WHAT IS IN A CAN OF OIL

Introduction

Despite the fact of modern day's information explosion and the relative ease of access to data on almost any topic, it is surprising the number of people who do not know or understand what is written on a can of oil and therefore has no idea of what they are buying/using. Even more surprising is the fact that automotive oils to a large extent, and engine oil in particular, has been "degraded to a commodity product, more often than not being purchased by the housewife as part of the monthly groceries list, where price is almost the only driver in product selection. The purpose of this article is to provide a guideline on the basic understanding of the jargon used on oil labels and the importance of such information in terms of what the oil is supposed to do and how it will perform in a given application.

The following minimum information should appear on an oil label:

1. The purpose for which it is intended (ie Motor oil, Gear oil, etc)
2. The viscosity grade (ie SAE 20W/50, SAE 80W/90, etc)
3. The specifications that it meets (ie API, ACEA, etc)
4. Manufacturer's approvals (ie MB 229.3, VW505.00, etc)

What this information means and why it is important

For the purpose of clarity, the above four points will be discussed in sequence.

1. **Application:** Although it may sound obvious, it cannot be over emphasized that all oils are intended for a specific application and in general are not interchangeable. Therefore, do not for example put an Automatic Transmission Oil or a Gear Oil in the engine or vice versa. It is important to know what the oils intended purpose is.

2. **Viscosity:** Most oils on the shelves today are "Multigrades", which simply means that the oil falls into 2 viscosity grades eg SAE 20w/50, etc). Multigrades were first developed some 60 years ago to avoid the old routine of using a thinner oil in winter and a thicker oil in summer. In a SAE 20W/50 for example the “20W” part (W = winter grade) simply means that the oil must have a certain maximum viscosity or flow at low temperature. The lower the "W" number, the better the oil’s low temperature/cold start performance. The “50” on the other hand, means that the oil must fall within certain viscosity limits at 100°C, the latter reflecting more or less the normal operating temperature of the engine. This is a fixed limit and all oils that end in “50” must achieve these limits. Once again the lower the number, the thinner the oil, ie a SAE 40 oil is thinner than a SAE 50 oil at 100°C etc. The vehicle’s user handbook will usually specify what viscosity grade is required. A rough guide, as far as operating temperature is concerned, is given in Fig. 1

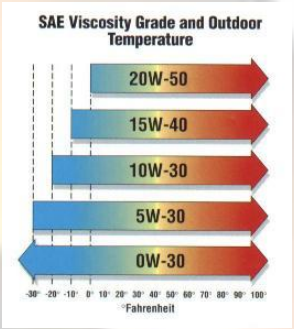

Fig. 1 Viscosity grade vs temperature selection chart

3. **Specifications:** Specifications are important as these indicate the performance level of the oil and whether it has met or passed the latest tests or whether the formulation is effectively obsolete or out of date. There are at least two specifications that one should look for on an engine oil label and these are the American Petroleum Institute (API) the Association des Constructeurs Europeen d'Automobiles (ACEA) specs. An understanding of what these mean is important and always ensure that the oil used is in compliance with the manufacturer’s recommendation. Cheap oils generally carry out-of-date specifications and additive technology.

(i) API – These specifications are split into two categories notably "S" for Spark Ignition Petrol Engines and "C" for Compression Ignition Diesel Engines. Most oils carry both petrol and diesel specifications. The following list reflects how up to date the specifications are:

Petrol Engine Sequences

SA to SE Introduced pre-1979 and are obsolete.

SF Introduced in 1988 and is obsolete. Only suitable for old engines or as a running-in oil.

SG Introduced in 1993 and is obsolete.

SH Introduced in 1996 and is obsolete. It has the same engine tests as SG, but includes control of foam, volatility and shear stability.

SJ Introduced in 2001. It has the same engine tests as SG/SH, but phosphorus content is controlled together with variation on volatility limits.

SL Introduced in 2004. New engine tests are reflective of moern engine designs meeting current emissions standards.

SM Introduced in 2004. It has improved oxidation resistance, deposit and wear protection, as well as better low temperature performance over the life of the oil, compared to previous categories.

Diesel Engine Sequences

CA to CB Introduced pre-1960 and are obsolete.

CC Introduced in 1961 and is obsolete.

CD Introduced 1975 and is obsolete. The spec is based using single cylinder test engine only. It is suitable for certain naturally aspirated and turbo-charged engines.

CDII Introduced in 1987 and is obsolete. Designed for 2-stroke engines.

CE Introduced in 1987 and is obsolete. It showed improved control of oil consumption, oil thickening, piston deposits and wear. The spec was designed using multi-cylinder test engines.

CF4 Introduced in 1990 for high-speed 4-stroke, naturally aspirated and turbo-charged engines. It showed improvements in control of oil consumption and piston deposits and uses low emission test engine

CF Introduced in 1994 for off-road, indirect injection and other diesel engines, including engines using high sulphur fuels.

CFII Introduced in 1994 for severe duty, 2-stroke engines. Controls cylinder deposits and ring-face scuffing.

CG4 Introduced in 1995. A development of CF4 giving improved control of piston deposits, wear, oxidation stability and soot entrainment. Uses low sulphur diesel fuel in engine tests and meeting 1994 emission standards.

CH4 Introduced in 1998, giving further improvements in control of soot related wear and piston deposits. Uses a more comprehensive engine test program to include low and high sulphur fuels

CI4 Introduced in 2002. It was developed to meet 2004 emission standards and may be used where EGR (exhaust gas recirculation) systems are fitted and with fuel containing up to 0.5 % sulphur.

CJ4 Introduced in 2006. Suitable for use in engines fitted with EGR and DPF (diesel particulate filter) systems. Improved valve train and bearing protection, reduced piston deposits and oil consumption and emissions friendly.

