

SMI INCUBATORS 100 – 120 Voltage



Installation and Operation Manual

SMI2, SMI6, SMI7, SMI11, SMI12

Previously designated as

GI2, GI6, GI7, GI11, GI12

Shel Lab General Purpose Incubator 100 – 120 Voltage

Installation and Operation Manual

Part number: 4861572-1

Revised: October 29, 2015

Pictured on cover: SMI6



SMI2



SMI7



SMI11



SMI12

These units are TÜV CUE listed as general-purpose air incubators for professional, industrial, or educational use where the preparation or testing of materials is done at approximately atmospheric pressure and no flammable, volatile, or combustible materials are being heated.

These units have been tested to the following requirements:

CAN/CSA C22.2 No. 61010-1:2012

CAN/CSA C22.2 No. 61010-2-010 + R:2009

UL 61010A-2-010:2002

UL 61010-1:2012

EN 61010-1:2010

EN 61010-2-010:2003

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INTRODUCTION

Thank you for purchasing a Sheldon Manufacturing Incubator. We know that in today's competitive marketplace, customers have many choices when it comes to constant temperature equipment. We appreciate you choosing ours. Our continued reputation as a leading laboratory product manufacturer rests with your satisfaction. Sheldon Manufacturing, Inc. stands behind our products, and we will be here if you need us.

These general purpose dry incubators are intended for professional, industrial, or educational cell cultivation applications. They are not designed for use in hazardous or household locations.

Before using the incubator read the entire manual to understand how to install, operate, and maintain the incubator in a safe manner. Keep this manual available for use by all incubator operators. Ensure that all operators are given appropriate training before the incubator 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 unit and its recommended accessories are designed and tested to meet strict safety requirements. It is designed to connect to a power source using the specific power cord type shipped with the unit.

For continued safe operation of your unit, always follow basic safety precautions including:

- Always plug the unit power cord into a protective earth grounded electrical receptacle (outlet) that conforms to national and local electrical codes. If the unit is not grounded properly, parts such as knobs and controls can conduct electricity and cause serious injury.
- Avoid damaging the power cord. Do not bend it excessively, step on it, or place heavy objects on it. A damaged cord can be a shock or fire hazard. Never use a power cord if it is damaged.
- Always position the unit so that end-users can quickly unplug it in the event of an emergency.
- Do not attempt to move the unit while in operation or before the unit has cooled.
- Use only approved accessories. Do not modify system components. Any alterations or modifications to your incubator can be dangerous and void your warranty.
- Follow all local ordinances in your area regarding the use of this unit. If you have any questions about local requirements, please contact the appropriate agencies.

INTRODUCTION (CONTINUED)

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 distributor for assistance.

CONTACTING ASSISTANCE

If you are unable to resolve a technical issue with your incubator, 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** (see page 7).

EMAIL: tech@shellab.com PHONE: 1-800-322-4897 extension 3, or (503) 640-3000 FAX: (503) 640-1366

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

RECEIVING YOUR INCUBATOR

When an incubator leaves the factory, safe delivery becomes the responsibility of the carrier. Damage sustained during transit is not covered by the manufacturing defect warranty. When you receive your incubator inspect it for concealed loss or damage to the interior and exterior. If you find damage, **follow the carrier's procedure for claiming damage or loss.**

INSPECTING THE SHIPMENT

Before leaving the factory, SMI incubators are packaged in high-quality shipping materials to provide protection from transportation-related damage.

Carefully inspect the shipping carton for damage. Report any damage to the carrier service that delivered the incubator. If the carton is not damaged, open the carton and remove the contents. Carefully check all packaging before discarding. Save the shipping carton until you are certain that the unit and its accessories function properly.

Inspect the incubator for damage. The orientation photos on the pages following this one can serve as useful visual references.

The unit should come with an Installation and Operation Manual and a Certificate of Compliance. Verify that the correct number of accessories are present in the ship kit.

Included accessories

| Model | Shelves | Shelf Slides | Leveling Feet | Power Cord |
|--------------|----------------|---------------------|----------------------|-------------------|
| SMI2, SMI7 | 2 | 4 | 4 | 1 |
| SMI6 | 3 | 6 | 4 | 1 |
| SMI11 | 6 | 12 | 4 | 1 |
| SMI12 | 6 | 12 | 4 | 2 |

Each unit is provided with a 115 volt 15 Amp, 9ft 5 in (2.86m) NEMA 5-15P power cord. The SMI12 is provided with two of these cords — one for each chamber.

Carefully check all packaging before discarding. Save the shipping carton until you are sure everything works properly.

RECEIVING YOUR INCUBATOR (CONTINUED)

RECORDING DATA PLATE INFORMATION

The data plate contains the incubator **model number** and **serial number**. Record this information for future reference.

The data plate is located on the top right corner of the incubation chamber door, inside the chamber.

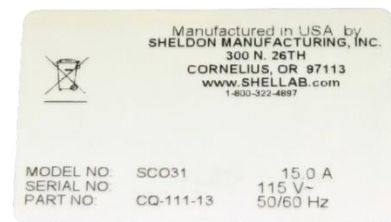


Figure 1: Data Plate

Date Plate Information

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

REFERENCE SENSOR DEVICE

A reference sensor device must be purchased separately for performing temperature display accuracy verifications or calibrations.

Reference devices must be accurate to at least 0.1°C. The device should be regularly calibrated, preferably by a third party. For best results, use a digital device with a wired-connected temperature sensing probe that can be placed in the incubation chamber through the unit access port, while leaving the device and its display outside the unit. For example, a wire thermocouple probe. Reference readings that avoid chamber door openings during verification and calibration eliminate subsequent waits for the chamber temperature to re-stabilize before proceeding.

