

GREEN POWER
Feeds Your Engine



2nd VegOil

Demonstration of 2nd Generation Vegetable Oil Fuels in Advanced Engines

**Workpackage WP4
Engine Oil Development**

**Deliverable N° 4.7:
Engine Lubricant Provision
for Field Trial**

Version: 2.0

Hazelwood, 21ST August 2009

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1 Summary

Appropriate amounts of lubricant were sent to the test field trial sites in France, Austria and Poland for field testing in Stage 3A tractors and to Germany for field testing in tractors being converted to stage 3B. The following table summarises deliveries of lubricant samples sent.

TEST LOCATIONS:	Type of Testing	Tractor/Engine Types - Timing	Lubricant Supply
Germany	Field Trial	4 Tractors/ Stage 3 (1 for TFZ, other 3 converted to Stage 3B for France Austria and Poland) 2 tractors/Stage 3B - Summer '10. 2 Tractors/Stage 4 - Feb '11)	<i>60l E7 sent to TFZ. 60l E7 and 120l E9 sent to JDWM (March '09)</i>
France	Field Trial	2 tractors/Stage 3A - March 2009 1 tractors/ Stage 3A (JDWM) - add retrofit DPF March 2010	<i>2 x 60l of E7 sent (March '09).</i>
Austria	Field Trial	4 tractors/Stage 3A - March 2009 1 tractor/Stage 3A (JDWM) - add retrofit DPF March 2010	<i>2 x 60l E7 2 x 60l E9 (Sent Feb '09)</i>
Poland	Field Trial	4 tractors - Stage 3A 1 tractor - Stage 3A (JDWM)	<i>240l of E7 sent (March '09).</i>



Below is a copy of the despatch note for the 60 litres of ACEA E7 engine lubricant sent to John Deere Mannheim.

DEFINITION: On the Air Waybill we, our and we refer to Federal Express Corporation, its subsidiaries and branches, with their respective employees, agents and independent contractors. You and your refer to the shipper, its employees, agents and agents. If your shipment originates outside the United States, your contract of carriage is with the Federal Express subsidiary, branch or independent contractor who originally accepts the shipment from you. "Package" means any container or envelope that is accepted by us for delivery, including any such items tendered by you including any electronic systems, meters, instruments or waybills. "Shipment" means all packages, which are tendered to and accepted by us in a single Air Waybill.

AGREEMENT TO TERMS: By giving us your shipment, you agree, regardless of whether you sign the front of the Air Waybill, for your self and on behalf of any other person having an interest in this shipment, to all terms in the EXEMPTIBLE Air Waybill, to any applicable local, and in our current Service Guide or Standard Conditions of Carriage, copies of which are available upon request. If there is a conflict between the Air Waybill and either the current Service Guide or Standard Conditions then in effect, the last and the terms of any customer information agreement between the shipper and Federal Express will control. The Service Guide or Standard Conditions have secondary priority. The only information that will prevail in the event of a conflict is the information on the Air Waybill and the information on the invoice for transport by air, and that the shipment is properly marked, addressed (including postal codes) and packaged to meet applicable international and ordinary care handling.

DEFERRED CARRIAGE: You warrant that each article in the shipment is properly described on the Air Waybill and is acceptable for transport by air, and that the shipment is properly marked, addressed (including postal codes) and packaged to meet applicable international and ordinary care handling.

DEFERRED CARRIAGE LIMITATIONS OF LIABILITY: An Carriage Notice. If the carriage of your shipment by air involves an ultimate destination or stop in a country other than the country of departure, the Warsaw Convention, an international agreement relating to international carriage by air, may be applicable, which treaty would then govern and limit your and our liability for loss or delay or damage to your shipment. In the U.S., the Warsaw Convention limits your liability to U.S. \$20 per pound U.S. \$30 per kilogram, unless you declare a higher value for carriage as described below. The interpretation of the Warsaw Convention liability limits may vary in other countries. There are no stopping places which are agreed to the time of loading of the shipment and we reserve the right to re-ship, repackage or in any way re-ship as we see fit. The interpretation of the Warsaw Convention liability limits may vary in other countries. There are no stopping places which are agreed to the time of loading of the shipment and we reserve the right to re-ship, repackage or in any way re-ship as we see fit.

DEFERRED CARRIAGE: Items are transported partly or solely by road by an explicit agreement to do so and only to a country which is party to the Convention on the Contract for the International Carriage of Goods by Road (the "CMR") are subject to the terms and conditions of the CMR, subject to any other provisions of this Agreement. In the country. For these shipments transported solely by road, a conflict arises between the provisions of the CMR and the provisions of the terms of the Air Waybill shall prevail.

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WARRANTIES: We make no warranties, express or implied.

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<p>From: Origin ID ZLXA 01332 845476 SILVAIN COOPER LUBRIZOL LTD 111 KNOWLE NETHER LANE HAZELWOOD DERBY, DE564AN UNITED KINGDOM</p>	<p>FedEx Express</p> <p>E</p> <p>CL64529072423</p>	<p>Ship Date: 19MAR09 ActWgt: 60 KG Dimmed 45 X 30 X 30 CM System#: 9325455/FWST0715 Account#: S 188805248</p>
<p>SHIP TO: 49 0 6218295531 BILL SENDER STEFANIE DIERINGER JOHN DEERE WERKE MANNHEIM JOHN-DEERE STRASSE 90</p>	<p>REF: SUC/0640 DESC: 1 LUBRICANTS - NON HAZARDOUS DESC: 2 DESC: 3 DESC: 4</p>	<p>COUNTRY MFG: GB CARRIAGE VALUE: UKL CUSTOMS VALUE: 15UKL T/C: S 188805248 D/T: R SIGN: S Cooper EIN/VAT:</p>
<p>MANNHEIM, 68163 DE</p>	<p>1/3 TRK# 9840 3330 6175 0430</p>	<p>INTL PRIORITY A3</p>
	<p>## MASTER ##</p>	<p>FRA -DE 68163</p>
<p>9G-MHGA</p>		

