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LUBRICANT

ADDITIVES

LUBRICANT ADDITIVES

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VANDERBILT CHEMICALS, LLC
CERTIFIED TO ISO 9001:2015
10002461

NSF® Certified

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CONTACT

CUVAN®	MOLYVAN®	NACAP®	VANLUBE®	VANCHEM®
Corrosion Inhibitor	Antiwear Compound Friction Reducer	Corrosion Inhibitor Metal Deactivator	Lubricant Additive	Corrosion Inhibitor Metal Deactivator

Committed to the European Market

Our team of highly trained professionals, dedicated strictly to the lubrication market, gives us the ability to be responsive to your needs from both a technical as well as a commercial perspective, and in doing so provide a level of service second to none.

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		Aromatic Amines	Hindered Phenols	Sulfur Compounds	Organo-molybdenum	Other							
3	**CUVAN® 303**							♦					
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6	**NACAP®**							♦		♦			
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7	**VANCHEM NATD**							♦		♦			
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8	**VANLUBE PA**					♦							
8	**VANLUBE RD**	♦											
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10	**VANLUBE RI-A**										♦		
10	**VANLUBE RI-G**										♦		
10	**VANLUBE RI-BSN**										♦		
11	**VANLUBE RI-CSN**										♦		
11	**VANLUBE RI-ZSN**										♦		
11	**VANLUBE TK-100**												♦
12	**VANLUBE W-324**						♦		♦				♦
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Page	Product	Category											
		Antioxidants					Antiwear & Extreme Pressure Additives	Metal Deactivators	Friction Reducers	Chemical Intermediates	Rust Inhibitors	Multi-Purpose Additive Packages	Other
		Aromatic Amines	Hindered Phenols	Sulfur Compounds	Organo-molybdenum	Other							
14	**VANLUBE® 407**					♦							
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15	**VANLUBE 622**						♦		♦				
15	**VANLUBE 672**						♦						
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18	**VANLUBE 829**						♦						
18	**VANLUBE 871**						♦						
18	**VANLUBE 887**	♦											
19	**VANLUBE 887E**	♦											
19	**VANLUBE 887 FG**	♦											
19	**VANLUBE 961**	♦											
20	**VANLUBE 972M**						♦						
20	**VANLUBE 972 NT**						♦						
20	**VANLUBE 981**			♦									
21	**VANLUBE 996E**			♦									
21	**VANLUBE 0902**											♦	♦
21	**VANLUBE 1202**	♦											
22	**VANLUBE 1305**												♦
22	**VANLUBE 2305**	♦	♦										
22	**VANLUBE 7611M**						♦						
23	**VANLUBE 7723**			♦									
23	**VANLUBE 8610**			♦			♦						
23	**VANLUBE 8912E**										♦		
24	**VANLUBE 9123**						♦				♦		
24	**VANLUBE 9317**	♦											
24	**TPS® 20**						♦						
25	**TPS 32**						♦						
25	**TPS 44**						♦						

This brochure contains brief descriptions of most of the products sold by Vanderbilt Chemicals, LLC to the lubricating oil and grease industry. The products not included in this brochure are either experimental, or those that are only available on a local basis. We also welcome inquires with regard to custom-made lubricants or joint research projects. For more detailed information, please contact your Vanderbilt Worldwide Technical Sales Representative, or email us at info@vanderbiltworldwide.com.

Vanderbilt Chemicals, LLC will continuously improve all products and services to consistently meet customer expectations the first time and every time.

Quick-Scan

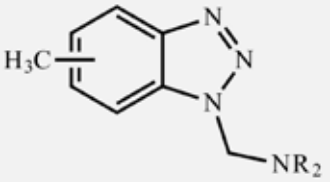
APPLICATION/ FUNCTION GUIDE

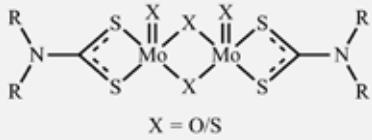
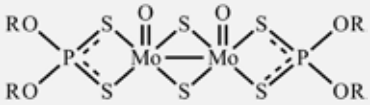
APPLICATION	CUVAN® 303	CUVAN 313	CUVAN 484	CUVAN 826	MOLYVAN® A	MOLYVAN L	MOLYVAN FEI Plus	MOLYVAN 807 NT	MOLYVAN 822 NT	MOLYVAN 855	MOLYVAN 3000	NACAP®	VANCHEM™ DMTD	VANCHEM NATD	VANLUBE® AZ	VANLUBE BHC	VANLUBE EZ	VANLUBE PA	VANLUBE RD	VANLUBE RI-A	VANLUBE RI-G	VANLUBE RI-BSN	VANLUBE RI-CSN	VANLUBE RI-ZSN	VANLUBE SB	VANLUBE SN	VANLUBE SS	VANLUBE TK-100*	VANLUBE W-324	VANLUBE 73	VANLUBE 73 Super Plus	VANLUBE 81	VANLUBE 289
Coolant												✓	✓	✓																			
Water-Based Fluids												✓	✓	✓																			
Auto Transmission Fluid	✓	✓													✓	✓		✓								✓	✓					✓	✓
Compressor Oil	✓	✓	✓	✓											✓	✓		✓								✓	✓			✓		✓	✓
Engine Oil	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓				✓	✓		✓							✓	✓	✓		✓	✓		✓	✓
Fuel	✓	✓		✓																													
Gear Oil	✓	✓	✓	✓		✓		✓	✓		✓				✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓
Grease	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hydraulic Oil	✓	✓	✓	✓												✓		✓		✓	✓	✓	✓	✓		✓							
Metalworking	✓	✓	✓	✓		✓				✓			✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓		✓					✓
Rust Preventive															✓					✓	✓	✓	✓	✓				✓					
Synthetic Lube	✓	✓			✓	✓		✓	✓		✓				✓	✓	✓	✓	✓							✓	✓		✓	✓		✓	
Turbine Oil	✓	✓	✓	✓												✓		✓		✓		✓	✓	✓		✓	✓					✓	
FUNCTION																																	
Ashless	✓	✓	✓	✓									✓			✓		✓	✓	✓	✓					✓	✓					✓	✓
High Temp.					✓																						✓		1			✓	
Antioxidant			2	2	2	2	1	2	2	2	2	2			1	1	1	1	1							1	1			2	2	1	
Antiwear/ Antiscuff			2		1	1	1	1	1	1	1				2		1								2				1	2	1		1
Friction Reducer					1	1	1	1	1	1	1																		1	2			1
Corrosion Inhibitor	1	1	1	1			2					1	1	1	2					2	2	2	2	2									
Demulsifier																						2	2	2									
Chemical Intermediate												1	1	1																			
Extreme Pressure					2	2		2	2		2						1								1					1	1		
Metal Deactivator	1	1	1	1								1	1	1	2																		
Rust Inhibitor																				1	1	1	1	1									

✓ = Application/Function 1 = Primary Function 2 = Secondary Function * = Tackifier

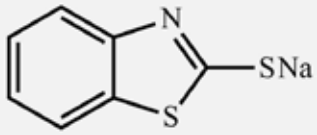
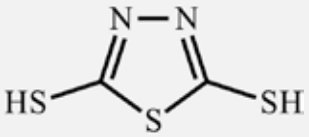
APPLICATION	VANLUBE® 289 HD	VANLUBE 407	VANLUBE 601	VANLUBE 601E	VANLUBE 622	VANLUBE 672	VANLUBE 672E	VANLUBE 692	VANLUBE 692E	VANLUBE 704S	VANLUBE 719	VANLUBE 727	VANLUBE 739	VANLUBE 829	VANLUBE 871	VANLUBE 887	VANLUBE 887E	VANLUBE 887 FG	VANLUBE 961	VANLUBE 972M	VANLUBE 972 NT	VANLUBE 981	VANLUBE 996E	VANLUBE 0902	VANLUBE 1202	VANLUBE 1305	VANLUBE 2305	VANLUBE 7611M	VANLUBE 7723	VANLUBE 8610	VANLUBE 8912E	VANLUBE 9123	VANLUBE 9317
Coolant																																	
Water-Based Fluids																																	
Auto Transmission Fluid	✓											✓	✓			✓	✓	✓	✓				✓					✓					
Compressor Oil	✓	✓											✓			✓	✓	✓	✓			✓	✓		✓				✓				✓
Engine Oil	✓	✓			✓							✓	✓		✓	✓	✓	✓	✓				✓		✓		✓	✓					
Fuel			✓	✓																													
Gear Oil	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓			✓	✓	✓					✓	✓	✓	✓	
Grease	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
Hydraulic Oil		✓	✓	✓						✓		✓	✓			✓	✓	✓	✓			✓	✓					✓	✓		✓		
Metalworking	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓											✓					✓			✓		
Rust Preventive																															✓	✓	
Synthetic Lube	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓				✓
Turbine Oil	✓	✓	✓	✓						✓			✓			✓	✓	✓	✓			✓	✓		✓				✓		✓		
FUNCTION																																	
Ashless	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓			✓	✓
High Temp.		✓												✓		✓	✓	✓				✓	✓		✓				✓				✓
Antioxidant		1	2	2	2	2	2	2	2		2	2		2	2	1	1	1	1			1	1	2	1	1	1	2	1	2			1
Antiwear/ Antiscuff	1				1	1	1	2	2		2	1		2	1					2	2	2		1		1	1	1	2	2		1	
Friction Reducer	1				1									2								2				1	1		2				
Corrosion Inhibitor			1	1						1			2	2									2	2						2		
Demulsifier										2																							
Chemical Intermediate																																	
Extreme Pressure					1	1	1	1	1		1			1						1	1	2		1					1	1			
Metal Deactivator			1	1						1				2						2	2		2										
Rust Inhibitor										1			1											2							1	1	

