



# 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](http://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

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## A.1 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.

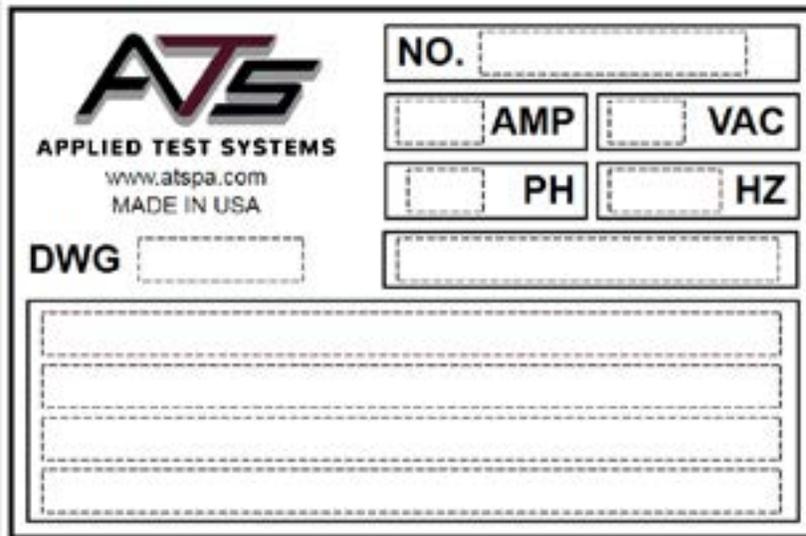
## A.2 Warranty Information

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 rectangular data tag form for Applied Test Systems (ATS). On the left side, there is the ATS logo (stylized 'ATS' in red and black), the text 'APPLIED TEST SYSTEMS', the website 'www.atspa.com', and 'MADE IN USA'. Below this is a field labeled 'DWG' with a dashed box. On the right side, there are several input fields: 'NO.' with a dashed box, a row with 'AMP' and 'VAC' each in a dashed box, a row with 'PH' and 'HZ' each in a dashed box, and a long dashed box. At the bottom, there are three horizontal dashed lines for additional information.

Figure A.1: ATS Sample Data Tag

## B. Safety

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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.

### 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.

### 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

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### 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 with 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 110°C/121°C. 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

Benchtop Unit	Integral Vessel/Oven Design Vertical Loading with Fixture
Specimen Capacity	10 Pans
Specimen Pans	Per AASHTO T 179
Physical Dimensions	30" high, 22" deep, 27" wide (760mm high, 558.8 mm deep, 685.8 mm wide)
Weight	300 lbs (136.078 kg)
Operating Pressure	304.5 psi (2.1± 0.05 MPa)
Temperature Accuracy	Setpoint ± 0.5°C
Temperature Range	80°C to 110°C/121°C

RTD Temperature Measurement	0.1°C Resolution and ± 0.1° accuracy Microprocessor Temperature Control with overlimit protection
Power Requirements	230/240 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 110°C/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 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

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### D.1 Unpacking

Carefully unpack the equipment and inspect it for damage during shipment. 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 the carrier and ATS immediately. If it is necessary to file a damage claim, retain the packaging materials for inspection by the carrier.

### D.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.

### D.3 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.

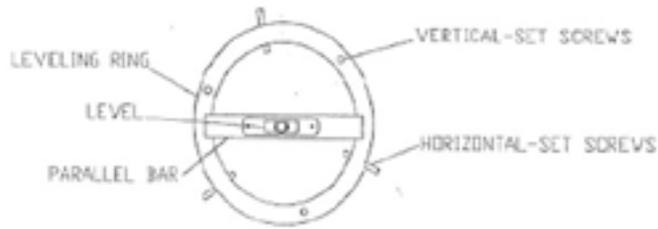


Figure D.1: Pan Holder Leveling

## D.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.



Figure D.2: Power connector

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 I.Maintenance for information on what to do if the flow adjust valve detaches.

