TurboChef Service Manual

FOR THE TURBOCHEF NGC (TORNADO) OVEN

Accelerating the World of Cooking

800.90TURBO
Part Number: NGC-1007 / Revision A, July 23, 2004

IMPORTANT SAFETY INFORMATION - PLEASE READ FIRST

⚠ WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

This product employs an exposed radiant heating element on the bottom of the cavity. This element is HOT during operation and will remain at dangerous temperatures after the unit is switched off. NEVER attempt to touch the element during operation or while the oven is warm.

- DO NOT store or use gasoline or any other flammable vapors or liquids in the vicinity of this or any other appliance.

The information contained in this manual is important for the proper installation, use and maintenance of this oven. Adherence to these procedures and instructions will result in satisfactory baking results and long trouble-free service. Please read this manual carefully and retain it for future reference.

Errors - descriptive, typographic or pictorial - are subject to correction. Specifications are subject to change without notice.

Table of Contents

Important Safety Instructions i
Precautions to Avoid Possible Exposure to Excessive Microwave Energy ii
Grounding Instructions ii
RF Interference Considerations ii

Chapter 1: Installation, Specifications and Maintenance
Specs and Dimensions 1
- Dimensions
- Construction
- Standard Features
- Accessories
- Certification
- Packaging
- Power Supply - North America

Delivery and Product Placement 2
- Lifting and Placement of the Oven
- Restraint Oven Kit

Electrical Specifications 2
Setup and Initial Operation 2
- Setup
- Programming
- Initial Power-Up

Maintenance 3

Chapter 2: Theory of Operation
The Theory of Operation 5
Glossary of Common Operating Terms 6

Chapter 3: Fault Codes
To View Fault Codes 9
Fault Code Definitions 9
Fault Code Table 10

Chapter 4: The Control System
Control System Schematic 11
Control System Component Descriptions 12
Test Function Options 13
Status Indicators 14
Programming 14
User Configurable Options 15
Passwords 16
Control System Panel Parts 17
Control System Trouble Shooting 18

Chapter 5: The Microwave System

Overview of a Microwave Circuit 21
Monitor Circuit Description 21
Microwave Circuit Theory of Operation 22
Microwave System Parts 22
Microwave System Components 23
Wave Guide Cover Replacement 24
Wave Guide/Wave Guide Cover Parts 25
Wave Guide Replacement and Cleaning 26
High Voltage Transformer & Filament Transformer Replacement 26
- Wiring the High Voltage Transformers
- Wiring the Filament Transformers

Measuring RF Leakage for Microwave Safety 27
Testing Microwave Components 28
- Testing the High Voltage Diode
- Checking a Diode
- Checking a Capacitor
- Checking a Magnetron for Open/Shared Filament
- Checking a High Voltage Transformer or Filament Transformer

High Voltage and Filament Transformer Resistance Table 29
Microwave System Trouble Shooting 30

Chapter 6: The Cook Door

Removing/Reinstalling the Cook Door 33
Cook Door Parts 33
Adjusting the Cook Door 34
Adjusting the Primary and Secondary Interlock Switches 34
Primary and Secondary Interlock Switches Adjustments and Parts 35
Door Switch Assembly and Parts 36
Adjusting the Monitor Safety Switch 36
Monitor Safety Switch Parts 37
Cook Door Assembly 38
Cook Door Parts 38
Screw Torque Chart 39
Interlocks Trouble Shooting 40

Chapter 7: The Convection Circuit

Convection System Components 41
Convection Circuit Parts 42
Blower Motor Parts 43
Convection Circuit Trouble Shooting 44
Motor Winding Resistance Table 45

Chapter 8: IR Element and Catalytic Converter

Components 47
IR Element and Catalyst Removal 47
- Removing the IR Element
- Removing & Installing the Catalytic Converter
- Installing a New IR Element

IR Element and Catalytic Converter Parts 48

Chapter 9: Schematic and Schematic Parts

NGC (Tornado) Schematic Inside 49
Schematic Parts 49
- Line Voltage Components
- Low Voltage Components
- Wire Harness Replacement P/N's

I/O Control Board Item Identification and Test Point Locations 49

Chapter IO: Service Parts and Illustrations

Figure 4: NGC (Tornado) Control System 51
Figure 12: Control System Panel Enclosure and Parts 52
Figure 13: Monitor Circuit - Shown in Failsafe State 53
Figure 15: Microwave System Parts 53
Figure 16: Microwave System Parts 54
Figure 17: Wave Guide Cover/Wave Guide Removal and Replacement 54
Figure 18 & 19: High Voltage Transformer and Filament Wirings 55
Figure 21&22: High Voltage Diode and Magnetron 55
Figure 23: Cook Door Removal and Parts 56
Figure 26: Primary and Secondary Interlocks Adjustment and Parts 56
Figure 27: Door Switch Assembly and Parts 57
Figure 28: Motor Switch Adjustment and Assembly 58
Figure 29: Cook Door Assembly 59
Figure 31: Convection Circuit Block Diagram 60
Figure 32: Convection Circuit Assembly and Parts 61
Figure 33: Blower Motor Parts and Assembly 62
Figure 34: IR Element and Catalytic Converter Parts and Assembly 63
Figure 35: NGC (Tornado) Schematic 64
Figure 36: I/O Control Board and Test Point Locations 64
Figure 37: Covers and Miscellaneous Parts 66

IMPORTANT SAFETY INSTRUCTIONS

The following basic safety precautions should be strictly adhered to when using electrical appliances, so as to reduce the risk of burns, electric shock, fire, injury to persons or exposure to excessive microwave energy.

- ☐ Read all instructions before using the appliance.
- ☐ Read and follow the Specific Precautions to Avoid Possible Exposure to Excessive Microwave Energy found on page ii.
- ☐ This appliance must be grounded. Connect only to properly grounded outlet. See Grounding Instructions found on page ii.
- ☐ Install or locate this appliance only in accordance with the provided installation instructions.
- ☐ Some products such as whole eggs and sealed containers - for example: closed glass jars - may explode and should not be heated in this oven.
- ☐ Use this appliance only for its intended use as described in this manual.
- ☐ This appliance should be serviced only by qualified service personnel. Contact the nearest authorized service facility for examination, repair or adjustment.
- ☐ Keep cord away from heated surfaces.
- ☒ DO NOT allow children to use this appliance.
- ☒ DO NOT use corrosive chemicals or vapors in this appliance. This type of oven is specifically designed to heat, cook or dry food. It is not designed for industrial or laboratory use.
- ☒ DO NOT operate this appliance if it has a damaged cord or plug, is not working properly, or has been damaged or dropped. See Power Supply Cord Replacement found on page ii.
- ☒ DO NOT cover or block any openings on the appliance.
- ☒ DO NOT store this appliance outdoors.
- ☒ DO NOT use this product near water - for example: near a kitchen sink, in a wet basement or near a swimming pool.
- ☒ DO NOT immerse cord or plug in water.
- ☒ DO NOT let cord hang over edge of table or counter.
- ☒ DO NOT use a water jet for cleaning. See the Maintenance section of this manual on page 3 for proper cleaning procedures.

To reduce the risk of fire in the oven cavity:

- ☐ Remove wire twist-ties from paper or plastic bag in the oven.
- ☐ If materials inside the oven should ignite, keep oven door closed, turn oven off and disconnect the power cord or shut off power at the fuse or circuit breaker panel.
- ☐ If smoke is observed, switch off or unplug the oven. Keep the door closed in order to stifle any flames.
- ☒ DO NOT use the cavity for storage purposes.
- ☒ DO NOT overcook food. Carefully attend the oven if paper, plastic or other combustible materials are placed inside the oven to facilitate cooking.
- ☒ DO NOT leave paper products, cooking utensils or food in the cavity when not in use.

SAVE THESE INSTRUCTIONS

PRECAUTIONS TO AVOID POSSIBLE EXPOSURE TO EXCESSIVE MICROWAVE ENERGY

To reduce the risk of exposure to excessive microwave energy:

- ⊠ DO NOT attempt to operate this oven with the door open. Open-door operations can result in harmful exposure to microwave energy. It is important not to defeat or tamper with the safety interlocks.
- ⊠ DO NOT place any object between the oven front face and the door or allow soil or cleaner residue to accumulate on the sealing surfaces.
- ⊠ DO NOT operate the oven if it is damaged. It is particularly important that the oven door close properly and that there is no damage to the door (bent), hinges and latches (broken or loosened), door seals and sealing surfaces.
- ⊠ DO NOT have the oven adjusted or repaired by anyone except a factory authorized service technician.

GROUNDING INSTRUCTIONS

This appliance must be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This appliance is equipped with a cord that has a grounding wire with a grounding plug. The plug must be plugged into an outlet that is properly installed and grounded. Consult a qualified electrician or serviceman if uncertain about the ability to follow grounding instructions or if doubt exists as to whether the appliance is properly grounded.

- ⊠ DO NOT use an extension cord. If the power supply cord is too short, have a qualified electrician or serviceman install an outlet near the appliance.

Power Supply Cord Replacement

If the power supply cord is damaged, it must be replaced by the manufacturer, its service agent or a similarly qualified person in order to avoid a hazard.

⚠ WARNING: Improper grounding can result in a risk of electric shock.

RF INTERFACE CONSIDERATIONS

The NGC (Tornado) oven generates radio frequency signals. This device has been tested and was determined to be in compliance with applicable portions of FCC part 18 requirements and to the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility at the time of manufacture. However, some equipment with sensitivity to signals below these limits may experience interference.

If your equipment experiences interference, the following steps should be considered:

- □ Increase the physical separation between this oven and the sensitive equipment.
- □ If the sensitive device can be grounded, do so following accepted grounding practices.
- □ If battery powered microphones are being affected, insure that the batteries are fully charged.
- □ Keep sensitive equipment on separate electrical circuits if possible.
- ⊠ DO NOT route intercom wires, microphone wires or speaker cables near the oven.

SAVE THESE INSTRUCTIONS

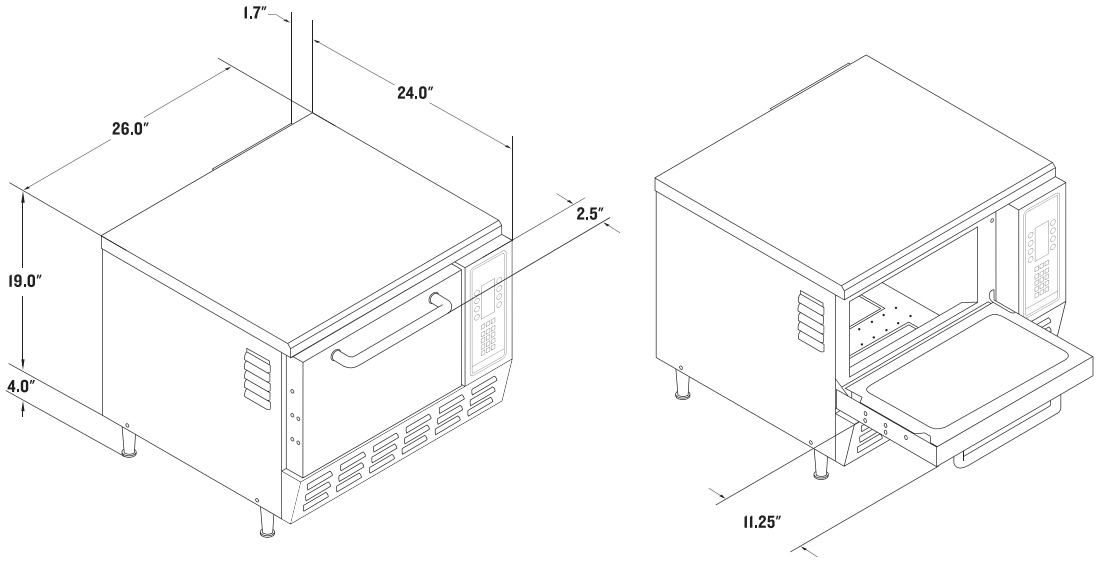


FIGURE 1: NGC (Tornado) Dimensions

SPECS AND DIMENSIONS

Dimensions

	EXTERIOR	COOK CAVITY
Height	23” (with 4” legs)	8”
Width	26”	15.5”
Depth	25.7”	14.7”
	28.2” (with handle)	
Weight	190 lbs.	

WALL CLEARANCE

Back	0”
Sides	2”

ENTRY CLEARANCE (minimum)

Crated	30”
Uncrated	24”

Construction

EXTERIOR

- 430 stainless steel front, top and sides.
- 4” chrome plated adjustable legs
- Nickel plated handle
- Cool to the touch pull down door

INTERIOR

- 304 stainless steel line
- Fully insulated cooking chamber
- Removable wire cooking rack with optional platter
- Adjustable lower cooking element

Standard Features

- Recirculating airpath with TurboChef Technologies patented catalytic converter system
- Multi-speed convection blower
- Conventional wire baking rack
- Independently controlled bottom browning element
- Stackable design
- Smart Voltage Sensor Technology
- Factory programmed with up to 128 cooking programs
- Smart Card for remote programming
- Warranty - 1 year parts and labor

Accessories (Additional Charge)

- 24” stainless steel oven stand with locking casters for single units
- 17” stainless steel oven stand with locking casters for stacked units

Certifications

UL, cUL, NSF, FDA, FCC

Packaging

All ovens are packaged in a double-wall corrugated box with integrated corrugated skids.

Power Supply - North America

SMART VOLTAGE SENSOR TECHNOLOGY

Universal Voltage:	208/240 VAC, 60 Hz, 1 phase
Amperage:	Nameplate rating 30 Amp (3-wire including ground)
Cordset:	10 gauge, 3 conductor, 5 foot cordset
Plug:	NEMA 6-30

NOTE: The Smart Voltage Sensor Technology does not compensate for lack of or over voltage situations. It is the responsibility of the owner to supply voltage to the unit according to the above specifications.

DELIVERY AND PRODUCT PLACEMENT

Remove oven from carton. Immediately note any damage and contact shipping company within 24 hours in order to file a claim. TurboChef will not be responsible for product damaged in shipment. The carton may be discarded after oven is removed.

⚠ WARNING: Oven weight is approx. 190 lbs. Two or more persons are required to lift it.

Lifting and Placement of the Oven

Position one or more persons on either side of the oven and lift from the bottom. Never lift the oven from the front and rear. Place the oven on a countertop surface at least 28 inches deep and capable of supporting 200 lbs.

Once properly positioned on the counter, plug the oven into a NEMA 6-30R wall mounted electrical receptacle. See Electrical Specifications.

Restraint Oven Kit (P/N TC3-0240)

An optional system intended to hinder the oven from moving forward during use and/or cleaning. The Restraint Oven Kit will not prevent the oven from falling off a countertop if the legs are allowed to slide off the edge or if the oven is intentionally or forcefully pulled off.

Proper installation instructions are included in the Restraint Oven Kit, if the operator has ordered one. If additional help is needed, please call customer service at 800.90TURBO.

ELECTRICAL SPECIFICATIONS

Operating Voltage	208 VAC/240VAC
Current Draw	30 Amps
Phase	1 Phase
Frequency	60 Hz
Max Input	5990/6675 watts
Microwave Input Power	3500 watts*

*Maximum Independent Input Power

⚠ WARNING: Never lift the oven by its door handle. Physical damage to the oven and/or personal injury may result. The operator must ensure that the oven is properly placed on the countertop at all times. TurboChef will not recognize a fallen oven as a warrantable claim and is not liable for any injuries that may result.

SETUP AND INITIAL OPERATION

Setup

Once oven is properly positioned on the counter, remove any packing material and/or any foreign objects from within the cavity. Install the oven rack by sliding the rack onto the support shelves.

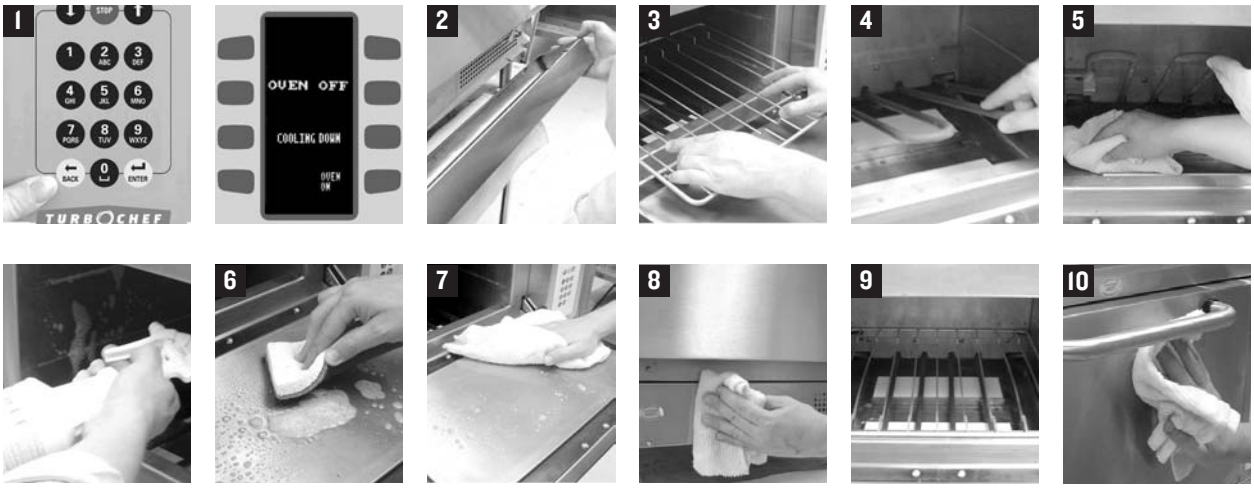
Programming

The oven comes preprogrammed and is ready to operate out-of-the-box.

Initial Power-up

To turn the oven On, press the “On” Key next to the word “On” on the display. The oven will begin to warm up to its predefined cooking temperature of 500ºF. This takes approximately 10 minutes.

When the Warm-up Cycle is completed, the oven will beep and display the “Ready State”. At this point, the oven is ready to cook.



DAILY MAINTENANCE FOR THE NGC

The Daily Cleaning Recommendation below will help in maintaining the NGC (Tornado) oven. Be sure to use only TurboChef® Oven Cleaner. The use of any other cleaning products can damage critical parts and may void warranty on those parts.

Supplies and Equipment

TurboChef® Oven Cleaner, nylon green scrub pad, cleaning towel

Step I: Prepare the Oven.

- ☐ Turn oven off by pressing the "Back" key.
- ☐ The oven will display "Oven Off-Cooling Down".
- ☒ DO NOT attempt to clean oven during the cool down cycle, indicated by "Cooling Down" signal on display.
- ☐ Cooling takes approximately 90 minutes.

NOTE: The oven operates at 500°F and may cause injury if not allowed to cool properly.

Step 2: Remove the Lower Access Panel.

- ☐ Wipe out any crumbs that have collected.

Step 3: Remove the Wire Rack.

- ☐ Wash, rinse and sanitize the wire rack.

NOTE: Be sure oven interior is cool prior to removing the wire rack.

Step 4: Lift Bottom Element.

- ☐ Be sure the bottom element is cool prior to lifting.

NOTE: The oven element operates at 1000°F and may cause injury if not allowed to cool properly.

Step 5: Remove Particles and Spray Oven Interior with TurboChef® Oven Cleaner.

- ☐ Using a damp towel, remove any large particles from the oven.
- ☐ If stubborn stain is present, sparingly spray TurboChef® Oven Cleaner into the cavity and on the door.
- ☐ Allow cleaner to penetrate for five (5) minutes.
- ☐ Never saturate the bottom of the oven with water or oven cleaner.

Step 6: Clean Oven Interior.

- ☐ Using a nylon green scrub pad, clean the oven door and cavity.

⚠ CAUTION: Do not apply pressure to white Wave Guide Caps. Breaking will result in a non-warranty service call.

Step 7: Wipe Out Oven Interior.

- ☐ Wipe oven door and cavity clean using a damp towel.
- ☐ Wipe the element with a clean damp towel.

Step 8: Clean Area where Lower Access Panel is Located.

- ☐ Wipe the area on the outside of the oven where the lower access panel is located.
- ☒ DO NOT spray any chemical in this area.

Step 9: Lower the Bottom Element and Replace the Wire Rack and Lower Access Panel.

Step 10: Clean Oven Exterior.

- ☐ Wipe the oven exterior with a clean, damp towel.
- ☐ Oven is ready to turn on.

DO'S AND DO NOT'S

DO:

- ☐ Ensure the oven is cleaned daily.
- ☐ Use only TurboChef® Oven Cleaner.
- ☐ Remove items from the oven as soon as they are cooked.
- ☐ Use only microwave-safe TurboChef approved cooking accessories in the oven.
- ☐ Review cooking instructions to ensure oven settings are correct for corresponding products.
- ☐ Keep the TurboChef Installation Guide for future reference.
- ☐ Call TurboChef immediately if Wave Guide Caps are broken.

DO NOT:

- ☒ Lift oven by handle.
- ☒ Slam or mishandle the oven door.
- ☒ Place foil or metal objects of any kind in the oven.
- ☒ Operate the oven without food in the cook chamber.
- ☒ Frequently open and close the door to check the product.
- ☒ Cook items wrapped in plastic or any type of cling film.
- ☒ Put products in the oven until ready to cook.
- ☒ Use cleaning agents that are not approved for the oven.
- ☒ Allow any cleaning solution or water to remain on the bottom of the cooking chamber after cleaning or at any other time.
- ☒ Place excessive weight on top of the oven.

THE THEORY OF OPERATION

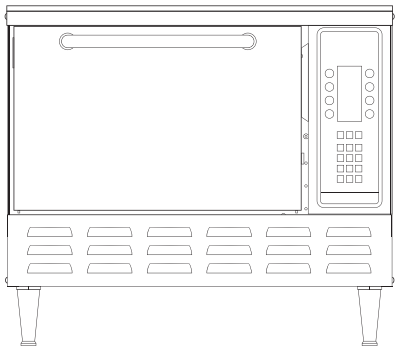
The TurboChef NGC (Tornado) oven utilizes three independent heat transfer mechanisms in order to rapidly cook food.

The systems are as follows:
- Convection
- Infrared energy
- Microwave energy

By combining these mechanisms along with the ability to control each mechanism independently, the NGC (Tornado) oven is able to reduce the cook time of most foods by 70-90 percent.

Figure 2 below represents the oven's different systems and the critical components of each system. Should a problem arise with any of the components listed below, please turn to the appropriate section within this manual for further instructions.

For the purpose of this manual, each independent heat transfer mechanism is individually identified. For instance, if an oven is experiencing difficulties browning the food, focus on the Convection Circuit and/or the Infrared Circuit, versus the Microwave Circuit. Focus on the Microwave System if an oven is browning the food but not heating the food.



Chapter 4
CONTROL SYSTEM

I/O Control Board
Keypad
Display
Mechanical Relays
SS Relays

Chapter 5
MICROWAVE SYSTEM

Magnetrons
High Voltage Transformers
Filament Transformers
High Voltage Capacitors
High Voltage Diodes
Fuse

Chapter 7
CONVECTION SYSTEM

Convection Heater
Blower Controller
Convection Blower
Catalytic Converter
Hi-Limit Thermostat

Chapter 8
BOTTOM IR AND CCV

Bottom Infrared Element
Mechanical Relays
SS Relays

FIGURE 2: NGC (Tornado) Systems and Critical Components

GLOSSARY OF COMMON OPERATING TERMS

Off State
All the oven's control systems are off and the Cook Chamber Temperature is below 150ºF.

Cool Down
A subset of the Off State. During Cool Down the oven will circulate the main convection blower until the Cook Chamber Temperature is below 150ºF.

Ready State
Refers to an oven that has successfully warmed-up to the predefined Set-Temperature. At this point the oven control is ready to receive cook commands via the Keypad.

Set-Temperature (TSET)
A predefined temperature at which the oven cooks.

Cook Chamber Temperature (TCC)
The actual temperature registered by the Cook Chamber Thermocouple.

Edit Mode
The mode which enables the user to change stored or predefined Recipes and the Set-Temperature.

Warm-Up
The mode when the oven is warming itself to the Set-Temperature.

Idle Mode
Similar to the Ready State. In this mode, the oven's control may cycle the blower or heaters in order to maintain the Set-Temperature.

Cook Cycle
A period of operation as defined by a Recipe.

Test Mode
A special diagnostic mode that enables the service technician to turn on and off all oven systems independent of one another.

Keypad
The primary interface for the operator.

Display
Displays all visual information to the operator.

Self-Test (STEST)
A special diagnostic function that tests all critical subsystems to determine their operational state.

Recipe
A set of user defined Events that determine a Cook Cycle.

Events
A single operational element that is a part of a Recipe. Each Recipe may have up to six Events depending on programming. Each Event lasts a percentage of the Total Cook Time and can be set between 0 and 100% of the Total Cook Time. The sum of all the Event Percent (%) Times must equal 100%.

Total Cook Time
The total duration of a Recipe.

Percentage (%) Time
An event subset that specifies the duration of the Event.

Percentage (%) Air
An event subset that specifies the relative amount of impingement airflow (speed of convection motor) during the Event. Valid between 10 and 100%.

NOTE: Maximum 100% = 7100 RPM Blower Motor Speed. Blower Motor Speed scale is linear.

Percentage (%) Microwave (MW)
An event subset specifying the microwave cycle (on time) during the Event. Valid between 0 and 100%.

Fault Code
A code assigned to an Event that the Control considers to be a failure. Upon discovering a Fault, the Control will display the Fault Code and a brief description of the failure. The Control will also increment the Fault Code Counter.

Error Message
A message that is displayed when an unusual event occurs. The Control will display the Error Message only when it occurs. Error Messages are not logged in the Fault Code Counter.

The NGC (Tornado) oven has the ability to continually monitor and log various fault conditions. Some fault conditions will terminate Cook Cycles, while others will not. Please refer to the Fault Code Table on page 10 for more detailed information.

When a fault is detected, the Fault Code Counter will increment. However, if the fault is subsequently cleared by some action, whether service related or not, the Fault Code Counter will not decrement.

TO VIEW FAULT CODES

To view the Fault Log, press the "4" and "6" Keys simultaneously while the oven is in the Off State. The oven will display all faults logged. Figure 3.

Each Fault Log will log up 255 instances before rolling back to zero. Press the "0" Key to reset the Fault Code Counter.

NOTE: The Fault Log also displays the Cook Counter, which will log up to 65,535 Cook Cycles. In order for the Control to log a Cook Cycle, the oven must complete the first Event of any given Recipe. If a Recipe only has one (1) Event, the oven must complete the entire Cook Cycle in order to count the Cook Cycle.

FAULT CODE DEFINITIONS

F1: Blower Running Status Bad

Fault is displayed when the Blower Controller indicates no running status.

The Motor and Motor Controller state is monitored continuously in all Modes with special handling in the Self-Test and Test Mode. If a fault is detected, the Control will bounce the oven into the Off State. Upon turning the oven On, the Control will attempt to restart the Motor. If the restart is successful the fault indication will be cleared. The fault is also cleared at the onset of cooking or when the blower is tested in the Test Mode.

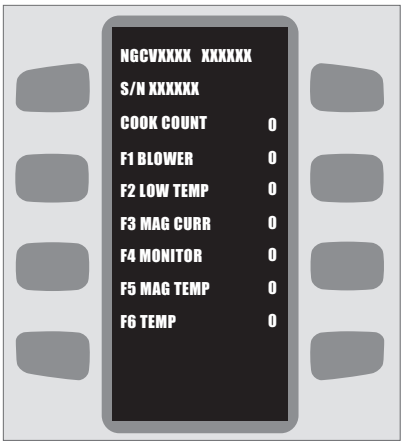


FIGURE 3: Fault Display

F2: Cook Temperature Low

Fault is displayed if the Cook Chamber Temperature is more than 84°F below the Set Temperature after five (5) seconds into a Cook Cycle.

The fault is cleared at the onset of cooking if the Cook Chamber Temperature is within 84°F of the Set Temperature or when the heater is tested in the Test Mode.

F3: Magnetron Current Low

Fault is displayed when the Current Transformer (CT) on the I/O Control Board does not detect enough current. The Fault is monitored when the microwave is on during a Cook Cycle or Self-Test.

The fault is cleared at the onset of a Cook Cycle if the CT detects current or when the magnetron is successfully energized in the Test Mode.

