ACROSS INTERNATIONAL
AT SERIES VACUUM DRYING OVENS
USER'S MANUAL






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1. SAFETY NOTES / ILLUSTRATED SYMBOLS

Thank you for choosing our AT Series. Please read this manual carefully before operating the unit. Keep this manual on-hand so it can be used by all operators of the unit. Across International is not responsible for any injury or damage caused by misuse.

Symbol	Explanation of Symbols / Explication des Symboles
	Watch out Important note *Attention Remarque Importante*
	Protective earth connection *Connexion de terre de protection*
	Caution Hot Surface *Attention Surface Chaude*
	Caution High Voltage *Attention Haute tension*
	Danger: Situation is dangerous and may result in death or serious injury *Danger: La situation est dangereuse et peut entraîner la mort ou des blessures graves*
	Attention: Beware of rotating objects *Attention: Attention aux objets en rotation*
	Attention: Wear protective gloves and goggles to prevent personal injury *Attention: Porter des gants et des lunettes de protection pour éviter les blessures*

2. PRECAUTIONS

English

- THIS IS NOT AN EXPLOSION PROOF OVEN. THIS OVEN IS NOT SUITABLE FOR USE IN CLASS I, II, OR III LOCATIONS, AS DEFINED BY THE NATIONAL ELECTRICAL CODE NFPA 70.
- NEVER LEAVE YOUR OVEN UNATTENDED WHILE OPERATING.
- Across International is not responsible for any loss of material inside the unit.
- DO NOT try to heat combustible or explosive materials, or materials that may release corrosive/erosive gases.
- Never clean the unit with flammable cleaners. Assure that all cleaning agents are completely evaporated and dried before reconnecting the unit to the power supply.
- Keep the unit away from any electromagnetic interferences, vibrations, flammable materials, fire, or corrosive/erosive gases.
- In the event of spelled of hazardous material in the oven chamber, please decontaminate the chamber properly before using the oven. Consult the MSDS of the material used for cleaning process or call Across International.
- Avoid vibration or any corrosive/erosive gases around the oven.
- Always wear thermal gloves and protective goggles during operation.
- Always make sure your unit is on the correct power source (110V or 220V) and grounded properly. Always use the power cord that comes with the unit. Never modify the cable or power plug.

- The unit chamber should be cleaned and disinfected prior to use. There are many commercially available disinfectants available that are non-corrosive and non-abrasive and suitable for use on stainless steel surfaces.
- Do not use the unit as a positive pressure chamber.
- Do not position the equipment so that it is difficult to operate the disconnecting device.
- Consider conditions that may affect your oven's ability to accurately control its temperatures. Such as extreme heat from radiators, stoves, other ovens, autoclaves, etc. Avoid direct sun, fast-moving air currents, heating/cooling ducts, and high traffic areas.
- To ensure proper air circulation around the oven, allow a minimum of 12 inches between the oven and any walls or partitions.
- A separate circuit for the oven is strongly recommended to prevent possible loss of product due to overloading or failure of other equipment on a shared circuit.
- If the equipment is not used in a manner specified in this manual, the protection provided by the equipment may be impaired
- Returning shipment: Save the shipping crate until you are sure your unit is consistently working properly. If for any reason you must return the unit, first contact AI for a return material authorization (RMA) number.

3. INTRODUCTION

The AT DESKTOP series (0.9 and 1.9 cu ft) digital vacuum ovens feature an easy-to-clean stainless-steel chamber with a large tempered glass safety window and small footprints. Come standard with aluminum shelves which provides excellent temperature uniformity inside the chamber. Also come standard is the adjustable gas back fill capability with needle valve and vent port.

The AT SHELF-HEAT series (3.2, 7.5 and 16 cu ft) digital vacuum ovens feature production scale chamber built with easy-to-clean stainless steel, and large observation window with heavy duty 3/4" tempered safety glass. With our unique SHELF-HEAT technology, each shelf in these ovens comes with its own heater, in-shelf temperature sensor and temperature controller, together with great thermal-conducted aluminum, the result is perfect uniformity, accurate temperature, super-fast heating rates, minimum heat loss and very low power consumption.

Features

- Dual layer observation window with tempered safety glass. Radiant wall heating (0.9 and 1.9 cu ft models) provides optimal uniformity and conserves chamber space.
- New SHELF-HEAT technology with in-shelf temperature sensors give you perfect uniformity, super-fast heating rates and very low power consumption (3.2, 7.5 & 16 cu ft models).
- Easy-to-clean, heavy duty stainless steel interior for exceptional durability and ease of maintenance.
- Force-adjustable latch and one-piece door sealing gasket maintain consistent vacuum levels.
- This product is intended for indoor use only
- Built-in alarm alerts you when oven has been shut down by safety circuitry due to out of range temperature.
- Optional sliding and stackable shelves in different materials maximize your production scale.

⚠ Every one of our vacuum ovens goes through a 2-time 24-hour vacuum leak test, and is quality controlled in New Jersey or Nevada before leaving our warehouses.

⚠ The oven interior was cleaned at the factory, but not sterilized. Clean with a disinfectant that is appropriate for your application. Before initial use, run oven at 400°F without vacuum for 15 minutes to burn off any residue that may have been introduced during the manufacturing process.

4. SPECIFICATIONS

Model		AT09	AT19	AT32	AT75a	AT160
Electrical requirements		110V, 50/60Hz 1-PH/ 220V, 50/60Hz 1-PH				
Output Power		1500 W / 1200W	1500 W	1500 W	1500 W	1500 W
Environmental Operation Conditions		• Indoor use and altitude up to 2000m • Temperature 5-40°C • Max. relative humidity 80% for temperatures up to 30°C decreasing linearly to 50 % relative humidity at 40°C • Mains supply volt fluctuations up to ±10 % of the nominal voltage • Transient overvoltage up to the levels of overvoltage category II (See Note 1). • Temporary overvoltage occurring on the mains supply. • Applicable pollution degree of the intended environment (pollution degree 2 in most cases (See Note 2). Note 1: These levels of transient overvoltage are typical for equipment supplied from the building wiring. Note 2: Manufacturers may specify more restricted environmental conditions for operation, nevertheless the equipment must be safe within these normal environmental conditions.				
Chamber	Size (WxDxH)	12 x 12 x 11"	16.5 x 14.5 x 14"	18 x 18 x 18"	22 x 23.5 x 25"	25.6 x 30 x 35.5"
	Material	Stainless steel				
	Capacity	0.9 cubic foot	1.9 cubic foot	3.2 cubic feet	7.5 cubic feet	16 cubic feet
Temperature Controller	Controller	3rd gen low proportional gain, microcomputer PID controlled with LCD display				
	Range	Ambient to 480°F (248°C)				Ambient to 200°F (100°C)
	Display units	Fahrenheit or Celsius				
	Accuracy	± 1				
	Uniformity	±5% of setpoint				
	Dwelling Time	1 to 9999 minutes				
	Warm up time to 100°F	40 minutes	45 minutes	35 minutes	45 minutes	55 minutes
Vacuum		Ultimate vacuum level: better than 500 microns/millitorrs (may vary based on your altitude) Mechanical vacuum gauge range: 0 to 30" mercury Mechanical vacuum gauge type: oil-filled Vacuum port: KF25 flange x 1 Vent port: KF25 flange x 1				
Door gasket material		Silicone or Viton (Optional)				
Observation window		1/2" tempered safety glass		3/4" tempered safety glass		
Shelves	Included with oven purchase	4 aluminum slide-in shelves	5 aluminum slide-in shelves	3 non-removable aluminum shelves	5 non-removable aluminum shelves	6 non-removable aluminum shelves
	Size (W x D)	11.5 x 11.25"	16 x 14.25"	17.5 x 17.25"	22 x 23.25"	25 x 29.25"
	Maximum area	129.4 x 8 = 7 ft^2	228 x 10 = 16 ft^2	302 x 3 = 6 ft^2	512 x 10 = 36 ft^2	731 x 12 = 60 ft^2
	Capacity	25 lbs. each	30 lbs. each	20 lbs. each	20 lbs. each	
	Distance between shelves	1.0 "	1.0 "	4.0 "	4.0 "	5.0 "
Unit Weight		90 lbs.	140 lbs.	260 lbs.	410 lbs.	710 lbs.
Shipping Weight		165 lbs.	240 lbs.	405 lbs.	640 lbs.	1118 lbs.
Unit Dimensions (WxDxH)		23.4 x 20 x 19"	28 x 23 x 21.75"	30.5 x 24 x 29"	35 x 31 x 38"	33 x 37 x 52"
Shipping Dimensions (WxDxH)		28 x 24 x 26"	32 x 27 x 29"	36 x 34 x 36"	40 x 39 x 43"	42 x 45 x 61"
Safety		Built-in circuit breaker, controller overheat protection, secondary over-temp protection dial				
In-door lights		White LED (pre-installed)				
Compliance		UL (E482564), CSA, CE				

