

FUNCTIONAL PRODUCTS INC.

Innovative Chemistry for Lubricants

Advantages of Functional V-255 Polymer:

- **Easy to handle.** The solid pellet polymer eliminates the need for a guillotine and grinder, which saves the customer money. Also, if a viscosity boost is needed the polymer may be easily blended.
- **Rapid solubilization.** The pellets have high amount of surface area reducing blending time. Blending is recommended at < 120 C. The time depends on the customer's current blending set up.
- **Excellent PSSI (shear stability) of 25%**, which allows for formulation in oil blends. Shear stability is a calculated number which compares the change in viscosity of fresh oil against mechanically worked oil. The lower the number, the better. A PSSI of 25% means that 75% of the polymers thickening power have been retained. ASTM-D6278 and ASTM-D 6022.
- **Readily available** from our manufacturing plant in Ohio, or our distribution points throughout the world.

THE CUSTOMER IS RESPONSIBLE FOR CHECKING THE PRODUCT IN ITS APPLICATION. THE EVALUATION SHOULD INCLUDE ALL TESTS APPROPRIATE FOR A GASOLINE OR DIESEL ENGINE OIL. THE RESPONSIBILITY OF END APPLICATION PERFORMANCE IS THE CUSTOMERS

Background and Accomplishments - Functional Products:

- Founded in 1985. ISO 9001:2008 certified. REACH Compliant
- Functional received the "**Best Paper Award**" at the 2011 ELGI (European Lubricants and Grease Institute) Annual Meeting in Paris in May. The topic was polymer compatibility in mineral and vegetable oils. There were 400 delegates from 27 countries.
- Dan Vargo Senior Research Scientist at Functional Products was recently named a Technical Editor to TLT (Tribology Lubrication Transactions, the STLE technical journal).
- Functional Products contributed to the TLT's article on Viscosity Modifiers in the September 2011 and the December 2012 on polymers used in grease.
- Functional Products will provide instruction on polymers to the Advanced Grease Course at NLGI conference.
- Authored technical papers, written chapters in books- Leslie Rudnick's Lubricant Additives chapter on tackifiers, and actively participate in a numerous technical associations throughout the world.
- In October 2011, Functional Products received an award for its paper at the National Lubricating Grease Symposium in Wuyishan China

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COMPETITIVE PRODUCT PERFORMANCE:

	<u>V-255</u>	<u>Lubrizol 7067 C</u>	<u>Keltan 1200</u>
Shear Stability			
PSSI-ASTM D-6022	25.0%	25.0%	21%
Thickening Efficiency			
1% polymer+ ISO 32, cSt	10.5 cSt	11.5 cSt	9.4 cSt
% Polymer = 1000 cSt	13.0%	12.4%	13.0%
Low Temperature:			
ASTM D-5293			
CCS @ -20 C	2447	4070*	2143
ASTM D-97			
8% polymer in ISO 32	-8 C	NA	-12 C
+ .03% PD-610	-27	NA	-33 C
* LZ 7077 had a detergent and add package, which may have decreased low temp results. All products are acceptable in terms of performance.			

APPROXIMATE POLYMER TREAT RATES FOR MOTOR OIL:

	<u>SAE 15/40</u>	<u>SAE 20/50</u>	<u>SAE 25W/50</u>
Base Oil SN 150 ISO 32			
Viscosity Modifier:			
V-255 (pellet by weight)	1.4-1.8%	1.8-2.5%	1.8-2.5%
V-255L (liquid by weight)	12.0%	16.7%	16.7%
Detergent	as recommended	as recommended	as recommended
Pour Point Treat Rate			
Functional PD-610	0.3%	0.3%	0.3%
CCS Vis D-5293	Pass	Pass	Pass
Permanent Shear Stability	25%		

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Functional Products Inc. 8282 Bavaria Rd. Macedonia, Ohio 44056

Ph: 330.963.3060 Fax: 330.963.3322