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API engine oil classifications

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Pending final publication in API 1509 and ASTM D4485

Formulating
tomorrow
together

Passenger vehicle engine oil requirements for API SQ-RC and ILSAC GF-7A/B categories

Requirements	Test Method	Properties	Unit	Limits – API SQ-RC/GF-7
1. LABORATORY/BENCH TESTS				
1.1 Viscosity Grades	SAE J300	ILSAC Grades are 0W-16, 0W-20, 5W-20, 0W-30, 5W-30 and 10W-30. API allows all eligible grades.	cSt (mm2/s) & cP (mPa-s)	As defined by SAE J300
1.2 New Oil MRV	ASTM D4684	Low temperature Pumping Viscosity	cP (mPa-s)	40,000 max, no yield stress [33]
1.3 Foam Tests	ASTM D892 [34] ASTM D6082 [34]	Sequence I [35],[36] Sequence II [35],[36] Sequence III [35],[36] Sequence IV [35]	tendency/stability, ml	10/0 max 50/0 max 10/0 max 100/0 max
1.4 EOFT	ASTM D6795	Flow Reduction	%	50 max
1.5 EOWTT	ASTM D6794	with 0.6% Water with 1.0% Water with 2.0% Water with 3.0% Water	% flow reduction % flow reduction % flow reduction % flow reduction	50 max 50 max 50 max 50 max
1.6 Aged Oil Low-Temperature Pumpability [37]	ASTM D8111 or ASTM D7528 [38]	MRV TP-1 Apparent Viscosity and Yield Stress	cP and mPa-s	60,000 cP with no yield stress [39]
1.7 TEOST 33C	ASTM D6335	High temperature deposits	total deposit weight, mg	30 max [40],[46]
1.8 Emulsion Retention	ASTM D7563	Oil mixed with 10% Water and 10% E85	0°C and 25°C @ 24 hours	No water separation
1.9 Homogeneity & Miscibility	ASTM D6922	Oil Compatibilty	None	Pass [41]
1.10 Gelation Index [42]	ASTM D5133	Scanning Brookfield Viscosity, Yield Stress	Calculated	12 max [43]
1.11 Volatility	ASTM D5800	Evaporation Loss (Noack)	% off 250°C	15.0 max [44]
1.12 Ball Rust Test [42]	ASTM D6557	Rust rating	Avg Gray Value	100 min
1.13 Elastomer Compatibility	ASTM D7216, Annex A2 Polyacrylate Rubber (ACM-1) Hydrogenated Nitrile (HNBR-1) Silicone Rubber (VMQ-1) Fluorocarbon Rubber (FKM-1) Ethylene Acrylic Rubber (AEM-1) Polyacrylate Rubber (ACM-2) Ethylene Acrylic Rubber (AEM-2) Ethylene Acrylic Rubber (AEM-3) Fluoroelastomer Rubber (FKM-3)	Volume Change, % -5, 9 -5, 10 -5, 40 -2, 3 -5, 30 Rate & Report Rate & Report Rate & Report Rate & Report	Hardness, pts -10, 10 -10, 5 -30, 10 -6, 6 -20, 10 Rate & Report Rate & Report Rate & Report Rate & Report	Tensile strength change, % -40, 40 -20, 15 -50, 5 -65, 10 -30, 30 Rate & Report Rate & Report Rate & Report Rate & Report
1.14 Shear Stability	ASTM D6278 or D7109 (30 passes) ASTM D6709 (Sequence VIII)	Diesel Injector, SAE XW-16 only Diesel Injector, 0W-8 & 0W-12 10-hour stripped Kinematic Viscosity	KV @ 100°C after 30 passes cSt KV @ 100°C after 30 passes cSt @ 100°C	5.8 min 0W-8=4.0 min, 0W-12=5.0 min Stay in original visc grade [45]
1.15 Sequence IIIHB	ASTM D8111	Phosphorus retention	%	81 min [46]
1.16 Phosphorus [47]	ASTM D4951 or D5185	Phosphorus content	%	0.06 - 0.08 [48],[49]
1.17 Sulfur [47]	ASTM D4951, D5185 or ASTM D2622	Sulfur content of SAE 0W and 5W multigrades	%	0.5 max [48]
		SAE 10W-30 and all other grades	%	0.6 max [48]
1.18 Engine Oil Gelation Test [50]	WK86363	Flow Reduction	%	Rate and Report
1.19 Sulfated Ash	ASTM D874	Sulfated Ash Content	%	0.9 max [51]

Passenger Vehicle Engine Oil Requirements For API SQ-RC and ILSAC GF-7A/B Categories *continued*

Requirements	Test Method	Properties	Unit	Limits – API SQ-RC/GF-7		
2. ENGINE TESTS						
2.1 Sequence IIIH	ASTM D8111	Kinematic viscosity increase, Average Weighted piston deposits, Average Hot stuck rings	% @ 40°C after 100 hours Merits #	0W-8/ 0W-12 150 max 3.7 min None	xW-16 100 max 4.2 min None	Other 100 max 4.6 min None
2.2 Sequence IVA [52]	ASTM D6891	Average cam wear SAE 0W-8 and 0W- 12 only	µm	90 max		
2.3 Sequence IVB [52]	ASTM D8350	Average intake lifter volume loss (8 position avg.) End of test iron	mm^3 ppm	2.7 max 400 max		
2.4 Sequence VH [42]	ASTM D8256	Average engine sludge Average rocker cover sludge Average engine varnish Average piston skirt varnish Oil screen sludge Oil screen debris Hot stuck compression rings Cold stuck rings Oil ring clogging	Merits Merits Merits Merits % area % area # # % area	7.6 min 7.7 min 8.6 min 7.6 min Rate & report Rate & report None Rate & report Rate & report		
2.5 Sequence VIE [51],[53]	ASTM D8114	SAE XW-20	%FEI SUM %FEI2	4.3 min 2.1 min		
		SAE XW-30	%FEI SUM %FEI2	3.6 min 1.8 min		
		SAE 10W-30 and all other grades not listed above	%FEI SUM %FEI2	3.0 min 1.4 min		
2.6 Sequence VIF [51]	ASTM D8226	SAE XW-16 only	%FEI SUM %FEI2	4.3 min 2.1 min		
2.7 Sequence VIII [45]	ASTM D6709	Bearing weight loss	mg	26 max		
2.8 Sequence IX and Sequence IX Aged [54]	ASTM D8291 Including Appendix X2	Average number of events for 4 iterations Number of events per iteration	# #	5 max 8 max		
2.9 Sequence X	ASTM D8279	EOT chain elongation	% increased	0W-8/0W-12 0.085 max	Others 0.080 max	
2.10 JASO M365 [55]		SAE 0W-8 and 0W-12 only	% FEI	0W-8 2.0	0W-12 1.7	
2.11 JASO M366 [55]		SAE 0W-8 and 0W-12 only	% FEI	0W-8 1.1	0W-12 1.1	

Passenger vehicle engine oil requirements for API SP-RC/ILSAC GF-6A/6B categories

Requirements for API SP are the same as RC version, except as per footnotes.