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		Page 1 / 1	
Shipper/Expéditeur: LUBRIZOL THE KNOWLE, NETHER LANE HAZELWOOD Derbyshire DE56 4AN UNITED KINGDOM		Ship Date/Date d'Expédition: March 19, 2009 Delivery Date/Date de livraison: March 18, 2009 Delivery No./No.de livraison: 81175651 LZ Sales Order No./No.de Commande: 927947 Cust. PO No./Réf. du Client: CRJN	
Ship to/Destinataire: 1000000080 JOHN DEERE WERKE MANNHEIM ATTN. STEFANIE DIERINGER (5852) JOHN-DEERE STRASSE 90 68163 MANNHEIM GERMANY		Invoice to/Facturer A: 1000000080 HAZELWOOD SEGMENT MANAGEMENT DERBY UNITED KINGDOM	
Loading Point/Lieu de Chargement: Hazelwood Package Truck/Air		Vessel/Navire:	
Delivery Point/Lieu de Livraison: MANNHEIM		Port of Loading/Port de Chargement:	
Seal No/Identification des Plombs:		Port of Discharge/Port de déchargement:	
Transportation ID No/Identification de Véhicule:		Mean of Transport/Moyen de Transport:	
Transport Details/Détails de Transport: Carrier/Transporteur: FEDERAL EXPRESS EUROPE INC Forwarder/Transitaire: Incoterms: CPT Actual Carrier/Transporteur Réel: Attn. Stefanie Dieringer (5852) - sample from Craig Jones			
Qty Nbre	Materials, Special Marks & Instructions Produit, Marques et Instructions Spéciales	Gross Weight Poids Brut Kg	Net Weight Poids Net Kg
60.0	OS241963H 3X25L PLASTIC CANS	53.1	53.1
60.0	Total	53.1	53.1

2 Engine Lubricants Selection for 2nd VegOil Project

The engine lubricants chosen to be researched as part of the 2nd VegOil project are:

- OS240946 = a lubricant which is capable of meeting the ACEA E9-2008 specification
- OS241936 = a lubricant which is capable of meeting the ACEA E7-2008 specification

The ACEA 2008 nomenclature and specifications for E7 and E9 lubricants is detailed in Appendix A. Appendix A reproduces the ACEA 2008 specifications which are available from the ACEA website (<http://www.acea.be>)

Appendix A

ACEA 2008 European Oil Sequences



A C E A
European
Automobile
Manufacturers
Association

ACEA EUROPEAN OIL SEQUENCES

2008

SERVICE FILL OILS FOR GASOLINE ENGINES LIGHT DUTY DIESEL ENGINES ENGINES WITH AFTER TREATMENT DEVICES and HEAVY DUTY DIESEL ENGINES

Laboratory tests for gasoline and light duty diesel engine oils,
Engine tests for gasoline and light duty diesel engine oils,
Laboratory tests for engine with after treatment devices,
Engine tests for engine with after treatment devices.
Laboratory tests for heavy duty diesel engine oils,
Engine tests for heavy duty diesel engine oils,

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SGB 210-0069404-04

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCES FOR SERVICE-FILL OILS	Dec. 2008
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This document details the ACEA 2008 European Oil Sequences for Service-fill Oils for Gasoline engines, for Light Duty Diesel engines, for Gasoline & Diesel engines with after treatment devices and for Heavy Duty Diesel engines. These sequences define the minimum quality level of a product for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

These sequences will replace the ACEA 2007 sequences as a means of defining engine lubricant quality from 22nd December 2008.

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 Practice¹, 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 2008 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 oil marketers' Letter of Conformance (for details: www.atiel.org).

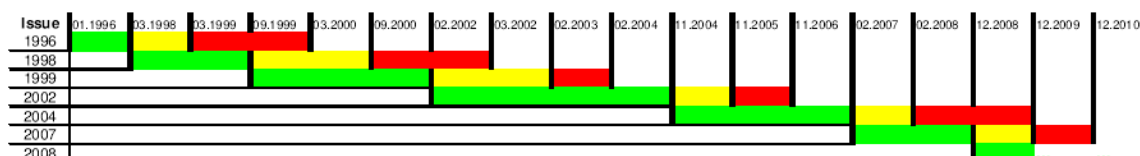
The ACEA oil sequences are underlying a constant development. Replacement tests and other changes required by the European automobile manufacturers are integrated and new issues are published on a regular basis. As new editions are published older editions have to be withdrawn. Validities of new and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

Issue year of full document	First allowable use	All new claims by	withdrawn
1996	1 st January 1996	1 st March 1997	1 st March 2000
1998	1 st March 1998	1 st March 1999	1 st March 2002
1999	1 st September 1999	1 st September 2000	1 st February 2004
2002	1 st February 2002	1 st February 2003	1 st November 2006
2004	1 st November 2004	1 st November 2005	31 st December 2009
2007	1 st February 2007	1 st February 2008	22 nd December 2010
2008	22 nd December 2008	22 nd December 2009	

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

All new claims by means that from this date onward all claims for new oil formulations must be according to the latest ACEA release. Until that date new claims can also be made according to the previous ACEA release. (For example until 1st February 2008, oil marketers can make claims against the ACEA 2004 release even though the 2007 release is active. After 1st February 2008, any new oil claims must be according to the ACEA 2007 sequences.)

Withdrawn means that no claims can be made against the issue after the date indicated.



¹ The ATIEL Code of Practice is the sole property of ATIEL and is available from ATIEL (Association Technique de l'Industrie Européenne des Lubrifiants), Boulevard du Souverain 165, B-1160 Brussels, Belgium.

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The marketer of an oil claiming ACEA performance requirements is responsible for all aspects of product liability.

Where limits are shown relative to a reference oil, then these must be compared to the last valid Reference Result on that test stand prior to the candidate and using the same hardware. Further details will be in the ATIEL Code of Practice.

Where claims are made that Oil performance meets the requirements of the ACEA sequences (e.g. product literature, packaging, labels) they must specify the ACEA Class and Category (see Nomenclature & ACEA Process for definitions).

