

VISCOPEX® 4-677

A Shear-Stable Highly Concentrated VI Improver

A RohMax Product



Function

VISCOPEX® 4-677 is a multifunctional engine oil additive combining the functions of viscosity index improver (VII) and pour point depressant (PPD).

This product is designed to formulate multigrade gasoline and diesel engine oils meeting the most stringent specifications set by API, ACEA, and OEMs. It is particularly useful to blenders located in remote areas or where climatic conditions require the use of polymers with outstanding handling properties.

Composition

VISCOPEX® 4-677 is a unique low-viscosity emulsion based on ethylene and propylene copolymer in a carrier fluid. Its physical properties are listed in Table 1. (These do not constitute specifications.)

Performance

VISCOPEX® 4-677 is a very cost-effective viscosity modifier with exceptionally high thickening power. It confers good rheological properties to the formulated oil at both low and high temperatures.

The use of VISCOPEX® 4-677 facilitates the formulation of engine oils exhibiting good low-temperature properties at low shear rate: Pour Point (ASTM D97) and borderline Pumping Temperature (ASTM D4684) with a wide variety of base stocks and additive packages. Furthermore, the contribution of VISCOPEX® 4-677 to the viscosity of the oil at 150 °C, and its good resistance to both permanent and temporary viscosity losses, enables formulation of engine oils meeting API and ACEA viscosity and shear stability requirements.

VISCOPEX® Series 4 Engine Oil Viscosity Index Improvers

Table 1

Typical Physical Properties of
VISCOPEX® 4-677

Visual Appearance	Turbid
Color (visual)	Brown
Viscosity at 40 °C, mm ² /s (ASTM D445)	7,500
Density at 15 °C, g/cm ³ (ASTM D4052)	0.90
Flash Point, °C (ASTM D3278)	150
Shear Stability Index (ASTM D6278)	28

Characteristics

The characteristics of typical formulations based on VISCOPLEX® 4-677 are shown in Table 2.

Treat Rates

Table 3 summarizes the typical treat rates and percentages of viscosity loss after 30 passes in the Bosch Injector test in the most common SAE grades.

Product Benefits

Highly Efficient VI Improver

Compared to other traditional polymer solutions having the same shear stability, VISCOPLEX® 4-677 offers:

Lower treat rates

- 4 times lower than with a traditional OCP solution
- 2.5 times lower than with a PAMA solution

Reduced storage

- Fewer and/or smaller storage tank(s)
- Fewer drums to store

Reduced transportation cost

- Lower transportation cost per unit of thickening power

Superior formulation flexibility

- Enables increased usage of blender's own base oils
- 4 times more finished oil is produced with one unit of VISCOPLEX® 4-677 compared to traditional OCP solutions

Low Bulk Viscosity

Compared with other traditional polymer solutions, VISCOPLEX® 4-677 – even at room temperature – can be pumped and processed easily and provides:

Reduced storage costs

- Storage tanks
 - Less heating or no heating necessary
 - No special pumps or traced lines
- Drums
 - No need to heat the drums if the ambient temperature is above 20 °C
 - Less product is lost when emptying drums
 - Less cleaning is required when cleaning and recycling drums

Table 2 Characteristics of Typical Formulations

		20W-50	15W-40	10W-40
VISCOPLEX® 4-677	% wt	2.2	2.6	3.4
DI package	% wt	12.0	12.0	12.0
150 SN	% wt	25.8	69.9	63.6
600 SN	% wt	60.0	15.5	–
NEXBASE 3043	% wt	–	–	21.0
KV @ 100 °C	mm ² /s	19.2	14.65	14.8
KV @ 40 °C	mm ² /s	171.7	109.9	97.9
VI	–	127	141	158
CCS SAE J300 May 04	mPa.s	9200	6600	6600
KV 100 °C after shear	mm ² /s	16.7	12.6	12.6
KV 100 °C loss after shear	%	12.9	14.3	15.4
ASTM D 4684 MRV TP-1, SAE J300 May 04	mPa.s	38000	25000	35000
HTHS @ 150 °C	mPa.s	4.9	4.0	4.0
Pour Point	°C	-30	-39	-39

