

VL BOILER BASE SERIES CONVECTION STEAMERS

(GAS, ELECTRIC, DIRECT AND REGENERATED)



VL2GPS SHOWN

VL2GPS	ML-52391	VL2DPS	ML-52749
VL2GMS	ML-52388	VL2DMS	ML-52750
VL2GAS	ML-52390	VL2DAS	ML-52751
VL2GSS	ML-52389	VL2DSS	ML-52752
VL3GPS	ML-52395	VL3DPS	ML-52753
VL3GMS	ML-52392	VL3DMS	ML-52754
VL3GAS	ML-52394	VL3DAS	ML-52755
VL3GSS	ML-52393	VL3DSS	ML-52756
VL2EPS	ML-52741	VL2RPS	ML-52757
VL2EMS	ML-52742	VL2RMS	ML-52758
VL2EAS	ML-52743	VL2RAS	ML-52759
VL2ESS	ML-52744	VL2RSS	ML-52760
VL3EPS	ML-52745	VL3RPS	ML-52761
VL3EMS	ML-52746	VL3RMS	ML-52762
VL3EAS	ML-52747	VL3RAS	ML-52763
VL3ESS	ML-52748	VL3RSS	ML-52764

- 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.

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GENERAL

INTRODUCTION

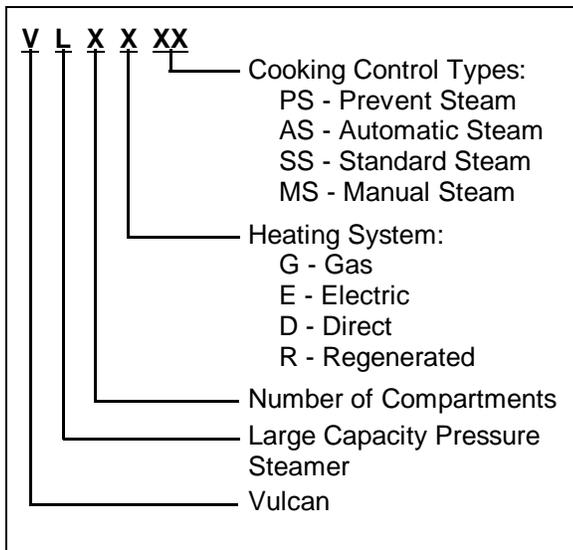
Steam Cooking

Large capacity pressure steamers offer an efficient way to produce a wide variety of foods in small portions or larger batches. Steamers can be used to cook fresh foods, blanch foods for complete cooking later or will steam defrost and cook frozen foods. Cooking with steam assures the food will retain its maximum color, flavor and nutritional value with the least expenditure of energy and labor.

Compartment Pan Capacity

PANS PER COMPARTMENT	SIZE	DEPTH (INCHES)
4	12" x 20"	6.0
6	12" x 20"	4.0
8	12" x 20"	2.5
6	*18" x 20"	1.0
* Remove center support for 18x20 inch pans		

Model Designations



Boiler Code Descriptions

Vulcan-Hart incorporates redundant controls in compliance with California Code (Cal-Code) and CSD-1 as an option on steam equipment when required by state and/or local building code requirements. Descriptions of the codes are listed below.

Cal-Code 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 one dual function water level cycling and low level cut off control and one single function low water level cut-off control (Aux - LLCO) and a high pressure relief switch in conjunction with a mechanical pressure relief valve.

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 one dual function water level cycling and low level cut off control and one single function low water level cut-off control (LLCO) and a high pressure relief switch in conjunction with a mechanical pressure relief valve. Additionally, both circuits have individual indicator lights that will illuminate for a visual verification of the shutdown mode.

Cal-Code and CSD-1 construction both require operator intervention in the event of a shutdown. CSD-1 is more informative by using indicator lights to show which safety system was shutdown.

WATER CONDITIONING

Furnishing the boiler with soft 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, thermostat bulbs and water level probes. Because of the high temperature of these surfaces, the precipitated minerals bake onto them and become very difficult to remove.

This causes several problems:

1. Reduce the heat transfer efficiency of the heating system.
2. Cause premature failure of Electric heaters.
3. Water level probes will give false readings.
4. Thermostat bulbs will sense temperature incorrectly.

These problems are common to any manufacturer's steamer regardless of design, but they can all be prevented by furnishing the boiler with soft water. Vulcan recommends the water contain less than 60ppm of "total dissolved solids" (TDS) and have a PH factor between 7 to 8. These water properties can be achieved by using a properly maintained water softener.

Other chemical properties in water supplies can also affect good steam generation and vary from within each state and locality.

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.

NOTE: The use of strainers, or filters will not remove minerals from the water.

Vulcan recommends that a local water treatment specialist 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 softener, which have developed a heavy scale build up, should be cleaned before using a water softener.

TOOLS

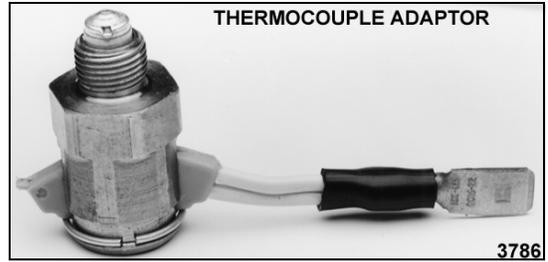
Standard

- 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

- CLR Treatment Kit - Used to remove Calcium/Lime/Rust from a boiler (Contact Vulcan Authorized Service Centers).
- Adaptor to test thermocouple closed circuit voltages (DC) on gas models with manual ignition (purchase locally).

NOTE: Adaptors vary between manufacturers. An example of one adaptor type is pictured below.



SPECIFICATIONS

Water Supply

Supply pressure should be	20-80 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)	

Steam Supply

Dry steam must be provided to the steamer for suitable use. If the steam is heavy with condensate, a Ball Float Trap must be used in the line and plumbed in before the pressure reducing valve. To ensure rapid heat up of heavy cold loads, the steam supply line must be sized to maintain pressure as outlined below.

	DIRECT STEAM STEAMERS (POTABLE)	REGENERATED STEAMERS - OLDER MODELS (*NON-POTABLE)
Supply Pressure Input	15 psi (min.)	15 psi (min.)
Flow Rate	50 lb. per hour per compartment	125 lb. per hour
Pressure Reducing Valve Output	10 psi (furnished)	set accordingly for good steam generation (10-12psi)
*Potable steam is not required for regenerated models but could be used.		

VL SERIES STEAMERS - GENERAL

Gas Steamers

MODEL	INPUT (BTU/HR)		MANIFOLD PRESSURE (INCHES W.C.)		LINE PRESSURE (INCHES W.C.)					LOAD (WATTS)	AMPS (MAX)
	NAT.	PROP.	NAT.	PROP.	NATURAL		PROPANE		MAX		120V 60HZ
					RECOMMEND	MIN	RECOMMEND	MIN			
VL2GPS	200,000	200,000	4.0	10.0	7.0	5.0	11.0	11.0	14.0	360	3.0
	240,000	240,000									
VL2GMS	200,000	200,000	4.0	10.0	7.0	5.0	11.0	11.0	14.0	360	3.0
	240,000	240,000									
VL2GAS	200,000	200,000	4.0	10.0	7.0	5.0	11.0	11.0	14.0	360	3.0
	240,000	240,000									
VL2GSS	200,000	200,000	4.0	10.0	7.0	5.0	11.0	11.0	14.0	360	3.0
	240,000	240,000									
VL3GPS	200,000	200,000	4.0	10.0	7.0	5.0	11.0	11.0	14.0	360	3.0
	240,000	240,000									
VL3GMS	200,000	200,000	4.0	10.0	7.0	5.0	11.0	11.0	14.0	360	3.0
	240,000	240,000									
VL3GAS	200,000	200,000	4.0	10.0	7.0	5.0	11.0	11.0	14.0	360	3.0
	240,000	240,000									
VL3GSS	200,000	200,000	4.0	10.0	7.0	5.0	11.0	11.0	14.0	360	3.0
	240,000	240,000									

Electric Steamers

MODEL	TOTAL KW	AMPERAGE					
		1 PHASE		3 PHASE			3 PHASE - 4 WIRE
		208V	240V	208V	240V	480V	220/380V & 240/415V
VL2EPS	24*	116	100	67	58	29	34
	36			100	87	44	50
	42			117			
	48				116	58	67
VL2EMS	24*	116	100	67	58	29	34
	36			100	87	44	50
	42			117			
	48				116	58	67
VL2ESS	24*	116	100	67	58	29	34
	36			100	87	44	50
	42			117			
	48				116	58	67
VL2EAS	24*	116	100	67	58	29	34
	36			100	87	44	50
	42			117			
	48				116	58	67

*std

STEAMER OPERATION

Ensure that all utility connections to the steamer have been made and are turned on.

On models that are CSD-1 equipped, amber colored lights for hi pressure and low water level will illuminate and stay on until the boiler is full and the manual reset switch pressed.

Gas Powered Steam Boiler

5. Open the cabinet door and turn main power switch ON. The red light will illuminate, water will begin filling the boiler and the blowdown solenoid valve will close. The boiler should fill, in four to eleven minutes. Observe water level gauge glass to verify that water is in boiler and that the level in the gauge glass is about half full. Both valves on gauge glass assembly must be open to fill the gauge. Older models equipped with a manual "ball" type blowdown valve must be closed for the boiler to fill. The cycling pressure switch will maintain the proper steam pressure in the boiler by cycling the heating system on and off to generate steam pressure.

A. **On Models with Manual Ignition** - The knob on the gas combination control valve has three positions (On-Pilot-Off) for control of main burners and pilot. Turn knob on gas combination valve to PILOT then depress and light pilot burner with a lit taper. Maintain knob in depressed position for about 30 seconds and release. Observe that pilot burner flame stays on. If the flame should go out, wait 5 minutes before relighting.

Turn knob on gas combination control valve to ON. If the water level in the boiler has reached the minimum level, burners will ignite and begin 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 steam pressure of 9-11 psi for models with a pressure regulating valve or 4-6 psi for models without the valve.

B. **On Models with Automatic Ignition** - The knob on the gas combination control valve has two positions (On-Off) for control of main burners and pilot. For the automatic ignition system to work, the knob must be set in the ON position or gas for the pilot and main burners will not flow.

Also, the ignition control module ON/OFF/RESET switch must be in the ON position to operate. This switch is located on the upper left side of the electrical control box for the ignition control module. A red light will illuminate when the switch is in the ON position. **DO NOT ATTEMPT TO MANUALLY LIGHT THE PILOT IN AN AUTOMATIC TYPE IGNITION SYSTEM.**

After the main power switch is turned ON and the ignition control modules RESET switch is in the ON position, sparking will begin three seconds later to light the standing pilot. If the pilot lights, a signal is sent back through the ignition cable indicating the presence of pilot flame and sparking stops. If the water level in the boiler has reached the minimum level, the burners will ignite and begin 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 9-11 psi for models with a pressure regulating valve or 4-6 psi for models without the valve. If a pilot 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 burner lighting cycle again.

Electrically Powered Steam Boiler

Open the cabinet door and turn main power switch ON. The red light will illuminate, water will begin filling the boiler and the blowdown solenoid valve will close. The boiler should fill, in approximately 11 minutes. Observe water level gauge glass to verify that water is in boiler and that the level in the gauge glass is about half full. Both valves on gauge glass assembly must be open to fill the gauge. Older models equipped with a manual "ball" type blowdown valve must be closed for the boiler to fill. If the water level in the boiler has reached the minimum level, the heater contactors will close, the heaters will energize and begin 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 steam pressure of 9-11 psi for models with a pressure regulating valve or 4-6 psi for models without the valve.

Regenerated Steam Powered Boiler

Open the cabinet door and turn main power switch ON. The pilot light will illuminate, water will begin filling the boiler and the blowdown solenoid valve will close. Models equipped with a manual "ball type" blowdown valve need to be closed for the boiler to fill. The boiler should fill, in approximately 15 minutes.

Observe water level gauge glass to verify that water is in boiler and that the level in the gauge glass is about half full.

Both valves on the gauge glass assembly must be open to fill the gauge. When the water reaches the minimum level, the steam solenoid valve will open, allowing steam to enter the steam coil in the heat exchanger tank and begin heating the water. After approximately 20 minutes, a sufficient amount of pressurized steam should be present for cooking product.

Direct Steam Powered Cooker

1. Open the cabinet door and turn main power switch ON.
 - A. The red light on the switch will illuminate.
 - B. If steam pressure is above the minimum setting on the cooking compartment pressure switch then the switch will close, ready light will come ON and power to the other controls will be supplied.
 - C. Observe that the steam pressure gauge in the cabinet base, indicates 10-12 psi.
2. Steamer is ready to cook product.

Boiler Blowdown and Steamer Shut off

Turn the steamer off at least once daily and blow down the boiler to remove sediments, scalants and lime build-up in the boiler. Always blowdown the boiler when it is under maximum pressure and no steam is being used.

3. **Automatic blowdown.**
 - A. Newer Models - Open the cabinet door and turn main power switch OFF. The switches' red light will go out, the blowdown/drain solenoid valve will be de-energized and the boiler will begin to drain. The cold water condenser solenoid will continue to operate, as needed, to condense steam and to cool the water going into the drain.
 - B. Older Models - Turn power switch OFF and depress blowdown timer button. Blowdown timer will operate for 4 minutes. At the end of blowdown, turn fill switch ON and allow boiler to fill.
4. **Manual blowdown.**
 - A. All Models - Turn power switch OFF. Open blowdown valve located on the bottom front of the cabinet base. After the boiler has completely drained, close blowdown valve and turn fill switch to ON and allow boiler to fill.

Cooking Compartment Controls

Close the compartment door and turn the screw handle clockwise until the gasket touches the compartment surface then ½ turn further to adequately seal the compartment. If steam leaks occur after compartment heat up and pressurization, turn handle clockwise again to increase the sealing force until the leak stops.

Proceed to the cooking compartment control instructions that apply to the steamer in use.

1. Manual

- A. Set the manual timer to the desired cooking time. If preheating is desired, allow five to ten minutes (recommended) of additional time at the beginning of the cook cycle. The length of time will vary with the type, size, temperature and condition (frozen or thawed) of the product and must be determined from experience. Pull the steam control arm handle forward and lock it by pulling the handle down. This closes the steam exhaust gate valve and opens the steam inlet gate valve, allowing steam to enter the compartment. During preheat, cooler air and condensate are exhausted from the compartment through the steam trap (condenser) until the temperature reaches 180°F, closing the internal bellows. Throughout the cooking cycle, the compartment pressure should be 6 psi if equipped with a compartment pressure regulating valve. On models without the compartment pressure regulating valve, the compartment pressure cycles with the boiler pressure between 4 and 6 psi.
- B. When the timer bell rings to signal the end of a cook cycle, turn it OFF. Lift the steam control arm handle to unlatch steam control arm. An internal spring will automatically pull the arm to the rear. This closes the steam inlet gate valve and opens the steam exhaust gate valve, allowing steam and pressure to exit the compartment.
- C. Wait approximately 30 seconds for the steam to exhaust from the compartment and to depressurize. Turn the screw handle on the compartment door counterclockwise until the gasket no longer seals against the compartment surface. After the remaining steam escapes, move the latch paddle to the left and open the door.

2. Standard

- A. Set the timer to the desired cooking time. The timer must be set past five minutes to change the state of the timer control micro switch contacts. If preheating is desired, allow five to ten minutes (recommended) of additional time at the beginning of the cook cycle. The length of time will vary with the type, size, temperature and condition (frozen or thawed) of the product and must be determined from experience.
- B. Pull the steam control arm handle forward and lock it by pulling the handle down. This closes the steam exhaust gate valve and opens the steam inlet gate valve, allowing steam to enter the compartment.
- C. Press the compartment power switch to energize the timer and red light. The balance of the cooking sequence is automatic. During preheat, cooler air and condensate are exhausted from the compartment through the steam trap (condenser) until the temperature reaches 180°F, closing the internal bellows. Throughout the cooking cycle, the compartment pressure should be 6 psi if equipped with a compartment pressure regulating valve. On models without the compartment pressure regulating valve, the compartment pressure cycles with the boiler pressure between 4 and 6 psi.
- D. Approximately one minute before timer reaches zero the steam control solenoid is energized to unlatch the steam control arm. An internal spring will automatically pull the arm to the rear. This closes the steam inlet gate valve and opens the steam exhaust gate valve, allowing steam and pressure to exit the compartment. When the timer reaches "0" the red light shuts off and a buzzer sounds indicating the end of the cook cycle. Turn the compartment power switch OFF to silence the buzzer and remove power from the compartment controls.
- E. Turn the screw handle on the compartment door counterclockwise until the gasket no longer seals against the compartment surface. After the remaining steam escapes, move the latch paddle to the left and open the door.

3. Automatic

- A. Set the timer to the desired cooking time. The timer must be set past five minutes to change the state of the timer control micro switch contacts.
- B. Pull the steam control arm handle forward and lock it by pulling the handle down. This closes the steam exhaust gate valve and opens the steam inlet gate valve, allowing steam to enter the compartment.
- C. Press the compartment power switch to supply power to the compartment controls. The automatic compartment controls, feature load compensated cooking time by utilizing a thermal switch. With this feature, when the compartment temperature reaches 180°F (the temperature at which preheating or defrosting is complete) the red light will then come on and the timer will start. For a small food load, the delay time before the timer starts might be a minute or less. For a large food load, the delay time could be four to five minutes. During preheat, cooler air and condensate are exhausted from the compartment through the steam trap (condenser) until the temperature reaches 180°F, closing the internal bellows. Throughout the cooking cycle, the compartment pressure should be 6 psi if equipped with a compartment pressure regulating valve. On models without the compartment pressure regulating valve, the compartment pressure cycles with the boiler pressure between 4 to 6 psi.
- D. Approximately one minute before timer reaches zero the steam control solenoid is energized to unlatch the steam control arm. An internal spring will automatically pull the arm to the rear. This closes the steam inlet gate valve and opens the steam exhaust gate valve, allowing steam and pressure to exit the compartment. When the timer reaches "0" the red light shuts off and a buzzer sounds indicating the end of the cook cycle. Turn the compartment power switch OFF to silence the buzzer and remove power from the compartment controls.
- E. Turn the screw handle on the compartment door counterclockwise until the gasket no longer seals against the compartment surface. After the remaining steam escapes, move the latch paddle to the left and open the door.

4. Prevent

- A. Set the timer to the desired cooking time. The timer must be set past five minutes to change the state of the timer control micro switch contacts.
- B. Pull the steam control arm handle forward and lock it by pulling the handle down. This opens the steam inlet gate valve, allowing steam to enter the compartment.
- C. Press the compartment power switch to supply power to the compartment controls. The prevent compartment controls feature load compensated cook times by utilizing a thermal switch. With this feature, when the compartment temperature reaches 180°F (the temperature at which preheating or defrosting is complete) the red light will come on and the timer will start. For a small food load, the delay time before the timer starts might be a minute or less. For a large food load, the delay time could be four and five minutes. During preheat, the steam exhaust solenoid valve (N.O.) is open to allow the full free venting of cooler air and condensate from the compartment. When the temperature reaches 180°F, the exhaust solenoid valve is energized and closes. The compartment should then pressurize to 6 psi.
- D. Approximately one minute before timer reaches zero the steam control solenoid is energized to unlatch the steam control arm. An internal spring will automatically pull the arm to the rear. This closes the steam inlet gate valve and opens the steam exhaust gate valve, allowing steam and pressure to exit the compartment. When the timer reaches "0" the red light shuts off and a buzzer sounds indicating the end of the cook cycle. Turn the compartment power switch OFF to silence the buzzer and remove power from the compartment controls.
- E. Turn the screw handle on the compartment door counterclockwise until the gasket no longer seals against the compartment surface. After the remaining steam escapes, move the latch paddle to the left and open the door.

COMPONENT FUNCTION

CABINET BASE BOILER CONTROLS

Water Level

Gauge Assembly Permits a visual confirmation the water level is being maintained in boiler during operation. The correct water level is a point one-half of the height of 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 Level Control and Level Sensing Probes

These controls allow water to enter the boiler to fill and maintain the proper water level. They will also shut off the heat source to the boiler if the water level drops too low. 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).

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.

Cycling Pressure Switch

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

High Limit Pressure Switch

A switch of identical design to the cycling pressure switch but used as a high limit. The pressure settings are at higher and lower limits than the cycling pressure switch in order to turn off the heat source before the boiler pressure reaches its limit and automatically resets after the pressure drops below the lower limit set point.

Blowdown/Drain

Solenoid Valve

This valve is plumbed into the drain line of the boiler. Newer steamer models will automatically blowdown when power is turned off by using a normally open solenoid valve. Older models can have a solenoid valve that is activated by depressing a separate blowdown timer button or have a manual "ball" type valve.

Inlet Water Strainer

A strainer is used in the water inlet 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. A "Y" strainer should be inserted upstream of the fill solenoid valve. On models using a direct steam supply, a strainer is also used in the pressure regulating valve.

Power Switch

When turned ON, power is supplied to the controls and the steam generating process is started in the boiler. The power switch is located on the front of the boiler control box.

Water Inlet Valve

The water inlet valve is used to stop water flow to the steamer when the steamer is being serviced. Newer models will have a small Petcock type valve while older models will be a "ball" type valve. This valve should remain open during normal operation.

High Limit Thermostat

A protective device that shuts off the heat source if the boiler temperature exceeds a specified limit. All standard models are equipped with a surface high limit.

Descaler

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

- Handhole Cover Assembly** When unbolted and removed, allows internal examination and cleaning of boiler shell and its components if required.
- Boiler Pressure Gauge** Indicates the amount of steam pressure in the boiler.
- Check Valve** On models with the delime piping assembly option, prevents the ejection of hot water and steam out of the delime funnel if the manual delime fill valve were to be opened.
- Delime Port Assembly** On models with the delime piping assembly option, allows the boiler and other internal components to be delimed, easily removing calcium, lime and rust build up.
- Gas Pilot** Should always remain lit to light the main burners upon a call for heat unless the steamer will not be in use for an extended period. If the pilot flame goes out, wait 5 minutes before relighting.
- Gas Burners** Heats the water in the boiler to generate steam.
- Gas Combination Control Valve** ... A gas solenoid valve that opens to allow gas flow when a call for heat is made. Also regulates the manifold gas pressure and supplies the gas pilot.
- Transformer** Provides 24VAC power to ignition control module. (gas models with electronic ignition)
- 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 main valve coil upon a call for heat to supply gas to the main burners. The pilot and main solenoids are part of the gas combination control valve. (gas models with electronic ignition)
- Ignition Control Module
Reset (ON/OFF) Switch** Controls power to the ignition control module and allows a reset of the module if the gas ignition exceeds trial time. (gas models with electronic ignition)
- Heater Contactor
(Electric Boilers)** When coil is energized, supplies power to the electric heating elements.
- Heating Elements
(Electric Boilers)** Heats the water in the boiler to generate steam.
- Steam Header Assembly** Main steam supply line from the boiler to the steam header inlet in the cooking control compartment.
- Pressure Relief Valve** A mechanical device that opens to relieve steam pressure in the boiler if the pressure exceeds 15 psi.
- Compartment Pressure
Regulating Valve** Reduces steam pressure form the boiler or building steam (direct and regenerated models) to supply the compartments a steam pressure of 6 psi. Standard on PS, option on MS, SS and AS compartment controls.

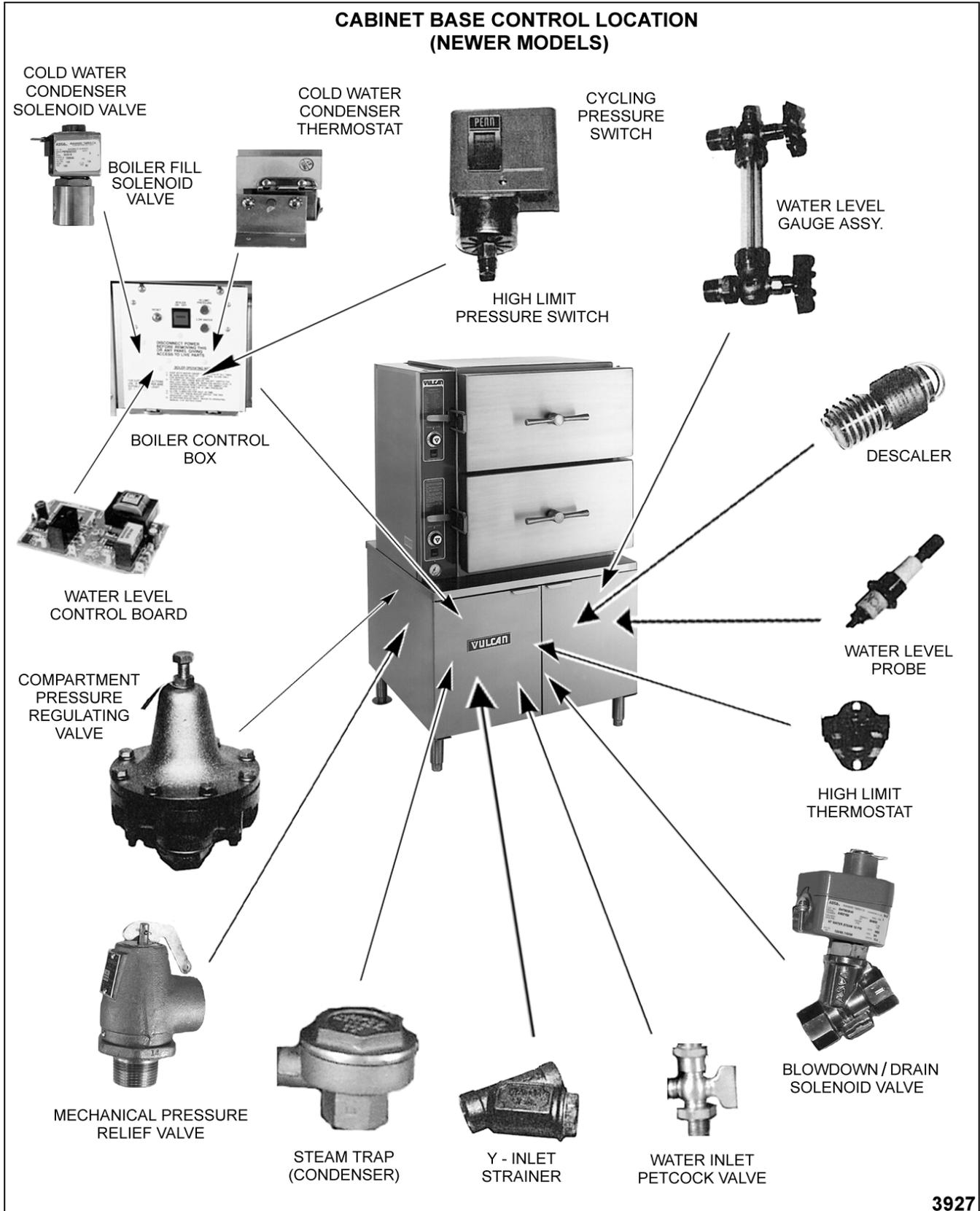
COOKING COMPARTMENT CONTROLS

The top half of the steamer consists of two to three separate cooking compartments depending on the model. Each compartment functions independently with its own set of controls. Power is supplied to the controls through the compartment power switch and the cooking timer control micro switch contacts. Prevent and Automatic models have a load compensating thermal switch that prevents the controls from receiving power until the compartment reaches 180°F to close the switch.

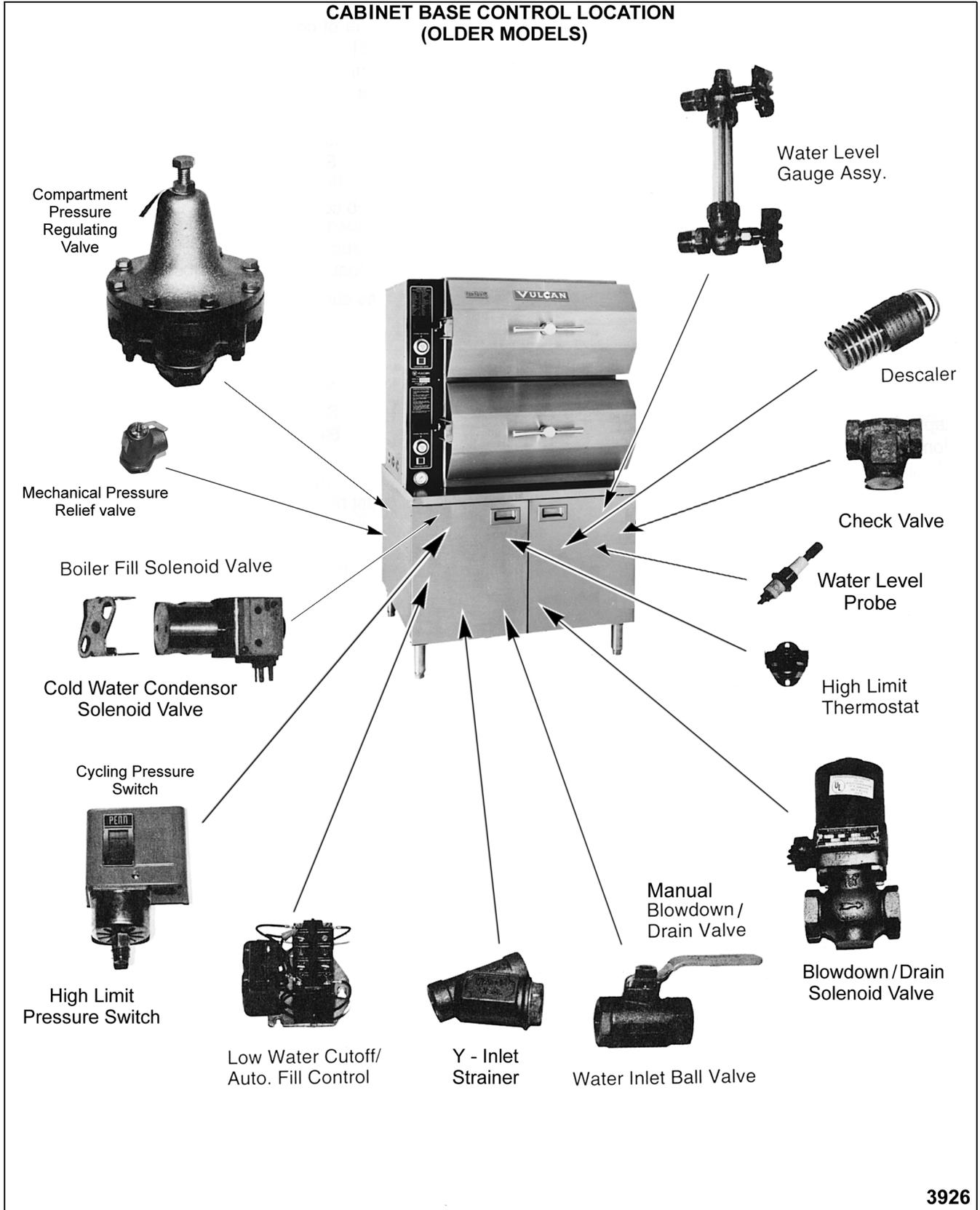
- Compartment Power Switch** Supplies power to the cooking compartment controls.
- Cooking Light (Red)** When lit, indicates steamer is in a cooking cycle. (All models except manual)
- Cooking Timer** Use to set desired cooking cycle time between 0-60 minutes. Energizes the buzzer when time expires (All models except manual). On Prevent models, also de-energizes the steam exhaust solenoid valve one minute before the end of a cook cycle to allow compartment venting.
- Buzzer** Signals end of a cook cycle, must be turned off manually. (All models except manual)
- Steam Exhaust Solenoid Valve** A normally open valve that allows full compartment venting of air and condensate up to 180°F during compartment heat up and “limited free venting” after energized by the closing of the thermal switch. The valve remains closed to allow compartment pressurization to 6 psi until one minute before the end of a cook cycle at which point the timer control micro switch contacts (SW2) change state and de-energize the valve to vent the compartment of pressure and steam. (prevent models)
- Steam Header Inlet (manifold)** Main steam supply line from the boiler for each cooking compartment. Supplies steam to the manual steam gate valves.
- Compartment Pressure Gauge** Indicates the amount of steam pressure in cooking compartments.
- Steam Control Arm Solenoid** When energized, engages the lift arm (plunger) to raise the steam control arm off of the catch, allowing it to return to its rear position. This closes the steam inlet gate valve and opens the steam exhaust gate valve. (prevent, automatic and standard models)
- Thermal Switch (Load Compensator)** Controls power to the preheat cycle components. Turns the cooking light on, energizes the steam exhaust solenoid valve and energizes the cooking timer motor to start timing, after the compartment reaches 180°F. (prevent and automatic models)
- Steam Gate Valves** Manual valves actuated by the steam control arm. Allows steam to flow into the cooking compartment through the inlet steam gate valve when the arm is in a forward position and exhaust the steam through the exhaust steam gate valve when the arm is at the rear. Prevent models use a steam exhaust solenoid valve to exhaust the steam and a single steam gate valve as the steam inlet. The automatic, standard and manual models use one steam gate valve to exhaust the steam and one additional steam gate valve as the steam inlet.
- Steam Trap (Condenser)** Exhausts air and condensate from compartment during preheat until the compartment temperature reaches approximately 180°F. The bellows then close, stopping the exhaust. (all models except prevent)

REMOVAL AND REPLACEMENT OF PARTS

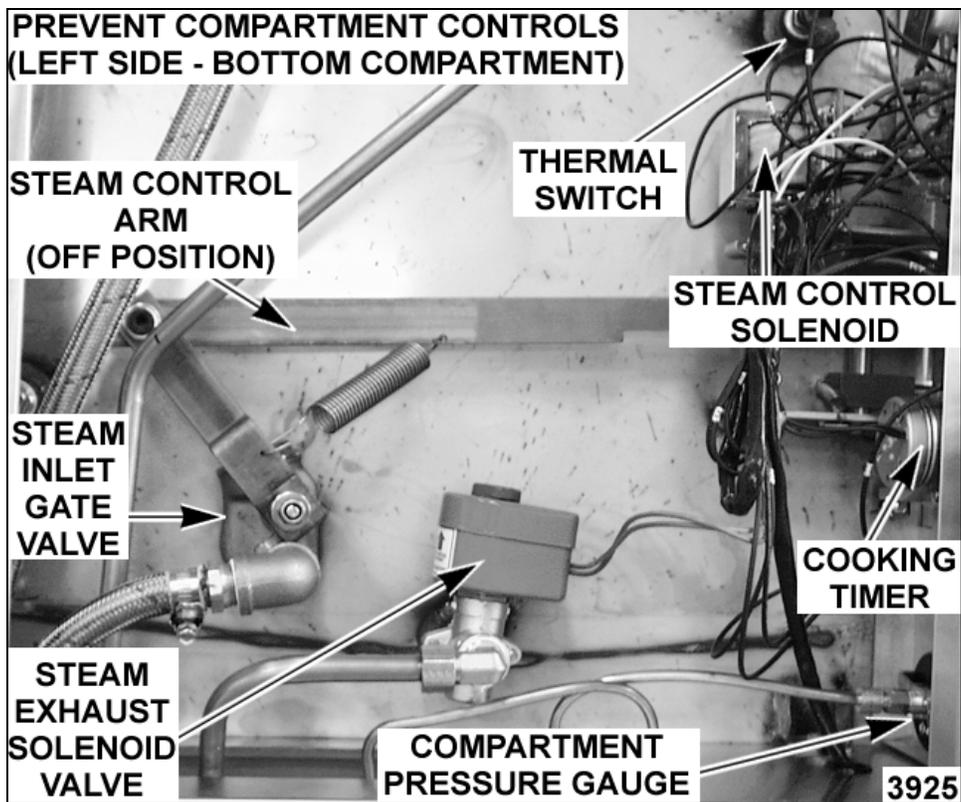
COMPONENT LOCATIONS



**CABINET BASE CONTROL LOCATION
(OLDER MODELS)**



3926



COOKING COMPARTMENT CONTROLS - COMPONENT CONFIGURATIONS	
1. Prevent (shown above)	thermal switch, inlet steam gate valve, steam exhaust solenoid valve, steam control arm solenoid, timer, buzzer and power switch with light. Does <u>not</u> use a steam trap.
2. Automatic	same as prevent except does <u>not</u> include steam exhaust solenoid valve but <u>does</u> include an exhaust steam gate valve and two steam traps.
3. Standard	same as automatic except does not include thermal switch.
4. Manual	manual and exhaust steam gate valves and a manual timer. Includes two steam traps.

