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FUNCTIONAL PRODUCTS INC.

Functional Products Inc. was founded in 1985. We received our ISO 9001:2008 certification in 2011, 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.

Definitions:

Extreme Pressure Property – (EP)
The ability of a lubricant to reduce scuffing, scoring and the seizure of contacting surfaces when applied loads are high.

Lubricity – The reduction of friction or wear between two load-bearing surfaces, in relative motion, by the addition of a lubricant.

Demulsibility – The tendency of an oil to resist emulsification in the sump.

R&O Package – Provides protection against rust and oxidation within the hydraulic system pump. Primarily for piston pumps.

AW Package – Provides protection against wear, rust and oxidation within the hydraulic system pump. Also, contains anti-foam. Primarily for vane pumps.

Industrial Packages

FUNCTIONAL PRODUCTS Industrial Packages are fully formulated concentrates that are added to a base oil at minimal amounts to create a finished fluid, hydraulic, gear or way oil, that meets all industry standards for the type of fluid.

FUNCTIONAL PRODUCTS INC. offers industrial packages for mineral and vegetable oil to make finished hydraulic fluids, gear oils and way oils. This catalogue presents physical data on these packages and the standards the finished fluids meet. Detailed performance data is available upon request.

Worthy of Note

- FUNCTIONAL PRODUCTS was given the “Best Paper Award” at the 2011 ELGI Annual Meeting in Paris for their paper on polymer compatibility in mineral and vegetable oils.
- In October 2011, FUNCTIONAL PRODUCTS received an award for its paper at the National Lubricating Grease Symposium in Wuyishan, China.
- Dan Vargo, our Senior Research Scientist, was named a Technical Editor for Tribology Lubrication Transactions, the STLE technical journal.
- FUNCTIONAL PRODUCTS provides instruction on polymers to the Advanced Grease Course at the NLGI Annual Conference.

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
FUNCTIONAL offers two high performance gear oils: FUNCTIONAL GA-783 for industrial and automotive uses and GA-785 which is optimized for limited slip differentials and axles. FUNCTIONAL GA-783, a high performance fully formulated multi-functional gear oil additive used in industrial and automotive applications, is recommended for use in industrial and rock drill lubricants.

FUNCTIONAL GA-783 is a proprietary formulation recommended for Group I and Group II base stocks and provides the following performance benefits:

- Proprietary EP chemistry for maximum protection and durability
- Superior copper corrosion protection
- Excellent demulsibility and foam suppression
- Multi-functional performance
- Superior storage stability

FUNCTIONAL GA-785 is a premium multifunctional gear oil additive designed to produce lubricants for use in automotive, light duty or heavy-duty axles and heavy-duty non-synchronized manual transmissions. Lubricants formulated with GA-785 is best used used for limited-slip differential axles.

HANDLING:

FUNCTIONAL GA-783 and GA-785 are skin and eye irritants, and should be handled with suitable personal protection. Their concentrated forms should not be heated unnecessarily, as heating could release fumes which could be an inhalation irritant. The oils made with FUNCTIONAL GA-783 and GA-785 are not hazardous. See the appropriate material safety data sheet for detailed information.

Cold flow improvers impede the crystal formation of mineral and vegetable lubricants to improve performance at low temperature. FUNCTIONAL offers PD-555C for vegetable oils and esters and PD-600 and PD-610 for mineral oils. PD-555C is effective under both rapid cooling and extended storage for use in canola, rapeseed, soybean oils and certain esters. A 0.5% treat rate improves the cold flow properties by 10°C to 25°C.

FUNCTIONAL PD-600 and FUNCTIONAL PD-610 are wax-crystal modifiers used in mineral oils with applications in hydraulic fluids, gear oils, chain stays, pneumatic tools, and motor oils. The selection between PD-600 and PD-610 depends on the compatibility between the cold flow improver and specific chain structure of the base oil. A treat rate of 0.1% may reduce the base oil cold flow properties by 20°C. FUNCTIONAL will test our cold flow improvers on your base oils and report the results to you.
**Additives for Mist Inhibition and Worker Safety**

Misting of metalworking coolants is an environmental and health concern in many metal-removal applications such as milling and grinding. Conventional control technologies frequently involve high capital expenditures and maintenance cost. **FUNCTIONAL MW-612** and **V-162** are additives that greatly reduce the formation of coolant mists, and are especially valuable in equipment that lacks mist-collecting systems.

**FUNCTIONAL MW-612** is for soluble oils, semi-synthetics and full synthetic coolants. It is added tank side at a 0.05% treat rate in the finished fluid, or at a 0.5% in an additive package. **MW-612** reduces misting by 63% at a 0.05% treat rate.

