

Volume 23, Issue 1 Winter 2009
ISSN 1069-2010

The Shot Peener

Dedicated to sharing information and expanding markets for shot peening and blast cleaning industries



Flapper Peening

PICKS UP SPEED

PLUS:

New Products are Problem Solvers
Almen Strip Consistency Testing

2008 Shot Peener of the Year
Size and Variability of Cast Steel Shot Particles

EQUIPMENT • REBUILDS • RETROFITS • PARTS • SERVICE

PREPARED FOR TAKEOFF.

We've spent more than a century perfecting surface preparation technology. Today our products help the aircraft industry achieve higher productivity and lower maintenance of their blast equipment. Tomorrow we can do the same for your company. Call us now. Because the future of metal working runs through Pangborn.



PANGBORN

Surface preparation systems, equipment and services.

©2009 Pangborn Corporation

www.pangborn.com 1.800.638.3000

The Shot Peener

Dedicated to sharing information and expanding markets for shot peening and blast cleaning industries

4

Flapper Peening Picks Up Speed

Flapper peening usage is growing in aerospace maintenance, repair and overhaul facilities. Find out what is contributing to the rise of this portable peening process.



10

Two New Products are Problem Solvers

Control and coverage validation are two crucial aspects of the shot peening process. Shockform has developed products that help peening operators obtain both.



Articles

The Shot Peener

22 years in publication
Over 5,700 subscribers
Read in 85 countries

The Shot Peener
56790 Magnetic Drive
Mishawaka, Indiana, 46545 USA
Telephone: 1-574-256-5001
shotpeener@shotpeener.com
www.shotpeener.com

Inclusion of articles in The Shot Peener does not indicate that The Shot Peener management endorses, recommends, or disapproves of the use of any particular commercial products or process, or that The Shot Peener endorses or concurs with the views expressed in articles contributed by our readers.

Articles in The Shot Peener may not be distributed, reprinted in other publications, or used on the internet without the written permission of The Shot Peener. All uses must credit The Shot Peener.
Please email requests to:
shotpeener@shotpeener.com.

2008 Shot Peener of the Year P.12

If you have attended an EI Shot Peening Workshop, you've probably met our 2008 Shot Peener of the Year. He is an engineer with a leading German aero engine manufacturer and maintenance facility. Can you guess who he is?

Almen Strip Consistency Testing P.14

Before bringing their Almen strips to market, EI developed a custom air blast test cabinet and shot peened approximately 4,000 strips manufactured over a three-year period. Review the results of their testing program.

Blasting High-Precision Tools for High-Precision Surgery P.18

A blast cleaning solution from Herb Tobben

Size and Variability of Cast Steel Shot Particles P.24

An academic study from Dr. David Kirk

Sonnimax AS to Celebrate 40th Anniversary P.36

Erik Pandrup with Sonnimax shares the company's anniversary celebration plans and the reasons for its success.

Industry News P.40

News from Nadcap, Wheelabrator, and Wheelabrator Group

The Parting Shot P.42

Flapper Peening

PICKS UP SPEED

Flapper peening (also called roto-peening) looks like such a small, delicate process—more like jewelry making than shot peening. But don't let the equipment size fool you. Flapper peening's benefits are huge and its usage is growing in aerospace maintenance, repair and overhaul (MRO) facilities.

FLAPPER PEENING WAS THE ANSWER

During the Vietnam war, U.S. Army helicopters were used in greater numbers than ever before in a land war. Repair and maintenance had to be fast and effective, especially on components like rotors. Shot peening was needed but taking the aircraft out of service for any length of time wasn't an option.

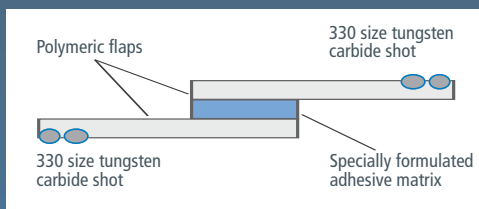
3M™ had the solution. The company worked with tool manufacturers to adapt their TC330 roto peening flap assembly to a flexible shaft tool. The resulting 3M™ Roto Peen Flap Assembly had a small footprint, was portable, and replaced free-flying shot. Because it was capable of repairing gouges, scrapes and corrosion in small and hard-to-reach areas, it was ideal for peening helicopter components like rotor hubs.

In the early 1970s, the TC330 was qualified at Wright-Patterson Air Force Base in Dayton, Ohio and written into the military specifications MIL-R-81840 and MIL-R-81841. Its usage quickly spread to civilian aerospace companies that appreciated its portability and effectiveness.

Flapper peening, however, wasn't limited to the field of aviation. Dr. David Kirk, Visiting Professor in Materials, Faculty of Engineering and Computing at Coventry University, used flapper peening 20 years ago at a billion-dollar steam turbine facility. During commissioning, fatigue cracks started to appear at the roots of the blade/rotor fir-tree assemblies. These areas had not been peened prior to assembly. Disassembly and shipping parts halfway around the world would have cost millions of dollars. "Acting as a consultant, I carried out flapper peening on test blocks followed by the determination of induced residual compressive stress profiles. Results were so encouraging that flapper peening was subsequently carried out in situ on the steam turbine assemblies. To the manufacturer's great relief,



The 3M™ Roto Peen Flap Assembly is a captive shot flap technology that uses high strength resin to bond tungsten carbide shot to a flexible polymeric flap. This provides a cleaner, more precise method than loose shot peening and the uniform 330 shot size contributes to consistent results. The two polymeric flaps are bonded together with a specially formulated adhesive matrix for easy placement in a flap mandrel.



The flap/mandrel assemblies provide convenient portability and are especially effective for precision in-service rework, manufacturing, repair of small areas, and peening holes with diameters down to 1/2" (12.7mm). Flaps can also be cut with scissors to peen confined areas or peen into areas with a radius down to 1/16" (1.6mm).

Applications include:

- Landing gear assemblies
- Wing structures
- Helicopter rotor hubs
- Jet engine support members
- Peening after grinding
- Peening before plating
- Peening of surfaces subject to stress corrosion
- Peen straightening
- Peen forming
- Weld heat affect zone
- Bond testing

RESOURCE: 3M™ Roto Peen Flap Assemblies TC330 Application Notes



Whether you are peening large areas with centrifugal wheels or targeting specific areas with automated airblast nozzles, Wheelabrator Group will deliver the right solution to meet your need.

Your investment in Wheelabrator technology and equipment will lead to consistent and repeatable peening results with both types of media propulsion techniques.

Shown right: Wheelabrator Model® LGA-08 Landing Gear System, picture courtesy of Hawker Pacific Aerospace

Call us for more information or to visit one of our technology centers for a live demonstration:

U.S.: 706-844-6884 800-544-4144

Canada: 905-319-7930 800-845-8508

info@wheelabratorgroup.com

www.wheelabratorgroup.com

Wheelabrator is a registered trademark of Wheelabrator Technologies, Inc.

Aerospace Peening Solutions



wheelabrator
●●●●●●●●■■■■GROUP

no further fatigue failures were encountered in service," said Dr. Kirk.

FLAPPER PEENING IN TODAY'S MRO FACILITIES

As evidenced by Dr. Kirk, flapper peening can be used in other fields besides aviation but its greatest usage is in MRO. We asked Dave Barkley, a flapper peening trainer with Electronics Inc. Education Division, for his viewpoint on flapper peening's popularity.

Shot Peener: Who is using flapper peening today?

Mr. Barkley: We're training staff from large aerospace companies, U.S. military bases and small, independent shops.

Shot Peener: Flapper peening looks easy, why would you need training?

Mr. Barkley: Flapper peening is a manual process and the operator is responsible for more than just pushing a button to initiate a typical automated peening process. Putting residual compressive stress back into the repaired area is as important as the initial shot peening but the flapper peening technician needs to follow different rules from conventional peening and use specific techniques to make it a controlled process.

Shot Peener: Who attends flapper peening training?

Mr. Barkley: In most cases our students are machine operators and artisans that have never worked with shot peening. That's why we make sure our flapper peening training includes a thorough review of all aspects of shot peening.

Shot Peener: What components will your students be flapper peening?

Mr. Barkley: They're using flapper peening on previously-peened parts that are in for repair or maintenance and require peening on the worked areas. Practically any component that was shot peened can be flapper peened. The big advantage for our customers is when they can repair and peen components like landing gear parts or helicopter rotor hubs without disassembling them. Even sensitive assemblies can be flapper peened because there is no stray media. I don't see it very often, but

flapper peening is also used for part straightening or forming.

Shot Peener: What do your students think of flapper peening after training?

Mr. Barkley: They are excited about what they have learned. Exposing them to the theory and benefits of shot peening gives them an appreciation for what they are doing. They leave the training with a new sense of pride in their craft.

Flapper Peening Saves Time and Money for KLM

KLM Royal Dutch Airlines' Engineering and Maintenance Division uses flapper peening for several reasons. One big reason is the size of the parts that need to be peened—they don't fit in a shot peening cabinet. An example is a flaptrack of an airplane. Flaptracks are located in wings and can be up to 8 feet in length. "Often the holes in the flap-track need mechanical rework and then require shot peening," said Marcel van Wonderen, KLM's Master Engineer on Process, Equipment and Materials Development. "In that case, we use flapper peening on the holes."

Sometimes the type of damage calls for flapper peening. "Recently, a landing gear was dented. We had to blend away the dent, which is an initiation point for micro-cracking, and used flapper peening to introduce compressive stress on the blended area," said Mr. van Wonderen.

Additionally, KLM flapper peens parts that have to be peened on site. Oxide removal with blending is typically done locally and KLM's mechanics flapper peen the worked area to compensate for the tension stress induced by the blending and to increase resistance to oxidation.



KLM flapper peens small areas on large components, like the holes in the flaptrack from a wing.



"Students are excited about what they have learned. They leave the training with a new sense of pride in their craft."

Dave Barkley
Flapper Peening Specialist
Electronics Inc. Education Division

YOU'LL GET MORE

THAN JUST THE SURFACE TREATMENT

FROM

PROGRESSIVE



94%

Progressive Technologies will treat you right. Our in-house engineers can meet any challenge, from high-tech to high-volume and across all process ranges. From cost-competitive standard models to custom-designed, automated systems, Progressive has the technology to meet your needs.

There's tremendous value beneath the surface of a Progressive system. We conduct testing and product validation at our plant, and invite you to qualify your system before it ships to you. Installation is seamless, with no unpleasant surprises. And if you need help later, we're on-call 24/7 with technical support, process troubleshooting, on-line diagnostics, and training.

Ninety-four percent of our customers order additional Progressive equipment. They've experienced the customized solutions, reliable operation, and responsive customer service that make Progressive systems the best value in the industry.

Treat yourself to high-tech, worry-free shot peening and blasting equipment. Call Progressive today.

Automated surface treatment machinery

- shot peening
- grit blasting
- waterjet cleaning
- thermal spraying



PROGRESSIVE
TECHNOLOGIES

800.968.0871
www.ptihome.com

Flapper peening's convenience and portability saves money for KLM. In the case of the dented landing gear mentioned above, it would have cost \$80,000 to remove the landing gear from the plane, take the landing gear apart and send the part to the engine shop. Figured into the cost is also the repair activities and turn-around time of three days (turn-around time is a big issue in the aircraft overhaul business). "The whole flapper peening procedure was completed in only 20 minutes and cost maybe \$150," said Mr. van Wonderen. Some repairs, such as removing oxide spots and peening afterwards, can only be done with flapper peening. Mr. van Wonderen asked, "How do you calculate the cost savings on that?"

THE FUTURE OF FLAPPER PEENING

Two advancements are enhancing flapper peening's position as a viable, controllable process: a relevant and accurate specification and a RPM controller. The SAE Aerospace Metals Engineering Division's Shot Peening Sub-Committee is developing an AMS version of a flapper peening specification intended to displace the MIL-R-81841 specification. MIL-R-81841 has several erroneous concepts and requirements.

Shockform's FlapSpeed™ controller brings a new level of control and confidence to the flapper peening procedure. "Several of our clients in the aerospace sector have told us that they liked the flexibility, speed and cleanliness of flapper peening but they wished that the process was more controlled," said Sylvain Forgues, co-owner of Shockform. Furthermore, new requirements such as the Nadcap audit criteria AC7117/4 requires that companies use "flapper peening equipment capable of maintaining the required RPM to consistently conform to the required intensity values". Until now, this requirement was difficult to fulfill since no RPM controller was commercially available for flapper peening. The recently-released patented controller is small, robust and easy to use in a production or MRO environment. "It will help users meet their quality requirements for the flapper peening process," said Mr. Forgues. ●

Resources

3M™ Roto Peen Flap Assemblies TC330
Electronics Inc. 1-800-832-5653 or 1-574-256-5001
www.electronics-inc.com

Flapper Peening Training

Dave Barkley, Flapper Peening Training Specialist
Electronics Inc. Education Division
dave.barkley@electronics-inc.com

FlapSpeed™ Controller

Sylvain Forgues, co-owner of Shockform Inc.
1-450-430-8000
info@shockform.com or www.shockform.com

Get up to speed on flapper peening

with flapper peening training from the experts



Flapper peening is ideal for repairing small and hard-to-reach areas. Flapper peening can be done in the field, making the time-consuming and expensive disassembly and transportation of components unnecessary.