WATER LEVEL CONTROLS - LOW LEVEL CUT OFF AND DIFFERENTIAL

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.

Solid State

1. Open the cabinet base doors.
2. Remove the two screws at the top of the boiler control box and allow cover to drop down.
3. Water level control is mounted on the back side of cover.
4. Disconnect lead wires from the board and remove the water level control.
5. Reverse procedure to install and check for proper operation.

Electro Mechanical

1. Open the cabinet base doors.
2. Remove the two screws from the left and right side of the water level control box and lift cover off.
3. Disconnect lead wires from the control being replaced and remove.
4. 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 doors 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.
5. When reinstalling the tube use new sealing washers. Do not over tighten the packing nuts; it could break the gauge glass.
6. Open the top and bottom valves and check for proper operation.

CYCLING AND HIGH LIMIT PRESSURE SWITCHES (GAS AND ELECTRIC MODELS)

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 doors and remove the left side panel.
2. Remove the two screws at the top of the boiler control box and allow cover to drop down.
3. The pressure switches are located at the rear of the box. The pressure switch on the right is the cycling or primary control; the one on the left is the high limit control. They are identical switches, differing only in their settings.
4. Remove the cover from the pressure switch being replaced and disconnect the lead wires.
5. Disconnect the pressure fittings at the bottom of the switch.
6. Remove the mounting screws on the back side of the control box and lift out the pressure switch.
7. Preset the new pressure switch to the approximate cut-out (off) and cut-in (on) set points before installing. See the boiler pressure chart under "CYCLING AND HIGH LIMIT PRESSURE SWITCHES (GAS AND ELECTRIC MODELS)" in "SERVICE PROCEDURES AND ADJUSTMENTS".
8. Reverse procedure to install.
9. Adjust the pressure switch(s) final set points as outlined under "CYCLING AND HIGH LIMIT PRESSURE SWITCHES (GAS AND ELECTRIC MODELS)" in "SERVICE PROCEDURES AND ADJUSTMENTS" and check for proper operation.

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. Blow down the boiler and allow to cool, if necessary.
2. Ensure that all utilities to the steamer are off and disconnected. Drain any excess water from the boiler.
3. Disconnect the steam supply line, power leads and drain lines from the cooking compartment top to the boiler base.
4. Disconnect all plumbing connections and power leads from the components inside the control boxes that would obstruct the removal of the boiler through the front of the base, then remove those control boxes.
5. Disconnect the remaining plumbing and electrical connections from the boiler to the controls.
6. Remove the screws holding the flue and flue collector to the base.
7. Remove the anchor screws holding the boiler to the frame. Slide the boiler forward. The burner box, anchored only by the boiler, must be prevented from sliding forward with the boiler.
8. Reverse procedure to install a new boiler and check for leaks and proper operation.

HIGH LIMIT THERMOSTAT

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 doors.
2. Electric models only - for gas models proceed to step 3.
 - A. Newer Models - are not equipped with a hi limit thermostat but rely on the Hi limit pressure switch instead.
 - B. Older Models - the high limit thermostat is located behind the contactor box cover. On electric boilers with two heating elements, the thermostat is connected to one of the heating element lugs. On electric boilers with four heating elements, the thermostat is located on an aluminum plate between the center pair of elements at the top of the elements. Remove the thermostat lead wires and mounting nuts, replace thermostat and check for proper operation.
3. Gas Models only.
 - A. Remove the thermostat cover which is located on the front of the boiler. Disconnect the thermostat lead wires and remove the nuts securing the high limit thermostat to the boiler surface.
4. Reverse procedure to install 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 doors and remove the two screws at the top of the boiler control box and allow cover to drop down. Both solenoid valves are located side by side near the front of the boiler control box with the boiler fill on the right and the cold water condenser to the left.
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 AND THERMOCOUPLE ASSEMBLY (GAS MODELS)

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. Open the cabinet doors to access the pilot and thermocouple assembly. The assembly is located to the right of the center burner and half way back from the front.
2. Disconnect thermocouple and pilot gas supply tubing from the combination control valve.
3. Remove the two screws holding the pilot to its bracket.
4. Replace the thermocouple or pilot assembly and check for proper operation.

GAS COMBINATION CONTROL 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.

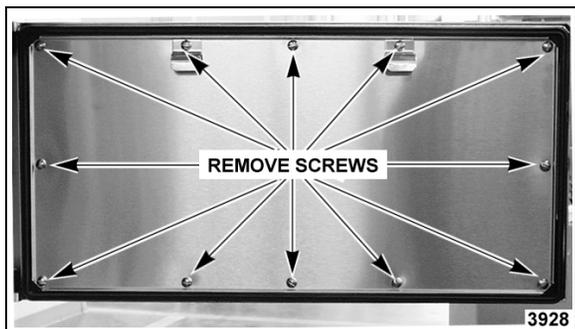
NOTE: Gas combination control valves are not serviceable and should not be disassembled. Once the problem has been isolated to this control, replace it. Do not attempt to repair the assembly.

1. Open the cabinet base doors and remove the two screws at the top of the boiler control box and allow cover to drop down.
2. Disconnect electrical supply wires and conduit running to the combination control valve.
3. Disconnect the thermocouple lead (if applicable), pilot gas supply tube from control and pipe connections on each side of the control.
4. Reverse procedure to install.
5. Set manifold pressure as outlined under "GAS MANIFOLD PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS".
6. Check for proper operation.

COMPARTMENT GASKET AND DOOR SCREW NUT, DOOR AND BUSHINGS

Gasket

1. Open the compartment door to be replaced.
2. Remove screws securing the gasket retaining plate to the gasket.

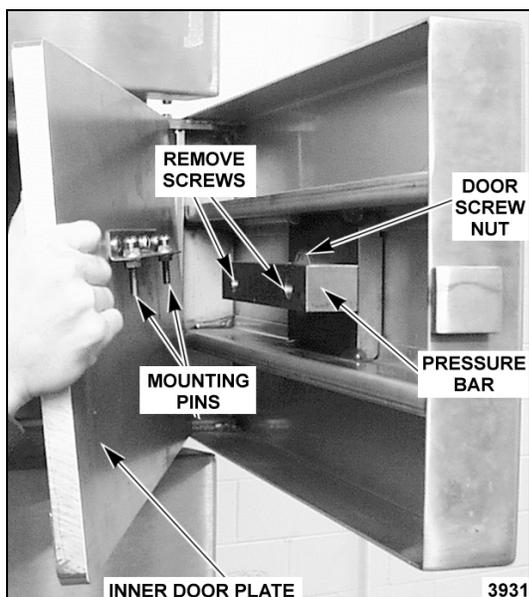


3. Lift the gasket off the inner door plate.
4. Position the new gasket on the inner door plate and reverse procedure to install.

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

Door Screw Nut

1. Open compartment door to be serviced.
2. Turn screw handle fully clockwise to extend inner door plate assembly.
3. Lift the inner door plate assembly up, until the mounting pins are out of the holes in the pressure bar and set the assembly aside.



4. Turn screw handle fully counterclockwise and remove from door.
5. Remove screws mounting the pressure bar to the backside of the compartment door.

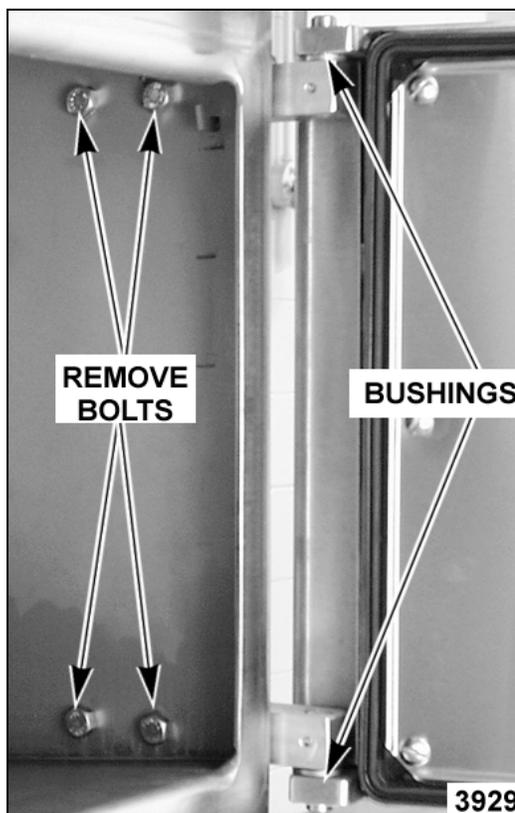
NOTE: A compression spring is mounted behind each screw. Set aside for reuse.

6. Remove screws mounting the door screw nut (bronze) to the backside of the compartment door.
7. Reverse procedure to install and check for proper operation.

Door and Bushing

1. Open the compartment door to be replaced.
2. Remove the right side pan support inside the compartment.
3. Remove the four bolts inside the compartment that secure the block hinges to the exterior side of the compartment.

CAUTION: Door is extremely heavy and will drop when bolts are removed.



4. At this time, the bushings can be replaced if necessary, by removing the bushings from the pin on each block hinge.
5. Reverse procedure to install and check for proper operation.

HEATER CONTACTORS

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 doors, remove the two screws from the contactor box cover and lift cover off.
2. Disconnect the electrical lead wires to the coil and the power supply wires from the contactor being replaced.
3. Remove the screws from the base of the contactor and lift out.
4. Reverse procedure to install and check for proper operation.

HEATING ELEMENTS

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 doors, remove the two screws from the contactor box cover and lift cover off.
2. Disconnect the electrical lead wires to the element being replaced.
3. Remove the bolts securing the heating element flange to the boiler and lift the element out.
4. Clean the mating surface of the boiler and install a new flange gasket and heating element.
5. Check for leaks and proper operation.

REGENERATED STEAM MODELS (STEAM COIL)

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 STEAM SUPPLY BEFORE SERVICING THE UNIT.

1. Disconnect pipe unions in the steam supply line to the coils and in the condensate discharge line from the coils.
2. Remove header that supplies steam to the coils by disconnecting union at each coil.
3. Remove coil condensate collection header.
4. Remove bolts securing the coil being replaced and pull coil forward.
5. Clean the mating surfaces of the steam coil flange and the boiler.
6. Reverse procedure to install a new steam coil and gasket.
7. Check steamer for proper operation.

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 scale and lime build up on a quarterly basis. In hard water areas or for steamers heavily used, a more 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".

WARNING: READ AND FOLLOW THE INSTRUCTIONS ON THE CLR BOTTLE. USE PLASTIC OR RUBBER GLOVES TO AVOID SKIN CONTACT. IF CLR LIQUID COMES IN CONTACT WITH THE SKIN, RINSE WITH CLEAN WATER.

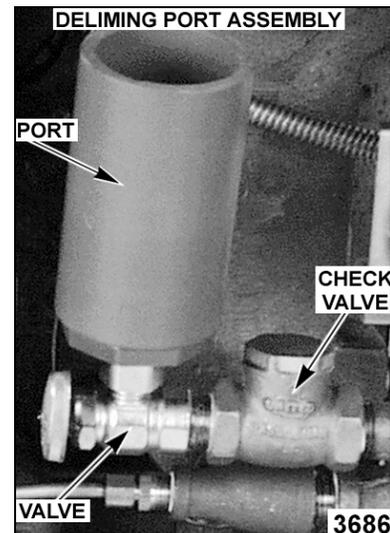
Clean-Out (All Boiler Models)

1. Turn steamer OFF and drain boiler.
2. Remove hand hole plate and gasket (top front) from the boiler by removing the nut and clamp, then tapping the cover lightly to free it while holding the cover stud. This prevents the cover from dropping into boiler.
3. Remove old descaler retaining springs if present.
4. With a wire brush, or equivalent, dislodge and remove all loose scale from boiler shell. The loose material must be either scooped from the boiler or flushed through the drain.
5. Check probe canister and float valve assembly (regenerated models) for a scale build up and clean as necessary.
6. Check drain hole for obstructions.
7. Inspect the condition of the descalers as outlined in this section and replace if necessary.
8. Mix the deliming solution according to the instructions for the chemical being used.

NOTE: Boiler water capacities vary between seven to nine gallons for both gas and electric models depending on the boiler size and BTU/KW rating.

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

- A. Models with Blowdown Timer - Pour deliming solution into boiler shell. Proceed to step 9.
- B. Models without Blowdown Timer - Turn off the incoming water supply. Turn the power switch ON to close the drain valve. Pour deliming solution into boiler shell. Proceed to step 9.
- C. Models with Deliming Port Assembly - Before pouring deliming solution into boiler, clean the seating surfaces for the hand hole gasket and then install a new gasket. Position the hand hole plate and tighten down. Turn off the incoming water supply. Turn the power switch ON to close the drain valve. Open the deliming assembly valve and pour the deliming solution into the port. Close the deliming assembly valve and proceed to step 10.



9. Clean the seating surfaces for the hand hole gasket and then Install a new gasket. Position and tighten the hand hole plate.

10. Cooking compartment timers are to be in the OFF position. Turn the boiler switch ON and open water valve if necessary.
11. Boiler is to operate under pressure for 90 minutes or per the instructions for the chemical in use.
12. Drain boiler by normal methods.
13. Refill boiler and allow to heat until fully pressurized.
14. Repeat step 13 three times.
15. The steamer is now ready for normal operation.

Deliming Only (Models with Deliming Port Assembly)

Boiler deliming should be performed on a weekly, bi-weekly or monthly basis, depending on the quality of the local water supply. See "WATER CONDITIONING" under "GENERAL".

On steamers using a water purification 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.

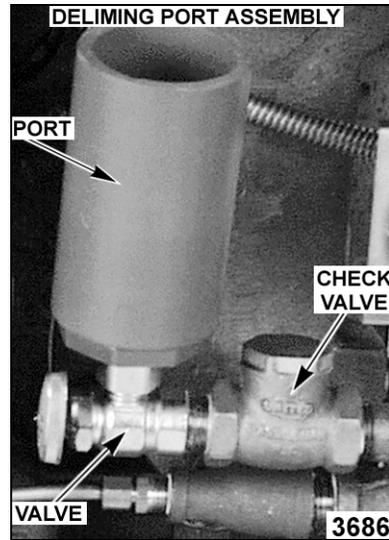
1. Turn steamer OFF and drain boiler.
2. Mix the deliming solution according to the instructions for the chemical being used.

NOTE: Boiler water capacities vary between seven to nine gallons for both gas and electric models depending on the boiler size and BTU/KW rating.

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

- A. **Models with Blowdown Timer** - Open the deliming assembly valve and pour the deliming solution into the port. Close the deliming assembly valve and proceed to step 3.

- B. **Models without Blowdown Timer** - Turn off the incoming water supply. Turn the power switch ON to close the drain valve. Open the deliming assembly valve and pour the deliming solution into the port. Close the deliming assembly valve and proceed to step 3.



3. Top compartments are to be in the OFF position. Turn the boiler switch ON and open water valve if necessary.
4. Boiler is to operate under pressure for 90 minutes or per the instructions for the chemical in use.
5. Drain boiler by normal methods.
6. Refill boiler and allow to heat until fully pressurized.
7. Repeat step 6 three times.
8. Steamer is now ready for normal operation.

Descaler

The descaler is accessible through the hand hole opening. It is a coiled wire wound around a solid cylindrical core, and hangs by an open loop from the shell's horizontal stay rod, about 4 inches from the front of the shell. If the wire is eaten through, or if the core of the descaler is eaten away to half its original size, a new descaler should be installed.

To install a new descaler, stretch its wire coil so the descaler hangs with its core completely below the minimum water level in the boiler, but hanging free. The descaler must not contact the bottom of the boiler shell, electric heating elements or regenerating steam coils.

WATER LEVEL CONTROL(S) TEST

Loose electrical connections may prevent the heat from coming on or may cause the boiler to overflow. 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 prevent the boiler from filling or cause dry firing. Dry firing will result in damage to the heating elements on electric models or to the boiler on gas or electric models.

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

Solid State - Low level Cut-Off & Differential Control

1. Turn the power switch ON.
2. Ensure that water is filling the boiler.
 - A. Confirm that water supply valve(s) are turned on.
 - B. Observe boiler water level in the water level gauge. If empty, boiler should fill in approximately 11 minutes.
3. Check the voltage across terminals L1 & L2 on the board. Meter should read 120VAC.
 - A. If voltage is correct then the high level (HL) relay should energize, closing HL-3 contacts and the HL LED should light up. The boiler fill solenoid should then energize and start filling the boiler. Verify boiler fill solenoid valve is receiving 120VAC and water is flowing through it.
 - B. If boiler fill solenoid is receiving power but no water is flowing, inspect fill solenoid for malfunction or valve for clogged ports. If solenoid is bad or ports can not be cleaned, then replace boiler fill solenoid and check for proper operation.
 - C. If boiler fill solenoid is not receiving power and the electrical connections have been checked, then the HL relay is not being energized or the HL-3 contacts are not closing. Replace water level control board and check for proper operation.
4. If boiler is filling properly, when the water level reaches the low level cut-off (LLCO) probe, LLCO relay should energize closing LLCO-2 contacts, heat source should come on (standard models only) and LLCO LED will light.
5. Once the water level reaches the high level (HL) probe, the inverse latching relay of the board (solid state) should energize and lock through the low level probe (LL) and ILR-1 contacts. With ILR-2 contacts open, the HL relay is de-energized and HL LED goes out. With the HL-3 contacts open, the boiler fill solenoid should de-energize and stop the boiler fill.
6. If water is in the boiler but is not being detected by the water level probes, the probes may need cleaned and/or boiler delimed. See "Water Level Probes" as outlined below for inspecting and cleaning of probes and "BOILER" for a procedure on boiler inspection, clean-out and deliming.
7. Turn the power switch OFF and disconnect the lead wire from each probe. Check the probes as outlined below.
 - A. With an ohmmeter, check between the probe terminal and boiler shell. An open circuit should be present when the boiler is empty. If resistance is present, remove and inspect the probes as outlined below under "Water Level Probes". When the boiler is full of water, a resistance reading should be measurable between the probes and boiler.

NOTE: The actual resistance reading will depend on water quality and probe condition.

8. After performing steps 1-5A and verifying the water level control boards operation, if the control is not functioning as described, then replace it and check for proper operation.

Electro Mechanical - Low level Cut-Off & Differential Control

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

1. Ensure that water is filling the boiler.
 - A. Confirm that water supply valve(s) are turned on.
 - B. Observe boiler water level in the water level gauge.
 - C. Verify boiler fill solenoid valve is receiving 120VAC and water is flowing through it.
2. Check for correct voltage being applied to the low level and differential water level controls.
 - A. Turn the water supply valve off then turn the power switch ON. Check the input voltage across terminals 1 & 2. Meter should read 120VAC. If voltage is correct proceed to step 2B. If voltage is incorrect, find the source of the problem and repeat this step.

- B. With the boiler empty, check the voltage across terminals 9 & 10. Meter should read 300 to 350VAC. If voltage is correct proceed to step 3. If voltage reading is approximately 30VAC then the internal contactor is energized but the probes are scaled over and moist and/or have a damaged insulator giving a false reading. See "Water Level Probes" listed below for inspecting and cleaning and "BOILER" for procedures on boiler inspection, clean-out and deliming. If you do not read any voltage, then contactor coil on the water level control is bad and the control should be replaced. Check for proper operation after replacement.
 3. If water is in the boiler but is not being detected by the water level probes, the probes may need cleaned and/or boiler delimed. See "Water Level Probes" listed below for inspecting and cleaning and "BOILER" for procedures on boiler inspection, clean-out and deliming.
 4. Turn the power switch OFF and disconnect the lead wire from each probe. Note the location of the probes and the number of the wire connected to it.
 - A. Check the resistance between the probe terminal and boiler shell. An open circuit should be present when the boiler is empty. If resistance is present, remove and inspect the probes as outlined below under "Water Level Probes". A resistance reading should only be measurable between the probes and boiler shell (ground) when the boiler is full of water.
- NOTE:** The actual resistance reading will depend on water quality and probe condition.
5. If after performing steps 1-4 and the control is not functioning properly, verify the water level controls operation as outlined in "WATER LEVEL CONTROLS" under "ELECTRICAL OPERATION".
 6. After checking the above items, if the low level cut off or differential water level control does not appear to be functioning as described, then replace the control and check for proper operation.

Water Level Probes

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. Remove the cover over the water level probes and disconnect the lead wire from each probe. Note the location of each probe and the number of the wire connected to it. Remove each water level probe for examination.

2. If lime scale build up is evident on the probe, thoroughly clean it removing all deposits from the probe and insulator. Do not use any thing abrasive on the insulator; use a soft cloth.
3. Inspect the probes for a cracked or damaged insulator. If a probe appears to be damaged, replace it with a new one and proceed to step 5. If a probe does not appear to be damaged then proceed to step 4.
4. Check through the probe socket opening in the top of the canister assembly for the presence of water. Water must drain from the probe canister and if in doubt, pour water into the canister and observe that it drains quickly. If water fails to drain from the canister, remove the cover or canister assembly and clean.
5. Reverse procedure to install and check for proper operation.

CYCLING AND HIGH LIMIT PRESSURE SWITCHES (GAS AND ELECTRIC MODELS)

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

Remove the boiler control box cover as outlined under "CYCLING AND HIGH LIMIT PRESSURE SWITCHES (GAS AND ELECTRIC MODELS)" to access the two controls. The pressure switch on the right is the cycling or primary control; the one on the left is the high limit control. They are identical switches, differing only in their settings.

Turn the power ON and let the boiler come up to pressure. Close and seal one of the compartment doors, set a time past 5 minutes on the cooking timer, pull the steam control arm handle forward and turn the compartment power switch ON to exhaust pressure from the boiler. Observe boiler pressure gauge readings for several cycles and compare them with the pressure settings in the chart.

If the readings differ, adjust the pressure settings as described below.

Two slotted and square headed adjustment screws extend through the top of the switch case. A pressure scale and indicating pointers are visible through the sight glass window to indicate the approximate pressure setting. The adjustment screw directly above the right side pointer changes the cut-out (off) set point and the adjustment screw directly above the left side pointer changes cut-in (on) set point. Adjust the screw to obtain the proper cut-out (off) setting first, then adjust the other screw to obtain the proper cut-in (on) setting. Turn the screw clockwise to increase the pressure setting and counterclockwise to decrease the pressure setting. The pressure settings for each switch are listed below.

BOILER PRESSURE SETTINGS (PSI)					
CONTROL TYPE	VL MODELS	CYCLING		HIGH LIMIT	
		ON	OFF	ON	OFF
With Compartment Pressure Regulating Valve	PS	9	11	6	15
	AS				
	SS				
	MS				
With-Out Compartment Pressure Regulating Valve	AS	4	6	2	15
	SS				
	MS				

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.

Check to assure the solenoid valve is receiving power. If the solenoid valve is receiving power but the valve is not opening, the coil may be malfunctioning. Replace the solenoid valve and check for proper operation. 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. To check solenoid valve further, follow the procedure outlined below.

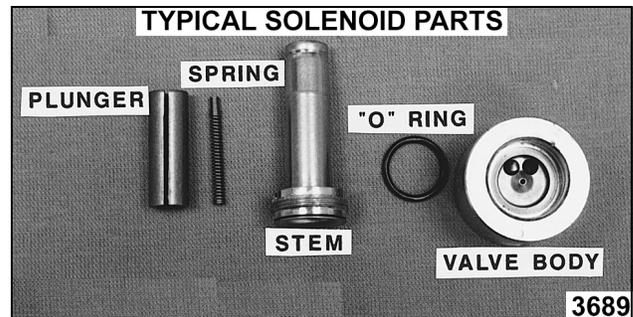
Disassembly

NOTE: It is recommended that the valve be removed for cleaning as outlined in this procedure. This will prevent damage to the lines and fittings when the stem is removed from the body.

1. 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.
2. Clamp the body of the valve in a vise.
3. Mark a scribe line on the stem nut to the valve body for proper retightening.
4. Remove the stem locking nut to remove the stem from the valve body.
5. 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.



6. Reverse procedure to install.

COMPARTMENT PRESSURE ADJUSTMENT

Remove the left side panel from the boiler base to access the compartment pressure regulating valve. If the steamer is equipped with the compartment pressure regulating valve and the steamer is operating, set the pressure regulating valve to read 6 psi on the compartment gauge. Turn the hex head screw at the top clockwise to increase the pressure and counterclockwise to decrease. If the steamer is not equipped with the compartment pressure regulating valve, then the compartment will cycle at the same pressures of the boiler. A mechanical pressure relief valve serves as a safety backup control and is pre-set for a maximum of 8 psi.

HIGH LIMIT THERMOSTAT

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.

Remove thermostat (bi-metallic disk type) as outlined under "HIGH LIMIT THERMOSTAT" in "REMOVAL AND REPLACEMENT OF PARTS". Inspect the temperature sensing side of thermostat for corrosion or rust. Clean mounting and thermostat surfaces before remounting or replacing. A good metal-to-metal contact is essential for proper functioning of the thermostat. This service must be performed at least once a year. If thermostat mating surface can not be thoroughly cleaned or is severely pitted and rusted, then replace and check for proper operation.

BOILER NOT FILLING WITH WATER

Ensure that water to the steamer is turned on, then turn power switch ON. After approximately 10 minutes, if no water is observed in the water level gauge sight glass, then check for a problem with the boiler fill solenoid valve, water level control(s) or the water level probes. See "WATER LEVEL CONTROL TEST". Also, "water hammering" in the supply line, in conjunction with a check valve can cause a high water pressure pocket in the water line to the fill solenoid valve. The fill solenoid valve will not be able to overcome this pressure and operate to supply the boiler with water. Shut off the water supply and relieve the pressure in the line. Turn the water supply back on and check for proper operation.

NOTE: To eliminate this problem, the customer must install a "water hammer suppression device" in the supply line to the boiler.

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.

Scalants may be covering the water level control probe giving a false indication of a sufficient water level in the boiler. Remove and thoroughly clean the water level probes to remove scalants and lime build up. Also, Check through the probe socket opening in the top of the canister assembly for the presence of water.

Water must drain from the probe canister and if in doubt, pour water into the canister and observe that it drains quickly.

If water fails to drain from the canister, remove the cover or canister assembly and clean. These conditions indicate extremely poor water quality being supplied to the boiler and/or boiler clean out and deliming has not been performed.

The water condition must be cleared up immediately with a proper water conditioner to avoid further problems with the steamer. Re-install the water level probes and canister assembly (if applicable). Perform a boiler inspection, clean-out and deliming procedure as outlined under "BOILER". Check for proper operation.

Water may be draining through an open boiler blowdown solenoid valve as quickly as it's fed to the boiler. Loose wiring, a burned out coil or particles of scale trapped in the valve seat may prevent the valve from closing.

Newer steamer models use a plunger type rod that raises and lowers to permit steam/water flow out of boiler. If debris has accumulated around the water orifice, the plunger may not seat properly to close off the opening. If this symptom is suspect, remove the solenoid as outlined in "FILL AND COLD WATER SOLENOID VALVES". Remove any debris found on sealing surfaces, reassemble and install. If the solenoid valve still does not function properly, replace it with a new valve and check for proper operation.

Older steamer models have a movable blade and when closed, the blade reacts as a guillotine that should be free to move fully down into the valve pocket (projection at bottom of valve) so that the pierced hole in the blade aligns perfectly with the body opening. If debris has accumulated in the bottom of the valve pocket, then the blade will not move into the pocket completely. If this symptom is suspect, remove the solenoid as outlined in "FILL AND COLD WATER SOLENOID VALVES".

NOTE: On this valve body, remove the two assembly bolts holding the brass body together and remove the loose internal parts. Remove any debris found on sealing surfaces, reassemble and install. If the solenoid valve still does not function properly, replace it with a new valve and check for proper operation.

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.

If the blowdown operation appears to function sluggishly or not at all, considerable scalants may be lodged in the drain pipe and/or the valve. Disconnect the valve from the drain line and inspect both the valve and the drain pipe fixed to the boiler. If considerable scalants or lime build up is apparent, then not only the 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.

1. If your steamer has an automatic blowdown drain valve.

A. Newer Models

- 1) Are equipped with normally open solenoid valves that close when energized by the main power switch. When the main power switch is turned off, the solenoid valve is de-energized and the boiler blowdown valve re-opens.

B. Older Models

- 1) Turn the power switch(s) OFF and press the blowdown timer button. This activates the boiler blowdown timer and energizes (opens) the solenoid valve. Timer operates approximately four minutes then shuts off.

2. If your steamer has a manual blowdown drain valve.

- A. Turn the power switch(s) OFF then open the valve to blowdown the boiler. Close the valve at the end of the blowdown sequence so boiler will be ready to fill.

BOILER SLOW TO PRESSURIZE

If the boiler requires more than 15 minutes (20 minutes for regenerated models) to achieve normal operating pressure as listed in below, then check the following conditions.

