SERVICE MANUAL

5901

VHX24G SHOWN

VHX BOILER BASE SERIES HIGH EFFICIENCY GAS STEAMERS

VHX24G	ML-114795
VHX24G5	ML-126590
MHB24G	ML-114954 (BASE ONLY)

- NOTICE -

This Manual is prepared for the use of trained Vulcan Service Technicians and should not be used by those not properly qualified. If you have attended a Vulcan Service School for this product, you may be qualified to perform all the procedures described in this manual.

This manual is not intended to be all encompassing. If you have not attended a Vulcan Service School for this product, you should read, in its entirety, the repair procedure you wish to perform to determine if you have the necessary tools, instruments and skills required to perform the procedure. Procedures for which you do not have the necessary tools, instruments and skills should be performed by a trained Vulcan Service Technician.

A product of VULCAN-HART LOUISVILLE, KY 40201-0696

F24700 (October 2001)

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INSTALLATION

Refer to the Installation and Operation Manual for detailed installation instructions.

MAINTENANCE

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Refer to the Installation and Operation Manual for specific cleaning instructions.

INTRODUCTION

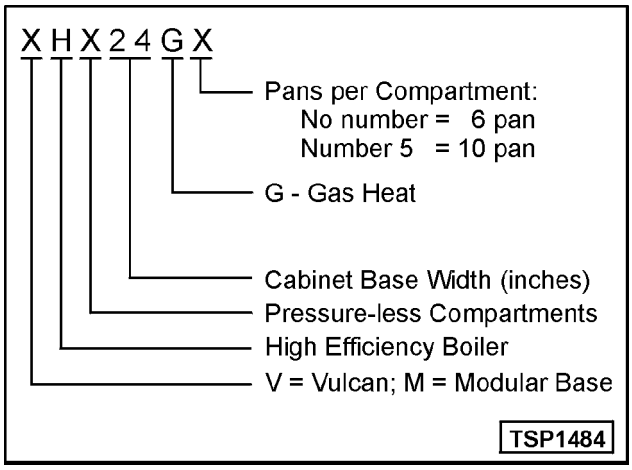
Steam Cooking

Convection cooking in pressure-less steaming compartments will steam cook fresh foods or will steam defrost and cook frozen foods providing the maximum color, flavor and nutritional value with the least expenditure of energy and labor. The pressure-less steaming compartments on the VHX series allows the operator to open and close the door, anytime during a cooking cycle. The steam supply will shut off when the door is opened, then re-start when the door is closed.

Compartment Pan Capacity

MODEL	NUMBER OF PANS PER COMPARTMENT	PAN DEPTH (INCHES)
VHX24G	2	4.0
	3	2.5
	6	1.0
VHX24G5	3	4.0
	5	2.5
	10	1.0
Pan Size 12" x 20"		

Model Designations



Boiler Code Descriptions

Vulcan-Hart incorporates redundant controls in compliance with the CSD-1 controls and safety devices for boiler construction on these High Efficiency Steam models. A Description of the code is listed below.

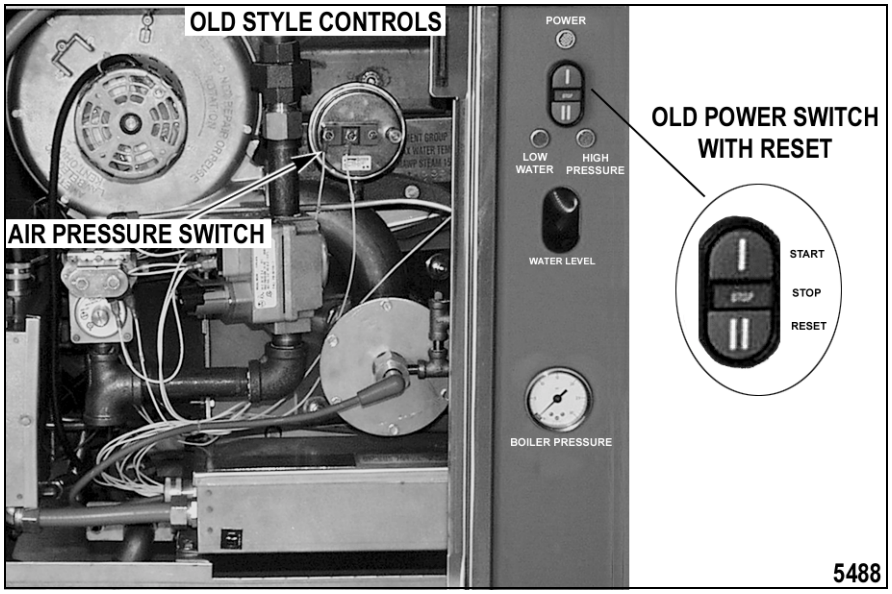
CSD-1 Construction - Redundant controls in the electrical safety circuits that, if tripped, must manually be reset after the condition causing the trip subsides. These controls consist of - (1) dual function water level cycling and low level cut off control and (1) single function low water level cut-off control (Aux LLCO) and a high pressure relief switch in conjunction with a mechanical pressure relief valve. Additionally, both circuits have individual indicator lights for low water and high pressure that will illuminate for a visual verification of the shutdown mode.

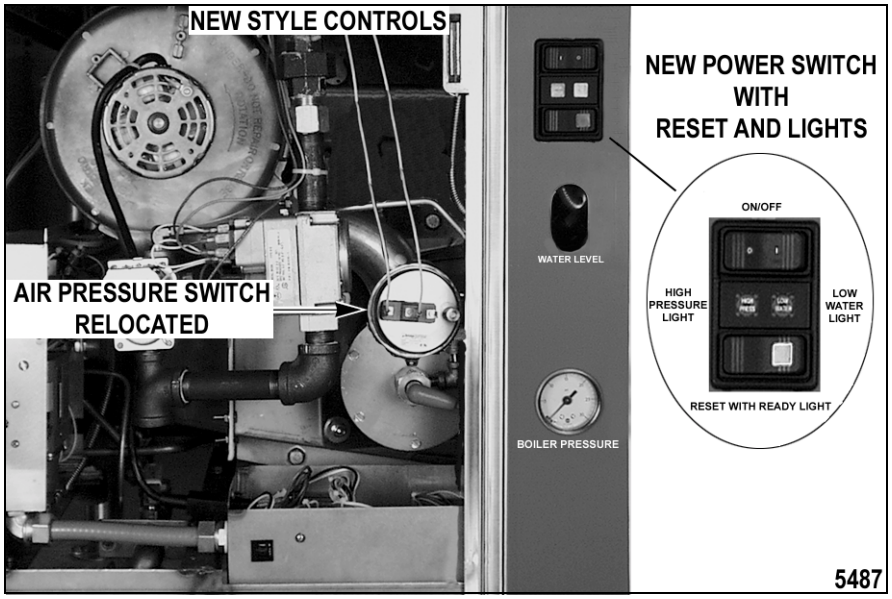
CSD-1 construction requires operator intervention in the event of a shutdown. The indicator lights show the operator which safety system was shutdown.

Boiler Control Styles

VHX Steamers manufactured using the old style boiler controls ended on 5/19/00. Steamers that were in stock at the time of the boiler control changeover were removed and equipped with the new style controls without recording the serial number for tracking.

Refer to the pictures below to differentiate between the old style and new style boiler controls.





WATER CONDITIONING

Furnishing the boiler with treated water to reduce scale formation is important. Scale formation will reduce steam output, cause premature component failure, and shorten equipment life. Most water supplies contain scale producing minerals such as Calcium and Magnesium. As steam is generated, the minerals remain and dissolve into the water. As the concentration of these minerals increases past a certain point, they precipitate from the water and coat the inside of the boiler, heating elements, and water level sensors. Because of the high temperature of these surfaces, the precipitated minerals bake onto them and become very difficult to remove.

This may cause several problems:

1. Reduced heat transfer efficiency.
2. Premature heating element failures.
3. False readings from water level sensors.

These problems are common to any manufacturer's steamer regardless of design, but they can all be minimized by furnishing the boiler with treated water.

Other factors affecting steam generation are iron content, amount of chlorination and dissolved gases.

The desired water properties can best be achieved by using a **properly maintained water treatment system.**

The water level probes in the boiler use ions in the water to detect the water level. **Do not use fully demineralized or de-ionized water since it is "non conductive" and the water level can not be detected.**

The use of strainers or **non approved** filters will not remove minerals from the water.

Water supplies vary from state to state and from locations within a state. Therefore, a **water treatment specialist should be consulted** before the installation of any steam generating equipment.

Steamers that operate over a long period of time without the benefit of a water treatment system, which have developed a heavy scale build up, should be cleaned before using the system.

SPECIFICATIONS

Water Supply

The fact that a water supply is potable is no guarantee that it is suitable for steam generation. The supply connection to the steam generator should be “treated” water and must be within the guidelines listed below. For drain water cooling only, an “untreated“ water supply connection should be used.

Supply pressure should be	20-60 psig
In line strainer for supply line	(Not Supplied)
Supply connection	cold
Total dissolved solids (TDS)*	less than 60 ppm
Total alkalinity	less than 20 ppm
Silica	less than 13 ppm
Chloride	less than 30 ppm
PH factor	7 to 8
(*17.1 ppm = 1 grain of hardness)	

Electrical

Voltage - 120/60/1

Amps - 3.0 (max)

Boiler Pressure

Operating - 8 to 10 psi

Maximum - 15 psi

Gas Supply

MODEL	INPUT (BTU/HR)		MANIFOLD PRESSURE (INCHES W.C.)		PILOT PRESSURE (INCHES W.C.)		LINE PRESSURE (INCHES W.C.)		
							NATURAL	PROPANE	MAXIMUM ALLOWED
	NAT.	PROP.	NAT.	PROP.	NAT.	PROP.	MINIMUM RECOMMENDED	MINIMUM RECOMMENDED	
VHX24G	200,000	200,000	3.0	3.0	3.5	3.5	7.0	11.0	14.0
	270,000	270,000	3.0	3.0	3.5	3.5	7.0	11.0	
VHX24G5	200,000	200,000	3.0	3.0	3.5	3.5	7.0	11.0	
	270,000	270,000	3.0	3.0	3.5	3.5	7.0	11.0	
MHB24G	200,000	200,000	3.0	3.0	3.5	3.5	7.0	11.0	
	270,000	270,000	3.0	3.0	3.5	3.5	7.0	11.0	
NOTE:	1. Output Boiler Horsepower (BHP): 4.3 BHP for 200,000 BTU; 5.5 BHP for 270,000 BTU. 2. Input BTU/HR difference is based on gas orifice size and air orifice size.								

TOOLS

Standard

- Standard set of hand tools.
- Volt-Ohm-Meter (VOM) with AC current tester.

  (Any quality VOM with a sensitivity of at least 20,000 ohms per volt can be used)
- Gas leak checking equipment.
- Gas pressure manometer
- Temperature meter and thermocouple.

Special

- The recommended deliming chemical for the water treatment system in use, for deliming of the boiler. Contact Vulcan Authorized Service Centers.
- Heat Exchanger Gasket (joint sealant strip, Teflon) P/N 854058-1.

STEAMER OPERATION

CABINET BASE BOILER

Ensure that all utility connections to the steamer have been made and are turned ON and that the knob on the main gas valve is in the ON position.

The VHX Series steamers are CSD-1 compliant and are equipped with amber colored lights on the boiler control panel for High Pressure and Low Water level that illuminate and stay on until the boiler is full and the manual reset switch pressed.

1. Turn power switch ON.
   A. Amber colored lights on the boiler control panel for High Pressure and Low Water level will illuminate. and stay on until the boiler is full and the reset switch is pressed.
   B. Water will begin filling the boiler and the blowdown solenoid valve will close. The boiler should fill, in four to eleven minutes.
   C. As water fills the boiler, observe water level gauge glass to verify that water is in boiler. See "WATER LEVEL GAUGE ASSEMBLY" in "COMPONENT FUNCTION" and COMPONENT LOCATION " under "REMOVAL AND REPLACEMENT OF PARTS".
   D. Once the water in the boiler reaches the minimum level, the green ready light on the boiler control panel will illuminate.

   NOTE: If the fill has stopped, one visible inch of water should be in the gauge glass.
2. Press the reset switch on the boiler control panel.
   A. Low water level safety circuit will be reset and the Low Water level light (amber) will turn off.
   B. High pressure safety circuit will be reset and the High Pressure light (amber) will turn off.
   C. Sparking will begin three seconds later to light the pilot burner.
      1) If the pilot burner lights, a signal is sent back through the ignition cable indicating the presence of pilot burner flame and sparking stops.
      2) If pilot burner flame is not established immediately, sparking will continue for 90 seconds. After that duration, the ignition control module will lock out and needs to be reset to start the pilot and main burner lighting cycle again.

      New Style Controls - Power to the Pilot gas valve operates on a "timer" circuit allowing gas flow to the pilot for approximately 15 seconds, during ignition trial, then turns off.
   D. Main gas valve opens, burner ignites and begins to heat the water in the boiler. After approximately 15 minutes, steam should be present for cooking product. Observe that the boiler pressure gauge indicates a steam pressure of 8-10 psi before the burner shuts OFF.
3. The cycling pressure switch will maintain steam pressure in the boiler by cycling the main burner ON and OFF.

COOKING COMPARTMENT CONTROLS

When the steam pressure in the cooking compartment manifold reaches approximately 3 psi, the cooking compartment pressure switch closes, suppling power to the other cooking compartment controls. The ready lights will illuminate and after approximately one minute, the steam pressure in the boiler will reach the upper limit of 10 psi. If the pressure drops below approximately 3 psi, the pressure switch will open, removing power from the controls.

NOTE: On initial startup, if a cooking timer is set immediately after the ready light comes on, steam solenoid chattering will be heard (oil canning) and the ready lights will flash for several seconds. This condition is caused by the manifold steam pressure being on the "fringe" of the pressure switch set point. When a cook timer is set, the compartment steam solenoid valve opens causing the manifold steam pressure to drop, slightly below the pressure switch set point. At the same time, steam pressure is still increasing in the boiler. This opposing condition causes a pressure "bounce" to occur. After the steam pressure passes approximately 4 psi this condition subsides. During normal operation, this condition will not be seen.

1. With both timer knobs at the off position, open the compartment doors and observe that no steam has entered the cooking compartments, then close the doors.
2. Set both timer knobs at 2 minutes. The ready lights will go off, the cooking lights will come on, and steam will begin to enter the compartments.
3. After one minute, open each door and observe that steam has ceased to enter each compartment, cooking lights go back to ready, and one minute is remaining on each cook timer.
4. Close doors and steam generation and cook timing will resume. Observe the floor drain to ensure that live steam from compartments is being cooled by cold water from the cold water condenser solenoid valve.
5. When timer knobs reach "0", buzzers will sound, steam generation will cease, cooking lights will go off and ready lights will come on. To silence buzzers, turn timer knobs to off position.
6. During idle time or a cooking cycle, the heating system will cycle on and off as necessary to maintain steam pressure in the boiler.
7. Turn power switch off to remove power from the steamer.
   A. Boiler blowdown starts.

BOILER BLOWDOWN AND STEAMER SHUT OFF

Turn the steamer off at least once daily to blowdown the boiler. This will aid in the removal of sediment and scale build-up in the boiler.

NOTE: Boiler should be with-in normal operating pressures.

1. Turn power switch OFF.
2. Boiler blowdown sequence starts.
   A. The blowdown/drain solenoid valve will be de-energized and the boiler will begin to drain.
   B. The cold water condenser solenoid will operate, as needed, to condense steam and to cool the water going into the drain.

COMPONENT FUNCTION

CABINET BASE BOILER CONTROLS

Power Switch (ON/OFF) . . . . . When turned ON, supplies power to the control circuit.

Reset Switch (Manual) . . . . . Resets the low water level safety circuit on initial startup or the occurrence of a low water condition and allows the boiler to fill with water. Also, resets the high pressure level safety circuit on initial startup or the occurrence of a high pressure condition and allows the gas ignition cycle to start.

Boiler Fill Solenoid Valve . . . . . Admits water to the boiler when demanded by the water level control to maintain the correct water level in the boiler.

Cold Water Condenser Solenoid Valve . . . . . Allows cold water flow into the boiler blowdown drain box to condense steam and cool the hot water before its discharge into the drain.

Blowdown/Drain Solenoid Valve . . . . . A normally open valve (N.O.) that closes to allow boiler to fill and pressurize when power switch is turned ON and opens when power switch is turned off to blowdown and drain the boiler. This valve is plumbed into the drain line of the boiler.

Cycling Pressure Switch . . . . . Controls boiler pressure between prescribed limits by turning the heat source on and off.

High Limit Pressure Switch . . . . . Protects the boiler from pressures above 15 psi by removing power from the heating circuit. This pressure setting is higher than the cycling pressure switch in order to turn off the heat source before the boiler pressure reaches its limit. After the pressure drops below approximately 12psi, press the rest switch of the front control panel to rest the safety circuit.

Main Water Level Control . . . . . A dual functioning control that allows water to fill and maintain the proper level in the boiler providing differential water level control; and shuts off the main gas valve if the water level drops too low providing low level cut-off protection. The water level control works by using three different probe lengths to monitor the water level. The probes consist of a high level (HL), low level (LL) and low water cut-off (LLCO).

Auxiliary Water Level Control . . . . . A back up to the low level cut-off on the main control. Protects the boiler and heating system components from a low water cut-off condition by opening the 24VAC voltage path to the heating system circuit. Also, energizes the low water "light" on the front control panel.

Transformer . . . . . Provides 24VAC power to ignition control module and heating circuit.

Ignition Control Module . . . . . Controls and monitors gas heating. Energizes pilot valve coil to supply gas to pilot, generates spark to ignite gas at the pilot, monitors the presence of flame and energizes the main and pilot valve coils on the main gas valve upon a call for heat.

Main Gas Valve . . . . . A gas solenoid valve that opens to allow gas flow to the main burner after the successful ignition of the pilot burner when a call for heat is made.

Pilot Gas Valve . . . . . A gas solenoid valve that opens to allow gas flow to the pilot to ignite the main burner when a call for heat is made. The valve is energized by a time delay circuit on the relay board during ignition trial for approximately 15 seconds. New style controls only.

Combustion Blower . . . . . Provides forced air to the gas/air mixture for gas pilot and main burner combustion.

Relay Board . . . . . Provides a centralized location for wire harness connections and power transfer through board relays (K1-K7) to the steamer controls. Also, provides a condition or component troubleshooting indicator by utilizing seventeen LED'S on the board to represent the status of the condition or component in the operation sequence. For an LED legend, see "RELAY BOARD" under "ELECTRICAL OPERATION". New style controls only.

NOTE: The relay's below are mounted on the relay board and are not individually replaceable.

K1 Relay . . . . . Energized when Aux LLCO is satisfied and turns ready light (green) ON if high limit pressure switch is closed. Also, K1 allows K3 to be energized when the reset switch is pressed.

K2 Relay . . . . . Energized when high limit pressure switch is closed (high limit pressure condition satisfied). When K1 & K2 are energized, the ready light (green) will be ON.

K3 Relay . . . . . When Aux LLCO is satisfied and the manual reset switch is activated, K3 is energized. When K3 is energized, turns water error light OFF and allows the ignition sequence to begin. K3 must be energized for ignition sequence to begin.

K4 Relay . . . . . Energized when K2 contacts are closed and manual reset switch is activated. When K4 is energized, the high pressure light is OFF. When K3 and K4 are both energized, power to the ignition system is supplied.

K5 Relay . . . . . Energized when operating conditions are met and reset switch is activated. Provides power to start combustion blower.

K6 Relay . . . . . Energized by time delay circuit for approximately 15 seconds. When K6 and K7 are energized, power is supplied to the pilot gas valve.

K7 Relay . . . . . Energized when pilot voltage (PV) from the ignition module is present. Also used in the time delay circuit.

Pilot . . . . . Ignites to light the main burner upon a call for heat.

Main Burner . . . . . Heats the water in the boiler to generate steam.

Water Level Gauge Assembly . . . . . Permits a visual confirmation the water level is being maintained in boiler during operation. The correct water level is approximately one visible inch in the glass. The manual valves at the top and bottom of this assembly must be fully open and only closed if the glass tube is damaged.

Water Inlet Valve (manual) . . . . . The water inlet valve is used to stop water flow to the steamer when the steamer is being serviced. This valve should remain open during normal operation.

Inline Water Strainer . . . . . A "Y" strainer is installed upstream of the blowdown solenoid valve to prevent foreign matter from becoming lodged in the valve. A strainer (not supplied) should also be installed in the water supply line to prevent foreign matter from becoming lodged in the fill or cold water condenser solenoid valves and to keep unwanted particles out of the system.

Pressure Relief Valve . . . . . A mechanical device that opens to relieve steam pressure in the boiler if the pressure exceeds 13 psi.

High Pressure Relief Valve . . . . . A back-up mechanical device that opens to relieve steam pressure in the boiler if the pressure exceeds 15 psi.

Descaler . . . . . Hangs below the water level inside the boiler and is used to help control boiler surface scaling. Two descalers are used in each boiler.

Boiler Pressure Gauge . . . . . Indicates the amount of steam pressure in the boiler.

Steam Header Assembly . . . . . Main steam supply line from the boiler to the steam header inlet in the cooking control compartment.

COOKING COMPARTMENT CONTROLS

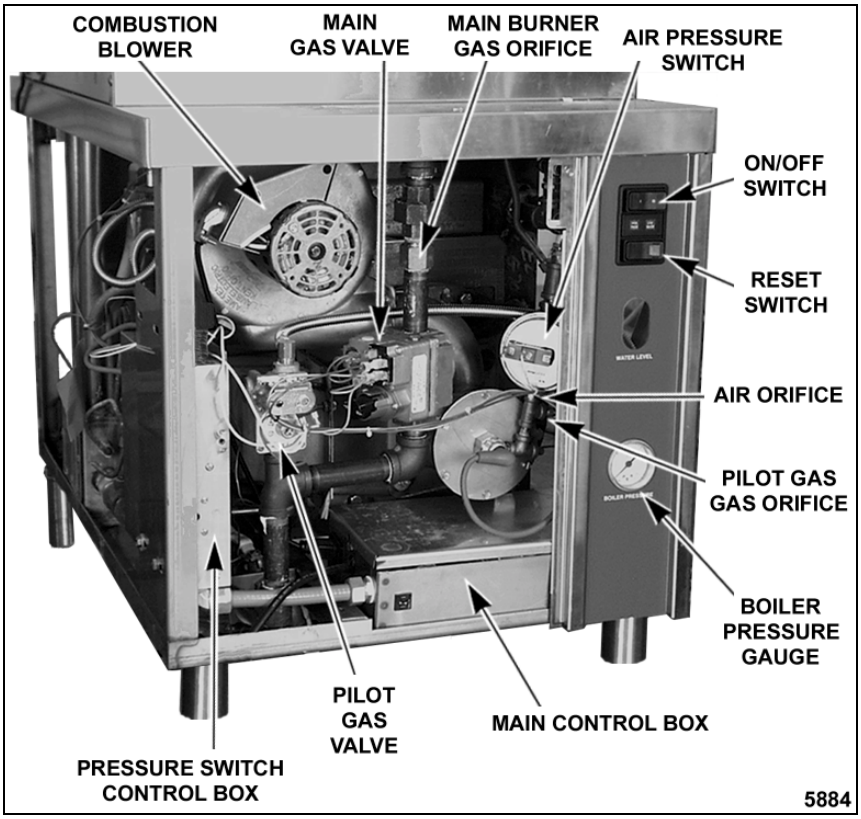
The upper section of the steamer consists of two separate cooking compartments. Each compartment functions independently with its own set of controls. Power is supplied to the controls only after the steam pressure rises above the compartment pressure switch setting to close the N.O. contacts.

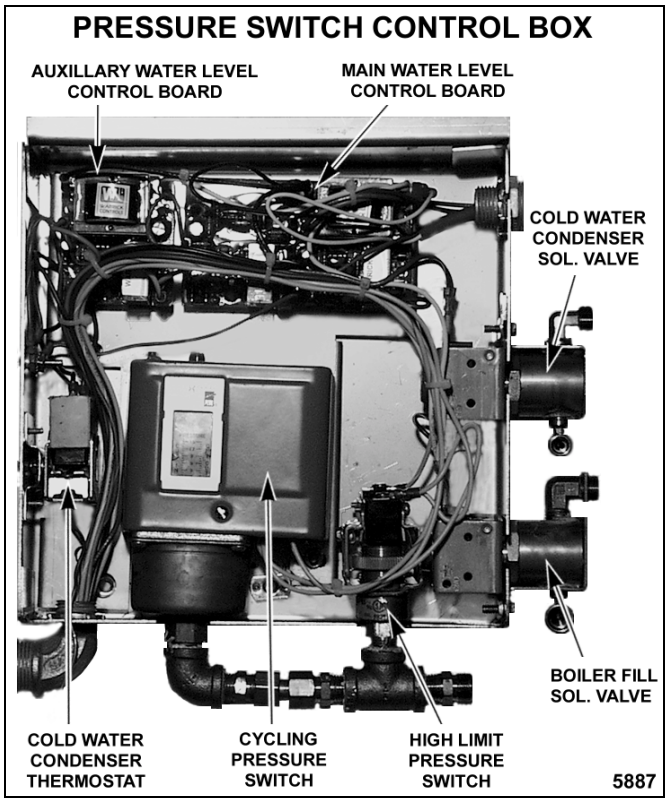
Ready Light (Green)	When lit, indicates steamer is ready to cook.
Cooking Light (Red)	When lit, indicates steamer is in a cooking cycle.
Cooking Timer	Use to set desired cooking cycle time between 0-60 minutes. When a timer is set, the steam supply solenoid valve is energized to allow steam into the cooking compartment but only after the boiler has reached its operating pressure. Also, energizes the buzzer when time expires.
Buzzer	Signals end of a cook cycle, must be turned off manually.
Door Switch	Removes electrical power to the timer. If time is dialed on the cooking timer and compartments are steaming, removes power to the steam solenoid valve when the compartment door is opened.
Steam Solenoid Valve	When energized, opens to allow steam into the cooking compartment (normally closed valve).
Compartment Pressure Switch	Supplies power to the controls only after the steam pressure rises above approximately 3 psi to close the compartment pressure switch. The switch remains closed as long as steam pressure stays above this pressure.
Manifold Pressure Gauge	Indicates the amount of steam pressure in manifold. The intake shut-off valve should be adjusted so manifold pressure remains at 9 psi with both compartments on.
Steam Supply Manifold	Main steam supply line from the boiler for each cooking compartment. Supplies steam up to the steam solenoid valve.
Intake Shut-Off Valve	Main steam supply shut-off from the boiler to the steam supply manifold. This valve should NOT be left fully OPEN to boiler steam supply. See “INTAKE SHUT-OFF VALVE ADJUSTMENT (STEAM FLOW)" in “SERVICE PROCEDURES AND ADJUSTMENTS".

