

**Lubricants compatible with  
elastomers and plastics**



# Elastomer and plastic compatibility of different lubricants

The application of lubricants in contact with plastic materials is of growing importance. An essential requirement is the compatibility between lubricant and polymeric material. In the BECHEM laboratories a large variety of test equipment is available to check the compatibility of these materials.

BECHEM products for plastic lubrication excel in outstanding compatibility with plastic and have proven their suitability worldwide in many applications under severest conditions.

● resistant    ◐ partly resistant    ○ not resistant

## Lubricating grease group A

Mineral oils with metal soaps, polyurea or inorganic thickeners e.g.:

BERULUB FA 46  
BERUTOX M 21 HT  
BECHEM HIGH-LUB LT 2 EP  
BECHEM HIGH-LUB SW 2

Lubricating greases and their behaviour towards sealing materials (elastomers)	Abbreviation	Elastomers	
	<b>ACM</b>	acrylate rubber	●
	<b>CR</b>	chloroprene rubber	◐
	<b>EPDM</b>	ethylene-propylene-diene rubber	○
	<b>FKM/FPM</b>	fluorinated rubber	●
	<b>FEPM</b>	propylene-tetrafluoroethylene rubber	●
	<b>HNBR</b>	hydrogenated nitrile-butadiene rubber	●
	<b>NBR</b>	nitrile-butadiene rubber	●
	<b>SBR</b>	styrene-butadiene rubber	◐

	Abbreviation	Plastics (thermoplastics/thermosets)	Lubricating grease group A
Lubricating greases and their behaviour towards plastic materials (thermoplastics/thermosets)	<b>ABS</b>	acrylonitrile-butadiene-styrene	●
	<b>PA 6</b>	polyamide (polycaprolactam)	●
	<b>PC</b>	polycarbonate	◐
	<b>PC/ABS</b>	polycarbonate/acrylonitrile-butadiene-styrene	◐
	<b>PE</b>	polyethylene	●
	<b>PET/PBT</b>	polyethylene-/polybutylene terephthalate	●
	<b>POM</b>	polyoxymethylene, polyacetal	●
	<b>PP</b>	polypropylene	●
	<b>PTFE</b>	polytetrafluoroethylene	●
	<b>PU</b>	polyurethane	●
	<b>PVC</b>	polyvinyl chloride	●
	<b>TPE-E</b>	thermoplastic elastomer (polyether/polyester)	◐

THE MENTIONED COMPATIBILITIES ARE BASED ON LABORATORY TESTS AND REFERENCES. IN VIEW OF THE VARIETY OF USED RAW MATERIALS AS WELL AS THE COMPLEX CHEMICAL AND MORPHOLOGICAL STRUCTURE OF THE POLYMERS THE GIVEN INFORMATION REPRESENT GENERAL TENDENCIES ONLY. IN INDIVIDUAL CASES AND ESPECIALLY PRIOR TO SERIAL PRODUCTION THE COMPATIBILITIES SHOULD BE CONFIRMED BY THE SUPPLIER OR VERIFIED IN LABORATORY TESTS.

<b>Lubricating grease group B</b> Diester oils, polyglycols, polybutenes with metal soaps or inorganic thickeners e.g.: BERULUB FK 30 BERULUB FK 35 B BERULUB HYDROHAF 2 BERULUB KR-EL 2 BERULUB KR-EP 2 BERUPLEX LG 21 F	<b>Lubricating grease group C</b> Special ester oils with polyurea or inorganic thickeners e.g.: BERULUB FK 64 BERULUB FK 97 E BERULUB FK 122 BERULUB PAL 1	<b>Lubricating grease group D</b> Synthetic hydrocarbons with metal soaps, polyurea or inorganic thickeners e.g.: BERULUB FB 34 BERULUB FH 57 BERULUB FR 16 BERULUB FR 43 BERULUB FR 70 BERUSOFT 10 BERUSOFT 15 BERUTOX FH 28 KN CERITOL PK 1 CERITOL PK 1 SOFT	<b>Lubricating grease group E</b> Silicone oils with PTFE (polytetrafluoroethylene), metal soaps or inorganic thickeners e.g.: BERULUB FO 34 BERULUB OX 40 EP BERULUB SIHAF 2 BERULUB WAGA 2 FUTURE BERUSIL FO 22 BERUSIL FO 22 F BERUSIL FO 25 BERUSIL FO 26 BERUSIL FO 36-2
○	●	●	●
○	◐	◐	◐
◐	○	◐	●
◐	●	●	●
●	●	●	●
○	●	●	●
○	●	◐	◐
○	◐	◐	◐