Requirements	Test Method	Properties	Unit	Limits – SP-RC/GF-6	
1. LABORATORY/BENCH TESTS					
Viscosity Grades	SAE J300	All those that apply, typically SAE 0W-20, 0W-30, 5W-20, 5W-30 and 10W-30.	Manufacturer sets targets within SAE J300 specification		
Foam Tests	ASTM D892 (21) ASTM D6082 (21)	Sequence I (11), (12) Sequence II (11), (12) Sequence III (11), (12) Sequence IV (11)	tendency/stability ml	10/0 max 50/0 max 10/0 max 100/0 max	
EOFT	ASTM D6795	Flow Reduction	%	50 max	
EOWTT	ASTM D6794	with 0.6% Water with 1.0% Water with 2.0% Water with 3.0% Water	% flow reduction % flow reduction % flow reduction % flow reduction	50 max 50 max 50 max 50 max	
Aged Oil Low-Temp Pumpability (16)	ASTM D8111 or D7528 (7)	MRV TP-1 Apparent Viscosity and Yield Stress	cP and Pa	<60,000 cP with no yield stress (17)	
TEOST 33C	ASTM D6335	High temperature deposits	total deposit weight, mg	30 max (1), (2), (15)	
Emulsion Retention	ASTM D7563	Oil mixed with 10% Water and 10% E85	0°C and 25°C @ 24 hours	No water separation (2), (30)	
Homogeneity & Miscibility	ASTM D6922	Oil Compatibility	None	Pass (13)	
Gelation Index (5)	ASTM D5133	Scanning Brookfield Viscosity, Yield Stress	Calculated	12 max (2), (14)	
Volatility	ASTM D5800	Evaporation Loss (Noack)	% off @ 250°C	15.0 max (8)	
Ball Rust Test (5)	ASTM D6557	Rust rating	Average Gray Value	100 min	
Elastomer Compatibility	ASTM D7216, Annex A2	Volume Change, %	Hardness, pts	Tensile strength change, %	
	Polyacrylate Rubber (ACM) Hydrogenated Nitrile (HNBR) Silicone Rubber (VMQ) Fluorocarbon Rubber (FKM) Ethylene Acrylic Rubber (AEM)	-5, 9 -5, 10 -5, 40 -2, 3 -5, 30	-10, 10 -10, 5 -30, 10 -6, 6 -20, 10	-40, 40 -20, 15 -50, 5 -65, 10 -30, 30	
Shear Stability	ASTM D6278 ASTM D6709 (Seq VIII)	Diesel Injector, SAE XW-16 only 10-hour stripped Kinematic Viscosity	KV @ 100°C after 30 passes cSt @ 100°C	5.8 min Stay in original visc grade (31)	
Sequence IIIHB	ASTM D8111 (SP-RC) or ASTM D7320 (GF-6A)	Phosphorus retention	%	81 min (2), (30)	
Phosphorus (9)	ASTM D4951 or D5185	Phosphorus content	%	0.06 - 0.08 (4), (10)	
Sulfur (9)	ASTM D4951, D5185 or ASTM D2622	Sulfur content of SAE 0W and 5W multigrades	%	0.5 max (4)	
		SAE 10W-30 and all other grades	%	0.6 max (4)	
2. ENGINE TESTS					
Sequence IIIH	ASTM D8111	Kinematic viscosity increase Average weighted piston deposits Hot stuck rings	% @ 40°C after 100 hours Merits #	All others: 100 max / 4.2 min / None 0W8 and 0W12: 150 max / 3.7 min / None	
Sequence IVA (32)	ASTM D6891	Average cam wear SAE 0W8 -12 only	µm	90 max	
Sequence IVB	ASTM D8350	Average intake lifter volume loss (8 position avg.) End of test iron	mm³ ppm	2.7 max 400	
Sequence VH (5)	ASTM D8256	Average engine sludge Average rocker cover sludge Average engine varnish Average piston skirt varnish Oil screen sludge Oil screen debris Hot stuck compression rings Cold stuck rings Oil ring clogging	Merits Merits Merits Merits % area % area # # % area	7.6 min 7.7 min 8.6 min 7.6 min Rate & report Rate & report None Rate & report Rate & report	
Sequence VIE (2) (6) (15) (32)	ASTM D8114	SAE XW-20	%FEI SUM/ %FEI2	3.8 min/ 1.8 min	
		SAE XW-30	%FEI SUM/ %FEI2	3.1 min/ 1.5 min	
		SAE 10W-30 and all other grades not listed above	%FEI SUM/ %FEI2	2.8 min/ 1.3 min	
Sequence VIF (32)	ASTM D8226	SAE XW-16 only	%FEI SUM/ %FEI2	4.1 min/ 1.9 min	
Sequence VIII (31) (32)	ASTM D6709	Bearing weight loss	mg	26 max	
Sequence IX (32)	ASTM D8291	Average number of events for 4 iterations Number of events per iteration	# #	5 max 8 max	
Sequence X	ASTM D8279	EOT elongation	% increase	0.085 max	
JASO M365		SAE 0W-8 and 0W-12 %FEI	SAE 0W-8 and 0W-12 %FEI	0W8: 2.0 / 0W12: 1.7	
JASO M366		SAE 0W-8 and 0W-12 %FEI	SAE 0W-8 and 0W-12 %FEI	1.1 for both	

Passenger vehicle engine oil requirements for API SN PLUS-RC/SN-RC/ILSAC GF-5 categories

Requirements For API SN PLUS/SN are the same as RC version, except as per footnotes.

Requirements	Test Method	Properties	Unit	Limits – SN PLUS-RC/SN-RC GF-5 ILSAC GF-5 was obsolete in 2021	
1. LABORATORY/BENCH TESTS					
Viscosity Grades	SAE J300	All those that apply, typically SAE 0W-20, 0W-30, 5W-20, 5W-30 and 10W-30.	Manufacturer sets targets within SAE J300 specification		
Foam Tests	ASTM D892 (Option A) ASTM D6082 (Option A)	Sequence I (11), (12) Sequence II (11), (12) Sequence III (11), (12) Sequence IV (11)	tend/stab ml	10/0 max 50/0 max 10/0 max 100/0 max	
EOFT	ASTM D6795	Flow Reduction	%	50 max	
EOWTT	ASTM D6794	with 0.6% Water with 1.0% Water with 2.0% Water with 3.0% Water	% flow reduction % flow reduction % flow reduction % flow reduction	50 max 50 max 50 max 50 max	
Aged Oil Low-Temp Pumpability (16)	ASTM D4684 (7)	MRV TP-1 Apparent Viscosity and Yield Stress	cP and Pa	<60,000 cP with no yield stress (17)	
TEOST 33C	ASTM D6335	High temperature deposits	total deposit weight, mg	30 max (1), (2), (15)	
TEOST MHT (9)	ASTM D7097	High temperature deposits	deposit weight, mg	35 max (3)	
Emulsion Retention	ASTM D7563	Oil mixed with 10% Water and 10% E85	0°C and 25°C @ 24 hours	No water separation (2), (15)	
Homogeneity & Miscibility	ASTM D6922	Oil Compatibility	None	Pass (13)	
Gelation Index (5)	ASTM D5133	Scanning Brookfield Viscosity, Yield Stress	Calculated	12 max (2), (14)	
Volatility	ASTM D5800 ASTM D6417	Evaporation Loss (Noack) Simulated distillation (GCD)	% off @ 250°C % off @ 371°C	15 max (8) 10 max	
Ball Rust Test (5)	ASTM D6557	Rust rating	Average Gray Value	100 min	
Elastomer Compatibility	ASTM D7216, Annex A2	Volume Change, %	Hardness, pts	Tensile strength change, %	
	Polyacrylate Rubber (ACM) Hydrogenated Nitrile (HNBR) Silicone Rubber (VMQ) Fluorocarbon Rubber (FKM) Ethylene Acrylic Rubber (AEM)	-5, 9 -5, 10 -5, 40 -2, 3 -5, 30	-10, 10 -10, 5 -30, 10 -6, 6 -20, 10	-40, 40 -20, 15 -50, 5 -65, 10 -30, 30	
Phosphorus (9)	ASTM D4951	Phosphorus content	%	0.06 - 0.08 (4), (10)	
Sulfur (9)	ASTM D4951 or ASTM D2622	Sulfur content of SAE 0W and 5W multigrades	%	0.5 max (4), (10)	
		Sulfur content of SAE 10W multigrades	%	0.6 max (4), (10)	
2. ENGINE TESTS					
				Seq IIIG	Seq IIIH
Sequence IIIG or Sequence IIIH	ASTM D7320 or ASTM D8111	Kinematic Viscosity increase Average weighted piston deposits Average cam plus lifter wear Hot stuck rings	% @ 40°C after 100 hours merits microns #	150 max 4.0 min 60 max none	150 max 3.7 min n/a none
Sequence IIIGB or Sequence IIIHB	ASTM D7320	Phosphorus retention	%	79 min (2), (15)	81 min (2), (15)
Sequence IVA	ASTM D6891	Average Cam wear (7 position avg.)	microns	90 max	
				Seq VG	Seq VH
Sequence VG or Sequence VH (5)	ASTM D6593	Average engine sludge Average rocker cover sludge Average piston skirt varnish Average engine varnish Oil screen sludge Hot stuck compression rings Cold stuck rings Oil ring clogging Oil screen debris	merits merits merits merits % area # # % area % area	8.0 min 8.3 min 7.5 min 8.9 min 15 max none rate & report rate & report rate & report	7.6 min 7.7 min 7.6 min 8.6 min n/a none rate & report rate & report rate & report
Sequence VIII	ASTM D6709	Bearing weight loss 10-hour stripped Kinematic Viscosity	mg cSt @ 100°C	26 max Stay in original visc grade (18)	
				Seq VID	Seq VIE
Sequence VID or Sequence VIE (2), (6), (15)	ASTM D7589 or ASTM D8114	SAE xW-20	% FEI SUM/ % FEI2	2.6 min/ 1.2 min	3.2 min/ 1.5 min
		SAE xW-30	% FEI SUM/ % FEI2	1.9 min/ 0.9 min	2.5 min/ 1.2 min
		SAE 10W-30	% FEI SUM/ % FEI2	1.5 min/ 0.6 min	2.2 min/ 1.0 min
Sequence VIF	ASTM D8226	SAE 0W-16 (19)	% FEI SUM/ % FEI2	3.8 min/ 1.8 min	
3. ENGINE TESTS FOR API SN PLUS-RC/SN PLUS (same as API SN Engine Tests above in addition to following)					
Sequence IX (API SN-RC PLUS/SN PLUS only)	ASTM D8291	Average LSPI events	#	5 max	

