HIGH-PERFORMANCE OVENS 220 - 240 Voltage

SHEL LAB®

Installation - Operation Manual

SMO28HP-2, SMO10HP-2

SMO28HP-2 formerly designated SMO34HP-2

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

Pictured on front cover: SMO28HP-2 (left) and SMO10HP-2 (right)

The SMO28HP-2 was previously designated SMO34HP-2

SMO High-Performance Ovens 220 - 240 Voltage

Installation and Operation Manual

Part number (Manual): 4861777

Revision: December 19, 2016

These units are TÜV CUE listed 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 C22.2 No. 61010-1:2012
CAN/CSA C22.2 No. 61010-2-010:2004 Reaffirmed: 2014-07
UL 61010-1:2012-05
UL 61010A-2-010:2002-03
EN 61010-1:2010
EN 61010-2-010:2014
Supplemented by: UL 61010-2-010:2015

TABLE OF CONTENTS

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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.

Locations and Applications Range

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

User Manual

Before using the unit, read this 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 that all operators are given appropriate training before the unit begins service.

GENERAL SAFETY CONSIDERATIONS

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

Your oven and its recommended accessories have been designed and tested to meet strict safety requirements. For continued safe operation of your oven, always follow basic safety precautions including:

- 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.
- Avoid damaging the power feed. Do not bend it excessively, step on it, place heavy objects on it. A damaged power feed can easily become a shock or fire hazard. Never use a power feed after it has been damaged.
- Position the equipment so the end-user can quickly and easily disconnect or uncouple the power feed in the event of an emergency.
- Use only approved accessories. Do not modify system components. Any alterations or modifications to your oven may be dangerous and will void your warranty.
- Do not attempt to move the unit while in operation or before the unit has cooled.
- Only use the oven for its intended range of applications.
- Follow any local or regional ordinances in your area regarding the use of this unit.

INTRODUCTION

SHELDON MANUFACTURING

Shel Lab is a product brand of Sheldon Manufacturing, INC.

ENGINEERING IMPROVEMENTS

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

CONTACTING ASSISTANCE

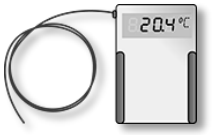
If you are unable to resolve a technical issue with the oven, please contact Sheldon Technical Support. Phone hours for Sheldon Technical Support are 6am – 4:30pm Pacific Coast Time (west coast of the United States, UTC -8).

Please have the following information ready when calling or emailing Technical Support: the **model number** and the **serial number**. These will be found on the unit data plate, which is located on the back of the unit at the top right, next to the power supply as mandated by regulatory requirement. See page 10.

EMAIL: tech@shellab.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

TEMPERATURE REFERENCE SENSOR DEVICE



The oven does not come with a temperature reference device. A reference device must be purchased separately for performing in-house accuracy validations or calibration adjustments of the oven temperature display.

The device must be accurate to at least 0.1°C, and should be regularly calibrated by a third party. For best results, use a digital device with one or more thermocouple probes. Remote readings eliminate chamber door openings and avoid subsequent waits for the chamber temperature to re-stabilize. Select probes suitable for the application temperature you will validate or correct the display accuracy at.

Alcohol thermometers are insufficient for conducting accurate validations and calibrations. Do not use a mercury thermometer. **Never place a mercury thermometer in the oven chamber.**

RECEIVING YOUR OVEN

INSPECT THE SHIPMENT

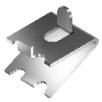
- When a unit leaves the factory, safe delivery becomes the responsibility of the carrier.
- Damage sustained during transit is not covered by the manufacturing defect warranty.
- Save the shipping carton until you are certain that the unit and its accessories function properly

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

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

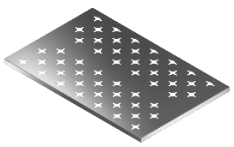
Included accessory items

Model	Shelves	Shelf Clips	Leveling Feet
SMO10HP-2	3	12 Clips	4
SMO28HP-2	6	24 Clips	4

