120 VAC to the pump motor on a call for heat. If voltage is not present, check wiring leading to the main control board. Replace the main control board if necessary. • If 120 VAC is present on a call for heat and the pump is not operating, replace the pump. • If the system pump is a variable speed pump, ensure the system flow is not less than the boiler flow. • Check temperature setting of the main control board. • Check resistance of water sensors and compare to the tables on page 33 of this manual. Replace the sensor if necessary. • Replace high limit.
Inlet Low	The inlet water temperature did not exceed 130° within 15 minutes of ignition.	<ul style="list-style-type: none"> • Raise temperature set point above 130°. • Install a 3-way valve per the piping diagram in <i>Section 4 - Water Connections</i> of the Power-fin Installation and Operation Manual. • Replace the main control board.
Fan Low OR Fan Speed Low (Will require a manual reset once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	The actual fan RPM is 30% lower than what is being called for.	<ul style="list-style-type: none"> • Vent/air intake lengths exceed the maximum allowed lengths. Refer to <i>Section 2 - Venting</i> of the Power-fin Installation and Operation Manual for proper lengths. • Check for obstruction or blockage in the vent/air intake pipes or at terminations. • Check wiring connections at the fan and at the main control board. • Replace the fan. • Replace the main control board.
	Blown fuse.	<ul style="list-style-type: none"> • Replace fuse F3 on the main control board, see page 31 of this manual.

3 Troubleshooting *(continued)*

Table 3F (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Operator Interface

FAULT	DESCRIPTION	CORRECTIVE ACTION
Fan High OR Fan Speed High (Will require a manual reset once the condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	The actual fan RPM is 30% higher than what is being called for.	<ul style="list-style-type: none"> • Vent/air intake lengths exceed the maximum allowed lengths. Refer to <i>Section 2 - Venting</i> of the Power-fin Installation and Operation Manual for proper lengths. • Check for obstruction or blockage in the vent/air intake pipes or at terminations. • Check wiring connections at the fan and at the main control board. • Replace the fan. • Replace the main control board.
Flue Open OR Flue Shorted (For M9 Models operation will not be affected. For B9 Models the unit will not modulate.)	The flue sensor wiring has been disconnected, grounded, or the flue sensor has been removed from the flue.	<ul style="list-style-type: none"> • Check the sensor and associated wiring. Repair or replace sensor or wiring if damaged. • Reinstall sensor in flue outlet.
Sensor Open (Will require a manual reset once the condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	Either the inlet water or outlet water temperature sensor has been disconnected.	<ul style="list-style-type: none"> • Check the sensors and their associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistance of the sensors and compare the resistance to the tables on page 33 of this manual. • Replace the sensor if necessary.
Sensor Shorted (Will require a manual reset once the condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	Either the inlet water or outlet water temperature sensor has been shorted.	<ul style="list-style-type: none"> • Check the sensors and their associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistance of the sensors and compare the resistance to the tables on page 33 of this manual. • Replace the sensor if necessary.
Louver Proving (Lockout will reset automatically after 5 minutes or may be reset immediately once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	An optional remote proving switch is not making.	<ul style="list-style-type: none"> • Check function of remote devices. • Check for loose or misplaced jumper if proving switch is not installed.
Tank Open	Sensors equipped with an internal limit (such as the Lochinvar Squire® Indirect Tank), the limit has opened due to temperature (195°F) or the sensor has become disconnected.	<ul style="list-style-type: none"> • Check the tank temperature. • Repair or replace the sensor wiring if damaged. • Replace the sensor if necessary.

3 Troubleshooting

Table 3F (continued from previous page) *Troubleshooting Chart - Fault Messages Displayed on Operator Interface*

FAULT	DESCRIPTION	CORRECTIVE ACTION
APS Open (Lockout will reset automatically after 5 minutes or may be reset immediately once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	The air pressure switch did not make within 1 minute after the combustion air blower has been energized.	<ul style="list-style-type: none"> • Check air filter. Clean or replace as necessary. • Vent/air intake lengths exceed the maximum allowed lengths. • Check for blockage or obstruction in vent/air inlet pipe or at terminations. • Verify combustion air blower is operating. Replace if necessary.
APS Closed (Lockout will reset automatically after 5 minutes or may be reset immediately once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	The SMART SYSTEM control sensed that the air pressure switch was closed before the combustion air blower was energized.	<ul style="list-style-type: none"> • Check for jumper on air pressure switch. • Check for an unusually high negative draft in the vent stack.
Wrong ID Plug	Control module ID plug does not match parameter L5.	<ul style="list-style-type: none"> • Verify that ID plug is connected properly to connector X5 on the control module. • Verify that the wiring in the ID plug is not cut or damaged and that the wiring connectors are seated properly in the plug. • Verify that the number on the ID plug matches the number in parameter L5. If not, replace the control module. • When replacing control modules, verify that the number in parameter L5 matches the number on the ID plug. If so, press the ENTER button on the SMART SYSTEM display. If not, replace the control module.
Temp O/Shoot (Lockout will reset automatically after 5 minutes or may be reset immediately once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	The stack temperature has exceeded the set parameters for the boiler/water heater.	<ul style="list-style-type: none"> • Inspect the heat exchanger. Reference page 30 of this manual for the procedure on how to clean the flue side of the heat exchanger. • Inspect the flue sensor and associated wiring. Measure the resistance of the flue sensor and compare to Table 3C on page 33 of this manual. Replace the sensor if necessary. • Verify that the vent/air intake pipes are properly installed and that there are no obstructions. • Replace the main control board.

