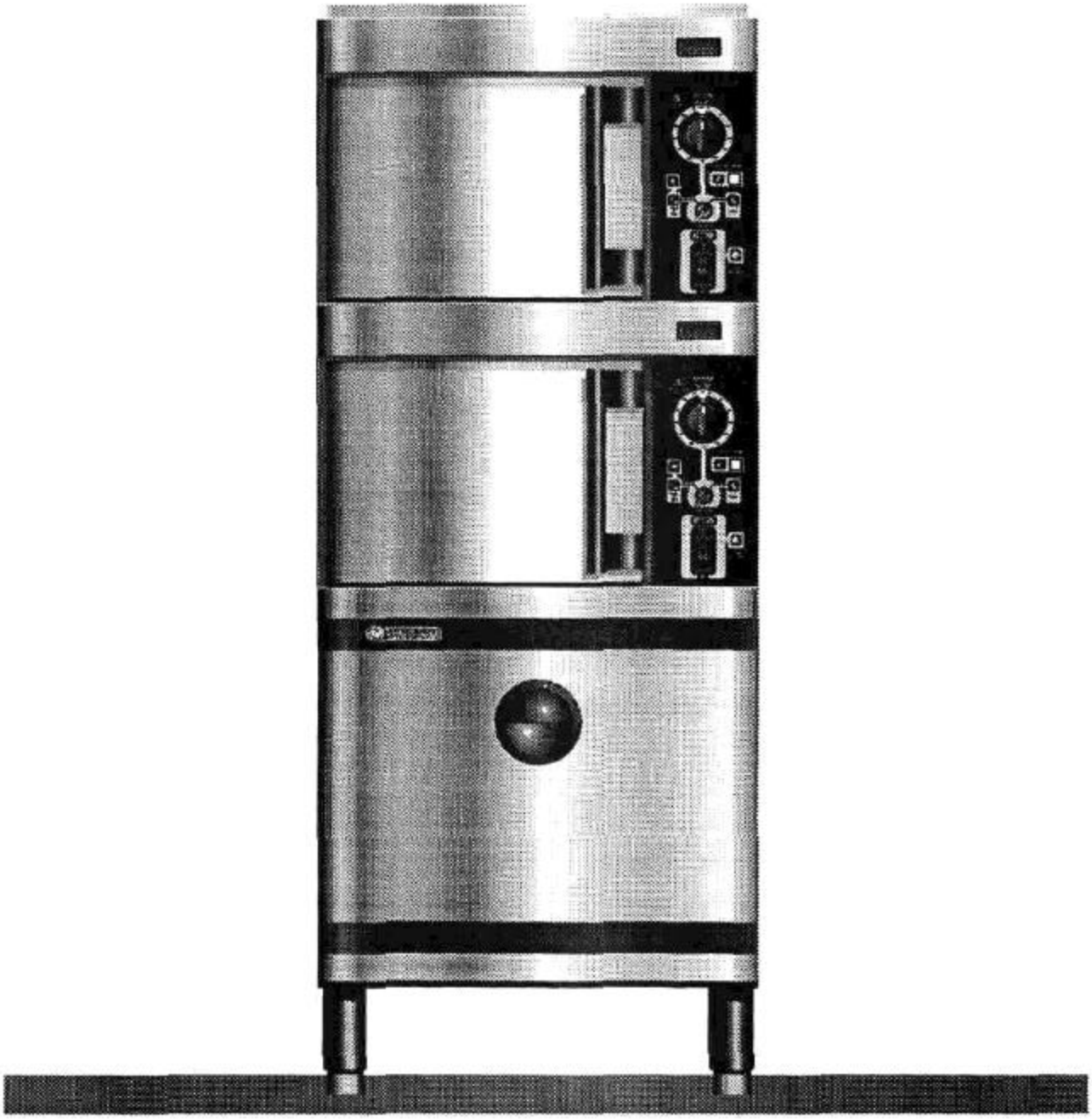
STEAM TECH PLUS

ELECTRIC STEAM COOKER



PRINCIPLES OF OPERATION

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MARKET FORGE INDUSTRIES INC

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PRINCIPLES OF OPERATION

1 GENERAL

The Steam Tech Plus pressureless steam cooker consists of two identical cooking compartments, one above the other, in a single cabinet assembly. Each compartment Is fitted with independent electrically operated steam generators and control circuitry. Compartments can be used separately or simultaneously in any cook mode with no effect on cooking times or quality.

This section includes explanations of the steam generation, control, drainage, suppression and cold air evacuation systems.

