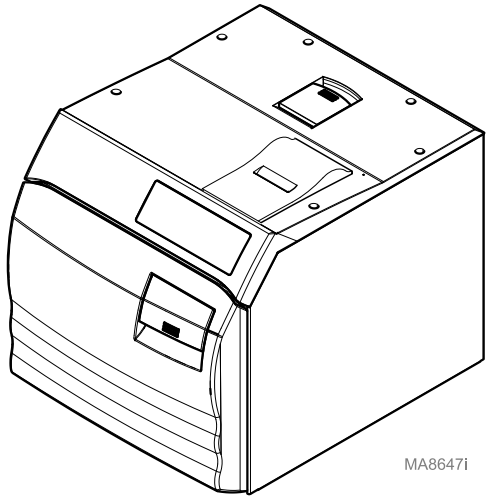
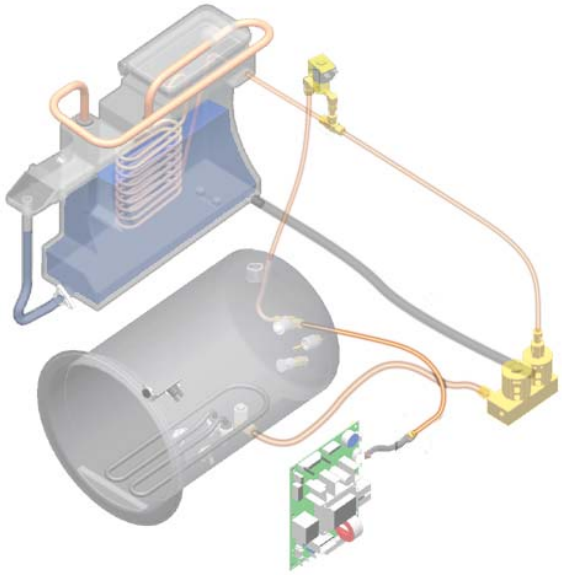
Theory of Operation: *M9/D & M11/D*



MA8647i

NOTE
This document applies to the following models:
M9/D (-020 thru -022) (-033 & -034)
M11/D (-020 thru -022) (-033 & -034)

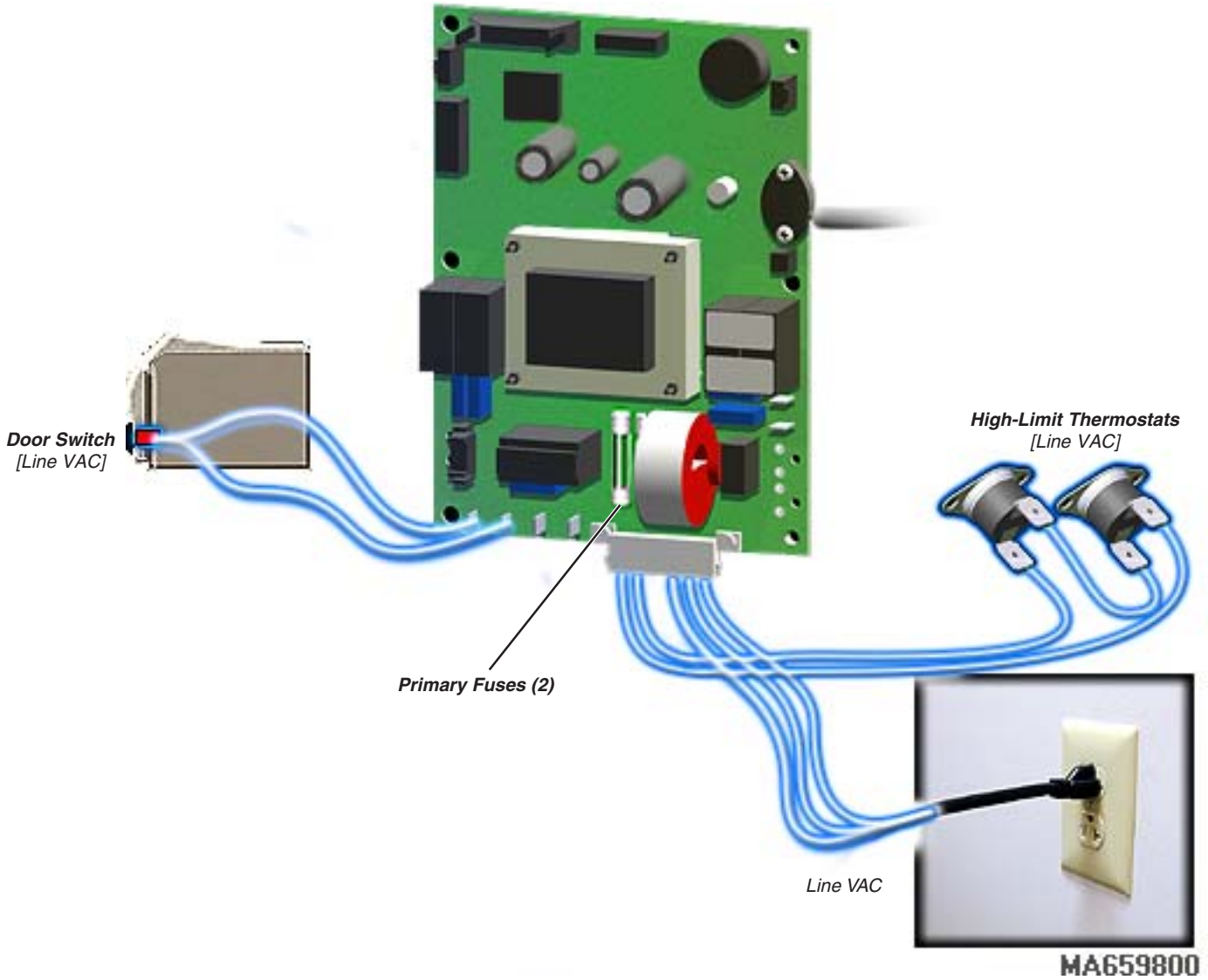
Mode / System **Page**



Theory of Operation

Power-Up Mode

This illustration shows the components that affect, or are monitored during all cycle modes.
Refer to the following page for a detailed description of the Power-Up Mode.



Power-Up Mode

Primary Fuses
With the sterilizer's power cord properly connected, facility supply voltage is supplied to the Main PC Board thru the two primary fuses.

