CLEANROOM OVEN

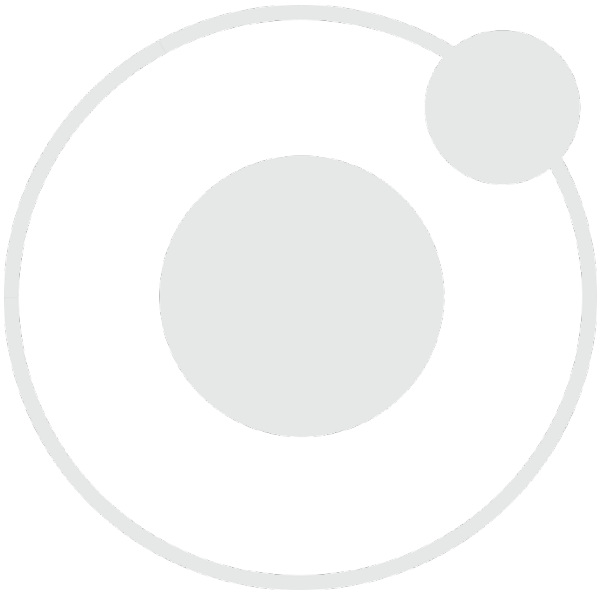
SHEL LAB®

220 – 240 Voltage

Installation - Operation Manual

SMO5CR-2

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



Manufacturing Warranty

For information on your warranty and online warranty registration please visit:

sheldonmanufacturing.com/warranty

SMO5CR-2 Cleanroom Oven

220 – 240 Voltage

Part Number (Manual): 4861580

Revision: May 8, 2018

SHEL LAB is a brand of Sheldon Manufacturing, INC.

Safety Certifications

These units are CUE listed by TÜV SÜD as high-performance 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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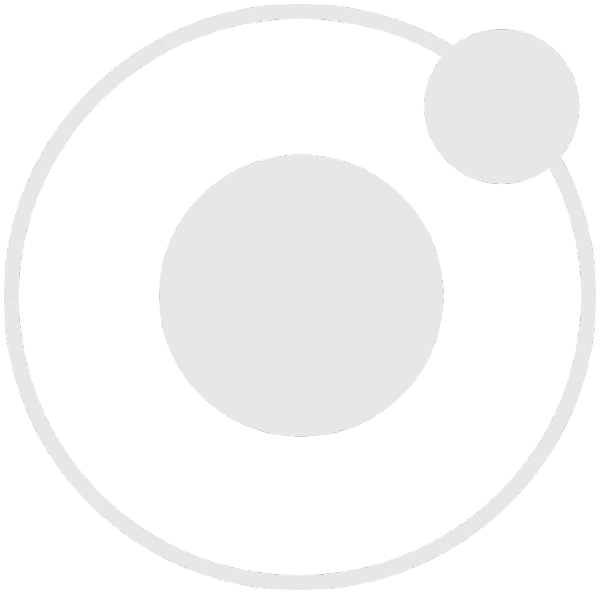


INTRODUCTION

Thank you for purchasing a SHEL LAB product. 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 cleanroom 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, or 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 unit not explicitly authorized by the manufacturer can 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), Monday – Friday. Please have the following information ready when calling or emailing Technical Support: the **model number**, **serial number,** and **part number** (see page 13).

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

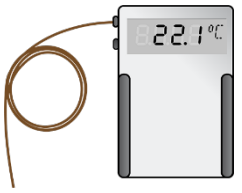
Sheldon Manufacturing, INC.
P.O. Box 627
Cornelius, OR 97113

ENGINEERING IMPROVEMENTS

Sheldon Manufacturing continually improves all 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



Temperature Reference

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

Reference devices must meet the following standards:

- Accurate to at least 0.1°C

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

Temperature Probe

Use a digital device with a wire thermocouple probe that can be introduced into the unit chamber through the door space. Select a thermocouple suitable for the application temperature you will be calibrating at.

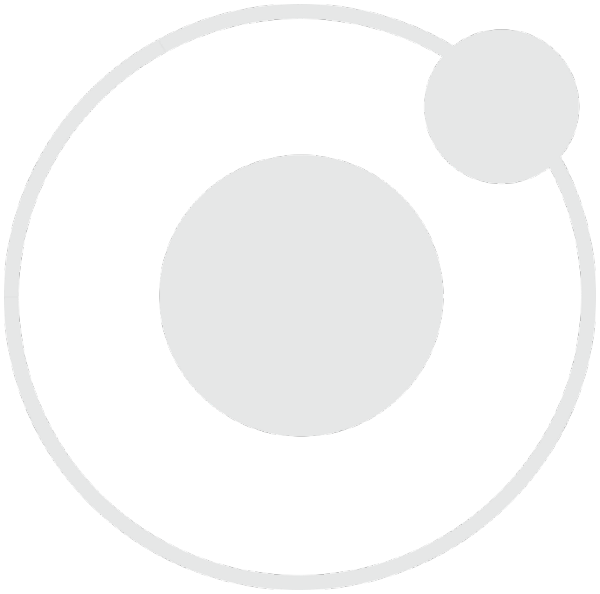
Why Probes?

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 conduct accurate temperature calibrations. **Never place a mercury thermometer in the unit chamber.** Always use thermocouple probes.

INTRODUCTION



RECEIVING YOUR UNIT

INSPECT THE SHIPMENT

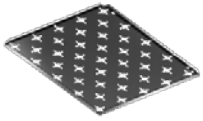
- When a unit leaves the factory, safe delivery becomes the responsibility of the carrier.
- **Damage sustained during transit is not covered by the manufacturing defect warranty.**
- Save the shipping carton until you are certain that the unit and its accessories function properly.

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. Inspect the unit for signs of damage. See the orientation depiction on the next page as a reference.
5. The unit should come with an Installation and Operation Manual.
6. Verify that the correct number of accessory items has been included.
7. Carefully check all packaging for accessory items before discarding.

