Vanderbilt Chemicals, LLC
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Chemicals Technical Data
Distributed in the Interest of Product Development

VANLUBE™ W-324

Tungsten Lubricant Additive

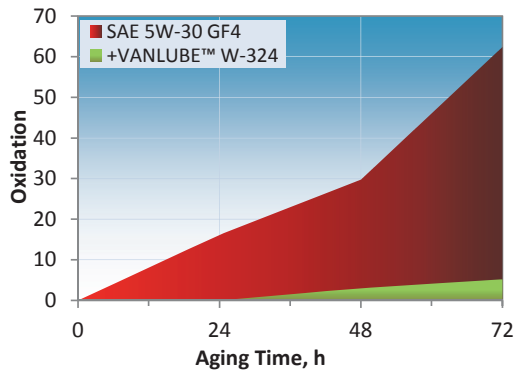
Antiwear Agent *Antioxidant*

Typical Properties	
Physical State:	Liquid
Density at 25°C, Mg/m³:	1.06
Flash Point, PMCC, °C:	175
Nitrogen Content, %:	0.5-2.1
Tungsten Content, %	13-16
Viscosity @ 40°C, mm²/s	177-269

VANLUBE W-324 Lubricant Additive is an organotungstate which is soluble in petroleum and synthetic lubricants. It is an effective general purpose, sulfur and phosphorus free antioxidant and antiwear agent for a wide range of automotive and industrial lubricants.

VANLUBE W-324 is most effective at elevated temperatures and extends the life of conventional antioxidants, antiwear additives, and corrosion inhibitors in oxidatively stressed oils.

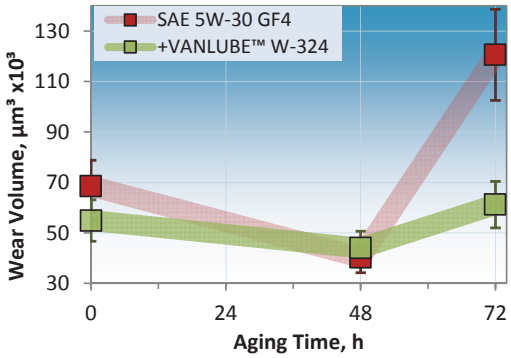
Oxidative Stability



HTCBT* Corrosion TEST
*165°C, 0-72h; 750 ppm W
ASTM D7214 FTIR
Oxidation

VANLUBE W-324 provides superior overall oxidative stability to this fully formulated 5W-30 oil. Oxidation is monitored by the increase in oxidative decomposition products via FTIR. The **VANLUBE W-324** treated oil at 72 hours is equivalent to the 5W-30 base formulation at 7 hours.

Wear Retention After Aging



HTCBT* Corrosion TEST
*165°C, 0-72h; 750 ppm W
SRV® ASTM D5707
140°C, 2 hours, 200N, 50Hz, 1mm

VANLUBE W-324 protects primary wear additives from oxidation so they last longer. Even with aging, this fully formulated 5W-30 motor oil treated with **VANLUBE W-324**, maintains 100% wear retention.

