

acea

October 2024

ACEA Oil Sequences

Heavy-duty engines





SERVICE-FILL ENGINE OILS FOR HEAVY-DUTY DIESEL ENGINES (E AND F CATEGORIES)

Date	Revision	Updated documents
1 October 2024	Revision 0	Initial release of 2024 ACEA Oil Sequences for Heavy-Duty Engines October
1 December 2024	Revision 1	Correction of typographical errors in the 2024 ACEA Oil Sequences for Heavy-Duty Engines

The [ACEA Oil Sequences – General Requirements](#) are an integral constituent of compliance with the requirements specified in this document.

VALIDATION OF OLD AND NEW EDITIONS OF ACEA HEAVY-DUTY OIL SEQUENCES

As new sequence editions are published older editions have to be withdrawn.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

Sequences 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	1 May 2024*
2022	1 May 2022*	1 May 2023*	1 October 2026*
2024	1 October 2024*	1 October 2025*	

* ACEA Oil Sequences for Heavy-Duty Engines only

- ‘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 Oil Sequences issue. Up to that date, new claims can also be made according to the previous ACEA Oil Sequences issue. After the date indicated, no new claims according to the previous ACEA Oil Sequence can be made. Then all oil formulations must be developed according to the latest ACEA Oil Sequence release.
- ‘Oils with this claim may be marketed until’ means that no further marketing of oils with claims to this issue are allowed after the date indicated.

The marketer 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 Oil Sequences (eg product literature, packaging, labels), they must specify the ACEA class and category (see nomenclature and ACEA process for definitions).

E/F: Heavy Duty Diesel Engine Oils

The OEM manual is mandatory, the below table gives an overview
For oil drain interval information please refer to the OEM manual

On-Highway

Engine Oil Sequence	Euro VI	Euro I, II, III, IV, V	EGR engine compatibility	Exhaust treatment (DPF, SCR & Cathalyst)	Fuel compatibility		How to read the table
					High Sulfur*	Biodiesel**	
E4	X	!	!	X	✓	!	✓ recommended ! for some applications X not recommended
E7	X	!	✓	X	✓	!	
E8	✓	✓	✓	✓	!	✓	
E11	✓	✓	✓	✓	!	✓	
F01	✓	✓	✓	✓	!	✓	

* >50 ppm Sulfur

** Recommendations may differ between engine manufacturers, especially with >B7 biodiesel blends; please consult driver manuals and/or dealers if in doubt.

Off-Highway

Engine Oil Sequence	Stage IIIb, IV, V	Stage I, II, IIIa	EGR engine compatibility	Exhaust treatment (DPF, SCR & Cathalyst)	Fuel compatibility		How to read the table
					High Sulfur*	Biodiesel**	
E4	X	!	!	X	✓	!	✓ recommended ! for some applications X not recommended
E7	X	!	✓	X	✓	!	
E8	✓	✓	✓	✓	!	✓	
E11	✓	✓	✓	✓	!	✓	

* >50 ppm Sulfur

** Recommendations may differ between engine manufacturers, especially with >B7 biodiesel blends; please consult driver manuals and/or dealers if in doubt.

