

LOCTITE[®]



ZERO LEAKS DESIGN

Better joints. Better seals.
Better performance.

Henkel

The best way to meet zero leak requirements is to learn from experience.

We've learned a lot. Learn from us.

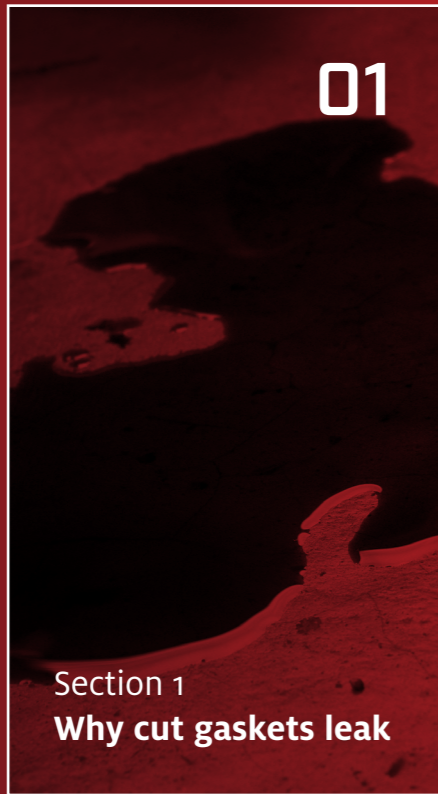
We've learned a lot about avoiding leaks over the years. Some things we've learned from experience, some from performing thousands of pressure tests, joint evaluations and calculations. We've also learned from partnering with research institutions like the University of Stuttgart. Our extensive experience is available to you to support your design process, and this ebook can help introduce you to some of the major design topics to consider.



Zero Leak Design: A performance tool

In this ebook, we'll discuss zero-leak design, a concept that supersedes the need for cut or mechanical gaskets and their issues. Liquid gasket materials facilitate machine designs that avoid the common causes of gasket failures, building higher performing and more reliable machines with every joint.

CONTENTS



Why cut gaskets leak

It's a fact: Mechanical gaskets can have a lot of issues. Designing machines with liquid gaskets saves time, money and hassle while improving performance.



They're too relaxed

A standard gasket works by compressing into the flange surface. However, over time the gasket's ability to push back against the flange can be reduced due to "compression set". This can result in bolt loosening and leaks. In addition, compression gaskets can be misaligned and localized stress from bolts can break or tear them.



They can't play rough

The most common cause of gasket failure is surface irregularities. With rougher surface finishes, it takes a higher load to deform the gasket into the surface finish—creating more wear and potential for compression set. And blowout resistance decreases with rougher surfaces, making surface finish a critical challenge often resulting in increased cost of production.



"One Size" Does Not Fit All

Maintenance is a chore, but finding the right replacement for your worn mechanical gasket can be impossible. Keeping inventory can be costly due to all of the different types of cut gaskets potentially needed. And it doesn't always work because doesn't always work, because stored gaskets can become brittle or damaged while waiting to be put into service.

What makes better joints

Where joints are under high stress, one important design consideration is the distribution of flange pressure, which should be uniform within permissible limits.

Another consideration is operating load. To minimize deformations, the joint under load has to be as rigid as possible. Liquid gaskets bond as well as seal, helping to increase rigidity and unitize flange surfaces.

Other factors critical to achieving the best possible seal include accounting for variances in temperature and pressure.

Rigidity and Temperature

When designing, select the correct amount of rigidity in the sealing flange to distribute the sealing stress of the gasket in all flange areas. Ensure sufficient bolt pre-load reserves to minimize loss of load due to gasket relaxation. And consider both the high- and low-temperature thermal expansions of different flange materials (like aluminum and steel), which can overload gaskets or cause contraction that can unload bolts and gaskets.

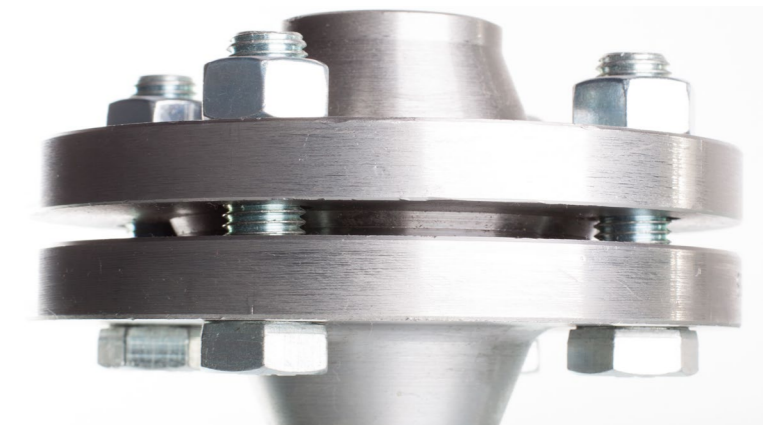
Stress Management

To minimize the stress and strain of the gasketed joint caused by external forces, locate it as far as possible from the point where the forces feed into the housing. Moving the bolt head away from the sealing area improves the bolt clamping load distribution (see right), and adjusting the flange width obtains a more uniform compressive stress distribution.



BOLT LENGTH

Optimize the compressive stress distribution in the housing by ensuring that the sealing area is in the middle of the effective bolt length.



BOLT CONNECTIONS

Make certain the theoretical straight connection lines between bolts do not deviate significantly from the centerline, allowing uniform compressive stress distribution.