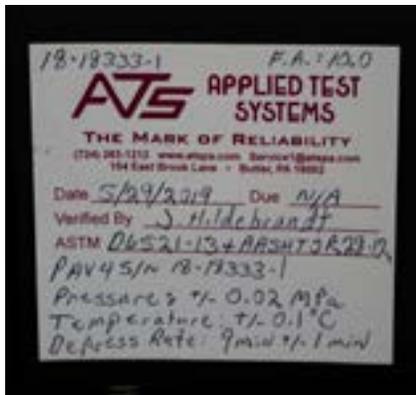


Figure D.3: Sticker with values



Figure D.4: Flow Control valve

## D.5 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



Figure E.2: PAV Main Screen

The screen will show values for current chamber temperature and pressure, chamber set point, remaining cycle time, 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, 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.

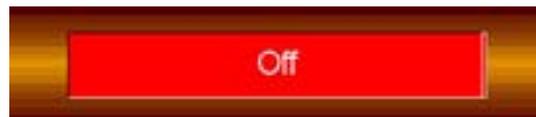


Figure E.4: Off State

## 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.

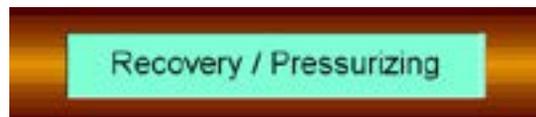


Figure E.7: Recovery / Pressurizing State

### **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 pressuere 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, 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 should be used as the parts are still very hot.



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. You can think of this like a “coffee timer”.

Below are the Graph and Data screens that are 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.

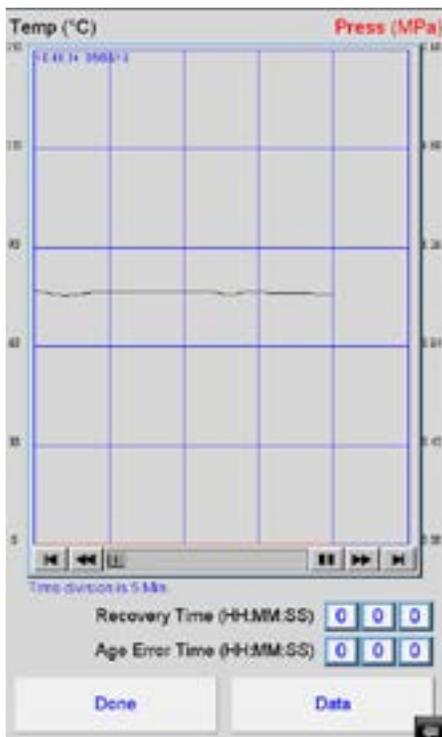


Figure E.11: Graph Screen

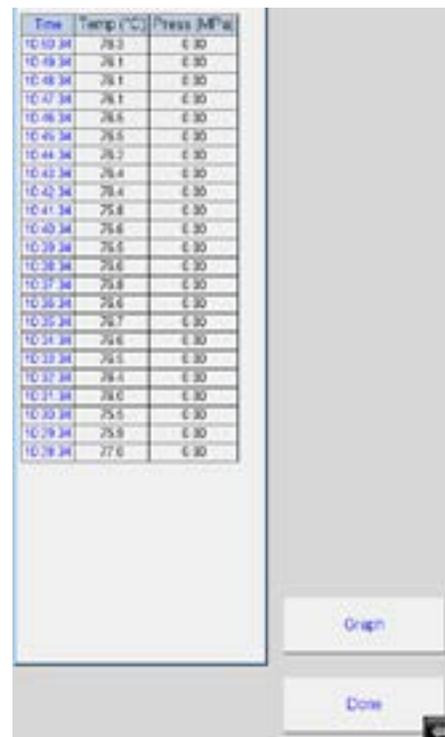


Figure E.12: Data Screen

Current recovery error time and age error time are displayed on the graph view screen.

### Data Button

Will switch to the Data View Screen.

### Graph Button

Will switch to the Graph View Screen.

### Done Button

Will return you to the Main 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.

## E.3 View Screen

Figure E.13 below shows the View Screen. It is shown 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.

