ACCUTEMP SERIES
VACUUM DRYING OVENS

USER'S MANUAL

ACROSS INTERNATIONAL

@AcrossIntl

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Thank you for choosing our AccuTemp series vacuum drying oven. Please read this manual carefully before operating the unit. Keep this manual on-hand, so that it can be used by all operators of the unit. Across International is not responsible for any injury or damage caused by misuse. If the equipment is used in a manner not specified by Across International, the protection provided by the equipment may be compromised.

PRECAUTIONS

- IMPORTANT! NEVER LEAVE YOUR OVEN UNATTENDED WHILE OPERATING. Across International is not responsible for any loss of material inside of the oven.
- 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.
- It is important to use vacuum grade tubing for all vacuum hookups. Other types of tubing may collapse and prevent complete evacuation.
- The vacuum chamber should be thoroughly cleaned and disinfected prior to use. There are many commercially available disinfectants that are non-corrosive, non-abrasive, and suitable for use on stainless steel surfaces. Choose the one that will work best for your application.
- 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.
- Do not try to heat flammable, combustible or explosive materials, or other materials that may release corrosive substances.
- Do not heat sealed containers in the oven. The pressure differential under vacuum can could potentially cause the container to explode.
- Avoid exposing the unit to vibrations or any corrosive/erosive gases.
- Always wear thermal gloves and protective goggles during operation.
- Always use the power cord that comes with the unit. Never modify the cable.
- Keep oven away from any electromagnetic interference. Do not unplug the oven during normal operation.
- Do NOT use the vacuum oven as a positive pressure vessel.
- When vacuuming is complete, close the vacuum valve before turning off your vacuum pump. This will prevent pump oil from back flowing into the oven, if you are using an oil vane pump.
- Consider conditions that may affect your oven's ability to accurately control its temperatures. Examples include extreme heat from radiators, stoves, other ovens, autoclaves, etc. Avoid direct sun, fast-moving air currents, and heating/cooling ducts.
- To ensure proper air circulation around the oven, allow a minimum of 10 inches between the oven and any walls or partitions.
- A separate circuit for the oven and the pump is strongly recommended to prevent possible loss of product, either due to overloading or failure of other equipment on a shared circuit.
- Returning shipments: Save the original 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 authorization (RMA).
- It is strongly advisable to have at least two people lift or move all desktop models.

1. INTRODUCTION

This ACCUTEMP DESKTOP series (0.9 and 1.9 cu ft) digital vacuum oven features an easy-to-clean stainless steel chamber with a large tempered glass safety window. Each unit comes standard with aluminum shelves, which provides excellent temperature uniformity inside the chamber. They also feature adjustable gas back fill capability with a needle valve and vent port. The low proportional gain temperature controller keeps your oven temperature within +/- 1°F accuracy, in either °F or °C.

The ACCUTEMP SHELF-HEAT series (3.2, 7.5 and 16 cu ft) digital vacuum oven features a larger, production sized chamber with easy-to-clean stainless steel, as well as a 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 heat source, in-shelf temperature sensor and temperature controller. 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 maintains consistent vacuum levels.
- Built-in check valve prevents vacuum oil back flow.
- Built-in alarm alerts you when oven has been shut down by the safety circuitry, due to excessive variance in temperature.
- Optional sliding and stackable shelves maximize your production scale. Many different types of shelving materials are available.

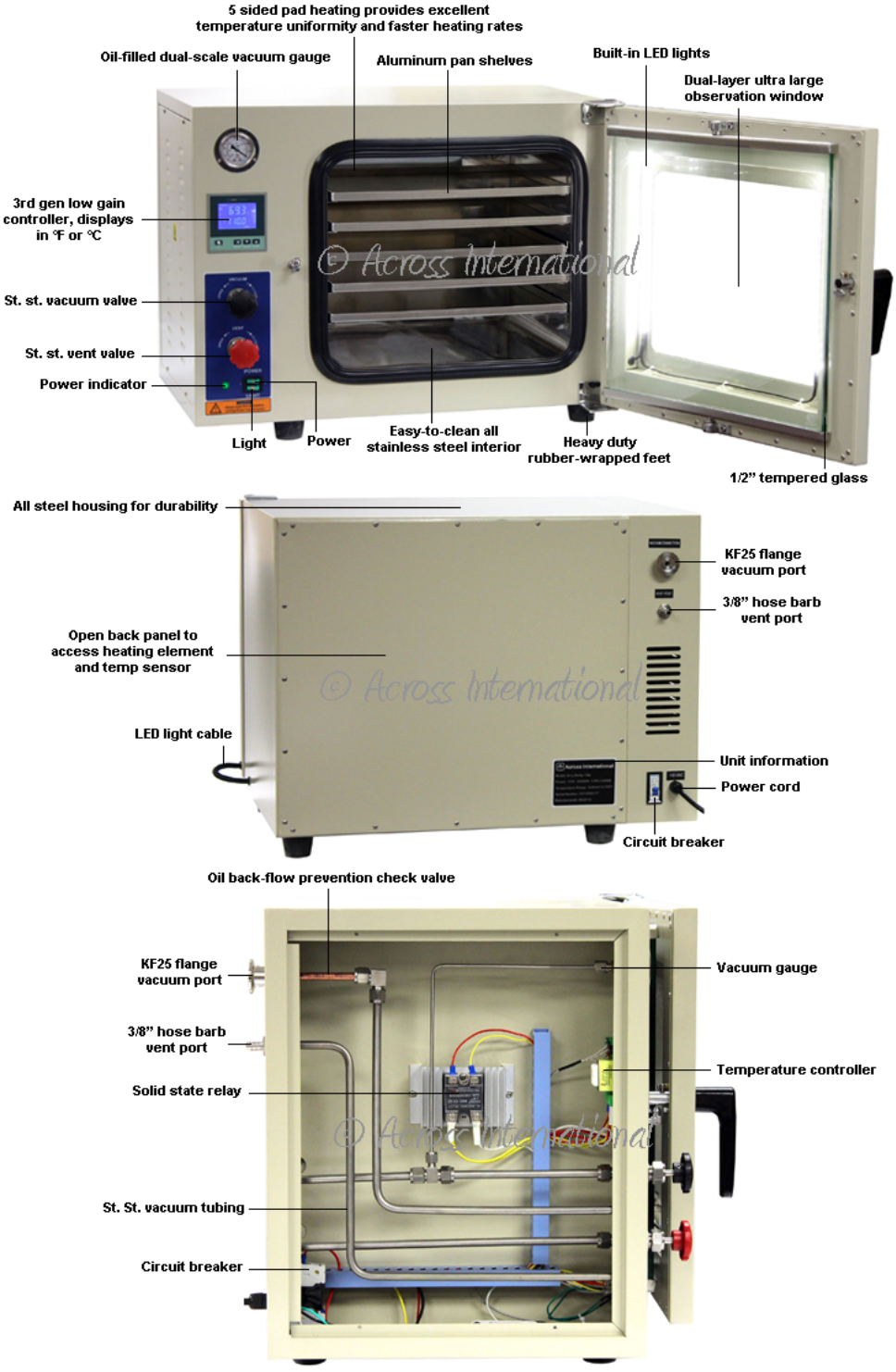
Every one of our vacuum ovens goes through a 2-time, 24-hour vacuum leak test, and is quality controlled in New Jersey or Nevada, USA, before leaving our warehouses.

