



APPLIED TEST  
SYSTEMS

**Instruction  
Manual**

THE MARK OF RELIABILITY

# Pressure Aging Vessel

## PAV3





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Revised January 2015

# Preface

## *Unpacking*

Retain all cartons and packing materials until the unit is operated and found to be in good condition. If damage has occurred during shipping, notify Applied Test Systems (ATS) and the carrier immediately. If it is necessary to file a damage claim, retain the packing materials for inspection by the carrier.

## *Warranty*

All new ATS systems are shipped with a warranty. Units have a warranty against defective parts and workmanship for one full year from date of shipment. Please see Appendix A of this manual for complete details on the warranty.

NOTE: Please see the warranty information included with the computer. It details information that will ensure proper transfer of the computer warranty from ATS to the appropriate company.

## *After-Sale Support*

If there are any questions concerning the operation of the unit or software, contact the ATS Service Department at +1-724-283-1212. Before calling, please obtain the software revision number and the serial number from the unit's data tag. A sample data tag is shown below and can be completed with the unit's information for easy reference. Please be prepared to give a complete description of the problem to ATS Service Engineers.

	NO.	
	AMP	VAC
	PH	HZ

## **Section 1: Introduction**

The Applied Test Systems (ATS) Pressure Aging Vessel (PAV) simulates in-service oxidative aging of asphalt binder according to procedures developed by the Strategic Highway Research Program (SHRP). The PAV system is fully compliant with the most recent versions of ASTM standard D6521 and AASHTO standard method R28.

This information is related to the function, setup, safe operation, and maintenance of the PAV and its related components.

This manual is intended for anyone who will be setting up and/or operating the PAV.

## Section 2: Safety

All ATS equipment is designed to be operated with the highest level of safety. This manual and ATS endeavor to educate the operator about safety issues surrounding certain parts of the machinery by using equipment labeling.

### 2.1 For Owners, Operators, and Maintenance Personnel

Read and understand all instructions and safety precautions listed in this manual before installing or operating the unit. If there are any questions regarding operation of the unit or the instructions in this manual, contact the ATS Service Department at +1-724-283-1212.

In addition to the safety warnings listed on the equipment, warnings are posted throughout this manual. Read and follow these important instructions. Failure to observe these instructions can result in permanent damage to the unit, significant property damage, personal injury, or death.



Read Operator's Manual



General Danger



Protective Earth (Ground)



Burn Hazard (Hot Surface)



Electrical Shock/Electrocution



Hand Crush Force From Above



European Directive CE Mark



No Access for Unauthorized Persons

## 2.2 Safety Instructions

1. Read and follow all warning and caution statements in all related equipment manuals before attempting to operate this machine. If in doubt about any statement or sequence, contact ATS Service.
2. Installation of electrical devices must be accomplished by competent personnel and done in accordance with any current local and national codes. Equipment grounding is a **MUST** for both safety and proper operation.
3. Before supplying electrical power to the unit, turn all power switches and controls to an OFF or NEUTRAL position.

## 2.3 Warnings

The following statements are warning statements. Unlike caution statements, warning statements alert the operator to conditions that may injure personnel. Operators must be aware of these conditions in order to prevent injuries that may occur while operating this equipment.



**WARNING:** Obey electrical code requirements. The oven and control system must be wired and grounded in accordance with national and local electrical code requirements.



**WARNING:** Be careful when working with equipment at elevated temperatures. In order to prevent burns, wear protective clothing.



**WARNING:** Use caution when opening the oven lid. Electrically-heated equipment can cause severe burns.



**WARNING:** Allow adequate time to relieve all the pressure from the vessel before opening the oven lid and the pressure vessel lid. Any unrelieved pressure can cause equipment damage and possible personal injury.



**WARNING:** Unpack and operate on a stable surface.

## 2.4 Cautions

The following statements are caution statements. These statements alert the operator to conditions that may damage equipment. Operators must be aware of these conditions in order to ensure safe operation of this equipment.



CAUTION: Installation of electrical devices must be accomplished by competent personnel and done in accordance with any current local and national codes.



CAUTION: The PAV must be grounded and wired in accordance with national and local electrical code requirements.



CAUTION: Before energizing the electrical power to the Pressure Aging Vessel, place all controls in an OFF position.



CAUTION: Do not exceed the maximum operating temperature. Refer to the specifications in Section 3 of this manual.



CAUTION: Closing the flow adjust valve when the PAV is in operation will cause damage to the valve.



CAUTION: All supporting and contacting surfaces must be non-flammable. Do not allow flammable materials to contact the shell.



CAUTION: If an emergency shutdown needs to be performed, place ON/OFF switch in an OFF position. Unit will depressurize automatically within 10-15 minutes.



CAUTION: Do not overflow PAV pans. Refer to test specifications for proper amount of material.

## Section 3: System Overview

### *3.1 General Description*

The ATS Pressure Aging Vessel (PAV) is designed specifically to prepare specimens for tests developed by the Strategic Highway Research Program (SHRP) to simulate in-service oxidative aging that occurs in asphalt binders during service.

A PAV system consists of the following: ASME/CE code stainless steel pressure vessel enclosed in a stainless steel oven, pressure regulator, metering valve, pressure transducer and indicator, RTD, temperature controller with data logging, and pan holder.

#### *3.1.1 Vessel Certification*

ASME Code: Unless otherwise noted, the Pressure Aging Vessel (PAV) is designed, fabricated, inspected, tested, and stamped in accordance with the *ASME Boiler and Pressure Code*, Section VIII, Divison 1, for service at a maximum pressure of 2.45 MPa/350 psig and a maximum temperature of 150° C/300° F. *The ASME Boiler and Pressure Vessel Code* is an Internationally Recognized Standard.

Contact ATS for the vessel certificate/U-IA Report and CE Declaration of Conformity.

### 3.2 Specifications

Benchtop Unit	Integral Vessel/Oven Design Vertical Loading with Fixture
Specimen Capacity	10 Pans
Specimen Pans	Per AASHTO T 179
Physical Dimensions	30" high, 18" deep, 27 ½" wide (760 mm high, 460 mm deep, 700 mm wide)
Weight	290 lbs (130 kg)
Operating Pressure	304.5 psi (2.1 ±0.05 MPa)
Temperature Accuracy	Setpoint ±0.5°C
Temperature Range	80°C to 115°C
RTD Temperature Measurement	0.1°C Resolution and ±0.1° Accuracy Microprocessor Temperature Control
Overtemperature Protection	ASME Oven High Limit Switch 293°F (145°C)
Power Requirements	240 VAC, 10 amps, 50/60 Hz
Vessel Per ASME Code Section VIII	Division 1; 1992 A 93 Contact ATS with the PAV's serial number for a copy of the certification.
Vessel Design Conditions	325 psig (2.24 MPa) at 250°F (121°C)
Pressure Safety Release Valve	340 psi
Temperature Uniformity	±0.5°C
Pressure Display Accuracy	±1%
"TIME" Timer Accuracy	0.1%
"OUT OF RANGE" Timer Accuracy	0.1%

Air Inlet

Male ¼" NPT Fitting

Solenoid Valve

Closed when power is applied. In the event of power loss, solenoid valve will open and release any pressure in the PAV vessel.

