ATAMI Standard Operating Procedure

Instron 5960

Last saved by Randy Greb on 11/5/2019 11:00 AM

Revision	Date	Description/Change	Curator
0	April 30, 2019	New document	Randy Greb
1	November 5, 2019	Updated shutdown procedure. Updated Contents formatting for simpler reading.	Randy Greb

Contents

Scope:

Basic operations of the Instron tool for both tensile and compression testing.

System Specifications:

See the Tool Summary on the ATAMI website.

Safety

General

Give a general description here of the safety issues of the system.

PPE Required

Safety glasses at all times.

Nitrile gloves when handling parts.

Hazardous Energies

Electrical

All maintenance is conducted by ATAMI staff. Do no expose any panels.

Mechanical

Crush hazards - Be aware of moving parts in the test head assembly, the

Flying debris – For brittle samples, especially with compressive testing, it's possible that debris may fly out from the test region when the sample breaks. ALWAYS wear safety glasses. If you have a brittle sample, discuss additional safety protections with ATAMI staff before testing.

Stored/Potential

The test head may be heavy, use caution.

Never try to remove a sample when it is under stress!

Thermal

If you are testing heated samples, use appropriate thermal protection.

Materials/Consumables Hazards

NA.

Interlocks

NA

Training Requirements

1. Pass all ATAMI required safety courses
2. Finish lab tour with qualified ATAMI trainer.
3. Complete all hands on training for this system and signed off by trainer.
4. Verify access to this document for reference.

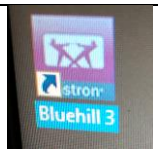
Procedures

Installing a Load Cell:

The default load cell is 30kN. Installing a load cell requires care and correct torque settings for the mounting bolts. Please contact ATAMI staff if you want to change load cells.

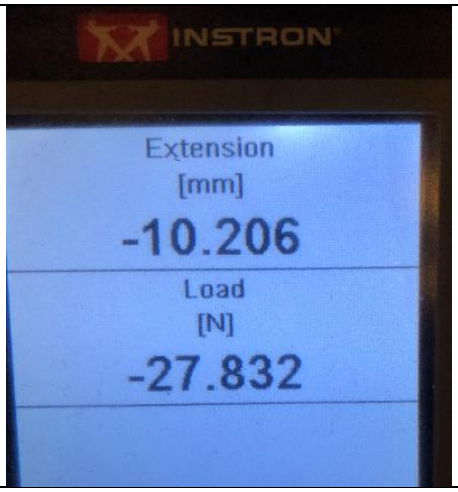
How to Start the System:

Step	Action	Notes
1	Turn on the frame. The power button is on the side of the frame, as shown here.	 After power up, the frame will go through a power up sequence and you'll see LED's light on/off, and then the display will look something like: 

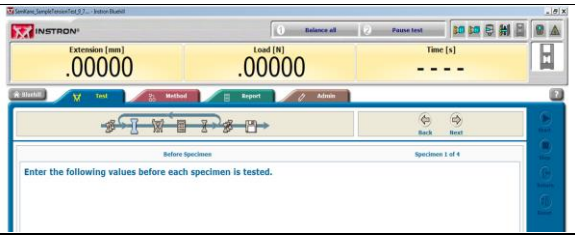
2	Wait 15 minutes for the load cell to warm up.	This is required for repeatable measurements.
3	Open the Bluehill software from the desktop icon and let it start.	 If the PC is turned off, go ahead and power it up. You may get a connection error popup message. If you do, go ahead and select yes to try to re-connect.

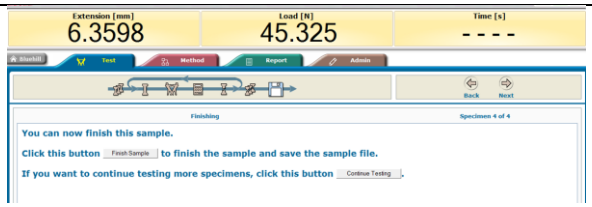
How to Shutdown the System and leave it for next user:

Step	Action	Notes
1	If you are using the large grippers, balance the load using the Bluehill button to get it reading roughly zero, after you have removed your sample.	
2	Place the board on the bottom gripper.	
3	Carefully move the top gripper down until it is almost touching the board.	

