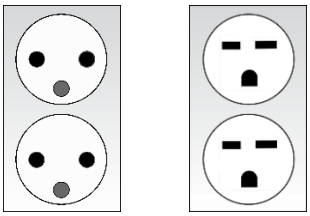
CASCADE™ TEK

FORCED AIR OVENS TFO-1-2 TFO-3-2 TFO-5-2

Installation and Operation Manual

Depicted on front cover, left to right: TFO-1-2, TFO-3-2, TFO-5-2

The oven requires a 220 – 240 volt power supply outlet to plug into.



Warning: This product contains chemicals, including triglycidyl isocyanurate, known to the State of California to cause cancer as well as birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

¡Advertencia! Este producto contiene sustancias químicas, incluido el triglicidil isocianurato, que el estado de California sabe que causa cáncer, así como defectos de nacimiento u otros daños reproductivos. Para obtener más información, visite www.P65Warnings.ca.gov**.**

Avertissement! Ce produit peut vous exposer à des produits chimiques, dont l'isocyanurate de triglycidyle, reconnu par l'État de Californie pour provoquer le cancer, des anomalies congénitales ou d'autres problèmes de reproduction. Pour plus d'informations, visitez le site www.P65Warnings.ca.gov.

TFO Forced Air Ovens

220 – 240 Voltage

Part Number (Manual): 4861793

Revision: November 15, 2021

Cascade TEK Part ID Numbers:

Model Name	TFO-1-2	TFO-3-2	TFO-5-2
Part ID	CTF122-EA	CTF322-EA	CTF522-EA

Part ID designates the specific build type of the model.

Cascade TEK Solutions, LLC is an ISO 9001 certified manufacturer.

Safety Certifications

These units are CUE listed by TÜV SÜD as forced air ovens for professional, industrial, or educational use where the preparation or testing of materials is done at an ambient air pressure range of 22.14 – 31.3 inHg (75 – 106 kPa) and no flammable, volatile, or combustible materials are being heated.

The units have been tested to the following requirements:

CAN/CSA-22.2 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

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INTRODUCTION

Thank you for purchasing a Cascade TEK oven. We know you have many choices in today's competitive marketplace when it comes to constant temperature equipment. We appreciate you choosing ours. We stand behind our products and will be here if you need us.

READ THIS MANUAL

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

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

SAFETY CONSIDERATIONS AND REQUIREMENTS

Follow basic safety precautions, including all national laws, regulations, and local ordinances in your area regarding the use of this unit. If you have any questions about local requirements, please contact the appropriate agencies.

SOPs

Because of the range of potential applications this unit can be used for, the operator or their supervisors must draw up a site-specific standard operating procedure (SOP) covering each application and associated safety guidelines. This SOP must be written and available to all operators in a language they understand.

Intended Applications and Locations

TFO forced-air ovens are engineered for constant temperature forced-air drying, curing, and baking applications in professional, industrial, and educational environments. The ovens are not intended for use at hazardous or household locations.

Power

Your unit and its recommended accessories are designed and tested to meet strict safety requirements.

- The unit is designed to connect to a power source using the specific power cord type shipped with the unit.
- Always plug the unit power cord into a protective earth grounded electrical outlet conforming 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.
- Use only approved accessories. Do not modify system components. Any alterations or modifications to your oven can be dangerous and void your warranty.

CONTACTING ASSISTANCE

Phone hours for Customer 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 Customer Support: the **model number**, **serial number, part number,** and **part ID** (see page 12).

support@cascadetek.com
1-888-835-9250
1-971-371-4096
FAX: 1-(503) 640-1366

Manufacturing and Customer Support
Cascade TEK Solutions, LLC
PO Box 625
300 N 26th Ave
Cornelius, OR 97113
USA

MANUFACTURING WARRANTY

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

https://www.cascadetek.com/warranty/

ENGINEERING IMPROVEMENTS

Cascade TEK 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 Cascade TEK dealer or customer service representative for assistance.

RECEIVING YOUR UNIT

INSPECT THE SHIPMENT

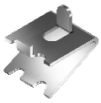
- When a unit leaves the factory, safe delivery becomes the responsibility of the carrier.
- **Damage sustained during transit is not covered by the manufacturing defect warranty.**
- Save the shipping carton until you are certain that the unit and its accessories function properly.

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

1. Carefully inspect the shipping carton for damage.
2. Report any damage to the carrier service that delivered the unit.
3. If the carton is not damaged, open the carton and remove the contents.
4. Inspect the unit for signs of damage. See the orientation depiction on the next page as a reference.
5. The unit should come with an Installation and Operation Manual and a Programming Guide.
6. Verify that the correct number of accessory items has been included.
7. Carefully check all packaging for accessory items before discarding.

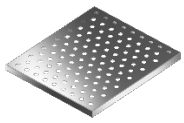
Included accessory items

Model	Shelves	Shelf Clips	Leveling Feet	Power Cord US	Power Cord EUR
TFO-1-2	2	8	4	1	1
TFO-3-2	2	8	4	1	1
TFO-5-2	2	24	4	1	1



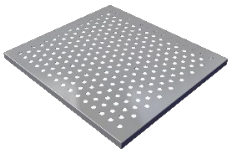

Shelves

TFO-1-2



TFO-3-2

TFO-5-2



A high-temperature access port stopper ships installed in the port located on the back of the oven.