The categories A2 and B2 are not included in this edition of the ACEA European Oil Sequences because they are unsuitable for some of the current engines and will be unsuitable for many future engines. Misuse may cause engine damage. However, the use of A2/B2 oils for older engines (where owner's or workshop's literature recommends this use) is still appropriate and can be done according to the categories A2-96 Issue 3 and B2-98-Issue 2.

REPLACEMENT of CCMC sequences

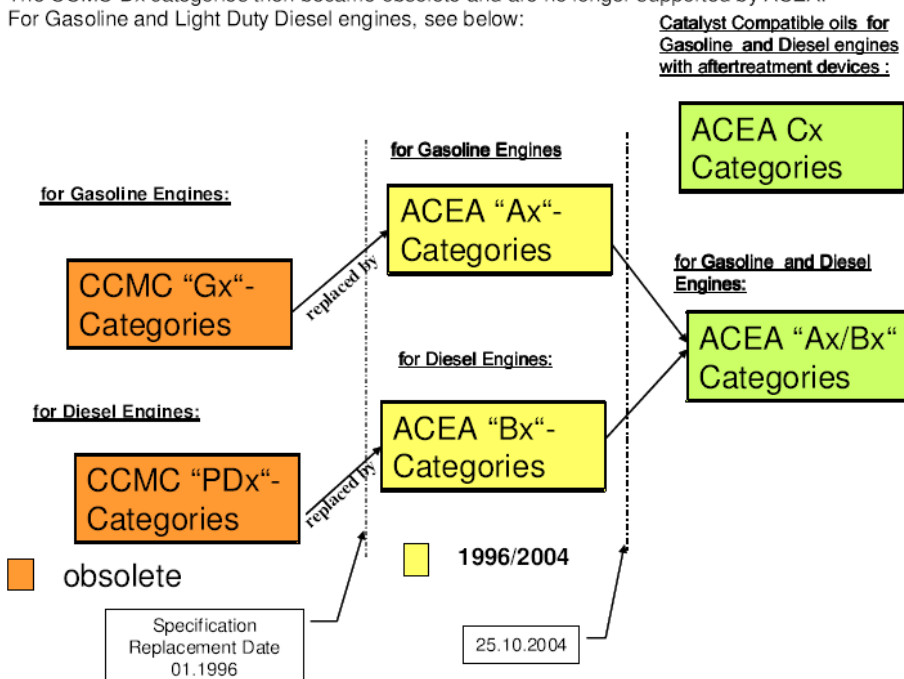
The chart below shows the evolution of the engine oil specifications commonly developed by the European Automobile manufacturers. CCMC (Comité des Constructeurs du Marché Commun) was the forerunner organisation to ACEA.

In January 1996 the CCMC European Oil Sequences became obsolete and were replaced by the ACEA European Oil Sequences. This is true for light duty engine oils as well as heavy duty engine oils. CCMC European Oil Sequences are not supported any more by ACEA.

With the 2004 release of the ACEA European Oil Sequences the A and B categories have been combined to the respective A/B categories. At the same time, a new set of categories has been introduced with the intention to create specifications for engine oils being suitable for the latest and future aftertreatment systems for Gasoline and Diesel engines. These categories are designated as Cx-categories.

For Heavy Duty Diesel engines, the CCMC Dx categories were replaced by the ACEA Ex categories as of 1 January 1996. The CCMC Dx categories then became obsolete and are no longer supported by ACEA.

For Gasoline and Light Duty Diesel engines, see below:



X= 1, 2, 3, 4 or 5 depending of categories

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The ACEA 2008 European Oil Sequences for Service-fill Oils comprise 3 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 - four (A1/B1, A3/B3, A3/B4 & A5/B5) for gasoline and light duty diesel engines; four (C1, C2, C3, C4) specifically for engines with after treatment devices, and four (E4, E6, E7, 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.

The sequences define the minimum quality level of a product for self-certification to EELQMS and presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual ACEA member companies.

NOMENCLATURE & ACEA PROCESS:

Each set of sequences is designated for consumer use by a 2 part code comprising a letter to define the CLASS (e.g. C), and a number to define the CATEGORY (e.g. C1).

In addition, for industry use, each sequence has a two-digit number to identify the YEAR of implementation of that severity level (e.g. A1 / B1-04).

The CLASS indicates oil intended for a general type of engine - currently A / B = gasoline and light duty diesel engines; C = catalyst compatible oils for gasoline and diesel engines with after treatment devices. Other classes may be added in future if, for example, Natural Gas engines prove to require oil characteristics which cannot readily be incorporated into existing classes.

The CATEGORY indicates oils for different purposes or applications within that general class, related to some aspect or aspects of the performance level of the oil. Typical applications for each sequence are described below for guidance only. Specific applications of each sequence are the responsibility of the individual motor manufacturer for their own vehicles and engines. Oils within a category may also meet the requirements of another category, but some engines may only be satisfied by oils of one category within a class.

The YEAR numbers for ACEA Sequence is intended only for industry use and indicates the year of implementation of that severity level for the particular category. A new year number will indicate, for example, that a new test, parameter or limit has been incorporated in the category to meet new / upgraded performance requirements whilst remaining compatible with existing applications. An update must always satisfy the applications of the previous issue. If this is not the case, then a new category is required.

An administrative ISSUE Number is added for industry use where it is necessary to update the technical requirements of a sequence without the intention to increase severity (e.g. when a CEC test engine is updated to the latest version whilst maintaining equivalent severity; or where a severity shift in the test requires modification of the specified limits.).

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCES FOR SERVICE-FILL OILS	Dec. 2008
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Where claims are made that Oil performance meets the requirements of the ACEA sequences (e.g. product literature, packaging, labels) they must specify the ACEA Class and Category (see Nomenclature & ACEA Process for definitions).