**FUNCTIONAL V-162** is formulated into an oil-based cutting oil to reduce the oil mist during use. Depending on the speed of machining and the viscosity of the cutting oil, treatment levels vary from 0.02% to 0.10% (200 - 1000 ppm). For tank side additions, a weekly replenishment is appropriate, but for high-shear applications such as deep boring might require daily replenishment. **V-162** reduces oil mist by 46% at a 0.1% treat rate.

The test method used in the **FUNCTIONAL PRODUCTS** lab was developed by a major industrial company.

*Copies of the anti-mist test protocol are available upon request.*
Rust & Oxidation Inhibitor Additive Package

**FUNCTIONAL HF-750** is a fully formulated rust and oxidation inhibitor additive package engineered for high-performance turbine grade R&O hydraulic fluids. **FUNCTIONAL HF-750** provides excellent rust and oxidation protection. **FUNCTIONAL HF-750** is a robust formulation designed to cope with moderate water contamination and provide superior filterability for longer life and reduced system maintenance.

**FUNCTIONAL HF-750** is a proprietary blend of rust and oxidation inhibitors optimized to meet the following industry specifications:
- Cincinnati Milacron P-38, P-55, P-54, and P-57
- General Electric GEK-32568
- Solar Turbines ES9-224
- U.S. Military MIL-H-17672D
- DIN 51524, Part 1
- Hagglunds Denison, HF-1
- Hagglunds Denison, HF-0 Bench tests

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<tr>
<th>Typical Properties</th>
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<tbody>
<tr>
<td>Appearance</td>
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<tr>
<td>Specific Gravity</td>
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<tr>
<td>Lbs. per Gallon</td>
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<tr>
<td>Flash Point</td>
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<tr>
<td>Kinematic Viscosity</td>
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<tr>
<td>Nitrogen</td>
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<td>solubility in oil</td>
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<tr>
<td>solubility in water</td>
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<tr>
<td>Treatment Level</td>
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**HANDLING:**
In its concentrated form **FUNCTIONAL HF-750** is a skin and eye irritant, and should be handled with suitable personal protection. The concentrated form should not be heated unnecessarily, as heating could release fumes which could be an inhalation irritant. See the material safety data sheet. The oils made with **FUNCTIONAL HF-750** are not hazardous.

Additives For Biobased Hydraulic Fluid

**FUNCTIONAL HF-560** is a robust hydraulic fluid package which meets rigorous performance data for industrial and military specifications, and is an additive package for making Military Specification MIL-PRF-32073 type hydraulic fluids based on biodegradable esters or vegetable oils. We recommend using refined vegetable oils to pass the Military oxidation requirement. **FUNCTIONAL HF-560** provides oxidation and corrosion protection, extreme-pressure and anti-wear activity, foam resistance and resistance to water.

**TREATMENT LEVEL**
**FUNCTIONAL HF-560** is used at 1.85% by weight in a suitable biodegradable base stock in combination with 0.5 – 1.0% **FUNCTIONAL PD-557** (for low temperature stability) to produce a biodegradable hydraulic fluid. The viscosity of the hydraulic fluid may be raised to ISO 46 or ISO 68 with a thickener such as **FUNCTIONAL V-516**. Mill-PRF-32073 Grades 3 and below may require a partial or full synthetic base stock to pass the low temperature requirements.

<table>
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<th>Typical Properties</th>
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<tbody>
<tr>
<td>Appearance</td>
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<td>Flash Point</td>
</tr>
<tr>
<td>Kinematic Viscosity</td>
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<tr>
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</tbody>
</table>

**HANDLING**
Use normal safe procedures for handling or blending **FUNCTIONAL HF-560**. Heating before blending is not required. Review the current Material Safety Data Sheet before using.
Slide Way Additive Packages

Slide way lubricants are used to lubricate the ways of planers, grinders, horizontal boring machines, shapers, jig borers and milling machines. Our additive packages are formulated to provide high extreme pressure properties, a substantial reduction of friction, excellent wear protection and corrosion inhibition.

For a way lubricant to provide continuing protection to a slide-way, it must remain on the surface. “First-generation” way lubricants contained only oil and sulfurized fats, and did remain on the way despite being washed by coolants.

Most widely used full-performance way lubricants have improved friction-modifying additives that impart excellent protection against “stick-slip” chatter. Unfortunately, these same components make the lubricants sensitive to the alkalinity of synthetic coolants and soluble oils. Our additives are designed to make full-performance way lubricants that have excellent friction properties, are insensitive to alkalinity and are therefore resistant to removal by coolants.

A related problem with way lubricants is their tendency to emulsify in coolants, causing a coolant-management problem. The removal resistance of our additives will reduce the amount of tramp oil to be separated, and the way lube that does enter the coolant will readily separate without emulsification.

