

## 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-4 category will generally follow the trend toward continuous improvement while also addressing a perceived GF-3 weakness in the area of high temperature wear.

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"><li>• High temperature oil thickening</li></ul>	Sequence IIIC
API SF	1980	<ul style="list-style-type: none"><li>• Overhead valve train wear and fuel economy</li></ul>	Sequence IIID Sequence VD
API SG	1988	<ul style="list-style-type: none"><li>• Engine sludge</li></ul>	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. Federal requirements are Corporate Average Fuel Economy (CAFE) and compliance to the Federal Clean Air Act Amendments. Consumer desires include reduced oil consumption, reduced maintenance and a preference for larger vehicles with more powerful engines. The requested GF-4 timing of first use in October 2003 is driven by new "Tier 2" emissions standards that begin phase-in with the 2004 model year vehicles.

## BACKGROUND

Although CAFE requirements have not changed since 1990 for cars and 1996 for light trucks, consumer demand for larger vehicles and SUVs has put pressure on the passenger car manufacturers to improve vehicle fuel economy. The CAFE standard enacted by Congress in 1975 is currently 27.5 MPG for cars and 20.7 MPG for light trucks, which includes pickups and sport utility vehicles. The automobile industry successfully lobbied Congress since 1995 to support freezing CAFE levels. In early 2001, the Alliance of Automobile Manufacturers (AAM) decided to stop asking for a continuation of the freeze. AAM is now taking a proactive leadership role in research and development of advanced fuel economy technologies for passenger cars and light trucks.

Beginning with 2004 MY vehicles, the Federal Clean Air Act Amendments place more stringent regulations on the performance of emission control systems for an extended period of service. This requires vehicle manufacturers to reduce potential sources of catalyst degradation that include reducing the oil consumption characteristics of their cars. Vehicle manufacturers have made significant improvements in reducing mechanical oil losses; oil manufacturers have made 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"> <li>• CMA Code of Practice</li> <li>• Emissions system protection</li> <li>• Improvement in fuel economy</li> </ul>	None
API SJ/ ILSAC GF-2	1996	<ul style="list-style-type: none"> <li>• Improvement in fuel economy</li> <li>• Emissions system protection</li> <li>• Improved volatility</li> </ul>	Sequence VIA
API SL/ ILSAC GF-3	2000	<ul style="list-style-type: none"> <li>• Improvement in fuel economy</li> <li>• Addition of fuel economy retention</li> <li>• Improved oxidation and high temperature deposit control</li> <li>• Improved volatility</li> </ul>	BRT IIIF IVA VG VIB VIII

## **BACKGROUND**

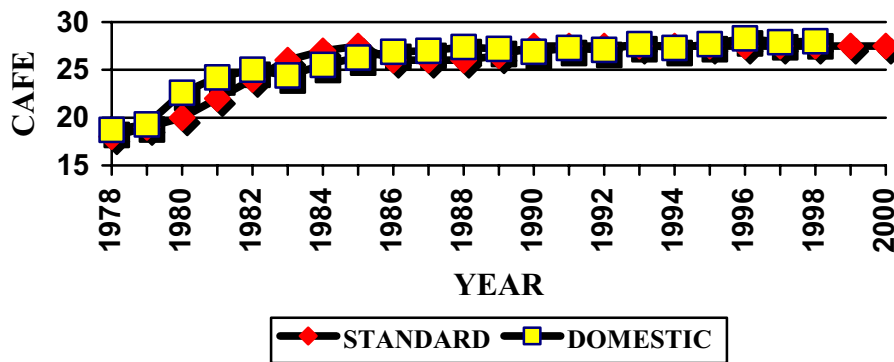
The development of the GF-4 category is expected to follow the recent trend of continuous improvement with further enhancement of the performance parameters that were the focus of GF-3. Additionally, GF-4 will look to improve the deposit performance of oils to maintain engines in "as new" condition, 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. Low phosphorus oils are a key desire by OEMs to reduce catalyst poison and extend catalyst life. In sum, since MY 2004 vehicles can be in the marketplace as early as 1Q/03, meeting the proposed timing of 1/1/2004 for first licensing will be an extremely challenging target for industry.

