



OEM Engine Oil Lubricant Specifications

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Original equipment manufacturer (OEM) lubricant specifications are intended to provide the end user with a degree of certainty that if a specified lubricant is utilized that the equipment will operate properly and reach its expected life.

These OEM specifications (contingent on the user adhering to proper operating and maintenance procedures) can often provide the basis for satisfying OEM warranties and ensure that both end

customers and lubricant manufacturers are aligned on the product performance targets for a class of equipment.

Almost all OEM lubricant specifications refer to a finished lubricant. It is an uncommon occurrence to see the individual constituents of a finished lubricant (i.e. additives or base stocks) specified by an OEM.

However there may be a hierarchy of lubricant specifications designated based on requirements for standard performance

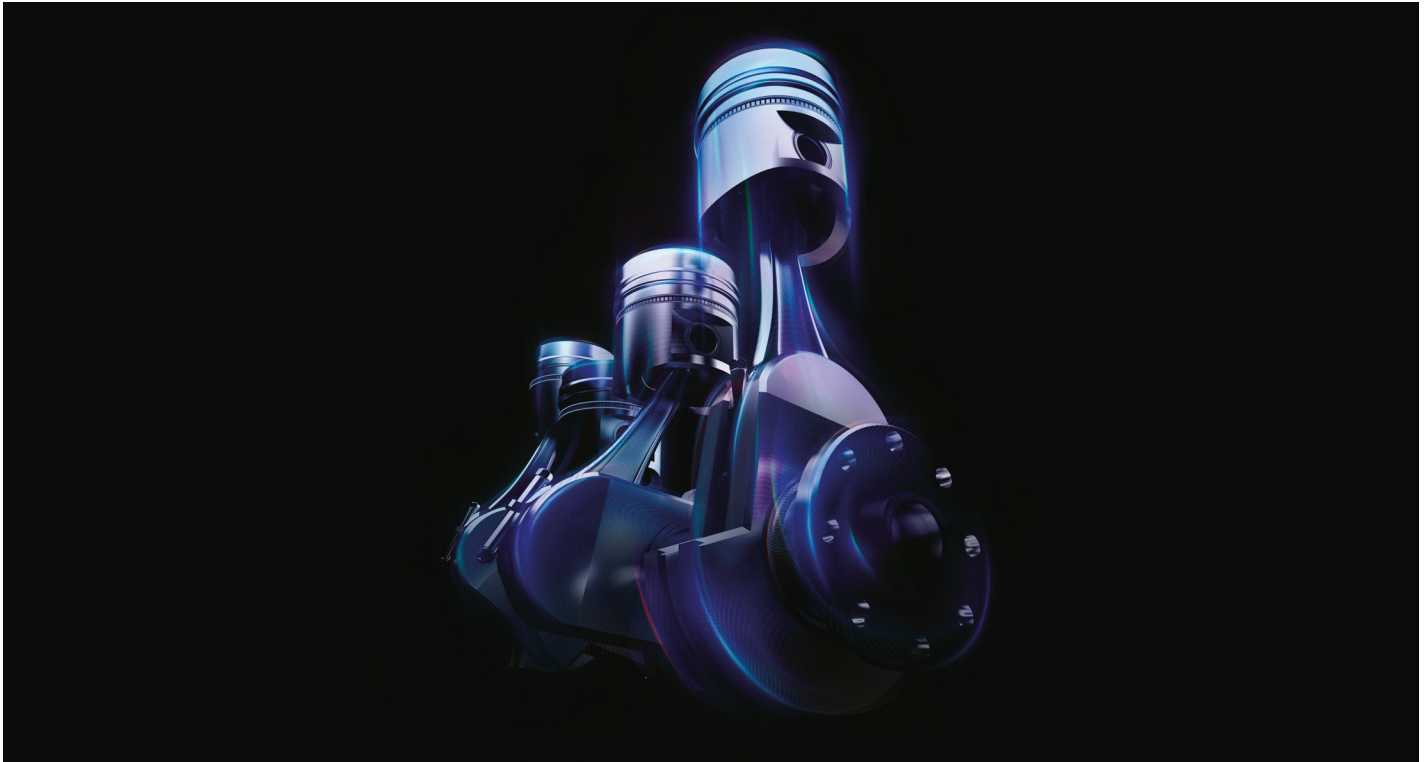
or for a higher level of performance.

In many cases the higher performance level lubricant specification will indicate or imply the use of API Group IV or V base stocks being required.

The following is a high level review of the various lubricant applications along with the types of OEM lubricant specifications commonly used in these applications and the role of API Group IV and V base stocks.