Passenger vehicle engine oil requirements for API SM and ILSAC GF-4 categories

Requirements	Test Method	Properties	Unit	Limits – SM / GF-4 ILSAC GF-4 was obsolete in 2011	
1. LABORATORY/BENCH TESTS					
1.1 Viscosity Grades	SAE J300	All those that apply, typically SAE 0W-20, 0W-30, 5W-20, 5W-30 and 10W-30.		Manufacturer sets targets within SAE J300 specification	
1.2 Foam Test	ASTM D892 (Option A) ASTM D6082	Sequence I (20) Sequence II (20) Sequence III (20) Sequence IV (11)	tend/stab ml	10/0 max 50/0 max 10/0 max 100/0 max	
1.3 Phosphorus	ASTM D4951	Phosphorus content	%	0.06 - 0.08 (4), (10)	
1.4 EOFT	ASTM D6795	% reduction in flow	%	50 max	
1.5 EOWTT	ASTM D6794	with 0.6% Water with 1.0% Water with 2.0% Water with 3.0% Water	% reduction % reduction % reduction % reduction	50 max 50 max 50 max 50 max	
1.6 TEOST (MHT4)	ASTM D7097	Total Deposits	mg	35 max (3), (9)	
1.7 Homogeneity & Miscibility	ASTM D6922	Oil Compatibilty		pass (13)	
1.8 Gelation Index (5)	ASTM D5133	Scanning Brookfield Viscosity, Yield Stress	Calculated	12 max (14)	
1.9 Volatility	ASTM D5800 (8) ASTM D6417	Evaporation Loss (Noack) Simulated distillation (GCD)	% off @ 250°C % off @ 371°C	15 max 10 max	
1.10 Ball Rust Test (5)	ASTM D6557	Rust rating	Avg Gray Value	100 min	
1.11 Sulfur	ASTM D4951 or ASTM D2622	Sulfur content of SAE 0W and 5W multigrades Sulfur content of SAE 10W multigrades	% %	0.5 max (4), (10) 0.7 max (4), (10)	
1.12 Aged Oil Low-Temperature Pumpability (2), (16)	ASTM D4684	MRV TP-1 Apparent Viscosity and Yield Stress	cP and Pa	<60,000 cP with no yield stress (16), (17)	
2. ENGINE TESTS					
				Seq IIIG	Seq IIIH
2.1 Sequence IIIG or Sequence IIIH	ASTM D7320 or ASTM D8111	Viscosity increase at 100 hours Average weighted piston deposits Hot stuck rings Average cam plus lifter wear	% merits # microns	150 max 3.5 min none 60 max	150 max 3.2 min none n/a
2.2 Sequence IVA	ASTM D6891	Cam wear average	microns	90 max	
				Seq VG	Seq VH
2.3 Sequence VG or Sequence VH (5)	ASTM D6593	Average engine sludge Rocker arm cover sludge Average piston skirt varnish Average engine varnish Oil screen clogging Hot stuck rings Cold stuck rings Oil ring clogging Follower pin wear, cyl #8, avg Ring gap increase, cyl #1 & #8, avg Oil screen debris	merits merits merits merits % # # % microns microns % area	7.8 min 8.0 min 7.5 min 8.9 min 20 max none rate & report rate & report rate & report rate & report rate & report	7.6 min 7.7 min 7.6 min 8.6 min n/a none rate & report rate & report rate & report rate & report rate & report
2.4 Sequence VIII	ASTM D6709	Bearing weight loss 10 hr. stripped viscosity	mg cSt	26 max Stay in grade	
2.5 Sequence VIB (2)	ASTM D6837	SAE xW-20 viscosity grades SAE xW-30 viscosity grades SAE 10W-30	% FEI1/% FEI2 % FEI1/% FEI2 % FEI1/% FEI2	2.3 min/2.0 min 1.8 min/1.5 min 1.1 min/0.8 min	

Passenger vehicle engine oil requirements for API SJ and SL categories

Requirements	Test	Properties	Unit	Limits	
				SJ	SL
1. LABORATORY TESTS					
1.1 Viscosity Grades		All those that apply, typically SAE 0W-20, 5W-20, 5W-30 and 10W-30.		Manufacturer sets targets within SAE J300 specification	
1.2 Foam Test	ASTM D892 (21) ASTM D6082 (21)	Sequence I (20) Sequence II (20) Sequence III (20) Sequence IV (22)	tendency/stability mL	10/0 max 50/0 max 10/0 max 200/50 max	10/0 max 50/0 max 10/0 max 100/0 max
1.3 Phosphorus	ASTM D4951 or D5185	Phosphorus Content	%	0.10 max (2), (10)	0.10 max (2), (10), (23)
1.4 EOFT	ASTM D6795	% reduction in flow	%	50 max	50 max
1.5 EOWTT	ASTM D6794	0.6% Water 1.0% Water 2.0% Water 3.0% Water	% % % %	report report report report	50 max 50 max 50 max 50 max
1.6 TEOST	ASTM D6335	Total Deposits	mg	60 max	NR
1.7 TEOST (MHT4)	ASTM D7097	Total Deposits	mg	NR	45 max
1.8 Homogeneity and Miscibility	ASTM D6922	Oil Compatibility		pass	pass
1.9 Scanning Brookfield (5)	ASTM D5133	Gelation Index		12 max (2)	12 max (2), (10)
1.10 Volatility	ASTM D5800 ASTM D6417	Evaporation Loss (Noack) Simulated distillation (GCD)	% %	22 max (24) 17 max	15 max 10 max
1.11 BRT	ASTM D6557	Rust rating	Gray value	100 min	100 min
2. ENGINE TESTS FOR API SJ AND SL					
2.1 Sequence IIIF	ASTM D6984	% Viscosity increase Average piston skirt varnish rating Weighted piston deposit rating Cam plus lifter wear avg Hot stuck rings Low temperature viscosity performance	% merits merits microns # cP	325 max @ 60 hr 8.5 min @ 80 hr 3.2 min 20 max none NR	275 max @ 80 hr 9.0 min @ 80 hr 4.0 min 20 max none rate and report
2.2 Sequence IVA	ASTM D6891	Cam wear average	microns	120 max	120 max
2.3 Sequence VG (29)	ASTM D6593	Average engine sludge Rocker arm cover sludge Average piston skirt varnish Average engine varnish Oil screen clogging Hot stuck compression rings Cold stuck rings Oil screen debris Oil ring clogging	merits merits merits merits % # # % %	7.8 min 8.0 min 7.5 min 8.9 min 20 max none n/a n/a n/a	7.8 min 8.0 min 7.5 min 8.9 min 20 max none rate and report rate and report rate and report
2.4 Sequence VIII	ASTM D6709	Bearing weight loss 10 hr. stripped viscosity	mg cSt	26.4 max Stay in grade	26.4 max Stay in grade

