



PAV4

Pressure Aging Vessel 4



This manual contains important operating and safety information. Carefully read and understand the contents of this manual prior to the operation of this equipment.

www.atspa.com

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Information in this document is subject to change without notice and does not represent a commitment on the part of:

Applied Test Systems (ATS)
154 East Brook Lane
Butler, PA 16002
USA

Telephone: +1-724-283-1212

For assistance with set-up or operation, contact the ATS service department. Please have this manual and product serial number available when you call.

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A. Introduction

A.1 Unpacking

Carefully remove the equipment and 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.

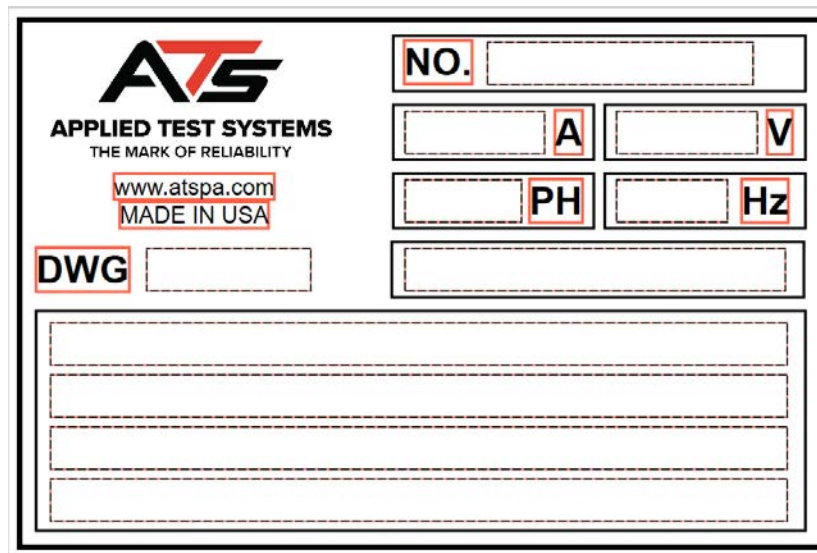
A.2 Warranty Information

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

A.3 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 from the View Screen and the serial number from the unit's data tag. A sample data tag is illustrated 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 the ATS Service Department.



The image shows a sample data tag for Applied Test Systems (ATS). The tag is rectangular with a black border and contains the following information and fields:

- ATS Logo:** The letters "ATS" in a stylized font, with "A" and "S" in black and "T" in red.
- Company Name:** "APPLIED TEST SYSTEMS" in bold black text.
- Tagline:** "THE MARK OF RELIABILITY" in smaller black text.
- Website:** "www.atspa.com" in a red-bordered box.
- Origin:** "MADE IN USA" in a red-bordered box.
- Serial Number:** "NO." followed by a large empty rectangular box.
- Software Revision:** A row of two boxes. The first box contains "A" and the second box contains "V".
- Hardware Revision:** A row of two boxes. The first box contains "PH" and the second box contains "Hz".
- Drawings:** "DWG" followed by an empty rectangular box.
- Description:** A large rectangular area at the bottom with four horizontal dashed lines for text entry.

Figure A.1: ATS Sample Data Tag

B. 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.

If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

B.1 For Owners, Operators, and Maintenance

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 Operators 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

B.2 Safety Instructions

1. Read and follow all warnings and caution statements in all related equipment manuals before attempting to operate this machine. If in doubt about any statement or sequence, contact the ATS Service Department.
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.

B.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.



WARNING: The PAV is designed to operate using grade D compressed breathing air ONLY. Use of other compressed gases may create potentially hazardous conditions and/or damage the PAV, and are NOT RECOMMENDED.

B.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 C 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.

C. System Overview

C.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 black powder coated steel enclosure, pressure regulator, metering valve, pressure transducer and indicator, RTD, temperature controller, data logging, and pan holder.

C.2 Vessel Certification

ASME Code: Unless otherwise noted, the PAV is designed, fabricated, inspected, tested, and stamped in accordance with the ASME Boiler and Pressure Code, Section VIII, and a maximum temperature of 121°C/250°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.

C.3 Specifications

Unit Design	Benchtop unit with integral vessel/oven design
Specimen Capacity	10 TFOT Sample pans
Specimen Pans	Per AASHTO T 179
Physical Dimensions	27 in. W x 18 in. D x 30 in H (685.8 mm W x 457.2 mm D x 762 mm H)
Weight	290 lbs (130 kg)
Operating Pressure	2.1 ± 0.05 MPa (304 psi)
Operating Temperature Range	Standard: 90°C, 100°C, and 110°C; Programmable from 50°C to 150°C
Temperature Accuracy	Setpoint ± 0.5°C
RTD Temperature Measurement	0.1°C Resolution and ± 0.1° accuracy Microprocessor Temperature Control with overlimit protection
Power Requirements	208-240 V, 1 ph, 50/60 Hz, 10 A

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 121°C/250°F
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 1/4" 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.

C.4 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 that the PAV is placed in should be well ventilated and containing no open flames or materials that may constitute a fire hazard.

