Benchtop Vacuum Purge Ovens

CVO-2: 110 – 120 Voltage North America

CVO-2-2: 220 – 240 Voltage

Part Number (Manual): 4861791

Revision: February 22, 2018

The CVO-2 requires a standard 110 – 120 volt NEMA 5-15 power supply outlet to plug into.

The CVO-2-2 requires a NEMA 6-15R 220 – 240-volt power supply outlet to plug into.
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Replacement Gaskets
This certificate satisfies NRTL safety requirements

TÜV SÜD CUE

Certificate Number: U8 17 04 64872 077

These units are CUE listed by TÜV SÜD as forced air 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 ±3° (77°F ±5.4°) and at nominal voltage. 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.

**TEMPERATURE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Range</th>
<th>Uniformity</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVO-2</td>
<td>Ambient +26°F to 250°F</td>
<td>±1.5° @105°F</td>
<td>± 0.4°F @ 105°F</td>
</tr>
<tr>
<td>CVO-2-2</td>
<td>Ambient +26°F to 250°F</td>
<td>±1.5° @105°F</td>
<td>± 0.4°F @ 105°F</td>
</tr>
</tbody>
</table>

**POWER**

<table>
<thead>
<tr>
<th>Model</th>
<th>AC Voltage</th>
<th>Amperage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVO-2</td>
<td>110 – 120</td>
<td>6.0</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>CVO-2-2</td>
<td>220 – 240</td>
<td>4.0</td>
<td>50/60 Hz</td>
</tr>
</tbody>
</table>

**VACUUM**

Operational Vacuum Range - All Ovens

<table>
<thead>
<tr>
<th>inHg</th>
<th>mmHg</th>
<th>kPa</th>
<th>bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.0</td>
<td>-76</td>
<td>-10</td>
<td>0.0016</td>
</tr>
<tr>
<td>-29.9</td>
<td>-760</td>
<td>-101</td>
<td>0.0125</td>
</tr>
</tbody>
</table>

Vacuum Display Range – All Ovens

<table>
<thead>
<tr>
<th>inHg</th>
<th>mmHg</th>
<th>kPa</th>
<th>bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>37.5</td>
<td>5</td>
<td>0.05</td>
</tr>
<tr>
<td>-29.9</td>
<td>-757</td>
<td>-101</td>
<td>0.013</td>
</tr>
</tbody>
</table>
## UNIT SPECIFICATIONS

### WEIGHT

<table>
<thead>
<tr>
<th>Model</th>
<th>Shipping Weight</th>
<th>Unit Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVO-2</td>
<td>183 lb / 83.0 kg</td>
<td>148 lb / 67.1 kg</td>
</tr>
<tr>
<td>CVO-2-2</td>
<td>183 lb / 83.0 kg</td>
<td>148 lb / 67.1 kg</td>
</tr>
</tbody>
</table>

### DIMENSIONS

**Inches**

<table>
<thead>
<tr>
<th>Model</th>
<th>Exterior W × D × H</th>
<th>Interior W × D × H</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVO-2</td>
<td>18.8 x 24.5 x 24.5 in</td>
<td>12.0 x 20.0 x 12.0 in</td>
</tr>
<tr>
<td>CVO-2-2</td>
<td>18.8 x 24.5 x 24.5 in</td>
<td>12.0 x 20.0 x 12.0 in</td>
</tr>
</tbody>
</table>

**Millimeters**

<table>
<thead>
<tr>
<th>Model</th>
<th>Exterior W × D × H</th>
<th>Interior W × D × H</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVO-2</td>
<td>478 x 622 x 622</td>
<td>305 x 508 x 305</td>
</tr>
<tr>
<td>CVO-2-2</td>
<td>478 x 622 x 622</td>
<td>305 x 508 x 305</td>
</tr>
</tbody>
</table>

### CAPACITY

<table>
<thead>
<tr>
<th>Model</th>
<th>Cubic Feet</th>
<th>Liters</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVO-2</td>
<td>1.67</td>
<td>47.2</td>
</tr>
<tr>
<td>CVO-2-2</td>
<td>1.67</td>
<td>47.2</td>
</tr>
</tbody>
</table>
**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 - Friday. Please have the following information ready when calling or emailing Technical Support: the **model number** and the **serial number** (see page 14).