Commercial vehicle engine oil requirements for API CK-4 and API FA-4 categories

Requirements	Test Method	Properties	Unit	Limits	
				CK-4	FA-4
1. LABORATORY TESTS FOR API CK-4 AND API FA-4					
1.1 Viscosity Grades		SAE J300		xW-30, xW-40	xW-30
1.2 High Temperature/ High Shear	ASTM D4683 or ASTM D4171 or ASTM D5481	Viscosity @ 150° C xW-30 Grades xW-30 Grades xW-40 Grades	 cP cP cP	 3.5 min n/a Meets SAE J300	 2.9 min 3.2 max n/a
1.3 Shear Stability	ASTM D7109	KV after 90 pass, shearing, @ 100° C xW-30 0W-40 Other xW-40 HTHS Viscosity @150° C min xW-30 grades	 cSt cSt cSt cP	 9.3 min 12.5 min 12.8 min 3.4 min	 9.3 min n/a n/a 2.8 min
1.4 Chemical Limits (10)	ASTM D4951 ASTM D4951 ASTM D874	Mass fraction phosphorous (26) Mass fraction sulfur Mass fraction sulfated ash	% % %	0.12 max 0.4 max 1.0 max	
1.5 Noack Volatility	ASTM D5800	Evaporative loss @ 250° C	%	13 max	
1.6 Foaming	ASTM D892	Sequence I Sequence II Sequence III	tend/stab ml	10/0 max 20/0 max 10/0 max	
1.7 High Temperature Corrosion Bench Test, 135° C.	ASTM D6594	Copper, used oil increase Lead, used oil increase Copper Strip Rating	ppm ppm —	20 max 120 max 3 max	
1.8 Seal Compatibility	ASTM D7216	Volume Change, %	Hardness, pts	Tensile strength, %	Elongation, %
	Nitrile (NBR) Silicone (VMQ) Polyacrylate (ACM) Fluoroelastomer (FKM) Vamac G	+5/-3 +TMC 1006/-3 +5/-3 +5/-2 +TMC 1006/-3	+7/-5 +5/-TMC 1006 +8/-5 +7/-5 +5/-TMC 1006	+10/-TMC 1006 +10/-45 +18/-15 +10/-TMC 1006 +10/-TMC 1006	+10/-TMC 1006 +20/-30 +10/-35 +10/-TMC 1006 +10/-TMC 1006

2. ENGINE TESTS FOR API CK-4 AND API FA-4	Test Method	Rated or Measured Parameter	Unit	Primary Performance Criteria		
				1 Test	2 Tests	3 Tests
2.1 Mack T-11	ASTM D7156	TGA % Soot @ 4.0 cSt TGA % Soot @ 12.0 cSt TGA % Soot @ 15.0 cSt	% % %	3.5 min 6.0 min 6.7 min	3.4 min 5.9 min 6.6 min	3.3 min 5.9 min 6.5 min
2.1a Sooted Oil MRV	ASTM D6896	Viscosity, 180 hour sample from Mack T-11 or T-11A Viscosity @-20° C Yield Stress	cP Pa	25,000 max </= 35 max		
2.2 Mack T-12	ASTM D7422	Top Ring Mass Loss Cylinder Liner Wear	mg µm	105 max 24.0 max	105 max 24.0 max	105 max 24.0 max
2.3 Cummins ISB	ASTM D7484	Slider tappet mass loss, average Cam lobe wear, average Crosshead mass loss, average	mg µm mg	100 max 55 max Report	108 max 59 max Report	112 max 61 max Report
2.4 Cummins ISM	ASTM D7468	Merit rating Top Ring Mass Loss	Merits mg	1000 min (27) 100 max	1000 min (27) 100 max	1000 min (27) 100 max
2.5 Caterpillar 1N	ASTM D6750	Weighted demerits (WDN) Top groove fill (TGF) Top land heavy carbon (TLHC) Oil consumption, (0 h – 252 h) Piston, ring, and liner scuffing Piston ring sticking	Demerits % % g/kWh	286.2 max 20 max 3 max 0.54 max None None	311.7 max 23 max 4 max 0.54 max None None	323.0 max 25 max 5 max 0.54 max None None
2.6 Caterpillar C13	ASTM D7549	Merit rating Hot stuck piston rings	Merit	1000 min (27) None	1000 min (27) None	1000 min (27) None
2.7 COAT	ASTM D8047	Average Aeration, 40 h to 50 h	%	11.8 max	11.8 max	11.8 max
2.8 Roller Follower Wear Test	ASTM D5966	Average pin wear	mils (µm)	0.30 max (7.6 max)	0.33 max (8.4 max)	0.36 max (9.1 max)
2.9 Volvo T-13	ASTM D8048	T-13 FTIR Peak Height Oxidation at EOT, Abs. Kinematic Viscosity Increase at 40° C (300 h-360 h) max Avg. Oil Consumption, 48 h to 192 h, max	cm^{-1} % g/h	125 75 Report	130 85 Report	133 90 Report

Commercial vehicle engine oil requirements for API CJ-4 category

Requirements	Test Method	Properties	Unit	Limits		
1. LABORATORY TESTS FOR API CJ-4						
1.1 Viscosity Grades		SAE J300		Manufacturer specifies viscosity target within SAE J300 specification		
1.2 High Temperature Corrosion, 135°C	ASTM D6594	Copper, used oil increase Lead, used oil increase Copper Strip Rating	ppm ppm -	20 max 120 max 3 max		
1.3 Foaming	ASTM D892 (Option A) ASTM D6082 (Option A)	Sequence I Sequence II Sequence III	tend/stab ml	10/0 max 20/0 max 10/0 max		
1.4 Shear Stability	ASTM D7109	KV @ 100°C after 90-passes for SAE XW-40 KV @ 100°C after 90-passes for SAE XW-30	cSt cSt	12.5 min 9.3 min		
1.5 Noack Volatility	ASTM D5800	Evap Loss @ 250°C, Vis Grades other than SAE 10W-30 Evap Loss @ 250°C, SAE 10W-30	% %	13 max 15 max		
1.6 High Temperature/ High Shear	ASTM D4683 or ASTM D4171 or ASTM D5481	Viscosity @ 150°C	cP	3.5 min		
1.7 Chemical Limits (10)	ASTM D874 ASTM D4951 ASTM D4951	Mass fraction sulfated ash Mass fraction phosphorus Mass fraction sulfur	% % %	1.0 max 0.12 max 0.4 max		
1.8 Seal Compatibility	ASTM D7216	Volume Change, %	Hardness, pts	Tensile strength, %	Elongation, %	
	Nitrile (NBR) Silicone (VMQ) Polyacrylate (ACM) Fluoroelastomer (FKM) Vamac G	+5/-3 +TMC 1006/-3 +5/-3 +5/-2 +TMC 1006/-3	+7/-5 +5/-TMC 1006 +8/-5 +7/-5 +5/-TMC 1006	+10/-TMC 1006 +10/-45 +18/-15 +10/-TMC 1006 +10/-TMC 1006	+10/-TMC 1006 +20/-30 +10/-35 +10/-TMC 1006 +10/-TMC 1006	

