

# Gliding and release agents for the rubber industry



# About Evonik

Evonik Industries is the creative industrial group from Germany which operates in three business areas: Chemicals, Energy, and Real Estate. Evonik is a global leader in specialty chemicals, an expert in power generation from hard coal and renewable energies, and one of the largest private residential real estate companies in Germany. Our strengths are creativity, specialization, continuous self-renewal, and reliability. Evonik is active in over 100 countries around the world.

The Industrial Specialties Business Line of Evonik Goldschmidt GmbH focuses on pro-

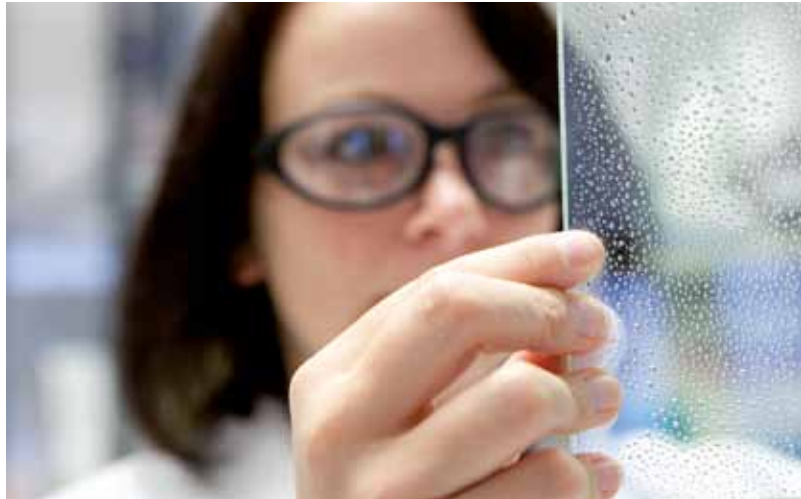
duction of various organic specialty surfactants and organically modified siloxanes. We are a leading producer of antifoams, emulsifiers, anti-corrosion additives, dispersants, water repellents and wetting agents, plasticizers, and radiation-curing release coatings.

With our broad product portfolio and technological expertise, we serve a wide range of industries; such as plastics, rubber, label manufacturers, construction, lubricants, agricultural, and textile.

Products of the rubber processing industry are used worldwide in a large number of applications such as rubber seals for window construction, shaped hoses for automotive manufacture, and garden hoses, to mention only a few examples. Rubber products are distinguished by high durability, flexibility, and moldability. To allow optimal exploitation of the properties of rubber in the end application, process auxiliaries

are needed that enable the production and processing of rubber products in the first place. For the rubber processing industry we offer gliding agents for insertion of rubber seals in window profiles, and release agents for production of hoses and molded rubber parts. Thanks to our many years of experience, global presence, and innovative strength, we can provide you with the ideal support in optimizing your production pro-

cesses. Continual development and improvement of our products in conjunction with our customers is an integral part of our business model, allowing us to offer technical solutions that are economically and ecologically viable, now and in the future. The following graphic shows the applications for which Evonik products are available.



<b>Function</b>	Gliding agent	Release agent		
<b>Application</b>	Rubber seals	Shaped hoses	Long hoses	Molded rubber articles
<b>Product name</b>	GETREN® P	GETREN® R	GETREN® L	GETREN® M
<b>Chemical base</b>	OMS* or silicone oil	OMS*, fatty acid ethoxylates, polyethers		OMS* or polyethers

\*OMS: organomodified siloxane

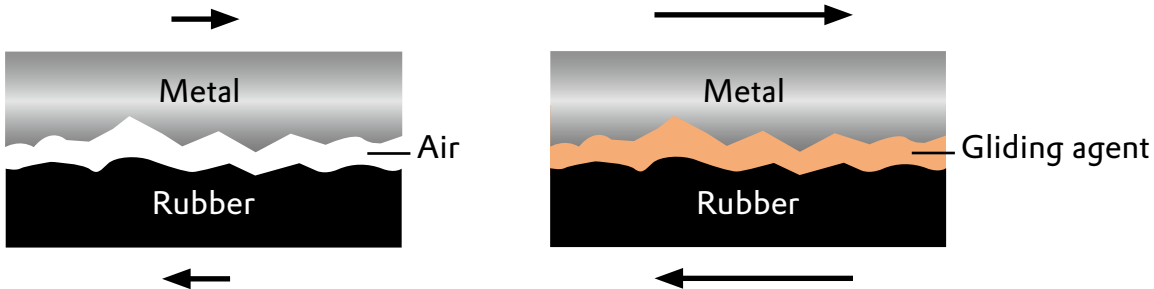
# The GETREN® P series – Gliding agents for window rubber seals

Evonik gliding agents allow rubber seals to be inserted easily into window profiles.