NOTE: The various systems which have been separated in the following sections to simplify their descriptions are actually very closely interrelated to, and dependent on one another to achieve precise steam control and high efficiency. See Figures I and 2 on pages 7 - 9 for schematic illustrations.

2 FILL/COLD WATER INLET

When the POWER switch Is pressed into the ON position, two normally closed solenoid operated fill valves energize and open. One valve supplies cold water to the tempering tank, while the other valve supplies cold water to the corresponding steam generator. At the same time, two normally open solenoid operated drain valves energize and close allowing the tempering tank and steam generator to fill with water. Both the tempering tank and steam generator will simultaneously fill until the factory predetermined level is reached.

The water level in the tempering tank is sensed by a normally closed magnetic reed float switch. As the float rises to the factory predetermined level, a magnetic sensor opens the circuit to the tempering tank fill/cool solenoid valve. This shuts off the flow of water Into the tempering tank. The fill/cool solenoid valve also regulates the temperature of the drain water. See Section 9 for more details on drainage.

The water level in the steam generator is sensed by high and low water sensor rods which are mounted on the front of the generator. The rods are connected to the electronic water level control board which, controls the opening and closing of the generator fill valve. When the water level has reached the high water level sensor rod, the electronic board cuts power to the generator fill valve. As steam is created and used up, the water level in the steam generator will drop. When the water level falls below the level of the low water level sensor rod, the electronic board will close the circuit to the generator fill valve, allowing fresh water to enter the generator until the water has risen back up to the level of the high water level sensor.

3 PREHEATING & STANDBY

When the water level in the generator has risen up to the low water level sensor rod, the electronic water level control board closes a circuit which activates a relay. This relay supplies power to the heater. The heater will stay on at full power until the water temperature in the steam generator reaches 193°F. The steam generator water temperature is sensed by a thermostatic switch mounted inside the steam generator, below the water level. The steam generator will standby or idle at 193°F, ready to make steam when it is called for.

4 STEAM GENERATION

The Steam Tech Plus will not create steam until it is called for. Steam is called for by:

a) setting the TIMER (in conjunction with the MODE SELECT switch), or

b) pressing the CONSTANT STEAM button.

The cooking compartment doors each contain a magnet which activates a magnetic reed switch.

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These are located behind the front face of the unit, next to each of the cooking cavity openings. When the door is opened, the magnet and switch are separated. This opens one of the circuits to the heater, which will halt the creation of steam, but allow the heater to maintain 193°F water temperature in the steam generator.

When the unit is on, the heater will maintain 193°F water temperature in the steam generator, to insure quick generation of steam when it is called for.

When steam is called for, a circuit is closed which activates a relay. This relay doses the 208v, 240v, or 480v circuit which supplies power to the heater. The generator now begins to create steam.

Steam passes from the steam generator directly through the cooking compartment side wall opening, into the cooking compartment. The perforated sheetmetal baffling on the right side pan support rack (which covers the steam inlet opening), insures uniform distribution of steam throughout the interior of the cooking compartment.

The fresh steam entering the cooking compartment forces the colder air to the bottom of the compartment and down the cooking compartment drain line. The cooking compartment drain line branches into 3 lines. The first branch terminates at a check valve which serves as a vacuum breaker. This branch also contains an extremely sensitive pressure switch, which will be further discussed in Section 5. The second branch terminates inside the tempering tank, below the water level which creates a water seal. The third branch passes through a steam trap valve.

As long as the air passing through the steam trap valve Is below 200°F, it remains open, and the system is open to the atmosphere. While the system is open to the atmosphere, it will not build any pressure and steam will be continuously generated by the heater. As the temperature of the air being pushed out of the cooking compartment, down the drain line, and through the steam trap, rises above 200°F, the steam trap valve will close. This will seal the system off from the atmosphere. As excess steam is generated, a slight pressure will begin to build. When the pressure switch senses a pressure of a 2" water column, it opens the circuit to the relay which supplies full 208v, 240v, or 480v power to the heater. Before any more steam is created, the food inside the cooking compartment must absorb all of the steam energy that is already present. As the steam energy is absorbed by the food in the cooking compartment, the pressure will begin to drop. When the pressure drops below a I" water column, the pressure switch will again close the circuit to the heater, creating more steam.

5 STEAM CONTROL AND EFFICIENCY

The Steam Tech Plus pressureless steam cooker uses an integrated steam control system which allows it to achieve its high cooking efficiency. The system monitors the slight pressure fluctuation in the cooking compartment and steam generator. The pressure in these areas is a direct reflection of how much steam is being absorbed by the food in the cooking compartment and the rate at which it is being absorbed.