### *3.3 Environmental Conditions*

Operation of the ATS Pressure Aging Vessel involves use of high temperatures and contents being contained at high pressure. The location and placement of the PAV should always take these elements into consideration to ensure a safe working environment. The PAV is meant for use in laboratory/factory settings in a dry and clean work environment. The work surface that the PAV is placed on should be a clean and sturdy work surface at a reasonable working height and away from any water, gas, or electrical hazards. The work surface should be able to support more than the weight of the unit itself. The indoor area the PAV is placed in should be well ventilated and containing no open flames or materials that may constitute a fire hazard.

# Section 4: Unpacking and Installation

## 4.1 Unpacking

Carefully unpack the equipment and inspect it for damage during shipment. Retain all cartons and packaging materials until the unit is operated and found to be in good condition. If damage has occurred during shipping, notify the carrier and ATS immediately. If it is necessary to file a damage claim, retain the packing materials for inspection by the carrier.

## 4.2 Installation

1. Use an overhead crane or forklift to remove the PAV from the crate and position it in the desired location.
2. Position the PAV in the testing position, such as on the PAV heavy-duty steel stand or on a workbench or lift cart.



**CAUTION:** All supporting and contacting surfaces must be nonflammable. Do not allow flammable materials to contact the shell.

3. Level the PAV by adjusting the screws on the four feet.
4. Inspect the O-ring seal. Make sure it is clean and lightly coated with silicone grease. If the O-ring appears to be worn or damaged, contact ATS.

## 4.3 Pan Holder Leveling

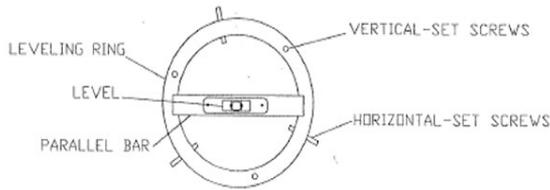
1. Once the PAV is in place, verify that the ring located inside the bottom of the pressure vessel is level by placing the parallel bar and a level across the top of the leveling ring.



**WARNING:** When placing the level and the parallel bar onto the ring, do not interfere with the RTD located in the bottom of the pressure vessel. The RTD is factory-set and should not be moved.

2. If the level indicates that the ring is not evenly balanced, make the necessary corrections by rotating the three vertical-set screws to lower or raise the ring. Use a 1/8" hex wrench to make this adjustment.

3. After leveling the ring, hand rotate the horizontal-set screws in order to secure the ring in the bottom of the vessel.



#### 4.4 Air and Power Connections

1. Install the air pressure line to the 1/4" male pipe-threaded fitting provided on the back of the control cabinet.



**CAUTION:** Use a regulated air supply of 340 to 350 psi (2.34 to 2.41 MPa). Do not exceed 350 psi (2.41 MPa) or the PAV's performance may be impaired by excessive pressure.

2. A connector is provided with the unit. This connector may be changed if it does not match the available receptacle. Power requirements are: 230-240 VAC,  $\pm 5$  V, 10 amp, single-phase, 50/60 Hz.



**CAUTION:** The PAV requires a minimum of 230 VAC to operate correctly. Check the supply voltage to ensure it is 230-240 VAC. If the supply voltage is less than 230 VAC, a Step-Up or Buck-Boost transformer can be supplied to provide the proper operating voltages. Contact ATS. Be prepared to provide the ATS Service representative with information about the available AC voltage so the correct transformer wiring configuration can be provided.



**CAUTION:** The PAV and control system must be grounded according to national and local code requirements.



3. If equipped, connect the optional UPS battery backup supply.
  - a. Use the supplied standard power cord to plug the UPS into the wall. The system should charge for 24 hours before connecting it to the PAV.
  - b. Attach the supplied cord from the UPS to the PAV.
  - c. See manufacturer’s literature for further setup instructions.
  
4. Check the flow adjust valve on the PAV (marked Flow Control) to ensure it is set at the correct values. This valve controls the rate at which the PAV depressurizes. When the flow adjust valve is set at the recommended setting, the PAV will depressurize at optimal rate. The unit will have a sticker (see below) with the correct values. Use the value marked Flow Adj.

NOTE: See Section 7 for information on what to do if the flow adjust valve detaches.

**ATS APPLIED TEST SYSTEMS**  
 THE MARK OF RELIABILITY  
 (724) 283-1212 www.atspa.com Service1@atspa.com  
 154 East Brook Lane • Butler, PA 16002

Date \_\_\_\_\_ Due \_\_\_\_\_

Verified By \_\_\_\_\_

ASTM \_\_\_\_\_

S/N : \_\_\_\_\_

TEMP: +/- 0.1 C

Pressure: +/-0.02 MPa

Flow Adj: \_\_\_\_\_



### 4.4.1 Regulator Connections

1. Secure the air connection to the air tank using the supplied male and female connections.

2. Connect the hose to the regulator.

NOTE: Do NOT connect the hose to the part marked FLOW. This is the pressure relief valve, and nothing should be connected to it.

NOTE: Outside of the United States, a different adapter may be required. A CGA adapter is included.

3. Attach the hose to the PAV using the quick connections. Connect the male end of the hose to the female connection on the PAV by sliding the female connection towards the PAV, connecting the hose, and releasing the slide.

4. Verify that all connections are tightly sealed by applying soapy water on the connections and turning on the air. If suds appear, apply more compound or tape to seal the leak.



## Section 5: Operation

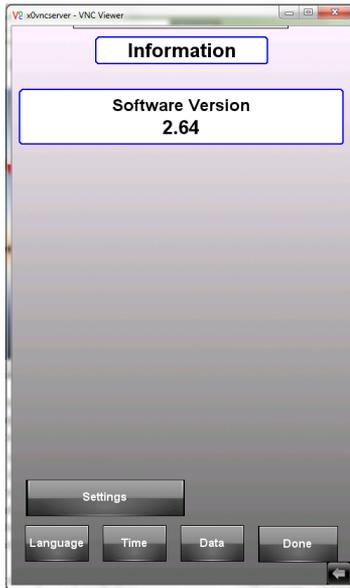
1. Power on the PAV by turning the Main Power switch located on the front of the PAV clockwise to the “ON” position.



NOTE: Make sure the air is connected and set at 340-350 psi as described in Section 4.4.

