



SURFACE VEHICLE INFORMATION REPORT

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(R) Global Tests and Specifications for Automotive Engine Oils

RATIONALE

No other single source exists which attempts to summarize all international engine oil performance tests and specifications.

FOREWORD

Engine and laboratory tests are utilized to determine the performance of engine oils. The API, ASTM, and SAE have established engine tests and classifications to describe engine oil performance. Such tests are included in SAE J183, SAE J304, and SAE J300. Additionally, tests to characterize the energy-conserving characteristics of engine oils are described in SAE J1423. Engine and laboratory tests apart from those described in these SAE documents are also established in Europe and Japan. The purpose of this document is to summarize the respective international tests and specifications utilized to characterize the performance of service fill automotive engine oils, outside of SAE J304 and SAE J183. Since specifications are likely to change frequently, it is recommended that all specifications be confirmed with the appropriate manufacturer or technical society at the time that critical usage is contemplated.

1. SCOPE

This SAE Information Report lists engine and laboratory tests for service fill engine oils which are associated with specifications and classifications established outside of SAE J304 and SAE J183. These specifications and classifications include those developed prior to April 1, 2017, by international technical societies, as well as individual original equipment manufacturers. The information contained within this report applies to engine oils utilized in gasoline- and diesel-powered automotive vehicles.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

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Documents
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2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J183	Engine Oil Performance and Engine Service Classification (Other Than “Energy-Conserving”)
SAE J300	Engine Oil Viscosity Classification
SAE J304	Engine Oil Tests
SAE J1423	Classification of Energy Conserving Engine Oil and Resource Conserving Engine Oil for Passenger Cars, Vans, Sport Utility Vehicles, and Light-Duty Trucks

2.1.2 API Publications

Available from API, 200 Massachusetts Avenue NW, Suite 1100, Washington, DC 20001-5571, Tel: 202-682-8000, www.api.org.

API Publication 1509	Engine Oil Licensing and Certification System
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2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D 4485	Standard Specification for Performance of Engine Oils
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2.1.4 CEC Publications

Available from the Coordinating European Council, Boulevard du Souverain 165, B-1160, Brussels, Belgium, www.cectests.org.

CEC Annual Report

CEC Catalogue of Methods

2.1.5 ACEA Publications

Available from ACEA (European Automobile Manufacturers Association), Avenue des Nerviens 85, B-1045, Brussels, Belgium, Tel: +32-2-732-55-50, www.acea.be.

European Oil Sequences 2016	Service Fill Oils for Gasoline and Light-Duty Diesel Engines, Gasoline and Light-Duty Diesel Engines with Exhaust After-Treatment Devices, and Heavy-Duty Diesel Engines
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2.1.6 Global Performance Specifications

Available through the following sites: <http://www.truckandenginemanufacturers.org/>, <http://www.jama-english.jp/>, and www.acea.be.

Global DHD-1	Global Performance Specification for Diesel Engine Oil
Global DLD-1, DLD-2, DLD-3	Global Performance Specification for Light-Duty Diesel Engine Oil

2.1.7 International Lubricant Standardization and Approval Committee Standards

Available from API, 200 Massachusetts Avenue NW, Suite 1100, Washington, DC 20001-5571, Tel: 202-682-8000, www.api.org, and contained within API Publication 1509.

International Lubricant Standardization and Approval Committee (ILSAC) Standards for Passenger Car Engine Oils ILSAC GF-5

2.1.8 JASO Publications

Available from Society of Automotive Engineers of Japan, 10-2, Gobancho, Chiyoda-ku, Tokyo 102-0076, Japan, Tel: +81-3-3262-8211, www.jsae.or.jp.

JASO Standard M331:2011	Low and Medium Temperature Detergency Test Procedure for Evaluating Automobile Gasoline Engine Oils
JASO Standard M336:2014	Automotive Diesel Engine Oils - Detergency Test Procedure
JASO Standard M354:2015	Automobile Diesel Engine Oils - Valve Train Wear Test
JASO Standard M355:2017	Automotive Diesel Engine Oil Standard
JASO Standard M362:2017	Automotive Diesel Engine Oils - Fuel Economy Test Procedure

2.1.9 JIS Publications

Available from Japanese Standards Association, 4-1-24 Akasaka, Minato-Ku, Tokyo 107-8440 Japan, Tel: +81-3-3583-8005, www.jsa.or.jp

2.1.10 Manufacturer Publications

Available from the respective original equipment manufacturers:

BMW Longlife Oil Specifications BMW LL-01, LL-01 FE, LL-04, LL-12 FE, LL-14 FE+

Caterpillar ECF-1a, ECF-2, and ECF-3

Chrysler MS-6395, MS-10902, MS-12633

Cummins 20074, 20078, 20081, 20085, 20086, 20087, and 20088

DAF Specifications HP1, HP2

Detroit Diesel Specifications 93K215, 93K214, 93K218, 93K222, and 93K223

Deutz Specifications DQC I-02, DQC II-18, DQC II-18 LA, DQC III-18, DQC III-18 LA, DQC IV-18, DQC IV-18 LA

Fiat 9.55535 Specification

Ford WSS-M2Cxxx-x Specifications

MAN Specifications 270, 271, 3275, 3277, 3477, 3575

Mercedes Benz Betriebsstoff-Vorschriften V2017.1 (Jan. 6, 2017)

MTU MTL 5044 Oil Category 1, 2, 2.1, 3, and 3.1

GM Global Specifications dexos1™ Gen 2, dexos2™, and dexosD™

Perkins Engine Specification P.M.S. S.1.01-1983, TSD 3187-1998, PS No. 7294/SB019

PSA (Peugeot) B71 2295, B71 2296, B71 2297, B71 2290, B71 2300, B71 2312

Porsche Engine Oil Specifications A40, C40, and C30

Renault Engine Oil Specifications RN0700, RN0710, RN0720

Scania LDF, LDF-2, LDF-3, and Low Ash Specifications

Volkswagen Service Engine Oil Norms (501.00, 502.00, 504.00, 505.00, 507.00)

Volvo Drain Specification (VDS, VDS-2, VDS-3) and Volvo Global Engine Oil Standard (Mack EO-O Premium Plus, Volvo VDS-4, Renault RLD-3)

3. DEFINITIONS

DI: Direct Injection

DPF: Diesel Particle Filter

GPF: Gasoline Particle Filter

HTHS: High Temperature High Shear Viscosity

SAPS: Sulphated Ash, Phosphorus, Sulphur

TWC: Three-Way Catalyst

4. EUROPEAN ACEA SEQUENCES

Oil sequences are established by the European Automobile Manufacturers Association (ACEA) to ensure that suitable lubricants are available to meet the minimum requirements of European vehicles. ACEA, which was formed in February 1991, is engaged in a broad range of activities including safety and environmental concerns and any regulations which have a direct impact on the European automobile industry. ACEA members are all the European motor vehicle manufacturers.

The ACEA oil sequences define laboratory tests and engine tests which lubricants must satisfy to achieve the minimum performance requirements established by European manufacturers. These sequences are divided into categories for gasoline, light-duty diesel, engines with after-treatment devices, and heavy-duty diesel engines. The categories are divided further into sub-groups, which more precisely define the performance for specific applications.

The ACEA oil sequences undergo continuous improvement. Replacement tests and other changes required by the European automobile manufacturers are integrated and new issues are published on a regular basis. As new editions are published, older editions have to be withdrawn. Validities of new and old editions are overlapping for limited periods of time as shown in the following table.

Sequence Issue	First Allowable Use	Mandatory for New Claims	Oils with This Claim May be Marketed Until
2004	1 November 2004	1 November 2005	31 December 2009
2007	1 February 2007	1 February 2008	23 December 2010
2008	22 December 2008	22 December 2009	22 December 2012
2010	22 December 2010	22 December 2011	22 December 2014
2012	14 December 2012	14 December 2013	1 December 2018
2016	1 December 2016	1 December 2017	...

“First allowable use” means that claims cannot be made against the specification before the date indicated.

“Mandatory for new claims” means that from this date onward, all claims for new oil formulations must be according to the latest ACEA oil sequence issue. Up to that date, new claims can also be made according to the previous ACEA oil sequence issue. (For example, until 1 December 2017, oil marketers could make claims against the ACEA 2012 release, even though the 2016 release was active. After 1 December 2017, any new oil claims must be according to the ACEA 2016 sequences.) After the date indicated, no new claims to the previous ACEA sequence can be made. Then all oil formulations must be developed according to the latest ACEA release.

“Oils with this claim may be marketed until” means that no further marketing of oils with claims to this issue is allowed after the date indicated.

