FUNCTIONAL PRODUCTS INC.

Innovative Chemistry for Lubricants

Tackifier Products

QMS Certified to ISO 9001:2008 (With Design) REACH and GHS Compliant

8282 Bavaria Road - Macedonia, Ohio - 44056

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FUNCTIONAL PRODUCTS INC.

Functional Products Inc. was founded in 1985. The Quality Management System is certified to ISO 9001:2008 (with design). Functional Products is committed to compliance with current REACH and CLP regulations, including the Globally Harmonized System (GHS) for classification and labeling standard.

Functional Products is an active member or participant in the following professional technical associations: **NLGI, ELGI, NLGI India, STLE, KSTLE, AOCS, NSF, UEIL and ILMA.**

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.

Health and Safety:

The product descriptions here, in Technical Data Sheets (TDSs) and on product labels are not intended to take the place of a Safety Data Sheet (SDS).

A SDS is provided with each order or sample shipment of an order or a sample and can be downloaded from our website:

www. functionalproducts. com
Phone: 1-330-963-3060

Tackifier Products

Tackifiers are additives that confer tack, or stringiness, to a substance and are typically used to provide adherence in fluid lubricants and stringiness in grease. Thickeners give additional body to greases and fluid lubricants. Both tackifiers and thickeners also provide drip resistance and serve to inhibit stray mist in pneumatic system lubricants.

FUNCTIONAL PRODUCTS INC. offers an extensive line of tackifiers for various systems and applications. This catalog presents information regarding our mineral oil, vegetable oil, and latex based products. The catalog also lists the appropriate application for each tackifier.

FUNCTIONAL PRODUCTS INC. offers a wide range of tackifiers to fit your requirements. Custom products are our specialty. If you require something not in our standard catalog, please let us know. We will be happy to create a tackifier that meets your need.

Definitions

NSF —The NSF, a non-governmental non-profit corporation, assumed responsibility from the FDA. Registry numbers are assigned to approved products, lubricants and lubricant additives.

OCP —Olefin copolymer

PAO —Polyalphaolefin

PIB —Polyisobutylene

String Length —A measure of tackifier performance as determined by the Ductless Siphon Test (see page 7).

Noteworthy

Scientists at **FUNCTIONAL PRODUCTS** authored the chapter "Tackifiers and Antimisting Additives" in the reference book *Lubricant Additives: Chemistry and Applications,* second edition, edited by Leslie R. Rudnick.

FUNCTIONAL PRODUCTS was given the "Best Paper Award" at the ELGI Annual Meeting in Paris for their paper on polymer compatibility in mineral and vegetable oils.

FUNCTIONAL PRODUCTS provides instruction on polymers in the Advanced Grease Course at the NLGI conferences.

FUNCTIONAL PRODUCTS received an award for its paper at the National Lubricating Grease Symposium in Wuyishan, China.

Industrial Lubricant Tackifiers

Applications and Treat Levels*

- **Way Lubricants: 0.5-1.0%**
- **Chain Oils: 0.3-1.5%**
- **Greases: 0.5-1.5%**
- **Aerosol Resistance: 0.5-2.0%**

*Treat levels are typical ranges. Since there are no standardized tests for these properties, the actual treat level is best determined by the formulator.

Typical Properties

Product	Diluent Oil	Polymer	Viscosity (cSt at100°C)	Color (ASTM D1500)	Shear Stability	String Length (0.5 wt% in ISO 68)
V-172	Paraffinic	PIB	4000	<4	Very Good	48
V-172E	Paraffinic	PIB	2800	<2	Very Good	34
V-174	Paraffinic	PIB	800	<3	Good	50
V-176	Paraffinic	PIB	2900	<4	Good	47
V-177	Paraffinic	PIB	10500	<4	Good	98
V-177L	Paraffinic	PIB	6800	<4	Good	76
V-178	Paraffinic	PIB	4000	<4	Good	90
V-178E	Paraffinic	PIB	2100	<4	Good	67
V-179	Paraffinic	PIB	300	<4	Good	63
V-184	Naphthenic	PIB/OCP	4000	<4	Very Good	49
V-188	Paraffinic	OCP	4000	<4	Excellent	28*
V-189A	Paraffinic	OCP	1300 at 40°C	<4	Excellent	20*
V-198A	Paraffinic	PIB	5000	<4	Poor	52
V-298	Technical White	PIB	4000	<1	Poor	53
V-298F	Technical White	PIB	6250	<1	Poor	78
V-298L	Technical White	PIB	2000	<1	Poor	36
V-378	Group III	PIB	5000	<3	Good	75
V-388	Group III	OCP	4000	<3	Excellent	22*

* OCP tackifiers confer lower string lengths than those of PIB tackifiers. However, the shear stability of OCP tackifiers is much higher, resulting in smaller decreases in string length in applications where shear is present.