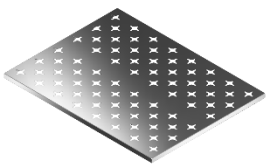


Shelves

SMO10HP-2



SMO28HP-2



ORIENTATION

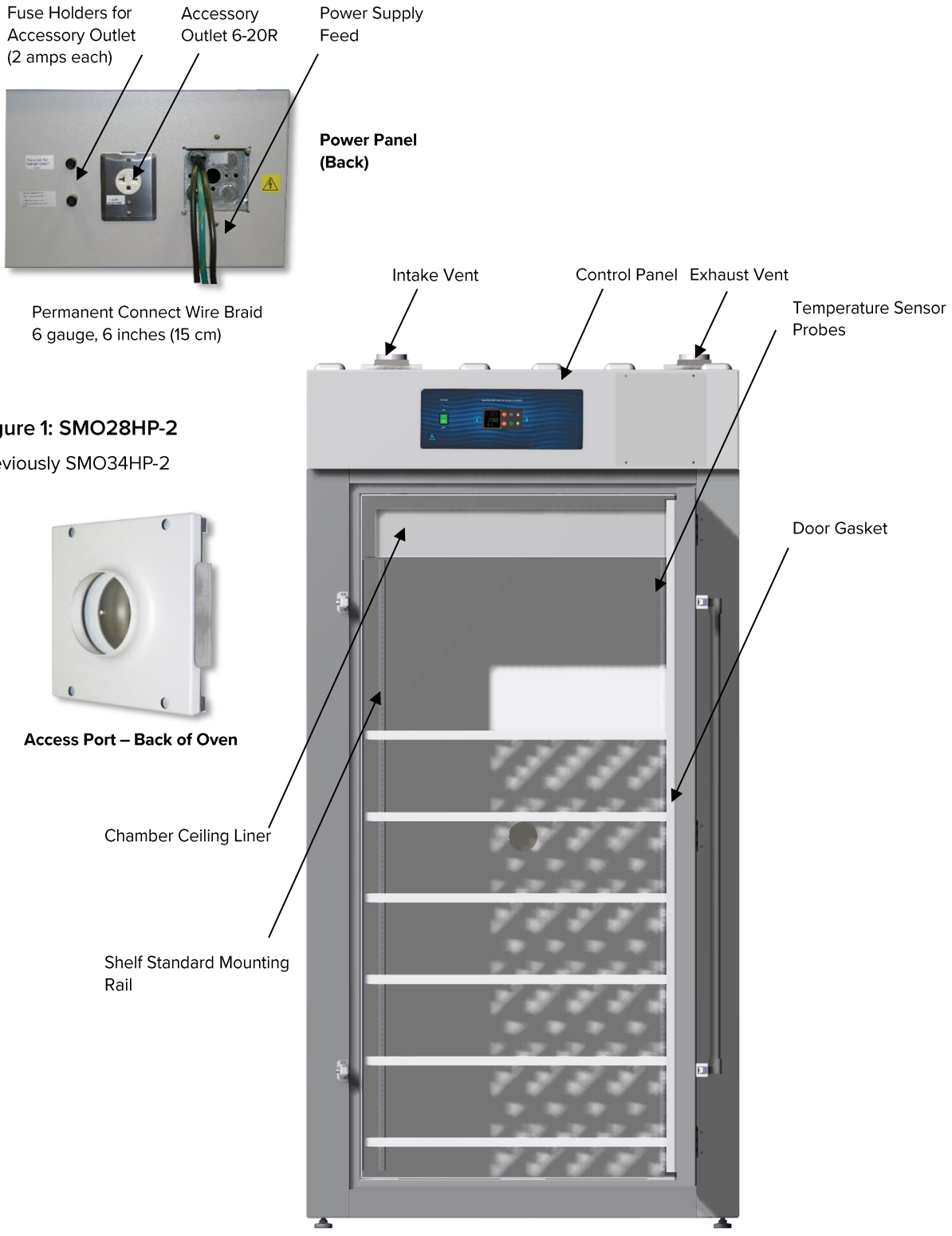
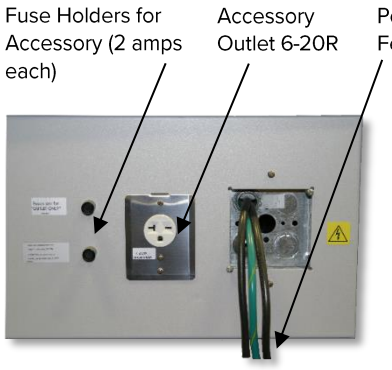


Figure 1: SMO28HP-2

Previously SMO34HP-2

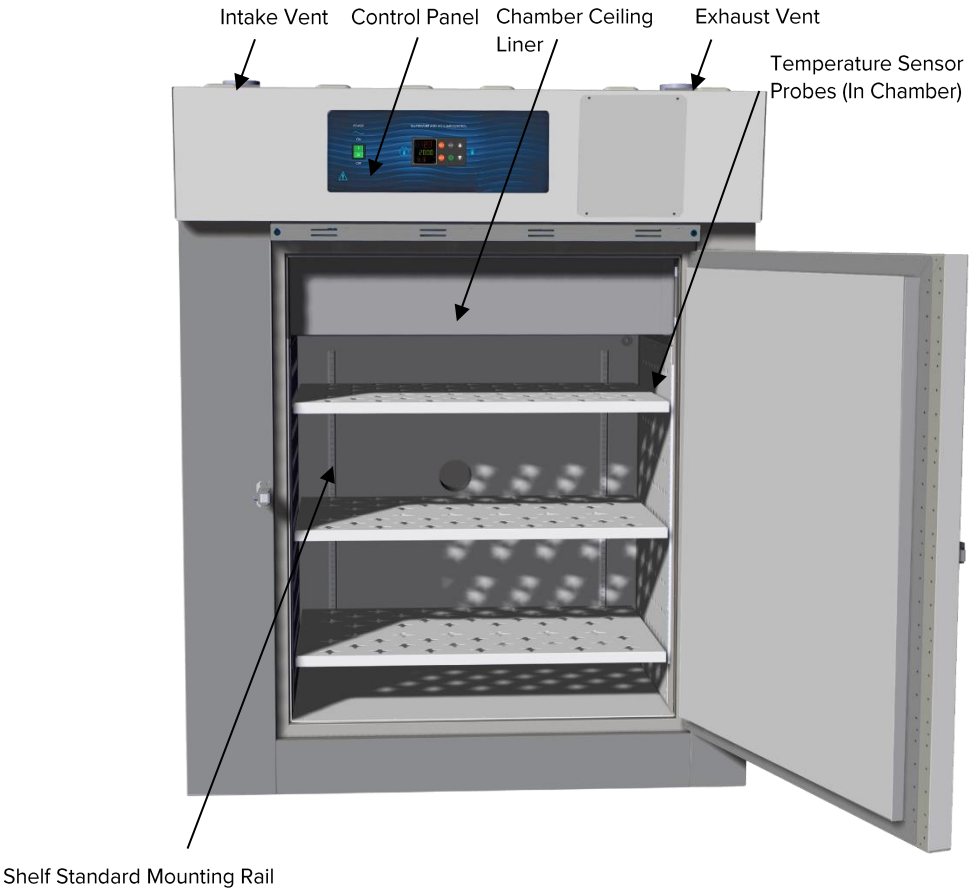
Figure 2: SMO10HP-2



Power Panel (Back)

Access Port – Back of Oven

Permanent Connect Wire Braid 10 gauge, 6 inches (15 cm)