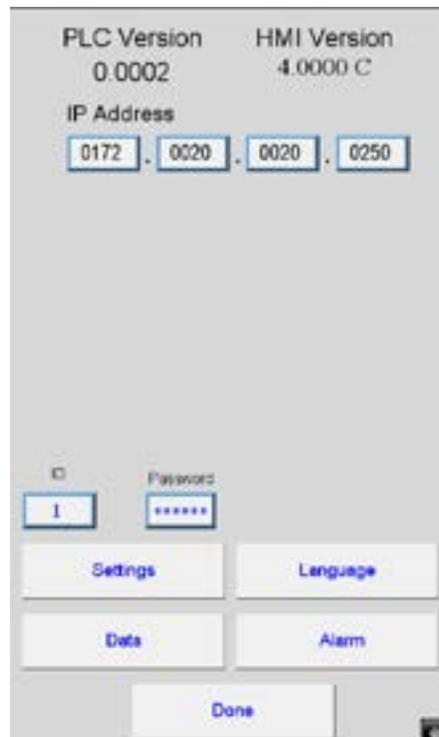


Figure E.13: View Screen

The screen will show the current version of the software in the PLC and HMI. This is very important information, and is most often ask 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 has 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 has been entered. Once it is displayed, pressing it will go to the password screen. (Default ID: 3, Password: 333333).

### **Settings, Language, Data, and Alarm Buttons**

Each take you to their 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 the 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.

### Pressure Temp Window



Figure E.15: Settings Screen

Indicates the amount of temperature below the cycle temperature that the system will start to pressurize. So, once the age button is pressed the system will recover temperature and when it passes the (Age Temp – Pressure Temp Window) temperature it will start to pressurize.

### **Age Time**

The time that the system will run the age cycle. It starts to 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 +/- 0.2 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 in 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 what units of temperature the system will display in its screens.

### **Pressure Drop-Down Field**

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

### **Shutoff Heater at End of Test Checkbox**

Selects if the system automatically turns off the heaters when the age cycle is finished. If you are going to be starting another test right after the current one then you do not want to check the box to save preheat time. If you are not going to be running another test for a while you may wish to check this box to save power.

## **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. You can think of it like a “coffee timer”. 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, also when the system detects an alarm or warning and the “Stop Test on all Errors” checkbox is checked.

It will show all current alarms (in Red) and warnings (in Yellow). 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.

## **Done Button**

Will return you to the Main Screen.

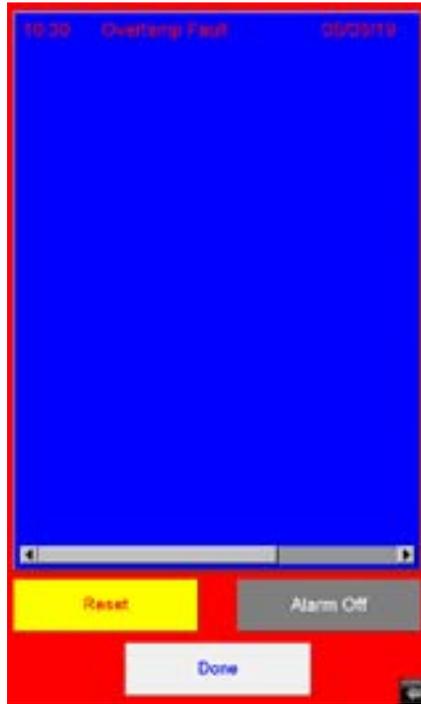


Figure E.16: Alarm Screen

## E.7 Data Screen

Figures E.17 and E.18 show the Data Screen and the Graph that are available when you press the Data button on the View Screen. It allows you to view data and graphs of age cycle log files.

The field at the top left will show a data table for the currently selected log file. The field at the top right will show all the log files currently on the system. Use this field to select one to look at.

### Backup All to USB

Allows the operator to backup all the log files currently on the system to a USB flash drive. These will be \*.csv data log files. Note, there is a checkbox on the standardization screen to delete all log files after back up. If it is checked, all log file files will be deleted after they are backed up to the USB drive.

### Done Button

Will return you to the View Screen.