Food Grade Tackifiers

For Incidental Food Contact

Applications

- **Greases**
- **Chain Oils**
- **Anti-mist**
- **Way Oils**

NSF
Nonfoods Compounds Program Listed

Typical Properties

Product	Diluent	Polymer	Viscosity (cSt at100˚C)	Color (ASTM D1500)	Shear Stability	String Length (0.5 wt% in ISO 68)
V-422	White Mineral Oil	PIB	3000	<1	Good	53
V-425	White Mineral Oil	OCP	3000	<2	Excellent	15*
V-498	White Mineral Oil	PIB	4000	<1	Good	53
V-584	Vegetable Oil	Proprietary	2500	<4	Fair	10**

* OCP tackifiers confer lower string lengths than those of PIB tackifiers. However, the shear stability of OCP tackifiers is much higher, resulting in smaller decreases in string length in applications where shear is present.

** 0.5% by weight in Canola oil

● **For more information please refer to our *Additives for Food Grade Lubricants* catalog.**

Biobased Tackifiers

Biobased tackifiers are primarily used to provide adherence in saw-chain and saw-guide oils in environmentally sensitive locations.

Typical treatment level for a chain lube is 3-10%. This level will bring a vegetable oil to ISO 46 or ISO 68 grade. Low temperature properties can be improved with the addition of **FUNCTIONAL PD-551** at 0.2-1.0%.

Typical Properties

Product	Diluent	Viscosity	Color (ASTM D1500)	Shear Stability	String Length (0.5 wt% in Canola)
V-515	Vegetable Oil	8000 cSt at100˚C	<4	Good	5
V-584	Vegetable Oil	2500 cSt at 40˚C	<4	Fair	10

The polymers themselves are not readily biodegradable, but allow the formulation of tacky lubricants in bio-based oil systems.

● **For more information please refer to our *Additives for Biobased Products* catalog.**

Emulsion Based Grease Tackifiers

As an emulsion, the high active polymer level results in modest viscosity compared to oil based tackifiers. These additives are for use in greases that are either made with water, or where water is formed as a by product of soap formation. **FUNCTIONAL V-191M** is more resistant to 'clotting' during blending. The typical treat level is 0.5-2.0%.

Typical Properties

Product	Diluent	Polymer	Appearance	pH	Odor
V-191	Water	Hydrocarbon	White Liquid	10	Slight ammonia
V-191M	Water	Hydrocarbon	White Liquid	10	Slight ammonia

HANDLING:
These products are subject to freezing at temperatures below 32°F. Freezing must be prevented to avoid irreversibly breaking the emulsion. Recommended storage temperature is 40-100°F.

High Temperature Tackifiers

FUNCTIONAL V-378 and **V-388** are additives that provide stringiness and water resistance to thermally stable lubricants and greases based on PAO and Group III base oils. Lubricants using Group III oils or PAOs with these tackifiers are more thermally and oxidatively stable than other products made with the same base oils and conventional tackifiers.

Typical Properties

Product	Diluent	Polymer	Flash Point	Viscosity (cSt at 100˚C)	Color (ASTM D1500)	String Length (0.5 wt% in ISO 68)
V-378	Group III Oil	PIB	410˚F (210˚C)	5000	<2	75
V-388	Group III Oil	OCP	410˚F (210˚C)	4000	<2	22*

* OCP tackifiers confer lower string lengths than those of PIB tackifiers. However, the shear stability of OCP tackifiers is much higher, resulting in smaller decreases in string length in applications where shear is present.

HANDLING:
Due to their viscosity, elevated temperatures can facilitate handling. Safe handling precautions are the same as those to be taken with the base oil; see the current SDS.

