

ELASTOSIL®

LUMISIL®

SILMIX®

SILPURAN®

SOLID AND LIQUID SILICONE RUBBER MATERIAL AND PROCESSING GUIDELINES



WELCOME TO THE WORLD
OF SILICONE RUBBER

Contents

Section 1: Silicone rubber – basic principles	6
General characteristics of silicones and why WACKER silicones are so successful.	
Chemical fundamentals, the most important silicone rubber grades, their components and curing mechanisms	
Section 2: Silicone rubber – material and processing advantages	14
Why and when silicone rubber is the material of choice.	
Material and processing advantages	
Section 3: WACKER silicone rubber grades	20
Which applications and properties are typical?	
Overview of the most important applications and properties	
Section 4: Material preparation	26
Temperature, viscosity, additives and what to consider in advance.	
Storing and compounding silicone rubber	
Section 5: Processing of material	38
How to process silicone rubber and where to be careful.	
Extrusion, compression molding, injection molding and coating of textiles	
Section 6: Secondary finishing	62
How to finish cured silicone rubber.	
Post-curing, bonding technology, coating and printing	
Section 7: Service	74
How we support you along the entire process chain.	
Advice on product choice, technical support, customized ready-to-use compounds, WACKER ACADEMY, e-business	
Section 8: Rubber solutions A-Z	82
Facts and figures about silicone.	





WACKER is one of the world's three biggest silicone manufacturers. For over 50 years, we have been developing, refining and producing silicones for a huge variety of applications.

Global production – local customer support

The silicones that WACKER makes at its various production sites world-wide meet identical quality standards. What's more, we have set up technical centers across the globe to offer all manner of support for product selection, manufacturing, and end-product specification.

Close on 100 years of experience – Close on 100 years of innovation

WACKER is one of the most research-intensive companies in the industry. We maintain our own basic-research institute as well as industry-oriented innovation teams in close contact with universities. This enables us to offer you ever more refined solutions.

Silicone rubber – 1,000 and more grades

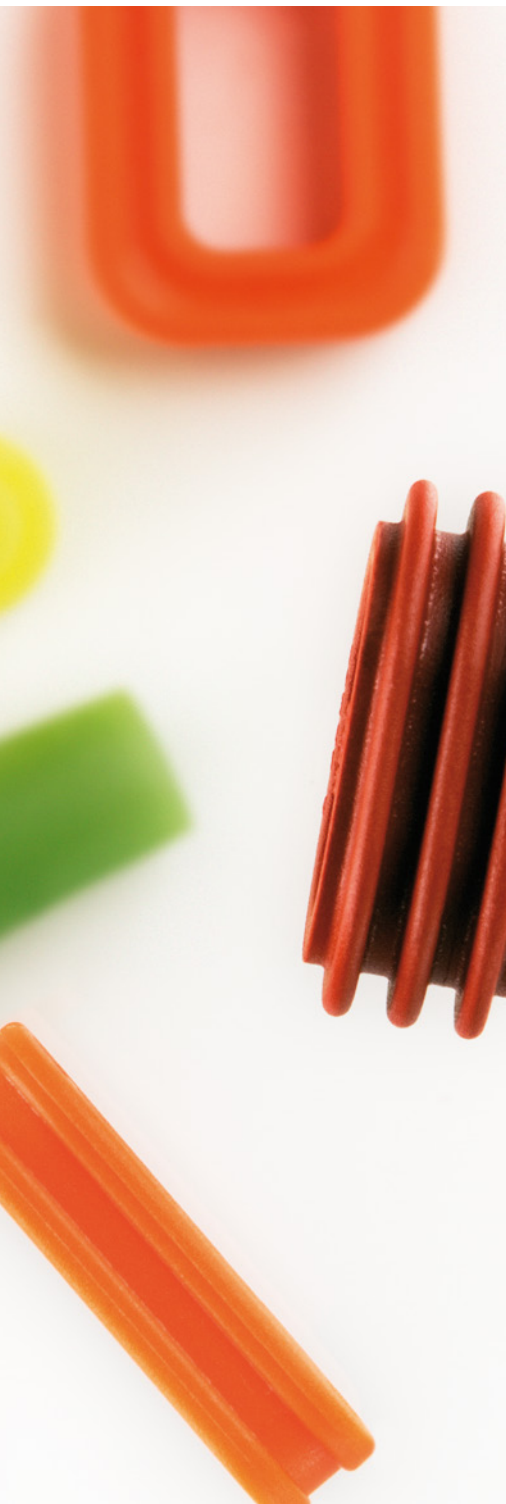
Silicones can be tailored to practically any application. Accordingly, we have a very wide and deep product range. Your choice of product depends on processing parameters and the properties required for the cured rubber product. Our experts will gladly assist you in choosing the right silicone grade.

WACKER production sites for silicone rubber

Burghausen (Germany): Production and technical center
Nünchritz (Germany): Production
Pilsen (Czech Republic): Production
Adrian (USA): Production and technical center
Ann Arbor (USA): R&D center
Chino (USA): Production
North Canton (USA): Production
Zhangjiagang (China): Production and technical center
Akeno-Tsukuba (Japan): Production and technical center
Jandira (Brazil): Technical center
Mumbai (India): Technical center
Amtala (India): Production
Panagarh (India): Production

SECTION 1: SILICONE RUBBER – BASIC PRINCIPLES





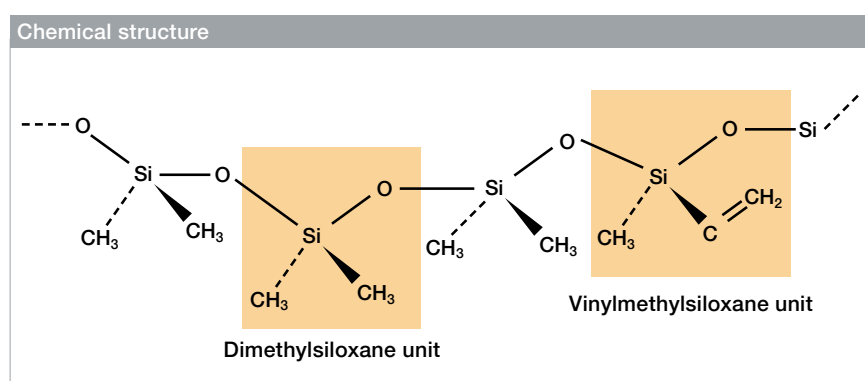
Contents

General characteristics of silicones and why WACKER silicones are so successful

1.1 Chemical structure	8
Why silicone rubber is inherently different from other elastomers	
1.2 Major classes of silicone rubber	9
How solid and liquid silicone rubber grades differ, and what characterizes them	
1.3 Components of silicone rubber	10
Fillers, additives and catalysts, and their role in formulation	
1.4 Curing	12
Peroxide curing and platinum-catalyzed addition curing: Two different processes and their specific advantages	

1.1

CHEMICAL STRUCTURE



From sand to silicone

Silicones are made from quartz sand, a raw material available in practically unlimited quantities. WACKER manufactures silicone monomers in a closed-loop integrated production system based on the Müller-Rochow process, creating the precursors for around 3,000 silicone products.

Sustainable production

The highly integrated energy and raw-material production system is exclusive to WACKER. The by-products of the chemical processes are either used immediately or returned elsewhere to the production loop, so that virtually no waste is generated. Waste heat is also recovered and utilized, increasing the system's overall energy efficiency.

Uncured silicone rubber contains polymers of different chain lengths. It always comprises a principal silicon-oxygen chain (the siloxane backbone) and an organic moiety bound to the silicon. A silicon atom has four valence electrons, which is why silicone rubber is often abbreviated with a Q for "quaternary group". The properties of silicone rubber vary greatly depending on the organic groups and the chemical structure.

The organic groups may be methyl, vinyl, phenyl or other groups. Depending on which organic groups are present, silicone polymers in common use are classified as follows:

MQ

MQ, or polydimethylsiloxane (PDMS), denotes a polymer in which two methyl groups are bound to the siloxane backbone.

VMQ

VMQ stands for a polydimethylsiloxane in which a small number of methyl groups have been replaced by vinyl groups.

PVMQ

PVMQ stands for an VMQ in which a small number of methyl groups have been replaced by phenyl groups.

FVMQ

FVMQ stands for an VMQ in which a small number of methyl groups have been replaced by trifluoropropyl substituents.

1.2

MAJOR CLASSES



Solid silicone rubber bar
(standard supply form)

Aside from polymer structure, the viscosity frequently serves as a classification feature. A distinction is accordingly made between liquid and solid silicone rubber.

Solid silicone rubber

Solid silicone rubber contains polymers with a high molecular weight and relatively long polymer chains. It is referred to as HCR (= high consistency rubber). WACKER offers two product ranges based on solid silicone rubber: a range of peroxide-curing grades marketed as ELASTOSIL® R (R = Rubber) and a range of addition-curing (platinum-catalyzed) grades marketed as ELASTOSIL® R *plus*.

The standard delivery form is as bars measuring 90 x 100 mm (cross-section), which are wrapped in PE film and shipped in cartons. For special requirements, we also offer our ready-to-use blends in the form of strips, round-cords, pellets and profile strips.



Drum pair of liquid silicone rubber
(A and B component)

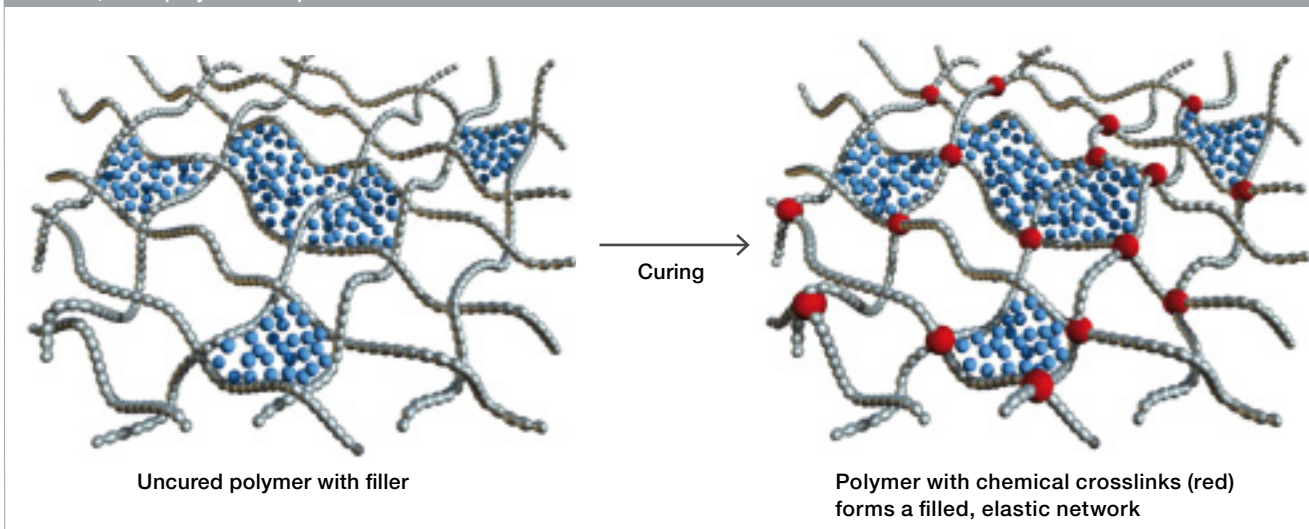
Liquid silicone rubber

Liquid silicone rubber contains polymers of lower molecular weight and hence shorter chains. It also has better flow properties. Liquid silicone rubber is always addition-curing (platinum-catalyzed), and is marketed by WACKER as ELASTOSIL® LR (where LR stands for liquid rubber). LSR grades are supplied as 2-component systems. The A component contains the platinum catalyst, while the B component contains the crosslinker.

- 20-kg pails with a PE inliner (ø inside 280 mm)
- 200-kg drums with a PE inliner (ø inside 571.5 mm)

1.3 COMPONENTS

Uncured, filled polymer compared with cured rubber



Aside from the “pure polymer”, uncured silicone rubber generally contains only three additional substances: crosslinker, fillers and additives.

Crosslinkers

A crosslinker is required to convert the raw rubber into a mechanically stable cured product. Use is made of peroxides or platinum catalyst systems (see section 1.4, pages 12-13, and 4.3, pages 36-37).

Fillers

Fillers are needed to reinforce the elastic silicone network. The nature, composition and quantity of the fillers have a crucial influence on the properties of the raw and cured rubber.

- Reinforcing fillers:
Pyrogenic silica with very high BET surface areas (more than 100 m²/g) is the most frequently used reinforcing filler. WACKER HDK® has proven to be especially effective here, although precipitated silica and carbon black can also be used.
- Non-reinforcing fillers:
These have a fill-up function and are used to adjust certain properties. Quartz, for example, increases the cured rubber's resistance to various media.



ELASTOSIL® COLOR PASTES blend especially easily and fast into rubber compounds on the roll mill

Additives

Compared with other elastomers, silicone rubber requires few additives because the essential properties are determined by the siloxane polymer used. Thus, a finished polymer compound may consist only of polymer and filler. Particularly notable is the fact that silicone rubber is free of curing accelerators or retarders, organic plasticizers and organic antioxidants. Additives include stabilizers, masticating aids and colorants.

Stabilizers

Stabilizers are available for special applications in order to optimize properties such as heat and media resistance.

Colorants

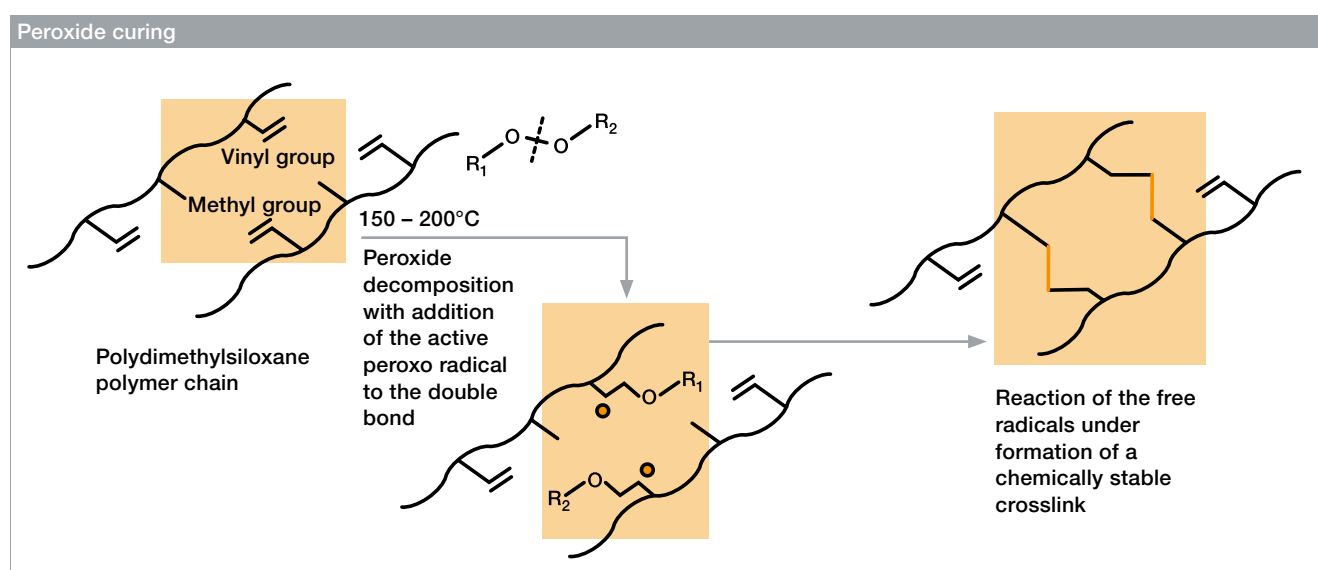
Silicone rubber is generally transparent and can be colored as desired: from transparent through translucent to opaque. WACKER will supply you with suitable color pastes, both for liquid silicone rubber and solid silicone rubber. These color pastes are tailored specifically to the rubber grade in question and are easily blended into the compound while on the roll mill or via metering equipment during injection molding. It should be remembered that some additives are themselves inherently colored.