At the beginning of a cooking cycle, the food will absorb nearly all of the steam that can be generated and almost no pressure will build in the system. As the food cooks and its surface temperature rises, it will absorb less and less steam, at progressively slower rates. When pressure has built up to a 2" water column, (about the same pressure it takes to blow bubbles through a straw), the pressure switch will open the circuit to the relay which supplies power to the heater. This causes the heater to shut down until the food has absorbed enough steam to lower the pressure to a I" water column. At a I" water column, the pressure switch will close the circuit to the relay which supplies full power to the heater. The heater will then energize again to create more steam to replace what was absorbed by the food. This cycling on and off of the heater will

continue throughout any cooking cycle. The rate of this cycling will vary depending on the particular quantity, temperature, and characteristics of the food being cooked.

Any excess pressure buildup (over 3" water column) in the system will push down on the water seal until it bubbles out the end of the tube which is submerged in the tempering tank. This water seal is a safety device which prevents internal pressures from reaching unsafe levels.

These slight pressure fluctuations can be monitored by observing the Steam DEMAND indicator light located at the top of the control panel. The Steam DEMAND indicator will light up red whenever the heater is creating steam. You will notice that at the beginning of a cook cycle, the Steam DEMAND indicator is almost always on. As the cooking progresses, the light will begin to cycle off more often and for longer periods of time. Near the end of the cooking cycle, the Steam DEMAND indicator will be off most of the time, and may only flash on for brief intervals. This can be used to monitor the cooking progress of the food inside the cooking compartment without opening the door.

6 STEAM SUPPRESSION

The Steam Tech Plus pressureless steam cooker uses an integrated steam suppression system to allow quick and convinient access to the cooking compartment when the door is opened during cooking cycles. Steam suppression is accomplished through a combination of steam quenching and vacuum assisted ventilation.

6.1 Steam Suppression System Plumbing

The steam suppression system plumbing consists of a spray nozzles and a normally closed water solenoid valves, a steam trap valve, and a series of tubes which connect these components.

When the door to the cooking compartment is opened, the magnetic reed switch opens the circuit the heater relay, which cuts power to the heater, stopping the creation of steam. The heater will idle at 193°F. When the door is opened, the circuit to an interval timer closes. The timer closes the circuit to a relay. This relay completes the circuit to the normally closed solenoid valve for 3 to 5 seconds. The solenoid valve supplies water to the spray nozzle.

This spray nozzle is located at the top of the steam generator. This nozzle will be referred to as the generator spray nozzle. The plumbing for the generator spray nozzle passes through a check valve. This assures an instant response from the generator spray nozzle when the door is opened. The generator spray nozzle injects a fine mist into the steam generator. This condenses any steam in the generator when the door is opened. This also creates a low pressure area into which steam from the cooking compartment is drawn and condensed.

6.2 Steam Suppression System Ventilation

The steam suppression system ventilation consists of a blower which draws air and steam in through the steam vent hoods, into a series of ductwork, and finally out through the louvers located on the rear panel of the unit.

The blower is located inside the unit. It is mounted onto the blower box assembly, located on the rear, center of the floorpan. The blower will run continuously whenever either POWER switch is in the ON position.

When a cooking compartment door is opened, any steam from that cooking compartment which has not been condensed by the spray nozzle, is drawn up into the steam vent hood which is located directly above the cooking compartment. This assures quick and convient access to food inside the cooking compartments during operation.

Air/steam is drawn in by the blower, into the steam vent hoods, and passes through the upper and lower horizontal ducts, to the common vertical intake duct. Air/steam then enters the blower box, and passes over the blower fan, which drives it up the vertical exhaust stack ,and out through the louvers in the rear panel of the unit.

7 COLD AIR EVACUATION SYSTEM

The Steam Tech Plus cold air evacuation system insures that the cooking cycle is able to resume rapidly as the cooking compartment door is closed. When the door is opened, the cooking compartment fills with room temperature air, which is cool in comparison to the steam produced by the generator. It is inefficient to try to heat this air. The cool air is forced out of the system and replaced with fresh steam by the generator. The components which make up the cold air evacuation system include a steam trap valve, water spray nozzle, water solenoid valve, drain tubes, and pressure switch.

The cold air evacuation system becomes active when the cooking compartment door is opened. As mentioned in Section 6.1, this activates a solenoid valve. This valve also supplies cold water to a solid stream nozzle. This nozzle injects a solid stream of cold water at the bellows of the steam trap valve. This causes the valve to open, which opens the system to the atmosphere. This assures an open path for the cool air to exit the system as it is replaced by the fresh steam from the generator when the door is closed.

