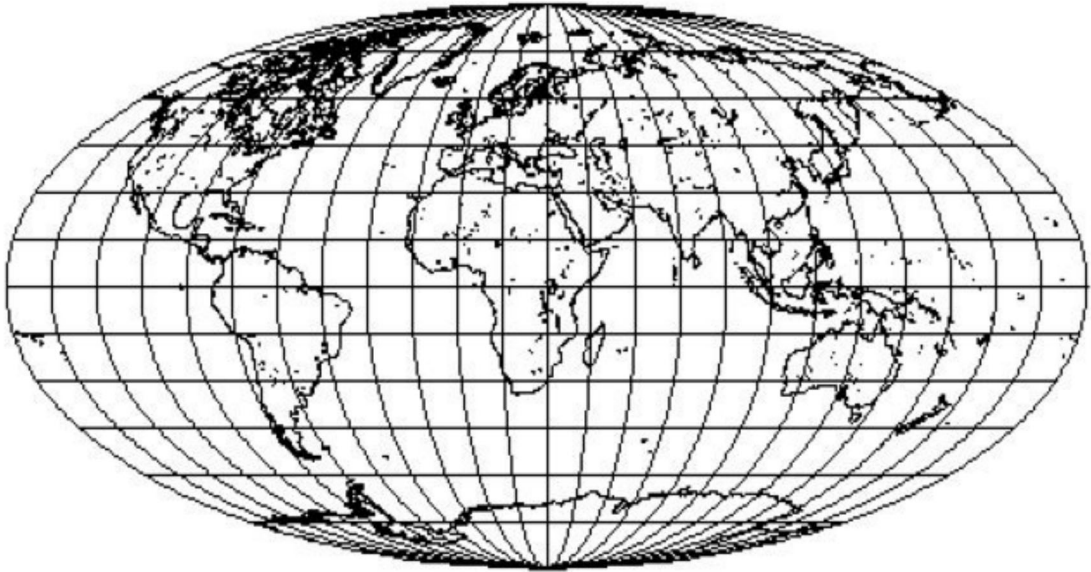


DRAFT DOCUMENT

These ILSAC recommendations are being developed with input from automobile manufacturers, lubricant producers and lubricant additive companies in a process that is open to public review.

INTERNATIONAL LUBRICANT SPECIFICATION ADVISORY COMMITTEE



ILSAC GF-6A RECOMMENDATIONS FOR PASSENGER CAR ENGINE OILS

DRAFT November 28, 2017



ILSAC GF-6A RECOMMENDATIONS

1. FRESH OIL VISCOSITY REQUIREMENTS

1.a SAE J300

Viscosity grades should be limited to SAE **0W-20, 5W-20, 0W-30, 5W-30 and 10W-30** multigrade oils. Oils should meet all of the requirements of SAE J300.

1.b Gelation Index: ASTM D5133 12 maximum

To be evaluated from -5°C to the 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.

2. ENGINE TEST REQUIREMENTS

2.a Oil Thickening: ASTM Sequence IIH Test, ASTM D8111

Kinematic Viscosity Increase @ 40°C , %	100 maximum
Average Weighted Piston Deposits, merits	5.0 minimum
Hot Stuck Rings	None

2.b Sludge, and Varnish Test: Sequence ~~VG VH (or equivalent)~~, ASTM D6593

Average Engine Sludge, merits	7.6 minimum
Average Rocker Cover Sludge, merits	7.7 minimum
Average Engine Varnish, merits	8.6 minimum
Average Piston Skirt Varnish, merits	7.6 minimum
Oil Screen Sludge, % area	Rate and report
Oil Screen Debris, % area	Rate and report
Hot Stuck Compression Rings	None
Cold Stuck Rings	Rate and report
Oil Ring Clogging, % area	Rate and report

2.c Valvetrain Wear: Sequence IVA (or equivalent), ASTM D6891

Average Cam Wear (7 position average), μm	90 maximum
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2.d Bearing Corrosion: Sequence VIII, ASTM D6709

Bearing Weight Loss, mg	26 maximum
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2.e Fuel Efficiency, Sequence VIE ASTM DXXXX

SAE XW-20 viscosity grade:

FEI SUM

4.5 minimum**

FEI 2

2.1 minimum after 125 hours aging*

SAE XW-30 viscosity grade:

FEI SUM

3.7 minimum**

FEI 2

1.8 minimum after 125 hours aging*

SAE 10W-30:

FEI SUM

3.4 minimum**

FEI 2

1.5 minimum after 125 hours aging*

(*FEI2 equivalent to 10,000 miles of oil aging, 0.5% improvement in FEI2 over GF-5)

(**1.0% improvement in FEISUM over GF-5)

2.f Chain wear: Test TBD
% increase

0.07 maximum

2.g Low Speed Preignition Prevention,
Number of events

5 maximum

3. BENCH TEST REQUIREMENTS

3.a Catalyst Compatibility

Phosphorus Content, ASTM D4951

0.08% (mass) maximum

Phosphorus Volatility, ASTM D8111
(Sequence IIIHB phosphorus retention)

81% minimum

Sulfur Content, ASTM D4951 or D2622
0W-XX, 5W-XX
10W-30

0.5% (mass) maximum

0.6% (mass) maximum

3.b Wear

Phosphorus Content, ASTM D4951

0.06% (mass) minimum

3.c Volatility

Evaporation Loss, ASTM D5800 B

15.0% maximum, 1 h at 250°C

Simulated Distillation, ASTM D6417
At 371°C

10.0% Max

3.e High Temperature Deposits, TEOST 33C, ASTM D6335

Total Deposit Weight, mg	30 maximum
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Note: No TEOST 33C limit for SAE 0W-20.