D. Installation

D.1 Installation

1. Use an overhead crane or forklift to remove the PAV from the crate and position it in the desired location. Uncrated, the PAV 4 weighs 290 pounds and can be moved by hand with sufficient help. Avoid excessive leverage on control cabinet and cover grab handle. Use heavy gloves or other protection to prevent cutting or slicing your hands when lifting on the oven.
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.



WARNING: This equipment must be positioned so that the plug is accessible unless other means for disconnection from the power supply (e.g., circuit breaker or disconnect switch) is provided.

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.

D.2 Pan Holder Leveling

1. Once the PAV is in place, you will need to verify that the leveling ring is evenly balanced. The leveling ring is removed prior to shipment, and needs to be checked on a level surface with a level, prior to placing it back in the vessel.



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.

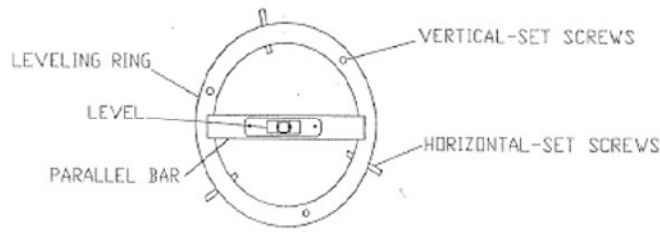


Figure D.1: Pan Holder Leveling

D.3 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. The provided power cord does not include a plug. The end user is responsible for connecting the appropriate plug in accordance with local electrical code. Power requirements are: 208-240 V, ± 5 V, 10 A, single-phase, 50/60 Hz.



CAUTION: The PAV requires a minimum of 208 V to operate correctly. Check the supply VAC to ensure it is 208-240 V. If the supply VAC is less than 208 V, a Step-Up or Buck-Boost transformer can be supplied to provide the proper operating VAC. Contact ATS. Be prepared to provide the ATS Service representative with information about the available VAC so the correct transformer wiring configuration can be provided.

**VAC requirement may change after testing.*



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



CAUTION: Do not replace detachable mains supply cords with inadequately rated cords. Failure to use properly rated cords may result in personal injury due to electric shock.



Figure D.2: Provided Cable Assembly - Customer to provide approved connector in accordance with local electric code.

3. If equipped, connect the optional UPS battery backup supply.
 - a. Provide power to the UPS to charge it. The system should charge for 24 hours before connecting it to the PAV.
 - b. Connect the supplied power cable between the UPS and the PAV.
 - c. Refer to UPS manufacturer's literature for further setup instructions.
4. Check the flow adjust valve on the PAV (marked Flow Control) to ensure it is set to the correct values. This valve controls the rate at which the PAV de-pressurizes. When the flow adjust valve is set to the recommended setting, the PAV will de-pressurize at optimal rate. The unit will be affixed with a label (Fig D.3) indicating the correct values. Refer to the value marked Flow Adj. (F.A.).



NOTE: See Troubleshooting Section H.3 to repair a detached flow adjust valve.

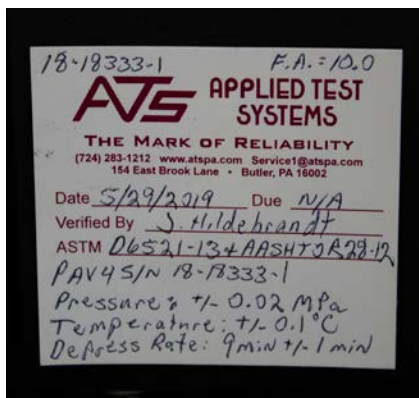


Figure D.3: Sticker with values



Figure D.4: Flow Control valve

D.4 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.



Figures D.5 - D.7: Regulator Connections

E. Software Overview

E.1 Software Screen Map

Figure E.1 shows the PAV's software screens.



Figure E.1: PAV Software Screen Map

E.2 Main Screen

Figure E.2 below shows the Main Screen, which displays when the PAV is started. It allows you to setup and run age cycles.

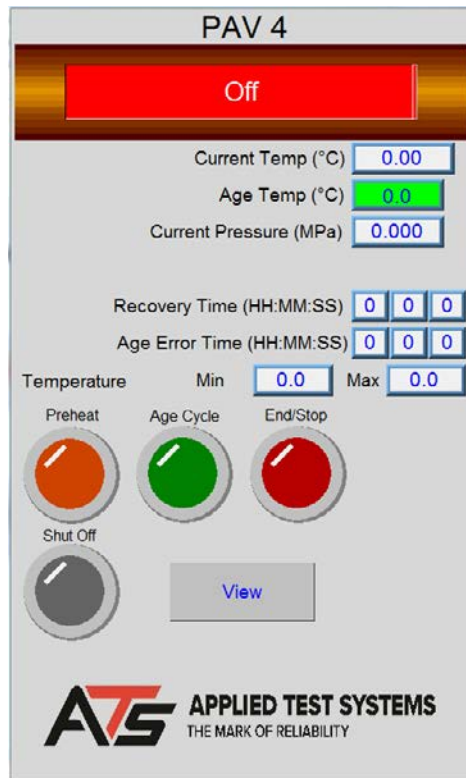


Figure E.2: PAV Main Screen

The screen will show values for current chamber temperature and pressure, chamber set point, remaining cycle time, minimum and maximum temperatures, and error times. It also has several controls to set-up and run the pressure aging vessel (PAV).

