

CONTROLLED ATMOSPHERE IR BELT FURNACE

Model LA-309P Operation & Theory

**Infrared Furnace Setup, Operation,
Theory and Troubleshooting Guide**

*Stephen L. Barber
James M. Clark*



Covers 2013 - 2016 LCI LA-309P Models

This manual contains operating instructions, theory and information regarding features and options which may or may not be included in your furnace system.

Controlled Atmosphere IR Belt Furnace

Model: LA-309P (2013-2016)

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INTRODUCTION

The LCI LA-309P furnace is a high quality controlled atmosphere infrared belt furnace designed for industrial production and laboratory continuous infrared thermal processing. This manual covers models manufactured by LCI in 2013 and later, controlled with a programmable logic controller (PLC) and the closed-loop belt speed control introduced in 2013.

While the furnace is very easy to use, proper control of both the heat and gas flow is essential to achieve exceptional performance of the furnace. Achieving high performance and high yields is attainable with careful adjustment of the sophisticated digital temperature controllers and exceptional process gas system provided on the LA-309P. Infrared furnaces are highly responsive to critical temperature settings. With lamps as the primary heat source, the equipment is literally heating with light. The unique gas management system when properly adjusted delivers an even distribution and well-regulated flow of gas throughout the process chambers.

WHAT IS IN THIS MANUAL

This manual provides manufacturer specifications and limitations as well as installation, operating and service and troubleshooting instructions for the LA-309P furnace by LCI Furnaces. Some equipment described in this manual is optional or may not apply to your model as configured. Also covered are aspects of infrared processing theory and techniques to assist in achieving highly repeatable and reliable thermal processes.

Study this manual carefully, particularly regarding proper operation and limitations of the furnace equipment for reliable results and long life. *Note also, the manufacturer's warranty will not apply if the equipment or any components thereof have been subject to: (1) operation, maintenance, overhaul, installation, storage or use which is improper or not in accordance with the manufacturer's instructions; (2) any alteration modification, or repair by anyone other than the manufacturer or its authorized representative; (3) any accident, misuse, neglect, or negligence after shipment; or (4) damage due to uncontrollable external events or acts of God.* Experience has shown that operators who master the contents of this manual can become expert in understanding the process system capabilities of our infrared furnaces. In doing so, many are able to push the initial process performance envelope and thus achieve higher degrees in both process reliability and throughput than previously anticipated.

Throughout this manual the equipment is generally referred to as a furnace. A dryer is a furnace with only the top lamp elements installed or operated.

FORMATTING CONVENTIONS

This manual uses the following formatting conventions.



DANGER: This signifies a potential threat to human safety.

Warning: This signifies a potential threat to equipment damage or product loss.

Note: This signifies an important fact that could affect process control.

Examples are shown in italic text.

Bold text words or phrases embedded in this document, are terms with definitions in the glossary.

Bold Underlined text is used for pop-up windows, button descriptions & selector button/box choices.

Cross-references to "Section Titles" are bound with quotes.

(Optional) accessories are in parenthesis with a checkbox. If supplied, please check the box as appropriate.

ABOUT LCI

LCI Furnaces specializes in the manufacture and sales of near infrared (0.5-5.5 μm) wavelength continuous belt dryers, ovens and furnaces worldwide. We provide the highest quality controlled atmosphere infrared thermal processing equipment, parts and service available anywhere.

We endeavor to improve our equipment design and performance. To this end, LCI encourages users to suggest ideas for improving designs and service. Additionally, we will discuss, in confidence, new thermal processing requirements, however difficult or routine they may be. If needed, LCI can design new equipment and features to meet the special and challenging needs our partners require.

Should you have a furnace operating question, contact LCI Furnaces or FurnacePros Technical Support.

WHERE TO GET HELP

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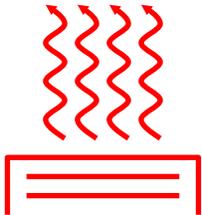
New Furnaces: www.LCIfurnaces.com
Aftermarket Parts: www.FurnacePros.com

GENERAL SAFETY GUIDELINES

The following set of guidelines is intended to create awareness of potential health and safety hazards.

Normal Good Laboratory Practice

Normal good laboratory practices apply to the operation of IR furnaces. Do not use the space above the furnace as storage. Do not block the cabinet doors preventing the cooling of the electronic equipment inside. Do not operate with side covers off as this will prevent normal cooling of the electronic equipment thus voiding the warranty. Tuck electrical cords out of the way. Do not store flammables in the vicinity of the furnace and especially while operating the furnace with an oxygen atmosphere.

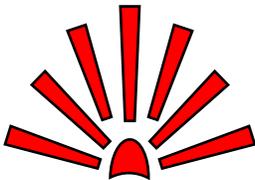


HIGH TEMPERATURES. In general, the operation of any furnace may expose operators or maintenance technicians to the risk of burns. After being processed in an infrared furnace, customer product may still be dangerous to handle. Each owner is responsible for providing a safe work environment and proper training in the handling of material being processed in a furnace.



