APPLIED TEST SYSTEMS

THE MARK OF RELIABILITY

Instruction Manual

WinTensile

Windows Elevated Temperature Tensile System

APPLIED TEST SYSTEMS

Instruction Manual

THE MARK OF RELIABILITY

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Revised June 2014

Section 1: Introduction

1.1 Overview

WinTensile is a temperature control system designed for elevated temperature tensile testing with a multi-zone (typically three (3)-zone) laboratory furnace. The system consists of WinTensile Temperature Controllers and WinTensile software, which is run on a Windows-based personal computer.

This operation manual is intended to give the operator basic knowledge of system operation. Consult the Applied Test Systems (ATS) factory for additional information if required at +1-724-283-1212.

1.2 Computer Specifications

Minimum computer specifications include the following:

Processor: 2.8 GHz or better

Operating System: Microsoft® Windows® 7 Professional, 32-bit

Memory: 2GB or better

Hard Drive: 250GB or better

DVD Drive: 16x or better

3

Section 2: Assigning User Names, Privileges, and Passwords

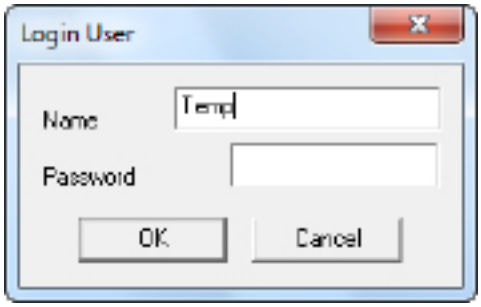
2.1 Assigning User Names

Other than certain viewing functions, no operation of the system is possible unless a user possessing the appropriate assigned privileges has logged in. User names and passwords should be assigned by a System Administrator prior to testing. It is important to set up and use individual user accounts if more than one operator uses the tester. This will deny unauthorized access to specific functions of testing, allowing for greater accountability and accuracy of testing data.

2.1.1 Initial User Account Setup

When the system first arrives, it is important to first create a username and password for the administrator.

1. The log-in information upon initial setup is “Temp” for name. A password is not required.



NOTE: Do not use quotations when typing in this user name.

2. Once logged in under this temp account, the administrator should follow the steps in 2.1.2 to create user names and passwords for each operator of the system.

NOTE: Be sure to assign all of the privileges for this initial user name. This will give the administrator or Lab Manager all rights and privileges in the system.

3. Log out of the username account and log in under the new administrator user name and password.

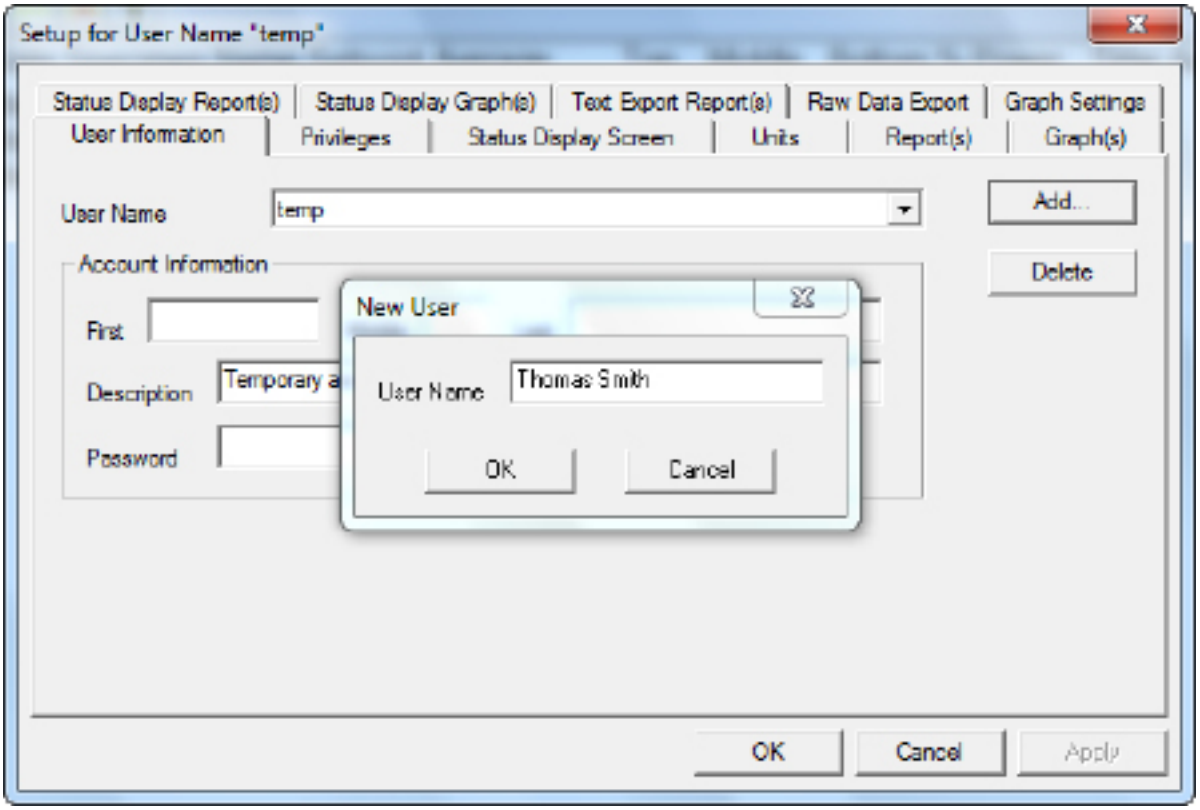
4. Follow the steps in 2.1.3 to delete the “Temp” account from the system, ensuring that no unauthorized access is available to operators.

5. Create operator accounts, with the appropriate privilege designations, according to the steps in 2.1.2.

2.1.2 Adding a New User

To add a new user to the system,

1. Select Privileges from the User Menu.
2. Select the Add button.
3. Enter the new user name or operator name and click OK.



4. The administrator will be returned to the User Information screen with the new user or operator name displayed.
5. Enter the password and check boxes for all the privileges assigned to this user. The administrator can also enter any account information at this time.
6. Click OK to save all changes.

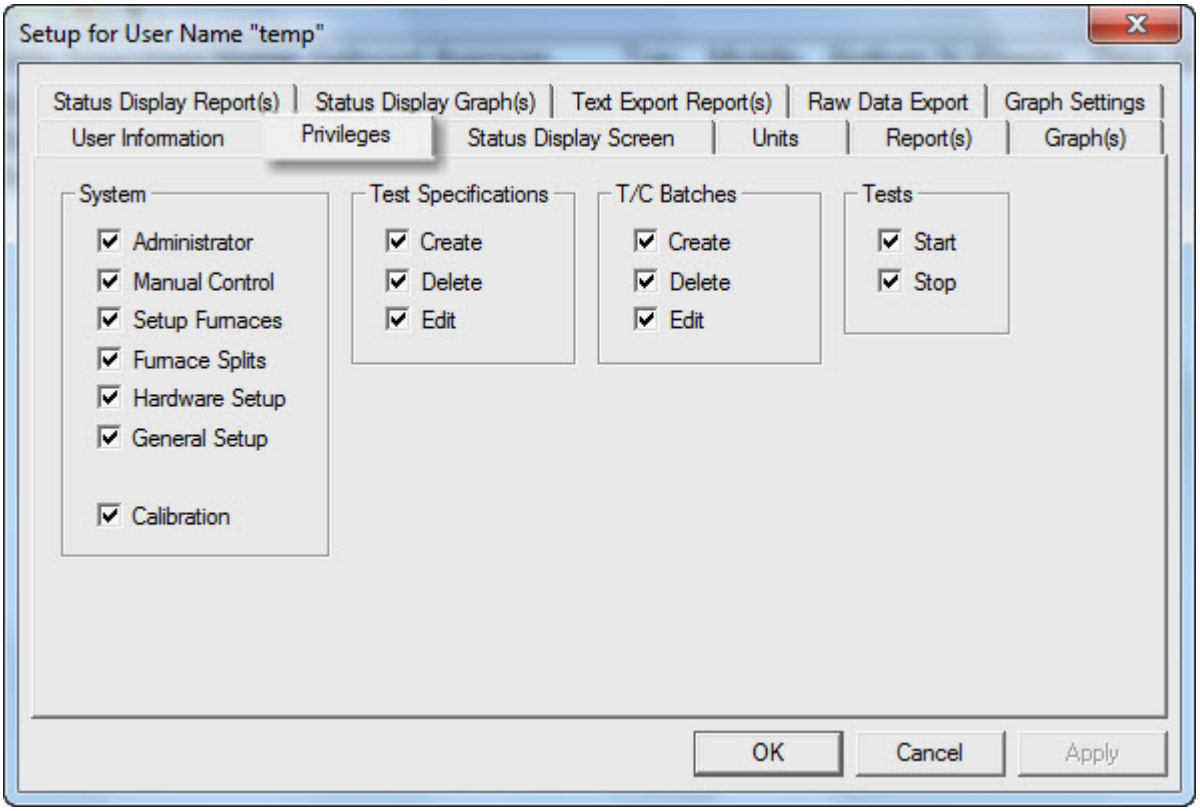
2.1.3 Deleting a User

To delete a user from the system:

1. Select Privileges from the User menu.
2. Choose the user for deletion from the User name pull-down menu.
3. Click Delete.
4. Ensure the named user is the one marked for deletion and click OK.