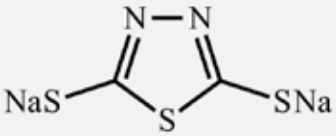
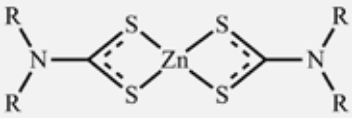
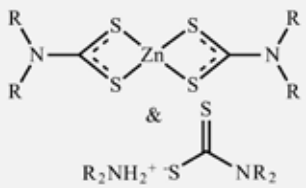
✓= Application/Function 1 = Primary Function 2 = Secondary Function

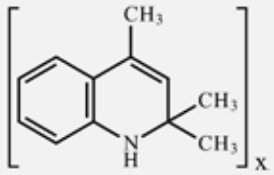
	CUVAN® 303 Metal Deactivator	CUVAN 484 Metal Deactivator	CUVAN 826 Metal Deactivator
Formula		Proprietary	Proprietary
Application	Auto Transmission Fluid, Compressor Oil, Engine Oil, Fuel, Gear Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube, Turbine Oil	Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Metalworking, Turbine Oil	Compressor Oil, Engine Oil, Fuel, Gear Oil, Grease, Hydraulic Oil, Metalworking, Turbine Oil
Function	Ashless, Corrosion Inhibitor, Metal Deactivator	Ashless, Antioxidant, Antiwear/ Antiscuff, Corrosion Inhibitor, Metal Deactivator	Ashless, Antioxidant, Corrosion Inhibitor, Metal Deactivator
Chemical Composition	N, N-bis(2-ethylhexyl)-ar-methyl-1H-benzotriazole-1-methanamine	2,5 dimercapto-1,3,4-thiadiazole derivative	2,5 dimercapto-1,3,4-thiadiazole derivative
Physical State	Liquid	Liquid	Liquid
Color	Amber	Amber	Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	0.95 (7.9) @ 25˚C	1.07 (8.9)	1.04 (8.7)
Viscosity @ 100˚C mm²/s	5.81	11	3.32
Flash Point (PMCC), ˚C	125	76	192
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum lubricating bases.
Use Concentration, % mass	0.05 - 0.20	0.10 - 0.50	0.10 - 0.50
Typical Uses	**CUVAN 303** is an oil-soluble corrosion inhibitor and metal deactivator for lubricants, greases and metalworking fluids. As a corrosion inhibitor, it is effective in protecting copper, copper alloys, cadmium, cobalt, silver and zinc. As a metal deactivator, it is effective in precipitating ions of the same metals, thus preventing galvanic corrosion of other metal surfaces and inhibiting these ions from acting as oxidation catalysts. **NSF® Certified HX-1, 138995**	**CUVAN 484** is an ashless oil-soluble corrosion inhibitor and metal deactivator for nonferrous metals, particularly for copper. Useful in industrial and automotive oils and greases, metalworking fluids, etc. **CUVAN 484** may also enhance the antiwear and oxidation properties of lubricants.	**CUVAN 826** is a ashless oil-soluble corrosion inhibitor and metal deactivator for nonferrous metals, particularly for copper. It is useful in industrial and automotive oils and greases, metalworking fluids, etc. **CUVAN 826** has a unique composition that enables it to suppress the corrosive action of hydrogen sulfide.

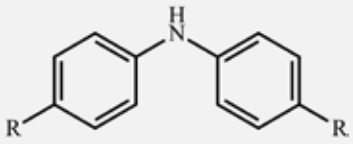
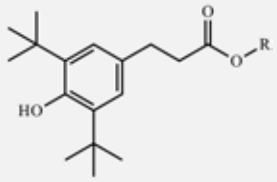
	MOLYVAN® A Friction Reducer	**MOLYVAN L** Friction Reducer	**MOLYVAN FEI PLUS** Friction Reducer
Formula	 X = O/S		Proprietary
Application	Grease, Synthetic Lube	Engine Oil, Gear Oil, Grease, Metalworking, Synthetic Lube	Engine Oil
Function	High Temperature, Antioxidant, Antiwear/Antiscuff, Friction Reducer, Extreme Pressure	Antioxidant, Antiwear/Antiscuff, Friction Reducer, Extreme Pressure	Friction Reducer, Antioxidant, Antiwear
Chemical Composition	Molybdenum di-n-butyldithio-carbamate	Molybdenum di(2-ethylhexyl) phosphorodithioate	Antioxidant, Antiwear, Friction Reducer Blend
Physical State	Powder	Liquid	Liquid
Color	Yellow	Dark Green	Dark Amber to Brown
Density @ 15.6˚C Mg/m³ (lb/gal)	1.59 @ 25°C	1.08 (9.0)	1.01 (8.4) @ 25°C
Viscosity @ 100˚C mm²/s	—	8.6	10.8
Flash Point (PMCC), ˚C	—	142	178
Solubility	Slightly soluble in aromatic hydrocarbons. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant base stocks. Insoluble in water.
Use Concentration, % mass	0.5 - 3.0	0.25 - 1.0	0.1 - 4.0
Typical Uses	**MOLYVAN A** is used in long life chassis greases for ball joints, steering linkages and other lubricating greases requiring good antioxidant and antiwear at high temperatures for long periods of time. It is an organic molybdenum extreme pressure and antiwear additive for petroleum and synthetic lubricants. It has good high temperature stability. In lubricating greases it is superior to inorganic molybdenum additives for both antiwear and antioxidant properties. **MOLYVAN A** is slightly basic and does not promote rusting. It has a low specific gravity which makes it easy to disperse with simple equipment. It is used in non-petroleum base valve lubricants. Not recommended for diesel engine oils without proper corrosion testing and voluntary assumption of risk.	**MOLYVAN L** is an oil-soluble organic molybdenum additive containing sulfur and phosphorus. It functions as a friction reducer, antioxidant, antiwear, and extreme pressure agent. It is used in engine oils, metalworking compositions and in a variety of industrial and automotive lubricating oils, greases and specialties. **MOLYVAN L** is an outstanding antiwear agent. It is quite useful in automotive and industrial gear oils and greases which operate under heavy load conditions. Not recommended for diesel engine oils without proper corrosion testing and voluntary assumption of risk.	**MOLYVAN FEI Plus** is a lubricant composition that when combined with a dispersant, detergent, VI improver and base oil constitutes a low phosphorus, high molybdenum containing engine oil with enhanced fuel economy and catalyst compatibility. Not recommended for diesel engine oils without proper corrosion testing and voluntary assumption of risk.