F4: Door Monitor Defective

Fault is displayed when the Control detects that the Monitor Interlock Switch unlatches before both the Primary and Secondary Interlock Switches during a Cook Cycle.

In addition this fault will blow the F3 Fuse if the microwave high voltage system is energized when the fault occurs. The fault is cleared only when the oven is turned Off and On.

NOTE: Door Interlock Switches are in parallel. See Figure 35, on the inside of page 49. The fault is monitored during a Cook Cycle or Self-Test, when the Microwave is on.

F5: Magnetron Over Temperature
Fault is displayed when the Thermostat on either Magnetron is "Open".

The fault is cleared at the onset of a Cook Cycle if the Thermostat is closed or when the Magnetron is successfully tested in the Test Mode.

F6: EC (Electrical Compartment) Temperature High
Fault is displayed when the EC Thermocouple exceeds 158°F and is monitored once per minute.

The fault is cleared when the EC Thermocouples temperature is below the indicated limit.

F7: Thermocouple Open
Fault is displayed when the Control detects that either the IR or CC Thermocouple is "Open".

- 999°F indicates the CC Thermocouple is "Open".
- 1999°F indicates the IR Thermocouple is "Open".

Fault is cleared when the control detects continuity on the open Thermocouple Circuit.

F8: Heat Low
An Error Message (not a Fault Code) displayed during Warm-up or Self-Test if the Cook Chamber Temperature (TCC) fails to rise 14°F within thirty (30) seconds.

FAULT CODE TABLE

FAULT CODE AND DESCRIPTION	WHEN ACTIVE				REFER TO
	Warm - up	Idle Mode	Cook Mode	Self-Test	
F1: Blower Running Status Bad	X	X	X	X	Page 19
F2: Cook Temperature Low			X		Page 20
F3: Magnetron Current Low			X	X	Page 30
F4: Door Monitor Defective			X		Page 36
F5: Magnetron Over Temperature			X	X	Page 24
F6: EC Temperature High	X	X	X		Page 12
F7: Thermocouple Open	X	X	X	X	Page 18
F8: Heat Low	X			X	Page 44

Fault Codes are listed in order of hierarchy. For example: If during cooking the oven experiences an F1 and F2 Fault, the oven will only report a F1 Fault since the software will halt all actions upon discovering the F1 Fault. F7 and F8 Faults are displayed on the primary screen and are not displayed or counted in the Fault Log.

NOTE: All Fault Codes listed in **Bold** will terminate a Cook Cycle upon discovery. Any fault occurring in a Cook Cycle will be logged in the Fault Code Counter.

The Control System is comprised of the components that signal, sense, command and switch the oven's various components. Figure 4 shows a functional diagram of all the components that make up the Control System.

NOTE: The part numbers for each component are given within the parentheses in addition to being included with the descriptions for each part on the following page.

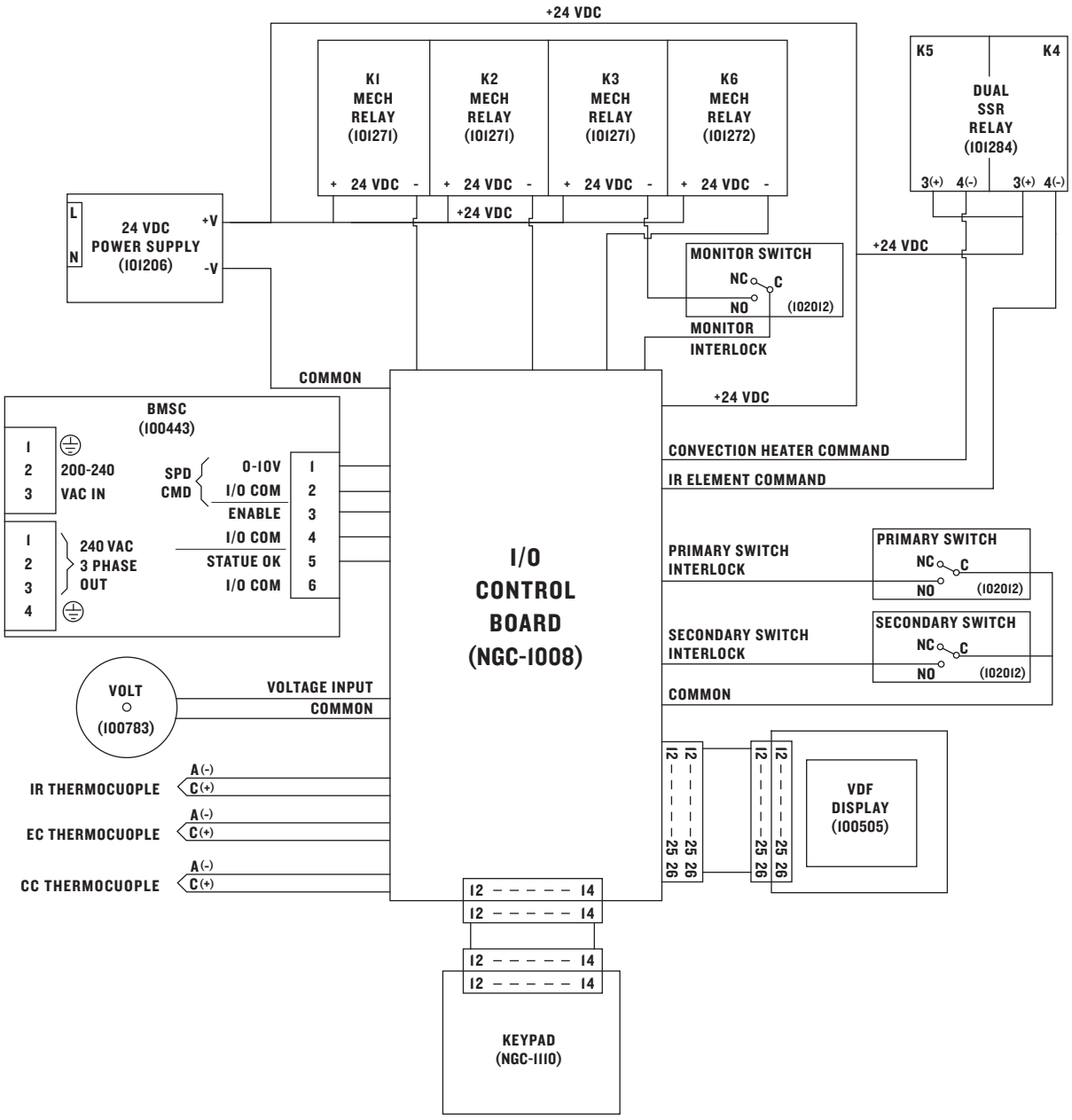


FIGURE 4: NGC (Tornado) Control System

CONTROL SYSTEM COMPONENT DESCRIPTIONS

24 VDC Power Supply (P/N 101206)
24 VDC Output at 40 Watts. Supplies control voltage for I/O Control Board, 24 VDC Mechanical Relays and Solid State Relays.

K1 Mechanical Relay (P/N 101271)
240 VAC, 30 Amp, Double Pole, Double Throw, 24 VDC Relay Coil. Switches power to the Magnetron Filament Transformers.

K2 Mechanical Relay (P/N 101271)
240 VAC, 30 Amp, Double Pole, Double Throw, 24 VDC Relay Coil. Switches power to the Magnetron High Voltage Transformers.

K3 Mechanical Relay (P/N 101271)
240 VAC, 30 Amp, Double Pole, Double Throw, 24 VDC Relay Coil. Safety Interlock device designed to short L1 and L2 if the Monitor Switch opens before the Primary and Secondary Interlock Switches.

K4/K5 SSR (P/N 101284)
240 VAC, Dual 40 Amp Solid State Relay. K4 (right) controls the Convection Heater and K5 (left) controls the IR Element.

K6 Mechanical Relay (P/N 101272)
240 VAC, 30 Amp, Three Pole, Double Throw, 24 VDC Relay Coil. Responsible for switching between the 208VAC and 240VAC taps on the High Voltage and Filament Transformers.

Interlock Switches (P/N 102012 for all three)
Primary, Secondary and Monitor Interlock Switches. Switches must be actuated by the Cook Door in the following order: M-S/P. When the Cook Door opens, the order is reversed: P/S-M.

IR Thermocouple (IR Element)
Type K Thermocouple. Thermocouple is embedded in the IR Element. The Thermocouple measures the internal/sheath temperature of the IR Element. Valid IR Set points are between 500°F and 1200°F. The display indicates 1999°F, if the Thermocouple is "Open".

EC Thermocouple (P/N 700-1179)
Type K Thermocouple. Thermocouple measures the temperature of the Electrical Compartment. If the temperature within the Electrical Compartment is above 158°F, the Control displays "F6 - EC Temp".

CC Thermocouple (P/N NGC-1140)
Type K Thermocouple. Thermocouple measures the temperature of the re-circulating impingement airflow. Valid IR Set points are 450-540°F. If the display indicates 999°F, the Thermocouple is Open.

BMSC (P/N 100443)
A proprietary Brushless DC Motor Controller designed solely to operate the Convection Motor.

VDF Display (P/N 100505)
Vacuum Fluorescent Display.

Keypad (P/N NGC-1110)
3x8 Matrix Membrane Switch. Keypad is connected to the Control via a 14 Pin Flat Cable.

Voltage Sense Module (P/N 100783)
Proprietary device designed to measure incoming line voltage and switch between 208 and 240 VAC operation. The device only measures and configures the oven when the oven is switched from the Off State to the On State.

TEST MODE

The Test Mode allows the service technician to operate the oven's subsystems individually. It also allows the operator to configure various presets.

To enter the Test Mode:
1. Press the "Back" Key until the display is in the Off State.
2. Press the "Back" and "Enter" Key simultaneously.
3. Enter the access code: 9-4-2-8 when prompted and press "Enter".

The "Test" Screen displays the Software Version, Cook Chamber and IR Element Temperature at the top of the screen. The Control also displays the

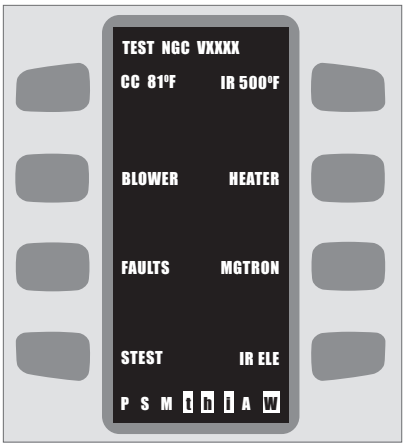


FIGURE 5: Test Mode - Screen 1

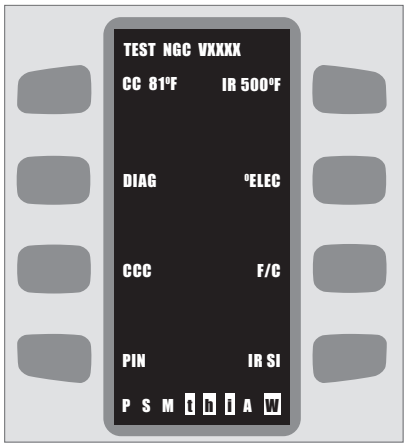


FIGURE 6: Test Mode - Screen 2

first of two (2) pages of the test function options (Figure 5). To display the second page (Figure 6), press either the "Down or Up Arrow" Key. To test a component or sub-system, press the corresponding Soft Key.

TEST FUNCTION OPTIONS

Blower Speed

The "Blower" Key increments the Blower Speed in 10% steps. When the Blower Speed is 100%, the next press sets the speed to 0%.

Electronic Compartment Temperature

The "ºELEC" Key displays the temperature inside the electronic enclosure.

Self-Test Function

The "STEST" Key initiates the Self-Test function to test all major components of the oven. To run the Self-Test, press the corresponding Soft Key once. Press the "Back" Key to return to the Idle Mode.

Heater Test

The "Heater" Key turns the heater On or Off. If the heaters are On, pressing the corresponding Soft Key turns the heaters Off. If the heaters are Off pressing the "Heater" Key turns the heaters On. If the Blower Speed is 0, the Blower Speed is set to the Idle Airflow.

Magnetron

The "MGTRON" Key is a press and hold key to test the Magnetron. If the Magnetron Filaments are Off when the "MAG" Key is pressed, the message "MAG Warming Up" is displayed. After a five (5) second delay or if the filaments are already On, "MAG Power On" is displayed. The Magnetron should operate at this point. Once the "MGTRON" Key is released, the high voltage supply is switched Off to the Magnetron and the Magnetron will stop radiating; however, the power is still supplied to the Magnetron Filaments and Magnetron Cooling Fan for an extra three (3) minutes.

Diagnostic Display

The "DIAG" Key turns On or Off the Diagnostic Display feature. This feature adds temperature displays to the "Menu Group" Screens.

While cooking, the Cook Cycle parameters are displayed when diagnostics are enabled.

In addition, the Status Indicators are displayed on the bottom of the screen. When a Status Indicator is highlighted/backlit the corresponding system associated with that Status Indicator is Off. For example: W would indicate that the Microwave System is Off.

The Status Indicator section on the following page offers a more detailed description of each indicator.

Faults
Pressing the "Faults" Soft Key will display all the accumulated faults in the Fault Log. For more information, see page 9.

F/C
Changes how the oven's temperature units are displayed. The F/C Key alternately selects Fahrenheit or Celsius.

CCC
Displays the total number of accumulated Cook Counts for all Recipes.

PIN
Allows the operator to select a new Access Number for entering the Test and Edit Modes.

IR ELE
Pressing the "IR ELE" Key will turn On the IR Element. When pressed, the Control will display "IR Element On". To turn the IR Element Off, push the "IR ELE" Key an additional time.

IR SI
This is a factory setting and should never be altered. Consult the factory before changing this value.

STATUS INDICATORS

See Figures 5 and 6 on page 13.

P Primary Switch – closed or open
S Secondary Switch – closed or open
M Monitor Switch – closed or open
t Magnetron Thermostats – closed or open
h Main Convection Heater – off or on
i IR Element – off or on
A Blower Motor Controller – enabled or disabled
W Microwave Current – Less than or greater than 7 Amps*

* Microwave (MW) Status Indicator is not highlighted/backlit when the current is more than 7 Amps.

The Status Indicators are displayed at the bottom of the display screen when the oven is in the Test and DIAG Mode. Refer to Figures 5 and 6.

If a Status Indicator is highlighted/backlit the item or component is in an un-energized or Off State. Conversely, if a Status Indicator is not highlighted, the component is energized or in the On State.

PROGRAMMING

Edit Mode
The Edit Mode enables the operator to alter Recipes and the Cook Chamber Temperature (TCC).

To access the Edit Mode:
1. Press the "Up and Down Arrow" Keys on the Keypad simultaneously.
2. When prompted, enter the Access Code "9" and then press "Enter".

Changing the Cook Chamber Temperature
The first screen in Edit Mode allows you to change the Cook Chamber Temperature (TCC) by pressing the "Up and Down Arrow" Keys. The operator may adjust the temperature between 450-540ºF in 10ºF increments. Once you have selected the desired temperature, press the "Enter" Key to set TCC.

Altering a Recipe
The NGC (Tornado) oven control has 128 unique Recipes available for the operator. The display shows two (2) pages each with eight (8) Recipe Groups. Each Recipe Group contains eight (8) Subgroups or Recipes. See Figures 7 and 8.

To alter a Recipe:
1. Enter the Edit Mode as described earlier.

2. Enter the Access Code "9" and set TCC. The screen displays the first set of eight (8) Recipe Groups. To access the second set of eight (8) Recipe Groups, press either the "Up or Down Arrow" Key.

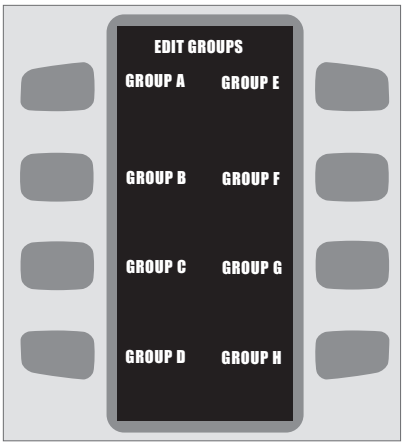


FIGURE 7: Edit Groups

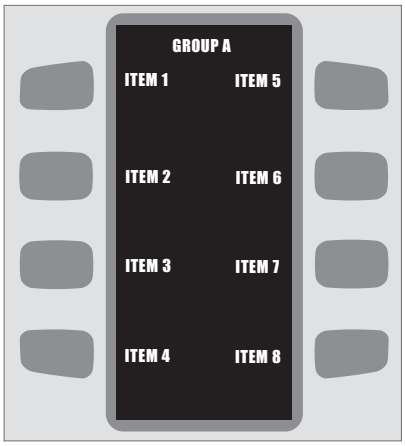


FIGURE 8: Edit Groups

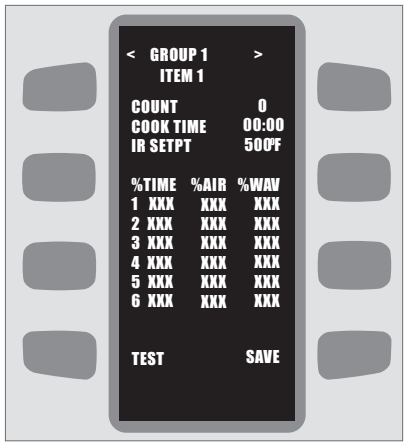


FIGURE 9: Edit Groups

3. Select the Recipe Group which contains the individual Recipe you wish to alter. Select which Recipe you wish to alter by pressing the Soft Key corresponding to the Recipe Item. Figure 8.

4. Use the "Up and Down Arrows" Keys to navigate through a Recipe. Use the Keypad and "Enter" Key to alter any of the following three (3) parameters: (See Figure 9.)

   1. Cook Time
      Total duration of the Cook Cycle. Enter the desired time and press "Enter". Valid times are between one (1) second and five (5) minutes.

   2. Infrared Set Point Temperature (IR SETPT)
      The relative temperature which the lower radiant element will maintain during the entire Cook Cycle. Valid temperatures are between 500ºF and 1150ºF.

   3. Events 1…6
      Use the Keypad and "Enter" Key to enter values for Percent (%) Time, % Air and % Microwave (MW).

      The % Time for all Events must total 100%. The operating system will not allow a combination of Events not totaling 100% or that exceed 100%.

      The % Air and % Microwave (MW) parameters are valid between 10 and 100%.

      NOTE: If an Event is unused, the % Air parameter may default and be displayed as 10%.

Once the desired changes have been made, test the Recipe by pressing the "Test" Soft Key. This will execute the altered Recipe. Once satisfied with the Recipe, press "Save" to permanently store any changes. Press the "Back Arrow" Key four (4) times to exit the Edit Mode.

USER CONFIGURABLE OPTIONS

Users may enable or disable the Edit Mode, Done State and Test State.

Edit Mode

For security purposes the Edit Mode can be disabled.

To disable the Edit Mode:
1. Simultaneously press the "Back Arrow" and "Enter" Keys.
2. Enter the Access Pin: 8-4-3-3 ("T-I-D-E") and "Enter".
3. When prompted select "9" to re-enable the Edit Mode or any other Key to disable the Edit Mode.

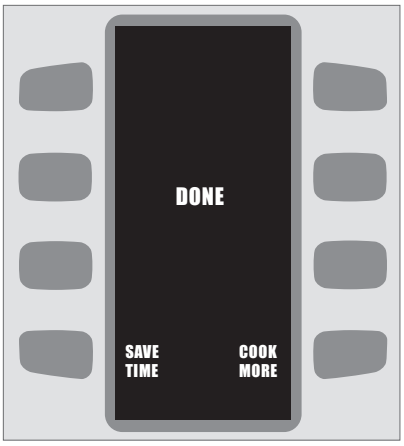


FIGURE 10: Done State

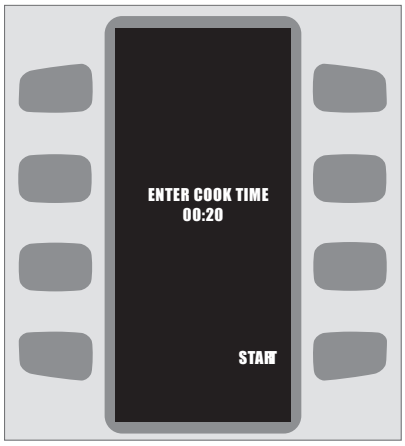


FIGURE 11: Time State

Done State

The Done State (Figure 10) can be removed to eliminate the option to Save an altered Time or the option to Cook More.

To disable the Done State:
1. Simultaneously press the "Back Arrow" and "Enter" Keys.
2. Enter the Access Pin 3-6-6-3 ("D-O-N-E") and "Enter".
3. When prompted, press "9" to re-enable or any other Key to disable the Done State.

Time State

This state can be removed in order to prevent the operator from adjusting the Total Cook Time prior to pressing the "Start" Soft Key to begin a Cook Cycle. Figure 11.

To disable the Time State:
1. Simultaneously press the "Back Arrow" and "Enter" Keys.
2. Enter the Access Pin 8-4-6-3 ("T-I-M-E") and "Enter".
3. When prompted, press "9" to re-enable or any other Key to disable the Time State.

PASSWORDS

Edit Mode

1. Press "Up and Down Arrow" Keys simultaneously.
2. Enter the Pin "9" and press "Enter".

Test Mode

1. Press "Back" and "Enter" Keys simultaneously.
2. Enter the Pin "9-4-2-8" & press "Enter".

Reset Control (Soft Restart)

1. Press "Back" and "Enter" Keys simultaneously.
2. Enter the Pin "9-4-7-1" & "Enter".

Erase

1. Press "Back" and "Enter" Keys simultaneously.
2. Enter the Pin "3-7-2-7" & press "Enter".
3. When asked "Erase Menu" press "3".

⚠ WARNING: The Erase command permanently deletes all stored Recipes and settings.

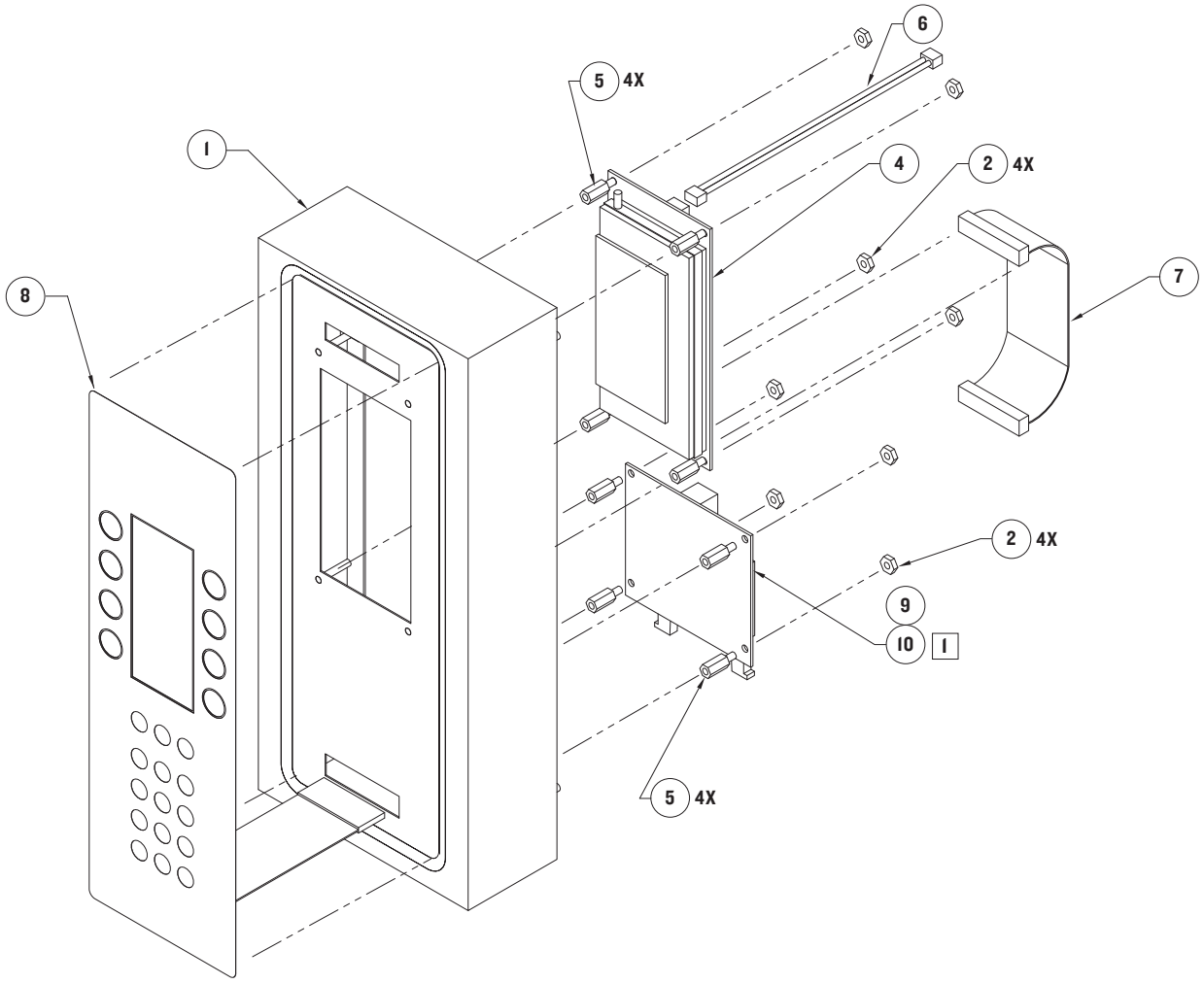


FIGURE 12: Control System Panel Enclosure and Parts

CONTROL SYSTEM PANEL PARTS

Figure 12.

1.	NGC-1040	Cover, Keypad Display
2.	102960	Nut, 4-40, Stainless
3.		Reserved For Future Use
4.	100505	Display
5.	101954	Spacer, 1/2” Lg, Al
6.	100193	2 Pin Power Cable
7.	100184	26 Pin Ribbon Cable
8.	NGC-1110	Keypad, NGC
9.	100506	Connector*
10.	100182	Cable Connection

*Optional Feature

Assembly Notes

1. Item 10 not shown for clarity.

CONTROL SYSTEM TROUBLE SHOOTING

ISSUE	RESOLUTION
No Display (Blank)	1. Verify power 208 VAC or 240 VAC is going to the oven correctly. If not, correct the voltage supply. 2. Control DOES NOT beep when any Key on the Keypad is pressed. Check power going to the 24VDC Power Supply. Supply must have 208 or 240 VAC across L and N terminals. ▫ If there is No Voltage: Change F1 and F2 Fuses. ▫ If the Voltage is OK: Verify output of Power Supply is 24 VDC. If there is no Output, change the Power Supply. If the Power Supply is 24 VDC, see below. Output is 24VDC: Verify I/O Control Board has 24 VDC by checking the voltage on the D6 Diode (striped end) on the I/O Control Board to Chassis. Reference page 50 for a schematic of the I/O Control Board. ▫ No Voltage: Check wires from Power Supply to I/O Control Board. ▫ Voltage is 24VDC, but 5VDC is not present on the I/O Control Board J3 connector: Change I/O Control Board. 3. The control DOES beep when any Key on the Keypad is pressed. Check all connections between the I/O Control Board and Display. Correct any loose connections. If connections are OK and 5 VDC is present on the J3 connector, but there is still no Display, change Display.
No Keypad Input	1. Check Keypad Ribbon Cable going to the I/O Control Board. ▫ Cable and Connection Bad: Replace Keypad. ▫ Cable and Connection OK: Replace the I/O Control Board.
F7: Thermocouple Open CC Thermocouple Reads 999ºF or IR Thermocouple Reads 1999ºF	1. Check the connection of Open Thermocouple on the I/O Control Board. If the Connection is OK, verify Thermocouple is not an open circuit by using your Ohm meter. The Cook Chamber Thermocouple should measure approximately 4-5 Ohms and the IR Thermocouple should measure around 30-40 Ohms. Measurement to be made at the I/O Control Board 40 Pin Connector. ▫ Thermocouple indicates open circuit: Replace defective Thermocouple. ▫ Thermocouple OK: Replace the I/O Control Board.