2.2 Privileges

Privileges are the specific tasks an operator is allowed to employ when working with the software. One administrator with full privileges is necessary.



To assign user privileges:

1. Select Privileges from the User Menu.
2. Select the Privileges tab.
3. Check the appropriate box to assign a privilege.
4. Click OK to save the changes. To modify user privileges,

1. Select Privileges from the User Menu.
2. Click on the Privileges tab.
3. Enter the name of the user in the User Name pull-down list.
4. Make the appropriate changes by checking or unchecking the boxes.
5. Click OK to save the changes.

2.3 Passwords

To change the password of an existing user:

1. Select Account Information from the User Menu.
2. Enter the new password.
3. Click OK to save the changes.

2.4 Miscellaneous Functions

There are additional options available for customization under the Setup for User Name window. The user can:

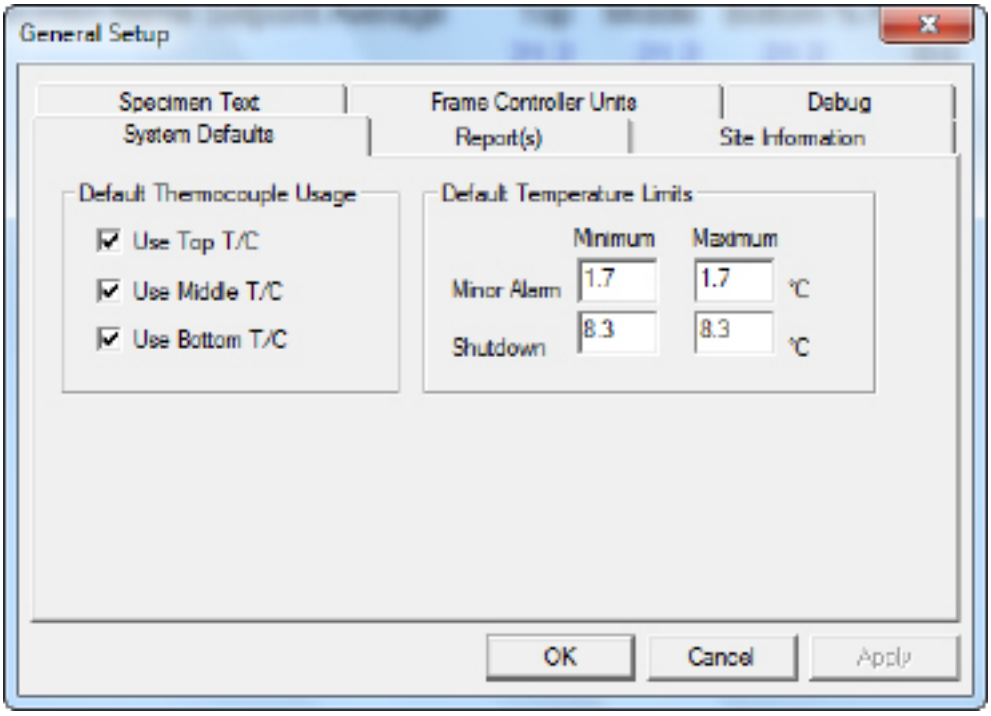
1. Change the units displayed on the screen by clicking on the Units tab. For example, one operator can choose to view data in metric units while another can view data in English units. Each unit can be chosen on an individual basis if necessary.
2. Modify the status display screen by clicking on the Status Display Screen tab.
3. Select the preferable status display graph by clicking on the Status Display Graph(s) tab.
4. Adjust graph line sizes to fit the screen or to fit printer requirements by clicking the Graph Settings tab. The typical default value for the screen is one pixel, and the printer default value is three pixels.

Section 3: System Setup

3.1 General Setup

Set the desired Default Thermocouple Usage and Default Temperature Limits values:

1. From the System Menu, select General Setup and click on the System Defaults tab.



2. ***Default Thermocouple Usage***: Select the specimen thermocouples that are intended to be used by default on most tests.

3. ***Default Temperature Limits***:

   a. Minor Alarm (Minimum and Maximum): Enter the desired minimum and maximum temperature deviations from setpoint that will create an alarm. Any time the temperature deviates beyond these limits during the soak and test modes, the furnace will go into alarm and the deviation will be recorded in the Event Log.

   b. Shutdown (Minimum and Maximum): Enter the desired minimum and maximum temperature deviations from setpoint that will shut down the system.

4. Enter information as needed into the remaining tabs. Click OK to save the choices.

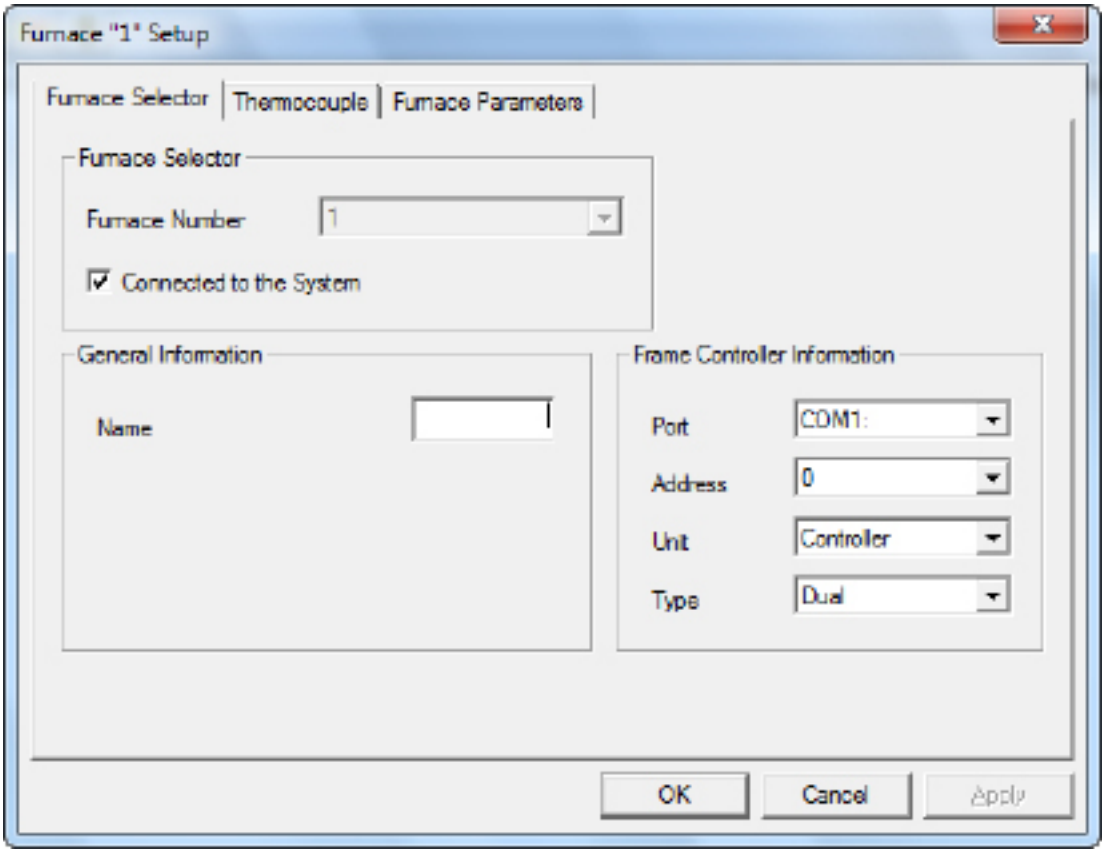
NOTE: The Site Information and Debug tabs have no function at this time.

3.2 Furnace Setup

The following options allow the user to set up individual furnace information.

3.2.1 Furnace Selector

From the System Menu, select Furnace Setup. The Furnace Selector tab will appear. Another option is to double-click the status line of a furnace while holding down the shift key.



1. Check the box that says, “Connected to the System.”
2. Enter a name for the furnace.
3. Enter the appropriate Frame Controller Information that corresponds with the appropriate Furnace Controller.

