

# PYRO-CLEAN™ OVEN

Operator's Manual

*SERIES OV134200, OV134300, OV134400*

## Type

OV134210-33

OV134310-33

OV134410-33

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# Safety Information

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## Alert Signals



### Warning

Warnings alert you to a possibility of personal injury.



### Caution

Cautions alert you to a possibility of damage to the equipment.



### Note

Notes alert you to pertinent facts and conditions.



### Hot Surface

Hot surfaces alert you to a possibility of personal injury if you come in contact with a surface during use or for a period of time after use.



### Electric Shock

Electrical shocks alert you to a possibility of personal injury due to live electrical components which may be exposed inside of the cover or unit.

Your Thermolyne oven has been designed with function, reliability, and safety in mind. It is the user's responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert boxes throughout the manual.

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## Warnings

### To avoid electrical shock, this furnace must:

1. Use a properly grounded electrical supply of correct voltage and current handling capacity.
2. Be disconnected from the power supply prior to maintenance and servicing.

### To avoid personal injury:

1. Do not use in Class I, II or III locations as defined by the National Electrical Code.
2. Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such materials.
3. Do not put sealed containers in oven.
4. Refer servicing to qualified personnel.
5. THIS PRODUCT CONTAINS REFRACTORY CERAMIC, REFRACTORY CERAMIC FIBER OR FIBERGLASS (GLASS WOOL) INSULATION WHICH CAN PRODUCE RESPIRABLE FIBERS AND DUST WHEN HANDLED. THESE FIBERS OR DUSTS CAN CAUSE IRRITATION AND CAN AGGRAVATE PRE—EXISTING RESPIRATORY DISEASE. REFRACTORY CERAMIC INSULATIONS MAY CONTAIN OR MAY FORM CRYSTALLINE SILICA (CRYSTOBALITE) WHICH MAY CAUSE LUNG DAMAGE (SILICOSIS).

THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) HAS CLASSIFIED REFRACTORY CERAMIC FIBER AND FIBERGLASS AS (2B) POSSIBLY CARCINOGENIC. IARC HAS CLASSIFIED CRYSTALLINE SILICA AS (2A) PROBABLY CARCINOGENIC.

The insulating materials are located in the door, the hearth collar, in the chamber of the product or the top plate assembly. Tests performed by the manufacturer indicate that there is no significant risk of exposure to dust or respirable fibers resulting from operation of this equipment under normal conditions. However, there may be a risk of exposure to respirable dusts or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing the materials in a manner which causes release of dust or fibers therefrom. Through the use of proper handling procedures you can work safely with these insulating materials and minimize any exposure. Accordingly, before you repair or replace any insulating materials, or perform any other servicing on this product which could disturb or cause exposure to dust from insulating materials, you should consult the appropriate Material Safety Data Sheets (MSDS's) for such products with respect to proper handling and appropriate protective equipment. For additional MSDS's, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department of Barnstead International.

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## Warning

This warning is presented for compliance with California Proposition 65 and other regulatory agencies and only applies to the insulation in this product. This product contains refractory ceramic, refractory ceramic fiber or fiberglass insulation, which can produce respirable dust or fibers during disassembly. Dust or fibers can cause irritation and can aggravate pre-existing respiratory diseases. Refractory ceramic and refractory ceramic fibers (after reaching 1000°C) contain crystalline silica, which can cause lung damage (silicosis). The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber and fiberglass as possibly carcinogenic (Group 2B), and crystalline silica as carcinogenic to humans (Group 1).

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## SAFETY INFORMATION

The insulating materials can be located in the door, the hearth collar, in the chamber of the product or under the hot plate top. Tests performed by the manufacturer indicate that there is no risk of exposure to dust or respirable fibers resulting from operation of this product under normal conditions. However, there may be a risk of exposure to respirable dust or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing them in a manner which causes release of dust or fibers. By using proper handling procedures and protective equipment you can work safely with these insulating materials and minimize any exposure. Refer to the appropriate Material Safety Data Sheets (MSDS) for information regarding proper handling and recommended protective equipment. For additional MSDS copies, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department at Barnstead International at 1-800-553-0039.

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# Principles of Operation and Use

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## Use

The Pyro-Clean Oven is designed to clean glass or metal parts contaminated with residues of various organic substances, such as polymers, waxes, resins, asphalts, tars, or other similar contaminants. Cleaning is done entirely with heat, eliminating the use of solvent or chemical cleaning. Organic residues are thermally decomposed and vaporized off of the metal parts at 900°F. Virtually all types of heat-resistant glass and metal parts can be cleaned in the Pyro-Clean unit.

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## How It Works

### ***Heat Decomposes and Vaporizes Organic Residues from the Metal Parts***

The Pyro-Clean Oven is a high-temperature oven capable of operating at 900°F. This temperature is sufficient to thermally decompose (vaporize) most polymeric residues and other organic material to volatile gases and carbonized residues without harming the metal parts. The pyrolysis smoke and gases produced by degradation of the organic residues reacts with a catalyst suspended in stainless steel wire mesh which comprise the bottom of the two racks (trays) inside the oven chamber. If sufficient smoke or pyrolysis gases are produced inside the oven, the oxidation of this smoke will consume oxygen inside the oven and inert the oven to a very low oxygen level of one to two percent.

### ***Pyrolysis Smoke and Gases are Consumed by Electric/Catalytic Oxidizer***

Any unreacted pyrolysis products formed inside the oven exit through a pipe at the top of the oven and pass through a small oxidizer chamber that sits on top of the oven. The oxidizer is a combination electric/catalytic system which preheats the oven exhaust gases to 1300°F with excess air before they pass through a honeycomb ceramic catalyst which completes any oxidation not occurring in the preheat zone of the chamber. This pollution control method is very effective at destroying any smoke and odor produced during the cleaning process. The cooled exhaust gases from the oxidizer chamber are free of smoke and odor, resulting in a pollution-free cleaning process.

***Final Cleaning is Accomplished by Oxidation Stage***

The heat-cleaning process consists of two distinct stages. The first stage is the pyrolysis stage described above. The second stage consists of oxidation of any carbonized residues produced during the pyrolysis stage. Virtually all organic materials produce some soot-like, carbon residues on thermal decomposition. Maintaining the Pyro-Clean Oven at 900°F for additional time oxidizes any carbon residues to carbon dioxide, leaving the glassware or metal parts completely free of any organic matter.

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## Advantages

The Pyro-Clean Oven has significant advantages over older methods of cleaning laboratory glassware.

1. Because cleaning is done entirely with heat, the use of solvents, chemicals and laborious hand brushing can be eliminated.
2. This results in increased safety and eliminates solvent or chemical costs. The significant problems of waste disposal tracking and costs are likewise eliminated.
3. The cleaning processes are completely automated and essentially labor free. Once the oven is loaded and the cleaning cycle started, the unit can be left unattended.
4. A reduction in losses due to broken glassware results because manual handling is greatly reduced.
5. Discarding of difficult-to-clean glassware is eliminated because glassware that is too difficult or too expensive to clean can be economically cleaned in Pyro-Clean Ovens.

For example, cross-linked polymers such as polyethylene, are often completely insoluble in any solvent or chemical cleaning agent. Yet this material is easily removed in a Pyro-Clean Oven, preventing the glassware from being thrown away.

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## Limitations

Pyro-Clean Ovens clean only with heat, so they cannot remove any non-volatile, inorganic residues from the parts being cleaned. This includes paint pigments such as titanium dioxide, fillers such as clay, talc, fiberglass, ordinary dirt, or any other inorganic ashes. Such inorganic residues are normally easily removed from the glass or metal parts by wiping off with a cloth or rinsing with water. The ashes are easy to remove because all organic resins, which act as a binder or “glue”, are decomposed, freeing the inorganic material.

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## Parts Which Can Be Cleaned

Any part that can withstand a temperature of 800-900°F can be cleaned in the oven. Laboratory glassware, particularly the heat resistant types, as well as heat-resistant ceramic or metal parts are easily cleaned without damage or distortion.

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## Organic Residues Which Can Be Removed

Virtually any contaminant which is organic in nature can be removed at the normal operating temperature of the cleaning oven, 900°F. In recent years, new high-temperature polymers have been developed which are very resistant to heat and are not easily removed thermally. However, the number of these polymers is quite limited.

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## Organics Which Should Not Be Processed

Plastics or polymers which contain large amounts of halogens such as chlorine, bromine, or fluorine would not be processed in the oven as they will react with the catalyst contained inside the oven trays and deactivate it. The most common example of this plastic is PVC (polyvinyl chloride). The oven oxidizer is designed to handle organic residues which contain predominantly carbon, hydrogen, and oxygen. Do not process any parts which may emit vapors of toxic metals such as lead or mercury. Do not process any material which decomposes violently upon heating. Nitrocellulose or other explosive materials are in this category.

Never clean any hollow, sealed glass or metal parts which might build up dangerous, internal pressures during the heating cycle. Make sure all parts have vent holes or openings to allow pyrolysis gases or steam to escape as they are formed. Any pumps, pipes, or vessels must have openings to allow pyrolysis gases to escape, to avoid a rupture in an explosion.

***Special Note Regarding Silicones***

Silicone oil is commonly used in many laboratories as a heating medium for carrying out reactions in glass vessels. Glassware, which contains silicone oil residues from the heating medium, should be wiped off with a cloth or paper towels or rinsed with acetone. Experience has shown that when silicone polymers are removed in the oven, they leave a “cloudy” residue which etches the glassware and affects its appearance. A round-bottomed flask coated on the outside with silicone heating oil will be cloudy if cleaned in the oven without removing the silicone. Glass stopcocks lubricated with silicone grease should likewise be wiped free of silicone before cleaning the glassware in the oven.

Silicones are poisons for the catalysts used both in the oven chamber and the catalyst used in the oxidizer and should not be removed in the oven.

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## Automatic Cleaning Cycle

The Pyro-Clean system is equipped with an automatic cycle time feature, which adjusts itself to the load placed in the oven. For ovens equipped with the optional electric/catalytic oxidizer, the cleaning time is limited by the processing speed of the oxidizer. The more organic residues or polymers on the parts, the more smoke that will be evolved from the parts during the cleaning process. The oxidizer is equipped with a temperature sensor and controller, which monitors the amount of smoke evolved off the parts and controls the heat up rate of the oven to prevent the oxidizer from being overwhelmed by too much smoke. The oxidizer control system will cut off the oven heaters if too much smoke is being produced. The oven temperature seeks whatever temperature is necessary to produce the maximum amount of smoke the oxidizer can process. Thus the oxidizer controls the heat up rate. When all the organic residue is pyrolyzed/vaporized off the parts, smoke



**Electric Shock**

Live circuits are present inside of the control panel. It is recommended that the power be turned off at the source before entering the panel to perform adjustments.

evolution will fall off, allowing the oven temperature to climb to the normal processing temperature of 900°F to finish the cleaning process.

A cycle timer relay is located inside the control box, with an adjustable range of 0 to 10 hours. The factory setting of 2 hours is recommended for most applications.

**NOTE:** *For removing asphalts, a cycle timer setting of 4 to 5 hours is recommended as asphalts are among the more difficult organics to remove. Asphalts produce a carbon residue during pyrolysis that is resistant to oxidation, therefore requires more processing time during the oxidation portion of the cleaning cycle.*

The cycle timer relay does not run until the oven temperature reaches 10°F below the controller setpoint and a time delay of 30 minutes has passed. (With a normal set point of 900°F, the cycle timer is not energized and does not start timing until the oven temperature reaches 890°F and a 30-minute time delay elapses.) The time delay relay is adjustable. Its normal delay setting is 30 minutes. It should never be set below 30 minutes, but can be set over 30 minutes if necessary. When the timer is energized, its green indicating light blinks, indicating it is timing. When the cycle timer relay times out, its green LED lamp remains on.

If the glass or metal parts do not come clean with a 2-hour setting on the cycle timer relay, then increase the time until any soot-like, carbonaceous residues are completely removed. If cleaning times require more than 5 hours on the cycle timer, then consult Barnstead International, as this would be quite uncommon. (Asphalt residues are the exception).

**For safety reasons, never set the cycle timer relay at less than one hour. One hour at 900°F should ensure that the oven cycle does not shut down before all organic residues are evolved off as smoke or pyrolysis gases.**

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## Cost of Operation

Cost of operation depends on the local rates for electrical power and the specific model.