If either fuse is faulty, the sterilizer will have no power.

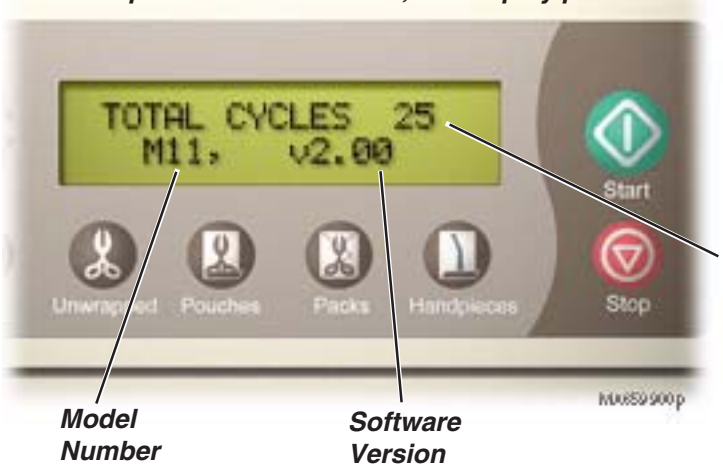
High-Limit Thermostats
When power is supplied to the Main PC Board, current continuously flows thru the two *(normally closed)* High-Limit Thermostats. This circuit powers all line voltage components *(except Fan System)*.

If either thermostat opens for any reason *(overheat or malfunction),* the sterilizer will shut down until unit cools, or thermostat is replaced.

Door Switch
Once a cycle is initiated, the Main PC Board continuously monitors the status of the Door Switch.

If an open door is detected, the cycle will not start. If the door switch opens during a cycle, the cycle will be terminated and the corresponding error code will appear in the display.

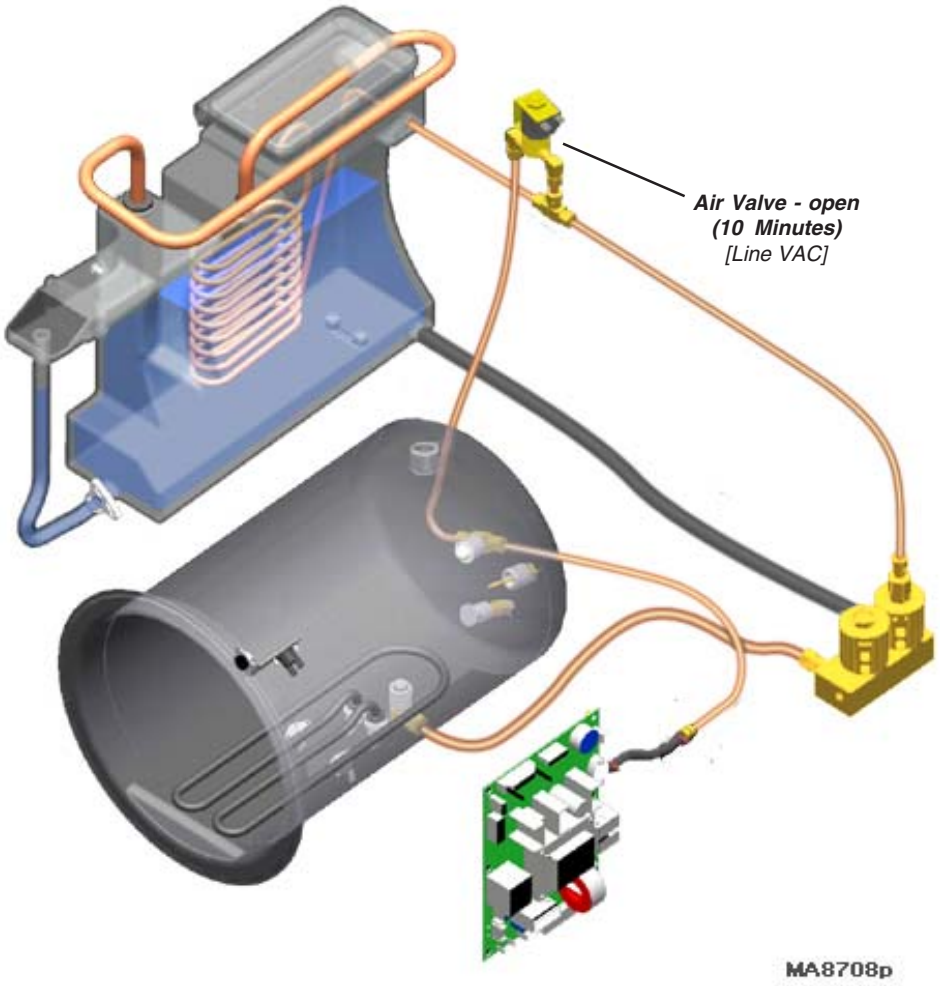
Each time power is reconnected, the display panel will show:



Theory of Operation

Select Cycle Mode

This illustration calls out the components that are energized / monitored during the Select Cycle Mode. Refer to the following page for a detailed description of the Select Cycle Mode.



Select Cycle Mode

During the Select Cycle Mode, the air valve is energized for ten minutes after a cycle is completed or after Power-Up Mode.

*[All electrical current is supplied thru the two high-limit thermostats (on bottom of chamber). Refer to '**Power-Up Mode**', for further detail].*