NORMAL OPERATING STEAMER PRESSURES (PSI)					
CONTROL TYPE	VL MODELS	CYCLING		HIGH LIMIT	
		ON	OFF	ON	OFF
With Compartment Pressure Regulating Valve	PS	9	11	6	15
	AS				
	SS				
	MS				
With-Out Compartment Pressure Regulating Valve	AS	4	6	2	15
	SS				
	MS				

1. All Models (With Boiler)

- A. Check for low water pressure input, line strainer clogged or fill solenoid valve malfunction. See "FILL AND COLD WATER SOLENOID VALVES".
- B. Boiler blowdown solenoid valve may be clogged and not fully closing. Check for a slow leak out of steamer drain. If not able to verify, then proceed to step 1C. If blowdown solenoid valve appears to be functioning properly, then proceed to step 1D.
- C. Turn power switch OFF, disconnect lead wires from blowdown solenoid and remove it for inspection.
- D. A heavy build-up of scalants has possibly coated the interior of the boiler. The insulating effect of the scalants hampers heat transfer. Unbolt and remove the hand hole cover plate and gasket assembly. Examine interior of boiler and if scalants and/or lime build up is apparent, perform a boiler inspection, clean-out and deliming procedure. See "BOILER". If considerable scalants are evident, then both the boiler blowdown solenoid valve and the water level probes must also be examined.

2. Gas Models

- A. Low incoming gas pressure causes reduced BTU output. Check incoming line and manifold gas pressures as outlined in "GAS MANIFOLD PRESSURE ADJUSTMENT."
- B. Gas combination control valve malfunction. Check incoming and manifold gas pressures as outlined in "GAS MANIFOLD PRESSURE ADJUSTMENT." If pressure adjustments are made and manifold pressure remains low, replace the combination valve and check for proper operation.

- C. Gas burner ports clogged or obstruction around air shutter. After a period of time, gas burners can accumulate carbon in their ports or become clogged by food and grease debris from kitchen cleaning, restricting performance. To clean burners, remove them from burner box and boil in water for 10 -15 minutes to dislodge clog. Clean-out any remaining debris from the gas ports using a wire brush, scribe or pic type metal instrument. Remove any other foreign objects that appear to be obstructing the gas ports or air shutters.
- D. Gas orifice clogged or obstructed around air shutter. It is possible for debris to become lodged in the small gas orifice opening over time. Clean-out the gas orifice using a round metal instrument of the same hole diameter or slightly smaller. Clean as needed. If clogging reappears, the orifice should be removed, cleaned and reinstalled. Remove any other foreign objects that appear to be obstructing the gas orifice or air shutters.

3. Electric Models

- A. One or more electric heating elements malfunctioning. See "HEATING ELEMENTS"
- B. One or more heater contactors not pulling in to power heating elements.
- C. If steamer operates under three phase power, then check line for all phases.
- D. Heavy scale build up on heating element causes reduced heating.

4. Direct Steam Models

- A. Building steam supply pressure low.
- B. Cooking compartment steam solenoid valve malfunction.
- C. Steam pressure regulator adjusted too low.
- D. Clogging in the steam line reduces steam supply.

5. Regenerated (Steam Coil) Steamers

- A. Heavy scale build up inside copper steam coil.
- B. Building steam supply pressure low
- C. Cooking compartment steam solenoid valve malfunction.

INLET WATER STRAINER

The in-line Y strainer should be located upstream of the fill valve solenoid. Shut off the water supply. Unscrew the cap from the body on the leg of the Y that should be pointing downwards toward the floor. Remove the screen and any foreign particles trapped in the opening. Rinse the screen thoroughly to remove accumulated debris and replace the screen in the valve body. If screen can not be thoroughly cleaned, replace it with a new one. Reinstall the cap and ensure that the Y strainer is positioned with the cap pointing downward to catch debris.

The pressure regulating valve strainer will become clogged if dirty steam lines are connected to direct steam models. Remove the hex nut on the bottom of the pressure regulating valve to clean the strainer and valve seat.

PILOT AND THERMOCOUPLE ASSEMBLY (GAS MODELS)

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.

The pilot thermocouple when heated, supplies a DC millivolt signal to an internal solenoid valve on the gas combination control valve. This solenoid valve is designed to shut off the gas flow to the pilot and main burners in case of a malfunction in the system. When energized by the thermocouple voltage, the valve is held in the open position to permit gas flow. The pilot burner flame is controlled by an adjustable needle valve located under a small cap screw on the combination control valve.

When experiencing pilot outages, visually check pilot flame for the proper contact on thermocouple and the flame color. Also, check to see that excessive air drafts are not interfering with proper heating of the thermocouple by the pilot flame.

The pilot flame should be a steady blue flame that envelopes the thermocouple tip. The flame should be about one inch long with half its length extending beyond the outer edges of the pilot shield. If the pilot flame does not appear to be this length and color, then adjust as necessary. See the diagram below for an example of unsatisfactory pilot flames. Turn clockwise to decrease pilot flame and counterclockwise to increase.

NOTE: If adjustments in gas or pilot pressure settings are made, always replace the adjustment cover screw to assure proper gas control operation.

APPEARANCE	CAUSE
<p>SMALL BLUE FLAME</p> 	<p>CHECK FOR LACK OF GAS FROM:</p> <ul style="list-style-type: none"> PILOT ADJUSTMENT AT MINIMUM CLOGGED PILOT ORIFICE LOW GAS SUPPLY PRESSURE
<p>LAZY YELLOW FLAME</p> 	<p>CHECK FOR LACK OF AIR FROM:</p> <ul style="list-style-type: none"> PILOT ADJUSTMENT AT MINIMUM LARGE ORIFICE DIRTY LINT SCREEN, IF USED DIRTY PRIMARY AIR OPENING, IF THERE IS ONE
<p>WAVING BLUE FLAME</p> 	<p>CHECK FOR:</p> <ul style="list-style-type: none"> EXCESSIVE DRAFT AT PILOT LOCATION RECIRCULATING PRODUCTS OF COMBUSTION
<p>NOISY LIFTING BLOWING FLAME</p> 	<p>CHECK FOR:</p> <ul style="list-style-type: none"> PILOT ADJUSTMENT TOO HIGH HIGH GAS PRESSURE
<p>HARD SHARP FLAME</p> 	<p>THIS FLAME IS CHARACTERISTIC OF MANUFACTURED GAS</p> <p>CHECK FOR:</p> <ul style="list-style-type: none"> HIGH GAS PRESSURE ORIFICE TOO SMALL

EXAMPLES OF UNSATISFACTORY PILOT FLAMES.

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If the adjustment does not result in a pilot flame of proper size, then gas might not be flowing properly to the pilot. Check for a plugged pilot orifice, a kinked or plugged pilot gas supply tube and for low gas supply pressure. The pilot operates unregulated at gas supply pressures while the pressure regulator in the combination control valve regulates pressure to the main burners only. Visually check the thermocouple tip (hot end) and tube lead for kinks or pinches that might be causing a short between the tube and the wire inside. Also, check the threaded connector tip for corrosion, tarnish or dirt which can cause a poor connection. If the thermocouple shows either of these signs, it should be replaced with a new one.

NOTE: The connection of the tubing from the thermocouple tip to the control valve is an electrical connection and must be clean. Do not use any sealing compound on the threads or over tighten the threaded connection. Finger tighten the nut plus 1/4 turn with a wrench. Over tightening the nut could crush the insulator, shorting the thermocouple.

If the pilot flame is correct and there are no drafts, then the problem is in the thermocouple output voltage or the gas solenoid valve in the combination control.

Check the thermocouple output voltage as follows:

1. Turn the power switch OFF and disconnect the thermocouple from the gas combination control valve.
2. Check the thermocouple DC millivolt output with a VOM. If a meter is not available, replace the thermocouple with a new one and check operation again.
 - A. Install a thermocouple adaptor into the connection on the gas combination control valve. Screw the thermocouple in to the adaptor then connect the meter leads to it. See "TOOLS" under "GENERAL" for information on thermocouple adaptor. If a thermocouple adaptor is not available then turn the power switch OFF, disconnect the thermocouple from the gas combination control valve and proceed to step 2D.
 - B. Turn the power switch ON and light the pilot. Allow the pilot to heat the thermocouple for one to two minutes and take a closed circuit reading. Compare the readings with the chart below.
 - 1) If the reading is less than the minimum or thermocouple is not operating as described, replace the thermocouple as outlined under "PILOT AND THERMOCOUPLE ASSEMBLY (GAS MODELS)" in "REMOVAL AND REPLACEMENT OF PARTS" then check for proper operation.
 - 2) If the reading is within the range listed in the chart below then thermocouple is operating properly. Reconnect the thermocouple to the gas combination control valve.
 - 3) If after replacing thermocouple, the pilot or main burners are still not functioning properly, then a problem in the gas combination control valve exists as well. Replace the combination control valve as outlined under "GAS COMBINATION CONTROL VALVE" in "REMOVAL AND REPLACEMENT OF PARTS" then check for proper operation.
 - C. Turn the power switch OFF and disconnect the thermocouple adaptor from the gas combination control valve and thermocouple.

D. With the thermocouple disconnected, connect the meter leads to the tube and threaded end. Turn the power switch ON and light the pilot. Hold down the OFF/PILOT/ON knob and allow the pilot to heat the thermocouple for one to two minutes. Take an open circuit reading and compare with the chart below.

- 1) If the reading is less than the minimum or thermocouple is not operating as described, replace the thermocouple as outlined under "PILOT AND THERMOCOUPLE ASSEMBLY (GAS MODELS)" in "REMOVAL AND REPLACEMENT OF PARTS" then check for proper operation.

3. If after checking and/or replacing thermocouple, the pilot or main burners are still not functioning properly, then a problem in the gas combination control valve exists as well. Replace the combination control valve as outlined under "GAS COMBINATION CONTROL VALVE" in "REMOVAL AND REPLACEMENT OF PARTS" then check for proper operation.

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

THERMOCOUPLE DC MILLIVOLT READINGS		
	CLOSED CIRCUIT (CONNECTED)	OPEN CIRCUIT (DISCONNECTED)
Typical	15	
Range	10 - 20	20 - 35

GAS BURNERS

The main gas burners are located under the boiler for heating and number five to seven depending on the steamer model. They are made of aluminized steel with lanced type ports and have adjustable air shutters in the front. Fixed orifice type hoods extend from the manifold to establish gas flow to each burner.

Air Shutter Adjustment

1. Ignite the burners and allow to heat up for at least five minutes.
2. Verify the manifold pressure as outlined under "GAS MANIFOLD PRESSURE ADJUSTMENT".

3. Loosen the set screw on the burner being adjusted. Closing the air shutter will decrease primary air to the burner and opening the shutter will increase primary air the burner.
4. Monitor the burner flame and set the air shutter opening as follows:

- A. Open up the air shutter until the inner portion (blue) of the flame lifts off the burner port and then turn the air shutter back until the flame touches the burner port again. A slight tinge of orange and yellow in the flame is acceptable. An extremely yellow flame indicates too little primary air (oxygen), producing poor burning characteristics and the heating efficiency drops off. A by product of this would be soot (carbon).

Factory air shutter settings are: **natural gas** - open approximately 1/2 inch;
propane gas - fully open.

5. After the air shutter adjustment is made, tighten the set screw.

Inspection

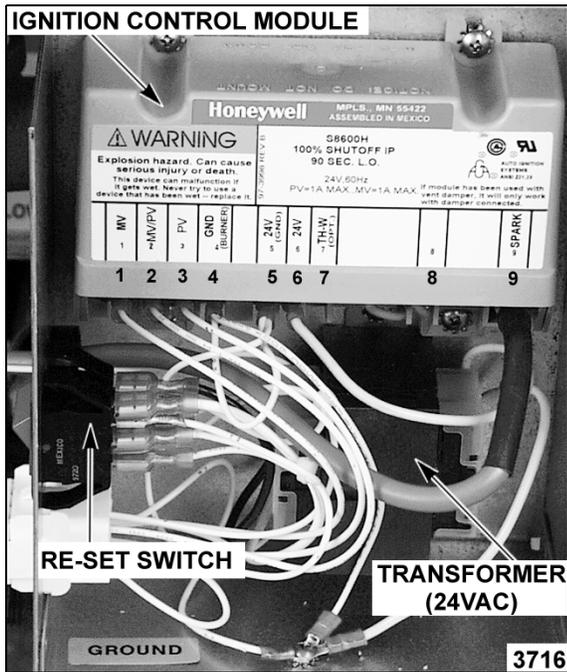
Remove gas burners by lifting burner up and sliding it to the rear just enough to clear the gas orifice hood. Lower the front end of burner and bring it forward under the gas manifold pipe. Inspect burner for clogged or damaged ports. Clean or replace as necessary. When reinstalling burners, assure that locating pin is in the hole for proper positioning and to prevent burner from rolling over.

AUTOMATIC IGNITION SYSTEMS (GAS MODELS)

When the main power switch is turned ON and the ignition control modules reset switch is in the ON position, the ignition control module is energized with 24VAC between terminals five and six.

High voltage is sent from terminal nine to the spark electrode and an output of 24 volts is sent from terminals two and three to the pilot coil in the combination valve, allowing gas to flow to the pilot. The sparking will continue for 90 seconds or until the flame sensor has confirmed that an adequate pilot flame is present.

Once the pilot flame is confirmed, a 24 volt output from terminal one will be sent, allowing the main valve (cycling) coil of the combination valve to operate at the request of the cycling pressure switch.



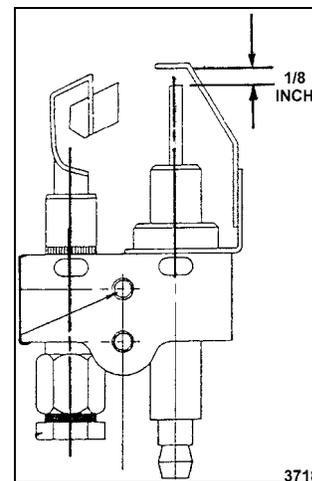
Terminals:

1. Main Valve - 24VAC will be present on terminal #1 with the pilot sensing electrode sensing an adequate pilot flame. This output will remain present as long as the pilot flame remains adequate.
2. Common (MV/PV).
3. Pilot Valve - 24VAC will be present on terminal #3 at the instant an input voltage is supplied to the module. This 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 (The pilot flame current is sensed by the Ignitor Module via the spark electrode high voltage wire and terminal #9).

Spark Ignition Control Test

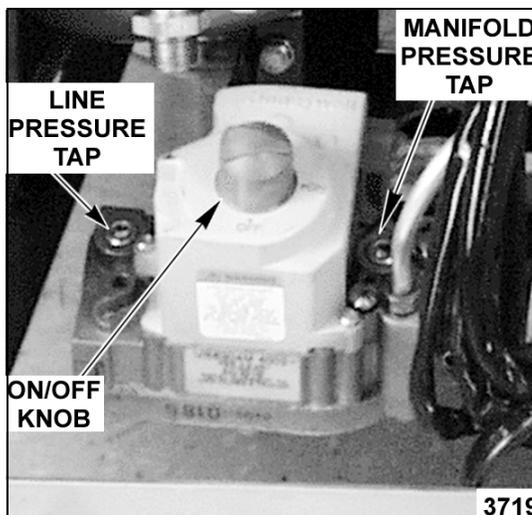
1. If the ignition control module does not appear to be sparking to ignite gas, perform the following:

- A. Check to ensure that all electrical terminal connections on the ignition control module and the ignitor are clean and tight. If loose connections are found, make the necessary adjustments.
- B. Verify that the ignition control module and the ignitor have good ground wire connections. The ignitor mounting bracket should have good metal to metal contact to its mounting surface.
- C. Remove the pilot ignitor and check the following:
 - 1) The gap between the spark probe and the ground clip should be approximately 1/8 inch. If the gap appears to be excessive or poor sparking is occurring then adjust.



- 2) 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 the pilot ignitor and re-test.
 - 3) Check the ignition cable for tightness or damaged insulation. If the ignition cable appears to be damaged, then replace it and re-test.
2. Install the pilot ignitor and attach ignition cable.
 - A. Turn the main power switch ON and verify the ignition control modules re-set switch is ON. Observe spark condition from ignitor.
 - 1) If a spark from ignitor is present and ignites the gas from the pilot and burner then the system is working properly.

- 2) If a spark from ignitor is present but does not ignite gas before the ignition control module locks out, (90 sec.) there may not be enough gas in the line for ignition. Verify the gas supply and gas combination control valve are both on. Turn the ignition control modules re-set switch OFF then ON to reset the module. Sparking should then resume to ignite gas. The module may need reset several times before ignition takes place.
- 3) If ignitor is still not sparking proceed to step 3.
3. Check the ignition control module and transformer.
 - A. Turn the ignition control modules re-set switch OFF then ON to eliminate a lockout condition.
 - B. Check for 24VAC output on the ignition control module transformer.
 - 1) If 24VAC is present between terminals 5 & 6 on the ignition control module but ignitor is not sparking, then replace ignition control module and re-test.
 - 2) If 24VAC is not present then ensure that transformer is receiving 120VAC input. If ignition control module transformer is receiving proper voltage, then replace ignition control module transformer and re-test.
4. After making the necessary component adjustments or replacements, check for proper operation.
4. After the burner lights, compare the 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 incoming pressure should be checked. then the gas supply needs to be checked by the gas line installer or the local gas company for adequate sizing.
 - B. If no other gas appliances are connected to the gas line or 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.



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 front cabinet doors and turn the gas combination control valve off.
2. To measure the manifold pressure, remove the 1/8 inch NPT plug (pressure tap) on the outlet side of the valve and attach a manometer.
3. Turn the gas combination control valve and the main power switch to ON.

6. After the burner lights, 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.

		PRESSURE READINGS (INCHES W.C.)		
GAS TYPE	MANIFOLD	LINE		
		RECOMMENDED	MIN	MAX
Natural	4.0	7.0	5.0	14
Propane	10.0	11.0	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 power switch OFF, replace the adjustment screw cap and 1/8 inch NPT plug (pressure tap) on the outlet side of the valve.
8. Check for proper operation.

DIRECT STEAM MODELS

These models consist of a pressure regulator and gauge that run off a buildings potable steam supply. The regulator used will be of the adjustable type and should be set for a discharge pressure of 10 psi. The maximum input pressure to the regulator should be 15 psi. Incoming power (120VAC) for the compartment controls is supplied from a junction box in the base.

REGENERATED STEAM (OLDER MODELS)

The steam coils on a regenerated type steamer are intended for use at a steam supply pressure of 15 psi maximum. A pressure regulating valve is available as optional equipment for steamers where a buildings steam supply pressure exceeds 15 psi. The regulator used will be of the adjustable type and should be set for a discharge pressure high enough for good steam generation. This pressure can be monitored by the supplied pressure gauge. The regulator should be set, only when steam is flowing (steam solenoid valve is open). If steam is heavy with condensate, install a ball float trap in the steam line before the pressure regulating valve.

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

To remove a steam coil, disconnect union in steam supply line to the coils and in the condensate discharge line from the coils. Remove header that supplies steam to coils by disconnecting union at each coil. In same way, remove coil condensate collection header. Remove four bolts clamping each coil flange in place and pull coil forward. Use a new flange gasket when replacing coil. The faces that mate with gasket must be clean.

Turn steamer power switch ON, allowing steam generation and, consequently, pressure to rise to normal operating level and then turn power switch OFF for a final purging of boiler and steam supply lines. Steamer is now ready for use.

HEATER CONTACTORS

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.

The contactor can be serviced by removing the cover of the contactor box.

A noisy contactor (hum or chatter) is generally due to excessive dust or dirt on the armature pole faces or around the armature core preventing the magnet coil from pulling the armature into a completely sealed position. This can usually be corrected by blowing or wiping the pole faces clean. To inspect electrical contacts, remove cover at top of contactor by removing two screws which hold it in place. Replace contactor if the electrical contacts appear to be severely pitted or burned.

HEATING ELEMENTS

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

1. Measure the voltage at the heating element terminals and verify it against the data plate voltage.
 - A. If voltage is incorrect, find the source of the problem.
 - B. If voltage is correct, check current draw (amps) through the heating element lead wires. **See table below for proper values.**
 - C. If current draw is correct then heating element is ok.
 - D. If current draw is not correct then replace the element and proceed to step 3.

NOTE: When replacing an element, always use a new gasket and ensure that the flange and tube surfaces which contact the gasket are clean. If removed element shows a pronounced scale build-up on its heating tubes, the other elements should be removed and mechanically cleaned to remove the scale. This will prolong their life. DO NOT immerse elements in a chemical solution to descale.

2. Check for proper operation.

VOLTAGE	TOTAL KW	NUMBER OF ELEMENTS	KW PER ELEMENT	AMPERAGE PER LINE		RESISTANCE PER ELEMENT (OHMS)
				1 PH	3 PH	
208	18	2	9	87	50	14.42
240	18	2	9	75	44	19.20
480	18	2	9		22	76.80
*220/380 240/415	18	2	9		25	19.20
208	24	2	12	116	68	10.82
240	24	2	12	100	58	14.40
480	24	2	12		29	57.60
*220/380 240/415	24	2	12		34	14.40
208	36	4	9		100	14.42
240	36	4	9		87	19.20
480	36	4	9		44	76.80
*220/380 240/415	36	4	9		50	19.20
208	42	4	10.5		117	12.36
240	48	4	12		116	14.40
480	48	4	12		58	57.60
*220/380 240/415	48	4	12		67	14.40

NOTES:

1. Values in the table are nominal. Tolerance is +/-10 %.
2. Asterisk (*) indicates 3 phase/4wire.
3. Each heater has three internal elements.

THERMAL SWITCH - PREVENT AND AUTOMATIC MODELS

The load compensator is a thermal switch in a stainless steel housing that screws into a 3/8 NPT fitting (newer models) on the left side wall of the compartment. The switch contacts should close when the compartment temperature reaches 180°F, supplying power to the steam exhaust solenoid valve, pilot light and cooking timer motor.

1. Newer Models

- A. This switch is NON-ADJUSTABLE. Check to see if the switch is operating properly as described below. If the switch is suspected to be malfunctioning, replace it and check for proper operation.

2. Older Models

- A. The switch can be adjusted by turning the slotted screw. Turn the screw clockwise to lower the closing temperature and counterclockwise to raise the closing temperature. Check the operation of the switch as described below. These models are ½ NPT.

The correct adjustment or verification of the load compensator can best be made by using a digital thermometer and thermocouple to sense the compartment temperature.

1. Position the thermocouple near the exposed bulb of the load compensator inside the compartment.
2. Close and seal the compartment. Pull the steam control arm handle forward, set the timer and turn the compartment power switch ON.
3. Monitor the thermocouple temperature, and adjust or verify (as applicable) the load compensator temperature.
 - A. The red light of the compartment switch should light when the thermocouple reads 185 ±7 °F.
 - B. After the cooking cycle ends and the compartment temperature lowers, the thermal switch should then re-open at 165 ±7 °F.
 - C. If the load compensator can not be adjusted correctly or the temperature is out side the allowable limits, then replace thermal switch and check for proper operation.

- D. If the cooking cycle is started normally, but the red light and timer do not come on or an abnormal amount of time elapses before they come on, then the load compensator is set too high. Also, if the timer stops, the red light goes out, and the buzzer does not sound after the compartment has exhausted the steam or if the time is set as usual for the product and the product is overcooked or if the time is set as usual for the product and the product is overcooked.
- E. If there is too short a time between starting and the red light coming on, or if it comes on immediately, the load compensator is set too low. Also, if the time is set as usual for the product and the product is undercooked.

WATER LEVEL GAUGE ASSEMBLY

1. Close the valve at the top and at the bottom of the gauge assembly.
2. Unscrew the packing nuts at the top and bottom of the glass tube.
3. Slide the glass tube upwards, until the bottom of the tube is clear of the fitting and lift it out.
4. Reinstall the tube and use new sealing washers. Do not over tighten the packing nuts, it could break the gauge glass.
5. Open the top and bottom valves fully.
6. Check for proper operation.

STEAM GATE VALVE(S)

On all models, each cooking compartment has its own mechanical steam gate valve that supplies steam to the cooking compartment when the steam control arm handle is pulled forward. The Prevent models use a solenoid valve to exhaust steam from the compartment whereas the Automatic, Standard and Manual models use an additional steam gate valve to exhaust steam when the steam control arm handle is returned to the rear. These gate valves are a standard type and can be disassembled for cleaning and gasket replacement.

If steam leaks are noticed around the packing nut and stem during cooking, tighten the packing nut until the steam leak ceases. Release steam control arm to ensure its automatic return. If arm does not return freely or steam is still leaking, then further inspection or adjustments are necessary. Turn the timer and compartment power switch OFF and blowdown the boiler. Remove the control arm bracket and packing nut from the stem and clean out the old string packing. The valve stems may then be re-packed using a string packing suitable for steam service.

Replace the packing nut and control arm bracket. Tighten the packing nut finger tight plus $\frac{1}{2}$ turn and check for proper operation. If steam continues to leak, tighten the packing nut in additional $\frac{1}{2}$ turn increments until it stops and re-check operation of the steam control arm.

NOTE: Do not over tighten packing glands, the linkage system must be free enough for the spring to return the steam control arm to the fully closed position.

For other service to these valves, remove the stem assembly and cap at the top of the valve. Check the valve linkage for loose or binding parts.

The steam gate valve linkage for these controls are simple and their function easily seen. The inlet and exhaust steam gate valves must be positioned so the inlet valve is open and the exhaust valve closed when the steam control arm handle is pulled forward and reverses when the control arm is released.

NOTE: In the event of an electrical component or a power failure, the steam control arm can be operated manually on automatic models.

ELECTRICAL OPERATION

WATER LEVEL CONTROLS

Solid State - 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. 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. Performs 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 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) supplies power to one side of the internal relays LLCO, HL and ILR. 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.

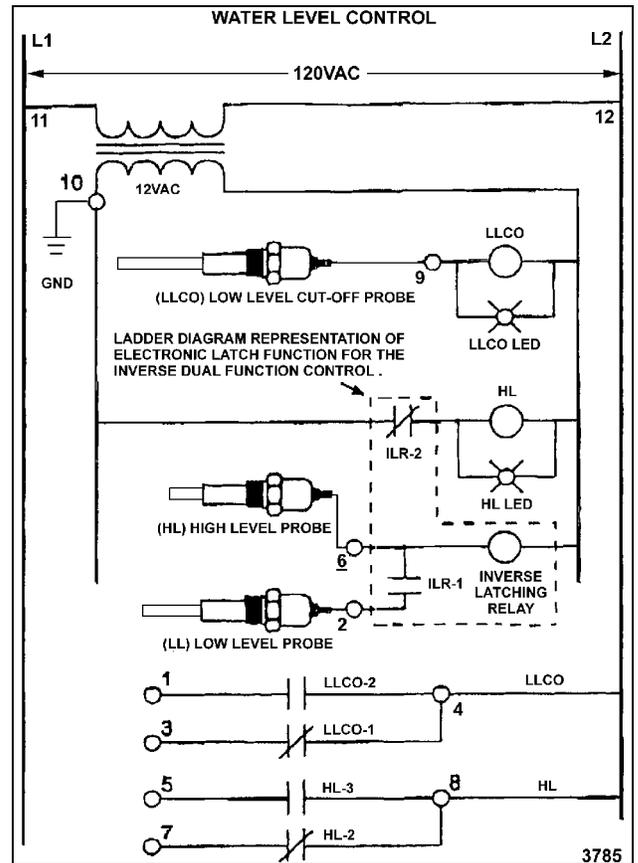
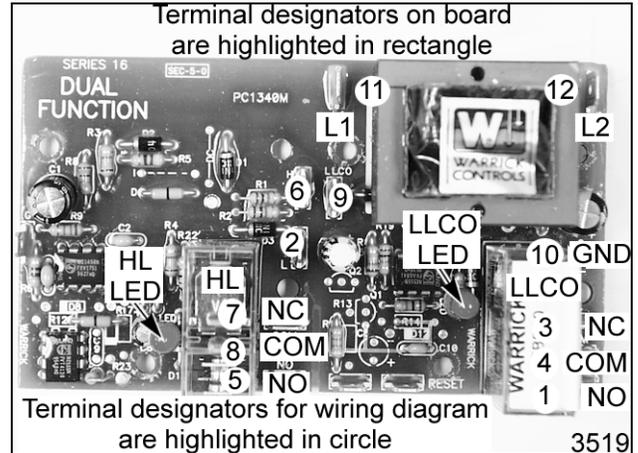
When the main power switch is turned ON, power is supplied to the WLC board which energizes the high level (HL) relay and illuminates the HL relay LED. With the HL-3 contacts closed, the boiler fill solenoid is energized and water begins filling the boiler.

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.

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.



Solid State - Auxiliary Low Level Cut-Off

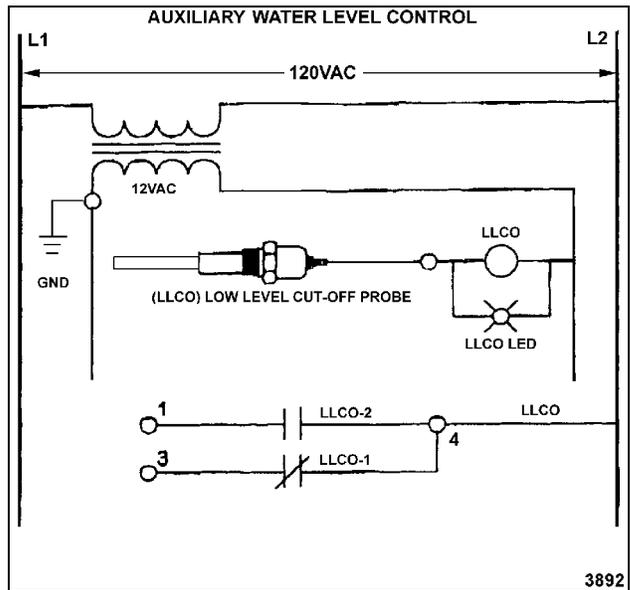
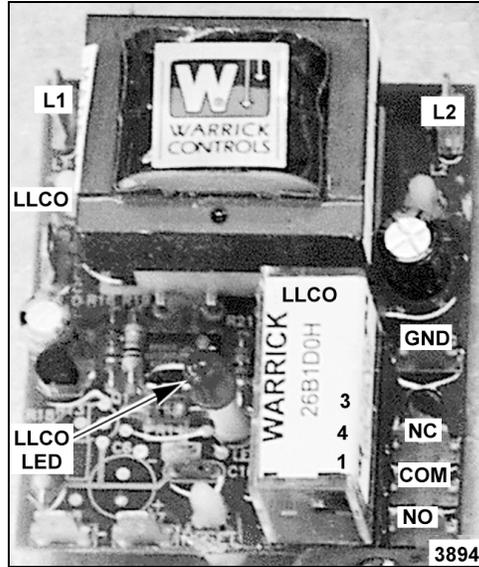
This control serves as a safety backup to the main water level control (WLC) board to meet Cal-Code and CSD-1 code requirements. The auxiliary control provides auxiliary low level cut-off protection to shut off the heat source in case the water level drops below the low level cut-off (LLCO) probe. A single LLCO probe is connected to the auxiliary control.

The auxiliary water level control (WLC) has input voltage (120VAC) across terminals L1 and L2 to power the transformer primary. On one side of the transformer secondary, power is provided to the control by a series path through chassis ground. The other side of the transformer secondary (12VAC) supplies power to one 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. On CSD-1 models, the low water level indicator light (amber) on the boiler control box comes on.

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 auxiliary heating control 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.

When the boiler stops filling, press the manual reset button on the boiler control box. On CSD-1 models, this energizes the low water relay, turns off the low water light and energizes the heat source auxiliary control. On Cal-Code models, this closes and locks the manual reset switch contacts to energize the heat source auxiliary control.



Electro Mechanical - Low level Cut-Off & Differential Control

The steamer is equipped with three water level sensing probes (high, low and low level cut-off), a differential level control (1G1GO) and a low level cut-off control (1D1DO). The low-level cut-off is an additional control that is identical to the differential level control but serves as the safety backup to shut off the heat source in case the water level drops below the low level cut-off (LLCO) probe. The differential level control maintains the water level between the low and high water level probes.

Each control is powered by input voltage (120VAC) on terminals 1 and 2 which also connect to the primary side of the internal transformer. The transformer secondary (300VAC) will provide power to the internal contactor coil through a series path going from one side of the secondary winding, through the contactor coil, through the water level control probe, through the water in the boiler and to the boiler for ground. The other side of the transformer secondary is attached to ground.