⚠ For best performance and faster heating rates, perform an Auto-Tune before initial use. Instructions can be found in section 6 of this manual.

2. SPECIFICATIONS

Model	AccuTemp-09	AccuTemp-19	AccuTemp-32	AccuTemp-75	AccuTemp-75a	AccuTemp-160
Electrical requirements	110V or 220V 50/60Hz 1-PH					220V 50/60Hz 1-PH
Chamber capacity	0.9 cubic foot	1.9 cubic foot	3.2 cubic foot	7.5 cubic foot	7.5 cubic foot	16 cubic foot
Chamber dimensions (WxDxH)	12 x 12 x 11"	16 x 14 x 14"	18 x 18 x 18"	22 x 23 ½ x 25"	22 x 23 ½ x 25"	25 ½ x 30 ½ x 35 ½"
Chamber material	3mm thick stainless steel					
Output	1200 watts	1500 watts	1500 watts	1500 watts	1500 watts	3000 watts
Warm-up time to 100°F	60 minutes	60 minutes	35 minutes	45 minutes	50 minutes	55 minutes
Shelf	Maximum 4 sliding shelves	Maximum 5 sliding shelves	3 heated shelves, holds another maximum of 3 stackable shelves	3 heated shelves, holds another maximum of 6 stackable shelves	5 heated shelves, holds another maximum of 5 stackable shelves	6 heated shelves, holds another maximum of 6 stackable shelves
Distance between shelves	2 inches	2 inches	4 ¾ inches	7 inches	4 ¼ inches	5 inches
Number of temperature controllers	1	1	3	3	5	6
Observation window	1/2" tempered safety glass	1/2" tempered safety glass	5/8" tempered safety glass	3/4" tempered safety glass	3/4" tempered safety glass	3/4" tempered safety glass
Unit weight	90 Lb	140 Lb	280 Lb	400 Lb	430 Lb	710 Lb
Shipping weight	150 Lb	200 Lb	350 Lb	500 Lb	530 Lb	940 Lb
Unit dimensions (WxDxH)	24x20x18"	28x22x22"	30x24x29"	35x31x38"	35x31x38"	33x36x53"
Shipping dimensions (WxDxH)	28x24x24"	32x27x28"	34x30x35"	38x35x43"	38x35x43"	43x40x60"
Temperature range	Ambient to 480°F in 0.1°F steps					Ambient to 250°F in 0.1°F steps
Temperature controller	Low proportional gain with LCD screen. Microcomputer-controlled automatic PID selection					
Temperature units	Fahrenheit or Celsius					
Temperature accuracy	+/- 2°F					
Temperature uniformity	+/- 6% of set point (After target temperature fully stabilized)					
Dwelling timer range	1 to 9999 minutes					
Vacuum level	Better than 500 microns/millitorrs					
Maximum vacuum	29.9 inches of mercury (may vary based on your local altitude)					
Vacuum gauge range	0 to 30 inches of mercury					
Door gasket material	Silicone					
Vacuum connection	KF25 flange					
Safety	Built-in circuit breaker, over-heat protection					

3. OVEN COMPONENTS



0.9 and 1.9 cubic foot models

3.2 cubic foot model

7.5a cubic foot model

4. PREPARATION

4.1. Your oven should be placed on a sturdy platform that is approximately 30 inches off the ground, or the same distance your building code requires for a water heater.

4.2. Best practices for vacuum operations:

a. Place all shelves that you will use inside oven, make sure vent port, vacuum port are closed, and oven door is closed securely.
b. Connect vacuum pump with KF25 stainless steel bellow, clamps and o-rings.
c. Turn on your vacuum pump.
d. Open vacuum port on the oven and watch the vacuum level on the vacuum gauge.
e. When desired vacuum level is reached, close the vacuum port FIRST, and then turn off your vacuum pump. (It is a good idea to leave the pump on at all times during the heating process, and then for an additional 30 to 60 minutes afterwards, to allow the pump to clear out any moisture that may have been pulled into it during the vacuuming process.)

4.3. Guidelines for using the vacuum oven

a. Put your sample into the oven. Close the door securely, then close the vacuum release, open the vacuum valve, and turn on the power to the vacuum pump to start the purging process. When your vacuum level inside the oven is where you want it to be, close the vacuum valve first, then turn off the vacuum pump.
b. Turn on the oven and set your target temperature. Temperature in the oven will start to rise and the heating indicator will blink. Usually, the oven enters into temperature-dwelling mode within 30 to 120 minutes, depending on your target temperature.
c. If your target temperature is low, you can set your temperature at two intervals to minimize temperature spikes. For example, if your target temperature is 100°F, the first target temperature value can be set to 90°F, and when temperature reaches that point, set the temperature one more time to 100°F. By doing so, temperature overshooting can be reduced or prevented and temperature dwelling state can be started as soon as possible.
d. The length of drying time should be selected based on the humidity level of your sample. In case drying time is long and vacuum level reduces due to off-gassing, etc, it is necessary to purge the oven again to restore desired vacuum level. (Make sure your vacuum pump can work at your target temperature when doing this).
e. After the drying process is done, turn off the oven, open the vacuum release valve, then open the door. It is possible that the sealing gasket may become stuck to the door glass, causing the door to not open easily. If this happens, wait a few minutes until the gasket restores itself before trying to open the door again.

We recommend using our T series cold trap in between your oven and vacuum pump, to protect your pump from damage caused by the extraction of solvents or other gases.

5. OVEN OPERATION

[MAIN] mode: After the oven is first turned on, controller enters into [MAIN] (running) mode.

[SET] mode: Hold and press "Set" button for 3 seconds in [MAIN] mode to enter into 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.

