Installation, Operation & Maintenance Manual

Model: Fuel-Fired Batch Oven

Effective: 7/10/13

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Warranty

NOTE: This warranty supersedes all previous editions.

Seller's warranty as stated herein shall be effective only upon payment in full by the Buyer for the affected goods and/or services.

Every LEWCO, Inc. product has been carefully inspected before shipment and we guarantee to correct any defect caused by faulty material or workmanship. Seller's obligation under this warranty is for one year or 4000 hours of use, whichever comes first, after shipment of products or equipment. The Seller warrants that the equipment furnished and the material used in its manufacturing shall be of good quality and free from defects. Subject to the conditions stated herein, the Seller will replace (F.O.B. Sandusky, OH) or repair any equipment proving defective in material or workmanship. Defect(s) to be verified by Seller's inspection upon receiving products or equipment at Seller's plant. Cost for shipping of defective and/or replacement parts to be incurred by Buyer. Credit for return shipping charges may be issued to the Buyer after any and all inspections are concluded. Failure due to abuse, overloading, maintenance neglect, exposure to corrosive or abrasive materials, or improper use shall not be subject to said warranty. Any modification to equipment or systems without Seller's written consent voids this warranty. Component parts not of Seller's manufacture (such as motors, fans and reducers) will be covered by the original manufacturer's warranty and not by Seller. In the case of failure during the warranty period, contact your Seller's representative or the nearest authorized service representative of the manufacturer. Standard warranty does not include labor to remove and/or install defective equipment. If a Seller's Representative is required for additional assistance, contact our Customer Service Department. Labor will be charged at a prevailing rate, plus travel expenses. Seller shall not be liable for loss of profits, delays or expenses incurred by failure of said parts, whether incidental or consequential. Except as stated herein, the Seller makes no other warranties, expressed or implied, including warranties of merchantability and fitness for a particular purpose. There are no warranties, which extend beyond the description on the face thereof. Buyer's exclusive remedy for claims arising hereunder shall be for damages. The Seller's alleged liability for defective products or equipment, irrespective of whether such defects are discoverable or latent, shall in no event exceed the cost to the Seller of repairing, at the Seller's option, the defective or damaged products or equipment. In no event, including in the cost of a claim of negligence, shall the Seller be liable for incidental or consequential damage. The Seller makes no warranties or representations, express or implied, with respect to the product or any service, advice or consultation, if any, furnished to the Buyer by any other party, by the Seller or its representatives. Seller shall not be liable for any loss, personal injury or property damage directly or indirectly arising from the use of its product, advice or service, or for incidental, consequential or punitive damages of any description, whether any such claim be based on warranty, contract, negligence, strict liability or other tort, or otherwise. No deviation from these standard Terms and Conditions of Warranty will be recognized or allowed unless prior written authorization is obtained by Buyer, from Seller.

TABLE OF CONTENTS

INTRODUCTION

SAFETY SYMBOL DEFINITIONS

Manual Specific Warnings	
	Safety Instruction where an electrical hazard is involved
	Safety instruction where non-compliance would affect safety
	Safety instruction where non-compliance could potentially cause an explosion
	Safety instruction where non-compliance could potentially cause a fire
	Safety instruction relating to safe operation of the equipment (ATTENTION)
	Safety instruction where non-compliance could potentially result in a pinch point or a description of a known existing pinch point.
CAUTION	Indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury. CAUTION [signs] without a safety alert symbol may be used to alert against unsafe practices that can result in property damage only.
DANGER	Indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury. The signal word "DANGER" is to be limited to the most extreme situations. DANGER [signs] should not be used for property damage hazards unless personal injury risk appropriate to these levels is also involved.
NOTICE	Symbol is used to describe preferred to address practices not related to personal injury.
WARNING	Indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury. WARNING [signs] should not be used for property damage hazards unless personal injury risk appropriate to this level is also involved.

Equipment Specific Warnings	
	Moving equipment may cause severe injury. Keep Away
	Hazardous voltage will cause severe energy or death. LOCK OUT POWER before servicing
	Potential arc flash hazard
	Hot Surface Do Not Touch

DEFINITIONS

ARC FLASH: An arc flash is a phenomenon where a flashover of electric current leaves its intended path and travels through the air from one conductor to another, or to ground. The results are often violent and when a human is in close proximity to the arc flash, serious injury and even death can occur.

