



# Service Manual For MCO GS/GD Full Size "Gas" Convection Ovens With 200, 410, 450, 455, 470, 475 Series Controllers



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# Section One Operation Manual



CONGRATULATIONS! You have just purchased the finest commercial cooking equipment available anywhere.

Like any other fine, precision built appliance, it should be given regular care and maintenance. Periodic inspections by your dealer or a qualified service agency is recommended. When corresponding with the factory or your local authorized factory service center regarding service problems or replacement parts, be sure to refer to the particular unit by the correct model number (including the prefix and suffix letters and numbers) and the warranty serial number. The rating plate affixed to the unit contains this information.

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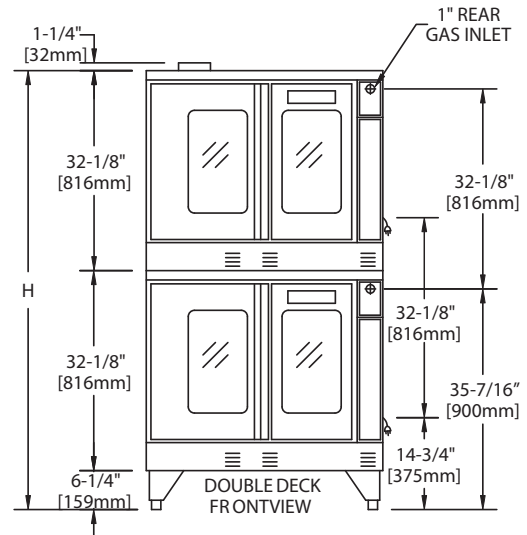
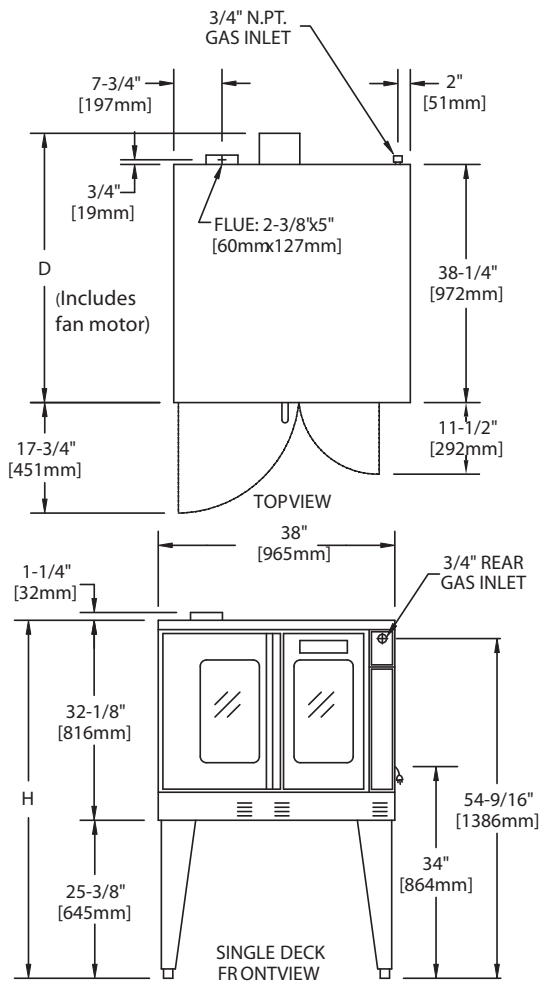
# DIMENSIONS & SPECIFICATIONS

Single-Deck Models	Int. Dimensions :In (mm)			Ext. Dimensions: In (mm)			Ship Wt	Ship Dim.
	W	H	D	W	H*	D	Lbs/kg	Cubic Ft.
Standard Depth	29 (736)	24 (610)	24 (610)	38 (965)	57-1/2 (1461)	41-1/4(1048)	600/273	64
Deep Depth	29 (736)	24 (610)	28 (711)	38 (965)	57-1/2 (1461)	44-1/2(1130)	600/273	64

Double-Deck Models	Int. Dimensions: In (mm)			Ext. Dimensions: In (mm)			Ship Wt.	Ship Dim.
	W	H	D	W	H*	D	2@Lbs/kg	Cubic Ft.
Standard Depth	29 (736)	24 (610)	24 (610)	38 (965)	70-1/2 (1791)	41-1/4(1048)	1150/523	128
Deep Depth	29 (736)	24 (610)	28 (711)	38 (965)	70-1/2 (1791)	44-1/2(1130)	1150/523	128

\*Height with or without standard casters. Height with low profile casters (double deck) is 68-1/2" (1740mm).

Models	Input Ratings, Nat & Pro			Electrical Specifications	
	BTU/hr	kW Equiv.	Gas Inlet	120V/1Ph.	240V/1Ph.
Single Deck	60,000	17.6	(1) @ 3/4" NPT	(1)@9.4A	(1)@ 5.2A
Double Deck	120,000	35.2	(1) @1" NPT	(2)@9.4A	(2)@ 5.2A



### Installation Notes:

#### Combustible Wall Clearances:

Sides: 1" (25mm)  
Back: 3" (76mm)

#### Entry Clearance:

Crated: 47" (1194mm)  
Uncrated: 32-1/2" (826mm)

### Operating Pressure:

Natural: 4.5" WC (11 mbar)  
Propane: 10" WC (25 mbar)  
Max 13.8" WC @ 70°F (21°C)

NOTE: Data applies only to North America

### Notes:

- Standard electrical specifications include motor requirements.
- (120V units) 115V 3/4 HP, 2-speed motor; 1140 and 1725 rpm 60Hz
- (240V units) 200-240V, 3/4 HP, 2-speed motor; 1140 and 1725 rpm, 60Hz
- A 6 ft. line cord is provided for each 120V deck with a (NEMA #5-15P) plug.
- Garland recommends a separate 15 AMP circuit for each 120V unit.

Gas Input ratings shown here are for installations up to 2,000-ft. (610m) above sea level. Specify altitudes over 2,000 ft.

Commercial cooking equipment requires an adequate ventilation system. For additional information, refer to the National Fire Protection Association's standard NFPA96, "Vapor Removal from Cooking Equipment." (NOTE: For North America only)

Please specify gas type when ordering.

# INSTALLATION

## Installation Notes:

Combustible and Non-Combustible Wall Clearance: Side: 1.0" (25 mm) Rear: 3.0" (76 mm)

NOTE: Adequate clearance must be provided for servicing and proper operation.

The importance of the proper installation of Commercial Gas Cooking Equipment cannot be over stressed. Proper performance of the equipment is dependent, in great part, on the compliance of the installation with the manufacturer's specifications. Installation must conform to local codes or, in the absence of local codes, with the National Fuel Code, ANSI Z223.1, Natural Gas Installation Code, CAN/CGA-B149.1, or the Propane Installation Code, CAN/CGA-B149.2, as applicable.

Before assembly and connection, check gas supply.

- A. The type of gas for which the unit is equipped is stamped on the data plate located behind lower front panel. Connect a unit stamped "NAT" only to natural gas; connect a unit stamped "PRO" only to propane.
- B. If it is a new installation, have gas authorities check meter size and piping to assure that the unit is supplied with sufficient amount of gas pressure required to operate the unit.
- C. If it is additional or replacement equipment, have gas authorities check pressure to make certain that existing meter and piping will supply fuel at the unit with not more than 1/2" water column pressure drop.

NOTE: When checking pressure be sure that all other equipment on the same gas line is on. A pressure regulator is supplied with GARLAND Convection Ovens. Regulator is preset to deliver gas at pressure shown on the rating plate.

The appliance and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 PSI (3.45 kPa).

The appliance must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSI (3.45 kPa).

## Installation Of Ovens Equipped With Casters

- A. For an appliance equipped with casters, the installation shall be made with a connector that complies with the Standard for Connectors for Movable Appliances, ANSI Z21.69 or Connectors for Moveable Gas Appliances, CAN/CGA-6.16, and a quick-disconnect device that complies with the Standard for Quick-Disconnect Devices for Use With Gas Fuel, ANSI Z21.41, or Quick-Disconnect Devices for Use with Gas Fuel, CAN1-6.9, and adequate means must be provided to limit the movement of the appliance without depending on the connector and the quick-disconnect device or its associated piping to limit the appliance movement and the location(s) where the restraining means may be attached to the appliance shall be specified.
- B. The front casters of the unit are equipped with brakes to limit the movement of the oven without depending on the connector and any quick-disconnect device or its associated piping to limit the appliance movement.
- C. The restraint can be attached to the unit near the gas inlet. If the restraint is disconnected, be sure to reconnect the restraint after the oven has been returned to its originally installed position.

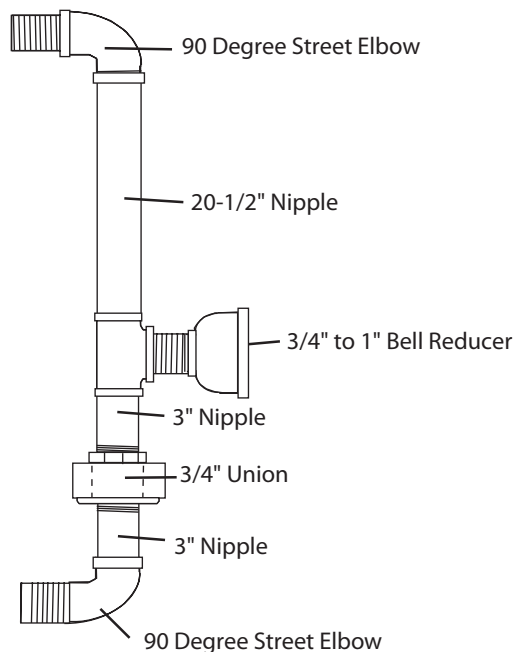
## Installation Of Double Deck Models

- A. Position insert in bottom leg opening and tap insert up into leg till it seats at collar. Attach six inch (6") legs to lower oven section. Raise unit or lay on its left side. Place the front legs on the oven so as to line up with four (4) attaching bolt holes. Secure leg to oven frame using (4) 3/8-16 x 3/4 bolts and washers provided. Repeat at rear of unit.
- B. Remove lower front cover of top deck (located under oven doors). Raise top deck into place and line up body sides and back of the unit. Fasten the rear of the units together, with the stacking bracket, as shown, using (6) 1/4-20 machine screws, lock washers and nuts, (provided).
- C. Install the interconnecting flue parts, carefully following the instructions contained in the stacking kit. Pay particular attention to the type of ovens you are stacking and be sure to follow the corresponding instructions.



- D. Assemble the stacking pipes provided in the stacking kit as shown in the diagram at the top of this page. This allows both ovens to be supplied by a single gas line. The minimum recommended size of a single supply line for two stacked ovens is 1 inch. Use a pipe thread compound that is intended for use on propane gas piping and be sure to check for leaks before finalizing the installation.
- E. Check leveling of unit four (4) ways (using a common carpenter's level on the rack inside the oven).
- F. Plug the cord set of each unit into a 115-Volt power supply outlet.
- G. Maintain clearance from combustibles.

Each gas appliance shall be located with respect to building construction and other equipment so as to permit access to the appliance. Such access and clearance may be necessary for servicing and cleaning.



**CAUTION:**  
**DISCONNECT BOTH UNITS FROM ELECTRICAL SUPPLY BEFORE SERVICING.**

**POWER FAILURE**  
**In the event of a power failure, no attempt should be made to operate this oven.**

**IMPORTANT**

**All gas burners and pilots need sufficient air to operate and large objects should not be placed in front of this oven, which would obstruct the airflow through the front. Objects should not be placed on main top rear of oven while in use. This could obstruct the venting system of the unit's flue products.**

**Gas Connection**

The 1" NPT inlet at the rear must be considered in piping the gas supply for double stack units or 3/4" NPT for individual (or single deck) connections. Undersized gas supply line(s) may restrict the gas supply and affect performance. If other gas appliances are supplied by the same supply line, the supply line must be sized to carry the combined volume without causing more than 1/2" pressure drop at the manifold of each appliance on the line at full rate.

Recommended supply pressures are 7" WC, (NAT), and 11" WC, (PRO); ± 5%. (Must not exceed 13.8" WC [NAT], and 15" WC [PRO]).

**Electrical Connection**

A 15 AMP service must be provided for each oven. For 115 VAC usage, a cord and plug (NEMA #5-15P) is provided but connection to the electrical service must be electrically grounded in accordance with local codes, or in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70, or the Canadian Electrical Code, CSA C22.2, as applicable.

This appliance is equipped with a three-prong (grounding) plug for your protection against shock hazard and should be plugged directly into a properly grounded three-prong receptacle.

DO NOT CUT OR REMOVE THE GROUNDING PRONG FROM THIS PLUG.

A wire diagram is affixed to the rear of the unit.

**Ventilation & Air Supply**

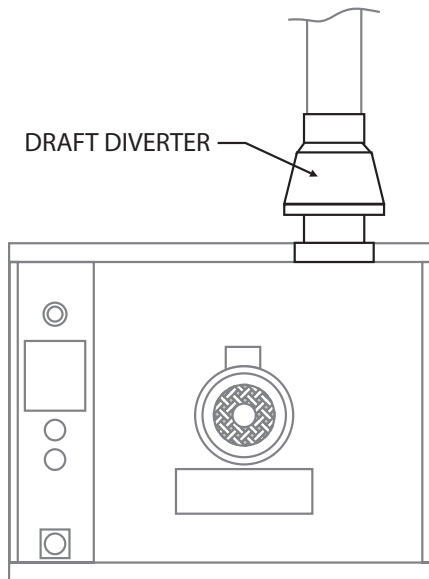
Proper ventilation is highly important for good operation. There are only two choices for properly venting an oven: 1) canopy hood style or 2) direct venting. The ideal method of venting a GAS Convection Oven is through the use of a properly designed canopy, which should extend 6" (150 mm), beyond all sides of the appliance and 6'6" (1950 mm) from the floor.

A strong exhaust fan will create a vacuum in the room. For an exhaust system vent to work properly, exhaust and make-up air must be balanced properly. For proper air balance contact your local H.V.A.C. contractor.

All gas burners and pilots need sufficient air to operate and large objects should not be placed in rear and bottom of this oven, which would obstruct the airflow through the front.  
**INSTALLATION OF A DIRECT FLUE.**

When the installation of a canopy type exhaust hood is impossible the oven may be direct vented. Before direct venting check your local codes on ventilation, in the absence of local codes, refer to the National Fuel Code NFPA 54, ANSI Z223.1 (latest revision).

If the unit is to be connected directly to a direct flue, it is necessary that draft diverter be installed to insure proper ventilation.



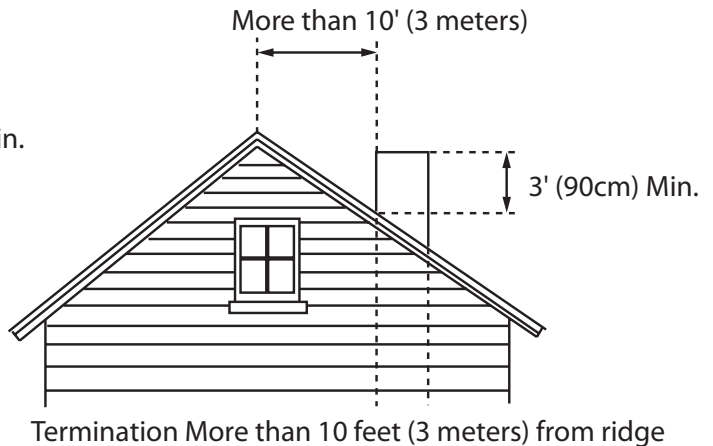
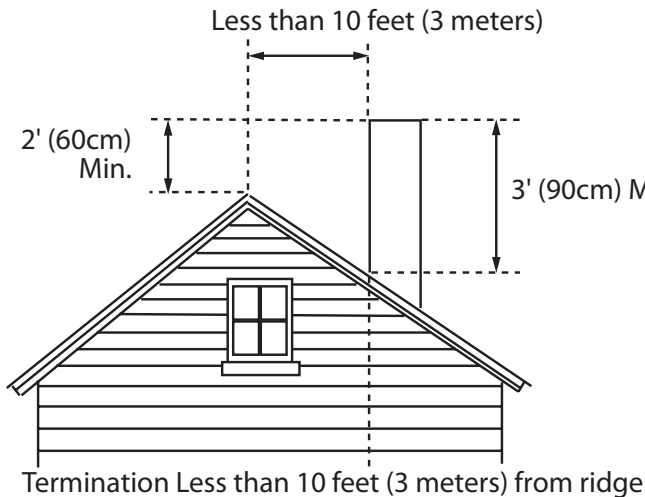
Direct venting as described above, should be positioned on the main top and fastened with sheet metal screws provided. All parts described above are available from the manufacturer.

**NOTE:** Each oven has been factory tested and adjusted prior to shipment. It may be necessary to further adjust the oven as part of a proper installation. Such adjustments are the responsibility of the installer. Adjustments are not considered defects in material and workmanship, and they are not covered under the original equipment warranty.

**DO NOT UNDERSIZE VENT PIPE!**

This can cause resistance to flow and impede good venting. We suggest that if a horizontal run must be used it should rise no less than 1/4" (6.25mm) for each linear foot of run, and after a total of 180° of bends you should increase the size of stove pipe by two (2") inches. The flue should rise 2' (60cm) to 3' (90cm) above the roof line or 2' (60cm) to 3' (90cm) above any portion of a building within a horizontal distance of 10 (3 meters) feet.

The following diagram is only one example from the National Fuel Gas Code Book NFPA 54, ANSI Z223.1, 7.5.3:



## Testing & Lighting Instructions

1. Turn on main gas valve. Remove the lower front cover and the service panel above the control panel. Drop the control panel and leak test all fittings and connections upstream from the service valve located on the redundant combination gas valve. Should any gas leaks be detected, turn OFF main gas valve, correct the problem and retest.
2. Open shutoff valve located on the redundant combination gas valve. Activate control panel and set to desired temperature. The pilot and burner is now ignited by direct spark. Check all fittings again and correct any leaks and recheck.

Replace all service panels and covers before operation.

NOTE: All electronic ignition systems are supplied with a redundant gas valve. Therefore, the unit is not supplied with an external pressure regulator.

NOTE: During installation there will be air in the gas line, this air will have to bleed off before ignition can be established. The electronic ignition system has a ninety second lock-out as a safety device on all units. Therefore, several attempts may be required before pilot ignition is established, wait five minutes after each attempt.

**FOR YOUR SAFETY: KEEP YOUR APPLIANCE AREA FREE FROM COMBUSTIBLES.**

**TO CONSERVE ENERGY:**

Do not waste energy by leaving controls at high temperature settings during idle periods. Lower settings will keep oven warm and ready for next use period. Master 400 Series controls have an auto setback feature that is user programmable to help with these applications.

# OPERATION

## Master 200 Mechanical Control with Timer

### In Off Mode:

When the oven is off, there are no lights or indicators.

### Start Up:

Press the Cook/Off/Cool Down rocker switch to the "Cook" position. The green lamp will light indicating the oven is powered in cook mode.

The oven will begin to heat to the temperature set on the thermostat dial. The amber lamp will light indicating the heat is active. As the heat cycles on and off to maintain the set temperature this light will go on and off accordingly.

The door must be closed for the oven to operate in cook mode. Opening the door will cause the heat to stop. The motor and fan will shut off. This is a safety feature.

### Fan Speed:

The fan speed can be either high (1725 RPM) or (1150 RPM). The fan speed is controlled by the left rocker switch marked high and low.

### Lights:

The oven lights are activated by pressing the light switch on the control panel. This is a momentary switch and the lights will stay lit as long as this button is held in the on position. Lights will work whenever there is electrical power connected to the oven.

### Cool Down:

Pressing the Cook/Off/Cool Down rocker switch to the Cool Down position activates the fan and motor to cool the oven cavity. The door must be open slightly for the fan and motor to start. The heat is not active in this mode.

Optimal cool down will be achieved with the door open slightly. Opening the door too far will shut the fan and motor off. This is a patented safety feature.

Pressing the button to the OFF position cancels the cool down and turns the oven off.

### Temperature:

The temperature range is from 150°F to 500°F (66°C to 250°C) is controlled by rotating the temperature dial and aligning the indicator to the desired temperature.

### Timer:

The timer is set by rotating the dial clockwise aligning the indicator to the desired time cycle. The timer will count down from 2 minutes to 60 minutes. At the end of the timing cycle the buzzer will sound. The buzzer is turned off by rotating the dial counter-clockwise to the off position as shown on the control panel.



## MASTER 300 Solid State Control with Mechanical Timer

### In Off Mode:

When the controller is off, the unit will have no active prompts. Pressing the ON/OFF key will activate the controller into Start Up mode.

### On Start Up:

In Start Up mode, the controller will heat to the temperature indicated on the temperature control. The fan speed will be that which was most recently set. When the oven cavity reaches the set temperature and is ready for operation the "LOAD" LED will light.

### Controller Keys

Pressing the ON/OFF key will activate the oven.

Pressing the LIGHT key will turn the lights on for 30 seconds. The lights will work if the controller is in the Off mode. When the door is opened, the light will come on and stay on for 30 seconds.

Pressing the FAN HIGH key will activate the higher speed fan and light its LED.

Pressing the FAN LOW key will activate the lower speed fan and light its LED.

Pressing the COOL DOWN key will deactivate the heat, turn the fan on high and light its LED. The Cool Down will operate when the door is closed or opened *slightly*. When the door opens wider, the Cool Down mode will deactivate and the LED will flash. *This is a patented safety feature. Optimal cool-down will be achieved with the door open slightly.* If the doors are closed, the LED will flash. Pressing the COOL DOWN key again will turn the LED off and stop this mode. Pressing the ON/OFF key will also cancel Cool Down.

When the door is opened the fan and heat will stop until the door is closed. *This is a patented safety feature.*

When the ON/OFF key is pressed to turn the oven off and the oven is above 200°F (93°C), the oven will go into an Auto Cool Down mode. In Auto Cool Down, the oven will run the fan on high until the oven cavity drops below 150°F (66°C). During this time the "AUTO COOL DOWN" LED will light. When the oven temperature drops below 150°F (66°C) the oven turns off. This feature protects the oven motor from pre-mature failure. Optimal cool-down will be achieved with the door open slightly. Controller Dials.

Cooking TEMPERATURE is set by rotating the TEMPERATURE dial to the desired temperature, 150°F (66°C) to 550°F (288°C).

Cooking TIME is set by rotating the TIMER dial to the desired cooking time, up to 60 minutes.



**NOTE:** The "PROBE ERROR" LED will light if the oven temperature probe is malfunctioning or has become damaged or disconnected. Call for service if this occurs.

## **MASTER 410 ELECTRONIC CONTROL**

## **MASTER 450 ELECTRONIC CONTROL WITH COOK-N-HOLD**

## **MASTER 455 ELECTRONIC CONTROL WITH COOK-N-HOLD & CORE PROBE**

### **In Off Mode:**

When the controller is off, the display will show "OFF". Pressing the ON/OFF key will activate the controller into Start Up mode.

### **On Start Up:**

In Start Up mode, the controller will heat to the last set temperature, time and fan speed. The factory defaults are 350°F (177°C), 30 minutes and low fan speed. The display will indicate "LO" when the oven is below the set temperature. When the oven cavity reaches the set temperature and is ready for operation the display will indicate "LOAD".

**NOTE:** If the oven temperature goes above the requested temperature the display will indicate "HI". If the oven temperature goes above 575°F (302°C) the display will indicate "HELP" and an audible signal will sound. *This is a safety feature.*

If the door is opened during a Cooking mode, the fan and heat will stop, and the display will indicate "DOOR" until the door is closed. *This is a patented safety feature.*

Pressing the **ACTUAL TEMP** key will display the actual oven temperature in 5° increments. Controller Keys.

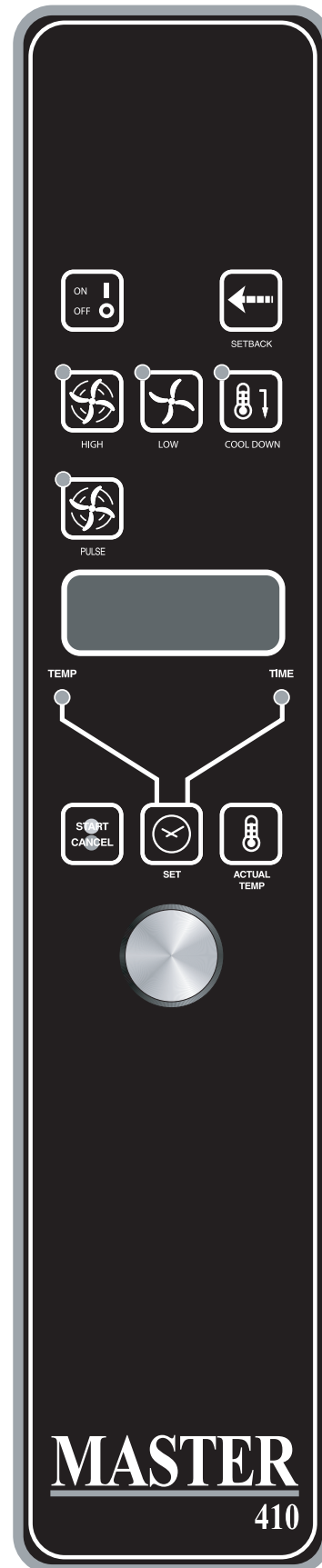
Pressing the ON/OFF key will activate the oven.

Pressing the LIGHT key will turn the lights on for 30 seconds. The lights will work if the controller is in the Off mode. When the door is opened, the light will come on and stay on for 30 seconds.

Pressing the FAN HIGH key will activate the higher fan speed and light its LED.

Pressing the FAN LOW key will activate the lower fan speed and light its LED.

Pressing the FAN PULSE key will activate the lower fan speed and light its LED. The fan will be active for 30 seconds then off for 30 seconds, and continues this cycle.



Pressing the **SETBACK** key will cool the oven cavity to a preprogrammed temperature (factory set at 250°F [121°C]). The oven will automatically go into Setback mode after the pre-programmed non-usage time, (see 'Changing Factory Setback Program'). The display will indicate "**SETB**". This is an energy-saving feature.

Pressing the **COOL DOWN** key will deactivate the heat, turn the fan on high and light its LED. The display will indicate "**OPEN DOOR**" if the door is closed, prompting the user to open the door slightly. With the door open slightly the display will indicate "**COOL**". The Cool Down will operate when the door is closed or opened *slightly*. **Optimal cool-down will be achieved with the door open slightly.** When the door opens wider, the Cool Down mode will deactivate and the display will indicate "**DOOR**". *This is a patented safety feature.* Pressing the **COOL DOWN** key again will turn the LED off and stop this mode. Pressing the **ON/OFF** key will also cancel Cool Down. Cool Down is not active during a cook.

When the **ON/OFF** switch is pressed to turn the oven off and the oven was above 200°F (93°C), the oven will go into an **Auto Cool Down** mode. In Auto Cool Down, the oven will run the fan on high until the oven cavity drops below 150°F (66°C). During this time the display will indicate "**AUTO**". When the oven temperature drops below 150°F (66°C) the oven turns off. *This feature protects the oven motor from premature failure.* **Optimal cool-down will be achieved with the door open slightly.**

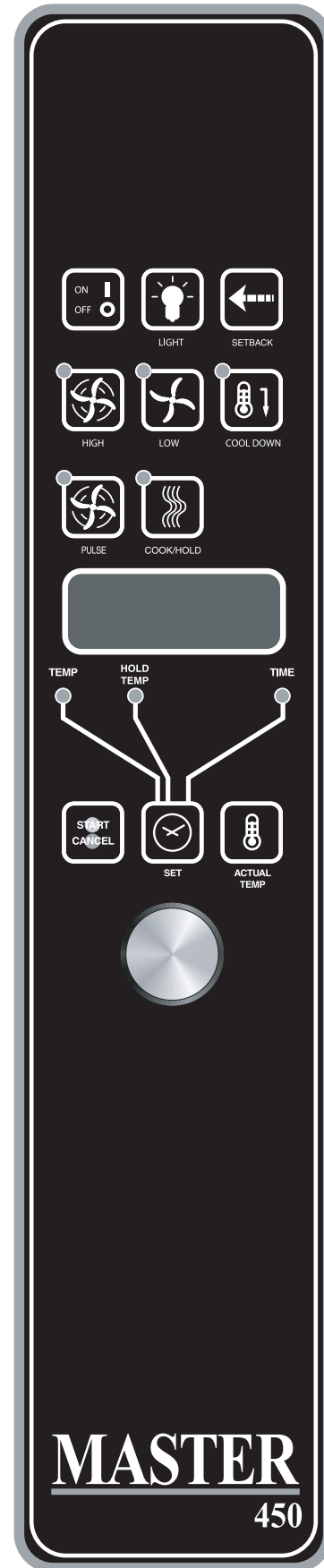
### Operating the Controls

Setting the cook temperature and time are done in the same manner. Pressing the **SET** key will light the **TEMP** LED. The operator then sets the temperature by rotating the dial on the controller until the desired temperature is shown on the display. Pressing the **SET** key a second time lights the **TIME** LED and allows the operator to select the desired cook time as shown on the display. Pressing the **SET** key a third time ends the programming.

Pressing the **START/CANCEL** key will start the timing cycle. The display will count down from the Set time in minutes and seconds (solid colon) or hours and minutes (blinking colon) the minutes and seconds. When the cycle is completed, processing this key will also cancel the "**DONE**" prompt. To cancel a timing cycle in progress, press and hold the **START/CANCEL** key for 3 seconds.

### Cook-N-Hold Operation

Pressing the **COOK/HOLD** (450 and 455 Controllers Only) key activates the Cook-N-Hold mode and lights its LED. To verify the proper hold temperature has been selected, press the **SET** key twice. The display will show the hold temperature. At the end of the cook cycle, an audible alarm will sound, the display will flash "**DONE**" and change to count "**UP**" the hold time. The oven will switch to the programmed hold temperature.





Setting the cook temperature, hold temperature and time are done in the same manner. Pressing the **SET** key will light the **TEMP** LED. The operator then sets the temperature by rotating the dial on the controller until the desired temperature is shown on the display. Pressing the **SET** key a second time will light the **HOLD** LED and allows the operator to select the desired hold temperature as shown on the display. Pressing the **SET** key a third time lights the **TIME** LED and allows the operator to select the desired cook time as shown on the display. Pressing the **SET** key a fourth time ends the programming.

Pressing the **START/CANCEL** key will start the timing cycle. When the cycle is completed, pressing this key will also cancel the "DONE" prompt. To cancel a timing cycle in progress press and hold the **START/CANCEL** key for 3 seconds.

### Core Probe Operation

The **Core Probe option** (455 Controller Only) is only active when the core probe is plugged into its connector. To set the core temperature, first plug the core probe into its connector. The display will indicate "100" and the **CORE TEMP** LED will be on. The operator then sets the temperature by rotating the dial on the controller until the desired temperature is shown on the display. Pressing the **SET** key stores the core temperature and starts the cooking process.

To set the oven temperature, press the **SET** key again. The **TEMP** LED will light and the oven temperature can be set by rotating the dial on the controller until the desired temperature is displayed. Pressing the **SET** key again will light the **HOLD** LED allowing the operator to set the hold temperature in the same manner.

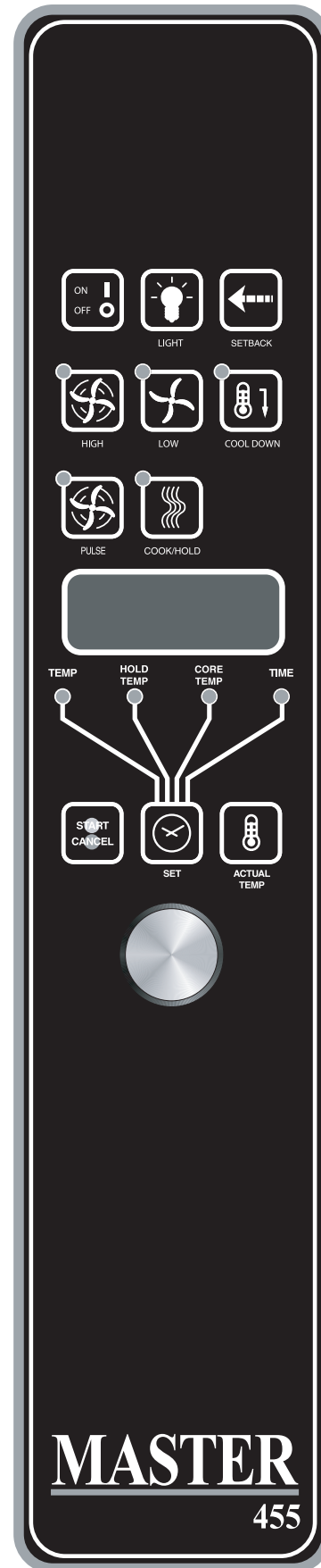
**NOTE:** If the hold temperature is not set, the default hold temperature is 150°F (66°C) or the last programmed temperature. (Hold temperature range is 140°F (60°C) to 210°F (99°C).

When the core temperature is reached, the display will sound and flash "DONE" for 3 seconds. Automatically, the display will switch to count "UP" the time the oven is on hold.

### CHANGING FACTORY SETBACK PROGRAM

To change the factory setback settings, press and hold the **SETBACK** key for two seconds. The **TEMP** LED will light and a temperature will be displayed (factory preset at 250°F [121°C]). Set the temperature using the dial, then press the **SET** key. The **TEMP** LED will go out and the **TIME** LED will light. Set the time using the dial, then press the **SET** key. Press the **SET** key one more time to exit programming.

Note: To disable the setback function, set the temperature to 250° F (121°C) and the time to zero..





## MASTER 470/475 ELECTRONIC PROGRAMMABLE CONTROL

### Manual cooking:

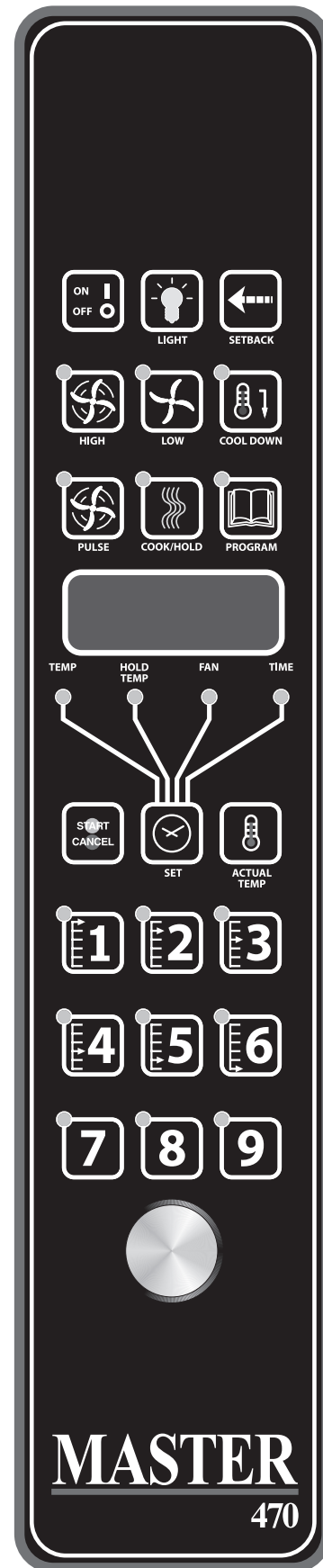
1. Press SET key - TEMP LED will light.
2. Set temperature using the dial (factory preset at 350°F).
3. Press SET key - FAN LED will light.
4. Select fan mode using one of the three (3) fan keys (HIGH, LOW, PULSE) - the selected fan LED will light.
5. Press SET key - TIME LED will light.
6. Set cook time using the dial (factory preset at 30:00).
7. Press SET key - ready to cook.
8. Press START/CANCEL to begin manual cooking.