aceea		2024 ACEA Oil Sequences for Heavy-Duty Engines				October 2024 Revision 1		
REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS				
				E4-24	E8-24	E7-24	E11-24	F01-24
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.				XW-30
1.2 Shear stability	CEC L-14-93 or ASTM D6278 or ASTM D7109	Viscosity after 30 cycles measured at 100°C.	mm ² /s	Stay in grade				
	ASTM D7109	Viscosity after 90 cycles measured at 100°C	mm ² /s	Stay in grade				
1.3 HTHS viscosity	CEC L-36-90	Dynamic viscosity at 150°C and Shear Rate of 10 ⁶ s ⁻¹	mPa·s	≥3.5			≥ 2.9 & ≤ 3.2	
		Dynamic viscosity at 100°C and shear Rate of 10 ⁶ s ⁻¹	mPa·s	Report				
1.4 Evaporative loss	CEC L-40-93 (Noack)	Max weight loss after 1h at 250°C	%	≤13				
1.5 Sulphated ash	ASTM D874		% m/m	≤2.0	≤1.0	≤2.0	≤1.0	≤1.0
1.6 Phosphorus	ASTM D5185 or D4951		% m/m		≤0.08		≤0.12	≤0.12
1.7 Sulphur	ASTM D5185 or D4951		% m/m		≤0.3		≤0.4	≤0.4
1.8 Chlorine	ASTM D6443		% m/m	Report				
1.9 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				
		Elongation at break	%	-70/+20, -65/+15, -51/+9, -65/+19				
		Volume change	%	-1.5/+1.8, -1.8/+7.7, 0.0/+10.7, -1.5/+13.8				
1.10 Foaming tendency	ASTM D892 without option A	Tendency – stability	ml	Sequence I (24°C) 10 – nil				
		Tendency – stability	ml	Sequence II (94°C) 20 – nil				
		Tendency – stability	ml	Sequence III (24°C) 10 – nil				
1.11 High temperature foaming tendency	ASTM D6082	Tendency - stability	ml	Sequence IV (150°C) 200-50				
1.12 Oxidation	CEC L-85-99 (PDSC)	Oxidation induction time	min.	≥65				
1.13 Corrosion	ASTM D6594	Copper increase	ppm	Report		≤20	≤20	
		Lead increase	ppm	Report		≤100		
		Copper strip rating	max	Report			3	3
1.14 * TBN	ASTM D2896		mg KOH/g	≥12	≥7	≥9	≥7	≥7
1.15 Low Temperature Pumpability	CEC L-105-12	MRV	mPa·s	According to SAE J300 for fresh oil				
		Yield stress	Pa					
		MRV at SAE J300 temperatures applicable for the fresh oil viscosity grade						
1.16 Oil oxidation with biodiesel	CEC L-109-14	Oxidation increase after 168h	A/cm	≤90	≤80	≤120	≤90	≤90
		KV100 increase after 168h	%	≤130	≤130	≤300	≤150	≤150

aceea		2024 ACEA Oil Sequences for Heavy-Duty Engines					October 2024 Revision 1	
REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS				
				E4-24	E8-24	E7-24	E11-24	F01-24
2. ENGINE TESTS								
2.1 Wear	CEC L-99-08 (OM646LA)	Cam wear outlet (avg max wear 8 cams)	µm	≤140	≤140	≤155	≤155	≤155
2.2 * Soot in oil	ASTM D5967 (Mack T-8E)	Test duration 300h relative viscosity at 4.8% soot and 50% shear loss		≤2.1	≤2.1	≤2.1	≤2.1	≤2.1
2.31 * Piston cleanliness	CEC L-118-21 (OM471)	Piston cleanliness (grooves and piston undercrown), average	%	≥74	≥74			
		Oil consumption	g/h	Report	Report			
2.32 * Piston cleanliness	ASTM D6750 (CAT 1N)	Weighted demerits (WDN)	Demerits			≤286.2		
		Top groove fill (TGF)	%			≤20		
		Top land heavy carbon (TLHC)	%			≤3		
		Oil consumption (0-252 h)	g/kWh			≤0.54		
		Piston, ring, and liner scuffing				None		
		Piston ring sticking				None		
2.33 * Piston cleanliness	ASTM D7549 (CAT C13)	Merit rating	Merit			≥1000	≥1000	
		Hot stuck rings				None	None	None
2.4 Soot Induced Wear	ASTM D7468 (Cummins ISM)	Merit rating	Merit			≥1000	≥1000	
		Top ring mass loss	mg			≤100	≤100	
		Crosshead, weight loss	mg			≤7.5	≤7.1	≤7.1
		Oil filter diff. press at 150h	kPa			≤55	≤19	≤19
		Engine sludge	Merit			≥8.1	≥8.7	≥8.7
		Adj. screw weight loss	mg			≤49	≤49	≤49
2.5 * Wear (liner-ring-bearings)	ASTM D7422 (Mack T-12)	Merit rating	Merit		-	≥1000	-	-
		Cylinder liner wear (CLW)	µm		≤24.0	≤26	≤24.0	≤24.0
		Top ring weight loss (TRWL)	mg		≤105	≤117	≤105	≤105
		End of test lead	ppm			Report	Report	Report
		Delta lead 250-300h	ppm			Report	Report	Report
		Oil consumption (Phase II)	g/h			Report	Report	Report
		Piston cleanliness, average	Merit			≥RL255 + 6	≥RL255 + 4	≥RL255 + 4
2.6 Biofuel impacted piston cleanliness and engine sludge	CEC L-104-16 (OM646LA Bio)	Ring sticking **	ASF			Report	Report	Report
		Engine sludge, average **	Merit			Report	Report	Report
		KV increase (300-360h)	%			≤75	≤75	≤75
2.7 Oxidation stability	ASTM D8048 (Volvo T-13)	Oxidation peak height	A/cm			≤125	≤125	≤125
		Nitration peak height	A/cm			Report	Report	Report
		Oil consumption (avg 48-192h)	g/h			Report	Report	Report
2.8 Aeration	ASTM D8047 (COAT)	Aeration	%			≤11.8	≤11.8	≤11.8