Preheat Button

Used to heat the PAV up to operating temperature before loading samples into the vessel.

Age Cycle Button

Used to tell the system that parts are loaded and to start the recovery for the age cycle.

End/Stop Button

Used to tell the system to finish the cycle. It can also be used anytime the PAV is in cycle to stop the age cycle. When the age cycle has finished this button will blink to show the cycle is finished. If pressed while in an aging cycle a pop-up dialog will ask if you are sure you wish to end the current test.

Shut Off Button

Can be used at any time to shut down the PAV. This will stop all cycles, shut off heat, and reset the system to the off state. If pressed a pop-up dialog will ask if you are sure you wish to end the current test.

View Button

Used to get to all other screens in the system for set-up. This button will be replaced with a Graph Button when an age cycle is running. See sections below referencing the Graph and Data screens for more information.

Below is what the main screen looks like when the system is in aging cycle state. Note the “Remaining Time” being displayed. This will show up for the Preheat Delay and the Aging Cycle states and will display the time remaining for this part of the cycle.

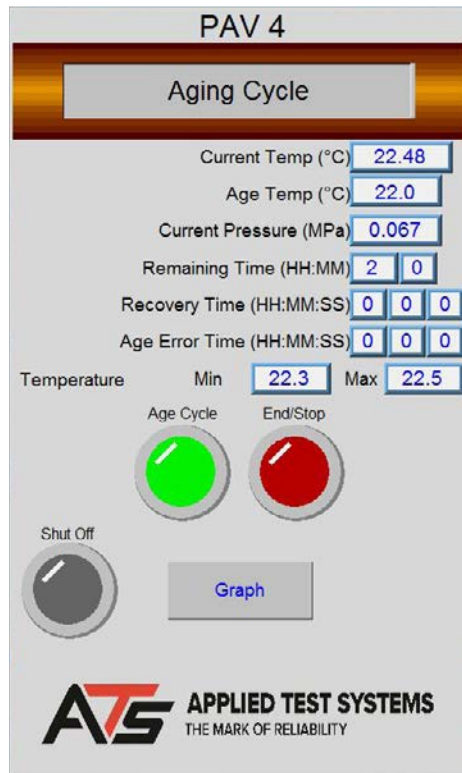


Figure E.3: PAV Main Screen - Aging Cycle

Near the top of the display is a status bar that will show the current state of the oven cycle. Below are the different states in the order that they usually run.

Off State



Figure E.4: Off State

Displayed when the system is sitting idle. No heat or cycle is running.



Figure E.5: Preheat State

Preheat State

Displayed when the chamber is heating up. The system will stay here until the chamber is at temperature and stable.



Figure E.6: Load Samples State

Load Samples State

Displayed when the chamber is stable at temperature. The system will stay here until the Age Cycle button is pressed.

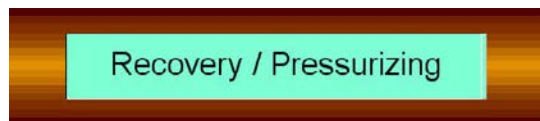


Figure E.7: Recovery / Pressurizing State

Recovery / Pressurizing State

Displays when the Age Cycle button has been pressed. The system will recover to the cycle temperature. When it gets within the pressure temperature window it will start to pressurize. It will stay in this state until the vessel is at cycle temperature and pressure.

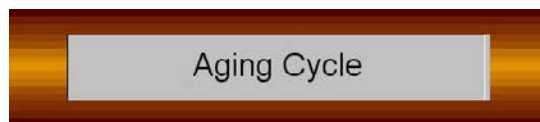


Figure E.8: Aging Cycle State

Aging Cycle State

Displays when the vessel is at cycle temperature and pressure, and the age cycle starts. It will stay in this state holding temperature and pressure until the age cycle has timed out.

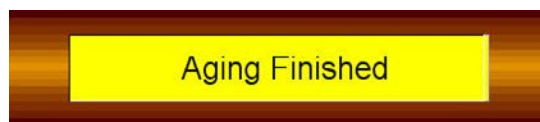


Figure E.9: Aging Finished State

Aging Finished State

Displays when the age cycle has timed out and the system is waiting for the operator to press the “End” button and remove the parts.



CAUTION: The parts are still very hot.



NOTE: Press “End/Stop” to leave the heaters on for the next cycle or press “Shut Off” to turn the heaters off.



Figure E.10: Preheat Delay State

Preheat Delay State

Displays when the system has been set up to start the preheat automatically after a time delay.

Graph Button

Will switch to the Graph View Screen. Fig. E.11 shows the Graph screen that is available when you press the Graph button on the Main Screen. It allows you to view the graph and data of the currently running age cycle. Current recovery time and age error time are displayed on the graph view screen.