Automotive Gear Sequences:

GL1 to GL3 and GL6 are obsolete

GL4 For gears operating under severe conditions of sliding speed, particularly hypoid gears, in passenger cars and other automotive-type equipment operated under high speed/low torque and low speed/high torque conditions.

GL5 For gears, particularly hypoid gears, in passenger cars and other automotive equipment operated under high speed/shock load, high speed/low torque, and low speed/high torque conditions. Equivalent to MIL-L-2105D.

MT1 This specification addresses the performance needs of non-synchronized manual transmissions used in modern commercial vehicles. It resulted from North American OEMs to maintain oil drain intervals despite the fact that operating temperatures had increased significantly. It accesses oxidation and thermal stability of lubricants as well as viscosity increases and insolubles. It also includes ratings for sludge and varnish. Deposits in bearings, oil passage ways, synchronizer clutches or oil seal lips can lead to transmission failure; therefore, the cleanliness rating allows users to exclude lubricants which are not thermally and oxidatively stable.

(ii) ACEA – ACEA is the European equivalent of API.

ACEA replaced CCMC (Comite des Constructeurs d'Automobiles du Marche Commun) in 1996 primarily to allow for greater read-across in test programs (eg for viscosity, viscosity modifiers and base oil). The CCMC specifications were G (1 to 5) for gasoline, D (1 to 5) or heavy duty diesel and PD1 and PD2 for passenger car diesel. ACEA though, have a slightly different nomenclature and can be summarized as A for petrol, B for passenger car diesel,

C for catalyst compatible or low SAPS (sulphated ash, phosphorus and sulphur) passenger cars and E for heavy duty diesel. The ACEA grades also contain the year of issue as part of the nomenclature eg ACEA08 A3

Full ACEA specs are:

Petrol Engine Sequences

A1 Fuel economy grade.

A2 Standard performance level.

A3 High performance and/or extended oil drain.

A4 Reserved for future use in certain direct injection engines.

A5 Combines A1 fuel economy with A3 performance.

Passenger Car Diesel Sequences

B1 Fuel economy diesel.

B2 Standard performance level.

B3 High performance and/or extended drain.

B4 For direct injection passenger car diesel engines.

B5 Combines B1 fuel economy with B3/B4 performance.

Catalyst Compatibility and Low SAPS Sequences

C1 Petrol and light duty diesel engines, based on A5/B5 low SAPS, two way catalyst compatible.

C2 Petrol and light duty diesel engines, based on A5/B5 mid SAPS, two way catalyst compatible.

C3 Petrol and light duty diesel engines, based on A5/B5-04 mid SAPS, two way catalyst compatible, Higher performance levels due to higher HTHS (high temperature, high shear characteristics.

Heavy Duty Diesel Sequences

E1 Non-turbo charged light duty diesel.

E2 Standard performance level.

E3 High performance extended drain.

E4 Ultra high performance, providing control of piston cleanliness, wear, soot handling and lubricant stability. Recommended for highly rated diesel engines meeting Euro 1. Euro 2, Euro 3 and Euro 4 emission requirements and running under severe conditions. Suitable for EGR engines.

E5 (1999) High performance/long drain intervals plus API performances. - This was ACEA's first attempt at a global spec.

E7 A stable, stay-in-grade oil, providing effective control with respect to piston cleanliness and bore polishing. It also provides excellent wear- and turbocharger deposit control, soot handling and lubricant stability. It is recommended for highly rated diesel engines meeting Euro 1, Euro 2, Euro 3 and Euro 4 emission requirements and running under severe conditions. Oil drain intervals can be extended according to manufacturer's recommendations. It is suitable for engines without particulate filters and for most EGR engines. Also suitable for most engines fitted with NOx (nitrous-oxide) reduction systems.

(iii) Other Specifications - There is a host of other specifications which may appear on the label but they are less prominent that the above. These may include the following:

DIN Deutsches Institut for Normung

ILSAC International Lubricant Standardisation Advisory Committee

JAMA Japanese Automotive Manufacturers Association

JASO Japanese Automobile Standards Association

MIL–L Prefix designation for US Military specifications

4, Approvals: Many oils mention various OEM's (Original Equipment Manufacturers) on the label. This list can be extensive, depending on the performance quality of the oil. In addition to the specifications discussed above, some of the major OEMs design and incorporate their own engine and/or filed testing specifications and if an oil passes these requirements, it carries an approval from that particular manufacturer. The following are the more prominent OEM approvals:

VW - 500.00, 501.00 and 505.00, 503, 504, 506 or 507
MB - 229.1, 229.3 and 229.5 for petrol engines and 228.3, 228.5 and 228.51 for diesel engines
BMW - LL98, LL01 and LL04.
Volvo - VDS 2, VDS 3 and VDS 4
Caterpillar - CAT- ECF-1a, ECF-2 and ECF-3
MAN - M270/271, M3275, M3277
Mack - EO-L, EO-M, EO-O
Cummins - MTU Category 1, 2 and 3

Recommendation

The question of which oil is best is not, and probably never will be settled. Most people's requirement of an oil is; "The oil must be inexpensive, lasts a long time, and makes the engine never break". Well, the engine might not explode if it is run on "Mousemilk No2" but it certainly won't last very long either… but neither will it last forever, even if it runs on "Super Magic Racing Formula Full Synthetic 0W/30". Like everything in life, you get what you pay for and the cheaper the oil, the cheaper the ingredients usually the lower the performance levels. When selecting an oil for any application, make sure its specifications and approvals commensurate with the design requirements and performance level of the equipment and that it is in accordance with the OEMs recommendation.