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STAGE 8 Locking Fasteners has developed a line of active mechanical locking fasteners. The company will design custom units for any application. Pictured is a "bridge assembly" design used for applications where there is nothing to brace the locking retainer of a standard fastener.

Stage 8 Locking Fasteners Ride the Rails

Despite countless technological advances in other areas, industry continues to be plagued by problems that may seem mundane, yet are often devastating — joint fastener failures. In transportation, such headaches have occurred frequently throughout railroad systems, where fastener failures due to intense stresses have inflicted costly damage and disruption on locomotives, track and maintenance-of-way equipment.

"On the railroad, most fasteners are very prone to loosening and backing out because they are in one of the worst possible environments holding joints that are constantly being mechanically agitated and thermally cycled," said Larry Biess, director, CSX Transportation Advanced Engineering. "That includes locomotives, cars, track and maintenance equipment."

"What causes mechanical fasteners to loosen and shear is usually some external force, such as vibration, torsion, shock or thermal cycles," explained Bruce Bennett, president of STAGE 8 Locking Fasteners, San Rafael, California, U.S.A. "In the past, design engineers were forced to use bolts with insufficient stretch due to tight fit or other configuration problems. Once joint integrity is lost, even the most advanced and durable equipment is likely to fail."

The extensive joint fastener mainte-

nance required by heavy vibrations and thermal cycles is time consuming and potentially expensive. When maintenance-intensive fastener applications are overlooked, the consequences can be even more costly.

For example, the exhaust manifolds on CSX locomotives are attached to heavyweight GE or ElectroMotive Diesel engines. The engines plus the locomotives themselves are continually vibrating and causing the manifold fasteners to loosen and back out of their mounts.

"In effect, the exhaust manifold is a big pipe assembly that is located above the engine, which is vibrating mechanically and going through many heating and cooling cycles," says Biess. "And so you really can't use standard locking fasteners. They have to be retorqued constantly."

If the proper torque is not maintained on exhaust manifold bolts, the manifold will leak exhaust gases, a Federal Railroad Administration defect that will take a US\$2 million locomotive out of service — just for want of an effective locking fastener.

To eliminate these problems, STAGE 8 developed an active mechanical locking fastener. Available in several models, it is designed to stop joint failure and production downtime by preventing thread loosening from even starting.

STAGE 8's patented GrooveLok fas-

tener locking system acts like a small wrench locked onto a bolt head. This locking retainer is braced against a nearby abutment such as a frame, casting or protrusion, thereby locking a bolt or nut in place.

If there's no abutment to brace against to stop loosening, a bridge-type or strap retainer can fit over two or three bolts, locking them together, or a retainer can be bent over an edge or frame. For counter-bored applications, the locking fastener system incorporates a secondary counter-bore, a milled slot adjacent to the main counter-bore, into which a locking retainer is fixed. Once installed, fasteners never need to be retightened because loosening never has a chance to start, according to the company.

In solving the loosening of the locomotive exhaust manifolds, Biess said the locking fastener has been particularly helpful. "We've been using the STAGE 8 locking fastener on exhaust manifolds for several years now, and have never had a failure," he says. "Once installed, there is just no way for those fasteners to loosen. It's a positive lock — fail-safe."

"They create a tangible cost savings just on the periodic retorquing, and monitoring and scheduled maintenance we used to have to perform just to make certain that these things were all buttoned down," Biess said. "We've alleviated all of that. So, I believe it's safe to say that after we apply these things, our maintenance personnel are able to concentrate on other matters, because no way were the manifold bolts loosening up."

The STAGE 8 system retrofits existing components, is fully reusable, and has been used in items as small as eyeglass screws and as large as needed for holding generator propellers in a hydroelectric dam. To date, the system has no reported failures in over 10 000 000 installations, ranging from industrial, mining, construction, manufacturing, automotive, and miles-deep oilfield drilling assemblies, according to the company. ☞

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