ACEA — ACEA 2007 european oil sequence for service-fill oils for gasoline and diesel engines — Feb 2007

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.

1. LABORATORY TESTS

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				A1/B1-04	A3/B3-04	A3/B4-04	A5/B5-04
1.1 Viscosity grades		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-14-A-93 or ASTM D6278	100°C Viscosity after 30 cycles	mm^2/s	xW-20 stay in grade xW30 ≥ 8.6 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-36-A-90 *(2nd edition)* *(Ravenfield)*	Viscosity at 150°C and 10^6 s^{-1} shear rate	mPa.s	max. 3.5. xW-20 2.6. min All others 2.9 min.	≥ 3.5	≥ 3.5	min 2.9 max. 3.5
1.4 Evaporative loss	CEC-L-40-A-93 (Noack)	Max. weight loss after 1 h at 250°C	%	≤15	≤13	≤13	≤13
				Note: the following sections apply to all sequences			
1.5 Sulphated ash (2)	ASTM D874		% m/m	≤1.3	≤1.5	≤1.6	≤1.6
1.6 Sulphur (1)	ASTM D5185		% m/m	Report			
1.7 Phosphorus (1)	ASTM D5185		% m/m	Report			
1.8 Chlorine	ASTM D6443		% m/m	Report			
1.9 Oil / elastomer compatibility (3)	CEC-L-39-T-96	Max. variation of characteristics after immersion for 7 days in fresh oil without pre-ageing Hardness DIDC Tensile strength Elongation at rupture Volume variation	 points % % %	RE1 -1/+5 -40/+10 -50/+10 -1/+5	RE2-99 -5/+8 -15/+18 -35/+10 -7/+5	RE3-04 -22/+1 -30/+10 -20/+10 -1/+22	RE4 -5/+5 -20/+10 -50/+10 -5/+5	AEM (VAMAC) As per Daimler-Chrysler
1.10 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				
1.11 High Temperature foaming tendency	ASTM D6082 High temperature foam test	Tendency – stability	ml	Sequence IV (150°C) 100 - nil				

2. ENGINE TESTS

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				A1/B1-04	A3/B3-04	A3/B4-04	A5/B5-04
2.1 High temperature deposits Ring sticking Oil thickening	CEC-L-88-T-02 (TU5JP-L4) 72 Hour test	Ring sticking (each part) Piston varnish (6 elements, average of 4 pistons) Absolute viscosity increase at 40°C between min & max values during test Oil consumption	Merit Merit mm^2/s kg/test	≥ 9.0 ≥ RL216 ≤RL216 Report	≥ 9.0 ≥ RL216 ≤0.8 x RL216 Report	≥ 9.0 ≥ RL216 ≤0.8 x RL216 Report	≥ 9.0 ≥ RL216 ≤0.8 x RL216 Report
2.2 Low temperature sludge (4)	ASTM D6593-00 (Sequence VG) Under protocol & requirements for API	Average engine sludge Rocker cover sludge Average Piston skirt varnish Average engine varnish Comp. ring (hot stuck) Oil screen clogging	Merit Merit Merit Merit %	≥ 7.8 ≥ 8.0 ≥ 7.5 ≥ 8.9 none ≤20	≥ 7.8 ≥ 8.0 ≥ 7.5 ≥ 8.9 none ≤20	≥ 7.8 ≥ 8.0 ≥ 7.5 ≥ 8.9 none ≤20	≥ 7.8 ≥ 8.0 ≥ 7.5 ≥ 8.9 none ≤20
2.3 Valve train scuffing wear	CEC-L-38-A-94 (TU3M)	Cam wear, average Cam wear, max. Pad merit (Ave. of 8 pads)	µm µm Merit	≤10 ≤15 ≥ 7.5	≤10 ≤15 ≥ 7.5	≤10 ≤15 ≥ 7.5	≤10 ≤15 ≥ 7.5
2.4 Black sludge	CEC-L-53-T-95 (M111)	Engine sludge, average	Merit	≥ RL140	≥ RL140	≥ RL140	≥ RL140
2.5 Fuel economy (5)	CEC-L-54-T-96 (M111)	Fuel economy improvement vs. Reference oil RL191 (15W-40)	%	≥ 2.5	-	-	≥ 2.5
2.6 Ring sticking & Piston cleanliness	CEC-L-46-T-93 (VW 1.6 TC D) (6)	Ring sticking Piston cleanliness	Merit Merit	≥ RL148 ≥ RL148	≥ RL148 ≥ RL148	-	-
2.7 Medium temperature dispersivity	CEC-L-093 (DV4TD) (8)	Absolute viscosity increase at 100°C and 6% soot Piston merit (7)	mm^2/s Merit	≤0.60 x RL223 result ≥ (RL223 – 2.5 pts)	≤0.60 x RL223 result ≥ (RL223 – 2.5 pts)	≤0.60 x RL223 result ≥ (RL223 – 2.5 pts)	≤0.60 x RL223 result ≥ (RL223 – 2.5 pts)
2.8 Wear, Viscosity stability & Oil consumption	CEC-L-51-A-98 (OM602A) (9)	Cam wear. Average (new tappet) Viscosity increase at 40°C Bore polishing Cylinder wear. Average Oil consumption	µm % % µm kg/test	≤50.0 ≤90 ≤7.0 ≤20.0 ≤10.0	≤50.0 ≤90 ≤7.0 ≤20.0 ≤10.0	≤50.0 ≤90 ≤7.0 ≤20.0 ≤10.0	≤50.0 ≤90 ≤7.0 ≤20.0 ≤10.0
2.9 DI diesel Piston cleanliness & Ring sticking	CEC-L-78-T-99 (VW DI)	Piston cleanliness Ring sticking (Rings 1&2) Average of all 8 rings Max. for any 1st ring Max. for any 2nd ring	Merit ASF ASF ASF			≥ RL206 minus 3 pts. ≤1.2 ≤2.5 ≤0.0	≥ RL206 ≤1.2 ≤2.5 ≤0.0

(1) The internal standard method has to be used. (2) Maximum limits, values take into account method and production tolerances. (3) Use either complete Daimler-Chrysler requirements + RE3, or complete requirements according to 1.9 above + DC 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) The test according to CEC L78-T-99 may be run instead of CEC-L-46-T-93 for A1/B1 and A3/B3. The limits shall be as A3/B4. (7) Piston merit is not yet an official CEC parameter. (8) XUD11 BTE passing results obtained before the end of 2005 can be used instead of the DV4. (9) OM646LA results at an equivalent performance level can be used as soon as the test becomes available as CEC test. In the event of OM602A and OM646 are not available, ACEA will define an alternative.