5-1. Basic settings: Target temperature and dwelling time

a. Plug in the power cable, switch on the circuit breaker in the back, and turn on the oven.

b. Press 'Set' button once. The controller will display "SP". Now use "Shift", "Decrease" or "Increase" button to set your target temperature.

c. 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.

d. Press 'Set' again to confirm all settings.

e. 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.

f. Press and hold the "Dec/Rst" button for 3 seconds to restart oven operation.

g. 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

5.2. Finishing your process

After purging and heating is done, turn off the main power switch. If you wish to fill your oven with inert gas, use the vent port (shown below) to connect to a nitrogen, argon, etc. source. Open the vent port and let the vacuum level restore to atmospheric pressure, then open the door and remove your samples (caution: surfaces may be hot!).

5.3. 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.

6. AUTO TUNE (AT) CALIBRATION

6.1. 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.

6.2. When should you perform an AT?

a. 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.)
b. If you've recently changed or replaced any parts inside your oven.
c. If you see a big temperature difference between controller display and actual oven temperature.

6.3. Calibration by Auto-Tune (AT)

Follow the steps below to perform a standard Auto Tune:

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

b. 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.
c. 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.
d. A new set of optimized PID values will be automatically saved for future use.
e. Now set the target temperature. You are ready to use the oven.

6.4. Calibration by formula

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

6.4.1. 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.

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

6.4.3. 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]

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

6.5. 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.

a. "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).
b. "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.
c. "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.

7. ADVANCED SETTING (FOR 1-SEGMENT CONTROLLER)

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.)

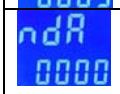
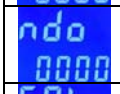
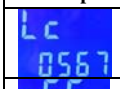
Prompt	Name	Description	Range (factory value)
	*Lc: Pass key*	*When Lc = 9, controller enters into the menu below*	*3, 9, 27, 567 (0)*
	ndA: Temp alarm mode	0: with over-temp alarm only 1: with over-temp alarm and under-temp alarm	0-1 (0)
	ndT: Timer mode	0: no timer function 1: with timer function, 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 (572) under °F mode SPL to 400 (300) under °C mode

Table 3

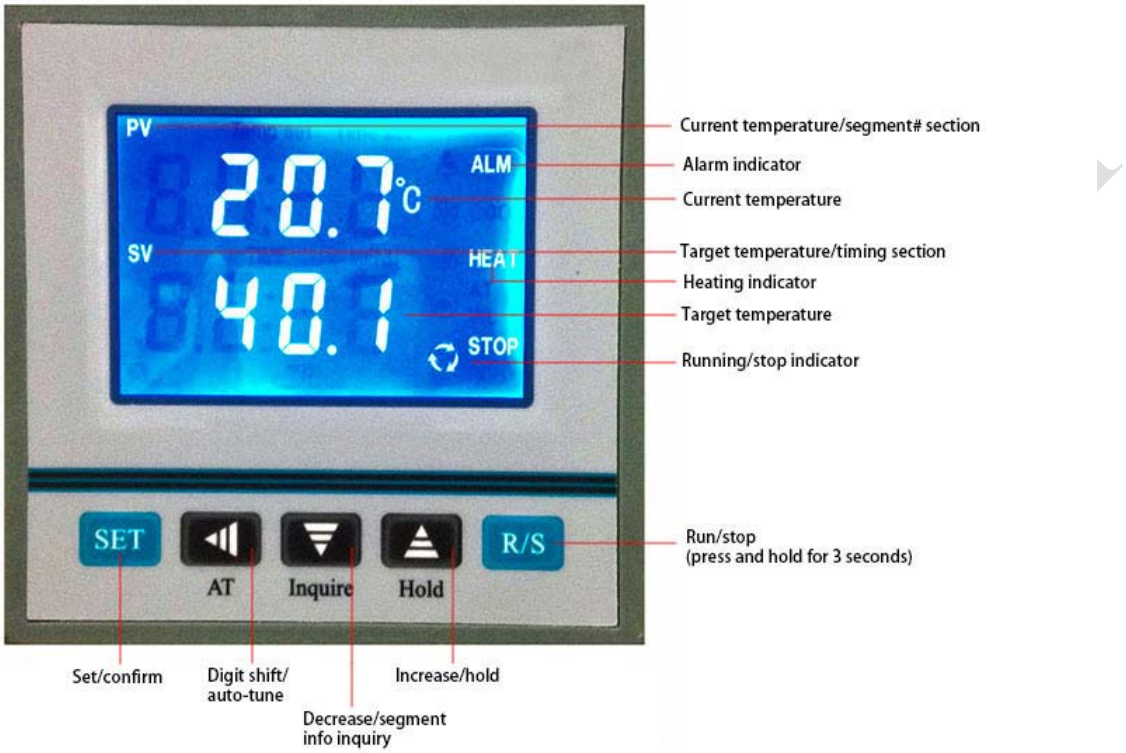
Prompt	Name	Description	Range (factory value)
	*Lc: Pass key*	*When Lc = 27, controller enters into the menu below*	*3, 9, 27, 567 (0)*
	FC: Temperature display mode	0: Celsius 1: Fahrenheit	0-1 (0)