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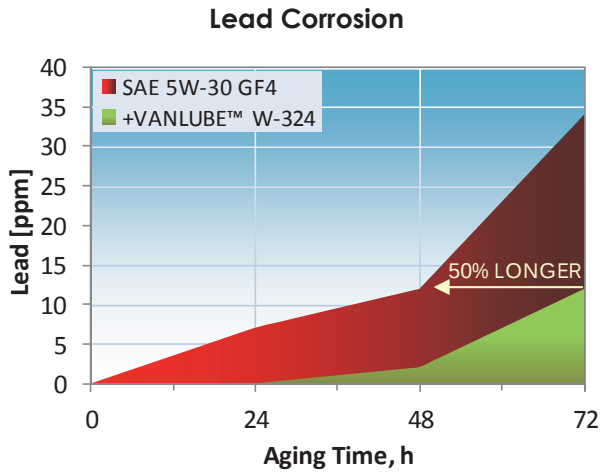
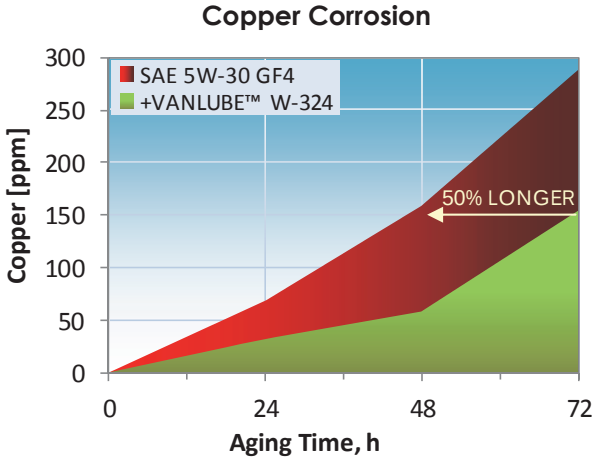


HTCBT* Corrosion TEST
*165°C, 0-72h; 750 ppm W
ICP Analysis

VANLUBE™ W-324 Tungsten Lubricant Additive provides superior lead corrosion protection to this fully formulated 5W-30 oil. The oil with **VANLUBE W-324** resists Pb corrosion almost twice as long as the base formulation.



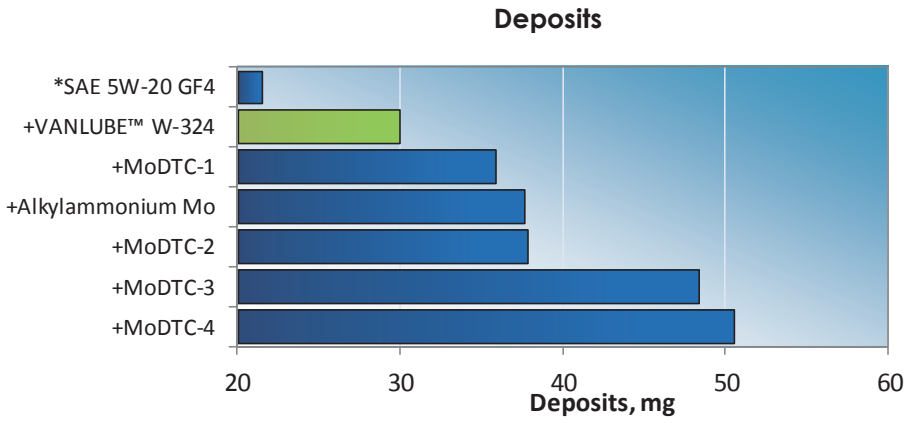
HTCBT* Corrosion TEST
*165°C, 0-72h; 750 ppm W
ICP Analysis

VANLUBE W-324 provides superior copper corrosion protection to this fully formulated 5W-30 oil. The oil with **VANLUBE W-324** resists Cu corrosion almost twice as long as the base formulation.

VANLUBE W-324 is more deposit resistant than molybdenum containing additives.

ASTM D6335: TEOST® 33C
700 ppm W or Mo
*Base Formulation has no Significant Mo Content

