

2021 Almen Strip Consistency Testing Results

QUALITY CONTROL TESTING SINCE 2007

Electronics Inc. (EI) developed a performance consistency testing program on their A and N Almen strips in 2007 to ensure they are consistent in thickness, flatness and hardness. The purpose of EI's testing program is to verify that the strips will perform consistently, from lot to lot, from year to year.

TESTING METHOD

EI uses their own custom-built air blast cabinet with a variable speed rotary table with 39 Almen strip holders, a fixture for adjusting nozzle distance from the strips, a MagnaValve® for media flow rate control, and controls to adjust air pressure and table rotation.

During testing, the table is rotated at a fixed speed, and the cabinet is set for a specific pressure and constant media flow rate so each strip passes under the blast nozzle at the same angular velocity for the same predetermined number of revolutions. In addition, test strips from each lot are intermixed proportionally for each shot peening session. EI does this because all the Almen strips can't be peened at once, so an equal amount of strips from each lot is peened in each session. This way a slight process difference, if any, between peening sessions is "distributed" over all the test lots.

For each test, a sample size of 36 strips is used. EI measures and records the flatness of the strips before testing. After each test cycle, the arc heights are measured on a calibrated Almen gage and the flatness compensation is applied. The values are put into histograms for analysis. A histogram is a graphical display of tabulated frequencies, shown as bars. It shows what proportion of cases fall into each of several categories. A histogram differs from a bar chart in that it is the area of the bars that denotes the value, not the height of each bar.

TEST RESULTS

Histograms exhibit nearly identical lot-to-lot arc height results, thereby verifying the uniformity of the product. Test results from 2007 to 2021 are available at www.electronics-inc.com.

Each histogram represents a test to verify the performance of an individual lot. The results illustrate the performance consistency of the strips as defined by the nearly identical mean values and the narrow standard deviations. The mean is the sum of the observations divided by the number of observations. The mean describes the central location of the data, and the standard deviation describes the spread. The

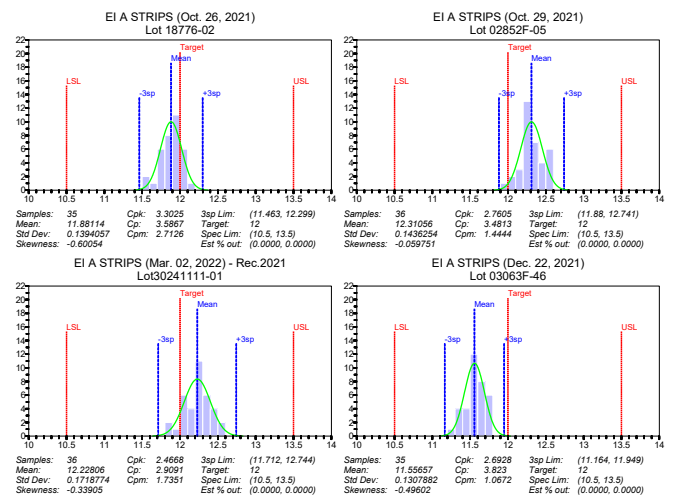
standard deviation is a statistic that tells how tightly all the examples are clustered around the mean in a set of data.

When the examples are tightly grouped together and the bell-shaped curve is steep, the standard deviation is small. When the examples are spread apart and the bell curve is relatively flat, it signifies a relatively large standard deviation. In the case of the Almen strip testing, the tight standard deviation signifies the consistency of the arc height reading.

In addition to documented consistency results, this testing program has provided a substantial technical support base for EI's Almen strip customers. EI has available:

- Current lot-to-lot comparison data on EI strips
- Comparisons of EI strips to other strips
- Performance data on other strips

EI's research is thoroughly documented. For each test, EI records the scope, setup parameters, procedures, test results and analysis, histograms, saturation curves (where applicable), and a summary conclusion. EI uses the performance data to answer customers' questions related to process variables and to help customers identify performance problems such as arc height variations and out-of-spec results with non-EI strips. When EI does not have data available on a unique problem, EI will perform tests to analyze a customer's problem or even duplicate, as closely as possible, their process setup. ●



The histogram represents a 40-piece sample size with the x-axis as the arc height of the strip after peening and the y-axis indicating the number of samples measured at that value (arc height values x .001 inches).