



European
Automobile
Manufacturers
Association

ACEA EUROPEAN OIL SEQUENCES FOR HEAVY DUTY ENGINES

2016

SERVICE FILL ENGINE OILS HEAVY DUTY DIESEL ENGINES (E Categories)

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30 April 2021	Rev. 0	New document of ACEA Heavy Duty Oil Sequences 2016 Rev 3

ACEA EUROPEAN OIL SEQUENCES, GENERAL REQUIREMENTS

https://acea.be/uploads/news_documents/2021_ACEA_oil_sequences_general_requirements.pdf are an integral constituent for compliance with requirements specified in this document.

VALIDITY OF OLD AND NEW EDITIONS OF ACEA HD OIL SEQUENCES

As new editions are published older editions will be withdrawn. Validities of new and old editions are overlapping for limited periods of time as shown in the following table and the accompanying text below. When a new ACEA HD Oil Sequence is introduced, oils with claims against the previous can be marketed only for another two years.

Sequences Issue	First allowable use	Mandatory for new claims	Oils with this claim may be marketed until
2004	1 st November 2004	1 st November 2005	31 st December 2009
2007	1 st February 2007	1 st February 2008	23 rd December 2010
2008	22 nd December 2008	22 nd December 2009	22 nd December 2012
2010	22 nd December 2010	22 nd December 2011	22 nd December 2014
2012	14 th December 2012	14 th December 2013	1 st December 2018
2016	1 st December 2016	1 st December 2017	
2021			

- 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 made according to the latest ACEA HD Oil Sequences Issue. Up to that date new claims can also be made according to the previous ACEA HD Oil Sequences Issue. After the date indicated no new claims according to the previous ACEA Sequence can be made. Then all oil formulations must be developed according to the latest ACEA HD 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 supplier of any 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 are in the ATIEL Code of Practice.

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

«Consumer Language»:

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 NOx 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, Euro V and Euro VI 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 NOx 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 NOx 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, Euro V and Euro VI 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 Sulphur diesel fuel. However, recommendations may differ between engine manufacturers so driver manuals and/or dealers should be consulted if in doubt

This sequence defines the minimum quality level of a product for self-certification to EELQMS and for presentation to ACEA members. Individual member companies may indicate performance parameters other than those covered by the tests shown or more stringent limits.

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				E4-16	E6-16	E7-16	E9-16
1. LABORATORY TESTS							
1.1 Viscosity		SAE J300 Latest Active Issue		No restriction except as defined by shear stability and HTHS requirements. Manufacturers may indicate specific viscosity requirements related to ambient temperature.			
1.2 Shear stability	CEC L-014-93 or ASTMD6278 or ASTMD7109	Viscosity after 30 cycles measured at 100 °C.	mm ² /s	Stay in grade			
	ASTMD7109	Viscosity after 90 cycles measured at 100 °C after 90 cycles	mm ² /s		Stay in grade		
1.3 HTHS Viscosity	CEC L-036-90	Dynamic Viscosity at 150 °C and Shear Rate of 10 ⁶ s ⁻¹	mPaxs	≥ 3.5			
		Dynamic Viscosity at 100 °C and shear Rate of 10 ⁹ s ⁻¹	mPaxs	Report			
1.4 Evaporative Loss	CEC L-040-93 (Noack)	Max. weight loss after 1 h at 250 °C	%	≤13			
1.5 Sulphated Ash	ASTMD874		% m/m	≤2.00	≤1.00	≤2.00	≤1.00
1.6 Phosphorus	ASTMD5185		% m/m		≤0.08		≤0.12
1.7 Sulphur	ASTMD5185		% m/m		≤0.30		≤0.40
1.8 * Oil / Elastomer Compatibility	CEC L-112-16	Max. variation of characteristics after immersion for 7 days in fresh oil without pre-ageing		RE6	RE7	RE8	RE9
		Tensile Strength	%	Report	Report	Report	Report
		Elongation at Break	%	-70/+20	-65/+15	-51/+9	-65/+19
		Volume Change	%	-5.5/+2.1	-1.8/+8.9	0.0/+12.0	-2.5/+16
1.9 Foaming Tendency	ASTMD892 without option A	Tendency – stability	ml	Sequence I (24 °C) 10 – nil			Seq I 10/0
			ml	Sequence II (94 °C) 50 – nil			Seq II 20/0
			ml	Sequence III (24 °C) 10 – nil			Seq III
							10/0
1.10 High Temperature Foaming Tendency	ASTMD6082	Tendency - stability	ml	Sequence IV (150 °C) 200-50			
1.11 Oxidation	CEC L-085-99 (PDSC)	Oxidation induction time	min.	≥ 65			
1.12 Corrosion	ASTMD 6594	Copper increase	ppm	Report	Report	≤20	
		Lead increase	ppm	Report	Report	≤100	≤100
		Copper strip rating	max	Report	Report	3	
1.13 * TBN	ASTMD2896		mg KOH/g	≥12	≥ 7	≥ 9	≥7
1.14 Low Temperature Pumpability	CEC L-105-12	MRV	mPaxs	According to SAE J300 for fresh oil			
		Yield stress	Pa				
		(MRV at SAE J300 Temperatures applicable for the fresh oil viscosity grade)					
1.15 Oil Oxidation with Biodiesel	CEC L-109-16	Oxidation increase after 168 h	A/cm	≤90	≤80	≤120	≤90
		KV100 increase after 168 h	%	≤130	≤130	≤300	≤150

