KEEPING THE WORLD RUNNING SMOOTHLY.

PHILLIPS 66

MINING & CONSTRUCTION
CATERPILLAR TO-4/FD-1

Tough conditions. Extreme temperatures. Long days under the heaviest loads. Whatever you face, Caterpillar makes the equipment to get the job done. And all that hard work requires lubrication that works even harder.

Phillips 66® TO-4 and FD-1 fluids meet more than just the demands of Caterpillar specifications. They meet the demands of the harshest environments and most extreme temperatures. Keep your heavy-duty equipment in the field where it belongs by keeping it filled with the best lubrication possible.

CATERPILLAR TO-4

POWERDRIVE® FLUID
- SAE 10W
- SAE 30
- SAE 50
- SAE 60

POWERDRIVE SYNTHETIC ALL SEASON
- SAE 5W-30

POWERDRIVE SYNTHETIC ARCTIC
- SAE 0W-20

FD-1 FLUIDS

POWERDRIVE 6000
- SAE 60

SYNCON® FINAL DRIVE
- ISO 320/SAE 70

Phillips 66® PowerDrive® Fluid

Caterpillar TO-4

A FLUID AS HEAVY-DUTY AS YOUR EQUIPMENT

Phillips 66 PowerDrive Fluid is the next-generation result of more than two decades of tests and improvements. Intentionally developed to meet the extreme demands of mining and heavy construction, it's formulated with a remarkable additive that lets you haul bigger loads with less wear on pumps and gears—even when your equipment runs hotter, faster and longer under the heaviest loads and toughest conditions.

APPLICATIONS

Phillips 66 PowerDrive Fluid is a multifunctional fluid used in heavy equipment in mining, quarrying, construction and forestry projects.

Applications include

- Final drives
- Transmissions
- Wet brakes
- Steering systems
- Hydraulic systems

SAE GRADE	BENEFITS
10W	• Keeps hydraulic systems clean and operating at peak efficiency • Protects pressure, flow and directional valves against varnish and deposits
30	• Smooth shifting and engagement of transmission components • Enhanced wear protection for clutches and gears
50 **60**	• Protects final drive gear sets under extreme loading conditions • Minimizes unscheduled downtime

Phillips 66® PowerDrive® Fluid

Test Results

IMPROVED WEAR AND LOAD PROTECTION

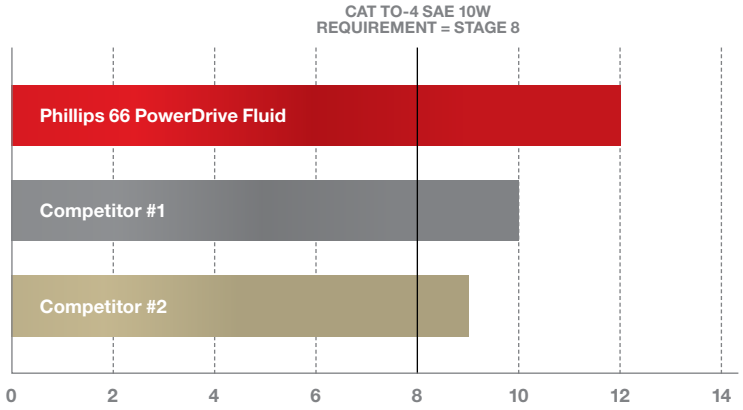
PowerDrive Fluid is intentionally formulated to provide superior protection against copper corrosion or friction without compromises.

BENEFITS

- Improves load-carrying capacity
- Protects final drive gear sets against heavy loading to extend gear life
- Reduces downtime due to unscheduled gear replacement

EP PROTECTION

FZG A20/8.3/9/90 (HIGHER IS BETTER)



The FZG Load Stage Test runs oil under increasingly high loads—with gears assessed after every load—until wear materializes. The "failing load stage" occurs when the oil is no longer capable of protecting the gears. To meet Caterpillar® TO-4 specs, an SAE 10W is required to reach Stage 8. Phillips 66 PowerDrive Fluid goes well beyond those standards and outperforms the competition in this test.