ORIENTATION IMAGES

Figure 1: TFO-5-2

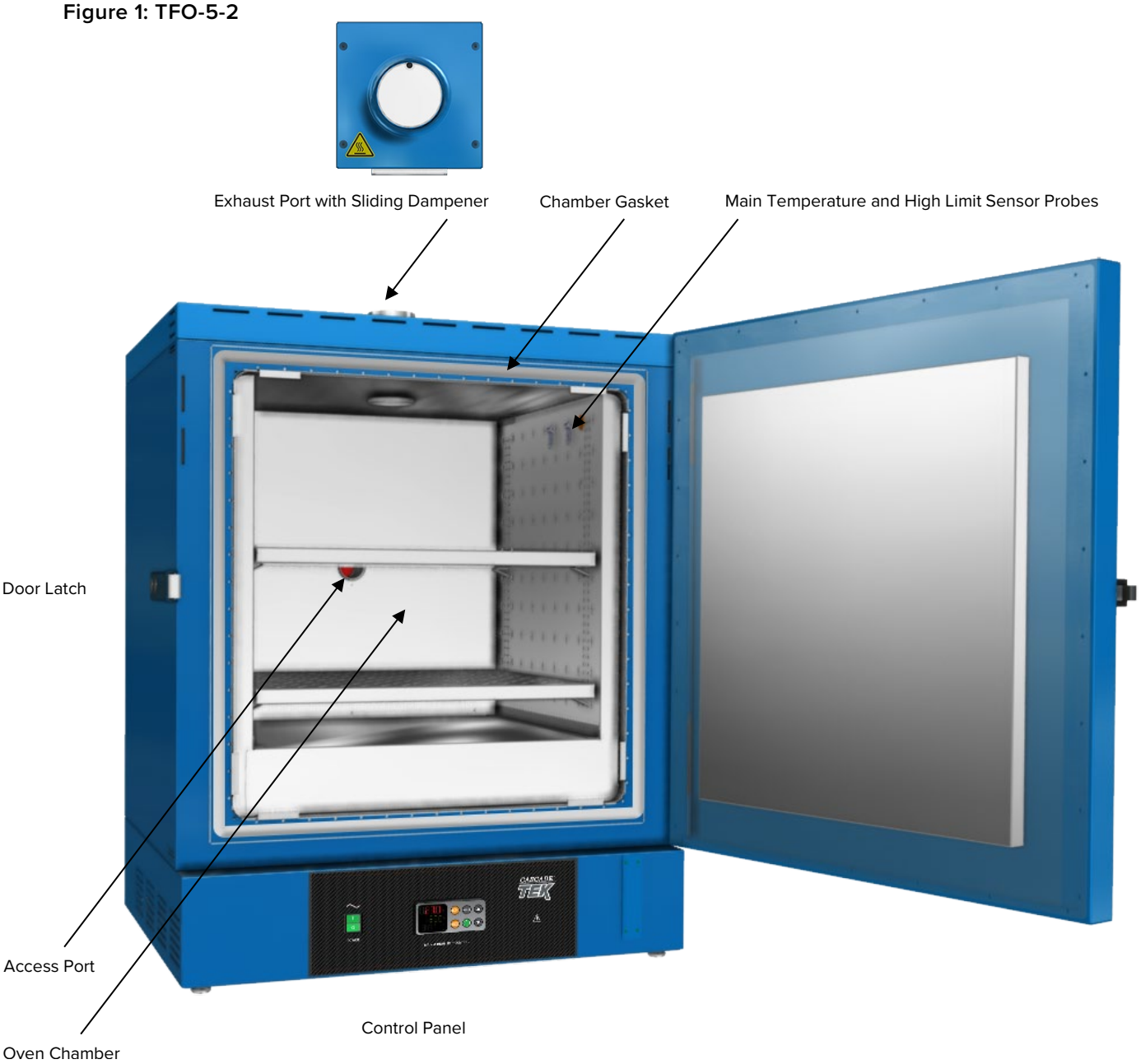


Figure 2: TFO-3-2

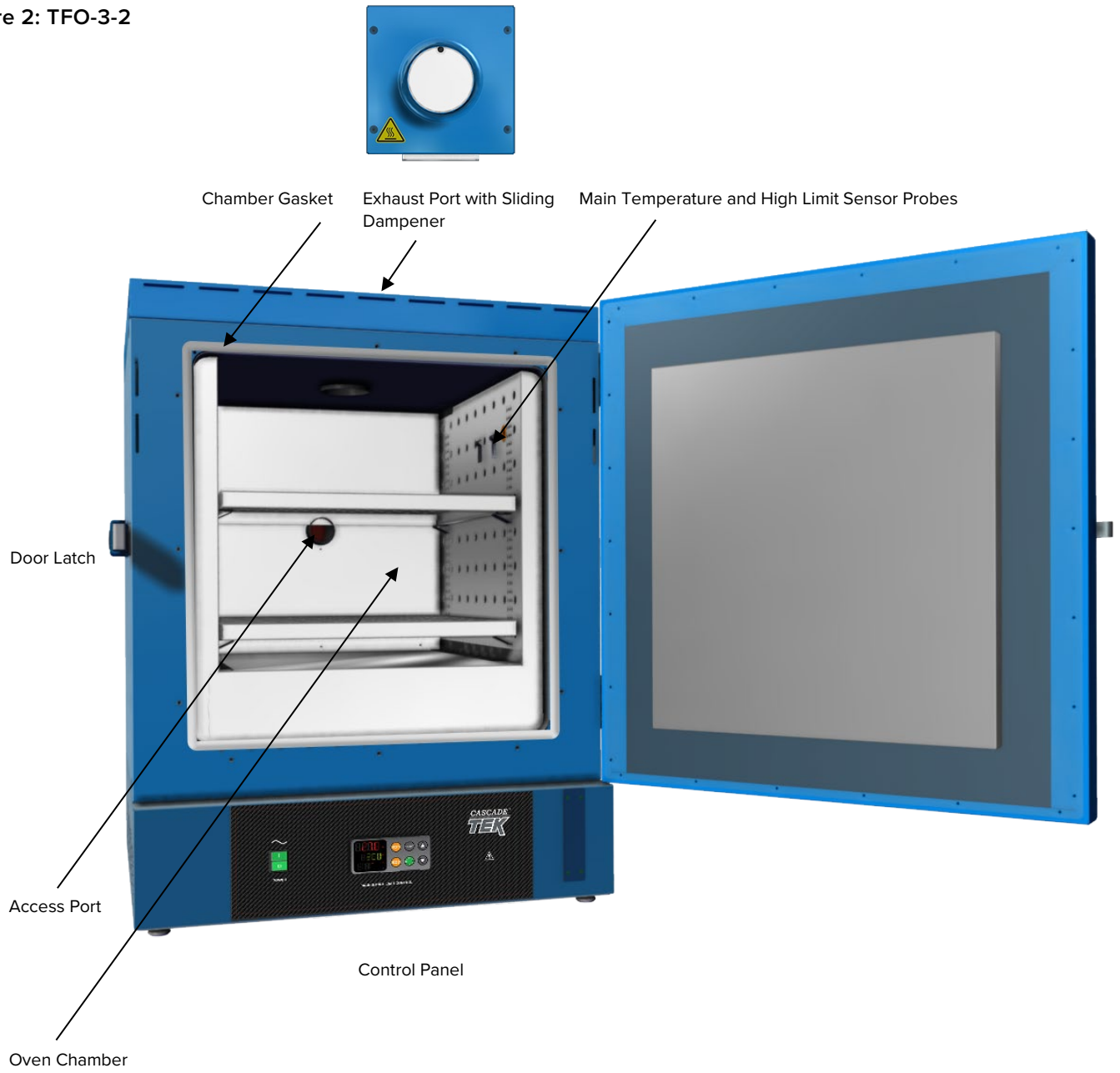


Figure 3: TFO-1-2

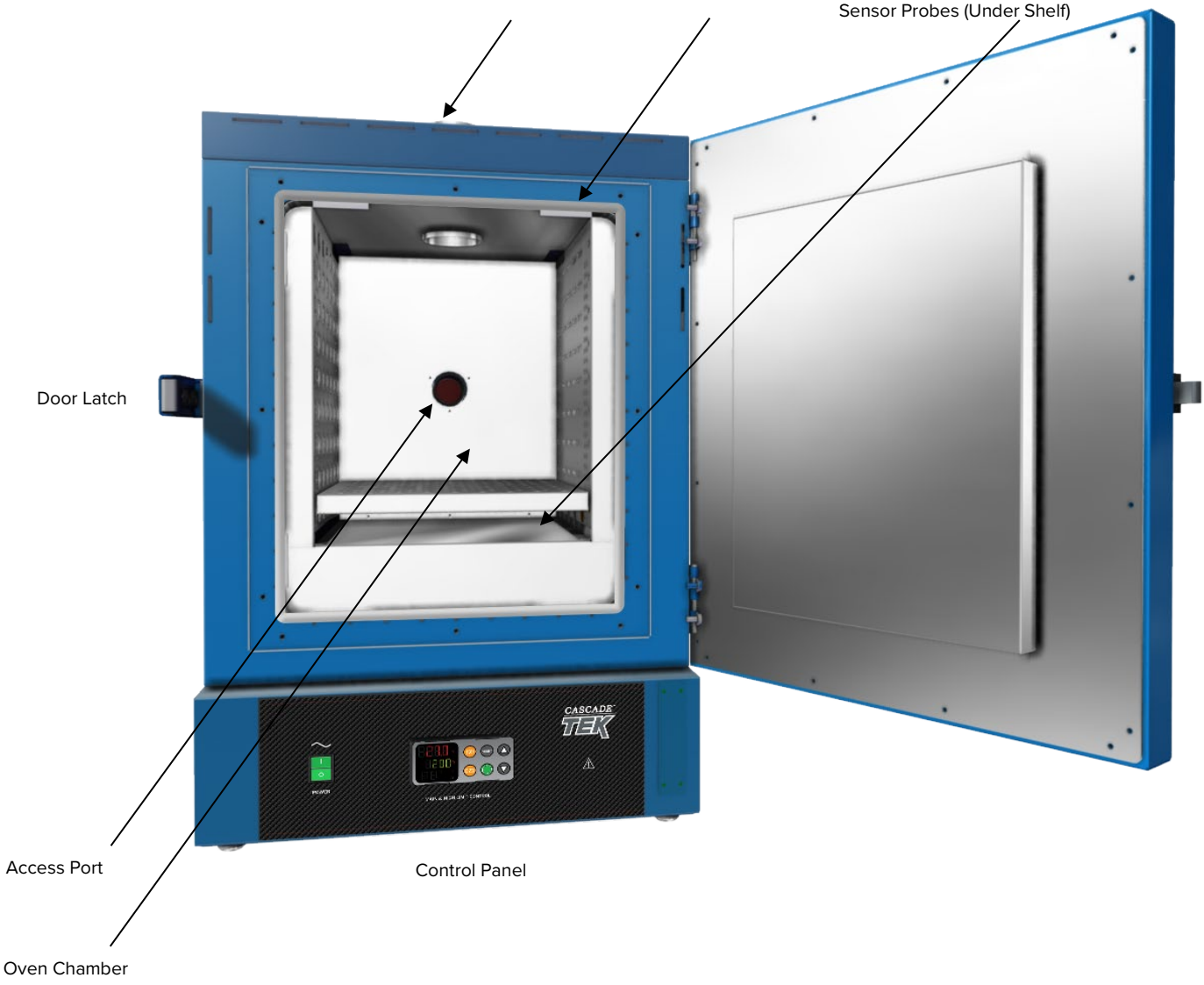


Figure 4: Unit Back

RECORDING DATA PLATE INFORMATION

The data plate contains the unit **model number** and **serial number**. Customer Support will need this information during any support call. Record it below for future reference.

- The data plate is located on the back of the oven above the power inlet.

Data Plate Information

Model Number	
Serial Number	

INSTALLATION PROCEDURE CHECKLIST

For installing the unit in a new workspace location.

Pre-Installation

✓ Check that the required workspace ambient conditions for the oven are met, page 14.

- Unit dimensions may be found on page 43

✓ Check that the required ventilation and spacing requirements are met, page 14.

✓ Check that a suitable electrical outlet and power supply is present, page 15

Installing the oven

✓ Review the lifting and handling instructions, page 16