<b>Lubricating grease group B</b>	<b>Lubricating grease group C</b>	<b>Lubricating grease group D</b>	<b>Lubricating grease group E</b>
◐	◐	●	◐
●	●	●	●
○	◐	◐	◐
○	◐	◐	◐
●	●	●	●
●	●	●	●
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●	●	●	●
◐	◐	◐	◐

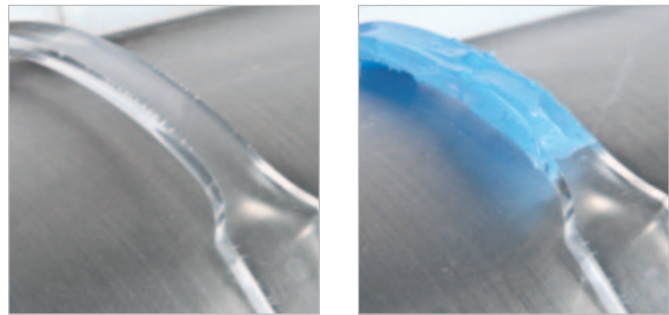
**Lubricating grease group F**  
 PFPE (perfluoropolyether oils) with PTFE (polytetrafluoroethylene) e.g.:  
 BERUGLIDE L  
 BERUTEMP 500 T 2  
 BERUTOX VPT 54-2  
 BERUTOX VPT 64-2  
 BERUTOX VPT 64 BN 3  
 BERULUB FK 33  
 BERULUB FK 164-2

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- Lubricating grease group F**
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# Tension stress cracking caused by lubricants in contact with thermoplastics or thermosets

In case of internal and / or external tensions at formed parts of thermoplastic and thermosetting polymers tension cracks may occur when getting in contact with lubricants.

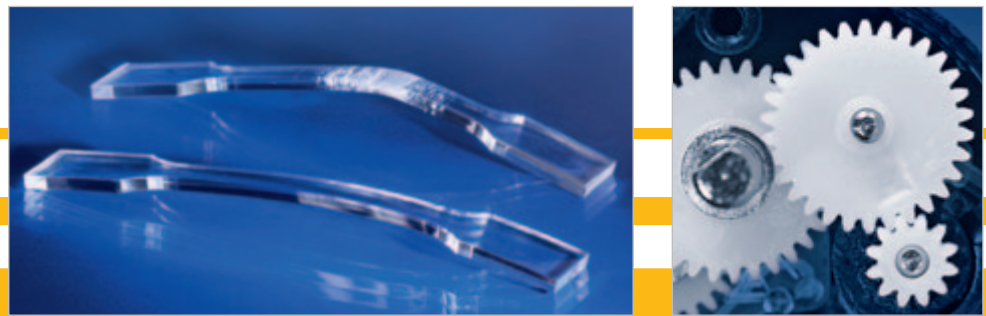


*Test specimen in bent strip test acc. to EN ISO 22088-3 without and with lubricant.*

Caused by wetting, diffusion and lubricant properties the following physical process can take place in case of incompatibility with the lubricant:

Potential microscopically small cavities or tension cracks will lead to breakages due to the wetting and swelling ability of the lubricant. The physical condition of the highly polymeric formed construction part (morphology, molecular mass, molecular mass distribution, branching, cross-linking, internal stress and orientation) determines this process. Polycarbonate, polystyrene, polymethylmethacrylate, styrene-acrylonitrile-copolymer and polyvinyl chloride without plasticizers are especially susceptible to tension cracking. Tension stress cracking behaviour can be determined by using standardised test specimen or the corresponding construction part itself.

Tension crack formation can be partly or fully prevented by selecting the suitable lubricant.



# Swelling or shrinking of elastomer sealing materials (elastomers) in contact with lubricants

In many technical applications elastomers are used as sealing material. In contact with lubricants interaction with the elastomer occurs. There are two ways of interaction:

- physical interaction
- chemical interaction

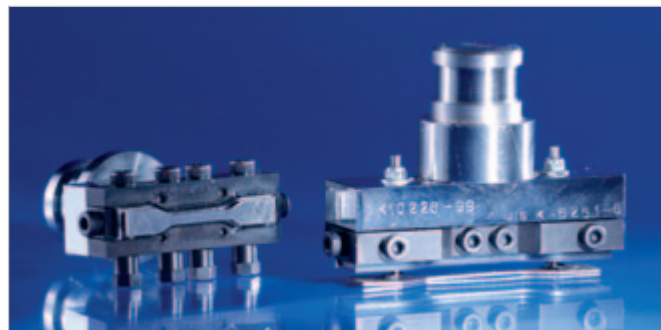
**Physical interaction** comprises two simultaneous processes:

**A: Absorption of the lubricating medium by the sealing material**

**B: Extraction of the soluble parts – especially plasticizers – from the sealing material.**

The result is always a change in volume, i.e. swelling when A exceeds B or shrinking when B exceeds A.

