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A close-up photograph of a hand holding a long, thin, curved metal rod. The rod is held between the thumb and index finger, with the rest of the hand supporting it from below. The rod is curved into a gentle S-shape. The background is a blurred image of a person's face, looking towards the camera. The lighting is soft, highlighting the metallic texture of the rod and the skin of the hand.

**Of Machining  
and Mandrels**

# Quick-Change Fixturing Locks in Time, Cost Savings

BY MATT DANFORD

Even if no specific pre-machining bottlenecks can be identified, time spent performing multiple setups on multiple workstations can compound quickly and adversely affect the bottom line. This is especially true for job shops, which typically produce a variety of parts in a range of quantities.

Military support system manufacturer Seyer Industries is no job shop, but it nonetheless faces similar challenges, says Mark Seyer, manufacturing manager. "While we see some jobs with hundreds of parts or even thousands, we're not a high-production operation," he explains. "We've got to be very flexible because we also see a lot of smaller

quantities, typically in the 10- to 25-piece range."

One recent equipment investment has been particularly effective at addressing setup flexibility challenges, Mr. Seyer says. Installed in 2009, the Ball Lock quick-change fixturing system from Jergens, Inc. (Cleveland, Ohio) enables operators to quickly change-over all the company's VMCs. As a result, Seyer has reduced setup times by 20 to 50 percent, depending on the part. The system has also contributed to reduced scrap rates.

Founded in 1957, Seyer Industries is a third-generation, family-owned business based in St. Peters, Missouri. At its four-facility, 80,000-square-foot campus, the company designs and manufactures ground support equipment, training and simulation systems, aircraft subsystems and other defense-industry components, primarily for the aerospace sector. In addition to supplying such customers as Boeing, Pratt & Whitney and Lockheed Martin Corporation, Seyer often contracts directly with the military. In-house capabilities include CNC machining, assembly, design engineering, painting, kitting and welding.

Seyer has been working to implement lean principles since 1999. As part of its waste reduction and continuous improvement efforts, the company regularly conducts Accelerated Improvement Workshops (AIWs) focused on particular aspects of its operations. "We identify something we can improve in the shop, and then we spend a week or so with representatives from different departments to try and find a better way to do it,"

## SEYER INDUSTRIES

**PROBLEM** Sought to reduce setup time through more efficient workholding

**SOLUTION** Ball Lock quick-change fixturing system from Jergens, Inc.

**RESULTS** Faster setups, improved accuracy



Seyer Industries caters exclusively to military customers. The company's four-facility campus has capabilities for CNC machining, design engineering, painting, kitting, welding and more.



The Ball Lock system operates with three primary components: shanks, liner bushings and receiver bushings. The shank extends through the liner bushing in a fixture plate and into the receiver bushing to locate and secure the fixture.



Mr. Seyer explains. “AIWs aren’t just free-thinking or brainstorming—we’ll actually sit with the operator and use a stop watch to identify which particular procedures take the most time so we can focus on those aspects.”

In 2009, the company held a workholding-focused AIW to identify ways to reduce setup time. Coincidentally, a Jergens, Inc. representative held a seminar on the Ball Lock system at a local manufacturing facility around that same time. Mr. Seyer attended and was intrigued enough to investigate the system. Initially, the company configured two of its 24 CNC machining centers to accommodate the system. Shortly thereafter, significant time and cost savings on those two machines led Seyer to outfit every VMC on the shop floor.

At the core of the Ball Lock system are three components: shanks, liners and receiver bushings. Each shank inserts through a liner mounted on a fixture plate and into a receiver bushing mounted in a subplate on the machine table. Clamping is achieved via three locking balls arranged around the inside perimeter of the bottom end of each shank. A larger fourth ball, the actuating ball, is situated above the three locking balls. Twisting a screw at the top of the shank pushes the actuating ball downward into the locking balls, forcing them outward into a tapered groove.

According to the developer, the system locks and locates in the same motion. No wrenches or other tools are necessary for clamping because the shanks’ turning screws are tightened by hand. Moreover, with repeatability of  $\pm 0.0005$  inch ( $\pm 0.013$  mm), the system minimizes the need to

indicate fixtures. Each shank exerts as much as 20,000 lbs (9,000 kg) of clamping force.

Jergens offers everything a manufacturer would need to get started, including fixture plates, subplates and tooling columns with pre-installed receiver bushings and liners, as well as vises custom designed to work with the system.

However, Seyer Industries opted to retrofit its machines and workholding devices in-house to accommodate the quick-change system. This involved drilling and reaming holes in its own grid plates to accommodate the receiver bushings and mounting each of its existing vises on its own subplate, complete with liners. The process of outfitting its own equipment was eased by the fact that all of its VMCs use grid plates with 2-by-2-inch hole patterns. Nonetheless, it still took a few months to retrofit the grid plates to accommodate the receiver bushings. While that’s mostly because the company had to keep churning out parts in the meantime, precision was also a concern. “You can only be as accurate as the table is, so we wanted to make sure we did it right,” Mr. Seyer says.

Ball Lock is employed for a large percentage of the company’s jobs—“pretty much anything that we need to put in a vise fixture,” he notes. It provides the greatest benefit for the company’s longer setups, which are typically those that involve multiple vises in a line.

Pre-Ball Lock, each vise would have to be indi-



CNC machinist Ricky Goble secures a fixture using the Ball Lock system. Tightening shanks by hand saves time, locking and locating the fixture in one motion.

cated separately to find a zero location, a process that could take 30 minutes per fixture. Now, the company can be confident that all vises are properly in line and within tolerance once mounted. Mounting is fast and easy thanks to the system's ability to locate and secure the fixture simultaneously, he adds, especially because the shanks can be tightened by hand. He estimates setup time savings range from 20 percent for a single vise to

as much as 50 percent for four or more.

Easier change-overs and faster setups aren't the only benefits provided by the quick-change system. "Our scrap rate is definitely less," Mr. Seyer notes. "The system makes it less likely that we'll be out of tolerance and scrap parts due to misaligned vises or other fixturing issues. Between that and the setup time savings, it's more than paid for itself." ■



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