Sequence IX Engine Test
(ASTM D8291)

Specifications
- ILSAC GF-6
- API SN+, SP

Objective
- Evaluates the ability of a motor oil to mitigate pre-ignition in the combustion chambers of gasoline, turbocharged, direct-injection (GTDI) engines under low-speed and high-load operating conditions.

Test Fixture
- Ford 2.0L Ecoboost inline four-cylinder engine as found in the 2012 Ford Explorer.

Test Parameters
- The test consists of 4 iterations. Each iteration is 175,000 ignition cycles from each cylinder with the first 170,000 valid cycles evaluated for the number of pre-ignition events.
- Unleaded Haltermann EEE test fuel is used.

Pre-ignition Event Definition
- In-cylinder pressure sensors are used to record the peak pressure of each cycle and the crank angle at which 2% of the mass fraction of fuel is burned (MFB2 calculated from pressure rise).
- A statistical method is applied to find peak pressure (very high) and MFB2 (very early) outliers, and when both conditions are met that is deemed an LSPI event.

Used Lubricant Analysis
- Viscosity @ 40 °C (ASTM D445)
- Viscosity @ 100 °C (ASTM D445)
- Fuel dilution (ASTM D3525)
- Wear metals (ASTM D5185)

Pass/Fail Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit</th>
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<tbody>
<tr>
<td>API SN+, SP, GF-6</td>
<td>Average number of pre-ignition events per an iteration over 4 valid iterations (AVPIE)</td>
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<tr>
<td>SP, GF-6</td>
<td>Maximum number of events during any iteration (MAXPIE)</td>
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We welcome your inquiries. For additional information, please contact:

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