The ACEA 2016 European Oil Sequences for Service-Fill Oils comprise three sets (classes) of sequences: one for gasoline and light-duty diesel engines; one specifically for gasoline and light-duty diesel engines with after-treatment devices; and one for heavy-duty diesel engines. Within each of these sets, there are categories which reflect different performance requirements: three (A3/B3, A3/B4, and A5/B5) for gasoline and light-duty diesel engines; five (C1, C2, C3, C4, and C5) specifically for engines with after treatment devices; and four (E4, E6, E7, and E9) for heavy-duty diesel engines. Typical applications for each sequence are described below for guidance only. Specific applications of each sequence are the responsibility of individual engine manufacturers for their own vehicles/engines.

4.1 A/B

Gasoline and diesel engine oils; “high SAPS.”

4.1.1 A3/B3

Stable, stay-in-grade engine oil intended for use in passenger car and light-duty van gasoline and diesel engines, and/or for extended drain intervals where specified by the engine manufacturer, and/or for year-round use of low viscosity oils, and/or for severe operating conditions as defined by the engine manufacturer.

4.1.2 A3/B4

Stable, stay-in-grade engine oil intended for use in passenger car and light-duty van gasoline and DI diesel engines, but also suitable for applications described under A3/B3.

4.1.3 A5/B5

Stable, stay-in-grade engine oil intended for use at extended drain intervals in passenger car and light-duty van gasoline and diesel engines designed to be capable of using low viscosity oils with HTHS viscosity of 2.9 to 3.5 mPa*s. These oils are unsuitable for use in certain engines; consult vehicle-OEM's owner's manual/handbook in case of doubt.

4.2 C

Catalyst and GPF/DPF compatible engine oils for gasoline and diesel engines; “low SAPS.”

NOTE: These oils will increase the DPF/GPF and TWC life and maintain the vehicle's fuel economy.

WARNING: Some of these categories may be unsuitable for use in certain engine types; consult the vehicle OEM's owner's manual/handbook in case of doubt.

4.2.1 C1

Stable, stay-in-grade engine oil with lowest SAPS-level, intended for use as catalyst compatible oil at extended drain intervals in vehicles with all types of modern after-treatment systems and high performance passenger car and light-duty van gasoline and DI diesel engines that are designed to be capable of using low viscosity oils with a minimum HTHS viscosity of 2.9 mPa*s.

4.2.2 C2

Stable, stay-in-grade engine oil with mid-SAPS-level, intended for use as catalyst compatible oil at extended drain intervals in vehicles with all types of modern after-treatment systems and high performance passenger car and light-duty van gasoline and DI diesel engines that are designed to be capable of using low viscosity oils with a minimum HTHS viscosity of 2.9 mPa*s.

4.2.3 C3

Stable, stay-in-grade engine oil with mid-SAPS-level, intended for use as catalyst compatible oil at extended drain intervals in vehicles with all types of modern after-treatment systems and high performance passenger car and light-duty van gasoline and DI diesel engines that are designed to be capable of using oils with a minimum HTHS viscosity of 3.5 mPa*s.

4.2.4 C4

Stable, stay-in-grade engine oil with low SAPS-level, intended for use as catalyst compatible oil at extended drain intervals in vehicles with all types of modern after-treatment systems and high performance passenger car and light-duty van gasoline and DI diesel engines that are designed to be capable of using oils with a minimum HTHS viscosity of 3.5 mPa*s.

4.2.5 C5

Stable, stay-in-grade engine oil with mid-SAPS-level, for further improved fuel economy, intended for use as catalyst compatible oil at extended drain intervals in vehicles with all types of modern after-treatment systems and high performance passenger car and light-duty van gasoline and DI diesel engines that are designed to be capable and OEM-approved for use of low viscosity oils with a minimum HTHS viscosity of 2.6 mPa*s.

4.3 E

Heavy-duty diesel engine oils.

4.3.1 E4

Stable, stay-in-grade oil providing excellent control of piston cleanliness, wear, soot handling, and lubricant stability. It is recommended for highly rated diesel engines meeting Euro I, Euro II, Euro III, Euro IV, and Euro V emission requirements and running under very severe conditions, e.g., significantly extended oil drain intervals according to the manufacturers recommendations. It is suitable for engines without particulate filters, and for some EGR engines and some engines fitted with SCR NOx reduction systems. However, recommendations may differ between engine manufacturers, so driver manuals and/or dealers shall be consulted if in doubt.

