# Oil Sales Guide Including DEF, Grease, Coolant, Fuel Additives





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# Plus-50<sup>™</sup> II Premium Engine Oil 15W-40, 10W-30, and 0W-40

#### Applications

Plus-50 II Premium Engine Oil has been developed to meet the needs of John Deere engines, both modern and heritage. It is recommended for all 4-stroke naturally aspirated, turbocharged, and supercharged diesel engines, including those with Diesel Particulate Filter (DPF), Selective Catalytic Reduction (SCR), Diesel Oxidation Catalyst (DOC), and Exhaust Gas Recirculation (EGR). Examples of applications include heavy-duty off-road equipment, on-road trucks, 4-cycle marine engines, natural gas engines, pickups, and automobiles.

Plus-50 II is an exclusive John Deere formula that exceeds current industry requirements and is highly recommended for use in all engines requiring oil with API service categories of CJ-4, CI-4 PLUS, CI-4, CH-4, and CG-4, as well as SN, SM, SL, and SJ.

#### Features and benefits:

- Superior protection for current and older engines.
- Extended drain intervals up to 500 hours when using Plus-50 II and John Deere filters and Ultra Low Sulfur Diesel (ULSD) fuel in a John Deere engine.<sup>†</sup>
- Formulated specifically to inhibit wear, corrosion, sludge, varnish, and oxidation.
- Delivers excellent low-temperature performance.
- Proven performance in low-emission engines.
- Full-fleet solution.
- Unsurpassed performance in John Deere JDQ-78X diesel engine oil dyno test.
- Compatible with biodiesel fuels and qualified with B20 biodiesel blend.

<sup>t</sup>**Note:** We strongly recommend that all John Deere engines use Plus-50 II oil to ensure optimal performance, including extended drain-interval options. Review the service-interval recommendations for each type of engine as described in the next section.

#### Limited Performance Warranty

John Deere guarantees Plus-50<sup>™</sup> II Engine Oil will meet or exceed the performance needs of diesel engines. Regardless of hours or miles, John Deere will pay for any damages (parts and labor) to your engine which are caused by an oil defect so long as:

- The oil defect is verified by oil analysis.
- The engine oil used is confirmed to be unadulterated and non-contaminated Plus-50 II.
- Plus-50 II meets the engine manufacturer's specifications for the service and application.
- The engine is used under normal operating conditions and maintained according to manufacturer's recommendations.

To secure warranty service, report the product failure to an authorized John Deere dealer.

To make a claim under this warranty, it will be necessary to provide the following as part of the technical investigation:

- Records showing that the engine was serviced according to the manufacturer's recommendations.
- Submit an oil sample from the failed engine for analysis to determine if oil is defective.
- Make the failed engine available.

John Deere disclaims all liability for indirect or consequential damages.

Your rights and remedies pertaining to this warranty are limited as set forth herein. Implied warranties of merchantability and fitness are not made and are excluded.

# JDQ-78X Dyno Engine Test

In the development of Plus-50 II, John Deere engineers tested the oil under the most extreme conditions using the JDQ-78X dyno engine test. The JDQ-78X test uses a John Deere engine that is run for 500 hours at full load and high heat to thoroughly test the capabilities of the oil. At the end of the test we evaluate the engine parts and the oil to determine how well the oil protects the engine and how long the oil will last under such extreme conditions.

The JDQ-78X off-road dyno engine test also incorporates the latest in engine-emission technology and fuel options. The JDQ-78X test ensures that Plus-50 II will protect our heavy-duty off-road diesel engines and our reputation. Plus-50 II exceeds the demands of the John Deere JDQ-78X high-temperature performance test. JDQ-78X is the most severe diesel engine test for high-temperature oil oxidation in the industry. The proven performance in the JDQ-78X, along with extensive field testing, allows extended drain intervals up to 500 hours when using Plus-50 II and John Deere filters for your John Deere engine.

# JDQ-78X Test Conditions

- 500 hours
- IT4 EGR rate 19% EGR
   Biodiesel proven fueled with B20
- $->140^{\circ}$ C oil gallery
- Biodiesei proven fueled wi – No make-up oil added



# Superior Dispersants and Soot Handling

- Soot is a combustion by-product that collects in the oil and can cause excessive wear on engine parts.
- To reduce the adverse effects of soot, soot particles must be dispersed evenly in the oil throughout the drain interval.
- If soot is not dispersed properly in oil, the soot particles stick to each other and form larger agglomerates.
- The larger soot agglomerates cause the oil to thicken and plug filters; the soot then behaves as an abrasive that reduces the lubricating capability of the oil.

Feature: Plus-50<sup>™</sup> II has excellent soot-handling capability.

**Advantage:** Plus-50 II retains its viscosity and protects better than industry CJ-4, CI-4 PLUS, CI-4, and CH-4 oils.

**Benefit:** Plus-50 II provides superior lubrication for longer engine life and maximum drain intervals, resulting in cost savings.

# Pistons from the JDQ-78X Test

Competitive oil leaves more carbon deposits in the land and groove area and undercrown area of the piston; more carbon deposits can cause the rings to perform differently than designed and heat transfer can be reduced. Plus-50 II is formulated for tougher off-road conditions to reduce piston deposits so the engine will last for a long time.







Competitor CJ-4 Premium Oil



Plus-50 II Premium Oil

# Extended Drain Intervals — Only with Plus-50 II

#### Service intervals

Oil and filter service intervals in John Deere diesel engines are based on a combination of factors, including:

- 1. The type of engine oil and filter in the application.
- 2. The sulfur content of the diesel fuel.
- 3. The volume of oil in the system.
- 4. The power output of the engine.

We recommend changing the oil and oil filter at least once every 12 months, even if the hours of operation are fewer than the otherwise recommended service interval.

# Service intervals for John Deere Tier 4 emission-certified and older diesel engines

Operators using John Deere Tier 4 emission-certified and older diesel engines may now utilize 500-hour oil and filter service intervals beyond what is published in the Operator's Manual delivered with the machine when all of the following conditions are met:

- 1. John Deere Plus-50 II and John Deere filters are used.
- 2. Use of Ultra Low Sulfur Diesel (ULSD) fuel with a sulfur content less than 0.0015% (15 mg/kg or 15 ppm) is required.
- 3. The original volume oil pan (or larger) that was delivered with the engine is still in use and the oil level is maintained at normal volumes through the service interval.<sup>(a)</sup>

<sup>(a)</sup>This 500-hour service interval is now possible in John Deere Tier 3 emissioncertified and older diesel engines because of two favorable factors: At the time when these engines were placed into service, operating conditions regarding oil class and fuel types were different. Engines beginning service in the U.S. before the 1990s were operating with API CE-4 or lower service class oils. The diesel fuel for on-road applications was at 5,000-ppm sulfur, with off-road up to 10,000 ppm. Environmental concerns and industry regulations have driven improvements to the oil types available, as well as significant reductions in the sulfur level of diesel fuel. John Deere Plus-50 II is designed for performance through longer service intervals, handling the heat and contaminants of combustion, while maintaining viscosity, lubricity, detergency, dispersants, and acid-buffering properties. Diesel fuel sulfur levels have been reduced from as much as 10,000 ppm to the current 15 ppm, equating to the elimination of over 99.5% sulfur. These converging factors deliver the achievement of 500-hour service intervals with the oil system capacity already designed into existing John Deere Tier 3 emission-certified and older diesel engines.



#### Engine Oil

If any of the previous conditions are not met, refer to the Operator's Manual for the equipment/engine for the engine-oil and filter service recommendations.

# Service intervals for John Deere Tier 4 emission-certified diesel engines

Operators must follow the engine-oil and filter service interval recommendations in the Operator's Manual.

These engines are designed to deliver power while operating at a reduced emission level. They must use diesel fuel with 15 ppm or less sulfur (ULSD) and diesel engine oil rated at API CJ-4, ACEA E9, or ACEA E6 to remain in compliance with emission regulations. Use of other specification fuel or oils in Tier 4 engines can result in emission noncompliance and premature DPF service requirements. John Deere Plus-50<sup>™</sup> II is the product recommended for these applications and the only product<sup>(b)</sup> approved for extended service intervals in John Deere diesel engines.

<sup>(b)</sup>Break-In<sup>™</sup> Plus is also recommended for and supports an initial oil-service interval equal to that of Plus-50 II.

# Performance-Level Comparison

- Oil is not just oil. There is a difference between high-performance oils and oils that just meet the minimum industry requirements.
- Universal competitive oils in the marketplace only have to meet minimum performance levels set by the API. Using minimum-level oils will result in reduced performance and shorter engine life.
- John Deere Plus-50 II Premium Engine Oil exceeds all industry requirements, plus it meets the high standards set by John Deere engineers.
- John Deere Plus-50 II Premium Engine Oil is developed to give the maximum engine protection and the longest life possible.

During the course of oil development and qualification, we test the oil under extreme conditions using the JDQ-78X engine test:

- This test was developed by John Deere as a standardized test. It is the most severe diesel engine test in the industry with regards to lubricant thermal-oxidation.
- It involves running a John Deere engine for 500 continuous hours at very high temperatures with no top-up oil added.
- The objectives of the test are to stress the oil by making it oxidize and to measure oil thickening, acids build-up, piston deposits, and wear.
- This is the primary engine oil test used by John Deere to determine how well an oil will perform in heavy-duty, offroad applications.

# Engine Tests for API CJ-4

In addition to our own extensive testing, we also participate in all of the tests that define the minimum requirements of API CJ-4 oil. For the comparisons represented by these graphs, lubricant test results must be at or below the CJ-4 limit to be approved. Lower is better. These results represent the magnitude of which Plus-50 II exceeds the performance metrics that make up the API requirements for CJ-4.





# Plus-50<sup>™</sup> II Premium Synthetic Engine Oil (0W-40)

Plus-50 II Premium Synthetic Engine Oil (0W-40) is excellent for all climates; however, it was specifically developed for customers who operate equipment in extremely cold conditions and want to maximize engine life and performance.

#### Applications

Excellent for all diesel engines requiring OW-40 viscosity grade and API Service Categories CJ-4 and SN.

#### Features and benefits:

- Unique to John Deere formulated with exclusive Plus-50 II performance additives and 100% PAO (polyalphaolefin) synthetic base oil.
- Excellent for other brands of diesel engines.
- Excellent for all automotive and heavy- and light-duty diesel engines.
- Synthetic base stock with Plus-50 II additives provides excellent performance in a temperature range of -40 °C to +50 °C (-40 °F to +122 °F).
- Additive package reduces engine wear, provides superior protection against high-temperature thickening compared to competitive oils, and offers additional protection in neutralizing corrosive acids formed as by-products of combustion.
- Formulated specifically to inhibit oxidation, deposit, corrosion, and wear with superior soot control.
- Performance is equal to Plus-50 II 15W-40 in wear-reduction and antioxidation tests.
- Provides maximum sludge and varnish control.
- Superior low-temperature fluidity reduces engine startup wear in cold weather.
- Extended drain intervals up to 500 hours when using Plus-50 II and John Deere filters in a John Deere engine.
- Reduces maintenance costs and downtime, and extends engine life.



# Break-In<sup>™</sup> Plus, Special-Purpose Engine Oil

**Break-In Plus** is a special-purpose engine oil developed to be used in rebuilt or remanufactured engines and new John Deere engines during the initial break-in period.

This oil is formulated to provide a controlled environment for piston rings and cylinder liners to establish a good mating surface for maximum performance and long engine life. At the same time, Break-In Plus provides the necessary wear protection for the valve train and gears.

#### Application

Break-In Plus is designed to be used in rebuilt or remanufactured engines and new John Deere engines for the initial oilservice interval. Operate the engine under various conditions, particularly heavy loads with minimal idling, to help seat engine components properly.

Break-In Plus delivers performance and protection for an initial service interval equal to that of our premium Plus-50<sup>™</sup> II. During the initial operation of a new or remanufactured engine with Break-In Plus, change the oil and filter between a minimum of 100 hours and a maximum of up to 500 hours. The 100-hour minimum applies to all new or remanufactured engines, regardless of tier rating. The maximum service interval is the same as the service-interval recommendation for Plus-50 II up to 500 hours. Check your Operator's Manual for the maximum interval recommendation.

**Features and benefits:** Piston rings and liners establish a good wear pattern for maximum performance and extended engine life.

Break-In Plus provides two major differences from traditional break-in oil:

- Meets the oil requirements for Tier 4 engines and supports all legacy engines.
- Service drain interval up to 500 hours.\*

John Deere Break-In Plus Engine Oil can be used for all John Deere diesel engines at all emission-certification levels.



# Torq-Gard<sup>™</sup> Engine Oil

When you are looking for hardworking, standard-interval engine oil, Torq-Gard is a great choice. It protects in a broad range of applications, including 4-stroke diesel, natural gas, and gasoline engines.

#### Applications

#### SAE 15W-40

Recommended for both diesel and gasoline engines in all types of service; ideal for mixed commercial fleets.

#### SAE 10W-30

Premium quality recommended for both diesel and gasoline engines in all types of service; ideal for mixed commercial fleets.

#### SAE 5W-30

High-performance oil that offers maximum protection for diesel and gasoline engines where excellent low-temperature pumpability is required.

#### SAE 30

Recommended for all diesels and gasoline, as well as natural gas engines with superior wear, oxidation, and deposit characteristics.

#### SAE 10W

Exclusively formulated for cold weather, on- and off-highway and diesel engine applications, and some hydraulic applications.

#### Features and benefits:

- Neutralizes acid to reduce corrosion.
- Provides sludge control for cleaner engines.
- Many viscosity grades offered for applications in moderate to very cold operating temperatures.
- Low-temperature fluidity for reduced engine startup wear.
- Standard drain-interval performance.

\*Always follow Operator's Manual.



# Turf-Gard<sup>™</sup> 4-Cycle Motor Oil

#### Applications

SAE 10W-40, SAE 10W-30, and SAE 5W-30

- Recommended for all 4-cycle gasoline engines used in lawn and garden tractors, riders, walk-behinds, edgers, shredders, commercial mowers, tillers, generators, and other outdoor powered equipment.
- Recommended for automotive gasoline engines requiring API SN classification oil.
- Meets ILSAC GF-5\* and "Energy Conservation Classification" for improved fuel economy.

\*Does not apply to Turf-Gard 10W-40.

#### Features and benefits:

- Keeps engine clean.
- Provides effective engine wear protection.
- Provides fuel-efficient lubrication.
- Multiple viscosity grades produce rapid oil circulation in cold and hot weather for excellent performance.
- Recommended for John Deere equipment and meets or exceeds manufacturers' engine warranty requirements.

#### ENGINE OIL-SERVICE CLASSIFICATIONS AND EXPLANATIONS

Several global associations have established classifications and categories for gasoline and diesel engine oil-performance ratings. In addition, some regions and equipment manufacturers have performance specifications for their engines and/or oils. Oil manufacturers label their products with the common category or classification for the region in which their product would likely be used. The most common are the American Petroleum Institute (API) and the European Automobile Manufacturers Association (ACEA). The chart shown at right lists these associations along with various manufacturers, and identifies which classifications John Deere Plus-50 II, Torq-Gard, Plus-4, and Turf-Gard engine oils meet.

API Category: The American Petroleum Institute.

ACEA Sequence: European Automobile Manufacturers Association (Association des Constructeurs Européens d'Automobiles).

JASO: The Japanese Automotive Standards Organization. JASO is part of the Society of Automotive Engineers of Japan.

ILSAC: The International Lubricant Standardization and Approval Committee.

MTU: In 1937, the GM Diesel Division, and in 1965, Detroit Diesel. In 1994, partnered with MTU, and in 2000, combined into MTU Detroil Diesel, Inc. in North America.

MB: Mercedes-Benz.

DDC: Detroit Diesel Corporation.

MAN: MAN Nutzfahrzeuge Group of Nuremberg (Germany). The diesel engine developed at MAN by Rudolf Diesel between 1893 and 1897.

GM: General Motors.

SAE: SAE International, formerly the Society of Automotive Engineers.

### Engine Oil-Service Classification

		Pl	<mark>us-50</mark> ™	II	Torq-Gard™				Plus 4 <sup>™</sup>	™ Turf-Gard™		тм	
S	ervice Classification	15W-40	10W-30	0 <del>0</del> -40	15W-40	10W-30	5W-30	30	MOL	10W-30	0 <del>1</del> -W01	10W-30	5W-30
	CJ-4												
	CI-4 PLUS												
_	CI-4												
AP	CH-4												
	CG-4	•		•									
	CF-4												
	CF		-	-	-		-	-					
line)	SN												
AP	SM	-						_			-		
0	SL											-	
	E9	-	-		_								
CEA	E7			_									
A	E3												
	E2												
JASO	DH-2	-	-	_									
John [	Deere JDQ-78X	-											
÷	EO-O Premium Plus 07	-	-		-								
Ma	EO-N Premium Plus 03												
	EO-M Plus												
	CES 20081												
ins	CES 20078												
E	CES 20077												
J	CES 20076												
	CES 20075												
<b>e</b>	228.31	•											
2	228.3												
0	VDS-4												
vlov	VDS-3												
-	VDS-2												
Man N	<b>//</b> 3275												
MTU 1	Гуре 2.1												
ĸ	93K218												
ā	93K214												
ŧ	RLD												
enau	RXD												
ž	RD												
Allisor	n C-4												
5	ECF-3												
pilla	ECF-2												
ater	ECF-1-a												
Ű	TO-2												
GM 60	)94M												
ILSAC	GF-5												
ILSAC	GF-4												

**Note:** Boldface classifications are current, whereas lightface classifications have become obsolete. Plus-50 II is subjected to additional tests besides industry requirements for API Service Category engine oils. These tests include quality control, low-temperature performance, life tests, and field tests. JDQ-78X high-temperature diesel engine dyno test exceeds industry requirements for viscosity increase, and engine deposits and wear.

**How to use this chart:** Read down the chart to locate the service classification required by the application. Read across the chart to determine the John Deere oils with category equivalent.

# Chemical and Physical Properties

Plus-50<sup>™</sup> II and Torq-Gard<sup>™</sup>

				PLUS-50 II				TORQ-GARD		
Property	Units	ASTM Method	15W-40	10W-30	0W-40	15W-40	10W-30	5W-30	30	10W
Viscosity	mm²/s (cSt)	D 445								
@ 40 °C	_	—	128	87	95	118	79	64	98	46
@ 100 °C	—		15.6	12.1	14.7	15.7	12.0	10.8	11.4	6.8
Viscosity Index	—	D 2270	127	133	162	140	145	161	108	115
Pour Point	°C	D 97	-36	-40	-57	-34	-35	-37	-31	-35
Flash Point	°C	D 92	225	223	228	232	223	223	227	212
Total Base Number	mg KOH/g	D 2896	10.5	10.5	10.5	10.0	9.2	10.0	9.2	8.0
Sulfated Ash	mass%	D 874	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.0
HTHS, @ 150 °C	сP	D 4683	4.3	3.6	3.7	_		_	_	_

#### Plus-4<sup>™</sup>, Turf-Gard<sup>™</sup>, and Break-In<sup>™</sup> Plus

			PLUS-4		TURF-GARD		BREAK-IN PLUS
Property	Units	ASTM Method	10W-30	10W-40	10W-30	5W-30	10W-30
Viscosity	mm²/s (cSt)	D 445					
@ 40 °C	—	—	69	102	69	64	64
@ 100 °C	—		10.5	14.8	10.6	10.8	9.7
Viscosity Index	—	D 2270	112	150	143	161	134
Pour Point	°C	D 97	-34	-36	-35	-36	-42
Flash Point	°C	D 92	223	225	223	219	210
Total Base Number	mg KOH/g	D 2896	7.7	7.7	7.4	7.5	10.5
Sulfated Ash	mass%	D 874	0.9	1.0	0.9	0.9	1.0
HTHS, @ 150 °C	cP	D 4683	_			_	3.1

# John Deere Engine Oils Air-Temperature Chart

Determine oil viscosity based on the expected air-temperature range during the period between changes.



#### For heavy-duty diesel engines:

John Deere Plus-50 II SAE 15W-40 SAE 10W-30 SAE 0W-40

#### John Deere Torq-Gard

SAE 15W-40 SAE 10W-30 SAE 5W-30 SAE 30 SAE 10W

#### John Deere Break-In Plus SAE 10W-30

#### For gasoline engines:

John Deere Turf-Gard SAE 10W-40 SAE 10W-30 SAE 5W-30

John Deere Plus-4 SAE 10W-30

John Deere Plus-50 II John Deere Torq-Gard



## Hy-Gard<sup>™</sup> and Low-Viscosity Hy-Gard Transmission and Hydraulic Oil

Hy-Gard and Low-Viscosity Hy-Gard transmission and hydraulic oils are unique oils developed by John Deere engineers to meet the exact needs of John Deere machines. Both Hy-Gard fluids are multi-viscosity fluids with high-viscosity index. Low-Viscosity Hy-Gard has an ISO 32 viscosity grade. Hy-Gard viscosity places it between ISO 46 and 68 grades. Hy-Gard may be used in many applications specifying either of these grades. Low-Viscosity Hy-Gard has the same performance specifications as Hy-Gard and can be used as a replacement for Hy-Gard in cold weather. In some machines, Low Viscosity Hy-Gard is the correct fluid to use year around. Consult the Operator's Manual for recommended fluid operating temperatures.

#### **Applications:**

- The exclusive Hy-Gard formula was designed for use in John Deere equipment; however, it can also be used in many non-John Deere transmission and hydraulic systems.
- Low-Viscosity Hy-Gard is used for factory fill in some machines. Consult the machine's Operator's Manual to determine what machines require Low-Viscosity Hy-Gard. It is also used as a replacement for Hy-Gard in cold-weather applications.
- Low-Viscosity Hy-Gard is compatible with JDM J21A hydrostatic fluid and can be added to systems which contain hydrostatic fluid.

#### Features:

- Performance tested both in the lab and in the field, and approved by John Deere engineers to meet the increased demands for performance and protection of transmissions and hydraulic systems.
- Hy-Gard utilizes a polymeric viscosity index improver to expand the usable operating temperature range and make it a multi-grade oil. Proper viscosity control is extremely important. If viscosity is too low, it can lead to increased wear, leakage in pumps and around seals, and generate additional heat. If viscosity is too high, more energy is used to pump the oil and starvation can occur at lower temperatures.
- Reduces wet-brake chatter and ensures high braking capacity.
- Superior wet-clutch performance smooths clutch operation.
- High tolerance to water contamination without sludge formation, which could cause filter clogging and hydraulicsystem malfunction.
- The antioxidation capability allows the oil to work effectively at high temperatures, helping keep transmissions and hydraulic system parts cool and clean.
- Provides protection against rust and corrosion, particularly during low-use periods.
- Anti-wear additives keep gear and bearing wear to a minimum. The extreme-pressure formulation of Hy-Gard develops a durable fluid film, which helps prevent metal-to-metal contact.

#### Functions

Because some systems have combined transmission and hydraulic oil reservoirs, the oil must perform many different tasks at the same time. There is very little margin for error. Robust balanced properties are essential. To understand the complexity of transmission hydraulic oil, let's review its functions:

- 1. Prevents wear of heavily loaded gears and bearings.
- 2. Provides wear and corrosion protection for the hydraulic pump.
- 3. Provides proper friction for clutches to engage and absorb shock loads without excessive slipping or abrupt shifts.
- 4. Withstands extreme pressures in the hydraulic system without breaking down.
- 5. Prevents the formation of deposits on all internal parts.
- 6. Prevents foam and water damage to all internal parts.
- 7. Provides proper friction for brakes to ensure low chatter, long life, and high capacity.