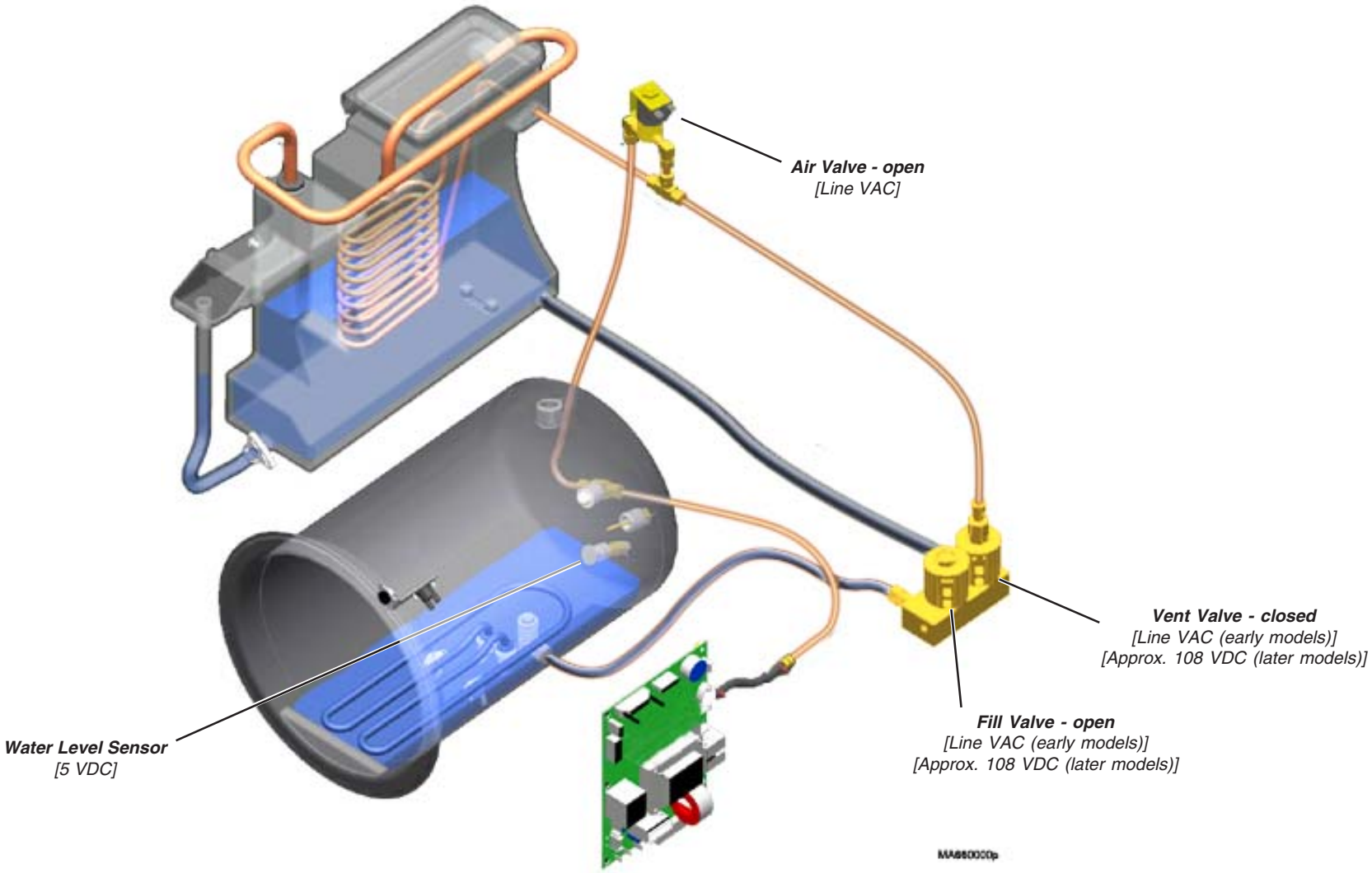
Air Valve
For the first ten minutes of the Select Cycle Mode, line voltage is supplied to the *(normally closed)* air valve.
When energized, the air valve opens.
[This allows air to pass thru the valve, preventing pressure from building in the chamber].

Note
Pressing the start button when SELECT CYCLE is displayed, at the beginning or end of a cycle, activates the heater for 10 minutes. The display flashes ADDITIONAL HEAT. This allows the Operator to preheat the chamber before starting an operation or to add additional time to the Dry mode at the end of an operation. Pressing STOP will end the Additional Heat time. Additional Heat can only be activated once between sterilization cycles.

Theory of Operation

Fill Mode

This illustration calls out the components that are energized / monitored during the Fill Mode.
Refer to the following page for a detailed description of the Fill Mode.



Fill Mode

During the Fill Mode, water flows from the reservoir, thru the fill valve into the chamber.

*[All electrical current is supplied thru the two high-limit thermostats (on bottom of chamber). Refer to '**Power-Up Mode**', for further detail].*

Air Valve
Throughout the Fill Mode, line voltage is supplied to the *(normally closed)* air valve. When energized, the air valve opens. *[This allows air to pass thru the valve so that water can flow from the reservoir].*

Vent Valve
Throughout the Fill Mode, voltage is supplied to the *(normally open)* vent valve. When energized, the vent valve closes. *[This prevents water from flowing back into the reservoir thru the vent valve].*

Fill Valve
During the Fill Mode, voltage is supplied to the *(normally closed)* fill valve. When energized, the fill valve opens allowing water to flow into the chamber.

When the water level in the chamber reaches the water level sensor, the PC Board stops the current flow to the fill valve. This allows the valve to close, stopping the flow of water into the chamber.

During the Fill Mode, the display panel will show:

