# HIGH-PERFORMANCE OVEN

SHEL LAB®

220 - 240 Voltage

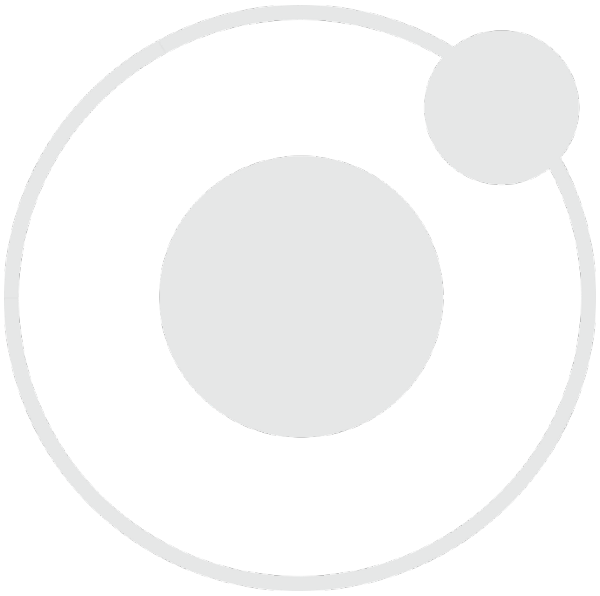
# Installation - Operation Manual

SMO5HP-2

**These ovens require permanent connect wiring (also known as hardwiring) to a power supply.**

**Purge Port**

The SMO5HP-2 can be built with a 3/8 inch ID (9.5mm) gas-in port on the back of the oven. This optional port can be connected to a cylinder of nitrogen ($N_2$) or other inert gas to purge the oven chamber during baking applications. **This option must be ordered prior to the construction of the oven.**



# SHEL LAB Oven High Performance 220 - 240 Voltage

## Installation and Operation Manual

## Part Number (Manual): 4861706

## Revision: January 31, 2018

SHEL LAB is a brand of Sheldon Manufacturing, INC.

## Safety Certifications

These units are CUE listed by TÜV SÜD as forced air ovens for professional, industrial, or educational use where the preparation or testing of materials is done at an ambient air pressure range of 22.14 – 31.3 inHg (75 – 106 kPa) and no flammable, volatile, or combustible materials are being heated.

The units have been tested to the following requirements:

CAN/CSA-22.2 No. 61010-1:2012
CAN/CSA-C22.2 No. 61010-2-010:2015
UL 61010-1:2012
UL 61010-2-010:2015
EN 61010-1:2010
EN 61010-2-010:2014

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# INTRODUCTION

*Thank you for purchasing a SHEL LAB oven. We know you have many choices in today's competitive marketplace when it comes to constant temperature equipment. We appreciate you choosing ours. We stand behind our products and will be here if you need us.*

## READ THIS MANUAL

Failure to follow the guidelines and instructions in this user manual may create a protection impairment by disabling or interfering with the unit safety features. This can result in injury or death.

Before using the unit, read the manual in its entirety to understand how to install, operate, and maintain the unit in a safe manner. Keep this manual available for use by all operators. Ensure all operators are given appropriate training before the unit begins service.

## SAFETY CONSIDERATIONS AND REQUIREMENTS

Follow basic safety precautions, including all national laws, regulations, and local ordinances in your area regarding the use of this unit. If you have any questions about local requirements, please contact the appropriate agencies.

**SOPs**

Because of the range of potential applications this unit can be used for, the operator or their supervisors must draw up a site-specific standard operating procedure (SOP) covering each application and associated safety guidelines. This SOP must be written and available to all operators in a language they understand.

**Locations and Intended Applications Range**

SMOHP forced-air ovens are engineered for constant temperature forced-air drying, curing, and baking applications in professional, industrial, and educational environments. The ovens are not intended for use at hazardous or household locations.

**Power**

Your unit and its recommended accessories are designed and tested to meet strict safety requirements.

- Always hardwire the unit power feed to a protective earth-grounded electrical source that conforms to national and local electrical codes. If the unit is not grounded, parts such as knobs and controls may conduct electricity and cause serious injury.
- Position the unit so the end-user can quickly and easily disconnect or uncouple the power feed in the event of an emergency.
- Avoid damaging the power feed. Do not bend it excessively, step on it, place heavy objects on it. A damaged power feed can easily become a shock or fire hazard. Never use a power feed after it has been damaged.
- Use only approved accessories. Do not modify system components. Any alterations or modifications to your oven may be dangerous and will void your warranty.

## *CONTACTING ASSISTANCE*

Phone hours for Sheldon Technical Support are 6 am – 4:30 pm Pacific Coast Time (west coast of the United States, UTC -8). Please have the following information ready when calling or emailing Technical Support: the **model number** and the **serial number** (see page 11).

EMAIL: support@sheldonmfg.com
PHONE: 1-800-322-4897 extension 4, or (503) 640-3000
FAX: (503) 640-1366

Sheldon Manufacturing, INC.
P.O. Box 627
Cornelius, OR 97113

## *ENGINEERING IMPROVEMENTS*

Sheldon Manufacturing continually improves all of its products. As a result, engineering changes and improvements are made from time to time. Therefore, some changes, modifications, and improvements may not be covered in this manual. If your unit's operating characteristics or appearance differs from those described in this manual, please contact your SHEL LAB dealer or customer service representative for assistance.

## *REFERENCE SENSOR DEVICE*

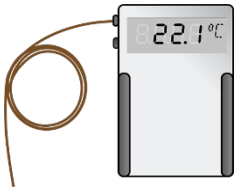
**Must be purchased separately**

A reference sensor device is required for calibrating the oven temperature display.

Reference devices must meet the following standards:

- Accurate to at least 1°C

The device should be regularly calibrated, preferably by a third party.




**Temperature Reference**

**Temperature Probes**

Use a digital device with wire thermocouple probes that can be introduced into the oven chamber through the unit access port. Select thermocouples suitable for the application temperature you will be calibrating at.

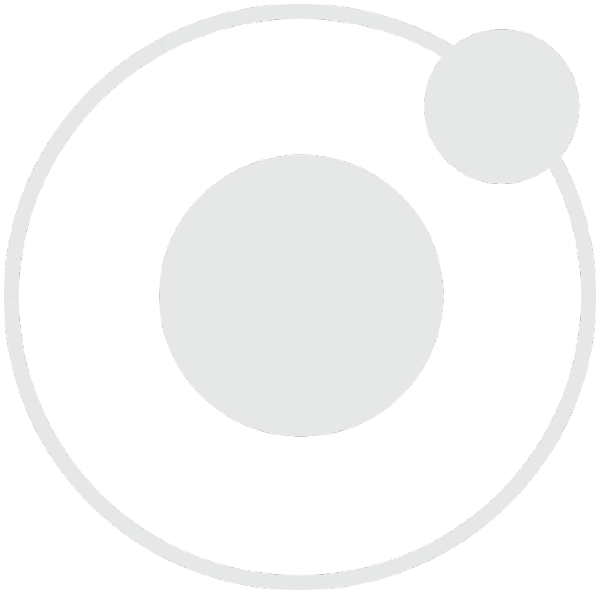
**Why Probes?**

Reference readings taken outside the chamber using wire temperature probes avoid chamber door openings. Openings disrupt the chamber temperature. Each disruption requires **a minimum 1-hour wait** to allow the atmosphere to re-stabilize before continuing.