An industry classification for hydraulic transmission oil does not exist. Each manufacturer establishes a minimum requirement that oils must meet for use in their equipment. John Deere has established the JDM J20 specification for minimum tractor hydraulic fluid performance. John Deere does not monitor competitive or "will-fit" oils. While claiming to meet John Deere requirements, it is possible that the competitive or "will-fit" oils do not meet even the minimum performance requirements for John Deere machines, which could result in premature failures.

John Deere Hy-Gard<sup>™</sup> and John Deere Low-Viscosity Hy-Gard exceed the performance of their JDM J20 specification counterparts. The performance requirements for our family of Hy-Gard products are higher, and many more performance tests are mandatory.

- Hy-Gard oil can be used in most transmission and hydraulic applications calling for 10W-30 or 5W-30 engine oil.
   NOTE: Hy-Gard should be used in all applications calling for JDM J20C.
- Low-Viscosity Hy-Gard should be used in all applications calling for JDM J20D.
- Low-Viscosity Hy-Gard and Hy-Gard are compatible with JDM J21A hydrostatic fluid and can be added to systems that contain hydrostatic fluid.

### Wet Brake Test

**Result:** Customers can expect up to 24-percent better brakechatter control using John Deere Hy-Gard Transmission and Hydraulic Oil compared to oils meeting the minimum performance JDM J20 specification.

### Competitive Oil Tested to Meet John Deere Current JDM J20 Specifications



Hy-Gard has been formulated to ensure wet brakes have high braking capacity with minimum brake chatter. Three elements are considered in the wet brake test:

- 1. Braking capacity the ability of the brake system to absorb energy, which is measured in torque.
- Torque variation the ability of the brake system to maintain smooth frictional operation without vibration or brake chatter.
- 3. Wear low wear to ensure long life.

**Feature:** Hy-Gard Oil is formulated to maximize brake capacity with minimum brake chatter and wear.

**Advantage:** This formula provides 24-percent better brakechatter control than competitive oil.

**Benefit:** Better brake-chatter control provides smooth stopping, reduced damage from vibration, less noise, and longer brake life.

# Wet Clutch Test



**Result:** Customers can expect up to 15-percent better clutch performance (smoother engagement, less slippage, and reduced wear) when using John Deere Hy-Gard<sup>™</sup> Transmission and Hydraulic Oil.

### John Deere Current JDM J20 Specifications



Three elements are compared in the wet clutch test:

- 1. The ability of the clutch to provide smooth engagement under maximum load.
- 2. The ability of the clutch to resist slippage.
- 3. The ability of the clutch to resist wear.

**Feature:** Hy-Gard's friction modifiers provide smooth clutch engagement.

**Advantage:** Smooth clutch engagement provides 15-percent better clutch performance than competitive oils.

**Benefit:** Better clutch performance provides longer clutch life with reduced maintenance costs. Hy-Gard allows limited clutch slippage for smooth engagement, which reduces clutch wear and provides long life. Too little clutch slippage results in rough, jerky engagement, while too much slippage can cause clutch surfaces to burn or glaze.

### Gear Test

**Result:** Wear in the JDQ 95B final drive test run with Hy-Gard Transmission and Hydraulic Oil was shown to be 20% less than the wear of a minimum-performance JDM J20C fluid.

### Competitive Oil Tested to Meet John Deere Current JDM J20 Specifications



Anti-wear extreme-pressure additives play a vital role in keeping gear and bearing wear to a minimum. Oil without these additives lacks the qualities to properly lubricate transmission parts.

The JDQ95A and B spiral bevel/final drive-gear test measures a fluid's ability to prevent destructive wear of gear-contact surfaces.

Feature: Hy-Gard contains superior anti-wear additives.

**Advantage:** These additives have been shown to generate 20% less than the wear of a JDM J20C fluid.

**Benefit:** Less gear wear extends component life and reduces downtime.









John Deere Hy-Gard

Competitive Oil

### Low Temperature Flow



Oil needs to flow properly at low temperature to ensure lubricant gets to where it is needed. Flow requirements are specified at low temperature to ensure the proper flow is provided by the oil. The picture above shows how the cold temperature flow of Hy-Gard<sup>™</sup> can be much better than oils that claim they meet JDM J20C.

**Feature:** Hy-Gard contains a polymeric viscosity index improver additive.

**Advantage:** This additive ensures proper viscosity at all operating temperatures; competitive oils may not contain this additive.

**Benefit:** The proper viscosity at all temperatures increases efficiency and decreases wear, resulting in lower operating costs and reduced downtime. It also reduces the cost of the multiple oil changes associated with mono-grade oils due to changes in operating temperatures.

Hy-Gard can be used when the following oils are specified for use in hydraulic, transmission, hydrostatic, drivetrain, and/or gearbox systems:

#### AGCO

Massey Ferguson	. M1135, M1141, M1139, M1143, M1145
WhiteQ-1	722, Q-1766, Q-1766B, Q-1802, Q-1826
Allis-Chalmers, Deutz-	Allis, AGCO Allis Power fluid 821XL
CNH	
Case, Case IH	MS 1207, MS 1209, MS 1210, MAT3505
Ford/New Holland	ESN-M2C41-B. M2C134-D. M2C48-B.
	M2C48-C, M2C159-B/C, M2C86-B,
	FNHA-2C-200, MAT3526,
	FNHA-2C-201, MAT3525
Caterpillar	TO-2
Clark	MS-68
Deutz	
Dresser	Transmission hydraulic fluid. (HMS B806-0002)
Eaton Hydraulic Division	Hydraulic transmission (Form 3-401-123)
IHC	В-6
John Deere	All-weather hydraulic fluid (JDM J21A)
Kubota UDT I	nydraulic transmission fluid, Super UDT
Oliver	
Sunstrand	
Zetor	OT-H, GL-4
ZF	

Check the Operator's Manual for specific applications. Low-Viscosity Hy-Gard should be used in place of an SAE 10W oil in John Deere combine hydraulic transmission systems.

# TZT Oxidation Test



Hy-Gard<sup>™</sup>

Competitor's Oil



#### Test runs:

at 160°C (320°F)

- 400 hours continuous test with air injection

John Deere uses the TZT Oxidation Test to determine a transmission and hydraulic oil's ability to protect against extreme heat. Oxidation resistance is important to ensure the oil is durable and with will provide the proper performance for the entire service interval.

The pictures above show the difference in performance of Hy-Gard and an inferior hydraulic fluid. The competitor oil has left heavy deposits on the pan and the viscosity has increased dramatically. This can cause valve sticking and the oil may be corrosive.

Hy-Gard parts look like new. It leaves no sludge or deposits for longer equipment life. You need a high-quality tractor hydraulic oil for tough off-road conditions.

#### Chemical and Physical Properties of Hy-Gard Fluids

Property	Units	ASTM Method	Hy-Gard	Low-Viscosity Hy-Gard
Viscosity @ 40 °C	mm²/s (cSt)	D-445	59	33
Pour Point	°C	D97	-40	-51
Flash Point (typical)	°C	D92	227	180
Base Number	mg KOH/g	D2896	8.5	8.5
Viscosity Index	_	D2270	140	195

### Air-Temperature Chart — John Deere Hy-Gard Hydraulic Transmission Oils

Use the oil viscosity based on the expected air-temperature range during the period between changes. Always check the Operator's Manual for specific applications. Some applications may be restricted at the upper or lower limits of the temperature range.



### Vickers 35VQ25 Performance



- The Vickers 35VQ25 test was performed on Bio Hy-Gard II and competitive biodegradable oil.
- This test evaluates fluid in high-pressure operation using a Vickers 35VQ25 vane pump with the test fluid at a specified speed, pressure, and temperature.
- Three runs of 50 hours each are performed using a new pump cartridge for each run.
- The test consists of operating a Vickers 35VQ25 vane pump at high-pressure conditions for 50 hours. Test pressure is 3,000 psi, inlet fluid temperature is 200 degrees F, and pump speed is 2,400 rpm.
- The required horsepower input is in the range of 100.
- Evaluation of test results is done by a visual qualitative review of pump parts and weight-loss determinations.

#### **Bio Hy-Gard II Chemical and Physical Properties**

Property	Units	ASTM Method	Bio Hy-Gard II
Viscosity @ 40 °C	mm²/s (cSt)	D-445	46.5
Pour Point	°C	D97	-36
Flash Point (min.)	°C	D92	251
ISO Viscosity	_	_	46

Bio Hy-Gard II has the following biodegradability and ecotoxicity properties:

- OECD 301b (Sturm) fast biodegradability 75%.
- OECD 202 EC50 >100mg/l.
- CEC L33-A-93 biodegradability 94%.
- WGK rating 1.



# Bio Hy-Gard II Hydraulic Transmission Oil

Bio Hy-Gard II protects your land and your equipment. It can be recommended as a replacement for mineral oil-based hydraulic/ transmission oil. Bio Hy-Gard II is formulated for multi-functional systems including transmissions, axles, hydraulics, wet brakes, and wet clutches. It is recommended when biodegradable tractor hydraulic fluid or hydraulic oils are desired.

#### Applications

Forestry, turf care (golf courses/cemeteries), construction, city services (garbage collection/street services), waterway operations, orchards, and farming operations.

#### Features:

- Base oil from farm-grown products.
- Formulated from canola-based oil.
- 94 percent biodegradable.
- Exceed environmental eco-toxicity performance requirements.
- Brake chatter suppressed while superior brake performance maintained.
- Excellent corrosion protection.
- Over 13,000 hours of trouble-free field-testing.
- Compatible with mineral-based oils.

Hydrau<sup>™</sup>/Hydrau<sup>™</sup> XR

#### 50°C 122°F 40°C 104°F 30°C 86°F Hydrau 20°C 68°F HYDRAU 10°C 50°F TRANS IN SALE OF HYDRAU XR 0°C 32°F -10°C 14°F -20°C -4°F -30°C au XR -22°F -40°C -40°F 191 (5 64 85

Hydrau and Hydrau XR premium hydraulic oils were recently introduced to meet the stringent performance requirements of our construction and forestry equipment hydraulic systems. Hydrau uses a mineral oil base stock, while Hydrau XR uses a synthetic blend base stock. These two fluids are available as factory fill and can provide all-season performance in either extreme high- or low-ambient temperatures. From arctic to sustained high-heat conditions, Hydrau and Hydrau XR maintain exceptional resistance to thermal and mechanical shear-induced viscosity loss, while providing the low-temperature pumpability and flow characteristics essential for satisfactory system startup.

The very effective anti-wear additive technology used in Hydrau and Hydrau XR provides necessary protection against wear and scuffing in gear, piston, and vane pumps even in severe-service, high-pressure applications. Due to the additional exposure to moisture and contaminants found in construction and forestry operating environments, Hydrau and Hydrau XR provide enhanced demulsibility performance, increased oxidation stability, increased productivity, reduced operating cost, and extended change intervals. Exceptional anti-foam performance contributes to predictable hydraulic system performance throughout the useful life of the fluid.

When stored properly in the original sealed containers, the recommended shelf life for Hydrau and Hydrau XR is three years.

#### Applications

Hydrau and Hydrau XR are specifically designed for use in the hydraulic and hydrostatic systems of construction and forestry equipment. These fluids exceed the highest industry performance standard, ISO 11158, category HV. For John Deere and Hitachi excavators, a system flush of factory-fill zinc-free Hitachi fluid is required before use of any hydraulic fluid containing zinc anti-wear additive. These products are not for use in mechanical transmissions, axles, or multi-function systems featuring gears, clutches, or wet brakes.

#### Features:

- Excellent cold-temperature-flow characteristics.
- Exceptional shear stability under severe operating conditions.
- Superior high-temperature viscosity.
- Superior oxidation and thermal stability.
- Exceptional anti-wear performance over the life of the fluid.
- Excellent anti-foam and air-release properties.
- Protects against rust and corrosion.
- Enhanced filtration efficiency.
- Reduced air entrainment.

#### Physical specifications

Operating Range	Hydrau	Hydrau XR
Ambient	–25 °C (–13 °F) to	–40 °C (–40 °F) to
Temperature	+50 °C (122 ° F)	+40 °C (104 °F )
Physical Properties	_	_
ISO Viscosity Grade	68	46
Viscosity	_	_
@ 40 °C	67.5	43.10
@ 100 °C	11.9	10.37
Viscosity Index	174	236
Flash Point	215 °C (419 °F)	195 °C (383 °F)
Pour Point	–45 ℃ (–49 °F)	48 °C (54.4 °F)
Oil Color from Factory	Orange	Pink
Oil Color in Aftermarket	Orange	Purple

#### Industry-specific tests:

# Parker / Denison HF-0 Test

The Parker / Denison HF-0 test is one of the most sought-after pump-durability tests when reviewing oil quality and anti-wear protection. The test is run on a hybrid pump that has a variabledisplacement axial piston pump section and a fixed-displacement vane pump section. Both pumps are cycled from minimum to maximum pressure every two seconds, with the vane pump maximum pressure being 3,625 psi, and the piston pump maximum pressure being 4,000 psi. The test is split into two parts, a "dry" phase and a "wet" phase. The dry phase is run first for 307 hours with the test oil at 230 degrees F. Then for the wet phase, 1% water is added to the oil, the oil temperature is reduced to 178 degrees F (so the water does not evaporate out), and the test continues for an additional 300 hours. The wet portion of the test is to further stress the fluid and to assess its hydrolytic stability and its ability to provide continued lubrication under such extreme conditions. A fluid that cannot perform under such extreme conditions will show significant pump wear during the post-test inspection.

Both Hydrau and Hydrau XR passed this test with minimal wear on both the vane and piston pump sections.

#### Other Lubricants

#### Pump run with Hydrau<sup>™</sup> Test passed





Pump run with Brand X

#### ASTM D943 oxidation test

This test is designed to measure a fluid's oxidation stability. It is an industry-standard specification used for hydraulic fluids that are subject to moisture ingestion such as those used on construction and forestry equipment. The test is run at an oil temperature of 203 degrees. The oil sample is in contact with oxygen, water, and a copper/iron catalyst to promote the onset of oxidation. The test is run until the fluid's Total Acid Number (TAN) reaches a level of 2. The longer the time span of the test, the better the fluid is at resisting oxidation. Fluids with a shorter test duration cannot resist the onset of oxidation and will have a shorter service life in the field. Both Hydrau and Hydrau XR have superior oxidation stability and will outlast other leading hydraulic fluids by several thousand hours. This means longer service life in excess of 4,000 hours on production-class equipment. Service life varies by machine and application. Consult your Operator's Manual for recommended change intervals.

### Excavator Hydraulic Fluid

Through our marketing agreement with Hitachi Construction Equipment and Hitachi Mining Company to represent and support John Deere and Hitachi excavators marketed in the Americas, we have adopted a common hydraulic platform that includes the integration of this specialized hydraulic fluid. Super EX 46 HN and Super Hydro 32 AU are offered in two viscosity grades, ISO 46 and ISO 32.

John Deere excavators in the Americas share a common factory fill and recommended service fluid with Hitachi excavators and mining shovels manufactured worldwide. We offer this same exact factory-fill product as the aftermarket solution for excavators. This specialized fluid uses an alternate chemistryadditive approach to provide excellent performance and protection in these hydraulic systems.

Super EX 46 HN and Super Hydro 32 AU are manufactured to exacting engineering specifications and are available through John Deere and Hitachi equipment dealers in North and South America. These products are formulated with high-quality base oils and specialized non-zinc-additive technology to deliver a very stable excavator hydraulic oil.

These products should not be mixed with other lubricants or put into systems that use zinc-type-additive oils. These products are not for applications calling for Hy-Gard, JDM J20C, or JDM J20D. They are not for use in mechanical transmissions, axles, or multifunction systems featuring gears, clutches, or wet brakes.



#### Applications

These products are engineered and produced to meet the specific requirements of excavator hydraulic systems.

#### Features:

- A non-sludge-type, heat-resistant, wear-resistant, long-life hydraulic fluid prepared with a combination of a non-zinc, ashless extreme-pressure additive and a variety of antioxidants.
- 46HN matches the hydraulic factory-fill product for all metric excavator models, both John Deere and Hitachi.
- Stable formulation for maximum service intervals.
- Superior low-temperature performance.
- Quality base oil resists oxidation.
- Viscosity stable across full operating temperature range.
- Protection against rust and corrosion.
- Predictable hydraulic-system performance.

#### Physical specifications

			46HN	32AU
Test Method	Unit	ASTM#	<b>Typical Value</b>	Typical Value
ASTM Color	—	D-1500	L0.5	Light Yellow
Density @ 15 °C	cm <sup>3</sup>	D-1298	0.86	0.87
Flash Point	°C	D-92	238	222
Kinematic Viscosity @ 40 °C	cSt	D-445	47.54	31.82
Viscosity Index	—	D-2270	125	102
Pour Point	°C	D-97	-42.5	-40
Total Acid Number	mgKOH/g	D-974	0.04	0.06





# Allison Automatic Transmission Fluid TES-295

John Deere HD SynTran is a full-synthetic, heavy-duty transmission fluid designed for use in transmissions operating in severe conditions.

This blended fluid is specifically intended for Allison transmissions and for use in John Deere articulated dump trucks (ADTs).

John Deere HD SynTran provides superior protection against thermal breakdown and is ideal for year-round use in all climates.

#### **Applications:**

- John Deere 250C ADT
- John Deere 300C ADT
- John Deere 350C ADT
- John Deere 400C ADT
- John Deere 250D ADT
- John Deere 300D ADT
- John Deere 350D ADT
- John Deere 400D ADT
- Allison automatic transmissions



#### Features:

- Superior wear resistance and protection.
- Extended transmission life.
- Improved shift quality.
- Outstanding thermal stability and oxidation resistance.
- Excellent shear stability.
- Exceptional friction durability for long service life.
- Meets the Allison Automatic Transmission Fluid Specification TES-295 (AN-071006) for severe- and extended-duty intervals.

#### **Physical specifications**

John Deere HD SynTran	
Viscosity, ASTM D 445	
cSt @ 40 °C	39
cSt @ 100 ℃	7.3
Brookfield Viscosity, ASTM D 5293	
–cP @ −40 °C	8400
Viscosity Index, ASTM D 2270	168
Pour Point, ºC, ASTM D 97	-54
Flash Point, °C, ASTM D 92	236
Density @ 15 °C kg/l, ASTM D 4052	0.85
Color	Red
Pour Point, °C, ASTM D 97 Flash Point, °C, ASTM D 92 Density @ 15 °C kg/l, ASTM D 4052 Color	–54 236 0.85 Red

#### Other Lubricants

# Combine Feederhouse Synthetic Gear Lubricant

Synthetic HD460 Gear Lubricant for combine feederhouse drives is specifically designed for lubricating heavy-duty gears under high load-carrying capacity. Due to its anti-friction characteristics, this gear lube also withstands high thermal loading and resists the formation of sludge and other harmful by-products of oxidation.

#### Applications

Synthetic HD460 Gear Lubricant is recommended for higherperforming gear drives and heavier load conditions. This product can replace 80W-90 GL5 gear lube for the combine feederhouse reverser gear case ONLY. All 70 Series and newer combines with variable-speed feederhouse drives are factory filled with HD460 Gear Lubricant. HD460 protects and maintains the service life of a wide variety of enclosed industrial gearing, including spur, bevel, herringbone, and many worm gears.

#### Meets ANSI/AGMA 9005-E02.





#### Features:

- Improved viscosity control across the operating temperature range.
- Reduces air entrapment for stabilized viscosity and superior cooling.
- Minimizes gear pitting.
- Outstanding oxidation and thermal stability.
- Withstands high thermal loading and resists the formation of sludge.

#### **Physical specifications**

HD460	
ISO Viscosity Grade	460
Kinematic Viscosity	
At 40 °C mm²/s	460
At 100 °C mm <sup>2</sup> /s	30.8
Viscosity Index	97
Flash Point: COC °C	264 °C
Flash Point: COC °F	507 °F
Pour Point	–36 °C
Density at 15 °C g/cm <sup>3</sup>	0.879
Specific Gravity	0.85

# Cool-Gard<sup>™</sup> II

#### Applications

Cool-Gard II is designed to protect your cooling system for up to six years or 6,000 hours.\* Cool-Gard II coolant is an excellent choice for use in all internal combustion engine cooling systems including heavy-duty diesel, gasoline, and alternative fuel engines. Cool-Gard II is engineered with your equipment, for your equipment, so it meets the exact requirement for your machine. It is highly recommended for use in all John Deere engines; however, it doesn't have to be a Deere machine or engine to benefit from this protection. Cool-Gard II protects any liquid-cooled engine equally well. When the coolant level gets low, the best choice is to top-off the cooling system with Cool-Gard II prediluted coolant. This will also ensure the product doesn't become over diluted, reducing the freeze protection or diluting the corrosion-protection package.

Cool-Gard II PG is made with propylene glycol to protect those environmentally friendly areas. It meets all the performance specifications of Cool-Gard II. As a result of this product's lower toxicity, it provides an increased level of safety for animals and pets that may be exposed to new or used engine coolant.

#### Protect your entire fleet

It doesn't have to be a John Deere machine to get John Deere protection. Cool-Gard II can protect any liquid-cooled engine. Use Cool-Gard II for:

- On-highway vehicles.
- Irrigation pumps.
- Generators.
- Compressors.
- Any other liquid-cooled engine.

#### Features and benefits:

- Extended life coolant.
- Exceeds all aspects of ASTM D6210.
- High thermal and oxidative stability for engines with cooled exhaust gas recirculation (EGR).

- Extended-life, six-year or 6,000-hour\* service life, reducing downtime and lowering operating costs.
- Provides superior performance in all liquid-cooling system designs.
- Protects against corrosion and deposits in both summer and winter conditions.
- Cavitation control for longer liner life and more efficient water-pump performance.
- Contains a bittering agent to help discourage accidental ingestion.
- Excellent for diesel and automotive engines.

#### Product specifications

Property	ASTM D6210 Specification	Typical Values for Cool-Gard II
Specific Gravity 60/60 °F	1.065	1.065
Freeze Point °F (50/50)	-34	-34
Boiling Point °F (50/50)	226	226
Ash Content Mass %	2.5	2.5
pH, (50/50 in DI water)	7.5–11.0	7.9
Chloride, PPM	25 maximum	<13
Reserve Alkalinity	Varies by manufacturer	7
Effect on Automotive Finish	None	None

\*Rating applies when complete cooling system flush is performed prior to use.

### JDQ-1522 Test

Cool-Gard<sup>™</sup> II differentiates itself from other coolants on the market by providing the highest level of protection for heavyduty, off-road applications. The JDQ-1522 test is a proprietary John Deere test designed to assess oxidation that occurs due to the extreme thermal conditions by testing metals typically found in a cooling system. The metals and coolant are combined and exposed to extreme heat under highly oxidative conditions. Through continual agitation over an accelerated period, this test accurately depicts the corrosion protection that various coolants provide in heavy-duty, non-road applications. It proves Cool-Gard II is clearly the best choice for heavy-duty, non-road conditions and is equally suited for any liquid-cooled internal combustion engine.

#### JDQ-1522 test conditions

- 300 °F (148 °C).
- Seven-day duration.