2. ENGINE TESTS FOR API CJ-4	Test Method	Properties	Unit	Limits		
				1 Test	2 Tests	3 Tests
2.1 Mack T-11	ASTM D7156	TGA % Soot @ 4cSt Inc TGA % Soot @ 12cSt Inc TGA % Soot @ 15cSt Inc	% % %	3.5 min 6.0 min 6.7 min	3.4 min 5.9 min 6.6 min	3.3 min 5.9 min 6.5 min
2.1a Sooted Oil MRV	ASTM D6896	180 hour sample from Mack T-11 or T-11A Viscosity @ -20°C Yield stress	cP Pa	25,000 max </= 35 max		
2.2 Mack T-12	ASTM D7422	Merits		1000 min (27)	1000 min (27)	1000 min (27)
2.3 Cummins ISB	ASTM D7484	Slider tappet mass loss, average Cam lobe wear, average Crosshead mass loss, average	mg µm mg	100 max 55 max Rate/report	108 max 59 max Rate/report	112 max 61 max Rate/report
2.4 Cummins ISM	ASTM D7468	Merits, min Top Ring Mass Loss	mg	1000 min (27) 100 max	1000 min (27) 100 max	1000 min (27) 100 max
2.5 Caterpillar 1N	ASTM D6750	Top land heavy carbon (TLHC) Top groove fill (TGF) Weighted demerits (WDN) Oil consumption, (0 h – 252 h) Piston, ring, and liner scuffing	% % demerits g/kWh	3 max 20 max 286.2 max 0.54 max None	4 max 23 max 311.7 max 0.54 max None	5 max 25 max 323.0 max 0.54 max None
2.6 Caterpillar C13	ASTM D7549	Merits Hot Stuck Piston Rings		1000 min (27) None	1000 min (27) None	1000 min (27) None
2.7 Engine Oil Aeration	ASTM D6894	Oil Aeration Volume	%	8.0 max	MTAC applies	
2.8 Roller Follower Wear Test	ASTM D5966	Roller Follower Pin Wear	µm (mils)	7.6 max (0.30 max)	8.4 max (0.33 max)	9.1 max (0.36 max)
2.9 Sequence IIIF/IIIG/IIIH	ASTM D6984/ D7320/ D8111	Kinematic Viscosity Inc at 40°C	%	275/150/ 370 max	MTAC applies	

Commercial vehicle engine oil requirements for API CI-4 and API CI-4 PLUS categories

Requirements	Test Method	Properties		Unit	Limits		
1. LABORATORY TESTS FOR API CI-4 AND CI-4 PLUS							
1.1 Viscosity Grades		SAE J300			Manufacturer specifies viscosity target within SAE J300 specification		
1.2 High Temperature Corrosion Bench Test	ASTM D6594	Copper increase Lead increase Copper strip rating (D130) Tin increase		ppm ppm ppm	20 max 120 max 3 max report		
1.3 Foam Test	ASTM D892	Sequence I Sequence II Sequence III		tend/stab ml	10/0 max 20/0 max 10/0 max		
1.4 Shear Stability [A]	ASTM D6278	After shear viscosity, SAE 10W-30 After shear viscosity, SAE 15W-40		cSt cSt	9.3 min 12.5 min		
1.5 Noack Volatility	ASTM D5800	Evaporative loss at 250°C		%	15 max		
1.6 High Temperature/ High Shear	ASTM D4683 or ASTM D4171 or ASTM D5481	Viscosity @ 150°C		cP	3.5 min		
1.7 Elastomer Compatibility	ASTM D7216	Volume Change, %	Hardness, pts	Limits Tensile strength, %	Elongation, %		
	Nitrile (NBR)	+5/-3	+7/-5	+10/-TMC 1006	+10/-TMC 1006		
	Silicone (VMQ)	+TMC 1006/-3	+5/-TMC 1006	+10/-45	+20/-30		
	Polyacrylate (ACM)	+5/-3	+8/-5	+18/-15	+10/-35		
	Fluoroelastomer (FKM)	+5/-2	+7/ -5	+10/-TMC 1006	+10/-TMC 1006		
2. ENGINE TESTS FOR API CI-4				Unit	Limits		
					1 Test	2 Tests	3 Tests
2.1 Mack T-8E [28]	ASTM D5967	Relative viscosity at 4.8% soot by TGA			1.8 max	1.9 max	2.0 max
2.2 Mack T-10 [B]	ASTM D6987/ D6987M	Merit Rating			1000 min	1000 min	1000 min
2.2a Sooted Oil MRV	ASTM D4684	Viscosity of used oil sample from T-10 at -20°C Yield stress		cP Pa	25,000 max </= 35 max		
2.3 Cummins M11-EGR [C]	ASTM D6975	Average Crosshead mass loss Average Top ring mass loss Oil filter differential pressure at 250 h Average engine sludge, CRC merits at EOT		mg mg kPa merits	20.0 max Report 275 max 7.8 min	21.8 max Report 320 max 7.6 min	22.6 max Report 341 max 7.5 min
2.4 Caterpillar 1R [D]	ASTM D6923	Weighted demerits		demerits	382 max	396 max	402 max
		Top groove carbon		demerits	52 max	57 max	59 max
		Top land carbon		demerits	31 max	35 max	36 max
		Initial OC (0 h - 252 h), average		g/h	13.1 max	13.1 max	13.1 max
		Final OC (432 h - 504 h), average		g/h	IOC+1.8 max	IOC+1.8 max	OC+1.8 max
		Piston ring and liner distress			None	None	None
		Ring Sticking			None	None	None
2.5 Caterpillar 1K [E]	ASTM D6750	Weighted demerits		demerits	332 max	347 max	353 max
		Top groove fill		%	24 max	27 max	29 max
		Top land heavy carbon		%	4 max	5 max	5 max
		Oil Consumption (0-252) h Piston ring and liner scuffing		g/kWh	0.54 max None	0.54 max None	0.54 max None
2.6 Roller Follower Wear Test	ASTM D5966	Average Pin Wear		µm (mils)	7.6 max (0.30 max)	8.4 max (0.33 max)	9.1 max (0.36 max)
2.7 Engine Oil Aeration Test	ASTM D6894	Aeration		Vol %	8.0 max	MTAC applies	
2.8 Sequence IIIF/IIIG/IIIH	ASTM D6984/ D7320/ D8111	Viscosity increase at 40° C		%	275/150 370 max	MTAC applies	
3. ENGINE TESTS FOR API CI-4 PLUS (same as API CI-4 Engine Tests above in addition to following)							
3.1 Mack T-11	ASTM D7156	TGA Soot Content at 12.0 cSt increase at 100° C		%	6.00 min	5.89 min	5.85 min

[A] Limit after 30 cycles for API CI-4, 90 cycles for API CI-4 PLUS.
[B] ASTM D7422 (T-12) is an acceptable alternative.
[C] ASTM D7468 (ISM) is an acceptable alternative.
[D] ASTM D6681 (1P) is an acceptable alternative.
[E] ASTM D6750 (1N) is an acceptable alternative.

