

PeenSolver Pro (Testing)

File Edit Help

EI Electronics Inc.
Shot Peening Control

Get in Touch...
Electronics Inc.
56790 Magnetic Dr.
Mishawaka, IN USA 46545

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Process Settings:
Operator: Ken Derucki
Date: Oct 4, 2022
Comments: Testing
Peening Method: Conventional
Strip Type: A
Curve Type: AUTO (EXP2P)
Unit System: Imperial (in)
Control Type: Time
Control Units: s
Shot Type: S230
Air Pressure: 65 psi
Flow Rate: 10 lb/min
Speed: 10 rpm
Blasting Angle: 90 deg
Nozzle Size: 0.25"
Nozzle Distance: 8"

Top Side

Name: Top

Strip	Pre-Bow (in)	Time (s)	Arc Height (in)
1		2	0.0069
2		4	0.0078
3		8	0.0084
4		16	0.0086

Saturation Point
Arc Height (in)
0.0076
Time (s)
2.8

Add Location
Delete Location
Force Update
Add Strip
Remove Strip

Graph Options
 Display All Locations
 Display Current Only
Top
Side
 Show Saturation
 Show Limits

Saturation Curve

Location	Target	Measured
Top	0.0077	0.0078
Side	0.0097	0.0099

Last Verification Test Results:
Operator: Dave Barkley
Timestamp: 10/4/2022 9:52 AM
Time: 3

File Location: C:\Users\kderucki\Desktop\Testing.peen

Perform New Verification Test

PeenSolver Pro™

Instruction Manual



56790 Magnetic Drive, Mishawaka, Indiana 46545 USA • 1-800-832-5653 or (574)256-5001 • www.electronics-inc.com

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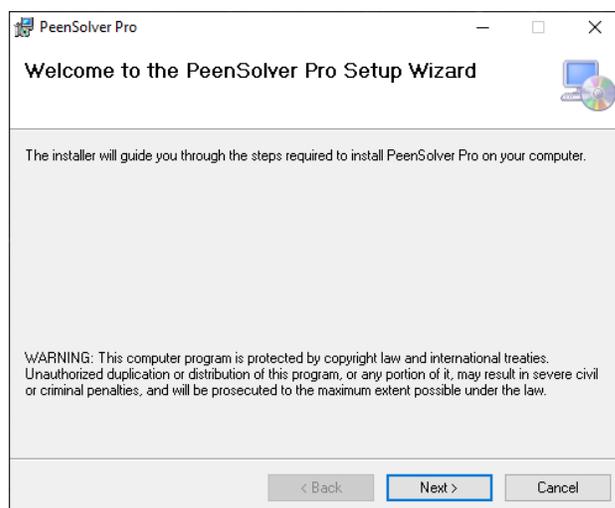
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Introduction

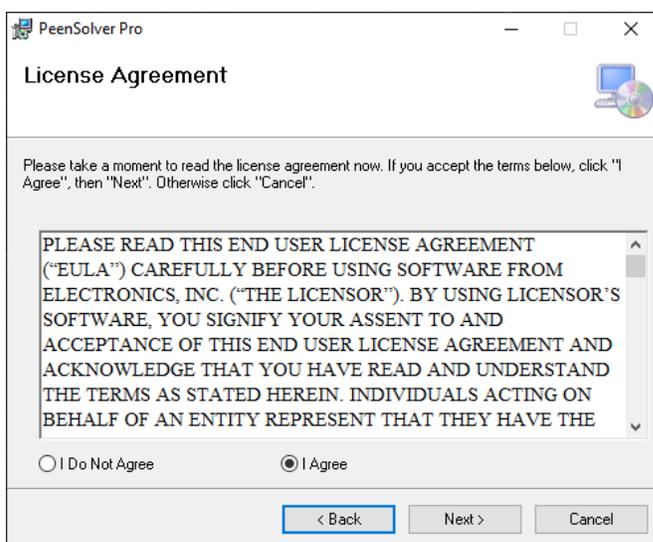
PeenSolver Pro™ is the latest saturation curve solver from Electronics Inc. This program includes many features seen in other curve solvers with new features added after reviewing customer feedback. The manual will provide the necessary information to operate the program and it should be read carefully to ensure all procedures are followed and to take advantage of the program's features.