When the cooking compartment door is closed, the pressure switch will sense no pressure and call for steam (See section 5 Steam Control and Efficiency). The heater will become fully energized. As fresh steam is produced by the generator, it enters the cooking compartment, displacing the cooler air. The cooler air will flow down the drain line, and out through the open steam trap valve. When the temperature of the air flowing through the steam trap valve reaches 200°F, the valve will close, sealing the system. The system will now begin to build pressure which will be sensed by the pressure switch. This will cause the heater to cycle on and off, as it was before the door was opened, as described in Section 5.

8 HOLD FEATURE

The Steam Tech Plus comes equipped with a unique HOLD feature which allows it to automatically operate as a holding cabinet at the end of a timed steaming cycle. The HOLD feature is made possible by the use of an auxiliary heater attached directly to the outside of the cooking compartment wall.

The HOLD feature is activated by selecting the STEAM & HOLD mode using the MODE SELECT switch and setting the TIMER. When the TIMER has timed out (0 minutes), the circuit which activates the buzzer in the STEAM mode will instead activate the HOLDING indicator light in the STEAM& HOLD mode. The generator will idle at 190°F, ready to create steam again.

The HOLD system consists of an electrically operated strip heater which is controlled by a surface mount thermostatic switch. Both are mounted on the outside of the cooking compartment walls. The steam generator, cooking compartment, auxiliary heater and thermostatic switch are all wrapped together in a I inch thick layer of insulation.

When the thermostatic switch senses that the temperature of the cooking compartment has dropped below 165°F, it activates the auxiliary heater. This heater will raise the temperature inside the cooking compartment. When the thermostatic switch senses that the temperature of the cooking compartment has risen to 175°F, it cuts power to the auxiliary heater.

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This system insures that the internal temperature of the cooking compartment will stay within a safe holding temperature range of 160°F to 180°F, indefinitely.

The temperature inside each of the cooking compartments can be monitored by observing the temperature gauges. Temperature gauges are located on the steam vent hoods, just above the control panels for each of the cooking compartments.

9 DRAINAGE

The Steam Tech Plus has three normally open solenoid operated drain valves, one for each of the steam generators and one for the common tempering tank. This allows the system to drain automatically when POWER switch is pressed into the OFF position. It also incorporates two drip troughs, one located below each of the two cooking compartment openings. All drain water is collected in the tempering tank where it is regulated to stay below 130°F before passing through the tempering tank drain line, and down into your main floor drain.

9.1 Cooking Compartment Drainage

The floor of the cooking compartment is slightly angled towards the rear of the unit. This assures that any condensate build-up or spills will be directed towards die drain hole which is located at the bottom center at the rear of the cooking compartment. Any liquid exiting the cooking compartment runs down the cooking compartment drain tube and into the tempering tank, through die water seal. This water seal allows liquid to exit the cooking compartment, but not air or steam. This is to hold the slight pressure necessary for the cycling of the heater (see Section 5) to achieve high cooking efficiencies.

9.2 Drip/Spill Trough Drainage

The Steam Tech Plus has drip/spill troughs below each of the cooking compartment openings. They will catch any condensate gathering on the front of the unit when the doors are opened. The drip/spill troughs will protect the user, should a large spill occur inside the cooking compartment. They will safely catch any overspill from the cooking compartment which can not flow quickly enough down the cooking compartment drain line.

Both drip/spill troughs have perforated metal screens which will keep large debris from clogging the drain tube. The drain tube routes all liquid gathered in the drip/spill trough to the tempering tank.

9.3 Steam Generator Drainage

Each steam generator has its own independent drainage system. Steam generator drainage is controlled by a normally open solenoid operated drain valve. When the POWER switch is pressed into the ON position, power is supplied to the corresponding drain valve, which causes it to close, allowing the corresponding generator to fill. When the POWER switch is pressed into the OFF position, power to the corresponding generator drain valve is cut, causing it to open. The corresponding steam generator will now automatically drain.

Drainage for each of the steam generators is independently routed through a tube (controlled by a solenoid valve) into the tempering tank.

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9.4 Tempering Tank Drainage

The Steam Tech Plus has a common drain tank located inside the unit, mounted to the floor pan. All drain water exiting the unit passes through this tank where it is cooled before being discharged down the main drain line. This tank is referred to as the tempering tank.