Flapper peening is one of the fastest-growing shot peening methods—it's effective, economical and fast. Electronics Inc. Education Division offers one-day on-site training programs for companies and military bases that want to expand their flapper peening skills.

Our flapper peening training will:

- Help you achieve a controllable process
- Increase your operators' skill
- Demonstrate how to achieve compliance to specifications and standard practices
- Expand your use of this productive process

Our training program is beneficial to operators, supervisors, inspectors and application engineers.

Mechanics that are qualified under FAA rules to perform inspections may receive credit for taking this class.

Ask us for more information.

1-800-832-5653 (U.S. and Canada) or 1-574-256-5001
or visit www.electronics-inc.com



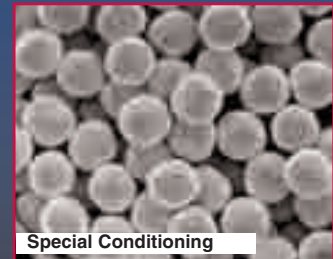
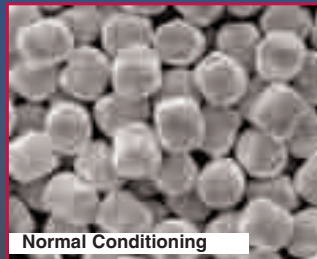
Get flapper peening training from the company that knows how to do it right. Jack Champaigne, President of Electronics Inc., is the Chairman of the Shot Peening Sub-Committee of the Aerospace Metals Engineering Committee of the Aerospace Materials Division of SAE. His committee will be responsible for writing the new flapper peening specification. EI provides flapper peening training to aerospace companies and military bases worldwide.

Premier Shot

A cut above

The advantages of Premier Cut Wire Shot

- **Highest Durability** - Due to its wrought internal structure with almost no internal defects (cracks, porosity, shrinkage, etc.) the durability of Premier Cut Wire Shot can be many times that of other commonly used peening media.
- **Improved Consistency** - Highest consistency from particle to particle in size, shape, hardness and density compared to commonly used metallic media.
- **Highest Resistance to Fracture** - Cut Wire Shot media tends to wear down and become smaller in size rather than fracture into sharp-edge broken particles which may cause damage to the surface of the part being peened.
- **Lower Dust Generation** - Highest durability equals lowest dust levels.
- **Lower Surface Contamination** - Cut Wire Shot doesn't have an Iron Oxide coating or leave Iron Oxide residue - parts are cleaner and brighter.
- **Improved Part Life** - Parts exhibit higher and more consistent life than those peened with equivalent size and hardness cast steel shot.
- **Substantial Cost Savings** - The increase in useful life of Premier Cut Wire Shot results in savings in media consumption and reclamation, dust removal and containment, surface contamination and equipment maintenance.



(216) 651-6758
www.premiershot.com

The advantages of the Premier Shot Company

Premier Shot is proudly produced in the United States. It is manufactured to meet today's high quality shot peening standards and is used in automotive and aerospace applications worldwide.

Premier Shot Company: 1203 West 65th Street • Cleveland, Ohio 44102



Flapper Peening Controller



Coverage Inspection Camera

New Products are Problem Solvers

Shockform Inc. introduced two new products at the Electronics Inc. 2008 Shot Peening and Blast Workshop in Cincinnati, Ohio

Control and coverage validation are two crucial aspects of the shot peening process. Shockform has developed products that help peening operators obtain both.

El Shot Peening Workshop attendees were able to try the new FlapSpeed™ Controller and InspectView™ 20/20 camera at Shockform's exhibit. Now our readers can take a closer look at these easy-to-use products that will greatly improve the quality of your shot and flapper peening programs.

FlapSpeed™ Flapper Peening Controller

The FlapSpeed™ Controller was a big attraction at the workshop. The controller was tested by visitors to Shockform's booth and it was presented by workshop instructors, Pete Bailey and Dave Barkley, during their Flapper Peening Theory and Application classes.

Flapper peening (or roto-peening) has been used since the 1960s but it has always lacked real-time rotational speed control. The FlapSpeed™ Controller addresses that problem: It continuously monitors and adjusts the rotational speed of the flap during the peening process. Because the peening intensity relies on the rotational speed, the flapper peening process now has increased stability and repeatability.

The patented controller was designed to be small, robust and easy to use in a production or Maintenance, Repair and Overhaul (MRO) environment. It comes in both electric and compressed air models and offers a direct input of peening intensity. The controller converts the requested intensity into the associated flap rotational speed. The time required to generate Almen intensity curves is reduced and the productivity of the operator is increased. Overall, the FlapSpeed™ controller reduces the setup time and makes flapper peening more reliable.

"Shockform is very proud of the controller because it brings a new level of confidence to the flapper peening process while making it faster and much easier than before," said Sylvain Forgues, co-owner of Shockform.

InspectView™ 20/20 Coverage Inspection Camera
Although achieving appropriate coverage is very



A workshop attendee tries the FlapSpeed™. With the new flapper peening controller, peening is more reliable and meeting Nadcap requirements is much easier.

important in the peening process, the best inspection tool to date has been a standard magnifier. The magnifier works for simple geometries but it isn't viable when inspecting complicated geometries or areas that are difficult to access. Ironically, this is when a thorough coverage inspection is most important.

Shockform's new InspectView™ 20/20 coverage inspection camera improves visual inspections. It features a 3.5-inch color monitor and a 39-inch long probe. The probe has a small diameter (0.23-inch) and four integrated LED that can be adjusted using a step-less wheel. The camera also features a series of 10X, 20X and 30X lenses for inspecting coverage and media as well as 35, 45 and 60 degree mirrors for inspecting the inside of bores. The InspectView™ 20/20 camera allows you to take pictures and movies that can easily be transferred to your computer through a SD card or a USB port and shared with colleagues, management or clients in prints or reports.

El Workshop participants used the small camera to inspect the coverage of complicated parts as well as



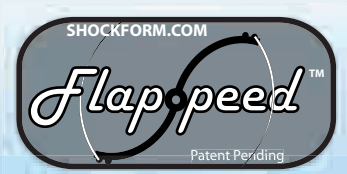
Easier and Faster ^{+ More Reliable} with the FlapSpeed™ Controller

Here it is! The new way to do flapper peening. The FlapSpeed™ Controller offers what the industry has been waiting for: the continuous monitoring and adjustment of the flapper rotation speed to ensure repeatable and reliable peening.

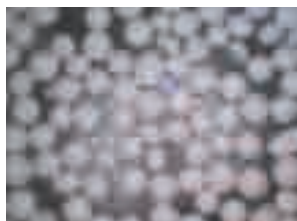
Available for both electrical and compressed air flapper peening, the FlapSpeed™ Controller lets you select the required Almen intensity or the flapper RPM. No more precious time lost making endless saturation curves. The FlapSpeed™ Controller will give you less variability and more productivity. It is a better, easier and faster way to do flapper peening.



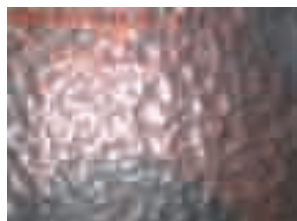
Find the FlapSpeed Controller and all your flapper peening needs at Shockform.com or call (450) 430-8000



peening media. Some even went as far as inspecting their friend's mouth and ears. It is sometimes scary what one can find with advanced inspection tools! ●

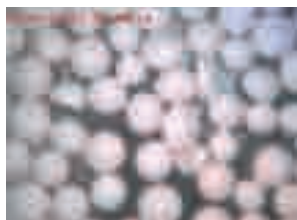


Media



Coverage

10X



Media

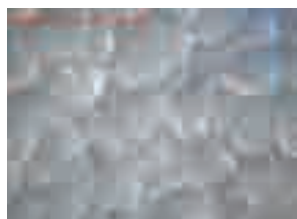


Coverage

20X



Media



Coverage

30X

Media and Coverage Inspection Photos taken with the InspectView™ 20/20 Camera



Sylvain Forgues and Brigitte Labelle are co-owners of Shockform Inc. Shockform has over 20 years of experience in fatigue life improvement through innovative peening products. Contact Shockform at 1-450-430-8000 or through their web site at www.shockform.com

2008 Shot Peener of the Year

The Shot Peener is proud to announce the recipient of its 2008 Shot Peener of the Year award—**Holger Polanetzki**.

Mr. Polanetzki is an Engineer of Metallurgy and a Designated Process Specialist Shot Peening/Grit Blast and GE Certifying Agent Shot Peening. MTU Aero Engines is Germany's leading aero engine manufacturer and a global leader in commercial aero engine maintenance services. Mr. Polanetzki started working at MTU in 1986 with responsibility in several areas including chemical/electrochemical processes, thermal spray and mechanical processes. He conducts audits and consults on design, quality and manufacturing, and development and implementation of new technology such as ultrasonic shot peening. Mr. Polanetzki has achieved Electronics Inc. Shot Peening Level III certification status.

Mr. Polanetzki was chosen as the 2008 Shot Peener of the Year for his work in the Aerospace Metals Engineering Committee (AMEC) of the Aerospace Materials Division of SAE. He also contributes his time to the new shot peening sub-committee that is responsible for creating and updating shot peening specifications. "Mr. Polanetzki travels to the U.S. several times a year to participate in committee meetings and his perspective on the European workplace has made a major contribution to the committee's work," said Jack Champaigne, Chairman of the AMEC shot peening sub-committee and Editor of *The Shot Peener* magazine.

Mr. Polanetzki was the Keynote Speaker at the Shot Peening and Blast Cleaning Workshop in Cincinnati, Ohio in October. His presentation on MTU Aero Engines included a preview of their next generation engine and their shot peening processes.

The Shot Peener of the Year award program was initiated in 1992 by *The Shot Peener* magazine as a way to recognize academic and industry leaders that make significant contributions to the advancement of shot peening. ●



Holger Polanetzki received his 2008 Shot Peener of the Year plaque from Jack Champaigne at the 2008 U.S. Shot Peening and Blast Cleaning workshop.

The Almen Strip Experts Since 1987



Electronics Inc. Certified Almen Strips

- Proven in the field
- Consistent quality
- Repeatable performance
- Trusted worldwide

Electronics Inc. manufactures and maintains the world's largest inventory of Almen strips for worldwide distribution. EI can provide strips to any specification, from standard MIL specifications to rigid aerospace specifications. Almen A, N or C strips in GradesSM 3, 2, 1 and I-S are ready-to-use and are pre-qualified. Due to EI's heat treatment process, additional benefits of the strips include improved control of hardness and flatness as well as eliminating the potential for decarburization.



Electronics Inc.
Shot Peening Control

1-800-832-5653 or 1-574-256-5001

info@electronics-inc.com www.electronics-inc.com 56790 Magnetic Drive, Mishawaka, Indiana 46545 USA

SM Service Mark of Electronics Inc.



Almen Strip Consistency Testing

SUMMARY

Shot peening intensity is the measure of the energy of the shot stream and intensity control is one of the essential means of meeting peening specifications. Intensity is measured using Almen strips. When an Almen strip is shot peened, the residual compressive stress causes the Almen strip to bend or arc toward the peened side. The Almen strip arc height is a function of the energy of the shot stream and is very repeatable. Therefore, for Almen strips to provide reliable and repeatable intensity verification, it is critical that they are consistent in thickness, flatness and hardness.

Electronics Inc. (EI) brand of Almen strips have undergone extensive testing to ensure consistency from lot to lot. Before bringing their Almen strips to market, EI developed a custom air blast test cabinet and shot peened approximately 4,000 strips manufactured over a three-year period. The data was put into histograms for accurate analysis.

The histograms show nearly identical lot-to-lot arc height results. For example, the means range from 11.99 to 12.14 (0.001-inch units) and standard deviations range from 0.096 to 0.185. (Histogram samples are available on page 16.) EI's testing capabilities and test results validate EI's ability to produce reliable Almen strips.

INTRODUCTION

Electronics Inc., a manufacturer of products that control and improve shot peening processes, has been a worldwide supplier of Almen strips for over 21 years. In 2008, EI launched their own brand of A and N Almen strips to meet increasing demand for their strips in the aerospace industry and to better control the quality of the product. During research and development, EI began consistency testing to quantify the strips' performance and to develop documented confirmation that the strips were manufactured under conditions more stringent than SAE J442 specifications.

TESTING METHOD

EI built an air blast cabinet with a variable speed rotary table with 26 Almen strip holders, a fixture for adjusting nozzle distance from the strips, a MagnaValve for media flow rate control,

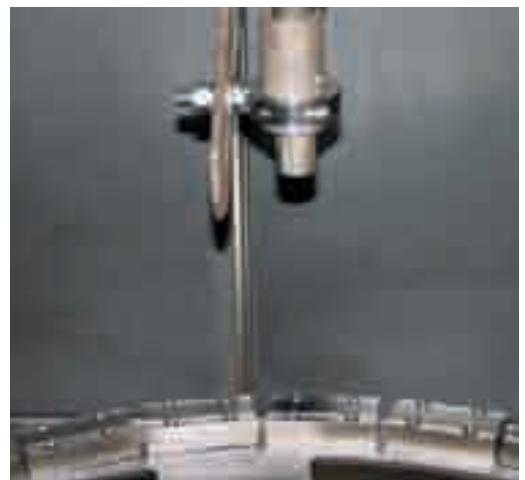
and controls to adjust air pressure and table rotation. During testing, the table was rotated at a fixed speed, and the cabinet was set for a specific pressure and constant media flow rate so each strip passed under the blast nozzle at the same angular velocity for the same predetermined number of revolutions.