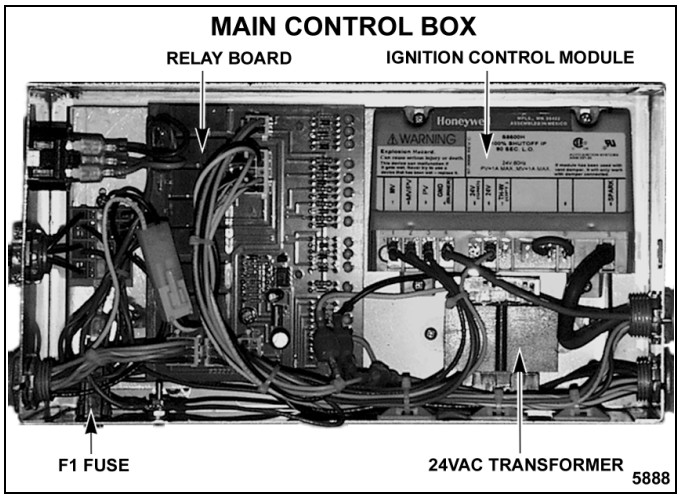
REMOVAL AND REPLACEMENT OF PARTS

COMPONENT LOCATIONS

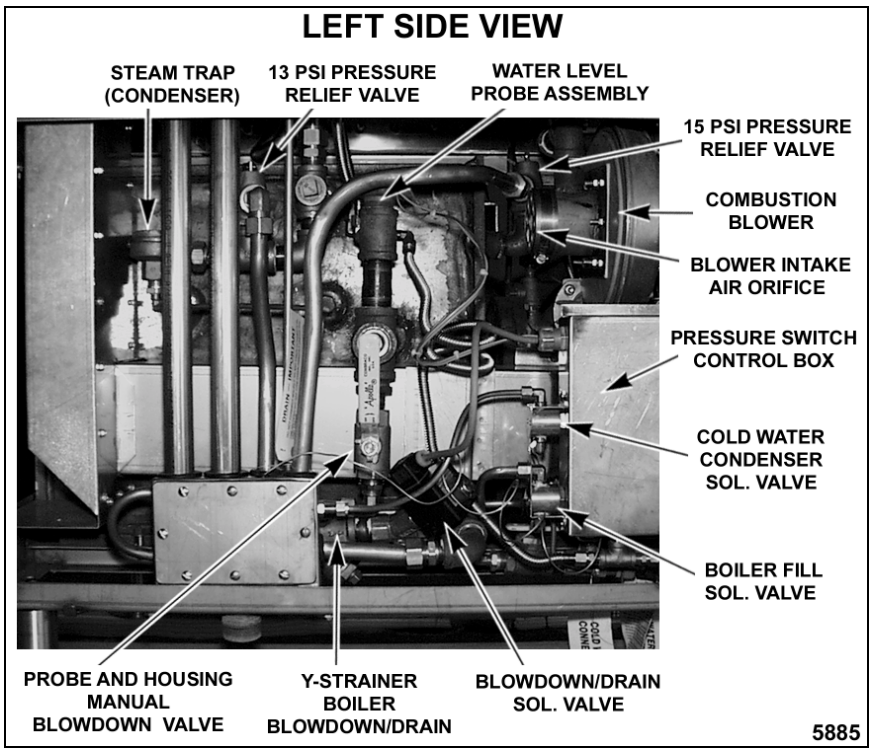
Cabinet Base Boiler Controls

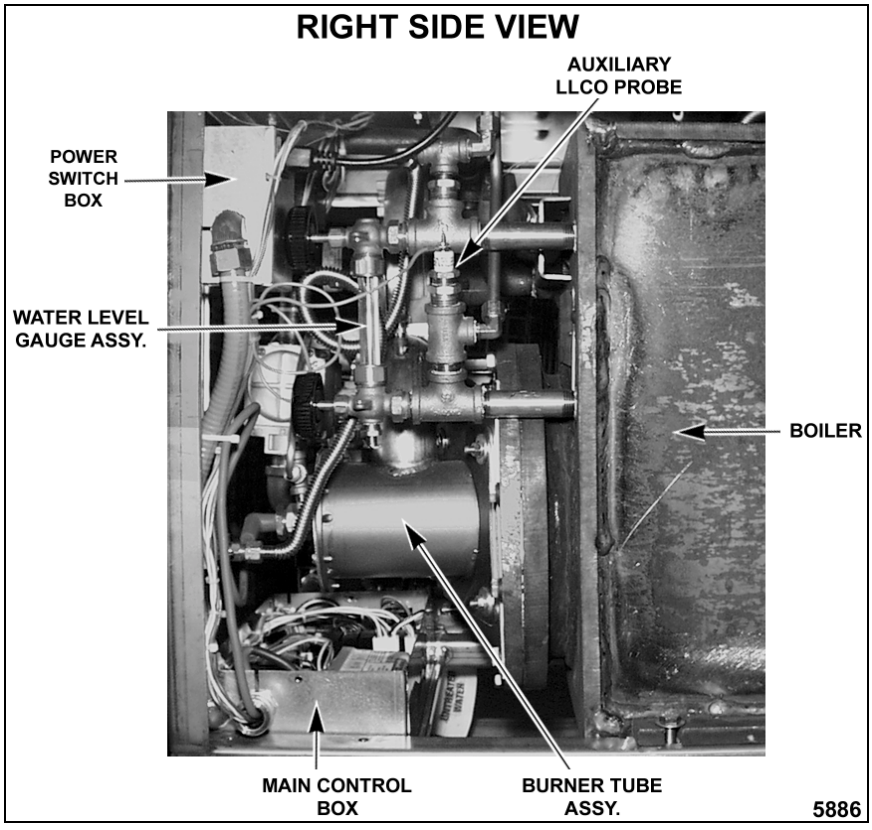




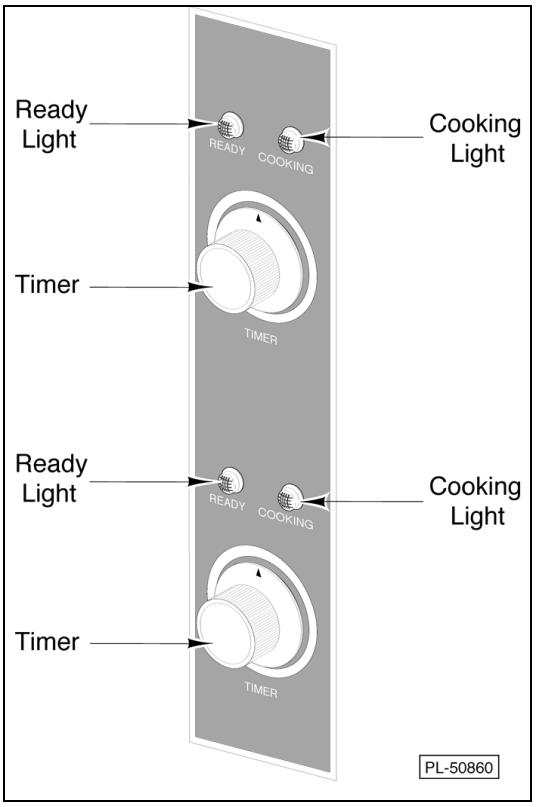


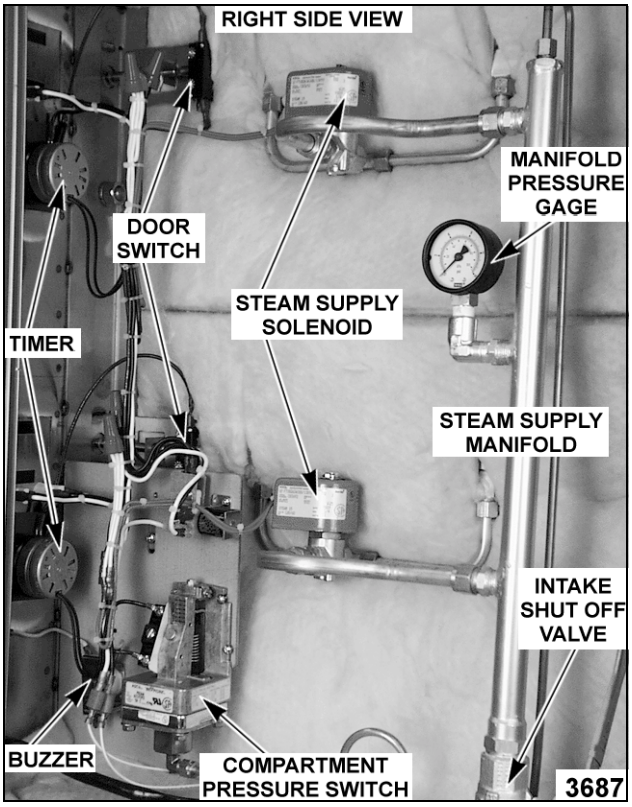
Cabinet Base Boiler Controls Continued





Cooking Compartment Controls





WATER LEVEL CONTROLS (MAIN OR AUXILIARY LLCO)

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

1. Open the cabinet base door.
2. Remove the cover from the pressure switch control box to access the water level controls. Refer to "CABINET BASE BOILER CONTROLS" under "COMPONENT LOCATIONS" in "REMOVAL AND REPLACEMENT OF PARTS".
3. Disconnect lead wires from the board being replaced.
4. Compress the locking tab on the board mounting "standoffs" and remove the water level control.
5. Reverse procedure to install and check for proper operation.

RELAY BOARD

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

1. Open the cabinet base door.
2. Remove the cover from the main control box to access the relay board. Refer to "CABINET BASE BOILER CONTROLS" under "COMPONENT LOCATIONS" in "REMOVAL AND REPLACEMENT OF PARTS".
3. Disconnect all lead wires from the board.
4. Compress the locking tab on the board mounting "standoffs" and remove the relay board.
5. Reverse procedure to install and check for proper operation.

WATER LEVEL GAUGE ASSEMBLY

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

1. Open the cabinet base door and remove the right side panel.
2. Close the valve at the top and at the bottom of the gauge assembly.
3. Unscrew the packing nuts at the top and bottom of the glass tube.
4. Slide the glass tube upwards until the bottom of the tube is clear of the fitting and lift it out.

NOTE: Clean tube if dirty or clogged and replace if damaged or broken.

NOTE: Do not over tighten the packing nuts or gauge glass may break.

5. Install the tube using new sealing washers.
6. Open the top and bottom valves.
7. Turn the power switch ON and allow boiler to come up to pressure.
8. Check gauge glass for water/steam leaks and if necessary, gradually tighten packing nuts until leak stops.

PRESSURE SWITCHES

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

1. Open the cabinet base door and remove the left side panel.
2. Remove the cover from the pressure switch control box to access the pressure switches. Refer to "CABINET BASE BOILER CONTROLS" under "COMPONENT LOCATIONS" in "REMOVAL AND REPLACEMENT OF PARTS".
3. The pressure switches are located at the bottom of the box. The pressure switch on the *left* is the cycling or primary control; the one on the *right* is the high limit control.
4. If replacing:
   A. Cycling control - remove cover from pressure switch and disconnect the lead wires.
      1) Remove the mounting screws on the back side of the control box and lift out the pressure switch. Proceed to step 5.
   B. High limit control - disconnect the lead wires.
5. Disconnect the pressure fittings at the bottom of the switch.
6. Preset the new pressure switch to the approximate cut-out (OFF) and cut-in (ON) set points before installing. Refer to "PRESSURE SWITCHES" in "SERVICE PROCEDURES AND ADJUSTMENTS".
7. Reverse procedure to install.
8. Adjust the pressure switch(s) final set points as outlined under "PRESSURE SWITCHES" in "SERVICE PROCEDURES AND ADJUSTMENTS".

BOILER ASSEMBLY

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

WARNING: SHUT OFF THE GAS BEFORE SERVICING THE UNIT.

WARNING: ALL GAS JOINTS DISTURBED DURING SERVICING MUST BE CHECKED FOR LEAKS. CHECK WITH A SOAP AND WATER SOLUTION (BUBBLES). DO NOT USE AN OPEN FLAME.

1. Blowdown the boiler and, if necessary, allow to cool.
2. Disconnect the steam supply line, power leads and drain lines from the cooking compartment top to the boiler base.
3. Refer to "HEAT EXCHANGER" and perform steps 3 through 12A.
4. Remove bolts securing the boiler to frame.
5. Drain any remaining water from the boiler.
   A. The suggested methods are:
      1) Where the drain line exits the boiler on the lower left side, separate the drain line union.
      2) Remove the access panel between the boiler and the cooking compartment on the right side.
      3) Disconnect the steam supply hose from the cooking compartment steam manifold.

a. From the bottom right side, raise the boiler two to three inches so it tilts to the left. When the remaining water has drained out, lower the boiler before. proceeding.

B. Remove the drain/scale clean-out plug from the bottom of the boiler.

6. Slide the boiler forward and remove it from base frame.
7. Install a new boiler and secure it to frame.
8. Refer to "HEAT EXCHANGER" and perform steps 13 through 15.
9. Reconnect all steam, water, drain and power connections and check for proper operation.

BOILER FILL AND COLD WATER CONDENSER SOLENOID VALVES

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

1. Turn off the water supply to the steamer.
2. Open the cabinet base door and remove the cover from the pressure switch control box to access the solenoid valves. Both solenoid valves are located side by side at the rear of the box with the boiler fill near the bottom and the cold water condenser near the middle. Refer to "CABINET BASE BOILER CONTROLS" under "COMPONENT LOCATIONS" in “REMOVAL AND REPLACEMENT OF PARTS”.
3. Disconnect the power lead wires from the solenoid valve being serviced.
4. Disconnect the water lines for the valve being serviced and remove the valve.
5. Reverse procedure to install.

PILOT GAS VALVE

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

WARNING: SHUT OFF THE GAS BEFORE SERVICING THE UNIT.

WARNING: ALL GAS JOINTS DISTURBED DURING SERVICING MUST BE CHECKED FOR LEAKS. CHECK WITH A SOAP AND WATER SOLUTION (BUBBLES). DO NOT USE AN OPEN FLAME.

NOTE: Gas combination control valves are not serviceable and should not be disassembled. Once the problem has been isolated to this component, replace it. Do not attempt to repair the assembly.

1. Open the cabinet door to access the Pilot gas valve.
2. Disconnect the lead wires.
3. Remove pilot gas tubing from the top of the valve (outlet side).
4. Remove the valve from the gas supply piping.
5. Reverse procedure to install and adjust pilot pressure as outlined under "GAS PILOT PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS".

MAIN GAS VALVE

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

WARNING: SHUT OFF THE GAS SUPPLY BEFORE SERVICING THE UNIT.

WARNING: ALL GAS JOINTS DISTURBED DURING SERVICING MUST BE CHECKED FOR LEAKS. CHECK WITH A SOAP AND WATER SOLUTION (BUBBLES). DO NOT USE AN OPEN FLAME.

NOTE: Gas combination control valves are not serviceable and should not be disassembled. Once the problem has been isolated to this component, replace it. Do not attempt to repair the assembly.

1. Open the cabinet base door to access the main gas valve.
2. Disconnect the lead wires.
3. Separate the union above the gas valve (outlet side).
4. Remove the valve from the gas supply piping.
5. Reverse procedure to install and adjust manifold pressure as outlined under "GAS MANIFOLD PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS".

BURNER HEAD ASSEMBLY

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

WARNING: SHUT OFF THE GAS SUPPLY BEFORE SERVICING THE UNIT.

1. Remove the pressure gauge tubing and power cable from the rear of the control panel then remove the panel.
2. Disconnect the spark ignition cable from the ignitor terminal.
3. Disconnect pilot gas tubing from the air pressure switch tee.
4. Separate the union above the main gas valve and remove the gas valve piping assembly.

NOTE: Removal of the gas valve piping assembly assumes the use of a gas line quick connect or union at the gas supply inlet to the steamer.

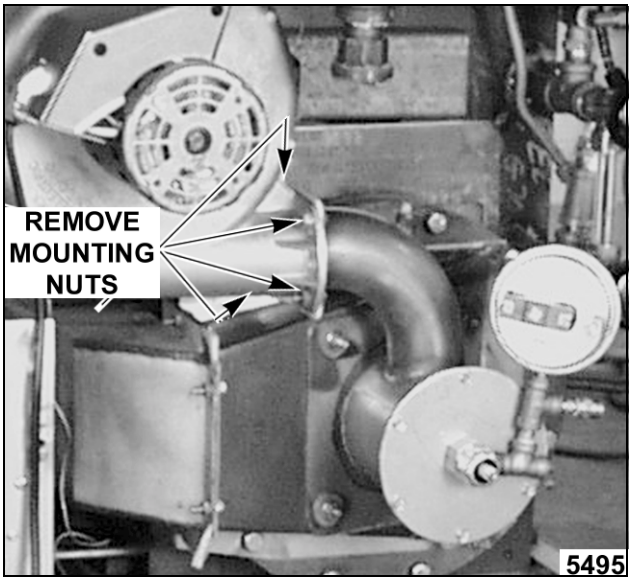
5. Remove the screws from the burner head assembly end plate and pull the assembly out from the complete burner assembly.
6. Reverse procedure to install and check for proper operation.

COMPLETE BURNER ASSEMBLY

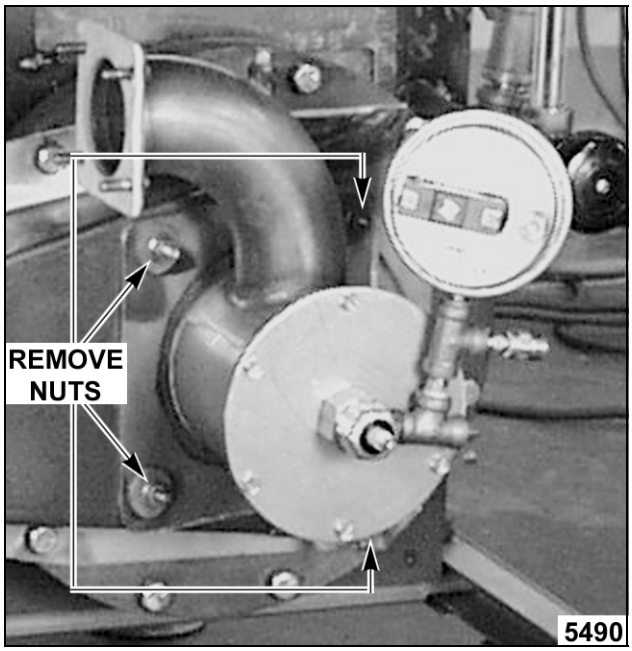
WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

WARNING: SHUT OFF THE GAS SUPPLY BEFORE SERVICING THE UNIT.

1. Refer to steps 1 through 4 under "BURNER HEAD ASSEMBLY".
2. Remove the four nuts from combustion blower mounting flange and remove blower from burner tube assembly.



3. Remove the four nuts from the burner tube assembly then slowly pull the assembly straight out from the heat exchanger.



CAUTION: Use care while removing as to not damage the ceramic insulation surrounding the burner.

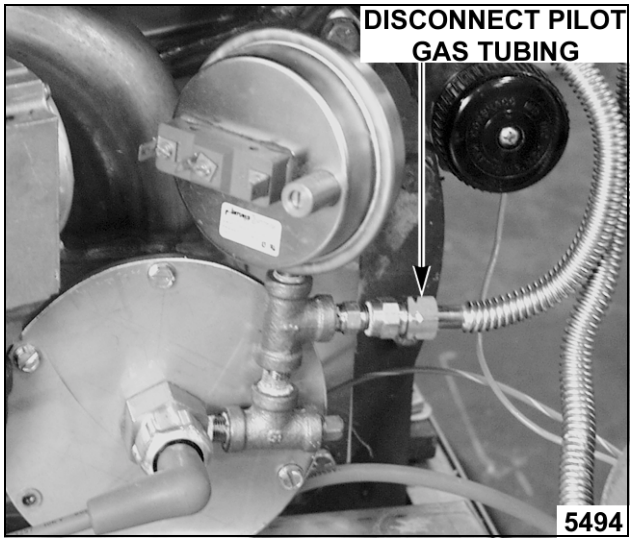
4. Reverse procedure to install and check for proper operation.

HEAT EXCHANGER

WARNING: SHUT OFF THE GAS BEFORE SERVICING THE UNIT.

WARNING: ALL GAS JOINTS DISTURBED DURING SERVICING MUST BE CHECKED FOR LEAKS. CHECK WITH A SOAP AND WATER SOLUTION (BUBBLES). DO NOT USE AN OPEN FLAME.

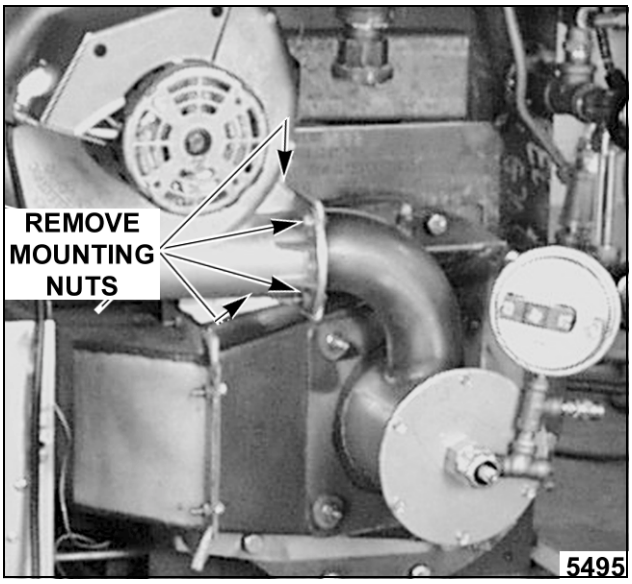
1. Blowdown the boiler and, if necessary, allow to cool.
2. Disconnect the electrical power to the machine at the main circuit box. Place a tag on the circuit box indicating the circuit is being serviced.
3. Remove the pressure gauge tubing and power cable from the rear of the control panel then remove the panel.
4. Disconnect the electrical lead wires exiting the boiler control box from:
   A. Auxiliary LLCO probe (Orange).
   B. Burner ground (green).
   C. Air pressure switch (yellow & yellow/white stripe).
   D. Main gas valve (purple & grey).
   E. Pilot burner valve (red & grey).
   F. Spark ignition cable.
5. Remove bolts securing the boiler control box (front) to the base frame.
   A. Lift up on left side of box and slide out.
6. Disconnect pilot gas tubing from the air pressure switch tee.



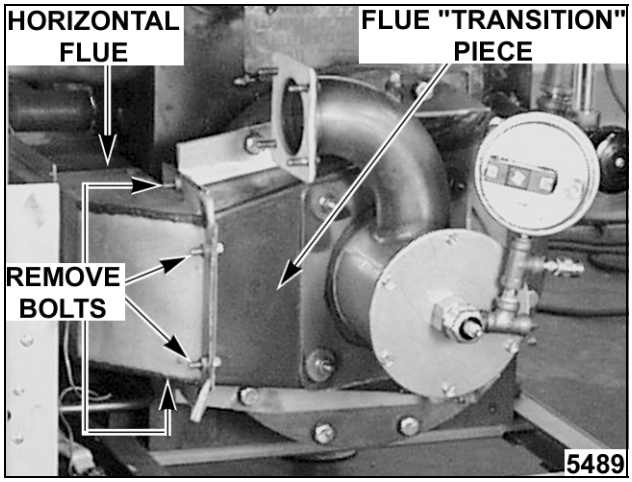
7. Separate the union above the main gas valve and remove the gas valve piping assembly.

NOTE: Removal of the gas valve piping assembly assumes the use of a gas line quick connect or union at the gas supply inlet to the steamer.

8. Remove the four nuts from combustion blower mounting flange and remove blower from burner tube assembly.



9. Remove the four bolts connecting the horizontal flue (left of boiler) to the flue "transition" piece.

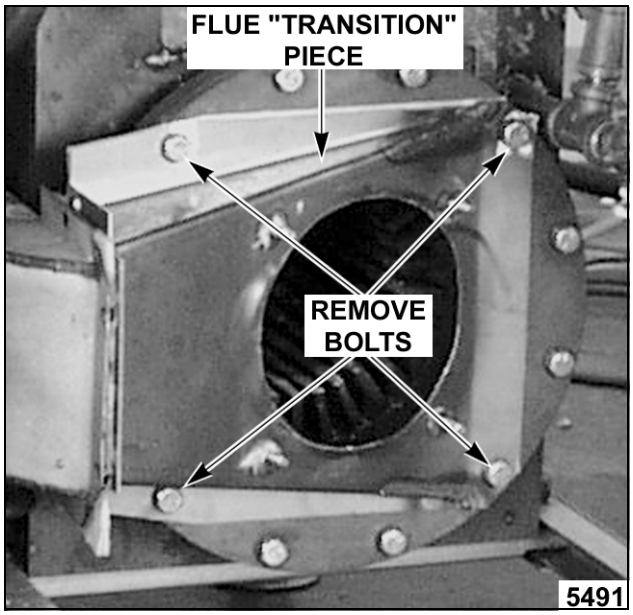


   A. Separate the horizontal flue from flue "transition" piece, leaving the horizontal flue in place.

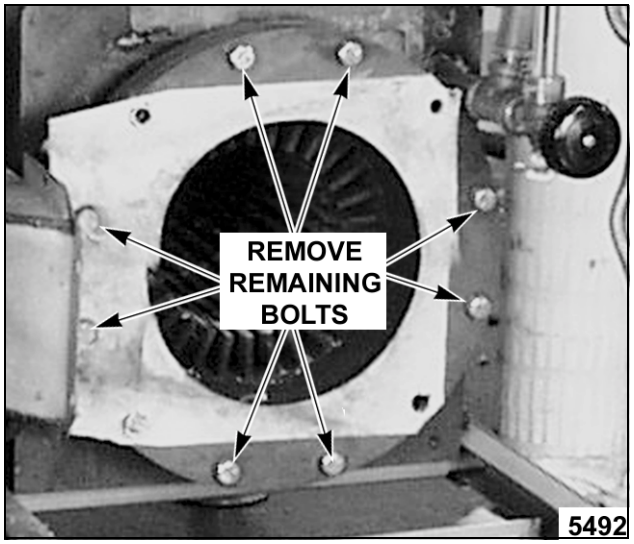
10. Remove the four nuts from the complete burner tube assembly then slowly pull the assembly straight out from the heat exchanger.