ISSUE	RESOLUTION
"Cook Door Open" Message when door is closed.	1. Determine which Interlock Switch is open by entering the Test Mode. Examine the Switch(es) indicated as "Open". ▫ If the Switch(es) is/are mechanically opened - i.e., the Cook Door is not actuating the switch - then refer to page 34 to adjust the Cook Door. ▫ If the switches are mechanically closed, but the Control indicates an "Open" verify wiring going to each Interlock Switch. Correct any wiring issue or replace the Interlock Switch if it is failed closed.
F1: Blower Running Status Bad Motor not running when commanded.	1. Status Indicator "A" is highlighted/backlit in Test Mode. Verify 208/240 VAC is going to the Motor Controller via Pins 2 and 3. ▫ 208/240 VAC is present: Verify control wiring from the Motor Controller and I/O Control Board, specifically Low Voltage Wire OR-9. If all wires are OK, then refer to page 45 for Motor Controller Trouble Shooting. ▫ 208/240 VAC is not present: Correct wiring going to the Motor Controller. 2. Status Indicator "A" is not highlighted in Test Mode. Refer to page 45 (F1: "Blower Defective") for Motor Controller Trouble Shooting.
F3: Magnetron Current Low	1. Check that the K2 Mechanical Relay is in good working order. If Relay is OK: Refer to page 30 (F3: Magnetron Current Low) for detailed instructions on trouble shooting.
F8: Heat Rise Low NOTE: This message occurs in Warm-up and Self-Test if the oven fails to warm-up in a predetermined time period.	1. Verify the High-Limit Thermostat is not tripped. ▫ If High-Limit is tripped: Reset and allow the oven to warm-up. ▫ If High-Limit is not tripped: Proceed to instructions below. High-Limit is not tripped: Check both K4 and K5 SSRs by activating them in Test Mode. When actuated, the (-) control input of the SSR will go to 0.00 VDC. When the relay is not actuated the input will read -24.00 VDC. ▫ If the control voltage is not pulled down during actuation: Verify the wiring between SSR and the I/O Control Board. Replace SSR if wiring OK. ▫ If the control voltage is pulled down: Refer to Figure 31 on page 41.

ISSUE	RESOLUTION
F2: Cook Temperature Low	1. Verify the High-Limit Thermostat is not tripped. ▫ If High-Limit is tripped: Reset and allow the oven to warm-up. ▫ If High-Limit is not tripped: Follow the instructions below. High-Limit is not tripped. Place a small water load in a microwave transparent container (approx. 275 ml) in the oven and place the oven in Test Mode. Press the "MGTRON" Key to actuate the microwave. While holding down the "MGTRON" Key watch the CC and IR Temperatures. If either temperature bounces substantially there may be a noise (EMI) problem. To correct this problem examine the wire routing for each Thermocouple wire. If the wires are routed near any high voltage components such as the Magnetron or High Voltage Transformers re-route the wires. If this does not correct the problem, verify that both Magnetrons are securely mounted. Call Customer Service for further details at 800.90TURBO.

The Microwave System is the most complex system in the oven. Proper care must be taken during servicing to protect both the operator and technician.

OVERVIEW OF A MICROWAVE CIRCUIT

The Microwave Circuit consists of a Magnetron and Voltage Doubler Circuit. The Voltage Doubler consists of a special step-up transformer, a capacitor and a diode.

MONITOR CIRCUIT DESCRIPTION

In addition to understanding the High Voltage Circuit, it is imperative to understand how the Monitor Circuit operates. The Monitor Circuit is a failsafe circuit designed to protect the operator if both the Primary and Secondary Interlock Switches fail to operate normally.

The Monitor Circuit consists of the Primary and Secondary Interlock Switch, Monitor Safety Switch, Monitor Relay and the F3 Fuse. When the Cook Door closes during normal operation, the Monitor, the Secondary and the Primary Switches close in the order listed above. When all switches are closed, the Microwave System is allowed to operate.

If during normal operation, either Interlock Switch opens - such as when the Cook Door opens - the Control System will turn Off the Microwave. If the Monitor Switch opens before both the Primary and Secondary Interlock Switches - abnormal operation - the Monitor Switch de-energizes the Monitor Relay. When this occurs, a dead short is placed across L1 and L2. The short then blows the F3 Fuse, which permanently interrupts power to the Microwave System until both the Primary and Secondary Interlock Switches are repaired.

Figure 13 shows a schematic of the Monitor Circuit. Make sure to note the following:

- Primary and Secondary Switches interlock the High Voltage Control Signal.
- Normal Operation: When the K2 and K3 Relays energize, power is supplied to the High Voltage Transformers.
- Abnormal Operation: When K2 is energized and K3 is un-energized (via an opening of the Monitor Switch) L1 and L2 short to blow the F3 Fuse and failsafe.

Figure 14 on the following page details the theory of operation of the Microwave High Voltage Circuit.

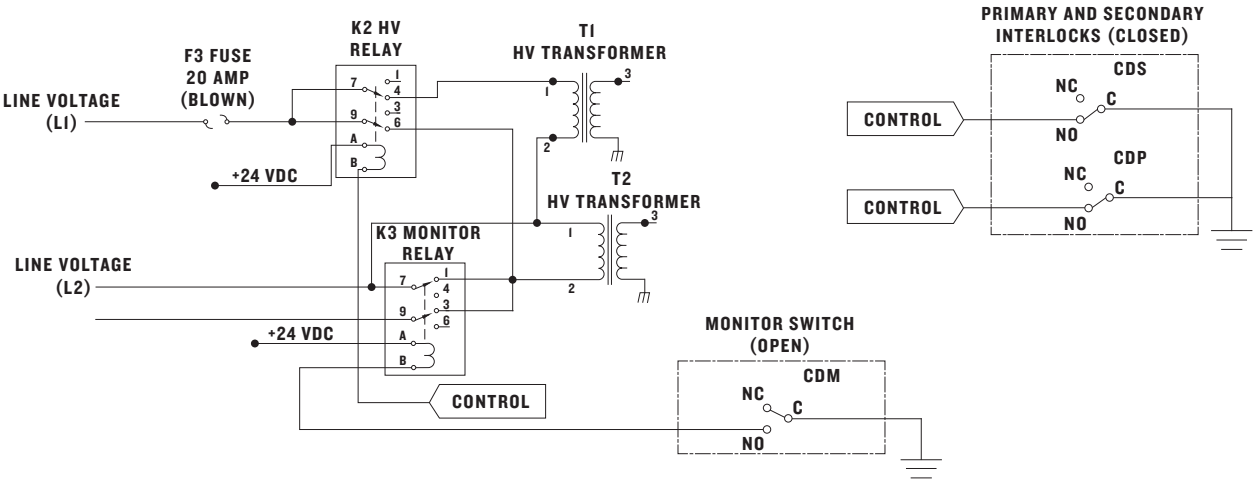


FIGURE 13: Monitor Circuit - shown in failsafe state.

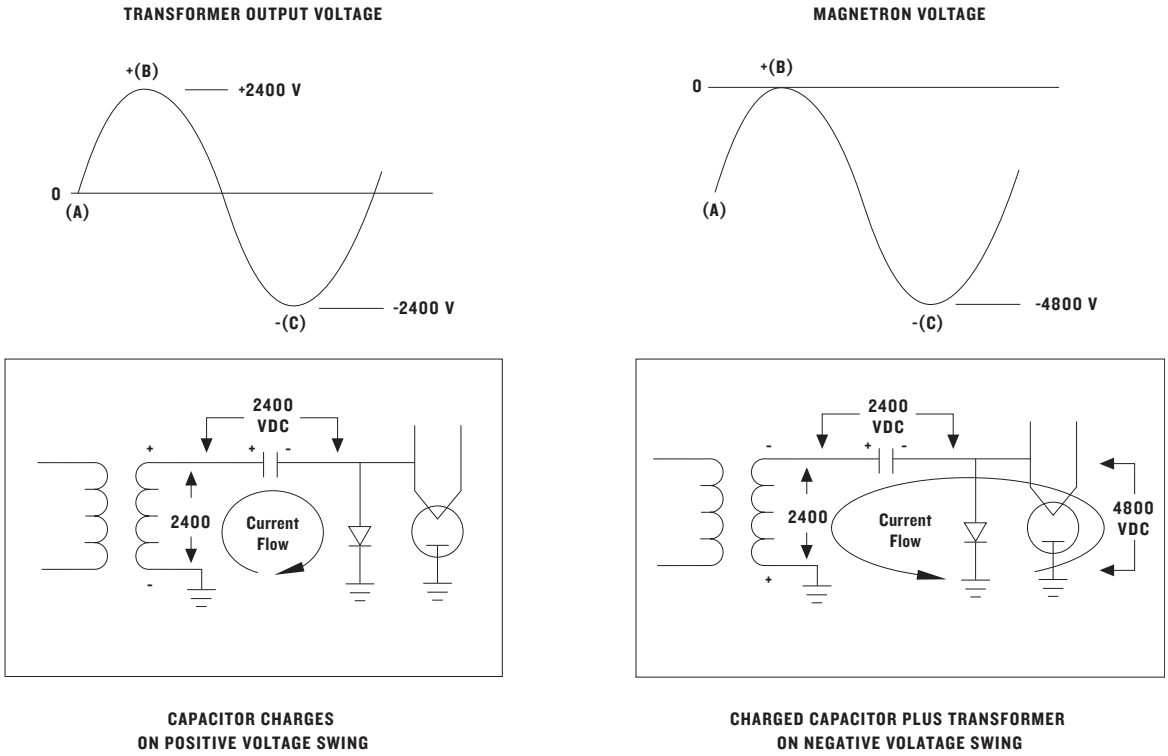


FIGURE 14: Microwave Circuit Theory of Operation

MICROWAVE CIRCUIT THEORY OF OPERATION

Figure 14

1. The High Voltage Transformer steps up the input voltage to approximately 2400 volts peak (4800 volts peak to peak).

2. The High Voltage Capacitor charges to 2400 volts on the positive going voltage via the High Voltage Diode's conduction.

3. The High Voltage Transformer plus the charged High Voltage Capacitor supply down to -4800 volts to the Magnetron when the voltage goes negative. (High Voltage Diode is back biased.)

4. The Magnetron converts negative input voltage (and current) to RF energy at 2450 MHz.

⚠ WARNING: Do not attempt to measure these voltages.

MICROWAVE SYSTEM PARTS

Figure 15

11. 102101	High Voltage Transformer 2
12. 102101	High Voltage Transformer 1
13. 100201	High Voltage Capacitor 2
14. 100201	High Voltage Capacitor 1
15. 100481	High Voltage Diode 2
16. 100481	High Voltage Diode 1
17. 102102	Filament Transformer 2
18. 100083	Mag Cooling Fan
19. 101271	K3 Monitor Relay
20. 101271	K2 High Voltage Relay
21. 101271	K1 Filament Relay
22. 102102	Filament Transformer
23. 100599	F3 Fuse - 20 Amp
24. 102070	Mag 2 Thermostat
25. 100861	Magnetron 2
26. NGC-1106	Wave Guide #2
27. 102070	Mag 1 Thermostat
28. 100861	Magnetron 1
29. NGC-1044	Wave Guide #1

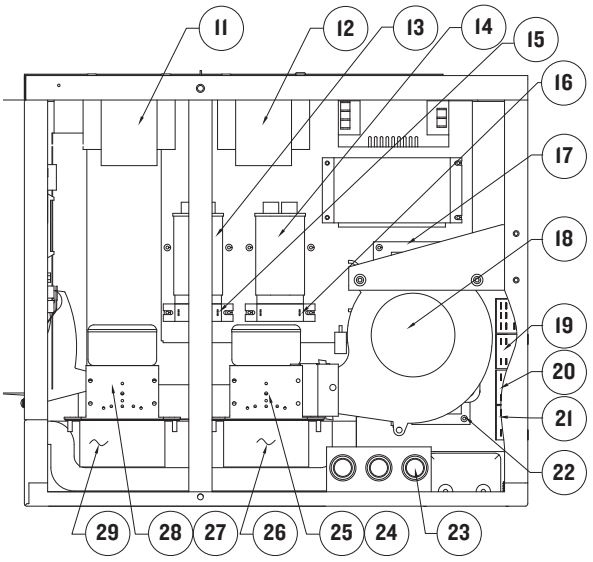


FIGURE 15: Microwave System Parts

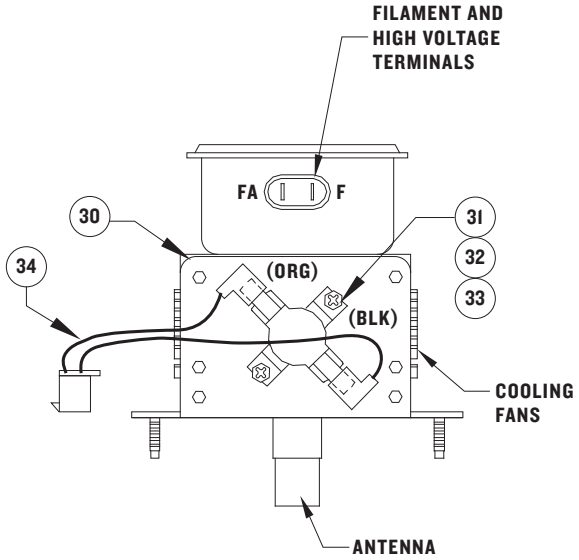


FIGURE 16: Microwave System Parts

Figure 16

30. 100861	Magnetron
31. 102070	Magnetron Thermostat
32. NGC-1163	Insulator, Adhesive
33. 100186	Screw #6 Sheet Metal
34. 100186	Magnetron Wire

MICROWAVE SYSTEM COMPONENTS

Below is a description of each component within the Microwave Circuit and how these components act within the Circuit.

Magnetron (P/N 100861)

Magnetrons supply the RF energy at 2.45 GHz and begin to oscillate when they are supplied with approximately 4.1KVDC at approximately .350 mA. During operation each Magnetron will output a nominal 1 kW of power.

High Voltage Transformers (P/N 102101)

High Voltage Transformers are a ferro-resonant design which limits fault currents and minimizes magnetron power changes due to input voltage changes. The High Voltage Transformer supplies the high voltage for the Voltage Doubler Circuits. They are controlled via the K2 Relay.

⚠ WARNING: Never attempt to measure the voltage values of the High Voltage Transformers with the High Voltage Transformers enabled. Lethal voltage will be present on your meters. Reference page 26.

Filament Transformers (P/N 102102)

For better operation and reliability, the oven uses separate transformers in order to preheat the Magnetron Filament.

Prior to fully energizing the Microwave Circuits, the Control energizes the Filament Transformers for approximately three (3) seconds prior to supplying the necessary high voltage via the High Voltage Transformers. When in operation, the Filament Transformers supply approximately 3.15 VAC at 10 Amps to each Magnetron Filament. The Filament Transformers are controlled via the K1 Relay.

F3 Fuse (P/N 100599)
The F3 Fuse is a 20 Amp Class CC fuse designed to blow in the case of an over current scenario, such as a High Voltage Transformer or Capacitor failure. The Fuse also blows if the Monitor Circuit trips the failsafe.

High Voltage Capacitors (P/N 100201)
Their rating is 0.91uF, 2500 VDC.

High Voltage Diodes (P/N 100481)
They are rated at 16 kVDC.

Monitor Relay (P/N 101271)
The Monitor Relay, K3, acts as a failsafe device in the High Voltage Circuit. In its normal un-energized position the Monitor Relay shorts L1 and L2. If the K2 Relay energizes the High Voltage Transformers while the K3 Relay is un-energized the F3 Fuse will blow.

Magnetron Thermostats (P/N 102070)
The Magnetron Thermostats are an open on rise type thermostat. These Thermostats are designed to open at 212ºF.

NOTE: Both Magnetron Thermostats are wired in series. Therefore, if one opens the Control will switch off both Magnetrons until the Thermostats close. The Thermostats are self-resetting.

Magnetron Cooling Fan (P/N 100083)
The Magnetron Cooling Fan supplies cooling air for both Magnetrons. The Fan operates at 208/240 VAC and is controlled via the K1 Relay.

Wave Guide Covers (P/N NGC-1097)
Wave Guide Covers protect and seal the Wave Guides from moisture and debris.

WAVE GUIDE COVER REPLACEMENT

The Wave Guide Covers keep moisture and debris out of the Wave Guides. If contamination gets into the Wave Guides, the life of the Magnetrons may be shortened. In most cases, the Wave Guides will not be contaminated if the Wave Guide Covers are cracked or broken - it depends on how long they have been cracked and how much product has been cooked. However, if a Magnetron has failed and the Wave Guide Cover is cracked, the Wave Guide may need to be removed and either cleaned thoroughly or replaced.

Figure 17 details the removal and replacement of the Wave Guide Covers. To remove the Wave Guide Covers, follow the steps below:

1. Locate the fourteen (14) #8 truss head sheet metal screws securing the broken Wave Guide Cover. If the screw heads are dirty, it will be necessary to clean the heads thoroughly.

   ⚠ DANGER: Do not strip the screw heads.

2. Spray screw heads with a penetrating oil such as WD 40 and allow them to sit for a few minutes.

3. Remove the fourteen (14) #8 screws using a good #2 Phillips Screw Driver. The cover should come loose with gentle pressure.

   - DO NOT remove the two (2) right and left most screws. These screws secure the Wave Guides to the oven floor. Only remove them if the Wave Guide is being removed as well.

4. Remove the old Wave Guide Cover and discard, unless otherwise specified.

   NOTE: It may be necessary to gently pry the Wave Guide Covers to remove them from the oven floor as they are sealed with RTV.

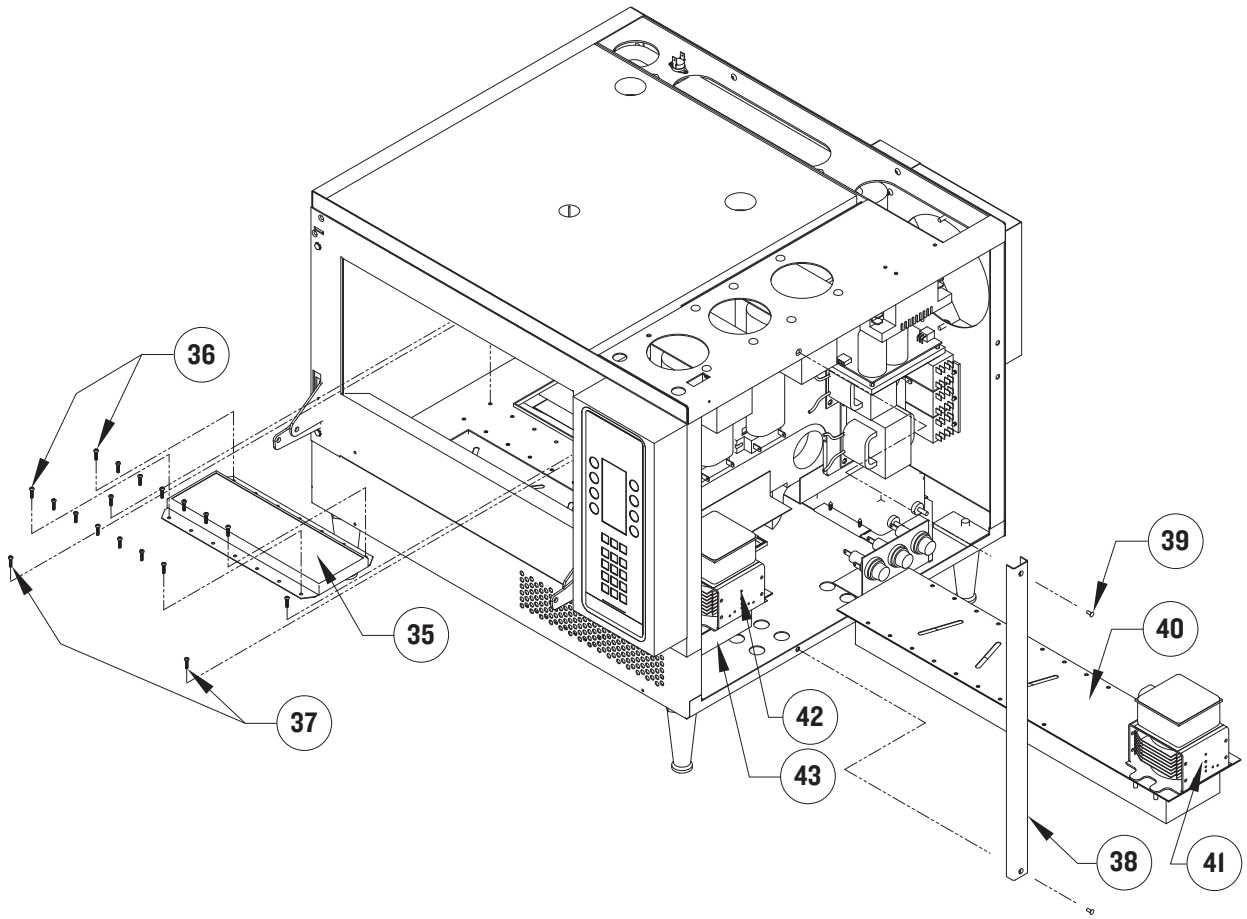


FIGURE 17: Wave Guide Cover/Wave Guide Removal and Replacement

5. Clean the oven floor where the new Wave Guide Cover will sit with Acetone.

6. Apply a 1/8" diameter bead of high temperature RTV (P/N 102562) along the outside edge of the flanges surrounding the Wave Guide.

   NOTE: It is important to use the correct high temperature RTV as supplied by TurboChef.

7. Place the new Wave Guide Cover in place. Secure with the fourteen (14) #8 Sheet Metal Screws removed in Step 3.

WAVE GUIDE/WAVE GUIDE COVER PARTS

Figure 17

35. NGC-1097	Assy, Wave Guide Cover
36. 102921	Screws, #8-32 x 3/8", SS
37. 101688	Screws, #8 x 1/2" Sheet Metal PTH
38. NGC-1047	Support, Frame
39. 102809	Screws, #8-32 x 3/8" CSK (100º)
40. NGC-1106	Assy, Wave Guide #2
41. 100861	Magnetron #2
42. 100861	Magnetron #1
43. NGC-1044	Assy, Wave Guide #1

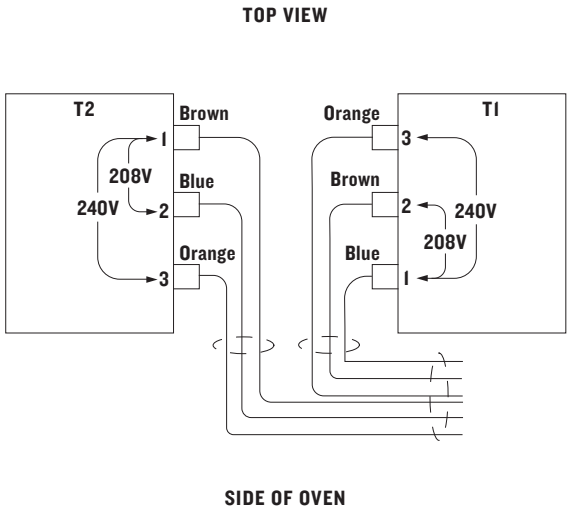


FIGURE 18: High Voltage Transformer Wiring

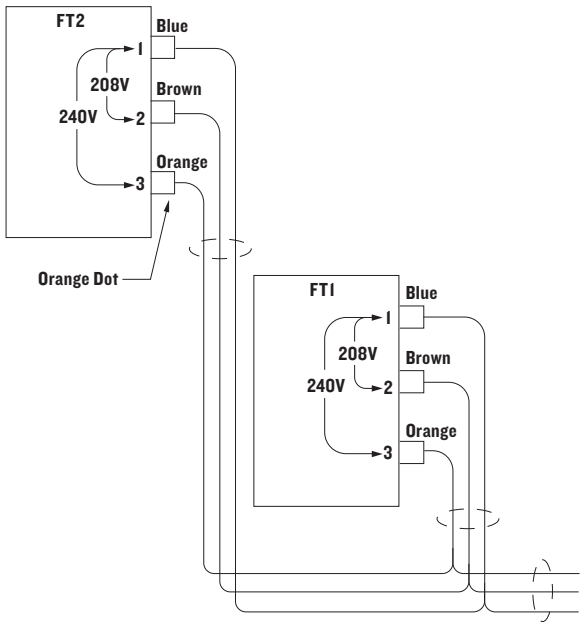


FIGURE 19: Filament Transformer Wiring

WAVE GUIDE REPLACEMENT AND CLEANING

NOTE: If the Wave Guide is contaminated with excess debris, it is very important to clean and dry the Wave Guide. Dirt and contaminates in the Wave Guide can cause premature Magnetron failures.

1. Remove the Wave Guide Cover. See Wave Guide Cover Replacement on page 24.

2. Remove the two (2) right and left most #8-32 x 3/8" screws securing the Wave Guide.

3. The Wave Guide should now be loose so as to easily slide out from the right side of the oven. If replacing the Wave Guide proceed to Step 6. If cleaning continue on to Step 4.

   NOTE: Take care not to damage the insulation when removing the Wave Guide.

4. Thoroughly clean the contaminated Wave Guide using any standard degreaser.

5. Thoroughly rinse and dry the Wave Guide before reinstalling.

6. Reinstall the clean or new Wave Guide using the four (4) #8-32 x 3/8" mounting screws removed in Step 2.

7. Reinstall the Wave Guide Cover.

HIGH VOLTAGE TRANSFORMER AND FILAMENT TRANSFORMER REPLACEMENT

The proper reinstallation of the High Voltage and Filament Transformer is critical as both Transformers are equipped with 208 VAC and 240 VAC taps.

Wiring the High Voltage Transformer

Upon removing a High Voltage Transformer, make sure to note where each wire was installed. Refer to the top view diagram detailing the proper wiring (Figure 18) and the Schematic on the inside of page 49.

As shown in Figure 18, Transformers are installed mirror opposite and wired 180º out-of-phase. It is essential for longevity that High Voltage Transformers remain 180º out-of-phase. This can be checked by placing a volt meter across terms T1-1 and T2-1.

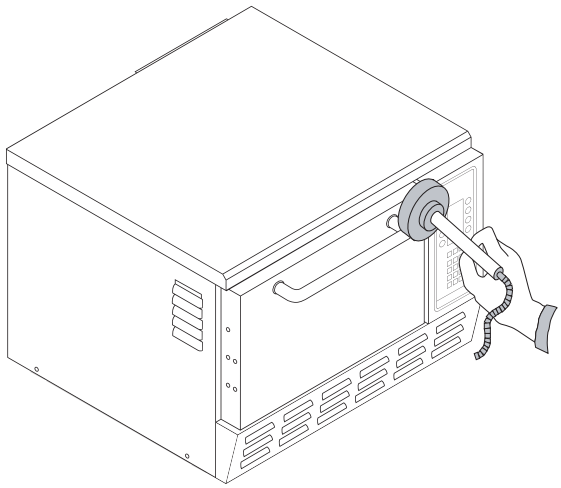


FIGURE 20: Microwave Survey Meter Placement

With the Microwave System energized, the volt meter will read 208-240 VAC. If the meter reads 0 VAC, the High Voltage Transformers are most likely wired in-phase. As a last check, energize the Microwave System and verify the voltages between taps 1 & 2 and 1 & 3 on each High Voltage Transformer. If the voltages are not 208 VAC between 1 & 2 and 240 between 1 & 3, the wiring issue must be corrected prior to returning the oven to service.

NOTE: The terminals with the Orange Dot or the Orange Wire always go to Terminal 3.

Wiring the Filament Transformers

The installation of Filament Transformers is straightforward. Filament Transformers are wired in-phase and in-line. Refer to Figure 19, detailing the proper wiring of Filament Transformers.

To verify correct wiring, measure the voltages between Terminal 1 & 2 and 1 & 3 on FT1 and FT2. The voltages must be 208 and 240VAC respectively.

NOTE: The Terminals with the Orange Dot or the Orange Wire always go to Terminal 3.