Thermal Oxidative Stability Comparison

PRODUCT TEST RESULTS (weight changes in mg / metal; less weight change indicates less wear

Metal Type	Cool-Gard II	Universal	Long Life	Automotive
Copper	28	269	205	240
Solder	5	24	32	26
Brass	17	68	123	151
Steel	6	86	29	173
Cast Iron	5	386	160	361
Aluminum	0	371	342	34

Tested using John Deere JDQ1522 thermal oxidative stability test. This test is proprietary to John Deere and evaluates the high temperature oxidation stability of engine coolants.





### Grease

The purpose of grease is to replace dry friction with either thin-film or fluid-film friction, depending on the load, speed, or intermittent action of the moving part.

Grease is for use in applications where oil will not collect, such as open bearings or gears. Operating conditions affect grease selection for each application. Conditions include ambient and operating temperature, ambient or turbulent water resistance, oxidation stability, etc. The performance characteristics of the grease also need to be understood, including the thickener material type, the grease grade (consistency), and the viscosity of the base oil.

Grease lubricants are semisolid and have several important advantages: They resist squeezing out, they are useful under heavy load conditions, and they provide sustained lubrication into areas that are difficult to access.

#### Grease must perform several different functions simultaneously. Its characteristics are to:

- Lubricate moving parts to prevent wear.
- Protect components from corrosion.
- Flow under all temperatures to protect moving parts.
- Remain intact and in place under severe pressures or shock loads.
- Help seal and keep foreign contaminants out of lubrication points.
- Remain in place and continue to lubricate when exposed to water.

John Deere grease is specially formulated to meet the demanding lubricating needs of tough off- and on-road conditions. The right high-quality John Deere grease could help you save money through longer equipment life, reduced downtime, and decreased labor and equipment-operation costs.

Proper lubrication is essential to reliable equipment operation. If lubrication is absent, contaminated, or insufficient, metal-onmetal contact occurs between anti-friction bearing rollers and raceways. When this happens, the components will fatigue prematurely and likely fail quickly. A lubricant, either grease or oil, by itself is not an enduring substance; it will have a service life requiring replacement in order to allow bearings to reach their allowable life span.

Threats from water, heat, bearing load, and dust put even the best lubrication products and procedures to the test. That is why you need John Deere grease, which was designed to handle very harsh conditions. The most common greases used in normal bearing, bushing, and universal joint applications are NLGI no. 2.

The most efficient and cost-effective machinery-maintenance program is one that allows for the application of the ideal amount of lubrication at the proper operating intervals.

Grease is typically described with two or three qualifying terms. These are application, thickener, and NLGI grade. Some examples include:

#### SD Polyurea no. 2:

- SD means Super Duty.
- Polyurea thickener.
- NLGI no. 2 grade "thick."

#### HD Lithium Complex no. 2:

- HD means Heavy Duty.
- Lithium Complex thickener.
- NLGI no. 2 grade "thick."

#### Special-Purpose Corn Head Grease no. 0:

- Corn Head Grease.
- Polyurea thickener.
- NLGI no. 0 grade "thick."

The application may be broad coverage or special purpose, and the manufacturer may choose to describe the expected use in the name.

The thickener brings performance or product features to the blend. Different thickeners provide physical properties desirable in various applications.

The NLGI grade tells the user the thickness or stiffness of the grease. The NLGI grading scale begins with 000, 00, 0, or 1, and goes up to 6. The grade 000, pronounced "triple aught," refers to very fluid grease, one much closer to regular oil. The very common no. 2 grease has a consistency something like paste car wax or cake frosting. The thickest grade of grease is no. 6, and it resembles a solid, non-pumpable material like a crisp apple. The lower the number, the thinner the grease.

There are several other classifications applied to grease presented as physical properties and test results. Color, dropping point, additive treatments, and other terms may be included when describing grease products. Be sure to read the Operator's Manual when selecting service grease.



### Multi-Purpose SD Polyurea High-Temperature Extreme-Pressure (EP) Grease

#### **Applications:**

- High-temperature, extreme-pressure grease.
- Ideal in rolling-contact applications.
- − −15 to 380 °F (−26 to 193 °C).
- Used for initial lubrication at the factory in U-joints and axle bearings.
- Factory-fill grease for most AG equipment.
- For excellent protection in corrosive and wet conditions.
- Compatible with most other types of grease.
- Excellent for all-purpose applications, especially those requiring a severe-duty grease.
- Our best multi-purpose grease.

#### Service ratings:

- Equipment manufacturers' extended-service intervals.
- NLGI no. 2.
- JDM J13E1, J13E4, J13E5, and J25C.
- GC-LB.

#### **Physical properties:**

- Green color (emerald).
- Polyurea thickened.
- Paraffinic-base oil with extreme-pressure and antirust additives.



### Multi-Purpose HD Lithium Complex Extreme-Pressure (EP) Grease

#### Applications:

- High-temperature and extreme-pressure grease.
- –15 to 350 °F (–26 to 177 °C).
- Heavy-duty long-lasting grease.
- High-quality grease in heavy-duty applications where lithium greases are recommended or preferred.
- For wheel bearings, universal joints, suspension systems, ball joints, and anti-friction plain bearings.
- A very good multi-purpose grease.

#### Service ratings:

- Meets equipment manufacturers' extended-service intervals.
- NLGI no. 2.
- JDM J13C3, J13C3A, and J13C6.
- GC-LB.

- Amber color.
- Lithium-complex thickened.
- Formulated to prevent corrosion and water washout.
- Paraffinic-base oil with extreme-pressure and antirust additives.



# Multi-Purpose Extreme-Duty Synthetic Grease

#### **Applications:**

- -45 to 450 °F (-43 to 232 °C).
- Farm, construction, and commercial equipment including universal joints, wheel bearings, suspension systems, and brake calipers.
- Marine including inboard/outboard drives and prop shafts.
- General purpose including windows, garage doors, hinges, bicycles, shop tools, locks, and many other applications.
- Extremely low coefficient of friction properties.

#### Service ratings:

- Outlasts petroleum-based greases and oils.
- GC-LB.
- NLGI no. 2.
- USDA-rated H-1 for incidental food contact.

#### **Physical properties:**

- P.T.F.E.
- Synthetic with Teflon<sup>™</sup>; no silicone.
- Repels dirt, dust, and grime.
- Prevents rust and corrosion.
- Water- and saltwater resistant.
- Will not drip, run, or evaporate.
- Non-staining and odorless.
- High dielectric strength excellent electrical insulation characteristics.



### Multi-Purpose Lithium Grease

#### **Applications:**

- Ideal for all-season, general-purpose lubrication applications.
- − −30 to 290 °F (−34 to 143 °C).
- Excellent performance in light-duty applications.

#### Service ratings:

- NLGI no. 2.
- JDM J13C3A and J13C3.

- Reddish brown.
- Lithium thickened with high-density polyethylene.



# Calcium Sulfonate Grease with 5% Moly

#### **Applications:**

- Superior pressure and antiwear properties.
- Protects against corrosion and oxidation.
- Extreme shear stability.
- Operating temperature: -32 °C (-25 °F) to 149 °C (300 °F)
- Not recommended for high-speed bearings.
- Construction, forestry, mining, heavy-duty farming, and industrial.

#### Service ratings:

- NLGI Grade no. 2

#### **Physical properties:**

- Fortified with molybdenum disulfide (MoS<sub>2</sub>) to withstand heavy loads and shock loading.
- Environmentally friendly, does not contain detrimental additives.



# Special-Purpose Golf and Turf Cutting Unit Grease

#### Applications:

- 30 to 330 °F (-34 to 165 °C).
- John Deere reel mower gearboxes.
- Excellent at high and low temperatures.
- Competitive machines requiring NLGI no. 0 grease.

#### Service ratings:

- NLGI no. 0.
- JDM J13A5, J13E6, and J25A.

- Green color.
- Contains extreme-pressure properties.
- Contains antirust properties.
- Resists moisture and water washout.
- Polyurea-thickened grease.



## Special-Purpose Heavy-Duty (HD) Water-Resistant Grease

#### **Applications:**

- Lawn and grounds care equipment.
- Agricultural and industrial machines.
- Marine applications.
- 0 to 290 °F (–18 to 143 °C).
- Formulated with higher-viscosity base oil to prevent water washout.

#### Service ratings:

- Meets equipment manufacturers' extended-service intervals.
- NLGI no. 2.

#### **Physical properties:**

- Blue color.
- Lithium 12 thickened.



# Special-Purpose Corn Head Grease

#### Applications:

- Formulated for John Deere corn head and other slow-speed gear cases less than 1,000 rpm.
- Extra-soft grade of lubricating grease; required for row-unit gear cases of John Deere corn heads.
- − −30 to 330 °F (−34 to 165 °C).
- Thixotropic (thins to a gear oil when hard at work and thickens when at rest).

#### Service ratings:

- NLGI no. 0.
- JDM J13A5, J13E6, and J25A.

- Green color.
- Contains extreme-pressure additives.
- Excellent at high and low temperatures.
- Resists moisture and water washout.
- Polyurea-thickened grease.
- Contains antirust properties.



# Special-Purpose Heavy-Duty (HD) Moly Grease

#### Applications:

- High-temperature and extreme-pressure grease with 3% moly.
- A premium high-quality grease.
- − −10 to 350 °F (−23 to 177 °C).
- For use with pins and bushings, and ball joints.
- For use where shock loading and slow, sliding contact occurs.
- For chain, cable, and conveyor lubrication.
- For applications where pitting, scoring, and wear failures are a problem.
- Compatible with lithium, aluminum, and calcium greases.

#### Service ratings:

- Meets equipment manufacturer's extended-service intervals.
- NLGI no. 2.
- JDM J25C and J13C7.

- Slate-gray color.
- Lithium-complex thickened.
- Contains 3-percent molybdenum disulfide (MoS<sub>2</sub>).





## Cotton Picker Spindle Lubricants/ John Deere Spindle Grease

#### Quality

John Deere Spindle Grease is a lithium-based grease that can be used in all makes of cotton pickers. It is specially formulated with highly refined base lubricating oils and unique anti-wear additives to prevent abrasion and extend the service life of high-wear parts. It's not just another off-the-shelf product. John Deere Spindle Grease was specifically designed to ensure maximum lubricating performance and the efficiency of highspeed spindles in John Deere cotton pickers, as well as other makes. Thoroughly tested and proven to outperform competitive greases, this quality-made product will provide the best value for your investment. Don't jeopardize your equipment! There's a tremendous amount of metal-to-metal contact in a picker head. Using high-quality grease ensures maximum performance by reducing wear on these metal surfaces. To keep your equipment running efficiently, even under the harshest operating conditions, you can depend on John Deere Spindle Grease.

#### Superior formula

Not all spindle greases provide the same level of performance. That's why we developed our own. Here's what makes the John Deere Spindle Grease outperform other brands:

- High-grade, anti-wear additives and rust inhibitors protect the spindles and picking unit components, extending the service lives of all parts.
- Lithium soap holds oil in suspension better than other types of greases. Bentonite-clay greases, for example, can form deposits or "caking" in the picker bars, preventing the grease from lubricating the picking assembly.

- Proper base lubricating oil ensures excellent performance and lubrication in extremely hot operating temperatures. It will not thin out like other brands. If base oil viscosity is too low, it can reduce bearing life. If it is too high, a cotton picker will be forced to use higher horsepower at lower temperatures.
- John Deere Spindle Grease is an ALL-IN-ONE lubricating grease, gear lubricant, penetrating oil, and corrosion protector.

#### Value-added benefits

If you buy spindle grease based on price alone, you may be losing money. A lower-priced, lesser-quality spindle grease can cost a lot more than you expect — especially if it won't stand up to the harmful effects of extreme temperatures, high-speed spindle operation, rust, and corrosion. John Deere Spindle Grease is competitively priced and is the best value for your investment. It will help reduce operating and maintenance costs, and prolong the life of your picker heads.

#### Features and benefits:

- Special semi-fluid, lithium-based grease developed expressly by John Deere for use in John Deere and other mechanical cotton pickers.
- Formulated with highly refined base lubricating oils, which are blended and milled into a lithium-based grease, along with special additives to enhance lubrication performance.
- Flows freely, but has sufficient body to resist excessive leakage from spindle bearings.
- Performs well over a wide range of temperature conditions, resulting in low, cold-weather-starting torque, yet does not thin down and leak out at higher operating temperatures.
- Special additives are incorporated reduces wear and provides rust protection to equipment while the machine is standing idle during the off-season.
- Continued and exclusive use provides extended equipment life and reduces downtime for maintenance.
- Prevents dirt, water, and other contaminants from entering bearings and other parts being lubricated.





### John Deere Spindle Cleaner

#### Grease compatible

The quality of spindle cleaner you use also plays a critical role in increasing your harvesting performance and reducing your operating and maintenance costs. That's why we developed our own superior grease-compatible spindle cleaner. John Deere Spindle Cleaner does much more than soap and water can do for the spindles and interfacing parts:

- Specially formulated, water-in-oil emulsion is compatible with lubricating spindle grease. Won't wash grease off the bushings like soap and water does.
- Water-soluble oil mix easily clears cotton and sticky plant sap off the spindles and moving parts, even when mixed with extremely hard water.
- Also lubricates and coats the spindles, and maximizes spindle doffing.
- Extends the service life of doffers and moisture pads.

#### Why soap and water aren't enough:

- Using dishwashing soap instead of a quality spindle cleaner doesn't protect your picker's mechanical parts from rust, oxidation, and corrosion.
- Even worse, dishwashing soap actually washes away the lubricating spindle grease from the bushings and attachments, leaving them unprotected.

#### Features and benefits:

- Uniquely formulated, water-soluble product when mixed with water at a ratio of up to 100 gallons of water to 11/2 gallons of spindle cleaner.
- Moistens and cleans spindles effectively even when working with extremely hard water.
- No harmful effect on doffers and pads such as some other products might produce.
- Applies easily through small nozzles, reducing consumption and allowing longer intervals between tank refills.



### John Deere Fuel-Protect Diesel Fuel Conditioner

John Deere Fuel-Protect Diesel Fuel Conditioner is specifically formulated to provide maximum engine horsepower and fuel efficiency by keeping legacy fuel systems clean, extending injector and high-pressure pump life, and improving the overall quality of fuel in storage tanks.

There are two formulas: winter or blue stripe label, for use when the outside temperature is below 32 degrees F; and summer or red stripe label, for temperatures above 32 °F (0 °C).

#### Features and benefits:

- Designed primarily for legacy fuel systems.
- Reduces downtime and maintains fuel-injector life.
- Can be used with any petroleum-based diesel fuel (high-sulfur, low-sulfur, or ultra-low sulfur) and biodiesel fuel.
- Minimizes smoking and emission deteriorations caused by deposits.
- Improves water tolerance.
- Improves lubricity of fuel.
- Extends fuel filter life.
- Boosts cetane number.
- When added to diesel fuel in storage, it will also extend the useful life of the fuel by providing improved stability and preventing oxidation.
- Winter formula available to improve operability in cold weather.
- Can be combined with Keep Clean to gain the benefits of both products.

- Meets JDN354 specifications.



### John Deere Fuel-Protect Keep Clean

John Deere Fuel-Protect Keep Clean does exactly that — it keeps fuel systems clean. Designed for newer high-pressure fuel systems with tight clearances, John Deere Fuel-Protect Keep Clean will prevent and strip away harmful deposits that cause injector sticking and block spray holes, resulting in power/fueling loss, rough running, smoke, and misfire. Designed primarily for ultra-low sulfur diesel fuels, it may be used for higher sulfur-content fuels as well as when strong cleaning is necessary to prevent or remove stubborn fuel deposits.

Keep Clean may be used in two ways: a cleaning treat rate that doubles the dose to achieve a system clean-up in 40–70 hours of operation, and a maintenance treat rate which prevents the return of these stubborn deposits that rob power and result in poor engine operation.

#### Features and benefits:

- Designed for newer higher-pressure fuel systems to remove stubborn fuel deposits. Also works on legacy fuel systems.
- Can be used with any petroleum-based diesel fuel (high-sulfur, low-sulfur, or ultra-low sulfur) and biodiesel fuel.
- Eliminates the hard starting, rough running, smoke, power/ fueling loss, and misfire that often requires the replacement of injectors to resolve.
- When added to diesel fuel in storage, it will also extend the useful life of the fuel by providing improved stability and preventing oxidation.
- Can be combined with Diesel Fuel Conditioner to gain the benefits of both products.



# Diesel Exhaust Fluid (DEF)

DEF, or diesel exhaust fluid, is used in a selective catalytic reduction (SCR) system to remove nitrogen oxides (NO<sub>x</sub>) from engine exhaust. DEF is 32.5% high-purity urea and 67.5% deionized water. The ratio provides the lowest possible freeze point. John Deere DEF is compatible with all engines using selective catalytic reduction (SCR) aftertreatment technology. This includes John Deere diesel engines and equipment, non-road and stationary equipment, on-road trucks, and automobiles. With John Deere DEF, you can be confident you are getting a high-quality product that will provide unsurpassed performance while protecting your equipment investment. Simplify your operation by integrating John Deere DEF into your fluid-maintenance routine.

#### Features and benefits:

- Convenient container sizes.
- Translucent containers to monitor fluid levels.
- Non-toxic, non-hazardous, and non-flammable.
- Dispense nozzle included with each jug.
- Drums outfitted with 2-in. bung opening for direct-pump or closed-system dispensing valve and drop-tube installation.
- Totes include integrated closed-system dispensing valve and drop tube.
- Forklift access beneath tote cage for ease in handling.
- ISO 22241 compliant.
- American Petroleum Institute (API) certified.

#### **Typical usage rates**

John Deere Engine Rate	
6.8 L	0.4 L/hr (0.1 gal./hr)
9.0 L	0.8 L/hr (0.2 gal./hr)
13.5 L	1.1 L/hr (0.3 gal./hr)

# Fluid Analysis Introduction

One way to understand the value of John Deere lubricants and coolant is to perform used fluid analysis with your customers. This service is offered through John Deere programs in the U.S. and Canada. Other John Deere programs exist or are being developed in other regions around the world.

John Deere has developed a relationship with independent service providers that understand our commitment to quality and maintaining integrity for our customers. A key aspect of these partners is that they are independent. The test results of fluid analysis are reported as they are returned. The independent lab has no incentive to report results favorably or unfavorably. They are unbiased.



Another key feature of our programs is the long-term relationships we have established with our lab partners. Time has improved the data bank of knowledge from our equipment, our customers' applications, and our lubricants. With this background, the labs are able to provide reliable report comments in support of confident maintenance decisions.

John Deere offers fluid analysis for lubricants, coolant, and fuel.

### The Process

John Deere oil-sampling programs provide a comprehensive chemical and physical analysis of an oil sample taken from any enclosed lube system such as engines, hydraulics, or transmissions.

Using the appropriate sample test kit, the dealer or the customer collects a representative fluid sample and sends it to the lab for independent analysis. This analysis provides details of the

sample: wear metals, contaminants, chemical composition, physical properties, and an indication of the remaining useful life of the oil. General comments are provided based on the sample test results and the information provided in the sample information form submitted with the sample.

Review report information for a preliminary overview of the oil and the component system. This process is most effective when oil samples are taken and analyzed at regularly scheduled intervals. By comparing the most recent analysis to previous test histories on a given machine, trends which allow early detection of abnormal conditions become apparent. No two machines, even machines of exactly the same type, accumulate contaminants or wear at the same rate. "Trend" analysis, based on histories developed from each individual oil compartment, is the most effective method of detecting abnormal conditions before they can develop into major problems. Trend analysis adds tremendous value to the data and the quality of the decision making that results.

Knowing this, the frequency of taking oil samples depends on the machine type, severity of the application, and operating conditions. Low-use, redundant equipment may only get sampled once a year during inspections. Mission-critical equipment may be sampled several times over the course of a year to monitor for wear or contamination to keep the equipment in production.

#### What is required from the supporting dealer is simple:

- Support your customers with the appropriate sample kits based on the fluid to be evaluated.
- Advocate clean collection of representative fluid samples.
- Completely fill in the sample label and the sample information form with customer and equipment details as prompted. Key machine details are the serial number (PIN), fluid brand and type, and the hours or miles on the machine and the fluid.
- Send the sample, identified with the customer and machine information, to the lab the same day it is taken. Make sure the container lid is secure, and place the sample in a plastic bag. Do not put the sample processing form in the bag with the sample.
- Review the sample reports and manage the data with your customers to provide appropriate service and support.

# IMPORTANT: The sample reports and recommendations do have limitations.

**Test results only reflect what was present in the sample.** If the sample represents the fluid in the system, this is great. If the sample represents other features not from the system fluid, this can be misleading.

The sample results are only one set of data. If something on the report indicates there is a variance, you should be asking additional questions. Said another way, get a second opinion. For example, if the report from an engine oil sample suggests coolant is present, the equipment manager (or the dealer) should be asking questions such as, "Is the coolant level down?" "Is the engine producing unusual smoke?" "Is the engine running different, smelling different, losing power, making noise, etc.?" It would be easy enough for a technician who is servicing the engine to be exposed to any number of contaminants from outside sources that may end up in the oil sample. Verify the sample results using additional cross-checking methods to prevent performing unnecessary service. Asking questions is more economical than performing unneeded service. It will also support getting to the root cause of an issue instead of just replacing a component.

In all cases, the final decision to follow the recommendations lies with the end user. Our programs provide a tool for monitoring the lubricant and system condition, and maintenance practices and procedures used on equipment. The quality of the analysis is directly related to the quality of the sample taken, the information provided, and the desire to use the program to its full potential.

If you have questions about a report, contact your Territory Customer Support Manager and discuss your concerns. Together you can contact the lab for advice on interpretation, exchange ideas regarding additional areas to investigate, and collaborate in making confident decisions with your customers.

Fluid analysis is a fantastic tool that can alert you to issues with a fluid, a component, or a system, and it can play a strong supporting role in proactive maintenance. This tool is also an excellent way to validate the performance and protection your customer is getting from our John Deere lubricants and coolant.

# The Programs

Programs are set up to offer several testing options depending on the sample origin and the expected level of reporting.

In general, each type of testing is specific for the types of properties or contaminants that support good decision making. For example, engine oil tests check for fuel dilution and Total Base Number (TBN), not typically of value when looking at a hydraulic system. Hydraulic and gear system tests check for water content and particle count, again not typically of value when looking at engine lubricant systems. Some tests such as elemental analysis are included when checking samples from either engine or powertrain systems to show wear metals, contaminants, and chemical makeup.

#### Some features of the programs are:

- Samples are processed and reported within 48 hours after receipt at the lab.
- Sample reports are posted online for rapid access and ease of sharing.
- Our programs are supported by independent laboratories specializing in the analysis of fluid.

# Selling and Promotional Ideas

Selling and promoting fluid analysis kits and programs are easy. These features will help you promote the value of this program:

#### Customer benefits:

- Sample reports provide data about the fluid, the system and components, wear activity, and contaminants, while data outside of the expected range is flagged for attention generally much earlier than would be detected by other methods.
- Suspected problems can be investigated and corrective actions can be scheduled before problems cause costly, untimely breakdowns.
- Minor repair versus major overhaul reduces nonscheduled downtime costs.
- Alerts customers to oil degradation, which could be causing increased fuel and oil consumption.
- Provides indication of lubrication effectiveness and confidence in lubrication service intervals.
- Provides feedback for adjusting service intervals to avoid overor under-maintaining equipment.
- Sustains engine and machinery life when maintenance and repairs are performed efficiently.
- Improves equipment availability by reducing nonscheduled downtime.
- Determines that proper lubricants are being used.
- Can help improve the resale value of equipment.