You will find additional information on fillers, additives, stabilizers and colorants in section 4.3, as from page 31.

1.4

CURING

PEROXIDE CURING



To become an elastomeric material, raw silicone rubber has always to be cured. This can be done either by peroxide or addition curing.

Peroxide curing involves the use of organic peroxides. At elevated temperatures, they decompose to form highly reactive radicals which chemically crosslink the polymer chains. The result is a highly elastic, three-dimensional network. WACKER offers peroxide crosslinkers in paste or powder form.

Advantages

Peroxide curing is a time-tested and technically mature process. Peroxide-curing silicone rubber from WACKER has been in use for more than 50 years and is refined continuously in close cooperation with our customers. The same applies to the production processes, which ensure consistently high quality.

The peroxide-containing compounds are characterized by low sensitivity to catalyst poisons and have a particularly long shelf life.

Processing information

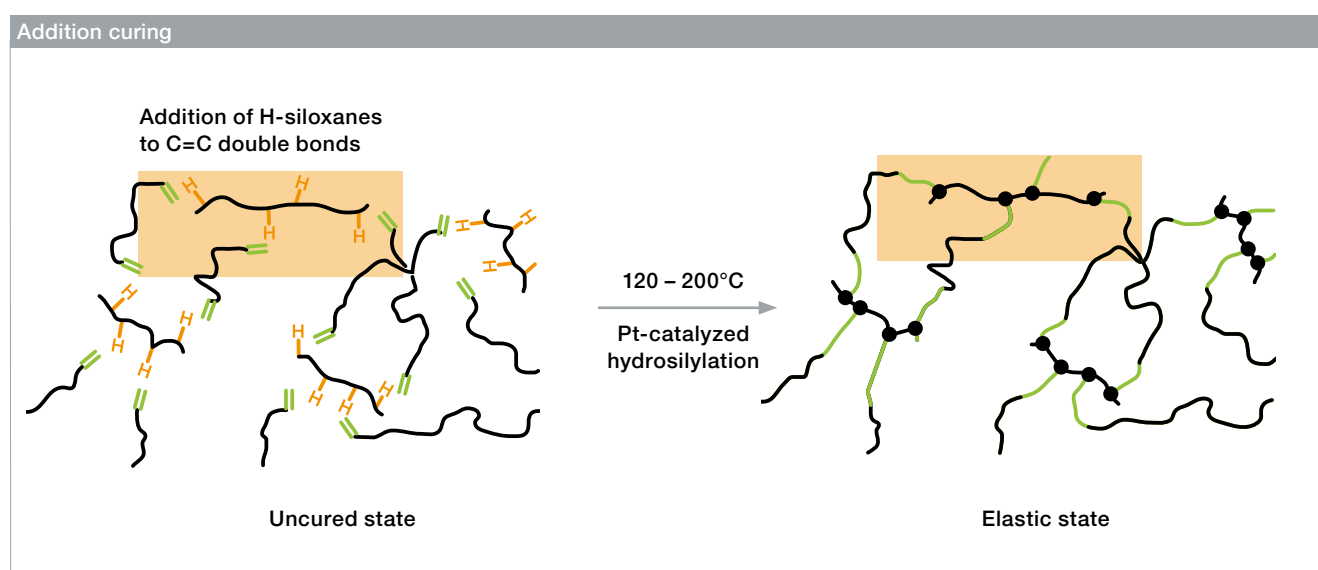
Some peroxide crosslinkers (ELASTOSIL® AUX CURING AGENT C1 and ELASTOSIL® AUX CURING AGENT C6) are inhibited by atmospheric oxygen. Any surface coming into contact with air during curing will cure incompletely and remain sticky.

You will find additional information on the various crosslinkers in section 4.3, page 36.

1.4

CURING

PLATINUM-CATALYZED ADDITION CURING



During platinum-catalyzed addition curing, the crosslinker's Si-H groups react with the vinyl groups of the polymers to form a three-dimensional network. WACKER offers silicone rubber grades which already contain the platinum catalyst as well as grades to which the catalyst must be added prior to use.

Advantages

Unlike peroxide-curing, platinum-catalyzed addition reactions do not produce odor- or flavor-impairing by-products. This is a major advantage for food-contact applications. Curing is fast, and the curing speed can be controlled via the temperature. The cured rubber demolds very easily and has a dry surface, thus facilitating further processing and reducing production cycle times.

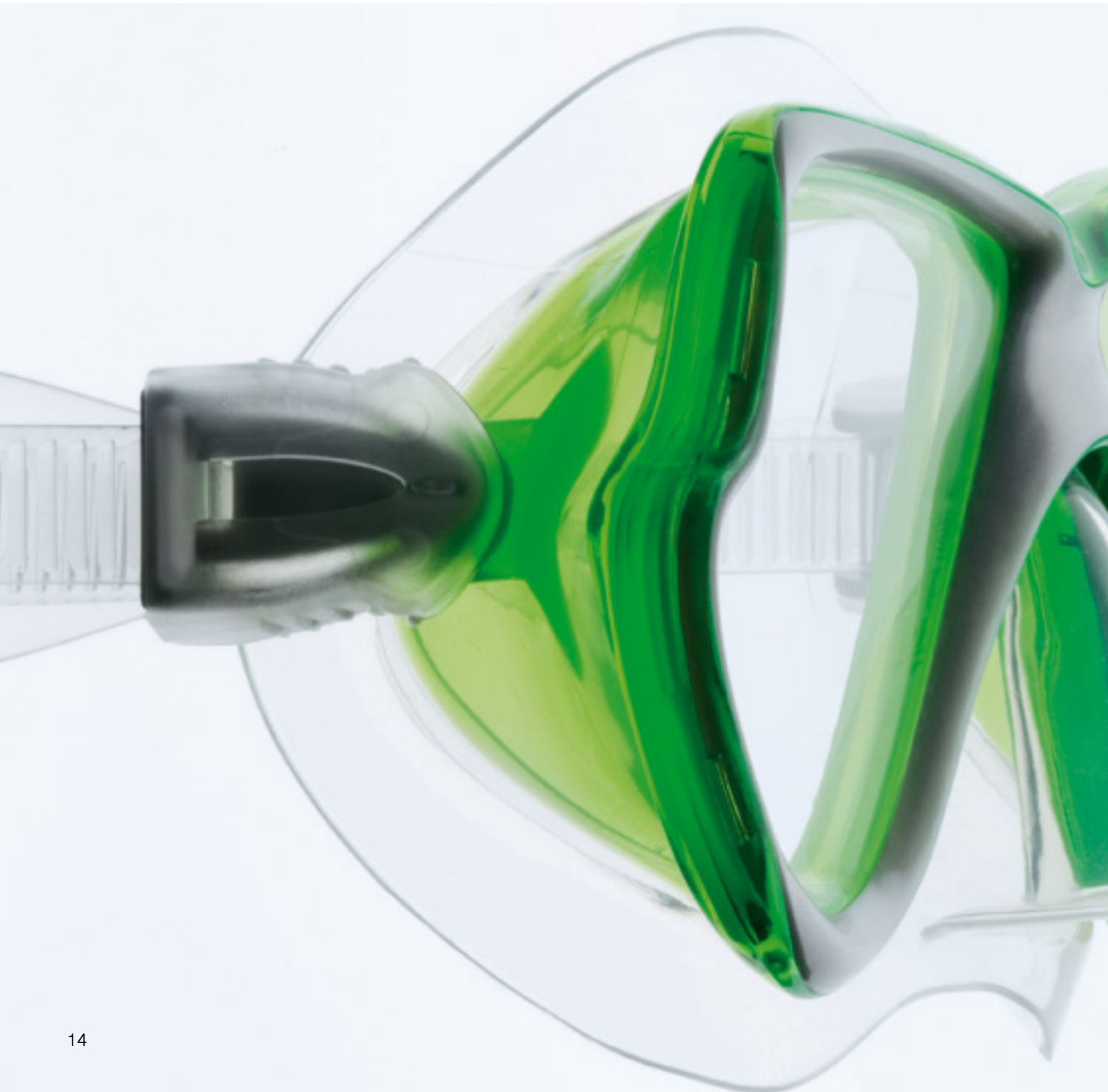
Processing information

Even small amounts of catalyst poisons in the ambient air can inhibit the catalyst, especially amine- and sulfur-containing compounds of the kind encountered during processing of organic rubber grades. For this reason, platinum-catalyzed systems must be stored and processed in a separate room, well away from organic rubber. Roll mills and processing machinery must always be scrupulously cleaned in order to prevent cross-contamination.

You will find additional processing information in section 5, page 39.

SECTION 2:

SILICONE RUBBER – MATERIAL AND PROCESSING ADVANTAGES





Contents

Why and when ELASTOSIL® silicone rubber is the material of choice

2.1 Material advantages

16

Why the property range is unique, and how it differs from other elastomers

2.2 Processing advantages

19

Where ELASTOSIL® solid and liquid rubber grades are particularly efficient

2.1

MATERIAL ADVANTAGES

INHERENT PROPERTIES



ELASTOSIL® silicone rubber is flame resistant and flame retardant. Clothing made of silicone-coated fabric provides vital protection for rescue personnel in action

SILPURAN® silicone rubber is highly transparent, chemically inert, does not contain organic plasticizers and therefore complies with medical standards

ELASTOSIL® silicone rubber is extremely heat resistant, odorless, tasteless and permanently elastic, making it predestined for seals and gaskets

Silicone rubber differs from other elastomers in its unparalleled property range. Of particular interest are the characteristics resulting not from additives or surface treatment but from the polymer and filler structure. These are inherent properties of the silicone rubber.

Material benefits resulting from the polymer structure
Silicones are characterized by a fully saturated backbone of alternating silicon and oxygen atoms. The Si-O links in the chain have an exceptionally high bond energy of 451 kJ/mol. C-C links, by comparison, have a bond energy of 352 kJ/mol. At the same time, the Si-O chain mobility is very high. The organic side groups shield the backbone, so surface energy is low.

This results in the following properties:

- Excellent high-temperature resistance combined with low-temperature flexibility
- High resistance to chemicals and environmental influences
- Water repellent surface

2.1

MATERIAL ADVANTAGES

GENERAL PROPERTIES



ELASTOSIL® silicone rubber withstands continuous high temperatures and dynamic stress, and thus represents the perfect solution for turbocharger hoses

All ELASTOSIL® silicone rubber grades have good mechanical properties. Specialty grades have very high tear resistance, making them ideal for bottle nipples and pacifiers

ELASTOSIL® silicone rubber has good release properties. Since it is odorless and tasteless, it is suitable for the manufacture of baking liners or molds

Material benefits resulting from the polymer/filler structure

Silicone rubber usually contains pyrogenic silica as filler, e.g. HDK® from WACKER. Pyrogenic silica is structurally very similar to the polymer. They both consist predominantly of Si and O which leads to very interesting properties:

- High transparency
- Good mechanical properties thanks to effective polymer-filler interaction
- Good flame resistance; non-toxic combustion products in the case of fire

General properties of silicone rubber

- Broad operating-temperature range from -50 °C to +250 °C, (specialty grades: -110 °C to +300 °C)
- Only slight changes in physical properties between -50 and +180 °C
- Excellent compression set
- Odorless and tasteless (many grades are BfR and FDA compliant)
- Can be pigmented as desired
- Can be easily processed
- Can be adjusted electrically from insulating to semiconducting
- High radiation resistance
- Biocompatible

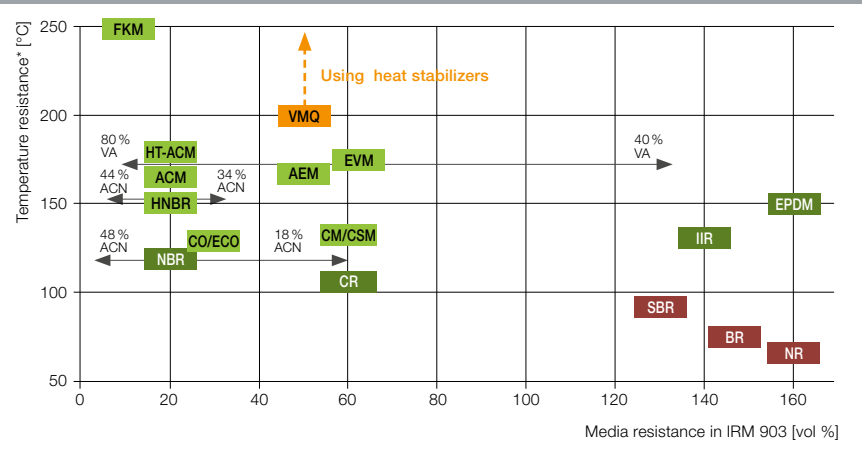
Typical range of mechanical properties

- Density 1.05 – 1.60 g/cm³
- Shore A hardness 3 – 90
- Tensile strength 5 – 11 N/mm²
- Elongation at break 100 – 1,100%
- Tear strength (ASTM D 624) 5 – 55 N/mm
- Compression set (22 h /175 °C) 5 – 25%
- Rebound resilience 30 – 70%

2.1

MATERIAL ADVANTAGES

Temperature and oil resistance (as per ASTM-D 2000/SAE J 200)



Exceptional property profile

Elastomers are generally expected to be heat resistant, oil resistant and flexible at low temperatures. Outstanding performance in any of these properties is likely to come at the expense of the other ones. Silicone rubber is an exception here: it shows excellent mechanical properties over a very wide temperature range and exhibits satisfactory resistance to oil. Silicones also have an outstanding low compression set.

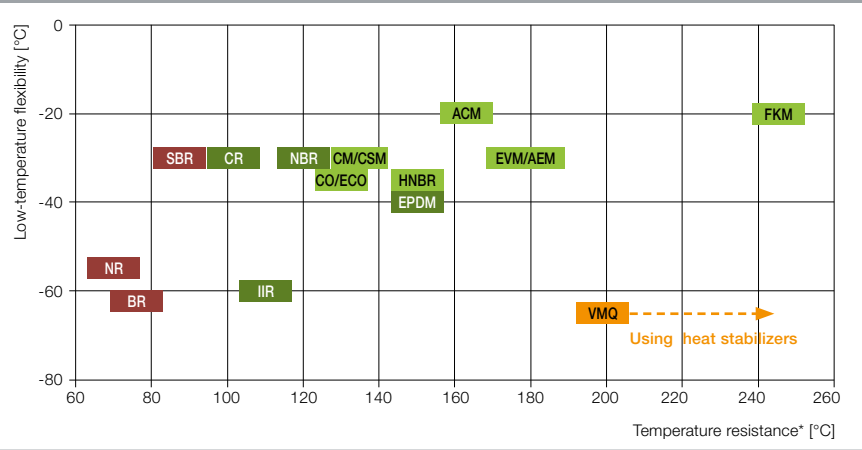
High purity

Compared to other elastomers, silicone rubber is exceptionally pure and is therefore also suitable for use in the food and medical sectors.

Ready-to-use compounds

Silicone rubber is available as ready-to-use compounds or as compounds to which the crosslinker and, if required, pigment, must be added.

