A Roto-Flap Peening Technique Study

A fellow instructor and I recently conducted on-site training for a company that offers repair and overhaul services for air freight companies. The training consisted of basic and intermediate shot peen training as well as instruction for Roto-Flap peening. During the Roto-Flap training I was treated to a perfect example of why different operators must generate their own saturation curves. This practice is outlined in many specs and the EI Education Division instructors emphasize it in our training.

After a Roto-Flap lecture, the students use the equipment themselves. With the help of the instructor, each student practices their technique on a scrap part or an Almen strip. If needed, the instructor will correct bad practices until the student demonstrates proper technique. There are only a couple simple rules to observe when establishing a proper technique and individual styles are acceptable. Different styles can consist of how high the mandrel is held away from the surface or the size of the circular pattern.

Normally, in the last part of the hands-on training, one student from the group generates the data points required for a group saturation curve. Each student then uses those arc heights to plot a curve and estimate an intensity value. In this training session, each of the five students produced a data point for the group's saturation curve. We did this to include everyone noting that this is a big no-no outside of an educational environment. In the past doing this didn't affect our results enough to make intensity estimation difficult. This class was unique. The technique of all five students, while correct, was very different. The resulting saturation curve was impossible to estimate intensity. I then asked a single student to generate all five data points to correct the problem. The resulting curve made it much easier to determine an intensity value. I used the exercise as an example as to why saturation curves can only be made by one operator and the curve represents only that operator's intensity value.

The Trial

After returning from the training, I wanted to duplicate the experience in our own shop. I started by putting a freshly sanded 9/16" x 1-1/4" flap in my electric rotary tool. I then used a tachometer to adjust the speed to 4300 RPM. I monitored the RPM by using a stroboscope and made adjustments when needed. I exposed one Almen "A" strip to various times in order to obtain five arc heights/data points. Each time the application was purposely being done with a specific style. My exposure times were 1, 2, 4, 6, and 8 minutes.

The first minute was done in what I've labeled my "normal" style. This is with comfortable stand-off distance (to me) and a large circular pattern. The second minute on the strip was done with a low stand-off distance and small circular pattern. The fourth minute was completed at a higher than normal stand-off distance, a large circular pattern and about a 10 degree angle difference between the mandrel and strip surface (poor technique). To complete the sixth minute, I returned to my normal style. The final two minutes were done using a very low stand-off distance with a large circular pattern. The resulting curve can be seen in Figure 1. I plotted the original data points in red and the adjusted data points in blue (data points must be adjusted when using a magnetic strip holder. Multiplying the original arc height by 0.77 was used for adjustment). I drew a smooth curve going through the adjusted points in order to estimate intensity. This saturation curve is similar to the curve we created at the on-site training and it was impossible to determine an intensity value.

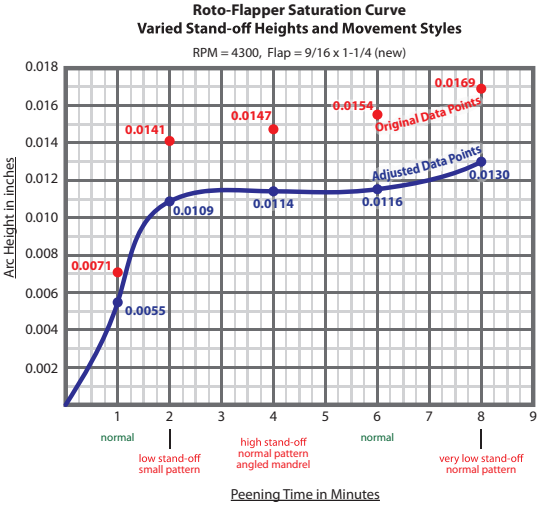

Figure 1

After installing a new flap in the rotary tool, I then went on to create a second saturation curve. The exposure times for this strip were identical to the first, but this time I maintained my normal style while

