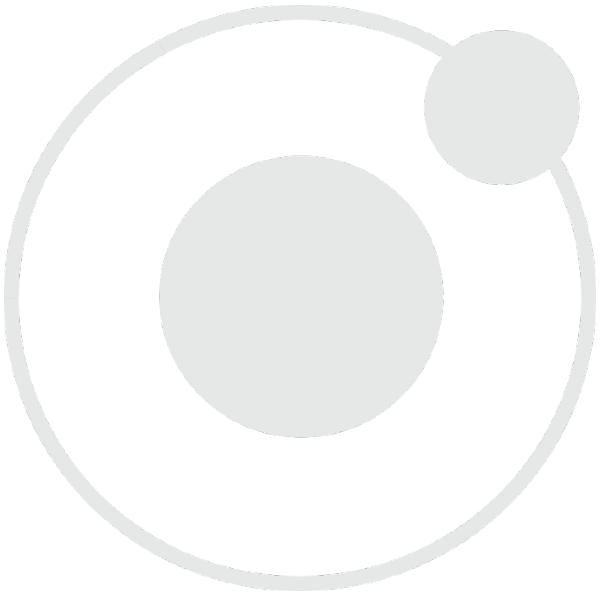
FORCED AIR OVENS 110 - 120 Voltage

SHEL LAB®

Installation - Operation Manual

SMO1 SMO3 SMO5



SHEL LAB SMO Forced Air Ovens, 110 - 120 Voltage

Part Number (Manual): 4861725

Revision: January 30, 2018

Pictured on Cover: Left to right, SMO1, SMO3, SMO5

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/U2:2016-04
CAN/CSA-C22.2 No. 61010-2-010:2015
UL 61010-1:2012/R:2016-04
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.

Intended Applications and Locations

SMO 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.

- The unit is designed to connect to a power source using the specific power cord type shipped with the unit.
- Always plug the unit power cord into a protective earth grounded electrical outlet conforming to national and local electrical codes. If the unit is not grounded properly, parts such as knobs and controls can conduct electricity and cause serious injury.
- Do not bend the power cord excessively, step on it, or place heavy objects on it.
- A damaged cord can be a shock or fire hazard. Never use a power cord if it is damaged or altered in any way.
- Use only approved accessories. Do not modify system components. Any alterations or modifications to your oven can be dangerous and 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 14).

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, Inc. 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

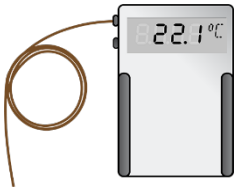
Must be purchased separately

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

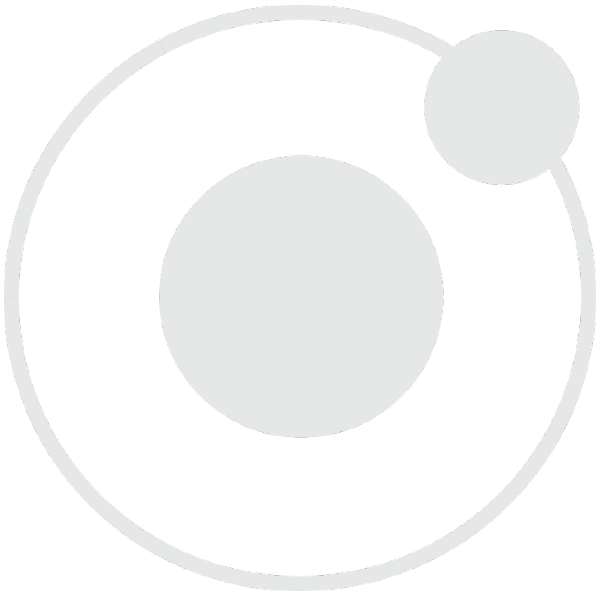
Use a digital device with wire thermocouple probes that can be introduced into the oven chamber through the unit access port. Select thermocouples suitable for the application temperature you will be calibrating at.

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.



INSPECT THE SHIPMENT

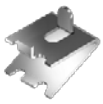
- When a unit leaves the factory, **safe delivery becomes the responsibility of the carrier**.
- Damage sustained during transit is not covered by the manufacturing defect warranty.
- Save the shipping carton until you are certain the unit and its accessories function properly.

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.
5. Verify that the correct number of accessories have been included.

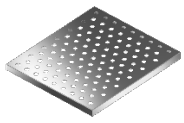
Included Accessories:

Model	Shelves	Shelf Clips	Leveling Feet	Power Cord
SMO1	2	8	4	1
SMO3	2	8	4	1
SMO5	2	8	4	1



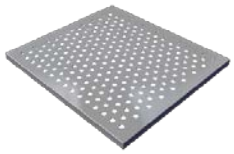
Shelves

SMO1



SMO3

SMO5



A high-temperature access port stopper ships installed in the port located on the back of the oven.

