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GF-6 and PC-11 – Key Market Drivers

The key drivers for development of **ILSAC GF-6** and **PC-11** engine oil categories come from a combination of factors such as

- ✓ Government Regulations – mandate on Fuel economy & Emission
- ✓ Energy Conservation
- ✓ Alternate Energy sources

This in turn has driven……

- ➢ Changes in engine technology to meet emissions, renewable and fuel economy standards.
- ➢ Engine Test Obsolescence (Hardware Becoming Unavailable), therefore need for replacing older tests.
- ➢ Finally resulting in changes in Fuels and lubes.

But **what are the effects or impacts on engine oil requirements**?

- ❖ Fuel economy
- ❖ Long oil drains
- ❖ Oxidation stability
- ❖ Aeration control
- ❖ Shear stability
- ❖ Alternate fuel compatibility
- ❖ Wear protection

ILSAC GF-6:
We shall see new categories like ILSAC GF-6 targeted for January 1 2017 and PC-11 for April 1st 2016 for first allowable use. However, there are chances for potential of further delay as the progress of development of new engine test still remains on the critical path to meet the OEMs desired timeline. Both ILSAC and Heavy-duty OEMs are likely to make crucial decisions that may force some of the test development or delay in any one of them to affect the final timing.

ILSA GF-6, unlike its predecessors, will be divided into two subcategories, one that will be backward compatible and one will not. While the Diesel Engine Oil Advisory Panel (**DEOAP**) develops new heavy-duty equipment categories such as PC-11, the new Auto-Oil Advisory Panel (**AOAP**) is the passenger vehicle counterpart.

The Auto-Oil Advisory Panel, co-chaired by Teri Kowalski of Toyota and Luc Girard of Petro-Canada, replaces the ILSAC/ oil category development system— though it is comprised of basically the same people. Like PC-11 the new category calls for improvements in fuel economy

and better engine protection than currently exists at lower viscosities. For **ILSAC GF-6**, four needs were identified:

1. **Increased Fuel Economy.** This needs to be maintained throughout the oil change interval.
2. **Enhanced Oil Robustness.** This applies to spark-ignited internal combustion engines and is necessary to ensure acceptable engine oil performance in regional markets due to service requirements, fuel availability, environment issues, etc.
3. **Protection against low-speed engine pre-ignition (LSPI).** This specifically refers to LSPI attributed to engine oil.
4. **Adequate wear protection for frequently started engines.** These engines experience frequent starts and/or starts after extended periods of downtime.

A number of changes have been proposed by ILSAC. Some of the tests are **new** and replacement from the existing tests that were part of the GF-5.

These are as follows:

- **Sequence IIIG**: Replaced with Chrysler Oxidation and Deposit test - IIIH
- **Sequence VD**: Replaced with a Ford Sludge and Varnish test - VH
- **Sequence VID**: Replaced with GM Fuel efficiency - VIE, **appetite / sensitivity**
- **Sequence IVA** : Replaced by Toyota Low temperature Cam and Tappet Wear test - IVB
- **LSPI Test** : New Ford low-speed pre-ignition test
- **Chain Test** : New Ford Chain wear test

LSPI and Chain wear are the two new proposed engine tests by ILSAC. Similarly, SAE will introduce a new viscosity grade for GF-6 (currently proposed as **SAE 16**), to its J300 specification. This viscosity grade has been established primarily for the fuel economy benefits of **low-viscosity oils**.

SUB –CATEGORIES:

ILSAC GF-6 will have two subcategories (one backward compatible and one not). The two subcategories will be called **ILSAC GF-6A** and **ILSAC GF-6B**.

ILSAC GF-6A is the successor to GF-5 and will be backward compatible. It will include SAE 0W-XX, SAE 5W-XX and SAE 10W-30 oils. The minimum high-temperature/ high-shear viscosity for all GF-6A grades will be 2.6 mPa-sec.

