



# GLOBAL COLLABORATION AND DEVELOPMENT OF THE LATEST ENGINE OIL STANDARDS

Quiariat Cuadra<sup>1,2</sup>, Raj Shah<sup>1</sup>, Stanley Zhang<sup>1,2</sup>

1. Koehler Instrument Company, Inc., Holtsville, NY 11724, USA
2. Department of Materials Science and Chemical Engineering, Stony Brook University, Stony Brook, NY 11794, USA

## Introduction

The Automotive Industry began in the 1880's, since then engine oil has proven essential in the lubrication of automobile engines. Engine oils decrease friction between moving parts, reduce wear, transfer heat, and minimize energy loss in combustion engines. Engine oils often contain complex and advanced additives to help perform various functions. At the same time, engine oils must support emissions reduction aftertreatment devices to comply with strict regulations. Engine oils must be developed and categorized with careful examination. One of the most important properties of an engine oil is its viscosity; adequate viscosity forms a lubricating film between moving components while decreasing viscous drag during hydrodynamic lubrication. Organizations around the world set standards that pertain to their domestic markets and distinct driving conditions.

## Global Lubricants Test Standards Collaboration Team

There are multiple standard developing organizations around the world. For international marketing, standards must be translated across involved countries. This poses an issue as some test methods that seem similar, vary enough to discredit their relevance. Another concern that demonstrates the complexity of testing is that assessing wear or piston deposits have multiple testing methods for each. It is important for international oil company consumers to understand how oils affect the performance of their engine. To combat these difficulties, the Global Lubricants Test Standards Collaboration Team (GLTSCT) was formed in 2019, with the mission of encouraging industry collaboration by providing a communication forum. The GLTSCT does not create new oil test standards. Rather, the organization conceptualizes existing standards, while reducing redundancy.



Figure 1. Methods of streamlining collaboration via the GLTSCT

## United States Upgrades to ILSAC GF-6 to Combat LSPI

In the United States, there has been a push for smaller, more efficient engines. This led to the creation of turbocharged direct injection (TGDI) engines, yielding greater engine performance but increased risks associated with low-speed pre-ignition (LSPI). To prevent LSPI and timing chain wear, International Lubricant Specification Advisory Committee (ILSAC) GF-6 standards were implemented. The American Petroleum Institute (API) introduced the CK-4 and FA-4 standards for heavy-duty diesel engine oils. CK-4 and FA-4 maintain engine durability, protect emissions reduction devices, and have identical levels of sulfated ash, phosphorus, and sulfur (SAPS).

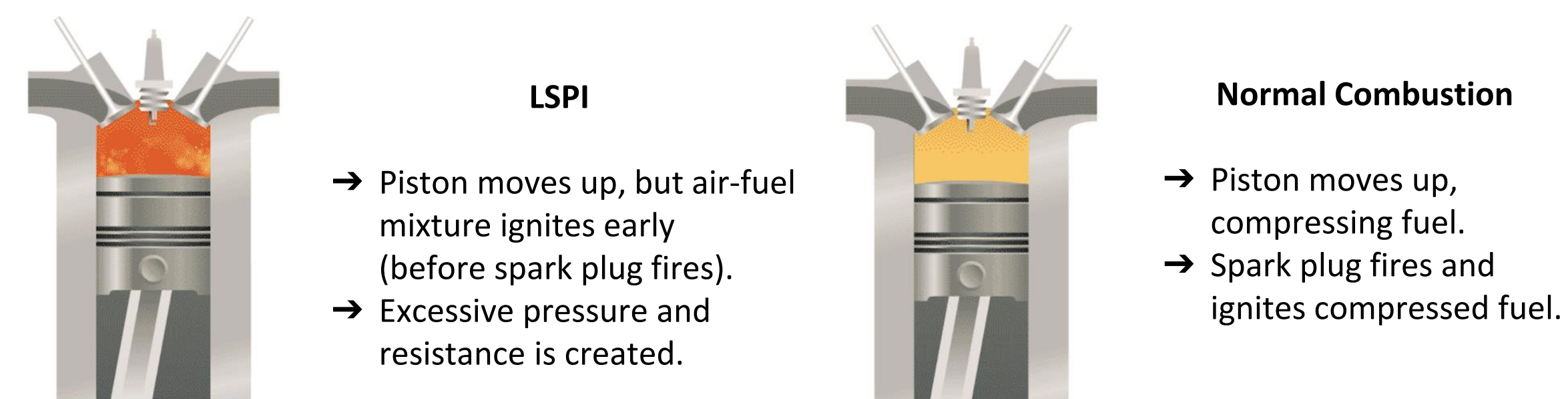


Figure 2. LSPI event compared to normal combustion event.

## Europe Introduces new ACEA E8, E11, F8, and F11 Oils

In Europe, test standards are set by the European Automobile Manufacturers Association (ACEA). Oil sequences are categorized into classifications for passenger motor oils (A/B class), catalyst compatible motor oils (C class), and heavy-duty diesel engine oils (E class). ACEA E6 and E9 will be replaced by E8 and E11, while E4 and E7 remain constant. ACEA released F8 and F11, which requires lubricants to have a HTHS viscosity between 2.9 to 3.2 mPa·s. These changes will increase fuel economy and lower greenhouse gas emissions without disrupting engine protection. ACEA C5 will be removed and ACEA C6 will be set to include performance tests for LSPI, chain wear, and turbocharger deposits. ACEA A5/B5 will be replaced by ACEA A7/B7. Europe's engine oil standards are distinct in their oil change intervals and emissions regulations.