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

ORIENTATION PHOTOS

Figure 1: SMO5

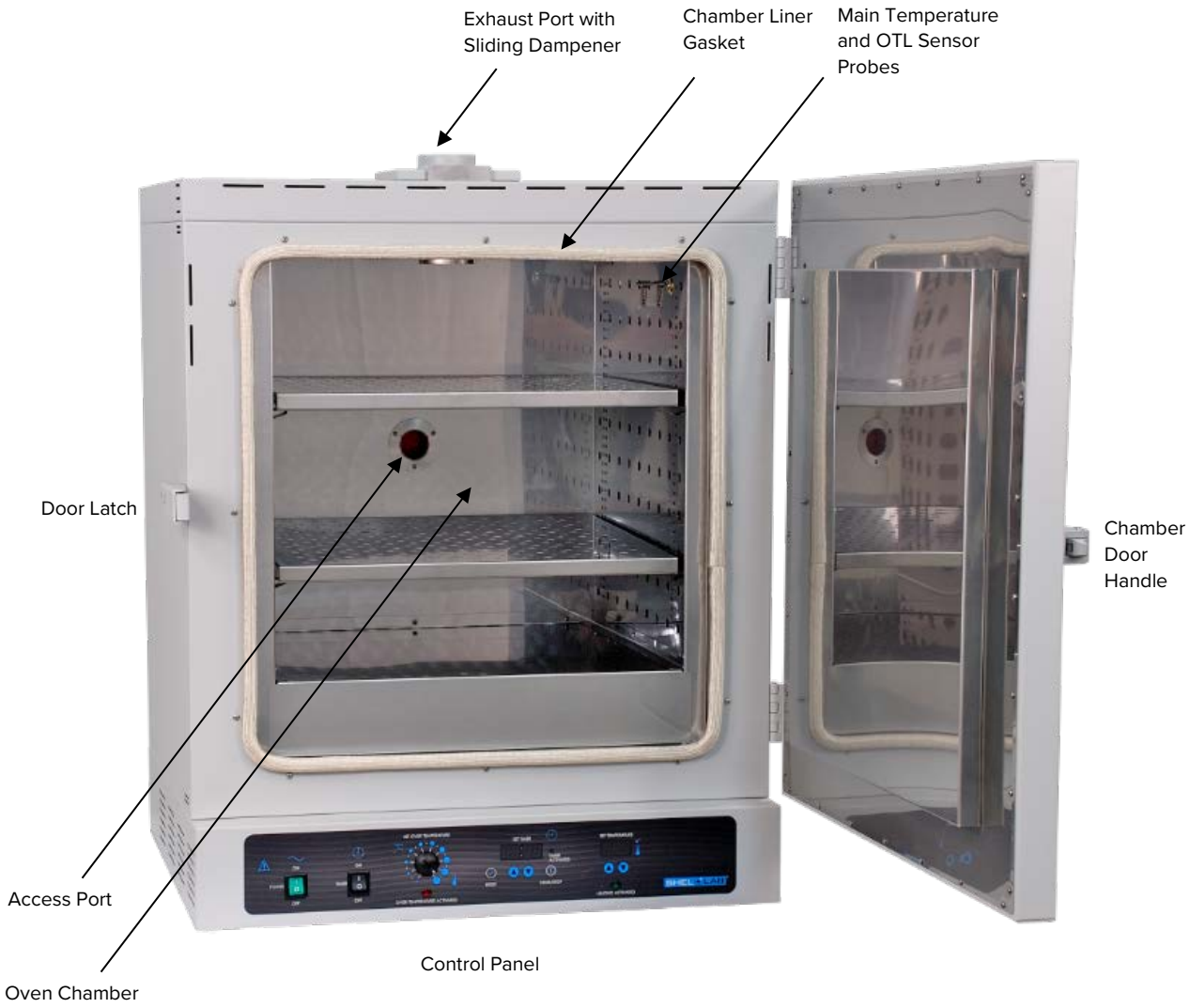


Figure 2: SMO3

Figure 3: SMO1

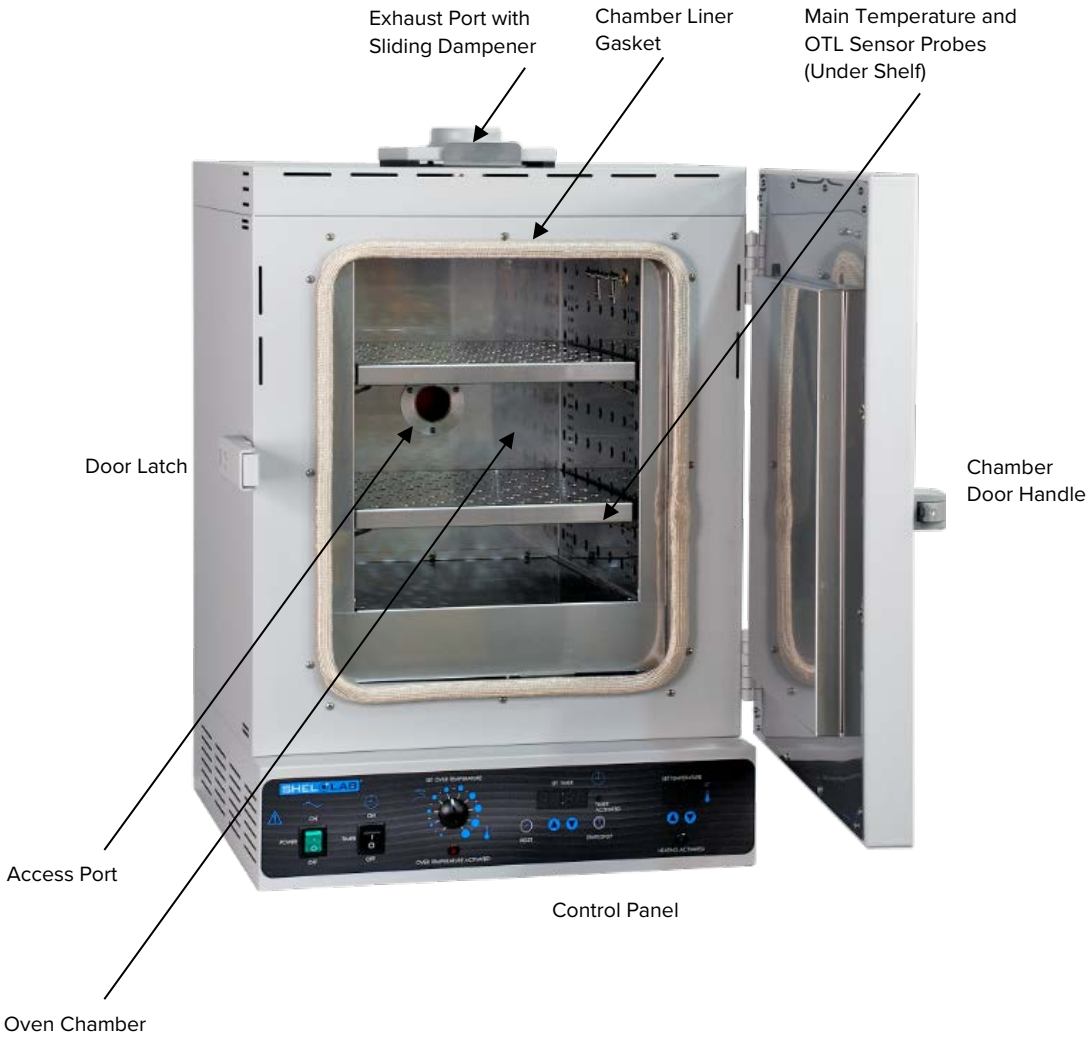


Figure 4: Unit Back

RECORD DATA PLATE INFORMATION

Locate the data plate on the back of the oven above 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	

INSTALLATION PROCEDURE CHECKLIST

Pre-Installation

✓ Check that the required ambient conditions for the oven are met, page 16.

- Unit dimensions may be found on page 40

✓ Check that the required ventilation and spacing requirements are met, page 16.

