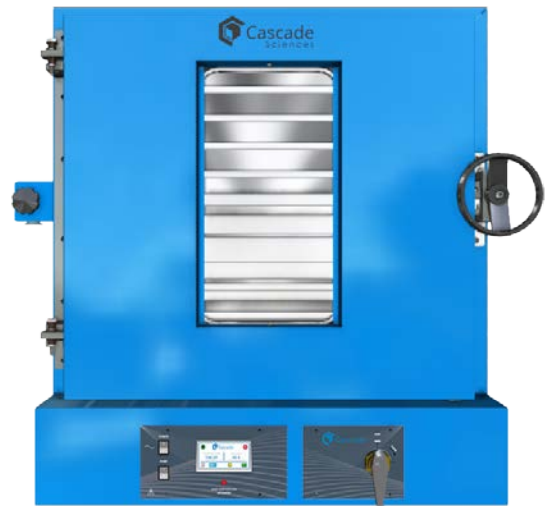


Vacuum Purge Ovens



CVO-5 CVO-5-2

CVO-10

Installation - Operation Manual

Vacuum Purge Ovens

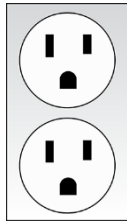
CVO-5: 110 – 120 Voltage North America

CVO-5-2, CVO-10: 220 – 240 Voltage

Part Number (Manual): 4861790

Revision: February 21, 2018

The **CVO-5** requires a standard 110 – 120 volt NEMA 5-15 power supply outlet to plug into.



The **CVO5-2** and **CVO-10** require a NEMA 6-15R 220 – 240-volt power supply outlet to plug into.

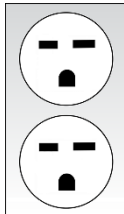
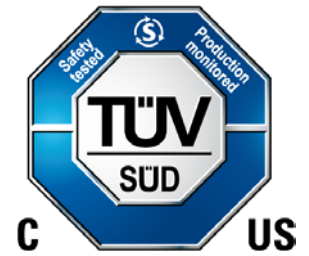


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This certification satisfies NRTL safety requirements

TÜV SÜD CUE

Certificate Number: U8 17 04 64872 077

These units are CUE listed by TÜV SÜD as vacuum ovens for appropriate professional, industrial, or educational use. TÜV SÜD America Inc. is an OSHA recognized NRTL and a Standards Council of Canada accredited certification body.

The units have been tested to the following requirements:

CAN/CSA-C22.2 No. 61010-1:2012 + U2:2016-04

CAN/CSA-C22.2 No. 61010-2-010:2015

UL 61010-1:2012/R:2016-04

UL 61010-2-010:2015

EN 61010-1:2010

EN 61010-2-010:2014



UNIT SPECIFICATIONS

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 $\pm 3^\circ$ (77°F $\pm 5.4^\circ$) and at nominal voltage. The temperatures specified are determined in accordance with 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

TEMPERATURE

Model	Range	Uniformity	Stability
CVO-5	Ambient. +26° to 250°F	$\pm 1.5^\circ$ @ 105°F	$\pm 0.4^\circ$ @105°F
CVO-5-2	Ambient. +26° to 250°F	$\pm 1.5^\circ$ @ 105°F	$\pm 0.4^\circ$ @105°F
CVO-10	Ambient. +26° to 250°F	$\pm 1.5^\circ$ @ 105°F	$\pm 0.4^\circ$ @105°F

Model	Heat Up Time to 105°F
CVO-5	120 minutes
CVO-5-2	120 minutes
CVO-10	120 minutes

POWER

Model	AC Voltage	Amperage	Frequency	Phase
CVO-5	110 – 120	14	50/60 Hz	1
CVO-5-2	220 – 240	7	50/60 Hz	1
CVO-10	220 – 240	10	50/60 Hz	1

UNIT SPECIFICATIONS

WEIGHT

Model	Shipping	Net Weight
CVO-5	449lbs / 203.7kg	360lbs / 163.3kg
CVO-5-2	449lbs / 203.7kg	360lbs / 163.3kg
CVO-10	775lbs. / 352kgs	663lbs. / 301kgs

DIMENSIONS

Inches

Model	Exterior W × D × H	Interior W × D × H
CVO-5	26.5 x 34.5 x 32.3 in	18.0 x 24.0 x 18.0 in
CVO-5-2	26.5 x 34.5 x 32.3 in	18.0 x 24.0 x 18.0 in
CVO-10	44.0 x 42.0 x 40.0 in	28.0 x 24.0 x 24.0 in

Millimeters

Model	Exterior W × D × H	Interior W × D × H
CVO-5	673 x 876 x 819 mm	457 x 609 x 457 mm
CVO-5-2	673 x 876 x 819 mm	457 x 609 x 457 mm
CVO-10	1118 x 1067 x 1016 mm	711 x 609 x 609 mm

UNIT SPECIFICATIONS

CAPACITY

Model	Cubic Feet	Liters
CVO-5	4.5	127.4
CVO-5-2	4.5	127.4
CVO-10	9.3	264

SHELF CAPACITY BY WEIGHT

Model	Per Shelf	Total
CVO-5	50lbs / 22.6kg	225lbs / 102kg
CVO-5-2	50lbs / 22.6kg	225lbs / 102kg
CVO-10	50lbs / 22.6kg	225lbs / 102kg



INTRODUCTION

READ THIS MANUAL

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

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

Intended Applications and Locations

CVO vacuum ovens are engineered for drying, curing, and baking applications under vacuum in professional, industrial, and educational environments. The ovens are not intended for use at hazardous or household locations.

CONTACTING ASSISTANCE

Phone hours for Technical Support are 6 am – 4:30 pm Pacific Coast Time (west coast of the United States, UTC -8), Monday through Friday. Please have the following information ready when calling or emailing Technical Support: the **model number** and the **serial number** (see page 17).

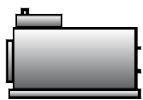
PHONE: 866-466-7511 or 503-847-9047

Cascade Sciences
5285 NE Elam Young Parkway
Unit B100
Hillsboro OR, 97124

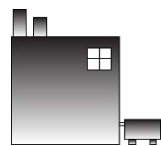
ENGINEERING IMPROVEMENTS

Cascade Sciences 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 oven dealer or customer service representative for assistance.

INTRODUCTION



Vacuum Pump



Building
Vacuum Supply

VACUUM SUPPLY REQUIRED

CVO ovens require a vacuum supply source, which **must be purchased separately from the oven**. Please see the Cascade Sciences website for pumps and vacuum system accessories suitable for your application.

cascadesciences.com/vacuum-pumps

GASKETS

Gaskets are high-wear items, subject to compression forces, heat, and outgassed byproducts. Keeping a spare gasket on hand during operations is strongly recommended.

Each CVO oven comes with a replaceable Buna silicon gasket installed on the chamber liner. This gasket seals against the chamber door to maintain the vacuum integrity of the chamber. The gasket must be replaced periodically and is rated to 221°F (105°C). It is resistant to solvents but not acids.



RECEIVING YOUR OVEN

INSPECT THE SHIPMENT

- When an oven 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.

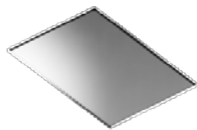
When you receive your unit, inspect it for concealed loss or damage to its interior and exterior. If you find any damage to the oven, **follow the carrier's procedure for claiming damage or loss.**