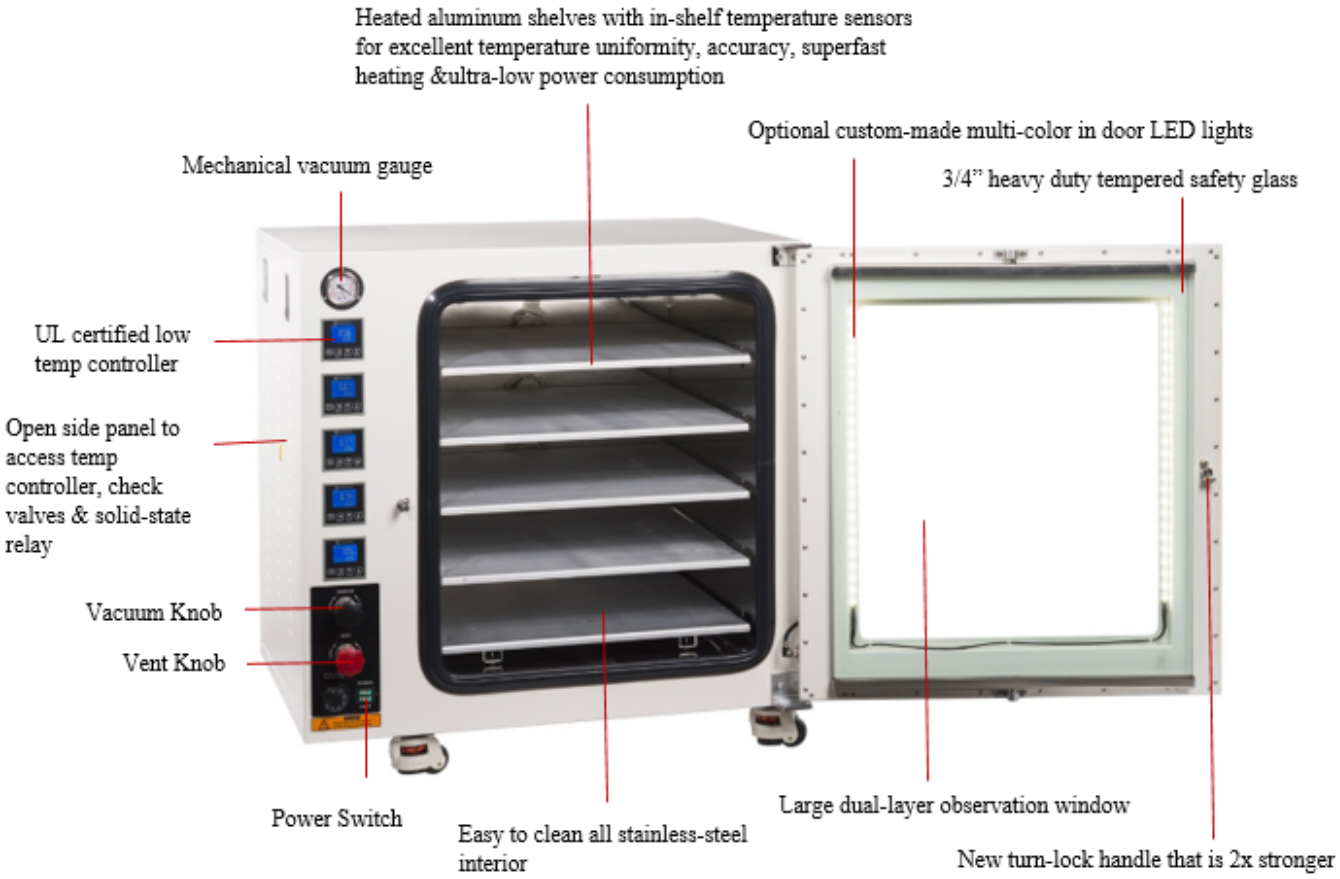
Model		AT50x	AT75X
Electrical Requirement		110/220VAC, 50/60Hz, 1-PH	220VAC, 50/60Hz, 1-PH
Output Power		3000 W	4600 W
Environmental Operation Conditions		• Indoor use and altitude up to 2000m • Temperature 5-40°C • Max. relative humidity 80% for temperatures up to 30°C decreasing linearly to 50 % relative humidity at 40°C • Mains supply volt fluctuations up to ±10 % of the nominal voltage • Transient overvoltage up to the levels of overvoltage category II (See Note 1). • Temporary overvoltage occurring on the mains supply. • Applicable pollution degree of the intended environment (pollution degree 2 in most cases (See Note 2). Note 1: These levels of transient overvoltage are typical for equipment supplied from the building wiring. Note 2: Manufacturers may specify more restricted environmental conditions for operation, nevertheless the equipment must be safe within these normal environmental conditions.	
Chamber	Size (WXDXH)	19.75 x 21.5 x19.75"	22 x 23.5 x 25 "
	Material	Stainless Steel	
	Capacity	5 Cu Ft	7.5 Cu Ft
Temperature Controller	Controller	3rd gen low proportional gain, microcomputer PID controlled with LCD	
	Range	Ambient to 480°F (248°C)	
	Display Units	F or C	
	Accuracy	± 1	
	Uniformity	±7 % of set point	
	Dwelling Time	1 to 9999 minutes	
	Warm up to 100F	45 minutes	
Vacuum		Ultimate vacuum level: better than 500 microns/millitorrs (may vary based on your altitude) Mechanical vacuum gauge range: 0 to 30" mercury Mechanical vacuum gauge type: oil-filled Vacuum port: KF25 flange x 1 Vent port: KF25 flange x 1	
Door gasket material		Silicone or Viton (Optional)	
Observation Window		½" tempered safety glass	
Shelves	Included with oven purchase	7 aluminum pan-shaped shelves	9 aluminum pan-shaped shelves
	Size (WXDXH)	19.25 X 21 X 0.5"	21. 75 X 23 X 0.5"
	Distance between shelves	1.25"	
In door light		White LED (pre-installed)	
Unit Weight		390 lbs	450
Shipping Weight		640 lbs	765
Unit Dimensions		32.25 x 28 x 30	37 x 33.5 x 38
Shipping Dimensions		40 x 39 x 43	43 x 40 x 46
Safety		Built-in circuit breaker, controller overheat protection, secondary over-temp protection dial	
Warranty		2 Years	

