

## ILSAC GF-4 REQUIREMENTS

### 1. FRESH OIL VISCOSITY REQUIREMENTS

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#### 1.a SAE J300

Oils shall meet all of the requirements of SAE J300. Viscosity grades are limited to SAE 0W, 5W, and 10W multigrade oils.

#### 1.b Gelation Index: ASTM D 5133

12 maximum

To be evaluated from  $-5^{\circ}\text{C}$  to the temperature at which 40,000 cP is attained or  $-40^{\circ}\text{C}$ , or 2 Celsius degrees below the appropriate MRV TP-1 temperature (defined by SAE J300), whichever occurs first.

### 2. ENGINE TEST REQUIREMENTS

#### 2.a Wear and Oil Thickening: ASTM Sequence IIIG Test

Kinematic Viscosity Increase @ $40^{\circ}\text{C}$ , %	150 maximum
Average Weighted Piston Deposits, merits	3.5 minimum
Hot Stuck Rings	None
Average Cam plus Lifter Wear, $\mu\text{m}$	60 maximum

#### 2.b Aged Oil Low Temperature Viscosity: ASTM Sequence IIIGA Test

Evaluate the EOT oil from the ASTM  
The D 4684 viscosity of the EOT  
Sequence IIIGA test with ASTM D 4684 sample must meet the  
(MRV TP-1) requirements of the original grade or the next higher grade.

#### 2.c Wear, Sludge, and Varnish Test: Sequence VG, ASTM D 6593

Average Engine Sludge, merits	7.8 minimum
Average Rocker Cover Sludge, merits	8.0 minimum
Average Engine Varnish, merits	8.9 minimum

Average Piston Skirt Varnish, merits	7.5 minimum
Oil Screen Sludge, % area	20 maximum
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
Follower Pin Wear, cyl #8, avg, $\mu\text{m}$	Rate and report <sup>a</sup>
Ring Gap Increase, cyl #1 & #8, avg, $\mu\text{m}$	Rate and report <sup>a</sup>

<sup>a</sup>ASTM Surveillance Panel will review statistics annually.

**2.d Valvetrain Wear: Sequence IVA, ASTM D 6891**

Average Cam Wear (7 position average),  $\mu\text{m}$  90 maximum

**2.e Bearing Corrosion: Sequence VIII, ASTM D 6709**

Bearing Weight Loss, mg 26 maximum

**2.f Fuel Efficiency: Sequence VIB\*, ASTM D 6837**

SAE 0W-20 and 5W-20 viscosity grades:  
 2.3% FEI 1 minimum after 16 hours aging  
 2.0% FEI 2 minimum after 96 hours aging

SAE 0W-30 and 5W-30 viscosity grades:  
 1.8% FEI 1 minimum after 16 hours aging  
 1.5% FEI 2 minimum after 96 hours aging

SAE 10W-30 and all other viscosity grades not listed above:  
 1.1% FEI 1 minimum after 16 hours aging  
 0.8% FEI 2 minimum after 96 hours aging

\*All FEI 1 and FEI 2 values determined relative to ASTM Reference Oil BC.

**3. BENCH TEST REQUIREMENTS**

**3.a Catalyst Compatibility**

Phosphorus Content, ASTM D 4951	0.08% (mass) maximum
Sulfur Content, ASTM D 4951 or D 2622	
SAE 0W and 5W multigrades	0.5% (mass) maximum
SAE 10W multigrades	0.7% (mass) maximum

3.b Wear

Phosphorus Content, ASTM D 4951                      0.06% (mass) minimum

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3.c Volatility

Evaporation Loss, ASTM D 5800                      15% maximum, 1 h at 250°C  
(Note: Calculated conversions specified in D 5800 are allowed.)

Simulated Distillation, ASTM D 6417                      10% maximum at 371°C

3.d High Temperature Deposits, TEOST MHT

Deposit Weight, mg    35 maximum

3.e Filterability

EOWTT, ASTM D 6794

with 0.6% H <sub>2</sub> O	50% maximum flow reduction
with 1.0% H <sub>2</sub> O	50% maximum flow reduction
with 2.0% H <sub>2</sub> O	50% maximum flow reduction
with 3.0% H <sub>2</sub> 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 D 6795    50% maximum flow reduction

3.f Foaming Characteristics, ASTM D 892 (Option A)

	<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 10-minute settling period

3.g High Temperature Foaming Characteristics, ASTM D 6082 (Option A)

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

\*After 1-minute settling period

3.h Shear Stability, Sequence VIII, ASTM D 6709

10-hour stripped KV @ 100°C

Kinematic viscosity must remain in original SAE viscosity grade.

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3.i Homogeneity and Miscibility, ASTM D 6922

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

3.j Engine Rusting, Ball Rust Test , ASTM D 6557

Average Gray Value

100 minimum

4. APPLICABLE DOCUMENTS

4.a SAE Standard, Engine Oil Viscosity Classification - SAE J300, SAE Handbook.

4.b SAE Standard, Standard Reference Elastomers (SRE) for Characterizing the Effects on Vulcanized Rubbers, Proposed Draft 2003-5 - SAE J2643, SAE Handbook

4.c ASTM Annual Book of Standards, Volume 5, Petroleum Products and Lubricants, current edition.

4.d ASTM Sequence IIIG Test Research Report.

4.e M. Batko and D. F. Florkowski, "Low Temperature Rheological Properties of Aged Crankcase Oils," SAE Paper 2000-01-2943.

4.f 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.