Back to Basics: Soft Gaskets

Third in a Series

By **Chett Norton**
FSA Member, Triangle Fluid Controls Ltd.

DOS & DON'TS FOR SOFT GASKET MATERIAL

DO	DO NOT
Contact the manufacturer for recommended torque values to ensure both bolt stress and gasket load do not exceed the maximum recommended value.	Do not use grease or adhesive to stick the gasket to the flange so that the gasket is held into place prior to bolt-up. This action may prematurely begin to chemically attack or break down the gasket.
Always use a new gasket; never reuse an older or existing gasket.	Do not rip or tear the gasket. Ensure that the material is cut clean with a sharp edge or die.
Ensure the gasket is the proper dimensions (ID, OD and thickness).	Do not glue or use two gaskets together to achieve the desired thickness.
Always use the thinnest gasket material available to minimize the effects of gasket creep relaxation.	Do not re-torque or hot torque a gasket once it has been put into service.
When installing the gasket, ensure that you are checking the gap around the flanges with a measurement tool to ensure that they are parallel when moving toward one another.	Do not exceed the maximum gasket load for the gasket material.

This is the first of two articles in this "Back to Basics" series that will discuss gasketing. This article will focus on non-metallic (soft) gaskets, and the second will focus on semi-metallic gaskets.

A non-metallic gasket is one that does not have any metal in its construction and that consists of one or more materials such as elastomers, polytetrafluoroethylene (PTFE), flexible graphite, natural fibers or mineral-based materials. The gasket also may be composed of a binder and filler(s), or it could be completely homogeneous.

Understanding the forces acting within a bolted joint flange assembly (BJFA) is critical because these forces have a direct impact on the performance and longevity of a soft gasket installed within a BJFA.

Figure 1 (page 56) shows the three main forces that act upon a BJFA. Force A is the flange/bolt load. It must compress the gasket enough to fill any serrations or imperfections on the sealing surface to prevent any potential leak paths. Force B is the hydrostatic end load caused by the internal pressure of the fluid in the system. It tries to push the two flanges apart. Force C is the internal blowout pressure that acts upon the gasket and tries to push it out through the gap between the flanges. A main concern is determining the gasket stress or load that will be applied to the gasket. The load is Force A (flange/bolt load) minus Force B (hydrostatic end load). This remaining gasket load must then be greater than Force C (internal blowout pressure) to ensure the integrity of the seal; otherwise, a leak or gasket blowout can occur.

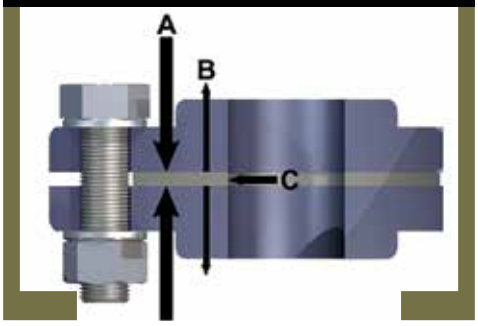
Soft Gasket Materials

Soft gaskets are used in a wide range of applications for both general-service and corrosive applications. They are suitable for low-, medium- and high-temperature ranges depending on the materials from which they are manufactured. As a rule of thumb, soft gaskets should be used only in Class 150# and 300# applications.

In some higher-pressure class piping systems, both the pressure and temperature under the operating conditions may be below the maximum allowable amounts for the material. Using a soft gasket material in this scenario is not recommended.

Routinely, when piping systems are pressure tested, the pressure used is at least 1.5 times the pressure class rating, not the actual operational conditions. This test pressure could easily exceed the maximum pressure rating of the product. Note that soft gaskets should not be used in flange classes above 300#. The amount of load on the gasket and the resulting gasket stress created to achieve

Figure 1. The three main forces that act upon a BJFA *(Images and graphics courtesy of FSA)*



a typical minimum 40 to 70 percent bolt yield would crush the gasket. This is because of the larger diameter and/or quantity of bolting that is found in higher-pressure class flanges.

The next important factor to consider is gasket selection. When selecting a gasket for your application, there are three main things to consider: pressure, temperature and media. Gasket manufacturers provide pressure-versus-temperature (PxT) charts for soft gasket materials. These charts allow one to determine if the material is suitable for a particular application and give a safe-to-use or not-safe-to-use criteria. With soft gasket materials, as the temperature of the application increases, the material's maximum working pressure decreases. Once the pressure and temperature portion of the application has been verified, a chemical compatibility chart can be cross-referenced to ensure that the selected material is resistant to the chemicals being sealed.

Other factors to consider include the type of joint, the condition of the sealing faces, the loading effects on the gasket material (compressibility and recovery), and varying operating conditions (cycling or fast startup times). While these factors are important, they are often overlooked.

To help eliminate the risk, use a Gasketed Joint Application Form so nothing is missed when collecting gasket application information. The form asks all relevant questions about a BFJA. Being able to provide all pertinent information allows a gasket application engineer to narrow the options and recommend the right gasket, saving time and money and eliminating potential problems.

After choosing the correct gasket material, installation is next. Studies have shown that between 80 and 85 percent of all gasket failures are the result of improper installation. If your company has a gasket installation procedure, use it. If not, you can purchase a copy of American Society of Mechanical Engineers (ASME) PCC-1 – Guidelines for Pressure Boundary Bolted Flange Joint Assembly.

Even if you do have a gasket installation procedure, consider comparing your procedure to similar methods listed in PCC-1 to ensure the installer is using the best methods when installing the gasket. The following are a few tips to keep in mind.

1. Ensure the flanges are clean. Visually inspect for dings, marks or indentations in the flange sealing faces. If debris or foreign gasket material is stuck on the flange, use a brass or soft wire brush to lightly remove it. Do not use a grinder, scraper or chisel to remove any foreign material stuck to the flange.
2. Align flanges properly to maximize sealing contact and to provide a uniform gasket load.
3. Lubricate working surfaces of all fastening components (bolts, nuts and washers) to ensure uniform friction.
4. Verify material/grade and ensure that the material and bolts are in good condition. Make sure the nuts spin freely onto the thread and do not bind before installation.
5. Number and tighten bolts using a proven tightening sequence or assembly pattern, and use a calibrated torque-control device to ensure proper torque values are applied.
6. Assembly records should always be kept for each BJFA because they allow the installer to verify that proper procedures were followed, and they are essential for later investigation if issues occur. ■

Next Month: **Back to Basics: Semi-Metallic Gaskets**

We invite your suggestions for article topics as well as questions on sealing issues so we can better respond to the needs of the industry. Please direct your suggestions and questions to sealingsensequestions@fluidsealing.com.

Chett Norton, C.E.T., is the QA/engineering manager for Triangle Fluid Controls Ltd., with 14 years of experience in both fluid sealing and industrial process. He is a certified member with Ontario Association of Certified Engineering Technicians and Technologists – Mechanical Discipline and an active participating member of the Fluid Sealing Association Gasket Technical Committee.