#### Dealer benefits:

- About 20% of oil-sample results indicate that some form of service may be needed. That is, one in five sample results opens the door for parts and labor growth.
- Having the conversation about planned and scheduled service is much easier than trying to coordinate resources for an unscheduled major repair.
- Can help improve the resale value of dealer-owned rental fleet equipment.
- Establish or enhance the customer relationship with routine contact.
- Establish the dealership as the knowledge resource for service advice.
- Can be used on all makes of equipment or fluids.
- Sample report data enhances the value of machine-inspection reports.



#### Marketing ideas:

- Include the kits as part of an oil and filter, coolant, or other promotion.
- Link maintenance service to a comprehensive customersupport program.
- Use the display box which comes with the kits. Set up the display where it will be noticed, and talk it up!
- Capitalize on your customers' success stories! Use their stories to sell the program to additional customers. Compare the cost of the test kit to the cost of the minor repair in relation to the major repair.
- Keep trend reports on-hand to help communicate the value of routine testing.

#### Breaking it down:

Talk to your customers about the program:

- It's easy to do.
- Impart valuable information for managing their equipment investment.
- Take good representative samples.
- Label the sample information form completely.
- Promptly send the sample to the lab.
- Review the objective lab results subjectively with your customers.
- Question data that is outside expectations.
- Make good maintenance decisions with "inside" information.
- Remind your customers of the reassurance they are getting regarding the quality of John Deere lubricants.

### Marketing

John Deere lubricating oils offer you sales potential like no other parts group you market. Every equipment owner, whether he's an equipment customer of yours or not, needs engine, hydraulic, and transmission oils.

You've read about the benefits of John Deere oil and why it's best for John Deere equipment. These features also make it the best for competitive equipment. Tell all your customers how it stacks up against the competition.

This section outlines a marketing strategy to capitalize on that potential. Review these marketing suggestions and implement a sales program suited to your trade area.

Be aggressive and creative. Most parts sales are lost because dealers sit back and wait for business to come to them. That seldom happens. The people who get the business are the ones who go after it!

# Analyze the Competition

#### It is very important to:

- Identify who your competition is in your trade area. If you do not know, find out. To be successful in increasing your oil sales, you will have to capture some of their business.
- You will have to be aggressive. Remember that they have taken your customers from you. John Deere premium products support equipment performance. When your customer uses competitive products, not only are you losing lubricant sales, their equipment may not perform as expected. This in turn may lower their opinion of our equipment and our brand. There are more than just oil sales at risk.
- Perhaps the easiest and most reliable way to determine why your customers are buying oil elsewhere is to ask them. You can do this at the parts counter.
- Start by taking care of your customer's immediate parts needs. Then do some suggestive or related selling. Up-selling lubricants alone is a great place to start because of the coverage we offer for other brands of equipment. Asking about filter needs is a complimentary way to let your customer know you are interested in servicing their needs.
- Feel free to ask your customers why you are not getting their business. It shows you are interested and are looking to get back lost business.

### **Buy Smart**

Programs are in place to support purchasing products at reduced costs. Coordinate and manage your inventory strategy to take advantage of these opportunities. These benefits allow you to buy at the lowest price possible with the opportunity to pass savings on to your customers.



# Develop a Sales Strategy

Buying smart is a good start. Your approach in selling to customers is just as important. Here are some ways to approach your customers. The common thread is that these methods are proactive.

# Sell in the Field

# Field sales calls are the most direct and promising of all selling opportunities available to you:

- Dealing with customers on their jobsites is convenient, with less time spent away from their work.
- Low prices are definitely important, but the old saying "Being in the right place at the right time" also applies to oil sales. The right place is out in the field with the customer and his machines. In most cases, the competition is out in the field visiting with your customers regularly. He's getting the jump on you. He recognizes the sales potential and knows he has to contact the customer before you or someone else gets there first.
- When selling in the field, be prepared. Know as much about your customer, his equipment, and his oil needs as possible. Know the product you are selling. Your confidence will be noticed, and your customer will be comfortable buying from you.





# Sell at the Parts Counter

To be successful in selling oil at the parts counter, you will have to do some suggestive selling, which is selling the customer parts he had not planned to buy. It is the sale of items over and above those the customer originally planned to buy.

#### Customers want suggestions from you:

- Suggestions can remind them of products or parts they need.
- Suggestions can also help a customer identify needs of which he was not aware.
- Suggestive selling can save both time and money for you and your customer.
- Sell filters like bacon and eggs, filters and oil go together.

# **Related Selling**

At the parts counter, you also have a chance to do some related selling. This is getting the customer to buy products or parts related to those of his original purchase. If a customer buys filters, sell him oil! That's related selling.

#### Here are some other examples of related selling:

- Customer comes in with a broken hydraulic pump inform him of the need to flush system before installing a new pump — sell him oil.
- Customer comes in looking for a replacement hydraulic hose — if it is time for an oil change and not to top off the system, sell him oil.
- Customer comes in looking for a hydraulic cylinder repair kit — if it is time for an oil change, sell him oil.

# Telephone Marketing

Another way of promoting oil is through telephone marketing. It's been proven through numerous examples from the field that pre-selling oil can improve your sales.

#### Give your customers a call:

- First develop a call list.
- Ask your sales department to help assemble a listing of all potential customers. It's important to maintain current listings.
- Review the quantity and type of John Deere equipment the customer has.
- Approximate how much oil the customer might use in a year.
- Be aware of your company strategy of offering discounts as an extra incentive for qualified customers with large oil-volume potential or purchase history.
- In addition, when customers call your parts and service departments, take care of their service or parts needs, and then close the call with a sales pitch on John Deere oil.

### John Deere Plus-50<sup>™</sup> II Price-Comparison Form

- Save money by using John Deere Plus-50 II Engine Oil with extended-hour usage.
- Review the example comparison form and then complete the blank form using your drain intervals, oils, and prices. Remember, when used in a John Deere engine with a John Deere filter, and using ULSD, drain intervals may be extended 100%, up to 500 hours. Example: Operator's Manual recommendation: 250 hours; John Deere Plus-50 II Engine Oil: 500 hours.

Machine – 624K		Date - 9/14/12			Us	er Inputs
Annual usage (hours)	(A)		1450			
Drain interval (hours) without Plus-50 II				(B)		250
Drain interval (hours) with Plus-50 II				(C)		500
Number of oil and filter changes per year	without	Plus-50 II (A divi	ded by B)	(D)		6
Number of oil and filter changes per year	with Plus	s-50 II (A divided	l by C)	(E)		3
Gallons required per change				(F)		6.25
Cost of engine oil filters (RE541420)				(G)	Ś	\$14.17
				Competiti	ve Oils	
Use Plus-50 II Engine Oil and Save*		Plus-50 II	#1	#2		#3
Price per gallon		\$19.25	\$18.00	\$16.0	)0	\$13.00
Gallons per change (F)	x	6.25	6.25	6.25	5	6.25
Oil cost per change	=	\$120.31	\$112.50	\$100.	00	\$81.25
Engine oil filter(s) cost (G)	+	\$14.17	\$14.17	\$14.1	7	\$14.17
Total cost per change	=	\$134.48	\$126.67	\$114.	17	\$95.42
Changes per year (rounded up) (E) & (D)	x	3	6	6		6
Annual oil and filter cost	= (H)	\$403.45	\$760.02	\$685.	02	\$572.52
Less Plus-50 II annual cost	— (H)	—	\$403.45	\$403.4	45	\$403.45
Plus-50 II savings per year*	=	_	\$356.57	\$281.	57	\$169.07

#### **COMPARE PLUS-50 II AND SAVE\***

Save Money, Time, and Engine Life!

\*Cost of labor not included in this comparison. \*Part numbers and figures are for example only and are subject to change.

#### **COMPARE PLUS-50 II AND SAVE\***

Machine		Date – 9/14/12		U	ser Inputs
Annual usage (hours)		(A)			
Drain interval (hours) without Plus-50 II				(B)	
Drain interval (hours) with Plus-50 II				(C)	
Number of oil and filter changes per year	without	Plus-50 II (A divi	ded by B)	(D)	
Number of oil and filter changes per year	with Plu	s-50 II (A divideo	l by C)	(E)	
Gallons required per change				(F)	
Cost of engine oil filter(s)				(G)	
				Competitive Oils	
Use Plus-50 II Engine Oil and Save*		Plus-50 II	#1	#2	#3
Price per gallon					
Gallons per change (F)	х				
Oil cost per change	=				
Engine Oil Filter(s) cost (G)	+				
Total cost per change	=				
Changes per year (rounded up) (E) & (D)	х	(E)	(D)	(D)	(D)
Annual oil and filter cost	= (H)	(H)			
Less Plus-50 II annual cost	(H)	(日)			
Plus-50 II savings per year* = —					
Save Money, Time, and Engine Life!					

\*Cost of labor not included in this comparison.

Make a copy of the above chart and insert your prices. Take time to understand the benefits and value of John Deere Plus-50 II oil in addition to the dollar savings from the chart. TRY IT! IT WORKS!

## Base Oil

Crude petroleum oil is a mixture of a wide variety of hydrocarbon compounds of different molecular sizes, determined by the number of carbon atoms linked together with hydrogen atoms to form a chainlike structure. In general, the longer the hydrocarbon chain, the higher its boiling temperature. Through the oil-refining process of distillation, crude oil can be separated into its various components due to the fact that they vaporize, or boil off (longer chains separate from short chains), at different temperatures. These vapors are then cooled and condensed back into liquids such as solvents, gasoline, diesel fuel, and lubricating oils. These base lubricating oils are called base stocks, which are further purified and blended with various performance ingredients to make finished engine oils, hydraulic oils, transmission fluids, and gear lubes.

#### **API Group Classifications**

Lubricating oil base stocks are classified according to their chemical structure and sulfur content. A carbon atom can have up to four other atoms attached to it. Natural gas, or methane, is the simplest hydrocarbon compound, with four hydrogen atoms attached to one carbon atom. Lubricating oils are long chains of carbon atoms linked together, with hydrogen atoms attached to all the other available spots on the carbon chain. Sometimes the carbon atoms can be joined together in what are called double or even triple bonds, with fewer spots for hydrogen atoms to attach to the chain. Unfortunately in these situations, the hydrocarbon molecules are less stable and can react with other compounds inside an operating system to form gums, varnishes, sludge, and other harmful deposits.

#### API Group I

API Group I base stocks were for many years the main component in engine oil, and performed adequately in yesterday's engine operating conditions. Group I base stocks contained hydrocarbon chains with significant amounts of multiple bonds and higher amounts of sulfur contaminants. As engine operating temperatures and horsepower outputs have increased, it has been found that engine oils made with Group I base stocks are not capable of withstanding these harsh operating conditions. They break down to form gums, varnishes, and carbon deposits.

#### API Group II and Group III

API Group II and Group III base stocks are further refined to remove almost all sulfur content and reduce the number of multiple bonds in the hydrocarbon molecules. This process is called hydro-treating. In addition, a more severe refining process called hydrocracking can be used to break apart extremely long hydrocarbon chains to produce a very pure and stable base stock. These two processes produce base stocks that are much more stable and capable of resisting high-temperature breakdown and deposit formation. John Deere Plus-50<sup>™</sup> II SAE 15W-40 and 10W-30 engine oil are blended using only the highestquality Group II and Group III base stocks to help keep engines clean and free of harmful and performance-robbing deposits.

#### Group IV

Lubricating oils can be formulated using synthetically made base stocks instead of those refined from crude oil. There are sophisticated chemical processes that can link together carbon and hydrogen atoms to produce very uniform hydrocarbon molecules with very precise chemical and physical properties. Classified as Group IV base stocks, these synthetic lubricants can offer performance advantages over mineral oil base stocks. These advantages include better high-temperature performance by resisting high-temperature oil breakdown, oxidation thickening, and deposit formation; and better cold-temperature performance by retaining more fluid to guickly flow to moving parts at start-up in very cold conditions, building oil pressure and lessening start-up wear. John Deere Plus-50 II SAE 0W-40 Synthetic engine oil, blended with the highest-quality synthetic base stocks, is the best choice for use in extremely cold environments to ensure maximum engine-lubrication protection.

# Facts About Oil and Its Usage

#### Off-road engines have different needs:

- The off-road engine (farm or industrial) has less stop-and-go operation and performs most of the time at normal operating temperatures. Load factors range from 70 to 80% of the continuous rated load.
- An on-highway engine (truck and automobile) is subjected to more stop-and-go operation, idling, and cold-engine operation. It is seldom subjected to the off-road engine's extended high-load operation. Load factors range from 40 to 50% of the continuous rated load.
- Manufacturer's engine oil specifications take into consideration these differences when formulating or specifying oils for their engines.

#### Operator's Manual recommendations are critical:

- Lubrication recommendations in Operator's Manuals ensure good performance over a long period of time. Refer to the Operator's Manual and follow the recommended lubrication practices.
- Oil changes are necessary regardless of base stock type.
- Oil loses many of its lubrication qualities as it absorbs contaminants and its additives are depleted.
- Oil thickens as it breaks down and oxidizes. If it gets thinner during use, fuel dilution or coolant leak may be the cause.
- Oil oxidation and excessive contamination cause the oil to eventually become unfit for further use.

#### Oil color may not determine replacement need:

 In a diesel engine, good oil should turn dark with use to be effective. Detergent and dispersant additives in oil attract and hold soot and other combustion products in suspension for removal at the time oil is drained. In a hydraulic system, it may be different.

#### Cheap oil does not save money:

 Too many people are trying to save money on oil when they should be saving their equipment. Ten dollars saved through buying cheap oil can result in hundreds or thousands of dollars of expense incurred prematurely.

#### Use manufacturer's recommended filter:

 Buy quality oil filters as recommended in your Operator's Manual. The money saved by buying cheap "will-fit" filters is negligible compared to the damage that can possibly result from their use. Filters meeting exact operating specifications are critical to the life of the machine.

#### An aftermarket oil additive may reduce protection:

- John Deere has adopted a general policy of not approving the use of additional or supplemental oil additives, oil treatments, or engine treatments.
- Additional oil additives and engine treatments could produce more problems than benefits. These products could create a general chemical imbalance in the oil formulation and adversely affect the overall performance of the oil.
- There is no need to add anything to improve John Deere oils, which already deliver exceptional performance.

#### Synthetic oils:

- Synthetic oils are composed of base-stock products altered from their natural state through changes in their structure.
- Synthetic base stocks, like petroleum base stocks, require the addition of the proper additives for the optimum performance of the finished engine oil. Synthetic engine oils perform the same functions as mineral oil and require the same oil-drain intervals.
- The value of operating with synthetic oils is most apparent under extreme operating conditions — very cold and very hot ambient temperatures.

#### **Re-refined oils:**

 John Deere supports the recycling of used oils. Since re-refined engine and transmission oils must provide the same performance levels as other lubricants, they also must meet the requirements for: (1) physical and chemical specifications, and (2) all performance-test requirements.

### Storing and Handling Oils

Follow these easy storing and handling tips to reduce the chance of dirt and moisture contamination in oil. Remember, what gets into the oil gets into the equipment.

#### Packaged product:

- Store oil inside clean, enclosed areas. If oil is stored outdoors, it should be under cover and protected from the weather elements.
- Keep oil temperature relatively stable. Changes in temperature can draw water into oil barrels.
- Lay oil barrels on their sides if stored outside, or tilt them slightly so the opening is away from any water collection.
- Keep barrel openings drawn tight using a bung tool and wooden mallet.



#### Bulk stored product:

- Clean all dirt and moisture from around the filler cap before removing it for adding oil to bulk storage tanks. Do the same before removing filters or dispensing connections.
- Always use fully functioning caps and filtered vents.
- Keep tanks as full as practical to help prevent condensation.
- If equipped, drain the sediment and water from the tank drain valve periodically.
- With the tank positioned at a slight angle, place the pick-up tube at the higher end of the tank so the sediment and water can be collected and drained at the lower end of the tank.
- Minimize direct sunlight and thermal cycling to reduce condensation to support product stability.
- If bulk storage tanks must be in direct sunlight, paint tanks a light color to minimize heating and temperature swings.

# Disposing of Oil

- Improper disposal of drained oil can harm the environment and ecology. Never pour oil on the ground, down a drain, or into a waterway, stream, lake, or pond.
- Always observe environmental regulations. John Deere recommends that all used oil be returned to responsible recyclers.



# Glossary of Oil Terminology

ACEA

European Automobile Manufacturers Association

Additive

A chemical added to a base oil to improve desirable properties or suppress undesirable properties

**Alkalinity** Having the ability to neutralize acids

Antifreeze A compound added to a liquid to lower its freezing point

**API** American Petroleum Institute

Ash level The amount of ash formed when oil is burned

**ASTM** American Society for Testing and Materials

**Baseline** The standard by which test results are compared

**Brake chatter** Brakes that operate with an irregularity that causes rapid intermittent noise or vibration

**Classification** A systematic arrangement of oils in groups or categories according to established criteria **Combustion** The act of burning fuel, as in engines

**Composition** A product of mixing or combining various elements or ingredients

**Congeal** To change from a fluid to a semisolid state

**Consumption** To use up or waste away

**Contaminant** Undesirable element which can make oil unfit for use

**Corrosion** The process of wearing away gradually by chemical action

**Crude oil** Oil in its natural state unaltered by processing

**Decompose** To undergo chemical breakdown

**Density** A measure of the oil's weight per unit volume

**Depressant** An agent that reduces the activity or moves to a lower position

**Dispersant** A substance for promoting the suspension (as fine particles) more or less evenly throughout

**Distillation** A process that separates hydrocarbon fractions according to their boiling range

**EPA** Environmental Protection Agency

**Flash point** The temperature at which oil vapors will ignite momentarily with a flame

**Formulate** To prepare according to a set method or mixture

Fractionation To separate (as a mixture) into different portions

Friction The rubbing of one body against another

Fuel oil An oil that is used as fuel

**Gel** To change into or take on a more solid form

**Grade** A position in a scale of, as in oil

Inhibitor An agent that slows or interferes with a chemical reaction, such as rusting

#### JASO

Japanese Automotive Standards Organization

#### Kinematic viscometer

An instrument used to determine the viscosity grade of an oil

Lubricant A substance that lessens or prevents friction, heat, and wear

**Natural gas** Gas issuing from the earth's crust used chiefly as a fuel and raw material

**Neutralize** To counteract the activity or effect of

**OEM** Original Equipment Manufacturer

**Oxidation** The process of combining with oxygen or the thickening of oil

#### Petroleum

An oily, flammable, bituminous liquid that is a complex mixture of hydrocarbons prepared for use as gasoline, naphtha, or other products by various refining processes

#### Polyalphaolefins (PAOs)

A common base stock used to blend synthetic lubricants

#### Polymer

A chemical compound or mixture of compounds consisting of repetitive structural units

#### Pour point

The lowest temperature at which a substance flows under specified conditions

#### Premature wear

Wear occurring before the usual time

Rating

A classification according to grade

#### **Reference fluid**

A fluid by which performance is compared

#### Refinery

A building and the equipment used for separating the material in crude oil and producing useful products from it

#### Resin

Natural organic substance soluble in organic solvents (ether) but not in water

Retention

The act of holding secure or intact

#### Rust

The reddish, brittle coating (iron oxide) formed when chemically attacked by moist air

#### SAE

Society of Automotive Engineers

#### Saybolt

An instrument used to determine the viscosity of an oil; a unit of measure

#### Sludge

A precipitate or material setting (as a mixture of impurities and acid) from an oil

#### Stability

Resistance to chemical change or physical disintegration

#### Suspension

The state of a substance when its particles are mixed with but remain undissolved in a fluid or solid

#### TBN

Total Base Number; a measure of the alkalinity level of oil

#### Viscosity Resistance to flow

#### Viscosity index (VI)

A number assigned as a measure of the change of the viscosity of a lubricating oil with change of temperature, with higher numbers indicating viscosities that change little with temperature

#### Wear

The progressive loss of substance from the surface of a body occurring as a result of relative motion at the surface

#### Zinc

Oil additives containing zinc minimize engine wear and oil oxidation

# Engine Oil

A complex group of ratings, classifications, grades, etc. surrounds today's engine oils, which have become more sophisticated, as have the engines in which these oils are used. This section will discuss these complex engine oil specifications. But first we will look at the demands today's engines place on lubricating oils.

#### **Engine Oil Requirements**

We all know that, basically, lubricants reduce friction and wear between moving parts. Refined oil was adequate when the horse and buggy were the primary means of transportation, but today's equipment requires more sophisticated lubricants. The development of more powerful engines is constantly changing our technology, and lubricants must be formulated to perform under new conditions.

Today's high-performance automotive, light-duty, and heavyduty engines demand a great deal from a lubricating oil. Here are the four most important demands:

#### 1. Oil Must Reduce Friction and Wear

Engine friction and wear are caused by the interference contact of moving parts. Combustion by-products and other contaminants present in the oil also add to engine wear. To prevent metal-to-metal contact, the oil must maintain enough viscosity or film thickness to provide a cushion between moving parts under all operating temperatures.

In spite of high, localized operating temperatures, the viscosity under other conditions must be no higher than necessary and still provide good starting and the least friction under sustained running.

#### 2. Oil Must Cool Moving Parts

Engine oil is largely responsible for piston cooling. This is done by direct heat transfer through the oil film to the cylinder walls and into the cooling system. Additionally, oil splash directed at the underside of the piston crown and shirt carries heat to the engine crankcase for dispersion.

Oils of equal viscosities have the same heat-transfer capabilities, but the oil must have enough heat stability to resist decomposition when it is exposed to hot surfaces.

#### 3. Oil Must Help Seal the Cylinders

During combustion, pressures in the cylinder may be 18,000 kPa (2,600 psi) or higher. Oil helps the piston rings seal these pressures in the combustible chamber by forming an oil film on the piston rings and cylinder walls.



#### 4. Oil Must Keep Parts Clean

Contrary to popular opinion, engine oils do wear out. Extended service depletes the additives and oxidizes the base oils, forming harmful compounds. While good filtration will prolong oil life, many contaminants are soluble in oil and can pass through the filter. These contaminants are primarily unburned or partially burned fuel; additionally, corrosive acids and water are frequently present. The oil must prevent the formation of these materials or, once formed, keep them in suspension so they do not settle on the engine's internal surfaces.

Engine oil must fulfill all these requirements, not only when new, but throughout the complete drain interval:

- Keep a protective oil film on moving parts.
- Resist high temperatures.
- Resist corrosion.
- Prevent ring-sticking deposits.
- Prevent sludge formation.
- Flow easily at low temperatures.
- Resist thickening after prolonged use.
- Resist foaming.
- Suspend insolubles.
- Minimize deposits.

# Engine Oil Classifications

A number of separate organizations cooperate to provide standards and classification systems so engine oil performance can be tested and rated:

- European Automobile Manufacturers Association (ACEA)
- Japanese Automotive Standards Organization (JASO)
- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API)
- American Society for Testing and Materials (ASTM)
- Various engine manufacturers and the military also provide their own specifications

All of these classification systems define minimum performance.