MINIMIZED CORROSION

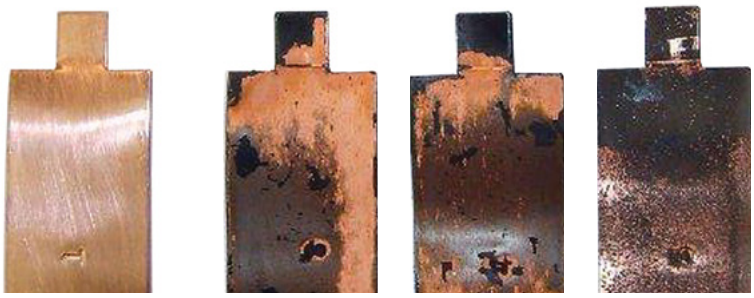
Even in the most extreme environments, PowerDrive Fluid protects against performance-compromising corrosion that can lead to higher maintenance costs and field failure.

BENEFITS

- Guards yellow metal parts against corrosion and deposits
- Helps extend the life of clutch discs and thrust washers
- Improves efficiency of hydraulic systems

INDIANA STIRRING OXIDATION TEST (ISOT)

150˚C/96 HOURS



Phillips 66 PowerDrive Fluid | Competitor #1 | Competitor #2 | Competitor #3

Copper strips were submitted to an OEM bench test to simulate the aging of oil. PowerDrive obviously outperforms competitive fluid when it comes to protecting against corrosion. Similar results were found in the Komatsu Amihot Oxidation Test, where test plates are subjected to 20 hours at 165°C with air bubbled through to simulate aging.

INCREASED FRICTION PROTECTION

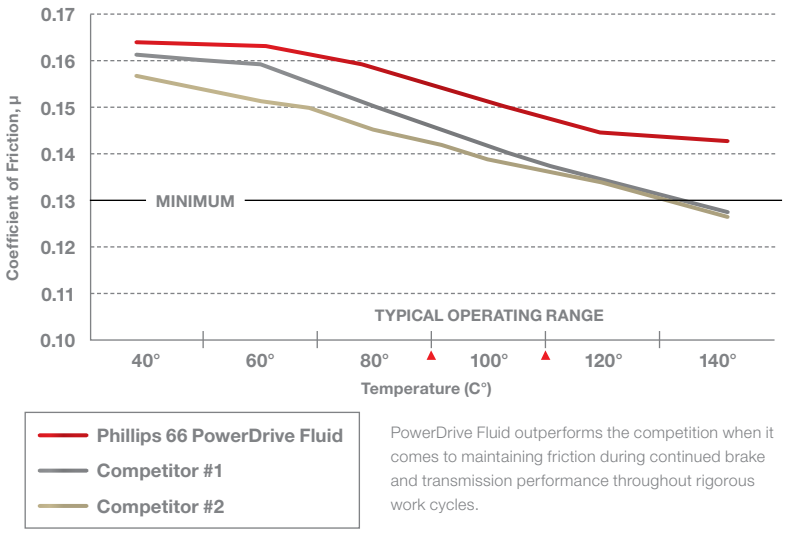
Formulated for smoother engagement of the clutch disc and drive plate, PowerDrive Fluid minimizes slippage to protect against the high temperatures that can warp discs and lead to clutch failure.

BENEFITS

- Allows precise clutch engagement over a wide temperature range (40ºC–140ºC)
- Provides smooth, shudder-free wet brake action
- Improves power transmission shifting for smoother operation

FRICTION PERFORMANCE

(HIGHER IS BETTER)



PowerDrive Fluid outperforms the competition when it comes to maintaining friction during continued brake and transmission performance throughout rigorous work cycles.