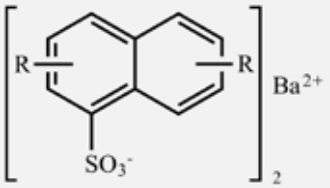
	MOLYVAN® 807 NT Friction Reducer	MOLYVAN 822 NT Friction Reducer	MOLYVAN 855 Friction Reducer
Formula	Proprietary	Proprietary	Proprietary
Application	Engine Oil, Gear Oil, Grease, Synthetic Lube	Engine Oil, Gear Oil, Grease, Synthetic Lube	Engine Oil, Grease, Metalworking
Function	Antioxidant, Antiwear/Antiscuff, Friction Reducer, Extreme Pressure	Antioxidant, Antiwear/Antiscuff, Friction Reducer, Extreme Pressure	Antioxidant, Antiwear/Antiscuff, Friction Reducer
Chemical Composition	Molybdenum dialkyldithiocarbamate in oil	Molybdenum dialkyldithiocarbamate in oil	Organomolybdenum complex
Physical State	Liquid	Liquid	Liquid
Color	Dark Green	Brown	Brown
Density @ 15.6˚C Mg/m³ (lb/gal)	0.97 (8.1)	0.97 (8.1)	1.08 (9.0)
Viscosity @ 100˚C mm²/s	13	13	55
Flash Point (PMCC), ˚C	135	135	193
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.25 - 0.5	0.25 - 0.5	0.1 - 1.0
Typical Uses	**MOLYVAN 807 NT** offers a unique molybdenum-sulfur combination in an oil-soluble form which is easy to blend into lubricants. It can be used to maintain the antifriction properties of an engine oil while reducing the phosphorus content. To obtain significant increases in extreme pressure properties and to impart improved antiwear performance. **MOLYVAN 807 NT** can be used in combination with **VANLUBE® 7723** Antioxidant, a nonmetallic dithiocarbamate which functions as an antioxidant and extreme pressure agent. Not recommended for diesel engine oils without proper corrosion testing and voluntary assumption of risk.	**MOLYVAN 822 NT** may be used to maintain or improve the antifriction properties of an engine oil while reducing the phosphorus content. Not recommended for diesel engine oils without proper corrosion testing and voluntary assumption of risk.	**MOLYVAN 855** is a liquid organomolybdenum friction reducer specifically designed for crankcase oils. **MOLYVAN 855** provides engine oils with a substantial reduction in the coefficient of friction. Not recommended for diesel engine oils without proper corrosion testing and voluntary assumption of risk. 

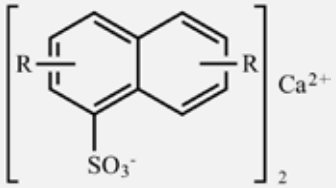
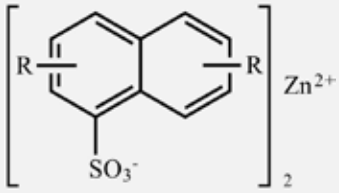
	MOLYVAN® 3000 Friction Reducer	NACAP® Corrosion Inhibitor	VANCHEM® DMTD Metal Deactivator
Formula	Proprietary		
Application	Engine Oils, Gear Oils, Greases, Synthetic Lubes	Coolant, Water-Based Fluids	Coolant, Water-Based Fluids, Metalworking
Function	Friction Reducer. Antiwear/ Antiscuff, Extreme Pressure	Antioxidant, Corrosion Inhibitor, Chemical Intermediate, Metal Deactivator	Ashless, Corrosion Inhibitor, Chemical Intermediate, Metal Deactivator
Chemical Composition	Molybdenum Dithiocarbamate in oil	Sodium 2-mercaptobenzothiazole, 50% aqueous solution	2,5-dimercapto-1,3,4-thiadiazole
Physical State	Liquid	Liquid	Powder
Color	Brown	Light Amber	Cream to Light Yellow
Density @ 15.6˚C Mg/m³ (lb/gal)	1.05 (8.8)	1.27 (10.6)	1.79
Viscosity @ 100˚C mm²/s	50 - 100	—	—
Flash Point (PMCC), ˚C	>145	—	—
Solubility	Soluble in petroleum and synthetic base oils. Insoluble in water.	Soluble in water, alcohols and glycols. Insoluble in petroleum hydrocarbons.	Soluble in water, ethanol, acetone and diesters. Slightly soluble in petroleum lubricant bases, hexane, petroleum ether, chloroform and toluene.
Use Concentration, % mass	0.1 - 1.0	0.1 - 0.6	Chemical Intermediate
Typical Uses	**MOLYVAN 3000** may be used to maintain or improve the antifriction properties of an engine oil while reducing the phosphorus content. Not recommended for diesel engine oils without proper corrosion testing and voluntary assumption of risk.	**NACAP** is a corrosion inhibitor for water, alcohol and glycol systems. It is particularly effective in preventing corrosion of copper and brass. Widely used in antifreeze, where it functions as a copper corrosion inhibitor and alkaline buffer. It is an excellent corrosion inhibitor for aluminum in systems where aluminum is used in the presence of copper and copper alloys. **NACAP** is one of the standard copper corrosion inhibitors for the antifreeze industry. Used as a chemical intermediate.	**VANCHEM DMTD**'s common reactions are double decomposition reactions with soluble metal salts, salt formation with alkaline metal hydroxides, oxidation reactions involving mercaptans, addition reactions with organic compounds containing activated double bonds, reactions with epoxy groups, reactions with aldehydes and alcohols, salt formation with amines and ammonia and reactions with acyl chlorides. The two active sites on **VANCHEM DMTD** can generally be reacted successively.

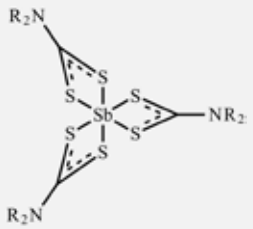
	VANCHEM® NATD Metal Deactivator	VANLUBE® AZ Lubricant Additive	VANLUBE EZ Antioxidant
Formula			Mixture of: 
Application	Coolant, Water-Based Fluids, Metalworking	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Metalworking, Rust Preventive, Synthetic Lube	Gear Oil, Grease, Metalworking, Synthetic Lube
Function	Corrosion Inhibitor, Chemical Intermediate, Metal Deactivator	Antioxidant, Antiwear/Antiscuff, Corrosion Inhibitor, Metal Deactivator	Antioxidant, Antiwear/Antiscuff, Extreme Pressure
Chemical Composition	Disodium 2,5-dimercaptothiadiazole, 30% aqueous solution	Zinc diamyldithiocarbamate in oil	Zinc diamyldithiocarbamate and diamyl ammonium diamyldithiocarbamate
Physical State	Liquid	Liquid	Liquid
Color	Amber	Amber	Yellowish/Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	1.22 (10.2)	1.02 (8.5)	1.10 (9.2)
Viscosity @ 100˚C mm²/s	—	9.8	40 - 70
Flash Point (PMCC), ˚C	—	136	93
Solubility	Soluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.1 - 0.25	0.25 - 4.0	0.1 - 2.0
Typical Uses	**VANCHEM NATD** is a corrosion inhibitor and metal deactivator for nonferrous metals in aqueous systems. It is particularly indicated for the protection of solder, aluminum, copper and copper alloys. It is stable and active at lower pH values than many mercapto compounds. **VANCHEM NATD** is a stable reactive dimercaptide which is readily alkylated, oxidized to the disulfide, or converted to metal salts.	**VANLUBE AZ** is used in engine oils, in industrial oils, and in soap and clay-thickened greases. Used in both gasoline and diesel crankcase oils to inhibit oxidation, bearing corrosion and wear. Used in combination with detergents, it inhibits corrosion and wear by inhibiting oxidation of the oil and also by the formation of protective films on metal surfaces. Used as a partial replacement for zinc dithiophosphates. Because of its effectiveness at high temperatures, it is a good additive for crankcase oils in heavy duty service. In industrial oils and automatic transmission fluids it functions as a high temperature oxidation and corrosion inhibitor. Used in lubricating greases both as an oxidation inhibitor and metal deactivator. An excellent copper corrosion inhibitor of film-forming type.	**VANLUBE EZ** is a multifunctional additive that imparts excellent antiwear, extreme pressure, corrosion resistance and antioxidant properties to industrial lubricants and greases. It contains no diluent oil.