RECORDING DATA PLATE INFORMATION

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

Date Plate Information

Model Number	
Serial Number	

INSTALLATION

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 CHECKLIST

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

Pre-Installation

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

Install the Oven in a suitable workspace location

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

Set up the Oven for use

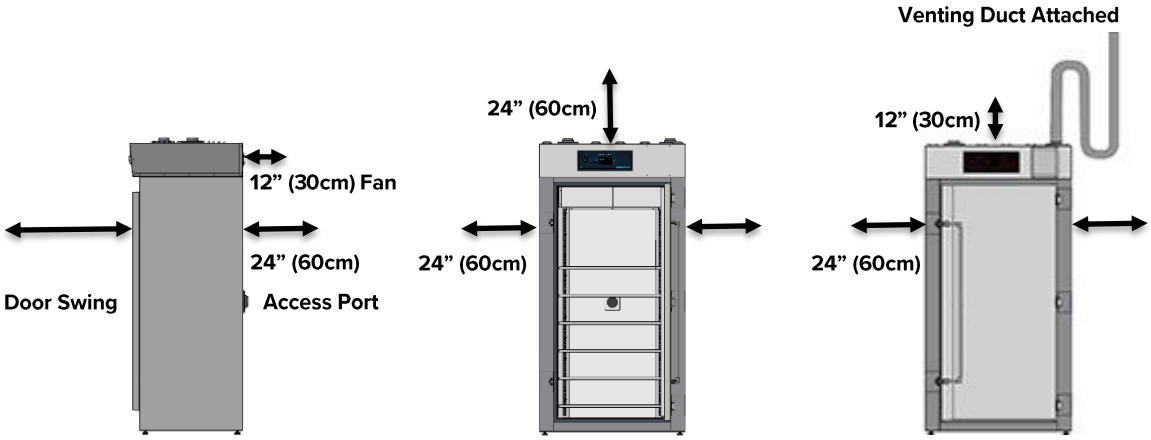
- ✓ Clean the oven chamber and shelving if needed, page 17
- ✓ Install the shelving in the oven chamber, page 18

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).

Required Clearances

- Allow **24 inches (60cm)** of empty space between the sides and back of the oven and any walls or partitions for unobstructed airflow and cooling. The same spacing is required between the top of the oven and any overhead cover.



- **12 inches (30cm)** of vertical headspace clearance will suffice if the oven exhaust is vented from the workspace through a duct or other channeling. Make sure the exhaust vent remains unobstructed.
- **Do not place objects on top of the oven**. Exception: A power exhaust blower offered by Shel Lab may be mounted on the exhaust vent.
- Allow at least **12 inches (30cm)** 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.

Operating the unit outside of these conditions may adversely affect its temperature range and stability. For conditions outside of those listed above, please contact your distributor to explore other oven options suited to your laboratory or production environment.

INSTALLATION

ENVIRONMENTAL DISRUPTION SOURCES

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

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

POWER SOURCE REQUIREMENTS

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

Power supply: The power supply must meet the power requirements listed on the oven data plate (located on the back of the unit, beneath the power feed inlet.

- These ovens are intended for a 220 - 240 volt, 50/60 Hz applications at the following amperages:

Model	Amperage		Model	Amperage
SMO10HP-2	26		SMO28HP-2	50

- The power source must be **single (1) phase** and **protective earth grounded**.
- The power source must conform to all national and local electrical codes.
- **Supplied voltage must not vary more than 10% from the data plate rating**. Damage to the oven may result if the supplied voltage varies more than 10%.
- Use a separate circuit to prevent loss of the unit due to overloading or circuit failure. The circuit must meet or exceed the amperage requirements listed on the oven data plate.

Switch or circuit-breaker: A switch or circuit-breaker must be used in the building installation to protect against overcurrent conditions.

- The required circuit-breakers are: SMO10HP-2 30 amps — SMO28HP-2 60 amps.

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.

Continued on next page

Accessory Outlet Fuses: The oven is also provided with a pair (2) of 2-amp fuses installed adjacent to the external power receptacle used to power accessory blower fans.

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

These fuses do not provide protection against overcurrent events associated with major components of the oven. Overcurrent protection for the oven must be set up in the location power supply external to the unit. See the circuit breaker requirements above.

Power Feed Wiring

The oven comes provided with an integral 6 inch (15 cm) wire braid consisting of:

- SMO10HP-2 – two 10-gauge hot wires and a 10-gauge earth ground.
- SMO28HP-2 – two 6-gauge hot wires and a 6-gauge earth ground.

The wires for power source connection should be in accordance with the following for all units: Green/Yellow – Earth; Black – Hot; Black – 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 protections against potentially dangerous electric shocks and create a possible fire hazard.

Lifting and Handling

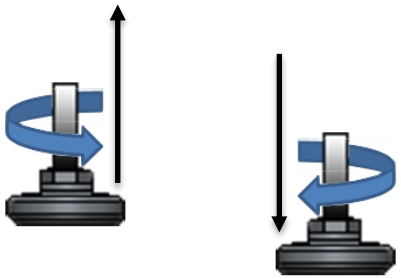
The oven is heavy. Use appropriate lifting devices that are sufficiently rated for these loads. Follow these guidelines when lifting the oven:

- Lift the oven only from its bottom surface.
- Doors, handles, and knobs are not adequate for lifting or stabilization.
- Restrain the oven completely while lifting or transporting so it cannot tip.
- Remove all moving parts, such as shelves and trays, and 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.

- Verify that the oven stands level and does not rock. Adjust the leveling feet as needed.

INSTALLATION CLEANING

The unit was cleaned at the factory, but not sterilized. It may have been exposed to contaminants en route during shipping.

- Remove all wrappings and coverings from shelving prior to cleaning and installation.
- **Do not clean with deionized water.**
- See the **Cleaning and Disinfecting** topic in the User Maintenance section (see page 33) for more information on how to clean the oven chamber prior to putting the unit into operation.

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 4 shelf clips in 4 slots on the shelf standard rails on the left and right walls and the rear wall of the chamber interior.
    a. Squeeze each clip.
    b. Insert the top tab first, then the bottom tab using a rocking motion.
    c. The slots must all be at equal height from the oven chamber floor.
2. Set the shelf on the clips.

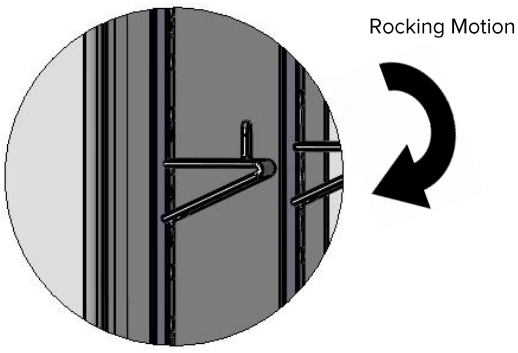


Figure 4: Installing Shelf Clip

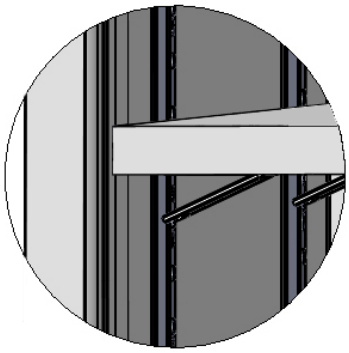
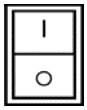