The OV134210 consumes a maximum of 5.5 Kilowatts per hour, 23 amperes at 240 volt, single phase. At a cost of 0.10 cents per KWH, operating costs would be 5.50 KWH x \$0.10 = \$0.55 per hour for the first hour of operation, when the oxidizer and oven are heating up to operating temperatures. Once at temperature, the heaters will stay on about 50% of the time, reducing the power usage by half. With a typical cycle times of 6 hours, cost would be 55 cents for the first hour, then about 27 cents after that (assuming 50% duty cycle on the heaters). Five hours x \$0.27 = \$1.35. \$1.35 + \$0.55 would give a total cost of \$1.90 for a 6-hour cycle for the OV134210, an average operating cost of 32 cents/hour.

The OV134310 and OV134410 consumes a maximum of 6.5 Kilowatts, 27 amperes at 240 volt, single phase. At a cost of 0.10 cents per KWH, operating costs would be 6.50 KWH x \$0.10 = \$0.65 per hour for the first hour of operation when the oxidizer and oven is heating up to operating temperatures. Once at temperature, the heaters will stay on about 50% of the time, reducing the power usage by half. With a typical cycle times of 6 hours, cost would be 65 cents for the first hour, then about 33 cents after that (assuming 50% duty cycle on the heaters). Five hours x \$0.33 = \$1.65. \$1.65 + \$0.65 would give a total cost of \$2.30 for a 6-hour cycle for the Model OV134310, an average cost of 38 cents/hour.

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## Training of Operators

Because the success and safety of the cleaning process is dependent upon proper loading and operation of the Pyro-Clean Oven, do not allow anyone to use the oven unless they fully understand how it works and its limitations. Users of the oven must be cautioned against overloading the oven with glass or metal parts containing very large amounts of organic residues. The Pyro-Clean is designed for removing small amounts of asphalts, organic residues, or plastics only, up to about 2 to 3 pounds. More than 2 to 3 pounds of organic residues should not be loaded into the oven.

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## Declaration of Conformity

(for CE models only)

Barnstead International hereby declares under its sole responsibility that this product conforms with the technical requirements of the following standards:

EMC: EN 61326-1	Electrical equipment for measurement, control and laboratory use; Part I: General Requirements
Safety: EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use; Part I: General Requirements
EN 61010-2-010	Part II: Particular requirements for laboratory equipment for heating of materials

per the provisions of the Electromagnetic Compatibility Directive 89/336/EEC, as amended by 92/31/EEC and 93/68/EEC, and per the provisions of the Low Voltage Directive 73/23/EEC, as amended by 93/68/EEC.

The authorized representative located within the European Community is:

Electrothermal Engineering Ltd.  
419 Sutton Road  
Southend On Sea  
Essex SS2 5PH  
United Kingdom

Copies of the Declaration of Conformity are available upon request.

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## Environmental Conditions

Operating: 17°C to 27°C; 20% to 80% relative humidity, non-condensing. Installation Category II (overvoltage) in accordance with IEC 664. Pollution degree 2 in accordance with IEC 664.

Altitude Limit: 2,000 meters.

Storage: -25°C to 65°C; 20% to 80% relative humidity

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# Operating Controls

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## “Oven Heater On” and “Cycle Started” Lights

The green indicating light comes on when the “Start Cycle” button is depressed, visually indicating that the cleaning cycle has begun. The door should not be opened while the cleaning cycle is in progress. The amber light labeled “Oven Heater On” indicates when the oven heaters are powered. After the oven has reached cleaning temperature and run for the dialed amount of time set on the Cycle Timer, the cleaning cycle will end. The amber heater light will go off, the “Cycle Started” light will go off, and the oven will begin to cool down. The exhaust blower will continue to run to help remove the heat in the oven and oxidizer chambers.

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## Oven Temperature Controller

A digital, indicating temperature controller displays both the oven set point and the actual cleaning temperature as the oven heats up and carries out the thermal cleaning process. The normal cleaning temperature of 900°F is adequate for virtually all organic residues and should not be changed. The controller alarm contacts (alarm 1) are configured as a deviation alarm, closing at -10° below the setpoint (890°F for a setpoint of 900°F). The alarm contacts activate a time delay relay (set for 30 minute delay), which energizes the cycle timer, ensuring that the chosen cycle time is a true “time at temperature”.

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## Oxidizer Temperature Controller

For ovens equipped with an oxidizer for destruction of the smoke created during the cleaning process, an oxidizer temperature controller is furnished. It controls the temperature of the oxidizer chamber. Typical setpoint of this controller is 1300°F. An alarm setting of 100 to 200°F above the set point is used to detect excessive smoke evolution from the oven chamber and shut off the oven heaters. For example, a typical setting of 200°F deviation alarm for the oxidizer controller would shut off the oven heaters if the oxidizer temperature exceeds 1500°F. Thus the oxidizer controller actually limits the oven temperature to the permissible level of smoke evolution from the oven. If the

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amount of plastic or organic residue on the glass or metal parts is very small and smoke evolution never exceeds the maximum temperature of the oxidizer controller, then the oven heat-up rate is not affected by the oxidizer controller.

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## Cycle Timer

A 0 to 10 hour cycle timer relay located inside the oven control box allows the time at process temperature to be selected. Typical settings are 2 to 4 hours for most parts. For materials which form larger amounts of carbon residues during pyrolysis, longer times may be required. For safety reasons, never set the cycle timer at less than 1 hour. This is to ensure that the oven never shuts down before all smoke from the thermal cleaning is gone. For removing asphalt residues, the typical cycle timer setting is 4 to 5 hours.

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## Ramp/Soak Feature

This oven is equipped with a special feature, which allows the oven temperature to be brought up to a temperature below the actual setpoint, and held for a time at that temperature, before proceeding to the setpoint temperature. As an example, the oven can go to 775°F, hold for 30 minutes, and then proceed up to its setpoint of 900°F. This feature is similar to what a controller equipped for ramp control can do, yet the controller is not equipped for true ramp control. In effect, a single ramp and hold feature can be configured using Alm 2 of the oven temperature controller and the counter relay, which can be set for 0-99 counts. Before describing the electrical operation of this circuit, let us describe the purpose of this feature.

Experience has shown that if the oven is allowed to proceed to setpoint, it can sometimes over power the oxidizer with smoke, resulting in an overshoot and poor control. By allowing the oven to reach temperatures between 775 and 825°F, and holding for 15 to 30 minutes, the oven temperature and smoke control is smoothed out, resulting in virtually no overshoot of the oxidizer temperature. The factory default "soak" temperature is 775°F with a counter relay setting of 05 counts. (This corresponds to a setting of 125°F below setpoint for the Alm2 of the oven controller. For asphalts, the recommended setting is 75°F below setpoint, corresponding to 825°F when the setpoint is 900°F).

Five counts translate to about 20 minute soak cycle. After the soak temp and time are over, the oven proceeds up to set point with virtually no overshoot of the oxidizer controller.

***Electrical Description of the Soak/Ramp Feature***

By setting Alm 2 of the oven temperature controller at 125°F below setpoint, then these contacts will open at 775°F and shut off the heater elements. Each time the Alm 2 contacts open and close, a counter relay counts these pulses. When the pulses reach the total set on the counter, the counter relay contacts close and bypass the Alm2 contacts which keep the oven from reaching above the value of the Alm2 setting. Therefore the oven temperature reaches 775°F and maintains this temperature until the counter relay counts out and bypasses the Alm2 contacts. Then the oven heaters can come back on and bring the oven temperature up to set-point. By changing the value of Alm2 setting, you can change the soak temperature. For example if the set point is 900°F and Alm 2 is 150° below setpoint, then the soak temp is 750°F. For an alarm setting of 100°F below setpoint, the soak setting is 800°F (only if the setpoint is 900°F). The default factory setting for Alm 2 of the Oven controller is 125°F below setpoint, which is a soak temp of 775°F when the process set point is 900°F. By changing the number of counts on the counter relay, the actual time at soak temperature can be changed. The more counts, the longer time the oven temp remains at the soak temp. The number of counts required to maintain the oven temperature at its soak temp must be determined experimentally and will vary from oven to oven somewhat. Typically, 5 counts on the counter relay translate into about 20 minutes of soak time.

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## **“Start Cycle” Switch**

Momentarily depressing the “Start Cycle” switch begins the cleaning process. The green, indicating light, “Cycle Started”, lights and remains on until the Cycle Timer times out and shuts down the cleaning process. The oven door should not be opened until the oven has cooled down to below about 500-600°F.

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## “Stop/Reset” Button

This button ends the cleaning cycle, shutting off the oxidizer and oven heaters, but allows the exhaust fan to continue to run. In normal operation, this control should not be used. Once the cleaning cycle has started, it is best to let the oven proceed completely automatically through its cleaning process. The stop button can safely be used to end the cycle only if you are certain no smoke is present inside the oven chamber.

**In an emergency, use the “Stop/Reset” button to terminate a cleaning cycle after the oven heaters have come on. Do not use the main power switch to shut the unit off.**

**After the oven heaters have come on, some smoke or pyrolysis gases may be present in the oven and it would not be safe to open the door. Do not add more metal parts in the middle of the cleaning cycle. If the metal parts are not put in the oven at the beginning of the cycle, leave it for the next run.**

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## Power Switch

The main power toggle switch activates the 120 volt control circuit and energizes the temperature controllers. After a few seconds, both the setpoint and the oven temperature should be displayed. The top display reads oven temperature; the lower display shows the set point (900°F normally). For the oxidizer controller, the normal set point is 1300°F.

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## Oven Door Interlock Switch and Electric Door Interlock

This oven is equipped with an electric door lock which is activated when the cleaning cycle is started. It is released when the cleaning cycle is over. The Oven door also activates a safety interlock switch so the oven portion cannot be operated unless the door is closed.

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## Over-Temperature Protection for Oven & Oxidizer Chambers

If the oven temperature should go over 950°F, an independent high-limit temperature switch will open and kill power to the oven heaters. The switch is located inside the main control box and is the manual reset type. Once the switch trips open, it can be manually reset by turning the oven main power off and on with the main power on/off power switch.

If the oxidizer temperature goes 50°F over its normal set-point of 1300°F when no load is being processed, or all smoke production has ceased, Alarm 2 of the oxidizer temperature controller will energize the oxidizer heater power relay, opening its NC contacts, and shutting the oxidizer heater off. This prevents failure (fusing or sticking closed) of the oxidizer solid state relay from causing the oxidizer chamber temperature to climb so high that its heater elements fail. If such a failure occurs, the Pyro-Clean units will not time out normally. The oxidizer chamber temperature will cycle at set-point 50°F above setpoint (1350°F) while the oven temperature will stabilize at its normal set-point of 900°F. If this occurs, shut down the unit by pressing the “Stop/Reset” button and replacing the failed solid-state relay.

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## Pressure Relief Door and Interlock Switch

Pyro-Clean models have a pressure relief panel on the top of the oven, located under the front cover. This panel is snugly stuffed with insulation to form a good airtight seal, but will blow out to release any sudden, violent pressure. The insulated panel is covered with an insulated door that is held by spring-loaded hinges. If a sudden pressure opens the door, it will reclose. The door has an interlock switch, which will stop the cleaning cycle if the door momentarily opens and then recloses.

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## Sampling Port

A sampling port is located on the front cover of the oxidizer chamber cover. It is connected with a short section of rubber tubing to the manometer. This port is used for measuring the negative draft pressure in the oven to ensure it is vented properly. The oven pressure should always be slightly negative, preferably -0.04 inches water column, with limits of from -0.02 to -0.06 inches water column. Refer to the Installation section for details on achieving the correct oven negative pressure.

***DANGER: THE OVEN MUST OPERATE WITH THE PROPER DRAFT OR IT WILL NOT WORK PROPERLY AND MAY CREATE AN UNSAFE CONDITION.***

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## Proving Switch for Draft Inducer Blower Motor

The Pyro-Clean unit is equipped with a pressure-sensing switch mounted inside the main control box that senses the pressure generated by the draft inducer when it is running. This pressure switch is interlocked to the oven heaters so they cannot come on if the draft inducer blower motor is not running. If the pressure switch does not close, then the power relay for the high-limit switch is not energized, and the oven heaters do not receive power. This switch is wired in series with the front door safety switch.

The draft inducer pressure switch is connected to the draft inducer with a short piece of tubing. This tubing must be connected for the pressure switch to sense the blower motor is running. The oven heaters will not come on if this tubing is not connected during installation.

