

How can installation procedures improve gasket life?

This month's Sealing Sense was submitted by FSA member Steve Stratton, edited by Pete Petrunich

Successfully sealing bolted flange connections depends on all the components of a well-designed bolted joint working together. Selection of the appropriate gasket for the application is one of the first important steps in the process. Beyond the selection process is a series of important actions that can ultimately lead to reliable performance or serious problems. These steps that outline proper installation and assembly are essential to ensure the optimum service life of the gasket and leak-free operation.

Gasket Selection

Proper selection of the gasket material and type for the application is of fundamental importance. This selection must ensure that the gasket seals effectively throughout all operating conditions that the application experiences including:

- Temperature
- Internal pressure
- Process fluid
- Compressive load

The gasket must be able to tolerate the temperatures and internal pressures experienced during all phase of operation. It must also be chemically compatible with the process fluid and handle the compressive loads required for effective sealing without being crushed. In addition, the gasket must have the correct dimensions with a thickness appropriate for the flange conditions and service. Once received from the manufacturer or supplier, the gasket must be stored and handled according to the requirements of the material to ensure that it is appropriate for installation.

Installation Tools and Fasteners

As with any process, the proper tools and safety equipment that enable a secure and reliable installation are of utmost importance. These tools include a calibrated torque wrench, hydraulic or other reliable tensioner and brushes for cleaning the flange and fastener surfaces, specified lubricants and appropriate safety equipment. Bolts, studs and hardened

washers specified for the application must be selected so that the load conditions required for optimum gasket life and sealability can be achieved.

Installation Procedures

The recently published *ASME PCC-1-2010 Guidelines for Pressure Boundary Bolted Flange Joint Assembly* provide detailed procedures for the proper installation of gaskets. The most current information on all phases of the preparation, installation and assembly of a bolted flange joint is presented in this document. The appendices cover a wide range of related topics from flange surface finish requirements to flange alignment and tightening procedures. They also contain troubleshooting information for start-up and in-service leaks.

A brief summary of some key steps in the installation and assembly procedures consistent with those in *PCC-1* is shown below:

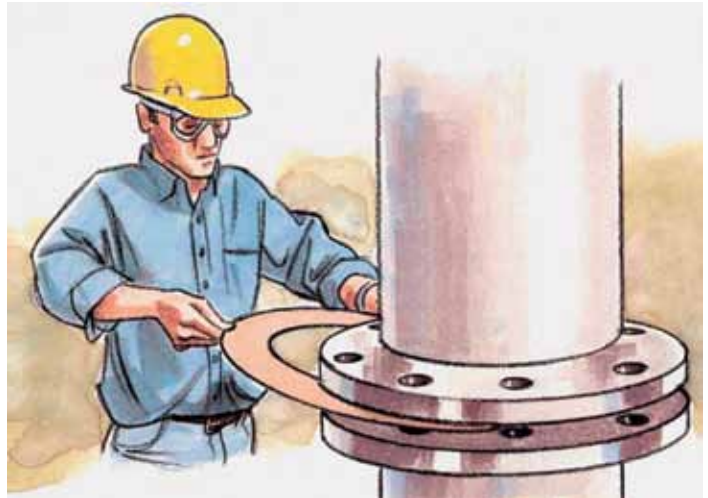
- **Cleaning and examination**—Contact surfaces of the flanges and fasteners must be carefully cleaned to remove foreign material and debris and examined to ensure that anything prohibiting proper gasket seating has been removed or replaced. This includes warping, scratches and radial scores in the flanges. Brass wire brushes are generally accepted for the cleaning operation.
- **Flange alignment**—Alignment of flanges is essential to providing the maximum seating stress and life of the gasket. Flange faces must be aligned to ensure that they are parallel with the bolt holes allowing free passage of the bolts. Excessive force should not be required for proper alignment. Any irregularities that prohibit the gasket from seating properly must be avoided.
- **Gasket installation**—Before the gasket is installed, it must be examined to ensure that it is free of defects and is of the specified size, material and type. The gasket then should be carefully inserted and centered between the flanges. Joint compounds or release agents should not be used on the gasket or seating surfaces unless specified by

the manufacturer. The flanges then should be brought together ensuring that the gasket is not pinched or damaged.

- **Lubrication of fasteners and load-bearing surfaces**—Proper lubrication is essential to reducing friction and providing the torque transmission to achieve the required load on the gasket. It also aids in disassembly of the joint. Specified lubricants should be uniformly applied to all threads, nut and washer load-bearing surfaces but not contaminate either the flange or gasket faces. Lubrication must be chemically compatible with the bolt/nut/washer materials and the process fluid.
- **Bolt installation**—Bolts, nuts and washers should first be examined to ensure that they are as specified for the application. Bolting material should be rated for the application temperatures and of sufficient strength for the flange loads required. Nuts should first be installed on the bolts hand-tight. It has been shown that uniformly loaded gaskets that are properly compressed will provide optimum life.
- **Assembly**—Detailed procedures for assembly are well documented in *PCC-1* and beyond the scope of this article. Tightening procedures and sequences, torque determinations, target pre-stress and tightness testing are all detailed in the document, as is the guidance on determining assembly bolt stress. It is critical to initially “snug-up” the fasteners so the flanges are aligned. Failure to do so may allow the flanges to misalign when the first bolt is tightened. Fasteners should be tightened in increments and patterns as prescribed in *PCC-1* to distribute the load evenly.

Summary

Gasket life is important to ensuring long, leak-free operation of



Gasket Installation

a bolted joint. While selection of the proper gasket is an important first step, improper installation procedures can damage gaskets and prevent them from achieving their service life potential. Consultation with your gasket manufacturer will help ensure the proper gasket selection for your application conditions and provide guidance on installation procedures that will enable long gasket life with leak free operation.

Next Month: *How can I select mechanical sealing systems using life cycle costs?*

We invite your questions on sealing issues and will provide best effort answers based on FSA publications. Please direct your questions to: sealingsensequestions@fluidsealing.com.

P&S



“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 (ESA), the FSA also supports the 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 (LCC) principles.

The Gasket division of the FSA is one of six with a specific product technology focus. As part of its mission, it develops publications such as the *Metallic Gasketing Technical Handbook* as well as joint publications such as the newly revised *ESA/FSA Flange Gaskets – Glossary of terms, and Guidelines for safe seal usage—Flanges and Gaskets* as well as the *FSA/ESA Gasket Installation Procedures* that are available in eight languages. These are intended to complement the more detailed manufacturers’ documents produced by the member companies.

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