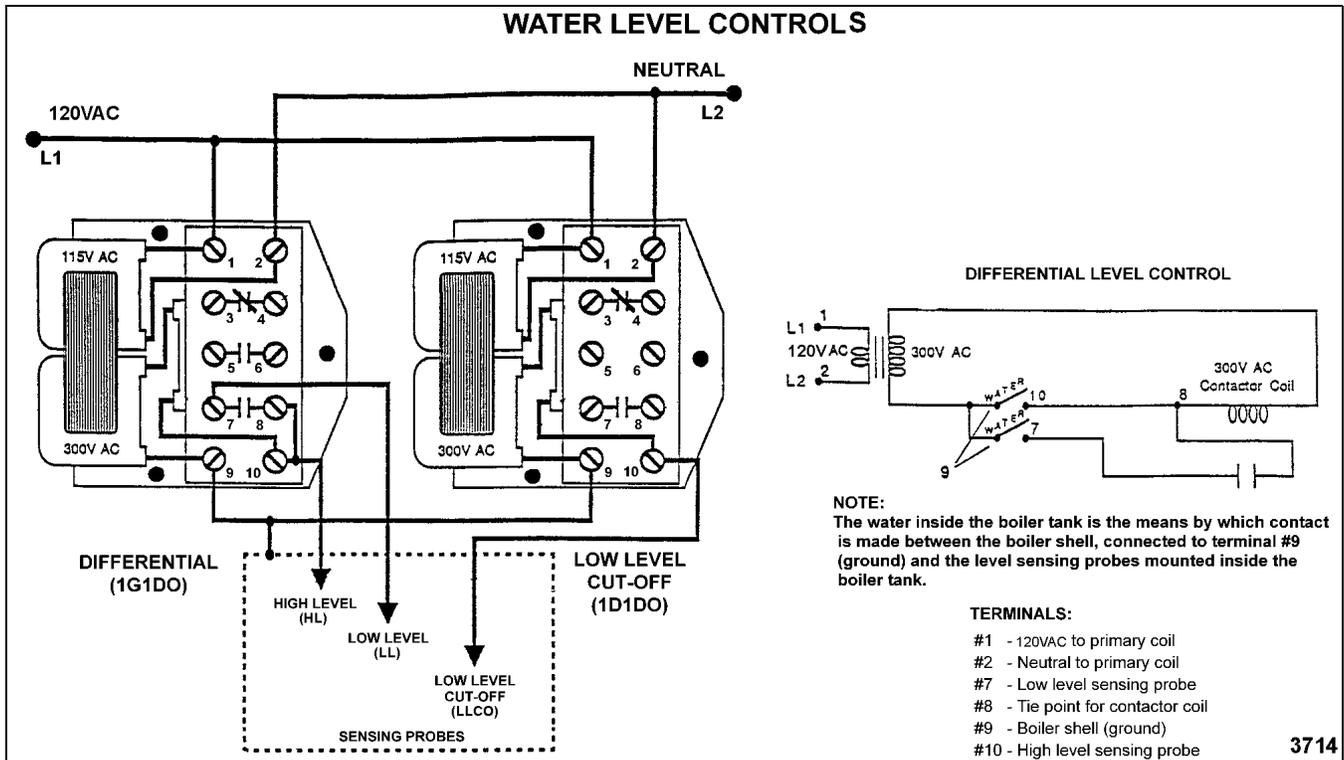
When the main power switch is turned ON, both water level controls are energized. The boiler fill solenoid is then energized through the normally closed contacts (terminals 3 & 4) on the differential level control and water begins filling the boiler.

When the water level reaches the low level cut-off (LLCO) probe, the internal contactor coil on the low water level control is energized. With the contacts on terminals 7 & 8 now closed, the heat source is then energized. The internal contactor coil will remain energized until the water level in the boiler drops below the LLCO probe.

When the water level reaches the low level (LL) probe, power to terminal 7 on the differential level control will be present but no switching occurs.

After the water level reaches the high level (HL) probe, the differential control contactor coil is energized and the normally closed contacts on terminals 3 & 4 open, which de-energizes the boiler fill solenoid and stops the flow of water into the boiler. The internal contactor coil will have a locking path through contacts 7 & 8 to the low level probe to keep the coil energized after the water level drops below the high level probe.

When the water level drops below the low level (LL) probe, the internal contactor coil is de-energized, returning contacts 3 & 4 back to their normally closed state and energizing the boiler fill solenoid to refill the boiler. The water level must then fill to the high level probe again, to energize the internal contactor coil. The differential control will toggle ON and OFF during a cooking cycle as needed.



Electro Mechanical - Auxiliary Low Level Cut-Off

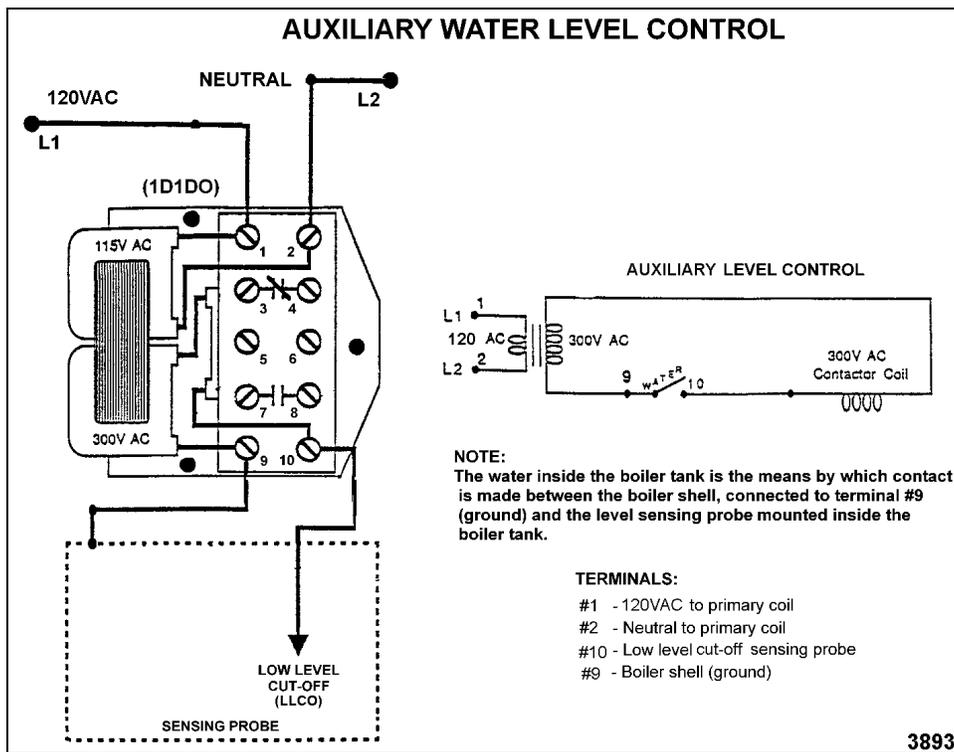
This control serves as a safety backup to the main low level cut-off (LLCO) control to meet Cal-Code requirements. The operation of the auxiliary control is identical to the main low level cut-off control but performs a single function: 1) Provide auxiliary low level cut-off protection to shut off the 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 low level cut-off control is connected to the auxiliary control.

The auxiliary control is powered by input voltage (120VAC) on terminals 1 and 2 which also connect to the primary side of the internal transformer. The transformer secondary winding (300 VAC) will provide power to the internal contactor coil through a series path going from one side of the secondary winding, through the contactor coil, through the water level control probe, through the water in the boiler and to the boiler for ground. The other side of the transformer secondary is attached to ground.

When the main power switch is turned ON, the auxiliary low level control is energized but no switching occurs.

When the water level reaches the low level cut-off (LLCO) probe, the internal contactor coil on the low level control is energized, closing the contacts on terminals 7 & 8. The internal contactor coil will remain energized until the water level in the boiler drops below the LLCO probe.

When the boiler stops filling, press the manual reset button on the boiler control box. This closes and locks the manual reset switch contacts to energize the heat source auxiliary control.



SEQUENCE OF OPERATION

GAS MODELS

This sequence of operation is written for steamers with electronic ignition, solid state water level controls, CSD-1 (code) boiler controls option and with Prevent cooking compartment controls. Refer to schematic diagram numbers 3928 and 3929 for a boiler control schematic and 3962 for a schematic and wiring diagram on Prevent cooking compartment controls.

Initial Fill and Preheat

1. Conditions.
 - A. Power switch OFF.
 - B. Ignition module reset switch ON
 - C. Cooking timers off.
 - D. Compartment power switches OFF.
 - E. Unit connected to correct voltage .
 - 1) L1 (HOT) to one side of the cooking compartment controls; to one side of the cold water condenser thermostat; to one side of the power ON/OFF switch.
 - 2) L2 (NEUTRAL) to one side of the cooking compartment controls; to one side of the cold water condenser (CWC) solenoid valve; to one side of the power ON/OFF switch.
 - F. Unit properly grounded. (Boiler and water level control share a common ground)
 - G. Water supply valve on.
 - H. Gas supply valve on.
 - I. Gas combination control valve ON.
 - J. Control (cycling) pressure switch closed.
 - K. High limit pressure switch closed.
 - L. Cold water condenser (CWC) thermostat open.
 - M. Blowdown solenoid valve (drain) open and boiler empty.
 - N. Compartment doors open.
2. Power switch turned ON. (located on boiler control box)
 - A. Power switch indicator light (red) comes on.
 - B. Hi pressure indicator light (amber) comes on.
 - C. Low water level indicator light (amber) comes on.

NOTE: The high pressure indicator light will remain on and the safety circuit de-energized until boiler steam pressure is within operational limits (high limit pressure switch closed) and the manual reset button is pressed. The low water indicator light will remain on and the safety circuit de-energized until the water level in the boiler reaches the low level cut-off probes (minimum level) for the water level control, the auxiliary low level cut-off control and the manual reset switch is pressed. The gas burners will not light until these conditions are satisfied.

- D. Water level control (WLC) is powered.
 - 1) High level (HL) relay is energized, HL-3 (N.O.) contacts close and HL LED lights up.
 - 2) The inverse latching relay of the board remains de-energized, leaving the ILR-1 (N.O.) and ILR-2 (N.C.) contacts in their shelf state.
- E. Auxiliary low water level cut-off control is powered, LLCO-2 (N.O.) contacts remain open.
- F. With the HL-3 and ILR-2 contacts closed, the fill solenoid is energized and water boiler begins filling.
- G. Blowdown solenoid valve is energized and closes.
- H. Ignition module begins sparking to light pilot after a 3 second delay.
 - 1) If pilot ignition is established (pilot lit) then a micro amp flame sense current is sent back to the ignition control module through the ignition cable. Sparking stops, pilot remains lit and is ready to ignite burners.
 - 2) If pilot ignition is not established after 90 seconds, sparking stops and the ignition control module locks out power to the combination gas valve (pilot valve and main valve remain closed). The module remains locked out until the reset switch on the ignition control module box is switched to OFF then ON to re-start the ignition trial cycle.

NOTE: If the modules re-set switch is in the OFF position, no sparking will occur or if it's turned OFF while idling or cooking, then pilot and burners will go out and not re-ignite upon call for heat by the cycling pressure switch.

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. Power to terminal 9 on the water level control.
 - 1) LLCO relay energizes, LLCO-2 (N.O.) contacts close and LED lights.
 - B. Power to terminal LLCO on the auxiliary low water level cut-off control.
 - 1) LLCO relay energizes, LLCO-2 (N.O.) contacts close and LED lights.

NOTE: 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.
 - A. Power to terminal 2 on the water level control is present but no switching occurs.
5. Water reaches HL (high level) probe.
 - A. Power to terminal 6 on water level control.
 - 1) The inverse latching relay of the board is energized, changing the state of ILR-1 (N.O.) and ILR-2 (N.C.) contacts. The inverse latching relay will remain energized through the alternate latching path of ILR-1 contacts until the water level recedes below the low level probe.
 - 2) With ILR-2 contacts open, HL relay is de-energized, HL-3 (N.O.) contacts open and HL LED goes out.
 - 3) Water fill solenoid is de-energized. (boiler fill time approx. 11 min.)
6. Manual re-set switch is pressed, energizing the coils on the high limit and low water relays.
 - A. Contacts 1 & 9 on the high pressure relay change state and lock from N.C. to N.O. and turn off the high pressure indicator light. Concurrently, Contacts 1 & 9 on the low water relay change state and lock from N.C. to N.O. and turn off the low water indicator light.
 - B. Contacts 5 & 9 on the high pressure relay change state and lock from N.O. to N.C., supplying power (NEUTRAL) to one side of the auxiliary gas solenoid valve. Concurrently, Contacts 5 & 9 on the low water relay change state and lock from N.O. to N.C., supplying power (L1) to the other side of the auxiliary gas solenoid valve.
7. Boiler steam pressure reaches upper limit set point of 11 PSI. (Approximately 15 min.)
 - A. Auxiliary gas solenoid valve is energized and opens to allow gas flow.
 - B. As long as the ignition control module is sensing a pilot flame, the internal main valve (MV) contacts close (N.O.) on the ignition control module. The main gas valve is energized and gas begins flowing.
 - C. Burners light and water in boiler begins to heat up.
7. Boiler steam pressure reaches upper limit set point of 11 PSI. (Approximately 15 min.)
 - A. Cycling pressure switch opens, main gas solenoid valve de-energizes, gas flow shuts off and burners go out.
 - B. 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. This solenoid is powered by the CWC thermostat.
8. Boiler steam pressure drops below lower limit set point of 9 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 main gas solenoid valve starting and stopping the flow of gas, which in turn, cycles the burners on and off. This sequence continues until one of the following occurs:
 - 1) Boiler pressurizes to 15 PSI, causing the high limit pressure switch to open. At that time, the auxiliary gas valve de-energizes, shutting off the gas flow to the burners and the high limit failure light will come on. This light will stay lit until the pressure drops below the lower limit set point of 6 PSI and the manual re-set switch is pressed.
 - 2) Boiler water level drops below the LLCO probes for the water level and the auxiliary low level cut-off controls which then de-energizes the LLCO relays, changing the contact state of LLCO-2 (N.O.) back to open. This de-energizes the main and auxiliary gas solenoid valves. The gas solenoid valves will remain off and the low water level light will come on and stay lit until the water level rises above the LLCO probes and the manual re-set switch is pressed.

NOTE: For both relays to energize, the high pressure switch must be closed and the water level in the boiler must be above the low level cut-off probes in order for LLCO-2 (N.O.) contacts to close.

Cook Cycle

1. A Cook cycle should not be started, until the initial fill and preheat is completed, in order for the boiler steam pressure to be within operational limits.
 - A. Insert product into steamer.
 - B. Compartment door is closed and screw handle tightened down.
 - C. Compartment steam control arm is pulled forward and latches, allowing steam to enter compartment.

NOTE: Cool air and condensate exit through the steam exhaust solenoid valve (N.O.) until compartment temperature reaches 180°F.

- D. Time is dialed on timer (past 5 minutes).
 - 1) Micro switch SW1 contacts change state from N.C. to N.O.
 - 2) Micro switch SW2 contacts also change state from N.C. to N.O.
- E. Compartment power switch is turned ON.
 - 1) L1 (HOT) to one side of the thermal switch.

NOTE: L2 (NEUTRAL) is connected to the other side of the buzzer, steam exhaust solenoid valve, trip solenoid, pilot light and timer motor.

- F. Once compartment temperature reaches approximately 180°F thermal switch closes and supplies power L1 (HOT) to:
 - 1) Steam exhaust solenoid valve (N.O.) energized and closes.

NOTE: Even though steam exhaust solenoid valve is closed, a small opening exists in the “guillotine” blade of the valve to allow “limited free venting” of condensate during a cook cycle.

- 2) Pilot light (red) comes on indicating timed cooking at 180°F has started.
- 3) Timer motor energized
2. Cooking Timer times down to approximately one minute before zero.
 - A. Micro switch SW2 contacts change state from N.O. back to N.C. (normal starting position).
 - 1) Steam exhaust solenoid valve is de-energized and opens to exhaust steam and pressure from the compartment.
 - 2) Steam trip solenoid is energized and unlatches steam control arm allowing it to return to the rear. Steam supply the compartment is shut off.
3. Cooking timer reaches zero.

- A. Micro switch SW1 contacts change state from N.O. back to N.C. (normal starting position)..
4. Cooking timer is manually turned off.
5. Compartment power switch is turned OFF, buzzer is de-energized and power is removed from the common side of micro switch SW1.
6. Steamer reverts to preheat cycle until:
 - A. A cooking cycle is started. i.e. compartment door is closed and screw handle tightened down, time is dialed into timer (past 5 minutes) and the compartment power switch is turned ON.
 - B. Water level drops below low level cut-off probe.
 - C. Power switch is turned OFF.

NOTE: Burners will re-light after the boiler pressure drops below the low pressure set point limit (9 psi) and will stay on until the high pressure set point (11 psi) is reached. As long as steam pressure is within limits, even while cooking, burners can go off. The boiler is able to re-pressurize to the upper set point limit even with all compartments in cook mode.

NOTE: The cold water condenser thermostat remains closed and cold water condenser solenoid stays energized while cooking. If main water is shut off after boiler fill, then no cold water is present to condense steam/hot water and steam vapors exit the floor drain.

Water Refill (After Initial Fill)

1. Water level drops below low level probe (LL).
 - A. Power is removed from terminal 2 on the water level control .
 - 1) The inverse latching relay is de-energized, returning ILR-1 (N.O.) and ILR-2 (N.C.) contacts back to their original state.
 - B. HL relay is energized.
 - 1) Contacts HL-3 close.
 - 2) HL LED comes on.
 - 3) Fill solenoid is energized and water flows into tank.
2. Water reaches LL (low level) probe.
 - A. Power to terminal 2 on the water level control is present but no switching occurs.
3. Water reaches high level probe.
 - A. The inverse latching relay of the water level control is energized, changing the state of ILR-1 (N.O.) and ILR-2 (N.C.) contacts.
 - B. HL relay is de-energized.

- 1) HL-3 opens.
 - 2) Fill solenoid de-energized and water stops flowing into tank.
 - 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. Main power switch turned OFF.
 - A. Boiler blowdown sequence starts.
 - B. The 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.

ELECTRIC MODELS

This sequence of operation is written for steamers with electro mechanical water level controls, Cal-Code boiler controls option and with Prevent cooking compartment controls. Refer to schematic diagram number 3941 for a boiler control schematic and 3962 for a schematic and wiring diagram on Prevent cooking compartment controls.

INITIAL FILL AND PREHEAT

1. Conditions.
 - A. Power switch OFF.
 - B. Manual reset switch OFF.
 - C. Cooking timers off.
 - D. Compartment power switches OFF.
 - E. Unit connected to correct voltage supply.
 - 1) L1 to one side of the boiler fill solenoid valve; to one side of the main and auxiliary contactor(s); to one side of the power on light (red); to one side of the heat on light (amber); to one side of the timer motor; to one side of the cold water condenser solenoid valve; to one side of the blowdown solenoid valve; to terminal 1 on the auxiliary low level control then jumpers connect L1 to terminal 1 on the differential and low level controls; to the compartment controls.

- 2) L2 to the common terminal on the blowdown timer relay; to pin 4 on the boiler ON/OFF switch; to one side of the manual reset switch; to one side of the auxiliary switch(s) mounted on the side of the auxiliary contactor(s); to the compartment controls.
- F. Unit properly grounded. (Boiler and water level control share a common ground)
 - G. Water supply valve on.
 - H. Control (cycling) pressure switch closed.
 - I. High limit pressure switch closed.
 - J. Cold water condenser (CWC) thermostat open.
 - K. Blowdown solenoid valve (drain) closed and boiler empty.
 - L. Compartment doors open.
2. Power switch turned ON. (located on boiler control box)
 - A. Power to terminal 2 on the differential water level control then jumpers connect to terminal 2 on both the low level cut-off and auxiliary low level cut-off water level controls.
 - B. Power switch indicator light (red) comes on.
 - C. Boiler fill solenoid valve is energized and boiler begins to fill.

- NOTE:** The safety circuit remains de-energized until the water level in the boiler reaches the low level cut-off probe (minimum level) for the auxiliary low level cut-off control and the manual reset switch is pressed. Also, until the water level in the boiler reaches the low level cut-off probe (minimum level) for the low level cut-off control, the low level cut-off control remains de-energized. The heating elements will not come on until the manual rest switch is pressed these conditions are satisfied.
3. Water level reaches LLCO (low water level cut-off) probe for the low level cut-off control and to the auxiliary LLCO probe for the auxiliary low level cut-off control.
 - A. Power to terminal 10 on the low level cut-off and on the auxiliary low level cut-off control is present. The internal contactor coil on the water level controls are then energized.
 - 1) The normally open contacts on terminals 7 and 8 for both the main and auxiliary low level cut-off controls close.
 - 2) The main heater contactor(s) are then energized.

NOTE: Power the internal contactors on the low level cut-off and auxiliary low level cut-off will remain, until the water level drops below the LLCO probes or the power switch is turned OFF.

4. Manual reset switch is pressed (momentary).
 - A. The auxiliary heater contactor is energized supplying power to the heating elements and the heat light (amber) comes on.
 - 1) Water in boiler heats up.
 - B. Internal relay on manual reset switch is energized.
 - 1) Normally open contacts close and lock to provide power to the auxiliary heater contactor and the heat light after the reset switch is released.
5. Water reaches LL (low level) probe.
 - A. Power to terminal 7 on the differential level control is present but no switching occurs.
6. Water reaches HL (high level) probe.
 - A. Power to terminal 10 on the differential level control.
 - 1) The internal contactor coil on the differential level controls is energized.
 - a. The normally closed contacts on terminals 3 and 4 open, de-energizing the boiler fill solenoid and the boiler stops filling.

NOTE: The internal contactor coil has a locking path through contacts on terminals 7 & 8 to the low level probe to keep the coil energized after the water level drops below the high level probe.

7. Boiler steam pressure reaches upper limit set point of 11 PSI. (Approximately 15 min.)
 - A. Cycling pressure switch opens, heater contactor(s) de-energize and power to the heating elements is removed.

NOTE: Steam should not be seen entering a compartment until the manual steam control arm is pulled forward and locked.

8. Boiler steam pressure drops below lower limit set point of 9 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 element contactor(s), which in turn, cycles the heating elements on and off. This sequence continues until one of the following occurs:

- 1) Boiler pressurizes to 15 PSI, causing the high limit pressure switch to open. At that time, the auxiliary heating element contactor(s) are de-energized, shutting off power to the heating elements. The pressure switch will remain open until the pressure drops below the lower limit set point of 6 PSI. Boiler water level drops below the LLCO (low water level cut-off) probes for the low level cut-off and the auxiliary low level cut-off controls, de-energizing the internal contactor on both controls. This de-energizes the main and auxiliary heater contactors, shutting off power to the heating elements. The heating elements will remain off until the water level rises above the LLCO probes and the manual re-set switch is pressed.

COOK CYCLE

1. A Cook cycle should not be started, until the initial fill and preheat is completed, in order for the boiler steam pressure to be within operational limits.
 - A. Insert product into steamer.
 - B. Compartment door is closed and screw handle tightened down.
 - C. Compartment steam control arm is pulled forward and latches, allowing steam to enter compartment.
- D. Time is dialed on timer (past 5 minutes).
 - 1) Micro switch SW1 contacts change state from N.C. to N.O.
 - 2) Micro switch SW2 contacts also change state from N.C. to N.O.
- E. Compartment power switch is turned ON.
 - 1) L1 (HOT) to one side of the thermal switch.

NOTE: L2 (NEUTRAL) is connected to the other side of the buzzer, steam exhaust solenoid valve, trip solenoid, pilot light and timer motor.

- F. Once compartment temperature reaches approximately 180°F thermal switch closes and supplies power L1 (HOT) to:
- 1) Steam exhaust solenoid valve (N.O.) energized and closes.

NOTE: Even though steam exhaust solenoid valve is closed, a small opening exists in the “guillotine” blade of the valve to allow “limited free venting” of condensate during a cook cycle.

- 2) Pilot light (red) comes on indicating timed cooking at 180°F has started.
 - 3) Timer motor energized
2. Cooking Timer times down to approximately one minute before zero.
 - A. Micro switch SW2 contacts change state from N.O. back to N.C. (normal starting position).
 - 1) Steam exhaust solenoid valve is de-energized and opens to exhaust steam and pressure from the compartment.
 - 2) Steam control solenoid (trip) is energized and unlatches steam control arm allowing it to return to the rear. Steam supply the compartment is shut off.
 3. Cooking timer reaches zero.
 - A. Micro switch SW1 contacts change state from N.O. back to N.C. (normal starting position).
 - B. Buzzer is energized.
 4. Cooking timer is manually turned off.
 5. Compartment power switch is turned OFF, buzzer is de-energized and power is removed from the common side of micro switch SW1.
 6. Steamer reverts to preheat cycle until:
 - A. A cooking cycle is started. i.e. compartment door is closed and screw handle tightened down, time is dialed into timer (past 5 minutes) and the compartment power switch is turned ON.
 - B. Water level drops below low level cut-off probes.
 - C. Power switch is turned OFF.

NOTE: Heating elements will come back on, after the boiler pressure drops below the low pressure set point limit (9 psi) and will stay on until the high pressure set point (11 psi) is reached. As long as steam pressure is within limits, even while cooking, heating elements can go off. The boiler is able to re-pressurize to the upper set point limit even with all compartments in cook mode.

WATER REFILL (AFTER INITIAL FILL)

1. Water level drops below low level probe (LL).
 - A. Power is removed from terminal 7 on the differential water level control.
 - 1) The internal contactor coil is de-energized returning contacts 3 and 4 back to there original state and energizing the boiler fill solenoid to refill the boiler.
 2. Water reaches LL (low level) probe.
 - A. Power to terminal 2 on the water level control is present but no switching occurs.
 3. Water reaches HL (high level) probe.
 - A. Power to terminal 10 on the differential level control.
 - 1) The internal contactor coil on the differential level controls is energized.
 - a. The normally closed contacts on terminals 3 and 4 open, de-energizing the boiler fill solenoid and the boiler stops filling.
- NOTE:** The internal contactor coil has a locking path through contacts on terminals 7 & 8 to the low level probe to keep the coil energized after the water level drops below the high level probe.
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.

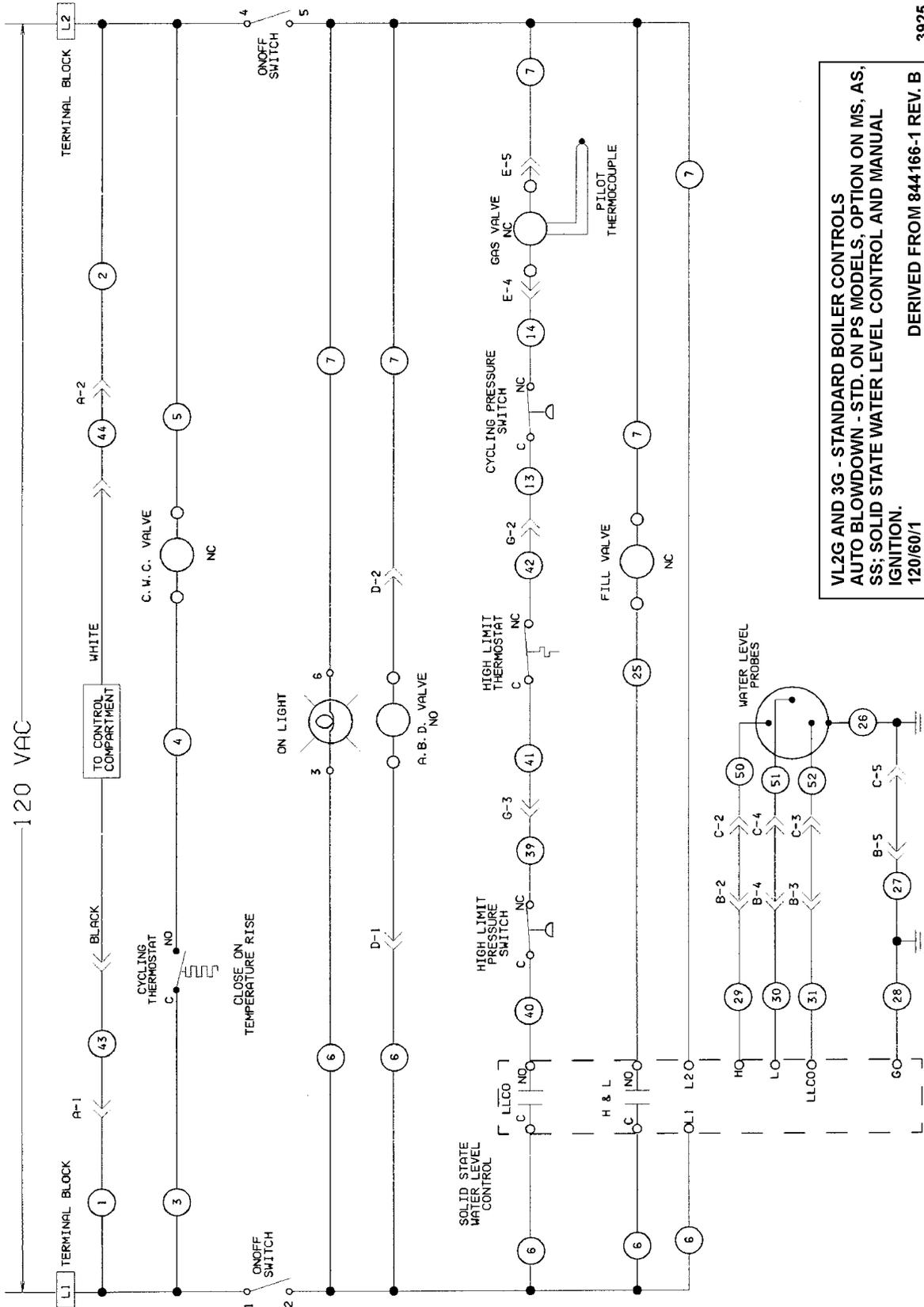
BOILER BLOWDOWN/DRAIN

1. Main power switch turned OFF.
 - A. Power switch indicator light (red) goes out and power is removed form all boiler controls except the blowdown timer.
2. Blowdown timer switch is pressed.
 - A. The normally open timer contacts close, energizing the blowdown solenoid valve and the cold water condenser valve.
 - B. Boiler begins blowing down and draining until timer “times out” after approximately 4 minutes.
 - C. Timer contacts re-open and power is then removed from the blowdown solenoid valve and the cold water condenser valve.