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## Nitrogen Purge Feature

During the initial heat-up and pyrolysis stages of the cleaning cycle, significant amounts of combustible smoke and gases may be evolved from the glassware or metal parts by the thermal vaporization of the organic residues. The Pyro-Clean unit is equipped with a special "catalytic" metal tray that contains a catalyst that is activated above 500-600°F. This catalyst helps any smoke inside the oven chamber to react with the oxygen in the initial air of the chamber. This

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## OPERATING CONTROLS

consumes the oxygen and effectively “self-inerts” the cleaning chamber. However the catalyst is poisoned by silicones and is deactivated by halogenated compounds. Additionally, if glassware might contain small amounts of volatile solvents such as acetone, hexane, toluene, etc., these solvents can create a flammable atmosphere inside the oven chamber before the self-inerting catalytic system is thermally activated. In such cases, nitrogen purge gas is recommended to inert the oven chamber during the pyrolysis portion of the cleaning cycle. The recommended purge flows for the three standard Pyro-Clean units are:

<b>Model Size</b>	<b>Nitrogen Purge Rate, scf/hr</b>
OV134210	25 to 30
OV134310	30 to 35
OV134410	40 to 45

High-pressure cylinders of nitrogen gas (2000 psig or more) are not suitable sources for the nitrogen supply, as one cylinder would only supply about 6 hours of nitrogen until empty. Typically, such high-pressure cylinders contain only about 200 cubic feet of nitrogen.

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# Installation and Setup

## Receiving

The Pyro-Clean oven is shipped completely assembled and crated. Inspect the oven crate and any other additional boxes or crates carefully upon receipt. If there is any sign of damage to the crate or oven, do not sign the delivery receipt until the freight company has been notified and such damage has been noted on the receipt. Claims for shipping damage must be made by the customer to the Freight Company and not to the distributor or manufacturer.

Remove the crate lumber carefully to avoid damaging or scratching the surface of the oven.

The OV134210 weighs about 400 pounds crated and can be moved with a fork truck or heavy dolly while crated. Uncrated, the oven weighs slightly over 325 pounds and can be moved by hand with sufficient help.

The OV134310 weighs about 500 pounds crated and can be moved with a fork truck or heavy dolly while crated. Uncrated, the oven weighs slightly over 425 pounds and can be moved by hand with sufficient help.

The OV134410 weighs about 650 pounds crated and can be moved with a fork truck or heavy dolly while crated. Uncrated, the oven weighs 550 pounds and can be moved by hand with sufficient help.

Avoid excessive leverage on the door to prevent from bending or spraining its hinges. Use heavy gloves or other protection to prevent cutting or slicing your hands when lifting on the oven. The door is removable if necessary by lifting it off its hinges.

A draft inducer is wrapped in protective bubble wrap and is packed in the oven. After the oven is uncrated and in position, the draft inducer should be attached to the top of the exhaust port on top of the oven oxidizer as shown in the attached photograph. A small section of 1/4 inch tubing is used to sense the pressure of the draft inducer blower motor.

***CAUTION: THIS CONNECTION MUST BE MADE AS THE OVEN HEATERS ARE INTERLOCKED TO THIS PRESSURE SWITCH. THE OVEN HEATERS CANNOT COME ON UNTIL THE PRESSURE SWITCH SENSES THE BLOWER MOTOR IS RUNNING.***

**A 4 to 6 inch pipe adapter is furnished with each unit to aid in connection to the recommended 6-inch exhaust duct.** Exhaust gases from the draft inducer are mixed with the hot gases of the oxidizer and cooled dramatically. These warm gases exiting the draft inducer must be vented outdoors. Proper venting is very critical. Refer to this section in later paragraphs.

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## Electrical Service

The oven has been completely tested and checked at the factory before shipment.

The total power use of the OV134210 is 5.5 kilowatts. The oven heaters draw about 13 amperes at 240 volts. The oxidizer heaters draw about 8-9 amps at 240 volts. The oven control circuit is 120 volts and is powered by a 240/120 Volt control transformer, 0.500 kva.

The total power use of the OV134310 and OV134410 is 6.5 kilowatts. The oven heaters draw about 17 amperes at 240 volts. The oxidizer heaters draw about 8-9 amps at 240 volts. The oven control circuit is 120 volts and is powered by a 240/120 Volt control transformer, 0.500 kva.

The oven should be connected to its own separate, 30 amp circuit breaker, and should be clearly labeled to prevent accidental shut-down of the oven if it is located in a breaker box where personnel routinely shut off lights or other equipment by using the breakers. Power should be available to the oven at all times except when it requires electrical service. The circuit breaker should be turned off and locked off when work is necessary inside the control box.

---

## Installing Unit with Small Front-to-Back Tilt

Rather than install the oven on a level basis, we recommend installing the oven so the front of the unit is about 1/2 to 3/4 inch higher than the back of the unit. The oven has 4 adjustable legs so this small front-to-back tilt is easily achieved. This front elevation of the unit helps to prevent any liquid residues that might miss the drain pan on the bottom of the unit from flowing out onto the bottom of the door gaskets. Instead any material that degrades and flows should drain toward the back of the oven interior, which is welded solid. The flow able material will be destroyed during the cleaning cycle, rather than draining out of the gaskets and bottom of the unit.

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## Location and Venting

***CAUTION: Pyro-Clean ovens are not “ordinary” industrial ovens and have special venting requirements that must be met. Read and follow the guidelines given in the following sections carefully. Consult Barnstead International if you have any questions.***

For the oven to work properly and safely, it must be correctly vented. Standard double walled vent pipe (6 inch i.d.) should be used. Long runs, and runs with excessive elbows should be avoided to minimize friction losses to achieve the correct draft. The draft inducer is very sensitive to back pressure. In most cases, long runs of flexible vent pipe should not be used as it will generally result in high back pressure (friction losses), preventing you from getting an acceptable draft.

However, a small section of flexible, six inch pipe (6 to 8 inches long) is strongly recommended to allow the draft inducer to be removed and replaced for final adjustment of the draft as described in “How to Measure the Oven Draft” section of this manual.

The preferred location for this piece of flexible duct is between the rigid 6 inch duct pipe and the 6 inch side of the 4 to 6 inch adapter which connects to the top of the draft inducer. The draft inducer located on top of the oven generates a negative pressure of about -0.03 to -0.04 inches water column before any vent pipe is added to the exhaust of the draft inducer. It is extremely important that the final

draft achieved on the oven when in operation range from -0.02 to -0.06 inches water column. The final duct pipe and venting arrangement must achieve this result, regardless of the specifics of how the oven is ducted. Some general guidelines for various possible installations are discussed below. If there are any questions regarding venting of the oven, consult Barnstead International for recommendations for your specific location and circumstances.

For convenience, a small manometer and hose to measure the oven pressure during installation and set-up is supplied. The manometer is mounted to the front cover of the oxidizer. Instructions on how to use the manometer are included in "How to Measure the Oven Draft" section of this manual, but please consult Barnstead International if uncertain how to measure the small negative pressures required by Pyro-Clean ovens.

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### Venting to the Outdoors through a Wall or Roof

Standard 6 inch I.D., double walled vent pipe should be used for venting to outdoors for best results. The exhaust temperature of the gases ranges from 120 to 150°F so is not much hotter than the exhaust from clothes dryer or other low-heat appliances. Elbows can be used, but must be kept to a minimum to prevent excessive friction losses. Because the draft inducer diameter is 4 inch, an adapter to go from 4 to 6 inch exhaust pipe is necessary. This adapter is commonly available from most heat/air conditioning supply houses, as is the vent pipe. For convenience, the 4 to 6 inch adapter is supplied with the Pyro-Clean unit. It connects directly to the top of the draft inducer. A non-restricting vent hood or cap should be used to prevent rain from entering the exhaust pipe.

Regardless of the final physical arrangement of the vent pipe and cap, it should not decrease the draft below -0.02 inch w.c. and should not increase it over -0.06 inch w.c.

If your venting arrangement to the outdoors gives insufficient draft, then means to achieve the proper draft must be supplied by an additional powered draft inducer. Again, it must be emphasized that if the oven exhaust pipe is connected to a device capable of pulling a high draft (negative pressure), then the pressure must be adjusted so it is not too negative!

---

## Venting into a Lab Hood or Other Negative Pressure Exhaust System

The Pyro-Clean oven requires a small negative pressure of about -0.04 inches water column to work correctly. Exhausting the oven gases to a lab hood or vent system is recommended and acceptable as long as the final measured draft of the oven itself is in the proper range of -0.02 to -0.06 inches w.c.

Do not pipe the oven exhaust directly into the duct work itself of a powered exhaust system, as the suction (negative pressure) may be too strong to permit adjustment to the slight negative pressures required.

**CAUTION: IF THE OVEN IS EXHAUSTED INTO A POWERED VENT SYSTEM SUCH AS A LAB HOOD, THE HOOD EXHAUST SYSTEM SHOULD BE ON ALL THE TIME THAT THE OVEN IS ON. DO NOT LEAVE THE BUILDING AND SHUT OFF THE HOOD, THEREBY SHUTTING OFF THE EXHAUST SYSTEM FOR THE OVEN.**

---

## How to Measure the Oven Draft

A small Dwyer manometer is supplied with the oven for convenience to facilitate installation of the proper vent system for the unit. A test port is located on the front cover of the "Electri-Cat" oxidizer. It is connected with flexible tubing to the manometer used for measuring the draft inside the oven. The manometer has been filled to the proper level with special red oil at the factory. To zero the manometer, remove the tubing from the metal tip of the draft port and adjust the zero knob of the manometer until the oil is at the zero reading. When the manometer has been properly adjusted and zeroed, reconnect it to the draft port to measure the negative draft of the oven.

**CAUTION:** The Dwyer manometer has two ports labeled "Low" and "High". When the manometer tubing is connected to the "High" port, the manometer pressures (or drafts) will read correctly as the manometer is marked. That is, negative draft will cause the oil to move to the left into the red markings, which are labeled as negative readings. The black markings to the right will indicate positive pressures, rather than draft.

If the manometer tubing is connected to the “Low” port of the manometer, the readings obtained will be OPPOSITE the way the manometer is marked. That is, negative pressures (i.e., draft) will cause the red oil in the manometer to move to the right into the black markings.

Observe whether the oven exhibits any pressure due strictly to the installed exhaust piping. For example, connection to a hood exhaust might pull a slight negative pressure dependent on the power of the hood system itself. Turn the oven power switch on to power up the blower and observe the negative draft achieved inside the oven. The optimum pressure is -0.04 inches w.c., and the necessary range is from -0.02 to -0.06 inches w.c. If the exhaust system/duct to which the oven is piped pulls a draft higher than -0.06 inches, then the oven exhaust must be adjusted until the correct draft is achieved. The oven draft has been factory adjusted with the draft inducer running without any exhaust stack. Adding stack to the top of the draft inducer will change the draft slightly, but it still should remain in the proper range.

***CAUTION: DO NOT END A CLEANING CYCLE BY TURNING OFF THE MAIN POWER TOGGLE SWITCH. THIS PREVENTS THE MAIN OVEN EXHAUST FAN FROM RUNNING TO REMOVE THE NORMAL HEAT PRESENT DURING COOL-DOWN.***

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## How to Adjust the Oven Draft

Once the Pyro-Clean unit is installed and vented, the oven draft should be measured as described in previous sections. If the draft is not within proper limits, then it must be adjusted. The oven draft is achieved by the venturi effect of air sucked around the oxidizer exhaust pipe. The draft inducer suction pulls air past and around the stainless steel exhaust pipe.

The oven is fitted with a damper which allows external adjustment of the draft. By moving the slide towards the front of the oven, the draft is increased and by moving the slide towards the rear of the oven, the draft is decreased. If this doesn't provide sufficient adjustment, additional adjustment is achieved by the following steps:

*TO INCREASE OVEN DRAFT, THE HEIGHT OF THE EXHAUST PIPE IS INCREASED.*

*TO LOWER OVEN DRAFT, THE HEIGHT OF THE EXHAUST PIPE IS DECREASED.*

Positioning a screw in the side of the pipe changes the height of the pipe out of the oxidizer chamber. The pipe has 5 or 6 holes drilled in it to allow adjustment of the pipe height outside the chamber. The entire pipe can be pulled out of the oxidizer chamber (with pliers if the pipe is hot), the screw repositioned to raise or lower the pipe height. The draft inducer must be removed from the top of the unit so you can reach down inside the exhaust duct with pliers to remove the pipe. The draft inducer must be replaced and restarted to measure the oven draft after any change of the pipe height.

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## Why is Proper Draft to the Oven So Important?

It is important to recognize that Pyro-Clean ovens manufactured by Barnstead International are not "ordinary ovens." Pyro-Clean ovens are specialized, high-temperature systems specifically designed and built for thermal cleaning of valuable objects such as lab glass or metal parts. Even though the amount of organic matter on the metal parts being cleaned should be small, some pyrolysis gases are created during the cleaning process.