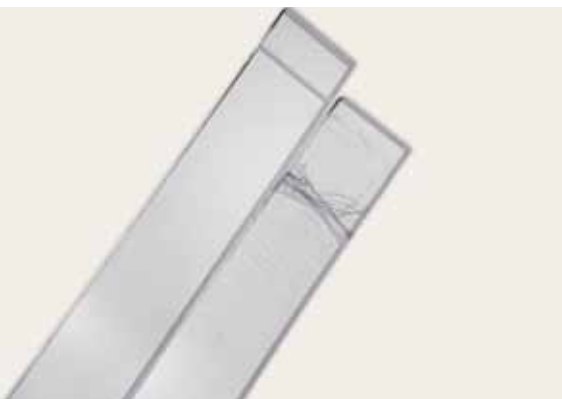
Rubber seals and aluminum window profiles are not easily combined—but the use of a gliding agent considerably simplifies the insertion of rubber seals into a window profile. With the gliding agent, rubber seal and window profile easily attain the correct position; without it, insertion is difficult or even impossible. A gliding agent forms a lubri-

cant film so that rubber and metal are no longer in direct contact. In the absence of a lubricant film, the microscopically rough surfaces of rubber and metal can interlock so that sliding is difficult. By preventing direct contact of the surfaces, the film significantly reduces friction between them.

Surface contact without (left) and with (right) gliding agent



Plexiglas without (left) and with (right) stress cracks

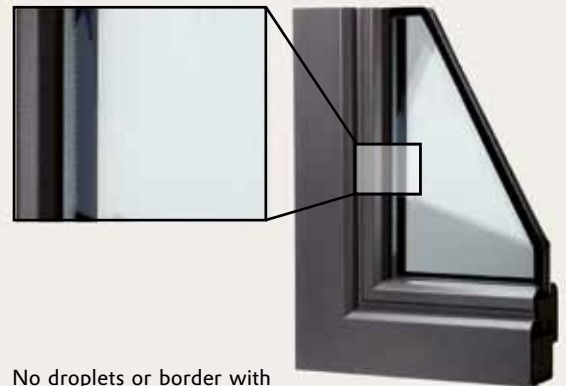


The gliding agents that Evonik offers from its GETREN® P series are water-based silicone oil emulsions as well as gliding polymers that form a solid lubricating film. Products of the GETREN® P series can be applied by dipping or spraying, at the user's choice, after extrusion. Silicone oil emulsions provide excellent gliding action, allowing rubber seals to be inserted into window profiles with little effort.

Specially formulated silicone oil emulsions from Evonik are even suitable for assembly of rubber seals on Plexiglas or polycarbonate plates without formation of stress cracks. Additionally, they offer an outstanding price-performance ratio. A disadvantage of silicone oil emulsions is that they never dry out completely, which could result in staining of the production area or soaking of the transport packaging.



Formation of droplets and a border with the use of silicone oil



No droplets or border with GETREN® P gliding polymers

Effect of gliding agent on self-cleaning glass

Gliding polymers are advanced variants of gliding agents. In contrast to silicone oil emulsions, gliding polymers form a stable dry film on the rubber profile. This means that the gliding polymer does not drip off the profile and offers uniform gliding action over the entire length of the profile. Moreover, a dry film improves occupational safety because floors are not

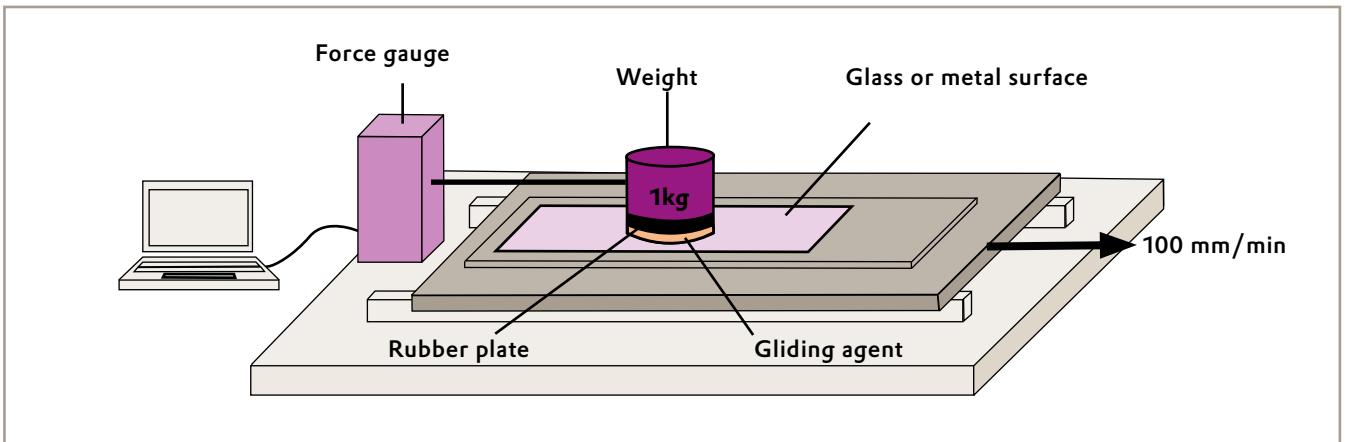
soiled with slippery silicone oil and the transport packaging of the profiles stays dry. Rubber profiles that have been coated with gliding polymers and dried can be used not only with conventional glass but also with self-cleaning window glass. For such glasses the gliding agent must meet special requirements to prevent drop formation at the edges.

