The technical association of
the European lubricants industry

atiel
DRIVING STANDARDS
IN LUBRICANT TECHNOLOGY

The ATIEL
Code of Practice

for developers and marketers of engine lubricants meeting the requirements of the ACEA Oil Sequences

Supersedes all previous issues. Applicable to all new engine lubricant developments initiated after the date of this issue.

Issue Number 19
September 2013

Foreword

This Code of Practice has been devised by ATIEL on behalf of the European engine lubricants industry. It is intended to aid continuous improvement in the development of engine lubricants and the consistency and validity of performance claims made for them.

This Issue of the ATIEL Code of Practice is published by ATIEL and comes into effect on 9th September 2013. It supersedes Issue 18, which is withdrawn, although it and earlier issues will remain available on the ATIEL website.

This issue is part of a continuing effort to ensure the Code remains fit-for-purpose in its intended use and remains compatible with the latest version of the ACEA Oil Sequences and to make further improvements. It aligns the Code with the 2012 ACEA Oil Sequences. Technical modifications to the previous issue of this Code are printed in red.

This revision is part of a continuing effort to ensure the Code remains fit-for-purpose in its intended use and remains compatible with the latest version of the ACEA Oil Sequences and to make further improvements. This includes revision of B.6 Guideline for selection of the most severe base stock.

To ensure that users of the Code of Practice interpret the document correctly, attention is drawn to the following Table that shows the meaning to be associated with the auxiliary verbs 'shall', 'should', 'can' and 'may':

Verb	Meaning	Example
shall	mandatory requirement, command	Guidelines included in API 1509 shall be applied.
should	recommendation	Lubricant marketers should be able to demonstrate…
can	capability, ability	PAOs can be interchanged without additional testing
may	permission, sanction	A data package may be used to support performance.

The latest version of this document is available on the ATIEL website (www.atiel.org). New versions of the ATIEL Code of Practice are uploaded to the ATIEL website as they are issued. In addition, a notification is sent to an email ID nominated by each signatory of the ATIEL Letters of Conformance. This email address is also used to supply additional information on matters relating to the Code.

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Questions arising from the Code of Practice should be communicated to the ATIEL Secretary General at:

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1 Introduction

1.1 General

ATIEL is committed to supporting the development and marketing of automotive engine lubricants that fully satisfy the European performance and quality requirements deemed necessary by the European Automobile Manufacturers' Association (ACEA) for satisfactory engine life and operation.

The ATIEL Code of Practice, hereafter referred to as the Code, forms an integral part of the European Engine Lubricant Quality Management System (EELQMS) that has been developed jointly by the European Automobile Manufacturers' Association (ACEA), the Technical Committee of the Petroleum Additives Manufacturers in Europe (ATC) and ATIEL.

The purpose of the Code is to provide lubricant marketers with a mechanism, and a commitment, to standardise their practices when developing engine lubricants for which compliance with the ACEA Oil Sequences[1] is claimed. It specifies engine tests, procedures, and record keeping. The Code has been in operation since 1996 and has made a significant contribution to testing and product quality levels for engine lubricants.

The Code is available to all companies on a voluntary basis and nothing in the Code forms part of a contract.

Note 1: The EELQMS, of which the ATIEL Code of Practice forms part, is a voluntary system. However, it may be mandatory in circumstances where it is required by external bodies -see 2.1.

1.2 Overview of the Code

The Code applies to the ACEA Oil Sequences[1] (see 2.1) and stresses the importance of testing requirements as a pre-requisite to the generation of consistent and precise test data. The Code provides a series of guidelines to be observed during the process of lubricant development, commencing with the commissioning of the test programme on the lubricant candidate (see 2.2). The Code describes:

- the changes that can be made to the composition of this lubricant (see 2.3 and 2.4) during its development, consistent with the basic principles of best industry practice;
- the standards that should be exercised in the reporting of test results;
- the maintenance of test records (see 2.5).

The Code requires that all procedures and test reporting are subjected to internal auditing and that an accredited auditable quality management system (QMS) is used for blending and manufacture of the final product (see Section 4).

[1] *ACEA European Oil Sequences: Service Fill Oils for Gasoline Engines, Light-Duty Diesel Engines, Engines with After-Treatment Devices and Heavy-Duty Diesel Engines,* ACEA, Avenue des Nerviens 85, B-1040 Bruxelles, Belgium. Available at www.acea.be

1.3 Lubricant marketers' responsibilities

1.3.1 Overall responsibilities

The lubricant marketer is fully responsible for the quality of the lubricant reaching the consumer, together with the performance claims being made in the marketplace. The lubricant marketer remains responsible for all aspects of product liability.

Note 2: A lubricant marketer is defined[2] as the marketing organisation responsible for the integrity of the brand name and the representation of the branded product in the market place.

1.3.2 Specific lubricant marketers' responsibilities

In addition to the overall responsibilities described in 1.3.1, specific lubricant marketers' responsibilities are given in the following sections:

- Section 2.2.4 Test(s) 'Out of Control' or 'Test Unavailable' provisional data set requirements;
- Section 2.3.3 Lubricant marketers' responsibilities;
- Section 2.4 Use of OEM approvals to evaluate lubricant performance against ACEA Oil Sequence requirements;
- Section 2.5 Data set requirements;
- Section 3 Description of the European Engine Lubricant Quality Management System;
- Section 4 Blending plant requirements.

[2] API Publication 1509 *Engine Oil Licensing and Certification System,* American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005, USA, available at www.api.org

2 ATIEL Code of Practice

2.0 General

This Code provides a technical framework for the development of automotive engine lubricants, either independently by a lubricant marketer or by a process involving the collaboration of a third party, such as a petroleum additive supplier. In either case, the lubricant marketer's responsibilities described in Section 1.3.1 apply. The Code provides the lubricant marketer with a set of guidelines and standards considered by ATIEL to be compatible with current industry best practice. The primary aim is to generate an ACEA Performance Data Set to support fully the technical integrity of a candidate lubricant relative to the ACEA performance requirements.

The key steps for developing engine lubricants to meet ACEA Oil Sequences are shown in Figure 1.

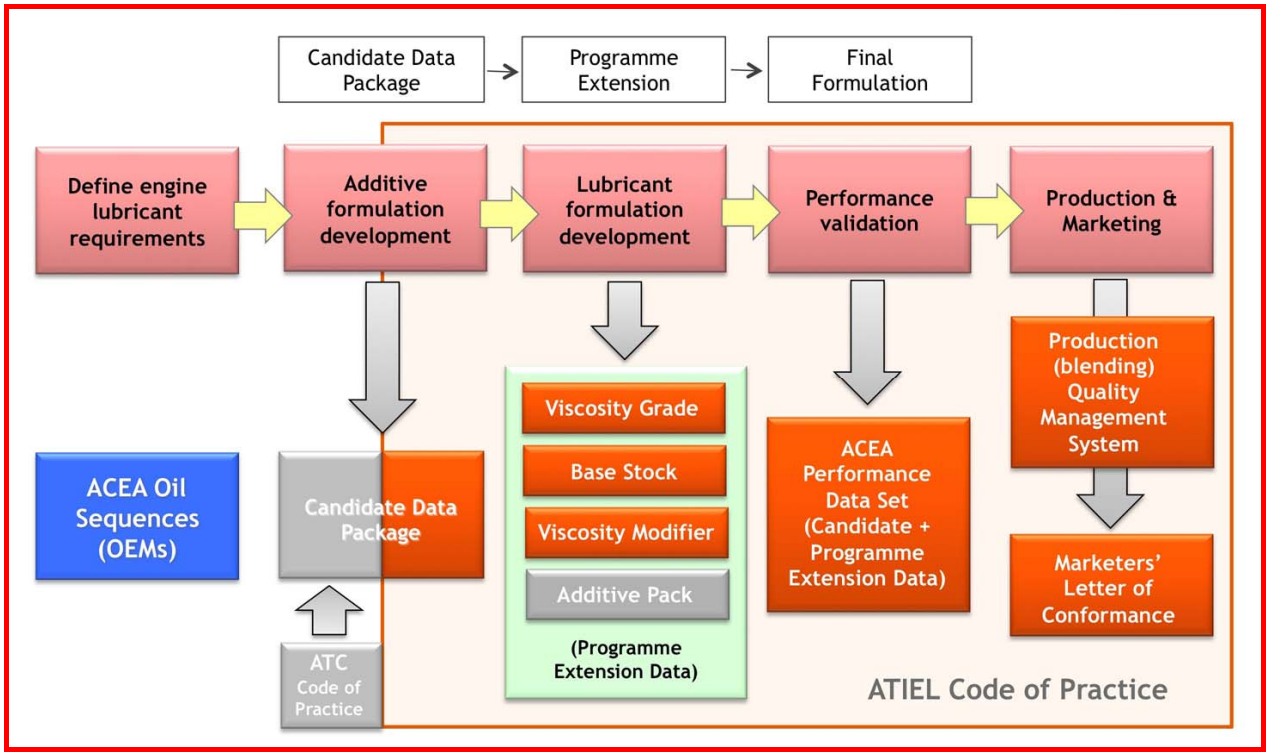

Figure 1 Steps for developing engine lubricants to meet ACEA Oil Sequences

All steps are auditable by a recognised QMS such as, but not limited to, those described in ISO 9001[3] , ISO/TS 16949[4] and ISO 17025[5]. The process is one of self-certification and the development process of ACEA quality lubricants using this Code shall be referred to in the marketer's quality management procedures.

[3] *ISO 9001 Quality management systems,* International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, available at www.iso.org

[4] *ISO/TS 16949: Quality management systems: Particular requirements for the application of ISO 9001:2008 for automotive production and relevant service part organizations,* available at www.iso.org

[5] *ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories*, available at *www.iso.org*

2.1 ACEA Oil Sequences

ACEA, which represents the vehicle manufacturers in Europe, has issued an engine lubricant classification system[1] setting stringent demands on lubricants to satisfy changes in engine hardware technology operating under European conditions.

The ACEA Oil Sequences for service-fill engine lubricants cover present needs for gasoline and light-duty diesel engines, engines with after-treatment devices and heavy-duty diesel engines; these sequences are further sub-divided into individual performance categories.

Each sequence comprises laboratory tests and engine tests, to be run in accordance with test methods developed by ASTM[6] and CEC[7]. The ACEA Oil Sequences represent minimum standards to be met voluntarily by lubricant marketers. However, ACEA has specified[1] the following:

> *'**Conditions for use of performance claims against the ACEA Oil Sequences***
>
> *ACEA requires that any claims for oil performance to meet these sequences must be based on credible data and controlled tests in accredited test laboratories.*
>
> *ACEA requires that engine performance testing used to support a claim of compliance with these ACEA sequences should be generated according to the European Engine Lubricants Quality Management System (EELQMS), but ACEA reserves the right to define alternatives in exceptional cases.*
>
> *EELQMS which is described in the ATIEL Code of Practice, addresses product development testing and product performance documentation, and involves the registration of all candidate and reference oil testing and defines the compliance process. Compliance with the ATIEL Code of Practice is mandatory for any claim to meet the requirements of the 2012 issue of the ACEA sequences. Therefore ACEA requires that claims against the ACEA oil sequences can only be made by oil companies or oil distributors who have signed the EELQMS lubricant marketers' Letter of Conformance (for details: www.atiel.org).'*

As indicated in this statement, ACEA reserves the right to define alternative requirements in exceptional circumstances. Where ACEA unilaterally defines such alternative criteria that do not meet the criteria set out in this Code, ATIEL dissociates itself from any such initiative.

2.2 Testing requirements

2.2.1 General

An essential aim of the Code is to ensure the use of a system of statistically valid testing based on current best industry practices. In this regard, ATIEL recognises the importance of existing industry practices as provided under Codes of Practice developed by ATC and the American Chemical Council (ACC), namely:

- the ATC[8] Code of Practice as applied to CEC test methods

[6] ASTM 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 USA. www.astm.org

[7] *CEC The Co-ordinating European Council for the development of performance tests for fuels,lubricants and other fluid,* Lynk House, 17 Peckleton Lane, Desford, Leicestershire, LE9 9JU, UK. www.cectests.org

[8] *ATC Code of Practice*, ATC Sector Group, CEFIC, Avenue E van Nieuwenhuyse 4, Box 1, B-1160 Bruxelles, Belgium, available at www.atc-europe.org

- the ACC Petroleum Additives Product Approval Code of Practice[9] as applied to ASTM test procedures. ATIEL shares with both the ACC and ATC a mutual interest in the operation of practices by which engine lubricant tests are monitored regularly to encourage more consistent and precise operation and which also act to stimulate the continuous improvement of such test procedures.

Sections 2.2.2 to 2.2.4 describe the critical aspects of these Codes that ATIEL considers to be essential elements of the testing regime.

2.2.2 Quality requirements

2.2.2.1 Test methods

The basis of the Code is the availability of quality engine and laboratory test methods, without which lubricants with the required performance cannot be developed. The Code applies, therefore, only to those ACEA Oil Sequences specifying the use of test methods conforming to minimum quality and precision standards. Currently, the minimum quality/precision requirement is either a CEC[7] designated test with a precision statement or an ASTM[6] test method, also with a precision statement. The Code does not apply to test methods deemed to be of a lower quality than CEC or ASTM tests.

2.2.2.2 Laboratory accreditation

The Code requires laboratories conducting CEC tests to:

- cover these tests within the scope of their ISO 17025[5] accreditation or equivalent;
- submit to the ATC-European Registration Centre[10] (ATC-ERC) a letter of intent to comply with the ATC Code of Practice.

ASTM tests shall be conducted in accordance with the requirements specified in the ACC Code of Practice.

2.2.3 Test registration and tracking

The ATC Code of Practice requires that all candidate lubricant engine tests and all reference lubricant tests be carried out by a registered test laboratory. In addition, CEC and ASTM engine tests shall be registered with the ATC-ERC[8] and the ACC-Monitoring Agency[11](MA), respectively. The purpose of this registration is to provide unambiguous documentation and a simple tracking system for all registered engine tests, thereby facilitating auditing of the test development process.

2.2.4 Test(s) 'Out of Control' or 'Test Unavailable' - provisional data set requirements

In the event that either ASTM or CEC declares any test used in any ACEA Oil Sequences 'out of control' or 'unavailable', ATIEL shall notify by e-mail all ATIEL Letter of Conformance signatories and post the information on the ATIEL website (www.atiel.org). The date of the ASTM or CEC declaration will also be posted on the ATIEL website.

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[9] *ACC Product Approval Code of Practice,* American Chemistry Council, 700 Second St., NE, Washington, DC 20002, USA, available at www.americanchemistry.com/paptg

[10] ATC European Registration Centre, 6555 Penn Avenue, Pittsburg, PA 15206, USA, https://atc-erc.org

[11] American Chemistry Council Monitoring Agency, https://acc-ma.org

Under these circumstances, it is permitted to use, on a provisional basis only, a data set that is complete except for the data from this one test in support of performance claims against single or multiple ACEA Oil Sequences.

The use of this temporary waiver shall be properly documented in the Candidate Data package by ticking the appropriate boxes on Form D.1 (Candidate Data Package checklist) and Form D.2 (Programme Extension Data checklist) of Appendix D and inserting the text ‘out of control ‘or ‘test unavailable’, as appropriate, in the relevant test result field in Form D.3 Parts B and C of the ACEA Performance Data Set.

In addition, the lubricant marketer shall include data based on Fundamental Formulation Knowledge, as defined in the ATC Code of Practice[6], to support the performance of the candidate formulation in the test that was not conducted.

A lubricant marketer using the procedure described in this Section to support temporarily the claims made against ACEA Oil Sequence(s) remains responsible for product quality, as described in 1.3.

After ATIEL has officially notified all ATIEL Letter of Conformance signatories by email that the test in question is ‘no longer out of control’ or is now ‘available’, the lubricant marketer using a waived data set shall obtain a valid passing result in this test within six months of the notification to maintain the ACEA claim. This expiry date will be posted on the ATIEL website.

If a valid passing result cannot be obtained within six months of the notification, the subject data set can no longer be used to support claims made against the particular ACEA Oil Sequence(s).

In the event that either ASTM or CEC declares more than one test used in any ACEA Oil Sequences ‘out of control’ or ‘unavailable’, ATIEL shall notify by e-mail all Letter of Conformance signatories and post the information on the ATIEL website, clearly stating that data set without these engine tests cannot be used to support any ACEA Oil Sequences claim.

2.3 Read-across and interchange guidelines

2.3.1 General

Read-across and interchange guidelines define the minimum physical and engine testing necessary to ensure the engine lubricant performance remains compliant for the ACEA Sequences claimed. Following the guidelines ensures that the lubricant meets the requirements of the ACEA Oil Sequence being claimed. The following guidelines have been developed for engine tests used in the ACEA Oil Sequences:

- viscosity grade read-across (VGRA) – see 2.3.4
- base oil interchange (BOI) – see 2.3.5
- viscosity modifier interchange (VMI) – see 2.3.6
- performance additive package modifications – see 2.3.7.

ATIEL revises the guidelines periodically as a result of new test data, new or revised test methods or changes in the ACEA Oil Sequences.

2.3.2 Restrictions

2.3.2.1 During the design of a test programme, each individual interchange shall be considered step by step. This evaluation shall be documented and be available for auditing. BOI, VMI, VGRA and performance additive package modifications are four different ’interchanges’, each looking at

a single aspect of the engine lubricant formulation. The guidelines designed for that specific case must be applied separately**.**

The purpose of the step-wise evaluation is to identify which engine lubricant formulations are to be tested in which engine tests to support the intended ACEA Oil Sequence performance.