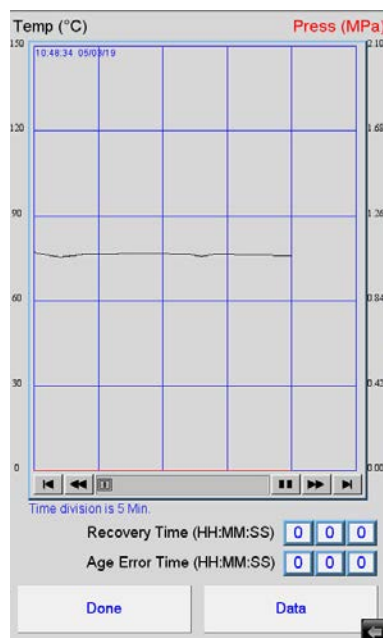


Figure E.11: Graph Screen

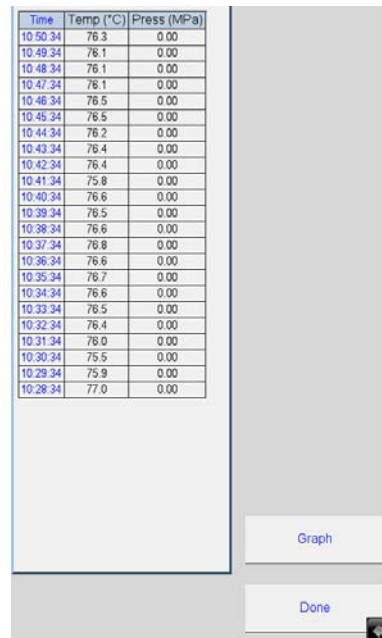


Figure E.12: Data Screen



NOTE: When in the graph view, pressing either the min or max value of either temperature or pressure will allow you to adjust the scale values or graph scaling.

Graph Scale

Selecting the Graph Scale button displays a dialog box that allows adjustments to the scale values and graph scaling.

Data Button

Will switch to the Data View Screen as shown in Fig. E.12.

Done Button

Will return you to the Main Screen.

E.3 View Screen

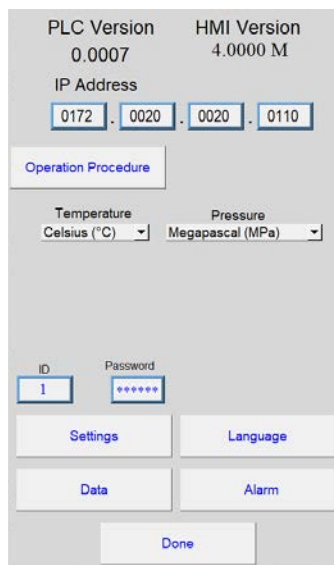


Figure E.13: View Screen

Figure E.13 shows the View Screen. It is displayed anytime the View button is pressed on the Main Screen. It allows access to the rest of the screens in the system. If the system is not idle this button is not visible and you will not be able to get to this screen to make changes.

The screen will show the current version of the software in the PLC and HMI. This is very important information, and is most often asked for when calling into ATS service.

IP Address

Used to allow someone at a remote location to monitor the system using a VNC viewer program. There is no password, but there is no machine control either.

ID

A user ID and should be set to the user access you wish to use.

Password

Associated with the User ID and used to access other screens. When the correct ID and Password are entered other buttons (colored on the above screen) will be displayed.

Standardize Button

Will not be displayed until the correct ID and Password have been entered. Once it is displayed, pressing it will go to the standardize screen. (Default ID: 2, Password: 222222).

Passwords Button

Will not be displayed until the correct ID and Password have been entered. Once it is displayed, pressing it will go to the password screen. (Default ID: 3, Password: 333333).

Language, Settings, Alarm, and Data Buttons

Each take you to their respective screens, which are described later in this section.

Done Button

Will return you to the Main Screen.

E.4 Language Screen

Figure E.14 displays the Language Screen, which is shown when you press the Language Button on the View Screen. It allows you to set the language used in all screens.

Simply select your language of choice then press the Done button to go back to the View Screen.

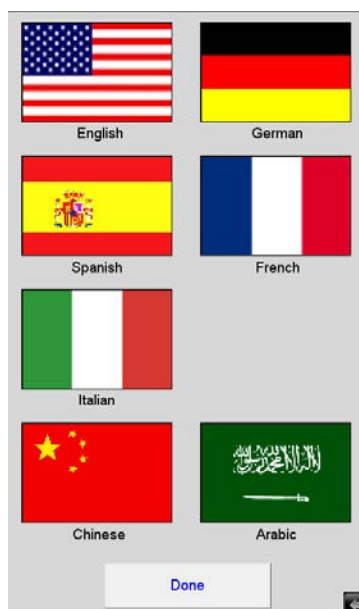


Figure E.14: Language Screen

E.5 Settings Screen

Figure E.15 below shows the Settings Screen, which is displayed when the Settings button is pressed on the View screen. It allows set up of the system.

