

BACKGROUND

Introduction

Passenger Car Engine Oil specification development has changed focus in the last 10 years, shifting from the development of solutions to problems observed in the field toward continuous improvement of oil quality. This shift to continuous improvement has been accompanied by an increase in the number of tests and a reduction in specification life. The development of the GF-3 category will generally follow the trend toward continuous improvement while also addressing a perceived weakness in the area of high temperature deposits.

Primarily driven by problems observed in the field, specification changes in the 1970s and 1980s were long lived and typically included a new or modified test to address the field problems. The API SE/SF/SG categories fit this description.

Category Drivers during the 1970s/1980s

Category	Introduction Date	Reason for Change	New Tests Included
API SE	1972	<ul style="list-style-type: none">High temperature oil thickening	Sequence IIIC
API SF	1980	<ul style="list-style-type: none">Overhead valve train wear and fuel economy	Sequence IIID Sequence VD
API SG	1988	<ul style="list-style-type: none">Engine sludge	Sequence VE Sequence IIIE

More recently, category development has been driven by the desire for continuous improvement in oil quality in response to governmental and consumer pressures. These include Federal Corporate Average Fuel Economy (CAFE) requirements, the Federal Clean Air Act Amendments, consumer desires for reduced oil consumption and consumer preference for larger vehicles with more powerful engines.

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Although CAFE requirements have not changed in recent years, consumer demand for larger vehicles has put pressure on the passenger car manufacturers to improve fuel economy performance. The Federal Clean Air Act Amendments placed more stringent regulations on the performance of emission control systems for an extended period in service, pressuring the vehicle manufacturers to reduce potential sources of catalyst degradation. Additionally, consumers have expressed interest in reducing the oil consumption characteristics of their cars. Vehicle manufacturers have made significant improvements in reducing mechanical oil losses and are looking for further improvement by lowering the volatility of engine oils.

Recent Category Drivers

Category	Introduction Date	Reason for Change	New Tests Included
API SH/ ILSAC GF-1	1993	<ul style="list-style-type: none">• CMA Code of Practice• Emissions system protection• Improvement in fuel economy	None
API SJ/ ILSAC GF-2	1996	<ul style="list-style-type: none">• Improvement in fuel economy• Emissions system protection• Improved volatility	Sequence VIA

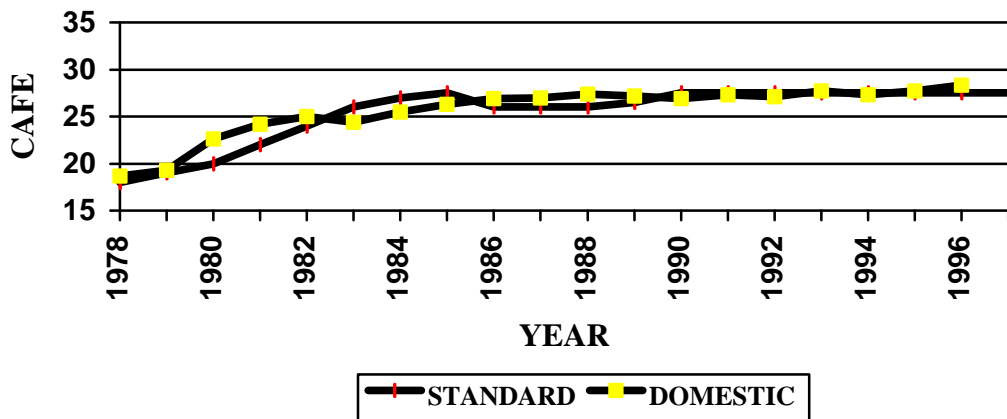
The development of the GF-3 category is expected to follow the recent trend of continuous improvement with further enhancement in the focus areas of GF-2. GF-3 will also look to improve the deposits performance of oils to maintain engines in “as new” condition, minimizing engine-out emissions. Engine designs are increasingly less tolerant of deposits, and improved deposit performance should aid in compliance with the Federal Clean Air Act Amendments.