CIRCULATING FAN: The fan used to "move" the air around the work space in order to more evenly distribute and more efficiently transfer the heat from the heat source to the material.

CLASS A OVEN: Ovens that can be utilized in processes with solvents present, volatile materials or other flammable or combustible contents. NFPA 86 cites several materials requiring the Class A rating, specifically including:

- Paints, powders, inks and adhesives from finishing processes such as dipped, coated, sprayed and impregnated materials
- The substrate material
- Wood, paper and plastic pallets, spacers or packaging materials
- Polymerization or other molecular arrangements. Potentially flammable materials such as quench oils, waterborne finishes, cooling oil, or cooking oils that present a hazard are ventilated according to Class A standards.

COMBUSTION BLOWER: A blower used to force air into the burner for combustion when mixed with a fuel gas.

EXHAUST FAN: A fan used to remove air with contaminants from the work space through a duct to outside of the plant. This air may also include products of combustion.

FLAME ROD: A flame rod is a simple piece of heat-resistant metal (nichrome, inconel, etc) in contact with a flame. A flame consists of ionized particles undergoing chemical reactions and therefore is conductive. The flame rod takes advantage of that fact. The rod has a small potential on it and when the flame touches it, a small current flows from the rod through the flame to ground. This current is detected and uses to "prove" the flame.

HEATER BOX: The insulated box containing the burner or heating elements and circulation blowers. The heater box us USUALLY found on top of the workspace. No material may be placed in the heater box.

INTERLOCKS: Are devices for preventing a mechanism from being set into action when another mechanism is in such a position that the two operating simultaneously might produce undesirable results

PURGE: The replacement of a flammable, indeterminate atmosphere with another gas that, when complete, results in a nonflammable final state.

SAFETY DEVICE: An instrument, a control or other equipment that acts, or initiates action, to cause the furnace to revert to a safe condition in the event of equipment failure or other hazardous event.

SAFETY SHUT OFF VALVE: Two, solenoid actuated normally closed valves in series serving as an automatic safety gas shutoff.

SWITCH

Differential Pressure Switch: A switch that is activated by the flow of a gaseous or liquid fluid. This flow is detected by measuring pressure at two different points to produce a pressure differential across the sensor.

Limit Switch: A switch that actuates when an operating limit has been reached.

High Fuel Pressure Switch: A pressure activated switch arranged to enact a safety shutdown of the burner system in the event of abnormally high fuel pressure.

Low Fuel Pressure Switch: A pressure activated switch arranged to enact a safety shutdown of the burner system in the event of abnormally low fuel pressure.

TEMPERATURE CONTROLLER: A device that measures the temperature and automatically controls the input of heat into the oven.

TRIAL FOR IGNITION PERIOD: The interval of time during light-off that a safety control circuit allows the fuel safety shutoff valve to remain open before the combustion safeguard is required to supervise the flame.

UV SCANNER: A UV or Ultra Violet scanner is a scanner that has a high sensitivity ultraviolet (UV) sensor for monitoring gas or oil flames. When UV light is detected, a signal is sent from the scanner to the flame safety.

VALVE:

Safety Shutoff Valve: A normally closed valve installed in the piping that closes automatically to shut off the fuel in the event of abnormal conditions.

Equipment Isolation Valve: A manual shutoff valve for shutoff of the fuel to each piece of equipment.

SECTION 1 – GENERAL INFORMATION

This manual has been prepared for use in familiarizing personnel with the design, installation, operation and maintenance of your LEWCO, Inc. Industrial Oven. Information presented herein should be given careful consideration to assure safe, optimum performance of the equipment. This manual should always be accessible to the operators for quick reference.

This manual should be used in conjunction with the drawing(s), data sheets and component manufacturers' documentation attached hereto that clarify specific features, installation, utility connections, anchoring, rigging etc.

WARNING: Only trained and properly qualified operators may use this equipment. Improper use may cause equipment damage, injury or death. Oven control systems are designed to react to system and operator input. Be sure to understand the system reaction before making any system adjustments.

1-1 DESCRIPTION

The oven is a natural gas or LPG fueled fired system. The burner is mounted in the heater box which is directly attached to the oven. The flame is not in the workspace however the products of combustion are present. The casing is an insulated mild steel shell. When possible, all of the combustion system components are installed directly onto the oven heater box.