**No Alcohol or Mercury Thermometers**

Alcohol thermometers do not have sufficient accuracy to conducti accurate temperature calibrations. **Never place a mercury thermometer in the oven chamber!** Always use thermocouple probes.

# INTRODUCTION



# RECEIVING YOUR UNIT

## *INSPECT THE SHIPMENT*

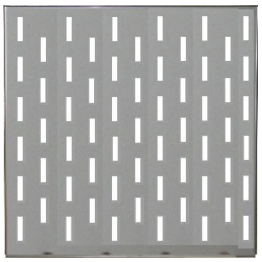
- When a unit leaves the factory, safe delivery becomes the responsibility of the carrier.
- Damage sustained during transit is not covered by the manufacturing defect warranty.
- Save the shipping carton until you are certain that the unit and its accessories function properly

When you receive your unit, inspect it for concealed loss or damage to its interior and exterior. If you find any damage to the unit**, follow the carrier's procedure for claiming damage or loss**.

1. Carefully inspect the shipping carton for damage.
2. Report any damage to the carrier service that delivered the unit.
3. If the carton is not damaged, open the carton and remove the contents.
4. The unit should come with an Installation and Operation Manual and a Programming Guide.
5. Verify that the correct number of accessory items have been included.

**Included accessories**

**2 Shelves**



**4 Shelf Slides**

**4 Leveling Feet**

6. Carefully check all packaging for loose accessory items before discarding.

## ORIENTATION


**Figure 1: SMO5HP-2 Oven**

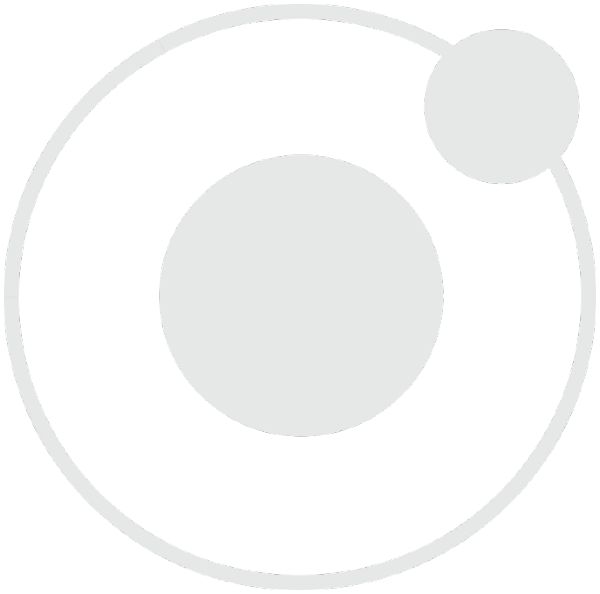
## *RECORDING DATA PLATE INFORMATION*

Locate the data plate on the back of the oven next to the power inlet. The data plate contains the oven model number and serial number. Enter this information below for future reference.

**Date Plate Information**

| | |
|---|---|
| **Model Number** | |
| **Serial Number** | |

# RECEIVING YOUR UNIT



## HARDWIRE REQUIREMENT

The oven requires permanent connect wiring (commonly known as hardwiring). Wiring to the power source **must be performed by a qualified electrical technician.** All other Installation steps may be performed by the end user.

## INSTALLATION PROCEDURE CHECKLIST

Perform the procedures and steps listed below to install the oven in a new workspace location and prepare it for use. All procedures are found in the Installation section of this manual.

**Pre-Installation**

- ✓ Check that the required ambient condition for the oven are met, page 14
- ✓ Check that the spacing clearance requirements are met, page 14
  - Unit dimensions may be found on page 39
- ✓ Check for performance-disrupting heat and cold sources in the environment, page 14
- ✓ Check that a suitable permanent connect electrical power supply is present, page 15

**Install the Oven in a suitable workspace location**

- ✓ Review the lifting and handling instructions, page 16
- ✓ Install the oven in its workspace location, page 17
- ✓ Make sure the oven is level, page 16

**Set up the Oven for use**

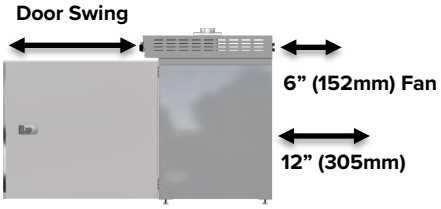
- ✓ Clean the oven chamber and shelving if needed, page 17
- ✓ Install the shelving in the oven chamber, page 17

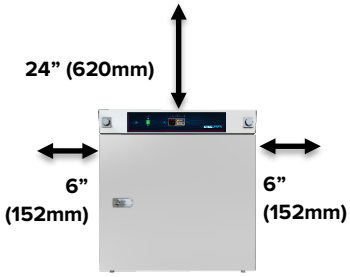
## REQUIRED AMBIENT CONDITIONS

This oven is intended for use indoors, at room temperatures between **15°C and 40°C** (**59°F and 104°F)**, at no greater than **80% Relative Humidity** (at 25°C / 77°F).

**Operating the unit outside of these conditions may adversely affect its temperature range and stability.** If this is the case, please contact your distributor to explore other oven options suited to your laboratory or production environment.

## REQUIRED CLEARANCES




**12” (305mm) headspace with Ducting Attached**

These clearances are required for the oven to operate safely and meet its stated temperature specifications

- **12 inches (305 mm)** of vertical headspace clearance will suffice if the oven exhaust is vented from the workspace through a duct or other channeling.
    - Otherwise, **24 inches (610 mm)** of headspace clearance is required between the exhaust vent and any overhead cover or partition.
- Do not place objects on top of the oven. Exception: A power exhaust blower offered by SHEL LAB maybe mounted on the top exhaust vent.
- Allow at least **6 inches (152 mm)** from the access port and fan vent on the back of the oven to the nearest wall or partition. Keep the fan unobstructed at all times.

## ENVIRONMENTAL DISRUPTION SOURCES

When selecting a location to install the unit, consider all environmental conditions that can affect its temperature performance. For example:

- Proximity to other ovens, autoclaves, and any device that produces significant radiant heat
- Heating and cooling ducts, or other sources of fast-moving air currents
- High-traffic areas
- Direct sunlight

## *POWER SOURCE REQUIREMENTS*

When selecting a location for the oven, check that **each** of the following requirements is satisfied:

**Power Source**: The power source must match the voltage and ampere requirements listed on the oven data plate. This oven is intended for **220 - 240 volt**, **50/60 Hz** applications at **12 Amps**.

- The power source must be **single (1) phase** and **protective earth grounded**.
- The power source for the oven must conform to all national and local electrical codes.
- **Supplied voltage must not vary more than 10% from the data plate rating**. Damage to the oven may result if supplied voltage varies more than 10%. A separate circuit is recommended to prevent possible loss of product due to overloading or failure of other equipment on the same circuit.