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 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

Minimum Vacuum Draw

In order to seal completely, the oven chamber must be under a minimum vacuum draw of:

<table>
<thead>
<tr>
<th>inHg</th>
<th>mmHg</th>
<th>kPa</th>
<th>bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.0</td>
<td>-76</td>
<td>-10</td>
<td>-0.1016</td>
</tr>
</tbody>
</table>

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-2 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. See page 48 for more information on gasket type suitability for baking applications.
RECEIVING YOUR OVEN

**INSPECT THE SHIPMENT**

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

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

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

**Included Accessories:**

<table>
<thead>
<tr>
<th>Tall Shelves</th>
<th>Medium Shelves</th>
<th>Short Shelf w/ Clip</th>
<th>Power Cord</th>
<th>Leveling Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

![Included Accessories Images]
Orienta tion

Control Panel
Vacuum Valve Control
Intake Vent Control (allows external atmosphere into the oven chamber)

Chamber Door Latch

CVO-2s

Chamber Gasket
Access Port
Temperature Sensor Probe

Intake Vent Port ¼ inch OD

USB Data Port

Power Cord Inlet

KF-25 Vacuum Port

Intake Vent Port 3/8 inch OD

Vacuum Port 3/8 inch OD
**Power Panels**

Located on the back of each unit

**CVO-2**

- Intake Vent – To the oven chamber ¼ in (6.35mm) OD
- USB Data Port
- Data Plate
- Power Cord Inlet with fuse
- Vacuum Inlet 3/8in (9.52mm) OD - Connect the vacuum pump or supply

**CVO-2-2**

- Intake Vent – To the oven chamber ¼ in (6.35mm) OD
- USB Data Port
- Data Plate
- Power Cord Inlet with fuse
- Vacuum Inlet 3/8in (9.52mm) OD - Connect the vacuum pump or supply
- Fuse Holder, 2nd Fuse
RECEIVING YOUR OVEN

**RECORD DATA PLATE INFORMATION**

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

Data Plate Information

<table>
<thead>
<tr>
<th>Model Number</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Number</td>
<td></td>
</tr>
</tbody>
</table>
INSTALLATION

**INSTALLATION CHECKLIST**

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

**Pre-Installation**

- ✔ Verify that a vacuum supply source (stand-alone pump or in-house system) suitable for your application is available and can be connected to the oven. See page 20 for the oven gas and vacuum port locations.

- ✔ Check that the required ambient conditions, ventilation, and spacing for the oven are met, page 16.
  - Unit dimensions may be found on page 8.

- ✔ Check for performance-disrupting heat and cold sources in the environment, page 16.

- ✔ Check that a suitable electrical outlet and power supply for the oven is present, page 17.

- ✔ Check that a suitable electrical outlet and power supply for the vacuum pump is present. Please see the pump operator manual for electrical requirements.

**Install the Oven in a suitable workspace location**

- ✔ Review the lifting and handling instructions, page 18.

- ✔ Install the oven in its workspace location, page 18.

- ✔ Make sure the oven is level, page 18.

**Set up the Oven for use**

- ✔ Clean the oven shelving. Clean the chamber if needed, page 18.

- ✔ Install the shelving in the oven chamber, page 19.

- ✔ Connect the oven to its vacuum supply source, page 20.

- ✔ **Optional:** Connect the oven to a neutral purging gas. See page 21.
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**

- Leave at least **12 inches (305mm)** of empty space between the top and back of the oven and any walls or partitions for unobstructed airflow and cooling. Allow at least **6 inches (152mm)** of ventilation on the sides.

