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The Shot Peener

From Abstract to Reality

Behind the Scenes of the ICSP-11 Abstract Selection Process

Plus:

Shot Peening Operator's Checklist II

Roto-Flap Peening Technique Study

Only Two Almen Strips for Intensity Verification?

A Foreign Exchange

The

Shot Peener

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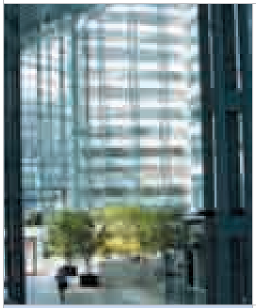
Articles



From Abstract to Reality

The ICSP-11 Local Organizing Committee Approves Abstracts and Posters for Presentation at the Upcoming Conference

The Eleventh International Conference on Shot Peening • September 12-15, 2011 • South Bend, Indiana USA

What's an abstract anyway?

An abstract is a shortened version of the paper that must contain all information necessary for the reader to determine:

- the objectives of the study
- how the study was done
- what results were achieved
- the significance of the results

A well-written abstract is crucial for acceptance into a conference because an organizing committee has the task of making a judgment on the validity of the research based on the abstract.

The final research paper will open with the abstract. It's also a useful tool for the reader to determine the content of the paper.

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University of Washington

Prof. Steven R. Schmid
University of Notre Dame

Prof. Yung Shin
Purdue University

Dr. Marsha Tuft
General Electric

Photograph: Marriott lobby - the ICSP-11 hotel.

The ICSP-11 Local Organizing Committee gathered in South Bend, Indiana for two days in late August to review paper abstracts and conduct a site tour of the 2011 conference venue. The committee, comprised of representatives from academia and industry, had the substantial responsibility of contributing to the international conference through the selection of appropriate paper and poster summaries. The presentation materials must have in-depth content, yet appeal to an audience that will range from students to experts.

A large number of papers and posters abstracts were submitted — 90 abstracts and five posters—but the committee members were well-prepared and the review process went smoothly. The discussion was lively as the merits of each submission were debated on the criteria of originality, significance, interest, clarity, relevance and correctness. The committee also determined the appropriate topic placement of each approved abstract.

The following comments provide additional insight on the committee members and their impressions of the upcoming conference.

What is the value of ICSP-11 to you?

The conference brings together industrial practitioners and academic researchers (and other researchers) with the common goal of better understanding and further developing/deploying surface residual stress treatments.

—Professor Michael Hill
University of California

To me, all ICSP conferences give the audience a great value in enhancing their knowledge, not only in shot peening, but other surface enhancements as well. Looking forward to a great conference in 2011.

—Hali Diep, The Boeing Company

It will provide a forum to exchange information about shot peening and related processes.

—Prof. Steven R. Schmid
University of Notre Dame

Keeping abreast of industry developments.

—Dr. John Cammett, Consultant

In 2008, I took part in ICSP-10 in Tokyo, where hundreds of shot peening experts gathered together to share their experiences and discuss their research results. As a new student in this field, I acquired a lot of information and made several important friends in my life, with which I discuss my research very often. As a group leader for the study of the shot peening with several industries and universities, ICSP-11 will supply with me a big platform to share and to learn the most updated shot peening applications and research projects in the world.

—Dr. Hong Yan Miao
ECOLE Polytechnique Montreal

ICSP papers have been very valuable to my aerospace contract research and graduate students for the last 15 years. The conference will play an important role in our future research activities in the development of alternative surface treatment methods.

—Prof. Mamidala Ramulu
University of Washington

Why did you agree to serve on the Local Organizing Committee?

Opportunity to connect with others and to support a useful event.

—Professor Michael Hill
University of California

As a member of the International Scientific Committee for Shot Peening, I was happy to help out when Jack Champaigne asked me.

—Hali Diep, The Boeing Company

Being able to work together with lots of outstanding shot peening researchers is an exciting experience for me. As a Chinese, this work means more for me. Since this conference never happened in China, I would like to help China to organize the International Conference of Shot Peening in the future and to help Chinese industries and research centers to understand better the applications and the importance of the shot peening.

—Dr. Hong Yan Miao
ECOLE Polytechnique Montreal

One of my areas of interest is "improving fatigue life." Shot peening is clearly in my self-interest and I agreed to serve and render my services in ICSP.

—Prof. Mamidala Ramulu
University of Washington

What is your opinion of the quality of abstracts submitted to the conference?

Many of the abstracts are of excellent quality.

—Professor Michael Hill
University of California

There are many valuable papers that could help enhance shot peen technology.

—Hali Diep, The Boeing Company

For the most part, they were exceptional.

—Prof. Steven R. Schmid
University of Notre Dame

I am very happy to see the number of quality abstracts submitted from the international community. This reassures me that shot peening research is alive and growing strong.

—Prof. Mamidala Ramulu
University of Washington

The consensus is that the committee was pleased with the quality of abstracts but was there an abstract that was particularly interesting to you?

One related to fine particle peening to obtain a graded material with WC near the surface.

—Professor Michael Hill, University of California

Yes, all papers that dealt with manufacturing processes, i.e., forming, optimization.

—Hali Diep, The Boeing Company

Most of them are good and valuable and it is unfair to name any abstract as an interesting one since I am involved in traditional shot peening and developing water peening technology.

—Prof. Mamidala Ramulu, University of Washington

What do you think of South Bend and the Century Center as the ICSP-11 venue?

I like the views of the river and think it will be nice to have the event in a facility with those views.

—Professor Michael Hill, University of California

I think the Century Center is a great place to hold the conference.

—Hali Diep, The Boeing Company

South Bend can be a great conference location. Costs are reasonable and the city has a lot to offer.

—Prof. Steven R. Schmid, University of Notre Dame

Good venue, impressive. I particularly liked the smaller auditorium for break-away sessions.

Dr. John Cammett, Consultant

Watch for more information on the research that will be presented at ICSP-11 in upcoming issues of *The Shot Peener*.

Thank you to ICSP-11 Benefactors

- Electronics Inc.
- Metal Improvement Company
- Proto Manufacturing

The members of the Local Organizing Committee express their appreciation to the Benefactors of ICSP-11. The generosity of these contributors made the Abstract Review and upcoming conference events possible.

"Metal Improvement Company is pleased to be a Benefactor of the ICSP-11 Conference. We are fully supportive and appreciative of the prior contributions this conference has made to the field of engineered residual stress technology."

—Robert Specht
Metal Improvement Company

Electronics Inc. Shot Peening Control

The ICSP-11 Organizing Committee poses in the Great Hall of the Century Center—the venue for the 2011 conference in South Bend, Indiana. Photographed from left to right, back row: Jack Champaigne, Dr. John Cammett, Prof. Yung Shin, Prof. Michael Hill. Front row, from left to right: Prof. Mamidala Ramulu, Hali Diep, and Prof. Alten Grandt. Committee members not in attendance: Christine Corum, Dr. Hong Yan Miao and Dr. Marsha Tufft. (Prof. Steven Schmid attended the Abstract Review but wasn't available for the photograph.)

The Shot Peening Operator's Checklist

Part two of a two-part series

In Part I (Summer Shot Peener, 2010), we discussed general machine inspections and defined the wear characteristics of the blast cabinet and work fixtures. We then identified their cumulative effect on peening results. Our discussion here will continue with other items on the peening operator's checklist such as blast wheel components, blast nozzles, media and pneumatic circuits.

#1 What to look for in a blast wheel

The year 1932 saw a major breakthrough in the blast cleaning industry with the introduction of the airless abrasive blast wheel. Until that time, compressed air was used to propel abrasive, regardless of the application. With the blast wheel, controlled centrifugal force is used to throw abrasive from a rapidly rotating wheel driven by an electric motor. The variety of applications and productivity requirements dictate the wheel type and connected motor power.

In a blast machine, any component that comes in contact with blast media experiences wear. The blast wheel is the prime example; its components are turning at speeds as high as 3600 RPM. In a blast wheel, the critical parts include the following: (a) cast alloy impeller to accelerate the media, (b) the cast alloy control cage that directs the media and (c) the set of blades that actually propel the abrasive on to the part being cleaned or peened. Let's elaborate on some commonly encountered issues with blast wheels.

The control cage determines the path of the abrasive out of the blast wheel. It is responsible for creating the wheel's "hot spot." The hot spot is the area on a target where maximum energy is transferred from the blast stream. In peening applications, it is important that the hot spot is directed to critical areas where intensity needs to be measured.

Two of the common causes (and cures) of pattern-related problems include:

1) Control cage turned too far in the direction of rotation, causing excess wear on wheel housing end liner at trailing edge of housing. Fix: turn cage CCW as needed to correct error.

2) Control cage too far in the opposite direction of rotation causing excess wear on end liner at leading edge. Fix: Turn cage CW as needed to correct error.