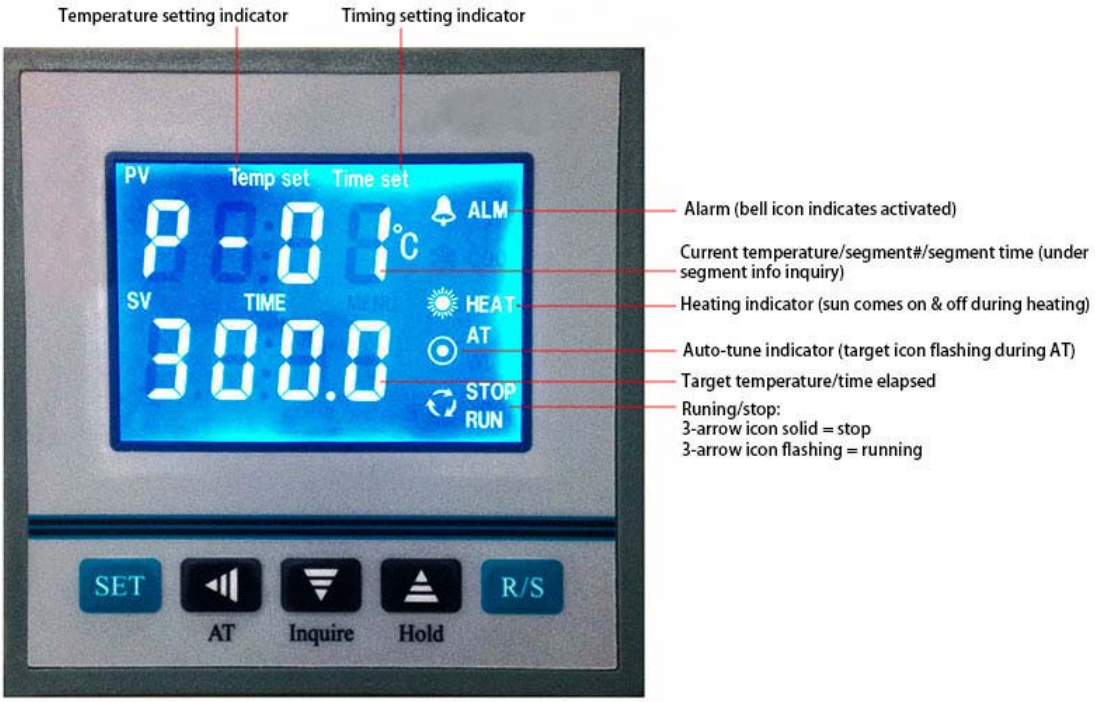
Table 4

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)

8. MULTI-SEGMENT RAMP TEMPERATURE CONTROLLER OPERATION

8.1. Controller components





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 non-editable	SP00 to SP30
St	Time	St00: 0-9999, St01-31: -002 to 9999	St01 to St31

8.2. Operation

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

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

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

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.

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

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

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).

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

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) 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.

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.

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

8.3. 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.

8.4. Advanced settings

Press and hold the "SET" button for 5 seconds. The controller will display "Lc". Enter your pass key and then press "SET" to enable the advanced setting menus. Press and hold the "SET" button for 5 seconds to quit.

Prompt	Name	Description	Range (factory value)
Lc	Pass key	When Lc = 3, the controller enters into the menu below	0
AL	Alarm	When temperature is beyond "SP+AL", the ALM indicator will turn on. The buzzer will sound and the oven will turn off.	0.0 to 100.0℃ (20.0)
T	Control cycle	The control cycle of temperature control.	1 to 60s (5)
P	Proportional	Increasing P may reduce temperature overshooting. Decrease P to allow faster heating rates.	1.0 to max temp set in next table or SPH (35.0)
I	Integral	Increase I to lower temperature fluctuation.	1 to 1000s (200)
d	Differential	Adjusted to reduce temperature overshooting. Usually set to 1/5 - 1/4 of the value of I.	0 to 1000s (100)
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℃ (0.0)
PK	Hot adjustment	Adjust when the temperature of the controller is different from the actual temperature inside of the oven. PK = (actual value - target value) x 1000 / maximum controller temperature	-999 to 999 (0)

Prompt	Name	Description	Range (factory value)
Lc	Pass key	When Lc = 9, the controller enters into the menu below.	0
Pon		Not used.	0 to 2 (0)
Stn		Not used.	0 to 0 (0)
odr		Not used.	0 to 5 (0)
Addr		Communication address.	1 to 16 (1)
SPH	Max Temp	Sets the maximum temperature the controller can go to (Do NOT modify. Setting max temperature too high could permanently damage your oven!)	0 400 (300)

9. TROUBLESHOOTING

9.1. Issue: Oven temperature is consistently overshooting

Solution: It is normal for temperatures to overshoot in a vacuum oven, prior to stabilization. A generally accepted range of temperature overshoot within 2 to 5 degrees. Once stable, the oven should maintain within the specified uniformity. If the oven is overshooting and remains too hot, check the following:

a) Temperature controller set drastically higher than where it was calibrated.
b) The oven is not under vacuum. Always run the oven under vacuum.
c) The oven needs to be re-calibrated under Auto Tune.

9.2. Issue: Temperature displayed and reference value are different

Solution 1: Because there is no air in the chamber, the heat must radiate and conduct across the shelves and through the chamber, it takes a lot of time for the temperature to stabilize. It is common for shelves to be much cooler than the walls for a number of hours during the warm up process. When using an independent thermocouple to verify temperature, pay attention to the following:

- Always have the unit under vacuum when checking temperature.
- Allow time for the oven to stabilize. We recommend anywhere from 1 to 4 hours.
- Attach the probes to the shelves with heat-resistant tape.
- The reading should be within the uniformity tolerance in the specifications. It might not match exactly, but it should be very close.
- If the shelves run cooler than you would like, you can use the temperature setting to increase the heat. Turn the oven up until the parts on the shelves are at your desired temperature.

Solution 2: Offset the temperature differences manually in the advanced settings by using the "Calibration by Formula" process, described in section 6.4.

9.3. Issue: Oven cannot hold vacuum properly

Solution: Before calling AI for technical support, please check the following:

- Is the vacuum port open, the vent port closed, and pump connected properly to the vacuum port?
- Check the door's sealing gasket and make sure it is clean, well seated, and has no splits, cracks, flattened, or melted spots, or any other defects.
- Check the door alignment. When you close the door, is it making good contact with the gasket all the way around? When in doubt, use a little vacuum grease on the door gasket, then shut the door. Did the grease transfer all the way around the gasket to the glass when opened? If not, realign the door.

9.4. Issue: Oven vacuum gauge cannot get to ultimate 30 inches of mercury vacuum

Solution: Make sure your vacuum pump is right size for your oven, and the pump is getting the right amount of power. Check if there is a large amount of off-gassing coming from the samples, and that the door is sealed properly. Your altitude in relation to sea level is also a big factor. Please refer to **section 11**.

Issue	Reason	Solution
No power	Oven is turned off.	Check circuit breaker and turn on oven. Make sure oven is getting enough power to turn on.
	Broken power cord or loose plug.	Change or secure the power cord.
	Circuit breaker is off	Turn on circuit breaker, located on back of oven.
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 failed to heat	Dwelling time is over	Reset dwelling time and restart the oven.
	Loose connection on temp controller	Check and make sure all connections are secure.
	Faulty controller	Replace temperature controller.
	Faulty heating element	Replace heating elements.
	Parameter error	Reset all parameters to factory setting using parameter table #4.
Temperature control failure	Loose connection on temperature sensor	Check all connections.
	Faulty controller	Replace temperature controller.
	Target temperature too low	Set a higher target temperature.
Abnormal alarming for oven temperature	Faulty controller	Replace temperature controller.
Large temperature difference between oven display (PV) and temperature measured by yourself with a thermometer placed inside of the oven.	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 6.3 above
	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. Try using a regular thermometer instead.
	If solutions above do not fix the difference	Perform a "Calibration by formula" as described in section 6.4 above
	Parameter error	Reset all parameters to factory setting using parameter table #4 in section 7

10. MAINTENANCE

10.1. Oil/rotary vane pumps: These pumps will require oil changes. The frequency of the changes will depend on how often the pump is used, and for how long. Watch for the oil to become cloudy, darkened, or milky. As soon as the color becomes varied, it's time to change the oil. We recommend ultra-grade 19 vacuum pump oil. Depending on how much water or gunk is being pulled off your product and thru the pump, it may be a good time to also replace the exhaust oil mist filter.