Installation

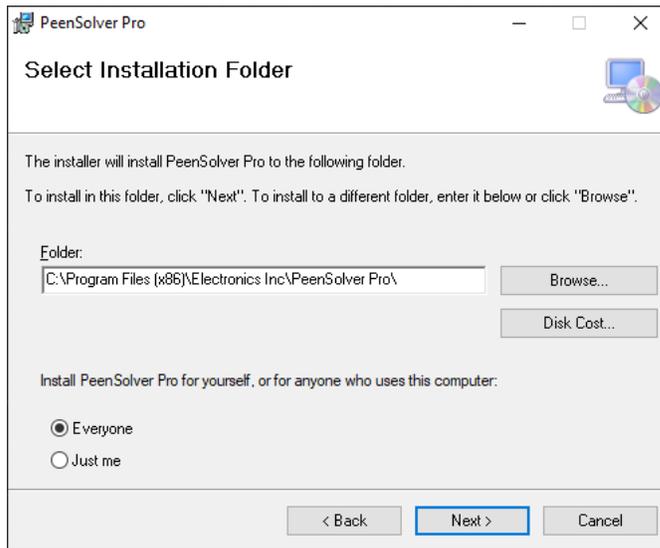
- Download from www.electronics-inc.com
- Run file named "PeenSolverPro-Installer.X.X.X"
- Follow on-screen instructions



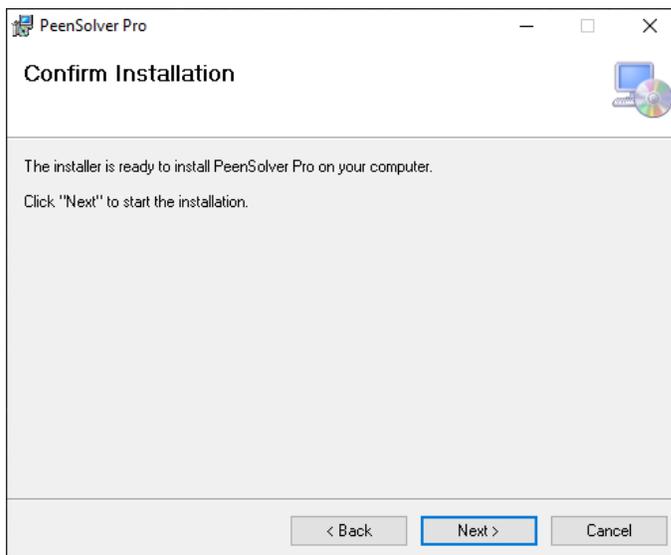
- Click "Next >"



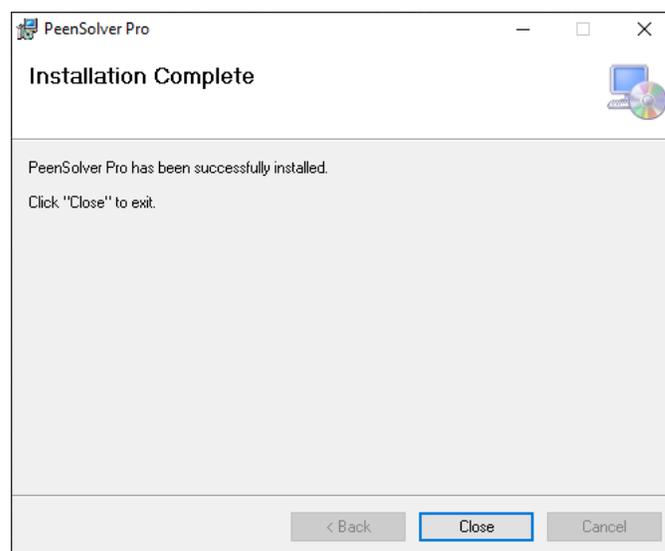
- Agree to the license agreement and click "Next >"



