

API Engine Oil  
Classifications  
For Service  
Fill Oils

API Engine Oil Classifications

SERVICE FILL OILS FOR GASOLINE, LIGHT-DUTY DIESEL AND HEAVY-DUTY DIESEL ENGINES



Performance you can rely on.





# API Engine Oil Classifications For Service Fill Oils

Requirements for API SN are the same as those for API SN-RC, except as noted in the table to the right.

## Footnotes

- (1) Not required for SAE 0W-20.
- (2) Not required for SN Non-ILSAC GF-5 viscosity grades.
- (3) 45 max for SN Non-ILSAC GF-5 viscosity grades.
- (4) No maximum for SN Non-ILSAC GF-5 viscosity grades.
- (5) If API CI-4 and/or CJ-4 categories precede the “S” category and there is no API Certification Mark, the Sequence 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.
- (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 SN-RC oils.
- (12) After 10-minute settling period for non-ILSAC GF-5 viscosity grades which are not 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) Not Required for SN ILSAC GF-5 viscosity grades which do not also contain the API Certification Mark or are not SN-RC.
- (16) The aged oil is an end-of-test sample generated either in the Sequence IIIGA test (ASTM D7320) or the ROBO test (ASTM D7528).
- (17) The temperature at which the ASTM D4684 (MRV TP-1) test is conducted is determined by first measuring the low-temperature cranking viscosity (CCS) of the aged oil sample at the temperature corresponding to the original viscosity grade in SAE J300.

(a) If CCS viscosity measured is less than or equal to the maximum CCS viscosity specified for the original viscosity grade, run ASTM D4684 at the low-temperature pumping viscosity temperature specified in SAE J300 for the original viscosity grade.

(b) If CCS viscosity measured is higher than the maximum CCS viscosity specified for the original viscosity grade in SAE J300, run ASTM D4684 at 5°C higher temperature.

