Product Data Sheet

SpectraSyn Plus™ Polyalphaolefins (PAO)

Description
ExxonMobil’s low viscosity SpectraSyn Plus™ PAOs are a unique class of API Group IV products. They are hydrogenated olefin oligomers manufactured by the catalytic polymerization of linear alphaolefins that have well-defined, wax-free isoparaffinic structures.

These products provide an unsurpassed combination of volatility and low-temperature fluidity (Noack and CCS viscosity) relative to conventional PAO. SpectraSyn Plus™ PAO products have high viscosity indices, which translate into improved flow at low temperatures and increased film thickness at high temperatures. In addition, these low viscosity SpectraSyn Plus™ PAO products are hydrolytically stable, have good compatibility with mineral oils and can be combined with other more polar synthetic basestocks (e.g. esters or alkylated naphthalenes) to improve their solvency and deposit control. Finally, due to their excellent response to antioxidants, SpectraSyn Plus™ PAO can be formulated to resist thermal oxidative attack.

Applications
ExxonMobil’s low viscosity SpectraSyn Plus™ PAO fluids provide superior lubrication as the primary basestocks for synthetic lubricants used in passenger car engines, heavy-duty diesel engines, transmissions, and a variety of industrial applications. SpectraSyn Plus™ PAO can also be combined with high viscosity SpectraSyn™ PAO and/or SpectraSyn Ultra™ PAO to meet a range of viscosity targets including wide multi-grade engine and automotive gear oils as well as various ISO VG industrial oils. SpectraSyn Plus™ PAO should be considered for upgrading mineral oil or Group III basestocks for improved low temperature and volatility performance.

Synthetic lubricants formulated with SpectraSyn Plus™ PAO may offer the following benefits:
• Extended drain intervals
• Improved fuel economy/energy efficiency
• Enhanced wear protection
• Wide range of operating temperatures
• Cost effective low temperature and volatility performance blends with mineral oils

SpectraSyn Plus™ PAO products are registered worldwide, meet the FDA 21 CFR 178.3620(b) requirements for Technical White Oil, have USDA H1 approval for lubricants with incidental food contact, and are listed in the National Sanitation Foundation (NSF) White book.

<table>
<thead>
<tr>
<th>SpectraSyn Plus™</th>
<th>3.6</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basics</strong></td>
<td></td>
<td></td>
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<tr>
<td>Specific Gravity @15.6/15.6˚C a</td>
<td>0.816</td>
<td>0.820</td>
<td>0.827</td>
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<tr>
<td>Kinematic Viscosity @ 100˚C, mm²/s, (cSt) a</td>
<td>3.6</td>
<td>3.9</td>
<td>5.9</td>
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<tr>
<td>Kinematic Viscosity @ 40˚C, mm²/s, (cSt) a</td>
<td>15.4</td>
<td>17.2</td>
<td>30.3</td>
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<tr>
<td>Kinematic Viscosity @ -40˚C, mm²/s, (cSt) a</td>
<td>2,000</td>
<td>2,430</td>
<td>7,400</td>
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<tr>
<td>Viscosity Index</td>
<td>120</td>
<td>126</td>
<td>141</td>
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<tr>
<td>Noack Volatility, wt. % a</td>
<td>&lt; 17</td>
<td>&lt; 12</td>
<td>&lt; 6</td>
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<tr>
<td>Pour Point, ˚C</td>
<td>&lt; - 65</td>
<td>&lt; - 60</td>
<td>&lt; - 54</td>
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<tr>
<td>Flash Point, Open Cup, ˚C</td>
<td>224</td>
<td>228</td>
<td>246</td>
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<tr>
<td>Water, ppm</td>
<td>&lt; 50</td>
<td>&lt; 50</td>
<td>&lt; 50</td>
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<tr>
<td>Refractive Index @ 25.0˚C a</td>
<td>1.4530</td>
<td>1.4530</td>
<td>1.4579</td>
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<tr>
<td>Total Acid Number (TAN), mg KOH/g</td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
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<tr>
<td><strong>Appearance</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Appearance</td>
<td>Bright &amp; Clear</td>
<td>Bright &amp; Clear</td>
<td>Bright &amp; Clear</td>
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<tr>
<td>Color, ASTM</td>
<td>&lt; 0.5</td>
<td>&lt; 0.5</td>
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### SpectraSyn Plus™