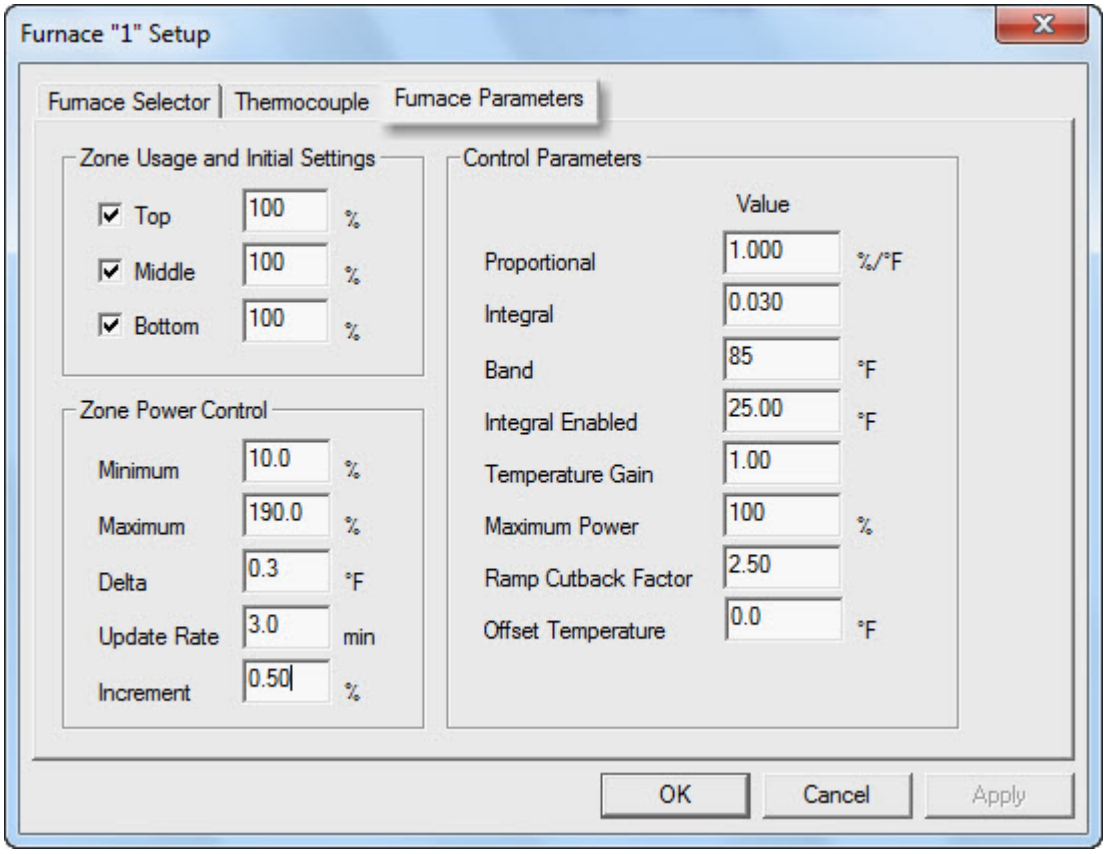
3.2.2 Thermocouple Setup

Click on the Thermocouple tab and select the desired thermocouple type. Be sure the system is wired with the matching type of thermocouple extension wire and connectors. See Section 4 for more information on thermocouples.

3.2.3 Furnace Parameters

Since many different types of furnaces and ovens can be attached to the test frame, it is important to set the proper parameters in the system before testing begins. Select the Furnace tab from the Frame Setup menu.

The default Furnace Parameters are shown below. If any changes are desired, please contact ATS at +1-724-283-1212 for assistance.



Zone Usage and Initial Settings: Check the appropriate boxes to indicate the number of independent control zones in the furnace that are attached to the frame. These settings must agree with the wiring configuration. If the correct configuration is unknown, refer to the installation drawings or consult ATS at +1-724-283-1212.

The typical installation will have three furnace zones. Special circumstances, such as the use of either a high temperature furnace or a box oven, may require a single control zone.

NOTE: The number of thermocouples attached to the specimen is not necessarily the same as the furnace zone number.

NOTE: Single-zone furnaces will only collect data and control temperature from the top thermocouple.

Zone Usage and Initial Settings/Initial Power Split: During the ramp of the furnace to the setpoint, no attempt is made to balance the power into zones. Equal power is applied to all zones. Due to the nature of the furnace, and the chimney effect, the bottom zone will normally be colder than the others. Due to the cooling effect of the top pull rod, the top zone may or may not also be colder.

After observing the temperature graphs of several tests, the situation regarding differential temperatures may be apparent. NOTE: The relative temperatures vary as the overall temperature approaches the setpoint. The only relevant data is the information near the setpoint.

If one zone is always significantly colder or hotter (at least 15 degrees) as the setpoint is reached, then the initial power split may be changed to improve the balance of the zones. This will result in less time spent in the presoak state because the computer will have fewer changes to make to get all zones within the minor alarm limit. The test can then proceed to the programmed soak time.

NOTE: When changing this initial power split, it is important to note that if power is added to one zone, it must be taken from another zone. The total of the three zones must still equal 300.

For example, if the bottom zone is 35 degrees low when the top zone reaches the setpoint value, removing some of the power from the top zone and redistributing it to the bottom zone may solve the problem. Setting the values at Top 90, Middle 100, and Bottom 110 can help. Evaluating the changes is the only way to test its effectiveness.

If the zones are within 10-15 degrees, changing the initial split values in this section will not make enough of a different.

Zone Power Control: This section gives the system information about furnace zone control in order to ensure optimum temperature stability and furnace performance. The values given in the original setup will rarely change. If a change seems necessary, contact ATS. Typical values are:

Minimum 10%

Maximum 190%

Delta 0.3°F

Interval 3.0 min

Increment 0.50%

Control Parameters: The system uses a PID algorithm to determine the power needed in each zone to maintain the specimen temperature at a value near the specified setpoint value. Since furnaces vary widely in size and power rating, the PID terms will probably require "tuning" in order to realize optimum operating performance from the furnace.

The following are typical default terms that will serve as a starting point and help achieve optimal settings:

NOTE: Unlike other setup parameters, the PID parameters may be changed while the furnace is operating.

P (Proportional) Default value 1.000%/°F: The Proportional term (P) is in control during ramp to setpoint. The Integral term (I) is enabled when the temperature reaches the difference between the setpoint and Integral Enabled value, which is normally set at 25°F and should not be changed. To experiment with furnace tuning:

1. Set the I term to zero and raise the P term until there is an oscillation of temperature. Reduce the P term until oscillation disappears. This is the optimal value for the P term.

2. Increase the I term until the transition from ramp to steady state setpoint value is a smooth, continuous curve without overshoot. This should occur within a reasonable time. If overshoot exists, reduce the I term. If the transition time is excessive, increase the I term.

NOTE: It should not be necessary to change the remainder of the default values. Consult ATS at +1-724-283-1212 if satisfactory temperature is not achieved.

I (Integral) Default value 0.030%/°F: The I term is enabled during the latter part of the ramp function.

Band Default 85°F: This is the amount of "swing" allowed to the control parameters, meaning the WinCCS control box varies the parameters during the control process as necessary. For normal creep furnaces, this value will not need to be changed. Contact ATS for questions.

Integral Enabled Default 25°F: This is the point on the ramp, in degrees, at which the control algorithm enables the I term as the temperature approaches the setpoint value. In the case of the value set at 25°F and the set point at 1000°F the I term will be enabled at 975°F. Enabling the I term prematurely results in a longer time to reach the setpoint. Enabling it later may contribute to overshoot when the setpoint is reached. It is seldom necessary to change this value.

Temperature Gain Default 1.00: This gain term is not normally changed.

Maximum Power: This is normally set at 100%, which allows the control system to make use of the full potential of the furnace. If full power is not needed from the furnace, set this default to a lesser value. The control system will limit the power applied to that value.

Ramp Cutback Factor: As the setpoint approaches, furnace power is automatically cut back from the transition between the ramp and the steady state. This avoids overshooting and creates a steady, continuous curve. The value of this cutback is typically set at 2.50 for a creep furnace.

Offset Temperature: The default value is set at 0.0 This term is not typically changed.

Section 4: Thermocouple Calibration

4.1 Thermocouple Batch Calibration

The system is set up to use any standard NIST-specified thermocouple type. Simply by selecting, during the setup procedure, the type of thermocouple wire used, the temperature readout will be correct for an ideal perfect thermocouple. Because no thermocouple ideal exists, it is common practice to calibrate the actual thermocouple and provide a chart of actual temperature, indicated temperature, and offset.

The calibration information can be entered with an identifying Batch name. Every time a thermocouple is made from this particular batch of wire used, the system will correct temperatures using this calibration information. Completing this calibration process will ensure that temperatures are corrected across different batches of wire. See the instructions below on how to create a batch.

If uncalibrated thermocouples are used, select the Zero Offset Batch Name, and the system will assume a perfect NIST Thermocouple.

Typically, the thermocouple is tested at several temperatures over the useful range of the thermocouple wire type and a chart is provided as a calibration record (see below). Sometimes an error is reported, as in the following example. At other times, the program will present the error as a correction factor, which will return the temperature to the NIST profile.

True Temperature (°Celsius)	Measured Temperature	Offset/Deviation
200	199.40	+0.60
400	399.50	+0.50
600	599.60	+0.40
800	800.10	-0.10
1000	1000.00	0.00
1200	1200.20	-0.02

NOTE: The Actual Temperature is the sum of the Measured Temperature and the Offset.

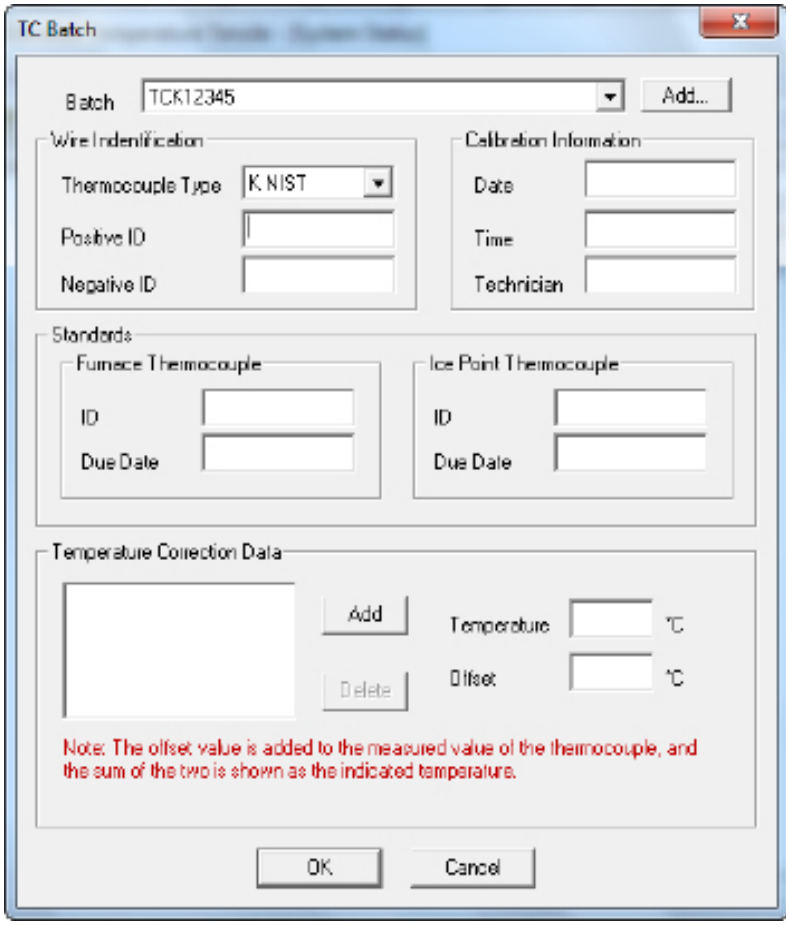
The system will simply add the measured temperature and the offset. If the previous offsets were entered into the batch file, the correction would be opposite of the desired effect.