## Passenger Car Engine Oil Laboratory/Bench Test and Engine Test Requirements For API SN-RC/ILSAC GF-5 Categories

Requirements	Test Method	Properties	Unit	Limits SN-RC/GF-5
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	Sequence I, tendency/stability <sup>(11), (12)</sup> Sequence II, tendency/stability <sup>(11), (12)</sup> Sequence III, tendency/stability <sup>(11), (12)</sup> Sequence IV, tendency/stability <sup>(11)</sup>	ml ml ml ml	10/0 max 50/0 max 10/0 max 100/0 max
	ASTM D6082, Option A			
EOFT	ASTM D6795	Filterability	% flow reduction	50 max
EOWTT	ASTM D6794	Filterability with 0.6% Water	% flow reduction	50 max
		Filterability with 1.0% Water	% flow reduction	50 max
		Filterability with 2.0% Water	% flow reduction	50 max
		Filterability with 3.0% Water	% flow reduction	50 max
Aged Oil Low-Temperature Pumpability	ASTM D4684	MRV TP-1 Apparent Viscosity and Yield Stress	cP and Pa	<60,000 cP with no yield stress <sup>(16) (17)</sup>
TEOST 33C	ASTM D6335	High temperature deposits	total deposit weight, mg	30 max <sup>(1), (2), (15)</sup>
TEOST MHT <sup>(9)</sup>	ASTM D7097	High temperature deposits	deposit weight, mg	35 max <sup>(3)</sup>
Emulsion retention	ASTM D7563	Oil mixed with 10% Water and 10% E85	0°C and 25°C @ 24 hours	No water separation <sup>(2), (15)</sup>
Homogeneity & Miscibility	ASTM D6922	Oil Compatibility	None	Pass <sup>(13)</sup>
Gelation Index <sup>(5)</sup>	ASTM D5133	Scanning Brookfield Viscosity, Yield Stress	Calculated	12 max <sup>(2), (14)</sup>
Volatility	ASTM D5800 ASTM D6417	Evaporation Loss (Noack)	% off @ 250°C	15 max <sup>(8)</sup>
		Simulated distillation (GCD)	% off @ 371°C	10 max
Ball Rust Test <sup>(5)</sup>	ASTM D6557	Rust rating	Average Gray Value	100 min
Elastomer compatibility	ASTM D7216, Annex A2			
Polyacrylate Rubber ACM-1 (SAE J2643)	ASTM D471 ASTM D2240 ASTM D412	Volume	% change	-5,9
		Hardness	pts	-10,10
		Tensile strength	% change	-40,40
Hydrogenated Nitrile HNBR-1 (SAE J2643)	ASTM D471 ASTM D2240 ASTM D412	Volume	% change	-5,10
		Hardness	pts	-10,5
		Tensile strength	% change	-20,15
Silicone Rubber VMQ-1 (SAE J2643)	ASTM D471 ASTM D2240 ASTM D412	Volume	% change	-5,40
		Hardness	pts	-30,10
		Tensile strength	% change	-50,5
Fluorocarbon Rubber FKM-1 (SAE J2643)	ASTM D471 ASTM D2240 ASTM D412	Volume	% change	-2,3
		Hardness	pts	-6,6
		Tensile strength	% change	-65,10
Ethylene Acrylic Rubber AEM-1 (SAE J2643)	ASTM D471 ASTM D2240 ASTM D412	Volume	% change	-5,30
		Hardness	pts	-20,10
		Tensile strength	% change	-30,30
Phosphorus <sup>(9)</sup>	ASTM D4951	Phosphorus content	%	0.06 min <sup>(10)</sup>
Phosphorus <sup>(9)</sup>	ASTM D4951	Phosphorus content	%	0.08 max <sup>(4), (10)</sup>
Sulfur <sup>(9)</sup>	ASTM D4951 or	Sulfur content of SAE 0W and 5W multigrades	%	0.5 max <sup>(4), (10)</sup>
Sulfur <sup>(9)</sup>	ASTM D2622	Sulfur content of SAE 10W multigrades	%	0.6 max <sup>(4), (10)</sup>
2. ENGINE TESTS				
Sequence IIIG	ASTM D7320	Kinematic Viscosity increase	% @ 40°C after 100 hours	150 max
		Average weighted piston deposits	merits	4.0 min
Sequence IIIGB	ASTM D7320	Average cam plus lifter wear	microns	60 max
		Hot stuck rings	#	none
Sequence IVA	ASTM D6891	Phosphorus retention	%	79 min <sup>(2), (15)</sup>
Sequence VG <sup>(5)</sup>	ASTM D6593	Average Cam wear (7 position avg.)	microns	90 max
		Average engine sludge	merits	8.0 min
		Average rocker cover sludge	merits	8.3 min
		Average piston skirt varnish	merits	7.5 min
		Average engine varnish	merits	8.9 min
		Oil screen sludge	% area	15 max
		Hot stuck compression rings	#	none
		Cold stuck rings	#	rate & report
		Oil ring clogging	% area	rate & report
		Oil screen debris	% area	rate & report
Sequence VIII	ASTM D6709	Bearing weight loss	mg	26 max
		10-hour stripped Kinematic Viscosity	cSt @ 100°C	Stay in original viscosity grade
Sequence VID <sup>(2), (6), (15)</sup> (Required for ILSAC GF-5 and SN-RC only)	ASTM D7589 SAE 0W-20 and 5W-20 viscosity grades	FEI SUM min / FEI2 min	% FEI SUM / % FEI2	2.6 min / 1.2 min
	SAE 0W-30 and 5W-30 viscosity grades	FEI SUM min / FEI2 min	% FEI SUM / % FEI2	1.9 min / 0.9 min
	SAE 10W-30 and all other viscosity grades	FEI SUM min / FEI2 min	% FEI SUM / % FEI2	1.5 min / 0.6 min