✓ Install the oven in its workspace location, page 16

✓ Make sure the oven is level, page 16

Set up the oven for use

✓ Clean the oven chamber and shelving if needed, page 16

✓ Install the shelving in the oven chamber, page 17

✓ Verify that the stopper is installed in the access port on the outside of the oven, page 17

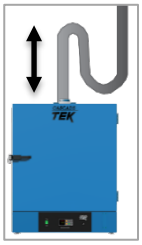
Required Ambient Conditions

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

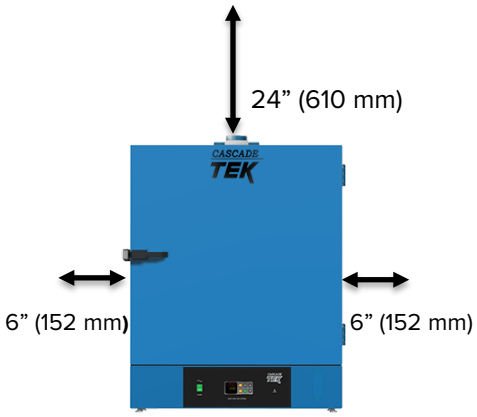
- Proximity to other ovens, autoclaves, and any device that produces significant radiant heat
- Heating and cooling ducts, or other sources of fast-moving air currents
- High-traffic areas
- Direct sunlight

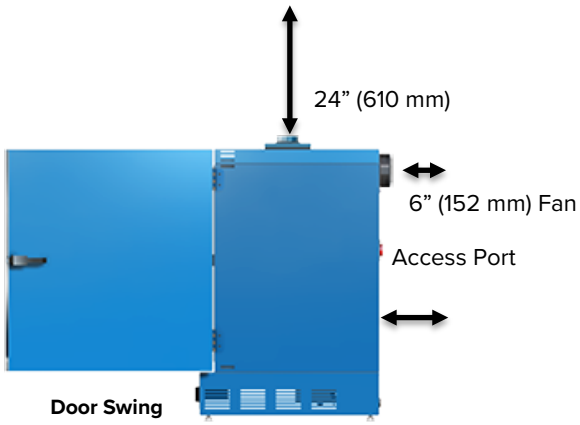
This oven is intended for use indoors, at room temperatures between **59°F and 104°F (15°C and 40°C)**, at no greater than **80% Relative Humidity** (at 77°F / 25°C). Operating the unit outside of these conditions may adversely affect its temperature range and stability.