ILSAC GF-6B is a subcategory meant for the **SAE 0W-16** and **SAE 5W-16** viscosity now being developed. They will **not be backward** compatible. GF-6B may have the same performance requirements as GF-6A except for a high-temperature/high-shear viscosity of less than 2.6 mPa-sec. ILSAC GF-6B may be too low for older engines.

ILSAC GF-6B is primary a Japanese OEM requirement. Japanese Automobile Manufacturers Association (**JAMA**) is targeting to license the new SAE 0W-16/5W-16 grades in API system for use primarily in Japan. The most current request is that licensing of API SN-RC oils of these viscosity grades will ensure fuel economy performance at a level beyond SAE XW-20. There are concerns of the low viscosity oils given the limited experience of existing engines to handle oils below 2.6 HTHS viscosity.

PC-11:

In 2011 the National Highway Traffic Safety Administration (**NHTSA**) issued a regulation, which phases in from 2013 to 2018, that limits greenhouse gases and for the first time requires fuel economy improvements for medium and heavy-duty trucks.

This was a primary driver for **PC-11**. In June 2011 the Engine Manufacturers Association (**EMA**) asked the American Petroleum Institute (**API**) to develop a new lubricant category for heavy-duty diesel engines that were being developed. PC-11 (***PC stands for proposed category***) will offer performance beyond the time-tested API CJ-4 engine oils.

The CJ-4 oil specification was introduced in October 2006 and has been the performance standard for past several years. But since October 2006, engine designs have changed significantly.

The need for **PC-11** was mainly driven by:

- ✓ Proposed U.S. government regulations on **fuel economy** and **CO2 emissions**.
- ✓ Increasing use **Biodiesel** use.
- ✓ The need for improved protection from higher engine temperatures.
- ✓ The need for improved shear stability.
- ✓ The need for adhesive wear protection.
- ✓ The need to reduce or eliminate engine oil aeration.

EMA requested that the new category for lubricants be split into separate and distinct subcategories, one that is backward compatible to the old heavy-duty requirements (higher HTHS) and one that provides fuel efficiency benefits while maintaining durability (lower HTHS).

The proposal presented by the EMA includes performance specifications to address:

- ➢ Compatibility with and protection from biodiesel.
- ➢ Better engine protection from aeration.
- ➢ Better protection against scuffing wear.
- ➢ Improved shear stability and oxidation stability.

After receiving the request, API determined that a need did indeed exist and eventually established the PC- 11 designation. In addition, the institute recognized the need to establish new category tests.

PC-11 will introduce **two new oils**:

- One will be increased engine protection at traditional viscosities, and the other will be new oils at lower viscosity which meet the same performance requirements.
- Two separate designations are sought for the two distinct specifications. PC-11 is scheduled for API licensing by **April 1, 2016**.

PC-11 TEST:

Four new engine tests are in development for PC-11.These is as follows:

- ➢ **Caterpillar C-13**: Engine Oil Aeration Test
- ➢ **Mack T-13**: Ring and Liner Wear & Oil Oxidation test.
- ➢ **Detroit Diesel DD13**: Scuffing Test **(reproducibility issue / field relevance?)**
- ➢ **Caterpillar Oxidation Test:** Oil thickening due to Oxidation (Mack T-13 as Option?)
- ➢ **Shear Stability:** DEOAP decided to retain the same Kurt Orbhan test at the current 90 cycles

Except a new stay in grade minimum limit for SAE XW40 oils of 12.8 cSt minimum after a 90 cycles Kurt Orbhan shear test (currently the limit is 12.5 cSt) will be implemented. There might be a notable exception for 0w-40, which would remain at the current limit of 12.5 cSt, as they need to

meet the desired timing and have to finish the BOI and VGRA requirements for the new test inclusion.

All this will represent substantial investment for all parties involved in introducing these new categories. The challenge still exists to meet the timeline of introducing two API categories separated by a year.

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