The operator must, therefore, examine the calibration report carefully and make sure the sign of the correction factor is entered properly.

NOTE: Care must be taken to ensure the test temperature is within the calibrated range. If the measured temperature drops below the minimum or rises above the maximum, a correction factor will not be applied.

In order to create a batch name and enter calibration information, perform the following steps:

a. Select Create from the Thermocouple Batch pull-down under the Calibration menu.



b. Click on New or Add and enter the Batch name. Be sure to use a unique name for each batch.

c. Enter the appropriate information.

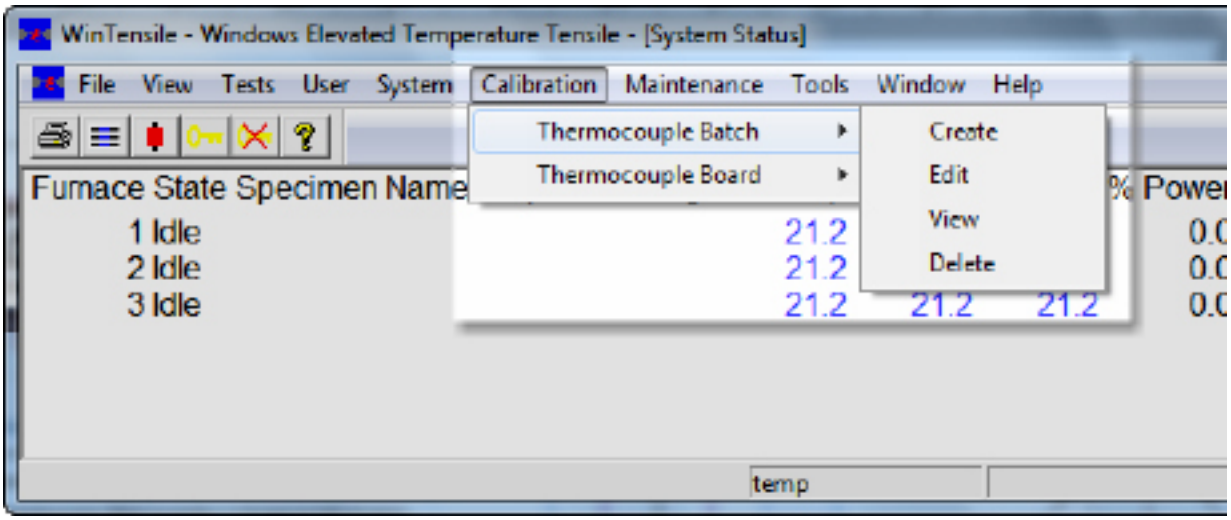
d. Enter the Temperature and Offset Correction in the appropriate windows.

e. Click Add.

f. Repeat these steps for each temperature point in the Correction Data window.

g. Click OK to complete the batch creation process.

Previously created batches can be edited, viewed, or deleted by choosing the appropriate option from the Thermocouple Batch pull-down from the Calibrate menu.



4.2 Thermocouple Circuit Board Calibration

CAUTION: ATS SERVICE PERSONNEL HAVE ALREADY CALIBRATED THE THERMOCOUPLE BOARD BEFORE THE MACHINES AND COMPUTERS ARRIVE AT THE SETUP LOCATION. For questions, contact ATS Service Personnel at +1-724-282-1212.

4.3 Proper Thermocouple Attachment

Good contact between the specimen thermocouples and the specimen must be maintained to provide the best temperature measurement and control.

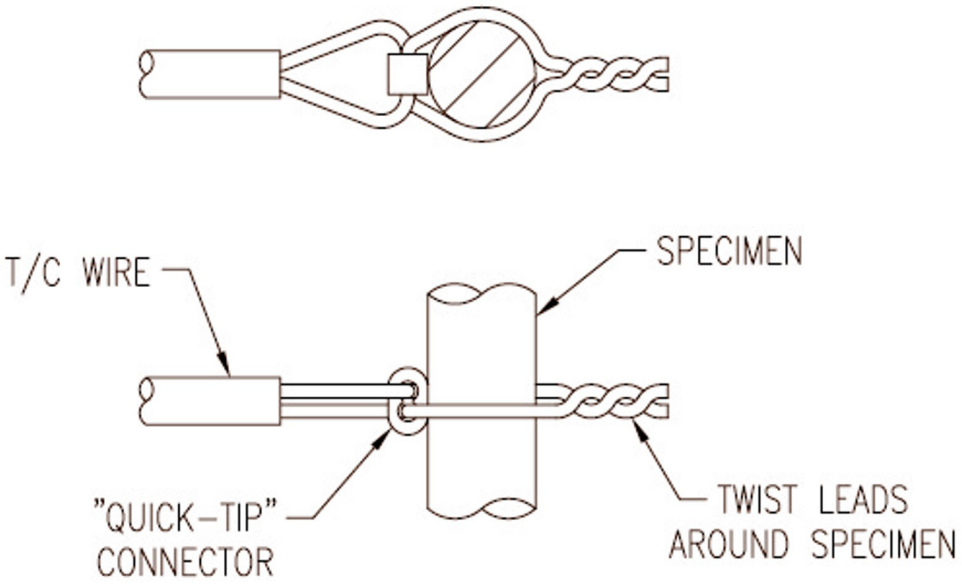
The use of Quik-Tips is one of the most effective ways to provide this contact.

1. Start with a length of insulated thermocouple wire with sufficient length to extend from the gauge section of the furnace to the thermocouple junction box. It is typical to route the thermocouple out of the bottom of the furnace adjacent to the pull rod. Allow an extra 2 in. (50 mm) of wire on the specimen end.

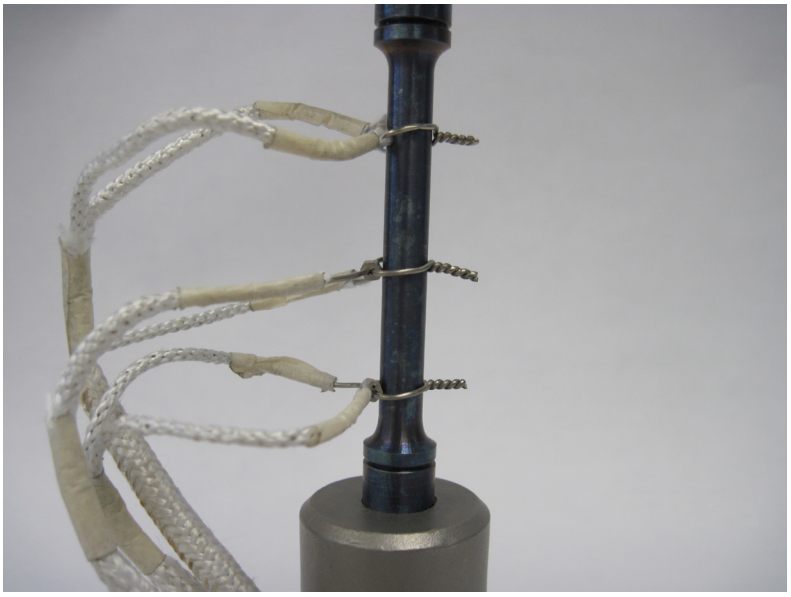
2. Attach a Male Thermocouple Connector to the Junction Box end of thermocouple wire.

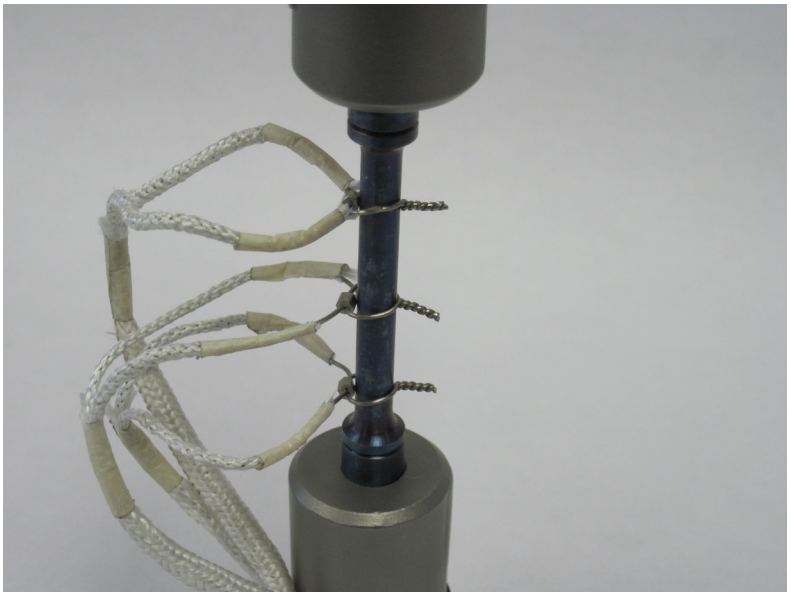
3. Slide a Quik-Tip onto the specimen end of the wire about 2 in. (50 mm) per the illustration and crimp using the Quik-Tip Tool.