Combustion air is provided by means of a high pressure blower. The gas train is comprised of a gas regulator, high and low pressure switches and a dual blocking Safety Shutoff Valve combination. Some systems may have a proof of closure indicator on the bottom of one of the Safety Shutoff Valves. The gas then flows through an automatic gas modulating valve.

Flame is monitored through a flame rod or ultraviolet (UV) scanner mounted on the burner and a flame supervision system in the control cabinet.

Any process heating application involves a combination of time and temperature to achieve desired material properties. Although the previous can sometimes be pre-determined based on heat transfer calculations and empirical data, these values are an engineering estimate at best. The precise combination of time and temperature, for a specific application, is best determined through actual trial use. By accurately monitoring time, temperature and material properties closely, in a controlled environment, optimum process parameters can be safely and accurately determined.

1-2 SAFETY

NOTICE: No installation of this equipment should take place until this manual has been studied and understood by the person responsible. Handling, transportation and installation of this equipment shall only be undertaken with the proper use of lifting gear.

Typically an oven is purchased for a specific application. If the application for this equipment has changed, or you have reason to doubt the adequacy of the equipment for the application, consult your LEWCO, Inc. representative for proper use of your oven.

	**DANGER:**	Explosion or fire may result from misapplication of this equipment. Know the properties of the materials you are putting into the oven and be sure they can be heated safely at elevated temperature. **Applications that may introduce flammable solvents or combustible materials into an oven require special non-standard safety features**. The National Fire Protection Agency (NFPA) designates these as "Class A" Ovens.
	**CAUTION:**	Do not leave the oven in operation unattended. Property damage or injury to personnel may result.
	**CAUTION:**	This equipment is to be operated by only trained and responsible personnel.
	**WARNING:**	Oven surfaces may be hot and burns could result.
	**CAUTION:**	Heated oven air can burn lungs. Do not breathe oven air.
	**CAUTION:**	Do not operate the oven above its rated maximum temperature.
	**DANGER:**	When heating materials that may generate hazardous vapors, venting or exhausting of the oven is required. Use caution when opening doors to avoid breathing air from inside the oven.
	**CAUTION:**	This equipment may create a confined space hazard. The user is responsible for analyzing the installation in order to make a determination, posting warnings and complying with applicable OSHA standards pertaining to confined space hazards.
	**DANGER:**	Disconnect and lockout electrical power, gas supply and all other sources of energy before performing maintenance. Know where arc flash is possible and take proper precautions.
	**DANGER:**	Be sure any blower or fan shafts have stopped rotating. Keep body, hands and foreign objects away from the inlet and outlet, and the other moving parts of the fan such as shafts, belts and pulleys.
	**CAUTION:**	Do not operate fans without belt & bearing guards in place as bodily injury may result. Always disconnect and lockout power before removing covers or guards.
	**CAUTION:**	Do not operate conveyor ovens with drive guards or covers removed. Disconnect and lockout power before removing covers and guards.
	**CAUTION:**	Maintain cleanliness inside and around the oven. Plenums and ducts may be subjected to a build-up of flammable deposits or combustible debris that may be fire hazards.
	**WARNING:**	Pinch points may exist at door(s). Keep hands and arms clear.
	**DANGER:**	Vertical lift doors must be blocked before entering the oven.

To reduce the possibility of injury to personnel operating or in the vicinity of the oven, warning signs are posted at potential hazard points on the equipment. Examine the equipment and become familiar with potential hazard areas. Instruct all personnel to be aware of these areas and to heed all posted caution and warning signs.

After complete installation of the equipment, a safety study should be made of the application and additional guards and warnings should be installed and posted as necessary. Any code requirements are the responsibility of the user and not that of LEWCO, Inc. Violation of the above safety rules hereby removes all product liability claims from LEWCO, Inc.

NOTICE: It is the responsibility of the user to comply with all safety standards, including OSHA and other Federal, State, and Local codes or regulations.

1-3 PPE (PERSONAL PROTECTIVE EQUIPMENT)

PPE (Personal Protective Equipment) required will be site and process specific. LEWCO, Inc. recommends conducting a detailed study of your installation and process to determine what PPE will be required for safe operation.

