Intensity Investigation

The Electronics Inc. staff is often called upon to solve shot peening mysteries. The usual villain is a lack of intensity control. Intensity control problems have many sources and the most common are:

1. A lack of understanding of the intensity measurement process
2. Poor media management
3. Equipment maintenance issues

The following field report from an in-house shot peening shop visit has a sampling of problems in each area.

The Mystery

"We can't get our intensity level up to the expected 15-18A intensity range requested by our customer. We used to get it but now we can't. We have a two-wheel machine and we're using cut wire media. We peen the inside surface of a large cylinder. Can you come over and help us?"

The Investigation

The lead investigator for this case was Jack Champaigne, President of Electronics Inc. and Editor of *The Shot Peener* magazine. The following is a recap of his field report.

The shop had processed this type of part for a long time and they had performed periodic "intensity checks". I put intensity checks into quotation marks because they never ran saturation curves.

Clue: The industry-standard tool for determining intensity is an Almen saturation curve. Almen strips exposed to the blast stream for only one exposure time are not sufficient to qualify intensity levels for new set-ups.

The company's intensity checks were based on exposure of five strips mounted on a vertical stalk, using the cycle time as the exposure time. I explained the concept of Almen saturation curves and interpretation using the 10% rule and then had them run a proper saturation curve. As expected, the intensity was low, about half of what was needed. But now I had a profile of the current settings and could proceed with my investigation.

I focused next on the media. Since the media was cut wire, I expected to see spherical particles of about the same size. I gathered samples of new media, in-use media and discarded media. The customer did not have a Ro-Tap machine and sieves so I had to wait until I returned to Electronics Inc. to perform a size analysis. However, observation of the media at the site strongly suggested that there were too many smaller sizes in the media mix.

Clue: Intensity will be decreased when using smaller media because smaller media has less mass and impact energy. This makes media management a crucial contributor to intensity control.

Even with this evidence, I wasn't convinced that undersize media was the only deficiency in the quest for a higher intensity. The wheel speed was running at maximum-rated RPM so I couldn't get any more velocity with that adjustment. A quick look at the wheel blades showed some wear but it wasn't excessive. As I pondered the situation, I was told that the blades had been recently replaced. That sounded like a good clue. Then I was told that the wheel liner was also replaced since it showed excessive wear. Okay. Now we're on to something.

Here's what I discovered: During a recent wheel maintenance, the control cage was re-installed at the wrong position. Media was being introduced to the blade prematurely and therefore it was sliding off of the blade inside the wheel housing, causing excessive erosion of the wheel housing liner. The media would then bounce off of the liner before hitting the target (often called the "hot spot") and Almen strips. This condition often moves the hot spot and also reduces the media intensity by about one-third.

I inquired about the cage position and was told that the target misalignment had been noticed but moving the cage seemed to move the hot spot in the wrong direction. Instead of moving the hot spot up with a clockwise adjustment to the control cage, the hot spot moved lower. This can occur when the media

is hitting the wheel housing liner. So, pieces of the puzzle seemed to be coming together. Readjustment of the control cage was a major contributor to the low intensity problem.

Clue: Consistent and repeatable intensity requires consistent and repeatable machine functions. For example, blast wheels are always mounted in a permanent and rigid location in the blast cabinet. Altering the control cage settings will change the point of blast media discharge from the blast wheel and change the intensity.

But what caused someone to adjust the control cage in the first place? I'm guessing it was probably the low intensity due to undersized media that started the downward spiral. I also learned that the on-machine screen separator had not been inspected recently and it might have been malfunctioning or the screen was not the correct size. By malfunctioning, I mean that the shaking was not proper or that the screen could have been clogged with media trapped in the mesh, thus preventing undersized media from being discharged. Since there were no periodic media inspections with Ro-Tap and sieve screens, there was no awareness of defective media conditions.

So, in addition to the importance of conducting saturation curves, what else can we learn from this investigation? Well, let's consider the machine cycle time. No one seemed to know how it was selected. No one was aware of how to determine 100% coverage. (Dr. Kirk's article on page 24 of this issue is an excellent primer on coverage.) My inspection of peened parts revealed that they had certainly attained at least 100% coverage and much, much more, to the possible detriment of the component.

None of the problems that I encountered at this facility were uncommon. Many companies do not know the variables that affect intensity or know how to conduct a saturation curve. Correcting these problems isn't difficult. I typed up my findings and list of recommendations that included a proper coverage determination, periodic media size and shape inspections and adherence to the appropriate specification (some projects still refer to MIL-S-13165. MIL-S-13165 has been cancelled and replaced by AMS-S-13165. AMS-S-13165 has been cancelled and replaced by AMS 2430). To get up to speed on intensity and coverage, I suggested that my friends acquire copies of SAE documents on both intensity (SAE J443) and coverage (SAE J2277) and send their managers and operators to Electronics Inc. shot peening workshops.

Education is the only defense against shot peening misdemeanors. ●