If the oven pressure is positive instead of slightly negative, these pyrolysis gases may escape into the room and slight smoke or odor will be observed.

If the oven pressure is too negative, excessive air is sucked through the oven (even though it is tightly sealed). This excessive leakage rate can prevent the oven from reaching its normal setpoint (or struggle to reach its set-point) and/or ignition of any combustible, pyrolysis gases may occur because of the high oxygen level caused by excessive draft and leakage.

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## Proving Switch for Draft Inducer Blower Motor

The Pyro-Clean unit is equipped with a pressure-sensing switch mounted inside the main control box, which senses the pressure generated by the draft inducer when it is running. This pressure switch is interlocked to the oven heaters so they cannot come on if the draft inducer blower motor is not running. If the pressure switch does not close, the power relay for the high-limit switch is not energized. Consequently, the oven heaters are not powered.

The draft inducer pressure switch is connected to the draft inducer with a short piece of 1/4 inch aluminum tubing. This must be connected for the pressure switch to sense that the blower motor is running.

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## Nitrogen Purge Feature

If possibility of volatile combustible solvents such as acetone, xylene, etc., could ever be on the glassware to be cleaned, nitrogen purge gas is essential to inert the oven chamber during the pyrolysis portion of the cleaning cycle.

The Pyro-Clean unit is equipped with nitrogen purge, and a 0-50 SCFH rotameter is mounted near the bottom of the front control box panel and has an adjustment knob to regulate the flow. The back of the control box has a fitting to connect the nitrogen source. Inlet pressure of the nitrogen source must be regulated at between 30 to 50 psig. Never exceed 100 psig as this exceeds the pressure rating of the rotameter itself. The nitrogen source must be regulated so that a smooth flow of nitrogen can be achieved by adjusting the rotameter knob. A flow rate of 25 to 50 SCFH of nitrogen is generally adequate to inert the chamber, depending on model size.

When the "Start" button of the Pyro-Clean unit is momentarily depressed, this begins the cleaning cycle and activates the nitrogen purge. The green, "Cycle Started" light comes on. Adjust the rotameter knob to give 30-35 SCFH of nitrogen flow for OV134310 (25-30 scfh for OV134210, 40-45 for OV134410). The nitrogen purge gas will continue to flow until the Ramp/Soak portion of the cleaning cycle ends and the counter relay counts out. See "Ramp/Soak Feature" section of this manual for a detailed description of the Ramp/Soak feature. At this time, the nitrogen solenoid valve is closed and nitrogen purge ends. The cleaning cycle will continue until the cycle is complete and the unit shuts down.

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# Startup and Operation

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## Initial Start-Up: Empty Load

Do not operate the oven with a load if the correct, slight negative draft/pressure in the oven chamber is not achieved. Refer to Installation instructions.

After the Pyro-Clean oven has been installed and properly vented with the correct negative draft, it is ready to operate. However, it is best to run the oven through a short cleaning cycle with it empty to familiarize the operator with the normal operating sequence and location of the controls and check that all controls, indicating lights, and components are operating normally. Also to ensure that the proper draft to the oven is obtained through out the cleaning cycle.

The oven door latch is a compression type and must be turned completely to the right until the door “pulls up” and is completely latched.

**CAUTION: The Model OV134410 has two door latches on the oven door. Check that BOTH door latches are properly engaged and latched before starting a cleaning cycle.**

When the main power toggle switch is turned on, the oven and oxidizer (oxidizer) temperature controllers will be powered and should display both set point and process temperature. The upper display is process temperature while the lower display is set point. Normal set-point for the oven controller for metal parts cleaning is 900°F. The normal setting for the oxidizer controller is 1300°F. Do not use any other setting unless Barnstead International is consulted. For this test only, set the cycle timer relay inside the control box to about 30 minutes. The normal setting of this relay is 2 hours, or for cleaning asphalts, the normal setting is 4 to 5 hours.

To start the empty test run, press the “Start Cycle” button. The green lamp labeled “Cycle Started” on the oven control panel will come on. The door lock also is activated. The nitrogen purge will start. Adjust the purge to the recommended flow for the model size. A small air pump that feeds a small stream of air to the oxidizer is started at the same time. The oxidizer heaters come on and you should see the oxidizer temperature begin to rise to its normal set point of 1300°F. Typical heat-up time for the oxidizer to reach 1300°F is about 30 minutes. A oven time delay relay

for the oven heaters prevent the oven heater from coming on until a 30 minute delay is over, allowing the oxidizer to get hot before starting the cleaning process. After the oven heaters come on, the temperature controller will indicate a steady rise in oven temperature, and the amber lamp, labeled "Oven Heater On" will come on.

During an empty run, the oven will heat up to its ramp/soak set point, typically 775°F and control at this temperature until the counter relay counts out. Nitrogen purge will stop at this point. Then the oven heat up will continue to the normal set point of the oven temperature controller, typically 900° F. When the oven temperature reaches within -10° of the setpoint, a time delay relay set for 30 minutes is energized and when it times out, starts the 0-10 hr. cycle timer relay located inside the control box. Its small green LED lamp blinks on/off while it is timing. When it times out, the green LED lamp stays on continuously. The oven heater light will go out, the "Cycle Started" lamp will go out, and the oven will begin to cool down naturally. The electric door lock for the oven door will also unlock.

After the oven has cooled down to below 500-600°F, the door can be opened to allow faster cooling. However, in a normal cleaning cycle for glass or metal parts, it is best to let the oven cool down as much as possible to minimize the handling of hot parts.

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## Starting a Normal Load of Dirty Glassware or Metal Parts

### ***Tips On Loading***

The glass or metal parts should have relatively small amounts of organic residues, on the order of grams to several pounds. Parts with very heavy residues of combustible, organic matter should not be processed in the Pyro-Clean unit. Practical limits for the unit is the range of 2 to 3 pounds of plastic residues per load/cycle.

Whenever possible, always load the parts to promote drainage of any visible residues. The oven is furnished with a metal tray on the chamber bottom to catch molten residues that drains off the parts. This will give the best cleaning results. Longer cycle times will be required if the contaminants are not allowed to drain out of the parts during the pyrolysis cleaning cycle.

The Pyro-Clean is furnished with three racks (trays) to hold the metal parts. One of these three racks has a stainless steel wire mesh on the bottom that holds catalyst pellets, which help destroy the pyrolysis gases formed during the cleaning cycle.

**USE THIS CATALYST TRAY DURING EVERY CYCLE. IT SHOULD NOT BE LEFT OUT OF THE OVEN UNDER ANY CIRCUMSTANCE.**

A metal drip pan on the bottom of the oven is furnished to catch any dripping of molten material. The drain pan helps prevent any plastic or polymer from running down on the oven floor and onto the door gaskets where the residue could cool, harden and tear off the gasket when the door is opened. Always place any metal parts with the heaviest residues toward the back of the oven to prevent any organic material from dripping on the oven door gaskets.

---

## Cycle Times for Cleaning

The Pyro-Clean is equipped with an automatic cycle time feature, which adjusts itself to the load placed in the oven. For ovens equipped with the optional electric/catalytic oxidizer, the cleaning time is limited by the processing speed of the oxidizer. The more plastic on the parts, the more smoke that will be evolved off the parts during the thermal cleaning process. The oxidizer is equipped with a temperature sensor and controller, which monitors the amount of smoke, evolved off the parts and controls the heat up rate of the oven to prevent the oxidizer from being overwhelmed by too much smoke. The oxidizer control system will cut off the oven heaters if too much smoke is being produced. The oven temperature seeks whatever temperature is necessary to produce the maximum amount of smoke the oxidizer can process. Thus the oxidizer actually controls the heat up rate if sufficient plastic residues are on the parts. When all the organic residue is pyrolyzed/vaporized off the parts, smoke evolution will fall off, allowing the oven temperature to climb to the normal processing temperature of 900° to finish off the cleaning process.

A cycle timer relay is located inside the control box, with an adjustable range of 0 to 10 hours. The factory setting of 2 hours (4-5 for asphalts) is recommended for most applications. The cycle timer relay does not run until the oven temperature reaches within -10°F of the setpoint of the oven

temperature controller and a time delay of 30 minutes elapses. (With a normal setpoint of 900°F, the cycle timer is not energized and does not start timing until the oven temperature reaches 890°F and 30 minutes elapses). When the timer is energized, its green indicating light blinks on/off, indicating it is timing. When the cycle timer relay times out, its green LED lamp stays on.

The cycle timer does not actually run until the oven temperature is within -10° of setpoint and a 30 minute delay elapses. This ensures that the dialed amount of time is a true “time at temperature”. For safety reasons, never set the timer at less than 1 hour. This ensures that volatile, pyrolysis gases are exhausted from the oven before the oven shuts down.

For most plastics and organic residues, pyrolysis and vaporization of the residues into smoke will actually begin below 900°F, so it is quite common for the oven temperature to seek a level of about 700 to 800°F while the maximum amount of smoke is being vaporized off the parts. After the bulk of the smoke is gone, the oxidizer controller senses this and allows the oven to heat up to process setpoint, typically 900°F. For some heavy metal parts, the parts themselves may serve as heat sinks and allow the oven temperature to reach set point even though the metal parts are too cool to produce enough smoke to turn off the oven heaters. In this case, the oven temp may reach set point for 20-30 minutes until the metal parts get hot enough to start significant smoke production. Then the oxidizer controller will take control of the cleaning process and limit the oven temperature to that which produces the maximum smoke, processing rate of the oxidizer. Thus the oven temperature may reach set-point until enough smoke is produced to drive the oven temperature to a lower level. After all the smoke is vaporized away, the oven temperature is then allowed to climb to 900°F and finish the cleaning cycle.

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## Cool-Down Before Removing the Glassware or Metal Parts

When the cycle timer ends, the oven and oxidizer heaters shut off, ending the cleaning cycle. The oven exhaust fan continues to run for about 80 minutes to help remove the heat as the oven and oxidizer cools. Let the oven cool to at least 500-600°F before opening the door. Where possible, it is best to let the oven cool down low enough that the parts can be removed and handled comfortably without special gloves or precautions.

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## Precautions

Do not rinse glassware or metal parts with flammable solvents such as acetone, toluene, etc. and then clean the parts in the oven without allowing the solvents to dry. Flammable solvents such as acetone or toluene will ignite or explode inside the oven if present in sufficient concentration.

Do not clean remove silicon materials in the oven. This will poison the catalytic system of the oven (and oxidizer catalyst, if so equipped).

Do not clean any sealed vessel, glass or metal, which could develop explosive forces and rupture inside the oven.

Do not overload the oven with metal parts containing heavy organic residues. The maximum load for the Pyro-Clean unit is 2 to 3 pounds of organic residues. Consult Barnstead International if heavier loads need to be cleaned.

***DANGER: Do not operate the oven without the special catalytic tray inside the oven. This tray contain a special catalytic material which helps inert the oven atmosphere and destroys the pyrolysis gases produced during the cleaning process. If a specially large piece of glass or metal parts requires that one of the trays be moved from their normal racks, then ensure that the normal, metal tray (not the catalytic tray) is the one removed.***

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# General Maintenance

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## Door Seals and Gaskets

The oven door has two gaskets. One is a high temperature gasket that serves both as a seal and a heat barrier to protect the silicone gasket. Periodic replacement of the high temperature gasket is considered necessary routine maintenance. The high temp gasket contains an inner core stainless steel mesh, covered with woven glass fiber. Because of its porous nature, the high temp gasket will gradually absorb condensed smoke or vapors from inside the oven and begin to harden. This gasket can be recycled and used again by removing it, replacing it with a new high temp gasket, and cleaning the old gasket inside the oven at the same time a typical load of glass or metal parts are cleaned. The blackened, old gasket will come out of the oven looking almost new. The gasket can be used again unless it was mechanically torn, ripped, or otherwise damaged during removal.

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## Using the Manometer

Check the manometer reading of the oven draft at the start of every run to ensure the oven operates under the required draft (negative pressure) of about -0.03 to -0.06 inches of water column. For an accurate reading of the oven draft, the manometer must be “zeroed” with the manometer tubing disconnected from the brass fitting, and then connected back to the brass fitting. The draft inducer blower motor must be running to induce draft. Refer “Locating and Venting” section of this manual on detailed instructions on how to read the manometer. Remember, the manometer is only a measuring device, it only reads the draft and does not create draft.

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## Cleaning the Oven Trays

One of the two oven trays has a bottom of stainless steel wire mesh containing special catalytic pellets, which help destroy the pyrolysis gases inside the oven chamber by reaction with the oxygen in the oven atmosphere. As this tray get dirty and accumulate inorganic ashes, it should be removed and rinsed with water to get the catalyst pellets free of obstruction or coatings, which would prevent it from working.