The availability of the test programme design document shall be confirmed in the Forms D1 and D2 checklists.

The evaluation documentation shall be confirmed in the Forms D.2 and D.3 checklists.

The purpose of this process is to provide transparency on the proper use of the guidelines.

2.3.2.2 Unless otherwise specified, read-across is not allowed for laboratory tests.

Note 3: Laboratory tests are those specified in the ACEA Oil Sequences (and are also summarised on Form D.3 of Appendix D). They include bench tests such as Noack Evaporation Loss and Foaming Tendency, physical tests such as viscosity, and chemical analyses such as phosphorus and sulphur concentrations.

2.3.3 Lubricant marketers' responsibilities

Following the read-across guidelines does not absolve the lubricant marketer of the responsibilities described in 1.3.

When applying the guidelines, lubricant marketers shall:

a) ensure that the current guidelines and most up-to-date amendments applicable to the issue date of the ACEA Oil Sequences being claimed are used.
b) ensure that a product meets the specifications claimed against the ACEA Oil Sequence by carrying out the minimum acceptable level of testing defined by the guidelines.
c) run engine tests required to support read-across or interchange in accordance with the ACC or ATC Codes of Practice, as applicable.
d) demonstrate actual performance by testing the original formulation in the specific engine test for which read-across will be applied.
e) use for read-across purposes, only engine test results meeting or exceeding the requirements specified in the relevant ACEA Oil Sequence.
f) observe the restrictions described in 2.3.2.

2.3.4 Guidelines for viscosity grade read-across

VGRA guidelines have been developed to allow extrapolation of engine test data from one viscosity grade[12] to another under certain conditions. The guidelines have been developed by ATIEL and API and are described in detail in Appendix A.

2.3.5 Guidelines for base oil interchange

Base oils can differ in their physical properties and chemical composition, which may result in differences in the performance of formulated engine lubricants in engine tests and in service.

[12] *SAE J300 Engine Oil Viscosity Classification*, SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, USA. Available at www.sae.org

The ATIEL BOI guidelines define the minimum engine testing necessary to ensure that the standard of engine lubricant performance defined by the ACEA Oil Sequences will be maintained when one base oil is substituted by another.

Apply the BOI guidelines in Appendix B.

2.3.6 Guidelines for viscosity modifier interchange

Viscosity modifiers (VMs) can differ in their molecular structure and chemical composition, which may result in differences in the performance of formulated engine lubricants in engine tests and in service. The ATIEL VMI guidelines define the minimum engine testing required to ensure that the standard of engine lubricant performance defined by the ACEA Oil Sequences is maintained when substituting one VM for another.

Apply the guidelines in Appendix C.

2.3.7 Performance additive package modifications

Modifications or additions to the performance additive package may be required. Apply the Performance additive package modification guidelines contained in the ATC or ACC Codes of Practice[8,9], as appropriate, when making performance additive changes. These Codes also define changes allowed for other additives, such as pour point depressants and foam inhibitors. All modifications to the performance additive package shall be documented. The availability of the test programme design document shall be confirmed in the Forms D.1 and D.2 checklists.

2.4 Use of OEM approvals to evaluate lubricant performance against ACEA Oil Sequence requirements

Some of the engine tests and limits included in ACEA Oil Sequences also form part of individual Original Equipment Manufacturers' (OEMs) in-house specifications and approvals. By granting approval for a specific lubricant formulation against an in-house specification, the OEM endorses that the lubricant formulation has particular performance capabilities in the specific engine test(s) involved.

The lubricant marketer may, therefore, opt to use an OEM approval for a given lubricant formulation in support of an ACEA performance claim for the same formulation instead of carrying out a test, solely for the purpose of meeting ACEA requirements. This option may be used even if the OEM approval is given without the test having been carried out on the specific lubricant formulation. The following conditions shall be met whenever an OEM approval is used in this way:

a) Only OEMs sponsoring engine test(s) included in the ACEA Oil Sequences and having a lubricant approval system are qualified.
b) OEM approvals used instead of testing are only valid for the test(s) that the OEM sponsors.
c) Test procedure and limits for a test involved with an OEM approval are the same or more severe than those specified in the ACEA Oil Sequences.
d) Additive package modifications involved in obtaining the OEM approval shall meet the requirements of the ACC or ATC Codes of Practice, as appropriate.
e) Once the formulation for the engine lubricant to be marketed is defined and identified by a specific formulation code number, the lubricant marketer shall obtain specific written confirmation of the approval for the engine lubricant from the OEM, even if there is a generic, package or blanket approval letter.

f) The lubricant marketer shall include all relevant test data and the OEM approval letter in the documentation supporting the ACEA Oil Sequence claim.

2.5 Data Set Requirements

2.5.1 General

The test data used to support ACEA Oil Sequence performance claims are the responsibility of the individual lubricant marketer. Test data documentation requirements are divided into the following three distinct categories:

a) Candidate Data Package
b) Programme Extension Data
c) ACEA Performance Data Set.

2.5.2 Candidate Data Package

The ACEA Performance Data Set is derived from the Candidate Data Package (referred to as ATC-Candidate Data Package in ATC Code of Practice) and, if appropriate, any Programme Extension Data. The Code requires all CEC engine tests to be conducted in accordance with the ATC Code of Practice[8]. When ACEA Oil Sequences involve ASTM tests, the ACC Code of Practice[9] applies. Use the Form D.1 checklist of Appendix D to compile the information to be contained in the Candidate Data Package. It is recommended that this checklist is adopted for internal audit purposes.

2.5.3 Programme Extension Data

Lubricant marketers are permitted to apply read-across and interchange guidelines and performance additive package modifications to derive Programme Extension Data from the Candidate Data Package (see Figure 2). The ATC and ACC Codes of Practice[8,9] provide the guidelines regarding performance additive package modifications. Read-across and interchange guidelines specify the circumstances under which the Candidate Data Package may be extended to different viscosity grades, different base oils and different VMs. Apply the read-across and interchange guidelines described in 2.3.

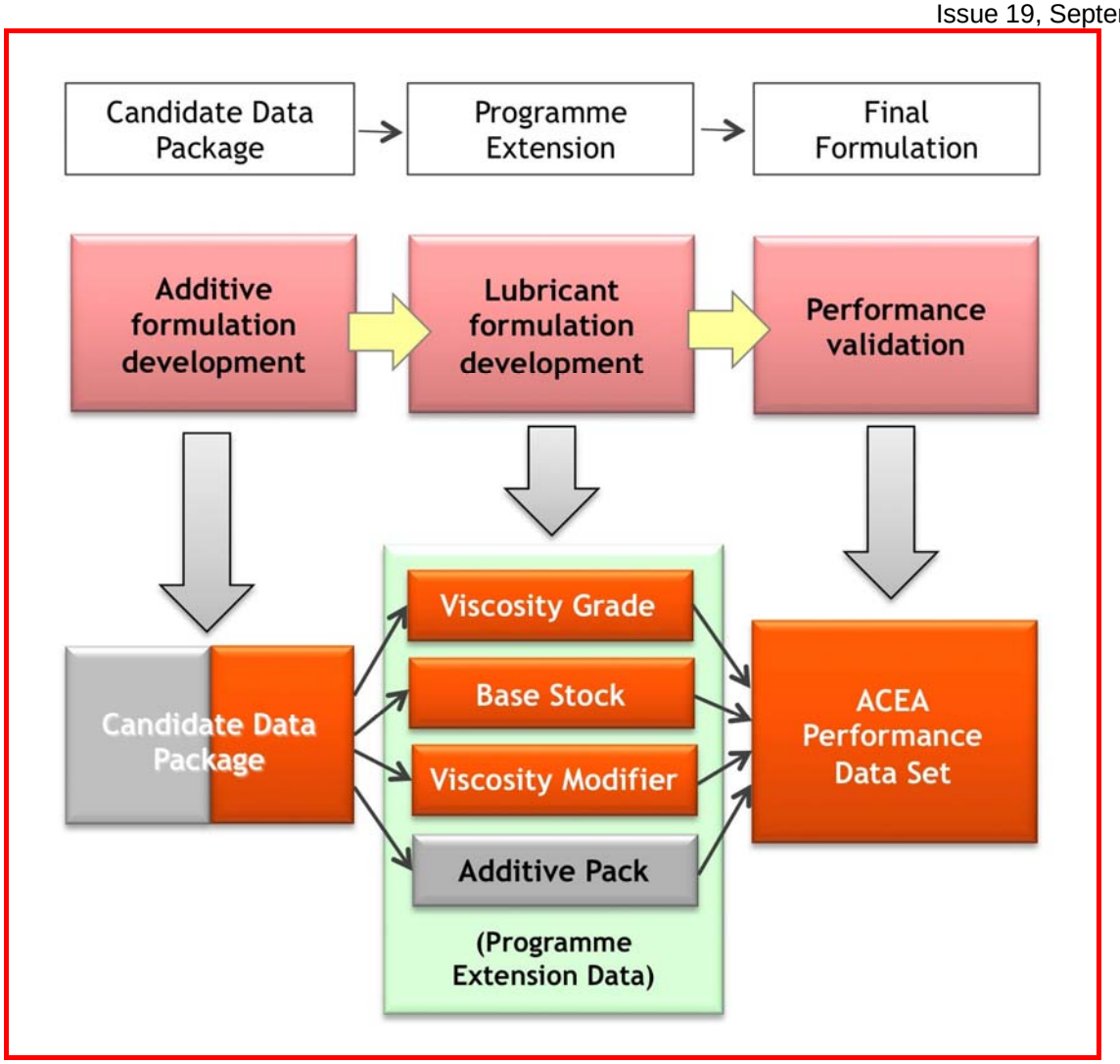

Figure 2 The derivation of the Programme Extension Data from the Candidate Data Package

In accordance with 2.3.2.2, all final formulations shall be tested to demonstrate compliance with the laboratory test requirements included in the ACEA Oil Sequences to be claimed.

Use the Form D.2 checklist of Appendix D to compile the information to be contained within the Programme Extension Data. It is recommended that this checklist is adopted for internal audit purposes.

2.5.4 ACEA Performance Data Set

All lubricant marketers shall maintain a complete record of each test development programme conducted under the Code. The ACEA Performance Data Set is a summary of the total documentation required by a lubricant marketer to confirm the performance of an engine lubricant against the relevant ACEA Oil Sequence(s).

The lubricant marketer shall hold on file a copy of the ACEA Performance Data Set for each brand and viscosity grade of engine lubricant. This Data Set is company confidential, but shall be made available for Quality Management System audit purposes or, with the lubricant marketer's consent, for review by an external organisation. A standardised format for the ACEA

Performance Data Set has been developed comprising the following sections (see Form D.3 of Appendix D):

- Part A: Details of the lubricant marketer and engine lubricants
- Part B: Laboratory tests
- Part C: Engine test results
- Part D: Checklist and qualification conformance.

2.6 Revisions and updates of the ACEA Oil Sequences

2.6.1 Validity of the ACEA Oil Sequences

The ACEA Oil Sequences are under constant development. Replacement tests and other changes required by European automobile manufacturers are integrated and new issues are published on a regular basis.

The time permitted between the issuing of new ACEA Oil Sequences and commercial implementation is specified by ACEA. Validities of new and old editions of the ACEA Oil Sequences overlap for limited periods of time and are detailed in the sequences[1].

2.6.2 Equivalency guidelines ('grandfathering')

These Guidelines describe acceptable 'grandfathering' of CEC and ASTM engine test results. The ACEA Oil Sequences identify those tests which ACEA has identified as suitable for the application of grandfathering principles.

Note 4: 'Grandfathering' is a clause exempting certain pre-existing classes of people or things from the requirements of a regulation.

ERC registered engine test results generated prior to the revision of test procedures and test limits that comply with ACEA-2010 requirements may be used in place of the new results generated under the new procedure or limit. It has been recognised by ATIEL/ACEA/ATC that, for the tests specified below, the data from the earlier version of the test, assessed versus the ACEA-2010 oil sequence limits, can be read-across in place of the later version. This is because the revised procedure/limit does not signify an increase in severity or change of quality level.

The intent of this Guideline is to avoid the need to re-run later versions of the procedure or report results in revised form when existing prior data are considered to provide the necessary quality assurance.

Test equivalency applies to certain test parameters contained in specific ACEA Oil Sequence categories. Grandfathering is permitted for the following tests under circumstances defined in the ACEA-2012 Oil Sequences:

- DV4TD to DV6C (when this test becomes available)
- OM441LA to OM501LA
- OM602A to OM646LA (for E-sequences only)
- Cummins M11 or M11EGR to Cummins ISM
- Mack T-11 to Mack T-8E
- Mack T-10 to Mack T-12 at API CI-4 merit number.

3 Description of the European Engine Lubricant Quality Management System

3.1 General

ATIEL shares with ACEA, ATC and CEC a mutual interest in the development of improved lubricants in Europe as required by the automotive industry. The European Engine Lubricant Quality Management System (EELQMS) arose out of this shared interest and was developed through close collaboration by the stakeholders. An overview of the elements of the EELQMS is shown in Figure 3.

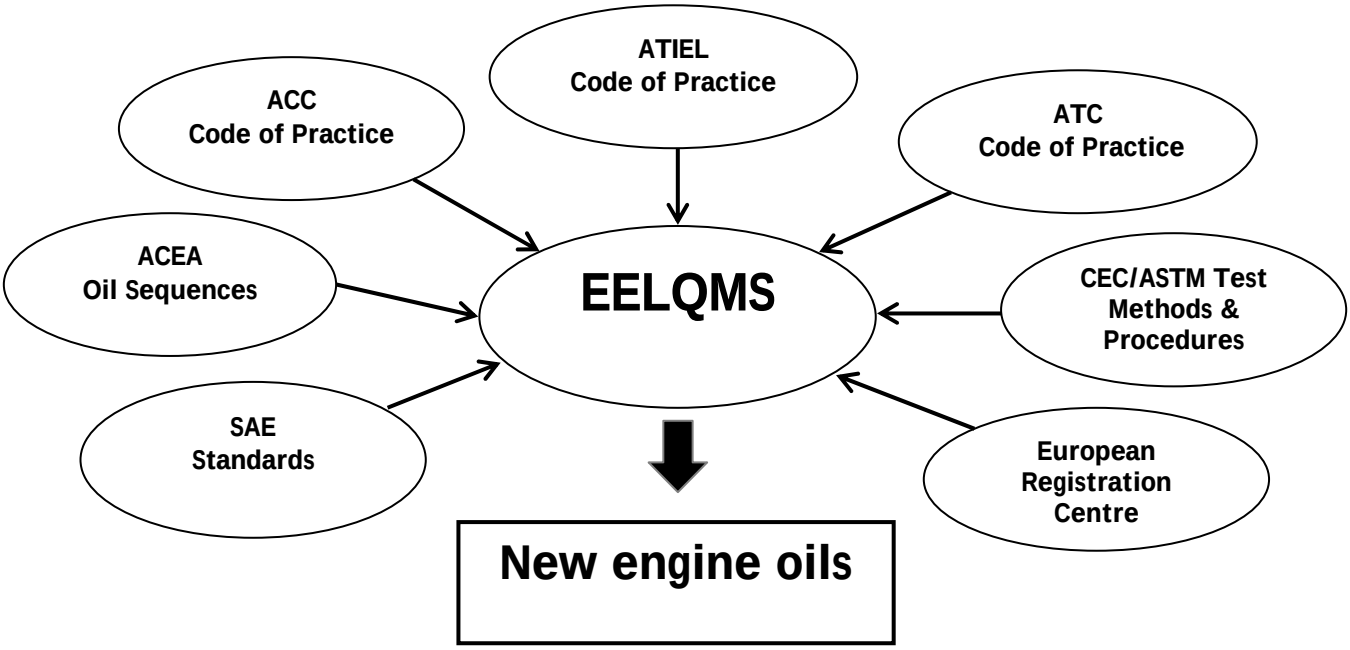

Figure 3 Overview of the EELQMS

As shown in Figure 3, the EELQMS embraces various standards, test methods and procedures, Codes of Practice and the ACEA Oil Sequence requirements. The EELQMS has led to the development of:

- improved specifications by ACEA for service-fill engine lubricants[1];
- new test procedures by CEC[7] with better discrimination and reproducibility;
- the ATC Code of Practice[8] intended to encourage the consistent and precise operation of CEC engine testing, coupled with a standardised system for reporting test results;
- the ATIEL Code of Practice.

The ATIEL Code is a key element of the EELQMS, providing a practical contribution to regularise engine lubricant standards in Europe in co-operation with other organisations.

3.2 EELQMS guidelines

3.2.1 Lubricant marketers intending to develop engine lubricants for which compliance with ACEA Oil Sequences will be claimed shall apply the guidelines of the EELQMS, as detailed in 3.2.2 to 3.2.7.

3.2.2 Incorporate the EELQMS guidelines, as described in this Section, in a QMS such as ISO 9001[3], or ISO TS 16949[4]. This incorporation does not require re-typing all the EELQMS guidelines in the QMS. By means of proper referencing to the EELQMS guidelines in the QMS, the lubricant marketer shall ensure that effectively the same result as with full incorporation of the EELQMS guidelines in the QMS is obtained.

3.2.3 Ensure an independent audit of the development process by QMS officers.

3.2.4 Conduct all engine tests at accredited laboratories in line with the requirements defined in the ATC or ACC Codes of Practice[8,9], as applicable.