The screenshot displays the Settings Screen with the following parameters and options:

- Pressure Temp Window (°C): 5.0
- Age Time (hr): 0.01
- Age Temp (°C): 22.0
- Age Pressure (MPa): 0.000
- Pressure Alarm Time (min): 0.50
- Recovery Limit (min): 17.00
- Age Limit (min): 60.00
- Disable Procedure Popup
- Disable end-of-test alarm
- Stop test on all errors
- Current Time: 04 / 27 / 2021 / 12 / 19 / 01 (Month, Day, Year, Hours, Minutes, Seconds)
- Preheat Delay: Hours 0, Minutes 1
- Done button

Figure E.15: Settings Screen

Pressure Temp Window

Indicates the amount of temperature below the cycle temperature that the system will start to pressurize. Once the age button is pressed the system will recover temperature. When it passes the (Age Temp – Pressure Temp Window) temperature the system will start to pressurize. It is recommended not to change factory settings.

Age Time

The time that the system will run the age cycle. It starts to record time after the age button is pressed and the system has recovered to temperature and pressure.

Age Temp

The current temperature set-point that the system must hold during the age cycle. It controls within +/- 0.5°C during the test.

Age Pressure

The pressure that the system must hold during the age cycle portion of the test. This needs to be set close to 2.1 MPa with a window of +/- 0.1 MPa during a test.

Pressure Alarm Time

The amount of time that the system has to reach the age pressure once the system starts to pressurize. If it does not reach pressure within this time a pressure error is set.

Recovery Limit

Sets the maximum recovery error time that the system may have before a recovery error is set.

Age Limit

Sets the maximum age error time that the system may have before an age error is set.

Temperature Drop-Down Field

Allows the operator to select which units of temperature the system will display in its screens.

Pressure Drop-Down Field

Allows the selection of which units of pressure the system will display in its screens.

Disable Procedure Popup Checkbox

Select to disable the Operation Procedure Screen from popping up each time the “Preheat” button is pressed.

Disable End-of-Test Alarm Checkbox

Select to disable the Operation Procedure Screen from popping up each time the “Preheat” button is pressed.

Stop Test on All Errors Checkbox

Selects what the system will do if an error is generated. If checked, the system will stop the test and display the alarm screen when any of the following errors happen:

- Over Temperature
- Recovery Error Limit
- Age Error Limit
- No Pressure Error
- Standardization Error

Current Time

Allows the operator to set the current time of the system. This will affect any log files created.

Preheat Delay

Used to allow the system to be set up to start automatically after a time delay. Just enter the Hours and Minutes you wish to wait before preheat start and press the yellow button. The button will light to show that a delay has been set. The delay button is a toggle switch, so to turn off a delay that has been started just press the button again. The status of the system will show “Preheat Delay” when it is active and the remaining time before preheat start is shown.

Done Button

The Done button will return you to the View Screen.

E.6 Alarm Screen

Figure E.16 shows the Alarm Screen. It is shown anytime the Alarm button is pressed on the View Screen, and also when the system detects an alarm or warning and the “Stop Test on All Errors” checkbox is selected.

It will show all current alarms (in Red). You can try to reset these with the “Reset” button. Some alarms will go away automatically when the alarm condition goes away.

Alarm Off Button

Will turn off the alarm buzzer if it is on.

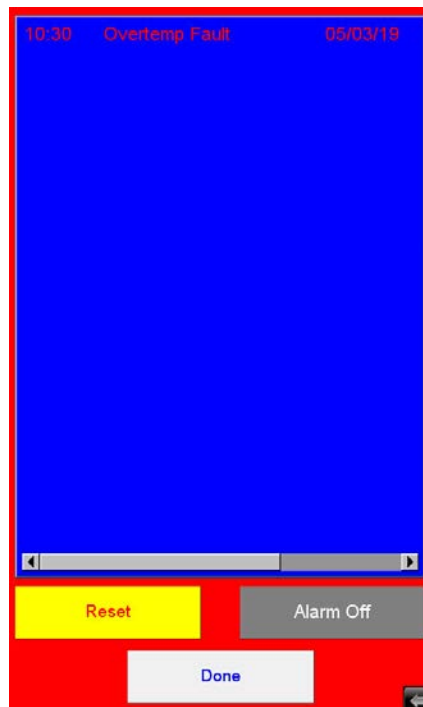


Figure E.16: Alarm Screen

Done Button

Will return you to the Main Screen.

E.8 Operation Procedure Screen

Figure E.19 shows the Operation Procedure screen. This screen provides the operator with a step-by-step procedure on how to properly operate the PAV. This screen can be accessed from the View Screen or when the operator presses the 'Preheat' button from the Main Screen. The screen popup appears after the operator presses the 'Preheat' button can be disabled/enabled from a checkbox located on the Settings Screen.

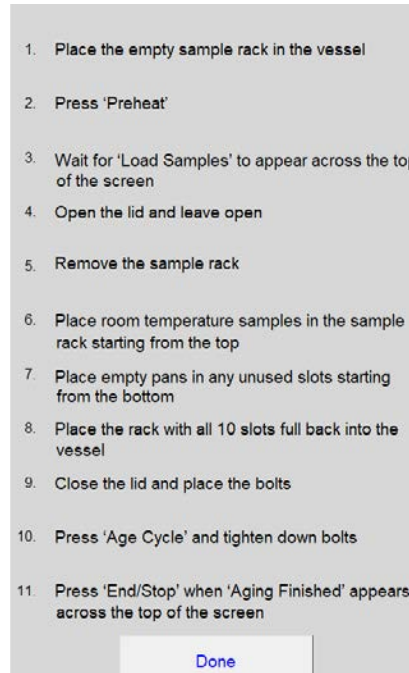


Figure E.19: Operation Procedure Screen

F. Operation

The process below assumes that the PAV has been standardized, air pressure has been attached to the PAV, and that the system is ready to run test cycles.