### Manual cooking using Cook-N-Hold:

1. Press the COOK/HOLD key, that key's LED will light.
2. Press SET key - TEMP LED will light.
3. Set cook temperature using the dial (factory preset at 350°F).
4. Press SET key - HOLD LED will light.
5. Set hold temperature using the dial (factory preset at 200°F).
6. Press SET key - FAN LED will light.
7. Select fan mode using one of the three (3) fan keys (HIGH, LOW, PULSE) - the selected fan LED will light.
8. Press SET key - TIME LED will light.
9. Set cook time using the dial (factory preset at 30:00).
10. Press SET key - ready to cook.
11. Press START/CANCEL to begin manual cooking.

### Programming Product Keys (Master 475):

NOTE: Cooking time(s) is the element of the program that tells the controller that other information (temperature, fan speed, etc.) will be inputted into the controller. The first step is to enter all the time periods required, followed by the addition of the other cooking elements.



1. Press and hold PROG key for three (3) seconds - all the product key LEDs light.
2. CODE will be displayed. The controller is asking for the access code. Press 4-2-7-5 and the START/CANCEL key. PROD will be displayed indicating you have gained access to Product Programming.
3. Press the product key (1 - 9) into which you want to store a cooking program. SHLF will be displayed. The control is asking if you want to program the key as a shelf timer or with a cooking profile. Select your answer by pressing the START/CANCEL key. When the correct answer is displayed, press the SET key. The TIME LED will light. 30:00 will be displayed.
4. Set first cook time using dial. If more than one cooking profile is desired:
  - press the product key where the program is to be stored (1 - 9) - PR-2 will be displayed.
  - set the second cook time using the dial (factory presets for PR-2 through PR-5 are :00).
  - press the same product key (1 - 9) again - PR-3 will be displayed.
  - Repeat this process for all profiles. When the last profile time has been entered, press the SET key, OR

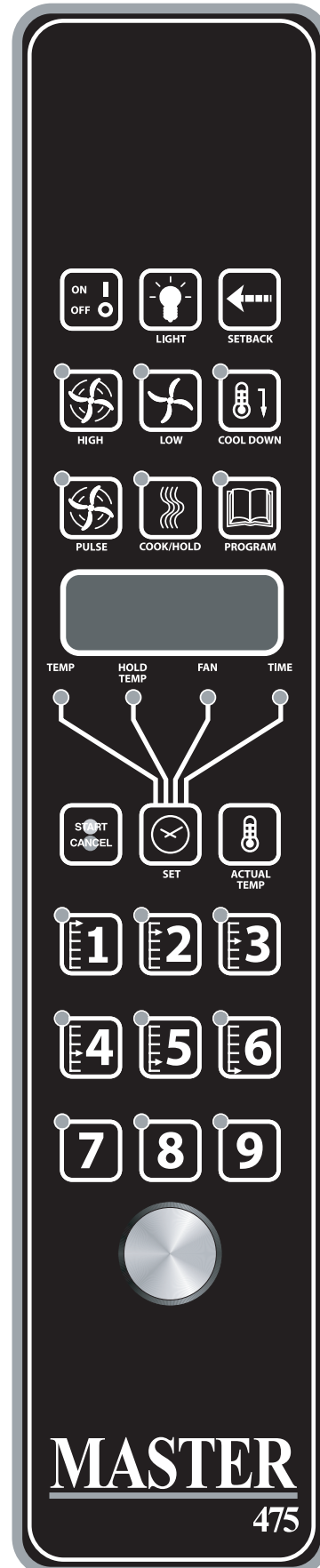
If less than five (5) profiles are desired press the SET key after the last required profile - PRE will be displayed, followed by :00. The controller is asking if you would like a reminder alarm (pre-alarm) to sound during the cooking process. (factory preset is :00).
5. If a pre-alarm signal is desired - dial in the time that the alarm is to sound. (Ex. If the product is to be turned halfway through the 60 minute cooking cycle, set the pre-alarm to 30 minutes). If pre-alarm is not desired verify that ":00" is displayed. Press the SET key - TEMP Led will light, and the display will show the first profile cooking temperature. (factory preset at 350°F).
6. Set the first cooking temperature using the dial.
 

Press the product key - PR-2 will be displayed followed by the second temperature.

Set the second cooking time using the dial.

Repeat as you did for cooking time, for all the profiles desired.

NOTE: The controller will only accept cooking temperatures for the number of profiles for which a cooking time has been set. If the product key is pressed after the last programmed profile, the first temperature will be displayed.



Press SET after the last cooking temperatures has been entered, HOLD will be displayed.

7. Use the START/CANCEL key to select yes or no. Press the SET key.
8. If yes was selected, the HOLD LED will light. Enter the hold temperature using the dial. (factory preset at 200°F) Press the SET key. FAN will be displayed and the FAN LED will light.

Set the fan speed desired for the first cooking profile using the individual fan keys (HIGH, LOW or PULSE), press the product key and set the fan speed for the second cooking profile. Continue until all the profiles have been assigned a fan speed. Press the SET key when complete. As with the temperature, if the product key is pressed after the last programmed profile, the first fan speed will be displayed.

9. FL or St will be displayed (for flex time or straight time) (factory preset for flex time). Select flex or straight time using the START/CANCEL key for the first profile. Press the product key and select straight time or flex time for the second profile. Continue until all the profiles have been assigned straight or flex time. Press the SET key when complete. If the product key is pressed after the last programmed profile, the first profile will be displayed.
10. Programming for that product key is complete.

### Programming Product Keys (Master 470):

NOTE: The Master 470 controller will only accept a single cooking profile per product key (one cooking time, one cook temperature, one fan speed, and one choice for straight or flex time).

Press and hold PROG key for three (3) seconds - all the product key LEDs light.

1. CODE will be displayed. The controller is asking for the access code. Press 4-2-7-5 and the START/CANCEL key. PROD will be displayed indicating you have gained access to Product Programming.
2. Press the product key (1 - 9) into which you want to store a cooking program. SHLF will be displayed. The control is asking if you want to program the key as a shelf timer or a cooking profile. Select your answer by pressing the START/CANCEL key. When the correct answer is displayed, press the SET key. The TIME LED will light. 30:00 will be displayed.
3. Set the cook time using dial.

Press the SET key - PRE will be displayed, followed by :00. The controller is asking if you would like a reminder alarm (pre-alarm) to sound during the cooking process. (factory preset is :00).

4. If a pre-alarm signal is desired - dial in the time that the alarm is to sound. (Ex. If the product is to be turned halfway through the 60 minute cooking cycle, set the pre-alarm to 30 minutes). If pre-alarm is not desired verify that ":00" is displayed.

• Press the SET key - TEMP Led will light, and the display will show the cooking temperature. (factory preset at 350°F).

5. Set the cooking temperature using the dial.  
Press the SET key. - FAN will be displayed and the FAN LED will light.
6. Set the fan speed desired using the individual fan keys (HIGH, LOW or PULSE).  
Press the SET key. - FL or St will be displayed (for flex time or straight time) (factory preset for flex time).
7. Select flex or straight time using the START/CANCEL key.  
Press the SET key when complete.
8. Programming for that product key is complete.

### Cooking Using The Product Keys (Master 475 and Master 470):

1. On initial start-up, press the product key for the menu item to be cooked. Wait until LOAD is displayed.
2. Load the oven.
3. Press the product key for the loaded menu item.
4. Press the START/CANCEL key.
5. To cancel the alarm or the hold, press the START/CANCEL key followed by the product key.

### Verifying hold time (Master 475 and Master 470):

While a product is being held, press and hold the product key. The actual hold time will be displayed.

Selecting Fahrenheit or Celsius (Master 475 and Master 470):

Press PROG and ACTUAL TEMP keys at the same time, F or C will be displayed. (factory preset for F)

Press the START/CANCEL key to switch between F and C,

When the desired setting is displayed press the PROG and ACTUAL TEMP keys at the same time.

## Cooking with the Shelf Timer (Master 475 and Master 470):

The shelf timer option is used to independently time each of the up to six different shelves or racks within the oven.

**NOTE:** To use the shelf timer option, at least one product key must be programmed with a cooking profile (temperature, time, fan speed, flex or straight time). The program key must be limited to a single cooking profile to be used with the shelf timing option. If more than one product key is to be used, all product keys to be used must feature the same cooking temperature and fan speed. Flex or straight time and cooking time can be different. The Cook-N-Hold option can not be used with the shelf timer operation.

Pressing the desired product key will bring the oven to the desired cooking temperature, once the oven has reached the proper cooking temperature as indicated by LOAD in the display.

1. Press the product key containing the desired cooking profile (1 - 9).
2. Press the shelf key for the shelf location to be timed (1 - 6).  
NOTE: product keys and shelf keys are the same keys.
3. Press the START/CANCEL key to begin the cooking/timing process.
4. When the cooking/timing process is complete for each shelf, an audible "done" signal will sound and the display will indicate which shelf is finished. Example: SH-1
5. To turn off the alarm press the product key with the flashing LED.

Example: Two product profiles contain the same cooking temperature, fan speed and are both programmed for flex time - keys 1 and 6.

Two trays of product are going to be cooked in the oven at the same time. The first tray will use product key 1 and will be placed in rack position 2. The second tray will use product key 6 and will be placed in rack position 4. Once the oven display indicates LOAD:

1. Load food product into oven on shelf 2.
2. Press product key 1, then shelf key 2.
3. Press the START/CANCEL key to start cooking on shelf 2.
4. Load food product into oven on shelf 4.
5. Press product key 6, then shelf key 4.
6. Press the START/CANCEL key to start cooking on shelf 4.
7. When product on shelf 2 is finished cooking, an audible alarm will sound and the display will flash DONE, then SH-2, and the product key 1 LED will be flashing.
8. To turn off the alarm, press product key 1.
9. When product on shelf 4 is finished cooking, an audible alarm will sound and the display will flash DONE, then SH-4, and the product key 6 LED will be flashing.
10. To turn off the alarm, press product key 6.

# PERFORMANCE RECOMMENDATIONS

1. Preheat oven thoroughly (approximately 20 minutes) before use.
  2. As a general rule, temperature should be reduced 25° to 50° from that used in a standard/conventional oven. Cooking time may also be shorter, so we suggest closely checking the first batch of each product prepared.
  3. Use the chart of suggested times and temperatures as a guide. These will vary depending upon such factors as size of load, temperature and mixture of product (particularly moisture) and density of product.
  4. Keep a record of the times, temperature and load sizes you establish for various products. Once you have determined these, they will be similar for succeeding loads.
  5. When practical, start cooking the lowest temperature product first and gradually work up to higher temperatures.
  6. If you find that your previous temperature setting is more than 10° higher than needed for succeeding loads, press the COOL DOWN key to reach the desired temperature before setting a new cooking temperature.
  7. When loading oven, work as quickly as possible to prevent loss of heat.
  8. Oven will continue to heat even though the timer goes off. Product should be removed from the oven as soon as possible to avoid over cooking.
  9. Center pans on racks and load each shelf evenly to allow for proper air circulation within the cavity.
  10. When baking, weigh or measure the product in each pan to assure even cooking.
  11. When cooking six pans, use rack positions 2, 4, 6, 8, 10 and 12, starting from the top.
  12. Do not overload the oven. Six pans are suggested for most items, i.e., cakes, cookies, rolls, etc. However, the maximum (13 pans) may be used for fish sticks, chicken nuggets and hamburgers. Cooking times will have to be adjusted.
  13. Muffin pans should be placed in the oven back to front or with the short side of the pans facing the front. This results in the most evenly baked product.
  14. When re-thermalizing frozen casseroles, preheat the oven 100° over the suggested temperature. Return to cooking temperature when the oven is loaded. This will help compensate for the introduction of a large frozen mass into the cavity.
  15. Use pan extenders or two inch deep 18"x26" pans for batter type products which weigh more than eight pounds, i.e., Pineapple Upside Down Cake.
  16. Never place anything directly on the bottom of the oven cavity. This obstructs the airflow and will cause uneven results.
- NOTE: Moisture will escape around the doors when baking products with heavy moisture content, such as: chicken, potatoes, etc.

# COOKING GUIDE

The following suggested times and temperatures are provided as a starting guide. Elevation, atmospheric conditions, gas supply, recipe, cooking pans and oven loading may affect your actual results.

Product	°F	Time
White Sheet Cakes – 5 lb	300°	20 min
White Sheet Cakes – 6 lb	300°	
Yellow Layer Cake – 21 oz	325°	15 min
Yellow Sheet Cake – 5 lb	300°	22 min
Chocolate Layer Cake – 21 oz	300°	22 min
Angel Food Cake	375°	22 min
Brownies	350°	15 min

Product	°F	Time
Chicken Parts	350°	45 min
Hamburger Patties, 10/lb fzn	350°	8 min
Hamburger Patties, 10/lb fresh	350°	5 min
Hamburger Patties, 4/lb fzn	350°	12 min
Hamburger Patties, 4/lb fresh	350°	8 min
Meatloaf – 4#	325°	45 min
Bacon	350°	10 min
Roast Beef - 20#	325°	3 hr 15 min
Prime Rib - 10#	300°	1 hr 45 min
Stuffed Pork Chops	350°	45 min
Lamb Chops	375°	40 min
Boneless Veal Roast	300°	3 Hr

Product	°F	Time

Product	°F	Time
Soda Biscuits	400°	6 min
Yeast Rolls	325°	24 min
Sweet Bread	325°	24 min
Corn Bread	350°	22 min
Gingerbread	300°	24 min
Apple Turnovers	350°	25 min
Cream Puffs	300°	25 min
Sugar Cookies	325°	12 min
Chocolate Chip Cookies	375°	8 min
Apple Pie (Fresh)	375°	25 min
Blueberry Pie (Fresh)	350°	30 min
Blueberry Pie (Frozen)	300°	56 min
Pumpkin Pie (Frozen)	300°	50 min
Frozen Pizza	300°	6 min
Macaroni & Cheese	350°	15 min
Fish Sticks	350°	16 min
Stuffed Peppers	350°	45 min
Baked Potatoes	350°	60 min

Product	°F	Time

## COOK AND HOLD

Please refer to the operating instructions to program the 450 and 455 control units for cook and hold feature. The times and temperatures listed below are to be used as a starting guide. Your actual results may vary greatly depending on your elevation, gas supply, atmospheric conditions and other items being cooked at the same time.

Weight in lbs	Time in Hours					
	Temperature: 200°F		Temperature: 250°F		Temperature: 300°F	
	Rare	Medium	Rare	Medium	Rare	Medium
8	2.5	3.5	1.5	2	1.25	1.5
9	2.75	3.75	1.75	2.25	1.25	1.75
10	3	4.25	2	2.5	1.5	1.75
11	3.25	4.5	2	2.75	1.5	1.75
12	3.5	5	2.25	3	1.5	2
13	3.75	5	2.5	3.25	1.5	2.25
14	4	5.75	2.5	3.5	1.75	2.5
15	4.25	6	2.75	3.5	2	2.5
16	4.5	6.25	2.75	3.75	2	2.75
17	4.75	6.5	3	4	2.25	2.75
18	4.75	6.75	3.25	4.25	2.25	3
19	5	7.25	3.25	4.25	2.25	3
20	5.25	7.5	3.5	4.5	2.5	3.25
21	5.5	7.75	3.5	4.75	2.75	3.5
22	5.75	7.75	3.5	4.75	2.75	3.5
23	6	8.25	3.75	5	2.75	3.75
24	6	8.75	3.75	5	2.75	3.75
25	6.25	9	4.25	5.5	3	4
26	6.5	9.25	4.25	5.5	3.25	4.25
27	6.75	9.5	4.25	5.75	3.25	4.25
28	7	9.75	4.5	6	3.25	4.25
29	7.25	10	4.75	6.25	3.5	4.5
30	7.25	10.25	4.75	6.25	3.5	4.5

## PROBLEMS / SOLUTIONS

<b>Problem</b>	<b>Solution</b>
If cakes are dark on the sides and not done in the center	Lower oven temperature.
If cakes edges are too brown	Reduce number of pans or lower oven temperature.
If cakes have light outer color	Raise temperature.
If cake settles slightly in the center	Bake longer or raise oven temperature slightly. Do not open doors too often or for long periods.
If cake ripples	Overloading pans or batter is too thin.
If cakes are too coarse	Lower oven temperature.
If pies have uneven color	Reduce number of pies per rack or eliminate use of bake pans.
If cupcakes crack on top	Lower oven temperature.
If meats are browned and not done in center	Lower temperature and roast longer.
If meats are well done and browned	Reduce time. Limit amount of moisture.
If meats develop hard crust	Reduce temperature or place pan of water in oven.
If rolls have uneven color	Reduce number or size of pans.



# CLEANING & MAINTENANCE

**NOTE:** Disconnect line cord from power supply before cleaning or servicing.

## Break-In Period

When oven is new, operate it for one hour at 450°F before you begin your normal cooking operation. After cooling, wipe the interior, including the racks, with a clean damp cloth.

## Exterior Cleaning

Establish a regular schedule. Any spills should be wiped off immediately.

1. The oven should always be allowed to cool sufficiently before any cleaning is attempted.
2. Wipe exposed, cleanable surface when cool with a mild detergent and hot water. Stubborn residue spots may be removed with a lightweight non-metallic scouring pad. Dry thoroughly with a clean cloth.
3. Painted surfaces should be cleaned using a mild soap and warm water solution on a sponge or soft Cloth. Dry thoroughly.
4. Stainless Steel surfaces can often be cleaned adequately with the same method. Stubborn stains may be removed by using a non-metallic abrasive pad, rubbing in the direction of the metal's grain. If necessary, for particularly heavy deposits, you may mix a thin paste of water and scouring powder, and apply it with a sponge. Be careful to apply light pressure and remember to rub only in the direction of the grain in the metal.
5. The control panel surface is easily cleaned with hot water, soap and a soft cloth. Do not use hard abrasives, solvent type materials or metallic scouring pads since these will scratch or cloud the surface.
6. Never spray the perforated areas or control panel with steam or water, as this will allow moisture into the control cavity, which could damage electrical components.

## Interior Cleaning

Establish a regular cleaning schedule or wipe off on the same day when spills occur.

1. Cool down oven.
2. Remove oven racks.
3. Lift rack guides on either side of oven off of holders. Racks and guides may be run through dishwasher while oven cavity is being cleaned.
4. Clean with soap and water using a non-metallic scouring pad, if necessary. If dirt and grease have accumulated, a mild ammonia solution or commercial oven cleaner such as Easy-Off or Dow may be used.
5. To reinstall, reverse procedure. Place the bottom of the rack guide against the cavity wall. Keeping the top pulled away from the wall lift up. Push the top of the rack guide against the wall and push down locking it into place.

## Fan Area Maintenance

If aluminum foil is routinely used to wrap food or cooking vessels during oven operation, the following preventive maintenance must be performed:

1. Turn power switch to "OFF" position.
2. Remove oven racks and rack guides.
3. Remove air baffle and clean any stains or deposits.
4. Check blower wheel and air baffle for particles of aluminum foil or food deposits. Clean fins of blower wheel. (Caution: edges of blower wheel fins may be sharp).
5. Reinstall the air baffle, rack guides and oven racks.

This simple practice, if performed on a regular basis will keep your Garland oven operating at peak performance.

## MOTOR CARE

The motor on your convection oven is maintenance free since it is constructed with self-lubricating sealed ball bearings. It is designed to provide durable service when treated with ordinary care. We have a few suggestions to follow on the care of your motor. When the motor is operating, it cools itself internally by air entering at the rear of the motor case, provided proper clearance has been allowed.

Since the blower wheel is in the oven cavity it is at the same temperature as the oven. If the motor is stopped while the oven is hot, the heat from the blower wheel is conducted down the shaft and into the armature of the motor. This action could shorten the life of the motor.

We recommend, at the end of the bake or roasting period, when the oven will be idle for any period of time, or before shutting down completely, that the doors be left open slightly, and press the COOL DOWN key on the control panel. The fan will continue to run until the oven cools down to 150°F (66°C). At the end of the day, press the ON/OFF key to activate the Auto Cool Down feature. The fan will run on high until the oven cavity drops below 150°F (66°C). During this time the "AUTO COOL DOWN" LED will light. When the oven temperature drops below 150°F (66°C) the oven turns off. This feature protects the oven motor from pre-mature failure. Optimal cool-down will be achieved with the door open slightly.



# Section Two

# Electronic Pilot

# & Main Burner



# IGNITION SEQUENCE

## First Stage – Trial For Pilot Ignition

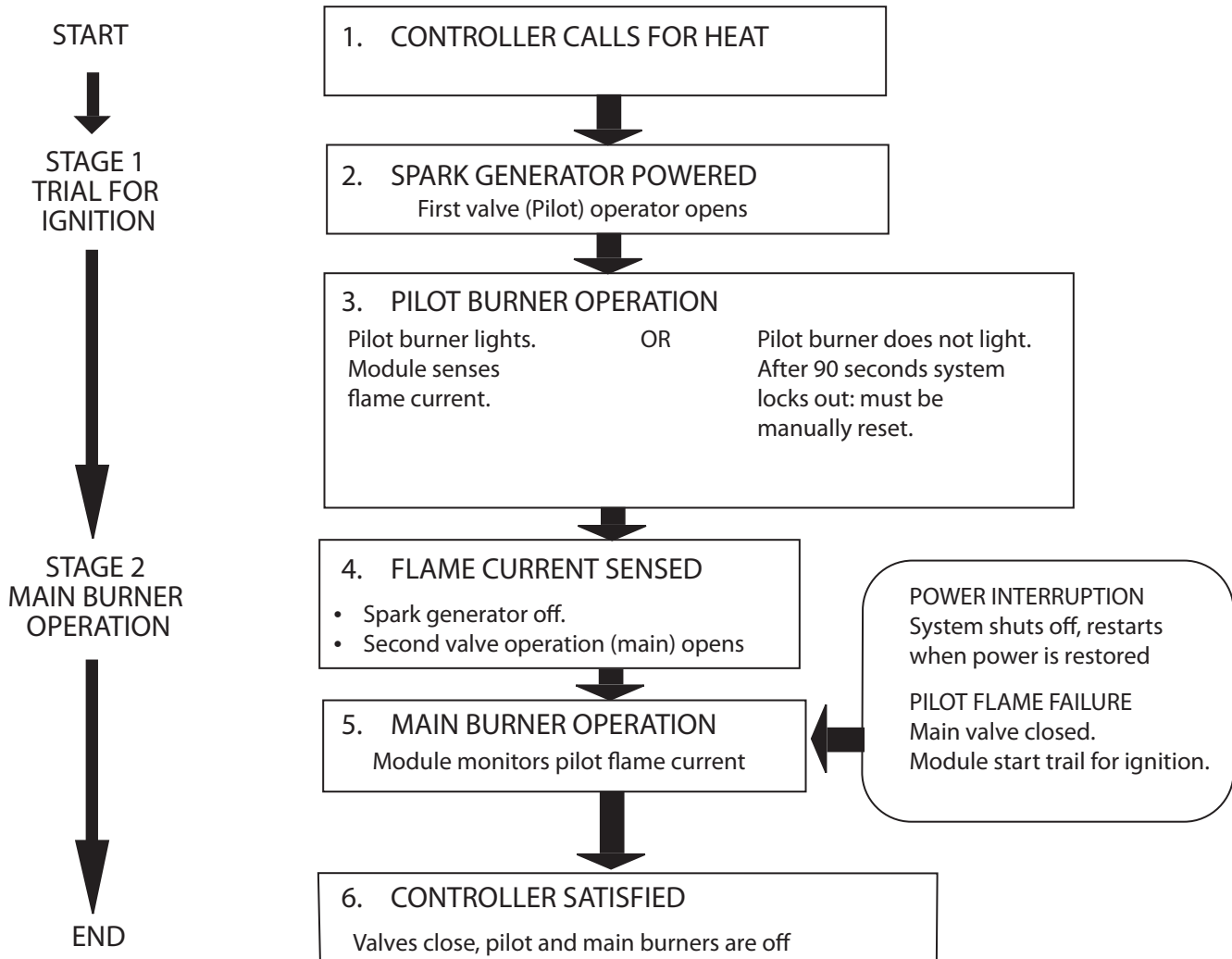
On every call for heat (system start), the S86 performs an internal safe-start check and shows that a flame-simulating condition is present. During a normal start, the S86 opens the pilot valve in the gas control. This allows gas to flow to the pilot burner. Simultaneously the electronic spark generator in the S86 produces a 30,000 volt pulse output. This voltage produces a spark at the pilot burner igniter/sensor rod, igniting the gas flow around the electrode. If the pilot flame is not detected during the trial for pilot ignition, the S86H contains a safety lockout timer (90 Seconds) to limit the ignition period.

## Second Stage – Main Burner Operation

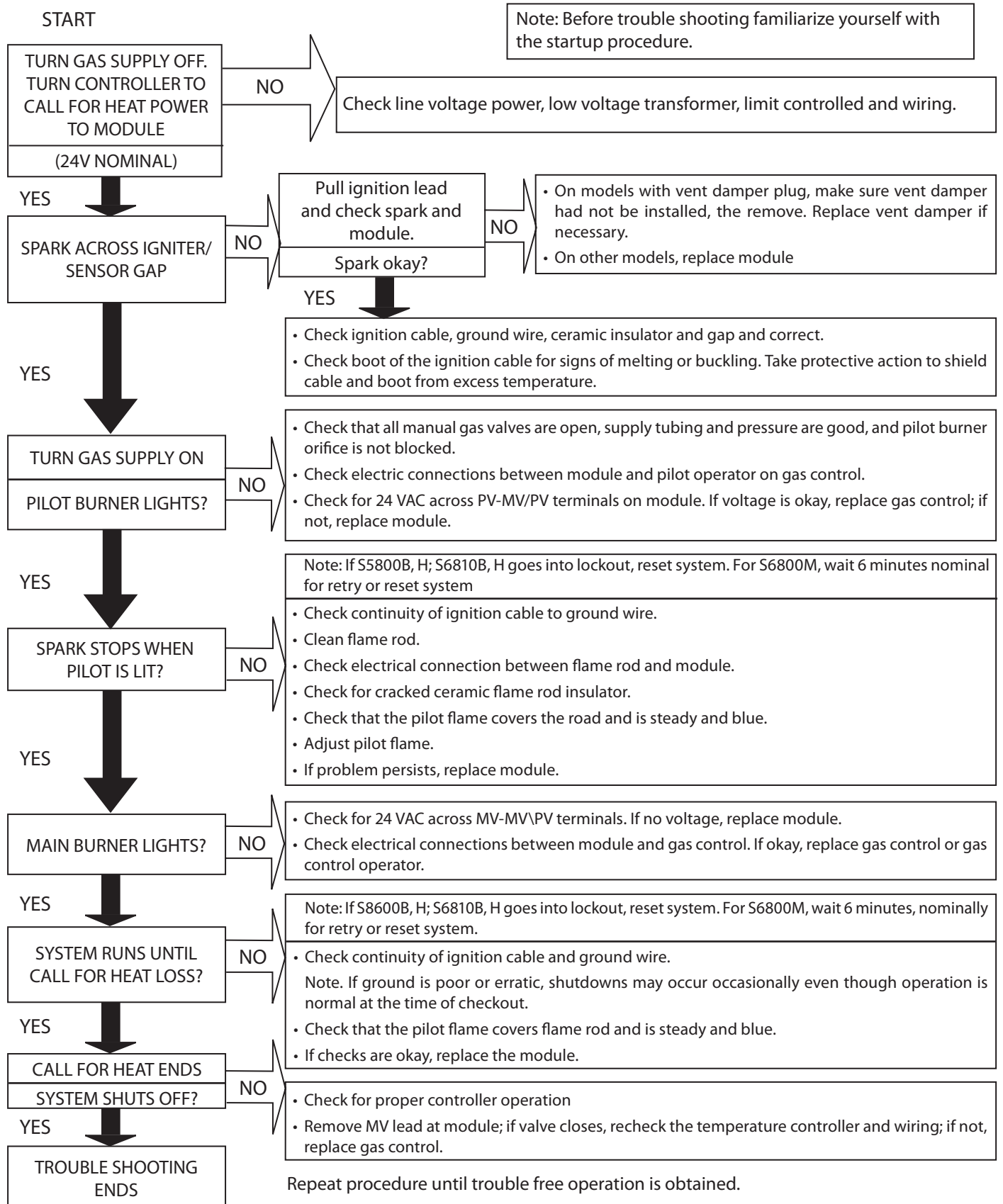
When the Pilot flame is established, a flame rectification circuit is complete to the burner ground. The S86 flame sensing circuit detects the flame circuit and shuts the spark generator off. At the same time the second operator (main gas valve) is opened in the gas control, allowing gas flow to the burners. This pilot flame ignites the main burner conventionally.

### Safety Lock Out Time.

The safety lockout timer circuit starts timing the moment the trail for the pilot ignition starts. When the timing periods runs out, the trial for ignition ends, and the control module goes into lockout. Before another attempt to start can be made, the S86 must be reset. Reset by adjusting the thermostat or controller below room temperature, or to its "OFF" position. An alternate method is to shut the system power "OFF". If normal ignition does not occur, use the trouble shooting table to determine the problem.



# TROUBLE SHOOTING TABLE



## Preliminary Check

The following visual checks should be made before trouble shooting and after installation or maintenance.

1. Check power to the appliance and S86.
2. Manual shutoff cocks in the gas line must be open.
3. Make certain all wiring connections are clean and tight.
4. First de-energize the system and wait at least one (1) minute. This resets the module allowing a return to the start condition.
5. Review the S86 system normal sequence of operation.

## System Trouble Shooting

Start the system by setting the controller above the required temperature. Observe the system response. Establish the type of malfunction or deviation from the normal operation. Use the S286 Intermittent Pilot system trouble shooting table to check for normal system operation.

Use the table by following the instruction questions in the box. If the conditions is true or okay (answers yes), go down to the next box underneath. If the condition is not true or not okay (answer no), go right to the next box alongside. Continue checking and answering conditions in each box encountered, until a problem and/or the repair is explained. After any maintenance or repair, the trouble shooting sequence should be repeated until the trouble shooting procedure ends with a normal system operation.

## Check Grounding

A common ground is required for the pilot burner, the igniter-sensor, the GND terminal of the S86, and the main burner. The main burner generally serves as the common ground. If the ground is poor or erratic, safety shutdowns may occur occasionally even though operation is normal at time of check out. Therefore, if nuisance shutdowns have been reported, be sure to check the grounding.

Note: If the ground circuit path is incomplete, the S86H system control will allow one trial for ignition before going into safety lock out.

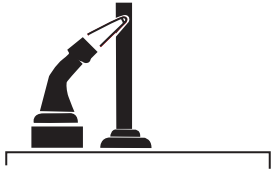
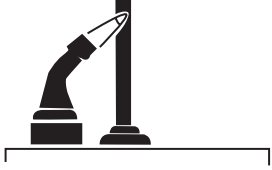
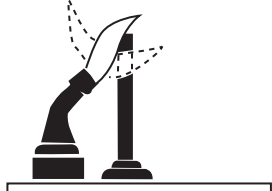


Electric grounding connections at the pilot burner, igniter/sensor and S86 must be clean and tight. If a lead wire is damaged or deteriorated, use only No. 14 or 18 gauge moisture resistant thermoplastic insulated wire with 105°C (221°F) minimum ratings as replacement. Excessive temperature at the ceramic flame rod can also permit electrical leak to ground. Examine the flame rod and mounting bracket, and correct if bent out of position. Replace igniter/sensor if insulator is cracked.

## Check Spark Ignition Circuit

The electronic module and step-up transformer in the S86 provides a spark ignition at 30,000 volts (open circuit). This circuit can be checked at the S86 module as follows:

1. Turn off the manual gas cock to prevent the flow of gas.
2. Disconnect the ignition cable at the S86 stud terminal to isolate the circuit from the pilot burner/igniter/sensor, and prepare a shot jumper lead using heavily insulated wire, such as ignition cable.
3. Energize the S86 touch one of the jumper firmly to the S86 ground terminal (GND). Do not disconnect the existing ground lead. Move the free end slowly toward the stud terminal to establish a spark and then pull the lead wire slowly away from the stud. Note the length of the gap at which the arching stops.  
  
*CAUTION:* Do not touch either the stripped end of the jumper or stud terminal. This is a very high voltage circuit and electrical shock can result. Perform the test immediately upon energizing the system – before the S86H goes into safety lock out and interrupts the spark circuit.
4. An arch length of 1/8" (3.2mm) or more indicates a satisfactory voltage output. Replace the S86 if not arc can be established or the maximum gap is less than 1/8" (3.2mm), and the fuse and power to the S86 input terminal was okay.

## Examples Of Unsatisfactory Pilot Flames.

APPEARANCE	CAUSE
<p style="text-align: center;">SMALL BLUE FLAME</p> 	<p>Check for lack of gas from:</p> <ul style="list-style-type: none"> <li>• Clogged orifice filter</li> <li>• Clogged pilot filter</li> <li>• Low gas supply pressure</li> <li>• Pilot adjusted at the minimum</li> </ul>
<p style="text-align: center;">LAZY YELLOW FLAME</p> 	<p>Check for lack of air from:</p> <ul style="list-style-type: none"> <li>• Large orifice</li> <li>• Dirty lint screen, if used</li> <li>• Dirty primary air opening, if there is one</li> <li>• Pilot adjusted at minimum</li> </ul>
<p style="text-align: center;">WAVING BLUE FLAME</p> 	<p>Check for:</p> <ul style="list-style-type: none"> <li>• Excessive draft at pilot locations</li> <li>• Recirculating products of combustion</li> </ul>
<p style="text-align: center;">NOISY LIFTING BLOWING FLAME</p> 	<p>Check for:</p> <ul style="list-style-type: none"> <li>• High gas pressure</li> </ul>
<p style="text-align: center;">HARD SHARP FLAME</p> 	<p>This flame is characteristic of manufactured gas</p> <p>Check for:</p> <ul style="list-style-type: none"> <li>• High gas pressure</li> <li>• Orifice too small</li> </ul>

### Control Module Flame Sensor Circuit.

The control module provides AC power to the igniter/sensor that the pilot burner flame rectifies to a direct current. If the flame signal back the control module is not at least 1.0  $\mu\text{A}$  DC, the system will lockout. The output of the flame sensing circuit cannot be checked directly, so check the flame sensing circuit indirectly by checking the flame sensing current from the igniter/sensor to the control module as follows:

1. Connect a meter (DC micrometer scale) in a series with the flame signal ground wire (Burner Ground Terminal). Disconnect the ground wire at the control module. Connect the red (positive) lead of the meter to the free end of the ground wire. Connect the black (negative) meter lead to the quick-connect ground terminal on the control module.
2. Restart the system and read the meter. The flame sensor current must be at least 1.0  $\mu\text{A}$ , and the reading must be steady. If the reading is below the value designated or the reading is unsteady, check the pilot flame and electrical connection. Also, replace the igniter/sensor if the ceramic insulator is cracked.



# G77x INTERMITTENT PILOT CONTROLS



## Application Requirements

The following are the application requirements of the G77x control.

- The G77x can be used on gas-fired equipment with a maximum firing rate of 117kW (400,000 BTU/Hr). Any application over 117kW (40,000 BTU/Hr) must have written approval in advance from the Johnson Controls Heating Products Engineering Department.
- All G77x applications must use a redundant gas valve system where the pilot and main valve seats are in series and opened in sequence for intermittent pilot ignition.