- Click "Next >"



- Click "Next >"



- Click "Close" when complete

Calculating Saturation Curve

Configuring Test Settings

- Open PeenSolver Pro™ by double clicking on desktop app
- Once open, navigate to File->New
- Settings window will pop up
- Configure test setting as desired
- Click “Continue” once settings are filled

Universal Settings

- **Operator:** Name of person who completed the test
- **Date:** Date testing was completed
- **Comments:** Any additional information not covered by settings
- **Strip Type (Default: A):** Allows for user to select between “A”, “N”, and “C” Almen Strips.
- **Unit System (Default: Imperial):** Toggles between Imperial and SI units and units will be reflected on the graph. Units will be displayed in inches and millimeters.
- **Curve Type (Default: Auto (2PF)):** Determines the equation used to draw saturation curve. There are five (5) possible modes to choose from:
 - 1) Auto (2PF): Determines the equation based on the number of strips. If four (4) strips are entered the 2PF equation is used. If five (5) or more are entered, the 3EXP equation is used.
 - 2) Auto (2EXP): Same functionality as Auto-2PF but uses 2EXP for four strips rather than 2PF
 - 3) 2PF: Uses 2PF equation regardless of strip count
 - 4) 2EXP: Uses 2EXP equation regardless of strip count
 - 5) 3EXP: Uses 3EXP equation regardless of strip count
- **Control Type (Default: Time):** Changes the X unit on graph and input table. Other options include Speed and Feed Rate.
- **Units (Default: s):** Time unit used in for testing. Must be “s” for seconds or “m” for minutes.
- **Curve Verification Check Box (Default: on):** Notifies user that a measured arc height is outside of a given range of the calculated curve. Turning off this feature will hide program notifications of an error.
- **Curve Error (Default: 5%):** Threshold for the program to notify that a calculated point has deviated from a measured point.
- **Intensity Limits:** User determined values for intensity limits. These values are used to display limits graphically on the saturation curve.
- **Test Verification Limit (Default: +/-0.0015):** Limit for test verification strips to be off from the original test. If limit is exceeded, the user will be notified that the test verification value is outside the desired range.
- **Auto Export Verification (Default: On):** CSV file is automatically generated or updated every time a new verification is saved. **Note:** Data will be saved in .peen file regardless if data is exported to .CSV at each verification. Turning this back on will export all data that was not exported in previous tests.

Conventional Peening

Process Settings [X]

Operator: Date: [Calendar]

Comments:

Peening Method: Strip Type: Unit System: Curve Type: Control Type: Units:

Shot Type: Air Pressure: Flow Rate: Speed (RPM):

Blast Angle: Nozzle Size: Nozzle Distance:

Enable Curve Verification

Error (%):

Intensity Limit 1 (in): Upper: Lower:

Intensity Limit 2 (in): Upper: Lower:

Verification Limits (in):

Export Verification Data Automatically

- **Shot Type:** The type of media used in testing
- **Air Pressure:** Air pressure at the nozzle used in test
- **Flow Setting:** Flow rate of media
- **RPM:** Speed of table or fixture used to hold Almen Strips
- **Blast Angle:** Angle nozzle is to blasting surface
- **Nozzle Diameter:** Inner diameter of nozzle
- **Height Above Strip:** Distance from nozzle to strip

Rotary Flapper Peening

- **RPM:** Speed of rotary flapper device when testing
- **Flapper Conversion:** Conversion of a flapper peened strip to a conventional strip due to differing Almen holders. For this test, if “A” strip is selected in “Strip Type”, either “0.77” or “AMS” can be selected. PeenSolver Pro will also convert for “N” strips. **Note:** Selecting “N” strip will override any conversion entered in this box.

The following page shows a screenshot of PeenSolver Pro™ after the “Continue” button is pressed. With the test settings configured, it is now time to enter data. It is also possible to skip entering in settings and go straight to entering data. Settings can be configured later by going to Edit-> Process Settings. The same window will pop up as when File->New is selected.