Hearing Protection – According to OSHA, protection against the effects of noise exposure shall be provided when the sound levels exceed those determined as unsafe.

Safety Glasses – It is never recommended to enter the workspace with the circulation fans running. However, if anyone must do so for any reason, safety glasses MUST be worn.

Steel Toe Boots (Metatarsals) – Nothing inherent to the oven or its process should require foot protection aside from the loading and unloading of the material from the oven. Use proper plant safety considerations for material handling and PPE

Gloves/Sleeves – If unloading hot material always wear high temperature gloves. If the material being loaded / unloaded is sharp, protective gloves should be worn.

Temperature/Flame Resistant Clothing - If the material is being unloaded hot, wear the appropriate clothing. This may include temperature resistant sleeves, jacket, pants or any combination of the afore mentioned clothing.

Fall Protection – Normal operation of the oven will not require the operator to be on top of the equipment, however, some maintenance and troubleshooting may require personnel to be more than 6’ off of the ground. If this is the case, proper fall protection must be used at all times.

1-4 RECEIVING & HANDLING

1-4.1 RIGGING

Special care must be taken in handling this equipment due to its configuration, size and weight. Lifting lugs are provided at the (4) top corners on most models. It is important to note that rigging cables or chains must not exceed a maximum angle of 10 degrees from vertical (see Figure 2). Use a spreader beam, or rigging of adequate length, to avoid damage to the equipment. **Please refer to any attached drawings for specific assembly and rigging instructions.**

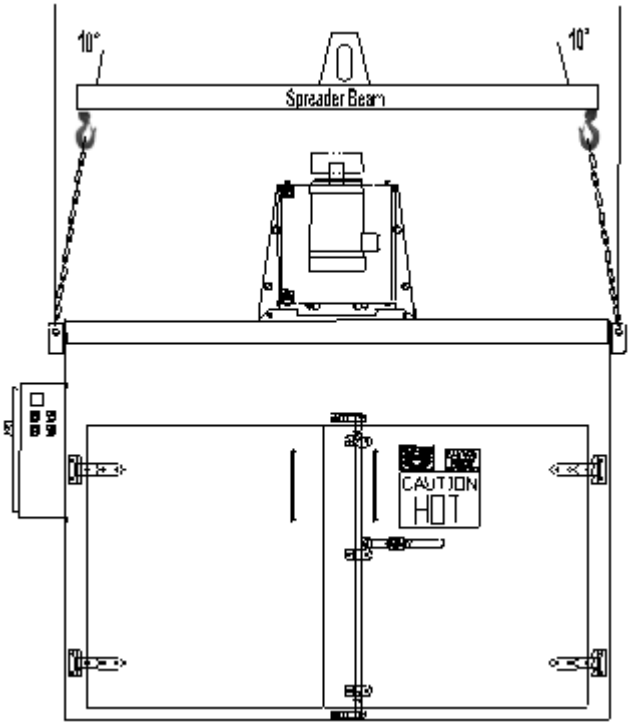

Figure 2: Typical Rigging

1-4.2 RECEIVING INSPECTION

Before removing banding and/or packaging materials, locate the packing slip. The packing slip contains a complete list of all materials shipped. Verify completeness of shipment against packing slip for each item. Inspect each item for damage that could have occurred during shipment.

On collect shipments, all claims for shipping damage must be made against the carrier by the purchaser. All shipments received “short or damaged” must be so noted on the freight bill when signed by the receiver. The delivering carrier may deny a claim if not so noted on the freight bill when signed by the receiver. However, if damage is concealed, and not discovered at the time of delivery, an inspection must be requested to the delivering carrier within 24 hours.

All claims for shortages against the packing list must be made against LEWCO, Inc. within 48 hours of receipt. Claims for replacement materials and equipment must be submitted within 48 hours of receipt or will be invoiced to the customer.

SECTION 2 – INSTALLATION

Prior to installation, the owner should consult with their insurance underwriters for recommendations and requirements regarding the installation and maintenance of industrial ovens.

2-1 LOCATION

Due to the inherent hazards of heat processing equipment, including the possibility of fire, property damage, and personal injury, selection of the oven's location must be carefully planned. In planning the location, consideration should be given to the following.