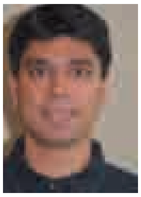
PEENING TIP
Almen strip readings, saturation curves and coverage (visual) are best indicators of control cage settings. If readings are below desired range, or if the part shows insufficient coverage, it's possible that a portion of the blast energy is being wasted by blasting the liners.

Abrasive wear on the impeller must also be monitored. In order to distribute the abrasive onto the blade throwing surface, there must be a "lead" between each impeller segment and its corresponding blade. If an impeller segment wears enough that it becomes parallel with the blade, the abrasive will hit and split on the blade's bottom edge. When abrasive hits the edge, it bounces rather than slides on the blade surfaces, slowing down the flow of abrasive and causing excessive wear.

PEENING TIP
Lower intensity values could be caused by lower media velocities. One of the reasons could be a worn impeller as discussed above.

Loss of control over the blast pattern results in reduced blast efficiency. Longer blast cycles, improper part coverage, reduced intensity, and higher than normal maintenance costs are all directly traceable to blast pattern issues. Wear on the primary wheel parts is the chief cause for a shift in the blast pattern. Therefore, it is important to regularly inspect these parts and replace them before excessive wear results.

Blast wheels operating at less than full amperage, as indicated by the motor nameplate, indicate a problem with abrasive flow to or through the wheel. Two conditions of the blast wheel could result in inefficient blasting—a flooded wheel or a starved wheel.



Kumar Balan
is a Product Engineer with Wheelabrator Group and a presenter at the Electronics Inc. Education Division workshops.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Here's a simple test: With the wheel running, turn on abrasive. Turn off abrasive flow and observe the ammeter reading.

- If the amperage increases slightly before falling to "No Load." the problem is a flooded wheel. Possible causes are the abrasive valve is opened too far, a misaligned feed spout, worn impeller, etc.
- If the amperage falls immediately to "No Load," the problem is a starved wheel. This problem could be caused by insufficient abrasive in the storage hopper or any physical interruption to the flow of abrasive through the feed pipe or valve.

#2 Wear of a blast nozzle

Blast nozzles undergo wear just like a blast wheel even though they use a simpler media-propulsion method. Wear of a blast nozzle is indicated by an increase in both nozzle bore and compressed air consumption. This, in turn, leads to higher flow rates of abrasive through the nozzle. Here's a comparison to illustrate this example: a commonly used 3/8" (No. 6) nozzle consumes 182 CFM of compressed air at 90 PSI. The consumption rate at this same pressure increases to 240 CFM when the nozzle bore increases to 7/16", 320 CFM with a 1/2" nozzle, and as high as 720 CFM for a 3/4" diameter.

PEENING TIP

Greater volume of compressed air due to increased bore also increases the media flow rate. At the same air pressure, this will reduce the impact energy and the peening intensity will also be reduced.

Variation in intensity values can be resolved by checking the condition of the blast nozzles on a regular basis using a go and no-go gage. In its simplest form, a drill bit of the same size as the nozzle is inserted into the nozzle to check whether it can be inserted, and the clearance within. It's also important to also check the condition of the blast hoses and couplings at the same time.

#3 The pneumatic circuit

Compressed air peening machines built to conform to commonly used specifications are provided with a closed feedback loop for pressure control. This operator inputs the desired blast pressure as part of the technique / recipe for the part being processed. A pressure transducer (switch) senses the air pressure in the blast tank and compares it with the desired setting. Any variation between the two values is automatically corrected by an Analog Proportional Regulator provided in the main airline to the blast tank.

In addition to this corrective feedback loop, the controls system could also incorporate a setting for bandwidth values (limits). The system could be set to shut down the process if the required pressure is not maintained within a specified time period.

#4 Blast tank

Blast tanks used for pressurizing peening media have similar valves for common functions in their operation: the air valve, pressurization valve, sealing valve and flow control valve. The valves operate under high pressure and some come in direct contact with the abrasive. Improper cycling of the blast tank could result in insufficient media in the vessel and the blast nozzle(s). It's important to cycle the tank in manual mode to verify its proper functioning. All valve seals should be inspected on a regular basis and replaced as required upon signs of wear.

PEENING TIP

The closed feedback loop could be tested by shutting off compressed air supply to the machine and checking to see if the machine shuts down. The damage caused by incorrect compressed air volume or absence of compressed air is devastating to peening results.

All flow control valves have to be calibrated by means of an actual drop test conducted per nozzle or wheel. Drop test flow values should be compared with displayed values on the operator interface and corrections made as required.

#5 Nozzle manipulation

Sophisticated peening systems employ different means of moving blast nozzle(s) to match the contour of the work being peened. This is either carried out by a custom nozzle manipulator or a robot.

Paths followed by such arrangements are resultant of at least three axes, the X, Z and Tilt. Though fully programmable, each axis works off a data table before combining its motion with the other axes. An incorrect axis movement could cause extensive damage to your part.

Make following checks on a periodic basis to ensure effective functioning of the nozzle manipulator:

- Check the proximity switch brackets and ensure that they are all secure and rigid in their locations. A loose proximity switch will incorrectly sense the location of the carriage axis, resulting in potential crashes.
- A dirty proximity switch (photo-eye) could fail to count the teeth of a sprocket, also resulting in a potential manipulator crash.
- Physically check the length of travel of each axis in the manipulator and compare that with the value displayed on the operator interface screen for each axis.
- Regularly check the condition of the belts, sheaves, ball screws or any such arrangement provided for manipulator motion.

In Summary

As this industry evolves, control systems are becoming increasingly intuitive and are able to identify and localize faults with ease. However, this doesn't replace the routine checks covered in this series. Additional process details such as checking the quality and size of peening media, intensity, and saturation curve generation have not been included in this discussion with the assumption that the peening operator is already aware of them.

In a peening machine, there really is no substitute for pro-active inspections and maintenance. The component that you're processing is expensive and significant value has been added to it since the raw material stage.

Establish a routine with your procedures that assures a quality peened part for your customer at all times. ●

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.

Dave Barkley is the Director for the EI Education Division and one of EI's flapper peening instructors.

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.

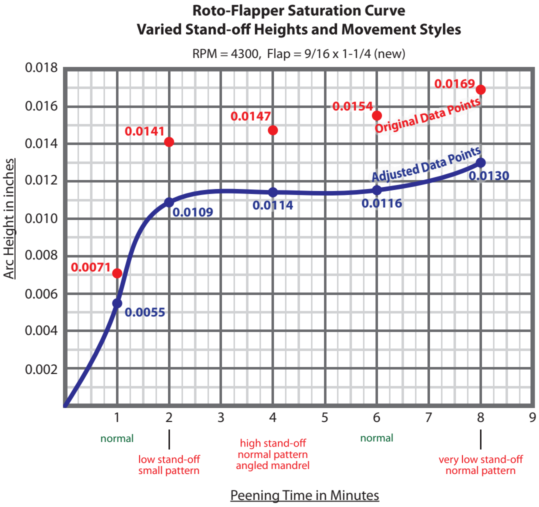


Figure 1

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

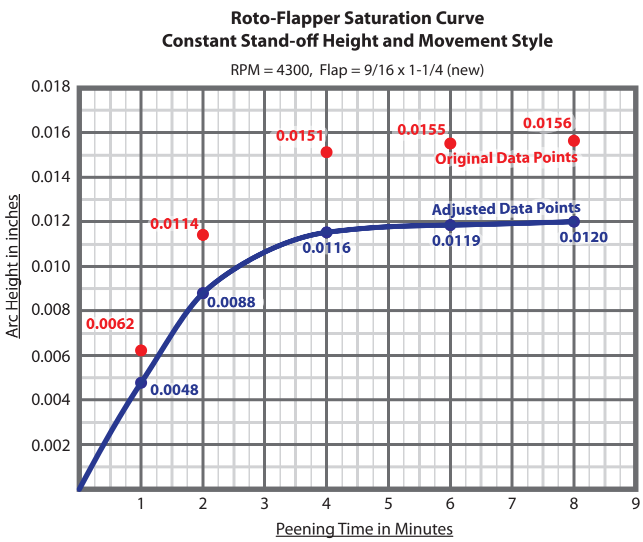


Figure 2

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

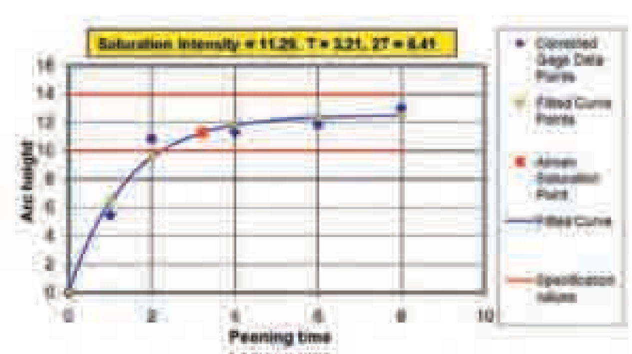


Figure 3

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.