1. Turn the power switch on the front of the PAV to the ON position. The HMI display will power on. The status display will show “Off”.
2. Select “View” on the HMI Main Screen.
3. Select “Settings” on the HMI View Screen.
4. Verify that all the parameters are set correctly for your application.
5. Select “Done” to return to the View Screen.
6. Select “Done” to return to the Main Screen.
7. Open the oven lid by unlatching the latches. Unbolt (see note below) and open the vessel lid. Insert an EMPTY pan holder into the PAV vessel.



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



NOTE: Bolt 1 in Figure F.1 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.

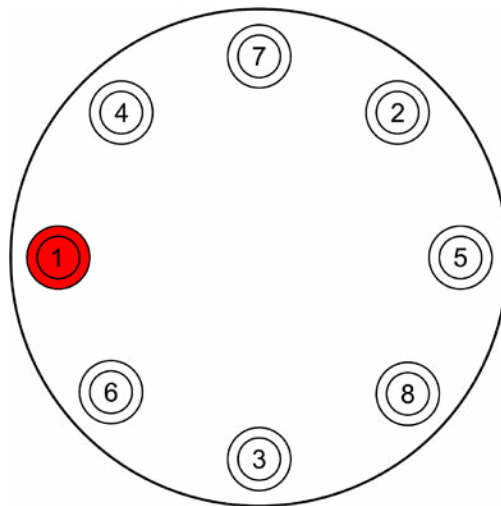


Figure F.1 - Bolt 1

8. 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.
9. Press the “Preheat” button. The system should change the status display to “Preheat” and the temperature should slowly start to rise.
10. Wait until the status display changes to “Load Samples.” It will do this when the vessel is at the age cycle temperature and stable. This is a good time to get your samples ready, if you have not already done so.
11. When the status display changes to “Load Samples” open the oven lid by unlatching the latches. Unbolt and open the vessel lid. Carefully remove the specimen holder from the PAV as it will be very hot.
12. Load specimens into the rack. Load all ten pans into the sample holder even if there are not ten samples to age.
13. 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.
14. Close the vessel lid and secure the bolts according to Figure F.1. Tighten in sequential order with the wrench provided. Go around twice to tighten bolts to 55 inch/pounds.
15. Once the vessel lid is secured, close the oven lid and secure with latches.
16. Press the “Age Cycle” button immediately, DO NOT WAIT for the temperature in the PAV to recover to the age setpoint. The status display should change to “Recovery / Pressurizing”. Be mindful of the pressure setpoint.
17. Once the temperature and pressure are stable the status display will change to “Aging Cycle” and the remaining time will be displayed.
18. When the age cycle time has expired the status display will change to “Aging Finished.”
19. The system will wait here until you press the “End / Stop” button.



CAUTION: When the age cycle finishes there is still pressure in the vessel. This has a slow linear bleed down and will take about 9-10 minutes. Check the current pressure reading and make sure the vessel is NOT pressurized before you attempt to remove samples.

G. Verification

G.1 Verifying Temperature

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

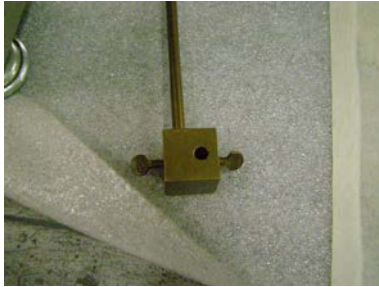


Figure G.1: Temperature Probe
Inside Calibration Block



Figure G.2: Inside of PAV



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

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 wooden block to keep the lid from pinching the wire on the temperature probe. **DO NOT BOLT THE LID DOWN.**



Figure G.3: Calibration block on RTD



Figure G.4: Keep Lid from Pinching Wire

3. Set up the setpoint and start the PAV.
4. 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.
5. Note any difference and call ATS for calibration, or use the difference to offset future tests.

G.2 Verifying Pressure

1. Remove the brass plug from the vessel lid.

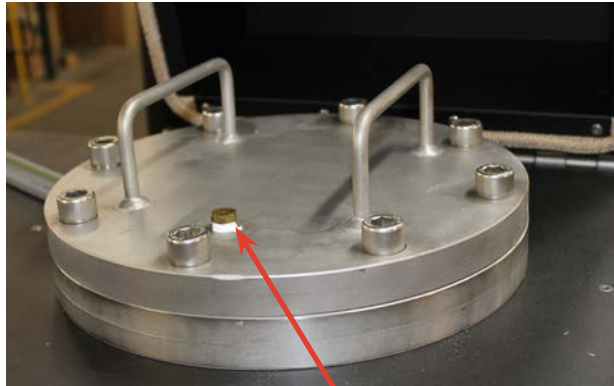


Figure G.5: Screw on Vessel Lid

2. Screw the pressure gage into that space. Make sure the lid is secured according to the directions in Section F, Step 14.
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.