PERSONNEL SAFETY

CAUTION: Avoid installations near exits or main aisles to minimize the risk to personnel associated with fire, explosion, or asphyxiation. Explosion venting doors and panels are designed to open if pressure builds inside the oven. If possible, the oven should be located such that these devices are oriented away from aisles and work areas.

FLOOR: The oven should always be placed on a non-combustible surface. Avoid installations in basements and on upper floors of multi-story buildings. Check floor capacity. Consideration must be given to the weight of the oven, weight of the materials being processed, and the weight of any carts or fixtures.

PROXIMITY

DANGER: Do not locate the oven against walls. To protect adjacent structures and equipment from excessive temperatures, provide a minimum air space equal to the wall thickness of the oven. If the oven is equipped with explosion venting doors or panels, allow adequate clear distance at these devices to permit their full release. Consider maintenance access to controls, blowers, thermocouples, burners, and filters. Consideration should also be given to the proximity of adjacent storage areas, particularly those that may include flammable liquids or gasses, or combustible materials as these vapors or materials may be drawn into the oven through combustion blower(s) or make-up air vents.

VENTILATION: The oven should be located so that air circulation around the equipment is not restricted. Do not block fresh air inlets or exhaust outlets. Particular consideration should also be given to all blowers and motors.

2-2 LEVELING & ANCHORING

Set the oven on a non-combustible, level surface. The oven should be leveled both side-to-side and front-to-back in reference to the base of the unit. This is important to insure proper door alignment and operation. Shim the oven as required. Secure the oven to the floor through the anchor holes provided. Use an anchor 1/8" diameter smaller than the holes provided.

2-3 EXHAUSTING & VENTING

Ovens may be equipped with a powered exhaust fan to remove products of combustion. The exhaust fan may also be required to remove flammable vapors in the case of NFPA Design Class

A ovens. **The fan outlet must be connected to an exhaust stack of adequate size for discharge to an outside location.** Exhaust stacks are to be installed in accordance with applicable state and local codes and regulations. The shortest and most direct path should always be used. Stack temperatures are the same as oven temperatures and care must therefore be taken to protect building materials from the hot exhaust stack. Stacks passing through combustible walls or roof must be insulated. Stacks must be constructed of sheet metal or stove pipe with tight seams and laps in the direction of air flow. Never install dampers or restrictions that can impede flow. Stacks installed lower than 8 feet off the floor must be insulated to protect personnel. **For Class A Design ovens handling flammable solvents, the exhaust rate must be checked against the minimum safe exhaust rate shown on the oven data plate.**

2-4 FUEL GAS CONNECTIONS

Fuel gas piping to the oven must be installed by qualified personnel in accordance with local codes.

A remotely located fuel gas shutoff valve is required to allow the fuel supply to the oven to be turned off in an emergency and shall be located so that fire or explosion at the oven does not prevent access to the valve. This valve is usually a manual valve installed at the upstream end of the gas train before shipping. Operators should be knowledgeable as to the location and operation of this valve.

It is the owner's responsibility to provide an individual gas regulator properly sized to supply the pressure and volume required. As standard, the oven installation requires 2 psig at the oven connection and a minimum gas line size the same as the oven's fuel gas connection inlet. Refer to the appropriate drawings (or oven nameplate) for additional information on fuel requirements and burner capacity.

Ovens shipped disassembled due to size may require additional fuel gas piping. Refer to installation drawings as applicable.

Upon completion of the installation, the owner is responsible to complete a thorough leak test of all fuel gas piping. Leak tests should be conducted at least annually and immediately if the smell of fuel gas is present.

Prior to start-up, "bleed" the fuel gas piping at the union nearest the burner to remove air from the line thereby assuring an uninterrupted fuel supply per NFPA 54 guidelines.

2-5 ELECTRICAL INSTALLATION

Electrical connections should be made by a qualified electrician in accordance with NFPA 70, The National Electric Code. The installation must also meet the requirements of any applicable state and local codes.

Oven models shipped as single units are factory wired complete. Connect power to the main disconnect switch using wire of adequate size to carry the full load current rating of this device. Secure all connections and ground the unit adequately. A grounding lug is provided in the main control panel.

After wiring is complete, make a final check of all electrical connections to confirm that none have vibrated loose in shipping from the factory. Tight power connections will reduce component failure due to poor contact.