Tackifier and Thickener for Aqueous Systems

FUNCTIONAL V-801 is an environmentally friendly, non-hazardous liquid additive that thickens and confers tack/stringiness to fluids made from water or emulsions of water and soluble oils. It may be blended to increase adherence and drip resistance to liquids or colloidal suspensions used in aqueous bar and chain oils or wire rope lubricants. **V-801** can also be used in flocculating agents, home care/cleaning, and ceramic applications, including as a binder for powders and an anti-sag agent in paints.

The active ingredient in **FUNCTIONAL V-801** is a high molecular weight proprietary polymer that provides tackiness and thickening. The polymer is not consdered biodegradable.

Typical Properties	
Appearance	Tacky, visous liquid
Color	White, opaque
Specific Gravity	1.01
Lbs per Gallon	8.42
Kinematic Viscosity	40,000 @ 40°C

The typical treatment level is 0.3 - 5%, depending on the application. At temperatures greater than 200°C, the product degrades into a film that does not build up. At temperatures below 5°C, **V-801** may be combined with a cold flow improver such as ethylene or propylene glycol. Due to the range of applications, treatment level is best determined by the end-user.

HANDLING:

FUNCTIONAL V-801 flows readily at ambient temperature and may be pumped into transfer systems. The product should be stored at temperatures above 5°C and below 45°C. Replace container lid tightly after use to maintain product consistency and quality. Exposure to air for more than a few hours may cause the formation of surface film. The film may be easily removed prior to use.

FUNCTIONAL V-801 has a shelf life of 6 months. Avoid mechanical shearing during handling and blending to minimize possible loss of tackiness.

Safe handling precautions are the same as those to be taken with other tackifiers. See the current Safety Data Sheet.

Testing, Handling and Blending Information

String Length Testing using the Ductless Siphon Method:

A vacuum pump draws fluid through a capillary with one end initially placed under the surface of the liquid. As liquid is removed through the capillary, the level drops so that the capillary is above the surface. The suction pulls the tacky liquid up even through airspace. Tackier solutions will draw a longer filament than less tacky solutions; non-tacky solutions are not drawn across the airspace at all. A graduated cylinder is used as the container; the siphon draws the level down until the filament breaks. The maximum height of the filament supported by the vacuum is recorded as the string length.

A comprehensive discussion of this test method is available. The ductless siphon test is based upon a paper, *Evaluating Tackiness of Polymer Containing Lubricants by the Open Siphon Method: Experiments, Theory, and Observation,* which was authored by scientists from **FUNCTIONAL PRODUCTS INC.** and the University of Akron Department of Polymer Engineering.

Incompatibilities:

Like other polymers, tackifier polymers can drop out of solution if the polarity of the diluent is changed. Usually, this problem arises when a polymer is blended with another (more-polar) additive such as a motor oil detergent package, way oil package or a sulfonate emulsifier. In such cases the polymer may drop out of solution. Incompatibility can be avoided by attention to the blending sequence; when blending a polymeric additive and a polar additive, always completely dissolve one additive in the diluent oil before starting the addition of the other.

Blending:

Viscous additives like tackifiers can be difficult to mix into low-viscosity diluents. Poor mixing may cause incompatibility when other additives are added (as stated above). If the agitation is not sufficient for good blending, the easiest solution is to heat the tackifier before blending.

Thermal Breakdown:

Except for **FUNCTIONAL V-378,** polyisobutylene-based tackifiers start to break down above 100°C (212°F). Fortunately, most tackifier applications are at modest temperatures. Some greases, however, are made at higher temperatures and breakdown can occur.

Be especially wary of the long cooling time of grease that is drummed hot.

Shear Breakdown:

The high molecular weight of polymers provides tack in solution. While some tackifiers are more shear-stable than others, shear will eventually break down any tackifier. The shear that occurs in agitating with air or with ordinary open propellers is typically not a serious problem. Shear in pumping, however, frequently leads to loss of tackiness. Best practice is to use a diaphragm pump or centrifugal pump, without pump recirculation during blending. The number of transfer operations should be minimized. Be especially careful about devices that re-circulate through a bypass to limit pressure. One solution is to replace the pump with an air-driven diaphragm pump, which will stop pumping when the discharge pressure reaches the limit.

Purchasing Information

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