For each test, a sample size of 40 strips was used. These lots were produced in 2006, 2007 and 2008. EI measured and recorded the prebowl of the strips before testing. After each test cycle, the arc heights were measured on a calibrated Almen gage and the prebowl compensation was applied. The values were put into histograms for analysis.

TEST RESULTS

Histograms created over the three-year period exhibited nearly identical lot-to-lot arc height results, thereby verifying the uniformity of the product.

Four histograms are available on page 16. Each histogram represents a test completed to verify the performance of an individual lot. The results illustrate the performance consistency of the strips as defined by the nearly identical mean values and the narrow standard deviations.



The Almen strips were tested in an air blast cabinet with a variable speed rotary table with 26 Almen strip holders, a fixture for adjusting nozzle distance from the strips, a MagnaValve for media flow rate control and controls to adjust air pressure and table rotation.

IPS..... Manufacturer of high quality automated shot peening and abrasive blasting machinery at an affordable price. Our intelligent motion computer controlled shot peening machines offer cutting edge electrical and media delivery technologies. Our systems are manufactured using 1/2" steel plate and we can customize a system specifically for any customer using proven components and experience. Other areas of expertise include blast rooms, job shop shot peening and coatings, plastic media blasting and machine repair and modifications.

CIMCAP
Software

Controlled
Intelligent
Motion
Computer
Alarm
Parameters



Blast Rooms



Innovative Peening Systems

2825 Simpson Circle, Norcross, GA 30071
Ph770.246.9883 Fax 770.449.6573
innovativepeening.com

In addition to documented consistency results, this testing program has provided a substantial technical support base for EI's Almen strip customers. EI has available:

- Current lot-to-lot comparison data on EI strips
- Comparisons of EI strips to other strips
- Performance data on other strips
- Analysis on the effect of variations in manufacturing parameters (hardness, thickness, etc.)

EI's research is thoroughly documented. For each test, EI records the scope, setup parameters, procedures, test results and analysis, histograms, saturation curves (where applicable), and a summary conclusion.

EI uses the performance data to answer customers' questions related to process variables and to help customers identify performance problems such as arc height variations and out-of-spec results with non-EI strips.

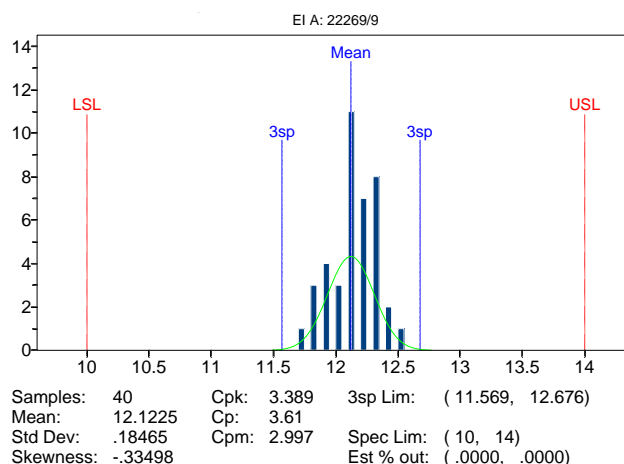
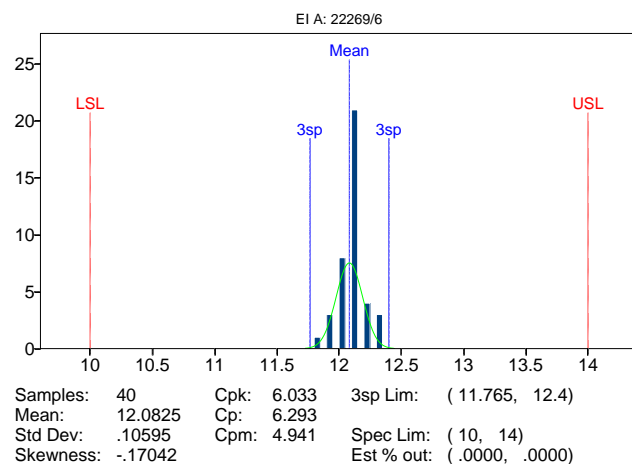
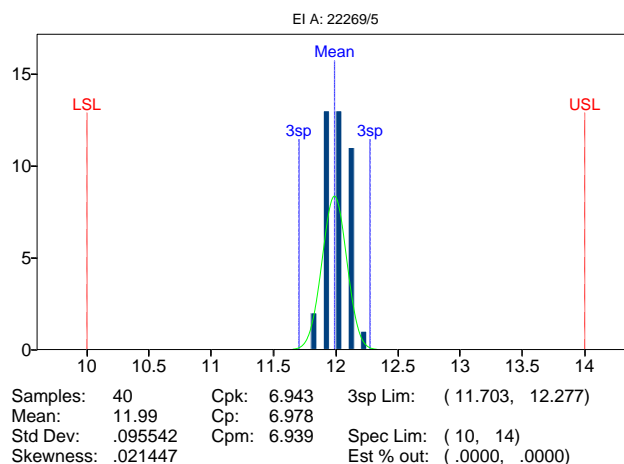
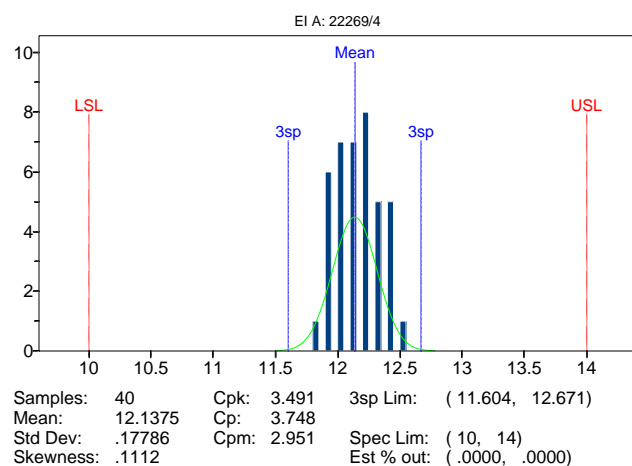
When EI does not have data available on a unique problem, EI will perform tests to analyze a customer's problem or even duplicate, as closely as possible, their process setup. ●

About Histograms


A histogram is a graphical display of tabulated frequencies, shown as bars. It shows what proportion of cases fall into each of several categories. A histogram differs from a bar chart in that it is the *area* of the bars that denotes the value, not the height of each bar as in bar charts.

About Mean Value and Standard Deviation

The mean is the sum of the observations divided by the number of observations. The mean describes the central location of the data, and the standard deviation describes the spread. The standard deviation is a statistic that tells how tightly all the examples are clustered around the mean in a set of data. When the examples are tightly grouped together and the bell-shaped curve is steep, the standard deviation is small. When the examples are spread apart and the bell curve is relatively flat, that signifies a relatively large standard deviation. In the case of the Almen strip testing, the tight standard deviation signifies the consistency of the arc height reading.



Each histogram represents a 40 piece sample size with the x-axis as the arc height of the strip after peening and the y-axis indicating the number of samples measured at that value. (Note: arc height values x .001 inches)



CERAMIC BLASTING &
PEENING MEDIA FOR
SURFACE TREATMENTS

**When your ideas take off,
we're there for you**

We offer surface treatment solutions to keep you in the lead.

Not every supplier is ready to go above and beyond. But with our state-of-the-art Research Center and Demonstration Workshop, we can take your project to the next level by providing an original solution backed by ongoing and full scale testing. Most of all by listening to you, we can help to make your projects soar and respond to your unique needs.

This is how we achieve new heights in performance.

Saint-Gobain Zircro, your partner in high performance surface treatment ceramic media. Produced by electrofusion and used mainly for cleaning and finishing operations or shot peening, Zirblast and Zirshot can be used either in wheel turbine or air compressed equipment.

www.zircro.com


SAINT-GOBAIN
ZIRPRO



Blasting High-Precision Tools for High-Precision Surgery

Got a question about shot peening, abrasive blasting, or sample processing? Clemco can help.

Call Herb Tobben at 636 239-8172 or submit your request online at www.clemcoindustries.com

Herb Tobben is Sample Processing Manager for Clemco Industries Corp. He is a regular speaker at the EI Shot Peening Workshop.

©2008 Clemco Industries Corp.

Problem:

Having an operation makes most people a little anxious. But knowing the surgeon is skilled and the instruments precise can allay fears, at least a little. For a good outcome, the surgeon and the hospital must do everything possible to cure the patient and avoid post-surgical infection. Today, most surgical instruments are single-use, disposable tools. The practice of using instruments only once has dramatically increased demand for these tools and requires incredible production capacity.

I recently worked with one such manufacturer of very high quality medical instruments whose demand for precision exceeded almost any other application I've worked with, even compared with shot peening applications. Most of you know the stringent requirements associated with shot peening specifications, so this application was very special.

The company makes laparoscopic instruments, which are fabricated stainless steel tubes of very small diameter, with wall thicknesses between .010" to .017", and some are over a foot long. The purpose of blasting is cleaning and deburring the parts. While blasting produces acceptable parts, the inherent issues associated with blasting are warping, distortion, and part growth. Due to high production demand, the company wanted to control the process themselves. They had experimented with sending the parts to a job shop and using a mix of glass bead and aluminum oxide, but they were dissatisfied with the level of rejected parts and they felt they were wasting time shipping parts back and forth and waiting on new batches of parts. They strived for the right equipment solution, and the benefits it would bring to their operation.

Solution:

Their local ZERO distributor worked closely with them to articulate their needs and specify the challenges to be overcome. Once in the lab, we determined that we could produce good parts with 120-mesh aluminum oxide in a suction-style (venturi-style) indexing turntable blast cabinet, equipped with vertical oscillation. The machine had two blast stations, each with 4 blast guns, and could process six parts at a time.

The most challenging aspects of this application related to its very sensitive setup requirements. The customer required a very high degree of precision to maintain extremely tight tolerances due to the thinness of the stainless steel tubes. Each part had to be processed identically for a repeatable outcome. It was therefore critical that the position of the guns, the blast angle, the part rotation speed, and the media flow were identical for both stations.

In addition, maintaining the working media mix was critical. To accomplish this, an automatic media-add system was included so that small amounts of new media would be added at a determined interval to keep the media size consistent. The primary goals were repeatability and consistency.

The company puts the parts through a 100% inspection process that involves visual inspection and a specialized test bench to check concentricity tolerances and length to ensure that the parts meet their specification.

In the end, we were able to help the customer reduce cost by processing the parts in-house. Not only are they able to meet production demands more quickly, but also they are able to control variables, immediately respond to process issues, and eliminate the delays associated with batch processing at a distant location. They are saving time, saving money, and achieving an extremely high level of quality, making us proud to have contributed to this successful project. ●



With two stations and fixtures to hold multiple parts, this semi-automated machine processes thousands of parts per day.



Special gun set up, satellite rotation speed, and media mix provides precise repeatability and consistent parts.

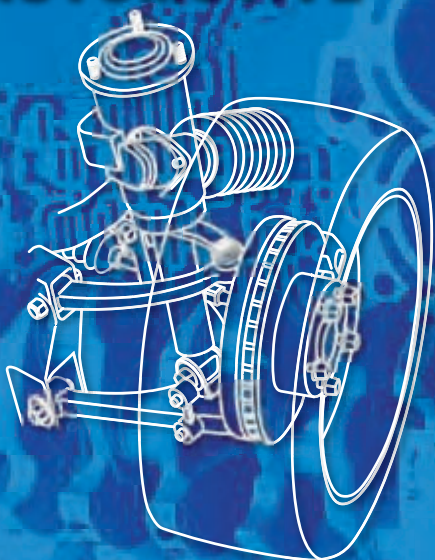


YOUR SHOT PEENING EXPERTS

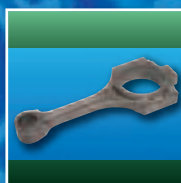
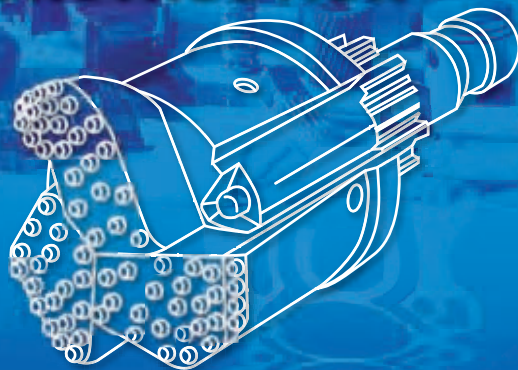
"Providing solutions to the Peening Industry based upon expertise in equipment construction, media selection and process parameters"

www.sinto.com

AUTOMOTIVE



CONSTRUCTION



Connecting Rod



Turbine Blades

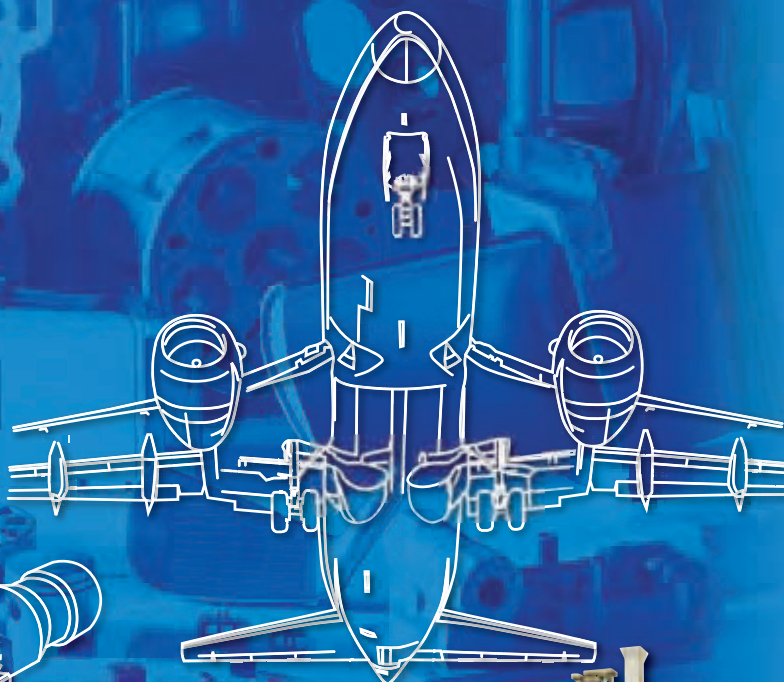


Pinion Gear



Suspension Spring

AEROSPACE



Providing Surface Treatment Solutions for 75 years.

