DOVERLUBE NCL-2P
PHOSPHORUS BASED LUBRICANT ADDITIVE

Doverlube NCL-2P is a proprietary, phosphorus-based anti-wear additive that exhibits and enhances extreme Pressure (EP) properties. It can be utilized to enhance performance in rolling oils and other related metal forming operations. Additionally, **NCL-2P** can be incorporated into metal removal formulations inclusive of cutting oils to enhance EP performance. **NCL-2P** exhibits a lower to moderate range viscosity offering benefits in material handling, while maximizing performance.

Doverlube NCL-2P is non-corrosive on both steel and yellow metals. The test results found below demonstrate no contribution to corrosion.

Corrosion Tests	
Test	**Doverlube NCL-2P**
Copper corrosion (3 hours @ 150°C)	1A
Steel Panel Test [1]	Pass

The Steel Panel stain test was run by coating two panels with a 50/50 additive and GPII base oil mix. Panels were then pressed together for 2hrs @ 120C, followed by continued aging at 60C for an additional 12hrs. Panels were separated with one beingstoredin ambientconditionsandtheotheraging ina humiditycabinetfor4hrs.Panelswerethenmeasuredforstainandcorrosion.

PERFORMANCE EVALUATION DATA

Doverlube NCL-2P offers good load carrying capabilities. ASTM D-3233 results at 5% loading levels in Paraffinic basestock (100SUS) yielded full load performance.

Falex Pin and Vee Block ASTM D-3233 (4500 lbs.)	
Doverlube NCL-2P @ 5%	Pass

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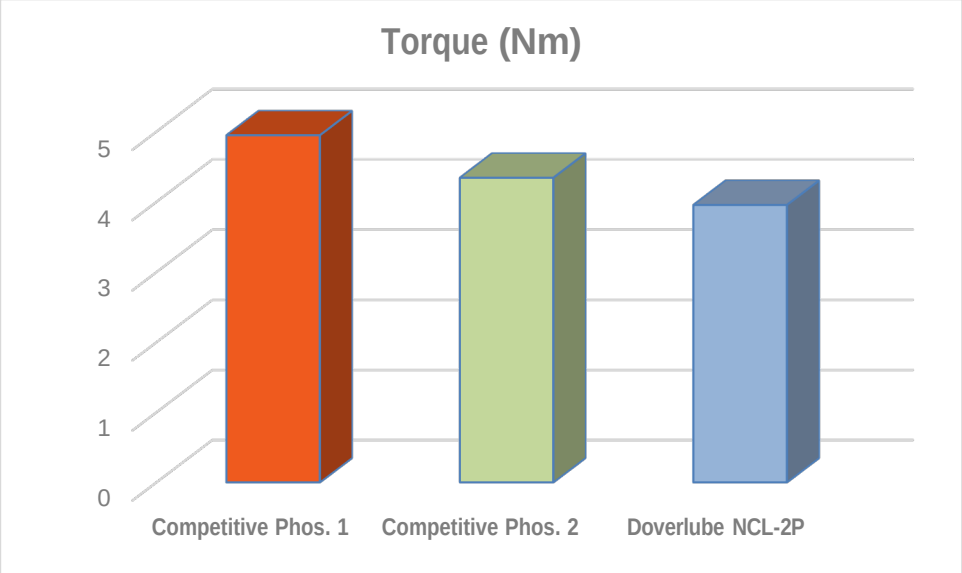
Additionally, 4-Ball Wear Testing under standard ASTM procedures D-4172 yields improved wear scar and CoF performance vs. other phosphorus-based chemistries.

Four Ball Wear Test			
	Load (kg)	**Wear Scar Width (mm)**	**CoF**
ASTM D-4172A NCL-2P (5% in GPII)	15 kg	0.217	0.086
ASTM D-4172B NCL-2P (5% in GPII)	40 kg	0.823	0.099

Machineability data utilizing **Doverlube NCL-2P** shows improved efficiency and lower torque generation for aluminum substrates. The below Microtap torque values were performed on 6061 Aluminum at 2% loading. Testing was completed under ASTM D-8288-19 procedures at 1,000 rpm utilizing a form tap.