3.2.5 Carry out all:

a) VGRA in accordance with the guidelines in 2.3.4;
b) BOI in accordance with the guidelines in 2.3.5;
c) VMI in accordance with the guidelines in 2.3.6;
d) performance additive package modifications in accordance with the guidelines included in the ATC or ACC Codes of Practice[8,9], as applicable.

3.2.6 Forms D.1, D.2 and D.3 checklists shall be signed off by an authorised company representative.

3.2.7 Blend the product in manufacturing plants conforming to the requirements described in Section 4, including accreditation to auditable quality management systems.

3.3 Letters of Conformance

3.3.1 Lubricant marketers' Letter of Conformance

Lubricant marketers making claims against the ACEA Oil Sequences are required by ACEA (see 2.1) to submit the Code of Practice Letter of Conformance to ATIEL. The letter is reproduced in Appendix E and a template is available on www.atiel.org where ATIEL publish a list of lubricant marketers who have submitted a Code of Practice Letter of Conformance.

3.3.2 Base stock manufacturers' Letter of Conformance

Base stock manufacturers may also sign a Letter of Conformance declaring that they manufacture base stocks in accordance with the ATIEL Base Stock Assurance Guidelines (see B.5.3 for details).

3.4 Example of an EELQMS development programme

3.4.1 Main elements

A programme for the development of engine lubricants for which compliance with ACEA Oil Sequences is claimed should consist of the following four elements:

a) definition of the target ACEA Oil Sequence performance level(s);
b) definition of desired viscosity grades;
c) selection of base stocks to be used in various viscosity grades;
d) selection of VM(s) to be used in various viscosity grades.

3.4.2 Detailed steps - Flow diagram

The flow diagram shown in Figure 4 provides more information about the detailed steps, which are as follows:

a) Decide which base oils and VMs are required to be covered. Using the BOI and VMI guidelines, identify the minimum testing required to cover all the desired formulations.
b) Develop the performance additive package. This may be developed either by the lubricant marketer or in cooperation with a third party, following the guidelines included in the ACC or ATC Codes of Practice[6,7] (Section H, ATC Code of Practice and Appendix H and I, ACC Code of Practice), as appropriate. This ensures read-across of engine performance within the restrictions of the guidelines for performance additive package modifications.
c) Conduct all engine tests at accredited test laboratories (see 2.2.2.2). Pre-register all candidate and reference lubricant tests to be included in the candidate data package. Carry out the necessary laboratory testing.
d) Compile all the data required in the checklist for the Candidate Data Package and ensure the checklist is signed off by an authorised company representative.
e) If further viscosity grades or other base stocks or VMs are required, use the data in the Candidate Data Package to establish, with the help of the ATIEL VGRA, BOI or VMI guidelines, the additional test requirements.
f) After completion of all engine and laboratory tests required for read-across and interchange purposes, compile the checklist for the Programme Extension Data and ensure it is signed off by an authorised company representative.
g) Finally, complete a full ACEA Performance Data Set for each product on which an ACEA Oil Sequence claim is made. This data set shall be signed off by an authorised company representative.

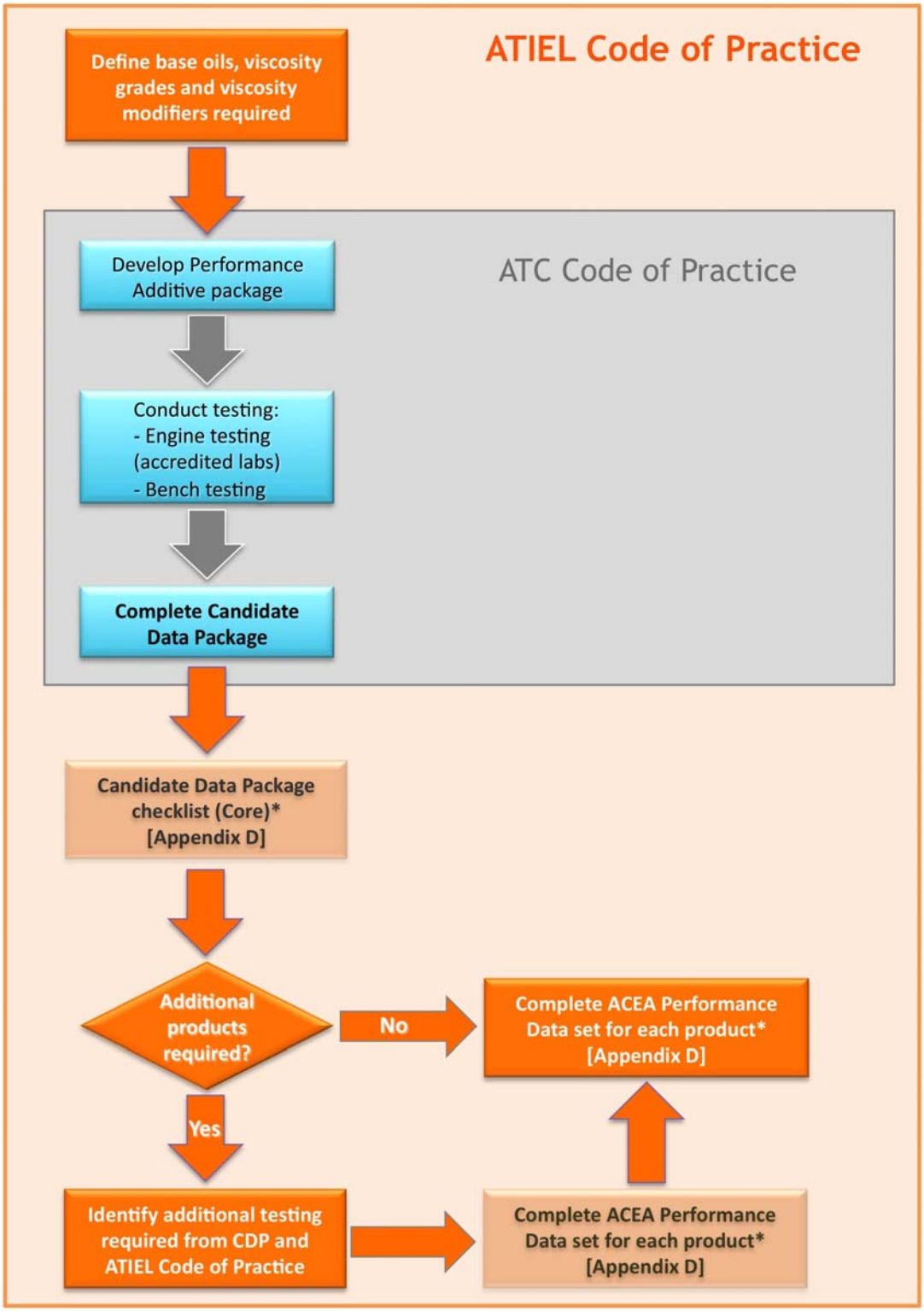

Figure 4 Flow diagram for an EELQMS development programme

4 Blending plant requirements

4.1 Formulation to be used

The blending plant shall ensure that the formulation used for blending the commercial product accurately reflects the formulation used to establish the ACEA Performance Data Set.

4.2 Quality management systems

4.2.1 Existing blending plants

All lubricants claiming compliance with the ACEA Oil Sequences shall be blended in manufacturing plants accredited to auditable quality management systems such as ISO 9001[3].

4.2.2 New blending plants

For new blending plants, a commitment shall be made to complete certification against auditable quality management systems such as ISO 9001[3] or ISO/TS 16949[4] within 18 months of the production start-up date.

4.3 Handling products after blending

In operations where products are subject to further handling prior to sale (for example re-packaging, re-labelling or filling remotely from the blending plant) and where such actions are considered to be capable of affecting product quality, such operations shall also be certified against auditable quality management systems such as ISO 9001[3] or ISO/TS 16949[4].

4.4 Products supplied by third parties

In cases where products that have been supplied by third parties are marketed, the lubricant marketer shall ensure that the supplier of the product has appropriate qualification systems in place, as described in 4.2.

5 Reference publications

5.1 Other Codes of Practice

Parts of the ATIEL Code require use of other Codes of Practice that are considered to offer best industry practice. These publications are referred to in this document but are not reproduced in detailed form. Users of the ATIEL Code shall ensure they use the latest editions of the following:

- ATC Code of Practice[8] available at www.atc-europe.org;
- ACC Petroleum Additive Product Approval Code of Practice[9] available at www.americanchemistry.com.

5.2 Other publications

- The *ACEA Oil Sequences*[1]*, Service Fill Oils for Gasoline Engines, Light Duty Diesel Engines, Engines with After-treatment Devices and Heavy Duty Diesel Engines*, available at www.acea.be.
- The SAE J300[12] Engine Oil Viscosity Classification Standard defines the limits for a classification of engine lubricating oils in rheological terms only. It is used by ACEA to define viscosity grades and other rheological properties of engine oils. The latest version is available from www.sae.org.
- Information about the API Engine Oil Licensing and Certification System and the API Base Oil Interchangeability Guidelines for Passenger Car Motor Oils and Diesel Engine Oils is available in API Publication 1509[2] at www.api.org/eolcs.
- Information about ISO quality management systems[3, 4, 5] is available at www.iso.org.
- Information about ASTM[6] and the test methods it develops is available at www.astm.org
- Information about CEC[7] and the test methods it develops is available at www.cectests.org.
- Information about the ATC-ERC[10] system for registration of engine oil tests for CEC tests is available at https://atc-erc.org.
- Information about the ACC-MA[9]system for registration of engine oil tests for ASTM tests is available at https://acc-ma.org.

Appendix A

Guidelines for viscosity grade read-across

Issue Number 19, September 2013

This issue supersedes all previous issues.
All new engine lubricant developments initiated after the date of this issue shall use this issue.

Contents

A.1 General
A.2 The SAE J300 viscosity classification system
A.3 VGRA guidelines
A.4 Laboratory tests
A.5 Requirements for applying VGRA guidelines

A.1 General

It is permitted to use the VGRA guidelines to waive testing, provided the requirements described in A.5 are met. The restrictions and lubricant marketers' responsibilities described in 2.3.2 and 2.3.3 also apply.

A.2 The SAE J300 viscosity grade classification system

The SAE J300[12] viscosity system defines the limits for a classification of engine lubricants in rheological terms only. These limits are used by ACEA to determine the engine lubricant viscosity grades recommended for use in the ACEA Oil Sequences. Lubricant marketers also use these limits in formulating, manufacturing and labelling their products. Lubricant marketers are expected to market only products that are within the relevant viscosity specifications in J300.

Two series of viscosity grades are defined in J300:

- those containing the letter W;
- those without the letter W.

Single-viscosity-grade lubricants ('single-grades') with the letter W are defined by maximum low-temperature cranking and pumping viscosities, and a minimum kinematic viscosity measured at 100°C (KV100).

Single-grade lubricants without the letter W are based on a set of minimum and maximum KV100 values and a minimum high-temperature, high-shear-rate viscosity (HTHS viscosity) measured at 150 °C and 10^6 s^{-1} shear rate.

Multi-viscosity-grade lubricants ('multigrades') are defined by both of the following criteria:

- maximum low-temperature cranking and pumping viscosities corresponding to one of the W grades;
- minimum and maximum KV100 values and a minimum HTHS viscosity corresponding to one of the non-W grades.

A.3 VGRA guidelines

A.3.1 CEC engine tests

For the CEC engine tests specified in the ACEA Oil Sequences, apply the ATIEL VGRA Guidelines shown in Tables A.1 to A.10.

A.3.2 ASTM engine tests

A.3.2.1 API guidelines

For ASTM engine tests specified in the ACEA Oil Sequences, with the exception of the tests described in Section A.3.2.2, use the viscosity grade read-across (VGRA) guidelines described in Appendix F of API 1509[2].

A.3.2.2 ATIEL guidelines

For the Mack T-8E engine test use the ATIEL-developed Guidelines shown in Table A.11.

A.4 Laboratory tests

A.4.1 Unless stated otherwise below, VGRA is not allowed for laboratory tests.

A.4.2 For the ASTM D6594 High-Temperature Corrosion Bench Test (HTCBT), use the Guidelines described in API 1509, Section F.

A.5 Requirements for applying VGRA guidelines

A.5.1 It is permitted to apply VGRA guidelines at any time from candidate formulations developed during a programme.

A.5.2 The following requirements shall be met when the VGRA guidelines are applied:

a) Use the same performance additive package at equal concentration for the read-across viscosity grade.

b) Use the same viscosity modifier (VM).

c) Use base stocks from the same base stock slate. Base stocks can be rebalanced, or replaced within the same base stock slate, or both.

Table A.1 VGRA for the TU3MS valve-train scuffing test CEC L 38-A-94

Test run on:	Can be read-across (RA)[1,2] to:														
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50
0W-20	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
0W-30		-	RA		RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
0W-40			-			RA	RA		RA	RA	RA	RA	RA	RA	RA
5W-20		RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-30			RA		-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-40						-	RA		RA	RA	RA	RA	RA	RA	RA
5W-50							-			RA	RA		RA		RA
10W-30			RA			RA	RA	-	RA	RA	RA	RA	RA	RA	RA
10W-40							RA		-	RA	RA	RA	RA	RA	RA
10W-50										-	RA		RA		RA
10W-60											-				
15W-40							RA			RA	RA	-	RA	RA	RA
15W-50											RA		-		RA
20W-40							RA			RA	RA		RA	-	RA
20W-50											RA				-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirement is met:

- KV100 of the finished lubricant of the read-across viscosity grade is greater than or equal to that of the tested viscosity grade.

(2) A shaded cell indicates read-across is not permitted.

Table A.2 VGRA for the TU572 high-temperature deposit test CEC L 88-A-02

Test run on:	Can be read-across (RA)[1,2] to:														
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50
0W-20	-			RA	RA			RA	RA			RA	RA	RA	RA
0W-30	RA	-		RA	RA	RA		RA	RA	RA		RA	RA	RA	RA
0W-40	RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-20				-				RA				RA		RA	RA
5W-30	RA			RA	-			RA	RA			RA	RA	RA	RA
5W-40	RA	RA		RA	RA	-		RA	RA	RA		RA	RA	RA	RA
5W-50	RA	RA	RA	RA	RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA
10W-30				RA				-				RA		RA	RA
10W-40	RA			RA	RA			RA	-			RA	RA	RA	RA
10W-50	RA	RA		RA	RA	RA		RA	RA	-		RA	RA	RA	RA
10W-60	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	-	RA	RA	RA	RA
15W-40				RA				RA				-		RA	RA
15W-50	RA			RA	RA			RA	RA			RA	-	RA	RA
20W-40														-	
20W-50				RA				RA				RA		RA	-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirement is met:

- If the VM concentration increase is larger than 15 % mass fraction relative, Level 2 technical support data as defined in the ACC Code of Practice is available to justify the read-across.

(2) A shaded cell indicates read-across is not permitted.

Table A.3 VGRA for the M111 sludge test CEC L-53-95 for non-dispersant VMs

Test run on:	Can be read-across (RA)[1,2] to:														
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50
0W-20	-			RA	RA			RA	RA			RA	RA	RA	RA
0W-30	RA	-		RA	RA	RA		RA	RA	RA		RA	RA	RA	RA
0W-40	RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-20				-				RA				RA		RA	RA
5W-30	RA			RA	-			RA	RA			RA	RA	RA	RA
5W-40	RA	RA		RA	RA	-		RA	RA	RA		RA	RA	RA	RA
5W-50	RA	RA	RA	RA	RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA
10W-30				RA				-				RA		RA	RA
10W-40				RA	RA			RA	-			RA	RA	RA	RA
10W-50	RA			RA	RA	RA		RA	RA	-		RA	RA	RA	RA
10W-60	RA	RA		RA	RA	RA	RA	RA	RA	RA	-	RA	RA	RA	RA
15W-40				RA				RA				-		RA	RA
15W-50				RA				RA	RA			RA	-	RA	RA
20W-40														-	
20W-50												RA		RA	-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirement is met:

- If the VM concentration increase is larger than 15 % mass fraction relative, Level 2 technical support data as defined in the ACC Code of Practice is available to justify the read-across.

(2) A shaded cell indicates read-across is not permitted.

Table A.4 VGRA for the M111 sludge test CEC L-53-95 for dispersant VMs

Test run on:	Can be read-across (RA)[1,2] to:														
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50
0W-20	-	RA			RA	RA			RA	RA			RA		
0W-30		-	RA			RA	RA			RA	RA				
0W-40			-				RA				RA				
5W-20	RA			-	RA			RA	RA			RA	RA		RA
5W-30	RA	RA			-	RA			RA	RA			RA		
5W-40		RA	RA			-	RA			RA	RA				
5W-50			RA				-				RA				
10W-30	RA			RA	RA			-	RA			RA	RA		RA
10W-40	RA	RA			RA	RA			-	RA	RA		RA		
10W-50		RA	RA			RA	RA			-	RA				
10W-60			RA				RA				-				
15W-40	RA			RA	RA			RA	RA			-	RA		RA
15W-50	RA	RA			RA	RA			RA	RA			-		
20W-40								RA				RA		-	RA
20W-50	RA				RA			RA	RA			RA	RA		-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirement is met:

- If the VM concentration increase is larger than 20 % mass fraction relative, or the decrease is larger than 10 % mass fraction relative, Level 2 technical support data as defined in the ACC Code of Practice is available to justify the read-across**.**

(2) A shaded cell indicates read-across is not permitted.