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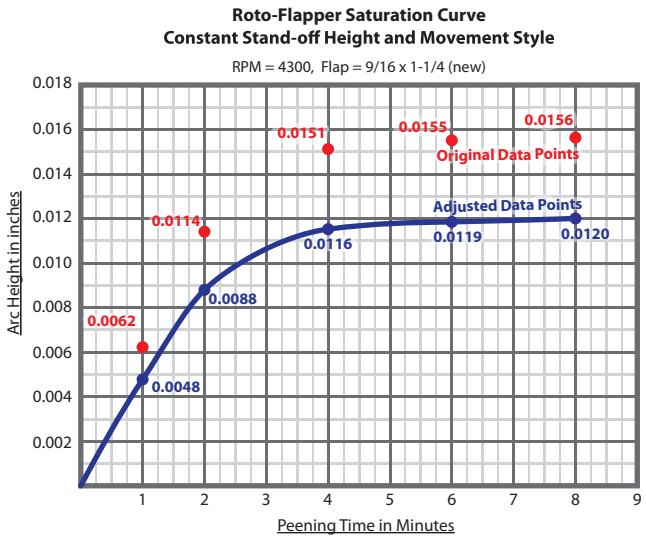

Figure 2

generating all the data points. Like the second curve at the on-site training, this saturation curve was easy to work with (Figure 2). I estimated the intensity to be about 0.011A. To get an exact intensity value I entered the data points into EI's free Curve Solver. The results were surprising.

The Flapper Spec Curve Solver

Both figures 1 and 2 were drawn in a graphics program. I neatly drew each curve to flow nicely through each data point. This smooth curve approach is most commonly used in manual saturation curve generation. The use of a "fitted curve" is intended to compensate for slight errors in arc height reading for various reasons. Trying to manually sketch a fitted curve for Figure 1 would only be guessing. Plugging the first curve's data points into the Curve Solver easily produced a fitted curve (Figure 3). The Flapper Spec Curve Solver adjusts the original arc height for the use of a magnetic holder and plots a blue diamond for each data point. It then completes a fitted curve.

Curve Solver's answer for the first curve was close to what I had estimated for the second curve, 11A. All the conditions of the trial were identical except for the varied styles. I wondered how well the fitted curve feature compensated for the varied application styles of the first curve. To satisfy my curiosity, I entered the data points the second curve into the Curve Solver. The results can be seen in Figure 4. Again the fitted curve feature of Dr. Kirk's programming made some adjustments, but this time they weren't as drastic.

I want to give a nod to Dr. Kirk and the work he's done on the Curve Solver spreadsheet. Its intensity calculation for the first curve was 11.3A and the 11.2A for the second. This is a difference of only

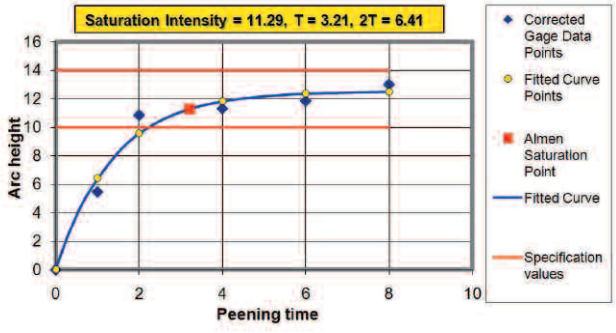

Figure 3

0.1A (or 0.0001A) between the two saturation curves. I'm impressed with how the fitted curve feature of the Curve Solver was able to compensate for the drastic differences in technique.

While interesting, this discovery isn't what I set out to find, so it's not meant to give operators a reason to stray from current practices. The specs are still the same. Roto-Flap operators need to do their own saturation curves and maintain a consistent technique for the best results. I recommend a Roto-Flap version of the Curve Solver—it will adjust for the magnetic strip holder and provide you with an accurate intensity value.

To get the free program, complete the the request form at www.shotpeener.com/learning/program_request_form.php.

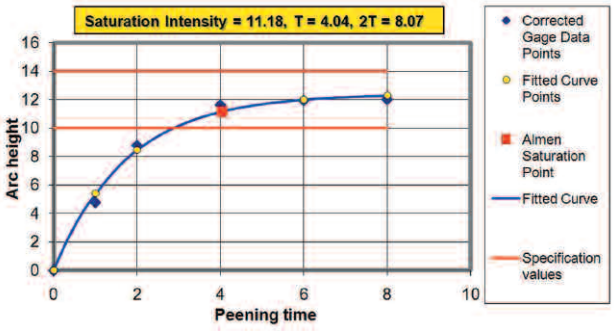

Figure 4