## Operating Mode Definitions

The following definitions describe operating conditions.

- *Prepurge*: Initial time delay between thermostat contact closure and trial for ignition.
- *Trial for Ignition*: Period during which the pilot valve and spark are activated, attempting to ignite gas at the pilot burner. The control attempts to prove flame at the pilot burner within the trial-for-ignition time.
- *Run*: Pilot and main gas valves remain energized and spark is turned off after successful ignition.
- *100% Shutoff*: For controls with automatic recycle, pilot gas did not ignite within the trial-for-ignition time. The control de-energizes the spark circuit and pilot valve.
- *Automatic Recycle*: If shutoff occurs, the control delays for a specific recycle delay period before beginning another trial for ignition (models with recycle only).
- *Interpurge*: Period between trials for ignition when both the gas valve and spark are deactivated to allow unburned gas to escape before the next trial. Interpurge occurs between unsuccessful trials on a multi-trial control or after a flameout (if the control has an interpurge).

- *Ignition Lockout*: Pilot gas did not ignite within the final trial-for-ignition time. Open thermostat contacts for 30 seconds, then close to restart the sequence of operation. (Models with an optional LED will flash the LED to indicate ignition lockout.)
- *Flameout*: Loss of proven flame.
- *Hard Lockout*: The control detected a fault. Open thermostat contacts for 30 seconds, then close to restart the sequence of operation. (Models with an optional LED will turn off the LED to indicate a hard lockout.)

## Sequence of Operation

Figure 2 illustrates the sequence of operation of the G77x control.

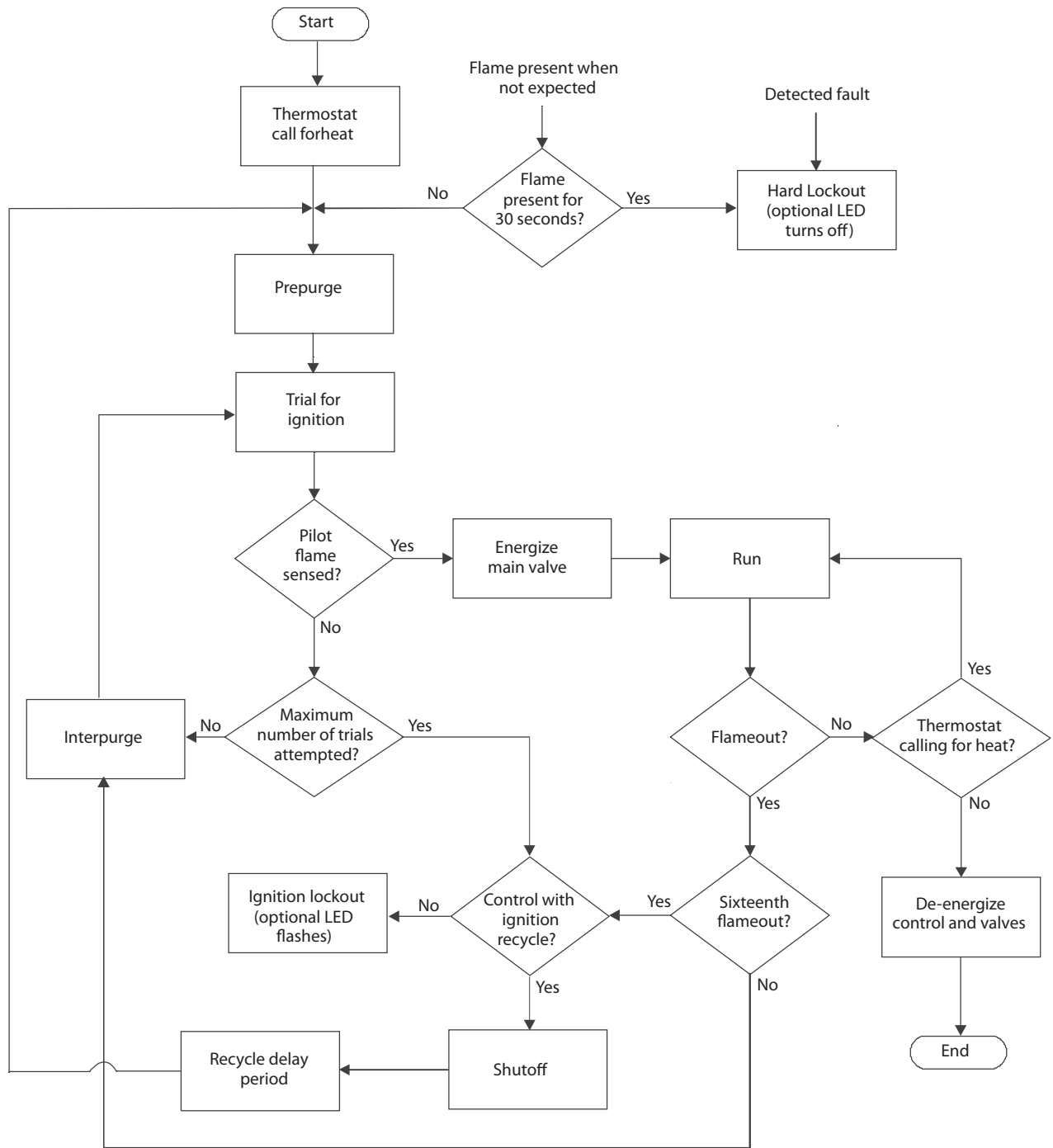
The control is energized on a call for heat from the system thermostat. (Models with an optional LED will turn on the LED [steady on] until the call for heat is satisfied.) The vent damper, if used, is energized and when fully opened, also energizes the ignition control. If the control is equipped with the optional prepurge, the appliance prepurge fan or relay is also energized through the thermostat contacts. In the prepurge mode, the control will delay for the time selected (e.g., 15 seconds) before simultaneously opening the pilot valve and supplying a continual spark at the pilot burner. If prepurge is not selected, the pilot valve is opened and spark initiated within one second after the call for heat.

Under normal conditions, the pilot burner gas ignites within the trial-for-ignition time (e.g., 8 seconds), the pilot flame sensor detects pilot flame and signals the control to energize the main valve. The main gas valve will not be energized until the flame sensor detects the presence of pilot flame. The spark will continue until flame is sensed at the pilot burner or the trial-for-ignition time has elapsed, whichever occurs first. If the pilot flame is not sensed before the end of the trial-for-ignition time, the control may:

- proceed to interpurge, followed by another trial (three trial models whose first two trials produced no flame).
- proceed to a lockout (no automatic recycle models whose final trial produced no flame).
- proceed to a recycle delay period followed by another trial (automatic recycle models whose final trial produced no flame).



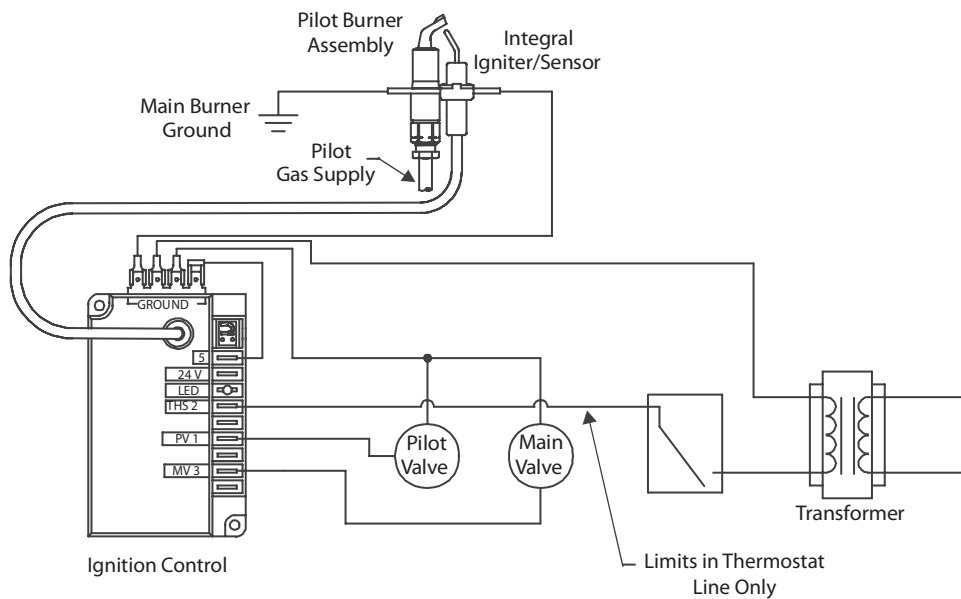
**Figure 2**



If the pilot burner flame extinguishes during the run state (flameout), the control de-energizes the pilot and main gas valve for the interpurge period. After this period, another trial for ignition is initiated. If the flameout cycle repeats for a total of 16 times (pilot burner flame established then lost), the control will:

- Enter the lockout mode if the control is a G770/G777. The thermostat contacts must be opened for 30 seconds and then closed to escape the lockout condition.
- Enter the shutoff mode and recycle period (5 minute recycle delay for the G775/G779 and 60 minute recycle for the G776/G778) before beginning another trial for ignition, starting with prepurge.

### Wiring Diagram For Integral Spark/Sense Without Vent Damper



# G76X DIRECT SPARK IGNITION CONTROLS



## Application Requirements

Following are the application requirements of the G76x control.

- The G76x can be used on gas-fired equipment with a maximum firing rate of 117 kW (400,000 Btu/hr). Any application greater than 117 kW (400,000 Btu/hr) must have written approval in advance from the Johnson Controls Heating Products Engineering Department.
- All G76x applications must use a redundant gas valve system where the main valve seats are in series and open simultaneous for direct spark burner ignition.

## Operating Mode Definitions

The following definitions describe operating conditions:

- *Prepurge*: Initial time delay between thermostat contact closure and trial for ignition.
- *Trial for Ignition*: Period during which the main valve and spark are energized in an attempt to ignite gas at the main burner. The control attempts to prove flame at the main burner within the trial-for-ignition time.
- *Run*: Main gas valve remains energized and the spark is turned off after successful ignition.
- *100% Shutoff*: For controls with automatic recycle, main gas did not ignite within the trial-for-ignition time. The control de-energizes the spark circuit and main valve.
- *Automatic Recycle*: If 100% shutoff occurs, the control delays for a specific recycle delay period before beginning another trial for ignition. (Models with recycle only.)

- *Interpurge*: Period between trials for ignition when both the gas valve and spark are deactivated to allow unburned gas to escape before the next trial. Interpurge occurs between unsuccessful trials on a multi-trial control or after a loss of proven flame (flameout).
- *Ignition Lockout*: Main gas did not ignite within the final trial-for-ignition time. Open the thermostat contacts for 30 seconds, then close to restart the sequence of operation. (Models with an optional LED will flash the LED to indicate ignition lockout.)
- *Flameout*: Loss of proven flame.
- *Hard Lockout*: The control detected a fault. Open the thermostat contacts for 30 seconds, then close to restart the sequence of operation. (Models with an optional LED will turn off the LED to indicate a hard lockout.)

## Sequence Of Operation

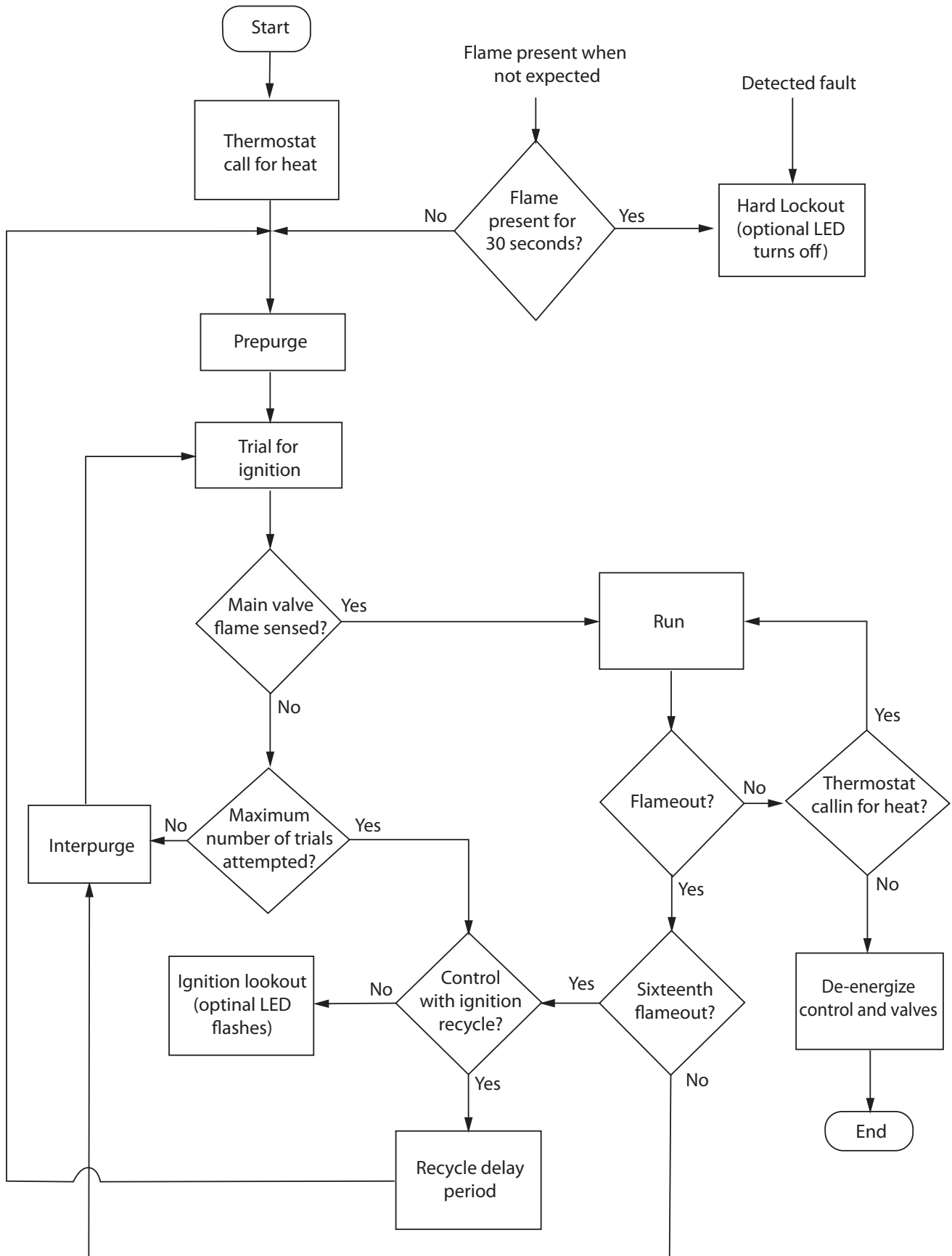
Figure 3 illustrates the sequence of operation of the G76x control.

The control is energized on a call for heat from the system thermostat. (Models with an optional LED will turn on the LED [steady on] until the call for heat is satisfied.) If the control is equipped with the optional prepurge, the control will delay for the time selected before initiating a trial for ignition. During the trial for ignition, the control attempts to light the main burner by simultaneously energizing the main gas valve and supplying a continuous spark at the igniter electrode. If the optional prepurge is not selected, then the trial for ignition begins within one second after the call for heat. The spark is deactivated immediately following the trial for ignition.

Under normal conditions, the main burner gas ignites within the trial-for-ignition time. If the control senses main burner flame by the end of the trial, the control proceeds to a run condition. During the run state, the control energizes the main valve until the call for heat ends, or until a flameout occurs. If main burner flame is not sensed by the end of the trial-for-ignition time, the control may:

- Proceed to a 30-second interpurge followed by another trial (three trial models whose first two trials produced no flame)
- Proceed to a lockout (no automatic recycle models whose final trial produced no flame)
- Proceed to a recycle delay period followed by another trial (automatic recycle models whose final trial produced no flame)

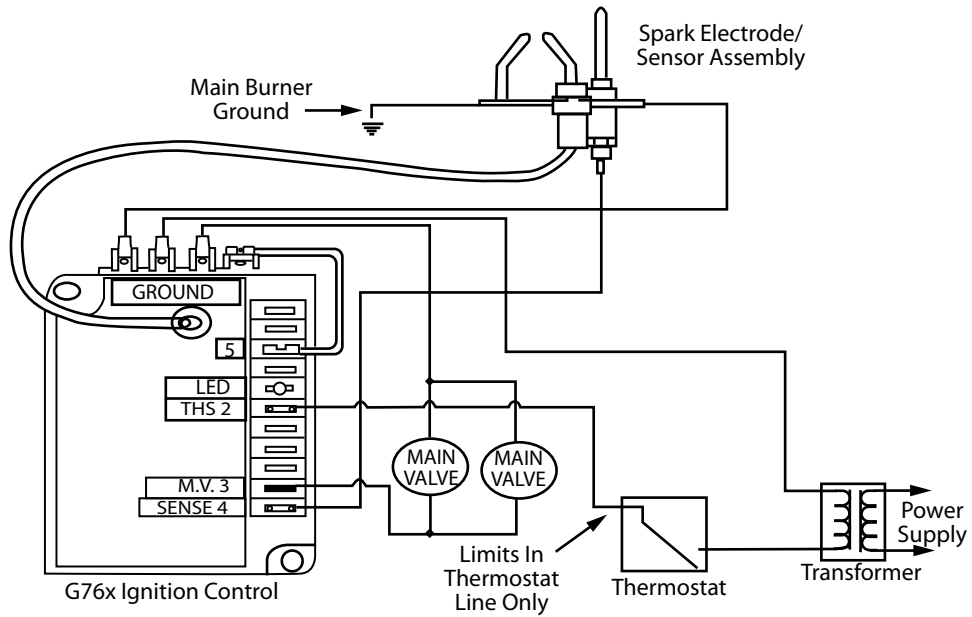
**Fig 3 Sequence of Operation**



If the main burner flame extinguishes during the run state, the control de-energizes the main gas valve for an interpurge of 30 seconds. After this period, another trial for ignition is initiated. If this flameout cycle repeats for a total of 16 times (main burner flame established, then lost), the control will:

- Enter the lockout mode if the control is a G760. The thermostat contacts must be opened for 30 seconds and then closed to escape the lockout condition.
- Enter the 100% shutoff mode and recycle period (5 minute recycle delay for the G765 and 60 minute recycle delay for the G766) before beginning another trial for ignition, starting with prepurge.

### Wiring Diagram for G76x Ignition Control







# Section Three

# Temperature

# Calibration



# GENERAL CALIBRATION

## Instrumentation

A thermocouple type test instrument is preferred for measuring oven temperatures accurately. Mercury thermometers are acceptable providing they can be proven accurate.

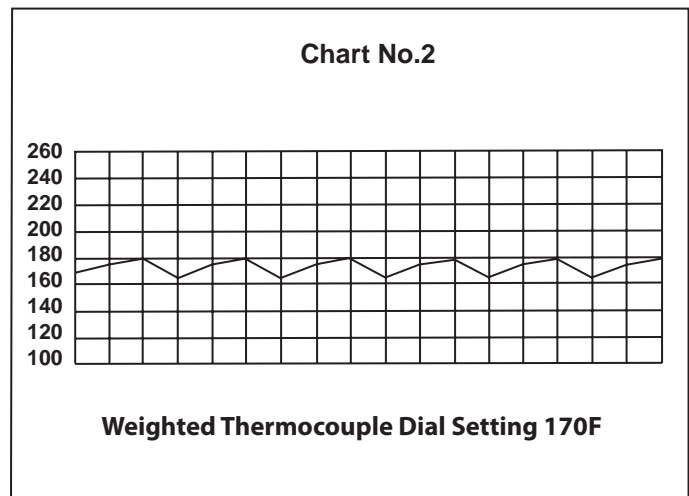
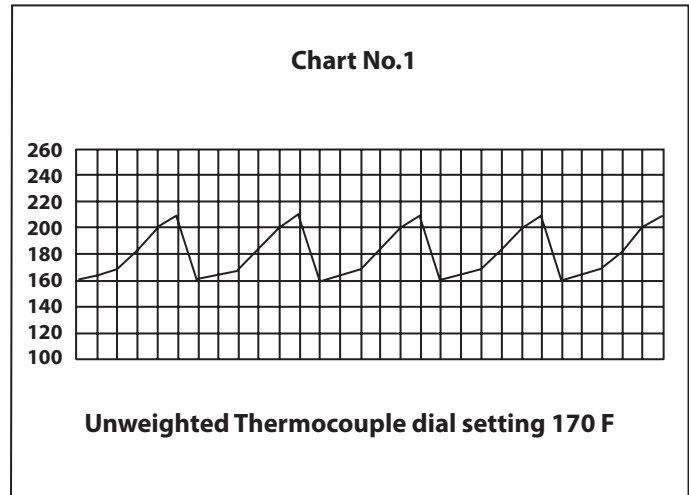
Regardless of the type instrument used, it is most desirable to double-check it just before making an oven temperature check. This can be done simply and quickly by placing the thermocouple tip (or immersing the entire mercury thermometer) in boiling water. Note: Mercury oven thermometers should be the "Total immersion type." The resulting reading should be within several degrees of 212°F, depending on the altitude.

Generally, a mercury thermometer can drop and excess of 25° F when the doors are opened to check oven temperature. This condition makes it extremely difficult to get a true temperature reading.

Almost all convection ovens today have oven burners which cycle "on and off" The high and low points of the resulting temperature "swing" (differential) in the oven must be measured- and averaged- to determine the true operating temperature. A thermocouple type test instrument is best suited to measure these temperature changes quickly and accurately, and without opening the oven door.

With an accurate, thermocouple test instrument or mercury thermometer, it is still difficult to measure these changing oven temperatures and then, average correctly. This is why we recommend that the thermocouple tip or the bulb of the thermometer be "weighed" Weighing (adding mass) to the test instrument compensates for oven temperature changes making the test instrument less sensitive to these constant changes in temperature. Note: How this weighting can be done is discussed later.

Measuring these changing high and low temperature points in an oven is possible with either type of test device with out weighing, but is subject to possible inaccuracies. This is most true at a low temperature setting because, in this area, the function of "time" becomes a factor. The simple averaging of temperatures then may not produce the true operating temperature. "Weighing" provides the compensation for both time and temperature that is necessary. We produced test curved showing actual results in the low temperature area showing the difference in results when using an unweighted and weighted thermocouple or thermometer. Tests were made with the same control, same oven and dial set at 170° mark (not moved).



From the above, it can be seen that an error of 15°F is possible. Chart #1, unweighted thermocouple indicates an erroneous average oven temperature of 185°F, Chart #2 weighted thermocouple indicates the "average" or true temperature to be 170°F.

## Weighing of Thermocouple

A thermocouple can be weighted by clamping the tip between two one inch square 1/16" inch thick aluminum. The thermocouple can also be weighted (just as successfully) by using a letter sized sheet of aluminum foil. Fold the foil five times doubling the thickness each fold. After the fifth fold, place the thermocouple tip in the center of the aluminum piece and fold once more. Finally fold in the sides so that the foil clings to the thermocouple tip. A mercury thermometer can be weighted in much the same way by wrapping several layers of aluminum foil around the bulb end thus creating the necessary mass. This procedure is a must if you open the door to check the temperature.



## Resistance Vs. Temperature Chart For Internal Oven Temperature Sensor

The Chart below will provide the Ohms at various temperatures. This will enable you to determine if the temperature probe is operable.

The chart is in degrees Fahrenheit.

TEMP	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	932	953	974	995	1016	1038	1059	1080	1101	1122
100°	1143	1163	1184	1205	1226	1247	1267	1288	1309	1329
200°	1350	1370	1391	1411	1432	1452	1472	1493	1513	1533
300°	1553	1574	1594	1614	1634	1654	1674	1694	1714	1733
400°	1753	1773	1793	1813	1832	1852	1871	1891	1911	1930
500°	1949	1969	1988	2008	2027	2046	2065	2085	2104	2123

## 200 & 300 SERIES CONTROLLERS CALIBRATION

Both the 200 & 300 series controllers use a 0 to 10.25k OHM potentiometer. First check the sweep on the potentiometer between the middle wire and one of the outside wires for a gradual increase or decrease in the resistance as the potentiometer stem is turned.

### Gas Units – Calibration 300 Series

1. Remove the temperature dial from the potentiometer.
2. Turn the potentiometer to its lowest setting (fully counter clock-wise).
3. Place the temperature dial back on the potentiometer.
4. Align the mark on the temperature dial to the top left edge of the 'F': on the left of the temperature dial and snug down one of the set screws. DO NOT fully tighten yet.
5. Set the temperature dial to 150°F and allow the oven cavity for reach set temperature.
6. Confirm the temperature inside the oven cavity with you meter and that shown on the temperature dial.

7. If an adjustment is required, loosen the set screw and position the mark on the temperature dial to the temperature shown on your meter.
8. Tighten set screw down.
9. Repeat as required (once is usually enough).
10. Fully tighten both set screws.

### Gas Units – Calibration 200 Series

1. Remove the temperature dial from the potentiometer.
2. Turn the potentiometer to its highest setting (fully clock-wise).
3. Place the temperature dial back onto the potentiometer.
4. Align the mark on the temperature dial 1/4" PAST the 500°F marking on the overlay and snug down one of the set screws. Do NOT fully tighten yet.
5. Set the temperature dial to 159°F and allow the oven cavity to reach set temperature.

6. Confirm the temperature inside the oven cavity with your meter and that shown on the temperature dial.
7. If an adjustment is required, loosen the set screw and position the mark on the temperature dial to the temperature shown on your meter.
8. Tighten set screw down.
9. Repeat as required (once is usually enough).
10. Fully tighten both set screws.

### **Electric Units – Calibration 300 Series**

1. Remove the temperature dial from the potentiometer.
2. Turn the potentiometer to its lowest setting (fully counter clock-wise).
3. Place the temperature dial back on the potentiometer.
4. Align the mark on the temperature dial to the top left edge of the "F": on the left of the temperature dial and snug down one of the set screws. Do Not fully tighten yet.
5. Set the temperature to 300°F and allow the unit to cycle 3 times.
6. Confirm the temperature inside the oven cavity with your meter and that on the temperature dial.
7. If adjustment is required, loosen the set screw and position the mark on the temperature dial to the temperature shown on your meter.
8. Tighten set screw down.
9. Repeat as required (once is usually enough).
10. Fully tighten both set screws.

### **Electric Units – 200 series**

1. Remove the temperature dial from the potentiometer.
2. Turn the potentiometer to its highest setting (fully clock wise).
3. Place the temperature dial back on the potentiometer.
4. Align the mark on the temperature dial 1/4" PAST the 500°F marking on the overlay and snug down one of the set screws. Do NOT fully tighten yet.
5. Set the temperature to 300°F and allow to cycle 3-times.
6. Confirm the temperature inside the oven cavity with your meter and that on the temperature dial.
7. If adjustment is required, loosen the set screw and position the mark on the temperature dial to the temperature shown on your meter.
8. Tighten set screw down.
9. Repeat as required (once is usually enough).
10. Fully tighten both set screws.



# Section Four

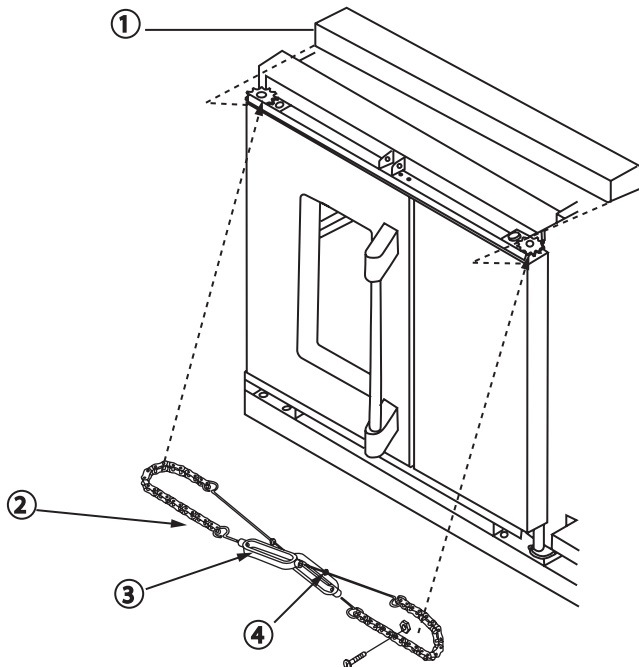
# Convection Oven

# Components



# DOORS

## To Remove Doors From Oven



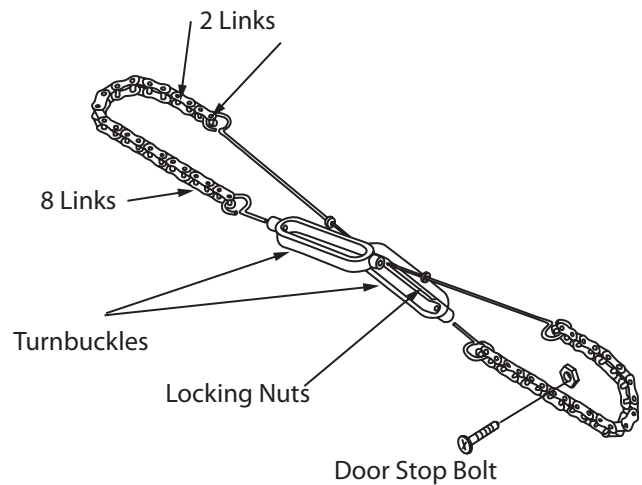
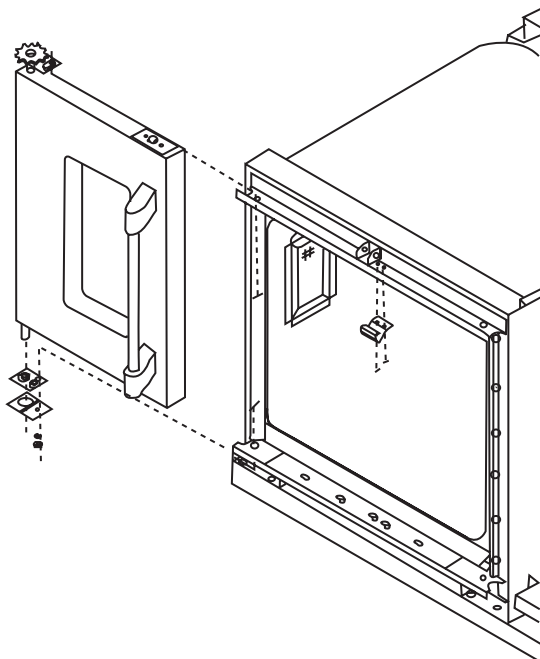
1. Remove top front cap veneer.
2. Remove door chain assembly (Note: The "A" model does not come equipped with door chain).
3. Remove flat head metal screw 1/4"-2-x1/2" from bearing retainer.
4. Push the door toward the hinge and lift up. NOTE: The bottom bearing retainer will stay in place.
5. Remove the right door in the same manner.

## To Reinstall Doors onto Convection Oven

1. Reverse procedure above.
2. Close doors.
3. Reinstall the door chain.

## Installing and Adjusting Door Chain

1. Make sure two links are between sprocket and door rod, and there should be 8 regular links plus one master link on the forward side of each chain.
2. Tighten up the buckles, the right door should close approximately 1/2" before the left door.
3. Secure the turnbuckles by tightening the lock nuts.

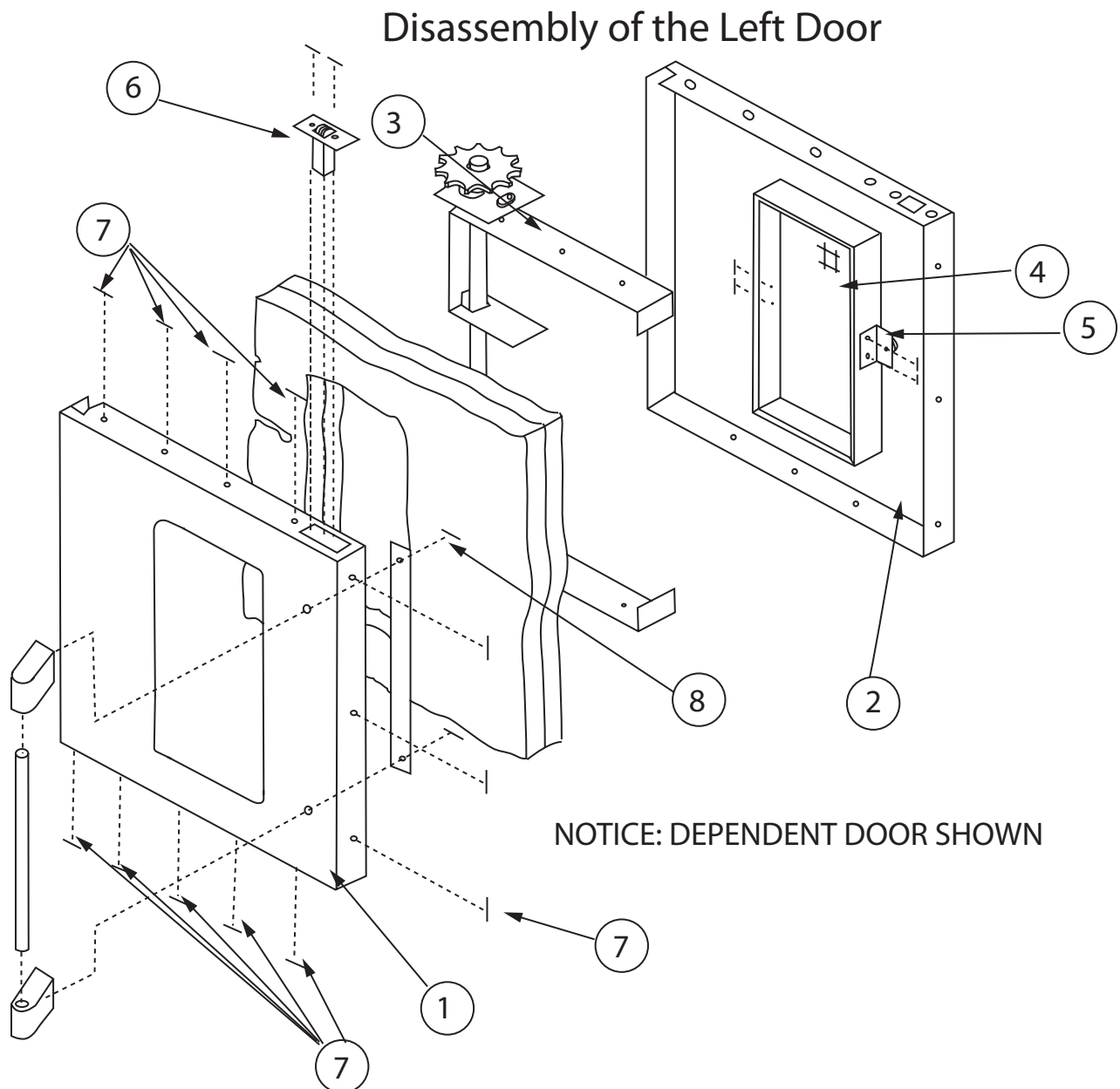


## Disassembly Of The Left Door

1. Once the door has been removed from the oven (refer to previous instructions), remove the 12 truss head 10 x 1/2 Phillips screws.
2. Remove 2 allen head cop screws from the door handle.
3. Carefully pry off the door panel from the door window bezel.
4. Remove 2 hex head m.s. 1/4-20x1/2 from the door liner that attach hold down straps to the door liner.
5. Lift out the door frame.

6. Carefully pry off the door window for the door liner.
7. To remove the door catch remove 2 pan head Phillips screws.
8. To reassemble – reverse the above procedure.