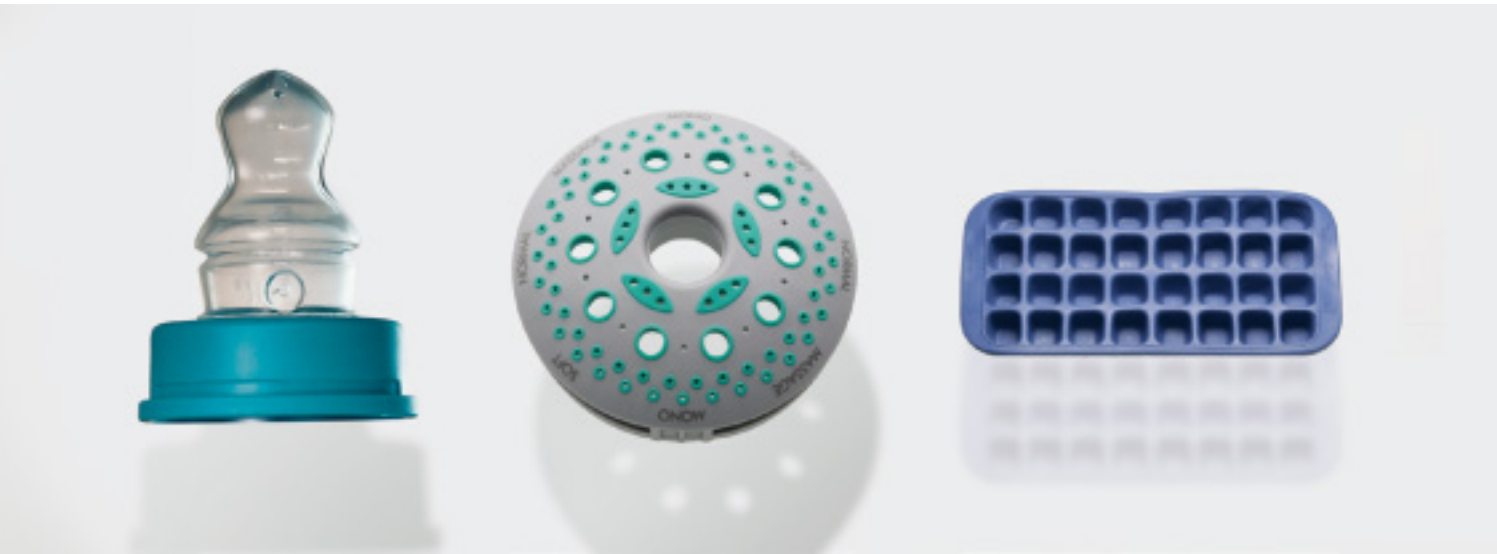
Low-temperature flexibility versus high-temperature resistance



* Temperature at which – after 1000 h – half of the initial elongation at break remains.

2.2

PROCESSING ADVANTAGES



ELASTOSIL® liquid silicone rubber permits mass production of parts without secondary finishing

Self-adhesive ELASTOSIL® silicone rubber grades permit the production of composite materials in a single operation

ELASTOSIL® solid silicone rubber ensures high flexibility when it comes to manufacturing processes and long production runs

Besides curing properties, the processing properties also represent a major criterion for the choice of a suitable elastomer. Liquid and solid silicones each have a large number of processing advantages:

Advantages of solid silicone rubber

- Processing is highly variable, so that, e.g. a wide range of different parts can be made with a few basic silicone grades
- High flexibility for small-to-medium series

Processes:

- Press curing, injection molding
- Extrusion
- Calendering

Advantages of liquid silicone rubber

- Short cycle times (low viscosity, high curing speed)
- Process can be fully automated
- Molds with up to 256 cavities
- Suitable for complex part geometry
- 2K injection molding
- No secondary finishing

SECTION 3:
WACKER SILICONE RUBBER GRADES





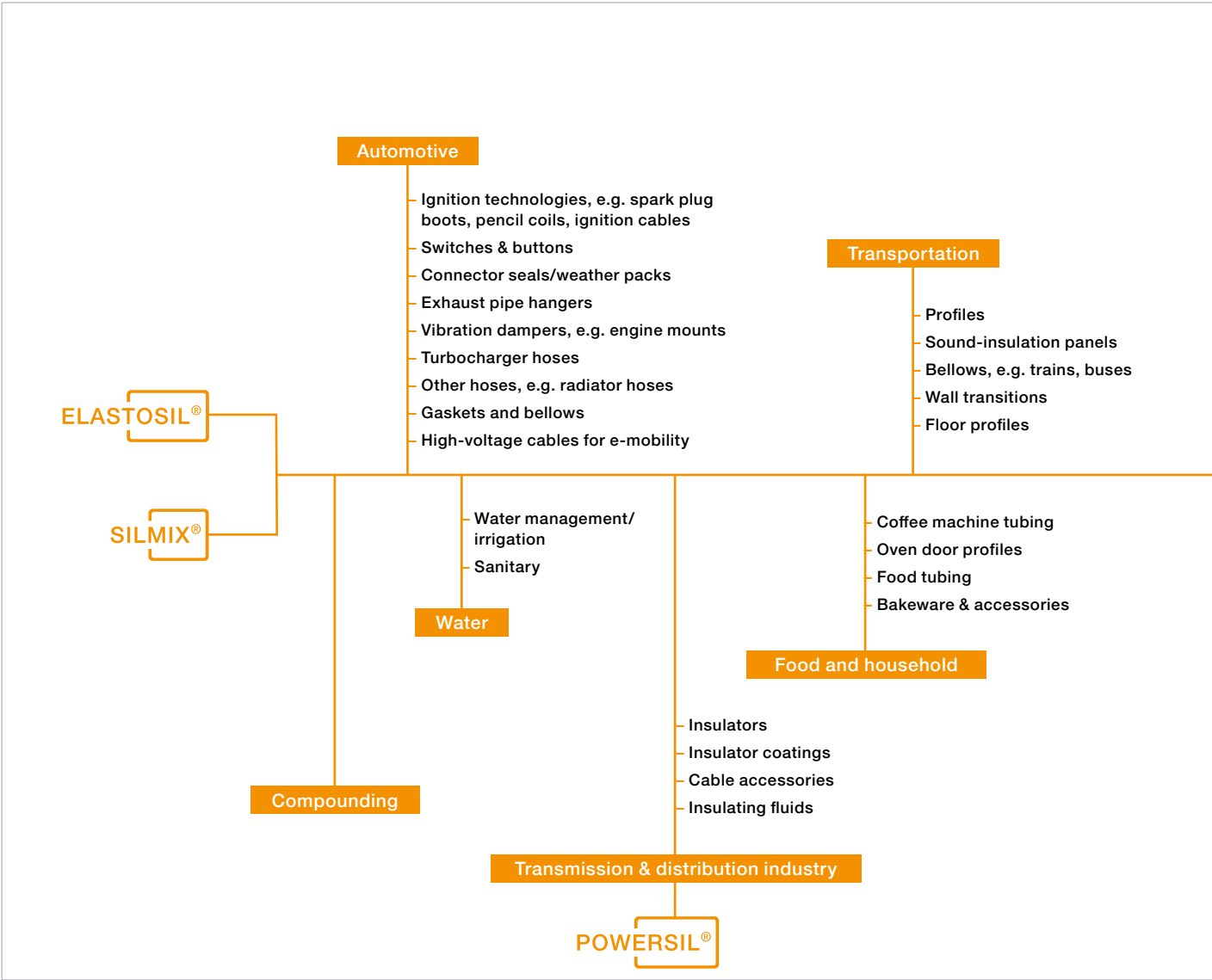
Contents

Which applications and properties are typical?

3.1 Overview of important applications	22
3.2 Overview of typical properties	24

3.1

IMPORTANT APPLICATIONS OF SILICONE RUBBER



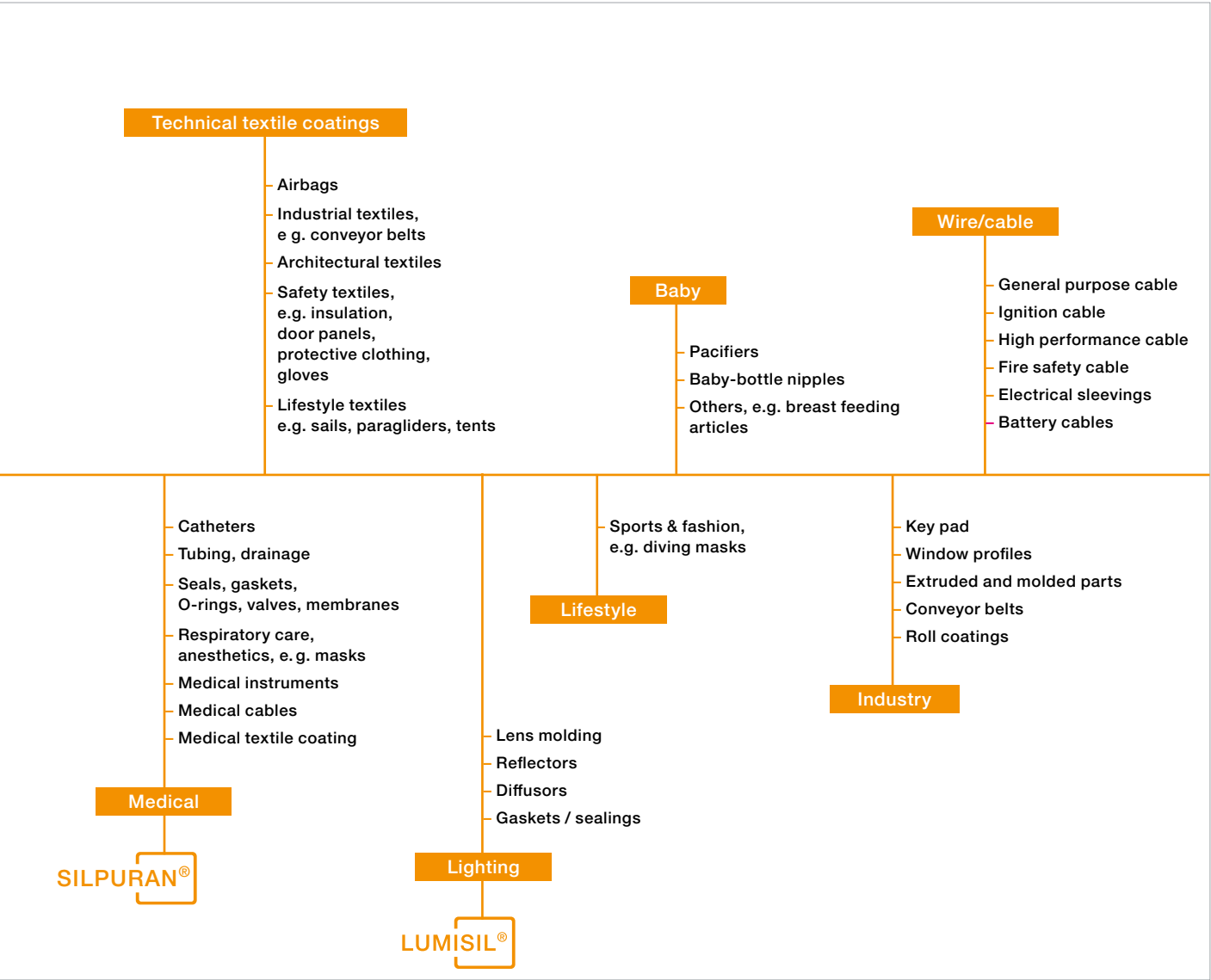
Please also see our applications-specific brochures on medical technology, SILPURAN®, automotive, cables and textile coatings.

Looking for a specific product?

The most important products are listed in the product overviews.

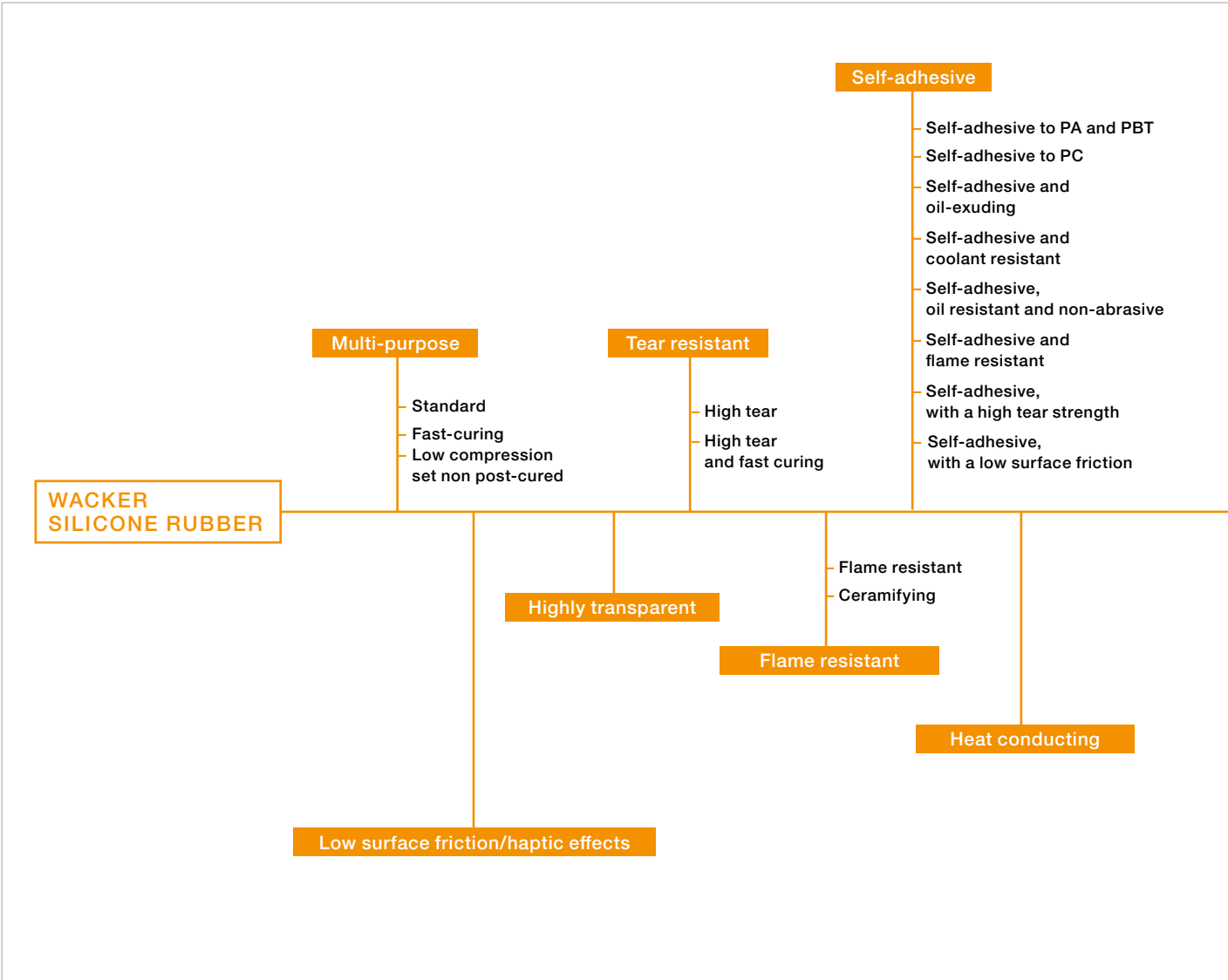
Your application is not listed?

Why not give us a call? Our specialists will quickly tell you whether a particular silicone rubber is the right material for you.



