



Know Your Limits

A spring manufacturer finds a successful balance between in-house and outsourced shot peening.

WINAMAC COIL SPRING (WCS), located in Kewanna, Indiana, has been family owned and operated since its inception in 1948. The company manufactures wire forms and compression, single torsion, double torsion and extension springs for agricultural, off-road recreational vehicle, lawn and garden, railroad, construction, recreational vehicle, valving, industrial, furniture, and general industrial markets. Springs and wireforms are produced on state-of-the-art CNC spring formers and innovative secondary equipment. Their engineering department develops custom spring designs. Because of their commitment to innovation and customer service, WCS is the sole or primary source for many of their customers.

Over the years, the product engineers at WCS developed a successful shot peening program that encompasses in-house and outsourced shot peening. Compression, extension, single and double torsion springs are peened in Winamac's tumblast machines. Torsion springs that aren't suited for the tumblast machines, due to their size and shape, are sent to Metal Improvement Company (MIC).^{*} "Our shot peening service provides an economic shot peen process for customers that aren't interested in specific performance targets but want the added benefit of fatigue resistance," said Chris Swope, Product Engineering Manager at Winamac.

This division of labor served the company well until a manufacturer of off-road recreational vehicle components wanted a longer fatigue life for a compression spring than Winamac typically produces.

Investing in a New Process

The company requesting the new spring was a valued customer. Winamac has developed numerous spring designs for them and approximately 100,000 springs are outsourced annually to MIC for peening. The Winamac team was therefore willing to make the investment to find the ideal solution. WCS put together a research team of Chris Swope, Joe Zielinski (Chicago area sales manager for MIC/Curtiss-Wright Surface Technologies) and Michael Brauss (President of PROTO Manufacturing). Each company contributed their specialty to the study. Winamac provided the spring design, coiling and fatigue testing. MIC provided a range of shot peening treatments. PROTO provided residual stress measurements which clarified how different levels of residual compressive stress correlate to spring performance. The team

had the following objectives:

- Design a compression spring similar to those used in the off-road recreational vehicle industry
- Design and manufacture a fatigue test stand that could withstand high loads for months of testing
- Generate a matrix of shot peening treatments to produce different amounts of residual compressive stress
- Measure the shot peening residual compressive stress via X-Ray Diffraction (XRD)
- Correlate the residual stress to fatigue life performance
- Evaluate the effects of a post shot peening bake cycle on fatigue performance

The team measured the residual stress levels and fatigue tested the following shot peening variables:

- No peening (baseline)
- 230R @ 0.30-0.40 mm A (regular hardness shot)
- 230H @ 0.30-0.40 mm A (fully hardened shot)
- 460H @ 0.20-0.25 mm C (fully hardened shot, with and without post peen 204°C bake)
- 460H-230H dual peen (0.20-0.25 mm C followed by 0.25-0.35 mm A)
- Reversing the order of shot peening and cold pressing

The testing and analysis showed that harder shot and dual peening had a more beneficial effect on residual stress and fatigue life than higher shot peening intensity. The customer is pleased with the newfound knowledge and WCS continues to



Springs for high fatigue applications.

^{*}Metal Improvement Company is a business unit of Curtiss-Wright Surface Technologies.

be their primary source for technical information and spring design. In addition, Winamac has incorporated this MIC shot peening process into spring designs for other customers.

Recognizing Your Limitations

Winamac Coil Spring had already been working with MIC for many years so the decision to partner with them to develop a new peening process was an easy decision. For companies that have never used an outside resource, they must balance the ability to control costs by doing the work in-house versus employing the expertise of a specialist. “Failure to recognize your strengths and weaknesses can win or lose customers,” said Joe Zielinski. “For a large spring company that shot peens a high percentage of their product, it may not be cost competitive to outsource 100% of their peening requirements. Managing tight delivery requirements also becomes a greater challenge when doing significant outsourcing, especially on a diverse product line,” he added.

Your Product Line Matters

The shot peening requirements of an engineered spring company, such as Winamac, that makes a variety of spring designs are different than a spring company with a more focused product line such as those that specialize in engine valve springs. Companies with fewer product lines put great effort into streamlining the process and reducing cost. They are most likely to optimize an in-house shot peen process with the same shot size and the same or similar machines with similar process parameters. In comparison, a dedicated shot peening job shop specializes in managing a wide variety of peening media (usually more than 20) and rotating media through different machines depending on current workflow—that level of specialization isn’t feasible for many manufacturers. The best solution for Winamac, with its multiple product lines, is to peen what they can in-house and outsource the rest to MIC.

“What MIC offers to spring manufacturers is a wide variety of shot peening media sizes and media materials including steel, stainless steel, glass and ceramic. Peening companies have the common tumble peen-blast machines and also air nozzle machines. A small percentage of springs require shot peening in local areas such as specific radii or inside coils that can’t be reached with tumble peening. In addition, the quality department at a peening company is solely dedicated to shot peening quality,” said Joe.

“It’s important to understand the limits of your in-house shot peening capabilities and to know when to move on. We couldn’t meet the new fatigue life requirements ourselves and MIC developed a process that no other company could have done for us. Our close relationship with Metal Improvement Company through the years has given us a better understanding of the shot peening process. Their expertise is a readily available resource that many spring manufacturers do not have,” said Chris. ●



Winamac Coil Spring typically sends compression springs for high fatigue applications like these to Metal Improvement Company for shot peening.

The 10 Most Popular Languages

Given that shot peening is an international industry—would it benefit you to learn another language? Here’s a list of the 10 most popular languages spoken worldwide, along with the number of countries where the language is established, and the approximate number of primary or first language speakers for that language.

- Chinese/Mandarin—37 countries, 13 dialects, 1,284 million speakers
- Spanish—31 countries, 437 million
- English—106 countries, 372 million
- Arabic—57 countries, 19 dialects, 295 million
- Hindi—5 countries, 260 million
- Bengali—4 countries, 242 million
- Portuguese—13 countries, 219 million
- Russian—19 countries, 154 million
- Japanese—2 countries, 128 million
- Lahnda—6 countries, 119 million

Source: Mark Rosenberg @ www.thoughtco.com