### Graph Button

Will display a graph like the one in Figure E.18, of the currently selected data log file. Pressing the done button on the graph window will return you to the data screen.



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

Time	Temp (°C)	Press (MPa)	
10:42:34	76.4	0.00	06032018_1028
10:43:34	75.8	0.00	06032018_0719
10:44:34	76.8	0.00	06032018_0717
10:45:34	76.5	0.00	06032018_0714
10:46:34	76.8	0.00	06032018_1722
10:47:34	76.8	0.00	04232018_0708
10:48:34	76.6	0.00	04102018_1454
10:49:34	76.7	0.00	04102018_1418
10:50:34	76.8	0.00	04102018_1307
10:51:34	76.5	0.00	04102018_1302
10:52:34	76.4	0.00	
10:53:34	76.0	0.00	
10:54:34	75.5	0.00	
10:55:34	75.9	0.00	
10:56:34	77.0	0.00	

Buttons: Backup All to USB, Done, Graph

Figure E.17: Data Screen

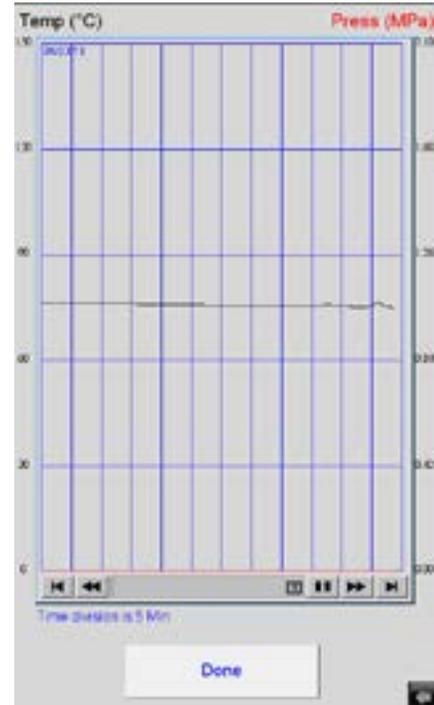


Figure E.18: Graph

## 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 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.

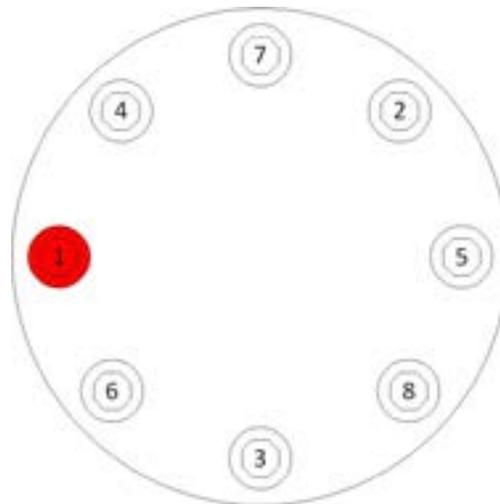


Figure F.1 - Bolt 1

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.

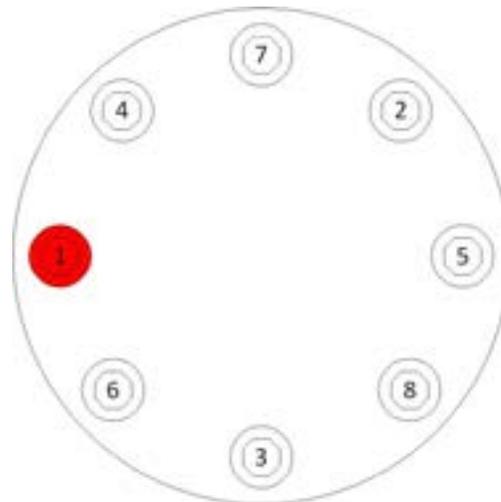


Figure F.1 - Bolt 1

14. Close the vessel lid and secure the bolts according to the diagram. 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 15 minutes. Check the current pressure reading and make sure the vessel is NOT pressurized before you attempt to remove samples.

# G. Verification

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## 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 popsicle stick 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 screw in top of the vessel lid.

