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6-1964

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Recommended Citation

Waelti, H. and Moe, D. L., "Selection of Motor Oil" (1964). *Agricultural Experiment Station Circulars*. Paper 189.
http://openprairie.sdstate.edu/agexperimentsta_circ/189

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Circular 163
June 1964

Selection
of MOTOR OIL



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Selection of Motor Oil

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Knowledge of different types and classifications of crankcase oils means savings when selecting motor lubricants. In many cases farmers take recommendations of dealers and salesmen when buying oils, because of confusion on types and grades, different engines and conditions under which engines operate.

Crankcase oils perform four main functions in internal combustion engines. They are:

1. Lubricating— this is accomplished by forming a protective film between bearing surfaces to prevent metal to metal contact. Friction and abrasive wear is reduced.
2. Sealing — oil forms a seal between piston, rings and cylinder wall to prevent loss of power and crankcase contamination.
3. Cooling — oil helps to carry away a large amount of heat produced in the engine.
4. Cleaning — oil aids in keeping engines clean by holding impurities or sediments in suspension and reducing deposit formation.

Some other functions include: reducing noise, cushioning shock, and protection of parts. How well these functions are performed depends on type and quality of oil used in the engine.

CLASSIFICATION MAKES OIL SELECTION EASY

For convenient selection of engine oil it is classified in terms of viscosity and service.

Viscosity of an oil is its resistance to flow. A light (thin) oil offers less resistance to flow than a heavy (thick) oil and therefore has a lower viscosity. Viscosity of an oil changes with its temperature. It is desirable to have as little viscosity change as possible with temperature change. An oil should be thin enough to properly lubricate an engine when running cold and thick enough for proper lubrication when the engine is running at operating temperatures of 160-190°F.

Viscosity index of an oil indicates amount of viscosity change in a temperature change from 0° to 210°F. Low viscosity index means a large change and high viscosity index means a small change in viscosity for 210°F. temperature change.

Viscosity Classification

The Society of Automotive Engineers (SAE) has classified oil in terms of viscosity by using SAE viscosity numbers. These are: SAE 20, 30, 40, 50. SAE 20 is a light (thin) oil and SAE 50 a heavy (thick) oil. These oils have certain specified viscosities at 210°F. Special cold weather oils are designat-

ed by the numbers SAE 5W, 10W, and 20W. They have specified viscosities at 0°F. to assure easy winter starting and proper lubrication at low starting temperatures.

In the past few years the so-called multi-grade oils have come into general use. They are, for example, SAE 5W20 and 10W30 oils. SAE 5W20 has the starting characteristics of SAE 5W oil plus the characteristics of an SAE 20 oil at operating temperatures. These oils have a higher viscosity index through addition of viscosity index improvers.

Multi-grade oils can be used satisfactorily in most gasoline burning internal combustion engines, however, the operator's manual should always be consulted to make certain that the manufacturer's recommendations are followed. This is especially so for diesel engines. In most cases the operator's manual will tell what viscosity number to use. Newer engines usually use a lighter oil than older, worn engines. In new engines bearings are tight and a thin oil is needed to form a protective film between bearing surfaces. In worn bearings a heavier oil with more body is needed to obtain adequate protection.

API Service Classification

Today's modern engines are operated under many different conditions and use several types of fuel. The American Petroleum Institute (API) has provided an oil classification based on engine design and construction, operating conditions, and fuel characteristics.

The system includes three kinds of oil for gasoline and LPG engines and three kinds of oil for diesel engines.

OIL CLASSIFICATION FOR GASOLINE ENGINES

Service ML. "Service typical of gasoline and other spark ignition engines used under light and favorable operating conditions, the engines having no special lubrication requirements and having no design characteristics sensitive to deposit formation."

This service rating includes older, worn engines, driven at moderate r.p.m. and temperature. Stop-start type of driving is definitely not in this classification.

Service MM. "Service typical of gasoline and other spark ignition engines used under moderate to severe operating conditions, but presenting problems of deposit or bearing corrosion control when crankcase oil temperatures are high."

This includes automobiles, farm tractors, trucks, and power units used in moderate conditions under speeds and loads that are not excessively high.

Service MS. "Service typical of gasoline and spark ignition engines used under unfavorable or severe types of operating conditions, and where there are special lubrication requirements for deposit, wear or bearing corrosion control, due to operating conditions or to design or fuel characteristics."

The majority of spark ignition engines require MS service oils, es-

pecially new engines which are equipped with hydraulic valve lifters or valve rotators. Also, engines running cold with short operating periods, start and stop operations or engines running hot, overloaded, or at high speeds.

Examples: long, high-speed trips (car or truck) frequent short trips (car or truck) stop-start type of driving, heavy field work with tractor, dusty conditions, daily chores with tractor.

OIL CLASSIFICATION FOR DIESEL ENGINES

Service DG. "Service typical of diesel engines in any operation where there are no severe requirements for wear or deposit control due to fuel, lubricating oil or to engine design characteristics."

Generally most diesel farm tractors operate under more severe conditions than described in DG service. DG service oils can be used for engines running at continuous rated loads at moderate temperatures and using fuel of low sulfur content. No. 1 diesel fuel has a sulfur content of less than $\frac{1}{2}\%$ and can be considered a low sulfur fuel.

Service DM. "Service typical of diesel engines operating under very severe conditions or using fuel of a type normally tending to promote deposits and wear, but where there are design characteristics or operating conditions which may make the engine either less sensitive to fuel effects or more sensitive to residues from lubricating oil."

For diesel engines running under DS service conditions but where

engine design makes it impossible to use oils in the DS classification. Operator's manuals or lubrication charts will indicate when DM service oil should be used.