Figure 3: Shelf Set on Clips

GRAPHIC SYMBOLS

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

Symbol	Definition
	Indicates that you should consult your user manual for further instructions. Indique que l'opérateur doit consulter le manuel d'utilisation pour y trouver les instructions complémentaires.
	Indicates Adjustable Temperature Indique température réglable
	Indicates AC Power Repère le courant alternative
	Indicates I/ON and O/OFF I repère de la position MARCHE de l'interrupteur d'alimentation O repère de la position ARRÊT de l'interrupteur d'alimentation
	Indicates protective earth ground Repère terre électrique
	Indicates UP and DOWN respectively Touches de déplacements respectifs vers le HAUT et le BA
	Indicates a Potential Shock Hazard Signale danger électrique
	Indicates the unit should be recycled (Not disposed of in land-fill) Indique l'appareil doit être recyclé (Ne pas jeter dans une décharge)
	Indicates: Caution hot surface Indique: Avertissement symbole de surface chaude

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CONTROL PANEL OVERVIEW

Figure 5: Control Panel and Controller

Power Switch

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

Temperature Controller - Display on Homepage

Top Line (Red): Present chamber air temperature

Middle Line (Green): The constant temperature set point

Bottom Line: Flashing “2” indicates active heating

While on the Homepage, the **Up** and **Down arrow** buttons adjust the constant temperature set point. Pressing and holding both buttons jumps from the homepage to the Operations menu, if the controller has been unlocked to perform a calibration.

The green **Advance** button scrolls forward through menus and parameters lists when programming heating recipe profiles or performing a temperature calibration. On the homepage, it scrolls through operating parameters such as the unit of temperature display (°C or °F) or profile start.

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

The EZ1 button quick launches Profile 1 or aborts any active heating profile (see **the Programmed Operations section** on page **28**).

The EZ2 button launches heating Profile 2 (Step 11). Pressing EZ2 again while running aborts Profile 2.

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OPERATING PRECAUTIONS

Warning: The oven is not an explosion proof unit!

Avertissement: Ce sont des fours pas résistants aux explosions

- This oven is not designed to safely contain flammable or combustible gasses, vapors, or liquids.
- Do not place combustible or flammable materials into the chamber, or items that have been processed with or tainted by combustible or flammable substances.
- The bottom surface of the chamber should **not** be used as a work surface.
- Never place samples or product on oven chamber floor.
- Never place alcohol or mercury thermometers in the oven.
- The SMOHP oven is provided with a dampened exhaust vent. For safe and efficient oven operation follow these precautions:
    - During normal baking operations, the damper is closed.
    - Outgassed byproducts may be hazardous to or noxious for operating personal. If either is the case, oven exhaust should be positively ventilated to a location outside workspace in accordance with national and local regulations.
- Do not operate the oven in an environment with noxious fumes.
- The oven is not designed for use in Class I, II, or III locations as defined by the US National Electric Code.

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

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

THEORY OF OPERATIONS

Heating

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

The oven temperature controller stores the constant temperature set point and 40 programmable heating profile recipe steps. The steps come allocated to 4 ten-step profiles, but successive profiles may be combined to run sequentially as one profile. Step types include timed-interval ramping (heating or cooling), soaking (constant temperature), and ending states. Please see the **Programed Operations** section on page 28 and the *Watlow EZ-Zone Profile Programing Guide for more details*.

Along with storing set points and profile steps, the temperature controller monitors the oven chamber air temperature using a solid-state probe located in the airstream on the right wall of the chamber. When the processor detects that the chamber temperature has dropped below the currently active temperature set point, it pulses power to a heating element in a recirculation air duct space located above the oven chamber.

SMOHP ovens rely on natural heat radiation for cooling.

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

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

Air Circulation

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

Vents – Intake and Exhaust

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

Accessory Power Exhaust Outlet

SMO High-Performance 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 are either activated by the temperature controller as part of a user-programed heating recipe profile or can be activated from the homepage 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, lowering the temperature ceiling significantly by boosting the rate that cooler outside air is brought in.

High Limit Control System

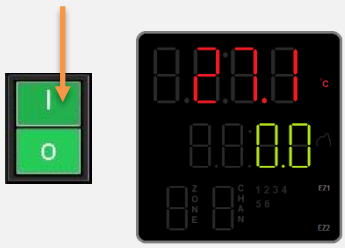
The temperature controller contains a heating cutoff system with independent circuitry connected to a redundant solid state temperature sensor probe inside the oven chamber. This high limit system depowers the oven heating elements whenever the chamber air temperature exceeds to the current limit setting.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

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

PUT THE OVEN INTO OPERATION

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

1



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

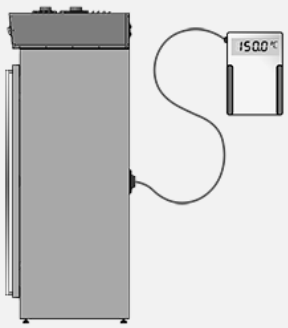
The controller display will illuminate, show the current firmware revision number, and then default to the homepage. The red top line shows the current chamber air temperature. The green middle line shows either the constant temperature set point (default) or the current PID-calculated profile set point if a profile has been launched.

2

Carry out the following procedures found in the Operation section:

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

3



Optional: If you are required to validate or verify the accuracy of the temperature display for regulatory or industry standards compliance, perform the Set Up and first step of the **Calibrate the Temperature Display procedure** in the User Maintenance chapter. See page 35.

End of Put the Oven into Operation

SET THE HIGH TEMPERATURE LIMIT

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

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

1

On the homepage, advance to the Limit High Set Point.

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

Limit High Option

2

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

a. Set the limit in the red top-display using the Up and Down arrow buttons.

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

3

Save the new Limit High Setting.

a. Press the Advance button.

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

4

Return to the homepage.

a. Press the Reset button.

Returned to Homepage

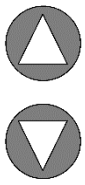
End of Procedure

SHELLAB®

SETTING THE CONSTANT TEMPERATURE SET POINT

1

Set the constant temperature set point on the homepage.



a. Use the **Up** and **Down** arrow buttons to adjust the set point in the green mid-level display to your constant-temperature application set point or a pre-warming temperature for a heating recipe.

b. Do not exceed the high temperature limit set point.

