Dan Crawford | Quality Supervisor | Collins Machine Works | collinsmachine.com

Bringing Shot Peening In-House

AT COLLINS MACHINE WORKS, we are always striving to perform all our work in-house. One of the few processes we outsourced was shot peening. In January of 2020, our company CEO Robert Twine challenged us to research and develop a plan to perform shot peening. Our role previous to this was limited to scheduling the peening company, performing the 10x visuals of the completed surfaces, and scanning and saving the paperwork. For the most part, we knew little of the actual process of shot peening.

We were starting at ground zero with drawing references pointing to SAE AMS-S-13165 as well as SAE AMS-2430. Thoroughly reviewing those specs helped us to make our blast media selection and choose the correct equipment. We also knew we needed the best training our people could get. Our research led us to one destination—Electronics Inc. (EI). We already planned on purchasing an Almen gage, "A" strips, strip holders, etc., from them. Why not have them perform the training?

One major problem, however, was quickly developing—COVID-19. In the summer of 2020, there were still many unknowns about COVID-19 and the proper preventative measures and equipment required. All EI seminars and classes had been cancelled. Dave Barkley, Director of EI training, worked closely with us and was able to safely hold a class in our Charleston, South Carolina location. Our class consisted of an engineer, two machinist apprentices, a Quality Supervisor, and a Quality Assistant. After completion of the class, Quality Supervisor Dan Crawford, wrote the shot peening procedure. With a few adjustments from company peers, the procedure was approved for use.

In July of 2020, we had our first shot peen job to perform on a Navy propeller shaft. This particular shaft is unique in that it is 100% forged steel, but one end is clad with Inconel. The steel end of the shaft is shot with AMS 2431/1 cast steel shot, but the Inconel end requires AMS 2431/7 ceramic shot. Due to the size and configuration of marine shafting, temporary containment must be built around the area to be peened. Our temporary containment is a tent of commercial quality.

The complex geometry at the ends of the shafts requires the nozzle to be re-directed after each peened band achieves the required coverage. This requires the operator to be inside the containment during the peening process. Quality Specialist Maria Crawford (CeCe) stepped-up and said, "I want to be the one inside, peening the shaft." This came as a shock to everyone in the mostly male shop. How is this 5'3" fragile-looking little girl going to withstand this harsh environment?

Like a champ!

CeCe and Quality Supervisor Dan Crawford worked together to dial-in the equipment, peen multiple Almen strips, and plot the saturation curves for the steel and ceramic shots. Generating the saturation curves was not an easy task. Setting the "A" strips on a 70-foot-long shaft that weighs 70,000 lb., getting the mass rolling at the desired speed, then peening for 1, 2, 4, and 8 rotations, only to find out your intensity is too high or too low. Make some adjustments and try it all over again. New "A" strips affixed 1, 2, 4, 8 rotations, getting closer! Make adjustments, new "A" strips affixed and hopefully you have it right this time. Once it is right, set Almen strips for the "IN" and verify your intensity is correct. Once intensity is verified, shoot the part in its entirety and check for coverage. If all is well, set-up the "out" Almen strips.

But wait, that is only one end of the part! Now we must clean the machine out, clean the containment structure (tent) and perform all the above for the other blast media! New Almen "A" strips 1, 2, 4, 8 rotations all over again until we get it right. As we were going through these motions, Dave Barkley was our "phone-a-friend". Dave made great recommendations and got us going the right direction. Remember, we started from ground zero with nothing but determination. Dave taught us well, and along with the guidance he gave us, he referred us back to our training. This clarified his recommendations and made it seem less like voodoo magic and more like a science.

Being a small-ish company, Collins Machine Works (CMW) has employees that wear many hats. CeCe and the women of CMW are no exception to this rule. Add to this, CeCe's family immigrated to the USA from the Philippines 26 years ago when she was 12. She and her family spoke little English back then and she had a very tough time with language skills. For her to take the EI Level 1 and Level 2 class and get the same score as an engineer really shows her determination. Her continued determination has also led her to welding and fabrication, borescope inspections, shop safety officer, as well as obtaining her certification in rotary-flap peening.