FUNCTIONAL PRODUCTS additives permit the formulating of way lubes that have the excellent performance properties of modern way lubes and also have coolant resistance as good as “first-generation” products.

Our WA series of way oil packages provide extreme pressure protection, prevents stick-slip and protects against corrosion of both ferrous and copper alloys. All of our packages meet Cincinnati Milacron standards and one meets General Motors LS-2 requirements. All of the packages resist emulsification in coolants and are easily skimmed. Cincinnati Milacron and LS-2 data available upon request.

<table>
<thead>
<tr>
<th>Property</th>
<th>WA-19</th>
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<tbody>
<tr>
<td>Cincinnati Milacron</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>G.M. LS-2</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Extreme pressure</td>
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<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Lubricity</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Corrosion Inhibition</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Demulsibility</td>
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<td>Excellent</td>
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<td>Black</td>
<td>Amber</td>
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<td>Group I</td>
<td>Group I/II/III/IV</td>
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<tr>
<td>Treat Level wt%</td>
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<td>1.75</td>
<td>1.75</td>
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</table>
Evaluating the Coolant Compatibility of Way Lubricants

The coolant compatibility of a way lubricant is its ability to resist emulsifying into metalworking coolants. This property is important for two reasons: If the way lubricant emulsifies into the coolant, it will be more easily washed off the slide way, and once off the slide way, it will contaminate the coolant. Also, if the way lubricant includes a tackifier, incompatibility can cause the tackifier to come out of solution and accumulate at the top of the sump as a sticky, gummy material. It is critically important to evaluate a way lubricant with the actual coolant. If the coolant is not available, or if the way lubricant is to be used with several coolants, use an aqueous solution of the coolant’s pH. While most way lubricants are resistant to emulsification in neutral water, the friction modifier additive of many way lubricants forms a salt when it is exposed to the alkalinity of many coolants. The salt can act as an emulsifier, and these way lubricants can therefore emulsify into the coolant, even though they are resistant to neutral water.

The ready separation of coolant from the FUNCTIONAL PRODUCTS derived lubricants shows that the way lubricant is resistant to the coolant. When it is otherwise still serviceable, the coolant may be returned to use after merely skimming the tramp way oil. An emulsion from another way lubricant implies that the coolant will remove the way lube from the way, and shows that a more elaborate treatment (such as acidification) would be necessary to separate the oil, a treatment that will prepare the coolant for disposal rather than reuse.

Quantitative Evaluation:
Coolant compatibility can be quantitatively evaluated using ASTM D 6553. In this test, 40 mls of coolant and 40 mls of lubricant are agitated for 5 minutes under standardized conditions. The test is observed every 5 minutes and amount of oil, aqueous phase and emulsion are recorded. The aqueous phase should be either the actual coolant or an alkaline buffer of pH 9.0 rather than distilled water. Separation from neutral pH water, whether tap or distilled, is not predictive of separation from coolants. A good way lubricant will separate within 30 minutes. The Schmidt-Koburg test evaluates similar separation from a variety of coolants over a period of a week.

Qualitative Evaluation:
Sometimes a qualitative evaluation is sufficient. The ASTM D 6553 can be simulated by placing 40 mls of the candidate way lube and 40 mls of the buffer or coolant in a 100 ml graduated cylinder and inverting ten or twenty times. A persistent emulsion or a coolant layer that stays cloudy with tramp oil demonstrates bad compatibility. A good coolant-compatible way lubricant will quickly float to the top of the cylinder and the coolant will become clear.

Blending Way Lubricants
We recommend using paraffinic oils in blending way lubricants. Soluble oil coolants are usually designed to effectively and efficiently emulsify naphthenic oil. These emulsifiers are not as effective with paraffinic oils, so paraffinic-based way lubricants will be more resistant to most soluble oils.

While way lubricant packages and tackifiers are compatible in the finished lubricant, they are not compatible in the absence of the diluent oil. Do not make an additive cocktail by blending the two additives. When blending a way lubricant, be sure that either the way lubricant package or the tackifier is completely dispersed and dissolved before adding the other.