3.2

PROPERTIES OF SILICONE RUBBER

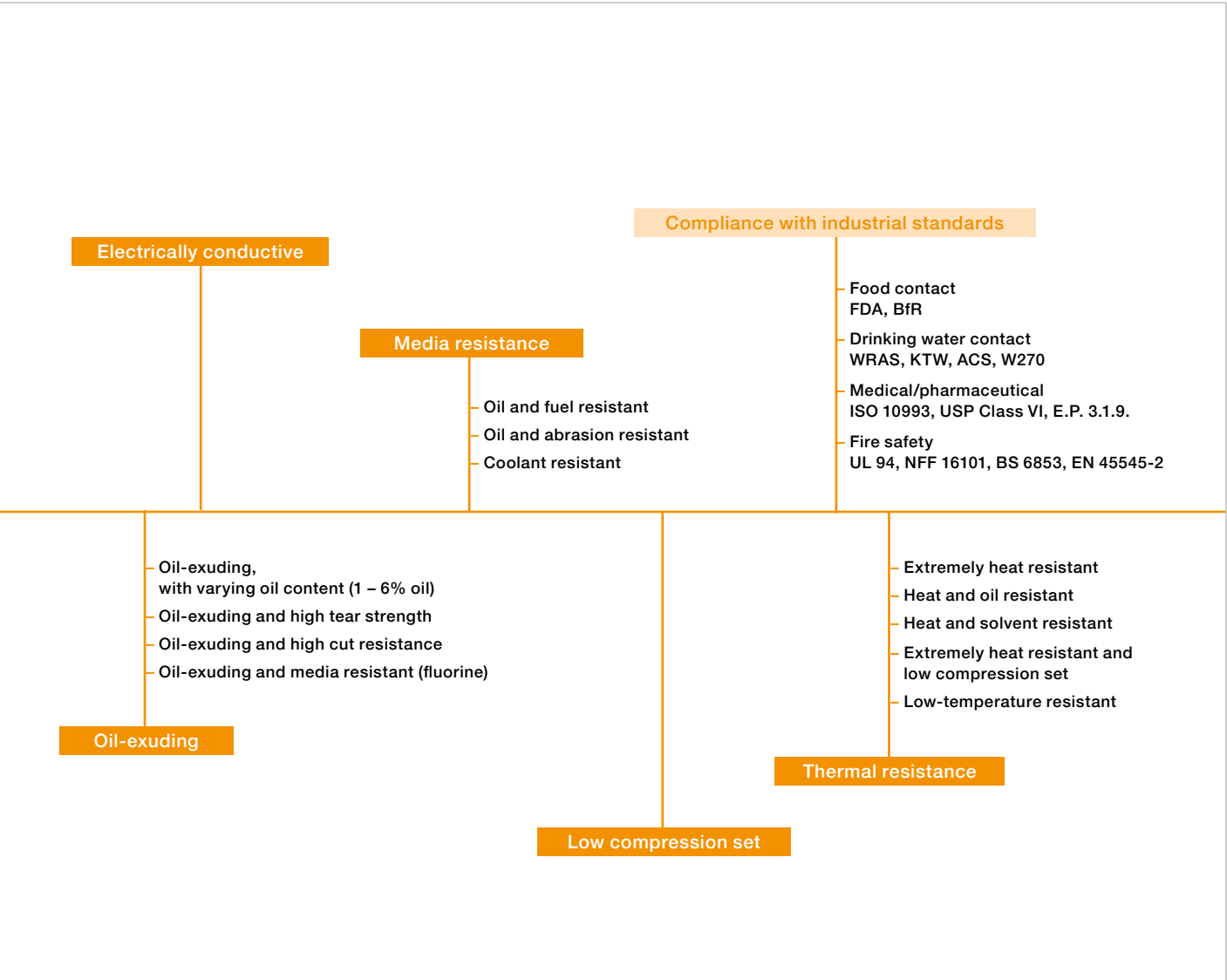


Looking for a specific product?

The most important products are listed in the product overviews.

Your application is not listed?

Why not give us a call? Our specialists will quickly tell you whether a particular silicone rubber is the right material for you.



SECTION 4:
MATERIAL PREPARATION





Contents

Temperature, viscosity, additives and what to consider in advance

4.1 Storage of ELASTOSIL® solid silicone rubber 28
Optimal storage conditions

4.2 Storage of ELASTOSIL® liquid silicone rubber 29
Optimal storage conditions

4.3 Compounding ELASTOSIL® solid silicone rubber 30
Additives, colorants and stabilizers: important information
on roll-mill compounding. When the method of choice is
peroxide curing and when it is addition curing

4.1

STORAGE OF SOLID SILICONE RUBBER



Properly stored, ELASTOSIL® solid silicone rubber has a shelf life of up to 12 months depending on the grade. Products which have been stored longer may also still be usable. For quality assurance reasons, however, you should check that the rubber still has the properties required for the intended use.

Storage-induced increase in Mooney viscosity

Long-term storage of silicone rubber may cause a rise of its Mooney viscosity. This is due to polymer/filler orientation that causes stronger mutual interaction. However, this phenomenon is reversible, and the rubber can be processed in the normal way within the given storage period. The viscosity is reduced when additives are blended in on a roll mill or when the rubber is extruded or compression molded. Rubber which has been stored too long can usually be made suitable for processing by replasticating it on a roll mill. If this doesn't work, a mastication aid may be used in addition.

General information on storing ELASTOSIL® solid silicone rubber

- Store in closed containers in cool rooms at 0 – 30 °C
- Do not expose to direct sunlight
- Keep separate from organic rubber and crosslinker chemicals

Caution:

- If stored above 30 °C, platinum-catalyzed grades and compounds containing curing agent E are particularly susceptible to scorching
- Contact with organic rubber may inhibit the curing system and also cause discoloration

Safety information:

Please consult our safety data sheets if you require additional safety information.

4.2

STORAGE OF LIQUID SILICONE RUBBER



If kept in closed containers at 0 to 30 °C, ELASTOSIL® liquid silicone rubber has a shelf life of up to 12 months from the delivery date depending on the grade. Even if the product is stored for longer than the recommended time, you can usually still use it. For quality assurance reasons, however, please check that the rubber still has the properties required for the intended use.

Viscosity increase

As with solid silicone rubber, the viscosity of liquid silicone rubber may increase during storage. This is due to a particular polymer/filler orientation that can be reversed at any time. Despite its higher viscosity, the rubber can be processed in the normal way within the given storage period. When the rubber is injected into the injection molding machine, the screw generally causes its viscosity to decrease, enabling the rubber to flow better and fill the mold.

General information on storing ELASTOSIL® liquid silicone rubber

- Store in closed containers in cool rooms at 0 – 30 °C
- Higher average temperatures may shorten the shelf life
- Do not expose to direct sunlight
- When opening the container, make sure that no dirt falls onto the surface of the rubber

Safety information:
Please consult our safety data sheets if you require additional safety information.



4.3

COMPOUNDING

ELASTOSIL® solid silicone rubber is characterized by its ease of processing. Most applications involve the use of additives. Typically, the compounding components are blended in the following order: rubber, stabilizers, colorant, cross-linker. At WACKER, compounds which do not contain additives have the affix oH or S (standard). We offer many solid silicone rubber grades in a ready-to-process form (having the affix mH) or as a customized, ready-to-use SILMIX® grade.

Recommendations*

- The roll mills should be temperature-controlled (water cooling)
- Friction should be about 1:1.2. If your roll mills have rough surfaces, soft formulations may stick to them
- The roll nip should be always adjusted in such a way to allow the formation of a sufficient rubber bead (= mixing zone) in the nip
- First feed the harder grade onto the roll mill, then the softer one, and homogenize them thoroughly
- Homogenize the silicone rubber for 2 to 10 minutes before incorporating paste additive
- To speed up and optimize homogenization, make frequent incisions at the edges of the sheet, or roll it up into “dollies” and fold it back into the center of the nip

*All recommendations are intended only as a suggestions and not as instructions for any particular application. It is essential that you check for yourself in how far these recommendations are suitable for your application, your compound and your machine.

4.3

COMPOUNDING

STABILIZERS AND ADDITIVES

For particularly demanding applications, special properties of silicone rubber can be further enhanced by the addition of stabilizers and other additives.

Improving hot-air resistance

Parts exposed to extremely high temperatures, such as turbocharger hoses, need to be heat-stabilized. Special oxides of transition metals (e.g. iron) and special carbon blacks are particularly suitable for this purpose. WACKER supplies ELASTOSIL® AUX H0 – H6 hot-air stabilizers in the form of pastes that are readily incorporated via the roll

mills. The correct choice of stabilizer depends on the curing agent, color and operating temperature. Please note that the ELASTOSIL® AUX CURING AGENT E is incompatible with ELASTOSIL® AUX H3 stabilizer. All other heat-stabilizer grades can be used without restriction. ELASTOSIL® AUX C1 and ELASTOSIL® AUX C6 curing agents can be used safely with all stabilizers. They should therefore be preferably used for colored compounds. As regards liquid silicone rubber, specialty FL color pastes can be added during pigment metering.

Reversion stabilizers

ELASTOSIL® AUX R stabilizer is used as an anti-reversion agent (reversion = breakdown of the network in conditions that exclude oxygen). It also prevents a blooming effect on the surface of non-postcured rubber products by binding by-products of ELASTOSIL® AUX CURING AGENT E (2,4-dichlorobenzoyl peroxide) and ELASTOSIL® AUX CURING AGENT E2. Stabilizer ELASTOSIL® AUX R simultaneously improves the rubber's oil resistance. We recommend adding 0.8 – 1 % paste via the roll mill.

Recommendations for the right choice of heat stabilizer for HCR grades are depicted in the following table		
ELASTOSIL® AUX STABILIZER	Recommended maximum service temperature for HCR grades	
	Peroxide curing rubber	Addition curing rubber
H0	225 °C	225 °C
H1	250 °C	225 °C
H2	250 °C	250 °C
H3	275 °C	275 °C
H4	275 °C	225 °C
H6	300 °C	225 °C
H6 F	300 °C	225 °C

The hot-air resistance of ELASTOSIL® LR grades can be improved by adding ELASTOSIL® COLOR PASTES FL		
ELASTOSIL® COLOR PASTES FL	Recommended maximum service temperature	Recommended amount / %
IVORY RAL 1014	225 °C	2-3
RED BROWN RAL 2001	225 °C	2-3
RED BROWN RAL 2001 K1	225 °C	2-3
RED IRON OXIDE RAL 3013	225 °C	2-3
DEEP BLACK RAL 9005	225 °C	2-3
BLACK RAL 9005 F	225 °C	2-3

4.3

COMPOUNDING

STABILIZERS AND ADDITIVES

Improving flame resistance

If the flame resistance of solid silicone rubber has to be improved, we recommend adding 2.2% ELASTOSIL® AUX BATCH SB 2.

Using a mold-release aid

In the production of press-vulcanized rubber parts, the metal molds are often treated with external release agents, e.g. with ELASTOSIL® AUX Mold Release Agent 32. The internal mold release agent ELASTOSIL® AUX Mold Release Agent A can serve as a feasible alternative. The paste is incorporated into the rubber in a concentration between 0.3 and 1.0%. However, consider the following: ELASTOSIL® AUX Mold Release Agent A slightly impairs the rubber's compression set. We therefore strongly advise you to conduct thorough tests before using it!

Adding fillers on roll mills

Never add quartz powder on an open roll mill because of the silicosis risk. It is better to use products already containing quartz powder, such as ELASTOSIL® R 701 or R 780/80 from WACKER. Small amounts of amorphous fillers, such as diatomaceous earth or pyrogenic silica, can be added on a roll mill fitted with a good ventilation hood.

Fillers and additives

Additive group	Additive
Stabilizer R	ELASTOSIL® AUX Stabilizer R
Heat stabilizers	ELASTOSIL® AUX Stabilizer H0
	ELASTOSIL® AUX Stabilizer H1
	ELASTOSIL® AUX Stabilizer H2
	ELASTOSIL® AUX Stabilizer H3
	ELASTOSIL® AUX Stabilizer H4
	ELASTOSIL® AUX Stabilizer H6
	ELASTOSIL® AUX Stabilizer H6 F
Mastication aids	ELASTOSIL® AUX Mastication Aid 4
Mold release agents	ELASTOSIL® AUX Mold Release Agent 32
	ELASTOSIL® AUX Mold Release Agent A
Flame resistance	ELASTOSIL® AUX BATCH SB 2
Foam batches	

You don't do your own compounding?

WACKER supplies almost 1.000 different ready-to-use rubber grades. We also supply additional, customized grades whenever required. Just ask us about our SILMIX® system!

Description/effect	%	Comments	BfR*	FDA**
Improves oil resistance and reversion stability	0.8 – 1	Lowers reversion tendency (thermal network breakdown) Binds of curing agent E, thus preventing surface blooming Easy to add on the roll mill		
Milky white	0.5 – 2	May cause slight brown discoloration of the cured rubber		
Reddish brown	3		●	●
Beige	2			
Jet black	1.5	Incompatible with ELASTOSIL® AUX CURING AGENT E	●	●
Reddish brown	3		●	●
Beige	3			
Beige	3		●	●
Enhances ease of adding and soft-rolling properties on the roll mill, and stabilizes the viscosity	1 – 3		●	●
Improves mold-release properties; a detergent which is sprayed onto the mold			●	●
Improves mold-release properties; paste for adding to the solid rubber	0.3 – 1	Has a negative effect in the compression set test and should only be used after thorough testing	●	●
Improves flame resistance	2.2			
Upon request				

* BfR XV, Part A, "Silicones", 182. Communication BGBl. 32, 211 (1989).

** FDA Chapter 21 CFR § 177.2600 Rubber Articles Intended for Repeated Use.

4.3

COMPOUNDING

COLORS

WACKER is a “one-stop supplier”. We can supply you with suitable color pastes for both solid silicone rubber grades (ELASTOSIL® COLOR PASTES PT) and liquid silicone rubber grades (ELASTOSIL® COLOR PASTES FL). ELASTOSIL® COLOR PASTES are ready-to-use master-batches comprising specific pigments and reactive silicone polymers which are commonly used to produce ELASTOSIL® silicone rubber. This ensures a homogeneous covulcanization of the color paste without significant impairment of the physical properties (e.g. hardness) and without migration as it may be observed for systems based on silicone oil.

Choosing your color

Choose the color you would like from our range of standard and special colors (see table on page 35 and our separate color paste leaflet). As our color pastes can be mixed in any ratio, almost any desired color shade can be obtained.

Our technical support specialists will gladly assist you in matching a specific color shade in their lab. Many ELASTOSIL® COLOR PASTES FL and PT may be used for coloring silicone parts intended for sensitive applications and complying with recommendation “IX. Colorants for Plastics and other Polymers Used in Commodities” and “XV. Silicones” of the BfR as well as FDA Regulation CFR 21 §177.2600 “Rubber Articles Intended for Repeated Use”. Please check the actual Product Compliance Sheet and/or separate Food Contact Statement and our letter called “U.S. Federal Food, Drug and Cosmetic Act (FDA) Food Contact Conformance Evaluation” of the respective ELASTOSIL® COLOR PASTE for detailed information about food contact, including information about any limitation in the amounts, food types, and/or conditions of use that may apply for this product, before using an ELASTOSIL® COLOR PASTE. Some ELASTOSIL® COLOR PASTES FL and PT have passed tests for biocompatibility according to USP<88> class VI

and selected tests of ISO 10993. Statements are available on request.

Adjusting colors with PT pastes on the roll mill

We recommend to add the PT color pastes together with the crosslinker because a homogeneously colored material will then indicate a uniform distribution of the crosslinker.

Processing tip

We recommend to homogenize PT color pastes on the roll mill before use. In general, PT color pastes are dosed with 1%, FL pastes with 2%. Please note the specific exceptions like e.g. for ELASTOSIL® COLOR PASTE PT BLACK RAL 9005.

Looking for a special color?

Should you require a particular color paste not included in our portfolio of standard and special color pastes, we are happy to check whether a special formulation is possible. Just contact us!



- 1) The RAL values in the table and the color field shown in this brochure are only intended as a guide. The real colors may differ.
- 2) Complies with the requirements of BfR recommendations “XV. Silicones” and „IX. Colorants for Plastics and other Polymers Used in Commodities“ (for details see the actual issue of our Product Compliance Sheet or the separate Food Contact Statement of the respective ELASTOSIL® COLOR PASTE).
- 3) Complies with the requirements of FDA regulation CFR 21 §177.2600 „Rubber Articles Intended for Repeated Use“. Use condition see table 2 in 21 CFR§176.170 (c). Further limits, e.g. with respect to maximum allowed dosage may occur (for details see the actual issue of our letter called “U.S. Federal Food, Drug and Cosmetic Act (FDA) Food Contact Conformance Evaluation”).
- 4) Complies with the requirements of Standard GB 9685-2016 (for details see the actual issue of our Product Compliance Sheet or the separate Food Contact Statement of the respective ELASTOSIL® COLOR PASTE).
- 5) Complies with the requirements under GMC N° 15/2010 (for details see the actual issue of our Product Compliance Sheet or the separate Food Contact Statement of the respective ELASTOSIL® COLOR PASTE).
- 6) USP<88> class VI and selected tests according to ISO 10993. For statements regarding the biocompatibility of our ELASTOSIL® COLOR PASTES FL and PT, please contact our technical service department.