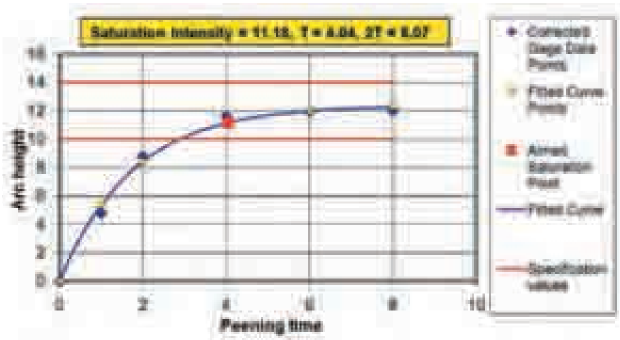
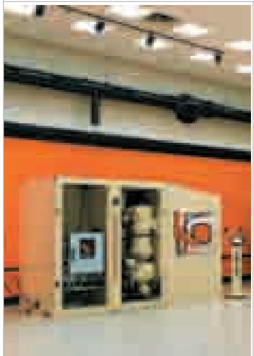


Figure 4



Lab Demonstrates Blast-Equipment Solutions and Familiarizes Users with Current Technology

Increasing competition within manufacturing arenas underscores the importance of finding and harnessing opportunities to improve quality and reduce costs. Surprisingly, advances in metal finishing, even within mature technologies such as air blasting, remain untapped, usually because of limited R&D funding, inadequate physical resources or the "it works, don't fix it" philosophy. As a consequence, test blasting not only plays a pivotal role in proving new or unique finishing processes, it also uncovers more efficient approaches for tackling traditional jobs.

Empire Abrasive Equipment Company, a longtime provider of test blasting services and a major manufacturer of air-blast machines since the 1940s, completed its first formal test laboratory and demonstration room in 1987. (Previously, the company conducted test blasting in a designated area on the shop floor.) Last year, this 23,000 cubic-foot room underwent an extensive renovation including updated air-blast equipment supported by improved ventilation and sound attenuation systems. (Figure 1)

(Fig. 1) Empire's laboratory and demonstration facility (partial view shown) includes a variety of finishing systems for testing and educational purposes. The facility now supports eight fully functional systems.

Today's lab/demo room, tucked within Empire's Langhorne-PA headquarters, plays multiple roles. First, it serves as a testing center and proving ground for both new and improved finishing processes. Next, it provides a hands-on experience for educating distributors and customers of Empire products as well as new company hires. Finally, it gives current and prospective customers a broad sampling of the state-of-the-art equipment in air-blast technology. The room contains 15 pieces of equipment ranging from portable blasters to a robotic blast system and includes two centrifugal disc machines. Eight systems stand ready for action, supported by tools for analyzing surface results and measuring media quality to ensure sound science.

The room's first function, test blasting, unfolds in a number of ways. It starts when customers supply sample parts along with a finishing specification that normally lists the size and type of blast media to be used. Specifications range from straightforward (white metal clean, for example) to complex. Once preliminary tests establish that blasting can produce the desired results, a dialogue begins with the customer to sort out all the essentials necessary for a quote. In some cases, a standard blast cabinet or one with some automated features such as a nozzle oscillator and powered turntable provides the solution. Most applications, however, present bigger challenges, which bring the experience and resourcefulness of Empire's engineering team into play.

(Fig. 2) Robert Heaton, product support manager (right) and Dan Herbert, product manager, put a piece of custom equipment through its paces prior to shipping. Test blasting demonstrated the ability of this single system to process a long list of customer parts to spec and on budget.

Robert Heaton (Fig 2), who has handled testing for over 20 years during his 36-year career in the air-blast industry, points out that some solutions found in the lab can represent quantum leaps forward. One example involved a firm using 16 oscillating suction blast guns, loaded with aluminum oxide, to clean new aircraft castings within a blast cabinet in batches

About the author: W. R. Shimer started as an independent writer in 1980 and has worked closely with Empire Abrasive Equipment Company for more than 20 years.

of 5 to 10 work pieces per cycle. Mr. Heaton reported that each cycle in the customer's existing system consumed up to three hours, mainly because the oscillating guns spent much of their time retracing the striped pattern they had left on previous passes. "When the customer saw our rotary head (Fig. 3) do the same job in fewer than 10 minutes per side, with no striping, they were amazed with the rotary head's performance," he said.

(Fig. 3) Rotary blast heads provide broad coverage while conserving compressed air. Available with up to nine guns, these rotating heads improve efficiency in many in-line, turntable and batch air-blast systems.

Another customer, involved with peening turbine blades, got a similar wakeup call. The company was using six 3/8" pressure nozzles, operating between 60 and 80 psi, to achieve specified intensity on the root sections of small turbine blades. Using an accepted Almen Sub-Strip Arc Height evaluation procedure, the Empire lab demonstrated that the same job could be performed at a mere 14 to 20 psi using only four 1/4" pressure nozzles, leading to an order for a 36", 12-station, indexing turntable machine. Put simply, the previous system spent most its time and energy missing its targets. In both these cases, lab work uncovered glaring opportunities to conserve compressed air and reduce wear on equipment.

Lab work finds smaller opportunities too, as demonstrated in the rebuilding of truck-engine pistons. Here, a company familiar with air-blast technology was using bicarbonate of soda in a pressure-blast system to clean pistons prior to rebuilding. While bicarbonate works gently, it also works slowly and recycles poorly. To boost efficiency, the company converted its existing system to glass beads—a more aggressive, reusable abrasive—and added recycling equipment. Unfortunately, this tougher approach underestimated the individuality of used pistons; trying to clean the dirtiest and cleanest (Fig. 4) in a single pass proved counter productive because of excessive part damage.

(Fig. 4) Lab work and number crunching found improved tactics for cleaning pistons. Less pressure and more expensive media reduced per-unit costs by 30%.

Some hard number crunching and dedicated lab time showed that complete cleaning of only 95% of the pistons in a single pass, accompanied by a switch from glass beads to more expensive ceramic media, reduced per-unit

(Fig. 5) Blast system coordinates movements of 16 blast guns, oscillating vertically and horizontally, with spinning stations on a rotating platform. Eight guns oscillating vertically clean the sides and skirts of pistons. Guns sweeping horizontally clean tops and interiors.

costs by over 30% with the proper equipment (Fig. 5). Rework on the dirtiest pistons (5%) proved more economical than increasing the rate of damage to the other 95%. In addition, the ceramic media produced few, if any, of the sharp-edged fragments that contributed to substrate damage when glass beads were recycled.

Beyond advancing the science of air blasting, Empire's laboratory and demonstration room offers visitors hands-on experience. For example, a central test cabinet, piped to deliver either suction- or pressure-blasting, gives customers a flat playing field for comparing the two approaches. Other machines demonstrate numerous paths to automated blasting, starting with timers and stroke counters and moving up to programmable and robotic controls. To help finishers evaluate current technology, eight distinct systems—including baskets blasters, manual cabinets, rotary head systems, cell machines and robotic systems—are available for test drives (Fig. 6). Empire provides a quick 360° spin of its laboratory and demonstration facility at www.empire-airblast.com.

(Fig. 6) Teach pendant provides a fast, flexible means for programming robotic blast machines. Visitors to Empire's test laboratory and demonstration room are encouraged to give it a try.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Two Strip Setting-Up and Verification Program for Peening Intensity

Dr. David Kirk is a regular contributor to The Shot Peener. Since his retirement, Dr. Kirk has been an Honorary Research Fellow at Coventry University, U.K. and is now Visiting Professor in Materials, Faculty of Engineering and Computing at Coventry University.

INTRODUCTION

The most accurate method of estimating peening intensity is to produce and analyze a saturation curve constructed from the arc heights of four (or preferably more) peened Almen strips. There are, however, situations where it is expedient to employ a quicker, albeit less accurate, method. These include when a new set-up is being developed and when an established set-up has to be periodically verified. This article presents a simple computer program that optimizes two-strip setting-up and verification testing.

Fig.1 shows the basic features of peening intensity estimation based on the arc heights of four Almen strips peened for different time periods. These time periods can be actual times but are commonly integral numbers of passes or strokes of the shot stream over the Almen strip. The peening intensity is preferably estimated as the unique 'time' for which doubling that time produces a precise 10% increase in arc height. That unique time, **T**, will rarely coincide with an integral number of passes. Moreover, each strip's arc height falls somewhere within an error band. Computer programs, such as the Solver suite, easily and objectively derive the unique peening intensity, **H**, that occurs at the defined time, **T**. The required objective is that **H** shall lie between user-defined upper and lower values.

A feature of saturation curves is that, for a steady shot stream, they all have a characteristic shape. This shape corresponds to a mathematical equation. The set of data points (arc height versus peening time) can be computer-fitted to a known mathematical equation.