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SCHEMATICS, GAS STEAMERS, BOILER CONTROLS
VL2G AND VL3G - PREVENT, AUTOMATIC, STANDARD AND MANUAL

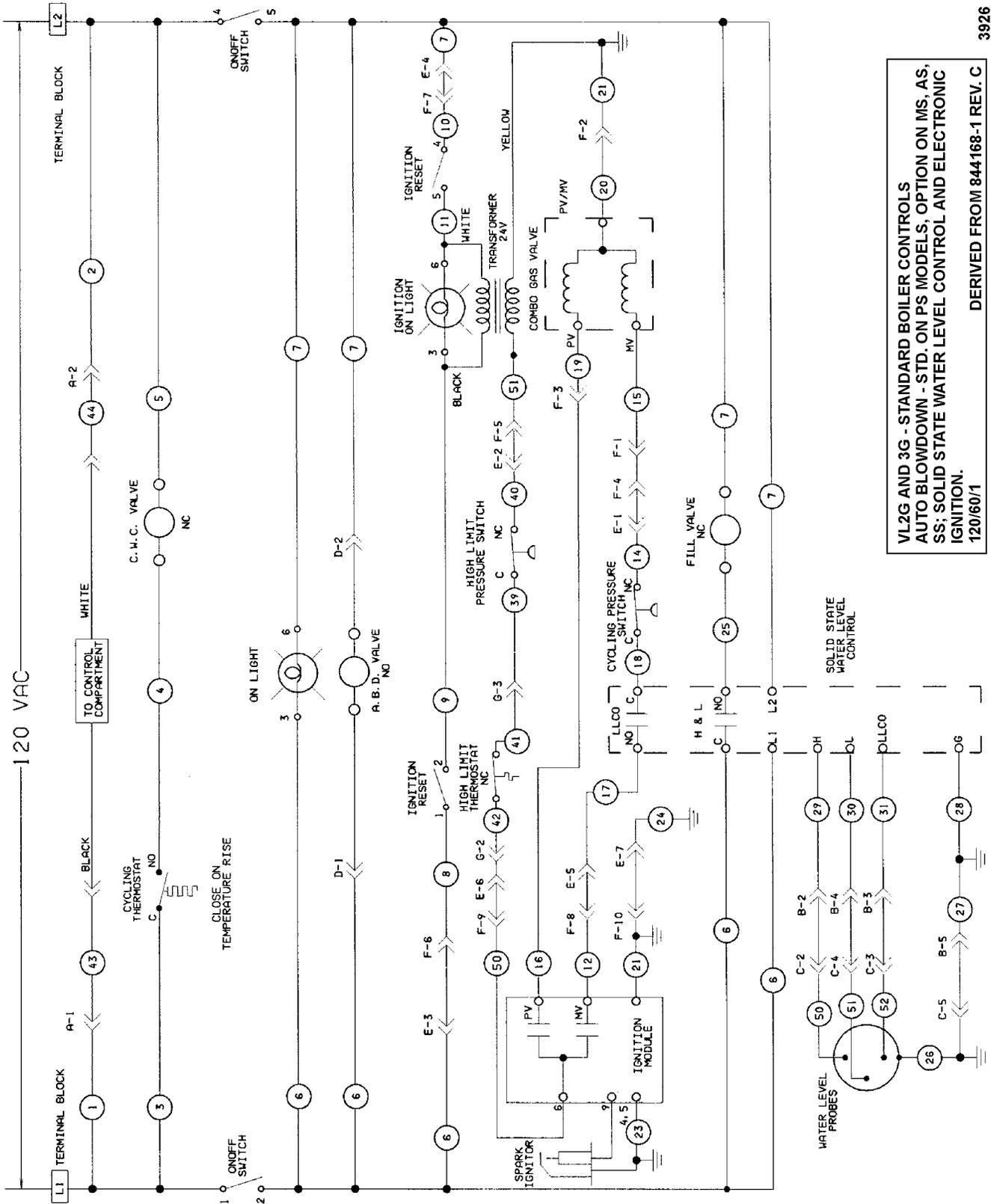
Manual Ignition, Standard Controls



VL2G AND 3G - STANDARD BOILER CONTROLS
AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON MS, AS,
SS; SOLID STATE WATER LEVEL CONTROL AND MANUAL
IGNITION.
 120/60/1
 DERIVED FROM 844166-1 REV. B

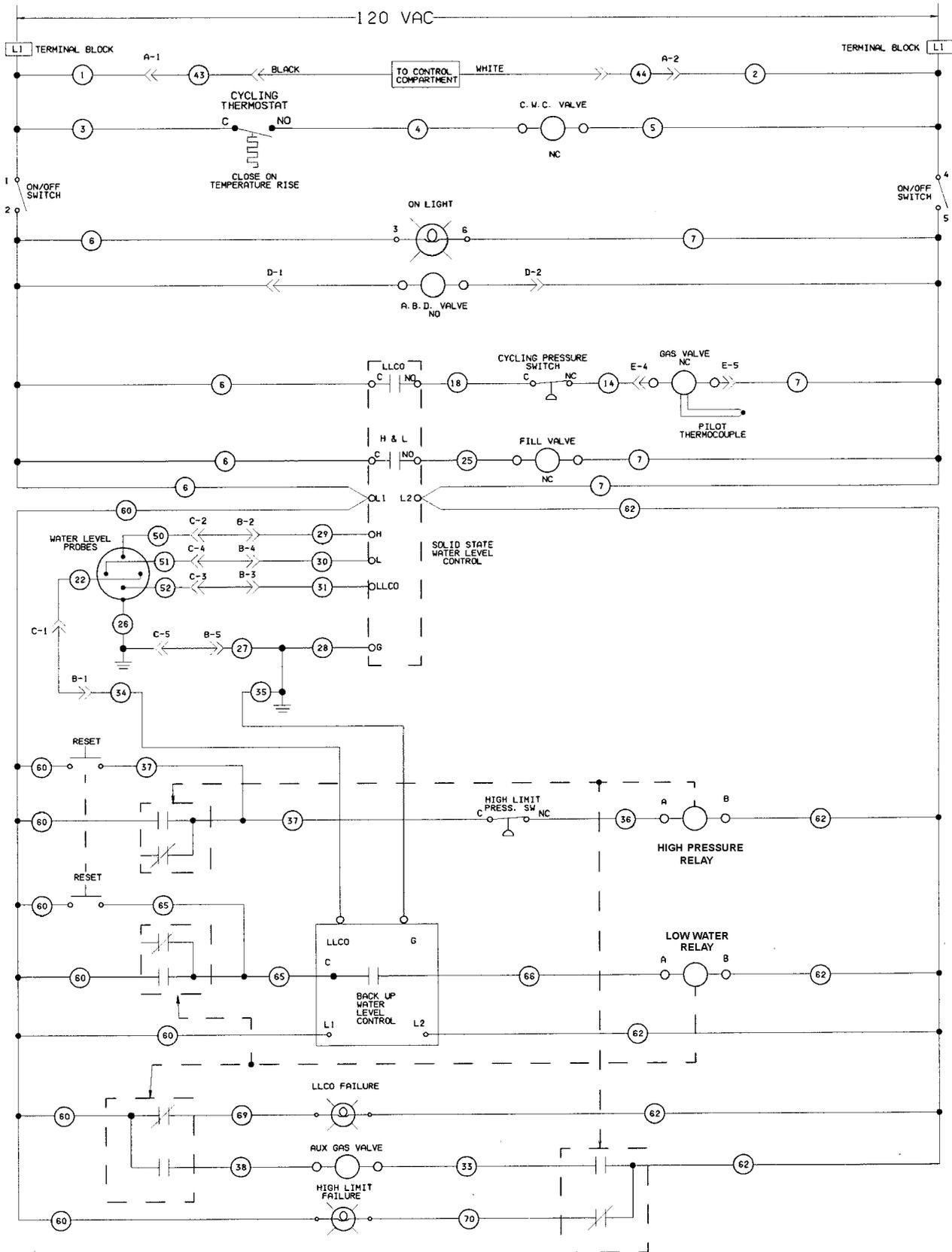
3925

Electronic Ignition, Standard Controls



VL2G AND 3G - STANDARD BOILER CONTROLS
 AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON MS, AS,
 SS; SOLID STATE WATER LEVEL CONTROL AND ELECTRONIC
 IGNITION.
 120/60/1
 DERIVED FROM 844168-1 REV. C

Manual Ignition, CSD-1 Code Controls

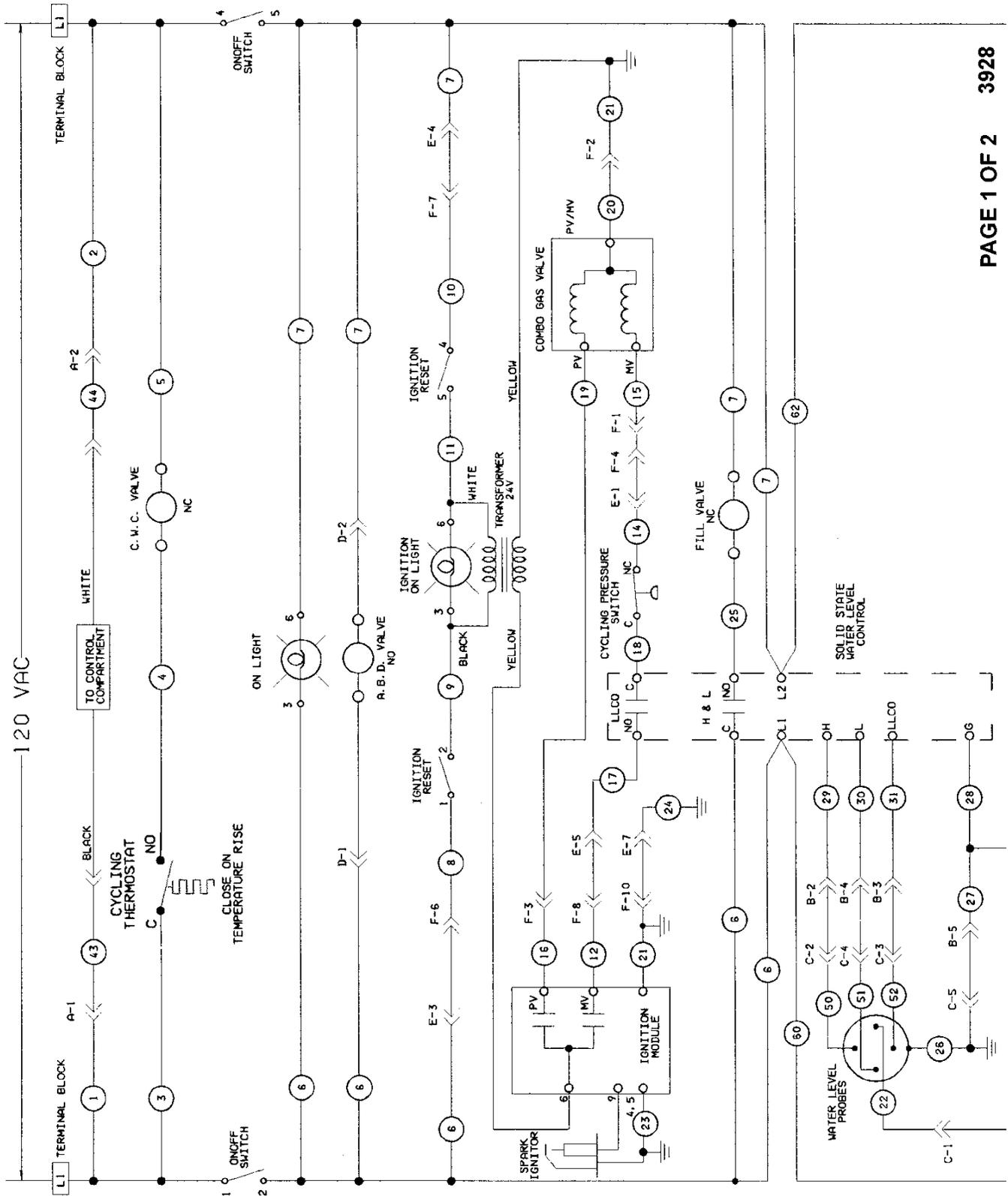


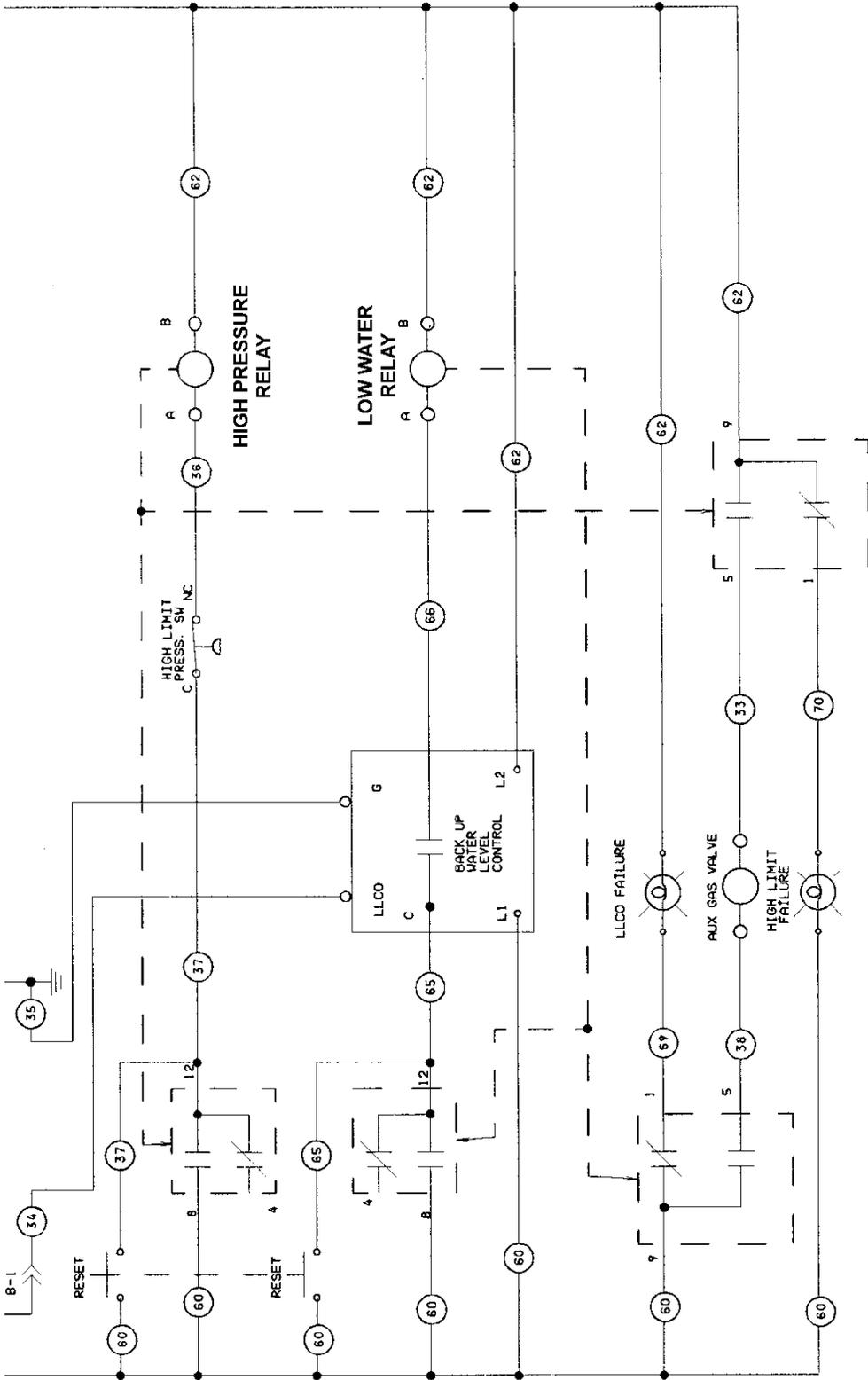
NOTE:
CSD-1 MEETS AND EXCEEDS CAL-CODE REQUIREMENTS
AND IS OFTEN REFERRED TO AS CAL-CODE/CSD-1.

VL2G AND 3G - CSD-1 BOILER CONTROLS
AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON MS, AS,
SS; SOLID STATE WATER LEVEL CONTROLS AND MANUAL
IGNITION. 120/60/1 DERIVED FROM 851264-1 REV. C

3927

Electronic Ignition, CSD-1 Code Controls



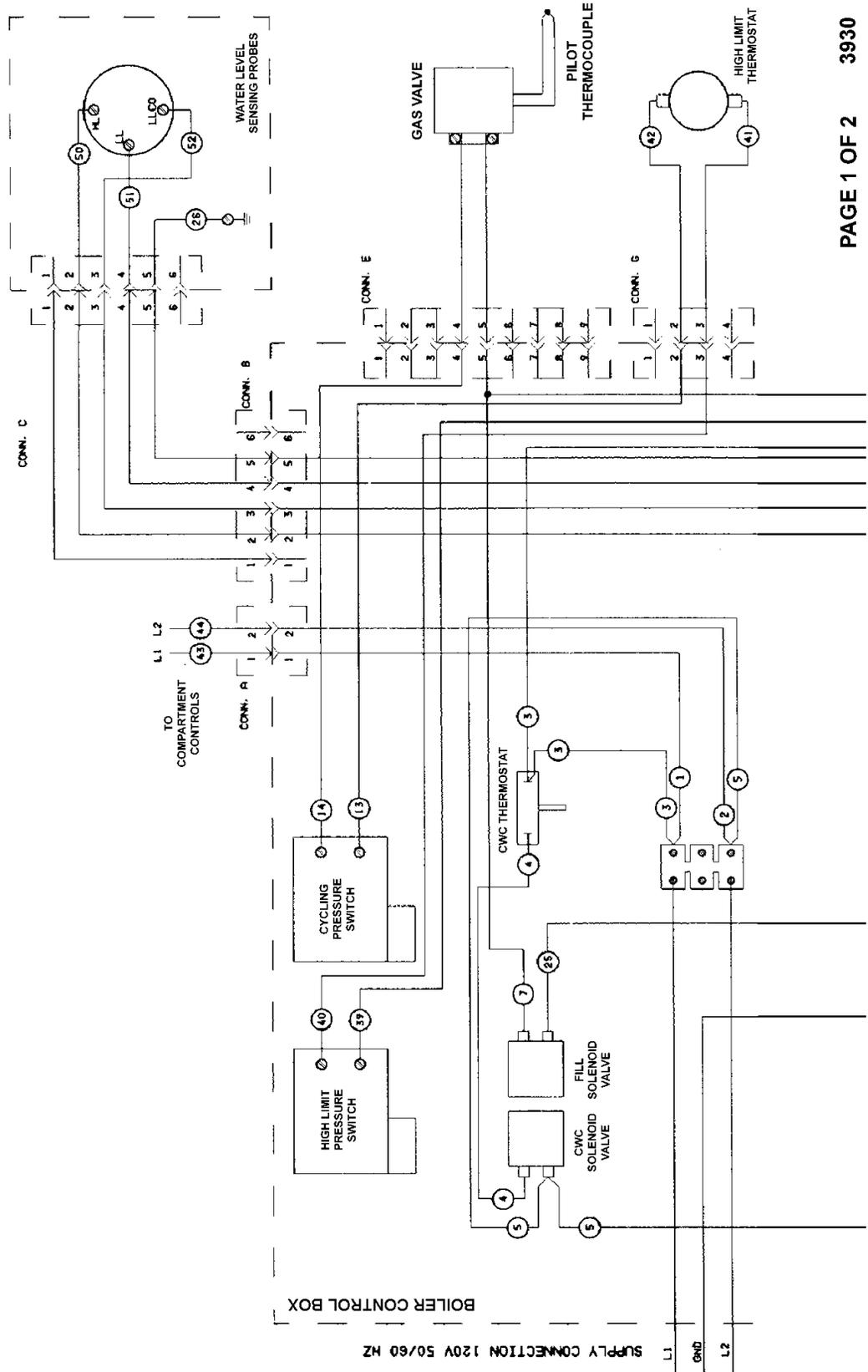


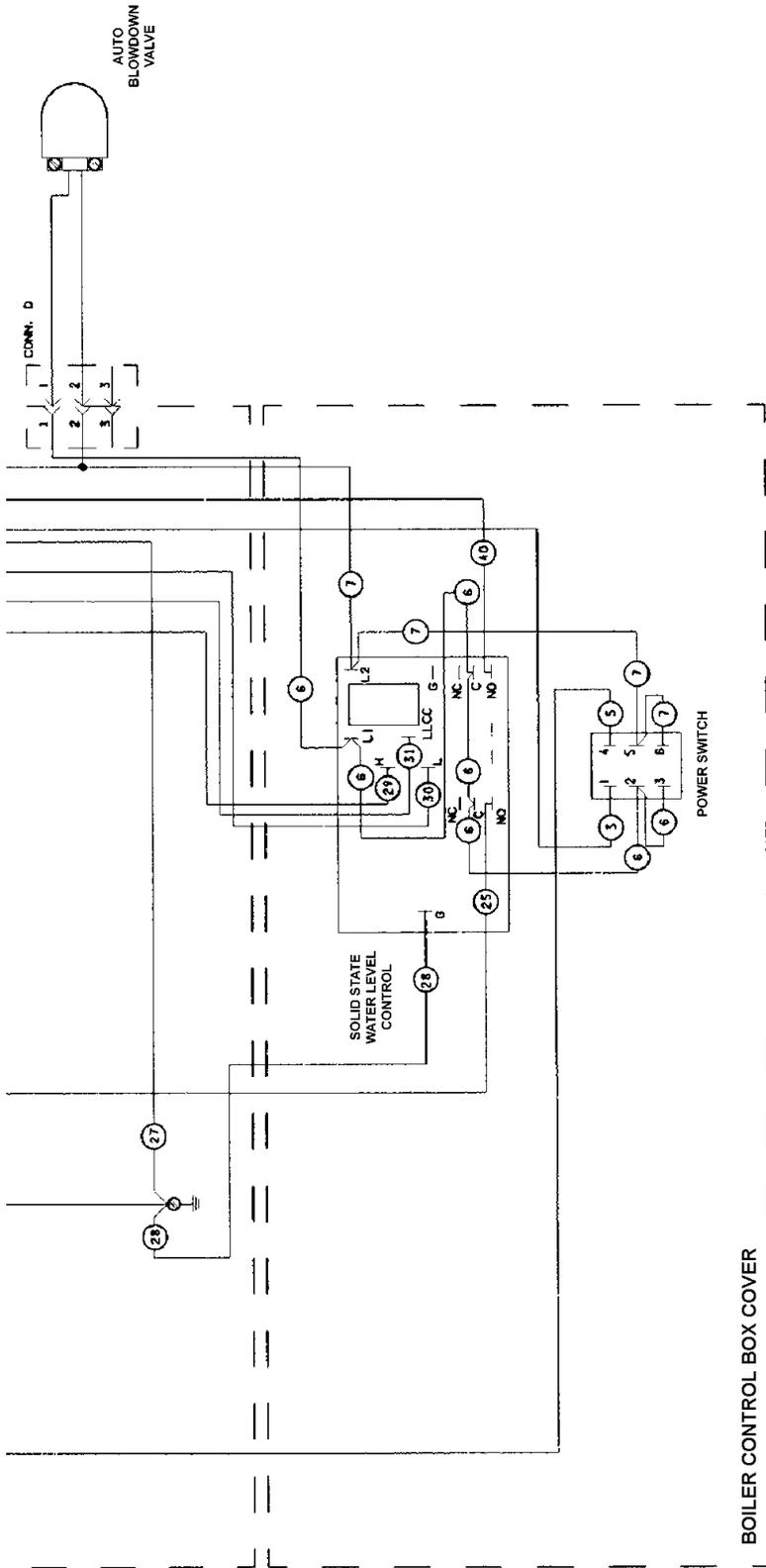
NOTE:
 CSD-1 MEETS AND EXCEEDS CAL-CODE
 REQUIREMENTS AND IS OFTEN REFERRED
 TO AS CAL-CODE/CSD-1.

**VL2G AND 3G - CSD-1 BOILER CONTROLS
 AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON MS, AS,
 SS; SOLID STATE WATER LEVEL CONTROLS AND ELECTRONIC
 IGNITION. 120/60/1
 DERIVED FROM 851265-1 REV. C**

**WIRING DIAGRAMS, GAS STEAMERS, BOILER CONTROLS
VL2G AND VL3G - PREVENT, AUTOMATIC, STANDARD AND MANUAL**

Manual Ignition, Standard Controls





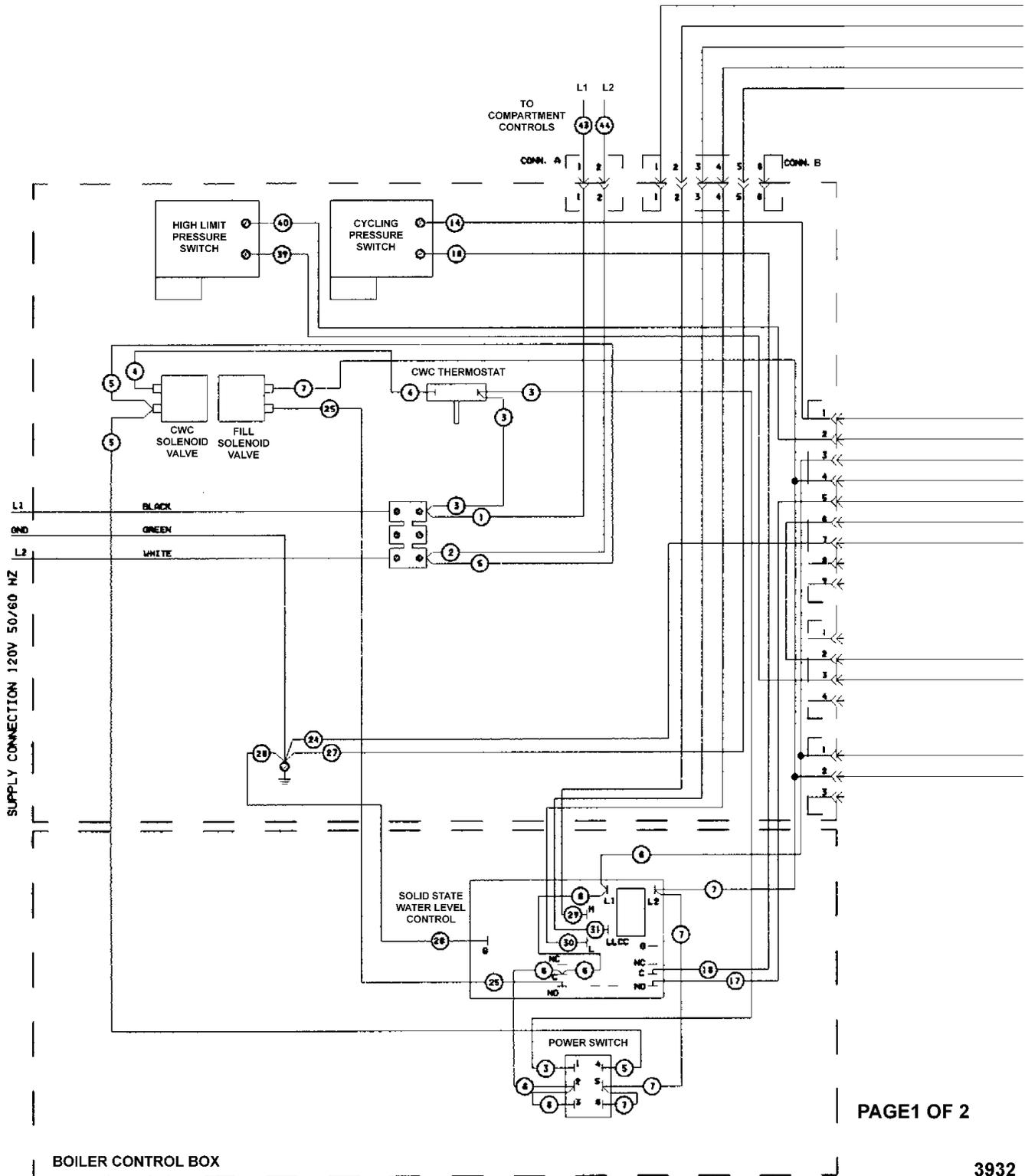
NOTE:
HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY.
SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.

PAGE 2 OF 2

VL2G AND 3G - STANDARD BOILER CONTROLS
 AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON MS, AS,
 SS; SOLID STATE WATER LEVEL CONTROL AND MANUAL
 IGNITION. 120/60/1
 DERIVED FROM 844166-1 REV. B

3931

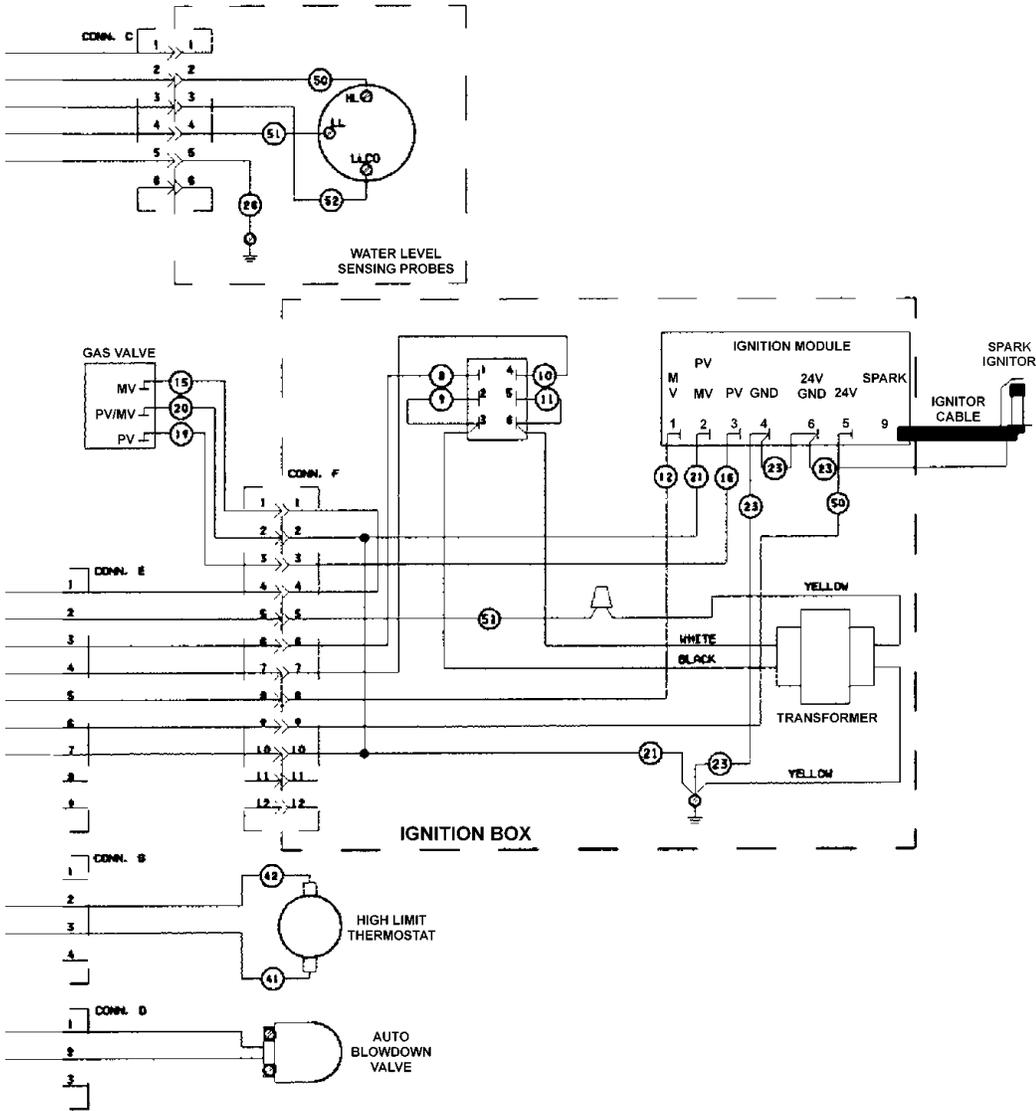
Electronic Ignition, Standard Controls



PAGE 1 OF 2

BOILER CONTROL BOX

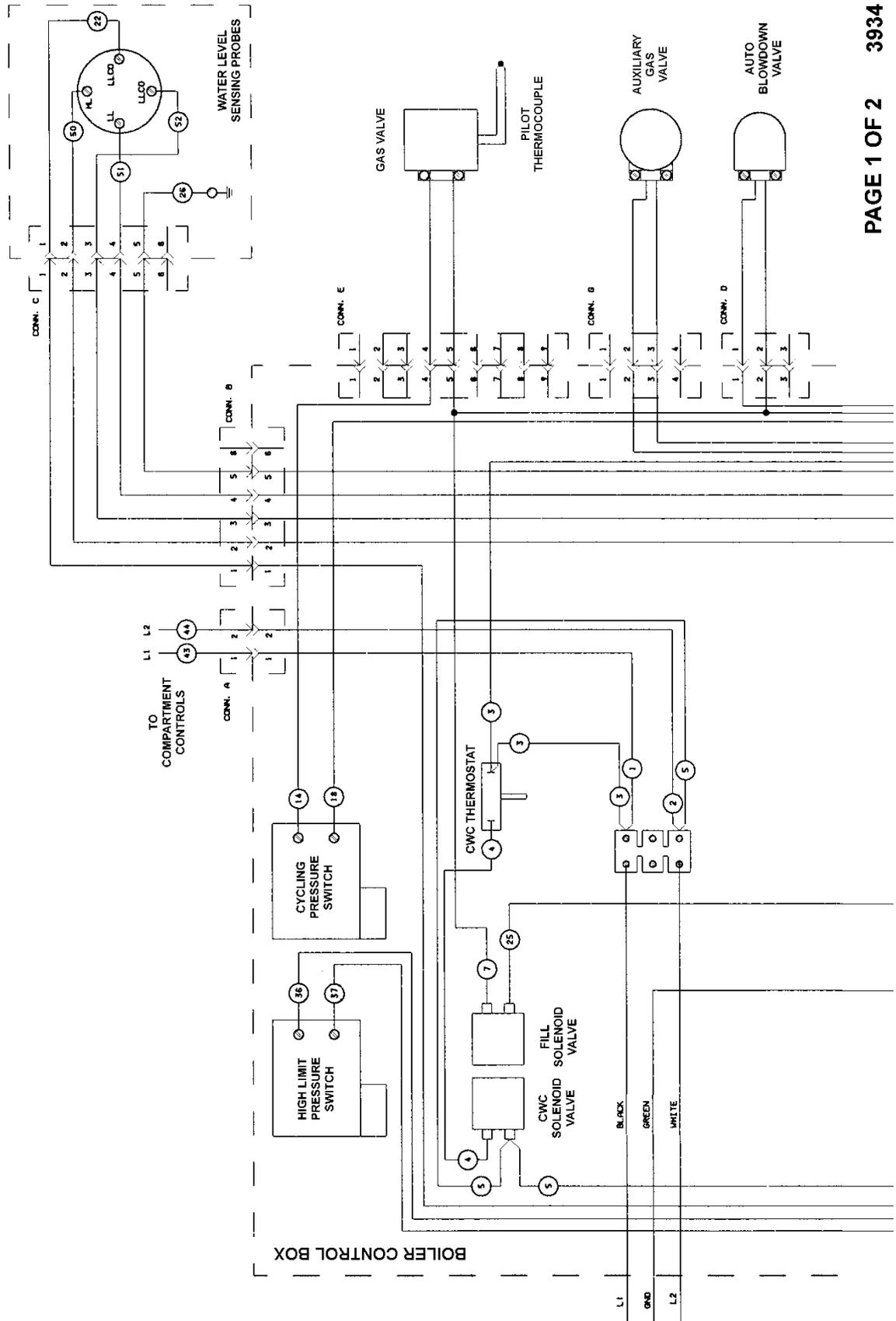
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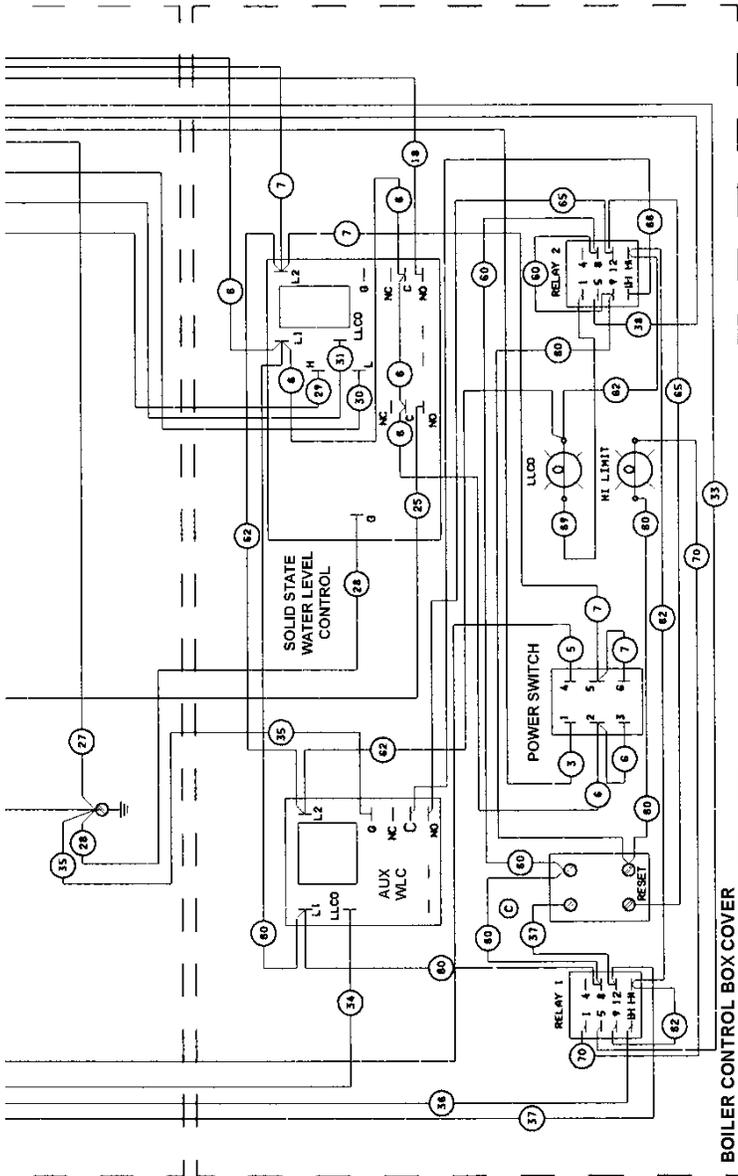


NOTE: HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY. SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.