NOTE: There is a seam on one side of the bezel that is part of the door window, reinstall working from the opposite side of that the seam is on and work around the window towards that seam.



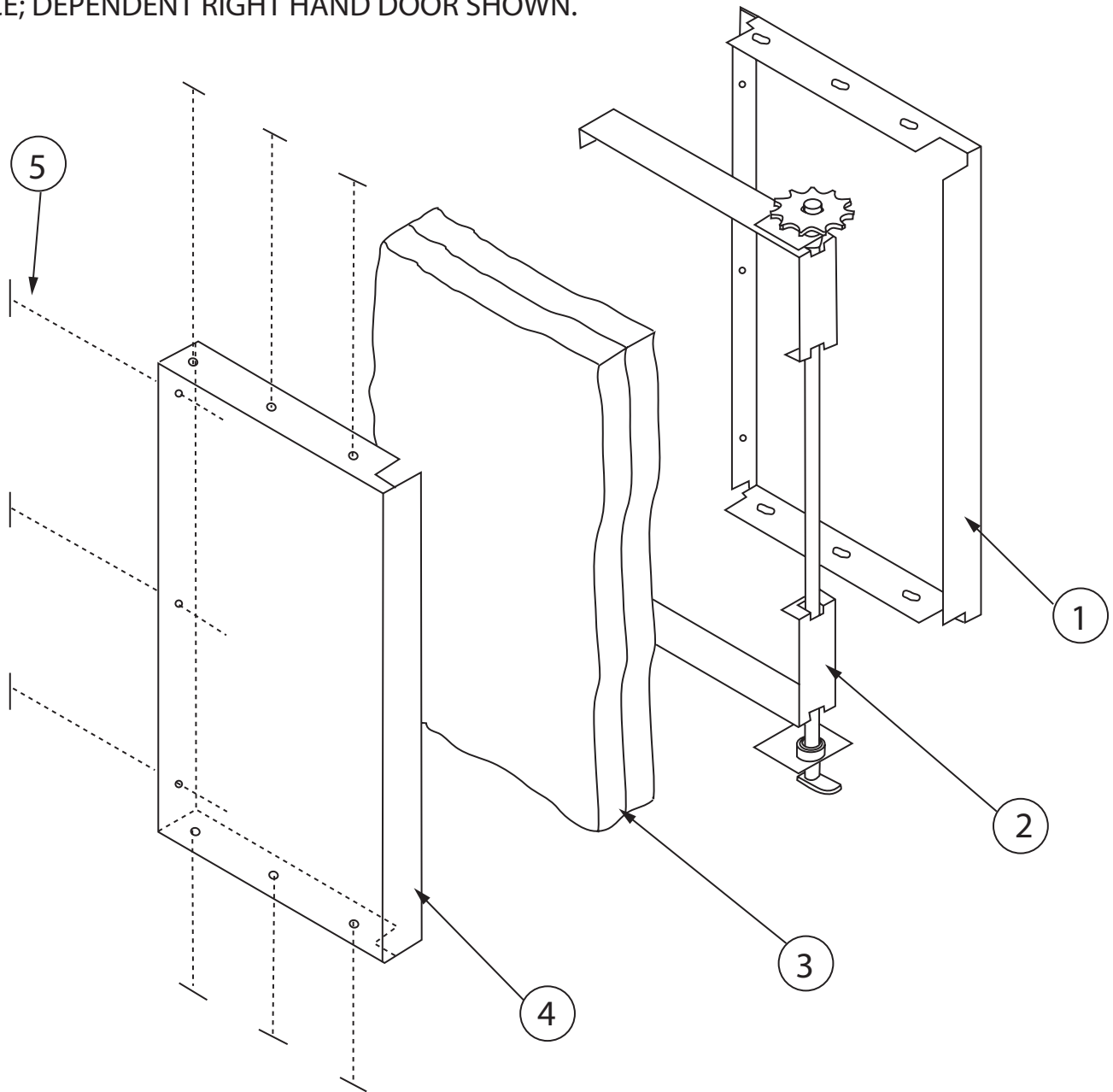
### Disassembly of the Right Door (w/o window)

1. Once the door has been removed from the oven (See previous section), remove 9 truss head s.m.s. 10 x 1/2 from the top, bottom and left side (as shown) from the door panel.

2. Pry the door liner apart from the door panel. This will expose the door frame.  
3. To reassemble, reverse the above procedure.

## Disassembly of the Right Door (w/o window)

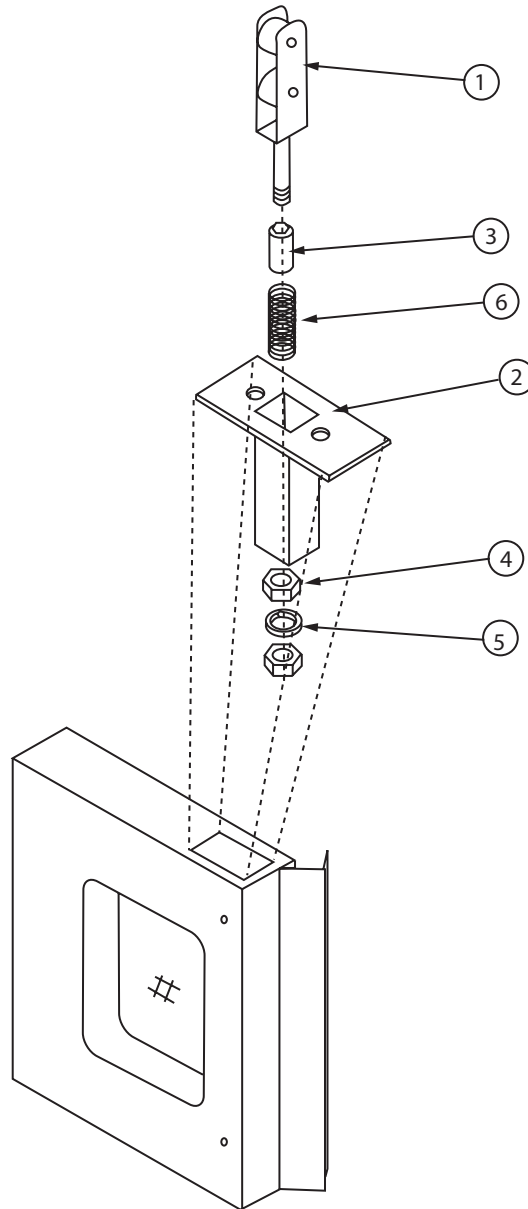
NOTICE; DEPENDENT RIGHT HAND DOOR SHOWN.



# DOOR LATCH MECHANISM

## To Replace Or Adjust The Door Latch Mechanism

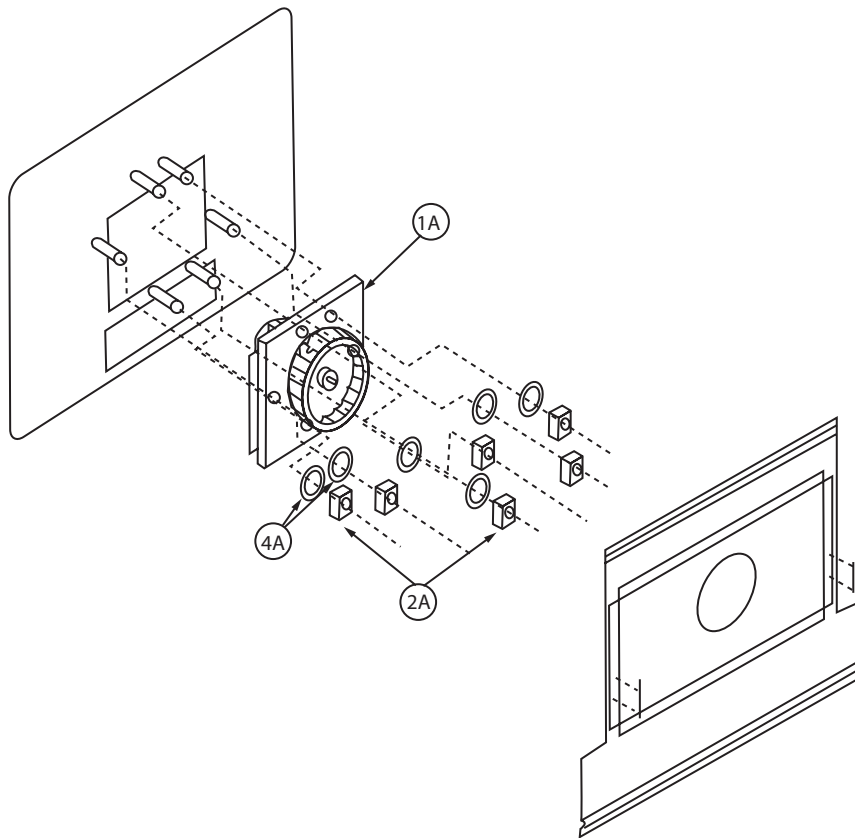
1. Open the oven doors.
2. Remove 2 pan head Phillips screws.
3. Lift door latch mechanism up and out of the door assembly.
4. To adjust the latch mechanism, loosen lock nut & adjust by tightening or loosening the adjustment nut.



# MOTOR

## To Replace Convection Oven Motor Assembly

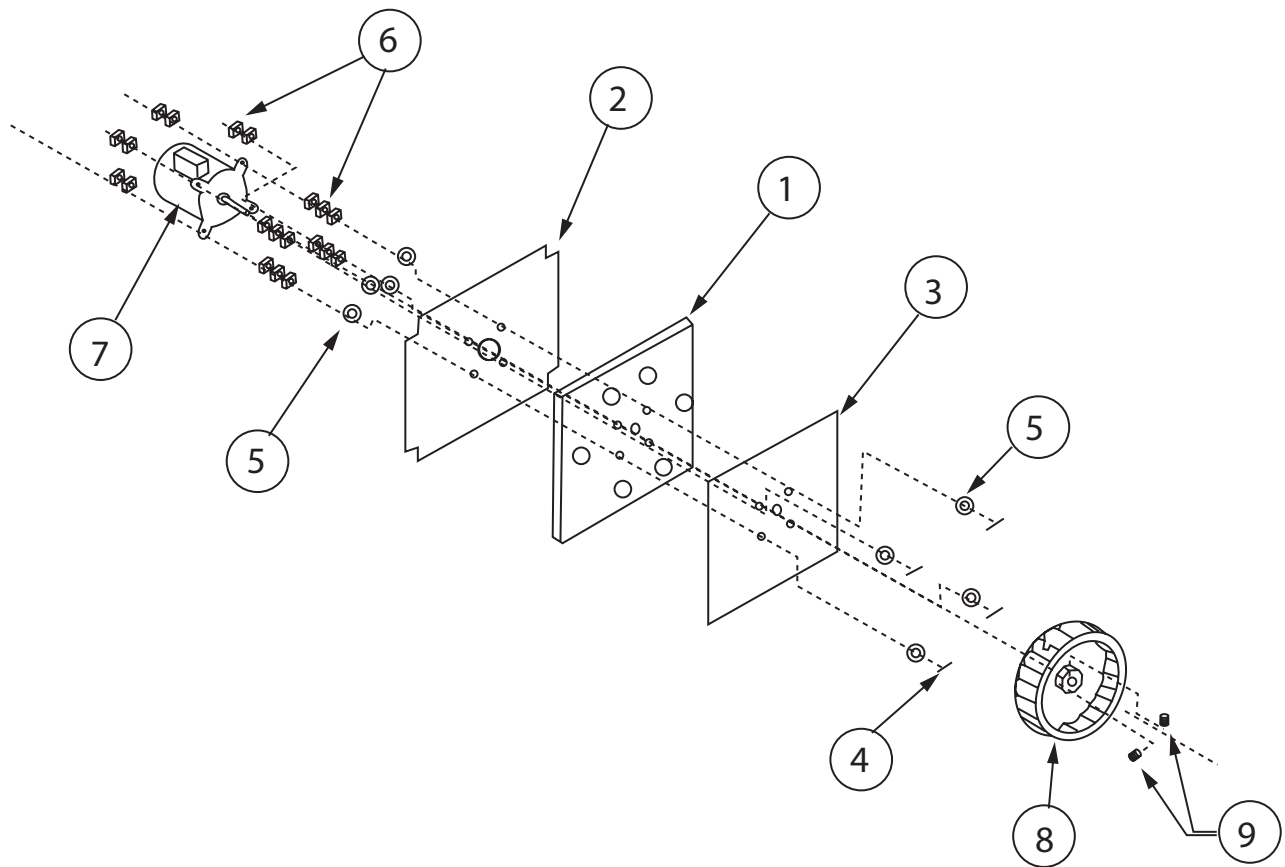
1. Open doors and remove all oven racks.
2. Remove 4 #10 sheet metal screws (that secure the air baffle) and remove air baffle.
3. Remove six hex nut 1/4-20x7/16" (2A) and lock washers (4A) from the motor mounting studs.
4. Place a piece of cardboard on the oven floor to protect from scratching or chipping.
5. Pull the entire motor assembly (1A) away from the rear oven wall into the oven cavity and place on cardboard.
6. Disconnect wiring, be sure to note wire locations.
7. To reinstall reverse the above procedure.



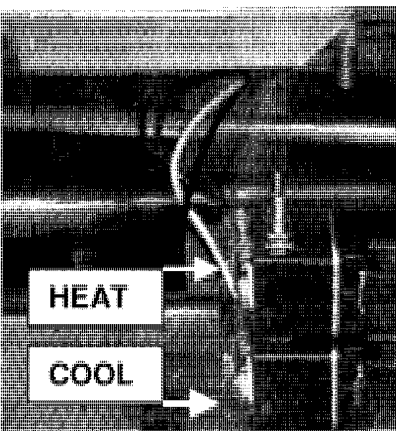
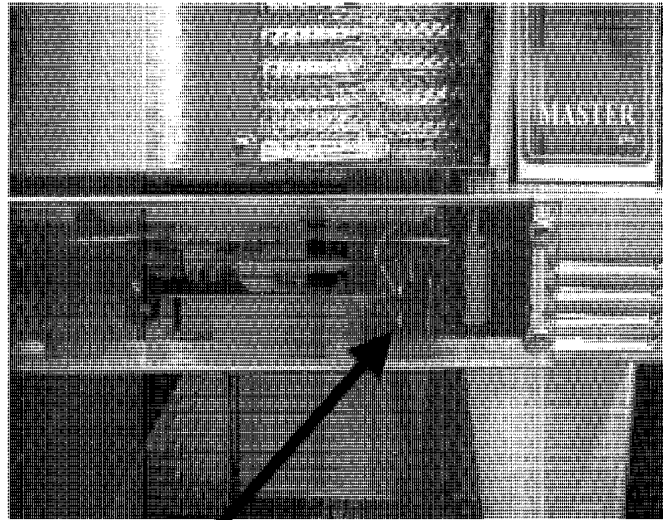


## Convection Oven Motor Assembly

1. Assemble the motor mount plate, insulation, and motor mount plate inner together by fastening four flat head m.s. 1/4-20x2 1/2" into the four holes noted on the above drawing.
2. Secure each flat head m/s/ 1/4-20x2 1/2" with a flat washer and three hex nuts 1/4-20.
3. Attach the motor mounting plate to the motor. Insert the four flat head m.s. 1/4-20x2 1/2" though the mounting tabs on the motor as shown. Secure with two hex nuts 1/4-20.
4. Insert the shaft of the motor through the hub of the blower wheel. Space the wheel 1/4" away from the inner motor mounting plate.
5. Secure the blower wheel to the shaft of the motor by tightening the two set screws on the blower wheel hub. Use a torque wrench and tighten to 180 inch pounds for proper securing.



# DOOR MICROSWITCH



## Upper micro switch "Heat"

- BROWN wire goes from normally open door switch to terminal T3 on the relay board.
- BLUE wire goes from the common on the door switch to terminal T4 on the relay board.

## Lower micro switch "Cool"

- BLACK wire goes from normally open door switch to terminal T6 on the relay board.
- WHITE wire goes from common on the door switch to terminal T5 on the relay board.

# PROBES

## Oven Cavity Probe

Resistance vs. Temperature Chart For Internal Oven Cavity Temperature Sensor.

The chart below will provide the Ohms at various temperatures. This will enable you to determine if the temperature probe is operable.

The chart is degrees Fahrenheit.

TEMP	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	932	953	974	995	1016	1038	1059	1080	1101	1122
100°	1143	1163	1184	1205	1226	1247	1267	1288	1309	1329
200°	1350	1370	1391	1411	1432	1452	1472	1493	1513	1533
300°	1553	1574	1594	1614	1634	1654	1674	1694	1714	1733
400°	1753	1773	1793	1813	1832	1852	1871	1891	1911	1930
500°	1949	1969	1988	2008	2027	2046	2065	2085	2104	2123

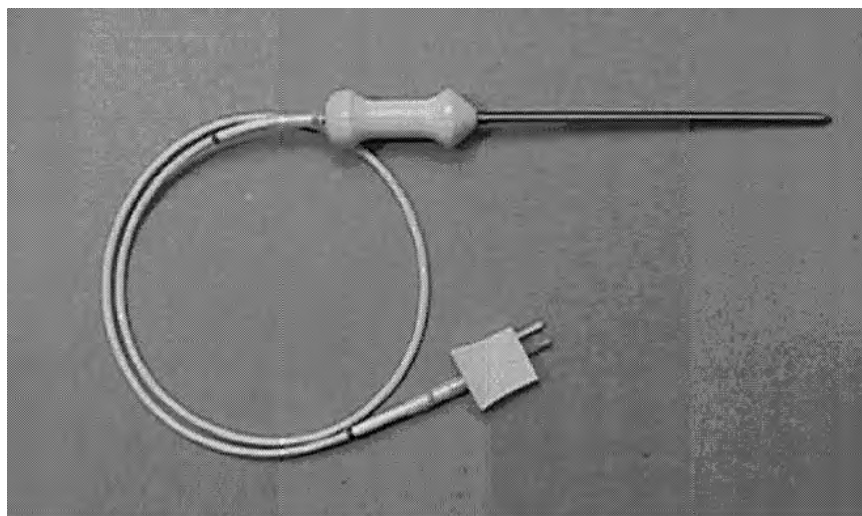
## Cavity Core Probe (455 Only)

Resistance Readings

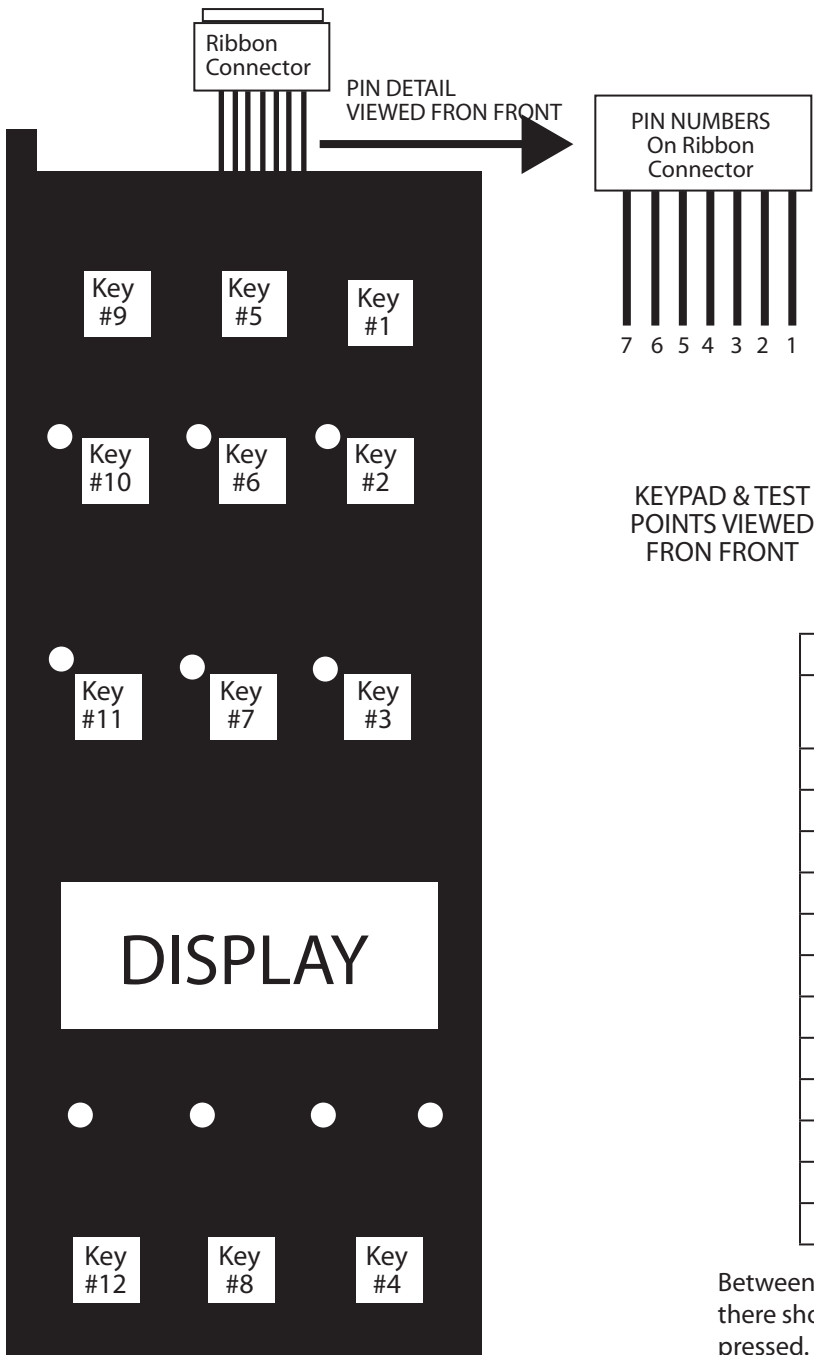
77°F	=	1000 ohms
100°F	=	1103 ohms
200°F	=	1350 ohms
300°F	=	1554 ohms
350°F	=	1654 ohms
400°F	=	1753 ohms

NOTE: If the cavity core probe is used, the core probe Led will be lit on the control panel, the temperature of the product will be displayed if the product is about 32°F.

The programmed range for the core probe is 100°F to 200°F.



# KEY PAD TEST



PIN- OUT TEST POINTS		
Key #	PIN-OUTS	<u>OVERLAY MARKINGS</u>
1	1 & 4	SET BACK
2	1 & 5	COOL DOWN
3	1 & 6	PROGRAM
4	1 & 7	ACTUAL TEMP
5	2 & 4	CAVITY LIGHT
6	2 & 5	FAN LOW
7	2 & 6	COOK / HOLD
8	2 & 7	SET
9	3 & 4	ON / OFF
10	3 & 5	FAN HIGH
11	3 & 6	PULSE
12	3 & 7	START/CANCEL

Between the above pin test points on the ribbon connector, there should be continuity when the corresponding key is pressed.

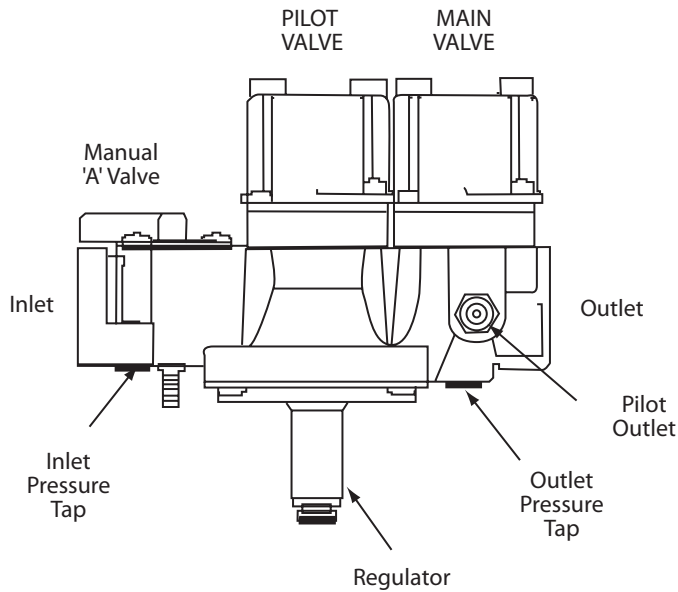
**EXAMPLE:** When Key # 1 is pressed and held, there should be continuity between pins 1 & 4 at the ribbon cable.

**NOTE:** The keypad must be attached to the control panel bezel when tested. The keypad is grounded to the panel to complete the circuit. Disconnect the ribbon connector from the SMART BOARD / CONTROLLER to gain better access to teest points.

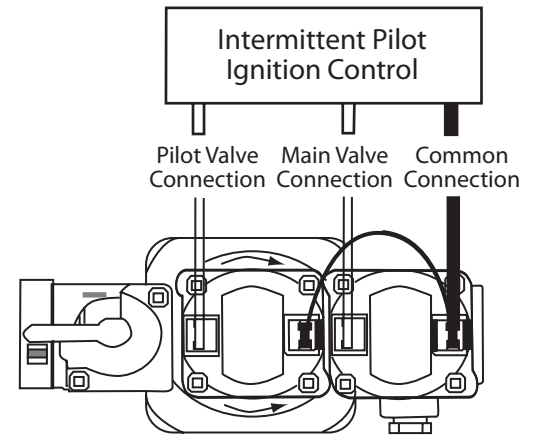
Not all overlays will have the above-indicated markings.

# MCO CONVECTION OVEN GAS VALVE

SIDE VIEW



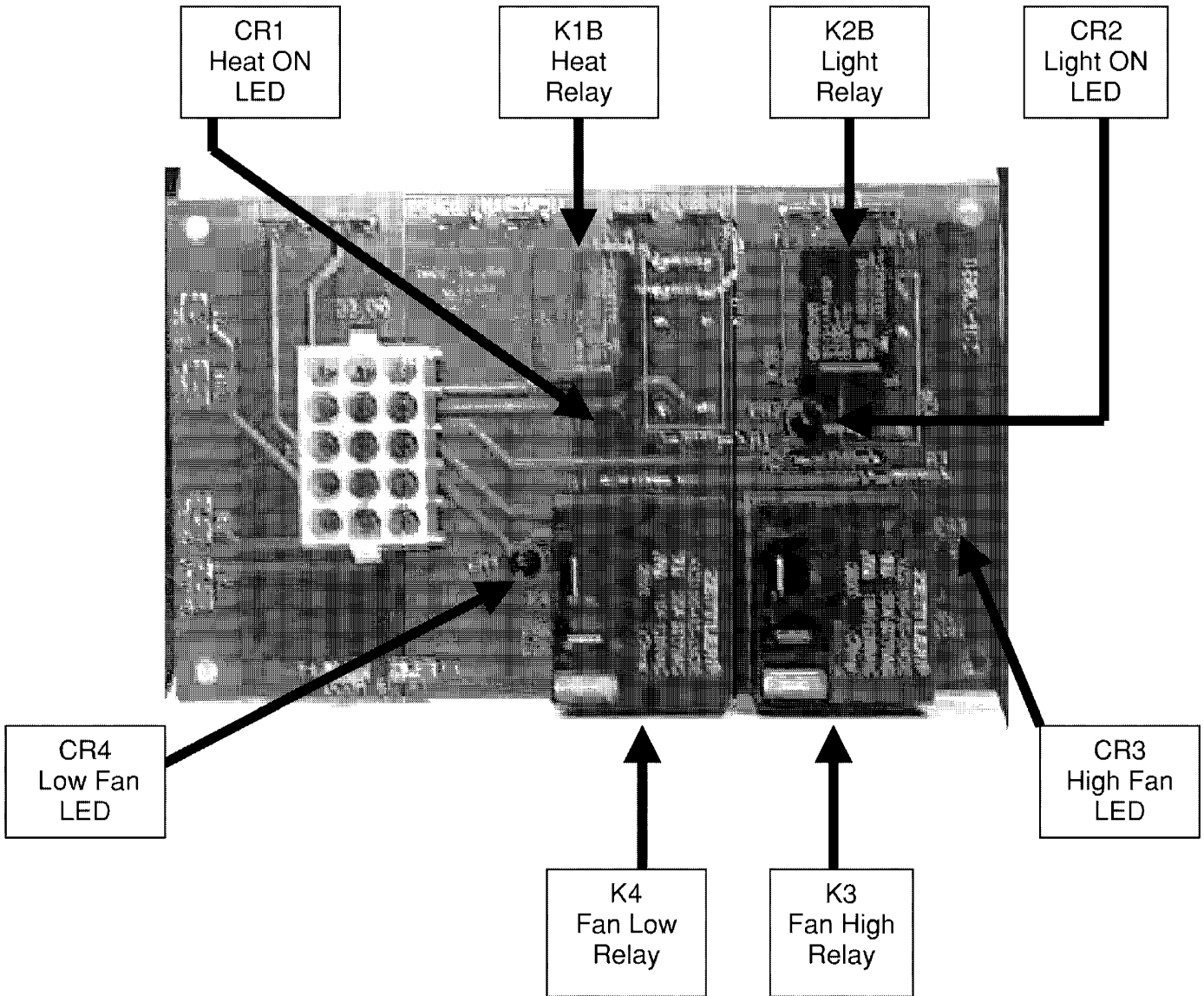
TOP VIEW



## Specifications

Regulator Adjustment Range	3 to 6" WC natural gas 5 to 12" WC propane gas
Maximum Operating Pressure	14" WC both natural & propane gas
Minimum Incoming Pressure	7" WC natural gas 14" WC propane gas

# RELAY BOARDS





## Testing

### Test Points at 15 Pin Molex Connection

Through the back side of the Molex Connection with both the controller and the Relay board connected:

Power to Controller	Pin 1 (white) & Pin 3 (white)	24 v.a.c. $\pm$ 10%
Door Switch SW1 for HEAT (Upper Switch)	Pin 9 (black) & Pin 10 (white/gray)	5 v. a..c. $\pm$ 10%
Door Switch SW2 for COOL (Lower Switch)	Pin 9 (black) & Pin 12 (grey)	5 v. a..c. $\pm$ 10%

### The Next Pin Tests are Key Function Specific

(Criteria: You must activate the switch you are testing)

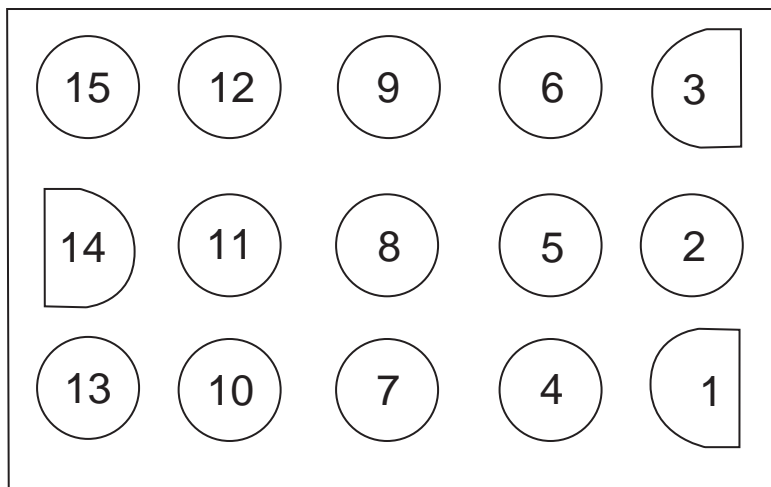
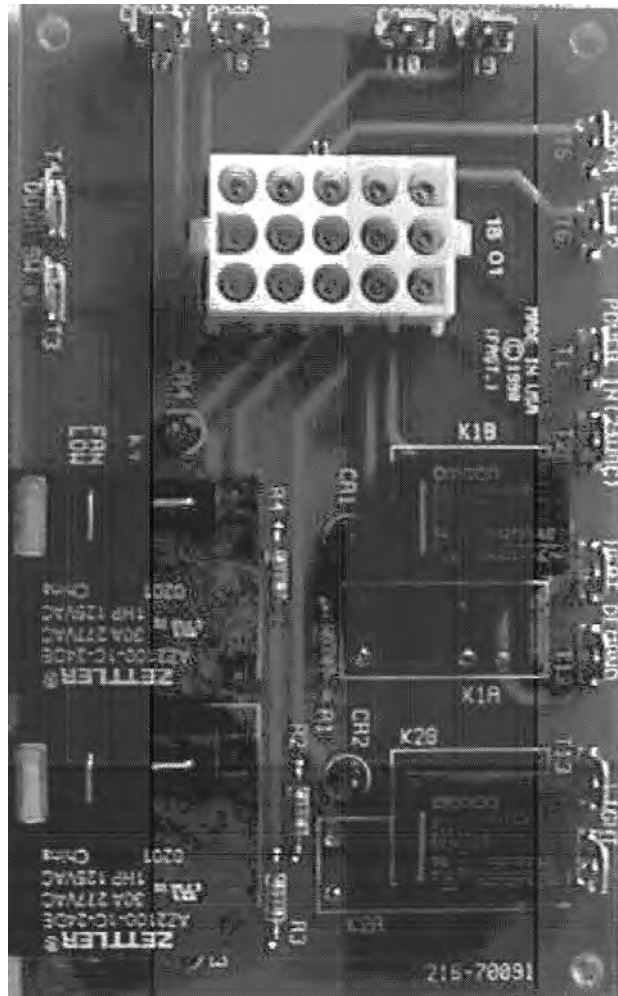
Fan High	Pin 5 (red) & Pin 7 (orange/white)	24 v.a.c. $\pm$ 10%
Fan Low	Pin 5 (red) & Pin 8 (orange)	24 v.a.c. $\pm$ 10%
Heat Demand	Pin 5 (red) & Pen 4 (white/violet)	24 v.a.c. $\pm$ 10%
Oven Light	Pin 5 (red) & Pin 6 (violet)	24 v.a.c. $\pm$ 10%

### The Next tests are Ohm Readings

Criteria: You must disconnect the probes and test probes only.

Cavity probe open (oven)	See RTD chart under Probes this section
Core Probe (meat)	See chart under Probes, this section

# Motor Relay Board





# CONTROLS

## Display Codes – Prompts

<b>OFF</b>	Oven is in the OFF mode.
<b>Lo</b>	Oven cavity temperature is below set point.
<b>Hi</b>	Oven cavity temperature is above set point.
<b>LOAD</b>	Oven cavity has reached set temperature - prompt for operator to load oven.
<b>SETb</b>	Oven has defaulted to factory set back temperature.
<b>Auto</b>	Oven is in 'auto cool down' mode and will remain in auto until cavity temp is below 150°F.
<b>OPEn</b>	Display will toggle from 'OPEN' to 'DOOR' to prompt for operator to open door when unit is in cool down.
<b>Door</b>	
<b>Door</b>	In auto cool down mode, door is open past 30° or in cooking mode, door is opened.
<b>Prob</b>	Open or shorted cavity sensing probe.
<b>HELP</b>	Oven cavity has exceeded 560°F.
<b>CodE</b>	475 controllers, prompt for operator to enter access code from programming 4-2-7-5.
<b>SHLF</b>	475 controllers, prompt for operator to select shelf to be programmed.
<b>PR-2</b>	475 controllers, prompt for operator to program the profile for the second cook time if required.
<b>PRE</b>	475 controllers, prompt for operator to set pre-alarm if required.
<b>HoLd</b>	475 controllers, prompt for operator set the hold temperature the oven is in programmed HOLD temperature.
<b>FAn</b>	475 controller, prompt for operator to se fan speed.
<b>DonE</b>	Oven has completed its cooking cycle.
<b>Cool</b>	Door is open less then 30° in cool down mode.





# Section Five

## Trouble Shooting



# CONTROLLER OPERATIONAL TESTS

For the Garland (US Range) 200(20) – 300(30) – 410(41) – 450(45) – 455(45+) – 470 – 4712 – 475 FAST convection oven controls.