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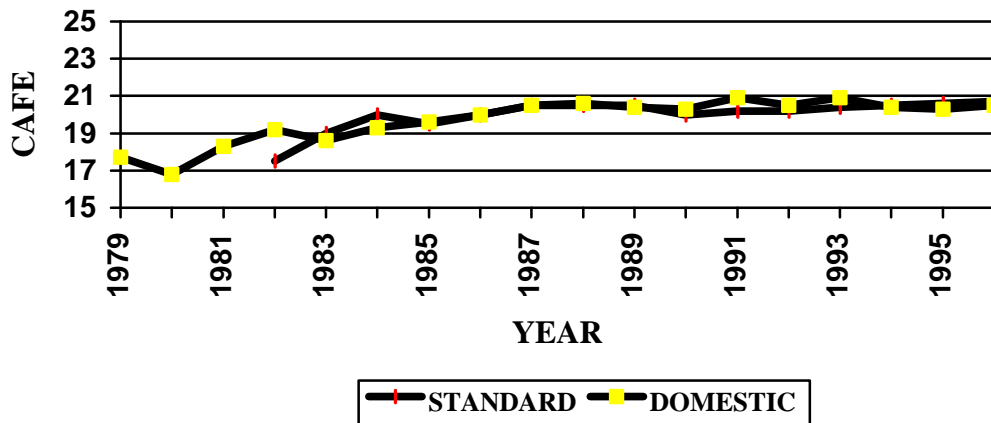
Recent Vehicle Trends

The 1997 model year is projected by the National Highway Traffic Safety Administration to show the lowest fleet average (passenger cars and light trucks market segments combined) fuel economy for domestic automobile manufacturers since 1980. Although fuel economy is improving within each market segment, the overall drop in fleet fuel economy is due to the preference shown by consumers for pickup trucks, vans, and sport utility vehicles over smaller, more fuel efficient passenger cars.

CAFE PERFORMANCE - PASSENGER CARS

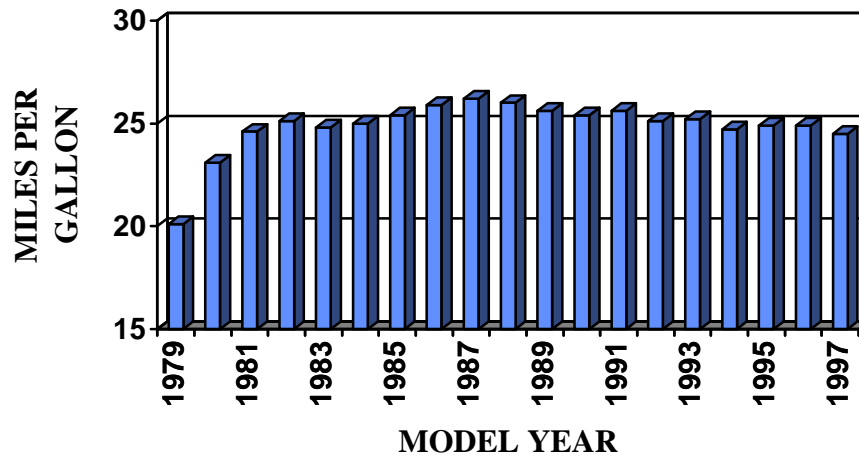


CAFE PERFORMANCE - LIGHT TRUCKS



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CAFE PERFORMANCE - FLEET AVERAGE



The fuel economy trends shown above have led to speculation that automobile manufacturers may be required to pay penalties for failing to meet CAFE standards.

The regulation imposes a civil penalty of \$5 for each tenth of a MPG by which a manufacturer's CAFE level falls below the standard, multiplied by the total number of passenger automobiles or light trucks produced by the manufacturer in that model year.

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Federal Regulation Details

The Clean Air Act of 1970 gave the Federal Environmental Protection Agency (EPA) broad authority to regulate motor vehicle emissions, and the EPA emission control policies have become progressively more stringent over time.

The 1990 Clean Air Act Amendments are the latest step in the evolution of these policies, reducing tailpipe emissions and increasing the required durability and warranty period for emissions systems. A summary of the change in requirements is shown on the following page.