DS Service. "Service typical of diesel engines operating under very severe conditions, or having design characteristics of using fuel tending to produce excessive wear or deposits."

The most severe service is covered by this classification. Most diesel farm tractors fall into this category due to part-load cold operation in winter and high temperature and often overload conditions at other times. New engines with turbochargers or high sulfur content fuel require oils for service DG. Sometimes the type of engine construction requires the use of DM service oils. Consult the operator's manual.

HOW API SYSTEM IS USED

Oil manufacturers label containers as to viscosity and service classification. As there are multi-viscosity oils there are also multi-service oils. For example, an oil could be marked "For service MM, MS, and DG." In such a case the oil meets all requirements for each of the three classifications.

Sometimes, it might be desirable to change an engine to a more severe classification oil. This can be done; however, extreme caution is a must. For example, changing from an ML to an MS oil is not recommended in an old engine, because MS oil contains detergent and ML does not. The detergent, which is

added to the oil to keep carbon and other particles in suspension, will loosen and clean up carbon deposits in the old engine and cause high oil consumption problems. Also, the loosened deposits can clog oil passages and filters reducing lubrication of some parts of the engine. This danger can be eliminated or reduced by changing oil and filters frequently until the engine is "cleaned-up."

ADDITIVES

Additives are substances added to lubricants or fuels to improve certain physical or chemical properties or to reduce or eliminate some undesirable properties. When an additive functions by a physical means, it simply mixes physically with the lubricant or fuel. When the additive acts in a chemical way it reacts with the lubricant or fuel chemically and forms a new product.

Some widely used additives are:

- Detergent
- Rust and corrosion inhibitor
- Anti-oxidant
- Anti-foam agent
- Metal de-activators
- Film strength improvers
- Extreme pressure additives
- Viscosity index improver
- Pour-point depressant
- Octane improver in gasoline

Many additives are carefully blended into lubricating oils during the manufacturing process. Kinds and amounts added depend on severity of the service of an oil. For example, an oil for DS service has many more additives than an oil intended for MM service. A DS oil is intended for the most severe running conditions of an engine,

while MM oil is intended for comparatively light service. The extra additives in the DS oil are reflected in its higher cost.

Here's how additives function when added to lubricants or fuel:

Detergents. They form a coating around dirt and other particles non-soluble in oil and keep them in suspension in the oil. This is the reason why detergent oil discolors much quicker than non-detergent oil. This discoloring also is a reason why it is impossible to determine condition of an oil by color. As long as particles stay in suspension they do not deposit on bearings and other surfaces. This results in a cleaner running engine.

Rust and Corrosion Inhibitors. Main reason for adding these compounds is to prevent corrosion of metal surfaces in contact with the fuel or lubricant. This could be the pipe line transporting oil, storage tanks, fuel pumps, bearings, and other places.

Anti-oxidants. These prevent or at least slow down oxidation of oil. Oxidation rate of oil depends mostly on temperature, oxygen, and anti-oxidant present.

Anti-foam Agent. Oil tends to foam when pumped around a closed system. If excessive foaming occurs the oil pump may lose suction. Anti-foam agents, which are mostly silicone compounds, tend to break up foaming of an oil. This is extremely important for oil in the hydraulic system of a tractor because of high pressures and heavy churning.

Metal De-activators. When oil oxidizes, certain products of oxidation react with the metal in the engine. This reaction may form soluble products which can act as catalysts and speed up the oxidation process. Copper and bronze, used in bearings, are especially susceptible to oxidation. Metal de-activators usually act as a de-oxidizer. They prevent oxidation of the oil in the first place and also combine with oxidation products to make them inactive.

Film Strength Improvers and Extreme Pressure Additives. In general, these additives prevent metal to metal contact between moving parts subjected to extreme loads which might force the lubricant out from between the surfaces. They are used mostly in gear lubricants but may be in engine lubricants.

Viscosity Index Improver. Viscosity index improvers reduce the amount of viscosity change for a 210°F. temperature change. For example, a 5W20 oil is a very light oil with a V.I. improver added. At low temperatures it will act like a SAE 5 oil and at high temperature like a SAE 20.

COMMERCIAL ADDITIVES

Marketing crankcase oil and fuel additives that are used directly by the farmer or motorist has become a multimillion dollar business. These are generally available where other oil and fuel products

are sold. Some advertised claims about these products, such as reduced engine wear and friction, increased power and performance, increased gas mileage, and freeing sticky valves, are appealing.

Most "treatments" include a petroleum base with chemicals added. Some have a thinning effect on the oil which also makes the engine start easier in cold weather. Similar effects can be obtained by using an oil of a lower SAE number. Other additives have a thickening effect which usually tends to reduce oil consumption. If a thicker oil is desirable it can simply be replaced by an oil of higher SAE number using SAE 30 in place of SAE 20 for example. Many commercial treatments contain detergents, rust inhibitors and other useful additives. Generally these useful additives are mixed in quality motor oil during the manufacturing process.

Oil manufacturers must improve their lubricants to meet engine requirements, competition, and the API classification standards. This is why many additives are put into lubricants during the manufacturing process. Extra additives added later may actually be harmful by upsetting the chemical balance of the oil. It is therefore also unwise to mix different types and brands of oil. Engine manufacturers usually void the warranty on engines if damage occurs due to improper use of lubricants.

OPTIMUM ENGINE PERFORMANCE

To help assure best continuous engine performance follow these suggestions:

1. Consult the operator's manual when selecting API Classification and SAE number of a motor oil for a particular engine.
2. Purchase oil that meets API standards. Labels on containers indicate API classifications.
3. Service the engine as recommended in the operator's manual. Follow instructions on adjustments, air and oil filter cleaning and replacement, crankcase draining.
4. Run engine in the proper operating temperature range.
5. Use only high quality fuel.