4	Use the fine position control knob to carefully move the top gripper down until the Load value just starts changing (negative). Then back of slightly so it's slightly negative by a few Newtons.	
5	Shutdown the PC software.	
6	Turn off the frame.	
7	Ensure that the workspace is clean and organized, and all supplies are put back correctly in their storage locations.	

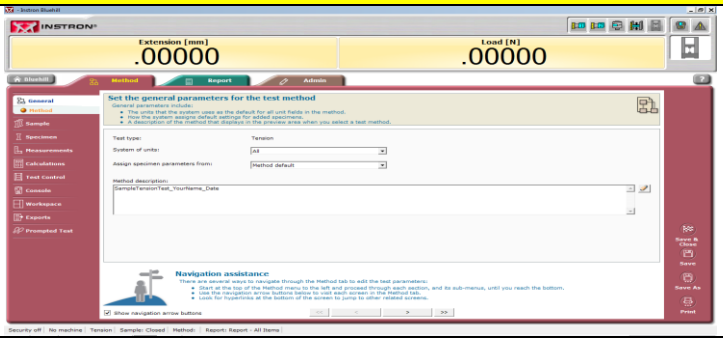
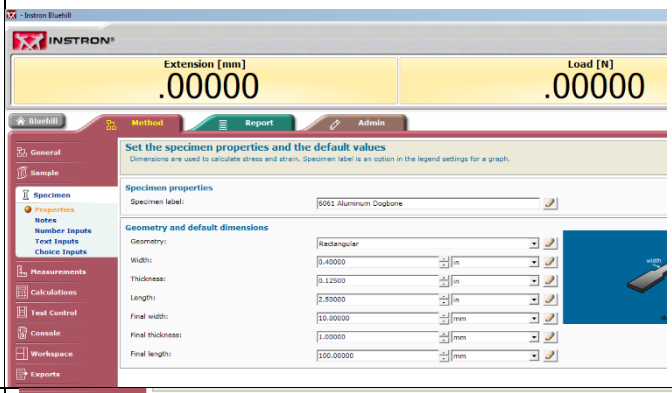
How to Run a Test:

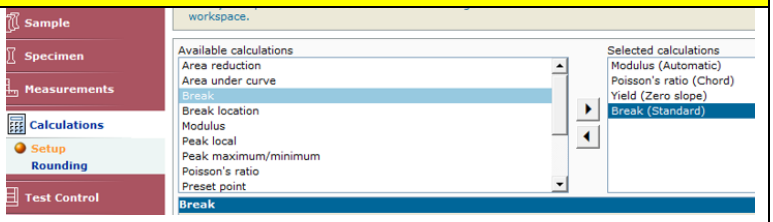
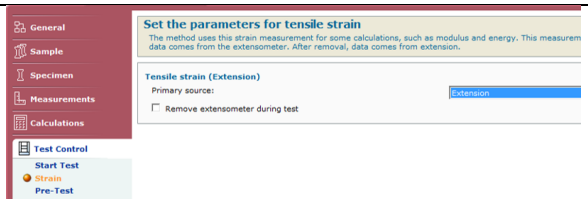
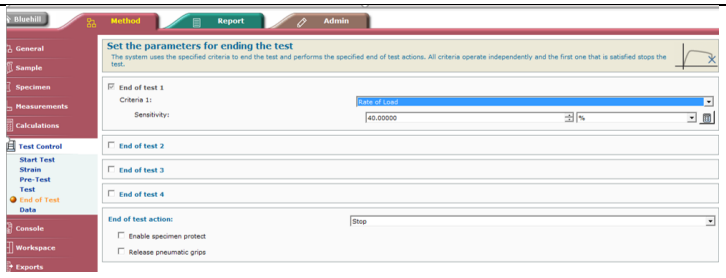
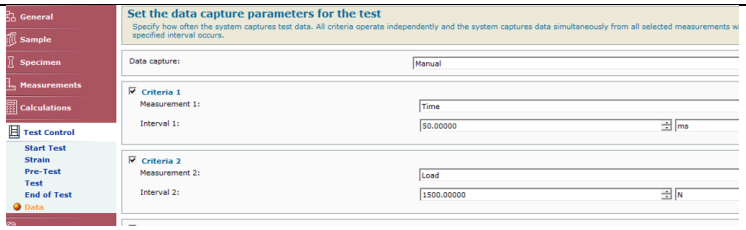
Step	Action	Notes
1	From the Bluehill home page, select the "Test" button.	
2	Select your newly created tension method from the list and click the "next" button. In the "Sample name" field, verify your name and edit as necessary.	
3	Press Balance all to set the re-set the extension and load values in the live display. Use the next and back buttons to navigate throught eh test.	
4	Load the sample in the top grip.	The sample should be pushed up against the back of the grips. The bottom corner of the shoulder should align with the red indicator marks on the grips. Tighten the grips. See the image for clarification. 

