

# SYNALOX™ Lubricants

**High Performance Polyalkylene Glycols  
for demanding applications**

**DOW**



# Dow Lubricants — Focused on Your Success

## **Dow strength in polyglycols brings customers many benefits.**

The Dow Chemical Company is a science and technology based company and one of the world's largest producers of polyglycols. Our worldwide research, manufacturing, and distribution include facilities in Europe, North America, Latin America, and Asia-Pacific.

With over 30 years experience in polyglycol manufacturing, one of the industry's broadest product lines and a leadership position in new product development, Dow is uniquely positioned to meet the needs of a diverse global marketplace. This success results from expanding our customers' markets through combined knowledge of their requirements and Dow's alkoxylation expertise in joint development applications. Together we focus these resources to help ensure success for our customers and their products.

## **Secure and reliable product supply.**

Dow's unique raw material position means that you can rely on consistent product quality and a secure supply of a full array of polyglycol products. Our position is one of strength because Dow is the back-integrated manufacturer of all three alkylene oxides used to produce polyglycols, with manufacturing locations around the world.

## **Products tailored to customer needs.**

Dow's technical leadership in alkoxylation allows us to design unique polyglycol products to meet standard or exceptional formulation and process needs. We are experts at adjusting polyglycol physical properties to find the ideal polyglycol for your application or to produce a polyglycol to your specifications.

Our research, pilot plants, and manufacturing flexibility enable us to rapidly develop and test new products, then quickly scale-up to deliver the performance qualities required for your tailor-made polyglycol.

Whether you are looking to improve an existing product or to develop an innovative new product, there's a good chance that a Dow polyglycol already exists, or can be readily customized, that will help ensure your success.

## **Technical expertise when and where you need it.**

Dow experts on polyglycol products are regionally located to quickly respond to your needs. They are globally networked to take maximum advantage of years of combined experience. Whether your question involves products, applications, or regulations, Dow offers comprehensive customer service and technical assistance.

## **Safe use and handling**

Dow polyglycol products are easy to store and handle. Safety Data Sheets should be consulted prior to the use of Dow polyglycols. For specific safe use and handling information, or to obtain a Dow polyglycol Safety Data Sheet, contact your local Dow representative.

## **Product stewardship**

Dow encourages its customers and potential users of Dow polyglycols to review their applications for such products from the standpoint of human health and environmental quality. To help ensure that Dow polyglycols are not used in ways for which they were not intended or tested, Dow personnel will assist customers in dealing with environmental and product safety considerations.

## **SYNALOX™ Lubricants – Polyalkylene glycols developed specifically for lubricant applications**

SYNALOX™ Lubricants are helping formulators meet today's ever-increasing demands placed on lubricants. SYNALOX™ Lubricants have been developed with special characteristics that make them ideal choices as base stocks, components, or additives in a wide variety of lubricant formulations. They feature excellent lubricity, high viscosity indices, low pour points, and clean burning properties, which are all important attributes of synthetic lubricants.

While each SYNALOX™ Lubricant has unique properties useful in specific applications, all share the valuable properties listed on page 6.

SYNALOX™ Lubricants are produced by polymerizing ethylene oxide (EO), and/or propylene oxide (PO) in the same molecule. The ratio and order of the oxide addition, together with the choice of initiator and the molecular weight, control the chemical and physical properties of the final polyglycol.

The family of SYNALOX™ Lubricants includes a diverse range of polyglycols with homopolymers and random copolymers on to mono-, di- or multifunctional initiators (See Table 1 and 2 for the SYNALOX™ Lubricants product family).

SYNALOX™ Lubricants expand your formulating possibilities by combining excellent lubrication properties coupled with unique performance properties and broad product mix. SYNALOX™ Lubricants are available in the ISO viscosity range of 22–1000, as water soluble and water insoluble products. They show very good response to conventional lubricant additives and can be formulated to meet the highest performance standards, particularly in applications where high temperatures can degrade petroleum based products. Gear lubricants, compressor lubricants, hydraulic fluids and greases are common applications. Page 6 lists typical applications for SYNALOX™ Lubricants.

## **Custom manufactured products available**

Through our alkoxylation expertise and unique raw material supply, Dow can provide customized solutions that significantly expand your formulation options. We can offer custom manufactured polyglycols to meet your exact specifications or we can suggest alternatives based on your performance requirements.

We have the flexibility to produce polyglycols to a wide range of viscosities, molecular weights, biodegradability, pour points, cloud points, or solubilities in water and petroleum derived oils. Customized Dow polyglycols have provided many opportunities for customers to create or enhance their products and expand their markets.