Table A.5 VGRA for the medium-temperature dispersivity test DV4TD CEC L-93-04 or DV6C CEC L-106 for non-dispersant VMs

Test run on:	Can be read-across (RA)[1,2] to:															
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50
0W-20	-			RA	RA			RA	RA			RA	RA	RA	RA
0W-30	RA	-		RA	RA	RA		RA	RA	RA		RA	RA	RA	RA
0W-40	RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-20				-				RA				RA		RA	RA
5W-30	RA			RA	-			RA	RA			RA	RA	RA	RA
5W-40	RA	RA		RA	RA	-		RA	RA	RA		RA	RA	RA	RA
5W-50	RA	RA	RA	RA	RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA
10W-30				RA				-				RA		RA	RA
10W-40				RA	RA			RA	-			RA	RA	RA	RA
10W-50	RA			RA	RA	RA		RA	RA	-		RA	RA	RA	RA
10W-60	RA	RA		RA	RA	RA	RA	RA	RA	RA	-	RA	RA	RA	RA
15W-40				RA				RA				-		RA	RA
15W-50				RA				RA	RA			RA	-	RA	RA
20W-40														-	
20W-50												RA		RA	-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirement is met:

- If the VM concentration increase is larger than 15 % mass fraction relative, Level 2 technical support data as defined in the ACC Code of Practice is available to justify the read-across.

(2) A shaded cell indicates read-across is not permitted.

Table A.6 VGRA for the medium-temperature dispersivity test DV4TD CEC L-93-04 or DV6C CEC L106 for dispersant VMs

Test run on:	Can be read-across (RA) [1,2] to:														
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50
0W-20	-	RA			RA	RA			RA	RA			RA		
0W-30		-	RA			RA	RA			RA	RA				
0W-40			-				RA				RA				
5W-20	RA			-	RA			RA	RA			RA	RA		RA
5W-30	RA	RA			-	RA			RA	RA			RA		
5W-40		RA	RA			-	RA			RA	RA				
5W-50			RA				-				RA				
10W-30	RA			RA	RA			-	RA			RA	RA		RA
10W-40	RA	RA			RA	RA			-	RA	RA		RA		
10W-50		RA	RA			RA	RA			-	RA				
10W-60			RA				RA				-				
15W-40	RA			RA	RA			RA	RA			-	RA		RA
15W-50	RA	RA			RA	RA			RA	RA			-		
20W-40								RA				RA		-	RA
20W-50	RA				RA			RA	RA			RA	RA		-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirement is met:

- If the VM concentration increase is larger than 20 % mass fraction relative, or the decrease is larger than 10 % mass fraction relative, Level 2 technical support data as defined in the ACC Code of Practice is available to justify the read-across.

(2) A shaded cell indicates read-across is not permitted.

Table A.7 VGRA for the OM602A CEC L-51-98 and the OM646LA CEC L-99-08 wear tests

Test run on:	Can be read-across (RA)[1,2] to:																
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50	30	40
0W-20	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
0W-30		-	RA		RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
0W-40			-			RA	RA		RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-20		RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-30			RA		-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-40						-	RA		RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-50							-			RA	RA		RA		RA		RA
10W-30			RA			RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA	RA
10W-40							RA		-	RA	RA	RA	RA	RA	RA	RA	RA
10W-50										-	RA		RA		RA		RA
10W-60											-						
15W-40							RA			RA	RA	-	RA	RA	RA	RA	RA
15W-50											RA		-		RA		RA
20W-40							RA			RA	RA		RA	-	RA	RA	RA
20W-50											RA				-		RA
30																-	RA
40																	-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirement is met:

- For multigrade lubricants, the KV100 of the finished lubricant of the read-across viscosity grade is greater than or equal to that of the tested viscosity grade

(2) A shaded cell indicates read-across is not permitted.

Table A.8 VGRA for the M111E fuel economy test CEC L-54-96

Test run on:	Can be read-across (RA)[1,2] to:														
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50
0W-20	-														
0W-30	RA	-													
0W-40	RA	RA	-	RA											
5W-20	RA			-											
5W-30	RA	RA		RA	-										
5W-40	RA	RA	RA	RA	RA	-									
5W-50	RA	RA	RA	RA	RA	RA	-	RA							
10W-30	RA	RA		RA	RA			-							
10W-40	RA	RA	RA	RA	RA	RA		RA	-						
10W-50	RA	RA	RA	RA	RA	RA	RA	RA	RA	-					
10W-60	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	-	RA		RA	
15W-40	RA	RA	RA	RA	RA	RA		RA	RA			-			
15W-50	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA		RA	-		
20W-40	RA	RA	RA	RA	RA	RA		RA	RA			RA		-	
20W-50	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA		RA	RA	RA	-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirements are met:

- The KV40 of the finished lubricant of the read-across viscosity grade is lower than or equal to that of the tested viscosity grade.
- The KV100 of the finished lubricant of the read-across viscosity grade is lower than or equal to that of the tested viscosity grade.
- The HTHS viscosity of the finished lubricant blend of the read-across viscosity grade is lower than or equal to that of the tested viscosity grade.

(2) A shaded cell indicates read-across is not permitted.

Table A.9 VGRA for the VW DI ring sticking and piston cleanliness test CEC L-78-99 for non-dispersant VMs

Test run on:	Can be read-across (RA)[1,2] to:														
	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	**10W-60**	15W-40	15W-50	20W-40	20W-50
0W-20	-			RA	RA			RA	RA			RA	RA	RA	RA
0W-30	RA	-		RA	RA	RA		RA	RA	RA		RA	RA	RA	RA
0W-40	RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-20				-				RA				RA		RA	RA
5W-30	RA			RA	-			RA	RA			RA	RA	RA	RA
5W-40	RA	RA		RA	RA	-		RA	RA	RA		RA	RA	RA	RA
5W-50	RA	RA	RA	RA	RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA
10W-30				RA				-				RA		RA	RA
10W-40	RA			RA	RA			RA	-			RA	RA	RA	RA
10W-50	RA			RA	RA	RA		RA	RA	-		RA	RA	RA	RA
10W-60	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	-	RA	RA	RA	RA
15W-40				RA				RA				-		RA	RA
15W-50				RA	RA			RA	RA			RA	-	RA	RA
20W-40														-	
20W-50				RA				RA				RA		RA	-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following **s**tipulated requirement is met:

- If the VM concentration increase is larger than 15 % mass fraction relative, Level 2 technical support data as defined in the ACC Code of Practice is available to justify the read-across.

(2) A shaded cell indicates read-across is not permitted.

Table A.10 VGRA for the OM441LA (CEC L-52-97) and the OM501LA (CEC L-101-09) tests for non-dispersant VMs

Test run on:	Can be read-across (RA)[1,2] to:											
	0W-30	5W-30	5W-40	5W-50	10W-30	10W-40	15W-40	15W-50	20W-40	20W-50	30	40
0W-30	-											
5W-30		-			RA	RA	RA	RA				
5W-40			-			RA	RA	RA				
5W-50				-				RA				
10W-30					-		RA					
10W-40						-	RA	RA				
15W-40							-					
15W-50								-				
20W-40									-			
20W-50										-		
30											-	
40												-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

(1) RA indicates read-across is permitted provided the following stipulated requirement is met:

- If the VM concentration increase is larger than 15 % mass fraction relative, Level 2 technical support data as defined in the ACC Code of Practice is available to justify the read-across.

(2) A shaded cell indicates read-across is not permitted.

Table A.11 VGRA for the MACK T-8E soot test ASTM D5967 (for ACEA Oil Sequences only)[1]

Test run on:	Can be read-across (RA)[2,3] to:											
	0W-30	5W-30	5W-40	5W-50	10W-30	10W-40	15W-40	15W-50	20W-40	20W-50	30	40
0W-30	-											
5W-30	RA	-	RA	RA								
5W-40	RA		-	RA								
5W-50	RA			-								
10W-30	RA	RA	RA	RA	-	RA						
10W-40	RA	RA	RA	RA		-						
15W-40	RA	RA	RA	RA	RA	RA	-	RA				
15W-50	RA	RA	RA	RA	RA	RA		-				
20W-40	RA	RA	RA	RA	RA	RA	RA	RA	-	RA		
20W-50	RA	RA	RA	RA	RA	RA	RA	RA		-		
30	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	-	RA
40	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	-

Note A.1 Footnotes 1 and 2 apply in all read-across cases.

Note A.2 ATIEL read-across Table A.11 includes more viscosity grade read-across than API 1509 to reflect the European market.

(1) These read-across guidelines have been produced only for test data to be used to support ACEA Oil Sequence claims and shall not be used to support API claims where the relevant read-across guidelines in API 1509 shall be used.

(2) RA indicates read-across is permitted.

(3) A shaded cell indicates read-across is not permitted.

Appendix B

Guidelines for base stock quality assurance and interchange

Issue Number 19, September 2013

This issue supersedes all previous issues.
All new engine lubricant developments initiated after the date of this issue shall use this issue.

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B.2 Definitions
B.3 Guidelines for base stock quality assurance
B.4 Guidelines for using alternative base stocks in validated formulations
B.5 Verification of conformance with defined procedures
B.6 Guideline for selection of the most severe base stock

B.1 Introduction

B.1.1 Guidelines provided

This Appendix provides guidelines on base stock quality assurance and on base oil interchange. The guidelines relate specifically to engine lubricants marketed as complying with ACEA Oil Sequences.

B.1.2 Responsibilities

B.1.2.1 Lubricant marketer

The lubricant marketer's responsibilities are described in 1.3. They include ensuring that the EELQMS guidelines (see Section 3) have been followed during product development and performance validation stages.

B.1.2.2 Base stock manufacturer

The Code requires base stocks to be produced in manufacturing plants accredited to internationally recognised, auditable quality management systems such as ISO 9001 or equivalent.

Base stock manufacturers and partner groups remain responsible for detailed operating procedures and specifications. Developers of lubricants are responsible for the content and integrity of development programmes run under these guidelines, including putting in place procedures to ensure that base stock quality remains consistent with that of the initial engine lubricant validation.

B.1.3 Verification of conformance

B.5 describes the steps required to verify conformance with the procedures defined in this Appendix.

B.1.4 Caveats

The physical and chemical characteristics of base stocks influence their lubrication performance. However, it has not yet proved possible to predict fully the base stock characteristics required for a particular engine lubricant application. Practical measurements in engine tests remain the only reliable means of validating the performance of engine lubricants.

Base stocks having the same quality control specifications cannot be assumed to be interchangeable. A guideline for base stock selection is given in B.6.

B.2 Definitions

For the purpose of this Code, the following definitions apply.

B.2.1 Base oil

the base stock or blend of base stocks which, when mixed with performance additives, is used in an engine lubricant marketed as conforming to ACEA Oil Sequences.

B.2.2 Base stock

a base oil component that:

a) is produced and used in accordance with the ATIEL base stock quality assurance and interchange guidelines given in this Appendix;
b) is produced by a single manufacturer or partner group to the same specification, independently of feed source or manufacturer's location;
c) meets the same manufacturer's or partner group's specification and is identified by a unique formula, product identification number or both;
d) may be manufactured using a variety of different processes including but not limited to distillation, solvent refining, hydrogen processing, oligomerisation, esterification, and re-refining;
e) is substantially free from materials introduced through manufacturing, contamination, or previous use.

B.2.3 Base stock group

For the purposes of this Appendix, base stocks are divided into five base stock groups according to defined physical and chemical characteristics as follows:

Group I Base stocks containing less than 90 mass % saturates or greater than 0.03 mass % sulphur or both, and having a viscosity index greater than or equal to 80 and less than 120, measured using the test methods specified in the Table B.1.

Group II Base stocks containing greater than or equal to 90 mass % saturates and less than or equal to 0.03 mass % sulphur and having a viscosity index greater than or equal to 80 and less than 120, measured using the test methods specified in Table B.1.

Group III Base stocks containing greater than or equal to 90 mass % saturates and less than or equal to 0.03 mass % sulphur and having a viscosity index of greater than or equal to 120, measured using the test methods specified in Table B.1.

Group IV Base stocks are polyalphaolefins (PAO).

Group V All base stocks not included in Groups I, II, III or IV.

Table B.1 The analytical methods to be used in the definition of base stock groups

Property	Test method[1]
Saturate concentration	ASTM D2007 IP129
Viscosity index	ASTM D2270
Sulphur concentration (Use one of the listed methods.)	ASTM D2622 ASTM D4294 ASTM D4927 ASTM D3120

[1] Alternative test methods may be used providing a satisfactory correlation with the specified ASTM test method has been demonstrated.

B.2.4 Base stock manufacturer

a producer, at one or more manufacturing sites, of base stock(s) for use in lubricants for which compliance with ACEA Oil Sequences is claimed.

B.2.5 Feedstock

the starting material, such as crude oil, refinery intermediate or used lubricating oil, from which base stocks are produced at a manufacturing site. A particular feedstock may originate from a single source or multiple sources.

B.2.6 Base stock slate

a product line of base stocks that:

a) is produced by the same manufacturer;
b) meets the ATIEL definition of base stock;
c) is in the same ATIEL Base Stock Group;
d) may have different specified viscosities and other properties;
e) has been demonstrated, in lubricants for which compliance with ACEA Oil Sequences is claimed, to be technically substitutable by other appropriate base stocks on the same slate.

A base stock manufacturer may produce more than one base stock slate.

B.2.7 Linked slates

base stock slates that the lubricant manufacturer or base stock manufacturer or partner group concerned has demonstrated, according to the requirements of Appendix B, are interchangeable without the need for further engine testing.

B.2.8 Partner group

a voluntary grouping of two or more base stock manufacturers who have:

a) base stock slates complying with the ATIEL definition of base stock slate;

b) linked base stock slates on the basis of a written agreement.

B.2.9 Base stock interchange

the process of substituting base stock(s) from alternative base stock slates in engine lubricants validated as complying with ACEA Oil Sequence(s).

B.2.10 Experts

individuals having expertise in the manufacturing of base stocks or the formulating and performance testing of engine lubricants, or both.

B.3 Guidelines for base stock quality assurance

B.3.1 General

The ATIEL Guidelines for base stock quality assurance are divided into four main sections:

a) feedstock approval procedures
b) refining process control procedures
c) routine quality control procedures
d) verification of conformance with defined procedures.

These guidelines emphasise the need for base stock manufacturers to:

e) have routine access to technical expertise that enables sound judgements to be made on quality assurance matters;
f) maintain documented, externally auditable quality management procedures.

B.3.2 Feedstock approval procedures

B.3.2.1 General

Feedstock shall be screened for general suitability using verifiable evaluation procedures. Base stocks shall then be produced from suitable feedstocks and evaluated for approval.

Procedures shall be in place to determine the maximum acceptable proportions of unapproved feedstock, experimental fractions and other unapproved materials that may enter the commercial pool of approved materials.

B.3.2.2 Feedstock screening

A chemical and physical characterisation of candidate feedstock shall be carried out and the results appraised using a database derived from previous feedstock evaluations. An expert assessment shall then be made of the nature of the feedstock and its potential as a source for base stock production.

B.3.2.3 Making base stocks for approval

A series of intermediate fractions are made from the feedstock. Base stocks shall be produced from these intermediate fractions using targeted characteristics set jointly by base stock and formulation experts.

If physical and chemical analyses of the base stocks indicate a need to modify targeted characteristics, the base stock manufacturer shall produce new samples under modified processing conditions.

B.3.2.4 Evaluating candidate base stocks for approval

The evaluation shall include a study of the following.

a) Intrinsic properties of the base stocks, such as, but not necessarily limited to:

- chemical composition
- contamination arising from feedstock and processing impurities
- volatility
- viscosity
- inherent oxidation stability
- deposit forming tendencies
- pour point.

b) Performance in blended lubricants, such as, but not necessarily limited to:

- high-temperature deposit formation
- low-temperature sludge formation
- detergency/deposit control
- soot-handling
- foaming behaviour
- oxidation behaviour
- elastomer compatibility
- finished-lubricant viscometry
- homogeneity and stability of formulations.

B.3.2.5 Approval of feedstock

A feedstock can be approved if base stocks made from it have been demonstrated to be suitable for formulating engine lubricants for which ACEA Oil Sequence claims are to be made. Formal approval shall be the joint responsibility of manufacturing and product experts.

Base stocks that have been approved under the provisions of these guidelines may be commingled without further testing, consistent with the provisions of Appendix B.

Base stock manufacturers shall maintain a register of the approval status of various feedstocks and corresponding processing conditions.

The approval status shall be reviewed periodically.

B.3.2.6 Mixtures of feedstocks

Mixtures of feedstocks at the manufacturing plant can arise from, but are not limited to:

a) the intentional scheduling of mixtures;
b) the cross-contamination that can occur during feedstock changeovers;
c) accidental mixing.

A mixed feedstock may be approved even though the components are not themselves approved. Approved feedstocks may be mixed in all proportions up to the maximum approved limits for each component.

B.3.2.5 Auditing

For auditing purposes, use the Form D.4 checklist of Appendix D.

B.3.3 Refining process control

B.3.3.1 Procedures

The primary aim of refining process control is to ensure that base stocks are reliably and consistently manufactured according to approved processing conditions and base stock specifications. All relevant steps, from feedstock approval to base stock despatch, shall be reflected in documented, auditable, quality management procedures.

These procedures shall define action to be taken if it is planned to make significant changes to approved processing conditions.

B.3.3.2 Changes to operating conditions

Significant changes of operating conditions are defined as changes that are outside the ranges of conditions specified at the time of the feedstock or base stock approval. To safeguard base stock quality, assessment of the significance of particular processing changes and actions to be taken shall be undertaken by appropriate experts.