## BACKGROUND

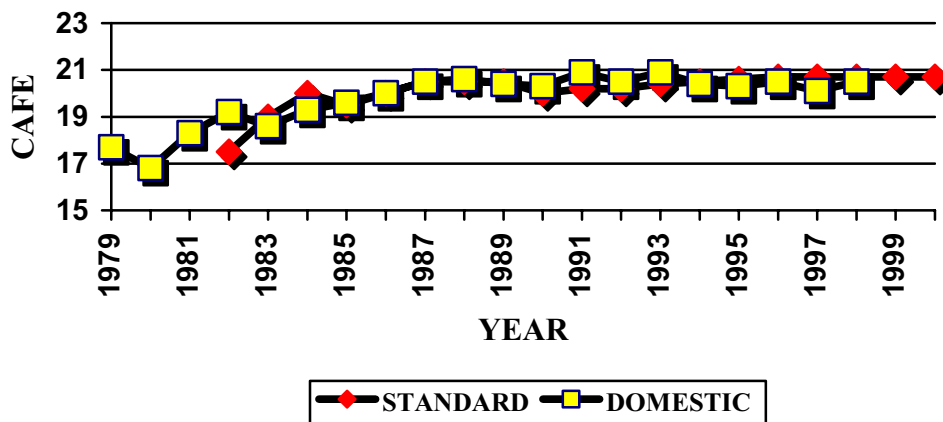
# Recent Vehicle Trends

The 1997 model year had 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

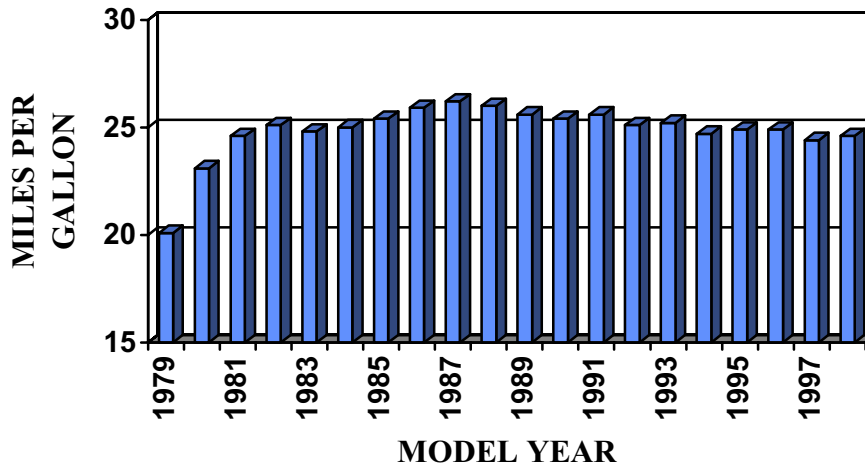


### CAFE PERFORMANCE - LIGHT TRUCKS



## BACKGROUND

### 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 \$5.50 for each tenth of a MPG (0.1 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.

## **BACKGROUND**

# **Federal Regulation Details**

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

The first standard took effect for the 1975 model year. In 1977, Congress amended this Clean Air Act and tightened emission standards.

In 1990, Congress again amended this Clean Air Act, further tightening emission standards by reducing tailpipe emissions and increasing the required durability and warranty period for emission systems. These standards are known as “Tier 1”.

The Clean Air Act Amendments of 1990 also required EPA to assess the air quality need, cost effectiveness and feasibility of tighter emission standards for the 2004 model year and beyond.

In 1998, as required by the Clean Air Act Amendments of 1990, EPA issued the “Tier 2 Report to Congress.” The report contained strong evidence of the need, cost-effectiveness and feasibility for tighter tailpipe emission standards in the future (beginning in the 2004 model year). Three main factors supported EPA’s decision:

1. Highway vehicles currently account for 30 percent of smog-forming emissions (VOC and NO<sub>x</sub>) nationally. Because the total number of miles driven is increasing (up 127 percent since 1970), they will continue to be a significant contributor to pollution;
2. Larger, heavier vehicles, such as sport-utility vehicles (SUVs) that currently are not required to meet the same tailpipe emission standards as cars, pollute three to five times as much as cars and make up 50 percent of the vehicles sold today; and
3. The technology to meet more stringent emission standards is available and cost-effective.

## **BACKGROUND**

In 2000, EPA finalized the “Tier 2” tailpipe emission standards to take effect beginning in the 2004 model year. This represents the first time that both cars and light duty trucks will be subject to the same vehicle pollution control requirements. A summary of the changes in requirements follows.

## Clean Air Act Certification Standards Passenger Cars

	<b>Tier 0</b> (Prior to 1994)	<b>Tier 1</b> (Phase in '94-'97) Gasoline/Diesel (intermediate useful life <sup>1</sup> )	<b>Tier 1</b> (Phase in '94-'97) Gasoline/Diesel (full useful life)	<b>Tier 2</b> (Phase in '04-'07) Gasoline/Diesel (full useful life)
<b>Tailpipe Emissions</b>				
HC (gm/mile)	0.41	0.41 / 0.41	- / -	- / -
NMHC (gm/mile)	None	0.25 / 0.25	0.31 / 0.31	0.125
CO (gm/mile)	3.4	3.4 / 3.4	4.2 / 4.2	1.7
NO <sub>x</sub> (gm/mile)	1.0	0.4 / 1.0	0.6 / 1.25	0.02 / 0.07
PM (gm/mile)	None	0.08 / 0.08	0.10 / 0.10	--
CO (20 deg F), (gm/mile)	None	10	--	3.4
<b>Emission System Durability</b> , (miles / years)	50,000	50,000	100,000 / 10	120,000 / 10
<b>Emission System Warranty</b> , (miles)	50,000		80,000	120,000 / 10

<sup>1</sup>Intermediate useful life at 5 years or 50,000 miles

## BACKGROUND

# Engine Tests Proposed for GF-4

Most of the tests currently used for product approvals of Passenger Car Engine Oils are based on engines that are anticipated to be available for many more years. Thus, most GF-3 test procedures are anticipated to be carried over to GF-4. However, the Sequence IIIF will most likely be replaced with the IIIG since the IIIF is not believed to adequately measure high temperature wear.