Included Accessories

Shelves	Shelf Mounts	Leveling Feet
2	4	4



ORIENTATION

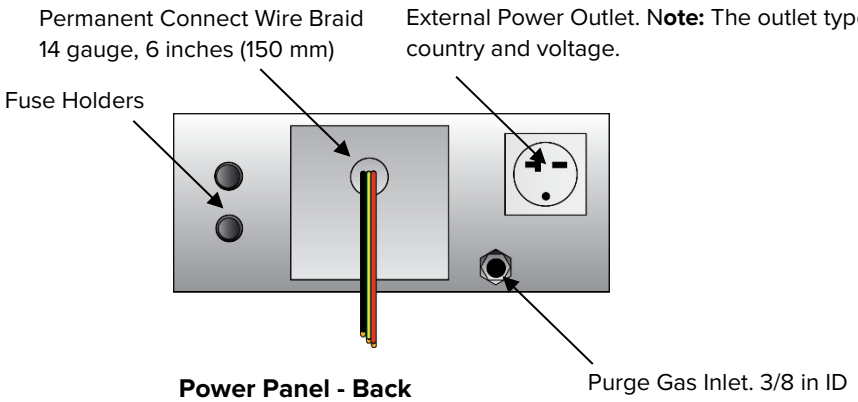
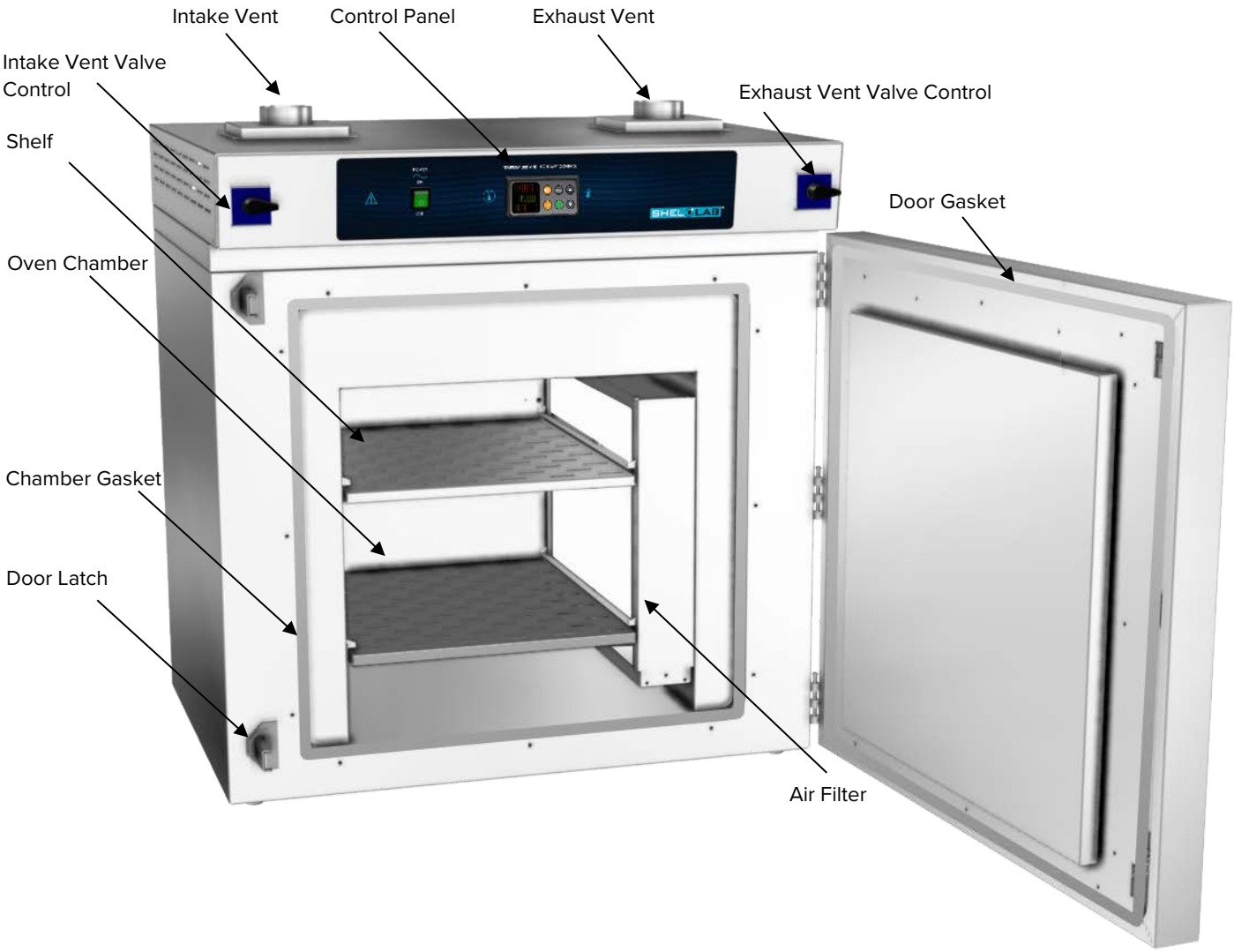


Figure 1: SMO5CR-2 Power Panel - Back



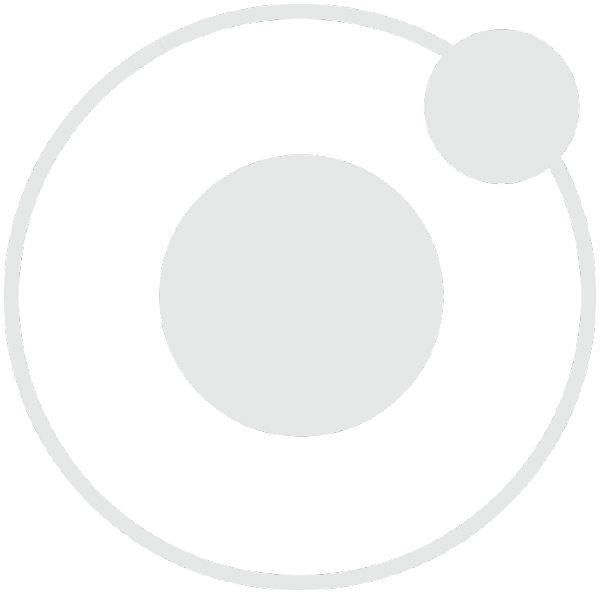
RECORDING DATA PLATE INFORMATION

Record the unit **model number**, **serial numbe**r, and **part number** below for future reference. Tech Support needs this information to provide accurate help during support calls and emails.

- The data plate is located on the back of the oven next to the power feed.

MODEL NO:	
SERIAL NO:	
PART NO:	

INTRODUCTION



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

Note: The oven air filter requires a burn-in heating run to prepare it for use. This produces some smoke and other gas byproducts. Verify that the installation location has sufficient ventilation equipment prior to installing an oven with a new filter in a new location. See page 29.

Pre-Installation

- ✓ Check that the required ambient conditions for the oven are met, page 16.
- ✓ Check that the spacing clearance requirements are met, page 16.
    - Unit dimensions may be found on page 47.
- ✓ Check that a suitable permanent connect electrical 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 19.
    - The oven may be connected to its power supply after this procedure.
- ✓ Make sure the oven is level, page 19.

Set up the oven for use

- ✓ Clean the oven chamber and shelving (recommended), page 19.
- ✓ Install the shelving, page 20.