# Passenger Car Engine Oil Laboratory/Bench Test and Engine Test Requirements For API SM and ILSAC GF-4 Categories

Requirements	Test Method	Properties	Unit	Limits SM/GF-4
<b>1. LABORATORY/BENCH TESTS</b>				
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, tendency/stability <sup>(1)</sup> Sequence II, tendency/stability <sup>(1)</sup> Sequence III, tendency/stability <sup>(1)</sup> Sequence IV, tendency/stability <sup>(2)</sup>	ml initial Foam/ml after settling	10/0 max 50/0 max 10/0 max 100/0 max
1.3 Phosphorus	ASTM D4951	Phosphorus content	%	0.06 min 0.08 max <sup>(3)</sup>
1.4 EOFT	ASTM D6795	0.6% Water - with dry ice - % reduction in 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	% reduction % reduction % reduction % reduction	50 max 50 max 50 max 50 max
1.6 TEOST (MHT4)	ASTM D7097	Total Deposits	mg	35 max <sup>(4)</sup>
1.7 Homogeneity & Miscibility	ASTM D6922	Oil Compatibility		pass <sup>(5)</sup>
1.8 Gelation Index <sup>(6)</sup>	ASTM D5133	Scanning Brookfield Viscosity, Yield Stress	Calculated	12 max <sup>(7)</sup>
1.9 Volatility	ASTM D5800 ASTM D6417	Volatility (Noack) Volatility (GCD)	% off @ 250°C % off @ 371°C	15 max 10 max
1.10 Ball Rust Test <sup>(6)</sup>	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 <sup>(3)</sup> 0.7 max <sup>(3)</sup>
1.12 Aged Oil Low-Temperature Pumpability <sup>(3)</sup>	ASTM D4684	MRV TP-1 Apparent Viscosity and Yield Stress	cP and Pa	<60,000 cP with no yield stress <sup>(8) (9)</sup>
<b>2. ENGINE TESTS</b>				
2.1 Sequence IIIG	ASTM D7320	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
2.2 Sequence IVA	ASTM D6891	Cam wear average	microns	90 max
2.3 Sequence VG <sup>(6)</sup>	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
2.4 Sequence VIII	ASTM D6709	Bearing weight loss 10 hr. stripped viscosity	mg cSt	26 max Stay in grade
2.5 Sequence VIB (Required for ILSAC GF-4 only)	ASTM D6837	SAE 0W-20 and 5W-20 viscosity grades SAE 0W-30 and 5W-30 viscosity grades SAE 10W-30 and all other viscosity grades	% FEI1 / % FEI2 % FEI1 / % FEI2 % FEI1 / % FEI2	2.3 min / 2.0 min 1.8 min / 1.5 min 1.1 min / 0.8 min

<sup>(1)</sup> Stability after 10-minute settling period.

<sup>(2)</sup> Stability after 1-minute settling period.

<sup>(3)</sup> Not required for non-ILSAC GF-4 viscosity grades.

<sup>(4)</sup> 45 max for non-ILSAC GF-4 viscosity grades.

<sup>(5)</sup> Shall remain homogeneous and, when mixed with ASTM reference oils, shall remain miscible.

<sup>(6)</sup> If API CI-4 and/or CJ-4 categories precede the "S" category and there is no API Certification Mark, the Sequence VG (ASTM D6593), Ball Rust (ASTM D6557), and Gelation Index (ASTM D5133) tests are not required.

<sup>(7)</sup> 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.

<sup>(8)</sup> The aged oil is an end-of-test sample generated in the Sequence IIIGA test (ASTM D7320).