VL2G AND 3G - STANDARD BOILER CONTROLS
 AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON MS, AS, SS;
 SOLID STATE WATER LEVEL CONTROL AND ELECTRONIC IGNITION.
 120/60/1 DERIVED FROM 844168-1 REV. C

Manual Ignition, CSD-1 Code Controls





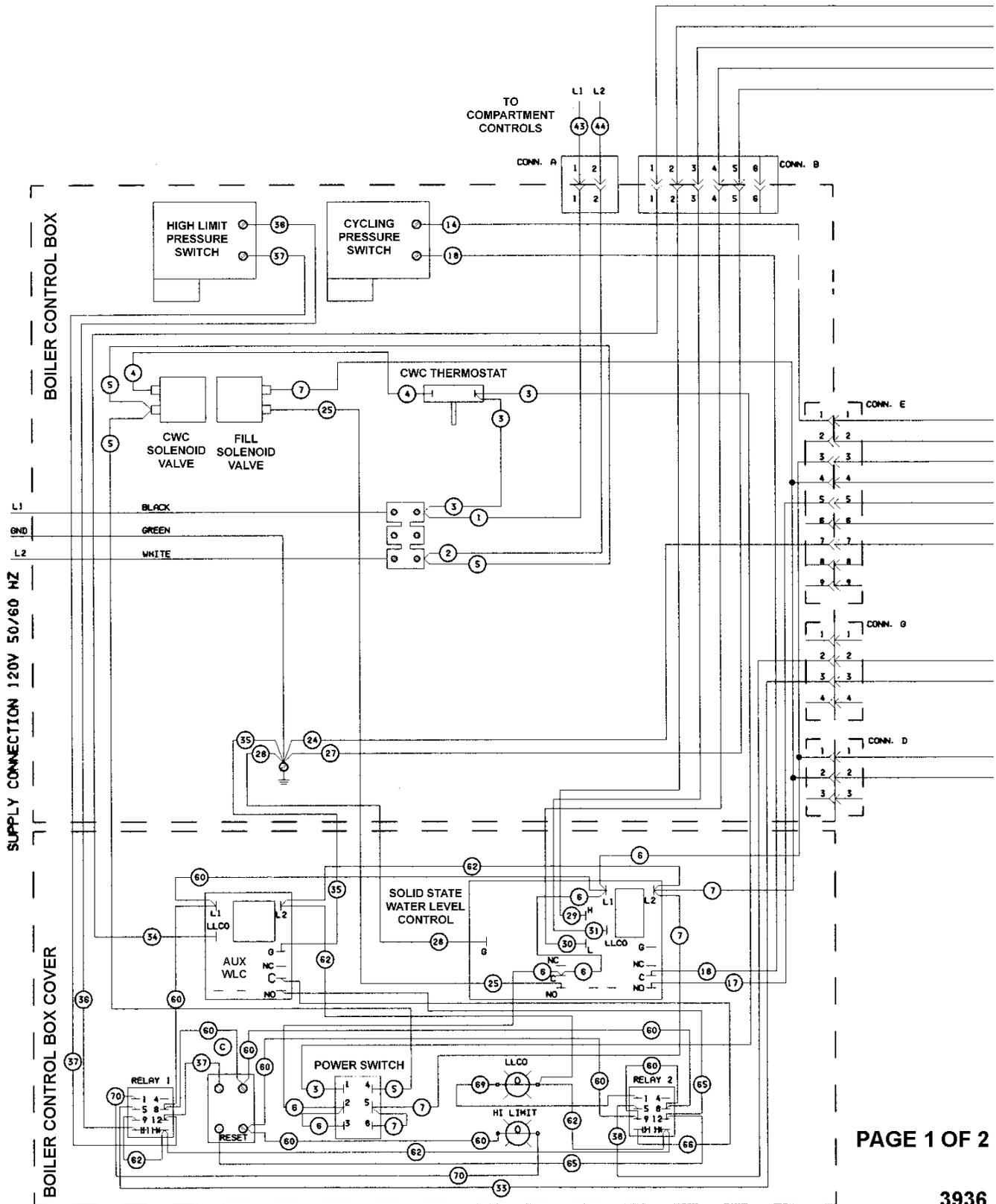
BOILER CONTROL BOX COVER

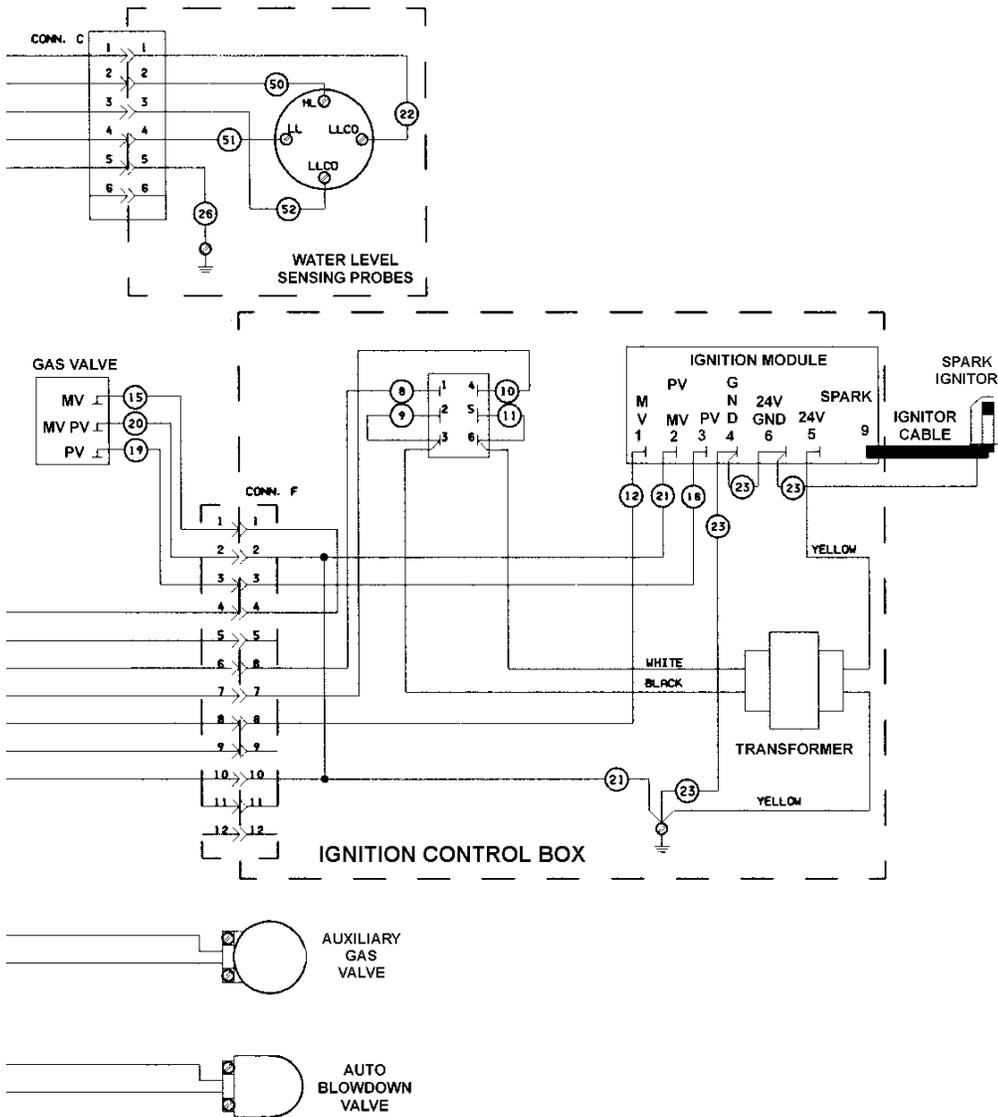
NOTE: CSD-1 MEETS AND EXCEEDS CAL-CODE REQUIREMENTS AND IS OFTEN REFERRED TO AS CAL-CODE/CSD-1.

NOTE: HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY. SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.

**VL2G AND 3G - CSD-1 BOILER CONTROLS
 AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON
 MS, AS, SS; SOLID STATE WATER LEVEL CONTROLS
 AND MANUAL IGNITION.
 120/60/1 DERIVED FROM 851264-2 REV. C**

Electronic Ignition, CSD-1 Code Controls





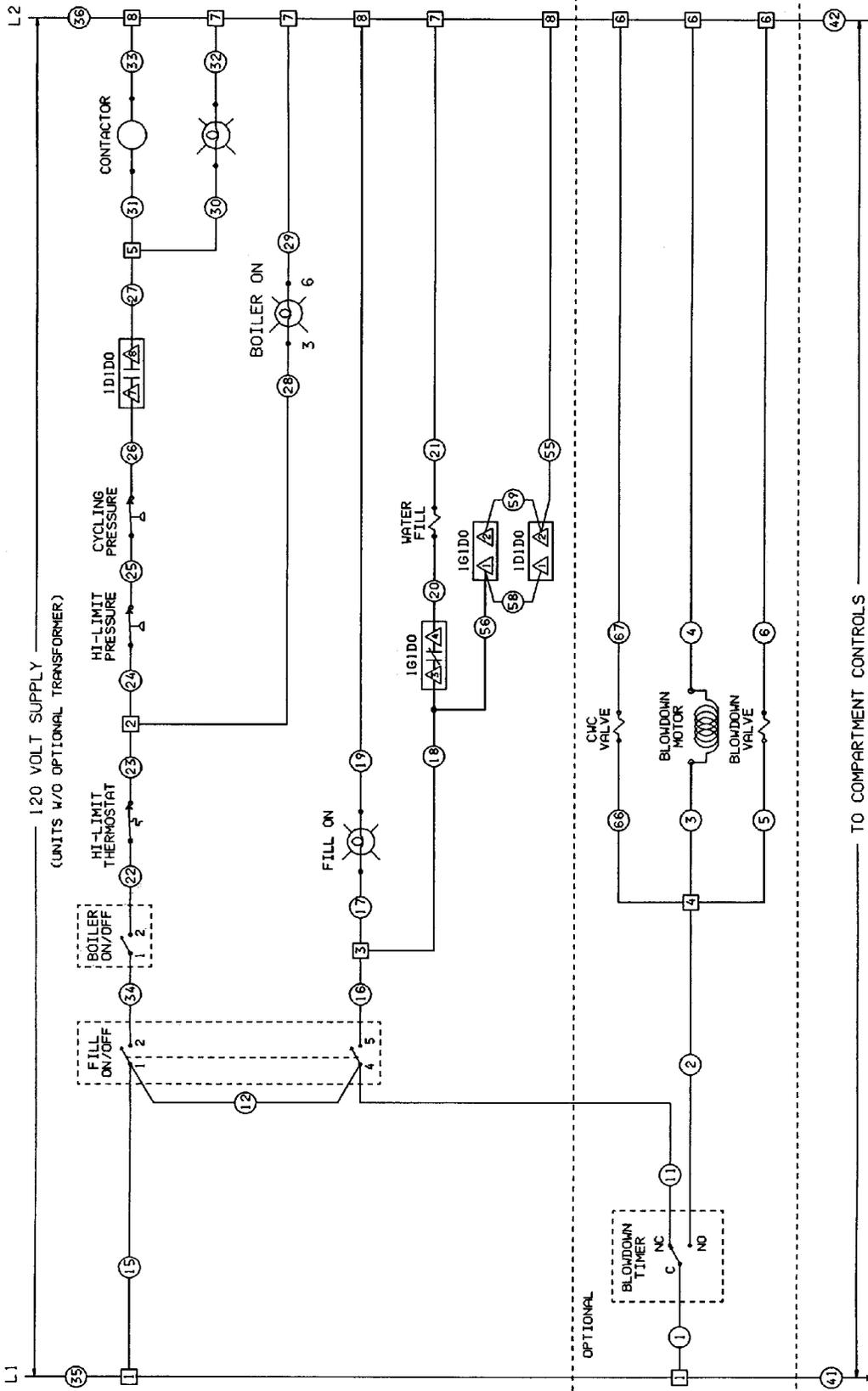
NOTE:
 CSD-1 MEETS AND EXCEEDS CAL-CODE REQUIREMENTS
 AND IS OFTEN REFERRED TO AS CAL-CODE/CSD-1.

NOTE: HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY.
 SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.

VL2G AND 3G - CSD-1 BOILER CONTROLS
AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON MS, AS,
SS; SOLID STATE WATER LEVEL CONTROLS AND ELECTRONIC
IGNITION. 120/60/1 DERIVED FROM 851265-2 REV. C

**SCHEMATICS, ELECTRIC STEAMERS, BOILER CONTROLS
VL2E AND VL3E - PREVENT, AUTOMATIC, STANDARD AND MANUAL**

Auto Blowdown, Standard Controls



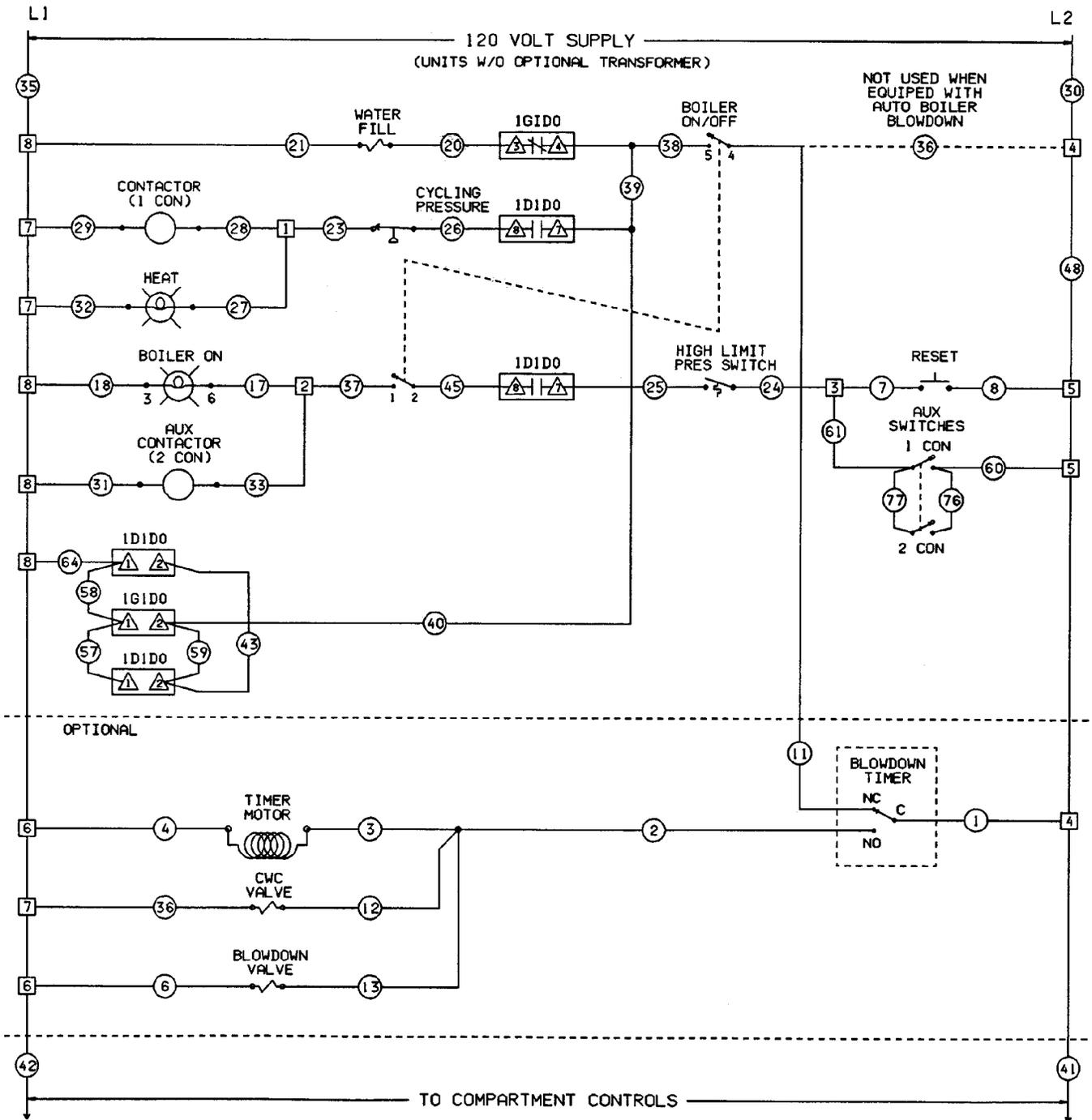
VL2E AND 3E - STANDARD BOILER CONTROLS
 AUTO BLOWDOWN WITH TIMER - STD. ON PS MODELS, OPTION
 ON MS, AS, SS AND ELECTRO-MECHANICAL WATER LEVEL CONTROLS
 18KW - 208/240V 1PH, 208/240/480V 3 PH, 220/380 & 240/415V 3 PH 4W
 24KW - 208/240V 1PH
 24KW & 36KW - 208/240V 3 PH, 480V 3 PH, 220/380 & 240/415V 3 PH 4W
 42 KW - 208V 3PH
 48 KW - 240/480V 3PH, 220/380 & 240/415V 3PH 4 W

NOTE:
 THE NUMBER OF CONTACTORS VARY FROM
 1 TO 2 DEPENDING ON THE MODEL AND KW.

DERIVED FROM 853074
 REF. DRAWING 817359

3940

Auto Blowdown, Cal-Code Controls



NOTE:
THE NUMBER OF CONTACTORS VARY FROM
2 TO 4 DEPENDING ON THE MODEL AND KW.

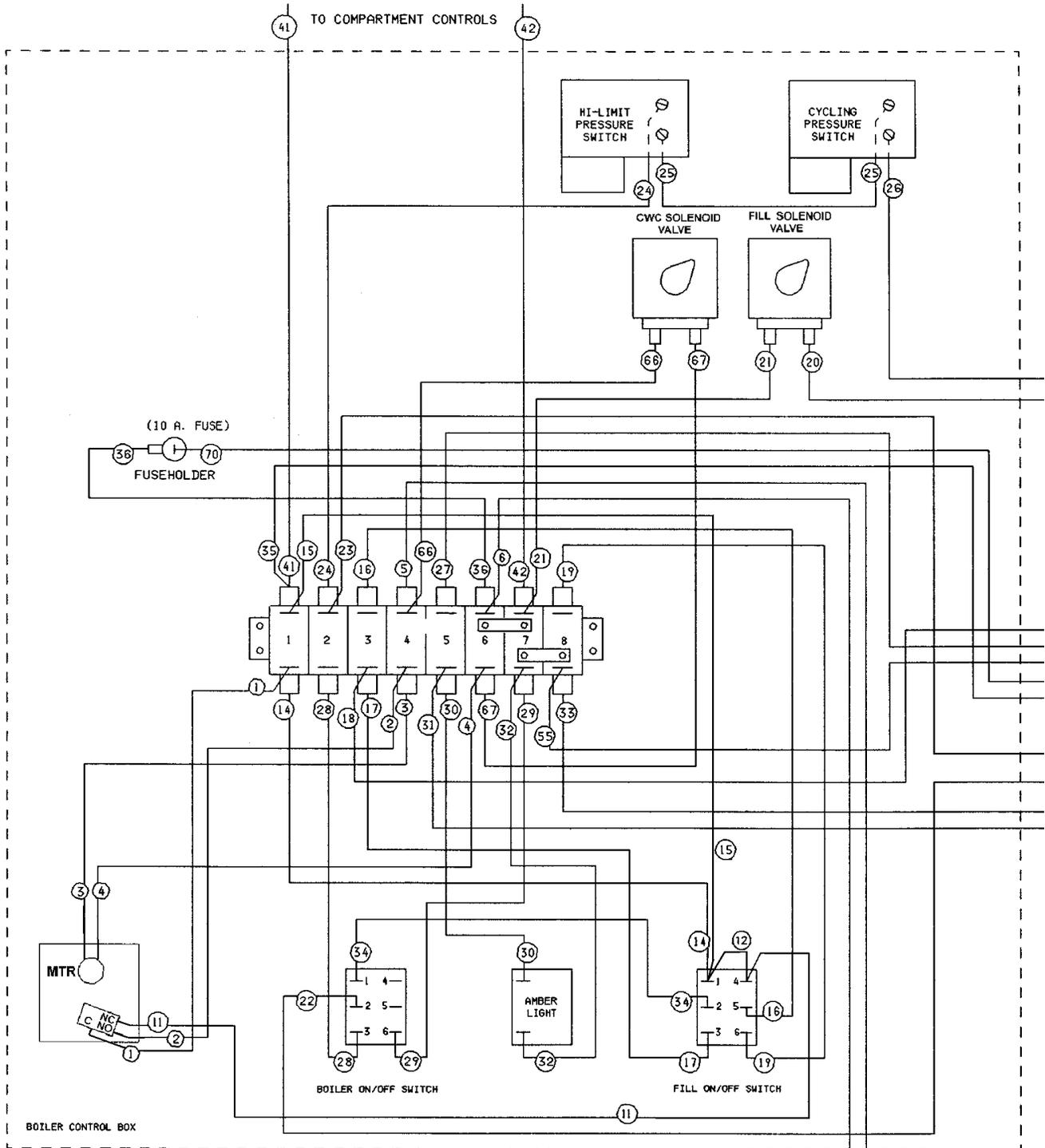
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REF. DRAWING 881725

VL2E AND 3E - CAL CODE BOILER CONTROLS
AUTO BLOWDOWN WITH TIMER- STD. ON PS MODELS, OPTION
ON MS, AS, SS AND ELECTRO-MECHANICAL WATER LEVEL CONTROLS
18KW - 208/240V 1PH, 208/240/480V 3 PH, 220/380 & 240/415V 3 PH 4W
24KW - 208/240V 1PH
24KW & 36KW - 208/240V 3 PH, 480V 3 PH, 220/380 & 240/415V 3 PH 4W
42 KW - 208V 3PH
48 KW - 240/480V 3PH, 220/380 & 240/415V 3PH 4 W

3941

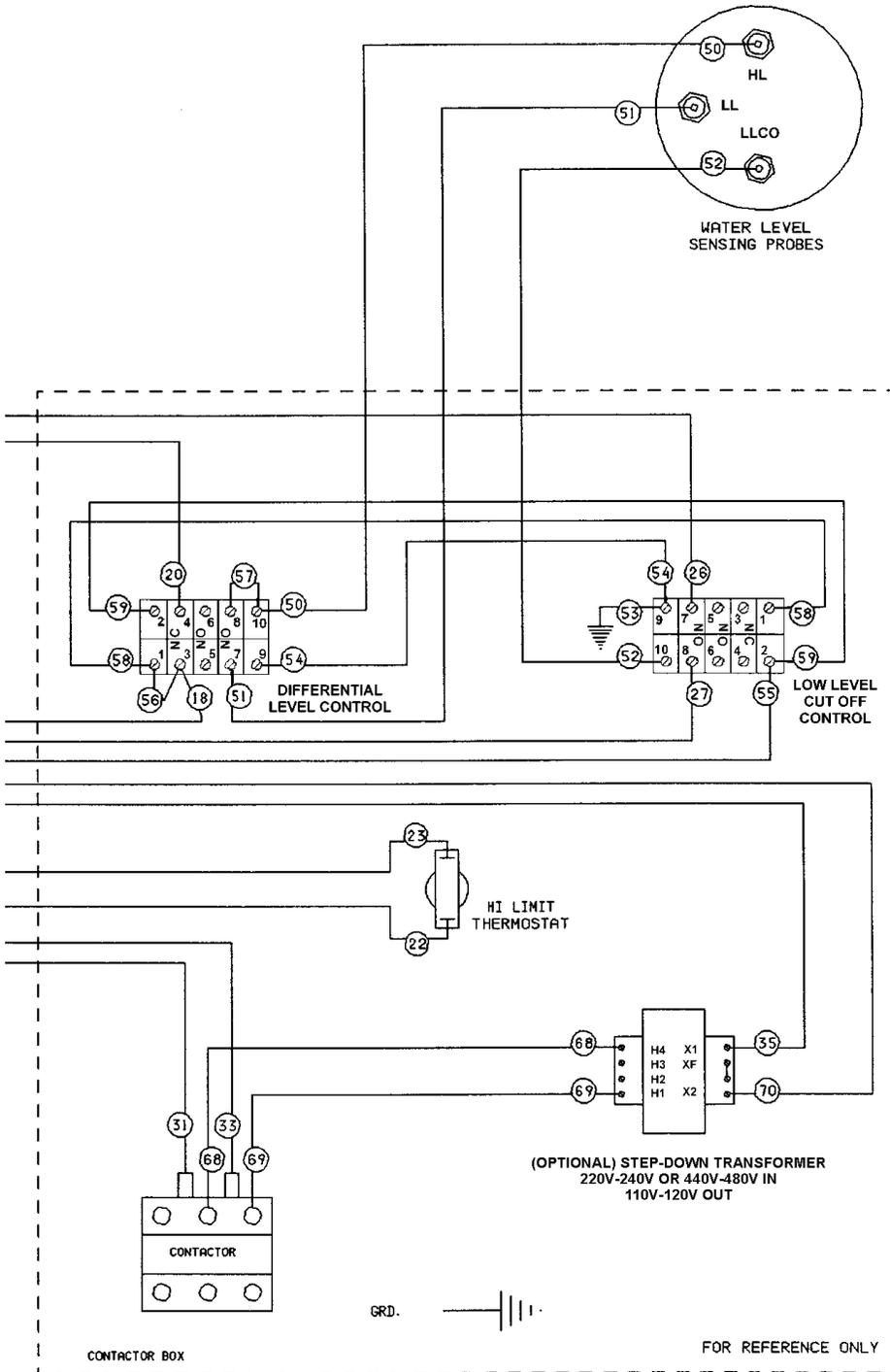
**WIRING DIAGRAMS, ELECTRIC STEAMERS, BOILER CONTROLS
VL2E AND VL3E - PREVENT, AUTOMATIC, STANDARD AND MANUAL**

Auto Blowdown, Standard Controls (contactor - 1 std.)



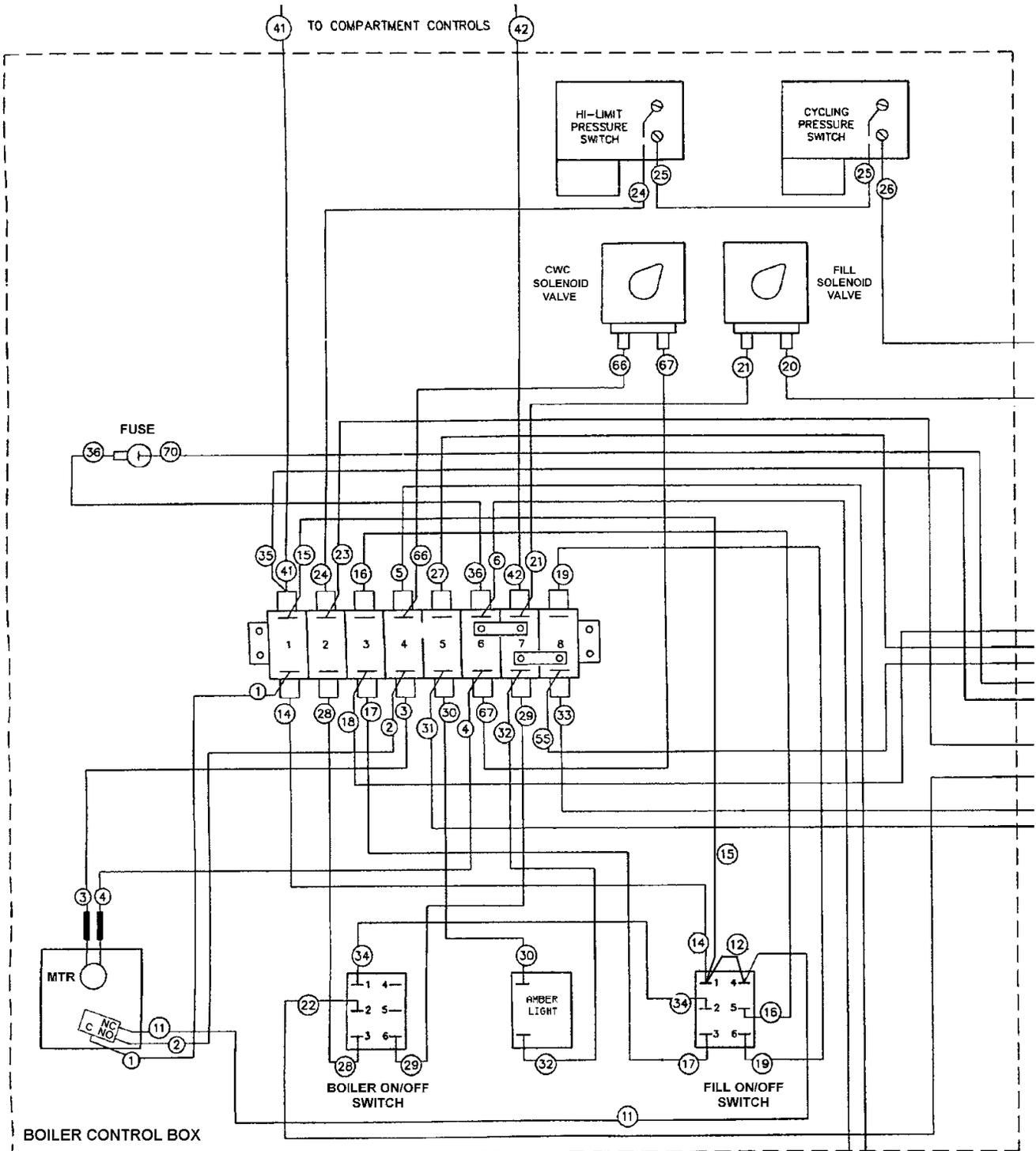
DERIVED FROM 842711 REV. B

NOTE: HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY. SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.



