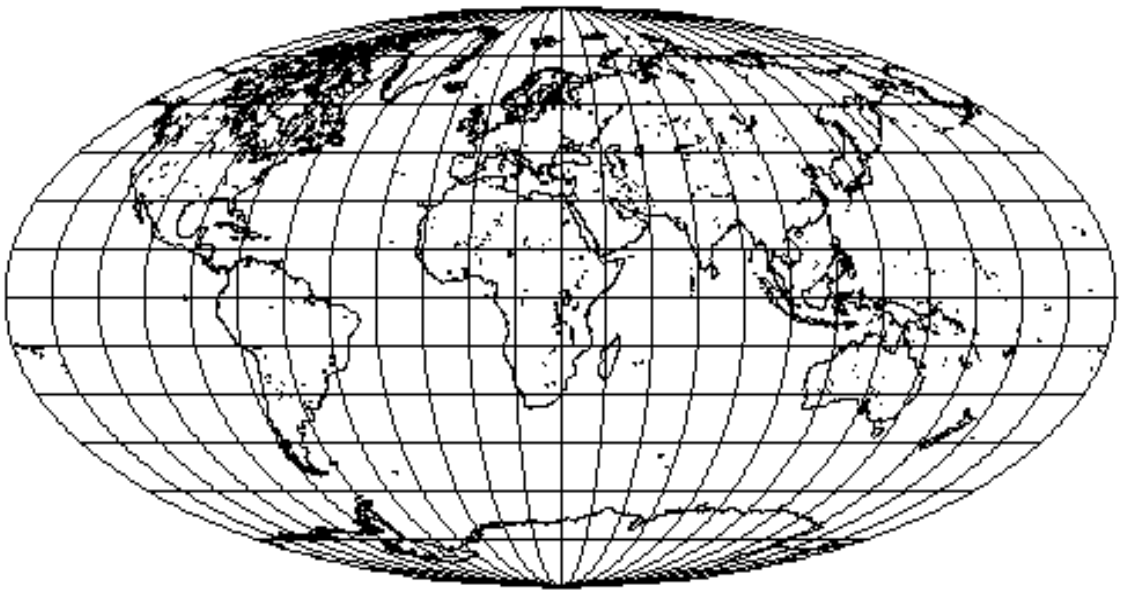
These ILSAC recommendations are being developed with input from automobile manufacturers, lubricant producers and lubricant additive companies in a process that is open to public review.

# INTERNATIONAL LUBRICANT SPECIFICATION ADVISORY COMMITTEE



# ILSAC GF-7B RECOMMENDATIONS FOR PASSENGER CAR ENGINE OILS

March 10, 2023

## ILSAC GF-7B RECOMMENDATIONS

## 1. FRESH OIL VISCOSITY REQUIREMENTS

1.a SAE J300

Viscosity grades shall be limited to 0W-16.
**New Oil MRV: 40,000cP**

Note: Any viscosity grades lower than SAE 16 as defined by HTHS150, i.e., <2.3 mPa-s, would have to be reviewed and approved by AOAP (or its successor group) before being included in the above list of viscosity grades approved for GF-7B

1.b Gelation Index: ASTM D5133 **N/C** 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 IIIH Test, ASTM D8111

| | |
|---|---|
| Kinematic Viscosity Increase @ 40°C, % | **N/C** 100 maximum |
| Average Weighted Piston Deposits, merits | **4.6 Min.** (was 4.2 minimum) |
| Hot Stuck Rings | **N/C** None |

2.b Sludge, and Varnish Test: Sequence VH ASTM D8256

| | |
|---|---|
| Average Engine Sludge, merits | **N/C** 7.6 minimum |
| Average Rocker Cover Sludge, merits | **N/C** 7.7 minimum |
| Average Engine Varnish, merits | **N/C** 8.6 minimum |
| Average Piston Skirt Varnish, merits | **N/C** 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 IVB ASTM D8350

| | |
|---|---|
| Average Intake Lifter Volume Loss (8 position average), $mm^3$ | **N/C** 2.7 maximum |
| End of Test Iron, ppm | **N/C** 400 maximum |

2.d Bearing Corrosion: Sequence VIII, ASTM D6709

Bearing Weight Loss, mg **N/R**

2.e Fuel Efficiency, Sequence VIF ASTM D8226

SAE 0W-16 viscosity grade:

| | |
|---|---|
| FEI SUM | **4.3 Min.** (was 4.1 min.) |
| FEI 2 | **2.1 Min.** (was 1.9 min.) after 125 hours aging |

2.f Low Speed Preignition Prevention, Sequence IX, ASTM D8291

| | |
|---|---|
| Average number of events for 4 iterations | **N/C** 5 maximum |
| Number of events per iteration | **N/C** 8 maximum |