With CeCe leading the way, CMW has now peened nearly 30 shafts in under two years. Others in the Navy shafting industry have taken notice of our newfound abilities and have now contracted CMW to perform peening on their shafts. CMW has also peened experimental test pieces for a major Navy shipbuilder. The shipbuilder is researching and measuring the effects of various media types, differing intensities, and their effect on various materials.

CMW has an abundance of peening work to perform in Charleston and at other Naval overhaul facilities. CMW performs new construction and overhaul work of Naval shafting in Charleston and Portsmouth, Virginia. CMW also performs on-site machining of Naval vessels, power generation, steel and paper mills worldwide. Shot peening and rotary-flap peening will be no exception to this. Our equipment is housed in custom transport boxes and can be delivered anywhere in the world.

Our peening capabilities compliment our other services, providing one-stop shopping. Quality Supervisor Dan Crawford said, "We learn with every job we perform and just keep getting better, every time. I highly recommend EI for their products and their training. Without the education and continued guidance from EI we would not have been successful in our endeavors."

About Collins Machine Works

Since 1960, Collins Machine Works has specialized in industrial-scale solutions. In addition to shot peening, the company provides the following services:

- On-site service
- Pump repair
- Industrial engineered machinery
- Quality assurance
- Large/heavy machinery
- CNC machinery
- Specialized welding services
- Machine shafting and components
- Project management

Collins Machine Works serves these industries:

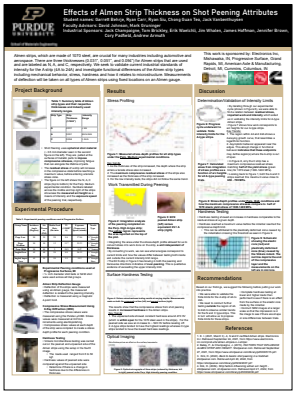
- Marine
- Steel
- Power generation
- Mining
- Paper and pulp
- General industry
- Municipalities

Facilities:
Charleston, South Carolina
Portsmouth, Virginia

Contact:
702 5th Street, Portsmouth, Virginia 23707 | 757-399-7777

Almen Strip Research

ENGINEERING STUDENTS at Purdue University recently presented their senior-year project work in a poster session.



One such poster was titled "Effects of Almen Strip Thickness on Shot Peening Attributes." The participating students are Garrett Behrje, Ryan Carr, Ryan Siu, Chong Guan Teo, and Jack Vanbenthuysen. The faculty advisors are David Johnson and Mark Gruninger. The industrial sponsors for this project through the Center for Surface Engineering and Enhancement program are Electronics Inc., Progressive Surface, American Axle & Manufacturing, and Cummins.

Poster Introduction

Almen strips, which are made of 1070 steel, are crucial for many industries including automotive and aerospace. There are three thicknesses (0.031", 0.051", and 0.094") for Almen strips that are used and are labeled as N, A, and C, respectively. We seek to validate current industrial standards of intensity for the A strip (4A to 24A) and investigate functional differences of the Almen strip types including mechanical behavior, stress, hardness and how it relates to microstructure. Measurements of deflection will be taken on all types of Almen strips using fixed locations on an Almen gauge.

Recommendations

Based on our findings, we suggest the following before putting our work into practice.

- We were able to validate the finite limits for the A strip of 4A to 24A.
- We need to conduct further testing **outside** the region of 4A to 24A to observe similar trends for the N and C type strips. This in turn will allow us to propose finite limits for these strips.
- Complete hardness testing at lower and higher loads than performed to see if there is an effect from the surface or the elastic core made by the indenter.
- Conduct SEM images at a larger scale so that the impression is in the image to see if there are shape or size differences between trials.

Visit www.shotpeener.com or scan the QR code for the complete poster.