ILSAC has also identified a desire for three other new tests in addition to those already in GF-3.

- A fuel economy test to evaluate performance in engines with sliding contact valvetrains.
- A performance test to evaluate the impact of engine oil on exhaust emission system durability.
- A test to evaluate high temperature piston deposits, oxidation and retention of low temperature viscometric properties.

In late 2000, the US OEMs presented at several industry forums an initial list of performance requirements anticipated for GF-4. Also a list of potential test procedures to measure these parameters was discussed. See page A-9 for a summary of these initial proposal discussions.

## Initial (October 2000) GF-4 Performance Input

Test Procedure	Engine	Performance parameters
BRT	Bench rig	Rust
<b>Sequence III G</b>	GM 5.7L V-8	High temperature wear
Sequence IVA	Nissan 2.4 L I-4	Low temperature wear
Sequence VG	Ford 4.6L V-8	Sludge and varnish
Sequence VIB	Ford 4.6L V-8	Fuel economy & fuel economy retention
<b>Sequence VIC<sup>1</sup></b>	Slider valve train (engine ??)	Fuel economy & fuel economy retention
<b>Sequence VII<sup>2</sup></b>	Bench rig	Exhaust emissions
Sequence VIII	Labeco single - cylinder	Bearing corrosion & shear stability
<b>Sequence?<sup>3</sup></b>	DC 2.7L V-6	Oxidation, high temperature deposits & low temperature viscometrics
MHT-4 TEOST	Bench rig	High temperature deposits

**Bold text indicates new tests.**

<sup>(1)</sup> There is an OEM desire to add another fuel economy requirement but in an engine with more “boundary” friction than that of the VIB. A bench friction test has been considered as an alternate.

<sup>(2)</sup> A **Fuel/Oil Catalyst Aging System (FOCAS)** is the leading candidate test procedure. If development of this test is unsuccessful, a maximum phosphorus limit of 0.05% is proposed by ILSAC.

<sup>(3)</sup> DaimlerChrysler 2.7L engine test procedure for evaluating oxidation, deposits and low temperature viscometrics.

Since the initial discussion of GF-4 performance desires in late 2000, it became apparent to all stakeholders that the time and resources required to develop the four preferred test procedures initially proposed were not adequate to meet desired GF-4 specification timing. ILSAC met in late May 2001 to discuss GF-4 performance needs and timing to develop a first draft proposal that was consistent with meeting 2004 model year emission requirements. This draft is included in section C, pages C-4 to C-12 and summarized below. In recognition of the effort required to develop completely new engine tests, the proposed new tests have been limited to a IIIG (modified IIIF) and a VIB with increased aging length. Sequence VII (OPEST) development is also continuing as an alternate to maximum phosphorus limit, however, this test is unlikely to meet GF-4 timing.

Test Procedure	Engine	Performance parameters	Proposed limits
BRT	Bench rig	Rust	Same as GF-3
<b>Sequence IIIG</b>	Mod IIIF	High temperature wear, oxidation, deposits, low temperature viscosity retention	<b>2x IIIF oxidation, improved wear discrimination, max. one viscosity grade change</b>
Sequence IVA	Nissan 2.4 L I-4	Low temperature wear	Same as GF-3
Sequence VG	Ford 4.6L V-8	Sludge, varnish and wear	Deposits same as GF-3; <b>lifter roller pin wear under review</b>
<b>Sequence VIC</b>	Ford 4.6L V-8	Fuel economy & fuel economy retention	<b>Phase two aging increased to 120 hours; all FEI limits increased 0.4%</b>
<b>Sequence VII (OPEST)</b>	Bench rig	Exhaust emissions	<b>0.05% phos. Max.</b> or Seq. VII if available
Sequence VIII	Labeco single - cylinder	Bearing corrosion & shear stability	Same as GF-3

**Bold text indicates new tests.**

The bench tests are proposed to be same as for GF-3 with the following exceptions:

- 1.) TEOST MHT-4 limit tightened to 25 mg.
- 2.) Foam to be measured on used oil (VG or IIIG). Still under review.
- 3.) Sulfur content limit of 0.50% added using ASTM D1552.

## **BACKGROUND**

# **Original GF-4 Timing Proposal**

The initial ILSAC presentation indicating a need for a new specification was made during 4Q2000. This presentation included a proposed development process and a timetable for specification development.

This initial specification timetable is shown on the following page.