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

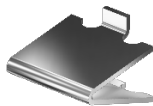
Included Accessory Items

CVO-5s

5 Shelves



20 Shelf Clips



4 Leveling Feet

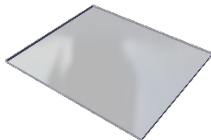


1 Power Cord



CVO-10

9 Shelves



4 Leveling Feet



1 Power Cord



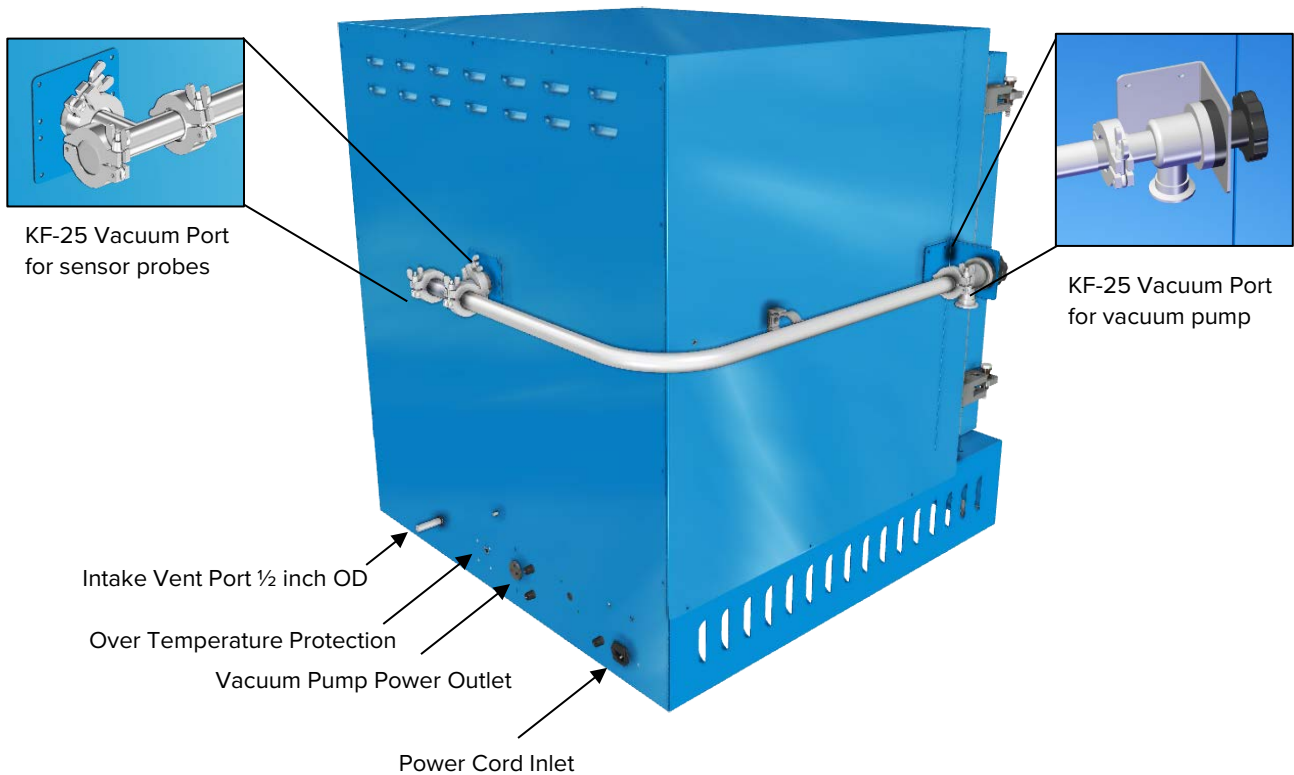
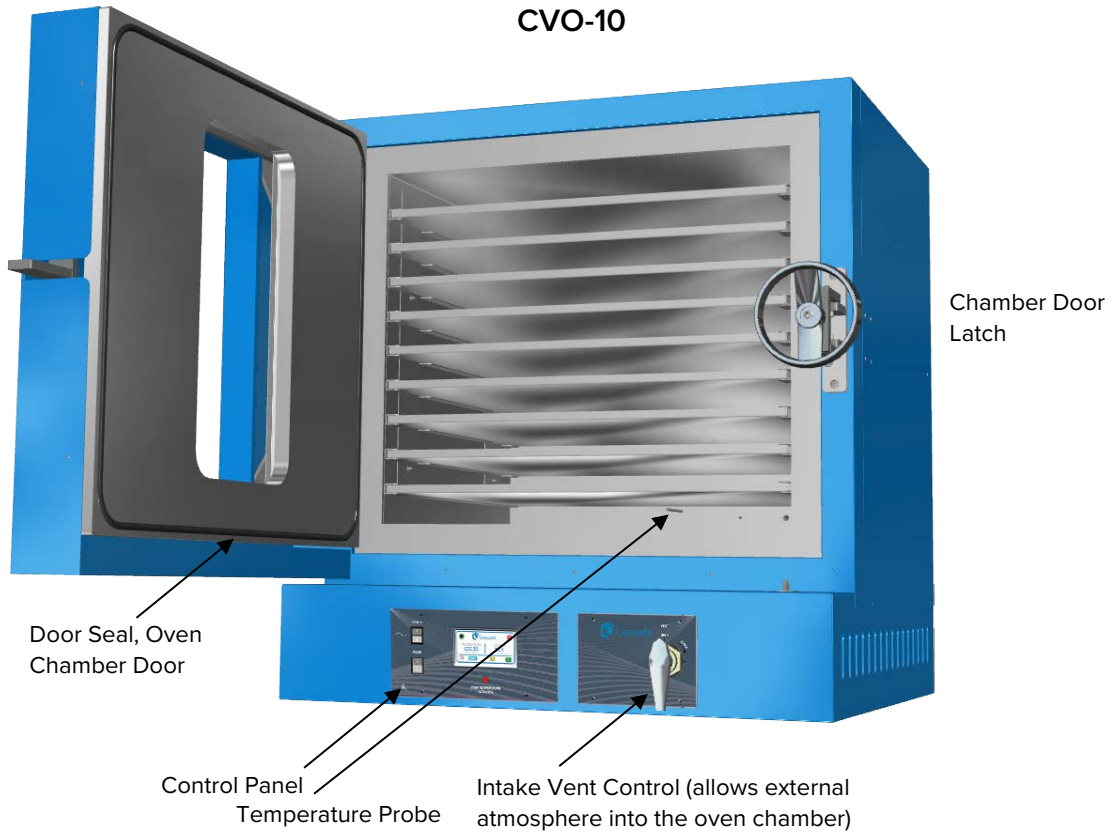
Vacuum Connection
Kit