TABLE 1 Typical OEM lubricant specifications

Type of OEM Specification	Frequency of Occurrence	Definition
No Specification	Extremely Rare	Leaves it up to the end user to decide or suggest the end user consult with a lubricant supplier
Generic Specification	Very rare	Provides minimal detail leaving it open to a wide variety of choices (e.g. "use an SAE 30 engine oil")
Referral Specification	Common in automotive & aviation applications	A specification that refers to another specification such as an industry or trade association specification (e.g. API, ACEA, MIL spec, DIN, ISO, etc.)
Detailed Specification	Common	Can consist of (individually or in combination) physical or chemical properties, and performance requirements comprised of standardized or unique lab bench testing, equipment or rig testing, and/or field testing
Lubricant trade name listing	Common	A specification that lists the trade names of approved or suggested lubricants. Can be used alone or in combination with another type of OEM specification



OEM Lubricant Specifications for Engine Applications

To assist end use consumers, most engine OEM's reference the various industry classification systems to define the quality and performance specifications for engine oils in their operations manuals and published literature.

The American Petroleum Institute (API) service categories primarily apply to engine oils manufactured for vehicles designed in North America and Asia.

For example, for a new 2018 U.S. gasoline engine passenger car, the engine oil designated as being suitable for service under warranty might be referred to as for API Service SN and SN Plus. Diesel engines manufactured in these regions

follow the API engine oil classification system for commercial diesel engine service referred to as commercial oils "C" or fuel economy "F" (as an example API CK-4 and FA-4 are the latest diesel engine oil categories). In addition to API service categories, the International Lubricant Standardization and Approval Committee (ILSAC) have created the GF (gasoline fueled) service specification principally designed to measure fuel economy benefits of engine oils. A new GF-6 specification is currently expected to be licensable sometime in 2020.

Most European designed vehicles follow a different set of minimum standards for engine oils as designated in the European Automobile Manufacturers' Association ACEA European Oil Sequences.

The ACEA engine oil sequences cover three different applications for engines: A/B class for gasoline and light duty diesel, the C class for engines with after treatment devices, and the E class for heavy duty diesels. Additional fuel economy engine oil classes are being targeted for future ACEA updates.

All engine OEM's use the SAEJ300 viscosity classification for establishing the recommended viscosity grade for engine oil use in engines (e.g. SAE 15W-40). The engine oil viscosity recommendation can vary depending on the expected range of ambient temperatures that the vehicle will be operating in and specific design parameters of the engine.

While many OEM's refer to industry standards to define oil quality, many OEM's have internal engine oil specifications for both factory fill and service fill applications. These internal OEM engine oil specifications usually have slightly different performance requirements from the standard industry specification with more stringent limits in parameters of interest to the OEM.

Although it is rare to see the specific API Group base stock defined in an OEM engine oil specification, there are occasions where higher performance requirements may dictate the use of API Group IV/V base stocks. For their high performance engines, several OEM's will use synthetic engine oils for factory fill and specify this for aftermarket use and many are made with Group III/IV/V base stocks. This includes performance vehicles such as Porsche, Mercedes Benz AMG, Acura, Chevrolet Corvettes and Camaro SS, Ford Mustang Cobra R, and Dodge Challenger SRT-8 just to name a few. In addition many OEM's recognize the higher performance of synthetic and synthetic blend engine oils and will recommend their use for extended service intervals or to optimize fuel economy.

Engine OEM's are continuing to focus on improving fuel economy in their vehicles and the use of lower viscosity oils reduces hydrodynamic friction resulting in improved fuel economy. The need for high quality base stocks with lower volatility, better low temperature properties, and higher oxidative stability continues to increase with the use of lower viscosity oils. As the typical OEM recommended viscosity for gasoline engines is lowered from 0W-20 and 0W-16 to 0W-12 and 0W-8 to reach improved fuel economy targets, this is where the limitation of Group III base stocks are overcome by the use of higher performance Group III+/IV/V base stocks.

These same fuel economy drivers for lower viscosity are also impacting OEM specifications for automatic transmission fluids with the viscosity being lowered from 6.8cSt to 5.5cSt to 4.5cSt (at 100°C) and lower in the future creating more demand for the use of higher viscosity index Group IV base stocks.

Drive axle OEM's for commercial vehicles have their own lubricant specifications and often reference a specific API gear lubricant service designation or SAEJ2360 for multipurpose gear oils. It is common in these applications for synthetic oils, that use Group IV/V base stocks, to be recommended for extended oil drain capability, extended warranty, and other specialized applications. To highlight this, the following is an excerpt from the Dana Spicer Lubrication Manual LM072012 for Drive Axles: "Extended Drain synthetic lubricants offer superior thermal and oxidative stability for extended product performance and reliability. The superior performance characteristics of these lubricants enable Dana to offer extended drain and extended warranties. Added benefits include a more efficient drivetrain that translates into proven fuel economy savings over mineral based lubricants. Synthetic lubricants are recommended for severe duty applications and in cold climates."

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