<sup>(9)</sup> 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.

## Passenger Car Engine Test Category For API SJ and SL

Requirements	Test	Properties	Unit	Limits	
				SJ/EC GF-2	SL/EC GF-3
1. LABORATORY TESTS					
1.1 Viscosity Grades		All those that apply, typically SAE 0W-20, 0W-30, 5W-30 and 10W-30.		Manufacturer sets targets within SAE J300 specification	
1.2 Foam Test	ASTM D892	Sequence I Sequence II Sequence III Sequence IV	ml initial Foam/ml after settling	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	0.10 max <sup>(1)</sup>
1.4 EOFT	GM 9099P	0.6% Water - with dry ice - % reduction in flow	%	50 max	50 max
1.5 EOWTT	ASTM D6794	0.6% Water - without dry ice - % rate of change 1.0% Water - without dry ice - % rate of change 2.0% Water - without dry ice - % rate of change 3.0% Water - without dry ice - % rate of change	% % % %	report report report report	50 max 50 max 50 max 50 max
1.6 TEOST	ASTM D6335	Total Deposits, max	mg	60 max	NR
1.7 TEOST (MHT4)	ASTM D7097	Total Deposits, max	mg	NR	45 max
1.8 Homogeneity and Miscibility	FTM STD 791C	Oil Compatibility		pass	pass
1.9 Scanning Brookfield	ASTM D5133	Gelation Index		12 max	12 max
1.10 Volatility	ASTM D5800 ASTM D6417	Volatility (Noack), % off Volatility (GCD), % off	% %	22 max 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 D1491	% Viscosity increase at 60 hours, max % Viscosity increase at 80 hours, max Average piston skirt varnish rating, min Weighted piston deposit rating, min Cam plus lifter wear avg, max Hot stuck rings Oil consumption, max Low temperature viscosity performance	% % merits merits microns # liters cP	325 max NR 8.5 min 3.2 min 20 max none 6.5 NR	NR 275 9.0 min 4.0 min 20 max none 5.2 max rate and report
2.2 Sequence IVA	ASTM D6891	Cam wear average, max	microns	120 max	120 max
2.3 Sequence VG	ASTM D6593	Average engine sludge, min Rocker arm cover sludge, min Average piston skirt varnish, min Average engine varnish, min Oil screen clogging, max 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 rate and report rate and report rate and report	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 VE (Only if oil Phosphorus < 0.08%)	ASTM D5302	Cam wear Average, max Maximum, max	microns microns	NR NR	127 max 380 max
2.5 Sequence VIII	ASTM D6709	Bearing weight loss, max 10 hr. stripped viscosity	mg cSt	26.4 max Stay in grade	26.4 max Stay in grade
2.6 Sequence VIB (FEI1 using BC before only)	ASTM D6837	For viscosity grades: SAE 0W-20 and 5W-20 Other SAE 0W- and 5W- multigrades All SAE 10W- multigrades	% improvement % improvement % improvement	2.0 min 1.6 min 0.9 min	NR NR NR
2.7 Sequence VIB	ASTM D6837	SAE 0W-20 and 5W-20 (FEI1/FEI2/sum), min SAE 0W-30 and 5W-30 (FEI1/FEI2/sum), min All other viscosity grades (FEI1/FEI2/sum), min	% improvement % improvement % improvement	NR NR NR	2.0/1.7/NR min 1.6/1.3/3.0 min 0.9/0.6/1.6 min