Model	AT160x-UL
Electrical Requirements	220V +/-10% 50/60Hz 1-PH 27A, 6,000 watts
Chamber	Size: 25.6 x 30 x 35.5" Material: Stainless steel Capacity: 16 cubic feet
Heater	5-sided heating (left 900W, right 900W, top 900W, bottom 900W, back 250W x 4)
Temperature Control	Controller: low proportional gain, microcomputer PID controlled with LCD display Range: ambient to 250°C (480°F) Display units: Fahrenheit or Celsius Uniformity: ± 7% of setpoint Dwelling timer range: 1 to 9999 minutes Heating speed • Ambient to 100°C: 40 mins • Ambient to 150°C: 1 hour • Ambient to 200°C: 2 hours • Ambient to 250°C: 2.5 hours
Vacuum	Ultimate vacuum level: better than 500 microns/millitorrs (may vary based on your altitude) Mechanical gauge range: 0 to 30 inch mercury Vacuum port: KF25 flange Vent port: KF25 flange Vacuum pump: Sold separately
Weight	Unit: 800 Lbs, shipping: 1320 Lbs
Dimensions	Unit: 44 x 38 x 51.5" Shipping: 50 x 47 x 59"
Shelves	Shelf size: 25 x 30" (WxDxH) Material: aluminum Style: pan-shape Capacity: 26 shelves max. Comes standard with oven purchase: 13 shelves Total area with 26 shelves: 89 sq ft or 12,857 sq inch Distance between the most adjacent shelves: 1.25 inches
Door Gasket Material	Silicone or Viton
Observation window	1/2" tempered safety glass
Safety	Built-in circuit breaker Overheat shutoff protection Secondary over-temp protection dial
In-Door Lights	White LED (pre-installed)
Compliance	ETL certified to UL and CSA standards
Warranty	2 years

Model	AT19-500C
Electrical Requirements	220V +/-10% 50/60Hz 1-PH, 3,000 watts
Chamber	Size: 16.5 x 14.5 x 14" Material: Stainless steel Capacity: 1.9 cubic foot
Heater	4-sided heating (left 750W, right 750W, top 750W, bottom 750W)
Temperature Control	Controller: low proportional gain, microcomputer PID controlled with LCD display Range: ambient to 500°C Display units: Fahrenheit or Celsius • Dwelling timer range: 1 to 9999 minutes
Vacuum	Ultimate vacuum level: better than 500 microns/millitorrs (may vary based on your altitude) Mechanical gauge range: 0 to 30 inch mercury Vacuum port: KF25 flange Vent port: KF25 flange Vacuum pump: Sold separately
Weight	Unit: 190 Lbs, shipping: 270 Lbs
Dimensions	Unit: 28 x 20 x 21.75" With handle and vacuum port: 28 x 23 x 21.75" Shipping: 32 x 28 x 29"
Shelves	Included with oven purchase: 5 stainless steel slide-in shelves Capacity: 10 shelves max. Style: pan-shape Size: 16 x 14.25 inches Total area: 228 x 10 = 16 sq ft or 2,280 inch2 Distance between shelves: one inch
Door Gasket Material	Silicone or Viton
Observation window	1/2" tempered safety glass
Safety	Built-in circuit breaker Overheat shutoff protection
Warranty	2 years

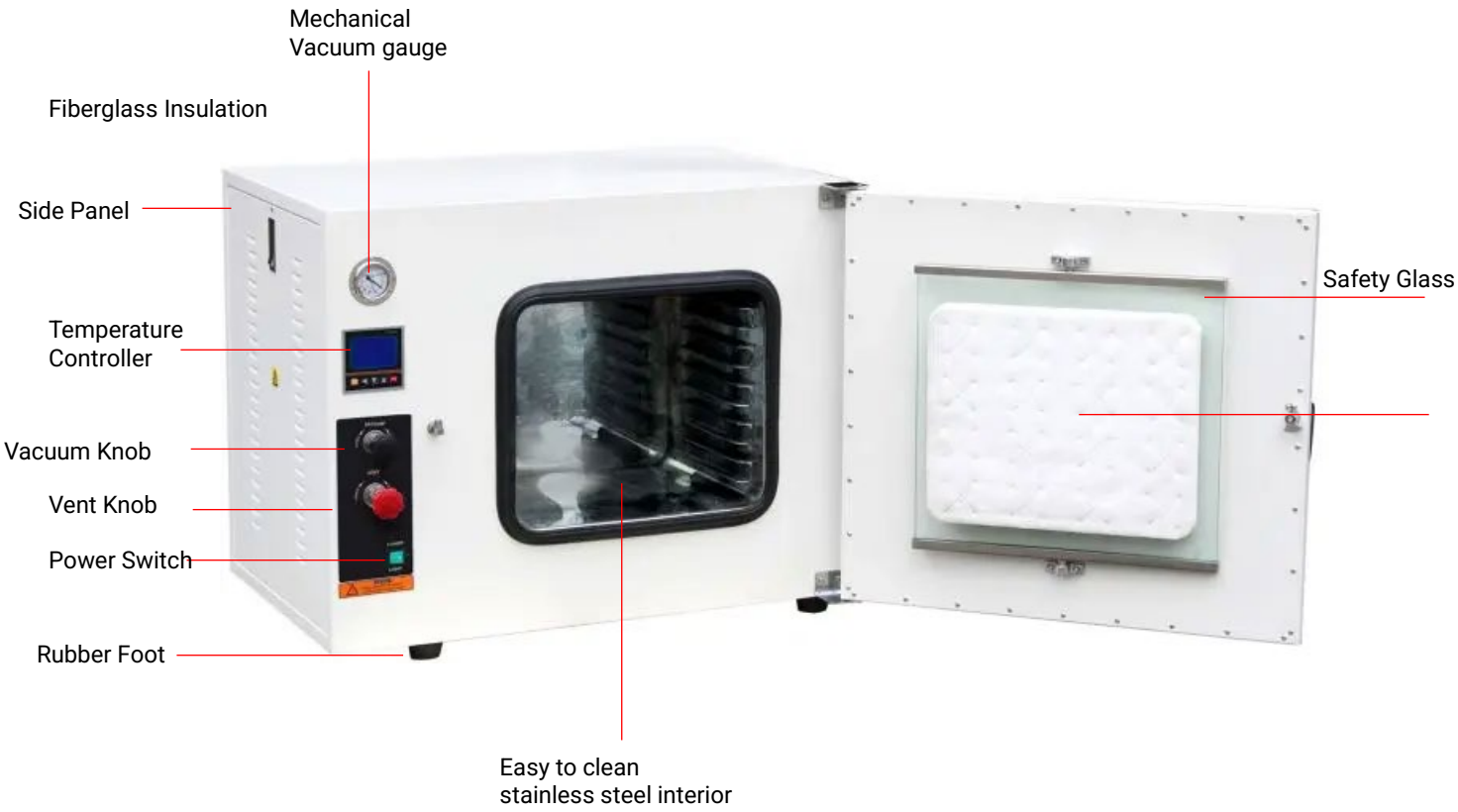
5. COMPONENTS

AT09 and AT19 Models



AT32, AT75 and AT160 Models

AT50x, AT75x and AT160x Models



AT19-500C Model

6. INSTALLATION

Depending on what unit you bought, it is necessary for 2-3 people to assist in uncrating this unit. Crated unit can weigh between 150-940 Lbs. and can be a little heavy for one person. Remember your safety is our concern, so please use all the safety equipment to move the crate such as a pallet jack and good gloves. When uncrating the unit, remove the bottom screws of crate and pull the crate up, remembering that 2-3 people will need to help. Next remove all foam and any plastic bags that come with unit.