  ![Diagram showing clearances](image)

- Do not place objects on top of the oven.
- The required 12 inches from the back of the oven **includes 6 inches (152mm)** clearance between the fan on the back and any obstruction.
- A KF-25 vacuum port is located on the back of the oven for introducing potted (sealed) probes into the chamber or connecting to an external vacuum supply source. Leave sufficient clearance for operators to safely access this port.

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

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

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

**Power Source:** The wall power outlet must meet the power requirements listed on the unit data plate.

<table>
<thead>
<tr>
<th>Model</th>
<th>AC Voltage</th>
<th>Amperage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVO-2</td>
<td>110 - 120</td>
<td>6.0</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>CVO-2-2</td>
<td>220 - 240</td>
<td>4.0</td>
<td>50/60 Hz</td>
</tr>
</tbody>
</table>

- Wall power sources must be protective earth grounded and **single phase**.
- Wall power sources must conform to all national and local electrical codes.
- **Supplied voltage must not vary more than 10% from the data plate rating.** Damage to the unit may result if the supplied voltage varies more than 10%.
- **The recommended wall circuit breakers for these units are CVO-2 15 amps, CVO-2-2 10 amps.**
- Use a separate circuit to prevent loss of product due to overloading or circuit failure. The circuit must match or exceed the amperage requirement listed on the unit the data plate.

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

**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:

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Quantity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVO-2</td>
<td>T6.3A 250V</td>
<td>1</td>
<td>Power cord inlet</td>
</tr>
<tr>
<td>CVO-2-2</td>
<td>T4A 250V</td>
<td>2</td>
<td>Power cord inlet and 1 in a fuse holder adjacent to the cord inlet.</td>
</tr>
</tbody>
</table>

**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.
**INSTALLATION**

**LIFTING AND HANDLING**

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

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

**LEVELING**

The unit must be level and stable for safe operation. CVO-2 ovens ship with four leveling feet with the 4 corner holes on the bottom of the oven.

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**

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

- Do not connect the oven to its power source at this time.

**INSTALLATION CLEANING**

The manufacturer recommends cleaning the shelving and oven chamber prior to installation of the shelving in the chamber. The unit was cleaned at the factory but may have been exposed to contaminants during shipping. Remove all wrappings and coverings from shelving prior to cleaning and installation. Do not clean with deionized water.

See the Cleaning and Disinfecting topic in the User Maintenance section (see page 39) for more information on how to clean the oven chamber and shelving.
**SHELVING INSTALLATION**

Heating in a vacuum environment takes place primarily through conduction. Heat is transported from the heating elements to the samples or product through the shelves. Perform the following steps to install the shelves so that heat conducts properly and the oven measures the correct shelving temperature.

1. Carefully slide the short shelf into position on the chamber floor
   a. Slide the clip located on the bottom of the short shelf onto the oven temperature probe. The oven probe extends from the back wall near the floor of the chamber
   • The short shelf must be on the bottom of the shelf-stack to ensure the oven measures the oven chamber temperature accurately when the chamber is under vacuum.

2. Place the 2 tall shelves on top of the short shelf.

3. Place the 2 medium shelves on top of the tall shelves.

---

**CVO-2s Shelving Configuration**

---

**Temperature Probe Shelf Clip**

**Bottom Shelf Upside Down**

---

**Temperature Probe**
**CONNECT TO THE VACUUM SUPPLY**

**The Vacuum Port – 3/8 Inch (9.52mm) OD**
- Connect a vacuum supply capable of supplying up to -29 inches of mercury (inHg) of vacuum to this port. Chamber atmosphere is evacuated through this port.
- This port is opened and closed by the Vacuum Valve control on the front control panel.

**The Chamber Vent Port – 1/4 Inch (6.35mm) OD**
- This intake port allows external atmosphere back into the oven chamber when the chamber Vent Valve control on the front control panel is open.
- **Optional**: An inert purging gas supply source may be connected to this port. Please page 21.