Select probes suitable for the application temperature you will be calibrating or verifying the incubator displays at.

Alcohol thermometers do not have sufficient accuracy for conducting accurate temperature verifications and calibrations. Do not use a mercury thermometer. **Never place a mercury thermometer in the incubation chamber.**

INSTALLATION

AMBIENT CONDITIONS

SMI incubators are intended for use indoors at room temperatures between **15°C and 30°C (59°F and 86°F)**, at no greater than an ambient **80% Relative Humidity** (at 25°C / 77°F). Allow a minimum of **4 inches (10cm)** between the incubator and walls or partitions, and **2 inches (5cm)** of clearance above the top of the incubator for unobstructed airflow.

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

ENVIRONMENTAL FACTORS

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

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

POWER SOURCE REQUIREMENTS

When selecting a location for the unit, verify that each of the following requirements is satisfied.

The required circuit amperage to support these units is 15amps. Wall power sources must match the voltage and ampere requirements listed on the unit data plate. These units are intended for 100 – 120 VAC 50/60 Hz applications at the following amperages: SMI2 4.5 Amps; SMI6 6.0 amps; SMI7 6.5 amps; SMI11 7.0 amps; SMI12 12 amps (6.0 amps for each chamber).

- The wall power sources must conform to all national and local electrical codes.
- Wall power sources must be protective earth grounded. Use a separate circuit to prevent loss of product due to overloading or circuit failure.
- **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 unit is provided with a 115 volt 15 Amp, 9ft 5 in (2.86m) NEMA 5-15P power cord for each inlet (SMI12 is provided with 2 cords).

- The unit must be positioned so that all end-users can quickly unplug power cords in the event of an emergency.
- Units are provided with the following types of fuses located in each power inlet:
 - SMI7 and SMI11 - 250V time-lag T10 amp 5x20mm
 - SMI2, SMI6, SMI12 - 250V T6.3A 5x20mm

INSTALLATION (CONTINUED)

LIFTING AND HANDLING

The unit should only be lifted by its bottom surfaces using proper heavy lifting machinery such as a forklift or pallet jack. Handles and knobs are inadequate for lifting or stabilization. The unit should be completely restrained from tipping during lifting. Transporting the unit while lifted is not recommended and may be hazardous. Remove all moving parts, such as shelves and trays, and secure the door in the closed position prior to lifting the unit.

Do not attempt to move the unit while in operation or before the unit has cooled.

LEVELING

The unit must be level and stable for safe operation. Each unit ships with four leveling feet.

1. Insert one leveling foot into each of the four holes in the bottom corners of the unit.
2. Adjust the foot at each corner until the unit stands level and solid without rocking. To raise a foot, turn it in a counterclockwise direction.
3. To lower a foot, turn it in a clockwise direction.

Figure 2: Leveling Foot



2700512

To prevent damage to the feet while in transport turn all feet to the maximum counterclockwise position.

INSTALL INCUBATOR IN LOCATION

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

ACCESS PORT

SMI incubators are provided with a plastic cap for the access port on the left side of the incubation chamber. Always leave this cap in place, except when introducing probes into the chamber for temperature calibrations or verifications. Removing the cap during normal operations can adversely impact temperature stability and uniformity.

DEIONIZED AND DISTILLED WATER

Do not use deionized water to clean or humidify the incubator. Use of deionized water may corrode metal surfaces and voids the warranty. Sheldon Manufacturing 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 and humidifying applications.

INSTALLATION (CONTINUED)

INSTALLATION CLEANING AND DISINFECTION

If required by your laboratory protocol, clean and disinfect the incubation chamber and shelving components prior to installation. Cleaning and disinfecting now reduces the risk of contamination. The chamber and shelving were cleaned and disinfected at the factory, however, Sheldon Manufacturing cannot guarantee that the incubator was not exposed to contaminants during shipping.

Remove all protective wrappings from shelving components prior to cleaning.

Please see the [Cleaning and Disinfecting](#) entry on page 21 in the User Maintenance section for information on how to clean and disinfect without damaging the incubator or its components.

SHELVING INSTALLATION

To install the incubator shelves perform the following:

1. Hold the shelf slide at about a 10° angle (Figure 2A).
2. Insert the hooked tab into the vertical slot at the desired height (Figure 2B).
3. Push the slide into the horizontal slots.
4. Repeat for shelf slide at the same height on the opposite side of the incubator.
5. Place a shelf on the shelf slides. Repeat this procedure for additional shelves as needed.

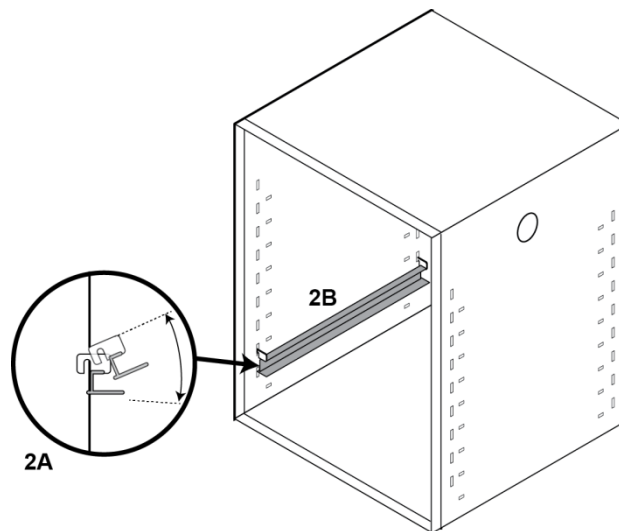












Figure 3: Shelving Installation

GRAPHIC SYMBOLS

Your incubator comes provided with graphic symbols on its exterior surfaces. These identify hazards and the function of the adjustable components, as well as important notes in the user manual.