***: Footnotes referring to the following requirements:

- No 1.14 For E7-24, values < 9.00 are not accepted
- No 2 Unless otherwise stated, for ASTM engine tests in these ACEA HD Sequences, data meeting the requirements of API CK-4 are acceptable, including Multiple Test Evaluation Procedures (MTEP)
- No 2.2 ASTM D5967 (Mack T-8E): Data meeting the requirements of API CH-4 are acceptable, including Multiple Test Evaluation Procedures (MTEP). Mack T-11 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 T-8E
- No 2.31 CEC L-118-21 (OM471): Alternatively, CEC L-101-09 (OM501LA) data meeting the requirements of ACEA E4-16 can be used to support an ACEA E4 claim
- No 2.32 ASTM D6750 (CAT 1N): Alternatively, CEC L-101-09 (OM501LA) data meeting the requirements of ACEA E7-24 can be used to support an ACEA E7-24 claim. Alternatively, CEC L 118 21 (OM471) data meeting the requirements of ACEA E4-24 / E8-24 can be also be used to support an ACEA E7-24 claim.
- No 2.33 ASTM D7549 (CAT C13): Alternatively, CEC L-101-09 (OM501LA) data meeting the requirements of ACEA E9-24 can be used to support an ACEA E11-24 and F01-24 claim. Alternatively, CEC L 118 21 (OM471) data meeting the requirements of ACEA E4-24 / E8-24 can be also be used to support an ACEA E11-24 and ACEA F01-24 claim.
- No 2.4 ASTM D7468 (Cummins ISM): For ACEA E7-24, data meeting the requirements of API CI-4 are acceptable, including Multiple Test Evaluation Procedures (MTEP).
- No 2.5 For ACEA E11-24 and F01-24, merit number shall be calculated according to the CK-4 specification
ASTM D7422 (Mack T-12), For ACEA E7-24 only:
Data meeting the requirements of API CI-4 are acceptable, including Multiple Test Evaluation Procedures (MTEP). Merit number shall be calculated according to the API CI-4 specification.
Mack T-10 results obtained as part of an API CI-4 or CI-4 plus approval program, can be used in place of Mack T-12.
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.
- No. 2.6 ** Not CEC approved parameters



ABOUT THE EU AUTOMOBILE INDUSTRY

- 12.7 million Europeans work in the auto industry (directly and indirectly), accounting for 6.6% of all EU jobs
- 11.5% of EU manufacturing jobs – some 3.5 million – are in the automotive sector
- Motor vehicles are responsible for €398.4 billion of tax revenue for governments across key European markets
- The automobile industry generates a trade surplus of €76.3 billion for the European Union
- The turnover generated by the auto industry represents more than 8% of the EU's GDP
- Investing €58.8 billion in R&D per year, automotive is Europe's largest private contributor to innovation, accounting for 32% of the EU total

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