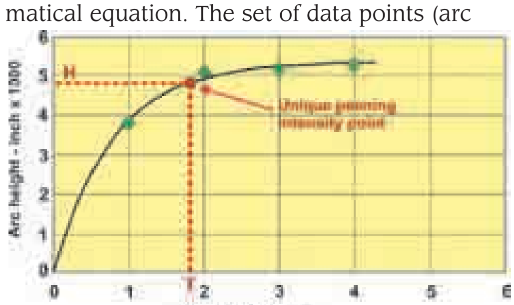

*Fig.1 Unique peening intensity, **H**, occurring at the defined time, **T**.*

PRINCIPLE OF THE TWO-STRIP PROGRAM

The simplest mathematical equations that reasonably represent saturation curve shape contain only two parameters, **a** and **b**. Two such equations are the rational and exponential functions:

$$h = a*t/(b + t) \text{ and}$$
$$h = a(1 - \exp(-b*t))$$

where **h** is arc height and **t** is peening time.

Two data points are produced having co-ordinates $h_1.t$ and $h_2.2t$. Note that the second peening time, **2t**, has to be double that of the first peening time, **t**. These two data points are assumed to lie exactly on a two-parameter equation's curve, as illustrated in fig.2. The co-ordinates of the two data points are then used to 'solve' the equation for its parameters **a** and **b** and hence determine the equation's unique peening intensity value, **H**, at a corresponding peening time, **T**.

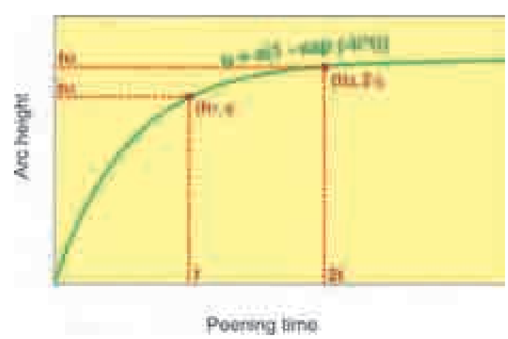

Fig.2 Two data points, (h_1, t) and (h_2, 2t), lying exactly on a two-parameter curve.

Solving of Equation for its Parameters, a and b.

The following description is only of the methodology required to solve equations. Details of the solution process are contained in the Appendix to this article.

Solving of any type of two-parameter equation is based on manipulating a pair of 'simultaneous equations'. The pair is obtained

by substituting the two measured values of both **h** and **t** (**h_1.t and h_2.2t**) into the curve's equation. Manipulation of this pair of simultaneous equations allows one parameter to be eliminated - hence yielding the value of the remaining parameter. Having determined that parameter its value is substituted into the equation to yield the value of the second parameter.

The manipulation and substitution routines required for the two quoted equations yield the following general expressions for **a** and **b**:

Equation	a	b
h = a*t/(b + t)	h_1*h_2/(2h_1 – h_2)	2t(h_2 – h_1)/((2h_1 – h_2)
h = a(1 – exp(-b*t))	h1^2/(2h_1 – h_2)	-ln(h_2/h_1 – 1)/t

Peening intensity, H, at Time, T, obtained by using Parameters a and b.

For the rational function equation the unique peening intensity, **H**, is **9*a/11** at a time, **T**, of **9*b/2**. For the exponential function, **H** is **0.9*a** at a time, **T**, of **2.303/b**. Hence we have the following general expressions for **H** and **T**:

Equation	H	T
h = a*t/(b + t)	9*h_1*h_2/(11(2h_1 – h_2))	9*t(h_2 – h_1)/(2h_1 – h_2)
h = a(1 – exp(-b*t))	0.9*(h_1^2)/(2h_1 – h_2)	-2.303*t/ln(h_2/h_1 – 1)

TWO-STRIP PROGRAM

The expressions described in the previous section have been used to compile an Excel-based program. Fig.3 is a sample of the program's worksheet. For this sample, 'perfect' data point values have been used (h2 being exactly 10% greater than h1).

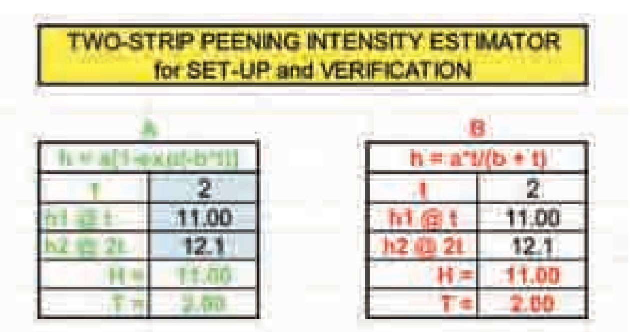

Fig.3 Example of Excel worksheet for Two-strip Estimator program

With 'perfect' values the first data point coincides exactly with the unique peening intensity, **H**, and is at the unique time, **T**. The second 'perfect' data point, at **2T** has an arc height exactly 10% greater than **H**. For such a perfect pair of data points every equation representing a saturation curve must yield exactly the same values for **H** and **T**. Normally, however, the first of the pair of data points will be different from **H**,**T**. The derived **H** and **T** values will then depend, slightly, upon the particular equation that is being used. The difference will only be substantial if the first data point is a long way away from **H**,**T**.

SETTING-UP PROCEDURE

Setting-up of a new peening project has two prime objectives. These are to ensure that the control factors (air pressure/wheel speed, shot size, feed rate, nozzle diameter, stand-off distance etc.) produce:

1) A peening intensity that is within the customer-specified range and
2) the required level of coverage in an economical time.

The level of expertise, prior knowledge and experience that is applied during setting-up will determine how closely an operator can forecast the shot stream's intensity and the time needed to reach the intensity point.

There is no direct connection between peening intensity and coverage. There is, however, a direct connection between coverage and the time, **T**, at which the unique intensity, **H**, occurs. For example, it may be known from previous experience, that a particular component/material reaches a nominal "100% coverage" in a time 50% greater than that to reach **T** (on Almen strips). If a customer requires "300% coverage" and **T** is found on setting-up to be, say, 2.4 passes then we will need 1.5 x 2.4 x 3 passes = 10.8 (or 11 as an integral number of passes).

Real test data is used in the following Case Study – everything else is hypothetical.

Case Study: Two-point Setting-Up Tests based on SAE Data Set No.3

An example of what could have been several two-point setting-up tests is shown in fig.4. This is, in fact, SAE Data Set No.3. This data set is tested using, for simplicity, only Curve A of the program.

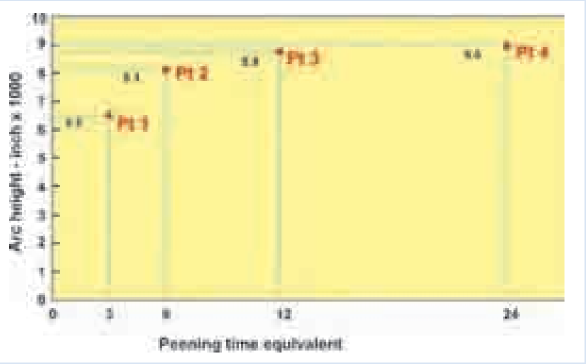

Fig.4 Four data points produced for a given shot stream.

For this study it has to be imagined that three pairs of points were produced independently by three different operators.

1 Imagine that the first operator's best guess for a two-point setting-up gave points 1 and 2. Feeding the values t = 3, h1=6.5 and h2=8.1 into the computer program predicts that the peening intensity point will be **H = 7.8 @ T = 4.9**.

2 Imagine next that a second operator's best guess gave points 2 and 3. The computer program now predicts that the peening intensity point will be **H = 8.0 @ T = 5.6**.

3 A third operator's best guess gave the points 3 and 4. The computer program now predicts that the peening intensity point will be **H = 8.1 @ T = 7.3**.

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Case Study continued:

The three predictions can now be tested against the customer's intensity requirement and against each other.

All three predictions of peening intensity, **H**, are reasonably close to one another. If the customer's intensity requirement range had been, say, 6 to 10, then it could have been assumed that the machine settings were good– whichever of the three point pairings had actually been produced. It would then have been worth producing a full saturation curve. If, on the other hand, the customer's intensity requirement range was 10 to 14, then machine settings would have to be modified. For a required range of 8 to 10, the predictions would indicate that a slight 'tweaking' of one or more settings to increase the peening intensity would be advantageous.

The three predictions can be tested against each other by comparing them with the saturation curve peening intensity - derived using all four points. Fig.5 shows the effect of saturation curve analysis using the Solver 2EXP program.