4. Attach the thermocouple to the specimen by wrapping the 2 in. (50 mm) extension around the specimen and twisting the ends to tighten the thermocouple to ensure the Quik-Tip is making good contact with the specimen. Make sure the thermocouple wires are not touching each other prior to the junction with the Quik-Tip.



Once these steps are completed, the thermocouples will be properly attached to the specimen.





Section 5: Operation

Before beginning any test, ensure that:

1. All setup procedures have been completed.

2. The thermocouples properly attached. Refer to 4.3 for proper thermocouple attachment.

3. Observe all safety precautions.

WARNING: TESTING MAY INVOLVE VERY HIGH FURNACE TEMPERATURES. ENSURE THAT THE FURNACE IS CLOSED, MATERIALS ARE IN A POSITION TO AVOID A FIRE HAZARD, AND HIGH TEMPERATURE WARNING NOTICES ARE POSTED TO ALERT PERSONNEL OF POTENTIAL HAZARDS.

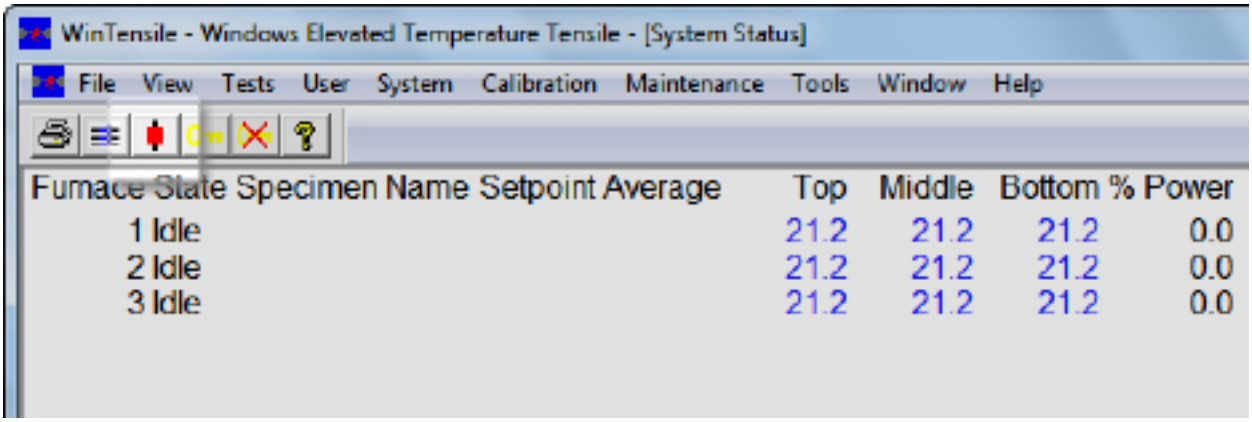
The System Status Display is the main display used by the operator during normal operation of the system. Machine states and alarm conditions are displayed on the status display screen.

5.1 Starting a Test

1. It is possible to access the Start a Test screen using any of the following methods:

    a. From the main menu, select Tests, then Start. The Specimen Information screen will appear.

    b. Click the Furnace Services icon on the main menu.



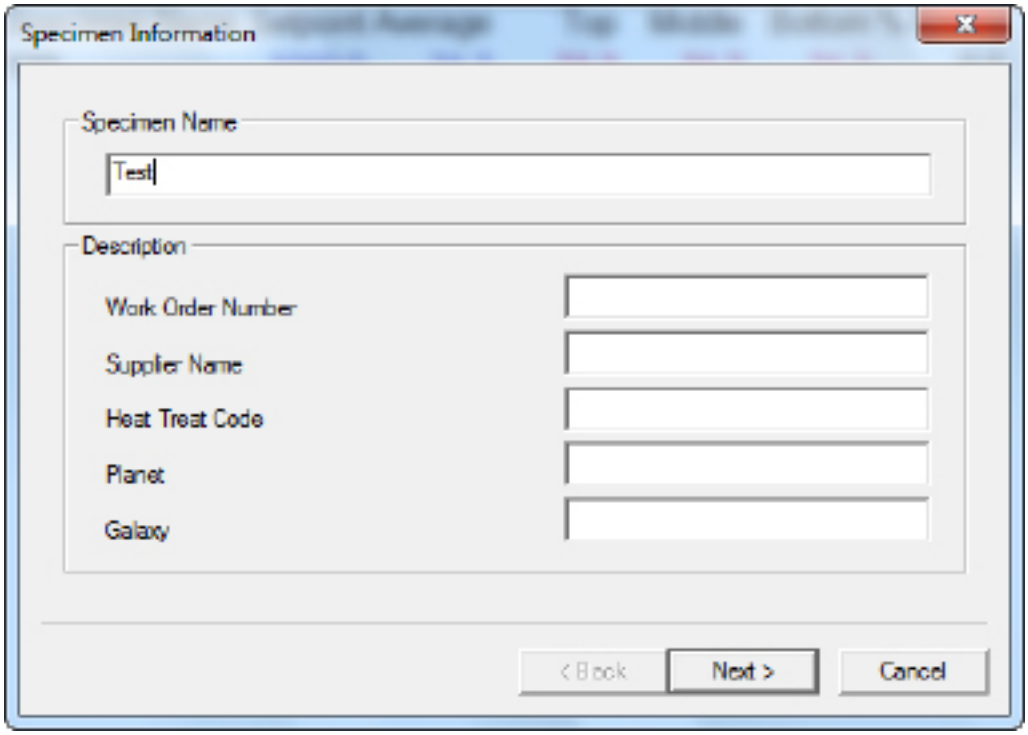
    c. Double-click on the Status Display line for the furnace to be tested.

        i. The Furnace Services menu will show.

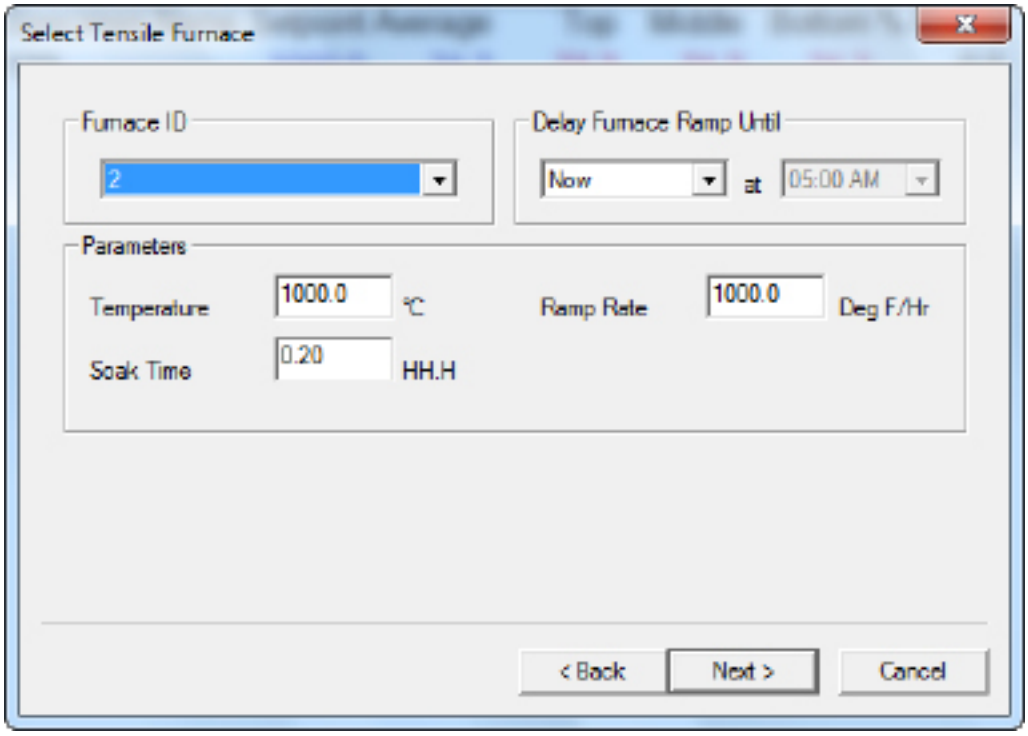
        ii. Click on Start a Test, and the Specimen Information screen will appear.

NOTE: In all three options, the correct furnace must be selected by either double-clicking on it (Option a) or selecting it from the Frame pull-down menu (Options b-c).

