

## **LUBRICANT SERVICE CLASSIFICATIONS AND SPECIFICATIONS**

### **API SERVICE CLASSIFICATIONS (ENGINE CRANKCASE OILS)**

The American Petroleum Institute (API) Engine Service Classification was developed as a result of a co-operative effort in the USA between the API, the American Society for Testing and Materials (ASTM) and the Society of Automotive Engineers (SAE). The tripartite was developed to form a means of communication between the engine manufacturers and lubricants suppliers.

The system defines classes of service for both petrol and diesel engine applications as well as stipulating the accepted engine laboratory tests.

The letter 'S' (Service Station Classification) is designated for spark ignition engines (petrol engines) in passenger cars and light commercial vehicles. For compression ignition engines (diesel engines), the letter 'C' (Commercial Classifications) has been designated. The following is a brief summary of the API classifications.

#### **API Base Oil Definitions**

Group I base stocks contain less than 90% saturates and/or greater than 0.03% sulphur and have viscosity index greater than or equal to 80 and less than 120.

Group II base stocks contain greater than or equal to 90% saturates and less than or equal to 0.03% sulphur and have viscosity index greater than or equal to 80 and less than 120.

Group III base stocks contain greater than or equal to 90% saturates and less than or equal to 0.03% sulphur and have viscosity index greater than or equal to 120.

Group IV base stocks are polyalphaolefins (PAO).

Group V base stocks include all other base stocks not included in Group I, II, III or IV.

#### **API Automotive Gear Lubricant Specifications**

### **API SERVICE CLASSIFICATIONS**

The most important internationally accepted system defining automotive gear oil performance characteristics is laid down by the American petroleum institute (API).

#### **API GL-1**

Designates the type of service characteristics of automotive spiral-bevel and worm gear axles and some manually operated transmissions operating under such mild conditions of low unit pressures and sliding velocities that a non-additive mineral oil can be used satisfactorily. Oxidation and rust inhibitors, anti-foam additives and pour point depressants may be utilized to improve the characteristics of lubricant for this service. Does not contain friction modifiers and extreme-pressure agents.

#### **API GL-2**

Designates the type of service characteristics of automotive-type worm gear axles operating under such conditions of load, temperature and sliding velocities that lubricants satisfying API GL-1 service will not suffice. Products suited for this type of service contain anti-wear or very mild extreme-pressure agents that provide protection for worm gears.

#### **API GL-3**

Designates the type of service characteristics of manual transmissions and spiral-bevel axles operating under moderately severe conditions of speed and load. These service conditions require a lubricant having load carrying capacity greater than that which will satisfy API GL-1 service, but below the requirements of lubricants satisfying API GL-4 service. Lubricants designated for this service typically contain additives that are active at the tooth surface at the temperatures resulting from high-speed or load.

#### **API GL-4**

Designates the type of service characteristics of gears in manual transmissions operating under severe conditions of sliding speed, particularly spiral bevel and hypoid gears in moderate service, in passenger cars and other automotive-type equipment operated under high speed/low torque and low speed/high torque conditions.

#### **API GL-5**

Designates the type of service characteristics of gears particularly hypoid, 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, this category is mainly applicable to axles but may also be used for certain manual transmissions.

#### **API GL-6 (Obsolete)**

The type of service designated by API GL-6 is characteristic of gears, specifically high offset hypoid gears in passenger cars and other automotive equipment operated under high-speed high-performance conditions. This classification is obsolete. The equipment required for the test procedure to verify lubricant performance is no longer available.

#### **API MT-1**

This category defines a gear lubricant for heavy-duty manual transmissions that has thermal stability, high temperature cyclic durability and copper compatibility level exceeding API GL-1 through GL-5. Gear lubricants in this category typically meet the service requirements of non-synchronized manual transmissions in heavy-duty trucks and in buses.

