ILSAC GF-6: A New Level of Performance for Engine Oils to Meet Changing Fuel Economy and Emission Standards

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Abstract

With the continued modernization and improvements being made in the automotive industry, a new level of performance is required for engine oils. Engines are being built to be more durable, while also being designed for better fuel economy and to meet higher emission standards. The current GF-5 engine oil standard does not meet all the new requirements, specifically those of the USA Corporate Average Fuel Economy (CAFE) which will require the average fuel economy to be 54.5 MPG by the year 2025. While oils with lower viscosities can meet these fuel economy requirements, the oil must also maintain the engine durability, hence the need for the GF-6 performance levels.

Along with performance needs, the engine testing needs have also undergone a lot of recent changes. Older engine tests have been replaced with updated versions and brand new tests have been developed that will all need to be accounted for in the ILSAC GF-6 specification. Because of the significant number of new tests and requirements the GF-6 standard has seen numerous delays and is not expected to be finalized until Q2 of 2020. This poster will go deeper into the needs for the new GF-6 specifications along with the reasons why it has taken so long to achieve.

Introduction

- ILSAC defines lubrication specifications and licensing standards to meet the needs and requirements of the automotive industry and legislative bodies.
- ILSAC GF-6 is the upcoming engine oil standard for passenger vehicles and light trucks in the United States.
- ILSAC GF-6 has been pushed back several times, but first acceptable usage is expected to be in 2020.

History of ILSAC

- Prior to ILSAC’s formation in 1992, engine oil standards were issued under the Tripartite System headed by the following organizations: API, SAE, and ASTM.
- The AAMA and the JASO founded the ILSAC in 1992 to meet industry needs in a timely manner.
- Tripartite System and ILSAC merged to form the Engine Oil Licensing and Certification System (EOLCS).
- Each member of EOLCS has different functions.
- ILSAC sets minimum performance standards.
- SAE determines the needs of engine oil specifications based on automaker inputs and market trends.
- ASTM develops tests and parameters for each specification provided by SAE.
- API licenses and certifies the engine oil.

The Need for ILSAC GF-6

- Corporate Average Fuel Economy (CAFE) requires passenger cars and light trucks to attain an average fuel economy of 54.5 mpg.
- Reducing greenhouse gas (GHG) emissions is a primary concern for legislators and car manufacturers.
- Lubricants tend to improve fuel economy by only up to 3%, but with light-duty vehicles producing 80% of GHG emissions from the U.S. transportation sector, there is huge GHG emission reduction potential.
- Turbocharged/diesel direct injection (TDI/DI) engines have grown in popularity.
- Low speed pre-ignition is very common in T/GDI engines.
- Piston cleanliness and particulate matter reduction for overall longevity.

ILSAC GF-1

The ILSAC GF-1 standard indicates the oil meets both API SJ and the Energy Conserving II (EC-II) requirements. It was created in 1990 and upgraded in 1992 and became the minimum requirement for oils used in American and Japanese automobiles.

ILSAC GF-2

- ILSAC GF-2 replaced GF-1 in 1996. The oil must meet both API SJ and EC-II requirements. The GF-2 standards require 0W-30, 0W-40, 5W-20, 5W-30, 5W-40, 10W-30, 10W-40 and 10W/50 motor oils to meet stringent requirements for phosphorus content, low temperature operation, high temperature deposits, and foam control.

ILSAC GF-3

An ILSAC GF-3 oil must meet both API SL and the EC-II requirements. The GF-3 standard has more stringent parameters regarding long-term effects of the oil on the vehicle emission system, improved fuel economy and improved volatility, deposit control and viscosity performance. The standard also requires less additive degradation and reduced oil consumption rates over the service life of the oil.

ILSAC GF-4

ILSAC GF-4 is similar to the API SM service category, but it requires an additional sequence VIB Fuel Economy Test (ASTM D6577).

ILSAC GF-5

- Introduced in October 2010 for 2011 and older vehicles, designed to provide improved high temperature deposit protection for pistons and turbochargers, more stringent sludge control, improved fuel economy, enhanced emission control system compatibility, seal compatibility, and protection of engines operating on ethanol-containing fuels up to E85.

ILSAC GF-6

First standard to have two subcategories

Future of Lubricants

First acceptable use of ILSAC GF-6 is expected in 2020

New lubricants are needed for changing engine technology

Solid-state lubricants may be an alternative to thinning engine oils

References


Acknowledgements

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