✓ Check for performance-disrupting heat and cold sources in the environment, page 17

✓ Check that a suitable electrical outlet and power supply is present, page 17

Install the Oven in a suitable workspace location

✓ Review the lifting and handling instructions, page 18

✓ Install the oven in its workspace location, page 18

✓ Make sure the oven is level, page 18

Set up the Oven for use

✓ Clean the oven chamber and shelving if needed, page 18

✓ Install the shelving in the oven chamber, page 19

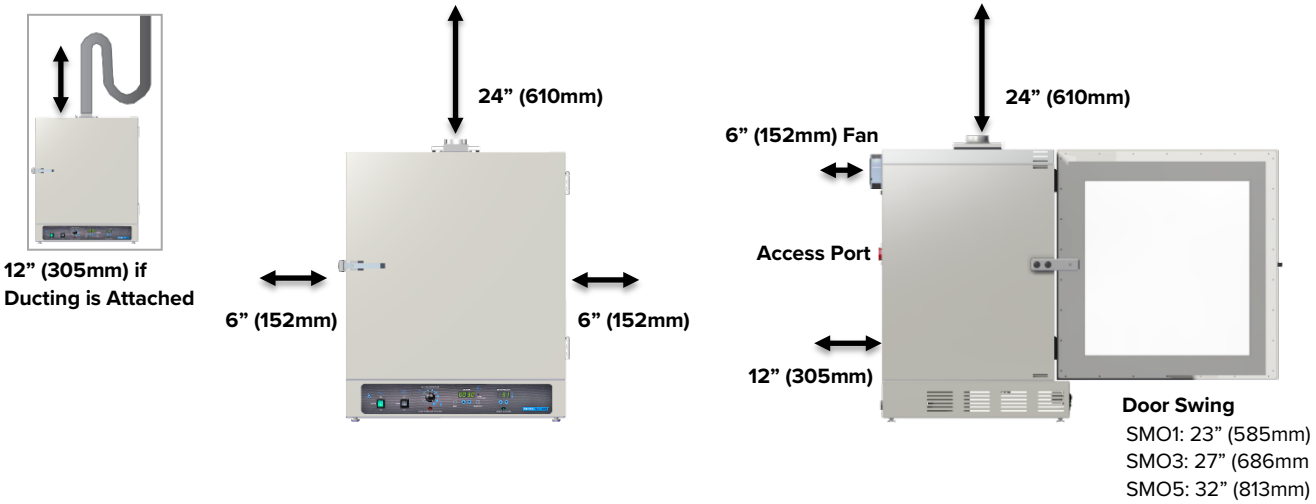
✓ Verify the stopper is installed in the access port on the outside of the oven, page 19

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



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.
- 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.
- The chamber access port is located on the back of the oven. Leave sufficient room for easy access if oven operators will be using the port.

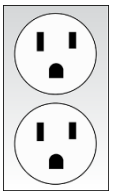
Environmental Disruption Sources

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 unit, verify that each of the following requirements is satisfied:



Power Source: The wall power outlet must meet the power requirements listed on the unit data plate. These units are intended for **110 – 120 VAC 50/60 Hz** applications at the following amperages:

SMO1 **12.0 Amps**; SMO3 **14.0 Amps**; SMO5 **14.0 Amps**

- Wall power sources must be **protective earth grounded** and **single phase**.
- Wall power sources 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 unit may result if supplied voltage varies more than 10%.
- **The recommended wall circuit breakers for these units are 15 amps.**
- Use a separate circuit to prevent loss of product due to overloading or circuit failure. The circuit must match or exceed the amperage requirement listed on the unit the data plate.

Power Cord: The unit comes provided with a 125 volt, 15Amp, 9ft 5 in (2.86m) NEMA 5-15P power cord.

- The unit must be positioned so that all end-users can quickly unplug the oven in the event of an emergency.

Fuse: Each oven ships with a 16 amp 250V 5x20mm fuse installed in the power cord inlet.

- The fuse must be installed and intact for the unit to operate.
- Always find and fix the cause of a blown fuse prior to putting the unit back into operation.

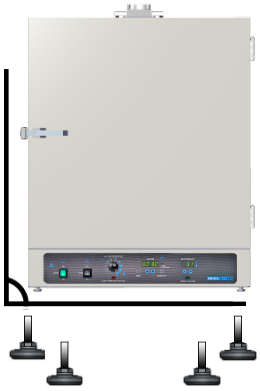
LIFTING AND HANDLING

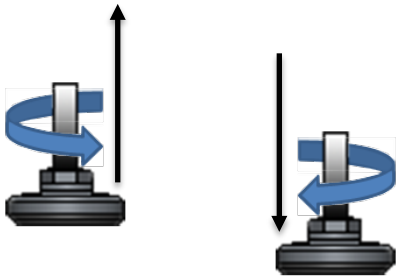
The oven is heavy. Use appropriate lifting devices that are sufficiently rated for these loads. Follow these guidelines when lifting the oven:

- 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 lock doors 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.

INSTALLATION CLEANING

The unit was cleaned at the factory, but not sterilized. It may have been exposed to contaminants en route during shipping. See the **Cleaning and Disinfecting** topic in the User Maintenance section (see page 35) for more information on how to clean the oven chamber prior to putting the unit into operation.

- Remove all wrappings and coverings from shelving prior to cleaning and installation.

Shelving Installation

1. Install 4 clips for each shelf in the slots located on the sides of the chamber interior.
    a. Squeeze each clip.
    b. Insert the top tabs first, then the bottom tabs using a rocking motion.
2. Place the shelves on the clips.

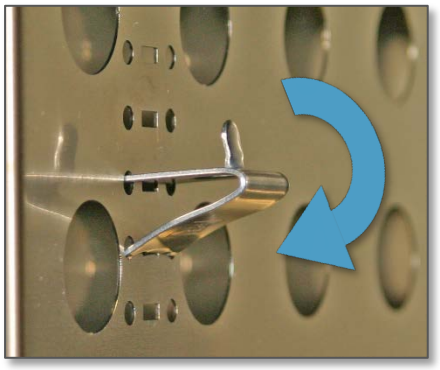


Figure 5: Install Clips

Figure 6: Place the Shelf

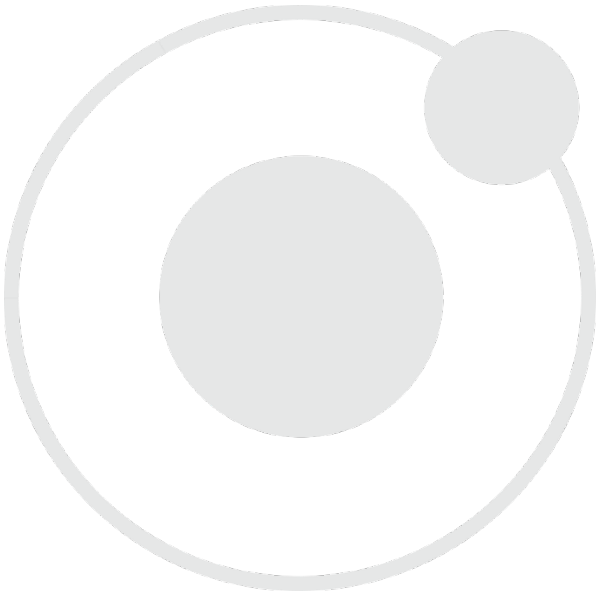
Access Port Stopper

Verify the port stopper is installed in the access port on the back of the unit. The oven will not meet its temperature performance specifications without the stopper installed.

