


Automotive Engines Theory and Servicing
Ninth Edition

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Chapter 15
Engine Oil



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OBJECTIVES (1 OF 2)

15.1 Explain the purpose of engine oil and engine oil additives.

15.2 Discuss the properties of engine oil.

15.3 Discuss SAE rating, API rating, ILSAC oil rating, European oil rating system, and Japanese oil rating.

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OBJECTIVES (2 OF 2)

15.4 Discuss synthetic oil and high mileage oils.

15.5 Discuss vehicle-specific specifications of oil.

15.6 Discuss the purpose and function of oil filters.

15.7 Describe the oil change procedure.

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PROPERTIES OF ENGINE OIL (1 OF 2)

- Engine oil provides the following functions in every engine.
 - Lubricates moving parts; helps cool engine parts; helps seal piston rings; helps to neutralize acids created by the by-products of combustion; reduces friction in the engine; helps to prevent rust and corrosion

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PROPERTIES OF ENGINE OIL (2 OF 2)

- The most important engine oil property is its thickness or viscosity.
 - As oil is cooled, it gets thicker.
 - As oil is heated, it gets thinner.

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SAE RATING (1 OF 2)

- Engine oils are sold with a Society of Automotive Engineers (SAE) grade number, which indicates the viscosity range into which the oil fits.
- Oils tested at 212°F (100°C) have a number with no letter following.

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SAE RATING (2 OF 2)

- An SAE 5W-30 multigrade oil meets the SAE 5W viscosity specification when cooled to 0°F (-18°C),
 - And meets the SAE 30 viscosity specification when tested at 212°F (100°C).
- Most vehicle manufacturers recommend the following multiviscosity engine oils.
 - SAE 5W-30
 - SAE 10W-30

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FIGURE 15-1 The SAE viscosity rating required is often printed on the engine oil filler cap. Most hybrid electric vehicles specify either SAE 0W-20 or SAE 5W-20 engine oil.



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API RATING (1 OF 4)

- The American Petroleum Institute (API) has established an engine oil performance classification.
 - The only information available to help determine which oil is satisfactory for use in an engine.
- Gasoline Engine Ratings
 - SA - Straight mineral oil (no additives), not suitable for use in any engine

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FIGURE 15–2 API doughnut for a SAE 5W-30, SM engine oil. When compared to a reference oil, the “energy conserving” designation indicates a 1.1% better fuel economy for SAE 10W-30 oils and 0.5% better fuel economy for SAE 5W-30 oils.



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API RATING (2 OF 4)

- Diesel Engine Ratings
 - CA Obsolete
 - CB Obsolete
 - CC Obsolete
 - CD Minimum rating for use in a diesel engine service
 - CE Designed for certain turbocharged or supercharged heavy-duty diesel engine service

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API RATING (3 OF 4)

- Diesel Engine Ratings
 - CF For off-road indirect injected diesel engine service
 - CF-2 Two-stroke diesel engine service
 - CF-4 High-speed four-stroke cycle diesel engine service
 - CG-4 Severe-duty high-speed four-stroke diesel engine service

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API RATING (4 OF 4)

- CI-4 Severe-duty high-speed four-stroke diesel engine service
- CJ-4 Required for use in all 2007 and newer diesels using ultra-low-sulfur diesel (ULSD) fuel

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ILSAC OIL RATING (1 OF 2)

- The International Lubricant Standardization and Approval Committee (ILSAC) developed an oil rating that consolidates the SAE viscosity rating and the API quality rating.
- If an engine oil meets the standards, a "starburst" symbol is displayed on the front of the oil container.

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ILSAC OIL RATING (2 OF 2)

- The original GF-1 (gasoline fueled) rating in 1993
- Updated to GF-2 in 1997
- Updated to GF-3 in 2000
- Updated to GF-4 in 2004
- Updated to GF-5 in 2010

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FIGURE 15-3 The International Lubricant Standardization and Approval Committee (ILSAC) starburst symbol. If this symbol is on the front of the container of oil, then it is acceptable for use in almost any gasoline engine.



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EUROPEAN OIL RATING SYSTEM

- How are gasoline engine oils and diesel engine oils rated?
- Starting in 2004, the ACEA began using combined ratings such as A1/B1, A3/B3, A3/B4, and A5/B5.

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FIGURE 15-4 ACEA ratings are included on the back of the oil container if it meets any of the standards. ACEA ratings apply to European vehicles only such as BMW, Mercedes, Audi, and VW.



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ENGINE OIL ADDITIVES (1 OF 2)

- Oil producers are careful to check the compatibility of the oil additives they use.
 - A number of chemicals that will help each other can be used for each of the additive requirements.

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ENGINE OIL ADDITIVES (2 OF 2)

- The balanced additives are called an additive package.
 - Additives to Improve the Base Oil
 - Additives to Protect the Base Oil
 - Additives to Protect the Engine

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FIGURE 15-5 Viscosity index (VI) improver is a polymer and feels like finely ground foam rubber. When dissolved in the oil, it expands when hot to keep the oil from thinning.



