

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				
				E2-96 Issue 5	E4-07	E6-04 Issue 2	E7-04 Issue 2	
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-14-A-93 or ASTM D6278	Viscosity after 30 cycles measured at 100°C	mm <sup>2</sup> /s	xW-30≥9.0 xW-40≥12.0 xW-50≥15.0 mono grades no req	Stay in grade			
	ASTM D6278	Viscosity after 90 cycles measured at 100°C	mm <sup>2</sup> /s			Stay in grade		
1.3 Viscosity High Temperature High Shear Rate	CEC-L-36-A-90 (2nd Edition) (Ravenfield)	Viscosity at 150°C and 10 <sup>6</sup> s <sup>-1</sup> shear rate	mPa.s	≥3.5				
1.4 Evaporative Loss	CEC-L-40-A-93 (Noack)	Max. weight loss after 1h at 250°C	%	≤13				
1.5 Sulphated Ash	ASTM D874		% m/m	≤2.0	≤2.0	≤1.0	≤2.0	
1.6 Phosphorus (1)	ASTM D5185		% m/m			≤0.08		
1.7 Sulphur (1)	ASTM D5185		% m/m			≤0.3		
1.8 Oil Elastomer Compatibility (2)	CEC-L-39-T-96	Max. variation of characteristics after immersion for 7 days in fresh oil without pre-aging Hardness DIDC Tensile strength Elongation rupture Volume variation	points	RE1	RE2-99	RE3-04	RE4	AEM (VAMAC)
			%	-1/+5	-5/+8	-25/+1	-5/+5	As per
			%	-50/+10	-15/+18	-45/+10	-20/+10	Daimler-
			%	-60/+10	-35/+10	-20/+10	-50/+10	Chrysler
			%	-1/+5	-7/+5	-1/+30	-5/+5	
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				
1.10 High temperature foaming tendency	ASTM D6082	Tendency - stability	ml	Sequence IV (150°C) 200 - 50				
1.11 Oxidation	CEC-L-85-T-99 (PDSC)	Oxidation Induction time	min				≥35	
1.12 Corrosion	ASTM D6594	Lead increase	ppm				≤100	
1.13 TBN	ASTM D2896			≥12				

## 2. ENGINE TESTS

REQUIREMENT	TEST METHOD	PROPERTIES	UNIT	LIMITS			
				E2-96 Issue 5	E4-07	E6-04 Issue 2	E7-04 Issue 2
2.1 Bore polishing/ Piston cleanliness (3)	CEC L-42-T-99 (OM364LA)	Bore polishing	%	≤3.5			
		Piston cleanliness	Merit	≥40.0			
		Average Cylinder wear	µm	≤3.5			
		Sludge	Merit	≥9.4			
		Oil consumption	kg/test	≤16.0			
2.2 Wear (4)	CEC L-51-A-97 (OM602A)	Cam wear	µm	≤50.0	≤50.0	≤50.0	≤50.0
		Viscosity increase at 40°C	%	≤90	≤90	≤90	≤90
		Bore polishing	%	≤7.0	≤7.0	≤7.0	≤7.0
		Cylinder wear	µm	≤20.0	≤20.0	≤20.0	≤20.0
		Oil consumption	kg/test	≤10	≤10	≤10	≤10
2.3 Soot in oil (5)	ASTM D 5967 (Mack T-8E)  ASTM D5967 (Mack T-8)	Test duration:	Hours		300	300	300
		Relative viscosity at 1 test/2 test/ 3 test average			4.8% soot ≤2.1/2.2/2.3	4.8% soot ≤2.1/2.2/2.3	4.8% soot ≤2.1/2.2/2.3
		Viscosity increase at 1 test/2 test/ 3 test average	mm <sup>2</sup> /s		3.8% soot ≤11.5/12.5/13.0	3.8% soot ≤11.5/12.5/13.0	3.8% soot ≤11.5/12.5/13.0
		Filter plugging, Diff. pressure	kPa		≤138	≤138	≤138
		Oil consumption	g/kWh		≤0.304	≤0.304	≤0.304
2.4 Bore polishing Piston cleanliness Turbocharger deposits (6)	CEC L-52-T-97 (OM441LA)	Bore polishing	%		≤2.0	≤2.0	≤2.0
		Piston cleanliness	Merit		≥40.0	≥40.0	≥25.0
		Boost pressure loss at 400 hrs	%		≤4	≤4	≤4
		Oil consumption	kg/test		≤40	≤40	≤40
2.5 Soot induced wear (7)	Cummins ISM	Rocker pad average weight loss at 3.9% soot	mg				≤7.5/7.8/7.9
		1 test/2 test/ 3 test average Oil filter diff.press @ EOT	kPa				≤55/67/74
		1 test/2 test/ 3 test average Engine sludge	Merit				≥8.1/8.0/8.0
		1 test/2 test/ 3 test average					
2.6 Wear (liner-ring- bearings) (8)0	Mack T10 ASTM D6987 (Mack T-12)	Merit			≥1000	≥1000	
		Avg. liner wear	µm		≤32 (26)	≤32 (26)	
		Average top ring weight loss	mg		≤158 (117)	≤158 (117)	
		End of test lead	ppm		≤35 (42)	≤35 (42)	
		Delta lead 250-300 hrs	ppm		≤14 (18)	≤14 (18)	
		Oil consumption (Phase II)	g/hr		≤65 (95)	≤65 (95)	

(1) The internal standard method has to be used. (2) Use either the most recent complete Daimler-Chrysler requirements + RE3 according to requirement 1.8 above, or complete requirements according to 1.8 above + DC requirements for AEM. (3) Results from a CEC L-52-T-97 (OM441LA) test as part of a Daimler-Chrysler sheet 228.1 approval can be used as an alternative. Only tests according to CEC L-52-T-97 are acceptable. (4) OM646LA results at an equivalent performance level can be used as soon as the test becomes available as a CEC test. In the event the OM602A and the OM646 are not available, then ACEA will define an alternative. (5) Mack T11 (ASTM D7156) results obtained as part of a API CI-4, CI-4 plus or API CJ-4 approval program, can be used in place of Mack T8E. (6) OMS01LA results at an equivalent performance level can be used as soon as the test becomes available as a CEC test. (7) Results from Cummins M11 HST (ASTM D6838), at API CH-4 or M11 EGR test (ASTM D6975) at API CI-4 or CI-4 Plus can be used in place of Cummins ISM test. (8) Mack T12 results can be used in place of Mack T10. In this case the merit scale for CI-4 Plus approvals must be applied to the Mack T12 results. Maximum allowable values for the Mack T12 test are given in parentheses.