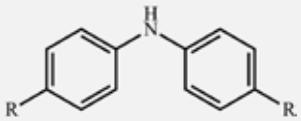
	VANLUBE® PA Antioxidant	VANLUBE RD Antioxidant	VANLUBE SB Lubricant Additive
Formula	Proprietary		Proprietary
Application	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube, Turbine Oil	Grease, Synthetic Lube	Engine Oil, Gear Oil, Grease, Metalworking
Function	Ashless, Antioxidant	Ashless, Antioxidant	Antiwear/Antiscuff, Extreme Pressure
Chemical Composition	Alkylated diphenylamines & sterically hindered phenol	Polymerized 1,2-dihydro-2,2,4-trimethylquinoline	Sulfur-based additive
Physical State	Liquid	Small Pastilles	Liquid
Color	Clear Yellow	Amber	Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	0.97 (8.1)	1.06	1.14 (9.5)
Viscosity @ 100˚C mm²/s	8	—	10
Flash Point (PMCC), ˚C	200	—	79
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in diesters, polyalkylene glycol UCON™ fluids. Insoluble in water and petroleum oils.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.1 - 2.0	0.1 - 1.0	1.0 - 2.0
Typical Uses	**VANLUBE PA** is a synergistic combination of alkylated diphenylamine (ADPA) and sterically hindered phenol. **VANLUBE PA** provides optimized antioxidant performance in many applications: Industrial Oils - turbine oil, hydraulic oils, compressor oils, heat transfer fluids, metalworking fluids and greases; Engine Oils - both passenger car and diesel engine oils; Automatic Transmission Fluids.	**VANLUBE RD** inhibits oxidation in polyglycols, Ucon® fluids and diester synthetic lubricants. Good high temperature inhibitor for both petroleum and synthetic lubricants. Widely used in Ucon and polyglycol brake fluids at concentrations of 0.1 to 0.25%. Prevents the depolymerization of polyoxyethylene and similar polymers. Used as a high temperature oxidation inhibitor in both petroleum and synthetic base lubricating greases. Effective in both static (ASTM grease pressure vessel) and dynamic (bearing life or spindle) oxidation tests.	**VANLUBE SB** is a sulfur-based additive used in the formulation of industrial gear oils, automotive and industrial greases of various types, and other formulations where noncorrosive sulfur is desired. **VANLUBE SB** is an economical source of sulfur in a form that provides good load-carrying and antiwear properties combined with low copper corrosion.

	VANLUBE® SN Antioxidant	VANLUBE SS Antioxidant	VANLUBE BHC Antioxidant
Formula	Proprietary		
Application	Turbine Oils, Compressor Fluids, hydraulic fluids, automatic transmission fluids, engine oils, gear oils, industrial oils, greases	Auto Transmission Fluid, Compressor Oil, Engine Oil, Grease, Synthetic Lube, Turbine Oil	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube, Turbine Oil
Function	Antioxidant	Ashless, High Temperature, Antioxidant	Ashless, Antioxidant
Chemical Composition	Alkylated diphenylamine/ hindered phenol blend	Octylated diphenylamines	Butylated hydroxy-hydrocinnamate
Physical State	Liquid	Powder	Liquid
Color	Light Brown	Light Tan	Yellowish
Density @ 15.6˚C Mg/m³ (lb/gal)	Density @ 25 °C Mg/m³ (lb/gal): 0.95 (7.90)	1.02	0.97 (8.1)
Viscosity @ 100˚C mm²/s	23	—	6.2
Flash Point (PMCC), ˚C	Flash Point (CCC), °C: 211	—	152
Solubility	Soluble in most mineral and synthetic oils. Not Soluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.1 - 2.0	0.5 - 2.0	0.1 - 2.0
Typical Uses	**VANLUBE SN** is a synergistic liquid antioxidant blend composed of alkylated diphenylamines (ADPA) and a high molecular weight sterically hindered phenol (HP). It is a general-purpose antioxidant good for all types of lubricant applications such as turbine, compressor, hydraulic fluids, automatic transmission fluids (ATF), passenger car motor oils (PCMO), and heavy-duty diesel engine oils (HDDEO). VANLUBE SN can be used to boost the oxidation performance of older category engine oils.	**VANLUBE SS** is a general-purpose antioxidant. It is used as a high temperature antioxidant in petroleum and synthetic lubricants. Effective as an antioxidant and corrosion inhibitor in silane and siloxane synthetic lubricants - both in fluids and greases. Used in hydraulic fluids, various industrial oils, automatic transmission fluids and synthetic and petroleum-based engine oils. **NSF® Certified HX-1, 155717**	**VANLUBE BHC** is an effective general purpose, nonstaining, ashless antioxidant that provides excellent oxidative stability to wide range of automotive and industrial lubricants. It has excellent solubility in mineral and non conventional base stocks, and contains no diluents. It is easy to handle and will not crystallize at low temperatures. It has low volatility and helps control oxidation and high temperature deposits especially when combined with alkylated diphenylamines, molybdenum compounds, sulfur-containing antioxidants and/or phosphites in many industrial oils and automotive lubricants.

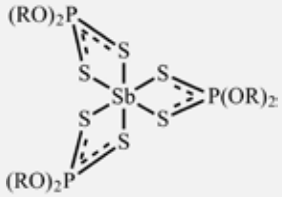
	VANLUBE® RI-A Lubricant Additive	VANLUBE RI-G Lubricant Additive	VANLUBE RI-BSN Lubricant Additive
Formula	Proprietary	Proprietary	
Application	Gear Oil, Grease, Hydraulic Oil, Rust Preventive, Turbine Oil	Gear Oil, Grease, Hydraulic Oil, Rust Preventive	Gear Oil, Grease, Hydraulic Oil, Metal Working Fluid, Rust Preventive, Turbine Oil
Function	Ashless, Corrosion Inhibitor, Rust Inhibitor	Ashless, Corrosion Inhibitor, Rust Inhibitor	Corrosion Inhibitor, Rust Inhibitors, Demulsifer
Chemical Composition	Dodecenylsuccinic acid reaction product	Fatty acid derivative of 4,5-dihydro-1H-imidazole	Neutral barium dinonylnaphthalene sulfonate in light mineral oil
Physical State	Liquid	Liquid	Liquid
Color	Amber	Amber	Dark Brown
Density @ 15.6˚C Mg/m³ (lb/gal)	0.96 (8.0) @ 25°C	0.94 (7.8)	1.01 (8.4) @ 20°C
Viscosity @ 100˚C mm²/s	19	117	65.0
Flash Point (PMCC), ˚C	165	271	>165 (COC)
Solubility	Soluble in petroleum lubricant bases.	Soluble in petroleum lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.05 - 2.5	0.25 - 0.50	0.005 - 10.0
Typical Uses	**VANLUBE RI-A** is an oil-soluble rust inhibitor recommended for steam turbine oils, circulating oils and hydraulic oils. In industrial gear oils with extreme pressure additives, levels of approximately 0.25% are recommended. **VANLUBE RI-A** is most effective in greases when used with a sulfonate such as **VANLUBE RI-BSN** in a 50/50 ratio. **NSF® Certified HX-2, 139738**	**VANLUBE RI-G** was specifically designed to provide excellent rust inhibition for greases. It is compatible with other **VANLUBE** extreme pressure, antioxidant and antiwear additives.	**VANLUBE RI-BSN** is an effective general purpose rust inhibitor recommended for use where excellent rust inhibition and water resistance are needed. It can be used in industrial lubricants operating in the presence of moisture such as paper machine oils, rock drill oils, turbine, hydraulic and circulating oils. It can also be used as rust inhibitor in lubricating greases and as rust preventive for metal parts from metalworking processes.

	VANLUBE® RI-CSN Lubricant Additive	VANLUBE RI-ZSN Lubricant Additive	VANLUBE TK-100 Lubricant Additive
Formula			Proprietary
Application	Gear Oil, Grease, Hydraulic oil, Metal Working Fluid, Rust Preventive, Turbine Oil	Gear Oil, Grease, Hydraulic oil, Metal Working Fluid, Rust Preventive, Turbine Oil	Gear Oil, Grease, Metalworking, Rust Preventive
Function	Corrosion Inhibitor, Rust Inhibitor, Demulsifier	Corrosion Inhibitor, Rust Inhibitor, Demulsifier	Tackifier
Chemical Composition	Neutral calcium dinonylnaphthalene sulfonate in light mineral oil	Neutral zinc dinonylnaphthalene sulfonate in light mineral oil	Solution of a copolymer of ethylene and propylene
Physical State	Liquid	Liquid	Liquid
Color	Dark Brown	Dark Brown	Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	0.98 (8.2)	0.97 (8.1)	0.89 (7.4)
Viscosity @ 100˚C mm²/s	125	32.0	4500
Flash Point (PMCC), ˚C	>165 (COC)	>160 (COC)	121
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.1 - 20.0	0.1 - 20.0	0.5 - 5.0
Typical Uses	**VANLUBE RI-CSN** is an effective general purpose rust inhibitor recommended for use where excellent rust inhibition and water resistance are needed. It can be used in industrial lubricants operating in the presence of moisture such as paper machine oils, rock drill oils, turbine hydraulic and circulating oils. It can also be used as rust inhibitor in lubricating greases and as rust preventive for metal parts from metalworking processes.	**VANLUBE RI-ZSN** is an effective general purpose rust inhibitor recommended for use where excellent rust inhibition and water resistance are needed. It can be used in industrial lubricants operating in the presence of moisture such as paper machine oils, rock drill oils, turbine hydraulic and circulating oils. It can also be used as rust inhibitor in lubricating greases and as rust preventive for metal parts from metalworking processes.	**VANLUBE TK-100** is used to provide adherence in way oils, chain lubricants and greases. It provides excellent aerosol resistance in pneumatic system lubricants.

