

Close contact

Failure of stainless steel threaded connections can have massive knock-on consequences. Dow Corning's **Phil Grellier** tells O&G how these failures can be reduced by simply choosing the right anti-seize paste.

When engineers at an oil drilling company started experiencing unacceptable failure rates in stainless steel threaded connections on its massive oil drilling equipment, the situation created some serious problems. Each time the stainless drill components had to be removed from service for repair at a specialty machine shop offsite, the firm not only incurred the expense of extra labour, shipping and refacing the damaged threads, but it also lost the critical sections for up to a week of field service.

Steerable rotary drilling systems are comprised of multiple segments, with critical sections made of stainless steel. Each stainless component is secured with 4-1/2" or 6-5/8" API threaded connections, tightened to standard torque values of 32,000 and 62,000 lbs- ft or 43,400 and 84,100 Newton metres (Nm) respectively.

As this company moved toward commercialising its newest generation of rotary steerable drilling systems, one of its design teams consulted with Dow Corning to investigate a possible reason for the thread damage: a traditional anti-seize paste appeared to be failing under the immense torque required to assemble the components. The investigation revealed the traditional anti-seize pastes contained a number of different metal-based lubricating solids, including chromium, copper, nickel and molybdenum. Stainless steel also contains molybdenum, chromium and nickel, which do not readily react with oxygen; therefore, only very thin metal-oxide layers are formed. Once the oxide layer is damaged by abrasion the oxide-free metal seizes under extreme pressure.

Additionally, the solid lubricants found in the traditional paste re-form oxide layers, which are again removed during abrasion. This cycle continues in a manner where oxide layers and particles build up, clogging thread clearances so the metal components cannot be disassembled. Also, traditional pastes contain sulfur, phosphorous, zinc and lead-based

compounds that can cause stress corrosion cracking and embrittlement. Both lead to grain-boundary cracks which propagate until bolt fracture occurs. According to this company's records, failure rate was around 25 percent.

Finding a solution

Dow Corning and engineers of this drilling company worked together to develop a list of criteria for the application. They knew they would need an anti-seize compound formulated to provide adhesion to the stainless steel connections that could create and maintain an effective lubricating film despite the extreme loads, contaminants and temperatures of an oil drilling environment. Further, the formulation should have low sulfur and halogen content, with a minimum of phosphorous, zinc,

lead and other metals that can contribute to stress cracking or embrittlement.

The replacement material selected was Molykote P-37 Paste that forms a continuous lubricating film with high contact adhesion that withstands extreme forces of drilling applications, contributing to excellent sealing and facilitating disassembly without thread deformation. In fact, the formulation has proven so successful that the drilling equipment manufacturer reports an immediate drop in thread-related failures of more than 50 percent.

Molykote P-37 achieves excellent load-carrying capacity and temperature range of -40°F to 2550°F (-40°C to 1400°C) by containing a synergistic blend of metal-free solid lubricants delivering outstanding seize protection, even under severe operating conditions. Molykote P-37 is approved for use on threaded connections by power plant turbine and steam valve manufacturers.

Molykote P-37 Anti-Seize Paste delivers outstanding purity for critical applications, containing less than 200 ppm total halogen content (including chlorine, fluorine and bromine) and less than 500 ppm sulfur content (sulfur contributes to stress corrosion cracking). The odourless, grey metal-free paste is extremely stable under difficult service conditions, giving it excellent durability. It is not classified as hazardous waste upon disposal, and poses no known health or environmental risks from transportation or use. The result is that Molykote P-37 Anti-Seize Paste has proven its ability to form a durable lubricating film in threaded connections requiring 32,000 and 62,000 lbs- ft or 43,400 and 84,100 Newton meters (Nm) of torque. Drilling engineers have found that the lubricant adheres tenaciously to the stainless steel components, facilitating easy disassembly when required and helping to reduce failures. ■



Phil Grellier is Global Strategic Marketing Manager for Dow Corning and based in Europe for the MRO Markets, where oil and gas is one focus segment. He is a trained industrial chemist with specific experience in electro-coating metallurgy and corrosion protection and has spent 28 years with Dow Corning working within engineering or maintenance applications of Dow Corning and Molykote products. He has also worked in technical sales, commercial management, strategic marketing and solutions/service development.

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MOLYKOTE® Specialty Lubricants for the Oil & Gas Industry Trusted Performance. Smart Lubrication.

