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COLORADO STATE UNIVERSITY EXTENSION SERVICE

Motor oils—classifications and service

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Quick Facts

- In selecting a proper motor oil, both the oil viscosity and the lubricant service requirement must be considered.
- The Society of Automotive Engineers developed an oil classification system based on viscosity measurements.
- The American Petroleum Institute Engine Service Classification System enables oils to be defined and selected on the basis of their performance characteristics and the type of service for which they are intended.
- The S (Service) Classification is used by garages, filling stations, car dealers, etc.
- The C (Commercial) Classification is used by fleets, contractors, farmers, etc.

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SAE Oil Viscosity Classification System

The Society of Automotive Engineers (SAE) developed an oil classification system based on viscosity measurements. This system, which has been modified over the years, establishes distinct oil viscosity classifications or grades: SAE 5W, SAE 10W, SAE 20W, SAE 20, SAE 30, SAE 40 and SAE 50.

The "W" following the SAE viscosity grade stands for "winter" and indicates that an oil is suitable for use in colder temperatures. Oils carrying the "W" designation must have the proper viscosity value when measured at appropriate low temperatures (-18°C or 0°F). Those SAE classifications that do not include the "W" define oil grades for use at higher temperatures. The viscosity of these oils (SAE 20, 30, 40 and 50) must have the proper viscosity value when measured at 100°C (210°F).

SAE 20 and SAE 20W, for example, are two separate classifications. With today's well refined, high viscosity index oils, however, an SAE 20 will usually meet the viscosity requirements of SAE 20W and vice versa. Those that do are classified SAE 20W-20.

The development of viscosity index improvers extended the operating temperature range of oils and made possible the manufacture of multi-graded oils. These oils, such as SAE 10W-30 and SAE 10W-40 are widely used because, under all but extremely hot or cold conditions, they are light enough for easy cranking at low temperatures and heavy enough to perform satisfactorily at high temperatures. The engine manufacturers' recommendations for crankcase oil viscosities always should be followed, however, a basic guide prepared from car owners' manuals is shown in the following table:

Table 1: Guide to SAE grades of motor oil.

Lowest atmospheric temperature expected	Single-grade oils	Multi-grade oils
32°F (0°C)	20, 20W, 30	10W-30, 10W-40, 10W-50, 15W-40, 20W-40, 30W-50
0°F (-18°C)	10W	10W-30, 10W-40
Below 0°F (-18°C)	5W*	5W-20,* 5W-30, 5W-40

**SAE 5W and 5W-20 grade oils are not recommended for sustained high-speed driving.*

It is important to understand that the SAE viscosity grade classification system identifies only viscosity and indicates nothing about the type or quality of an oil or the service for which it is intended.

API Engine Service Classification System

In 1970, the American Petroleum Institute (API), the American Society for Testing and Materials and the American Society of Automotive Engineers cooperated in establishing a new API Engine Service Classification System to enable oils to be defined and selected on the basis of their performance characteristics and the type of service for which they are intended.

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It should be emphasized that the API Engine Service Classification System has absolutely no effect on, or connection with, the SAE Crankcase Oil Viscosity Classification System which gives SAE viscosities of oils. Both are necessary to adequately define a motor oil's characteristics to select the proper product to meet an engine's needs.

Ten classifications for motor oils have been made by the American Petroleum Institute.

The oil designations make it easier for consumers, oil suppliers and dealers to understand the various oil classifications and to use them properly. The revised system describes operating conditions for which the different types of lubricating oils are suited.

The ten types of oils are separated into two groups, S and C. The S designation is for passenger cars and light trucks. The C designation is for heavier vehicles operated by fleet owners, contractors, farmers, and for stationary power plants and similar applications.

The API engine service classification system is open-ended. New categories can be added as required without changing or deleting existing categories.

S Classification—Service

SA oils are a non-additive type for utility gasoline and diesel engine service. This type of service is typical for engines operated under such mild conditions that the protection afforded by compounded oil is not required. The SA classification has no performance requirements.

SB oils are for minimum duty gasoline engine service, typical for engines operated under such mild conditions that only minimum protection afforded by compounding is desired. Oils designed for this service provide only antiscuff capability and resistance to oil oxidation and bearing corrosion.

SC oils are for 1964 gasoline engine warranty service, typical for gasoline engines in 1964-67 car and truck models operating under engine manufacturers' warranties. Oils designed for this service provide control of high and low temperature deposits, wear, rust and corrosion in gasoline engines.

SD oils are for 1968 gasoline engine warranty service, typical of gasoline engines in cars and trucks beginning with 1968 through 1970 models and operating under engine manufacturers' warranties. Oils designed for this service provide more protection from high and low temperature engine deposits, wear, rust and corrosion in gasoline engines than SC oils.

SE oils are for 1972 automobile warranty maintenance requirements. They also can be used in place of lower grades in older model engines. This oil provides additional protection over SD oils against oil oxidation, high temperature engine deposits, rust and corrosion and problems associated with the change in engine operating characteristics due to the use of air pollution control devices and other accessories. SE oils have significant improvement in resistance to oil thickening from high temperature oxidation.

SF oils are for 1980 and later gasoline engine warranty maintenance service. Oils developed for this service provide increased oxidation stability and improved anti-wear performance relative to oils which meet the minimum requirements for API Service Category SE. These oils also provide protections against engine deposits, rust and corrosion. Oils meeting API Service Classification SF may be used when API Service Categories SE, SD or SC are recommended.

C Classification—Commercial

CA oils are for light duty diesel engine service, typical for diesel engines in mild to moderate duty and operated on high quality fuels, or occasionally for gasoline engines in mild service. These oils provide protection from bearing corrosion and from high temperature deposits in normally aspirated diesel engines when using fuels of such quality that they impose no unusual requirements for wear and deposit protection.

CB oils are for moderate diesel engine service, typical for diesel engines operated in mild to moderate duty, but on lower quality fuels that necessitate more protection from wear and deposits. Occasionally, this service has included gasoline engines in mild service. Oils designed for this service were introduced in 1949. Such oils provide necessary protection from bearing corrosion and from high temperature deposits in normally aspirated diesel engines with higher sulfur fuels.

CC oils are for moderate duty diesel and gasoline engine service, typical for lightly supercharged, diesel and certain heavy duty gasoline engines operated in moderate to severe duty. Oils designed for this service were introduced in 1961 and used in many trucks, industrial and construction equipment and farm tractors. These oils provide protection from high temperature deposits in lightly supercharged diesels and from rust, corrosion and low temperature deposits in gasoline engines.

CD oils are for severe duty diesel engine service, typical for supercharged diesel engines in high-speed, high-output duty requiring highly effective control of wear and deposits. Oils designed for this service were introduced in 1955 and provide protection from bearing corrosion and from high temperature deposits in supercharged diesel engines using fuels of a wide quality range.

Use of API Letter Designations

The representation of an oil as meeting the requirements of a particular API service such as "API Service SF" is the responsibility of the marketer of that particular brand of oil. If, for example, an oil is suitable for both API Service SF and API Service CC, it is appropriate that the oil be designated "API Service SF-CC."

It is the responsibility of the engine manufacturer to evaluate the class of service applicable to the design and intended use of a particular engine and to recommend the appropriate API Service Classification.