The stopper must always be installed on the outside of the oven. Installing the stopper on the inside of the oven risks damaging the stopper.

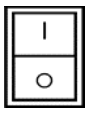
The intended use of the port is to introduce sensor probes into the oven chamber.

Figure 7: Port Stopper in Access Port



GRAPHIC SYMBOLS

The unit is provided with multiple graphic symbols on its exterior. The symbols identify hazards and the functions of the adjustable components, as well as important notes in the user manual.

Symbol	Definition
	Consult the user manual. Consulter le manuel d'utilisation
	Temperature display Indique l'affichage de la température
	Over Temperature Limit system Thermostat température limite contrôle haute
	AC Power Repère le courant alternatif
	I/ON O/OFF I indique que l'interrupteur est en position marche. O indique que le commutateur est en position d'arrêt.
	Protective earth ground Terre électrique
	Indicates UP and DOWN respectively Touches de déplacements respectifs vers le HAUT et le BA
	Manually adjustable Indique un réglage manuel
	Recycle the unit. Do not dispose of in a landfill. Recycler l'unité. Ne jetez pas dans une décharge.
	Caution hot surface Attention surface chaude

GRAPHIC SYMBOLS

Symbol	Definition
	Indicates the timer Indique le minuterie
	Start or Stop the Timer Lancer ou arrêter le minuteur
	Reset the Timer Réinitialisation de la Minuterie

CONTROL PANEL OVERVIEW

Figure 8: SMO3 SMO5 Control Panel

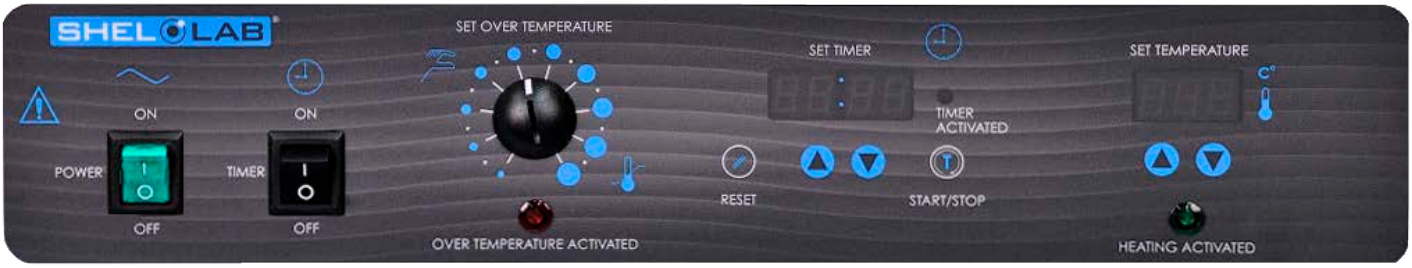


Figure 9: SMO1 Control Panel

Power Switch

The green Power Switch controls power to the oven and its systems. When in the ON (I) position, the switch illuminates and the oven will heat to and maintain the currently programmed temperature set point.

Timer Switch

The black Timer Switch controls power to the timer system. When this switch is in the ON position, the ovens ceases heating, the SET TIMER display illuminates, and the user may launch a timed, steady-state heating profile running at the current temperature set point. The oven **will not heat** while the Timer system is on unless a profile is launched.

Over Temperature Limit Control (OTL)

This graduated dial sets the temperature cutoff limit for the Over Temperature Limit system. The OTL is an independent mechanical heating cutoff that prevents unchecked heating of the oven in the event of a failure of the main temperature controller system. For more details, please see the explanation of the **Over Temperature Limit System** on page 27 in the Theory of Operation entry.

OTL Light

Marked OVER TEMPERATURE ACTIVATED, this light illuminates whenever the OTL System is routing power away from the heating elements. Under normal operating conditions this light should not illuminate.

CONTROL PANEL OVERVIEW

Timer Display and Control Pad

The SET TIMER display shows the duration of the currently programmed heating profile, or a flashing duration adjustment mode, or the countdown of an active profile to 0.

The "//" RESET button is used to place the Timer display in its adjustable duration mode, and then to scroll through the duration time parameters.

The SET TIMER arrow buttons adjust the heating profile duration time parameters when the display is in its duration adjustment mode.

The "T" START/STOP timer button launches a heating profile or pauses an active profile.

Temperature Display and Control

Marked SET TEMPERATURE, this display shows the current oven chamber air temperature accurate to within 1.0°C. The display can also show an adjustable temperature set point as well as an adjustable chamber temperature value while in calibration mode.

The arrow buttons can be used to adjust the temperature set point or put the unit into its calibration mode, and then enter a calibration offset value.

Heating Activated Light

The green light located beneath the label HEATING ACTIVATED illuminates whenever the oven elements are powered and heating the oven chamber. The oven uses measured pulses to achieve and maintain the temperature set point.

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 Safety Guidelines and Operating Cautions, 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 OPERATION

Heating

When powered, the SMO oven chamber heats to and then maintains the currently programmed temperature set point. The oven comes from the factory with a temperature set point of “OFF”. The set point may be adjusted by the end-user using the Set Temperature controls.

Heating is controlled by a microprocessor controller board that stores the temperature set point. The microprocessor senses the chamber air temperature via a solid-state probe located in the airstream on the right wall of the oven chamber. When the processor detects that the chamber temperature has dropped below the 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 chamber air temperature levels. PID-controlled heating pulse intensities and lengths are proportional to the difference between the measured chamber temperature and the current set point. The frequency of pulses is derived from the rate of change in the difference. The integral function slows the rate of pulses when the temperature nears the set point to avoid overshooting.

SMO ovens rely on natural heat radiation for cooling.