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OIL BRAND COMPATIBILITY

- Many technicians and vehicle owners have their favorite brand of engine oil.
- The choice is often made as a result of marketing and advertising, as well as comments from friends, relatives, and technicians.

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SYNTHETIC OIL (1 OF 3)

- Synthetic engine oils have been available for years for military, commercial, and general public use.
 - Synthetic means that it is a manufactured product and not refined from a naturally occurring substance, as engine oil (petroleum base) is refined from crude oil.
 - Synthetic oil is processed from several different base stocks using several different methods.

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SYNTHETIC OIL (2 OF 3)

- According to the American Petroleum Institute, engine oil is classified into the following groups.
 - Group I
 - Group II
 - Group III
 - Group IV
 - Group V

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SYNTHETIC OIL (3 OF 3)

- Advantages of Synthetics
- Disadvantages of Synthetics
- Synthetic Blends

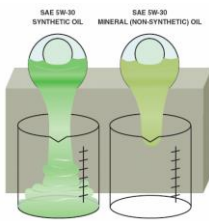


FIGURE 15-8 Both oils have been cooled to -20°F (-29°C). Notice that the synthetic oil on the left flows more freely than the mineral oil on the right even though both are SAE 5W-30.

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VEHICLE-SPECIFIC SPECIFICATIONS

- Some oils can meet industry specifications, such as SAE, API, and/or ILSAC ratings, but not pass the tests specified by the vehicle manufacturer.

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FIGURE 15-9 European vehicle manufacturers usually specify engine oil with a broad viscosity range, such as SAE 5W-40, and their own unique standards, such as the Mercedes specification 229.51. Always use the oil specified by the vehicle manufacturer.



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HIGH MILEAGE OILS

- What is high mileage oil?
- What makes it different?

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OIL FILTERS

- Construction
- Oil Filter Valves
- Oil Filter Disposal



FIGURE 15-10 A rubber diaphragm acts as an antidrainback valve to keep the oil in the filter when the engine is stopped and the oil pressure drops to

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OIL CHANGE

- Intervals
- Oil Life Monitors
- Oil Change Procedure



FIGURE 15-13 Many vehicle manufacturers can display the percentage of oil life remaining, whereas others simply turn on a warning lamp when it has been determined that an oil change is

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1 Before entering the customer's car for the first time, be sure to install a seat cover as well as a steering wheel cover to protect the vehicle's interior.



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2 Run the engine until it is close to operating temperature. This will help the used oil drain more quickly and thoroughly.



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3 Raise the vehicle on a hoist, and place the oil drain container in position under the oil drain plug. Be sure to wear protective gloves.



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4 Remove the plug and allow the hot oil to drain from the engine. Use caution during this step as hot oil can cause painful burns!



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5 While the engine oil continues to drain, remove the engine oil filter using a filter wrench. Some oil will drain from the filter, so be sure to have the oil drain container underneath when removing it.



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6 Compare the new oil filter with the old one to be sure that it is the correct replacement.



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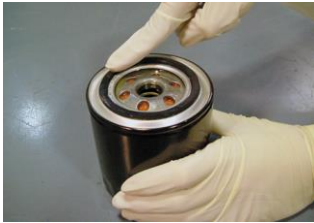
7 The wise service technician adds oil to the oil filter whenever possible. This provides faster filling of the filter during start-up and a reduced amount of time that the engine does not have oil pressure.



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8 Apply a thin layer of clean engine oil to the gasket of the new filter. This oil film will allow the rubber gasket to slide and compress as the oil filter is being tightened.



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9 Clean the area where the oil filter gasket seats to be sure that no part of the gasket remains that could cause an oil leak if not fully removed.



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10 Install the new oil filter and tighten it by hand. Do not use an oil filter wrench to tighten the filter! Most filters should be tightened 3/4 of a turn after the gasket contacts the engine.



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11 Carefully inspect the oil drain plug and gasket. Replace the gasket as needed. Install the drain plug and tighten firmly but do not overtighten!



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12 Use a funnel to add the specified amount of oil to the engine at the oil fill opening. When finished, replace the oil fill cap.



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13 Remove the oil-level dipstick and wipe it clean with a shop cloth. Reinstall the oil-level dipstick. Remove the dipstick a second time and read the oil level.



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14 The oil level should be between the MIN and the MAX lines. In this case, the oil level should be somewhere in the cross-hatched area of the dipstick.



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SUMMARY (1 OF 2)

- Viscosity is the oil's thickness or resistance to flow.
- SAE rating measures the viscosity of the oil.
- API ratings reflect the quality of the oil.
- The ILSAC rating symbol on the front of the container helps consumers find oil suitable for use in most gasoline engines.
- Most vehicle manufacturers recommend use of SAE 5W-30 or SAE 10W-30 engine oil.

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SUMMARY (2 OF 2)

- Many vehicle manufacturers provide specific oil standards for their vehicles.
- Most vehicle manufacturers recommend changing the engine oil every six months or every 7,500 miles (12,000 km), whichever comes first.
 - Most experts recommend changing the engine oil every 3,000 miles (5,000 km), or every three months, to help ensure long engine life.

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