Required Ambient Conditions

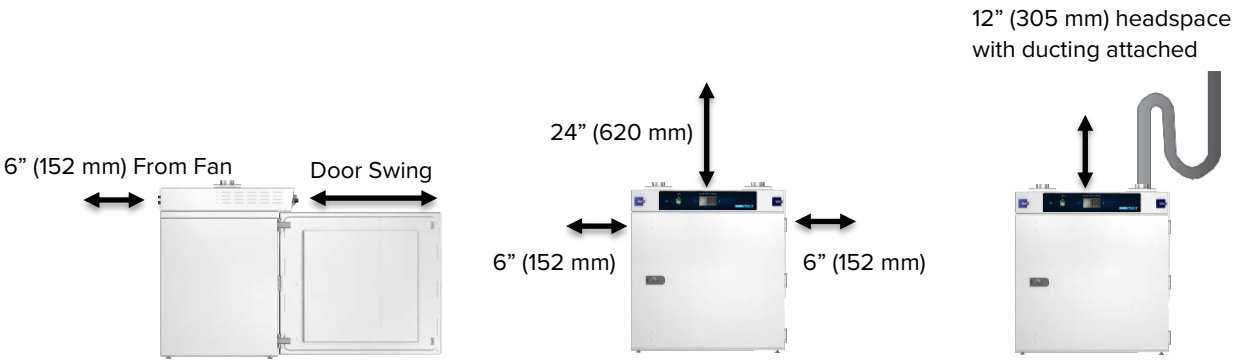
These units are built for use indoors at room temperatures between **15°C and 40°C (59°F and 104°F)**, at no greater than **80% Relative Humidity** (at 25°C / 77°F). Operating outside these conditions may adversely affect the unit temperature performance.

When selecting a location to install the unit, consider all environmental conditions that can adversely impact its temperature performance. These include:

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

Required Clearances

These clearances are required to provide air flows for ventilation and cooling.



6 inches (152 mm) of clearance is required on the sides and back.

12 inches (305 mm) of headspace clearance is required if the oven exhaust is vented from the workspace through a duct or other channeling.

24 inches (620 mm) of headspace clearance is required between the exhaust vent and any overhead cover or partition **if no exhaust venting is connected.**

Do not place objects on top of the oven. Exception: A power exhaust blower may be mounted on the top exhaust vent.

POWER SOURCE REQUIREMENTS

When selecting a location for the oven, verify each of the following requirements is satisfied:

Power Source: The power source must match the voltage and amperage requirements listed on the unit data plate. This unit is intended for **220 – 240 V 50/60 Hz** applications at the following amperage:

Voltage	Amperage
220 – 240	12

- **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 wall power source must be protective earth grounded.
- Use a separate circuit to prevent loss of the unit due to overloading or circuit failure.
- **A switch or circuit-breaker must be used in the building installation** to protect against overcurrent conditions.
    - Required circuit-breaker for the wall power source is **20 Amps.**
- The wall power source must conform to all national and local electrical codes.

Power Feed Disconnect: 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.

Fuses: The oven ships with two fuses installed in fuse holders adjacent to the power feed braid on the rear power panel of the unit.

- Both fuses 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.
- Fuse Type: 20 amp, 240V, 5x20mm.

Accessory Outlet Fuse: The oven is also provided with two 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.

- Fuse Type: 2 amp, 250V, 5x20mm

Power Feed Wiring

The oven comes provided with an integral 6-inch (150 mm) wire braid consisting of:

1. One 14-gauge high-temperature (300°C) hot wire – Black
2. One 14-gauge high-temperature (300°C) hot wire – Red
3. One 14-gauge earth ground wire – Green/Yellow

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 potential fire hazard.

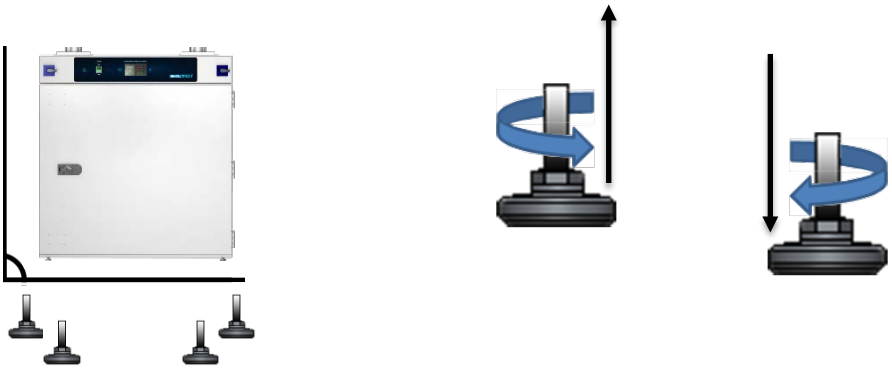
Lifting and Handling

The oven is heavy. Use appropriate lifting devices that are sufficiently rated for these loads. 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 in the corner holes in 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 4 leveling feet so that the leg of each foot sits inside the unit.

INSTALL THE OVEN

Install 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.
- **A qualified technician may now connect the oven to its power source**.

DEIONIZED AND DISTILLED WATER

Do not use deionized water to clean the unit chamber even if it is readily available in your laboratory.

- Use of deionized water may corrode metal surfaces and voids the manufacturing defect warranty.
- The manufacturer recommends the use of distilled water in the resistance range of 50K Ohm/cm to 1M Ohm/cm, or a conductivity range of 20.0 uS/cm to 1.0 uS/cm, for cleaning applications.

Installation Cleaning and Disinfection

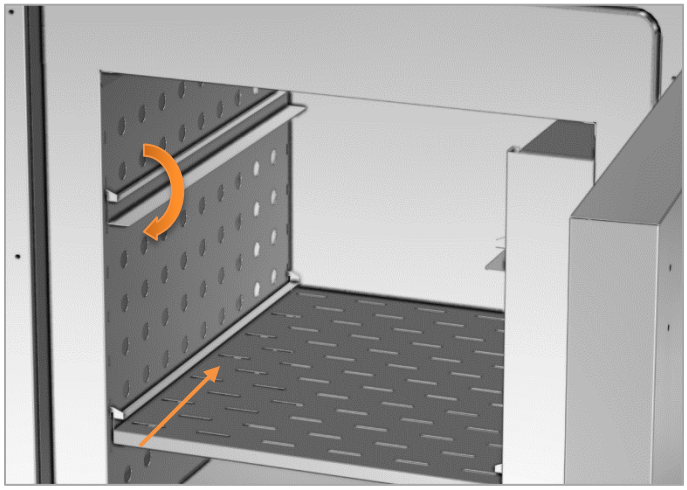
The manufacturer recommends cleaning the shelving and unit chamber prior to installation of the shelving in the chamber.