When the oven is powered, the chamber air temperature cannot go 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 temperature floor is **ambient +20°C**.

The oven depends on the operation of the blower fan to maintain temperature uniformity and stability in the chamber.

Air Circulation

The oven continually circulates air internally while powered. Air is forced through the small vent holes on the right side of the chamber, blows across the shelf space to the large holes on the left side, and is then pulled up into a heating and recirculation air duct by the action of the blower fan.

The oven is provided with a dampener vent that may be opened or closed using a dampener slide located on the oven top. **SMO forced air ovens must be run with the dampener closed in order to achieve the stated temperature performance specifications.**

The dampener is intended to speed drying or evaporation rates **after** the heated portion of an application is complete. Opening the dampener vent while the oven is running may speed the rate of material drying, depending on the nature of your application. However, it also introduces cool air into the chamber while allowing heated air to exit. This will likely impact the temperature performance of the oven.

Timed Heating Profile

The oven is provided with a Timer subsystem that, when set, runs the oven in a steady-state heating profile at the current temperature set point from 1 minute up to 99 hours, 59 minutes. Allow the oven to heat to temperature prior to launching a profile. Launching a profile with the temperature set point set to 150°C immediately after turning on the oven will result in the first several minutes of the profile spent with the chamber rising from room temperature to 150°C.

When the Timer system is on, **the oven will not heat** unless a profile of 1 minute or greater has been launched.

The Over Temperature Limit System (OTL)

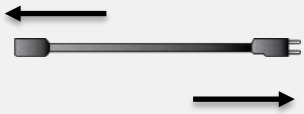
When set, the mechanical OTL heating cutoff system prevents runaway heating in the oven chamber. The OTL operates independently of the microprocessor and is provided with a separate, hydrostatic temperature sensor probe located in the oven chamber. In the event the chamber air temperature exceeds the current OTL setting, the OTL routes power away from the heating elements. The OTL will continue to prevent heating until the temperature drops below its limit setting. The Over Temperature Limit is set **by the end-user**, typically at approximately 5°C above the application temperature set point.

Note: The oven may produce light smoking during its first use above 150°C as the remnants of a protective oil coating burn off the heating element.

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.

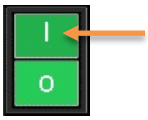
1
2



Attach the power cord that came with the unit to the power inlet receptacle on the back of the oven.

Plug the power cord into the workspace electrical supply outlet.

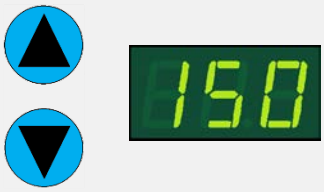
3



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

- The switch will illuminate.
- The Temperature display will illuminate.

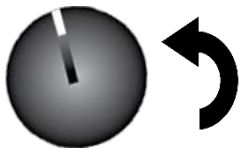
4



Set the Temperature the Set Point to your baking application temperature.

- See page 29

5



Set the Over Temperature Limit. See page 30.

The oven must be heated and stable at your application temperature to perform this procedure.

Optional: Set the oven timer duration.

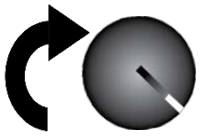
See page 31.

End of procedure

SET THE OVEN TEMPERATURE SET POINT

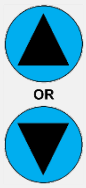
Adjust the oven temperature set point to that of your application.

1. Turn the OTL dial clockwise to its maximum position, if not already set to max.



- This prevents the heating cutoff system from interfering with this procedure.

2. Jump to the Temperature Set Point Adjustment mode



Press and hold either

Set Temperature

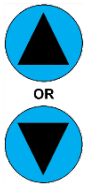
Set Point Adjustment Mode

Current Set Point

Note: The display will automatically exit the adjustment mode after 5 seconds of inactivity, with the last shown set point value saved.

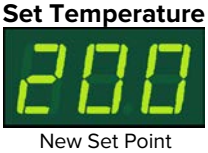
- The display will briefly flash the letters “SP” and then show the flashing, adjustable temperature set point.

3. Set the Temperature Set Point



Adjust

Set Temperature



New Set Point

4. Wait for 5 seconds after entering the Set Point

Wait 5 Seconds

Set Temperature

HEATING ACTIVATED

- The display will stop flashing. The set point is now saved in the controller.
- The oven will now automatically heat or passively cool to match the set point.
- The display will revert to showing the current chamber air temperature.

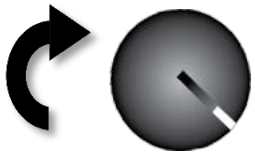
End of Procedure

SET THE OVER TEMPERATURE LIMIT

This procedure sets the Over Temperature Limit heating cutoff to approximately 5˚C above the current chamber temperature. Perform the steps when the oven has been running with no temperature fluctuations at your application temperature **for at least 30 minutes**.

Note: Test the OTL system at least once per year to verify its functionality.

1



The Set Over Temperature Limit dial must be set to the maximum clockwise position.

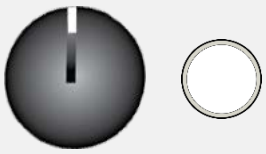
2

Turn the dial counterclockwise until the red Over Temp Limit Activated light illuminates.

3

Slowly turn the dial clockwise until the Over Temperature Limit Activated light turns off. Stop turning the dial.

4



Leave the OTL dial set slightly above the activation point.

- The OTL is now set to cut off heating if the chamber exceeds the current temperature by approximately 5˚C.

Optional: You may turn the dial slightly to the left to bracket in closer to the set point temperature. This sets the OT Limit nearer to the current chamber temperature.

If the OTL sporadically activates after setting the control, turn the dial very slightly to the right (clockwise).

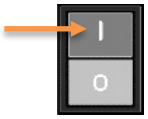
The Over Temperature Limit System activates when the oven chamber air temperature exceeds the setting of the OTL System. If the oven microprocessor controller has failed, or the OTL is set below your chosen temperature set point, the OTL alarm indicator will turn on and off indefinitely as the OTL depowers the heating elements each time the temperature exceeds the cutoff limit. If this is happening, repeat steps 1 - 3 to verify that the OTL is set **above** the temperature set point. Contact technical support or your distributor if the OTL continues to activate.

End of procedure

SETTING THE TIMER

This procedure enters a heating profile duration in the Timer system. When launched, the profile runs the oven for the duration at the present temperature set point.