Required Ventilation Clearances



12” (305 mm) if ducting is attached





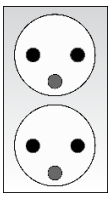
TFO-1-2: 23” (585mm)
TFO-3-2: 27” (686mm
TFO-5-2: 32” (813mm)

This spacing is required for the oven to operate safely and meet its stated temperature specifications:

- **24 inches (610 mm)** of headspace clearance is required between the exhaust vent and any overhead cover or partition.
    - **12 inches (305 mm)** of vertical headspace clearance suffices if the oven exhaust is vented from the workspace through a duct or other channeling.
- Do not place objects on top of the oven. Exception: A properly mounted power exhaust blower.
- Allow at least **6 inches (152 mm)** from the access port and fan vent on the back of the oven to the nearest wall or partition. Keep the fan unobstructed at all times.
- The chamber access port is located on the back of the oven. Leave sufficient room for easy access if oven operators will be using the port.

POWER SOURCE REQUIREMENTS

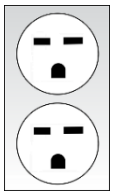
When selecting a location for the unit, verify that each of the following requirements is satisfied:



Standard EURO CEE7/7 wall socket

Power Source: The wall power outlet must meet the power requirements listed on the unit data plate. These units are intended for **220 – 240 VAC 50/60 Hz** applications at the following amperages:

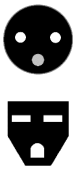
TFO-1-2	TFO-3-2	TFO-5-2
8.0 Amps	10.0 Amps	10.0 Amps



NEMA 6-15R wall socket

- 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 supplied voltage varies more than 10%.
- **The recommended wall circuit breakers for these units are 16 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.



- The unit comes provided with a 250 volt, 10 Amp, 2.5m (8ft) Euro CEE7/7 power cord.
- This unit is also provided with a 250 Volt, 13Amp, 8.2 feet (2.5m), NEMA 6-15P power cord.
- Always use this cord or an identical replacement.

Fuses: Each oven ships with two T10 amp, 250V, 5x20mm fuses installed in the power cord inlet and in a fuse holder adjacent to the inlet.

- Both fuses must be installed and intact for the unit to operate.
- Always find and fix the cause of a blown fuse prior to putting the unit back into operation.

LIFTING AND HANDLING

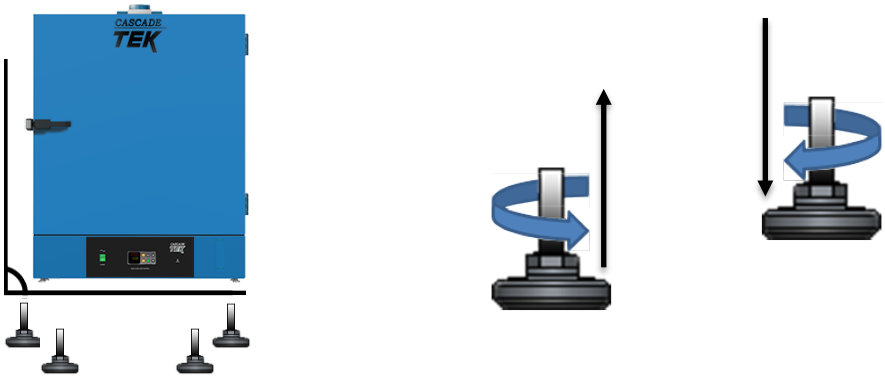
The oven is heavy. Use appropriate lifting devices that are sufficiently rated for these loads. Follow these guidelines when lifting the oven:

- 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 the door in the closed position during transfers to prevent shifting and damage.

LEVELING

Install the 4 leveling feet with the 4 corner holes on the bottom of the oven.

The oven must be level and stable for safe operation.



Note: To prevent damage when moving the unit, turn all 4 leveling feet so that the leg of each foot sits inside the oven.

INSTALL THE OVEN

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

INSTALLATION CLEANING

The unit was cleaned at the factory but may have been exposed to contaminants en route during shipping.

- Remove all wrappings and coverings from shelving prior to cleaning and installation.
- See the **Cleaning and Disinfecting** topic in the User Maintenance section (see page 33) for more information on how to clean the oven chamber prior to putting the unit into operation.

SHELVING INSTALLATION

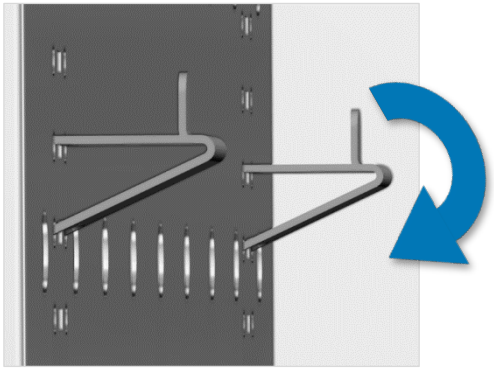


Figure 5: Install Clips

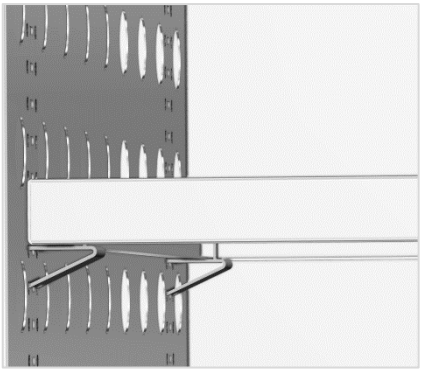


Figure 6: Place the Shelf

1. Install 4 clips for each shelf in the slots located on the sides of the chamber interior.
   a. Squeeze each clip.
   b. Insert the top tabs first, then the bottom tabs using a rocking motion.
2. Place the shelf on the clips.

ACCESS PORT STOPPER

Verify the port stopper is installed in the access port on the back of the unit. The oven will not meet its temperature performance specifications without the stopper installed.

The stopper must be installed on the outside of the oven. Installing the stopper on the inside of the oven risks damaging the stopper.

The intended use of the port is to introduce sensor probes into the oven chamber.

Figure 7: Port Stopper in Access Port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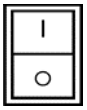
TEK

GRAPHIC SYMBOLS

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

Symbol	Definition
	Consult the user manual. Consulter le manuel d'utilisation
	Indicates adjustable temperature Indique température réglable
	AC Power Repère le courant alternatif
	I/ON O/OFF I indique que l'interrupteur est en position marche. O indique que le commutateur est en position d'arrêt.
	Protective earth ground Terre électrique
	Indicates UP and DOWN respectively Indique UP et DOWN respectivemen
	Potential shock hazard Risque de choc électrique
	Recycle the unit. Do not dispose of in a landfill. Recycler l'unité. Ne jetez pas dans une décharge.
	Caution hot surface Attention surface chaude

GRAPHIC SYMBOLS

CONTROL PANEL OVERVIEW

Figure 8: Control Panel and Controller

Power Switch

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

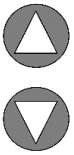
Temperature Controller - Display on Homepage

Top Line (Red): Present chamber air temperature

Middle Line (Green): Active temperature set point (constant or profile)

Bottom Line: "2" indicates the controller is calling for power to the heating elements

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



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

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

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

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

OPERATION

Safe operation of the oven is dependent on the actions and behavior of the oven operators. **Operating personnel must read and understand the Operating Precautions in this section prior to operating the oven.** The operators must follow these instructions to prevent injuries and to safeguard their health, environment, and the materials being treated in the oven, as well as to prevent damage to the oven. Failure to adhere to the 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.