Unit must be installed 2 feet away from the wall for easy access of main power switch.

6.1 Guidelines using the vacuum oven

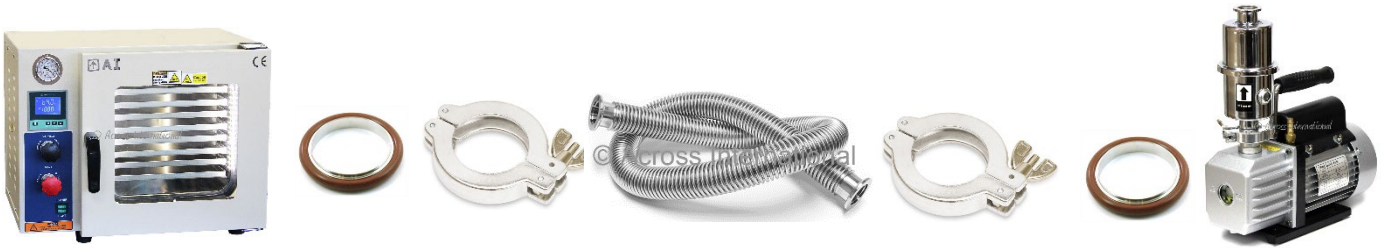
1. Remove the protective film from all the shelves
2. Place all the shelves with your samples inside the oven and close the door (DO NOT PLUG THE POWER CORD IN YET)
3. Make sure the vent and vacuum knobs are closed
4. Connect the vacuum pump to the oven (refer to section 6.2 Vacuum Pump Set Up)
5. Turn the pump on and after 30 seconds, open the vacuum port on the oven and watch the vacuum level on the vacuum gauge.
6. When desired vacuum level is reached, close the vacuum port FIRST, then turn the vacuum pump off (Based on your process, you may need to keep the pump on the whole time).
7. Turn the oven on and set your target temperature (refer to section 7. Operation). The oven's temperature will start rising, and the heating indictor will start blinking.
8. Length of drying time should be selected based on humidity level of your sample. In case drying time is long and vacuum level reduces, it is necessary to purge the oven again to restore desired vacuum level (make sure your vacuum pump can work at your target temperature).
9. After drying process is done, turn the oven off, open the vacuum port before opening the door. It is possible that the sealing gasket on the door may stuck on the door glass and the door cannot open easily. Wait until the gasket restores itself before trying to open the door gasket.

6.2 Vacuum Pump Set Up:

6.2.1 Barbed pump

1. Place the centering ring onto the oven's vacuum port
2. Place KF-25 to 3/8" hose barb adapter over the centering ring
3. Use the quick clamp to seal the oven's vacuum port and the adapter together
4. Connect one side of the silicone tubing to the hose bard adapter
5. Connect the other side of the silicone tubing to the pump's barb fitting

6.2.2 Flanged pump



1. Place the centering ring onto the oven's vacuum port
2. Place one end of the stainless-steel bellow over the centering ring
3. Use the quick clamp to seal the oven's vacuum port and the bellow together
4. Place another centering ring onto the vacuum pump's inlet
5. Place the other end of the stainless-steel bellow over the pump's inlet
6. Use another quick clamp to seal the pump's inlet and the bellow together

⚠ We recommend using our T series cold trap in between your oven and vacuum pump, to protect your pump from damage caused by solvent or other gases

7. OPERATION

Version 1 (Please refer to Omega temperature controller manual) Version 2

[MAIN] mode: After the oven is first turned on, controller enters [MAIN] (running) mode.
[SET] mode: Hold and press "SET" button for 3 seconds in [MAIN] mode to enter the [SET] (setting) mode.
[AT] indicator: Light blinks when auto-tune is in progress. Blinking indicator stops when auto-tune is done.
[ALM] indictor: Light turns solid if over-temperature alarm is triggered. Flashes if under-temperature alarm sounds. Turns off when oven is under normal operation.
[HEAT] indicator: Turns on when oven is being heated.
[RUN/STOP] indicators: Turns off when dwelling time is completed.

7.1. Basic Settings: Target temperature and dwelling time

1. Plug the power cable in, switch the circuit breaker on in the back, set the over temperature knob to a temperature higher than your target temperature, and turn the switch on.
2. Press the "SET" button once. The controller will display "SP". Now use "Shift", "Decrease" or "Increase" button to set your target temperature.

3. Press "SET" again to confirm the temperature. The controller will display "ST". Use "Shift", "Decrease" or "Increase" button to set the dwelling time in minutes. You can set it to display in hours with the "Hn" setting. (The timer will start as soon as the actual temperature reaches target temperature.) If "ST" is set to zero, the oven will continue to run at the target temperature until it is turned off manually.

4. Press "SET" again to confirm all settings.
5. When the dwelling time is complete, the controller will display "End" and buzz for 60 (or value in EST) seconds. It can be muted by pressing any button.

6. Press and hold the "Dec/Rst" button for 3 seconds to restart oven operation.
7. During heating, if the alarm is set and the actual temperature is over that limit, a buzzer will sound continuously and the "ALM" light will come on. Press any key to mute it.

Prompt	Name	Description	Range (factory value)
SP	Target temperature	Set target temperature in °F or °C. use code "FC" to set temperature unit.	SPL to SPH (see parameter table #2)
ST	Dwelling time	0 = continuous heating. Use code "Hn" to set timing unit	0-9999 (0) minutes or hours

7.2. Switching the temperature display between Fahrenheit (°F) and Celsius (°C)

Under [MAIN] mode, press and hold the "SET" button for 3 seconds. The controller will display "Lc", shown below. Enter 27 and press "SET" to access the "FC" (temperature display) setting screen, also shown below.

Set "FC" to 0 to display the temperature in Celsius, or 1 for Fahrenheit. When done, press and hold "SET" for 3 seconds to save and exit to [MAIN] mode.

(0001 = Fahrenheit °F)

⚠ For optimal uniformity, allow 60 to 90 minutes for oven temperature to stabilize after target temperature Is reached.

8. AUTO-TUNE (AT) CALIBRATION

8.1. What is Auto Tune (AT)?

Auto tune is a process of optimizing your oven's performance. It helps increase heating rates, minimize temperature differences, and prevents overshooting. A set of optimal PID values will be saved automatically after AT is done.

8.2. When should you perform an AT?

1. If your target temperature is above 200 °F or higher, the first time you are using your oven. (If less than 200 ºF, you can skip this process.)
2. If you've recently changed or replaced any parts inside your oven.
3. If you see a big temperature difference between controller display and actual oven temperature.

8.3. Calibration by Auto-Tune (AT)

Follow the steps below to perform a standard Auto Tune:

1. Under [MAIN] mode, press and hold the "Shift/AT" button for six seconds, until you see the screen below

2. Press the "Inc/BL" button and set AT to "on", then press "SET" to confirm. The controller will display a flashing [AT] light, indicating that auto-tune is in progress. After a few cycles of fluctuation, auto-tune will complete and the [AT] light will turn off. This could take a few hours. The "SET" button is disabled during this period.
3. If necessary, press and hold the "Shift/AT" button for six seconds during the auto-turn process to abort. The [AT] light will turn off.
4. A new set of optimized PID values will be automatically saved for future use.
5. Now set the target temperature. You are ready to use the oven.

8.4. Calibration by formula

Offset the temperature difference between temperature controller and your reference value manually.