| Symbol | Definition |
|---|---|
|  | Indicates that you should consult your operator's manual for further instructions. Indique que l'opérateur doit consulter le manuel d'utilisation pour y trouver les instructions complémentaires. |
|  | Indicates Temperature Indique un affichage de la température |
|  | Indicates Over Temperature Protection Indique le système de dépassement de température |
|  | Indicates AC Power Repère le courant alternatif |
|  | Indicates I/ON and O/OFF I repère de la position MARCHÉ de l'interrupteur d'alimentation O repère de la position ARRÊT de l'interrupteur d'alimentation |
|  | Indicates Protective Earthground Repère terre électrique |
|  | Indicates Up and Down respectively Touches de déplacements respectifs vers le HAUT et le BAS |
|  | Indicates Manually Adjustable Signale un élément réglable manuellement |
|  | Indicates Potential Shock Hazard Signale un danger électrique |
|  | Indicates Incubator should be recycled (Not disposed of in land-fill) Indique l'appareil doit être recyclé (Ne pas jeter dans une décharge) |

CONTROL PANEL OVERVIEW



Figure 4: Control Panel

Over Temperature Limit Thermostat (OTL)



This graduated dial sets the heating cut off point for the OTL temperature limit system. The OTL system prevents unchecked heating of the chamber in the event of a failure of the main digital controller. For more details, please see the [Over Temperature Limit System](#) description in the Theory of Operations (page 13).



The red Over Temp Activated light illuminates when the Over Temperature Limit system cuts off heating by rerouting power away from the heating elements.

Power Switch



The power switch controls all power to each incubator and its systems. Power is supplied when the switch is in the (I) on position and the Power On light illuminated.



Temperature Control and Display



Labeled Set Temperature °C, this display shows the current air temperature in the incubation chamber accurate to within 0.1°C. The arrow buttons can be used to adjust the temperature set point, or place the display in its temperature calibration mode and then enter a display value correction.



The green indicator labeled Heating Activated illuminates whenever the temperature control system is heating the incubation chamber.

OPERATION

THEORY OF OPERATION

The SMI general purpose incubators are engineered to provide constant temperature incubation environments. Each unit can obtain a stable, uniform temperature in its chamber, ranging from the room temperature (ambient) +8°C up to 70°C for incubation applications. Each incubator features a glass viewing door that allows visual inspection of samples without compromising the chamber temperature environment. Each incubator unit in an SMI12 is independently powered and heated.

Heating

When powered, an incubator heats to and maintains the incubation chamber air temperature at the currently programmed temperature set point. An internal microprocessor stores the temperature set point. The microprocessor board is wired to a solid-state temperature probe located on the chamber interior right wall. When the processor detects that the chamber temperature has dropped below the temperature set point, it pulses power to heating elements located in the air-jacket insulation space and the outer chamber door. During normal operations with the doors closed most heating pulses correct for deviations of less than 0.1°C.

The processor employs proportional-integral-derivative analytical feedback-loop functions when measuring and controlling the chamber air temperature. 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 that difference. The integral function slows the rate of pulses when the temperature nears the set point to avoid overshooting.

Each incubator relies on natural heat radiation for cooling. An incubator can achieve a low-end temperature of the ambient room temperature +8°C.

The chamber door is self-heating to bolster the thermal uniformity and stability of the chamber and to minimize condensation on the glass viewing door. The glass door will cool while the chamber door is opening, eventually leading to condensate on the door and impacting the chamber temperature stability and uniformity. Minimize sample viewing times when possible.

Insulation is provided by a heated, recirculating air jacket.

The Over Temperature Limit System (OTL)

When set, the OTL system prevents runaway heating in the event of a failure of the temperature microprocessor or its sensor probe by rerouting power away from the heating element whenever the temperature in the incubator chamber exceeds the OTL setting. The OTL is provided with an independent hydrostatic temperature probe located in the incubation chamber. The system is set **by the end-user** at approximately 1°C above the current chamber temperature, typically when stabilized at the application temperature. Because of its nature as a mechanical cutoff and its lack of PID analytics, the OTL cannot deliver the same degree of temperature stability and measurement precision as the digital display and controls. The OTL System should only be used as a means of heating regulation for the incubation chamber until a failed processor board and its temperature probe can be repaired or replaced.

OPERATION (CONTINUED)

PREPARING THE INCUBATOR FOR USE



8 Hours Total

Setting up the incubator for use in a new workspace environment requires an 8-hour period for the unit to come up to and stabilize at temperature and humidity levels prior to loading the incubation chamber with samples. During this period the incubator must be powered continually with the chamber doors closed. Allowing time for stabilization helps protect samples. It is also necessary for the optional temperature display accuracy verification procedures, as well as any calibrations performed.

Perform the following steps and procedures to prepare an SMI incubator for use each time it is installed in a new workspace environment:

1. A clean and disinfected thermocouple probe for performing the optional temperature display accuracy verification may be inserted through the access port now. This saves time by allowing the unit chamber temperature to stabilize undisturbed prior to the verification procedure.
 - a. See the [Temperature Display Accuracy Verification procedure](#) on page 16 for the correct introduction and placement of the thermocouple probe.
2. Verify that the workspace power supply and the incubator power requirements listed on the unit data plate have been matched.
 - a. See the [Power Source Requirement](#) entry on page 8.
3. Attach the power cord(s) that came with the incubator to the power inlet(s) receptacle on the back of the unit.
4. Plug the power cord(s) into the workspace supply outlet(s).
5. Place the **Power** switch(s) in the on (I) position.
6. Perform the following procedures in the Operation section to finish preparing the incubator:
 - a. [Set the Temperature Set Point](#) page 15
 - b. Allow the incubator to heat undisturbed for 8 hours before continuing.
 - c. **Optional:** [Verify Temperature Display Accuracy](#) page 16
 - d. [Set the Over Temperature Limit](#) page 18
 - e. [Load the Chamber](#) page 19