OPERATING PRECAUTIONS

- Do not use this oven in unsafe improper applications that produce flammable or combustible gases, vapors, liquids, or fuel-air mixtures in quantities that can become potentially explosive.
- Outgassed byproducts may be hazardous to or noxious for operating personnel. Exhaust should be vented to a location outside the workspace in a safe manner in accordance with all applicable laws, ordinances, and regulations. Do not operate the oven in an unsafe area with noxious fumes.
- Do not use this oven for applications heating hazardous fibers or dust. These items can become airborne and come into contact with hot surfaces.
- 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.
- 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.
- Do not place sealed or filled containers in the oven. These may burst open when heated.
- Do not place alcohol or mercury thermometers in the oven. These devices may rupture under heat or other improper uses.
- Do not move the oven until it has finished cooling.

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

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

THEORY OF OPERATIONS

Heating

When powered, the TFO oven heats the oven chamber atmosphere to the current constant temperature set point. The oven can also be programmed with multi-step automated heating recipe profiles. When launched, a profile overrides the constant temperature set point. In its default setting, the oven resumes heating to the constant temperature set point after a profile completes or is aborted.

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

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

TFO ovens rely on natural heat radiation for cooling.

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

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

Heating Profiles

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

Air Circulation

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

Exhaust Vent

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

High Limit Control System

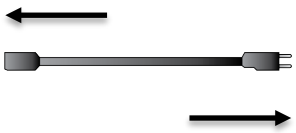
The temperature controller contains a heating cutoff system with independent circuitry connected to a redundant solid-state temperature sensor probe inside the oven chamber. This high limit system depowers the oven heating elements whenever the chamber air temperature exceeds the current limit setting.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

The high limit is set by the end-user to a minimum of 10˚C above the highest temperature of the application process the oven is currently being used for. Failure to set the high limit control system voids the oven manufacturing defect warranty in the event of an overtemperature event.

PUT THE OVEN INTO OPERATION

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

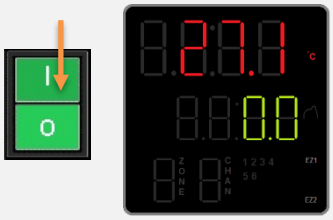
1. Plug in the power cord



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 outlet.

2. Power the oven



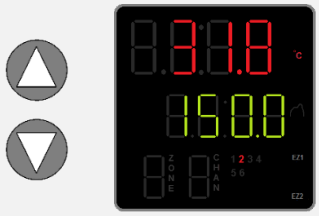
Place the oven **Power Switch** in the on (I) position.

- The controller display will illuminate, show the current firmware revision number, and then default to the homepage.

3. Set the High Limit Temperature heating cutoff point

See the **Set the High Limit** procedure on page 27.

4. Set the operating temperature



- **Set the constant temperature set point.** See page 28.

Or

- **Program multistep heating recipe profiles.** See page 28.

SET THE HIGH TEMPERATURE LIMIT

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

The high temperature limit is set by the operator at least 10°C above the highest temperature the oven will run at during your recipe profile or constant-temperature application.

1. Advance to the Limit High Set Point, starting on the Homepage

Push Advance

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

2. Adjust the high limit to at least 10°C above the highest temperature of your application

Adjust

- The oven will automatically save and apply the new High Limit setting after you have stopped adjusting.

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

3. Return to the Homepage

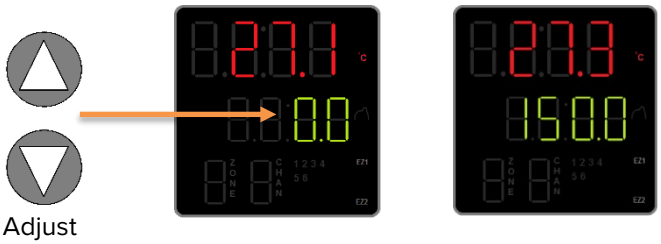
Push Reset

- Returned to Homepage

End of Procedure

Setting the Constant Temperature Set Point

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



- Do not exceed the high limit set point.

Note: Holding down an arrow button will cause the temperature to advance in increments of ten (10).

2. Release the Arrow buttons after adjusting the Set Point

- There may be a brief pause as the oven controller calculates the optimum power usage to achieve the set point starting from the current oven chamber temperature.
- A small illuminated 2 near the bottom of the display indicates the temperature controller is calling for heat.

Heating Profiles

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

High Temperature Limit Activated

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

Indicators

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

Alternating Alert Screens

Attention Screen

Heating Off

High Limit Activation Conditions

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

If you suspect an ignition event in the oven chamber or hardware failure, **turn off the oven and wait for the oven to cool to room temperature before opening chamber door.** Contact **Customer Support** for assistance.

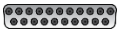
Clearing the High Limit Heating Cutoff

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

1. Push the Reset button.

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

Data Port and Data Jack



The 25-pin RS485 data port, located on the back of the oven, connects to the oven temperature controller. It is primarily intended for updating the controller software but can be used for data logging and graphical profile programming. Accessing the controller with a computer requires a 25-pin RS485-to-USB converter cable and driver software.

Applications and Utility Software

- **National Instrument LabView** and **Watlow Specview** — Temperature monitoring and data logging in graphical user interface environments.
- **Watlow's EZ Zone™ Configurator** — Programming heating profiles in a drop-down menu environment. Configurator can also be used to copy and save the controller configuration file, which includes the currently programmed heating profiles.
    - Configurator is available for free on the Watlow website.

Jack Port

The jack port accepts standard audio jacks (phono jacks) and outputs an analog signal (0 – 10 volts) corresponding to the current temperature of the oven chamber (0 - 306°C).

Change Unit of Measurement

$^{0}C \rightarrow {}^{0}F$

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

1. From the homepage, advance to the "C_F1" unit of measurement option.
    a. Press the green Advance button 7 times.

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

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

CASCADE™ TEK

AUTO TUNING

The auto tuning function runs the oven for a period of hours to optimize the controller PID parameters for a **large volume** or **significant mass of product** in the oven chamber. PID optimization is intended to be used if the oven temperature is lagging, overshooting, or failing to achieve the set point under the above conditions.

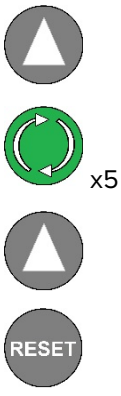
Auto tuning will not allow the oven to exceed its maximum specified heating rates. The oven will use the optimized PID settings until the controller is either tuned to different conditions or restored to its factory configuration.