## Heavy-Duty Diesel Engine Test Category For API CJ-4

Requirements	Test Method	Properties		Unit	Limits				
					1 Test	2 Tests	3 Tests		
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, max Lead, used oil increase, max Copper Strip Rating, max		ppm ppm -	20 120 3	No MTAC <sup>(1), (2)</sup>			
1.3 Foaming	ASTM D892	Foaming/Settling, max Sequence I Sequence II Sequence III		% % %	10/0 20/0 10/0	No MTAC <sup>(1), (2)</sup>			
1.4 Shear Stability	ASTM D7109	KV @ 100°C after 90-passes for SAE XW-40, min KV @ 100°C after 90-passes for SAE XW-30, min		cSt cSt	12.5 9.3	No MTAC <sup>(1), (2)</sup>			
1.5 Noack Volatility	ASTM D5800	Evap Loss @ 250°C, Vis Grades other than SAE 10W-30, max Evap Loss @ 250°C, SAE 10W-30, max		% %	13 15	No MTAC <sup>(1), (2)</sup>			
1.6 High Temperature/ High Shear	ASTM D4683	Viscosity @ 150°C, min		cP	3.5	No MTAC <sup>(1), (2)</sup>			
1.7 Sooted Oil MRV	ASTM D6896	180 hour sample from Mack T-11 or T-11A Viscosity @ -20°C, max Yield stress		cP Pa	25,000 <35	No MTAC <sup>(1), (2)</sup>			
1.8 Chemical Limits (Non-Critical)	ASTM D874 ASTM D4951 ASTM D4951	Sulfated Ash, max Phosphorus, max Sulfur, max		% % %	1.0 0.12 0.4	No MTAC <sup>(1), (2)</sup>			
1.9 Seal Compatibility (ASTM D7216)	Nitrile Silicone Polyacrylate FKM Vamac G	Volume Change		Hardness		Tensile strength		Elongation	
		+5 / -3		+7 / -5		+10 / -TMC1006		+10 / -TMC1006	
		+TMC1006 / -3		+5 / -TMC1006		+10 / -45		+20 / -30	
		+5 / -3		+8 / -5		+18 / -15		+10 / -35	
		+5 / -2		+7 / -5		+10 / -TMC1006		+10 / -TMC1006	
		+TMC1006 / -3		+5 / -TMC1006		+10 / -TMC1006		+10 / -TMC1006	
2. ENGINE TESTS FOR API CJ-4				Unit	Limits				
					1 Test	2 Tests	3 Tests		
2.1 Mack T-11	ASTM D7156	Soot @ 4cSt Inc, min Soot @ 12cSt Inc, min Soot @ 15cSt Inc, min		% % %	3.5 6.0 6.7	3.4 5.9 6.6	3.3 5.9 6.5		
2.2 Mack T-12	ASTM D7422	Merits, min			1000 <sup>(3)</sup>	1000 <sup>(3)</sup>	1000 <sup>(3)</sup>		
2.3 Cummins ISB	ASTM D7484	Tappet Wear, max Cam Wear, max Crosshead Weight Loss		mg microns mg	100 55 Rate/report	108 59 Rate/report	112 61 Rate/report		
2.4 Cummins ISM	ASTM D7468	Merits, min Top Ring Wt Loss, max		mg	1000 <sup>(3)</sup> 100	1000 <sup>(3)</sup> 100	1000 <sup>(3)</sup> 100		
2.5 Caterpillar 1N	ASTM D6750	Top Land Heavy Carbon, max Top Groove Fill, max Weighted Demerits, max Oil Consumption (0-252) h, max Ring / Liner Scuffing		% % demerits g/MJ	3 20 286.2 0.139 None	4 23 311.7 0.139 None	5 25 323.0 0.139 None		
2.6 Caterpillar C13	ASTM D7549	Merits, min Hot Stuck Rings			1000 <sup>(3)</sup> None	1000 <sup>(3)</sup> None	1000 <sup>(3)</sup> None		
2.7 Engine Oil Aeration	ASTM D6894	Oil Aeration Volume, max		%	8.0	8.0 (MTAC)	8.0 (MTAC)		
2.8 Roller Follower Wear Test	ASTM D5966	Roller Follower Pin Wear, max		microns (mils)	7.6 (0.30)	8.4 (0.33)	9.1 (0.36)		
2.9 Sequence IIIF <sup>(4)</sup>	ASTM D6984	Viscosity Inc at EOT, max		%	275	275 (MTAC)	275 (MTAC)		