1. Turn on the Timer System



Push to On (I)

Set Timer

1 Minute Profile

- The **Timer Display** will illuminate, showing the previously programmed profile duration.
- The oven will cease heating

2. Place the Timer Display in its adjustable Set Timer mode

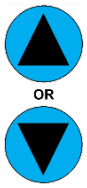
Press and hold RESET

Set Timer

Hours Selected

Note: If 5 seconds elapse with no activity on the Arrow Pad buttons, the Timer Display will exit the adjustment mode with the last entered time values saved.

3. Set the Hour parameter



Adjust

Set Timer

1 Hour, 1 Minute

4. Advanced to Tens-of-Minutes parameter

Press

Set Timer

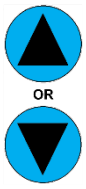
Tens of Minutes Selected

Note: Advancing saves the adjusted hour parameter.

Procedure continued on next page

Set Timer (Continued)

5. **Set the Tens-of-Minute parameter**



Adjust

Set Timer

1 Hour, 51 Minutes

6. **Advance to the Minutes parameter**

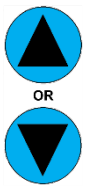
Press

Set Timer

Minutes Selected

- The flashing decimal point will advance to between the third and fourth numbers, saving the new Tens-of-Minutes parameter setting

7. **Set the Minutes parameter**



Adjust

Set Timer

1 Hour, 55 Minutes

8. **Wait for 5 seconds after entering the Minutes parameter**

Set Timer

- The display will exit adjustment mode.
- The Minutes parameter, along with the previous two parameter values, is now saved.

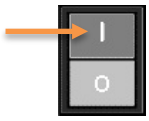
End of procedure

Launch a Heating Profile

Allow the oven to come up to temperature prior to launching a profile. See the **Setting the Timer procedure** on page 31 for how to set the length of the profile.

Note: While the Timer system is on, the oven will **not** heat unless a profile is running.

1. Turn on the Timer System



Push to On (I)

Set Timer

1 Hour, 55 Minute Profile

- The **Timer Display** will illuminate, showing the previously programmed profile duration.
- The oven will cease heating

2. Launch the current profile

Press and Hold

Set Timer

TIMER ACTIVATED

- The Timer Display will start counting down.
- The oven will resume heating.

Optional: Pausing a running profile

Push

- The oven will cease heating until the profile is restarted, reset, or the Timer system is turned off.
- To continue the profile where it left off, press the **Start/Stop** "T" button again.

3. The oven ceases heating upon reaching "00:00"

Set Timer

Profile Complete

- To resume manual heating place the **Timer Switch** in the OFF (O) position.
- To launch another profile, press the "//" **Reset** button and enter a new profile, or allow the previous profile to reset automatically after 5 seconds.

End of procedure

HIGH EXTERIOR TEMPERATURES

Note: Allow the oven to cool or use appropriate PPE and tools when adjusting the chamber gasket seating.

If the chamber gasket comes out of alignment, oven chamber air may be drawn into the insulating baffle spaces. This can result in heating of the oven exterior surfaces.

If the oven is exterior is unusually warm or hot, push the chamber gasket inward along its entire length to restore the integrity of the seal.

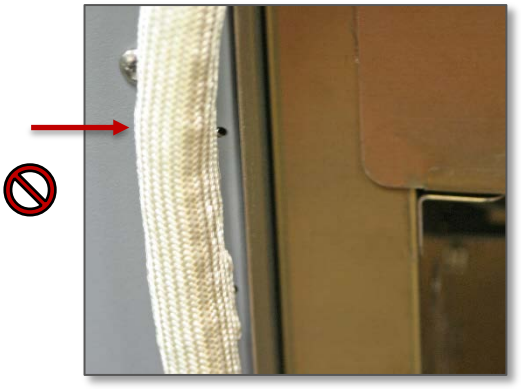


Figure 10: Chamber Gasket Misaligned

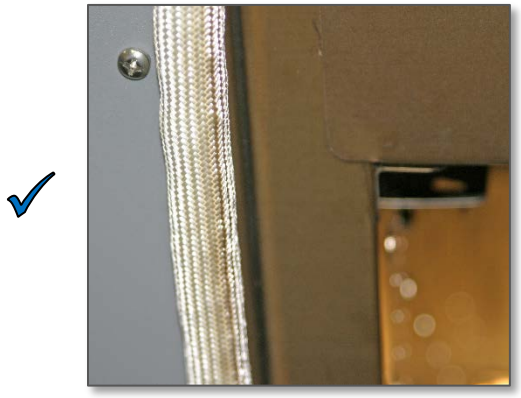


Figure 11: Chamber Gasket Aligned

DRYING RACKS AND OTHER ACCESSORIES

Make sure that any accessories used inside the oven chamber, such as drying racks, are suitable for your application and will not suffer damage when brought to temperature. Always set the OTL cutoff system to approximately 5°C above your application temperature set point in order to safeguard accessories against over temperature events. The manufacturing defect warranty does not cover damage caused by melted or otherwise overheated accessory items.

Warning: Disconnect the unit from its power supply prior to performing maintenance or services.

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

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.

These ovens use snap-in fiberglass door gaskets. The only tool required for swapping out these gaskets is a cutting implement for tailoring the length of the new gasket. Use proper PPE for handling exposed fiberglass when making the cuts.

Electrical Components

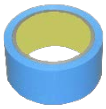
Electrical components do not require maintenance. If the oven fails to operate as specified, please contact your SHEL LAB distributor or Technical Support for assistance.

CALIBRATE THE TEMPERATURE DISPLAY

Note: Please see the **Reference Sensor Device entry** on page 6 for the minimum device requirements.