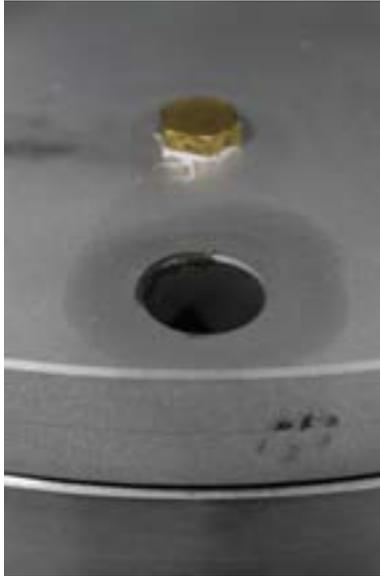


Figure G.5 - Screw on Vessel Lid

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  $2.1 \pm 0.1$  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.



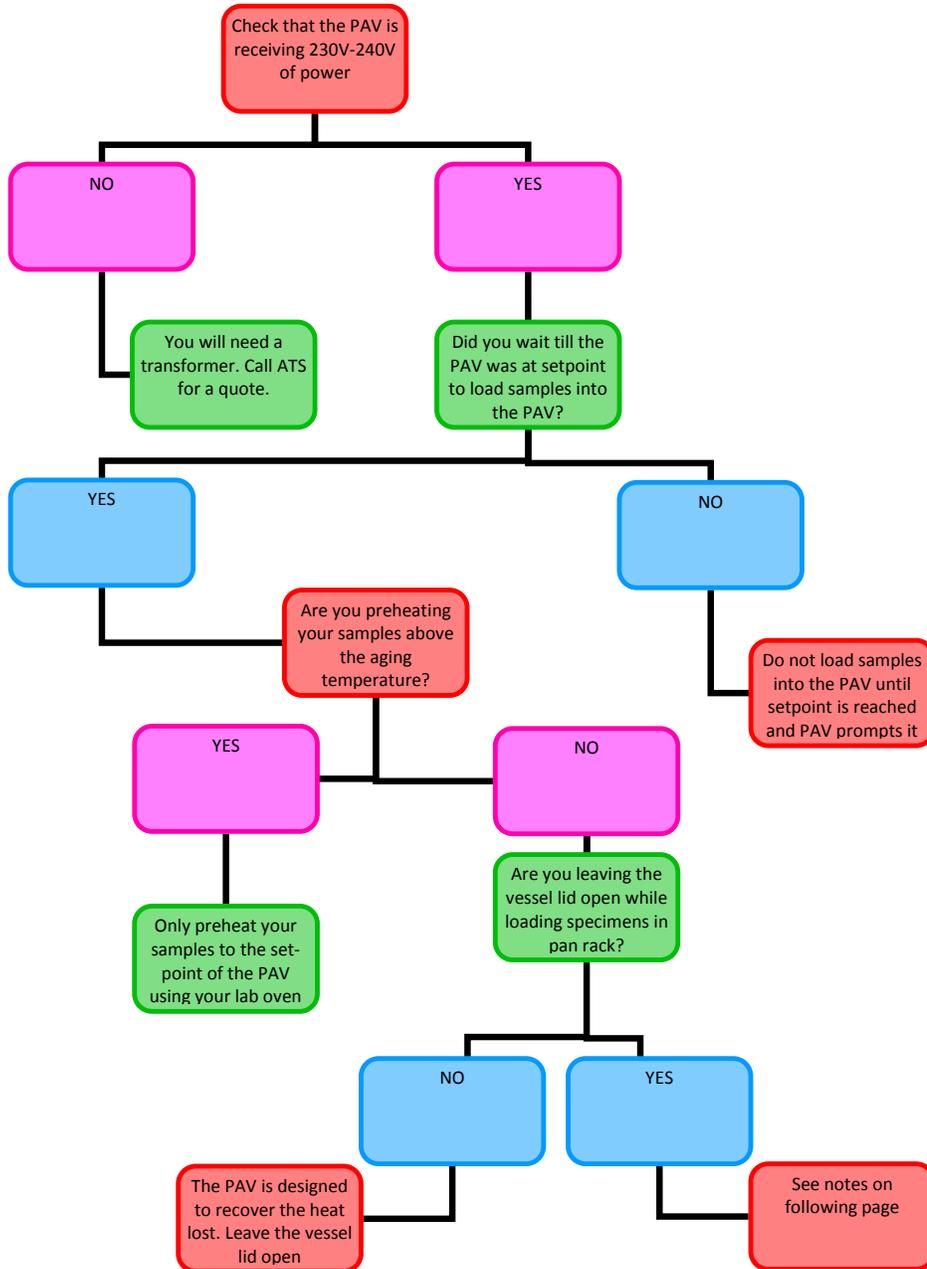
NOTE: It is best to have the PAV setpoint at a low temperature.



