Additives for Grease

Polymer Additives for Water Spray-off and Shear Stability ........ 3
Tackifiers ................................................................. 3
Extreme Pressure Additives ................................. 4
Mobility and Dropping Point Improvers ..................... 4
**FUNCTIONAL PRODUCTS INC.**

Functional Products Inc. was founded in 1985. We received our ISO 9001:2008 certification in 2010, and we are REACH compliant.

Functional Products formulates and blends over 200 active products and also provides custom formulary capability for short and long-run needs.

Headquarters, general offices and manufacturing plant are located in Macedonia, Ohio. Sales offices and stocking points are located throughout the United States and Canada, as well as Latin America, Europe, Australia, India and Asia.

---

**Mission Statement:**
Functional Products Inc. is committed to providing our customers with quality products and services that meet or exceed their expectations through the use of continuous improvement.

---

**ADDITIVES FOR GREASE**

**Improve Your Greases With Our Polymer Additives**

**FUNCTIONAL PRODUCTS, INC.** offers a variety of polymer additives that positively affect the performance of grease. The interaction of polymers in grease is more complex than the thickening polymers confer to base oils. Our specialty polymer additives form an interpenetrating, physical network with the grease soap to greatly improve the performance of the grease: better shear stability, enhanced water spray-off and thicken the grease.

---

**How do Polymers Improve Grease?**

The polymer forms an interpenetrating network with the grease soap matrix by chemical bonding, entanglement, or an amorphous crystalline reinforcement. The result is improved functional properties and a robust appearance.

- **Improved Shear Stability**
  FUNCTIONAL V-4004A, V-207, V-211, and V-176 greatly improve Cone Penetration (ASTM D217) and Roll Stability (ASTM D1831) performance test results for grease.

- **Enhanced Water Resistance**
  FUNCTIONAL V-4004A, V-207, V-211, and V-176 reduce water spray-off grease loss by as much as 90% (ASTM D4049).

- **Increased Yield**
  FUNCTIONAL V-4004A, V-207, V-211, and V-176 stiffen the grease and lower the NLGI rating grade. To bring the grease back in grade, approximately 10% more oil is added.

**What Types of Grease Soap may be treated with polymers?**

The specialty polymers are compatible with the following mineral and vegetable oil-based grease soaps: aluminum, lithium, lithium complex and calcium sulfonate systems.

**Compatibility with Vegetable and Mineral Greases**

Differences between vegetable and mineral oils require the use of compatible polymers when forming greases (see the illustration below). Although both oils are characterized by long hydrocarbon chains, vegetable oils have polar ester groups (A) and unsaturated double bonds (B).

**Definitions:**

- **Triglyceride** — An ester derived from glycerol and fatty acids.

---

**Health and Safety:**

The product descriptions here, the Technical Data Sheets (TDS) and the product labels are not intended to take the place of a Material Safety Data Sheet (MSDS).

An MSDS is provided with each shipment of an order or a sample, or can be downloaded from our website:

www.functionalproducts.com

Phone: 1-330-963-3060

---

**Structural Differences Between Vegetable and Mineral Oils**

![Structural Differences Between Vegetable and Mineral Oils](image_url)
POLYMER ADDITIVES
For Water Spray-off and Shear Stability

APPLICATION
FUNCTIONAL V-207 and FUNCTION V-211 are powdered polymers absent of diluent oil for formulating flexibility. Both provide exceptional visual tackiness to grease.

FUNCTIONAL V-4004A is a multifunctional polymer in liquid form designed to improve water resistance and mechanical stability. FUNCTIONAL V-4004A also increases the tackiness of the grease and reduces the soap content.

FUNCTIONAL V-4020 is a rapidly dissolving pellet polymer that interacts with the grease soap matrix and greatly boosts the soap’s performance for water spray-off and shear stability.

FUNCTIONAL V-207, FUNCTION V-211 and FUNCTIONAL V-4020 are specifically designed for compatibility with the grease soap matrix. FUNCTIONAL V-207 and V-211 are added while cool, below 100°C.

FUNCTIONAL V-4004A, V-207 and V-211 are added while cool, below 100°C. FUNCTIONAL V-4020 is added during initial reaction, with temperatures above 200°C.

TACKIFIERS

APPLICATION
FUNCTIONAL V-176 is a yellow-orange (<3 ASTM) tackifier that confers tack or stringiness to a lubricant, and may be used to provide adherence.

FUNCTIONAL V-191M is a white liquid best used in greases made with water or where water is a by-product of soap formation. The high active polymer level results in a modest viscosity compared to solutions of tackifier polymers in oil.

FUNCTIONAL V-570 and V-572 are yellow-orange (<4 ASTM) tackifiers for fatty oil-based greases. FUNCTIONAL V-570 is biodegradable and FUNCTIONAL V-572 is approximately 90% readily biodegradable.

FUNCTIONAL V-584 is NSF registered as X1 category (No. 120913), where incidental food contact may occur.