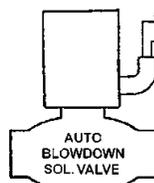
VL2E AND 3E - STANDARD BOILER CONTROLS
AUTO BLOWDOWN - STD. ON PS MODELS, OPTION ON MS, AS, SS; ELECTRO-MECHANICAL WATER LEVEL CONTROL AND STEP DOWN TRANSFORMER OPTION.
24KW - 208/240/480V 3PH, 220/380V & 240/415V 3PH 4 WIRE
36KW & 48 KW - 480V 3PH

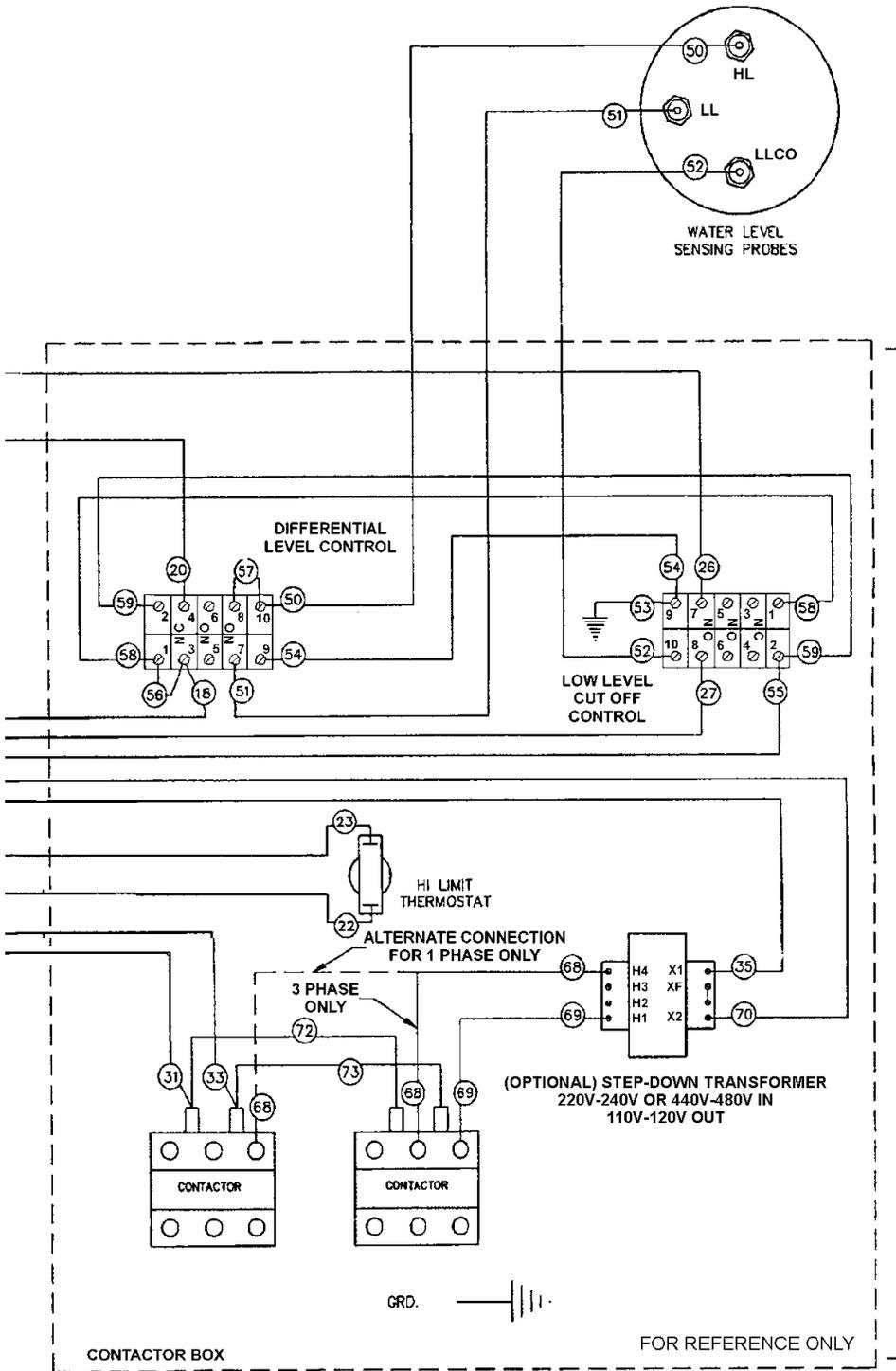
Auto Blowdown, Standard Controls (contactors - 2 std.)



DERIVED FROM 842707 REV. B

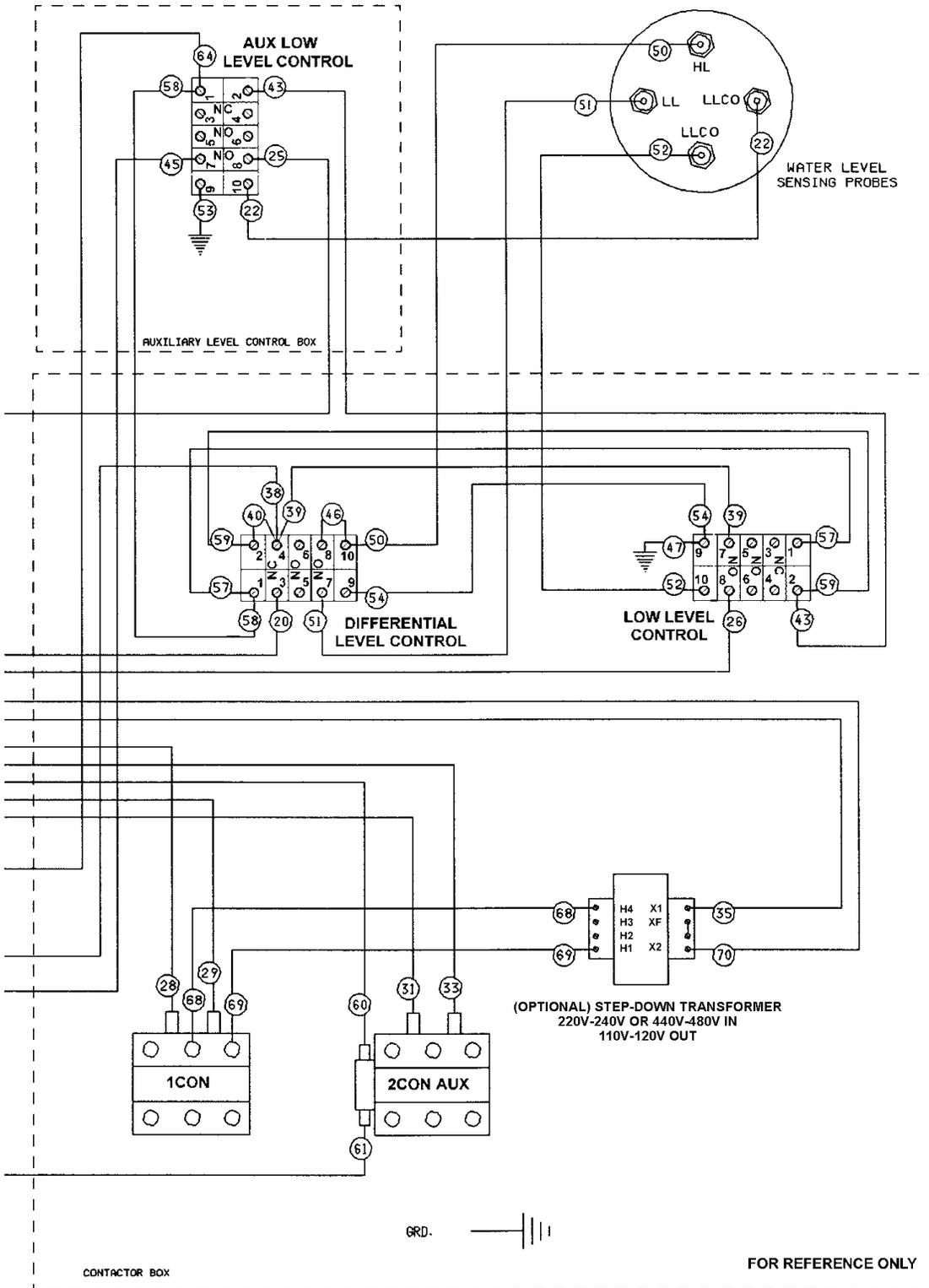
NOTE: HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY. SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.





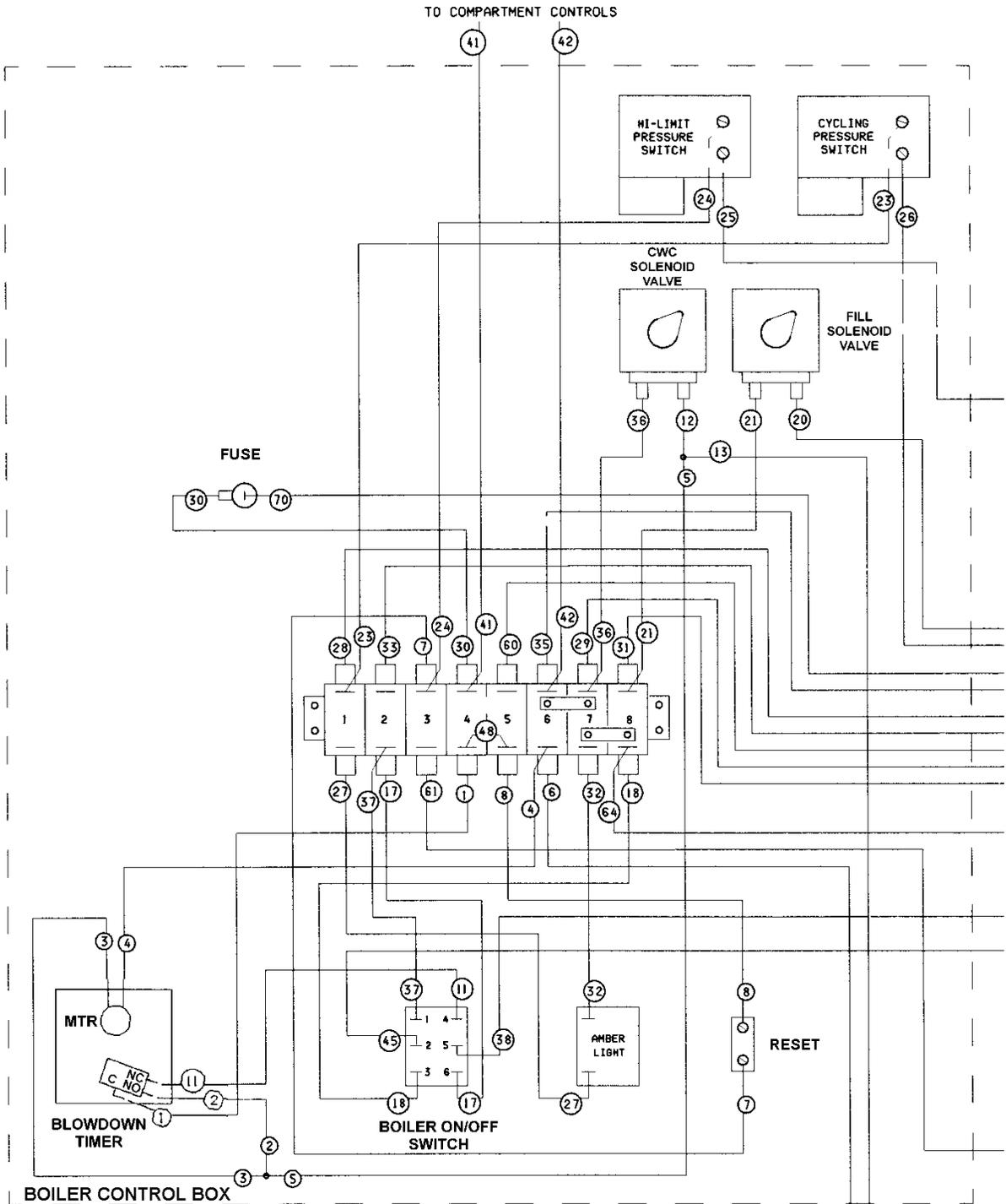
VL2E AND 3E - STANDARD BOILER CONTROLS (ALL MODELS - PS, MS, AS & SS) AUTO BLOWDOWN, ELECTRO-MECHANICAL WATER LEVEL CONTROL AND STEP DOWN TRANSFORMER OPTION.
 24KW - 208/240V 1PH
 36KW & 48 KW - 480V 3PH, 220/380V & 240/415V 3PH 4 WIRE
 42 KW - 208V 3PH, 220/380V & 240/415V 3PH 4 WIRE
 48 KW - 240V 3PH, 220/380V & 240/415V 3PH 4 WIRE

VL SERIES STEAMER - ELECTRICAL OPERATION



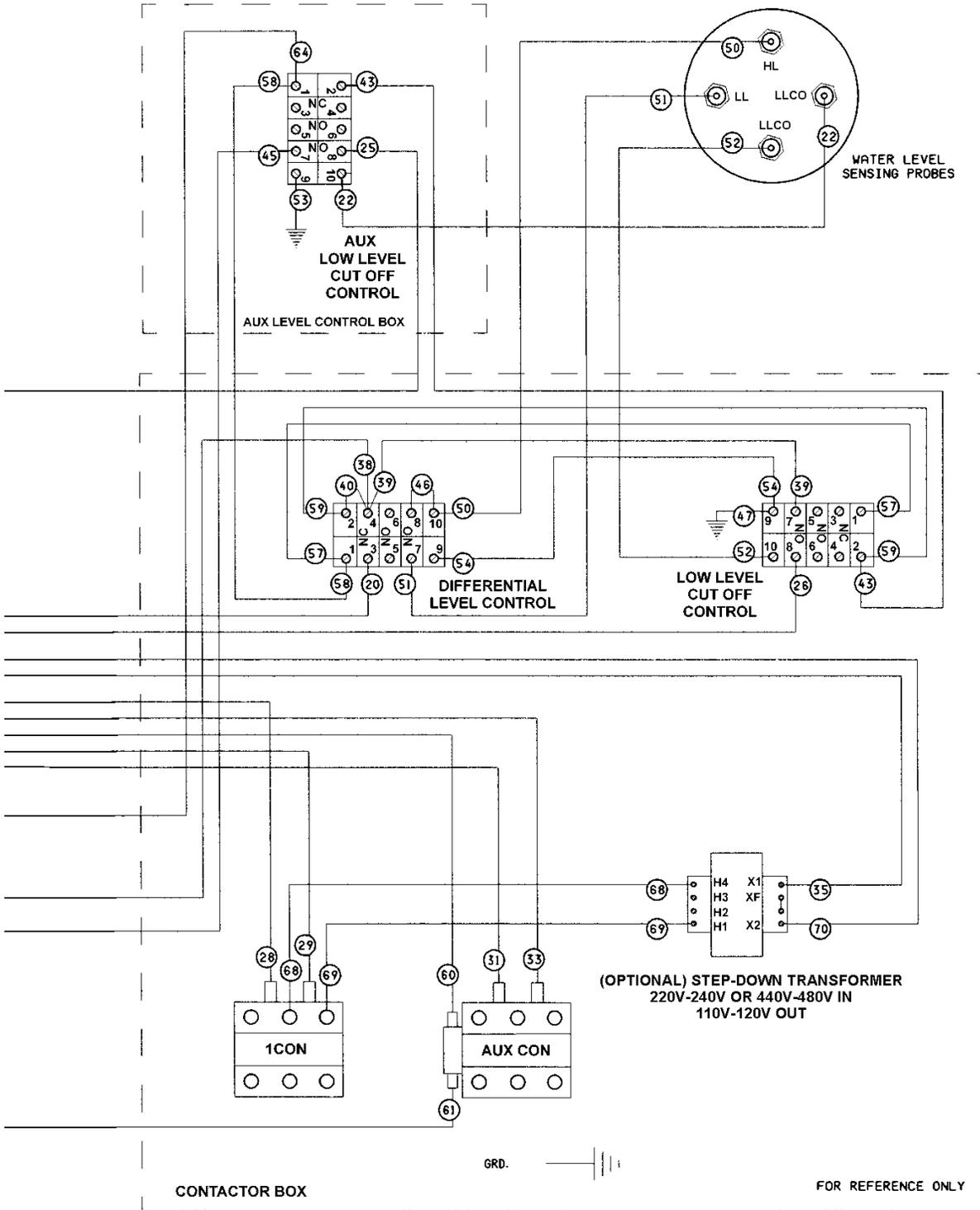
VL2E AND 3E - CAL CODE BOILER CONTROLS (MS, AS & SS)
 MANUAL BLOWDOWN, ELECTRO-MECHANICAL WATER LEVEL
 CONTROLS AND STEP DOWN TRANSFORMER OPTION.
 24KW - 208/240/480V 3PH, 220/380V & 240/415V 3PH 4 WIRE
 36KW & 48 KW - 480V 3PH

Auto Blowdown, Cal-Code Controls (contactors - 1 std. 1 aux.)



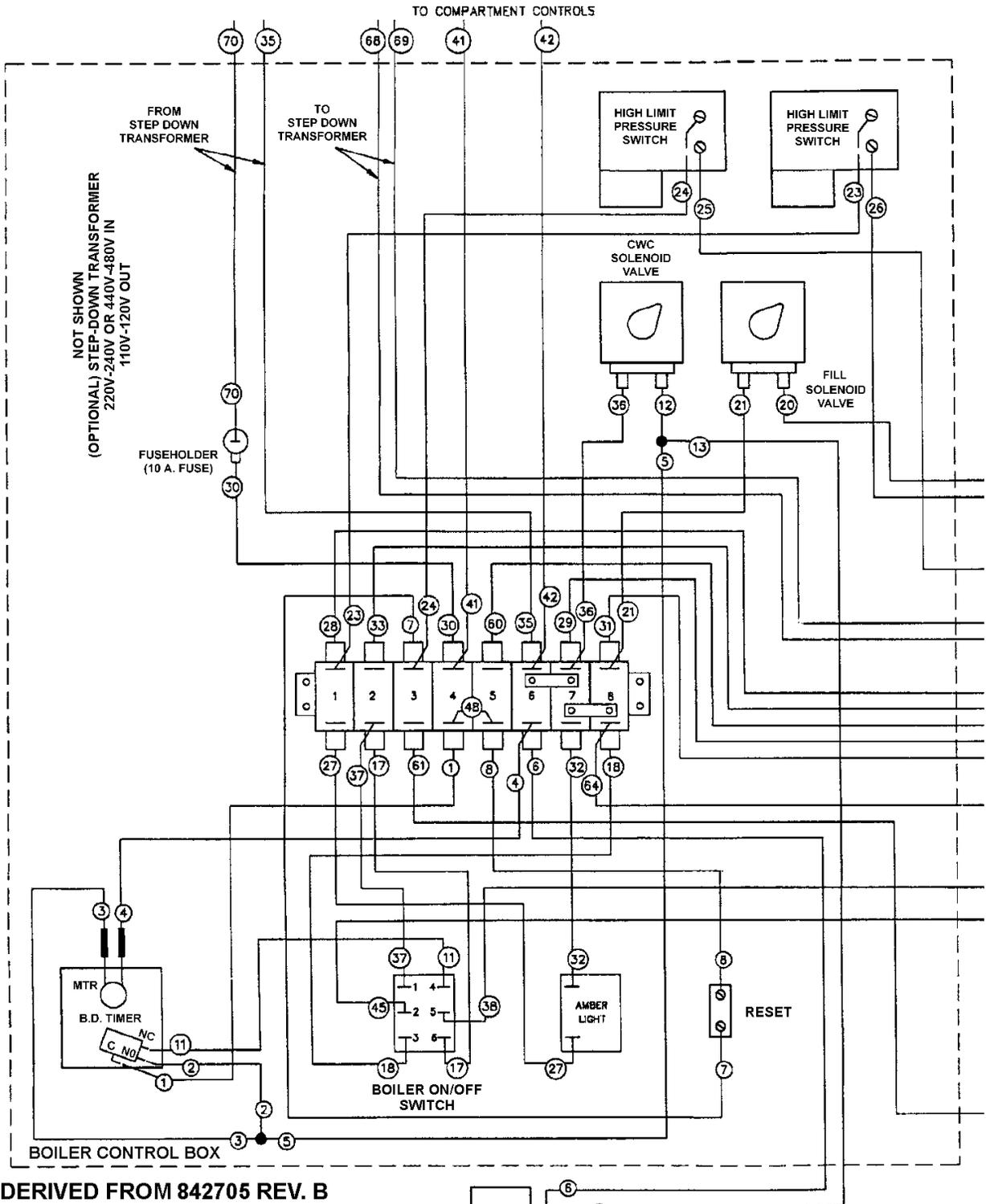
DERIVED FROM 842709 REV. B

NOTE: HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY. SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.



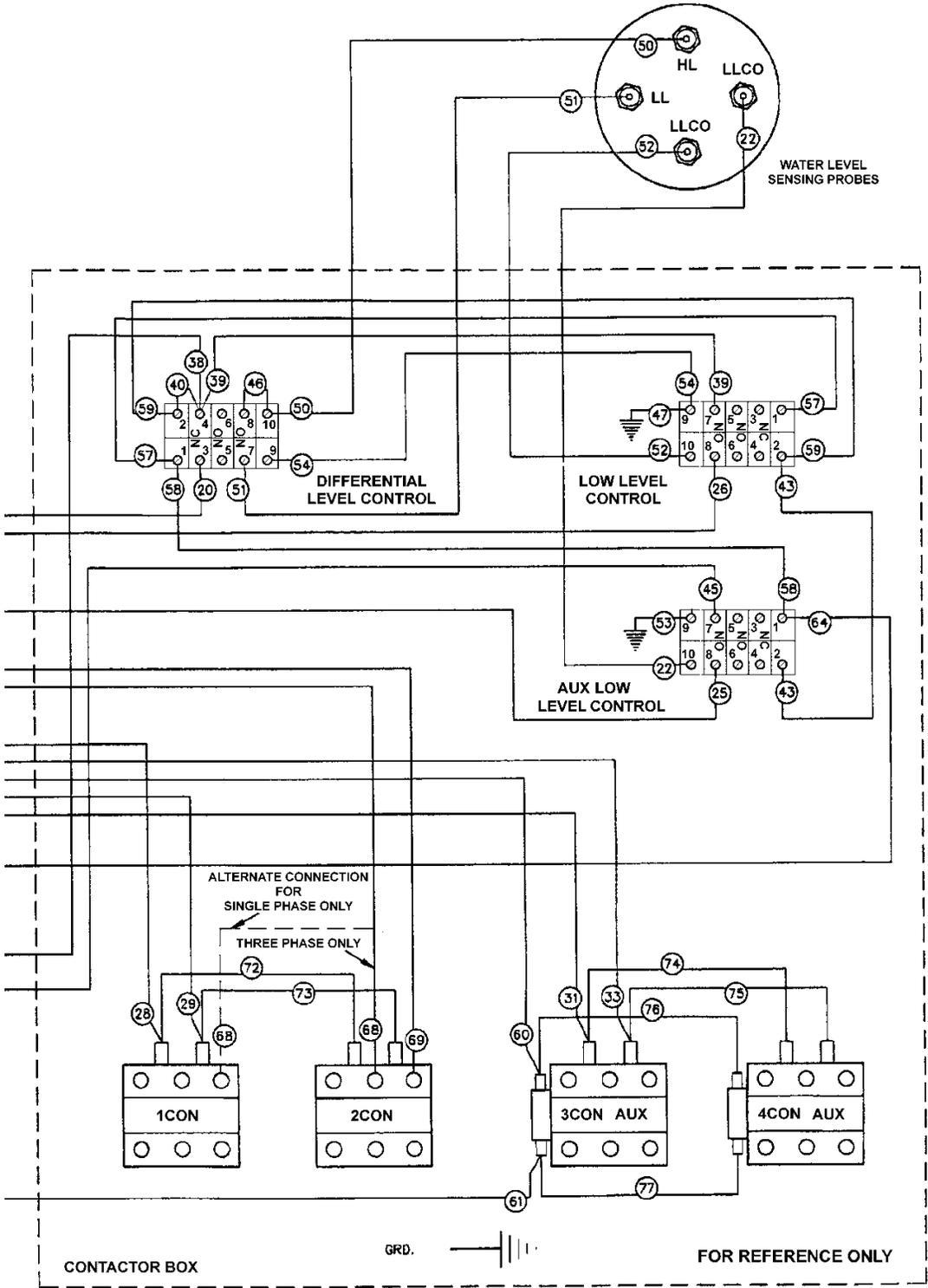
VL2E AND 3E - CAL CODE BOILER CONTROLS (ALL MODELS - PS, MS, AS & SS) AUTO BLOWDOWN, ELECTRO-MECHANICAL WATER LEVEL CONTROLS AND STEP DOWN TRANSFORMER OPTION.
24KW - 208/240/480V 3PH, 220/380V & 240/415V 3PH 4 WIRE
36KW & 48 KW - 480V 3PH

Auto Blowdown, Cal-Code Controls (contactors - 2 std. 2 aux.)



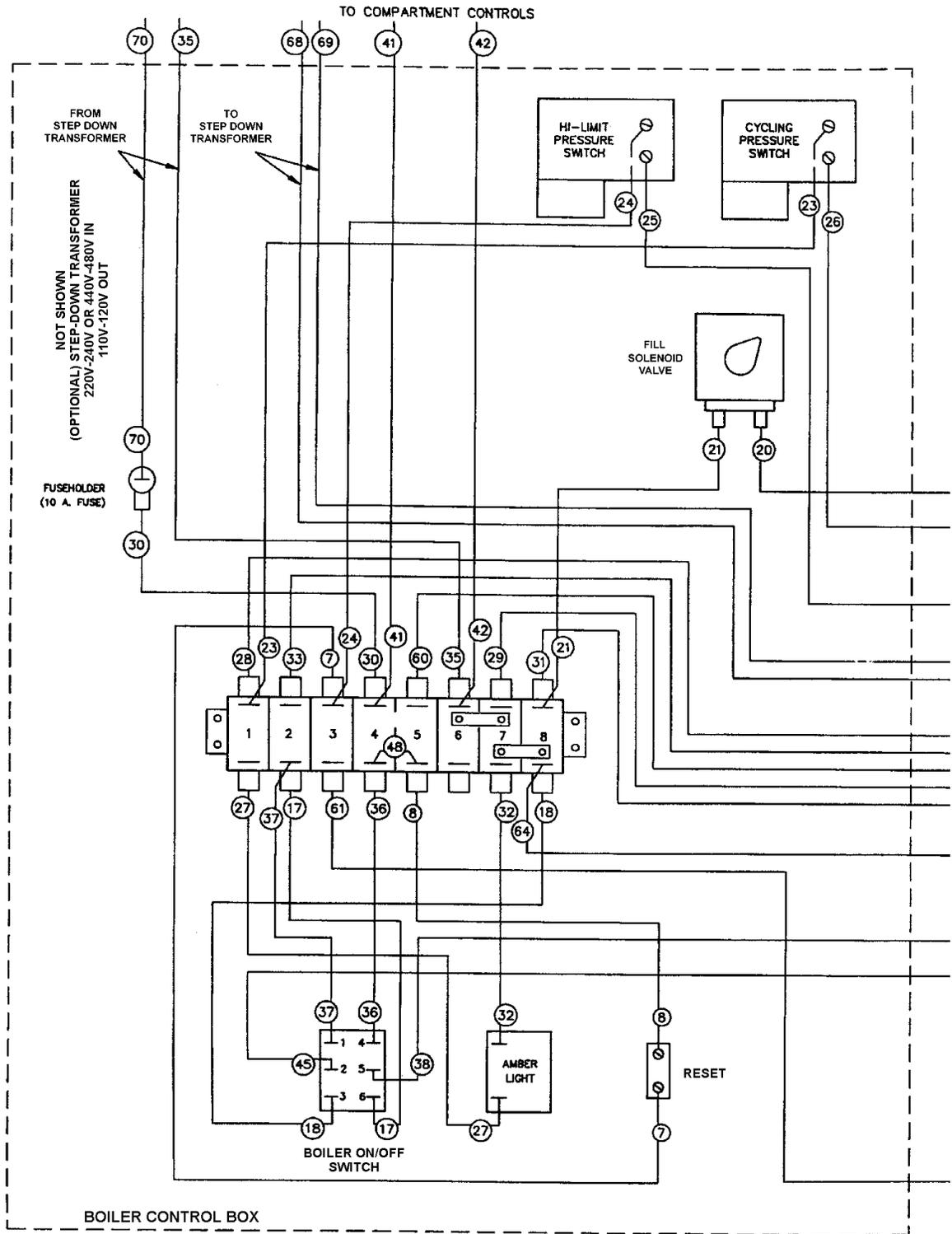
DERIVED FROM 842705 REV. B

NOTE: HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY. SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.



VL2E AND 3E - CAL CODE BOILER CONTROLS (ALL MODELS - PS, MS, AS & SS) AUTO BLOWDOWN, ELECTRO-MECHANICAL WATER LEVEL CONTROLS AND STEP DOWN TRANSFORMER OPTION.
24KW - 208/240V 1PH
36KW & 48 KW - 480V 3PH, 220/380V & 240/415V 3PH 4 WIRE
42 KW - 208V 3PH, 220/380V & 240/415V 3PH 4 WIRE
48 KW - 240V 3PH, 220/380V & 240/415V 3PH 4 WIRE

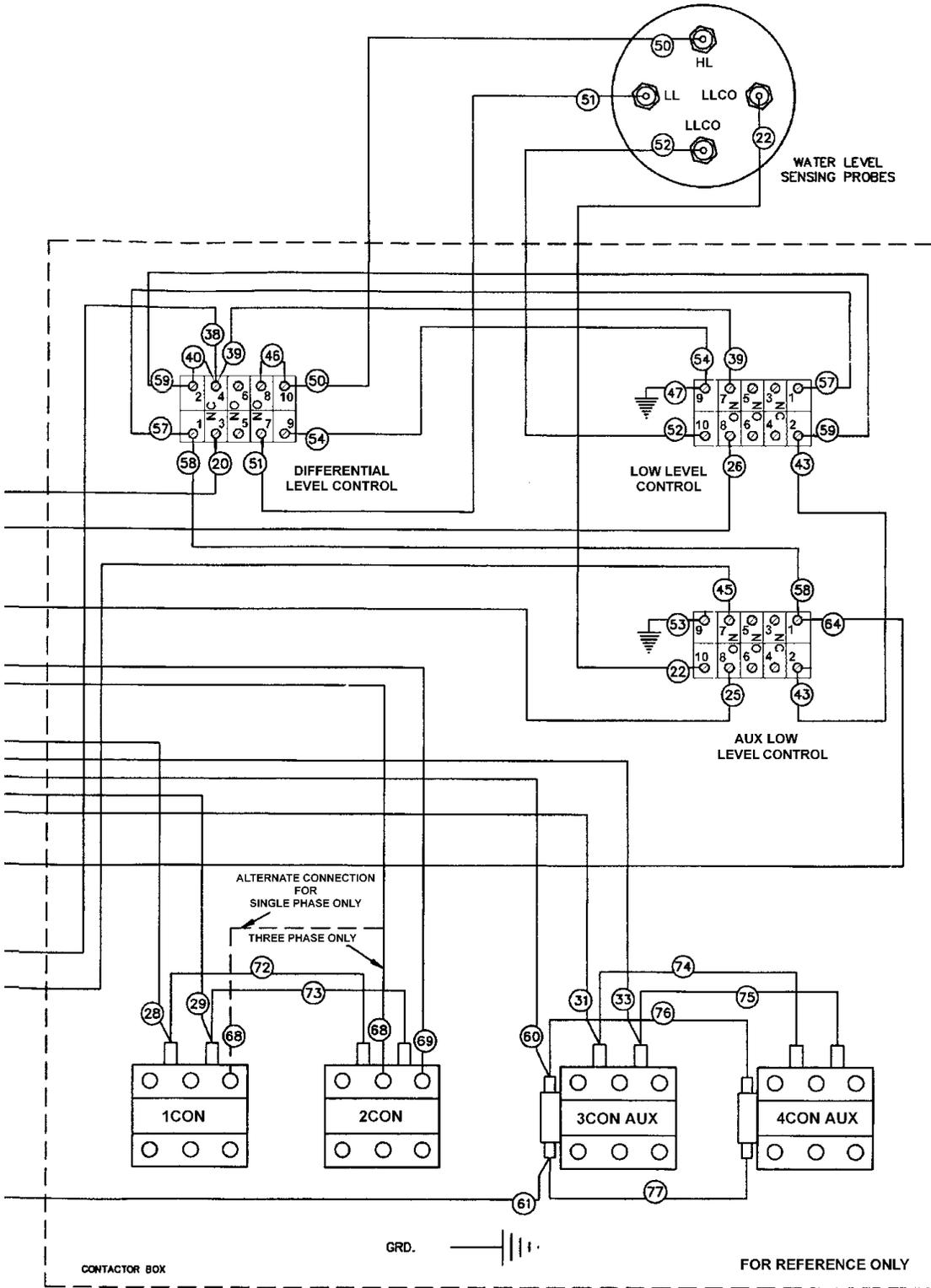
Manual Blowdown, Cal-Code Controls (contactors - 2 std. 2 aux.)