3 Troubleshooting *(continued)*

Table 3F (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Operator Interface

FAULT	DESCRIPTION	CORRECTIVE ACTION
Temp O/Shoot (continued) (Lockout will reset automatically after 5 minutes or may be reset immediately once condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	The temperature rise across the heat exchanger has exceeded the set parameters for the appliance.	<ul style="list-style-type: none"> • Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the appliance is piped properly into the heating system. Refer to <i>Section 4 - Water Connections</i> of the Power-fin Installation and Operation Manual for the proper piping methods. • Check for 120 VAC to the pump motor on a call for heat. If voltage is not present, check the wiring leading to the main control board. Replace the main control board if necessary. • If 120 VAC is present on a call for heat and the pump is not operating, replace the pump.
	Outlet water temperature has exceeded the maximum outlet water temperature.	<ul style="list-style-type: none"> • Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the appliance is piped properly into the system. Refer to <i>Section 4 - Water Connections</i> of the Power-fin Installation and Operation Manual for the proper piping methods. • Check 120 VAC to the pump motor on a call for heat. If voltage is not present, check wiring leading to the main control board. Replace the main control board if necessary. • If 120 VAC is present on a call for heat and the pump is not operating, replace pump. • Replace the main control board.
Rem Ctrl Flt	External control is cycling too often.	<ul style="list-style-type: none"> • Check set point of the external control. • Check the wiring between the external control and the unit. • Replace the control.
Parameters Progr (Will require a manual reset once the condition has been corrected. Press the RESET button on the SMART SYSTEM display to reset.)	After downloading parameters from a laptop or a pocket pc, the main control board must be reset.	<ul style="list-style-type: none"> • Press the ENTER/RESET button on the Smart System display panel.

3 Troubleshooting

Table 3F (continued from previous page) *Troubleshooting Chart - Fault Messages Displayed on Operator Interface*

FAULT	DESCRIPTION	CORRECTIVE ACTION
Service Blk	While the unit is in Service Mode, the outlet temperature has exceeded 185°F (85°C).	<ul style="list-style-type: none"> • Establish a heating load to remove heat from the system. • Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the appliance is piped properly into the system. Refer to <i>Section 4 - Water Connections</i> of the Power-fin Installation and Operation Manual for the proper piping methods. • Check 120 VAC to the pump motor on a call for heat. If voltage is not present, check the wiring leading to the main control board. Replace the main control board if necessary. • If 120 VAC is present on a call for heat and the pump is not operating, replace the pump.
Low Voltage	120 VAC input to the main control board has dropped below 80 VAC.	<ul style="list-style-type: none"> • Check 120 VAC supply to the transformer. • Check wiring connections at the low voltage terminal strip. • Check the wire size/length to remote devices. • Replace the main control board.
Watch Dog Error	The main control board has detected an internal fault.	<ul style="list-style-type: none"> • Replace the main control board.
Write EEPROM	The main control board has detected an internal fault.	<ul style="list-style-type: none"> • Replace the main control board.
Program EEPROM	The main control board has detected an internal fault.	<ul style="list-style-type: none"> • Replace the main control board.
CRC Parameters	The main control board has detected an internal fault.	<ul style="list-style-type: none"> • Replace the main control board.
No Error Stored	The main control board has detected an internal fault.	<ul style="list-style-type: none"> • Replace the main control board.

NOTES

Revision Notes: *Revision B (PBX-PFX-SER- Rev B) reflects the addition of Models 502 - 1302 to the manual.*

Revision C (PBX-PFX-SER-Rev C) reflects the addition of parameter ranges.

Revision D (ECO #C02918) reflects the addition of Tank Sensor Open on page 39.

Revision E (ECO C06058) reflects the removal of heat exchanger cleaning information in "Maintenance and annual startup" section on page 22.

Revision F (ECO C08868) reflects the update of the Gas Manifold Pressure Chart on page 27.

Revision G (ECO C12077) reflects the update of ignition timing information on pages 9 and 10.

Revision H (ECO C16101) reflects the correction of the gas valve adjustment procedure on page 29.