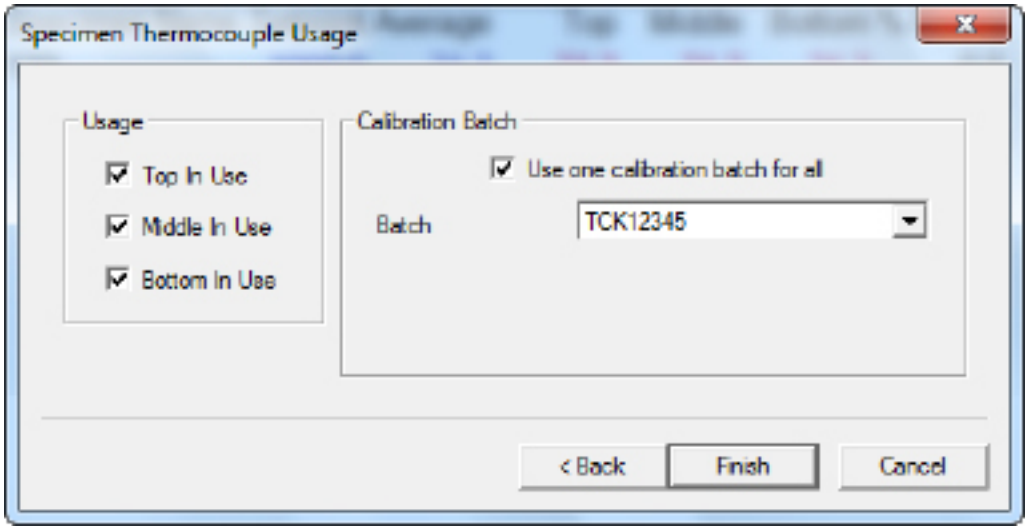
2. Enter the Specimen Name and Description data as needed and click Next.



3. The Select Tensile Furnace screen will appear. Select the desired furnace, test temperature, ramp rate, and soak time for the test.



4. Select the thermocouple usage and batch.



5. Ensure that the furnace, specimen, and thermocouples are set up properly on the test frame.

6. Click Finish to start the test.

7. The furnace will go through Startup, Ramp, and Soak phase before the test begins.

8. Once the test is indicated, the furnace and load train can be connected to the Universal Test Machine and the test can be run.

5.2 Stopping a Test

At any time a test is running, the operator may stop the test manually. There are a variety of reasons why this might be desired. For example, if a problem is detected that would render the test results invalid, or if no further useful data will result, the test can be terminated.

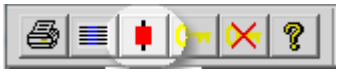
1. From the main menu, select Tests, then Stop.

    a. Select the furnace to be stopped from the pull-down menu.

    b. Click OK.

    c. Verify that the system should stop this test and click Yes. The test will be terminated.

2. Click the Furnace Services icon on the main menu.



    a. Select the appropriate furnace from the Furnace Services menu.

    b. Click Stop the Test from the options.

    c. Verify that the system should stop this test and click Yes. The test will be terminated.

3. Double-click on the appropriate line of the Status Display screen.

    a. Select Stop the Test from the Furnace Services menu.

    b. Verify that the system should stop this test and click Yes. The test will be terminated.

Once the operator has terminated the test, the system will proceed to Post Test Mode.

At this point, the operator may choose to enter information into the Post Test area or Reset and Clear.

1. If Post Test is selected, the furnace will be set to an Idle state, and it can be used at any time for another test. All data will be moved to the Previous Test section. See 5.3.2 for details.

2. If Reset and Clear is selected, the furnace will be set to an Idle state, and it can be used at any time for another test. All record data of the test will be lost.

NOTE: Do NOT select Reset and Clear in error. Recorded test data will be deleted and cannot be recovered.

5.3 View Test Data

The WinTensile System incorporates provisions to view the results of both currently-running tests and previously-archived tests in both graphic and report form.

5.3.1 View Running Tests

There are three ways to view a test currently running.

1. From the main menu, select View, then Running Test.

    a. When the Select Running Test(s) to View screen appears, select the desired frame. Using the Report and Graph tabs here, choose what kind of reports are desired.

    b. Click OK, and the Report screen will appear.

2. Click on the Furnace icon from the main menu. The Furnace Services screen will appear.

    a. Use the frame pull-down menu to select the desired frame.

    b. Select View Data from the pull-down list of options. The Select Reports and Graphs screen will appear.

3. Double-click the appropriate line of the Status Display screen. The Frame Services screen will appear.

    a. Select View Data. The Select Reports and Graphs screen will appear.

A quick look at data for a running test can be accessed by double-clicking on the status line of the frame on the Status Display screen.

NOTE: The information displayed in the Status Display Report and graphs will coincide with the default settings chosen by each user. This display can be changed for each test.

5.3.2 View Previous Tests

Tests that have been completed and automatically archived during the Post Test procedure are known in the system as Previous Tests. The test data, along with the supporting information, are archived on the computer hard drive in a subdirectory reserved for that purpose. The default name for this subdirectory is Tests.

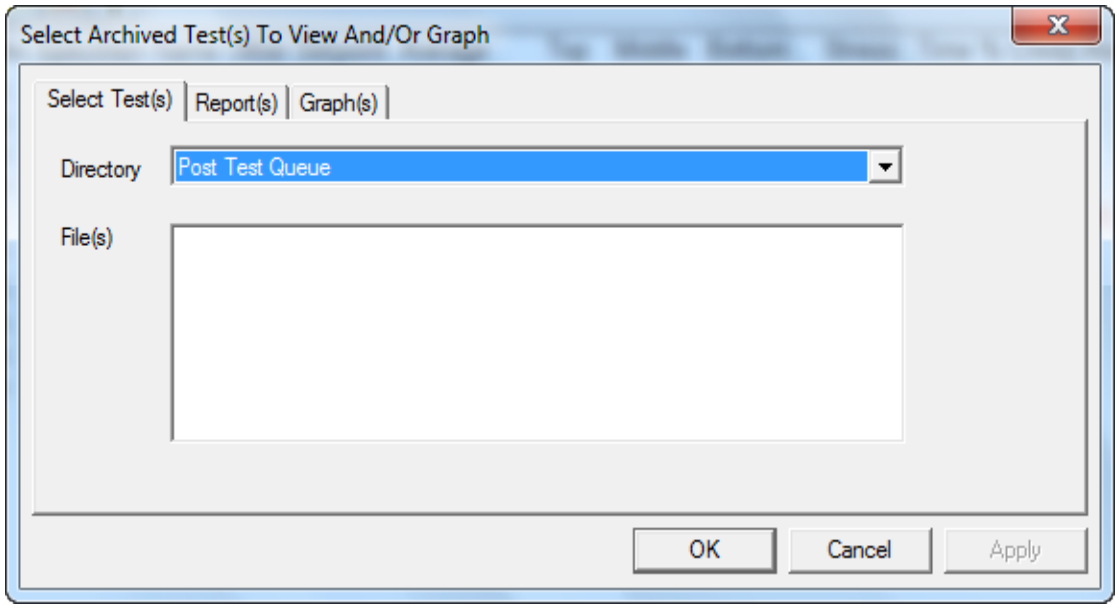
NOTE: There are two different subdirectories that hold test data. One holds data for completed tests, and the other holds data for tests that are currently running. See 5.3.5 for information on how to properly locate data.

To view a completed test:

1. Select View from the main menu, then Previous Tests. The Select Archived Test to View screen will appear.

2. Use the Directory pull-down menu to select Tests.

3. Use the File menu to select the appropriate specimen name from the list of archived tests.

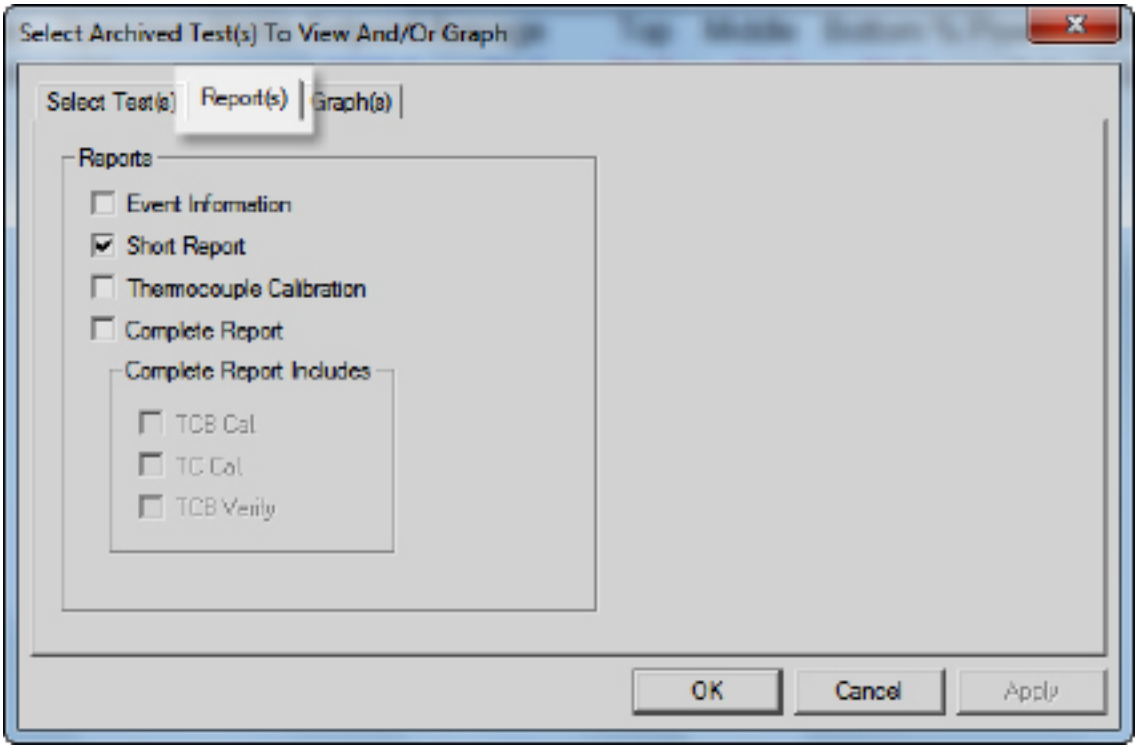


NOTE: There are two special cases where tests are neither complete nor currently running on a frame, yet the test records are stored in the subdirectory. One is a test that has been cleared from a frame before the Post Test process was completed (found in the Post Test Queue). The other case is a test that has stopped but will resume later (found in the Continue Test Queue). To access these records, go to the Post Test Queue or the Continue Test Queue by choosing from the Directory drop-down menu.