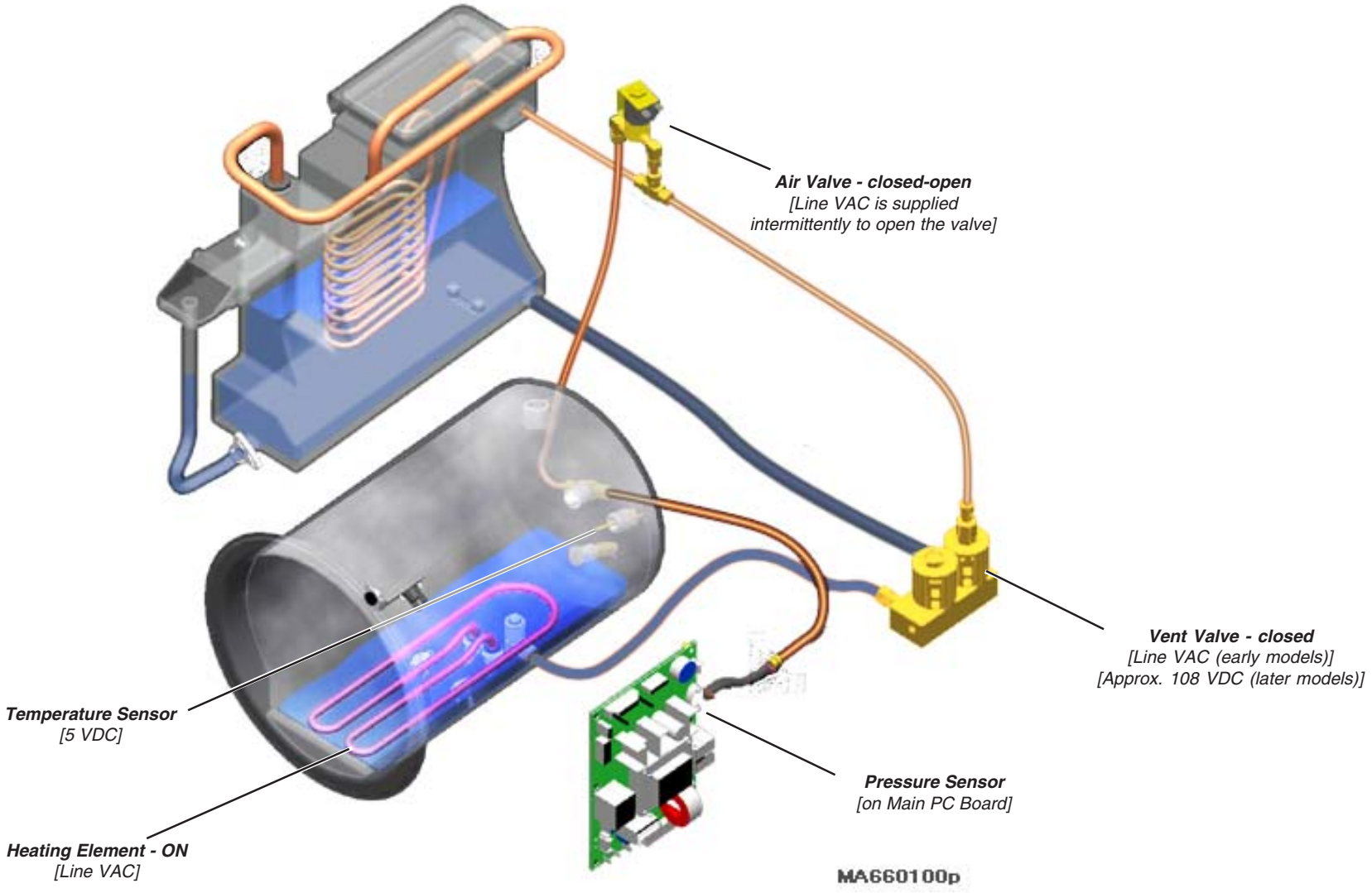
Water Level Sensor
Throughout the Fill Mode, 5 VDC is supplied to the water level sensor. When the water level in the chamber reaches the sensor, a circuit is completed and current flows back to the PC Board.

When the 5 VDC from the water level sensor is detected, the PC Board stops the current flow to the fill valve.

Theory of Operation

Heat-Up Mode

This illustration calls out the components that are energized / monitored during the Heat-Up Mode.
Refer to the following page for a detailed description of the Heat-Up Mode.



Heat-Up Mode

During the Heat-Up Mode, the water in the chamber is heated to achieve the proper temperature for sterilization.

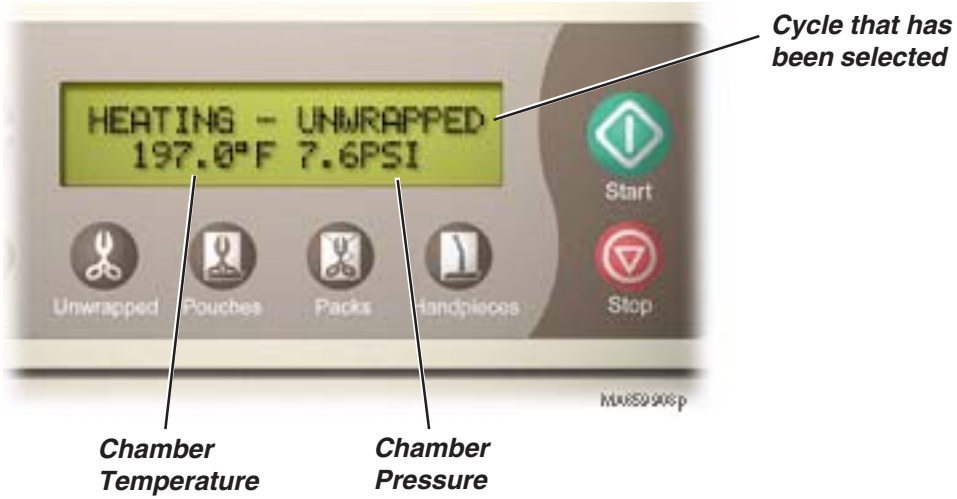
*[All electrical current is supplied thru the two high-limit thermostats (on bottom of chamber). Refer to '**Power-Up Mode**', for further detail].*

Heating Element
Throughout the Heat-Up Mode, line voltage is continually supplied to the heating element. The heating element heats the water in the chamber until sterilzation temperature is achieved.

Vent Valve
Throughout the Heat-Up Mode, voltage is supplied to the *(normally open)* vent valve. When energized, the vent valve closes. *[This prevents water from flowing back into the reservoir thru the vent valve].*

Air Valve
Periodically during the Heat-Up Mode, line voltage is supplied to the *(normally closed)* air valve. When energized, the air valve opens. *[This occurs three times during this mode to expel air from the chamber.]*

During the Heat-Up Mode, the display panel will show:



Temperature Sensor & Pressure Sensor
The temperature sensor *(inside chamber)* & pressure sensor *(on Main PC Board)* monitor the temperature & pressure conditions inside the chamber.