	VANLUBE® W-324 Lubricant Additive	VANLUBE 73 Lubricant Additive	VANLUBE 73 Super Plus Lubricant Additive
Formula	Proprietary		Proprietary
Application	Engine Oils, Gear Oils, Grease, Synthetic Lubricants	Compressor Oil, Engine Oil, Gear Oil, Grease, Synthetic Lube	Gear Oil, Grease
Function	Antiwear, Antioxidant and high temperature Friction Reducer	Antioxidant, Antiwear/Antiscuff, Friction Reducer, Extreme Pressure	Antioxidant, Antiwear/Antiscuff, Extreme Pressure
Chemical Composition	Dialkylammonium Tungstate	Antimony tris(dialkyldithiocarbamate) in oil	Proprietary blend of dialkyldithiocarbamates
Physical State	Liquid	Clear to Hazy Liquid	Liquid
Color	Amber to Black	Dark Amber	Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	—	1.03 (8.6)	1.10 (9.2) @ 25°C
Viscosity @ 100˚C mm²/s	11.6	11	33.3
Flash Point (PMCC), ˚C	>140	171	>118
Solubility	Only soluble in lubricants using dispersants. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.01 - 0.5	0.1 - 1.0 as antioxidant, 2.0 - 5.0 as extreme pressure agent.	2.0 - 4.0
Typical Uses	**VANLUBE W 324** is a liquid additive that enhances the antioxidant, antiwear and friction properties of greases, engine oils and other lubricating oils.	**VANLUBE 73** is one of the most versatile of the dithiocarbamate additives. It has excellent antiwear, extreme pressure and antioxidant properties. It is used as an antiwear additive, a bearing corrosion inhibitor in motor oils, gas engine oil, compressor oils, etc. It is used in lubricating greases of all types as an antioxidant, antiwear and extreme pressure additive. **NSF® Certified HX-2,137553**	**VANLUBE 73 Super Plus** is a proprietary mixture of dialkyldithiocarbamates. Based on equivalent antimony content, the load-carrying capability of **VANLUBE 73 Super Plus** is superior to that of antimony dialkyldithiocarbamate (SDDC), and comparable to that of combinations of SDDC and sulfurized olefin. As an antioxidant, **VANLUBE 73 Super Plus** outperforms both SDDC and SDDC/sulfurized olefin and, unlike sulfurized olefin, it does not lower the dropping point of lithium complex grease. **VANLUBE 73 Super Plus** does not have the pungent order of sulfurized olefin.

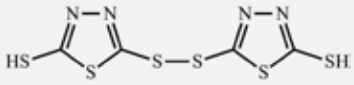
	VANLUBE® 81 Antioxidant	VANLUBE 289 Lubricant Additive	VANLUBE 289 HD Lubricant Additive
Formula		Proprietary	Proprietary
Application	Auto Transmission Fluid, Compressor Oil, Engine Oil, Grease, Synthetic Lube,Turbine Oil	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Metalworking	Heavy Duty Engine Oil, Auto Transmission Fluid, Compressor Oil, Gear Oil, Grease, Metalworking
Function	Ashless, High Temperature, Antioxidant	Ashless, Antiwear/Antiscuff, Friction Reducer	Ashless, Antiwear/Antiscuff, Friction Reducer
Chemical Composition	p,p'-dioctyldiphenylamine	Borate ester	Borate ester
Physical State	Powder	Liquid	Liquid
Color	Off White	Yellowish	Gold to Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	1.01 (8.4)	0.99 (8.3)	0.97 (8.1)
Viscosity @ 100˚C mm²/s	—	22.3	—
Flash Point (PMCC), ˚C	—	191	160
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.5 - 2.0	0.5 - 1.0	0.5 - 1.0
Typical Uses	**VANLUBE 81** is similar chemically to **VANLUBE SS** but is a better high temperature oxidation inhibitor because of its high purity and high p,p'-dioctyldiphenylamine content. VANLUBE 81 can be used in a variety of petroleum and synthetic lubricants where an ashless oxidation inhibitor with good high temperature properties is needed. Effective in silane, siloxane, silicone and diester fluids at concentrations of 0.5 to 2.0% and temperature of 400 to 500˚F. In lubricating greases, **VANLUBE 81** is effective in both oxidation pressure vessel tests and in high speed spindle tests. Siloxane greases containing 2% VANLUBE 81 have given outstanding results in bearing performance tests at 350˚F. Has a good color stability. Widely used as a high temperature antioxidant in jet engine oils. **NSF® Certified HX-1, 143815**	**VANLUBE 289** is an oil-soluble borate ester that is an effective antiwear additive, by itself or in synergistic combinations with other antiwear/ extreme pressure additives such as dithiophosphates, dithiocarbamates and alkyl thiadiazoles. It contains no phosphorous, sulfur or metals. It is therefore useful in eliminating and/or reducing levels of these elements in lubricants and greases while maintaining cost-effective performance. USDA CERTIFIED BIOBASED PRODUCT PRODUCT 76%	**VANLUBE 289 HD** is specially formulated for heavy duty engine oils with enhanced metal corrosion protection. **VANLUBE 289 HD** is an oil-soluble borate ester that is an effective antiwear additive, by itself or in synergistic combinations with other antiwear/ extreme pressure additives such as dithiophosphates, dithiocarbamates and alkyl thiadiazoles. It contains no phosphorous, sulfur or metals. It is therefore useful in eliminating and/or reducing levels of these elements in lubricants and greases while maintaining cost-effective performance.

	VANLUBE® 407 Antioxidant	VANLUBE 601 Lubricant Additive	VANLUBE 601E Lubricant Additive
Formula	Proprietary	Proprietary	Proprietary
Application	Industrial Oil, Turbine Oil, Compressor Oil, Greases, Food Grade HX-1 Lubricants	Fuel, Gear Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube, Turbine Oil	Fuel, Gear Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube, Turbine Oil
Function	High Temperature, Antioxidant	Ashless, Antioxidant, Corrosion Inhibitor, Metal Deactivator	Antioxidant, Corrosion Inhibitor
Chemical Composition	Blend of octylated phenyl-alpha-napthylamine with proprietary antioxidants	Heterocyclic sulfur-nitrogen compound	Heterocyclic sulfur-nitrogen compound
Physical State	Liquid	Liquid	Liquid
Color	Clear Light Amber	Dark Amber	Dark Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	1.02 (8.5)	0.98 (8.2)	0.98 (8.2)
Viscosity @ 100˚C mm²/s	23.7	10.5	7
Flash Point (PMCC), ˚C	212	122	157
Solubility	Soluble in meneral oils, polyalkylene glycols, synthetics esters and most non-polar synthetic base oils.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	—	0.02 - 1.0	0.02 - 1.0
Typical Uses	**VANLUBE 407** is a liquid blend of octylated phenyl-alpha-naphthylamine with other proprietary antioxidants. This unique combination provides exceptional antioxidant performance in PDSC (ASTM D6186) and RPVOT (ASTM D2272) at very low treat rates. **VANLUBE 407** is approved by NSF for use in USDA HX-1 food grade lubricants with incidental food contact. **NSF® Certified HX-1, 152988**	**VANLUBE 601** is a copper passivator, corrosion and rust inhibitor of the film-forming type. It exhibits synergistic properties with various metal organic extreme pressure additives such as the dithiocarbamates. Used in petroleum fuels and solvents at concentration of 1 to 10 pounds per 1,000 barrels to prevent copper stain and corrosion. Used in petroleum base oils and greases and in synthetic base greases at concentrations of 0.02 to 0.5% to protect copper. **VANLUBE 601** has color stabilizing properties in oils and greases stored at elevated temperatures. It is useful EP/synergist with a variety of extreme pressure and antiwear additives.	**VANLUBE 601E** is a copper passivator, corrosion and rust inhibitor of the film-forming type. It exhibits synergistic properties with various metal organic extreme pressure additives such as the dithiocarbamates. Used in petroleum fuels and solvents at concentrations to 1 to 10 pounds per 1,000 barrels to prevent copper stain and corrosion. Used in petroleum base oils and greases and in synthetic base greases at concentrations of 0.02 to 0.5% to protect copper. **VANLUBE 601E** has shown color stabilizing properties in oils and greases stored at elevated temperatures. It is a useful extreme pressure/synergist with a variety of extreme pressure and antiwear additives.