MEASURING RF LEAKAGE FOR MICROWAVE SAFETY

An RF (Microwave) leakage test must be performed at the conclusion of the following service tasks:

- Door removal, replacement and/or adjustment
- Wave Guide removal and/or replacement
- Magnetron removal and/or replacement

⚠ WARNING: If the unit fails the radiation test (leakage greater than 4 mW/cm2), the oven must be taken out of service immediately until the defect is corrected. In addition, the CDRH Regulations 21 Subpart C, 1002.20 requires that leakage readings of over 4 mW/cm2 must be reported to the manufacturer.

Procedure for Measuring RF Leakage

1. Place the oven in Warm-up Mode and allow it to warm-up to the Cook Set Temperature (TSET). This should take no more than 10 minutes.

2. Once the oven has warmed-up, place the oven into Test Mode (see page 12). Place a water load into the Cavity. Water load must conform to the following specification:
   a. Volume: 275ml ± 15ml
   b. Temperature: 68 ± 9ºF
   c. Vessel: Low form, 600 ml beaker with an inside diameter of approximately 3.35" and made of Pyrex or glass ceramic

3. Position the Microwave Survey Meter as shown in Figure 20.

4. Press and hold the "MGTRON" Soft Key to energize the Microwave System.

5. While holding the "MGTRON" Soft Key, move the Survey Meter around the outline of the Cook Door keeping the tip of the Meter in contact with and perpendicular to the Cook Door. Record the highest leakage.

6. Using the same procedure, measure the leakage with the Cook Door opened to the point just before the Primary/Secondary Switches disengage. Record the highest leakage.

FIGURE 21: High Voltage Diode (P/N 100481)

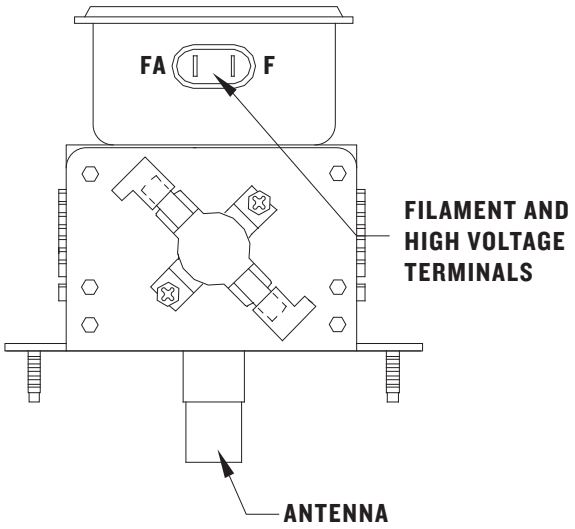


FIGURE 22: Magnetron (P/N 100861)

TIP: To hold the Cook Door open, for this test, back out the top center screw around the perimeter of the Cook Door. Continue backing this screw out until the Primary and Secondary Interlock Switches disengage. As this point, tighten the screw until both Switches re-engage.

7. Using the same procedure, measure the leakage around the oven's entire exterior surface. Record the highest leakage.

HOW TO TEST MICROWAVE COMPONENTS

Testing the High Voltage Diode (P/N 100481)

The High Voltage Diode (Figure 21) is assembly constructed by connecting several 1000 volt -1500 volt semiconductor diodes in a series in order to increase the reverse voltage capability. In the circuit, the High Voltage Diode conducts to prevent the filament voltage from becoming positive, thus as the High Voltage Winding of the transformer goes to 2400 VPK, the High Voltage Capacitor is charged to 2400 volts. When the High Voltage Winding starts to go toward negative, the High Voltage Diode becomes non-conducting with the charged High Voltage Capacitor in series with the High Voltage Winding. When the transformer gets to its negative peak of -2400 VPK, the voltage applied to the Filament is negative 4500 volts.

⚠ CAUTION: Never attempt to measure high voltage directly.

How to check a Diode

1. Disconnect the oven from the power source.
2. Isolate the Diode from the circuit.
3. Connect the meter leads to the Diode Terminals.
4. Infinite resistance (open) should be indicated in the reverse direction.
5. Resistance readings in the forward direction may be indeterminate.
6. If continuity in both directions: shorted Diode.

7. If there is infinite resistance in both direction: open Diode.

8. Due to the High Voltage Diode consisting of approximately 15 x 1000 volt Diodes in series, the forward Diode drop is approximately 9 volts. A normal low voltage Ohmmeter will not provide sufficient voltage in the resistance ranges to measure an impedance in the forward direction of the High Voltage Diode.

How to check a Capacitor

1. Disconnect the oven from the power source.

2. Isolate the Capacitor from the circuit.

3. Fully discharge the Capacitor.

4. Connect the Ohmmeter between the Capacitor Terminals. The Ohmmeter should momentarily indicate a low impedance and then slowly return to infinite resistance.

5. Reverse the Ohmmeter leads and repeat Step 4.

6. Check each terminal to case. Infinite resistance (open) should be indicated.

How to check a Magnetron for Open/Shorted Filament

1. Disconnect the AC power source and discharge the High Voltage Capacitors.

2. Isolate the Magnetron from the circuit by removing the wires from the F and FA terminals. Figure 22.

3. An Ohmmeter connected between the Filament Terminals (F, FA) should indicate a reading of less than 1 Ohm. Figure 22.

4. A continuity check between either Filament Terminal and the Magnetron Chassis should indicate an infinite resistance (open).

How to check a High Voltage or Filament Transformer

1. Disconnect all the wires in question going to the Transformer.

2. Use an Ohmmeter to check the impedance of the Primary and Secondary Winding. Refer to the High Voltage and Filament Transformer able below to determine if the transformer is OK. If the resistance is different then the table indicates, replace the Transformer.

HIGH VOLTAGE AND FILAMENT TRANSFORMER RESISTANCE TABLE

DESCRIPTION	P/N	PRIMARY 208 TAPS (1 & 2) (Ω)	PRIMARY 240 TAPS (1 & 3) (Ω)	SECONDARY TAPS (4 & GROUND) (Ω)
High Voltage Transformer	102101	0.882–1.08 Ω	1.06–1.29 Ω	53.64–65.56 Ω
Filament Transformer	102102	19.17–23.43 Ω	22.41–27.39 Ω	0.088–0.108 Ω

MICROWAVE SYSTEM TROUBLE SHOOTING

ISSUE	RESOLUTION
F3: Magnetron Current Low	1. Check F3 Fuse. ▫ Fuse OK: Go to Step 2. ▫ Fuse Blown: Refer to "F3 Fuse Blown" on the following page. 2. Verify K1 Relay is operating correctly. ▫ K1 Not Energizing: Correct Control issues. See Chapter 4 (The Control System). ⚠ DANGER: Remove F3 Fuse before attempting to measure filament currents. ▫ K1 Energizing OK: Measure Filament Currents to each Magnetron to verify Filament Transformers are OK. Place Amp Probe on wires M1-F and then M2-F. 1. Current < 8 Amps on Magnetron 1, Magnetron 2 or both: Correct wiring or replace failed Filament Transformer(s). 2. Current = 8 to 10 Amps on M1-F and M2-F. Filament Transformers OK. Go to Step 3 below. 3. Verify K2 Relay is operating correctly. ▫ K2 Not Energizing: Correct Control issues. See page 21, Figure 13. ▫ K2 Energizing OK: Place the oven in Test Mode, place a Clamp-on Amp Meter on the wire going to the Current Transformer on the I/O Control Board. Measure and record current when Magnetrons are energized. 1. 0 Amps – High Voltage Transformers 1 and 2 not energizing. Repeat Step 1 above. If both High Voltage Transformers have failed, replace High Voltage Transformers. See the Transformer Winding Resistances Table on page 29 to verify failure. 2. Less than (<) 6 Amps – High Voltage Transformers are energizing, but the Magnetrons are not drawing full current (14-17 Amps). 208 Volts is 17 Amps, 240 Volts is 14 Amps. Check High Voltage Diodes. If Diodes fail, replace Diodes. If Diodes are OK, replace Magnetron 1 and 2. NOTE: If Magnetron failed, it is important to understand why. Investigate each failed Magnetron. If the antenna is strongly discolored, look for contamination in the Wave Guides. If contamination exists, check the Wave Guide Seals. Replace any broken Wave Guide Seals.

ISSUE	RESOLUTION
F3 Fuse Blown	1. Fuse Blown: Replace F3 Fuse and determine why F3 Fuse opened. NOTE: There are generally only three (3) faults that will cause the F3 Fuse to open. They are as follows: 1. High Voltage Transformer Primary Winding shorted: Replace High Voltage Transformer. 2. High Voltage Capacitor shorted or failing: Replace the High Voltage Capacitor. NOTE: A failing High Voltage Capacitor will typically cause the High Voltage Transformer supplying power to the failing capacitor to draw excessive current. This may open the F3 Fuse if the duration of the excess current is long enough. 3. Monitor Circuit Fault: Verify operation of all Interlock Switches. In addition, check the Fault Code Counter. If the Monitor Switch opened prior to the Primary and Secondary Interlocks, the Control would have recorded the occurrence. See page 21 and Chapter 6 (Cook Door) to trouble shoot the Interlocks.
Mag 1 or Mag 2 Not Working or Food Not Cooking Evenly	Determine which Magnetron is not oscillating by placing a clamp-on Amp Meter on the Primary Winding of each High Voltage Transformer and energizing the Microwave System. 1. Amp = 0. High Voltage Transformer not energizing. Check K2 Relay and wiring going to suspect High Voltage Transformer. ▫ K2 Relay or wiring bad: Replace K2 Relay and/or repair wiring. ▫ K2 Relay OK: Check High Voltage Transformer. See the Table on page 29 for resistance values. Replace High Voltage Transformer if defective. 2. Amps = 3 Amps on High Voltage Transformer. Magnetron is not oscillating, but High Voltage Transformer is energizing. ▫ Diodes failed: Replace Diodes. ▫ Diodes OK: Replace defective Magnetron.
Magnetron Circuit is Drawing Excessive Current.	1. Measure resistance of High Voltage Capacitor(s). Resistance should start out in the megohm range and continue to rise as the probes are held on the Capacitor. If the resistance is low (less than the megohm range), replace the Capacitor and visually check the associated High Voltage Transformer Primary winding for signs of over heating (winding is very dark and discolored). If Transformer Primary Winding looks bad, replace it.

ISSUE	RESOLUTION
High Voltage and/or Filament Transformer(s) Faulty	1. Determine if the High Voltage or Filament Transformer(s) is defective. Use an Ohm meter to measure the Primary and Secondary Winding Resistances. Refer to the High Voltage and Filament Transformer Table on page 29 to determine if the Transformer is OK. If the resistance is different then the Table indicates, replace the Transformer.
Wave Guide Covers Broken	1. Replace Wave Guide Covers per Figure 17 on page 25. NOTE: Do Not remove the two (2) topmost and two (2) bottommost screws as shown in Figure 17. These screws secure the Wave Guide to the bottom of the oven cavity.

The proper fit and adjustment of the Cook Door is essential for safe and reliable operation of the NGC (Tornado) oven.

The Cook Door provides three primary functions:
1. To protect the operator from the hot convection airflow.
2. To protect the operator from exposure to microwave energy.
3. To actuate the Interlock Switches.

REMOVING/RE-INSTALLING THE COOK DOOR

To remove or reinstall the Cook Door, follow the steps below. Refer to Figure 23.

1. Open the Cook Door to its full open position. Locate the two (2) thru holes in the bottom of the left and right hinge assemblies. Insert a screw or nail into the holes to keep the hinges open while removing the Cook Door.
2. Locate and remove the two (2) #10-32 x 1/2" hex screws on the left and right side of the door.

   NOTE: The plastic caps have to be removed.

3. Remove the Cook Door by pulling the door away from the oven. Door will slide off the hinges.

COOK DOOR PARTS

Figure 23

44. 102809	#8-32 x 3/8" PFH CSK
45. NGC-1060	Assy, Oven Door
46. NGC-1061	Hinge Block
47. 102804	Right Hinge (only)
48. 102805	Left Hinge
49. 101381	#10-32 x 1/2" Hex SS
50. 102140	#10 Flat
51. 102350	#10 Split Loc
52. 101191	Cap, Hole

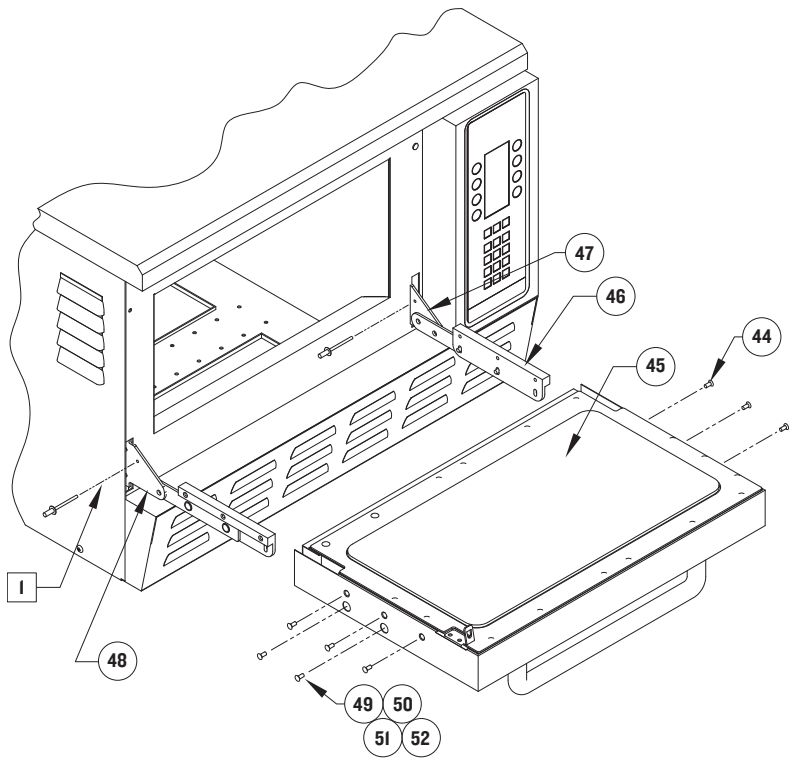


FIGURE 23: Cook Door Removal & Parts

ADJUSTING THE COOK DOOR

1. Slightly loosen the two (2) hex head screws on the left and right side of the Door Cover. See Figure 24, Note 4 .

2. Close the Cook Door and press the door squarely against the Oven Flange.

3. Starting on left side of the Cook Door, tighten the two (2) hex head screws.

4. Gently open the Cook Door. Tighten the two (2) remaining hex head screws on the right side.

5. Repeat the above procedure until the Cook Door sits properly.

Critical Adjustment Notes

1. The door in Figure 24 is adjusted incorrectly. Note that the bottom of the Cook Door is rotated away from the Flange.

   CORRECTIVE ACTION: Loosen the hex screws and push the bottom of the Door towards the Flange and re-tighten.

2. The door in Figure 25 is adjusted incorrectly. Note the top of the Cook Door is rotated too far away from the Flange and the Latch Toggle is rotated too far counter-clockwise. The Latch Toggle should be level when the Door is adjusted correctly as in Figure 24.

   CORRECTIVE ACTION: Loosen torx screws and push top of the Door towards the Flange. Re-tighten screws. The bottom of the Latch Toggle will be level when the Door is adjusted correctly. See Figure 25.

3. When the Cook Door is adjusted correctly, the Door will snap shut.

4. Door mount hardware. See page 33, Figure 23 Items 49-52.

⚠ WARNING: Check for excessive Microwave Leakage, after adjusting the Cook Door. See page 27 for proper procedure.

ADJUSTING THE PRIMARY AND SECONDARY INTERLOCK SWITCHES

The Primary and Secondary Interlock Switches are located on the left side of the oven. To properly adjust the switches follow the procedure below:

1. Ensure the Cook Door is adjusted. Refer to the previous section on adjusting the Cook Door.

2. Open and close the Door several times to ensure the Cook Door closes smoothly and the Door Actuator (Item 53) clears the slot in the Flange. Reference Figure 26.

3. While the Cook Door is closed, verify that the bottom of the Toggle is level or very nearly level to the bottom of the frame. If not, readjust the Cook Door.

4. While the oven is cool, temporarily adjust the Primary and Secondary Interlock Switches by loosening the #8-32 screw (Item 55) and the two (2) #4-40 screws (Item 56). Figure 26.

5. Rotate the Interlock Switches (Item 57) until the gap between the Switch Paddles and the Switch Body is 0.02 inch. Figure 26.

6. Restore power to the oven. Allow the oven to Warm-up to its Set Temperature.

7. Allow the oven to remain at the Set Temperature for ten (10) minutes after warm up before making any final adjustment.

8. Securely tighten Items 55 and 56 once any final adjustments have been made.

NOTE: Hi-temperature grease must be present between the Torsion Spring and the Switch Bracket Assembly (Item 58). Grease as required to ensure smooth action.

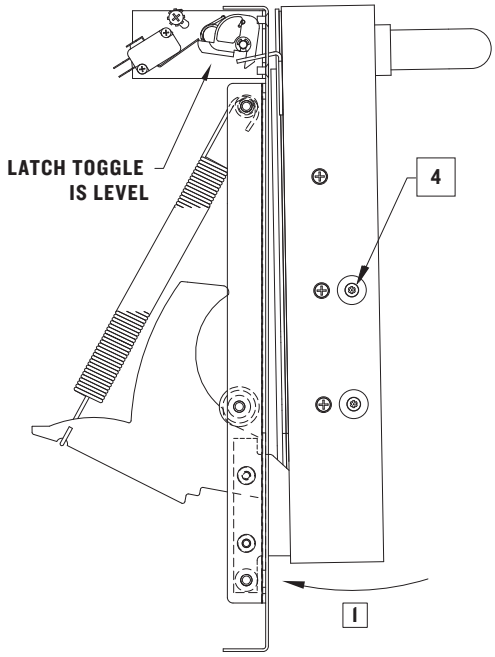


FIGURE 24: Mis-adjusted Cook Door

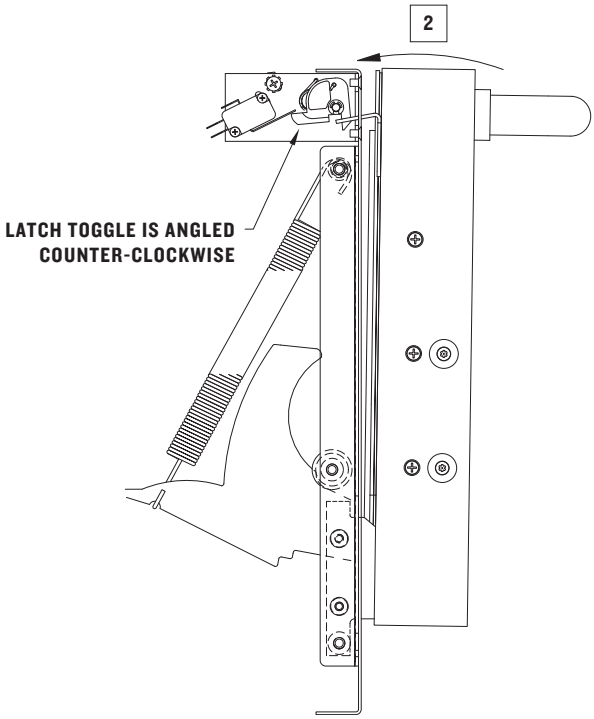


FIGURE 25: Mis-adjusted Cook Door

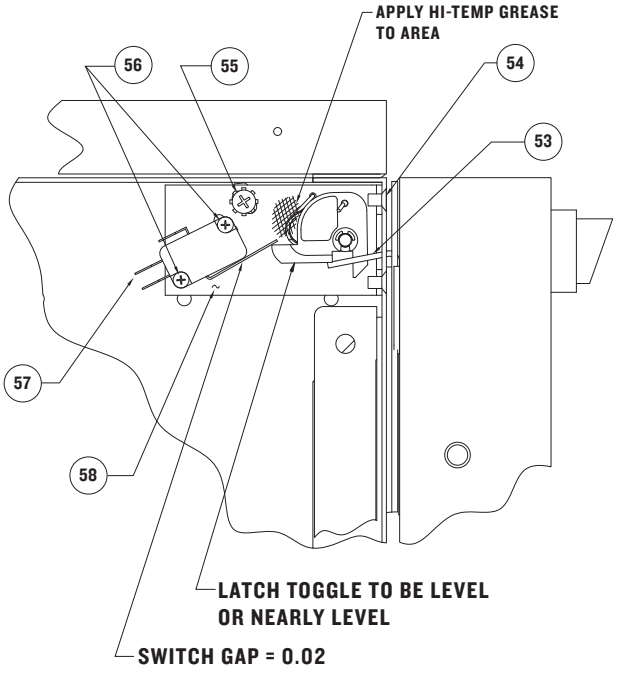


FIGURE 26: Primary and Secondary Interlock Adjustment and Parts

PRIMARY AND SECONDARY INTERLOCK SWITCHES ADJUSTMENTS AND PARTS

Figure 26

53. NGC-1076	Actuator, Door
54. 102684	Screw, #8-32 x 1/2" 100° CSK
55. 102921	Screw, #8-32 x 3/8"
56. 101557	Screw, #4-40 x 1 1/4"
57. 102012	Interlock Switches
58. NGC-1075	Assy, Door Switch*

*See Figure 27 for Assy Detail.

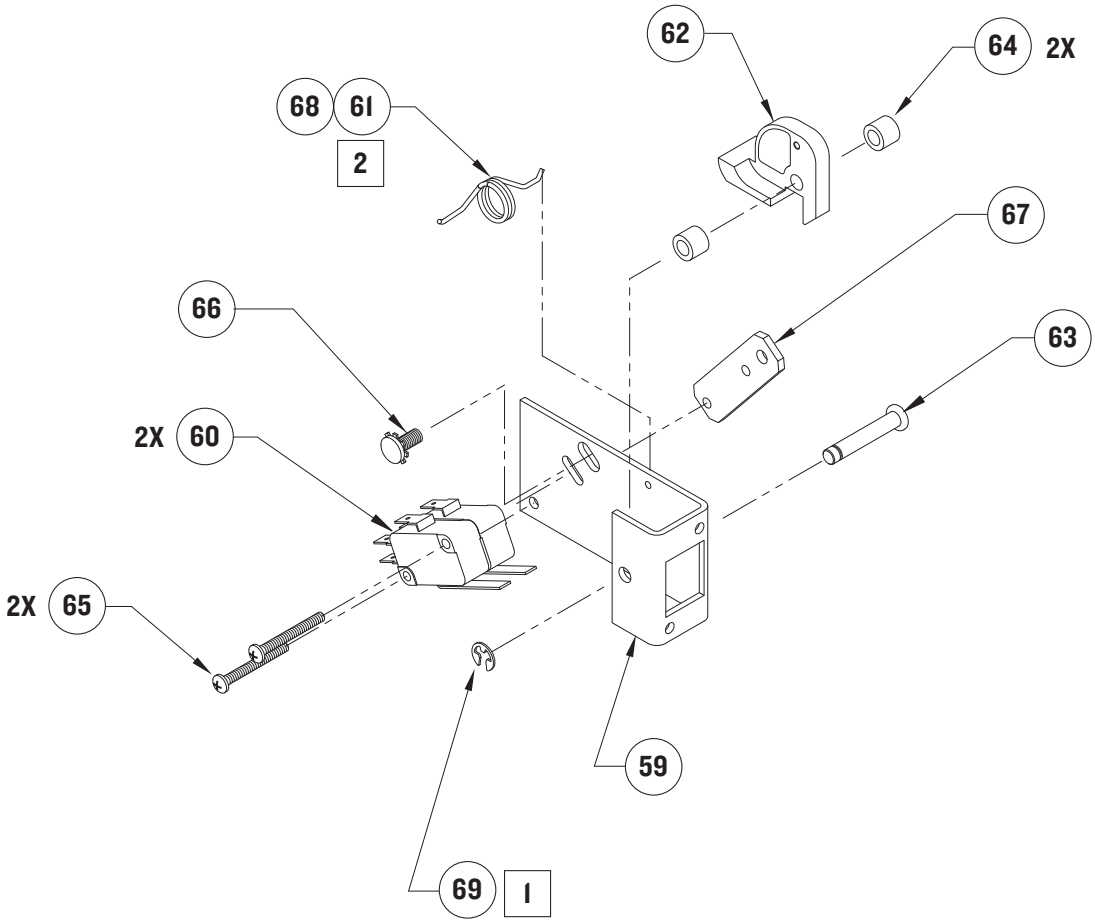


FIGURE 27: Door Switch Assembly and Parts

DOOR SWITCH ASSEMBLY AND PARTS

Figure 27

59. NGC-1072	Bracket Latch
60. 102012	Switch, Micro, 0.1A/125VAC
61. NGC-1087	Spring Door Latch
62. NGC-1073	Toggle, Latch
63. 101119	Pin, Clevis, ø3/16 x 1" Lg
64. 100059	Bearings, Bronze, 3/16ID x 5/16OD x 1/4" Lg
65. 101557	Screw, #4-40 x 1.25" Lg, PPHD, CRES
66. 102921	Screw, #8-32 x 3/8", Internal Tooth Sems, PPHD, SS
67. NGC-1126	Plate, Door Switch
68. 100639	Grease, USDA H-1, Food Grade
79. 101296	Ring, Eclip

Assembly Notes

1. Ring, Eclip (Item 69) is supplied with Item 63.
2. Spring and Bracket must be lubricated with high-temperature pure FM Grease (Item 68).
3. Assembly to be hand-tightened prior to any final adjustment.

ADJUSTING THE MONITOR SAFETY SWITCH

The Monitor Safety Switch is located on the right hand hinge assembly. To adjust the Switch, follow the steps below.

NOTE: The oven should be cool for this adjustment.

1. Ensure the Cook Door is adjusted. Refer to Adjusting the Cook Door on page 34.

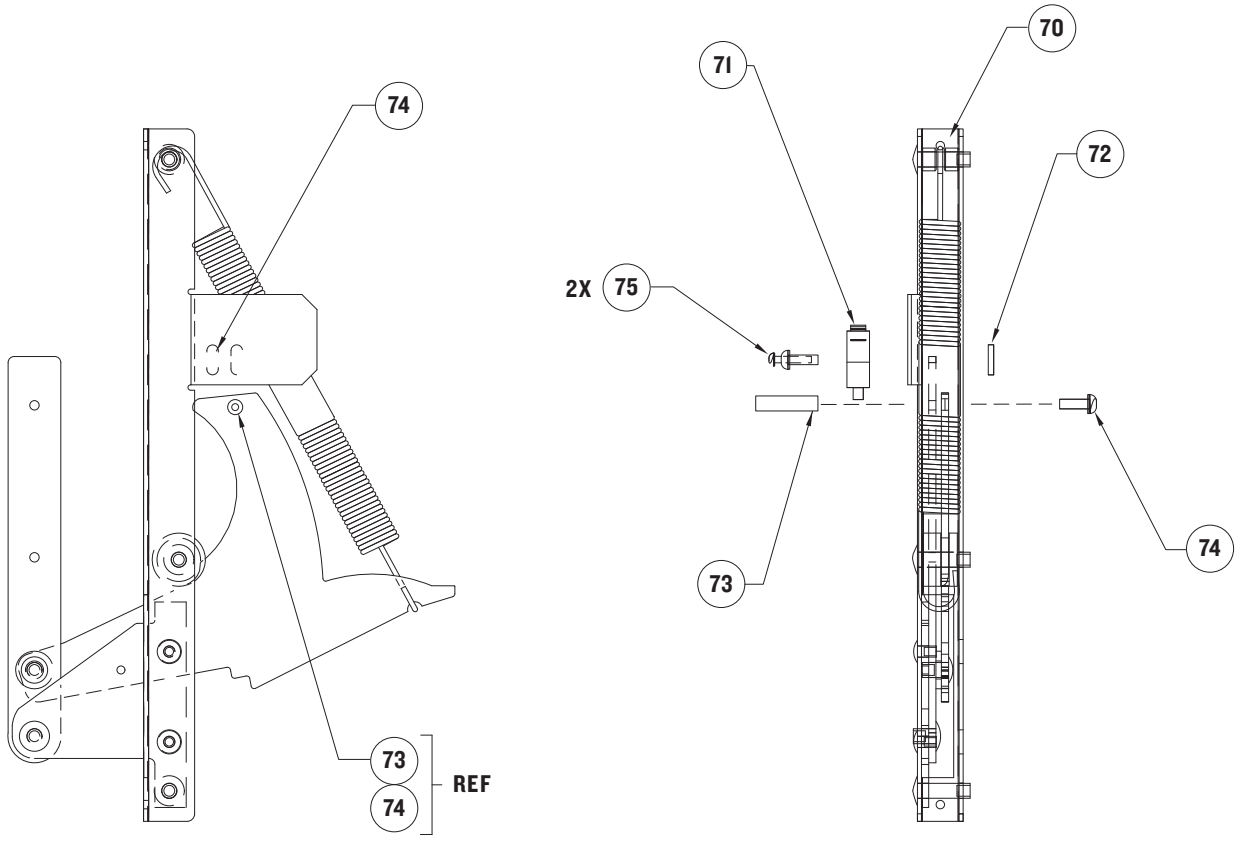


FIGURE 28: Monitor Switch Adjustment and Assembly

2. Open and close the Cook Door several times to ensure the Door closes smoothly and the Door Actuator (Item 70) clears the slot in the Flange. Reference Figure 26.