10.2. Dry/scroll pumps: These pumps will require "tip seal" changes. Most pump manufacturers recommend every 9,000 hours of use, or at least once per year. Degradation of vacuum levels or poor pump performance may mean it's time for a tip seal change. AI carries various service kits and tip seal kits for the pumps that we offer.

10.3. Gasket inspection: The door gasket is considered a "high-wear" item. Heat and pressure will eventually cause the gasket to need replacing. 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, to minimize down time.

10.4. Keep the oven clean at all times. Clean the glass, sealing gasket, and chamber after each use.

10.5. The oven must be unplugged under the following circumstances: Repairing, moving the oven, or when the oven is not being used for a long time.

10.6. If the oven needs to be placed into storage for a long time, be certain that the chamber is dry, the latch to the door closed, and the power cord has been disconnected. Cover the oven entirely to keep it away from dust and moisture.

11. ULTIMATE VACUUM LEVELS AT DIFFERENT ALTITUDES

There are many ways to measure vacuum levels. AI's vacuum ovens use both mechanical vacuum gauges (standard, read in inHg) and digital vacuum gauges (optional, reads in inHg, mmHg, psi, etc.). The achievable ultimate vacuum level will depend on your altitude. Please use table below for reference.

ALTITUDE		BAROMETER		ATMOSPHERIC PRESSURE	
FEET	METERS	inHg	mmHg	psi	kPa
-5,000	-1,524	35.58	903.7	17.48	120.5
-4,500	-1,372	35	889	17.19	118.5
-4,000	-1,219	34.42	874.3	16.9	116.5
-3,500	-1,067	33.84	859.5	16.62	114.6
-3,000	-914	33.27	845.1	16.34	112.7
-2,500	-762	32.7	830.6	16.06	110.7
-2,000	-610	32.14	816.4	15.78	108.8
-1,500	-457	31.58	802.1	15.51	106.9
-1,000	-305	31.02	787.9	15.23	105
-500	-152	30.47	773.9	14.96	103.1
Sea level 0	0	29.92	760	14.7	101.3
500	152	29.38	746.3	14.43	99.49
1,000	305	28.86	733	14.16	97.63
1,500	457	28.33	719.6	13.91	95.91
2,000	610	27.82	706.6	13.66	94.19
2,500	762	27.32	693.9	13.41	92.46
3,000	914	26.82	681.2	13.17	90.81
3,500	1,067	26.33	668.8	12.93	89.15
4,000	1,219	25.84	656.3	12.69	87.49
4,500	1,372	25.37	644.4	12.46	85.91
5,000	1,524	24.9	632.5	12.23	84.33
6,000	1,829	23.99	609.3	11.78	81.22
7,000	2,134	23.1	586.7	11.34	78.19
8,000	2,438	22.23	564.6	10.91	75.22
9,000	2,743	21.39	543.3	10.5	72.4
10,000	3,048	20.58	522.7	10.1	69.64
15,000	4,572	16.89	429	8.3	57.16
20,000	6,096	13.76	349.5	6.76	46.61
25,000	7,620	11.12	282.4	5.46	37.65
30,000	9,144	8.9	226.1	4.37	30.13
35,000	10,668	7.06	179.3	3.47	23.93
40,000	12,192	5.56	141.2	2.73	18.82
45,000	13,716	4.37	111.1	2.15	14.82
50,000	15,240	3.44	87.5	1.69	11.65
55,000	16,764	2.71	68.9	1.33	9.17
60,000	18,288	2.14	54.2	1.05	7.24
70,000	21,336	1.33	33.7	0.651	4.49
80,000	24,384	0.827	21	0.406	2.8
90,000	27,432	0.52	13.2	0.255	1.76
100,000	30,480	0.329	8.36	0.162	1.12

Pressure unit conversion

	kPa	MPa	kgf/cm²	bar	psi	mmHg (Torr)	inHg	atm
1 kPa	1	1×10^{-3}	1.01972×10^{-2}	1×10^{-2}	1.45038×10^{-1}	7.50062	0.2953	9.86923×10^{-3}
1 MPa	1×10^{3}	1	1.01972×10	1×10	1.45038×10^{2}	7.50062×10^{3}	0.2953×10^{3}	9.86923
1 kgf/cm²	9.80665×10	9.80665×10^{-2}	1	9.80665×10^{-1}	1.42234×10	7.35559×10^{2}	2.8959×10	9.67841×10^{-1}
1 bar	1×10^{2}	1×10^{-1}	1.01972	1	1.45038×10	7.50062×10^{2}	2.953×10	9.86923×10^{-1}
1 psi	6.89473	6.89473×10^{-3}	7.03065×10^{-2}	6.89473×10^{-2}	1	5.17147×10	2.036	6.80457×10^{-2}
1 mmHg (1 Torr)	1.33322×10^{-1}	1.33322×10^{-4}	1.35951×10^{-3}	1.33322×10^{-3}	1.93368×10^{-2}	1	3.9370×10^{-2}	1.31579×10^{-3}
1 inHg	3.3864	3.3864×10^{-3}	3.4531×10^{-2}	3.3864×10^{-2}	0.4912	2.5400×10	1	3.342×10^{-2}
1 atm	1.01325×10^{2}	1.01325×10^{-1}	1.03323	1.01325	1.46960×10	7.60000×10^{2}	2.9921×10	1

12. PRESSURE VS VAPORIZATION

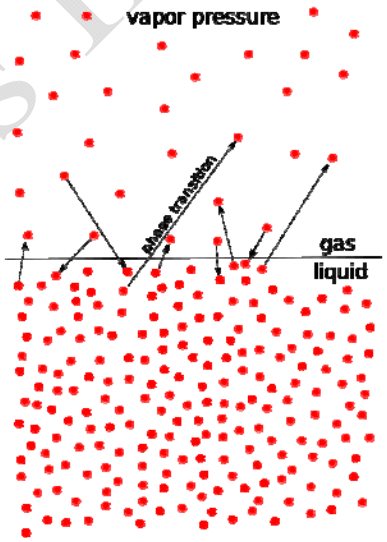
Vacuum evaporation is the process of causing the pressure in a vacuum oven to be reduced below the vapor pressure of the liquid, causing the liquid to evaporate at a lower temperature than normal.