Check the fan(s) and blower(s) for proper rotation direction. An arrow on each blower housing indicates proper direction of rotation. The installer should also verify that the fan drive components (belt and pulleys) have not become misaligned or loose during shipment. Excessive noise and/or vibration may be the result of loose or misaligned drive components.

Ovens shipped disassembled due to size may require additional field wiring. Refer to installation and wiring drawings at the end of this manual as applicable.

Verify the settings on any pressure switches and the outputs from any regulators agree with the site settings listed on the appropriate drawings and component literature. Be sure to correct any settings before attempting to ignite the oven. After igniting the oven, be sure to follow the component manufacturer's documentation for setting up the burner. Fuel composition, elevation and other site specific parameters may change characteristics of combustion and require some slight changes in the combustion settings for optimal performance and efficiency.

2-6 STARTUP

Prior to releasing the oven to production, all safety systems MUST be inspected and tested for function and operation. Safeties installed on your LEWCO oven include but are not limited to Emergency stop(s); high and low gas pressure and differential air pressure switches.

To check operation of a safety circuit, force the input criteria into a failure state and verify the oven reacts correctly.

Example: Low Gas Pressure switch – Connect a meter capable of reading $\pm$ .1 ohms to the NO and COM contacts which should be made. If the resistance is more than 1 ohms remove the switch from service. Verify the switch changes state when pressure is changes past the current setting on the switch. This may also be done with a ohm meter as the circuit should open as the switch changes state. To cause the switch to change state, turn the switch setting counterclockwise until the switch trips. Allow the burner to go through a startup sequence and verify that the burner faults and is not allowed to light. Close all test taps and down upstream ball valve. When finished close all pressure test points.

Once the safety systems have been checked and proper operation verified, document all component settings on the oven. These settings are to be kept with your operating instructions for reference in the case of maintenance and annual safety inspections. Documentation of this information and annual inspection of the system is required per NFPA 86.

SECTION 3 – OPERATION AND USE

3-1 GENERAL

Operators must be adequately trained in start-up and shutdown procedures as well as the oven's safety features. It is the owner's responsibility to insure that operators are also familiar the oven's intended application and aware of the design limitations of the equipment in order to avoid misapplication.

For optimum performance, do not overload the oven. Restricted airflow caused by too densely, or improperly packed parts will adversely affect temperature uniformity. Leave space between parts on shelves or racks to allow air to move freely between the parts. If at all possible, stagger parts in order to minimize dead spots in the air flow pattern.

For safety, temperature uniformity and operating efficiency, proper balance of exhaust and fresh air are essential. Adjust intake and exhaust damper(s) enough to prevent fouling of the work. For Class A ovens handling solvents, the exhaust rate must be confirmed to be at least the minimum listed on the data plate. If the process generates significant amounts of smoke or moisture, it is necessary to exhaust enough air to remove these materials. When exhaust is increased fresh air intake must also be increased. Failure to provide adequate fresh air will result in air being drawn into the oven via the door gaskets, thus creating cold spots within the oven workspace. Excessive exhaust or inadequate fresh air intake can also create negative pressure in the oven. When the fresh air intake dampers are properly adjusted, there should be a slight leaking of hot air out of the door gaskets.

While your LEWCO, Inc. oven has been engineered and built to the highest standards. In the unlikely event of equipment malfunction, the following steps should be followed:

1. Press the emergency stop button. If access to the emergency stop button is limited, or the oven does not have an emergency stop button, turn off the electrical disconnect providing power to the oven
2. Close the Equipment Isolation Valve cutting fuel to the oven.
3. Depending on the severity of the issue, evacuate or restrict access to the area until the issue has been resolved.

Operating instructions, specific to this equipment, are detailed in the Appendix. It is recommended that the owner post a copy of operating instructions at the oven.

SECTION 4: MAINTENANCE

4-1 GENERAL

To maximize service life and to assure safe, optimum performance of the equipment, the owner must develop and follow a preventative maintenance program for this equipment.

NOTICE: These are guidelines only. The customer should make the final determination on maintenance intervals and tasks to be performed while considering the working environment.

Industry experience indicates that improper maintenance is another leading cause of industrial oven failure, often resulting in property damage or injury to personnel. Operation of the oven's safety features, such as shutoff valves, exhaust blowers, purge timers and flame sensors must be confirmed at least semi-annually. Safety devices should never be bypassed or "jumpered" out. Cleanliness must be maintained inside and around the oven.