PeenSolver Pro (Untitled)

File Edit Help

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Process Settings:
Operator: Ken Derucki
Date: Oct 4, 2022
Comments: Testing
Peening Method: Conventional
Strip Type: A
Curve Type: AUTO (EXP2P)
Unit System: Imperial (in)
Control Type: Time
Control Units: s
Shot Type: S230
Air Pressure: 65
Flow Rate: 10 lb/min
Speed: 10 rpm
Blasting Angle: 90 deg
Nozzle Size: 0.25"
Nozzle Distance: 8"

Location 1
Name: Location 1

Add Location Add Strip
Delete Location Remove Strip
Force Update

Strip	Pre-Bow (in)	Time (s)	Arc Height (in)
1			
2			
3			
4			

Saturation Point
Arc Height (in)
Time (s)
Enter at least four arc heights to determine saturation.

Graph Options
 Display All Locations
 Display Current Only
Location 1
 Show Saturation
 Show Limits

Saturation Curve

Location Target Measured

Perform New Verification Test

File Location:

Saturation Curve Generation

- **Enter Data:** To enter data, simply select the cell you wish to change and enter the desired data. The default settings give room for four (4) strips to be entered. This can be changed by clicking “Add Strip” or “Delete Strip”, to the left of the table. The minimum number of strips needed is four (4) and the most that can be entered is seven (7). Do not leave rows blank. If a row is not being used, delete the row. To add another strip location, select “Add Location” and another tab will open to input data.
- **Once at least four (4) strips are entered, the program will automatically plot the data and update as data is changed.**

PeenSolver Pro (Testing)

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Process Settings:
Operator: Ken Derucki
Date: Oct 4, 2022
Comments: Testing
Peening Method: Conventional
Strip Type: A
Curve Type: AUTO (EXP2P)
Unit System: Imperial (in)
Control Type: Time
Control Units: s
Shot Type: S230
Air Pressure: 65 psi
Flow Rate: 10 lb/min
Speed: 10 rpm
Blasting Angle: 90 deg
Nozzle Size: 0.25"
Nozzle Distance: 8"

Top Side

Name: Top

Strip	Pre-Bow (in)	Time (s)	Arc Height (in)
1		2	0.0069
2		4	0.0078
3		8	0.0084
4		16	0.0086

Saturation Point
Arc Height (in): 0.0076
Time (s): 2.8

Add Location
Delete Location
Force Update
Add Strip
Remove Strip

Graph Options
 Display All Locations
 Display Current Only
 Top Side
 Show Saturation
 Show Limits

Saturation Curve

Location	Target	Measured
Top	0.0077	0.0078
Side	0.0097	0.0099

File Location: C:\Users\kderucki\Desktop\Testing.peen

Perform New Verification Test

Post Calculation Options

Saturation Point

- **Intensity:** Intensity result of the selected strip location.
- **T:** T result of the selected strip location.
- **Errors:** Errors in the selected strip. Errors can be of two (2) types:

- **Longest Peened Time is Shorter Than 2T**

Saturation Point

Arc Height (in)

0.0129

Time (m)

18 mins 6.12 secs

Error: Curve is invalid. Longest peened time is shorter than 2T.

- **Shortest Peened Time is Longer Than T**

Saturation Point

Arc Height (in)

0.007

Time (m)

4 mins 0 secs

Warning: Type 2 Curve – Shortest peened time is longer than T. Intensity changed to first peened strip's arc height.

Graph Options

- Display All Locations: Displays all locations in the program. Graphs can be toggled by selecting the highlighted locations
- Display Current Only: Displays only the selected location
- Show Saturation: Toggles the saturation point for the selected location tab
- Show Limits: Toggles user defined limits set in process settings page

PSP also allows the user to trace the curve and display the corresponding point. Left click the desired curve and hold down while dragging along the curve.