ELECTRICAL SHOCK HAZARD. IR furnaces operate at high voltages. Operation with side covers off constitutes a safety hazard. Ensure that main power is off while side covers are removed.

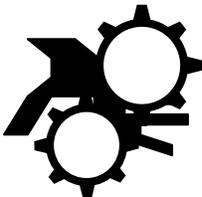
Electrical shock hazards exist for those technicians who service the furnace. High voltages are required to operate the furnace and precautions must be taken to reduce the exposure to these elements. Again, it is the responsibility of the furnace owner to assure that only properly trained service technicians, familiar with high voltage operations be allowed to service the equipment



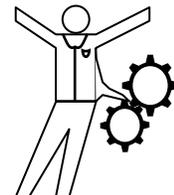
EXPLOSION Explosive dangers may exist in the high temperature process environment of the furnace. If the furnace operates with process gas containing hydrogen, the hydrogen content must be below 4.5% to assure the avoid the dangers of explosion. Furthermore, improper gas flow balance may draw oxygen rich air into the furnace, mixing with effluent gases and material from products, also creating a hazardous environment.



HAZARDOUS MATERIALS. Persons performing maintenance tasks such as replacement of lamps may become exposed to silica fiber compounds and/or toxic process residue. Such tasks should be performed by qualified persons wearing gloves, eye protection and a facemask to prevent inhalation of particulates or contact with toxic materials.



ROTATING EQUIPMENT. Roller dangers exist when working around the conveyor belt of the furnace. Care should be taken not to place hands or garments on or near the belt drive mechanisms when the conveyor system is operating as roller crush may occur. Operators should avoid walking near the open ends of the conveyor belt. Those who must be near the moving parts should wear close fitting clothing.



SAFETY EQUIPMENT

EMO Buttons



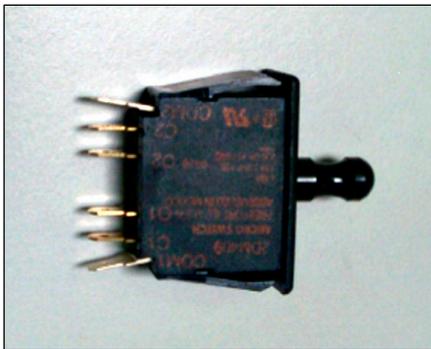
Each LA-309P infrared furnace is fitted with at least two SEMI S2 compliant Emergency Machine Off buttons (EMO's), one located at each end of the furnace. Each Emergency Machine Off button (EMO) is attached directly to a switch that automatically shuts down all furnace electrical systems. In many cases, process gas flow will remain on after power is shut off.

Locate the EMO buttons and insure their proper function prior to regular furnace operation.

Panel Interlock Switches

The LA-309P has (3) interlock switches positioned to prevent operation of the furnace with high voltage panel access covers out of place. One is located on the control enclosure hinged back access door, and one on each of the lower side panels closest to the furnace entrance safeguarding access to the high voltage at the chamber lamps. The control enclosure top access plate is not interlocked.

Bypass this switch to allow furnace operation with the panels removed. Grasp the protruding switch and pull it out to override the switch (see Figures). Setting the panel switches in bypass mode is useful during SCR calibration and other troubleshooting.



Panel Switch in Normal Operation Position (in)



Panel Switch Installed - Bypass (out) Position



DANGER: Bypassing the panel interlock switches increases maintenance personnel exposure to electrical hazards. The user must ensure that any interlock switches placed in override mode are returned to normal operation following any inspection or adjustment.

CDA Mixing

CDA Mixing options allows for introduction as GAS2, clean dry compressed air (CDA), nitrogen, forming gas or a specialty gas into specific furnace zones. When enabled, GAS2 can be added to the GAS1 flow introduced through the GAS FLOW CONTROL flowmeters (See Operation with FG below if operation with forming gas is contemplated.)

Operation with FG (Forming Gas): Nitrogen/Hydrogen Premix

The CDA Mixing and Dual Gas options each provide for use of forming gas (FG) as a process gas. Use of FG is generally safe provided the concentration of hydrogen in the mixture is lower than the lower flammable limit of hydrogen. Hydrogen is flammable in concentrations of 4.5%-74% in air; explosive range is 18-59% in air. Dual gas furnaces are equipped with an audible alarm to indicate low nitrogen and forming gas supply pressure. CDA mixing furnaces are equipped with an audible alarm to indicate low nitrogen supply pressure only.



DANGER: Except for furnaces specifically equipped with the hydrogen option, combustible gas should NOT be connected to the furnace. Forming gas or other gas mixtures which have a combustible gas component can be safely introduced into furnace provided the delivered concentration is below its lower flammable limit (LFL) in air.

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