Set Point Set

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 green display to your set point.

- A small illuminated 2 near the bottom of the display indicates when the temperature controller is calling for heat.
- 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.

Oven Heating

HEATING PROFILES

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

HIGH TEMPERATURE LIMIT ACTIVE

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

Alternating HTL Alert Screens

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

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

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

Restoring Heating

If the High Limit is set below or within 4°C of the current set point, perform the following steps to take the unit out of the protective heating cutoff:

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

2. Push the Advance button again.
    - Limit High Set Point "LhS1" will now show in the green display, and the High Limit temperature setting in the red top display. The display will resume alternating until you begin adjusting the limit setting.

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

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

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

Positive Exhaust Venting

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

Power Exhaust Blower

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

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

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

Mounting the Power Exhaust

1. Remove the 8 screws on the cover of the exhaust vent assembly on the top of the oven.
    a. Leave the assembly in place.
2. Mount the power exhaust blower on the exhaust vent cover assembly
    a. The open side of the blower mounting body should fit over the sliding damper.
    b. Align the blower and the assembly screw holes.
3. Reinstall the 8 screws to secure the blower and vent assembly.
4. Plug in the power exhaust into the 220 - 240 volt receptacle on the back of the oven.

Turning on the Power Exhaust – Constant Temperature Set Point

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

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

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

DATA PORT

The 9-pin RS485 data port, located on the back of the oven, connects to the oven temperature controller. It is primarily intended for updating the controller software. Accessing the controller with a computer requires a 9-pin RS485-to-USB converter cable and driver software.

Applications and Utility Software

The port can be used for temperature monitoring and data logging in graphic user interface environments using National Instrument LabView software or Watlow Specview. Watlow's EZ Zone™ Configurator software can be used to program heating profiles in a drop-down menu environment as well as to copy and save the controller configuration file. The config file includes the currently programed heating profiles. Configurator is available for free on the Watlow website.

CHANGE UNIT OF MEASUREMENT

The controller display can show temperatures in either Celsius or Fahrenheit.

1. From the homepage, advance to the unit of measurement option.
   a. Press the green Advance button 7 times.

2. Change the unit of measurement.
   a. Use the Arrow button to change the red parameter on the top display line. "C" is Celsius and "F" Fahrenheit.

3. After changing the Unit parameter, return to the homepage.
   a. Press the grey Return button.

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USER MAINTENANCE

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

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

CLEANING AND DISINFECTING

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

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

Warning: Never clean the oven with alcohol or flammable cleaners.

Avertissement: Ne jamais nettoyer l'appareil à l'alcool ou avec des nettoyants inflammables.

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. Perform the following steps to manually disinfect the oven:

1. Turn the unit off. Open all doors and carry out your laboratory or production space disinfection protocol.
2. Disinfect the oven chamber using commercially available disinfectants that are non-corrosive, non-abrasive, and suitable for use on stainless steel surfaces. If disinfecting external surfaces use disinfectants that will not damage painted metal or plastic. Contact your local Site Safety Officer for detailed information on the disinfectants compatible with your application or process.
3. If permitted by your protocol, remove all interior accessories (shelving and other non-attached items) from the chamber when disinfecting.
4. Disinfect all surfaces in the chamber, making sure thoroughly disinfect the corners. Exercise care to avoid damaging the sensor probes.

DOOR GASKETS AND CHAMBER INTEGRITY

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

The High-Performance Oven series uses 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

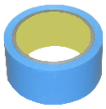
Electrical components do not require maintenance. If the oven fails to operate as specified, please contact your Shel Lab distributor or Technical Support for assistance.

CALIBRATING THE TEMPERATURE DISPLAY

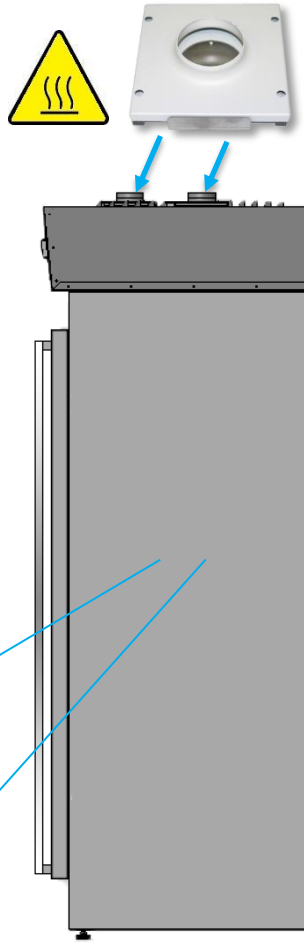
Note: Performing an accurate calibration of the temperature display requires a temperature reference device. Please see the **Reference Sensor Devices entry** on page 8 for the minimum device requirements.

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

A Suggested Calibration Set Up



Heat-resistant non-stick tape recommended



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

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

1) Introduce the reference device thermocouple sensor probes into the oven chamber through the rear access port. Carefully close port slider. Leaving a ¼ inch gap (6mm) is acceptable when wire probes are in the port and should not interfere with the verification accuracy. The chamber air pressure is close to neutral while the oven is in operation, limiting the exchange with cooler external atmosphere.

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

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

5) Heat up and stabilization period: The oven temperature must be stable at temperature in order to perform an accurate calibration. The temperature is considered stabilized when the oven chamber has operated at your calibration temperature for at least 30 minutes with no fluctuations of **±0.2°C or greater** when the oven is running at **80°C**, **±0.3°C or greater at 150°C**, or **±0.4°C or greater at 306°C**.