Commercial vehicle engine oil requirements for API CH-4 category

Requirements	Test Method	Properties	Unit	Limits		
1. LABORATORY TESTS						
1.1 Viscosity Grades		SAE J300		Manufacturer specifies viscosity target within SAE J300 specification		
1.2 High Temperature Corrosion Bench Test	ASTM D6594	Copper increase Lead increase Tin increase Copper strip rating (D130)	ppm ppm ppm	20 max 120 max report 3 max		
1.3 Foam Test	ASTM D892	Sequence I [20] Sequence II [20] Sequence III [20]	tend/stab ml	10/0 max 20/0 max 10/0 max		
1.4 Shear Stability	ASTM D6278	After shear viscosity SAE xW-30 After shear viscosity SAE xW-40	cSt cSt	9.3 min 12.5 min		
1.5 Volatility	ASTM D5800	Noack (SAE 10W-30) Noack (SAE 15W-40) or	% loss % loss	20 max 18 max		
	ASTM D6417	GCD (SAE 10W-30) GCD (SAE 15W-40)	% loss % loss	17 max 15 max		
2. ENGINE TESTS FOR API CH-4						
2.1 Mack T-8E	ASTM D5967	Relative viscosity @ 4.8% soot by TGA Viscosity increase @ 3.8% soot by TGA	cSt	2.1 max 11.5 max	2.2 max 12.5 max	2.3 max 13.0 max
2.2 Mack T-9 [F]	ASTM D6483	Average liner wear, norm to 1.75% soot Average top ring weight loss Increase in used oil lead level	µm mg ppm	25.4 max 120 max 25 max	26.6 max 136 max 32 max	27.1 max 144 max 36 max
2.3 Cummins M-11 [G]	ASTM D6838	Rocker pad average mass loss normalized to 4.5% soot Oil Filter differential pressure at EOT Average Engine Sludge at EOT	mg kPa merits	6.5 max 79 max 8.7 min	7.5 max 93 max 8.6 min	8.0 max 100 max 8.5 min
2.4 Caterpillar 1P	ASTM D6681	Weighted total demerits Top groove carbon Top land carbon Initial OC (0 h - 360 h), average Final OC (312 h - 360 h), average Piston ring and liner scuffing	demerits % % gm/hr gm/hr	350 max 36 max 40 max 12.4 max 14.6 max None	378 max 39 max 46 max 12.4 max 14.6 max None	390 max 41 max 49 max 12.4 max 14.6 max None
2.5 Caterpillar 1K	ASTM D6750	Weighted total demerits Groove No. 1 (Top) fill Top land heavy carbon Oil Consumption, (0-252) h Piston ring and liner scuffing	demerits % % g/kWh	332 max 24 max 4 max 0.54 max None	347 max 27 max 5 max 0.54 max None	353 max 29 max 5 max 0.54 max None
2.6 Roller Follower Wear Test	ASTM D5966	Average Pin Wear	µm (mils)	7.6 max (0.30 max)	8.4 max (0.33 max)	9.1 max (0.36 max)
2.7 Engine Oil Aeration Test	ASTM D6894	Aeration	% volume	8 max	MTAC applies	
2.8 Sequence IIIF/IIIG/IIIH	ASTM D6984/ D7320/ D8111	Viscosity increase at 40° C	%	295/150/110 max	MTAC applies	

[F] ASTM D6987/6987M (T-10) or ASTM D7422 (T-12) are acceptable alternatives.
[G] ASTM D7468 (ISM) is an acceptable alternative.

TABLE 7 – Diesel Engine Oil Category **CL-4**

Engine Test	Method	Rated or Measured Parameter	Primary Performance Criteria		
			One-test	Two-test	Three-test
T-13	D8048	IR Peak at EOT, Abs., cm^{-1}, max	80	87	90
		Kinematic Viscosity Increase at 40 °C, %, max	50	58	62
		Avg. Oil Consumption, 48 h to 192 h, g/h	Report	Report	Report
ISB Soot Viscosity	(D8617 ISB V156)	TGA % Soot at 6.0 mm^2/s increase, at 100 °C, min	3.5	3.3	3.3
		TGA % Soot at 12.0 mm^2/s increase, at 100 °C, min	5.6	5.5	5.4
		TGA % Soot at 15.0 mm^2/s increase, at 100 °C, min	5.7	5.6	5.5
C13	D7549	Merit rating [A], min	1000	1000	1000
Caterpillar Oil Aeration Test COAT	D8047	Average Aeration, [A] 40 h to 50 h, %, max	11.8	11.8	11.8
ISB	D7484	Slider tappet mass loss, mg, average, max	100	108	112
		Cam lobe wear, µm, average, max	55	59	61
		Crosshead mass loss, mg, average	Report	Report	Report
ISM	D7468	Top Ring Mass Loss, mg, max	100	100	100
		Merit Rating, [A] min	1000	1000	1000
DD13 Scuffing	D8074	Time to Scuff, hours, min	31	31	31

CL-4 Category Bench Tests

Test Method	Measured Parameter		Primary Performance Criteria		
	SAE J300 Viscosity Grade		SAE xW-30	SAE xW-40	
D4683 or D4741 or D5481	High temperature/high shear viscosity at 150 °C, mPa·s	min	3.5	Meet SAE J300	
		max	N/A		
HTCBT, 135 °C (D6594)	Copper, mg/kg increase, max		20	20	
	Lead, mg/kg increase, max		120	120	
	Copper strip rating, [B] max		3	3	
Noack (D5800)	Evaporative loss at 250 °C, %, max		13	13	
Foam (D892)	Foaming/settling, [C] Sequence I, mL, max		10/0	10/0	
	Foaming/settling, [C] Sequence II, mL, max		20/0	20/0	
	Foaming/settling, [C] Sequence III, mL, max		10/0	10/0	
D7109 and HTHS Viscosity after 90 pass shearing	Kinematic viscosity after 90 pass shearing, mm^2/s at 100 °C, min		xW-30	0W-40	Other xW-40
			9.3	12.5	12.8
	HTHS viscosity at 150 °C, mPa·s, min		3.4	N/A	N/A
Sooted Oil MRV TP-1 (D6896) **from a** (D8617) **OR** (D8617) **Annex A9 Engine test**	Viscosity, 108 h used oil sample from ISB Viscosity test [D], tested at −20 °C, mPa·s, max		25 000	25 000	
	Yield stress of the 108 h used oil sample above, Pa, max		<35	<35	

Chemical Limits (non-critical)

Test Method	Measured Parameter	Primary Performance Criteria
D874	Mass fraction sulfated ash, %, max	0.9
D4951 or D5185	Mass fraction phosphorus, %, max	0.08
	Mass fraction sulfur, %, max	0.3

D7216 (Elastomer Compatibility)

Note: These are the unadjusted specification limits for elastomer compatibility. Candidate oils shall, however, conform to the adjusted specification limits, the calculation of which is described in Annex A5.

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, −3)	(+7, −5)	(+10, −SL107-30)	(+10, −SL107-17)
Silicone (VMQ)	(+SL107, −3)	(+5, −SL107)	(+10, −45)	(+20, −30)
Polyacrylate (ACM)	(+5, −3)	(+8, −5)	(+18, −15)	(+10, −35)
Fluoroelastomer (FKM)	(+5, −2)	(+7, −5)	(+10, −SL107+2)	(+10, −SL107)
Vamac G	(+SL107+2, −3)	(+5, −SL107-2)	(+10, −SL107+2)	(+10, −SL107+10)
Hydrogenated Nitrile (HNBR)	(+10, −10)	(+12, −12)	Rate & Report	Rate & Report

Note: TMC SL107 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC SL107.