Table 3

Typical Mineral Formulations with VISCOPLEX® 4-677

	Treat Rate % Weight	% of KV 100 °C Loss (ASTM D6278)
SAE 10W-30	1.6 - 2.0	12
SAE 10W-40	3.0 - 3.6	16
SAE 15W-40	2.3 - 2.8	14
SAE 15W-50	3.7 - 4.6	18
SAE 20W-40	0.8 - 1.1	5
SAE 20W-50	1.8 - 2.2	12

Product Benefits

Good Low-Temperature Rheology

VISCOPLEX® 4-677 controls wax crystal formation at cold temperatures. This performance reflects the leadership position of RohMax in the field of low-temperature rheology additives.

Compared to traditional OCP or high-ethylene-content OCP, VISCOPLEX® 4-677 provides advanced formulations:

- No need to include additional pour point depressant (PPD)
- Consistent performance in terms of Pour Point, MRV TP-1, Gelation Index

Density

The typical density of VISCOPLEX® 4-677, as a function of temperature, is provided in Figure 1.

Handling

The exceptional low bulk viscosity of VISCOPLEX® 4-677 extends over a wide temperature range. Even at room temperature, VISCOPLEX® 4-677 can be pumped and processed easily. Typical viscosity values are shown in Table 4.

Bulk Viscosity

The bulk viscosity of VISCOPLEX® 4-677, as a function of temperature, is provided in Figure 2. As an emulsion, VISCOPLEX® 4-677 behaves different from a homogenous polymer solution. When heated above 100 °C, its viscosity increases. Therefore it is not recommended to heat the product above 100 °C.

Figure 1 Density vs. Temperature

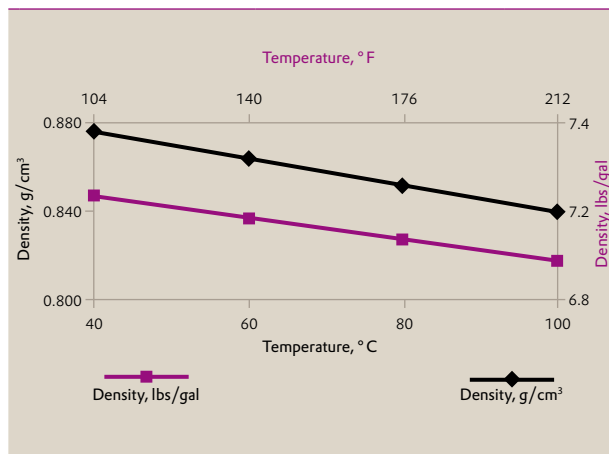
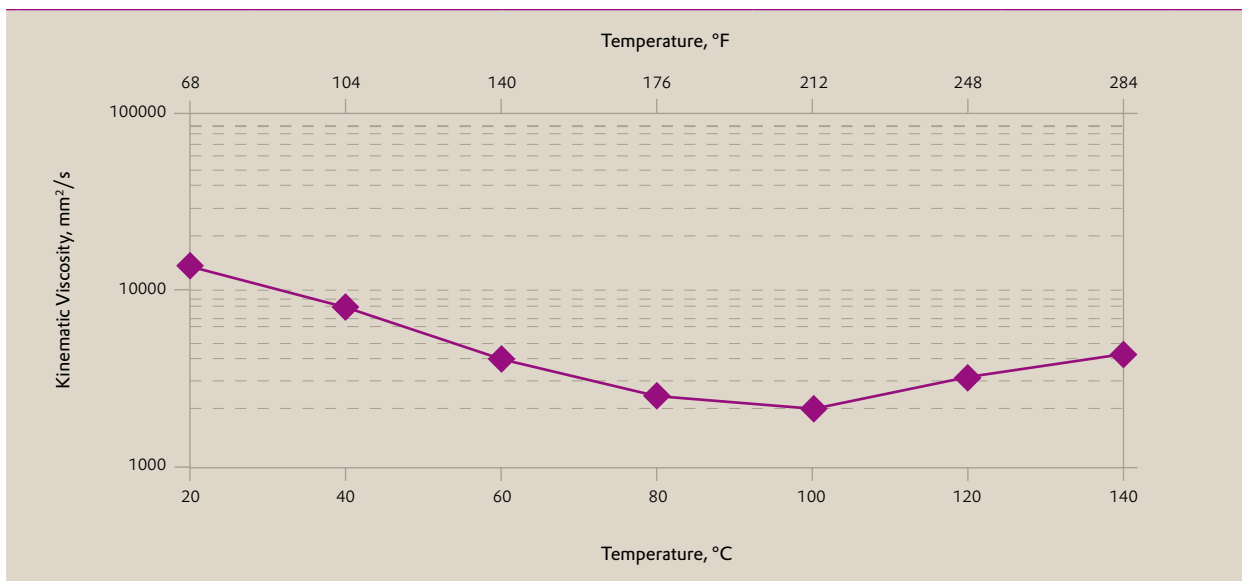