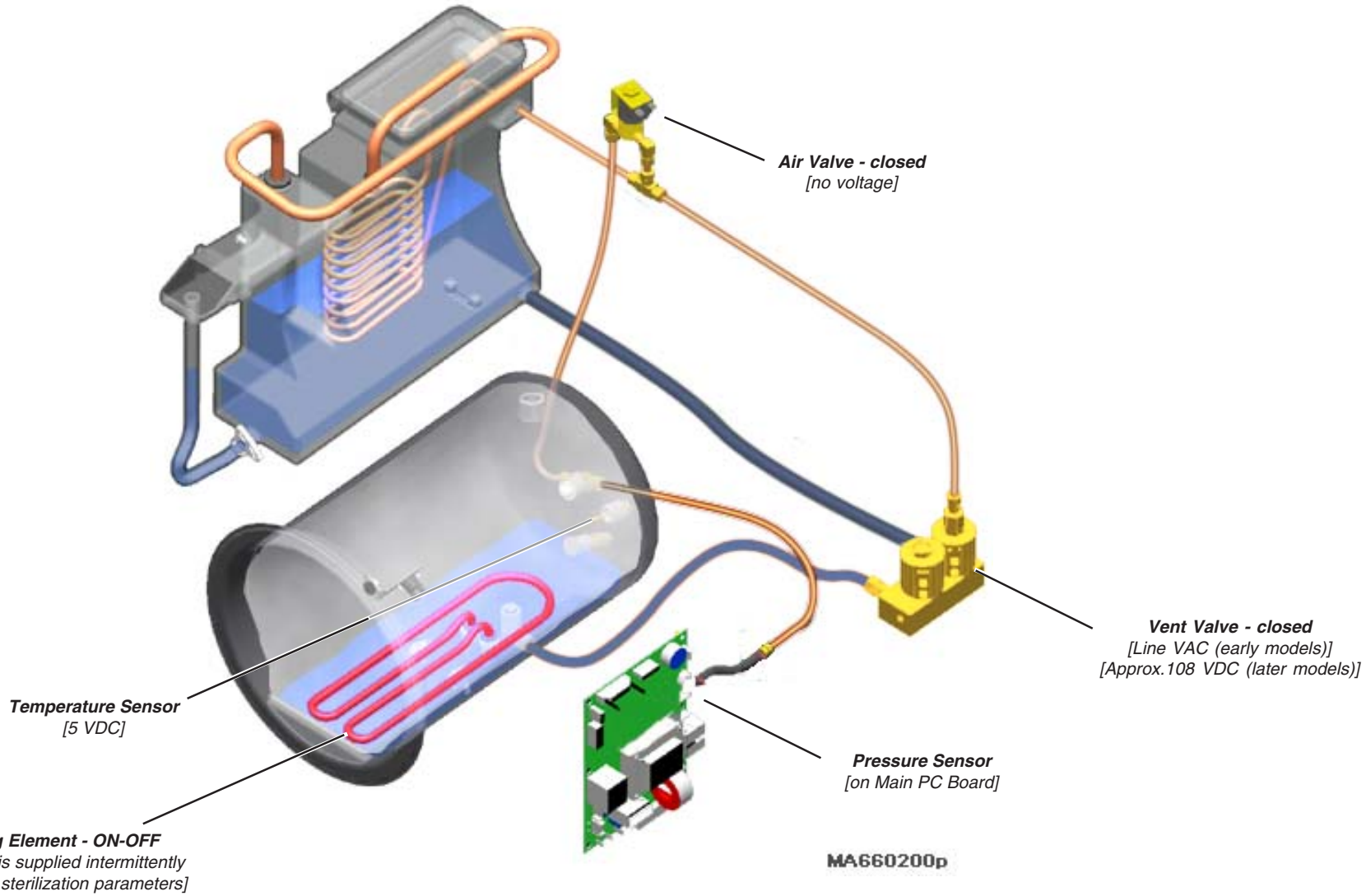
When the pre-set sterilization conditions are met, the Heat-Up Mode is complete & the unit goes into the Sterilization Mode.

Theory of Operation

Sterilization Mode

This illustration calls out the components that affect the Sterilization Mode.
Refer to the following page for a detailed description of the Sterilization Mode.

*[Refer to to **Power-Up Mode** for components that are continually monitored during all modes]*



Sterilization Mode

During the Sterilization Mode, the temperature and pressure parameters for the selected cycle are maintained for the required time.

*[All electrical current is supplied thru the two high-limit thermostats (on bottom of chamber). Refer to '**Power-Up Mode**', for further detail].*

Temperature Sensor & Pressure Sensor
The temperature sensor *(inside chamber)* & pressure sensor *(on Main PC Board)* monitor the temperature & pressure conditions inside the chamber throughout the Sterilization Mode.

Heating Element
Based on readings from the temperature sensor & pressure sensor, the heating element is cycled ON / OFF to maintain the required temperature and pressure for the selected cycle.

Vent Valve
Throughout the Sterilization Mode, voltage is supplied to the *(normally open)* vent valve. When energized, the vent valve closes.
[This prevents water from flowing back into the reservoir thru the vent valve].

Air Valve
The air valve is closed *(no voltage)* throughout the entire Sterilization Mode.
[This prevents pressure from escaping the chamber].

During the Sterilization Mode, the display panel will show:

