





SMALL ENGINE OILS

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STROKE MOTORCYCLE ENGINE OIL

GUIDE TO TWO-STROKE MOTORCYCLE ENGINES AND OEMs

Two-stroke engines are one of the categories of “Small Engines”. Two-stroke applications can be land-based or water-based. The land-based two-stroke applications are mostly air-cooled. Two-stroke air-cooled engines are used commonly in motorcycles, three-wheelers and also other consumer products like chainsaws and lawn mowers. Two-stroke water-based applications are virtually all water-cooled and commonly used in outboard engines.

Two-stroke engines have good power to weight ratio and have less parts as compared to 4-stroke engines. The two-stroke engines are low in cost and relatively easy to maintain. These positive features explain its existence even until today, when four-stroke engines are already predominant.

For a traditional two-stroke engine, scavenging is the design used. Various gas exchange regimes are used to maximise scavenging effectiveness. Scavenging has impact on lubricant use and also results in high hydrocarbon emissions. Increased environmental and health awareness has essentially led to the obsolescence of two-stroke engines in many countries.

Due to the simplicity of these 2-stroke engines, they are being used in a wide range of applications. For the less sophisticated consumer products like chainsaws and lawn mowers, there can be numerous OEMs for these applications. For chainsaws, Husqvarna and Stihl are the key OEM players. For the more complex applications like motorcycles, two-stroke engines have fallen out of favour due to its higher emissions and hence very few OEMs remain for two-stroke motorcycle engines. Only Yamaha is still manufacturing 2-stroke motorcycles.

2-STROKE MOTORCYCLE ENGINE OILS (2T OILS) AND SPECIFICATIONS

2-stroke engines are lubricated by the oil mixed into the fuel. The fuel will deposit the lubricant onto the cylinder walls, where it delivers its function of protecting the engine. The lubricant will be burnt together with the fuel during the combustion process. Lubricant is replenished with the delivery of new fuel. The combustion process produces black smoke which is discharged from the engine exhaust pipe and this is aesthetically undesirable. Ash is also produced during combustion, which will cause deposit issues and preignition problems.

Henceforth, the basic protection requirements of 2T motorcycle engine oil are:

- Detergency to control deposits, particularly in the piston ring belt areas
- Lubricity to prevent piston and liner scuffing
- Oxidation resistance to prevent ash/deposit formation
- Miscibility to ensure that the oil mixes readily with petrol
- Resistance to smoke formation

Some of the key tests used for defining 2T motorcycle engine oil include:

- Brookfield viscosity
- ASTM D2893

2-STROKE MOTORCYCLE ENGINE OIL SPECIFICATIONS

The four main classification/specification systems for 2-stroke engine oils are:

1. SAE : SAE J1536 for fluidity and miscibility; SAE J2116 for performance
2. API : Performance and application
3. TIS 1040 : Performance, primarily for Thailand
4. JASO M345 : Performance

SAE J1536 is a rheological specification only. It defines four fluidity/miscibility grades, namely SAE F/M 1, F/M 2, F/M 3 and F/M 4. Amongst them, they are intended to cover all two-stroke-cycle petrol engine oil fluidity and miscibility requirements in all climatic conditions. SAE J1536 is intended for use in conjunction with SAE J2116 and is also suitable for use with the other two-stroke-cycle petrol engine classification systems. SAE J2116 is a performance specification only. Currently, only API TC remains current but lifespan is limited by a finite supply of test engine parts. It defines oils suitable for use in larger high-performance, air-cooled engines. It is generally considered that for some applications, particularly those for portable power equipment, the lubrication requirements are not adequately covered by any of the later JASO and ISO categories.

TIS 1040 is a Thai National Standard, to which all air-cooled two-stroke-cycle petrol engine oils sold in Thailand must conform. There is an associated testing and certification scheme. It was the first institutional standard to cover reduced smoke oils, and so had some significance outside of Thailand. Although there is now the JASO FC and ISO EGC categories that describe the same kind of oils, TIS 1040 is still mandatory in Thailand, and has remained as a secondary performance benchmark outside of Thailand.

JASO M345 is the Japanese classification system which defines three performance categories of successive increasing performance specification for motorcycle two-stroke-cycle petrol engines. The active JASO performance standards are namely JASO FB, FC and FD. It includes an on-file product registration system. All our two-stroke engine oils are on-filed with JALOS if applicable.

ISO 13738 is an open-ended classification system, modelled on JASO M 345 but not quite identical to it. It currently defines three successively higher performance categories for motorcycle two-stroke-cycle petrol engines, namely ISO EGB, ISO EGC and ISO EGD. These generally align with JASO FB, JASO FC and JASO FD respectively, although there are some differences that make the ISO categories slightly more restrictive. Note that ISO EGD preceded JASO FD.

OEM SPECIFICATIONS

OEM specifications for two-stroke engine oil take the form of OEM genuine oil development. Performance specification of two-stroke OEM genuine oil is not disclosed and usually, these OEMs will undertake their own development of their genuine oil, and sometimes in collaboration with selected oil major (**word missing?**). They will either run in-house proprietary tests or conduct field trials to evaluate the oil quality.



CALTEX PRODUCT PORTFOLIO

A brief summary of the 2-stroke Motorcycle Engine Oils in the Caltex range is given below:

Product	Description	Approvals
Havoline® Super 2T	High performance, low ash, semi-synthetic 2T engine oil with very strong JASO performance and ISO lubricity. Recommended for use in Stihl chainsaws, based on successful field test in New Zealand. Suitable for other chainsaw models other monitoring.	This product meets ISO EGC and API TC. Registered as JASO FC.

The table below captures the various specifications against which Caltex products are approved or which products meet.

Specifications		Caltex Products	Havoline® Super 2T	Super Outboard
Specifications	Air-Cooled 2T Engines		•	
	Water-Cooled 2T Engines			•
Industry Specification	API TC		M	
	ISO EGC		M	
	ISOC EGB		M	
	JASO FC		A	
	JASO FB			
	TIS 1040-2541			
	NMMA TC-W3			A



HAVOLINE® SUPER 2T

PRODUCT DESCRIPTION

- Havoline Super 2T is a low smoke, semi-synthetic two-stroke motor oil, designed for use in engines requiring JASO FC or ISO EGC performance. It is suitable for use in air- and liquid-cooled two-stroke motorcycle or tricycle engines fitted with exhaust catalysts. Havoline Super 2T is formulated with a low ash additive system, reducing spark plug fouling under all operating conditions.