Do not attempt any maintenance on this equipment unless all sources of energy are disconnected and locked out. Before performing work on fans or blowers, special caution must also be taken to secure the wheel.

Refer to Section 4-2 of this manual for more detailed maintenance instructions on component parts specific to this equipment.

The following outlines a minimum list of recommended preventative maintenance items your program should include. The actual list may vary depending on the specific equipment provided.

4-2 OVEN MAINTENANCE ITEMS

Maintenance Item	Frequency				Spare Parts Required
	Daily	Monthly	Six Months	Annual	
Inspect the oven workspace, ductwork, plenums, air intake(s), and exhaust ducts for accumulation of foreign matter and clean as required.	•				
Inspect oven door(s) regularly for gasket wear	•				
Inspect electrical connections and components periodically for tightness and signs of wear		•			
Inspect the flame sensing devices for good condition and cleanliness		•			
Verify for proper air and gas pressures		•			
Check and clean igniter(s)		•			
Check and clean or replace the combustion blower filter.		•			
Check and clean the air blower rotor		•			
Tighten setscrews between bearings and shaft and also wheel set screws on all Circulation and Exhaust Fans.		•			
Explosion venting latches on doors and panels must be inspected monthly to confirm adequate lubrication and freedom of movement.		•			
Oil the pivot joint and apply grease to the latch spring and cam on the door(s).		•			
Check for belt tension and wear on belt driven fans.		•			
Fans and blowers should be inspected		•			
Fan and blower shaft bearings should be lubricated each 500 hours of operation.		•			
Confirm operation of airflow pressure switches			•		
Confirm exhaust rate at the stack outlet with the oven nameplate or drawing attached hereto. Inspect exhaust stack for cleanliness and integrity.			•		
Larger motors, or those subjected to severe duty, should be lubricated more frequently, at least every (6) months			•		
Test fuel-gas shutoff valves and gas train piping for leakage, at least semi-annually			•		
Fractional horsepower electric motors should be lubricated at least every 5,000 hours of service.				•	
Confirm operation of all safety interlocks. See component manufacturers' literature				•	
Inspect explosion relief devices				•	
Replace manual gas blocking valve				•	Y
Adjust combustion settings				•	
Leak test the Safety Shut off Valves for tightness of closure				•	
Test the pressure switch settings by checking the switch movements against pressure settings and comparing these with the actual impulse pressure				•	
Visually check the igniter cable and connectors				•	Y
Conduct operator training course or refresher course				•	
Replace all thermocouples / RTD's				•	Y

The above list of maintenance items is a general overview of items that may need to be addressed on your oven. Please review the supplied component manufacturer information for potential additional maintenance items.

NOTE: Air streams containing particulate or chemicals can cause abrasion or corrosion of the fan parts. When such wear is discovered, a decision must be made as to whether to rebalance or replace the wheel.

4-3 REPLACEMENT PARTS

Replacement parts are available through your LEWCO, Inc. representative. Be prepared to provide both the oven SERIAL NUMBER and MODEL NUMBER when ordering. A list of replacement parts may be found in appendix 6-3.