4.3.2 E6

Stable, stay-in-grade oil providing excellent control of piston cleanliness, wear, soot handling, and lubricant stability. It is recommended for highly rated diesel engines meeting Euro I, Euro II, Euro III, Euro IV, and Euro V emission requirements and running under very severe conditions, e.g., significantly extended oil drains according to the manufacturers recommendations. It is suitable for EGR engines, with or without particulate filters, and for engines fitted with SCR NOx reduction systems. E6 quality is strongly recommended for engines fitted with particulate filters and is designed for use in combination with low sulfur diesel fuel. However, recommendations may differ between engine manufacturers, so driver manuals and/or dealers shall be consulted if in doubt.

4.3.3 E7

Stable, stay-in-grade oil providing effective control with respect to piston cleanliness and bore polishing. It further provides excellent wear control, soot handling, and lubricant stability. It is recommended for highly rated diesel engines meeting Euro I, Euro II, Euro III, Euro IV, and Euro V emission requirements and running under severe conditions, e.g., extended oil drain intervals according to the manufacturer's recommendations. It is suitable for engines without particulate filters, and for most EGR engines and most engines fitted with SCR NOx reduction systems. However, recommendations may differ between engine manufacturers, so driver manuals and/or dealers shall be consulted if in doubt.

4.3.4 E9

Stable, stay-in-grade oil providing effective control with respect to piston cleanliness and bore polishing. It further provides excellent wear control, soot handling, and lubricant stability. It is recommended for highly rated diesel engines meeting Euro I, Euro II, Euro III, Euro IV, and Euro V emission requirements and running under severe conditions, e.g., extended oil drain intervals according to the manufacturer's recommendations. It is suitable for engines with or without particulate filters, and for most EGR engines and for most engines fitted with SCR NOx reduction systems. E9 is strongly recommended for engines fitted with particulate filters and is designed for use in combination with low sulfur diesel fuel. However, recommendations may differ between engine manufacturers, so drivers manuals and/or dealers should be consulted if in doubt

5. GLOBAL PERFORMANCE SPECIFICATION FOR DIESEL ENGINE OIL (GLOBAL DHD-1, DLD-1, DLD-2, DLD-3)

The Global DHD-1 specification was jointly developed by the European Automobile Manufacturers Association (ACEA), Engine Manufacturers Association (EMA), and the Japan Automobile Manufacturers Association (JAMA). It is a performance specification for engine oils to be used in high speed, four-stroke cycle heavy-duty diesel engines designed to meet 1998 and newer exhaust emission standards worldwide. Oils meeting this specification are compatible with certain older engines. Application of these oils is subject to the recommendation of individual engine manufacturers.

The Global DLD specifications were jointly developed by the ACEA, members of the Alliance of Automobile Manufacturers (Alliance), EMA, and the JAMA. They are performance specifications for engine oils to be used in high speed, four-stroke cycle light-duty diesel engines designed for older vehicles and those designed to meet model year 2000 and newer exhaust emission standards worldwide. Oils meeting these specifications are also compatible with certain older engines. Application of these oils is subject to the recommendation of individual engine manufacturers.

6. ORIGINAL EQUIPMENT MANUFACTURER SPECIFICATIONS

In addition to industry-recognized performance requirements developed by several organizations, original equipment manufacturers have developed individual specifications for engine oils which may demand additional laboratory and engine performance testing. These specifications are based upon several parameters, including engine type, service, and application.

6.1 BMW Longlife-04 (LL-04)

These oils are permitted for all BMW diesel engines, with or without particulate filters, and BMW gasoline engines. Release is currently limited to the EU, including Norway, Switzerland, and Liechtenstein. For BMW M GmbH engines, this quality is only permitted in new, designated models with S55 or S63 engines within the EU, Norway, Switzerland, and Liechtenstein.

6.2 BMW Longlife-12 FE (LL-12 FE)

Due to the reduced HTHS viscosity in comparison to the BMW Longlife-04 specification, these oils may only be used for the BMW diesel and gasoline engines released for this oil. These are also suitable for BMW diesel engines as of model year 2014 with no more than one turbocharger. For two or more turbochargers (four-cylinder diesel engines with power exceeding 140 kW, or six-cylinder diesel engines with power exceeding 195 kW), BMW Longlife-04 specification engine oils must continue to be used. BMW Longlife-12 FE must not be used for model X5 (E71). Detailed information is visible for BMW dealers/workshops via WebISTA or BMW-OSS. LL-12 FE can also be used for BMW gasoline engines as of model year 2002. Release is currently limited to the EU, Norway, Switzerland, and Liechtenstein.