Phillips 66 PowerDrive Fluid
Profile of grooves still strong despite severe test

Competitor #1
Heavy wear to plates, grooves worn, deep scratch

Competitor #2
Extreme wear, almost no profile remains on the friction plate

Friction Retention Tests (FRRET) measure a fluid's ability to protect friction parts from damage during long-term and extreme uses. PowerDrive's superiority against the competition is easily seen in the results of this double-length FRRET that was followed by a one-day Seq 1220 endurance test performed on sintered bronze.

BETTER OXIDATION CONTROL

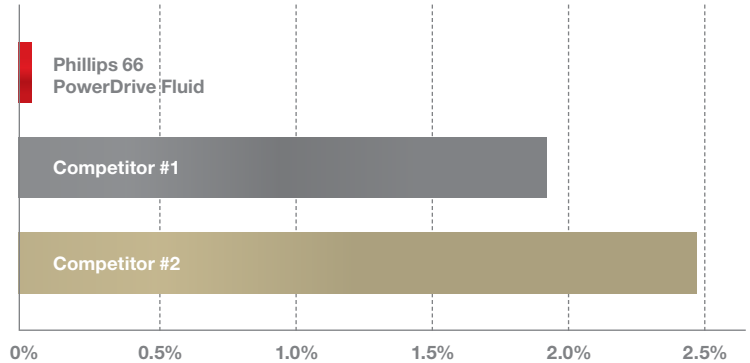
Sludge is formed by oxidation, increasing viscosity and producing the heat that accelerates further oxidation. This significantly decreases oil life. When you control oxidation, you control the rate at which sludge is produced and give more life to your oil.

BENEFITS

- Fights oxidation and limits viscosity increases
- Keeps hydraulic systems clean and operating at peak efficiency
- Protects valves from varnish and deposits

OXIDATIVE STABILITY

PERCENT VISCOSITY INCREASE (LOWER IS BETTER)



Compared to the competition, PowerDrive proves itself as an oxidatively stable fluid that minimizes increases in viscosity.

Phillips 66® PowerDrive® Synthetic All Season

Caterpillar TO-4

FOUR SEASONS, ONE FLUID

Phillips 66 PowerDrive® Synthetic All Season TO-4 Fluid meets or exceeds requirements of Caterpillar TO-4 and Allison C-4 specifications. Its state-of-the-art additive technology provides protection against wear, corrosion and sludge for superior year-round performance in off-highway mining and construction equipment.

APPLICATIONS

Phillips 66 PowerDrive Synthetic All Season TO-4 Fluid helps eliminate costly seasonal fluid changes and simplifies maintenance in mining and construction equipment manufactured by Caterpillar, Euclid, Komatsu and other OEMs.

Applications include:

- Final drives
- Transmissions
- Hydrostatic transmissions
- Torque converters
- Wet brakes
- Hydraulic systems

SAE GRADE	BENEFITS
5W-30	• Synthetic formulation for enhanced performance • Well-balanced frictional properties for positive shifting • Excellent deposit control and wear protection • High shear stability • Good foam resistance • Protects against yellow metal corrosion • Easier starting at low ambient temperatures • Compatible with a wide range of seals and friction materials

Phillips 66® PowerDrive® Synthetic All Season

Test Results

IMPROVED WEAR AND LOAD PROTECTION

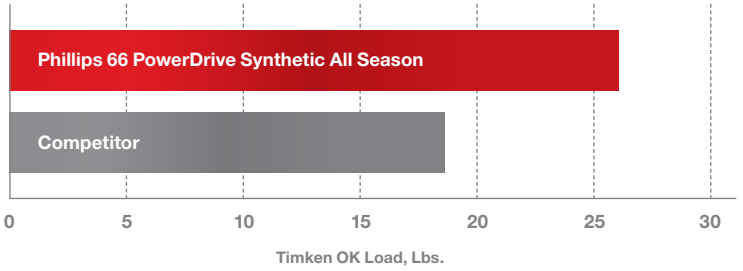
Purpose-built to provide excellent protection under severe operating conditions and subzero temperatures against copper corrosion or friction without compromises. Phillips 66 PowerDrive Synthetic All Season exhibits superior wear and extreme pressure protection when compared to competitors.