SINTOKOGIO, LTD.

28-12, 3-chome, Mei-Eki, Nakamura-ku, Nagoya 450-0002 Japan. TEL:(81)52-582-9217



DISA Shot Peening Systems

DISA Shot Peening Technology offers maximum process reliability with high adaptability to modified component specifications and easy compliance with future requirements. Benefit from flexible, reliable machine concepts, minimum wear, and a low consumption of energy and operating resources – today and in future.

DISA
www.disagroup.com

DISA Industries, Inc.
Oswego, IL 60543,
Phone 630 820 3000,
disasales@disagroup.com

Sort Anything Round From Anything Not Round!

Abrasives, Steel Shot, Glass Beads, Plastics,
All Types of Seed and Many Other Applications...

- Choose from our Standard Product Line or we can provide separators engineered to your specifications
- Operated by gravity and requires NO POWER
- We will TEST your material samples in our laboratory to recommend the unit that best serves your needs
- All Welded Galvanized or Stainless Steel, set into a HEAVY DUTY Steel Frame
- Single or Double Spiral units available in various configurations and options



PROFILE INDUSTRIES, INC.
"An Absolute Commitment to Excellence"

OEM

P.O. BOX 370
13251 GEORGE WEBER DR
NOGENT, MN 55374

PHONE - 763-428-8818
FAX - 763-428-6859
E-MAIL - sales@profile-ind.com

World's Most Versatile & Rugged Blast Cabinets

Empire Pro-Finish® cabinets set the world standard for versatility and durability.



- Over 80 standard models with work enclosures up to 140 ft³ and your choice of suction or pressure blast

- A long list of standard factory options to meet your specific production needs

- The toughest construction in the industry backed by the strongest warranty in the industry.

We Have It All!

- Blast Cabinets • Automated Blast Systems
- Portable Blasters • Hoffman Blast Rooms



EMPIRE
ABRASIVE EQUIPMENT

2101 West Cabot Boulevard, Langhorne, PA 19047-1893
Call: (215) 752-8800 E-Mail: Airblast@empire-airblast.com
Fax: (215) 752-9373 Visit: www.empire-airblast.com



Specializing in urethane and silicone rubber masking
for Shot Peen, Grit Blast, Thermal Spray,
and Part Decoration

GET LABOR AND COST SAVINGS FROM:

- Excellent part fit means less time taping
- Competitive pricing
- Highest quality product on the market
- Innovative design & tooling process
- Durable products outperform the competition
- Short lead times

Soft and rigid masking made from urethanes, high temp epoxies & metals

Call for a free sample of our shot peen boots



Maxol Studios

Priming All 6 Cores of Industry

PHONE 480 330 4639 FAX 480 393 3842

mark@maxolstudios.com www.maxolstudios.com
Maxol Studios 1645 East Aloe Place Chandler, AZ 85286

MagnaValves® take a load off the environment, too

Control your shot peening and blast cleaning processes with the MagnaValve magnetic media valve:

■ Reduce energy costs when you reduce the load on motors and shorten blast cycles

(less energy consumption and a smaller carbon footprint)

■ Reduce media usage when you control its flow

(less media disposal into landfills)

PLUS, THE MAGNAVALVE HAS NO MOVING PARTS—IT'S MAINTENANCE FREE!

Contact us and ask for our MagnaValve case studies on maintenance and energy savings.

**1-800-832-5653 or
1-574-256-5001**

www.electronics-inc.com

Electronics Inc.

56790 Magnetic Drive

Mishawaka, Indiana 46545 USA



MAGNAVALVE AND CONTROLLER FOR AIR MACHINES



CONTROLLER AND MAGNAVALVE FOR WHEEL MACHINES

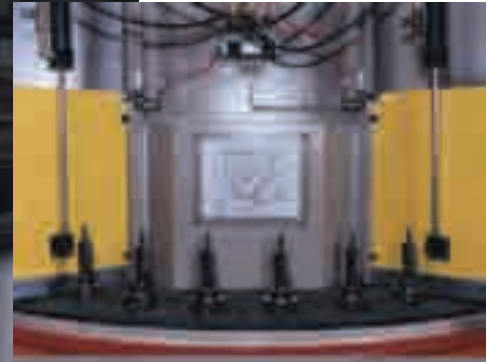




Engineered Abrasives

ISO/TS16949
ISO 14001
FORD Q1
Certified
Job Services

Manufacturers of the Finest Blast Finishing and Shot Peening Systems



All fixtures
A-2 tool steel
62-64 Rockwell.

Engineered Abrasives index units are the most durable machines on the market today with all our special features.



Patented 72" Index Unit with Shot Flow Controls, Sweco, Bucket Elevator, 12 Nozzles and 16 Spindles. Designed for automotive high-volume.



72" Manual Shot Peen Index Unit, 8 Nozzles, MagnaValves, Sweco with Low Profile Design and Bucket Elevator. All tooling and fixtures and gun rods A-2 tool steel.





GSA Schedule
Contract GS-06F-0028T

9 Axis CNC Shot Peen System
5 Axis on Gear
2 Axis on Rotating Lance
2 Axis on Turntables

**Special 48" Index Unit,
4 Nozzles, MagnaValves,
Cambot Pick and Place
Unit for automatic
loading, Safety Fence,
Material Handling,
Bucket Elevator.
All tooling fixtures and
gun rods A-2.
The finest made
high-volume index unit
for gears today.
(price and durability)**



ISO/TS16949
ISO 14001
FORD Q1
Certified
Job Services

Since its inception in 1935, Engineered Abrasives has honored countless requests to design and fabricate abrasive systems and equipment that will keep pace with the latest technology.

We can analyze and accommodate any situation to meet your production requirements. All design and fabrication is performed at Engineered Abrasives headquarters in Alsip, Illinois. Visitors are welcome at our plant; we invite you to see our equipment in operation. Call or write today for more information, or visit our web site at www.engineeredabrasives.com.

11631 S. Austin Avenue • Alsip, Illinois 60803 USA

Telephone: (708) 389-9700 or (773) 468-0440 Fax: (708) 389-4149 E-mail: mwern@engineeredabrasives.com



Size and Variability of Cast Steel Shot Particles

INTRODUCTION

Size is probably the most important property of cast steel shot. It affects saturation intensity, coverage rate and depth of work-hardened layer. Any variability of shot size is therefore important. Specifications, such as SAE J444 and AMS 2431, nominate cast steel shot size in terms of sieving results. Hence we have nominal shot sizes based on sieve mesh spacing. Cast steel shot size can also be associated with the diameter of a sphere. That is convenient because (a) cast steel shot particles are approximately spherical and (b) a sphere is the only geometrical figure that has only one dimension. Association of a particle's size with sphere diameter is based on the concept of its "equivalent sphere".

The "equivalent sphere" of an individual shot particle is one that has the same volume as that of the particle (and therefore the same mass). Fig.1 illustrates the difference between sieve spacing and equivalent sphere as methods for sizing shot particles.

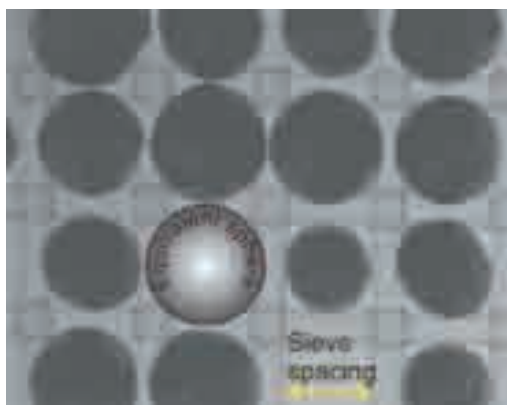


Fig.1 Cast steel shot particles on a nylon sieve.

Cast steel shot is available in a wide range of sizes. Fig.2 illustrates the size range covered by specification SAE J444. The 'S numbers' correspond to specified sieve spacings.

Each nominal size corresponds to a range of diameters. This range is associated with the methods used for producing and screening cast steel shot. Variability is accommodated in specifications – normally by stating the range of permitted values. The greater the range, the larger is the possible variation of peened



Fig.2 Nominal shot sizes as specified in J444 – with equivalent spheres drawn to scale.

component properties. On the other hand, the smaller the range the more expensive it is to produce and maintain shot that will satisfy the specification. We tend, however, to take specifications for granted, without considering their fundamental significance. It can be argued that:

"Specifications exist in order that a user can be assured that a product will be of a required standard".

All peening specifications are based on the **definition, measurement and variability restriction** of particular parameters. These three factors should be clearly stated and be as unambiguous as possible.

New and used cast shot differ significantly in terms of their size distribution. Any given batch of shot gets smaller with use due to wear. Used shot will therefore contain worn particles and additions of new shot – together with a significant proportion of relatively-small particles – produced as shot breaks down in service. The terms "virgin shot" and "maintained shot" are appropriate to distinguish the two conditions. A completely new charge of shot can simulate steady-state maintained shot by using a "commissioning mix". For example, maintained S230 can be simulated by mixing virgin shot grades of S110, S170 and S230.

NOMINAL SHOT SIZES

Nominal shot sizes give an indication of the average size of the particles in each class. If we assume that each shot particle is spherical and that the steel has a density of 7860 kg/m^3 then we can calculate the average particle mass – see Table 1 on page 26.

A 100g sample is commonly specified for test purposes so that it is of some interest to note how many particles there are per sample. These range from millions to thousands

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.



Magnifier

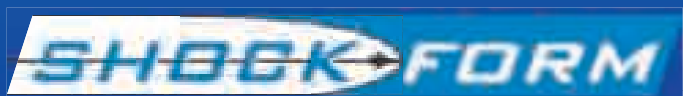


Come See What You've Been Missing

The visual inspection of the coverage is an important part of the process control.

The InspectView™ 20/20 portable visual inspection camera will make your inspections faster, easier and more thorough while providing unparalleled accessibility and ease of use. With its 10X, 20X and 30X magnification lenses and its 35, 45 and 60 degree mirrors, it's the coverage inspection tool you've been waiting for.

Find the InspectView™ 20/20 Camera at www.shockform.com or call 450.430.8000



Innovative Products - Expert Advice



Table 1. Nominal Shot Sizes derived from J444 using 'Equivalent Sphere' principle

SHOT	DIAMETER		MASS	PARTICLES
	-inch	-mm	-mg	per 100g
S70	0.0075	0.1778	0.00173	4,332.965
S110	0.0110	0.2794	0.00276	2,114.037
S170	0.0175	0.4318	0.00424	1,011.606
S230	0.0230	0.5842	0.00600	721.969
S290	0.0290	0.7112	0.00846	554.47
S330	0.0330	0.8382	0.01042	471.255
S390	0.0390	0.9906	0.01252	34.957
S440	0.0440	1.1184	0.01481	15.239
S550	0.0550	1.3970	0.02294	8.914
S660	0.0660	1.6756	0.03684	6.156
S780	0.0780	1.9812	0.05614	3.125
S930	0.0930	2.3622	0.08442	1.841
S1110	0.1110	2.8104	0.12604	1.084
S1320	0.1320	3.3508	0.17754	0.645
Ratio				
Highest:lowest	19.1	18.1	6700:1	6700:1

depending on shot size. 100kg of S110 circulating in a peening unit will consist of about a billion shot particles!

PRODUCTION VARIABILITY

Nominal shot size is a fixed quantity whereas actual samples contain a range of sizes. This range depends on production variability and associated screening procedures.

Cast steel shot is produced directly from the liquid state. The method employed is the prime cause of size variability. Liquid steel is poured from a ladle into high-pressure jets of water. The water jets break up the steel stream into tiny droplets that solidify to become shot particles. Droplets strive to reduce surface energy by minimizing the surface area-to-volume ratio. A spherical shape has the smallest surface area-to-volume ratio. Hence, as-cast shot particles approximate to spheres. Fig.3 illustrates possible variations of shot particle sizes produced by one ladleful of steel. These are close to what are called "normal distributions". The distribution has a mean that can be controlled, to a limited extent, by factors such as water jet pressure and geometry. Variation about the mean can be quantified by its variance value (square of standard deviation).