RECEIVING YOUR OVEN

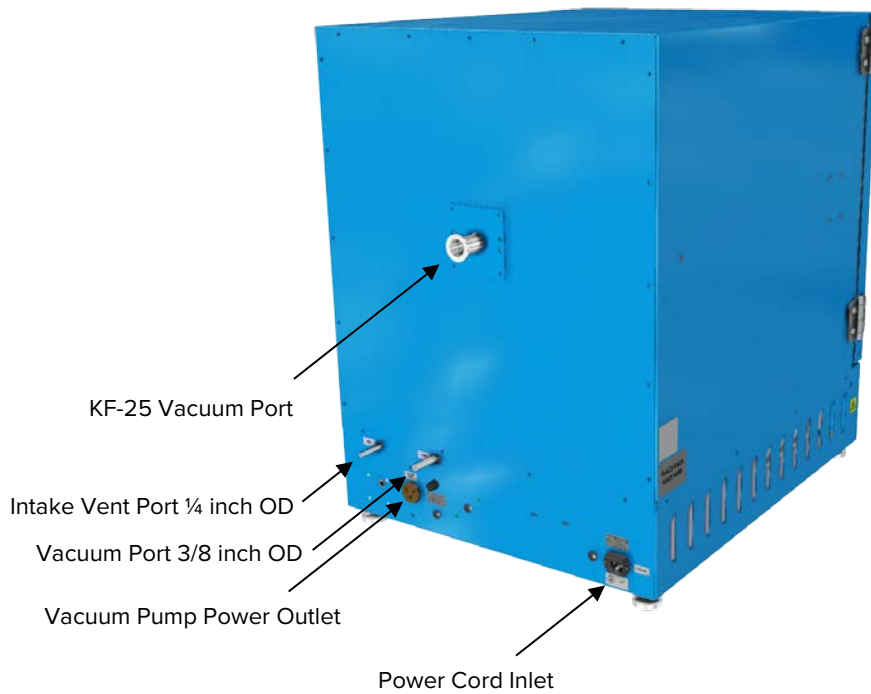
ORIENTATION

CVO-10



RECEIVING YOUR OVEN

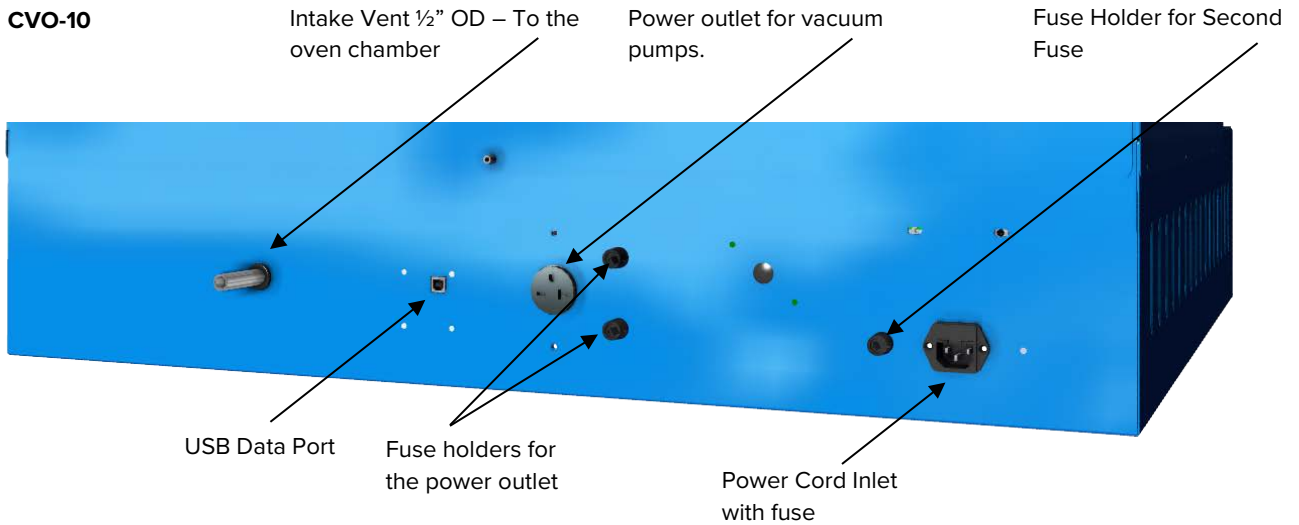
CVO-5s



RECEIVING YOUR OVEN

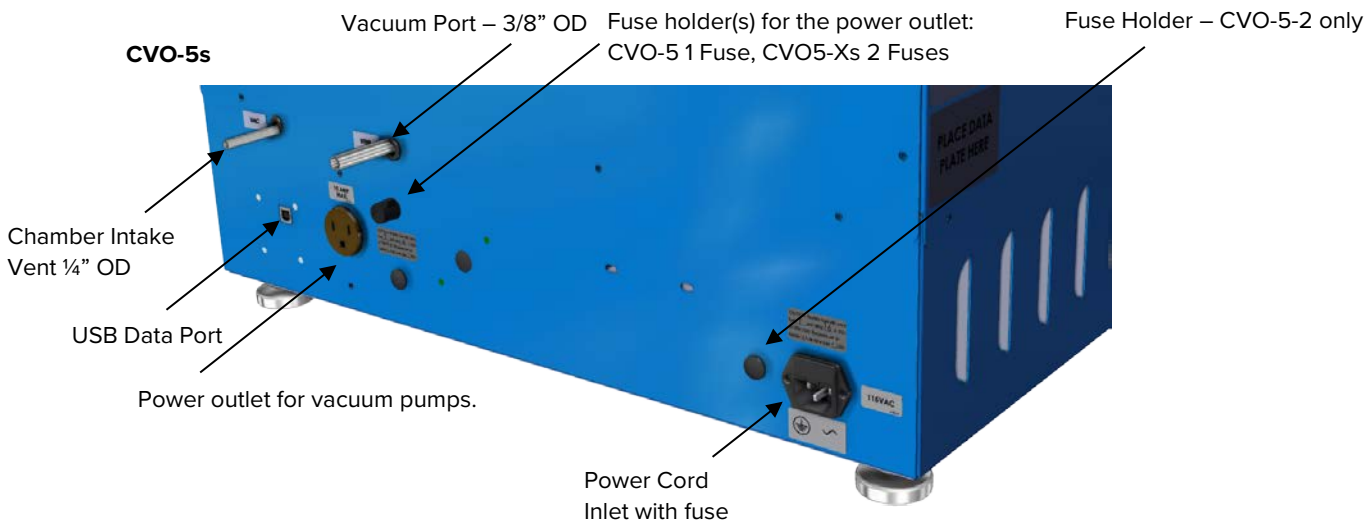
Power Panels

Located on the back of each unit



The vacuum pump power outlet type varies by unit voltage type.

Model	Voltage	Amperage	Outlet Type
CVO-5	110 - 120	8	NEMA5-15R
CVO-5-2	220-240	4	NEMA6-15R
CVO-10	220-240	4	NEMA6-15R



RECEIVING YOUR OVEN

RECORD THE DATA PLATE INFORMATION

Locate the data plate on the left side of the near the back. The data plate contains the oven model number and serial number. Enter this information below for future reference.

Data Plate Information

Model Number	
Serial Number	



INSTALLATION PROCEDURE 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 required ambient condition for the unit are met, page 20
- ✓ Check that the spacing clearance requirements are met, page 20
 - Unit dimensions may be found on page 5
- ✓ Check for performance-disrupting heat and cold sources in the environment, page 20
- ✓ Check that a suitable permanent connect electrical power supply is present, page 21

Installing the Oven

- ✓ Review the lifting and handling instructions, page 22
- ✓ Install the leveling feet, page 23
- ✓ Install the oven in its workspace location, page 23

Set up the Oven for use

- ✓ Clean the oven chamber and shelving if needed, page 23
- ✓ Install the shelving in the oven chamber, page 24
- ✓ Connect the vacuum supply to the oven, pages 25 and 26
- ✓ **Optional:** Connect the oven to a neutral purging gas. See page 27

INSTALLATION

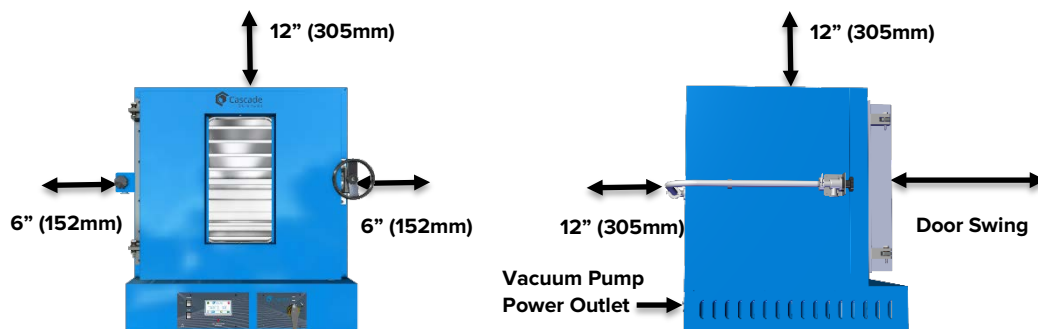
REQUIRED AMBIENT CONDITIONS

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

All Ovens

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



- 6 inches (152mm) of clearance is required on the sides.
- 12 inches (305mm) of headspace clearance between the top of the unit and any overhead partitions.

Do not place objects on top of the oven.

A vent intake port for restoring atmosphere to the oven chamber is located on the back of the oven. Do not obstruct the intake port.

Operating the unit outside of these spacing 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.

ENVIRONMENTAL DISRUPTIONS

When selecting a location to install the oven, consider all environmental conditions that can affect effective temperature range, uniformity, and stability of the oven. For example:

- 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

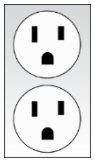
INSTALLATION

POWER SOURCE REQUIREMENTS

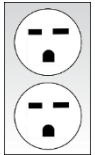
When selecting a location for the oven, check that each of the following requirements is satisfied:

Power source: The wall power outlet source must be **50/60 Hz, single (1) phase** at the following voltages and amperages:

Model	Voltage	Amps
CVO-5	110 - 120	14
CVO-5-2	220 - 240	7
CVO-10	220 - 240	10



CVO-5



CVO-5-2
CVO-10-2

- The power source must be **protective earth grounded**. The 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 supplied voltage varies more than 10%. Use a separate circuit to prevent loss of the unit due to overloading or circuit failure.
- The recommended wall circuit breaker for these units are:
 - CVO-5: **15 amps**
 - CVO-5-2, CVO-10: **15 amps**
- A separate circuit for the oven is recommended to prevent possible loss of product due to overloading or failure of other equipment on the same circuit.

Power Cord: The unit must be positioned so that all end-users can quickly unplug the oven in the event of an emergency. Always use the same type of power cord that was shipped with the oven.

Oven Fuses: All fuses must be present and not blown for the oven to operate. The cause of a blown fuse should always be determined and fixed prior to returning the oven to operation.

CVOs ship with the following 5x20mm fuses installed:

Model	Type	Quantity	Location
CVO-5	T16A 250V	1	Power cord inlet
CVO-5-2	T10A 250V	2	Power cord inlet and 1 in a fuse holder adjacent to the cord inlet.
CVO-10	T10A 250V	2	Power cord inlet and 1 in a fuse holder adjacent to the cord inlet.

Continued on next page

INSTALLATION

Accessory Outlet Fuses: Each oven ships with one or more 5x20mm fuses installed fuse holders next to the accessory outlet.

Model	Type	Quantity	Max allowed outlet draw
CVO-5	T8A 250V	1	8 amps
CVO-5-2	T4A 250V	2	4 amps
CVO-10	T4A 250V	2	4 amps

- These fuses **do not** protect against overcurrent conditions in the major systems of the oven. The fuses only safeguard against events involving outlet power supply.
- If one fuse blows, the outlet will cease to provide power. The cause of a blown fuse should always be determined and fixed prior to using the outlet or oven.

GENERAL POWER SAFETY

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 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.
- Do not bend the power cord excessively, step on it, or place heavy objects on it.
- A damaged cord can be a shock or fire hazard. Never use a power cord if it is damaged or altered in any way.
- Always position the unit so that end-users can quickly unplug it in the event of an emergency.

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:

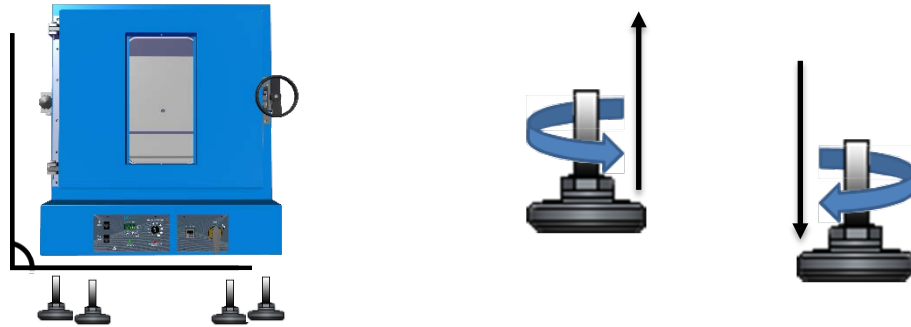
- Lift the oven only from its bottom surface.
- Doors, handles, and knobs are not adequate for lifting or stabilization.
- Restrain the oven completely while lifting or transporting so it cannot tip.
- Remove all moving parts, such as shelves and trays, and lock doors in the closed position during transfers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

INSTALLATION

LEVELING

Install the 4 leveling feet in the 4 corner holes in the bottom of the oven.

The oven must be level and stable for safe operation.



Note: To prevent damage when moving the unit, turn all 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 45) for more information on how to clean the oven chamber prior to putting the unit into operation.

INSTALLATION

SHELVING INSTALLATION

Heating in a vacuum environment takes place primarily through conduction. Heat is transported from heating elements in the chamber walls to your samples or product through the shelf slides and shelves. Perform the following steps to install the shelves so that heat is conducted properly.