# ILSAC GF-4 Timeline (2000)

	2000			2001			2002			2003			2004		
Request for Improvement			█												
Technology Demonstration				█	█	█									
Test Procedure Development				█	█	█	█								
Draft Released								█							
Technology Development and Optimization								█	█	█					
Industry Input to Standard									█	█					
Standard Issued											█				
Testing and Certification											█	█			
Commercial Use													█		

A-12

# ILSAC GF-4 Timeline (2002)

A-12-A

	2000				2001				2002				2003				2004			
Request for Improvement				█																
Technology Demonstration					█	█	█	█	█	█	█	█	█	█	█	█				
Test Procedure Development					█	█	█	█	█	█	█	█								
Draft Released									█	█										
Technology Development and Optimization										█	█		█	█						
IIIG Precision Matrix													█	█						
Industry Input to Standard									█	█	█				█					
Standard Issued															█					
Testing and Certification													█	█	█	█				
Commercial Use																	█	█	█	█

**Footnote:** At the October 22, 2003 ILSAC/Oil meeting it was agreed that July 31, 2004 would be the first date when the starburst can define ILSAC GF-4. It was also decided that all oils carrying the starburst can only define ILSAC GF-4 after April 30, 2005.

**For additional background the following document offers the OEM perspective on ILSAC GF-4 category development.**

## **ILSAC GF-4 – What, Why, When and How?**

**Michael L. McMillan  
General Motors Research and  
Development Center  
Warren, Michigan USA**

**Presented at Fuels and Lubricants Asia  
Conference  
Singapore  
January 29-February 1, 2002**

**December 2003**

## **Abstract**

**ILSAC GF-4, the next level of light-duty gasoline engine oil performance, has been identified as needed beginning in 2004. This paper will review the background of ILSAC GF-4, including what changes in engine oil performance will be necessary to meet ILSAC GF-4 requirements, why and when ILSAC GF-4 will be needed, and the process by which ILSAC GF-4 will be developed. A new level of engine oil performance targeted for application in Southeast Asia, ILSAC SG+, will also be discussed.**

**Background ILSAC GF-4 is on the horizon. The next level of light-duty gasoline engine oil performance is targeted for introduction in the fall of 2003, in time to meet the needs of most 2004 model year vehicles. This paper will discuss why ILSAC GF-4 is needed, when it is needed, the performance requirements which will be identified in ILSAC GF-4, and the process which will be used to develop ILSAC GF-4. Some of the background for ILSAC SG+, a performance guideline developed primarily for the Southeast Asian region of the world, will also be discussed.**

**From an historical perspective, ILSAC (which stands for International Lubricant Standardization and Approval Committee) was formed in 1987. Its vision is to create lubricant standards which vehicle and engine manufacturers worldwide deem necessary for satisfactory equipment performance and durability. When originally constituted, it was intended that ILSAC be composed of four major OEM trade associations: MVMA (the Motor Vehicle Manufacturers Association), JAMA (the Japan Automobile Manufacturers Association), CCMC (the Comité des Constructeurs d'Automobiles du Marché Commun), and EMA (the Engine Manufacturers Association). MVMA later became AAMA (the American Automobile Manufacturers Association), and was finally dissolved in 1999. CCMC became ACEA (the Association des Constructeurs Européens d'Automobiles) and has not joined ILSAC, so the current ILSAC membership includes JAMA, EMA and the three individual former AAMA members (General Motors, Ford, and DaimlerChrysler).**

**ILSAC's first passenger car gasoline engine oil standard (ILSAC GF-1) was introduced in 1992, its second (ILSAC GF-2) in 1995, and its third and most recent (ILSAC GF-3) in 2000. As mentioned above, the next passenger car gasoline engine oil standard (ILSAC GF-4) is targeted for late 2003.**

#### **Why Is GF-4 Needed?**

**The main driving force for ILSAC GF-4 is the Tier II emissions system requirement that vehicles emit no more than 0.07 g NOx/mile for 120,000 miles of service. This requirement will necessitate ensuring engine oil-emissions system compatibility, either by limiting phosphorus and sulfur contents (known catalyst poisons) in engine oil or by developing an emissions system compatibility test. Efforts are under way now to determine whether phosphorus contents as low as 0.05 percent can provide adequate engine wear protection, and to develop an emissions system compatibility test. If the latter effort is successful, it could eliminate the need to specify phosphorus and sulfur content maximums in GF-4. If it is unsuccessful, or is not completed in time to be used for GF-4, the trend of specifying a phosphorus maximum for engine oil will continue, and actually be expanded to include a sulfur maximum for GF-4.**

**Potential increases in CAFE (Corporate Average Fuel Economy) requirements are also dictating increases in both the initial fuel efficiency rating of engine oils and in the "aged" fuel efficiency performance. The point at which the aged performance rating is determined also needs to be extended, to account for the longer oil drain intervals being recommended by most vehicle manufacturers around the world.**

**And finally, to accommodate demands for extended engine oil life, substantial improvements in engine oil oxidation stability are needed. Such improvements are also necessary to ensure that fuel efficiency will be retained, even after increased oil aging.**

#### **When Is GF-4 Needed?**

**As mentioned earlier, the Tier II emissions requirements take effect for 2004 model year vehicles, at which time a**

substantial fraction of the 2004 model year production vehicles must begin to meet substantially lower gaseous emissions requirements, including a 0.07 g/mile maximum for NOx. In addition, vehicles must maintain this low emission performance for 120,000 miles (versus the earlier 100,000 mile requirement). Because the emissions systems on these vehicles will require ILSAC GF-4 oils with lower phosphorus and sulfur levels, such oils will need to be available in the marketplace by the beginning of 2004. This means that the new ILSAC GF-4 standard must be completed by the first quarter of 2003, basically one year from now. As will become apparent later in this paper, this will be a real challenge, given the short time available, and the uncertainty surrounding the process by which the GF-4 standard will be developed.