<table>
<thead>
<tr>
<th>Product</th>
<th>Composition</th>
<th>Appearance</th>
<th>Water Spray-off*</th>
<th>Roll Stability*</th>
<th>Treat Rate**</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-207</td>
<td>Copolymer based on ethylene and propylene</td>
<td>White rubber powder</td>
<td>14.0%</td>
<td>4.4%</td>
<td>1.0%</td>
</tr>
<tr>
<td>V-211</td>
<td>Styrene/ethylene/butylene copolymer</td>
<td>White-yellow rubber powder</td>
<td>15.0%</td>
<td>4.8%</td>
<td>1.0%</td>
</tr>
<tr>
<td>V-4004A</td>
<td>Hydrocarbon polymer in naphthenic oil</td>
<td>Yellow-orange liquid</td>
<td>33.0%</td>
<td>3.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>V-4020</td>
<td>Copolymer based on ethylene and propylene</td>
<td>White rubber pellets</td>
<td>21.0%</td>
<td>4.6%</td>
<td>0.25%</td>
</tr>
</tbody>
</table>

* Reference for comparison is a lithium complex grease with ASTM D-4049 of 63% and ASTM D-1831 of 11.0%.
** Treat Rates may be optimized for a specific grease, usually within ± 0.5% by weight

FUNCTIONAL V-4004A, V-207 and V-211 are added while cool, below 100°C. FUNCTIONAL V-4020 is added during initial reaction, with temperatures above 200°C.
EXTREME PRESSURE ADDITIVES

CERAMAX and RD-535 Extreme Pressure Grease Additives

FUNCTIONAL CERAMAX uses optimized bimodal particles to provide an efficient and economic additive for use in heavy industrial and food processing grease. CERAMAX provides lubrication and metal to metal protection under extreme loads and temperatures, making it an ideal replacement for graphite, MoS2 or PTFE. CERAMAX is available in white paste or white powder form with comparable performance, allowing maximum flexibility when formulating your grease.

FUNCTIONAL RD-535 is a liquid additive for vegetable based grease. At a 5.0% treat rate, RD-535 has a Timken Weld Load of greater than 71 pounds (32kg).

<table>
<thead>
<tr>
<th>Four Ball Extreme Pressure Test Results</th>
<th>Wear Scar 40kg (mm)</th>
<th>Extreme Pressure Weld (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium Complex Base Grease</td>
<td>1.060</td>
<td>126</td>
</tr>
<tr>
<td>Lithium Complex / 1% PTFE</td>
<td>0.890</td>
<td>200</td>
</tr>
<tr>
<td>Lithium Complex / 1% MoS2</td>
<td>0.805</td>
<td>250</td>
</tr>
<tr>
<td>Lithium Complex / 5% RD-535</td>
<td>0.820</td>
<td>250</td>
</tr>
<tr>
<td>Lithium Complex / 1% Ceramax</td>
<td>0.760</td>
<td>250</td>
</tr>
</tbody>
</table>

MOBILITY and DROPPING POINT IMPROVERS

FUNCTIONAL PD-555 is a wax-crystal modifier primarily used in improving cold-flow properties of vegetable oil-based greases at temperatures below their mobility flow rate. It is effective under both rapid-cooling and extended cold storage conditions. FUNCTIONAL PD-555 is effective in greases made from canola oil, sunflower oil or other triglycerides. FUNCTIONAL PD-555 is approximately 95% readily biodegradable. Mobility flow rate reduces by 5° to 15°C.

FUNCTIONAL PD-610 is a wax-crystal modifier primarily used in improving the cold-flow properties of mineral oil-based greases at temperatures below their mobility flow rate.

FUNCTIONAL DP-200 is a high-performance additive designed for simple Lithium 12 hydroxystearate soap greases. By increasing the three-dimensional association of soap fibers, the grease becomes more resistant to flow at elevated temperatures. FUNCTIONAL DP-200 is slightly dispersible in water. The dropping point is increased by 40°C.

Typical Properties and Treatment Levels

<table>
<thead>
<tr>
<th>Property</th>
<th>Mobility Improvers</th>
<th>Dropping Point Improver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>Vegetable Oil-based Greases</td>
<td>Lithium 12 hydroxystearate greases</td>
</tr>
<tr>
<td>Appearance</td>
<td>Light-colored liquid</td>
<td>Pale yellow to amber liquid</td>
</tr>
<tr>
<td>Odor</td>
<td>Mild fatty</td>
<td>Mild</td>
</tr>
<tr>
<td>Lbs. per Gallon</td>
<td>7.75</td>
<td>7.6</td>
</tr>
<tr>
<td>Flash Point</td>
<td>160°C (320°F), min.</td>
<td>150°C (°F), min.</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>0.93</td>
<td>0.90 Typical</td>
</tr>
<tr>
<td>Kinematic Viscosity</td>
<td>110 cSt @ 100°C</td>
<td>&lt;800 cSt @ 100°C</td>
</tr>
<tr>
<td>Acid Value</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Phosphorous Content</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Treatment Level</td>
<td>1%</td>
<td>0.10 – 0.50%</td>
</tr>
</tbody>
</table>

www.functionalproducts.com