## Determination of gliding properties

Products used for coating rubber profiles can be tested by measuring the coefficient of friction or sliding friction (COF). The diagram shows the apparatus used for this measurement. Essen-

tially, the method measures the coefficient of friction, the force required to drag a weight across a glass or metal plate coated with the gliding agent. The more easily the rubber weight can be

dragged, the better is the gliding performance of the product and the smaller the coefficient of friction.

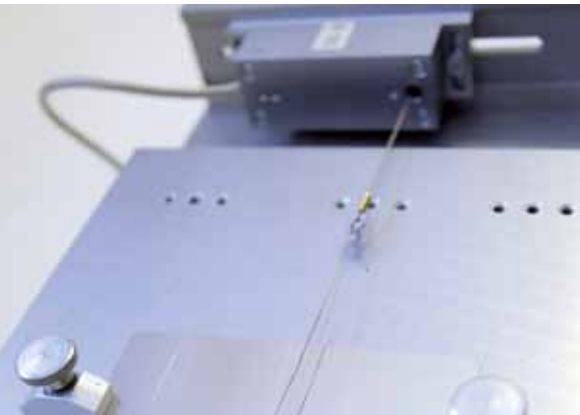


Schematic representation of measurement of COF

The results of the COF measurements are shown in the graphic. The friction coefficient is plotted against time, and uncoated rubber is compared with coated. The gliding action is monitored over a period of 12 weeks to determine the

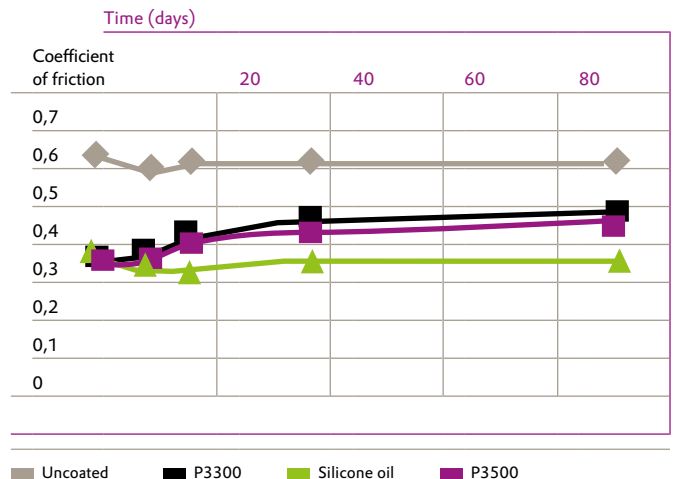
long-term effect of the gliding polymer layer. This is important because a certain time elapses between the coating of the profile and its installation in a window.

Measurement of COF



Coefficient of friction for a rubber surface coated with GETREN® P3500 and P3300 coated with a silicone oil emulsion, and with no coating, relative to an aluminum profile

### Coefficient of friction for GETREN® P3500 and P3300



It is evident that the gliding polymer lowers friction as reliably as a silicone oil emulsion, despite its being a solid coating.

The mini traction machine (MTM) is also suitable for measurement of sliding friction or tribology parameters.

In this case a rubber O-ring coated with gliding agent is attached to a measuring head, which rests on a round plate along. Both, the plate and the measuring head are set to rotation. The intensity of the friction arising from different preset rotational speeds is measured.



Mini traction machine

The measurement method is fast and gives well reproducible values for the coefficient of friction so that it is ideal for use in the development of our products and formulations.

Our well equipped R&D department allows us to react speedily to customer and market requirements and provide appropriate solutions.