1. First, calculate the offset value using the formula on the next page (in blue). Press and hold "SET" button for 3 seconds; controller will display "Lc" as below.

2. Enter 3 and press "SET". Continue to press "SET" until you see "PL", as shown below.

3. Use the formula below to calculate the offset value, then set PL to your calculated offset value.

   Offset value = (temperature measured by exterior thermocouple(s) – temperature displayed by controller [PV]) x 1000 / temperature displayed by controller [PV]

4. Press and hold "SET" for 3 seconds to confirm and return to [MAIN] mode.

8.5. Calibration by adjusting PID manually (requires experience and practice)

After an auto-tune, if you still feel that temperature is unstable, you can manually adjust the PID values. PID adjustment is very useful for you to control the oven temperature in an acceptable range but requires some practice and patience.

1. "P" represents proportion adjustment. Increasing "P" reduces temperature overshooting, while decreasing "P" allows for a faster heating rate. (You may need to try this step a few times before you get the best result).
2. "I" represents integral time. Increase "I" to lower temperature fluctuation. It can be used to eliminate the steady state error after the system enters a steady state by correctly setting "P". In other words, "I" is often used after "P". Give "I" a big value before decreasing "P" a little, in order to get to a steady state, and then decrease I to eliminate errors under the steady state. Check if the PV is in your desired range. Continue to try to change "P" and "I" to get the best result.
3. "D" represents differential time, which can overcome the unstable and oscillating state. Adjust "D" to reduce temperature overshooting. It is usually set after the "I" adjustment. Firstly, set "D" to 0, then gradually increase it to check if you have an acceptable result (In this process, "P" and "I" may also be changed). "D" is usually set anywhere between 1/5 to 1/4 of the value of "I".

⚠ Every oven has been calibrated and tested before leaving our factory. Under normal circumstances, self-calibration is not necessary. However, if the temperature requirements are very strict, or if target temperature is set around the upper or lower limits of the oven temperature range, the measured temperature might not be accurate against the actual temperature in the oven.

NOTE: If a calibration certification is required, then please contact our service department (additional fee may apply)

9. ADVANCED SETTINGS

Under [MAIN] mode, press and hold the "SET" button for 3 seconds. The controller will display "Lc" as shown on the next page. Enter 3, 9, 27 or 567 and press "SET to access the advanced setting tables on the following page Press and hold "SET" for 3 seconds to save and exit to [MAIN] mode.

Table 1

Prompt	Name	Description	Range (factory value)
	*Lc: Pass key*	*When Lc = 3, controller enters into the menu below*	*3, 9, 27, 567 (0)*
	ALH: Over-temp alarm	If SV>(SP+ALH), ALM light comes on, buzzer sounds, and oven stops heating.	0-180 (36) under °F mode 0-100 (20) under °C mode
	ALL: Under-temp alarm	If SV<(SP-ALL), ALM light will flash and buzzer will sound. Under-temp is not active if ALL is set to 0.	0-180 (0) under °F mode 0-100 (0) under °C mode
	P: Proportional	Increasing P may reduce temperature overshooting. Decrease P to allow for a faster heating rate.	1-540 (60) under °F mode 0.1-300 (60) under °C mode
	I: Integral	Increase I to lower temperature fluctuation.	1-2000 (900) seconds
	d: Differential	Adjusted to reduce temperature overshooting. Usually set to 1/5 to 1/4 of "I" value.	0-1000 (450) seconds
	T: Control cycle	Heating control cycle in seconds.	1-60 (20) seconds
	Pb: Ambient adjustment	Corrects the difference between ambient temperature and what the controller is reading. Pb = Temperature measured by the exterior thermocouple(s), vs. the temperature displayed by controller.	-90 to 90 (0) under °F mode -50 to 50 (0) under °C mode
	PL: Hot adjustment	Offset the temperature difference between the controller and actual reading inside the oven. (Use the calibration formula in section 6.4)	-999 to 999 (0)
	Addr	Communication address.	1-32 (1)
	Loc: Lock	Temperature and time setting: 0 = enabled 1 = disabled	0-1 (0)

Table 2 (Do NOT modify unless instructed by an AI technician.)

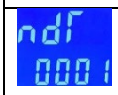
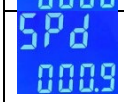
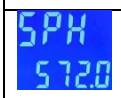
Prompt	Name	Description	Range (factory value)
	Lc: Pass key	When Lc = 9, controller enters into the menu below	3, 9, 27, 567 (0)
	ndA: Temp alarm mode	0: with over-temp alarm only 1: with over-temp alarm and under-temp alarm	0-1 (0)
	ndT: Timer mode	0: no timer function 1: with timer function, SV window will display dwelling time after oven temperature reaches target temperature. 2: with timer function, SV window will always display dwelling time.	0-2 (1)
	Hn: Timer unit	0: displays timer in minutes 1: displays timer in hours	0-1 (0)
	SPd: Constant temperature deviation	When PV > SV – SPd, oven is under constant temperature state	0.1-180 (0.9) under °F mode 0.1-100 (0.5) under °C mode
	SPT: Constant temp state buzzing time	Set buzzing time in seconds when oven enters into constant temp state. Buzzer will sound constantly if SPT is set to 9999.	0-9999 (0) seconds
	EST: Dwelling time up buzzing time	Set buzzing time in seconds when the dwelling time is up. Buzzer will sound constantly if EST is set to 9999.	0-9999 (60) seconds
	EH: Continue to heat after dwelling time ends	0: Turns off heating when dwelling time is over 1: Continues to keep the oven at constant temperature, even after dwelling time is over.	0-1 (0)
	ndo: Output mode	0: Output after dwelling time over. 1: Output after over-temp 2: Output when oven enters into constant temperature state.	0-2 (0)
	SPL: Min temperature	Set minimum temperature the controller can go to.	-58 to 122 (32) under °F mode -50 to 50 (0) under °C mode
	SPH: Max temperature	Set maximum temperature the controller can go to.	32-752 (480) under °F mode SPL to 400 (250) under °C mode

