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Why Intensity Isn't Dependent on Exposure Time

I RECENTLY RECEIVED an e-mail from someone thanking us for Dr. Kirk's Curve Solver program, followed by several interesting questions. The shot peening technician (let's call him SPT) had a fixture with six Almen holders. He understood how to run the fixture through their machine at four different exposure times, allowing him to construct a saturation curve according to SAE J443. (J443 requires a minimum of four data points on each curve.) He then had six curves, each with intensity value, but at differing T1 times. All of the intensity values were within the tolerance band allowed. SPT wanted to know "if his machine cycle time was set for the longest T1 time, would the intensity be too high for the shortest T1 time?"

The short answer is **NO**. SPT needs to understand why intensity isn't related to exposure time and that he needs to conduct two independent tasks—one to determine intensity and one to determine coverage, which is exposure time dependent. He had already calibrated the machine to a requested intensity. Each Almen holder position was receiving impacts within the requested intensity. The intensity values were not exactly the same but they were all within the tolerance band required. His next task would be to determine exposure time and this would be done by incrementally blasting his target for brief times and inspecting for coverage (surface denting). When the entire part is completely dented, he then has 100% coverage and now the machine cycle time can be established.

What about his concern that the intensity at the location of his shortest T1 time might be "out of spec" or "too high"? The intensity at that location was already proven to be within the tolerance band. Every shot particle is being impacted at that intensity. The intensity does not change with time. The intensity will change if he changes operating parameters like air pressure, nozzle style, shot hardness, etc., but it does not change with time.

If intensity changed with time, then peening a large part, perhaps needing two hours for complete coverage, would suffer from a very high intensity at the end of the cycle. Intensity stays fixed throughout the cycle unless you change an operating parameter.

Since we are talking about intensity checks in six locations, it might be useful to remember that SAE J443 has been updated to accommodate multi-holder situations. Remember, a new setup requires a saturation curve using a minimum of four data points for each holder. Once the machine is accepted and in production, machine operators are required to make periodic intensity confirmation tests. These don't have to be full saturation curves. Run a single strip through the machine using the saturation curve exposure time of T1 and take that arc height as a confirmation of peening intensity. However, in our example, SPT has six locations to check and each location will have its own "T1" time. He needs to decide what time to run the fixture through the machine for the future intensity confirmation checks. J443 now allows using a "target" time with "target" intensities. Let me explain.

Visualize a graph with six saturation curves on it. These curves represent the Almen strip arc heights for six different locations on the fixture. Using Dr. Kirk's Curve Solver, you can find the intensity for each graph and its corresponding T1 time. Earlier specifications required that you run the confirmation tests at the T1 time. What happens if you have six locations and six T1 times? Were you expected to run six different confirmation passes, one for each T1 time? Most people didn't follow that rule.

Thanks to J443 you are now allowed to pick any time you wish, which is within the shortest and longest T1 time for the six curves. Pick a time, draw a vertical line on the graph and see where the line intersects each of the six curves. These points are now your "target" arc heights, one for each location. So if you run your fixture through the machine, you will get six arc heights. If you do this once each day you should get the same "target" arc height for each location. Each confirmation arc height must be within ±0.038 mm or ±0.0015 inch of its corresponding target arc height. If any of the confirmation arc heights is not within this tolerance band, you must make adjustments (perhaps machine maintenance) and then perform a new set of six saturation curves.