## **New product development capabilities**

Our research, pilot and manufacturing facilities enable us to rapidly develop and test new products, then scale up to produce the quantities you require. Whether you are working to improve an existing product or to develop an innovative new product, there's a good chance that a Dow polyglycol product already exists, or can be readily customized, that will help ensure your success.

## **Toll blending your polyglycol-based lubricants**

Dow can help you in outsourcing the blending/formulation of your polyglycol based lubricants so that you can focus more on your customer and core businesses. As polyglycols are not miscible with hydrocarbon based oils, they do need dedicated blending plants to avoid production problems and guarantee high quality standards. Such dedicated blending facilities are usually very expensive to operate compared to standard blending plants for hydrocarbon based lubricants. If you would like to discuss this new service, please call us.

# The Family SYNALOX™ Lubricants and Their Typical Properties\*

**Table 1: SYNALOX™ Water Soluble Lubricant Base Stocks**

## Water Soluble SYNALOX™ Lubricants— EO/PO Random Copolymer

SYNALOX™ Water Soluble Lubricants are random copolymers of ethylene oxide and propylene oxide. This family of polyglycols is soluble in cold water, but exhibits inverse solubility at high temperatures. Water based solutions provide low surface tension, good wetting and good penetration characteristics, while also exhibiting low foaming properties. Water soluble SYNALOX™ Lubricants are extensively used in formulations for chemical fiber spin finishes and industrial lubricants. For example, SYNALOX™ 50-30B and SYNALOX™ 50-50B are key base stocks for spin finish lubricants in the production of textured polyester and nylon yarns. Dow offers an extensive viscosity range of water soluble SYNALOX™ Lubricant grades from ISOVG 22 to 1000.

Property	Molecular Weight	Viscosity @ 40°C	Viscosity @ 100°C	ISO Viscosity Grade
Test Method	Note 1	ASTM D445/446	ASTM D445/446	ISO 3448
SYNALOX™ 50-15B	500 g/mole	20 cSt	4.8 cSt	22
SYNALOX™ 50-30B	1000 g/mole	50 cSt	11 cSt	46
SYNALOX™ 50-50B	1300 g/mole	78 cSt	15 cSt	—
SYNALOX™ 55-70B	1600 g/mole	100 cSt	20 cSt	100
SYNALOX™ 50-100B	1900 g/mole	140 cSt	27 cSt	150
SYNALOX™ 40-D150	1900 g/mole	220 cSt	39 cSt	220
SYNALOX™ 40-D220	2500 g/mole	320 cSt	58 cSt	320
SYNALOX™ 40-D300	3400 g/mole	460 cSt	78 cSt	460
SYNALOX™ 40-D700	5300 g/mole	1050 cSt	178 cSt	1000

\*Table contains typical properties, not to be construed as specifications

**Table 1: SYNALOX™ Water Insoluble Lubricant Base Stocks**

## Water Insoluble SYNALOX™ Lubricants – PO Homopolymers

SYNALOX™ Water Insoluble Lubricants are homopolymers of propylene oxide. This family of polyglycols is insoluble in water, but is not compatible with mineral oils. Water Insoluble SYNALOX™ Lubricants are particularly used as base stocks in industrial gear oils, mill, and calender lubricants. Dow offers an extensive viscosity range of water insoluble SYNALOX™ Lubricant grades from ISOVG 32 to 680.

Property	Molecular Weight	Viscosity @ 40°C	Viscosity @ 100°C	ISO Viscosity Grade
Test Method	Note 1	ASTM D445/446	ASTM D445/446	ISO 3448
SYNALOX™ 100-20B	700 g/mole	30 cSt	6 cSt	32
SYNALOX™ 100-30B	850 g/mole	45 cSt	8 cSt	46
SYNALOX™ 100-40B	1100 g/mole	57 cSt	10 cSt	—
SYNALOX™ 100-50B	1300 g/mole	72 cSt	14 cSt	68
SYNALOX™ 100-D95	2000 g/mole	143 cSt	23 cSt	150
SYNALOX™ 100-150B	2600 g/mole	220 cSt	38 cSt	220
SYNALOX™ 100-D240	3800 g/mole	350 cSt	58 cSt	320
SYNALOX™ 100-D450	5600 g/mole	690 cSt	108 cSt	680