5.3.3 Report/Graphing Options

The Report/Graphing Options screen allows the user to select a specific report or graph and configure it to display test data in the most useful form. The screen also allows selected data to be exported into a Common Separated Variable (.csv) format for spreadsheet use.

1. Select View from the main menu, then either Previous Test(s) or Running Test(s) to access the Report/Graphing options tabs.

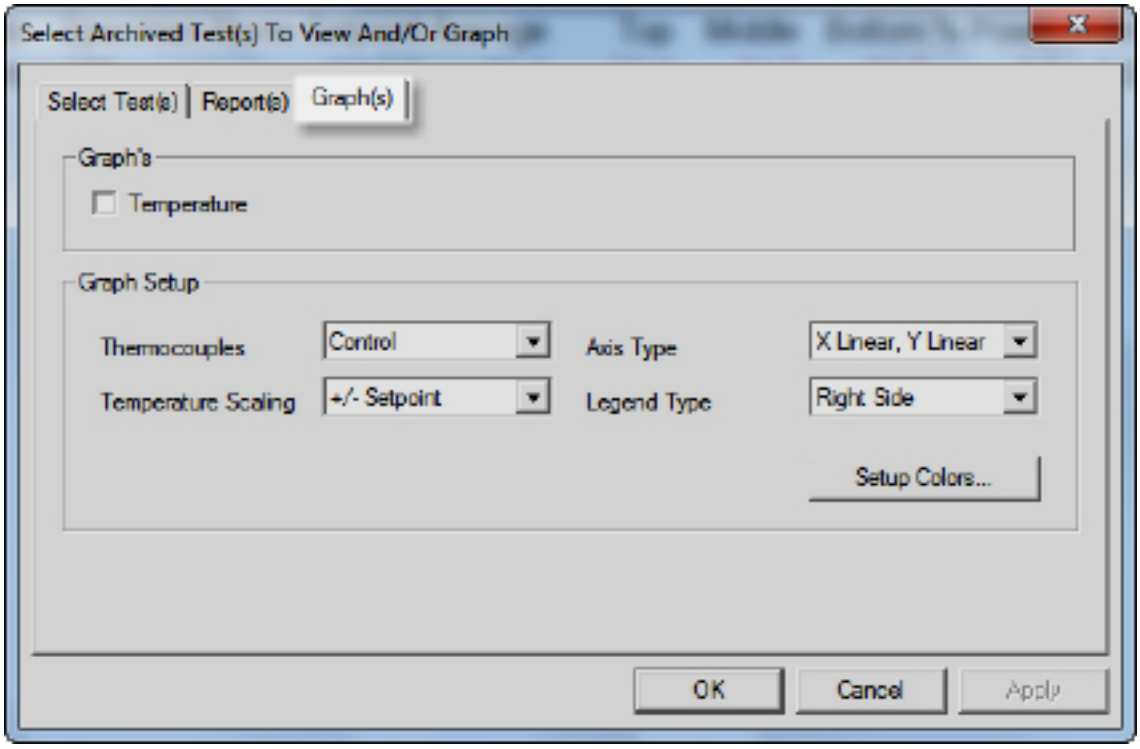


2. Under the Report(s) tab, check the boxes for the data to be shown in the report.

    a. If the Short Report box is checked, only basic information will be included in the report.

    b. If the Complete Report box is selected, all the data listed below the Long Form box will automatically be selected. If not all this information is desired, items can be selected individually.

3. Proceed to the Graph(s) tab if graphs are needed on the report. If not, skip to Step 7.



4. Check the appropriate boxes for the desired graphs.

5.3.4 Exporting Data

Data can be exported as an ASCII common separated variable (.csv) format, making it easy to use with Microsoft Excel or other spreadsheet programs. To export data:

1. Select File, then Export from the main menu.
2. Select either Previous Test(s) or Running Test(s).
3. Select Export Data. The Export Data to ASCII File screen will appear.
4. Under the Raw Data Export tab, select the type of data to be exported by making the appropriate choice from the Export Data field.
5. Specify File name and Path by clicking Browse.
6. Modify the file name, if desired, in the Save As text box.
7. Specify the Save In destination for the file by using the Browse button.
8. Select OK to complete the export process.

5.3.5 Exporting Test Data Files

Test data files are complete files containing all aspects of the test. This data is archived automatically once the test proceeds through the Post Test state. Test data files are accessed in the Previous Test(s) section.

Test data files can only be moved or deleted using Windows Explorer.

Tests are archived by year and can be found at C:\ProgramFiles\Virtech Inc\WinTensile\Archive\Year.

NOTE: There are two directories that hold all test data. If the wrong directory is chosen when exporting test data files, currently-running tests could be disrupted.

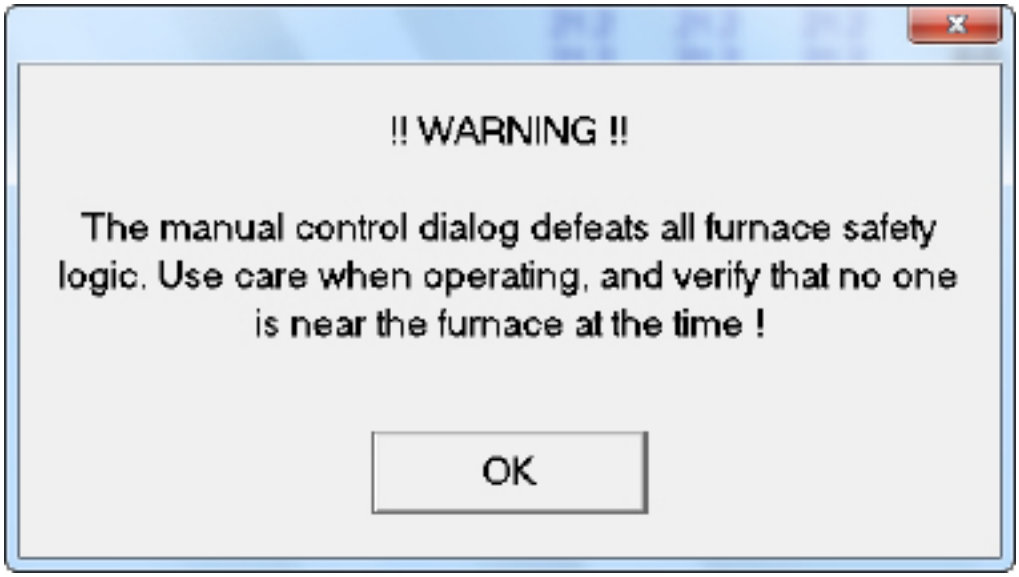
5.4 Maintenance

The WinTensile software offers maintenance options that can be accessed easily via the Maintenance menu. The following is a list of features available under the Maintenance toolbar.

CAUTION: DO NOT PERFORM MAINTENANCE FUNCTIONS WITHOUT ATS SERVICE PERSONNEL.

Furnace Logging: The furnace logging option allows the operator to log data for a selected frame. This data is sent to the WinCCS Logs directory, where it can be accessed and reviewed at the operator's convenience. The directory is located at C:\ProgramFiles\Virtech Inc\WinTensile\Logs.

Manual Control: This feature should be used ONLY in coordination with ATS Service. This option is typically used for troubleshooting purposes. If used improperly, selecting Manual Control can damage the machine. Upon selecting manual control, the following warning will appear:



5.5 Tools

Rename: The operator can assign an alternative name to a Previous Test or Running Test.

5.6 Help

For additional questions and information on using the WinTensile software, consult the individual sections of this manual or ATS Service at +1-724-283-1212.

Appendix A: System Status Display

A.1 Status Display Headings

Furnace: Each furnace has an identifier, either a name assigned during the setup process, or a number from one to the total system complement. The default lists frames in numerical order.

State: The furnace state allows the operator to monitor the process of the test.

Specimen Name: The specimen name is the unique identifier assigned to the particular test subject installed in the furnace. This identifier will be used for all archival purposes for subsequent test data.

Setpoint: The setpoint is the temperature specified in the test specification to which the specimen will be tested. In case of room temperature tests and idle furnaces, N/A is displayed to indicate the furnace is not in use.

Average: This column displays the average of the temperatures of all the thermocouples in use on this furnace.

Top (Middle, Bottom): The display here assumes that three thermocouples are in use, and the temperature of the uppermost thermocouples is displayed here. The middle and lower thermocouples are likewise shown in the adjacent columns.

Power: At any time during the test, the furnace control algorithm will be varying the power into the furnace in order to keep the temperature at the specified value. This display, which is a % of the total power available, provides an indication to the operator of the power level being delivered to the furnace.

Time: Depending on the furnace state, time may have a different meaning. For example, if a test is running normally, time will be the total run time of the test, starting from initial specimen loading. A frame in soak state will show the time remaining until specimen loading.