End of Preparation Procedure

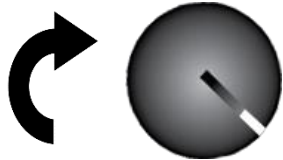
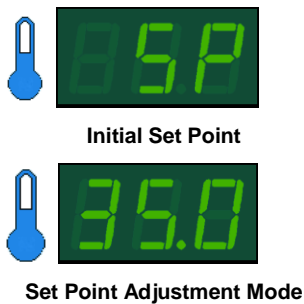

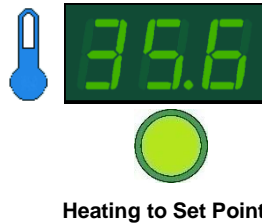
OPERATION (CONTINUED)

SET THE TEMPERATURE SET POINT

Perform the steps below to change the set point to the operational temperature you will be using during your incubation application. The incubator comes from the factory with a set point of 37°C.

Note: The visual example below depicts adjusting the incubator set point from 35°C to a 37°C application temperature.

Note: For the SMI12 the temperature must be set separately for each incubation unit.

| Set Temperature Set Point | |
|---|---|
| <p>1. Turn the OTL control clockwise to the maximum, if not already set to max.</p> <p>a. This prevents the Safety cutoff system from interfering with this procedure.</p> |  |
| <p>2. Press and release either of the temperature arrows to activate the temperature set point adjustment mode.</p> <p>a. The temperature display will briefly flash the letters “SP” to indicate the Set Point is about to be displayed.</p> <p>b. The temperature display will then show the flashing, adjustable temperature set point.</p> <p>Note: The display will automatically exit the adjustment mode after 5 seconds of inactivity, with the last shown set point value saved.</p> |  |
| <p>3. Use the Up or the Down arrow keys to adjust the set point to your application temperature.</p> |  |
| <p>4. Wait 5 seconds after entering the set point.</p> <p>a. The display will stop flashing, and the set point is now saved in the controller.</p> <p>b. The chamber will now automatically heat or passively cool to match your set point.</p> <p>c. The display will revert to showing the current chamber air temperature.</p> |  |
| <p>See the Set the OTL procedure on page 18 for how to set the OTL system once the incubation chamber has stabilized at your application temperature set point after you have performed any display verifications or calibrations.</p> | |

End of Procedure

OPERATION (CONTINUED)

Note: Each chamber temperature display on the SMI12 must be verified independently.

TEMPERATURE ACCURACY VERIFICATION

Note: Performing a temperature accuracy verification requires a temperature reference device. Please see the [Reference Sensor Devices entry](#) on page 7 for the device requirements.

Optional: Each incubator temperature display is calibrated at the factory at 37°C. A verification of the display accuracy may be carried out when preparing the incubator for use if required by your laboratory or production protocol. The verification procedure compares the incubator displayed temperature with the actual chamber air temperature, as provided by a calibrated reference device.

If an error between the actual and displayed temperatures is discovered, perform a temperature calibration. Please see the [Calibrate Temperature Display procedure](#) on page 24 in the User Maintenance section.

Probes

Reference device sensing probes may be introduced through the access port. Seal gaps around the probe wire using non-stick, non-marking tape. Do not introduce through the door space. Creating gaps in the door seal risks introducing leaks and cold spots, as well as condensation on the viewing door.

Place the sensor probe of the temperature reference device as close as possible to the geometric center of the incubation chamber. A thermocouple sensor probe may be taped to the shelving, as long as the exposed copper end is 2 inches (5cm) away from the shelf (see Figure 5). An exposed sensor probe in direct contact with the shelving may experience heat sinking, which can result in an inaccurate temperature reading.

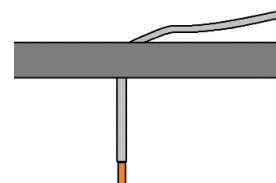


Figure 5: Probe End 2 inches (5cm) From Shelf Surface

Stability

After introducing and placing the temperature probe, allow the incubator to run undisturbed for 8 hours (for example, overnight) prior to performing the verification.



Wait 1 Hour

Prior to a verification, the chamber must operate at its verification temperature set point for **at least 1 hour with no fluctuations** of $\pm 0.1^{\circ}\text{C}$ or greater in order to be considered stabilized. Failure to wait for stabilization will result in an inaccurate verification. If the chamber door is opened during the verification the chamber must be allowed to re-stabilize with no fluctuations before continuing.

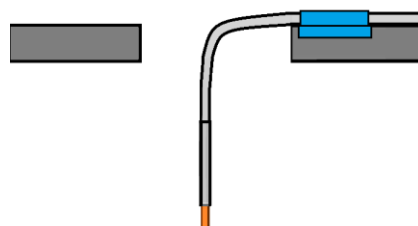


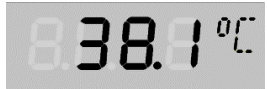



Figure 6: Probe Placement in SMI11 Double Chamber – Between Shelves, Center of Chamber

OPERATION (CONTINUED)

| Verifying the Temperature Display Accuracy | |
|---|---|
| <ol style="list-style-type: none"> 1. Once the chamber temperature has stabilized, compare the reference temperature device and incubator display readings. <ol style="list-style-type: none"> a. If the readings are the same, or if a difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber air temperature. The Temperature Verification procedure is now complete. b. See step 2 if a difference falls outside the acceptable range of your protocol. | <p>Reference Device</p>  <p>Set Temperature °C</p>  |
| <ol style="list-style-type: none"> 2. If there is an unacceptable difference, a display temperature calibration must be performed to match the display to the reference device. <ol style="list-style-type: none"> a. Please see page 24 in the User Maintenance section. | <p>Reference Device</p>  <p>Set Temperature °C</p>  |