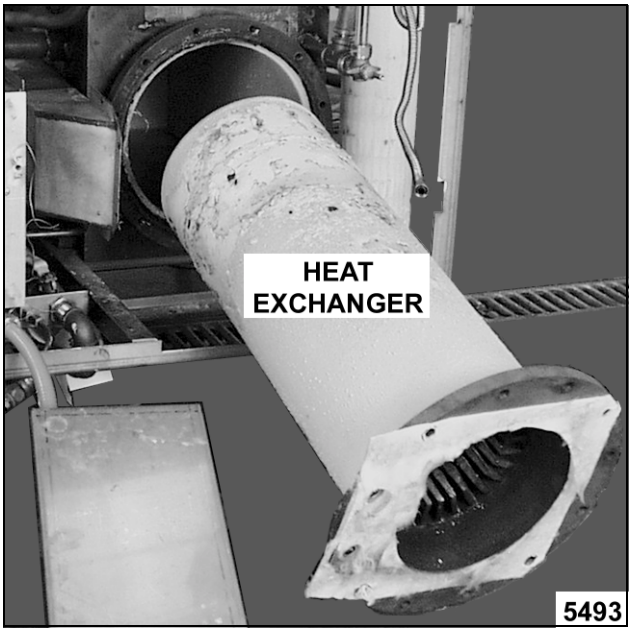
CAUTION: Use care while removing as to not damage the ceramic insulation surrounding the burner.

11. Remove the flue "transition" piece from the heat exchanger.

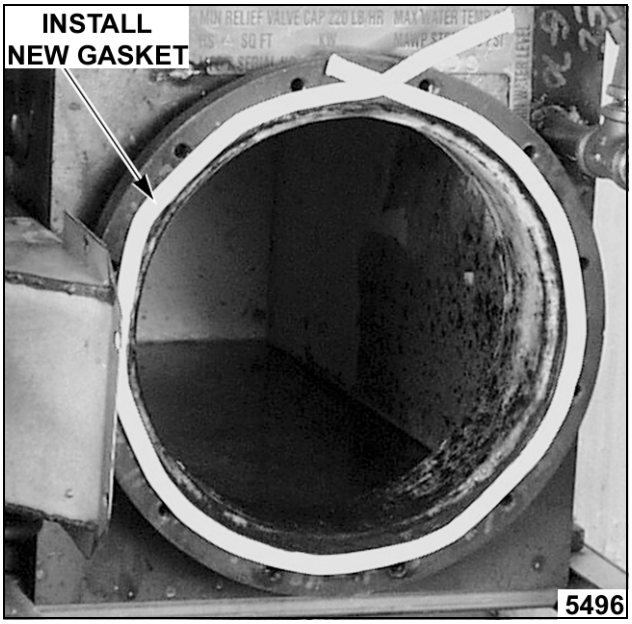


12. For clearance of the heat exchanger only, remove the drain nut (petcock) and the lower adjustment knob from the water level gauge.
    A. Remove the remaining bolts on the heat exchanger then pull heat exchanger straight out from the boiler.





13. To install heat exchanger:
    A. Clean the mating surfaces on the heat exchanger and boiler.
    B. Install a new gasket on the boiler side of the mounting flange.



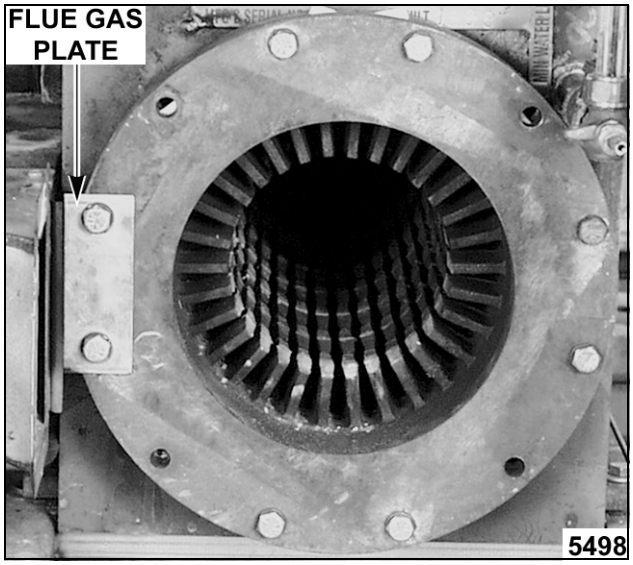
    C. Insert the heat exchanger back into the boiler and line up the mounting holes being careful not to disturb gasket.
    D. Attach a 2" C-Clamp between the heat exchanger mounting flange and the boiler side mounting flange. Tighten clamp only enough to allow starting of bottom bolt into mounting hole.

NOTE: It may be necessary to use two clamps to draw the bottom of the heat exchanger close enough to be clamped. Start one clamp at a 3 o'clock position then install other clamp near the bottom. Once the bolts are tight enough, C-Clamp will fall away.

E. Install two bolts at the bottom and two bolts at the top on the heat exchanger flange and tighten the bolts a few turns at a time. Starting with the bottom bolts, tighten the bolts in an alternating pattern between the bottom and top for a flush mounting of the heat exchanger flange and an even compression of the gasket.

NOTE: If a bolt is not threading in properly by hand, clean out the threads with the proper size tap.

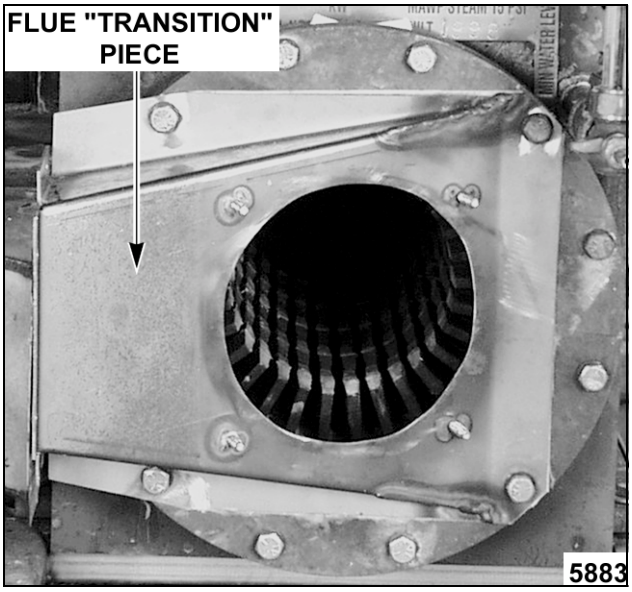
F. Once those bolts are tight, install the two bolts to the left and the two bolts to the right on the heat exchanger flange. On the left side, be sure to install the rectangular flue gas plate then tighten the bolts in an alternating pattern.



14. To install flue "transition" piece:

A. Clean the mating surfaces on the "transition" piece and the heat exchanger face.

B. Install new gasket on the "transition" piece then secure to the heat exchanger using the remaining bolts.



15. Starting at step 12, reverse procedure to install the remaining components.

16. Check for water leaks and proper operation.

COOKING COMPARTMENT DOOR(S)

Removal

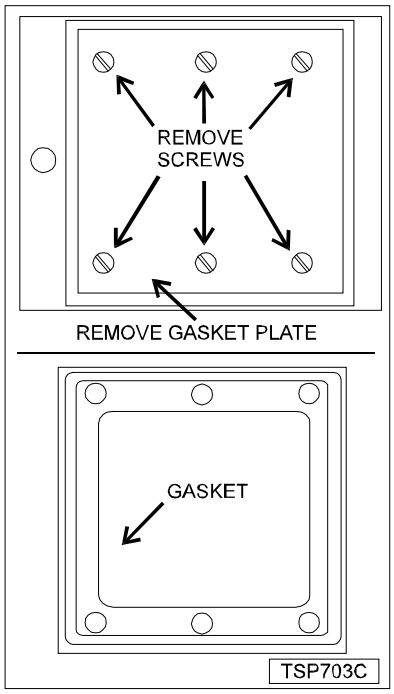
1. Remove top cover.
2. Open the door.
3. Pull hinge rod up.
4. Reverse the procedure to install, making sure the door bushings are in place.

Gasket

1. Open the door.
2. Remove screws from the gasket plate.
3. Pull the gasket plate out from the door housing and remove the gasket.
4. Position the new gasket on the gasket plate and reverse the procedure to install. Adjust the door as outlined in "DOOR SEALING ADJUSTMENT" under "COOKING COMPARTMENT".

NOTE: Do not over tighten gasket plate screws as this will compress the gasket excessively and interfere with proper door sealing.

NOTE: Damage to the gasket sealing surface, such as nicks or cuts, will cause steam leakage.

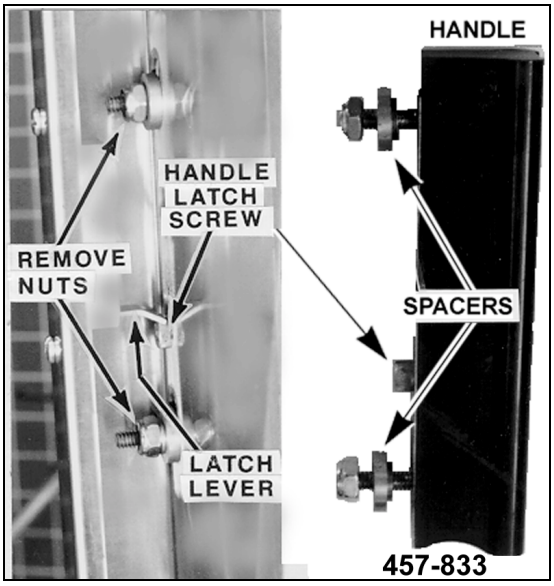


Handle

1. Open the door.
2. Remove screws from the top and bottom of the door.
3. Pull the inner door panel out from the door housing with the gasket plate and gasket still attached.

4. Remove the nuts and spacers from the handle screws and remove the handle from the door.

NOTE: When installing the spacers, the smaller diameter fits into the slot in the door and the latch lever must rest on top of the handle latch screw.



5. Reverse procedure to install.

Latch Assembly

1. Open the door.
2. Remove screws from the top and bottom of the door.
3. Pull the inner door panel out from the door housing with the gasket plate and gasket still attached.
4. Remove the screws from the side edge of the door that secure the latch mechanism and remove the latch from the door.

NOTE: When installing, the latch lever must rest on top of the handle latch screw.

5. Reverse procedure to install.

SERVICE PROCEDURES AND ADJUSTMENTS

WARNING: CERTAIN PROCEDURES IN THIS SECTION REQUIRES ELECTRICAL TEST OR MEASUREMENTS WHILE POWER IS APPLIED TO THE MACHINE. EXERCISE EXTREME CAUTION AT ALL TIMES. IF TEST POINTS ARE NOT EASILY ACCESSIBLE, DISCONNECT POWER, ATTACH TEST EQUIPMENT AND REAPPLY POWER TO TEST.

BOILER

Inspection

It is recommended the boiler be inspected for excessive lime scale build up in a time frame dependant on the quality of the local water supply and steamer usage. In hard water areas or for steamers heavily used, a frequent interval should be used. This inspection consists of an internal examination and cleaning of the boiler, an examination of the two hanging descalers, and for lime build up on the water level probes. Also, a check of all boiler controls, including the pressure switches.

Periodic service must be performed as outlined in these procedures. See “WATER CONDITIONING” under “GENERAL”.

Clean-Out

1. Turn power switch OFF.
    A. Boiler should automatically start blowdown/drain cycle.
2. Remove the burner assembly and heat exchanger as outlined under "HEAT EXCHANGER" in "REMOVAL AND REPLACEMENT OF PARTS".

NOTE: Access to the interior of the boiler through the hand hole cover is very limited on this model and is recommended to be removed for deliming purposes only.

3. Remove old descalers (cathodic protectors).
4. With a wire brush or equivalent:
    A. Dislodge and remove all loose scale from boiler shell. The loose material must be scooped from the boiler or flushed through the washout drain.
    B. Remove all loose scale form the heat exchanger.
    C. Clean the mating surfaces of the heat exchanger and boiler.
5. Check probe housing and water level probes for scale build up and clean as necessary. Refer to "WATER LEVEL CONTROLS TEST".
6. Check the drain line exiting the boiler for obstructions.
    A. Remove the strainer clean out plug, turn the steamer on and allow the boiler "fill water" to flush-out the drain line. Turn the steamer off, remove the cap and strainer screen and clean, if necessary, before replacing the screen and clean-out plug.
7. Inspect condition of the descalers as outlined under "DESCALER (Cathodic Protector)" in this section, and replace if necessary.
8. Install a new gasket and replace the burner assembly and heat exchanger by reversing the removal procedure from step 2.
9. Delime the boiler as outlined under "DELIMING" in this section.

Deliming

Boiler deliming should be performed in a time frame dependant on the quality of the local water supply and steamer usage. In hard water areas or for steamers heavily used, a frequent interval should be used. See “WATER CONDITIONING” under “GENERAL”.

On steamers using a water treatment system, follow the instructions for that system to delime the boiler. Only use the type of chemical recommended or described in the instructions for deliming with this type of system.

If a water treatment system is <u>not</u> used, follow the instructions for deliming the boiler as outlined in the steps below.

1. Turn power switch OFF.
    A. Boiler should automatically start blowdown/drain cycle.
2. Remove hand hole plate and gasket (top front) from the boiler by removing the nut and clamp, then tap the cover lightly to free it. Hold the stud in the plate while tapping to prevent the plate from dropping into boiler.
3. Clean the mating surfaces of the hand hole opening and plate.
4. Delime the boiler:
    A. If the boiler was delimed through a water treatment system, proceed to step 7.
    B. If the boiler has <u>not</u> been delimed, proceed to step 5.

WARNING: READ AND FOLLOW THE INSTRUCTIONS FOR THE DE-LIMING CHEMICAL BEING USED. USE PLASTIC OR RUBBER GLOVES TO AVOID SKIN CONTACT. IF THE CHEMICAL COMES IN CONTACT WITH SKIN, RINSE WITH CLEAN WATER.

5. Mix deliming solution according to the instructions for the chemical being used.

NOTE: Boiler water capacity is approximately seven gallons.

NOTE: If deliming solution comes in contact with steamer components, lightly rinse off with clean water.

   A. Turn OFF water supply.

   B. Turn power switch ON to close the drain valve.

   C. Pour deliming solution into the boiler shell.

6. Install a new gasket on the hand hole plate then position and tighten the plate to the boiler.

7. Ensure cooking compartment timers are OFF.

8. Turn power switch ON and open water supply valve.

9. Allow the boiler to reach operating pressure and run for 90 minutes or per the instructions for the deliming chemical in use.

   A. Turn power switch OFF and allow the boiler to completely drain.

   B. Turn power switch ON to refill boiler and allow to heat until fully pressurized.

10. Steps 9A and 9B **must** be repeated three times to thoroughly rinse the boiler.

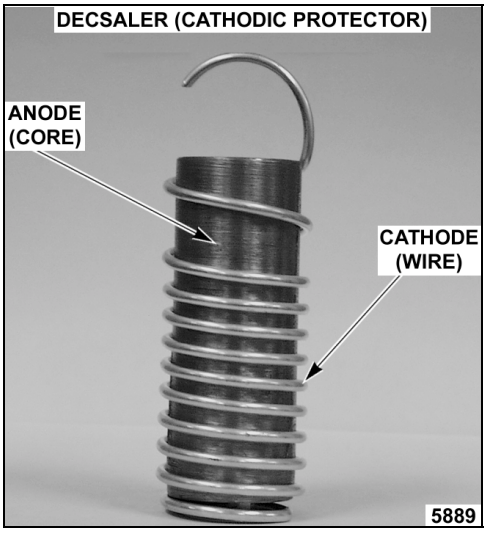
11. Steamer is now ready for normal operation.

Descaler (Cathodic Protector)

Two descalers are installed inside the boiler shell and are used to as a preventative measure to:

- Reduce scale deposit buildup
- Help remove existing scale deposits
- Inhibit boiler and component corrosion

The type of descaler used has a coiled wire (Cathode) wrapped around a solid cylindrical core (Anode) that hangs by an open loop from the front horizontal support rod inside the boiler.



The descaler materials serve as a sacrificial "Anode" and "Cathode" combination that chemically reacts with the contents of the boiler to meet the three objectives outlined above.

If the coiled wire has eroded away or if the cylindrical core of the descaler has eroded away to approximately half its original diameter, a new descaler should be installed. The size of a new descaler is approximately: 1 3/8" diameter and 3 3/4" long at the core.

NOTE: While the diameter of the descaler decreases through erosion, the length of the descaler will increase. If the descaler has increased to a length that is touching the bottom of the boiler shell, the descaler should be replaced.

The descalers are accessible through the "heat exchanger" opening in the boiler only. For removal of the heat exchanger refer to "HEAT EXCHANGER" under "REMOVAL AND REPLACEMENT OF PARTS".

To install a new descaler, stretch the coiled wire at the top to elongate the wire and form an open loop. Hang the descaler on the front horizontal support rod so that its core will be completely below the minimum water level in the boiler but hanging free. The descaler must not contact the boiler shell or the heat exchanger casting.

WATER LEVEL PROBE HOUSING BLOWDOWN

The water contained in the probe housing, being under pressure, should be "blown through" this manual valve and be noticeably visible exhausting out the steamer drain. The probe housing blowdown should be performed in a time frame dependant on the quality of the local water supply and steamer usage. In hard water areas or for steamers heavily

used, a frequent interval should be used. This blowdown procedure is essential to proper operation and component life by removing sediment and scalants that may be lodged in the probe housing.

NOTE: Boiler should be within normal operating pressures.

1. Remove the left side boiler base panel to access the ball valve.
2. Turn the power switch ON and allow the boiler to reach operating pressure.

WARNING: THE STEAMER AND ITS PARTS ARE HOT. USE CARE WHEN OPERATING, CLEANING OR SERVICING THE STEAMER. THE BOILER CONTAINS LIVE STEAM. STAY CLEAR WHEN OPENING THE VALVE.

3. Open the ball valve for approximately one minute while under pressure to thoroughly flush the probes and housing.
4. Close the ball valve and replace left side panel.
5. Press the reset switch (manual) on the boiler control panel and allow boiler to reach operating pressure.
6. Steamer is now ready for use.

WATER LEVEL CONTROLS TEST

The procedure below applies to the water level control boards for both the old and new style boiler controls. For additional information related to the new style controls, refer to "RELAY BOARD" and "SEQUENCE OF OPERATION" under "ELECTRICAL OPERATION". For specific information related to the water level controls operation, refer to "WATER LEVEL CONTROLS" under "ELECTRICAL OPERATION".

Loose electrical connections may prevent the steamer from operating properly.

An accumulation of lime scale on or near the water level sensing probes may cause them to retain water (moist) on the probe surface and give a false reading. Also, a cracked or damaged insulator may give a false reading.

These conditions may cause one or more of the following to occur:

- Gas burner no ignition
- Boiler no fill
- Boiler overfill.
- Boiler no fill and dry fire

NOTE: Dry firing may cause damage to the heat exchanger, burner assembly or the boiler. If this condition is suspect, the affected components should be inspected.

WARNING: THE FOLLOWING STEPS REQUIRE POWER TO BE APPLIED TO THE UNIT DURING THE TEST. USE EXTREME CAUTION AT ALL TIMES.

Main Water Level Control

NOTE: The main water level control is a dual functioning control that provides for low level cut-off protection and differential water level control

1. Turn power switch ON and verify:
   - A. Low water light is illuminated (front control panel).
   - B. HL LED is illuminated on the water level control board.
   - C. Boiler is filling with water.
     1) If boiler isn't filling with water:
        - a. Verify 120 Volt AC is being applied to the fill valve.
        - b. Verify fill valve isn't clogged.
        - c. Verify 120 Volt AC is on main water level control board.
     2) If water level control board doesn't have 120 Volt AC:
        - a. Check it's power source at the 10 pin J3 connector, pin 1 (white) and pin 2 (black). Disconnect the 10-pin J3 connector from the relay board in the main boiler control box.
        - b. If no voltage is measured on J3 pins 1and 2, check the F1 fuse (resettable circuit breaker) in the main control box, and the power switch connections in the power switch box.
        - c. If 120 volt AC was measured on J3 connector pins 1 and 2 but not on the water level control board, verify wire connections. There should be continuity between L1 on the water level control board and J3 pin 7. There should also be continuity between L2 on the water level control board and J3 pin 6. This path includes connections thru the J1 connector.
2. At the end of the initial fill:
   - A. Verify approximately one inch of water visible in the boiler sight glass.
   - B. Verify "green" ready light in the reset switch is illuminated.

C. Verify LED's on the water level control board, HL LED should be off, and LLCO LED should be illuminated.

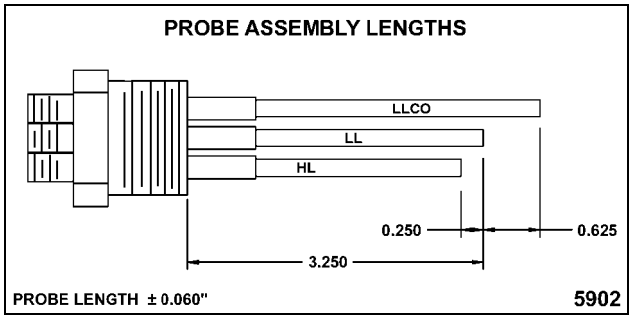
3. Open the ball valve in the probe housing assembly (boiler left side) about half way, to gradually remove boiler water and activate a fill cycle. **Do <u>not</u> press the reset switch to start the ignition cycle.** The next step requires a visual sight glass measurement that cannot be obtained, if there is boiling action in the vessel.

   A. Verify water level in the boiler sight glass drops 1/4" to 3/8" before a fill cycle is initiated. Repeat at least twice to verify correct fill.

      1) If proper fill wasn't obtained:

         a. Verify probes 50, 51, and 52 have the correct colored wire to them and to the water level control board.

         b. Remove the 3 probe assembly, clean lime scale build-up from the probes and compare probe lengths to drawing.



         c. Remove 3/8" flex line from the probe housing assembly to the boiler and remove any obstructions. The 1/4" compression fitting elbow and 1/4" tee into the boiler shell for the balance tube are sloped 1/8" so condensation drains into boiler. When replacing, the assembly **<u>must</u>** have this slope to prevent a blockage from condensate build-up.

4. Test the water level control board LLCO circuit.

   A. With the boiler full with water, turn off the water supply and open the ball valve in the probe housing assembly.

   B. Shortly after the water drops below the lowest visible level in the sight glass, the LLCO LED on the water level control board should turn off, LLCO relay should de-energize and the normally open contacts should return there shelf state.

   C. Repeat at least twice to verify correct LLCO operation.

Auxiliary Low level Cut-Off Control

5. Continued testing with focus on the auxiliary LLCO circuit. With water below the lowest visible level in the sight glass (below Aux LLCO probe), and boiler in state of initial fill:

   A. Verify Aux LLCO LED is off on the Aux water level control board.

   B. Verify Low Water light is illuminated (front control panel).

   C. Verify 24 volt AC is on Aux LLCO COM, and 0 volt is on Aux LLCO N.O. contacts.

      1) With the water level above the Aux LLCO probe and in the initial fill state:

         a. Verify Aux LLCO LED is illuminated on the auxiliary low water board.

         b. Verify N2 on the relay board is illuminated (new style boiler controls only).

         c. Verify the "green" ready light in the reset switch is illuminated.

         d. Verify 24 volt AC is on the Aux LLCO common and normally open contacts of the auxiliary water level control board.

      2) With the main gas valve turned off, water supply valve turned off, and probe housing assembly ball valve opened, press the reset switch.

         a. Verify low water light (front control panel).

         b. Blower comes on.

         c. Gas pilot cycles at approximately 15 seconds on and 5 seconds off.

      3) Shortly after water level drops below the lowest visible level in the sight glass, the Aux LLCO circuit should be activated.

         a. Low water light turns on.

         b. Aux LLCO led turns off.

         c. Combustion blower is de-energized.

         d. Gas pilot stops cycling.

      4) Press reset switch to verify lockout.

      5) Disconnect lead wire from Aux LLCO probe. If there is any measurable resistance between the probe and the

boiler shell, remove and clean the Aux LLCO probe.

a. Replace the probe and check resistance again. If resistance is still present, install a new probe.

b. Replace lead wire on probe and repeat steps "2) thru 4)" to verify proper operation.

PRESSURE SWITCHES

WARNING: THE FOLLOWING STEPS REQUIRE POWER TO BE APPLIED TO THE UNIT DURING THE TEST. USE EXTREME CAUTION AT ALL TIMES.

Remove the cover from the pressure switch control box to access the two pressure switches. The pressure switch near the front is the cycling pressure switch and the one beside it is the high limit pressure switch.

Cycling

1. If the boiler is already operating, proceed to step 2. If the boiler is not already operating, start the boiler as outlined under "CABINET BASE BOILER" in "STEAMER OPERATION".
2. Turn one of the cooking compartment timers ON to exhaust steam from the boiler.
3. Monitor the boiler pressure gauge for several cycles and note the pressures at which the burner comes ON and goes OFF.
   A. The main burner should come ON at 8 PSI and go OFF at 10 PSI. If the readings differ, adjust the pressure settings as described below.
      1) Two pressure adjustment screws extend through the top of the switch case. The screw directly above the right side pointer raises or lowers both the cut-out (OFF) and the cut-in (ON) set points simultaneously, without affecting the differential.

         The screw directly above the left side pointer raises or lowers the cut-in (ON) set point and changes the differential.

      2) Turn the adjustment screw above the right side pointer to obtain the proper cut-out (OFF) setting first, then adjust the other screw to obtain the proper cut-in (ON) setting.
         a. A clockwise rotation increases the pressure setting while a counterclockwise rotation decreases the pressure setting.
4. The cycling pressure switch will maintain the steam pressure setting in the boiler by cycling the main burner ON and OFF.

High Limit

Adjusting the High Limit pressure switch from a cold startup is the preferred condition of the boiler. On the initial cold startup, the highest overshoot pressure (drift) is achieved after the burner cycles OFF for the first time. If the boiler is already operating, the pressure setting can still be made after following the procedures outlined below.

1. The high limit pressure switch should be adjusted to allow a maximum pressure in the boiler of 14.5 to 15.0 PSI. Before making adjustments to the high limit pressure setting, the 13 PSI pressure relief valve (PRV- left side) must be **temporarily** disabled. This will allow a high enough pressure in the boiler to properly set the switch.
   A. The suggested methods to prevent the valve from releasing pressure are:
      1) Use a wooden block, a hand tool or other object to hold the valve plunger down.
      2) Use a metal wire threaded through the hole in the valve handle and tie the pressure relief valve handle to the piping below it.
      3) If neither of the two methods keep the valve fully closed without leaks, an alternate method is:
         a. Turn the power switch OFF and allow the boiler to blowdown.
         b. Remove the discharge piping from the valve outlet and insert a pipe plug for **temporary** use only.
2. Turn the power switch ON and allow the boiler to completely fill.
   A. High Pressure and Low Water indicator lights (amber) come ON.
3. When water in the boiler reaches the minimum level, the green light on the reset switch will come ON.
   A. Press the reset switch on the front control panel to reset the High Pressure and Low Water safety controls.
      1) Ignition sequence starts, main burner lights and water in the boiler begins to heat.
4. Monitor the boiler pressure gauge and note the pressure at which the high limit switch opens.