3. To adjust the Monitor Safety Switch (Figure 28), loosen the #8-32 screw and the two (2) #4-40 screws (Items 74 and 75) securing the switch.

4. Rotate the Monitor Safety Switch (Item 71) until the gap between the Switch Paddle and the Switch Body is 0.02 inch.

5. Open and close the Cook Door several times to make certain the adjustment is correct.

6. Tighten all screws when adjustment is complete.

MONITOR SAFETY SWITCH PARTS

Figure 28

70. 102804	Hinge, Right
71. 102012	Switch, Limit, Micro
72. NGC-1126	Plate, Door switch
73. 101912	Standoff, #8-32F/Fx1 in S
74. 102921	Screw, #8-32 x 3/8”
75. 102902	Screw, 4-40 x 5/8”

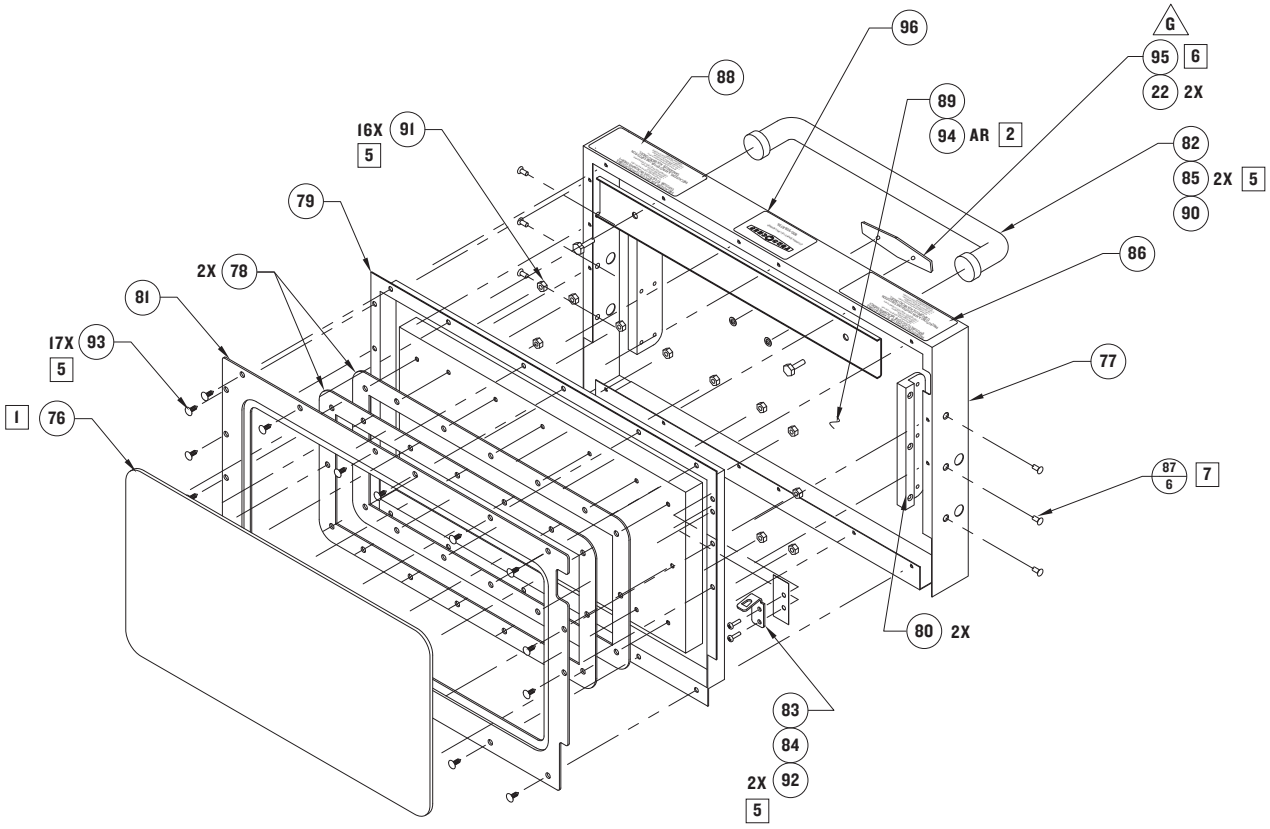


FIGURE 29: Cook Door Assembly

COOK DOOR ASSEMBLY

See Figure 29 above. For mis-adjustments, see Figures 24 and 25 on page 35.

COOK DOOR PARTS

Figure 29 and 30

76. NGC-1151	Assy, Shunt Plate
77. NGC-1056	Cover, Door, NGC
78. NGC-1057	Spacer, Shunt Door
79. NGC-1059	Shunt Cavity, Open Door
80. NGC-1061	Hinge Block
81. NGC-1062	Spacer, Plastic Edge
82. 102750	Handle, Door
83. NGC-1076-002	Actuator, Door
84. NGC-1132	Shim, Door Latch
85. 102945	Bolt, 1/4”-20 x 1.00
86. NGC-1138	Label, Precaution
87. 102809	#8-32 x 3/8” CSK 100°
88. NGC-1165	Label, Caution Empty
89. NGC-1125	Kit Door Insulation
90. NGC-1127	Channel, Door Handle
91. 102962	Nut, Keps #8-32
92. 102748	Screw, #8-32 x 3/8”, Trox Security
93. 101688	Screw, #8 x 1/2” PTH
94. 102698	Tape, Aluminum
95. NGC-1155	Name Plate, TurboChef
96. NGC-1170	Label, Service

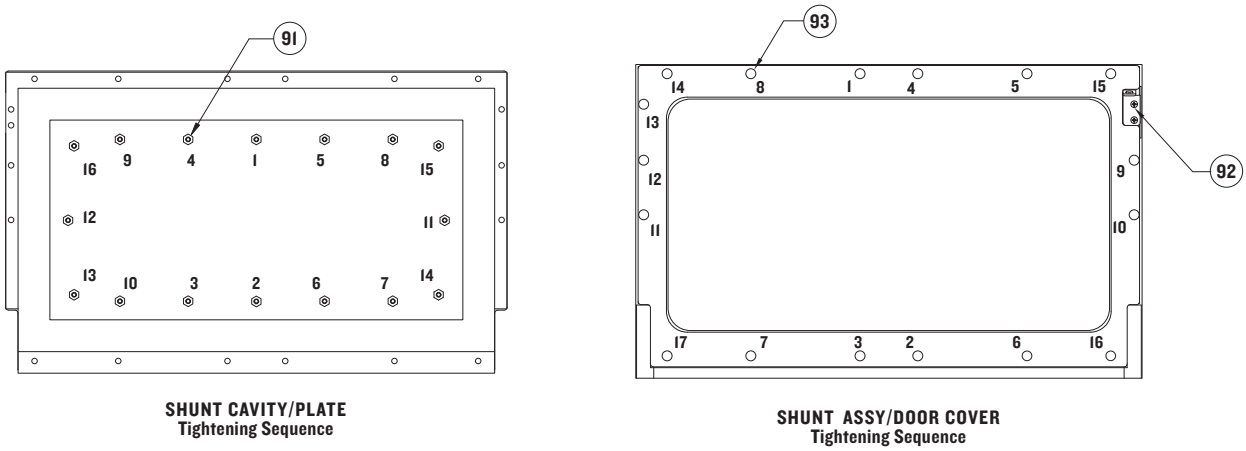


FIGURE 30: Cook Door Assembly: Tightening Specs

Critical Adjustment Notes (Figure 29)

1. Item 76 should be oriented with the Gasket Seam at them bottom of the door assembly. Gasket should be straight with no twists or pinching.

2. Attach insulation to the inside of the door cover using aluminum tape (Item 94).

   ⊠ DO NOT block openings at bottom.

3. Item 89, (insulation) not shown for clarity.

4. Door should be flat without twisting or warpage after tightening all hardware.

5. Refer to the chart to the right for torque specs and tightening sequence.

6. Attach Item 95 with adhesive backing using the two (2) locating holes on the front cover.

7. Item 80 and 77 must mount securely. If Item 80 can move after installation, reject.

SCREW TORQUE CHART

Refer to Figure 30 above.

PART PART NUMBER	TORQUE VALUE
85. Bolt, 1/4”-20 x 1.00 P/N 102945	80 In-Lbs
91. Nut, Keps #8-32 P/N 102962	21 In-Lbs
92. Screw, 8-32 x 3/8” Trox Security P/N 102748	21 In-Lbs
93. Screw, 8 x 1/2” PTH P/N 101688	21 In-Lbs

INTERLOCKS TROUBLE SHOOTING

ISSUE	RESOLUTION
"Cook Door Open" Message	Determine which Interlock Switch is Open. Access Test Mode to view Interlock Switch status. 1. P S M - Primary and/or Secondary Interlock(s) are/is open. Verify action of the Latch Assembly and Cook Door. When door closes, Actuator should freely clear the slot on the Flange and when it strikes the Toggle Latch should rotate smoothly to its closed position. ▫ Actuator doesn't clear slot: Bend or adjust actuator. If the Actuator is worn or has yielded, replace the Actuator. ▫ Toggle doesn't rotate freely or smoothly: Replace any worn parts. Clean assembly and re-lubricate all rotating parts. Be sure to grease the Torsion Spring. See Figure 26 and 27. ▫ Actuator and Toggle OK: Check adjustment and wiring on the Interlocks. If adjustment is necessary, see page 34 for the proper adjustment procedure. 2. P S M – Monitor Switch is open. Verify that Door closes freely and completely. ▫ Door does not close freely: Remove obstructions or readjust the Cook Door per the instructions on page 34. ▫ Door closes properly: Readjust the Monitor Safety Switch per the instructions on pages 36-37.

The Convection Circuit provides the high temperature airflow necessary to brown and cook food items.

CONVECTION SYSTEM COMPONENTS

The following is a description of each component within the Convection Circuit and how each acts within the Circuit. Figure 31 below shows a block diagram of the Convection Circuit.

Main Convection Heater (P/N 100661)

The Main Convection Heater is an open coil style heater rated at 3300 watts at 208 VAC with a resistance of 13.11 Ohms. The Convection Heater is controlled by the K4 Solid State Relay (SSR) (P/N 101284).

Convection Motor (P/N 100882)

The Convection Motor is a Brushless DC Switch reluctance type. Its top speed is 7200 RPM at 1 HP. The Motor is controlled by a proprietary controller.

Motor Controller (BMSC) (P/N 100443)

The Motor Controller is proprietary and will only operate the Convection Motor described above. The Motor Controller is controlled on command from the I/O Control Board and a 0-10VDC speed command from the I/O Control Board.

High Limit Thermostat (P/N 102075)

The High Limit Thermostat is a 250VAC, 3-Pole, manual reset thermostat with a trip point of 572°F. The Thermostat, which interrupts power to both the Convection Heater and the IR Element, should never operate during normal operation.

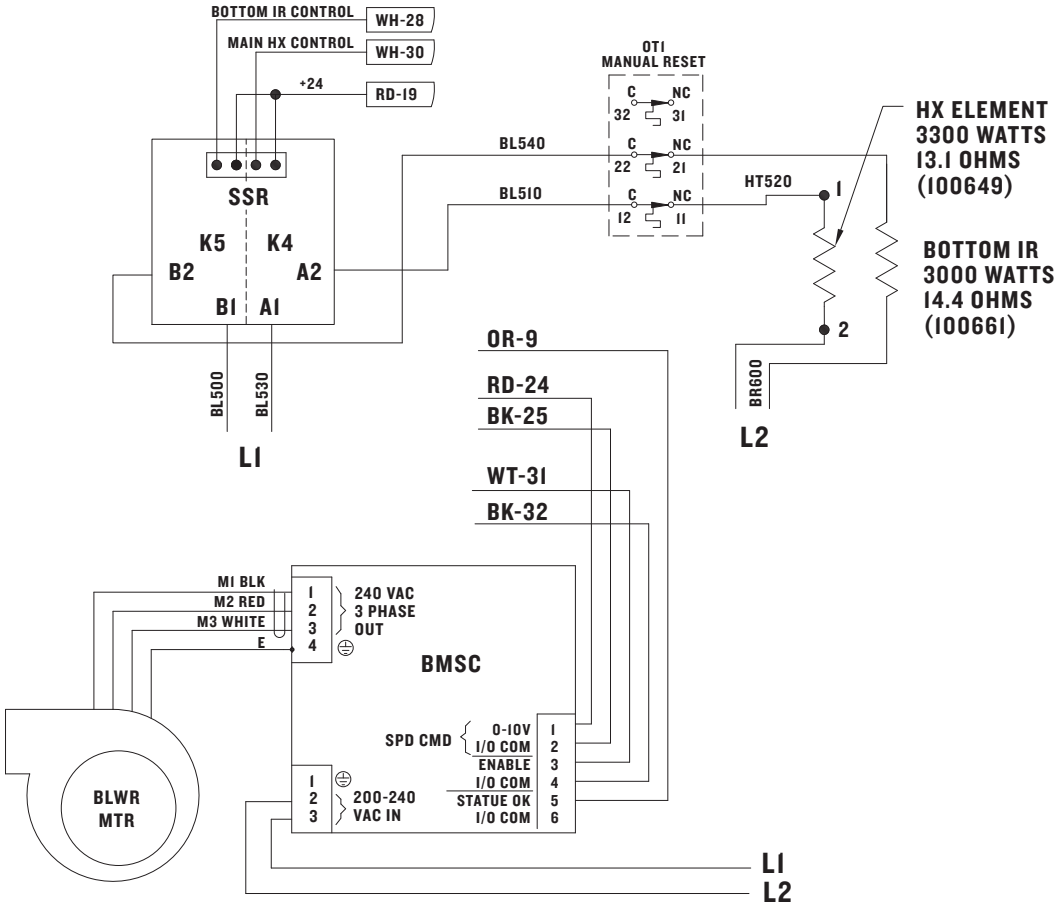


FIGURE 31: Convection Circuit Block Diagram

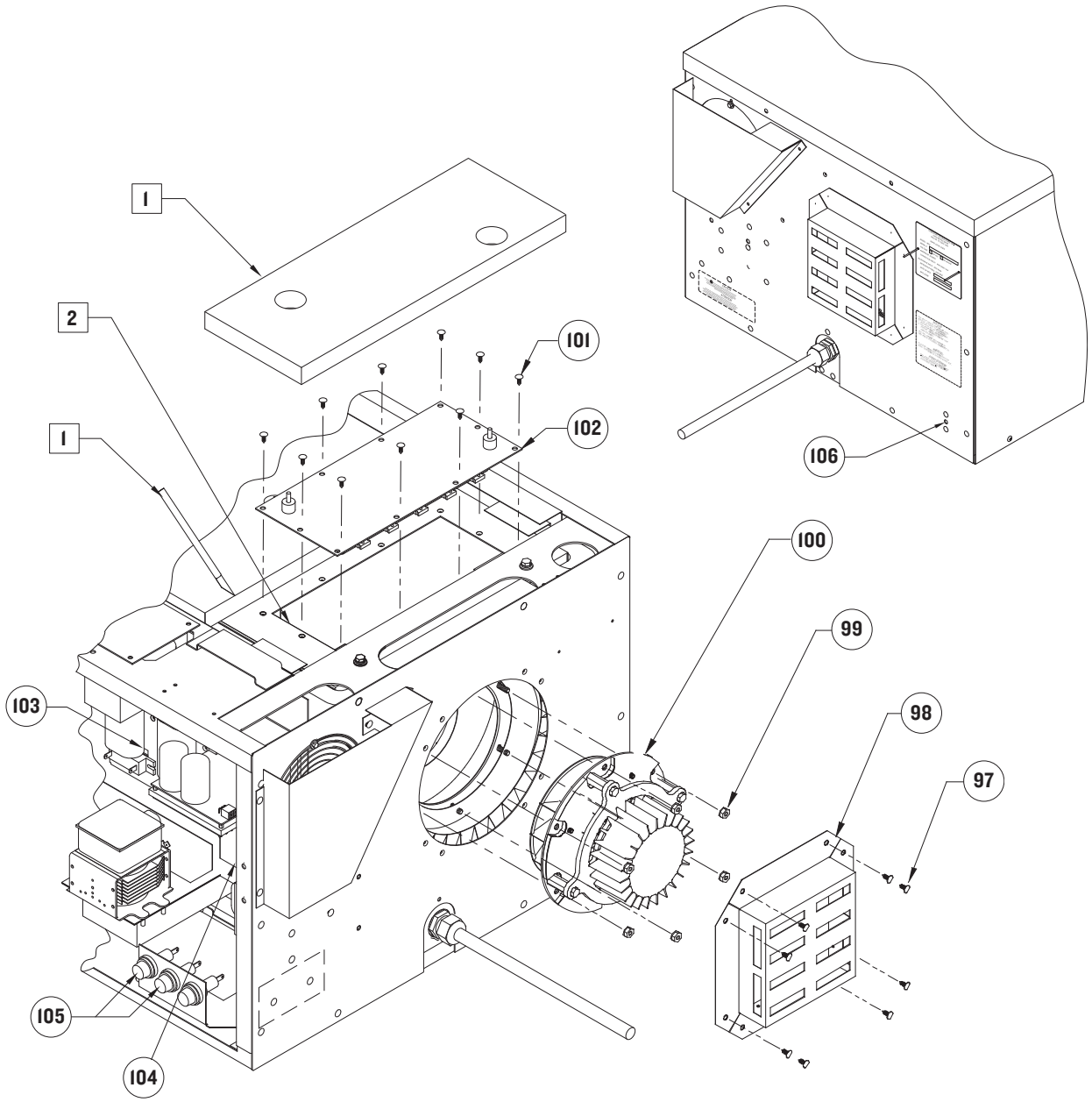


FIGURE 32: Convection Circuit Assembly and Parts

CONVECTION CIRCUIT PARTS

Figure 32

97.	101688	Screw, #8 x 1/2" PTH
98.	NGC-1081	Cover, Motor, Cap
99.	100905	Nut, 1/4"-20, Flange
100.	NGC-1025	Assy, Blower Motor
101.	101688	Screw, #8 x 1/2" PTH
102.	100661	Heater, Convection
103.	100443	Controller, Motor
104.	101284	Relay, K4/K5 SSR
105.	100592	Buss, Fuses (12 Amp)
106.	102075	High-Limit Thermostat

Assembly Notes

1. Cut insulation covering Conversion Heater as shown.
2. Gasket Convection Heater (P/N NGC-1043) not shown for clarity.

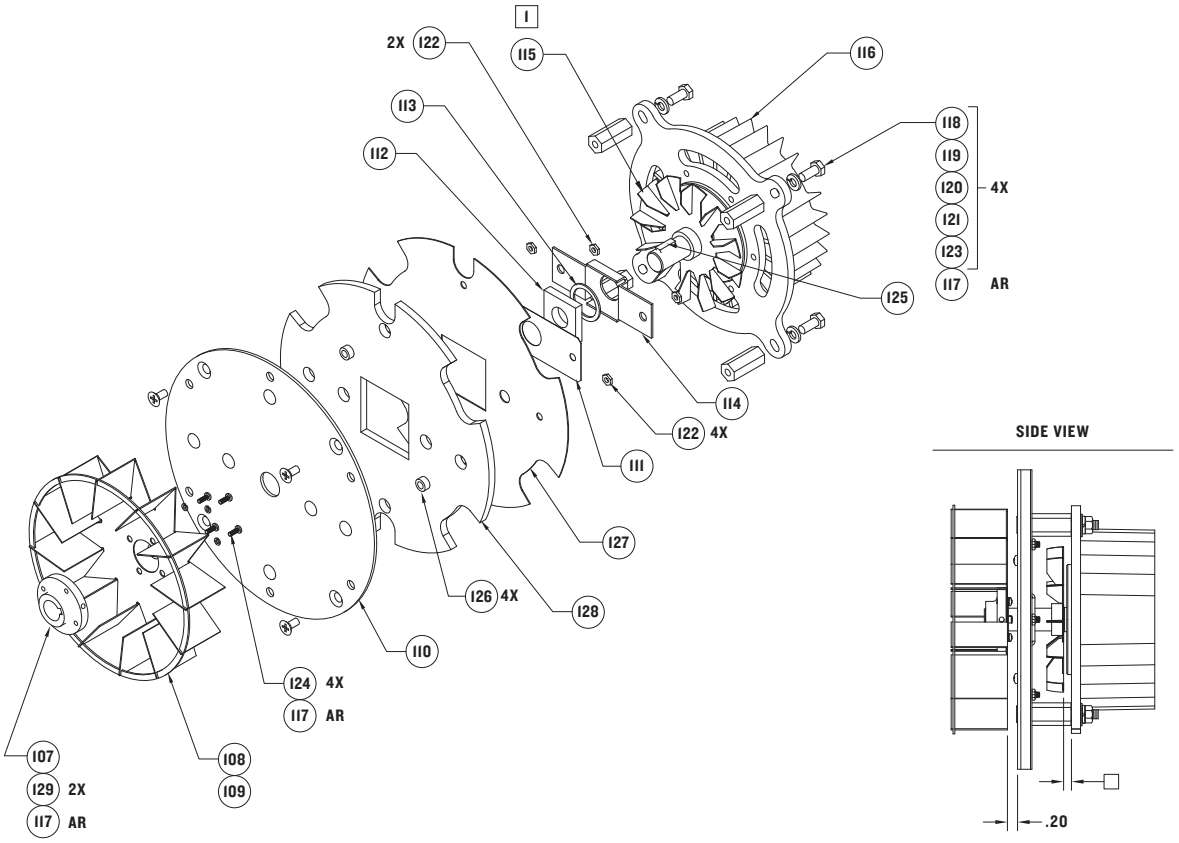


FIGURE 33: Blower Motor Assembly and Parts

BLOWER MOTOR PARTS

Figure 33

107.	700-0306-2	Hub, Small
108.	NGC-1019-2	Fan Blade, NGC Oven
109.	NGC-1020	Ring, Fan Blade
110.	NGC-1021	Plate, Blower Cap
111.	700-0284	Shim, Seal
112.	NGC-1024	Sealing Block Blower
113.	100443	Washer, Wave Spring, 30mmOD
114.	NGC-1023	Clamp, Blower Seal
115.	102708	Heat Slinger, Fan, PM Motor
116.	100882	Motor, 1HP, Flange Mount Aspen
117.	100790	Loctite, #272
118.	NGC-1022	Spacer, Blower Motor
119.	101394	Bolt, Hex, 1/4”-20 x 3/4” Lg, CRES
120.	101394	Washer, Splitlock, 1/4”, CRES
121.	101392	Screw, PFLH, 1/4”-20 x 1/2” Lg, 100º, Cres
122.	102963	Nut, Hex, #10-32 Ext Tooth Keps, CRES
123.	102200	Washer, Flat, 1/4”, Cres
124.	102921	Screw, #8-32 x 3/8” Int Tooth Keps, CRES
125.	100730	Key, Woodruff, Steal
126.	NGC-1122	Spacer, Blower, Insulation
127.	NGC-1102	Heat Shield, Blower Motor
128.	NGC-1123	Insulation, Blower Plate
129.	101711	Set Screw, Skt Hd #10-32 x 5/16” CRES

Assembly Notes

1. Item 115 to be located and installed as shown on shaft shoulder near the motor housing.
2. Spacing between Item 108 and 110 must be 0.20 inches minimum. See side view.

CONVECTION CIRCUIT TROUBLE SHOOTING

ISSUE	RESOLUTION
F8: Heat Low Oven Not Warming Up	1. Check that the Blower Motor is moving air. ▫ Blower Motor is not moving air: Check Blower Motor Assembly and verify Motor is stalled. Correct any issues with Motor Assembly. See Figure 33. ▫ Blower Motor is moving Air: Verify High-Limit Thermostat is not tripped. See the High-Limit Thermostat information below. High-Limit Thermostat: ▫ Thermostat tripped: Reset and determine why the Thermostat tripped (See Figure 32, Item 106). Look for excess build up of grease inside the oven or any other source for a fire. ▫ Thermostat is not tripped: Check Main Convection Heater. 1. Convection Heater is Defective: Replace the Convection Heater and verify the K4 SSR (Figure 31) is not shorted across output. 2. Convection Heater OK: Check the K4 SSR. ▫ K4 defective: Replace. ▫ K4 OK: Verify all wiring.
F2: Cook Temperature Low	1. Verify Cook Door Operation. ▫ "Cook Door Open" Message: Verify which switch is not actuating and readjust. See page 34 and 36. ▫ Cook Door OK: Verify High-Limit Thermostat is not tripped. See the High-Limit Thermostat below. High-Limit Thermostat: ▫ Thermostat tripped: Reset and determine why the Thermostat tripped (See Figure 32, Item 106). Look for excess build up of grease inside the oven or any other source for a fire. ▫ Thermostat is not tripped: Check Main Convection Heater. 1. Convection Heater is Defective: Replace the Convection Heater and verify the K4 SSR (Figure 31) is not shorted across output. 2. Convection Heater OK: Check the K4 SSR. ▫ K4 defective: Replace. ▫ K4 OK: Verify all wiring.

ISSUE	RESOLUTION
F1: Blower Running Status Bad	Determine if Status Indicator "A" is highlighted/backlit in Test Mode. 1. "A" is highlighted/backlit. Verify 208/240 VAC is going to the Motor Controller via Pins 2 and 3. ▫ 208/240 VAC is not present: Correct Line Voltage Wiring going to Motor Controller. ▫ 208/240 VAC is present: Verify the control wiring from Motor Controller and I/O Control Board, specifically Low Voltage Wire OR-9. If all wires are OK, refer to Motor Controller Trouble Shooting below. Motor Controller Trouble Shooting: ▫ Verify Motor spins freely. 1. Motor seized: Replace Motor or correct obstruction. 2. Motor spins freely: Verify Motor Windings. ▫ Verify Motor Windings are OK. Measure the resistance between windings and chassis. Replace Motor if resistances do not in agree with the values in the Motor Winding Resistance table below. ▫ If Motor is OK, Replace Motor Controller. 2. "A" is not highlighted. Check Motor per above steps. If Motor is OK, replace the Controller.

MOTOR WINDING RESISTANCES TABLE

TO	FROM	DESCRIPTION	EXPECTED RESISTANCE
Black	Red	Winding (A-B)	2.0 – 2.6 Ohms
Black	White	Winding (A-C)	2.0 – 2.6 Ohms
Red	White	Winding (B-C)	2.0 – 2.6 Ohms
Black, White or Red	Green	Windings to Chassis	Open

The IR Element and Catalytic Converter provide two very different, but essential functions.

The IR Element provides the bottom browning - similar to a residual broiler or salamander type cooking appliance - required for cooking most food items. The IR Element is independently controlled via the IR Thermocouple embedded inside the IR Element itself.

The Catalytic Converter scrubs the air to eliminate VOCs and grease particulates that are liberated during the cooking process. It is important to properly care for the Catalyst using only TurboChef® Oven Cleaner and distilled water. For more detailed information, see the Catalytic Converter section below.

COMPONENTS

IR Element (I00649)

The IR Element - a dual coil type heater - is located in the bottom of the oven cavity. The first coil is the heating coil. The second is the IR Thermocouple (TIR) wire. The heating coil outputs 3000 watts at 208 VAC. The heating coil's resistance is 14.4 Ohms at room temperature.