End of procedure

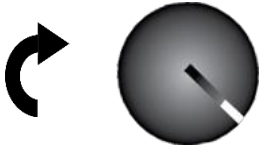
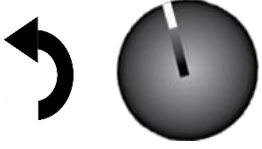
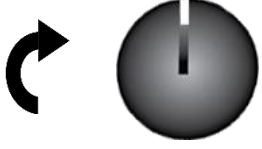
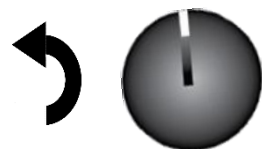

OPERATION (CONTINUED)

Note: Test the OTL system at least once per year for functionality.

Note: Both OTL systems must be set on the SMI12 to provide protection for the complete unit.

SET THE OVER TEMPERATURE LIMIT

The incubator must be operating at your incubation application temperature and must be stable for at least one hour prior to setting the OTL. Perform the following steps to set up the **Over Temperature Limit** system for use:

| Set OTL | Example |
|--|---|
| 1. Turn the Set Over Temperature Limit control dial clockwise to the maximum position, if it is not already set to maximum. |  |
| 2. Turn the Over Temperature Limit control dial counterclockwise until the red Over Temperature Limit Activated light illuminates. |  |
| 3. Slowly turn the dial clockwise until the Over Temperature Limit Activated light turns off. Stop turning the control. <ol style="list-style-type: none"> The Over Temperature Limit is now set approximately 1°C above the current chamber temperature. |  |
| 4. Optional: You may turn the dial slightly to the left to bracket in closer to the set point temperature. This sets the OT Limit nearer to the current chamber temperature. |  |
| 5. Leave the OTL dial set just above the activation point. |  |

If the OTL is sporadically activating, you may turn the dial very slightly to the right (clockwise).

If the OTL continues activating, check for ambient sources of heat or cold that may be adversely impacting the unit temperature stability. Check if any powered accessories in the chamber are generating heat. If you can find no sources of external or internal temperature fluctuations, contact Tech Support or your distributor for assistance.

End of Procedure

OPERATION (CONTINUED)

LOAD THE INCUBATOR

Place items on the shelves inside the incubation chamber as evenly spaced as possible. Proper spacing allows for maximum air circulation and a high degree of temperature uniformity. Leave 1 inch (2.5cm) between sample containers and the chamber walls.

This is the final step in the [Preparing the Incubator procedure](#).

ATTACHING EQUIPMENT TO THE INTERIOR ACCESSORY OUTLET

This unit has a 1 amp accessory outlet located inside the incubation chamber. The power switch on the control panel controls power to the outlet. The outlet can power devices such as magnetic stirrers, rockers, etc. Do not attach devices drawing more than 1 amp to this outlet.

Accessory devices may produce additional heat. This heat can impact the temperature performance of the incubator. Check that the incubator operates within your protocol or applications temperature range when accessory devices are active in the chamber.

HUMIDIFYING THE INCUBATOR

Long-term use of a large water container, such as a humidifier pan, may create excess water vapor in the unit and can damage the electrical components of an SMI series (GI series) dry incubator. Additionally, use of **deionized water** may cause significant corrosion damage to the incubator.

Placing only a small number of petri dishes or other media containers in the incubator chamber may lead to excessive drying of sample media. Leaving a small water-filled container, such as an open flask, in the chamber will help to prevent sample drying with **small loads**. Use of a large open container, such as a humidifier pan, can generate corrosion and damage electrical components. Overloading the unit with sample media may also damage the incubator from excessive media evaporation and disruption of air flow pathways through the shelf space.

OPERATION (CONTINUED)

CONDENSATION AND THE DEW POINT

Ambient humidity in excess of 80% relative humidity or overloading the incubation chamber with open or breathable sample containers will likely result in condensation in the chamber, possible leaks around the incubator. This may cause corrosion damage if allowed to continue for any significant length of time.

Condensation takes place whenever the humidity level in the incubator chamber reaches the dew point. The dew point is the level of humidity at which the air cannot hold more water vapor. The warmer the air, the more water vapor it can hold.

As the level of humidity rises in an incubation chamber, condensate will first appear on surfaces that are cooler than the air temperature. Near the dew point, condensate forms on any item or exposed surface even slightly cooler than the air. When the dew point is reached, condensate forms on nearly all exposed surfaces.

Managing condensation primarily depends on either lowering the humidity level or increasing the air temperature in the incubator chamber.

Note: Rising or falling air pressure from the weather will adjust the dew point up and down in small increments. If the relative humidity in the incubation chamber is already near the dew point, barometric fluctuations may push it across the dew point threshold.

Note: Thin air at higher altitudes holds less humidity than the denser air found at or near sea level.

If excessive condensate has appeared in the incubation chamber, dry the chamber interior and check the following.

- Verify that the access port on the left side of the chamber is closed. The black, plastic shipping cap that came with the unit should be installed in the outside of the port, and not in the chamber side of the port.
- Make sure samples on the shelves are evenly spaced to allow for good airflow.
- Ensure the chamber door is closing and latching properly.
- Are frequent or lengthy chamber door openings causing significant temperature disruptions and chilling the chamber surfaces? If so, reduce the number of openings.
- Are there too many open or “breathable” containers of evaporating sample media in the chamber? If so, reduce the number of open sample containers.
- Does the ambient humidity in the room exceed the stated operating range of 80% relative environmental humidity? If so, lower the room humidity.
- Is the incubator exposed to an external flow of cold air such as an air-conditioning vent or a door to a cooler hallway or adjacent room? Block or divert the air, or reposition the unit.
- Check the door gaskets for damage, wear, or signs of brittleness or dryness. Arrange for replacement of the gaskets if damaged or excessively worn.