Sterilization time counts down

Chamber Temperature

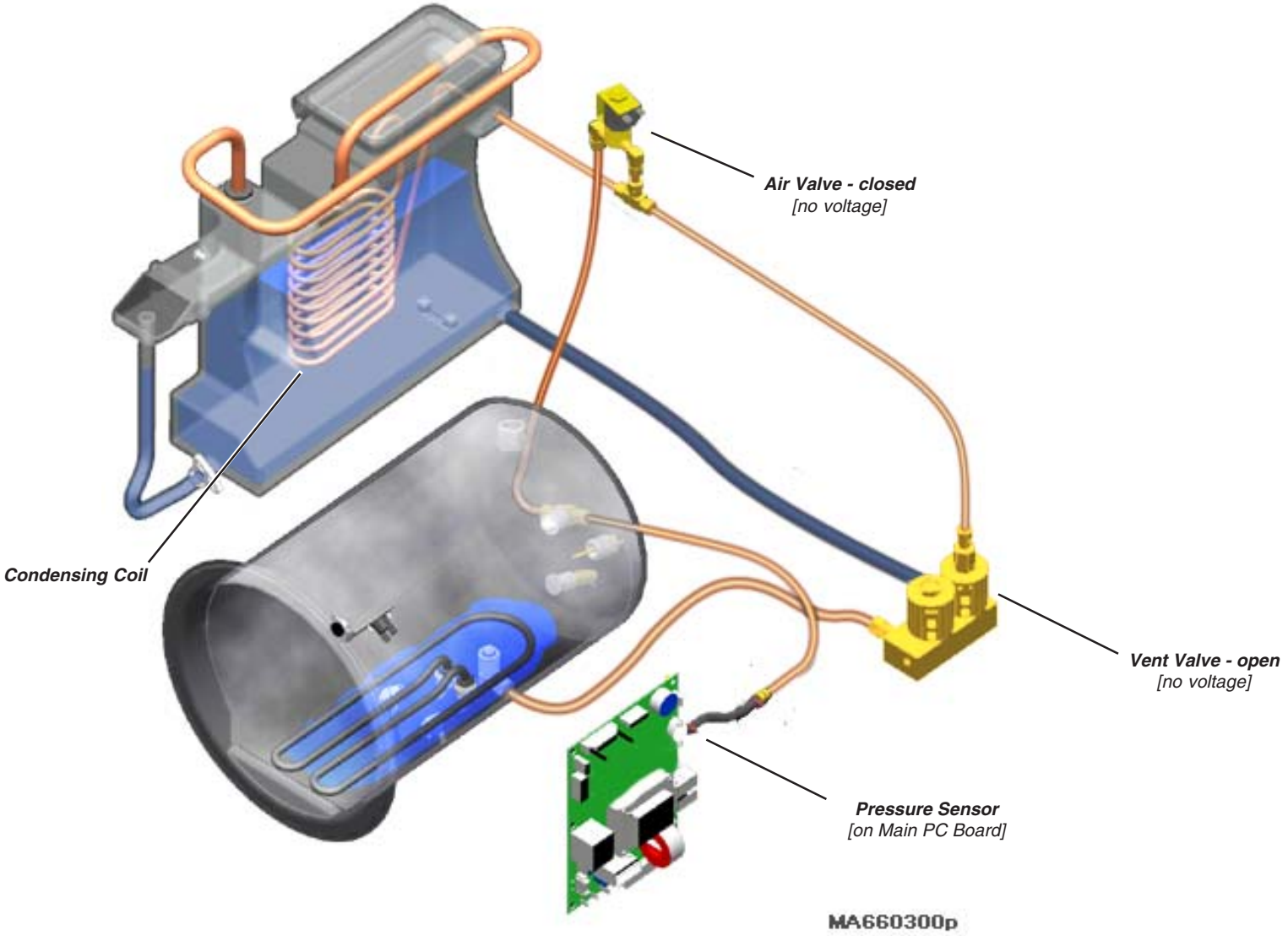
Chamber Pressure

Theory of Operation

Vent Mode

This illustration calls out the components that affect the Vent Mode.
Refer to the following page for a detailed description of the Vent Mode.

*[Refer to to **Power-Up Mode** for components that are continually monitored during all modes]*



Vent Mode

During the Vent Mode, pressure is released from the chamber. The steam cools as it passes thru the condensing coil and the water is returned to the reservoir.

*[All electrical current is supplied thru the two high-limit thermostats (on bottom of chamber). Refer to '**Power-Up Mode**', for further detail].*

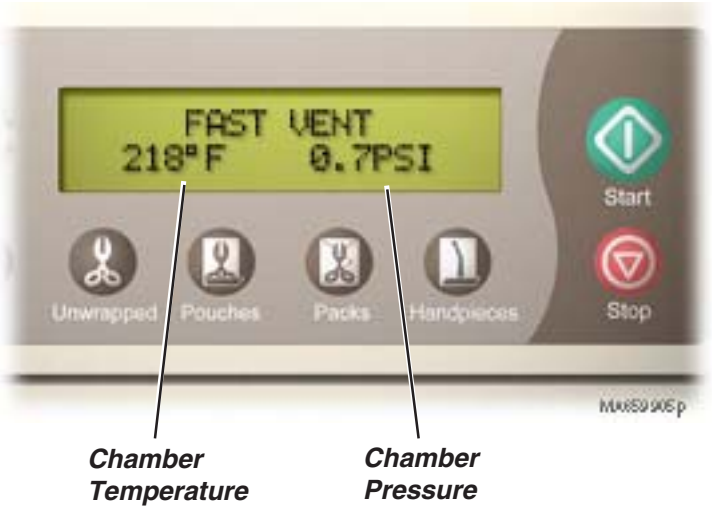
Vent Valve
During the Vent Mode, the PC Board stops the current flow to the *(normally open)* vent valve. This allow the valve to open, and the pressure *(steam)* is released from the chamber.

Condensing Coil
When the steam is released from the chamber, it passes thru the condensing coil. The coil cools the steam and returns the water back to the reservoir.

Air Valve
The air valve is closed *(no voltage)* throughout the entire Vent Mode.

Pressure Sensor
The pressure sensor *(on Main PC Board)* monitors the chamber pressure as it is released. When the pressure reaches 0.7 psi (5kPa), you will hear several *"beeps"*. This indicates the door will open in approximately 5 seconds.

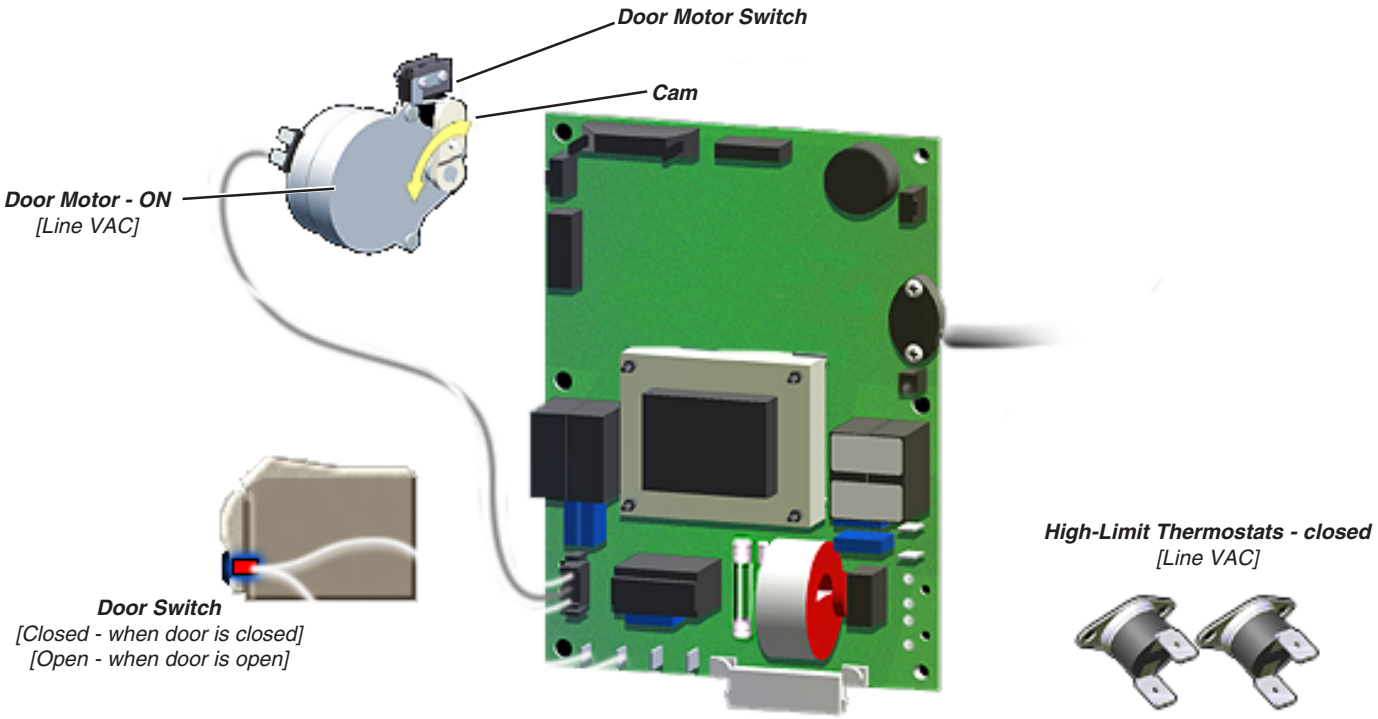
During the Vent Mode, the display panel will show:



