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—Small Engines—

Oils for Two-Cycle Engines

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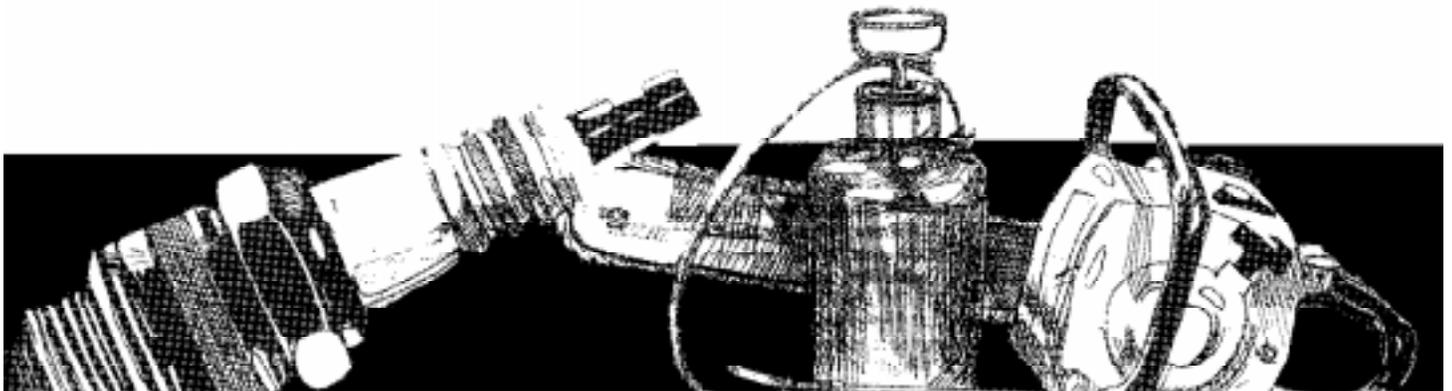
In 1947, the Society of Automotive Engineers established a standard for motor oils used in four-cycle engines. The standard was updated and changed in 1970 to reflect improvements in oil quality mandated by engine manufacturers. This current rating system for motor oils has assisted consumers in selecting the proper oil for use in their four-cycle engines.

Until recently, there had been no rating system for oils used in two-cycle, air-cooled engines. In fact, many owners of two-cycle engines were using motor oil designed for four-cycle engines. Motor oil will mix well with gasoline and appears to function as well as two-cycle oils. In this case, appearances are deceiving. Motor oil contains additives such as detergents, anti-foam agents, oxidation inhibitors and viscosity index improvers that prevent and interfere with proper lubrication of two-cycle engines. Ash deposits on spark plugs and residues in combustion chambers are two major disadvantages of using motor oil in two-cycle engines. Two-cycle oils are designed to minimize spark plug fouling and residue formation. They also reduce pre-ignition, ring sticking, scuffing, carbon formation and crankcase sludge. These are the major enemies of two-cycle engines that reduce engine life and performance. Two-cycle oils are typically

mixed with gasoline at recommended mix ratios as specified by the engine manufacturer. Common mix ratios are 12:1, 16:1, 24:1, 32:1, 50:1 and 100:1. For example, a mix ratio of 16:1 means that 16 parts of gasoline are mixed with one part of oil to achieve the proper lubrication for that specific engine. You may own several engines with different specified mix ratios. If so, you may be excited to learn about exact mix and one-mix oils described later in this factsheet.

In 1975, the Society of Automotive Engineers (SAE) formed a committee to address the problem of two-cycle oil classification. In 1976, the SAE effort was joined by the American Society for Testing and Materials (ASTM) and the American Petroleum Institute (API). These three organizations form a group responsible for most industry-accepted lubrication specifications in the U.S. In 1988, following 12 years of development, the classification system for air-cooled two-cycle engines was completed.

Part of the problem of establishing a standard is because the oil for two-cycle engines is usually mixed with the fuel for combustion. Problems were encountered determining miscibility (ability of the oil to mix with the gasoline) and fluidity (ability of the oil to flow in oil-injection systems). New testing procedures and equipment



currently available have eliminated these two testing problems. The new classification system has been initiated at the request of two-cycle engine manufacturers. The new system is based on a combination of engine performance attributes and the oil's physical properties. In the performance category, four designations are assigned to two-cycle oil.

Designations	Normal Service Application
TA	Mopeds and other extremely small engines (Typically less than 50cc).
TB	Motorscooters and other highly loaded small engines (Typically 50cc to 200cc)
TC	Various high performance engines (Not outboards) (Typically 50cc to 500cc)
TD	Outboard engines

An oil's performance rating is determined by a three-part engine test that evaluates (1) anti-scuff characteristics, (2) ring sticking and engine cleanliness and (3) pre-ignition.

Physical properties of two-cycle oils are evaluated in the second part of the classification system. Miscibility and fluidity are the two properties tested. In the evaluation process, candidate oils are compared to ASTM-reference oils at various temperatures. Four SAE miscibility/fluidity grades have been established. To achieve a particular SAE grade, a candidate oil must match the performance of the applicable reference oil. To determine miscibility, gasoline and the test oil are chilled to a target temperature. The gas is then poured on top of the oil and the mixture is turned over for a specific number of rotations. The number of rotations needed to obtain a homogeneous mixture of oil and gas is recorded. This number is compared to the number of rotations the reference oil required to form a homogeneous mixture. The candidate oil can then be placed in a grade based on performance when compared to a reference oil. To determine fluidity of a candidate oil, the oil is evaluated in a Brookfield viscometer. This instrument measures an oil's ability to

flow in cold temperatures. When the oil is labeled for the miscibility/fluidity category, only one grade will appear on the label. The following table indicates the four SAE miscibility/fluidity grades and the related test temperatures:

Grade	Test Temp, C	ASTM Reference Oil
1	0	VI-GG
2	-10	VI-FF
3	-25	VI-D
4	-40	VI-II

An oil certified under the new classification system would bear a label designation such as: API service TC, SAE Miscibility/Fluidity Grade 3. The new classification system will permit engine manufacturers to select a specific oil performance level for an engine and communicate these requirements to the consumer. The whole point of the system is to help consumers select the proper grade of oil for use with a particular engine. Most manufacturers will continue to recommend their own brand of oil for use in their engines. However, if that particular lubricant is not available, an alternate oil of the same grade may be substituted. This system should eliminate confusion by engine owners as to selection of an appropriate oil for specific engines.

Most lawn mower, weed trimmer, chainsaw, garden tiller and other lawn-associated engines will require the TC oil grade.

One-Mix and Exact-Mix Two-Cycle Oils

One way to eliminate several different containers with different oil mix ratios is to use an exact-mix or one-mix two-cycle oil. These oils can be used in engines requiring 1:1 to 50:1 mixes. A given amount of this oil (usually 2.6 oz) is mixed with one gallon of gasoline and can be used in any two-cycle engine which uses a mix ratio of 1:1 to 50:1.



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