

Ten Reasons Why Manufacturers Choose Shot Peening to Achieve Quality Objectives

In today's competitive global economy, customers increasingly can choose from numerous suppliers. That's why manufacturers can hardly ignore the importance of producing a high-quality product and better yet, one with a documented production record. ZERO cabinets serve a wide array of industries and applications. We are constantly test-processing parts for customers interested in improving production rates and achieving consistent and superior output quality.

Shot peening has broad application in the fabrication of metal products for improving their performance. In metal parts, it can generate an even compressive stress layer and eliminate microscopic surface defects. The process offers manufacturers a method to make high quality products in an efficient and reliably repeatable way.

Metal parts subjected to frequent cycle stress, stress reversal, twisting, and torsional stresses may fail through a fracture that begins at the surface. Controlled shot peening improves the permissible stress levels for various materials, and therefore, improves service life. How is this accomplished? Shot peening alters the metal surface by striking the substrate with a high-velocity stream of spherical particles. These particles, generically called peening media, include steel shot, glass beads, and ceramics. As each particle strikes the metal surface, it produces a rounded indentation. Plastic flow and radial stretching of the surface metal occur at the instant of contact, as the edges of the depression rise slightly above the original surface.

Where complete peening has been achieved, the compressive stress layer depth will vary application to application but can extend from about a few thousandths of an inch to 0.062 inch below the surface. Beneath this depth, a tensile stress layer will develop to achieve equilibrium. The tensile stress will be much lower than the surface compressive stress because it is distributed in a comparatively thicker core.

The shot peening operation is performed in an enclosure suitably sized to accommodate the part or range of parts to be processed along with the necessary cabinet accessories, like hoses and nozzles. Depending upon the goal of shot

peening, it can be accomplished in either a manual or automatic cabinet. However, these days to be in compliance with stringent military/SAE (Society of Automotive Engineers) specifications, which dictate a 'controlled, repeatable process', automated peening is a requirement.

By automating the process, all variables such as distance from nozzle to part, part and nozzle orientation, and dwell time can be strictly controlled. Through the use of specially designed fixturing and programmable controllers, even the most complicated surfaces and requirements can be accommodated.

Ten Ways Shot Peening Can Benefit Your Operation

Manufacturers with certain common challenges benefit from shot peening in the following ways:

1. Shot peening increases fatigue life.

Fatigue failure is associated with a dynamic loading condition—a tiring out of the metal due to repetitive, cyclical loading, which causes bending and twisting. Shot peening to improve fatigue life on parts exposed to repeated stresses needs to be controlled and repeatable, and therefore, performed in an automated manner.

Applications: aircraft landing gear, helicopter blades, leaf and coil springs, gear teeth, drive shafts, torsion bars, axles, drilling equipment, rotor-, compressor- and turbine-blades, discs, fuel injector parts, cam shafts, connecting rods, steering parts.

2. Shot peening reduces stress corrosion cracking.

Residual stress leaves metals more susceptible to corrosion, especially in high-



Herb Tobben, Manager of the Sample Processing Lab for ZERO Automation, creates solutions to customer problems.

strength materials. Stress failures result from the complex interaction of corrosives on sustained tensile stress in a metal surface. By applying a compressive stress layer to the surface metal through shot peening, its susceptibility is reduced.

Applications: aircraft landing gear, stainless steel hydraulic tubing

3. Shot peening prepares parts for plating.

Chrome plating can have a detrimental effect on the fatigue life of metal parts. Fine cracks commonly develop in metal plating. Shot peening parts prior to plating strengthens the part and enables it to resist the transfer of cracks from the plating through to the base metal.

Applications: landing gear cylinders, other metal parts to be plated.

4. Shot peening can straighten parts deformed during manufacturing.

Parts can be straightened by selective peening along a critical area. The radial stretching and plastic flow effects of an opposing surface caused by shot peening can straighten parts to a certain degree.

Applications: out-of-round piston rings, bulkheads, large structural shapes deformed during machining, parts deformed during heat treatment.

5. Shot peening reduces tensile stresses after grinding.

The shot peening process converts residual stress in many parts from tension to compression. The tensile layer, where failure occurs, is converted to a uniform compressive layer, thereby increasing fatigue strength and lengthening service life.

Applications: high-strength steel parts.

6. Shot peening is used to test electroplated surfaces.

Poorly-bonded surfaces will blister when peened, while a lack of blister indicates good adhesion. Peening can expose imperfections and quality problems.

Applications: detecting decarburized (softer) surface areas on metal parts; inspecting plated engine parts.

7. Shot peening reduces casting porosity.

Peening parts with a carefully chosen media size packs and compresses surface grain, closing pores through which hydraulic leakage can occur.

Applications: aluminum die-cast parts; transmission housings, gearboxes.

8. Shot peening can dimensionally alter parts.

During the design phase of product development, the effects of shot peening can be incorporated into the manufacturing process to slightly increase or reduce the part size. Likewise during rebuilds, shot peening can be used to alter the dimension of parts negatively affected by wear.

Applications: increasing the diameter of a shaft; decreasing the diameter of a hole.

9. Shot peening improves oil retention and lubricity.

The shot peening process alters the part surface and reduces friction. Shot peening also improves oil retention, thereby improving lubricity.

Applications: some bearing surfaces, engine pistons and cylinder walls.

10. Shot peening reduces notch sensitivity in high-strength steel.

The stronger the steel, the more susceptible it becomes to failure from notching (fatigue cracking). Shot peening improves the life cycle of steel and reduces fatigue cracking. Shot peening is commonly used in many applications to treat steel strengths greater than 200,000 psi.

Applications: landing gear, springs.

Specifications and Control in Shot Peening

The peening process, when properly controlled, ensures the same benefits to each part. Peening intensity, arc height, and coverage must be measured and controlled to ensure consistent results. Equipment for quantifying and measuring peening intensity, arc height, and coverage can be purchased to control and document the process.

Because so many variables affect shot peening results, standards help to ensure consistent quality. Many manufacturers set their own process standards, either to cover shot peening in their plants or to set standards for their vendors. Most standard specifications are patterned after military/SAE and engineering specifications.

Maintaining and documenting the peening process provide essential evidence that you, as a manufacturer, are committed to quality. Shot peening can play an important role in enabling you to deliver a high-quality product. At the same time, shot peening can lend credibility to your manufacturing expertise. The process improves documented quality and can create an arena to showcase the value you provide to your customers. To find out how you may take advantage of the benefits shot peening offers, call me for a consultation. It's worth a shot!

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The Shot Peener, in print since 1986, is a quarterly publication from Electronics Incorporated. It is dedicated to raising the awareness and appreciation for the shot peening and abrasive blast cleaning industries.

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