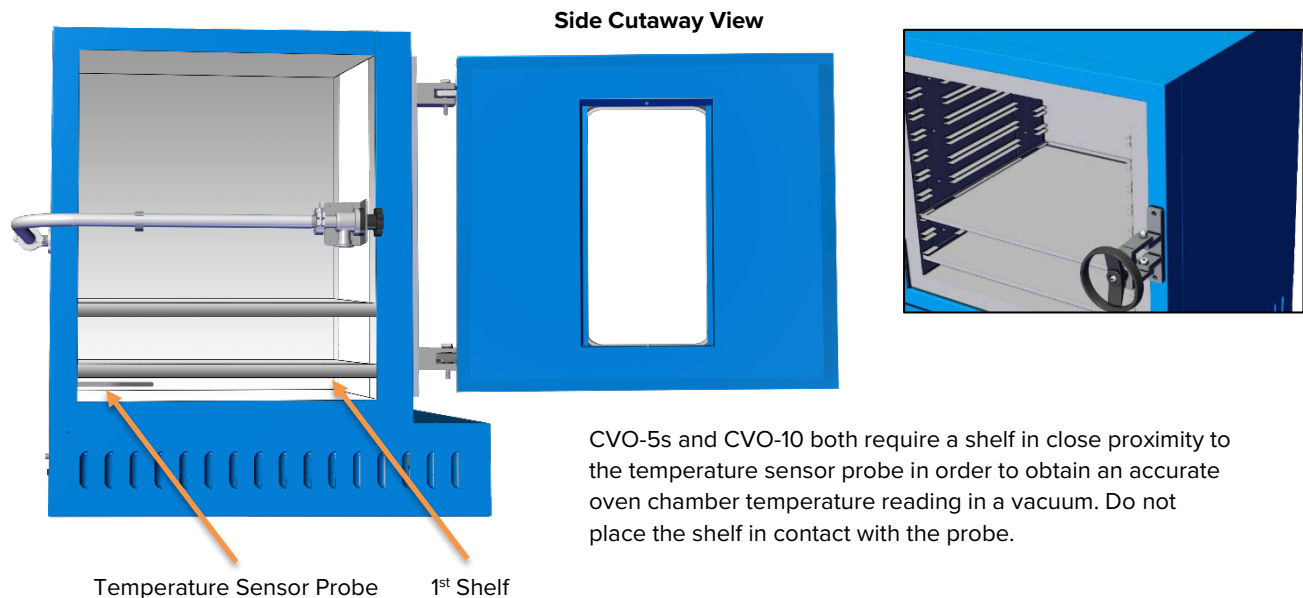
CVO-5s

1. Install the shelf clips in the slots of the shelf standard mounting rails located on the sides of the chamber interior, four clips (4) per shelf.
 - a. Squeeze each clip, insert the top tab first, and then the bottom tab using a rocking motion.
2. One shelf bottom **must be in close proximity to the oven temperature probe** that extends out from the back wall to ensure an accurate temperature measurement.
3. Set the shelves on the clips. Make sure the shelves are level.



CVO-10

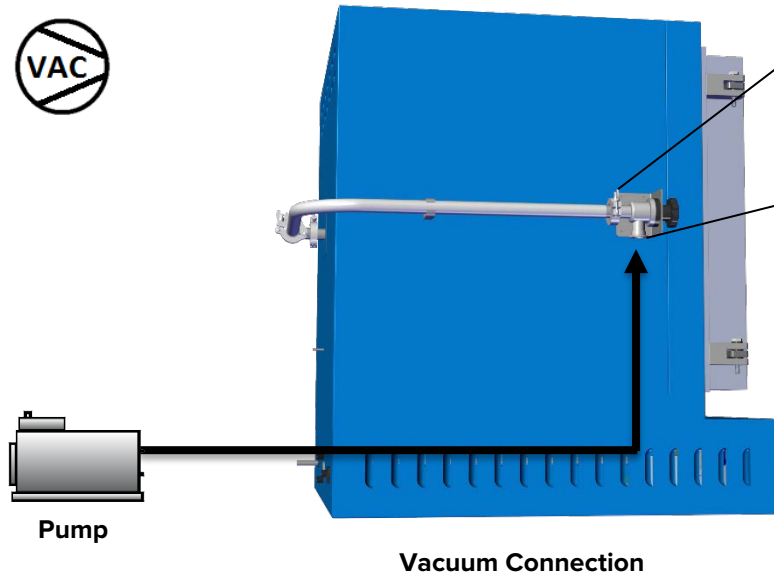
1. Slide each shelf into a pair of shelf slides.
 - a. Install the first shelf in the bottom-most pair of shelf slides, just above the temperature sensor probe. The shelf must be in close proximity to the probe, but not touching, in order for the oven to accurately measure the shelf temperature.



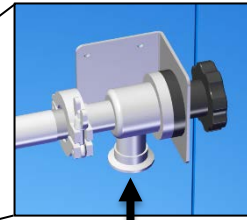
INSTALLATION

CONNECT TO THE VACUUM SUPPLY

CVO-10



KF-25

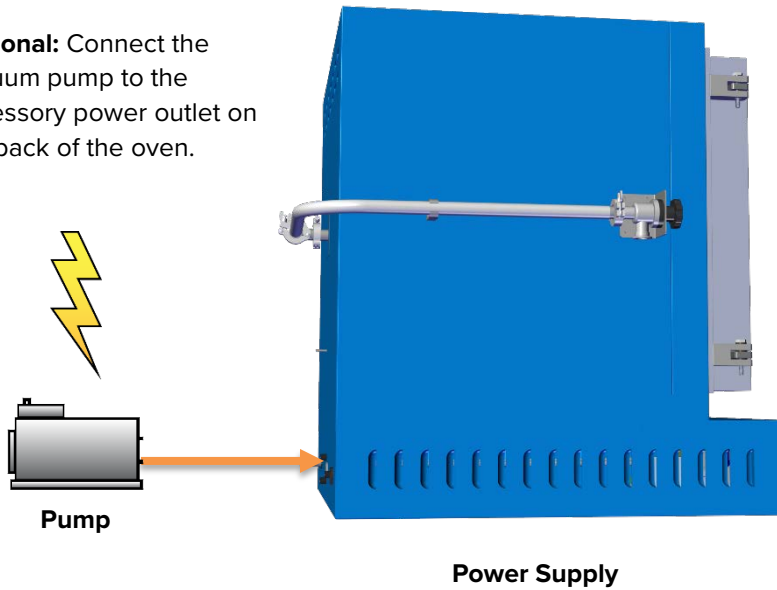


Connect your vacuum supply to this KF-25 port.



Connection Kit

Optional: Connect the vacuum pump to the accessory power outlet on the back of the oven.



4 amps is the maximum allowed power draw for the accessory outlet on all CVO-10 ovens.

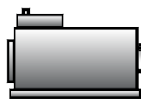
INSTALLATION

Connect to the Vacuum Supply (Continued)

CVO-5s



Pump

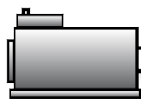


Connect your vacuum supply to the 3/8th vacuum fitting or the KF-25 port.



Vacuum Connection

Optional: Connect the vacuum pump to the accessory power outlet on the back of the oven.



Pump



Power Supply

8 amps is the maximum allowed power draw for CVO-5 accessory outlet.

4 amps is the maximum allowed power draw for CVO-5-2 accessory outlet.

INSTALLATION

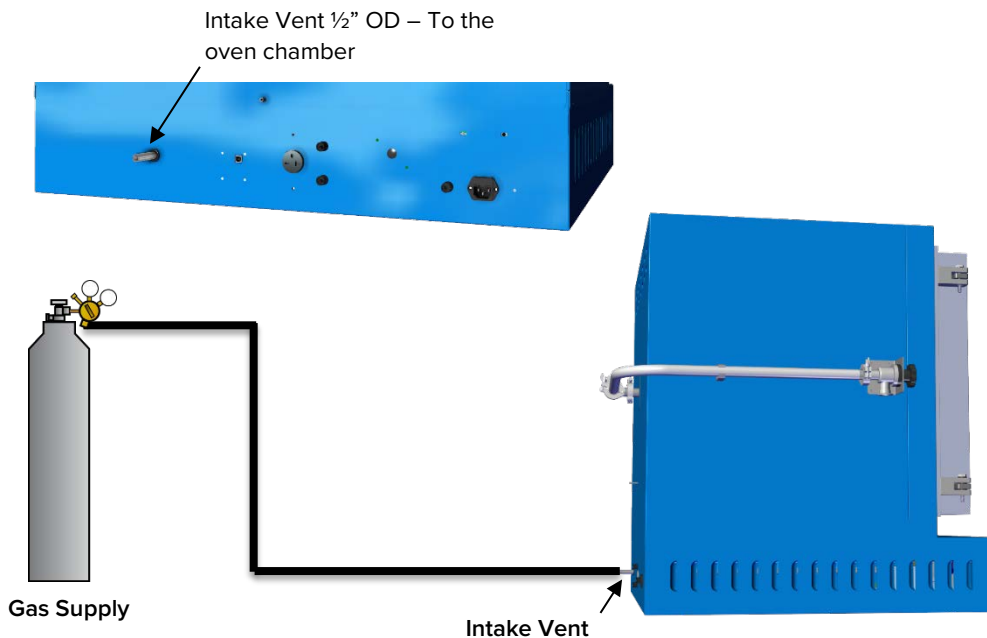
Exceeding 15 psi of gas backfill pressure may damage the oven.