ELASTOSIL® COLOR PASTES PT – standard colors

Product name	Similar to¹ /Suffix	BfR²	FDA³	China⁴	Merco-sur⁵	USP cl. VI / ISO 10993⁶	
ELASTOSIL® COLOR PASTE PT YELLOW	RAL 1016	●	A-H		●	●	
ELASTOSIL® COLOR PASTE PT YELLOW	RAL 1021	●	B-H		●		
ELASTOSIL® COLOR PASTE PT TRAFFIC YELLOW	RAL 1023	●	A-H				
ELASTOSIL® COLOR PASTE PT YELLOW	RAL 1026 F	●	C-H		●	●	
ELASTOSIL® COLOR PASTE PT YELLOW	RAL 1033	●	B-H		●		
ELASTOSIL® COLOR PASTE PT ORANGE	RAL 2004	●					
ELASTOSIL® COLOR PASTE PT ORANGE	RAL 2004 F	●	B-H		●	●	
ELASTOSIL® COLOR PASTE PT PURE ORANGE	RAL 2004 F2	●	B-H		●		
ELASTOSIL® COLOR PASTE PT RED	RAL 3000						
ELASTOSIL® COLOR PASTE PT RED	RAL 3000 F	●	C-H		●	●	
ELASTOSIL® COLOR PASTE PT RED BROWN	RAL 3013	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE PT TRAFFIC RED	RAL 3020	●	B-H		●	●	
ELASTOSIL® COLOR PASTE PT RASPBERRY RED	RAL 3027	●	A-H	●	●		
ELASTOSIL® COLOR PASTE PT VIOLET	RAL 4001						
ELASTOSIL® COLOR PASTE PT RED VIOLET	RAL 4002	●	A-H		●	●	
ELASTOSIL® COLOR PASTE PT ULTRAMARINE BLUE	RAL 5002	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE PT DARK BLUE	RAL 5010	●	A-H		●	●	
ELASTOSIL® COLOR PASTE PT LIGHT BLUE	RAL 5015	●					
ELASTOSIL® COLOR PASTE PT BLUE	RAL 5022	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE PT HELIOGREEN	RAL 6004	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE PT GREEN	RAL 6017	●	A-H		●	●	
ELASTOSIL® COLOR PASTE PT TRAFFIC GREEN	RAL 6024	●	A-H		●		
ELASTOSIL® COLOR PASTE PT GREEN	RAL 6032 F	●	A-H		●		
ELASTOSIL® COLOR PASTE PT GRAY	RAL 7040	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE PT LIGHT BROWN	RAL 8003	●					
ELASTOSIL® COLOR PASTE PT DARK BROWN	RAL 8015	●					
ELASTOSIL® COLOR PASTE PT DEEP BLACK	RAL 9005⁷	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE PT SILVER	RAL 9006	●	A-H				
ELASTOSIL® COLOR PASTE PT WHITE	RAL 9010	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE PT TRAFFIC WHITE	RAL 9016	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE PT BLACK	RAL 9011 F	●	A-H		●	●	
ELASTOSIL® COLOR PASTE PT BLACK	RAL 9017	●	A-H				
ELASTOSIL® COLOR PASTE PT BASIC BLACK	–	●					
ELASTOSIL® COLOR PASTE PT LASER MARKING WHITE	–	●	A-H		●	○	
ELASTOSIL® COLOR PASTE PT LASER MARKING BLACK TRL	–	●	A-H		●	○	

ELASTOSIL® COLOR PASTES FL – standard colors

Product name	Similar to¹ /Suffix	BfR²	FDA³	China⁴	Merco-sur⁵	USP cl. VI / ISO 10993⁶	
ELASTOSIL® COLOR PASTE FL YELLOW	RAL 1006	●	A-H		●		
ELASTOSIL® COLOR PASTE FL IVORY	RAL 1014	●	A-H				
ELASTOSIL® COLOR PASTE FL YELLOW	RAL 1016	●	A-H		●	●	
ELASTOSIL® COLOR PASTE FL YELLOW	RAL 1021	●	B-H		●		
ELASTOSIL® COLOR PASTE FL YELLOW	RAL 1026						
ELASTOSIL® COLOR PASTE FL YELLOW	RAL 1026 F	●	C-H		●	●	
ELASTOSIL® COLOR PASTE FL YELLOW	RAL 1033	●	B-H		●		
ELASTOSIL® COLOR PASTE FL RED BROWN	RAL 2001	●	A-H	●	●		
ELASTOSIL® COLOR PASTE FL RED ORANGE	RAL 2001 F	●	A-H	●	●		
ELASTOSIL® COLOR PASTE FL PASTEL ORANGE	RAL 2003 F	●	B-H		●		
ELASTOSIL® COLOR PASTE FL ORANGE	RAL 2004	●					
ELASTOSIL® COLOR PASTE FL ORANGE	RAL 2004 F	●	B-H		●	●	
ELASTOSIL® COLOR PASTE FL PURE ORANGE	RAL 2004 F2	●	B-H		●		
ELASTOSIL® COLOR PASTE FL RED	RAL 3000						
ELASTOSIL® COLOR PASTE FL RED	RAL 3000 F	●	C-H		●	●	
ELASTOSIL® COLOR PASTE FL RED IRON OXIDE	RAL 3013	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE FL RED	RAL 3020	●	B-H		●	●	
ELASTOSIL® COLOR PASTE FL RASPBERRY RED	RAL 3027	●	A-H	●	●		
ELASTOSIL® COLOR PASTE FL RED VIOLET	RAL 4002	●	A-H		●	●	
ELASTOSIL® COLOR PASTE FL ULTRAMARINE BLUE	RAL 5002	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE FL DARK BLUE	RAL 5010	●	A-H		●	●	
ELASTOSIL® COLOR PASTE FL LIGHT BLUE	RAL 5015	●					
ELASTOSIL® COLOR PASTE FL LIGHT BLUE	RAL 5015 F	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE FL BLUE	RAL 5022	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE FL HELIOGREEN	RAL 6004	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE FL GREEN	RAL 6010	●	A-H		●	●	
ELASTOSIL® COLOR PASTE FL GRAY	RAL 7000	●					
ELASTOSIL® COLOR PASTE FL GRAY	RAL 7012	●					
ELASTOSIL® COLOR PASTE FL GRAY	RAL 7040	●					
ELASTOSIL® COLOR PASTE FL DEEP BLACK	RAL 9005	●					
ELASTOSIL® COLOR PASTE FL BLACK	RAL 9005 F	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE FL DEEP BLACK	RAL 9011	●	A-H		●	●	
ELASTOSIL® COLOR PASTE FL SILVER	RAL 9006	●	A-H				
ELASTOSIL® COLOR PASTE FL WHITE	RAL 9010	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE FL TRAFFIC WHITE	RAL 9016	●	A-H	●	●	●	
ELASTOSIL® COLOR PASTE FL UV FLUORESCENT	–						
ELASTOSIL® COLOR PASTE FL LASER MARKING WHITE	–	●	A-H		●	○	
ELASTOSIL® COLOR PASTE FL LASER MARKING BLACK TRL	–	●	A-H		●	○	

4.3

COMPOUNDING

PEROXIDE CURING

WACKER offers three different peroxide curing agents for the peroxide-curing of solid silicone rubbers.

For pressureless vulcanization:
ELASTOSIL® AUX CURING AGENT E
or **ELASTOSIL® AUX CURING AGENT E2**

We recommend ELASTOSIL® AUX CURING AGENT E or ELASTOSIL® AUX CURING AGENT E2 (halogene-free) for pressureless vulcanization, e.g. for the extrusion of hoses, profiles and the like.

Processing tips:
It is important to be aware that the decomposition of ELASTOSIL® AUX CURING AGENT E starts at quite low temperature and that typical crosslink temperatures already start at 90 °C.

Processing tips ELASTOSIL® AUX CURING AGENT E:

- Consult the MSDS for safe handling and storage
- Always cool the rolls of the mill, the temperature of the rubber must not exceed 60 °C

- Let the rubber cool down quickly and don't roll up the milled rubber sheet into thick "dollies" to prevent overheating
- Maximum temperature for storage of accelerated, ready-to-use rubber compound containing ELASTOSIL® AUX CURING AGENT E is 30 °C

For Vulcanization under pressure or in steam: **ELASTOSIL® AUX CURING AGENT C1**

ELASTOSIL® AUX CURING AGENT C1 is used for producing compression molded articles. ELASTOSIL® AUX CURING AGENT C1 is hardly affected by temperature and can be handled safely under typical processing conditions. It decomposes at 155 °C.

Processing tips:

- Add the crystalline curing agent at about 45 °C. At this temperature, the crystals melt and the liquified curing agent is distributed homogeneously
- Intensive cooling of the roll mill is unnecessary

- The sheeted out rubber may be thicker than 15 mm in this case, and it can be folded into a zig-zag when laid out
- Avoid contact with atmospheric oxygen: all surfaces that come into contact with oxygen during cross-linking remain sticky

For vulcanization under pressure or in steam: **ELASTOSIL® AUX CURING AGENT C6**

ELASTOSIL® AUX CURING AGENT C6 is only used for processing rubber in compression molds and is easily incorporated as a paste on the roll mill. Like ELASTOSIL® AUX CURING AGENT C1, ELASTOSIL® AUX CURING AGENT C6 is largely unaffected by temperature. It is stable up to 160 °C, making processing particularly unproblematic.

Processing tips:
Avoid contact with atmospheric oxygen: all surfaces that come into contact with oxygen during cross-linking remain sticky.

Peroxide crosslinkers				
Name/grade	Peroxide	%	Vulcanization [°C]	Processing
ELASTOSIL® AUX CURING AGENT E	(50% paste in silicone fluid) bis-(2.4-dichlorobenzoyl-) peroxide	1.5 – 1.8	> 100	Especially suitable for rubber that is vulcanized under low-pressure conditions, especially for the extrusion of hoses and profiles
ELASTOSIL® AUX CURING AGENT E2	(50% paste in silicone fluid) bis-(4-methylbenzoyl)peroxide	1.2 – 1.5	> 115	Especially suitable for rubber that is vulcanized under low-pressure conditions, especially for the extrusion of hoses and profiles
ELASTOSIL® AUX CURING AGENT C1	Dicumyl peroxide (98%), crystalline powder	0.6 – 0.9	165 – 190	For manufacturing molded parts
ELASTOSIL® AUX CURING AGENT C6	(45% paste in silicone rubber) 2,5-bis-(tert.-butylperoxo)-2,5 dimethylhexane	0.6 – 1.5	170 – 190	For manufacturing compression molded parts, easy to add on the roll mill

4.3

COMPOUNDING

PLATINUM-CATALYZED CURING

We recommend platinum-catalyzed addition curing for all applications in which it is important that:

- No odor or flavor is produced (e.g. for food-contact applications)
- No volatile peroxide by-products are released
- Transparent articles do not discolor during post-curing
- Curing is fast and cycle times therefore short
- The cured product is readily demoldable and has a dry surface

WACKER offers two types of solid silicone rubber for these applications:

- Ready-to-process compound:
The platinum-catalyst is already contained in the rubber formulation (1-part compound), as typified by the grade ELASTOSIL® R plus 4001.
- 2-part system:
The catalyst is added later. WACKER offers the catalysts ELASTOSIL® AUX Batch PT 1 (for extrusion) and PT 2 (for molded articles). For example, the catalyst PT 1 is used with the grade ELASTOSIL® R plus 4305.

Processing tips:
Platinum-catalyzed 2-component grades may start crosslinking slightly even at room temperature; as a result, it is important not to exceed the shelf life. We recommend carrying out preliminary tests to ensure that the rubber still has the required processing properties. It is important that all batches are stored for the same length of time between compounding and processing. Catalyst poisons in the ambient air inhibit curing. This is particularly true of amines and sulfur containing compounds, which are common components of organic rubber systems. So always keep platinum-catalyzed silicone rubber well separated from organic rubber during storage and processing, and always clean roll mills and processing machinery meticulously to avoid cross-contamination.

Storing and adding crosslinker

- Always store peroxides in cool rooms
- Shelf life approx. 12 months
- To ensure homogeneous distribution, spread pasty crosslinkers onto the sheeted-out rubber during roll milling
- Add powdered crosslinkers portion-wise, and avoid inhaling any dust

Tip

Any special requests?
Further crosslinkers are available for special requirements

Platinum catalysts					
Crosslinkers		%	Vulcanization [°C]	Recommended for rubber grades	Recommended for processing
ELASTOSIL® AUX BATCH PT 1	Catalyst paste	1.5 – 2	165	ELASTOSIL® R plus	Extrusion
ELASTOSIL® AUX BATCH PT 2	Catalyst paste	1.5 – 2	165	ELASTOSIL® R plus	Molded articles

We offer additional catalysts for textile coating formulations and will gladly advise you on your specific application.

SECTION 5:
PROCESSING THE MATERIAL





Contents

Everything you need to know about processing ELASTOSIL® silicone rubber

5.1 Introduction	40
When to use which process, and which material is suitable	
5.2 Extrusion	41
Metering, conveying, extrusion die, vulcanization, troubleshooting	
5.3 Press molding	48
Compression molding, transfer molding and what to consider	
5.4 Injection molding	50
Metering and mixing, injection and vulcanization, demolding, 2K injection molding, troubleshooting	
5.5 Textile coating	60
Which properties can be achieved, which silicones are suitable and which processes are most important	

5.1

INTRODUCTION

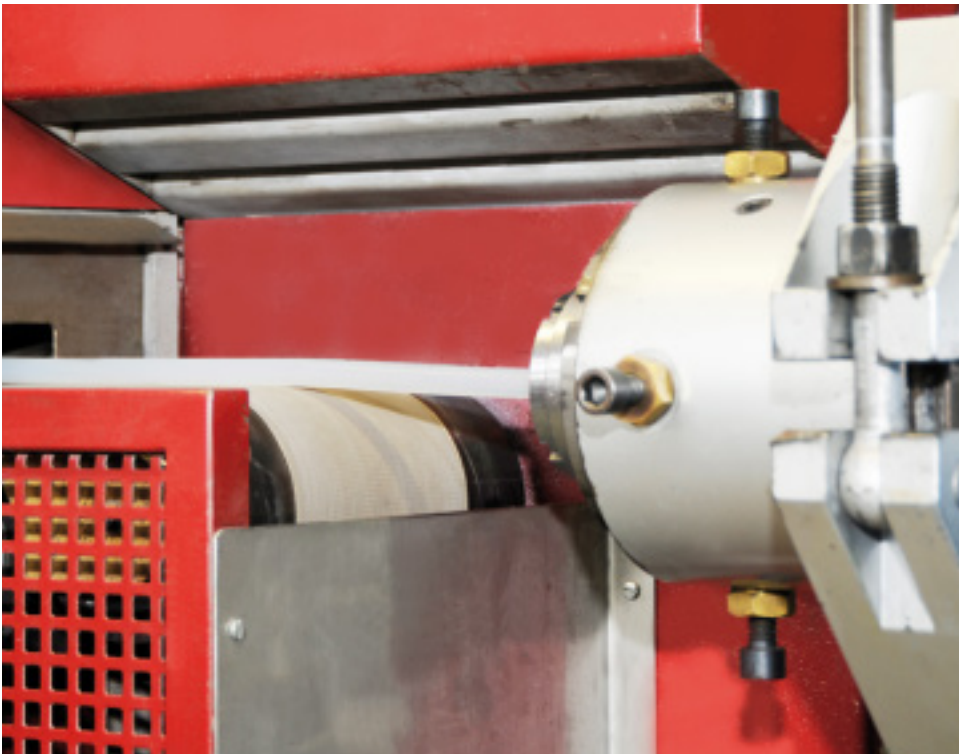
ELASTOSIL® silicone rubber can be processed in a variety of ways. The main processes include extrusion, coextrusion, compression molding, transfer molding, injection molding and knife coating (on textiles). Calendering and low-pressure filling are also possible.