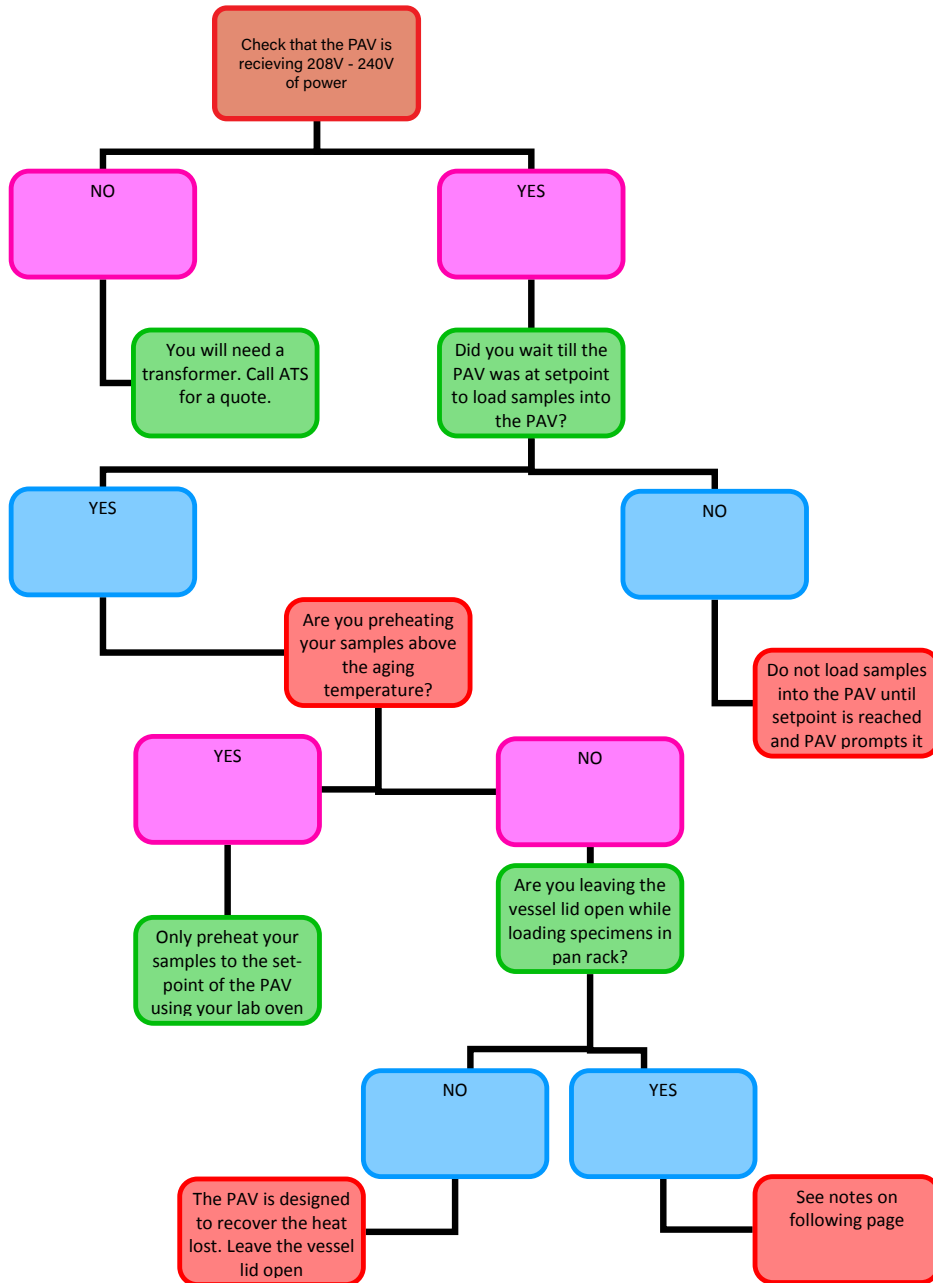
NOTE: For best results, set the PAV setpoint at a low temperature.



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

H. Troubleshooting

H.1 Temperature Does Not Recover to Setpoint



H.2 Troubleshooting the PAV Controller

The PAV4 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 sample rack to the desired conditioning temperature.
2. When PAV shows the Load Samples status display:
 - 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 the “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 PAV will preheat the samples according to specification.

H.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, and the adjustment knob.



Figure H.1: Detached Flow Adjust Valve



Figure H.2: Flow Control without Valve

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 (Figure H.3) and tighten the brass collar onto the shaft, ensuring it stays tightly against the vernier barrel.

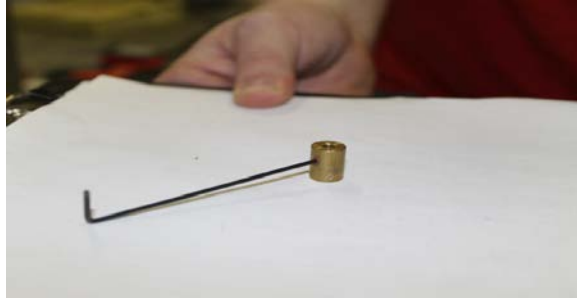


Figure H.3: Tighten with Hex Wrench

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 in Figure H.4 and tighten.