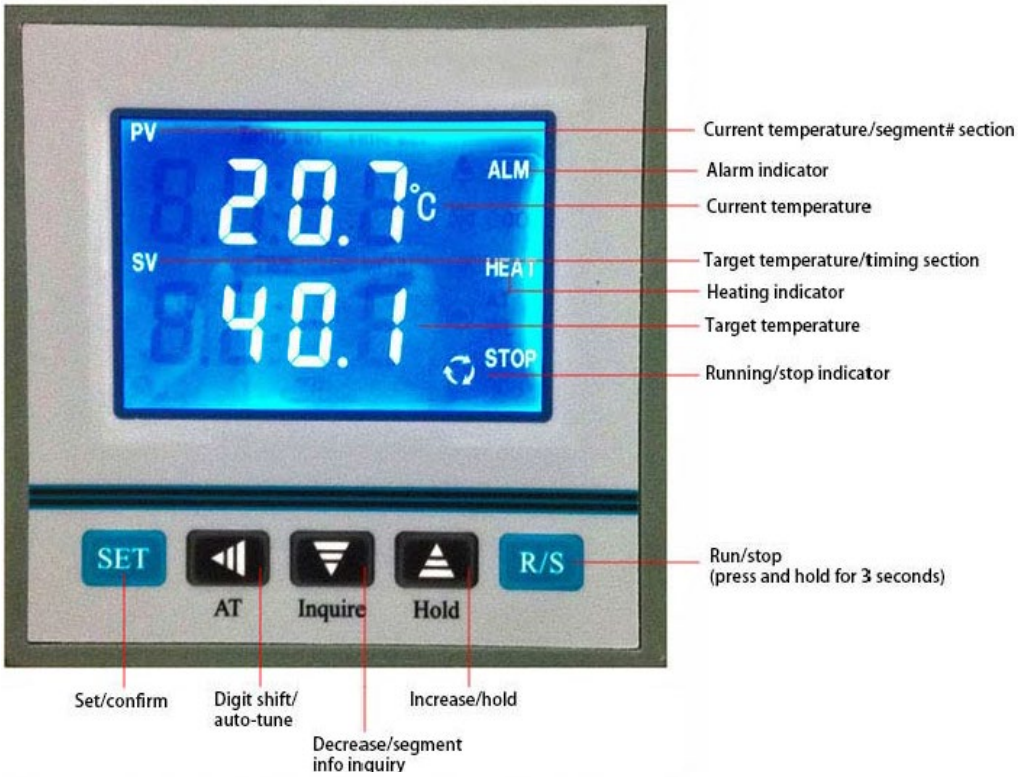
Table 3

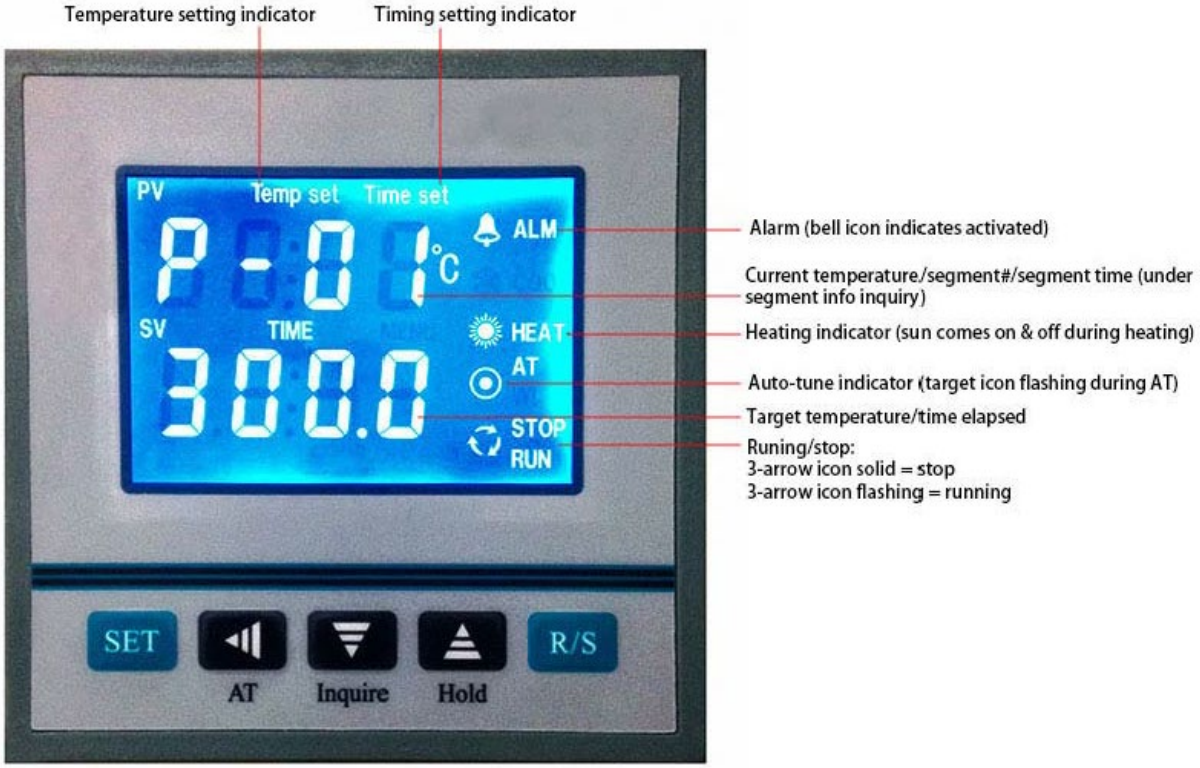
Prompt	Name	Description	Range (factory value)
	*Lc: Pass key*	*When Lc = 27, controller enters into the menu below*	*3, 9, 27, 567 (0)*
	FC: Temperature display mode	0: Celsius 1: Fahrenheit	0-1 (0)

Table 4

Prompt	Name	Description	Range (factory value)
	*Lc: Pass key*	*When Lc = 567, controller enters into the menu below*	*3, 9, 27, 567 (0)*
	rST: Factory reset	0: Do not reset to factory settings 1: Reset to factory settings	0-1 (0)

10.MULTI-SEGMENT RAMP TEMPERATURE CONTROLLER





Prompt	Name	Description	Range
SV	Target Temperature	Target temperature for each segment	0 to max temp (SPH)
PV	Current Temperature	Current temperature in the oven	
SP	Segments	SP00 displays current temperature and is not editable	SP00 to SP30
St	Time	St00: 0-9999, St01-31: -002 to 9999	St01 to St31

10.1 Operation

10.1.1 When the controller is switched on, display windows show "Pt" and the value of temperature range for 3 seconds, then it starts running.

10.1.2 "◄" button: In the setting mode, click the button to shift the digit.

10.1.3 "▼" button: In the setting mode, click the button to reduce the set value. Press and hold the button to reduce the value continuously.

10.1.4 " ▲" button: In the setting status, click the button to increase the set value. Press and hold the button to increase the value continuously. It can also turn the backlight on or off.

10.1.5 In the setting mode, if the controller is idle for more than one minute, it will automatically return to normal mode.

10.1.6 Temperature and time setting

Press the "SET" button. The controller will display: SP00; St01, SP01; St02, SP02 ... St30, SP30; St31".

- SP00 is the current measured temperature and cannot be modified.
- If "St > 0", this refers to the time the oven takes to get to target temperature of a segment.
- If "St = 0", the oven will heat to the target temperature of that segment in shortest period of time.
- If "St = -1", the oven will heat to target temperature and stay there until shut off manually.
- If "St = -2", the oven will shut off automatically when target temperature is reached.
- During the setup process, press and hold the "SET" button for 3 seconds to exit. The settings will be saved
- automatically.
- In the setup process, first press the "◄", then click the "SET" button to view on a set value.

EXAMPLE:

1. Heat oven to 80 degrees, from room temperature, in 20 minutes.
2. Remain at 80 degrees for 30 minutes.
3. Raise the heat to 120 degrees in 40 minutes.
4. Stay for 30 minutes at the 120 degrees.
5. Turn off the oven.

STEPS:

SP00 (current measured temperature, cannot be modified)
St01 = 20, SP01 = 80
St02 = 30, SP02 = 80
St03 = 40, SP03 = 120
St04 = 30, SP04 = 120
St05 = -002

10.1.7 Press and hold the "R/S" button for 2 seconds until you see "RUN" come on, then release the button to start the heating cycles. (The circular arrow icon will flash and the sun icon to the left of "HEAT" will come on and off periodically).

10.1.8 During the heating process, the PV will display the current temperature and SV will display the amount of time that has elapsed.

10.1.9 During heating process, press the "Inquire" button once. The controller will display the current segment number. Press the "Inquire" button again, and the PV will display the timed setting of the segment. The SV will display time elapsed.

10.1.10 To stop the oven manually, press and hold the "R/S" button for 2 seconds, until you see the "STOP" light come on, then release the button.

10.1.11 When the over-temperature alarm is triggered, a buzzer will beep continuously. The "ALM" light will come on. Press any button to stop the buzzer.