## 200 Series Controller (Thermostat only)

Turn the oven on, the oven should heat to set temperature within 30 minutes. If the oven does not heat, ohm out the probe, at room temperature the probe should read about 1,000 ohms. Ohm the probe at the faston connection. See the chart for other resistance readings. If the probe reads an open or short, replace the defective probe. Check the probe interconnect harness to make sure the circuit is good, connections etc.

The heat relay K1 should be energized when heating the oven and opened if it is not calling for heat.

The fan is not controlled by the controller.

## 300 Series Controller (Thermostat and relay board)

Turn the oven on, the oven should heat to set temperature within 30 minutes. If the oven does not heat, ohm out the probe, at room temperature the probe should read about 1,000 ohms. Ohm the probe at the faston connection. See chart for other resistance readings. If the probe reads an open or short replace the defective probe. Check the probe interconnect harness to make sure the circuit is good, connections, etc.

The heat demand rely K1B should be energized then heating the oven and opened if it is not calling for heat. Look at the heat LED CR1 on the relay board, the LED will be lit when the controller calls for heat. Check the door switch if the heat does not activate. Upper door switch is for HEAT.

The fan can switch from low to high speed. Look at the fan LED on the relay board (there is a low CR4 and a high fan CR30, the LED will be lit when the controller calls for either fan. If the operator cannot switch from one fan speed to another check the keypad. If the light switched on the display from one fan speed to another but the fan did not change speeds check the relay board. If the display switched and the fan went off, check the fan itself.

If the keypad does not respond, check the keypad as outlined in bulletin B-107-2001.

If the potentiometer does not adjust the temperature, check the potentiometer. Pot is a 0 to 10.25K Ohm pot.

## 410 Series Controller (Thermostat, display and relay board)

Turn the oven on, the oven should heat to set temperature within 30 minutes. Press the temperature icon and the temperature can be viewed above 100 degrees F. If the oven does not heat, ohm out the probe, at room temperature the probe should read about 1,000 ohms. Ohm the probe at the faston connection. See chart under Probes in section four for other resistance readings. If the probe reads an open or short replace the defective probe.

The heat demand relay K1F should be energized when heating the oven and opened if it is not calling for heat. Look at the heat LED CR1 on the relay board, the LED will be lit when the controller calls for heat. Check the upper door switch if the heat does not activate.

The fan can switch from low to high speed. Look at the fan LED on the relay board (CR3 LED for high and CR4 for low speed), the LED will be lit when the controller calls for either fan. If the operator cannot switch from one fan speed to another, check the keypad. If the light switched on the display from one fan speed to another but the fan did not change speeds check the relay board. If the display switched and the fan went off, check the fan itself.

If the keypad does not respond, check the keypad as outlined in bulletin B-107-2001. If the encoder does not adjust the temperature, check from idle; press the set function key and adjust the encoder; the display should change accordingly. If it does not, change the encoder.

## 450 Series Controller (Thermostat, display and relay board)

Follow the steps for the 410 controller.

If the display shows a temperature only and the function keys do not operate, check to see if the hold LED is active. Press cancel to deactivate the hold feature and return to the idle mode.

## 455 Series Controller (Thermostat, display and relay board)

Follow the steps for the 410 controller.

If the display shows a temperature only and the function keys do not operate, check to see if the hold or core temp LED is active. Press cancel to deactivate the hold feature and return to the idle mode or remove the core probe to return to idle mode.

## **470 Series Controller (Thermostat, display and relay board)**

Turn the oven on, oven should heat to set temperature within 30 minutes. Press the temperature icon and the temperature can be viewed above 100 degrees F. If the oven does not heat, ohm out the probe, at room temperature the probe should read about 1,000 ohms. Ohm the probe at the faston connection. See chart under Probes in section four for other resistance readings. If the probe reads an open or short, replace the defective probe.

The heat demand relay K1B should be energized when heating the oven and opened if it is not calling for heat. Look at the heat LED CR1 on the relay board, the LED will be lit when the controller calls for heat. Check the door switch if the heat does not activate. Upper door switch is for heat.

The fan can switch from low to high speed. Look at the fan LED on the relay board (CR3 LED for high and CR4 for low speed), the LED will be lit when the controller calls for either fan. If the operator cannot switch from one fan speed to another, check the keypad. If the light switched on the display from one fan speed to another but the fan did not change speeds, check the relay board. If the display switched and the fan went off, check the fan itself.

If the keypad does not respond, check the keypad. As outlined in bulletin B-107-2201

If the encoder does not adjust the temperature check, from idle press the set function key and adjust the encoder, the display should change accordingly. If not, change the encoder.

## **471 Series Controller (Custom configuration of the 470 series)**

Follow the steps for the 470 controller.

## **475 Series Controller (470 version controller with profiles)**

Follow the steps for the 470 controller.

# **CONTROLLER FAULT FINDING**

Unless otherwise stated the faults and trouble shooting are the same for all controllers.

## **DISPLAY FAULT**

Does not apply to 200 and 300 series.

### **Display does not light up**

Check the incoming voltage to the oven

Check for 24 volts AC voltage on pins 1 and 3 of the 15-pin connector

If both check out fine the control board is defective

### **Display does not change.**

Is the colon flashing? If yes, the controller is in hours and minutes not minutes and seconds. Enter programming to change the time. If no, disconnect the power for 2 minutes and reapply power and try to change the time.

If the display still does not change the control board is defective.

### **Display reads....**

"Auto" The controller is in auto cool. The fan will continue to operate until the cavity temperature cools to below 150°F. Then the control will turn off.

"Cool" The controller is in cool. This will happen if the cool down key is depressed and the door is opened to the first door switch only.

"HELP" cavity in excess of 560Deg. F

"Door" 1 of 2 door switches has opened -which one?

"oPEn" prompt for operator to open door during cool down.

"Prob" The controller cannot read the probe. Check to verify the probe is connected, if connected ohm the probe out - see temperature readings.

"Setb" The controller is in setback. This will happen if the setback key is pressed or if setback is active and there as been a non-usage time key. Setback is not active in a cook. Press setback to cancel setbacks.

### Keypad Fault

Does not apply to 200 series.

If the oven will not turn on when the On/Off button is pressed check to verify that the connection to the keypad connector is properly attached to the control board.

If the connector is attached the keypad is defective.

### No Sound Fault

Does not apply to 200 and 300 series

If the oven operates normally but the sound is different, adjust the piezo so that it is not touching any other component. If the oven operates properly but there is no sound, the piezo is defective and replace the control board.

### Door Switch Fault

Does not apply to 200 series.

If Cool down, the fans continuing to work when the door is opened, or the oven does not heat check the door switches. Upper door switch for HEAT, Lower door switch for COOL.

### Fan Fault

Does not apply to 200 series.

If the fan does not operate check the door switches, and the LEDs on the relay board. On the relay board next to the low and high fan relay is an LED that is lit when the fan is engaged (CR3 LED for high and CR4 for low speed). The controller will call for either low or high fan at all times. The pulse fan is the low fan speed that will pulse on for 30 seconds, off for 30 seconds. The heat will always be off when the fan is in the off cycle. If the control is calling for a fan speed and neither fan LED is lit, check the harness and the pins in the harness to verify that neither has been pushed out of it's connector. Check the motor or the fan if the rest of the system seems operating satisfactory.

### No Heat

Does not apply to 200 series.

If the oven does not heat check the door switches, the set temperature and the LED on the relay board. On the relay board next to the heat relay is an LED that is lit when the relay is engaged. If the controller is calling for heat and the, heat LED is not lit, check the harness and the pins in the harness to ensure that neither has been pushed out of it's connector. Check the contactor or gas valve if the rest of the system seems operating satisfactory.

### Potentiometer Or Encoder Fault

Potentiometer- 200 and 300 series. The potentiometer can turn 3/4 of a complete rotation. If the temperature does not change when the potentiometer is turned, (this will take 5 minutes or more) check to see if the potentiometer is connected to the control board. Pot is a 0 to 10.25K ohm.

If the oven only maintains one temperature and the potentiometer is connected the potentiometer is defective.

Encoder series 410,450,455,470,471 and 475 series. The encoder can turn indefinitely. If the temperature display does not change when the encoder is turned, check to see if the encoder is connected to the control board. If the display does not change when a manual temperature is entered the encoder is defective.

### Core Probe Failures

Applies to 455 only.

If the core probe is used, the core probe LED will be lit and the temperature of the product will be displayed if the product is above 32°F. The programmed range for the core probe is 100 to 200 °F.

### Temperature Readings

Room Temperature: 77 °F	=	1000 ohms
100°F	=	1103 ohms
200°F	=	1350 ohms
300°F	=	1554 ohms
350°F	=	1654 ohms
400°F	=	1753 ohms

## ADDITIONAL NOTES

- Note the pins and voltages for the 15 pin connector from control to relay board

Pins 1 & 3 is the power (24 volts-AC  $\pm$  10%)

Pins 4 & 5 is the heat demand (24 volt DC coil)

Pins 6 & 5 is the oven light (24 volt DC coil)

Pins 8 & 5 is the low fan (24 volt DC coil)

Pins 7 & 5 is the high fan (24 volt DC coil)

Pins 9 & 10 are Door Switch 1 (dry contact)

Pins 9 & 12 are Door Switch 2 (dry contact)

Pins 13 & 14 are cavity probe (1654 ohms at 350 F)

Pins 14 & 15 are Core probe (1000 ohms at room temperature)

Note: pin 11 is tied to pin 14

# GENERAL TROUBLE SHOOTING GUIDE

Problem	Possible Cause	Corrective Action
Fan will not run	A. No Power to Unit	A. Turn Power on
	B. No power to motor from relay board	B. Check for voltage from relay board to motor
	C. Micro Switch Not closing	C. Check micro switches
Button on key pad not responding	A. Loose ribbon connection between key pad and smart board	A. Check that ribbon connection from key pad is attached to smart board
	B. Faulty key pad	B. Refer to key pad testing procedure on bulletin #B-107-2001
'Prob' in display	A. Probe disconnected	A. Reattach probe
	B. Probe has failed	B. Confirm ohm resistance of probe. Refer to cavity probe chart for readings.
	C. Check for continuity between probe connection at relay board, probe harness & probe	C. Check for continuity between probe connection at relay board, probe harness & probe
Unit will not shut off	A. Cavity temperature above 150°F	A. Normal operation. Unit will not go to Off until cavity temperature is below 150°F
No HIGH speed but HIGH speed LED is illuminated on key pad	A. Bad relay board	A. CR3 on relay board should be on, if not check for 24VDC $\pm$ 10% at pins 5 & 7 at relay board. If voltage present replace relay board
	B. Bad smart board	B. Check for 24VDC $\pm$ 10% at pins 5 & 7 at relay board. If voltage is not present replace smart board
No LOW speed but LOW speed LED is illuminated on key pad	A. Bad relay board	A. CR4 on relay board should be on, if not check for 24VDC $\pm$ 10% at pins 5 & 8 at relay board. If voltage present replace relay board
	B. Bad smart board	B. Check for 24VDC $\pm$ 10% at pins 5 & 8 at relay board. If voltage is not present replace smart board
Unit will not heat. DOOR shown in display	A. Open circuit on upper door switch	A. Unplug unit from supply. With door closed between NO and COM switch should be open.
	B. With door open to 30° angle switch should be closed	B. With door open to 30° angle switch should be closed
	C. With door open all the way switch should be closed.	C. With door open all the way switch should be closed.
Ignition - Lighting problems	A. Incorrect gas pressure or gas turned off	A. Check incoming gas pressure
	B. Various faults possible	B. Refer to trial and ignition flow chart in Section Two of this manual
Unit will not turn ON when button is pushed, display reads OFF	A. Loose ribbon connection between key pad and smart board	A. Check connection
	B. Faulty key pad	B. Refer to key pad testing procedure on bulletin #B-107-2001
No Display	A. No power to smart board	A. Check for 24 VAC between pins 1 and 3 on smart board. If voltage present check for 24 VAC at pins 1 and 3 at relay board.
	B. No power to relay board	B. Check for 24 VAC into relay board and 24 VAC out of relay board between pins 1 and 3 on relay board



<b>Problem</b>	<b>Possible Cause</b>	<b>Corrective Action</b>
Burners and fan stay on when door is open past 30° opening	A. Loose wire from upper door switch	A. Check connections at door switch and relay board
	B. Shorted upper door switch	B. Replace upper door switch
Fan runs for a period of time, shuts down then comes back on after several minutes	A. Motor has tripped on internal overload	A. Check for a minimum 6" clearance at rear of the unit to a wall or heat source
		B. Check air intake vents on back of motor for obstructions
		C. If problem persists and above have been corrected replace motor assy
Timer slow counting down	A. Timer is in hours/min	A. Refer to operations manual or bulletin #B-19-2001 on how to change from hour/min to min/sec
Temperature out of calibration	A. 400 series controllers	A. Confirm oven cavity temp with resistance change. If out more than 20 OHMS replace probe
	B. 200 & 300 series controllers	B. Calibration can be performed by repositioning temperature dial. See Temperature calibration in manual
	C. Potentiometer defective	C. Check for proper 'sweep' on potentiometer 0.0 to 10.25 KOHMS





# Section Six

## Service Bulletins



## Convection Oven Bulletins

<b>Bulletin #</b>	<b>Bulletin Subject</b>	<b>Date Issued</b>
B-02-2001	Procedure to Return Parts	Jan 11/2001
B-19-2001	410, 450, 455 Controllers	Feb 15/2001
B-50-2001	Full Size Convection Oven Door Bushings	May 08/2001
B-59-2001	US Range Control Panel Service Kits	May 28/2001
B-60-2001	Garland 1/2 Size Control Panel Service Kits	May 28/2001
B-61-2001	Garland Control Panel Service Kits	May 28/2001
B-107-2001	Convection Oven Keypad Test Points	Sep 25/2001
B-110-2001	Full Size Convection Oven Motor Assy Kits	Sep 28/2001
B-148-2001	Convection Oven Keypads	Nov 22/2001
B-18-2002	Convection Oven Controller Troulbeshooting	Feb 14/2002
B-20-2004	Minual Control Panel Conversion Kits	Mar 11/2004
B-26-2004	Convection Oven Thermostats	Apr 05/2004
B-73-2007-S	Rating Plate Motor Return	Aug 21/2007

"A" = American

"C" = Canadian

"B" = Both



## **BULLETIN # B-02-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: January 11, 2001**

### **SUBJECT: Procedure to Return New Unused Parts**

Due to the high volume of new parts being returned and the increasing incidents of used, defective and generic parts being returned as new, we have changed some of our procedures to ensure that we process authorized returns in a more timely manner.

Basically, there are four types of credits that we process (warranty and returns) and they are handled differently. The four types are identified and the process to receive credit is detailed for you.

1. Warranty parts credits, where a service call was initiated by the end user and defective parts were replaced to resolve the service complaint. All warranty claims are to be submitted to the attention of the warranty department. . Defective warranty parts are not to be returned unless specifically requested by a service bulletin and the applicable service bulletin number is to be clearly marked on the outside of the shipping carton. Occasionally, a technical representative will request that a specific part be returned; complete shipping instructions will be provided in these instances. Defective parts are to be stored at the service agency for a period of 60 days after the claim has been paid in case an inspection is required.
2. 90-day parts warranty, where a new part has been deemed defective or failed within the first 90 days of installation. All claims for the 90-day parts warranty are to be submitted to the attention of the parts department. It is necessary to provide the Garland invoice for both the original and the replacement part for the claim to be processed. These defective parts are to be stored at the service agency for a period of 90 days after the claim has been paid in case

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an inspection is required. We may, in fact, ask for the part to be returned prior to

3. processing the credit in effort to validate the claim or return to the vendor; in which case, directions for return will be provided to you.
4. Shipping errors and freight damage, where Garland has provided the wrong part to the service agency or the shipment has been damaged in transit. These items are to be addressed within 10 days of invoicing. Claims for shipping errors are to be directed to the parts department (via fax, identifying all of the details, including part number, your order number, invoice number) to the attention of Dany Tremblay. The situation will be expedited through our system and return directions will be issued for each instance.
5. Occasional returns of slow moving parts, where a service agency is requesting to return a number of parts (not to exceed 2 times per year). Request a 'Request to Return New Parts' form from Rob Cochrane. This form will be faxed to the agency. List the part numbers and other required information on the form and return to Rob Cochrane via fax. This list will be reviewed and authorization approved by part number. (Some items are not returnable.) These returns may be subject to a 20% restocking charge or offsetting order. Due to the size of these returns and the inspection necessary prior to returning them to our inventory, the processing time is longer. Effective with shipments received after January 1, 2001, we are targeting to have these credits processed within 60 days of receipt.

#### **General notes:**

1. Once a Return Goods Authorization (RGA) number is given; parts are to be returned following the instructions provided and returned to the location identified in the instructions. (Credit will not be issued for parts returned to any location other than the one specified.)
2. Any shipments not quoting an approved RGA number on the outside of the shipping carton will be returned collect to the sender and no credit will be issued.
3. All returns are subject to inspection and credit will be issued based on the goods being received in new and undamaged condition.



**BULLETIN # B-19-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: February 15, 2001**

**SUBJECT: 410, 450, 455 CONTROLLERS**  
(USED ON GARLAND AND U.S. RANGE CONVECTION OVENS)

CUSTOMER COMPLAINT: Timer will not count down.

We have had a number of calls on this and a lot of controllers have been replaced thinking that there is a problem with the controller. In most cases, there is nothing wrong with the controller.

They are programmable with a cooking time of up to 99 hours and 59 minutes which means the timer will count down by minutes when programmed for more than 1 hour.

The timer will count down by seconds if a cooking time of less than 1 hour has been programmed.

A common operator error is to set a time of 5 hours and 30 minutes (for example) when what they intended to program was a time of 5 minutes and 30 seconds. In this example, the timer will then count down in minutes instead of seconds and the complaint will be that the timer will not count down or it counts down too slowly.

If the operator has programmed a time of more than 1 hour, the colon between the numbers will flash constantly until it drops below 1 hour, after that the colon will remain solid.

COLON FLASHING – Hours/Minutes

COLON SOLID – Minutes/Seconds

To switch from Hours/Minutes to Minutes/Seconds the encoder knob is turned counter-clockwise until passing the 1 hour mark.

To switch from Minutes/Seconds to Hours/Minutes, the encoder is turned clockwise until passing the 1 hour mark.

Contact a Technical Service Representative for additional information or instructions.

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**BULLETIN # B-50-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: May 8, 2001**

**SUBJECT: Full size convection oven door bushings**

**Models Affected : All full size gas and electric GARLAND MCO & US RANGE  
SUMMIT series units.**

We have had reports from the field of door bushings on full size Garland MCO and US Range SUMMIT convection ovens becoming stiff and / or wearing the door bearing assembly.

We have isolated the reported problems to units built in January 2001. While on a call, Garland is requesting that any units in your service area beginning with serial number **0101CJ0001 to 0101CJ9999** ( Jan 2001) have an inspection of the door bushings and have the bushings lubricated.

It is important to lubricate the door axle to allow the lubricant to *wick* up into the bushing. In order to do this properly the upper trim cover and lower trim cover will have to be removed.

**Complete Left & Right hand door assemblies are to be ordered and installed on units that fall within the above indicated time line.**

Both the door- bushing lubrication and door replacement will be covered under warranty.

Contact the Garland Service Department if you have any questions.



**BULLETIN # B-59-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: May 28, 2001**

**SUBJECT:** US Range Full size **SUMMIT** convection oven control pannel field service kits.

**Models Affected:** All Full size US Range GAS & ELECTRIC convection ovens from serial number **9908CJ0001** with electronic controls

There are now field service control pannel kits available. These kits include the control pannel bezel, overlay and membrane (keypad). The field service kits will eliminate the need to affix the keypad and overlay to the control pannel while on sight.

Originally when you had to replace a keypad, the overlay had to be changed as well. Often when this was done the grounding tab for the keypad was not attached properly and / or the overlay would have air bubbles.

If you have diagnosed the problem to be the keypad order the appropriate kit from the list on the attached pages.

**NOTE:** the field service kits DO NOT include the PCB board or relay board. These parts would have to be ordered separately if required.

## Full Size US Range SUMMIT Convection Oven Controller Pannel Assemblies

<b>Full Size GAS from SN 9908CJ0001</b>
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<u>Model Number</u>	KIT Part Number
SGM-100 / 200 ( IM30Controller with Light )	1952886
SGM-100 / 200 ( IM41 Controller with Light )	1952889
SGM-100 / 200 ( IM45 Controller with Light )	1952888
SGM-100 / 200 ( IM45+ Controller with Light )	1952887

<b>Full Size ELECTRIC from SN 9908CJ0001</b>
--

<u>Model Number</u>	KIT Part Number
SEM-100 / 200 ( IM30Controller with Light )	1952886
SEM-100 / 200 ( IM41 Controller with Light )	1952889
SEM-100 / 200 ( IM45 Controller with Light )	1952888
SEM-100 / 200 ( IM45+ Controller with Light )	1952887

Above listed kits include the control pannel bezel, keypad and overlay ONLY

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**BULLETIN # B-60-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: May 28, 2001**

**SUBJECT:** Garland ½ size convection oven control panel field service kits

**Models Affected :** All ½ size Garland GAS & ELECTRIC convection ovens from serial number **9905CJ0141 GAS units, 9904CJ0038 for ELECTRIC units** with electronic controls.

There are now field service control panel kits available. These kits include the control panel, overlay and membrane ( keypad ). The field service kits will eliminate the need to affix the keypad and overlay to the control panel while on sight.

Originally when you had to replace a keypad, the overlay had to be changed as well. Often when this was done the grounding tab for the keypad was not attached properly and / or the overlay would have air bubbles.

If you have diagnosed the problem to be the membrane ( keypad ) order the appropriate kit from the list on the attached page.

**NOTE:** the field service kits do not include the PCB board or relay board. These parts would have to be ordered separately if required.

**1/2 Size GARLAND Convection Oven Controller Panel Assemblies****1/2 Size GAS from SN 9905CJ0141**

<b>Model Number</b>	<b>KIT Part Number</b>
MCO-G-5RE ( IM470 Controller )	CK1957885
MCO-G-5LE ( IM470 Controller )	CK1957886
MCO-G-5RE ( IM475 Controller )	CK1957887
MCO-G-5LE ( IM475 Controller )	CK1957888
MCO-G-5RE ( IM450 Controller )	CK1957889
MCO-G-5LE ( IM450 Controller )	CK1957890
MCO-G-5RE ( IM410 Controller )	CK1957891
MCO-G-5LE ( IM410 Controller )	CK1957892
MCO-G-5RM ( IM300 Controller )	CK1957893
MCO-G-5LM ( IM300 Controller )	CK1957894

**1/2 Size ELECTRIC from SN 9904CJ0001**

<b>Model Number</b>	<b>KIT Part Number</b>
MCO-E-5 ( IM470 Controller )	CK1957895
MCO-E-5 ( IM475 Controller )	CK1957896
MCO-E-5 ( IM450 Controller )	CK1957897
MCO-E-5 ( IM410 Controller )	CK1957898
MCO-E-5 ( IM300 Controller )	CK1957899

Above listed kits include the control panel bezel, keypad and overlay ONLY

**1-800-427-6668**

**www.garland-group.com Fax: 1-800-361-7745**



**BULLETIN # B-61-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: May 28, 2001**

**SUBJECT:** Garland Full size convection oven control pannel filled service kits.

**Models Affected:** All Full size Garland GAS & ELECTRIC convection ovens from Serial number **9908CJ0001** with electronic controls

There are now field service control pannel kits available. These kits include the control pannel bezel, overlay and membrane (keypad). The field service kits will eliminate the need to affix the keypad and overlay to the control pannel while on sight.

Originally when you had to replace a keypad, the overlay had to be changed as well. Often when this was done the grounding tab for the keypad was not attached properly and / or the overlay would have air bubbles.

If you have diagnosed the problem to be the keypad order the appropriate kit from the list on the attached pages.

**NOTE:** the field service kits DO NOT include the PCB board or relay board. These parts would have to be ordered separately if required.

## Full Size GARLAND Convection Oven Controller Panel Assemblies

<b>Full Size GAS from SN 9908CJ0001</b>
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<u>Model Number</u>	<b>KIT Part Number</b>
MCO-GS-10-A/20-A MCO-GD-10-A/20-A ( IM300 Controller with Light )	1952893
MCO-GS-10-A/20-A MCO-GD-10-A/20-A ( IM300 Controller WITH OUT Light )	1952894
MCO-GS-10-A/20-A MCO-GD-10-A/20-A ( IM410 Controller with Light )	1952899
MCO-GS-10/20 MCO-GD-10/20 ( IM300 Controller with Light )	1952893
MCO-GS-10/20 MCO-GD-10/20 ( IM410 Controller with Light )	1952899
MCO-GS-10/20 MCO-GD-10/20 ( IM450 Controller with Light )	1952898
MCO-GS-10/20 MCO-GD-10/20 ( IM455 Controller with Light )	1952897
MCO-GS-10/20 MCO-GD-10/20 ( IM470 CHAIN Controller with Light )	1952896
MCO-GS-10/20 MCO-GD-10/20 ( IM475 CHAIN Controller with Light )	1952895

Above listed kits included the control pannel bezel, keypad and overlay ONLY

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## Full Size GARLAND Convection Oven Controller Panel Assemblies

## Full Size ELECTRIC from SN 9908CJ0001

<u>Model Number</u>	<b>KIT Part Number</b>
MCO-ES-10-A/20-A MCO-ED-10-A/20-A (IM300 Controller with Light )	1952893
MCO-ES-10-A/20-A MCO-ED-10-A/20-A ( IM300 Controller WITH OUT Light )	1952894
MCO-ES-10-A/20-A MCO-ED-10-A/20-A ( IM410 Controller with Light )	1952899
MCO-ES-10/20 MCO-ED-10/20 ( IM300 Controller with Light )	1952893
MCO-ES-10/20 MCO-ED-10/20 ( IM410 Controller with Light )	1952899
MCO-ES-10/20 MCO-ED-10/20 ( IM450 Controller with Light )	1952898
MCO-ES-10/20 MCO-ED-10/20 ( IM455 Controller with Light )	1952897
MCO-ES-10/20 MCO-ED-10/20 ( IM470 CHAIN Controller with Light )	1952896
MCO-ES-10/20 MCO-ED-10/20 ( IM475 CHAIN Controller with Light )	1952895

Above listed kits include the control pannel bezel, keypad and overlay ONLY

1-800-427-6668

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**BULLETIN B-107-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: September 25, 2001**

**SUBJECT: Convection Oven Keypad Test Points**

**Models Affected: Garland convection ovens with 300, 410, 450, 455, 470, 475 Controls.**  
**US Range convection ovens with 30, 41, 45, 45+ controls.**

There have been a large number of keypads returned as failed to Garland under warranty. A large number of those returned and tested showed no faults.

The attached test points are a useful service tool to better determine if the problem is with the keypad, controller, relay board assembly or other.

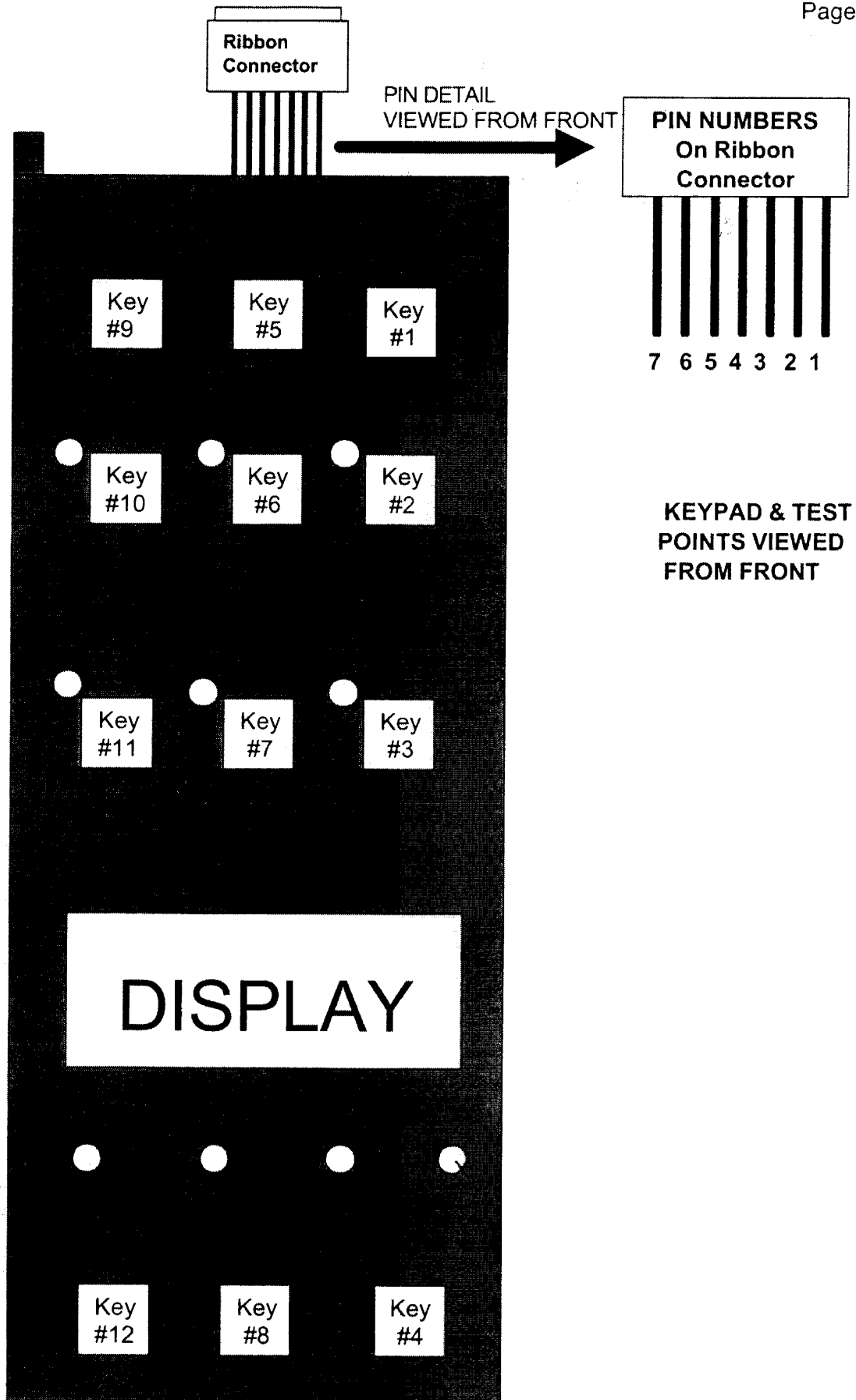
The attached pages shows the *PIN-OUT* test points for the keypad used on the above Garland & US Range convection ovens.

When servicing a unit with reported erratic or non-responsive controls, test the keypad first.

**NOTE: Consult operations manual to confirm unit is in normal operations mode. I.e. "unit will not turn off". Unit will not go to OFF mode until oven cavity temperature drops below 150° F. This is a normal operation of the controller in the auto cool down mode.**

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## Pin-Out Test Points

KEY #	PIN-OUTS	OVERLAY MARKINGS
1	1 & 4	SET BACK
2	1 & 5	COOL DOWN
3	1 & 6	PROGRAM
4	1 & 7	ACTUAL TEMP
5	2 & 4	CAVITY LIGHT
6	2 & 5	FAN LOW
7	2 & 6	COOK / HOLD
8	2 & 7	SET
9	3 & 4	ON / OFF
10	3 & 5	FAN HIGH
11	3 & 6	PULSE
12	3 & 7	START / CANCEL

Between above pin test points on ribbon connector, there should be continuity when the corresponding key is pressed

**EXAMPLE :** When KEY # 1 is pressed and held, there should be continuity between pins 1 & 4 at the ribbon cable.

**NOTE:** Keypad must be attached to control pannel bezel when tested.  
The keypad is grounded to panel to complete circuit. Disconnect the ribbon connector from the SMART BOARD / CONTROLLER to gain better access to test points.

Not all overlays will have the above-indicated markings.



**BULLETIN # B-110-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: September 28, 2001**

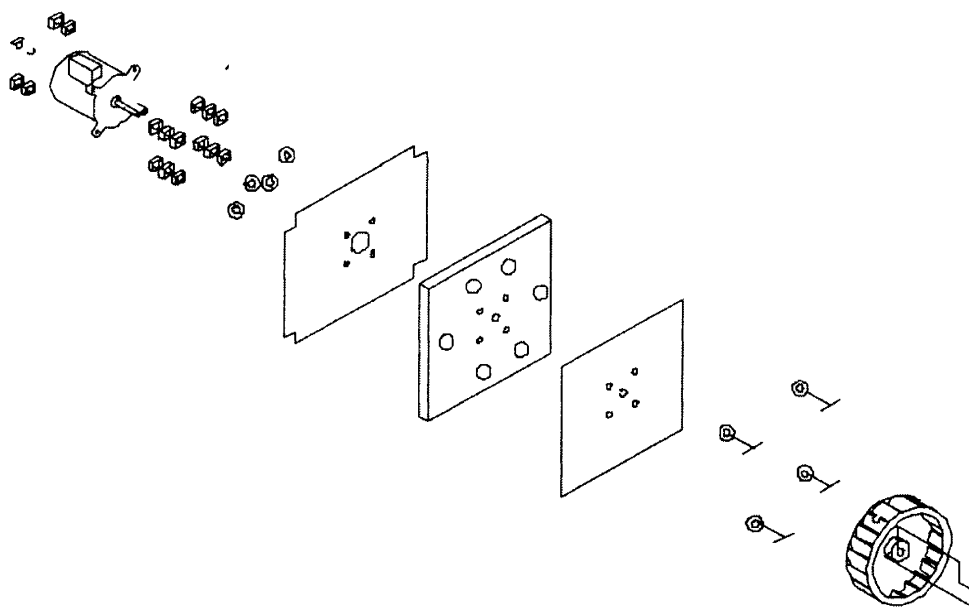
**SUBJECT:** Full Size Garland & US Range Convection ovens

When a replacement convection oven motor is required, a complete motor assembly should be ordered.

The assembly will :

- A. Reduce labour costs
- B. Reduce the likelihood of the original blower wheel being out of balance due to removal or debris build up in the original blower wheel.

The complete motor assembly includes the motor, motor mounting plate, motor plate inner, insulation, fasteners and blower wheel.



Garland Model #	US Range Model #	Voltage	Speed	Horsepower	Motor Assy. CK#	Motor ONLY
MCOGS MCOGD	SGE100 SGM100 P1-G-100	115V	2SPD	3/4 hp	CK1003090	1686711
MCOGS MCOGD	SGE100 SGM100	208V/240V	2 SPD	3/4 hp	CK1003091	1686712
MCOGS MCOGD	SGE100 SGM100 P1-G-100	115V/230V	1 SPD	1/2 hp	CK1003092	1686703
MCOES MCOED	SEE100 SEM100	208V/240V	2 SPD	3/4 hp	CK1003091	1686712
MCOES MCOED	SEE100 SEM100	115V/230V	1 SPD	1/2 hp	CK1003092	1686703

Garland Model #	US Range Model #	Voltage	Speed	Horsepower	Motor Assy. CK#	Motor ONLY
ICOG ECOG	CG100	115V/230V	1 SPD	1/2 hp	CK1003099	1686703
ICOG ECOG	CG100 SDG	115V	2 SPD	3/4 hp	CK1003095	1686711
ICOG TIM HORTON'S 'spritzer'		115V	2 SPD	3/4 hp	CK00-011	1686711
ICOE ECOE	CE100	208V/240V	2 SPD	3/4 hp	CK1003094	1686712



**BULLETIN # B-148-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: November 22, 2001**

**SUBJECT: Garland and US Range full size and half size convection oven  
Keypads (1911701).**

**Models Affected:** All Garland, US Range full and half size GAS & Electric convection ovens.

Garland is no longer supplying keypad part number 1911701 separately. If you have diagnosed the problem to be the keypad please order the appropriate field service kit, from previous service bulletins B59-2001, B60-2001 and B61-2001. To avoid errors please provide serial #, model and series of the equipment. (model series can be located on the front control panel)

**NOTE:** The field service kits DO NOT include the PCB board or relay board assembly. These parts would have to be ordered separately if required.