FOR MORE DETAILED INFORMATION ON HOW TO EXECUTE ZERO LEAK DESIGN, ASK ABOUT THE LOCTITE LIQUID GASKETING DESIGN GUIDE.

Liquid gaskets help you create better designs

In addition to allowing metal-to-metal contact, for more accurate tolerances, there are many direct design advantages that you can gain from choosing liquid gaskets:

- Completely seal all voids and imperfections for zero leaks
- Relaxed surface finish tolerances (no reworking because of scratches)
- Easier handling and application of vertical components
- Excellent chemical resistance
- Application can be easily automated

Better designs get better business results

Increasing the effectiveness of the applications you design also creates overall business benefits, too. These include:

- Decreasing inventory costs
- Reducing warranty claims
- Lowering manufacturing costs
- Improving your value proposition, supporting repeat and increased sales. More powerful system with the same design due to higher rigidity and higher load transmission



Choosing the right seal

The design process is a series of choices that add up to the success or failure of the final application. Unlike conventional gaskets, liquid gaskets don't require high compressive loading to form a seal, allowing you the freedom to design joints and flanges with metal-to-metal contact.

Metal-to-metal design advantages

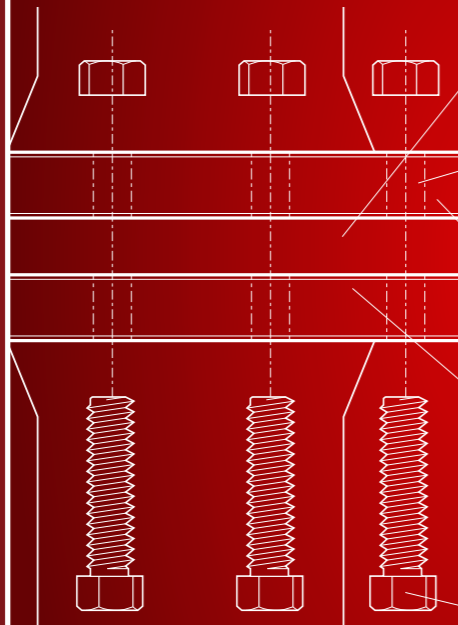
That helps eliminate the unnecessary space solid gaskets require, ensuring correct bolt tension through the life of the application and eliminating retorquing. With no need to accommodate gasket thickness, tolerances can be maintained more accurately, too.

LOCTITE

FIND DESIGN FREEDOM

Imagine...the ability to **design in zero leak performance**

LOCTITE liquid gaskets give you the freedom to design the way you need to. We partner with you to help build your dream machines.



Design

Create even flange pressure and rigid joints.

Consider:

- Flange rigidity
- Bolt pre-load reserves
- Thermal expansion
- Joint stress and strain
- Distribution of flange compressive stress
- Adjusting flange width

Surface Finish

For FIP* sealants, surface finish has zero influence on initial compressive load, but it does impact:

- Thickness of the sealant layer
- Cleaning and removal of contamination
- Blowout resistance

Housings

Following the basic rules of housing design helps develop a suitable sealing concept:

- Use small, spherical openings
- Use materials with similar thermal coefficients of expansion
- Ensure uniform temperature distribution

Flange Rigidity

RTV Elastomers FIP* gaskets are suitable when:

- Lacking minimum surface pressure for anaerobics
- Flanges are flexible
- Flanges are plastic or made from dissimilar substrates

Flange Design Verification

To achieve as uniform a flange pressure as possible, follow a standardized design verification process:

- Evaluate pressure distribution with Finite Element Analysis
- Optimize design
- Use real-time pressure maps for final analysis and verification

Bolts

Bolt positioning, spacing, grade and length can influence the effectiveness of the gasket and seal:

- Positioning and spacing $d_s + hG_d + 2h_g$
- Grade and length:
 - 80% proof load and 3-3.5x normal operating tensile load
 - 5x longer than diameter with optimum thread engagement

LOCTITE Liquid Gasket Design Advantages

1. 100% seal
2. Excellent chemical resistance
3. High blowout resistance
4. Maintains bolt clamp load over lifetime of part
5. Prevents micromovements – providing for higher transfer loads between flanges
6. Better gap fill allows for reduced machining tolerances
7. High performance on inactive metals, eliminating the need for a primer

*FIP (Formed-in-place) gaskets are formed by the application of a bead or by screen print of liquid elastomer or anaerobic sealer, which is then assembled in the uncured state.

IMPROVE JOINT DESIGN AND PERFORMANCE WITH LIQUID GASKETS

When you design the machines that make products for people, you have a lot to consider. For more detailed design guidelines and information, download our complete Liquid Gasketing Design Guide. It helps you build your dream machines.

Regionalization 1 Link | Regionalization 2 Link | Regionalization 3 Link



Your design partner

Imagine...the ability to **design in zero leak performance**

LOCTITE partners with you to design zero leak tolerance machines that perform better from the first run. We can help you in several ways:

- Supplying design tips and information in our Liquid Gasketing Design Guide. Download it here [LINK]
- Providing personal assistance from a Henkel Sales Engineer
- Developing a liquid gasketing technology suited to your specific needs

**FIND YOUR DESIGN FREEDOM.
PARTNER WITH LOCTITE TO
DESIGN YOUR NEXT PROJECT.**

DOWNLOAD OUR COMPLETE LIQUID GASKETING DESIGN POSTER HERE: