# Industry Insights Reveal Key Considerations for Using Grease with O-Rings in Vacuum Systems

*Experts explain when greasing O-rings can improve vacuum sealing performance — and when it may risk contamination, leaks, and system failure.*

Source: Pfeiffer Vacuum+Fab Solutions

ASSLAR, GERMANY, May 8, 2026 /EINPresswire.com/ -- After an extended period of use, the connections sealed by O-rings in a vacuum system may no longer be completely leak-free, and tightening the screws further does not help. One possibility to improve the seal is to grease the O-ring. But is this a good idea, or could this small change actually cause more problems than it solves in the vacuum application? Below, we will look at four reasons why greasing an O-ring can help – and four reasons why it can make things worse.

What is the purpose of an O-ring?
The purpose of an O-ring is to fill and compensate for any unevenness between two metallic sealing surfaces, such as flanges. This requires the flanges to be smooth and O-ring compression of approximately 20 to 30 % of its size.  Less than this will mean that the connection is not leak-tight; more than this could result in the O-ring being crushed and therefore compromised. The compression is precisely defined by a groove in a centering ring or in a flange. Because the depth of the groove physically limits how much the O-ring can be squeezed, the correct compression is set by the hardware design rather than how tight the screws are. Once the flanges have reached metal-to-metal contact at this limit, the O-ring is at its designed compression – tightening the screws further cannot increase the depth of the groove and will only add unnecessary stress to the joint.

Why do O-rings lose their tightness?
O-rings normally have a long lifetime under proper conditions. Leaks usually develop for two reasons:
1. Contamination introduced during installation. This can include dust, oils from the fingers, or

even residues from disposable gloves.
The contamination can often be resolved by opening the connection, carefully but thoroughly cleaning the O-ring, and resealing it.
Lint-free gloves are  essential during handling and installation to ensure that further residues are not introduced.
2.  Frequent opening and closing. Although O-rings are designed to provide a resealable connection – as opposed to a permanent seal like a welded or
brazed joint – repeated movement can scratch or deform the sealing surface, allowing air into the system.
In more demanding applications, such as those involving harsh chemicals, radiation or plasma, failure can be the result of the material itself degrading.
The choice of O-ring material is decisive here; perfluoro-elastomers are usually the most chemically resistant.

4 reasons why greasing an O-ring can be a good idea
1. Grease can fill surface unevenness
A small amount of grease can fill small imperfections in the surfaces, with the result that it can significantly reduce the leak rate.
2. Lower contact force becomes sufficient
Because grease assists the sealing action, it becomes possible to work with lower contact force and lower elastomer compression, reducing the potential
for a crushed and compromised O-ring, and therefore making it less likely to later develop a leak.
3. Slight swelling of the elastomer surface
Depending on the material combination, grease can diffuse into the elastomer's surface and cause it to swell slightly, which again helps compensate for
unevenness.
4. Rougher sealing surfaces become acceptable
Grease allows for a somewhat rougher sealing surface than would otherwise be acceptable without lubrication. This means that surfaces that are not – or
are no longer – perfectly smooth can still achieve a reliable vacuum seal, such as areas that have suffered normal wear or contain machining marks.

4 reasons why greasing an O-ring can be a bad idea
1. Grease contamination spreads easily
When handling lubricated components, the grease is readily transferred to other parts that may be more sensitive. Dust and dirt can also stick to it and
therefore introduce contamination and surface imperfections that would not otherwise have occurred.
2. Reduced space for thermal expansion
Excess grease can overfill the O-ring groove, leaving no room for thermal expansion of the elastomer. The elastomers that make up the O-ring can expand
more than ten times as much as the metal that surrounds them in the same temperature range.

Without the appropriate room to expand, they will deform and may no longer seal the gap.

3. Risk of grease entering the vacuum side

Due to its viscosity and high vapor pressure, small amounts of grease from the seal inevitably evaporate and distribute throughout the vacuum side. Over time, these deposits can also trap dust or outgas again. Mass spectrometers detect these traces easily. For many high-cleanliness applications, such as in research environments, they are unacceptable and could have a detrimental effect on the process or experiment.

4. Temperature-dependent behavior

Each grease type (such as mineral, silicone or perfluorinated) has a limited temperature range in which it is effective. Viscosity and lubrication properties vary strongly with temperature. Furthermore, if temperatures are too high, the grease can flow out of the groove, resulting in its sealing properties being reduced and the grease migrating to somewhere else where it should not be.

Conclusion – to grease or not to grease?

Before using vacuum grease on O-rings, the key question is: how clean must my vacuum be? When vacuum is used in the backing range with high gas flows and low temperatures – especially when also using oil-lubricated vacuum pumps – a little grease does no harm and can even help. However, in high-cleanliness environments, it is absolutely taboo so as to avoid any contamination.

If you decide to use grease, the rule “less is more” applies. The layer should be wafer-thin and almost dry to the touch to get the best performance from both the grease and the O-ring.

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