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**1-800-427-6668      www.garland-group.com      Fax: 1-800-361-7745**



**BULLETIN # B-18-2002**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: February 14, 2002**

**SUBJECT: Convection Oven Controller Troubleshooting**

**MODELS AFFECTED: All Garland & US Range convection ovens**

Garland / US Range has been receiving a high level of warranty claims for failed controllers, **Part Numbers 1905701 1905702 1905703 1905704 & 1905705**, that are used on our convection ovens. Analysis of the returned controllers proved that greater than **70%** were without any defects.

In order to reduce the percentage of faulty diagnosis, we have formatted the attached troubleshooting guide that must be used during future service calls where a controller is suspected of being faulty.

Be sure to follow the key pad testing procedures as outline in Bulletin # B-107-2001 prior to performing any testing on the rest of the controller circuit so as to eliminate a potential key pad problem.

If you do not use this guide and your returned controller is found to be functional, then your claim will be rejected.

Please contact the Garland / US Range Technical Service Department at (800) 427-6668 with any questions

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# Trouble Shooting Guide

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Fan will not run	A. No power to unit B. No power to motor from relay board C. Micro switch no closing	A. Turn power on B. Check for voltage from relay board to motor C. Check micro switches
Button on key pad not responding	A. Loose ribbon connection between key pad and smart board B. Faulty key pad	A. Check that ribbon connection from key pad is attached to smart board B. Refer to key pad testing procedure on bulletin # B-107-2001
'Prob' in display	A. Probe disconnected B. Probe has failed	A. Re attach probe B. Confirm ohm resistance of probe. Refer to cavity probe chart for readings C. Check for continuity between probe connection at relay board, probe harness & probe
Unit will not shut off	A. Cavity temperature above 150°F	A. Normal operation. Unit will not go to OFF until cavity temperature is below 150°F
No HIGH speed BUT HIGH speed LED is illuminated on key pad	A. Bad relay board B. Bad smart board	A. CR3 on relay board should be on, if not check for 24VDC +/- 10% at pins 5 & 7 at relay board. If voltage present replace relay board B. Check for 24VDC +/- 10% between pins 5 & 7 at relay board. If voltage is <u>not</u> present replace smart board
No LOW speed BUT LOW speed LED is illuminated on key pad	A. Bad relay board B. Bad smart board	A. CR4 on relay board should be on, if not check for 24VDC +/- 10% at pins 5 & 8 at relay board. If voltage is present replace relay board B. Check for 24VDC +/- 10% at pins 5 & 8 at relay board. If voltage is <u>not</u> present replace smart board.
Unit will not heat. <i>DOOR</i> shown in display	A. Open circuit on upper door switch	A. Unplug unit from supply. With door <b>closed</b> between NO and COM switch should be <u>open</u> . B. With door <b>open to 30°</b> angle switch should be <u>closed</u> C. With <b>door open all the way</b> switch should be closed
Unit will not turn ON when button pushed, display reads OFF	A. Loose ribbon connection between key pad and smart board B. Faulty key pad	A. Check connection B. Refer to key pad testing procedure on bulletin # B-107-2001



<b>Problem</b>	<b>Possible Cause</b>	<b>Corrective Action</b>
No display	A. No power to smart board  B. No power to relay board	A. Check for 24VAC between pins 1 and 3 on smart board. If voltage present check for 24VAC at pins 1 and 3 at relay board B. Check for 24VAC into relay board and 24VAC out of relay board between pins 1 and 3 on relay board
Fan runs for a period of time, shuts down then comes back on after several minutes	A. motor has tripped on internal thermal overload	A. check for a minimum 6" clearance at rear of unit to a wall or heat source B. Check air intake vents on back of motor for obstructions C. If problem persists and above have been corrected replace motor assy
Timer slow counting down	A. Timer is in hours / min	A. Refer to operations manual or bulletin # B-19-2001 on how to change from hour / min to min / seconds
Temperature out of calibration	A. 400 series controllers  B. 200 & 300 series controllers C. Potentiometer defective	A. Confirm oven cavity temp with resistance chart. If out by more than 20 Ohms replace probe B. Calibration can be performed by repositioning temperature dial. C. Check for proper 'sweep' on potentiometer. 0 to 10.25KOHMS

**RESISTANCE vs. TEMPERATURE CHART FOR INTERNAL OVEN TEMPERATURE SENSOR**

The chart below will provide the Ohms at various temperatures. This will enable you to determine if the temperature probe is operable.

The chart is degrees Fahrenheit.

<b>TEMP</b>	<b>0°</b>	<b>10°</b>	<b>20°</b>	<b>30°</b>	<b>40°</b>	<b>50°</b>	<b>60°</b>	<b>70°</b>	<b>80°</b>	<b>90°</b>
<b>0°</b>	932	953	974	995	1016	1038	1059	1080	1101	1122
<b>100°</b>	1143	1163	1184	1205	1226	1247	1267	1288	1309	1329
<b>200°</b>	1350	1370	1391	1411	1432	1452	1472	1493	1513	1533
<b>300°</b>	1553	1574	1594	1614	1634	1654	1674	1694	1714	1733
<b>400°</b>	1753	1773	1793	1813	1832	1852	1871	1981	1911	1930
<b>500°</b>	1949	1969	1988	2008	2027	2046	2065	2085	2104	2123

## Temperature Calibration

### 200 & 300 Series Controllers ONLY

Both the 200 & 300 series controllers use a 0 to 10.25K OHM potentiometer. First check the sweep on the potentiometer between the middle wire and one of the outside wires for a gradual increase or decrease in the resistance as the potentiometer stem is turned.

#### GAS Units – Calibration 300 Series

1. Remove the temperature dial from the potentiometer
2. Turn potentiometer to its lowest setting ( fully counter clock-wise )
3. Place the temperature dial back onto the potentiometer
4. Align the mark on the temperature dial to the top left edge of the 'F' on the left of the temperature dial and snug down one of the set screws. Do NOT fully tighten yet.
5. Set temperature dial to **150°F** and allow oven cavity to reach set temperature
6. Confirm temperature inside the oven cavity with your meter and that shown on the temperature dial
7. If adjustment is required, loosen set screw and position mark on temperature dial to temperature shown on your meter.
8. Tighten set screw down
9. Repeat as required (once is usually enough)
10. Fully tighten both set screws

#### GAS Units – Calibration 200 Series

1. Remove the temperature dial from the potentiometer
2. Turn potentiometer to its highest setting ( fully clock-wise )
3. Place the temperature dial back onto the potentiometer
4. Align the mark on the temperature dial  $\frac{1}{4}$ " **PAST** the 500°F marking on the overlay and snug down one of the set screws. Do NOT fully tighten yet.
5. Set temperature dial to **150°F** and allow oven cavity to reach set temperature
6. Confirm temperature inside the oven cavity with your meter and that shown on the temperature dial
7. If adjustment is required, loosen set screw and position mark on temperature dial to temperature shown on your meter
8. Tighten set screw down
9. Repeat as required ( once is usually enough )
10. Fully tighten both set screws

### **ELECTRIC Units – Calibration 300 Series**

1. Remove the temperature dial from the potentiometer
2. Turn potentiometer to its lowest setting ( fully counter clock-wise
3. Place the temperature dial back onto the potentiometer
4. Align the mark on the temperature dial to the top left edge of the “**F**” on the left of the temperature dial and snug down one of the set screw s. Do NOT fully tighten yet.
5. Set temperature to **300°F** and allow unit to cycle 3-times
6. Confirm temperature inside the oven cavity with your meter and that on the temperature dial
7. If adjustment is required, loosen the set -screw and position the mark on the temperature dial to temperature shown on your meter.
8. Tighten set screw down
9. Repeat as required (once is usually enough)
10. Fully tighten both set screws

### **ELECTRIC Units – 200 Series**

1. Remove the temperature dial from the potentiometer
2. Turn potentiometer to its highest setting ( fully clock wise )
3. Place the temperature dial back onto the potentiometer
4. Align the mark on the temperature dial  $\frac{1}{4}$ ” **PAST** the 500°F marking on the overlay and snug down one of the set screws. Do NOT fully tighten yet.
5. Set temperature to **300°F** and allow to cycle 3-times
6. Confirm temperature inside the oven cavity with your meter and that on the temperature dial
7. If adjustment is required, loosen the set-screw and position the mark on the temperature dial to temperature shown on your meter
8. Tighten set screw down
9. Repeat as required ( once is usually enough )
10. Fully tighten both set screws



**BULLETIN # B-19-2001**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: February 15, 2001**

**SUBJECT: 410, 450, 455 CONTROLLERS**  
(USED ON GARLAND AND U.S. RANGE CONVECTION OVENS)

CUSTOMER COMPLAINT: Timer will not count down.

We have had a number of calls on this and a lot of controllers have been replaced thinking that there is a problem with the controller. In most cases, there is nothing wrong with the controller.

They are programmable with a cooking time of up to 99 hours and 59 minutes which means the timer will count down by minutes when programmed for more than 1 hour.

The timer will count down by seconds if a cooking time of less than 1 hour has been programmed.

A common operator error is to set a time of 5 hours and 30 minutes (for example) when what they intended to program was a time of 5 minutes and 30 seconds. In this example, the timer will then count down in minutes instead of seconds and the complaint will be that the timer will not count down or it counts down too slowly.

If the operator has programmed a time of more than 1 hour, the colon between the numbers will flash constantly until it drops below 1 hour, after that the colon will remain solid.

COLON FLASHING – Hours/Minutes  
COLON SOLID – Minutes/Seconds

To switch from Hours/Minutes to Minutes/Seconds the encoder knob is turned counter-clockwise until passing the 1 hour mark.

To switch from Minutes/Seconds to Hours/Minutes, the encoder is turned clockwise until passing the 1 hour mark.

Contact a Technical Service Representative for additional information or instructions.

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**1-800-427-6668      www.garland-group.com      Fax: 1-800-361-7745**



## BULLETIN B-107-2001

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: September 25, 2001**

**SUBJECT: Convection Oven Keypad Test Points**

**Models Affected: Garland convection ovens with 300, 410, 450, 455, 470, 475 Controls.**  
**US Range convection ovens with 30, 41, 45, 45+ controls.**

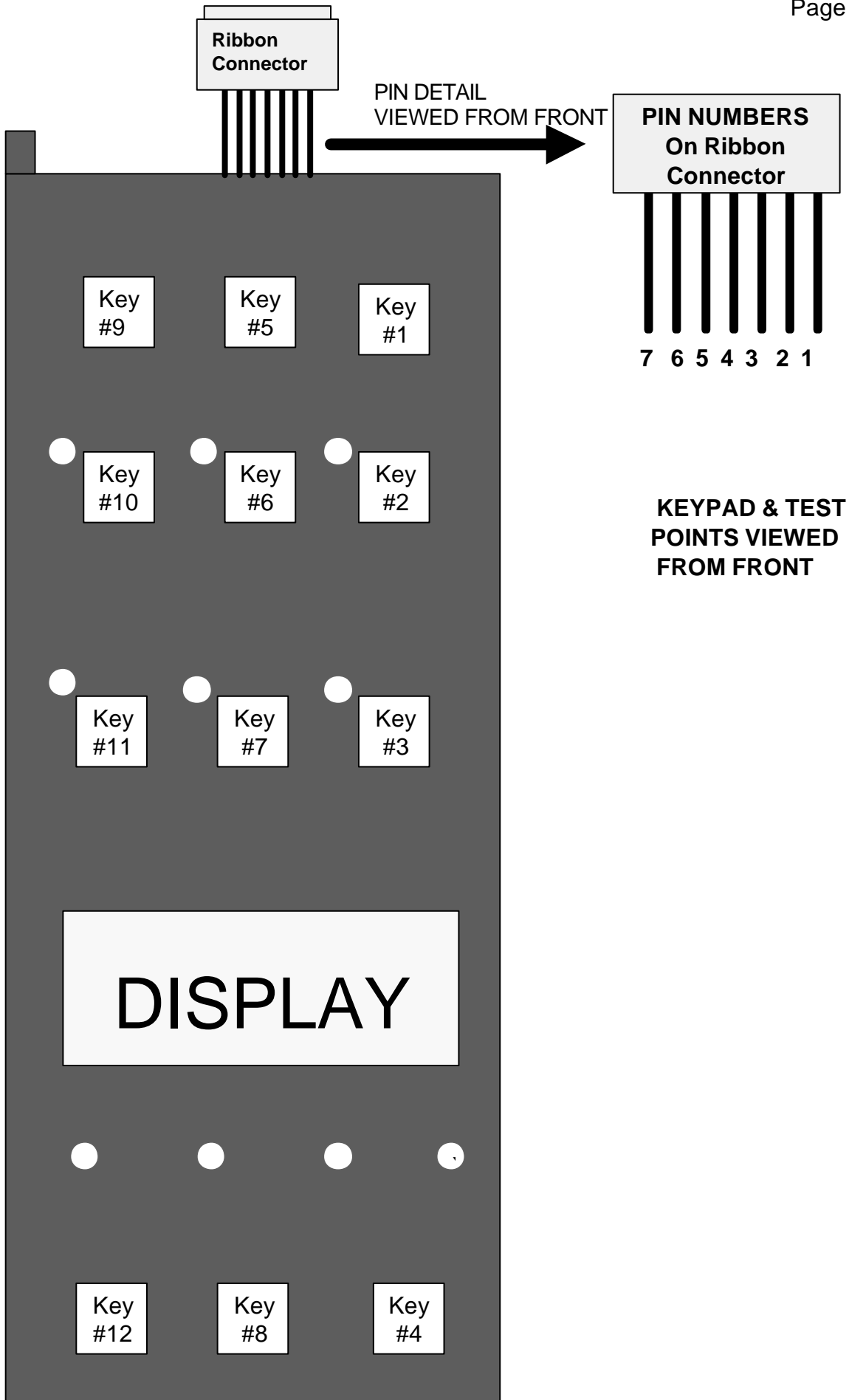
There have been a large number of keypads returned as failed to Garland under warranty. A large number of those returned and tested showed no faults.

The attached test points are a useful service tool to better determine if the problem is with the keypad, controller, relay board assembly or other.

The attached pages shows the *PIN-OUT* test points for the keypad used on the above Garland & US Range convection ovens.

When servicing a unit with reported erratic or non-responsive controls, test the keypad first.

**NOTE: Consult operations manual to confirm unit is in normal operations mode. I.e. "unit will not turn off". Unit will not go to OFF mode until oven cavity temperature drops below 150° F. This is a normal operation of the controller in the auto cool/down mode.**



**KEYPAD & TEST  
POINTS VIEWED  
FROM FRONT**

## Pin-Out Test Points

<b>KEY #</b>	<b>PIN-OUTS</b>	<b>OVERLAY MARKINGS</b>
<b>1</b>	<b>1 &amp; 4</b>	<b>SET BACK</b>
<b>2</b>	<b>1 &amp; 5</b>	<b>COOL DOWN</b>
<b>3</b>	<b>1 &amp; 6</b>	<b>PROGRAM</b>
<b>4</b>	<b>1 &amp; 7</b>	<b>ACTUAL TEMP</b>
<b>5</b>	<b>2 &amp; 4</b>	<b>CAVITY LIGHT</b>
<b>6</b>	<b>2 &amp; 5</b>	<b>FAN LOW</b>
<b>7</b>	<b>2 &amp; 6</b>	<b>COOK / HOLD</b>
<b>8</b>	<b>2 &amp; 7</b>	<b>SET</b>
<b>9</b>	<b>3 &amp; 4</b>	<b>ON / OFF</b>
<b>10</b>	<b>3 &amp; 5</b>	<b>FAN HIGH</b>
<b>11</b>	<b>3 &amp; 6</b>	<b>PULSE</b>
<b>12</b>	<b>3 &amp; 7</b>	<b>START / CANCEL</b>

Between above pin test points on ribbon connector, there should be continuity when the corresponding key is pressed

**EXAMPLE** : When KEY # 1 is pressed and held, there should be continuity between pins 1 & 4 at the ribbon cable.

**NOTE:** Keypad must be attached to control panel bezel when tested. The keypad is grounded to panel to complete circuit. Disconnect the ribbon connector from the SMART BOARD / CONTROLLER to gain better access to test points.

Not all overlays will have the above-indicated markings.



## **BULLETIN # B-20-2004**

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: March 11, 2004**

**PRODUCT: Half-Size Garland Gas Convection Ovens**  
**SUBJECT: Manual Control Panel Conversion Kits**

**Model Affected: Half-Size Garland Gas convection oven models, MCO-G-5LE and MCO-G-5RE with 300/400 series electronic control panels.**

There are now new field service manual control panel kits available for the Garland gas half-size convection ovens. These two kits include the complete control panel assembly and will convert an existing 300/400 series electronic control panel to the 200 series manual control panel.

Please make note of the following part numbers for these two kits.

1. Part number 4512251 designed to convert Garland gas models MCO-G-5LE from 300/400 electronic to 200 series manual controls.
2. Part number 4512253 designed to convert Garland gas models MCO-G-5RE from 300/400 electronic to 200 series manual controls.

If you have any questions, please contact the Garland/ US Range Service Department at 1-800-427-6668.





## BULLETIN # B-26-2004

**From: Parts and Service Division**  
**To: All Authorized Service Agencies**

**Date: April 5, 2004**

**SUBJECT: Convection Oven Thermostats**

**Models Affected: Garland ICO & US Range SDG series ovens**

We have noticed that the incorrect thermostats are being installed as replacement parts in the Garland ICO ELECTRIC convection ovens.

**Reference Garland bulletin B-66-2002.**

The Garland ICO ELECTRIC convection oven requires the use of pn 1032400 thermostat. This thermostat is rated for 30 AMPS.

The GAS thermostat, pn G02902-01 is rated at 1 AMP. If it is installed in an ELECTRIC convection oven it will not operate accurately / fail prematurely.

Ensure that the correct thermostat is being installed as a replacement part.

PART NUMBER	USED ON MODELS
G02902-01	GAS MCO,ICO, ECO & SDG series convection ovens with mechanical thermostats
1032400	ELECTRIC MCO, ICO, ECO series convection ovens with mechanical thermostats



## BULLETIN # B-73-2007-S

**From:** Parts and Service Division  
**To:** All Authorized Service Agencies

**Date:** August 21, 2007

### **Subject: Rating Plate Motor Return** **Model Affected: Garland Convection or Moisture Plus Oven**

Effective immediately, when replacing a failed motor for a convection oven or Moisture Plus oven, it will be necessary for you to return the rating plate label from the motor along with your warranty claim report and packing slip. If the rating plate label is not received, credit will not be issued.

Though ServiceBench will treat these parts as mandatory returns, it is no longer necessary to return the entire motor to the factory; you need only return the rating plate label from the motor along with the ServiceBench pack list. You can remove the rating plate label by peeling off the label as shown below. The rating plate label can be found on the body of the motor. Returns are to be packed and returned separately from any other component returns.



**A:US C:Canada B:Canada/US I:International S: Service P: Parts W: Warranty G: General**  
**1-800-427-6668 www.garland-group.com Fax: 1-800-361-7745**

The following part numbers are affected by this bulletin on Garland convection and Moisture Plus ovens:

<b>Part #</b>	<b>Description</b>
1686711	Motor 3/4 HP, 115V, 2 Speed
1686712	Motor 3/4 HP, 208/240V, 2 Speed
1686703	Motor 1/2 HP, 115/230V, 1 Speed
1773802	Motor 208/240V 2 Speed
1951501	Motor 110V 1/3HP 2SP 5/8 SHAFT
1951502	Motor 208/240 1/3HP 2SP
CK1003090	Motor Ass'y - 2 Speed - 115V
CK1003091	Motor Ass'y - 2 Speed - 208/240V
Ck1003094	Motor Assembly 2 Speed 208/240
CK1003095	Motor Assembly 2 Speed 115V
CK1003099	Motor Assembly 1 Speed
CK00-011	Motor Kit Tim Hortons
4518320	Kit, Motor Assembly - 240V M+
4518319	Kit, Motor Assembly - 120V
1615001	Motor - 3/4 Hp 115/240V 1725rpm CW/CCW

Please contact The Garland/US Range Technical Service Department with any question.

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**1-800-427-6668 www.garland-group.com Fax: 1-800-361-7745**





# Section Seven

## Wiring Diagrams



## Master Convection Ovens Wiring Diagrams

### GAS MODELS HoneyWell Ignition Modules

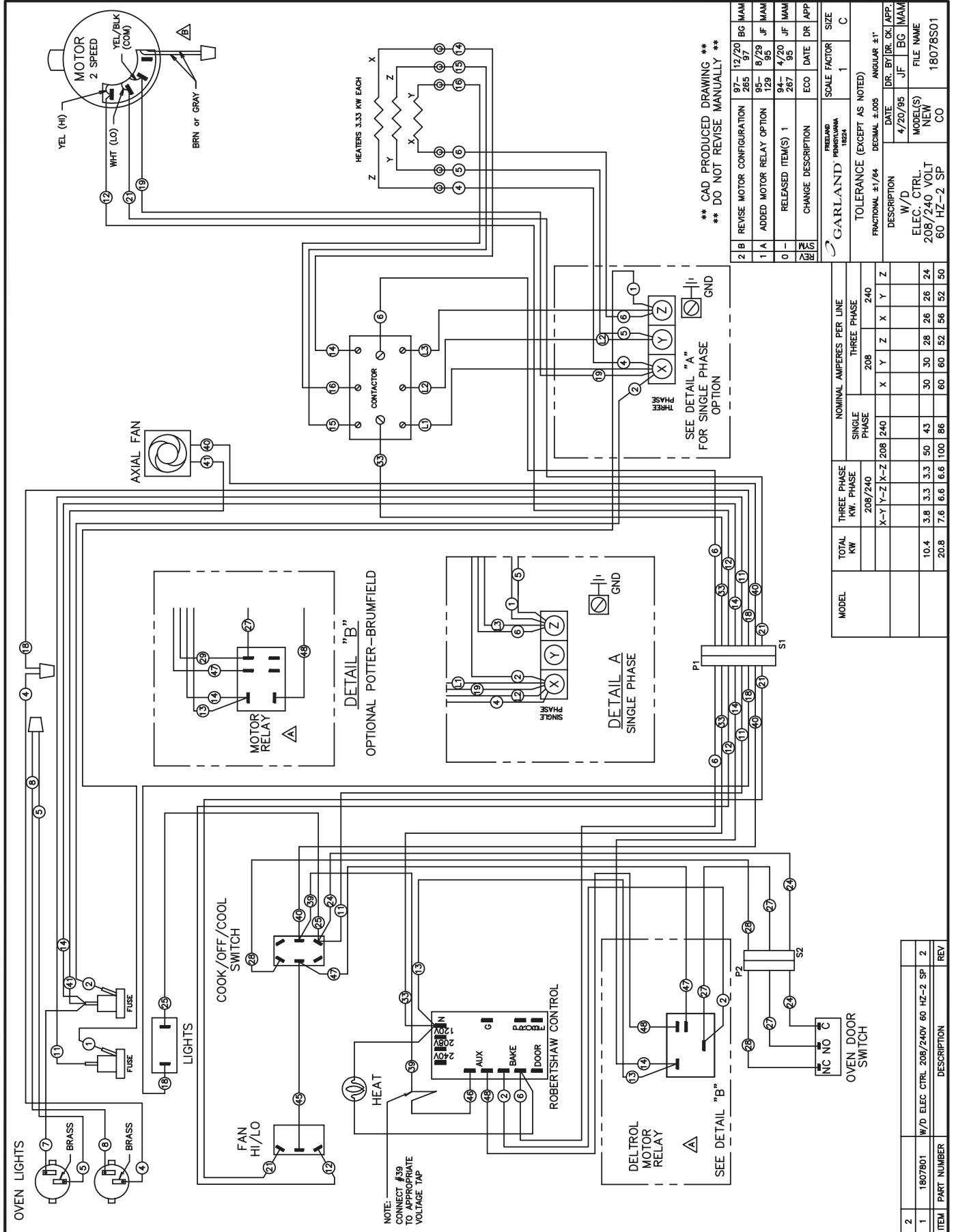
Voltage	200 Controller (Honeywell Ignition Module)	300 Controller (Honeywell Ignition Module)	400 Controller (Honeywell Ignition Module)	200 Controller (Johnson Ignition Module)	300 & 400 Controller (Johnson ignition Module)
<b>120V</b>	1949511-R02	1807833	1807824	1949511-R03	1949501

### GAS MODELS Johnson Ignition Modules

Voltage	200 Controller (Johnson Ignition Module)	300 & 400 Controller (Johnson ignition Module)	200 Controller (Johnson Direct Spark Ignition Module)	400 Controller (Johnson Direct Spark ignition Module)
<b>120V</b>	1949511-R03	1949501	1949511-R07	1949501-R04

### ELECTRIC MODELS

Voltage	Mechanical Control 1 speed	Mechanical Control 2 speed	Robershaw Electronic Controller 1 Speed	Robershaw Electronic Controller 2 speed	200 Controller	300 Controller	400 Controller
<b>208V/240V</b>	1807804	1807803	1807802	1807801	1949514	1807829	1807820
<b>460V</b>	1807812	1807811	1807810	1807809	1949515	1807830	1807830



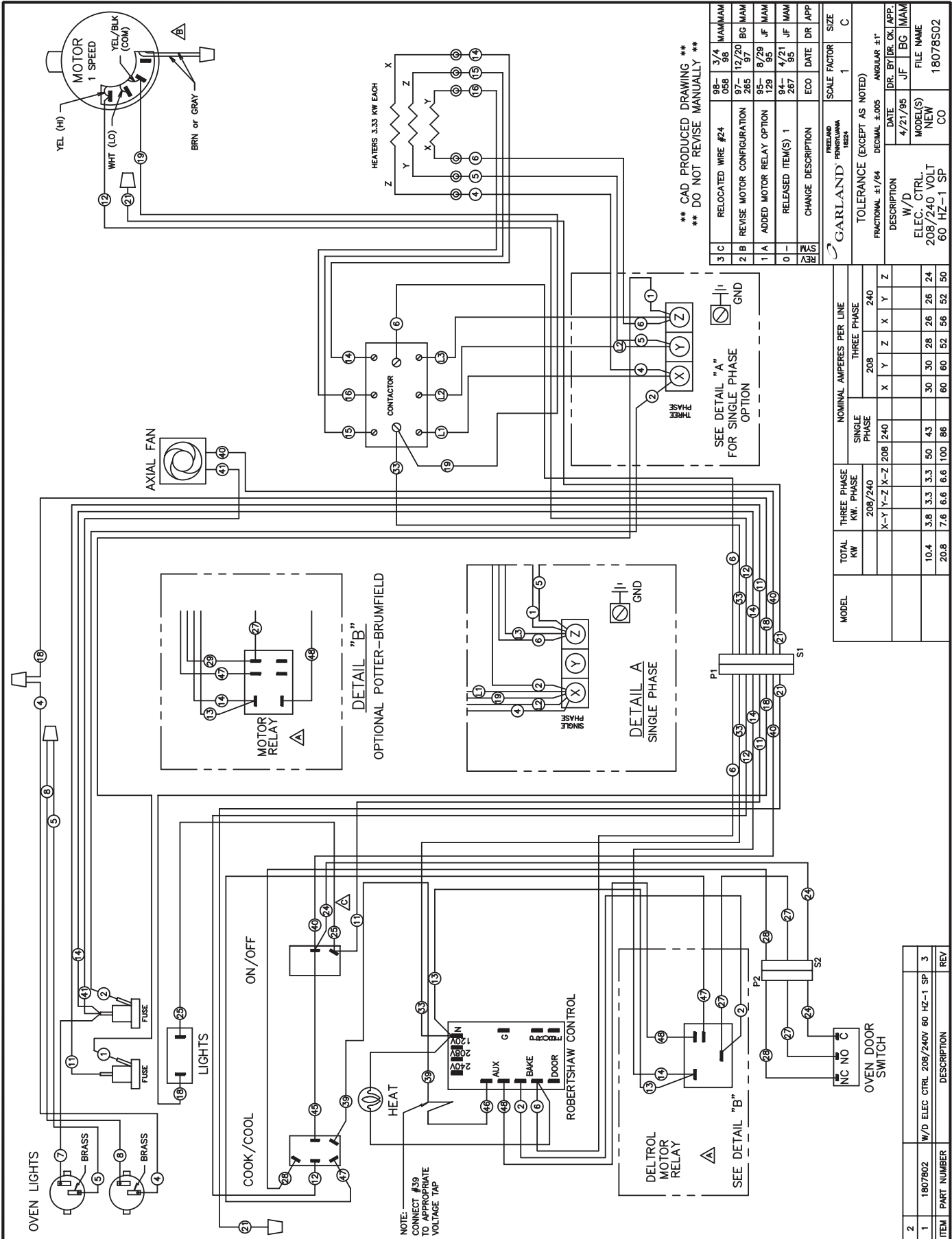
\*\* CAD PRODUCED DRAWING \*\*  
 \*\* DO NOT REVISE MANUALLY \*\*

2 B	REVERSE MOTOR CONFIGURATION	97-12/20	BG	MAM
1 A	ADDED MOTOR RELAY OPTION	95-8/29	JF	MAM
0 -	RELEASED ITEM(S) 1	94-4/20	JF	MAM
0 -	CHANGE DESCRIPTION	95-267	ECO	DR APP

GARLAND PENNSYLVANIA 18224		SCALE FACTOR		1		SIZE		C	
TOLERANCE (EXCEPT AS NOTED)									
FRACTIONAL ±1/64		DECIMAL ±.005		ANGULAR ±1°					
DESCRIPTION		DATE		DR.		BY		CHK.	
W/D		4/20/95		JF		BG		MAM	
ELEC. CTRL.		MODEL(S)		FILE NAME					
208/240 VOLT		NEW		18078501					
60 HZ-2 SP		CO							

MODEL	TOTAL KW	THREE PHASE KW. PHASE						NOMINAL AMPERES PER LINE									
		208/240	X-Y	Y-Z	X-Z	208	240	SINGLE PHASE	THREE PHASE			THREE PHASE					
		X-Y	Y-Z	X-Z	208	240	208	240	X	Y	Z	X	Y	Z	X	Y	Z
	10.4	3.8	3.3	3.3	50	43	30	30	28	26	26	24	24	24	24	24	24
	20.8	7.6	6.6	6.6	100	86	60	60	52	56	52	50	50	50	50	50	50

ITEM	PART NUMBER	DESCRIPTION	REV
2			
1	1807801	W/D ELEC CTRL. 208/240V. 60 HZ-2 SP	2



\*\* CAD PRODUCED DRAWING \*\*  
 \*\* DO NOT REVISE MANUALLY \*\*

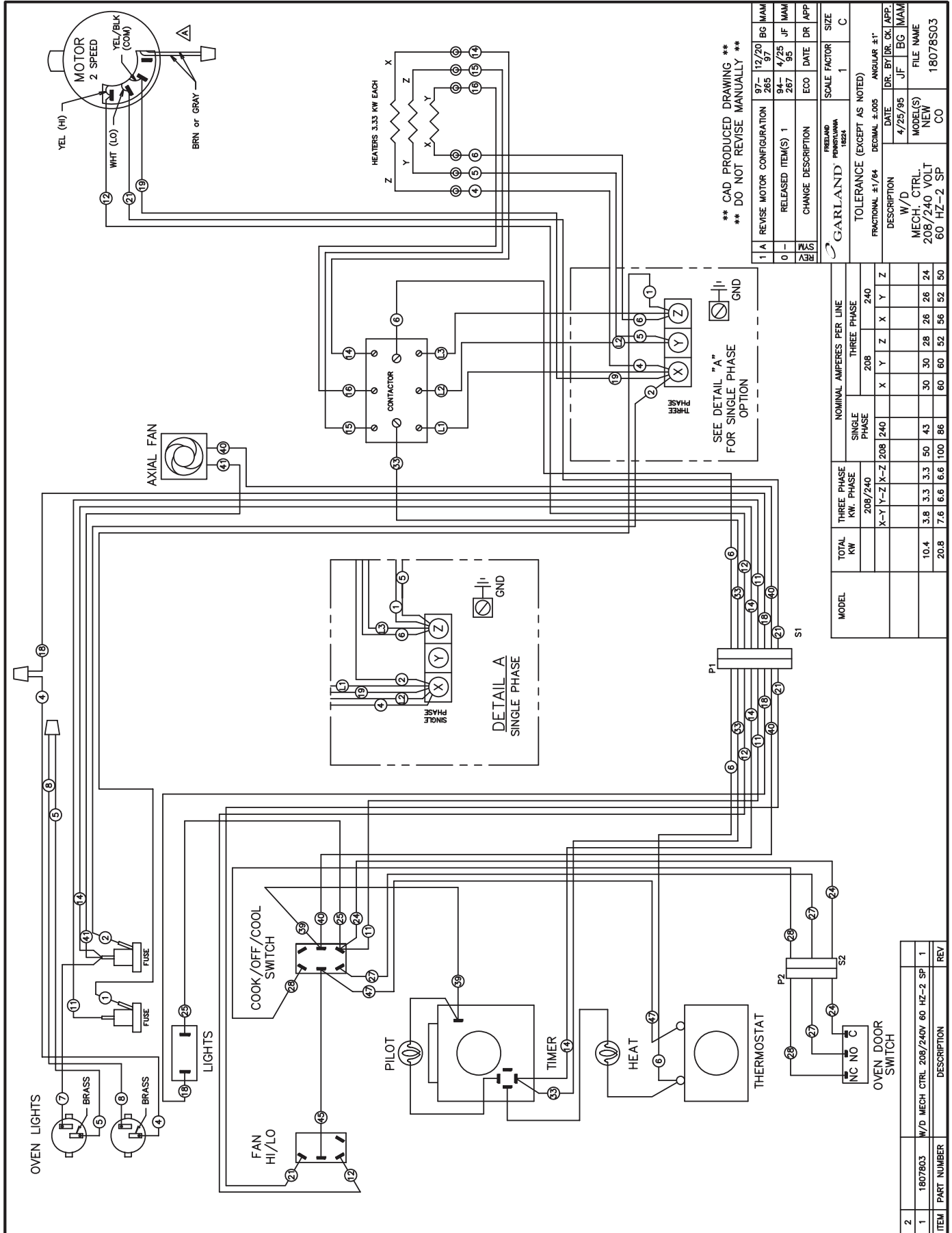
3	C	RELOCATED WIRE #24	98-088	3/4	MAM
2	B	REVERSE MOTOR CONFIGURATION	97-12/20	96	MAM
1	A	ADDED MOTOR RELAY OPTION	95-8/29	97	MAM
0	-	RELEASED ITEM(S) 1	94-4/21	95	MAM
REV		CHANGE DESCRIPTION	93-267	95	MAM
		ECO			DR APP