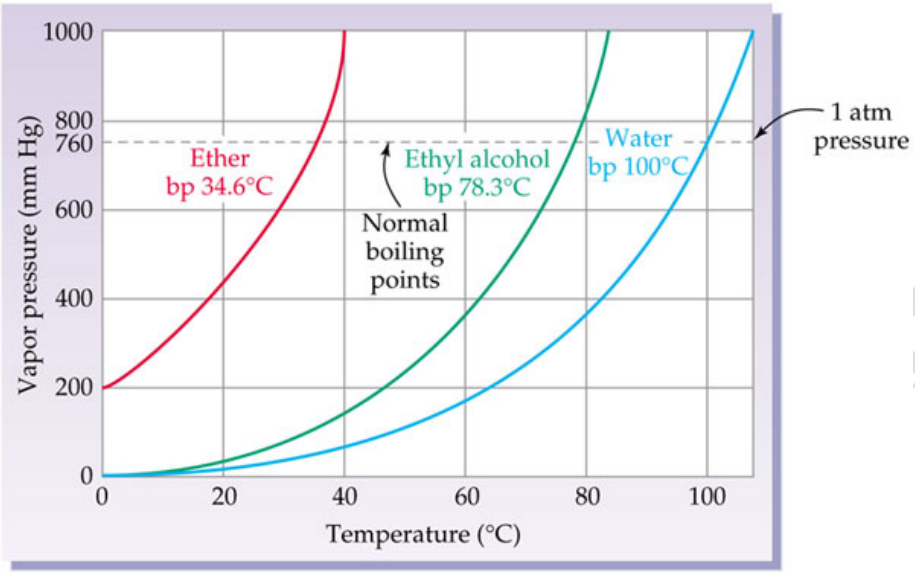
Liquids may change to a vapor at temperatures below their boiling points through the process of evaporation. Evaporation is a surface phenomenon in which molecules located near the liquid's edge, not contained by enough liquid pressure on that side, escape into the surroundings as vapor. On the other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




Vapor pressure (mm Hg)
1000
800
760
600
400
200
0
0
20
40
60
80
100
Temperature (°C)
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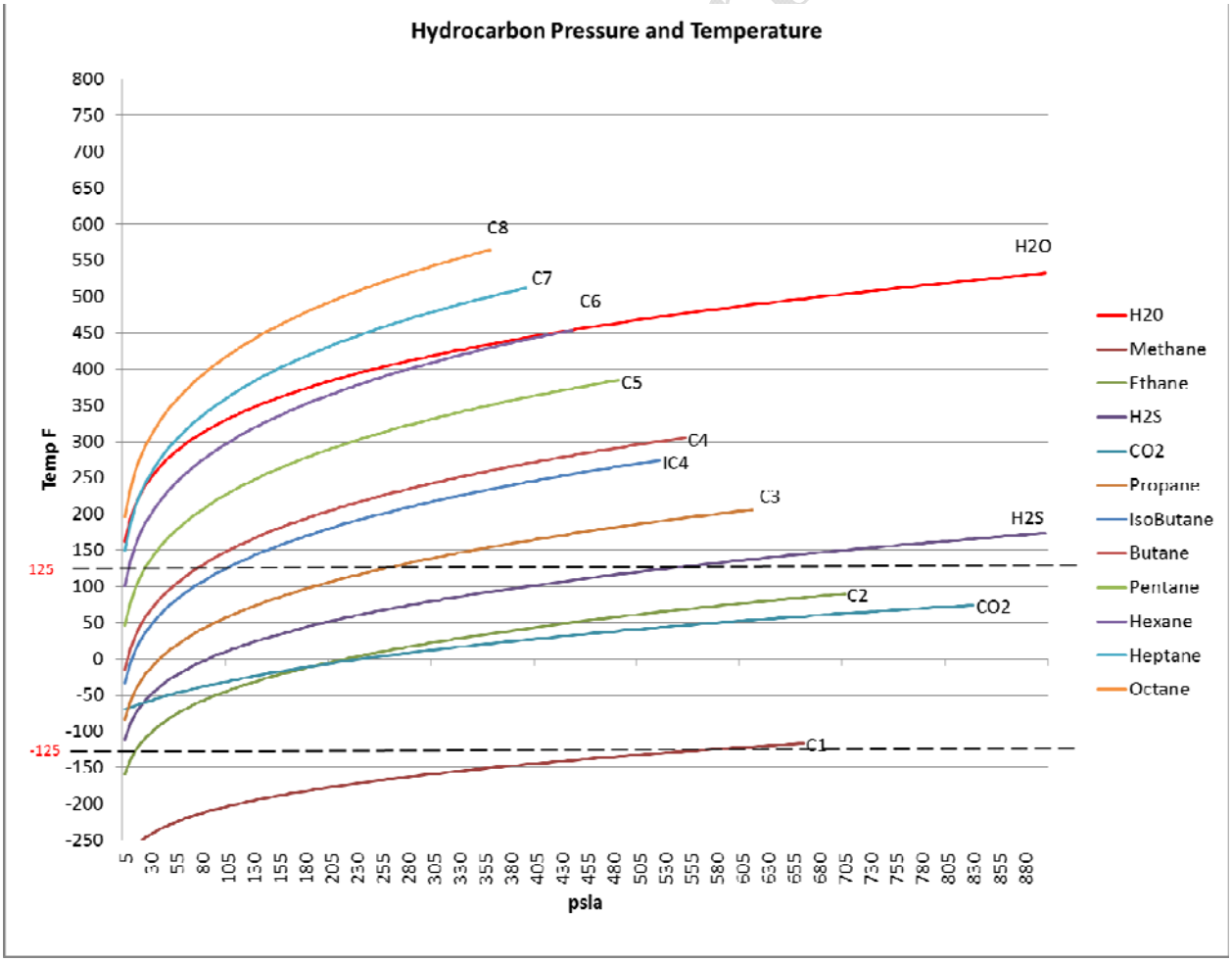
bp 34.6°C
Ethyl alcohol
bp 78.3°C
Water
bp 100°C
Normal
boiling
points
1 atm
pressure

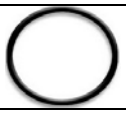

Hydrocarbon Pressure and Temperature
Temp F
psla
C8
C7
C6
C5
C4
IC4
C3
C2
C1
H2O
H2S
CO2
125
-125
H20
Methane
Fthane
H2S
CO2
Propane
IsoButane
Butane
Pentane
Hexane
Heptane
Octane