**Switch or Circuit-Breaker**: A switch or circuit-breaker must be used in the building installation.

- The required circuit-breaker is 20 Amps

**Oven Fuses:** The oven is provided with **two 20 amp fuses**. These are located in holders adjacent to the power feed braid on the back power panel of the unit.

- The fuses protect against overcurrent conditions related to the operation of the oven.
- If one fuse blows, the oven will shut down. For safe operation, the cause of a blown fuse should be determined prior to replacing it.

**Accessory Outlet Fuse:** The oven is also provided with a pair (2) of **2 amp fuses** installed adjacent to the external power outlet.

- The fuses protect against overcurrent conditions related to the operation of the outlet and an attached power exhaust blower.
- If one fuse blows, the outlet will depower. The cause of a blown fuse should be determined prior to replacing it.

**Power Feed:** The oven must be positioned so that all operators have access to the power feed disconnect in case of emergencies.

- The Disconnect must be in close proximity to the equipment and within easy reach of the operator.
- The Disconnect must be marked as the disconnecting device for the equipment.

## POWER FEED WIRING

The oven comes provided with an integral 6 inch (15 cm) wire braid of two 14-gauge high-temperature (300°C) hot wires and a 14-gauge earth ground.

The wires for power source connection should be Green/Yellow – Earth; Black – Hot; Red – Hot.

**The oven must be earth grounded using the protective conductor terminal** (green with yellow stripe wire. Do not remove the protective conductor (earth connection). Removing the protective conductor will negate the oven's protections against potentially dangerous electric shocks and create a possible fire hazard.

## LIFTING AND HANDLING

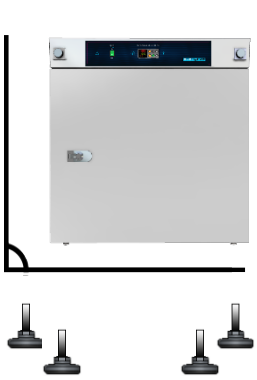
The oven is heavy. Use appropriate lifting devices that are sufficiently rated for these loads. Follow these guidelines when lifting the oven:

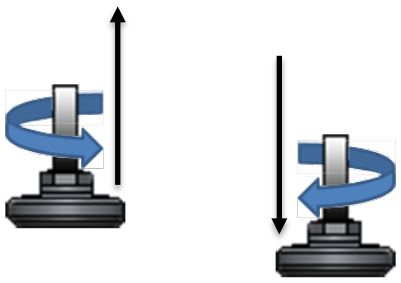
- Lift the oven only from its bottom surface.
- Doors, handles, and knobs are not adequate for lifting or stabilization.
- Restrain the oven completely while lifting or transporting so it cannot tip.
- Remove all moving parts, such as shelves and trays, and secure the door in the closed position during transfers to prevent shifting and damage.

## LEVELING

Install the 4 leveling feet with the 4 corner holes on the bottom of the oven.

The oven must be level and stable for safe operation.





**Note:** To prevent damage when moving the unit, turn all four leveling feet so that the leg of each foot sits inside the unit.

## INSTALL THE OVEN

Place the unit in a workspace location that meets the criteria discussed in the previous entries of the Installation section.

- Verify that the oven stands level and does not rock. Adjust the leveling feet as needed.
- **Power**: The oven may now be hardwired to its power source

## INSTALLATION CLEANING

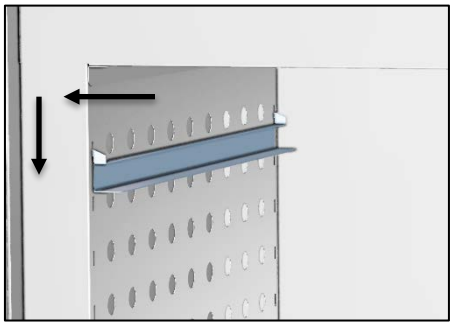
The unit was cleaned at the factory but may have been exposed to contaminants en route during shipping.

- Remove all wrappings and coverings from shelving prior to cleaning and installation.
- **Do not clean with deionized water.**
- See the **Cleaning and Disinfecting** topic in the User Maintenance section (see page 31) for more information on how to clean the oven chamber prior to putting the unit into operation.

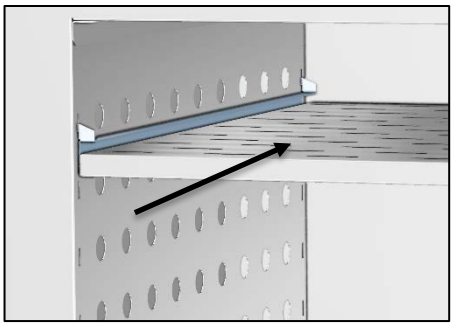
## INSTALL THE SHELVING

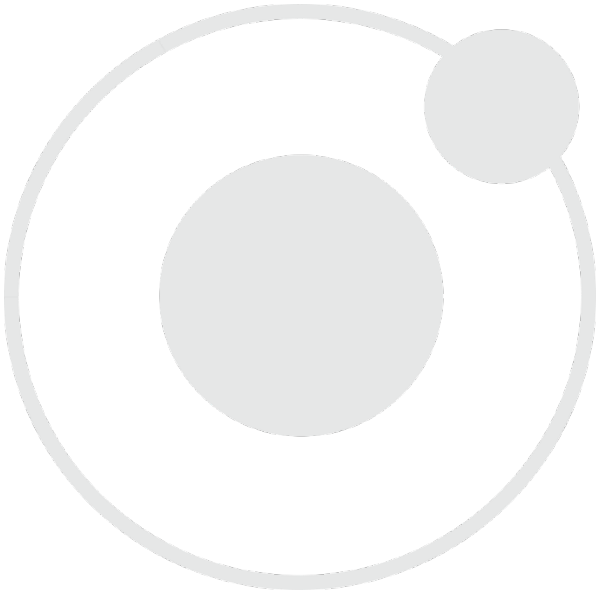
The horizontal airflow moves from to left in the oven chamber. Place the shelves so they do not obstruct the air duct holes on the left or right in order to maximize airflow across the shelf space.

1. Install shelf slide hangers on opposites sides of the oven by inserting the tabs of each slider into the chamber's mounting slots, then pushing down gently to secure the slider.



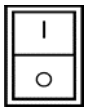
2. Hang the shelf from the two installed sliders.



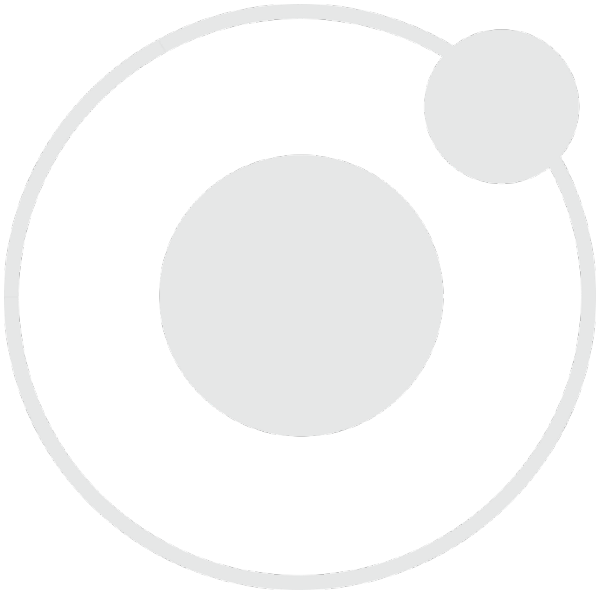


# GRAPHIC SYMBOLS

The oven is provided with multiple graphic symbols on its external and internal surfaces. The symbols identify hazards and the functions of the adjustable components, as well as important notes found in the user manual.

| Symbol | Definition |
|---|---|
|  | Consult the user manual.<br>Consulter le manuel d'utilisation |
|  | Indicates adjustable temperature<br>Indique température réglable |
|  | AC Power<br>Repère le courant alternatif |
|  | I/ON O/OFF<br>I indique que l'interrupteur est en position marche.<br>O indique que le commutateur est en position d'arrêt. |
|  | Protective earth ground<br>Terre électrique |
|  | Indicates UP and DOWN respectively<br>Touches d e déplacements respectifs vers le HAUT et le BA |
|  | Potential shock hazard<br>Risque de choc électrique |
|  | Recycle the unit. Do not dispose of in a landfill.<br>Reycle l'unité. Ne jetez pas dans une décharge. |
|  | Caution hot surface<br>Attention surface chaude |

# GRAPHIC SYMBOLS



# CONTROL PANEL OVERVIEW


### Power Switch

The self-illuminating main power switch controls all power to the oven and its systems. The switch must be in the ( I ) on position for the unit to function.


### Temperature Controller - Display on Homepage


**Top Line (Red): Present chamber air temperature**

**Middle Line (Green): The constant temperature set point**

**Bottom Line: Flashing “2” indicates active heating**

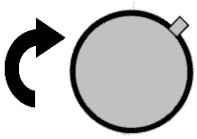
While on the Homepage, the **Up** and **Down arrow** buttons adjust the constant temperature set point. Pressing and holding both buttons jumps from the homepage to the Operations menu.

The green **Advance button** scrolls forward through menus and parameters lists when programming heating recipe profiles or performing a temperature calibration. On the homepage, it scrolls through operating parameters or profile start.

The gray **Reset button** scrolls the display back to the previous page or menu. Pressing the Reset button repeatedly returns the display to the homepage.

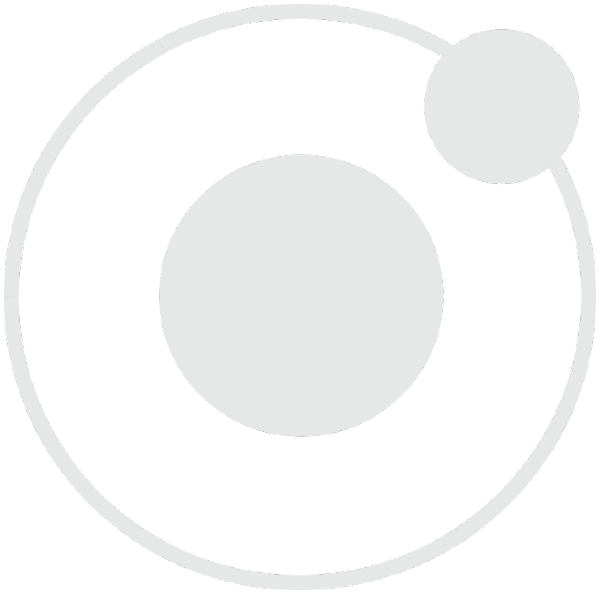

The **EZ1 button** quick launches Profile 1 or aborts any active heating profile.


The **Intake** and **Exhaust valve** controls open and closes the air flow vents on the top of the oven.



**Opening**

# CONTROL PANEL OVERVIEW



Safe operation of the oven is dependent on the actions and behavior of the oven operators. **Operating personnel must read and understand the Operating Precautions in this section prior to operating the oven.** The operators must follow these instructions to prevent injuries and to safeguard their health, environment, and the materials being treated in the oven, as well as to prevent damage to the oven. Failure to adhere to the Operating Precautions, deliberately or through error, is a hazardous behavior on the part of the operator.

Le fonctionnement sûr du four dépend des actions et du comportement des opérateurs du four. Le personnel d'exploitation doit lire et comprendre les consignes de sécurité et les précautions d'utilisation de cette section avant d'utiliser le four. Les opérateurs doivent suivre ces instructions pour prévenir les blessures et protéger leur santé, leur environnement et les matériaux traités dans le four, ainsi que pour éviter d'endommager le four. Le non-respect des consignes de sécurité et des précautions d'utilisation, délibérément ou par erreur, est un comportement dangereux de la part de l'opérateur.

## *OPERATING PRECAUTIONS*

- Do not use this oven in unsafe improper applications that produce flammable or combustible gasses, vapors, liquids, or fuel-air mixtures in quantities that can become potentially explosive.
- Outgassed byproducts may be hazardous to or noxious for operating personnel. Exhaust should be vented to a location outside the workspace in a safe manner in accordance with all applicable laws, ordinances, and regulations. Do not operate the oven in an unsafe area with noxious fumes.
- Do not use this oven for applications heating hazardous fibers or dust. These items can become airborne and come into contact with hot surfaces.
- Individual ovens are not rated to be explosion proof. Follow all building certification requirements and laws for Class I, II, or III locations as defined by the US National Electric Code.
- The bottom surface of the chamber should not be used as a work surface. It runs hotter than the shelf temperatures. Never place samples or product on the oven chamber floor.
- Do not place sealed or filled containers in the oven. These may burst open when heated.
- Do not place alcohol or mercury thermometers in the oven. These devices may rupture under heat or other improper uses.
- Do not move the oven until it has finished cooling.

**Warning**: The vent dampers may be hot to the touch. These areas are marked with Hot Surface labels. Proper PPE should be employed to minimize risk to burn.

**Avertissement**: Les clapets d'aération peuvent être chauds au toucher. Ces zones sont marqués avec des étiquettes de Surface chaude. Les EPI approprié devraient être employée pour réduire au minimum le risque de brûler.

## *THEORY OF OPERATIONS*

### Heating

When powered, the SMO High Performance oven heats the oven chamber atmosphere to the current constant temperature set point. The constant temperature set point, shown on the controller homepage, can be adjusted by the end-user using the temperature arrow controls on the oven control panel. The oven can also be programed with multi-step heating profile recipes. When launched, a profile overrides the constant temperature set point. The oven resumes heating to the constant temperature set point only after a profile terminates or is aborted.

The oven temperature controller stores 40 programmable heating profile recipe steps. The steps come allocated to 4 ten-step profiles, but successive profiles may be combined to run sequentially as one profile. Step types include timed-interval ramping (heating or cooling), soaking (constant temperature), and ending states. Please see the *Watlow EZ-Zone Profile Programing Guide* shipped with this oven for more details.