#### **What Will GF-4 Be?**

As indicated earlier, the primary needs for ILSAC GF-4 are related to emissions system compatibility, fuel efficiency, and increased oxidation stability. Because some of the field evaluations and test development efforts are still ongoing, and likely will not be finished for several months yet, it is too early to state exactly what the requirements for GF-4 will be. Several things are clear, however. The emissions systems that are being (and in some cases have already been) developed for 2004 model year vehicles will require engine oils containing lower levels of phosphorus and sulfur. An early draft of ILSAC GF-4 (1) suggested 0.05 percent phosphorus and 0.5 percent sulfur as maximum targets. Some vehicle manufacturers have indicated a need for oils with these levels for their vehicles, while others have indicated a desire for lower phosphorus and sulfur levels (than in current oils), but not at the expense of either engine durability or oil life. ILSAC expects to decide on the exact limits for phosphorus and sulfur (if no emissions system compatibility test emerges) by the middle of 2002.

The need for improved fuel efficiency and retention of fuel efficiency with oil aging will require a new engine dynamometer test. Sequence VIC is being developed for this purpose, and will likely include a longer aging cycle in addition to higher initial fuel efficiency requirements.

December 2003

**Increased oxidation stability of GF-4 oils will be ensured by the new Sequence IIIG Test, which is being developed by General Motors in cooperation with the San Antonio, Texas independent test laboratories, Southwest Research Institute and Perkin Elmer. The target in the GF-4 draft is for the Sequence IIIG Test to be twice as severe as the current Sequence IIIF Test in terms of oxidation severity.**

**Other improvements in performance associated with ILSAC GF-4 will be end-of-test Sequence IIIG pumpability requirements, and more stringent wear protection requirements, both as part of the Sequence IIIG Test. Other requirements, such as volatility, will remain essentially the same as in the current ILSAC GF-3 Standard.**

#### **How Will GF-4 Be Developed?**

**An excellent question! In ILSAC meetings following the development of GF-3, much dissatisfaction was expressed with the standard development process. This dissatisfaction was based on the current system not being responsive to consumer needs, being much too long and containing too many redundancies, the ASTM balloting process being too cumbersome, and the fact that new category limits often fall far short of technological capabilities. ILSAC concluded that the current system cannot respond to legitimate needs in a timely manner (i.e., less than three to four years), and that it cannot work for ILSAC GF-4 development, required for 2004.**

**In further discussions, ILSAC came up with three things that need to be changed in the standards development process for it to fit OEM needs:**

- 1) Needs should be defined by a consensus of OEM's who actually have the needs. Of course, input on such factors as technical feasibility would still be sought from other appropriate parties.**
- 2) Test procedures should continue to be developed by OEM's and formalized by technical organizations such as ASTM (American Society for Testing and Materials), CEC (Coordinating European Council) and JASO (Japanese Automobile Standards Organization).**

- 3) Test limits should be determined by OEM's based on the needs defined, after consideration of industry input.

Based on these requirements, ILSAC developed a proposal for a new system for engine oil standards development to be used in development of ILSAC GF-4. This proposal is shown schematically in Figure 1. This flow chart addresses the concerns raised following GF-3 development, and incorporates the three key elements outlined above. Because API (the American Petroleum Institute) is a partner with the former AAMA member companies in the current EOLCS (Engine Oil Licensing and Certification System), and because of a strong desire to retain API as the certification and licensing body for ILSAC Standards, API was included in the lower portion of Figure 1 in this capacity. The decision was made to take this new proposal to API and request their endorsement of it and participation in the new system. This was done in a presentation made to the API Lubricants Committee on November 16, 2000.

Following the API Lubricants Committee meeting, the proposal was widely circulated throughout the oil and petroleum additive industries. Feedback to ILSAC was provided by ILMA (the Independent Lubricant Manufacturers Association), API, and individual companies over the next several months. In March of 2001, the ACC (American Chemistry Council) also released a proposal it had developed for a new system, based on OEM's developing their own individual standards for engine oil performance. It became clear during this period that the oil and additive industries had many concerns with the ILSAC proposal. To address these concerns, the AGP (Administrative Guidance Panel – the oversight group for the EOLCS, comprised of three OEM and three API Lubricant Committee members) met on April 30, 2001 and again on July 25, 2001, to clarify issues raised and explore possible modifications to the ILSAC proposal which might be more acceptable to API. These meetings culminated in an API Lubricants Committee counterproposal made on August 30, 2001. This is shown schematically in Figure 2, and is based on a balanced ILSAC/OIL Group making key decisions on need and timing, funding, contents of draft standards, and test limits in final standards.