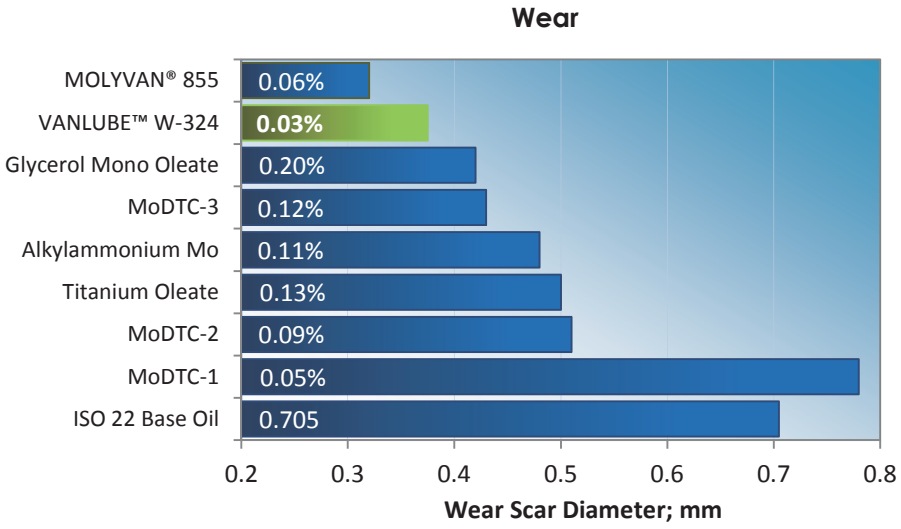
VANLUBE W-324 resists deposit formation more effectively than molybdenum when exposed to high temperatures.



VANLUBE™ W-324 Tungsten Lubricant Additive is an effective antiwear agent at very low concentrations.

ASTM 4172*: Four Ball Wear
*1800 rpm; 54°C; 1 h. @ 20 kgf
50 ppm metal where applicable
% = Weight Percent of Additive

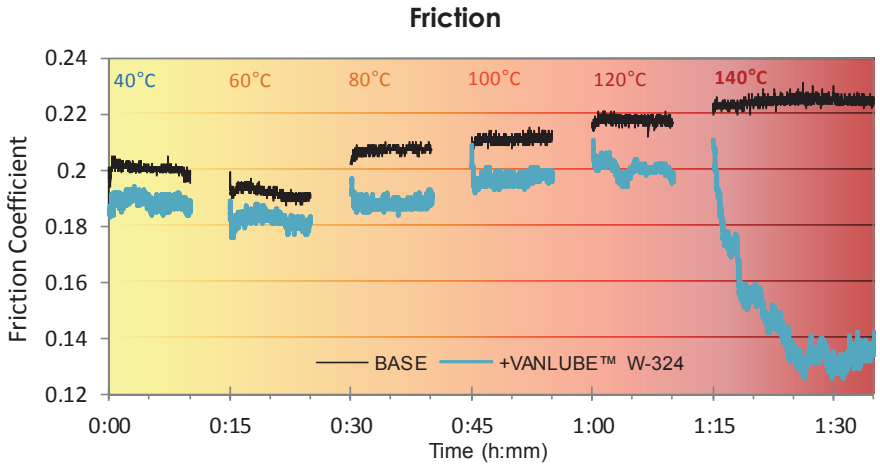
In the Four Ball Wear test, **VANLUBE W-324** provides excellent antiwear protection with only 50 ppm of tungsten, and at half the charged weight of its nearest competitor.



VANLUBE W-324 has a higher activation temperature than molybdenum for friction modification.

SRV® Friction Test
Ball on Disc; 4N; 20 Hz; 10 min @ *X* °C followed by 5 min hold
Base= ISO 32 Group II with: ADPA (1%), ZDDP (600ppm P), and Dispersant (3.9%),
700ppm Tungsten from **VANLUBE W-324**

VANLUBE W-324 activates at elevated temperatures to provide friction modification.



VANLUBE W-324 can be added to motorcycle oil without impairing transmission performance.

JASO T 904:2006 FRICTION			
Test Parameters	**MA-1 Specs**	**Commercial Oil**	**Oil + VANLUBE™ W-324 (100 ppm W)**
DFI Short shift, not too slow or abrupt	≥1.45 to <1.80	1.62	1.65
SFI Clutch holding power during acceleration	≥1.15 to <1.70	1.55	1.50
STI Clutch holding power during de-acceleration	≥1.55 to < 1.90	1.67	1.62

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