**KF-25 Fitting**
- A vacuum supply can be connected to the KF-25 flange for increased efficiency in vacuuming down the chamber. However, the Vacuum Valve control on the front control panel will not affect the level of vacuum and must be set to closed to prevent atmosphere from entering the chamber through the 3/8" Vacuum Port.
- This large fitting is normally used to introduce potted (sealed) sensor probes into the oven chamber. Probes must be inserted and secured prior to placing the chamber under vacuum.

Use of clamps to secure tubing to the Vacuum Port and Chamber Vent is recommended.
**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.

Exceeding 15 psi of gas backfill pressure may damage the oven.
The oven is provided with multiple graphic symbols on its interior and exterior surfaces. The symbols identify hazards and the functions of the adjustable components, as well as important notes in the user manual.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️⚠️</td>
<td>Consult the user manual. Consulter le manuel d'utilisation</td>
</tr>
<tr>
<td>🌊</td>
<td>AC Power Repère le courant alternatif</td>
</tr>
<tr>
<td>I/ON</td>
<td>I indique que l'interrupteur est en position marche. O indique que le commutateur est en position d'arrêt.</td>
</tr>
<tr>
<td>🌃</td>
<td>Adjustable Temperature Indique une température réglable</td>
</tr>
<tr>
<td>🕯️</td>
<td>Lighting Indique l'éclairage</td>
</tr>
<tr>
<td>🟢</td>
<td>Heating pause Indique une pause de chauffage</td>
</tr>
<tr>
<td>🔶 🔽</td>
<td>Indicates UP and DOWN respectively Touches de déplacements respectifs vers le HAUT et le BA</td>
</tr>
<tr>
<td>⚠️⚡</td>
<td>Potential shock hazard Risque de choc électrique</td>
</tr>
<tr>
<td>✖️</td>
<td>Recycle the unit. Do not dispose of in a landfill. Recycle l'unité. Ne jetez pas dans une décharge</td>
</tr>
<tr>
<td>🌊</td>
<td>Protective earth ground Terre électrique</td>
</tr>
<tr>
<td>🔥</td>
<td>Caution hot surface Attention surface chaude</td>
</tr>
</tbody>
</table>
CONTROL OVERVIEW

Light Switch
Controls the oven chamber light.

Power Switch
The Power Switch controls all power the oven and its systems. The switch must be in the I (on) position for the unit to function.

Main Temperature Display and Control
Marked SET TEMPERATURE, this display shows the current oven chamber temperature accurate to within 1°F. The display can also show an adjustable temperature set point in the display's set point mode, as well as an adjustable offset while in calibration mode.

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

The Hold Button temporarily disables heating in the oven chamber. Pressing the button once turns off power to the heating elements. Pressing the button a second time restores heating.

Over Temperature Activated
This red light illuminates if the Over Temperature Limit 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 30.
CONTROL OVERVIEW

Vacuum Gauge

This digital gauge shows the chamber vacuum level relative to the ambient atmospheric pressure. The gauge activates automatically when the Main Power switch is in the On (I) position.

In its factory setting, the gauge shows the chamber pressure in inches of mercury (inHg), with a display range of 0 – 29.9inHg. 0 is the room atmosphere pressure and -29.9inHg a near-perfect vacuum relative to sea level atmospheric pressure.

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 and active vacuum supply source.
- In the closed position, the valve cuts off the vacuum draw.

Vent Valve Control

This valve controls the chamber 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 gas backfill 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 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.
OPERATION

**Theory of Operation**

The CVO-2 ovens are intended for use in closed-cycle, under-vacuum applications.

**Vacuum**

Vacuum is supplied to the chamber by an external vacuum pump or building system. The supply is connected to either the 3/8-inch vacuum port on the back of the oven or the KF-25 fitting. The vacuum gauge on the main control panel displays the current level of vacuum relative to room atmospheric pressure.