USER MAINTENANCE



Warning: Prior to any maintenance or cleaning of this unit, disconnect the power cord 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 incubator, 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 incubator chamber should be cleaned and disinfected prior to first use. Periodic cleaning and disinfection are required to prevent microbiological contamination.

Do not use spray-on cleaners or disinfectants. These can leak through openings and coat electrical components. 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.** 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 material contained in it.



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

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

Cleaning

1. Remove all non-attached incubation chamber components and accessories (shelves, racks, and any additional items), if present.
2. Clean the chamber interior with a mild soap and water solution, including all corners.
3. Take special care when cleaning chamber sensor probes located at the rear of the chamber on the back wall.
4. Clean all removable accessories and components.
5. Clean and disinfect any attached sample tubing and replace if discoloring is present.
6. Rinse the chamber surfaces and shelving with distilled water and wipe dry with a soft cloth. **Do not use deionized water.**

USER MAINTENANCE (CONTINUED)

Disinfecting

Disinfect the incubation chamber on a regular basis. For maximum effectiveness, disinfection procedures are typically performed after cleaning and the removal of gross matter contamination. Perform the following steps to manually disinfect the incubator:

1. Turn the unit off. Open all doors and carry out your laboratory, clinical, or production space disinfection protocol.
2. Disinfect the incubation 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 cultivation or culturing applications.
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.
5. Gas concentrations from evaporating disinfecting agents can inhibit growth or cause metabolic symptoms in microbiological sample populations. Make sure that chlorines, amphylys, quaternary ammonias, or any other overtly volatile disinfecting agents have been rinsed or otherwise removed from the chamber surfaces, prior to placing samples in the chamber.

MINIMIZING CONTAMINATION EXPOSURE

The following are suggestions for minimizing exposure of the incubator chamber to potential contaminants.

- Maintain a high air quality in the laboratory workspaces around the incubator.
- Avoid placing the incubator near sources of air movement such as doors, air vents, or high traffic routes in the workspace.
- Minimize the number of times the incubator chamber door is opened during normal operations.

USER MAINTENANCE (CONTINUED)

STORAGE OF THE INCUBATOR

Perform the following steps if the incubator will be out of use for more than 24 hours to prevent microbiological contamination such as fungus or mold.

1. Depower the incubator.
2. Disinfect and clean if required by your laboratory protocol, or if the chamber has been exposed to pathogenic microorganisms.
3. Use a soft cloth to dry the chamber surfaces.

MAINTAINING ATMOSPHERIC INTEGRITY

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

ELECTRICAL COMPONENTS

Electrical components do not require maintenance. If the incubator fails to operate as specified, please contact your distributor or [Sheldon Technical Support](#) for assistance (please see page 5).

USER MAINTENANCE (CONTINUED)

CALIBRATE THE TEMPERATURE DISPLAY

Note: Performing a temperature display calibration requires a temperature reference device. Please see the [Reference Sensor Devices entry](#) on page 7 for device requirements.

Note: Each incubator unit on the SMI12 must be calibrated independently.

Temperature calibrations are performed to match the incubator temperature display to the actual air temperature inside the incubation chamber. The actual air temperature is supplied by a calibrated reference sensor device. Calibrations compensate for drifts in the unit microprocessor controller as well as those 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.

Probes

Reference device sensing probes may be introduced through the access port. Seal gaps around the probe wire using non-stick, non-marking tape. Do not introduce through the door space. Creating gaps in the door seal risks introducing leaks and cold spots, as well as condensation on the viewing door.

Place the sensor probe of the temperature reference device as close as possible to the geometric center of the incubation chamber. A thermocouple sensor probe may be taped to the shelving, as long as the exposed copper end is 2 inches (5cm) away from the shelf (see Figure 7). An exposed sensor probe in direct contact with the shelving may experience heat sinking, which can result in an inaccurate temperature reading.

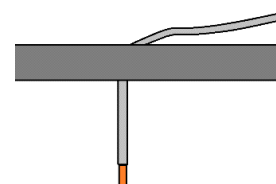


Figure 7: Probe End 2 inches (5cm) From Shelf Surface

Stability

Prior to a calibration, the chamber should operate undisturbed running at its application temperature set point with the doors closed for 8 hours in order to stabilize. A common practice is to introduce and place the temperature sensor probe in the chamber, allow the unit to operate and stabilize overnight, and then conduct the calibration the next day.



The chamber is considered stabilized when it has operated for **1 hour** with no fluctuations of $\pm 0.1^{\circ}\text{C}$ or greater. Failure to wait for stabilization will result in an inaccurate calibration and incubator temperature display reading.

