



Vanderbilt Chemicals, LLC

A Wholly Owned Subsidiary of R.T. Vanderbilt Holding Company, Inc.

Chemicals Technical Data

Distributed in the Interest of Product Development

VANLUBE™ W-324

Tungsten Lubricant Additive

Antiwear Agent

Antioxidant

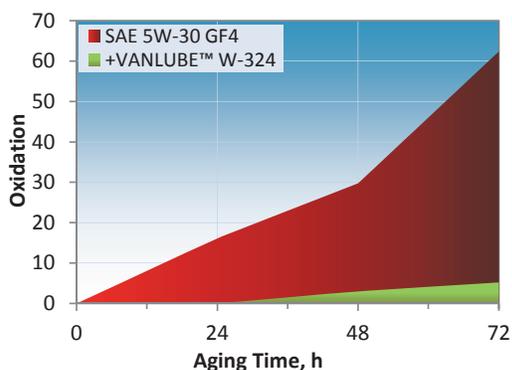
Typical Properties

Physical State:	Liquid
Density at 25°C, Mg/m ³ :	1.06
Flash Point, PMCC, °C:	175
Nitrogen Content, %:	0.5-2.1
Tungsten Content, %:	13-16
Viscosity @ 40°C, mm ² /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

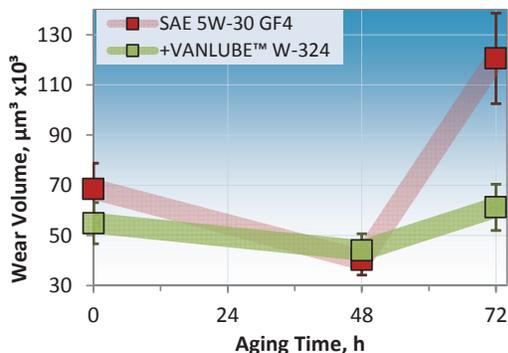
*165°C, 0-72h; 750 ppm W

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

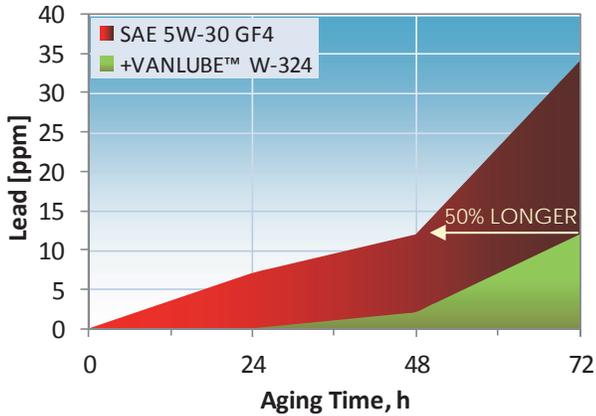
140°C, 2 hours, 200N, 50Hz, 1mm

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.

Vanderbilt Chemicals, LLC, 30 Winfield Street, P.O. Box 5150, Norwalk, CT 06856-5150
P: (203) 853-1400 • F: (203) 853-1452 • vanderbiltchemicals.com

Before using, read, understand and comply with the information and precautions in the Safety Data Sheets, label and other product literature. The information presented herein, while not guaranteed, was prepared by technical personnel and, to the best of our knowledge and belief, is true and accurate as of the date hereof. No warranty, representation or guarantee, express or implied, is made regarding accuracy, performance, stability, reliability or use. This information is not intended to be all-inclusive, because the manner and conditions of use, handling, storage and other factors may involve other or additional safety or performance considerations. The user is responsible for determining the suitability of any material for a specific purpose and for adopting such safety precautions as may be required. Vanderbilt Chemicals, LLC does not warrant the results to be obtained in using any material, and disclaims all liability with respect to the use, handling or further processing of any such material. No suggestion for use is intended as, and nothing herein shall be construed as, a recommendation to infringe any existing patent, trademark or copyright or to violate any federal, state or local law or regulation.

Lead Corrosion



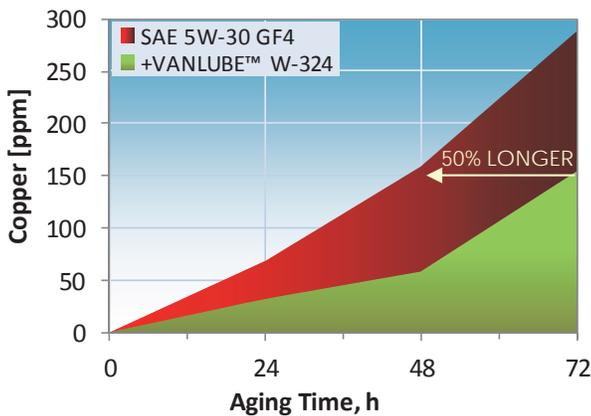
HTCBT* Corrosion TEST

*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.