Changes typically considered to be significant include, but are not limited to:

- change of solvent type
- change of catalyst or catalyst type
- change of reactor operating conditions beyond predefined acceptable range
- change of process sequence
- change in non-approved feedstock
- unacceptable variations of approved feedstock quality
- unacceptable contamination of feedstock.

B.3.3.3 Auditing

For auditing purposes, use the Form D.5 checklist of Appendix D.

B.3.4 Routine quality control

B.3.4.1 Purpose

Routine quality control shall be carried out to confirm that base stock production remains within approved specifications. It is important to recognise that routine quality control tests are indicators of consistency and not absolute measures to predict base stock and lubricant performance.

B.3.4.2 Procedures

Written, auditable, quality management procedures relating to base stock quality control shall:

a) embody the approved quality control specifications of the base stocks to be produced;
b) define responsibilities for maintaining the integrity of those specifications;
c) define testing frequencies and sampling requirements;
d) embody a requirement routinely to report and interpret quality control test results and statistical assessments;
e) define action to be taken in the event of non-conformances.

B.3.4.3 Quality control tests

Quality control tests for base stocks, and ranges of acceptable results in those tests, shall be defined at the time of approving a feedstock. Test requirements may later be amended to reflect changing industry requirements, subject to the agreement of relevant manufacturing and product experts.

Tests will vary from manufacturer to manufacturer and may include, but are not limited to:

a) density
b) colour

c) refractive index
d) spectroscopic analysis
e) viscosity
f) viscosity index
g) flash point
h) pour point
i) chemical composition
j) detection of contaminants.

In some cases, standard industry test methods may be used, but it is common for particular manufacturers to use proprietary methods to examine certain parameters.

B.3.4. Auditing

For auditing purposes, use the Form D.6 checklist of Appendix D.

B.4 Guidelines for using alternative base stocks in validated formulations

B.4.1 General

The guidelines in this Section outline measures necessary to support the use of alternative base stocks in engine lubricants for which compliance with ACEA Oil Sequences has already been validated. The guidelines enable base stocks to be interchanged:

a) between unlinked slates in particular formulations;

b) in all formulations where a link between slates has been established.

Base stocks within the same base stock slate or within linked base stock slates may be interchanged without additional testing.

BOI for formulations containing more than one base stock shall be in steps covering each base stock group separately.

The lubricant marketer is responsible for ensuring that interchange test programmes are consistent with the ACEA Oil Sequence claims made for the engine lubricants concerned.

Form D.7 provides a checklist for auditors for use of alternative base stocks in validated formulations.

B.4.2 Base stock interchange for unlinked slates

B.4.2.1 Engine tests involved

The guidelines described in B.4.2.2 may be used for base stock interchange for unlinked slates in the engine tests listed in Table B.2. Check the guidelines for each engine test to determine the test programme requirements for a specific lubricant formulation.

B.4.2.2 Interchange guidelines

Tables B.3 and B.4 identify the passing engine tests required to interchange base stocks in an originally-tested engine lubricant formulation with those from a different base stock slate.

Passing results are required only for those engine tests that are a requirement of the ACEA classes and categories for which support is being established.

Complete performance documentation is required for the original formulation.

B.4.2.3 Laboratory tests

For the ASTM D6594 High-Temperature Corrosion Bench Test (HTCBT), use the BOI Guidelines described in API 1509[2], Appendix E.

B.4.2.4 Additive package, viscosity modifier and viscosity grade

When applying these tables, the performance additive package and its concentration, the viscosity modifier (VM) and the viscosity grade of the formulations shall remain the same.

Within the same viscosity grade, the VM concentration may be adjusted $\pm$ 15 % mass fraction relative without additional engine testing. Changes beyond this amount shall follow the technical principles established in the VGRA guidelines.

B.4.2.5 Base stocks from more than one group

Where base stocks from more than one base stock group are interchanged simultaneously, the most severe testing requirements apply. The step-wise evaluation of the interchange programme shall be documented (see 2.3.2.1).

Table B.2 Engine tests for base oil interchange in ACEA Oil Sequences

Engine test name	Test description	Abbreviated name used in Tables B.3 and B.4	Test method reference	ACEA class involved		
				A/ B[1]	C[2]	E[3]
TU5JP-L4	high-temp. deposits, ring sticking, oil thickening	TU5JP-L4	CEC L-88-02	X	X	
M111	black-sludge deposits	M111SL	CEC L-53-95	X	X	
VW TDI	piston cleanliness and ring sticking in DI diesel engines	VW TDI	CEC L-78-99	X	X	
M111	fuel economy improvement	M111FE	CEC L-54-96	X	X	
TU3M	valve-train scuffing wear	TU3M	CEC L-38-94	X	X	
OM602A	wear	OM602A	CEC L-51-98	X	X	X
OM646LA	wear	OM646LA	CEC L-99-08	X	X	X
DV4TD	medium temperature dispersivity	DV4TD	CEC L-93-04	X	X	
DV6C	medium temperature dispersivity	DV6C	CEC L-106	X	X	
Sequence VG[4]	low temperature sludge	Seq VG	ASTM D6593	X	X	
OM441LA	bore polishing/piston cleanliness and turbocharger performance	OM441LA	CEC L-52-97			X
OM501LA	piston cleanliness	OM501LA	CEC L-101-09			X
Mack T-8E[4,6]	soot handling	Mack T-8E	ASTM D5967			X
Mack T-11[4,6]	soot handling	Mack T-11	ASTM D7156			X
Mack T-12[4]	wear (liner/piston rings/bearings)	Mack T-12	ASTM D7422			X
Cummins ISM[5]	Valve-train wear, soot-induced wear and oil filter plugging	Cummins ISM	ASTM D7468			X

[1] Category A/B are engine lubricants intended for gasoline and light-duty diesel engines.

[2] Category C are catalyst compatible engine lubricants intended for gasoline and light duty diesel engines with aftertreatment devices.

[3] Category E are engine lubricants intended for heavy-duty diesel engines.

[4] Where Sequence VG, Mack T-8E, Mack T-11, Mack T-12 and Cummins ISM tests are required, the rules described in the latest version of API Publication 1509 apply.

[5] A Cummins ISM test when required for support of ACEA E7, can be replaced by either:

- a Cummins M11 test (ASTM D6838) with passing results at API CH-4 or
- a Cummins M11EGR test (ASTM D 6975) with a passing result at API CI-4 is required

[6] A Mack T-8E test can be replaced by a Mack T-11 test with a passing result at API CI-4 Plus or API CJ-4.

B.4.2.6 Permitted concentrations of interchanged base stocks

Engine testing is not required if the concentrations of base stock to be interchanged are less than or equal to the permitted maximum values shown in Tables B.3 and B.4.

B.4.2.7 Modifications to the performance additive package

Modifications to the performance additive package that are allowed within the ACC or ATC Codes of Practice, as applicable, may be made prior to or subsequent to BOI testing, provided that:

a) such modifications are supported by the appropriate data as specified in the ACC or ATC Codes of Practice, as applicable;

b) the marketed engine lubricant includes all such modifications.

Attention should be given to covering all changes in programme design, as described in 2.3.2.1.

Table B.3 Base stock interchange for ACEA A, B and C Oil Sequences for CEC gasoline and light-duty diesel engines

(merge of former Tables 4.1.A/B and 4.1.C from Issue 17 / Tables B.3 and B.4 from Issue 18)

Base stock in original formulation	Interchange Base Stock[1, 3, 4, 5, 6, 8]								
	Group I		Group II		Group III		Group IV		Group V
Group I	≤ 10 %	NONE	≤ 10 %	NONE	≤ 30 %	NONE	≤ 30 %	NONE	
	> 10 %	TU5JP-L4 TU3M M111SL OM602A or OM646LA DV4TD or DV6C VW TDI M111FE	> 10 %	TU5JP-L4 TU3M M111SL OM602A or OM646LA DV4TD or DV6C VW TDI M111FE	> 30 %	TU5JP-L4 TU3M M111SL DV4TD or DV6C VW TDI M111FE	> 30 %	TU5JP-L4 TU3M M111SL DV4TD or DV6C VW TDi M111FE	ALL
Group II	≤ 10 %	NONE	≤ 10 %	NONE	≤ 30 %	NONE	≤ 30 %	NONE	ALL
	> 10 %	ALL	> 10 %	ALL	> 30 %	ALL	> 30 %	ALL	
Group III	≤ 10 %	NONE	≤ 10 %	NONE	≤ 10 %	NONE	≤ 10 %	NONE	ALL
	> 10 %	ALL	> 10 %	ALL	> 10 %	TU5JP-L4[7] TU3M M111SL OM646LA DV4TD or DV6C VW TDI M111FE	> 10 % ≤ 30 %	M111SL	
							> 30 %	ALL	
Group IV	≤ 10 %	NONE	≤ 10 %	NONE	≤ 10 %	NONE	NONE[2]		ALL
	> 10 %	ALL	> 10 %	ALL	> 10 % ≤ 30 %	M111SL			
					> 30 %	ALL			
Group V	ALL		ALL		ALL		ALL		ALL

Note B.1 For Sequence VG, read-across guidelines are given in API 1509[2], Appendix E.

(1) ALL = All tests specified within the ACEA Oil Sequence category.

NONE = No engine tests are required.

(2) Group IV base stocks, that is PAOs, can be interchanged without additional qualification testing, as long as the interchange PAO meets the original PAO manufacturer's specifications for physical and chemical properties. The following key properties shall be met in the substituted stock:

KV100, KV40 and KV-40; Viscosity Index (ASTM D2270); Noack Evaporation Loss (CEC L-040-93); Pour Point (ASTM D97); Unsaturates (IP129[B1]).

(3) All percentages are mass % of the formulated lubricant.

(4) No M111FE testing is required if the HTHS viscosity and KV40 of the interchange formulation are lower than or equal to that of the original formulation. *See also footnote 5.*

(5) An interchange of up to 30 mass % from Group I, II, III or IV to Group I, II, III or, IV is permitted without requirement for M111FE testing provided the requirements in footnote 4 are also met.

(6) Only the tests included in the ACEA Oil Sequence for which read-across is required need be run.

(7) No TU5JP-L4 testing is required if the Noack Evaporation Loss (CEC L-040-93) of the Group III base stock mix of the final formulation is lower than or equal to the Noack Evaporation Loss off the Group III base stock mix of the original TU5JP-L4 formulation. (see examples in B.4.2.8)

(8) When applying base stock interchange rules, the most severe base stock (see B.6) and the precision of the test shall be taken into consideration.

[B1] IP Test methods are published by the Energy Institute. www.energyinst.org

Table B.4 Base stock interchange for ACEA E Oil Sequences for CEC heavy-duty diesel engines

(former Table 4.1.E from Issue 17 / Table B.5 from Issue 18)

Base stock in original formulation	Interchange Base Stock[1, 3, 4]								
	Group I		Group II		Group III		Group IV		Group V
Group I	≤ 10 %	NONE	≤ 10 %	NONE	≤ 30 %	NONE	≤ 30 %	NONE	ALL
	> 10 %	OM441LA or OM501LA	> 10 %	OM602A or OM646LA OM441LA or OM501LA	> 30 %	OM441LA or OM501LA	> 30 %	OM441LA or OM501LA	
Group II	≤ 10 %	NONE	≤ 10 %	NONE	≤ 30 %	NONE	≤ 30 %	NONE	ALL
	> 10 %	ALL	> 10 %	ALL	> 30 %	OM602A or OM646LA OM441LA or OM501LA	> 30 %	OM602A or OM646LA OM 441LA or OM501LA	
Group III	≤ 10 %	NONE	≤ 10 %	NONE	≤ 10 %	NONE	≤ 30 %	NONE	ALL
	> 10 %	ALL	> 10 %	ALL	> 10 %	OM602A or OM646LA OM441LA or OM501LA	> 30 %	OM602A or OM646LA OM 441LA or OM501LA	
Group IV	≤ 10 %	NONE	≤ 10 %	NONE	≤ 30 %	NONE	NONE[2]		ALL
	> 10 %	ALL	> 10 %	ALL	> 30 %	OM602A or OM646LA OM441LA or OM501LA			
Group V	ALL		ALL		ALL		ALL		ALL

Note B.2 For Sequence VG, Mack T-8E, Mack T-11, Mack T-12 and Cummins ISM, read-across guidelines are given in API 1509, Appendix E.

(1) ALL = All tests specified within the ACEA Oil Sequence category.

NONE = No engine tests are required.

(2) Group IV base stocks, that is PAOs, can be interchanged without additional qualification testing, as long as the interchange PAO meets the original PAO manufacturer's specifications in physical and chemical properties. The following key properties shall be met in the substituted stock:

KV100, KV40 and KV-40; Viscosity Index (ASTM D2270); Noack Evaporation Loss (CEC L-040-93); Pour Point ; Unsaturates (IP 129).

(3) All percentages are mass % of the formulated lubricant.

(4 When applying base oil interchange rules, the most severe base stock (see B.6) and the precision of the test shall be taken into consideration.

B.4.2.8 Base stock interchange examples

ATIEL has established a correlation between the Noack and TU5JP-L4 engine test for Group III base stocks (see www.atiel.org).

Note B.3 In this Section, the Noack means the Noack Evaporation Loss as measured by CEC-L-040-93.

Example A

Question A:

An engine oil using a Group III base stock mix with a Noack of 10.3 mass % passed the TU5JP-L4 engine test. It is desired to switch to an alternative Group III base stock mix with a Noack of 10.0 mass %. Is it necessary to re run the TU5JP-L4 test?

Answer A:

It is not required to run a TU5JP-L4 engine test because the Noack of the Group III base stock mix of the alternative engine oil is lower than the Noack of the Group III base stock mix of the original engine oil.

Example B

Question B:

An engine oil using a Group III base stock mix with a Noack of 10.3 mass % passed the TU5JP-L4 engine test. It is desired to switch to an alternative Group III base stock mix with a Noack of 12.0 mass %. Is it necessary to re run the TU5JP-L4 test?

Answer B:

It is required to run a TU5JP-L4 engine test because the Noack of the Group III base stock mix of the alternative engine oil is higher than the Noack of the Group III base stock mix of the original engine oil.

Example C

Question C:

An engine oil using a Group III base stock mix with a Noack of 10.3 mass % passed the TU5JP-L4 engine test. It is desired to switch to an alternative Group III base stock mix with a Noack of 10.7 mass %. Is it necessary to re-run the TU5JP-L4 test?

Answer C:

It is not required to run a TU5JP-L4 engine test because the Noack of the Group III base stock mix of the alternative engine oil is lower than the Noack of the Group III base stock mix of the original engine oil taking into account the precision of the Noack test method (reproducibility, R = 0.8).

B.4.3 Guidelines for linking base stock slates

B.4.3.1 Pre-qualification for linking slates

Each of the base stock slates to be linked shall already have been used in engine oil formulations qualified against the appropriate ACEA Oil Sequences for which the linked slates are intended.

Parties wishing to link slates from different base stock manufacturers shall obtain a written statement from each manufacturer that the quality of the base stocks involved will be of consistent quality. If the quality changes, the base stock manufacturer shall inform the parties involved, eg the lubricant manufacturer and/or lubricant marketer.

B.4.3.2 Qualification to link slates

B.4.3.2.1 To qualify for linking slates, passing results shall be obtained, separately for each of the slates to be linked, in applicable tests in the ACEA Oil Sequences for which linking is intended. The applicable tests are those defined in Tables B.3 and B.4 for the sequence concerned. Qualification tests shall be carried out in accordance with the ATC[8] or ACC[9] Codes of Practice, as applicable.

B.4.3.2.2 The base stocks to be tested in the linkage qualification programme shall be suitable for formulating engine lubricants and, for each of the applicable laboratory and engine tests to be carried out, be those identified as the most severe (see B.6) within the respective slates.

B.4.3.2.3 Base stocks from each slate to be linked shall be separately evaluated using performance additive packages and SAE J300[12] viscosity grades agreed by the partners. For qualification tests in a given ACEA Oil Sequence, the same performance additive package and VM shall be used. For different ACEA Oil Sequences it is preferable, but not essential, to use different performance additive packages. The concentration of individual performance additive packages shall be set at the level normally recommended for the targeted ACEA Oil Sequence.

B.4.3.2.4 The SAE J300 viscosity grade of formulations evaluated shall be multigrade and the same for each specific test comparison conducted, but may vary between tests. The VM concentration may be varied by up to 15 mass % relative in order to meet viscosity requirements.

B.4.3.2.5 If linkage of Group I base stock slates is required, the formulations tested shall not contain base stocks from other groups.

B.4.3.2.6 If linkage of either Group II or Group III slates is required, it is preferable that base stocks from other groups are not used. However, if this is not feasible, mixtures of Group I with Group II or Group I with Group III may be tested. In this case, interchangeability between linked slates may be up to the concentration of Group II or Group III base stock(s) used in the formulations tested.

Where such mixtures are used in the testing to link Group II or Group III slates, the only variable between tested formulations shall be the Group II or Group III base stock. All other components shall remain constant.

Providing passing results are obtained against the requirements outlined above, the tested base stock slates may be linked.

B.4.3.3 Use of linked slates for existing engine oil formulations

Base stocks from linked slates may be used interchangeably in all relevant, previously validated formulations provided:

a) the previous validation was based on the most severe base stocks (see B.6) from the linked slates;
b) performance additive concentration rates are set at the levels originally used;
c) concentrations of Group II or Group III base stocks, or both do not exceed those originally approved.

Compliance with the requirements of the relevant ACEA Oil Sequences may be claimed for such formulations when using base stocks from a linked slate in place of the original base stocks.