	VANLUBE® 622 Lubricant Additive	VANLUBE 672 Lubricant Additive	VANLUBE 672E Lubricant Additive
Formula		Proprietary	Proprietary
Application	Engine Oil, Gear Oil, Grease, Synthetic Lube	Gear Oil, Grease, Metalworking, Synthetic Lube	Gear Oil, Grease, Metalworking, Synthetic Lube
Function	Antioxidant, Antiwear/Antiscuff, Friction Reducer, Extreme Pressure	Ashless, Antioxidant, Antiwear/ Antiscuff, Extreme Pressure	Ashless, Antioxidant, Antiwear/ Antiscuff, Extreme Pressure
Chemical Composition	Antimony o,o-dialkylphosphorodithioate in oil	Amine phosphate	Amine phosphate
Physical State	Clear to Slightly Hazy Liquid	Viscous Liquid	Viscous Liquid
Color	Amber	Light Amber	Light Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	1.20 (10.0)	1.02 (8.5)	1.02 (8.5)
Viscosity @ 100˚C mm²/s	5	250	250
Flash Point (PMCC), ˚C	150	113	113
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in water, petroleum and synthetic lubricant bases.	Soluble in water, petroleum and synthetic lubricant bases.
Use Concentration, % mass	0.5 - 3.0	1.0 - 3.0	1.0 - 3.0
Typical Uses	**VANLUBE 622** is an antiwear and extreme pressure additive for steel mill and other industrial gear oils. **VANLUBE 622** has outstanding extreme pressure and antiwear properties in a variety of base lubricants. It will give unusually high Timken, Falex and 4-Ball extreme pressure values at economical concentrations of 1 to 3%. It can also be used as an extreme pressure and antiwear additive in automotive gear oils.	**VANLUBE 672** is an extreme pressure and antiwear additive for industrial lubricants, including lubricating oils, greases and synthetic fluids. Used as an extreme pressure and antiwear additive in various metalworking lubricants such as drawing, stamping and forming compounds. Improves extreme pressure performance of conventional extreme pressure materials such as sulfurized olefins, fatty oils, chlorinated paraffins, metal dithiocarbamates and phosphorodithioates. Effective in low concentrations as an antiwear additive in synthetic lubricants.	**VANLUBE 672E** is an extreme pressure and antiwear additive for industrial lubricants, including lubricating oils, greases and synthetic fluids. Used as an extreme pressure and antiwear additive in various metalworking lubricants such as drawing, stamping and forming compounds. Improves extreme pressure performance of conventional extreme pressure materials such as sulfurized olefins, fatty oils, chlorinated paraffins, metal dithiocarbamates and phosphorodithioates. Effective in low concentrations as an antiwear additive in synthetic lubricants.

	VANLUBE® 692 Lubricant Additive	VANLUBE 692E Lubricant Additive	VANLUBE 704S Lubricant Additive
Formula	Proprietary	Proprietary	Proprietary
Application	Gear Oil, Grease, Metalworking, Synthetic Lube	Gear Oil, Grease, Metalworking, Synthetic Lube	Gear Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube, Turbine Oil
Function	Ashless, Antioxidant, Antiwear/ Antiscuff, Extreme Pressure	Ashless, Antioxidant, Antiwear/ Antiscuff, Extreme Pressure	Corrosion Inhibitor, Demulsifier, Metal Deactivator, Rust Inhibitor
Chemical Composition	Aromatic amine phosphate	Aromatic amine phosphate	Barium sulfonate blend
Physical State	Viscous Liquid	Viscous Liquid	Viscous Liquid
Color	Dark Amber	Dark Amber	Dark Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	0.99 (8.3)	0.99 (8.3)	1.03 (8.6)
Viscosity @ 100˚C mm²/s	53	53	72
Flash Point (PMCC), ˚C	≥65	≥65	188
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	1.0 - 3.0	1.0 - 3.0	0.05 - 0.25
Typical Uses	**VANLUBE 692** is used in nonmetallic industrial gear oils to give high load carrying properties. Extreme pressure and antiwear additive for lubricants based on petroleum oils and synthetics. **VANLUBE 692** enhances the extreme pressure properties of sulfurized olefins, chlorinated paraffins, dithiocarbamates and phosphorodithioates.	**VANLUBE 692E** is used in nonmetallic industrial gear oils to give high load carrying properties. Extreme pressure and antiwear additive for lubricants based on petroleum oils and synthetics. **VANLUBE 692E** enhances the extreme pressure properties of sulfurized olefins, chlorinated paraffins, dithiocarbamates and phosphorodithioates.	**VANLUBE 704S** is used in petroleum and synthetic lubricants as a multifunctional rust and corrosion inhibitor. **VANLUBE 704S** is a synergistic blend of polar additives capable of forming films or complexes on metal surfaces, particularly copper and copper alloys that might be exposed to free sulfur of active sulfur compounds. It is used in a variety of lubricants based on petroleum oils or synthetics. Economical concentrations enhance antioxidants by passivating catalytic metal surfaces in the lubricant system.

	VANLUBE® 719 Lubricant Additive	VANLUBE 727 Lubricant Additive	VANLUBE 739 Lubricant Additive
Formula	Proprietary	Proprietary	Proprietary
Application	Gear Oil, Metalworking, Synthetic Lube	Auto Transmission Fluid, Engine Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Turbine Oil
Function	Antioxidant, Antiwear/Antiscuff, Extreme pressure	Ashless, Antioxidant, Antiwear/ Antiscuff	Ashless, Corrosion Inhibitor, Rust Inhibitor
Chemical Composition	Amine phosphate package	Organosulfur-phosphorus compound	Ashless rust inhibitor in oil
Physical State	Liquid	Liquid	Liquid
Color	Amber	Light Amber	Light Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	0.99 (8.3)	1.01 (8.4)	0.92 (7.7)
Viscosity @ 100˚C mm²/s	48	2.6	5
Flash Point (PMCC), ˚C	85	100	130
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	1.0 - 4.0	1.0 - 2.0	0.05 - 0.5
Typical Uses	**VANLUBE 719** was developed primarily for steel mill and similar industrial gear oils. It gives good extreme pressure and antiwear properties, good high temperature stability, and good demulsibility. **VANLUBE 719** at a concentration range of 2 to 3% will meet the requirements of most steel mill gear oil specifications. It is also used in 2-cycle engine oils.	**VANLUBE 727** is a versatile additive for various types of automotive and industrial lubricating oils. **VANLUBE 727** functions as an antiwear agent and antioxidant. Its nonmetallic nature makes it of interest for ashless or low ash applications. Some suggested applications are: automotive engine oils, railroad diesel oils, compressor oils, gas engine oils, antiwear hydraulic and turbine oils, and various types of industrial oils. Bench tests indicate that the performance of **VANLUBE 727** is competitive with that of commonly used zinc dithiophosphates. One percent in SAE 90 gear oil gives a 12-stage pass in the FZG test.	**VANLUBE 739** was designed to improve rust protection in lube oils and greases.