Vacuum levels obtained in the oven chamber are dependent on pump performance, valve settings, and the nature of the application or process, including the volume of material outgassed. The maximum attainable vacuum is governed by altitude above sea level (see page 37 for more information).

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

Vacuum pumps and door gaskets should be selected based on the application or process. Gasket types are resistant and vulnerable to different chemicals, and vacuum pumps vary in suitability and safety depending on the outgassed byproduct types and moisture level produced in the oven chamber.

**Gas Backfill**

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

**Heating in a Vacuum**

In conventional ovens, powered elements transfers heat into the chamber air. The heated air then circulates by natural convection or blower fan action, and surrounds the product on the shelves, gradually bringing it to temperature. In a vacuum oven, heat transport takes place primarily by conduction. The oven heating elements are located in side ducts and 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.
OPERATION

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. The oven can achieve a low-end operating temperature of the ambient room temperature plus 26°F.

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 soaking 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 and 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: When running the oven at or near its maximum temperature for the first time, there may be light smoking from protective oil coatings on the elements.

PUT THE OVEN INTO OPERATION

Verify all of the required procedures in the Installation section have been carried out. Then perform the following steps and procedures to prepare the oven for use in a new location.

1 Attach the Power Cord

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

2 Plug in the Vacuum Pump

Plug the vacuum pump power cord into a wall power source.

3 Verify the Valves are Closed

Check that oven chamber door is closed and latched, and that the vent and vacuum valves are both in the closed position (turned all the way clockwise).

Always verify that the oven chamber is sealed prior to starting the oven to help safeguard your vacuum pump from prolonged exposure to streaming atmosphere.

4 Turn on the Oven

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

• The oven temperature display will illuminate.
• Any vacuum pump connected to the accessory power outlet will turn on.

Continued next page
OPERATION

6 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 33

10 Minute Minimum

Leave the chamber under vacuum to perform the Set the Over Temperature Limit procedure and the optional temperature verification procedure.

7 Set the Operating Temperature

Set the Oven Temperature to your baking application temperature. See page 34.

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

The oven is now ready for use
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.

This procedure assumes the oven is powered and plumbed to a powered vacuum supply source (pump).

<table>
<thead>
<tr>
<th>Vacuum Down the Oven Chamber</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Holding At Vacuum</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restore Atmosphere to the Oven Chamber</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

End of procedure
Set the Temperature Set Point

Adjust the oven temperature set point to that of your application. The chamber should be under vacuum when setting the temperature to help ensure an accurate display reading and to prepare for setting the over temperature limit heating cutoff point.

1. **Activate Temperature Setpoint Adjustment Mode**
   - Press and release either of the **Set Temperature** arrows
   - The display will briefly flash the letters “SP”, then show the flashing, adjustable temperature set point.

   **Note:** The display will automatically exit the adjustment mode after 5 seconds of inactivity, saving the last shown value as the new set point.

2. **Adjust the Setpoint**
   - Adjust the set point to your process temperature using the **Up** or **Down** arrow buttons.

3. **Allow the Setpoint to Save**
   - Wait 5 seconds after entering the set point.
   - The display will stop flashing. The set point is now saved in the controller.
   - The oven will now automatically heat or passively cool to match the set point.
   - The display will revert to showing the present chamber temperature.

End of Procedure
OVER TEMPERATURE ACTIVATION

Possible causes for the Over Temperature Limit system cutting off heating include:

- An external heat source or a heat source inside the chamber is causing the chamber
temperature to spike.
- The temperature controller or its sensor probe have failed and must be replaced in order to
resume safe operation of the oven.

If the OTL activated during normal operations, adjust the control dial clockwise halfway to the next
dot to increase the setting. If the OTL continues to interrupt heating of the oven chamber and there
no obvious external sources of nearby heating (autoclaves, another oven), depower the oven and
allow the oven chamber to cool before opening the oven door or troubleshooting.

End of procedure


**Vacuum Gauge Operations**

**Change the Unit of Measurement**

Perform the steps below to switch the unit of measurement displayed by the gauge.