Along with storing set points and profile steps, the temperature controller monitors the oven chamber air temperature using a solid-state probe located in the airstream on the right wall of the chamber. When the processor detects that the chamber temperature has dropped below the currently active temperature set point, it pulses power to a heating element in a recirculation air duct space located above the oven chamber. The processor employs proportional-integral-derivative analytical feedback-loop functions when measuring and controlling the shelving temperature. PID-controlled heating pulse intensities and lengths are proportional to the difference between the measured shelf temperature and the current set point. The frequency of pulses is derived from the rate of change in that difference. The integral function slows the rate of pulses when the temperature nears the set point to avoid overshooting.

SMOHP ovens rely on natural heat radiation for cooling.

When the oven is powered, the chamber air temperature cannot operate below the ambient room temperature **plus** the internal waste heat of the oven. Waste heat is generated primarily by the operation of the blower fan motor and the resulting air compression in the duct spaces. In practice, the lowest operational chamber temperature is ambient +15°C.

The heating rates given in unit specification section of this manual are for a 25°C environment. The ambient temperature of the workspace around the oven affects its heating and cooling performance.

### Air Circulation

The SMOHP continually circulates air internally while powered in order to maintain temperature uniformity and stability in the oven chamber and to speed drying rates. Air is forced through vent holes on the right side of the chamber, blows across the shelf space, and is then pulled into a duct that makes up the left chamber wall. From there, the air is drawn upward into a heating duct by the action of the blower fan. The oven is intended to be run as a closed air-cycle system.

### Vents – Intake and Exhaust

The oven is provided with an intake vent and exhaust vent that may be opened or closed using dampener slides located on the vents. The dampeners are intended to be opened **after** the heat treatment or bake out phases of an application are complete. Opening the dampener vents during the treatment or bake out may speed the rate of material drying, depending on the nature of the sample material, outgassed byproducts, and ambient conditions. However, running the oven with the dampeners open introduces a significant flow of cool air into the chamber while allowing heated air to exit. This will impact the temperature uniformity and stability of the chamber and lower the operational temperature ceiling.

## Accessory Power Exhaust Outlet

SMOHP ovens come with an external outlet intended to power an accessory exhaust blower attached to the oven exhaust vent. The outlet and blower are either activated by the temperature controller as part of a heating recipe profile or can be manually activated from the homepage options when the oven is running a constant temperature set point. The intended application of the power exhaust fan is to positively vent exhaust out of the workspace around the oven. The standard receptacle is a 240 volt, North American 6-20R.

A blower exhaust fan must be purchased separately from the oven.

The operation of the fan affects the oven chamber temperature, lowering the temperature ceiling significantly by boosting the rate that cooler outside air is brought in.

### High Limit Control System

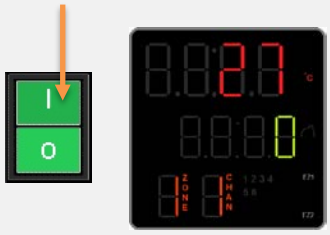
The temperature controller contains a heating cutoff system with independent circuitry connected to a redundant solid state temperature sensor probe inside the oven chamber. This high limit system depowers the oven heating elements whenever the chamber air temperature exceeds to the current limit setting. This safeguards samples or product in the oven chamber in the event of a failure of the main temperature control circuitry or main temperature sensor probe.

The high limit is set by the end-user to a minimum of 5˚C above the highest temperature of the application process the oven is currently being used for. Failure to set the high limit control system voids the oven manufacturing defect warranty in the event of an overtemperature event.

## *PUT THE OVEN INTO OPERATION*

Carry out the following steps and procedures to put the oven into operation after installing it in a new workspace environment.

1




Place the oven **Power Switch** in the on ( I ) position.

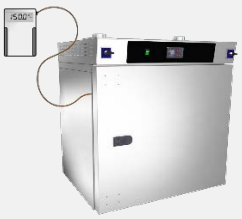
The controller display will illuminate, show the current firmware revision number, and then default to the homepage.

2

Carry out the following procedures found in the Operation section:

- **Set the Temperature High Limit** for your application, page 27.
- **Optional:** After setting the High Limit, you may set the constant temperature set point to a warm-up temperature or to your constant temperature baking set point. Read **Set the Constant Temperature Set Point**, page 28.
- Read the Programing Profile Guide that came with the unit if will you will be programming multi-step automated heating recipes to run the oven with.

3



**Optional**: If you are required to validate or verify the accuracy of the temperature display for regulatory or industry standards compliance, perform the Set Up andthe first step of the **Calibrate the Temperature Display procedure** in the User Maintenance chapter. See page 34.

End of Put the Oven into Operation

## *SET THE HIGH TEMPERATURE LIMIT*

**Note:** Test the high limit system once per year for functionality.

The high temperature limit is set by the end-user, typically at 5°C above the highest temperature the oven will run at during your recipe profile or constant-temperature application.

**1. Advance to the Limit High Set Point, starting from the Homepage**

Push Advance Multiple Times

Limit High Option

- Push the Advance button until “Lh.S1” (Limit High Set Point) shows in the green mid-level display line

**2. Adjust the high limit to at least 5°C above the highest temperature of your application**

Adjust

**Note**: If you are just checking the present high temperature limit setting, push the Reset button to exit the High Set Point menu and return to the homepage without saving any changes.

**3. Save the new Limit High Setting**

Push

- The top display (red) will show “SAFE”, indicating that the temperature limit has been saved

**4. Return to the Homepage**


Push Reset

- Returned to Homepage

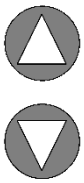
End of Procedure



SHEL LAB®

## *SETTING THE CONSTANT TEMPERATURE SET POINT*

**1. Adjust the constant temperature set point on the home page**



Adjust



- Do not exceed the high limit temperature set point.

**Note**: Holding down an arrow button will cause the temperature to advance in increments of ten (10).

**2. Release the Arrow buttons after adjusting the Set Point**


Oven Heating

- There may be a brief pause as the oven controller calculates the optimum power usage to achieve the set point starting from the current oven chamber temperature.
- A small illuminated 2 near the bottom of the display indicates the temperature controller is calling for heat.

## *HEATING PROFILE RECIPES*

Please see the *Programing Guide – Watlow EZ-Zone Controller Heating Profiles* document for instructions on how to program automated heating recipe profiles. The illustrated guide comes included with the oven and provides explanations for all major heating profile functions and programming steps.

## *High Temperature Limit Active Alert*

If the oven chamber temperature exceeds the present high temperature limit setting, the limit system will depower the heating element. This is accompanied by a loud “click.” The controller display will flash two alternating alert screen, fail and the homepage with the set point set to off. An illuminated “4” on the bottom-most display block indicates that the high limit circuitry has depowered the heating element.

**Alternating HTL Alert Screens**

The high temperature limit activates if one of three events happens.

- The high limit is set below or near the currently active temperature set point.
- An outside temperature source or a heat source in the oven chamber is pushing the oven temperature above the limit setting.
- The main controller circuitry or sensor probe have failed and must be replaced in order to maintain safe oven operations.

In the case of the latter two causes, the red oven chamber temperature will be higher than the green set point. If you suspect an ignition event in the oven chamber or hardware failure, **turn off the oven and wait for the oven to cool to room temperature before opening chamber door.** Contact **Technical Support** for assistance.