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REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				E4-16	E6-16	E7-16	E9-16
1. ENGINE TESTS							
2.1 * Wear	CEC L-099-08 (OM646LA)	Cam wear outlet (avg. max. wear 8 cams)	µm	≤ 140	≤ 140	≤ 155	≤ 155
2.2 * Soot in Oil	ASTM D 5967 (Mack T-8E)	Test duration 300 h Relative viscosity at 4.8% soot and 50% shear loss 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	≤ 2.1/2.2/2.3
2.3 * Bore Polishing Piston Cleanliness	CEC L-101-08 (OM501LA)	Piston cleanliness, average	Merit	≥ 26	≥ 26	≥ 17	≥ 17
		Bore polishing, average **	%	≤ 1.0	≤ 1.0	≤ 2.0	≤ 2.0
		Oil consumption **	kg/Test	≤ 9	≤ 9	≤ 9	≤ 9
		Engine sludge, average **	Merit	Report	Report	Report	Report
2.4 * Soot Induced Wear	ASTM D7468 (Cummins ISM)	Merit					≥ 1000
		Crosshead, weight loss 1 test / 2 test / 3 test average	mg			≤ 7.5/7.8/7.9	≤ 7.1
		Oil Filter Diff. Press at 150h 1 test / 2 test / 3 test average	kPa			≤ 55/67/74	≤ 19
		Engine sludge 1 test / 2 test / 3 test average	Merit			≥ 8.1/8.0/8.0	≥ 8.7
		Adj. screw weight loss	mg				≤ 49
		Merit			≥ 1000	≥ 1000	≥ 1000
		Cylinder liner wear (CLW)	µm		≤ 26	≤ 26	≤ 24
2.5 * Wear (liner-ring- bearings)	ASTM D7422 (Mack T12)	Top ring weight loss (TRWL)	mg	≤ 117	≤ 117	≤ 105	
		End of test lead	ppm	≤ 42	≤ 42	≤ 35	
		Delta lead 250-300 hrs	ppm	≤ 18	≤ 18	≤ 15	
		Oil consumption (Phase II)	g/hr	≤ 95	≤ 95	≤ 85	
2.6 Biofuel Impacted Piston Cleanliness and Engine Sludge	CEC L-104-16 (OM646LA Bio)	Piston cleanliness, average	Merit		≥ RL255 + 4		≥ RL255 + 2
		Ring sticking **	ASF		Report		Report
		Engine sludge, average **	Merit		Report		Report

***/**:** Footnotes referring to the following requirements in the E-Class:

- No. 1.8 Full Data sets being obtained on CEC L-039-96 + the Daimler requirements for DBL-AEM as specified by Daimler AG can be used instead of CEC L-112-16, provided the requirements as specified in ACEA 2012 are met.
- No. 1.13 For E7, values < 9.00 are not accepted.
- No. 2.1 Additional parameters may be included once approved by CEC
- No. 2.2 Mack T11 results obtained as part of an API CI-4, CI-4 plus, CJ-4, CK-4 or FA-4 approval program, can be used in place of Mack T8E.
- No. 2.3, 2.6 ** Not CEC approved parameters.
- No. 2.4 Merit number shall be calculated according to the API CI-4 specification
- No. 2.5 For E6 & E7 Merit number shall be calculated according to the API CI-4 specification.
For E6 & E7 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. Mack T-12 Cylinder Liner Wear and Top Ring Weight Loss results obtained as part of an API CK-4 or FA-4 approval program, which includes a passing Volvo T-13 at the API CK-4 or API FA-4 level, may be used to satisfy the requirements of the Mack T-12 in the ACEA Oil Sequences.