The Thermocouple coil is a Type K Thermocouple with a resistance of approximately 20 Ohms at the splices located approximately 6 inches from the heater and 40 Ohms measured at the extension wires at the I/O Control Board.

The IR Element is controlled via the K5 Solid State Relay (P/N 101284) and the IR Thermocouple via the I/O Control Board.

Catalytic Converter (NGC-1012)

The Catalytic Converter, a VOC type catalyst, is located behind the inside Cook Chamber Wall and is responsible for cleaning the recirculating airflow. The Catalyst functions by substantially lowering the combustion temperature of grease entrained in the air path to approximately the same temperature of the airflow, thus the grease burns and breaks down into CO^2 and H_2O as it passes through the Catalytic Converter. The Catalyst will operate most efficiently at temperatures above 475ºF.

The Catalyst material is very sensitive to certain chemical compounds. Irreversible damage can occur if the Catalyst is exposed to cleaning chemicals containing phosphates, NaOH, silicates, Na and Potassium Salts. These chemicals are found in most commercially available degreasers and cleaners; therefore, only TurboChef cleaners are to be used.

⚠ CAUTION: Clean the Catalytic Converter with TurboChef® Oven Cleaner and rinse thoroughly with distilled water. Let the Catalytic Converter air dry before reinstalling. If TurboChef® Oven Cleaner is not available, do not use a substitute. Use distilled water only.

IR ELEMENT AND CATALYST REMOVAL

Refer to Figure 34 and the instructions below for removing the IR Element and Catalytic Converter.

Removing the IR Element

1. Disconnect the Heater Wires going to the EMI Filter and the High-Limit Thermostat.

2. Locate where the IR Element protrudes through the Cook Chamber Walls and remove the Snap Rings (Item 130) using Snap Ring Pliers. Retain Snap Rings (Item 130) and Washers (Item 131). Figure 34.

3. Locate and remove the Microwave Shield (Item 133) by removing the four (4) #8 x 1/2" Sheet Metal Screws (Item 134).

4. Squeeze the IR Element together inside the Cook Chamber and pull the IR Element from the oven.

Removing and Installing the Catalytic Converter

1. Remove the IR Element.

2. Once the IR Element has been removed, remove the Catalytic Converter Clip (Item135) to access the Catalytic Converter. Figure 34.

   NOTE: It may be necessary to remove the Blower Motor Assembly (see page 41) to get access to the top of the Catalytic Converter. This will allow the Catalytic Converter to be pushed down out of the housing. Figure 34.

3. Remove the Catalytic Converter (Item 136).

4. Install a new Catalytic Converter.

Installing a new IR Element

1. Gently squeeze the new IR Element together in order to get the Terminals and Lead Wires into the cavity and through the mounting holes.

⚠ CAUTION: Do not allow the Thermocouple Lead Wires to kink. They are solid wire and will break.

2. Once the IR Element is installed, expand the IR Element in order to reinstall the Shim Washers (Item 131) and Snap Rings (Item130). Figure 34.

   NOTE: Be sure that the Snap Rings sit in the grooves on IR Element.

3. Reconnect the IR Element Lead Wires to the EMI Filter and the High-Limit Thermostat.

4. Reconnect the IR Thermocouple Lead Wires to the Thermocouple Extension Wires – Yellow to Yellow and Red to Red.

IR ELEMENT AND CATALYTIC CONVERTER PARTS

Figure 34

130.	101312	Snap Ring
131.	102449	Washer, Shim
132.	100649	IR Element
133.	NGC-1116	Shield, Microwave
134.	101688	Screw, #8 x 1/2” Sht Metal PTH
135.	NGC-1030	Clip, Catalytic Converter
136.	NGC-1012	Catalytic Converter

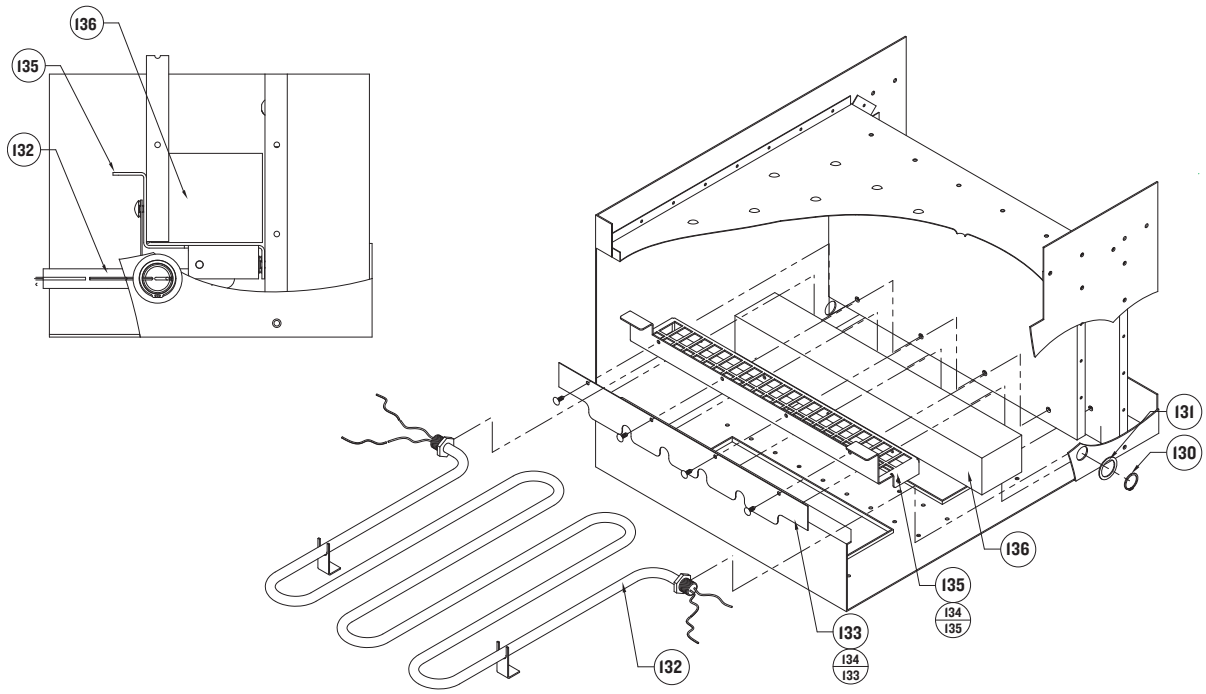


FIGURE 34: IR Element and Catalytic Converter Assembly

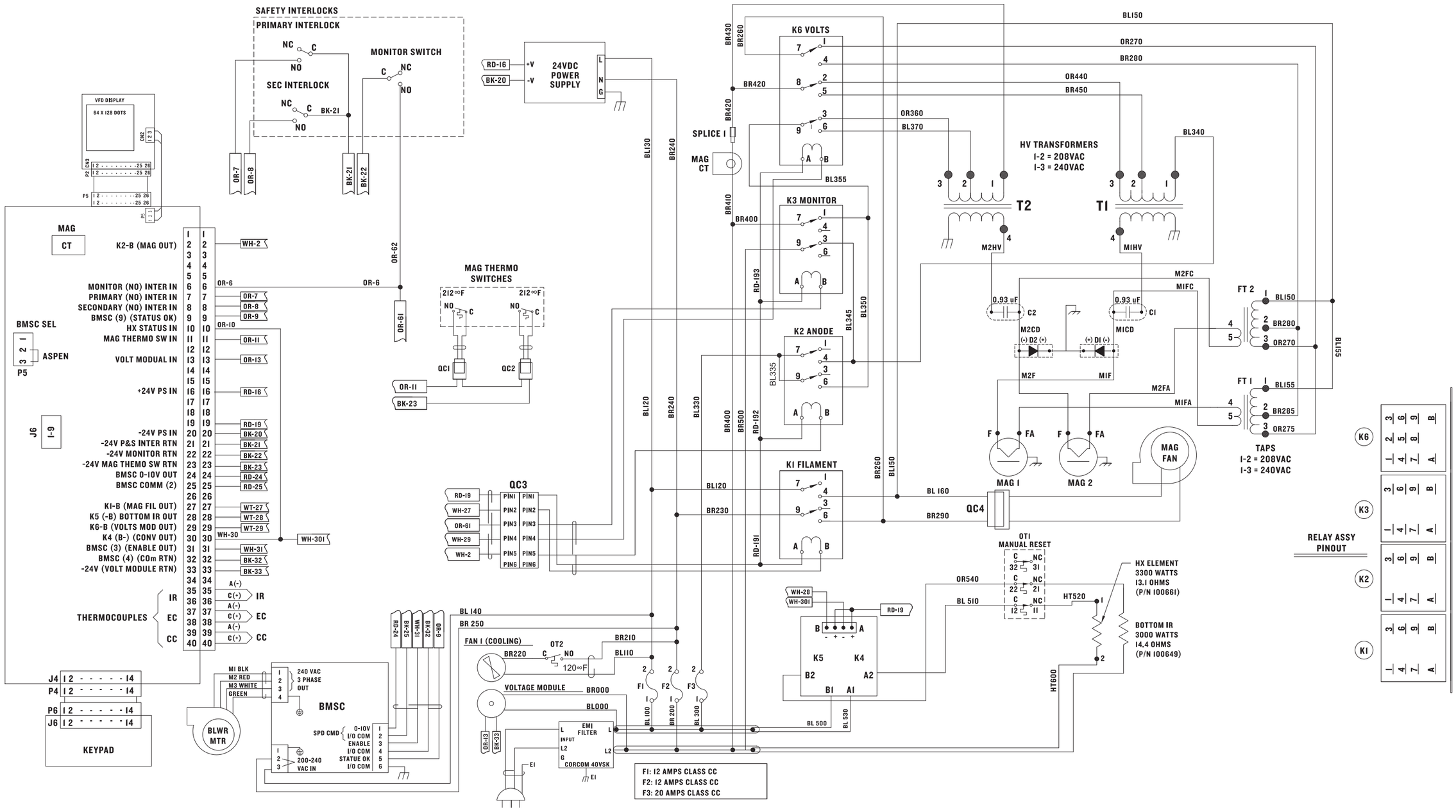


FIGURE 35: NGC (Tornado) Schematic (P/N NGC-1070, Revision H, July 22, 2004)

FIGURE 35: NGC OVEN SCHEMATIC (P/N NGC-1070)

See inside of this fold out page. Rev 2 Board, VFD Display, Single Phase, 280/240 VAC, 60 Hz

Notes

Schematic shows the oven with door open and without power applied.

Color Code (Line Voltage)

BL - Blue = Line V (208/240)
BR - Brown = Line V (208/240)
OR - 240 Line Input for Tap 3 on all Transformers
BK - Hi-Temp 240 VAC Wire

Color Code (Low/Control Voltage)

BK - Black = 24 VDC Common
OR - Orange = Status Input
WH - White = Control Input
RD - Red = +240VDC

Color Code (High Voltage/Tension)

WH - Hi-Voltage Wire For Mag 1
BK - Hi-Voltage Wire For Mag 2

SCHEMATIC PARTS

Figure 35. See the inside of fold out page.

Line Voltage Components

137. 100543	EMI Filter
138. 100586	F1, F2 and F3 - Fuse, Holders
139. 100592	F1, 12 Amp Fuse
140. 100592	F2, 12 Amp Fuse
141. 100599	F3, 20 Amp Fuse
142. 100783	Voltage Module
143. 100518	Fan 1, Cooling
144. 102086	OT2, Cooling Fan
145. 101271	K1 – Filament Relay
146. 101271	K2 - Anode Relay
147. 101271	K3 – Monitor Relay
148. 101284	K4/K5 – SSR Heater/IR Relay
149. 102075	OT1, Thermostat Heater
150. 100661	Heater, Convection
151. 100649	Heater, IR Element
152. 101272	K6 – Voltage Relay
153. 101206	PS – Power Supply, +24VDC
154. 100861	M1 – Magnetron
155. 100861	M2 – Magnetron
156. 102101	T1 – High Voltage Transformer
157. 102101	T2 – High Voltage Transformer
158. 102102	FT1 – Filament Transformer
159. 102102	FT2 -Filament Transformer
160. 100201	C1 – High Voltage Capacitor
161. 100201	C2 – High Voltage Capacitor
162. 100481	D1 – High Voltage Diode
163. 100481	D2 – High Voltage Diode
164. 100083	Fan 2 – Mag Fan
165. 100443	Controller, Motor
166. 100882	Motor, Convection

Low Voltage Components

167. 102012	Primary Interlock
168. 102012	Secondary Interlock
169. 102012	Monitor Safety
170. NGC-1008	I/O Control Board
171. 100505	Display, VFD
172. NGC-1110	Keypad, NGC Oven
173. 102070	Mag Thermo Switches

Wire Harness Replacement P/Ns

174. 100188	Line Voltage Harness
175. 100185	Low Voltage Harness
176. 100187	Power Cord
177. 100186	Magnetron Wire

I/O CONTROL BOARD ITEM IDENTIFICATION AND TEST POINT LOCATION

Figure 36

178. J2	40 Pin Connector for LV Harness
179. J3	3 Pin Connector for VFD Display
180. J4	14 Pin Connector for Keypad
181. J5	26 Pin Connector for Display Data
182. J6	RS-232 Connector (Unused)
183. RJ11	Connector for Smart Card Cable
184. U15	EPROM Socket
185. T1	Magnetron Current Transformer
186. P1	Voltage Reference 0-5 VDC
187. R42	Voltage Reference Adjustment
188. P3	Blower Controller Pin Configuration
189. C9	Capacitor
190. SKP1	Beeper
191. R51	Beeper Volume Adjustment

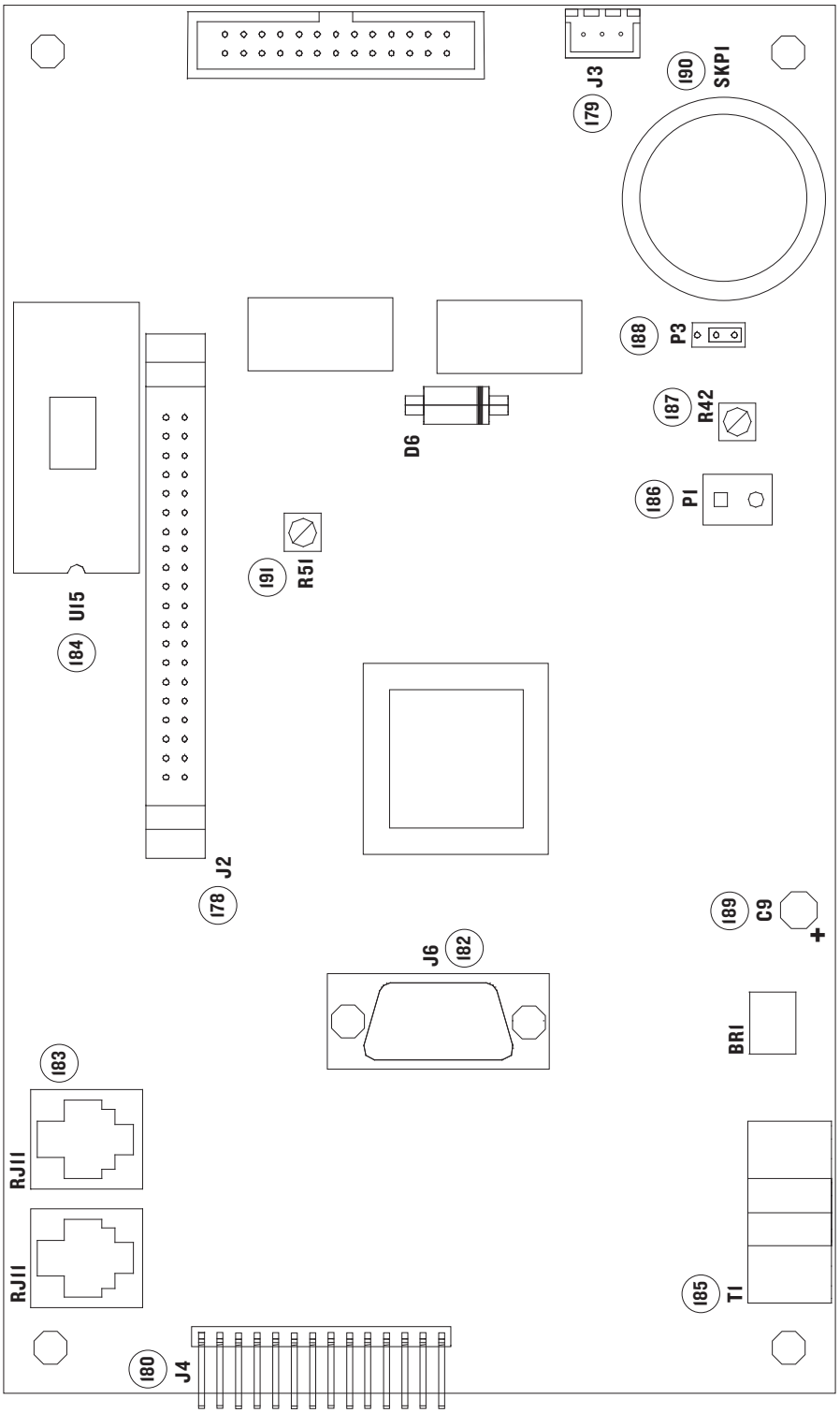


FIGURE 36: I/O Control Board and Test Point Locations

FIGURE 4: NGC (TORNADO) CONTROL SYSTEM

Chapter 4: The Control System - Page 11

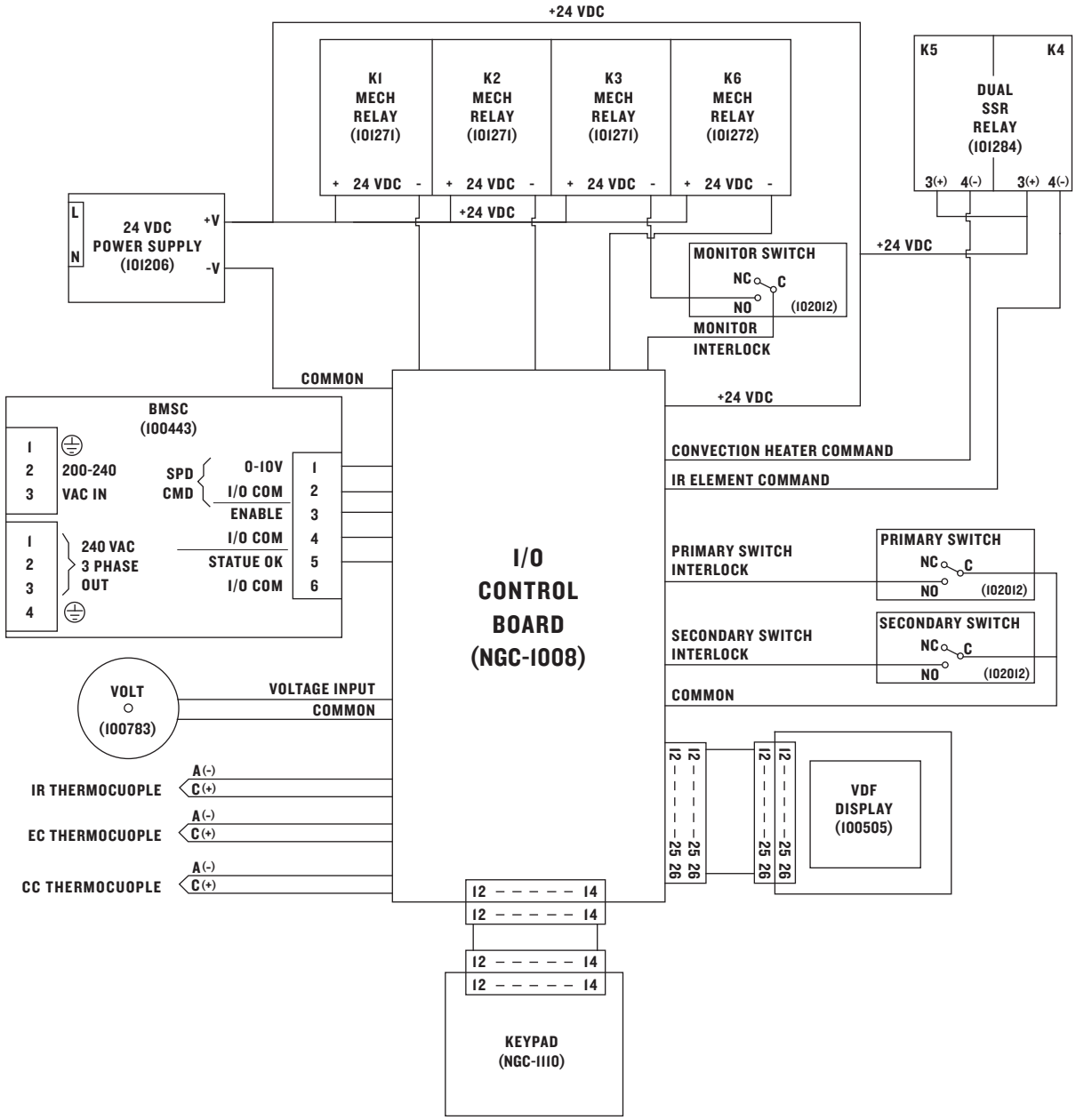
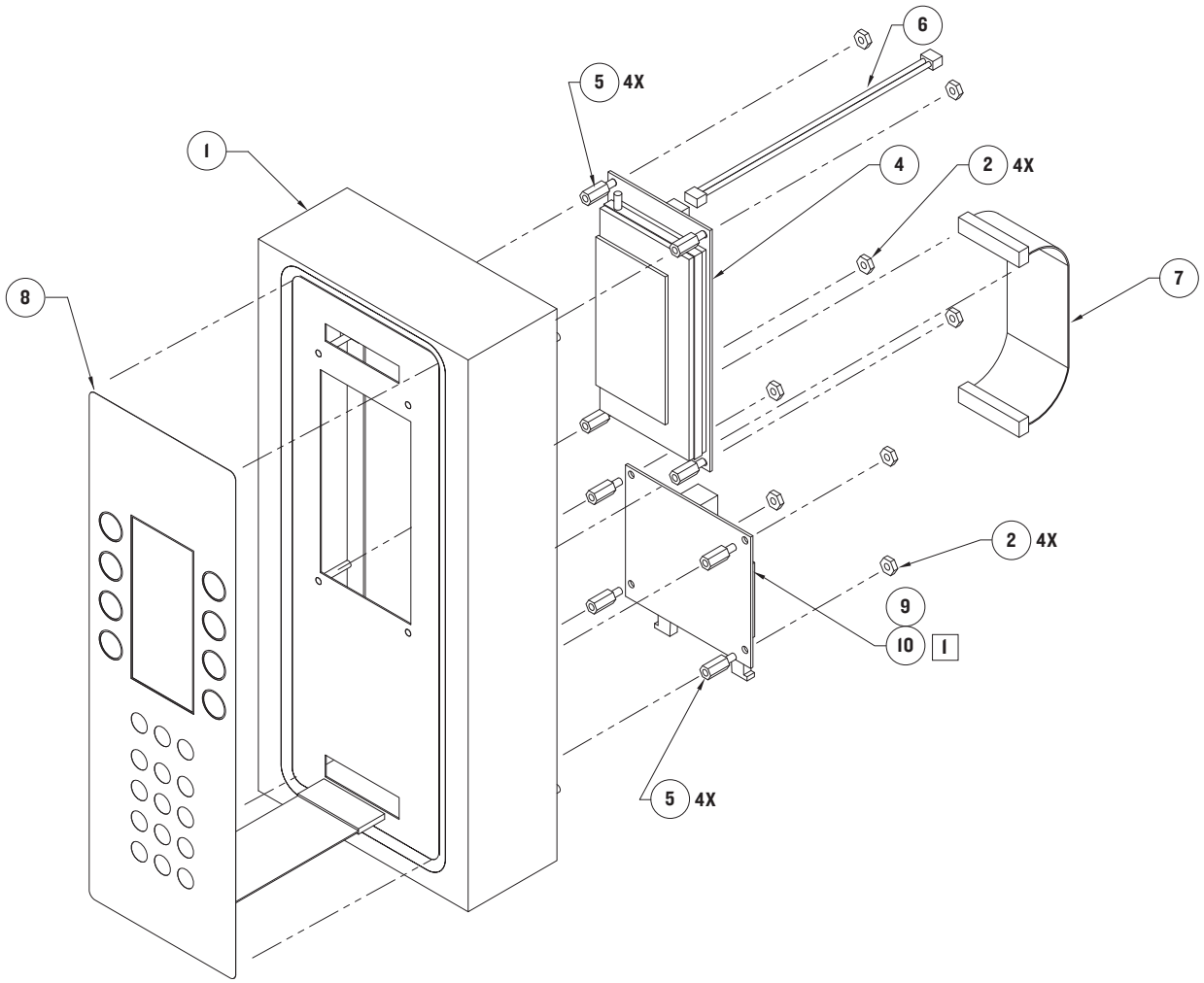


FIGURE 12: CONTROL SYSTEM PANEL ENCLOSURE AND PARTS

Chapter 4: The Control System - Page 17



Control System Panel Parts

1. NGC-1040	Cover, Keypad display
2. 102960	Nut, 4-40, Stainless
3.	Reserved For Future Use
4. 100505	Display
5. 101954	Spacer, 1/2” Lg, Al
6. 100193	2 Pin Power Cable
7. 100184	26 Pin Ribbon Cable
8. NGC-1110	Keypad, NGC
9. 100506	Connector*
10. 100182	Cable Connection

*Optional Feature

FIGURE 13: MONITOR CIRCUIT - SHOWN IN FAILSAFE STATE

Chapter 5: The Microwave System - Page 21

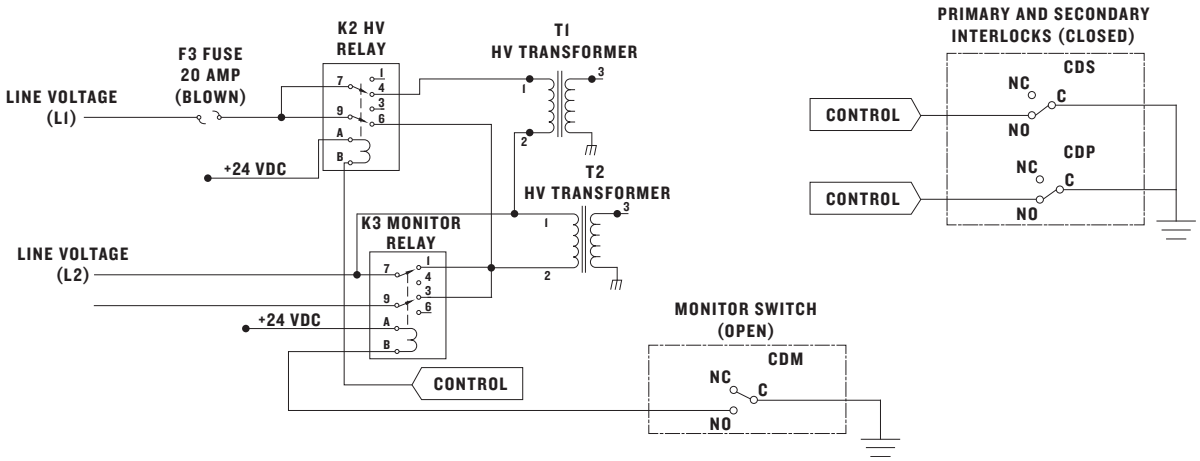


FIGURE 15: MICROWAVE SYSTEM PARTS

Chapter 5: The Microwave System - Page 23

Microwave System Parts

11. 102101	High Voltage Transformer 2
12. 102101	High Voltage Transformer 1
13. 100201	High Voltage Capacitor 2
14. 100201	High Voltage Capacitor 1
15. 100481	High Voltage Diode 2
16. 100481	High Voltage Diode 1
17. 102102	Filament Transformer 2
18. 100083	Mag Cooling Fan
19. 101271	K3 Monitor Relay
20. 101271	K2 High Voltage Relay
21. 101271	K1 Filament Relay
22. 102102	Filament Transformer
23. 100599	F3 Fuse - 20 Amp
24. 102070	Mag 2 Thermostat
25. 100861	Magnetron 2
26. NGC-1106	Wave Guide #2
27. 102070	Mag 1 Thermostat
28. 100861	Magnetron 1
29. NGC-1044	Wave Guide #1