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## **Removal of Ashes and Pigments**

Ashes, pigments, dirt, or other inorganic matter left from the cleaning process should be removed as necessary to maintain good house keeping. Do not allow such material to collect at the door gasket(s) where it might interfere with a good, tight seal.

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## **Periodic Empty Test & “Self-Cleaning” Cycles**

Every 3 to 6 months, run an empty test run (cycle) during daytime hours so the operator of the oven can verify that the oven controls are working properly. With no glassware in the oven, this test runs also act as a “self-cleaning” cycle, and helps remove any residual, built-up carbon residues, which may be deposited by numerous, moderate-to-heavy loads of organic contaminants.

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## **Replacement of Parts**

When electrical components must be replaced, refer to the Parts List included in this manual for the appropriate descriptions. Consult Barnstead International for current prices. Electrical parts on the oven are warranted for one year.

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## **Cleaning of Draft Inducer Blower**

Periodically, the squirrel cage blower of the draft inducer should be blown out with compressed air to remove accumulated dust and lint.

# Parts List

<b>PART NO:</b>	<b>DESCRIPTION</b>
TNX99	Transformer, 120/24vac
RYX34	Relay, Solid State, 25 Ampere
4440-00-10B	Relay, Crouzet OA2R-1, Time Delay On, 110 V, SPDT
4440-00-20C	Relay, IDEC 4 pole, RH4B-U
4440-00-25C	Relay, IDEC 2 pole, RH2B-U
4440-00-30C	Relay, IDEC 1 pole, RH1B-U
4440-00-40	Relay, Counter, Eagle 87E2A622, 0-99 counts
RYX56	Relay, Power 30 Amp, for Oven Heaters
RYX56	Relay, Power 30 Amp for Oxidizer Heaters
4800-00-12	Temp Controller Ogden ETR-9200-1321
CN71X114	Temp Hi-Limit Switch
RY1342X2	Door Lock, Electric, SDC Model 110, 24VDC, 0.5 amp
2200-00-22	Gasket, Door Replacement, Hi-Temp, Model 3 (78 inches)
2200-00-07	Gasket, Door Replacement, Silicone, Model 3 (88 inches)
2200-00-25	Gasket, Door Replacement, Hi-Temp, Model 5 (100 inches)
2200-00-10	Gasket, Door Replacement, Silicone, Model 5 (110inches)
2200-00-30	Gasket, Door Replacement, Hi-Temp, Model 7 (120 inches)
2200-00-13	Gasket, Door Replacement, Silicone, Model 7 (125inches)
TC1342X2	Thermocouple, Oven Control Type K
TC1342X1	Thermocouple, Oven Hi-Limit Type K
4860-00-15	Start Switch, Momentary (N-O), 2X894
4860-00-18	Stop/Reset Switch, Momentary (N-C), 2X901
4860-00-00	Switch Main Power, Toggle, SPST, 2X464
4860-00-20	Switch, Pressure Relief Door Interlock
2650-00-11	Heater Elements, Model 3 Oven (2 per oven)
2650-00-12	Heater Elements, Model 5 Oven (2 per oven)
EL1344X1	Heater Elements, Model 7 Oven (2 per oven)
PLX101	Heater ON Light, Amber LED, PH-31
3300-00-50	Manometer, Dwyer Mark II
TN1384X1	Transformer, Control 240/120 Volt
1500-50-13B	Rectifier, Door Lock, 24vac to 24vdc
3618-06-05	Pressure Switch, DI Blower Motor
4450-10-05	Rotameter 0-50 SCFH
FA1384X1	Draft Inducer Blower Motor
FAX7	Cooling Fan for Electrical Control Box
3300-00-51	Manometer Oil (WWG # 1TC00)
CAX99	Main Line Filter
CA1249X1	Capacitor, Main Line Filter
410167	Fuse, 30 Amp, Main
FZX8	Fuse, 1 Amp, Controller/120/24vac transformer
FZX87	Fuse, 0.5 Amp, 240/120V transformer
2-72441	Fuse, 3 Amp, 120V supply
RY1384X1	Valve, Nitrogen Solenoid
SWX163	Switch, Front Door
SW1342X1	Switch, Pressure Relief door

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## PARTS LIST

### OXIDIZER PARTS

2650-00-50	Heater Element, AB, Thermcraft RH-272, 1060 watts(uses 2)
1410-10-15	Catalyst, Ceramic Honeycomb, 5" Dia by 2"
4810-00-16	Thermocouple, K, 1/4" by 6 inch long, 36 in leads
PU1384X1	Air Pump, Oxidizer, KNI-UN-79
RY1384X2	Valve, Air Solenoid
3500-24-05	Oxidizer Assy, Complete

### OVEN TRAYS & PANS

#### Model 3 Size

TY1342X2	Tray, S.S, Regular, Model 3 Size
4800-18-06	Tray, S.S., Catalytic, Model 3 Size
3612-14-05	Pan, Drain, S.S., Model 3 Size

#### Model 5 Size

TY1343X5	Tray, S.S, Regular, Model 5 Size
4800-18-11	Tray, S.S., Catalytic, Model 5 Size
3612-14-10	Pan, Drain, S.S., Model 5 Size

#### Model 7 Size

TY1344X5	Tray, S.S, Regular, Model 7 Size
4800-18-15	Tray, S.S., Catalytic, Model 7 Size
TY1344X3	Pan, Drain, S.S., Model 7 Size

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# Troubleshooting - Electrical

The oven electrical circuit has a number of fuses, so check first to determine if a blown fuse is the problem. If assistance is needed to determine the problem, contact Barnstead International Technical Service. Virtually all digital temperature controllers require “programming” for the desired operation.

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# Sequence to Check Electrical Operation

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## Empty Cycle Test

### 1. TURN ON POWER SWITCH

Both temperature controllers are powered and display process set point and process temperatures.

### 2. PRESS START BUTTON

a. The door lock solenoid bolt is energized, locking oven door.

b. Nitrogen flow starts if equipped with this option. Adjust rotameter.

c. The draft inducer fan is powered and draft should be indicated on manometer. The pressure switch located inside the oven control box senses the pressure generated by the blower motor of the draft inducer. The switch closes its contacts and energizes the power relay (RY3). This allows the oven heaters to come on later in the oven cycle.

d. The air pump inside control box is energized, and small air flow is piped to the oxidizer through the normally open port of the solenoid valve.

e. The green "Cycle Started" light on front of control box comes on.

f. The oxidizer heaters come on, and oxidizer temperature begins to rise.

3. Oven heaters come on after TM3 relay times out (typical 30 min delay). The green light of TM3 stays on when it times out. The oven begins to heat up.

4. The oven heats up to temperature of "Soak Cycle", typically set at 775°F. Alm 2 of the oven temp controller is set as a deviation alarm at -125°F. With Oven set point of 900°F, oven will heat to 775°F, Alm 2 light will come on and oven heaters will shut off. The oven temperature will control at 775°F by the on/off action of Alm 2. The

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## SEQUENCE TO CHECK ELECTRICAL OPERATION

on/off pulses of 110 volts register as a counter on the 0-99 Eagle Counter Relay TM2, which is typically set to between 5 and 10 counts. The oven temperature will control around the 775 mark until the Counter Relay TM2 counts out. Nitrogen flow will stop at this point. When the Alm 2 red light of the oxidizer controller stays on and the oven temperature begins to climb above 775, you know that TM2 has counted out. The oven temperature will now climb to the 900 degree set point of the oven temperature controller.

5. After the counter counts out, its relay contacts close, bypassing the contacts of Alm 2 of the oven temp controller. The oven heaters will stay on, even though Alm 2 light is on. This occurrence signals the end of the "Soak Cycle". The oven will heat up to its set point of 900°F.
6. Timing sequence starts when oven temp reaches within 10°F of main setpoint. Alm 1 of oven temp controller is set at plus/minus 10°F, and is activated at 890°F. Alm 1 contacts close and power TM4 relay which is set for 30-minute time delay, and its green light comes on indicating it is timing. As long as oven temperature controls at  $\pm 10^\circ$  of main set point, TM4 will continue to time. After timing out, its green light remains on constantly, and this starts the Main Cycle Timer Relay, which is TM1. Typical settings for this relay are 2 hours (4-5 hours for asphalts). TM1 green light blinks off/on when it starts timing. When it times out the green LED stays on.
7. When the main cycle timer CR7 starts, the 3-way solenoid valve is powered, switching the air flow from the air pump from the oxidizer to inside the oven chamber. This promotes oxidation of carbon residues produced during the pyrolysis portion of the process, and speeds the cleaning process.
8. The oven continues to operate at 900°F for the timed period on TM1. After this relay times out, the system shuts down. The green "Cycle Started" light goes out. TM3 relay resets (its green LED go off). TM2, the ramp soak counter relay also resets. The oven and oxidizer heaters

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## SEQUENCE TO CHECK ELECTRICAL OPERATION

are cut off, the air pump is shut off, and the oven begins to cool down.

9. When oven temperature drops below 890°F (Alm 1 of oven temp controller), the oven timers, TM4 and TM1, reset (their LED lights go off), and the counter relay TM2 resets. After cool down, unit is ready for another cleaning cycle.

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# Sequence of Events During Cleaning Cycle with Parts Which Produce Smoke

1. If sufficient smoke is produced during the cleaning cycle, burning of the smoke inside the oxidizer temperature will cause its temperature to rise above its set point of 1300°F. Alm 1 of the oxidizer temp controller is set as a high deviation alarm of 200°F. If smoke production raises the oxidizer to 1500°F, Alm 1 contacts will open, cutting off the oven heaters. This will cool the oven and reduce the amount of smoke production.

THE OVEN TEMPERATURE WILL EQUILIBRATE OR SEEK WHAT EVER TEMPERATURE IT TAKES TO PRODUCE ENOUGH SMOKE TO KEEP THE OXIDIZER TEMPERATURE AT 1500°F.

Nearly always, smoke production occurs below the oven set point of 900°F, and it is quite common for oven to process at about 750 to 850°F, producing enough smoke to keep the Oxidizer at the controlling temp of 1500°F. When smoke production dies away, the oxidizer temp will fall back down to its normal control setting of 1300°F. When this happens, then control of the process switches back to the oven temp controller. It is normal for the process to be controlled first by the oven temp controller, switch over to control by the oxidizer temp controller during smoke production phase of the cleaning cycle, and then back to control by the oven temp controller after smoke evolution is essentially complete.

2. Alm 2 of the oxidizer temp controller is set as a high deviation alarm of 50°F. As long as sufficient smoke is being produced inside the oven to keep the oxidizer temp about 1350°F (Alm 2 setting), then TM4 and TM1 timing relays cannot run, preventing the timing sequence from starting. In essence, this circuitry acts as a form of “smoke detector”, preventing the timing sequence or the injection of air into the oven chamber until all smoke production has ended.

Air injection and start of the main cycle timer can begin only when the oven temperature is within  $\pm 10^\circ$  of its 900° setpoint and oxidizer temperature is below Alm 2 setting of the oxidizer controller (1350°F).

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## SEQUENCE OF EVENTS DURING CLEANING CYCLE WITH PARTS WHICH PRODUCE SMOKE

3. Once smoke production dies away, the oven temp controller, not the oxidizer temp controller, will again control the oven temperature. The oven temperature will continue to rise to set point, and begin the timing sequence. If sufficient smoke was generated at temperatures below the "Soak Cycle" to keep the oven temp depressed, then the oven temp will control at the "Soak" temp until the counter counts out, and then will rise up to the set point of 900°F, starting the timing circuitry.
4. The unit controls will operate the same as described in steps 6 through 9 of the previous section entitled "Operating Sequence to Check Electrical Operation: Empty Cycle".

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# Configuration of the Temperature Controllers

The oven and Oxidizer temperature controllers have been set-up and configured for proper operation in the Pyro-Clean unit by Barnstead International.