Theory of Operation

Door Motor System *(not applicable to M9D / M11D models)*

This illustration shows only the components that affect the Door Motor System.
Refer to the following page for a detailed description of the Door Motor System.



Door Motor System

Th Door Motor System automatically opens the sterilizer door when the Vent Mode is complete.

*[All electrical current is supplied thru the two high-limit thermostats (on bottom of chamber). Refer to '**Power-Up Mode**', for further detail].*

Door Motor / Door Motor Switch

For the first 15 seconds, line voltage is supplied directly to the door motor. This causes the motor to run, rotating the cam and linkage downward.

As the cam mechanism rotates, the motor switch closes. After 15 seconds, the current to the door motor flows thru the closed door switch. The cam continues to rotate, causing the linkage to lift the door latch mechanism and open the door.

When the cam reaches the bottom of its travel, the door motor reverses direction. When the mechanism reaches its original position, the motor switch is opened. This stops current flow to the motor, and the motor stops.

Door Switch

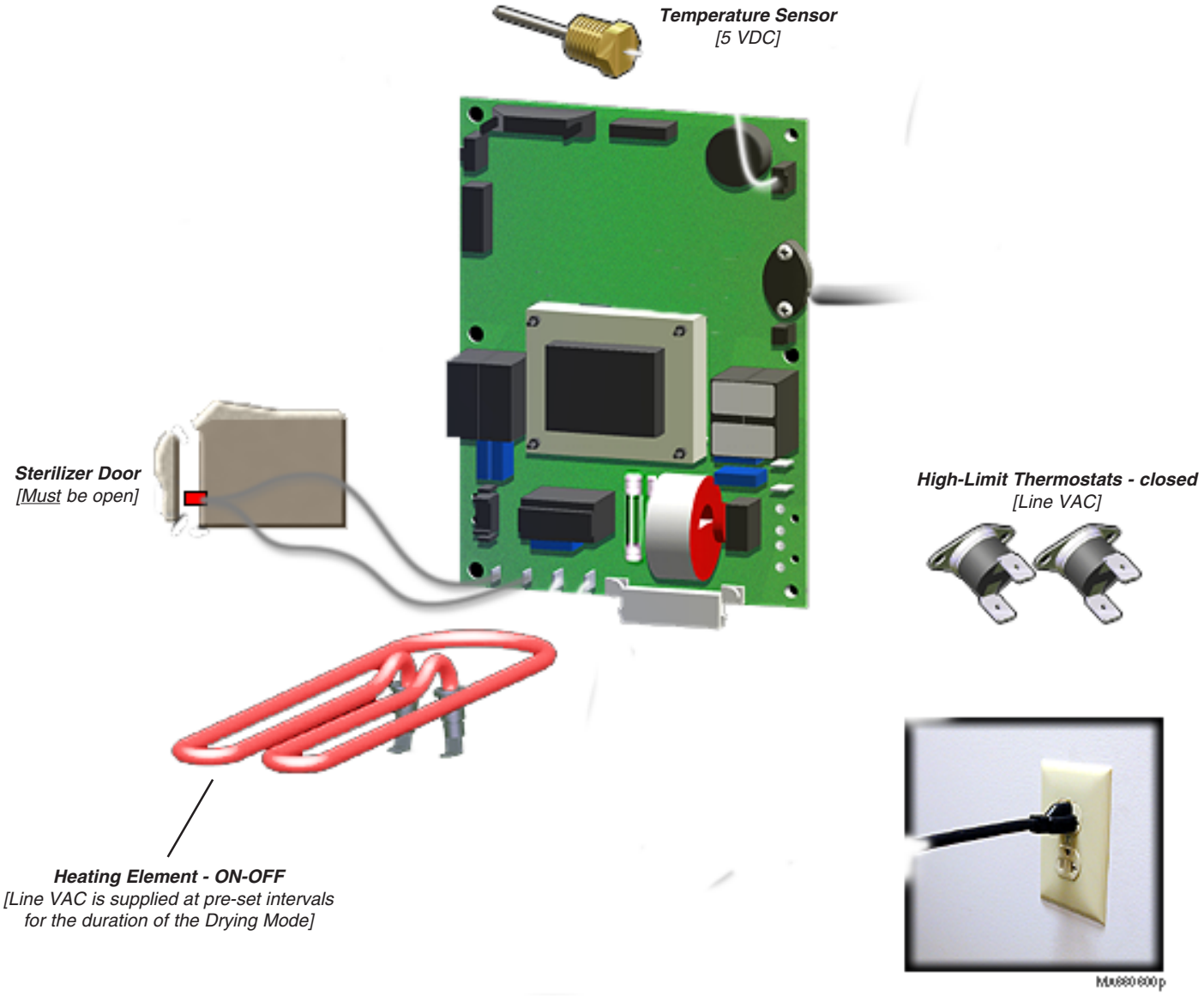
The status of the *(normally open)* door switch reflects the position of the door. *(ex. Door open= switch open)*

When the Door Motor System is activated, the display panel will show:

Theory of Operation

Drying Mode

This illustration shows only the components that affect the Drying Mode.
Refer to the following page for a detailed description of the Drying Mode.