3.f Filterability

EOWTT, ASTM D6794	
with 0.6% H ₂ O	50% maximum flow reduction
with 1.0% H ₂ O	50% maximum flow reduction
with 2.0% H ₂ O	50% maximum flow reduction
with 3.0% H ₂ O	50% maximum flow reduction

Test formulation with highest additive (DI/VI) concentration. Read across results to all other base oil/viscosity grade formulations using the same or lower concentration of the identical additive (DI/VI) combination. Each different DI/VI combination must be tested.

EOFT, ASTM D6795	50% maximum flow reduction
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3.g Fresh Oil Foaming Characteristics,
ASTM D892 (Option A and excluding paragraph 11)

	<u>Tendency</u>	<u>Stability*</u>
Sequence I	10 mL maximum	0 mL maximum
Sequence II	50 mL maximum	0 mL maximum
Sequence III	10 mL maximum	0 mL maximum

*After 1 minute settling period

3.h Fresh Oil High Temperature Foaming Characteristics,
ASTM D6082 (Option A)

<u>Tendency</u>	<u>Stability*</u>
100 mL maximum	0 mL maximum

*After 1-minute settling period

3.i Aged Oil Low Temperature Viscosity,

Aged oil low temperature viscosity must be measured on the final formulation, this includes base oil and additive combination being licensed, for each viscosity grade by either ROBO or IIIHA

Measure CCS viscosity of the EOT ROBO or IIIHA sample at the CCS temperature corresponding to original viscosity grade.

Aged Oil Low Temperature Viscosity ROBO Test, ASTM D7528

- a) If CCS viscosity measured is less than or equal to the maximum CCS viscosity specified for the original viscosity grade, run ASTM D4684 (MRV TP-1) at the MRV temperature specified in SAE J300 for the original viscosity grade.
- b) If CCS viscosity measured is higher than the maximum viscosity specified for the original viscosity grade in J300, run ASTM D4684 (MRV TP-1) at 5° C higher temperature (i.e., at MRV temperature specified in SAE J300 for the next higher viscosity grade).
- c) The EOT ROBO sample must show no yield stress in the D4684 test and its D4684 viscosity must be below the maximum specified in SAE J300 for the original viscosity grade, or the next higher viscosity grade, depending on the CCS viscosity, as outlined in a) or b) above.

or

Aged Oil Low Temperature Viscosity, ASTM Sequence IIIHA Test , ASTM D8111

- a) If CCS viscosity measured is less than or equal to the maximum CCS viscosity specified for the original viscosity grade, run ASTM D4684 (MRV TP-1) at the MRV temperature specified in SAE J300 for the original viscosity grade.
- b) If CCS viscosity measured is higher than the maximum viscosity specified for the original viscosity grade in J300, run ASTM D4684 (MRV TP-1) at 5° C higher temperature (i.e., at MRV temperature specified in SAE J300 for the next higher viscosity grade).
- c) The EOT IIIIGA sample must show no yield stress in the D4684 test and its D4684 viscosity must be below the maximum specified in SAE J300 for the original viscosity grade, or the next higher viscosity grade, depending on the CCS viscosity, as outlined in a) or b) above.

3.j Shear Stability, Sequence VIII, ASTM D6709

10-hour stripped KV @ 100° C

XW-20

Stay in grade

XW-30

Stay in grade

3.k Homogeneity and Miscibility, ASTM D6922

Shall remain homogeneous and, when mixed with TMC reference oils, shall remain miscible.

3.l Engine Rusting, Ball Rust Test, ASTM D6557

Average Gray Value

100 minimum

3.m Emulsion Retention, ASTM D7563

0° C, 24 Hours

No water separation

25° C, 24 Hours

No water separation

3.n Candidate oil testing for elastomer compatibility shall be performed using the five Standard Reference Elastomers (SREs) referenced herein and defined in SAE J2643. Candidate oil testing shall be performed according to ASTM D7216 Annex A2, The post-candidate-oil-immersion elastomers shall conform to the specification limits detailed herein.

Elastomer Material (SAE J2643)	Test Procedure	Material Property	Units	Limits
Polyacrylate Rubber (ACM-2)	ASTM D471	Volume	%	-5, 15
	ASTM D2240	Hardness	pts.	-10, 10
	ASTM D412	Tensile Strength	%	-15, 20
Hydrogenated Nitrile Rubber (HNBR-1)	ASTM D471	Volume	%	-5, 10
	ASTM D2240	Hardness	pts.	-10, 5
	ASTM D412	Tensile Strength	%	-20, 15
Silicone Rubber (VMQ-1)	ASTM D471	Volume	%	-5, 40
	ASTM D2240	Hardness	pts.	-30, 10
	ASTM D412	Tensile Strength	%	-50, 5
Fluorocarbon Rubber (FKM-1)	ASTM D471	Volume	%	-2, 3
	ASTM D2240	Hardness	pts.	-6, 6
	ASTM D412	Tensile Strength	%	-65, 10
Ethylene Acrylic Rubber (AEM-1)	ASTM D471	Volume	%	-5, 30
	ASTM D2240	Hardness	pts.	-20, 10
	ASTM D412	Tensile Strength	%	-30, 30

4. APPLICABLE DOCUMENTS