1. Place the vacuum gauge in its adjustment mode.
   a. Press and hold the “M” button for approximately 3 seconds.
   • The display will begin to blink and show a unit of measurement.

2. Use the arrow keys to scroll between units.

3. Exit the adjustment mode.
   a. Press and hold the “M” button for approximately 3 seconds.
   • The display will cease blinking and show the current chamber pressure.

**Units of Measurement – Display Characters**

<table>
<thead>
<tr>
<th>kPa</th>
<th>Kgf/cm²</th>
<th>bar</th>
<th>psi</th>
<th>mmHg</th>
<th>inHg</th>
<th>mmH₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td><img src="image7.png" alt="Image" /></td>
</tr>
</tbody>
</table>

**Zero Out the Gauge**

As set at the factory, the vacuum gauge shows a reading of 0 inches of mercury (inHg) when the chamber is at ambient room pressure. The display was set at near sea level.

If the gauge does not show 0inHg when the chamber is at room atmospheric pressure, perform the following step. See page 7 for the zero equivalent for units of measurement other than inHg.

1. With the chamber door open, press and hold both the Up and Down arrow buttons.
   a. Release the buttons when the display shows 0.0.
**OPERATION**

**MAXIMUM OBTAINABLE VACUUM**

The maximum vacuum obtainable, as measured by the oven gauge, is in part a function of altitude. While a vacuum pump will evacuate the same percentage of atmosphere from the oven chamber at higher altitudes, less overall pressure is expelled because of the reduced density. Or put differently, at sea level there are 29.9 inches of mercury pressure that can be expelled. At 5000ft (1524m) there are only 24.9 inches of pressure to be drawn from the oven chamber.

<table>
<thead>
<tr>
<th>Altitude (Feet)</th>
<th>Altitude (Meters)</th>
<th>Atmospheric Pressure</th>
<th>Maximum Vacuum Level Attainable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Level</td>
<td>Sea Level</td>
<td>14.70 psi</td>
<td>29.9 inHg</td>
</tr>
<tr>
<td>1000ft</td>
<td>305m</td>
<td>14.16 psi</td>
<td>28.9 inHg</td>
</tr>
<tr>
<td>2000ft</td>
<td>610m</td>
<td>13.66 psi</td>
<td>27.8 inHg</td>
</tr>
<tr>
<td>3000ft</td>
<td>914m</td>
<td>13.16 psi</td>
<td>26.8 inHg</td>
</tr>
<tr>
<td>4000ft</td>
<td>1219m</td>
<td>12.68 psi</td>
<td>25.8 inHg</td>
</tr>
<tr>
<td>5000ft</td>
<td>1524m</td>
<td>12.22 psi</td>
<td>24.9 inHg</td>
</tr>
<tr>
<td>6000ft</td>
<td>1829m</td>
<td>11.77 psi</td>
<td>24.0 inHg</td>
</tr>
<tr>
<td>7000ft</td>
<td>2134m</td>
<td>11.33 psi</td>
<td>23.1 inHg</td>
</tr>
<tr>
<td>8000ft</td>
<td>2438m</td>
<td>10.91 psi</td>
<td>22.2 inHg</td>
</tr>
<tr>
<td>9000ft</td>
<td>2743m</td>
<td>10.50 psi</td>
<td>21.4 inHg</td>
</tr>
<tr>
<td>10,000ft</td>
<td>3048m</td>
<td>10.10 psi</td>
<td>20.6 inHg</td>
</tr>
</tbody>
</table>