**CAUTION: Do not change without consulting Barnstead International. Unsafe operation of the oven may result!**

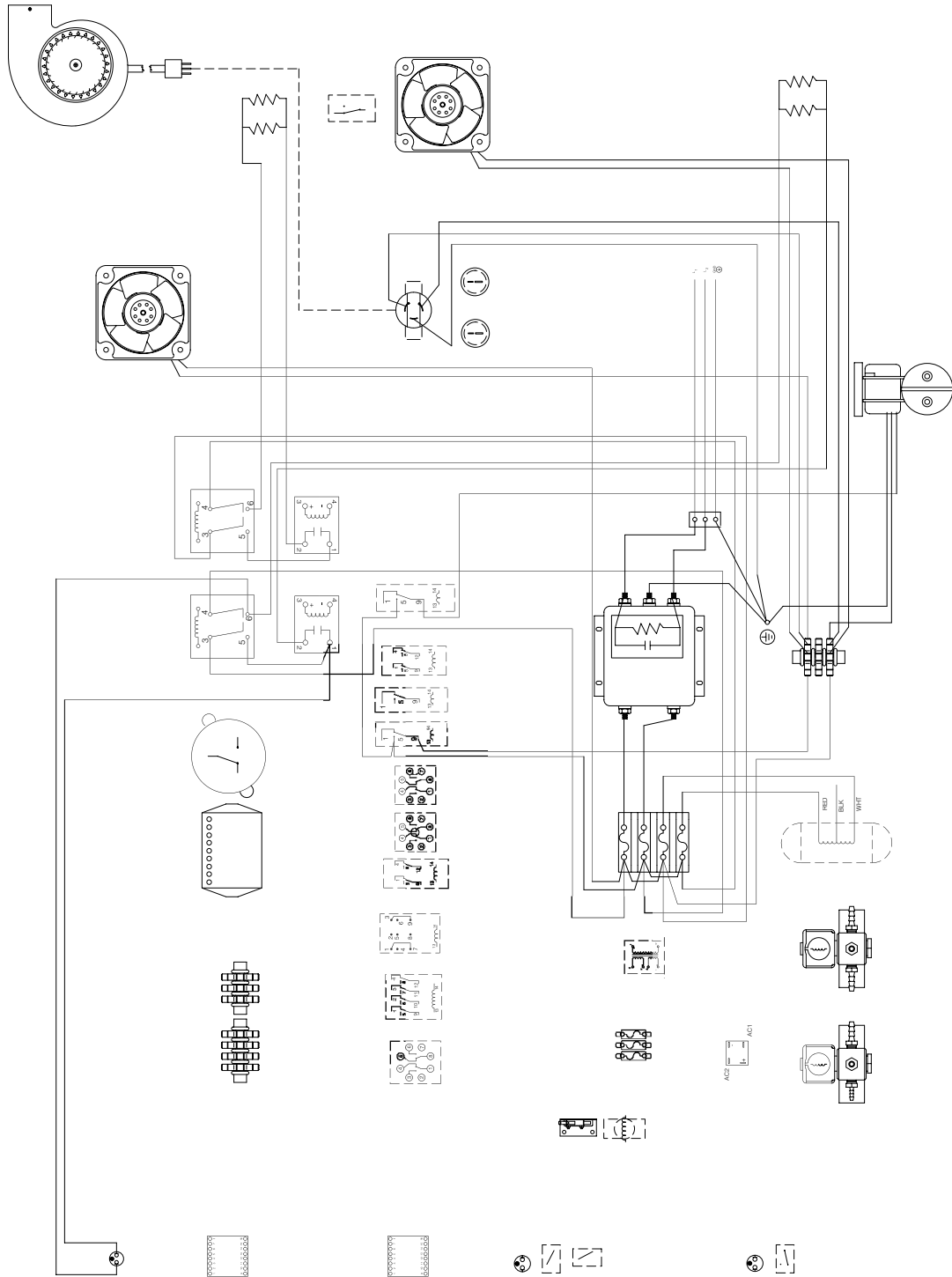
# Wiring Diagrams

## DIAGRAM COMPONENT LIST

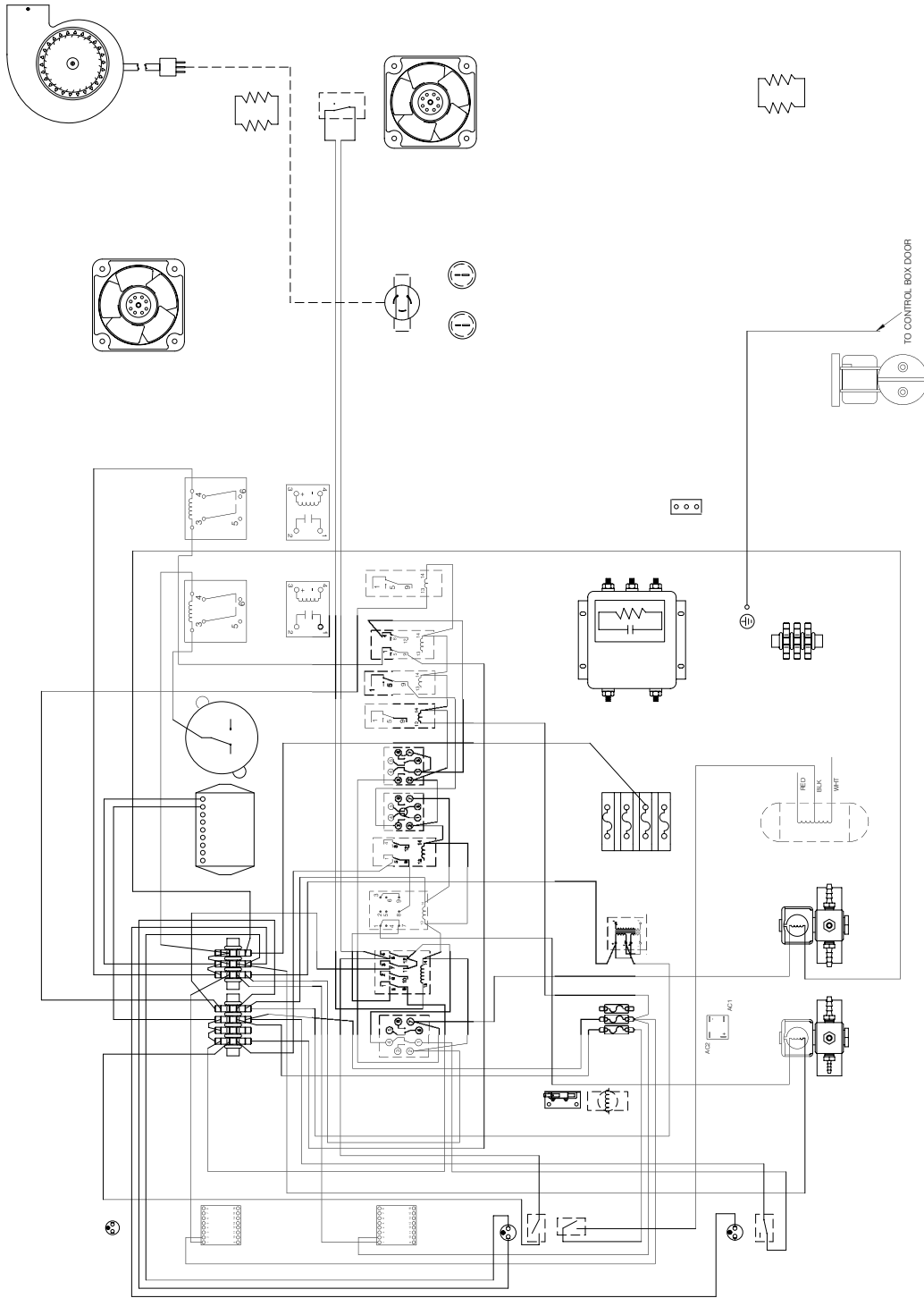
REF. NO.	DESCRIPTION	MODEL NO. AND OUR PART NO.(S)		
		OV134210-33	OV134310-33	OV134410-33
C1	CAPACITOR ASSEMBLY	CA1249X1	CA1249X1	CA1249X1
CE1	CONNECTOR, TWIST PLUG	CEX208	CEX208	CEX208
CE2	CONNECTOR, THERMOCOUPLE TYPE K	CEX199	CEX199	CEX199
CE3	CONNECTOR, THERMOCOUPLE TYPE K	CEX199	CEX199	CEX199
CN1	CONTROL, OVEN	4800-00-12	4800-00-12	4800-00-12
CN2	CONTROL, OXIDIZER	4800-00-12	4800-00-12	4800-00-12
CN3	CONTROL, HIGH LIMIT	4800-00-23	4800-00-23	4800-00-23
DS1	CYCLE LIGHT, HEATER ON	PLX101	PLX101	PLX101
DS2	INDICATOR LIGHT, CYCLE START	PL1342X1	PL1342X1	PL1342X1
DS3	INDICATOR LIGHT, HIGH LIMIT	PL1342X2	PL1342X2	PL1342X2
F1	FUSE, 30 AMP	410167	410167	410167
F2	FUSE, 30 AMP	410167	410167	410167
F3	FUSE, .5AMP	FZX87	FZX87	FZX87
F4	FUSE, .5 AMP	FZX87	FZX87	FZX87
F5	FUSE, 3 AMP	2-72441	2-72441	2-72441
F6	FUSE, 1 AMP	FZX8	FZX8	FZX8
F7	FUSE, 1 AMP	FZX8	FZX8	FZX8
FA1	CONTROL BOX FAN	FAX7	FAX7	FAX7
FA2	CASE, FAN	FAX7	FAX7	FAX7
FA3	FAN, DRAFT INDUCER	FA1384X1	FA1384X1	FA1384X1
FL1	LINE FILTER	CAX99	CAX99	CAX99
H1	HEATER, CHAMBER	2650-00-11	2650-00-12	EL1344X1
H2	HEATER, CHAMBER	2650-00-11	2650-00-12	EL1344X1
H3	HEATER, OXIDIZER	2650-00-50	2650-00-50	2650-00-50
H4	HEATER, OXIDIZER	2650-00-50	2650-00-50	2650-00-50
PU1	AIR PUMP	PU1384X1	PU1384X1	PU1384X1
RY1	RELAY, SOLID STATE	RYX34	RYX34	RYX34
RY2	RELAY, SOLID STATE	RYX34	RYX34	RYX34
RY3	RELAY, DP	RYX56	RYX56	RYX56
RY4	RELAY, DP	RYX56	RYX56	RYX56
RY5	RELAY, 4PDT	4440-00-20C	4440-00-20C	4440-00-20C
RY6	RELAY, DPDT	4440-00-25C	4440-00-25C	4440-00-25C
RY7	RELAY, SPDT	4440-00-30C	4440-00-30C	4440-00-30C
RY8	RELAY, SPDT	4440-00-30C	4440-00-30C	4440-00-30C
RY9	RELAY, DPDT	4440-00-25C	4440-00-25C	4440-00-25C
RY10	SOLENOID VALVE	RY1384X1	RY1384X1	RY1384X1
RY11	SOLENOID VALVE	RY1384X2	RY1384X2	RY1384X2
RY12	DOOR LOCK SOLENOID	RY1342X2	RY1342X2	RY1342X2
S1	SWITCH, POWER	04153	04153	04153
S2	SWITCH, STOP/RESET	4860-00-18	4860-00-18	4860-00-18
S3	SWITCH, START CYCLE	4860-00-15	4860-00-15	4860-00-15
S4	SWITCH, PRESSURE	3618-05-10	3618-05-10	3618-05-10
S5	RELIEF DOOR SWITCH	SW1342X1	SW1342X1	SW1342X1
S6	SWITCH, DOOR	SWX163	SWX163	SWX163
SC1	BRIDGE RECTIFIER	1500-50-13B	1500-50-13B	1500-50-13B
TB1	TERMINAL BLOCK, 4 PLACE	TRX177	TRX177	TRX177
TB2	TERMINAL BLOCK, 3 PLACE	TRX178	TRX178	TRX178
TC1	THERMOCOUPLE, OXIDIZER	4810-00-16	4810-00-16	4810-00-16
TC2	THERMOCOUPLE, OVEN	TC1342X2	TC1342X2	TC1342X2
TC3	THERMOCOUPLE, HIGH LIMIT	TC1342X1	TC1342X1	TC1342X1
TM1	CYCLE TIMER RELAY	4440-00-10B	4440-00-10B	4440-00-10B
TM2	RAMP SOAK COUNTER RELAY	4440-00-40	4440-00-40	4440-00040
TM3	TIME DELAY ON RELAY	4440-00-10B	4440-00-10B	4440-00-10B
TM4	CYCLE TIMER RELAY	4440-00-10B	4440-00-10B	4440-00-10B
TN1	TRANSFORMER, 240/120 VAC	4870-00-25	4870-00-25	4870-00-25
TN2	TRANSFORMER, 120/24 VAC	TNX99	TNX99	TNX99