«Consumer Language»:

A/B : gasoline and diesel engine oils

A1/B1 Stable, stay-in-grade oil intended for use at extended drain intervals in gasoline engines and car & light van diesel engines specifically designed to be capable of using low friction low viscosity oils with a high temperature / high shear rate viscosity of 2.6 mPa*s for xW/20 and 2.9 to 3.5 mPa.s for all other viscosity grades. These oils are unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

A3/B3 Stable, stay-in-grade oil intended for use in high performance gasoline engines and car & light van 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.

A3/B4 Stable, stay-in-grade oil intended for use in high performance gasoline and direct injection diesel engines, but also suitable for applications described under A3/B3.

A5/B5 Stable, stay-in-grade oil intended for use at extended drain intervals in high performance gasoline engines and car & light van diesel engines designed to be capable of using low friction low viscosity oils with a High temperature / High shear rate (HTHS) viscosity of 2.9 to 3.5 mPa.s. These oils are unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

C : Catalyst compatibility oils

C1 Stable, stay-in-grade oil intended for use as catalyst compatible oil in vehicles with DPF and TWC in high performance car and light van diesel and gasoline engines requiring low friction, low viscosity, low SAPS oils with a minimum HTHS viscosity of 2.9 mPa.s. These oils will increase the DPF and TWC life and maintain the vehicles fuel economy.

Warning: these oils have the lowest SAPS limits and are unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

C2 Stable, stay-in-grade oil intended for use as catalyst compatible oil in vehicles with DPF and TWC in high performance car and light van diesel and gasoline engines designed to be capable of using low friction, low viscosity oils with a minimum HTHS viscosity of 2.9mPa.s. These oils will increase the DPF and TWC life and maintain the vehicles fuel economy.

Warning: these oils are unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

C3 Stable, stay-in-grade oil intended for use as catalyst compatible oil in vehicles with DPF and TWC in high performance car and light van diesel and gasoline engines, with a minimum HTHS viscosity of 3.5mPa.s. These oils will increase the DPF and TWC life.

Warning: these oils are unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

C4 Stable, stay-in-grade oil intended for use as catalyst compatible oil in vehicles with DPF and TWC in high performance car and light van diesel and gasoline engines requiring low SAPS oil with a minimum HTHS viscosity of 3.5mPa.s. These oils will increase the DPF and TWC life.

Warning: these oils are unsuitable for use in some engines. Consult owner manual or handbook if in doubt.

SAPS : Sulphated Ash, Phosphorus, Sulphur
 DPF : Diesel Particulate Filter
 TWC : Three way catalyst
 HTHS : High temperature / High shear rate viscosity

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E : Heavy Duty Diesel engine oils

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 manufacturer's recommendations. It is suitable for engines without particulate filters, and for some EGR engines and some engines fitted with SCR NO_x reduction systems. However, recommendations may differ between engine manufacturers so Driver Manuals and/or Dealers shall be consulted if in doubt.

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 drain intervals according to the manufacturer's recommendations. It is suitable for EGR engines, with or without particulate filters, and for engines fitted with SCR NO_x reduction systems. E6 quality is strongly recommended for engines fitted with particulate filters and is designed for use in combination with low sulphur diesel fuel. However, recommendations may differ between engine manufacturers so Driver Manuals and/or Dealers shall be consulted if in doubt.

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 NO_x reduction systems. However, recommendations may differ between engine manufacturers so Driver Manuals and/or Dealers shall be consulted if in doubt.

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 NO_x reduction systems. E9 is strongly recommended for engines fitted with particulate filters and is designed for use in combination with low sulphur diesel fuel. However, recommendations may differ between engine manufacturers so Drivers Manuals and/or Dealers should be consulted if in doubt

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCE FOR SERVICE-FILL OILS FOR GASOLINE and DIESEL ENGINES	Dec. 2008
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This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS				
				A1 / B1-08	A3 / B3-08	A3 / B4-08	A5 / B5-08	
1. LABORATORY TESTS								
1.1 Viscosity grades		SAE J300 Latest active issue		No restriction except as defined by shear stability and HT/HS requirements. Manufacturers may indicate specific viscosity requirements related to ambient temperature.				
1.2 Shear stability	CEC L -014-93 or ASTM D6278	100°C Viscosity after 30 cycles	mm ² /s	Xw-20 stay in grade xW30 ≥ 9.3 xW40 ≥ 12.0	All grades to be stay in grade	All grades to be stay in grade	All grades to be stay in grade	
1.3 Viscosity at high temp. & high shear rate	CEC L-036-90 (2 nd Edition) (Ravenfield)	Viscosity at 150°C and 10 ⁶ s ⁻¹ shear rate	mPa.s	≥ 2.9 and ≤ 3.5; Xw-20: 2.6. min	≥ 3.5	≥ 3.5	≥ 2.9 and ≤ 3.5	
1.4 Evaporative loss	CEC L-040-93 (Noack)	Max. weight loss after 1 h at 250°C	%	≤ 15	≤ 13	≤ 13	≤ 13	
1.5 TBN	ASTM D 2896		mgKOH/g	≥ 8.0	≥ 8.0	≥ 8.0	≥ 8.0	
1.6 Sulphated ash	ASTM D874		% m/m	≤ 1.3 (see note 2)	≤ 1.5 (see note 2)	≤ 1.6 (see note 2)	≤ 1.6 (see note 2)	
NOTE: the following sections apply to all sequences								
1.7 Sulphur (see note 1)	ASTM D5185		% m/m	Report				
1.8 Phosphorus (see note 1)	ASTM D5185		% m/m	Report				
1.9 Chlorine	ASTM D6443		ppm m/m	Report				
1.10 Oil / elastomer compatibility	CEC L-039-96 (see note 3)	Max. variation of characteristics after immersion for 7 days in fresh oil without pre-ageing		Elastomer type				
				RE1	RE2-99	RE3-04	RE4	AEM
				-1/+5	-5/+8	-22/+1	-5/+5	(VAMAC)
				-40/+10	-15/+18	-30/+10	-20/+10	As per
				-50/+10	-35/+10	-20/+10	-50/+10	Daimler
		Hardness DIDC	points					
		Tensile strength	%					
		Elongation at rupture	%					
		Volume variation	%					
1.11 Foaming tendency	ASTM D892 without option A	Tendency - stability	ml	Sequence I (24°C) 10 - nil Sequence II (94°C) 50 - nil Sequence III (24°C) 10 - nil				
1.12 High temperature foaming tendency	ASTM D6082 High temperature foam test	Tendency - stability	ml	Sequence IV (150°C) 100 - nil				