- The unit was cleaned at the factory but may have been exposed to contaminants during shipping.
- Remove all wrappings and coverings from shelving prior to cleaning and installation. **Do not clean the shelving with deionized water.**
- Please see the Cleaning and Disinfection procedure on page 37 in the User Maintenance chapter for information on how to clean and disinfect without damaging the unit.

Install the Shelving

The horizontal airflow within the chamber moves from the small duct holes on the right-hand side of the chamber to the large holes on the left side. Place the shelves as not to obstruct the duct holes on either side. This maximizes airflow across the shelf space.

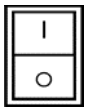
Space the shelves evenly in the oven chamber to ensure the best possible air circulation and temperature uniformity.



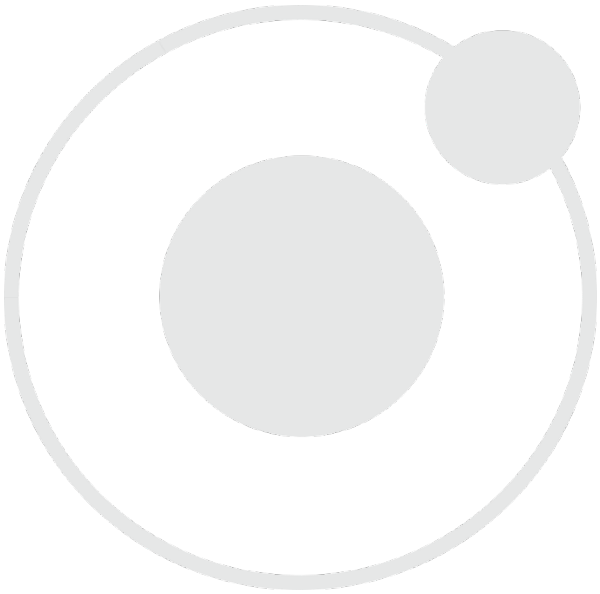
1. Install the shelf slide hangers on the left and right walls of the oven.
    - Insert the tabs of each slider into the chamber's mounting slots.
    - Push down gently to secure the slider.
2. Slide the shelves onto the shelf sliders.

GRAPHIC SYMBOLS

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

Symbol	Definition
	Consult the user manual Consulter le manuel d'utilisation
	Indicates adjustable temperature Indique température réglable
	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
	Adjusts UP and DOWN Ajuster le haut et vers le bas
	Potential shock hazard Risque de choc électrique
	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



CONTROL PANEL OVERVIEW

Control Panel

Power Switch

Power is supplied when the switch is in the ON (I) position.

Temperature Controller – Display on Home Page

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 home page, the **Up** and **Down** arrow buttons adjust the constant temperature set point. Pressing and holding both buttons navigates from the home page to menu pages. On the menu pages, the buttons adjust calibration offsets and heating profile variables.

When starting on the home page, the green **Advance** button navigates forward through parameter option pages and units of measurement (Celsius or Fahrenheit). The button also advances forward in menus and parameter lists when programming heating profiles.

The gray **Reset** button returns the display to the previous page or menu. Pushing the Reset button repeatedly returns the display to the home page.

Continued next page

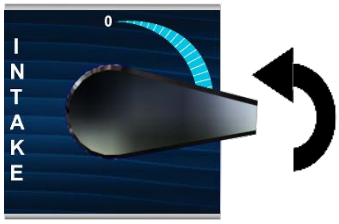
EZ1

The EZ1 button launches heating Profile 1. Pushing EZ1 again while running aborts Profile 1.

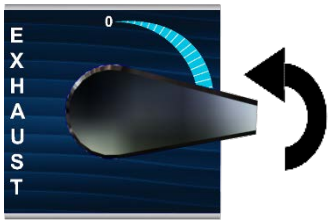
The EZ2 button has no function.

Vent Valves

The SMO5CR-2 comes with two vent valve controls on the front control panel. These open and close the intake and exhaust vents located on the top of the unit.



Turn handle counter-clockwise to close vents.



OPERATION

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

1. Do not use this oven in unsafe improper applications that produce flammable or combustible gases, vapors, liquids, or fuel-air mixtures in quantities that can become potentially explosive.
2. 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.
3. Do not use this oven for applications heating hazardous fibers or dust. These items can become airborne and come into contact with hot surfaces.
4. 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.
5. 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.
6. Do not place sealed or filled containers in the oven. These may burst open when heated.
7. Do not place alcohol or mercury thermometers in the oven. These devices may rupture under heat or other improper uses.
8. Do not move the oven until it has finished cooling.

Warning Hot Surfaces: These areas are marked with Hot Surface labels. Proper protective equipment should be employed to minimize the risk of burns.

Avertissement Surface Chaude: Ces zones sont marquées avec des étiquettes de surface chaude. Un équipement de protection approprié devrait être utilisé pour minimiser le risque de brûlures.

THEORY OF OPERATIONS

Heating

When powered, the oven heats the oven chamber atmosphere to the current constant temperature set point. The 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 controller 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 below the oven chamber.

The controller 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. These units can achieve a low-end temperature of the ambient room temperature plus the internal waste heat of the incubator.

Heating Profiles

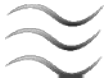
The oven can either heat to and run at a constant temperature setpoint or execute a programmable multistep heating profile with ramp up, heat soak, and ramp down intervals.

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 the current limit setting. This safeguards the oven 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 10˚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.

Air Circulation



The oven continually circulates air internally while powered in order to maintain temperature uniformity and stability in the oven chamber and to speed drying rates. An internal blower fan motor forces air through vent holes on the left chamber wall, and then is pulled up and blown across a heating element in the chamber ceiling. The air is then forced down through the E11 air filter mounted on the right chamber wall and blows across the shelf space. The oven is intended to be run as a closed air-cycle system.

Vents – Intake and Exhaust

The oven is provided with intake and exhaust vent dampeners that may be opened or closed using controls on the front panel of the oven. The vent dampeners are intended to be opened **after** the heat treatment or bake out phases of an application are complete. Running the oven with the vent 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, and may speed the rate of material drying, depending on the nature of the sample material, outgassed byproducts, and ambient conditions.

Accessory Power Exhaust Outlet

SMO cleanroom ovens come with an external accessory power outlet to supply electricity to a power exhaust fan attached to the oven exhaust vent. The outlet and any attached blower can be activated by the temperature controller as part of a user-programmed heating recipe profile or turned on from the home page options when the oven is running a constant temperature set point. The primary 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.