GARLAND		PENN/UMMA		SCALE FACTOR		SIZE	
1822A		1		1		C	
TOLERANCE (EXCEPT AS NOTED)							
FRACTIONAL ±1/64		DECIMAL ±.005		ANGULAR ±1°			
DESCRIPTION		DATE		DR. BY/DR. CKI. APP.		FILE NAME	
ELEC. CTRL		4/21/95		JF		BG MAM	
208/240 VOLT				NEW		MODEL(S)	
60 HZ-1 SP				CO		18078S02	

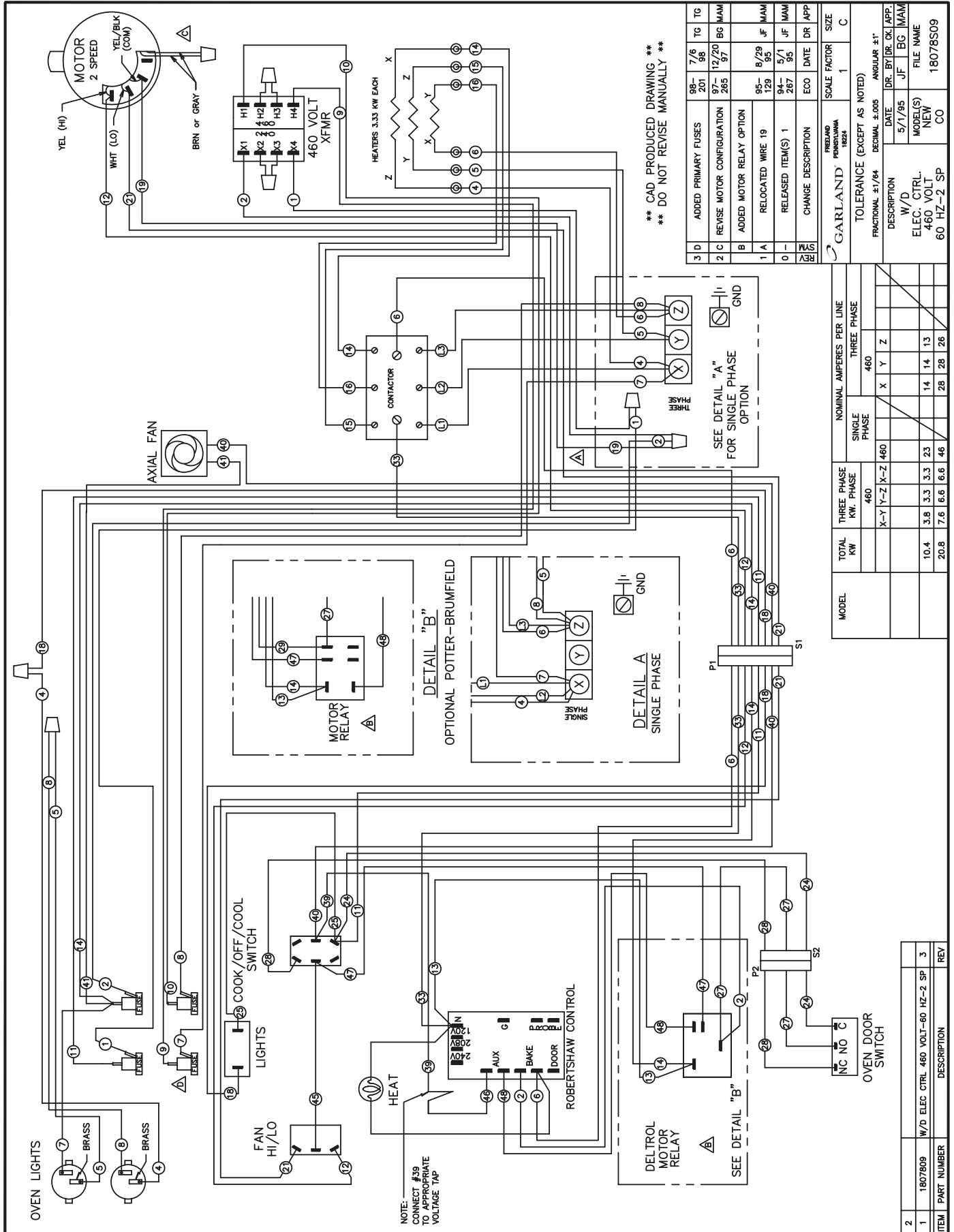
MODEL	TOTAL KW	THREE PHASE KW. PHASE			NOMINAL AMPERES PER LINE				
		208/240	X-Y	Y-Z	X-Z	240	X	Y	Z
	10.4	3.8	3.3	3.3	30	30	28	26	24
	20.8	7.6	6.6	6.6	60	60	52	56	50

2	18078S02	W/D ELEC CTRL 208/240V 60 HZ-1 SP	3
ITEM	PART NUMBER	DESCRIPTION	REV









\*\* CAD PRODUCED DRAWING \*\*  
 \*\* DO NOT REVISE MANUALLY \*\*

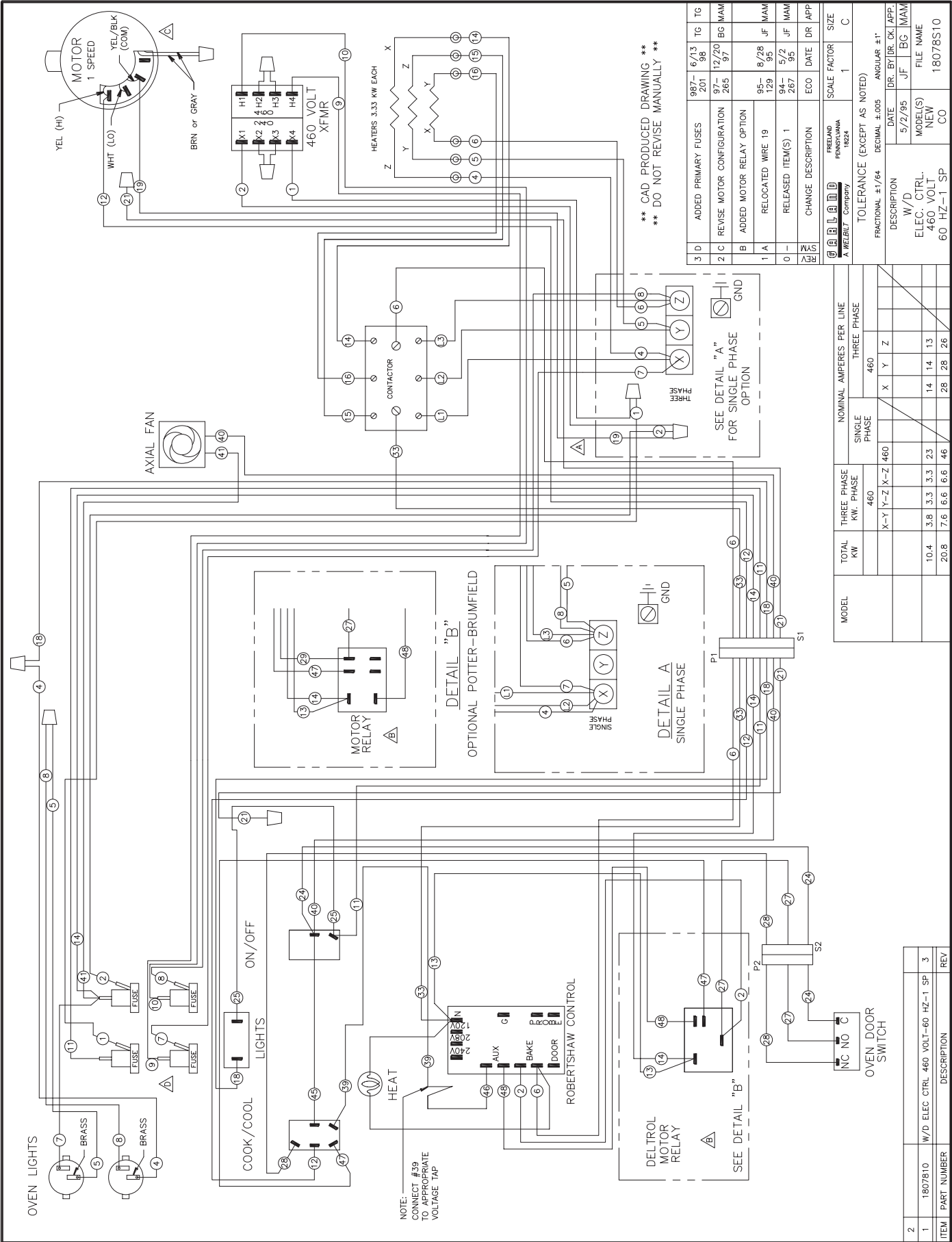
3 D	ADDED PRIMARY FUSES	7/6	TC		
98-	201	96			
2 C	REVISE MOTOR CONFIGURATION	12/20	BG MAM		
265		97			
B	ADDED MOTOR RELAY OPTION				
1 A	RELOCATED WIRE 19	8/29	JF MAM		
95-		95			
0 -	RELEASED ITEM(S) 1	5/1	JF MAM		
94-		267			
REV	CHANGE DESCRIPTION	ECO	DATE	DR	APP
1					

GARLAND PENNSLVANIA 18024		SCALE FACTOR	SIZE
		1	C
TOLERANCE (EXCEPT AS NOTED)			
FRACTIONAL ±1/64		DECIMAL ±.005	
ANGULAR ±1°			
DESCRIPTION			
W/D		DATE	DR. BY/DR. CK. APP.
ELEC. CTRL		5/1/95	JF BG MAM
NEW		MODEL(S)	FILE NAME
460 VOLT			
60 HZ-2 SP		CO	18078S09

MODEL	TOTAL KW	NOMINAL AMPERES PER LINE		
		THREE PHASE	SINGLE PHASE	THREE PHASE
	460		460	
	X-Y	Y-Z	X-Z	460
	10.4	3.8	3.3	3.3
	20.8	7.6	6.6	6.6

ITEM	PART NUMBER	DESCRIPTION	REV
2			
1	1807809	W/D ELEC CTRL 460 VOLT-60 HZ-2 SP	3



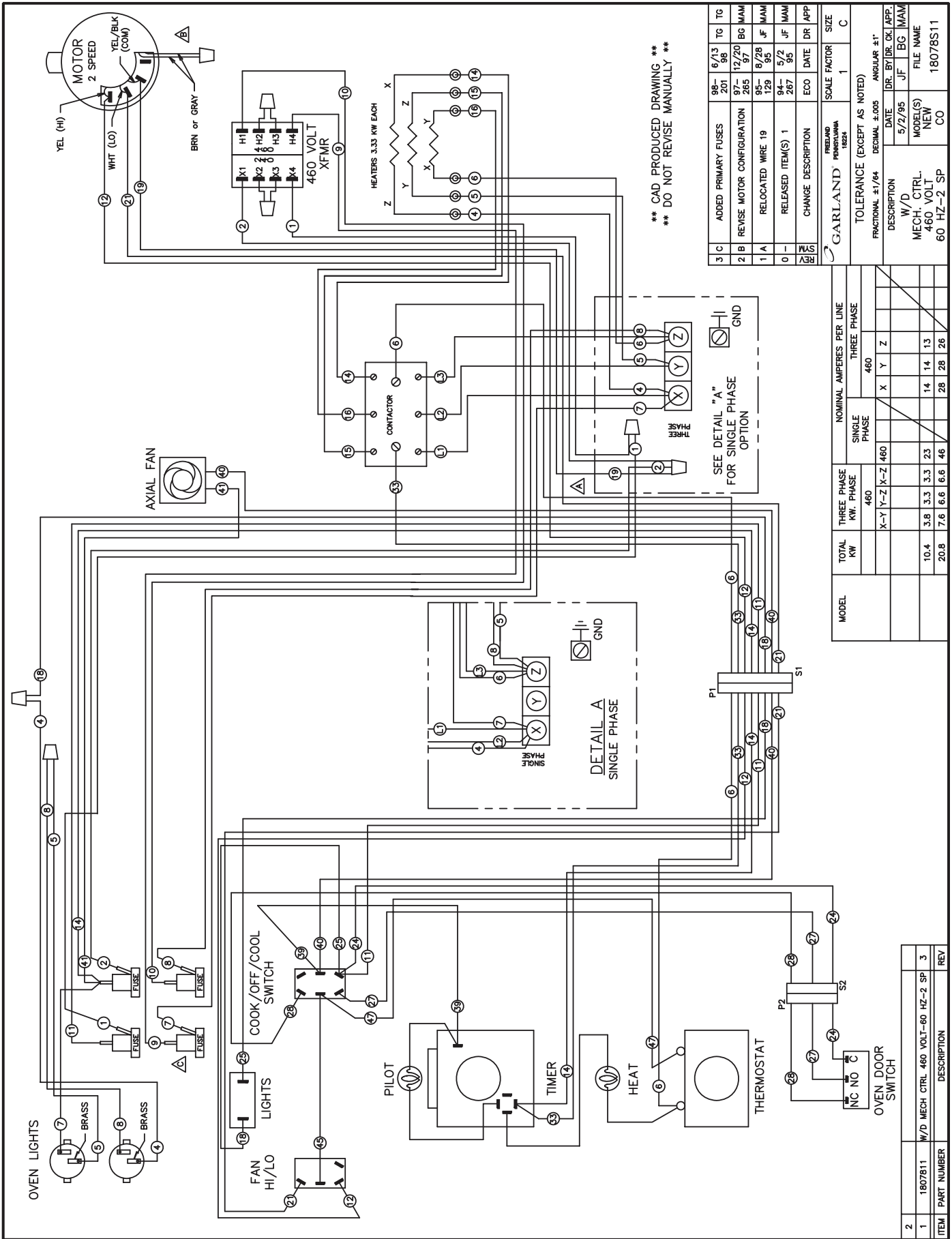
\*\* CAD PRODUCED DRAWING \*\*  
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3	D	ADDED PRIMARY FUSES	967-	6/13	TG
			201	96	
2	C	REVISE MOTOR CONFIGURATION	97-	12/20	BG MAM
			265	97	
B		ADDED MOTOR RELAY OPTION			
1	A	RELOCATED WIRE 19	95-	8/28	JF MAM
			129	95	
0	-	RELEASED ITEM(S) 1	94-	5/2	JF MAM
			267	95	
1	0	CHANGE DESCRIPTION	ECO	DATE	DR APP

FRELAND PENNSYLVANIA 18224		SCALE FACTOR	1	SIZE	C
A WELBETZ Company		TOLERANCE (EXCEPT AS NOTED)			
FRACTIONAL ±1/64		DECIMAL ±.005		ANGULAR ±1°	
DESCRIPTION	DATE	DR.	BY	DR. CK.	APP.
W/D	5/2/95	JF	BG	MAM	MAM
ELEC. CTRL	MODEL(S)	FILE NAME			
460 VOLT	NEW	18078S10			
60 HZ-1 SP	CO				

MODEL	TOTAL KW	THREE PHASE KW. PHASE	NOMINAL AMPERES PER LINE			
		460	SINGLE PHASE	THREE PHASE		
		X-Y	460	X	Y	Z
	10.4	3.8 3.3 3.3 2.3		14	14	13
	20.8	7.6 6.6 6.6 4.6		28	28	26

2					
1	1807810	W/D ELEC CTRL 460 VOLT-60 HZ-1 SP	3		
ITEM	PART NUMBER	DESCRIPTION	REV		



\*\* CAD PRODUCED DRAWING \*\*  
 \*\* DO NOT REVISE MANUALLY \*\*

3 C	ADDED PRIMARY FUSES	98-13	TG
2 B	REVISE MOTOR CONFIGURATION	201-36	BG MAM
1 A	RELOCATED WIRE 19	285-97	JF
0 -	RELEASED ITEM(S)	95-128	JF
REV	CHANGE DESCRIPTION	94-35	JF
		94-287	MAM
		ECO	DR APP

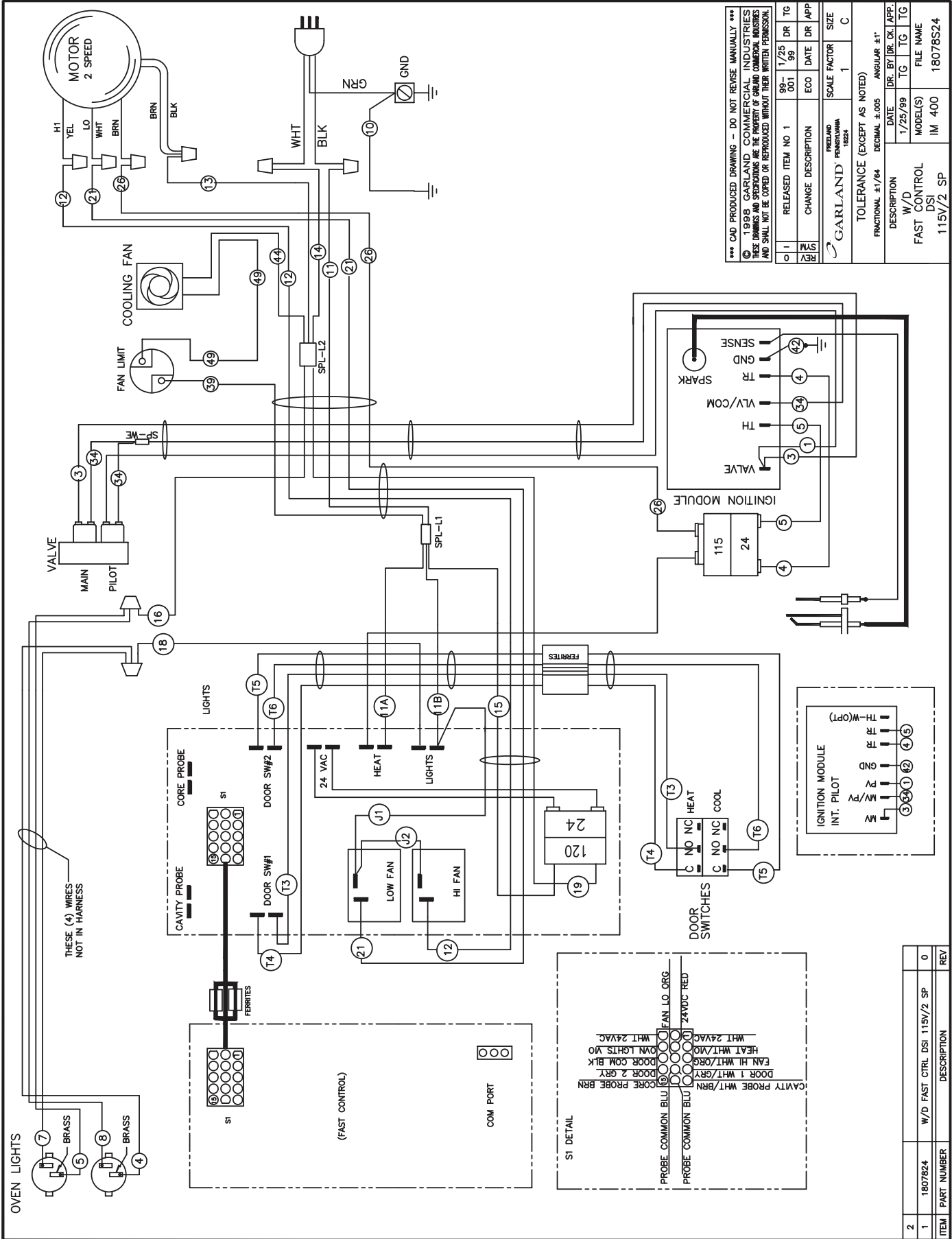
GARLAND FRENDSWAMA 1822A		SCALE FACTOR		SIZE	
TOLERANCE (EXCEPT AS NOTED)		1		C	
FRACTIONAL ±1/64	DECIMAL ±.005	ANGULAR ±1°			
DESCRIPTION	DATE	DR.	BY	CHK.	APP.
W/D	5/2/95	JF	BG	MAM	
MECH. CTRL.	MODEL(S)	FILE NAME		18078S11	
460 VOLT	NEW				
60 HZ-2 SP	CO				

MODEL	TOTAL KW	NOMINAL AMPERES PER LINE			
		SINGLE PHASE	THREE PHASE		
	460	460	X	Y	Z
	X-Y	Y-Z	X-Z		
	10.4	3.8	3.3	3.3	23
	20.8	7.6	6.6	6.6	46

2				
1	1807811	W/D MECH CTRL 460 VOLT-60 HZ-2 SP	3	
ITEM	PART NUMBER	DESCRIPTION	REV	







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REV	DESCRIPTION	ECO	DATE	DR	APP
01	RELEASED ITEM NO 1	98-001	1/25/99	DR	TG
02	CHANGE DESCRIPTION			DR	APP

GARLAND  
 PRELAWD PENNSYLVANIA 18224

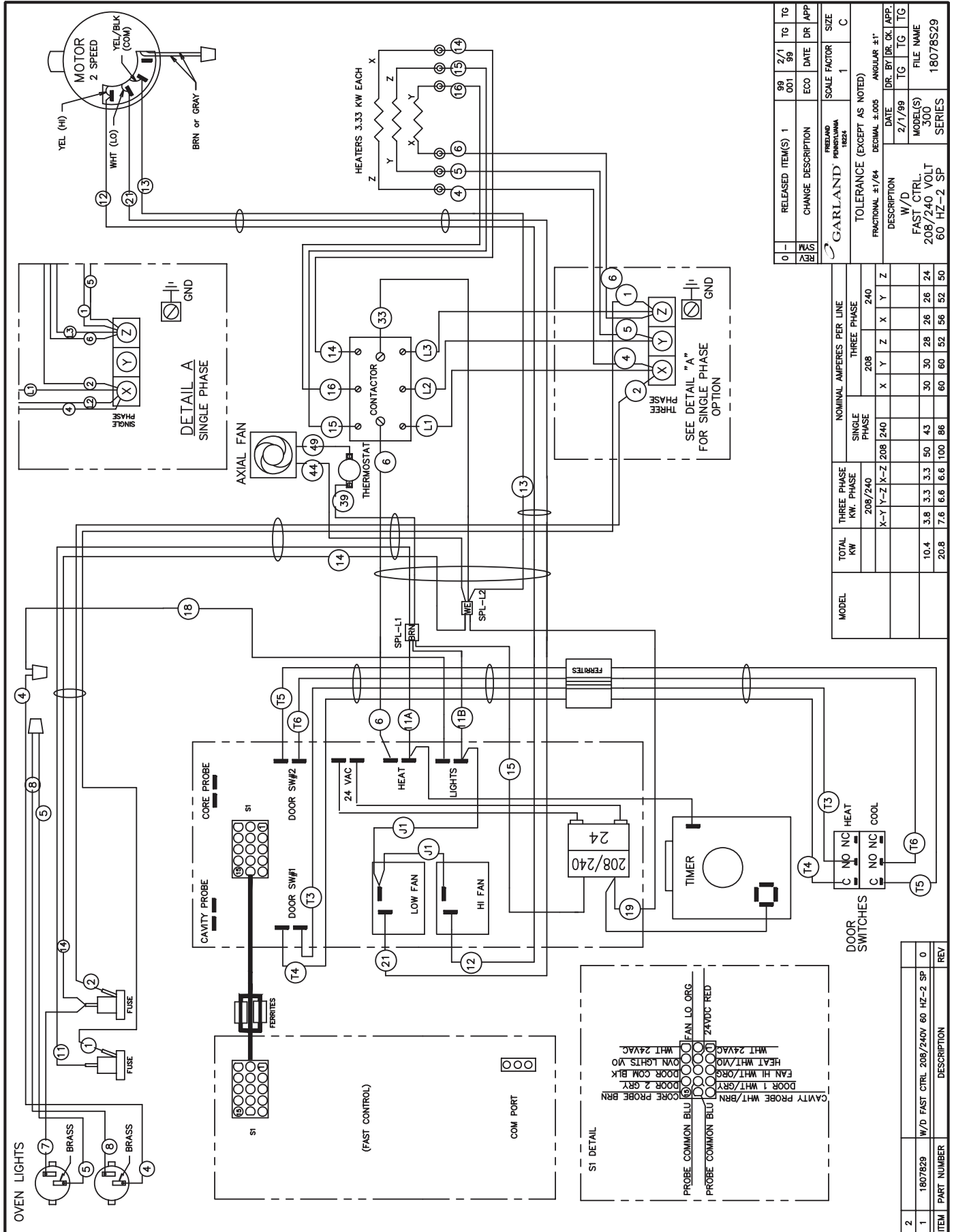
SCALE FACTOR: 1  
 SIZE: C

TOLERANCE (EXCEPT AS NOTED)  
 FRACTIONAL ±1/64 DECIMAL ±.005 ANGULAR ±1'

DESCRIPTION	DATE	DR	BY	DR	CHK	APP.
FAST CONTROL DSI	1/25/99	TG	TG	TG	TG	TG
MODEL(S)						FILE NAME
IM 400						18078S24

2					
1	1807824	W/D FAST CTRL DSI 115V/2 SP	0		
ITEM	PART NUMBER	DESCRIPTION	REV		



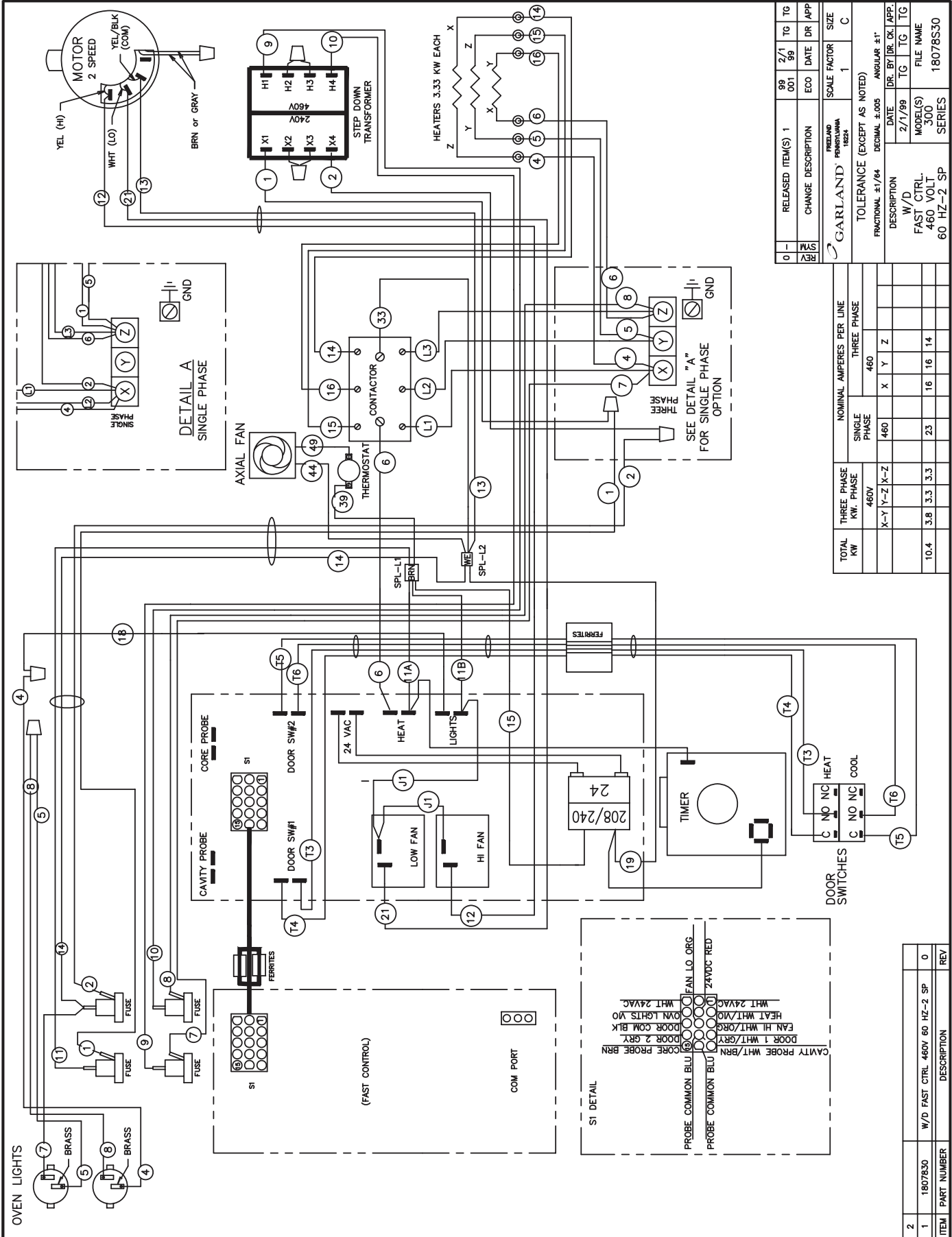


REV	SM	ECO	DATE	DR	APP	SIZE
0	1	99	2/1	TG	TG	C
RELEASED ITEM(S)	1	99	001	99		
CHANGE DESCRIPTION	PENSILVANIA 18024					
SCALE FACTOR 1						
TOLERANCE (EXCEPT AS NOTED)						
FRACTIONAL ±1/64			DECIMAL ±.005		ANGULAR ±1°	
DATE	DR.	BY	DR.	CHK.	APP.	
2/1/99	TG	TG	TG	TG	TG	
DESCRIPTION	W/D					
FAST CTRL	MODEL(S)					
208/240 VOLT	300					
60 HZ-2 SP	SERIES					
	18078S29					

MODEL	TOTAL KW	THREE PHASE KW. PHASE	NOMINAL AMPERES PER LINE		
			SINGLE PHASE	THREE PHASE	
		208/240	208	240	
		X-Y	X	Y	Z
		X-Z	X	Y	Z
		Y-Z	X	Y	Z
	10.4	3.8	3.3	5.0	4.3
	20.8	7.6	6.6	10.0	8.6
			60	60	52
			56	52	50

DOOR SWITCHES	C	NO	HEAT
			COOL
			T3
			T4
			T5
			T6

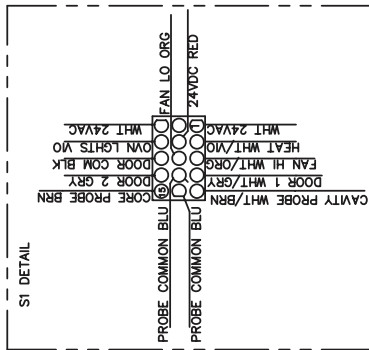
ITEM	PART NUMBER	DESCRIPTION	REV
2			
1	1807829	W/D FAST CTRL 208/240V 60 HZ-2 SP	0

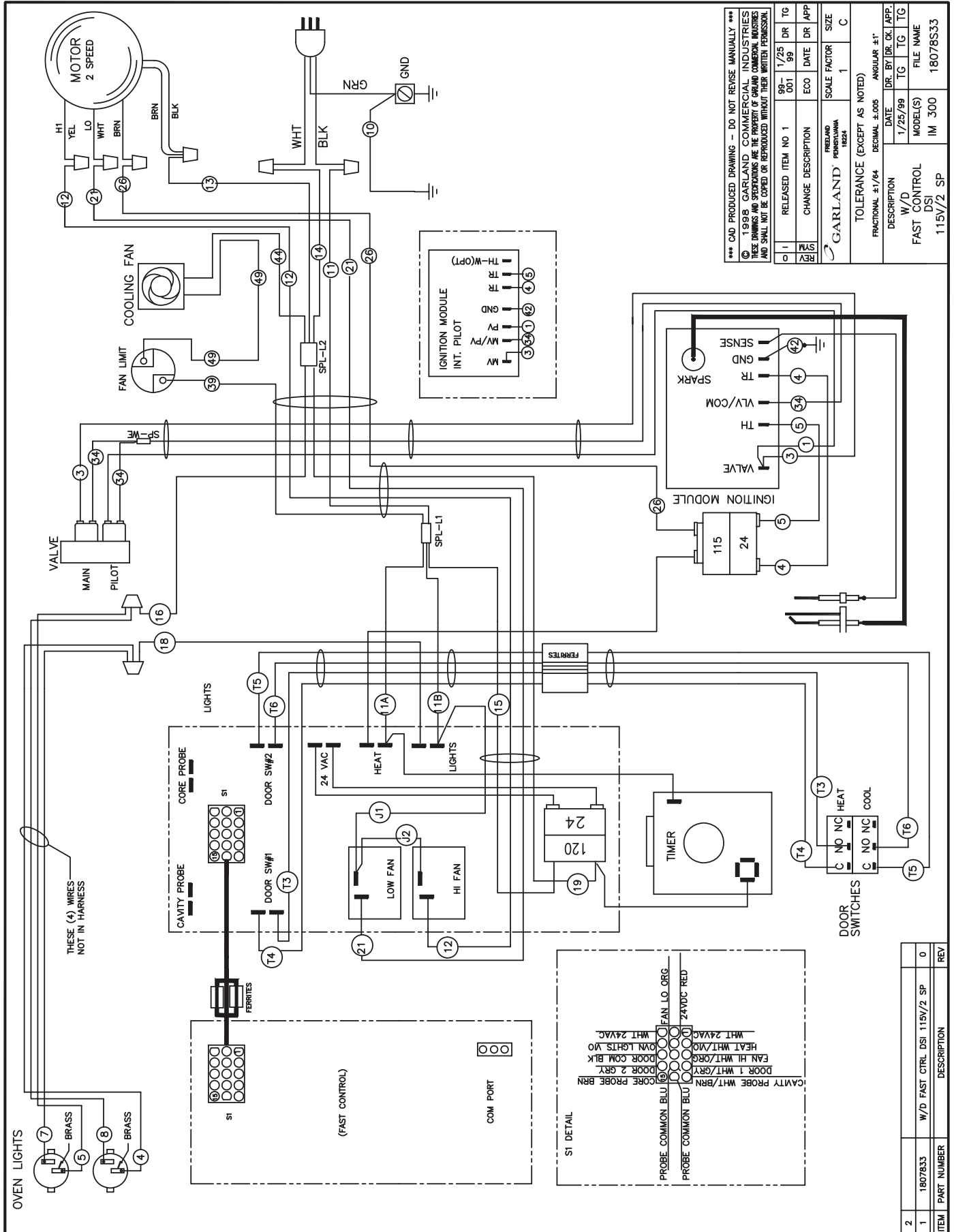


0	RELEASED ITEM(S)	1	99	2/1	TG	TG
REV	CHANGE DESCRIPTION	ECO	DATE	DR	APP	
GARLAND		PENSACOLA 1822A		SCALE FACTOR	1	
TOLERANCE (EXCEPT AS NOTED)		ANGULAR ±1°				
FRACTIONAL ±1/64		DECIMAL ±.005				
DATE		2/1/99		TG	TG	TG
DESCRIPTION		W/D		FILE NAME		
		FAST CTRL		300		
		460 VOLT		SERIES		
		60 HZ-2 SP		18078530		

TOTAL KW	THREE PHASE KW. PHASE	NOMINAL AMPERES PER LINE			
	460V	SINGLE PHASE	THREE PHASE		
	X-Y	460	X	Y	Z
	Y-Z	460			
	X-Z	460			
10.4	3.8	3.3	23	16	14