BENEFITS

- Improves pumping efficiency and flow at subzero temperatures
- Retains viscosity and film thickness to reduce wear
- Improves load-carrying capacity
- Protects final drive gear sets against heavy loading
- Reduces unscheduled gear replacement downtime

TIMKEN TEST

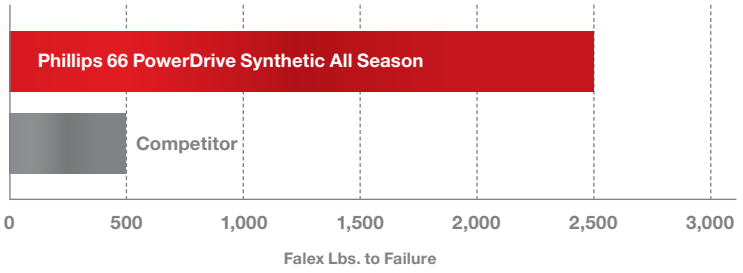
ASTM D2509 (HIGHER IS BETTER)



PowerDrive Synthetic All Season supports 50% more load than a major competitor.

FALEX PIN AND VEE BLOCK TEST

ASTM D3233B (HIGHER IS BETTER)



PowerDrive Synthetic All Season manages extreme pressure better than a major competitor. In fact, it can handle 2,000 pounds more force before metal scoring begins to occur.

BETTER OXIDATION STABILITY

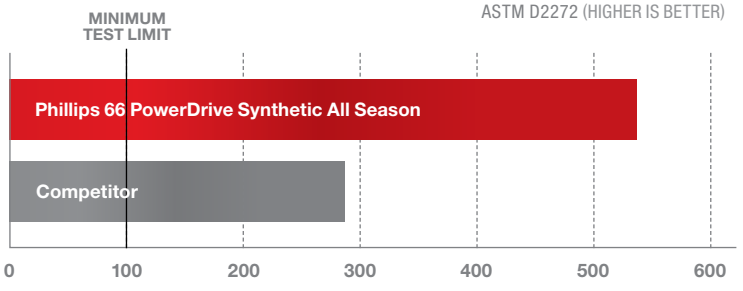
Better oxidation control from PowerDrive Synthetic All Season means longer oil life and less sludge.

BENEFITS

- Fights oxidation and limits viscosity increases
- Keeps hydraulic systems clean and operating at peak efficiency
- Protects valves from varnish and deposits
- Minimizes sludge

ROTARY PRESSURE VESSEL OXIDATION TEST

ASTM D2272 (HIGHER IS BETTER)



When measuring oxidation resistance, PowerDrive Synthetic All Season lasts nearly 95% longer than a major competitor before reaching the test limit.

INCREASED FRICTION PROTECTION

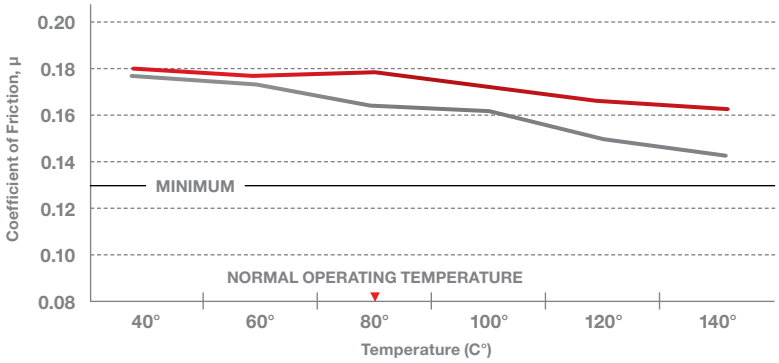
Retains a higher, more consistent friction coefficient over a wide temperature range. This delivers better holding power for clutches and wet brakes, as well as more consistent clutch engagement and torque transfer.