Setting Up the Auto Tune Conditions

Prior to auto tuning, set up the oven to match the conditions of your heating application.

- The oven should be turned off and resting at room temperature prior to starting the auto tuning.
- Set the oven intake and exhaust vent to match your process configuration (closed, both open, one slightly open, etc.).
- Product or samples must be present in the chamber in the volume, mass, and distribution (spacing) of your recipe or heat application process.
    - Depending on the heat levels involved, temperature spikes may occur in the chamber. The manufacturer strongly recommends using wasting or sacrificial product for the auto tuning.

Perform the Auto Tuning



1. Turn on the Oven
2. On the homepage, set the constant temperature set point to the temperature you wish to optimize for.
3. Advance to the “Aut1” Auto Tune parameter from the homepage using the Advance button.
4. Use the arrow button to switch “no” to “YES”.
    a. After approximately 4 seconds the display will start to flash the Auto tuning “Attn” alert message.
5. Use the Reset button to return to the homepage.
6. The oven will ramp up to and then down from the set point 5 times.
    - The total auto tuning time is dependent on the oven temperature and product mass being heated.

Auto Tuning

Tuning Launched

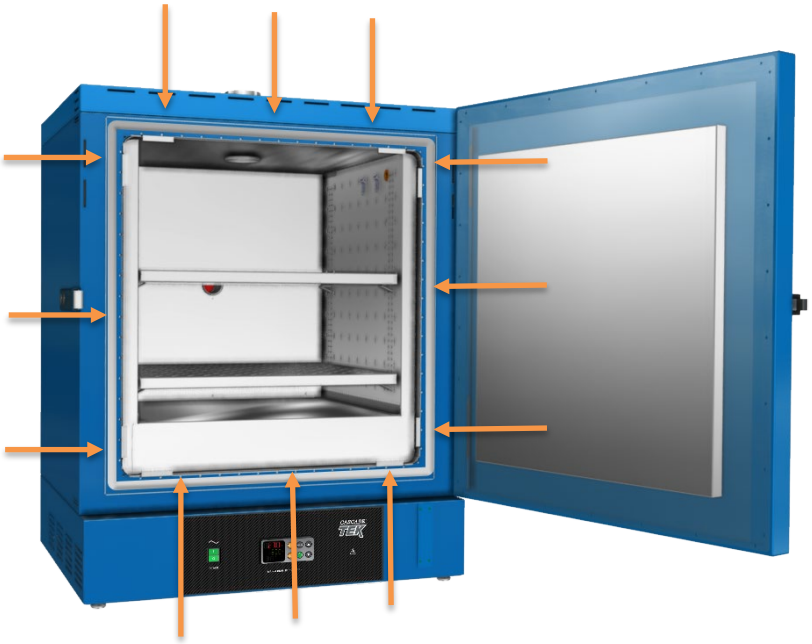
Tuning Alert

Note: Allow the oven to cool or use appropriate PPE and tools when adjusting the chamber gasket seating.

High Exterior Temperatures

If the chamber gasket comes out of alignment, oven chamber air may be drawn into the insulating baffle spaces. This can result in heating of the oven exterior surfaces.

If the oven is exterior is unusually warm or hot, push the chamber gasket inward along its entire length to restore the integrity of the seal.



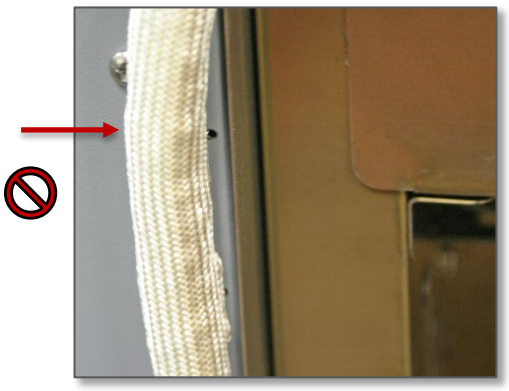


Figure 10: Chamber Gasket Misaligned

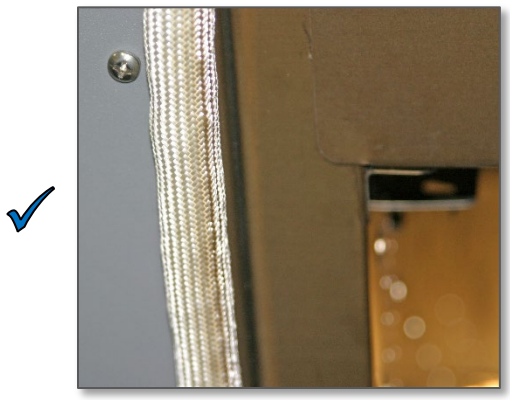


Figure 9: Chamber Gasket Aligned

Warning: Disconnect the unit from its power supply prior to performing maintenance or services.

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

CLEANING

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

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

Warning: 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 interior components such as shelving and accessories.
2. Clean the unit with a mild soap and water solution, including all corners. Do not use an abrasive cleaner that will damage metal surfaces. Do not use deionized water to rinse or clean with.
3. Rinse with distilled water and wipe dry with a soft cloth.
4. Take special care when cleaning around the temperature sensor probes in the chamber to prevent damage. Do not clean the probes.

Gaskets and Chamber Integrity

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

These ovens use snap-in fiberglass chamber gaskets. The only tool required for swapping out these gaskets is a cutting implement for tailoring the length of the new gasket. Use proper PPE for handling exposed fiberglass when making the cuts.

Electrical Components

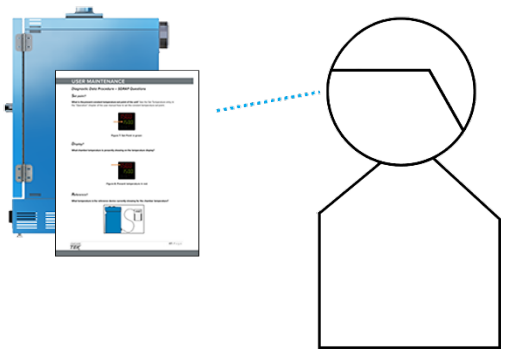
Electrical components do not require maintenance. If the oven fails to operate as specified, please contact your oven distributor or Customer Support for assistance.