Table 4 Viscosity in mm²/s at:

VII	20 °C	40 °C	60 °C	80 °C	100 °C
VISCOPLEX® 4-677	13000	7500	4000	2500	2000
Traditional OCP	40000	15000	4500	2000	1000

Figure 2 Kinematic Viscosity vs. Temperature



Base Stock Solubility and Compatibility

VISCOPLEX® 4-677 is completely soluble in most types of conventional base stocks (recommended temperature shown in following section, "Storage Life and Transfer Temperature") and at any concentration necessary to obtain SAE J 300 viscosity classification requirements. The addition of solvents or other additive concentrates into VISCOPLEX® 4-677, however, may result in incompatibility. Compatibility should thus be evaluated at appropriate treat levels with the specific detergent/inhibitor (DI) additives.

Storage Life and Transfer Temperature

Like all emulsions, VISCOPLEX® 4-677 has a finite storage life if storage recommendations are not followed.

- **Bulk Storage**

In the absence of circulation or agitation, storage stability is guaranteed for a minimum of one year. If VISCOPLEX® 4-677 can be circulated or agitated at least once every 6 months, it will remain homogenous for several years. Ideally, the bulk storage tank should be fitted with a circulation system.

- **Drum Storage**

The minimum storage time for drummed material is one year, if the drums are not moved. It is recommended to use the entire content of drums.

VISCOPLEX® 4-677 is a free-flowing fluid even at room temperature. Heating is thus generally unnecessary, if stored at temperatures higher than 20 °C.

- **Maximum temperatures**

Short-term storage and transfer: 100 °C
Long-term storage: 80 °C

Recommended Blending Procedure

Equipment:

Blending equipment requires a tank with an agitator and heating capability to 100 °C. A high shear circulation loop may be used to reduce blending time. Typical total

blending times are 2 to 6 hours depending on temperature and quality of agitation.

Tank height to tank diameter ratio:

$$h_T/d_T = 1 - 2$$

Top entry turbine agitator with agitator diameter to tank diameter:

$$d_A/d_T = 0.2 - 0.5$$

Process steps:

1. Charge 30-50% of the base oil. Agitator should be well covered with oil.
2. Heat to approximately 90 °C and agitate.
3. Charge VISCOPLEX® 4-677 into tank. Charge slowly into a central part of the tank close to the agitator or directly into the suction side of the circulation loop pump.
4. Blend using agitation and circulation loop for 2 to 4 hours.
5. Sample for visual appearance (homogeneity).
6. Add remaining oil.
7. Agitate for 1 to 2 hours.
8. Sample for viscometric properties.
9. Add DI Package or any other required component at the temperature recommended by the supplier.

The above mentioned procedure describes a process for typical blending equipment. Variations in the layout of the blending equipment may affect above stated blending times.

Additional Information

For additional information on product availability, performance data and Material Safety Data Sheets, please contact your RohMax account manager or Customer Service Representative.

For an overview of our entire VISCOPLEX® and VISCOBASE® product range and complete information on handling and storage, please visit the Products & Applications section on our website www.rohmax.com.

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