Selecting the right oil may often seem confusing given the various classifications provided by these organizations. To simplify this confusion, let's first look at viscosity grades that share a common rating for all engine oils.

### SAE Viscosity Grades

- The Society of Automotive Engineers has developed a viscosity grade classification system for engine oils, which is SAE J300.
- Viscosity is a measure of the oil's fluidity at a given temperature.
- Oils vary in viscosity as the temperature changes; oils become more fluid as the temperature increases and less fluid as the temperature decreases. Having fluid oil for cold morning starts is very critical. Engine oil must provide lubrication before the operating temperature is reached or severe component wear will occur.
- The SAE standard assigns numbers called viscosity grades to identify the oil's resistance to flow; examples are 8, 12, 16, 20, 30, 40, 50, and 60.
- Viscosity grades 8 and above must meet a high-temperature viscosity requirement.
- The letter "W" after the viscosity grade number indicates the oil has met a low-temperature (winter) requirement; examples are 0W, 5W, 10W, 15W, 20W, and 25W.
- John Deere recommends following the manufacturer's suggestions for oil selection.
- SAE 15W-40 provides the best engine performance and protection for all climates above –15 °C (+5 °F).
- Plus 50 II SAE 0W-40 is an all-season engine oil providing outstanding performance and protection for all diesel and gasoline engines in John Deere equipment down to -40 °C.
- John Deere prefers the use of SAE 10W-30 in all gasolineengine-powered units.

- SAE 10W-30 provides the best engine performance and protection for all climates above –20 °C (–4 °F).
- SAE 5W-30 oils may be used in cold-weather operations between –30 °C (–22 °F) and +40 °C (+104 °F) with draininterval restrictions.
- Arctic oils may be required in some locations where ambient operating temperatures are considerably colder than -40 °C.

The chart below shows the temperatures at which any oil must meet the respective requirements of its SAE viscosity grade.

# SAE J300 Engine Oil Viscosity Classification

	Low-Ten Visco	High-Temperature Viscosities			
SAE Viscosity	Cranking <sup>(1)</sup> , mPa-s at °C	Pumping <sup>(2)</sup> , mPa-s at °C	Pumping <sup>(2)</sup> , Kinematic <sup>(3)</sup> mPa-s at °C mm <sup>2</sup> /s at 10 °C		High Shear <sup>(4)</sup> , mPa-s at 150 °C and 10 <sup>6</sup> s <sup>-t</sup>
Grade	Max.	Max. (with no yield stress)	Min.	Max.	Min.
0W	6,200 at –35	60,000 at40	3.8	—	
5W	6,600 at –30	60,000 at –35	3.8	_	—
10W	7,000 at –25	60,000 at –30	4.1	—	
15W	7,000 at –20	60,000 at25	5.6	—	_
20W	9,500 at –15	60,000 at –20	5.6	_	_
25W	13,000 at –10	60,000 at –15	9.3	—	_
8	—	_	4.0	<6.1	1.7
12	—	—	5.0	<7.1	2.0
16	_	_	6.1	<8.2	2.3
20	—	—	6.9	<9.3	2.6
30	_		9.3	<12.5	2.9
40	_	_	12.5	<16.3	3.5 (0W-40, 5W-40, and 10W-40 grades)
40	_	_	12.5	<16.3	3.7 (15W-40, 20W-40, 25W-40 and 40 grades)
50	—	_	16.3	21.9	3.7
60	_	_	21.9	26.1	3.7

#### Example: a 15W-40 viscosity grade oil shall meet the requirements of both 15W and 40.

Notes: 1 mPa-s = 1 cP; 1 mm2/s = 1 cSt.

All values, with the exception of the low temperature cranking viscosity, are critical specifications as defined by ASTM D3244.

<sup>(1)</sup>ASTM D5293: Cranking viscosity — The non-critical specification protocol in ASTM D3244 shall be applied with a P value of 0.95.

 $^{\rm (2)} ASTM$  D4684: Note that the presence of any yield stress detectable by this method constitutes a failure regardless of viscosity.

#### <sup>(3)</sup>ASTM D445.

<sup>(4)</sup>ASTM D4683, ASTM D4741, ASTM D5481, or CEC L-36-90.

# Viscosity Test

- In the viscosity test, a measured quantity of the oil is brought to the test-measurement temperature. Viscosity is determined by the length of time it takes a specified volume of oil to flow through a small orifice in an instrument such as a Saybolt or Kinematic Viscometer.
- Low-temperature viscosity is measured in two tests: the Low-Temperature Cranking Test and the Low-Temperature Pumping Test. As the name implies, the Low-Temperature Cranking Test simulates engine cranking and is conducted at the various temperatures listed in the SAE J300 chart for the "W" grades.
- The Low-Temperature Pumping Test measures oil pumpability at temperatures 5 °C below those specified for the Low-Temperature Cranking Test. Satisfactory performance in the latter test is required to ensure oil flow is not restricted to critical areas of the engine after a cold engine start.
- High-Temperature, High-Shear (HTHS) viscosity relates to the viscosity under heavy loads, high temperatures, and high shear rates where viscosity index improver additives are stressed.

### Multi-Viscosity Oils

- For engines subjected to a wide range of operating temperatures, multi-viscosity oil should be used. Multi-grade or multi-viscosity oils are formulated to meet both low- and high-temperature viscosity requirements.
- These oils are identified as 10W-30, 15W-40, and so on.
- These oils are formulated by blending various base oils to obtain a viscosity grade such as 15W and adding polymers called viscosity index improvers. These polymers do not significantly affect oil viscosity at low temperatures, but they expand when the oil temperature rises. This expansion causes an increase in viscosity at higher temperatures that yields multi-grade oil such as 15W-40.
- Some oils may use synthetic oil or mixtures of petroleum-base and synthetic oil to obtain the multi-viscosity rating.

# Summary of SAE Viscosity Grades

In summary, the SAE viscosity grade indicates how oil flows at specified temperatures. It makes no attempt to define the oil's quality, additive content, performance, or suitability for specific service conditions.

# Performance Ratings

#### Engine Manufacturer's Oil Specifications

The most important part of selecting engine oil is using the equipment manufacturer's recommendations found in the Operator's Manual. If oil with the incorrect rating is used, the engine may not get the protection it needs and the warranty may be void.

#### ASTM Test Methods

The American Society for Testing and Materials (ASTM) develops standardized test methods for evaluating lubricants. These test methods contain strict controls on hardware, operating conditions, repeatability, and reproducibility. Surveillance groups continually review test results for severity. These standardized tests and minimum acceptable performance limits are used by the American Petroleum Institute (API) to define ratings.

#### **API Service Categories**

The API service ratings define minimum oil quality. Ratings beginning with the letter "C" are oils intended for diesel engines, while ratings beginning with the letter "S" are oils intended for gasoline engines.

The second letter indicates a rating update; the "CJ-4" rating is more current than "CI-4," and "SN" is more current than "SM," etc.

Lubricants meeting more than one service rating may be identified "For Service CJ-4/SN," etc. When dual ratings are indicated, the first rating is the primary use rating. In the above example, the oil "CJ-4/SN" is primarily a diesel oil which also meets a gasoline rating.

The chart on the next page provides a brief summary of the ratings and service oil descriptions.

# API Service Categories for Engine Oils

Category Designation (Diesel Engines)	Status	API Service Description (Diesel Engines)
CJ-4	Current	Introduced in 2006. For high-speed, four-stroke engines designed to meet 2007 model year on-highway exhaust emission stan- dards. CJ-4 oils are compounded for use in all applications, with diesel fuels ranging in sulfur content up to 500 ppm (0.05% by weight). However, use of these oils with greater than 15-ppm (0.0015% by weight) sulfur fuel may impact exhaust aftertreat- ment system durability and/or oil-drain interval. CJ-4 oils are effective at sustaining emission control system durability where particulate filters and other advanced aftertreatment systems are used. Optimum protection is provided for control of catalyst poisoning, particulate filter blocking, engine wear, piston deposits, low- and high-temperature stability, soot-handling proper- ties, oxidative thickening, foaming, and viscosity loss due to shear. API CJ-4 oils exceed the performance criteria of API CI-4 with CI-4 PLUS, CI-4, CH-4, CG-4, and CF-4, and can effectively lubricate engines calling for those API service categories. When using CJ-4 oil with higher than 15-ppm sulfur fuel, consult the engine manufacturer for service interval.
CI-4 PLUS	Current	Used in conjunction with API CI-4, the CI-4 PLUS designation identifies oils formulated to provide a higher level of protection against soot-related viscosity increase and viscosity loss due to shear in diesel engines.
CI-4	Current	Introduced in 2002. For high-speed, four-stroke engines designed to meet 2004 exhaust emission standards implemented in 2002. CI-4 oils are formulated to sustain engine durability where Exhaust Gas Recirculation (EGR) is used, and are intended for use with diesel fuels ranging in sulfur content up to 0.5% weight. Can be used in place of CD, CE, CF-4, CG-4, and CH-4 oils. Some CI-4 oils may also qualify for the CI-4 PLUS designation.
CH-4	Current	Introduced in 1998. For high-speed, four-stroke engines designed to meet 1998 exhaust emission standards. CH-4 oils are specifically compounded for use with diesel fuels ranging in sulfur content up to 0.5% weight. Can be used in place of CD, CE, CF-4, and CG-4 oils.
CG-4	Current	Introduced in 1995. For severe-duty, high-speed, four-stroke engines using fuel with less than 0.5% weight sulfur. CG-4 oils are required for engines meeting 1994 emission standards. Can be used in place of CD, CE, and CF-4 oils.
CF-4	Current	Introduced in 1990. For high-speed, four-stroke, naturally aspirated, and turbocharged engines. Can be used in place of CD and CE oils.
CF-2	Current	Introduced in 1994. For severe-duty, two-stroke-cycle engines. Can be used in place of CD-II oils.
CF	Current	Introduced in 1994. For off-road, indirect-injected, and other diesel engines including those using fuel with over 0.5% weight sulfur. Can be used in place of CD oils.
CE	Obsolete	Introduced in 1985. For high-speed, four-stroke, naturally aspirated, and turbocharged engines. Can be used in place of CC and CD oils.
CD-II	Obsolete	Introduced in 1985. For two-stroke cycle engines.
CD	Obsolete	Introduced in 1955. For certain naturally aspirated and turbocharged engines.
СС	Obsolete	Caution: Not suitable for use in diesel-powered engines built after 1990.
СВ	Obsolete	Caution: Not suitable for use in diesel-powered engines built after 1961.
CA	Obsolete	Caution: Not suitable for use in diesel-powered engines built after 1959.
Category Designation (Gasoline Engines)	Status	API Service Description (Gasoline Engines)
SN	Current	Introduced in October 2010. For 2011 and older vehicles designed to provide improved high-temperature deposit protection for pistons, more stringent sludge control, and seal compatibility. API SN with Resource Conserving (RC) matches ILSAC GF-5 by combining API SN performance with improved fuel economy, turbocharger protection, emission control system compatibility, and protection of engines operating on ethanol-containing fuels up to E85.
SM	Current	For all automotive engines currently in use. Introduced in 2004. SM oils are designed to provide improved resistance and deposit protection, and better wear protection and low-temperature performance over the life of the oil. Some SM oils may also meet the latest ILSAC specification and/or qualify as Energy Conserving.
SL	Current	For 2004 and older automotive engines.
۲S	Current	For 2001 and older automotive engines.
SH	Obsolete	For 1996 and older engines.
SG	Obsolete	For 1993 and older engines.
SF	Obsolete	For 1988 and older engines.
SE	Obsolete	Caution: Not suitable for use in gasoline-powered automotive engines built after 1979.
SD	Obsolete	<b>Caution:</b> Not suitable for use in gasoline-powered automotive engines built after 1971. Use in more modern engines may cause unsatisfactory performance or equipment harm.
SC	Obsolete	<b>Caution:</b> Not suitable for use in gasoline-powered automotive engines built after 1967. Use in more modern engines may cause unsatisfactory performance or equipment harm.
SB	Obsolete	<b>Caution:</b> Not suitable for use in gasoline-powered automotive engines built after 1951. Use in more modern engines may cause unsatisfactory performance or equipment harm.
SA	Obsolete	<b>Caution:</b> Contains no additives. Not suitable for use in gasoline-powered automotive engines built after 1930. Use in more modern engines may cause unsatisfactory performance or equipment harm.

# Military Specifications

In 1941, the military began qualifying engine oils. The U.S. Army 2104 specification was issued that year to cover oils meeting both Caterpillar and General Motors requirements. The military has continued to evaluate and classify engine oils as engines became more sophisticated.

Military specifications also include gasoline engine tests to evaluate the effect of engine oil quality on bearing corrosion, engine wear, and engine deposits such as rust, sludge, and varnish. Recent changes in military procurement regulations now allow the purchase of lubricants meeting applicable industry specifications for use in most military equipment.

Military Specifications	API "Equivalent"
U.S. Military MIL-PRF-2104H	CI-4
Non-current	
U.S. Military MIL-PRF-2104G	CG-4
U.S. Military MIL-L-2104F	CF-4
U.S. Military MIL-L-2104E	CE/SG
U.S. Military MIL-L-2104D	CD/SF
U.S. Military MIL-L-2104C	CD/SC
U.S. Military MIL-L-2104B	CD/SC
U.S. Military MIL-L-46152E	SG
U.S. Military MIL-L-46152D	SG
U.S. Military MIL-L-46152C	SF
U.S. Military MIL-L-46152B	SF/CC
U.S. Military MIL-L-46152A	SE/CC
U.S. Military MIL-L-45199B	CD

# **Engine Oil Additives**

John Deere does not recommend the addition of any aftermarket oil additives. John Deere oil is formulated with the correct balance based on oil treatment or engine treatment performance testing. Adding additional chemicals could cause an imbalance or have an adverse effect on engine performance.

During the 1930s, engine tests to evaluate the performance properties of engine oils were developed. Ring sticking and ring- and cylinder-scuffing problems became epidemic; through cooperation with several oil companies, the first additized oil was made available commercially in 1935.

Seventy-five years later, special oil additives are still used for enhancing lubricating oils to provide the extra performance required of today's engines. Each additive, or combination of addities, is included in an oil for a specific reason, based on the application and service expected from that oil. Additives enhance or impart new oil properties in three ways: protect engine surfaces, protect the base stock, and modify oil properties.

An oil may contain some or all of the additives described below. Each of the additives shown may include a number of different chemical compounds. These chemicals are chosen depending on their specific performance and compatibility with other chemicals in the lubricant.

#### Detergent-dispersant additives:

- Help keep metal surfaces clean and prevent deposit formation.

Particles of soot and oxidized oil or fuel are kept suspended in the oil. Suspension is so fine that it passes through the oil filter and continues to be carried by the oil. Regular drain periods result in the removal of suspended contaminants. Black oil is evidence that an oil is helping keep the engine clean by carrying combustion particles in the oil rather than letting them accumulate as sludge inside the engine.

#### Extreme-pressure anti-wear and friction-modifier additives:

- Ensure lubrication where extreme pressures between close tolerance and metal-to-metal surface contact are encountered.
- Reduce friction; prevent galling, scoring, seizure, and wear.
- Reduce energy consumption and heat generation.

#### Anti-rust additive:

- Prevents rusting of metal parts during storage periods and downtime.
- Neutralizes acids so they are no longer harmful.

#### Oxidation-inhibitor additives:

- Inhibit oil molecules from combining with oxygen, which causes oxidation or thickening of the oil.
- Prevent acid, varnish, and sludge formation.
- Protect alloy bearings from corrosion.

#### Anti-corrosion additives:

- Help prevent failure of alloy bearings from the corrosive acid which is formed as a normal by-product of combustion.
- Protect metal surfaces from corrosive attack.

#### Viscosity-index improvers:

- Help an oil perform properly through a wide temperature range.
- Give oil the beneficial properties of both light and heavy oils.

Multi-grade oils with this additive span an extra-wide range of viscosity grades compared to single-grade oils. Lighter single-grade oils make starting easier at lower temperatures but thin out as oil heats up. Heavier single-grade oils give good protection at moderate temperatures but thicken in cold temperatures, reducing protection and causing hard starting and improper lubrication.

#### Foam-inhibitor additive:

 Prevents lubricants from forming a persistent foam by reducing surface tension to speed the collapse of the foam. Foaming oil increases the oxidation rate, the oil thickness, and wear rates in bearings, rings, and gears.

#### Seal-swell additives:

- Prevent deterioration of seals.

Many different types of elastomers are used to retain lubricants in today's equipment. Seals must maintain their properties and not shrink, crack, revert to some other form, or swell excessively. A seal swell additive along with proper blending procedures helps maintain the properties of the sealing material throughout the wide temperature changes encountered.

#### Pour-point-depressant additives:

Prevent wax crystals from congealing in cold weather and forming clumps.

Some paraffin wax is present in lubricating oil, although most wax is removed during refining processes. These wax crystals tend to congeal in cold weather, interfering with oil flow and causing lubrication difficulties.

### **Engine Oil Contaminants**



The quality of oil is important. Using uncontaminated oil is just as important. In fact, oil contamination can hamper engine performance as much as using poor-quality oil. With this in mind, review the different types of oil contaminants, the problems contaminants cause, and ways to prevent oil contamination.

#### Dust, Dirt, Soot, and Metallic Particles

The process of combustion draws dust into the engine. In diesel systems, the fuel soot resulting from combustion joins with blow-by gases to contaminate crankcase oil. Topping off with oil make-up may also accidentally introduce dirt into the engine. And microscopic metal particles abraded from normal engine wear tend to infiltrate engine oil.

#### Problem

An excessive buildup of dust, soot, dirt, and metallic-particle contaminants can damage engine bearings, pistons, and rings, resulting in downtime and costly repair or equipment replacement.

#### Prevention

Service the engine regularly. Operators can help prevent early engine failure with regular service of the air cleaner, oil filter breather cap, and crankcase ventilator that restrict dirt particles from entering the engine. Filler caps, funnels, and other equipment used to add oil to the system should be cleaned before additions are made.

Change oil and filters regularly. Operator's Manuals give complete change intervals and capacity listings for oils, lubricants, and filters.

#### Water

Water can contaminate oil. Water vapor is a by-product of combustion. Each gallon of fuel consumed produces more than a gallon of water. Operating a cold engine condenses water that collects in the crankcase. As the water condenses, it is scraped down into the crankcase oil by the piston ring. The water does not start to vaporize until the cylinder wall reaches 63 °C (145 °F).

#### Problem

A buildup of water in used oil can result in soot particles forming larger molecules or sludge and plugging filters. When the filter plugs, a by-pass valve opens and allows unfiltered oil to circulate through the engine. If abrasive contaminants are present in the by-passed oil, damage to close-fitting components can result. Water can also cause metal surfaces to rust or corrode.

#### Prevention

Warm up the engine properly each time it is used and before a heavy load is applied. (Significantly more engine wear occurs in a cold engine operating at 38 °C [100 °F] than in a warm engine at 71 °C [160 °F].) Use a proper thermostat to heat the engine to the correct temperature as quickly as possible. Check engine temperature frequently.

Drain the crankcase oil only when the engine is warm to maximize contaminant removal and help prevent severe engine damage.

#### Antifreeze

Antifreeze is a contaminant of oil. It can enter the engine oil system through leaking head gaskets, damaged cylinder liners, oil coolers, and cylinder liner packings.

#### Problem

Antifreeze contamination in used oil can cause the problems discussed previously for water contamination: soot collection, sludge formation, and plugged filters. In addition, antifreeze contamination can cause bearing corrosion.

Antifreeze contamination usually indicates the need for major engine repairs.

#### Prevention

Follow specified service-manual procedures when torquing head bolts during overhaul. NOTE: Be sure to re-torque bolts when specified.

Use the recommended coolant to prevent cylinder liner damage. Guard against incorrect timing and improper use of starting fluids that can result in head-gasket damage:

- Never use automotive coolant in a heavy-duty diesel engine.

#### Fuel

When partially oxidized and unburned fuel mix with oil in the crankcase of gasoline or diesel engines, varnish deposits appear on piston surfaces.

In diesel engines, a cracked fuel pump diaphragm, a faulty injector, or a leaking fuel-injection pump-shaft seal causes oil contamination.

In gasoline engines, over-choking, engine misfiring, carburetor flooding, and cold engine operation allow gasoline to seep into the oil.

#### Problem

Diesel fuel in the crankcase reduces viscosity, leading to piston seizure, decreased bearing life, high oil consumption, and piston deposits. Deposits on pistons cause rings to stick, resulting in accelerated engine wear and increased oil contamination.

Raw fuel or gasoline may run down the cylinder walls, past the rings. This washes away the lubricating oil and increases engine wear.

#### Prevention

Keep the diesel fuel system in good condition.

Bring the engine to normal operating temperature each time it is used.

Avoid over-choking the engine, running the engine when it's misfiring, and excessive idling of diesel engines.

Repair faulty carburetors and fuel-injector systems.

#### Heat

High operating temperatures caused by heavy loads, faulty cooling systems, bad timing, pre-ignition, and detonation speed up the oxidation of oils.

#### Problem

The effect of oxidation is thickened oil and the reduced capability to neutralize the combustion by-products. The result will be an oil containing acids, which may corrode bearing metals and also form resins, which may deposit on the pistons and hot metal parts as varnish. The results may be ring sticking, valve sticking, and sludge formation.

#### Prevention

Make sure the cooling system is properly maintained and the temperature gauges are working properly. Check engine temperature frequently. Check engine timing periodically.

Antioxidants in new oil help protect the oil from oxidation and reduce oil breakdown. (The antioxidants in John Deere Plus-50 II Engine Oil excel in delaying oxidation in high-heat, heavy-duty operations.)

# Transmission — Hydraulic Oil



- John Deere equipment may have a common or separate reservoir for the transmission, differential, brake, and hydraulic system.
- John Deere Hy-Gard<sup>™</sup> is a multi-functional lubricant recommended for use in all of these systems.
- Some machines have hydraulic systems separate from the transmission. John Deere Hy-Gard is also recommended for these applications.
- Industry standards defining performance requirements for transmission and hydraulic fluids do not exist. Manufacturers' standards are used instead.

# Transmission — Hydraulic Oil Properties

The key properties of transmission-hydraulic oils are listed below:

#### **Contain Anti-Wear Extreme-Pressure Additives:**

- For reduced wear in operation of gears and pumps.

#### High Oxidation Stability:

- For long life and deposit protection.

#### Friction Modified:

- Minimizes chatter in wet-brake systems.
- Provides smooth clutch operation.

#### **Contain Rust and Corrosion Inhibitors:**

- Protects when fluid becomes slightly wet.

#### High Viscosity Index:

Provides best viscosity under a wide range of operating temperatures.

#### **Contain Foam Suppressors:**

- Reduces oil foaming as it circulates through the systems.

#### Compatible with All Types of Seals:

 Seals do not shrink, crack, revert to some other form, or swell excessively.

#### Low Pour Point:

- For low-temperature service.

#### Low-Temperature Fluidity:

 Meets special low-temperature fluidity tests to ensure functionality in low-temperature operations.

### Hydraulic Oil Requirements

- The primary function of hydraulic oil is to transmit power.
- However, the fluid must also be stable over long periods and protect the machine against corrosion and oxidation.
- Hydraulic oil must act as a lubricant and a heat absorber for the working parts.
- Some equipment has hydraulic systems separate from the transmission. John Deere Hy-Gard is also recommended for these applications.