All drainage from the tempering tank occurs through the main drain tube. This tube protrudes through the floor pan, at the bottom of the unit (for hook-up to your drain service connection, see Service Connections diagram and instructions on page 2.2 of the *Installation and Operation Manual).* Drainage from the tempering tank is controlled by the tempering tank drain valve and the tempering tank overflow tube.

The tempering tank drain valve is a normally open solenoid operated valve. When either of the POWER switches are pressed into the ON position, power Is supplied to the tempering tank drain valve's, solenoid, causing the valve to close. A normally closed, float type liquid level sensor mounted inside the tempering tank will sense low water level inside the tempering tank. This sensor will close the circuit to the tempering tank fill/cool solenoid valve The tempering tank fill/cool valve is a normally closed, solenoid operated valve. This valve fills the tempering tank with cold water until it reaches the factory predetermined level. When the float switch senses that the water in the tempering tank has reached this level, it closes the tempering tank fill/cool valve, ending the filling of the tank.

As previously described, all drain lines in the Steam Tech Plus are routed into the tempering tank. During normal daily operation, the temperature of the water in the tempering tank will begin to rise as the various systems are drained into it.

When the temperature of the water in the tempering tank reaches approximately 130°F, a thermostatic switch mounted inside the tempering tank closes the circuit to the tempering tank fill/cool valve. This valve will inject cold water into *the* tempering tank until the thermostatic switch senses that the temperature has dropped below 130°F.

As fresh cool water is injected into the tempering tank, the water level will begin to rise. As the water level rises, it will begin to flow into the overflow tube and down the main drain line.

The tempering tank will <u>not</u> drain unless both POWER switches are in the OFF position.
When both POWER switches are in the OFF position, power is cut to the tempering tank solenoid drain valve, causing it to open. This will allow the tempering tank to completely drain.

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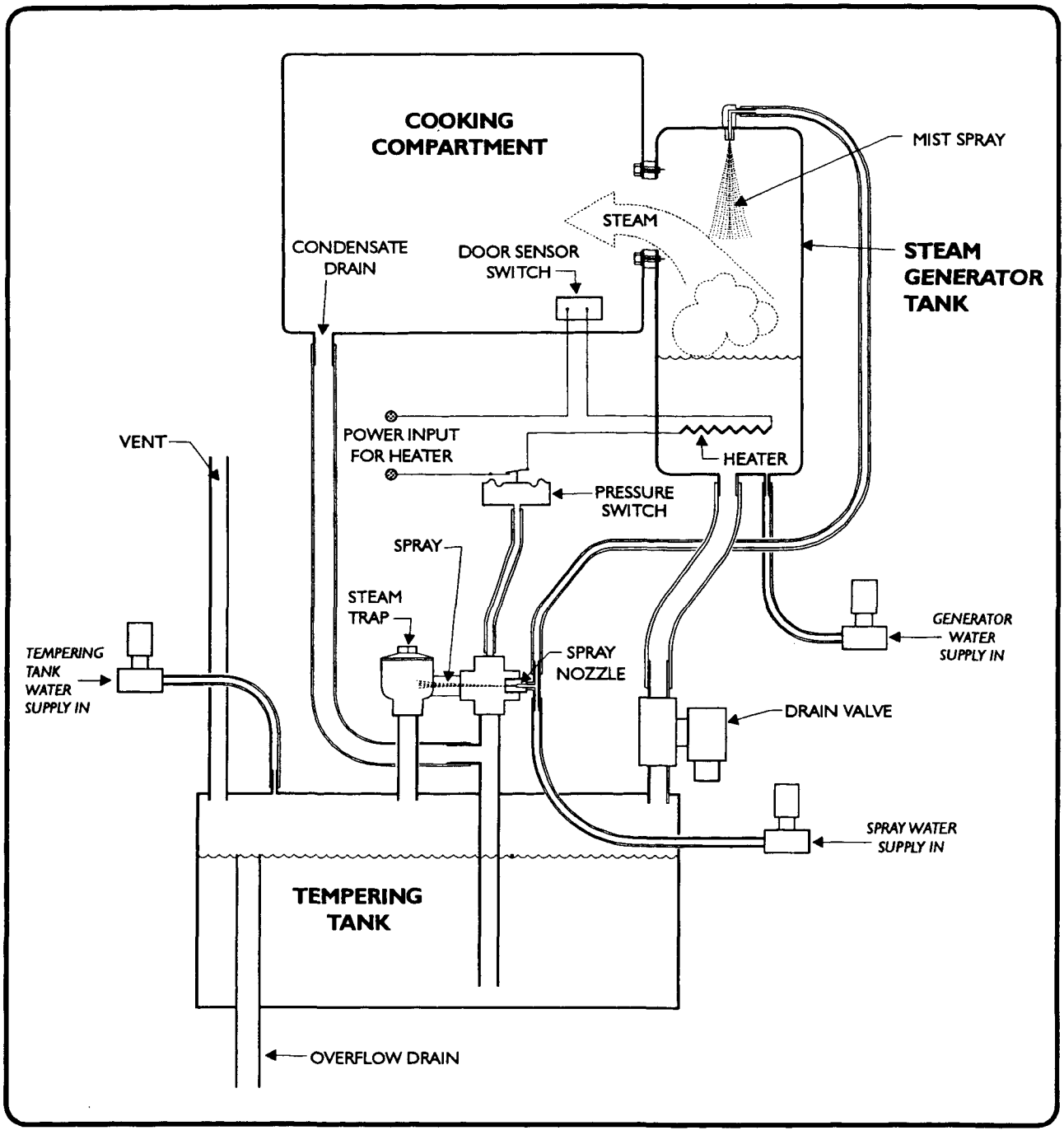