Curve Verification

- Hover on any entered arc height to display the error from the calculated curve.
- This feature can also be used for the entire curve. Right click on the “Arc Heights” cell on a given test to find the average error for all points.
- Figure below shows what a curve verification error looks like.

Time (s)	Arc Height (in)	
2	0.005	✘
4	0.008	✘
8	0.0081	
16	0.0081	

Arc Height (in)	Time (s)
0.0075	4.32

Time (s)	Arc Height (in)	
2	0.005	✘
4	0.008	✘
8	0.009	✘
16	0.0081	✘

Arc Height (in)	Time (s)
0.0078	4.656

Changing Test Settings After Curve Generation

If settings need to be changed after calculating or if settings were not entered into the program, they can be entered after the curves are calculated. Navigate to Edit-> Process Settings and the test settings window will come up.

PeenSolver Pro also can clear a given test or clear all data. To do this, navigate to Edit and either Clear Current Test or Clear All Tests. Clear Current test will clear whatever location tab is selected.

Saving/Loading Data

Saving Data

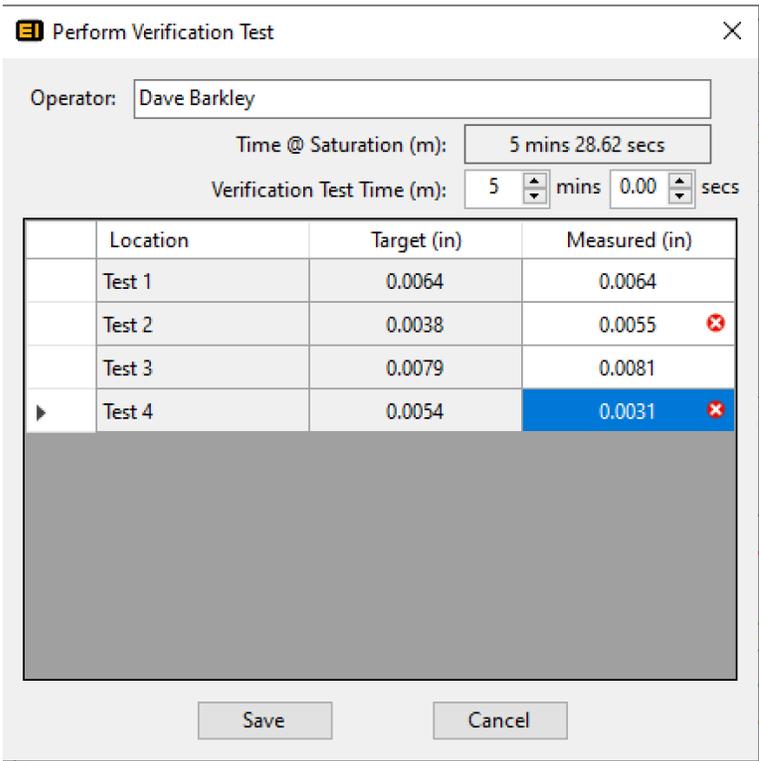
To save peening data, navigate to File->Save or Save As. If this is the first time saving, PeenSolver Pro™ will prompt the user to name and select a file location for the data. This will produce a .peen file. This contains all peening data and the verification data.

Note: Testing Verification will involve creating another file that will log verification values for future reference. This will be covered in the Verification Section.

Loading Data

If it is desired to reopen a saved test after closing PeenSolver Pro this can be easily done by navigating to File->Open and selecting the desired .peen file. PeenSolver Pro will automatically calculate the saturation curve when the data file is open. If changes are made to the data set or test settings, the test will need to be resaved. It is also possible to automatically open PeenSolver Pro by double clicking a .peen file.