Diagnostics - Heating Issues

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

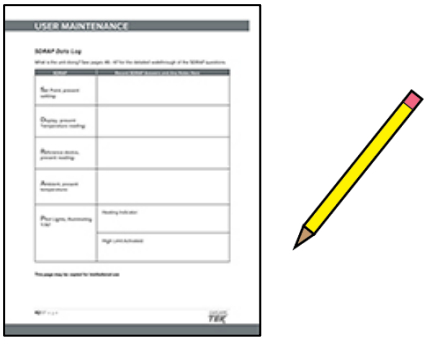
Steps

1



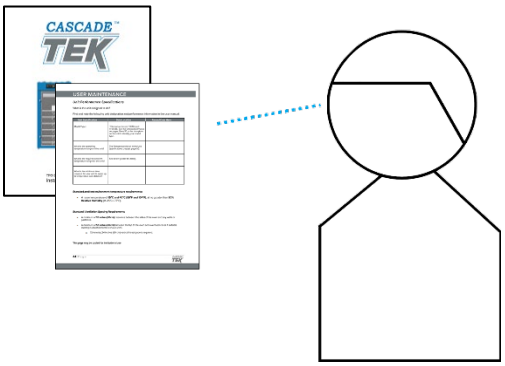
Read the SDRAP diagnostic questions on pages 40 and 41 and observe the unit in operation.

2



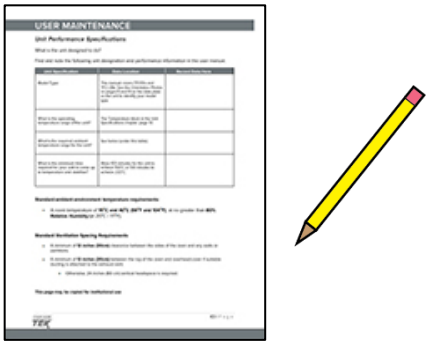
Record the observations in the SDRAP Data Log on page 36.

3



Read the Unit Performance Specification questions on page 37 and consult the user manual for answers.

4



Record the answers in the Unit Specifications Log on page 37.

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

SDRAP Data Log

What is the unit doing? See pages 40 – 41 for the detailed walkthrough of the SDRAP questions.

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

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Unit Performance Specifications

What is the unit designed to do?

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

Unit Specification	Data Location	Record Data Here
Model Type:	This manual covers TFO-1-2, TFO-3-2, and TFO-5-2. See the Orientation Photos on pages 8 through 10 or the data plate on the unit to identify your model type.	
What is the operating temperature range of the unit?	The Temperature block in the Unit Specifications chapter, page 44.	
What is the required ambient temperature range for the unit?	See below (under this table).	
What is the minimum time required for your unit to come up to temperature and stabilize?	Allow 15 minutes for the unit to achieve 150°C or 31 minutes to achieve 306°C.	

Standard ambient environment temperature requirements:

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

Standard Ventilation Spacing Requirements

- A minimum of **6 inches (152 mm)** clearance between the sides of the oven and any walls or partitions. **12 inches (305 mm)** between the back of the oven and any partition.
- A minimum of **12 inches (305 mm)** between the top of the oven and overhead cover if suitable ducting is attached to the exhaust vent.
    - Otherwise, **24 inches (610 mm)** vertical headspace is required.

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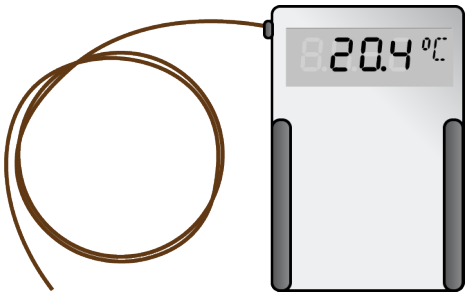
Required Items

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

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

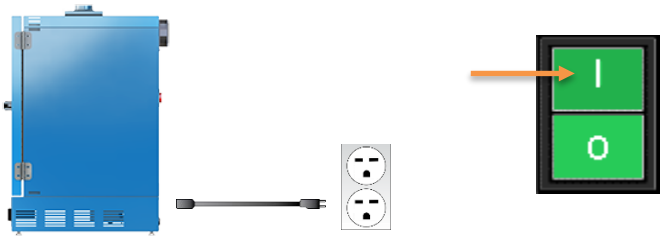


A copy of the user manual for the unit – Must be available in the same room as the unit for use.

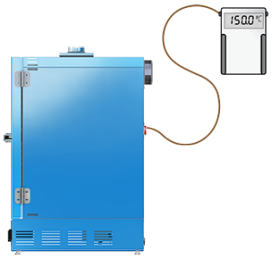
Note: Does the car actually have gas in the tank? Have you physically verified the computer is plugged in? Yes, we are going ask some very basic questions. Please bear with us. Methodical verifications and the elimination of assumptions are often the quickest means of getting a unit back into operation.

Before Starting

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



2. At least one reference temperature device sensor probe must be placed in the chamber.
    - Place the probe as close to the geometric center of the chamber as possible.



3. The oven chamber door must be closed and latched. The exhaust vent must be closed.

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

- Please see the Time to Temperature specification block on page 44 for the time required for the oven to reach your set point temperature.
- Start the “Diagnostic Data Procedure” when the allotted time has passed **even if the unit fails to achieve the set point temperature**.

Diagnostic Data Procedure – SDRAP Questions

Set point?

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

Figure 11: Set Point in green

Display?

What chamber temperature is presently showing on the temperature display?

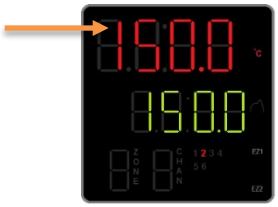
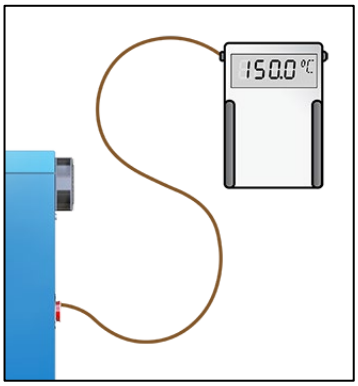


Figure 12: Present temperature in red

Reference?

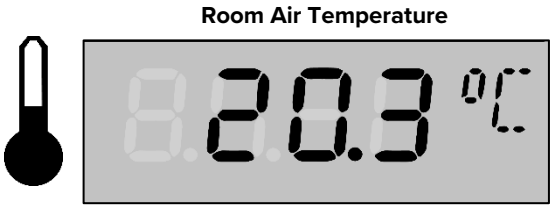
What temperature is the reference device currently showing for the chamber temperature?



Ambient?

What is the room temperature?

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



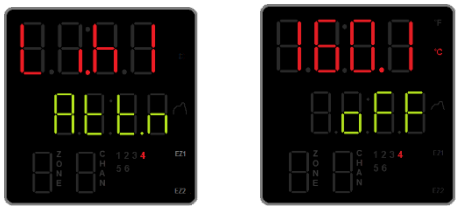
Pilot Lights?

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

Figure 13: Heating Indicator

"2" indicates the controller is calling for power to the element

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



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

Share!

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

Facilities Technicians

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

End diagnostic data procedure

UNIT SPECIFICATIONS

These ovens are 220 – 240 volt units. Please refer to the oven data plate for individual electrical specifications.

Technical data specified applies to units with standard equipment at an ambient temperature of 25°C and 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.