Figure 1
Principles of Operation Schematic

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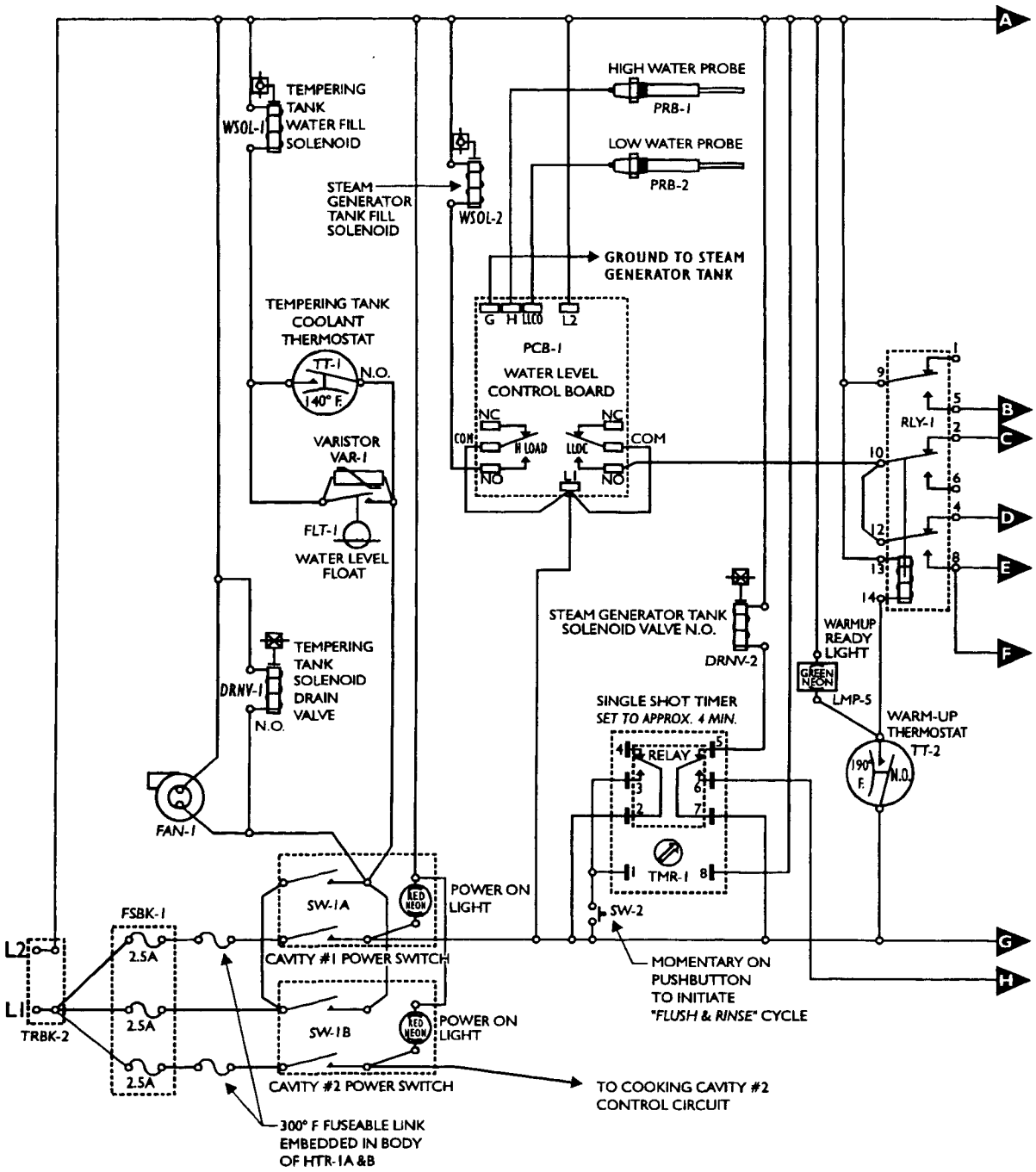
Figure 2
Single Cavity System Wiring Diagram