BENEFITS

- Increases component life, including clutches, transmissions and brakes
- Provides smooth, quiet, shudder-free wet brake action
- Improves power transmission shifting for smoother operation
- Improves frictional durability for better engagement of clutches and wet brakes

FRICTION PERFORMANCE

HIGHER IS BETTER



PowerDrive Synthetic All Season

Competitor

PowerDrive Synthetic All Season maintains a higher friction coefficient than a major competitor over a wider range of temperatures. This delivers better holding power for clutches and wet brakes.

MINIMIZED CORROSION

Uncompromised performance, decreased maintenance and fewer field failures—even in the harshest environments.

BENEFITS

- Emulsifies up to 25% water to reduce rust
- Protects yellow metal parts from corrosion and deposits in wet conditions and high operating temperatures
- Helps extend the life of clutch discs and thrust washers
- Improves hydraulic system efficiency

WATER TOLERANCE/CORROSION PROTECTION

ASTM D2619 HYDROLYTIC STABILITY (25% WATER)

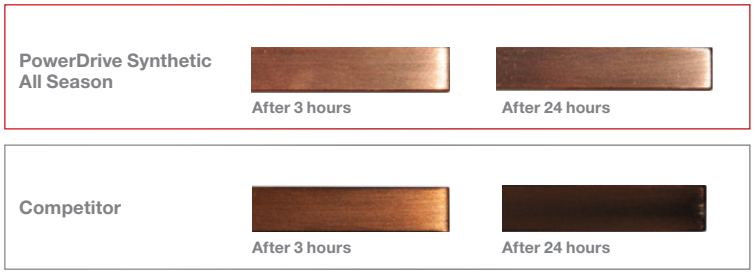
PowerDrive Synthetic All Season

Competitor

In hydrolytic stability testing, the difference is obvious when it comes to the advanced protection provided by PowerDrive Synthetic All Season for yellow metals under corrosive wet conditions when compared to a major competitor.

CORROSION PROTECTION

ASTM D130 COPPER CORROSION TEST (150°C)



PowerDrive Synthetic All Season also protects yellow metals better than a major competitor when operating in very high temperatures over time.

Phillips 66® PowerDrive® Synthetic Arctic

Caterpillar TO-4

EXTREME PROTECTION FOR EXTREME CONDITIONS

Specifically developed for off-highway equipment operating in arctic climates, PowerDrive Synthetic Arctic TO-4 fluid is a premium synthetic multigrade fluid that meets or exceeds Caterpillar TO-4 and Allison C-4 performance requirements. It's formulated with synthetic polyalphaolefin (PAO) base stocks, as well as advanced additive technology to provide a wide range of benefits.

APPLICATIONS

While not for use in engines, PowerDrive Synthetic Arctic TO-4 is a multifunctional fluid for use in Caterpillar, Euclid, Komatsu and other off-highway mining and construction equipment operating in arctic conditions.

Applications include:

- Powershift transmissions
- Hydrostatic transmissions
- Torque converters
- Final drives
- Hydraulic systems
- Wet brakes

SAE GRADE	BENEFITS
0W-20	• Excellent deposit control and wear protection • High shear stability • Good foam resistance • Protects against yellow metal corrosion • Easier starting at low ambient temperatures • Compatible with a wide range of seals and friction materials