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCE FOR SERVICE-FILL OILS FOR GASOLINE and DIESEL ENGINES	Dec. 2008
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This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				A1 / B1-08	A3 / B3-08	A3 / B4-08	A5 / B5-08
2. ENGINE TESTS							
2.1 High temperature deposits Ring sticking Oil thickening	CEC L-088-02 (TU5JP-L4) 72 Hour test	Ring sticking (each part)	Merit	≥ 9.0	≥ 9.0	≥ 9.0	≥ 9.0
		Piston varnish (6 elements, average of 4 pistons)	Merit	≥ RL 216	≥ RL 216	≥ RL 216	≥ RL 216
		Absolute viscosity increase at 40°C between min and max values during test	mm ² /s	≤ 0.8 x RL216	≤ 0.8 x RL216	≤ 0.8 x RL216	≤ 0.8 x RL216
		Oil consumption	kg/test	Report	Report	Report	Report
2.2 Low temperature sludge	ASTM D6593-00 (Sequence VG) Under protocol & requirements for API (See Note 4)	Average engine sludge	merit	≥ 7.8	≥ 7.8	≥ 7.8	≥ 7.8
		Rocker cover sludge	merit	≥ 8.0	≥ 8.0	≥ 8.0	≥ 8.0
		Average Piston skirt varnish	merit	≥ 7.5	≥ 7.5	≥ 7.5	≥ 7.5
		Average engine varnish	merit	≥ 8.9	≥ 8.9	≥ 8.9	≥ 8.9
		Comp. ring (hot stuck)		none	none	none	none
		Oil screen clogging	%	≤ 20	≤ 20	≤ 20	≤ 20
2.3 Valve train scuffing wear	CEC L-038-94 (TU3M)	Cam wear, average	µm	≤ 10	≤ 10	≤ 10	≤ 10
		Cam wear, max.	µm	≤ 15	≤ 15	≤ 15	≤ 15
		Pad merit (Ave. of 8 pads)	merit	≥ 7.5	≥ 7.5	≥ 7.5	≥ 7.5
2.4 Black sludge	CEC L-053-95 (M111)	Engine sludge, average	merit	≥ RL 140	≥ RL 140 + 4σ or ≥ 9.0	≥ RL 140 + 4σ or ≥ 9.0	≥ RL 140 + 4σ or ≥ 9.0
2.5 Fuel economy See Note (5)	CEC L-054-96 (M111)	Fuel economy improvement vs. Reference oil RL191 (15W-40)	%	≥ 2.5	—	—	≥ 2.5
2.6 Medium temperature dispersivity	CEC L-093-04 (DV4TD)	Absolute viscosity increase at 100°C and 6 % soot	mm ² /s	≤ 0.60 x RL223 result	≤ 0.60 x RL223 result	≤ 0.60 x RL223 result	≤ 0.60 x RL223 result
		Piston merit	merit	≥ (RL223 – 2.5pts)	≥ (RL223 – 2.5pts)	≥ (RL223 – 2.5pts)	≥ (RL223 – 2.5pts)
2.7 Wear See notes (6)	CEC L-099-08 (OM646LA)	Cam wear outlet (avg. max. wear 8 cams)	µm	≤ 140	≤ 140	≤ 120	≤ 120
		Cam wear inlet (avg. max. wear 8 c.; (8)	µm	≤ 110	≤ 110	≤ 100	≤ 100
		Cylinder wear (avg. 4 cyl.); s. note (8)	µm	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0
		Bore polishing (13 mm) - max. value of 4 cylinders; s. note (8)	%	≤ 3.5	≤ 3.5	≤ 3.0	≤ 3.0
		Tappet wear inlet (avg. max. wear 8 cams)	µm	report	report	report	report
		Tappet wear outlet (avg. max. wear 8cams)	µm	report	report	report	report
		Piston cleanliness (avg. 4 pistons)	merits	report	report	report	report
		Engine sludge avg.	merits	report	report	report	report

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCE FOR SERVICE-FILL OILS FOR GASOLINE and DIESEL ENGINES	Dec. 2008
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This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				A1 / B1-08	A3 / B3-08	A3 / B4-08	A5 / B5-08
2. ENGINE TESTS CONTINUED							
2.8	CEC L-078-99	Piston cleanliness	merit	≥ RL206	≥ RL206	≥ RL206	≥ RL206
DI diesel	(VW TDI)			minus	minus		
Piston cleanliness & Ring sticking		Ring sticking (Rings 1 & 2)		4 points	4 points		
		Average of all 8 rings	ASF	≤ 1.2	≤ 1.2	≤ 1.0	≤ 1.0
		Max. for any 1 st ring	ASF	≤ 2.5	≤ 2.5	≤ 1.0	≤ 1.0
		Max. for any 2 nd ring	ASF	0.0	0.0	0.0	0.0
See notes (9)		EOT TBN (ISO 3771); s. note (7 & 8)	mgKOH /g	≥ 4.0	≥ 4.0	≥ 4.0	≥ 4.0
		EOT TAN (ASTM D 664); s. note (7)	mgKOH /g	Report	Report	Report	Report

- (1) The internal standard method has to be used.
- (2) Maximum limits, Values take into account method and production's tolerances
- (3) Use either complete Daimler requirements (VDA 675301, 7 days +/- 2h, 4 materials (NBR: NBR34 DIN 53538 T3 (100 °C +/- 2°C); FPM: AK6 (150 °C +/- 2°C); ACM: E7503 (150 °C +/- 2°C); AEM: D 8948/200.1 (150 °C +/- 2°C)) + RE3, or complete requirements according to 1.10 above + Daimler requirements for AEM
- (4) The limits shown are based upon those applied in U.S. market requirements. ACEA will continuously review the situation to ensure that these limits are appropriate for European vehicles and lubricants.
- (5) ACEA considers the CEC L-54-T-96 test the only valid comparator against which claims of lubricant fuel economy improvement should be made.
- (6) For A1/B1 claims OM 602A passing results obtained before the end of 2008 can be used instead of OM 646LA results.
- (7) Test report has to give measured values before & after the test, all measurements to be taken in the same lab.
- (8) These parameters are not yet official CEC parameters.
- (9) Test results from tests performed before the publishing of the 2008 ACEA oil sequences are allowed to be used without passing the EOT TBN criteria and reporting EOT TAN values.