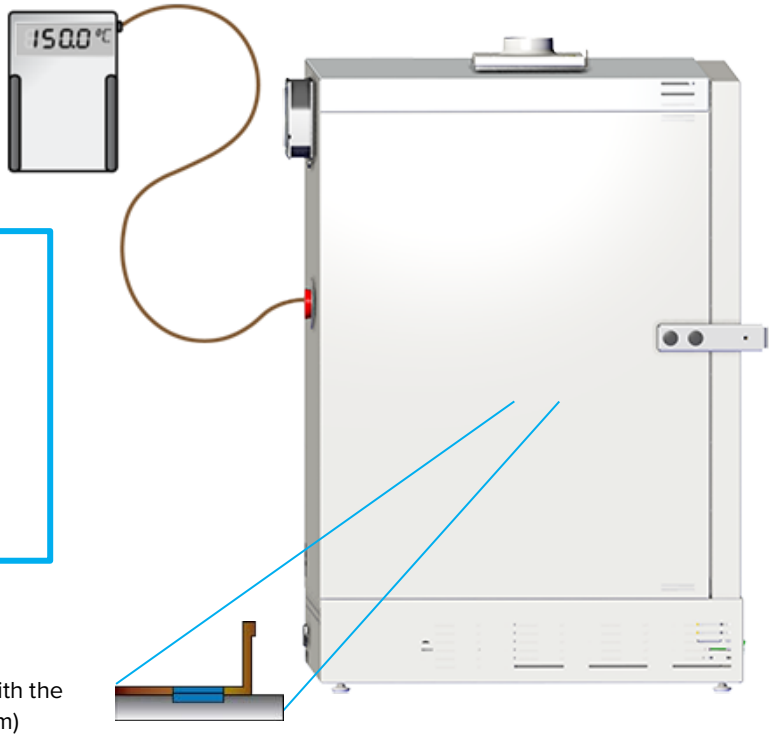
Temperature calibrations match the temperature display to the actual air temperature inside the oven chamber. The actual air temperature is supplied by a reference sensor device. Calibrations compensate for software drifts in the controller as well as deviations caused by the natural material evolution 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 exhaust vent should be closed to ensure an accurate calibration



1) Introduce the reference device thermocouple sensor probes into the oven chamber through the access port.

Alternatively, probes may be introduced through the chamber door space. Use heat-resistant, nonmarking tape to secure the wires and seal any exterior gaps. The door must close and latch fully.

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

If you are using only one thermocouple, place the sensor probe head as close to the geometric center of the oven chamber as possible.

3) Carefully place the port stopper over the probe wires.

5) The oven chamber door must be closed and latched.

5) Heat up and stabilization period.

- The oven chamber must be stable at temperature 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 of ±0.3°C or greater.

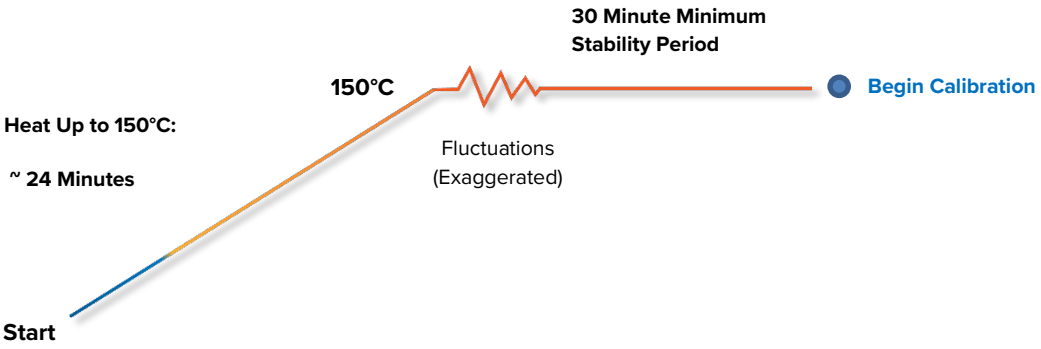
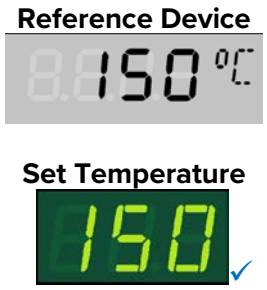


Figure 12: Oven Chamber Heat Up and Stabilization Phases

Suggested Calibration Procedure

1

Once the chamber has stabilized with no fluctuations of 0.3˚C or greater, compare the reference temperature device and chamber temperature display readings.



a. If the readings are the same, or the difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber temperature. **The Temperature Calibration procedure is now complete**.

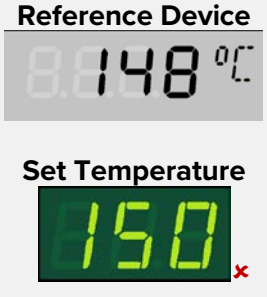
-OR-

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

2

The display requires calibration. Advance to Step 3.

- If the door was opened to check a reference device temperature inside the chamber wait 15 minutes **after the reference device reading stops fluctuating** before proceeding.

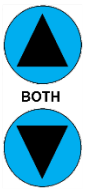


Continued on next page

Calibration continued

3

Place the oven in temperature calibration mode.

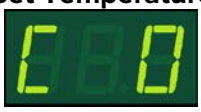


a. Press and hold **both** the **UP** and **DOWN** arrow buttons simultaneously.

- The Temperature Display will show the letters “C O”, then begin flashing the **current temperature value**.

Note: If an arrow key is not pressed for five seconds, the Temperature Display will cease flashing, and store the last displayed value as the new current chamber temperature value.

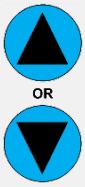
Set Temperature



Set Temperature

Current Temp. Value

4



Adjust the current temperature value to match the reference device.

a. Use the **UP** and **DOWN** arrow buttons.

Set Temperature

Corrected

Reference Device

5

After entering the correction adjustment, wait 5 seconds.

Wait 5 Seconds

- The temperature display will cease flashing and store the correction as an offset.
- The oven will now begin heating or allow itself to cool to reach your set point with the corrected display value.

Set Temperature

Heating with Corrected Value

6

Wait30Minutes

Wait for 30 minutes for the oven to stabilize with no fluctuations of ±0.3˚C or greater **after the oven has achieved the set point** with the corrected display adjustment.

- Failure to wait until the unit is fully stabilized will result in an inaccurate oven display reading.

Set Temperature

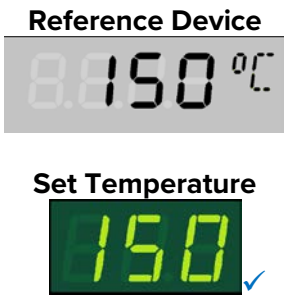
Procedure continued on next page

SHELLAB®

Calibration continued

7

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



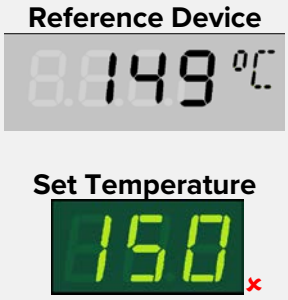
a. If the readings are the same, or the difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber temperature. **The Temperature Calibration procedure is now complete**.

-OR-

b. See Step 8 if a difference falls outside the acceptable range of your protocol.

8

If the two readings still fall outside the acceptable range of your protocol, repeat steps 2 – 7 up to two more times.