### API Engine Service Categories (Gasoline/Petrol Engines)

Category	Status	Service
SM	Current	For all automotive engines currently in use. Introduced November 30, 2004, SM oils are designed to provide improved oxidation resistance, improved deposit protection, better wear protection, and better low-temperature performance over the life of the oil. Some SM oils may also meet the latest ILSAC specification and/or qualify as Energy Conserving.
SL	Current	For all automotive engines presently in use. Introduced July 1, 2001. SL oils are designed to provide better high-temperature deposit control and lower oil consumption. Some of these oils may also meet the latest ILSAC specification and/or qualify as Energy Conserving.
SJ	Current	For 2001 and older automotive engines.
SH	Obsolete	For 1996 and older engines. Valid when preceded by current C categories.
SG	Obsolete	For 1993 and older engines.
SF	Obsolete	For 1998 and older engines.
SE	Obsolete	CAUTION – Not suitable for use in gasoline-powered automotive engines built after 1979.
SD	Obsolete	CAUTION – Not suitable for use in gasoline-powered automotive engines built after 1971. Use in more modern engines may cause unsatisfactory performance or equipment harm.
SC	Obsolete	CAUTION – Not suitable for use in gasoline-powered automotive engines built after 1967. Use in more modern engines may cause unsatisfactory performance or equipment harm.
SB	Obsolete	CAUTION – Not suitable for use in gasoline-powered automotive engines built after 1963. Use in more modern engines may cause unsatisfactory performance or equipment harm. Use only when specifically recommended by the manufacturer.
SA	Obsolete	CAUTION – Contains no additives. Not suitable for use in gasoline-powered automotive engines built after 1930. Use in modern engines may cause unsatisfactory engine performance or equipment harm. Use only when specifically recommended by the manufacturer.

Note: API intentionally omitted "SI" and "SK" from the sequence of categories.

For more information about API's Engine Oil Program, visit their website at [www.api.org/eolcs](http://www.api.org/eolcs).

### API Engine Service Categories (Diesel Engines)

Category	Status	Service
CI-4	Current	Introduced in 2002. For high-speed, four-stroke engines designed to meet 2004 exhaust emission standards implemented in 2002. CI-4 oils are formulated to sustain engine durability oils where exhaust gas recirculation (EGR) is used and are intended for use with diesel fuels ranging in sulphur content up to 0.5% weight. Can be used in place of CD, CE, CF-4, CG-4 and CH-4 oils. Some CI-4 oils may also qualify for the CI-4 PLUS designation.
CH-4	Current	Introduced in 1998. For high-speed, four stroke engines designed to meet 1998 exhaust emission standards. CH-4 oils are specifically compounded for use with diesel fuels ranging in sulphur content up to 0.5% weight. Can be used in place of CD, CE, CF-4 and CG-4 oils.
CG-4	Current	Introduced in 1995. For severe duty, high speed, four stroke engines using fuel with less than 0.5% weight sulphur. CG-4 oils are required for engines meeting 1994 emission standards. Can be used in place of CD, CE and CF-4 oils.
CF-4	Current	Introduced in 1990. For high-speed, four stroke, naturally aspirated and turbocharged engines. Can be used in place of CD and CE oils.
CF-2	Current	Introduced in 1994. For severe duty, two stroke-cycle engines. Can be used in place of CD-II oils.
CF	Current	Introduced in 1994. For off-road, indirect-injected and other diesel engines including those using fuel with over 0.5% weight sulphur. Can be used in place of CD oils.
CE	Obsolete	Introduced in 1985. For high-speed, four stroke, naturally aspirated and turbocharged engines. Can be used in place of CC and CD oils.
CD-II	Obsolete	Introduced in 1985. For two-stroke cycle engines.
CD	Obsolete	Introduced in 1955. For certain naturally aspirated and turbocharged engines.
CC	Obsolete	CAUTION – Not suitable for use in diesel-powered engines built after 1990.
CB	Obsolete	CAUTION – Not suitable for use in diesel-powered engines built after 1961.
CA	Obsolete	CAUTION – Not suitable for use in diesel-powered engines built after 1959.