**Following discussion of the counterproposal, ILSAC notified API on September 21, 2001 that it was rejecting the counterproposal because it**

- 1) was too far removed from the original ILSAC proposal**
- 2) did not address the major concerns raised by ILSAC in November 2000**
- 3) was more complicated than the current system, and**
- 4) was not markedly different than the current system in the key areas of establishing the need for and acceptance of the final ILSAC standard.**

**Recognizing that its rejection of the API counterproposal had left things “in limbo”, ILSAC again approached API on November 5, 2001 to reiterate what it believed to be the key elements of any new system ILSAC could support. These ILSAC “must haves” were identified as follows:**

- 1) ILSAC must have at least 50 percent of the input in establishing the need for and timing of any new standard.**
- 2) In the case of a deadlock, ILSAC would have the ability to determine the final limits in any new standard (e.g., via a tie breaking vote).**
- 3) Demonstration oils, if established as a requirement, must be the responsibility of the oil industry and cannot be a gate in the system.**
- 4) The system must include certification and licensing, as well as an aftermarket audit system.**

**Funding of industry test matrices and acceptance of new tests (by ASTM, CEC or JASO) were also identified as issues which cannot become gates in delaying the development of a new standard. In communicating this information to API, ILSAC asked for a response by December 31, 2001 as to whether API could accept the concepts outlined by ILSAC for a new system.**

**As of the writing of this paper, API had not responded to ILSAC's November 5, 2001 proposal. There was also an attempt being made to schedule an industry-wide meeting in mid-January to clarify some of the issues listed above, and to explore possible additional alternatives which, while retaining ILSAC's "must haves," might be more acceptable to all parties.**

**If, after these meetings are held, there is agreement between API and ILSAC on cooperating to develop a new engine oil standards development system, the details would have to be worked out, including completing the Establish Need and Timing step, by the end of the first quarter of 2002 to stay on the timing track identified earlier in this paper. If, on the other hand, API cannot agree with the concepts outlined by ILSAC for a new system, ILSAC will pursue other avenues to satisfy its needs and accomplish its objectives. This may include seeking another organization to certify and license engine oils complying with ILSAC standards, or developing other approaches to implement ILSAC standards.**

**ILSAC SG+ For many years, US and Japanese automakers have struggled with how to cope with the variability in engine oil quality around the world. Should we build different vehicles, with different lubrication requirements, to mesh with the low oil quality levels prevalent in some regions of the world, or should we build only one vehicle, and vary the maintenance requirements (including engine oil change interval), depending upon the oil quality available? ILSAC addressed this dilemma by proposing a tiered system for engine oil performance. The concept was described in a 1997 presentation at this Conference by Misangyi (2), and later repeated at an API Interindustry Forum (3). In the concept, three levels of engine oil performance are outlined. The highest level (Tier 1) would lubricate advanced technology engines under development by the OEM's. The middle level (Tier 2) would satisfy the requirements of current technology engines prevalent in the marketplace. The lower level (Tier 3) would be used for engines with limited exhaust emission control systems. At the time the proposal was made, ILSAC GF-3 was envisioned as the Tier 1 oil, ILSAC GF-2 was the Tier 2 oil, and an oil denoted as "SG for Asia" or "Asian SG" was**

identified as the Tier 3 oil. As new oil performance levels were developed, the Tier 3 oil would also be upgraded, and might eventually merge with the Tier 2 oil.

This latter oil, “SG for Asia” or “Asian SG”, originated in discussions within the SAE F&L Steering Committee for Asia, a group formed under the SAE Fuels and Lubricants Division to address fuel and lubricant issues specific to the Southeast Asia region of the world. In meetings held primarily in conjunction with this F&L Asia Conference, the Engine Oil Section of the SAE F&L Steering Committee for Asia identified a need for an engine oil quality level corresponding roughly to the former API SG level and asked ILSAC to develop the performance definition for such an oil quality level. The rationale was that, although below the higher quality levels available in some parts of the world (API SH and SJ at the time), API SG was significantly higher in quality than the predominant quality levels available in many parts of the world, including most of Southeast Asia. API SG would, therefore, represent a significant upgrade in oil technology in these areas. If API SG quality levels were widely available and identified in a way that vehicle manufacturers could promote their use, it was reasoned that lower quality level oils would begin to disappear from the market, and be replaced with the “SG for Asia” quality level oils. It was further reasoned that this level of oil quality would provide the performance needed in these areas of the world, where emissions and fuel economy issues have not become as significant as they have in other parts of the world. In following this approach, it was also reasoned that such oils could be blended and sold at a lower cost than ILSAC GF-2 or GF-3 oils, because they could utilize more conventional constituents (e.g., higher volatility base oils and higher phosphorus levels).