CUSTOMER BENEFITS

- Semi-synthetic formulation and good friction characteristics help protect against engine wear, scuffing and offer increased engine life.
- Low ash additive system reduces spark plug fouling and helps increase spark plug service life.
- Designed for use in a range of engines where JASO FC or ISO EGC performance lubricants are required, including high output machines operating under severe service.

APPLICATION

- Air- and liquid-cooled two-stroke motorcycle engines
- Particularly suitable for Japanese high performance motorcycle engines
- Japanese two-stroke engines fitted to portable power equipment (other than chainsaws)
- Oil-injected engines (except marine outboard) where no fuel/oil premixing is required
- Air-cooled, oil-petrol premix engines at manufacturers' recommended petrol-to-oil ratios, up to 50:1
- Two-stroke motorcycle and motor tricycle engines fitted with exhaust catalysts

Not recommended for use in marine outboard engines, in chainsaw or in CNG or LPG-fuelled engines.

PERFORMANCE STANDARDS

- JASO FC
JASO Identification Numbers: 061CTC684, 061CTC685
- ISO EGC
- API TC

TYPICAL TEST DATA

Havoline® Super 2T KEY PROPERTIES	RESULTS
SAE Grade	F/M 2
Product Code	500676
Flash Point, PMCC, °C	93
Pour Point, °C	-38
Sulphated Ash, m %	0.13
Viscosity, mm ² /s @ 40°C	59.2
Viscosity, mm ² /s @ 100°C	9.4

SERVICE CONSIDERATIONS

Havoline Super 2T is not recommended for use in marine outboard engines, chainsaw engines or any CNG- or LPG-fuelled two-stroke engines. The information given in the typical data does not constitute a specification but is an indication based on current production and can be affected by allowable production tolerances. The right to make modifications is reserved. This supersedes all previous editions and information contained in them.

Disclaimer: Caltex accepts no liability for any loss or damage suffered as a result of using this product for any application other than applications specifically stated in any Product Data Sheets.

Health, safety, storage and environmental: Based on current available information, this product is not expected to produce adverse effects on health when used for the intended application and in accordance with the recommendations provided in the Material Safety Data Sheet (MSDS). MSDSs are available upon request through your local sales office, or via the Internet. This product should not be used for purposes other than its intended use. When disposing of used product, take care to protect the environment and follow local legislation.





2-STROKE OUTBOARD ENGINE OIL

GUIDE TO TWO TWO-STROKE MOTORCYCLE AND OEMs

Two-stroke water-based applications are virtually all water-cooled and commonly used in outboard engines. Outboard engines are used in a wide range of marine applications, ranging from commercial fishing vessels to ski-tow leisure boats. These engines are mostly direct water-cooled, either by fresh or salt water, depending on location. Until about ten years ago, the vast majority of outboard marine engines have been of the two-stroke type. Consequently, the term Outboard Marine Oil (OBMO) is strongly associated with two-stroke engines. However, the production of four-stroke outboard engines is steadily increasing, and more recently four-stroke outboard motor oils have been introduced.

The salt water marine environment promotes severe rusting of iron and steel. Accordingly, corrosion is a concern to outboard motor engines, particularly those used in salt water. Additionally, outboard engines are frequently the sole power-plants of small vessels. The engines are frequently run under overload conditions, particularly of those used on commercial fishing vessels. Henceforth, unlike the case in most land-based applications, failure of the outboard engine is not just inconvenient, but can create a hazardous situation. Therefore, there are always HES considerations associated with outboard motor operations.

Note that there are some diesel outboard engines in production, usually for commercial applications. As with diesel motorcycles and tricycles, and portable power equipment, these are considered to be outside of the scope of coverage by the small engine oils product group, and simply a small "corner" of HDEO activities.

GUIDE TO 2-STROKE OUTBOARD ENGINE OILS (2T OILS) AND SPECIFICATIONS

Historically the term "Outboard Motor Oil" (OBMO) was used to describe those oils that are designed to lubricate two-stroke marine outboard petrol engines. However, the production of four-stroke outboard engines is steadily increasing, and more recently four-stroke outboard motor oils have been introduced. An industry performance standard for four-stroke outboard motor oils, namely NMMA FC-W, was released in 2004. Thus, today, when the term OBMO covers both two-stroke (2T) and four-stroke (4T) products, it is prudent to always distinguish between the two. It is worth noting that Caltex does not have any suitable products for four-stroke outboard engines.

The term 2T OBMO is also interchangeable with "water-cooled two-stroke engine oil", sometimes abbreviated to 2TWC. This is because outboard engines are nearly always water-cooled. On the other hand, for very many years, most land-based two-stroke engines were air-cooled, and were ideally lubricated with differently formulated oils. Today, there are land-based water-cooled two-stroke engines, but from a lubrication viewpoint, they are very similar to land-based air-cooled two-stroke engines, and are treated as part of the 2T Air-Cooled (2TAC) group for that purpose.

The most significant characteristic of OBMOs is that with very few exceptions, they are ashless. That is, they are formulated with all non-metallic additive components. This is because two-stroke outboard engines are more prone to destructive pre-

ignition than most land-based two-stroke engines. Frequently they operate for extended periods at high power outputs and constant rotational speeds. Thus, piston crown and combustion chamber surface temperatures tend to be relatively steady, and this in turn facilitates the adherence of ash to these surfaces. Ash deposits, if formed, act as ignition sources.

The NMMA TC-W3[®] specification does not directly require formulations to be ashless. However, it includes a severe pre-ignition engine test that is virtually impossible to pass with anything other than an ashless formulation. Hence, in practice, outboard motor oils are ashless.

The majority of two-stroke engine oils today are pre-diluted. Pre-dilution ensures good miscibility with petrol even at low ambient temperatures, and provides fluidity characteristics that are properly matched to the needs of oil injection equipment.

The NMMA fluidity and miscibility requirements correspond with the SAE F/M 3 grade of SAE Standard J1536, first released in 1988.

Some of the key tests used for defining 2T motorcycle engine oil include:

- **ASTM D4863:** Standard Test Method for Determination of Lubricity of Two-Stroke-Cycle Petrol Engine Lubricants
- **ASTM D4858:** Standard Test Method for Determination of the Tendency of Lubricants to Promote Pre-ignition in Two-Stroke-Cycle Petrol Engines
- **ASTM D4682:** Standard Specification for Miscibility with Gasoline and Fluidity of Two-Stroke-Cycle Petrol Engine Lubricants
- **ASTM D6352:** Standard Test Method for Boiling Range Distribution of Petroleum Distillates in Boiling Range from 174 °C to 700 °C by Gas Chromatography

2-STROKE OUTBOARD MOTOR ENGINE OIL SPECIFICATIONS

There is only one industry specification of significance when it comes to two-stroke outboard engine oils, namely the NMMA (National Marine Manufacturers Association) TC-W[®] series. It is of American origin but is used globally. For example, Japanese outboard engine builder Yamaha actively participates in the development of the NMMA specifications. National Marine Manufacturers Association (NMMA) with its TC-W series defines a complete specification, with accompanying certification and licensing scheme, for two-stroke outboard motor oils.