**PRESSURE UNITS CONVERSION CHART**

<table>
<thead>
<tr>
<th>Conversion</th>
<th>InHg</th>
<th>kPa</th>
<th>Kgf/cm²</th>
<th>bar</th>
<th>psi</th>
<th>mmHG</th>
<th>mmH₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inHg</td>
<td>1</td>
<td>3.3863</td>
<td>0.0345</td>
<td>0.3386</td>
<td>0.4911</td>
<td>25.400</td>
<td>345.32</td>
</tr>
<tr>
<td>1 kPa</td>
<td>0.2953</td>
<td>1</td>
<td>0.0102</td>
<td>0.01</td>
<td>0.1450</td>
<td>7.5006</td>
<td>101.97</td>
</tr>
<tr>
<td>1 Kgf/cm²</td>
<td>28.9590</td>
<td>98.0665</td>
<td>1</td>
<td>0.9806</td>
<td>14.2233</td>
<td>735.55</td>
<td>10000.27</td>
</tr>
<tr>
<td>1 bar</td>
<td>29.5300</td>
<td>100</td>
<td>1.0197</td>
<td>1</td>
<td>14.5037</td>
<td>750.06</td>
<td>10197.44</td>
</tr>
<tr>
<td>1 psi</td>
<td>2.0360</td>
<td>6.8947</td>
<td>0.0703</td>
<td>0.0689</td>
<td>1</td>
<td>51.750</td>
<td>703.09</td>
</tr>
<tr>
<td>1 mmHG</td>
<td>0.0394</td>
<td>1.3332</td>
<td>0.0014</td>
<td>0.0013</td>
<td>0.0193</td>
<td>1</td>
<td>13.5954</td>
</tr>
<tr>
<td>1 mmH₂O</td>
<td>0.0028</td>
<td>0.0098</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0014</td>
<td>0.0029</td>
<td>1</td>
</tr>
</tbody>
</table>
**Operation**

**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 (BSD license) emulator, Tera Term.
USER MAINTENANCE

**Warning:** Prior to 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 unit, 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 evaporés 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.
**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.

The gaskets are consumable items subject to significant compression forces, drying, and outgassed byproducts. As such, gaskets must be replaced periodically. The manufacturer recommends keeping one spare gasket on hand.

**Electrical Components**

Electrical components do not require maintenance. If the oven fails to operate as specified, please contact your distributor or Cascade Sciences for assistance.
**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 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 plumed 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**

<table>
<thead>
<tr>
<th>Note:</th>
<th>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. <strong>Never use alcohol or mercury based thermometers!</strong></th>
</tr>
</thead>
</table>

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. Vacuum
   
   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
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 of ±1°F or greater.

Figure 3: 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.
   a. If the readings are the same, or the difference between the two falls within the acceptable range of your protocol, the display is accurately showing the chamber temperature. The Temperature Calibration procedure is now complete.

   -Or-

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

2. The display requires calibration. Advance to Step 3.

Continued on next page
**USER MAINTENANCE**

### Calibration continued

#### 3

Place the oven in temperature calibration mode.

- Press and hold both the **UP** and **DOWN** arrow buttons simultaneously.
  - The Temperature Display will show the letters “C O”, then begin flashing the **current temperature value**.

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

#### 4

Adjust the current temperature value to match the reference device.

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

#### 5

After entering the correction adjustment wait 5 seconds.

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

#### 6

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

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

---

Procedure continued on next page
**Calibration continued**

7. Allow the oven to stabilize after achieving the temperature set point with corrected display value.

**Note:** The unit is stabilized when no fluctuations of ±1°F or greater have been detected with the reference device for a minimum of 30 minutes.

8. Once the temperature has stabilized, compare the reference device and the oven display temperature readings.
   
   a. If the readings are the same, or the difference between the two falls within the acceptable range of your protocol, **the oven is calibrated for temperature.**

      -Or-

   b. Advance to step 9.

9. If the two readings still fall outside the acceptable range of your protocol, repeat steps 3 – 8 up to two more times.
   
   - Three calibrations attempts may be required to successfully calibrate ovens more than ±3°F out of calibration.

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

End of procedure
USER MAINTENANCE
REPLACEMENT PARTS LIST

See the next page for gaskets.