**GETREN® P release agents are distinguished by**

- good COFs for metal, wood, PVC and coated profiles
- resistance to stress cracking of PMMA glass as shown by the Röhmer test
- usability with self-cleaning window glasses

# Requirements on release agents for hoses and shaped rubber parts

Release agents must meet special requirements depending on the application. For example, the viscosity of the release agent might be a decisive parameter in ensuring an appropriately low, or somewhat higher, thickness of the applied layer and therefore the required release action. There are also a number of other properties that every release agent must satisfy, regardless of the particular use for which it is intended.

## General requirements

- Very good gliding and release properties
- No negative impact on the physical properties of the rubber
- No negative impact on surface properties
- Temperature stability
- Environmental compatibility
- Corrosion-free application on metallic surfaces
- No odor

## The GETREN® R series – Release agents for shaped hoses

For production of shaped hoses, release agents must perform two tasks. First, in the event of manual shaping of the green tube on the mandrel, they reduce the force required for this process so that the green tube can be brought into the correct position without being damaged. At this stage of production, the release agent functions rather as a lubricant. Second, they facilitate the "release" or demolding of the finished

shaped hose from the mandrel after vulcanization is complete. In this removal process, it is necessary to distinguish between static friction and sliding friction, which must be overcome in succession; both are important for easy demolding.

The force required to overcome static friction is greater than for overcoming sliding friction. Static friction results from burning-up of the rubber on the

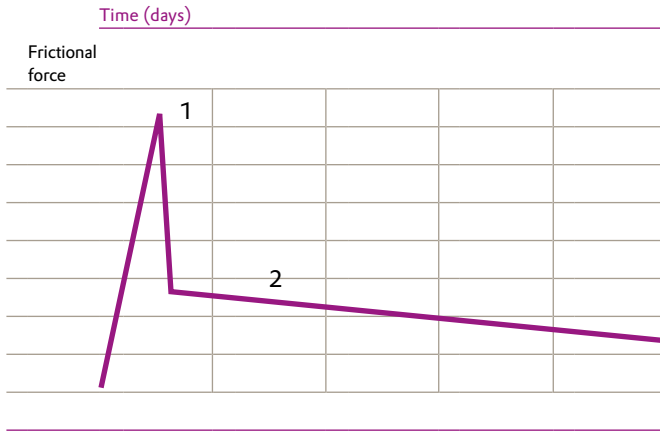
metal surface of the mandrel. It is overcome by an abrupt twist, which loosens the hose from the metal surface.

When the hose is then drawn off, the relatively low sliding friction must be overcome. The graphic shows the force required to overcome the two types of friction.



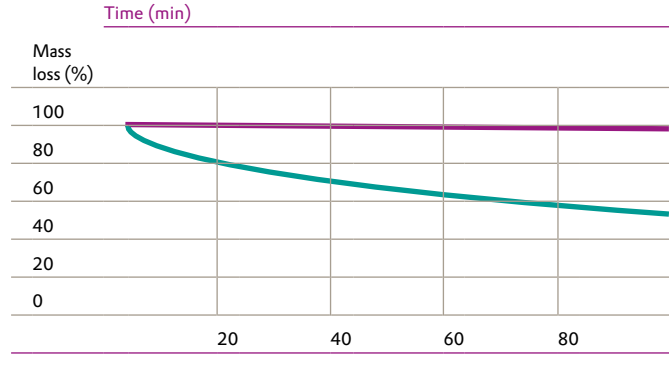
Shaped hoses and their assembly

## Forces in the demolding of a shaped hose



1 = loosening of hose from mandrel (static friction)  
 2 = pulling off of hose from mandrel (sliding friction)

## Thermogravimetric analysis at 180°C



■ GETREN® release agent: low mass loss = good release action  
 ■ Standard release agent: high mass loss = poor release action

Products of the GETREN® R series reliably reduce static as well as sliding friction, allowing continuous and trouble-free production of shaped hoses. In the frequent change processes, they ensure smooth release from the mandrel without time constraints or damage to the inner surfaces or cross-section of the hose.

Release agents should ideally withstand vulcanization without being changed or degraded at the high process temperatures involved. Thermal resistance is a basic requirement for keeping the release agent film liquid over a large number of cycles and ensuring reliable relubrication of the mandrel. GETREN® R release agents from Evonik are extremely resistant to the high temperatures and pressures required during vulcanization.

We use thermogravimetric analysis (TGA) to test thermal resistance. A sample of the release agent is heated to a defined temperature and the loss of mass determined over a period of time. The lower this loss, the lower is the degradation of the release agent. Low degradation in turn ensures good release action after vulcanization is complete.