A See Annex A8 for additional information
B The rating system in Test Method D130 is used to rate the copper coupon in Test Method D6594
C Ten minutes for Sequence I, II, and III
D From either a valid 108 h or 156 h ISB Viscosity D8617 test

TABLE 8 – Diesel Engine Oil Category **FB-4**

Engine Test	Method	Rated or Measured Parameter	Primary Performance Criteria		
			One-test	Two-test	Three-test
T-13	D8048	IR Peak at EOT, Abs., cm^{-1}, max	80	87	90
		Kinematic Viscosity Increase at 40 °C, %, max	50	58	62
		Avg. Oil Consumption, 48 h to 192 h, g/h	Report	Report	Report
ISB Soot Viscosity	D8617 at 108h [A] **OR** D8617 Annex A9 ISBV108	TGA % Soot at 12.0 mm^2/s increase, at 100 °C, min	4.8	4.7	4.6
C13	D7549	Merit rating [B], min	1000	1000	1000
Caterpillar Oil Aeration Test COAT	D8047	Average Aeration, [B] 40 h to 50 h, %, max	11.8	11.8	11.8
ISB	D7484	Slider tappet mass loss, mg, average, max	100	108	112
		Cam lobe wear, µm, average, max	55	59	61
		Crosshead mass loss, mg, average	Report	Report	Report
ISM	D7468	Top Ring Mass Loss, mg, max	100	100	100
		Merit Rating, [B] min	1000	1000	1000
DD13 Scuffing	D8074	Time to Scuff, hours, min	31	31	31

FB-4 Category Bench Tests

Test Method	Measured Parameter		Primary Performance Criteria	
	SAE J300 Viscosity Grade		SAE xW-20	SAE xW-30
D4683 or D4741 or D5481	High temperature/high shear viscosity at 150 °C, mPa·s	min	Meet SAE J300	2.9
		max		3.2
HTCBT, 135 °C (D6594)	Copper, mg/kg increase, max		20	20
	Lead, mg/kg increase, max		120	120
	Copper strip rating, [C] max		3	3
Noack (D5800)	Evaporative loss at 250 °C, %, max		13	13
Foam (D892)	Foaming/settling, [D] Sequence I, mL, max		10/0	10/0
	Foaming/settling, [D] Sequence II, mL, max		20/0	20/0
	Foaming/settling, [D] Sequence III, mL, max		10/0	10/0
D7109 and HTHS Viscosity after 90 pass shearing	Kinematic viscosity after 90 pass shearing, mm^2/s at 100 °C, min		6.9	9.3
	HTHS viscosity at 150 °C, mPa·s, min		2.5	2.8
Sooted Oil MRV TP-1 (D6896) **from a** (D8617) **OR** (D8617) **Annex A9 Engine test**	Viscosity, 108 h used oil sample from ISB Viscosity test [E], tested at −20 °C, mPa·s, max		25 000	25 000
	Yield stress of the 108 h used oil sample above, Pa, max		<35	<35

Chemical Limits (non-critical)

Test Method	Measured Parameter	Primary Performance Criteria
D874	Mass fraction sulfated ash, %, max	0.9
D4951 or D5185	Mass fraction phosphorus, %, max	0.08
	Mass fraction sulfur, %, max	0.3

D7216 (Elastomer Compatibility)

Note: These are the unadjusted specification limits for elastomer compatibility. Candidate oils shall, however, conform to the adjusted specification limits, the calculation of which is described in Annex A5.

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, −3)	(+7, −5)	(+10, −SL107-30)	(+10, −SL107-17)
Silicone (VMQ)	(+SL107, −3)	(+5, −SL107)	(+10, −45)	(+20, −30)
Polyacrylate (ACM)	(+5, −3)	(+8, −5)	(+18, −15)	(+10, −35)
Fluoroelastomer (FKM)	(+5, −2)	(+7, −5)	(+10, −SL107+2)	(+10, −SL107)
Vamac G	(+SL107+2, −3)	(+5, −SL107-2)	(+10, −SL107+2)	(+10, −SL107+10)
Hydrogenated Nitrile (HNBR)	(+10, −10)	(+12, −12)	Rate & Report	Rate & Report

Note: TMC SL107 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC SL107.

A A 108 h result from a 156 h test can support an FB-4 claim IF that stand is also calibrated per D8617 Annex A9.
B See Annex A8 for additional information.
C The rating system in Test Method D130 is used to rate the copper coupon in Test Method D6594.
D Ten minutes for Sequence I, II, and III.
E From either a valid 108 h or 156 h ISB Viscosity D8617 test.

SAE viscosity grades for engine oils* (H), (I)

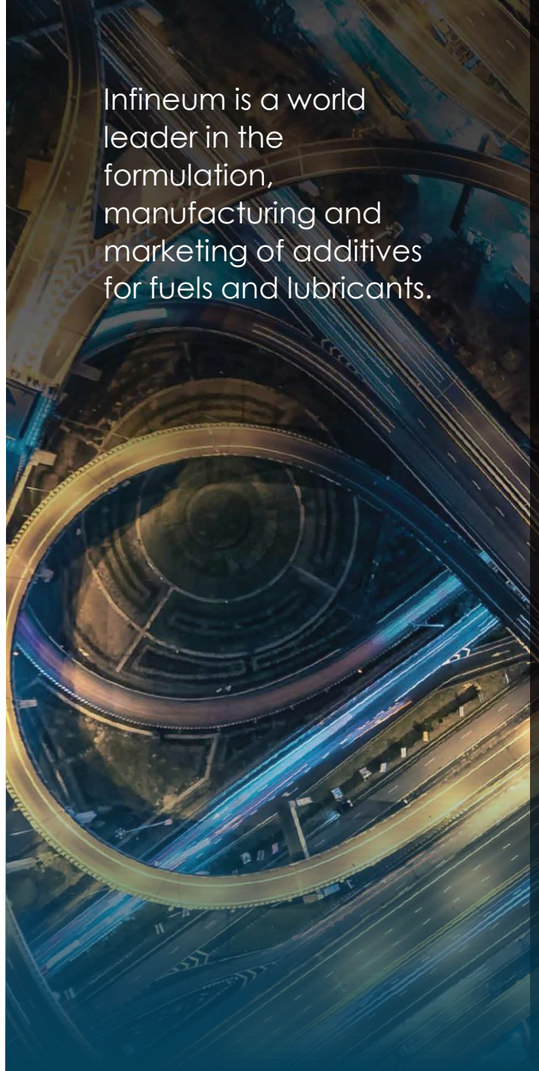
SAE Viscosity Grade	Low-Temperature (°C) Cranking Viscosity(3) (mPa-s) Min	Low-Temperature (°C) Cranking Viscosity(3) (mPa-s) Max	Low-Temperature (°C) Pumping Viscosity(4) (mPa-s) Max with No Yield Stress(4)	Low-Shear-Rate Kinematic Viscosity(5) (mm^2/s) at 100 °C Min	Low-Shear-Rate Kinematic Viscosity(5) (mm^2/s) at 100 °C Max	High-Shear-Rate Viscosity(6) (mPa-s) at 150 °C Min
0W		6200 at -35	60000 at -40	3.8	—	—
5W	6201 at -35	6600 at -30	60000 at -35	3.8	—	—
10W	6601 at -30	7000 at -25	60000 at -30	4.1	—	—
15W	7001 at -25	7000 at -20	60000 at -25	5.6	—	—
20W	7001 at -20	9500 at -15	60000 at -20	5.6	—	—
25W	9501 at -15	13000 at -10	60000 at -15	9.3	—	—
8	—	—	—	4.0	<6.1	1.7
12	—	—	—	5.0	<7.1	2.0
16	—	—	—	6.1	<8.2	2.3
20	—	—	—	6.9	<9.3	2.6
30	—	—	—	9.3	<12.5	2.9
40	—	—	—	12.5	<16.3	3.5 (0W-40, 5W-40, and 10W-40 grades)
40	—	—	—	12.5	<16.3	3.7 (15W-40, 20W-40, 25W-40, 40 grades)
50	—	—	—	16.3	<21.9	3.7
60	—	—	—	21.9	<26.1	3.7

NOTES:
(1) 1 mPa-s = 1 cP; 1 mm^2/s = 1 cSt
(2) All values, with the exception of the low-temperature kinematic viscosity, are critical specifications as defined by ASTM D3244 (see text, Section 7).
(3) ASTM D5293: Cranking viscosity – The non-critical specification protocol in ASTM D3244 shall be applied with a P value of 0.95.
(4) ASTM D4684: Note that the presence of any yield stress detectable by this method constitutes a failure regardless of viscosity.
(5) ASTM D445, ASTM D7945, or ASTM D7042 bias corrected to ASTM D445.
(6) ASTM D4683, ASTM D4741, ASTM D5481, or CEC L-36-90. In case of dispute, ASTM D4683 will be the referee method.