## 2. Software/Setting up User Language

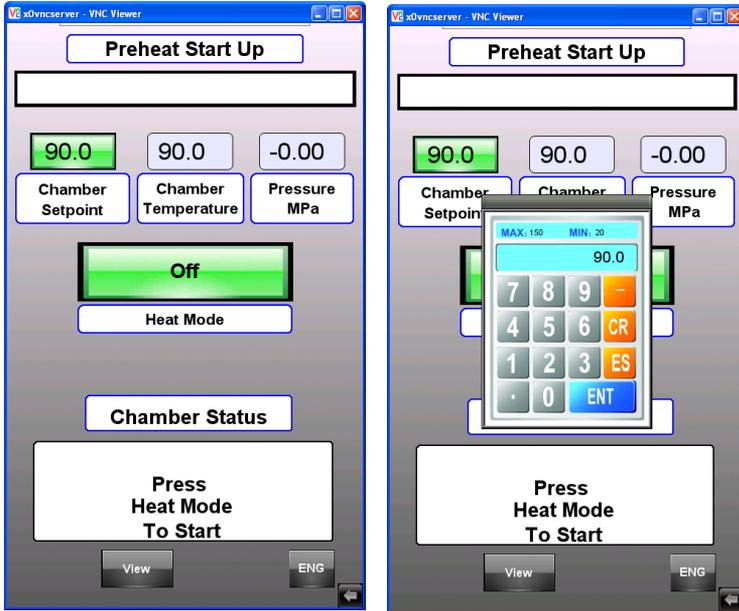
- a. Select “View.” This will display the Information screen. The current version of the PAV software will display.



- b. The PAV will display items in English as the default language. To change the language from English to one of the preprogrammed languages, access the options from the touch-screen display.
  - i. Select “View”
  - ii. Select “Language”



- iii. Touch the desired language for the display.
- c. Select “Done” to return to the preheat startup screen.



### 3. Setting up a Basic Test

#### a. Temperature

- i. Set the chamber setpoint by touching the green box above “Chamber Setpoint.”
- ii. Enter the setpoint temperature in the keypad that pops up.
  1. Temperature ranges are programmable from 50° C - 150° C; however, only temperatures between 80° C - 115° C are calibrated to be within  $\pm 0.5^\circ$  C of the setpoint.

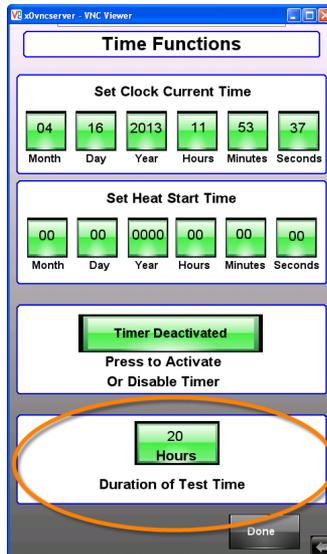
2. Do NOT enter a setpoint temperature higher than the actual temperature value which will be used for the Aging Procedure. The PAV is designed to operate most efficiently when the Pressure Vessel and Sample Rack are preheated to the temperature at which Aging will be done.

NOTE: Attempting to preheat the Pressure Vessel and/or Sample Rack to a higher temperature than the Aging procedure temperature may result in either a longer period of time required for the PAV to recover temperature after Pressure is applied and/or a poorer control of the chamber temperature after pressure is applied to the chamber.

- iii. When finished, touch "ENT."

b. Aging Duration

- i. Set the desired duration to age the samples by touching “View” and then “Time.” Touch the green box above “Duration of Test Time.”
- ii. Enter the amount of time desired for sample pressurization in the keypad that pops up.
  1. Time is programmable from 1 to 99 hours.
  2. ASTM D6521, AASHTO R28, and EN 14769 have specific time requirements. Check the latest standard for specific times if testing to these requirements.



- c. Select “Done” to return to the “Preheat Startup” screen.
- d. To change the soak time, select Settings from the Information screen. The soak time can be set at any time from 5-20 minutes.
  - i. If using preheated samples, the soak time can be reduced to five minutes. If the samples are at room temperature, select 20 minutes for the soak time. This will preheat the samples to the age temperature prior to aging.

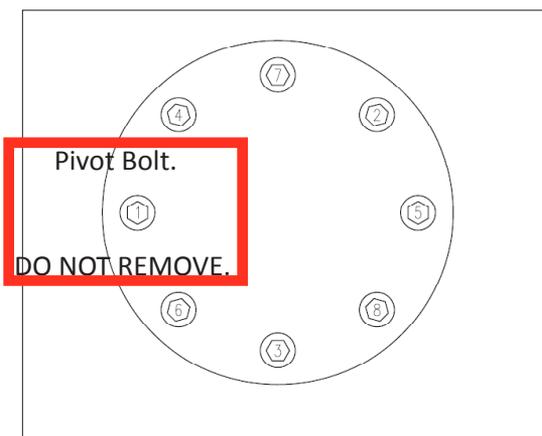


- e. The heaters on the PAV can be set to automatically shut off once a test is completed. Select “On” for this option. Selecting “Off” will cause the heaters to continue running after a test is complete.

- f. Insert the empty pan holder into the PAV and close the vessel lid.

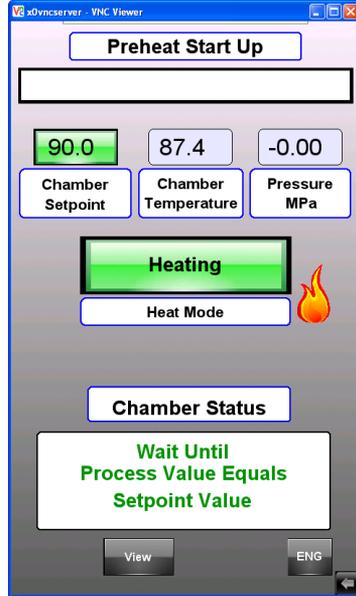
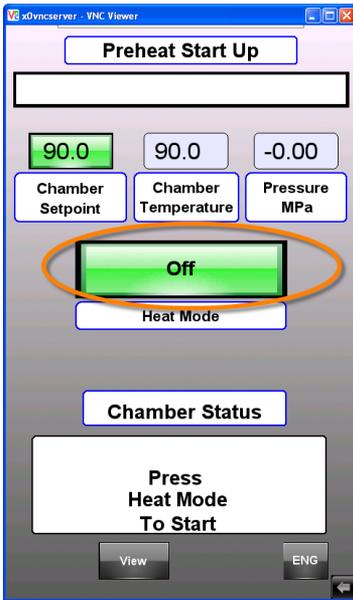
NOTE: Do NOT load any samples into the PAV at this time.

NOTE: Bolt 1 in the diagram is a pivot bolt and should only be loosened to allow the vessel lid to slide open and rest on the support block and to slide closed. This bolt should not be removed. Forcing this bolt may damage the bolt assembly.

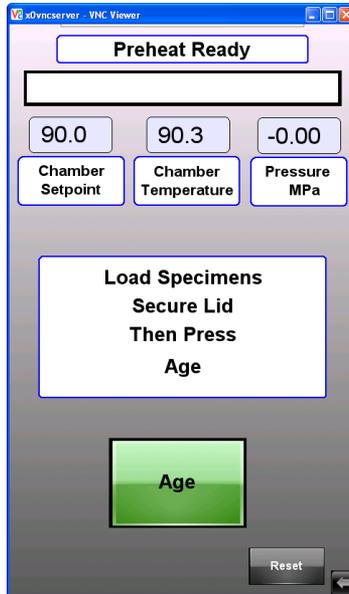


- g. Slide the vessel lid closed and insert bolts. The bolts only need to be engaged a turn or two. It is not necessary at this time to completely tighten the bolts. Close the oven lid and secure using the latches.