2	18078530	W/D FAST CTRL 460V 60 HZ-2 SP	0
ITEM	PART NUMBER	DESCRIPTION	REV





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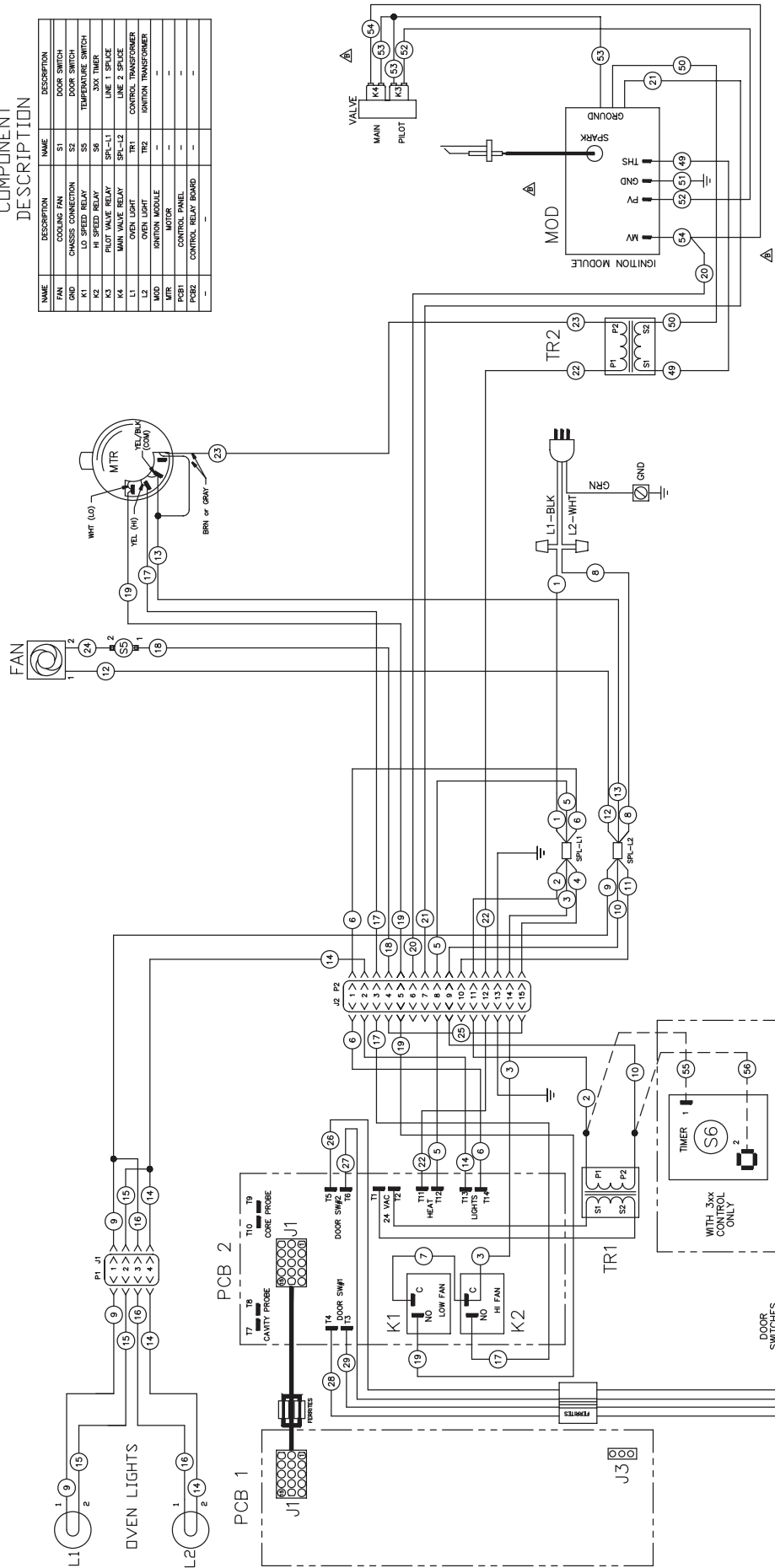
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REV	SM	ECO	DATE	DR	APP
01	1	98-001	1/25/99	DR	TG
RELEASED ITEM NO 1		CHANGE DESCRIPTION		ECO	DATE DR APP

GARLAND		SCALE FACTOR	SIZE
PENN/PA/MA		1	C
TOLERANCE (EXCEPT AS NOTED)			
FRACTIONAL ±1/64		DECIMAL ±.005	
ANGULAR ±1°			
DESCRIPTION		DATE	DR. BY DR. CK. APP.
FAST CONTROL		1/25/99	TG TG TG
W/D		MODEL(S)	
DSI		FILE NAME	
115V/2 SP		1807833	

**COMPONENT DESCRIPTION**

NAME	DESCRIPTION	NAME	DESCRIPTION
FAN	COOLING FAN	S1	DOOR SWITCH
GN1	CHASSIS CONNECTION	S2	TEMPERATURE SWITCH
K1	LO SPEED RELAY	SS	TEMPERATURE SWITCH
K2	HI SPEED RELAY	SP-L1	LINE 1 SPURCE
K3	PILOT VALVE RELAY	SP-L2	LINE 2 SPURCE
K4	MAIN VALVE RELAY	TR1	CONTROL TRANSFORMER
L1	OVEN LIGHT	TR2	IGNITION TRANSFORMER
L2	OVEN LIGHT	MTR	MOTOR
M1	IGNITION MODULE	PCB1	CONTROL PANEL
M2	MOTOR	PCB2	CONTROL RELAY BOARD



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REV	DESCRIPTION	ECO	DATE	DR	APP
2	CHANGED IGNITION MODULE	02	3/25	RG	BG
1	SWAP WIRE S8 & S4	02	05/11	GTB	GTB
0	RELEASED ITEM/S 1	002	2/01	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
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REV	DESCRIPTION	ECO	DATE	DR	APP
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REV	DESCRIPTION	ECO	DATE	DR	APP
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REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

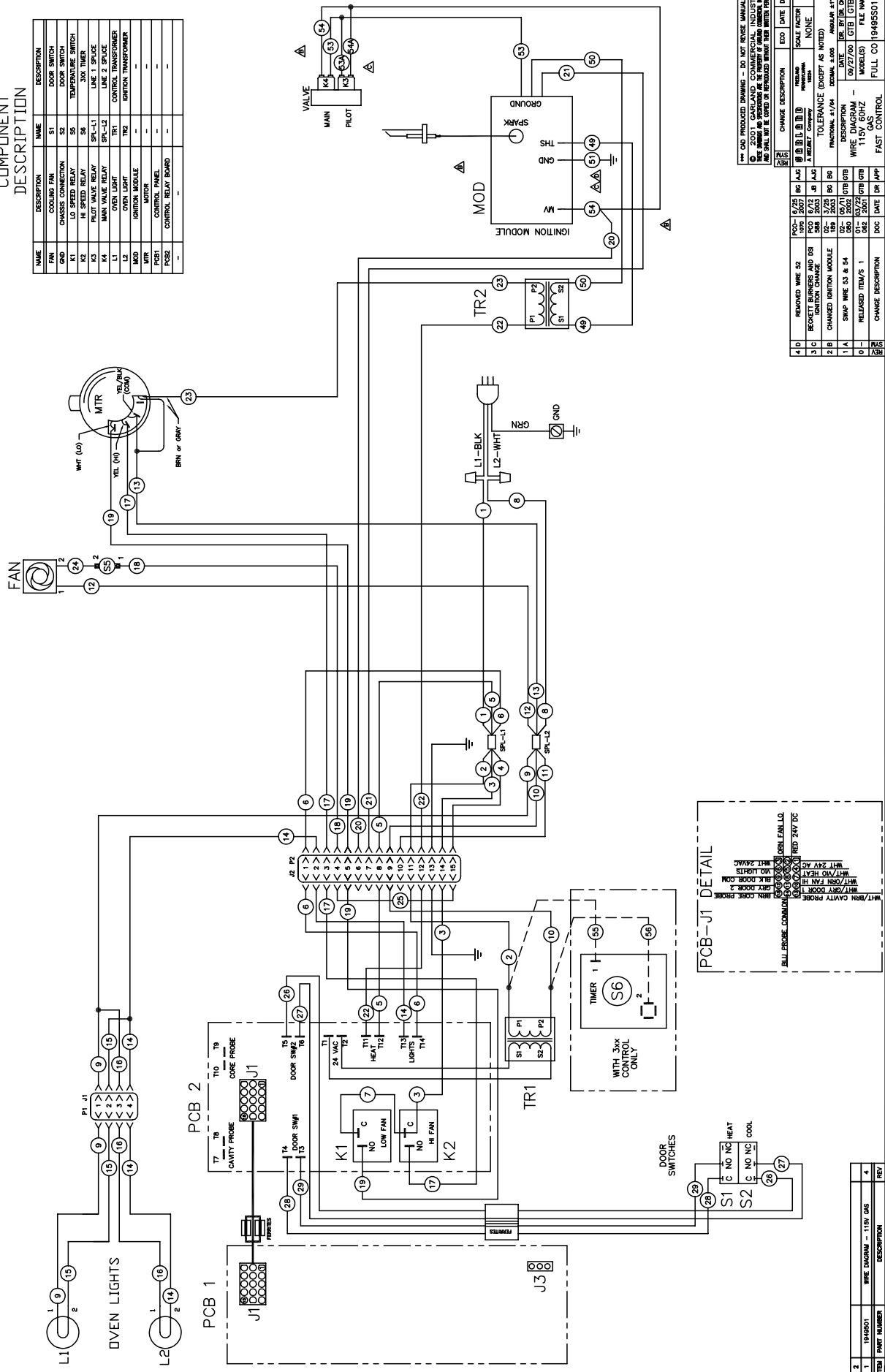
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REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

REV	DESCRIPTION	ECO	DATE	DR	APP
1	CHANGE DESCRIPTION	001	08/27	GTB	GTB

# COMPONENT DESCRIPTION

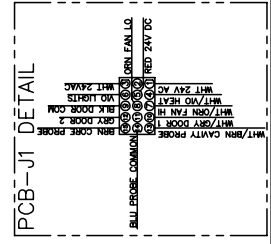
NAME	DESCRIPTION	NAME	DESCRIPTION
FAN	COOLING FAN	S1	DOOR SWITCH
CHD	CHASSIS CONNECTION	S2	DOOR SWITCH
K1	LO SPEED RELAY	S3	TEMPERATURE SWITCH
K2	HI SPEED RELAY	S4	30X TIMER
K3	PILOT VALVE RELAY	SP-1	LINE 1 SPICE
L1	OVEN LIGHT	SP-2	LINE 2 SPICE
L2	OVEN LIGHT	TR1	CONTROL TRANSFORMER
MOD	IGNITION MODULE	TR2	IGNITION TRANSFORMER
MTR	MOTOR		
PCB1	CONTROL PANEL		
PCB2	CONTROL RELAY BOARD		



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CHANGE DESCRIPTION	ECO	DATE	BY	APP	SCALE FACTOR	SIZE
INITIAL COMPANY					NONE	D

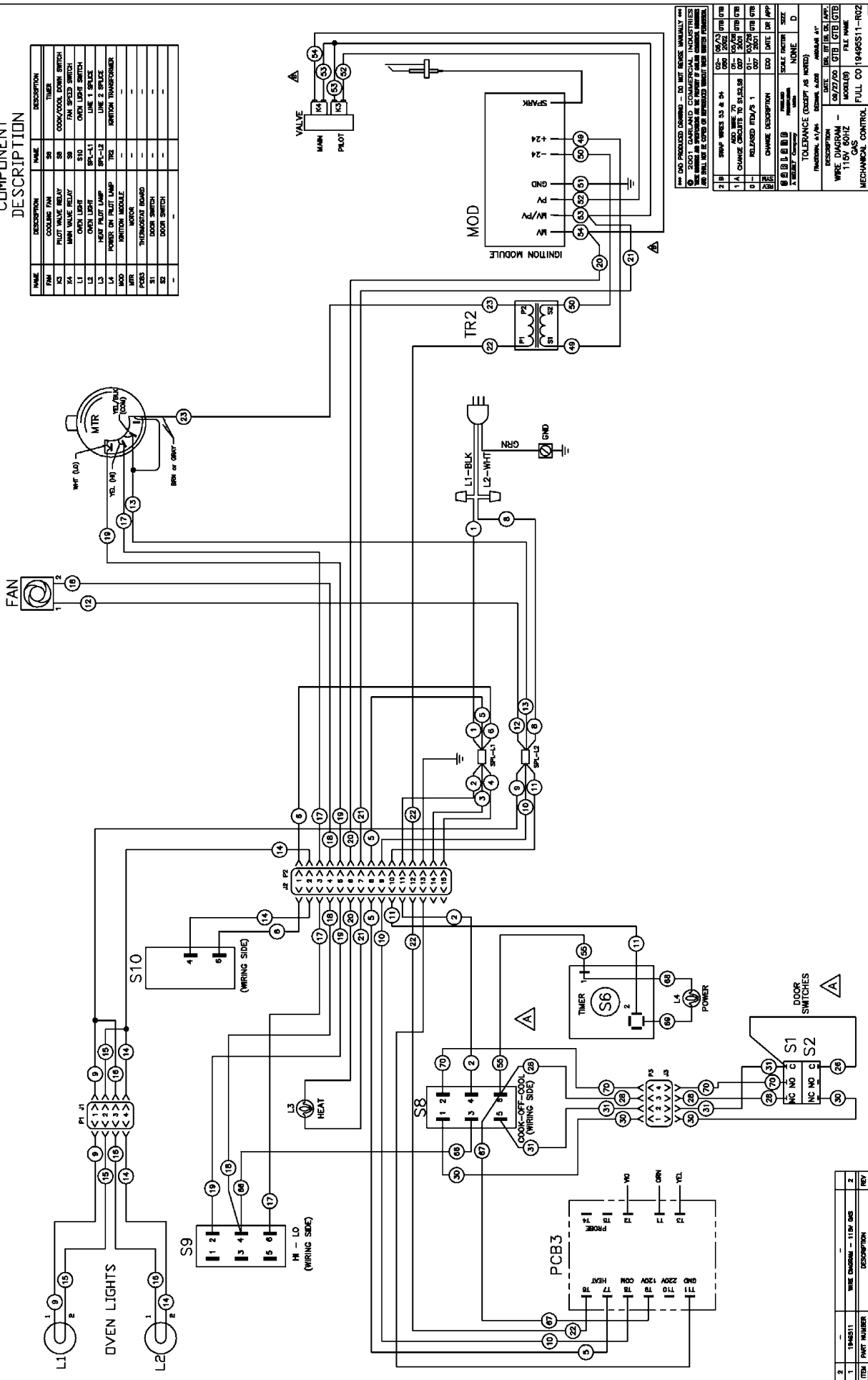
TOLEANCE (EXCEPT AS NOTED)  
 DIMENSIONS UNLESS OTHERWISE SPECIFIED  
 FINISH UNLESS OTHERWISE SPECIFIED  
 MATERIAL UNLESS OTHERWISE SPECIFIED  
 WEIGHT UNLESS OTHERWISE SPECIFIED  
 TOLERANCE UNLESS OTHERWISE SPECIFIED  
 FILE NAME  
 FULL CO 19485S01-R04



ITEM	PNW NUMBER	DESCRIPTION	REV
2	1948501	WIRE DIAGRAM - 115V GAS	4

# COMPONENT DESCRIPTION

NAME	DESCRIPTION	NAME	DESCRIPTION
FAN	COOLING FAN	S9	TIMER
K2	PILOT WALK RELAY	S8	COOK/COOL DOWN SWITCH
K4	MAIN WALK RELAY	S8	FAN SPEED SWITCH
L1	OVEN LIGHT	S10	OVEN LIGHT SWITCH
L2	OVEN LIGHT	SP-1-1	LINE 1 SPULCE
L3	HEAT PILOT LAMP	SP-1-2	LINE 2 SPULCE
L4	PILOT LAMP	TR2	IGNITION TRANSFORMER
MTR	MOTOR		
PCB3	CONTROL BOARD		
S1	DOOR SWITCH		
S2	DOOR SWITCH		



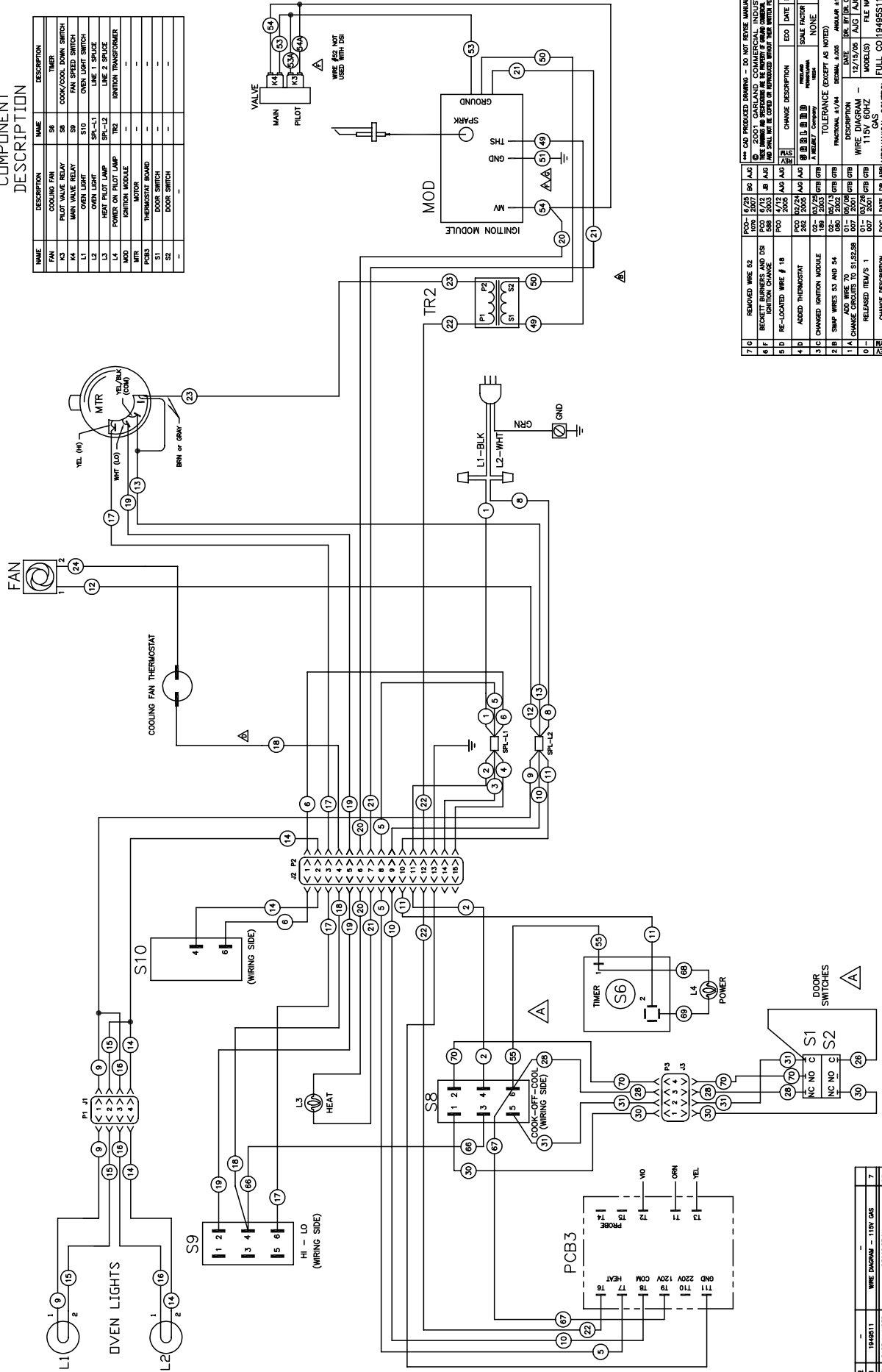
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2 11	SWAP WIRING 53 & 54
1 14	CHANGE CIRCUITS TO SUSSES
0	RELEASED ITEMS 1
0 15	CHANGE DESCRIPTION
0 16	CHANGE DATE OR APP
0 17	CHANGE PART NO.
0 18	CHANGE SIZE
0 19	CHANGE TOLERANCE
0 20	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 21	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 22	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 23	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 24	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 25	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 26	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 27	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 28	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 29	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 30	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 31	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 32	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 33	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 34	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 35	CHANGE TOLERANCE (EXCEPT AS NOTED)
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0 44	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 45	CHANGE TOLERANCE (EXCEPT AS NOTED)
0 46	CHANGE TOLERANCE (EXCEPT AS NOTED)
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0 100	CHANGE TOLERANCE (EXCEPT AS NOTED)

2	11/03/08	WIRE DIAGRAM - 110V GAS	2
1	11/03/08	WIRE DIAGRAM - 110V GAS	1
REV	DATE	DESCRIPTION	REV



COMPONENT DESCRIPTION

NAME	DESCRIPTION	NAME	DESCRIPTION
FAN	COOLING FAN	MTR	MOTOR
K3	PILOT VALVE RELAY	SR	THERMOSTAT BAND
K4	MAIN VALVE RELAY	S1	DOOR SWITCH
L1	OVEN LIGHT	S2	DOOR SWITCH
L2	PILOT LIGHT		
L3	HEAT PILOT LAMP		
L4	POWER ON PILOT LAMP		
MOD	IGNITION MODULE		
PCB3	PCB3		
S10	COOLING FAN THERMOSTAT		
S8	COOK-OFF-COOL		
S9	HI-LO		
S6	TIMER		
TR2	TRANSFORMER		



ITEM	PNR NUMBER	WIRE DIAGRAM - 115V GAS	DESCRIPTION	REV
2	11448511	WIRE DIAGRAM - 115V GAS		7
1			DESCRIPTION	

7 C	REMOVED WIRE #2	PROJ	6/25	86	AJC
6 F <td>RECKETT BURNERS AND DS</td> <td>500</td> <td>6/22</td> <td>48</td> <td>AJC</td>	RECKETT BURNERS AND DS	500	6/22	48	AJC
5 D <td>RE-LOCATED WIRE # 18</td> <td>500</td> <td>5/23</td> <td>48</td> <td>AJC</td>	RE-LOCATED WIRE # 18	500	5/23	48	AJC
4 D <td>ADDED THERMOSTAT</td> <td>500</td> <td>5/23</td> <td>48</td> <td>AJC</td>	ADDED THERMOSTAT	500	5/23	48	AJC
3 C <td>CHANGED IGNITION MODULE</td> <td>500</td> <td>5/23</td> <td>48</td> <td>AJC</td>	CHANGED IGNITION MODULE	500	5/23	48	AJC
2 B <td>SWAP WIRES #3 AND #4</td> <td>500</td> <td>5/23</td> <td>48</td> <td>AJC</td>	SWAP WIRES #3 AND #4	500	5/23	48	AJC
1 A <td>CHANGE CIRCUITS TO 51,52,58</td> <td>500</td> <td>5/23</td> <td>48</td> <td>AJC</td>	CHANGE CIRCUITS TO 51,52,58	500	5/23	48	AJC
0 <td>RELEASED ITEM/S 1</td> <td>500</td> <td>5/23</td> <td>48</td> <td>AJC</td>	RELEASED ITEM/S 1	500	5/23	48	AJC

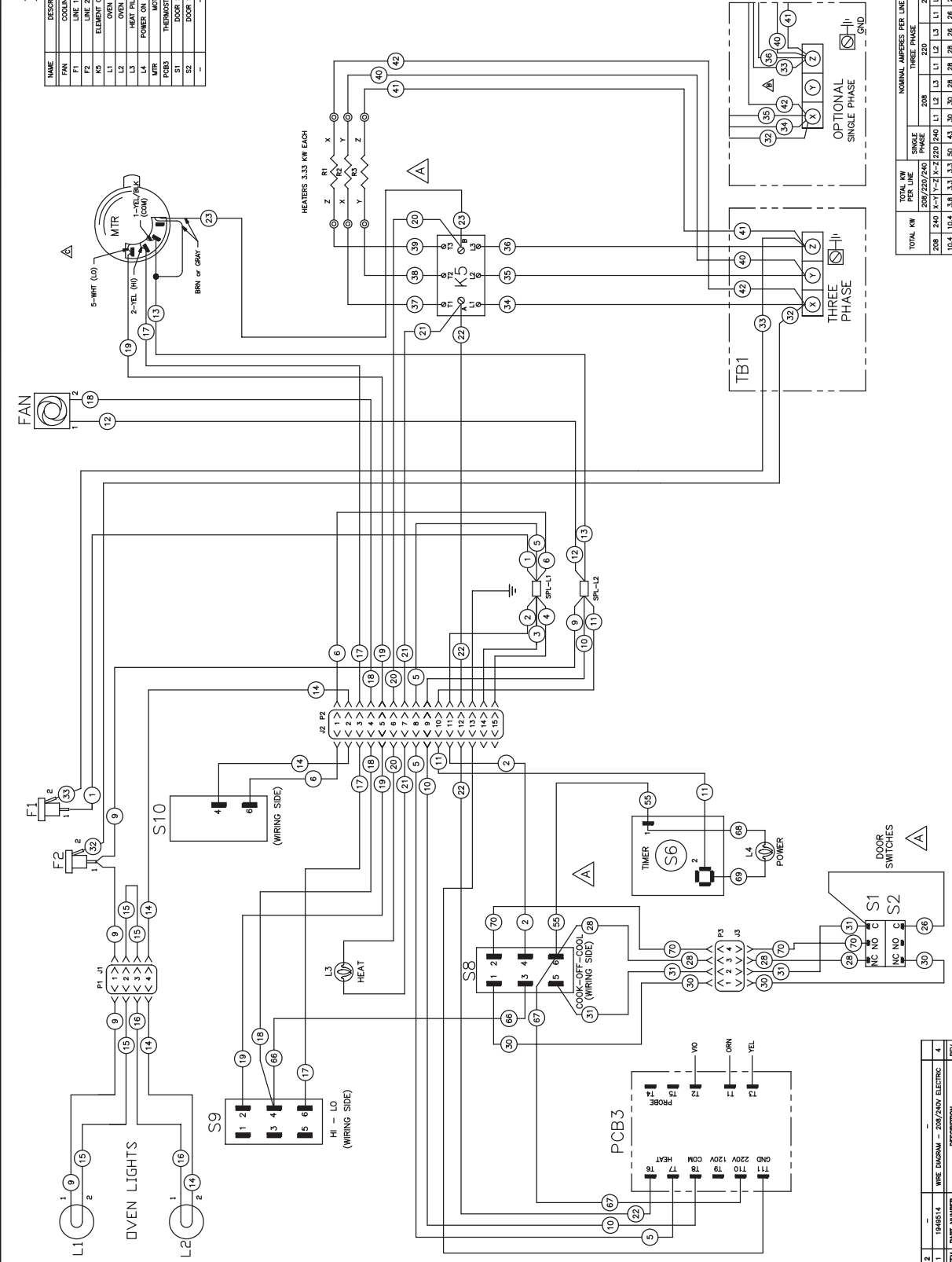
  

*** DO NOT PRODUCE DRAWING - DO NOT REUSE MANUALLY ***	DATE	BY	SCALE FACTOR	SIZE
2007 GARLAND COMMERCIAL INDUSTRIES	12/15/08	AJC	NONE	D
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CHANGE DESCRIPTION	ECO	DATE	BY	APP
DESCRIPTION (EXCEPT AS NOTED)	TOLERANCE (EXCEPT AS NOTED)			
SCALE FACTOR	NONE			
SIZE	D			
FILE NAME	11448511			
MECHANICAL CONTROL	FULL CO 1948511-R07			



# COMPONENT DESCRIPTION

NAME	DESCRIPTION	NAME	DESCRIPTION
FAN	COOLING FAN	S6	TIMER
F1	LINE 1 FUSE	S8	COOK/COOL DOWN SWITCH
F2	LINE 2 FUSE	S9	FAN SPEED SWITCH
K5	ELEMENT CONTACTOR	S10	OVEN LIGHT SWITCH
L1	OVEN LIGHT	SP-11	LINE 1 SPIDE
L2	OVEN LIGHT	SP-12	LINE 2 SPIDE
L3	HEAT LAMP	TB1	TERMINAL BLOCK
L4	POWER POINT LAMP	MTR	MOTOR
MTR	POWER POINT LAMP	PCB3	THERMOSTAT BOARD
PCB3	THERMOSTAT BOARD	S1	DOOR SWITCH
S1	DOOR SWITCH	S2	DOOR SWITCH
S2	DOOR SWITCH		



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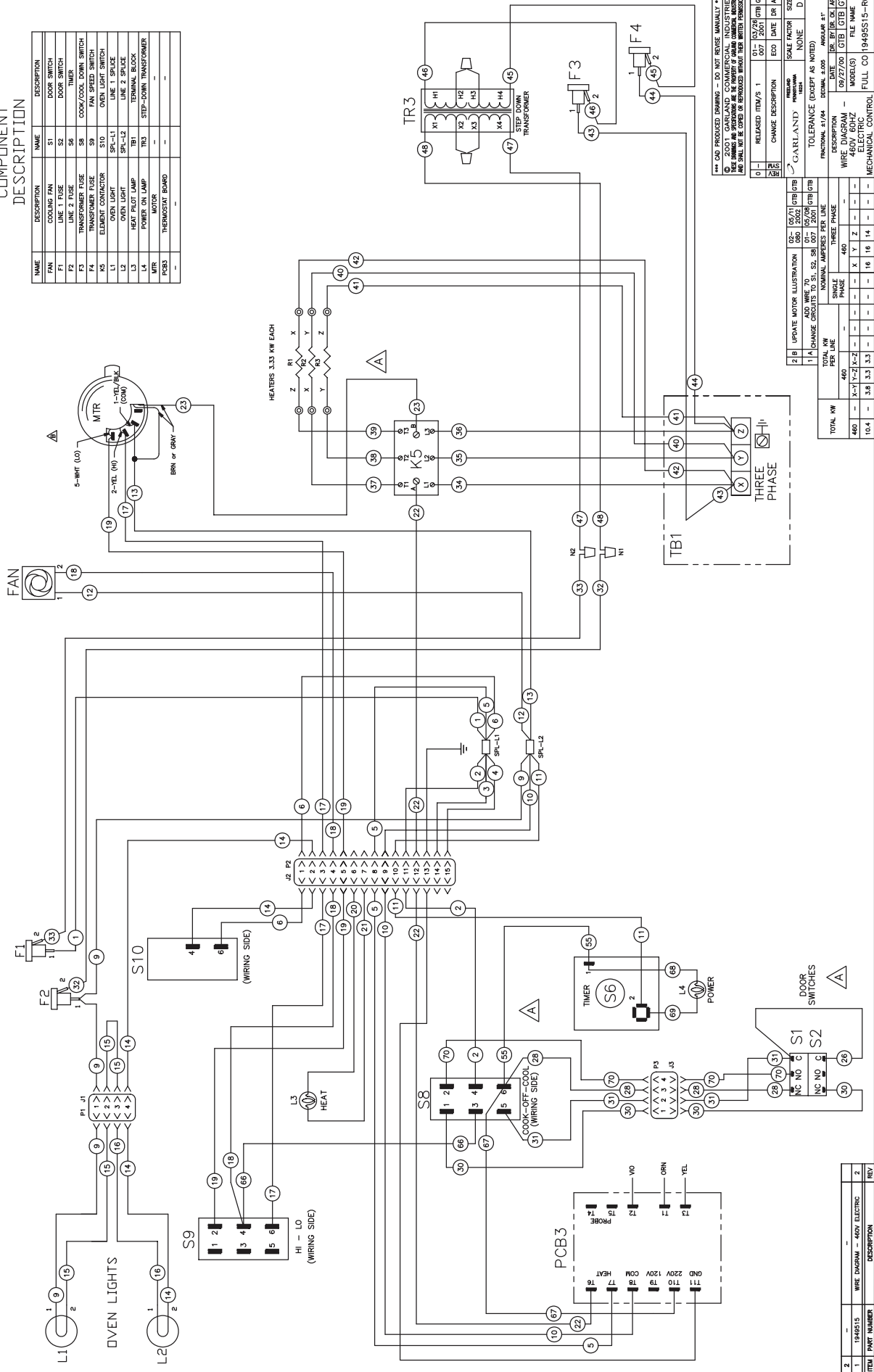
REV	DESCRIPTION	DATE	BY	CHK
4	REVISED 220V LOADING CHART	05/05/08	AB	TC
3	UPDATE MOTOR ILLUSTRATION	02/11/07	GTB	GTB
2	SWAP WIRES 41 & 42 IN SINGLE PHASE DETAIL	07/18/06	GTB	GTB
1	CHANGE CIRCUITS TO S1, S2, S8, S07, 2007	01/19/06	GTB	GTB
0	RELEASED ITEM/S 1	01/15/04	GTB	GTB
0	CHANGE DESCRIPTION	03/04/04	GTB	GTB
0	SCALE FACTOR	1.0000		
0	SCALE FACTOR	NONE		
0	SCALE FACTOR	NONE		

TOLERANCE (EXCEPT AS NOTED)  
 DIMENSIONS: 1/16" DECIMAL; .005 ANGULAR ±1°  
 FINISH: 100% POLISH; 100% POLISH WITH FINISHES  
 100% POLISH; 100% POLISH WITH FINISHES

ITEM	PART NUMBER	DESCRIPTION	REV
1	1948514	WIRE DIAGRAM - 208/240V ELECTRIC	4
2			

# COMPONENT DESCRIPTION

NAME	DESCRIPTION	NAME	DESCRIPTION
FAN	COOLING FAN	S1	DOOR SWITCH
F1	LINE 1 FUSE	S2	DOOR SWITCH
F2	LINE 2 FUSE	S6	TIMER
F3	TRANSFORMER FUSE	S8	COOK/COOL DOWN SWITCH
F4	TRANSFORMER FUSE	S10	FAN SPEED SWITCH
K5	ELEMENT CONTACTOR	SPL-1	OVEN LIGHT SWITCH
L1	OVEN LIGHT	SPL-2	OVEN LIGHT SWITCH
L2	OVEN LIGHT	TB1	
L3	HEAT PILOT LAMP	TR3	STEP-DOWN TRANSFORMER
L4	POWER ON LAMP	MTR	MOTOR
PCB3	THERMOSTAT BOARD		



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0	RELEASED	ITEM/S 1	01-15/24	OTB	OTB
1	CHANGE DESCRIPTION	ECO	DATE	ENR	APP
2					

SCALE FACTOR: NONE  
SIZE: D

FUNCTIONAL: 1/4  
TOLERANCE (EXCEPT AS NOTED): DECIMAL: 0.005

DESCRIPTION: 1949515  
WIRING DIAGRAM: 1949515  
ELECTRIC: 1949515-RO2  
MECHANICAL CONTROL: FULL CO 1949515-RO2

2 BI	UPDATE MOTOR ILLUSTRATION	S2-	05/21/07	OTB	OTB
1	CHANGE CIRCUITS TO ST. S2	S2	07/25/08	OTB	OTB

ADD WIRE TO: 02-02-007  
CHANGE CIRCUITS TO ST. S2: 007

NORMAL AMPERES PER LINE: THREE PHASE

TOTAL KW PER LINE	460
SINGLE PHASE	150
1	X-1
2	X-2
3	X-3
4	X-4
5	X-5
6	X-6
7	X-7
8	X-8
9	X-9
10	X-10
11	X-11
12	X-12
13	X-13
14	X-14
15	X-15
16	X-16
17	X-17
18	X-18
19	X-19
20	X-20
21	X-21
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30	X-30
31	X-31
32	X-32
33	X-33
34	X-34
35	X-35
36	X-36
37	X-37
38	X-38
39	X-39
40	X-40
41	X-41
42	X-42
43	X-43
44	X-44
45	X-45
46	X-46
47	X-47
48	X-48
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58	X-58
59	X-59
60	X-60
61	X-61
62	X-62
63	X-63
64	X-64
65	X-65
66	X-66
67	X-67
68	X-68
69	X-69
70	X-70

ITEM	PART NUMBER	DESCRIPTION	REV
1	1949515	WIRE DIAGRAM - 460V ELECTRIC	2
2			



 **Garland**<sup>®</sup>