WEIGHT

Model	Shipping Weight	Unit Weight
TFO-1-2	167 lb / 77 kg	126.5 lb / 57.4 kg
TFO-3-2	216 lb / 98 kg	170.5 lb / 77.3 kg
TFO-5-2	258 lb / 117 kg	208.0 lb / 94.3 kg

DIMENSIONS

By Inches

Model	Exterior W × D × H	Interior W × D × H
TFO-1-2	22.7 x 23.5 x 31.5	12.1 x 13.7 x 14.5
TFO-3-2	26.9 x 28.6 x 34.0	16.5 x 19.5 x 16.2
TFO-5-2	31.4 x 28.1 x 38.8	21.0 x 19.4 x 20.7

By Millimeters

Model	Exterior W × D × H	Interior W × D × H
TFO-1-2	577 x 596 x 800	307 x 349 x 368
TFO-3-2	684 x 727 x 840	419 x 495 x 412
TFO-5-2	798 x 714 x 986	533 x 494 x 527

CAPACITY

Model	Cubic Feet	Liters
TFO-1-2	1.4	39.4
TFO-3-2	3.0	85.0
TFO-5-2	4.9	138.0

SHELF CAPACITY BY WEIGHT

Model	Per Shelf	Max Total Load	Max No. Shelves
TFO-1-2	50.0 lb / 22.6 kg*	100.0 lb / 45.3 kg**	6 Shelves
TFO-3-2	50.0 lb / 22.6 kg*	200.0 lb / 91.3 kg***	7 Shelves
TFO-5-2	50.0 lb / 22.6 kg*	200.0 lb / 91.0 kg***	9 Shelves

*50 lb / 22.7 kg with weight evenly distributed across the shelf.

**100 lb / 45.0 kg total load for the TFO-1-2 shelves. Exceeding this limit risks damaging the chamber liner.

***200 lb / 91.0 kg total load for the TFO-3-2 and TFO-5-2 shelves. Exceeding this limit risks damaging the chamber liner.

TEMPERATURE

Range and Stability

Model	Operating Range	Stability
TFO-1-2	Ambient +20 to 306°C	± 0.2°C @150°C
TFO-3-2	Ambient +20 to 306°C	± 0.3°C @150°C
TFO-5-2	Ambient +20 to 306°C	± 0.3°C @150°C

Uniformity

Model	Uniformity @80°C	Uniformity @150°C	Uniformity @306°C
TFO-1-2	± 0.75°C	± 1.8°C	± 4.0°C
TFO-3-2	± 0.75°C	±2.5°C	± 5.0°C
TFO-5-2	± 0.75°C	±1.5°C	± 3.5°C

Time to Temperature: From an ambient temperature of 20°C.

Model	Heat Up to 80°C	Heat Up to 150°C	Heat Up to 306°C
TFO-1-2	8 Minutes	20 Minutes	52 Minutes
TFO-3-2	6 Minutes	15 Minutes	57 Minutes
TFO-5-2	6 Minutes	28 Minutes	80 Minutes

Temperature continued on next page

UNIT SPECIFICATIONS

Recovery Time: From a 30-second door opening.

Model	Recovery to 80°C	Recovery to 150°	Recovery to 306°C
TFO-1-2	2.5 Minutes	3.5 Minutes	7.0 Minutes
TFO-3-2	1.0 Minutes	1.5 Minutes	5.5 Minutes
TFO-5-2	2.0 Minutes	3.0 Minutes	20.0 Minutes

Recovery Time: From a 60-second door opening.

Model	Recovery to 80°C	Recovery to 150°	Recovery to 306°C
TFO-1-2	3.0 Minutes	4.5 Minutes	9.0 Minutes
TFO-3-2	2.0 Minutes	3.5 Minutes	11.0 Minutes
TFO-5-2	3.0 Minutes	5.5 Minutes	26.0 Minutes

AIR FLOW PERFORMANCE

Ventilation Rates

Model	Cubic Feet per Minute @80°C	Liters per Minute @80°C
TFO-1-2	5.6	158.6
TFO-3-2	11.3	320.0
TFO-5-2	15.2	430.4

Air Changes per Hour

Model	@80°C
TFO-1-2	330
TFO-3-2	225
TFO-5-2	180

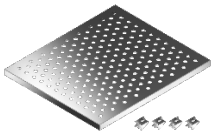
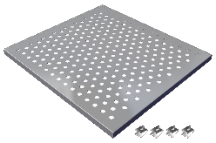
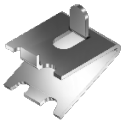
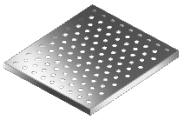
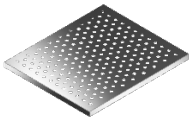
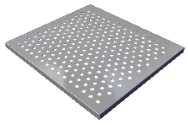
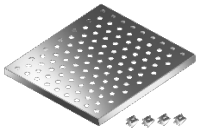
Air Velocity Across Shelf Rates

Model	Linear Feet per Minute	Meters per Minute
TFO-1-2	125	38.1
TFO-3-2	140	42.7
TFO-5-2	145	44.2

POWER

Model	AC Voltage	Amperage	Frequency
TFO-1-2	220 – 240	8.0	50/60 Hz
TFO-3-2	220 – 240	10.0	50/60 Hz
TFO-5-2	220 – 240	10.0	50/60 Hz

REPLACEMENT PART LIST

Description	Parts Number	Description	Parts Number
Adjustable Leveling Feet, TFO-1-2	 **2700512**	Shelf and 4 Shelf Clips, **TFO-3-2**	 **9751228**
Door Gasket, sold in 1 feet lengths TFO-1-2 – 5.4ft (1.65 meters) TFO-3-2 – 7.5ft (2.3 meters) TFO-5-2 – 8.1ft (2.5) meters	 **3450767 (1.5ft)**	Shelf and 4 Shelf Clips**, TFO-5-2**	 **9751229**
Fuse, T10A 250V 5x20mm (Requires 2 fuses)	 **300516**	Shelf Clip, Individual (1)	 **1250512**
Power Cord 250 Volt, 13Amp, 8.2 feet (2.5m), NEMA 6-15P	 **1800539**	Shelf (no Clips), **TFO-1-2**	 **5130887**
Power Cord 250 volt, 10 Amp, 2.5m (8ft), EU1-16P, CEE7/7	 **1800500**	Shelf (no Clips), **TFO-3-2**	 **5130888**
Port Stopper, High Temperature	 **7750572**	Shelf (no Clips), **TFO-5-2**	 **5130890**
Shelf Assembly, 12 x 13”, with 4 mounting clips, **TFO-1-2**	 **9751227**		

Parts may be ordered from Cascade TEK by calling 1-888-835-9250. Please have the **model number** and **serial number** of the unit ready, as Customer Support will need this information to match your oven with its correct part.

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