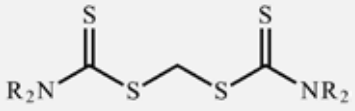
	VANLUBE® 829 Lubricant Additive	VANLUBE 871 Antioxidant	VANLUBE 887 Antioxidant
Formula		Proprietary	Proprietary
Application	Grease, Synthetic Lube	Engine Oil, Grease	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Turbine Oil
Function	Ashless, High Temperature, Antioxidant, Antiwear/Antiscuff, Friction Reducer, Corrosion Inhibitor, Extreme Pressure, Metal Deactivator	Ashless, Antioxidant, Antiwear/ Antiscuff	Ashless, High Temperature, Antioxidant
Chemical Composition	5,5-dithiobis(1,3,4-thiadiazole-2(3H)-thione)	2,5-dimercapto-1,3,4-thiadiazole alkyl polycarboxylate	Tolutriazole compound in oil
Physical State	Powder	Liquid	Liquid
Color	Yellow	Amber	Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	2.09	1.10 (9.2)	1.00 (8.3)
Viscosity @ 100˚C mm²/s	—	19.6	17
Flash Point (PMCC), ˚C	—	178	146
Solubility	Dispersible in grease.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	1.0 - 3.0	0.5 - 2.0	0.5 - 1.0
Typical Uses	**VANLUBE 829** possesses excellent extreme pressure properties when dispersed in various greases. It also functions as an antiwear agent and an antioxidant. **VANLUBE 829** should be used in greases in applications where extreme pressures prevail, such as steel mills and heavy equipment lubrication. **NSF® Certified HX-2,138302**	**VANLUBE 871** is a liquid ashless antioxidant/antiwear agent. Possible uses include both gasoline and diesel engine oil formulations to improve existing additive packages.	**VANLUBE 887** is a liquid ashless antioxidant. It is most effective as an antioxidant synergist with mixtures of hindered phenols and/or ashless dithiocarbamates such as **VANLUBE 7723**. **VANLUBE 887** possesses excellent high temperature stability. Combined with **VANLUBE 7723** and a suitable base stock, it will pass the MAG Cincinnati Machine Thermal Stability Test, Procedure A.

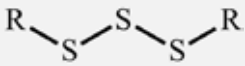
	VANLUBE® 887E Antioxidant	VANLUBE 887 FG Antioxidant	VANLUBE 961 Lubricant Additive
Formula	Proprietary	Proprietary	Proprietary
Application	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Synthetic Lube, Turbine Oil	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Synthetic Lube, Turbine Oil	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Synthetic Lube, Turbine Oil
Function	Ashless, High Temperature, Antioxidant	Ashless, High Temperature, Antioxidant	Ashless, Antioxidant
Chemical Composition	Tolutriazole compound in ester	Tolutriazole compound in ester	Mixed octylated and butylated diphenylamines
Physical State	Liquid	Liquid	Liguid
Color	Light Amber	Light Amber	Light Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	1.01 (8.4)	1.01 (8.4)	0.98 (8.2)
Viscosity @ 100˚C mm²/s	20	20	9.9
Flash Point (PMCC), ˚C	180	180	190
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.5 - 2.0	0.5 - 2.0	0.5 - 1.0
Typical Uses	**VANLUBE 887E** is a liquid ashless antioxidant. It is most effective as an antioxidant synergist with mixtures of hindered phenols and/or ashless dithiocarbamates such as **VANLUBE 7723**. **VANLUBE 887E** possesses excellent high temperature stability.	**VANLUBE 887 FG** is a liquid ashless antioxidant. It is most effective as an antioxidant synergist with mixtures of hindered phenols and /or ashless dithiocarbamates such as **VANLUBE 7723**. **VANLUBE 887 FG** possesses excellent high temperature stability. **NSF® Certified HX-1, 150690**	**VANLUBE 961** is a liquid ashless antioxidant for use in oils and greases of various types. It may be used in industrial lubricants, including compressor, hydraulic, turbine, gas engine and circulating oils. **VANLUBE 961** may be used as an ashless antioxidant in all types of crankcase oils. **NSF® Certified HX-1, HX-2, 135573**

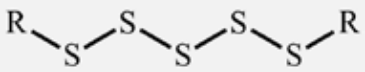
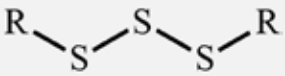
	VANLUBE® 972M Lubricant Additive	VANLUBE 972 NT Lubricant Additive	VANLUBE 981 Antioxidant
Formula	Proprietary	Proprietary	Proprietary
Application	Grease, Synthetic Lube	Grease, Synthetic Lube	Compressor Oil, Gear Oil, Grease, Hydraulic Oil, Synthetic Lube, Turbine Oil
Function	Ashless, Antiwear/Antiscuff, Extreme Pressure	Ashless, Extreme Pressure, Antiwear / Antiscuff	Ashless, Antioxidant
Chemical Composition	Thiadiazole derivative in polyalkylene glycols	Thiadiazole derivative in polyalkylene glycols	Dithiocarbamate derivative
Physical State	Liquid	Liquid	Liquid
Color	Amber	Dark Amber	Golden Yellow to Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	1.24 (10.3)	1.30 (10.8)	1.03 (8.6)
Viscosity @ 100˚C mm²/s	6.0	20	6
Flash Point (PMCC), ˚C	110	188	120
Solubility	Soluble in PAG fluids. Insoluble in petroleum lubricant bases and water.	Soluble in PAG fluids. Insoluble in petroleum lubricant bases and water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.5 - 3.0	0.5 - 3.0	0.1 - 1.0 as an antioxidant
Typical Uses	**VANLUBE 972M**, a thiadiazole derivative in polyalkylene glycol, is an ashless extreme pressure additive recommended for use in grease and some polyalkylene glycols (PAG) and some synthetic esters. The advantages this product offers are that it contains no metals, is easily handled, is readily biodegradable, is a cost effective alternative to other metal-containing EP additives and does not have the strong sulfur odor that is typical of the other sulfur EP additives.	**VANLUBE 972 NT** is a thiadiazole in a polyalkylene glycol. It is an ashless extreme pressure additive recommended for use in grease, some polyalkylene glycols, and some synthetic esters. Advantages of **VANLUBE 972 NT** are that it contains no metals, is easily handled, and is a cost effective alternative to other metal-containing EP additives. It does not have the strong sulfur odor that is typical of other sulfur EP additives. This product is HAPs (Hazardous Air Pollutants) free.	**VANLUBE 981** is an ashless antioxidant in lubricants.

	VANLUBE® 996E Antioxidant	VANLUBE 0902 Lubricant Additive	VANLUBE 1202 Lubricant Additive
Formula	Proprietary	Proprietary	Proprietary
Application	Auto Transmission Fluid, Compressor Oil, Engine Oil, Gear Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube, Turbine Oil	Grease and Industrial Gear Oils	Engine Oils, Gear oil, Grease, Metal Working Fluids and Synthetic Lubricants
Function	Ashless, High Temperature, Antioxidant, Corrosion Inhibitor	Multifunctional additive package for both greases and industricial gear oil	Antioxidant
Chemical Composition	Methylene bis (dibutyldithiocarbamate) and tolutriazole derivative	Metal-free multifuctional additive package, phosphorus containing sulfurized hydrocarbon	Alkylated PANA
Physical State	Liquid	Liquid	Solid, Powder
Color	Amber	Light Amber	Yellow to Brown
Density @ 15.6˚C Mg/m³ (lb/gal)	1.06 (8.8)	1.06 (8.8)	—
Viscosity @ 100˚C mm²/s	16.4	10 - 30	—
Flash Point (PMCC), ˚C	191	>90	186
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant base stocks. Insoluble in water.
Use Concentration, % mass	0.1 - 1.0 as antioxidant; 1-4 as extreme pressure agent	1.5 - 4.0	0.1 - 1.0
Typical Uses	**VANLUBE 996E** is a liquid ashless antioxidant that finds application in petroleum lubricants of all types. It possesses excellent high temperature stability and is noncorrosive despite having high sulfur content. **VANLUBE 996E** also exhibits extreme pressure performance alone and in combination with other additives.	**VANLUBE 0902** is a multifunctional additive package recommended for use at 1.5 to 2.25 % in suitable base stocks to formulate industrial gear oils. It is also recommended for use at 3.0 to 4.0% to formulate high performance greases.	**VANLUBE 1202** is a solid ashless antioxidant for use in lubricating oils and greases of various types and is especially effective in engine oils and other high temperature applications. **NSF® Certified HX-1, 150962**