NOTE: In front of the boiler there is an additional

Mechanical Pressure relief valve factory set to approximately 15 PSI. If the pressure in the boiler reaches this level, the valve will OPEN.

A. High pressure light (amber) will come ON.

1) If the pressure switch opens at a pressure range other than 14.5 to 15.0 PSI then an adjustment to the switch setting should be made.

a. Proceed to step 5.

CAUTION: While making the adjustment, do not press on the wheel with extreme force. The switch may rotate and develop a leak at the compression fittings or in some cases, the rear lead wire may touch the control box and create an electrical short.

5. Turn the adjustment wheel several clicks to change the pressure switch set point.

A. A counterclockwise rotation lowers the pressure switch set point while a clockwise rotation raises the pressure switch set point.

NOTE: For every click of the adjustment wheel during rotation, the pressure setting is changed approximately 1/8 PSI. **Make the adjustment in small increments.**

6. Raise the handle on the 15 PSI mechanical pressure relief valve and open the valve for approximately 4 minutes. This will exhaust steam down the drain line and lower the boiler pressure.

A. High limit pressure switch closes at approximately 12 PSI (non-adjustable).

1) Press the reset switch to reset the High Pressure safety control.

a. High pressure light (amber) goes out.

B. Lower the boiler pressure to approximately 8 PSI.

C. Ignition sequence starts, main burner lights and water in the boiler begins to heat.

7. Repeat steps 4 through 6 until the High Limit Pressure Switch opens at the correct pressure.

8. If the 13 PSI pressure relief valve (PRV- left side) was temporarily disabled as outlined in step 1:

A. Turn the power switch OFF and allow the boiler to blowdown.

B. Return the valve to its original state.

9. Check steamer for proper operation.

FILL AND COLD WATER SOLENOID VALVES

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

1. Check to ensure the solenoid valve is receiving power.

A. If the solenoid valve is receiving power but the valve is not opening, the coil may be malfunctioning.

1) Remove the lead wires from the solenoid coil and check for continuity.

a. If continuity is measured, proceed to step "1. B.".

b. If no continuity is measured, replace the solenoid valve and check for proper operation.

B. If the solenoid valve is receiving power and the valve appears to be opening but little or no water is flowing through it, then the valve ports may be clogged with debris or a valve component malfunctioning.

2. To check solenoid valve further, proceed to step 3 through 8 for disassembly and inspection of internal components.

3. Shut water supply off, disconnect the water line from the valve body then remove the solenoid valve from the steamer.

4. Remove the coil assembly from the valve stem by lifting up on the retaining cap at the top of the solenoid valve and sliding the metal cover plate off.

5. Clamp the body of the valve in a vise.

6. Mark a scribe line on the stem nut to the valve body for proper re-tightening.

7. Remove the stem locking nut to remove the stem from the valve body.

8. All parts are now accessible for inspection and cleaning.

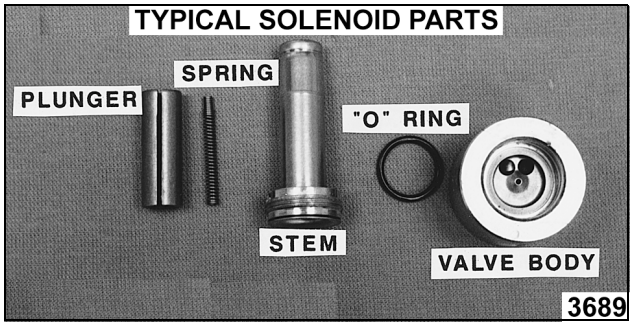
NOTE: If internal solenoid parts appear to be damaged or worn, then replace the solenoid valve. Do not reuse damaged or worn parts. **No internal solenoid parts are available as a service replacement.**

A. Check rubber seal on bottom of plunger.

B. Check plunger spring.

C. Check O-ring in valve body.

D. Check ports in valve body.



9. Reverse procedure to install.

BOILER BLOWDOWN/DRAIN SOLENOID VALVE

The water contained in the boiler, being under pressure, should be "blown through" this valve and be noticeably visible exhausting out the steamer drain. Daily boiler blowdown is essential to proper operation and component life by removing sediment and scalants that may be lodged in the chamber of the boiler.

The boiler blowdown/drain process is an automatic function and should start whenever the power switch is turned OFF after a normal operating cycle. The blowdown solenoid is a normally open (N.O.) valve that CLOSES when energized by the power switch. When the power switch is turned OFF, the blowdown solenoid is de-energized and the valve OPENS to allow the boiler to blowdown.

If the blowdown operation appears to function sluggishly or not at all, considerable scalants may be lodged in the drain line plumbing exiting the boiler, strainer, and/or the blowdown valve.

1. Turn the power switch OFF and allow boiler to blowdown.
2. Turn the ON/OFF knob on the main gas valve to OFF.
3. Remove the strainer clean-out plug located in the center of cap.
4. Turn the power switch ON and allow the boiler "fill water" to flush-out the drain line until no debris is seen exiting the clean-out hole.
5. Turn the power switch and the water supply OFF.
6. Turn the ON/OFF knob on the main gas valve back to ON.
7. Remove and clean the strainer as outlined under "INLINE WATER STRAINER CLEANING".

A. If the boiler blowdown is ok, then the drain line and valve are clear of debris and the valve is functioning properly.

B. If considerable lime scale debris is apparent, then not only the blowdown valve, but also the boiler and water level probes must be thoroughly cleaned. See "FILL AND COLD WATER SOLENOID VALVES" for an inspection and cleaning procedure of a solenoid valve and "BOILER" for a procedure on boiler inspection, clean-out and deliming.

INLINE WATER STRAINER CLEANING

The procedure outlined below can be used to inspect and clean the inline water strainer for the blowdown solenoid valve and, if installed, the inline water strainer for the boiler fill solenoid valve. Inline Y strainers should always be located upstream of a water solenoid valve.

NOTE: For proper operation, the strainer must be installed so the water flow is directed towards the solenoid valve and the leg of the Y with a threaded cap is pointing downwards to catch debris.

1. Turn the power switch OFF to and allow the boiler to blowdown.
2. When blowdown completes, shut OFF the water supply.
3. Remove the cap and strainer screen from the leg of the Y pointing downwards toward the floor.
4. Remove the screen from the cap and clean any accumulated debris from the screen and also remove any debris trapped in the opening of the strainer body.

NOTE: If screen can not be thoroughly cleaned, replace it with a new one.

5. Insert screen into cap then re-install cap to strainer body.
6. Turn the water supply and power switch ON and allow the boiler to reach operating pressure.
7. Turn the power switch OFF and check strainer for leaks, as the boiler blows down.

MAIN BURNER IGNITION CHECKS

The complete gas burner assembly is located inside the heat exchanger casting in the boiler. The perforated burner head functions as both pilot and main gas burner. The inner portion of the perforated burner head serves as the pilot to light the main burner during the trial for ignition. Once the main burner lights, the flame encompasses the entire perforated burner head and the pilot flame extinguishes.

If burner ignition problems are encountered, perform the following checks to ensure components are adjusted properly.

1. Turn power switch ON and allow the boiler to fill.
2. Verify "low water" and "high pressure" safety circuits are satisfied.
   - A. Water Level in boiler.
     - 1) Approximately one visible inch of water in the sight glass.
     - 2) Auxiliary LLCO is satisfied.
       - a. **N2** on relay board ON (low water safety circuit satisfied).
       - b. LED on auxiliary water level board ON.
   - B. High Limit Pressure Switch
     - 1) Zero reading on boiler pressure gauge.

     NOTE: Burner cycles ON at less than or equal to 8 PSI and OFF at 10 PSI.

     NOTE: High Limit Pressure Switch automatically resets at approximately 12 PSI.
   - C. Press the reset switch to reset the safety circuits.

   NOTE: Hi Pressure and low water lights on front control panel should be OFF.
     - 1) **N3** on relay board ON (high pressure safety circuit satisfied).
3. Verify blower is running and its operation is quiet.

   NOTE: A "noisy" blower rotation may indicate bearing wear and reduce air pressure output.
   - A. **N12** on relay board ON (120VAC supplied to the blower).
4. Verify air pressure switch is CLOSED.
   - A. **N13** on relay board ON (air pressure switch CLOSED and condition satisfied).
   - B. Pilot gas valve energized and ignition sequence starts.

   NOTE: If N13 is not ON or Pilot gas valve is not energized, then check the air pressure switch setting as outlined under "AIR PRESSURE SWITCH ADJUSTMENT".
5. Verify 24VAC to ignition module and pilot valve.
   - A. **N1** on relay board ON (24VAC is being supplied for the system).
   - B. **N13** on relay board ON (24VAC is being supplied to the ignition module).
   - C. **N14 & N15** on relay board ON (24VAC is being supplied to the pilot ignition timing circuit and the pilot valve.
6. Verify spark and pilot ignition.
   - A. If pilot lights, proceed to step 7.
   - B. If sparking occurs but pilot does not light, then check the pilot pressure setting as outlined under "GAS PILOT PRESSURE ADJUSTMENT".
   - C. If spark is not occurring:
     - 1) Restart power ON sequence by "rapidly" turning the power switch OFF then back ON. A rapid switching is needed to keep the boiler from starting automatic blowdown.
     - 2) Remove ignition cable boot from the ignitor rod terminal and check ignitor position in the burner head assembly.
     - 3) Measure distance the ignitor terminal extends past the ignitor nut. Distance should measure approximately 3/4" to 7/8". See diagram 5898 "COMPLETE BURNER ASSEMBLY" at the end of this procedure.

       NOTE: Touch ignitor terminal only and not the ceramic insulator.
       - a. If distance is ok, proceed to step 5) below and perform step "a" and "b" then continue with step "6)".
       - b. If distance is other than stated, loosen ignitor nut, set the ignitor position and then re-tighten the ignitor nut.
       - c. Re-connect ignition cable.
     - 4) Press reset switch to start the ignition process.

a. If ignitor sparks and pilot lights, proceed to step 7.

b. If ignitor does not spark, proceed to step "5)" below.

5) Restart power ON sequence by "rapidly" turning the power switch OFF then back ON. A rapid switching is needed to keep the boiler from starting automatic blowdown.

a. Grasp the ignitor terminal and rotate the ignitor approximately 45°.

b. Re-connect ignition cable.

6) Press the reset switch to start the ignition process.

a. If ignitor sparks and pilot lights, proceed to step 7.

b. If ignitor does not spark, repeat steps "5)" through this step until rod has been rotated 360°.

7. Verify main burner ignition.

A. If main burner lights and remains lit with no intermittent problems, then burner is functioning properly.

B. If main burner does not light or shows intermittent problems, then check the main burner pressure setting as outlined under "GAS MANIFOLD PRESSURE ADJUSTMENT".

1) If pressure is ok but intermittent burner problems continue, then the following components must be examined.

2) Turn the power switch OFF and allow the boiler to blowdown.

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

WARNING: SHUT OFF THE GAS BEFORE SERVICING THE UNIT.

3) Remove burner head assembly as outlined under "BURNER HEAD ASSEMBLY" in "REMOVAL AND REPLACEMENT OF PARTS".

4) The complete or intermittent loss of burner ignition or a burner operation that is loud and noisy may indicate the burner tube insulation or heat exchanger casting is damaged.

Verify the burner tube insulation and heat exchanger casting are intact.

NOTE: The suggested method for inspection is to mount a small mirror to a 2 foot long rod and insert the mirror inside the burner tube and use a flashlight to illuminate the area.

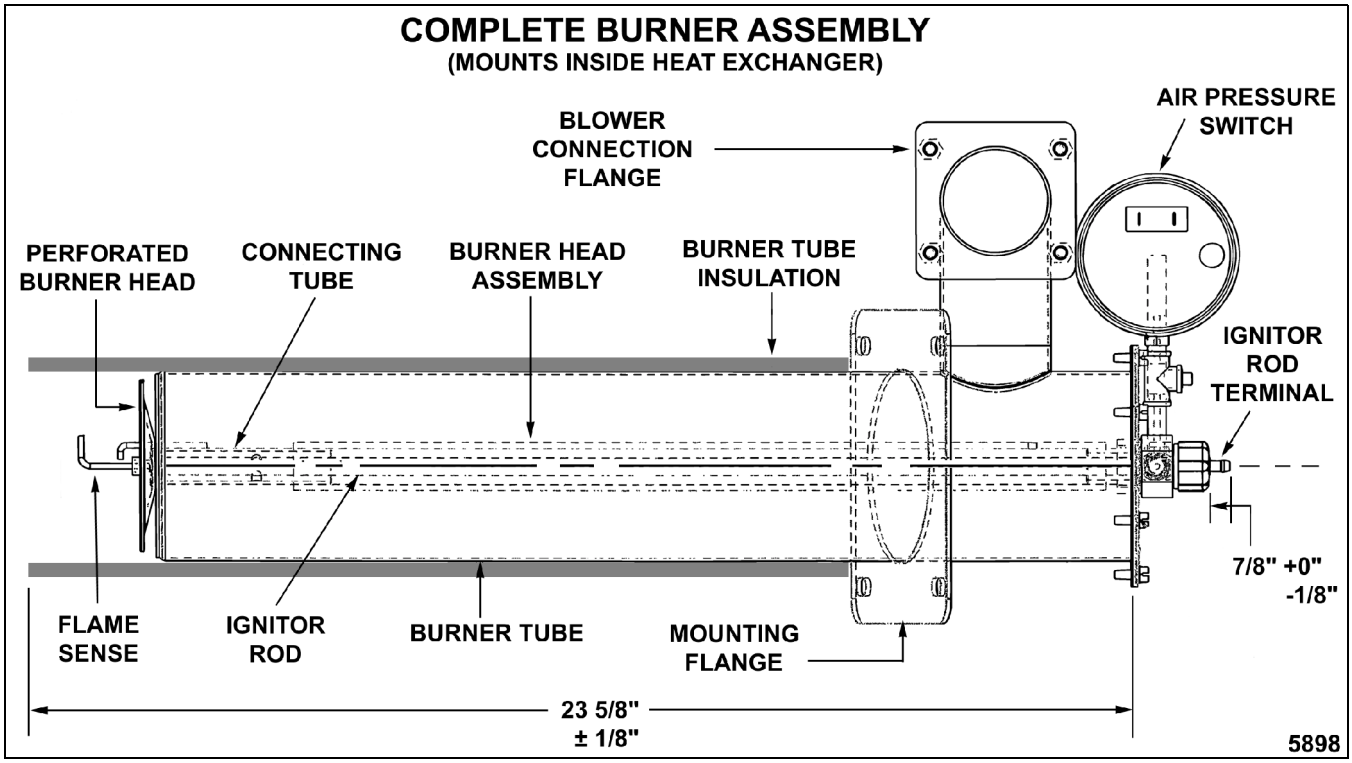
NOTE: If necessary, the complete burner tube assembly can be removed to aid in performing the measurement and inspections.

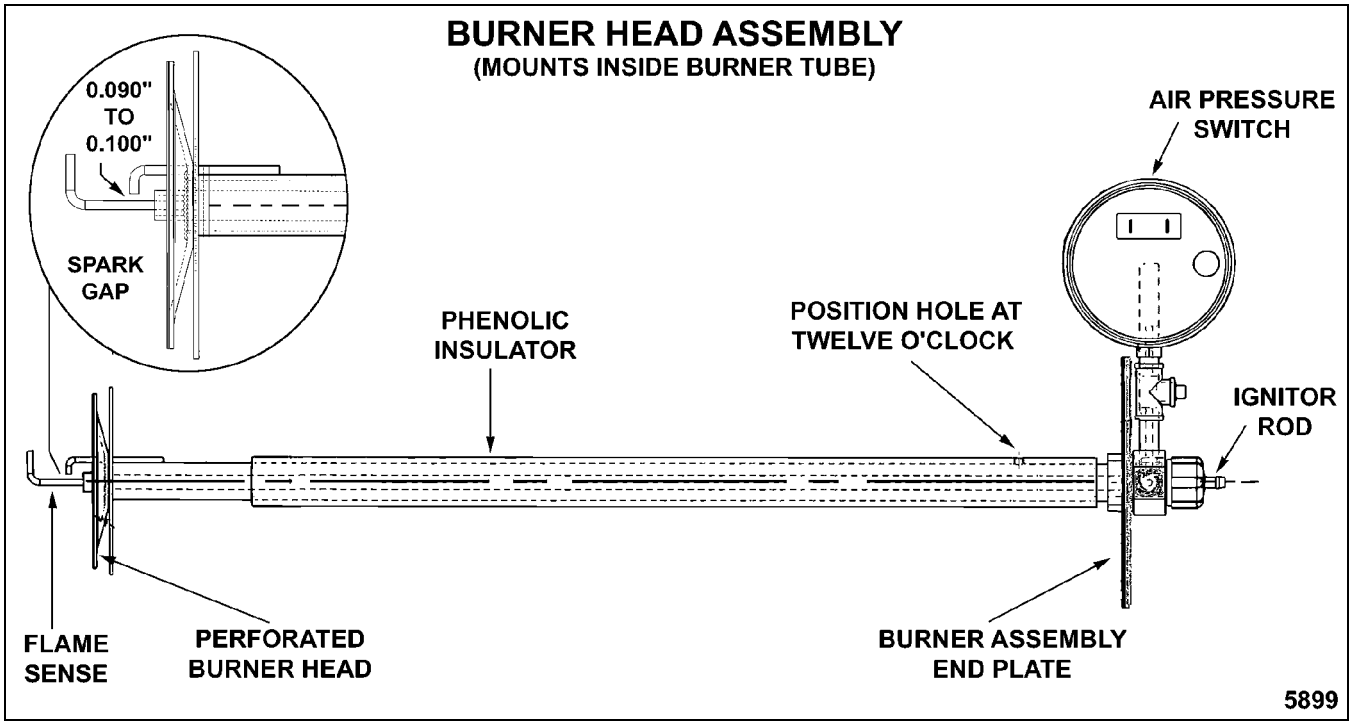
a. Inspect the ceramic insulation for damage at the area around the burner head inside the burner tube.

b. Measure ceramic insulation insertion depth/location from the end of the insulation that surrounds the burner head to the opposite end of the burner tube (end plate mounting flange). The dimension should measure approximately 23 5/8 inches ±1/8. See diagram 5898 "COMPLETE BURNER ASSEMBLY" at the end of this procedure.

c. Verify that casting debris is not clogging the "heat transfer fins" at the end of heat exchanger casting and that the fins have not eroded away.

d. Inspect the interior of heat exchanger casting for signs of water leakage. Also, signs of water leakage into the heat exchanger casting may be determined by examining the bottom area of the flue transition piece and floor.

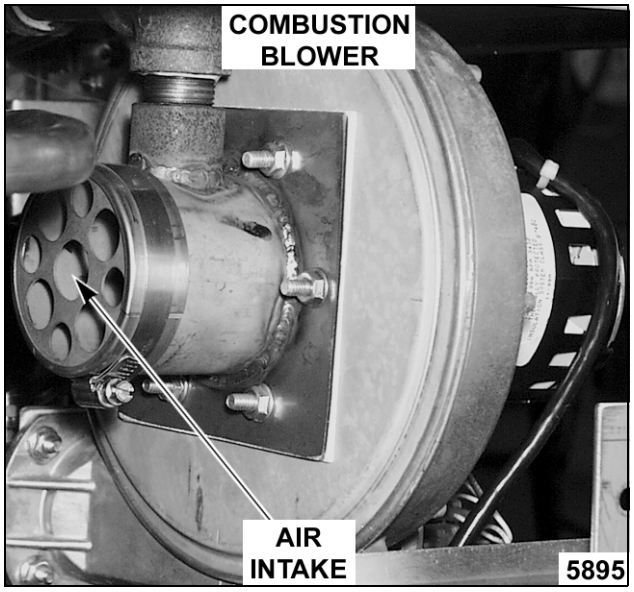

COMPLETE BURNER ASSEMBLY
(MOUNTS INSIDE HEAT EXCHANGER)
BLOWER CONNECTION FLANGE
AIR PRESSURE SWITCH
PERFORATED BURNER HEAD
CONNECTING TUBE
BURNER HEAD ASSEMBLY
BURNER TUBE INSULATION
IGNITOR ROD TERMINAL
7/8" +0" -1/8"
FLAME SENSE
IGNITOR ROD
BURNER TUBE
MOUNTING FLANGE
23 5/8" ± 1/8"
5898


BURNER HEAD ASSEMBLY
(MOUNTS INSIDE BURNER TUBE)
0.090" TO 0.100"
SPARK GAP
AIR PRESSURE SWITCH
PHENOLIC INSULATOR
POSITION HOLE AT TWELVE O'CLOCK
IGNITOR ROD
FLAME SENSE
PERFORATED BURNER HEAD
BURNER ASSEMBLY END PLATE
5899

AIR PRESSURE SWITCH ADJUSTMENT

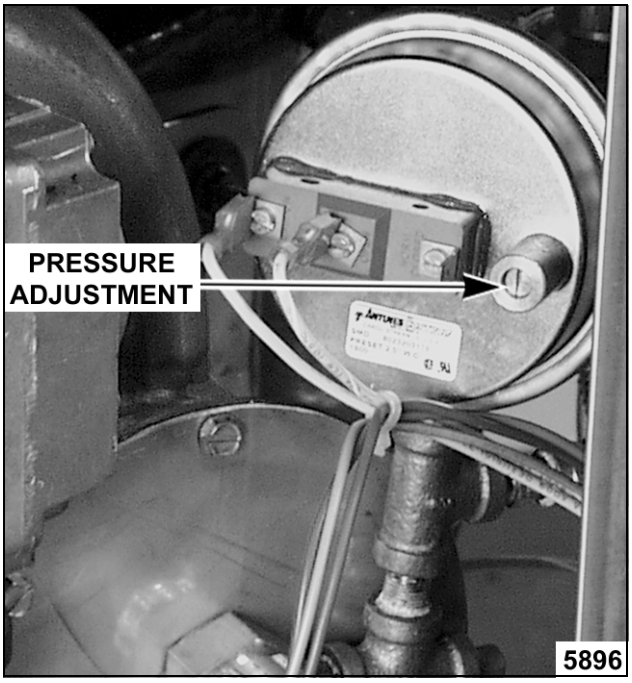
The air pressure switch senses the pressure level produced by the blower for combustion. When the pressure is sufficient, the switch closes and supplies power to the ignition control module. The gas ignition sequence starts to light the gas pilot and then main burner. If the gas pilot is not lighting (valve not energized), the ignition control module may not be receiving power, assuming the minimum water level is satisfied. Check the air pressure switch operation then adjust if necessary as outlined in the procedure below.

1. Turn the power switch OFF.
2. Remove the left side panel from the cabinet base.
   A. Inspect the air intake to the blower for debris build up and clogging.



   1) If debris is found, clean it away from the air intake.

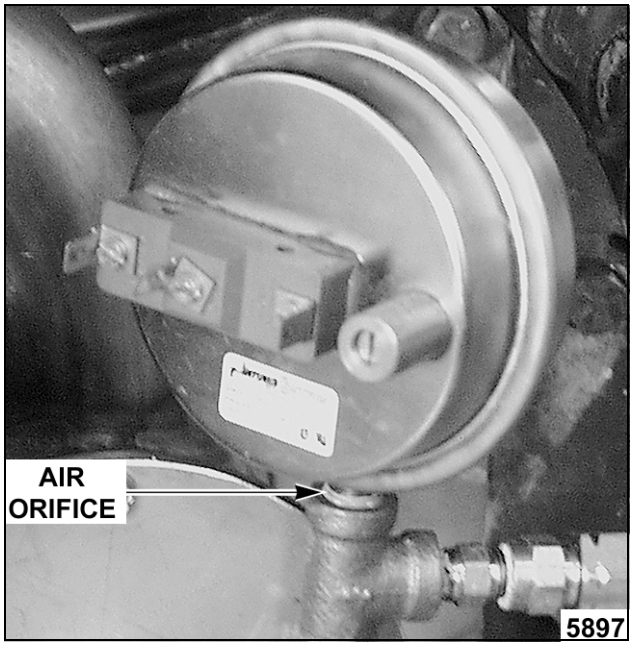
   B. Turn the power switch ON and verify main burner ignition.
      1) If burner ignites then no adjustment to the pressure switch setting is necessary.
      2) If burner does not ignite, proceed to step 3.
3. Open the cabinet base door and turn the ON/OFF knob for the main gas valve to OFF.
4. Adjust the air pressure switch setting as follows:



   A. Turn the adjustment screw fully clockwise to the highest setting.
   B. Slowly turn the adjustment screw counterclockwise until the pilot gas valve energizes then add ½ turn to the adjustment.

NOTE: The screw head should not extend out past the screw housing.

   1) If Pilot gas valve energizes, proceed to step 5.
   2) If Pilot gas valve does not energize, check the following:
      a. Remove the lead wires from the switch and verify with a meter that the switch contacts are closing with the blower ON. If necessary, continue to turn the adjustment screw several turns counterclockwise to CLOSE the switch contacts.
      b. If the switch contacts are not closing, turn the power switch OFF, remove the pressure switch from the TEE and check the air orifice for debris build up and clogging. If debris is found, clean it away from the orifice.



c. Replace the orifice, pressure switch and connect the lead wires to the switch. Turn the power switch ON and adjust the pressure switch again as outlined in steps 4A and 4B. Verify the pilot gas valve is energizing.

d. If the pilot gas valve is not energizing and power is available to the pressure switch, turn the power switch OFF. Replace with a new air pressure switch and adjust the switch as outlined from step 3 thru the end of this procedure.

5. Restart the ignition sequence by "rapidly" turning the power switch OFF then back ON. A rapid switching is needed to keep the boiler from starting automatic blowdown.

   A. Press the reset switch to start the ignition process.

      1) Listen for gas pilot ignition to verify operation.

         a. If gas pilot ignition is successful, turn the ON/OFF knob for the main gas valve back to ON.

         b. Listen for main gas burner ignition to verify operation.

   B. Verify the pilot and main burner both ignite in succession.

      1) Restart the ignition sequence by "rapidly" turning the power switch OFF then back ON. A rapid switching is needed to keep the boiler from starting automatic blowdown.

      2) Press the reset switch to start the ignition process.