The mass/size variations shown in fig.3 include only a small proportion of the most commercially-important shot sizes (such as S110, S170 and S230). A grit fraction could go directly to crushing - because the water-quenched state is very brittle. Normally, however, the whole output is classified, then austenized and quenched before rough

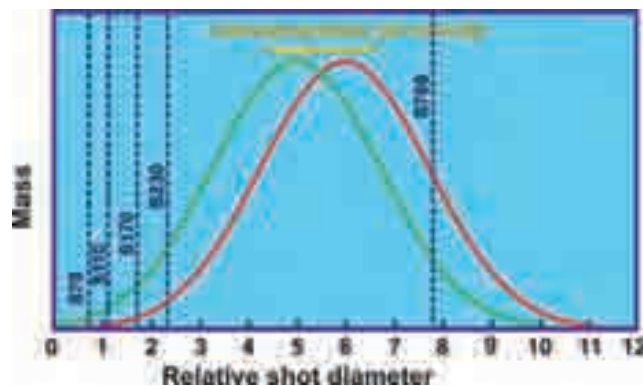


Fig.3. Type of size variability for as-cast steel shot.

screening to separate potential grit and shot fractions. The shot fraction is tempered and fine screened in order to yield different specification sizes of virgin shot.

Fine screening divides the shot fraction into sub-fractions – each of which will satisfy a corresponding standard specification. Precise details of fine screening are kept confidential by manufacturers. Fig.4 represents a possible screening routine designed to satisfy J444. Consider, for example, the S70 fraction - separated by having it pass through a 0.355mm sieve but not passing through a 0.125mm sieve. This would satisfy the J444 requirement of "All pass 0.425mm, 10% max on 0.355mm, 80% min on 0.180mm and 90% min on 0.125mm". The S110, S170 and S270 fractions shown would also satisfy the corresponding J444 requirements.

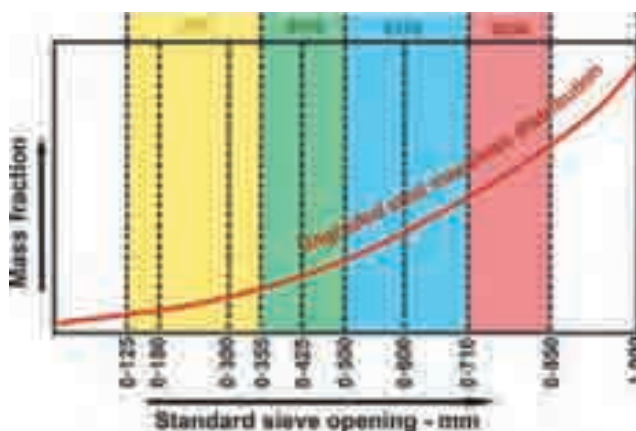


Fig.4 Possible screening system for cast steel shot.

Each nominal size of virgin shot will contain a range of sizes. For S70 produced using the procedure indicated in fig.3 the size range would be from 0.125mm to 0.355mm in diameter. The mass of a shot particle is its volume multiplied by the steel's density. Volume of a sphere is $\pi d^3/6$ (d being diameter). Hence the range of mass is the cube of the range of diameters. For the previous S70 example, the range of mass would be $(0.355/0.125)^3$ or 22.9 to 1! Mass ranges would be only 2.8 to 1 for S110, 2.9 to 1 for S170 and 1.7 to 1 for S230 respectively. If the shot manufacturer needed to produce smaller shot than S70 then the lower end of the S70 grade range could be reduced to 0.180mm which would still satisfy J444. The mass range would then be reduced to 7.7 to 1 for the finer-screened S70.

SIZE SPECIFICATION TESTING

A typical size specification test involves taking a 100g sample of a given batch, sieving it with a set of standard sieves and weighing the sieved fractions. This type of test involves several sources of variability. One is the sample itself – which has to be selected from a large batch of shot. Various techniques, such as 'splitter boxing', have been developed to ensure that the sample is reasonably representative. Another source of variability is that if we subject the same 100g sample to repeat testing then the weights will vary – albeit slightly. A third, more significant, source of variability is that of the sieves themselves. The individual openings in a given brand-new sieve vary in size – even with the highest quality of sieves. Wear in use exacerbates the variation in opening size – as well as causing the average opening size to drift to larger values. One noteworthy



2009

Shot Peening & Blast Cleaning Workshops

Singapore
February 24 & 25

Sinsheim, Germany
March 24 & 25

Toronto, Canada
April 28 & 29

Albuquerque, New Mexico
October 27 - 29

Are you comfortable with your shot peening education?

Taking action toward a thorough understanding of a quality shot peening program is an ongoing process.

No matter your experience level or job title, our shot peening and blast cleaning workshops will expand your knowledge and value in these dynamic metal treatment industries. Validate your contribution to the industry even more by earning a Certificate of Achievement after passing our Level I, II, III Certification or Flapper Peening Exams.

For more information on our 2009 workshops, call 1-800-832-5653 (USA and Canada) or 1-574-256-5001 or visit www.shotpeener.com

Survey comments from the 2007 Arizona Workshop:

"This was a great workshop for a rookie like me. I am a Maintenance Super and learning more about the process makes me a better troubleshooter."

"I learned more in 2 ½ days at this Workshop than in 25 years of what I thought was right!"

"This was my first. I learned a lot and will definitely try another Workshop and recommend to others!"

"Very nice workshop. I will recommend it to my colleagues!"

"Great job—I appreciated the classes, the tours and the food."

"The most beneficial classes were 'Coverage', 'Intensity' and 'Putting it all Together'."

"Very positive experience. I would definitely like to return."



Electronics Inc.
Education Division

56790 Magnetic Drive, Mishawaka, Indiana 46545 USA

feature is the very large numbers of particles that are present in a 100g sample – for example, about a million for 100g of S110.

Size specification gives only a limited amount of information about size variation – see fig.5. Rather more information is available for shot sieved according to AMS 2431 which has either five or four sieve sizes per grade (depending on shot size) as compared to the four or three for J444 shot.

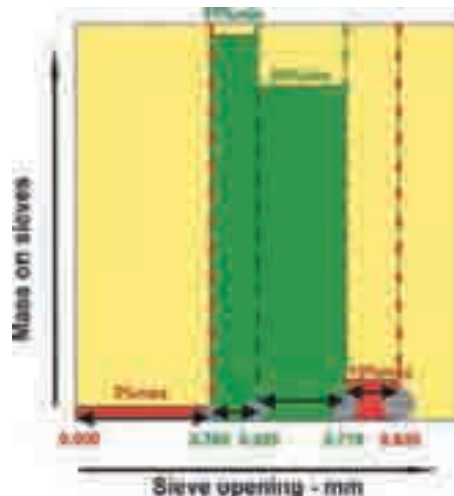


Fig.5. J444 specification limits for S170 cast steel shot.

Actual tests on 100g samples will give different weights depending on the sample. Size variation will be greatest for the 'worst case scenario' (i.e., one that only just meets the specification limits). Fig.6 illustrates this worst case scenario where 10g remained on the 0.850mm, 75g on the 0.710mm, 12g on the 0.355mm sieve and 3g passed through the 0.355mm sieve.

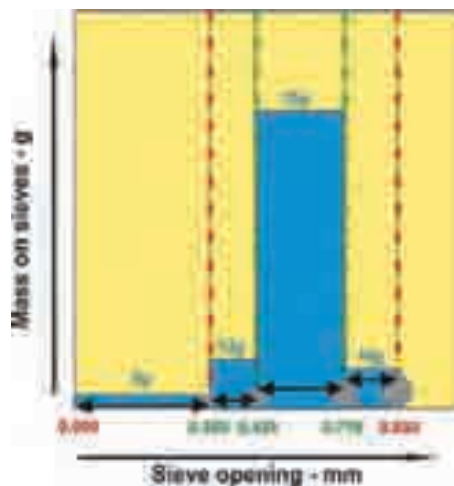


Fig.6. 'Worst case scenario' for S170 sieve test.

The nominal size for S170 corresponds to a sphere diameter of 0.425mm. An important question is "What is the average size of the shot samples sieved as shown in figs.6?" The correct answer is "We do not know – there isn't enough information." If we assumed that the average size of shot in each of the fractions was the average of the fraction limits then we can make an estimate. On the basis of that assumption we have 3g of 0.1725mm, 12g of 0.390mm, 75g of 0.5675mm and 10g 0.780mm particles so

that the average shot size is 0.352mm! That estimate comes from mass-to-volume translations. These show that the 3g fraction is 48% by number of particles, 17% for the 12g, 33% for the 75g and just 2% for the 10g fraction.

The previous estimate highlights the central problem of size assessment – **sieve size relates to diameter whereas mass is proportional to volume.**

A 'best case scenario' for S170 would be one of virgin shot that only had one fraction – all 100g passing the 0.710mm sieve and being caught on the 0.425mm sieve. Even then we would not know precisely the average diameter.

INDIVIDUAL SIZE MEASUREMENT

We can only assess size variation if we can measure individual particles. Measurement of individual particle size can be attempted in several ways. The most commonly-used methods are **precision weighing** and **image analysis**. Each method has its pros and cons. Sample size is important. A range of 10 to 1000 particles represents practical sample sizes. Less than 10 measurements are insufficient to detect variation with meaningful accuracy. More than 1000 measurements are probably too time-consuming. Weighing is independent of shape. Image analysis measurements, on the other hand, are affected by the shape of individual particles and are relatively subjective.

Weighing

Weight measurements are objective and accuracy can be assured for a given weighing instrument. The major drawback is that individual particles have to be manipulated onto and off a balance pan. This is facilitated by using a piece of nylon mesh to assemble the original sample (as in fig.1) and then transferring individual particles by means of a magnetic needle. Modern electronic balances can transfer mass values directly to an Excel spreadsheet.

Image Analysis

This requires the use of a camera microscope to obtain an image, followed by the application of an image analysis computer program. The initial problem is that programs cannot, of themselves, separate touching particles into discrete objects. As with weighing, a nylon mesh separating individual particles is therefore useful. Alternatively, images have to be 'computer-processed'. Computer processing involves progressive 'binary shrinking' (peeling of particle layers until none of the particles is touching) followed by 'binary expansion' that artificially prevents particles from touching one another. This results in an image of the shot particles that the computer can now treat as separate objects.

The mean of either image analysis or weight measurements will yield values for **average size**.

AVERAGE DIAMETER/MASS MONOLAYER MEASUREMENT

In order to measure the average particle size for a sample we can, as mentioned previously, measure a known number of particles individually and take the average. An alternative approach is to measure the total mass of a sample that, as a monolayer, occupies a fixed area. This approach is based on the fact that there is a direct relationship between average particle diameter, **d**, and mass, **M**, of a monolayer of area, **A**.

World's Almen

Finest Gage



**The World's Finest
Almen Gage meets:**

- SAE J442
- AMS-S-13165
- AMS 2430
- AMS 2432

- In compliance with AMS-S-13165 and other industry-approved specifications that require use of precision steel balls for support
- Patented magnetic grip and end stops
(U.S. Patent No. 5,297,418)
- An easy-to-read display
- .0001" (.001 mm) resolution
- SPC data port
- Convenient battery replacement
- Calibration blocks are available individually or as a kit (U.S. Patent No. 5,780,714)
- One-year warranty and continued product support



Electronics Inc.
Shot Peening Control

1-574-256-5001 or 1-800-832-5653
www.electronics-inc.com

56790 Magnetic Drive
Mishawaka, Indiana 46545 USA

For 'square-packed' spheres the number of particles, n , occupying an area, A , is given by $n = A/d^2$. The mass, m , of one particle is given by $\rho \cdot \pi \cdot d^3/6$. The mass, M , of the n particles occupying the area, A , is therefore given by: $M = A/d^2 \cdot \rho \cdot \pi \cdot d^3/6$ which simplifies to equation (1).

$$d = 6M/A \cdot \rho \cdot \pi \quad (1)$$

where ρ = density.

Fig.7 serves to illustrate equation (1), using identical 'square-packed' spherical particles.

The principle embodied in equation (1) can be applied by spreading a shot sample over a fixed area. The sample size will normally contain a very large number of particles. 10g of S110, for example, would contain more than 100,000 particles. Imagine, as a hypothetical example, a sample of S110 shot that has an average diameter that is exactly 0.0110" and, when spread over a fixed area, has a mass of precisely 10.00g. A 1% increase in sample diameter, other things being equal, would raise the mass to 10.10g.

Such a mass change is readily detected using the scales required for standard sieve tests.

Shot particles simply poured into a circular dish do not readily form a true monolayer. Fig.8 shows a number of 'second layer' particles together with 'vacant particle sites' (black dots versus white areas). Layers equivalent to monolayers can be produced in a few seconds by equating the numbers of 'second layer' and 'vacant particle sites'. Reproducibility of layer mass is then excellent – better than 0.1g for samples of about 10g. True monolayer production requires more sophisticated techniques than simple pouring. Gaging approach to true monolayer achievement is facilitated by projecting a magnified image from a digital camera onto a computer/TV screen.



Fig.8 SLR camera image of S330 shot sample viewed through a light box.