<sup>(1)</sup> Not an ACC Test.

<sup>(2)</sup> MTAC is a statistical method for treating multiple engine oil test results if applicable. Consult your sales representative for further information.

<sup>(3)</sup> Requires all individual merit ratings to be equal to or greater than zero. Consult your sales representative for further information.

<sup>(4)</sup> Passing Seq IIIG viscosity increase at API SM is an acceptable alternative.



# Heavy-Duty Diesel Engine Test Category For API CI-4 and CI-4 PLUS

Requirements	Test Method	Properties		Unit	Limits		
					1 Test	2 Tests	3 Tests
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, max Lead increase, max Copper strip rating, max (D130) Tin increase, max		ppm ppm ppm	20 120 3 report	No MTAC <sup>(1), (2)</sup>	
1.3 Foam Test	ASTM D892 (Option A not allowed)	Foaming/Settling, max Sequence I Sequence II Sequence III		mL mL mL	10/0 20/0 10/0	No MTAC <sup>(1), (2)</sup>	
1.4 Shear Stability	ASTM D6278	After shear viscosity, SAE 10W-30, min After shear viscosity, SAE 15W-40, min		cSt cSt	9.3 12.5	No MTAC <sup>(1), (2), (3)</sup>	
1.5 Volatility	ASTM D5800 (Noack)	Evaporative loss at 250°C, max		%	15	No MTAC <sup>(1), (2)</sup>	
1.6 High Temperature/High Shear	As allowed in SAE J300	Viscosity, min		mPa-s	3.5	No MTAC <sup>(1), (2)</sup>	
1.7 Low Temperature Pumpability	ASTM D4684 (MRV TP-1)	Viscosity of 75h used oil sample from T-10 Test at -20°C, max		mPa-s	25000	No MTAC <sup>(1), (2)</sup>	
	Modified D4684 (if yield stress)	Viscosity at -20°C, max Yield stress, max		mPa-s Pa	25000 35		
1.8 Elastomer Compatibility	Nitrile Silicone Polyacrylate FKM	Limits					
		Volume Change		Hardness	Limits Tensile strength		Elongation
		+5 / -3 +TMC1006 / -3		+7 / -5 +5 / -TMC1006	+10 / -TMC1006 +10 / -45 +18 / -15 +10 / -TMC1006		+10 / -TMC1006 +20 / -30 +10 / -35 +10 / -TMC1006
		+5 / -3 +5 / -2		+8 / -5 +7 / -5			
2. ENGINE TESTS FOR API CI-4							
2.1 Mack T-8E	ASTM D5967 (Ext. T8-E)	Relative viscosity at 4.8% soot, max (RV=Visc. at 4.8% soot/Visc. of new oil sheared in D6278)			1.8	1.9	2.0
2.2 Mack T-10	ASTM D6987/ D6987M <sup>(4)</sup>	Merit Rating, min			1000	1000	1000
2.3 Cummins M11-EGR	ASTM D6975 <sup>(5)</sup>	Crosshead weight loss, max Average Top ring weight loss, max Filter delta pressure at 250h, max Sludge rating, min		mg mg kPa merits	20.0 Report 275 7.8	21.8 Report 320 7.6	22.6 Report 341 7.5
2.4 Caterpillar 1R	ASTM D6923 <sup>(6)</sup>	WDR, max TGC, max TLC, max Initial Oil Consumption, max Final Oil Consumption, max Piston ring and liner scuffing Ring Sticking		demerits demerits demerits g/h g/h	382 52 31 13.1 IOC+1.8 None None	396 57 35 13.1 IOC+1.8 None None	402 59 36 13.1 OC+1.8 None None
2.5 Caterpillar 1K	ASTM D6750	WDK, max TGF, max TLHC, max Oil Consumption (0-252) h, max Piston ring and liner scuffing		demerits % % g/MJ	332 24 4 0.139 None	347 27 5 0.139 None	353 29 5 0.139 None
or  Caterpillar 1N	ASTM D6750	WDN, max TGF, max TLHC, max Oil Consumption (0-252) h, max Piston ring and liner scuffing Ring Sticking		demerits % % g/MJ	286.2 20 3 0.139 None None	311.7 23 4 0.139 None None	323.0 25 5 0.139 None None
2.6 Roller Follower Wear Test	ASTM D5966	Average Pin Wear, max		µm (mils)	7.6 (0.30)	8.4 (0.33)	9.1 (0.36)
2.7 Engine Oil Aeration Test	ASTM D6984	Aeration, max		Vol %	8.0	MTAC applies <sup>(2)</sup>	
2.8 Sequence IIIF	ASTM D6984 <sup>(7)</sup>	Viscosity increase at 80h, max		%	275	MTAC applies <sup>(2)</sup>	
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	T-11 Soot/ Viscosity Control	Minimum TGA Soot Content at 12.0 cSt increase at 100° C		%	6.00	5.89	5.85