13. PARTS LIST

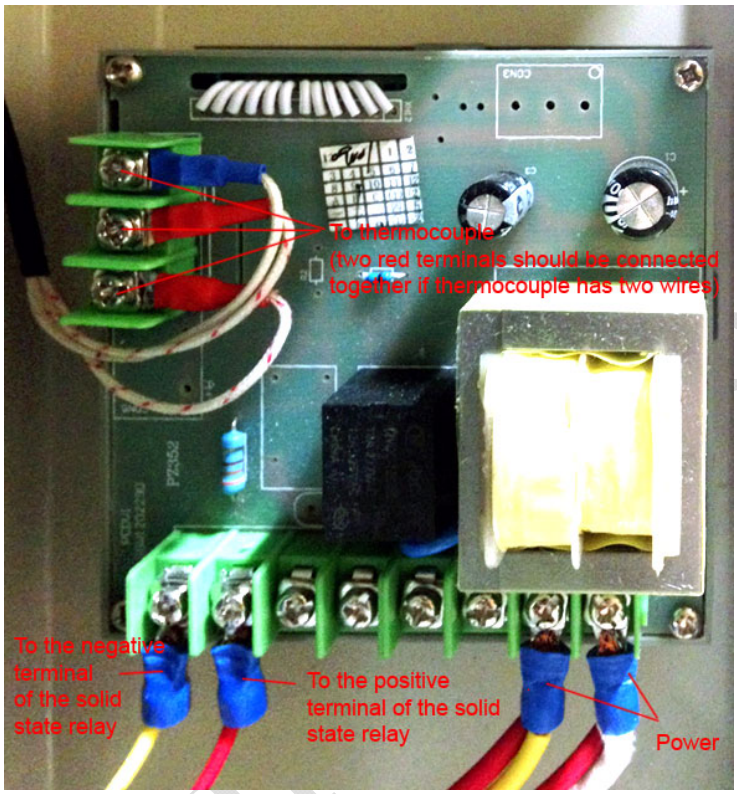
Standard package

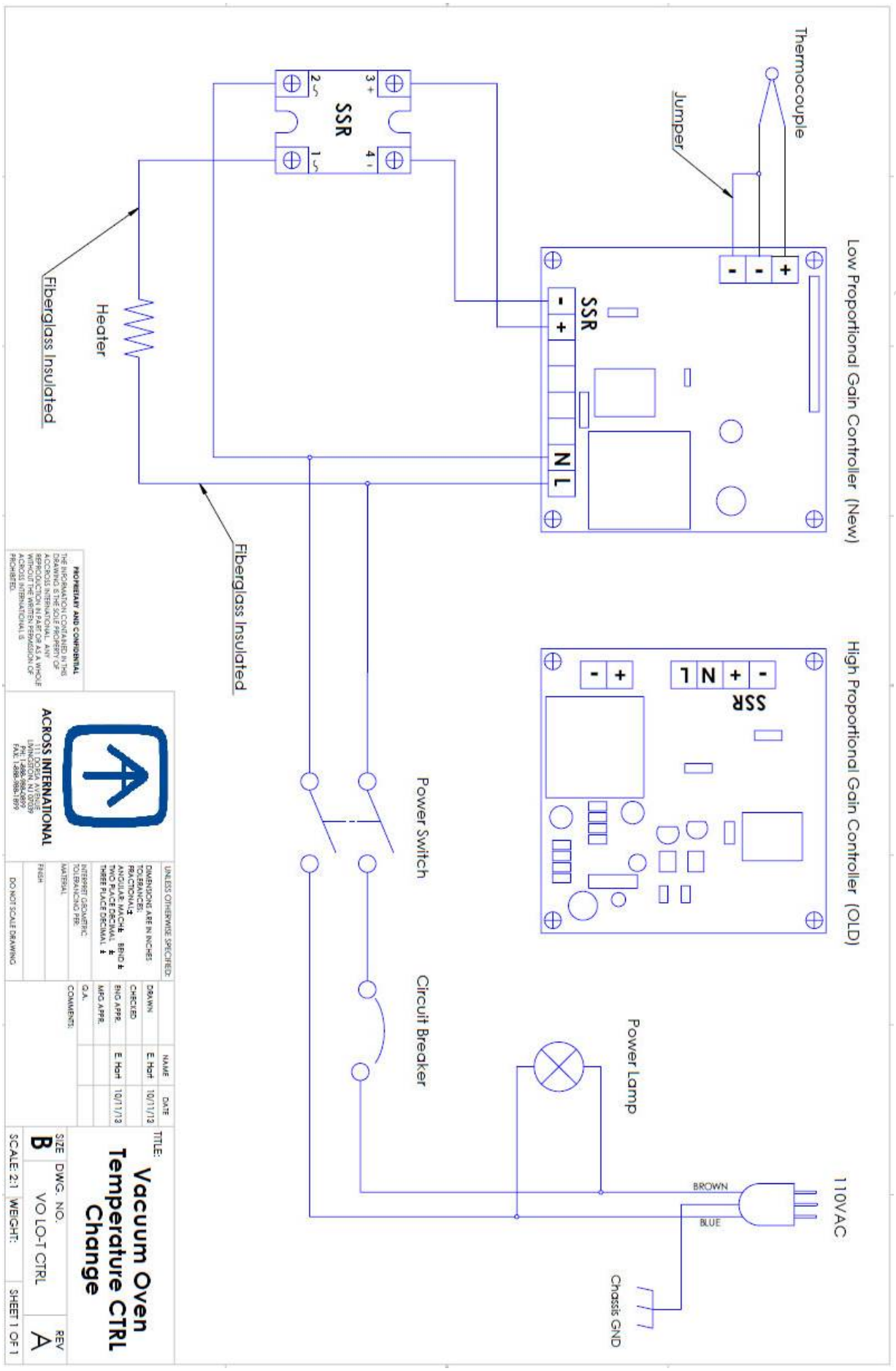
Part description	Quantity	Part image
AccuTemp series vacuum oven	1 pc	
Aluminum shelf (for 0.9 and 1.9 models only)	4-5 pcs	
User's manual	1 pc	