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

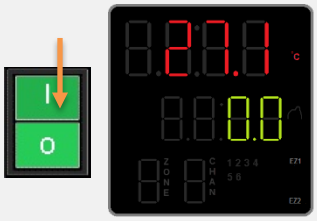
Purge Port

The unit comes with a 3/8-inch ID (9.5 mm) gas inlet port located on the back of the oven. Nitrogen or another inert gas can be connected to this port to purge the oven chamber during baking applications.

PUT THE OVEN INTO OPERATION

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

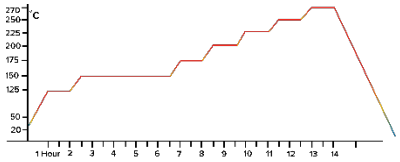
1. Power the Oven



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

- The controller display will illuminate and default to the home page.

2. Burn in the air filter



See the **Air Filter Burn-In procedure** (page 29).

Note: The air filter burn-in procedure takes approximately 14 hours. This procedure must be completed before the oven can be used.

3. Set the High Limit Temperature heating cutoff point

See the **Set the High Limit** procedure on page 31.

4. Set the Operating Temperature

- **Set the constant temperature set point.** See page 32.

OR

- **Program multistep heating recipe profiles.** See page 32.

Air Filter Burn-In

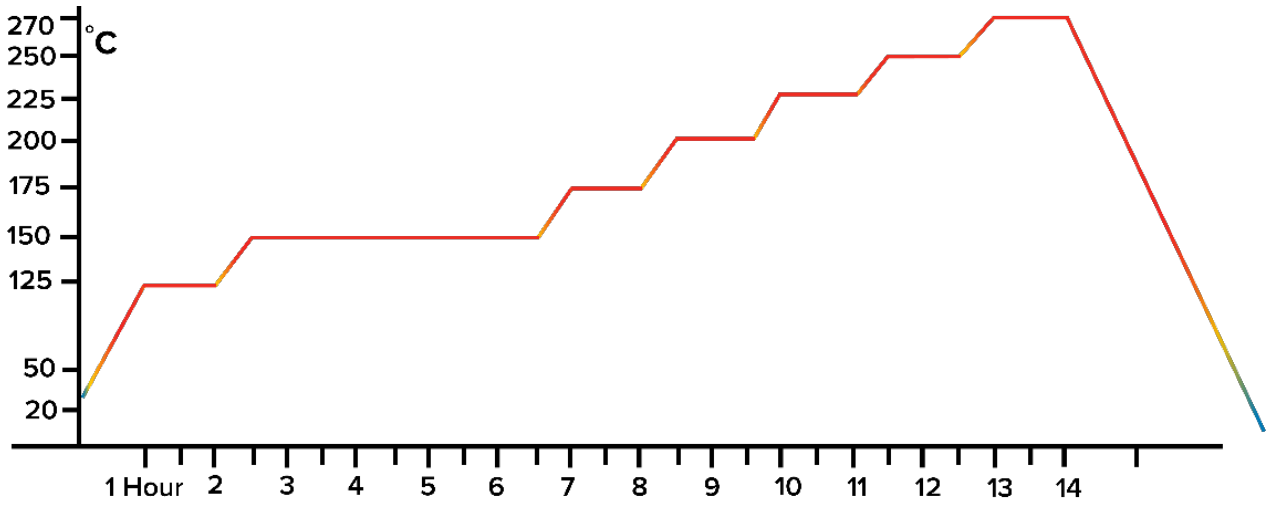
The air filter must be burned in prior to its first use. The oven intake and exhaust vent dampeners must be open throughout the procedure, as the air filter will fill with gas and produce significant smoke during the procedure.

The oven exhaust vent should be connected to a venting duct or placed under a ventilation hood.

Remove shelving from the oven prior to the burn-in.

Burn-in Procedure: Requires approximately 14 hours

Note: These steps may also be programmed to run as a multistep heating profile.



Burn-In Recipe

Step	Set Point	Time Interval	Step	Set Point	Time Interval
Step 1	125°C	30 Minute Ramp Up	Step 8	200°C	1 Hour Temperature Soak
Step 2	125°C	1 Hour Temperature Soak	Step 9	225°C	30 Minute Ramp Up
Step 3	150°C	30 Minute Ramp Up	Step 10	225°C	1 Hour Temperature Soak
Step 4	150°C	1 Hour Temperature Soak	Step 11	250°C	30 Minute Ramp Up
Step 5	175°C	30 Minute Ramp Up	Step 12	250°C	1 Hour Temperature Soak
Step 6	175°C	1 Hour Temperature Soak	Step 13	270°C	30 Minute Ramp Up
Step 7	200°C	30 Minute Ramp Up	Step 14	270°C	1 Hour Temperature Soak

Continued next page

Post-Burn-In Cleaning:

Note: Do not remove or disturb the air filter assembly cover after the burn-in. A burnt filter is fragile and easily damaged. Only remove the air filter housing cover when replacing the filter.

1. Turn off the oven. Allow the oven to cool to room temperature.
2. Clean the interior surfaces to remove the exhaust from the air filter.
    - Take care not to damage the temperature sensor probes when cleaning. These are located on the back wall of the oven chamber, adjacent to the air filter.
    - See the Cleaning and Disinfection procedure on page 37.

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 10°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 home page

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 10°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 home page 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 home page

Push Reset

- Returned to home page.

End of Procedure

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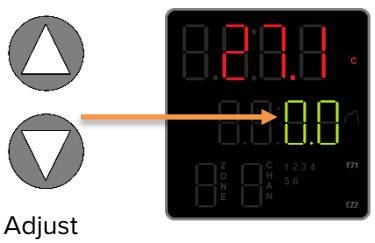
Set the Constant Temperature Set Point

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



Adjust

- Do not exceed the high limit 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 Profiles

Please see the profiles guide included with this oven for how to program automated heating recipe profiles. The guide provides illustrated explanations for all major profile functions and programming steps.

High Temperature Limit Activated

The High Limit system blocks heating in the oven chamber if the chamber temperature meets or exceeds the present High Limit setting. Heating remains disabled until the High Limit cutoff is manually cleared by the oven operator.

Indicators

The oven controller display screen flashes two alternating alert screens when a High Limit cutoff is active. Activation of the cutoff is accompanied by a click sound. Additionally, an illuminated “4” on the bottom-most display block indicates the oven is routing electricity away from the heating elements.

Alternating Alert Screens

Attention Screen

Heating Off

High Limit Activation Conditions

- The current temperature set point is above or near the High Limit cutoff setting. The High Limit should be set to **at least 10°C above** the highest intended temperature of your heating application.
- A heat source in the oven chamber is pushing the oven temperature above the limit setting.
- Significant outgassing in the chamber may be interfering with the measured temperature.
- Attempting to heat a significant mass of product or samples may trigger a temperature overshoot.
- The main controller circuitry or sensor probe have failed.