CONNECT TO A GAS BACKFILL SUPPLY

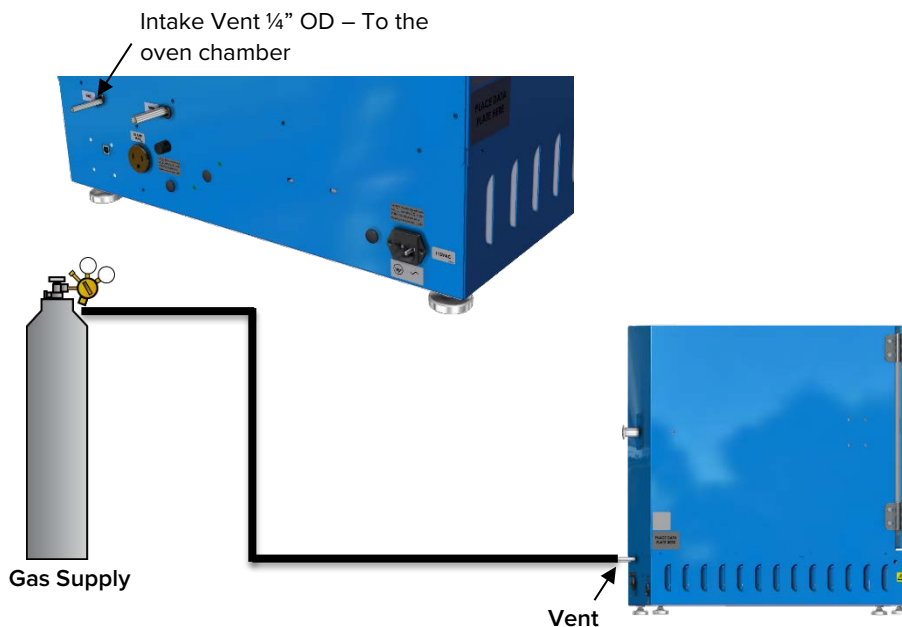
Optional: You may connect a clean or neutral gas supply—such as nitrogen (N₂) or argon—to the vent intake port located on the back of the oven. This supply will backfill the evacuated oven chamber when the vent intake valve is opened on the front control panel.

The maximum allowed gas backfill pressure is 15 psi.

CVO-10



CVO-5s





GRAPHIC SYMBOLS

The oven is provided with multiple graphic symbols on its interior and exterior surfaces and display screen. The symbols identify hazards and the functions of the adjustable components as well as important notes in the user manual.

Symbol	Definition
	Consult the user manual. Consulter le manuel d'utilisation
	AC Power Repère le courant alternatif
	I/ON O/OFF I indique que l'interrupteur est en position marche. O indique que le commutateur est en position d'arrêt.
	Begin heating Commencer le chauffage
	Oven heating Chauffage au four
	Heating pause Indique une pause de chauffage
	Lighting Indique l'éclairage
	Potential shock hazard Risque de choc électrique
	Recycle the unit. Do not dispose of in a landfill. Recycle l'unité. Ne jetez pas dans une décharge.
	Protective earth ground Terre électrique
	Caution hot surface Attention surface chaude



CONTROL OVERVIEW

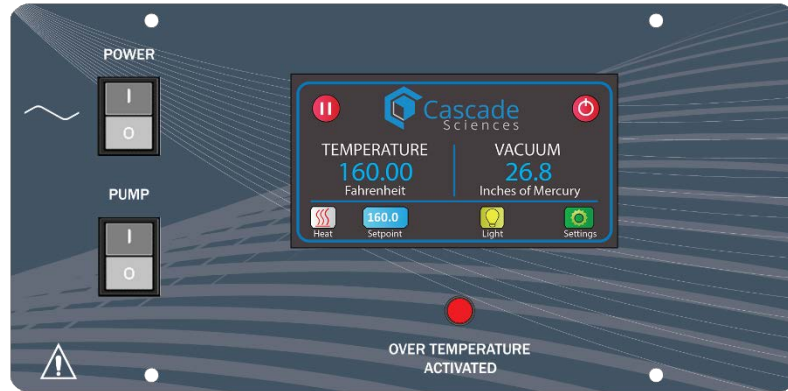
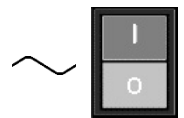


Figure 1: Control Panel

Power Switch

The Power Switch controls all power the oven and its systems.



Pump Switch

This switch supplies power to the vacuum pump power outlet on the pack of the oven when in the I (on) position.



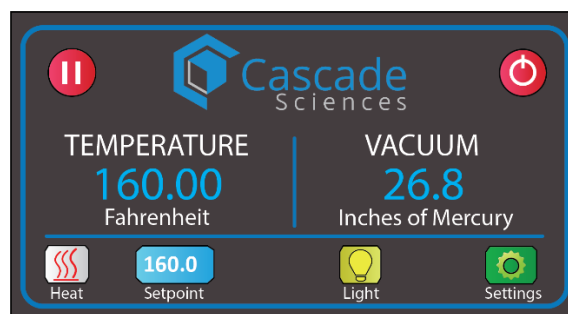
Over Temperature Activated

This red light illuminates if the Over Temperature heating cutoff system routes power away from the heating elements. The heating cutoff is triggered when the shelving temperature exceeds 250°F. For more details, please see the [Over Temperature Limit System](#) description on page 38.



Display

The display is a touch screen display and control. It controls heating and lighting in the oven chamber and displays the current chamber vacuum pressure.



Homepage

While the display comes set to show temperature in degrees Fahrenheit and vacuum pressure in inches of mercury drawn down, it can be changed to use Celsius for temperature and torr for vacuum.

When at room pressure, the Vacuum indicator should read 0 inches of mercury draw down.

CONTROL OVERVIEW

Home Screen Icons and Controls

Setpoint Button



This blue button shows the current setpoint. The setpoint is the temperature the oven heats to once the Heat Button is pushed.

Pressing the Setpoint Button brings up the setpoint page and keypad used to enter a new setpoint.

Heat Button



Pressing the green play button tells the oven to heat to and then maintain the set point is pressed. The play button is replaced by a red pause button while the oven is heating.

Heating Icon



The heating icon appears whenever the oven powers the chamber heating elements. During normal heating operations, this icon blinks on and off as the oven pulses power to achieve and then maintain the set point temperature.

Pause Heating



The red pause button is visible whenever the oven is in its heating mode. Pressing it pauses heating of the oven chamber.

Light Button



When the oven chamber lighting is off, this button will be partly grayed out. Pressing the button activates the chamber lighting.

Settings Button



Pressing the Setting Button calls up the Settings Menu. On this menu are slider bar controls for:

- Changing the temperature and vacuum units of measurement
- Changing the display brightness setting

Outage Indicator



This icon appears whenever the oven powers up. Dismiss it by touching the indicator after turning on the oven. If the indicator reappears while the oven was supposed to be running, a power outage has occurred.

CONTROL OVERVIEW

Home Screen Icons and Controls (Continued)

Standby

The red off-style button on homepage places the display in a standby mode.



Menu Screen

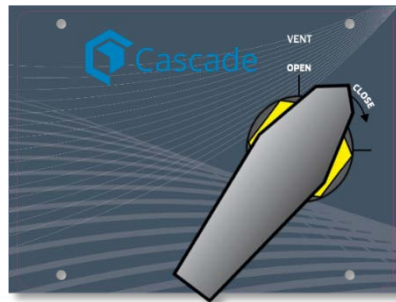
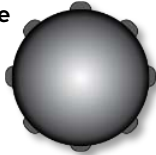
Home Button

The home button returns a menu screen to the homepage



CVO-10 Valves

Vacuum Valve

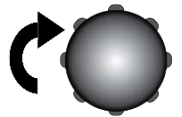


Vent Valve

Vacuum Valve Control

The Vacuum Control is located on the left side of the oven on a KF-25 vacuum port. This valve adjusts the level of vacuum draw applied to the oven chamber through the port

- In the open position, this valve applies vacuum draw to the oven chamber from a connected vacuum supply source.
- In the closed position, the valve closes off the vacuum draw.

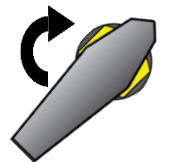


Closing

Vent Valve Control

This valve controls the chamber inlet Vent Port on the back of the oven.

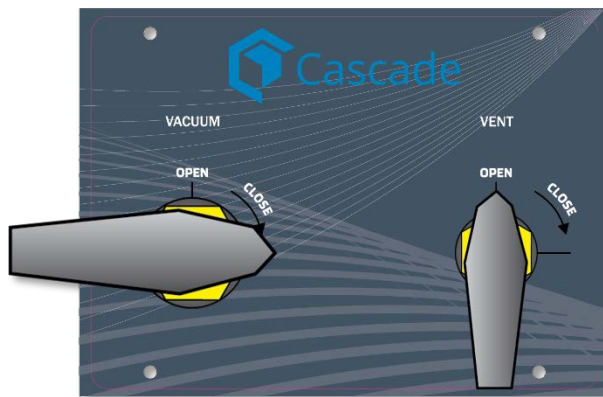
- In the **open** position, the oven chamber is open to external atmosphere through the vent intake port on the back of the oven.
- Optional: A backfill gas supply connected to the Vent Port will flow gas from the supply to the oven chamber when the Vent Valve is open.
- When the valve control is in the **closed** position, the chamber is cut off from external atmosphere and any gas supply.
 - **The vent must be closed before applying vacuum draw to the chamber.** Failure to do so may result in damage to your vacuum pump.



Closing

CONTROL OVERVIEW

CVO-5 Valves



Closed

Vacuum Valve Control

This valve adjusts the level of vacuum draw applied to the oven chamber through the vacuum port on the back of the oven.

- In the open position, this valve applies vacuum draw to the oven chamber from a connected vacuum supply source.
- In the closed position, the valve closes off the vacuum draw.



