

Oil Drilling Equipment Manufacturer Reduces Thread Failures with *Molykote*[®] P-37 Anti-Seize Paste

Customer

Noble Drilling Corporation—A global leader in the development and implementation of drilling technologies for the oil industry.

Location

Headquarters in Sugar Land, Texas

Challenge

Find a high-performance lubricant that can withstand extremely high torque in stainless steel threaded connections to prevent cold welding or galling of the sealing surfaces and reduce an unacceptable failure rate.

Solution

Dow Corning's *Molykote* team met with Noble engineers and examined the failed connections, which displayed galling and thread defects. It was determined that the existing anti-seize compound was being squeezed out by the extremely high torque, so Dow Corning recommended *Molykote*[®] P-37 Anti-Seize Paste.

Results

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 ft-lbs 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.

When engineers at Noble Drilling Corporation 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 labor, shipping and refacing the damaged threads, 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 ft-lbs, respectively.

As Noble moved toward commercializing its newest generation of rotary steerable drilling systems, one of its design teams consulted with Dow Corning to investigate a possible culprit for thread damage: a traditional anti-seize paste appeared to be failing under the immense torque required to assemble the components.

The investigation revealed the use of traditional anti-seize pastes containing a number of different metals-based lubricating solids, including chromium, copper, nickel and molybdenum. Stainless steel also contains molybdenum, chromium and nickel, which do not like to 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 which can cause stress corrosion cracking and embrittlement. Both lead to grain-boundary cracks which propagate until bolt fracture occurs. According to Noble's records, failure rate was around 25%.

Finding a Solution

Dow Corning and Noble engineers 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



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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, an ultrapure anti-seize compound designed specifically for austenite steel and steel alloy threaded connections. The high-viscosity paste 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 Noble reports an immediate drop in thread-related failures of more than 50%.

Molykote® P-37 achieves excellent load-carrying capacity and temperature range of -22°F to 2550°F (-30°C to 1440°C) by containing a synergistic blend of metal-free solid lubricants delivering outstanding seize protection, even under severe operating conditions.



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Molykote® P-37 is approved for use on threaded connections by power plant turbine and steam valve manufacturers, which are notoriously difficult lubrication applications.

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 250 ppm sulfur content (sulfur contributes to stress corrosion cracking). Additionally, *Molykote*® P-37 Anti-Seize Paste's high purity metal-free solid lubricants result in better protection from solder embrittlement, making non-destructive disassembly more likely.

The odorless gray 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. Standard personal protection (safety glasses at minimum) and industrial housekeeping procedures are recommended.

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