Parts and accessories

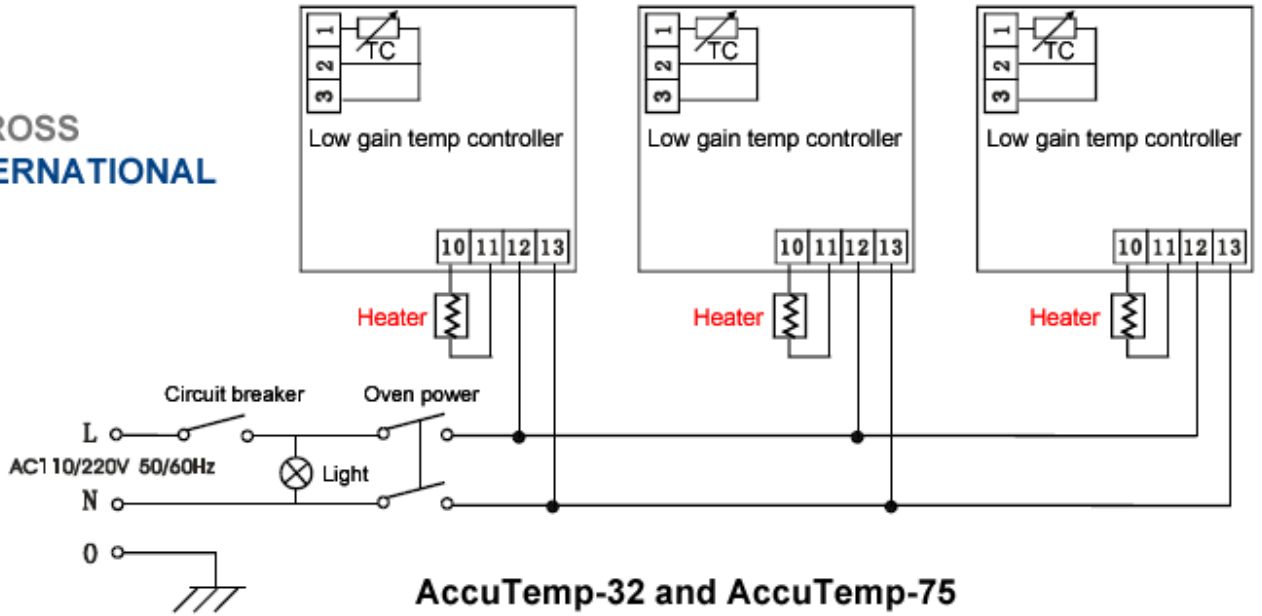
Part description	Part image
Stone shelf	
Vacuum oven door sealing gasket	
Solvent proof digital vacuum gauge read in multiply units	
1200 lbs heavy duty all welded steel mobile cart	
T series cold trap for safe vacuum operations	
Oil filled or oil free vacuum pumps	
vacuum pump service kits	
KF quick clamps and centering ring	
Exhaust mist filters and filter elements	
Food grade silicone or stainless steel vacuum tubing	

14. SCHEMATICS AND CONTROLLER CONNECTION

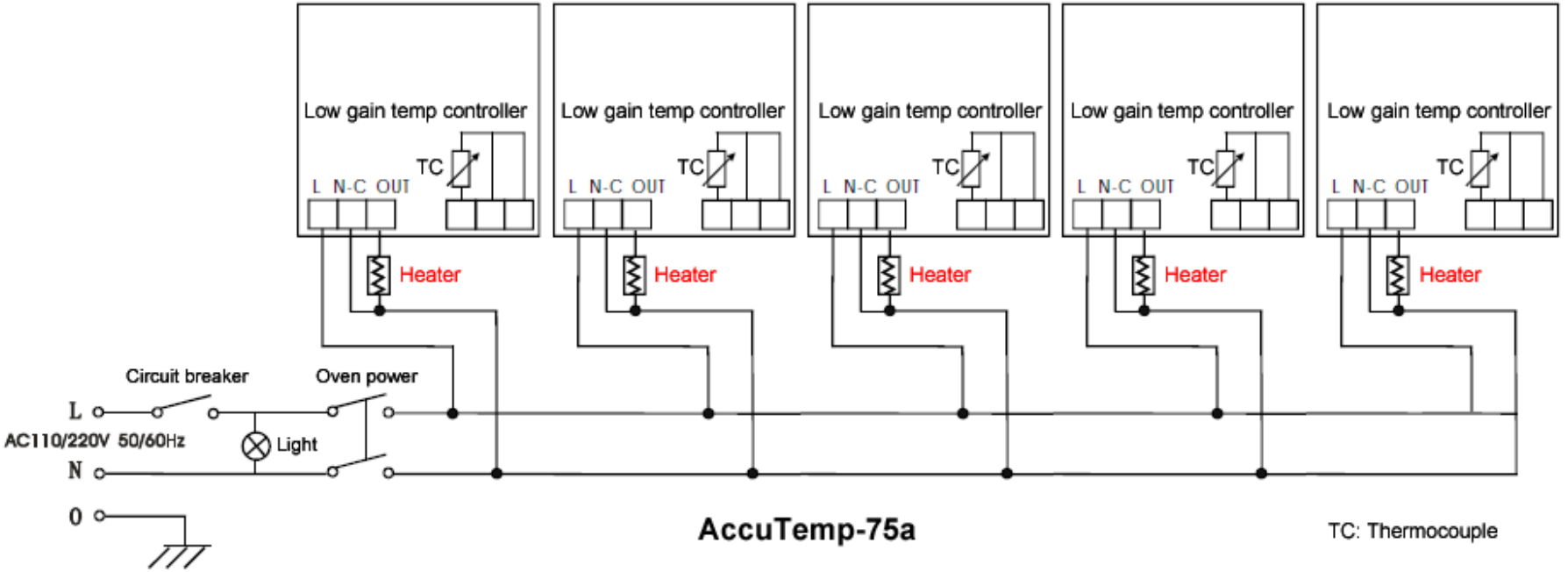



Thermocouple
Jumper
SSR
Low Proportional Gain Controller (New)
Fiberglass Insulated
Heater
Fiberglass Insulated
High Proportional Gain Controller (OLD)
Power Switch
Circuit Breaker
Power Lamp
110VAC
BROWN
BLUE
Chassis GND
PROPRIETARY AND CONFIDENTIAL
ACROSS INTERNATIONAL
Vacuum Oven Temperature CTRL Change
SIZE B
DWG. NO. VO LO-T CTRL
REV A
SCALE: 2:1
WEIGHT:
SHEET 1 OF 1

ACROSS INTERNATIONAL



AccuTemp-32 and AccuTemp-75



AccuTemp-75a

TC: Thermocouple

15. WARRANTY

Across International 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 to two years (depending on which model the user has) from the date of delivery to the original user – the "Warranty Period".

During the Warranty Period, Across International, 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.

Use of Across International's product in a system that includes components not manufactured by Across International is not covered by this warranty.

This warranty is void in the event that repairs are made by anyone other than Across International without prior authorization from Across International.

Any alteration or removal of the serial number on Across International's products will void this warranty. Under no circumstances will Across International 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. Across International expressly disclaims all implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose.

After the warranty period, Across International will continue to provide support and spare parts at a reasonable cost.

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