B.4.3.4 Development of new engine lubricants meeting existing ACEA Oil Sequences

The most severe base stocks (see B.6) from the linked slates identified for each engine test shall be used in development of new engine lubricants to meet existing ACEA Oil Sequences. If, in a particular test in the linking programme, base stocks are observed to have equivalent performance, it is permitted to use any of the base stocks concerned for future development work in that test.

Additive concentration in marketed formulations shall be set at a level established during development as necessary to pass all the relevant qualification tests.

B.4.3.5 New ACEA Oil Sequences

New ACEA Oil Sequences may contain new engine tests that are base stock sensitive; updates to Tables B.3 and B.4 will reflect such changes.

For each new test, the impact of base stocks on lubricant performance shall be assessed to identify the most severe base stock to be used in product development involving such tests.

B.4.3.6 Introducing a new base stock into a linked base stock slate

If a new base stock is to be added to a linked base stock slate, relevant experts shall assess the testing, if any, that needs to be carried out to confirm interchangeability.

B.4.3.7 Maintaining linked status

For new tests or tests with increased severity, the linked status shall be reconfirmed as described in B.4.3.

B.4.3.8 Examples

The following examples illustrate the use of these guidelines to link base stock slates.

Example A: Linking three Group I slates

Group I base stock slates P, Q and R needed to be linked and the most severe base stocks within these slates had been identified. All three slates met the pre-qualification requirements.

a) Qualification to link slates

Slates P, Q and R, each comprise three Group I base stocks. It was agreed to test SAE 15W 40 formulations against the requirements of ACEA Categories E7 and ACEA A3/B4 using additive packages S and T at concentration normally recommended for the targeted ACEA performances. The three formulations involved contained viscosity modifier G and H respectively. The details of the formulations are summarised in Table B.5.

G and H could have been the same viscosity modifiers and S and T the same additive technology.

The testing was successful as the engine test data met the agreed minimum performance standards (see Table B.5).

To obtain passes, it was necessary to repeat the Seq VG test on oil #2 (Slate Q base stocks) and the Mack T-8E test on oil #6 (Slate R base stocks).

In this example, it was assessed that Slate P base stocks are the most severe (see B.6) in Mack T-8E testing and Slate R base stocks the most severe in Seq VG testing. In all other tests the performance of each base stock was considered equivalent.

Slates P, Q and R were, therefore, considered linked.

b) Using linked slates for existing engine oil formulations

Base stocks from the linked slates can now be used interchangeably in all relevant, previously validated formulations based on slates P, Q and R, provided those formulations were validated using the most severe base stocks in the linked slates.

c) Development of new engine oils meeting existing ACEA Oil Categories

In new developments, as specified in B.4.3.2.2, use Slate P base stocks in Mack T8-E testing and Slate R base stocks in Seq VG testing. In other tests, use any relevant base stock selected from the most severe within the individual slates.

Base stocks from slates P, Q and R may be used interchangeably in new formulations validated using these most severe base stocks.

Table B.5 Linking three Group I slates[1]

Component		ACEA E7-08			ACEA A3/B4-08		
		Oil #1	Oil #2	Oil #3	Oil #1	Oil #2	Oil #3
Slate P	90 SN	2.2 %	—	—	—	—	—
	175 SN	72.0 %	—	—	77. 0 %	—	—
Slate Q	100 SN	—	10.0 %	—	—	10.0 %	—
	200 SN	—	64.5 %	—	—	67.3 %	—
Slate R	150 SN	—	—	64.6 %	—	—	66.9 %
	650 SN	—	—	10.0 %	—	—	10.0 %
Additive pack S		17.2 %	17.2 %	17.2 %	—	—	—
Additive Pack T		—	—	—	13.5 %	13.5 %	13.5 %
Viscosity modifier G		8.6 %	8.3 %	8.2 %	—	—	—
Viscosity Modifier H		—	—	—	9.5	9.2	9.6
Formulated oil		100.0 %	100.0 %.	100.0 %	100.0 %	100.0 %	100.0 %
SAE J300 viscosity grade		15W-40	15W-40	15W-40	15W-40	15W-40	15W-40
Mack T-8E		Pass[2]	Pass	Pass	—	—	—
OM501LA		Pass	Pass	Pass	—	—	—
Cummins ISM		Pass	Pass	Pass	—	—	—
Mack T-12		Pass	Pass	Pass	—	—	—
TU5JP-L4		—	—	—	Pass	Pass	Pass
Seq VG		—	—	—	Pass	Pass	Pass[3]
M111SL		—	—	—	Pass	Pass	Pass
VW TDI		—	—	—	Pass	Pass	Pass
Laboratory Tests[4]		Pass	Pass	Pass	Pass	Pass	Pass

[1] All percentages are mass % of the formulated lubricant.
[2] Repeated to obtain pass.
[3] Repeated to obtain pass.
[4] As specified in the ACEA Oil Sequences.

Example B: Linking two Group III slates

Group III base stock slates D and E needed to be linked and the most severe base stocks within these slates had been identified.

Note B.4 This example would also be applicable to linking Group II base stock slates.

a) Qualification to link slates

It was agreed to test Slates D and E against the requirements of ACEA Categories C3 and E6 using SAE 5W-30 and 10W-40 formulations. Additive package X was used at 13 mass % for ACEA C3. Additive package Y was used at 21 mass % for ACEA E6 testing.

The testing was successful as the engine test data met the minimum performance standards (see Table B.6).

Passing results were obtained in all tests at the first attempt but slate E base stocks were assessed to be more severe (see B.6) than those of slate D in all tests. Therefore, as specified in B.4.3.2.2, use the former, for all future testing to qualify formulations.

Slates D and E may, therefore, be considered linked.

b) Using linked slates for existing engine oil formulations

Base stocks from the linked slates can now be used interchangeably in all relevant, previously validated formulations based on slates D and E, provided those formulations were validated using the most severe base stocks E in the linked slates.

c) Development of new engine oils meeting existing ACEA Oil Categories

Base stocks from slates D and E may be used interchangeably in new formulations validated using slate E base stocks.

Table B.6 Linking two Group III slates[1]

Component		ACEA C3-08		ACEA E6-08	
		Oil #1	Oil #2	Oil #3	Oil #4
Slate D	Group III (4 mm^2/s)	32.7 %	—	15.8 %	—
Slate D	Group III (6 mm^2/s)	40.0 %	—	55.0 %	—
Slate E	Group III (4 mm^2/s)	—	34.0 %	—	17.9 %
Slate E	Group III (6 mm^2/s)	—	39.1 %	—	53.0 %
Additive pack X		13.0 %	13.0 %	—	
Additive pack Y		—	—	21.0 %	21.0 %
Viscosity modifier M		14.3 %	13.9 %	8.2 %	8.1 %
Formulated oil		100.0 %	100.0 %	100.0 %	100.0 %
SAE J300 viscosity grade		5W-30	5W-30	10W-40	10W-40
TU5JP-L4		Pass	Pass	—	—
TU3M		Pass	Pass	—	—
Seq VG		Pass	Pass	—	—
M111SL		Pass	Pass	—	—
OM646LA		Pass	Pass	—	—
DV4TD or DV6C		Pass	Pass	—	—
VW TDI		Pass	Pass	—	—
Laboratory tests[2]		Pass	Pass	—	—
OM646LA				Pass	Pass
Mack T-8E				Pass	Pass
OM501LA				Pass	Pass
Mack T-12				Pass	Pass
Laboratory tests[2]				Pass	Pass

[1] All percentages are mass % of the formulated lubricant.

[2] As specified in the ACEA Oil Sequences

B.4.4 Emergency temporary derogation of the ATIEL base stock interchange guidelines for unlinked slates

B.4.4.1 Scope

This Section details the circumstances and conditions under which it may be appropriate for an emergency, temporary derogation of the existing ATIEL base stock interchange guidelines for unlinked slates described in Tables B.3 and B.4.

The use of such derogation shall be applied in true *force majeure* situations, as defined in B.4.4.2, where the shortage of base stocks is beyond the lubricant marketer's control. The derogation is not intended for use, nor should it be used, in other situations where shortage of base stocks might arise for other, purely commercial reasons.

The derogation of the base stock interchange guidelines applies for a maximum of 90 days and can be initiated by any *force majeure* situation including, but not limited to, those arising from base stock or additive supply.

The derogation attempts to find a balance between rigidly adhering to the guidelines in B.4.2 (which might disadvantage those faced with a *force majeure* situation) and allowing too much flexibility (which would disadvantage those who are striving to adhere to the guidelines in B.4.2 by alternative means). In addition to the need for fairness in such situations, there is also a need to maintain the image and quality of products in the market. In effect, the derogation allows a marketer faced with a *force majeure* situation to market, on a temporary basis, a product while the base stock interchange data is being generated. The testing requirements, however, are identical to those that would normally have to be carried in non-*force majeure* situations, the only difference being that in the latter situation, the data must be generated before the product is marketed.

The use of this derogation should be seen as a last resort after all other alternatives have been rigorously pursued and documented.

Even with the use of this derogation, the quality of affected products and the claims made for them remain the sole responsibility of the lubricant marketer. ACEA performance claims are self-certifying and no change to that situation is implied or given by this derogation. ATIEL will accept no responsibility for any issues or claims arising from the use of this derogation.

The derogation does not take any responsibility for OEM performance claims made on products impacted by this derogation. Separate discussions are necessary with individual OEMs.

B.4.4.2 *Force Majeure*

Force majeure refers to a situation of material unavailability which is beyond the control of the lubricant marketer and involves failure to perform contractual obligations.

The restriction in the supply of base stock shall apply to a significant number of lubricant marketers, not just one. The restriction shall make it impossible for those lubricant marketers to continue selling their products resulting in a significant disruption in availability of suitable products in the market.

The material unavailability shall be caused by an unforeseeable event such as, but not necessarily restricted to, explosion, fire, legal action, act of terrorism, act of God or hurricane that is beyond the control of the lubricant marketer.

Force majeure does not apply to a situation referred to as commercial hardship where the marketer has failed to obtain supplies of suitable base stocks as a result of negligence, or failure to use good business practice or where, for example, as a result of market economics, it becomes harder or more expensive, but not impossible, to procure the necessary base stocks. Companies in this situation can attempt to alleviate their problems by means other than derogation, such as through discussions with their additive and base stock suppliers, or by temporarily revising the claims made the product or by selling alternative products.

B.4.4.3 Guidelines

Lubricant marketers wishing to make use of this derogation shall supply the ATIEL Secretary General with the information detailed in B.4.4.4. A database shall also be created containing the information detailed in B.4.4.5. ATIEL reserves the right to add additional requirements for specific situations if it sees fit.

Lubricant marketers shall complete the derogation template letter shown in Appendix F and send it to the ATIEL Secretary General.

The ATIEL Secretary General will not review this information on a case-by-case basis nor will it be circulated within ATIEL or to third parties. The ATIEL Secretary General will, however, publish a list on the public section of the ATIEL website (www.atiel.org), detailing the names of the companies applying the derogation and the derogation period. The ATIEL Secretary General will also send a copy of this list to the Secretary General of ACEA for their information.

Marketers making use of this derogation shall draw the attention of their internal and external auditors to its use and shall provide all necessary data requested as part of any such audit.

B.4.4.4 Information to be sent to ATIEL in support of a derogation

A marketer applying this derogation shall send the following information by registered mail to the ATIEL Secretary General:

a) The dates when the use of the derogation becomes effective and when it ceases, up to a maximum period of 90 days. The relevant dates are those when manufacturing commences and ceases.

b) A monthly report within the 90-day period on the steps being taken to rectify the material unavailability and steps being taken to add missing results to the data package.

c) Confirmation that the quality of the product to be marketed is sufficient to support the claims made for it.

d) A detailed description of the industry-wide material unavailability together with documentation of *force majeure* declaration by suppliers.

e) A detailed description of the actions already taken to find alternative sources of base stocks that would obviate the need for this derogation or to find alternative sources of finished products. Documentation shall be provided why these alternatives cannot be applied and why the removal of ACEA performance claims is not appropriate as a short-term measure.

f) An explanation of why the current base stock interchange guidelines cannot be applied to provide the necessary relief.

g) Details of the specific relaxation proposed for subject formulations.

B.4.4.5 Data Set required in support of a derogation

In addition to the information detailed in B.4.4.4, the lubricant marketer applying this derogation shall prepare a database, as detailed below, which is to be made available to its internal and external auditors. The database shall contain the following information:

a) Details of all missing test data for the standard candidate data package and the test work planned to close these gaps in the candidate data package as quickly as possible. Testing shall be completed even after the use of the provision has ended.

b) Details of which base stocks are currently used to comply with the ATIEL Code of Practice and the alternatives proposed under this derogation.

c) A list of all products and re-brands impacted by the use of this derogation, together with marketing territories and channels of trade.

d) Details of laboratory test (see B.4.2.3) results for base stocks and finished products using the current and proposed base stocks. (B.4.2 already provides guidance on how individual base stocks should be evaluated and how interchange between base stocks should be assessed).

e) Evidence of performance claims (and proposed changes) made for impacted products in labels and product data sheets.

f) Details of engine test data to support the claims to be made, highlighting gaps in the data set, together with a plan and time line to show that the missing data will be obtained and then reported. If passing data is not obtained under the existing industry protocols, the lubricant marketer shall notify the ATIEL Secretary General accordingly, cease making use of this derogation and advise what other corrective action is to be applied.

B.5 Verification of conformance with defined procedures

B.5.1 Management processes

Written procedures shall exist for all management processes referred to in Appendix B. Such procedures shall be auditable.

B.5.2 Auditing

Base stock manufacturing plants shall undergo regular auditing by an independent, appropriately accredited (ISO 9001 or equivalent) auditor.

Checklists to assist auditors in the assessment of conformance with the terms of the certification are given in Appendix D.

B.5.3 Base stock manufacturers' Letter of Conformance

Base stock manufacturers, including partner groups, wishing to declare that they manufacture base stocks in accordance with the ATIEL Guidelines for base stock quality assurance, as described in this Appendix B, may do so by submitting the Base Stock Manufacturers' Letter of Conformance to ATIEL. A letter template is given in Appendix E and also on www.atiel.org. ATIEL will publish on its website a list of base stock manufacturers who have submitted such Letters of Conformance.

Base oil manufacturers signing this letter shall ensure that all elements of the guidelines are fully implemented from the date of signing the letter.

B.6 Guideline for selection of the most severe base stock

B.6.1 General

This Section outlines how base stock selection for an engine lubricant product development should proceed, even within a given manufacturer's specific slate(s). The guidance offered is intended to be illustrative, not exhaustive.

B.6.2 to B.6.4 describe industry experiences and should be taken into account when making base stock selection for engine lubricant development. The interpretation of base stock slate definition shall not be allowed to compromise finished lubricant quality.

While the principle of severe base stock is defined in the context of 'slate/base stock linking' within the Code, this concept should apply for ***all*** product developments for engine lubricants marketed as complying with ACEA Oil Sequences.

B.6.2 Group I base stocks

B.6.2.1 Oxidation engine tests such as the TU-5JP-L4

B.6.2.1.1 Generally, the higher the sulphur concentration in the base stock, the better the oxidation performance in a hot, dry, oxidation engine tests.

For such engine tests, therefore, the most severe Group I base stock, based on sulphur considerations alone, will generally be that with the lowest sulphur concentration within a manufacturer's slate.

Another important factor to consider is aromatic content when selecting the most severe base stock.

B.6.2.1.2 Group I base stocks can be broadly divided into three categories characterised by whether the sulphur concentration is high, medium or low:

a) High to medium sulphur concentrations usually depend on the source of the crude oil feedstock. For example, Middle East crudes are typically in the high category whereas those from the North Sea are usually medium.

b) Hydro-processing or hydro-finishing usually result in low sulphur concentrations (for example, < 900 ppm mass fraction).

B.6.2.2 Soot dispersancy engine tests

B.6.2.2.1 Experience shows that the most severe Group I base stocks in soot dispersancy engine tests such as the Mack T-8E, Mack T-11 and Cummins ISM are those with the highest concentrations of polar molecules.

B.6.2.2.2 Polar compounds arise from the presence of aromatic molecules and those containing hetero-atoms such as nitrogen and sulphur. The concentration of polar molecules can be measured by IP 368.

B.6.2.2.3 It should be noted that the oxidation engine test and the soot dispersancy engine test will then have opposed severest base stock requirements.

B.6.3 Group II base stocks

B.6.3.1 Oxidation engine tests

B.6.3.1.1 A higher VI version of a given Group II base stock slate will normally a have lower concentration of volatile ‘light ends’ and hence better volatility performance in tests such as the Noack Evaporation Loss test. Other factors being equal, therefore, such base stocks will undergo a lower viscosity decrease in an oxidation engine test, because of the lower loss of ‘light ends’.

The most severe Group II base stock, therefore, in oxidation tests is that with a VI in the lower band (~ 100).

Note B.5 Commercial Group II base stocks can be divided into a lower VI (~ 100) band and a higher VI band (> 110) – sometimes unofficially referred to as Group II+.

B.6.3.1.2 As part of good practice when formulating oils for performance in oxidation engine tests, use Group II base stocks with VI in the lower band in the original development.

B.6.3.1.3 Group II base stocks with VI in the higher band can be used to achieve better cold crank simulator viscosity and volatility performance.

B.6.3.1.4 The performance of a Group II base stock in oxidation engine tests is also affected by the concentration of saturates (paraffinic and poly-naphthenic molecules). Saturate concentration at a given VI should also be considered when assessing the performance of base stocks in oxidation tests.