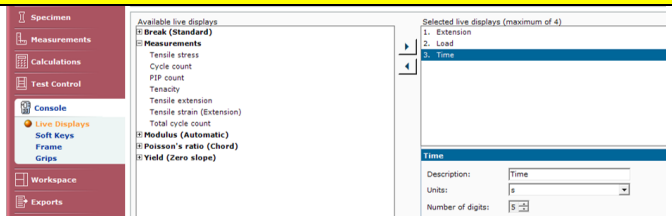
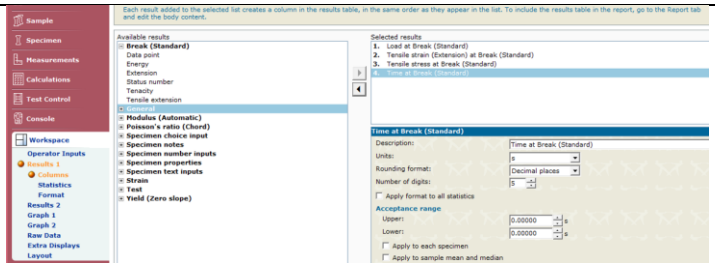
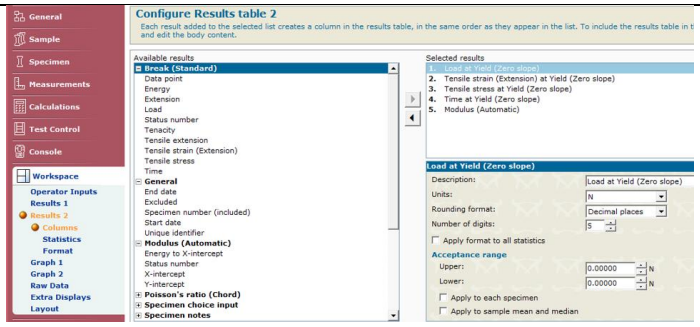
Step	Action	Notes
5	Use the jog up and down arrows and the scroll wheel on the controller to move the bottom gripper to a position to tighten the bottom of the sample.	
6	Click the “balance all” softkey again to re-set tension.	
7	Select start.	Your test will run until the sample fractures or the specimen protect is tripped.
8	When the test is complete, follow the prompts and click “next”.	Your results tables will show up on the right side of the screen based on the customized workspace that was created earlier.
9	If you specified more than one sample, click next to follow the prompts to load and run the tests on the additional samples.	
10	When the testing is complete, you can find the report in the location specified earlier.	

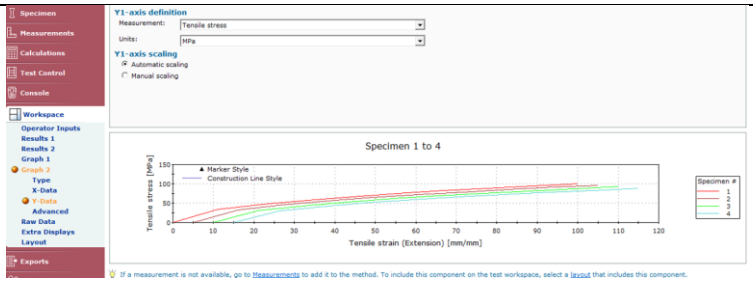
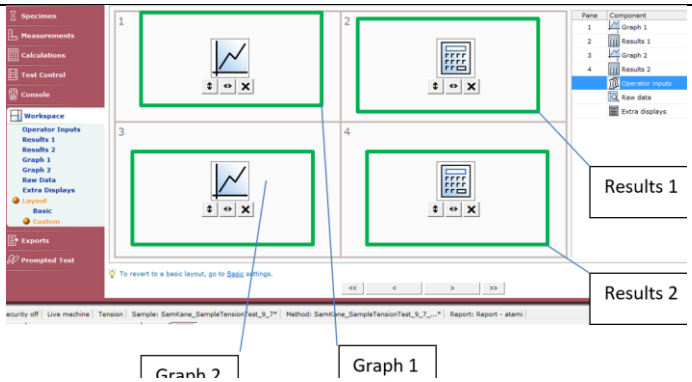
How to Create a New Method for a Tensile Test (test parameters):