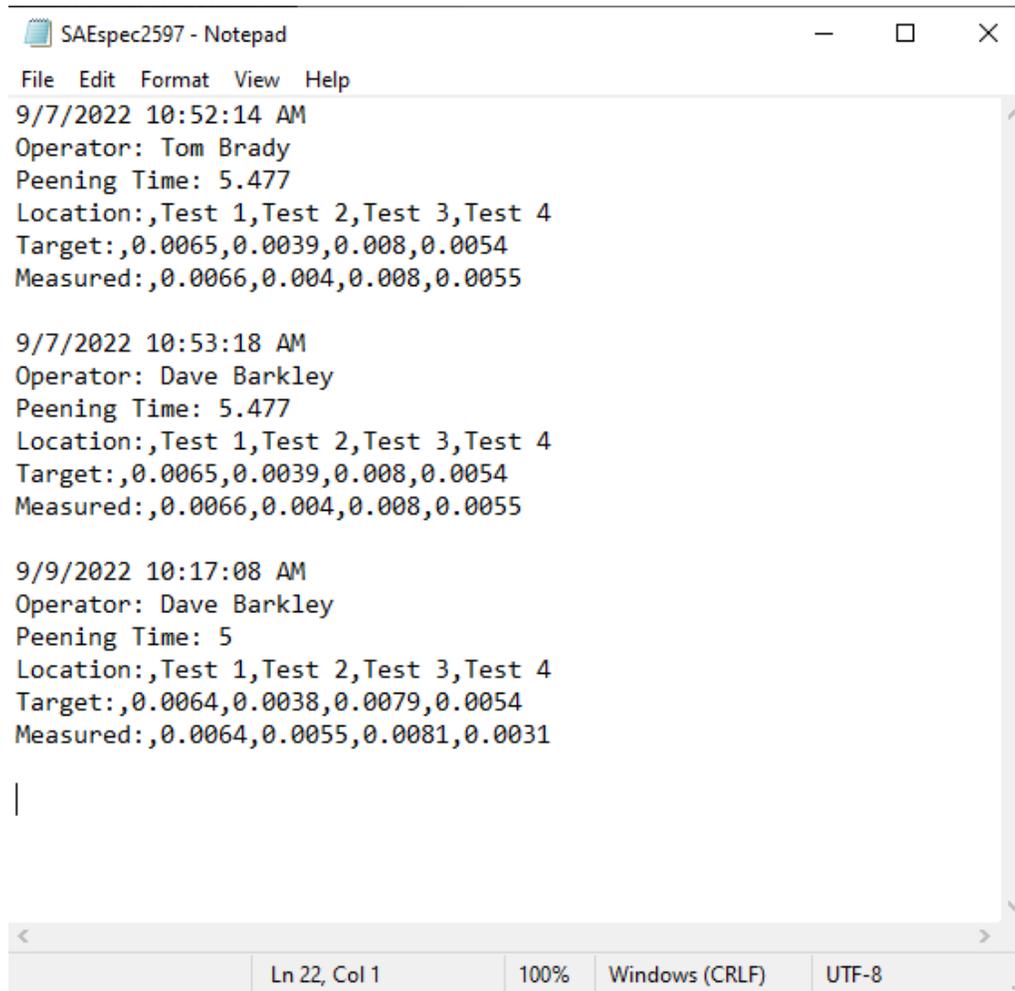
Verification



Once the desired curves are calculated, the largest T value from the data should appear in the “Time @ Saturation” box. The time values used for the test can be set by “Verification Test Time”. Arc heights at the time for each test will appear in the Target boxes. The user can then enter test verification data in the Measured boxes. If this entered value is outside the limit set for test verification, a red “X” will appear, notifying the user that there has been a problem.

With the test verification data entered, this can be exported to a log file that can be opened using software such as Notepad or Excel. Click the “Save” Button at the bottom of this tab and the verification data will be saved to a log inside the program. If “Auto Export Verification” is turned on, a .csv file will automatically be produced. If this setting is not turned on, all verification data can be manual exported by navigating to File->Export->Verification Data.