\*Table contains typical properties, not to be construed as specifications

Viscosity Index	Flash Point (COC)	Cloud Point (1% Aq.)	Pour Point	Density 20°C	Max. Friction Coefficient	Extreme Pressure Failure Load	Wear Scar (4 Ball)	Seizure Load (4 Ball)
ASTM D2270	ASTM D92	ASTM D2024	ASTM D97	ASTM D1298	Note 2	Note 3	DIN 51350	DIN 51350
172	161°C	60°C	-46°C	1.009 g/cm³	0.15	350 N	0.53 mm	120-140 kg
211	225°C	63°C	-45°C	1.030 g/cm³	0.14	450 N	0.36 mm	140-160 kg
218	238°C	55°C	-42°C	1.040 g/cm³	0.11	450 N	0.44 mm	180-200 kg
225	230°C	53°C	-56°C	1.042 g/cm³	0.11	700 N	n/d	n/d
230	240°C	55°C	-35°C	1.047 g/cm³	0.11	700 N	0.59 mm	180-200 kg
240	240°C	85°C	-38°C	1.082 g/cm³	0.10	850 N	n/d	n/d
250	245°C	80°C	-36°C	1.080 g/cm³	0.10	950 N	n/d	n/d
252	258°C	75°C	-35°C	1.074 g/cm³	0.10	1050 N	n/d	n/d
289	260°C	70°C	-31°C	1.073 g/cm³	0.10	1050 N	n/d	n/d

**Notes:** 1. Molecular weight was determined by gel permeation chromatography.  
2. Determined by oscillation of a steel ball on a steel disc at 30°C and under a load of 200 N.

3. Determined by oscillation of a steel ball on a steel disc at 30°C. Load was increased stepwise by 100 N until failure was detected as a massive increase in the measured friction coefficient.  
n/d = not determined

Viscosity Index	Flash Point (COC)	Cloud Point (1% Aq.)	Pour Point	Density 20°C	Max. Friction Coefficient	Extreme Pressure Failure Load	Wear Scar (4 Ball)	Seizure Load (4 Ball)
ASTM D2270	ASTM D92	ASTM D2024	ASTM D97	ASTM D1298	Note 2	Note 3	DIN 51350	DIN 51350
179	202°C	18°C	-44°C	0.979 g/cm³	0.19	900 N	0.53 mm	160-180 kg
190	213°C	10°C	-41°C	0.983 g/cm³	0.16	400 N	0.45 mm	120-140 kg
192	220°C	10°C	-35°C	0.985 g/cm³	0.12	600 N	0.51 mm	120-140 kg
193	225°C	10°C	-35°C	0.989 g/cm³	0.12	1150 N	0.57 mm	120-140 kg
191	236°C	15°C	-32°C	1.003 g/cm³	0.12	550 N	0.29 mm	120-140 kg
223	244°C	8°C	-31°C	0.999 g/cm³	0.13	700 N	0.46 mm	160-180 kg
230	235°C	9°C	-30°C	1.0025 g/cm³	0.13	450 N	0.54 mm	140-160 kg
254	226°C	9°C	-30°C	0.999 g/cm³	0.13	350 N	0.46 mm	160-180 kg

**Notes:** 1. Molecular weight was determined by gel permeation chromatography.  
2. Determined by oscillation of a steel ball on a steel disc at 30°C and under a load of 200 N.

3. Determined by oscillation of a steel ball on a steel disc at 30°C. Load was increased stepwise by 100 N until failure was detected as a massive increase in the measured friction coefficient.

## Unique Properties of SYNALOX™ Lubricants

**Viscosity** – SYNALOX™ Lubricants are commercially available in ISO viscosity range 22 to 1000.

**High Viscosity Index** – SYNALOX™ Lubricants have very high viscosity indices compared to petroleum derived base stocks and other synthetic lubricants and range typically from 180 to over 250.

**Excellent Lubricity** – SYNALOX™ Lubricants have outstanding overall load carrying capacity, film strength, and anti-wear properties.

**Cleanliness, No Sludge Formation**– SYNALOX™ Lubricants do not decompose to form sludges and carbon lacquers at high temperatures as is the case with other lubricant base stocks, which are subject to degradation and polymerization.

**Excellent Stability** – SYNALOX™ Lubricants exhibit high stability to heat, air (with addition of appropriate antioxidants), acids, alkalis and high shear environments.

**Low Pour Point** – SYNALOX™ Lubricants usually exhibit very low pour points ranging from -30°C to lower than -50°C. They do not contain nor require pour point depressants.

**Gas Solubility** – The solubility of common compressed gases, such as natural gas, ethylene, hydrogen, etc. in SYNALOX™ Lubricants is substantially lower than in petroleum oils and polyalphaolefins. Therefore, SYNALOX™ Lubricants maintain their viscosity better in intimate contact with such gases, thus providing thicker lubricant films and better lubrication.

## Typical Applications for SYNALOX™ Lubricants

**Gear Oils** – Excellent friction modification properties coupled with high thermal stability and high viscosity index make SYNALOX™ Lubricants the right choice as base stocks for gear oils, especially for worm gears and gears sealed for life. Polyglycols provide the highest energy efficiency in gear oil applications.