The current edition is NMMA TC-W3[®], and it includes performance, fluidity and miscibility requirements. All previous editions are obsolescent, and no longer licensable. TC-W3[®] is a registered trademark, usable only by marketers with a license. Caltex Lubricants maintains an active TC-W3 license with NMMA, which is renewed on an annual basis.

Currently licensed NMMA TC-W3[®] oils carry registration numbers in the RL-series, which was adopted following the previously-mentioned late 2003 specification amendment. All CGL products for which NMMA TC-W3[®] performance is claimed are properly registered with the NMMA.



CALTEX PRODUCT PORTFOLIO

A brief summary of the 2T Engine Oils in the Caltex range is given below:

Product	Description	Approvals
Super Outboard 3	Premium performance, ashless product formulated for use in 2T marine outboard motor engines.	This product is certified to meet NMMA TC-W3.



SUPER OUTBOARD 3



PRODUCT DESCRIPTION

- Super Outboard 3 is an efficient premium performance, two-stroke marine outboard oil, formulated with an ashless additive system. It is pre-diluted with a high flashpoint low aromatic solvent which aids easy mixing with petrol across a wide temperature range. Super Outboard 3 is designed for engines requiring NMMA TC-W3® certified lubricants, operating in a wide range of service conditions.

CUSTOMER BENEFITS

- **High power output** – highly refined mineral oil and ashless additives offer piston cleanliness and help maintain engine performance
- **Keep-clean performance** – formulated to offer protection against ring sticking, thus maintaining combustion efficiency and power output
- **Reduced maintenance costs** – robust additive system helps protect against wear under high speed, peak performance operation
- **Trouble-free operation** – ashless additives ensures that ash-induced deposits are eliminated and thus minimise the risk of harmful pre-ignition
- **Optimum spark plug life** – ashless additive system helps reduce spark plug fouling under a wide range of operating conditions

APPLICATION

- Water-cooled, two-stroke, marine outboard engines, including the latest designs under warranty protection
- Oil-injected engines
- Oil-petrol premix engines at a wide range of petrol-to-oil ratios up to and including 100:1
- Air-cooled, two-stroke engines where API TD or NMMA certified oils are specified

PERFORMANCE STANDARDS

- National Marine Manufacturers Association (NMMA) TC-W3®
NMMA TC-W3 Certification Numbers: RL00420J, RL93002J

TYPICAL TEST DATA

Super Outboard 3 KEY PROPERTIES	RESULTS
SAE Grade (J1536)	F/M 3
Product Code	560319
Ash, m %	<0.01
Flash Point, PMCC, °C	102
Pour Point, °C	-39
Sulphated Ash, m %	0.13
Viscosity, mm ² /s @ 40°C	56.2
Viscosity, mm ² /s @ 100°C	9.13

The information given in the typical data does not constitute a specification but is an indication based on current production and can be affected by allowable production tolerances. The right to make modifications is reserved. This supersedes all previous editions and information contained in them.

Disclaimer: Caltex accepts no liability for any loss or damage suffered as a result of using this product for any application other than applications specifically stated in any Product Data Sheets.

Health, safety, storage and environmental: Based on current available information, this product is not expected to produce adverse effects on health when used for the intended application and in accordance with the recommendations provided in the Material Safety Data Sheet (MSDS). MSDSs are available upon request through your local sales office, or via the Internet. This product should not be used for purposes other than its intended use. When disposing of used product, take care to protect the environment and follow local legislation.



4-STROKE MOTORCYCLE AND SCOOTER ENGINE OIL

GUIDE TO TWO-STROKE MOTORCYCLE ENGINES AND OEMs

The other category of “Small Engines” is the smaller four-stroke engine, used commonly in motorcycles, three-wheelers, motor scooters, All-Terrain Vehicles (ATV) and marine outboard. Like the two-stroke engines, such small four-stroke applications are mostly air/water-cooled for the land-based applications and water-cooled for water-based applications. As compared to the two-stroke engines, the four-stroke engines have a better emission profile, provide fuel economy benefits and are quieter. Caltex Lubricants does not offer any products for four-stroke water-based applications like marine outboard. Henceforth, the rest of the discussion will focus primarily on four-stroke engines used in motorcycles and scooters.

In contrast to the bigger four-stroke engines used in passenger cars, motorcycle engines typically have higher power densities and run at higher temperatures. The oil sump of motorcycle engines is also smaller in volume relative to that of passenger car engines, again exacerbating the high engine temperature condition. Thus, motorcycle engines provide a more severe “heat stress” environment for the oil than is the case for passenger car engines. The other main distinction of motorcycle engines is that the clutch and transmission systems are located just below the engine and hence share the same lubrication system as the engine. This is why motorcycle engines are commonly known as wet clutch systems. For this reason, motorcycle engine oil needs to be specially formulated engine oil that can simultaneously protect the transmission and clutch systems.

MOTORCYCLE OEMs

Without doubt, the Japanese OEMs are the global market leaders for motorcycles. In view of the tremendous growth potential of motorcycles in Asia, some other Asian OEMs have also joined the bandwagon in recent years. There are also European manufacturers of motorcycles, but these tend to focus primarily on the higher capacity motorcycles, used primarily for leisure or sporting.

Key OEMs manufacturing motorcycles that operate their own performance standards are listed below:

- Honda
- Hero Moto
- Yamaha
- Suzuki
- Kawasaki
- Bajaj
- Piaggio
- TVS

4-STROKE MOTORCYCLE ENGINE OILS (MCO) & SCOOTER OIL AND OEM SPECIFICATIONS

4-stroke Motorcycle Engine Oil (MCO)

In contrast to PCEO applications which essentially require a mono-functional fluid, the vast majority of 4T MCO applications require a multifunctional fluid. Therefore, a 4T MCO must be a clutch fluid with correct frictional properties, a gear oil capable of protecting the light and small but heavily loaded gears, as well as being an engine oil to deliver the usual lubrication requirements for the engine.

Providing good wear protection for both the critical engine components, such as the valve train, and the gears requires careful formulation balancing. For example, the anti-wear additive components often used in PCEOs to provide excellent low-to-medium temperature valve train wear protection are not always the most effective at protecting the gears from wear and pitting.