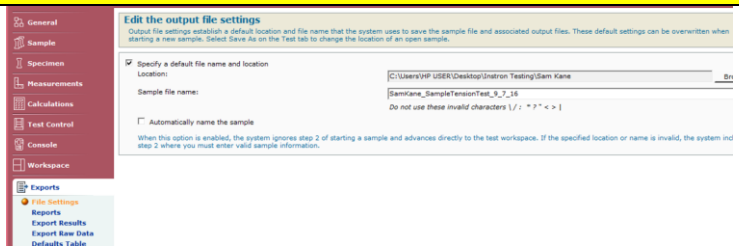
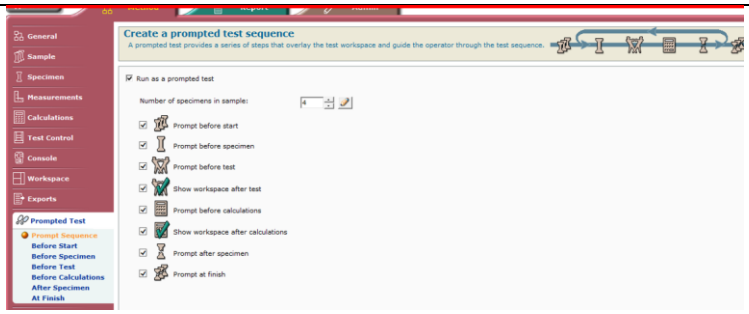
Step	Action	Notes
1	From the Bluehill Dashboard: • Click on the “Method Button”. • Select “Create New Method” from the list of options on the left side of the screen. • Select “Tension Method” from the dropdown menu.	

Step	Action	Notes
2	In the General Menu: Select *ALL* for system of units and *method default* for assign specimen parameters.	
3	Click the “>” navigation buttons to move on to each of the following menus.	Only menus that generally require input are listed in this procedure. Just navigate through the others with the “>” key and leave them at their defaults or blank. If you want to add additional information here, refer to the Bluehill manual in the Instron cabinet for more information.
4	In the Sample->Notes menu: Sample Description: *Dogbone Sample (for dogbone samples)* Sample Note 1: *A description of your sample (such as 6061 Al)* Sample Note 2: *Leave Blank* Sample Note 3: *Leave Blank*	
5	In the Specimen>Properties menu: Add the sample cross-section parameters (width/thickness, or radius if round) and length. These will be used for calculations but will not affect the test process. You can leave the “Final” parameters at their defaults.	
6	Use Measurements->Setup menu to add measurement types. Most tests should include the following: *Time, Extension, Load, Tensile Strain (Extension), Tensile Extension, Tensile Stress, Tenacity*	

Step	Action	Notes
7	Use the Calculations-Setup menu to add calculated output. Most tests should include the following: *Modulus (Automatic), Poisson's Ratio (Chord), Yield (Zero Slope), Break (Standard)*	
8	In the Test Control->Strain menu, ensure that *Extension* is chosen from the drop down menu and that the box by "Remove extensometer during test" is left <u>unchecked</u>.	
9	In the Test Control->Pre-Test menu: • Check the "Preload" box. Preloading the sample will ensure that there is no load on the specimen when the test starts. • For "Control Mode" select *Extension.* • For "Rate" select *1.5* with units of *mm/min*. • Leave all else on this page at the defaults.	
10	In the Test Control->Test menu: • Ensure that only the "Ramp 1" box is checked. • For "Control mode 1" select *Extension*. • For "Rate 1" select 6.5 mm/min.	
11	In the Test Control->End of Test" menu: • Ensure that the values match the image shown here. • "Criteria 1" should be *Rate of Load*. • "Sensitivity" should be *40%.* This parameter will end the test if the rate of extension drops below 40% of the rate set in Test Control->Setup menu.	
12	In the Test control->Data menu: • Select *Manual* from the dropdown menu for "Data Capture". • For "Criteria 1" have the time interval be *50 ms* instead of 100 ms. • For "Criteria 2" enter *1500 N* for the interval. • Make sure that the box next to "Criteria 3 is not selected.	