- h. Select “Off” from the “Preheat Start Up” screen to start the preheating process. When the PAV is heating, the Heat Mode will display “Heating” and a flame symbol will appear.



- i. Once the PAV has reached the setpoint, the display will prompt the operator to insert the specimens, secure the lid, and select “Age.”



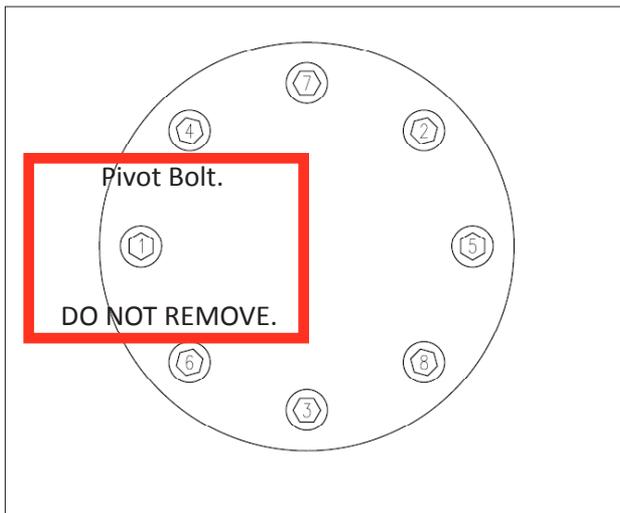
- i. Carefully remove the specimen holder from the PAV as it will be very hot.

NOTE: The PAV needs to experience heat loss so it knows what to do after “Age” is selected. If it does not experience heat loss, the PAV gets confused and does not know what to do next. This heat loss should happen when the specimens are loaded into the PAV.

- ii. Leave the vessel lid open. The PAV is designed to recover from the heat loss during this stage. If the vessel lid is closed and the temperature doesn't drop enough, the PAV may give erratic results and have a difficult time recovering to the setpoint.
- iii. Load specimens into rack.

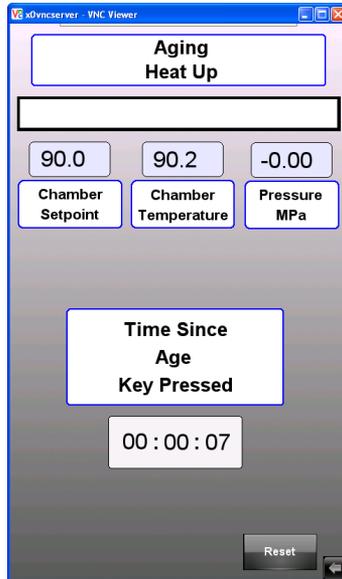
1. Load all ten pans into the sample holder even if there are not ten samples to age.
  - iv. Quickly and carefully return the sample holder to the PAV. The vessel temperature will decrease when the oven and vessel lids are open. To avoid a long temperature recovery, attempt to load the PAV and secure the vessel and oven lids as quickly and as safely as possible.

NOTE: Do not load samples into the PAV until the PAV is heated to the setpoint and the “Preheat Ready” screen is displayed.
  - v. Close the vessel lid and secure the bolts according to the diagram.



- vi. Tighten in sequential order with the wrench provided. Go around twice to tighten bolts to 55 inch/pounds.

- j. Once the vessel lid is secured, close the oven lid and secure with the latches.
- k. Immediately select “Age” from the touch screen. Do not wait for the temperature in the PAV to recover to the setpoint prior to selecting “Age.”
- l. The display will then resemble the image below and will attempt to recover the heat lost during specimen loading.



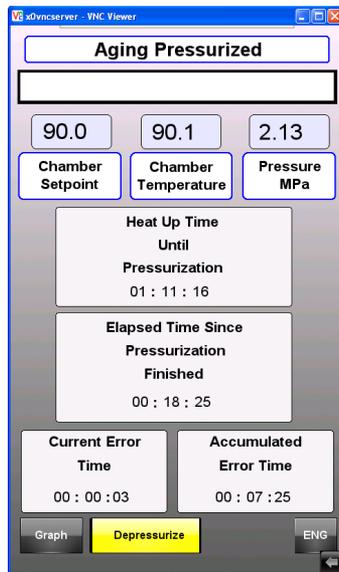
- m. Within two hours of selecting the “Age” function, the PAV temperature will recover the temperature lost while loading the samples. When the temperature recovers to within 0.3° C of the setpoint temperature, an approximate 20-minute delay will begin. This is built into the software to allow the chamber temperature to stabilize. Following this, the PAV will begin to pressurize. The timer on the Aging Heat Up screen will display the total time from when the “Age” button was pressed until the PAV starts to pressurize. When the PAV has pressurized to slightly above 2.00 MPa, the aging cycle will automatically begin. The screen shown at this time will resemble the “Aging Pressurized” screen.
  - i. If the PAV does not reach the setpoint and pressurize within the two-hour time frame or has difficulty returning to the setpoint after pressurizing, check that the power to the PAV is 230-240 volts. 230 volts electricity is the minimum required for the PAV to operate correctly.

If the power supply is 230-240 volts and the temperature has not recovered, verify the following:

- a. Be sure that the vessel lid remains open when loading sample pans into the sample holder.
- b. Verify that the samples are not being heated above the PAV setpoint prior to inserting them into the PAV.

c. Verify "Age" was selected from the touch screen immediately after loading the samples, securing the vessel, and latching the lid as described in the previous steps.

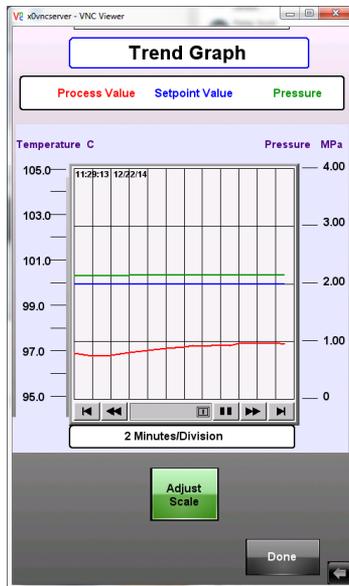
ii. If the PAV returns to the setpoint but does not pressurize completely, check that the air line is connected and open to allow 340-350 psi of airflow.



- n. Once this screen appears, the Current Error Time counter will begin to count. The Current Error Time counter will continue to count until the chamber temperature is within  $\pm 0.5^{\circ}$  C of the Chamber Setpoint. The Accumulated Error Time counter does not increment until the Current Error Time counter stops counting. At that time, the Current Error Time counter value will be loaded into the Accumulated Error Time counter. If the temperature or pressure inside the PAV goes outside of the allowable limits, the Current Error Time counter will reset and begin counting until the temperature and/or pressure has returned to within allowable limits, and the Accumulated Error Time counter will again be updated. The Accumulated Error Time counter will only update after the Current Error Time counter has quit counting.