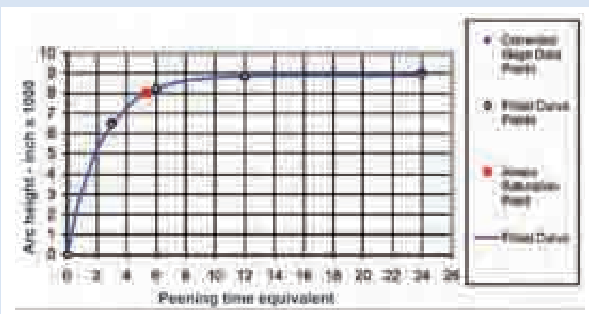

Fig.5 Solver 2EXP analysis of the four data points given in fig.4

Analysis using the Solver 2EXP program on all four data points indicates that the best estimate of peening intensity is **H = 8.0 @ T = 5.4**. The three imagined two-point predictions were **H = 7.8 @ T = 4.9**, **H = 8.0 @ T = 5.6** and **H = 8.1 @ T = 7.3**. It can be seen that the intermediate pair of points (with times of 6 and 12) gives the closest match to that from all four points. That is because the time, 6, of the first point of that pair is closest to the unique peening intensity time of **T = 5.4**.

VERIFICATION PROCEDURES

Shot peeners are required to verify, at regular intervals, that the shot stream's intensity continues to be within the specified range. A balance has to be struck between excessive and inadequate testing. The simplest verification tests require only one strip to be peened. Earlier specifications required that this strip be peened at the peening intensity time, **T**. This is clearly impossible if **T** is not an integral number of passes/strokes/table rotations. The latest version of SAE J443 addresses this problem and allows the single strip to be peened at the nearest practicable time to **T**. The arc height reading from the single strip "must repeat the value from the saturation curve plus or minus 0.038 mm (± 0.0015 in)."

A central problem with single-strip procedures is that they cannot possibly verify that the shot stream's intensity is being maintained! That is because an infinite number of saturation curves can pass through any one point (and the origin 0,0). Fig.6 illustrates this phenomenon and includes the fitted curve shown in fig.5. That fitted curve has a derived peening intensity of 8.0 occurring at a time, **T**, of 5.4 passes. Two additional saturation curves are shown in fig.6 having peening intensities of 9.0 and 13.5 respectively. Both curves pass through the point (5.4, 8.0).

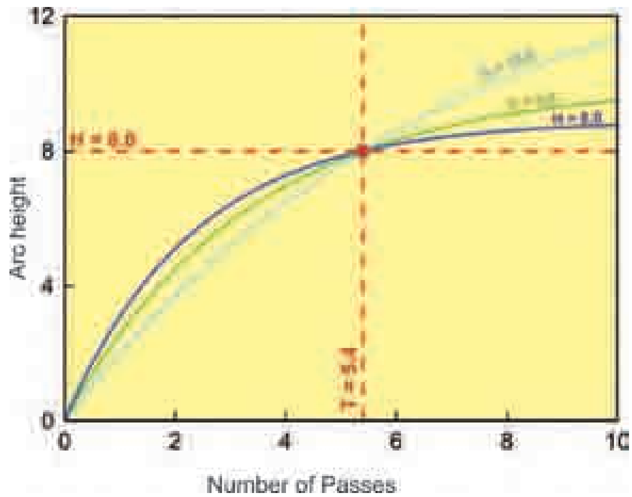

Fig.6 Different peening intensity saturation curves passing through the same point (8.0, 5.4).

If the original setting-up corresponds, for example, to a peening intensity of 8.0 then a single-strip verification arc height of 8.0 only means that the peening intensity is probably somewhere between 7.3 and a very much higher value!

An alternative to single-strip verification is two-strip verification. This is more expensive than single-strip verification. It does, however, afford some confidence that a given peening intensity is being maintained. Two-strip verification is currently employed in a number of organizations. The requirements for arc heights vary between organizations. It is suggested that the two-strip program shown in fig.2 could be employed for verification testing. The strips should be peened for times of **t** and **2t** where **t** is the nearest integral number of passes to the derived saturation peening intensity time, **T**. For example, if the full saturation curve was as shown in fig.5 then verification testing could be carried out at times of 5 and 10. If, for example, peening at those times gave arc heights of 7.9 and 8.6 respectively then those values could be substituted into the program. This, in fact, gives an estimated peening intensity of 7.8, 0.2 less than the 8.0 from the full curve but well within the J443 suggested range of ±1.5 (in thousandths of an inch). As a second example, if peening at times of 5 and 10 gave arc heights of 6.4 and 9.3 then the program would predict that the shot stream's intensity was 10.5 – 2.5 different from an 8.0 from the full saturation curve value of 8.0 and outside of the J443 suggested range of ±1.5.

DISCUSSION

The engineering industry progresses by embracing new ideas. Advances in computer-based technology and software have given rise to a huge range of new ideas and procedures. Reluctance to embrace these impedes progress

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and reduces competitiveness. The arc heights of peened Almen strips are an invaluable source of information when collected and stored effectively. That leads to an argument that the most effective utilization of arc height data should be computer-based. Techniques are already available for transferring arc height data directly from an Almen gage to an Excel spreadsheet. This data can then be used for a variety of purposes e.g. producing and analyzing saturation curves, setting-up and verification.

Optimum setting-up procedures require an efficient combination of operator experience and prediction technique. The two-strip program described in this article optimizes the prediction technique aspect but requires an initial 'best guess' as to the machine settings that will deliver the required peening intensity in an acceptable time. This 'best guess' can be based either entirely on an operator's prior knowledge or can invoke computer-stored data from previous setting-ups. Provided that the 'best guess' is reasonably good then peening of just two strips will be an effective guide to the adjustments necessary to complete setting-up.

Verification based on peening two strips and using the program described in this article is objective and efficient. Attempts to verify peening intensity by using only one strip are fundamentally flawed. That is because, as shown, any number of saturation curves – with different peening intensities – can pass through a single specified combination of verification time and arc height. The different peening intensity curves shown in fig.6 would arise, for example, through a combination of changes of both shot flow rate and shot velocity.

The two-strip setting-up and verification program is available, at no charge, from www.shotpeener.com.

Appendix

MATHEMATICAL SOLUTION OF TWO-EXPONENT RATIONAL AND EXPONENTIAL FUNCTIONS USING TWO DATA POINTS

Rational function: $h = a*t/(b + t)$

Substituting the two data points (h2,2t) and (h1,t) into the rational function equation gives the following pair of simultaneous equations:

$$h2 = a*2t/(b + 2t) \text{ and} \tag{1}$$

$$h1 = a*t/(b + t) \tag{2}$$

Dividing equation (1) by equation (2) immediately eliminates **a**, giving that:

$$h2(b + 2t) = 2*h1(b + t) \tag{3}$$

Applying some algebraic manipulation to equation (3) yields that:

$$b = 2*t(h2 - h1)/(2h1 - h2) \tag{4}$$

Equation (4) is the required solution for **b** as all of the terms on the right-hand side are known.

Equation (2) can be re-arranged as $a = h1(b + t)/t$. Substituting the now known expression for **b** gives that:

$$a = h1\{2*t(h1 - h2)/(h2 - 2h1) + t\} \tag{5}$$

Again applying algebraic manipulation to equation (5) gives:

$$a = h1*h2/(2*h1 - h2) \tag{6}$$

Equation (6) is the required solution for **a** as all of the terms on the right-hand side are known.

The unique value **H** (for which doubling the peening time increases **H** by 10.0%) is given by $H = 9*a/11$ so that the required equation is:

$$H = 9*h1*h2/(11(2*h1 - h2)) \tag{7}$$

The unique time, **T**, that corresponds to **H** on the rational function curve is given by $T = 9*b/2$. Substituting the value for **b** given by equation (4) yields the required equation for **T:**

$$T = 9*t(h1 - h2)/(h2 - 2h1) \tag{8}$$

Exponential function: $h = a(1 - exp(-b*t))$

Substituting the two data points (h2,2t) and (h1,t) into the exponential function equation gives the following pair of simultaneous equations:

$$h2 = a[1 - exp(-b*2t)] \text{ and} \tag{9}$$

$$h1 = a[1 - exp(-b*t)] \tag{10}$$

Equation (9) can be written as:

$$h2 = a[\ (1 - exp(-b*t)*(1 + exp(-b*t)] \tag{11}$$

Dividing equation (11) by equation (10) eliminates **a** to give that $h2/h1 = 1 + exp(-b*t)$. Taking natural logarithms on both sides and re-arranging yields:

$$b = -ln(h2/h1 - 1)/t \tag{12}$$

which is the required solution for **b**.