Alarms: This display shows an abbreviation name for the alarm state of the furnace. In addition, this column indicates to the operator that some action at the individual furnace is required.

A.2 Status Display Colors

Individual frame lines will change color frequently as the frame state and alarm conditions change.

Red: Major alarm or action required, alarm condition will be displayed.

Green: Normal run state, test in progress.

Blue: Indicates normal activity under Temperature Columns and signals a Minor alarm state, alarm condition will be displayed.

Black: Column header, idle frame state.

Orange: Time only, normally indicates time remaining until change of frame state.

A.3 System Status Error Codes

Error codes explain issues with the system. Some of the errors are fatal and will stop the test, while others supply information and indicate a potential problem but do not indicate that the test is faulty.

ACLow: The frame controller's AC power line has dropped below 95VAC, indicating a severe brownout condition.

ACV: The frame has no AC power to the frame and/or furnace.

BAT: The frame controller's battery for the NVRAM needs replacing.

Break: The frame's break detect switch is active.

Cal/Ver: The frame is currently having the extensometer calibrated or verified.

Com: The host PC is unable to communicate with the frame controller.

ECnt: The number of events in the event log is greater than fifty.

FZone: The furnace zone control algorithm has reached its limits and is unable to control the differential temperature between zones. This is usually caused by one or all of the following: open furnace zone, thermocouples in wrong position on the specimen, open zone control relay, or specimen too high or low in the furnace. See A.3.1 for an extended explanation of the FZone alarm.

LCtrl: The automatic load control system has faulted. This is usually due to elevator-style machines running out of travel, and the lever arm must be re-zeroed.

Load: The test is ready to load weights.

MLO: Machine Lockout

Open: A control thermocouple is open.

SErr: A startup error has occurred. This is caused by a reversed thermocouple or an open thermocouple specified as active in a test. Once the problem is corrected the test will start automatically.

SLoad: The test is ready for a load increase.

TCBCal: There is no thermocouple measurement unit calibration found on the system.

THigh: A control thermocouple is above the minor temperature alarm limit.

TLow: A control thermocouple is below the minor temperature alarm limit. See A.3.2 for more information about this alarm.

ZExt: The extensometer has traveled beyond its specified re-zero range and must be re-zeroed.

A.3.1 FZONE alarm:

Refer to the Furnace Setup menu, under “Furnace Parameters,” to find a set of parameters which define the zone power control limits.

Min and Max usually 10 and 90 percent, mean that of the available power to the furnace, any one zone should be receiving a minimum of 10%, and no zone should be receiving more than 90%. If the control algorithm cannot achieve the required control within these limits, the FZONE alarm will be activated, which indicates a problem with the furnace or specimen arrangement. It does not mean that the test should be stopped or is invalid. It means that attention is required.

The following problems are associated with the FZone alarm:

1. The problem can be with the hardware; for example, one half of the furnace elements in a zone may be open.

2. In unusual circumstances, a wiring error in the thermocouple connections or the furnace zone control relays could result in the thermocouple or zone relay being associated with the wrong zone. This produces a very distinctive temperature pattern, and a review of a test file will easily identify this problem. To receive advice through a review of archived test files, call the ATS Service Department.

3. It may be that one or more of the thermocouples are not properly attached or are not in the proper location.

4. It may mean that the furnace is not properly closed or that the end caps are not in place.

5. The most common problem is that the specimen is not in the center of the furnace, requiring the furnace to be adjusted vertically. If the specimen is below the center of the furnace, then the bottom end of the specimen will not be inside the furnace. This will result in the bottom of the specimen being even cooler than normal. This makes it much more difficult for the differential algorithm to function, resulting in the FZone alarm.

NOTE: With a specimen installed correctly, the furnace should be positioned so that the specimen is vertically centered in the middle zone. This is part of the installation procedure and should be checked any time a change is made to either specimen or pull rod length.

A.3.2 TLow alarm:

TLow simply means that the temperature of one or more of the thermocouples is more than the minor alarm value below the setpoint of the test specification.

Specimen size is not a factor. The system is designed to operate in a typical creep furnace, which is usually a three-zone arrangement with each zone typically 3-4 inches long and a specimen of about three inches. A shorter specimen is easier to control than a longer one.

In rare cases, widening the alarm band may help avoid these alarms, though relaxing these limits may exacerbate the problem. Frequently, the same problems that cause an FZone alarm lead to persistent TLow or THigh alarms.

If TLow occurs frequently during the soak cycle, it may be that the Integral Algorithm is not active enough. Increasing the “I” term of the furnace setup may help. For example, if the setting is 0.03, it may be beneficial to increase the value to 0.04 or 0.05. Contact ATS for help with this.

NOTE: These parameters may be reset during operation of the furnace, so if a test has persistent TLow alarms, change the “I” term value and observe what happens.

During operation, furnace power will not be equal among the zones because the bottom zone will typically receive more power to keep it to temperature. If everything is set up satisfactorily, one TLow alarm may appear at the beginning of the test. It is uncommon if the alarm continues to repeat and typically indicates an issue.

Appendix B: Glossary

B.1 Prompts that may appear during Setup and Running a Test

Apply Load: The load is applied to the specimen.

Cal/Ver: The frame is having the extensometer calibrated, verified, or checked.

Disable: This state makes sure that if the termination was due to a temperature alarm that the specimen did not actually break.

Fault: A hardware fault has occurred on the frame.

Idle: The frame status is idle.

Initial Load: Sets the initial drawhead or elevator position before ramping the furnace.

Loading 2: No action, except to take the frame offline. Used by the test load control.

Load Invalid: The load control has been unable to maintain the load within the 1% limit for over five minutes.

Manual: The frame is in manual control.

Pre Start up: The frame is requested to start; all parameters are downloaded to the frame controller.

Post Test: The test is complete and ready to be removed.

Ramp: The furnace is ramped from the current temperature up to the setpoint. When at least one of the thermocouples is within the minor limit, the soak state is entered.

Remove: The frame controller is waiting for the host to upload the final test data before the specimen is removed.

Restart: The system is restarting the test after a power failure.

Run: Normal running state of the test.

Shutdown: Entered at the termination of a test. Stops all frame motion and stops the furnace.

Soak: Furnace soak state.

Start-up: Refers to frame status.

Start-up Delay: Test start-up was delayed.

Terminate: This state is entered when a test is terminated by the operator.

Unload: The load on the specimen is removed.

WF Power: A power failure has just occurred and the system is waiting for the hardware to reinitialize.

B2: States that occur while Running a Test

All Specimen Thermocouples are Open: All control thermocouples are open and the test will be shut down.

Automatic Loading Failed: The automatic creep loading system failed; this statement is usually accompanied with a reason for load failure.

Automatic Loading Timed Out: The automatic creep step loading routine failed due to insufficient load change during the loading procedure.

Cannot Start, Open TCs: One or more thermocouples are open during the initial start-up or ramp of the specimen.

Check Furnace Alarm, Shutdown: A fatal temperature event precedes this message. This indicates the actual shutdown of the furnace control due to that event.

Control T/C Switched to Highest T/C: Informational alarm which indicates that the temperature control is completely stable and the control is now on the highest physical thermocouple in the furnace.

Furnace Split Exceeded: Indicates the system has adjusted the power split between the zones as much as possible and was not able to control temperature uniformity.

ISO Thermal Temperature Range Error, Shutdown: The temperature measurement subsystem ambient temperature sensor is outside the range of normal operation, which is less than 32 degrees Fahrenheit or greater than 120 degrees Fahrenheit.

Rezero of Extensometer Requested: The system has detected that the specimen has creeped close to the range of the displacement transducer. The system is requesting a mechanical rezero of the extensometer.

Shutdown Due to Furnace Out of Band Time Exceeded: The furnace has been out of band limits for more than fifteen minutes and the ramp up will be terminated. Check for the following conditions:

1. Open furnace element or solid state relay
2. Specified ramp rate is too fast
3. Shorted thermocouple
4. Low AC line voltage

Specimen Broke During Loading: The system was loading the specimen and after five minutes the break switch never went to a not broken state. The system assumes that the specimen broke.

Specimen is Ready to Load Weights: The specimen is ready to be loaded on manual frames.

Specimen Loaded: The specimen was loaded by the system.

Specimen Reached Creep Limit: The test is being shut down because the creep limit specified in the test specification has been reached.

Specimen Reached Life Hours: The test is being shut down because the run time limit specified in the test specification has been reached.

Specimen Reached Reference Plain or Life Hours: The notch specimen has reached the reference plain's hours and the test will be shut down.

Specimen Ruptured: The system has detected a specimen rupture.

Step Load Completed by User Name: Indicates the user that completed the manual step load.

Temperature Measurement Error, Shutdown: A fatal hardware error has occurred in the temperature measurement subsystem of the frame controller.

Test Reloaded or Restarted: Indicates that a test which had been previously removed and post tested has been restarted.

Test Restarted Automatically by System: The test has been automatically restarted after a controller power failure.

Test Restarted Manually: The test was restarted by a user after it had shut down.

Test Terminated by User Name: Indicates which user terminated the test.

(Top, Middle, or Bottom) T/C at x.x °F has returned below limit, dev x.x °F from setpoint: Indicates that specimen thermocouple has returned from below temperature limit.

(Top, Middle, or Bottom) Thermocouple is Open: The thermocouple is open.

(Top, Middle, or Bottom) Thermocouple Repaired: The thermocouple that was previously open has been repaired.

Appendix C: 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.

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