# WIRING DIAGRAMS

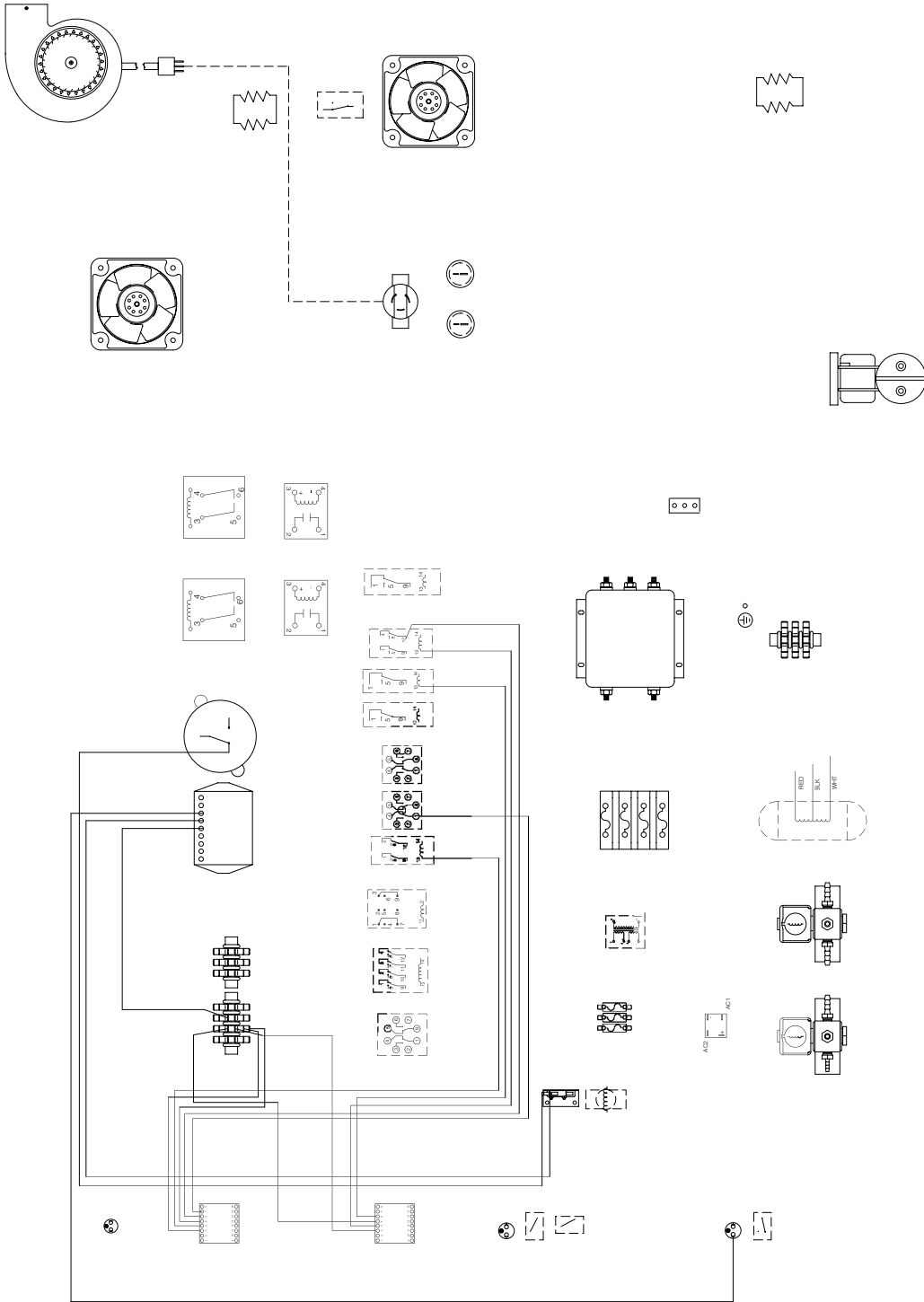


240 VOLT CIRCUIT DIAGRAM

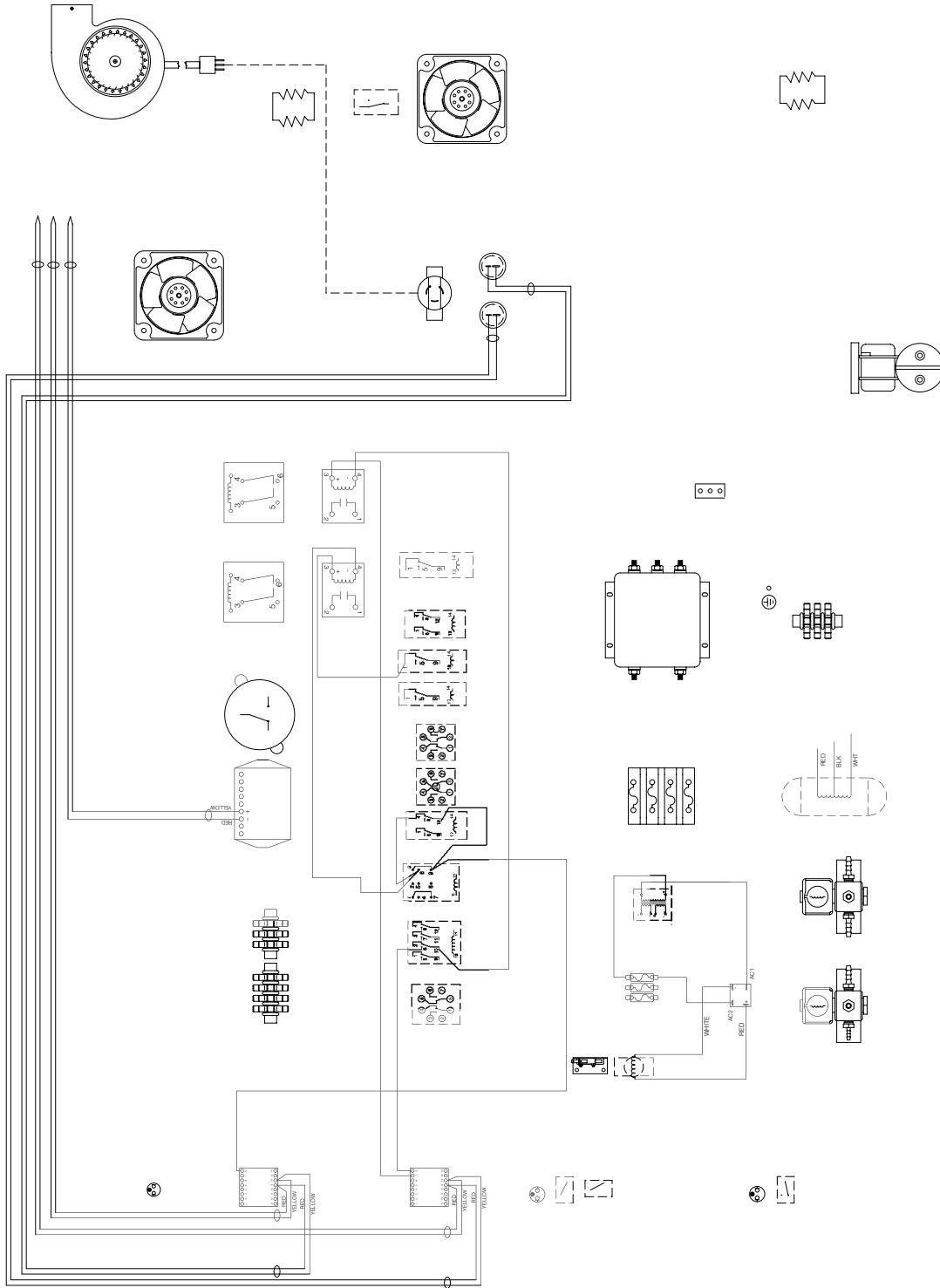


120 VOLT CIRCUIT DIAGRAM

# WIRING DIAGRAMS

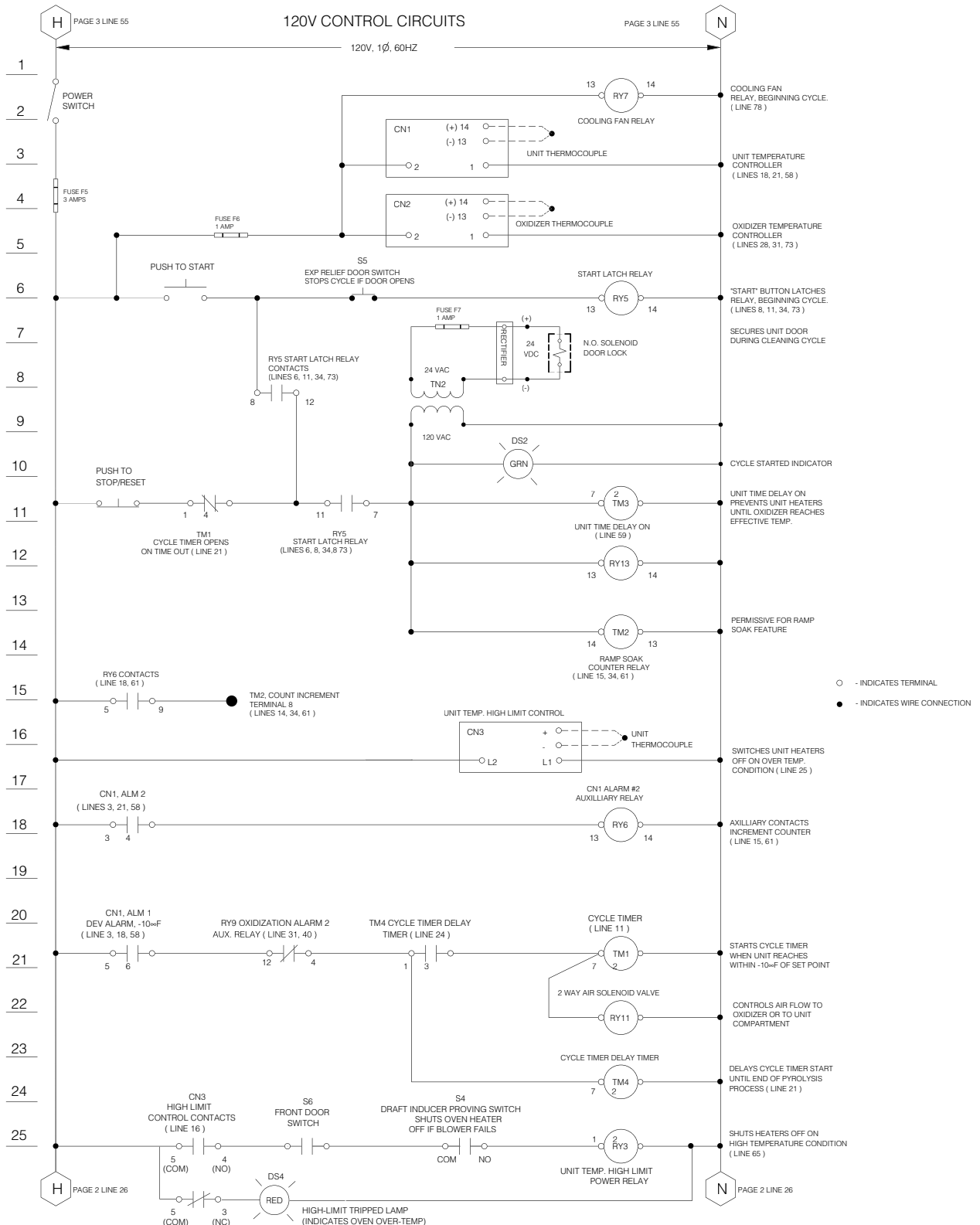


CONTROL CIRCUIT DIAGRAM

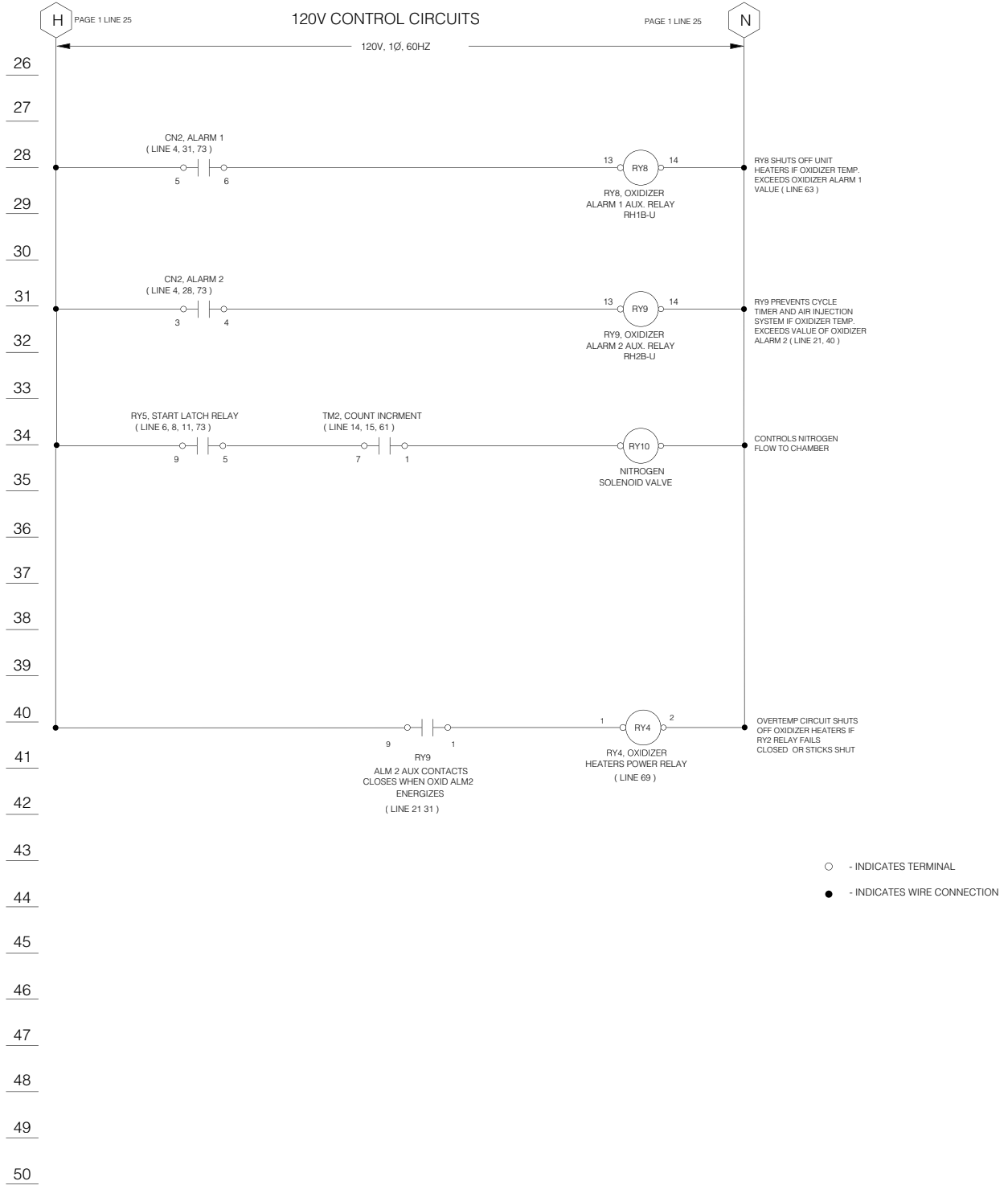


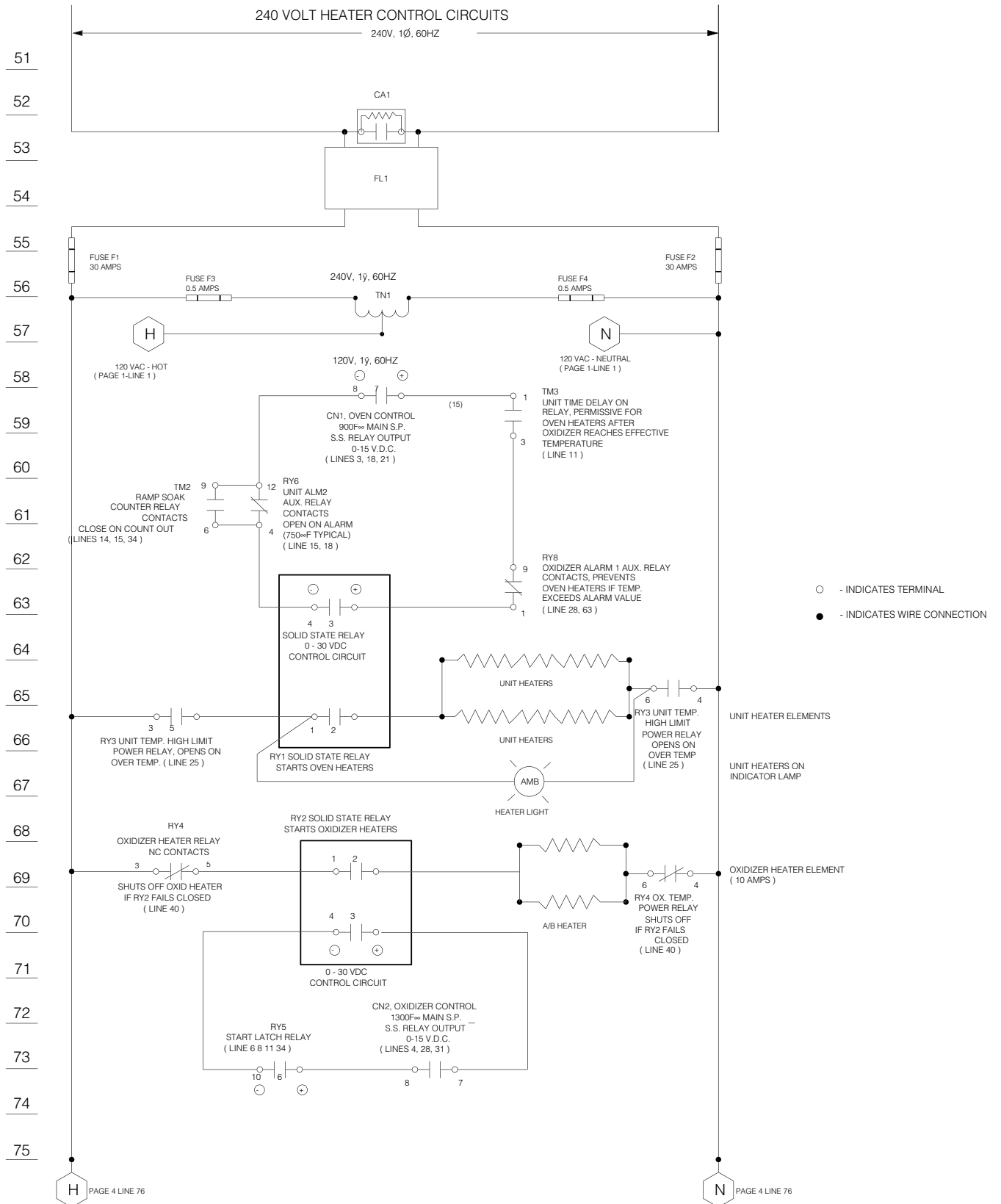
DC VOLTAGE CIRCUIT DIAGRAM



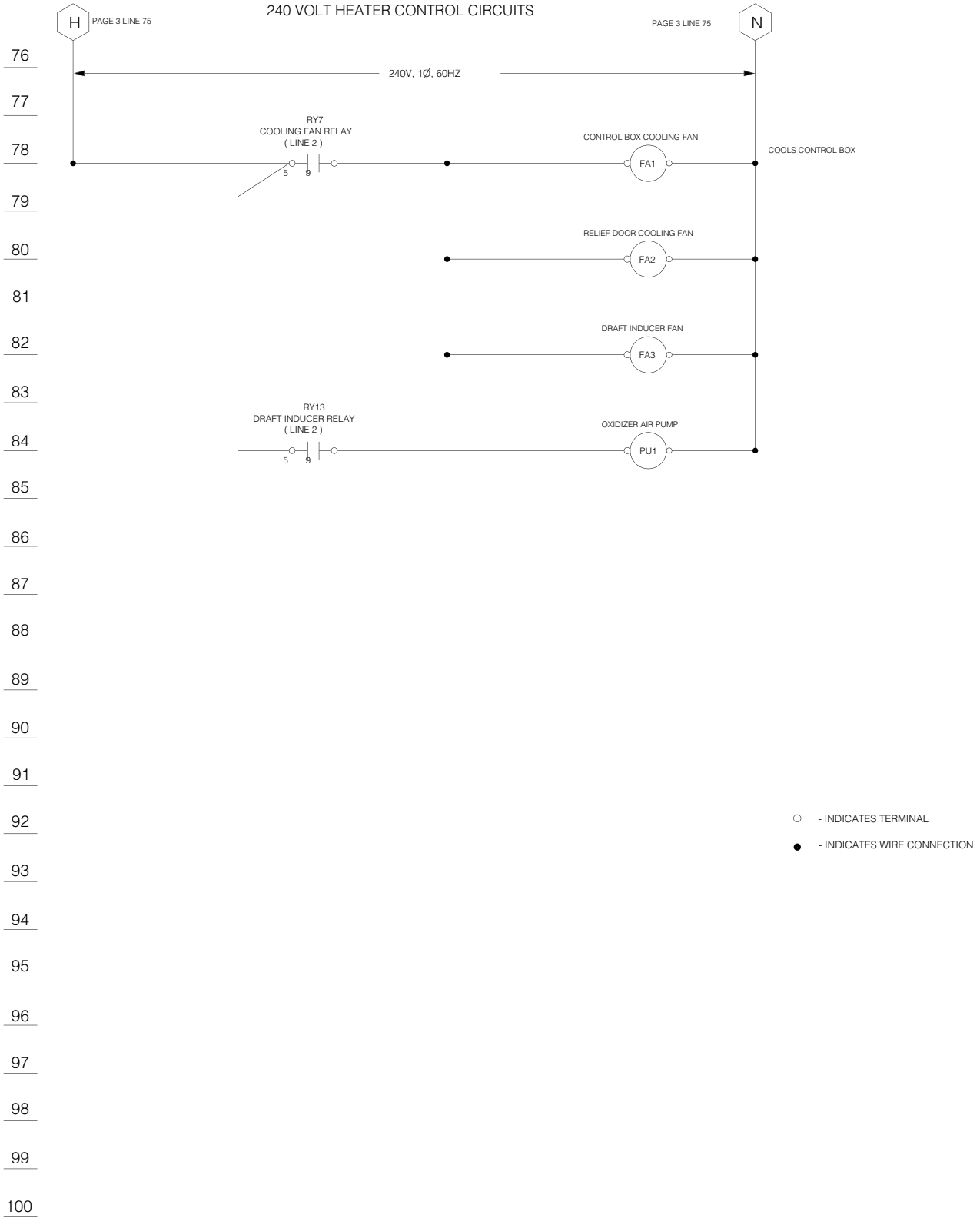


# WIRING DIAGRAMS





# WIRING DIAGRAMS



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# One Year Limited Warranty

Barnstead International ("BARNSTEAD") warrants that a product manufactured by Barnstead shall be free of defects in materials and workmanship for one (1) year from the first to occur of (i) the date the product is sold by BARNSTEAD or (ii) the date the product is purchased by the original retail customer (the "Commencement Date"). Except as expressly stated above, BARNSTEAD MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO THE PRODUCTS AND EXPRESSLY DISCLAIMS ANY AND ALL WARRANTIES, INCLUDING BUT NOT LIMITED TO, WARRANTIES OF DESIGN, MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

An authorized representative of BARNSTEAD must perform all warranty inspections. In the event of a defect covered by BARNSTEAD's warranty, BARNSTEAD shall, as its sole obligation and exclusive remedy, provide free replacement parts to remedy the defective product. In addition, for products sold by BARNSTEAD within the continental United States or Canada, BARNSTEAD shall provide free labor to repair the products with the replacement parts, but only for a period of ninety (90) days from the Commencement Date.