Step	Action	Notes
13	In the Console->Live Displays menu: • Move Extension, Load and Time to the right column.	
14	In the Console->Soft Keys menu: • Select *Balance All* and *Pause Test* from the menu on the right.	
15	In the Console->Frame menu: • Select *Below Crosshead* and set the threshold at *6000 N* for "specimen protect".	
16	In the Workspace->Results 1 menu: • Select the following from the "break standard" menu: *Load at Break (Standard), Tensile strain (Extension) at Break (Standard), Tensile Stress at Break (Standard), and Time at Break (Standard).* • Under "Statistics" select *Mean* from the left. • Under "Format" choose *Style 2.*	
17	In the Workspace->Results 2 menu: • Under "Columns" select the following <u>from the menu "Yield"</u> at the bottom of the left list: *Load at Yield, Tensile Strain (Extension), Tensile Stress at Yield, Time at Yield.* • In the menu "Modulus" in the left column, select *Modulus* and move it over to the right. • There should be 5 total parameters in the right column. • Under "Statistics" select *Mean.* • Under "Format" select *Style 2.*	
18	In the Workspace->Results 2->Graph1 menu: • Under "Type" leave all parameters at the system defaults. You will see a preview of Graph 1. Load (N) should be on the Y-Axis and Extension (mm) should be on the X-Axis. We will leave Graph 1 at system defaults and only be editing Graph 2. SKIP DOWN TO THE "Graph 2" SUBTAB.	

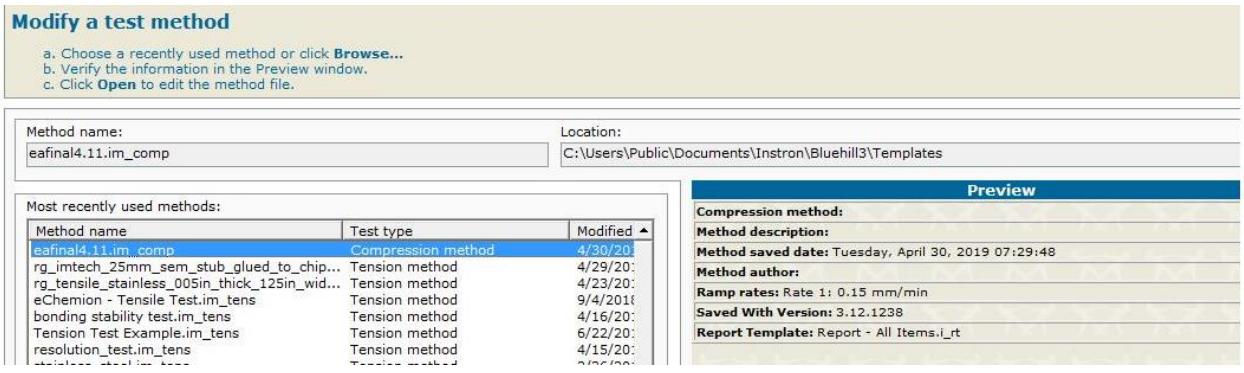
Step	Action	Notes
	• For Graph 2 we will be constructing a Stress-Strain graph with the intention of developing a stress-strain curve when testing begins. To achieve this go to the "X-Data" subtab under "Graph 2" and change the "measurement" to *Tensile Strain* and change the units to *mm/mm.* Make sure that the auto scaling bubble is checked.	
19	In the Workspace->Results 2->Graph2 menu: • Change "x-data" to "tensile strain" • Change x-axis units to mm/mm. • Make sure the automatic scaling bubble is checked. • Change the "y-data" measurement to *Tensile Stress*. • Change y-axis units to MPa.	
20	In the Workspace->Raw Data menu: • Select *Time, Extension, Load, Tensile Strain,* and *Tensile Stress* for the columns. Use default units and format. • Select *Style 3* for format.	
21	In the Workspace->Layout->Custom menu: • Set this up to include for panes: *Graph1, Graph 2, Results 1 and Results 2.* • To add or move panes use the up/down arrow buttons. • To remove panes use the X buttons. • Select the panes from the right side and move them to the panes window.	
22	In windows explorer add a directory with your name (if not already there) to the following directory: C:\libraries\Documents\Public Documents\Instron\Bluehill3\Output\	

Step	Action	Notes
23	In the Exports->File Settings menu: • Click the specify file name and location and use the following: C:\libraries\Documents\Public Documents\Instron\Bluehill3\Output\<your name>	
24	In the Exports->Reports menu: • Select "*Report-atami.i_rt*" as the template. • Select PDF as format.	
25	In the Prompted Test->Prompt Sequence menu: • Select the number of samples you will run. • Check "Run as a prompted test"	
26	Click the "Save & Close" button to the lower right.	When prompted, name the method and save it under the "Templates" folder.