Selecting the best process

Since the choice of process always depends on a number of factors, the following questions should be clarified:

- How are the properties specified for the application?
- Which chemical and physical properties is the vulcanized rubber required to have?
- How large is the required production series?
- Is liquid or solid silicone rubber the right choice?
- Which sort of geometry does the part have? Complex or simple?
- Which equipment is available and how much investment is required, if any?
- What experience/expertise is available for the particular processes?

A rapid decision can then be made about which processing technique to choose. For complex part geometries in large quantities, for example, injection molding is recommended, while extrusion is to be preferred for producing continuous articles.



Extrusion of ELASTOSIL® solid silicone rubber into tubing

Selection of the rubber grade by process		
Processing	Solid silicone rubber	Liquid silicone rubber
Extrusion	•	
Coextrusion	•	
Compression molding	•	
Transfer molding	•	
Injection molding	•	•
Doctor blade	•	•
Calendering	•	
Low-pressure filling		• (low-viscosity grades)

5.2

EXTRUSION

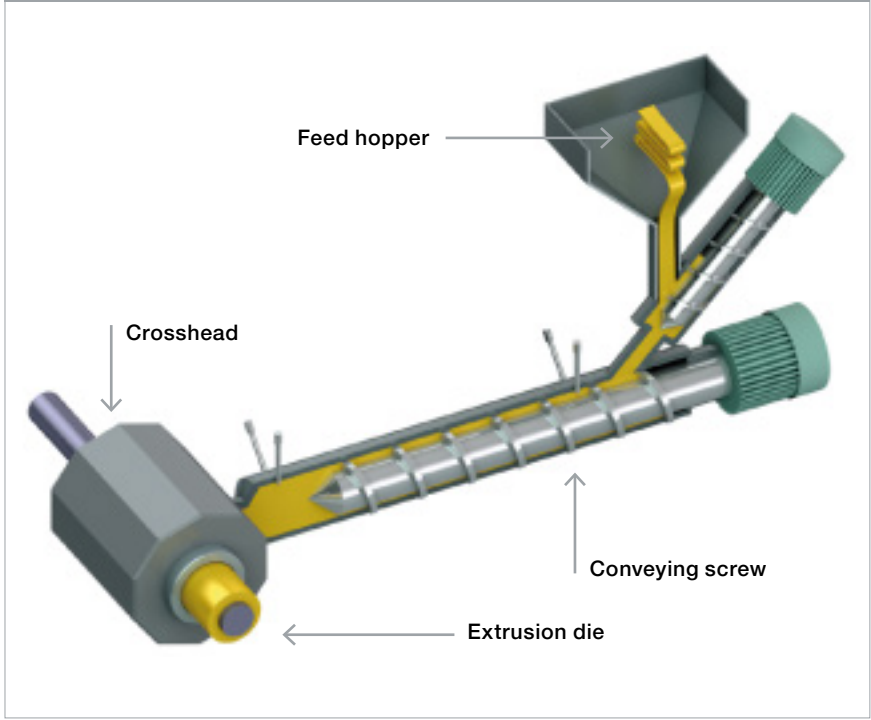
Extrusion is a continuous manufacturing process in which silicone rubber is squeezed through a die and then vulcanized. The die gives the extrudate its shape. The required pressure is produced via a conveying screw, in which the material is homogenized, compressed and deventilated.

Typical application

Extrusion is mainly used for the following products:

- Tubing
- Profiles
- Cables
- Flat tape
- Round cord

Schematic diagram of an extruder with crosshead die



Selection and preparation of the material

Peroxide and addition-curing ELASTOSIL® solid silicone rubber grades are suitable for extrusion. The materials are either available as ready-to-process compounds or have to be compounded in advance.

Screens of approx. 100 µm mesh remove foreign particles, homogenize the material, and eliminate any trapped air.

For this purpose, the rubber is compounded with the required additives and crosslinkers on the roll mill. To eliminate contaminants from the rubber compound, it should be subsequently passed through a strainer.

5.2

EXTRUSION

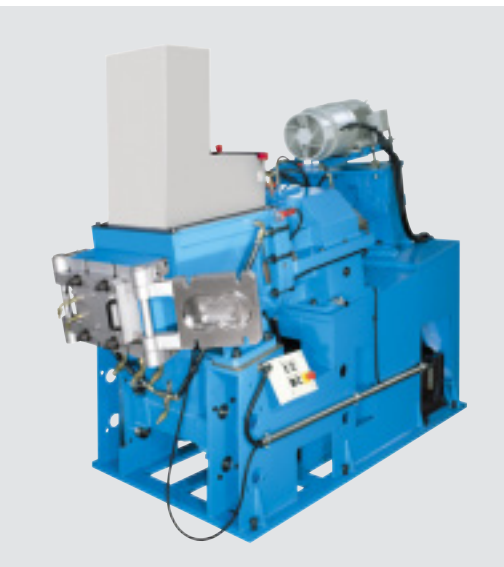
METERING



RotoFeeder® as metering unit for extrusion and injection molding



Interior of the RotoFeeder®:
Feed hopper with conveying screw



CTM® from Colmec

The extruder should be fed as uniformly as possible. This can be done manually, semi-automatically or automatically.

Manual feeding

For manual feeding, a sheet is produced on the roll mill, cut into strips and fed into the feed hopper manually.

Semi-automatic feeding

We offer special delivery forms for semi-automatic feeding. The rubber strips have already been wound into coils in the plant. They can be placed on a rotating disk coiler. Operation can be integrated directly into the extruder's machine control. Alternatively, the coil strips can be introduced directly from the cardboard box via a take-off unit.

Automatic feeding

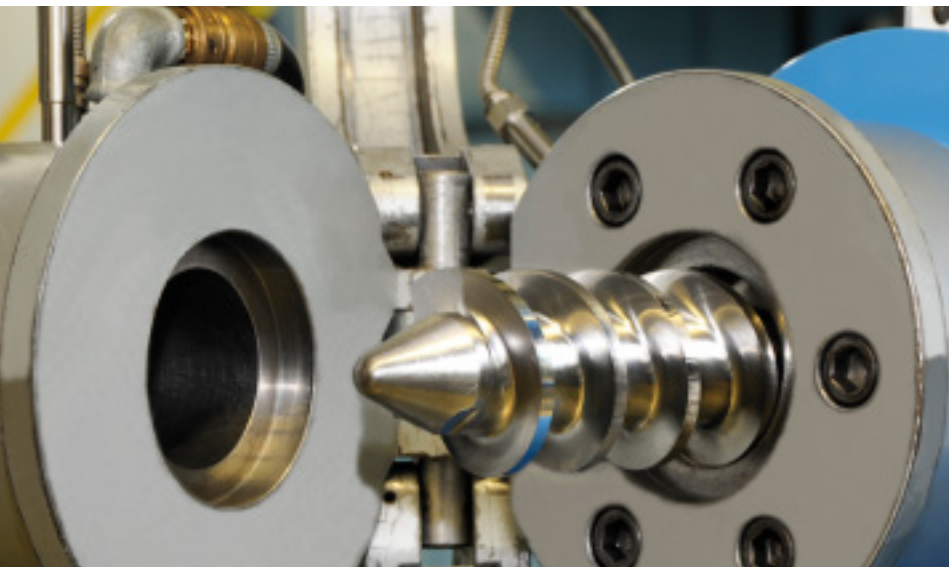
Feeding and metering can be performed automatically using appropriate auxiliary equipment (e.g. PolyLoad® from Krauss Maffei, RotoFeeder® from Engel or CTM®-System from Colmec). The material is transferred to a reserve container containing one or more screws. The screw feeds the extruder continuously via the outlet opening. For this purpose, ELASTOSIL®/SILPURAN®/SILMIX® solid silicone rubber can be used in all delivery forms.

RotoFeeder® is a registered trademark of Engel.
PolyLoad® is a registered trademark of Krauss Maffei.
CTM® is a registered trademark of Colmec.

5.2

EXTRUSION

CONVEYING IN THE SCREW



Open extruder with conveying screw

The screw performs several functions during the process, it conveys and compresses the rubber while at the same time building up the pressure for deaeration of the material. Homogenization, back venting and output rate can be controlled by varying the screw geometry and machine parameters.

Screw design

- Feeding is facilitated by maximum flight clearance in the screw feed zone. Slots in the flights have also proved successful
 - One or two-flight screws with compression ratios from 1 : 1.5 to 1 : 2 can be used. Twin-flight screws increase output
 - A progressive core or flight pitch is an advantage. With progressive cores, the core diameter increases gradually from the feed zone towards the screw tip. With a progressive pitch, the flight pitches decrease towards the screw tip
- Typical screw dimensions are length: diameter = 10 : 1 to 12 : 1
 - The screw and cylinder jacket must be cooled to prevent scorching of the material

5.2

EXTRUSION

EXTRUSION DIE

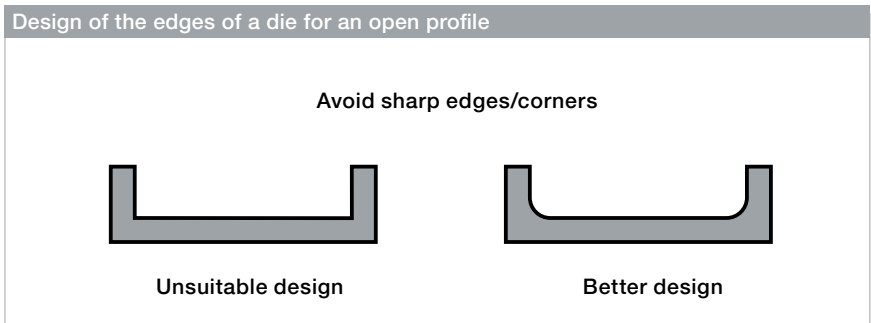
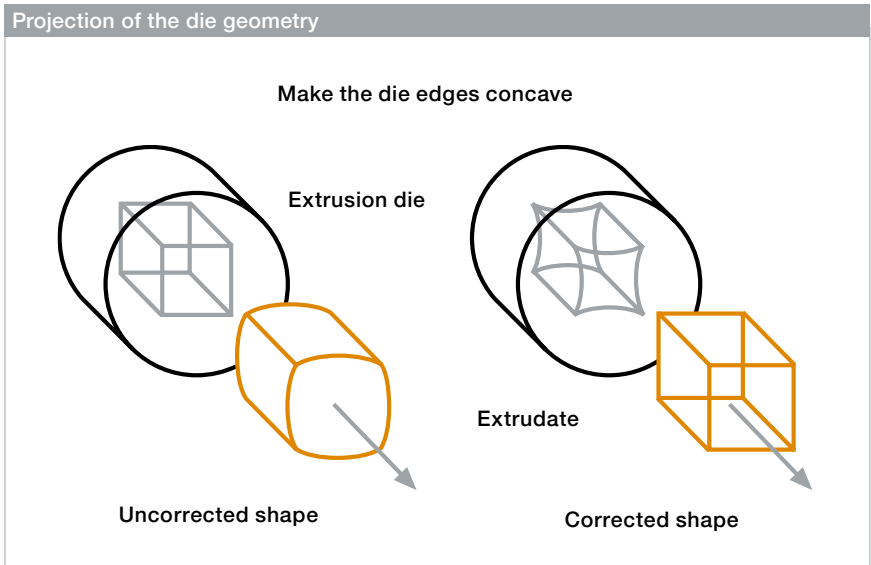
The extrusion die determines the profile of the cured rubber. Die design does not require any specific measures for silicone rubber; the customary guidelines apply.

- The wall should have the same thickness in all areas of the die
- Avoid sharp edges or corners: they can cause rough surfaces on the extrudate
- Avoid dead corners and sudden changes in direction of flow: material can accumulate in the dead corners and vulcanize
- It is important to have a uniform flow rate across the cross section. Material more distant from the die center has a slower flow rate. For the production of straight edges a concave design of the die edges is required

Compensating the die swell

The extrudate swells as it leaves the die. This phenomenon is affected by:

- Viscosity: the lower the viscosity, the greater the die swell
- The material temperature: the higher the temperature, the greater the die swell
- The extrusion velocity: the faster the extrusion, the greater the die swell
- The die diameter: the smaller the die, the greater the die swell



If the take-off belt of the heating tunnel runs faster than the extrudate leaves the die, stretching occurs. This can be used to adjust the desired diameter of the extrudate. As a result, die swell can be compensated and cured products manufactured with diameters smaller than the die orifice.

5.2

EXTRUSION

VULCANIZATION



Cable production: extrusion with subsequent vulcanization in the infrared tunnel

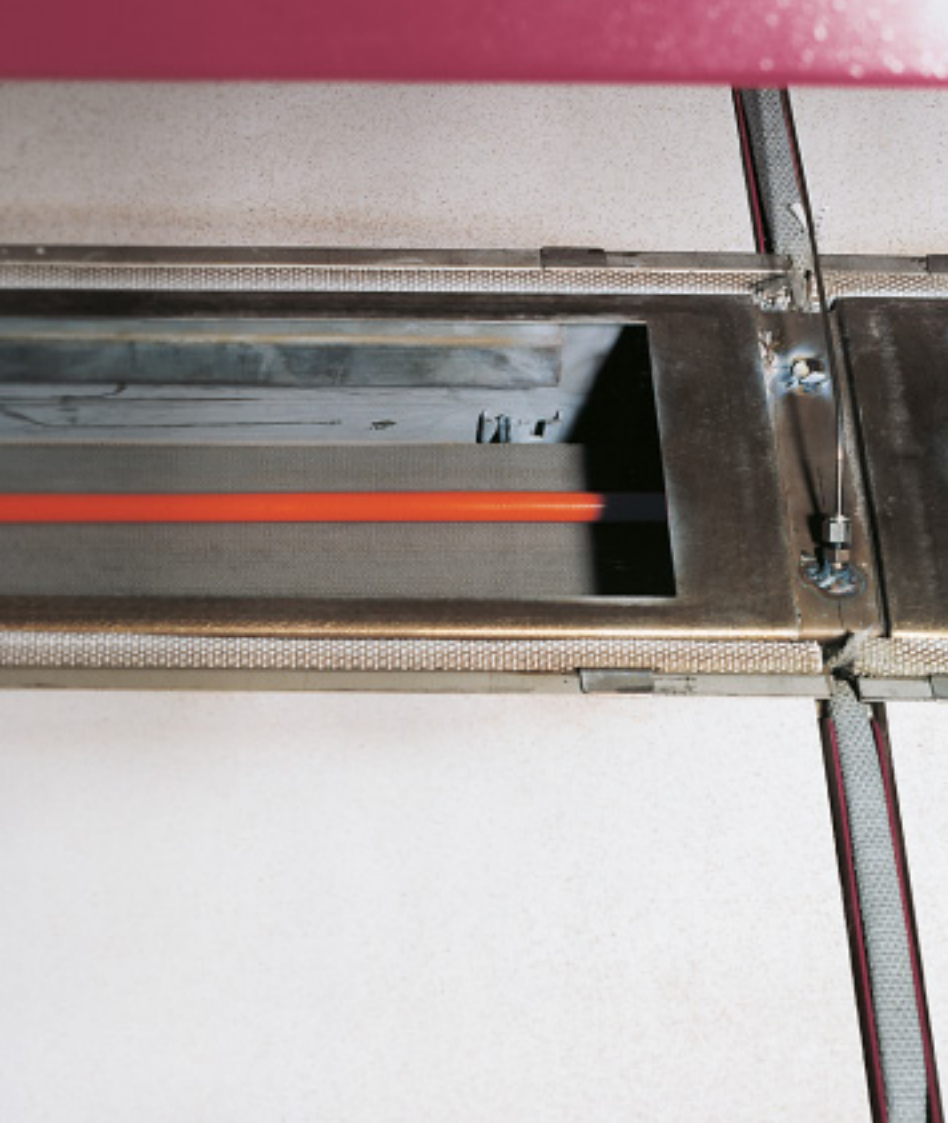
Extrudates are usually vulcanized via vertical or horizontal heating zones, with or without pressure. Silicone rubber is usually not vulcanized in a salt bath, though this option is possible in principle for peroxide-curing compounds.

