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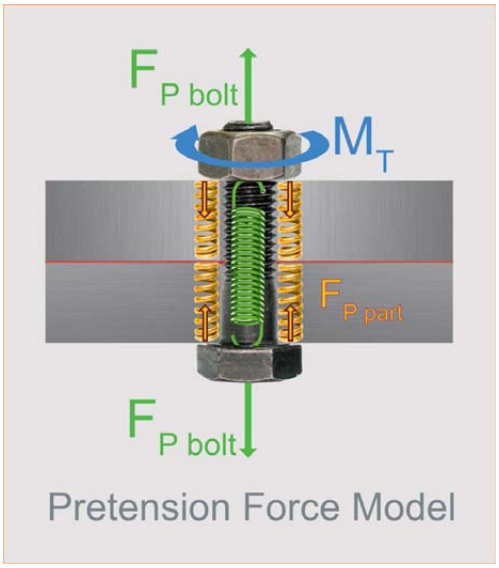
Do Bolts Require Lubrication?

Millions of various screws are used to connect components every year. Yet often it is not known, or at least not sufficiently appreciated, that bolts and lubricants are indispensably linked.

The function of a threaded connection is based on its ability to build up pretensioning force between parts to be connected. The applied tightening torque is translated via the thread pitch into the resulting preload force. **Without lubrication, the friction losses of combined head- and thread-friction reach values up to 90%.** That means only 10% of the tightening torque is available to apply pretension force. A defined friction value with low variation is an absolutely mandatory product feature for all threaded connections. The mechanical elements, used fastener, and lubricant are parts of a tribological system. Pretensioning force, coefficient of friction, and tightening torque are mathematically connected. Lubrication is the system's central element. It is important to know that there are many parameters for the tribological system of part and bolts. So while one and only lubricant for all applications is not possible, the best solution can still be found based on a set of selection criteria.



Pretension Force Model

Standard Guideline No. 1: No Threaded Connection Without Lubrication

Main issues regarding insufficient lubrication:

1) Pretension Load Out of Spec

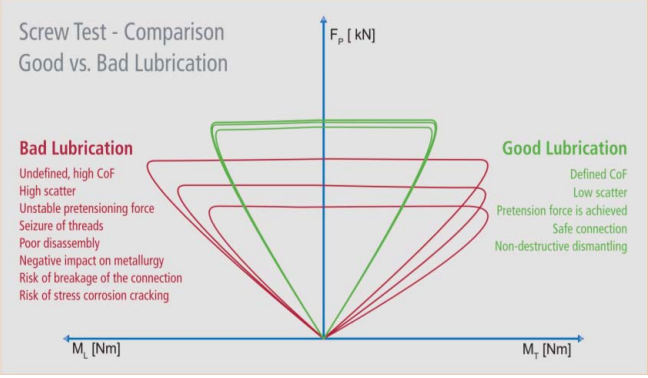
- This problem may result in leakages (flanges or oil pans) when the used fasteners show different pretensioning force from screw to screw.
- **Too low pretensioning force (as a result of too high friction) can trigger self-loosening of screws.**
- **Too high pretensioning force in combination with dynamic loads could lead to the yield strength of screws being exceeded, with subsequent loss of elasticity leading to breakage.**

2) Seizure of Threads

Seizure of threads can occur during tightening of screws - for materials such as austenitic steels or zinc platings this is very likely, while other material combinations show high friction values and high scatter. In the case of bolts made of high-temperature steels, thermal expansion can lead to high specific surface pressures on thread flanks: the yield point is exceeded and welding occurs.

3) Corrosion

Water and/or oxidizing gases penetrate the thread area - this causes the screw to seize up due to rust - normal loosening of the connection becomes impossible. Rust formation blocks the thread and make it impossible or much more difficult to dismantle the screw as intended.



4) Cracks, Material Brittleness, Stress Corrosion Cracking, Fretting Corrosion

High-strength and heat-resistant screws are susceptible to cracks or stress corrosion, cracking under certain conditions. The presence of elements such as chlorine, fluorine, sulphur, lead, or aluminium accelerate the effects. Lubricants have to be formulated with metallurgical compatibility in mind.

Fretting corrosion is an extremely effective wear mechanism - parts must be protected with highly-effective specialty lubricants.

5) High Torsional Load During Tightening - Risk of Breakage

High friction automatically generates high torsional stress, which can lead to premature screw breakage.

Standard Guideline No. 2: Fastener Lubrication is a Specialist Issue

How to Select the Right Lubricant

The following graphic shows the parameters that are crucial to selecting the right lubricant for a given threaded connection. The selection guide is based on tribological system elements, combined with practical experience and knowledge of the specific market segment.

Summary Various fasteners, materials, application and service conditions, specifications etc. require specific lubricant solutions. Many world leading lubricant solutions providers (e.g., COVENTYA and microGLEIT) are capable of offering these solutions to make it work and last.