NOTE: It is possible that the Current Error Time counter will continue to count for several seconds or more when the Chamber Temperature displayed is within  $\pm 0.5^{\circ}$  C of the Chamber Setpoint. This is normal and is due to the fact that the Chamber Temperature display is 1 decimal point of precision and is rounded up, while the error time is based on 3 decimal points of precision.

- o. Once the PAV is pressurized, it is possible to select “Graph” to see a graph of real-time data being collected.



- p. When finished, select “Done” to return to the previous screen.
- q. Once the test is complete, the display will change to resemble the one below. Pressure will automatically release in an approximate linear state and the PAV will remain at the preheated temperature until the “Reset” button is pressed.
- If the pressure does not release within the allowable time specified, check that the flow adjust valve located on the front of the PAV is open to the number stated on the calibration sticker.
  - To download data, select “Done” from the Aging Complete screen and then “Data” from the information screen.

**Aging Complete**

89.82      90.50      -0.00

Minimum Temperature      Maximum Temperature      Pressure MPa

Heat Up Time Until Pressurization  
01 : 11 : 16

Elapsed Time Since Pressurization Finished  
01 : 00 : 00

Current Error Time      Accumulated Error Time  
00 : 00 : 03      00 : 09 : 03

Done      Reset

**Information**

Software Version  
2.48E

Language

Time      **Data**      Overshoot      Done

**Historical Process Data**

Time	Temperature	Pressure
15:17:14	90.0	2.12
15:17:10	90.0	2.13
15:17:06	90.0	2.12
15:17:02	90.0	2.12
15:16:58	89.9	2.12
15:16:54	90.0	2.12
15:16:50	90.0	2.12
15:16:46	90.0	2.12
15:16:42	89.9	2.12
15:16:38	89.9	2.12
15:16:34	89.9	2.12
15:16:30	90.0	2.12
15:16:26	90.0	2.12
15:16:22	90.0	2.13
15:16:18	90.0	2.13
15:16:14	90.0	2.13
15:16:10	90.0	2.12
15:16:06	90.0	2.12
15:16:02	90.0	2.13
15:15:58	90.0	2.13
15:15:54	90.0	2.12
15:15:50	90.0	2.12
15:15:46	89.9	2.12
15:15:42	90.0	2.12
15:15:38	90.0	2.12

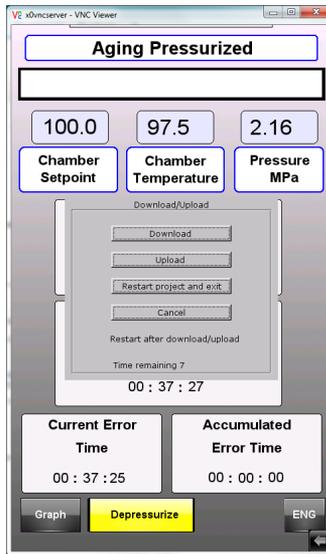
Backup Data USB 1

Backup Data Remote PC

Done

- iii. Insert a storage device into the USB port on the PAV.

NOTE: A window will appear any time a storage device is inserted into the USB port. Do not press anything at this time. The window will close after ten seconds.

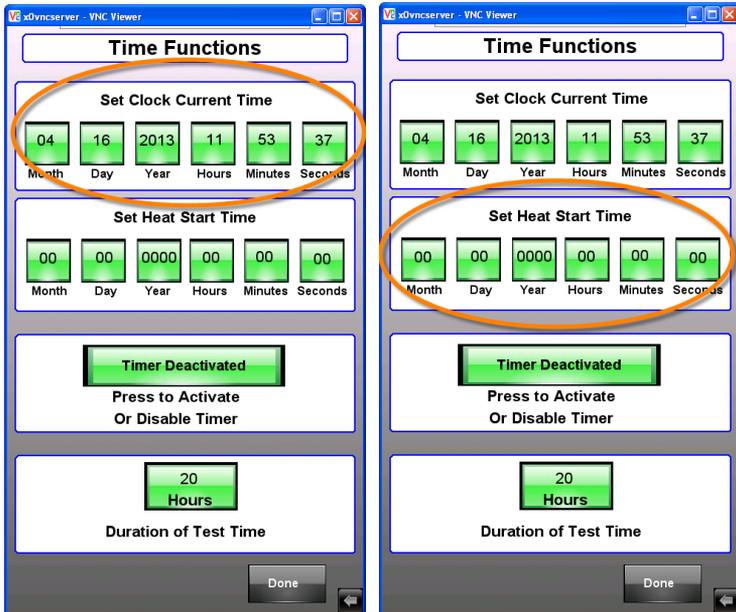


- iv. After the window closes, select “Backup Data USB1.”
  - 1. Data will be saved as a .CSV file that can be imported to Microsoft Excel®.

NOTE: The .csv files created use the US system of a comma as the delineator.

#### 4. Setting up Automatic Start

- a. From the Preheat Start Up screen, select “View” and then “Time” to reach the screen that will allow operators to set up the PAV to start automatically.

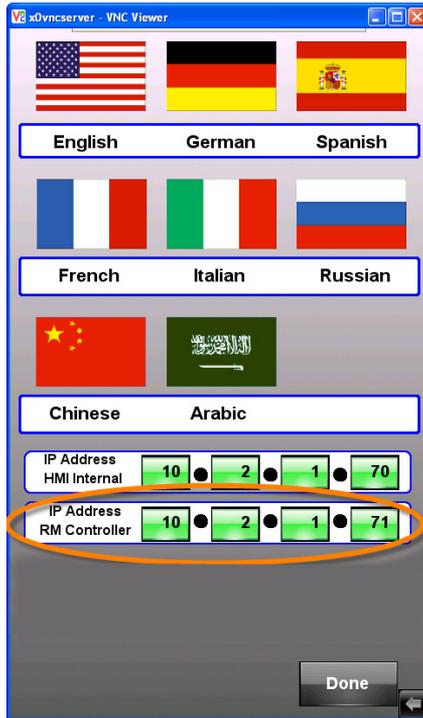


- b. Set the current time and date by selecting the green boxes and setting the current values in the “Set Clock Current Time” box.
- c. Set the time and date for the PAV to start automatically in the “Set Heat Start Time” box.
- d. Select “Timer Deactivated” to turn the timer on and enable automatic preheat at the time and date imputed.