Open

Vent Valve Control

This valve controls the inlet Vent Port on the back of the oven.

- In the **open** position, the oven chamber is open to external atmosphere through the vent intake port on the back of the oven.
- Optional: External atmosphere or a connected gas supply will flow into the oven chamber when the Vent Valve is opened, backfilling the chamber.
- When the valve control is in the **closed** position, the chamber is cut off from external atmosphere or any backfilling gas supply.
 - **The vent must be closed before applying vacuum to the chamber.** Failure to do so may result in damage to your vacuum pump.

Safe operation of the oven is dependent on the actions and behavior of the oven operators.

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



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



SAFETY GUIDELINES

Failure to follow the guidelines and instructions in this manual may create a protection impairment by disabling or interfering with unit safety features. This can result in damage to the unit and injury, death, or negative effects on the health of the oven operators.

- Follow all national laws, regulations, and local ordinances in your area regarding the use of this unit type and the applications you are using it for. If you have any questions about national and local requirements, please contact the appropriate agencies.
- Because of the range of potential applications this unit can be used for, the operator or their supervisors must draw up a site-specific standard operating procedure (SOP) covering each application and associated safety guidelines. This SOP must be written and available to all operators in a language they understand.
- Use only approved accessories. Do not modify system components. Any alterations or modifications to your oven can be dangerous and void your warranty.

Continued on next page

OPERATION



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

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

OPERATING PRECAUTIONS

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

THEORY OF OPERATION

These ovens are intended for use in closed cycle, under vacuum backing applications such as drying, purging or baking out volatiles.

Vacuum

Vacuum is supplied to the oven chamber by a vacuum pump or building system.

CVO-10: The vacuum supply should connect to the KF-25 fitting on the left side of the oven.

CVO-5s: The vacuum supply should connect to either the KF-25 fitting or the 3/8th vacuum fitting.

Achievable vacuum levels in the oven are dependent on pump performance, valve settings, and the nature of the baking application or process, including the amount of material outgassed from your product or samples.

The chamber must be sealed and evacuated at the start of a baking application. The oven is not built to operate with the chamber exposed to free atmosphere or to circulate air within the chamber. Running the oven with the vent open risks damaging the vacuum pump and integrity of the oven chamber.

Gas Backfill

Opening the vent intake allows atmosphere back into the oven chamber.

A gas supply can be connected to the vent intake port or KF-25 port located on the back of the oven. Nitrogen or another neutral gas may be used to backfill an evacuated oven chamber to avoid sample oxidation or particulate contamination. The maximum allowed backfill pressure is 15 psi of delivery at the oven vent or KF ports.

Heating in a Vacuum

In conventional ovens, a powered element transfers heat into the chamber air. The heated atmosphere then circulates by natural convection or blower fan action to surround the product on the shelves, gradually bringing it to temperature. In a vacuum oven, heat transport takes place primarily by conduction. In CVO ovens, the heating elements are attached to the left, right, top, and bottom sides of the oven chamber inside surrounding insulation duct spaces. The elements heat the chamber walls, which in turn transfer heat to the shelves. Each shelf then transports heat to the products or samples resting on it.

Direct radiant heating through infrared emission in a vacuum environment provides poor temperature uniformity compared to conductive heating.

Heating Control

The oven microprocessor stores a user-selected temperature set point. When powered, the oven heats the chamber shelves to the currently programmed temperature set point. The microprocessor board is wired to a solid-state temperature probe located in the chamber on the rear wall. When the processor detects that the shelf temperature has dropped below the temperature set point, it pulses power to the heating elements.

The processor employs proportional-integral-derivative analytical feedback-loop functions when measuring and controlling the shelving temperature. PID-controlled heating pulse intensities and lengths are proportional to the difference between the measured shelf temperature and the current set point. The frequency of pulses is derived from the rate of change in that difference. The integral function slows the rate of pulses when the temperature nears the set point to avoid overshooting.

The oven relies on natural heat radiation for cooling.

Warm Up

Allowing the oven to heat up with atmosphere in the chamber can result in a significant temperature drop when heated atmosphere is evacuated from the chamber. To achieve the best temperature stability and uniformity, allow the oven to heat up under vacuum prior to loading product. This heat soaks the oven body and insulation masses. Only pre-heat the oven if it is compatible with your application and safe practices.

The Over Temperature Limit System

The oven is equipped with a heating cutoff system which automatically cuts off electricity to the oven heating elements when the shelving temperature exceeds 392°F (200°C). This is intended to help prevent runaway heating in the event of a hardware failure.

OPERATION

Note: There may be **light smoking** from protective oil coatings on the elements when running the oven near its maximum temperature for the first time.

PUT THE OVEN INTO OPERATION

Verify all the required procedures in the Installation chapter have been carried out.

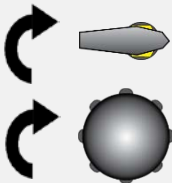
1. Plug In the Power Cord



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

Plug the power cord into the workspace electrical supply.

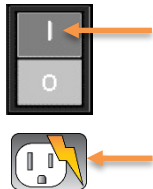
2. Verify all Valves are Closed



Always verify the oven chamber is sealed prior to starting the oven.

- This helps safeguard your vacuum pump from prolonged and possibly damaging exposure to streaming atmosphere.

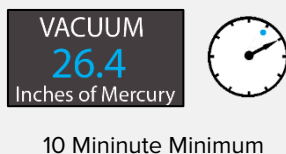
3. Turn on the Oven and Dismiss the Outage Indicator



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

Dismiss the Outage icon by pressing it once the homepage has loaded.

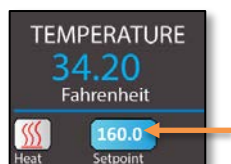
4. Verify Vacuum Integrity



Place the Chamber Under Vacuum for a **minimum of 10 minutes** to verify the integrity of the vacuum supply system. See page 40

- Leave the chamber under vacuum to perform the Set the Over Temperature Limit procedure in the next step.

5. Set the Operating Temperature



Set the Oven Temperature to your baking application. See page 41.

Note: The oven chamber should always be under vacuum when heating the chamber to the setpoint.

6. Heat the Oven Chamber



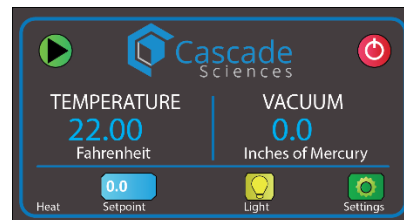
See page 42.

OPERATION

PUT THE CHAMBER UNDER VACUUM

Put the oven chamber under vacuum for at least 10 minutes when first putting the oven into operation in a new location to verify the integrity of the vacuum supply system.

The oven must be plumbed to a vacuum supply source before starting this procedure.



The oven chamber at room pressure (0 inches of mercury).

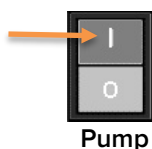
Evacuate the Oven Chamber

1



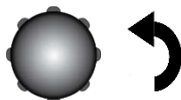
Always verify the Vent Valve control is in the closed position.

2



Turn on the vacuum pump

3



Open the oven Vacuum Valve, turning it all the way counterclockwise to bring oven chamber under vacuum.

- The Vacuum indicator on the display screen will show inches of mercury (inHg) drawn down, counting up from zero as more vacuum is achieved.
- The achievable vacuum level is dependent on altitude above sea level as well as the vacuum supply efficiency and the volume of outgassed byproducts.



20 inches of mercury equivalent pressure drawn down

Holding At Vacuum

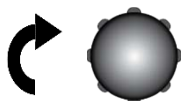
4



Keep the oven chamber under vacuum throughout the duration of your baking application to help evacuate outgassed byproducts.

Restore Atmosphere to the Oven Chamber

5



Turn the Vacuum Valve control back to the closed position (clockwise) to protect the vacuum pump from extended exposure to external atmosphere. The pump may remain on.

6



Slowly turn the Vent Valve control to the Open position to backfill the oven chamber with atmosphere or with gas from an attached supply.



Restored to room pressure

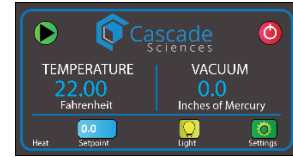
End of procedure

OPERATION

Note: The oven temperature probe must be in close proximity to a shelf to obtain an accurate display reading. See page 24.

SET THE TEMPERATURE SETPOINT

Enter and save the target temperature of your baking application.



Begin on the homepage

1 Jump to the temperature setpoint menu.



- Press the blue setpoint button on the display screen homepage.
- The display will jump to the temperature setpoint screen, showing a keypad on the right side.



Temperature setpoint menu

2 Enter a new temperature setpoint that oven will heat to

- Use keypad.



3 Save the new setpoint.



Press the blue SAVE button to the right of the keypad.

- The new setpoint will appear in the Setpoint icon on the left side of the screen.

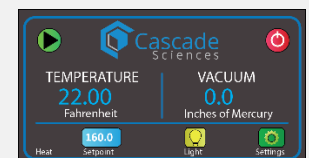


Setpoint

4 Return the display to the homepage.



- Press the Home button on the top left side of the temperature setpoint menu.