Oil stability is also more critical for 4T MCOs. Relatively small oxidative and evaporative loss viscosity increases that go unnoticed in passenger car engines can lead to perceptible problems in motorcycles, including but not limited to loss of power, excessive heat build-up in the clutch and gearbox casing, clutch shudder, and difficult gear shifting. With poorly formulated and/or low-performance 4TMOs, these effects can be noticed within 1 000 to 1 500 km of operation on an oil charge. Additionally, stability against viscosity loss due to temporary and permanent viscosity modifier shear-down is important for gear protection. This is one reason why 4TMOs typically have more rigorous high temperature, high shear viscosity and sheared viscosity specifications than is the case for PCEOs. All Caltex 4TMOs are designed to be effective multifunctional fluids and therefore fully suitable for use as four-stroke motorcycle oils, with individual product performance delivery matched to its positioning in the product line. In respect of the driveline element, correct frictional characteristics are an important part, but motorcycle oils must also provide adequate protection against gear wear and pitting, and clutch hub wear.

Something to note is that the API “S” categories that are the primary definitions of PCEO performance requirements take zero account of motorcycle applications, and there is no known correlation between the various Sequence tests and motorcycle needs. Therefore, meeting a given API “S” category is no assurance of good motorcycle performance. Certainly, the API “S” categories are important in terms of their performance positioning value and it is used primarily for to convey a quality differentiation to the consumers. However, this practice has also led to the convenient approach of using PCEO for motorcycle applications. PCEO development has steadily been departing from optimum 4T motorcycle requirements for many decades. With the emphasis of fuel economy in the PCEO world, friction modification of PCEOs became widespread and this formulation approach basically rendered them unsuitable for use in motorcycle wet clutches. In parallel, there has also been



4-STROKE MOTORCYCLE AND SCOOTER ENGINE OIL

GUIDE TO TWO-STROKE MOTORCYCLE ENGINES AND OEMS

a steady downwards trend in PCEO viscosity, not just in terms of SAE J300 grades but also in terms of HTHS viscosity and shear stability. Today, the latest specification PCEOs, such as those meeting ILSAC GF-5, have HTHS viscosities and shear stabilities lower than the level required for good motorcycle protection. PCEO anti-wear requirements have changed, as well. Back in the API SE era, it was possible for a typical premium PCEO formulation to also provide good gear wear and pitting protection, but since then the mix of anti-wear additives typically used in PCEOs has been chosen to provide good valve train wear protection at low and middle temperatures. This change of anti-wear chemistry tends to reduce gear protection capabilities.

As with PCEOs, HDEOs are also not suitable as 4T MCOs. Sometimes HDEOs that have petrol engine performance credentials are considered for use as 4TMOs, and one of the arguments advanced is that typically, they do not contain friction modifiers, so that one of the main objections to PCEOs is removed. Also, they are seen as having relatively high shear stability, which is considered to be advantageous for motorcycle applications. Nevertheless, HDEOs are not designed to be multifunctional motorcycle fluids, nor are they usually evaluated for such use. Many HDEOs have properties that are undesirable for motorcycle applications. For example, phosphorus content is very often quite high, well above the JASO MA limit of 0.12 mass% maximum, which is intended to ensure catalyst protection. Similarly, sulphated ash is also often high, above the JASO MA limit of 1.2 mass%, and well above the preferred limit of 1.0 mass%. And even the more recent 1.0 mass% sulphated ash HDEOs still have high phosphorus content. One major OEM recommends against the inclusion of API "C" category performance in 4TMOs, as its experience indicates that designing for diesel engine performance is generally antagonistic to good motorcycle performance. Overall, HDEOs are not promising candidates for use as 4TMOs, and CGL recommends against their use as such.

4-STROKE MOTORCYCLE ENGINE OIL AND SCOOTER OIL SPECIFICATIONS

Typically, MCOs are specified based on API "S" categories. This is due primarily to the simplicity of the API system and the historical as well as existing practice of using PCEO for 4T motorcycle application. However, as explained earlier, meeting a given API "S" category is no assurance of good motorcycle performance. Certainly, the API "S" categories are important in terms of their performance positioning value and it is used primarily for to convey a quality differentiation to the consumers.

The other well-known classification of MCO is the JASO standard, T903. This was first issued in 1999, and then updated with significant changes in 2006 and 2011. The latest revision is 2016 version. The JASO T903 is a classification system, built upon API "S" categories or ACEA sequence to define the core engine performance. The minimum base performance level to qualify for meeting JASO T903 is API SG. In addition, the JASO T903 fully defines frictional requirements to effectively

differentiate the non-friction modified engine oils from those that are friction modified. To ensure basic protection against gear pitting, a minimum limit of 0.08% phosphorus is included in JASO T903. This is not fully satisfactory from the industry and OEMs' standpoint.

The non-friction modified oils, classified as JASO MA oil, are suitable for use in 4T motorcycles. JASO MA is subdivided into two sub-categories, JASO MA1 and JASO MA2, although the JASO MA category itself remained in place, with unchanged frictional requirements. JASO MA1 covers the softer-friction end of JASO MA, whilst JASO MA2 covers the harder-friction end of JASO MA. Oils which meet JASO MA1 may be labelled as JASO MA or JASO MA1 at the marketer's choice. Likewise, oils which meet JASO MA2 may be labelled as JASO MA or JASO MA2 at the marketer's choice. However, dual labelling, JASO MA and MA1/2 is not permitted.

Classification of a JASO MA1 from a JASO MA2 oil depends on the results of the friction indices from the JASO clutch system friction test. There are 3 indices from this test, namely Dynamic Friction Characteristic Index, Static Friction Characteristic Index and Stop Time Index. Oils whose frictional indices fall within the JASO MA boundaries, but are not all three within JASO MA1 or JASO MA2, may be labelled as JASO MA only. The JASO MA1 and MA2 subdivisions allow OEMs to distinguish between applications that required hard-friction oils, namely JASO MA2, and those that can accept a limited amount of friction modification, namely JASO MA1.

The friction-modified oils, classified as JASO MB, are suitable for use in 4T scooters. JASO MB oils are referred as "soft" friction oil, usually friction-modified with organo-moly type components to achieve fuel economy performance.

OEM SPECIFICATIONS

Most motorcycle OEMs recommend use of their own genuine oils. OEM genuine oil typically requires enhanced performance as compared with industry standards. Details of genuine oil specification are often available only to genuine oil partners under secrecy agreements. Qualification of genuine oil includes multiple engine, clutch and/or gearbox tests. Honda is currently the leader in setting 4T MCO specifications.