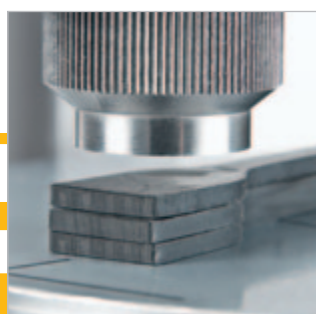
The change in volume depends on the composition of the interacting medium, on the structure of the sealing material as well as on temperature and pressure. Each change in volume – whether swelling or shrinking – causes changes in the mechanical properties of the sealing material. This relates to hardness, elasticity, tensile strength and break elongation. Depending on the extent, these changes may lead to a complete destruction of the sealing material.



*Punching tools for the production of standardised test specimen*

In case of **chemical interaction** the parts of the lubricating medium react with the sealing material which will change its structure, e.g. cross-linking or degradation. Slight chemical changes of the sealing material can lead to serious changes in the physical properties (embrittlement).

The compatibility of elastomers with lubricants is examined according to defined test methods. In most cases changes in volume and hardness as well as tensile strength after a certain time of exposure under well defined conditions are analysed to determine compatibility.



*Tensile strength test (left picture) and hardness tests of elastomers*



## Tomorrow's technologies. Today.

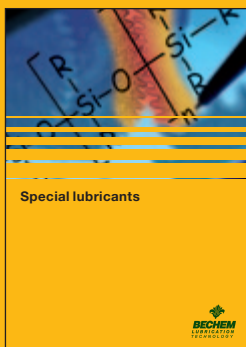
A tradition we are proud of since 1834. This is still today demonstrated by our trademark: the Rhus Flower. After permanent development, BECHEM is today a »Global Player«.

BECHEM special lubricants, industrial lubricants, metal working fluids and solutions for forming technology are based on our extensive experience in the development of special chemistry and on the latest tribologic knowledge. Our know-how with regard to friction, wear and lubrication always takes account of our customers' requirements for economical and ecological optimisation. We feel obliged to tradition and progress.

Besides the headquarter in Hagen, BECHEM has two other production sites in Germany – in Mieste and Kierspe. In addition to that, our worldwide distribution network allows us to develop markets all over the world. With daughter companies in France, India and Switzerland, as well as Joint Ventures in the USA, South Africa, Sweden and China, BECHEM shows its international presence.

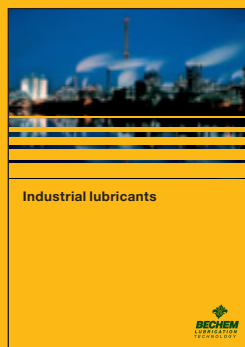
It is our target to supply our customers with high-quality products and to simultaneously meet the corresponding international standards. The quality of our products is guaranteed by our quality management system in accordance with the automotive standard ISO/TS 16949. All our production sites are systematically controlled by internal audits and regular external inspections by the certification association TÜV NORD CERT GmbH. Audits which are regularly carried out by our customers confirm the compliance with our high quality requirements.

**Further information material is available either direct from us or at [www.bechem.com](http://www.bechem.com)**



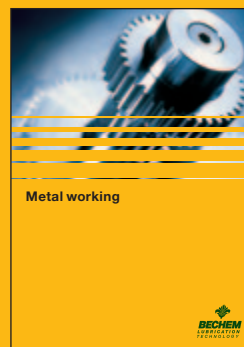
### Special lubricants

- Low and high temperature lubricants
- Plastic lubrication
- Electrical contact lubricants
- Food grade lubricants
- Valve lubricants
- Anti-Friction-Coatings



### Industrial lubricants

- High performance multipurpose greases
- Heavy duty and high temperature lubricants
- Hydraulic oils
- Gear lubricants
- »Green« lubricants



### Metal working

- Coolant lubricants
- Cutting and grinding oils
- Deep drilling oils
- Corrosion protection oils
- Cleaning agents



### Forming technology

- Wire drawing lubricants
- Cold forging oils
- Massive forming
- Tube drawing lubricants
- Sheet forming