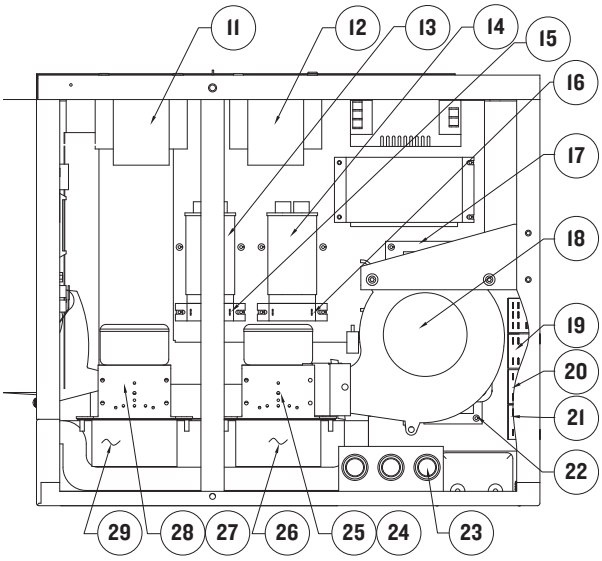
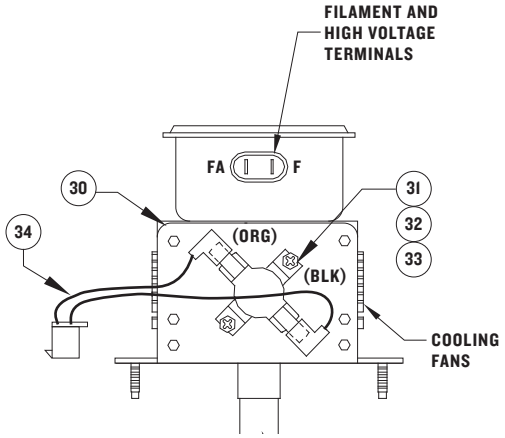


FIGURE 16: MICROWAVE SYSTEM PARTS

Chapter 5: The Microwave System - Page 23

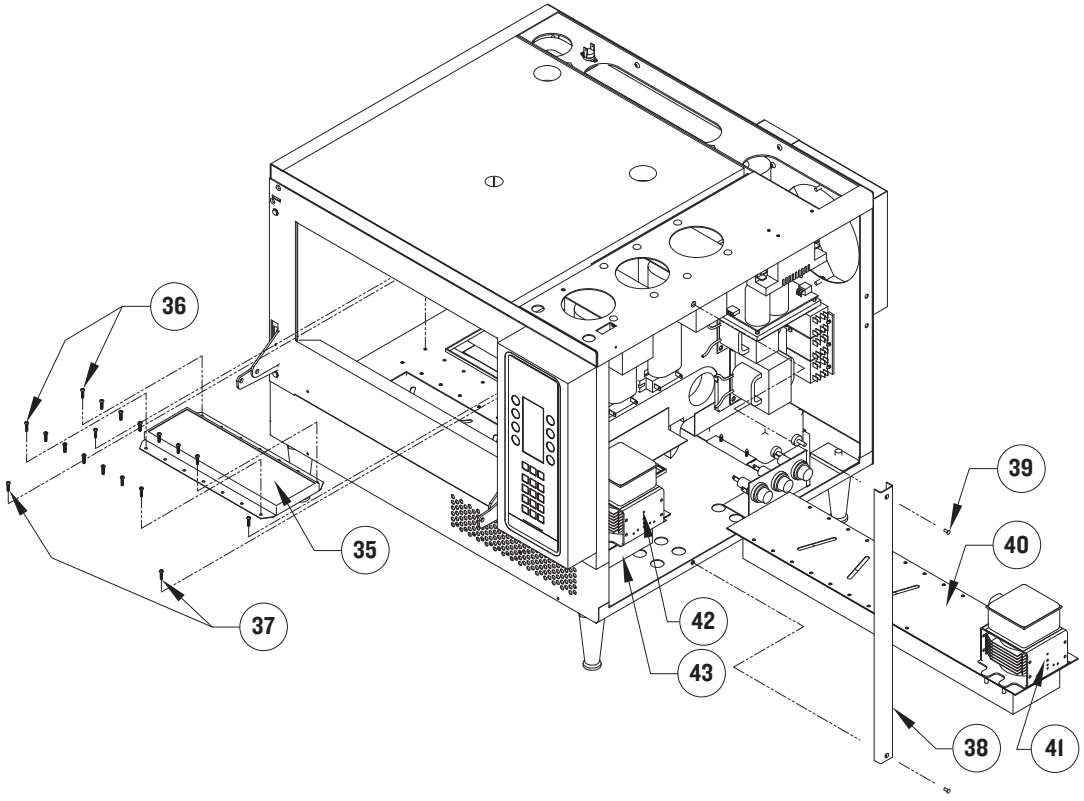


Microwave System Parts

30. 100861	Magnetron
31. 102070	Mag Thermostat
32. NGC-1163	Ad, Insulator
33. 100186	Screw #6 Sheet Metal
34. 100186	Magnetron Wire

FIGURE 17: WAVE GUIDE COVER/WAVE GUIDE REMOVAL AND REPLACEMENT

Chapter 5: The Microwave System - Page 25



Wave Guide/Wave Guide Cover Parts

35. NGC-1097	Assy, Wave Guide Cover
36. 102921	Screws, #8-32 x 3/8", SS
37. 101688	Screws, #8 x 1/2" Sheet Metal PTH
38. NGC-1047	Support, Frame
39. 102809	Screws, #8-32 x 3/8" CSK (100º)
40. NGC-1106	Assy, Wave Guide #2
41. 100861	Magnetron #2
42. 100861	Magnetron #1
43. NGC-1044	Assy, Wave Guide #1

FIGURE 18 & 19: HIGH VOLTAGE TRANSFORMER AND FILAMENT WIRING

Chapter 5: The Microwave System - Page 26

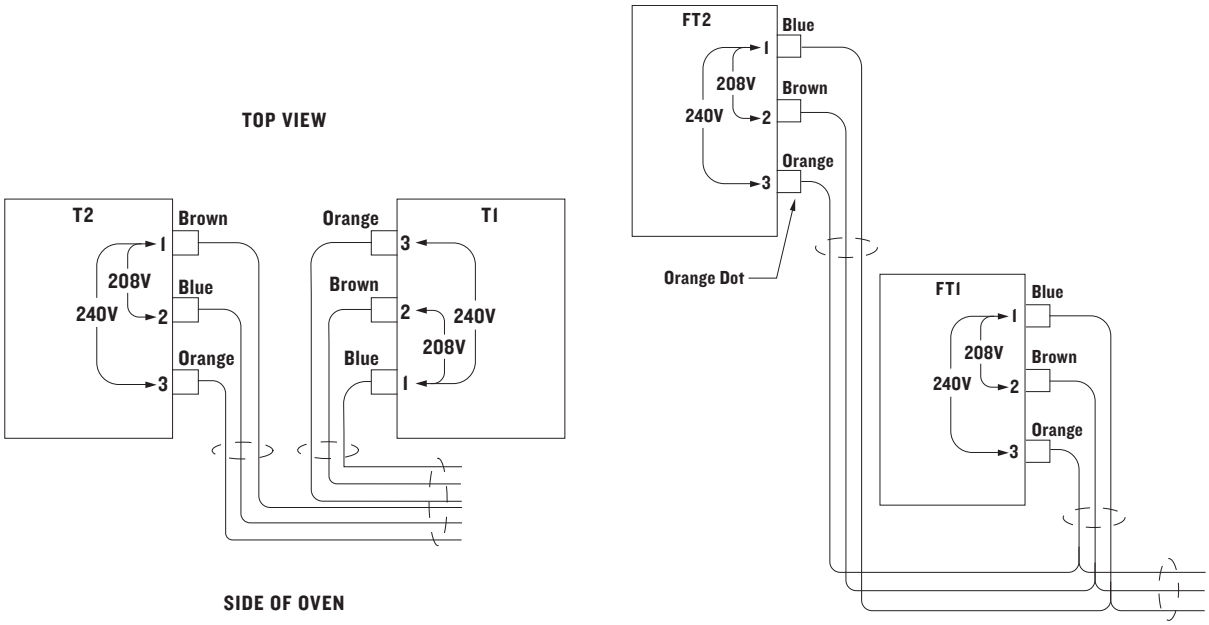


FIGURE 21 & 22: HIGH VOLTAGE DIODE AND MAGNETRON

Chapter 5: The Microwave System - Page 28

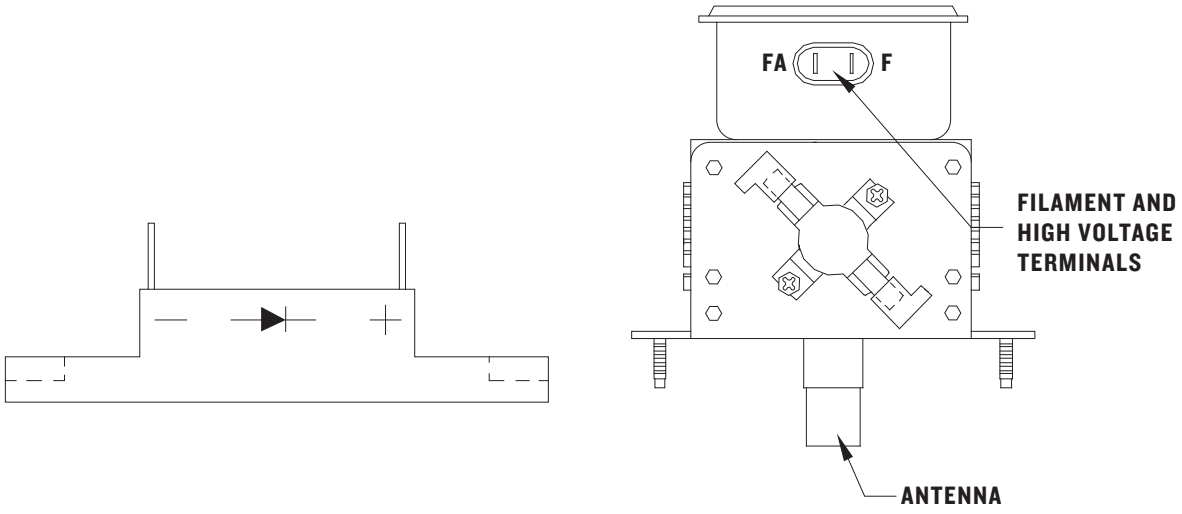


FIGURE 23: COOK DOOR REMOVAL AND PARTS

Chapter 6: The Cook Door - Page 33

Cook Door Parts

44. 102809	#8-32 x 3/8” PFH CSK
45. NGC-1060	Assy, Oven Door
46. NGC-1061	Hinge Block
47. 102804	Right Hinge (only)
48. 102805	Left Hinge
49. 101381	#10-32 x 1/2” Hex SS
50. 102140	#10 Flat
51. 102350	#10 Split Loc
52. 101191	Cap, Hole

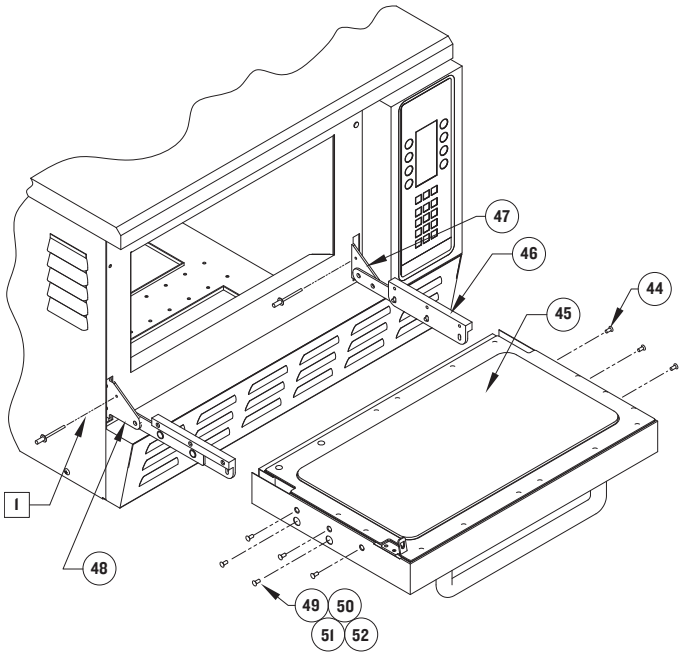


FIGURE 26: PRIMARY AND SECONDARY INTERLOCKS ADJUSTMENT AND PARTS

Chapter 6: The Cook Door - Page 35

Primary and Secondary Interlock Switch Parts

53. NGC-1076	Actuator, Door
54. 102684	Screw, #8-32 x 1/2” 100° CSK
55. 102921	Screw, #8-32 x 3/8”
56. 101557	Screw, #4-40 x 1 1/4”
57. 102012	Interlock Switches
58. NGC-1075	Assy, Door Switch

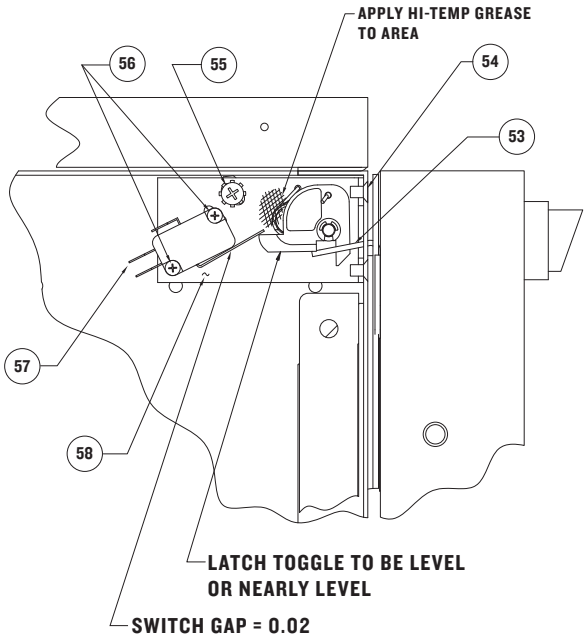
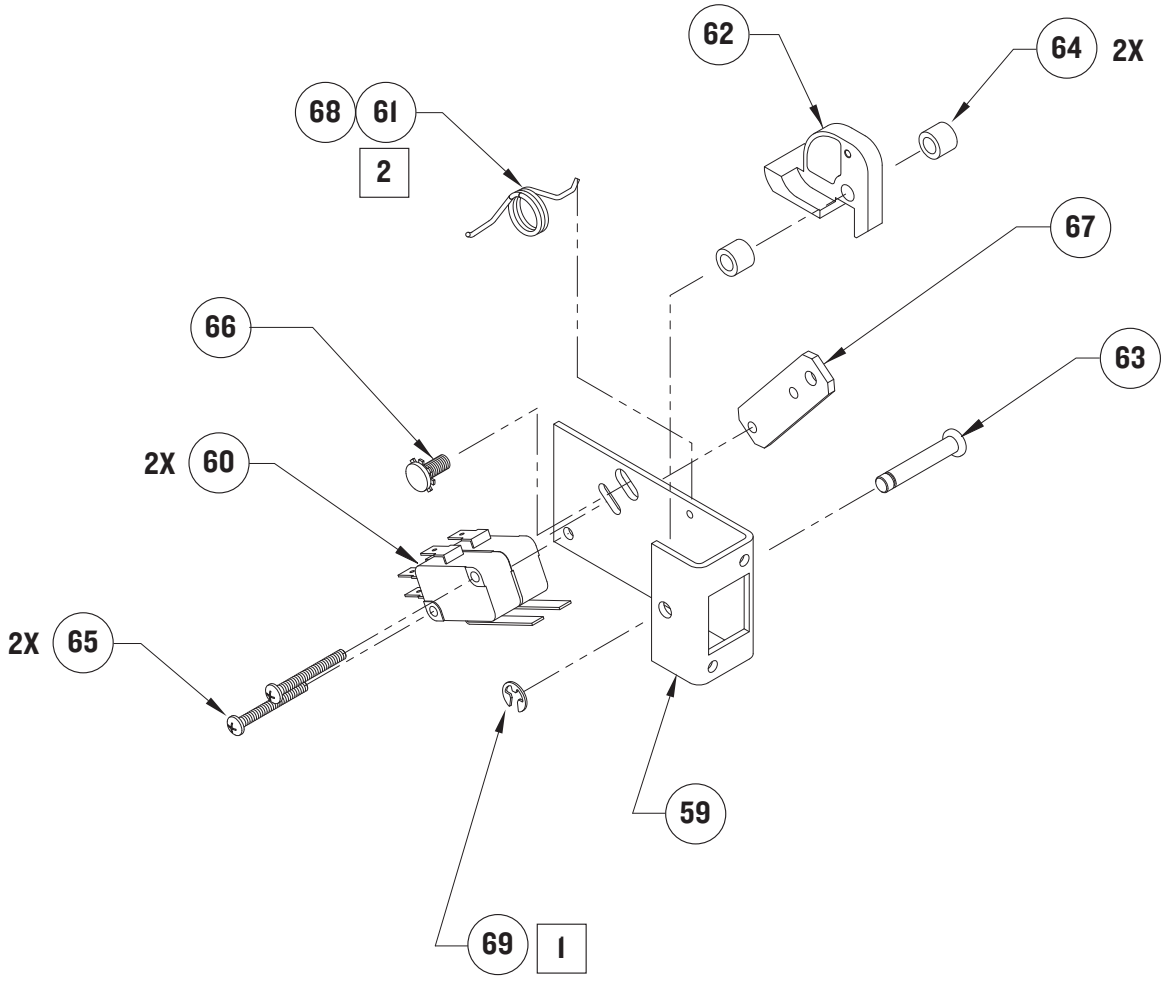


FIGURE 27: DOOR SWITCH ASSEMBLY AND PARTS

Chapter 6: The Cook Door - Page 36

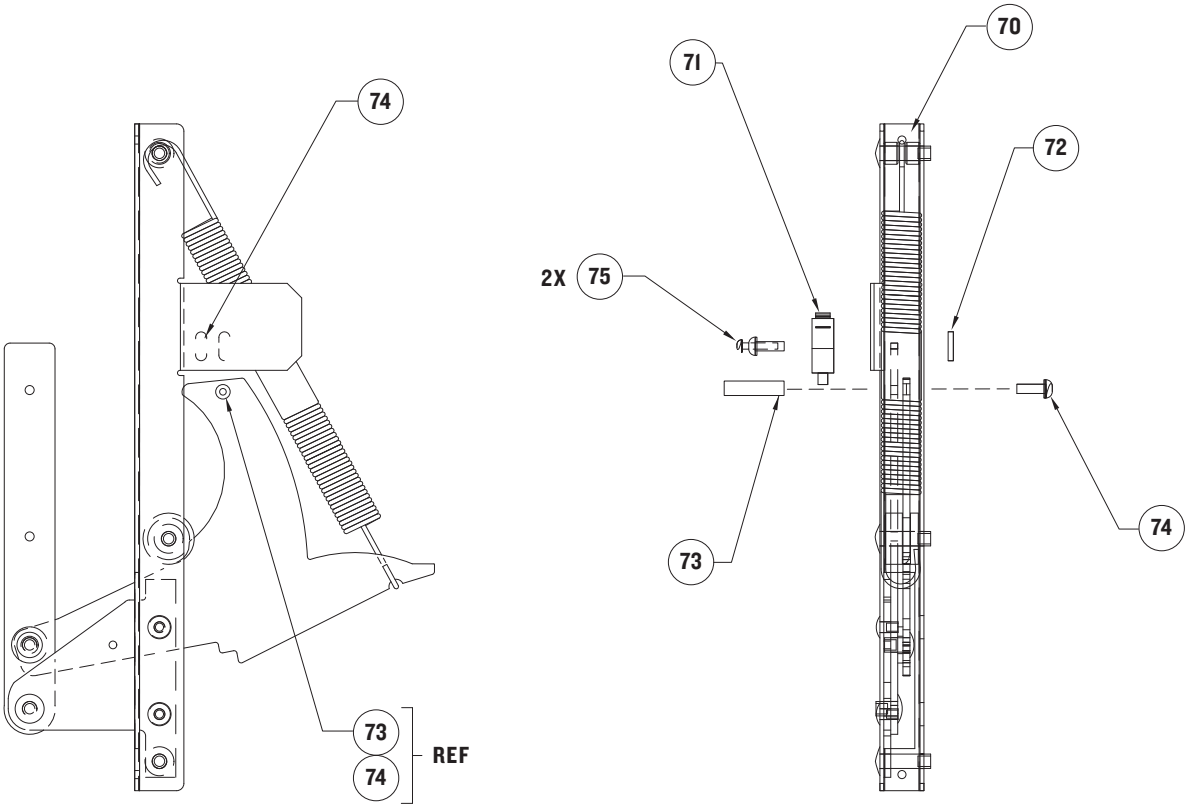


Door Switch Parts

59. NGC-1072	Bracket Latch
60. 102012	Switch, Micro, 0.1A/125VAC
61. NGC-1087	Spring Door Latch
62. NGC-1073	Toggle, Latch
63. 101119	Pin, Clevis, ø3/16 x 1” Lg
64. 100059	Bearings, Bronze, 3/16ID x 5/16OD x 1/4” Lg
65. 101557	Screw, #4-40 x 1.25” Lg, PPHD, CRES
66. 102921	Screw, #8-32 x 3/8”, Internal Tooth Sems, PPHD, SS
67. NGC-1126	Plate, Door Switch
68. 100639	Grease, USDA H-1, Food Grade
79. 101296	Ring, Eclip

FIGURE 28: MOTOR SWITCH ADJUSTMENT AND ASSEMBLY

Chapter 6: The Cook Door - Page 37

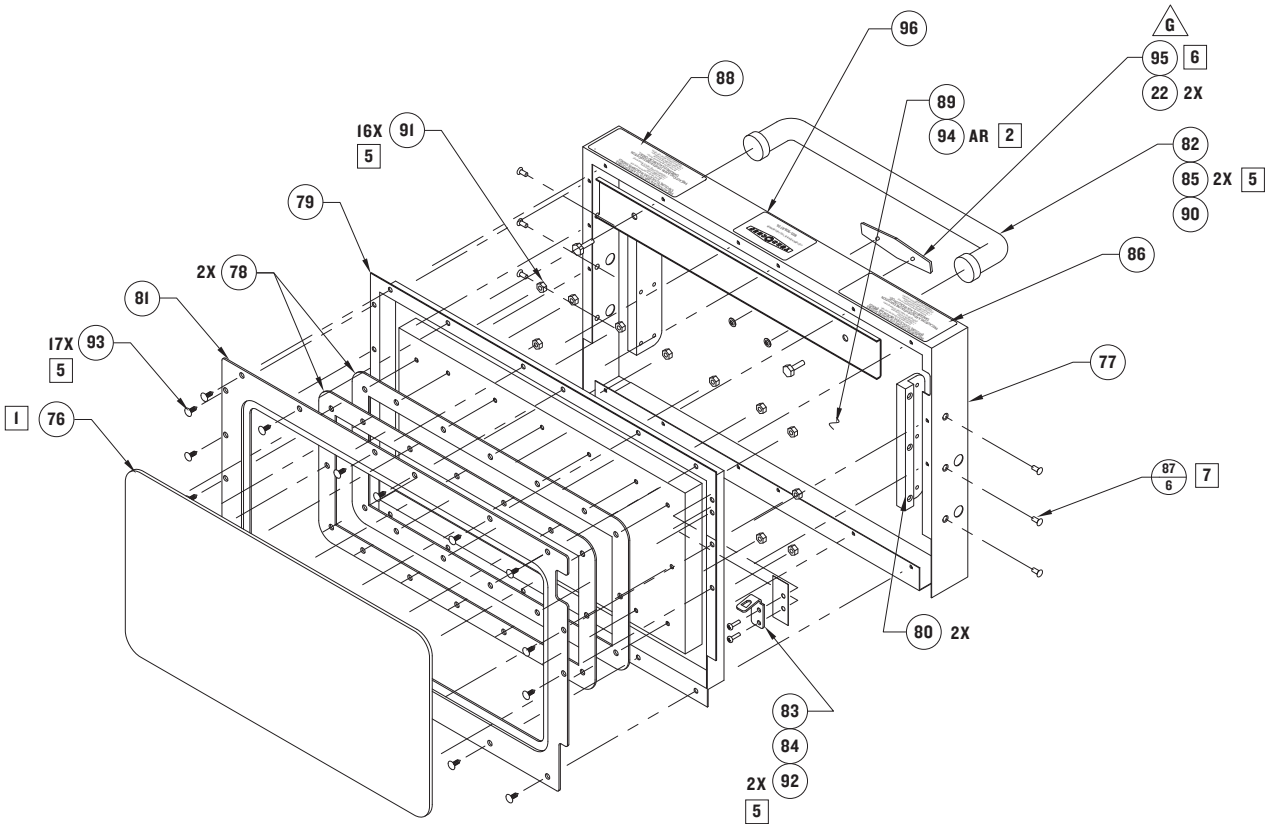


Monitor Safety Switch Parts

70. 102804	Hinge, Right	73. 101912	Standoff, #8-32F/Fx1 in S
71. 102012	Switch, Limit, Micro	74. 102921	Screw, #8-32 x 3/8”
72. NGC-1126	Plate, Door switch	75. 102902	Screw, 4-40 x 5/8”

FIGURE 29: COOK DOOR ASSEMBLY

Chapter 6: The Cook Door - Page 38



Cook Door Parts

76. NGC-1151	Assy, Shunt Plate	87. 102809	#8-32 x 3/8" CSK 100°
77. NGC-1056	Cover, Door, NGC	88. NGC-1165	Label, Caution Empty
78. NGC-1057	Spacer, Shunt Door	89. NGC-1125	Kit Door Insulation
79. NGC-1059	Shunt Cavity, Open Door	90. NGC-1127	Channel, Door Handle
80. NGC-1061	Hinge Block	91. 102962	Nut, Keps #8-32
81. NGC-1062	Spacer, Plastic Edge	92. 102748	Screw, #8-32 x 3/8", Trox Security
82. 102750	Handle, Door		
83. NGC-1076-002	Actuator, Door	93. 101688	Screw, #8 x 1/2" PTH
84. NGC-1132	Shim, Door Latch	94. 102698	Tape, Aluminum
85. 102945	Bolt, 1/4"-20 x 1.00	95. NGC-1155	Name Plate, TurboChef
86. NGC-1138	Label, Precaution	96. NGC-1170	Label, Service