### API Gravities and Densities

Note: All conversions are at 15.6°C

API Gravity°	Density kg/l	API Gravity°	Density kg/l
0	1.074	21	0.926
1	1.066	22	0.920
2	1.058	23	0.914
3	1.050	24	0.908
4	1.042	25	0.902
5	1.034	26	0.896
6	1.027	27	0.891
7	1.020	28	0.885
8	1.012	29	0.880
9	1.005	30	0.874
10	0.998	31	0.869
11	0.991	32	0.864

12	0.984	33	0.858
13	0.977	34	0.853
14	0.970	35	0.848
15	0.964	36	0.843
16	0.957	37	0.838
17	0.951	38	0.833
18	0.944	39	0.828
19	0.938	40	0.823
20	0.932	41	0.818

### ACEA European Sequences

The ACEA European Oil Sequences were first promulgated in 1996 to replace the CCMC Classifications and comprise 3 sets of sequences: one for gasoline engines; one for light duty diesel engines; and one for heavy duty diesel engines. The new ACEA European oil sequences for automotive lubricants were issued in March 1998. Within each of the 3 sets there are categories that reflect different performance requirements – three (A1, A2 & A3) for gasoline engines; four for diesel engines. By 1 March 1999 all new claims must be to the 1998 issue and by 1 March 2000 the 1996 issue will be withdrawn and no claims to meet them shall be made. Typical applications from each of the sequences are described below for guidance only. Specific applications are the responsibility of individual motor manufacturers.

#### Gasoline sequences

Category	Service
A1	Oil intended for use gasoline engines specifically designed to be capable of using low friction, low viscosity oils with a high temperature/high shear rate viscosity of 2.9 mPa.s to 3.5mPa.s. These oils may be unsuitable for use in some engines. Consult owner manual or handbook if in doubt
A2	General purpose oil intended for use in most gasoline engines with normal drain intervals, although it may not be suitable for some high performance engines.
A3	Stable, stay-in-grade oil intended for use in high performance gasoline engines and/or for year-round use of low viscosity oils, and/or for year-round use of low viscosity oils, and/or for severe operating conditions as defined by the engine manufacturer.

#### Light duty diesel sequences

Category	Service
B1	Oil intended for use in car and light van diesel engines specifically designed to be capable of using low friction, low viscosity oils with a high temperature/high shear rate viscosity of 2.9mPa.s. These oils may be unsuitable for use in some engines. Consult owner manual or handbook if in doubt.
B2	General purpose oil intended for use in most car and light van diesel engines (primarily indirect injection) with normal drain intervals, although it may not be suitable for some high performance engines.
B3	Stable, stay-in-grade oil intended for use in high performance car and light van diesel engines (primarily indirect injection) and/or year round use of low viscosity oils, and/or for severe operating conditions as defined by the engine manufacturer.
B4	Oil intended primarily intended for use in car and light van direct injection diesel engines where special quality oils are required.

#### Heavy duty diesel sequences

Category	Service
E1	Oil intended for use in naturally aspirated and lightly turbo-charged heavy duty diesel engines, light to medium duty cycle, and normal oil drain intervals.
E2	General purpose oil for naturally aspirated and turbo-charged heavy duty diesel engines, medium to heavy duty cycles and mostly normal oil drain intervals.
E3	This lubricant category provides effective control with respect to piston cleanliness, bore polishing, wear, soot handling and lubricant stability. It is therefore recommended for diesel engines meeting Euro 1 and Euro 2 emission requirements running under severe conditions. It is also suitable for extended oil drain intervals according to the manufacturers' recommendations.
E4	Stable, stay-in-grade oil providing further control of piston cleanliness, wear, soot handling and lubricant stability compared to E3. It is recommended for highly rated diesel engines meeting Euro 1 and Euro 2 emission requirements and running under very severe conditions, e.g. significantly extended drain intervals according to the manufacturers' recommendations.