10.1.12 If PV displays "----", the thermocouple or temperature controller may be faulty. Please check the thermocouple and wiring or replace your temperature controller.

10.2 Multi-segment controller Auto-Tune

Use the auto-tuning function for optimal temperature control. During auto-tuning, the "AT" indicator will flash. After auto-tuning is done, the "AT" stops flashing. The parameters and values will be saved automatically.

In stop mode, press and hold the "AT" button for 5 seconds. The controller will display "AT". If "AT" = 0, the controller will quit and return to normal display. If "AT" = 1, the controller displays "AtSP". After adjusting the AtSP" value, press the "SET" button again to start auto-tuning.

During the auto-tuning process, press the hold "AT" button for 5 seconds to quit manually.

NOTE:

While the program is running, the PV will show the present value and the SV will show the set value the oven is trying to achieve. Pressing the down arrow (Inquire) will change the display to show the step the program is in. A second press of the down arrow (Inquire) will change the display to show the time of the segment on the top line and the time elapsed of the segment on the bottom line.

10.3 Advanced Settings

Table 1:

Name	Description	Range (factory value)
Lc: Pass key	*When Lc = 3, controller enters into the menu below*	*3, 9 (0)*
AL: Over-temp alarm	If SV>(SP+ALH), ALM light comes on, buzzer sounds, and oven stops heating.	0-100 (20) °C
P: Proportional	Increaing P may reduce temperature overshooting. Decrease P to allow for a faster heating rate.	0.1-300 (35) °C
I: Integral	Increase I to lower temperature fluctuation.	1-2000 (200) seconds
d: Differential	Adjusted to reduce temperature overshooting. Usually set to 1/5 to 1/4 of "I" value.	0-1000 (100) seconds
T: Control cycle	Heating control cycle in seconds.	1-60 (50) seconds
Pb: Ambient adjustment	Corrects the difference between ambient temperature and what the controller is reading. Pb = Temperature measured by the exterior thermocouple(s), vs. the temperature displayed by controller.	-12.0 to 12.0 (0) °C
PY: Hot adjustment	Offset the temperature difference between the controller and actual reading inside the oven. (Use the calibration formula in section 6.4)	-999 to 999 (0)

Table 2:

Name	Description	Range (factory value)
Lc: Pass key	When Lc = 9, controller enters into the menu below	3, 9 (0)
Pon	Not used	0 to 2 (0)
Stn	Not used	0 (0)
Odr	Not used	0 to 5 (0)
Addr	Communication address.	1-16 (1)

11. TROUBLESHOOTING

Issue	Reason	Solution
No Power	Oven is turned off	Turn on oven
	Broken power cord or Loose plug	Change or secure power cord
	Circuit breaker is off	Turn on circuit breaker
PV window displaying "-----", "LLL.L" or "HHH.H"	Faulty temperature sensor or loose connection	Check connection or change temperature sensor
	Faulty temperature controller	If the temperature sensor is OK and connection is good, replace the temperature controller.
Unit fail to heat	Dwelling time is over	Reset dwelling time and restart the oven
	Loose connection on temp controller	Check and make sure all connection is secure
	Faulty controller	Replace temperature controller
	Faulty heating element	Replace heating elements
	Parameter error	Reset all parameters to factory setting using parameter tables in section 8.
Temperature Control Fail	Loose connection on temperature sensor	Check all connections
	Faulty controller	Replace temperature controller
	Target temperature too low	Set a higher target temperature
Abnormal alarming	Faulty controller	Replace temperature controller
Large temperature difference between oven display (PV) and temperature measured by yourself	Temperature and condition of your current working environment is different than the environment your oven was initially calibrated	Perform an Auto-Turn (AT) as described in section 7.
	Oven was not turned on long enough	Perform temperature measurement 30 minutes after oven reaches its target temperature, this allows temperature inside the oven to stabilize.
	Your temperature sensors were placed incorrectly	Place temperature sensors in the middle of the oven shelves.
	Your infrared gun is not used correctly or not properly calibrated	Make sure your infrared gun is calibrated correctly. Shooting an infrared gun across the oven window glass may give you incorrect readings.
	If solutions above, do not fix the difference	Perform a "Calibration by formula" as described in section 7.5 above
	Parameter error	Reset all parameters to factory setting using parameter tables in section 8.

12. PRESSURE VS. VAPORIZATION

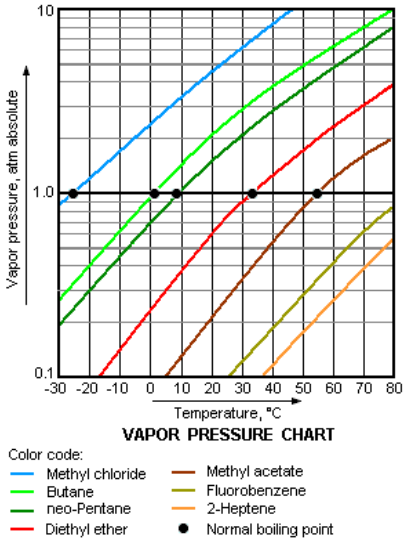
Vacuum evaporation is the process of causing the pressure in a vacuum oven to be reduced below the vapor pressure of the liquid, causing the liquid to evaporate at a lower temperature than normal.

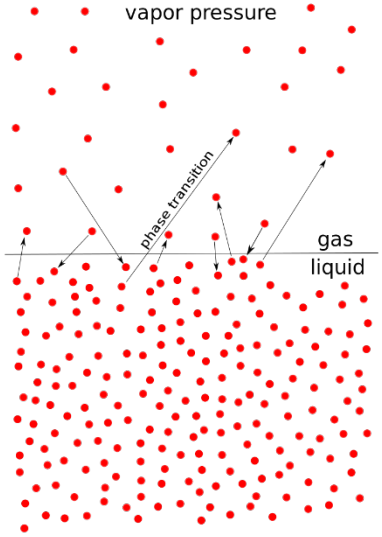
Liquids may change to a vapor at temperatures below their boiling points through the process of evaporation. Evaporation is a surface phenomenon in which molecules located near the liquid's edge, not contained by enough liquid pressure on that side, escape into the surroundings as vapor. On the other hand, boiling is a process in which molecules anywhere in the liquid escape, resulting in the formation of vapor bubbles within the liquid.

The vacuum evaporation treatment process consists of reducing the interior pressure of the vacuum oven below atmospheric pressure. This reduces the boiling point of the liquid to be evaporated, thereby reducing the heat necessary/eliminated in both the boiling and condensation processes. In addition, there are other technical advantages such as the ability to distill other liquids with high boiling points and avoiding the decomposition of substances that are sensitive to temperature, etc.

The boiling point of a substance is the temperature at which the vapor pressure of the liquid equals the pressure surrounding the liquid and the liquid changes into a vapor. The boiling point of a liquid varies depending upon the surrounding environmental pressure. A liquid in a partial vacuum has a lower boiling point than when that liquid is at atmospheric pressure. A liquid at high pressure has a higher boiling point than when that liquid is at atmospheric pressure.