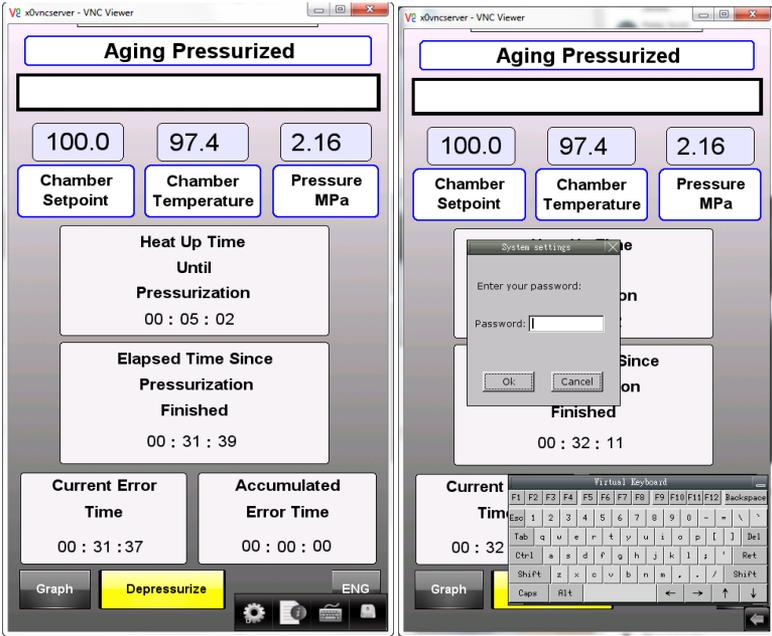
## 5. Setting up Remote Communication

- a. The PAV3 is network-ready and can be viewed and controlled with VNC Viewer software. ATS strongly recommends contacting a network administrator to set up this feature.
- b. Using VNC Viewer software requires two IP addresses (within 1/100 of each other), a subnet mask, and a gateway for each PAV3 on the network.
  - i. HMI IP Address: \_\_\_\_\_.\_\_\_\_\_.\_\_\_\_\_.\_\_\_\_\_
  - ii. RM IP Address: \_\_\_\_\_.\_\_\_\_\_.\_\_\_\_\_.\_\_\_\_\_
  - iii. Subnet Mask: \_\_\_\_\_.\_\_\_\_\_.\_\_\_\_\_.\_\_\_\_\_
  - iv. Gateway: \_\_\_\_\_.\_\_\_\_\_.\_\_\_\_\_.\_\_\_\_\_
- c. The HMI IP Address is the address of the touch screen controller.
- d. The RM IP Address is the address of the RM inside of the PAV. These two addresses need to be within 1/100 of each other to communicate.
  - i. Default settings are:
    1. HMI IP: 172.16.1.99
    2. RM IP: 172.16.1.100
    3. Sub: 255.255.255.0
- e. Check IP addresses and settings in **three** places.
  - i. On the PAV display, press View/Languages menu.
    1. Check the different languages and the IP addresses:  
HMI - 172.16.1.99 and  
RM - 172.16.1.100.

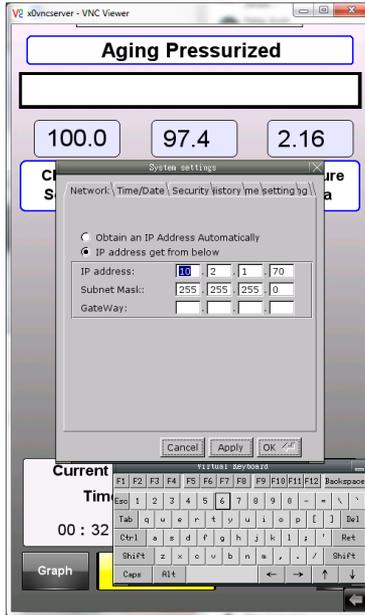
2. These settings may need to be entered.
3. Check/set the date and time.



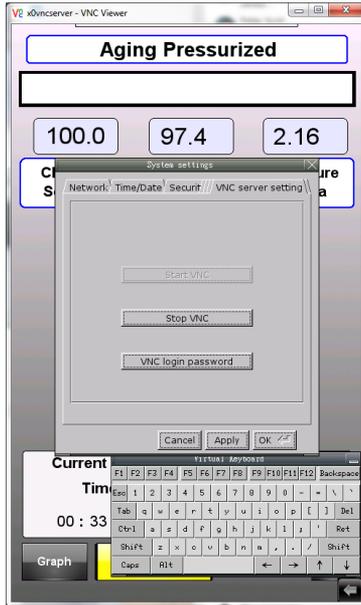
- ii. On the PAV display screen, use the "Settings" icon. This is a gear icon that appears in the lower right corner after the arrow is pressed.



1. Enter "1" six times on the "virtual keyboard."



2. Find the Network Tab and make sure the spot for “IP address get from below” is selected.
3. Fill in the correct numbers for the IP address. 172.16.1.99 is the default IP address. The subnet mask should be left as 255.255.255.0.
4. Go to the VNC Server tab, it is the second to the last tab and ensure “Start VNC” is greyed out. If it is not, select it to enable the VNC Viewer to connect.



iii. On the Watlow EZ\_Zone Controller:

1. Open the side panel of the PAV.
2. Find the RUI inside; it will look like the picture below:

NOTE: The RUI has many settings. Settings that are not mentioned in the instructions should not be changed. Changes to any other settings may cause the machine to function improperly.



3. Press the bottom two buttons simultaneously (the Advance key and the Down key) for three seconds until the digital display shows COM in the upper display and rUi in the lower display. The communication menu should appear.

NOTE: Use the Up and Down keys to move through the menus. The Infinity key goes back one menu level, the Advance key selects a menu.

4. Press the Advance key only until Com 1 appears.
5. Use the up arrow to change this to Com 2 and use the Advance key to select this menu.
  - a. iP.F1 is the first set of numbers in the IP address. Use the Up and Down keys to change this value to the desired value. The default value is 172. Select the Advance key when complete.



172  
Z  
O  
N  
E  
L I P . F 1

- b. iP.F2 is the second set of numbers in the IP address. Use the Up and Down keys to change this value to the desired value. The default value is 16. Select the Advance key when complete.



The image shows a digital display with two lines. The top line displays the number '16'. The bottom line displays the text 'ZONE' on the left and '1 P.F2' on the right. The '1' is positioned between the 'ZONE' label and the 'P.F2' text.

- c. iP.F3 is the third set of numbers in the IP address. Use the Up and Down keys to change this value to the desired value. The default value is 1. Select the Advance key when complete.



The image shows a digital display with two lines. The top line displays the number '1'. The bottom line displays the text 'ZONE' on the left and '1 P.F3' on the right. The '1' is positioned between the 'ZONE' label and the 'P.F3' text.

- d. iP.F4 is the fourth set of numbers in the IP address. Use the Up and Down keys to change this value to the desired value. The default value is 100. Select the Advance key when complete.

100  
ZONE  
IP.F4

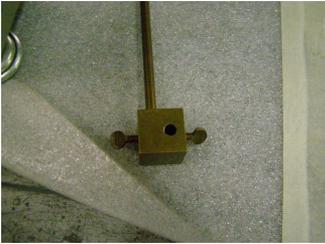
- e. The sub net can be changed the same way as the IP address. iP.FS1, iP.FS2, iP.FS3, and iP.FS4 are the values to change the sub net. The default values are 255.255.255.0. Use the Advance key to cycle through these options and use the Up and Down keys to change their values.
  
- f. Once all changes have been made, hold in the Infinity key for two seconds to return to the home page.
  
- g. Once all the values have been entered in the PAV under the languages section, under the settings section, and in the RUI, power off the PAV and then turn the PAV on again. If a yellow error box displays, check that the IP addresses are within 1/100 of each other and the same values have been entered in all three places in the PAV.