Substituting the value for **b** given by equation (12) into equation (10) and doing some re-arrangement gives that $a = h1/[1 - exp(ln(h2/h1 - 1)]$. This simplifies to:

$$a = h1/[1 - (h2/h1 - 1)] \tag{13}$$

Equation (13) further simplifies to give the required equation that:

$$a = h1^2/(2*h1 - h2) \tag{14}$$

For the exponential function the unique peening intensity is given by $H = 0.9*a$ occurring at a correspondingly unique time given by $T = 2.303/b$. Substituting the derived values for **a** and **b** (equations (13 and (12)) yields:

$$H = 0.9*h1^2/(2*h1 - h2) \tag{15}$$

and

$$T = 2.303*t/(-ln(h2/h1 - 1)) \tag{16}$$

Equation (16) can be further simplified, by introducing Common logarithmic form in place of Natural logarithmic form to give:

$$T = t/(-log(h2/h1 - 1)) \tag{17}$$

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Photograph:
An integrated PLC provides vitally important monitoring and machine process controls

Blasting using compressed air as the energy source is an age-old process. Over time, enhancements have helped users of this technology achieve greater productivity, economy, and safety through nozzle design, air-flow management, and controls. Air blasting is useful for achieving results from many industrial surface treatments, such as shot peening, paint stripping, preparing new surfaces for coatings, deflashing, deburring, and general cleaning.

Nozzle Design

During air blasting, the air-blast media stream focuses on the substrate through the use of one or more nozzles. The stream can be concentrated on a small area, or dispersed to cover larger areas with a single wide-spray nozzle or multiple nozzles. Nozzle type—straight, venturi or side angle—creates unique spray patterns. Nozzles can be manipulated to provide coverage from an infinite number of simple or compound angles. More nozzles are added for tough areas and pressure can be reduced for sensitive substrates. This flexibility with air blasting variables allows greater blasting control when compared with centrifugal (wheel) blasting.

Shot peening uses steel shot, glass beads or ceramic media with either suction- or pressure-blast equipment. Choosing between them depends upon your application, and the size and type of media required as well as intensity and saturation requirements.

Air-Flow Management

Suction systems function by passing air through a jet in the blast gun. The air volume remains constant. The air jet and nozzle combination creates vacuum that draws blast media into the gun and from there accelerates the media through the nozzle. Air jet , nozzle design and correctly installing them are very important for an efficient process. The ZERO BNP gun is engineered to properly combine the air and blast media for effective results.

Suction blasting is usually recommended for smaller steel shot particle sizes from S-70 to S-230, because of their density (the media are pulled by vacuum from the hopper to the gun where they mix with the compressed air). As the air-blast media mix discharges from the gun/nozzle, it picks up velocity for a short distance as it travels to the work surface.

In a pressure blast system, it is the size of the nozzle orifice that determines the volume of compressed air passing through it. As the nozzle wears, the air volume needed to maintain a constant blast pressure increases. Pressure systems will normally do three to four times more work than suction systems; however pressure blast systems also require three to four times the volume of compressed air. With the added velocity, blast media breaks down faster, and maintenance costs increase.

Pressure blasting is recommended for larger steel shot particles because blast media enters the air stream at the metering valve at the bottom of the blast machine and together the mix travels through the blast hose. As they pass through the hose, they gain velocity and achieve peak velocity when they exit the blast nozzle. The larger the particle size, the greater the surface impact. Pressure blasting is used when the application is blasting into deep recesses or blind holes, and for tough jobs like paint stripping.

Control

Beyond determining suction or pressure blasting and the type of nozzle to use, an important ingredient in modern-day blasting is control. Today, a number of sophisticated technologies are used to achieve and document the blasting processes for productivity and safety. Inventions of recent decades are now common in automated blast systems.

One such invention is the programmable logic controller (PLC) built to withstand harsh industrial applications. When integrated into the blast system, it can control blast on/off time, blast pressure, part rotation, nozzle traverse speeds etc. Each blast nozzle can be individually monitored and individually controlled. These controls allow for data recording for recordkeeping and control for precise process repeatability. Monitoring and control are vitally important in shot peening applications to comply with stringent specifications, such as AMS-2432.

Shot flow controllers, for ferric media applications, used in conjunction with a media shut-off valve, monitor and measure blast media flow and control that flow ensuring it remains at the prescribed rate. These controllers are capable of generating alarms to warn the operator of an out-of-specification condition and shutdown the system to prevent damage to parts or unacceptable parts.

Light curtains are employed as optic-controlled safety mechanisms for protecting operators from harm when loading and unloading parts from semi-automated systems.

More and more frequently, robotics are incorporated into automated cabinet systems for safety and productivity enhancements. Robotics can provide pick-and-place loading and unloading of parts. They can meet peening specification requirements for critical parameters such as nozzle positioning, stand-off distance, and nozzle manipulation. Robotics can speed work flow, reduce labor costs, and provide greater flexibility by providing multiple-axis positioning and manipulation of nozzles.

Successful Operations

For a successful outcome every time, it's important to recognize that no two jobs can be assumed to be alike. Every application should be evaluated to determine which type of blasting is most suitable. The application will dictate the type of blasting, the appropriate blast nozzle, and the blast media. It's all about efficiently manipulating the variables to use the forces of compressed air, blast media, and new technologies for each and every job you tackle.


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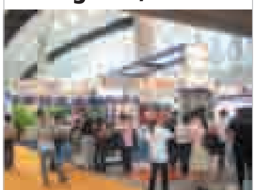
Smooth Going for SF EXPO China 2011

SF Expo China 2011
May 11-13, 2011
Guangzhou International Convention and Exhibition Center
Guangzhou, China



Photographs are from SF Expo China 2009

The Shot Peener magazine is proud to be a media sponsor of SF Expo China 2011

Preparations for SF EXPO China 2011, scheduled on May 11-13, 2011 at the Guangzhou International Convention and Exhibition Centre in Guangzhou, China, are proceeding smoothly. The organizing committee has been very aggressively promoting SF EXPO China 2011. With support from over 50 industry media outlets and more than 40 associations, the marketing to exhibitors has been very successful.

Promotion for SF EXPO China 2011

International media: SF EXPO China has developed partnerships with numerous industrial media venues specializing in surface finishing, coating and electroplating including Metal Finishing magazine (USA), The Industrial Coating (Japan), Anti-Corrosion Methods and Materials (Britain), and The Shot Peener Magazine (USA).

Domestic media: SF EXPO China has established partnerships with more than 40 Chinese media venues, including Materials Protection, Electroplating and Pollution Control, Plating & Finishing, and Electroplating & Finishing.

Partnerships with associations: We have established partnerships with Powder Coating Institute (USA), Korea Plating Industry Cooperative, Singapore Surface Engineering Association and Taiwan Surface Finishing Association. These association partners will not only help to promote SF EXPO China 2011 among their members via websites, conferences, e-mails, etc., but also organize exhibitor and visitor delegations. These relationships will make SF EXPO China 2011 an international event.

Promotion at industry events:

- November 18-20, 2009, Shanghai, SF CHINA 2009. The organizing committee began promoting SF EXPO 2011 during SF CHINA 2009. At the three-day exhibition, about 30,000 exhibition tickets were distributed.
- March 17-20, 2010, Dongguan. Industry event. Mr. Peiji Li, Mr. Zhi Zhang, Ms. Yanhui Chen and other members from the organizing committee met many partners and exhibitors in Dongguan, and exchanged ideas and confirmed the details.
- April 22, 2010, Shanghai. Award Ceremony for Top 10 Electroplating Enterprises. SF Expo China's project manager, Mr. Yanhui Chen, attended the 4th China Surface Finishing Industry Awarding Ceremony for Top 10 Electroplating Enterprises in Shanghai and met with companies' representatives.
- May 26-30, 2010, Korea. The First Korea-China Workshop For Surface Finishing. The leaders of SF EXPO China organizing committee, together with the representatives of Chinese companies, attended the First Korea-China Workshop For Surface Finishing in Jeju. Mr. Ma Jie (the General Secretary of China Surface Engineering Association), Ms. Sun Changlan (the Vice General Secretary of China Surface Engineering Association Electroplating Branch) and Mr. Zhang Zhi (The General Manager of Wise Exhibition) joined in this international workshop and promoted SF EXO China 2011.
- June 5, 2010, Shanghai. Award Ceremony for Top 10 Coating Equipment Enterprises. The representatives of organizing committee flew to Shanghai to attend The 4th China Surface Finishing Industry Awarding Ceremony for Top 10 Coating Equipment Enterprises and distributed exhibition invitation to attendees.
- June 7-10, 2010, Shanghai. 2010 Surface Engineering Association and Seminar. The leaders of the organizing committee attended 2010 Surface Engineering Association and Seminar and visited Wagner, ITW-Gema, Nordson, Wu Yuan, Feng Fang, Hong Zheng, J&C, Penc, and more. The commitee handed out exhibition tickets and information about SF EXPO China 2011.
- July 10-12, 2010, Wenzhou. The 8th China (Wenzhou) International Glasses and Surface Finishing Exhibition. The representatives of SF EXPO China attended The 8th China (Wenzhou) International Glasses and Surface Finishing Exhibition, to distribute exhibition invitations to all exhibitors and report on the exhibition's progress. Some companies confirmed participation in SF EXPO China 2011.