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.

Clearing the High Limit Heating Cutoff

- Clearing the cutoff restores power to the oven heating elements.
- The oven chamber temperature must be below the High Limit cutoff setting to clear the cutoff.
- Always verify it is safe to resume heating before clearing the High Limit cutoff.

1. Push the Reset button.

- The alert screens will flash 2 additional times before the oven controller ends the cutoff.

Positive Exhaust Venting

Exhaust ducting can be connected to the oven exhaust port to channel or positively vent exhaust away from the oven workspace. The manufacturer recommends including 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 exhaust blower that can be mounted 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 home page 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 it 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.
    - Leave the assembly in place.
2. Mount the power exhaust blower on the exhaust vent cover assembly.
    - The open side of the blower mounting body should fit over the exhaust vent.
    - 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

1. Advance to the home page Event parameter.
    1. Starting on the home page, push 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, indicated by the Red “3” light.

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

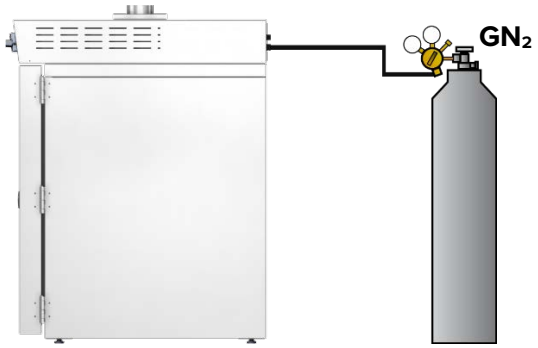
GN_2 PURGE

Purpose

A gas nitrogen (GN_2) purge generates an inert atmosphere in the oven chamber, preventing condensation, corrosion, or product oxidation during a baking application.

Asphyxiation Potential

- Gas nitrogen expelled from the oven can create an asphyxiation hazard.
- The onset of asphyxiation can be difficult to detect until personnel lose consciousness or suffer cognitive impairment.
- Ensure the workspace area around the oven is well ventilated with a **minimum** of 6 air changes per minute.

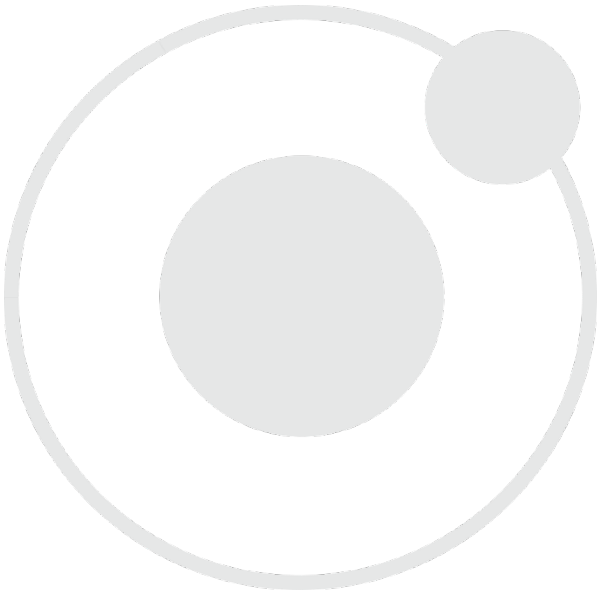


Process

1. Verify the Intake and Exhaust vents are both closed.
    - Failure to close the vents compromises the integrity of the purge.
2. Connect the GN_2 supply cylinder or other source to the 3/8-inch ID inlet on the back of the oven.
3. Set the supply regulator flow pressure.
4. Open the supply source valve to start a flow of nitrogen to the oven GN2 port.
5. Begin purging the oven prior to heating.

The volume of nitrogen required for a successful purge is 5 to 10 times that of the oven chamber volume. Failure to complete the purge cycle before applying heat may result in oxidation.

A flow of GN_2 must be maintained during the heating application or treatment. This generates overpressure, preventing infiltration by free atmosphere (room air). The nitrogen atmosphere and overpressure should be maintained until the heat load is below the oxidation temperature of your sample or product for the final time in the process.



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.

1. The unit chamber should be cleaned prior to first use.
2. Periodic cleaning is required.
3. Do not use spray on cleaners or disinfectants. These can leak through openings and coat electrical components.
4. 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.
5. 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 components (shelving and other accessories) from the chamber before cleaning.
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:

1. Turn off and unplug the unit to safeguard against electrical hazards.
2. 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.
3. If permitted by your protocol, remove all removable interior accessories (shelving and other non-attached items) from the chamber when disinfecting.
4. Disinfect all surfaces in the chamber, making sure to thoroughly disinfect the corners. Exercise care to avoid damaging the sensor probes.
5. When disinfecting external surfaces, use disinfectants that will not damage painted metal, glass, and plastic.

Maintaining Atmospheric 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.

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.

Air Filter Lifespan

The lifespan of the air filter can vary greatly depending on ambient conditions such as humidity and temperature, as well as the processes or applications the oven is being used for. The more particulates and oily fumes produced by material drying or baking out in the oven chamber, the faster the filter will become clogged and constrict airflow through the oven.

A useable life of one (1) year is common for many cleanroom applications. Replace the filter at least once per year. Replace more often if the exhaust output is noticeably reduced, or if required by your production or laboratory protocol, or regulatory requirements.