   C. Listen for main gas burner ignition to verify operation.

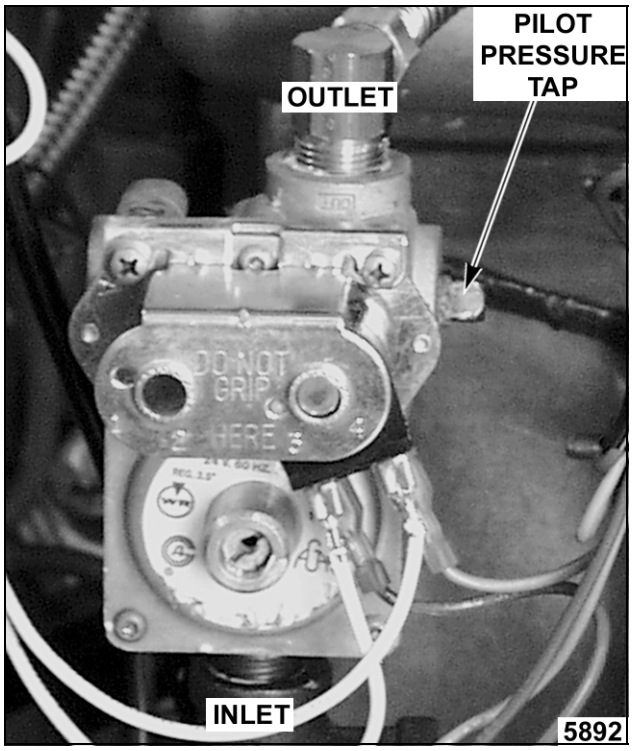
GAS PILOT PRESSURE ADJUSTMENT

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

WARNING: SHUT OFF THE GAS BEFORE SERVICING THE UNIT.

1. Open the cabinet base door to access pilot gas valve.

2. Remove the pilot pressure plug tap from the outlet side of valve.



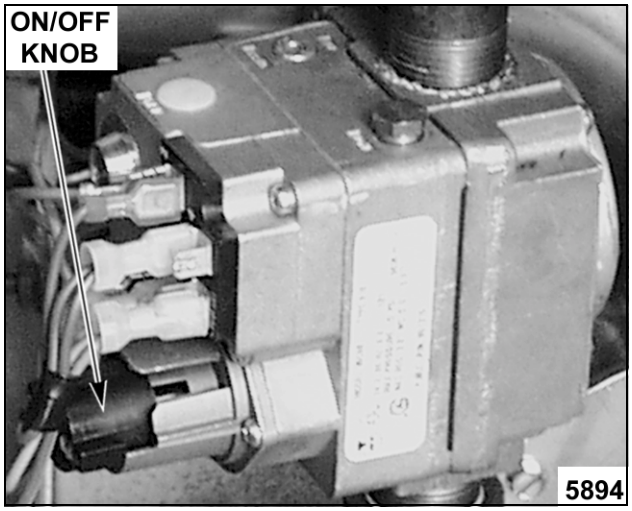
   A. Install a hose barb adaptor and attach a gas pressure manometer.

3. Turn the gas supply and power switch ON.

   A. Once the boiler fills, press the reset switch to start the ignition process.

   NOTE: The reset switch can be pressed after the green ready light on the switch comes ON. This indicates the water level in the boiler is at the minimum operating level.

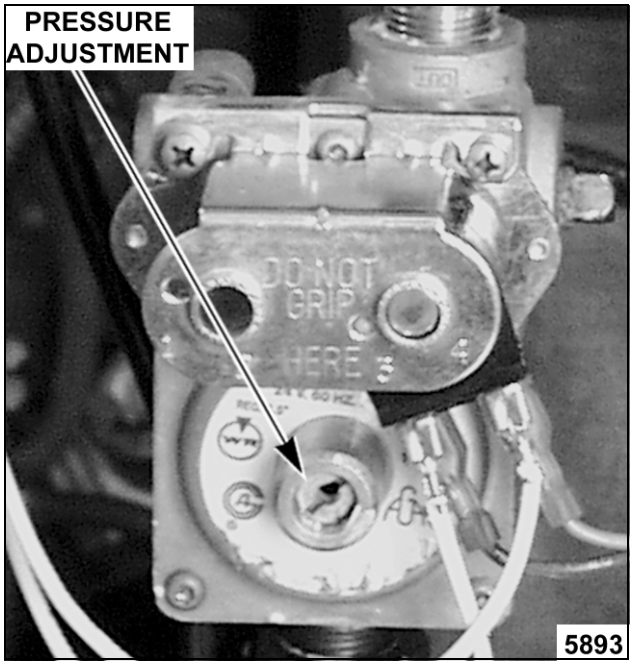
4. After the main burner lights, allow the boiler to reach operating pressure then turn the ON/OFF knob for the main gas valve to OFF.



5. Restart the ignition sequence by "rapidly" turning the power switch OFF then back ON. A rapid switching is needed to keep the boiler from starting automatic blowdown.
   A. Press the reset switch to start the ignition process.
6. After the pilot burner lights, compare the manometer pressure reading to the pressure chart near the end of this procedure.

NOTE: The pilot gas valve operates on a time delay circuit and will only be energized for approximately 15 seconds to light the main burner then shut OFF. The pilot pressure reading must be taken while the pilot valve is energized within this time interval. After the main burner ignition time expires, the ignition control module will sense there is no flame present and will then try to re-establish a flame to light the main burner. This cycle will continue to repeat until the main gas valve is turned back ON.

   A. If the pressure is <u>not</u> correct, proceed to step 7 to adjust.
   B. If the pressure is correct, turn the power switch OFF, replace the adjustment screw cap and pilot pressure plug tap to the gas valve. Turn the knob on the main gas valve back to ON.
7. Remove the adjustment screw cap to access the pressure adjustment screw.



8. With the burner lit, set the pressure as outlined below.
   A. To increase pressure, turn the screw <u>clockwise</u>.
   B. To decrease pressure, turn the screw <u>counterclockwise</u>.

NOTE: Accurate gas pressure adjustments can only be made with the gas ON and the burner lit.

GAS TYPE	PRESSURE READINGS (INCHES W.C.)		
	PILOT MANIFOLD	LINE	
		MINIMUM RECOMMENDED	MAX
Natural	3.5	7.0	14.0
Propane	3.5	11.0	

NOTE: If the incoming line pressure is <u>less</u> than the minimum recommended, then the manifold pressure can not be set correctly.

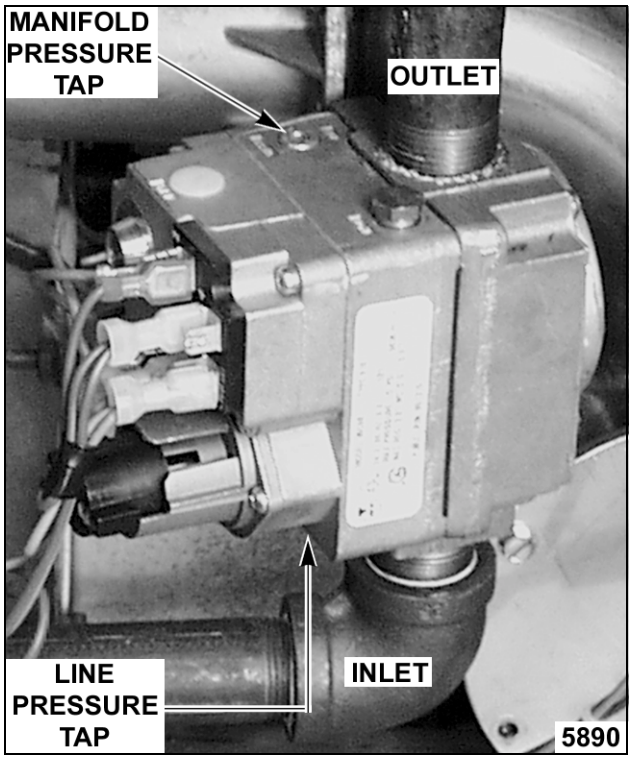
9. Once the correct pressure has been set, turn the gas supply and power switch OFF. Replace the adjustment screw cap and pilot pressure plug tap on the valve.
10. Turn the knob on the main gas valve to ON, the gas supply ON and check for proper operation.

GAS MANIFOLD PRESSURE ADJUSTMENT

WARNING: DISCONNECT THE ELECTRICAL POWER TO THE MACHINE AT THE MAIN CIRCUIT BOX. PLACE A TAG ON THE CIRCUIT BOX INDICATING THE CIRCUIT IS BEING SERVICED.

WARNING: SHUT OFF THE GAS SUPPLY BEFORE SERVICING THE UNIT.

1. Open the cabinet base door to access main gas valve.
2. Remove the manifold pressure tap plug from the outlet side of valve.



   A. Install a hose barb adaptor and attach a gas pressure manometer.

3. Turn the gas supply and power switch ON.

   A. Once the boiler fills, press the reset switch to start the ignition process.

   NOTE: The reset switch can be pressed after the green ready light on the switch comes ON. This indicates the water level in the boiler is at the minimum operating level.

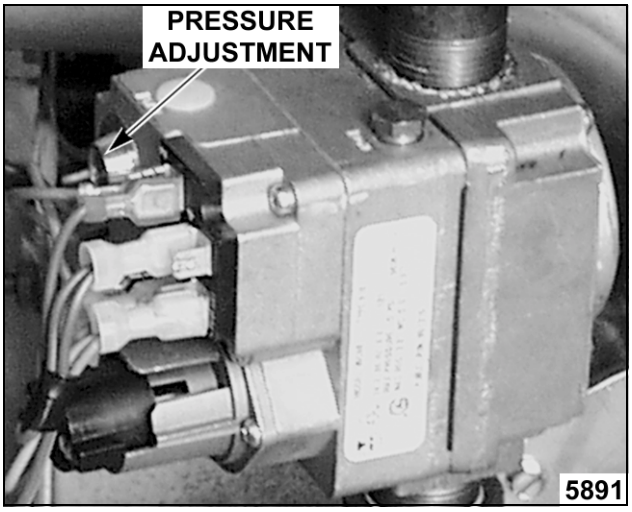
4. After the main burner lights, allow the boiler to reach operating pressure then compare the gas manometer pressure reading to the pressure chart near the end of this procedure.

   A. If other appliances are connected to the same gas line, turn them all ON and check manometer pressure reading again. If the pressure drops ½ inch water column or more, then the gas supply needs to be checked by the gas line installer or the local gas company for adequate sizing.

   NOTE: The gas supply line to the steamer should be a minimum of one inch diameter (ID).

   B. If the pressure does not drop as described above but the manifold pressure still requires adjustment, proceed to step 5.

5. Remove the adjustment screw cap to access the pressure adjustment screw.



6. With the burner lit, set the pressure as outlined below.

   A. To increase pressure, turn the screw clockwise.

   B. To decrease pressure, turn the screw counterclockwise.

NOTE: Accurate gas pressure adjustments can only be made with the gas ON and the burner lit.

GAS TYPE	PRESSURE READINGS (INCHES W.C.)		
	BURNER MANIFOLD	LINE	
		MINIMUM RECOMMENDED	MAX
Natural	3.0	7.0	14.0
Propane	3.0	11.0	

NOTE: If the incoming line pressure is less than the minimum stated, then the manifold pressure can not be set correctly.

7. Once the correct pressure has been set, turn the gas supply and power switch OFF. Replace the adjustment screw cap and manifold pressure plug tap plug on the valve.
8. Turn the gas supply on and check for proper operation.

IGNITION CONTROL MODULE CHECKS

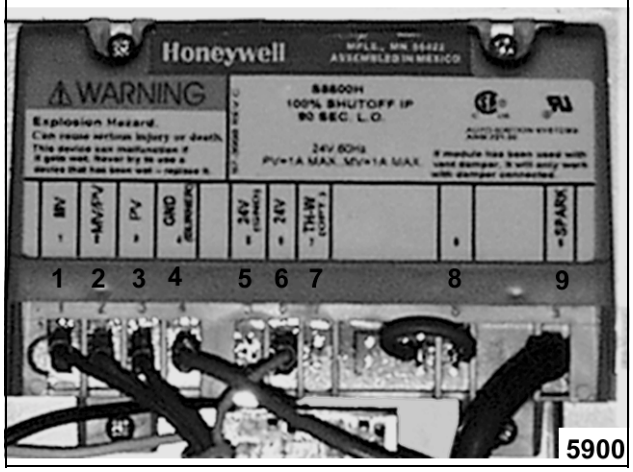
1. Turn the power switch ON and allow the boiler to fill.
2. Aux. water level control satisfied and high limit closed.
3. Press the reset switch.
   A. Combustion blower comes on and generates pressure to close the air pressure switch contacts.
   B. Ignition control module is energized and trial for ignition starts. Check for 24VAC between terminals five and six.
   C. Ignition module closes the internal pilot valve contacts. Check for 24 volts between terminals two and three.
      1) High voltage is sent from terminal nine to the spark electrode and sparking begins.
      2) At the same time, pilot timing circuit (control board) and pilot valve are both energized allowing gas flow to the pilot.

      NOTE: The pilot valve will be energized by the relay board timer circuit for approximately 15 seconds to light the main burner.
   D. Pilot ignition is established (pilot lit), and main gas valve is energized. Check for 24 volts between terminals one and two.
      1) Sparking stops.
      2) Ignition module monitors main burner flame.
      3) After 15 seconds relay board timer times out.
         a. Pilot valve de-energized.
   E. As long as the ignition control module is sensing a burner flame through the ignition cable on terminal nine, the internal main voltage (MV) and pilot (PV) contacts (N.O.) remain closed.

   NOTE: If pilot flame is not sensed within 15 seconds, you can re-start the ignition sequence.
   F. "Rapidly", turn the power switch OFF then ON. A rapid switching is needed to keep the boiler from starting automatic blowdown. Then press the reset button.

   NOTE: If the power is not re-set, the ignition module continues sparking for a total of 90 seconds, then locks out. The module remains locked out until the power switch is turned to OFF then back ON and the reset switch is pressed to re-start the ignition trial cycle.

IGNITION MODULE



Terminals:

1. Main Valve - 24VAC will be present on terminal #1 with the flame sensing electrode sensing an adequate burner fame. This output voltage will remain present as long as the burner flame remains adequate.
2. MV/PV (common).
3. Pilot Valve - 24VAC will be present on terminal #3 at the instant an input voltage is supplied to the module. This output voltage will remain present on terminal #3 providing an adequate pilot flame is established within 90 seconds. In the event that an adequate pilot flame is not established within 90 seconds this output voltage will drop out.
4. Ground (burner).
5. 24VAC Neutral (ground).
6. 24VAC Input.
7. High Voltage to spark electrode. Provides high output voltage (13kv peak) to the spark electrode to light the gas pilot. Once pilot is lit, provides a path for flame current sensing by the Ignition Module via the spark electrode high voltage cable on terminal #9.

Spark Verification Test

1. Turn the power switch OFF.
2. Check to ensure that all electrical terminal connections on the ignition control module and the ignitor rod are clean and tight. If the ignition cable appears to be damaged, replace it and re-try lighting burner.
3. Verify that the ignition control module and the burner ground have a good ground connection.
   A. If loose connections are found, make the necessary adjustments and check for proper operation.
   B. If connections are ok but sparking does not occur, proceed to step 4.
4. Remove ignition cable boot from the ignitor rod terminal and check ignitor position in the burner head assembly.
   A. Measure distance ignitor terminal extends past ignitor nut, approximately 3/4" to 7/8". See diagram 5898 "COMPLETE BURNER ASSEMBLY" under "MAIN BURNER IGNITION CHECKS".

      NOTE: Touch ignitor terminal only and not the ceramic insulator.

      1) If distance is ok, proceed to step 5 and perform steps B thru E.
      2) If distance is other than stated, loosen ignitor nut, set the ignitor position.
      3) Re-connect ignition cable.

   B. Turn the power switch ON and allow the boiler to fill.
   C. Press reset switch to start the ignition process.
      1) If pilot lights, then ignition system is working properly.
      2) If ignitor does not spark, proceed to step 5.
5. Turn the power switch OFF.
   A. Remove ignition cable boot from the ignitor rod terminal.
   B. Grasp the ignitor terminal and rotate the ignitor approximately 45°.

   NOTE: Touch ignitor terminal only and not the ceramic insulator.

   C. Re-connect ignition cable.
   D. Turn the power switch ON and allow the boiler to fill.
   E. Press reset switch to start the ignition process.
      1) If pilot lights, then ignition system is working properly.
      2) If ignitor does not spark, repeat steps E thru this step until rod has been rotated 360°.
      3) If ignitor still does not spark, proceed to step 6.

WARNING: SHUT OFF THE GAS BEFORE SERVICING THE UNIT.

6. Turn the power switch OFF.
7. Remove the burner head assembly as outlined under "BURNER HEAD ASSEMBLY" in "REMOVAL AND REPLACEMENT OF PARTS" and check the following:
   A. The gap between the spark probe and the ground pin should be approximately 0.090" to 0.100". Adjust as necessary. See diagram 5899 "BURNER HEAD ASSEMBLY" under "MAIN BURNER IGNITION CHECKS".
   B. Inspect the ceramic flame rod insulator for cracks or evidence of exposure to extreme heat, which can permit leakage to ground. If either of these conditions exist, then replace ignitor rod and re-test.
      1) If replacing ignitor rod, loosen the ignitor rod mounting nut and remove the ignitor rod from the burner head assembly.

WARNING: THE FOLLOWING STEPS REQUIRE POWER TO BE APPLIED TO THE UNIT DURING THE TEST. USE EXTREME CAUTION AT ALL TIMES.

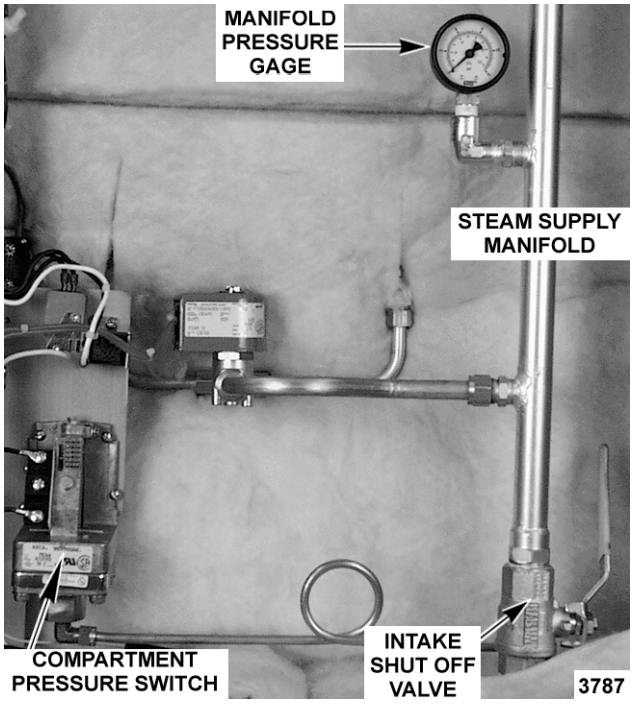
8. Verify spark at electrode.
   A. Place the assembly on the floor and attach a temporary ground wire from the burner ground on the heat exchanger to the burner head assembly.
   B. Turn the power switch ON and press the reset switch.
   C. Observe spark condition from ignitor.
      1) If a good spark from ignitor is present then the ignition system is working properly.
      2) If ignitor is still not sparking, replace the ignition control module and repeat steps 8A and 8B to check for proper operation.
      3) After making the necessary component adjustments or replacements, re-assemble and check for proper operation.

COOKING COMPARTMENT

NOTE: For access to compartment controls, remove the right side compartment panel.

Intake Shut-Off Valve Adjustment (Steam Flow)

1. With the right side compartment panel removed, open the intake shut-off valve completely.
2. If the steamer ready light is on, then proceed to step 4.
3. If the boiler is off, then turn main power switch ON and allow boiler to heat up until steamer ready light comes on. Allow boiler to cycle 2 to 3 times, then proceed to step 4.



4. Turn both cooking timers on.
5. Monitor the boiler until heat source turns off.
6. At that time, adjust the intake shut-off valve until the manifold pressure gauge reads 9 ±1 psi. The valve setting should be made while the boiler pressure is at the upper cycling limit.
7. Monitor gauge reading 1 to 2 cycles to ensure pressure is set correctly.
8. Once the valve is set, turn both cooking timers off and reinstall right side compartment panel.

Door Sealing Adjustment

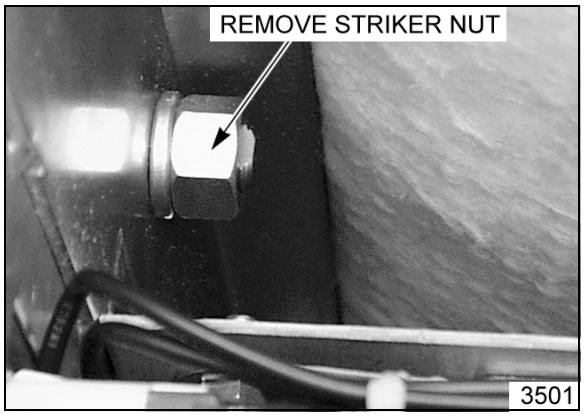
1. Check the door gasket quality. If damaged or worn, replace as outlined in "REMOVAL" under "COOKING COMPARTMENT DOOR(S)".
2. Loosen screws until the screw heads no longer touch the gasket plate.
3. Tighten screws until screw head touches gasket plate and at that point begin counting turns.
4. Tighten all screws approximately two turns.
5. Close the door and check for proper operation.
   A. If necessary, tighten all screws an additional 1/2 turn and repeat step 5.
6. Repeat step 5 until the door closes properly and no steam leaks are seen around the gasket seal.

Door Latch Adjustment

Should the cooker door jam and can not be opened, DO NOT FORCE OR PRY the door as damage will occur.

First, try lifting up on the bottom of the door at the handle end to disengage the latch. If that does not work, remove the right side panel.

The striker that catches on the door latch is located behind the front face of the cooking cavity. Remove the nut from the striker and this will release it from the panel.



Once the nut and washer have been removed, door will open freely.

Remove any burrs on the striker that may cause the latch to stick. Reinstall the striker and adjust, so door will not jam.

To adjust:

1. Reinstall the striker with the slot pointing upwards and hand tighten nut only.
2. Close the door to center the striker in the oval mounting hole.
3. Open the door and check the strikers' slot for horizontal alignment. The slot on the striker must be kept horizontal in order for the door latch to catch it properly and latch.

4. Once the proper slot alignment has been set, hold the striker close to its base using a rag and vise grips, then tighten the striker nut. Be careful not to damage the striker slot when tightening or door may not latch properly.

NOTE: Do not over tighten as the striker will begin to turn and change alignment.

ELECTRICAL OPERATION

WATER LEVEL CONTROLS

Low Level Cut-Off & Differential Control

The steamer is equipped with three water level sensing probes (high, low and low level cut-off) and a single water level control board (solid state). The water level control board performs two functions: 1) Provide low level cut-off protection to shut off the heat source in case the water level drops below the low level cut-off (LLCO) probe. 2) Perform as a differential level control to maintain the water level between the low and high water level probes.

The water level control (WLC) has input voltage (120VAC) across terminals 11 and 12 which powers the primary side of the transformer. On one side of the transformer secondary, power is provided to the control by a series path through chassis ground (terminal 10). The other side of the transformer secondary (12VAC) is attached to the probe that directs power to the other side of board relay coils (LLCO and HL) and to the Inverse Latching Relay (ILR) electronic circuit on the board. As water enters the boiler, it becomes part of the water level control's circuit. When the water level in the boiler reaches a probe, that circuit is completed.

The inverse latching relay of the board is de-energized, leaving the ILR-1 (N.O.) and ILR-2 (N.C.) contacts in their shelf state.

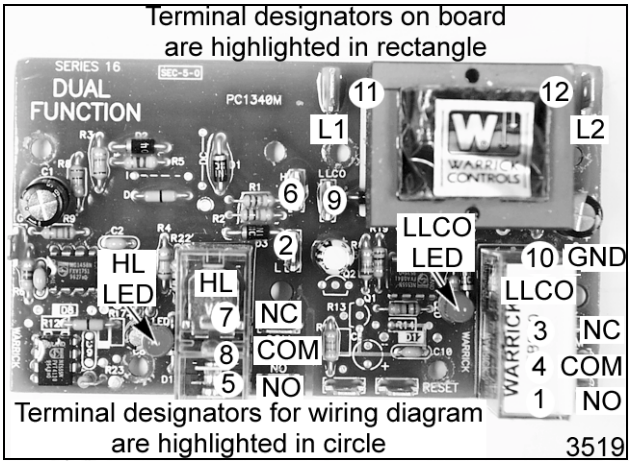
When the main power switch is turned ON, power is supplied to the WLC board which energizes the high level (HL) relay, closes HL-3 normally open contacts, and illuminates the HL relay LED. With the HL-3 contacts closed, the boiler fill solenoid is energized and water begins filling the boiler.

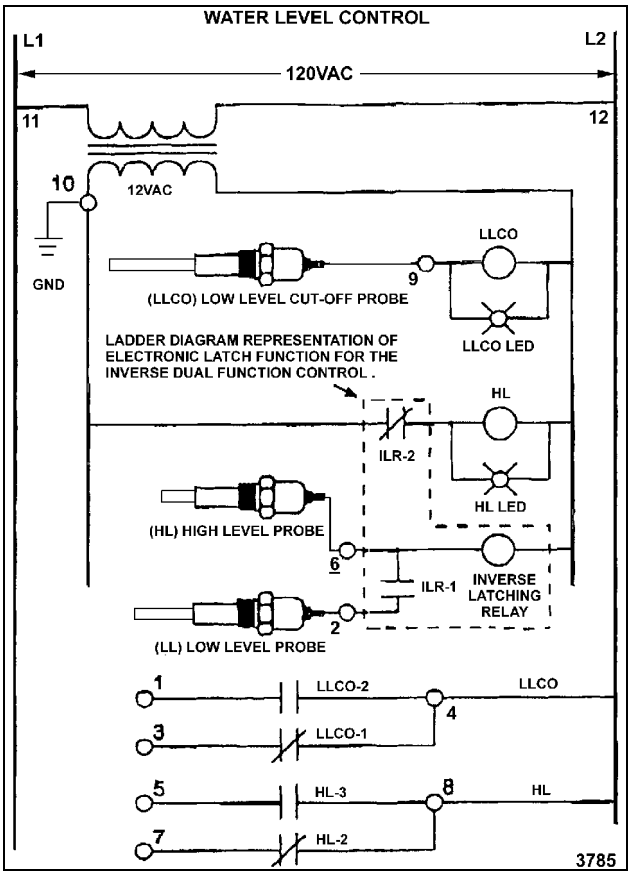
When the water level reaches the low level cut-off (LLCO) probe, the LLCO relay is energized and illuminates the LLCO LED. With the LLCO-2 contacts closed the heat source is then energized. The LLCO relay will remain energized and its LED will stay lit until the water level in the boiler drops below the LLCO probe. **NOTE:** Auxiliary control(s) in the heating circuit must also be satisfied before heating can start.

When the water level reaches the low level (LL) probe, power to terminal 2 on the WLC board is present but no switching occurs.