6.3 BMW Longlife-14 FE+ (LL-14 FE+)

Due to the low HTHS viscosity of 2.6 mPa*s, these oils may only be used in the BMW gasoline engines released for them. LL-14 FE+ are only suitable for new N20 and Bx8 gasoline engines from model year 2014. Release is currently restricted to the EU, Norway, Switzerland, and Liechtenstein, the U.S. market, and Canada. This quality is not permitted for BMW M GmbH engines.

6.4 Caterpillar ECF-1a

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines certified to Tier 3 emissions or earlier using fuels with sulfur levels that exceed 0.2% (2000 ppm). Minimum required quality level is API CH-4, plus additional engine manufacturer requirements.

6.5 Caterpillar ECF-2

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines certified to Tier 3 emissions or earlier using fuels with sulfur levels that exceed 0.2% (2000 ppm). Minimum required quality level is API CI-4, plus additional engine manufacturer requirements.

6.6 Caterpillar ECF-3

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines certified to EPA non-road Tier 4 emissions or earlier and is compatible with engines equipped with aftertreatment devices. Minimum required quality level is API CJ-4.

6.7 DAF Specification HP1

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines where the engine manufacturer recommends the use of low viscosity oil for improved fuel economy performance.

NOTE: Only for XE engine series applicable. Not for new MX engine series.

6.8 DAF Specification HP2

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines where the engine manufacturer recommends extended oil drain intervals.

NOTE: Only for XE engine series applicable. Not for new MX engine series.

6.9 Cummins CES 20074

This specification describes the requirements for premium low ash quality engine oils for use in Cummins natural gas engines.

6.10 Cummins CES 20078

This specification describes the requirements for premium quality engine oils for use in Cummins engines equipped with exhaust recirculation (EGR).

6.11 Cummins CES 20081

This specification describes the requirements for premium quality engine oils for use in Cummins engines equipped with exhaust recirculation (EGR) and exhaust aftertreatment.

6.12 Cummins CES 20085

This specification describes the requirements for premium medium ash quality engine oils for use in Cummins natural gas engines.

6.13 Cummins CES 20086

This specification describes the requirements for premium quality engine oils for use in Cummins engines equipped with exhaust recirculation (EGR) and exhaust aftertreatment. Minimum required quality is API CK-4, plus additional engine manufacturer requirements.

6.14 Cummins CES 20087

This specification describes the requirements for premium quality engine oils for use in Cummins engines equipped with exhaust recirculation (EGR) and exhaust aftertreatment. Minimum required quality is API FA-4, plus additional engine manufacturer requirements.

6.15 Cummins CES 20088

This specification describes the requirements for extended drain premium quality, high ash engine oils for use in Cummins emission controlled engines. This specification is not recommended for engines using DPF aftertreatment devices. Oils shall meet all the requirements of CES 20078, plus additional engine manufacturer requirements.

6.16 Detroit Diesel Specification 93K215

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines certified to EPA '98 and older emissions, and operating on diesel fuel with less than 5000 ppm sulfur. Minimum required quality is API CH-4, plus additional engine manufacturer requirements.

6.17 Detroit Diesel Specification 93K214

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines certified to EPA '04 or Euro IV and older emissions, and operating on diesel fuel with less than 500 ppm sulfur. Minimum required quality is API CI-4 PLUS, plus additional engine manufacturer requirements.

6.18 Detroit Diesel Specification 93K218

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines certified to EPA '07, EPA '10, GHG '14, or GHG '17 and older emissions, and operating on diesel fuel with less than 15 ppm sulfur. Minimum required quality is API CJ-4, plus additional engine manufacturer requirements.

6.19 Detroit Diesel Specification 93K222

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines certified to EPA '07, EPA '10, GHG '14, or GHG '17 and older emissions, and operating on diesel fuel with less than 15 ppm sulfur. Minimum required quality is API CK-4, plus additional engine manufacturer requirements.

6.20 Detroit Diesel Specification 93K223

Defines the minimum laboratory and engine test requirements for heavy-duty diesel engines certified to EPA '10, GHG '14, or GHG '17 and older emissions, and operating on diesel fuel with less than 15 ppm sulfur. Minimum required quality is API FA-4, plus additional engine manufacturer requirements.

6.21 FCA Global Specification 9.55535

Includes multiple specifications describing the minimum laboratory and engine test requirements for service fill automotive engine oils for passenger cars and light commercial vehicles globally.

6.22 FCA U.S. Material Specification MS-6395

Defines the minimum laboratory and engine test requirements for gasoline automotive engine oils. Minimum required quality is ILSAC GF-5, plus additional manufacturer requirements, including taxi fleet testing.