2.g **Aged Oil Low Speed Preignition Prevention, Sequence IX, ASTM XXXX**

| | |
|---|---|
| **Average number of events for 4 iterations** | **5 maximum** |
| **Number of events per iteration** | **8 maximum** |

2.h Chain wear: Sequence X, ASTM D8279

% increase **0.080 Max.** (was 0.085 maximum)

3. BENCH TEST REQUIREMENTS

3.a Catalyst Compatibility

| | |
|---|---|
| Phosphorus Content, ASTM D4951 | **N/C** 0.08% (mass) maximum |
| Phosphorus Volatility, ASTM D8111 (Sequence IIIHB phosphorus retention) | **N/C** 81% minimum |
| Sulfur Content, ASTM D4951 or D2622 | **N/C** 0.5% (mass) maximum |
| **Sulphated Ash Content, ASTM D874** | **New 0.90% (mass) maximum** |

3.b Wear

| | |
|---|---|
| Phosphorus Content, ASTM D4951 | **N/C** 0.06% (mass) minimum |

3.c Volatility

| | |
|---|---|
| Evaporation Loss, ASTM D5800 B/D | **N/C** 15.0% maximum, 1 h at 250°C |

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

| | |
|---|---|
| Total Deposit Weight, mg | **N/R** |

3.f Filterability

| | |
|---|---|
| EOWTT, ASTM D6794 | **N/C** |
| with 0.6% $H_2O$ | 50% maximum flow reduction |
| with 1.0% $H_2O$ | 50% maximum flow reduction |
| with 2.0% $H_2O$ | 50% maximum flow reduction |
| with 3.0% $H_2O$ | 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 | **N/C** 50% maximum flow reduction |
| **Gelation Test, ASTM D6795 Modification** | **TBD % Filter Plugging (max)** |

3.g Fresh Oil Foaming Characteristics,
ASTM D892 (Option A and excluding paragraph 11) **N/C**

| | Tendency | Stability* |
|---|---|---|
| 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, **N/C**
ASTM D6082 (Option A)

| Tendency | Stability* |
|---|---|
| 100 mL maximum | 0 mL maximum |

*After 1-minute settling period

3.i Aged Oil Low Temperature Viscosity, **N/C**

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 **N/C**

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 **N/C**

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 IIIHA 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, Diesel Injector, ASTM D6278 **N/C**

KV @ 100°C (after 30 passes)
0W-16 Oils 5.8 cSt minimum

3.k Homogeneity and Miscibility, ASTM D6922 **N/C**

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

3.l Engine Rusting, Ball Rust Test, ASTM D6557 **N/C**

| | |
|---|---|
| Average Gray Value | 100 minimum |

3.m Emulsion Retention, ASTM D7563 **N/C**

| | |
|---|---|
| 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-1) | ASTM D471 | Volume | % | -5, 9 |
| | ASTM D2240 | Hardness | pts. | -10, 10 |
| | ASTM D412 | Tensile Strength | % | -40, 40 |
| 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 |
| **ACM-2 (ACM-2)** | **ASTM D471** | **Volume** | **%** | **TBD** |
| | **ASTM D2240** | **Hardness** | **pts.** | **TBD** |
| | **ASTM D412** | **Tensile Strength** | **%** | **TBD** |
| **AEM-2 (AEM-2)** | **ASTM D471** | **Volume** | **%** | **TBD** |
| | **ASTM D2240** | **Hardness** | **pts.** | **TBD** |
| | **ASTM D412** | **Tensile Strength** | **%** | **TBD** |
| **AEM-3** | **ASTM D471** | **Volume** | **%** | **TBD** |

| | | | | |
|---|---|---|---|---|
| (AEM-3) | ASTM D2240 | Hardness | pts. | TBD |
| | ASTM D412 | Tensile Strength | % | TBD |
| Fluoroelastomer | ASTM D471 | Volume | % | TBD |
| (FKM-3) | ASTM D2240 | Hardness | pts. | TBD |
| | ASTM D412 | Tensile Strength | % | TBD |

## 4. APPLICABLE DOCUMENTS

a. SAE Standard, Engine Oil Viscosity Classification—SAE J300, SAE Handbook.
b. SAE Standard, Standard Reference Elastomers (SRE) for Characterizing the Effects on Vulcanized Rubbers, Proposed Draft 2003-5—SAE J2643, SAE Handbook.
c. STM Annual Book of Standards, Volume 5, Petroleum Products and Lubricants, current edition.
d. M. Batko and D. F. Florkowski, “Low Temperature Rheological Properties of Aged Crankcase Oils,” SAE Paper 2000-01-2943.
e. M. Batko and D. F. Florkowski, “Lubricant Requirements of an Advanced Designed High Performance, Fuel Efficient Low Emissions V-6 Engine,” SAE Paper 01FL-265