DERIVED FROM 842704 REV. B

NOTES:

- 1) HEATER CIRCUIT WIRING AND HEATERS ARE OMITTED FOR CLARITY. SEE HEATER CIRCUIT WIRING DIAGRAMS FOR CONNECTIONS.
- 2) FOR MANUAL BLOWDOWN & STANDARD CONTROLS OMIT:
 - A) AUXILIARY CONTACTOR
 - B) AUXILIARY LOW WATER LEVEL CONTROL



VL2E AND 3E - CAL CODE BOILER CONTROLS (MS, AS & SS)
 MANUAL BLOWDOWN, ELECTRO-MECHANICAL WATER LEVEL
 CONTROLS AND STEP DOWN TRANSFORMER OPTION.
 24KW - 208/240V 1PH
 36KW & 48 KW - 480V 3PH, 220/380V & 240/415V 3PH 4 WIRE
 42 KW - 208V 3PH, 220/380V & 240/415V 3PH 4 WIRE
 48 KW - 240V 3PH, 220/380V & 240/415V 3PH 4 WIRE

**WIRING DIAGRAMS, ELECTRIC HEATER CIRCUITS
VL2E AND VL3E - PREVENT, AUTOMATIC, STANDARD AND MANUAL**

Standard and Cal-Code/CSD-1 Controls

1-PHASE
1.8KW @ 208V & 240V, 50AMP CONTACTORS
2.4KW @ 208V & 240V, 50AMP CONTACTORS

3-PHASE
1.8KW @ 208V & 240V, 63AMP CONTACTORS
1.8KW @ 480V, 50AMP CONTACTORS
2.4KW @ 480V, 50AMP CONTACTORS

3-PHASE 4-WIRE
1.8KW @ 220/380V & 240/415V, 50AMP CONTACTOR
2.4KW @ 220/380V & 240/415V, 50AMP CONTACTOR

3-PHASE
208V & 240V, 63AMP CONTACTORS
36KW @ 208V, 75AMP CONTACTORS
48KW @ 240V, 75AMP CONTACTORS

3-PHASE
480V, 50AMP CONTACTORS
36KW @ 480V, 63AMP CONTACTORS
48KW @ 480V, 75AMP CONTACTORS

3-PHASE 4-WIRE
36KW @ 220/380V & 240/415V, 50AMP CONTACTOR
48KW @ 220/380V & 240/415V, 50AMP CONTACTOR

DERIVED FROM 844120

KW INPUT	AMPS PER LINE							
	1 - PHASE		3 - PHASE				3 - PHASE 4 - WIRE	
	208V	240V	208V	240V	480V	220/380V & 240/415V	25	34
18	87	75	50	44	22	25		
24	116	100	67	58	29	34		
36	--	--	100	87	44	50		
42	--	--	117	--	--	--		
48	--	--	--	116	58	67		

NOTE:
OPTIONAL AUXILIARY CONTACTORS
ARE FOR THE CAL-CODE/CSD-1
CONTROL OPTION.

**VL2E AND 3E - PS, AS, SS, MS (NEWER MODELS)
HEATER CIRCUIT WIRING DIAGRAMS
STANDARD, CAL-CODE AND CSD-1 OPTIONS**

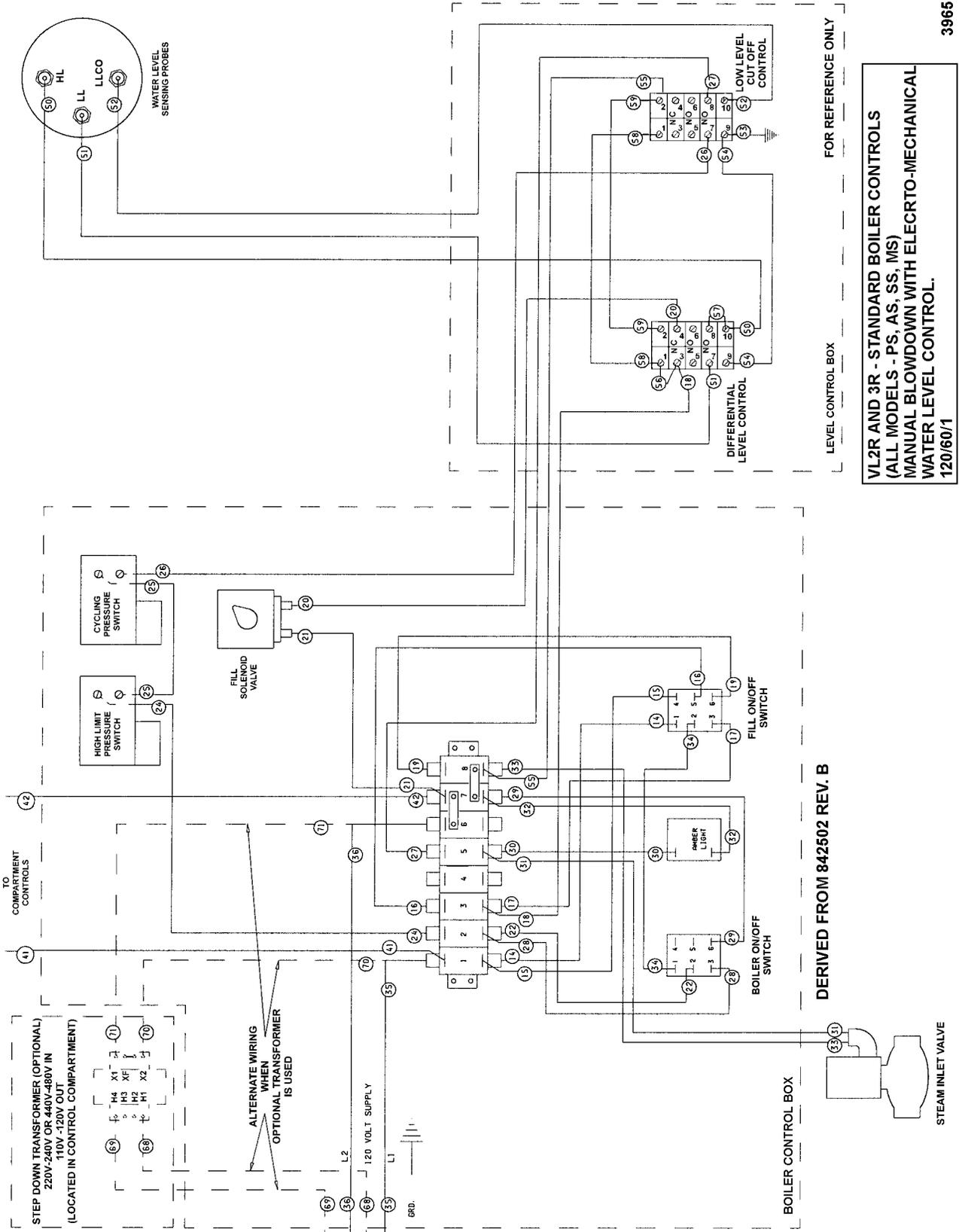
3956

**SCHEMATIC AND WIRING DIAGRAMS, DIRECT STEAMERS, CABINET BASE
VL2D AND VL3D - PREVENT, AUTOMATIC, STANDARD AND MANUAL**

See "SCHEMATIC AND WIRING DIAGRAMS - COMPARTMENT CONTROLS"

**WIRING DIAGRAMS, REGENERATED STEAMERS, BOILER CONTROLS
VL2R AND VL3R - PREVENT, AUTOMATIC, STANDARD AND MANUAL**

Manual Blowdown (Older Models)



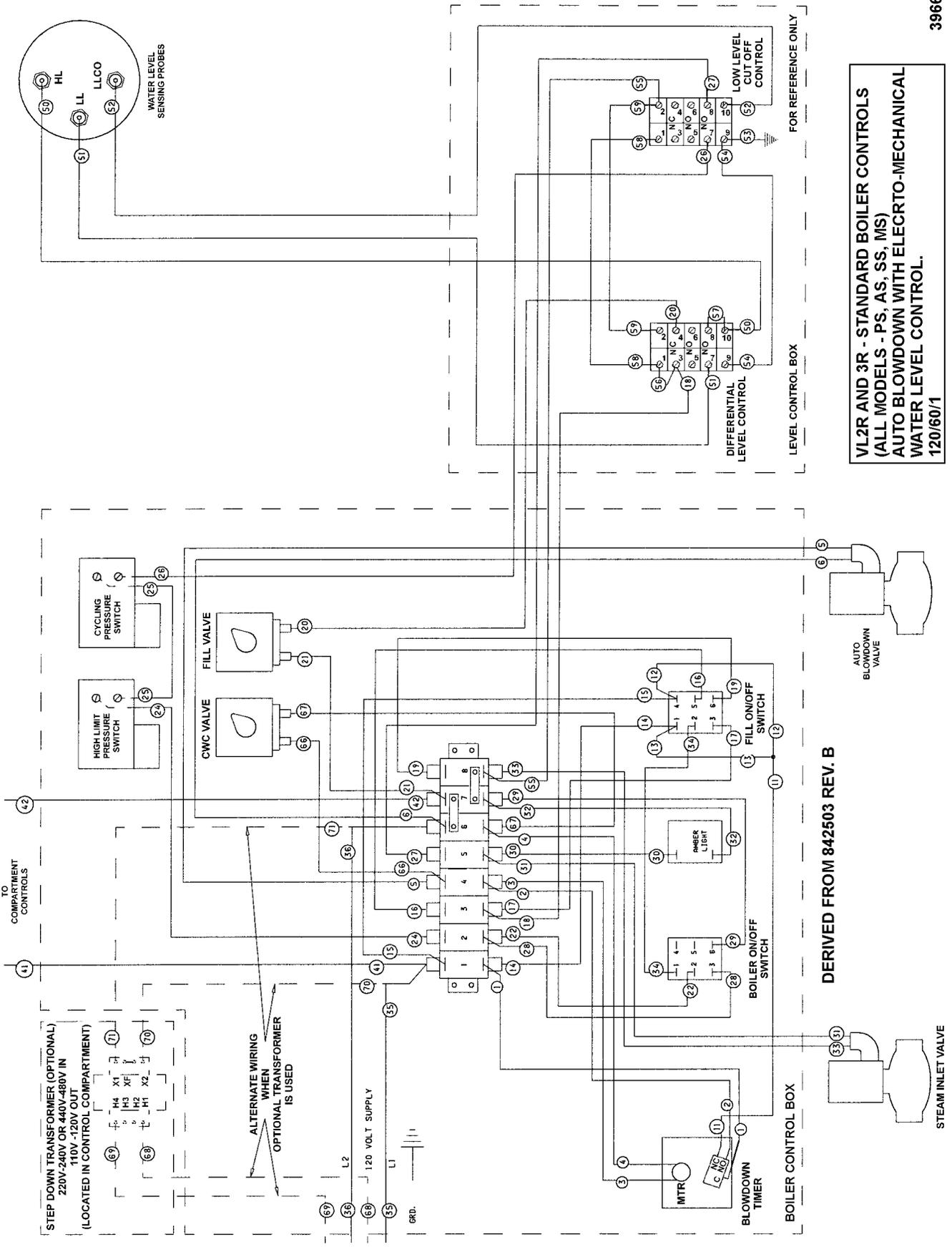
FOR REFERENCE ONLY

**VL2R AND 3R - STANDARD BOILER CONTROLS
(ALL MODELS - PS, AS, SS, MS)
MANUAL BLOWDOWN WITH ELECTRO-MECHANICAL
WATER LEVEL CONTROL.
120/60/1**

3965

DERIVED FROM 842502 REV. B

Auto Blowdown (Older Models)

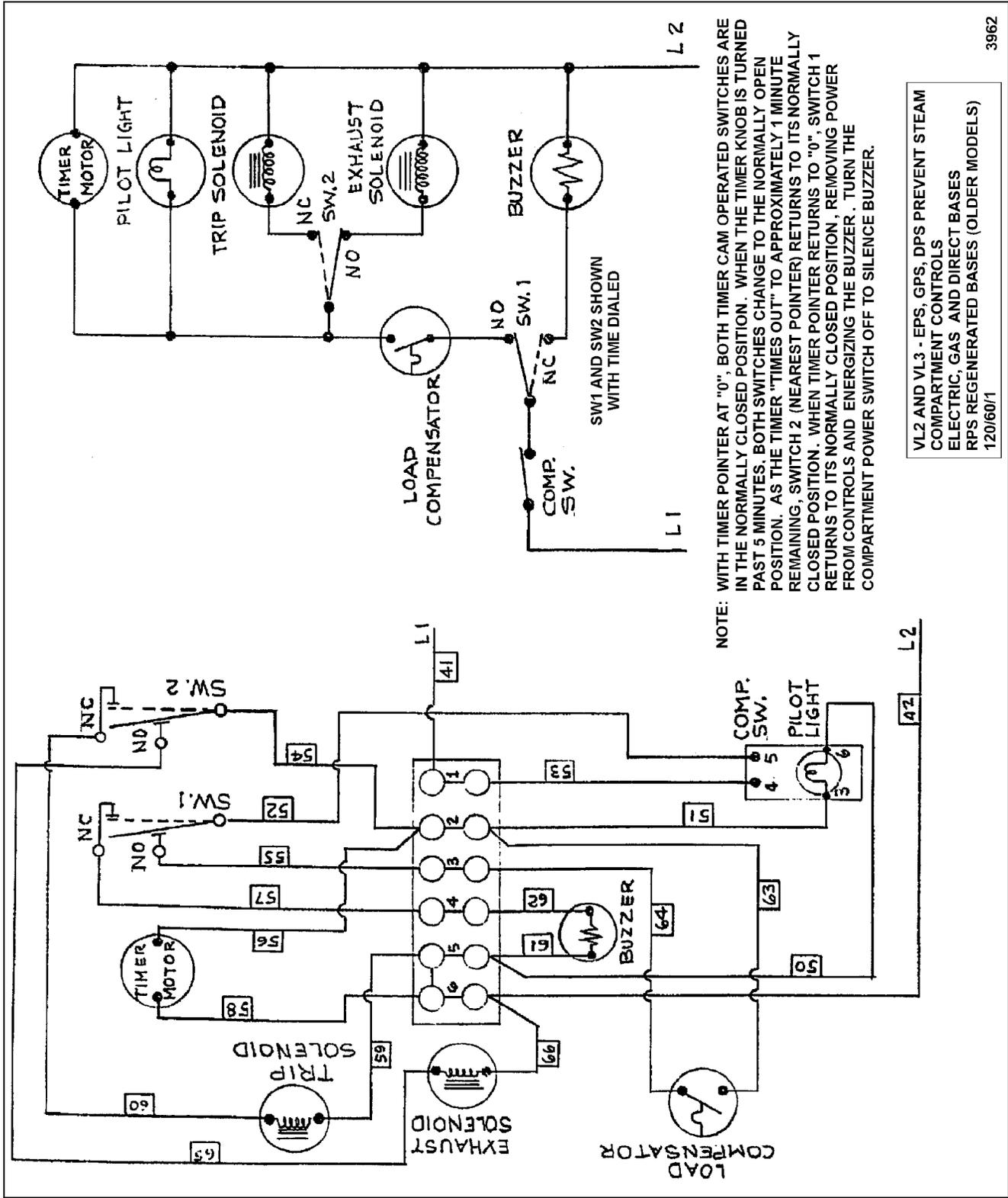


VL-2R AND 3R - STANDARD BOILER CONTROLS
 (ALL MODELS - PS, AS, SS, MS)
 AUTO BLOWDOWN WITH ELECTRO-MECHANICAL
 WATER LEVEL CONTROL.
 120/60/1

3966

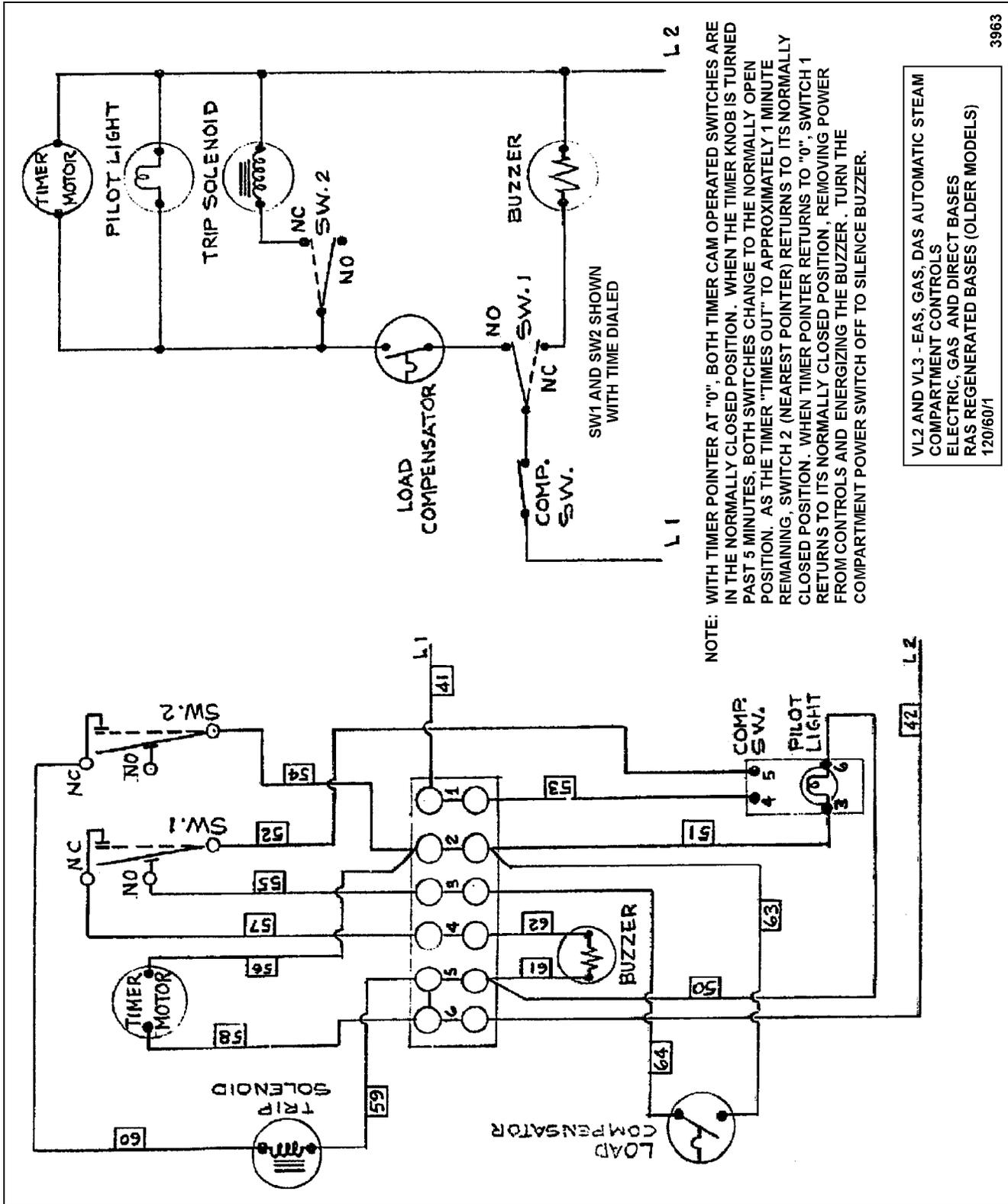
SCHEMATIC AND WIRING DIAGRAMS - COMPARTMENT CONTROLS

Prevent



3962

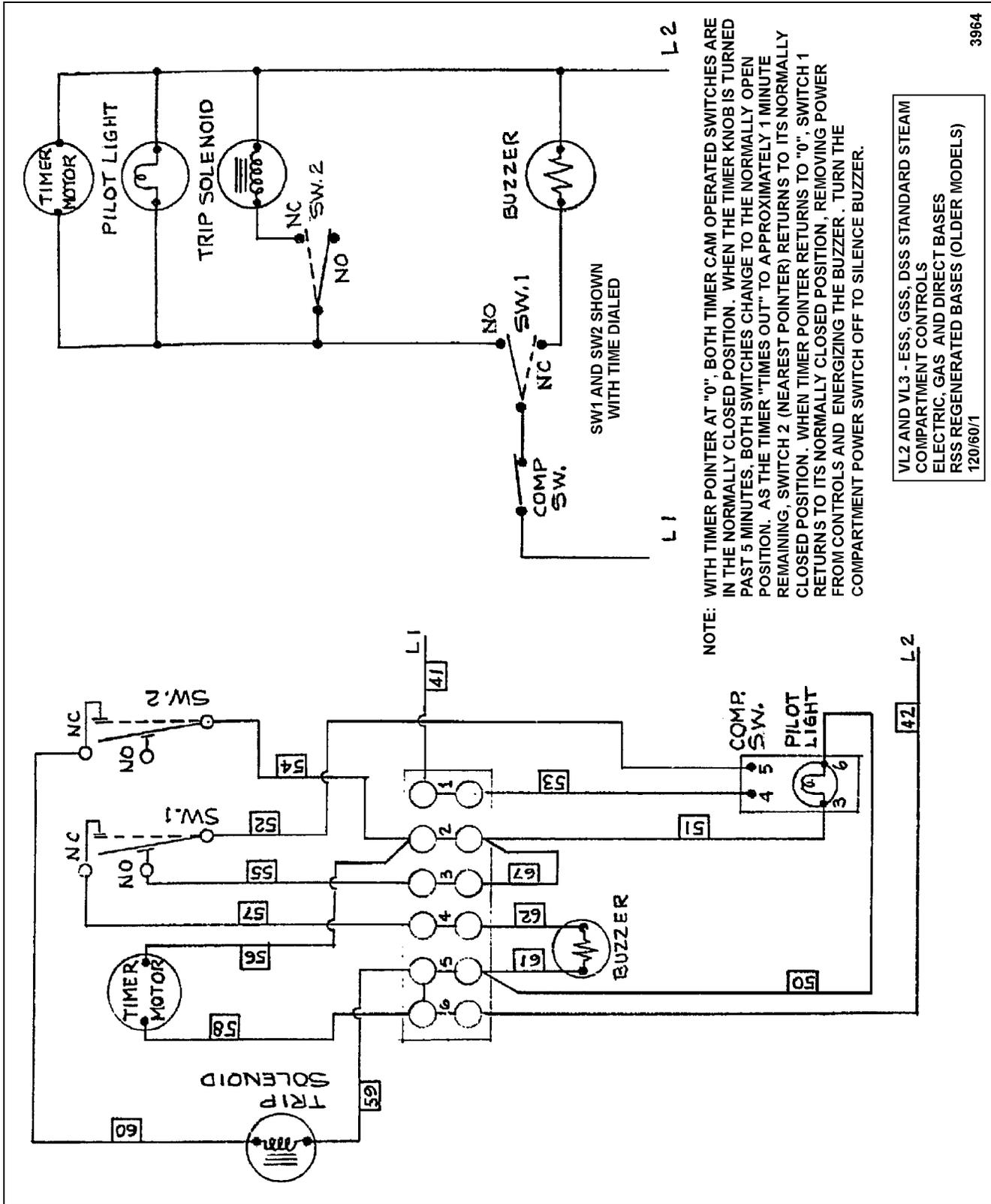
Automatic



VL2 AND VL3 - EAS, GAS, DAS AUTOMATIC STEAM COMPARTMENT CONTROLS
ELECTRIC, GAS AND DIRECT BASES
RAS REGENERATED BASES (OLDER MODELS)
120/60/1

3963

Standard



3964

Manual

NO ELECTRICAL COMPONENTS ARE USED WITH THE MANUAL COMPARTMENT CONTROLS OPTION.

THE CONTROLS CONSIST OF A MANUAL COOKING TIMER AND MANUAL STEAM CONTROL ARM TO CLOSE AND OPEN THE STEAM GATE VALVES.

TROUBLESHOOTING

ALL MODELS

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.

SYMPTOM	POSSIBLE CAUSES
Compartment leaks water around door.	<ol style="list-style-type: none"> 1. Drain screen clogged. 2. Drain line obstructed or not to an open gap drain. 3. Steamer not level. 4. Excessive cooking compartment pressures. <ol style="list-style-type: none"> A. On models equipped with the compartment pressure regulating valve, verify the compartment pressure is 6 psi during cooking. If pressure is higher then adjust the pressure regulating valve and re-check. See "COMPARTMENT PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES AND ADJUSTMENTS". B. On models with out the compartment pressure regulating valve, verify the compartment pressure is 6 psi during cooking. If pressure is higher then adjust the cycling pressure switch and re-check. See "CYCLING AND HIGH LIMIT PRESSURE SWITCHES (GAS AND ELECTRIC MODELS)" in "SERVICE PROCEDURES AND ADJUSTMENTS".
Cold water condenser not operating properly.	<ol style="list-style-type: none"> 1. Water supply not on. 2. Plugged spray nozzle. 3. Cold water condenser solenoid inoperative or plugged. 4. Cold water condenser thermostat malfunction or needs adjustment. 5. No power to cold water condenser solenoid.
Steam leaks around door.	<ol style="list-style-type: none"> 1. Compartment door not properly sealed. 2. Worn or damaged gasket. 3. Drain line obstructed or not to an open drain.
Steam generated inside compartment when timer or compartment power switch is OFF.	<ol style="list-style-type: none"> 1. Steam gate valve not fully closing (clogged, dirty or malfunctioning). See "STEAM GATE VALVE" in "SERVICE PROCEDURES".
Heat coming on without water in boiler (Dry firing).	<ol style="list-style-type: none"> 1. Lime scale (moist) on LLCO water level probe or probe damaged (shorted to ground). 2. Retention of water in probe canister assembly. 3. Water level control malfunction.
Pressure relief valve opening or leaking.	<ol style="list-style-type: none"> 1. Pressure relief valve malfunction. 2. Cycling pressure switch set to high. See "CYCLING AND HI LIMIT PRESSURE SWITCHES (GAS AND ELECTRIC MODELS)" in "SERVICE PROCEDURES".

SYMPTOM	POSSIBLE CAUSES
Boiler base will not heat or build pressure.	<ol style="list-style-type: none"> 1. Check incoming voltage. 2. Boiler not filled - check fill solenoid for power, clogging or malfunction. 3. Water Level Control malfunction. HL-3 relay not energizing or contacts not closing to power boiler fill solenoid. 4. Water too "pure" for probes to properly conduct electricity. 5. Contactor malfunction (electric only). 6. Heating element inoperative (electric only). 7. Cycling pressure switch open or set too high. Steamer is cycling on high limit. 8. High limit thermostat open. 9. Problem with auto blowdown timer (older models). 10. Power switch malfunction. 11. Pressure reducing valve malfunction or needs cleaned (direct or regenerated models only). 12. Low or no steam supply to steamer (direct or regenerated models only).
Steam output low or slow cooking.	<ol style="list-style-type: none"> 1. Steam gate valve not fully opening or blocked. 2. Cycling pressure switch malfunction or needs adjustment. 3. Steam header line (supply) blockage. 4. Heavy amount of condensate in the pressure controls steam supply line. 5. Pressure relief valve leaking. 6. Steam supply lines leaking.
Boiler leaks water.	<ol style="list-style-type: none"> 1. Loose water, steam or drain line connections (top or base). 2. Boiler hand hole gasket not sealing. 3. Leak at gauge glass.
Boiler fill solenoid cycling to frequently.	<ol style="list-style-type: none"> 1. LL probe lime scaled over (dry) or damaged and not sensing water. 2. Water level control malfunction.
Boiler water level too high.	<ol style="list-style-type: none"> 1. Fill solenoid does not shut off. 2. High level probe lime scaled over (dry) or damaged and is not sensing water (open circuit). 3. Water level control malfunction. HL-3 relay not de-energizing or contacts not opening.
Boiler does not fill or slow to fill.	<ol style="list-style-type: none"> 1. Water supply not on or pressure too low. 2. Line strainer clogged. 3. Fill solenoid not malfunctioning or plugged. 4. A High pressure pocket in the supply line to the boiler causes the fill solenoid valve not to open. See "BOILER NOT FILLING WITH WATER" in "SERVICE PROCEDURES AND ADJUSTMENTS". 5. Water level control malfunction. HL-3 relay not energizing or contacts not closing to power boiler fill solenoid.

SYMPTOM	POSSIBLE CAUSES
Cooking timer motor does not run.	<ol style="list-style-type: none"> 1. Timer not getting power. 2. Timer motor inoperative.
Buzzer not operating.	<ol style="list-style-type: none"> 1. Cooking timer malfunction. 2. Buzzer malfunction.
Compartment red light and timer do not come on; excessive time elapses before they come on; timer stops, the red light goes out, and the buzzer does not sound after compartment exhausts steam; time is set as usual for the product and the product is overcooked.	<ol style="list-style-type: none"> 1. Thermal switch (load compensator) is set too high.
Short a time between starting and the red light coming on; red light comes on immediately; time is set as usual for the product and the product is undercooked.	<ol style="list-style-type: none"> 1. Thermal switch (load compensator) is set too low.
Cooking Compartment Controls inoperative	<ol style="list-style-type: none"> 1. Ensure that voltage is reaching control circuit through compartment power switch when turned ON. 2. On electric heat models with a transformer, check step down transformer (located in the contactor box) for proper operation. 3. Check cooking timer function and contact position. See "SCHEMATIC AND WIRING DIAGRAMS - COMPARTMENT CONTROLS" under "ELECTRICAL OPERATION". 4. Check that timer motor operates when connected to power. If a problem is found in timer, replace it, do not take timer apart. 5. On prevent and automatic models check the load compensator for malfunction. 6. Check wiring for damaged insulation. (no short circuit) 7. Check that all connections and terminals are securely fastened. (no open circuits) 8. Check that all connections are made according to compartment control wiring diagram.
Cooking Compartment not venting at end of cook cycle (Prevent models) or when manual steam control arm is released.	<ol style="list-style-type: none"> 1. Steam control arm not returning after unlatching (automatic, standard and manual models). <ol style="list-style-type: none"> A. Broken or missing return spring. B. Packing nut on steam gate valve too tight. C. Steam control (trip) solenoid malfunction (prevent and automatic models). 2. Steam exhaust solenoid valve malfunctioning (prevent models).

GAS MODELS ONLY

SYMPTOM	POSSIBLE CAUSES
Burner won't light.	<ol style="list-style-type: none"> 1. Gas not on. 2. Ignition control module reset switch in the OFF position or malfunctioning. 3. Ignition module not receiving power. Check ignition module transformer for 24VAC output to module on automatic ignition systems. 4. Steamer not properly grounded and/or polarity of incoming power is incorrect on automatic ignition systems. 5. Low incoming gas pressure. See "GAS MANIFOLD PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES". 6. Ignition module malfunction. 7. Gas combination control valve malfunction. 8. Boiler not filling. Check fill solenoid for power, clogging or malfunction. 9. Water level control malfunction. HL-3 relay not energizing or contacts not closing to power boiler fill solenoid. 10. Water too "pure" for probes to properly conduct electricity. 11. High limit thermostat open (if equipped). 12. High limit pressure switch open. 13. Cycling pressure switch open or set too high. Steamer is cycling on high limit. See "CYCLING AND HI LIMIT PRESSURE SWITCHES (GAS AND ELECTRIC MODELS) in SERVICE PROCEDURES".
Burner won't stay lit.	<ol style="list-style-type: none"> 1. Gas pressure low. See "GAS MANIFOLD PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES". 2. Check gas orifice for obstruction. 3. Ignition module malfunction.

VL SERIES STEAMER - TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSES
Pilot not lit or goes out.	<ol style="list-style-type: none"> 1. Gas not on. 2. Pilot going out due to drafts, excess steam from drain or steamer not level. Improper venting can direct the pilot flame away from thermopile or flame sensor. 3. Low incoming gas pressure. See "GAS MANIFOLD PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES". 4. Pilot not adjusted correctly. See "PILOT AND THERMOCOUPLE ASSEMBLY (GAS MODELS)" in "SERVICE PROCEDURES AND ADJUSTMENTS". 5. Check thermopile millivolts. See "PILOT AND THERMOCOUPLE ASSEMBLY (GAS MODELS)" in "SERVICE PROCEDURES AND ADJUSTMENTS". 6. Burners ignite too violently. Check gas pressure to the steamer. See "GAS MANIFOLD PRESSURE ADJUSTMENT" in "SERVICE PROCEDURES". 7. If auto ignition and no sparking - ignition module malfunction. 8. Wrong pilot assembly used.
Spark Ignitor not sparking.	<ol style="list-style-type: none"> 1. Poor ground between pilot bracket and burner. 2. Loose, broken or damaged lead wires (including ground) from ignition module to ignitor. 3. Ignitor boot on ignition cable loose, damaged or missing causing excessive ignition voltage leakage. 4. Ceramic flame rod insulator on ignitor cracked or damaged from extreme heat. 5. Incorrect spark gap setting. See "AUTOMATIC IGNITION SYSTEMS (GAS MODELS)" in "SERVICE PROCEDURES". 6. Ignition module not receiving power. Check to ensure the ignition control module reset switch is ON. 7. Ignition module malfunction.