## Section 6: Verification

### 6.1 Verifying Temperature

To verify temperature:

1. Place the temperature probe inside the calibration block. Note the inside of the PAV after the pan holder is removed.



NOTE: This calibration block is from the ATS PAV Verification Kit. See Section 8.3.

2. Place the other hole in the calibration block over the RTD on the bottom of the vessel. Once the block is secure on the RTD and the temperature probe, slide the PAV lid closed. Use a small wrench or popsicle stick to keep the lid from pinching the wire on the temperature probe. **DO NOT BOLT THE LID DOWN.**



3. Verify the temperature.

- a. Set up the setpoint and start the PAV.

- b. Verify that the temperature display on the thermometer matches the temperature display on the PAV. Allow temperature to reach setpoint and stabilize for one hour.
- c. Note any difference and call ATS for calibration or use the difference to offset future tests.

NOTE: Do not verify temperature and pressure at the same time.

## 6.2 Verifying Pressure

To verify pressure:

1. Remove the screw in top of the vessel lid.



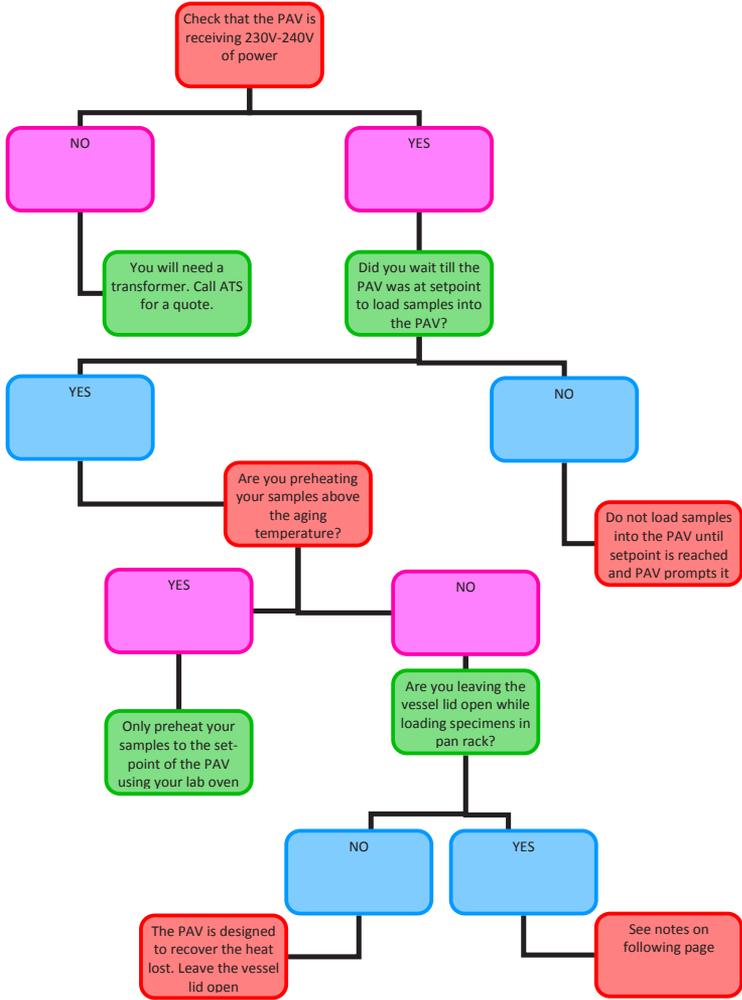
2. Screw the pressure gage into that space. Make sure the lid is secured according to the directions in Section 5.
3. Apply the pressure to the PAV. Allow pressure to reach 2.1 0.1 MPa and stabilize for fifteen minutes.
4. Verify that the display on the pressure gage matches the displayed pressure on the PAV display.
5. Note any difference and call ATS for calibration if the difference falls out of specification.

NOTE: It is best to have the PAV setpoint at a low temperature and the Soak Time set for five minutes.

NOTE: Do not verify temperature and pressure at the same time.

# Section 7: Troubleshooting

## 7.1 Temperature Does Not Recover to Setpoint



## 7.2 Troubleshooting the PAV Controller

The PAV3 was designed to allow for maximum user flexibility while also meeting the current ASTM, AASHTO, and EN specifications. The controller is programmed to respond to specific situations to allow for all of these criteria to be met.

Optimum Aging Performance is achieved by following these steps:

1. Preheat the PAV and empty the sample rack to the desired conditioning temperature.
2. When PAV shows the Preheat Ready screen:
  - a. Remove the hot sample rack.
  - b. Leave vessel lid open.
  - c. Load samples into the sample rack.
  - d. Place sample rack inside the pressure vessel.
  - e. Close lid and secure bolts as described.
  - f. Press “Age” immediately after lid is secured to begin the automatic aging process. Do NOT wait for temperature of the PAV to recover to the setpoint before pressing “Age” button.
3. Do NOT preheat samples prior to placing in PAV to a temperature higher than the temperature to be used to age the samples in the PAV. It is recommended to use room temperature samples. The built-in soak time will preheat the samples according to specification.

### 7.3 Reattaching the Flow Adjust Valve

In the event the flow adjust valve detaches, please use the following steps to correct it.

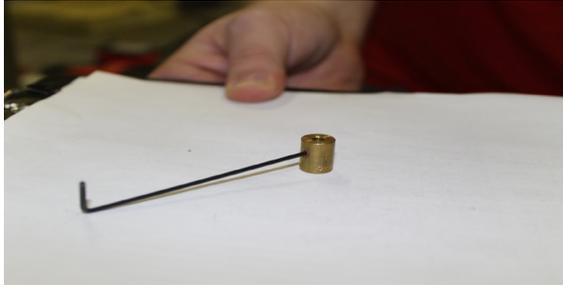
1. The flow adjust valve has three parts: the shaft, the brass collar, the adjustment knob.
2. The brass collar fits over the shaft, and the adjustment knob fits over the brass collar. If the brass collar is not visible, check the inside of the adjustment knob. If it is inside the adjustment knob, use a 1/16 in. hex wrench to loosen the screw in the adjustment valve so the brass collar can be removed.



3. Rotate the shaft fully clockwise to close the flow adjust valve.



4. Place the brass collar back on the shaft and ensure it is against the vernier barrel. Use a 1/16 in. hex wrench inserted into the hole shown below and tighten the brass collar onto the shaft, ensuring it stays tightly against the vernier barrel.



5. Line up the adjustment knob with zero at 12 o'clock, and insert over the brass collar and to the last line of the valve body. Using the 1/16 in. hex wrench, insert into the hole as shown below and tighten.



6. Turn the valve slowly counter-clockwise to open. Each full rotation should equal one line on the barrel. Rotate the knob to the value recorded on the calibration sticker. If there is no value on the calibration sticker, the default value is 10.