The graphic shows the TGA curve of a highly thermostable release agent of the GETREN® R series and of a less stable

standard product for comparison. The TGA provides valuable information about the performance characteristics of the release agent in practice. This is particularly important when peroxide cross-linked rubber systems are used that can attack the release agent and destroy it chemically.

Evonik's product portfolio offers, in addition to release agents for standard polymers like EPDM (ethylene/propylene terpolymers) and NR/NBR (natural rubber/nitrile rubber), products for special applications such as ECO (epichlorohydrin copolymers) and acrylic rubbers.

Our particular strength lies in the area of release agents for high-value acrylate rubbers and for high temperature applications. In addition to the general requirements for release agents, we also consider in our product development other special requirements for shaped hoses.

### GETREN® R release agents are distinguished by

- the absence of silicone oil
- fast elimination from the hoses by washing
- temperature stability
- biodegradability

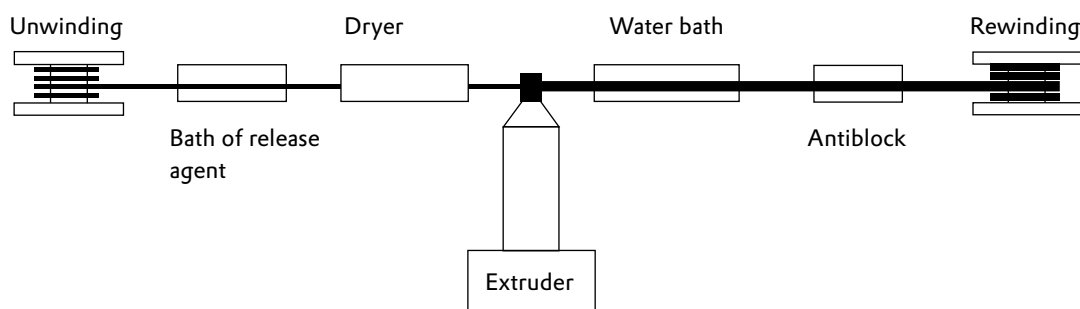
# The GETREN® L series – Release agents for long hose production

Release agents for long hose production are used in the continuous extrusion of rubber on mandrels, with hose lengths between 2 and 400 m. They are applied by dipping or dropping and then dried. Our products are water based, and a certain drying time is needed before extrusion of the rubber on the long hose mandrel to allow a continuous film of release agent to be formed.

The drying time can be kept short by the use of IR lamps or hot air ventilation. If no such equipment is available, it is recommended that the coated mandrels be allowed to stand for at least 24 hours. The diagram shows schematically the process of extrusion of a rubber compound on a coated mandrel, along with the required technical equipment.

**GETREN® L release agents are distinguished by**

- being solvent-free, and generally environmentally compatible in wastewater
- no swelling of the rubber
- usability for all conventional types of rubber
- fast elimination by washing



Schematic representation of long hose production

# The GETREN® M series – Release agents for molded rubber parts

Mold release agents of the GETREN® M series from Evonik can be used for all compression and injection molded rubber parts, drive belts, and conveyor belts.

They allow easy demolding of rubber parts and reduce soiling of the mold surface. This ensures the dimensional accuracy of the molded rubber part and reduces operating costs by significantly increasing the period for which the mold can be used without cleaning (e.g. blasting processes).

Apart from the time saved in process flows, the longer service life of the molds is an important advantage. GETREN® M release agents are naturally formulated so as not to impact corrosion of the mold.

For mold release we offer both silicone oil based and silicone oil free formulations that can be used for all the usual types of polymers in compression and injection processes.

**GETREN M release agents are characterized by**

- temperature stability to 200°C
- formation of a uniform film on the metallic surface of the mold
- no negative impact on the surface of the molded part, e.g. no streaking for application over large areas
- absence of solvents



CV-joint boot

## Process auxiliaries

### GETREN® B 7100 - Antiblock agent for green tubes

Antiblock agents are used before vulcanization to prevent adhesion of the green tubes or finished hoses among each other. The green tubes are usually stored in a box after extrusion and cutting and before

vulcanization. Undesired adhesion may occur during this storage, which our antiblock agent reliably prevents. GETREN® B 7100 can be used for all conventional types of rubber.

### GETREN® D 1570 - Cleaning concentrate for hoses

After vulcanization and release from the mandrel, shaped hoses are cleaned from any adhering residues of release agent in a cleaning step. To ensure the simplest possible yet thorough cleaning, it is useful to add a special cleaning solution to

the washing water. GETREN® D 1570 is a surfactant mixture specially formulated for the needs of the rubber industry and can be used for all conventional types of rubber.

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