

Evolving Interchange Guidelines

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Evolution of the European (ACEA) Specifications

The first ACEA European Oil Sequences were published in 1996 and cover the service fill engine oils specifications for gasoline (A Sequences) and light duty diesel engines (B Sequences) as well as for heavy duty diesel engines (E Sequences).

Over the years, these specifications evolved and are mainly driven by increasingly stringent European emission legislation. Initially the focus was on the reduction of SO₂, NO_x and Particulate Matter emissions, which in 2004 did lead to the introduction of new engine oil specifications for compatibility with exhaust after treatment systems (C Sequences). Now that tail pipe emissions have been reduced drastically the focus moved to the reduction of CO₂ emissions, which in practice translates to fuel economy improvements through friction reduction and hence the use of lower viscosity oils. To meet the viscometric requirements of the changing viscosity grades different base oil use shifted from Group I to Group II, III and IV base stocks.

The existing Viscosity Grade Read Across (VGRA) and Base Oil Interchange (BOI) guidelines were introduced

in 1996 together with the first ACEA Sequences and did not hold pace with the evolution in specifications.

The complexity challenge

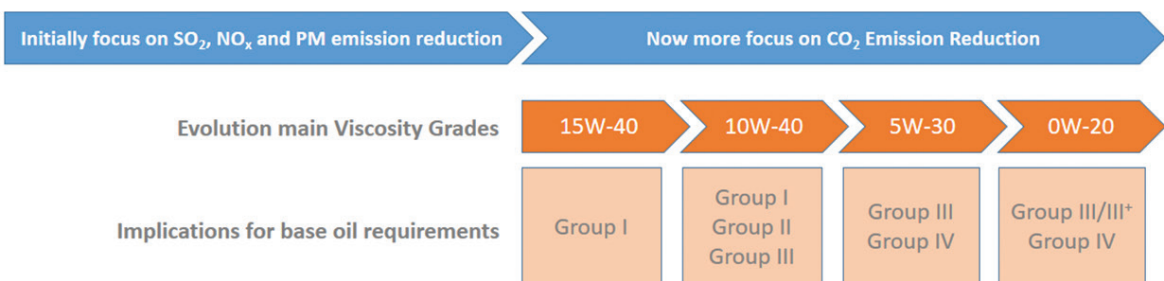
In the meantime the number of ACEA Sequences increased from 8 Categories in 1996 to 13 categories in the 2016 ACEA Sequences. On top of this the number of new engine tests expected in the “2020” Sequences has also drastically increased with one CEC test for the Heavy Duty Sequences and two new CEC tests for the Light Duty Sequences. For these new tests no interchange guidelines are available.

VGRA and BOI guidelines can contribute to managing the increased complexity and reduce engine oil development costs, while continuing to assure final product performance. ATIEL and ATC therefore joined forces to bring the development of Read Across Guidelines for (new) CEC Sequences forward and in 2017 embarked on the first European Industry Read Across test program.

As there was no process in place to develop Read Across Guidelines for new engine tests ATIEL and ATC jointly designed a framework for Read Across



Engine Oil Specifications driven by Emission Legislation



Increased use of Group II and III base oils in Light and Heavy Duty

- Very limited BOI interchange guidelines for Grp II and III
- Current guidelines focused around group 1 base stocks

Continued on page 42

development. It was agreed to proceed with the development of VGRA guidelines for the EP6CDT engine. A statistically designed test matrix was developed covering a maximum of 16 engine tests. The costs for the test program were equally shared across both industry associations. The program was completed in 2018 resulting in a VGRA Guideline allowing more flexibility for the industry. This guideline was published in the ATIEL Code of Practice Issue 21 in May 2019 and is now available for the industry.

Future Programs – Viscosity Grade read Across

After the success of the first interchange program, the industry is committed to continue with the development of further guidelines. For the next VGRA program, the industry established criteria to assist in the prioritisation of the next engine test to be tackled. There is a preference for the development of guidelines for new tests rather than for any existing test as 1) no guidelines are available for a new test and 2) benefit for the industry is maximised as the entire lifetime of the test from introduction to end of life is captured. Other selection criteria include test costs, duration of the test, coverage in the ACEA Sequences (is the test used in both Light and Heavy Duty Sequences). Based on these criteria ATIEL and ATC agreed to prioritise the development of VGRA guidelines for the new Toyota Turbocharger Test.

Future Programs – Base Oil Interchange Options

The development of base oil interchange guidelines is more complex as it potentially has to cover read-across within a base oil group and/or between base oils groups. To illustrate this we take the Peugeot EP6 Engine as an example. If base oil read across within Group II and III and between Group II and III is considered then a matrix design covering 3 base oil slates, 3 viscosity grades in 3 different additive technologies would result in a total of 22 tests requiring funding of €1,5 M. which can be prohibitive.

One of the options is to exclude interchange between base oil groups and only consider interchange within a group e.g. between Group III and Group III or Group II and Group II.

Another option is to take a stepwise approach designing the matrix with the ability to analyse at checkpoints, if the data shows with good statistical confidence at an earlier stage whether interchange is possible or not, then testing can be stopped. ATIEL is

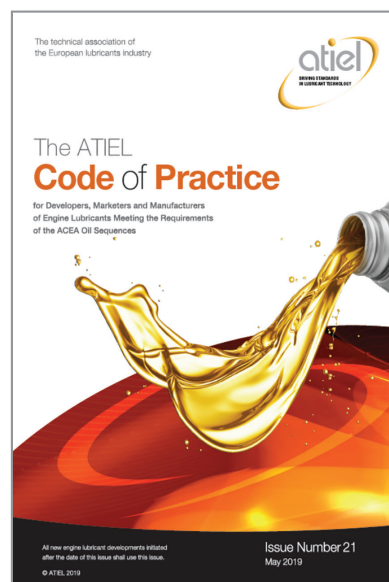
currently designing a base oil interchange matrix for one of the engine tests to evaluate and understand the requirements and costs. Target is to propose a full program that is affordable and technically and statistically robust.

Industry Challenges

The increased complexity poses many challenges for the industry. The development of interchange guidelines is an important option to reduce the complexity and associated costs for the industry, increasing speed to deliver new lubricants required by new vehicle, while never compromising on performance and quality standards.

Within the industry, alignment is required in the organisations and between the organisations. The costs of programs can be very high and needs to be shared amongst the beneficiaries. Funding of the programs is a key challenge and the question of how to distribute the costs is a debate that is ongoing and needs to be resolved. In addition, also the availability of test engines raises another difficulty for which alignment is required.

Ultimately, ATIEL believes that the best option is to include VGRA and BOI guideline development in the CEC test development phase. This is similar to the approach that API takes in the US, but in Europe there are still hurdles to overcome before this can be realised.



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