## 7.4 Updating the Software

1. Power up PAV3 from the front panel.
2. Unscrew USB port cover and install flash drive containing the updated version software into the USB port.
3. In a few seconds, a menu will pop up. Choose Download.
4. Another pop-up menu will appear prompting for a Password. Using the keyboard displayed on the screen below, type 111111 and select OK.
5. The next screen that appears will have 3 options.
  - a. ✓ Check the box that indicates Download Project Files.
  - b. Uncheck the boxes:
    - i. Clear History Files.
    - ii. Download History Files.
6. Two subdirectories will appear: pccard and usbdisk.
  - a. Select usbdisk.
  - b. Select disk\_a\_1.
  - c. Select OK.
7. The necessary files will now be downloaded.
8. Select View.
9. At the top of the screen, the current version of software should be indicated.
10. Select Done.

11. Verify IP address settings by selecting View, then Language.
12. All languages should have the first row indicating 172,16,1,99 and the second row indicating 172,16,1,100 unless changes were made to set up remote communication. If changes were made to set up remote communication, verify the settings are correct. If not correct, select the appropriate field and enter the correct setting.
13. The software update is now completed.

## Section 8: Maintenance

### 8.1 Preventive Maintenance

1. Keep the pressure vessel lid bolts lubricated using an anti-seize agent. Repeated insertion and extraction of stainless steel bolts in a stainless steel vessel without using anti-seize paste can cause galling. Lower speed insertion and extraction of bolts can also help to prevent galling. Use  $\frac{1}{4}$  to  $\frac{1}{2}$  the speed for steel in steel.
2. Periodically lubricate the O-ring with silicone lubricant. The O-ring is made of synthetic rubber and is located in the pressure vessel flange. Damaged or worn O-rings should be replaced with the same material.

### 8.2 Changing Fuses

1. Control Circuit Fuse: The control circuit fuse is a 2 amp, 250 volt 5 mm x 20 mm BUssmann GMA (or equivalent) fuse. It is located at the left rear of the system.
2. Heater Circuit Fuse: The heater circuit fuse is a 10 amp, 250 volt semiconductor-type BUssman GMA 2A (or equivalent) fuse. It is located inside the left control cabinet. If the heater circuit fuse should malfunction, contact the ATS Service Department at +1-724-283-1212 for instructions on how to service this fuse.

### 8.3 Spare Parts

Some parts are supplied from outside ATS. Refer to manufacturer’s literature.

#### Consumables

<b>Part Number</b>	<b>Description</b>
PAV1045	PAV O-Ring
PAV-PAN-KIT	Set Of (10) Specimen Pans
PAV-LUBE	Anti-Seize Lubricant
PAV1038	Fuse, 2A 5 X 20 MM Slow Blow F2
PAV1044	Fuse, 10 Amp 250 Volt
PAV1068	Led, Tri-Color Diffused
PAV1070	Led, Red Diffused 4
PAV1072	Led, Green Diffused 3

#### Accessories

<b>Part Number</b>	<b>Description</b>
PAV-115-SU-TRANS	Step-Up Transformer - Enables customers with power of 115 VAC, 1 Ph, 60 Hz, 10AMP to operate PAV (power requirements of 240 VAC, 1 Ph, 50/60 Hz, 10AMP.)
PAV-BUCK-TRANS	Buck Boost Transformer - Increases existing 208 volts to 230 volts
PAV-UPS-BU	UPS Battery Back Up System - Prevents Power Failures, Sags, Surges, Under and Over Voltages.
PAV-VER-KIT	PAV Verification Kit - Includes calibration block, thermometric device, and pressure gage

## Accessories

<b>Part Number</b>	<b>Description</b>
PAV-VER-KIT-NIST	NIST PAV Verification Kit - Includes calibration block, NIST certified thermometric device, and NIST certified pressure gage
PAV-STAND	PAV Steel Stand - Stand for PAV
PAV-CART	Hydraulic Lift Cart - for easy height adjustment of the PAV
PAV-LEVEL	Level with paralell bar
101521	RTD Thermometer W/Probe, Nist
100068	Digital Pressure Gage - NIST
100065	Thermometer
100067	Immersion Probe RTD - use with 100065
100069	Digital Pressure Gage
PAV-CAL-BLOCK	Calibration block for PAV

## Spare Parts

<b>Part Number</b>	<b>Description</b>
PAV-SS-REG-Europe	Single Stage Regulator for use in Europe
PAV-SS-REGULATOR	Single Stage Regulator
PAV-WRENCH	Wrench, Hex Socket 1/2 In Drive
PAV1148	Leveling Ring, 4-8310, Rv.2, It1
PAV9012	Tool, Pan Handling
PAV9015	Adapter, CGA
PAV9016	Wrench, Hex Socket 1/2In Drive
PAV9017	Wrench, Allen 1/8 Inch
PAV9020	Hose, High Pressure Assy
PAV-PAN-HOLDER	PAV Specimen Rack

# Appendix A: Warranty

## Warranty Statement

Your Applied Test Systems product has been manufactured and inspected by experienced craftsmen. Applied Test Systems warrants, for the original purchaser, each product to be free from defects in material and workmanship for a period of thirteen (13) months from date of shipment or twelve (12) months from date of installation whichever comes first.

This warranty does not apply to failures caused by normal usage, misuse, or repair or service by unauthorized personnel, nor does it cover limited life electrical components which deteriorate with age such as tubes, lamps, fuses, and heaters. The warranty does not extend to products not manufactured or assembled by Applied Test Systems.

This warranty is expressly limited to the repair, replacement, or adjustment of the product at Applied Test Systems' option. The product must be returned to the Applied Test Systems factory or an authorized repair center. Applied Test Systems shall not be liable for any labor, transportation, or installation costs that may arise in connection with the product or return.

To obtain warranty service:

1. Applied Test Systems must be promptly notified in writing of the defect.
2. Upon receipt of written authorization, said defective equipment is returned as directed, with transportation charges prepaid by the buyer and –
3. Applied Test Systems examination of such equipment discloses to its satisfaction that the defect exists and was not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranty of merchantability or fitness for particular purpose. In no event shall Applied Test Systems be liable for direct, indirect, special, incidental, collateral or consequential damages.

The aforementioned provisions do not extend the original warranty period of any article that has been either repaired or replaced by Applied Test Systems.

Applied Test Systems reserves the right to change published specifications.

DECLARATION OF CONFORMITY

Applied Test Systems  
154 East Brook Lane  
Butler, PA 16002  
Telephone: +1-724-283-1212

Product: Pressure Aging Vessel  
Model Number: PAV3-CE-EN, PAV2-CE, PAV3

The undersigned hereby declares, on behalf of Applied Test Systems of Butler, Pennsylvania, the above referenced product, to which this declaration relates, is in conformity with the following provisions.

Council Directive 98/37/EEC on the Approximation of Laws of the Member States Relating to Machinery/ECM;

Council Directive 89/336/EEC on Electromagnetic Compatibility;

Council Directive 73/23/EEC on General Electric Low Voltage Equipment.

The technical Construction File required by this directive is maintained at the corporate headquarters of Applied Test Systems, 154 East Brook Lane, Butler, Pennsylvania 16002.



David L. Fair  
General Manager  
Applied Test Systems



THE MARK OF RELIABILITY

154 East Brook Lane | Butler, PA 16002 USA | +1-724-283-1212 | [www.atspa.com](http://www.atspa.com)