# Hydraulic Oil Properties

#### Viscosity

Viscosity is probably the single most important property of hydraulic oil. Parts within a hydraulic system depend on close fits to create and maintain the necessary pressures.

Oils with viscosities that are too low can cause leakage, resulting in low system efficiency and a rise in temperature. Oils with viscosities that are too high can cause sluggish operation, overheating, and high pressure.

#### Cleanliness

Fluid cleanliness is also very important. Debris can cause excessive wear and is a common cause of valve sticking. A fluid should meet the cleanliness requirements of the components in the hydraulic system.

#### Stability

Hydraulic oils are subject to heat, moisture, agitation, and aeration, ideal conditions for oxidation and deterioration. In well-kept systems where there is little fluid loss and the oils will be in service for long periods, oxidation inhibitors are necessary. The rate of oil oxidation increases with a rise in temperature. Because of this, some manufacturers provide coolers to control the oil temperature and reduce oxidation.



Contaminated hydraulic oil scored these hydraulic pump pistons.

#### **Corrosion Resistance**

Since hydraulic systems are vented, it is impossible to prevent the reservoir "breathing" and intake of moisture that can result in the corrosion of metal parts.

Since only a very small degree of corrosion and its resultant pitting can adversely affect the operation of the finely machined parts in the system, hydraulic oil must contain very potent corrosion inhibitors.

#### **Pour Point**

Pour point is of prime importance to mobile and outdoor equipment. In some northern areas, winter temperatures fall far below the natural pour point of most oils. Therefore, the oil must be properly formulated and fortified with pour-point depressants to allow it to flow at sub-zero temperatures.

#### Anti-Foam

Foaming in hydraulic oils can be caused by excessive agitation in the presence of air, or by air leaking into the system. Chronic foaming is a design problem and should be treated as such. For added protection, most hydraulic fluids contain a small amount of foam suppressant. This does not prevent foaming but causes the foam to be very unstable and to break down rapidly.

#### **Compatible with Seals**

Seals in the hydraulic system contain rubber and other materials, which could deteriorate if oil contains harmful materials. For this reason, the oil must be made compatible with the seals in the system.

#### Anti-Wear

Hydraulic pumps and motors are very susceptible to wear. Many service instructions recommend using only oils containing antiwear compounds.

# Gear Oil

- One of the most important gear lubricant performance characteristics is load-carrying capacity.
- Some gears are operated under loads and speeds at which the very low load-carrying capacity of untreated oil is adequate.
- However, most gears require lubricants of greater loadcarrying capacity, which is provided through the use of additives.
- Gear lubricants compounded to achieve increased loadcarrying capacity are referred to as "extreme-pressure" (EP) lubricants.
- However, when this term is applied to a gear lubricant, it means only that the load-carrying capacity of the lubricant is greater than that of untreated oil, with no distinction as to how much greater it may be. Therefore, to differentiate among EP lubricants of various load-carrying capacities, it is necessary to classify them further.
- The component manufacturers and ASTM have developed tests and the American Petroleum Institute (API) has assigned designations to aid in determining lubricant application.

# Gear Oil Requirements

- Today's high-speed, high-torque powertrains use relatively small gears. The result is high sliding speeds and contact loads between mating parts. This makes lubrication more critical.
- In some applications and gear designs, the gear oil must contain special anti-wear agents.

# Gear Oil Ratings

#### **API Gear Oil Service Classifications**

The API System designates gear lubricants by the applications for which they may be suitable. **This is not a rating of performance.** 

#### API GL-1 (Obsolete)

For service in automotive-type spiral bevel, worm gear axles, and some standard transmissions, and operating under conditions of low pressures and sliding velocities. Rust and oxidation inhibitors, foam suppressors, and pour-point depressants may be used, while friction reducers and extreme-pressure agents must not.

#### API GL-2 (Obsolete)

For automotive-type worm gear axle service, under conditions of load, temperature, and sliding velocities where gear oils for Service GL-1 are not adequate.

#### API GL-3 (Obsolete)

For service in manual transmissions and spiral-bevel gear axles, under moderate conditions of speed and load. The service conditions are more severe than those of API GL-1 services, but not as demanding as those for GL-4.

### API GL-4

GL-4 is used for manual transmission spiral-bevel and hypoid gears in moderate service.

#### API GL-5

This is the preferred oil in John Deere components when gear oils are recommended. API GL-5 is for service similar to GL-4 but for more severe conditions. It applies to conditions encountered in hypoid gears. Other equipment operated under high-speed, shock-load; high-speed, low-torque; and low-speed, hightorque conditions may specify API GL-5.

#### API GL-6 (Obsolete)

API GL-6 is an obsolete classification.

#### API MT-1

API MT-1 provides additional oxidation resistance and sealcompatibility testing. It is intended for nonsynchronized manual transmissions used in trucks and buses.

# Military (MIL) or Manufacturer's Specifications

#### MIL-L-2105

This has been a long-standing performance level of gear oils determined by test sequences which define MIL-L-2105 standards. Products meeting this specification are of the API GL-5 type.

While the specification MIL-L-2105 is now obsolete, replaced by the current specification MIL-PRF-2105E, it is still widely used to indicate a performance level for some gear oils.

#### MIL-PRF-2105E

This is the current performance specification of a multi-purpose gear lubricant used under more severe operation than those covered by MIL-PRF-2105. These gear oils are under API designation GL-5. SAE J2360 has been written to replace MIL-PRF-2105E.

# SAE Gear Oil Classification

#### SAE J2360

SAE J2360 has been written to replace MIL-PRF-2105E, and it is equivalent to MIL-PRF-2105E when all requirements are met.

#### **SAE J306**

Society of Automotive Engineers (SAE) gear oil classification is based on viscosity alone and is no indication of quality or service (see chart at top of next page).

Automotive Gear Lubricant Viscosity Classification					
SAE Viscosity Grade	Maximum Temperature for Viscosity of 150 000 cP, °C <sup>(1,2)</sup>	Kinematic Viscosity at 100 °C, cSt <sup>(3)</sup> Minimum <sup>(4)</sup>	Kinematic Viscosity at 100 °C, cSt <sup>(3)</sup> Maximum		
70W	-55 <sup>(5)</sup>	4.1	—		
75W	-40	4.1	_		
80W	-26	7.0	—		
85W	-12	11.0	_		
80	—	7.0	<11.0		
85	_	11.0	<13.5		
90	—	13.5	<18.5		
110	_	18.5	<24.0		
140	—	24.0	<32.5		
190	—	32.5	<41.0		
250	—	41.0	_		

Notes:  $1 cP = 1 mPa \cdot s$ ;  $1 cSt = 1 mm^2/s$ .

<sup>(1)</sup>Using ASTM D 2983.

<sup>(2)</sup>Additional low-temperature viscosity requirements may be appropriate for fluids intended for use in light-duty synchronized manual transmissions. See text.

<sup>(3)</sup>Using ASTM D 445.

<sup>(4)</sup>Limit must also be met after testing in CEC L-45-A-99, Method C (20 hours).
<sup>(5)</sup>The precision of ASTM Method D2983 has not been established for determinations made at temperatures below –40 °C. This fact should be taken into consideration in any producer-consumer relationship.

While the SAE numbers of gear oils are higher than those of engine crankcase oils, gear oils are not necessarily that much higher in viscosity. To avoid confusion, higher numbers are assigned to gear oils. For example, SAE 80 gear oil actually has about the same viscosity as SAE 20 engine oil when measured at 100  $^{\circ}$ C (see chart below).

Approximate Engine Oil and Gear Oil Viscosity Comparison				
Engine Oil Viscosity	Gear Oil Viscosity			
SAE OW	—			
SAE 5W	—			
—	SAE 70W			
SAE 10W	SAE 75W			
SAE 20W	—			
—	SAE 80W			
SAE 30W	—			
SAE 40W	SAE 90W			
SAE 50W	—			
_	SAE 140W			

To avoid confusion, higher SAE viscosity numbers are assigned to gear oils.

Multi-grade gear oils are presently available from some suppliers in grades of SAE 75W-90, 80W-90, 80W-140, and SAE 85W-140.

Some manufacturers recommend engine crankcase oils for use in standard transmission service, while some transmissions may use SAE 50 engine oil as an alternate for SAE 90 gear oil. As a result, some gear-oil containers are marked SAE 50-90, indicating that the viscosity requirements of SAE 50 engine oil are met.

### **Mixing Gear Lubricants**

- As a general practice, the mixing of lubricants should be avoided.
- Mixing gear lubricants with even small amounts of other types of lubricants can result in antagonistic reactions between the additive chemicals in the mixture. Such reactions may result in a significant loss of gear protection.
- However, the mixing of SAE J2360-approved lubricants as in a top-up situation should not impair lubricant performance.
- SAE J2360 lubricants are required to demonstrate satisfactory storage stability when mixed with previously qualified gear lubricants as a condition of the SAE J2360 approval process.

This question-and-answer section is a quick training resource for new parts personnel or a refresher for the entire parts and service departments.

Listed below are the most frequently asked questions about oil.

### **General Information**

#### Q. Where does oil come from?

- A. Oil comes from refineries that convert the crude oil into gasoline, diesel, kerosene, fuel oils, lubricants, and other by-products.
- Q. How is crude oil converted?
- A. Oil refineries separate the fractions (or parts) of petroleum and convert them into oils and lubricants.
  - The key in the refining process is distillation.
  - This process separates the various fractions of crude oil based on the difference in their volatilities.
  - After processing, lubricating oil base stocks are blended to various viscosity grades and additives are introduced.

# Storing and Handling Oils

Q. Why should you use care when handling and storing oil?

A. Handling and storing oil properly reduces the chance of dirt and moisture contaminating the oil.

### Requirements

- Q. What are the requirements of engine oil?
- A. Engine oil must:
  - Reduce friction and wear.
  - Cool moving parts.
  - Help seal the cylinders.
  - Keep parts clean.

### Ratings

Q. How are engine oils rated?

- A. By using SAE Viscosity Grade and API Service Categories.
  - SAE Viscosity Grade is the measure of the fluidity of an oil at a given temperature. Oils vary in viscosity as the temperature changes.
  - API Service Ratings.
  - ACEA and JASO Ratings.
  - API Service Categories define minimum oil quality. Designations starting with "S" are oils primarily for gasoline engines (spark ignition), while "C" identifies oils primarily for diesel engines (compression ignition). The second letter indicates updates to the rating. "SM" is more current than "SL", and "CJ-4" is more current than "CI-4."

- Q. How do on- and off-road engine oil requirements differ?
- A. Among the differences are:
  - Off-road engines may be burning higher sulfur-content fuel than on-highway engines.
  - Off-road engines operate at a higher fuel-burn rate than on-highway engines.
  - Off-road engines operate commonly under the high pressures and combustion heat of full-load operation, while on-highway engines are seldom subjected to extended full-load operations.
  - Higher torque loads.
  - Less cooling.
  - Dustier ambient conditions.
  - Higher moisture ambient conditions.

### Plus-50™ II

- Q. Is John Deere oil a re-brand of standard shelf oil?
- A. Plus-50 II is a unique engine oil, developed by John Deere engineers and exclusive to John Deere dealers.
- Q. What makes Plus-50 II the best?
- A. Reduces wear.
  - Resists increases in oil viscosity.
  - Gives better oxidation control.
  - Fights against varnish and sludge deposits.
  - Saves money:
    - More hours between oil changes.
    - Fewer oil-drain services.
    - Less maintenance and labor costs.
  - Compared to other oils, it has greater thermal stability, a lower rate of viscosity thickening, better soot control, and better wear protection.
  - In summary, Plus-50 II was not developed to just meet a minimum API performance standard. It was developed to provide the ultimate protection and premium performance for John Deere engines in John Deere machines. It is a premium, heavy-duty engine oil, not just a generic-brand oil that meets minimum API standards. Documented test results from our field machines and lab engines support its superior-performance claims.

#### Q. How does Plus-50<sup>™</sup> II compare to other oils?

- A. Greater thermal stability, lower rate of viscosity thickening, and less degradation than with competitive oil.
  - Longer oil life with sustained performance and drain intervals increased 100% over Operator's Manual recommendation when used in John Deere engines with John Deere filters and Ultra Low Sulfur Diesel (ULSD).
  - Increased engine durability, and less abrasive and corrosive wear than with competitive oils.
  - Cleaner engine and less piston deposits than with competitive oils.
  - High initial alkalinity and good reserve at the end of recommended drain interval, allowing continued acid protection.
  - Excellent low-temperature fluidity.
- Q. Do Torq-Gard<sup>™</sup> and Plus-50 II have the same base oil?
- A. The same type of high-quality base oil blends are used in all John Deere lubricants.
- Q. Where can Plus-50 II engine oil be used?
- A. Primarily designed for off-highway, heavy-duty diesel engines, Plus-50 II oil also gives excellent performance in on-highway, heavy-duty diesel applications.
  - All diesel engines requiring SAE 15W-40 and API CJ-4 classification oil. Plus-50 II is also available in SAE 10W-30 and 0W-40.
- *Q.* Are there any applications where Plus-50 II should not be used (such as irrigation engines or power units)?
- A. Some engine manufacturers have oil recommendations that specify a unique product for an application. For example, 2-cycle Detroit Diesel recommends an ash level below 1.0% and a straight SAE 40 viscosity grade.
  - Some engines designed for natural-gas or liquid-propane fuels commonly recommend that ash levels be held below 0.5%.
  - Plus-50 II should not be used for initial fill in new or rebuilt engines. John Deere Break-In Plus oil is available for this purpose.
  - Check the Operator's Manual for oil recommendations before making any changes in engine oil type.
- *Q.* What is the advantage to a customer who intends to continue changing oil at 100-hour intervals?
- A. Use of Plus-50 II is added insurance. With Plus-50 II, the engine will run cleaner, with less wear and more power, even if used for only 100 hours.
- Q. The customer states, "I've used co-op oil for 12 years and never had a problem. Why should I change to Plus-50 II?"
- A. This depends on the customer's definition of a "problem":
  - If Plus-50 II is used, the customer will have a cleaner engine, more power, and less wear.
  - It is not a matter of avoiding catastrophic failure, but rather a matter of better performance and the extended life of the engine.

- Q. Can I put 2010 oils into 1960 machines?
- A. Operator's Manuals are to be used as the guideline in all cases.
  - Realize that older manuals do not recognize any advances of technology occurring after the product was introduced.
  - John Deere-marketed lubricants take into consideration older-model units and the recommendations for the use of these lubricants in those units.
  - Plus-50 II is recommended for use in all John Deere diesel engines and may be used in older John Deere and competitive engines recommending the use of API performance grades CD, CE, CF-4, CG-4, CH-4, CI-4, CI-4 PLUS, and CJ-4.
  - In general, older (lower alphabetical designations) API performance designations can be replaced with newer (higher alphabetical designations) API performance levels without affecting engine performance.
  - Performance and longevity are usually improved by this switchover.
- Q. Will changing brands of oil cause my engine to use oil?
- A. When upgrading to Plus-50 II oils following the use of other oils, little differences in oil-consumption rate should be expected. A small percentage of engines may experience a noticeable change in oil-consumption rates.
  - Those engines experiencing decreased oil consumption should require no further attention.
  - Normally no increase in consumption will be observed. However, if it does occur, it may be due to one of the following factors:
    - The previously used oil product may have built up deposits on internal components.
    - Introducing a premium-performance oil with different additive systems which contain additional detergents, dispersants, anti-wear characteristics, and antioxidants that may cause different chemical reactions to occur in the deposits already established.

The time required for the engine to regain previously observed oil-consumption rates with the new oil may vary from one to three normal drain intervals. This phenomenon is not unique to John Deere engines and oils, but is commonly reported for competitive engines when switching to competitive oils.

- Q. What specifically shows Plus-50 II is better than other oils?
- A. Plus-50 II is evaluated using a special high-temperature engine test, JDQ 78X, which is beyond what is required for API rating. This is a severe test of the oil's resistance to oxidation and thickening. It is also a severe test of the oil's ability to keep the pistons clean.

- Q. After I bought several pails of Plus-50<sup>™</sup> II oil, I found a few gallons of Torq-Gard<sup>™</sup>. Can I mix the two until I've used up the Torq-Gard?
- A. While the two oils are compatible and mixing of the two John Deere oil formulations is acceptable, mixing should not be done on an extended basis.
  - Mixing with Plus-50 II should be limited to short-term topping-off situations only.
  - When mixing these oils, the extended-drain feature of Plus-50 II would not be applicable.
- *Q. I changed my oil inventory from Torq-Gard SAE 30 to SAE 15W-40 Plus-50 II. Now I need to top off the oil prior to an oil change. Can I add 15W-40 Plus-50 II to the SAE 30 in my engine?*
- A. Yes, a one-time mix of the two formulations and viscosities is allowed; however, mixing is not recommended as an ongoing practice or during extreme conditions such as cold weather or continuous high loads.
- *Q.* Can I change from SAE 30 to 15W-40 oil in my John Deere engine?
- A. Yes:
  - In older equipment Operator's Manuals, SAE 30 is recommended.
  - Due to the improved additives in multi-grade oil, we now prefer customers use 15W-40 oil.
  - The customer now has the option to select the oil that best meets his equipment's operating conditions.
- *Q.* Can I use Plus-50 II oil as a "break-in" oil after rebuilding an engine?
- A. No, it is not recommended for use as a "break-in" oil:
  - Due to Plus-50 II's superior lubrication properties.
  - A rebuilt engine must be allowed to properly wear-in the piston rings and the cylinder liner walls during the first 100 hours of operation.
  - It is recommended to use John Deere Break-In<sup>™</sup> Plus oil.

#### Q. How do you know the engine is broken in?

A. The break-in process is successful after the point when the customer does not need to top off the crankcase with any additional oil. The break-in period may be as short as 100 hours and as long as 500 hours, and some replacement oil may be necessary, which is normal. As the engine works in these initial hours, the piston rings and liners will realize where any interference fit exists. These areas will wear into a match fit, creating a good seat between the rings and the liners. This fit causes effective power and reduced oil consumption. If there is a continuous need to top off the crankcase oil, this means oil is getting by the rings because they have not seated with the liner. A second break-in process may be initiated using Break-In Plus oil.

- *Q.* What causes the engine not to break in during the first 100 to 500 hours?
- A. We recommend the operator run the engine under high-load conditions during the break-in period and at various engine speeds (rpm). Operating the engine under less than high-load conditions, such as pulling a trailer, baler, or some light load, may not provide enough loaded piston action to cause ring and liner seating. Another factor that may interrupt the break-in process is the introduction of a premium lubricant like Plus-50 II prior to the completion of the break-in process.
- *Q.* Can I use Plus-50 II oil when an API classification of CF-2 is required?
- A. API CF-2 classification is for 2-cycle diesel engines. Oil used in these types of engines normally requires a low ash content of less than 1% and single-viscosity oils. Plus-50 II is a multi-viscosity oil, and therefore it is not recommended, even though it does have less than 1% ash.
- *Q. I use Torq-Gard SAE 10W oil in the winter and Torq-Gard SAE 30 in the summer. Can I use 15W-40 Plus-50 II oil year-round instead of changing oil grades seasonally?*
- A. Yes, Plus-50 II SAE 15W-40 can be used year-round. That would eliminate the possibility of having the wrong viscosity oil in the crankcase if an unseasonal hot or cold spell should occur. For the ultimate in cold-temperature stability, coldflow ability, and quick lubrication, consider using Plus-50 II SAE 0W-40 full synthetic formula. (Check your Operator's Manual for the proper low-temperature range.)
- Q. Should I use Plus-50 II in a new tractor?
- A. Yes, it is the recommended oil for John Deere engines after the break-in period.
- Q. What oil is in new John Deere engines?
- A. New John Deere engine-powered equipment is shipped with our special-purpose Break-In Plus oil. If additional oil is needed during the normal break-in period, use John Deere Break-In Plus oil for top-off. Do not add oil prior to the oil level dropping to the add mark on the dipstick.

- Q. Can I go 500 hours with Plus-50<sup>™</sup> II (CJ-4 / E9) in a Tier 4 or older engine?
- A. Yes, when all of the following conditions are met:
  - John Deere Plus-50 II and John Deere filters are used.
  - Use of Ultra Low Sulfur Diesel (ULSD) fuel with a sulfur content less than 0.0015% (15 mg/kg or 15 ppm) is required.
  - The original-volume oil pan (or larger) that was delivered with the engine is still in use, and the oil level is maintained at normal volumes through the service interval.
  - The engine is operating within the original factory specifications affecting power output, including engine control units (ECUs) and fuel-delivery systems.

This is possible in John Deere Tier 3 emission-certified and older diesel engines because the original oil-sump capacity aligned with using higher sulfur level diesel fuel as written in the original Operator's Manuals. We recommend changing the oil and oil filter at least once every 12 months, even if the hours of operation are fewer than the otherwise recommended service interval.

# **Engine Oil Additives**

- Q. Why are additives added to oil, and what do they do?
- A. They provide the extra performance required of today's high-speed engines. An oil may contain none, some, or all of the following:
  - Detergent-dispersant additive.
  - Extreme-pressure anti-wear and friction-modifier additive.
  - Anti-rust additive.
  - Oxidation inhibitor.
  - Anti-corrosion additive.
  - Viscosity-index improver.
  - Foam inhibitor.
  - Seal-swell inhibitor.
  - Pour-point depressant.
  - Metal deactivator.
- *Q. Should aftermarket additives or engine treatments be added to John Deere oil?*
- A. No, additional oil additives could create a general imbalance and affect the performance of the oil.

# **Engine Oil Contamination**

- *Q.* What contaminates oil, and why is it important to use uncontaminated oil?
- A. Contaminants include foreign particles such as dust, soot, and various wear particles; oxidation by-products; water; antifreeze; and fuel. Contaminants reduce engine life more than any other single factor.

# Hy-Gard<sup>™</sup> Hydraulic and Transmission Oil

John Deere first developed Hy-Gard oil for its own equipment in 1973, and it quickly became the industry standard. Since then, it has been tested and upgraded several times to improve performance.

- *Q.* What are the requirements for hydraulic oils, and what properties must they have?
- A. Hydraulic oil must provide the following properties: viscosity, stability, corrosion resistance, pour point, anti-foam, and seal compatibility. In some cases, friction modifiers are also needed.
- Q. What are the properties of transmission hydraulic oil?
- A. Properties include:
  - Anti-wear extreme-pressure additives.
  - High oxidation stability.
  - Friction modifier.
  - Rust and corrosion inhibitors.
  - Low pour point.
  - Compatible with all types of seals.
  - High viscosity index.
  - Foam suppressors.
  - Detergents.
- Q. What are J20C and J20D?
- A. J20C and J20D are standard requirements for **minimumperformance fluids** that can be substituted for Hy-Gard and Low-Viscosity Hy-Gard. J20C and J20D requirements are defined in our standard JDM J20. The viscosity of J20C fluids is designed to be similar to Hy-Gard, while the viscosity of J20D is designed to be similar to Low-Viscosity Hy-Gard. J20C and J20D minimum-performance requirements are established for other people to market their products.
- Q. What does it mean when an oil container says "Recommended where J20C is specified"?
- A. This may simply mean the marketer of the product recommends it. It does not state that it actually meets any requirements and, most likely, it is worded this way for a reason. We have seen products that are not even close to passing the minimum requirements in JDM J2OC, but the package says "Recommended where J2OC is specified." Hy-Gard exceeds the minimum requirements defined in JDM J2OC. Customers can be tricked into thinking they are buying a good product when it is actually substandard. If you stay with Hy-Gard and Low-Viscosity Hy-Gard, you are using top-quality products.