Do you need a better way lubricant?
A bottle test is useful for comparing way lubricants in an office or other non-laboratory environment. Half-fill two glass bottles with coolant. The bottle size is not critical, but bottles taller than about 4 inches (10 centimeters) give results that are easier to see. Add about ¼" (5-6 mm) of way lubricant, seal the bottles and invert a few times. Coolant compatibility is demonstrated by the quick appearance of a clear coolant layer; a coolant-incompatible way lubricant will emulsify into the coolant.
Purchasing Information

Headquarters

FUNCTIONAL PRODUCTS INC.
8282 Bavaria Road
Macedonia, OH 44056
Phone: 330-963-3060
Fax: 330-963-3322
sales@functionalproducts.com
www.functionalproducts.com

North America

United States

East Coast
(CT, DE, Eastern PA, Eastern NY, NH, NJ, MA, MD, ME, RI, VT)
Ivanhoe Industries, Inc.
818 William Leigh Drive
Building H
Tullytown, PA 19007
Phone: 215-547-1200
Fax: 215-946-7411
w.tuszynski@ivanhoeindustries.com

Southeast
(VA, NC, SC, GA, AL, MS, LA, FL, TX)
Lintech International
PO Box 10225
Macon, GA 31297
Phone: 877-546-8324
Fax: 478-784-1745
www.2lintech.com

Midwest
(MO, KS, OK, AR, NM, NE, IA, IL, CO)
Hall Technologies
6300 Bartmer Industrial Drive
St. Louis, MO 63130
Phone: 314-725-2600
Fax: 314-862-7377
www.halltechinc.com

West Coast
(AK, AZ, CA, ID, HI, MT, NV, OR, UT, WA, WY)
Tri-iso, Inc.
2187 Newcastle Ave. #101
Cardiff By The Sea, CA 92007
Phone: 909-626-4855
Fax: 909-621-9119
www.tri-iso.com

Canada
Tempo Canada ULC.
1175 North Service Road West, Suite 200
Oakville, ON Canada
L6M 2W1
Phone: 905-339-3309
Fax: 905-339-3385
bobv@tempo.ca
www.tempo.ca

Mexico
Proaínsa
Toledo 37, Col. Alamos
CP 03400 Mexico City DF, Mexico
Phone: 011-52-555-696-5551
Fax: 011-52-555-696-5420
www.proainsa.com

Canada
Tempo Canada ULC.
1175 North Service Road West, Suite 200
Oakville, ON Canada
L6M 2W1
Phone: 905-339-3309
Fax: 905-339-3385
bobv@tempo.ca
www.tempo.ca

Europe

France, Germany
Lumar France
6 Avenue Eiffel
78420 Carrières sur Seine
Phone: 33-130-150-809
Fax: 33-130-150-313
commercial.france@lumarquimica.com
www.lumarquimica.com

Italy
Lumar Italia
Str. Com. 1e per Campagna
20078 San Colombano al Lambro
(Milan)
Phone: 39-03-71-20-04-63
Fax: 39-03-71-20-04-45
italia@lumarquimica.com
lumarquimica.com

Spain, Turkey
Lumar Quimica, S.L
Ave. Olegario, 1-7, 3 2a
08290 Cerdeniola del Valles
(Barcelona)
Phone: 34-935-947-500
Fax: 34-935-947-501
lumar@lumarquimica.com
www.lumarquimica.com

Switzerland
Interferm AG
Untermühli 9
CH-6300 Zug
Phone: 41-41-725-3510
Fax: 41-41-725-3519
www.interferm.com

Asia

China
Kelly International Co. Ltd.
9th Floor, No. 1055 Changning Rd.
Shanghai, 200050
Phone: 86-21-5239-1188
Fax: 86-21-6212-7646
www.kellychemical.com

Smart Oil & Chemical Limited
5th Floor, Block 10, Lok Sheung Path
Royal Ascot, Shatin
NT. Hong Kong
Phone: 852-2887-5466
Fax: 852-2636-6562
brianay@smart-oil.com

India, Bangladesh
Environ Chem
A-305 Kemp Plaza
Chincholi Bunder Road
Malad (West)
Mumbai 400064
Phone: 91-22-4003-9230/31/32
Fax: 91-22-4003-9240
sales@environchem.com
www.environchem.com

Korea
Inwoo Corp.
2F Weedang Building
50-8 Banghee-Dong
Songpa Gu, Seoul 138-050
Phone: 82-2-2202-7028
Fax: 82-2-2202-7029
www.inwoocorp.com.kr

Singapore
Eweka International Pte., Ltd.
60 Kaki Bukit Place
#04-13 Eunos TechPark
Singapore 415979
Phone: 65-6348-7279
Fax: 65-6745-3865
eweka@pacific.net.sg

Taiwan, ROC
Shiony Chemical Co., Ltd.
12F-8, No. 70, Sec. 2
Roosevelt Road
Taipei 100
Phone: 886-2-2356-0258
Fax: 886-2-2396-8928
shiony@ms31.hinet.net
shiony.taipei@msa.hinet.net

Australia
A. S. Harrison & Co. Pty Ltd.
75 Old Pittwater Road
Brookvale, NSW, 2100
Australia
Phone: 61-2-8978-1000
Mark Anderson, Business Manager-Lubricants
lubricants.ash@harrison.com.au
www.asharrison.com.au