SEALING SENSE

Q. *How can spiral wound gasket selection and installation problems be avoided?*

A. Spiral wound gaskets (SWG) have been widely applied as static seals in standard ASME flanged joints, as well as in pumps, valves and other specialty equipment. While generally affecting a robust seal, these gaskets still require careful selection and installation to ensure optimum leak-tight performance. Not following some basic design and installation criteria may end in one of a number of potential problems.

The essential design of a spiral wound gasket consists of alternate plies of thin metal (typically .007" thick) and a soft filler sealing material, such as flexible graphite, mica graphite, PTFE or ceramic.

Figure 1. Essential SWG design

Of all of these non–asbestos filler products, flexible graphite and PTFE have become increasingly preferred for many applications. They tend to be naturally lubricious, as well as very effective sealants. It is, however, the combination of the thin metal layers with these lubricious fillers that also can lead to mechanical problems. These can adversely affect function, if proper design selection criteria are not followed.

Figure 2. SWG designs with an outer ring and both an outer and inner ring (center)

To prevent mechanical problems, spiral wound gasket designs are available with a solid outer ring that generally has a grooved inside diameter (I.D.) and/or a solid metal inner ring that has a beveled outside diameter (O.D.) to retain the spiral winding.

These rings will add mechanical stability for many applications, such as those that incorporate raised face flanges. They also can serve to center the gasket and act as a mechanical compression stop to help avoid crushing of the gasket. Furthermore, inner rings help to avoid the occurrence of inward buckling, which is the development of localized radial protrusions along the I.D. circumference of the gasket. Such buckling has been of concern to some users, particularly with PTFE or flexible graphite fillers.

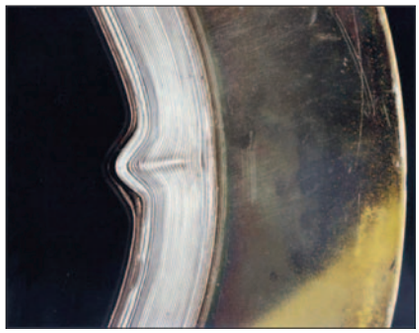

Figure 3. SWG with buckled inside diameter

Spiral wound gaskets must be designed so that a metal to metal "compression stop" physically limits the gasket compression. In this regard, the spiral wound gasket is unique to most metallic, as well as nonmetallic, gaskets, with the possible exception of some types of O-ring.

For every given thickness of spiral winding, there is an "optimum" compressed thickness, at which point the gasket compression should be mechanically limited. (*Contact the manufacturer for the optimum compressed thickness.*) This can be accomplished by the use of properly dimensioned outer (most common on raised face assemblies) and/or inner rings. Preferably, the spiral gasket is confined on both its I.D. and O.D. to prevent excessive extrusion and/or buckling of the inner plies. Such a configuration also allows for more load to be applied to the spiral-sealing element for better sealing. This effect also can be accomplished, where space is more limited (such as some boiler feed pumps), by machining a groove in the flanges to

retain the gasket and allow the flange faces to contact "metal to metal" at the point of optimum compression. In this case, the equipment (flange) itself serves as both the confinement (*if the gasket is retained on both I.D. and O.D.*) and compression stop, rather than using inner and outer rings.

Another important installation consideration is the need for the winding portion of the gasket to be compressed across its entire face. It should be noted that standard ASME B16.20 (1) spiral wound gaskets for pipe flanges do not always fit the flange corresponding to its nominal pipe size and pressure class. In fact, this ASME standard includes two tables, along with text, that reference the appropriate flange connection type (weld neck, slip-on, etc.) and pipe schedule for use with each size and class of spiral wound gasket.

One chart is for spiral wound gaskets with an outer ring, but no inner ring. Another is for spiral wound gaskets with both inner and outer rings. If a standard size spiral wound gasket is used with the wrong flange connection method and/or pipe schedule, the gasket may protrude into the flange bore, which can result in mechanical damage. This is most common on small diameter slip-on flanges. It also should be noted that the standard dimensions indicate that the outer ring contacts the raised face. Experience indicates that this will help keep the gasket on the raised portion and help the outer ring to limit compression.

Whenever spiral wound gaskets are unconfined on the I.D. due to ring or flange configuration, there is the potential for buckling with PTFE or flexible graphite fillers. It is considered good practice to use an inner ring where space and bore size permit. Outer rings are essential on raised face flanges and some other connections. Ideally, rings or the flange configuration on both the I.D. and O.D. will confine the gasket, without a pinch point for mechanical damage. The suggested flange surface finish generally is considered to be 125 to 250 AARH.

Lastly, one should always consider the temperature, pressure and chemical media to be sealed in the selection of any spiral wound gasket. Spiral wound gaskets can be made of virtually any metal alloy that is available in strip form, and there is a choice of any number of such materials.

This article does not attempt to consider the various media spiral wound gaskets may encounter. Moreover, the effect of external air acting as an oxidizer on the outside of the gasket also should be considered. Temperature is a key consideration in selection of filler material and winding metal. As for pressure, many manufacturers have the capability to adjust the gasket density to accommodate the pressure to be sealed and/or available bolt load. This factor is one design consideration often overlooked. (*Contact the manufacturer for specific applications.*)

References

1. *American Society of Mechanical Engineers, ASME B16.20-1998/B16.20a- 2000, Metallic Gaskets for Pipe Flanges, Ring-Joint, Spiral Wound, and Jacketed.*

Next Month: Potential problems and solutions for application of packing in pumps and valves.

Fluid Sealing Association

Sealing Sense is produced by the *Fluid Sealing Association (FSA)* as part of our commitment to industry consensus technical education for pump users, contractors, distributors, OEMs and reps. As a source of technical information on sealing systems and devices, and in cooperation with the *European Sealing Association*, the *FSA* also supports development of harmonized standards in all areas of fluid sealing technology. The education is provided in the public interest to enable a balanced assessment of the most effective solutions to pump systems technology issues on rational Total Life Cycle Cost principles.

The *Metallic Gasket* division of the *FSA* is one of six with a specific product technology focus. As part of its mission, this division develops publications such as the *Metallic Gasketing Technical Handbook,* as well as joint *FSA/ESA* publications such as *Guidelines for Safe Seal Usage - Flanges and Gaskets* and *Gasket Installation Procedures.* These are primers intended to complement more detailed manufacturers' documents produced by the member companies. In addition, standards such as *FSA-MG-501-02 Standard Testing Methods for Inward Buckling of Spiral Wound Gaskets* have been developed in response to important user issues.

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