<sup>(1)</sup> Not an ACC Test.

<sup>(2)</sup> MTAC is a statistical method for treating multiple engine oil test results if applicable. Consult your sales representative for further information.

<sup>(3)</sup> Limit after 30 cycles for API CI-4, 90 cycles for API CI-4 PLUS.

<sup>(4)</sup> ASTM D7422 (T-12) is an acceptable alternative.

<sup>(5)</sup> ASTM D7468 (ISM) is an acceptable alternative.

<sup>(6)</sup> ASTM D6681 (1P) is an acceptable alternative.

<sup>(7)</sup> ASTM D7320 (Sequence IIIG) is an acceptable alternative.

## Heavy-Duty Diesel Engine Test Category For API CH-4

Requirements	Test Method	Properties	Unit	Limits		
				1 Test	2 Tests	3 Tests
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, max Lead increase, max Tin increase, max Copper corrosion rating, max (D130)	ppm ppm ppm	20 120 report 3	No MTAC <sup>(1), (2)</sup>	
1.3 Foam Test	ASTM D892 (Option A not allowed)	Foaming/Settling, max Sequence I Sequence II Sequence III	mL mL mL	10/0 max 20/0 max 10/0 max	No MTAC <sup>(1), (2)</sup>	
1.4 Shear Stability	ASTM D6278	After shear viscosity SAE 10W-30, min After shear viscosity SAE 15W-40, min	cSt cSt	9.3 12.5	No MTAC <sup>(1), (2)</sup>	
1.5 Volatility	ASTM D5800	Noack (SAE 10W-30) Noack (SAE 15W-40) or	% loss % loss	20 18	No MTAC <sup>(1), (2)</sup>	
	ASTM D2887 or ASTM D5480	GCD (SAE 10W-30) GCD (SAE 15W-40)	% loss % loss	17 15		
2. ENGINE TESTS FOR API CH-4						
2.1 Mack T-8E	ASTM D5967-96 Ext	Relative viscosity @ 4.8% soot, max Viscosity increase @ 3.8% soot, max	cSt	2.1 11.5	2.2 12.5	2.3 13.0
2.2 Mack T-9	ASTM D6483 <sup>(3)</sup>	Liner wear, max Top ring weight loss, max Increase in lead level, max	microns mg ppm	25.4 120 25	26.6 136 32	27.1 144 36
2.3 Cummins M-11	ASTM D6838 <sup>(4)</sup>	Rocker pad average weight loss normalized to 4.5% soot, max Oil Filter delta pressure at EOT, max Average Sludge rating, min	mg	6.5	7.5	8.0
			kPa merits	79 8.7	93 8.6	100 8.5
2.4 Caterpillar 1P	ASTM D6681	Weighted total demerits, max Top groove carbon, max Top land carbon, max Average oil consumption, max Final oil consumption, max Piston ring and liner scuffing	demerits	350	378	390
			%	36	39	41
			%	40	46	49
			gm/hr	12.4	12.4	12.4
			gm/hr	14.6	14.6	14.6
			None	None	None	
2.5 Caterpillar 1K	ASTM D6750	Weighted total demerits, max Groove No. 1 (Top) fill, max Top land heavy carbon, max Oil Consumption, (0-252) h, max Piston ring and liner scuffing	demerits	332	347	353
			%	24	27	29
			%	4	5	5
			g/MJ	0.139	0.139	0.139
			None	None	None	
2.6 Roller Follower Wear Test	ASTM D5966	Pin Wear, max	µm (mils)	7.6 (0.30)	8.4 (0.33)	9.1 (0.36)
2.7 Engine Oil Aeration Test	ASTM D6894	Aeration, max	% volume	8	MTAC applies <sup>(2)</sup>	
2.8 Sequence IIIF	ASTM D6984 <sup>(5)</sup>	Viscosity increase at 60 hours, max	%	295	MTAC applies <sup>(2)</sup>	

<sup>(1)</sup> Not an ACC Test.

<sup>(2)</sup> MTAC is a statistical method for treating multiple engine test results if applicable. Consult your sales representative for further information.

<sup>(3)</sup> ASTM D6987/6987M (T-10) or ASTM D7422 (T-12) are acceptable alternatives.

<sup>(4)</sup> ASTM D7468 (ISM) is an acceptable alternative.

<sup>(5)</sup> ASTM D7320 (Sequence IIIG) is an acceptable alternative.

## SAE Viscosity Grades For Engine Oils\* <sup>(1), (2)</sup>

SAE Viscosity Grade	Low-Temperature (°C) Cranking Viscosity <sup>(3)</sup> , mPa-s Max	Low-Temperature (°C) Pumping Viscosity <sup>(4)</sup> , mPa-s Max with No Yield Stress <sup>(4)</sup>	Low-Shear-Rate Kinematic Viscosity <sup>(5)</sup> (mm <sup>2</sup> /s) at 100°C Min	Low-Shear-Rate Kinematic Viscosity <sup>(5)</sup> (mm <sup>2</sup> /s) at 100°C Max	High-Shear-Rate Viscosity <sup>(6)</sup> , (mPa-s) at 150°C Min
0W	6200 at -35	60000 at -40	3.8	-	-
5W	6600 at -30	60000 at -35	3.8	-	-
10W	7000 at -25	60000 at -30	4.1	-	-
15W	7000 at -20	60000 at -25	5.6	-	-
20W	9500 at -15	60000 at -20	5.6	-	-
25W	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

<sup>(1)</sup> Notes – 1 mPa-s = 1 cP; 1 mm<sup>2</sup>/s=1cSt

<sup>(2)</sup> All values, with the exception of the low-temperature cranking viscosity, are critical specifications as defined by ASTM D3244 (see text, Section 7).

<sup>(3)</sup> ASTM D5293: Cranking viscosity – The non-critical specification protocol in ASTM D3244 shall be applied with a P value of 0.95.

<sup>(4)</sup> ASTM D4684: Note that the presence of any yield stress detectable by this method constitutes a failure regardless of viscosity.

<sup>(5)</sup> ASTM D445

<sup>(6)</sup> ASTM D4683, ASTM D4741, ASTM D5481 or CEC L-36-90.

\*Reprinted from SAE J300 Jan 2015 © SAE International. Further use or distribution is not permitted without permission from SAE.

Source: Engine Oil Viscosity Classification, J300 Jan2015, SAE. The full publication is available from SAE at [www.sae.org](http://www.sae.org).