After the water level reaches the high level (HL) probe, the inverse latching relay of the board is energized and locked through the low level probe (LL) and ILR-1 contacts. With ILR-2 contacts open, this de-energizes the HL relay and the HL LED goes out. With the HL-3 contacts open, the boiler fill solenoid is de-energized, stopping the flow of water into the boiler.

When the water level drops below the low level (LL) probe, power is removed from the inverse latching relay, the HL relay energizes through ILR-2 and HL contacts change state. The fill solenoid is energized through HL-3 to refill the boiler and the HL LED is lit. The HL relay and LED will toggle ON and OFF during a cooking cycle as needed.





Auxiliary Low Level Cut-Off

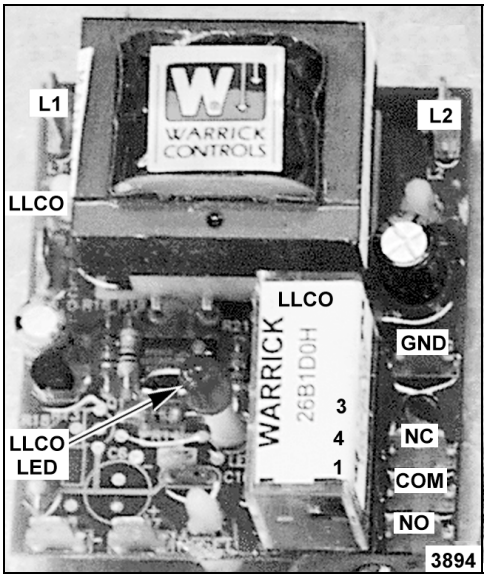
This control serves as a safety backup to the main water level control (WLC) board to meet CSD-1 code requirements. The operation of the auxiliary control is identical to the low level cut-off (LLCO) function of the main WLC board but performs a single function: 1) Provide auxiliary low level cut-off protection to shut off the heat source in case the water level drops below the low level cut-off (LLCO) probe. A single LLCO probe, identical to the LLCO probe on the main WLC board, is connected to the auxiliary control.

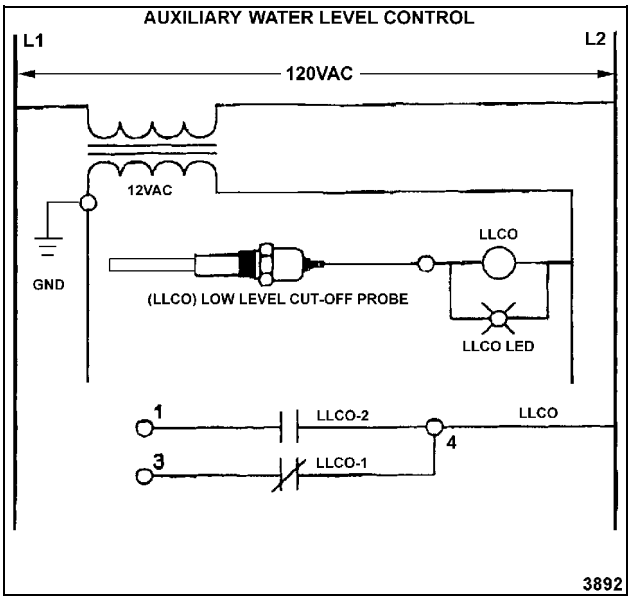
The auxiliary water level control (WLC) has input voltage (120VAC) across terminals 11 and 12 which powers the primary side of the transformer. On one side of the transformer secondary, power is provided to the control by a series path through chassis ground (terminal 10). The other side of the transformer secondary (12VAC) is attached to the control that directs power to the other side of the internal relay (LLCO). As water enters the boiler, it becomes part of the auxiliary water level control's circuit. When the water level in the boiler reaches the LLCO probe, the circuit is completed.

When the main power switch is turned ON, power is supplied to the auxiliary WLC board but no switching occurs. Also, the low water level indicator light (amber) on the boiler base control panel comes on.

When the water level reaches the low level cut-off (LLCO) probe, the LLCO relay is energized (LLCO-2 close) and the LLCO LED lights up. The LLCO relay will remain energized and its LED will stay lit until the water level in the boiler drops below the LLCO probe.

When the boiler stops filling, press the manual reset switch on the boiler base control panel. This turns off the low water light, energizes the combustion blower and allows the ignition cycle to begin.

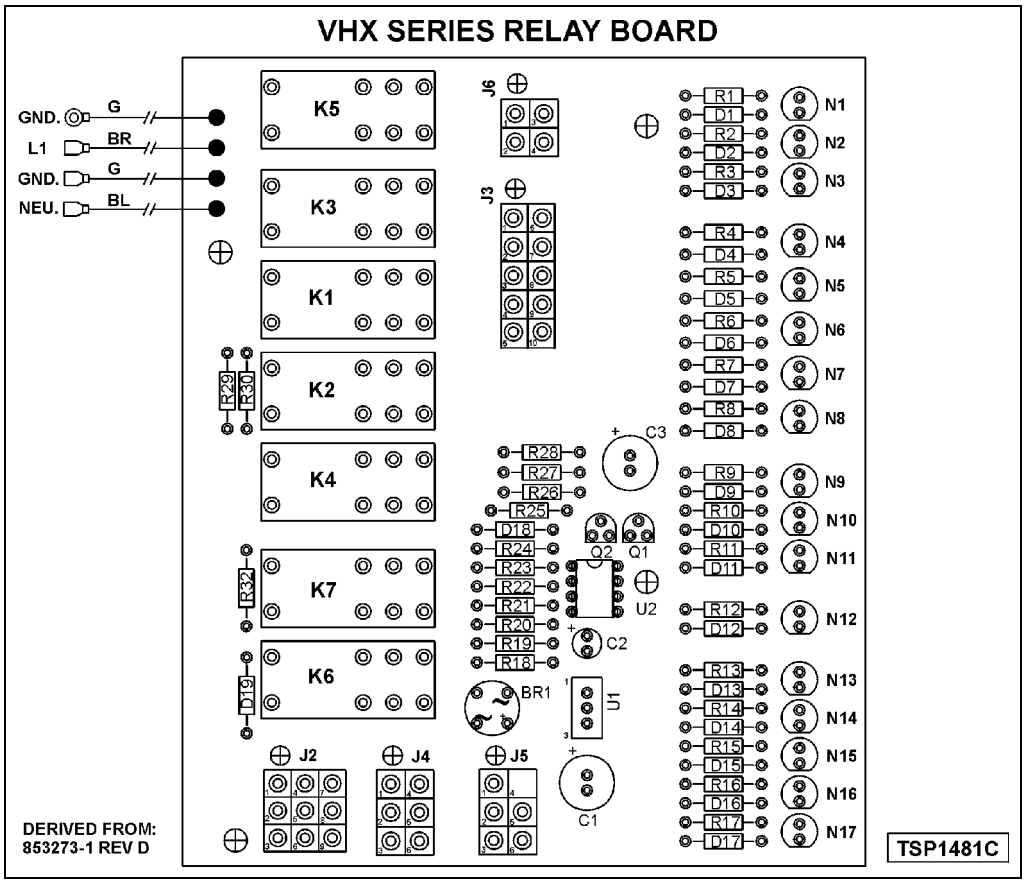




RELAY BOARD

Board Layout and LED Legend

The relay board Provides a centralized location for wire harness connections and power transfer through board relays (K1-K7) to the other steamer controls. Also, provides a condition or component troubleshooting indicator by utilizing seventeen LED'S on the board to represent the status of the condition or component in the operating sequence. When the condition for the component being monitored is satisfied or activated, an LED will light to indicate its proper operation. If the corresponding LED does not light then the condition or component has not been satisfied or is not activated.



LED LEGEND			
LED ON = Condition satisfied or component activated. [1] LED OFF = Condition not satisfied or component de-activated.			
LED	DESCRIPTION	LED	DESCRIPTION
N1	Board powered (24vac).	N10	Auxiliary water level satisfied (LLCO) and reset switch activated.
N2	Auxiliary water level satisfied (LLCO).	N11	Boiler operating pressure condition satisfied and reset switch activated.
N3	High limit pressure switch closed.	N12	Combustion blower ON.
N4	Steamer is ready (ready light "green" is ON).	N13	Combustion blower air pressure switch satisfied.
N5	Auxiliary water level satisfied (LLCO) and reset switch activated.	N14	Ignition module pilot voltage (PV) to board level timing circuit.
N6 [1]	Low water condition exists (N2 LED ON) or previously existed. If water level condition is satisfied and the reset switch is activated then N6 LED will turn off.	N15 [2]	Pilot voltage (PV) to pilot gas valve.
N7	Boiler pressure condition satisfied and reset switch activated.	N16	Ignition module main voltage (MV) to low water level contacts (LLCO) on water board.
N8 [1]	Boiler High pressure condition exists (N3 LED ON) or previously existed. If boiler pressure condition is satisfied and the reset switch is activated then N8 led will turn off.	N17	Low water level satisfied (LLCO) and main voltage (MV) from ignition module is supplied to main gas valve.
N9	Cycling pressure switch CLOSED "call for heat".		
NOTES: 1. At initial power on, N6 & N8 led's will be ON until conditions are satisfied and reset switch is activated. 2. Board level timing circuit energized and powers pilot gas valve for approximately 15 seconds then de-energizes.			

Boiler Operational Status (LED Indicator)

Use the tables below to determine the operational status of a component or condition by utilizing the LED indicators on the board. The operational state's are divided into categories A thru F.

Initial Conditions: (STATE A)

- 120V, water and gas supplied to steamer
- Power Switch ON
- HIGH PRESS and LOW WATER lights ON (amber, front control panel)
- Green "ready" light OFF
- Water is filling boiler

LED	STATUS		DESCRIPTION	ELECTRICAL COMPONENTS CONDITION
	ON	OFF		
N1	X		24V supplied to relay board	
N2		X	Aux Water level not satisfied	Aux. LLCO contacts OPEN
N3	X		High limit pressure switch satisfied	K2 energized - K2(1) CLOSE, K2(2) CLOSE
N4		X	Aux Water level is initially not satisfied. Therefore N4 is OFF	K1(1) OPEN
N5		X	Reset switch is not being energized	
N6	X		Aux Water level is/was not satisfied	K3 not energized
N7		X	Reset switch is not being energized	
N8	X		High Limit pressure switch is/was not satisfied	K4 not energized
N9	X		Cycling pressure switch is closed and unit is calling for HEAT	
N10 through N17 remain OFF				

Aux Water Level Satisfied: (STATE B)

- Green "ready" light ON (ready light remains ON, until a LOW WATER or HIGH PRESSURE) condition occurs.

Status of LED's are the same as "Initial Conditions" except for the following:

LED	STATUS		DESCRIPTION	ELECTRICAL COMPONENTS CONDITION
	ON	OFF		
N2	X		Aux water level is satisfied	Aux. LLCO relay energized, Aux. LLCO contacts CLOSED
N4	X		Aux LLCO water level and high limit are satisfied. Green "ready" light ON.	K1 energized - K1(1) CLOSE

Reset Engaged: (STATE C)

User presses/engages the RESET button

- LOW WATER and HIGH PRESSURE lights OFF (amber, front control panel)

LED	STATUS		DESCRIPTION	ELECTRICAL COMPONENTS CONDITION
	ON	OFF		
N1	X		same as “state A”	
N2	X		same as "state B"	
N3	X		same as “state A”	
N4	X		same as "state B	
N5	X		Reset switch is/was momentarily energized	K3 energized - K3(1) CLOSE (locking circuit)
N6		X	Aux Water level is satisfied. (Amber WATER light OFF)	K3 energized - K3(1) OPEN
N7	X		Reset switch is/was momentarily energized	K4 energized - K4(1) CLOSE (locking circuit)
N8		X	High Limit is satisfied. (Amber HIGH PRESS OFF)	K4 energized - K4(1) OPEN
N9	X		same as “state A”	
N10	X		High limit is satisfied and reset switch energized	K3(2) CLOSE
N11	X		Aux Water level is satisfied and reset switch energized	K4(2) CLOSE, K5 energized
N12	X		Air intake blower receiving power	K5(1) CLOSE
N13-N17 remain OFF				

Air Pressure Switch Satisfied: (STATE D)

Assume water level control “LLCO” is satisfied (LLCO contacts closed)

N1 thru N12 same as “Reset Engaged: (state C)"

LED	STATUS		DESCRIPTION	ELECTRICAL COMPONENTS CONDITION
	ON	OFF		
N13	X		Air pressure switch satisfied	24V to ignition module (term 6)
N14	X		Ignition module PV coil energized	PV CLOSE, 24V to K7
N15	X		Pilot gas valve is energized. **Note:** N15 and the pilot gas valve will be ON for approximately 15 seconds, then turn OFF.	K7 energized K7(1) CLOSE, relay board timer circuit energized and starts time count. K6 energized K6(1) CLOSE, pilot gas valve coil energized for 15 sec. only.
N16	X		Ignition module PV coil energized, pilot ignition flame is detected	MV CLOSE, 24V to water level board LLCO contacts
N17	X		Water level board LLCO is satisfied and main gas valve is receiving power.	Main gas valve coil energized, main burner lights and flame continues to be detected.

Burner ON, Boiler Heating to generate steam: (STATE E)

All LED’s ON except N6 & N8, N15 (still OFF from state D)

Burner OFF, Boiler Pressure Satisfied: (STATE F)

These LED’s should be OFF - N6, N8, N9, , N10, N11, N12, N13, N14, N15 (still OFF from state D) N16 & N17

These LED’s should be ON - N1 thru N5, N7

SEQUENCE OF OPERATION

NEW STYLE CONTROLS - BOILER

This sequence of operation is written for boiler bases with the new style boiler controls. See "BOILER CONTROL STYLES" under "GENERAL". Refer to schematic diagram TSP1480.

Initial Fill and Preheat

Conditions.

A. Power switch OFF.

B. Boiler connected to correct voltage (120VAC).

C. Boiler properly grounded.

D. Gas and water supply valve(s) ON.

E. Main gas valve manual valve in ON position

F. Cycling pressure switch closed.

G. High limit pressure switch closed.

H. Cold water condenser (CWC) thermostat open.

I. Automatic blowdown solenoid valve (A.B.D.) open and boiler empty.

2. Turn power switch ON.

   A. Automatic Blowdown valve (N.O.) is energized and close.

   B. Water level control (WLC) energized.

      1) High level (HL) relay energized, HL-3 contacts (N.O.) close.

         a. Fill solenoid energized, water begins filling the boiler (fill time 4-11 min.).

      2) HL LED lit.

   C. Auxiliary water level control is powered.

      1) Aux. LLCO N.O. contacts remain open.

   D. 120VAC to one side of K5(1) N.O., K1(1) N.O., K3(1) N.O., K4(1) N.O. contacts.

   E. **N6 lit.** Low Water light (control panel) lit thru K3(1) N.C.

   F. **N8 lit.** Hi Pressure light (control panel) lit thru K4(1) N.C.

   G. **N1 lit.** 24VAC transformer is energized and relay board is powered.

      1) 24VAC to one side of auxiliary water level control LLCO contacts (N.O.).

      2) **N3 lit.** K2 energized through the high limit pressure switch contacts (N.C.).

         a. K2 contacts K2(1) N.O. & K2(2) N.O. close, no power transferred.

      3) **N9 lit.** 24VAC to one side of K3(2) N.O. contacts through cycling pressure switch N.C.

3. Water level reaches LLCO probe for both water level control and auxiliary low level control.

   A. LLCO relay on water level board energizes, LLCO contacts (N.O.) close

      1) LED on board lights.

   B. Aux. LLCO relay energizes, aux. LLCO contacts (N.O.) close.

      1) LED on board lights.

      2) **N2 lit.** K1 is energized.

         a. K1(1) N.O. close.

         b. **N4 lit.** Ready light (green) on the control panel manual reset switch, ON.

      3) K1(2) N.O. close.

   NOTE: No power is transferred until manual reset switch pressed.

   NOTE: The LLCO and aux. LLCO relays will remain energized and LLCO LED'S will remain lit until the water level drops below the LLCO probes or the power switch is turned OFF.

   NOTE: The reset switch could be pressed to start combustion blower & ignition cycle but it's preferred to let the boiler fill the to the "High Level" before continuing.

4. Water reaches LL (low level) probe.

5. Water reaches HL (high level) probe.

   A. Fill solenoid is de-energized.

   B. HL-LED

6. Manual reset switch pressed.

   A. **N5 lit.** K3 is energized (120VAC).

   NOTE: Relay K3 remains energized through K3(1) N.O. locking circuit.

      1) **N6 goes out**. K3(1) N.O. contacts close and K3(1) N.C. contacts open.

      2) Low water light (control panel) goes out.

      3) **N10 lit.** K3(2) N.O. contacts close.

         a. 24VAC to one side of K4(2) N.O. contacts.

   B. **N7 lit.** K4 is energized (120VAC).

NOTE: Relay K4 remains energized through K4(1) N.O. locking circuit.

1) **N8 goes out.** K4(1) N.O. contacts close and K4(1) N.C. contacts open.

2) High pressure light (control panel) goes out.

C. **N11 lit.** K4(2) N.O. contacts close.

1) K5 is energized (24VAC).

a. **N12 lit.** K5(1) N.O. contacts close.

a) Combustion blower starts.

7. **N13 lit.** When the combustion blower generates sufficient air pressure, the air pressure switch N.O. contacts close.

A. Ignition module is powered (24VAC).

1) Ignition module starts sparking.

2) **N14 lit.** Pilot voltage (PV) N.O. contacts close.

a. K7 is energized.

a) K7(1) N.O. contacts close.

3) 15 sec. timer circuit (board level, solid state timer) energized and timing of pilot gas valve ON time begins.

a. K6 energized.

a) **N15 lit.** K6(1) N.O. close.

4) Pilot gas valve energized, pilot valve opens for gas to flow.

B. Pilot flame established. Micro amp flame "sense" current rectified to ignition module through ignition cable.

1) Sparking stops.

2) **N16 lit.** Main voltage (MV) N.O. contacts close.

a. **N17 LED lit.** Proves LLCO on water level board closed.

b. Main gas valve opens, burner lights and boiler begins to heat up.

C. 15 seconds after ignition module energized, relay board timer circuit times out.

1) **N15 goes out.** K6 de-energized.

a. Pilot valve closes, gas flow stops to pilot.

NOTE: If pilot ignition is not established within the allotted 15 seconds, the ignition module continues to spark. To attempt to relight the pilot, quickly cycle the reset switch to prevent the boiler from draining. If the pilot is not established within 90 seconds from the ignitor module being energized, the ignition module locks out power to the gas valves. The module remains locked out until the power switch is turned to OFF then ON and the manual reset switch is pressed to r e-start the ignition trial cycle.

D. As boiler heats up and builds pressure, some by-pass water/steam is produced which runs into the steam drain box. This causes the cold water condenser (CWC) solenoid to cycle, cooling the drain water and condensing any steam vapors before exiting the drain. The CWC solenoid is powered through the CWC cycling thermostat.

NOTE: On initial cold startup only, the boiler pressure may overshoot and cause the mechanical pressure relief valve to open momentarily.

E. As long as the ignition control module senses a burner flame, the internal main voltage (MV) contacts (N.O.) on the ignition module remain closed, and main gas valve stays ON.

NOTE: PV N.O. contacts are also closed, but K6 contacts are open to keep pilot valve closed.

8. Boiler steam pressure reaches upper limit set point of 10 PSI (Approx. 15 minutes).

A. Cycling pressure switch open.

1) **N9, N10, N11, N12, N13 go out.**

a. K5 de-energized.

a) K5(1) N.O. contacts open.

b. Combustion blower is de-energized.

a) Air pressure switch opens.

B. Ignition module is de-energized

1) PV and MV contacts open.

a. **N14, N16, N17 go out.**

b. Main gas valve closes, burner goes out.

c. K7 de-energized.

a) K7(1) open

9. Boiler steam pressure drops below lower limit set point of 8 PSI and the cycling pressure switch close.

A. Boiler steam pressure is maintained by the cycling of the pressure switch between the

upper and lower set point limits. The cycling pressure switch continues to energize and de-energize the heating circuit to cycle the burner ON and OFF.

This sequence continues until one of the following occurs:

1) Power switch is turned OFF.

2) Boiler water level drops below the LLCO probes for the main water level control (WLC) and the auxiliary low level control.

3) Boiler pressurizes to 15 PSI, causing the high limit pressure switch to open.

Water Refill (After Initial Fill)

1. Water level drops below low level probe (LL).
   A. HL relay is energized.
      1) HL-3 (N.O.) contacts close.
      2) Fill solenoid is energized.
      3) HL LED comes ON.
2. Water reaches LL (low level) probe.
3. Water reaches high level probe.
   A. HL relay is de-energized.
      1) HL-3 (N.O.) contacts open.
      2) Fill solenoid is de-energized.
      3) HL LED goes out.
4. The water refill cycle will occur whenever the water level is below the low level probe and will not affect the operation of either the preheat or cook cycle.

Boiler Blowdown/drain

1. Power switch turned OFF.
   A. Automatic blowdown solenoid valve (N.O.) is de-energized and valve opens to drain the boiler.
   B. Power is removed from all components except cold water condenser (CWC) thermostat and solenoid valve. The CWC thermostat cycles as necessary to lower the discharge temperature of the water and condense steam going into the drain.

OLD STYLE CONTROLS - BOILER

This sequence of operation is written for boiler bases with the old style boiler controls. See "BOILER CONTROL STYLES" under "GENERAL". Refer to schematic diagram 5480.

Initial Fill And Preheat

1. Conditions.
   A. Power switch OFF.
   B. Boiler connected to correct voltage (120VAC).
      1) Power to cooking compartment controls. See "COOKING COMPARTMENT CONTROLS" later in this section.
   C. Boiler properly grounded (boiler and water level controls share a common ground)
   D. Gas and water supply valve(s) ON.
   E. Main gas valve ON.
   F. Cycling pressure switch CLOSED.
   G. High limit pressure switch CLOSED.
   H. Cold water condenser (CWC) thermostat OPEN.
   I. Automatic blowdown valve (A.B.D.) OPEN and boiler empty.
2. Turn power switch ON.
   A. Relay R4 energized and R4 contacts (N.O.) CLOSE.
   B. Power ON light (red) comes ON.
   C. Blowdown solenoid valve is energized and CLOSES.
   D. Auxiliary water level control is powered.
      1) Aux. LLCO N.O. contacts remain OPEN (Aux. LLCO relay de-energized).
   E. Low water level light (amber) comes ON.

NOTE: The low water indicator light will remain ON and the safety circuit de-energized until the water level in the boiler reaches the auxiliary low level cut-off probes (aux. LLCO, minimum level) for the aux. water level control, and the manual reset switch is pressed.

   F. High pressure light (amber) comes ON.

NOTE: The high pressure indicator light will remain ON and the safety circuit de-energized until the manual reset button is pressed (high limit pressure switch must be closed).

   G. Power is connected through the high limit pressure switch contacts (N.C.) to one side of the push button reset switch.
   H. Water level control is powered (Low Level Cut-off & Differential Control).
      1) High level (HL) relay is energized, HL contacts (N.O.) CLOSE
         a. HL LED lights up.
         b. Fill solenoid is energized and water begins filling boiler (fill time 4-11 min.).

3. Water level reaches LLCO (low water level cut-off) probe for the water level control and to the auxiliary LLCO probe for the auxiliary low level cut-off control.

   A. LLCO relay energizes, LLCO contacts (N.O.) CLOSE and LED lights.

   NOTE: No power is transferred until ignition sequence starts.

   B. Aux. LLCO relay energizes, LLCO contacts (N.O.) CLOSE and LED lights.

NOTE: The LLCO and aux. LLCO relays will remain energized and LLCO LED'S will remain lit until the water level drops below the LLCO probes or the power switch is turned OFF.

4. Water reaches LL (low level) probe.
5. Water reaches HL (high level) probe.
   A. Fill solenoid is de-energized.
6. Press the manual reset switch.
   A. Relay coil (R1) energized.
      1) High pressure light turns OFF.
   B. Relay coil (R3) energized.
      1) Low water light turns OFF.
      2) Transformer (T1) energized.
7. 24VAC is connected through the cycling pressure switch contacts to the following components:
   A. Normally open (N.O.) side of the air pressure switch.

   NOTE: No power is transferred until air pressure switch CLOSES.

   B. Relay coil (R2) is energized and R2 contacts (N.O.) CLOSE.
      1) 120VAC is supplied to the combustion air blower and blower starts.
   C. Once the combustion blower develops sufficient pressure, the air pressure switch CLOSES.
      1) 24VAC is then applied to the Ignition control module and the ignition cycle starts.
         a. Pilot voltage (PV) N.O. contacts CLOSE.
         b. Pilot gas valve energized, pilot valve opens for gas to flow and Ignitor begins sparking to light pilot.
      2) Pilot ignition is established (pilot lit) and a micro amp flame "sense" current is sent back to the ignition module through the ignition cable.
      3) Main voltage (MV) N.O. contacts CLOSE.
         a. Main gas valve OPENS, burner lights and boiler begins to heat up.

   NOTE: As boiler heats up and builds pressure, some by-pass water/steam is produced which runs into the steam drain box. This causes the cold water condenser (CWC) solenoid to cycle, cooling the drain water and condensing any steam vapors before exiting the drain. The CWC solenoid is powered by the CWC thermostat.

   NOTE: On initial cold startup only, the boiler pressure may overshoot and cause the mechanical pressure relief valve to OPEN momentarily.

         b. As long as the ignition control module senses a burner flame, the internal main voltage (MV) contacts (N.O.) on the ignition module remain closed, and main gas valve stays ON.
         c. If sparking is allowed to continue for a total of 90 seconds, then the ignition module locks out power to the gas valve (pilot valve and main valve remain closed). The module remains locked out until the power switch is turned to OFF then ON and the manual reset switch is pressed to re-start the ignition trial cycle.
8. Boiler steam pressure reaches upper limit set point of 10 PSI (approximately 15 min).
   A. Cycling pressure switch opens and power is removed from the following components:
      1) Combustion air pressure switch normally open (N.O.) terminal.
      2) Relay coil (R2) returning R2 contacts to there N.O. shelf state.
         a. Combustion air blower de-energized.
   B. Ignition control module is de-energized, PV and MV contacts OPEN.
      1) Main gas solenoid valve de-energizes, gas flow shuts OFF and burner goes out.
9. Boiler steam pressure drops below lower limit set point of 8 PSI and the cycling pressure switch CLOSES.
   A. Boiler steam pressure is maintained by the cycling of the pressure switch between the

upper and lower set point limits. The cycling pressure switch continues to energize and de-energize the heating circuit to cycle the burner ON and OFF.