Phillips 66® PowerDrive® Synthetic Arctic

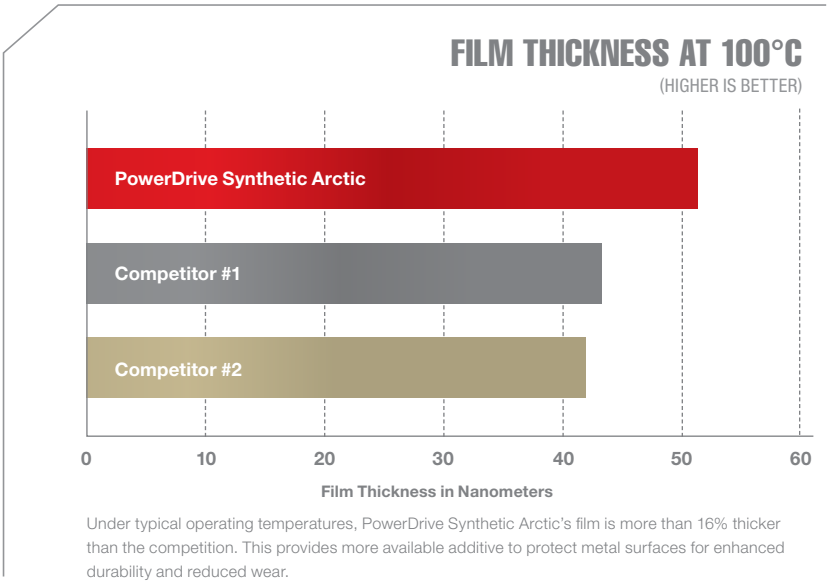
Test Results

WEAR AND LOAD PROTECTION

Specially developed for use in off-highway equipment operating in arctic climates. Under typical operating temperatures, PowerDrive Synthetic Arctic has shown enhanced durability and reduced wear compared to leading competitors.

BENEFITS

- High load-carrying capacity for protection of final drive gear sets
- Excellent deposit control and wear protection



Under typical operating temperatures, PowerDrive Synthetic Arctic's film is more than 16% thicker than the competition. This provides more available additive to protect metal surfaces for enhanced durability and reduced wear.

CORROSION PROTECTION

Uncompromised performance, decreased maintenance and fewer field failures—even in unforgiving arctic environments.

BENEFITS

- Protects yellow metals against corrosion
- Performs under very high operating temperatures
- Prevents rust under 100% humidity conditions after 96 hours in the ASTM D1748 Humidity Cabinet test at 48°C

PowerDrive Synthetic Arctic protects yellow metals under very high operating temperatures when compared to the competition, which can allow metal to tarnish after only several hours — and succumbs to extensive tarnishing after 24 hours.

LOAD CARRYING CAPACITY

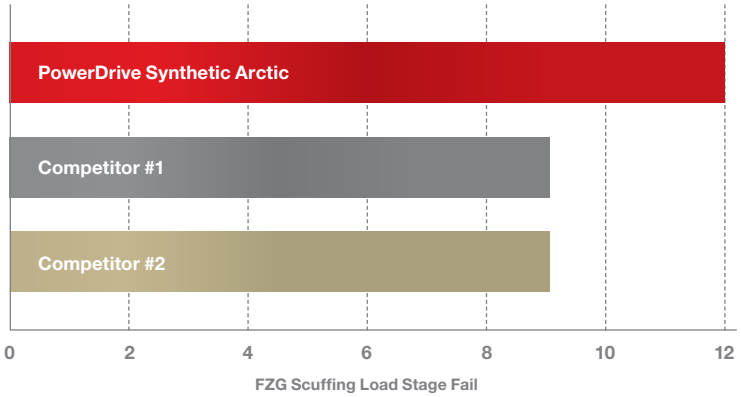
Formulated specifically to protect metal surfaces and extend gear life of equipment running heavy loads in arctic tempuratures.

BENEFITS

- Improves load-carrying capacity
- Protects final drive gear sets against heavy loading to extend gear life
- Reduces downtime due to unscheduled gear replacement

LOAD CARRYING CAPACITY FZG TEST

FZG A/8.3/90 (HIGHER IS BETTER)



PowerDrive Synthetic Arctic has a much greater load-carrying capacity than competitors, which indicates it will provide better protection for metal surfaces against wear and extend gear life.

OXIDATION STABILITY

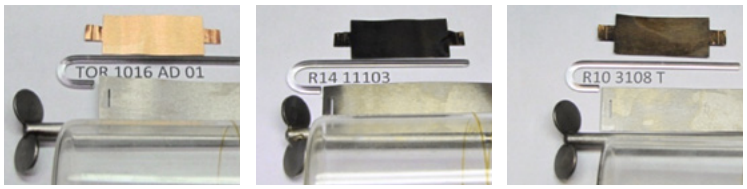
Outstanding oxidation resistance and thermal stability for long fluid life and protection from tarnish.