### Restoring Heating

Perform the following steps to take the unit out of the protective heating cutoff once it is safe to do so:

1. Push the green Advance button until Ignore “i9nr” shows in the top display and Limit High “Lih1” in the green display.

1. Push the Advance button again.

- Limit High Set Point “LhS1” will now show in the green display, and the High Limit temperature setting in the red top display. The display will resume alternating until you begin adjusting the limit setting.

2. Adjust the limit setting to +5°C above the application set point using the Up Arrow button.
    a. If the Limit was already set +5°C above the set point, raise the Limit to 6 or 7 degrees. Ambient temperature stability issues may be briefly pushing the chamber temperature over the +5°C limit.


3. Push the Reset button to save the new setting and return to the homepage.

4. Monitor the oven to see if the high limit trips with the new, higher setting.
    a. Contact Technical Support if the high limit continues to cutoff heating to the oven chamber.

## *Positive Exhaust Venting*

Exhaust ducting can be connected to the oven exhaust port in order to channel or positively vent exhaust away from the oven workspace. The duct should not extend straight up from the oven but should include a steep bend sufficient to stop condensation in the ducting from sliding down into the oven.

## *Power Exhaust Blower*

SHEL LAB offers an accessory forced-air power exhasut intended to mount directly on the exhaust vent and powered by the oven. The exhaust blower is activated either as part of a heating recipe profile step or can be activated manually from the homepage Options menu while running a constant temperature set point.

**Warning**: Exposure to sustained oven chamber temperatures above 80°C will damage the exhaust blower. Leave the oven exhaust vent dampener closed to protect the blower when attached, and only open when it is time to actively vent the oven chamber.

The exhaust is intended for use after a heat application. The operation of the power exhaust will significantly impact the oven chamber temperature.

### Mounting the Power Exhaust

1. Remove the 8 screws on the cover of the exhaust vent assembly on the top of the oven.
    a. Leave the assembly in place.
2. Mount the power exhaust blower on the exhaust vent cover assembly
    a. The open side of the blower mounting body should fit over the sliding damper.
    b. Align the blower and the assembly screw holes.
3. Reinstall the 8 screws to secure the blower and vent assembly.

4. Plug in the power exhaust into the 220 - 240 volt receptacle on the back of the oven.

### Turning on the Power Exhaust – Constant Temperature Set Point


x8

1. Advance to the homepage Event parameter.
    a. Starting on the homepage, press the Advance button 8 times Until the green mid-line reads “Ent 1”.


2. Turn on the blower.

    a. Use the Up or Down arrow button to change the red top-line display from off to on.
    - The blower power outlet will turn on after approximately 2 seconds, indicated by the Red “3” light



3. Press the Reset button to return to the homepage.
4. To turn off the blower, advance to the Event parameter again and change the setting from on to off.

**Warning**: Prior to maintenance or service on this unit, disconnect the power feed from the power supply.

**Avertissement**: Avant d'effectuer toute maintenance ou entretien de cet appareil, débrancher le cordon secteur de la source d'alimentation.

## *CLEANING AND DISINFECTING*

If a hazardous material or substance has spilled in the unit, immediately initiate your site's Hazardous Material Spill Containment protocol. Contact your local Site Safety Officer and follow instructions per the site policy and procedures.

- The unit chamber should be cleaned prior to first use.
- Periodic cleaning is required.
- Do not use spray on cleaners or disinfectants. These can leak through openings and coat electrical components.
- Consult with the manufacturer or their agent if you have any doubts about the compatibility of decontamination or cleaning agents with the parts of the equipment or with the material contained in it.
- Do not use cleaners or disinfectants that contain solvents capable of harming paint coatings or stainless steel surfaces. **Do not use chlorine-based bleaches or abrasives; these will damage the chamber liner.**

**Warning**: Exercise caution if cleaning the unit with alcohol or flammable cleaners. Always allow the unit to cool down to room temperature prior to cleaning and make sure all cleaning agents have evaporated or otherwise been completely removed prior to putting the unit back into service.

**Avertissement:** Soyez prudent lorsque vous nettoyez l'appareil avec de l'alcool ou des produits de nettoyage inflammables. Laissez toujours refroidir l'appareil à la température ambiante avant le nettoyage et assurez-vous que tous les produits de nettoyage se sont évaporés ou ont été complètement enlevés avant de remettre l'appareil en service.

### Cleaning

1. Disconnect the unit from its power supply.
2. Remove all removable interior components such as shelving and accessories.
3. Clean the unit with a mild soap and water solution, including all corners.
    - **Do not use an abrasive cleaner**, these will damage metal surfaces.
    - **Do not use deionized water to rinse or clean with!**
    - Take special care when cleaning around the temperature sensor probes in the chamber to prevent damage. Do not clean the probes.
4. Rinse with distilled water and wipe dry with a soft cloth.

**Disinfecting**

Disinfect the oven if algae, mold, bacteria, or other biological contaminants are an issue. For maximum effectiveness, disinfection procedures are typically performed after cleaning.

Keep the following points in mind when disinfecting the oven:

- Turn off and unplug the unit to safeguard against electrical hazards.
- Disinfect the oven chamber using commercially available disinfectants that are non-corrosive, non-abrasive, and suitable for use on stainless steel and glass surfaces. Contact your local Site Safety Officer for detailed information on which disinfectants are compatible with your applications.
- If permitted by your protocol, remove all removable interior accessories (shelving and other non-attached items) from the chamber when disinfecting.
- Disinfect all surfaces in the chamber, making sure to thoroughly disinfect the corners. Exercise care to avoid damaging the sensor probes.
- When disinfecting external surfaces, use disinfectants that will not damage painted metal, glass, and plastic.

## *Door Gaskets and Chamber Integrity*

Periodically, inspect the door latch, trim, catch, and gasket for signs of deterioration. Failure to maintain the integrity of the door system shortens the life span of the oven.

The High-Performance Oven series uses silicon-rubber gaskets. The only tool required for swapping out these gaskets is a cutting implement for tailoring the length of the new gasket.

## *Electrical Components*

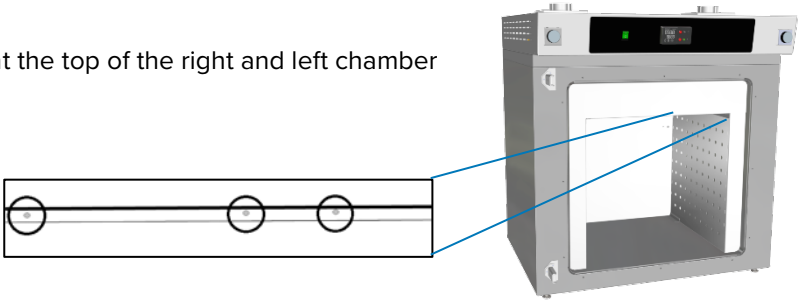
Electrical components do not require maintenance. If the oven fails to operate as specified, please contact your SHEL LAB distributor or Technical Support for assistance.