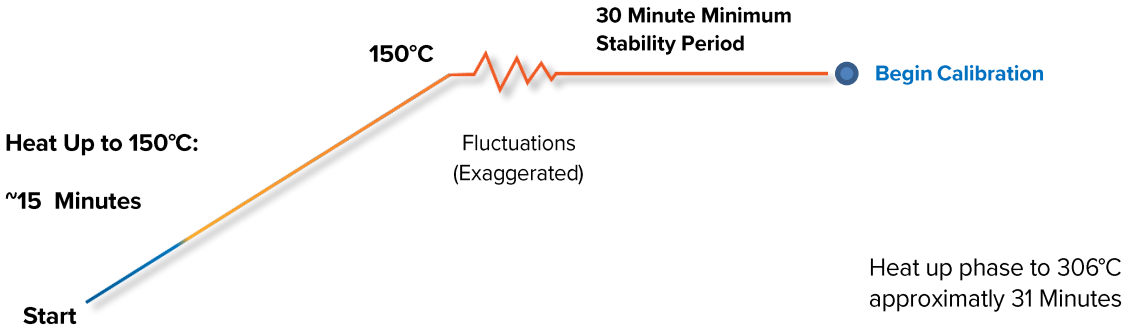


Figure 6: Oven Chamber Heat Up and Stabilization Phases

Suggested Calibration Procedure

1

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

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

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

2

The display requires a calibration adjustment.

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

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

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

Continued on next page

Calibration continued

3

Unlock the controller.

a. See the Unlocking procedure on page 39.

Note: The temperature controller must be unlocked in order to access the Operations menu and enter a calibration offset.

4

Jump to the Operations menu after unlocking the controller.

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

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

Operations Menu

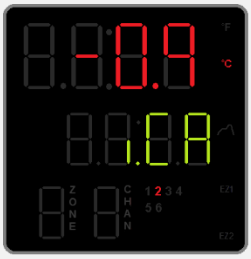
5

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

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

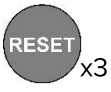
6

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



7

Save the calibration offset and return to the homepage.



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

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

Continued on next page

SHELLAB®

Calibration continued

8

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

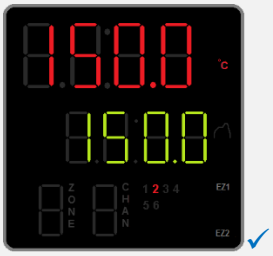
Note: The unit is stabilized when no fluctuations are detected of **±0.2°C or greater** when the oven is running at **80°C, ±0.3°C or greater at 150°C**, or **±0.4°C or greater at 306°C**.

9

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

Reference Device

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



b. See step 10 if the difference falls outside the acceptable range of your protocol again.

10

Repeat steps 2 – 9 up to two more times. You may skip Step 3 by leaving the controller unlocked until the unit is successfully calibrated.

Reference Device

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

Note: Always relock the temperature controller after a successful calibration has been carried out. This safeguards against a user accidently changing the controller configuration file and interfering with the functionality of the unit.

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

UNLOCKING THE TEMPERATURE CONTROLLER

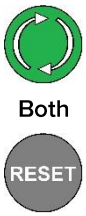
The oven temperature controller is software locked at the factory to ensure the integrity of its configuration file. This safeguards against end-users accidently altering the oven functionality or safe operating bounds.

The controller must be unlocked in order to access the Operations menu and enter calibration offsets.

Backing Up the Configuration File

The manufacturer recommends saving the controller configuration file prior to making any changes to Operations options. See the Configurator software description in the **Data Port entry** on page 31. This will allow you to restore the configuration file in the event a change is made that adversely affects the operation of the oven.

1



Jump to the Lock menu.

a. Press and hold **both** the **Reset** and **Advance** buttons for approximately 8 – 9 seconds.

Note: If the top red line shows the “CUSt” Custom option, use the Up or Down arrow keys to scroll to the “Loc” Security Setting option. Then press the Advance button as per Step 2.

2

Advance to the lock “LoC.o” parameter that controls the Operations page.

a. Push the Advance button once.

3

Once on the LoC.o page, adjust the setting from 3 to 2.

a. Use the **Down** arrow button.

Continued on next page

Unlocking the Controller Continued

4

Advance to the second security parameter, “LoC.P”.

a. Push the Advance button once, saving the previous parameter and advancing to the next parameter.

5

On the “LoC.P” Profiling Page parameter, adjust the setting from 2 to 3.

a. Use the Up arrow button.

6

Advance twice, skipping through the “PAS.E” Password Enable parameter to “rLoc”, leaving “PAS.E” set to Off.

x2

a. Press the Advance button twice.

Leave set to Off

7

Use the Up arrow button.

a. On the “rLOC” Read Lock page, switch the parameters from 2 to 5.

8

Advance to the “SLOC” Write Security parameter.

a. Press the Advance button once.

Unlocking the Controller Continued

9

Change the “SLoC” parameter from 2 to 5.

a. Use the Up arrow button.

10

Return to the homepage to access the now unlocked Operations page.

RESET x2

a. Push the Return button twice.

Relocking the Controller

Always relock the controller after completing a calibration or other Operations menu procedure.

- To relock controller, repeat the Unlocking procedure, only this time **restore** all of the Security lock parameters to the locked settings
- When first jumping from the homepage to the Factory menu to relock the controller, the red top display line will show the “CUSt” Custom option.
- Use the arrow keys to scroll to the “LoC” Security option, then press the Advance button as per Step 2 and carryout the rest of the procedure.

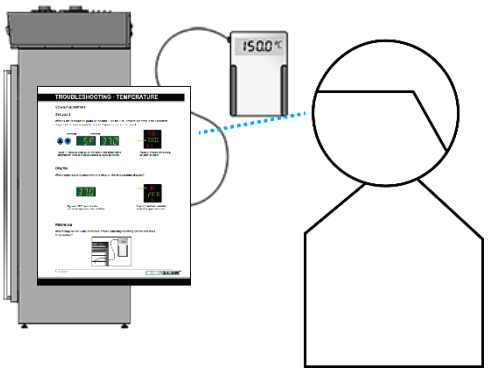
Parameter	Locked	Unlocked	Parameter Function
LoC.o	3	2	Operations Page
LoC.P	2	3	Profiling Page
PAS.E	Off	Off	Password Enable
rLoC	2	5	Read Lock
SLoC	2	5	Write Security

DIAGNOSTICS - HEATING ISSUES

If the unit is experiencing heating issues, use the following guide to gather information on the unit, prior to contacting Technical Support. Gathering and sharing this information with Tech Support significantly increases the chance a service technician will be dispatched with the parts needed to fix your unit during their first visit.