<table>
<thead>
<tr>
<th>Description</th>
<th>Parts Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustable Leveling Feet, CVO-2</td>
<td>2700512</td>
</tr>
<tr>
<td>Fuse, <strong>CVO-2</strong>, 5X20MM 6.3A 250V</td>
<td>3300515</td>
</tr>
<tr>
<td>Requires 1 fuse. Please see the power panel illustration page 13 for the CVO-2 fuse location.</td>
<td></td>
</tr>
<tr>
<td>Fuse, <strong>CVO-2-2</strong>, 5X20mm, T4.0A 250V</td>
<td>3300537</td>
</tr>
<tr>
<td>2 fuses are required to operate the oven. Please see the power panel illustration page 13 for the CVO-2-2 fuse locations.</td>
<td></td>
</tr>
<tr>
<td>Power Cord, <strong>CVO-2</strong>, 125 volt, 15Amp, 9ft 5 in (2.86m) NEMA 5-15P</td>
<td>1800510</td>
</tr>
<tr>
<td>Power Cord, <strong>CVO2-2</strong>, 250 Volt, 13Amp, 8.2 feet (2.5m), NEMA 6-15P</td>
<td>1800539</td>
</tr>
<tr>
<td>Shelf Short, Bottom, with temperature probe clip. Requires 1</td>
<td>9751226</td>
</tr>
<tr>
<td>Shelf Medium</td>
<td>5680582</td>
</tr>
<tr>
<td>Shelf Tall</td>
<td>5680567</td>
</tr>
</tbody>
</table>
## REPLACEMENT GASKETS

<table>
<thead>
<tr>
<th>Available Gaskets Types</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Silicon</strong>, black or red, (comes with oven), rated to 446°F (230°C)</td>
<td>3450707</td>
</tr>
<tr>
<td><strong>Applications</strong>: General and high temperature</td>
<td></td>
</tr>
<tr>
<td><strong>Resistant to</strong>: Moderate or oxidizing chemicals, ozone, and concentrated sodium hydroxide</td>
<td></td>
</tr>
<tr>
<td><strong>Attacked by</strong>: Many solvents, oils, concentrated acids, and diluted sodium hydroxide</td>
<td></td>
</tr>
<tr>
<td><strong>Buna</strong>, rated to 221°F (105°C)</td>
<td>3450708</td>
</tr>
<tr>
<td><strong>Applications</strong>: Solvent</td>
<td></td>
</tr>
<tr>
<td><strong>Resistant to</strong>: Many hydrocarbons, fats, oils, greases, and hydraulic fluids.</td>
<td></td>
</tr>
<tr>
<td><strong>Attacked by</strong>: Ozone (except PVC blends), ketones, esters, aldehydes, chlorinated, and nitro hydrocarbons.</td>
<td></td>
</tr>
<tr>
<td><strong>Fluorosilicone</strong>, rated to 347°F (175°C)</td>
<td>3450611</td>
</tr>
<tr>
<td><strong>Applications</strong>: Acidic</td>
<td></td>
</tr>
<tr>
<td><strong>Resistant to</strong>: Moderate or oxidizing chemicals, ozone, aromatic chlorinated solvents, and bases.</td>
<td></td>
</tr>
<tr>
<td><strong>Attacked by</strong>: Brake fluids, hydrazine, and ketones.</td>
<td></td>
</tr>
<tr>
<td><strong>Viton®</strong>, rated to 401°F (205°C)</td>
<td>3450670</td>
</tr>
<tr>
<td><strong>Applications</strong>: Acidic</td>
<td></td>
</tr>
<tr>
<td><strong>Resistant to</strong>: All aliphatic, aromatic and halogenated hydrocarbons, acids, and animal and vegetable oils.</td>
<td></td>
</tr>
<tr>
<td><strong>Attacked by</strong>: Ketones, low molecular weight esters, and compounds containing nitro.</td>
<td></td>
</tr>
</tbody>
</table>

### Gasket Dimensions

12 x 12 Inches (30.48 x 30.38cm)