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCE FOR SERVICE-FILL OILS FOR GASOLINE and DIESEL ENGINES WITH AFTER TREATMENT DEVICES	Dec. 2008
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This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS				
				C1-08	C2-08	C3-08	C4-08	
1. LABORATORY TESTS								
1.1 Viscosity grades		SAE J300 Latest active issue		No restriction except as defined by shear stability and HT/HS requirements. Manufacturers may indicate specific viscosity requirements related to ambient temperature.				
1.2 Shear stability	CEC L-014-93 or ASTM D6278	100°C Viscosity after 30 cycles	mm ² /s	All grades to be stay in grade	All grades to be stay in grade	All grades to be stay in grade	All grades to be stay in grade	
1.3 Viscosity at high temp. & high shear rate	CEC L-036-90 (2 nd Edition) (Ravenfield)	Viscosity at 150°C and 10 ⁶ s ⁻¹ shear rate	mPa.s	≥ 2.9	≥ 2.9	≥ 3.5	≥ 3.5	
1.4 Evaporative loss	CEC L-040-93 (Noack)	Max. weight loss after 1 h at 250°C	%	≤ 13	≤ 13	≤ 13	≤ 11	
1.5 Sulphur	ASTM D5185	(see note 1)	% m/m	≤ 0.2	≤ 0.3	≤ 0.3	≤ 0.2	
1.6 Phosphorus	ASTM D5185	(see note 1)	% m/m	≤ 0.05 (2)	≥ 0.070 ≤ 0.090 (2)	≥ 0.070 ≤ 0.090 (2)	≤ 0.090 (2)	
1.7 Sulphated ash	ASTM D874		% m/m	≤ 0.5 (see note 2)	≤ 0.8 (see note 2)	≤ 0.8 (see note 2)	≤ 0.5 (see note 2)	
1.8 Chlorine	ASTM D6443		ppm m/m	Report	Report	Report	Report	
1.9 TBN	ASTM D 2896		mg KOH / g			≥ 6.0	≥ 6.0	
NOTE: The following sections apply to all sequences								
1.10 Oil / elastomer compatibility	CEC L-039-96 (see note 3)	Max. variation of characteristics after immersion for 7 days in fresh oil without pre-ageing Hardness DIDC Tensile strength Elongation at rupture Volume variation	Elastomer type					
				RE1	RE2-99	RE3-04	RE4	AEM
			points	-1/+5	-5/+8	-22/ +1	-5/+5	As per
			%	-40/+10	-15/+18	-30/+10	-20/+10	Daimler
			%	-50/+10	-35/+10	-20/+10	-50/+10	
		%	-1/+5	-7/+5	-1/+22	-5/+5		
1.11 Foaming tendency	ASTM D892 without option A	Tendency - stability	ml	Sequence I (24°C) 10 - nil Sequence II (94°C) 50 - nil Sequence III (24°C) 10 - nil				
1.12 High temperature foaming tendency	ASTM D6082 High temperature foam test	Tendency - stability	ml	Sequence IV (150°C) 100 - nil				

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCE FOR SERVICE-FILL OILS FOR GASOLINE and DIESEL ENGINES WITH AFTER TREATMENT DEVICES	Dec. 2008
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This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				C1-08	C2-08	C3-08	C4-08
2. ENGINE TESTS							
2.1 High temperature deposits Ring sticking Oil thickening	CEC L-088-T-02 (TU5JP-L4) 72 Hour test	Ring sticking (each part)	Merit	≥ 9.0	≥ 9.0	≥ 9.0	≥ 9.0
		Piston varnish (6 elements, average of 4 pistons)	Merit	≥ RL 216	≥ RL 216	≥ RL 216	≥ RL 216
		Absolute viscosity increase at 40°C between min and max values during test	mm ² /s	≤ 0.8 x RL216	≤ 0.8 x RL216	≤ 0.8 x RL216	≤ 0.8 x RL216
		Oil consumption	kg/test	Report	Report	Report	Report
2.2 Low temperature sludge	ASTM D6593-00 (Sequence VG) Under protocol & requirements for API (See Note 4)	Average engine sludge	merit	≥ 7.8	≥ 7.8	≥ 7.8	≥ 7.8
		Rocker cover sludge	merit	≥ 8.0	≥ 8.0	≥ 8.0	≥ 8.0
		Average Piston skirt varnish	merit	≥ 7.5	≥ 7.5	≥ 7.5	≥ 7.5
		Average engine varnish	merit	≥ 8.9	≥ 8.9	≥ 8.9	≥ 8.9
		Comp. ring (hot stuck)	merit	none	none	none	none
Oil screen clogging	%	≤ 20	≤ 20	≤ 20	≤ 20		
2.3 Valve train scuffing wear	CEC L-038-94 (TU3M)	Cam wear, average	µm	≤ 10	≤ 10	≤ 10	≤ 10
		Cam wear, max.	µm	≤ 15	≤ 15	≤ 15	≤ 15
		Pad merit (Ave. of 8 pads)	merit	≥ 7.5	≥ 7.5	≥ 7.5	≥ 7.5
2.4 Black sludge	CEC L-53-95 (M111)	Engine sludge, average	merit	≥ RL 140 + 4σ or ≥ 9.0	≥ RL 140 + 4σ or ≥ 9.0	≥ RL 140 + 4σ or ≥ 9.0	≥ RL 140 + 4σ or ≥ 9.0
2.5 Fuel economy See Note (5)	CEC L-54-96 (M111)	Fuel economy improvement vs. Reference oil RL191 (15W-40)	%	≥ 3.0	≥ 2.5	≥ 1.0 (for Xw30 grades)	≥ 1.0 (for Xw30 grades)
2.6 Medium temperature dispersivity	CEC L-093-04 (DV4TD)	Absolute viscosity increase at 100°C and 6 % soot	s	≤ 0.60 x RL223 result	≤ 0.60 x RL223 result	≤ 0.60 x RL223 result	≤ 0.60 x RL223 result
		Piston merit	merit	≥ (RL223 – 2,5pts)	≥ (RL223 – 2,5pts)	≥ (RL223 – 2,5pts)	≥ (RL223 – 2,5pts)
2.7 Wear See notes (6)	CEC L-099-08 (OM646LA)	Cam wear outlet (avg. max. wear 8 cams)	µm	≤ 120	≤ 120	≤ 120	≤ 120
		Cam wear inlet (avg. max. wear 8 c.); (9)	µm	≤ 100	report, note(8)	≤ 100	≤ 100
		Cylinder wear (avg. 4 cyl.); S. note (9)	µm	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0
		Bore polishing (13 mm) - max. value of 4 cylinders; S. note (9)	%	≤ 3.0	≤ 3.0	≤ 3.0	≤ 3.0
		Tappet wear inlet (avg. max. wear 8cams)	µm	report	report	report	report
		Tappet wear outlet (avg. max. wear 8cams)	µm	report	report	report	report
		Piston cleanliness (avg. 4 pistons)	merits	report	report	report	report
		Engine sludge avg.	merits	report	report	report	report