This sequence continues until one of the following occurs:

1) Power switch is turned OFF.
2) Boiler water level drops below the LLCO probes for the main water level control and the auxiliary low level cut-off control
3) Boiler pressurizes to 15 PSI, causing the high limit pressure switch to OPEN.

Water Refill (After Initial Fill)

1. Water level drops below low level probe (LL).
   A. HL relay is energized.
      1) HL N.O. contacts CLOSE, fill solenoid is energized and HL LED comes ON.
2. Water reaches LL (low level) probe.
3. Water reaches high level probe.
   A. HL relay is de-energized.
      1) HL N.O. contacts OPEN, fill solenoid is de-energized and HL LED goes out.
4. The water refill cycle will occur whenever the water level is below the low level probe and will not affect the operation of either the preheat or cook cycle.

Boiler Blowdown/Drain

1. Power switch turned OFF.
   A. Boiler blowdown sequence starts.
   B. The automatic blowdown solenoid valve (N.O.) is de-energized and valve OPENS to drain the boiler.
   C. Power is removed from all components except cold water condenser (CWC) thermostat and solenoid valve. The CWC thermostat cycles as necessary to lower the discharge temperature of the water and condense steam going into the drain.

COOKING COMPARTMENT CONTROLS

1. Conditions.
   A. Doors shut (closes the N.O. door switch contacts).
   B. Cooking timers OFF.
   C. Compartment pressure switch contacts OPEN.
2. With boiler at operating pressure.
   A. Cooking compartment pressure switch CLOSES (approx. 3 PSI).
      1) Cooking compartment ready light (green) comes ON.
3. Start a cook cycle.
   A. Insert product into steamer and close door.
   B. Set a cook time.

   NOTE: On initial startup, if a cooking timer is set immediately after the ready light comes on, steam solenoid chattering will be heard (oil canning) and the ready lights will flash for several seconds. This condition is caused by the manifold steam pressure being on the "fringe" of the pressure switch set point. When a cook timer is set, the compartment steam solenoid valve opens causing the manifold steam pressure to drop, slightly below the pressure switch set point. At the same time, steam pressure is still increasing in the boiler. This opposing condition causes a pressure "bounce" to occur. After the steam pressure passes approximately 4 psi this condition subsides. During normal operation, this condition will not be seen.

   C. Contacts 1/3 of cook timer CLOSE and timer motor is energized.
      1) Compartment steam solenoid valve energized and steam begins to enter the compartment.
      2) Ready light (green) goes out and Cooking light (red) comes ON.

      NOTE: Steam should not be seen entering either compartment until a cook time is set. This energizes the steam solenoid valve of the cooking compartment to allow steam flow.
4. Time expires on timer.
   A. Timer contacts 1/3 OPEN, timer motor de-energized.
   B. Steam solenoid valve de-energizes, stopping the flow steam into compartment.
   C. Timer contacts 4/1 CLOSE and energize buzzer until manually turned OFF.
   D. Cooking light (red) goes out and Ready light (green) comes ON.
5. Timer manually turned OFF.
   A. Contacts 1/4 OPEN
   B. Alarm Buzzer de-energized and stops buzzing.
6. Steamer reverts to preheat cycle until time is dialed on timer and the door is shut, water level drops below low level cut-off probe or the power switch is turned OFF.

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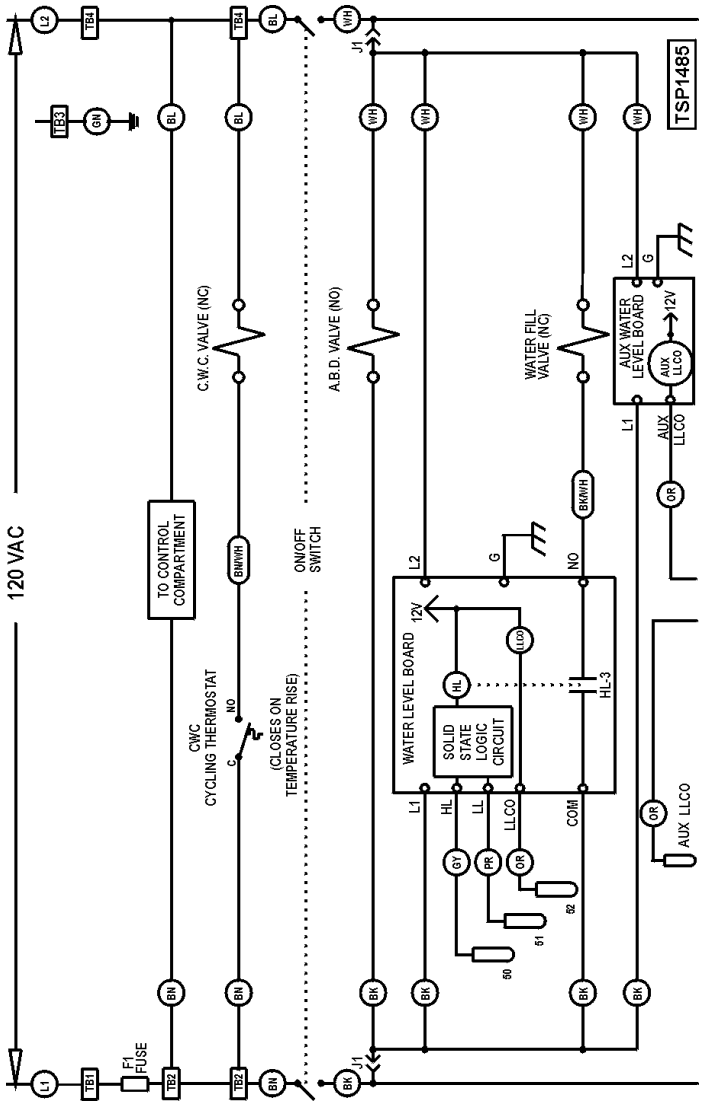
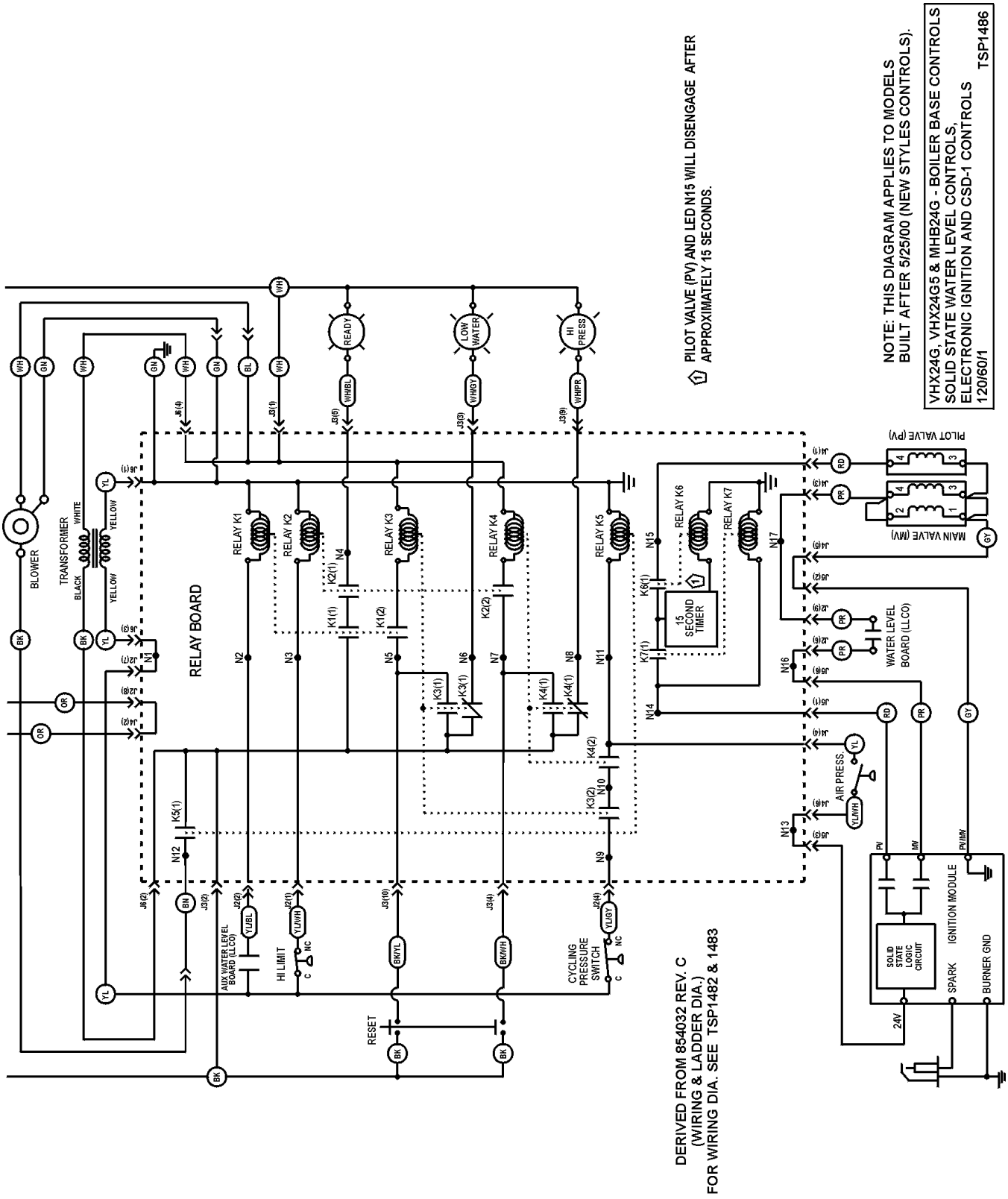
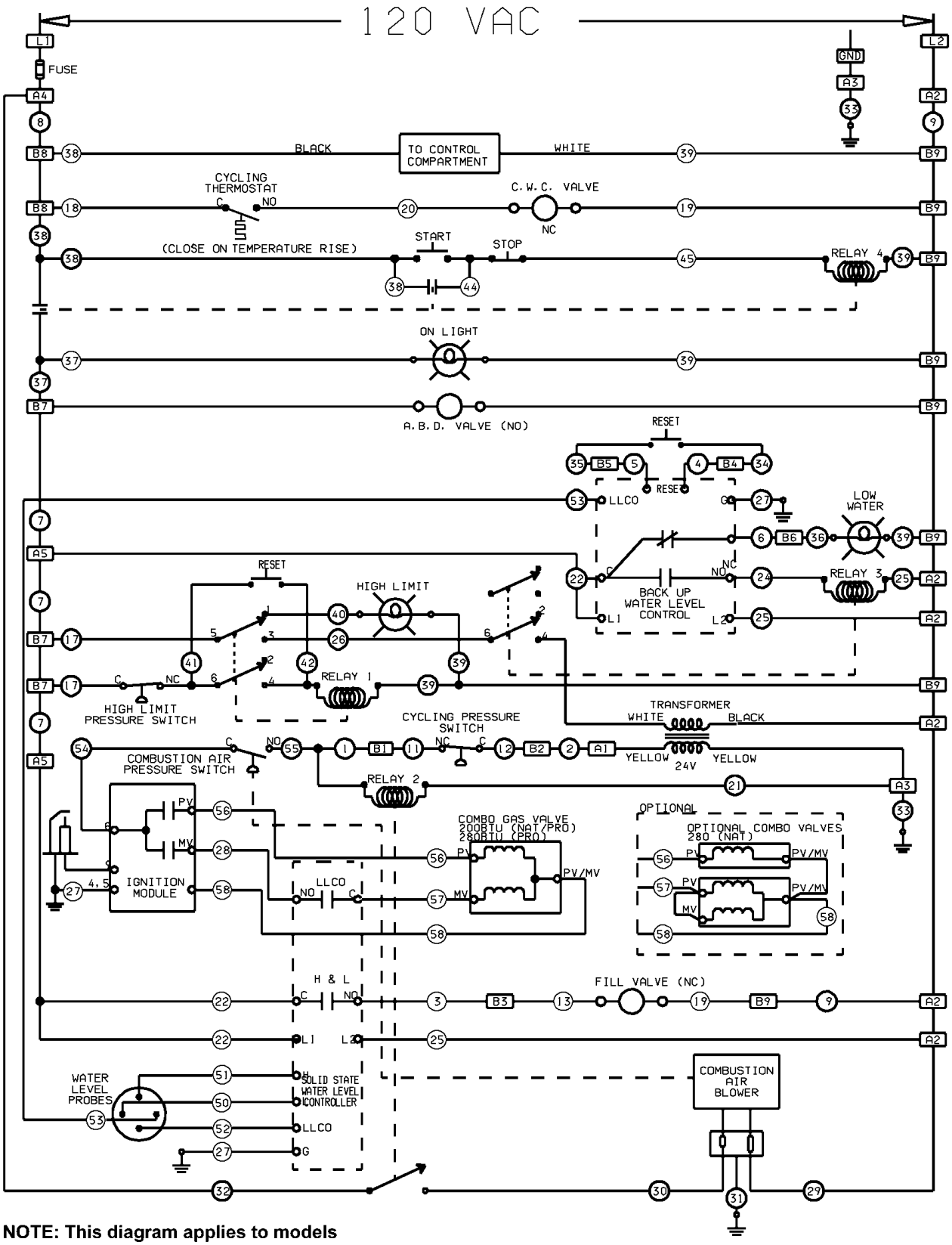
SCHEMATICS

Models Built After 5/25/00 (New Style Boiler Controls)




NOTE: THIS DIAGRAM APPLIES TO MODELS
BUILT AFTER 5/25/00 (NEW STYLES CONTROLS).
VHX24G, VHX24G5 & MHB24G - BOILER BASE CONTROLS
SOLID STATE WATER LEVEL CONTROLS,
ELECTRONIC IGNITION AND CSD-1 CONTROLS
120/60/1
TSP1486
1 PILOT VALVE (PV) AND LED N15 WILL DISENGAGE AFTER APPROXIMATELY 15 SECONDS.
DERIVED FROM 854032 REV. C
(WIRING & LADDER DIA.)
FOR WIRING DIA. SEE TSP1482 & 1483
BLOWER
TRANSFORMER
WHITE
BLACK
YELLOW
YELLOW
RELAY BOARD
RELAY K1
RELAY K2
RELAY K3
RELAY K4
RELAY K5
RELAY K6
RELAY K7
15 SECOND TIMER
READY
LOW WATER
HI PRESS
PILOT VALVE (PV)
MAIN VALVE (MV)
WATER LEVEL BOARD (LLCO)
AIR PRESS.
AUX WATER LEVEL BOARD (LLCO)
HI LIMIT
CYCLING PRESSURE SWITCH
RESET
SOLID STATE LOGIC CIRCUIT
IGNITION MODULE
SPARK
BURNER GND
24V
PV
MV
PV/MV

Models Built Before 5/25/00 (Old Style Boiler Controls)



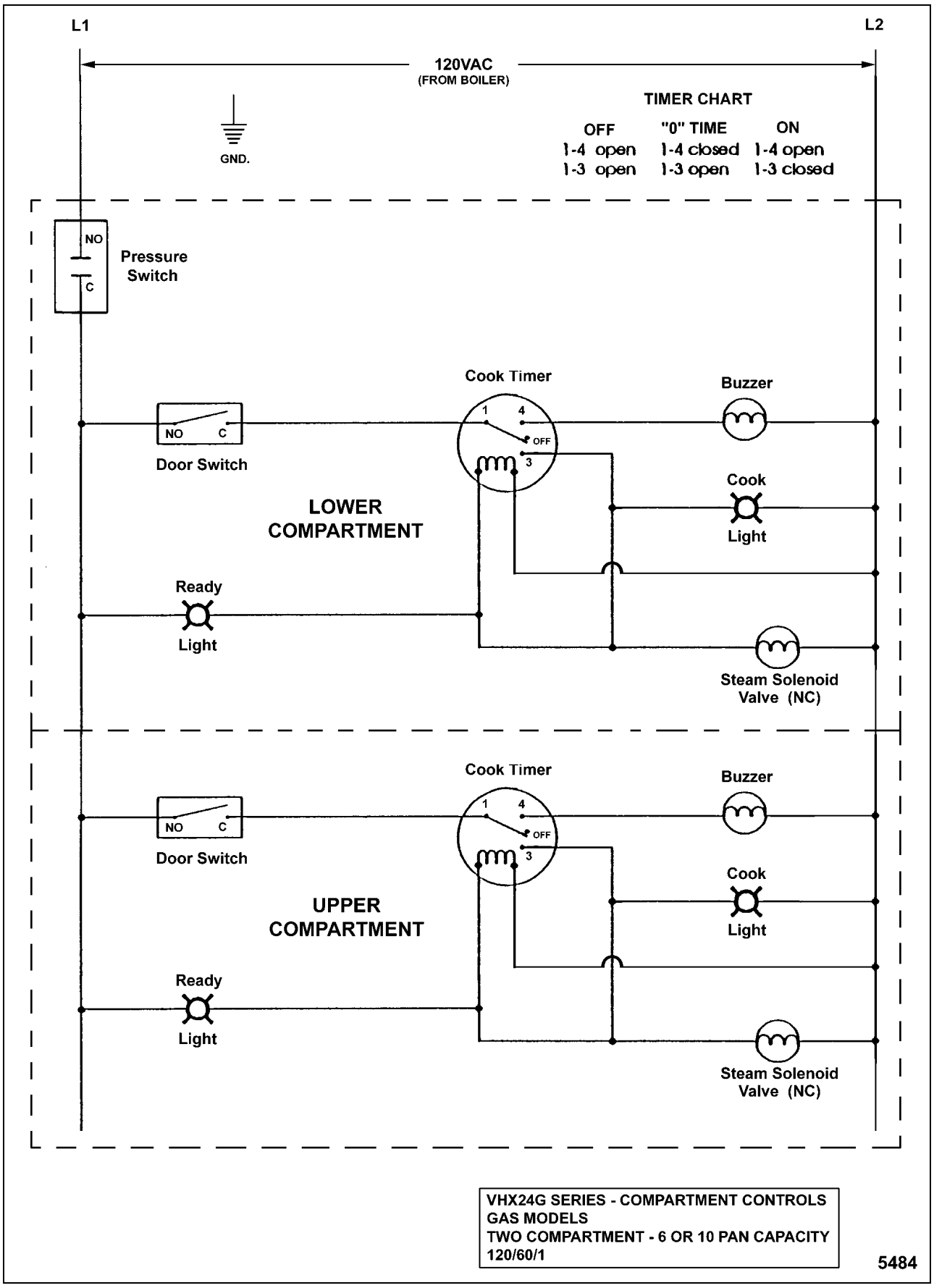
NOTE: This diagram applies to models built before 5/25/00 (Old Style Controls).

DERIVED FROM 853062 REV. B (WIRING & SCHEMATIC DIA.) SEE WIRING DIA. 5481

VHX24G SERIES - BOILER BASE CONTROLS SOLID STATE WATER LEVEL CONTROLS, ELECTRONIC IGNITION AND CSD-1 CONTROLS 120/60/1

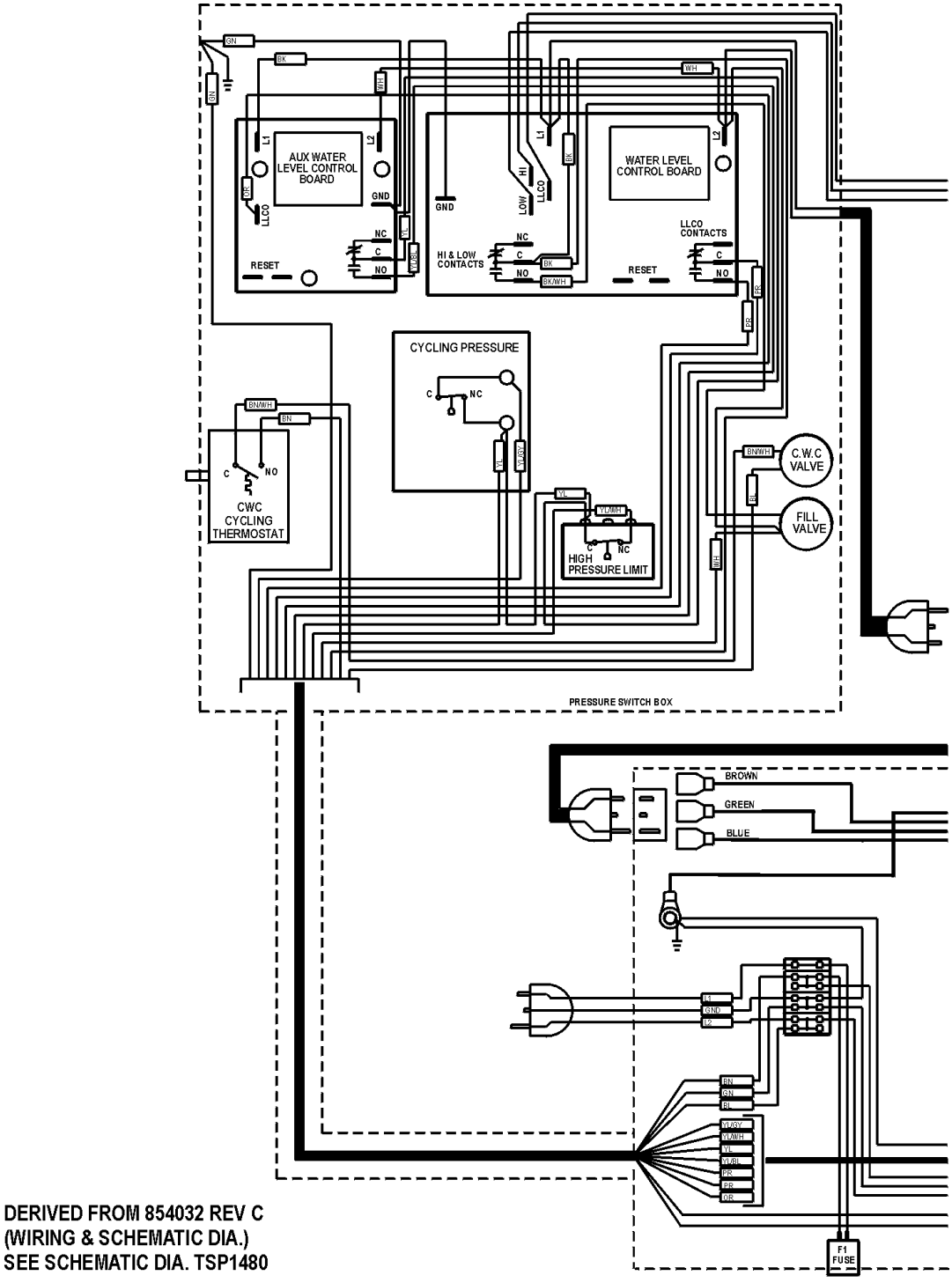
5480

Cooking Compartment Controls

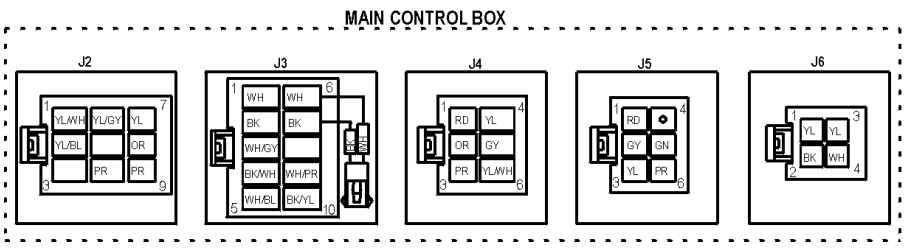


WIRING DIAGRAMS

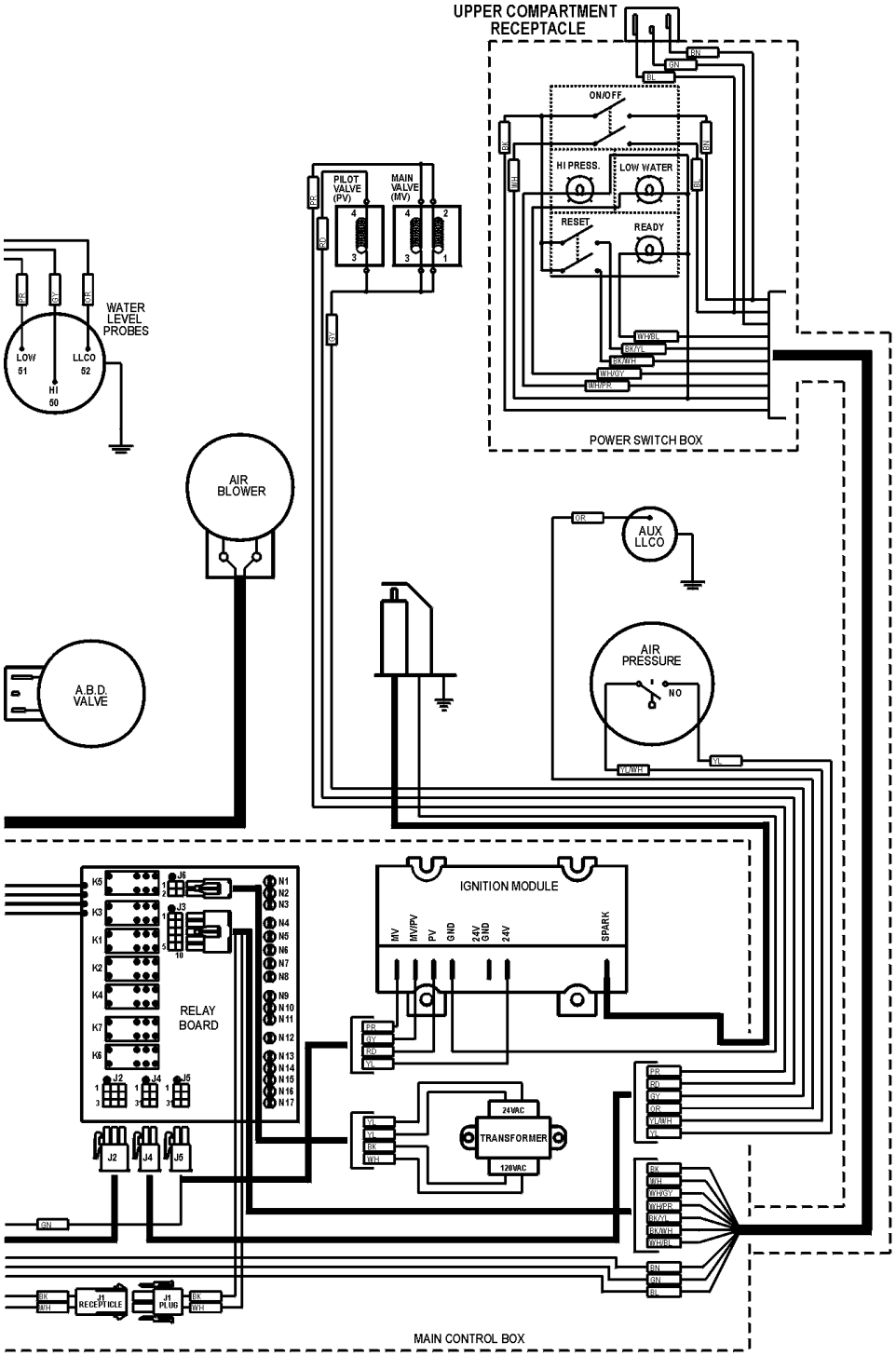
Models Built After 5/25/00 (New Style Boiler Controls)