	VANLUBE® 1305 Lubricant Additive	VANLUBE 2305 Antioxidant	VANLUBE 7611M Lubricant Additive
Formula	Proprietary	Proprietary	Proprietary
Application	Passenger car motor oil performance booster	Engine Oil	Auto Transmission Fluid, Engine Oil, Grease, Hydraulic Oil, Metalworking, Synthetic Lube
Function	Friction Reducer, Improves Oxidation & Deposit Control	Antioxidant, Antiwear, Friction Reducer	Ashless, Antioxidant, Antiwear/ Antiscuff
Chemical Composition	Proprietary Blend	Mixture	Ashless phosphorodithioate
Physical State	Liquid	Liquid	Liquid
Color	Brown	Brown	Light Amber
Density @ 15.6˚C Mg/m³ (lb/gal)	1.00 (8.3)	Density @ 25 °C Mg/m³ (lb/gal): 0.99 (8.2)4	1.08 (9.0)
Viscosity @ 100˚C mm²/s	230	13	2.54
Flash Point (PMCC), ˚C	186	Flash Point (CCC), °C: 193	142
Solubility	Soluble in fully formulated motor oil. Insoluble in water.	Soluble in most mineral and synthetic engine oils.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	1.0 - 3.5	1.0 - 3.5	1.0 - 2.0
Typical Uses	**VANLUBE 1305** is a low ash and phosphorus free engine oil performance booster for enhandced friction reduction, improved oxidation and deposit control and supplemental anti-wear protection.	**VANLUBE 2305** is a proprietary, low ash and phosphorus free engine oil booster that provides enhanced friction reduction, improved oxidation and deposit control, and supplemental anti-wear protection to existing passenger car engine oil formulations.	**VANLUBE 7611M** is an organic liquid additive containing sulfur and phosphorus. 4-Ball Wear tests show that **VANLUBE 7611M**, at a 20 kg load, performs equivalently to typical zinc dialkyldithiophosphates. At a 40 kg load it is superior to these products. **VANLUBE 7611M** will improve the antiwear properties of sulfurized extreme pressure additives. It is a useful component for extreme pressure/antiwear lubricant formulations and additive packages. **VANLUBE 7611M** does not contain metallic elements. Thus, it is applicable to ashless and low ash formulations. **NSF® Certified HX-2, 136048**

	VANLUBE® 7723 Lubricant Additive	VANLUBE 8610 Lubricant Additive	VANLUBE 8912E Lubricant Additive
Formula		Proprietary	Proprietary
Application	Compressor Oil, Gear Oil, Grease, Hydraulic Oil, Synthetic Lube, Turbine Oil	Gear Oil, Grease	Gear Oil, Grease, Hydraulic Oil, Metalworking, Rust Preventive, Turbine Oil
Function	Ashless, High Temperature, Antioxidant, Antiwear/Antiscuff, Friction Reducer, Extreme Pressure	Antioxidant, Antiwear/Antiscuff, Extreme Pressure	Corrosion Inhibitor, Rust Inhibitor
Chemical Composition	Methylene bis (dibutyldithiocarbamate)	Antimony dithiocarbamate/ sulfurized olefin blend	Calcium sulfonate
Physical State	Liquid	Liquid	Liquid
Color	Amber to Amber Green	Amber	Dark Brown
Density @ 15.6˚C Mg/m³ (lb/gal)	1.06 (8.8)	1.16 (9.7)	0.97 (8.1)
Viscosity @ 100˚C mm²/s	15	28.5	19
Flash Point (PMCC), ˚C	177	100	150 (COC)
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.
Use Concentration, % mass	0.1 - 1.0 as antioxidant; 2.0 - 4.0 as extreme pressure agent	1.25 - 2.0	0.05 - 0.10
Typical Uses	**VANLUBE 7723** is a general purpose, ashless antioxidant which should find application in petroleum lubricants of all types. It is effective at economical concentrations, readily soluble, and easy to blend. **VANLUBE 7723** has been tested in a variety of base stocks commonly used in compounding turbine, hydraulic and circulating oils. In addition to being an effective antioxidant, **VANLUBE 7723** also exhibits good extreme pressure performance alone and in combination with other additives. Useful as a component of additive packages. **NSF® Certified HX-1, HX-2, 136049**	**VANLUBE 8610** is an extreme pressure/antioxidant useful for various lubricating oils and greases. Impressive Timken loads of 90 to 100 lbs. are achieved with 2% treatment levels. **VANLUBE 8610** is compatible with other **VANLUBE** rust inhibitors/antioxidants and metal deactivators.	**VANLUBE 8912E** is an oil-soluble calcium sulfonate with excellent rust-inhibiting and water-resistant properties.

	VANLUBE® 9123 Lubricant Additive	VANLUBE 9317 Antioxidant	TPS® 20 Anti-wear & Extreme Pressure Additive
Formula	Proprietary	Proprietary	
Application	Gear Oil, Grease, Rust Preventive	Synthetic Lube	Gear Oils, Greases, Metal Working Fluids, Slideway Oils
Function	Ashless, Antiwear/Antiscuff, Rust Inhibitor	High Temperature, Antioxidant	Automotive and Transportation, General Industry
Chemical Composition	Amine phosphate	Organic amine compounds in a synthetic ester	Polysulfides di-tert-dodecyl
Physical State	Liquid	Liquid	Liquid
Color	Amber	Dark Brown	Slightly Yellow
Density @ 15.6˚C Mg/m³ (lb/gal)	0.94 (7.8)	0.98 (8.2)	0.95 (7.9) @ 20°C
Viscosity @ 100˚C mm²/s	24	128	219 @ 20°C
Flash Point (PMCC), ˚C	96	254	>100°C
Solubility	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Soluble in petroleum and synthetic lubricant bases. Insoluble in water.	Completely soluble in most hydrocarbon solvents such as toluene, white spirits and fuels. It is fully compatible with mineral and vegetable oils. It is slightly soluble in light alcohols but not soluble in water.
Use Concentration, % mass	0.10 - 1.0	0.5 - 4.0	—
Typical Uses	**VANLUBE 9123** is an excellent antiwear additive and rust inhibitor in a wide range of industrial oils and lubricating greases. **NSF ˚Certified HX-1, HX-2,135575**	**VANLUBE 9317** is an amine antioxidant designed to give excellent high temperature performance in synthetic polyolester based lubricants. At high temperatures, it significantly reduces the sludge and varnish typically seen with more conventional amine antioxidants.	**TPS 20** is di-tert-dodecyl polysulfide used as an antiwear and extreme pressure additive in applications where inactive sulfur is required. It is recommended for metalworking fluids that are used in the machining and forming of ferrous and non-ferrous metals. **TPS 20** is odorless and thus, it is especially suited for use in rolling oils. It is also an effective sulfur source for formulating automotive and industrial lubricants and greases.

	TPS® 32 Anti-wear & Extreme Pressure Additive	**TPS 44** Anti-wear & Extreme Pressure Additive	
Formula			
Application	Gear Oils, Greases, Metal Working Fluids, Slideway Oils	Gear Oils, Greases, Metal Working Fluids, Slideway Oils	
Function	Automotive and Transportation, General Industry	Automotive and Transportation, General Industry	
Chemical Composition	Polysulfides di-tert-dodecyl	Polysulfides, di-tert-Bu	
Physical State	Liquid	Liquid	
Color	Yellow	Yellow	
Density @ 15.6˚C Mg/m³ (lb/gal)	1.00 (8.3) @ 20°C	1.00 (8.3) @ 20°C	
Viscosity @ 100˚C mm²/s	603 @ 20°C	4 @ 20°C	
Flash Point (PMCC), ˚C	153°C	71°C	
Solubility	Soluble in most hydrocarbon solvents such as toluene, white spirits and fuels. It is fully compatible with mineral and vegetable oils. It is slightly soluble in light alcohols and is not soluble in water.	Soluble in most common hydrocarbon solvents such as toluene, white spirit, fuels. It is fully compatible with mineral and vegetable oils. It is slightly soluble in light alcohols but not soluble in water.	
Use Concentration, % mass	—	—	
Typical Uses	**TPS 32** is di-tert-dodecyl polysulfide with a high active sulfur content. It is a light colored and low odor extreme pressure additive designed for metalworking fluids used in the machining and forming of ferrous metals. **TPS 32** is recommended for semi-synthetic metalworking fluids and can be used to formulate industrial and automotive greases.	**TPS 44** is di-tert-butyl polysulfide used in formulation of industrial and automotive gear oils and greases. It is cost effective source of thermally stable sulfur that provides good load-carrying and antiwear properties to applications where inactive sulfur is required.	

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VANLUBE® 407 Antioxidant provides outstanding Performance in Both Thin-Film and Bulk Oxidation Protection.

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