The concept of an “SG for Asia” type of engine oil performance category was advanced by the SAE F&L Steering Committee for Asia during 1999. Based on its recommendation to the SAE F&L Division, SAE declared a need for such a product, and accordingly API was asked to develop a licensing system, including an identifying symbol, for “Asian SG.”

Unfortunately, API decided not to support this request from SAE. API's position was that higher quality API SJ oils are available throughout Asia, so there is no need for a lower performance level such as "Asian SG." Concerns were also expressed about how such oils would be formulated and tested, given changes in testing protocols which have occurred since API SG was a performance category.

Not satisfied with this decision by API, ILSAC discussed various options for implementing a new performance level oil for Southeast Asia. It was decided to proceed to define such an oil quality level, and accordingly, in July of 2001, ILSAC issued a new performance definition: ILSAC SG+ Performance Guideline for Passenger Car Engine Oils. As stated in the cover letter announcing the new Guideline (4), the objective was "to define a minimum acceptable performance level for automotive engine oils in Asia and other markets as appropriate." Requirements were updated to include the Sequence IIIF, IVA VG and VIII Tests now in use for ILSAC GF-3. It is further stated in the cover letter that "to support oil certification, the category represented by the guideline can use either newly generated data or data generated when API SG was a licensable category. This approach should help expedite the introduction of better quality oils while also minimizing costs. We understand that marketers will be expected to self-certify these oils to meet the new guideline."

In issuing the SG+ Guideline, ILSAC has attempted to retain the essential engine protection requirements for engine oil performance while easing some of the less essential requirements present in current performance levels such as ILSAC GF-2 and GF-3. In simple terms, compared to ILSAC GF-2, ILSAC SG+ can be higher volatility, has no phosphorus limit, and has no fuel efficiency requirements. The other performance requirements, as represented by current or past engine sequence tests, are identical. It should, therefore, be easier (and presumably less costly) to manufacture ILSAC SG+ engine oils for use in Southeast Asia.

It is unclear at this point in what areas of the world ILSAC SG+ will be used, or how widespread that use will be. ILSAC members have indicated they have no plans to recommend its use in the US, Europe or Japan, citing concerns such as

compatibility with advanced emission control systems, fuel efficiency and oil consumption. Plans to utilize it in other parts of the world are most likely in the formulation stages. The impact of SG+ on the oil quality levels available in other countries including those in Southeast Asia remains to be seen, but will likely depend on the availability of SG+ oils in the marketplace in these areas, and on how effective individual OEM's are in communicating the benefits of SG+ to their customers.

#### **REFERENCES**

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- 2. Misangyi, P.W., "Worldwide Fuel and Lubricant Requirements – A Ford Perspective," presented at Fuels and Lubricants Asia Conference, January 21, 1997, Singapore.**
- 3. Misangyi, P.W., "Worldwide Engine Oils – Passenger Car OEM Perspective," presented at API Interindustry Forum, April 15, 1998, Detroit, MI.**
- 4. Letter from M.L. McMillan to J. Demko and K. Nakamura, containing ILSAC SG+ Performance Guideline for Passenger Car Engine Oils, July 6, 2001.**