Homepage

End of Procedure

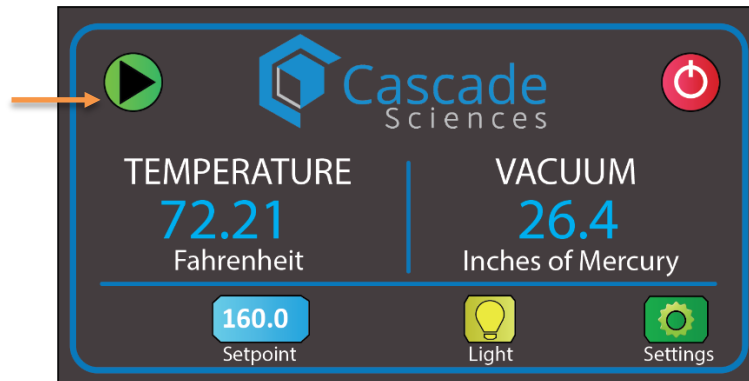
OPERATION

HEAT THE OVEN

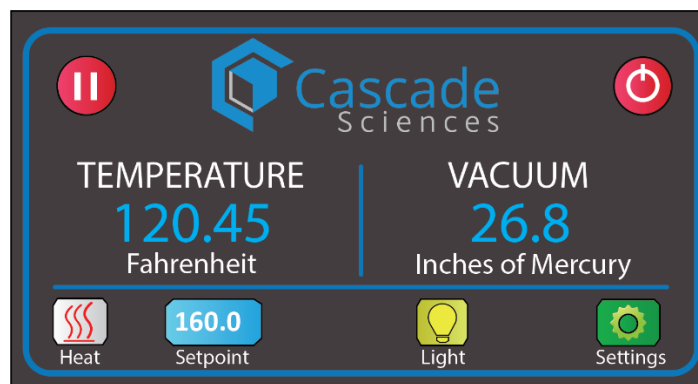
After entering and saving a setpoint, the oven is ready to begin heating.

To heat the oven:

1. Press the green Play button.



- The play button will be replaced by a red Pause button.
- The Heat icon on the lower left side of the display will blink on and off as the oven powers the heating elements in PID algorithm-controlled pulses.



Oven heating to 160°F

Pausing or End Heating



Press the red Pause Button on the display screen to end heating in the oven chamber. Heating at the same set point may be resumed by pressing the green Play Button.

End of Procedure

FLASHING TEMPERATURE

The displayed temperature begins flashing when the chamber pressure rises by 3inHg or more or when the chamber door is opened. This indicates the display is showing the last measured **vacuum temperature** of the chamber shelving and not the current air temperature of the backfilled chamber.

There can be a difference of up to +3°F temperature between the air and shelving temperatures during the first minutes after the chamber has backfilled. Because the temperature probe is surrounded by atmosphere in a backfilled chamber, the display would show the air temperature if not overridden.

The heat held by the newly introduced atmosphere impacts product or samples much less than the temperature of the shelving. In other words, most heating of items on the shelves will initially be driven by the shelving temperature and not the atmosphere—the shelving having considerably more mass to hold heat with than the new chamber atmosphere.

The temperature should **stop flashing after 2 minutes** and gradually adjust to showing the air temperature of the chamber as it equalizes with the shelving. The controller may keep the temperature display locked and flashing for up to 10 minutes if the difference remains greater than 1.5°F.

AUTO HEATING PAUSE

The oven automatically pauses heating if the chamber door is left open longer than 10 minutes. This is done to save power and prevent a significant heat spike when the door is closed and the chamber evacuated.

DATA PORT

The USB data port, located on the back of the oven outputs a digital log line once per minute. This output logs the oven temperature and vacuum level.



Required Software:

- Viewing and logging this output requires a terminal emulator program, such as the open source emulator, Tera Term (BSD license).

OPERATION

CHANGING SETTINGS

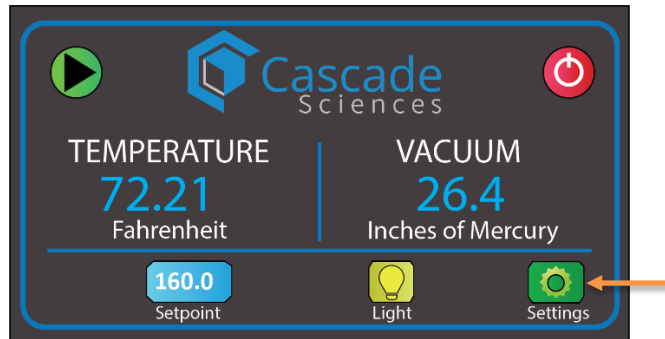
The settings menu controls:

- Temperature units of measurements – Fahrenheit or Celsius
- Vacuum units of measurements – Inches of mercury or torr
- The brightness of the display touch screen

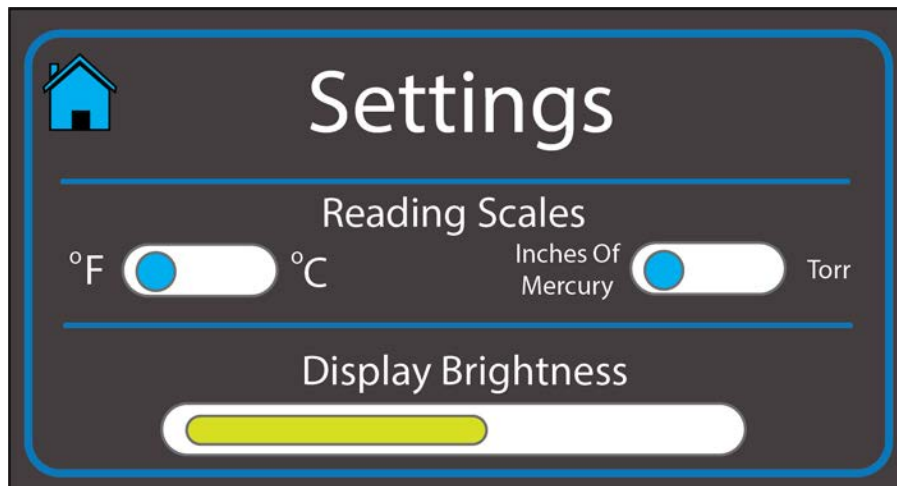
To access the Settings Menu page, perform the following steps.



1. Starting on the homepage, press the green Settings Button.



- The display will jump to the settings menu.
2. Use the slider bars on the settings page to change the units of measurement and screen brightness as needed.



3. Return to the homepage using the Home Button.

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 oven, immediately initiate your site Hazardous Material Spill Containment protocol. Contact your local Site Safety Officer and follow instructions per the site policy and procedures.

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

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



Cleaning

1. Remove all removable chamber accessories items (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 around the temperature sensor probes. Do not clean the probes.
4. Clean all removable accessories and components.
5. Rinse the chamber surfaces and shelving with distilled water and wipe dry with a soft cloth. Do not use deionized water.
 - Deionized water is an aggressive solvent that will attack most metals. Never use deionized water to clean your oven, even if it is readily available in your laboratory or production workspace.

USER MAINTENANCE

Disinfecting

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

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

MAINTAINING ATMOSPHERIC INTEGRITY

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

GASKETS

The door gasket is exposed to significant compressive forces and outgassed byproducts and must be replaced periodically by the end-user. See the Replacement Parts chapter at the end of this manual.

These ovens come with Buna liner gaskets for sealing the chamber door. These are rated to 221°F (105°C) and resistant to solvents.

ELECTRICAL COMPONENTS

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

USER MAINTENANCE

VACUUM PUMP MAINTENANCE

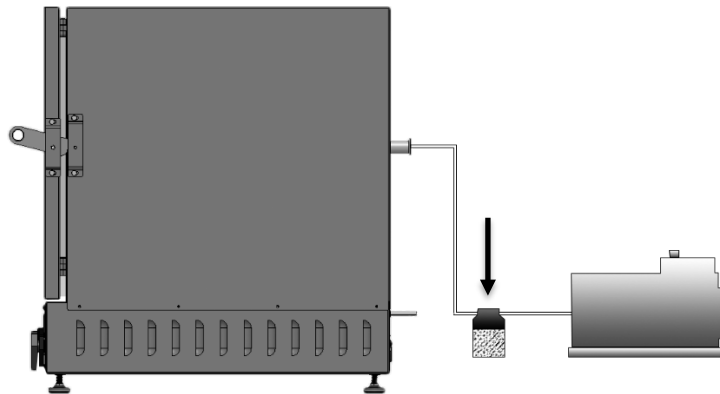
Vacuum pumps are high wear equipment and require replacement of seals and diaphragms **at least** once per year. Poor vacuum performance or bubbling or strained noises from the pump may indicate that the pump is in need of maintenance.

Pump Manuals

Refer to the operation manual supplied with your vacuum pump for recommended maintenance routines such as oil levels, replacement of sorbent charge, and exhaust filter change outs. **Contact your vacuum pump supplier if you do not have an operation manual.**

Trap

A filter trap plumbed to the vacuum line between the pump and the oven helps protect the pump from outgassed byproducts and extends the operational lifespan of the pump.



Example of a trap plumbed between an oven and vacuum pump

USER MAINTENANCE

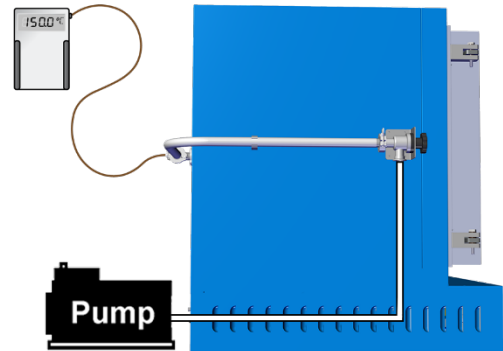
CALIBRATE THE TEMPERATURE DISPLAY



Note: A calibration reference device must be purchased separately. For best results, use a digital device with thermocouple probes. The device must be accurate to at least 0.1°F and should be regularly calibrated by a third party. **Never use alcohol or mercury based thermometers!**

Cascade Sciences CVO ovens do not normally require calibration. Should your SOP or quality program require calibrations, follow this guideline.