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
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<tbody>
<tr>
<td><strong>Flow</strong></td>
<td></td>
<td></td>
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<tr>
<td>Apparent Viscosity @ -40°C by Mini-rotary Viscometric, cP</td>
<td></td>
<td>2,060</td>
<td>2,023</td>
<td>6,243</td>
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<tr>
<td>Brookfield Viscosity @ -40°C, cP</td>
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<td>2,117</td>
<td>2,538</td>
<td>6,289</td>
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<td>Cold Cranking Simulator @ -25°C, cP</td>
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<td>733</td>
<td>1,400</td>
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<tr>
<td>Cold Cranking Simulator @ -30°C, cP</td>
<td></td>
<td>660</td>
<td>804</td>
<td>2,247</td>
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<td>Cold Cranking Simulator @ -35°C, cP</td>
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<td>1,050</td>
<td>1,290</td>
<td>3,600</td>
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<tr>
<td>High-Temp. High-Shear Viscosity @ 150°C, cP</td>
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<td>1.14</td>
<td>1.24</td>
<td>1.86</td>
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<td>Surface Tension @ 24°C, mN/m, (dynes/cm)</td>
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<td>29.1</td>
<td>29.2</td>
<td>29.5</td>
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<tr>
<td><strong>Thermal</strong></td>
<td></td>
<td></td>
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<tr>
<td>Specific Heat @ 37.8°C</td>
<td>b</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
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<tr>
<td>Autoignition Temperature, °C</td>
<td>a</td>
<td>321</td>
<td>346</td>
<td>360</td>
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<tr>
<td>Density Correction Factor, (g/cc)/°C</td>
<td>b</td>
<td>6.48 x 10^{-4}</td>
<td>6.44 x 10^{-4}</td>
<td>6.32 x 10^{-4}</td>
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<tr>
<td>Fire Point, °C</td>
<td></td>
<td>248</td>
<td>254</td>
<td>278</td>
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<td>Evaporation Loss @ 205°C for 6.5 hrs, wt%</td>
<td>a</td>
<td>22.6</td>
<td>15.2</td>
<td>5.7</td>
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<tr>
<td>Thermal Conductivity @ 37.8°C, [BTU/hr(ft)^2(°F/ft)]</td>
<td>b</td>
<td>0.0844</td>
<td>0.0848</td>
<td>0.0880</td>
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<tr>
<td>Vapor Pressure @ 150°C, mm Hg abs.</td>
<td>b</td>
<td>0.2</td>
<td>0.2</td>
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<tr>
<td><strong>Solubility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Aniline Point, °C</td>
<td>b</td>
<td>119</td>
<td>120</td>
<td>125</td>
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<tr>
<td>Kauri-Butanol Value (KB)</td>
<td>a</td>
<td>-2.1</td>
<td>-3.0</td>
<td>-9.4</td>
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<td>Solubility Parameter @ 25°C, (cal/cc)^0.5</td>
<td>b</td>
<td>8.09</td>
<td>8.12</td>
<td>8.15</td>
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<tr>
<td><strong>Performance</strong></td>
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<tr>
<td>Dielectric Constant @ 25°C</td>
<td>b</td>
<td>2.09</td>
<td>2.10</td>
<td>2.11</td>
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<tr>
<td>Dielectric Strength, kv</td>
<td>b</td>
<td>41.5</td>
<td>41.2</td>
<td>39.4</td>
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<td>Copper Corrosion @ 100°C for 3 hrs.</td>
<td>a</td>
<td>1b</td>
<td>1b</td>
<td>1b</td>
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<td>Demulsibility @ 82°C 40-40-0, min</td>
<td>a</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Foam, Seq. 1, mL/mL</td>
<td>a</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
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</tbody>
</table>

* Single sample or two sample average determinations
* Calculated

### Safety and Handling

For information on toxicology and safe handling of these products, refer to the Material Safety Data Sheets, available on request or visit our Web site at www.exxonmobilsynthetics.com.

### Shipping Information

DOT Hazard Class: Not Regulated.
DOT Hazard Labeling: None Required

### Availability

ExxonMobil Chemical's SpectraSyn Plus™ PAO products are available in drums and in bulk. Samples are available upon request. Please call 1.800.682.8342 in the U.S.; +32.2.722.36.50 in Brussels; 86.21.2407.5157 in Shanghai; 65.6885.8419 in Singapore; or 81.3.6713.4040 in Tokyo. Or visit our Web site at www.exxonmobilsynthetics.com.

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