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SAE AMS2590A

The First Revision of the Modern Rotary Flap Peening Specification

AS THE SPONSOR of the AMS2590 specification's five-year review, I took the opportunity to improve on its clarity and guidance. I'm happy that revision A was released in November of 2016 after over two years of work. To help you understand the what and why of the revision, I'll outline the changes to each of the relevant sections.

Section 1 outlines the "scope" of the specification. Changes to 1.2 (application) includes conformance to AMS2430. The initial peening of parts as well as peening for plating adhesion was added to its process applications. Even though the application additions were added per the request of another board member, AMS2590 has always allowed the application of the Rotary Flap peening as a replacement to automated or manual peening with customer approval.

Section 3 is "technical requirements" and contains the bulk of the changes in this revision. In 3.1.1 (tools), Table 1 was removed as it outlined required tool speeds for a given flap size. A tool's speed capability shouldn't be restricted as long as it can produce and maintain the RPM required to obtain a desired intensity. As in the original specification, the tool's speed must stay within ±100 RPM while under load from application to the work piece or the Almen test strip.

Section 3.1.4 (test strip holder) is what initially caused me to volunteer as the sponsor of AMS2590's five-year review. I had noticed in 2010 that a dimension error from the 1972 MIL specification had been carried over to AMS2590. The initial goal was to correct only this dimension error, but I realized I had the opportunity to make improvements inspired by the rotary flap peening training I've conducted over the years. I felt the magnetic test strip holder was too restrictive in design while not being specific enough on its proper use. Before I outline these changes, it's important to note that care was taken to include these design improvements without obsoleting the existing magnetic strip holder.

The magnetic holder uses a needlessly long block of aluminum as its base. The extra length is required only to permanently affix a full-size Almen strip next to the location of the actual test strip as it sits atop the magnets. The permanent strip's original purpose was to provide a backstop, preventing the test strip from sliding off the magnets when the spinning flap applied a slight horizontal force. It doesn't make sense to use a full-size Almen strip to serve only as a backstop, so I

updated the drawing and text to allow any form of backstop, as long as it keeps the strip in place. A shorter backstop allows the length of the aluminum block to be reduced.

When AMS2590 first replaced the MIL specification, it changed the role of the permanent strip. It was originally used as a backstop as explained above, but the shot on the flap could become dislodged when striking the exposed end of a test strip. AMS2590 allowed reversing the direction of flap rotation to create a "level approach" between the permanent strip and the test strip, thus increasing the longevity of the flap. The downside to this method is the absence of a backstop, which may allow slight movement of the test strip. To get the benefits of each method, the new specification has the option of a second backstop at the opposite end of the test strip. This provides a "level approach" from either flap direction while keeping the test strip in place.

Another issue I've seen as a trainer is when a technician tightens the magnetic strip holder's brass screws, limiting the magnet's ability to rise above the surface of the strip holder. This wasn't addressed in previous specifications, so the technician likely didn't know that doing this corrupts arc height values. The magnets must be allowed to move up and down in order to maintain contact with the test strip as it bends upwards. A strong magnetic force will prevent the strip from curving to a proper arc height when contact is broken between the magnet and the test strip.

To prove this I conducted a test with three conditions: The first used a standard magnetic strip holder, with its magnets free to travel well above the aluminum surface of the strip holder. For the second condition, I tightened the brass screws to prevent the magnets from protruding above the surface of the strip holder, thus breaking contact when the test strip bends. For the final condition, I removed the center magnet completely to eliminate any influence (magnetic or otherwise) on the center of the test strip. I flap peened six strips under each condition for five minutes at 3,000 RPM. The standard magnetic strip holder and the strip holder with its center magnet removed exhibited similar results with averaged arc heights of 0.0153" and 0.0151" respectively. The holder with the tightened brass screw had an averaged arc height of 0.0135". This proved that restricting contact between the magnets and the test strip will lead to inaccurate arc height readings, so proper magnet operation was added to the specification.

Section 3.3.6 (intensity verification) was formerly section 3.3.2.8. The method of verifying intensity did not change. Intensity is still verified in accordance with J443 by achieving an expected arc height found at the peening time of "T" from an established saturation curve. The frequency of intensity verification was removed and replaced with the new requirement to verify tool speed, which is outlined in the next section.

Section 3.4.1.1 (verification of tool speed) is new. It was established because a tool's speed is far easier to verify than intensity on regular intervals. The direct relationship between intensity and RPM will insure the proper intensity is maintained by verifying the tool's desired RPM and that it is constant. Tachometers and stroboscopes are now listed as tools used to verify RPM prior to saturation curve generation, intensity verification and application of the process to any single work area. If a single work area is very large, the elapsed time between RPM verification cannot exceed 60 minutes. Intervaled RPM verification is not required if a closed-loop rotary tool is used.

Much of section 3.4.3 (flap operation) is unchanged, however, flap defection is now more strictly defined as the "standoff distance from the bottom of the mandrel to the part surface." The operator may use any standoff within the range of 0.05" to 0.150".

Section 3.5 (coverage) was formerly labelled 3.4.4. The wording for coverage requirements now sources engineering drawings, but the rest remains basically the same with compliance to SAE J2277. The requirement of visual inspection with magnification from 5-30X is moved to section 4 along with the requirement of a suitable tool for coverage inspection inside holes. Section 3.5.1 (peening time) was formerly 3.4.5. This section is largely unchanged outside of the section number change and the modern term of "full" coverage used where 100% coverage was used before.

The content of section 3.6 (post peening operations) was removed and replaced with a reference to post peening operations as outlined in AMS2430. Section 3.8 (tolerances), formerly labelled as section 3.7, was also replaced by a reference to AMS2430.

Section 4 outlines quality assurance. The only change here was to 4.3.1 (intensity tests). This section now outlines only the frequency of intensity determination and verification. Much of the section was removed due to changing to an easier method of monitoring RPM to insure proper intensity. Other requirements in this section were removed because they repeated intensity verification requirements outlined in section 3.7.1.2.

Section 8 (notes) are not actual requirements of the specification, but rather general notes and recommendations to help people perform the process. The only change was to section 8.3 and was renamed "Equipment Recommendations" to draw more attention to its contents. This may be the most beneficial part of this article for some. This section previously discussed only how increasing a pneumatic tool's torque capabilities may cure variations in tool RPM, however this isn't a sure fix.

My travels around the world have found too many shops that are not properly regulating the air pressure to the tool. A good high-torque tool will only be as good as the air supplied to it. Using only a single regulator, or flow controller, to set a tool's target RPM will not maintain a consistent RPM. A second regulator upstream from the tool is needed to stop cycling system pressure from getting to the tool. If system pressure cycles between 100 and 120 psi, the upstream regulator can be set to 90 psi and fed to the tool with a dedicated hose. I recommend everyone with pneumatic rotary tools do this in effort to keep consistent tool RPM—confirmed with a tachometer or stroboscope.

Unfortunately, not all air systems can maintain enough pressure and/or volume and varying RPM may remain an issue. Small pipe diameters, the distance from the compressor, and other factors might make a fix impossible. If this is the case for your pneumatic (or electric) rotary tools, I highly recommend investing in a tool with closed-loop RPM control. Especially, if you repair planes. I fly a lot.

This article loosely describes the changes to the Rotary Flap peening specification. We highly encourage you to obtain your own copy of the new AMS2590A by visiting the SAE website (http://standards.sae.org/ams2590a).