- Q. What makes John Deere Hy-Gard<sup>™</sup> superior to competitive oils?
- A. It meets the exact performance specifications of the multiple functions of a machine system.
  - Comparison tests have shown the actual performance difference.
  - Refer to the Oil Sales Guide for test results.
  - Using oils that do not meet performance needs can cause premature wear and/or system failure.
- Q. Can Low-Viscosity Hy-Gard be mixed with hydrostatic fluid?
- A. Yes, Low-Viscosity Hy-Gard can be added to systems with hydrostatic fluid.
- *Q.* What is the viscosity grade of Hy-Gard and Low-Viscosity Hy-Gard?
- A. Hy-Gard and Low-Viscosity Hy-Gard are multi-viscosity oils. The viscosity of Hy-Gard is 59 cSt at 40 °C (104 °F). Compared to engine oil-viscosity grades, it is similar to SAE 10W-30.
  - Low-Viscosity Hy-Gard is 33 cSt at 40 °C (104 °F).
     Compared to engine oil, it is similar to SAE 5W-20.
- Q. Is a JDM J20 oil the same as Hy-Gard?
- A. No, JDM J20 is the minimum performance standard for lubricants used in John Deere units. Hy-Gard exceeds this performance requirement.
- *Q.* Can Hy-Gard and Low-Viscosity Hy-Gard be mixed with each other?
- A. Yes, the mixing of these fluids will affect only the viscosity.
  - The resulting viscosity will be somewhere between the two new fluid viscosities in proportion to the amount of mixing.
- *Q.* Can Hy-Gard or Low-Viscosity Hy-Gard be mixed with hydrostatic fluid and other hydraulic fluid?
- A. Yes. Mixing of our oils with other fluids is not recommended. Mixing Hy-Gard and Low-Viscosity Hy-Gard may occur. This does not dictate that the machine must be taken out of service for a complete flush and refill. The less mixing that occurs, the better; however, John Deere Hy-Gard and Low-Viscosity Hy-Gard are generally compatible with most fluids and can be mixed in any proportion. Mixing of specific fluids can be reviewed upon request.
- *Q.* Can Hy-Gard be used in non-John Deere applications and to top off machines using non-John Deere oils?
- A. Yes, Hy-Gard can be used in all transmissions and/or hydraulic applications requiring tractor/hydraulic fluid and applications requiring anti-wear hydraulic oil, but not in engines:
  - Hy-Gard is not designed for engines.
  - The viscosity grade should be matched to the application.
  - Hy-Gard can be used to top off machines that contain other transmission/hydraulic oils. It is compatible with most transmission/hydraulic oils.

- Q. What industry or military standard defines Hy-Gard fluids?
- A. There are no industry classifications for hydraulic/transmission oil because the needs are defined and met by the manufacturer. John Deere has defined a minimum service specification requirement for fluids used in John Deere equipment. The minimum performance specification JDM J20 was necessary to make sure that if a will-fit oil was used, at least minimum protection could be obtained. The JDM J20 standard defines two viscosity grades using designations J20C and J20D. In all cases, John Deere Hy-Gard outperforms the so-called will-fit oils on the market. John Deere does not monitor these oils; therefore, it is possible they do not meet even minimum performance needs, and some failures could result.
- Q. Can I recommend Hy-Gard for use in Cat machines?
- A. Hy-Gard can be used in Cat machines that recommend fluids meeting the TO-2 specification. Hy-Gard should not be used in machines calling for Cat TO-4 fluids.

### Gear Oil

- Q. How are gear oils used, and what are their requirements?
- A. Gear oils are used in enclosed gearboxes to lubricate mechanical transmissions, and differential and steering gears:
  - Today's high-speed, high-torque powertrains use relatively small gears.
  - The result is high tooth loads and harder rubbing between mating parts.
  - The gear oil must have anti-friction and anti-weld agents.
- Q. Do gear oils have ratings?
- A. Yes, SAE gear classification based on viscosity the API classification designates types of service. Example: SAE 85W-140; GL-5
- Q. Can gear lubricants be mixed?
- A. As a general practice, the mixing of lubricants should be avoided. Mixing gear lubricants with even small amounts of other types of lubricants can result in a reaction between mixtures. Such reactions may result in a significant loss of gear protection.
- *Q.* What do we recommend in a tractor hydraulic fluid application and why?
- A. Check your Operator's Manual to see what is specified for your machine and the appropriate operating temperature range for the fluid. We typically recommend Hy-Gard<sup>™</sup> and Low-Viscosity Hy-Gard for our equipment. We know these are top-quality fluids that provide unsurpassed performance in our equipment. Our machines are tested with and qualified using these fluids. By comparison, J2OC and J2OD fluids produced by others are meeting minimum-performance requirements. Hy-Gard and Low-Viscosity Hy-Gard must meet the more rigorous requirements of our internal standard RES 10060. We recommend our top-quality products because we want top performance from our equipment. If Hy-Gard and Low-Viscosity Hy-Gard are not available, a fluid meeting J2OC or J2OD will provide the minimum performance required.

- Q. Can a customer use Cat TO-4 oil in John Deere equipment?
- A. The use of Cat TO-4 oils in John Deere equipment is not recommended. Cat TO-4 oils have different frictional properties than Hy-Gard and are not multi-viscosity fluids. This means the shifting characteristics may be extremely severe and cause mechanical failures. Brake noise (chatter) will be unacceptable, and applications may be very aggressive. The TO-4 oil operating temperature range is also restricted, and the oils must be changed upon seasonal temperature shifts to maintain acceptable performance.

### Grease

- Q. Does it matter what grease I use?
- A. Always follow the manufacturer's recommendations for the type and grade of grease for each application. Some grease types are less compatible with other grease types. When changing from one grease type to another, it is always a good idea to flush or pump through as much of the old grease as possible from the application or bearing.

### Coolant

- Q. Is Cool-Gard<sup>™</sup> II compatible with other brands and types of coolant in the market place?
- A. Yes, Cool-Gard II is compatible with other coolants in the marketplace. Although we do not recommend mixing of other coolants with Cool-Gard II, as part of our due diligence, we have performed compatibility testing against other heavy-duty diesel coolants representing a spectrum of formulation strategies, including Caterpillar ELC, Detroit Diesel PowerCool and PowerCool Plus, and Cummins ES Complete and Cummins Optimax. Using standardized ASTM test procedures, Cool-Gard II was mixed at 3:1, 1:1, & 1:3 ratios and subjected to ASTM 1384 and ASTM 4340 test procedures. All of these mixtures did pass these two corrosion tests.
- Q. Is Cool-Gard II compatible with automotive coolant?
- A. Yes, with this cautionary note; we are compatible from a product perspective, but it must be noted that we do not recommend using any automotive coolant in a diesel or heavy-duty application. The main reason for this is that most automotive coolants are not designed to provide liner cavitation performance, and as such, mixing of Cool-Gard or Cool-Gard II with automotive coolant will dilute the ability of our coolants to provide adequate liner-cavitation protection. Mixing of Cool-Gard or Cool-Gard II with automotive coolant is not recommended.
- Q. Is Cool-Gard II compatible with glycerin products?
- A. It is too early to tell as there is very little to no glycerin-based coolant in the North American engine coolant market. There are additional questions of mixing different base fluids, i.e. ethylene glycol, and glycerin due to lack of standardization or history of product (glycerin) use. Compatibility with the Cummins glycerin-based coolant is planned and the results will be added to our coolant compatibility database.

- *Q.* Are there any changes to cautionary statements regarding consumption by animals?
- A. Cool-Gard II is made with an ethylene glycol (EG) base and all EG toxicity precautions should be followed. Although not required in all areas, we add the bittering agent to all Cool-Gard II packages. The bitter taste helps to prevent accidental ingestion of this product. Packaging labels will continue to contain a warning to keep out of reach of children and animals.
- Q. Can Cool-Gard II be recycled?
- A. Yes, Cool-Gard II should be recycled just like any other antifreeze/engine coolant, and it is not restricted.
- *Q. What will happen if coolant gets into the engine oil crankcase?*
- A. The adverse effects of ethylene glycol-based coolant are universal to the oil in an engine crankcase. Ethylene glycol (or almost any other glycol, for that matter) will disrupt the lubrication properties of the oil. Any amount of coolant that gets into the crankcase is detrimental. If the glycol/water mix displaces the oil in the bearings, lubrication and load carrying ability is lost, and severe wear is going to rapidly occur.
- Q. Can I mix Cool-Gard II EG and Cool-Gard II PG?
- A. No, Cool-Gard II PG is a non-toxic fluid. Combining the Cool-Gard II EG and Cool-Gard II PG would eliminate the non-toxic benefits of Cool-Gard II PG. Before filling with Cool-Gard II PG, a through flush is required to eliminate all previous coolant.

### **Fuel Conditioners**

#### Q. Is a diesel fuel conditioner really necessary and why?

A. Yes, the need to use a diesel fuel conditioner is now more important than ever. Diesel fuel quality can vary dramatically from source to source and even day to day. Inconsistent fuel quality, such as low cetane number and poor lubricity, can result in customer dissatisfaction over equipment life and performance. In addition, many diesel fuels (regular or premium) are designed for near-term use in on-highway equipment. John Deere Fuel-Protect Diesel Fuel Conditioner can improve most any diesel fuel up to acceptable standards. Therefore, it is recommended that John Deere Fuel-Protect Diesel Fuel Conditioner be used throughout the year.

- *Q.* There are many brands of fuel conditioners available over-the-counter as well as through co-ops and fuel distributors. Why is it strongly recommended that I use John Deere Fuel-Protect Diesel Fuel Conditioner?
- A. John Deere has a lot more at stake than just selling fuel additive. John Deere is in the business of providing customers with quality equipment that performs as promised. It is a fact that diesel equipment runs better and lasts longer when quality diesel fuel is used. John Deere Fuel-Protect Diesel Fuel Conditioner is a proprietary blend of fuel additives that are capable of improving most any diesel fuel. This is not true for many other fuel conditioners available over-the-counter or through a local fuel supplier. Test data shows that many commercially available additives are either non-functional or incomplete in their respective formulation. In addition, fuel additives offered by local fuel suppliers are often purchased on bid by buyers who understand additive price more that they understand additive performance and quality. Therefore, performance is often secondary for such products. This can often lead to customer dissatisfaction. It is recommended that John Deere Fuel-Protect Diesel Fuel Conditioner be used in all diesel fuel working in any application.
- *Q. What benefits will I get with John Deere Fuel-Protect Diesel Fuel Conditioner?*
- A. Both the Summer and Winter versions have the following benefits:
  - Exclusive formula only available through John Deere
  - Detergency Cummins L-10 superior rating insures clean injectors in legacy machines and maintains fuel economy
  - Modern lubricity technology superior performance over a wide range of fuels, including ultra-low sulfur diesel (ULSD)
  - Increased cetane number for better start-ups, increased power and smoother operation
  - Stability protection for oxidation and filter plugging and maximum filter life

In addition, the Winter version also offers:

- Superior cold flow properties to prevent fuel gelling and filter plugging
- Deicer to inhibit fuel and filter icing.
- *Q.* Why is John Deere Fuel-Protect Diesel Fuel Conditioner recommended for use in legacy and new diesel equipment?
- A. John Deere Fuel-Protect Diesel Fuel Conditioner improves the diesel fuel itself, which makes any engine run better and last longer. New engines will enjoy these benefits right from the start. Legacy engines will run better after just a few fill-ups. John Deere Fuel-Protect Diesel Fuel Conditioner can be used in any diesel-powered equipment — John Deere or other makes — on or off the farm. For newer machines with highpressure fuel systems, John Deere Fuel-Protect Keep Clean may be needed to address stubborn injector deposit issues. It can be used in combination with the John Deere Fuel-Protect Diesel Fuel Conditioners.

- Q. Why does John Deere offer a Summer and Winter formula?
- A. The summer formula offers the same important features as the winter formula without the costly winterization components. This results in a more cost-effective product. In addition, many John Deere customers are not concerned about winter weather, but their equipment will still benefit greatly from regular use of John Deere Fuel-Protect Diesel Fuel Conditioner.
- *Q. Can John Deere Fuel-Protect Fuel Conditioner be added to my bulk fuel storage tank?*
- A. Yes, and it should be. Treating fuel as it is added to the bulk fuel storage tank will ensure that the product is well mixed. As an added benefit, the conditioner contains a fuel stabilizer that should be added to any new fuel deliveries to maximize fuel storage and filter life, and to protect your bulk fuel storage tank from corrosion.
- *Q.* Why does the Winter formula have to be added when the fuel is above the cloud point?
- A. Diesel fuel contains wax that begins to form crystals at the cloud point of fuel. These crystals will continue to grow in size until the equipment ceases to operate (gelled filter). The Winter formula contains a "wax crystal modifier," or anti-gel, which allows the wax crystals to form, but changes the shape and size of the wax crystals as they form. Smaller crystals allow the filter to function at lower temperatures without plugging or shutdown. The way to change the crystal shape is to add the Winter formula at a warmer temperature prior to when the crystals first start to form. This is why the conditioner must be added when the fuel temperature is at least 15 degrees F above the cloud point of the fuel. For example, if the diesel fuel cloud point is 10 °F, the Fuel-Protect Diesel Fuel Conditioner Winter Formula must be added at 25 degrees F or higher.
- Q. Why does the Winter formula gel in the bottle when it gets cold?
- A. All fuel additives that contain large amounts of "anti-gel" will freeze in their concentrated form (prior to mixing with diesel fuel). Fuel additives that don't freeze contain little or no anti-gel components. This is similar to antifreeze/coolant that is put into radiators. Undiluted antifreeze actually freezes at about -4 degrees F. It needs water to lower the freezing point and work at lower temperatures. John Deere winter formula contains a large amount of anti-gel. Once added to the diesel fuel, it will outperform most competitive products. To prevent gelling of John Deere Fuel-Protect Diesel Fuel Conditioner Winter Formula, store the bottle at or above 50 degrees F. If the product has gelled in the bottle, thaw it out and agitate, then add it to the diesel fuel. The product is still effective after thawing — just be sure that it is added at a high enough fuel temperature to work properly. See question and answer above for additional information.

- *Q. If John Deere Fuel-Protect Diesel Fuel Conditioner Winter Formula is used, what temperature is the fuel protected to against gelling?*
- A. John Deere Fuel-Protect Diesel Fuel Conditioner Winter Formula is intended to be sold throughout the U.S. and Canada. In this wide range of temperatures and fuels, the Winter formula, like other products containing CFPP, typically protects down to 18 degrees F below the cloud point. This range will vary with some fuels, even when purchased from the same supplier. We recommend using fuel with the addition of 20% No. 1 ULSD or kerosene as your ambient temperature approaches 15 to 20 degrees F below the cloud point. Larger amounts of No. 1 fuel may be necessary if you are expecting to operate in even lower temperatures. John Deere Fuel-Protect Diesel Fuel Conditioner performs consistently better over a wide range of fuels when compared to other fuel additives.
- *Q.* What is the High Frequency Reciprocating Rig (HFRR), and why is it important?
- A. The HFRR is an industry test used to evaluate the lubricity of distillate fuels. Lubricity is an indication of a fuel's ability to protect fuel pumps and injectors from wear. Diesel fuels treated with John Deere Fuel-Protect Diesel Fuel Conditioner have been, and continue to be, regularly evaluated with this demanding test. John Deere Premium Diesel Fuel Conditioner has consistently performed at or above the levels set by engine and fuel pump manufacturers. This means longer life from your fuel injectors and fuel pumps. In addition, you will have more precise "fuel control" throughout the life of your equipment, which results in better fuel economy and lower emissions.
- Q. Does ultra-low-sulfur diesel (ULSD) fuel affect filter life?
- A. ULSD fuels have lower solubility than low-sulfur diesel (LSD) fuels, so there is less tolerance for fuel sediment and oxidation products. However, John Deere Fuel-Protect Diesel Fuel Conditioner contains special components to control oxidation and sediment formation, thereby extending filter life.
- Q. Does ULSD provide less power than low-sulfur diesel?
- A. The energy content can be slightly lower, but this small difference is hard to detect in power output. John Deere Fuel-Protect Diesel Fuel Conditioner contains a highly effective detergent that keeps legacy machines' fuel injectors clean plus cetane improver, providing maximum power and fuel efficiency in every gallon. In general, ULSD has better thermal stability, but can still degrade in storage stability over time. Since ULSD has lower solubility, it tends to drop out more sediment, water, and oxidation products than LSD. However, it still degrades in quality over time. In addition, ULSD is a poorer solvent and therefore tends to drop out more sediment, water, and oxidation products than LSD. Quality additives like John Deere Fuel-Protect Diesel Fuel Conditioner are specially formulated to allow long-term storage on and off the farm.

- *Q.* How do John Deere Fuel-Protect Diesel additives compare with other additives?
- A. The John Deere Fuel-Protect Diesel Fuel Conditioner product lineup will provide comparable or higher performance than other quality fuel additives. John Deere Fuel-Protect Diesel Fuel Conditioner is extensively tested in a wide range of fuels and is specifically designed to meet the requirements of even the most demanding diesel user.
- *Q. What is the most important performance property of a premium diesel?*
- A. Every aspect of the fuel is the most important part if it is important to the user. That's why John Deere Fuel-Protect Diesel Fuel Conditioner is designed to offer the best combinations of all performance properties while remaining a good value for your fuel dollar.
- *Q. Are John Deere Fuel-Protect Diesel Fuel Conditioners as good for on-road equipment as they are for off-road equipment?*
- A. John Deere Fuel-Protect Diesel Fuel Conditioners offer performance benefits to both on-road and off-road users.

# These Questions and Answers are related to the use of this product and other diesel fuel treatments from John Deere.

- Q. The John Deere Fuel-Protect Keep Clean label and product information indicates that there is a cleaning treat rate. Does this eliminate the need to use the Injector Flush tool and John Deere Clean-Up 2 solution?
- A. The Injector Flush service will continue to be promoted using John Deere Clean-Up 2 solution and Injector Flush tool. The Injector Flush service and John Deere Clean-Up 2 solution will dissolve the deposits, eliminating the symptoms of rough idle, hard starting, exhaust smoke, and low power, generally after a one-hour connection to the machine.

John Deere Fuel-Protect Keep Clean can be used at a cleaning treat rate to dissolve and remove the same deposits; however, it does require use over a period of 40 to 70 hours.

- *Q.* Why are there two treat rates for John Deere Fuel-Protect Keep Clean? What is the difference between maintenance and cleaning?
- A. **Maintenance Treat Rate** will prevent the ongoing formation of deposits.

**Cleaning Treat Rate** will remove existing deposits over a period of 40 to 70 hours.

- Q. Can the two products, John Deere Fuel-Protect Conditioner and John Deere Fuel-Protect Keep Clean, be used together?
- A. Yes, John Deere Fuel-Protect Conditioner use will manage nuisance issues that occur with variances in fuel quality. John Deere Fuel-Protect Keep Clean should be added to this routine when issues identified as injector sticking, engine misfire, rough idling, excess exhaust smoking, power loss, and/or hard starting conditions in modern high-pressure diesel fuel systems occur.

The chemistry of these two John Deere products is not aggressive towards each other, nor does it create a combined aggressive product. Use of these products within the guidelines of recommended use will not cause the user to exceed current emission regulations.

- Q. Do I need to use both John Deere Fuel-Protect Conditioner and John Deere Fuel-Protect Keep Clean?
- A. John Deere Fuel Conditioner does contain detergents that are effective in managing routine build-up of deposits and contaminants. John Deere Fuel Conditioner also has properties that control moisture, boost cetane number, and add lubricity. These additional benefits are not provided with Keep Clean as it is designed to address the stubborn deposit formation associated with some ULSD in higher-pressure fuel systems.
- Q. Can I use only John Deere Fuel-Protect Conditioner as it says it has detergents?
- A. John Deere Fuel Conditioner does contain detergents and they are effective in managing routine build-up of deposits and contaminants. John Deere Fuel Conditioner also has properties that control moisture, boost cetane number, and add lubricity. These additional benefits are not provided with John Deere Keep Clean as it is designed to address the stubborn deposit formation associated with some ULSD in higher-pressure fuel systems.
- *Q. What is our warranty policy on use of John Deere Fuel-Protect Keep Clean in John Deere engines?*
- A. Please contact your appropriate John Deere service contact for the most current solution.
- Q. Is John Deere the only company having injector problems?
- A. No, the issue of deposits forming in injector regions is occurring with multiple engine and injector manufacturers. There is an association of manufacturers representing engine, injector, fuel refiners, and additive companies working to understand this broad-reaching issue and bring resolution to the problem.
- *Q.* Can John Deere Fuel-Protect Conditioner be used in other brands of equipment?
- A. Yes, the chemistry in John Deere Fuel Fuel-Protect Conditioner is expected to be acceptable for use in diesel engine platforms.

- *Q.* Can John Deere Fuel-Protect Keep Clean be used in other brands of equipment?
- A. Yes, the chemistry in John Deere Fuel-Protect Keep Clean is expected to be acceptable for use in diesel engine platforms.
- Q. Can the Injector Flush Tool and John Deere Clean-Up 2 be used on other brands of equipment?
- A. Yes, the John Deere Injector Flush Tool is sold with a kit of adapters that is expected to facilitate connection to a wide range of fuel systems. The flush process is expected to address the performance issues associated with the accumulation of stubborn deposits in the injector region of higherpressure fuel systems.
- Q. Should I be using diesel conditioner in my gasoline pickup trucks?
- A. No, John Deere Fuel-Protect Conditioner is intended for use in diesel- and biodiesel (up to B20)-fueled engines.

# Diesel Exhaust Fluid (DEF)

- *Q. How is John Deere dealing with the potential for urea freezing in cold environments?*
- A. Diesel exhaust fluid (DEF) is made of 32.5% urea and 67.5% deionized water and will begin to gel at 12 °F (–11 °C). From an engine perspective, there will be heated DEF lines between the DEF tank and the decomposition tube where DEF is injected into the exhaust stream. When the engine is shut down, DEF is pumped out of all lines and the supply pump back into the DEF tank. The DEF tank itself is equipped with a heating element that utilizes engine coolant to thaw DEF in temperatures below 2 °F (–11 °C). The engine can be operated immediately and throughout the DEF tank thawing process.
- Q. How should DEF be stored?
- A. DEF should be stored in sealed containers to prevent contamination, evaporation, and ammonia release. Store DEF in the shade, where possible, to avoid fluid heating from direct sunlight.
- Q. What is the shelf life of DEF?
- A. Actual DEF shelf life is determined by many variables. It is recommended to keep DEF in sealed containers and out of high heat for sustained periods. DEF should be purchased in amounts that can be consumed in a reasonable amount of time.
- Q. Is DEF compatible with metals and other materials?
- A. DEF should always be transported and stored in appropriate containers. Only use containers made of DEF-compatible stainless steel, high-density polyethylene, or polypropylene. DEF can be corrosive to certain materials such as steel, iron, zinc, nickel, copper, aluminum, and magnesium. DEF contamination, even with trace amounts of metals, can damage the catalyst in the SCR system.
- Q. How do I know if I have bad DEF?
- A. DEF should be crystal clear with a light ammonia smell. If DEF appears cloudy, has a colored tint, or has a profound ammonia smell, it should not be used.