BARNSTEAD's warranty provided hereunder shall be null and void and without further force or effect if there is any (i) repair made to the product by a party other than BARNSTEAD or its duly authorized service representative, (ii) misuse (including use inconsistent with written operating instructions for the product), mishandling, contamination, overheating, modification or alteration of the product by any customer or third party or (iii) use of replacement parts that are obtained from a party who is not an authorized dealer of BARNSTEAD.

Heating elements, because of their susceptibility to overheating and contamination, must be returned to the BARNSTEAD factory and if, upon inspection, it is concluded that failure is due to factors other than excessive high temperature or contamination, BARNSTEAD will provide warranty replacement. As a condition to the return of any product, or any constituent part thereof, to BARNSTEAD's factory, it shall be sent prepaid and a prior written authorization from BARNSTEAD assigning a Return Materials Number to the product or part shall be obtained.

IN NO EVENT SHALL BARNSTEAD BE LIABLE TO ANY PARTY FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, OR FOR ANY DAMAGES RESULTING FROM LOSS OF USE OR PROFITS, ANTICIPATED OR OTHERWISE, ARISING OUT OF OR IN CONNECTION WITH THE SALE, USE OR PERFORMANCE OF ANY PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE), ANY THEORY OF STRICT LIABILITY OR REGULATORY ACTION.

The name of the authorized Barnstead International dealer nearest you may be obtained by calling 1-800-446-6060 (563-556-2241) or writing to:



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