Drying Mode

During the Drying Mode, the heating element is energized to dry the instruments in the chamber.

*[All electrical current is supplied thru the two high-limit thermostats (on bottom of chamber). Refer to '**Power-Up Mode**', for further detail].*

Heating Element
During the Drying Mode, line voltage is supplied to the heating element at pre-set intervals to turn it ON / OFF. This continues for the duration of the Drying Mode.

When the drying time expires, voltage is removed from the high-limit thermostats and the heating element.

Temperature Sensor
The temperature sensor *(inside chamber)* monitors the temperature throughout the Drying Mode. In general the temperature range will be approximately 170°F *(77°C)* to 200°F *(93°C).*
If the temperature exceeds 240°F *(115°C),* the PC board stops the current flow to the heating element until the temperature drops.

Sterilizer Door
The sterilizer door must remain open throughout the Drying Mode. If the door is closed, pressure may build up in the chamber resulting in an error code.

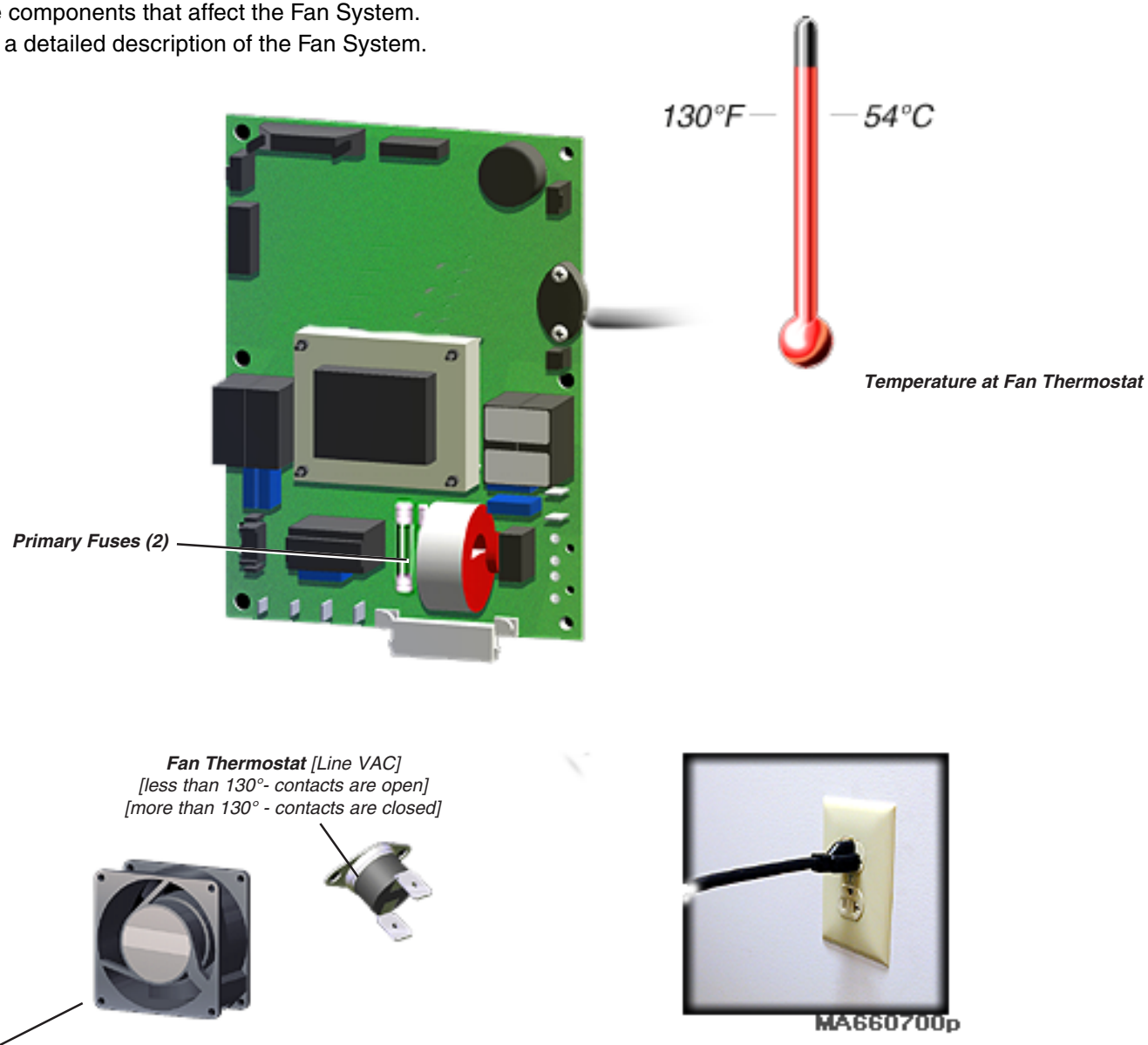
During the Drying Mode, the display panel will show:

Drying time counts down

Theory of Operation

Fan System

This illustration shows only the components that affect the Fan System.
Refer to the following page for a detailed description of the Fan System.



Fan System

The Fan System reduces heat inside the enclosure by circulating air between the chamber and the covers.

[The electrical current to the fan system does not pass thru the high-limit thermostats (on bottom of chamber)].

Primary Fuses
With the table's power cord properly connected, facility supply voltage is supplied to the Main PC Board thru the two primary fuses.

If either fuse is faulty, the sterilizer will have no power.

Fan Thermostat
When power is supplied to the Main PC Board, current continuously flows to the fan thermostat.

The fan thermostat controls the ON/OFF function of the fan. When the temperature *(at the thermostat)* is less than 130°, the fan thermostat contacts are open *(no current to the fan)*. When the temperature reaches 130°, the fan thermostat contacts close *(current flow to the fan)*.

When the temperature drops to approx. 100°, the contacts of the fan thermostat open and the fan stops running.

ATTENTION
The fan may run continuously when running consecutive cycles.

Fan
When the contacts of the fan thermostat are closed, line voltage is applied to the fan causing the fan to run. When the contacts of the thermostat open, current is removed, and the fan stops.

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