## *REMOVING THE CHAMBER LINER*

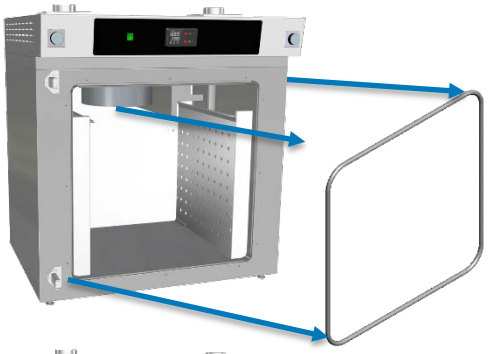
This procedure removes the ceiling liner and the side wall air ducts. The liner and ducts should be removed periodically and cleaned, and the surfaces beneath them cleaned.

***Note**: Door removed in illustrations for clarity. Do not remove the door from the oven.*

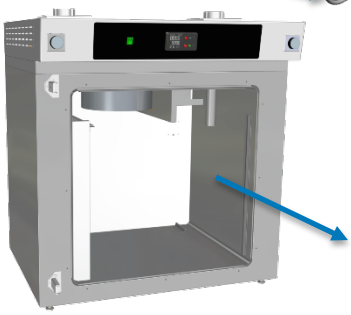
1. Remove all shelves and shelf sliders from the oven.



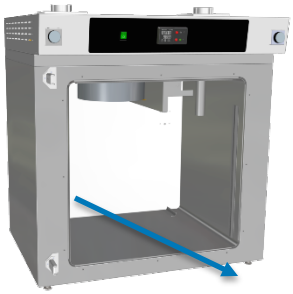
2. Unscrew the nuts located at the top of the right and left chamber walls.



3. Remove the chamber gasket so that there is room to pull the ceiling liner out through the door space. The gasket may be fully or partially removed.
4. Remove the chamber ceiling liner by pulling it out through the oven door space. The liner may require some side-to-side motion to free up.



5. Remove the right wall air duct by pulling it out through the door space.



6. Remove the left wall air duct by pulling it out through the door.

## *CALIBRATING THE TEMPERATURE DISPLAY*

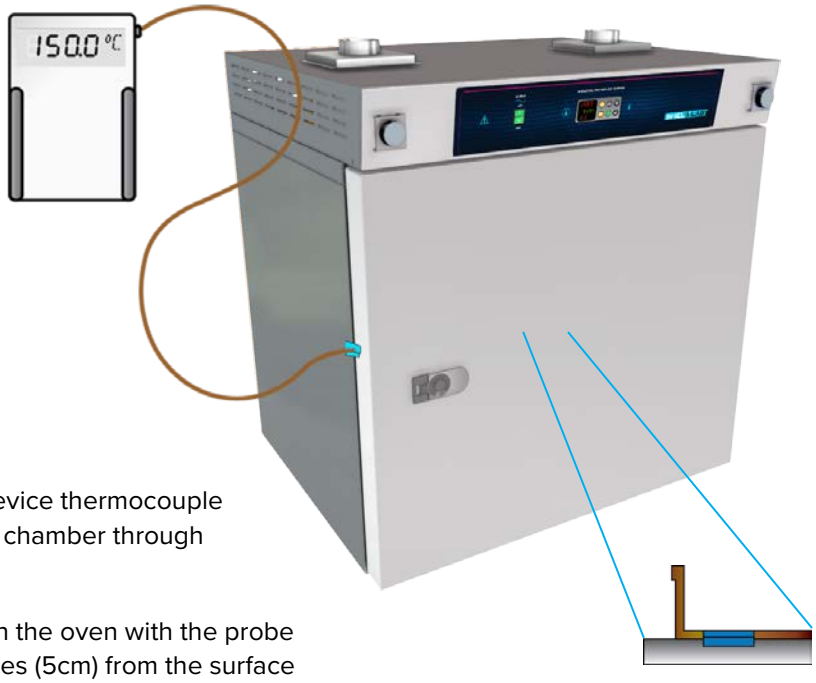
**Note:** Performing an accurate calibration of the temperature display requires a temperature reference device. Please see the **Reference Sensor Devices entry** on page 7 for the minimum device requirements.

Temperature calibrations match the temperature display to the actual air temperature inside the oven chamber. The actual air temperature is supplied by a reference sensor device. Calibrations compensate for software drifts in the controller as well as deviations caused by the natural material evolution of the sensor probe in the heated chamber space. Calibrate as often as required by your laboratory or production protocol, or regulatory compliance schedule. Always calibrate to the industry or regulatory standards required for your application.

**A Suggested Calibration Set Up**

**Heat-resistant non-stick tape recommended**

**4)** The intake and exhaust vents should **both** be closed to ensure an accurate calibration




**1.** Introduce the reference device thermocouple sensor probes into the oven chamber through through the door pace.

**2.** Place the sesnor probes in the oven with the probe heads at least at least 2 inches (5cm) from the surface of the shelving or walls to prevent heatsinking. Secure with non-stick, heat-resistant tape.

If using a single thermocouple, place the sensor probe head as close to the geometric center of the oven chamber as possible.

**3.** The oven chamber door must be closed and latched.

**5 ) Heat up and stabilization period**: The oven temperature must be stable at temperature in order to perform an accurate calibration. The temperature is considered stabilized when the oven chamber has operated at your calibration temperature for at least 30 minutes with no fluctuations **greater than ±0.2°C**.

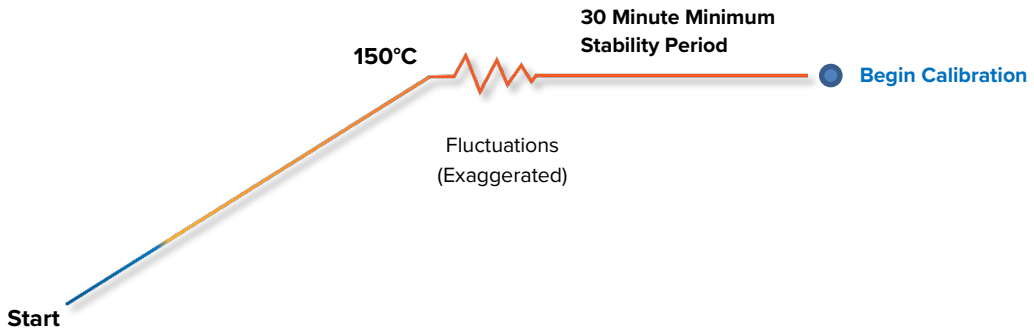



**Figure 2: Oven Chamber Heat Up and Stabilization Phases**

**Suggested Calibration Procedure**

**1**

Once the chamber has stabilized, compare the reference temperature device and chamber temperature display readings.

a. If the readings are the same, or the difference between the two falls within the acceptable range of your protocol, the display is accurately showing the chamber temperature. **The Temperature Calibration procedure is now complete**.

**-Or-**

b. See Step 2 if a difference falls outside the acceptable range of your protocol.


**2**

The display requires a calibration adjustment.