Temperature calibrations match the temperature display to the actual shelving temperature inside the oven chamber. The actual shelving temperature is supplied by a reference sensor device. Always calibrate to the industry or regulatory standards required for your application.



Suggested Temperature Calibration Set Up

1



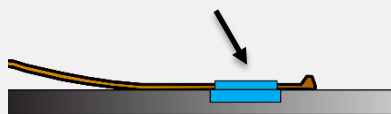
Introduce potted (sealed) thermocouple probes from a reference device into the oven chamber through the KF-25 port on the **back** of the oven.

2



Use the KF-25 clamp included with the oven to secure the potted probes and seal the adaptor port.

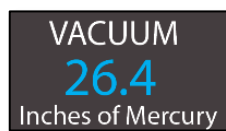
3



The thermocouple probe ends must be in direct contact with the shelving The probes may be taped to the shelves using heat-resistant non-stick tape. Use the tape to secure any loose wiring.

If using only a single thermocouple, place the probe on the shelving as close as possible to the geometric center of the chamber.

4



Place the oven chamber under vacuum at the level of your application or baking process. The chamber must be under vacuum in order to perform an accurate temperature calibration.

Continued on next page

USER MAINTENANCE

5) Heat up and stabilization period: The oven temperature must be stable at temperature and under vacuum in order to perform an accurate calibration. The temperature is considered stabilized when the oven chamber has operated at your calibration temperature for at least 30 minutes with no fluctuations greater than $\pm 0.4^{\circ}\text{F}$.

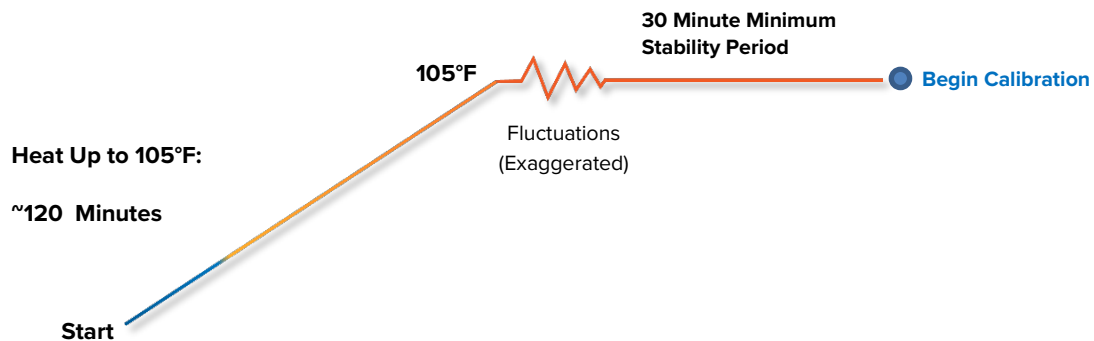


Figure 2: Oven Chamber Heat Up and Stabilization Phases

Suggested Calibration Procedure

1

Once the chamber has stabilized with no fluctuations, compare the reference temperature device and chamber temperature display readings.

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

-Or-

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

Reference Device

105.0 °F

TEMPERATURE
105.21
Fahrenheit ✓

2

The display requires calibration. Advance to step 3.

Reference Device

103.8 °F

Set Temperature
TEMPERATURE
105.21
Fahrenheit ✗

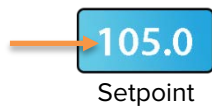
Continued on next page

USER MAINTENANCE

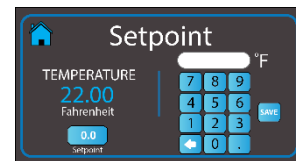
Calibration continued

3

jump to the temperature setpoint menu



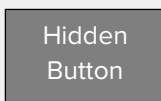
- Press the blue setpoint button on the display screen homepage.
- The display will jump to the temperature setpoint page.



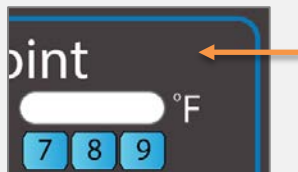
The temperature setpoint menu

4

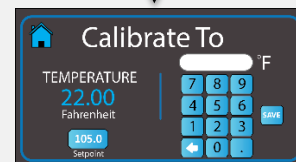
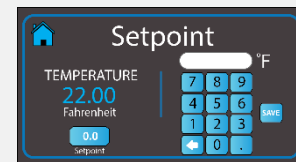
Place the setpoint page into its calibration mode.



- Press and hold the hidden button (blank space) on the top right of the screen.

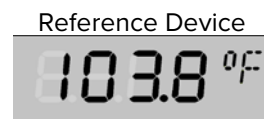
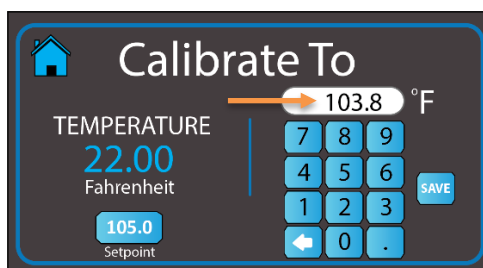


- The display will change to read "Calibrate To"



5

Use the keypad to enter the temperature shown on your reference device. This will match the oven display to the reference device reading.

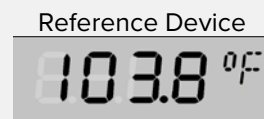


6

Save the calibration match, then return to the homepage.



- Press the Save Button
 - Press the Home Button
- The oven will now heat or passively cool to achieve the setpoint temperature with the display correction.



Procedure continued on next page

USER MAINTENANCE

Calibration continued

7



Wait 30 Minutes

Wait 30 minutes for the oven to stabilize **after the oven has achieved the setpoint** with the corrected display adjustment.

- Failure to wait will result in an inaccurate oven display reading.

TEMPERATURE
105.21
Fahrenheit

8

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

- a. If the readings are the same, or the difference between the two falls within the acceptable range of your protocol, **the oven is calibrated for temperature.**

-Or-

- b. Advance to step 9.

Reference Device

105.0 °F

TEMPERATURE
105.01
Fahrenheit ✓

9

If the two readings still fall outside the acceptable range of your protocol, repeat steps 3 – 8 up to two more times.

- Three calibration attempts may be required to successfully calibrate ovens more than $\pm 3^{\circ}\text{F}$ out of calibration.

Reference Device

104.0 °F






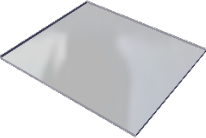
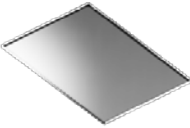
TEMPERATURE
105.21
Fahrenheit ✗

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

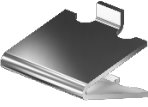


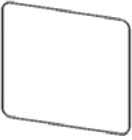
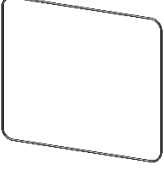

End of procedure



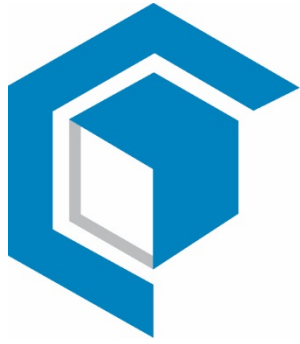
REPLACEMENT PARTS

Description	Parts Number
<p>Adjustable foot, 1 each (requires 4)</p>	 2700506
<p>Fuse CVO-5 T16A, 250V 5x20mm 1 fuse located in the power inlet is required to operate the oven. Please see the power panel illustration on page 16 for the fuse inlet location.</p>	 3300513
<p>Fuse, CVO-5-2 and CVO-10 5X20mm T10A 250V. 2 fuses are required to operate the oven, with one in the power inlet and the other in an adjacent fuse holder. Please see the power panel illustration on page 16 for the fuse locations.</p>	 3300516
<p>Fuse, accessory power outlet for the CVO-5 5x20mm, 8 Amp, 250V. Requires 1 fuse. This fuse goes in the fuse holder adjacent to the accessory power outlet on the back of the oven. Please see the CVO-5 illustration on page 16.</p>	 3300546
<p>Fuse, accessory power outlet for the CVO-5-2 and CVO-10 5x20mm, 4 Amp, 250V. 2 fuses are required to operate the accessory power outlet. These go in the fuse holders adjacent to the power outlet on the back of the oven. Please see the CVO-10 illustration on page 16.</p>	 3300537
<p>Shelf, CVO-10</p>	 5680562
<p>Shelf, CVO-5s</p>	 5680563

REPLACEMENT PARTS

Description	Parts Number
Shelf clips for CVO-5 and CVO-5-2 ovens Requires 4 clips per shelf	 1250510
Power cord, CVO-5 125 volt, 15Amp, 9ft 5 in (2.86m), NEMA 5-15P	 1800510
Power cord, CVO-5-2 and CVO-10 250 Volt, 13Amp, 8.2 feet (2.5m), NEMA 6-15P	 1800539
Oven chamber gasket, Buna, CVO-5 and CVO-5-2	 3450724
Oven chamber gasket, Buna, CVO-10	 3450774
Vacuum Tubing Connection Kit Tubing with KF-25 fittings and 2 KF-25-sized clamps.	 9990876





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