Vulcanization in heating zones without pressure

Tubing and profiles are usually vulcanized in a heating zone (at 200 – 500 °C) without the application of external pressure. Horizontal or vertical heating tunnels are heated by means of resistance heaters, infrared heating bars with reflectors, hot-air systems or ceramic dark radiators. The extrudates are conveyed on sheet-steel or mesh conveyor belts. The conveyor belts run on movable deflector rolls to compensate for the thermal expansion of the belt. Their velocity can be regulated. The conveyor belt return should be located in the heating tunnel to prevent excessive cooling. If this is not possible, use covers to prevent rapid heat loss.

To avoid pressure marks resulting from the conveyor belt, a shock tunnel can be fitted upstream in horizontal heating zones to prevulcanize the parts at about 600 °C.

In many instances, it is preferable to extrude vertically using an extruder head deflected through 90°. This prevents belt pressure marks, so that even very soft materials can be easily processed.



Hose vulcanization in a horizontal hot-air tunnel

Vulcanization in heating zones with pressure

Continuous vulcanization (CV) lines are primarily used to manufacture cables. Heating is usually by means of pressurized steam.

The line is usually fed with steam at a pressure of 4 to 20 bar. At least 6 bar is necessary to achieve the required vulcanization temperature. Different steam temperatures are reached, depending on the supply pressure. With this process, the extruder head is continually supplied with saturated steam. To prevent scorching, the extruder head must be intensively cooled. The vulcanization time depends on the length of the zone, the temperature, and the wall thickness of the insulation. It is usually between 30 seconds and 2 minutes.

General information on extrusion

Cooling:

During extrusion, high shearing rates occur, which generate heat.

- To avoid scorching, the extruder, screw and extruder head should be cooled to ensure that the rubber temperature lies safely below the decomposition temperature of the peroxide
- In addition, the highest output rates are obtained when the cylinder is cooled

Extruder size:

- Extruders with 45 to 90 mm screw diameter and an L/D ratio of 10:1 to 16:1 (typically 10:1 to 12:1) are most commonly used
- The bigger the extruder, and therefore the screw, the lower is the speed, and therefore the heat of friction for the same output

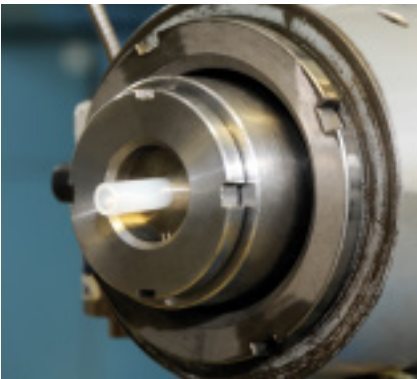
Coextrusion

Coextrusion allows extrudates to be produced from different materials. For example, it allows the manufacture of striped tubes, pigmented extrudates, or sheets with an extruded-on profile. WACKER offers self-adhesive ELASTOSIL® R *plus* grades for this purpose.

5.2

EXTRUSION

TROUBLESHOOTING



Fluctuations in the extrudate geometry

The following table shows the most common faults and possible causes. If you still have any questions, please ask your WACKER contact or call the WACKER info line.

In general, to avoid problems:

- The material has to be mixed homogeneously and has to be free of impurities
- The extruder should be thoroughly cleaned between two production runs
- Fluctuations in the material temperature and pressure should be avoided
- Material feed into the extruder should be uniform
- Strainer screens should be used (for ventilation of the material and to avoid pressure fluctuations)
- All machines should be regularly maintained

Overview	
Fault	Possible cause
Bubbles	Atmospheric moisture on machines, air inclusions
Fisheyes	No strainer sieve, scorching of particles due to excessive material temperature, inhomogeneous mixing
Brittle extrudate/white stripes when the extrudate is stretched	Material damage due to high curing temperature
Round, soft region in the center of the extrudate	Insufficient curing, line speed too high or temperature too low
Sharp edges on the extrudate have a sawtooth structure	Poor die design
Fluctuation in the extrudate geometry	Fluctuations in the material pressure or temperature
Rough surface	Scratched/damaged die surface, material temperature too high

5.3

PRESS MOLDING PROCESSES

COMPRESSION AND TRANSFER MOLDING

Press molding processes are used for a wide range of applications. ELASTOSIL® solid silicone rubber is vulcanized in molds by heat and pressure. Compression and transfer molding are the preferred methods for solid silicone rubber.

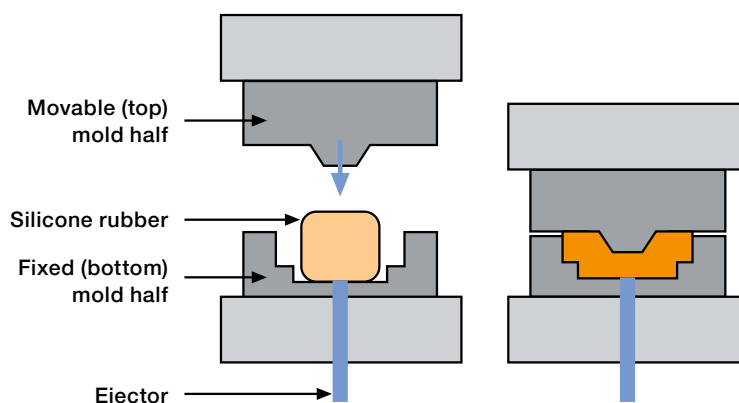
Material selection/mold filling

For compression molding, peroxide-curing and platinum-catalyzed ELASTOSIL® solid silicone rubber grades are preferred. Each cavity is individually filled with a precisely weighed amount of rubber.

Pressing/vulcanization

The platen presses are usually hydraulically operated, they are heated, e.g. electrically or with steam. For vulcanization of peroxide mixtures with ELASTOSIL® AUX CURING AGENT C1 or C6, and for platinum-catalyzed solid silicone rubber, a mold temperature of about 150 to 200 °C is usually chosen. The temperature plays an important role: it is required to be as high as possible to shorten the vulcanizing time, and therefore the cycle times. However it must not be too high, since scorching may otherwise occur. The vulcanizing time is determined by the temperature of the material, the mold temperature and the thickness of the part.

Compression molding



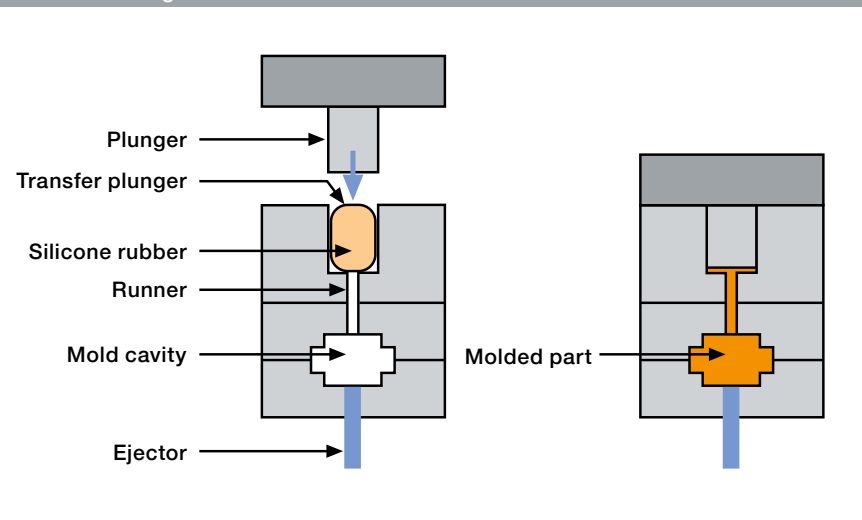
Demolding

External and internal mold-release agents can be used to assist demolding.

- External release agents:
In this case, a 1 – 3% aqueous solution of the mold release agent ELASTOSIL® AUX Mold Release Agent 32 is sprayed into the hot mold. The process is repeated as required.
- Internal mold-release agents:
Alternatively, ELASTOSIL® AUX Mold Release Agent A can be added to the silicone rubber.

However, it should be correctly metered. Too much release agent can lead to mold contamination by forming deposits on the hot mold wall. It can also cause inhomogeneities in the end product. If the mold release agent is pushed forward by the flow front during mold filling, it can lead to (undesirable) weld lines as a result of incomplete welding of the merging flow fronts. In both cases, the end product is no longer usable.

Transfer molding



Die cutting/slitting

Die cutting offers an economic alternative for very small quantities. In this process, parts such as O-rings are die cut from extruded, calendered or pressed sheet. Note that silicone rubber grades with high notch resistance are not easy to die cut. It is better to use blends of elastic grades and standard extrusion grades. Always carry out tests in advance.

For safety's sake

- Please follow the instructions in our material safety data sheets
- We recommend using an extractor to purify the room air

Transfer molding is a development of compression molding. It is more economic for small-volume parts with complex geometries, which are produced in large quantities and with less manual work (no secondary finishing). It differs from compression molding in that the mold is charged via a chamber (the “pot”) with runner. Transfer molding is particularly suitable for producing moldings in which high dimensional accuracy is required (precision parts).

Material selection/mold filling

The pot is charged with a defined amount of silicone rubber. A plunger then forces the rubber through a runner into the mold. For greater economy, several molds can be filled by using a sliding table unit or runner manifold.

5.4

INJECTION MOLDING



Injection molding is currently the most popular and efficient method of processing large quantities of silicones where there are strict demands for consistently high product quality.

Advantages of injection molding

Injection molding is characterized by high dimensional accuracy. It produces high quality parts without secondary finishing, and allows much shorter production cycles than other processes. The disadvantages are higher mold and machine costs, though these can be offset by the high productivity.

Typical applications

Injection molding is particularly suitable for the production of large numbers of small to medium-sized parts, such as:

- Nipples for baby bottles
- Gasket rings

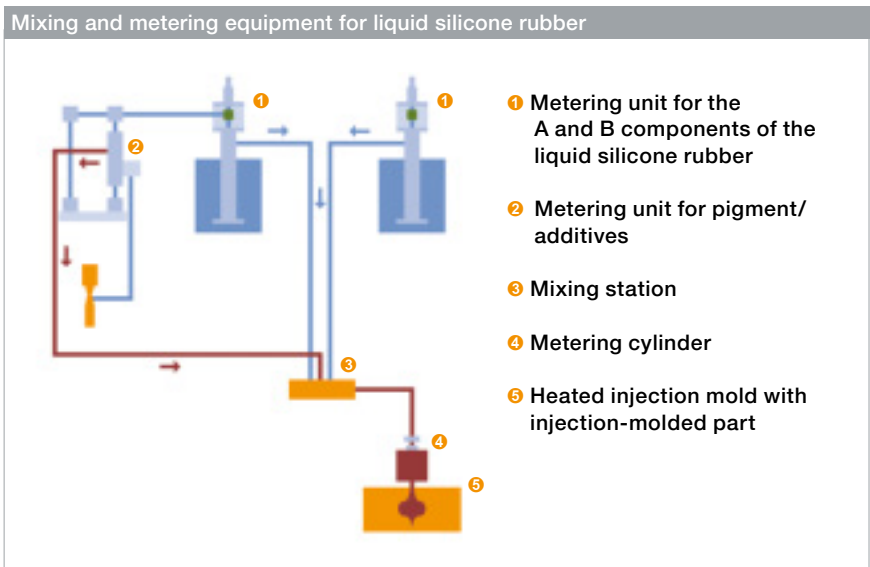
Material selection

ELASTOSIL® solid silicone rubber and ELASTOSIL® liquid silicone rubber are both suitable for injection molding.

5.4

INJECTION MOLDING

METERING AND MIXING



Due to their widely differing viscosities, liquid and solid silicone rubbers are metered and mixed differently.

ELASTOSIL® liquid silicone rubber
Liquid silicone rubber grades require special metering and mixing systems.

Metering

The metering units pump the A and B components of liquid silicone rubber directly from the pails or drums in a ratio of 1 : 1 and feed it to a mixer, and then to the feed dosing cylinder of the injection-molding machine. If required, ELASTOSIL® COLOR PASTE FL can be fed to the mixer via an additional pigment line.

Mixing

A static or dynamic mixer can be used. Static mixers do not have moving parts; the material is homogenized via fixed mixing elements in the interior. Dynamic mixers have moving parts supporting the homogenization. Static mixers are typically used for liquid silicone rubbers. After the two components A and B have been mixed, the material can be injected into the mold.

Injection

The mixed material is metered and injected into the mold with a screw in the injection cylinder. Modern injection molding machines offer precise control of the injection process.

Pot life

At room temperature (approximately 20 °C), the A/B mixtures of most WACKER LSR grades have a pot life of at least three days. If the temperature is higher, the pot life may decrease accordingly. To prevent premature vulcanization, it is advisable to temperature-control the metering cylinder and mixer by a thermostat. If a production interruption longer than three days is necessary or desired, cyclic operation of the production process is recommended. In this case, the process should be restarted every 2–3 days and a normal production cycle carried out, thereby rinsing old material from critical components and replacing it with fresh material. The duration of this production cycle depends on the material volume in the machine and mold, as well as the shot volume and cycle time. This procedure can be repeated if needed. However, the specific requirements and conditions of the machine and process must be taken into account.



ELASTOSIL® solid silicone rubber

ELASTOSIL® solid silicone rubber for injection molding is available in two supply forms:

- As ready-to-process material in different delivery forms. Preferably as bars, but also as strips or round cord, etc.
- As a silicone rubber base compound, to which the crosslinker and possibly other additives are added. This is usually performed via roll mills (see section 4, page 30)

Metering

Solid silicone rubber is generally metered to the injection molding machine via a stuffing box. It is generally performed either semi- or fully automatically in the case of profile strips. As an alternative to the stuffing box, RotoFeeder® (Engel) or PolyLoad® (KraussMaffei) systems can be used.

The cylinder and discharge from the stuffing box are usually maintained at 40 – 50 °C to facilitate material feed.

Please note

- The A and B components of liquid silicone rubber should have the same batch number, since the curing systems are matched to one another within a batch
- If the silicone rubber contains abrasive fillers, the cylinder, screw, non-return valve, needle valve, sprue and runners must be hard-faced

RotoFeeder® is a registered trademark of Engel.
PolyLoad® is a registered trademark of Krauss Maffei.

5.4

INJECTION MOLDING

INJECTION AND VULCANIZATION

ELASTOSIL® liquid silicone rubber

There are two types of sprue system: indirect gating via a cold runner and hot sub-runner, or direct gating. The cold runner may have a hydraulic needle valve. Each gating method has its pros and cons.