- The difference between the reference device and the display is an **offset value**.
- Examples of offset values:

| Reference Sensor Reading | Oven Temp. Display | Offset Value |
|---|---|---|
| 152.0°C | 150°C | 2 |
| 149.1°C | 150°C | -0.9 |
| 148.0°C | 150°C | -2 |

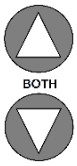

- **Note the offset value for use in Step 5.**

Continued next page

**Calibration continued**

**3**

Jump to the Operations menu.




a. Press and hold both the **Up** and **Down** Arrow buttons simultaneously for approximately 5 seconds.

b. Release the buttons when “A1” appears on the top display line and “oPEr” appears in the mid display line.

Operations Menu

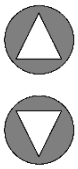
**4**

Advance through the Operations menu options to the Temperature Calibration offset parameter.


x2

a. Push the green **Advance button** repeatedly unit “i.CA” appears in the green mid display line and a number value in the red top line.


**5**



Adjust the number value in the top display line to match the offset value from step 2, using the arrow buttons.


**6**

Save the calibration offset and return to the homepage.

x3

a. Push the Reset button three times so the display shows the homepage.

- The oven will begin to heat or passively cool to reach the current set point using the offset display value for the current temperature.


Continued next page

**Calibration continued**

**7**

Allow the oven to stabilize after achieving the temperature set point using the offset display value.

**Note:** The unit is stabilized when no fluctuations of **±0.2°C or greater** are detected.


**8**

Once the chamber has stabilized, compare the reference temperature device and oven temperature display readings.

a. If the readings are the same or the difference between the two falls within the acceptable range of your protocol, the display is accurately showing the chamber temperature. **The calibration procedure is now complete**.

**-OR-**

b. Advance to the next step if the difference falls outside the acceptable range of your protocol again.



**9**

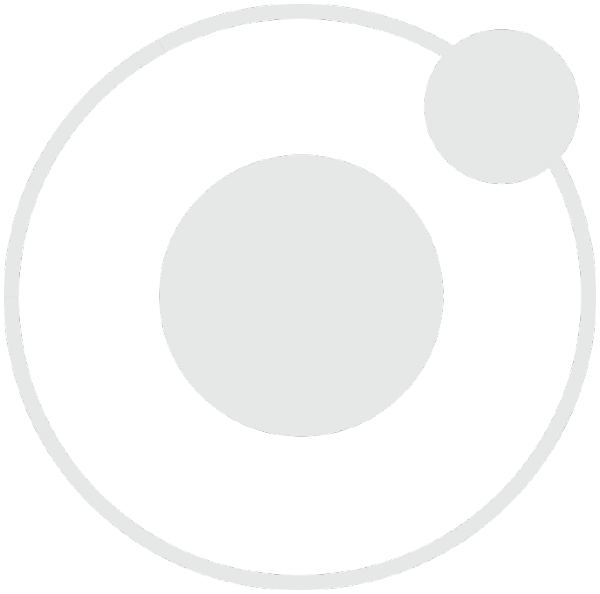
Repeat steps 2 - 8 up to two more times.

- Three calibration attempts may be required to successfully calibrate ovens that are more than ± 2°C out of calibration.



If the temperature reading difference still falls outside your protocol after three calibration attempts, contact your distributor or **Technical Support** for assistance.

End of procedure



# UNIT SPECIFICATIONS

The SMO5HP-2 is a 220 - 240 voltage unit. Please refer to the oven's data plate for individual electrical specifications.

Technical data specified applies to ovens with standard equipment at an ambient temperature of 25°C and a voltage fluctuation of ±10%. The temperatures specified are determined in accordance to factory standard following DIN 12880 respecting the recommended wall clearances of 10% of the height, width, and depth of the inner chamber. All indications are average values, typical for units produced in the series. We reserve the right to alter technical specifications at all times.

## *WEIGHT*

| Shipping | Net Weight |
|---|---|
| 412 lbs / 187 kg | 325.0 lbs / 147.0 kg |

## *DIMENSIONS*

By Inches

| Exterior W × D × H | Interior W × D × H |
|---|---|
| 35.0 x 30.0 x 37.6 | 20.5 x 20.7 x 20.0 |

By millimeters

| Exterior W × D × H | Interior W × D × H |
|---|---|
| 889 x 747 x 955 | 520 x 527 x 508 |

## *CAPACITY*

| Cubic Feet | Liters |
|---|---|
| 4.9 | 139.0 |

## *SHELF CAPACITY BY WEIGHT*

| Pounds | Kilograms |
|---|---|
| 50.0 lbs. per shelf | 22.7 kg per shelf |

## *TEMPERATURE*

| Range | Stability |
|---|---|
| Ambient + 20 to 306°C | ±0.3°C at 150°C |

**Uniformity**

| @80°C | @150°C | @306°C |
|---|---|---|
| ± 1.0°C | ± 2.0°C | ± 3.5°C |

**Time to Temperature:** From an ambient temperature of 20°C.

| Heat Up Time to 80°C | Heat Up Time to 150°C | Heat Up to 306°C |
|---|---|---|
| 10 minutes | 22 minutes | 35 minutes |

**Recovery Time:** From a 30-second door opening.

| Recovery to 80°C | Recovery to 150°C | Recovery to 306°C |
|---|---|---|
| 4 minutes | 5 minutes | 5 minutes |

**Recovery Time:** From a 60-second door opening.

| Recovery to 80°C | Recovery to 150°C | Recovery to 306°C |
|---|---|---|
| 5.5 minutes | 6.5 minutes | 7.5 minutes |

## *AIRFLOW PERFORMANCE*

**Ventilation Rates**

| Cubic Feet per Minute @80°C | Liters per Minute @80°C |
|---|---|
| 7.6 | 215 |

| Air Changes per Hour |
|---|
| 93 |

**Air Velocity Across Shelf Space**

| Linear Feet per Minute | Meters per Minute |
|---|---|
| 145 | 44.2 |

## *POWER*

| AC Voltage | Amperage | Frequency |
|---|---|---|
| 220 - 240 | 12 | 50/60 Hz |

# REPLACEMENT PARTS

| Description | Parts Number | Description | Parts Number |
|---|---|---|---|
| Adjustable Foot |  **2700512** | Fuse, Accessory Outlet, 2 Amps, 250V, 5x20mm. Requires 2 fuses. |  **3300502** |
| Chamber Gasket Silicone (unit of sales is per foot, requires 11 feet) |  **3450546** | Shelf Slide |  **5121189** |
| Door Gasket SMO5HP-2 Silicone (unit of sales is per foot, requires 11 feet) |  **3450587** | Shelf SMO5HP-2 |  **5121195** |
| Fuse, Oven, 20 Amp Slow Blow, 240V, 5x20mm. Requires 2 fuses. |  **3300538** | **Optional:** Power Exhaust Blower Unit 220 - 240 Volt |  **9990741** |

### Ordering Parts and Consumables

If you have the Part Number for an item, you may order it directly from Sheldon Manufacturing by calling 1-800-322-4897 extension 3. If you are uncertain that you have the correct Part Number, or if you need that specific item, please contact Sheldon Technical Support for help at 1-800-322-4897 extension 4 or (503) 640-3000. Please have the **model number** and **serial number** of the oven ready, as Tech Support will need this information to match your unit with its correct part.

SHEL LAB®

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