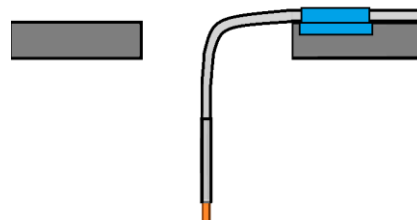




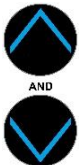













Figure 8: Probe Placement in SMI11 Double Chamber – Between Shelves, Center of Chamber

USER MAINTENANCE (CONTINUED)

| Temperature Calibration | |
|--|--|
| <p>1. Once the chamber temperature has stabilized, compare the reference device and temperature display readings.</p> <p>a. If the readings are the same, or if a difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber air temperature. The Temperature Calibration procedure is now complete.</p> <p>b. If a difference falls outside of your protocol range, advance to step 2.</p> | <p>Reference Device</p>  <p>Set Temperature °C</p>  |
| <p>2. A display calibration adjustment must be entered to match the display to the reference device. See next step.</p> | <p>Reference Device</p>  <p>Set Temperature °C</p>  |
| <p>3. Place the temperature display in its calibration mode.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>a. Press and hold both the UP and DOWN temperature arrow buttons simultaneously for approximately 5 seconds.</p> <p>b. Release the buttons when the temperature display shows the letters "CO". The display will begin flashing the current temperature display value.</p> </div> </div> <p>Note: If an arrow key is not pressed for five seconds, the display will cease flashing, and store the last displayed value as the new current chamber temperature value.</p> | <p>Set Temperature °C</p>  |



Continued on next page

USER MAINTENANCE (CONTINUED)

| Temperature Calibration (Continued) | |
|---|--|
|  OR  <p>4. Use the Up or Down arrows to adjust the current display temperature value until it matches the reference device temperature reading.</p> | <p>Reference Device</p>  <p>Set Temperature °C</p>  |
|  Wait 5 Seconds <p>5. After correcting for the difference, wait 5 seconds.</p> <p>a. The temperature display will cease flashing and store the corrected chamber display value.</p> <p>b. The incubator will now begin heating or passively cooling in order to reach the set point with the corrected display value.</p> | <p>Set Temperature °C</p>  <p>Adjusting to Set Point</p> |
|  Wait 1 Hour <p>6. Allow the incubator to operate undisturbed for at least one 1 hour to stabilize after it has achieved the set point with the corrected display value.</p> <p>a. Failure to wait until the incubation chamber is fully stabilized will result in an inaccurate reading.</p> | <p>Set Temperature °C</p>  |
| <p>7. Compare the reference device reading with the incubator temperature display again.</p> <p>a. If the reference device and the incubator temperature display readings are the same or the difference falls within the range of your protocol, the incubator is now calibrated for temperature.</p> <p>b. See the next step if the readings fail to match or fall outside of your protocol range.</p> | <p>Reference Device</p>  <p>Set Temperature °C</p>  |

Continued on next page

USER MAINTENANCE (CONTINUED)

| Temperature Calibration (Continued) | |
|--|---|
| <p>8. If a difference still falls outside the acceptable range of your protocol, repeat steps 3 – 7 up to two more times.</p> <p>a. Three calibration attempts may be required to successfully calibrate units that are more than $\pm 2^{\circ}\text{C}$ out of calibration.</p> | <p>Reference Device</p>  <p>Set Temperature °C</p>  |
| <p>9. If the temperature readings of the incubator and the reference device still fall outside your protocol after three calibration attempts, contact your distributor or Technical Support for assistance.</p> | |

End of procedure

INCUBATOR SPECIFICATIONS

These incubators are 100–120 volt. Please refer to the incubator 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 $\pm 10\%$. 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 | Net Incubator Weight |
|--------------|---------------------|----------------------|
| SMI2 (GI2) | 120 lbs. / 54.4 kg | 83 lbs. / 36.6 kg |
| SMI6 (GI6) | 186 lbs. / 84.3 kg | 158 lbs. / 71.7 kg |
| SMI7 (GI7) | 204 lbs. / 92.5 kg | 162 lbs. / 73.5 kg |
| SMI11 (GI11) | 300 lbs. / 136 kg | 195 lbs. / 88.5 kg |
| SMI12 (GI12) | 550 lbs. / 249.5 kg | 316 lbs. / 143.3 kg |

DIMENSIONS

In inches

| Model | Exterior W × D × H | Interior W × D × H |
|----------------|--------------------------|--------------------|
| SMI2 (GI2) | 21.25 × 22.25 × 26 in | 15 × 15 × 15.25 in |
| SMI6 (GI6) | 25.25 × 27.25 × 38 in | 19.5 × 20 × 26 in |
| SMI7 (GI7) | 30 × 31 × 32 in | 23.75 × 24 × 20 in |
| SMI11 (GI11) | 42 × 27 × 38 in | 36.25 × 20 × 26 in |
| SMI12 (GI12)* | 25.25 × 27.25 × 75.75 in | 19.5 × 20 × 26 in |
| * Each chamber | | |

In centimeters

| Model | Exterior W × D × H | Interior W × D × H |
|----------------|---------------------------|--------------------------|
| SMI2 (GI2) | 53.98 × 56.52 × 66.04 cm | 38.10 × 38.10 × 38.74 cm |
| SMI6 (GI6) | 64.14 × 69.22 × 96.52 cm | 49.53 × 50.80 × 66.04 cm |
| SMI7 (GI7) | 76.20 × 78.74 × 81.60 cm | 60.33 × 60.96 × 50.80 cm |
| SMI11 (GI11) | 106.68 × 68.58 × 96.52 cm | 92.08 × 50.80 × 66.04 cm |
| SMI12 (GI12)* | 64.14 × 69.22 × 192.41 cm | 49.53 × 50.80 × 66.04 cm |
| * Each chamber | | |

U SPECIFICATIONS (CONTINUED)

CAPACITY

| Model | Feet | Liters |
|---------------|--------|--------|
| SMI2 (GI2) | 1.99 | 56.23 |
| SMI6 (GI6) | 5.87 | 166.16 |
| SMI7 (GI7) | 6.5 | 186.81 |
| SMI11 (GI11) | 10.91 | 308.9 |
| SMI12 (GI12) | 11.74* | 332.4* |
| *Each chamber | | |