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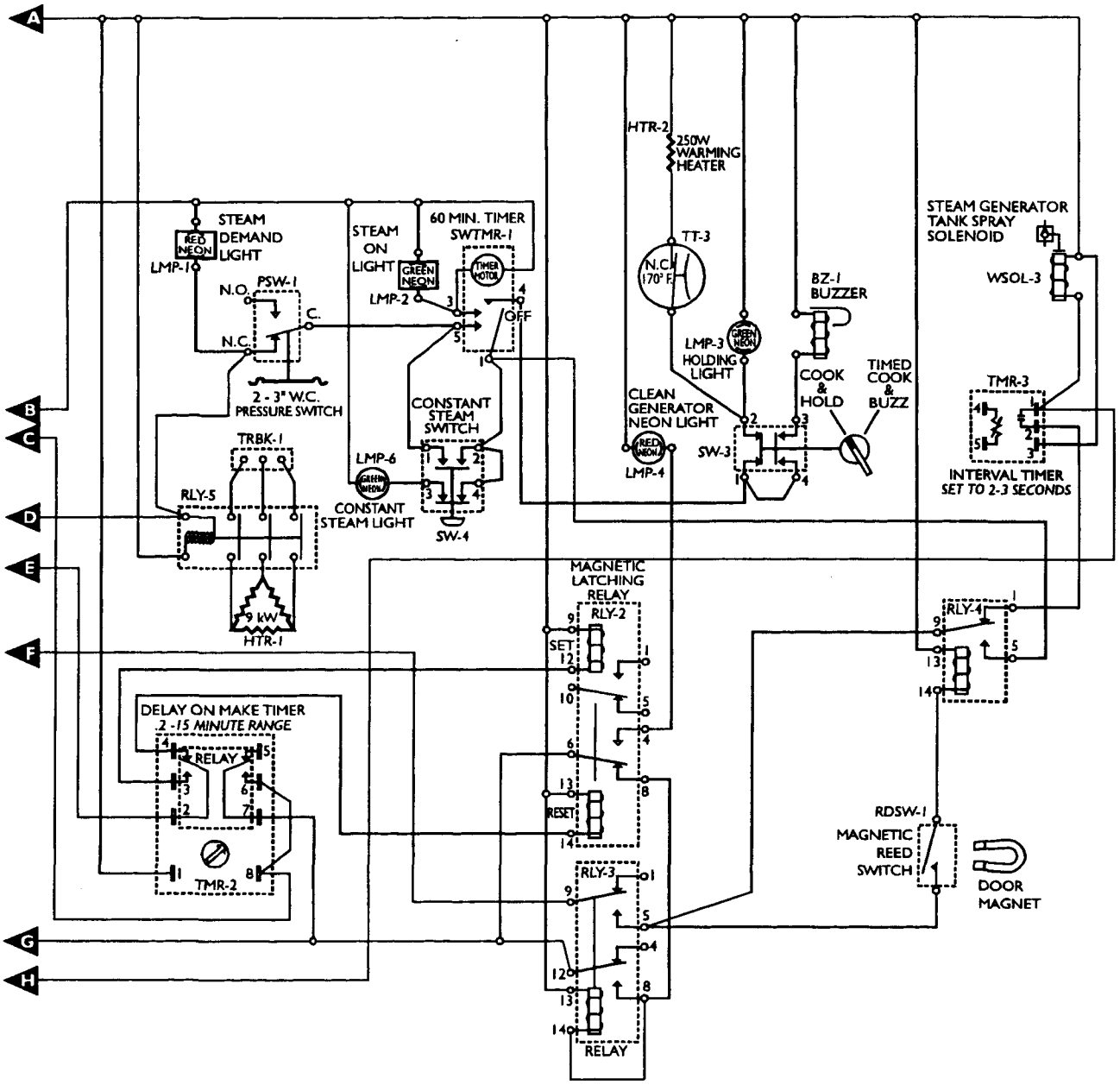