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Clean Air Act Certification Standards

Passenger Cars

	Tier 0 (Prior to 1994)	Tier 1 (Phase in '94-'97) Gasoline/Diesel (intermediate useful life¹)	Tier 1 (Phase in '94-'97) Gasoline/Diesel (full useful life)
Tailpipe Emissions			
HC (gm/mile)	0.41	0.41 / 0.41	- / -
NMHC (gm/mile)	None	0.25 / 0.25	0.31/0.31
CO (gm/mile)	3.4	3.4 / 3.4	4.2/4.2
Nox (gm/mile)	1.0	0.4 / 1.0	0.6/1.25
PM (gm/mile)	None	0.08 / 0.08	0.10/0.10
CO (20 deg F), (gm/mile)	None	10	--
Emission System Durability, (miles / years)	50,000	50,000	100,000/10
Emission System Warranty, (miles)	50,000		80,000

¹Intermediate useful life at 5 years or 50,000 miles

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Parts Availability for Existing Engine Tests

Many of the tests used for product approvals of Passenger Car Engine Oils are based on engines designed decades ago. Although the engines are out of production, parts stock-piling or manufacture has continued to maintain the parts for engine testing.

Several of these tests, however, are now depleting the final inventory of parts, and it will be very difficult or impossible to secure an additional supply. Specifically, the Sequence IID rust test, the Sequence IIIE oxidation/deposits/wear test, and the Sequence VE sludge/vanish/wear test are affected by limited parts supply. Provisions exist for a category to continue if a test is shown to be out of control or is otherwise unavailable, although it is unlikely GF-2 would continue if either the Sequence IIIE or VE was unavailable.

Replacements are being developed for the three affected tests and are planned for inclusion in the GF-3 specification. The Replacement Tests in ASTM (RETINA) Task Force has been established to monitor the parts supply and the progress of the replacement tests. The Task Force periodically updates the status of the parts inventory and projects a runout date based on historical test usage rates. A summary of parts availability for the affected tests is shown on the following page.

The likelihood of a test becoming unavailable during the GF-2 specification is dependent on the timing for the introduction of the replacement test, the degree of correlation between the existing test and its replacement, and the timing of the GF-3 specification. The Sequence IIIE appears to be on the critical path with the earliest projected date for unavailability. Industry groups are evaluating various options for securing additional testing hardware for the Sequence IIIE, and the current status is in the RETINA Task Force update in Section D-9.

Existing Engine Test Parts Availability Summary

Current Test	Engine	Fuel	Parts in Short Supply	Projected Parts Runout Date ⁽¹⁾	Replacement Test
Sequence IID	GM 5.7 L V-8	GMR 995	Engine blocks	6/2000	Ball Rust Test (BRT)
Sequence IIIE	GM 3.8 L V-6	GMR 995	Pistons/Rings Bearings Camshafts	3/1999 ⁽²⁾	Sequence IIIF
Sequence VE	Ford 2.3 L I-4	Phillips "J"	Engine kits	4/2000	Sequence VG Sequence IVA (KA24E)
L-38	Labeco 1 cylinder	Soltrol 10 plus 3 cc tetra ethyl lead	Leaded fuel	N/A ⁽³⁾	Sequence VIII (L-38 Unleaded)

←
8/98

⁽¹⁾Parts runout projection from RETINA Task Force updated on 10/14/97. Projection based on current parts supply and typical testing rates during previous 6-12 months.

⁽²⁾With GF-3 not possible before 1/1/2000 and the inclusion of the Sequence IIIE in PC-7, additional hardware is needed. Industry participants will be surveyed in early 1998 so a final one-time order can be placed for the test parts required.

⁽³⁾Hardware availability is not a concern. Same hardware will be used in the L-38 unleaded with only the fuel being changed.

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Original GF-3 Timing Proposal

The initial ILSAC presentation indicating a need for a new specification was made in the first half of 1995. This presentation included a proposed development process, a preliminary definition of the needs in the specification, and a timetable for specification development.

This initial specification timetable is shown on the following page.

ILSAC GF-3 Timeline (1995)

	1994		1995			1996			1997			1998			1999			2000		
Request for Improvement			█																	
Technology Demonstration			█	█	█	█	█	█												
Test Procedure Development			█	█	█	█	█	█	█	█										
Draft Released												█								
Industry Input to Standard												█	█	█						
Standard Issued														█						
Testing and Certification														█	█	█	█			
Commercial Use																			█	