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCE FOR SERVICE-FILL OILS FOR GASOLINE and DIESEL ENGINES WITH AFTER TREATMENT DEVICES	Dec. 2008
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This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				C1-08	C2-08	C3-08	C4-08
2. ENGINE TESTS CONTINUED							
2.8	CEC L-078-99 (VW TD1)	Piston cleanliness	merit	≥ RL206	≥ RL206	≥ RL206	≥ RL206
DI diesel		Ring sticking (Rings 1 & 2)					
Piston		Average of all 8 rings	ASF	≤ 1.0	≤ 1.2	≤ 1.0	≤ 1.0
cleanliness &		Max. for any 1 st ring	ASF	≤ 1.0	≤ 2.5	≤ 1.0	≤ 1.0
Ring sticking		Max. for any 2 nd ring	ASF	0.0	0.0	0.0	0.0
See notes (10)		EOT TBN (ISO 3771) and EOT TAN (ASTM D 664); s. note (7)	mgKOH/g	report	report	report	report

- (1) The internal standard method has to be used.
- (2) Maximum limits, Values take into account method and production's tolerances
- (3) Use either complete Daimler requirements (VDA 675301, 7 days +/- 2h, 4 materials (NBR: NBR34 DIN 53538 T3 (100 °C +/- 2°C); FPM: AK6 (150 °C +/- 2°C); ACM: E7503 (150 °C +/- 2°C); AEM: D 8948/200.1 (150 °C +/- 2°C)) + RE3, or complete requirements according to 1.10 above + Daimler requirements for AEM
- (4) The limits shown are based upon those applied in U.S. market requirements. ACEA will continuously review the situation to ensure that these limits are appropriate for European vehicles and lubricants.
- (5) ACEA considers the CEC L-54-T-96 test the only valid comparator against which claims of lubricant fuel economy improvement should be made.
- (6) Limits for C1 might be revised if needed. For C1 claims OM 602A passing results obtained before the end of 2008 can be used instead of OM 646LA results.
- (7) Test report has to give measured values before & after the test, all measurements to be taken in the same lab.
- (8) Limit under definition.
- (9) These parameters are not yet official CEC parameters.
- (10) Test results from tests performed before the publishing of the 2008 ACEA oil sequences are allowed to be used without reporting EOT TBN & TAN.

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCE FOR SERVICE-FILL OILS FOR HEAVY DUTY DIESEL ENGINES	Dec. 2008
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This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

REQUIREMENTS	TEST METHOD	PROPERTIES	UNIT	LIMITS				
				E4-08	E6-08	E7-08	E9-08	
1. LABORATORY TESTS								
1.1 Viscosity		SAE J300 Latest Active Issue		No restriction except as defined by shear stability and HT/HS requirements. Manufacturers may indicate specific viscosity requirements related to ambient temperature.				
1.2 Shear stability	CEC L-014-93 or ASTM D6278	Viscosity after 30 cycles measured at 100°C.	mm ² /s	Stay in grade				
	ASTM D6278	Viscosity after 90 cycles measured at 100°C	mm ² /s		Stay in grade			
1.3 Viscosity High Temperature High Shear Rate	CEC L-036-90 (2 nd Edition) (Ravenfield)	Viscosity at 150°C and 10 ⁶ s ⁻¹ Shear rate	mPa.s	≥ 3.5				
1.4 Evaporative Loss	CEC L-040-93 (Noack)	Max. weight loss after 1 h at 250°C	%	≤ 13				
1.5 Sulphated Ash	ASTM D874		% m/m	≤ 2.0	≤ 1.0	≤ 2.0	≤ 1.0	
1.6 Phosphorus (Note 1)	ASTM D5185 ⁺		% m/m		≤ 0.08		≤ 0.12	
1.7 Sulphur (Note 1)	ASTM D5185 ⁺		% m/m		≤ 0.3		≤ 0.4	
1.8 Oil Elastomer Compatibility (Note 2)	CEC L-039-96	Max. variation of characteristics after immersion for 7 days in fresh oil without pre-ageing Hardness DIDC Tensile strength Elongation rupture Volume variation	points % % %	RE1 -1/+5	Elastomer RE2-99 -5/+8	type RE3-04 -25/+1	RE4 -5/+5	AEM (VAMAC) As per Daimler
1.9 Foaming Tendency	ASTM D892 without option A	Tendency – stability	ml ml ml	Sequence I (24°C) 10 – nil Sequence II (94°C) 50 – nil Sequence III (24°C) 10 – nil			Seq I 10/0 Seq II 20/0 Seq III 10/0	
1.10 High temperature foaming tendency	ASTM D6082	Tendency - stability	ml	Sequence IV (150°C) 200-50				
1.11 Oxidation	CEC L-085-99 (PDSC)	Oxidation induction time	min	R&R	R&R	≥ 65	≥ 65	
1.12 Corrosion	ASTM D 6594	Copper increase	ppm	R&R	R&R	R&R	≤ 20	
		Lead increase	ppm	R&R	R&R	≤ 100	≤ 100	
		Copper strip rating	max	R&R	R&R	R&R	3	
1.13 Turbocharger performance (Note 3)								
1.14 TBN	ASTM D2896		mg KOH/g	≥ 12	≥ 7	≥ 9 (Note 4)	≥ 7	