TEMPERATURE

| Model | Range | Uniformity | Stability |
|--------------|---------------------|-----------------|-----------------|
| SMI2 (GI2) | Ambient +8° to 70°C | +/-0.35° @ 37°C | +/-0.1°C @ 37°C |
| SMI6 (GI6) | Ambient +8° to 70°C | +/-0.35° @ 37°C | +/-0.1°C @ 37°C |
| SMI7 (GI7) | Ambient +8° to 70°C | +/-0.35° @ 37°C | +/-0.1°C @ 37°C |
| SMI11 (GI11) | Ambient +8° to 70°C | +/-0.35° @ 37°C | +/-0.1°C @ 37°C |
| SMI12 (GI12) | Ambient +8° to 70°C | +/-0.35° @ 37°C | +/-0.1°C @ 37°C |

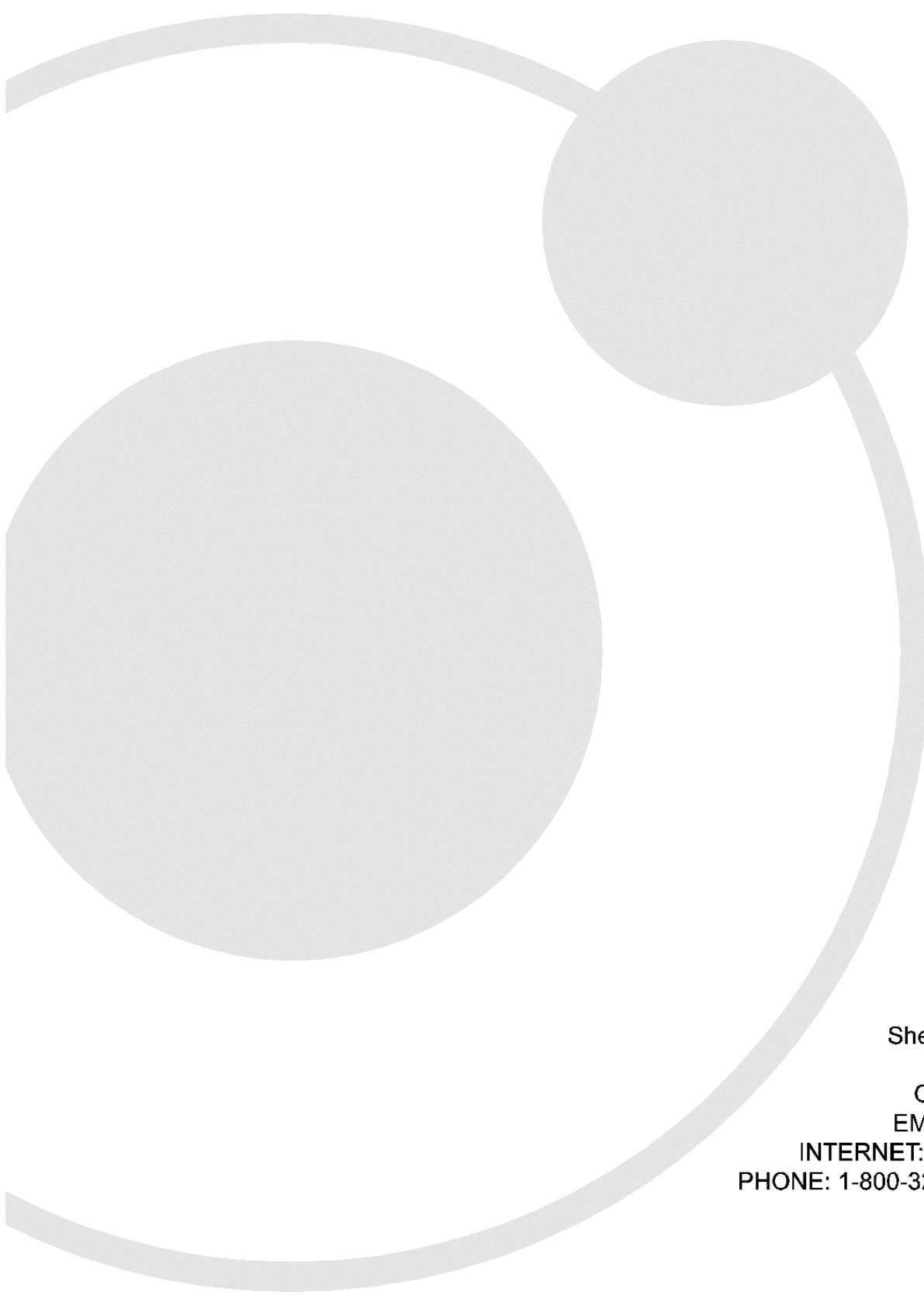
POWER

| Model | AC Voltage | Amperage |
|--------------|------------|-------------------------|
| SMI2 (GI2) | 100–120 | 4.5 |
| SMI6 (GI6) | 100–120 | 6.0 |
| SMI7 (GI7) | 100–120 | 6.5 |
| SMI11 (GI11) | 100–120 | 7.0 |
| SMI12 (GI12) | 100–120 | 12.0 (6.0 each chamber) |

PARTS LIST

PARTS

| Description | Parts Number |
|--|--------------|
| Fuse, 6.3 Amp 250V SMI2, SMI6, SMI12 (GI2, GI6, GI12) | 3300515 |
| Fuse, 10 Amp 250V SMI7, SMI11 (GI7, GI11) | 3300516 |
| Leveling Foot | 2700512 |
| Power Cord 115 volt 15 Amp, 9ft 5 in (2.86m) NEMA 5-15P | 1800510 |
| Shelf, SMI2 (GI2) | 5080758 |
| Shelf, SMI6, SMI12 (GI6, GI12) | 5130523 |
| Shelf, SMI7 (GI7) | 5130518 |
| Shelf, SMI11 (GI11) | 5130687 |



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