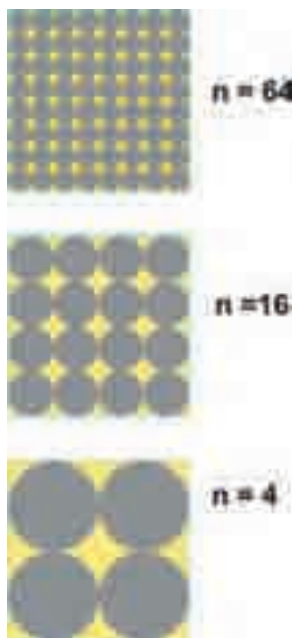


Fig.7. Effect of sphere diameter on number of particles per unit area.

SIZE VARIATION ANALYSIS

The two most useful procedures for representing size variation are:

HISTOGRAMS and BOXPLOTS.

Histograms

Histograms are based on dividing measurements into 'bins' – each bin containing all of the measurements that lie within a defined range. Figs.9 and 10 are histograms of 'number of particles in a given bin for 69 weighed particles of S780 shot. The mass measurements plotted in fig.9 were converted into diameters of 'equivalent spheres' for plotting as fig.10.

There are pros and cons attached to the use of histograms – some of which are indicated in figs. 9 and 10. Different types of distribution result from plotting different parameters. Mass variation appears to be skewed towards lower values whereas diameter variation appears to be bi-modal. The test sample originated from shot that had been segregated (by sieving) according to diameter. It is possible that the sample is a mixture of two sievings – each being normally-distributed about a different mean. Bin size, parameter and range strongly affect implied types of distribution.

Histograms do not yield quantitative parameters of distribution. Their strongest feature is that they present a familiar type of visual image. Data acquired for histogram analysis can be used to determine complementary parameters such as range, mean and standard deviation.

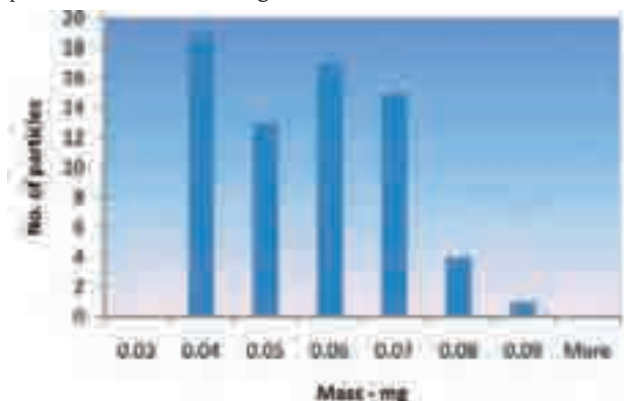


Fig.9 Histogram of S780 weighed particles – mass versus number per bin.

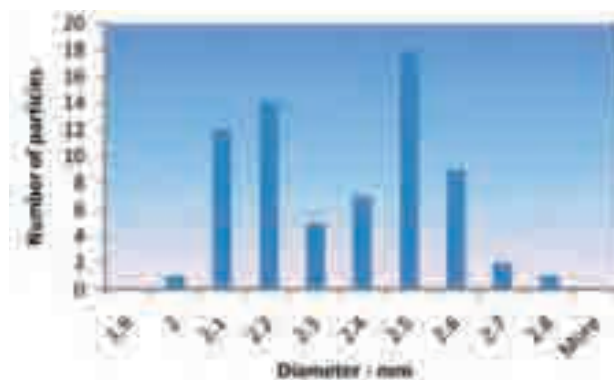


Fig.10 Histogram of S780 weighed particles – diameter versus number per bin.



MALYN.COM

NOZZLES & INSERTS

**Will Blast
You Away!**



MALYN **SUPER TITAN**



QUALITY • SERVICE • PRICE

The MALYN Difference!

Malyn Industrial Ceramics, Inc.
8640 Roll Road • Clarence Center, NY 14032
Tel: 716.741.1510 • Fax: 716.741.8402

EQUIPOS DE ABRASION S.A. DE C.V.

Machine Maintenance,
Rebuild and Upgrade
Services

Spare Parts for
Blast Equipment

Shot Peening
Accessories



Av. De las Granjas No. 81 Int. 3, Col. Jardin Azpocotla,
 C.P. 02530 México, D.F., Tel. 011-52-55-5355-0947, Fax 011-52-55-5355-6381
 E-mail: lavameia@prodigy.net.mx

Boxplots

Boxplots depict, graphically, a summary of five parameters obtained from a set of measurements. The five parameters are: **Minimum value, Maximum value, Lower quartile (Q1), Median** and **Upper quartile (Q3)**. "Median" is the middle value of a set of measurements – hence half of the measurements are larger than that of the median and half are smaller. "Quartile" is a quarter of the total number of measurements. It follows that the 'box' contains half of the measurements whilst a quarter are 'above' and the remaining quarter are below the box. Excel uses its own system for determining quartiles – together with minimum, maximum and median values.

Fig.11 shows a set of three Boxplots derived from hypothetical data using Excel. This illustrates how we can readily compare, quantitatively, the most important size parameters of shot in terms of difference.

Unlike histograms, Boxplots are completely objective in the sense that they are independent of plotting variables (such as bin size, number of bins etc.). That feature is particularly useful when it comes to possible specification considerations.

Interpretation of Boxplots gets easier with practice. This particularly applies to the very useful 'position of median within the box'.

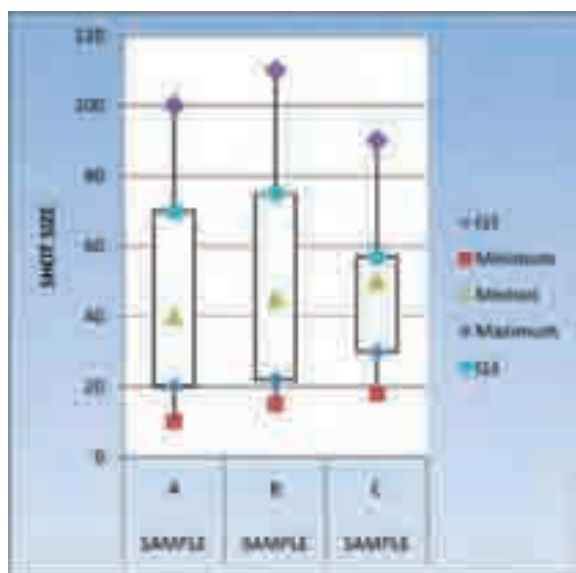


Fig. 11. Boxplot comparison of three hypothetical samples.

DISCUSSION AND CONCLUSIONS

This article has considered only cast steel shot – rather than the full range of types and materials that are commercially available for peening. That is in order to contain the article within a reasonable size whilst avoiding superficiality. The principles described using J444 can easily be extended to AMS 2431 shot specification.

The origin of variability lies with the casting process. Subsequent sieving operations are used to produce specified size grades. Size testing based on standard sieve tests on 100g samples yields restricted amounts of information in terms of size distribution and none on actual average size. Image analysis is now readily available and offers a way of obtaining much more detailed information. Care

must be taken to ensure that the image analysis procedure used on samples gives repeatable, consistent, results.

100g samples used for sieve testing are much larger than those used for image analysis. Even greater care must therefore be taken to ensure that image analysis samples are representative.

Analysis of size variation based on either image analysis or weight measurements can be carried out using either histograms or Boxplots. It is suggested that Boxplots are much more suitable than histograms as a basis for both specifications and quality control.

It has been proposed in this article that average size measurements can be made by weighing monolayers of known area. Preliminary results are very encouraging and techniques are being developed to facilitate monolayer production. ●

Almen Saturation Curve Solver Program

Get the program developed by Dr. David Kirk

Request the **FREE** program at:

www.shotpeener.com/learning/solver.php



**PELLETS
LLC**

FIRST IN CUT WIRE SHOT
ISO 9001: 2000 Certified

A CUT ABOVE THE REST

Number one in cut wire shot since first pioneering the process nearly 60 years ago. Product quality, consistency and durability combined with knowledge, customer service and delivery still make us number one today.

CALL 1.800.336.6017 TODAY FOR MORE INFORMATION,
OR VISIT WWW.PELLETSLLC.COM

SAE J441 | AMS-S-13165 | AMS 2431 | VDF1-8001 | BAC-5730 | MIL-S-851D



STAINLESS STEEL | ZINC | CARBON STEEL | ALUMINUM | COPPER

Surface finishing adds the value



RÖSLER®
finding a better way ...

Surface Finishing Shot Blasting

*Innovative solutions from
the world's leader in
surface finishing*

www.rosler.us

RÖSLER Metal Finishing USA L.L.C.
1551 Denso Road • Battle Creek • MI 49037
Tel.: 269-441-3000
Fax: 269-441-3001
info@rosler.us



SUPERIOR SHOT PEENING, INC.

Now Spanning the Globe

SUPERIOR SHOT PEENING INTERNATIONAL



COMPLETE LINE OF METAL FINISHING AND TREATMENT SERVICES TO PROTECT AGAINST FATIGUE, STRESS CORROSION FAILURES, CORROSION AND EROSION

TREATMENTS

- Shot Peening
- Surface Preparation and Finishing
- Phosphating
- Grinding
- HVOF
- Metalizing
- Hard Banding

OTHER SERVICES

- Equipment Manufacturing
- Consulting
- Ultrasonic Post Weld Stress Relief
- Ultrasonic Impact Fatigue Abatement

SUPERIOR POLYMERS

Custom Polymer Coatings for:

- High Abrasion Resistance
- Chemical/Corrosion Resistance
- High Temperature Applications
- High Release/Low Coefficient of Friction
- Spray-On or Molded

COATINGS

- Powder
- Liquids
- Xylans
- PVC

SPECIALTY

THERMAL SPRAY

- Metals
- Alloys
- Ceramics/TBC
- Blends/Composites
- Treatment for Turbine Components
- Carbide Hardfacing
 - Tungsten
 - Chrome

FIELD SERVICE

- Worldwide
- Portable Equipment
- Experienced Crews

Taking the World of Shot Peening Wherever It is Needed

NADCAP Certified
Member NACE

WORLD HEADQUARTERS

13930 Luthe Road
Houston, TX 77039
Tel: (281) 449-6559
Fax: (281) 449-9151
www.superiorshotpeening.com

INTERNATIONAL FACILITIES

Changzhou Superior Shot Peening, Ltd.,
Changzhou, China
GT Industrial PTE Ltd., Singapore
Daksha Engineering Co., Mumbai, India

GEAR TECHNOLOGY

The Gear Industry's Information Source



GEAR TECHNOLOGY

brings you technical articles on gear and gear drive design, manufacturing, testing and troubleshooting, from fundamentals to cutting-edge research. If you need to learn about gears, there's no better place than *Gear Technology*.—and it's Free!

Also, if you purchase or specify gears, bearings, motors, speed reducers, gear drives or other mechanical components, visit www.powertransmission.com for the most comprehensive online directory of power transmission components and their manufacturers.

Subscribe for FREE online at
www.geartechnology.com



Automated Peen Forming Solutions

www.ksa.de.com

KSA Kugelstrahlzentrum Aachen GmbH · Weststraße 22-24 · 52074 Aachen · Germany

SHOT PEENING

Cleaning, Deburring and Finishing

Looking for ways to enhance productivity?
Count on ZERO to turn
Our Experience into Your Solution!

- Manual & Automated Dry Blast Systems
- Wetblast Cabinets
- Tumble Blasters
- Options Plus Accessory Packages

For information and your nearest distributor visit
www.clemcoindustries.com

Mention this ad and receive a free gift from Clemco Industries Corp.

ZERO Automation

© 2004 Clemco Industries Corp.

100% 100% 100% 100%



Sonnimax AS to Celebrate 40th Anniversary

SONNIMAX HISTORY

In March 1969, Søren Max Nielsen ("Max") made one of the rooms in his home into an office and the story of Sonnimax began. Over the years, Max built a good reputation and strong relations with large and small clients within the Danish steel industry. After five years, Max moved his business and family to another residence closer to industry and located virtually in the middle of Denmark. "Stribgaarden" became known in the industry as the center of surface technology. During the next couple of years, Sonnimax expanded its activities and more employees entered the company. During the eighties, Sonnimax developed the largest and most diverse spare parts and abrasives stock in Denmark. In mid 2005, Max sold the company, now a public limited company, to the next generation, his son Erik. Erik had been the company sales manager for 10 years and he was ready to take Sonnimax further. As part of this process, Sonnimax moved its headquarters in 2007 to the central industrial quarter in Middelfart.

On March 1, 2009 Sonnimax turns 40. This anniversary will be celebrated on Feb. 26 and 27, 2009 when we turn our headquarters in Middelfart, Denmark into an "Eldorado" for our clients in Surface Technology, Coatings, Engineering and Foundry industries. The event will take place as an open house where many of our international partners will exhibit products (machines, equipment, blast media) and share information through presentations on surface treatment, shot blasting, sand blasting (wheel and airblast), metallisation, shot peening, blast machines, blast cabinets, blast media, foundry techniques, etc. Sonnimax will give talks on why it's advantageous to have us service their machinery.

Since our beginnings in 1969, our focus has been on service. Over the years this concept has naturally evolved with our clients' needs and the best solutions in our field. We service all types and models of wheel and air blast machines and plants. We inventory Denmark's largest stock of spare parts for our own brands as well as external brands.

Our company's know-how has grown solidly over the years. One example is our "field testing" of airblasters. Field testing is a test of our client's blast process in which we measure different parameters such as air-flow, blasting time, abrasive consumption, cleaned surface, etc. The tests are made by the client's own machine operator. The results of the test are supervised by Sonnimax, and possible changes/adjustments are made by our technicians while the client is present. The test results are entered into a data sheet, and the best results and possible cost savings are clearly evident.