BENEFITS

- Fights oxidation and limits viscosity increases
- Keeps transmissions, final drives, hydraulic systems and wet brakes clean and operating at peak efficiency
- Protects from varnish and deposits
- Minimizes sludge

INDIANA STIRRING OXIDATION TEST (ISOT)

150˚C/96 HOURS



PowerDrive Synthetic Arctic | **Competitor #1** | **Competitor #2**

Compared to the competition, PowerDrive Synthetic Arctic offers easily visible superior metal protection. PowerDrive Synthetic Arctic's part looks almost new, while other fluids leave their parts with severe tarnishing.

Phillips 66® PowerDrive® 6000

Caterpillar FD-1

LESS COST FOR YOU AND YOUR EQUIPMENT

Phillips 66 PowerDrive 6000 is a high-performance, cost-effective lubricant specifically designed to meet the stringent requirements of Caterpillar FD-1 specifications to protect gears and bearings in the differentials of off-road equipment. It delivers significant improvements in wear control and oxidation stability when compared to conventional TO-4 fluids, so you can extend drain intervals under normal operating conditions to reduce downtime without compromising performance or protection.

High Performance at Low Cost

Delivers improved performance and maximum protection for gears and bearings at a fraction of the cost of full synthetic options.

Superior Protection

Provides optimal wear protection under tough high-torque, low-speed operating conditions.

Oxidation Stability

Delivers excellent stability to reduce deposits and minimize viscosity thickening throughout the drain cycle.

Reduced Foam

Leads to lower wear rates in high-pressure contact zones.

Cleaner Gearboxes

Active additive system cleans gearboxes upon initial fill and helps sustain a cleaner environment over the long-term.

Extended Gear Life

Proven protection against pitting, wearing and scuffing.

APPLICATIONS

PowerDrive 6000 is a multifunctional fluid for use in mining, quarrying, construction and forestry equipment.

Applications include:

- Direct replacement for Caterpillar FDAO
- Axles
- Heavily loaded final drives
- Differentials

We don't recommend using PowerDrive 6000 in final drives that contain friction materials—or in wet brakes, engines, transmissions or hydraulic systems.

		°C		°F	
COMPARTMENT & VEHICLES	**SAE GRADE**	**MIN.**	**MAX.**	**MIN.**	**MAX.**
Differentials and Final Drives of Off-Highway Trucks and Tractors	60	*	**50**	*	**122**

*PowerDrive 6000 (SAE 60) is preferred in most applications, particularly with continuous operation. If the ambient temperature is below -10°C (14°F), the oil should be warmed up prior to operation (see Caterpillar Operation and Maintenance Manual, "Differential Warm-Up and Break-In"). If the ambient temperature is below -25° C (-13°F), consult your Lube Engineer for instructions. Failure to warm up the oil prior to operation will cause damage to the machine.

Phillips 66® Syncon® Final Drive

Caterpillar FD-1

ADVANCED EQUIPMENT DESERVES ADVANCED TECHNOLOGY

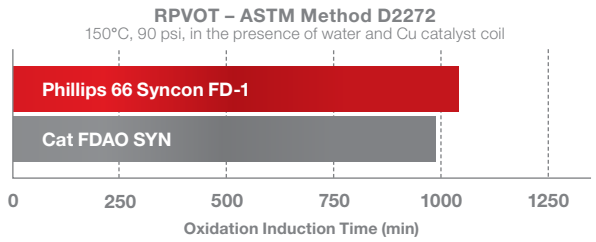
A full synthetic, high-performance lubricant, Phillips 66 Syncon Final Drive ISO 320 (SAE 60/70) is specifically formulated to meet or exceed the performance requirements of the Caterpillar FD-1 specification. Its advanced additive technology provides improved gear and bearing life in the final drives and axles (FDAO) of Caterpillar off-highway equipment. Syncon Final Drive protects against rust and corrosion, scuffing, pitting and wear plus its unique base oil combination provides a lower friction coefficient for better performance in the most adverse conditions.