FIGURE 31: CONVECTION CIRCUIT BLOCK DIAGRAM

Chapter 7: Convection Circuit - Page 41

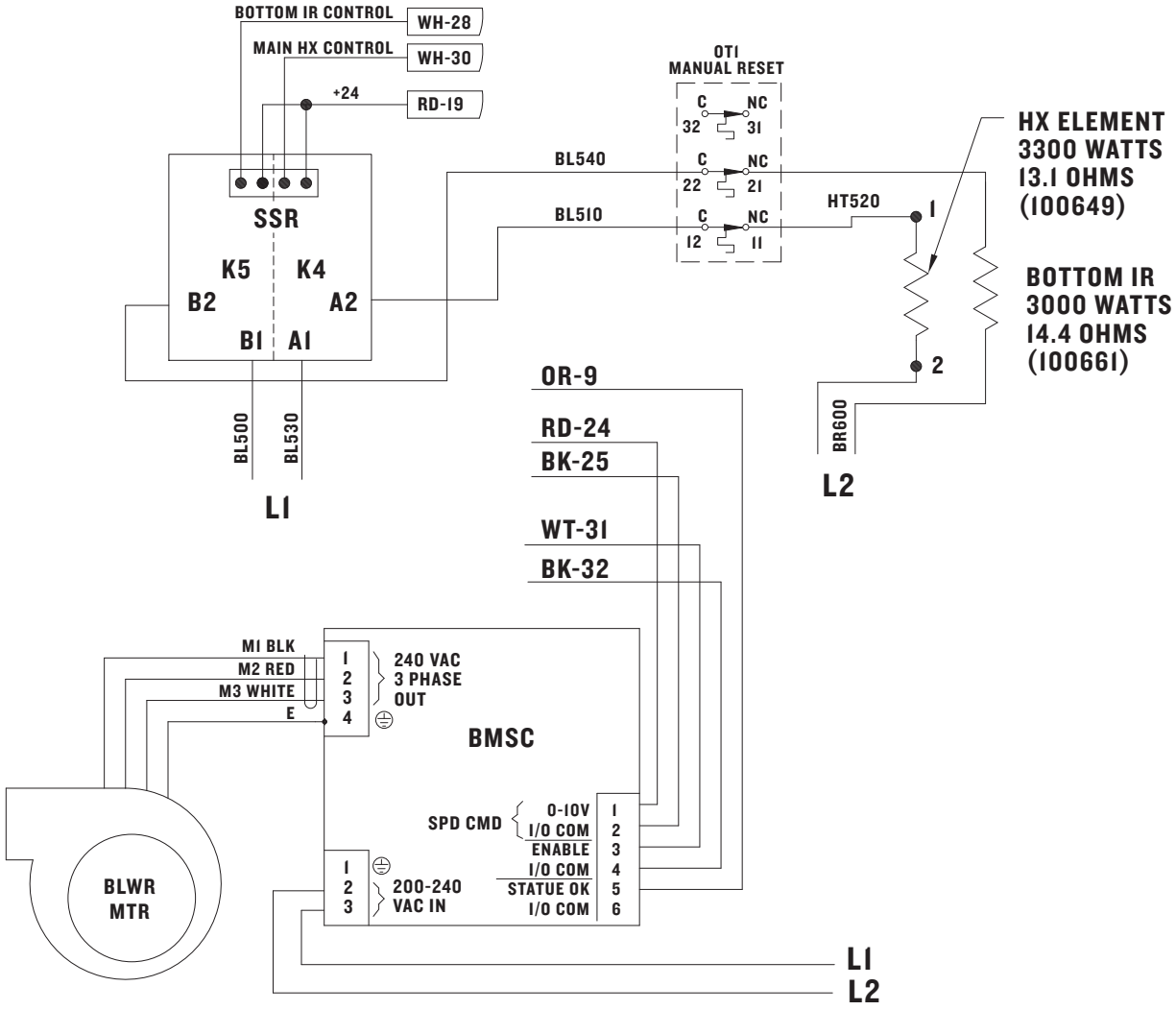
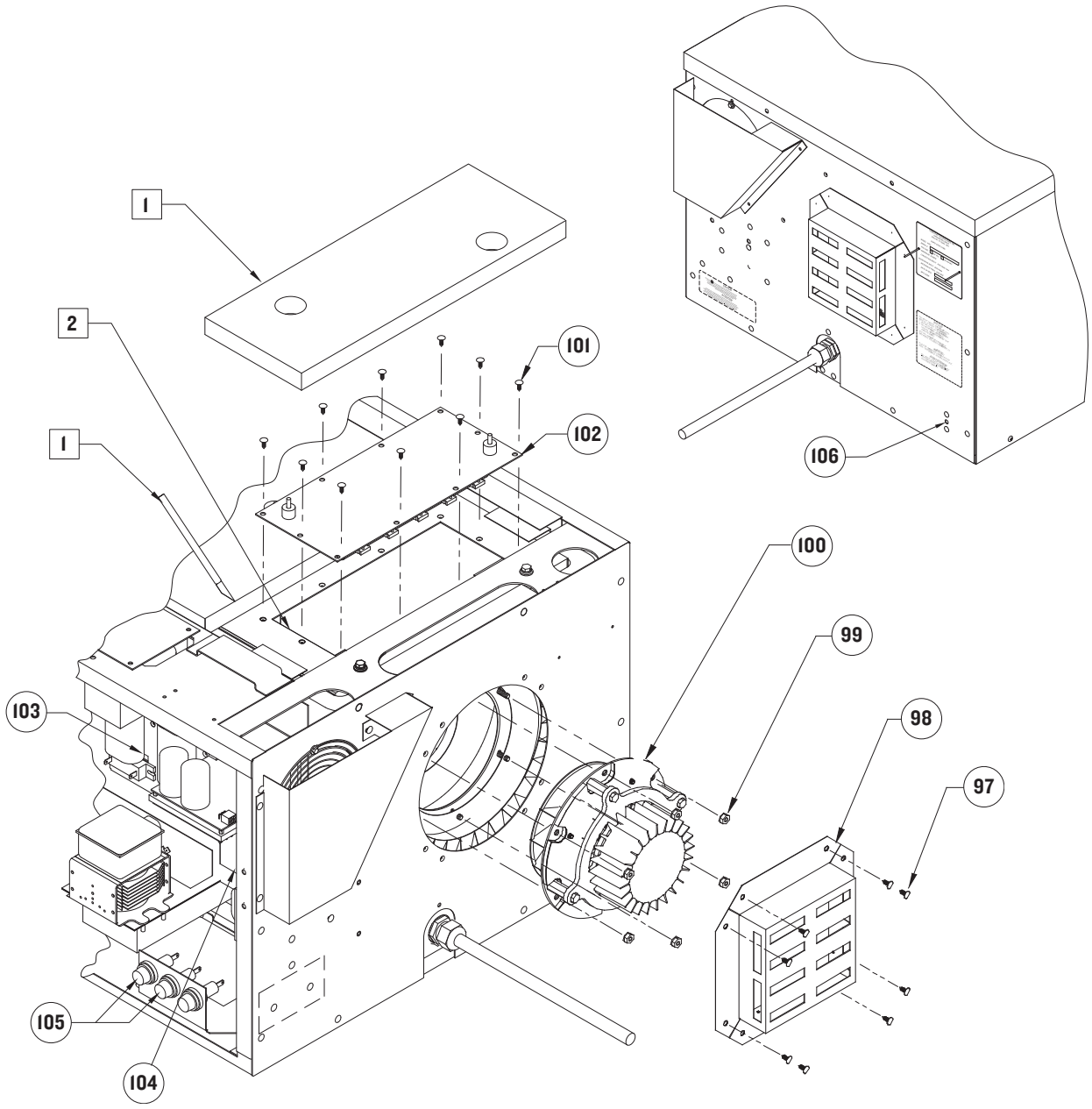


FIGURE 32: CONVECTION CIRCUIT ASSEMBLY AND PARTS

Chapter 7: Convection Circuit - Page 42

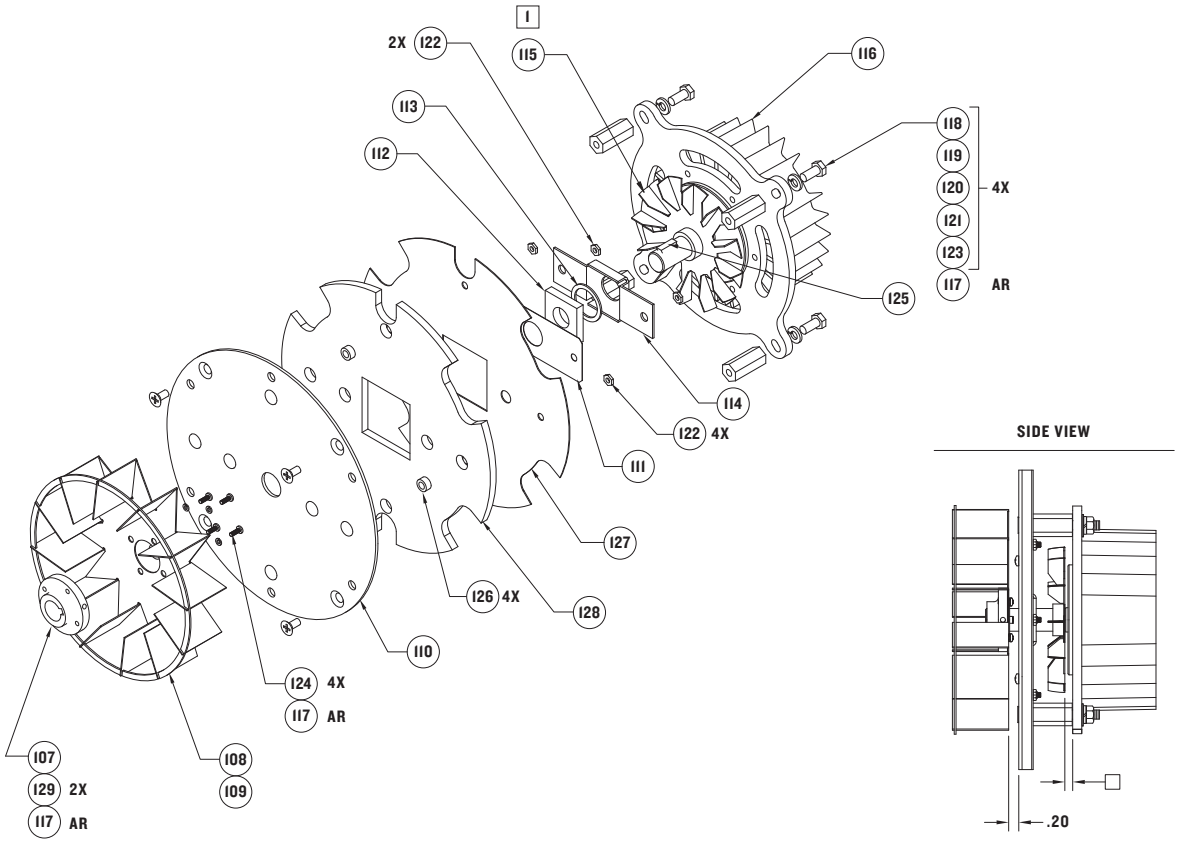


Convection Circuit Parts

97.	101688	Screw, #8 x 1/2" PTH	
98.	NGC-1081	Cover, Motor, Cap	
99.	100905	Nut, 1/4"-20, Flange	
100.	NGC-1025	Assy, Blower Motor	
101.	101688	Screw, #8 x 1/2" PTH	
102.	100661	Heater, Convection	
103.	100443	Controller, Motor	
104.	101284	Relay, K4/K5 SSR	
105.	100592	Buss, Fuses (12 Amp)	
106.	102075	High-Limit Thermostat	

FIGURE 33: BLOWER MOTOR PARTS AND ASSEMBLY

Chapter 7: Convection Circuit - Page 43

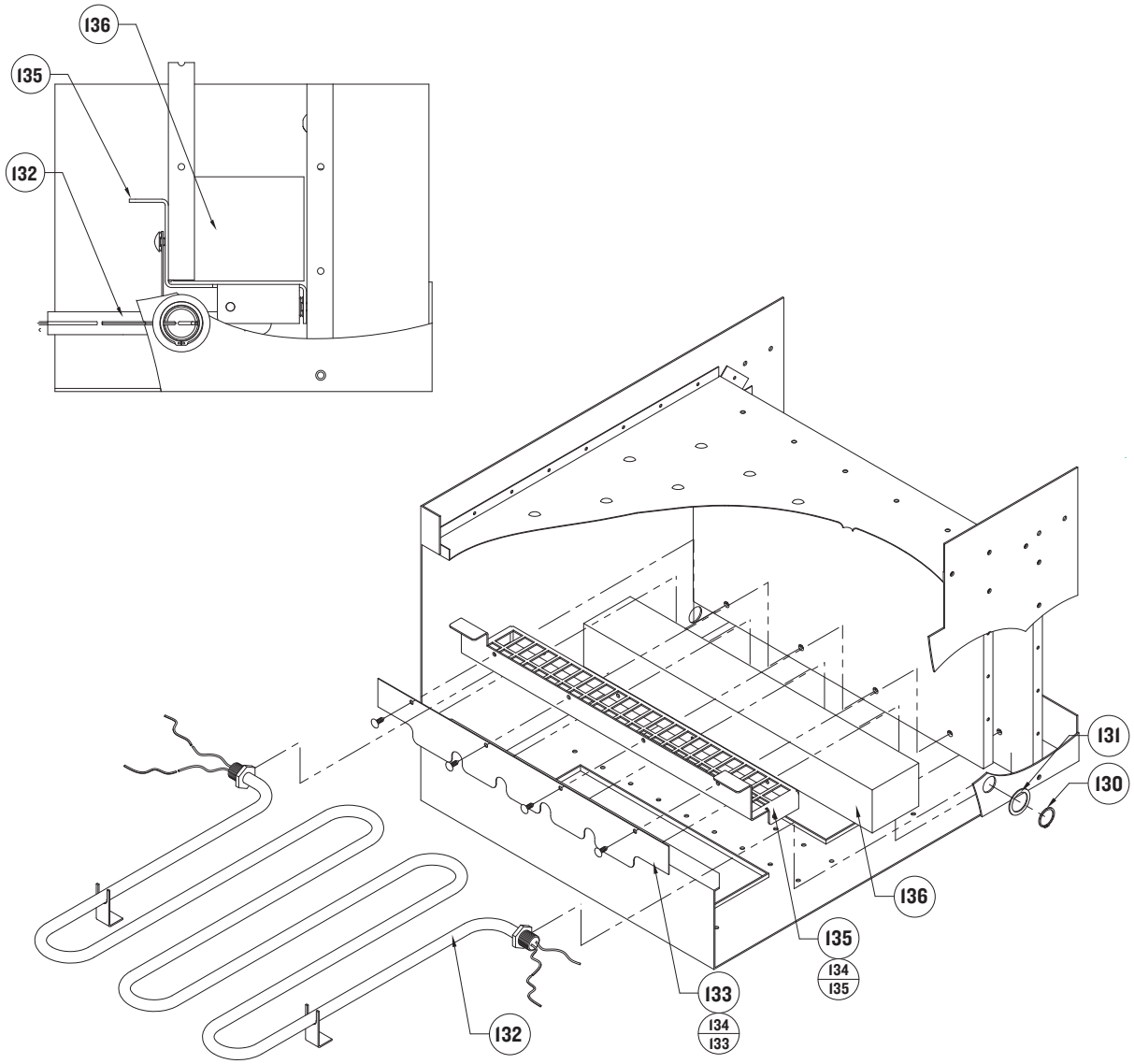


Blower Motor Parts

107. 700-0306-2	Hub, Small	120. 102400	Washer, Splitlock, 1/4", CRES
108. NGC-1019-2	Fan Blade, NGC Oven	121. 101392	Screw, PFLH, 1/4"-20 x 1/2" Lg, 100º, Cres
109. NGC-1020	Ring, Fan Blade	122. 102963	Nut, Hex, #10-32 Ext Tooth Keps, CRES
110. NGC-1021	Plate, Blower Cap	123. 102200	Washer, Flat, 1/4", Cres
111. 700-0284	Shim, Seal	124. 102921	Screw, #8-32 x 3/8" Int Tooth Keps, CRES
112. NGC-1024	Sealing Block Blower	125. 100730	Key, Woodruff, Steal
113. 100443	Washer, Wave Spring, 30mmOD	126. NGC-1122	Spacer, Blower, Insulation
114. NGC-1023	Clamp, Blower Seal	127. NGC-1102	Heat Shield, Blower Motor
115. 102708	Heat Slinger, Fan, PM Motor	128. NGC-1123	Insulation, Blower Plate
116. 100882	Motor, 1HP, Flange Mount Aspen	129. 101711	Set Screw, Skt Hd #10-32 x 5/16" CRES
117. 100790	Loctite, #272		
118. NGC-1022	Spacer, Blower Motor		
119. 101393	Bolt, Hex, 1/4"-20 x 3/4" Lg, CRES		

FIGURE 34: IR ELEMENT AND CATALYTIC CONVERTER PARTS AND ASSEMBLY

Chapter 8: IR Element and Catalytic Converter - Page 48



IR Element and Catalytic Converter Parts

130. 101312 Snap Ring
131. 102477 Washer, Shim
132. 100649 IR Element
133. NGC-1116 Shield, Microwave
134. 101688 Screw, #8 x 1/2" Sht Metal PTH
135. NGC-1030 Clip, Catalytic Converter
136. NGC-1012 Catalytic Converter

FIGURE 35: NGC (TORNADO) SCHEMATIC (P/N NGC-1070)

Chapter 9: Schematic and Schematic Parts - Inside the fold out of page 49
Part list to the right.

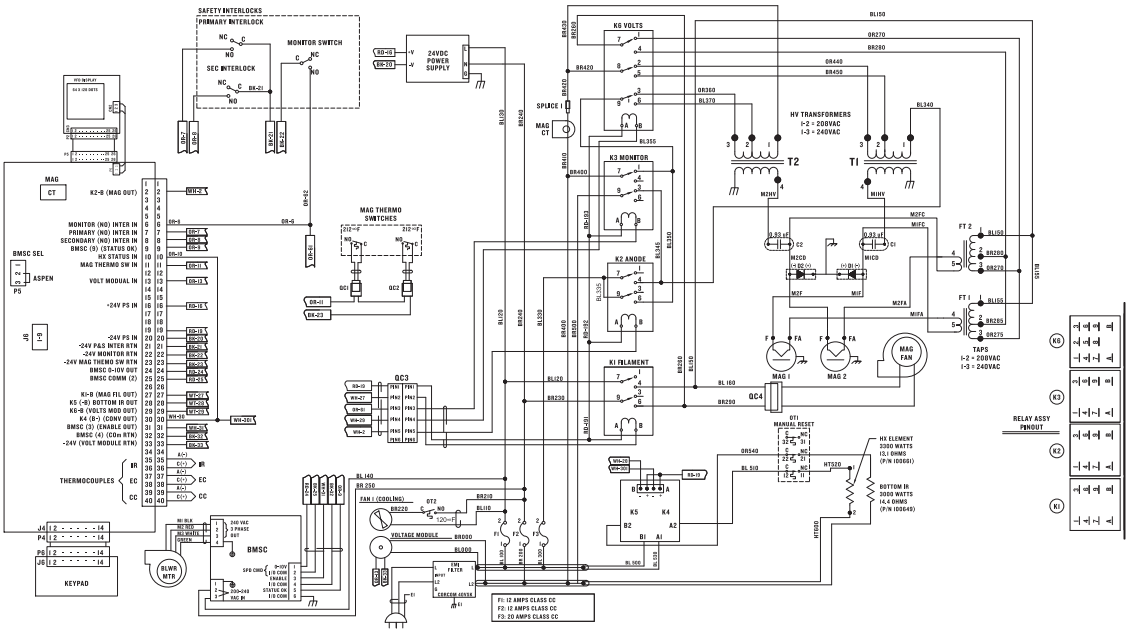
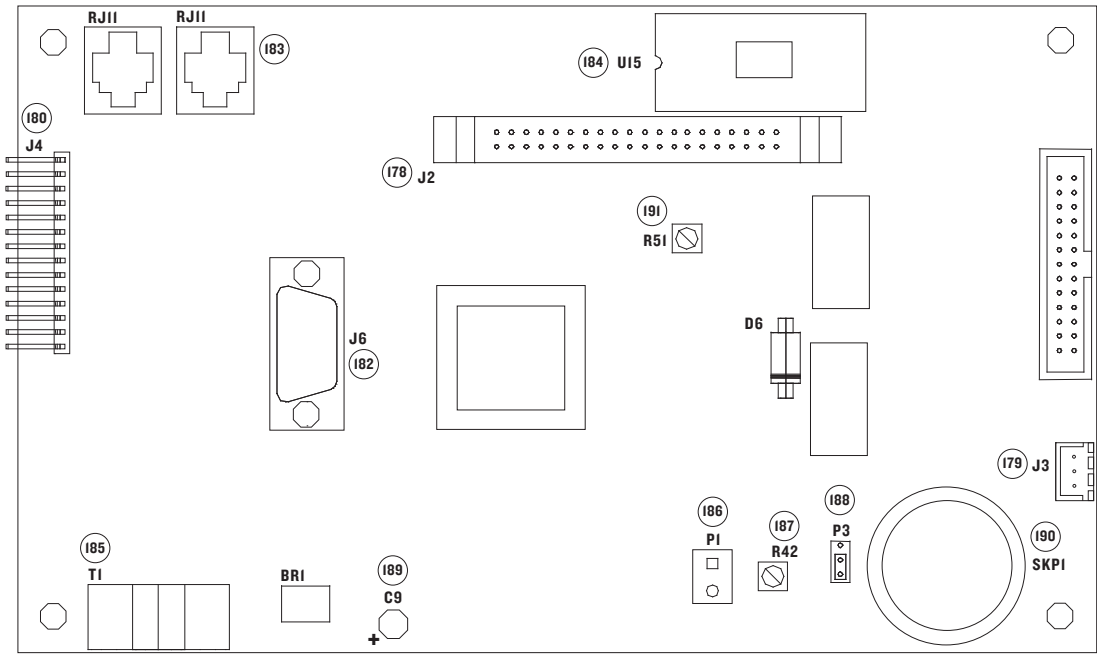


FIGURE 36: I/O CONTROL BOARD AND TEST POINT LOCATIONS

Chapter 9: Schematic and Schematic Parts - Page 50
Part list to the right.



Schematic Parts

Line Voltage Components

137. 100543	EMI Filter
138. 100586	F1, F2 and F3 - Fuse, Holders
139. 100592	F1, 12 Amp Fuse
140. 100592	F2, 12 Amp Fuse
141. 100599	F3, 20 Amp Fuse
142. 100783	Voltage Module
143. 100518	Fan 1, Cooling
144. 102086	OT2, Cooling Fan
145. 101271	K1 – Filament Relay
146. 101271	K2 - Anode Relay
147. 101271	K3 – Monitor Relay
148. 101284	K4/K5 – SSR Heater/IR Relay
149. 102075	OT1, Thermostat Heater
150. 100661	Heater, Convection
151. 100649	Heater, IR Element
152. 101272	K6 – Voltage Relay
153. 101206	PS – Power Supply, +24VDC
154. 100861	M1 – Magnetron
155. 100861	M2 – Magnetron
156. 102101	T1 – High Voltage Transformer
157. 102101	T2 – High Voltage Transformer
158. 102102	FT1 – Filament Transformer
159. 102102	FT2 -Filament Transformer
160. 100201	C1 – High Voltage Capacitor
161. 100201	C2 – High Voltage Capacitor
162. 100481	D1 – High Voltage Diode
163. 100481	D2 – High Voltage Diode
164. 100083	Fan 2 – Mag Fan
165. 100443	Controller, Motor
166. 100882	Motor, Convection

Low Voltage Components

167. 102012	Primary Interlock
168. 102012	Secondary Interlock
169. 102012	Monitor Safety
170. NGC-1008	I/O Control Board
171. 100505	Display, VFD
172. NGC-1110	Keypad, NGC Oven
173. 102070	Mag Thermo Switches

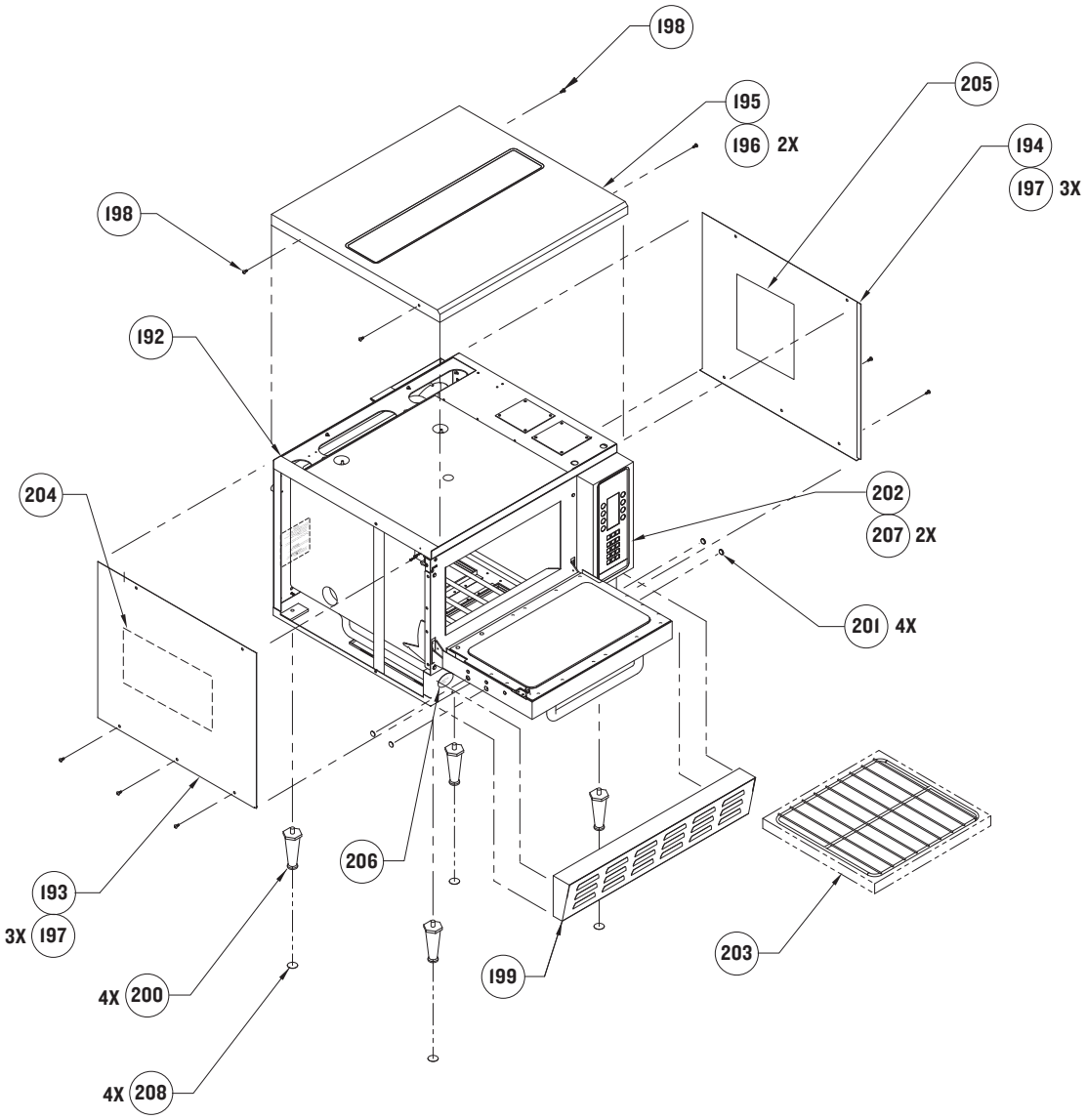
Wire Harness Replacement P/Ns

174. 100188	Line Voltage Harness
175. 100185	Low Voltage Harness
176. 100187	Power Cord
177. 100186	Magnetron Wire

I/O Control Board Item Identification and Test Point Location

178. J2	40 Pin Connector for LV Harness
179. J3	3 Pin Connector for VFD Display
180. J4	14 Pin Connector for Keypad
181. J5	26 Pin Connector for Display Data
182. J6	RS-232 Connector (Unused)
183. RJ11	Connector for Smart Card Cable
184. U15	EPROM Socket
185. T1	Magnetron Current Transformer
186. P1	Voltage Reference 0-5 VDC
187. R42	Voltage Reference Adjustment
188. P3	Blower Controller Pin Configuration
189. C9	Capacitor
190. SKP1	Beeper
191. R51	Beeper Volume Adjustment

FIGURE 37: COVERS AND MISCELLANEOUS PARTS



Covers and Miscellaneous Parts

192. NGC-1147	Assy, Rear Chassis/Door
193. NGC-1069-1	Cover, Left Side, NGC Oven
194. NGC-1069-2	Cover, Right Side, NGC Oven
195. NGC-1068	Cover, Top, NGC Oven
196. 102748	Screw, #8-32 x .38 Lg TORX HD Security
197. 101688	Screw, #8 Serrated Phillips TRHD, CRES
198. 102921	Screw, #8-32 x 3/8", PPHD, SEM, Int Tooth, SS
199. NGC-1071	Cover, Bottom Front
200. 100781	Leg. 4"
201. 10191	Hole Plug, 1/2" Dia, Black
202. NGC-1054-1	Assy, Keypad/Display HSNG
203. NGC-1064	Rack, NGC Oven
204. NGC-1176	Label, Schematic
205. NGC-1177	Label, Service Assistance
206. NGC-1148	Label, Caution Hot
207. 102962	Nut, KEPS HEX, #8-32, Ext Tooth, CRES
208. NGC-1187	Pad, Abrasive Non-slip