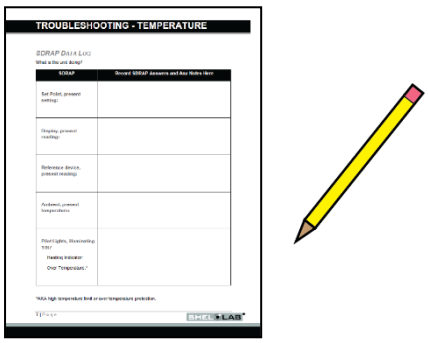
Steps

1



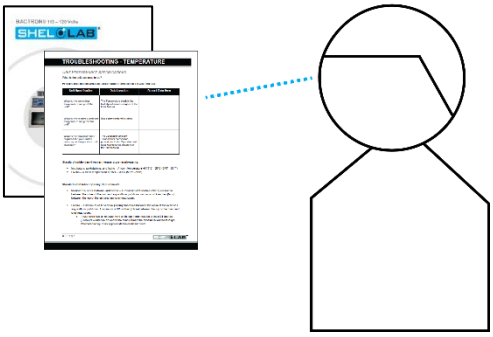
Read the SDRAP diagnostic questions on pages 47 and 48 and observe the unit in operation.

2



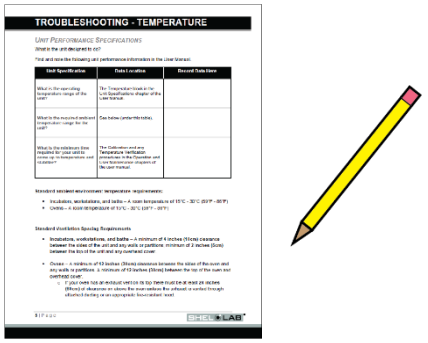
Record the observations in the SDRAP Data Log on page 43.

3



Read the Unit Performance Specification questions on page 44 and consult the user manual for answers.

4



Record the answers in the Unit Specifications Log on page 44.

5 **Share this information with Tech Support!**

SDRAP Data Log

What is the unit doing? See pages 47 - 48 for the detailed walkthrough of the SDRAP questions.

SDRAP	Record SDRAP Answers and Any Notes Here
Set Point, present setting:	
Display, present Temperature reading:	
Reference device, present reading:	
Ambient, present temperature:	
Pilot Lights, illuminating Y/N?	Heating Indicator:
	High Limit Activated:

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Unit Performance Specifications

What is the unit designed to do?

Find and note the following unit designation and performance information in the user manual.

Unit Specification	Data Location	Record Data Here
Model Type:	This manual covers SMO14HP-2s and SMO28HP-2s. See the Orientation Photos on pages 10 and 11 or the data plate on the unit to identify your model type.	
What is the operating temperature range of the unit?	The Temperature block in the Unit Specifications chapter, page 53.	
What is the required ambient temperature range for the unit?	See below (under this table).	
What is the minimum time required for your unit to come up to temperature and stabilize?	Allow 15 minutes for the unit to achieve 150°C or 31 minutes to achieve 306°C.	

Standard ambient environment temperature requirements:

- A room temperature of **15°C to 40°C (59°F to 104°F)**, at no greater than **80% Relative Humidity** (at 25°C / 77°F).

Standard Ventilation Spacing Requirements

- A minimum of **12 inches (30cm)** clearance between the sides of the oven and any walls or partitions.
- A minimum of **12 inches (30cm)** between the top of the oven and overhead cover if suitable ducting is attached to the exhaust vent.
    - Otherwise, **24 inches (60 cm)** vertical headspace is required.

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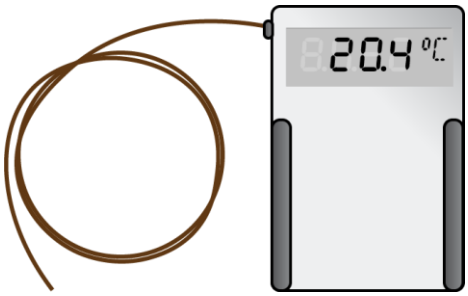
Required Items

You must have the following items on hand to answer the diagnostic questions.

A temperature reference device – A calibrated digital thermometer with at least one sensor probe. The device must be at least accurate to 0.1°C.

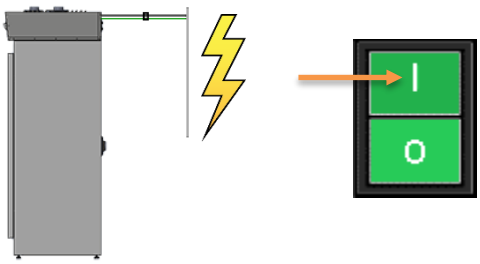


A copy of the user manual for the unit – Must be available in the same room as the unit for use.

Note: Does the car actually have gas in the tank? Have you physically verified the computer is plugged in? Yes, we are going ask some very basic questions. Please bear with. Methodical verifications and the elimination of assumptions are often the quickest means of getting a unit back into operation.

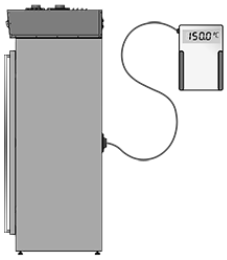
Before Starting

1. The unit must be Connected to a power source that meets the requirements in the Installation chapter (page 15) and turned on.



2. A reference temperature device sensor probe must be placed in the chamber.

   - See the probe placement suggestions in the **Temperature Display Calibration procedure** on page 35.



3. The oven chamber doors must be closed and latched. The intake and exhaust vents should both be closed.

4. The unit must have adequate time to come up to temperature and stabilize. **Failure to wait will result in an inaccurate diagnosis**.

- Allow 15 minutes for the unit to achieve 150°C or 31 minutes to achieve 306°C from room temperature.
- Start the “Diagnostic Data Procedure” when the allotted time has passed, **even if the unit fails to achieve the set point temperature**.

Diagnostic Data Procedure – SDRAP Questions

Set point?

What is the present constant temperature set point of the unit? See the Set Temperature entry in the "Operation" chapter of the user manual how to set the constant temperature set point.

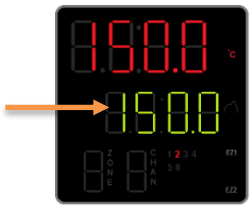


Figure 7: Set Point in green

Display?

What chamber temperature is presently showing on the temperature display?