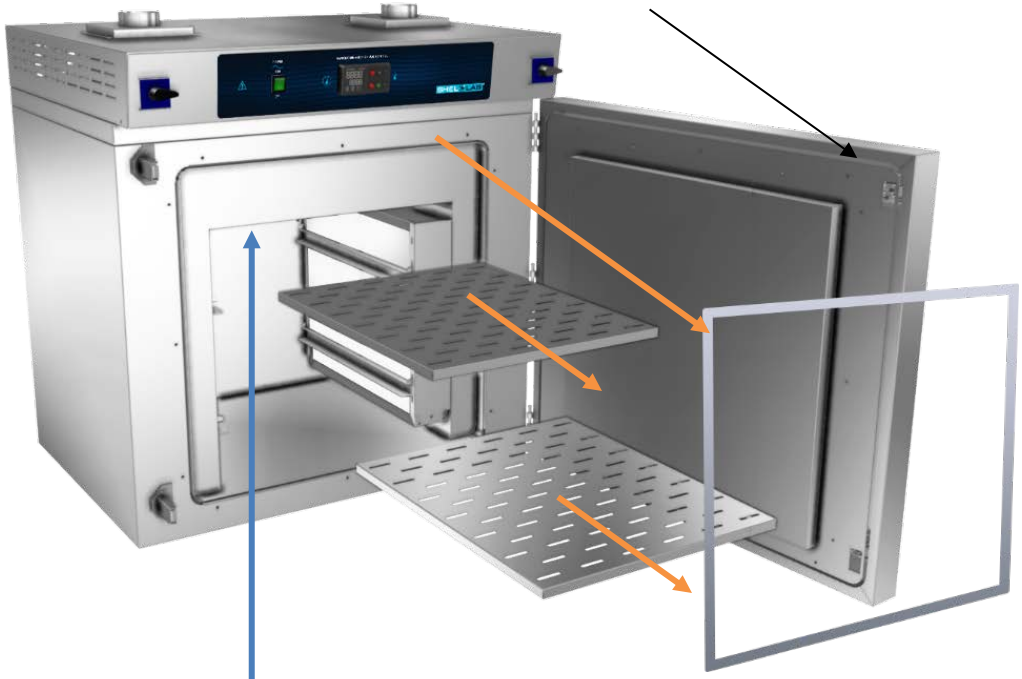
Replacing the Air Filter

Replace the air filter at least once per year. Replace more often if the exhaust output is noticeably reduced, or if required by your production or laboratory protocol, or regulatory requirements.

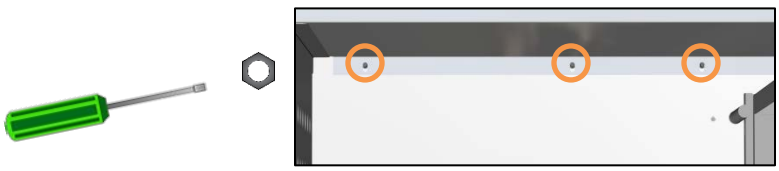
Note: The air filter burn-in procedure must be carried out each time a new air filter is installed. See page 29.

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

Exercise caution to avoid damaging the door gasket when removing chamber liner components in the next steps. Remove the door gasket if the door cannot be opened fully because of limited space and replace when the procedure is complete.



2. Remove the chamber gasket. It is difficult to remove the chamber liner components in the next steps without damaging the gasket if it is left in place.



3. Unscrew and remove the nuts and washers located at the top of the back wall of the oven chamber.

Continued next page

Replacing the air filter, continued

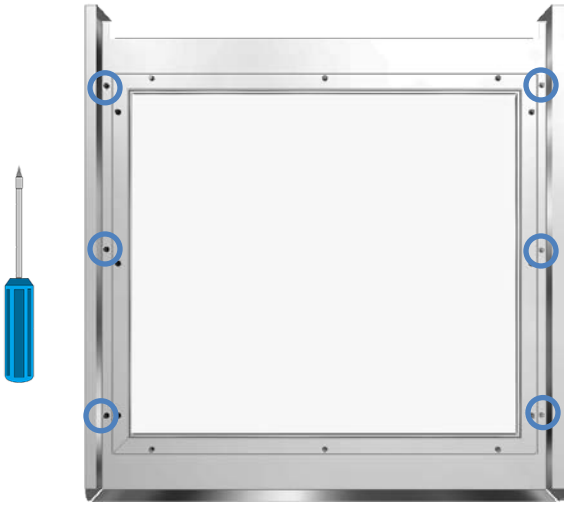
4. Remove the chamber ceiling liner. The liner may require a rocking motion to loosen.

5. Remove the right wall air duct and filter.

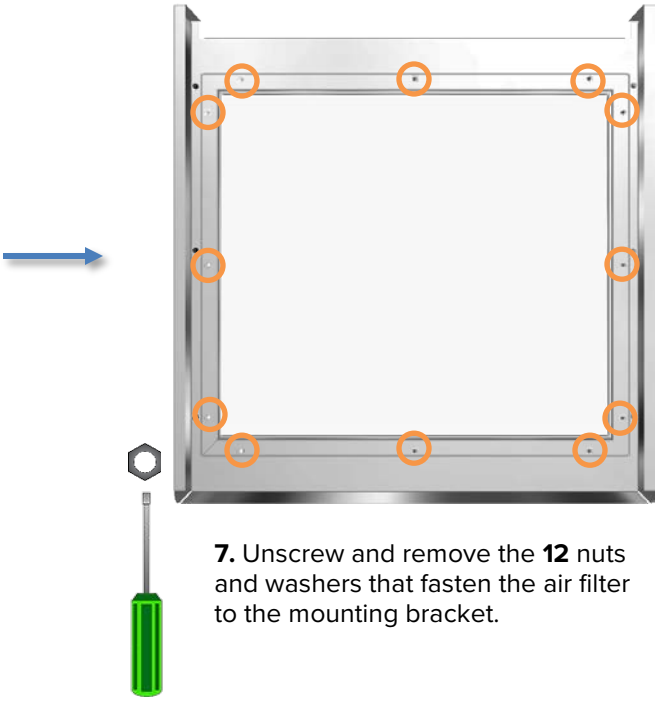
- Do so slowly. It may be necessary to use a rocking motion to move the air duct around the air pipe extending down into the duct space.

Continued next page

Replacing the air filter, continued



6. Loosen but **do not remove** the **6** screws on the air duct interior. This loosens the brackets that hold the filter in place.



7. Unscrew and remove the **12** nuts and washers that fasten the air filter to the mounting bracket.

8. Slide the old air filter down and out of the air duct bracket.

Continued next page

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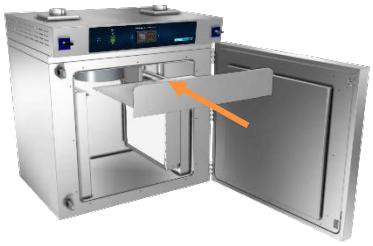
Replacing the air filter, continued

9. Slide the new air filter into the mounting bracket.

a) Screw in and tighten the **12** nuts and washers to secure the air filter.
b) Tighten the **6** mounting bracket screws.

Reassemble the Chamber Interior

10. Reinstall the air duct and filter on the right chamber wall.



11. Reinstall the chamber ceiling liner.

- Screw on and tighten the **3** ceiling liner nuts and washers on the back wall.

12. Reinstall the chamber and door gaskets.

13. Reinstall the shelves and shelf sliders.

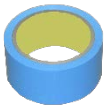
End of procedure

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 9 for the minimum device requirements.