### Fluid Analysis Preventive Maintenance

- *Q.* Is there any way used oil can be analyzed? What are the benefits for dealers and customers?
- A. John Deere oil-analysis programs provide analysis of used oil. An independent laboratory performs the testing. The lab test results (spectrochemical to determine wear, and physical properties to determine oil condition) are provided for the dealer and the customer, if known.

#### Benefits to dealer:

- Increases customer contact.
- Builds customer confidence.
- Provides more knowledge of equipment condition.
- Increases sales opportunities.
- Provides "lead-in" for salesman to call on customer.

#### Benefits to customer:

- Early problem detection leads to minor repairs versus major overhaul.
- Provides additional incentive to perform maintenance.
- Lets customer know how well his machine is being maintained.
- Invites professional advice when problems are encountered.
- Increases confidence in machine and dealer.
- Increases contact with dealer.

Coolant and diesel fuel testing are also available.

Oil, Lubricant, Grease, Coolant, and Fuel Conditioner Product Chart

	in Freemann Engine on	1511 10	
Part Number	Description	Size	Pkg. Qty.
TY26674	15W-40 Plus 50 II	1 qt.	12
TY26673	15W-40 Plus 50 II	1 gal.	6
TY26675	15W-40 Plus 50 II	2 1/2 gal.	2
TY26679	15W-40 Plus 50 II	5 gal.	1
TY26677	15W-40 Plus 50 II	30 gal.	1
TY26678	15W-40 Plus 50 II	55 gal.	1
TY26991	15W-40 Plus 50 II	275-gal. tote	1

#### U.S. — Plus-50<sup>™</sup> II Premium Engine Oil — 15W-40

#### U.S. — Plus-50 II Premium Engine Oil — 10W-30

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Part Number	Description	Size	Pkg. Qty.
TY26669	10W-30 Plus 50 II	1 qt.	12
TY26668	10W-30 Plus 50 II	1 gal.	6
TY26671	10W-30 Plus 50 II	5 gal.	1
TY26670	10W-30 Plus 50 II	55 gal.	1
TY26863	10W-30 Plus 50 II	330-gal. tote	1

#### Canada — Plus-50 II Premium Engine Oil — 15W-40

Part Number	Description	Size	Pkg. Qty.
TY26674	15W-40 Plus 50 II	946ml (1 qt.)	12
TY26658	15W-40 Plus 50 II	3.78L (1 gal.)	4
TY26675	15W-40 Plus 50 II	9.46L (2 1/2 gal.)	2
TY26679	15W-40 Plus 50 II	18.9L (5 gal.)	1
TY26644	15W-40 Plus 50 II	125L	1
TY26656	15W-40 Plus 50 II	205L	1
TY27325	15W-40 Plus 50 II	1000L tote	1

#### Canada — Plus-50 II Premium Engine Oil — 10W-30

Part Number	Description	Size	Pkg. Qty.
TY26652	10W-30 Plus 50 II	3.78L (1 gal.)	6
TY26671	10W-30 Plus 50 II	18.9L (5 gal.)	1
TY26650	10W-30 Plus 50 II	205L	1

#### U.S. and Canada Plus-50 II Engine Oil — OW-40 – Synthetic

Part Number	Description	Size	Pkg. Qty.
TY26665	0W-40 Plus 50 II Synthetic	1 qt. (946ml)	12
TY26664	0W-40 Plus 50 II Synthetic	1 gal. (3.78L)	6
TY26667	W-40 Plus 50 II Synthetic	5 gal. (18.9L)	1
TY26666	W-40 Plus 50 II Synthetic	55 gal. (208L)	1
TY27354	0W-40 Plus 50 II Synthetic	275-gal. (1040L) tote	1

#### U.S. and Canada— Torq-Gard<sup>™</sup> Engine Oil 15W-40 — (API – CJ-4)

Part Number	Description	Size	Pkg. Qty.
TY26802	15W-40	55 gal. (208L)	1
TY26801	15W-40	5 gal. (18.9L)	1
TY26800	15W-40	1 gal. (3.78L)	6
TY26799	15W-40	1 qt. (946L)	12

#### Torq-Gard Engine Oil — 5W-30, 10W-30, SAE 10W, SAE 30

Part Number	Description	Size	Pkg. Qty.
TY26803	5W-30	1 qt.	12
TY26804	5W-30	5 gal.	1
TY26805	5W-30	55 gal.	1
TY26797	10W-30	5 gal.	1
TY26798	10W-30	55 gal.	1
TY26794	SAE 10W	1 gal.	6
TY26795	SAE 10W	5 gal.	1
TY26796	SAE 10W	55 gal.	1
TY26790	SAE 30	1 qt.	12
TY26791	SAE 30	1 gal.	6
TY26792	SAE 30	5 gal.	1
TY26793	SAE 30	55 gal.	1

#### Canada — Torq-Gard Engine Oil — 5W-30, 10W-30, SAE 10W, SAE 30

Part Number	Description	Size	Pkg. Qty.
TY26803	5W-30	946ml	12
TY26804	5W-30	18.9L pail	1
TY26805	SW-30	208L drum	1
TY26797	10W-30	20L pail	1
TY26790	SAE 30	946ml	12

#### U.S. — Turf-Gard<sup>™</sup> Multi-Viscosity 4-Cycle Motor Oil

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	Part Number	Description	Size	Pkg. Qty.
	TY25121	5W-30	1 qt.	12
	TY22029	10W-30	1 qt.	12
	TY22076	10W-30	2 1/2 gal.	2
	TY22075	10W-30	55 gal.	1
	TY25122	10W-40	1 qt. (946ml)	12

#### Canada — Turf-Gard Multi-Viscosity 4-Cycle Motor Oil

Part Number	Description	Size	Pkg. Qty.
TY25121	5W-30	1L (1 qt.)	12
TY22029	10W-30	1L (1 qt.)	12
TY25122	10W-40	1L (1 qt.)	12

#### 2-Cycle Engine Oil

Part Number	Description	Size	Pkg. Qty.
UP08138	Semi-Synthetic 2-Cycle Oil	2.6 oz.	24
UP08140	Semi-Synthetic 2-Cycle Oil	6.4 oz.	24
UP08127	Semi-Synthetic 2-Cycle Oil	16 oz.	24

#### Bar and Chain Oil

Part Number	Description	Size	Pkg. Qty.
UP00856	Bar and Chain Oil	1 qt. (946mL)	12
TY26520	Bar and Chain Oil	1 gal. (3.78L)	4

#### Plus-4<sup>™</sup> Multi-Viscosity Automotive Engine Oil

Part Number	Description	Size	Pkg. Qty.
TY26811	10W-30	1 qt.	12

#### U.S. and Canada — Break-In<sup>™</sup> Plus Oil

Part Number	Description	Size	Pkg. Qty.
TY26661	Break-In Plus Oil	1 gal. (3.78L)	6
TY26663	Break-In Plus Oil	5 gal. (18.9L)	1
TY26662	Break-In Plus Oil	55 gal. (208L)	1

#### Canada — Break-In Plus Oil (This size offered only in Canada.)

Part Number	Description	Size	Pkg. Qty.
TY26643	Break-In Plus Oil	4L	4

#### U.S. — Hy-Gard<sup>™</sup> Transmission and Hydraulic Oil

Part Number	Description	Size	Pkg. Qty.
TY6354	Oil, Transmission, Hy-Gard	1 gal.	6
TY22062	Oil, Transmission, Hy-Gard	2 1/2 gal.	2
AR69444	Oil, Transmission, Hy-Gard	5 gal.	1
TY6238	Oil, Transmission, Hy-Gard	30 gal.	1
AR69445	Oil, Transmission, Hy-Gard	55 gal.	1
TY26992	Oil, Transmission, Hy-Gard	275 gal.	1

#### U.S. and Canada — Low Viscosity Hy-Gard Transmission and Hydraulic Oil

Part Number	Description	Size	Pkg. Qty.
TY22035	Oil, Transmission, Low Viscosity Hy-Gard	1 qt. (0.95L)	12
TY22000	Oil, Transmission, Low Viscosity Hy-Gard	1 gal.(3.78L)	6
TY6342	Oil, Transmission, Low Viscosity Hy-Gard	5 gal. (18.9L)	1
TY6344	Oil, Transmission, Low Viscosity Hy-Gard	55 gal. (208.2L)	1

#### Bio Hy-Gard II Transmission and Hydraulic Oil

Part Number	Description	Size	Pkg. Qty.
TY26252	Bio Hy-Gard II	5 gal.	1
TY22063	Bio Hy-Gard II	55 gal.	1

#### Canada — Hy-Gard Transmission and Hydraulic Oil

Part Number	Description	Size	Pkg. Qty.
AR69444	Oil, Transmission, Hy-Gard	18.9L jug	1
TY6238	Oil, Transmission, Hy-Gard	113L drum	1
AR69445	Oil, Transmission, Hy-Gard	208L drum	1
TY26975	Oil, Transmission, Hy-Gard (N/A on stock orders)	3.78L jug	4
TY6354	Oil, Transmission, Hy-Gard	3.78L jug	6
TY22062	Oil, Transmission, Hy-Gard	9.5L jug	2
TY22090	Oil, Transmission, Hy-Gard (N/A on stock orders)	125L drum	1
TY6267	Oil, Transmission, Hy-Gard (N/A on stock orders)	205L drum	1
TY27323	Oil, Transmission, Hy-Gard	1000L tote	1

#### Part Numbers

#### Canada — Low Viscosity Hy-Gard™

Part Number	Description	Size	Pkg. Qty.
TY22086	Oil, Transmission, Low Viscosity Hy-Gard	10L Jug	2
TY6342	Oil, Transmission, Low Viscosity Hy-Gard	18.9L Jug	1
TY22091	Oil, Transmission, Low Viscosity Hy-Gard (N/A on stock orders)	125L Drum	1
TY6274	Oil, Transmission, Low Viscosity Hy-Gard (N/A on stock orders)	205L Drum	1
TY27324	Oil, Transmission, Low Viscosity Hy-Gard	1000L Tote	1
TY22035	Oil, Transmission, Low Viscosity Hy-Gard	32 oz. (946mL)	12

#### Excavator Zinc-Free Hydraulic Oil

Part Number	Description	Size	Pkg. Qty.
2908-050	Hitachi Super EX-46HN Excavator Hydraulic Oil	5 gal. (18.9L)	1
2908-046	Hitachi Super EX-46HN Excavator Hydraulic Oil	55 gal. (208L)	1
TY26529	Hitachi Super EX-46HN Excavator Hydraulic Oil	330 gal. (1250L)	1
TY26399	Daphne Super Hydro 32A-U Excavator Hydraulic Oil	5 gal. (18.9L)	1
TY26400	Daphne Super Hydro 32A-U Excavator Hydraulic Oil	55 gal. (208L)	1

#### HD SynTran (ADT Transmission Fluid)

Part Number	Description	Size	Pkg. Qty.
TY26391	HD SynTran (Allison Approved)	6 gal.	1
TY26392	HD SynTran (Allison Approved)	1 gal.	1

#### Automatic Transmission Fluid

Part Number	Description	Size	Pkg. Qty.
TY26459	Automatic Transmission Fluid (ATF)	1 qt.	12

#### **Power Steering Oil**

Part Number	Description	Size	Pkg. Qty.
AF2235R	Power Steering Oil	1 qt.	12

#### Hydrau<sup>™</sup> for Construction and Forestry Equipment

Part Number	Description	Size	Pkg. Qty.
TY27366	Hydrau	2.5 gal. (9.46L)	1
TY27367	Hydrau	5 gal. (18.9L)	1
TY27368	Hydrau	55 gal. (208L)	1
TY27369	Hydrau	275 gal. (1041L)	1

#### Hydrau<sup>™</sup> XR for Construction and Forestry Equipment (Synthetic)

Part Number	Description	Size	Pkg. Qty.
TY27318	Hydrau XR	5 gal. (18.9L)	1
TY27319	Hydrau XR	55 gal. (208L)	1

#### **Cotton Picker Spindle Lubricants**

Part Number	Description	Size	Pkg. Qty.
AN114022	Spindle Cleaner	5 gal.	1
AN114023	Spindle Cleaner	55 gal.	1
AN113719	Spindle Grease	35 lb.	1
AN31360	Spindle Grease	120 lb.	1

#### U.S. — Bulk Spindle Grease

Part Number	Description	Size	Pkg. Qty.
TY25845	Spindle Grease	Bulk	1

#### **GL5** Lubricant

Part Number	Description	Size	Pkg. Qty.
TY6296	80W-90 GL5 Gear Lube	1 qt.	12
TY26815	80W-90 GL5 Gear Lube	1 gal.	6
TY26816	80W-90 GL5 Gear Lube	5 gal.	1
TY26817	80W-90 GL5 Gear Lube	30 gal.	1
TY6345	85W-140 GL5 Gear Lube	1 qt.	12
TY26812	85W-140 GL5 Gear Lube	1 gal.	6
TY26813	85W-140 GL5 Gear Lube	5 gal.	1
TY26814	85W-140 GL5 Gear Lube	30 gal.	1
TY25050	85W-140 GL5 w/ Limited Slip	5 gal.	1
TY26211	75W- 80LS GL5 w/ Limited Slip	5 gal.	1
TY26204	80W - 90LS GL5 w/ Limited Slip	5 gal.	1
TY26205	80W - 90LS GL5 w/ Limited Slip	55 gal.	1
TY26212	Limited Slip Axle Lubricant Additive	1 qt.	1

#### Canada — GL5 Lubricant

Part Number	Description	Size	Pkg. Qty.
TY26821	80W90 GL5 Gear Lube	4L	4
TY26816	80W90 GL5 Gear Lube	18.9L	1
TY26831	85W140 GL5 Gear Lube	3.78L	4

#### GL5 Synthetic Gear Lube

Part Number	Description	Size	Pkg. Qty.
TY26375	75W-90 GL5 Gear Lube	1 qt.	12
TY26376	75W-90 GL5 Gear Lube	5 gal.	1
TY26377	75W-90 GL5 Gear Lube	16-gal. drum	1
TY26372	80W140 GL5 Gear Lube	l qt.	12
TY26373	80W140 GL5 Gear Lube	5 gal.	1
TY26374	80W140 GL5 Gear Lube	16-gal. drum	1

#### Synthetic Specialty Gear Lube

Part Number	Description	Size	Pkg. Qty.
TY26408	HD460 Fully Synthetic (Combine Feederhouse)	1 qt. (0.95L)	12
TY27029	Synthetic Air Compressor Oil ISO 100	20 oz. (591mL)	1

#### Diesel Exhaust Fluid (DEF)

Part Number	Description	Size	Pkg. Qty.
SWDEF025PK	DEF	2.5 gal. (9.46L)	2
SWDEF025	DEF	2.5 gal. (9.46L)	72
SWDEF055	DEF	55 gal. (208L)	4
SWDEF275	DEF	275 gal. (1041L)	1
SWDEF330	DEF	330 gal. (1249L)	1
SWDEFB600	US — DEF	(Bulk, 600- gal. min.)	600 gal.
SWDEFB5000	US — DEF	(Bulk, 5,000- gal. full truck)	5,000 gal.
SWDEFB9464C	CA — DEF (Bulk 9464L)	Bulk	9,464 L
SWDEFB18927C	CA — DEF (Bulk 18927L)	Bulk	18,927 L

#### Fuel-Protect Conditioner for Regular and Biodiesel Fuel

Part Number	Description	Size	Pkg. Qty.
TY26784	Fuel-Protect Diesel Fuel Conditioner, Summer Formula	16 oz.	12
TY26785	Fuel-Protect Diesel Fuel Conditioner, Summer Formula	1 gal.	4
TY26786	Fuel-Protect Diesel Fuel Conditioner, Summer Formula	5 gal.	1
TY26787	Fuel-Protect Diesel Fuel Conditioner, Winter Formula	16 oz.	12
TY26788	Fuel-Protect Diesel Fuel Conditioner, Winter Formula	1 gal.	4
TY26789	Fuel-Protect Diesel Fuel Conditioner, Winter Formula	5 gal.	1

#### Fuel-Protect Keep Clean Solution for Diesel Injectors

		•	
Part Number	Description	Size	Pkg. Qty.
TY26827	Fuel-Protect, Keep Clean	946ml (32 oz.)	6
TY26828	Fuel-Protect, Keep Clean	3.78L (1 gal.)	4
TY26829	Fuel-Protect, Keep Clean	18.9L (5 gal.)	1
TY26830	Fuel-Protect, Keep Clean	208L (55 gal.)	1

#### FUELSAVER<sup>™</sup> Biocide (U.S. only)

Part Number	Description	Size	Pkg. Qty.
PM49614	FUELSAVER™ Biocide	32 oz.	6

### Part Numbers

#### U.S. Distributor Bulk Oil Program

Part Number	Description	Size	Pkg. Qty.
TY26682	Plus 50™ II (15W-40)	Per gal.	1
TY22028	Hy-Gard <sup>™</sup>	Per gal.	1

#### U.S. 6000 Master Bulk Oil Program

Part Number	Description	Size	Pkg. Qty.
Charleston, SC			
TY26680	Plus 50 II (15W-40)	Per gal.	1
TY22077	Hy-Gard	Per gal.	1
McKees Rocks, P	A		
TY26684	Plus 50 II (15W-40)	Per gal.	1
TY25263	Hy-Gard	Per gal.	1
Temple, TX			
TY26683	Plus 50 II (15W-40)	Per gal.	1
TY25261	Hy-Gard	Per gal.	1
Louisville, KY			
TY26681	Plus 50 II (15W-40)	Per gal.	1
TY6278	Hy-Gard	Per gal.	1
Richmond, CA			
TY26687	Plus 50 II (15W-40)	Per gal.	1
TY25265	Hy-Gard	Per gal.	1
Waterloo, IA			
TY27008	Plus 50 II (10W-30)	Per gal.	1
TY26686	Plus 50 II (15W-40)	Per gal.	1
TY26625	Hy-Gard	Per gal.	1
TY27399	Hitachi Super EX-46HN Excavator Hydraulic Oil	Per gal.	1
TY27340	Hydrau	Per gal.	1

#### Canada Bulk Oil Program (each product 6,800 L)

Part Number	Description	Size	Pkg. Qty.
TY26660	Plus 50 II (15W40)	۱L	Need to Add Freight
CXTY26072	Hy-Gard	۱L	Need to Add Freight
CXTY26074	Low Vis Hy-Gard	1L	Need to Add Freight

#### Canada Bulk Oil Program (each product 2,000 L)

Part Number	Description	Size	Pkg. Qty.
TY27384	Plus-50 II 15W-40	1L	Freight Included
TY27385	Hy-Gard	۱L	Freight Included
TY27386	Low Viscosity Hy-Gard	۱L	Freight Included

#### Antifreeze/Coolant, Cool-Gard, and Cool Gard II

Part Number	Description	Size	Pkg. Qty.
TY26573	Cool-Gard II Concentrate	1 gal. (3.78L)	6
TY26574	Cool-Gard II Concentrate	55 gal. (208L)	1
TY26575	Cool-Gard II Pre-mix	1 gal. (3.78L)	6
TY26576	Cool-Gard II Pre-mix	2.5 gal. (9.46L)	2
TY26577	Cool-Gard II Pre-mix	55 gal. (208L)	1
TY26578	Cool-Gard II Pre-mix	330-gal. (1249L) tote	1
TY26968	Cool-Gard II PG Pre-mix	1 gal.	6
TY26969	Cool-Gard II PG Pre-mix	55 gal.	1
TY26970	Cool-Gard II PG Pre-mix	330-gal. (1249L) tote	1

#### Sprayer Winterizer Fluid PG

Part Number	Description	Size	Pkg. Qty.
N305634	Sprayer Winterizer Fluid PG (Propylene Glycol)	2.5 gal. (9.46L)	2
TY26555	Sprayer Winterizer Fluid PG (Propylene Glycol)	55 gal. (208L)	1

1	Multi-Purpose and Special-Purpose Grease					
	Part Number	Description	Size	Pkg. Qty.		
	TY25744	Synthetic Grease (Food Grade Nssf H-1) Dielectric	14 oz.	12		
	TY6341	Multi-Purpose Sd Polyurea	14 oz.	30		
	CXTY24419	Multi-Purpose Sd Polyurea	3-oz. twin pack	12		
	TY24421	Multi-Purpose Sd Polyurea	35-lb. pail	1		
	TY24422	Multi-Purpose Sd Polyurea	120-lb. keg	1		
	TY26982	Multi-Purpose Sd Polyurea	400-lb. drum	1		
	TY24416	Hd Lithium Complex Grease	14 oz.	30		
	TY24417	Hd Lithium Complex Grease	35-lb. pail	1		
	TY24418	Hd Lithium Complex Grease	120-lb. keg	1		
	PT507	Lithium Grease	14 oz.	30		
	PT575	Lithium Grease	35-lb. pail	1		
	TY24425	Heavy-Duty Water-Resistant	14 oz.	30		
	TY24427	Heavy-Duty Water-Resistant	35-lb. pail	1		
	AN102562	Corn Head Grease	14 oz.	30		
	AH80490	Corn Head Grease	35-lb. pail	1		
	TY24428	Corn Head Grease	120-lb. keg	1		
	TY6333	Moly High-Temperature EP	14 oz.	30		
	TY22017	Moly High-Temperature EP	35-lb. pail	1		
	TY24502	Moly High-Temperature EP	120-lb. keg	1		
	TY26980	Moly High-Temperature EP	400-lb. drum	1		
	TY26981	Moly High-Temperature v	1,984-lb. tote	1		
	TY26822	5Th Wheel Bio-Based Grease	10 oz. (284g)	12		
	TY27373	Calcium Sulfonate with 5% Moly	14 oz.	30		
	TY27372	Calcium Sulfonate with 5% Moly	35-lb. pail	1		
	TY27370	Calcium Sulfonate with 5% Moly	120-lb. keg	1		
	TY27371	Calcium Sulfonate with 5% Moly	400-lb. drum	1		

#### U.S. — Multi-Luber Lubricant Grade 000

Part Number	Description	Size	Pkg. Qty.
AN11100	Multi-Luber Lubricant	32 oz.	12
AN100650	Multi-Luber Lubricant	1 gal.	12

#### PAG Refrigeration Oil (Air Conditioner)

Part Number	Description	Size	Pkg. Qty.
TY22100	High Viscosity PAG Oil ISO 150 (Delco)	12 oz. (354.9mL)	6
TY22101	Low Viscosity PAG Oil ISO 46 (Denso)	12 oz. (354.9mL)	6
TY22102	Low Viscosity PAG Oil ISO 46 (Non-Deere)	12 oz. (354.9mL)	6

#### **Cooling System Flush**

Part Number	Description	Size	Pkg. Qty.
PMCC2610	Cooling System Flush (Restore) Alkaline-Based Cleaner	3.78L (1 gal.)	4
PMCC2638	Cooling System Flush (Restore Plus) Acid-Based Cleaner	3.78L (1 gal.)	4

#### Fuel System Clean-Up 2 Fluid

Part Number	Description	Size	Pkg. Qty.
TY27017	Diesel Fuel System	2.84L	4
	Clean-Up 2 Fluid	(0.75 gal.)	

Part numbers subject to change.

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