Copper Corrosion



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.

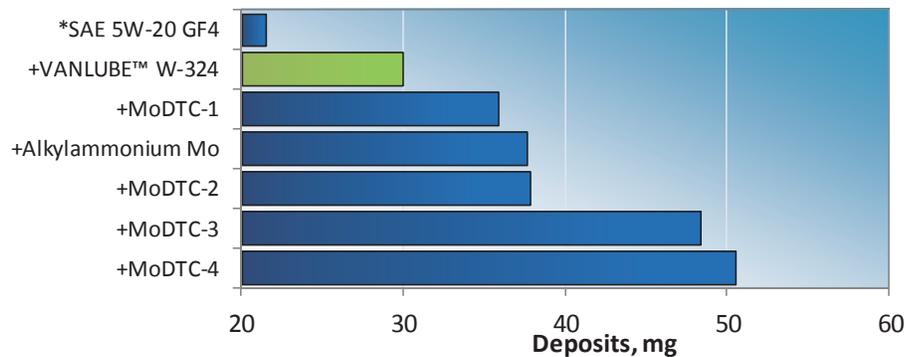
Deposits

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.

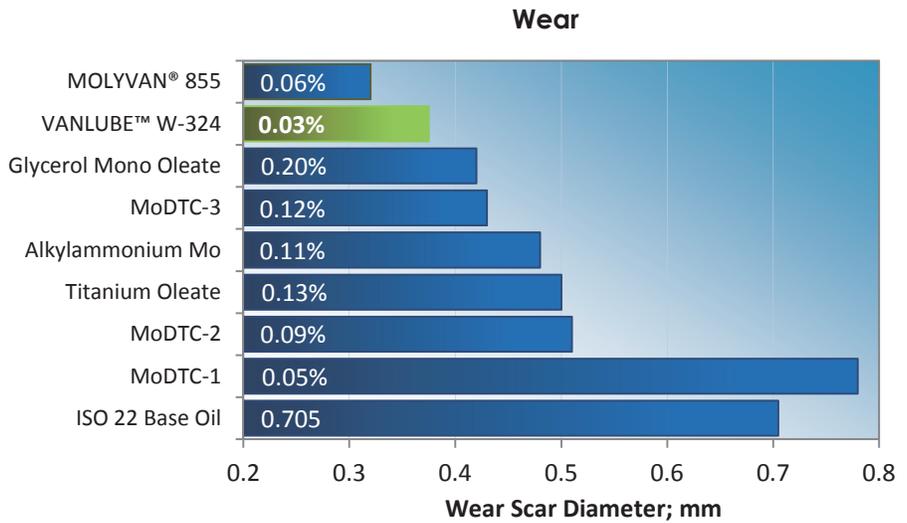
ASTM 4172*: Four Ball Wear

*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.



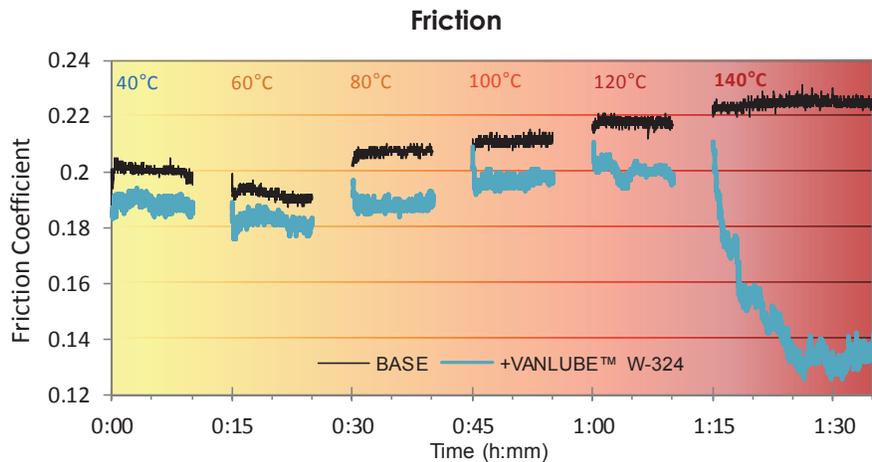
VANLUBE W-324 has a higher activation temperature than molybdenum for friction modification.

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

Registered and pending trademarks appearing in these materials are those of Vanderbilt Chemicals, LLC. For a complete trademark listing, please visit the About section at www.vanderbiltchemicals.com.