ACEA	ACEA 2008 EUROPEAN OIL SEQUENCE FOR SERVICE-FILL OILS FOR HEAVY DUTY DIESEL ENGINES	Dec. 2008
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This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Performance parameters other than those covered by the tests shown or more stringent limits may be indicated by individual member companies.

REQUIREMENTS	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				E4-08	E6-08	E7-08	E9-08
2. ENGINE TESTS							
2.1 Wear	CEC L-099-08 (OM646LA)	Cam wear outlet (avg. max. wear 8 cams)	µm	≤ 140 (Notes 5, 6)	≤ 140 (Notes 5, 6)	≤ 155 (Notes 5, 6)	≤ 155 (Notes 5, 6)
2.2 Soot in oil (Note 7)	ASTM D 5967 (Mack T-8E)	Test duration 300 h Relative viscosity at 4.8% soot 1 test/2 test/3 test average		≤ 2.1/2.2/2.3	≤ 2.1/2.2/2.3	≤ 2.1/2.2/2.3	
2.3 Soot in oil	Mack T11	Min TGA soot @ 4.0 cSt (100°C) Min TGA soot @ 12.0 cSt (100°C) Min TGA soot @ 15.0 cSt (100°C)	%				3.5/3.4/3.3 6.0/5.9/5.9 6.7/6.6/6.5
2.4 Bore polishing Piston Cleanliness	CEC L-101-08 (OM501LA)	Bore polishing, average Piston Cleanliness, average Oil consumption Engine sludge, average (Note 8)	% merit kg/test Merit	≤ 1.0 ≥ 26 ≤ 9 R&R (Notes 9,10)	≤ 1.0 ≥ 26 ≤ 9 R&R (Notes 9,10)	≤ 2.0 ≥ 17 ≤ 9 R&R (Notes 9,10)	≤ 2.0 ≥ 17 ≤ 9 R&R (Notes 9,10)
2.5. Soot induced wear	Cummins ISM	Merit Rocker pad average weight loss at 3.9 % soot 1 test/2 test/3 test average Oil filter diff.press @ 150h 1 test/ 2 test/3 test average Engine sludge 1 test/2 test/3 test average Adj. screw weight loss	mg kPa merit mg			≤ 7.5/7.8/7.9 ≤ 55/67/74 ≥ 8.1/8.0/8.0 (Note 11)	≥ 1000 ≤ 7.1 ≤ 19 ≥ 8.7 ≤ 49
2.6. Wear (liner-ring-bearings)	Mack T12	Merit Avg.liner wear Average top ring weight loss End of test lead Delta lead 250-300 hrs Oil consumption (Phase II)	µm mg ppm ppm g/hr		≥ 1000 ≤ 26 ≤ 117 ≤ 42 ≤ 18 ≤ 95 (Notes 12, 13)	≥ 1000 ≤ 26 ≤ 117 ≤ 42 ≤ 18 ≤ 95 (Notes 12, 13)	≥ 1000 ≤ 24 ≤ 105 ≤ 35 ≤ 15 ≤ 85

- (1) The internal standard method has to be used.
- (2) Use either the most recent complete Daimler requirements (VDA 675301, 7 days, 4 materials (NBR: NBR34 DIN 53538 T3 (100 °C); FPM: AK6 (150 °C); ACM: E7503 (150 °C); AEM: D 8948/200.1 (150 °C)) + RE3 according to requirement 1.8 above, or complete requirements according to 1.8 above + Daimler requirements for AEM.
- (3) Should a test become available before the next document update, ACEA reserves the right to set performance limits providing adequate data is available.
- (4) Values < 9.00 are not accepted.
- (5) OM602A data can be used instead of OM646LA data providing it meets the requirements as specified in the 2007 ACEA sequences.
- (6) Additional parameters may be included once approved by CEC.
- (7) Mack T11 results obtained as part of an API CI-4, CI-4 plus or API CJ-4 approval program, can be used in place of Mack T8E.

- (8) Bore polish, oil consumption and engine sludge are non-approved CEC parameters.
- (9) OM441LA data can be used instead of OM501LA data providing it meets the requirements as specified in the 2007 ACEA sequences.
- (10) Limits for the sludge parameter may be reconsidered when more data becomes available.
- (11) Results from M11HST (ASTM D6838), at API CH-4, or M11EGR (ASTM D6975), at API CI-4 or CI-4 Plus, can be used in place of Cummins ISM.
- (12) Merit number shall be calculated according to the API CI-4 specification
- (13) Mack T10 results obtained as part of an API CI-4 or CI-4 plus approval program, can be used in place of Mack T12.

Appendix B

List of Acronyms

ACEA – European Automobile Manufacturers Association

E7 – An engine lubricant which meets to ACEA E7 engine lubricant specification

E9 – An engine lubricant which meets to ACEA E9 engine lubricant specification

DPF – Diesel Particulate Filter