B.6.4 Group III Base Oils

B.6.4.1 Oxidation engine tests

B.6.4.1.1 A higher VI version of a given Group III base stock slate will normally a have lower concentration of volatile ‘light ends’ and hence better volatility performance in tests such as the Noack. Other factors being equal, therefore, such base stocks will undergo a lower viscosity decrease in an oxidation engine test such as the TU-5, because of the lower loss of ‘light ends’.

The most severe Group III base stock, therefore, in oxidation tests is that with a VI in the lower band (< 130).

Note B.6 Commercial Group III base stocks can be divided into a lower VI (< 130) band and a higher VI band (> ~130) – sometimes unofficially referred to as Group III+.

B.6.4.1.2 As part of good practice when formulating oils for performance in oxidation engine tests, use Group III base stocks with VI in the lower band in the original development.

B.6.4.1.3 Group III base stocks with VI in the higher band can be used to achieve better cold crank simulator viscosity and volatility performance.

B.6.4.1.4 The performance of a Group III base stock in oxidation engine tests is also affected by the concentration of saturates (paraffinic and poly-naphthenic molecules). Saturate concentration at a given VI should also be considered when assessing the performance of base stocks in oxidation tests.

Appendix C

Guidelines for Viscosity Modifier Interchange

Issue Number 19, September 2013

This issue supersedes all previous issues.
All new engine lubricant developments initiated after the date of this issue shall use this issue.

C.1 Viscosity modifier interchange (VMI)

VMI is a specific example of Programme Extension (see 2.5.3) and is subject to the minimum requirements given in the following sections.

Any VMI shall be supported by specific engine tests and rheological testing before implementation is permissible.

An engine lubricant formulation (VM plus performance additive package plus base stock) shall be fully supported by an ACEA Performance Data Set before VMI testing can take place.

C.2 VMI testing

VMI testing shall commence on the same performance additive package at the same concentration, and shall be carried out in the same base stocks and SAE J300[12] viscosity grade(s) that were used for the original programme. Minor re-balancing of the base stocks is permissible to achieve viscometric targets. Selection of viscosity grade(s) for VMI test work should be made based upon the coverage required for the interchange viscosity modifier and with regard to the relevant VGRA guidelines (see 2.3.6).

C.3 VMI suppliers

C.3.1 VMI may be permissible between products from the same or from different suppliers.

C.3.2 For products from the same supplier, this supplier is responsible for demonstrating those products that are equivalent and interchangeable without testing, and those for which testing is required before interchange is permissible. In any case, if the VM polymer concentration increase is greater than 15 mass %, VMI testing shall be carried out.

C.3.3 For products from different suppliers, VMI testing is always required. However, non-dispersant olefin copolymers (NDOCPs) meeting the following specifications can be interchanged provided a pre-qualification for this NDOCP interchange in a full ACEA A3/B3 programme (for passenger-car sequences A/B and C) or E7 programme (for heavy-duty sequences) for support of the 2010 or 2012 ACEA Oil Sequences is made:

- Ethylene content: 40-70 mass %
- Permanent shear stability index ≤ 33 (CEC L-014-93 or ASTM D6278)
- Weight average molecular weight by GPC : 90,000-170,000 amu

C.4 VMI programme

A complete VMI programme can be used to support other VMs from the same supplier, which are declared by the supplier to be equivalent and interchangeable. No additional interchange testing is required.

A VMI programme is performance additive package specific, but can extend to performance additive package systems of related technology within the formulation modification guidelines of the ACC or ATC Codes of Practice.

C.5 BOI test work

BOI test work must be separate from VMI testing. One BOI programme run on either the original VM/performance additive package or the interchange VM/performance additive package system will cover both systems.

C.6 Engine tests

Engine tests required by the proposed performance claim(s) shall be run for VMI. Specifically, for CEC tests governed by this Code and included in the ACEA Oil Sequences, the tests shown in Table C.1 shall be run before implementation of the interchange is permissible. Different test requirements have been identified for interchanging non-dispersant viscosity modifiers (NDVM) and dispersant viscosity modifiers (DVM).

Table C.1 Engine tests required before implementing VMI(1)

Performance Category	NDVM to NDVM(2,3,4)	DVM to DVM or NDVM to DVM(2,3,4)
Gasoline/light-duty diesel engines	TU5JP-L4 M111SL VW TDI M111FE	TU5JP-L4 M111SL OM602A or OM646LA DV4TD or DV6C VW TDI M111FE
Gasoline/light-duty diesel engines with aftertreatment devices	TU5JP-L4 M111SL VW TDI M111FE	TU5JP-L4 M111SL OM602A or OM646LA DV4TD or DV6C VW TDI M111FE
Heavy-duty diesel engines	OM441LA or OM501LA Mack T-8E(6), Cummins ISM(5,7)	OM602A or OM646LA OM441LA or OM501LA Cummins ISM(5,7) Mack T-8E(6)

Note C.1 For Sequence VG, tests are given in API 1509, Appendix E.

Note C.2 Where Mack T-8E and Cummins ISM tests are required, the rules described in the latest version of API 1509 apply, except for the specific conditions mentioned in the notes below.

(1) See Table B.1 for test methods to be used

(2) Full testing is required for VMI not listed above.

(3) Physical mixes of NDVM and DVM are treated as DVM.

(4) Only the tests included in the ACEA sequence for which read across is required have to be run.

(5) Cummins ISM not required if the new lubricant formulation has the same or a greater HTHS value compared with the original tested formulation

(6) MackT-8E requirement is waived if the replacement NDVM is within the same chemical type as the tested NDVM (chemical type means chemical family such as, but not limited to**,** styrene ester, polymethacrylate, styrene butadiene, styrene isoprene, polyisoprene, olefin copolymer and polyisobutylene).

(7) The Cummins M11 or Cummins M11EGR test may be used in place of the Cummins ISM test.

Appendix D

Data set requirements and auditors' checklists for base stock quality assurance

Issue Number 19, September 2013

This issue supersedes all previous issues.
All new engine lubricant developments initiated after the date of this issue shall use this issue.

D.1 Introduction

Appendix D comprises two sections:

- Candidate data package requirements
- ATIEL base stock quality assurance checklists

The first section of this Appendix contains checklists and ACEA Performance Data Set forms necessary to ensure correct documentation of ACEA performance claims.

The second section contains auditor checklists to ensure base stocks used in formulations making an ACEA performance claim meet the quality guidelines specified in the ATIEL Code.

D.2 Candidate data package requirements

All lubricant marketers shall prepare an ACEA Performance Data Set for each formulation making an ACEA performance claim. This Data Set is derived from the Candidate Data Package and, if appropriate, the Programme Extension Data, as described in 2.5; the Candidate Data Package and any additional programme extension data contain a complete record of each test development programme conducted under the Code and is required to confirm the performance of an engine lubricant against the relevant ACEA Oil Sequence(s).

- **Form D.1** Candidate Data Package checklist for ACEA Oil Sequence conformance
- **Form D.2** Programme Extension Data checklist for ACEA Oil Sequence conformance
- **Form D.3** ACEA Performance Data Set for ACEA Oil Sequence qualification

  Part A: Details of lubricant marketer and engine lubricants

  Part B: Laboratory tests

  Part C: Engine test results

  Part D: Checklist and qualification conformance

Form D.1 Candidate Data Package checklist for ACEA Oil Sequence conformance

Conducted by:

Additive package designation:

Viscosity grades:

Lubricant codes:

ATC data package reference number (if available):

	Included in this Data Package	Yes	No
1	Laboratory tests for formulations listed above	☐	☐
2	Formulations for all test lubricants	☐	☐
3	Results of all registered ASTM and CEC engine tests	☐	☐
4	Test declared 'out of control'	☐	☐
5	Test(s) declared 'not available'	☐	☐
6	Applicable test stand reference data	☐	☐
7	Properties and identity of base stocks used	☐	☐
8	Formulation modifications and read-across documentation	☐	☐
9	Test programme design document	☐	☐

Signed on behalf of (company):

Function:

Authorised name:

Authorised signature:

Date:

Company reference document number:

Form D.2 Programme Extension Data checklist for ACEA Oil Sequence conformance

Checklist for engine lubricant development programme		
Lubricant Code(s): **Viscosity grade(s) covered by this Data Package:**		
Included in this Data package	**Yes**	**No**
1 Form D.1 completed	☐	☐
For formulations developed in the programme extension		
2 Formulations for all test lubricants	☐	☐
3 Results of all laboratory tests on the final candidates	☐	☐
4 Results of all registered ASTM and CEC engine tests	☐	☐
5 Test has been declared 'out of control'	☐	☐
6 Test(s) declared 'not available'	☐	☐
7 Applicable test stand reference data	☐	☐
8 Properties and identity of base stocks used	☐	☐
9 Read-across documentation (VGRA, VMI, BOI)	☐	☐
Signed on behalf of (company): **Function:** **Authorised Name:** **Authorised Signature:** **Date:** **Company reference document number:**		

COMPANY LOGO OR STAMP	COMPANY CONFIDENTIAL INFORMATION

Form D.3 ACEA performance data set for ACEA Oil Sequence qualification

Part A Details of the lubricant marketer and engine lubricants	
Details of lubricant marketer	
Company:	
Address:	
Contact Person:	Function:
Phone No:	Fax No:
Email address:	
Lubricant details	
Brand Name:	SAE J300 viscosity grade:
Lubricant Code Number:	ACEA performance(1):
Details of any rebrands	
Brand Name(s):	
(1) List each applicable ACEA Oil Sequence category	
Company Document Ref. No.	

COMPANY LOGO OR STAMP	COMPANY CONFIDENTIAL INFORMATION

Form D.3 ACEA Performance Data Set for ACEA Oil Sequence qualification

Part B Laboratory tests

Laboratory test	Parameter	Test method	Units	Test result	Limits
SAE Viscosity	Kinematic viscosity at 100 °C Low-temperature cranking viscosity Low-temperature pumping viscosity	ASTM D445 ASTM D5293 ASTM D4684	mm^2/s mPa.s mPa.s		
Shear Stability	Viscosity after 30 cycles measured at 100 °C	CEC L-14-A-93 (Bosch injector)	mm^2/s		
Shear Stability	Viscosity after 90 cycles measured at 100 °C	ASTM D6278	mm^2/s		
HTHS Viscosity	Viscosity at 150 °C and 10^{-6} s^{-1} shear rate	CEC L-36-A-90	mPa.s		
Evaporative loss	Weight loss after 1 h at 250 °C	CEC L-40-93 Procedure B	mass %		
Sulphated Ash		ASTM D874	mass %		
Phosphorus		ASTM D5185	mass %		Report
Sulphur		ASTM D5185	mass %		Report
Chlorine		ASTM D6443	mass %		Report
TBN		ASTM D2896	mg KOH/g		
Oil/Elastomer Compatibility	Variation of characteristics after immersion for 7 days in fresh oil without pre-ageing	CEC L-39-96			
	Hardness DIDC RE-1 Tensile strength Elongation at rupture Volume variation		points % % %		
	Hardness DIDC RE-2 Tensile strength Elongation at rupture Volume variation		points % % %		
	Hardness DIDC RE-3 Tensile strength Elongation at rupture Volume variation		points % % %		
	Hardness DIDC RE-4 Tensile strength Elongation at rupture Volume variation		points % % %		
	Hardness DIDC AEM Tensile strength Elongation at rupture Volume variation		points % % %		
Foaming Tendency	Tendency - stability	ASTM D892 without Option A Seq. I (24 °C) Seq. II (94 °C Seq. III (24 °C)	 mL mL mL		
High Temp Foaming	Tendency - stability	ASTM D6082 Seq. IV(150 °C)	 mL		

Oxidation in the presence of biodiesel	Catalysed ageing test 144h at 170ºC & with air bubbling: **1** on pure oil **2** with B10 added (B71 1892 GO B10 LUB) PAI at 144h Kin. viscosity @ 100°C variation: at 72h at 96h at 120h at 144h	GFC-Lu-43T-11 Non-CEC test	 % mm²/s & % mm²/s & % mm²/s & % mm²/s & %		
Oxidation	Oxidation Induction time	CEC-L-85-T-99	min		
Low temperature pumpability	MRV Yield stress (MRV at SAE J300 temperatures applicable for the fresh oil viscosity grade)	CEC-L-105	mPa.s Pa		
Corrosion	Copper increase Lead increase Copper strip rating	ASTM D6594	mg/kg mg/kg max		
Company Document Ref. No.					

COMPANY LOGO OR STAMP	COMPANY CONFIDENTIAL INFORMATION

Form D.3 ACEA performance data set for ACEA Oil Sequence qualification

Part C Engine test results – light duty engines

Engine test	Parameter	Test method	Units	Test result	Ref. oil result	Limits
TU5JP-L4	Ring sticking (each part) Piston varnish (6 elements, average of 4 pistons) Absolute viscosity increase at 40 °C between mini and maxi values during test Oil consumption	CEC L-88-02	merit merit mm^2/s kg/test			
Seq VG	Average engine sludge Rocker cover sludge Average piston skirt varnish Average engine varnish Compression ring (hot stuck) Oil screen clogging	ASTM D6593	merit merit merit merit %			
TU3M	Cam wear, average Cam wear, max. Pad merit (average. of 8 pads)	CEC L-38-A-94	µm µm merit			
M111SL	Engine sludge, average Cam wear, average	CEC L-53-95	merit µm			
M111FE	Fuel economy improvement vs reference oil RL 191 (SAE 15W-40)	CEC L-54-96	%			
Company Document Ref. No.						

COMPANY LOGO OR STAMP	COMPANY CONFIDENTIAL INFORMATION

Form D.3 ACEA performance data set for ACEA Oil Sequence qualification

Part C Engine test results - light-duty diesel engines

Engine test	Parameter	Test method	Units	Test result	Ref. oil result	Limits
DV4TD	Absolute viscosity increase at 100 °C and 6 % soot (measurement with CEC L-83-A-97 method)	CEC L-93-04	mm^2/s			
DV6C	Absolute viscosity increase at 100 °C and 6 % soot Piston merit	CEC L-106	mm^2/s			
OM646LA	Cam wear inlet, average Cam wear outlet, average Tappet wear inlet, average Tappet wear outlet, average Cylinder wear, average Piston cleanliness Bore polishing (13 mm) max value Engine sludge, average	CEC L-099-08	µm µm µm µm µm merit % merit			
VW DI	Piston cleanliness Ring sticking (Rings 1 & 2) Average of all 8 rings Max. for any 1st ring Max. for any 2nd ring EOT TBN EOT TAN	CEC L-78-99	merit ASF ASF ASF mg.KOH/g mg.KOH/g			
Company Document Ref. No.						

COMPANY LOGO OR STAMP	COMPANY CONFIDENTIAL INFORMATION

Form D.3 ACEA performance data set for ACEA Oil Sequence qualification

Part C Engine test results - heavy-duty diesel engines

Engine test	Parameter	Test method	Units	Test result	Ref. oil result	Limits
OM602A	Cam wear, average Viscosity increase at 40 °C Bore polishing Cylinder wear, average Oil consumption	CEC L-51-98	µm % % µm kg/test			
OM646LA	Cam wear inlet, average Cam wear outlet, average Tappet wear inlet, average Tappet wear outlet, average Cylinder wear, average Piston cleanliness Bore polishing (13 mm) max value Engine sludge, average	CEC L-099-08	µm µm µm µm µm merit % merit			
Mack T8-E	Relative viscosity at 4.8 % soot 1st test 2 test average 3 test average	ASTM D5967				
Mack T-11	Min TGA soot @ 4 cSt Min TGA soot @ 12 cSt Min TGA soot @ 15 cSt		% % %			
Mack T-12	Merit Average Liner wear Average top ring weight loss End of test lead concentration, mass fraction Delta lead 250-300 h, mass fraction Oil consumption phase 1		 µm mg ppm ppm g/h			
Cummins M11	Rocker pad average weight loss at 4.5% soot 1 test 2 test average 3 test average Oil filter diff.press EOT1 test 2 test average 3 test average Engine sludge 1 test 2 test average 3 test average	ASTM D6838	 mg mg mg kPa kPa kPa merit merit merit			
Cummins ISM	Rocker pad average weight loss at 3.9% soot: 1 test/2 test/3 test average Oil filter diff press @ EOT: 1/2/3 test avg Engine sludge: 1/2/3 test average		 mg kPa merit			
OM441LA	Bore polishing Piston cleanliness Turbocharger deposits	CEC L-52-97	% merit mg			
OM501LA	Bore polishing Piston cleanliness Oil consumption Engine sludge	CEC L-101-08	% merit kg/test merit			
Company Document Ref. No.						

COMPANY LOGO OR STAMP	COMPANY CONFIDENTIAL INFORMATION

Form D.3 ACEA performance data set for ACEA Oil Sequence qualification

Part D Checklist and qualification conformance

Checklist Requirements

I hereby attest to using and satisfying the following criteria and/or guidelines as defined in ATIEL Code of Practice.

Qualification Conformance

I certify and claim that the lubricants listed in PART A meet the qualification criteria stipulated in the ATIEL Code of Practice.

Name of Authorised Company Representative:

Function:

Phone no: Email address:

Signature of Authorised Company Representative:

Date:

Company document reference no:

D.3 Guidelines for base stock quality assurance and interchange

Base stock manufacturers shall undergo periodic auditing by an appropriately accredited (ISO 9001 or equivalent) auditor. Forms required to assist in this process are described below. Details of the requirements for base stock manufacturers are given in B.3.