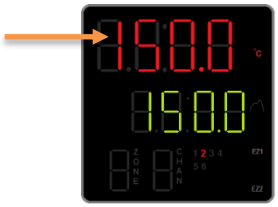
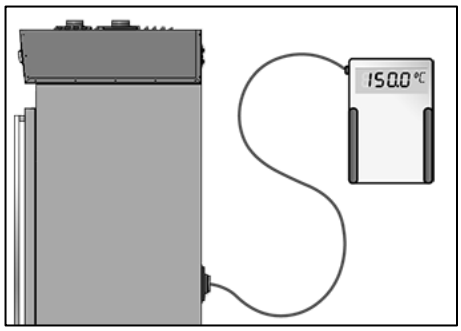


Figure 8: Present temperature in red

Reference?

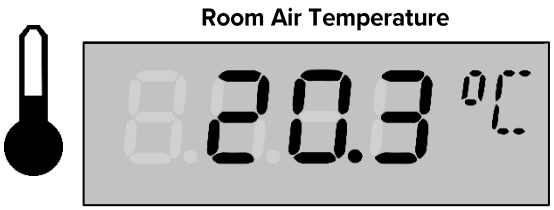
What temperature is the reference device currently showing for the chamber temperature?



Ambient?

What is the room temperature?

- For best results, measure the temperature in the same section of the room where the unit is located. Do not place your thermometer on the unit!



Pilot Lights?

1) Is the heating active indicator on the control panel flashing or otherwise illuminating.

Figure 9: Heating Indicator

2) Is the high limit heating cutoff activating? Answer yes if the limit is on continually or activating periodically.

Alternating alert screens flash when the high limit heating cutoff is active

Share!

Share the SDRAP and Unit Specifications data with Technical Support. This data is crucial for offsite personnel making accurate remote diagnoses. The information is used to help ensure service techs are dispatched with the tools and parts needed to fix your unit during their first visit.

Facilities Technicians

SDRAP and Unit Specifications data are also useful to any institutional repair technicians at your facility who may be responsible for servicing of out-of-warranty units.

End Diagnostic Data Procedure

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UNIT SPECIFICATIONS

These ovens are 220 - 240 voltage single phase 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
SMO10HP-2	450 lbs. / 204 kgs
SMO28HP-2	694 lbs. / 315 kgs

DIMENSIONS

By Inches

Model	Exterior W × D × H	Interior W × D × H
SMO10HP-2	44.0 x 28.3 x 55.1	30.0 x 19.0 x 30.1
SMO28HP-2	42.5 x 36.0 x 85.3	31.5 x 25.5 x 61.0

By Millimeters

Model	Exterior W × D × H	Interior W × D × H
SMO10HP-2	1118 x 719 x 1400	762 x 482 x 764
SMO28HP-2	1080 x 914 x 2167	800 x 647 x 1549

UNIT SPECIFICATIONS

CAPACITY

Model	Cubic Feet	Liters
SMO10HP-2	10.0	283
SMO28HP-2	28.0	792

Shelf Capacity by Weight

Model	Per Shelf	Total
SMO10HP-2	75 lbs / 34 kg	225 lbs / 102 kg
SMO28HP-2	75 lbs / 34 kg	450 lbs / 204 kg

AIR FLOW PERFORMANCE

Air Exchanges

Model	Cubic Feet	Cubic Liters
SMO10HP-2	120 per Minute	3398 per Minute
SMO28HP-2	125 per Minute	3560 per Minute

Air Flow Across the Shelf Space

Model	Cubic Feet	Liters
SMO10HP-2	16.9 per Minute	480 per Minute
SMO28HP-2	17.3 per Minute	490 per Minute

UNIT SPECIFICATIONS

TEMPERATURE PERFORMANCE

Range

Model	Operating Range
SMO10HP-2	Ambient +15° to 306°C
SMO28HP-2	Ambient +15° to 306°C

Uniformity

Model	@80°C	@150°C	@306°C
SMO10HP-2	1.0°C	1.5°C	5.0°C
SMO28HP-2	1.0°C	2.5°C	5.0°C

Stability

Model	@80°C	@150°C	@306°C
SMO10HP-2	± 0.2°C	± 0.3°C	± 0.4°C
SMO28HP-2	± 0.2°C	± 0.3°C	± 0.4°C

Heat Up Times from Ambient (25°C)

Model	To 80°C	To 150°C	To 306°C
SMO10HP-2	6 Minutes	15 Minutes	31 minutes
SMO28HP-2	6 Minutes	15 Minutes	31 minutes

Continued on next page

Temperature Performance Continued

Recovery Times from a 30 Second Door Opening

Model	@ 80°C	@ 150°C	@ 306°C
SMO10HP-2	3 Minutes	3 Minutes	6 Minutes
SMO28HP-2	3 Minutes	3 Minutes	5 Minutes

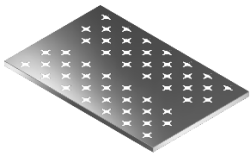
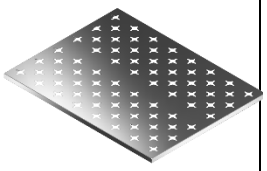
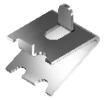
Recovery Times from a 60 Second Door Opening

Model	@ 80°C	@ 150°C	@ 306°C
SMO10HP-2	5 Minutes	6 Minutes	10 Minutes
SMO28HP-2	5 Minutes	5.5 Minutes	10 Minutes

POWER

Model	AC Voltage	Amperage	Frequency	Phase
SMO10HP-2	220 - 240	26	50/60 Hz	1
SMO28HP-2	220 - 240	50	50/60 Hz	1

REPLACEMENT PART LIST

Description	Parts Number	Description	Parts Number
Adjustable Leveling Feet:	 **2700506**	Shelf Assembly, 19 x 29”, SMO10HP-2	 **995-00007**
Door Gasket Fiberglass with clips, 1ft section SMO10HP-2 requires 11.5 feet SMO28HP-2 requires 17 feet	 **3450642**	Shelf Assembly, 23 x 31, SMO28HP-2	 **995-00005**
Power Exhaust Blower Unit 220 Volt, all models.	 **9990741**	Shelf Clip, 1	 **1250512**

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 oven with its correct part.

SHELLAB®

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