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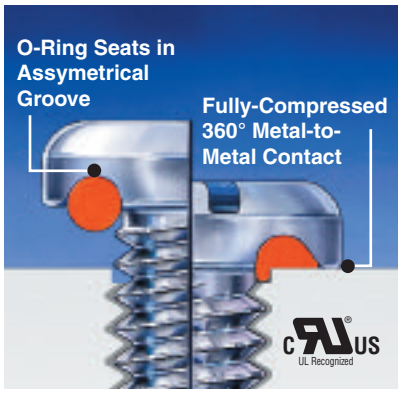
Embedded O-Ring Self-Sealing Fasteners vs. the Old Standbys

by Ken Schwinn, Contributing Writer

When gas or liquid are under pressure, system fasteners should be sealed to prevent leakage. This is true even for fasteners that are not under pressure, but where hostile environments such as water, gas, dust, lubricants, cleaning solvents, etc. are present and could penetrate past threads and leak onto the internal mechanism/operating area creating havoc. Fastener users have a number of sealing options to effectively block these contaminants and to contain fluids under pressure (internal/external). Once a fastening assessment has been made, one can easily review these options against the following criteria:

- Will the fastening be done as part of a high-speed automated assembly operation, or will manual fastening be the rule?
- Is the main sealing concern limited to initial installation, with little or no concern about warranty, or are there longer range potential maintenance considerations?
- What psi/vacuum rating (internal/external) is considered operational, and what will be the temperature conditions?
- What chemicals (including cleaning agents), gas or other liquids will the fastener be exposed to?
- Will there be concern about field servicing, especially spare parts availability?
- Will there be any preference for either a liquid or dry mechanical sealing method during production and post- field servicing?
- Will vibration be a consideration - therefore requiring additional threadlocking? If so, which method (liquid or dry) best addresses installation time, future maintenance and economic considerations?
- Will there be any security consideration that might require choosing a self-sealing fastener (screw or bolt) with a tamper-resistant head?
- Are there any other considerations unique to the specific application?



The liquid method (generally best suited for large automated production applications)—typically anaerobic adhesives/sealants and other pre-applied chemicals—are manufactured by a number of well known suppliers. Many of these suppliers offer products that are application specific, i.e. aerospace, electronics, transportation, durable and consumer goods. Some are designed for two-step operations involving prep/curing. If not properly selected, some may present difficulty in removing during service.

The dry mechanical method is an ideal alternative for many sealing applications where fluid is under pressure or seepage protection against the elements are prime considerations. Efficacy, ease of installation and field maintenance are the driving forces for deciding which of these traditional methods are best to use with screws, bolts, nuts and rivets. There's the O-Ring or flat-washer (deforming) technique, mounted under the fastener head method. Both are two step processes, using a crush and fill approach to achieve fastener sealing. Both require that replacement parts be handy when re-installing, as neither will survive in good condition to be re-installed. And, because neither methods are precise, there's some question about their sealing integrity. The "dry" with operating one-step Embedded O-Ring Fastener (originally patented by APM) seals to 20,000 psig/vacuum with operating temperatures from -160 to 500F. Upon torquing, it becomes fully clamped with a 360 degree (metal-to-metal) seal, and can be easily re-installed successfully many times. The stainless-steel screw and bolt versions can even be used for a bleeding function. The reason the Embedded design works so well is that its silicone O-Ring is embedded in a circular groove, strategically located under the head and next to the shank. The asymmetrical shaped groove controls the degree of O-Ring compression into a countersunk-threaded area for minimum wear—while still providing maximum sealing—enabling many service reinstallations without concern about potential sealing failure.

When needed, this class of self-sealing fasteners accommodates a variety of threadlocking techniques such as; adjustable polymer (normally Nylon) pellets embedded into the lower thread section; a polymer vertical strip, also embedded into the thread section; or a pre-applied dry coating process which becomes fused to the thread surface. They are delivered ready for installation without the need for curing or any other special preparation. Several versions of the dry-coating method are available, including one that will maintain torque values through extreme temperatures from -70 to 500F. A self-sealing stainless-steel nut is also offered by APM that incorporates a molded silicone rubber insert. The insert features continuous threads to lock in its sealing capability, an important consideration that isn't present in other sealing nut designs that just incorporates an O-Ring. There are self-sealing rivets with embedded O-Rings to choose from that provide high-pressure sealing; but like all rivets, will be damaged upon removal, and therefore they are not reusable.

A high-pressure air and water-tight, self-sealing washer version is also available from APM. This special washer assembly consists of a silicone disc bonded to a 300 series stainless steel contoured washer. It can be used with standard screws, bolts or studs in a wide variety of mechanical, electrical and electronics equipment sealing applications. All APM self-sealing fasteners are UL Recognized, and are IP66/68 water ingress rated.

Throughout industry, APM self-sealing are used extensively in challenging fastener applications found on equipment in laboratory and scientific instruments, manufacturing and process, material handling and packaging, motion control, network and communications, test and measurement, boat and other marine/off-shore, construction and off-road/recreational, powder and liquid handling, medical, military and security—and any other kind of equipment that requires wash-downs or exposure to the elements and extreme temperatures.

About the Author:

Ken Schwinn is the vice president of engineering for APM Corp.'s Fastener Division.