Sonnimax's facility in Middelfart, Denmark.

For Sonnimax, no task is "business as usual". In close cooperation with Danish sub-contractors within steel and coating industries, we have pointed out large savings for our clients. Particularly for customers in the Danish windmill industry and the steel shipyards, our expertise has provided large financial advantages. We are continually working on transferring these good results to other types of industries.

Wheelblasting has always been a core element for Sonnimax. Even though we service many different kinds of wheelblast clients, we always help each client save money even while they increase their production flow. We have also updated machines to meet the demands of "heavy duty" production.

Our experience tells us that customers often do not think about the cost of seemingly minor problems. For instance: The airwasher is wrongly adjusted, the load (measured in amp) on the blast wheels is not equally distributed, or parts of the wheel are worn. We calculate the cost per year for a poor setup compared to the savings of our recommended setup.

How much money can a typical company save by using a correct setup with their present yearly tonnage (capacity)? Very often savings of \$100,000 per year or more is possible. And this should be seen in relation to the fairly small expense of our services. We see it as a very good and safe investment for our clients.

In addition, as part of our service concept, we have the only abrasive lab in Denmark. We conduct flow measurements including airflow, abrasive flow, flow speed (velocity), surface tests, noise measurements, and more. ●



In September, Sonnimax held a flapper and shot peening seminar. Sonnimax is expanding its peening services to help customers create in-house peening programs.

APV II™
**AUTOMATIC PLUNGER
 VALVE II**

PIRATE BRAND®
 QUALITY

**POWDER
 COATED
 TOUGH**

**Better
 Performance**

**22%
 Less Parts**

**Lower
 Maintenance Cost**

Coming to a Shooting Classroom Near You July 1st, 2008
www.pirate-brand.com
 © 2008 All Rights Reserved

NEW!!



Shot & Grit

AMASTEEL

FROM ERVIN INDUSTRIES

(800) 748-0055

THE BEST QUALITY

Stainless Shot

AMACAST

FROM ERVIN INDUSTRIES

(800) 748-0055

IN THE INDUSTRY

Industry News

Parker Aerospace commits to Nadcap

Irvine, California. As of October 15, 2008, the US aerospace prime Parker Aerospace Group of Irvine, California, accepts Nadcap accreditation from their Americas-based suppliers for the following special processes:

- Aerospace Quality Systems
- Chemical Processing
- Coatings
- Fluid Distribution Systems
- Heat Treating
- Nondestructive Testing
- Nonconventional Machining
- Surface Enhancement
- Welding



Arshad Hafeez of PRI, which administers the Nadcap program, said: "By accepting Nadcap accreditation, Parker Aerospace Group is demonstrating its commitment to continual improvement and quality in special processes and supply chain management."

Wheelabrator celebrates 100th Anniversary at their LaGrange location

LaGrange, Georgia. Wheelabrator Group leads the worldwide surface preparation industry with 1,320 employees in 19 countries. The company recently marked its first century with the first of many global 2008 celebrations at a day-long LaGrange event for 150 local employees, company executives and civic leaders. "Today, we're the acknowledged leader in our industry segment," Wheelabrator President and CEO Robert E. Joyce, Jr. told employees. Joyce reminded employees that Wheelabrator leadership does not afford the opportunity to rest. "We cannot be satisfied with being good because there is always room for improvement. We need to change faster than our competitors in meeting clients' needs," said Joyce.

Georgia Congressman Lynn A. Westmoreland reminded employees and guests that Wheelabrator came into existence about the same time as the first automobile. Westmoreland praised Wheelabrator for its "great job of building a family unit that wants to work together and do great things." Gary Weil, Director of Risk Management and Technical Services for Wheelabrator Group, has been an employee of Wheelabrator for over 40 years. With such an extensive history with the company, Weil was able to give new employees an insight into the past of Wheelabrator and why the extraordinary company has been able to survive the tests of time. "Our business foundation had four primary supports that were alive and had to be fed to sustain our successes and reduce our failures: understanding the Global markets of the industries we served; understanding the raw materials and processes used by those industries; understanding what Wheelabrator Technology could and could not do; and understanding the part people play in the dynamics of truly successful selling," said Weil.

Founded in Pittsburgh, Pa. in 1908 by Verne E. Minich, Wheelabrator Group moved to LaGrange from Mishawaka, Indiana, in 1987. The company's continued success hinges on a consistent and clear purpose. Joyce stated, "Our focus is simple—give the customers what they need—and in order to effectively do that, we must continuously remake ourselves." He continued, "Our customers are seeking solutions to lower the cost of production, as well as find products that last longer. Wheelabrator works to meet this need every day through innovative solutions."

In remembrance of the company's 100 year celebration, Joyce presented Lukken and Westmoreland with specially commissioned Wheelabrator coins and a book, "**Revolutions, The first 100 years of Wheelabrator Group.**" The planting of a Japanese maple tree and the burial of a time capsule, to be opened in 50 years, also marked the occasion.

Wheelabrator Group celebrates 100 year milestone as a provider of surface preparation and finishing solutions

Burlington, Ontario. Wheelabrator Group Technology Centre Canada commemorated its 100 years in business with a Luncheon Celebration at its facility on September 12, 2008. As the acknowledged market leader within the automated blast cleaning industry, Wheelabrator Group manufactures and installs standard and custom Wheelabrator® blast systems for removing millscale and rust, and for profiling surfaces to improve the performance of protective coatings. Wheelabrator Group serves a diverse range of industries: aerospace, automotive, marine, steel fabrication, die casting, foundry and medical.

On June 1, 1908, intrepid entrepreneur, Mr. Verne Minich, took possession of his first sandcutting machine in Pittsburgh, Pennsylvania. He started with a simple idea—give the customers what they need. It was from this simple idea and auspicious beginning that the company now known as Wheelabrator Group began. The Canadian division of Wheelabrator also started with a humble beginning. Wheelabrator Group Canada began as a small sales office in 1960 in Scarborough, Ontario. Since December 1999 (having moved several office locations over the years including Milton and Oakville), the Wheelabrator Group Technology Centre Canada headquarters currently sits in Burlington. The Burlington location is responsible for engineering and manufacturing the blast cleaning systems.

"We continue to always ask ourselves the same question today as we did in 1908: what will our customers need in the future? We talk to our customers in order to understand their business challenges. We develop solutions and enhance our technology to meet their ever-changing needs and we are not afraid to remake ourselves to ensure that we never become complacent", confirms Mr. Robert E. Joyce Jr, CEO, Wheelabrator Group.

The Centennial Luncheon Celebration was hosted at its Burlington, Ontario facility. Wheelabrator invited its current employees, customers, international executives, distinguished past employees, local and provincial politicians, and local media to join in the celebration. Before the Luncheon festivities, Wheelabrator Group offered an Open House of its plant facility, showcasing their various blast cleaning machinery and technology offerings. Guest speaker, renowned Canadian Broadcast Journalist and President of John Stall Communications, Mr. John Stall, addressed the "Evolution of Wheelabrators Past, Present, Future", recapping 100 years of ground-breaking highlights and consistent success. Ms. Joyce Savoline, our local MPP, was also in attendance, representing the Burlington community.

To honor all current employees, a commemorative coin was given as a keepsake for their dedication and loyalty to the organization.

EI Distributors

MagnaValves® • Almen Gages • Almen Strips • Peening Products

Call the distributor nearest you for prompt and knowledgeable service on EI products.

AUSTRALIA
Blastmaster
3 Bruce Avenue
Marleston, South Australia 5033
Telephone: 61 8 8292 2000
Email: sales@blastmaster.com.au

BRAZIL
Febratec Ind. Com. Ltda
Estrada Geral Porto Grande, 111 Caixa Postal 86
89245-000-Porto Grande - Araquari-SC
Telephone: 55-47-2102-0250
Email: tacjato@tecjato.br

CANADA
Manus Abrasive Systems
1040-78th Avenue
Edmonton, Alberta, Canada T6P 1L7
Telephone: 780-468-2588
Email: manus1@telusplanet.net

Shockform Inc.
17 des Taels
Blainville, Quebec Canada J7C 5B6
Telephone 450-430-8000
Email: sylvain.forgues@shockform.com

Wickens Industrial Ltd.
8199 Esquesing Line
Milton, Ontario L9T 6E7 Canada
Telephone 1-905-875-2182
Email: info@wickens.com

CHINA
Allen Industry & Technology Co., Ltd.
Room 1401, Zhongshen International Building
2068 Hongling Road, Shenzhen, China
Telephone: 86-755-25869507
No. 10 5-702 Zuojiazhuang West Street
Chaoyang Dist.
Beijing, China
Telephone: 86-10-84519078
Email: yostyoung@sina.com

Beijing International
Aeronautical Materials Corp.
Rm 511, No 36, Xidajie Haidian
Beijing 100080, China
Telephone: 86-10-6254-6272
Email: biam@biam.com.cn

PakPal Surface Technology
Liguang Industrial Zone, Guanlan Town,
Bao'an District, Shenzhen City, Guangdong
Province, China 518110
Telephone: 86-755-29815654
Email: info@pakpal.com.sg

CZECH REPUBLIC
Krampe CZ spol. s r.o.
Blaticho 12
616 00 Brno, Czech Republic
Telephone: 420-5 4924 5064
Email: info@krampe.cz

DENMARK
SONNIMAX A-S
Nyang 3
Middelfart 5500, Denmark
Telephone: 45-6440-1122
Email: smn@sonnimax.com

FRANCE
Sonats
2, Rue de la Fonderie - BP 40538
44475 CARQUEFOU CEDEX, France
Telephone: 33-251-700-494
Email: sonats@sonats.com

GERMANY
Krampe Strahltechnik GmbH & Co. KG
Pferdekamp 6 - 8
D-59075 Hamm, Germany
Telephone: 49-2381 977 977
Email: info@krampe.com

sentenso GmbH
Klosterstrabe 13
45711 Datteln, Germany
Telephone: 49-2363-55 90 00
Email: kontakt@sentenso.de

HONG KONG
Asia Standard (H.K.) Ltd.
Unit 9, 22/F., New Trend Center
704 Prince Edward Road East, Kowloon,
Hong Kong
Telephone: 852-2321-9178
Email: asiastd@netvigator.com

INDIA
Mec Shot Blasting Equipments PVT. LTD.
E-279, M.I.A., Phase II, Basni P.O.
JODHPUR - 342 005 (Rajasthan) INDIA
Telephone: 91-291-2740609/2744068
Email: mecshot@sancharnet.in

IRELAND
Campbell Machinery Ltd.
Boghall Road, Units 26 and 27
Co. Wicklow, Ireland
Telephone: 353-1-2953426
Email: prc@campbellmachinery.ie

ISRAEL
TekTeam Ltd.
56 Haatzmaut St., P.O. Box 1062
Yehud, 56101 Israel
Telephone: 972-3-6323576
Email: Tekteam@inter.net.il

ITALY
Serim s.r.l.
Via G. Agnesi, 61
20039 Varedo Mi Italy
Telephone: 39-0362-581558
Email: renzo.giacometti@tin.it

JAPAN
Toyo Seiko Co., Ltd.
3-195-1 Umaganji
Yatomi-City Aichi 490-1412 Japan
Telephone: 81-567-52-3451
Email: toyo@toyoseiko.co.jp

KOREA
Alam Trading Company
824-19, Yeoksam-Dong
Kangnam-Ku
Seoul, Korea
Telephone: 82-2-565-1730
Email: alamind@hanafos.com

MEXICO
Equipos de Abrasion, S.A. de C.V.
Av. De Las Granjas No. 61 Desp. 3
Col. Jardin Azpetia, Azcapotzalco
02530 Mexico, D.F.
Telephone: 52-55-5355-0947
Email: lavmetal@prodigy.net.mx

NEW ZEALAND
Syntech Distributors Ltd.
12A Saunders Place, P.O. Box 19-341
Avondale, Auckland, New Zealand
Telephone: 64-9-820-2121
Email: sales@syntechnz.com

NORWAY
G & L Beijer AS
Lerpeveien 25
N - 3036 Drammen, Norway
Telephone: 47-3282-9080
Email: info@beijertech.se

POLAND
El-Automatyka
Handlowa 3
Rzeszow 35-109, Poland
Telephone: 48-178622-339
Email: el@pro.onet.pl

SINGAPORE
GT-Baikor Metal Finishing Pte Ltd
No. 10 Loyang Street
Singapore 508844
Telephone: 65-654-28993
Email: info@gt-ind.com.sg

SPAIN
Materias Primas Abrasivas SL
Calle Energia, 2 Cornellà
Barcelona, 08940 Spain
Telephone: 34933-778-255
Email: mpa@mpa.es

SWEDEN
CBC Yifinish Ab
Box 501
SE-442 15 Kungälv, Sweden
Telephone: 46-303-930-70
Email: Cbc.sweden@telia.com

THAILAND AND VIETNAM
Filtech Company Limited
11th floor Bangna-Thani Building
119/23 Moo 8
Bangna-Trad Rd, KM3
Bangna, Bangkok 10260 Thailand
Telephone: 66 2 3988169-70
Email: chartree@filtech.co.th

TURKEY
Millennium Industrial & Aerospace Supply
Ziyapasa Cad. Uzmez Sok. No:3
Eskisehir 26090, Turkey
Telephone: 90-222-221 3244
Email: info@milenyumhavacilik.com

UNITED KINGDOM
CraftLast Ltd.
2, Smithfield Close, Maidenhead, Berks
SL6 3XE U.K.
Telephone: 44-0-1628-825363
Email: craftlast@goolemail.com

UNITED STATES
Electronics Inc.
56790 Magnetic Drive
Mishawaka, IN 46545 USA
Telephone: 574-256-5001
Email: info@electronics-inc.com

Quality

ENGINEERING



**Precision shot peen masks and fixtures
for the aerospace and commercial sectors**

Timely quoting • Competitive lead times

An ISO 9001:2000 Certified Company

Quality Engineering Inc.