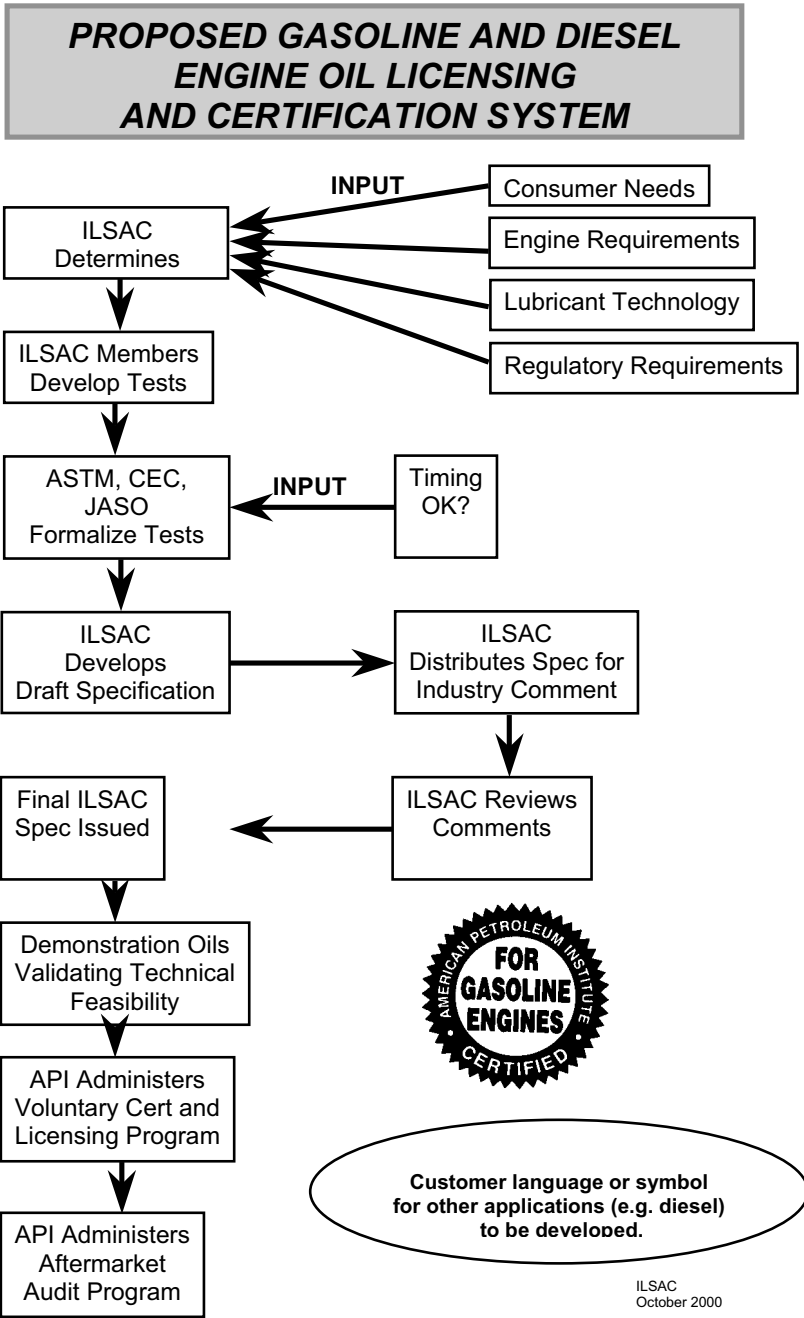


Figure 1. ILSAC Proposal for New Engine Oil Standard Development System.

**PROPOSED GASOLINE AND DIESEL ENGINE OIL LICENSING AND CERTIFICATION SYSTEM 8-30 AGP**

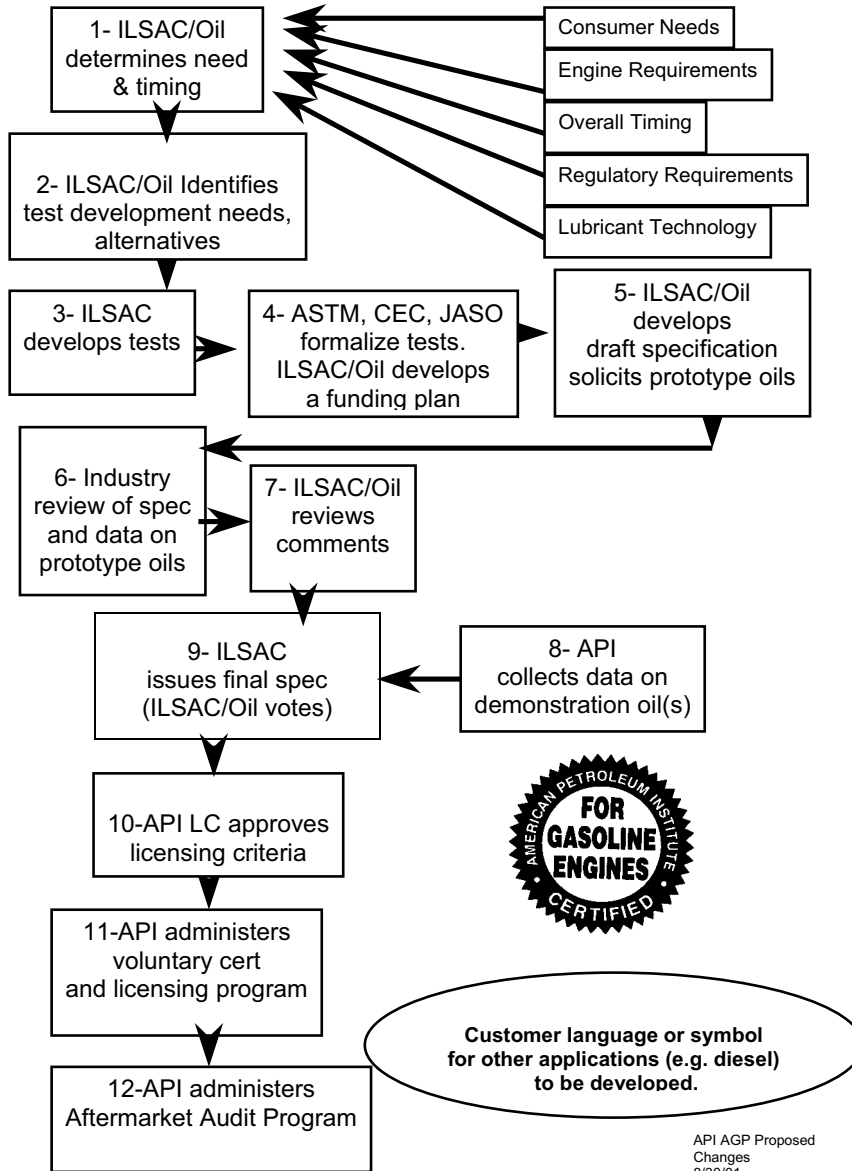


Figure 2. API Counterproposal for New Engine Oil Standard Development System.