API base oil classification

Group	Vis. Index	Saturates		Sulfur	Other
I	≥80 - <120	<90%	and/or	>0.03%	-
II	≥80 - <120	≥90%	and	≤0.03%	-
III	≥120	≥90%	and	≤0.03%	-
IV					PAO (Poly Alpha Olefin)
V					Everything Else

- Companies also use their own marketing phrases: “Group I-I+” and “Group II+”
- The word “Synthetic” is not part of the API Classification



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Notes

Notes

API engine oil classifications
For service fill oils

Footnotes

(1) Not required for SAE XW-16 and OW-20.
(2) Not required for Non-ILSAC viscosity grades.
(3) 45 max for Non-ILSAC viscosity grades.
(4) No maximum for API SP or SN Non-ILSAC viscosity grades.
(5) If API CI-4, CJ-4, CK-4 and/or FA-4 categories precede the "S" category and there is no API Certification Mark, the Sequence VH (ASTM D8256), or VG (ASTM D6593), Ball Rust (ASTM D6557), and Gelation Index (ASTM D5133) tests are not required.
(6) Viscosity grades are limited to SAE 0W, 5W and 10W multigrade oils.
(7) Not required for monograde and SAE 15W, 20W, and 25W multigrade oils.
(8) Calculated conversions specified in ASTM D5800 are allowed.
(9) For all viscosity grades: If API CH-4, CI-4 and/or CJ-4 categories precede the "S" category and there is no API Certification Mark, the "S" category limits for phosphorus, sulfur, and the TEOST MHT do not apply. However, the CJ-4 limits for phosphorus and sulfur do apply for CJ-4 oils, and the limit in the SP-RC column for phosphorus (0.08% mass max) applies when CK-4 with SP or FA-4 with SP is claimed. Note that these "C" category oils have been formulated primarily for diesel engines and may not provide all of the performance requirements consistent with vehicle manufacturers' recommendations for gasoline-fueled engines. This footnote cannot be applied if CK-4 or FA-4 is also claimed.
(10) This is a non-critical specification as described in ASTM D3244.
(11) After 1-minute settling period for all ILSAC viscosity grades and all API SP-RC or SN PLUS
(12) After 10-minute settling period for non-ILSAC viscosity grades and 5 viscosity grades which are not API SP-RC or SN PLUS-RC/SN-RC.
(13) Shall remain homogeneous and, when mixed with ASTM reference oils, shall remain miscible.
(14) To be evaluated from –5˚C to temperature at which 40,000 cP is attained or –40˚C, or 2 Celsius degrees below the appropriate MRV TP-1 temperature (defined by SAE J300), whichever occurs first.
(15) Required for API SP-RC, SN PLUS-RC/SN-RC, ILSAC GF-6A or GF-5. Not required for API SP or SN.
(16) The aged oil is an end-of-test sample generated either in the Sequence IIIHA test (ASTM D8111), IIIGA test (ASTM D7320) or the ROBO test (ASTM D7528).
(17) The ASTM D4684 (MRV TP-1) test is conducted at the original SAE J300 viscosity grade temperature if the measured CCS viscosity is less than or equal to the original viscosity grade maximum; and at 5°C higher temperature otherwise.
(18) Except XW-20, which must remain >/=5.6 cSt.
(19) This is not an ILSAC GF-5 viscosity grade.
(20) Stability after 10-minute settling period.
(21) Option A is required.
(22) Stability after 1-minute settling period.
(23) There is also a 0.08 min P requirement, unless a successful Sequence VG test has been run.
(24) Meet the volatility requirement in either Test Method D5800, D5480, or D6417.
(25) See ASTM D4485 for sludge parameters require in API SJ spec.
(26) Phosphorous must be less than 0.08m% to obtain API S claims for ILSAC grades.
(27) Requires all individual merit ratings to be equal to or greater than zero.
(28) T-11 is an acceptable alternative at CI-4 Plus limits.
(29) Sequence VE can be run in lieu of ASTM D6891 + ASTM D6593.
(30) Required for API SP-RC, SN PLUS-RC/SN-RC, ILSAC GF-6 A/B or GF-5.
(31) Not required for SAE XW-16.
(32) The following engine tests are not required for 0W-8 or 0W-12 viscosity grades for API SP-RC: VIE, VIF, VIII, and IX.

The following footnotes apply ONLY to the Requirements for API SQ RC and ILSAC GF-7 Categories found on pages 2 and 3.

(33) API SQ Other Eligible Viscosity Grades and API SQ-RC 0W-8 & 0W-12 remain as per SAE J300.
(34) Option A is required.
(35) After 1-minute settling period for ILSAC viscosity grades and all API SQ-RC.
(36) After 10-minute settling period for non-ILSAC viscosity grades.
(37) The aged oil is an end-of-test sample generated either in the Sequence IIIHA test (ASTM D8111) or the ROBO test (ASTM D7528).
(38) Not required for monograde and SAE 15W, 20W, and 25W multigrade oils.
(39) The ASTM D4684 (MRV TP-1) test is conducted at the original SAE J300 viscosity grade temperature if the measured CCS viscosity is less than or equal to the original viscosity grade maximum; and at 5°C higher temperature otherwise.
(40) Not required for API SQ-RC 0W-8, 0W-12, 0W-16, or 0W-20.
(41) Shall remain homogeneous and, when mixed with ASTM reference oils, shall remain miscible.
(42) If API CI-4, CJ-4, CK-4 and/or FA-4 categories precede the "S" category and there is no API Certification Mark, the Sequence VH (ASTM D8256), Ball Rust (ASTM D6557), and Gelation Index (ASTM D5133) tests are not required.
(43) To be evaluated from –5˚C to temperature at which 40,000 cP is attained or –40˚C, or 2 Celsius degrees below the appropriate MRV TP-1 temperature (defined by SAE J300), whichever occurs first.
(44) Calculated conversions specified in ASTM D5800 are allowed.
(45) Not required for SAE XW-16, 0W-8, and 0W-12.
(46) Not required for API SQ only.
(47) For all viscosity grades: If API CH-4, CI-4 and/or CJ-4 categories precede the "S" category and there is no API Certification Mark, the "S" category limits for phosphorus and sulfur do not apply. However, the CJ-4 limits for phosphorus and sulfur do apply for CJ-4 oils, and the phosphorus limit in the "SQ with Resource Conserving" column (0.08% max) applies when CK-4 with SQ or FA-4 with SQ is claimed. Note that these "C" category oils have been formulated primarily for diesel engines and may not provide all the performance requirements consistent with vehicle manufacturers' recommendations for gasoline-fueled engines.
(48) No maximum for API SQ Non-ILSAC viscosity grades.
(49) This is a non-critical specification as described in ASTM D3244.
(50) If available at time of licensing.
(51) Not required for API SQ only or API SQ-RC 0W-8 and 0W-12.
(52) Only one of Seq IVA or IVB are required for 0W-8 or 0W-12 grades.
(53) Viscosity grades limited to 0W, 5W, and 10W multi-grade oils.
(54) Not required for API SQ-RC 0W-8 and 0W-12.
(55) Only one of JASO M365 or JASO M366 are required for 0W-8 or 0W-12 grades and testing requirements will follow JASO base oil interchange (BOI) and JASO viscosity grade read-across (VGRA) guidelines.

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