SECTION 5: TROUBLESHOOTING

Symptom/Alarm	Possible Causes	Recommended Solutions
No control power	Power not supplied to the control panel	Verify the main disconnect is on
	Blown fuse in the control panel	Verify continuity of the fuses before and after the main transformer
	Emergency Stop push button has been activated	Verify the initial reason for the E-Stop activation has been corrected and clear the E-Stop
Combustion air blower, Exhaust Fan and/or Circulation Fan will not start	Control Power is off	Check the main disconnect
	Motor starter tripped	Reset the motor starter
	Blown Fuses	Replace Fuses
No interlock light	Exhaust, Circulation or combustion blower air flow switches do not make	Check the inputs to and output from switches.
		Check air filter on the combustion blower
		Check blower/fan rotation direction
	High or low limit gas pressure switches are faulted	Confirm the pressure to the furnace is within the rage of the gas pressure switches
	High or low gas pressure switches have activated	Check incoming gas pressure, adjust as necessary
		Check pressure switch setting and operation
Oven purges but does not try to ignite	No ignition:	
	• Attempting to ignite at inputs greater than 60%	Reduce gas flow, verify control circuit
	• Weak or non-existent spark	Verify ignition transformer is a 6,000 – 8,000 volt transformer (Not half wave)
	• No power to the ignition transformer	Restore the power to the ignition transformer
	• Open circuit between the ignition transformer and the igniter	Repair or replace the wiring to the igniter
	• The igniter needs cleaning	Clean the igniter
	• The igniter is not correctly grounded to the burner	Clean the threads on the igniter and burner. Do not apply grease when reassembling
	• Igniter is grounding out	Inspect the igniter and replace if broken
	Not enough gas:	
	The gas flow into the burner is too low	Check the startup settings and adjust if necessary
	Gas valve does not open	Check the wiring to the automatic gas shut off valve
		Check output from the flame safeguard
		Open manual gas cock
	No Flame Signal:	
	Dirty or broken flame rod	Replace if necessary
	Flame rod grounding out	Verify the flame rod is installed correctly and is the correct length

Symptom/alarm	Possible Causes	Recommended Solutions
Oven purges but does not try to ignite	Loss of purge flow	Ensure adequate purge flow
	Heat is disabled	Press the “Heat Enable” button
The low fire flame is weak or unstable	Not enough gas	Check start-up settings and adjust to increase gas flow
	Incorrect air flow setting	Check air pressure drop across the burner and adjust
The burner does not go to high fire	Not enough gas pressure out of the main gas regulator	Adjust pressure regulator to proper setting
	Gas pressure drops as input is increased	Check for clogging of valves and regulators in gas line. Replace if necessary
	Loss of 4-20mA Signal	Check signal, wire and connections
	Main gas control valve is not functioning	Check actuator and linkage
Burner does not achieve capacity	Main gas control valve is not functioning	Check actuator linkage
	Burner is firing below rated input	Check gas pressure differential. Adjust main gas pressure regulator as necessary
	Burner gas holes are plugged	Inspect gas holes for dirt or lint as needed
Main flame is uneven along the length of the burner	Air pressure drop/velocity is too low	Increase air pressure drop
	Poor air distribution in duct	Check profiling and duct obstructions
	Air wings are dirty, holes are clogged	Inspect and clean air wings if necessary
Main flame is yellow and long at high fire	Gas pressure too high at burner inlet	Check gas pressure against design. Adjust main gas pressure regulator.
	Air wings are dirty, holes are clogged	Inspect and clean air wings if necessary
	Air pressure drop /velocity too low	Open air damper on combustion air blower.
CO Emission is too high	Burner operating outside specified ratings	Adjust burner settings
	Process air velocity exceeds limits given	Bring velocity within limits, adjust process air blower.
Excessive Fan Vibration	Loose mounting bolts, setscrews, bearings or couplings	Tighten hardware to the proper torque
	Misaligned or excessive wear of couplings, bearings or misaligned or unbalanced motor.	Replace couplings and bearings and realign balanced shaft and wheel
	Accumulation of foreign matter on the wheel or wear/erosion of the wheel	Clean or replace fan wheel depending on extent of damage
Inadequate Performance	Fan running too slowly	Check voltages to motor or mechanical drag on the system
	Improper rotation direction	Change rotation direction
	Obstructions or sharp elbows in ductwork	Clean or replace ductwork for clean airflow
Excessive Nose	Loose accessories or components	Tighten accessory or component hardware
	Loose drive belts	Tension drive belts
	Worn Bearings	Replace bearings
Premature Component Failure	Prolonged major vibration	
	Improper or inadequate maintenance	
	Abrasive or corrosive elements in the airstream	
	Misaligned or physical damage to rotating components or bearings	
	Bearing failure from incorrect or contaminated lubricant or grounding through the bearings while arc welding	
	Excessive fan speed or extreme ambient temperatures	
	Improper belt tension or tightening of wheel setscrews	

SECTION 6: APPENDIX

The appendix of this manual will contain installation specific information. If your installation requires non-standard information requirements such as calibration certifications or equipment specific data, it will be found at the end of this section. Standard installation specific information includes:

6-1 OPERATING INSTRUCTIONS
6-2 DRAWINGS
6-3 REPLACEMENT PARTS
6-4 COMPONENT LITERATURE