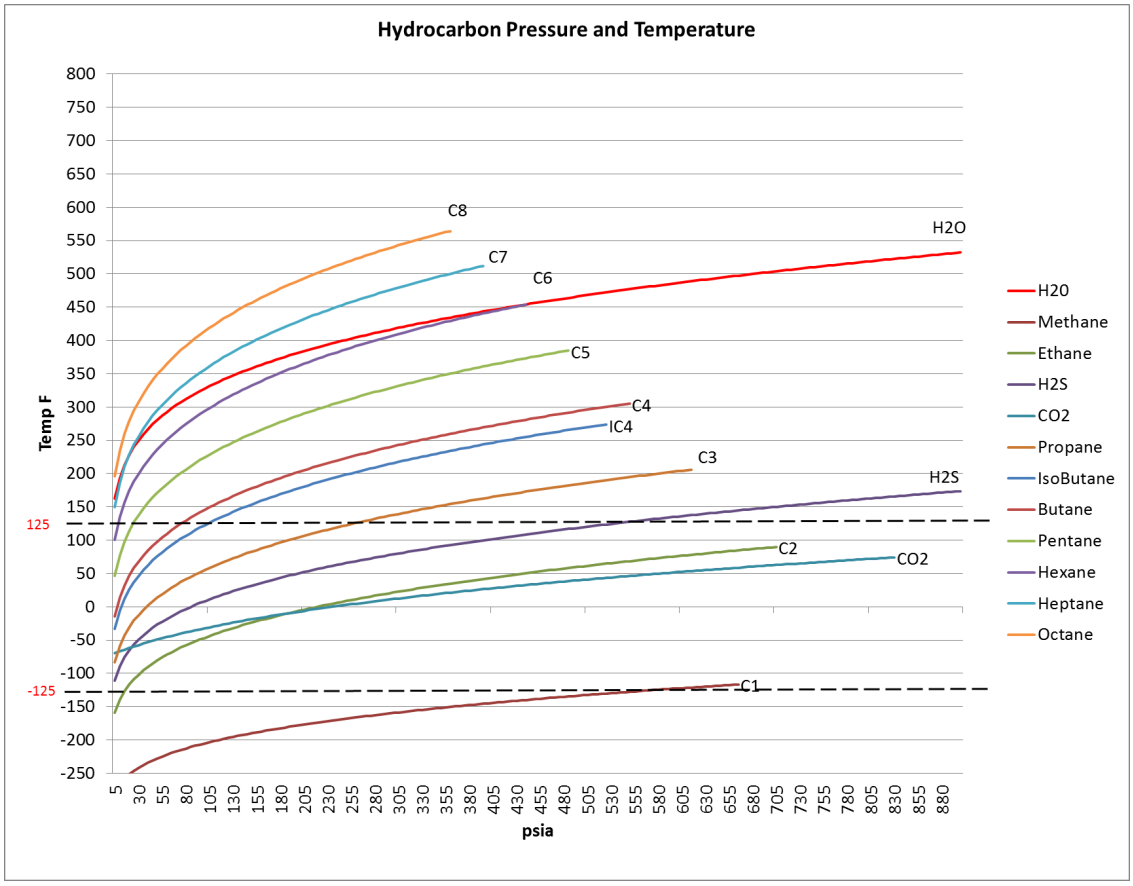
The normal boiling point (also called the atmospheric boiling point or the atmospheric pressure boiling point) of a liquid is the special case in which the vapor pressure of the liquid equals the defined atmospheric pressure at sea level, 1 atmosphere. At that temperature, the vapor pressure of the liquid becomes sufficient to overcome atmospheric pressure and allow bubbles of vapor to form inside the bulk of the liquid. The standard boiling point has been defined by IUPAC since 1982 as the temperature at which boiling occurs under a pressure of 1 bar.





Examples: the following table is a list of variety of substances ordered by increasing vapor pressure (in absolute units).

Substance	Vapor Pressure (SI units)	Vapor Pressure (Bar)	Vapor Pressure (Torr / mmHg)	Temperature
Tungsten	100 Pa	0.001	0.75	3203 °C
Ethylene glycol	500 Pa	0.005	3.75	20 °C
Xenon difluoride	600 Pa	0.006	4.50	25 °C
Water (H_2O)	2.3 kPa	0.023	17.5	20 °C
Propanol	2.4 kPa	0.024	18.0	20 °C
Ethanol	5.83 kPa	0.0583	43.7	20 °C
Methyl isobutyl ketone	2.66 kPa	0.0266	19.95	25 °C
Freon 113	37.9 kPa	0.379	284	20 °C
Acetaldehyde	98.7 kPa	0.987	740	20 °C
Butane	220 kPa	2.2	1650	20 °C
Formaldehyde	435.7 kPa	4.357	3268	20 °C
Propane[9]	997.8 kPa	9.978	7584	26.85 °C
Carbonyl sulfide	1.255 MPa	12.55	9412	25 °C
Nitrous oxide[10]	5.660 MPa	56.60	42453	25 °C
Carbon dioxide	5.7 MPa	57	42753	20 °C



13. MAINTENANCE AND INSPECTION

13.1 Maintenance

Please take the time to review all aspects of the unit and possible wear and tear items that are not listed below.

13.1.1 It is incumbent for you as a customer to have someone competent to maintain and service your equipment in a safe manner. No certification or special licenses are needed to maintain this unit, however, due to ever increasing of Safety regulations and OSHA, some level or Risk Management is needed for you to safely maintain this unit.

13.1.2 Thermocouple – It is important to clean the thermocouple after each use with alcohol.

13.1.3 Power Cord and Plug – Do not modify or change the power cord or plug. A dedicated circuit should be established power output.

13.1.4 Gasket inspection - The door gasket is considered a "high-wear" item. Heat and pressure will take its toll. If you notice a loss of vacuum, the gasket is the first item to check. It is always a good idea to have a spare gasket on hand.

13.2 Inspection

13.2.1 Every 3 – 6 months, qualified personnel should inspect the unit and keep any records of it maintenance for any City, State, or Federal Inspector.

13.2.2 Service Technician - equipment being serviced should at least be shut down for 4 hours prior to the Service Technician arriving.

13.2.3 Product specific risks that may affect service personnel:

13.2.3.1 Using Antistatic Gloves and or Grounding yourself is important so you won't get shocked.

13.2.4 Verification of the safe sate of the equipment after repair:

13.2.4.1 Visual inspections of the unit, is the first thing that will need to be done. Make sure that everything is adjusted or cleaned.

13.2.4.2 Testing the unit to see if all the repairs have worked is the form of verification

14. WARRANTY

Across International (AI) warrants for the original user of this product in the U.S.A. only that this product will be free from defects in material and workmanship for a period of one year from the date of delivery to the original user – the "Warranty Period".

During the warranty period, AI, at its election and expense, will repair or replace the product or parts that are proven to manufacturer's satisfaction to be defective, or at manufacturer's option, refund the price or credit (against the price of future purchases of the product) the price of any products that are proven to manufacturer's satisfaction to be defective.

This warranty does not include any labor charges if outside of the U.S.A. This warranty does not cover any damage due to accident, misuse, negligence, or abnormal use. This warranty is void in the event that repairs are made by anyone other than AI without prior authorization from AI.

Use of AI's product in a system that includes components not manufactured by AI is not covered by this warranty. Any alteration or removal of the serial number on AI's products will void this warranty. Under no circumstances will AI be liable for indirect, incidental, consequential, or special damages.

The terms of this warranty are governed by the laws of the states of New Jersey and Nevada without regards to the principles of conflicts of laws thereof. If any provision of this limited warranty is held to be unenforceable by any court of competent jurisdiction, the remainder of this limited warranty will remain in full force and effect.

This warranty is in lieu of and excludes all other warranties or obligations, either express or implied. AI expressly disclaims all implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose.

After the warranty period, AI will continue to provide support and spare parts at a reasonable cost. Returning shipment: Save the shipping crate until you are sure your unit is consistently working properly. If for any reason you must return the unit, first contact AI for a return material authorization (RMA) number.

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