TRACTOR OILS

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Guide to Agriculture Tractors and Tractor OEMs

Tractor Fluids and Specifications

CALTEX PRODUCT PORTFOLIO

1000 THF



GUIDE TO AGRICULTURAL TRACTORS AND TRACTOR OEMs

The term "Tractor" is used to describe a farm vehicle that provides the power and traction to mechanise agricultural tasks. The modern tractor is a very sophisticated machine. Its duties not only include towing, but it must be able to tow equipment that requires power from the tractor to perform a mechanical job such as seed sowers, balers, muck spreaders and snow clearing. It must also be able to provide hydraulic power to units or implements such as bulldozer blades, shovels, forklifts and hedge cutters among others.

Tractors also come in a range of sizes and shapes with engine outputs ranging from 25 to 300 horsepower, transmissions with up to 18 speeds, and lifting capacities between 1 000 and 3000 kilograms.

The tractor has these main mechanical components:

- **Transmission**

The transmission is a device that allows rotational speed reduction (and direction reversal) and torque increase as it transfers power from the engine to the final drive. A suitable lubricant must be able to resist oxidation and provide anti-wear protection. Transmissions can be of synchronised mechanical type; hydrostatic (variable flow hydraulic pump and hydraulic motors); stepped or dual clutch automatic; and continuously or infinitely variable type which can also be a combination of mechanical gearing and hydrostatic systems.

Popular transmission designs are as follows:

- **Hydrostatic:** Hydrostatic transmissions are typically used in small tractors having engine capacity of about 35-40 hp. The speed is controlled by regulating the flow of the transmission fluid through the variable displacement pump. In simple terms, this is a hydraulic system with hydraulic actuator motors.
- **Mechanically Synchronised:** Manual transmissions are commonly found in tractors with less than 100 hp engine capacity. Gear shifting is done while the clutch is disengaged.
- **Semi-Powershift:** Semi-powershift transmissions are typically found in tractors having an engine capacity from 100 hp to 180 hp. Within the same power range, the tractor operator does not need to de-clutch to perform a gear-shifting operation.
- **Full Powershift:** Full powershift transmissions are typically found in tractors with engine capacities over 180 hp. This would be a fully automatic transmission and therefore has no pedal clutch. The powershift mechanism in the design allows for continuous power transmission even in the process of selecting and changing gear ratios, providing no momentary power disconnection from the engine to the wheels. This is accomplished through the use of a torque converter and proper functioning of band and plate type clutches.
- **CVT Hydrostatic:** Continuously variable hydrostatic transmission combines and merges mechanical power and hydrostatic power to provide uninterrupted flow of power at any given speed. While mechanical gearing provides step-changes in gear ratio, supplemental hydrostatic

transmission working in parallel can provide continuous power transmission at any speed ratio. This transmission design is typically seen in tractors having engine power capacities from 120 hp to 180 hp.

- **Traction type IVT / CVT:** Modern transmissions may be made using alternative designs such as the Infinitely Variable Transmission (IVT) that employs toroidal shaped variators; and Continuously Variable Transmission (CVT) operating on the principle of variable diameter pulleys using belt or chain drive for speed variation and power transmission.

- **Final Drive**

The final drive is a drive axle gear reduction set that transfers power to the wheel; which operates under low speed, high torque conditions. The differential gear case in farm tractors are typically of the spiral bevel type, as there is little engineering need for hypoid gears. The hub reduction final drive commonly found in large farm tractors is a planetary gear set composed of straight-cut teeth on spur gears (one sun gear and three or four planet gears) and one annular ring gear. The lubricant should provide anti-wear and load carrying protection.

A watch point here is that some four-wheel drive tractors have front drive axles that are independently lubricated, and which generally follow conventional drive axle practice. As a result they are lubricated with automotive EP gear oils rather than tractor fluids. Hypoid gears need a higher viscosity lubricant compared to tractor fluids.

- **Wet Brakes**

Wet brakes are disc brakes (similar to multi-plate clutch packs in design), which are immersed in oil. Originally, tractors incorporated dry brakes – a common example of dry brake design is found in the family car. Today, wet brakes are standard equipment on tractors with greater than 40 horsepower. Some of the reasons why wet brakes are preferred to dry brakes include durability, running cooler, cleaner, reduced noise, and reduced maintenance. These benefits are important given the constant use of brakes, for stopping and manoeuvring, in tractor operations.

In order for wet brakes to operate effectively, the lubricant must have suitable frictional characteristics. The lubricant must allow sufficient friction to develop in order that the brakes can stop the tractor quickly. It must also have the correct frictional balance necessary to avoid a stick-slip action. This stick-slip action generates wet brake noise (commonly referred to as squawk or chatter) which can be unacceptable to the farmer. Wet brake noise can be reduced by increasing the level of friction modifier (in other words reducing friction) and increasing oil viscosity. Formulating a fluid that meets these somewhat "conflicting" friction requirements is not an easy task and is made more difficult given that the size of the discs, the friction material used and the engagement pressures can vary between tractor manufacturers.

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• **Power Takeoff (PTO)**

The Power Takeoff is a device with a rotating output shaft and coupling mechanism that transfers power to auxiliary equipment attached to the farm tractor. Inside the PTO unit, it contains a clutch that operates the PTO drive shaft. For the clutch to operate effectively, the fluid must have the correct frictional characteristics.

• **Hydraulic Outlet**

The hydraulic system of the farm tractor can provide hydraulic power to auxiliary equipment. The lubricant must be able to provide the range of properties common to hydraulic fluids such as cold start-up fluidity, oxidation stability, anti-wear, corrosion/rust inhibition, anti-foaming, seal compatibility and shear stability. Compatibility with other fluids is also important.

• **Engine**

The internal combustion engine is the basic power unit of the tractor and can be either diesel-fed or petrol-fed. The most common is a turbocharged diesel engine. The lubricant must provide the properties of an engine oil, such as detergency/dispersancy, oxidation stability, anti-wear and corrosion/rust inhibition. Also, because the operation of the tractor is all year round, the oil must be able to cope with the ambient temperature changes experienced throughout the year. Viscosity index improvers are added to impart multigrade characteristics, so that the oil will flow readily at low winter temperatures and provide sufficient lubricant film at higher temperatures.