Figure H.4: Turn Valve Counter-Clockwise

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.

H.4 New HMI Software

From time to time a new software version may come out for the HMI. Below are instructions for downloading the new software. The new version of software must be on the root of a flash drive.

1. Power up the machine.
2. Open USB port cover and install flash drive containing the new version of software into the USB port.

3. After a few seconds the menu in Figure H.5 will appear. Choose Download.



Figure H.5: Pop-Up Menu



Figure H.6: Second Pop-Up Window

4. Another pop-up menu will appear prompting for a password. Using the keyboard displayed on the screen (Figure H.6), enter 111111. Check the box that indicates Download Project Files and uncheck the boxes that indicate Clear History Files and Download History Files and select OK.

5. Next will appear 2 subdirectories - pccard and usbdisk. Click usbdisk, select disk_a_1, and click OK.



Figure H.7: disk_a_1

6. The necessary files will now be downloaded.

7. When done, remove the flash drive and replace the USB port cap.

H.5 New PLC Software

Periodically a new software version may be released for the PLC. If you need a new version, or to reload a version, please contact ATS service for help.

H.6 New Temperature Controller Software

Periodically a new software version may be released for the temperature controller. If you need a new version, or to reload a version, please contact ATS service for help.

I. Maintenance

I.1 Preventative 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.

I.2 Cleaning

Before cleaning the PAV4, unplug the machine and allow it to cool. Always wear personal protective gear, and clean using Acetone. Do not use any other flammable solvents to clean this machine. Allow equipment to sit, with lid open, for a minimum of 15 minutes before further use to allow any vapors from the cleaning solvent to dissipate.



WARNING: Do not use flammable solvents other than what is specified.



WARNING: Using solvents or products not specified by the equipment manufacturer may create potential for formation of flammable or volatile gas mixtures. Always refer to product SDS or contact the manufacturer.

I.3 Changing Fuses

1. Control Circuit Fuse (FU1 & FU2): The control circuit fuse is a 2 A, 250 V $\frac{1}{4}$ " x $1\text{-}\frac{1}{4}$ " Bussmann MDC (or equivalent) fuse.
2. Heater Circuit Fuse (FU3 & FU4): The heater circuit fuse is a 10 A, 250 V Bussman GBB (or equivalent) fuse.

I.4 Spare Parts

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

Consumables

Part Number	Description
PAV1045	PAV O-Ring
PAV-PAN-KIT	Set of Ten (10) Specimen Pans
PAV-LUBE	Anti-Seize Lubricant for Lid Bolts
102674	Fuse, 10 A, 250 V
ELE6110	Fuse, 2 A, 250 V

Accessories

Part Number	Description
PAV-115-SU-TRANS	Step-Up Transformer - Enables customers with power of 115 V, 1 Ph, 60 Hz, 10A to operate PAV (power requirements of 208-240 V, 1 Ph, 50/60 Hz, 10A). <i>*May not be needed based on testing</i>
PAV-UPS-BU	UPS Battery Back Up System - Prevents Power Failures, Sags, Surges, Under and Over VAC. <i>*May not be needed based on testing</i>
PAV-VER-KIT	PAV Verification Kit - Includes calibration block, thermometric device, and pressure gage
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	Hydrolic Lift Cart - for easy height adjustment of the PAV
PAV-LEVEL	Level with parallel bar
101521	RTD Thermometer w/Probe, NIST
100068	Digital Pressure Gage - NIST
100065	Thermometer
100067	Immersion Probe RTD - use with 100065

Part Number	Description
100069	Digital Pressure Gage
PAV-CAL-BLOCK	Calibration Block for PAV

Spare Parts

Part Number	Description
PAV-SS-REG-Europe	Single Stage Regulator for use in Europe
PAV-SS-REGULATOR	Single Stage Regulator
PAV1148	Leveling Ring, 4-8310, Rv.2, It1
PAV9012	Tool, Pan Handling
PAV9015	Nut for CGA 346 Cottles
PAV9015A	Nipple for CGA 346 Bottles
PAV9016	Wrench, Hex Socket 1/2In Drive
PAV9017	Wrench, Allen 1/8 Inch
PAV9020	Hose, High Pressure Assy
PAV-PAN-HOLDER	PAV Specimen Rack
102564	Stylus Pen
102565	Stylus Holder

I.5 Safe State Verification

Before re-starting the normal operations, the maintenance personnel should verify that everything is in a safe condition.

1. Verify proper operation of any repaired or replaced components.
2. Recalibrate when necessary.
3. Check for pressure leaks.
4. Check electrical components are properly grounded.
5. Check temperature chamber is clear and properly closed.
6. Check power cord is plugged in.
7. Boot up and check all systems are running properly on HMI (touchscreen).

Only after these verifications have been carried out successfully the Pressure Aging Vessel can return to normal operation.

Appendix A: Warranty

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, IAs, fuses, and heaters. Load cells are covered for manufactured defects only - incidents of over load or other customer misuse are not covered under warranty. 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.

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