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

If the temperature readings of the oven and the reference device fall outside your protocol after three calibration attempts, contact **Technical Support** or your distributor for assistance.

End of procedure

UNIT SPECIFICATIONS

These ovens are 110 - 120 volt units. Please refer to the oven data plate for individual electrical specifications.

Technical data specified applies to units 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

Model	Shipping Weight	Unit Weight
SMO1	167 lbs. / 77 kg	126.5 lbs / 57.4 kg
SMO3	216 lbs. / 98 kg	170.5 lbs. / 77.3 kg
SMO5	258 lbs. / 117 kg	208.0 lbs / 94.3 kg

Dimensions

By Inches

Model	Exterior W × D × H	Interior W × D × H
SMO1	22.7 x 23.5 x 31.5	12.1 x 13.7 x 14.5
SMO3	26.9 x 28.6 x 34.0	16.5 x 19.5 x 16.2
SMO5	31.4 x 28.1 x 38.8	21.0 x 19.4 x 20.7

By Millimeters

Model	Exterior W × D × H	Interior W × D × H
SMO1	577 x 596 x 800	307 x 349 x 368
SMO3	684 x 727 x 840	419 x 495 x 412
SMO5	798 x 714 x 986	533 x 494 x 527

Capacity

Model	Cubic Feet	Liters
SMO1	1.4	39.4
SMO3	3.0	85.0
SMO5	4.9	138.0

SHELF CAPACITY BY WEIGHT

Model	Per Shelf	Max Total Load	Max No. Shelves
SMO1	50.0 lbs. / 22.6 kg*	100.0 lbs. / 45.3 kg**	6 Shelves
SMO3	50.0 lbs. / 22.6 kg*	200.0 lbs. / 91.3 kg***	7 Shelves
SMO5	50.0 lbs. / 22.6 kg*	200.0 lbs. / 91.0 kg***	9 Shelves

*50lbs / 22.6kgs with weight evenly distributed across the shelf.

**100lbs / 45.3kgs total load for the SMO1 shelves. Exceeding this limit risks damaging the chamber liner.

*** 200lbs / 91.0kgs total load for the SMO3 and SMO5 shelves. Exceeding this limit risks damaging the chamber liner.

TEMPERATURE

Range and Stability

Model	Operating Range	Stability
SMO1	Ambient +20 to 306°C	± 0.2°C @150°C
SMO3	Ambient +20 to 306°C	± 0.3°C @150°C
SMO5	Ambient +20 to 306°C	± 0.3°C @150°C

Uniformity

Model	Uniformity @80°C	Uniformity @150°C	Uniformity @306°C
SMO1	± 1.0°C	± 2.3°C	± 4.7°C
SMO3	± 1.0°C	± 1.8°C	± 5.0°C
SMO5	± 0.75°C	± 1.8°C	± 4.5°C

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

Model	Heat Up to 80°C	Heat Up to 150°C	Heat Up to 306°C
SMO1	8 Minutes	20 Minutes	52 Minutes
SMO3	6 Minutes	27 Minutes	124 Minutes
SMO5	9 Minutes	28 Minutes	130 Minutes

Temperature continued on next page

Recovery Time: From a 30-second door opening.

Model	Recovery to 80°C	Recovery to 150°	Recovery to 306°C
SMO1	1.5 Minutes	4.5 Minutes	14.0 Minutes
SMO3	1.5 Minutes	2.0 Minutes	18.0 Minutes
SMO5	2.0 Minutes	4.0 Minutes	45.0 Minutes

Recovery Time: From a 60-second door opening.

Model	Recovery to 80°C	Recovery to 150°	Recovery to 306°C
SMO1	4.0 Minutes	6.0 Minutes	20.0 Minutes
SMO3	2.0 Minutes	4.5 Minutes	36.0 Minutes
SMO5	3.5 Minutes	6.0 Minutes	57.0 Minutes

Air Flow Performance

Ventilation Rates

Model	Cubic Feet per Minute @80°C	Liters per Minute @80°C
SMO1	5.6	158.6
SMO3	11.3	320.0
SMO5	15.2	430.4

Air Changes per Hour

Model	@80°C
SMO1	330
SMO3	225
SMO5	180

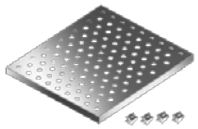
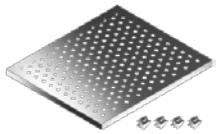
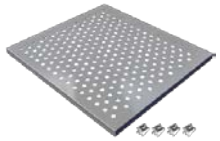
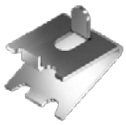
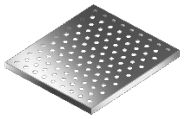
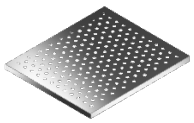
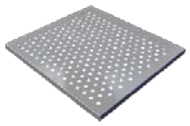
Air Velocity Across Shelf Space

Model	Linear Feet per Minute	Meters per Minute
SMO1	125	38.1
SMO3	140	42.7
SMO5	145	44.2

POWER

Model	AC Voltage	Amperage	Frequency
SMO1	110 - 120	12.0	50/60 Hz
SMO3	110 - 120	14.0	50/60 Hz
SMO5	110 - 120	14.0	50/60 Hz

PARTS LIST

Description	Parts Number	Description	Parts Number
Adjustable Leveling Feet, TFO-1	 **2700512**	Shelf and 4 Shelf Clips, SMO1-2	 **9751227**
Door Gasket, SMO1, sold by 1.5 feet, requires 5.4ft (1.65 meters)	 **3450767 (1.5ft)**	Shelf and 4 Shelf Clips, SMO3	 **9751228**
Door Gasket, SMO3, sold by 1.5 feet, requires 7.5ft (2.3 meters)	 **3450767 (1.5ft)**	Shelf and 4 Shelf Clips, SMO5	 **9751229**
Door Gasket, SMO5, sold by 1.5 feet, requires 8.1ft (2.5) meters	 **3450767 (1.5ft)**	Shelf Clip, Individual (1)	 **1250512**
Fuse, T16A 250V 5x20mm	 **3300513**	Shelf (no Clips), SMO1	 **5130887**
Power Cord 125 volt, 15Amp, 9ft 5 in (2.86m) NEMA 5-15P	 **1800510**	Shelf (no Clips), SMO3	 **5130888**
Port Stopper, High Temperature	 **7750572**	Shelf (no Clips), SMO5	 **5130890**

Ordering

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 unit ready, as Tech Support will need this information to match your unit to its correct part.

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