Standard or Example Recipes

Location of Methods:

Methods are located here. You can copy them to a USB stick for backup, if you have a critical method.



Standard method types:

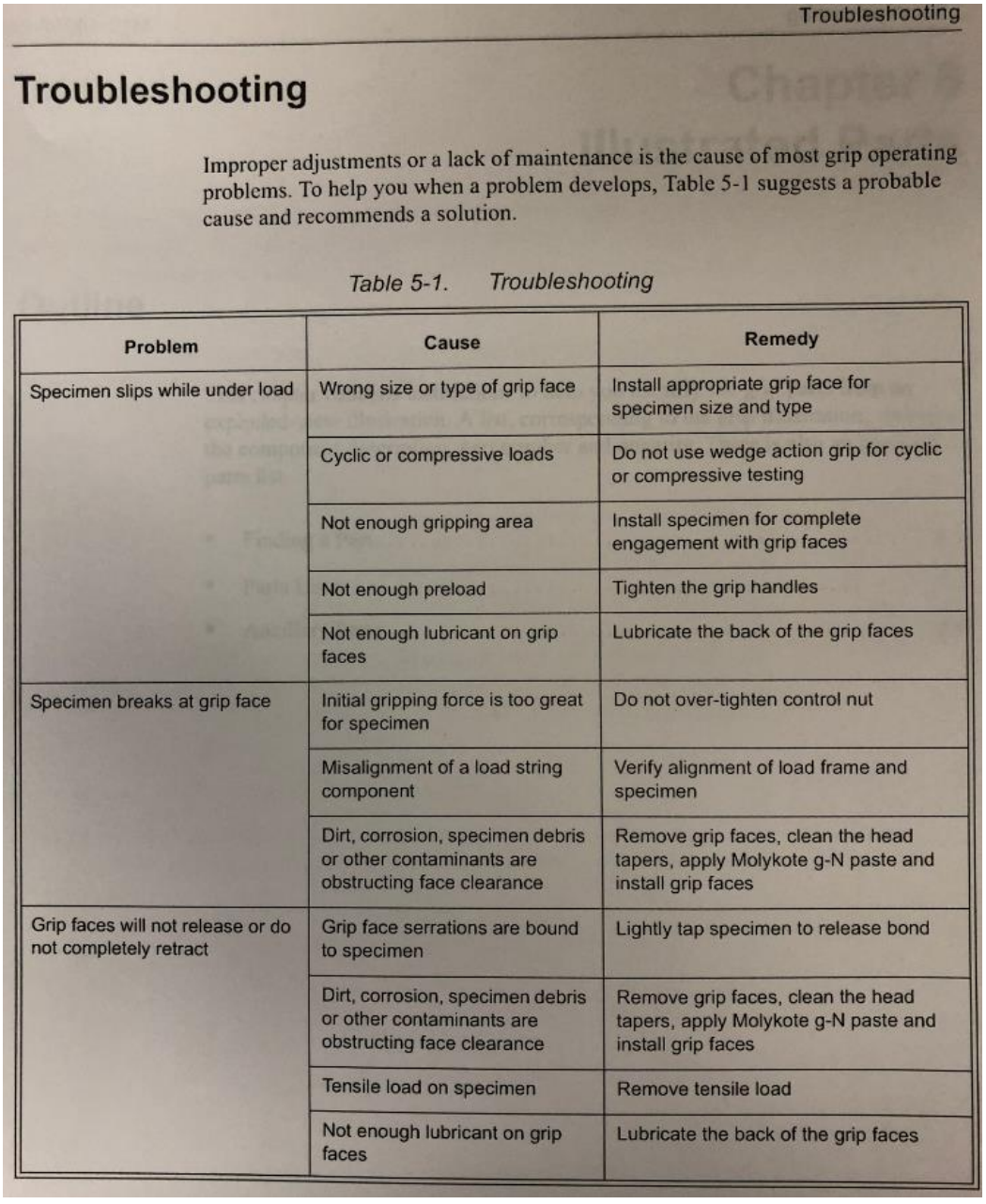
Table 1-1. Test Method Type Summary

TEST METHOD TYPE	Test Control	Calculations
TENSION	Preload, Precycle, up to 2 speeds	Absolute Peak, Local Peaks, Preset Points, User Calculations, Modulus (9 types), Yield (5 types), Break (6 types), Slack/Compliance Correction, Poisson's Ratio, Area Reduction, Break Location, Seam Slippage
COMPRESSION	(same as tension but for compression direction)	(Same as Tension but also provides compressive values)
CREEP/RELAXATION	Preload, Holds: extension, load, or strain	Same as Tension plus Total, Delta,Creep or Relaxation, Hold Preset Points,
FLEXURAL	Preload, Tensile/Compressive	Same as Tension modified for applicable Flexural fixture
PEEL/TEAR/FRICTION	Preload, Tensile	Same as Tension plus 1st Peak, Average values, Average peaks, Coefficient of Friction,
TENSION TESTPROFILER	Follows user created tensile waveform (Profile). Up to 96 segments of cycles, ramps or holds	Same as Tension and PTF applications but calculations can be applied to each segment or the complete test.
COMPRESSION TESTPROFILER	Follows user created compressive waveform (Profile). Up to 96 segments of cycles, ramps or holds	Same as Compression and PTF applications but calculations can be applied to each segment or the complete test.
METALS for EN/ISO standards	Preload, Precycle, up to three speeds, (Hysteresis reversal per EN1002)	Same as Tension plus r values, & n values, Non-Proportional Elongation, Yield Point Elongation, Tension calculations

Basic Troubleshooting

Issues with Using the Grippers:

Step	If	Then	Notes
1	You have issues with the grippers (hard to close, samples slipping, etc..	Use the troubleshooting guide shown below, here.	
2	If step 1 doesn't work.	Contact Atami staff.	



Troubleshooting

Troubleshooting