## 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 1-1/2" and "Group 2+"

• "Group III" can be legally labeled "Synthetic"

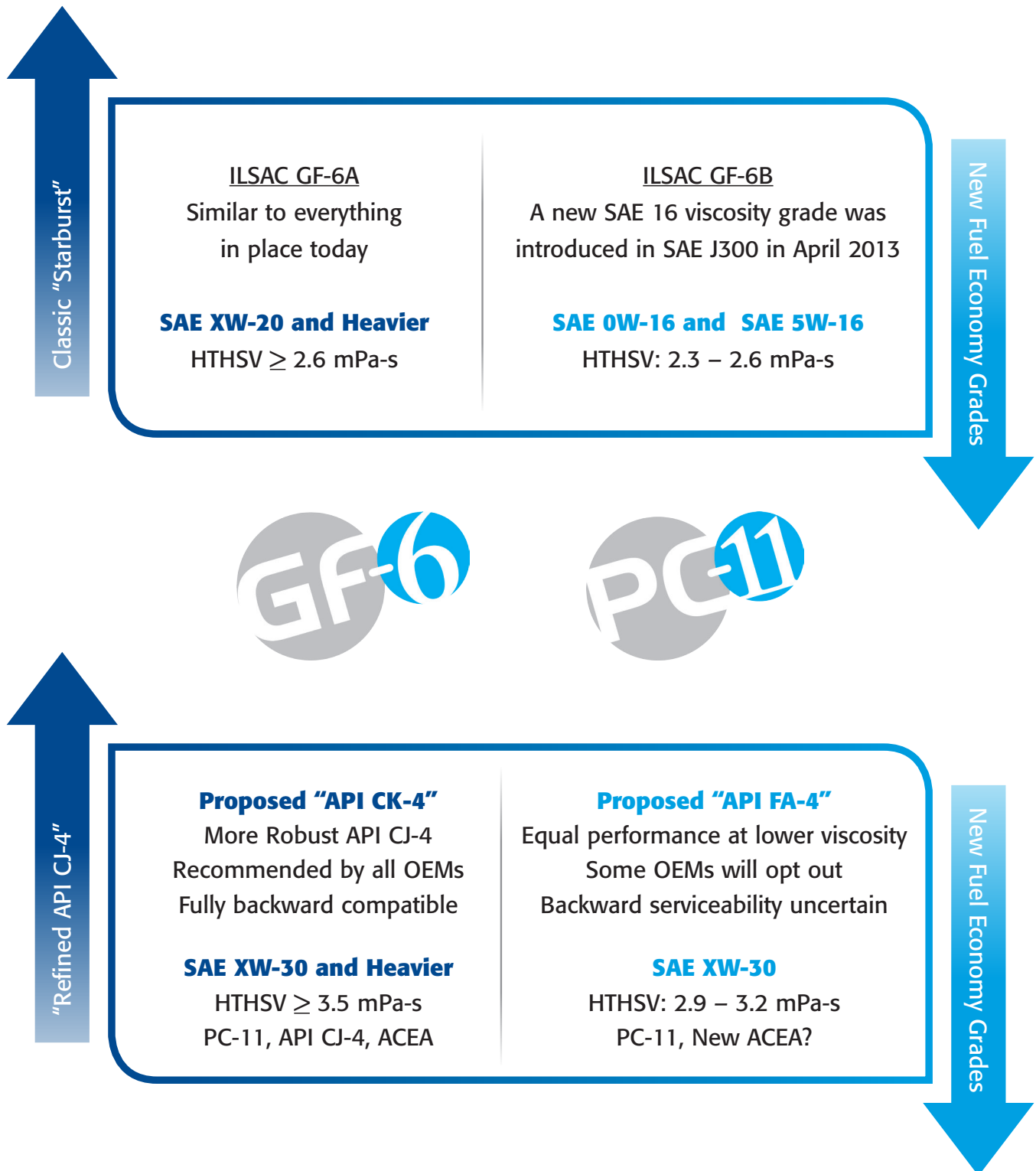
- The word "Synthetic" is not part of the API Classification

- "Synthetic" is a marketing term, not a technical term



# Proposed Next Generation North American Engine Oil Specifications

The timing of first licensing is still under debate with the earliest being 4Q 2016 – 1Q 2017 for PC-11 and 4Q 2017 for GF-6. There is still a desire to move these dates forward, but until engine test development is complete, industry will not be able to firm up these schedules. For the latest information, please visit [www.InfineumInsight.com](http://www.InfineumInsight.com)



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