No matter how harsh the environment or extreme the temperature, Molykote® brand specialty lubricants tackle your toughest lubrication challenges and deliver the performance you need. We call them Smart Lubrication™ solutions because they reliably extend equipment life and always simplify yours.

Our Molykote line of specialty lubricants includes greases, pastes, anti-friction coatings, and silicone compounds. All are formulated to help you achieve the highest levels of equipment productivity and operation reliability with the lowest levels of service downtime and repair expense. And, you can rely on our support for innovation and expertise in lubricant selection, field application, and maintenance optimization.

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Lubricating Pastes: Equipment Protection

High concentrations of solid lubricant powders fill metal voids to reduce friction and wear. Even under crushing pressures and searing temperatures, they maintain lubricity and reliably enable easy, non-destructive dismantling of screw connections and bolted metal joints.

Anti-Friction Coatings: Corrosion Prevention

Solid lubricants as well as a binder are dispersed in a solvent carrier. Once applied, a dry lubricating film provides long-term corrosion prevention and high load-carrying capacity. These coatings are ideal for long-lasting, reliable lubrication on inaccessible parts in dusty environments.



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Molykote Smart Lubrication solutions are available worldwide. To learn more about how our extensive product line and service capabilities can help you solve or prevent your toughest lubrication challenges, contact a local representative, visit www.molykote.com, or email industrial@dowcorning.com. Technical Information Center: +49 (0)611 237 778 (English); +49 (0)611 237 779 (German); +49 (0)611 237 773 (French)

Molykote® Brand Paste	Operating Temperature, °C (°F)	Physical Form
Molykote® P-37 Paste	Base Oil: -40 to 121 (-40 to 250) Solid Lubricant: -40 to 1400 (-40 to 2550)	Black, metal-free paste of solid lubricants in ultrapure, low-sulfur, partly synthetic oil
Molykote® G-n/G-n Plus Paste	Base Oil: -25 to 121 (-13 to 250) Solid Lubricant: -25 to 450 (-13 to 842)	Gray-black paste of MoS ₂ and other lubricating solids in mineral oil
Molykote® G-Rapid Plus Paste	Base Oil: -35 to 150 (-31 to 300) Solid Lubricant: -35 to 450 (-31 to 842)	Black paste of solid lubricants in mineral oil
Molykote® 1000 Paste	Base Oil: -30 to 121 (-22 to 250) Solid Lubricant: -29 to 650 (-20 to 1202)	Brown, mineral oil-based paste containing solid lubricants, powdered metals, and corrosion inhibitors
Molykote® P-40 Metal-Free Paste	Base Oil: -40 to 230 (-40 to 446) Solid Lubricant: -40 to 1200 (-40 to 2192)	Yellow-brown, metal-free paste containing corrosion inhibitors and white solid lubricants in synthetic oil

Molykote® Brand Anti-Friction Coating	Operating Temperature, °C (°F)	Solid Lubricant	Cure	Color
Molykote® D-708 Anti-Friction Coating	-180 to 240 (-292 to 464)	PTFE	180°C (356°F), 60 min 200°C (392°F), 20 min	Glossy Black
Molykote® 3402 C Anti-Friction Coating	-200 to 310 (-328 to 590)	MoS ₂	Ambient, 15 min Complete cure 2 hrs	Gray
Molykote® 321/D-321 R Dry Lubricant	-180 to 450 (-292 to 842)	MoS ₂	Ambient, 25 min Complete cure 4 hrs	Gray-Black
Molykote® 3400A Anti-Friction Coating, Lead-Free	-198 to 430 (-325 to 806)	MoS ₂	200°C (392°F), 30 min	Gray

Greases: Severe-Duty Performance

Solid lubricants are blended with fluid carriers to form high-quality greases for extreme-pressure lubrication, reliable equipment operation, and extended service intervals. Contaminants are kept out as the solid lubricating film adheres to metal and plastic surfaces.

Silicone Compounds: Specialized Needs

Silicone oils and greases meet lubricating needs for improving reliability of equipment and instruments operating with lighter loads in adverse environments. Fluorosilicone lubricants provide outstanding oil and gas resistance on a wide range of process equipment from compressors to vacuum pumps.



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Cut your production downtime and service costs with trusted protection from Molykote® brand specialty lubricants. Our Smart Lubrication™ solutions can improve operation reliability, extend equipment life, and capture real savings.

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