FARM TRACTOR OEMs

There has been a lot of mergers and acquisitions among tractor manufacturers; with a few that had retained the original company name, and the most notable is John Deere which is the world's largest. The listing below indicates some of the agricultural tractor companies and associated farm tractor brand names:

- John Deere & Co.
 - John Deere
- CNH Industrial
 - JI Case, CDC, Steiger, International Harvester, Steyr
 - Ford, Fiat, New Holland, Versatile
- AGCO Corporation
 - Massey Ferguson, Hesston
 - Challenger
 - Allis Chalmers
 - Valtra, AG Chem, Fendt, Willmar
 - White, Minneapolis Moline, Oliver
- SAME DEUTZ-FAHR
 - SAME, DEUTZ-FAHR, Lamborghini, Hürlimann, Grégoire
- CLAAS Group
 - Claas, Renault
- ARGO Tractors
 - McCormick, Landini, Valpadana
- Kubota Corporation
- Mahindra Group
 - Yuvraj, Mahindra, Arjun

- Sonalika
- Escorts Group
 - Farmtrac, Escort, Powertrac
- YTO Group
- Foton Lovol International Heavy Industry
- JCB
- and many others

TRACTOR FLUIDS AND OEM SPECIFICATIONS

TRACTOR FLUIDS

It can be seen from the preceding pages that there are many components which require lubrication. Although the nature of the components suggests that different lubricants are required, the tractor design is such that all the components share a common lubricating system, except for the engine. One of the main reasons why the tractor was developed with various parts using the same oil system was to avoid lubricant misapplication. The risks of compromising performance by not using specialised oils are outweighed by the chance of misapplication, given that around six different lubricants may be needed, and that consequent damage that may occur.

There are two major categories of tractor fluids: Super Tractor Oil Universal (STOU) and Universal Tractor Transmission Oil (UTTO).

SUPER TRACTOR OIL UNIVERSAL (STOU)

In concept, super tractor oil universal fluids can be used in all parts of the tractor. It is a general-purpose farm lubricant and, in some cases, can be used in the engines and transmissions of other farm vehicles and equipment provided the fluid qualifications meet the manufacturer's requirements; however, it does not meet the wear protection requirements of hypoid gears commonly found in vehicle differentials.

The typical STOU quality requirements for each of the equipment parts are:

- Engine : API CG-4/SF, CF-4/SF, CF/SF, CD/SE
- Gearbox : API GL-4; Allison C-4 / Caterpillar TO-2 or TO-4
- PTO : API GL-4 with friction modification to ensure smooth clutch engagement, without slip
- Final Drive/Rear Axle : API GL-4 (typically gears are planetary/spiral bevel)
- Hydraulic equipment : Denison HF-2; Vickers I-286-S (pump tests)
- Wet Brakes : In-house tests

Farm tractors fitted with modern engines may require higher performance engine oils, such that STOU products are inadequate and may be used in other parts of the farm tractor, except as crankcase oil. Diesel engine oils are now being specified by OEMs to meet the emission standards according to their latest engine models.

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UNIVERSAL TRACTOR TRANSMISSION OIL (UTTO)

This product group is also referred to as Tractor Hydraulic Fluid (THF), Tractor Differential Hydraulic (TDH) Fluid and Tractor Transmission Fluid (TTF). UTTOs are used for all the equipment parts listed above except for the engine. They are generally used for tractors where the equipment manufacturer recommends a separate engine oil. The basic lubricant quality is similar to STOU fluids, except that there is no engine oil performance qualification and the hydraulic oil performance requirement is higher – Denison HF-0 and Vickers M-2950-S.

Below is a summary of some performance tests for evaluating UTTOs:

Gear protection	New Holland 3000 Axle test
	John Deere JDQ 95 Gear Scoring Test
	Massey Ferguson Four-Square Rig
	FZG scuffing and wear tests
Brake chatter and capacity	New Holland 6610/7610 test
	John Deere JDQ 96
	Massey Ferguson Brake Chatter
Clutch / transmission capacity	New Holland High Energy Clutch test
	John Deere JDQ 94 PST
	Massey Ferguson IPTO Clutch test
	Allison C4 friction tests
Oxidation Control	Allison C4 Turbo Hydramatic Oxidation test (THOT)
Pump protection	John Deere JDQ 84 (piston pump)
	Vickers 35VQ25 (vane pump)

The most difficult task in developing suitable multipurpose tractor fluids is obtaining a fluid with frictional properties that enable wet brakes to quickly stop the tractor and, at the same time, eliminate brake noise. As a general comment, North American manufacturers tend toward placing greater emphasis on brake capacity rather than noise. This is due to the large horsepower tractors and large farm sizes typically encountered in the U.S.A. Conversely, Japanese and European manufacturers tend to emphasise brake noise in their specifications, due to the typically smaller horsepower tractors, smaller farm sizes and closer locality of farms to populated areas (particularly in Japan).

With regard to fluid use, the general trend in the market is away from STOU fluids towards using separate engine oil and THF. This is basically due to the fact that the requirement of engine oils is diverging from the lubrication requirements of the other components. It is expected that this trend will continue.

OEM SPECIFICATIONS

Except for engine oils, worldwide performance standards for tractor fluids are set by the Original Equipment Manufacturers (OEMs). The major tractor OEM groups are:

- John Deere
- AGCO (Massey Ferguson, White, Deutz, Allis Chalmers)
- Case New Holland (Ford, Fiat, Versatile; International Harvester, J.I. Case, Poclair)

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The key manufacturers' specifications are:

STOU

Ford	Ford M2C 159-C (similar to Ford ESN-M2C134-D) Ford ESN-M2C159-B (had superseded ESN-M2C159-A) ESN-M2C159-B1: SAE 10W-30 ESN-M2C159-B2: SAE 15W-30 ESN-M2C159-B3: SAE 20W-40
Ford New Holland	FNH 82009201/2/3 (replaced Ford ESN-M2C159-B) FNH 820092101: SAE 10W-30 FNH 820092102: SAE 15W-30 FNH 820092103: SAE 20W-40
New Holland	NH 024C: SAE 15W-40 (replaced FNH 820092102 and 820092103; and Ford M2C159-B2 and Ford M2C159-B3, respectively)
Case New Holland	CNH MAT 3525 (UTTO specification replaces STOU)
Massey Ferguson	M1145 (also a UTTO specification; previously M1144 that had superseded M1139)
John Deere	J27 (issued in 1992, rescinded in 2005)
Case	JIC 187
ZF	TE-ML 06F (STOU and UTTO) TE-ML 06B, 06C, 06D (STOU; Steyr)

UTTO

Case New Holland	CNH MAT 3525 (current specification; formerly FNHA-2-C-201/ FNH85700812) Ford ESN-M2C134-D (formerly M2C134-C; mid-viscosity; superseded by FNHA-2-C-201) CNH MAT 3526 (formerly FNHA-2-C-200; all-season, low viscosity) Ford M2C86-B (European low noise "quiet" application; high viscosity) Ford M2C86-C (European "super quiet" application; mid-viscosity) CNH MAT 3505 (zinc-free oil; formerly Case MS 1209 that had previously superseded I-H B-6) CNH MAT 3540 (CVT)
J I Case	M1207 (low viscosity; superseded by MS 1209)
New Holland	NH 410B (SAE 10W-30 version of Ford M2C134-D) NH 410C (Case MAT 3505 fluid) NH 420A (Ford M2C 86-B fluid)