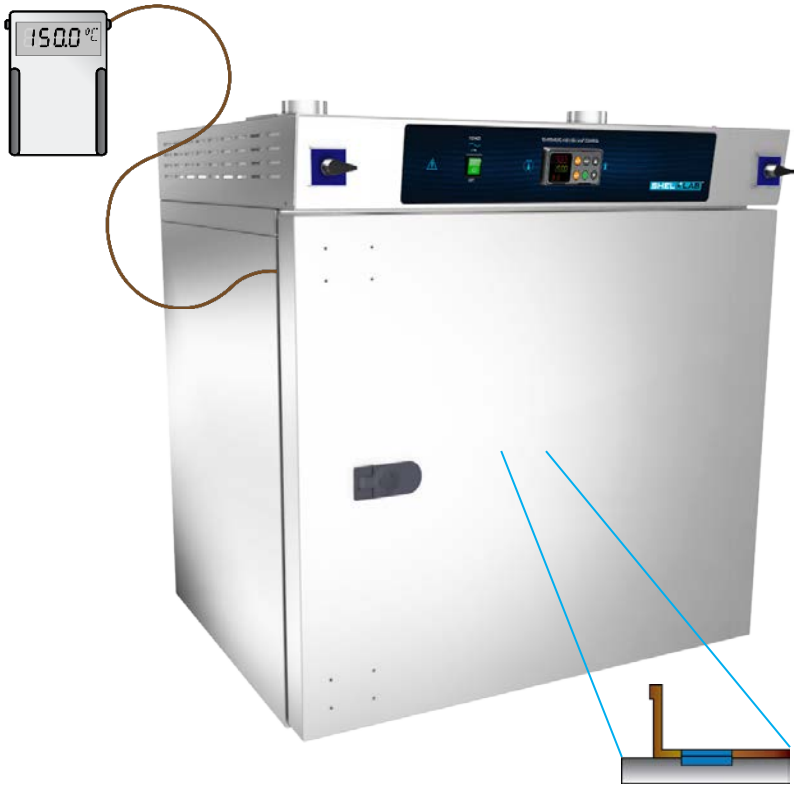
Temperature calibrations match the temperature display to the actual air temperature inside the oven chamber. The actual air temperature is supplied by a reference sensor device. Calibrations compensate for software drifts in the controller as well as deviations caused by the natural material evolution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

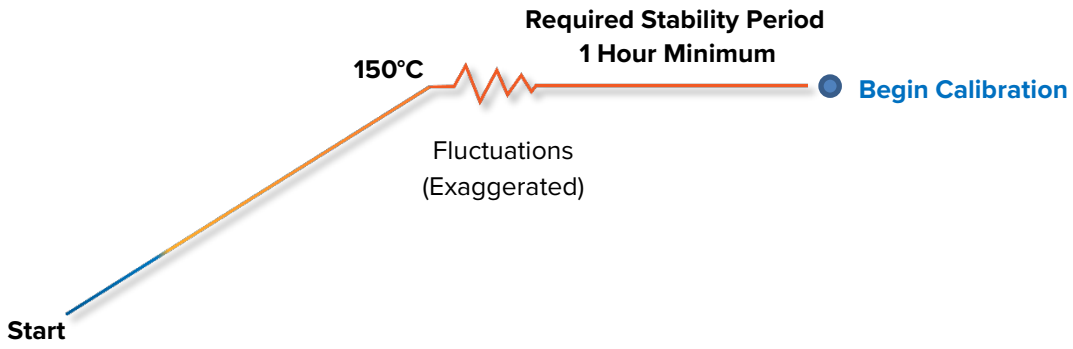


1. Introduce the reference device thermocouple sensor probe into the oven chamber through through the door space.

2. Place the sensor probe head as close to the geometric center of the oven chamber as possible, with the probe head at least 2 inches (50 mm) from the surface of the shelving to prevent heatsinking. Secure with non-stick, heat-resistant tape.

3. The oven chamber door must be closed and latched. Use non-stick tape to seal any gaps created by the probe wires.

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 one hour with no fluctuations greater than the specified stability of the oven (see the Unit Specifications chapter).



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.

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

Reference Device

✓

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.**

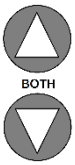
Reference Device

✗

Continued next page

Calibration continued

3



Place the controller display in the Operations menu.

a. Press and hold both the **Up** and **Down** Arrow buttons simultaneously for approximately 3 seconds.

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

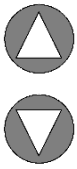
Operations Menu

4

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

1. Push the green **Advance** button repeatedly until “i.CA” appears on the green mid display line and a number value on 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 home page.

a. Push the Reset button repeatedly until the display shows the home page.

- 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

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Calibration continued

7

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

8

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

1. 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**.

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

Reference Device

✓

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.

Reference Device

✗

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 SMO5CR-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
429 lb / 195 kg	325.0 lb / 147.4 kg

Dimensions

By Inches

Exterior W × D × H	Interior W × D × H
35.0 x 30.0 x 37.6	17.0 x 20.0 x 20.0

By Millimeters

Exterior W × D × H	Interior W × D × H
889 x 747 x 955	431 x 508 x 508

Capacity

Cubic Feet	Liters
3.9	111.0

Shelf Capacity by Weight

Pounds	Kilograms
50.0 lb per shelf	22.7 kg per shelf

Temperature

Range	Stability
Ambient + 20 to 270°C	± 0.3°C @150°C

Temperature Data Continued

Uniformity

@80°C	@150°C	@270°C
± 1.0°C	± 2.5°C	± 5.0°C

Heat Up Time to 80°C	Heat Up Time to 150°C	Heat Up Time to 270°C
11 minutes	25 minutes	35 minutes

Recovery Time: From a 30-second door opening.

Recovery to 80°C	Recovery to 150°C	Recovery to 270°C
4 minutes	6 minutes	6 minutes

Recovery Time: From a 60-second door opening.

Recovery to 80°C	Recovery to 150°C	Recovery to 270°C
5.5 minutes	6.5 minutes	7 minutes

AIRFLOW PERFORMANCE

Ventilation Rates

Cubic Feet Per Minute @80°C	Liters per Minute @80°C
7.1	201

Air Changes per Hour
109

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

PARTS LIST

Description	Parts Number	Description	Parts Number
Adjustable Leveling Foot	 **2700512**	E11 Air Filter Assembly	 **9990503**
Chamber Gasket Silicone (unit of sales is per foot, requires 11 feet)	 **3450546**	Shelf Slide	 **5121189**
Door Gasket SMO5CR-2 Silicone (unit of sales is per foot, requires 11 feet)	 **3450587**	Shelf SMO5CR-2	 **5121195**
Fuse, Oven, 20 Amp Slow Blow, 240V, 5x20mm. Requires 2 fuses.	 **3300538**	Power Exhaust Blower Unit 220 – 240 Volt	 **9990741**
Fuse, Accessory Outlet, 2 Amps, 250V, 5x20mm. Requires 2 fuses.	 **3300502**		

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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