Exhibitor Organization

Atotech, Winstar, Sanfu, Norilsk, Conventya, Riyi, Wagner, and Ultra-union and more have committed to exhibit in SF EXPO China 2011.

Visitor Organization

The visitor organization has been started. In addition to traditional marketing, one-to-one research will be adopted to learn the exhibitors' expectations. To ensure a fruitful experience for all participants, the organizing committee will set up a department to invite and communicate with relevant buyers directly, provide visitors with detailed information about exhibitors and exhibits.

We sincerely invite you to attend SF EXPO China 2011!

The Benefits of a Foreign Exchange

by Kathy Levy

"Man cannot discover new oceans unless he has the courage to lose sight of the shore."
—Andre Gide
French Writer

No matter your role in the shot peening industry, if you're going to be successful, you have to be willing to learn and share information about your work. What determines your success? I'll share a few real-life lessons from a French engineering student.

Electronics Inc. (EI) was fortunate to have Julien Jeanneau working at their facility this summer. Julien lives in Nantes, France and attends ITII Pays de la Loire (Institut des Techniques d'Ingénieur de l'industrie) where he is working toward a Mechanical Engineering degree. ITII coordinates the delivery of an engineering degree in cooperation with academic and professional partners. Julien participates in an internship program at Sonats, the manufacturer of the Stresstonic® and a ultrasonic peening solution provider. In addition to the internship program, ITII requires each student to spend nine weeks working for a non-French speaking industrial company outside of France. The objectives of this work period are:

1) Improve communications in a foreign language
2) Develop autonomy in dealing with new and unpredictable situations
3) Increase awareness of cultural issues in the workplace
4) Develop the capacity to analyze and communicate one's experiences

Sonats asked EI if they would be interested in having Julien with them for the summer and EI agreed. I met Julien at the end of his stay in the United States.

Learning by Doing

The EI staff put Julien to work translating data sheets and instruction manuals on Almen strips, Almen gages, MagnaValves and controllers from English into French. The project was beneficial to Julien in two ways: he strengthened his ability to read and understand English and he learned more about Almen products. "Translating these materials really helped me," said Julien. "Sonats uses Almen strips and gages in their Measuring Department and now I understand them better." EI felt fortunate to have their technical documents translated by an engineering student and the materials will be available online soon.

ITII also required Julien to complete a technical project and EI's Operations Manager, Jeff Derda, assigned Julien the task of designing an automated media loader for EI's MagnaValve test stand. Currently, after shot has run through a MagnaValve, the technician has to lift the buckets to the top of the stand to replenish the hopper.

"Julien designed a media loader in 3D on his laptop computer; I was actually very surprised with the magnitude of his design, said Mr. Derda. "I did not expect something quite that detailed, since the duration of his visit was relatively brief and he was involved with other projects including the translation of product manuals. He has a very good grasp of mechanical systems and how they interface, which was evidenced in his design presentation. There are still a few issues that must be resolved and the

Julien Jeanneau, a French engineering student, spent the summer working in the U.S. as part of his apprenticeship program.

electronics have to be completed but the basic concept is very sound and we should be able to drive it to completion."

Julien enjoyed the assignment because it was an open project—the design was completely up to him and he could make all the decisions. However, he was responsible for a functional design that would be economical to build and maintain. He also demonstrated his English-speaking skills when he presented the project to the EI engineering and management team.

Bridging Communication Barriers

During Julien's stay in the United States, Sonats sent him to a client's facility in Pennsylvania for two weeks. The company peens bridge welds with Sonats' Ultrasonic Needle Peening units. One of Sonats' maintenance experts traveled to the U.S. to address a problem and Sonats' Technical Director, Vincent Defontaines, wanted Julien at the job site for a few days to observe and support the equipment operators.

The operators aren't metal peening specialists—they typically use a jackhammer—and they weren't familiar with an ultrasonic impact treatment device. Through training, equipment use and care instruction, and hands-on experience, best practices have been established. "At first, I didn't understand why there are workshops in shot peening," Julien concluded. "Now I see why training for the shot peening operators is important even when it doesn't directly sell products."

While Julien pointed out to us cultural differences in manufacturer and vendor relationships between French and Americans, his responsibilities at the customer's site emphasized an opportunity for all manufacturers: Train the people that will be using the product, not just the management or engineering staff. Engineers and equipment operators may be the same nationality, but they don't always speak the same language. Important product information could get lost in the translation.

A Sense of Adventure is Required

If going to a difficult work environment when English is your second language isn't adventuresome enough, Julien didn't want to spend a weekend in a hotel room so he drove from Pennsylvania to New York city. Alone. Let's give him an A+ for the internship program's Objective #2 right here and now: "Develop autonomy in dealing with new and unpredictable situations." I don't know many Americans who have never been to New York that would drive into Manhattan by themselves. Perhaps a better comparison would be an American driving in Paris alone. At least he would be driving on the correct side of the road.

Being Pleasant is Priceless

"Two things reduce prejudice: education and laughter."

—Dr. Laurence J. Peter
American Educator and Writer

Julien didn't expect to like Americans. "I was expecting the Ugly American: One that eats too much and talks loudly," he admitted. But he realized early in his trip that he was going to enjoy working with Americans. (He had the same reversal of attitude when he was in Korea earlier this year.) Jack Champaigne, President of EI, invited Julien to stay in his home and Mr. Champaigne enjoyed introducing Julien to American culture including our food and an all-American summer event: antique car shows. According to Mr. Champaigne, Julien enjoys grilled steak and he makes great Korean dishes. Julien also made crepes for the staff during the monthly EI breakfast.

Immersing oneself in another's culture doesn't guarantee that you're going to like them, but share a laugh and now we've formed a bond. I sat in on Julien's MagnaValve media loader presentation to the EI engineering staff and it was a energetic and enjoyable exchange of information and ideas. Julien even laughed at our "engineering jokes" (that's a paradox). Julien thought we were going to be loud and piggish; we were afraid he was going to be rude and abrupt. We were all wrong; probably because Julien approached everything and everyone with an open mind and a warm smile.

Who Was the Teacher?

ITII doesn't cover shot peening in its curriculum and Julien's exposure to shot peening at Sonats and EI has introduced him to a likely career path. However, the EI staff is impressed with ITII's academic program that prepares students to compete in a global economy and Julien gave us insights on marketing our products and services in Europe. In return, we think Julien saw why training makes equipment operators more accepting and appreciative of new products and work practices. We know for sure that Julien's engineering skills and ease in new situations will make him a tremendous asset in any work environment. It was a valuable learning experience for all of us.

Industry News

Linda McIntosh named Canada Region Manager

LaGrange, Georgia. Wheelabrator Group announces that Linda McIntosh has joined Wheelabrator Plus as Regional Manager for Canada. She will lead the Burlington, Ontario-based sales and customer support team for aftermarket parts, service, equipment modernization programs and technical support requirements.

In her new role, Linda has overall responsibility for managing and directing sales growth and industry best practices for all aftermarket sales growth operations including OEM parts, Parallel parts and Equipment Modernization Programs (EMP) in Canada. She has worked extensively in the manufacturing sector and joins Wheelabrator from Virtek Vision International with 20 years experience in customer relationship management and industrial operations including sales, service, and marketing.

Wheelabrator Group is a global provider of surface preparation and finishing solutions. Committed to offering the broadest array of technologies, products, services and technical know-how, the Wheelabrator Group works closely with customers to deliver the best solutions for their specific requirements. The company's strategically located and electronically linked offices allow Wheelabrator Group to provide unrivalled customer service and support worldwide.For more information on Wheelabrator visit the web site at www.wheelabratorgroup.com.

Nadcap Contributes to Aerospace Safety, Says Industry

Warrendale, Pennsylvania. Does Nadcap contribute to the overall aerospace industry safety record?

According to a June 2010 poll conducted by the Performance Review Institute (PRI), which administers the Nadcap program, it does!

198 aerospace workers from around the world responded to the question "Do you believe that Nadcap contributes to the overall aerospace industry safety record?"69% of the respondents agreed that Nadcap does contribute to overall aerospace safety.

Arshad Hafeez, former Executive Director of Global Business Operations and Corporate Strategies at PRI commented: "It is encouraging to see that the benefits of Nadcap accreditation are recognized around the world by people working in the aerospace industry." The results of this poll follow a more detailed survey conducted in June 2010 in recognition of PRI/Nadcap's 20th anniversary on 15 July 2010. 1,151 people responded to the survey. The survey results showed that the suppliers involved with Nadcap have significantly reduced their scrap rates, rework rates and escape rates. 35% have reduced their scrap rates; 41% have reduced their rework rates; and 44% have reduced their escape rates. In the same survey, 54% of the respondents reported that their sales and/or ability to attract new business has increased.