Example:



```
SAEspec2597 - Notepad
File Edit Format View Help
9/7/2022 10:52:14 AM
Operator: Tom Brady
Peening Time: 5.477
Location: ,Test 1,Test 2,Test 3,Test 4
Target: ,0.0065,0.0039,0.008,0.0054
Measured: ,0.0066,0.004,0.008,0.0055

9/7/2022 10:53:18 AM
Operator: Dave Barkley
Peening Time: 5.477
Location: ,Test 1,Test 2,Test 3,Test 4
Target: ,0.0065,0.0039,0.008,0.0054
Measured: ,0.0066,0.004,0.008,0.0055

9/9/2022 10:17:08 AM
Operator: Dave Barkley
Peening Time: 5
Location: ,Test 1,Test 2,Test 3,Test 4
Target: ,0.0064,0.0038,0.0079,0.0054
Measured: ,0.0064,0.0055,0.0081,0.0031

|

Ln 22, Col 1    100%    Windows (CRLF)    UTF-8
```

Saturation Report

PeenSolver Pro™ can output all data and curve to a simple PDF page that can be used for documentation purposes. Navigate to File -> Export -> Saturation Report. The user will then be prompted to select a save location for the PDF. An example Saturation Report can be found below, showing a report with two peening locations.



Saturation Report

Process Settings

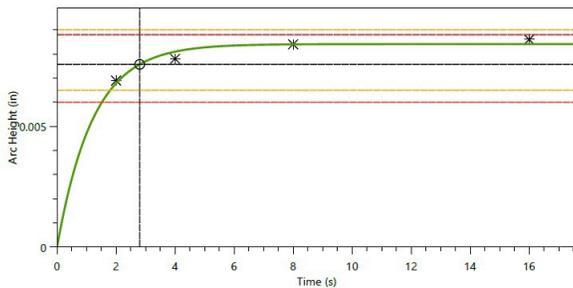
Name: Untitled	Date: 10/14/2022
Operator: Ken Derucki	
Comments: Testing	
Peening Method: Conventional	Strip Type: A
Curve Type: AUTO (EXP2P)	Control Type: Time (s)
Shot Type: S230	Air Pressure: 65 psi
Flow Rate: 10 lb/min	Speed: 10 rpm
Blasting Angle: 90 deg	Nozzle Size: 0.25"
Nozzle Distance: 8"	Flapper Speed: 5500

Top

Strip #	1	2	3	4
Time (s)	2	4	8	16
Arc Height (in)	0.0069	0.0078	0.0084	0.0086
Curve Error (%)	1.68	-3.66	0.03	2.27

Curve Type: EXP2P Saturation Intensity (in): 0.0076
 Average Error (%): 1.91 Saturation Time (s): 2.8

Saturation Curve





Saturation Report

Process Settings

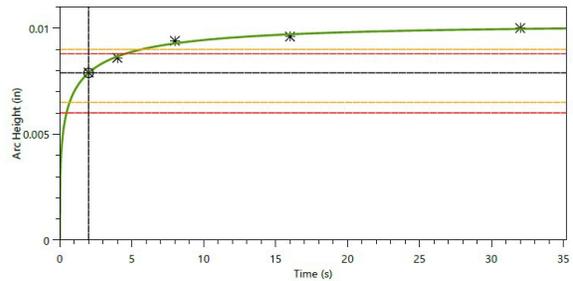
Name: Untitled	Date: 10/14/2022
Operator: Ken Derucki	
Comments: Testing	
Peening Method: Conventional	Strip Type: A
Curve Type: AUTO (EXP2P)	Control Type: Time (s)
Shot Type: S230	Air Pressure: 65 psi
Flow Rate: 10 lb/min	Speed: 10 rpm
Blasting Angle: 90 deg	Nozzle Size: 0.25"
Nozzle Distance: 8"	Flapper Speed: 5500

Bottom

Strip #	1	2	3	4	5
Time (s)	2	4	8	16	32
Arc Height (in)	0.0079	0.0086	0.0094	0.0096	0.01
Curve Error (%)	0.16	-0.72	1.3	-1.12	0.38

Curve Type: EXP3P Saturation Intensity (in): 0.0079
 Average Error (%): 0.74 Saturation Time (s): 2
 Warning: Type 2 Curve – Shortest peened time is longer than T. Intensity changed to first peened strip's arc height.

Saturation Curve



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