LONGER FLUID LIFE

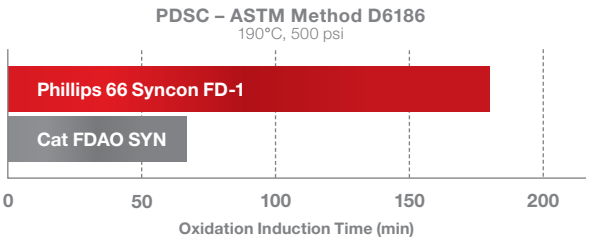
Compared with Caterpillar TO-4 fluids, Syncon Final Drive's excellent oxidation resistance and thermal stability allow extended time between drain intervals under normal operating conditions.

OXIDATION TESTS

(HIGHER IS BETTER)



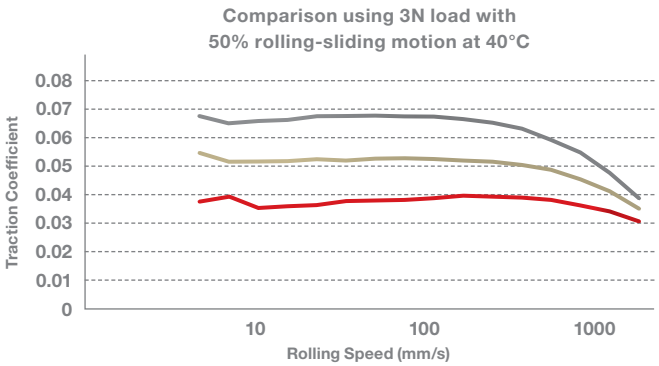
Phillips 66 Syncon Final Drive has slightly better performance versus Cat FDAO SYN.



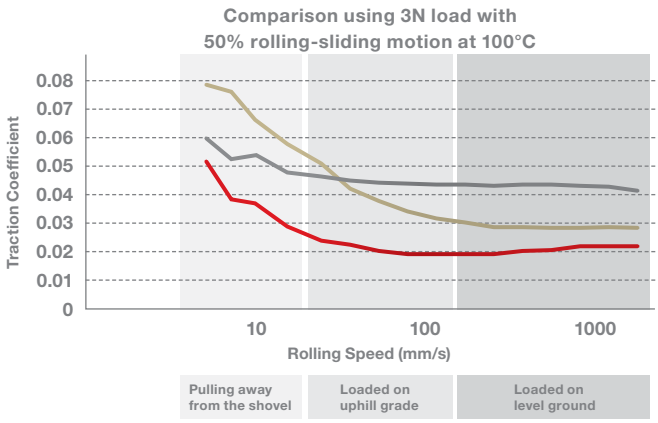
Phillips 66 Syncon Final Drive has significantly better performance than Cat FDAO SYN.

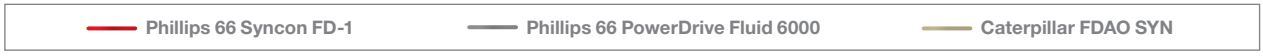
IMPROVED FRICTION PERFORMANCE

(LOWER IS BETTER)



Syncon Final Drive has the lowest friction coefficient at the testing conditions. Should result in lower temperatures and improved fuel efficiency.





APPLICATIONS

Recommended for use in certain highly loaded Caterpillar final drives and axles that don't contain friction materials. Because of its very high viscosity index, it's also recommended where SAE 60 is specified, and can be used as a direct replacement for Caterpillar Final Drive Axle Oil (FDAO) fill fluid.

KEEPING THE WORLD RUNNING SMOOTHLY.

StarWest PETROLEUM LTD.

Phillips 66® Lubricants offers a complete line of products for a wide variety of industries.
Check with us today for more information and product availability.

1855.880.7827 www.swpetroleum.ca info@swpetroleum.ca