One respondent commented, "Pursuit of lean manufacturing principles has been a prime objective across our site for many years. Although our special processes had previously been considered by our machining community as services supplied to support their activities (conventional machining), the Nadcap program has lead to increased respect and awareness across the organisation, of the supply requirements of these processes." Another stated, "Our Nadcap accreditation is value added to our company. It has assisted in standardization, increased profits, and increased quality. All companies are looking for value-added programs in this day and age: Nadcap is one that should not be overlooked. Learn more at www.pri-network.org.

Electronics Inc. Releases 2010 Almen Strip Testing Data

Mishawaka, Indiana. Saturation curves are only as dependable as the strips used to perform the test. If the strips aren't consistent in hardness and thickness, the tests won't be accurate.

That's why, before EI launched the Electronics Inc. brand of strips in 2007, they began consistency testing on their Almen strips to track their performance and to document that EI's strips were manufactured under conditions more stringent than SAE J442 specifications. The tests prove that EI strips are consistent in hardness and thickness from lot to lot, from year to year.

Results from tests conducted in January, May, and July, 2010 are available in easy-to-read histograms. An analysis of the data, specifically the mean values, verifies the consistency of the EI strips—the overall range for all the material lots tested is only .0006 inches. In addition, the small values for the standard deviations confirm the consistency within individual lots. Finally, using a typical peening range of .004 inches, the Cp and Cpk values provide the customer with complete confidence in the accuracy of the peening process. The report also includes the results of performance tests conducted in 2007, 2008, and 2009. To download the test results, go to www.electronics-inc.com/newsstrips.html.

From My Desk

Getting ready for the next International Conference on Shot Peening, ICSP-11, was a great experience for me as I got to reflect on the same activities I enjoyed in 1996. It was exciting to be affiliated with the International Scientific Committee on Shot Peening and a great honor to be selected the chairman of the ICSP-6 conference. Hosting the conference at The Fairmont, near the cable cars, Fisherman's Wharf, Ghirardelli Chocolate... what's not to like about that? The conference was a success mostly because of the large number of high quality papers presented. Here it is, 24 years later, and authors from all over the world are offering their contributions to the advancement of the science of shot peening. You can read the titles and abstracts accepted for the conference at the official web site: www.shotpeening.org.

South Bend should prove to be a great venue not only because of the excellent conference facilities and hotel accommodations but also for the many tourist opportunities. You can visit world famous Notre Dame University or travel back in time to Nappanee, Indiana and observe the Amish craftsman (or enjoy their excellent style of cooking). A visit to South Bend wouldn't be complete without visiting the Studebaker National Museum or to the Oliver Mansion, home of the inventor of the Oliver Chilled Plow. The plow is known around the world as one of the greatest advancements of agriculture. If you come to South Bend and don't have a good time, it's not my fault.

Speaking of progress in the shot peening industry, you might be interested to know of activities of SAE, Society of Automotive Engineers. SAE has two committees devoted to shot peening, one related to aerospace and one to automotive. The aerospace committee task group was recently formed as a sub-group of AMEC, Aerospace Materials Engineering Committee and I was asked to chair it. Previous to that the shot peening topics were addressed by engineers mainly interested in heat treatment and a few, usually four to six people, were keenly interested in surface treatments. I volunteered to get more people involved and it didn't take me long to get a roster of over 96 people from around the world. The task group, AMECSE, Aerospace Materials Engineering Committee Surface Enhancement, now meets the day before the AMEC meetings and usually attracts about 25-30 participants. The committee has not only addressed deficiencies in existing AMS specifications but has also launched several documents reflecting awareness of new technologies such as laser peening and ultrasonically activated peening.

Attention was also directed at creating AMS documents for the flapper peening process. The industry standard practice created by the U.S. government, primarily for repair of helicopters in Viet Nam, had not been updated since 1972. After a three-year effort by committee members from three countries we now have a modern (and technically correct) document for standard practices. Please contact me if you would like to join this committee. The next meeting is January 18-19 in Monterrey, California. The meeting will be held at The Beach Resort Monterrey hotel, right on the Pacific Ocean.

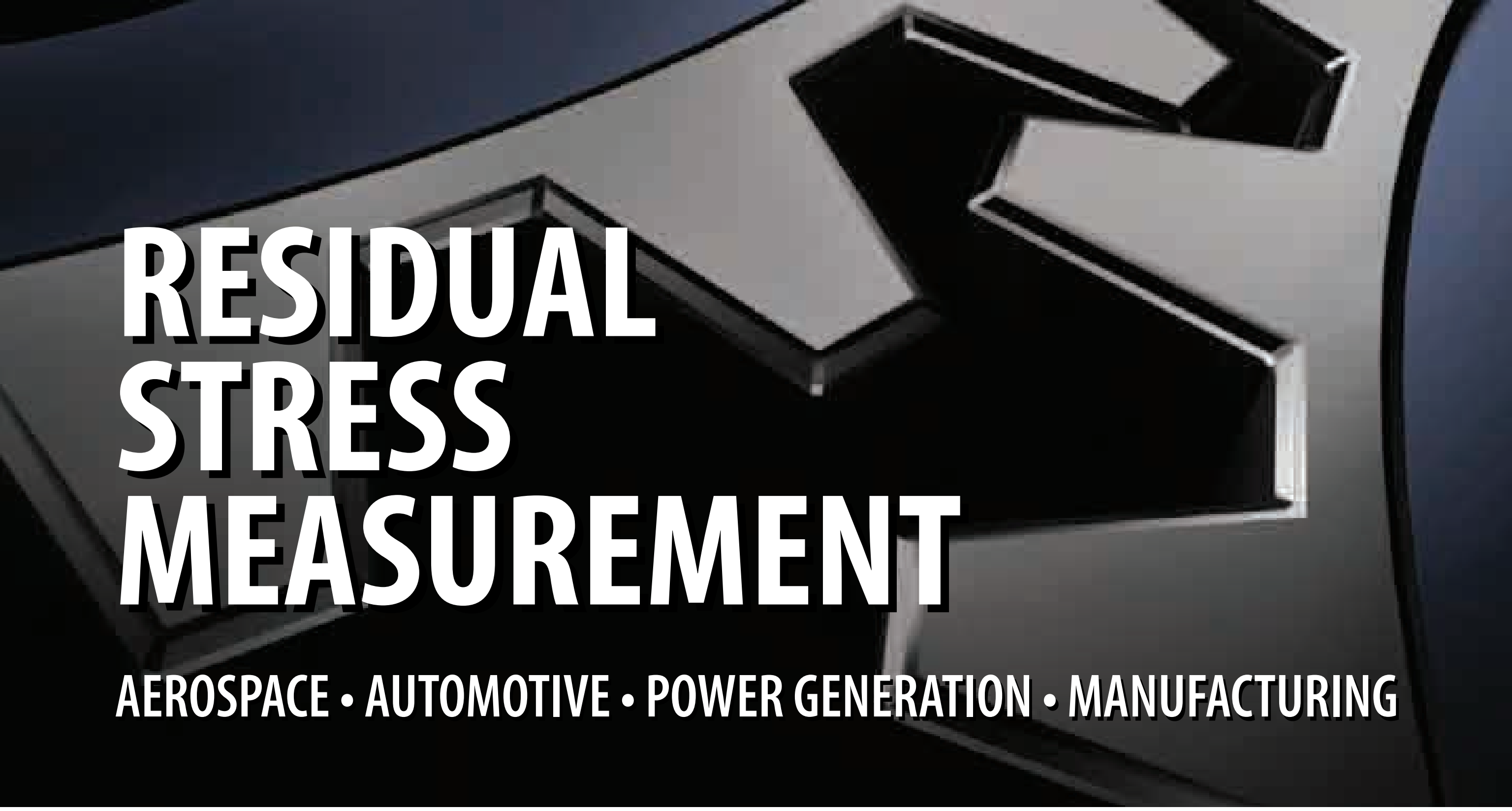
There are other SAE documents related to shot peening and you might recognize these as "J" specs. These include J 4441, J 442, J 443 and so on. The Materials, Processes and Parts Council (Land and Sea Division of SAE) has several committees, including Surface Enhancement Committee. This is the body responsible for the "J" specs. So, when you read an aerospace document, such as AMS 2430, you'll notice that references to intensity and coverage revert back to the "J" specifications. Active participants that serve on both committees has helped tremendously in achieving synchronization of these documents.

Want to get involved? Send me an email at jack.champaigne@electronics-inc.com.

Let me close with a special thanks to Metal Improvement Company and Proto Manufacturing. Both companies joined Electronics Inc. as ICSP-11 Benefactors and their early financial assistance is deeply appreciated.

October 2011
U.S. Shot Peening Workshop
Walt Disney World, Florida

Who says learning can't be fun?



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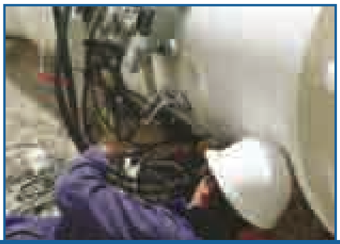

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