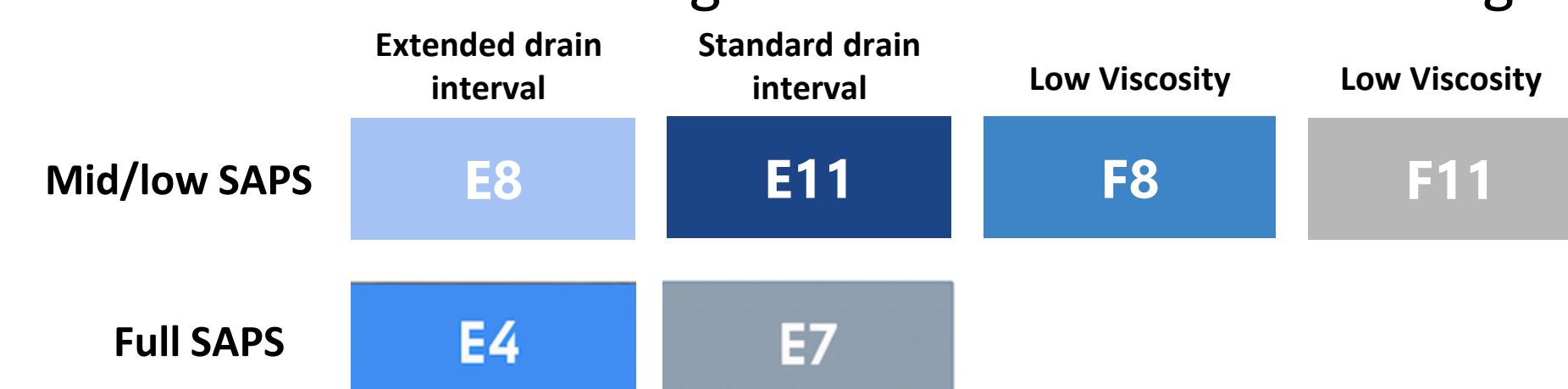


Figure 3. Latest ACEA Heavy-duty Sequences

## Canada Embraces API CK-4 and FA-4 Standards

Since Canada is in close proximity with the United States, the country has been utilizing API standards. Petro-Canada Lubricants reformulated their range of passenger car motor oils to meet new ILSAC GF-6 and API SP category specifications. These latest oils provide protection against LSPI, accelerated timing-chain wear, start-stop engines, and they bolster fuel economy. Experiencing vehicle market demands similar to the United States', Canada has adopted CK-4 and FA-4 standards.

## China Progresses Towards Its Own Domestic D1 Standard

China has adopted API engine oil standards as well as European emission standards—this has been the case for a significant amount of time. However, China's vehicle market continues to differ from the operating conditions found in the western market. The Chinese Lubricant Specification Development Alliance decided to develop their own domestic heavy-duty diesel oil specification, D1. The D1 standard adopts the API oil categories' viscosity classifications and bench tests but also adds Chinese diesel engine test methods tailored to their automobiles.

## India Makes a Jump to BS VI to Lessen Emissions

As the amount of vehicles in India continues to grow, the issue of pollution escalates. Still considered a developing country, India has used older API/ACEA standards and faced a several issues with the low speed, start-stop driving conditions in its urban areas. India implemented Bharat Stage VI emission standards, pushing the country to adopt updated standards to reduce vehicle pollution. This change regulates air quality and brings India's motor vehicle regulations in alignment with EU's Euro VI standard. Although India has been using American and European oil standards, aftertreatment systems in automobiles continue to decline due to the difference in driving patterns.

	Compression Ignition						Positive Ignition					
	CO	HC	HC + NOx	NOx	PM	PN	CO	HC	HC + NOx	NOx	PM	PN
BS IV	0.50 – 0.74	–	0.30 – 0.46	0.25 – 0.39	0.025 – 0.06	–	1.0 – 2.27	0.1 – 0.16	–	0.08 – 0.11	–	–
BS VI	0.50 – 0.74	–	0.17 – 0.215	0.08 – 0.125	0.0045	6x10 <sup>11</sup>	1.0 – 2.27	0.10 – 0.16	–	0.060 – 0.082	0.0045	6x10 <sup>11</sup>

Figure 4. Bharat emissions limits for light-duty vehicles

## Conclusion

The countries mentioned are similar in regard to performance targets and test methods—especially when comparing the United States and Europe. The engine oil standards set by API, ILSAC, and ACEA are most prevalent in the ever-evolving automotive industry. They differ because of their domestic markets, environmental issues, and the driving conditions within each area. The GLTSCT has proven beneficial as it has created a more global approach to help streamline test methods, specifications, and regulatory principles. In this way, the organization benefits oil companies in terms of time and finance.

## References

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