Massey Ferguson	M1145 (current, STOU and UTTO specification) Obsolete: CMS M1135 (European "quiet"; high viscosity) CMS M1141 (North American mid-viscosity; back-serviceable to M1127A and M1127B) CMS M1143 (European; may use M1145 fluid)
John Deere	JDM J20C (normal range: -20°C to +50°C) JDM J20D (low viscosity; -40°C to +20°C range)
Kubota	UDT (genuine oil, "super quiet when wet") Super UDT (Japan factory fill version) Super UDT2, Super UDT3 (latest versions)
White, Minneapolis Moline & Oliver	Q 1826 (evolved from Q 1705, 1766, 1766B, 1802)
Renk	Doromat 873, 874A, 874B
Fiat	AF87 (high viscosity)
Same Deutz-Fahr Group	ZF Eccom / TE ML 06D
ZF	TE-ML 03E, 03F (torque converter transmissions) TE-ML 03G (extended drain service) TE-ML 05F (rear axle planetary drive) TE-ML 05G (extended drain service) TE-ML 06D (Eccom 1.5; Agtron Same Deutz Fahr) TE-ML 06E (Eccom 1.5, 1.8; John Deere) TE-ML 06F (STOU and UTTO) TE-ML 06K (UTTO) TE-ML 06H (Eccom 3.5, 4.5, 5.0; CLAAS) TE-ML 21F (UTTO)
Volvo	WB 101 (wet brake transaxle oil)

The above list covers the dominant OEMs in the UTTO field, but is not exhaustive, there are other agricultural tractor and construction equipment OEMs who maintain UTTO specifications, whether in the public domain or hidden. The approval programme for tractor fluids usually includes physical and chemical testing, bench tests in various pieces of equipment to reflect in-service conditions and full-scale tests in tractors. However, many OEMs market their own genuine oils and generally do not grant approvals.



CALTEX PRODUCT PORTFOLIO

A brief summary of the Tractor Fluid products in the Caltex range is given below:

Product	Description	Recommended for use in applications calling for these fluid performance
1000 THF	<p>1000 THF is a high quality, multifunctional tractor hydraulic fluid, specially formulated for use in transmissions, final drives, wet brakes, and hydraulic systems of tractors and other equipment employing a common fluid reservoir.</p> <p>1000 THF is a Universal Tractor Transmission Oil (UTTO) formulated with highly refined base stocks, a viscosity index improver, oxidation and corrosion inhibitors, anti-wear and film strength additives, an antifoaming agent, and a pour point depressant.</p>	<ul style="list-style-type: none"> • AGCO improved power fluid 821XL • Case Corporation JIC-143, JIC-145, MS 1206, MS 1207, MS 1209, MS 1210 (TCH) • Case New Holland MAT 3525, MAT 3505 • Caterpillar TO-2 • Ford ESEN-M2C86-B • Ford New Holland ESN-M2C134-D, FNHA 2 C 201 • International Harvester B6 • John Deere J20C • Kubota UDT • Massey Ferguson M1135, M1141, M1143, M1145 • Minneapolis-Moline Q-1766, Q-1722, Q-1766B • Oliver Q-1705 • Renk Doromat 874A and 874B • Volvo WB 101 • White Farm Equipment Q-1826 • ZF TE-ML 03E, 05F, 17E, 21F (approved, ZF000100) • API GL-4
Super Tractor SAE 15W-40	<p>Shear stable, multi-viscosity super tractor oil universal (STOU) fluid designed for use in tractor engines, transmissions, final drives and hydraulic systems.</p>	<ul style="list-style-type: none"> • API GL-4 • ZF TE-ML 06B, TE-ML 07B (Suitable for use) • Ford ESN-M2C159-B2, -B3 • Ford New Holland FNH 820092102, 890092103 • New Holland NH 024C • Massey Ferguson CMS M1144

The table on the next page captures the various specifications against which Caltex products are approved or which products meet.

Specifications		Application Type		Caltex Products	
		STOU	UTTO	1000 THF	Super Tractor SAE 15W-40
Industry Specifications	API GL-4	•	•	M	M
	API CF-4/SF	•			
	API CF	•			M
Equipment Manufacturer Specification	AGCO Improved Power Fluid 821XL		•	S	
	Case New Holland CNH MAT 3525		•	S	
	Ford New Holland FNHA 2-C-201		•	S	
	Ford New Holland FNH 820092102				M
	Ford New Holland FNH 820092103				M
	Ford ESN-M2C134-D		•	S	
	Ford ESN-M2C86-B		•	S	
	Ford ESN-M2C159-B2				M
	Ford ESN-M2C159-B3				M
	International Harvester 86		•	S	
	John Deere JDM J20C		•	S	
	Kubota UDT		•	S	
	Massey Ferguson CMS M1135		•	S	
	Massey Ferguson CMS M1141		•	S	
	Massey Ferguson CMS M1143		•	S	
	Massey Ferguson CMS M1144				M
	Massey Ferguson CMS M1145	•	•	S	
	Minneapolis-Moline Q-1766		•	S	
	Minneapolis-Moline Q-1722		•	S	
	Minneapolis-Moline Q-1766B		•	S	
	New Holland NH 024C				M
	Oliver Q-170S		•	S	
	Renk Doromat 874A		•	S	
	Renk Doromat 874B		•	S	
	Volvo VCE WB 101 (Volvo Standard 1273, 03)			S	
	White Farm Equipment Q-1826		•	S	
	ZF TE-ML 03E		•	A	
	ZF TE-ML 05F		•	A	
	ZF TE-ML 06B				A
	ZF TE-ML 07B				A
ZF TE-ML 17E			A		
ZF TE-ML 21F		•	A		

1000 THF

MULTIFUNCTIONAL TRACTOR HYDRAULIC FLUID



PRODUCT DESCRIPTION

- 1000 THF is a high quality, multifunctional tractor hydraulic fluid, specially formulated for use in transmissions, final drives, wet brakes, and hydraulic systems of tractors and other equipment employing a common fluid reservoir. 1000 THF is formulated with highly refined base stocks, a viscosity index improver, oxidation and corrosion inhibitors, anti-wear and film strength additives, an antifoaming agent, and a pour point depressant.