ATIEL Guidelines for base stock quality assurance and interchange are divided into four sections. The forms for each section are as follows:

Form D.4 Feedstock approval procedures

Form D.5 Refining process control procedures

Form D.6 Routine quality control procedures

Form D.7 Use of alternative base stocks in validated formulations

Form D.4 Feedstock Approval Procedures

(see B.3.2)

CHECKLIST FOR AUDITORS			
Confirmed seen:		**Yes**	**No**
1	Documented feedstock evaluation and approval process		
2	Roles and responsibilities for feedstock approvals clearly defined and assigned		
3	Register of approved feedstocks		
4	Defined triggers for feedstock re-evaluation		
5			
6			
7			
8			
9			
10			

Function:

Name: Signature:

Company document reference no:

Form D.5 Refining process control

(see B.3.3)

CHECKLIST FOR AUDITORS			
Confirmed seen:		**Yes**	**No**
1	Documented refinery process control system for base stock manufacture		
2	Roles and responsibilities for refinery process controls clearly defined and assigned		
3	Documented process to handle significant changes to processing conditions		
4			
5			
6			
7			
8			
9			
10			

Function:

Name: Signature:

Company document reference no:

Form D.6 Routine Quality Control
(see B.3.4)

CHECKLIST FOR AUDITORS

Confirmed seen:		**Yes**	**No**
1	Documented system for routine base stock quality control		
2	Roles and responsibilities for base stock quality control clearly defined and assigned		
3	Documented responsibilities for actions in the event of non-conformances		
4	Certificates of analysis routinely produced for base stock shipments		
5			
6			
7			
8			
9			
10			

Title:

Name: Signature:

Company document reference no:

Form D.7 Use of alternative base stocks in validated formulations
(see B.4.2)

CHECKLIST FOR AUDITORS

Confirmed seen:		**Yes**	**No**
1	Manufacturer's defined base stock slate		
2	Pre-qualification requirements in B.4.3.1 have been met		
3	Where slate linkage is claimed, validated formulations against one category in each of ACEA Classes A, B and E exist for each base stock slate (i.e. pre-qualification data)		
4	The most severe base stocks in the linked slates have been identified for development purposes		
5	Application of linked slates to current products in accordance with B.4.2		
6	Slates linked in accordance with B.4.3 (i.e. qualification data exist)		
7			
8			
9			
10			

Title:

Name: Signature:

Company document reference no:

Appendix E

Letters of Conformance

Issue Number 19, September 2013

This issue supersedes all previous issues.
All new engine lubricant developments initiated after the date of this issue shall use this issue.

Contents

E.1 Lubricant marketers' Letter of Conformance

E.2 Base stock manufacturers' Letter of Conformance

E.3 Renewal of Letters of Conformance

E.4 Lubricant marketers' derogation from the Letter of Conformance

E.1 Lubricant marketers' Letter of Conformance

E.1.1 Introduction

Participation in the EELQMS implies a commitment to develop and manufacture those engine lubricants for which compliance with ACEA Oil Sequences will be claimed, or to have such engine lubricants developed or blended by third parties in accordance with the guidelines described in the Code. It also implies a commitment to ensure an independent audit of the development and manufacturing process. As stated in 3.3.1, these commitments are made in a Letter of Conformance (see E.1.2) issued by the participating entity to ATIEL.

E.1.2 The template for the lubricant marketer's Letter of Conformance

The template for the lubricant marketers' Letter of Conformance is reproduced in Form E.1. A template is available in the section on the Code of Practice on the ATIEL website - www.atiel.org.

Form E.1 Template for the EELQMS Lubricant marketers' Letter of Conformance

(Letter to be addressed to ATIEL and sent by registered mail) to:

ATIEL
Boulevard du Souverain 165
Brussels B 1160
Belgium

From: Company name

[Insert current address]

[Insert nominated e-mail address for correspondence][E1]

Subject: Participation in the ATIEL European Engine Lubricants Quality Management System: Letter of Conformance

[Name of the participating company], duly represented by the undersigned acting for *[name of participating company]* and entities acting under its brand, hereby formally declares to participate in the European Engine Lubricants Quality Management System (EELQMS). In this respect *[Name of the participating company]* undertakes to:

- apply the EELQMS guidelines, as described in the ATIEL Code of Practice, to develop and manufacture those engine lubricants for which compliance with ACEA Oil Sequences requirements will be claimed;
- inform its auditors of its agreement to implement the EELQMS;
- ensure that its ISO 9001 or equivalent procedures include conformance with the ATIEL Code of Practice and to identify these procedures to ISO 9001 (or equivalent) auditors;
- provide such auditors with the relevant copy(ies) of the ATIEL Code of Practice;

[E1] Future versions of the ATIEL Code of Practice will be uploaded to the ATIEL website. In addition, a notification will be sent to an email address nominated by each signatory of the ATIEL Letters of Conformance. This email address will also be used for provision of additional information relating to the Code.

- in case the development process, or parts thereof, are conducted by a third party, require that this third party, having signed the lubricant marketers' Letter of Conformance themselves, will apply the EELQMS guidelines, as described in the ATIEL Code of Practice, to ensure the independent audit of the development process;
- in case the engine lubricants are blended by a third party, require and ensure that this third party complies with the quality requirements for blending included in the ATIEL Code of Practice.

The commitments referred to in this letter will be valid until the expiry date published on the ATIEL website www.atiel.org. *[Name of the participating company]* is entitled to withdraw from its EELQMS commitments at any time prior to that date, by registered letter to ATIEL. Renewal of the participation in the EELQMS is possible for subsequent periods of two years. A renewal shall be notified in writing to ATIEL, on the basis of the standard Letter of Conformance applicable at that time.

[Name of the participating company] mandates ATIEL to:

- include its company name in the ATIEL List of Participants in the EELQMS which will be made available by ATIEL to any interested party and published on the ATIEL website www.atiel.org.

[Name of the participating company] shall be solely responsible for compliance with the obligations defined in this letter. It shall not assert, in any way, that any of its automotive lubricants or related products qualifies under the ACEA Oil Sequences, unless all tests and analyses of such products carried out prove that they merit the claimed qualifications of the ACEA Oil Sequences have been performed in strict compliance with and observance of all applicable or relevant procedures.

E.1.3 List of companies who have signed the EELQMS (lubricant marketers') Letter of Conformance

The section on the Code of Practice on the ATIEL website (www.atiel.org) gives the current list[E2] of entities registered by ATIEL as having declared their participation in the EELQMS by signing the lubricant marketer's Letter of Conformance (see Form E.1 for the template).

The appearance of an entity on the ATIEL list means only that ATIEL has entered in its register, as of the date of the list, a valid Letter of Conformance of the entity concerned, appearing, on the face of it, to be genuine. ATIEL assumes no responsibility for the implementation by the entities identified above of their obligations, as defined in such Letter of Conformance, or for any damage that a breach thereof may cause to third parties. ATIEL cannot be held responsible for any claims resulting from inclusion and non-inclusion of entities in this list. ATIEL also declines any responsibility with regard to the audit procedure, which belongs to the domain of the relevant auditor.

[E2] Any queries concerning this list should be addressed to the ATIEL office. See www.atiel.org

E.2 Base stock manufacturers' Letter of Conformance

E.2.1 Introduction

As stated in 3.3.2, base stock manufacturers may sign a Letter of Conformance declaring that they manufacture base stocks in accordance with the ATIEL Base Stock Assurance Guidelines (see B.5.3 for details). Signing the Base Stock Manufacturers' Letter of Conformance implies a commitment by base stock manufacturers and partner groups to the quality assurance guidelines described in Appendix B for the manufacture of base stocks to be used in engine lubricants for which compliance with ACEA Oil Sequences is to be claimed.

E.2.2 The template for the base stock manufacturers' Letter of Conformance

The base stock manufacturers' Letter of Conformance is reproduced in Form E.2. A template is available in the section on the Code of Practice on ATIEL's website - www.atiel.org.

Form E.2 Template for Base Stock Manufacturers' Letter of Conformance

(Letter to be addressed to ATIEL and sent by registered mail) to

ATIEL
Boulevard du Souverain 165
Brussels B 1160
Belgium

From: Company name

[Insert current address]

[Insert nominated e-mail address for correspondence][E1]

Subject: ATIEL Base Stock Quality Assurance Guidelines:
Letter of Conformance

[Name of participating company] hereby declares its undertaking to implement the ATIEL Base Stock Quality Assurance Guidelines as described in Appendix B of the ATIEL Code of Practice.

For the purposes of this Letter of Conformance, *[Name of the participating company]* represents all associated companies operating under its brand and is duly represented by the undersigned.

[Name of the participating company] in particular undertakes to:

- inform its auditors of its agreement to implement the ATIEL Guidelines for base stock quality assurance and interchange;
- ensure that its ISO 9001 or equivalent procedures include conformance with the ATIEL Code of Practice and to identify these procedures to ISO 9001 (or equivalent) auditors;
- provide such auditors with the relevant copy(ies) of Appendix B of the ATIEL Code of Practice;
- apply the ATIEL Base Stock Quality Assurance Guidelines to the production of base stocks by [Name of the participating company] where such base stocks are intended for use in lubricants for which compliance with ACEA Sequences is to be claimed;

[E1] Future versions of the ATIEL Code of Practice will be uploaded to the ATIEL website. In addition, a notification will be sent to an email address nominated by each signatory of the ATIEL Letters of Conformance. This email address will also be used for provision of additional information relating to the Code.

- ensure that, where base stocks produced by a third party are re-branded for sale under the *[Name of the participating company]* brand and where such base stock are intended for use in lubricants for which compliance with ACEA Sequences will be claimed, the third party concerned has: (a) applied the ATIEL Base Stock Quality Assurance Guidelines to the production of the base stocks supplied and (b) has itself submitted a letter of conformance to ATIEL.

It is understood by *[Name of the participating company]* that the commitments referred to above:

- will remain valid until the expiry date published on the ATIEL website www.atiel.org.
- may be revalidated for a further period of two years by submitting to ATIEL a new Letter of Conformance based on the template letter current at that time
- may be cancelled at any time by notifying ATIEL by registered mail of the withdrawal of any or all of the undertakings made in this Letter of Conformance.

[Name of the participating company] hereby agrees that ATIEL may include its name in a list of companies that have agreed wholly or in part to implement Appendix B of the ATIEL Code of Practice. This list may be made available to ATIEL members or to any interested party and published on the ATIEL website www.atiel.org.

[Name of the participating company] further agrees that it will be solely responsible for compliance with the undertakings it makes in this letter. It will not assert, in any way, that base stocks have been produced in compliance with Appendix B of the ATIEL Code of Practice unless all relevant procedures and test have been carried out.

Important note:

Base stock manufacturers signing this Letter of Conformance shall ensure that all elements of the guidelines are fully implemented from the date of signing the letter.

E.2.3 List of Companies who have signed the base stock manufacturer's Letter of Conformance

The section on the Code of Practice on the ATIEL website (www.atiel.org) gives the current list[E2] of entities registered by ATIEL as having declared their participation in EELQMS by signing the base stock manufacturers' Letter of Conformance (see Form E.2 for the template).

The appearance of an entity on the ATIEL list means only that ATIEL has entered in its register, as of the date of the list, a valid Letter of Conformance of the entity concerned, appearing, on the face of it, to be genuine. ATIEL assumes no responsibility for the implementation by the entities identified above of their obligations, as defined in such Letter of Conformance, or for any damage that a breach thereof may cause to third parties. ATIEL cannot be held responsible for any claims resulting from inclusion and non-inclusion of entities in this list. ATIEL also declines any responsibility with regard to the external audit procedure, which belongs to the domain of the relevant auditor.

[E2] Any queries concerning this list should be addressed to the ATIEL office. See www.atiel.org

E.3 Renewal of Letters of Conformance

E.3.1 Renewal process

There are fixed dates for renewal of Letters of Conformance, which apply to both lubricant marketers and base stock manufacturers. This process is designed to simplify administration of the Code and to ensure that the list of signatories posted on the ATIEL website is always up-to-date.

E.3.2 Renewal dates

Renewal dates are normally set at two year intervals.

E.3.3 Templates for the Letters of Conformance

Templates for renewing Letters of Conformance are available on the ATIEL website.

E.3.4 Bringing new signatories into line with the fixed renewal dates

New signatories whose Letter is received by ATIEL less than 12 months before the next fixed renewal date (31 May 2015) will be asked to agree to an extension to the succeeding renewal date; for example, if the Letter is received on 1 July 2014, the company will be asked to agree to the next renewal date after the 31 May 2015. (Otherwise they would have to sign again on 31 May 2015.)

New signatories whose Letter is received by ATIEL more than 12 months before the next fixed renewal will use that date as their next renewal date; for example, if the Letter is received on 1 March 2014, the renewal date will be 31 May 2015.

E.3.5 ATIEL's role in the renewal process

As a courtesy to signatories, ATIEL sends out first and second reminder letters approximately four months and two months before the fixed renewal dates.

E.3.6 Signatories responsibilities for renewal

Notwithstanding the reminder letters sent out by ATIEL, it is the responsibility of the signatories to ensure their Letters of Conformance are renewed in a timely fashion.

Companies who have not renewed their Letters of Conformance by the recurring expiry dates will be removed from the list of signatories posted on the ATIEL website. This removal means that the company will no longer be able to claim that it commits to the quality assurance guidelines described in the ATIEL Code of Practice. As a consequence, claims to meet the requirements of the ACEA sequences cannot be made.

E.4 Lubricant marketers' derogation from the Letter of Conformance

E.4.1 Introduction

Lubricant marketers wishing to make use of the emergency temporary derogation described in B.4.4 shall complete the derogation letter (reproduced in Form F.3) and send it to ATIEL. A template is available in the section on the Code of Practice on ATIEL's website - www.atiel.org. ATIEL will not review this information on a case-by-case basis, nor will it be circulated within ATIEL or to third parties.

E.4.2 List of companies who have signed the lubricant marketer's derogation from the Letter of Conformance

ATIEL will publish on its website a list of companies that have filed a letter of derogation.

Form E.3 Template for the EELQMS lubricant marketers' derogation from the Letter of Conformance

To: ATIEL EEIG
Boulevard du Souverain 165
Brussels B 1160
Belgium

From: Company name

[Insert current address]

[Insert nominated e-mail address for correspondence][E1]

Subject: Lubricant marketers' Derogation from the Letter of Conformance

[Name of the participating company], duly represented by the undersigned acting for *[name of participating company]* and entities acting under its brand, hereby formally declares that, in accordance with the provisions detailed in B.4.4 of the ATIEL Code of Practice (hereinafter referred to as Appendix B), it is applying the temporary, emergency derogation of the base stock interchange guidelines as described in B.4.2. In this respect, *[Name of the participating company]* confirms that:

- the derogation is effective from the date of manufacture of [*date*] and will be withdrawn on the date of manufacture of [*date*], with a maximum period of ninety days;
- the derogation arises from a shortage of base stock beyond the company's control and is as a consequence of a situation of *force majeure*, as defined in B.4.4.2 of Appendix B;
- the derogation is not as a consequence of commercial hardship, as defined in B.4.4.2.of Appendix B;
- the use of this derogation is a last resort, all other alternatives having been rigorously pursued and documented;
- It is solely responsible for the quality of affected products and the claims made for them when invoking this derogation;
- the derogation does not change the self-certifying nature of ACEA performance claims;
- ATIEL has no responsibility for any issues or claims arising from the use of this derogation;
- the attention of the internal and external auditors will be drawn to the use of this derogation and all necessary data requested as part of any such audit will be provided;
- a report will be sent to the ATIEL Secretary General every thirty days on the steps being taken to rectify the material impossibility and steps being taken to add missing results to the data package;

[E1] Future versions of the ATIEL Code of Practice will be uploaded to the ATIEL website. In addition, a notification will be sent to an email ID nominated by each signatory of the ATIEL Letters of Conformance. This email address will also be used for additional information.

- the quality of the product to be marketed is sufficient to support the claims made for it;
- the derogation does not take any responsibility for OEM performance claims made on products impacted by this derogation;
- attached to this letter is supporting evidence, as detailed in B 4.4.4.d) to B.4.4.4 g) of Appendix B, of the *force majeure* situation, the actions already taken to find alternative sources of base stocks, an explanation of why the current base stock interchange guidelines cannot be applied, and the specific relaxation proposed for subject formulations;
- if passing engine test data carried out as detailed in B.4.4.5 f) of Appendix B is not obtained, it shall cease making use of this derogation and will inform ATIEL Secretary General of the cessation date.

In addition, [*Name of the participating company*] confirms that it has created a database as detailed in B.4.4.5 of Appendix B providing details of:

- all missing test data and test work planned to close any gaps;
- the base stocks currently used to comply with the ATIEL Code of Practice and the alternatives proposed under this derogation;
- all products and re-brands impacted by the use of this derogation together with marketing territories and channels of trade;
- chemical and physical data and bench test results for base stocks and finished products using the current and proposed base stocks;
- evidence of performance claims (and proposed changes) made for impacted products in labels and product data sheets;
- engine test data to support the claims to be made, highlighting gaps in the data set, together with a plan and time line to show that the missing data will be obtained and then reported;
- The corrective actions taken if passing engine test data carried out as detailed in B.4.4.5 f) of Appendix B is not obtained;

[Name of the participating company] mandates ATIEL to:

- include its company name and the period of the derogation involved in a list of those applying this derogation and to make this list available to any interested party (including ACEA) by publishing it on the ATIEL website.

[Name of the participating company] shall be solely responsible for compliance with the obligations defined in this letter.