

GripSafe®: New technology for piping isolation and testing

USA Industries Inc.



Whether planned or not, facility outages are common to the industrial community. Related to energy, oil refining, and other liquid and gas processing facilities, even with today's modern industry practices and substantial operator focus on safety, tragic consequences occur while maintaining, repairing and inspecting systems. Documented cases are strewn through the news media and on YouTube showing collapsed piping systems from failed materials, explosions ignited from vapor releases, public exposure to chemical vapors from opened lines, and even failed products used to isolate and test lines that have led to immeasurable financial losses, injury and death.

Every incident that occurs provides an opportunity to learn from and improve upon existing processes and technology. These opportunities should be used to rethink the processes and technologies used to isolate and test these systems with an aim to improve safety and reliability of both the tools and the systems. Within this framework, USA Industries Inc. has wholly reimaged the essential gripping technology used in piping isolation and testing plugs with its all-new GripSafe® line of pipe plugs.

The earliest recorded patents for pipe plugs date to the 1890s, and it wasn't until 1945 that a more modern gripping-type pipe plug was introduced. After more than half a century of various industries using the same basic technology, with known incidents of catastrophic plug ejections, USA Industries realized there was a critical need for gripping-type plug technologies to

be improved and subsequently crafted the GripSafe pipe plugging system. Today's modern metal alloy piping systems allow for high-pressure containment and large diameters. These factors require a gripping plug to safely hold back up to several million pounds of force during hydrotesting. Earlier plug designs do not hold up safely to those aggressive demands.

Modern gripping-type pipe plugs utilize one of two modes of holding restraint, jack bolts or serrated grippers. Plugs utilizing jack bolts have a polar array of threaded holes aligned radially to the interior of a pipe. For each threaded hole, a bolt must be installed by an operator who is required to torque each one evenly. This type of gripping system is limited to holding substantially lower pressures than the serrated gripping design. Failure to precisely tighten all bolts evenly greatly reduces the plug's pressure holding capability. Furthermore, this system's holding capability is also reduced if the plug is inadvertently installed on a cant. Added reduction in holding capability is seen in harder, higher-strength alloy piping materials.

Undeniably, the serrated gripping system is a tremendous improvement over jack bolts. Plugs with this system integrate a solid cone with metal grippers that travel up and out, into the interior of the pipe's wall via torquing compression bolts. As with the jack bolt solution, this system has deficiencies. When force is applied to the plug, the initial energy exerted onto the grippers within the pipe is exceeded by multiples due to mechanical

advantages of the cone's angled geometry. Consequently, as more pressure is placed onto the plug, the grippers drive deeper into the pipe wall, thereby allowing greater pressure retention than the initial installation forces. The deep and sharp grooves on these grippers drive into the pipe wall, leaving heavy scarring behind even if the plug saw no pressure applied to it.

Pipe manufacturing practices reveal that pipes are not perfectly round and often present irregularities in the wall's interior like weld seams. With the serrated gripper design, the grippers are driven up the cone by a single plate; collectively, they all share the same relative position to the cone. This geometrical constraint can limit the number of touchpoints the grippers have when engaging with the out-of-round pipe wall, effectively reducing the plug's holding capabilities. Since the serrations must drive deeply into the pipe wall for proper engagement, these systems' holding capabilities are similarly reduced when applied against harder, higher-strength alloy piping materials. One recognized gripping-type plug manufacturer has designed a cross-cutting serrated pattern into its gripper design. While this gives improved wedge-to-wall engagement, customers have noted that it also increases the depth of penetration damage to the pipe wall. The scars left in the pipe must often be removed via grinding or by entirely removing the affected sections, thereby reducing the advantage of using a plug. In addition, once placed in service, the serrated edges must be carefully inspected between each subsequent use, because damage from previous uses can significantly reduce the holding capabilities of this plug type.

The newly developed GripSafe plugging system addresses these issues by using an independently actuating wedge system with a long-lasting proprietary surface coating called Gritlock™ that is durable and stronger than the steel piping it engages with. The independent actuation works by using heavy-duty springs to propel wedges up an



Gritlock™ is a long-lasting proprietary surface coating.



GripSafe® plugs use an independently actuating wedge system.

inclined plane and subsequently into the wall of the pipe. After proper preparation of the plug for installation into the pipe, the wedges automatically engage upon insertion into the pipe wall, ensuring the plug is positively secured in the pipe before a single bolt is ever torqued. This auto-locking feature provides the highest level of safety currently available in the industry.

Furthermore, the independent actuation of the wedge system allows the gripping mechanism to freely adjust to any eccentricities in the pipe, including weld seams, voids, out-of-round regions, etc. Also, against harder, higher-strength alloy piping materials, the plug's Gritlock coating grabs powerfully onto the pipe wall without leaving scarring or deformation. Like the single-cone serrated wedge solution, the inclined planes of the GripSafe wedge system afford the same mechanical advantage; with more force applied to the plug, Gritlock engages a stronger hold to the wall of the pipe. Unlike the serrated wedge solution, GripSafe's Gritlock coated wedges do not need to deeply penetrate the pipe wall to employ a superior grip. This is accomplished by having a greater surface to the pipe wall contact area. In a worst-case scenario, the pipe's internal wall is left with negligible markings, like what would be left after using a coarse piece of sandpaper. However, in most scenarios, there is no perceivable indication that a plug was installed at all.

USA Industries has taken pipe plug gripping technology to an all new, superior level of user safety and reliability over competitive products. Upon inspection, you will see USA Industries' heavy investment into its reimagined, professionally engineered GripSafe line of piping isolation and testing plugs stands above the rest. Stay tuned for more exciting information coming from USA Industries Inc. about its new line of isolation and testing plugs, including news on GripSafe's superior Tri-Ply™ seal technology.

For more information about GripSafe and all of USA Industries' best-in-class manufactured products, visit www.USAIindustries.com/GripSafe-BIC or call (866) 254-1902. ●

INSTANT SECURITY

USA Industries, Inc. has reinvented the fundamental design of gripping type pipe plugs with its patented Independent Actuating Wedge System technology offered exclusively on the ALL NEW GripSafe® plug line of isolation and testing products.



Double Block & Bleed (DBB)

Outboard Retraction Blocking (ORB)

Inboard Insertion Blocking (IIB)

Auto-locking functionality available on ORB and DBB models.



Patents & Trademarks
 - US PATENTS: 8,027,858 | 8,810,364 | 8,804,340 | 10,746,330
 - CANADIAN PATENT: 3,004,787
 - CANADIAN INDUSTRIAL DESIGN: CI 106293
 - EUROPEAN PATENT: 3,377,797 B1
 - EUROPEAN PATENT (Germany): 6020 16051064.3
 - EUROPEAN UNION DESIGN REGISTRATION: 00828264-001
 - INTERNATIONAL TRADEMARK REGISTRATION: 1590298
 - Other US and Foreign Patents Pending

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