Additive	Torque (Nm)	Variability (+/-)
Competitive Phos. 1	1.714	0.012
Competitive Phos. 2	1.661	0.008
Doverlube NCL-2P	1.647	0.012

Doverlube NCL2-P shows good performance benefits in the process of machining steel compared to other Phosphorus chemistries. Microtap form tap testing results demonstrated improved torque reduction with **NCL-2P** vs. other competitive chemistries on carbon steel.



ASTM D-8288-19 Carbon Steel; form tap, 400rpm, 5% additive in 100 Nap. Basestock.

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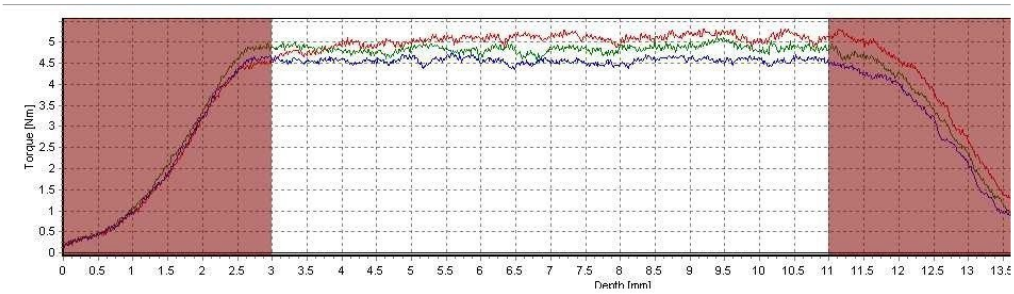
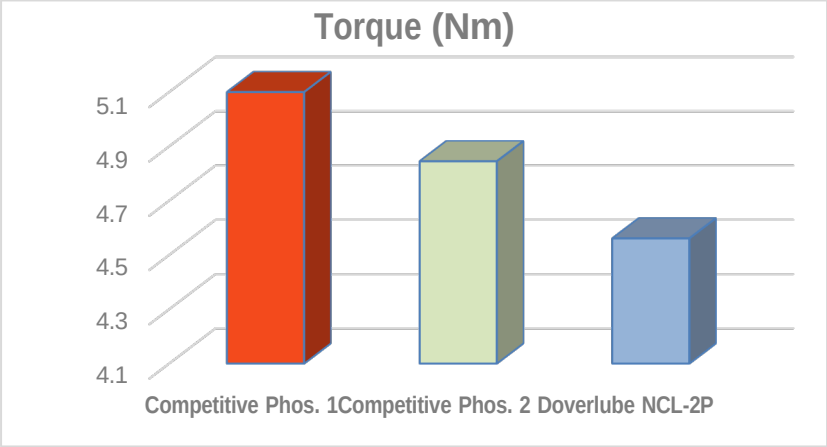
The above trend in **Doverlube NCL-2P** performance benefits improved when tapping speeds increased to 500rpm on carbon steel evaluations as shown below.



ASTM D-8288-19 Carbon Steel; form tap, 400rpm, 5% additive in 100 Nap. Basestock.



Doverlube NCL-2P is readily soluble in a range of paraffinic and naphthenic base stocks offering flexibility for formulation needs. **Doverlube NCL-2P** is non-corrosive to both ferrous and non-ferrous surfaces. **Doverlube NCL-2P** is based on natural chemistry and can exhibit titer at lower temperatures. To reverse this, heat with mixing until titer crystals fully solubilize.

TYPICAL PROPERTIES

Property	Typical Result
Appearance	Transparent, brown fluid
Odor	Mild, fatty
Viscosity, SUS @ 100°F	4,800
Specific Gravity @ 50°C	0.98
Phosphorous (%)	3.0
Acid number, mgKOH/g	130

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