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 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 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 “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, 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.

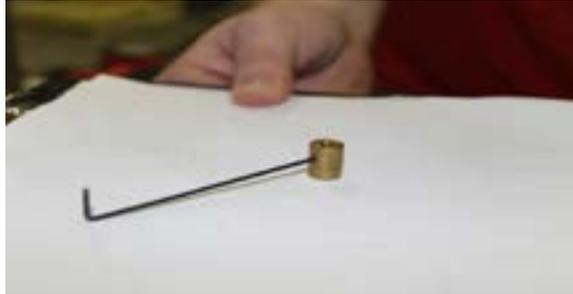


Figure H.3 - Tighten with Hex Wrench

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

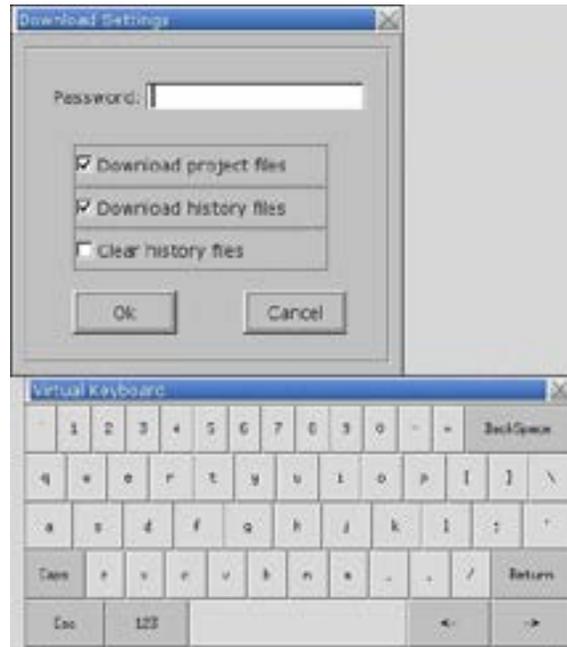


Figure H.6: Second Pop-Up Window

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**

From time to time a new software version may come out for the PLC. If you need a new version or you need to reload a version please contact ATS service for help.

## **H.6 New Temperature Controller Software**

From time to time a new software version may come out for the temperature controller. If you need a new version or you need to reload a version please contact ATS service for he

# I. Maintenance

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## 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 ¼ to ½ 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 Changing Fuses

1. Control Circuit Fuse (FU1 & FU2): The control circuit fuse is a 2 amp, 250 volt 1/4" x 1-1/4" BUssmann MDC (or equivalent) fuse.
2. Heater Circuit Fuse (FU3 & FU4): The heater circuit fuse is a 10 amp, 250 volt BUssman GBB (or equivalent) fuse.

## I.3 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 (10) Specimen Pans
PAV-LUBE	Anti-Seize Lubricant
PAV1038	Fuse, 2A 1/4" - 1 1/4" Slow Blow F2
102674	Fuse, 10 Amp 250 Volt
PAV1068	Led, Tri-Color Diffused
PAV1070	Led, Red Diffused 4
PAV1072	Led, Green Diffused 3

Part Number	Description
ELE 6110	Fuse, 2 AMP, 250 Volt

### Accessories

Part Number	Description
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 230/240 VAC, 1 Ph, 50/60 Hz, 10AMP.)
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
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 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

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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. 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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