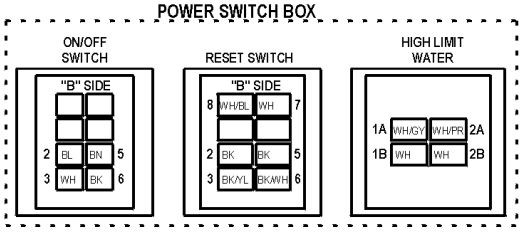


DERIVED FROM 854032 REV C
(WIRING & SCHEMATIC DIA.)
SEE SCHEMATIC DIA. TSP1480



PAGE 1 OF 2
(SEE TSP1483)
TSP1482





LEGEND

BK -BLACK
BN -BROWN
RD -RED
OR -ORANGE
YL -YELLOW
GN -GREEN
PR -PURPLE
GY -GRAY
WH -WHITE

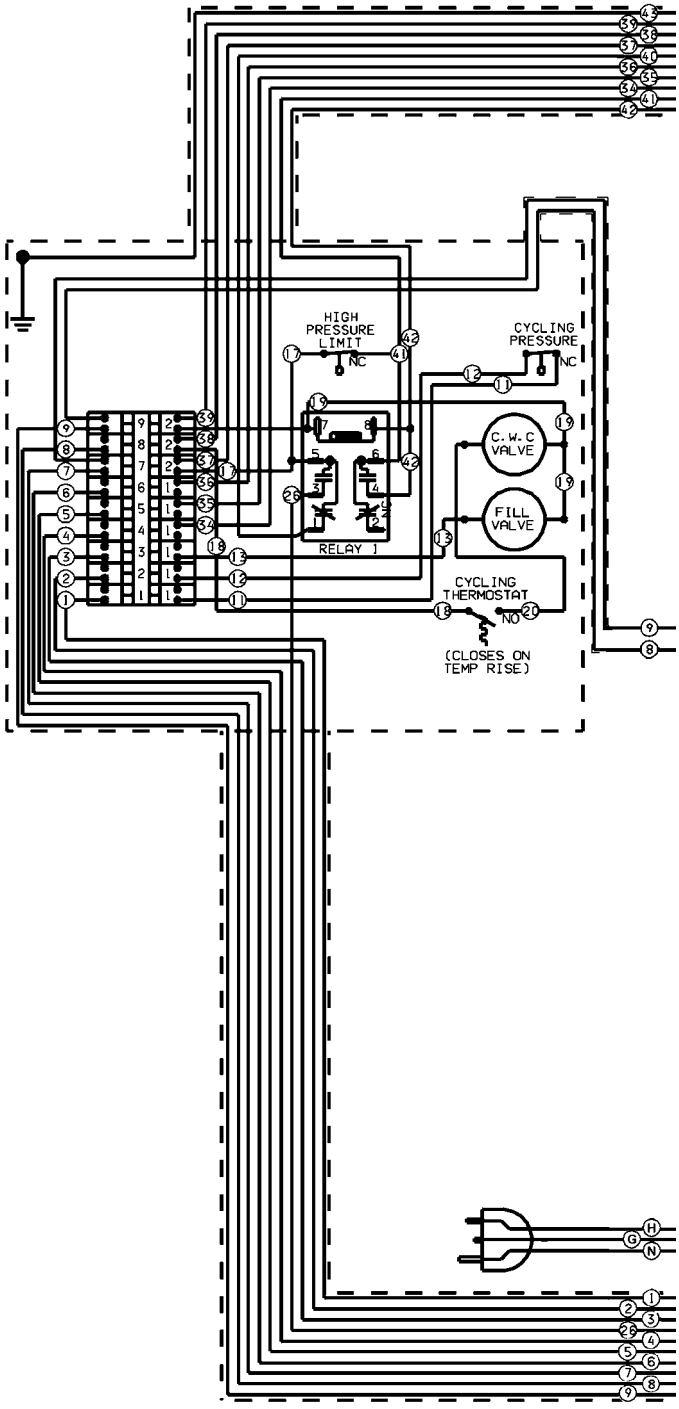
PAGE 2 OF 2
(SEE TSP1482)
TSP1483

NOTE: PILOT VALVE (PV) AND LED N15 WILL DISENGAGE AFTER APPROXIMATELY 15 SECONDS.

NOTE: THIS DIAGRAM APPLIES TO MODELS BUILT AFTER 5/25/00 (NEW STYLE CONTROLS)

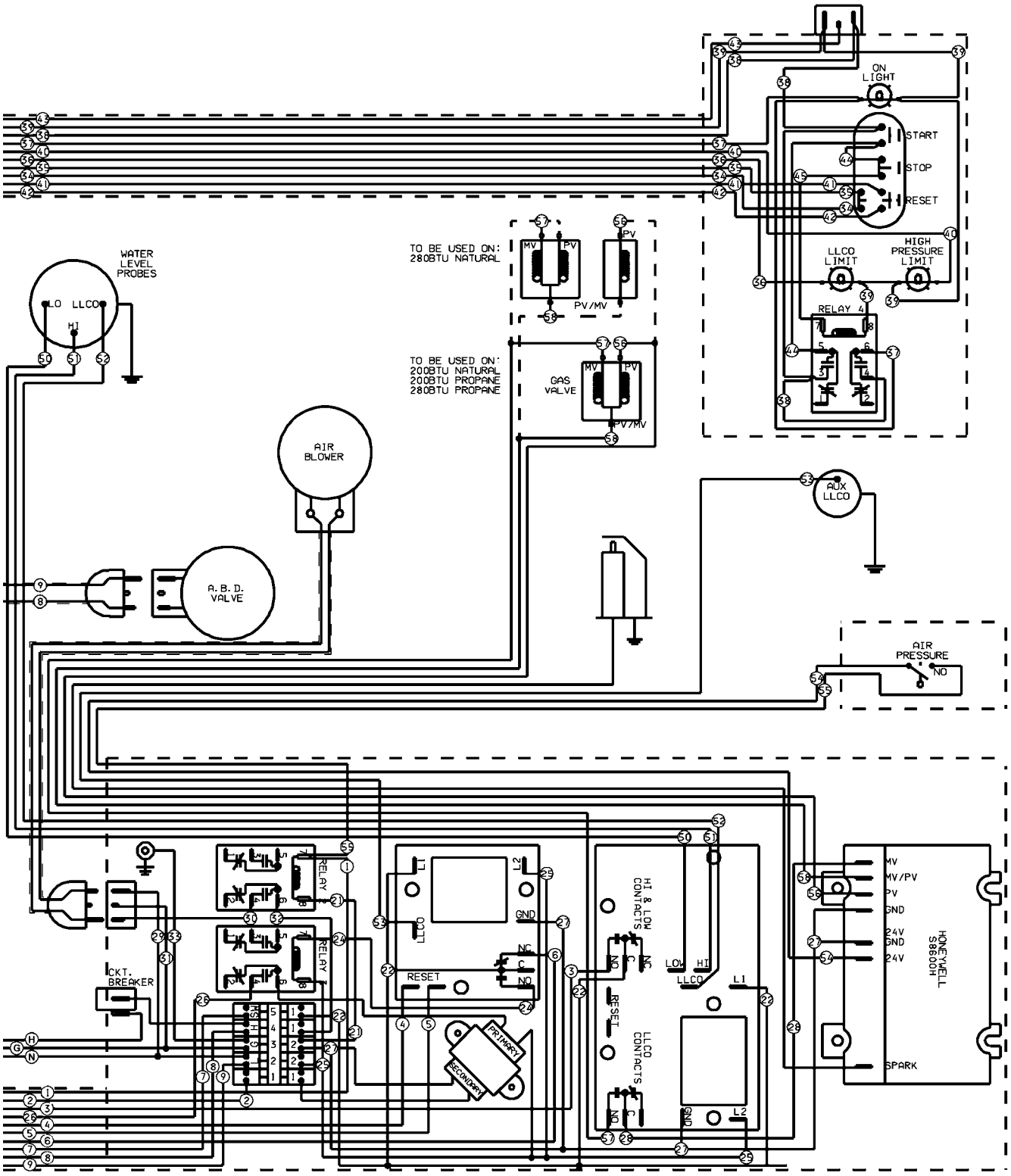
VHX24G, VHX24G5 & MHB24G - BOILER BASE CONTROLS
SOLID STATE WATER LEVEL CONTROLS,
ELECTRONIC IGNITION AND CSD-1 CONTROLS
120/60/1

Models Built Before 5/25/00 (Old Style Boiler Controls)



NOTE: This diagram applies to models built before 5/25/00 (Old Style Controls).

PAGE 1 OF 2
(SEE 5482) **5481**



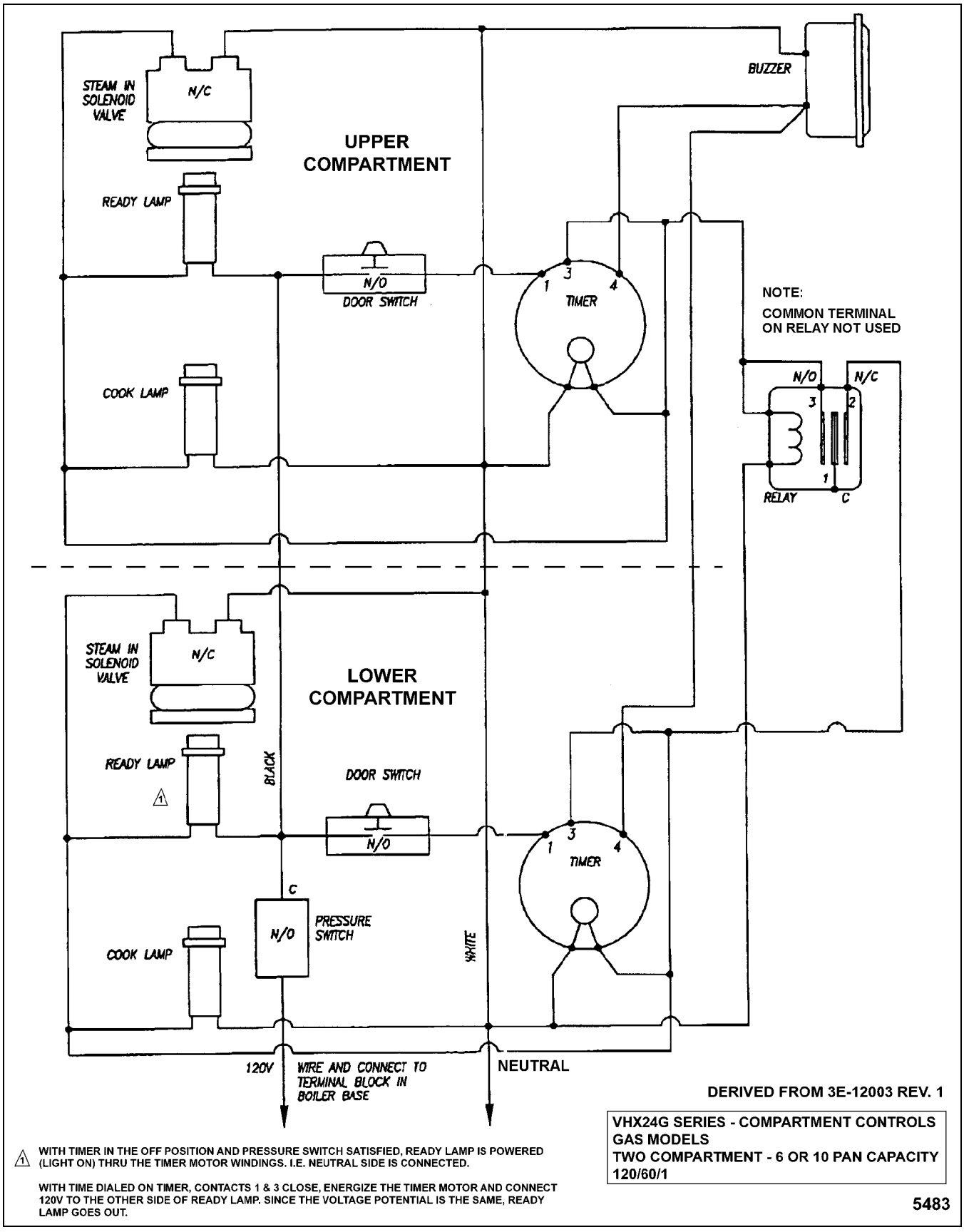
PAGE 2 OF 2
(SEE 5481)

DERIVED FROM 853062 REV. B
(WIRING & SCHEMATIC DIA.)
SEE SCHEMATIC DIA. 5480

VHX24G SERIES - BOILER BASE CONTROLS
SOLID STATE WATER LEVEL CONTROLS,
ELECTRONIC IGNITION AND CSD-1 CONTROLS
120/60/1

5482

Cooking Compartment Controls



⚠1 WITH TIMER IN THE OFF POSITION AND PRESSURE SWITCH SATISFIED, READY LAMP IS POWERED (LIGHT ON) THRU THE TIMER MOTOR WINDINGS. I.E. NEUTRAL SIDE IS CONNECTED.

WITH TIME DIALED ON TIMER, CONTACTS 1 & 3 CLOSE, ENERGIZE THE TIMER MOTOR AND CONNECT 120V TO THE OTHER SIDE OF READY LAMP. SINCE THE VOLTAGE POTENTIAL IS THE SAME, READY LAMP GOES OUT.

TROUBLESHOOTING

BOILER BASE CONTROLS

WARNING: CERTAIN PROCEDURES IN THIS SECTION REQUIRE ELECTRICAL TESTS OR MEASUREMENTS WHILE POWER IS APPLIED TO THE MACHINE. EXERCISE EXTREME CAUTION AT ALL TIMES. IF TEST POINTS ARE NOT EASILY ACCESSIBLE, DISCONNECT POWER, ATTACH TEST EQUIPMENT AND REAPPLY POWER TO TEST.

Models with new style controls: Before performing any of the troubleshooting checks listed below, remove the cover from the main control box and check the condition of the LED'S on the relay board for the status of the condition or component in the operating sequence. By utilizing the troubleshooting LED'S, the Service Technician can quickly and easily determine if a component is functioning properly or in need of repair. Refer to "RELAY BOARD" under "ELECTRICAL OPERATION".

SYMPTOM	POSSIBLE CAUSES
Steamer does not operate.	1. No power to steamer. 2. F1 Fuse open. 3. Malfunctioning power switch. 4. Malfunctioning power switch latching relay (old style controls only).
Steamer ON, cannot reset low water condition.	1. Low water level in boiler. A. Water inlet valve(s) OFF. B. Fill solenoid not receiving power, clogged or malfunctioning. 2. Manual blowdown valve on water level probe housing open. 3. Improper ground. 4. Lime scale build-up auxiliary water level probe. 5. Malfunctioning reset switch. 6. Malfunctioning auxiliary water level control board.
Steamer ON, cannot reset high pressure condition.	1. Excessive pressure in boiler. 2. Malfunctioning reset switch. 3. Malfunctioning high pressure limit switch. 4. Malfunctioning pressure switch latching relay (old style controls only).
Steamer ON, reset switch pressed but blower does not operate when calling for heat. (boiler pressure within operating limits)	1. Blower malfunctioning or loose connection on blower cord. 2. 24 VAC transformer malfunctioning. 3. Malfunction in cycling pressure switch. 4. Malfunctioning "Low Water" or "Hi Pressure" light not indicating true condition. 5. Blower relay malfunctioning (old style controls only).

SYMPTOM	POSSIBLE CAUSES
Blower operating, no pilot gas flow.	1. Main gas supply turned OFF. 2. Ignition module lockout. Turn power switch OFF for several seconds then ON to reset the module. 3. Air pressure switch: A. Not mounted in true vertical position. B. Incorrect pressure setting. C. Malfunctioning switch. 4. Malfunctioning Ignition module. 5. Malfunctioning pilot gas valve. 6. Blocked or dirty pilot gas orifice.
Pilot flame not proving or lighting main burner.	1. Gas not ON. 2. Incorrect manifold pressure for pilot gas. 3. Poor connection between igniter and ignition cable. 4. Fouled spark igniter. 5. Incorrect gap in spark igniter. 6. Faulty igniter or cracked insulation. 7. Improper ground. 8. Low water level in boiler or boiler not filling. 9. Flame sensing current too low. 10. Cracked or incorrect burner head attachment. 11. Incorrect igniter positioning. 12. Incorrect pilot orifice.
Main burner not lighting correctly or excessive ignition noise.	1. Blocked or dirty air orifice on blower. 2. Insufficient gas supply pressure. 3. Incorrect gas pilot pressure. 4. Incorrect gas manifold pressure. 5. Pilot flame not sensing correctly. 6. Burner tube insulation broken or deteriorated. 7. Blocked or restricted flue. 8. Incorrect pilot or main gas burner orifice size.
Excess combustion noise or combustion induced harmonics.	1. Blocked or dirty air orifice on blower. 2. Incorrect gas manifold pressure. 3. Insufficient gas supply pressure. 4. Steam vapors introduced into blower inlet. 5. Loose flue connections.
Boiler not maintaining set pressure and/or excessive burner on time.	1. Leaking boiler blowdown valve. 2. Manual blowdown valve on water level probe housing open. 3. Malfunctioning 13 psi overshoot relief valve. 4. Low incoming gas supply pressure. 5. Excessive load on steam outlet.

SYMPTOM	POSSIBLE CAUSES
Gas odor.	1. Leaks in pipe fitting connections or components. 2. Leaking pressure tap plug on pilot or main gas valve; loose or missing pressure adjustment screw cap on main gas valve. 3. Leaking gaskets in air/gas mixture path. 4. Pilot or main gas valve malfunction (improper venting or vent blocked). 5. Incorrect gas pressure. 6. Malfunctioning gas burner. 7. Blocked or dirty air orifice on blower. 8. Blocked or dirty gas orifice. 9. Malfunctioning blower. 10. No pilot ignition. 11. Improper hood venting, vent blocked or room not vented properly.
Drain box leaking.	1. Clog in drain line plumbing. 2. Drain restricted to size below 1-1/4" pipe. 3. Drain extension plumbing not at the proper slope or plumbing too lengthy. 4. Grommets not sealing. 5. Steamer draining while under pressure and relief valve opening at the same time (flooding drain box). 6. Cold water condensing spray is "over spraying". 7. Drain box thermostat improperly set or malfunctioning.
Cold water condenser not operating properly.	1. Water supply valves(s) turned off. 2. Cold water condenser solenoid not receiving power, inoperative or valve plugged. 3. Cold water condenser thermostat malfunction or needs adjustment. 4. Plugged spray nozzle. 5. Water supply pressure high (improper valve operation).
Heat coming on without water in boiler (Dry firing).	1. Lime scale build-up on water level probes (shorted to ground). 2. Retention of water in probe housing (assembly or aux.LLCO). 3. Water level control malfunction. 4. Aux. water level control malfunction.
Spark Ignitor not sparking.	1. Ignitor boot on ignition cable loose, damaged or missing causing excessive ignition voltage leakage. 2. Loose, broken or damaged lead wires (including ground) from ignition module to ignitor. 3. Poor ground on ignitor assembly. **NOTE**: Items 4, 5 & 7 see "IGNITION CONTROL MODULE CHECKS" in "SERVICE PROCEDURES AND ADJUSTMENTS". 4. Ignition module not receiving power. 5. Ignition module malfunction (no output voltages or spark). 6. Ceramic flame rod insulator on ignitor cracked or damaged from extreme heat. 7. Incorrect spark gap setting.

SYMPTOM	POSSIBLE CAUSES
Boiler Slow to Pressurize (over 15 min. to achieve operating pressure)	1. Low water supply pressure, inline water strainer clogged or fill solenoid valve malfunction. See "INLINE WATER STRAINER CLEANING" and "FILL AND COLD WATER SOLENOID VALVES" in "SERVICE PROCEDURES AND ADJUSTMENTS". 2. Boiler blowdown solenoid valve clogged and not fully closing. Check for a slow leak out of steamer drain. If not able to verify, then proceed to step 3. If blowdown solenoid valve appears to be functioning properly, then proceed to step 4. 3. Turn power switch OFF, disconnect lead wires from blowdown solenoid and remove it for inspection. 4. A heavy build-up of scalants has coated the interior of the boiler, creating an insulating effect. Examine interior of boiler as outlined under “BOILER” in "SERVICE PROCEDURES AND ADJUSTMENTS". 5. Low incoming gas pressure is reducing BTU output. A. Verify gas supply line to the steamer is a minimum of one inch diameter (ID). B. Check incoming line and manifold gas pressures as outlined in "GAS MANIFOLD PRESSURE ADJUSTMENT" under "SERVICE PROCEDURES AND ADJUSTMENTS". 6. Gas valve malfunction. A. Check incoming line and manifold gas pressures as outlined in "GAS MANIFOLD PRESSURE ADJUSTMENT under "SERVICE PROCEDURES AND ADJUSTMENTS".
Boiler will not heat or build pressure.	1. Gas not on. 2. Power/reset switch assembly malfunction. 3. Boiler not filling - check fill solenoid for power, clogging or malfunction. 4. Gas pilot and/or gas manifold pressure low. See "GAS PILOT PRESSURE ADJUSTMENT" and "GAS MANIFOLD PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS". 5. Cycling pressure switch open or set too high. Steamer is cycling on high limit. 6. High limit pressure switch open and not re-setting (malfunction). 7. Water too "pure" for probes to properly conduct electricity. **NOTE:** Items 8 & 9 see "WATER LEVEL CONTROLS TEST" in "SERVICE PROCEDURES AND ADJUSTMENTS". 8. Water Level Control malfunction. 9. Aux. Water Level Control malfunction.
Pressure relief valve(s) opening or leaking.	1. Pressure overshoot on initial startup or long burner on times under heavy usage. 2. Pressure relief valve malfunction. 3. Cycling pressure switch set to high. 4. High limit pressure switch not set correctly or malfunctioning.

SYMPTOM	POSSIBLE CAUSES
Steam output low or slow cooking.	1. Cooking Compartment. A. Blocked steam injector ports. (Open door, press door switch button and verify good steam flow into compartment). B. Steam solenoid valve not fully opening or blocked. C. Steam intake shut-off valve closed or out of adjustment. See "INTAKE SHUT-OFF VALVE ADJUSTMENT (STEAM FLOW)" in "SERVICE PROCEDURES AND ADJUSTMENTS". 2. Boiler Base. A. Cycling pressure switch malfunction or needs adjustment. B. Steam header line (supply) blockage. C. Heavy amount of condensate in the pressure controls steam supply line. D. Pressure relief valve leaking. E. Steam supply lines leaking badly.
Steamer leaks water.	1. Loose water, steam or drain line connections (top or base). 2. Heat exchanger gasket not sealing. 3. Leak at gauge glass.
Boiler water level too high.	1. Fill solenoid does not shut off. 2. Lime scale build-up (moist) on High level probe (open circuit). 3. Water level control malfunction.
Boiler does not fill.	1. Water supply not on. 2. Fill solenoid not opening or plugged. 3. Water level control malfunction.
Burner won’t light.	1. Gas not on. 2. Power/reset switch assembly malfunction. 3. Boiler not filling - check fill solenoid for power, clogging or malfunction. 4. Air pressure switch: A. Not mounted in true vertical position. B. Incorrect pressure setting. C. Malfunctioning switch. 5. Ignition module not receiving power. 6. Steamer not properly grounded and/or polarity of incoming power is incorrect on spark ignition systems. 7. Ignition module malfunction. 8. Gas valve malfunction. 9. Water too "pure" for probes to properly conduct electricity. 10. Cycling pressure switch open or set too high. Steamer is cycling on high limit. 11. High limit pressure switch open and not re-setting (malfunction). 12. Water level control malfunction. 13. Aux. water level control malfunction.

COOKING COMPARTMENT CONTROLS

SYMPTOM	POSSIBLE CAUSES
Cooking compartments do not operate.	1. No power to compartments. 2. Pressure in boiler is below compartment pressure switch setting. 3. Door switch malfunction. 4. Timer malfunction. 5. Malfunctioning pressure switch in compartment. 6. Verify correct compartment wiring and functioning components.
Steam generated inside compartment when timer is off.	1. Steam supply solenoid not fully closing (clogged or dirty). See "FILL AND COLD WATER SOLENOID VALVES" in "SERVICE PROCEDURES AND ADJUSTMENTS". 2. Timer contacts 1 & 3 closed.
Timer motor does not run.	1. Door open or door switch inoperative. 2. Timer not getting power. 3. Timer motor inoperative.
Door not closing properly.	1. Door latch assembly malfunction or out of adjustment. See "DOOR SEALING ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS" 2. Striker adjustment. See "DOOR LATCH ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS".
Door won't open.	1. Latch won't release. See "DOOR LATCH ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS".
Buzzer not operating.	1. Timer malfunction. 2. Buzzer malfunction.
Compartment leaks water around door or water accumulating in compartment .	1. Compartment drain screen clogged. 2. Drain line obstructed or not to an open gap drain. 3. Steamer not level.
Steam leaks around door.	1. Worn gasket - See "DOOR SEALING ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS". 2. Damaged gasket. 3. Drain line obstructed or not to an open drain.

- NOTES -

CONDENSED SPARE PARTS LIST

NEW STYLE CONTROLS ONLY

VHX24G, VHX24G5, MHB24G

PART NUMBER	DESCRIPTION	NOTES
853582-1	Igniter, Sensor	
850778-1	Switch, Air Pressure	
850735-1	Blower, Combustion	
354344-4	Valve, Pilot Gas	
851315-1	Valve, Main Gas	
851316-1	Valve, Pressure Relief 13 psi	
880413	Valve, Pressure Relief 15 psi	
817222	Valve(s), Cold Water Condenser and Boiler Fill	
833488	Switch, Pressure Cycling	
851578-1	Switch, Pressure High Limit	
844062-1	Thermostat, Condenser/drain Box	
411500-12	Transformer, 120vac to 24vac	
417980-1	Module, Ignition Control	
844070-1	Control, Aux. Low Water Board	
844069-1	Control, Water Board	
852081-1	Circuit, Breaker 5amp Slow Blow (fuse)	
851613-1	Boiler, Drain Valve (blowdown)	
851618-1	Power Cord, drain Valve	
844130-3	Cable, Ignitor 18"	
853275-1	Switch assembly, on/off, reset & lights	
853273-1	Relay Board	
411690-1	Timer, Cooking	
843836	Steam Solenoid Valves, Cooking Compartment	