CUSTOMER BENEFITS

- **Low operating costs**
1000 THF meets or exceeds fluid performance requirements of most OEMs, maintaining efficiency and reliability while minimising overall operating costs.
- **Long equipment life**
Special additives protect metal surfaces against scuffing and wear even under severe operating conditions leading to maximum equipment life.
- **Low inventory cost**
One fluid does the job of a full range of tractor hydraulic systems. Can replace multiple products and free up shelf space too!
- **Minimising weather and storage concerns**
Protects against rust and corrosion of highly finished precision parts when operating in humid conditions and during seasonal shutdown periods
- **Minimal downtime**
Good compatibility with seals, O-rings, and packing materials maintains their good condition and keeps leakage at a minimum
- **Smooth operation**
Formulated to suppress brake "chatter" and transmission "slip" for quiet and efficient action of brakes and transmission.
- **Reliable operation**
Formulation helps keep metal parts clean and free of varnish and sludge deposits that could result in premature breakdown.

APPLICATION

- 1000 THF is approved for:**
- ZF TE-ML 03E, 05F, 06K, 17E, 21F (ZF approval number ZF000100)
 - Volvo 97303 (WB 101, approval number 97303:004)
 - Hitachi aftermarket use in Rigid Dump Trucks (Model Code: "EH35000 AC-3, EH4000 AC-3 & EH5000AC-3)

1000 THF is recommended for use:

- as a multifunctional fluid in many types of farm tractors and equipment.
- in non-hypoid API GL-4 applications.
- Hitachi mid-sized wheel loader axle applications, transfer case and hydraulics
- ABB Dodge - controlled start-up transmissions

In applications which call for the following OEM lubricant specifications:

- AGCO – improved power fluid 821XL
- Case Corporation – JIC-143, JIC-145, MS 1206, MS 1207, MS 1209, MS 1210 (TCH)
- Case New Holland – MAT 3525, MAT 3505
- Ford ESEN-M2C86-B; Ford New Holland – ESN-M2C134-D, FNHA 2 C 201
- Caterpillar TO-2
- International Harvester B6
- John Deere – J20C
- Kubota UDT
- Oliver – Q-1705
- Renk Doromat – 874A and 874B
- White Farm Equipment – Q-1826
- Massey Ferguson – M1135, M1141, M1143, M1145
- Minneapolis-Moline – Q-1766, Q-1722, Q-1766B
- Ford New Holland ESEN-M2C86-B

1000 THF is also an excellent hydraulic fluid for many types of hydraulic systems requiring an anti-wear hydraulic fluid in this viscosity range. It passes the High Pressure Vane Pump Test, ASTM D2882, with less than 15 mg steel weight loss.

TYPICAL TEST DATA

1000 THF KEY PROPERTIES	RESULTS
Product Code	510082
Pour Point, °C	-42
Viscosity, Brookfield cP @ -35°C	40,000
Viscosity, Kinematic cSt @ 40°C	58.4
Viscosity, Kinematic cSt @ 100°C	9.5
Viscosity Index	145
Flash Point, °C	235
API Gravity	29.9
Colour	Orange

This bulletin was prepared in good faith from the best information available at the time of issue. While the values and characteristics are considered representative, some variation, not affecting performance, can be expected. It is the responsibility of the user to ensure that the products are used in the applications for which they are intended.

Environment, Health and Safety Information is available on this product in the Material Safety Data Sheet (MSDS) and Customer Safety Guide. Customers are encouraged to review this information, follow precautions and comply with laws and regulations concerning product use and disposal.

SUPER TRACTOR SAE 15W-40



PRODUCT DESCRIPTION

- Shear stable, multi-viscosity super tractor oil universal (STOU) fluid designed for use in tractor engines, transmissions, final drives and hydraulic systems.

CUSTOMER BENEFITS

- **Minimises application problems**
Unique multi-application additive package enables use in engines, transmissions, final drives and hydraulic systems, avoiding costly equipment failure due to misapplication.
- **Reduced maintenance costs**
Outstanding oxidation and nitration resistance minimises acid number increase, providing protection against bearing corrosion.
- **Extended oil change periods**
Very high oxidation stability protects against the formation of gums and varnishes, reduces oil thickening and increases oil life.
- **Maintains power output**
Detergent/dispersant additive system maintains power output by providing deposit control under the high temperature conditions encountered in both naturally aspirated and turbocharged diesel vehicles. Multi-viscosity characteristics ensure rapid oil circulation on start-up, preventing wear which contributes to power loss.
- **Smooth and quiet operation**
Special friction modifier component allows smooth action of the wet brakes and power take-off clutches, minimising chatter, stick slip and squawk.

APPLICATION

- Where tractor manufacturers specify the use of a STOU type product
- Mixed fleets of agricultural tractors and associated equipment
- Enclosed oil immersed (wet) brakes
- Power takeoff (PTO) clutches

PERFORMANCE STANDARDS

- API GL-4
- ZF TE-ML 06B, TE-ML 07B (approved and listed, reference 000789)

SUITABLE FOR USE WHERE THE FOLLOWING ARE SPECIFIED:

- Ford ESN-M2C159-B2, -B3
- Ford New Holland FNH 820092102, 890092103
- New Holland NH 024C
- Massey Ferguson CMS M1144

TYPICAL TEST DATA

SUPER TRACTOR SAE 15W-40 KEY PROPERTIES	RESULTS
SAE Grade	15W-40
Product Code	500421
Base No., D2896, mg KOH/g	10.1
Pour Point, °C	-33
Sulphated Ash, m %	1.4
Viscosity, Kinematic mm ² /s @ 40°C	113
Viscosity, Kinematic mm ² /s @ 100°C	15.1
Viscosity Index	139
Zinc, m %	0.14

Super Tractor SAE 15W-40 is a multifunctional fluid of the super tractor oil universal (STOU) type that is intended for use in both the engines and transmission compartments of agricultural tractors and related equipment, including those fitted with oil-immersed brakes.

For current and recent tractors, manufacturers separately specify the engine oil and transmission fluid requirements. Thus, in each case it is necessary to determine that Super Tractor SAE 15W-40 meets both sets of requirements. Historically some tractor makers issued a single STOU specification that covered both engines and transmission, but this practice has been discontinued for many years. Thus, it is recommended to use an engine oil with the correct performance qualification for the tractor's engine.

The diversity of tractor transmission fluid specifications is such that there are some mutual exclusivities, and it is not possible for one fluid to completely meet all specifications. Also, some specifications are not publicly available. Thus, in some cases, Super Tractor SAE 15W-40 is offered on a suitable-for-use basis, supported by a comprehensive combination of bench and equipment testing.

Although Super Tractor SAE 15W-40 does meet API GL-4, this is a secondary target and it is nevertheless not designed for nor intended for use in any on-highway drive axles of the hypoid type.