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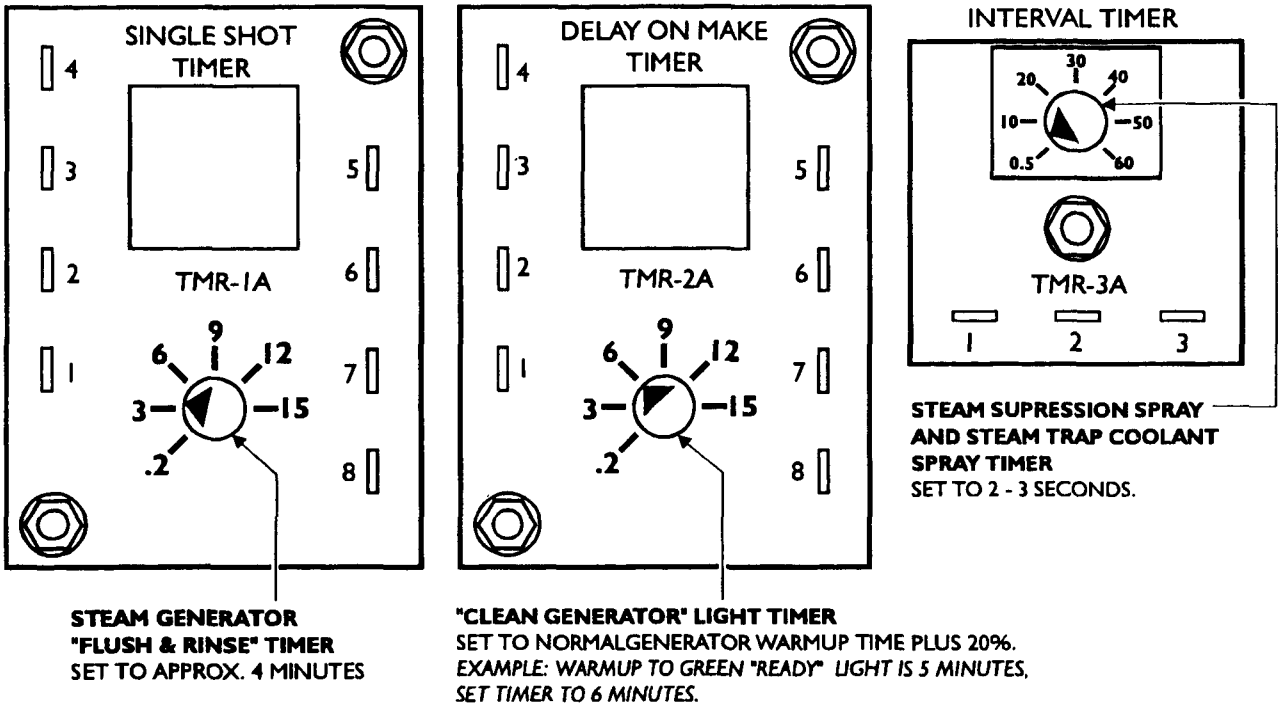

Figure 3
Timer Settings and Terminal Numbers & Locations

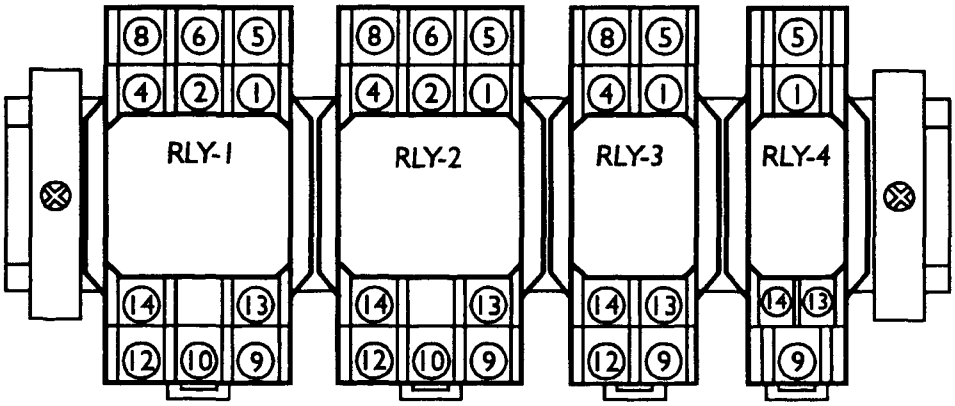

Figure 4
Relay Terminal Contact Numbers & Locations

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