**Metal Working Fluids** – Water soluble SYNALOX™ Lubricants are successfully used by formulators as the lubricity base for water soluble cutting and grinding fluids. Heat generated at a cutting tip or other machine tool can cause the polyglycol to come out of solution (inverse solubility) on to the metal surface providing a neat lubricant film. SYNALOX™ Lubricants are also used as lubricants in forming operations, such as drawing, stamping, and rolling.

**Compressors** – SYNALOX™ Lubricants are used extensively as base fluids for compressor lubricants in various applications such as ethylene, natural gas, hydrogen, vinyl chloride, ammonia, helium and nitrogen. The success of SYNALOX™ Lubricants in such applications is due to their adaptable solubility properties, excellent lubricity, high thermal stability and resistance to sludge and varnish formation.

**Mill & Calender Lubricants** – SYNALOX™ Lubricants are the preferred lubricant base stocks for high temperature, large-scale mills and calenders employed in the rubber, textile, paper, and plastic industries, due to their ashless burning characteristics coupled with high temperature stability and excellent lubrication properties.

**Two-Stroke** – Water insoluble SYNALOX™ Lubricants are uniquely adapted for use with air cooled two-stroke engines. The clean burn-off characteristics of SYNALOX™ Lubricants virtually eliminate engine problems related to spark plug fouling, exhaust port plugging, and combustion chamber deposits. SYNALOX™ Lubricants are the preferred lubricant base stock for model engines.

**Hydraulic Fluids** – SYNALOX™ Lubricants feature excellent lubricity and performance characteristics for use as industrial hydraulic fluids for equipment that must operate over a wide temperature range such as year-round outdoor use or high temperature applications. Specific SYNALOX™ Lubricants feature improved environmental properties (biodegradation and aquatic toxicity) over standard petroleum based fluids.

**Greases** – Superior greases can be made with SYNALOX™ Lubricants. These greases—highly adaptable for extreme applications of high and low temperature, as well as for standard uses—are characterized by the excellent properties of the base fluid. The solubility range of the SYNALOX™ product line permits the formulation of water soluble or hydrocarbon-resistant greases.

**Mould Release and Mandrel Lubricants** – SYNALOX™ Lubricants, with their negligible solvent and swelling effects on most natural and synthetic rubber compositions, as well as their excellent lubricity, are ideally suited as anti-stick, coating, and parting agents for the rubber industry. Water soluble SYNALOX™ Lubricants are especially used, as they can be easily rinsed off with water.

## Overview of Polyglycol Applications

Industry/Application	SYNALOX™ Lubricants	DOWFAX™ Nonionic Surfactants	Polyethylene Glycols (PEGs)	Polypropylene Glycols (PPGs)	Methoxypolyethylene Glycols (MPEGs)	Custom Polyglycols
<b>Foam Control Agents</b> DOWFAX™ Nonionic Surfactants and polypropylene glycols are nonionic and are used in a wide range of foam control applications, as neat products or components of foam-control formulations.	●	●	●	●	●	●
<b>Synthetic Lubricants</b> SYNALOX™ Lubricants feature excellent lubricity, low pour points, low volatility, and high thermal conductivity. They are non-varianting, low foaming, compatible with common lubricant additives, and used in a wide variety of lubrication formulations.	●	●	●	●	●	●
<b>Oil and Gas Applications</b> DOWFAX™ DM-Series Nonionic Surfactants are high-performance drilling fluid additives and performance chemicals.	●	●	●	●		●
<b>Detergents/Cleaning</b> DOWFAX™ Nonionic Surfactants are high performance nonionic polyglycols used in environments where low foaming and excellent surfactancy are required.		●	●		●	●
<b>Industrial Surfactants</b> DOWFAX™ Nonionic Surfactants are versatile enough to be used in a multitude of industrial applications including emulsifiers, rinse aids, and wetting agents.		●	●		●	●
<b>Chemical Intermediates</b> Polyglycols have terminal hydroxyl groups that can be reacted to modify the properties of a final product. Their versatility is demonstrated by the reaction of Dow polyglycols with fatty acids to make esters, a common commercial practice.	●	●	●	●	●	●
<b>Cosmetics and Personal Care Products</b> In cosmetic and personal care formulations, polyglycols provide lubricity and compatibility with other ingredients, as well as functioning as thickeners, bases, and carriers.			●	●	●	●
<b>Other Applications</b> Adhesives, agricultural formulations, ceramics, electronics, emulsion polymerization, food processing, inks, leather, paint and coatings, paint balls, paper processing, petroleum chemicals, pharmaceuticals, rubber and plastics, silica cutting, solder assist fluids, textile, and wood preservation.	●	●	●	●	●	●

This table lists a few of the many applications for DOW polyglycols, along with the product types typically used in Europe. Contact your Dow representative for more information on specific polyglycol applications.

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