Improper adjustments or a lack of maintenance is the cause of most grip operating problems. To help you when a problem develops, Table 5-1 suggests a probable cause and recommends a solution.

Table 5-1. Troubleshooting

Problem	Cause	Remedy
Specimen slips while under load	Wrong size or type of grip face	Install appropriate grip face for specimen size and type
	Cyclic or compressive loads	Do not use wedge action grip for cyclic or compressive testing
	Not enough gripping area	Install specimen for complete engagement with grip faces
	Not enough preload	Tighten the grip handles
	Not enough lubricant on grip faces	Lubricate the back of the grip faces
Specimen breaks at grip face	Initial gripping force is too great for specimen	Do not over-tighten control nut
	Misalignment of a load string component	Verify alignment of load frame and specimen
	Dirt, corrosion, specimen debris or other contaminants are obstructing face clearance	Remove grip faces, clean the head tapers, apply Molykote g-N paste and install grip faces
Grip faces will not release or do not completely retract	Grip face serrations are bound to specimen	Lightly tap specimen to release bond
	Dirt, corrosion, specimen debris or other contaminants are obstructing face clearance	Remove grip faces, clean the head tapers, apply Molykote g-N paste and install grip faces
	Tensile load on specimen	Remove tensile load
	Not enough lubricant on grip faces	Lubricate the back of the grip faces

Attachments

Force conversion table:

Units of force

v·t·e	newton (SI unit)	dyne	kilogram-force, kilopond	pound-force	poundal
1 N	≡ 1 kg·m/s^2	= 10^5 dyn	≈ 0.10197 kp	≈ 0.22481 lbf	≈ 7.2330 pdl
1 dyn	= 10^{-5} N	≡ 1 g·cm/s^2	≈ 1.0197 × 10^{-6} kp	≈ 2.2481 × 10^{-6} lbf	≈ 7.2330 × 10^{-5} pdl
1 kp	= 9.80665 N	= 980665 dyn	≡ g_n · (1 kg)	≈ 2.2046 lbf	≈ 70.932 pdl
1 lbf	≈ 4.448222 N	≈ 444822 dyn	≈ 0.45359 kp	≡ g_n · (1 lb)	≈ 32.174 pdl
1 pdl	≈ 0.138255 N	≈ 13825 dyn	≈ 0.014098 kp	≈ 0.031081 lbf	≡ 1 lb·ft/s^2

The value of g_n as used in the official definition of the kilogram-force is used here for all gravitational units.