Tel: 203-269-5054 Fax: 203-269-9277 Web: www.qes1.com

122 North Plains Industrial Road, Wallingford, CT 06492

For Quotations: qesadmin@qes1.com

Multi-Task Peening Systems Multiply Profit Potential.



Empire creates peening systems tailored to boost capabilities and profits.

- The system shown peens recesses and exterior slots on discs and hubs of many sizes and styles.

- Programmable controls assure on-spec peening and expedite changeovers between parts.

- This "no-frills" system helped a jet-engine-repair shop expand its business base — profitably!

See what Empire can do for you.

We Have It All!

- Automated Blast Systems • Blast Cabinets
- Portable Blasters • Hoffman Blast Rooms



EMPIRE

ABRASIVE EQUIPMENT

2101 West Cabot Boulevard, Langhorne, PA 19047-1893
Phone: (215) 752-8800 E-Mail: Airblast@empire-airblast.com
Fax: (215) 752-9373 Visit: www.empire-airblast.com

Study on the Failure Ratio of the High Carbon Cast Steel Shot

This paper was submitted by Xinhua Zhao, a graduate student at the Material Science & Engineering College of Shandong University in China. The Shandong Material Science & Engineering College extensively studies shot peening and blast cleaning and provides technology support to Shandong Kaitai Metal Abrasive Company, one of China's largest metal abrasive producers. According to Mr. Zhao, his study on the wear failure of high carbon cast steel shot brings new concepts to the abrasive field. The complete article is available in the online library at www.shotpeener.com.

Xinhua Zhao¹, Ruwei Liu¹, Hongwei Wang²,
Hongju Gao¹, Laibin Zhang³, Ruiguo Wang³

1. College of Materials Science and Engineering, Shandong University
Jinan 250061, P.R. China

2. Chemical Products Recovery Shop
Laiwu Steel Corporation
Laiwu 271104, P.R. China

3. Shandong Kaitai Metal Abrasive Co., Ltd.
Zouping 256217, P.R. China

Abstract

The ERVIN test machine was used in this study to mimic the actual blast cleaning process. The high carbon cast steel shot sample, heat-treated at five different temperatures, are put into a ERVIN tester and ran for predefined cycles. The wearing of the samples were examined under a magnifier. The failure ratio was defined and its influencing factors were studied. The results show that the failure modes, including brittle fracture, surface peeling and core spall, can be analyzed by means of failure ratio represented by the defined weight ratio G_f/G_t , the failure ratio are affected by the heat treatment, ERVIN cycle, microstructure and flaws, particle size, target hardness. Impact velocity and impact angle play an important role in the wearing failure process.

Keywords: high carbon cast steel shot, failure ratio, surface peeling; core spall, weight ratio, influencing factors

1. Introduction

From the appearance, it is difficult to distinguish the high carbon cast steel shot samples after different heat treatments, and at present the abrasive manufacturers only provide the

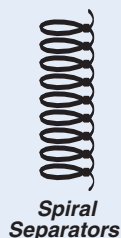
technical data and physical characteristics in the data sheet based on related standards[1,2], but the ERVIN life and the wearing failure modes are not given enough importance, hence the author suggests that ERVIN life, the main failure mode and its wearing ratio should be added to the data sheet, which can complete the abrasive standard, provide convenience for the end users to choose the suitable abrasive, encourage the manufacturers to improve their manufacturing process and improve the abrasive quality. But the failure ratio is affected by many factors so that it is necessary to evaluate the failure ratio under the same condition.

2. Samples and the Processing Procedure

The as-cast high carbon cast steel shot sample used in this experiment, manufactured by Shandong Kaitai Metal Abrasive Co., as shown in Table 1, was melted by medium frequency induction furnace and formed by centrifugal atomizing method. The samples were in good spherical shape without irregular forms and cracks. The box resistor stove was used as the heating device and water was used as the cooling medium. The samples were etched by the alcohol solution with 4% of nitric acid and then studied for the microstructures using a metalloscope. The micro hardness of the samples were tested by the vickers hardness tester with a 500g load. As shown in Table 1 and Table 2, five high carbon cast steel shot samples, undergone five various heat treatments, were prepared for this study; the samples, tempered at 150°C and 550°C and double quenched at 840°C, were run in ERVIN test machine for 500 cycles, 1000 cycles and 1500 cycles respectively. 20g samples were used in each run for clear observation of the wear failure morphology and hence easy assessment of the failure ratio,

DOWNLOAD COMPLETE ARTICLE FROM ONLINE LIBRARY AT WWW.SHOTPEENER.COM

The Original CLELAND SHOT CLEANING SPIRAL SEPARATOR



The **Cleland Spiral Separator** is the most successful method of separating round product from cracked, broken, or non-round materials. The **Cleland Spiral Separator** is available with a self-cleaning hopper to ensure total emptying of the top hopper bin.

"Cleland Spirals Work Around the World"

Phone/Fax: (763) 571-4606

Cleland Manufacturing Company
2125 Argonne Drive
Minneapolis, Minnesota 55421 USA

With superior craftsmanship we manufacture a full line of screening equipment - including specialized shot classification separators and rectangular screening equipment.

MIDWESTERN INDUSTRIES, INC.

CALL TOLL FREE

1-877-4-SIZING

(877-474-9664)

www.midwesternind.com

email: info@midwesternind.com

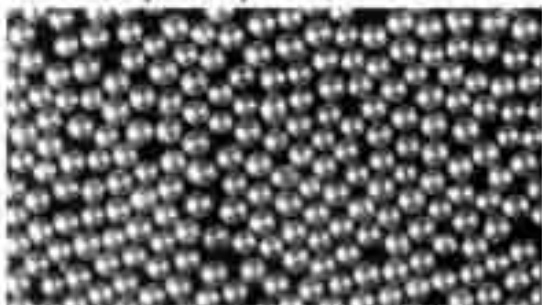


Headquarters
Mason, OH

Southern Facility
Macon, GA

Stainless Steel Beads Hi-carbon Steel Beads

The Only Steel Media under 300 µm
Fine, Spherical particle, Atomized



■ **Stainless Steel Beads:** High Durability
Save Money & Less than Any Other Media!
Make your Shop Clean!

■ **Hi-carbon Steel Beads:** High Hardness Hv800
High Performance Peening!



ITOH KIKOH CO., LTD

412-4 Nu-no-wari Minami-shibata-machi
Tokai, Aichi 476-0001 JAPAN
Tel: +81-52-604-1216 Fax: +81-52-604-1284
E-mail: tokohin@itoh-kikoh.co.jp

The best news in the industry is FREE!

To receive a free subscription to
The Shot Peener, please complete
the form or attach your
business card.



Name

Title

Company

Address

City, State, Zip, Country

Telephone

Email Address

Fax to: (574) 256-5222 Mail to: The Shot Peener, 56790 Magnetic Drive,
Mishawaka, Indiana 46545 USA



Outstanding Papers from ICSP-10

It all started in 1980 when Abbas Niku-Lari convened a meeting in Las Vegas to organize the first International Conference on Shot Peening in Paris. Close to 400 delegates attended from around the world to explore the opportunities to advance the science of peening. What evolved from that farsighted effort are tri-annual conferences held around the globe and tremendous research and development in the shot peening industry.

The most recent conference held in Tokyo continued the tradition of sharing information on innovations and adaptations in the war against metal fatigue. There were 91 papers presented in Tokyo at ICSP-10 which brings the total number of conference papers to 640. That's pretty impressive for an industry that's relatively unknown by many academics and industrial engineers and often referred to as the stepchild of the abrasive blast cleaning industry.

The following are just a few of my favorite papers from the conference.

Butt Joining of Sheet by Shot Peening

Y. Harada, K. Fukaura, A. Yamamoto, S. Ujihashi, Y. Kobayashi

This article illustrated a novel concept of joining dissimilar sheets with high tensile strength by peening the surfaces of notched edges. This technology can be used in applications where welding is not feasible or desirable.

A Novel 3D Finite Element Simulation Model for the Prediction of the Residual Stress State after Shot Peening

M. Zimmermann, V. Schulze, H.U. Baron, D. Lohe

The paper takes into account component thickness when performing Finite Element analysis. It was found that a small thickness has no influence on the residual stresses present in the surface region but great influence on the tensile residual stresses present in deeper regions. The new approach of model constraint takes into account deflection effects and yields to a very good accordance with experimental results.

A Scaling Law in Shot Peening Induced Surface Material Property Deviations

A.M. Frishman, C.C. H. Lo, Y. Shen, N. Nakagawa

"A Scaling Law in Shot Peening..." shows examples of several material property deviations

under varying Almen intensities and validates the predicted scaling relations against experimental data. This tool should be able to predict residual stress profiles at varying Almen intensities. The scaling law is also found useful in assuring consistency among nondestructive characterization measurements.

Development of Fe-Based Metallic Glass Shot Amo-Beads for Peening with High Strength and Long Life

K. Okumura, K. Kajita, J. Kurosaki, H. Kimuar, A. Inoue

Spheroidal particles made with the Fe-base metallic glass were used as shot for peening and it was proved that this is of high hardness together with long-life. This new product, introduced as AMO-Beads, was the result of intensive research led by Inoue and the Institute of Material Research of Tohoku University when they discovered a number of alloys with high Glass Forming Ability (GFA).

Fatigue Property Enhancement by Fine Particle Shot Peening for Aircraft Aluminum Parts

A. Inoue, T. Sekigawa, K. Oguri

Fine particle shot peening (FPSP), popular in the Japanese auto industry for many years, is now applied to aerospace applications and tests reveal that FPSP can offer superior fatigue life to conventional shot peening. Fatigue cracks appear at the subsurface layer as compared to conventional shot peening where the cracks originate at the surface due to small flaws and laps on the surface created by the conventional shot peening process.

These papers were of interest to me for many reasons. Some covered research that may benefit EI, some covered subjects that I've been interested in for years, some covered novel, exciting concepts. There were papers presented at ICSP-10 that will be of value to you, too. The Conference Proceedings, edited by Dr. Katsuji Tosha of Meiji University and Dr. Yoshihiro Watanabe with Toyo Seiko will be available for purchase at the Toyo Seiko web site (www.toyoseiko.co.jp) and at www.shotpeener.com for \$125.00 (65 euro), plus shipping. I encourage you to take advantage of the wealth of information that has been made available, thanks to The International Conference on Shot Peening. ●


**Shot
Peening**

Challenge Our Originality!

Conditioned Cut Wire (Aerospace approved)

Highest hardness Cut Wire Shot in the world (up to HRC65)

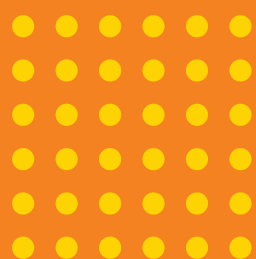
AS9100 & ISO9001 & ISO14001

Shot Peening Job Shop - Nadcap Accredited

Residual Stress Measurement

Development of Ultrasonic Process

Almen Strip, Almen gage, Magna Valve



TOYOSEIKO CO.,LTD.

TEL:+81-567-52-3451 FAX:+81-567-52-3457

E-mail: toyo@toyoseiko.co.jp

<http://www.toyoseiko.co.jp>

PREVENT PROBLEMS BEFORE THEY HAPPEN WITH RESIDUAL STRESS MEASUREMENT

Take advantage of Proto technology—the fastest residual stress measurement systems that consistently outperform the competition. For over 25 years, Proto has been providing systems and measurement services for aerospace, automotive, power generation, medical and other manufacturing environments. Proto has the accuracy, speed and technology to keep your product perfect right from the start.

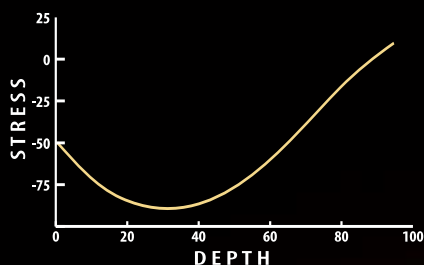


EXCELLENCE IN THE FIELD AND IN THE LAB

Proto's comprehensive line of laboratory and portable residual stress measurement systems ensure the best system is available to successfully perform RS measurements on your components.

RESIDUAL STRESS CHARACTERIZATION AT FAILURE CRITICAL LOCATIONS...WHERE IT COUNTS

Improve quality, enhance fatigue life, and ensure that surface enhancements are being applied correctly. Even complex geometries such as bores, holes and slots can be easily measured using our systems. Ensure that your components perform to their maximum potential with residual stress measurement.



North America 800.965.8378
+1.519.737.6330
www.protoxrd.com
xrdlab@protoxrd.com

Quantify your peening.