Indirect gating

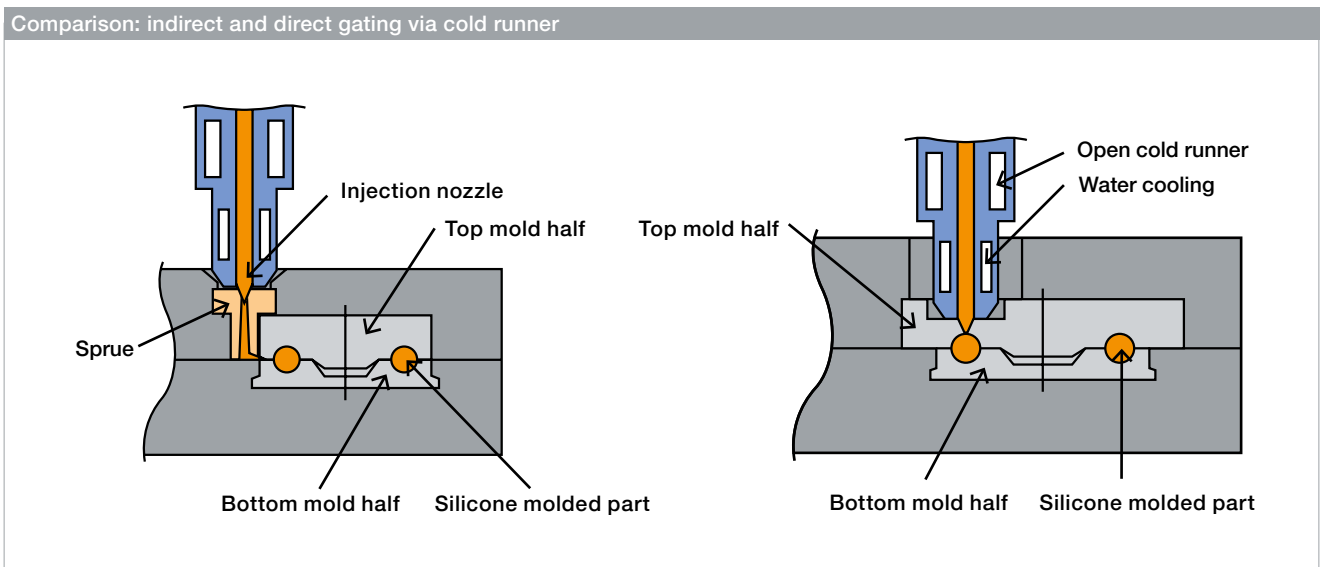
The material is injected into the cavities through a cold runner, via a manifold. The vulcanized sprue waste must be removed from the mold together with the molding, and discarded after separation from the molded part.

- Advantages:
 - Less expensive mold making
 - Suitable for small and medium-sized series
- Disadvantages:
 - High material consumption (sprue waste)
 - Secondary finishing of the parts is required (to remove the sprue)
 - Not suitable for fast-curing systems (risk of premature curing in the runners)

Direct gating

In this case the material in the cold runner is injected into the part. A cold runner with needle valve offers additional processing advantages, such as low shearing during injection.

- Advantages:
 - Articles do not require secondary finishing
 - High degree of automation possible
 - Low material consumption (no sprue waste)
 - Can also be used for rapid curing systems
- Disadvantages:
 - Expensive mold design/production
 - Higher costs for multicavity molds (a cold runner for each cavity) is required





Vulcanization

The curing temperatures and times depend on the quality of the heating system and on the material, volume and geometry of the rubber part. ELASTOSIL® liquid silicone rubber is usually processed at between 150 and 200 °C.

ELASTOSIL® solid silicone rubber

In general, it offers the same advantages as liquid silicone rubber. However, due to the higher viscosity, the runner cross-sections are generally larger.

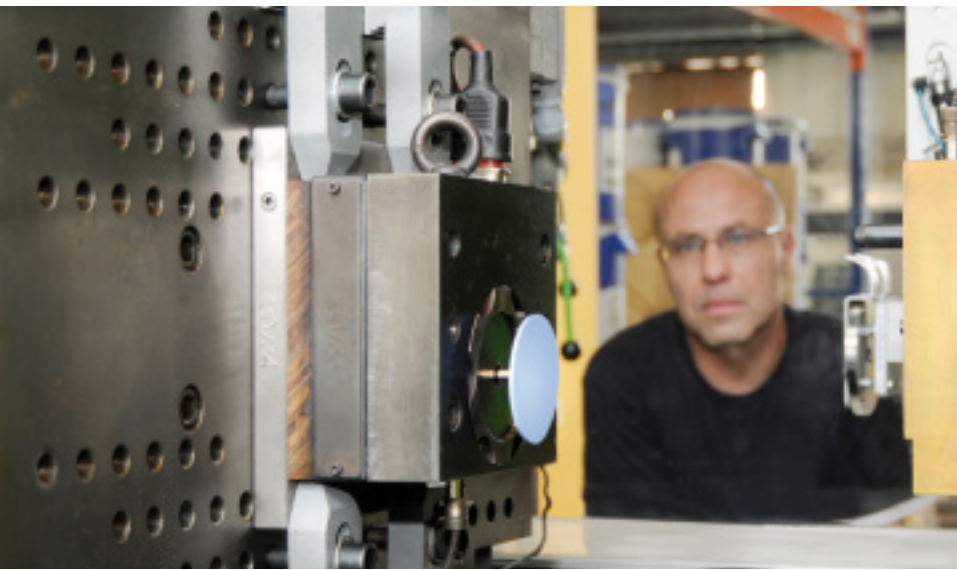
Curing

Solid silicone rubber is processed at between 150 and 200 °C.

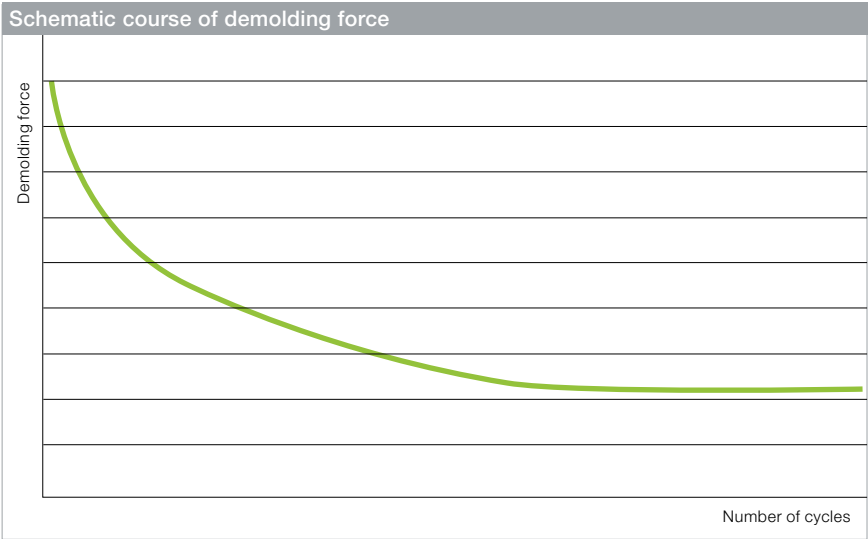
5.4

INJECTION MOLDING

DEMOLDING



Demolding an injection molded sheet from the mold



Vulcanized silicone rubber tends to stick to the mold wall. This can be solved in various ways.

Multiple process passes

Demolding may be more difficult at the beginning of the process. After multiple cycles, a release layer resulting from the silicone rubber forms on the mold surface, and assists in demolding (cf. diagram).

Mold release agents

The use of mold release agents, e.g. ELASTOSIL® Mold Release Agent 32, aids demolding on process startup.

Auxiliary equipment

The parts are generally demolded by means of ejector pins and brush or blower units.

5.4

INJECTION MOLDING

2K INJECTION MOLDING

Multicomponent parts can be manufactured by 2K injection molding.

- Soft-hard combinations (combinations of silicone rubber with thermoplastic or metal parts)
- Silicone rubber/silicone rubber combinations (e. g. color combinations or combinations of grades with different hardnesses)

Advantages of 2K injection molding

- Excellent adhesion of the components
- Greater scope for designers (color combinations, etc.)
- Soft or non-slip surfaces can be produced in one step
- Outstanding sealing, e. g. against dust or condensation

Material selection

WACKER offers self-adhesive ELASTOSIL® silicone rubber. For more information, please see our product overview leaflets.

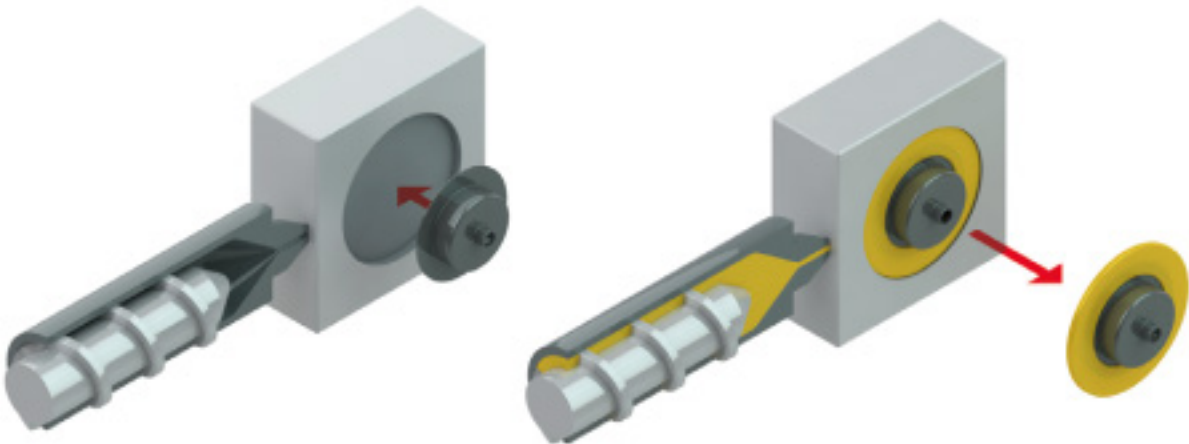
Process options

Combination parts can be produced by different processes.

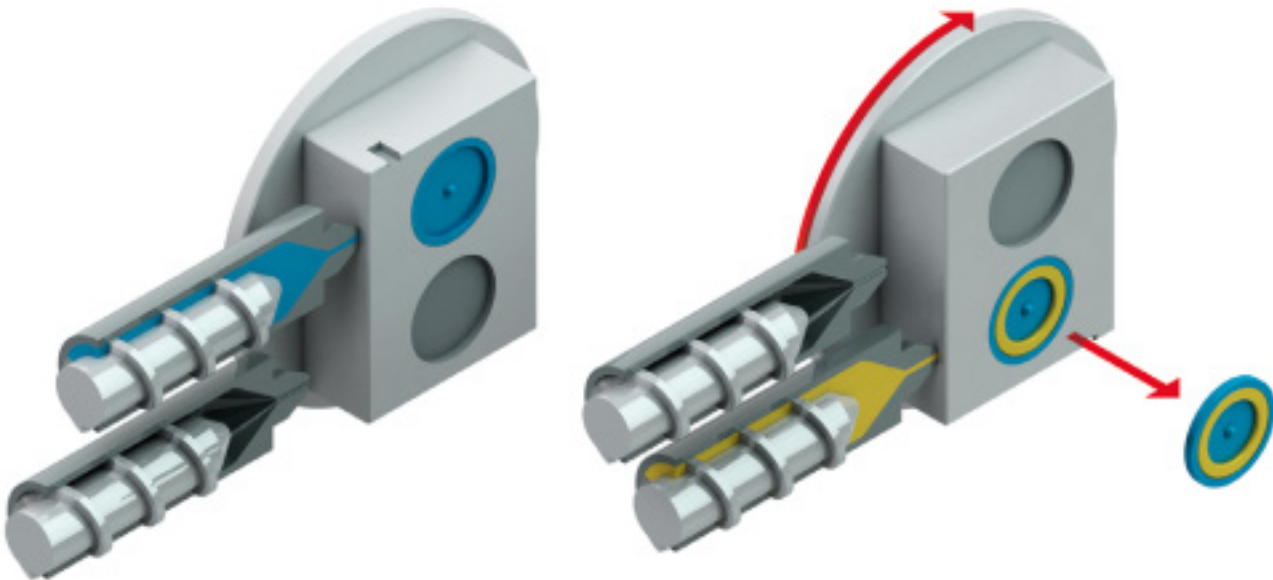
- Insert process:
Prefabricated hard components (thermoplastics, glass or metal) are inserted in the cavity on a 1K injection molding machine and then overmolded with ELASTOSIL® liquid silicone rubber. Before insertion, metals should be degreased with a solvent such as ethanol or acetone. With thermoplastics, ensure that they have first been properly dried, since adsorbed moisture leads to poor adhesion. With difficult material combinations, adhesion can be assisted by, e. g. flame, corona or plasma treatment.
- 2K injection molding on one injection molding machine:
A 2K injection molding machine with rotary table produces combination parts in one step. In the first position, the parts are molded from thermoplastic. The moldings are then transferred to position 2 on the turntable, where they are overmolded with liquid silicone rubber.

- 2K injection molding on two injection molding machines:

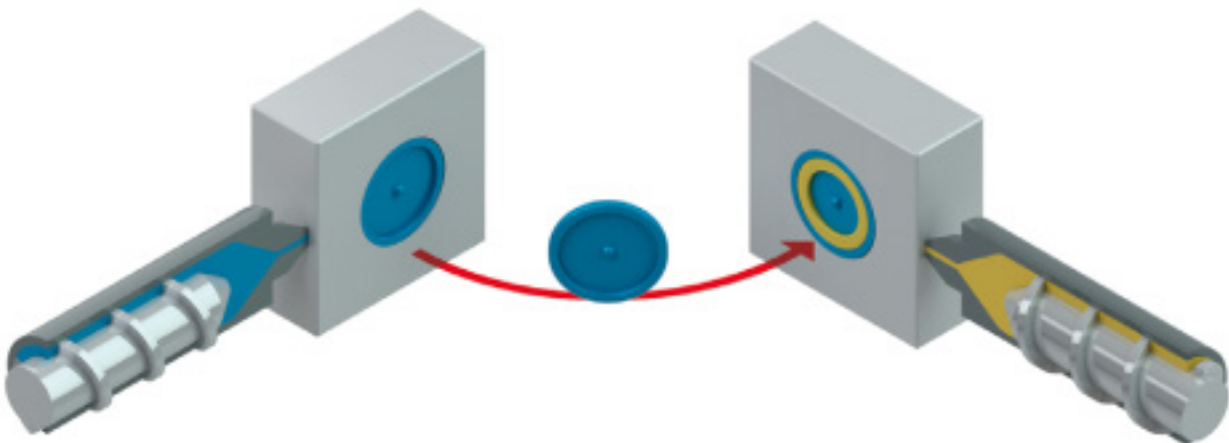
This is a two-stage process with two machines: the thermoplastic backing part is molded on the first machine in a thermoplastic mold. While the part is still hot, a gantry robot transfers it to a silicone mold on the second machine, where it is overmolded with liquid silicone rubber.



Insert process



2K injection molding on one injection molding machine



2K injection molding on two injection molding machines

5.4

INJECTION MOLDING

TROUBLESHOOTING

Troubleshooting					
	Symptoms				
	Moldings not fully crosslinked	Overpacking/flash	Mold adhesion/ parts not demoldable	Air inclusions/ bubbles	Burn marks/ white spot
Possible causes					
Mold temperature too low	●	●			
Mold temperature too high				●	●
Mold has excessive undercuts			●		
Mold surface too smooth			●		
Inadequate mold balancing (cold runner/manifold)					●
Mold defective		●			
Heating time too short	●			●	
Clamping force too low		●			
Inhomogeneous temperature distribution in the mold					
Inadequate deaeration/ vacuum				●	●
Injection too fast		●		●	●
Injection too slow					
Nonreturn valve faulty					
Holding pressure too high/ too long		●			
Too little material					
Switchover point to holding pressure incorrect		●			
Deviations in mixing ratio of the components	●		●		
Poor material mixing	●				
Faulty shut-off valve on material feed					
Air in the material feed				●	

Weld seam	Part deformation/ scorching	Defects in the molding	Irregular mold filling	Fluctuations from shot to shot	Underfilling	Sink marks
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5.5

TEXTILE COATING



Silicones are the right solution for a variety of coating requirements. Their special chemistry makes them perfect for a wide variety of uses.

This is mainly due to their special chemistry. What's more, their basic structure can be varied in almost any way as a result of chemical modification or skillful combination of additives.

Silicones can be used for coating nearly any type of fabric. The art of formulation requires a great deal of experience and creativity and a wealth of knowledge about relevant chemical and processing relationships. WACKER SILICONES' technical service specializes in precisely that. We help you manage the often difficult balancing act between product, coating system and substrate in order to achieve the perfect end result.

Info

We will advise you on formulations and will conduct application-related testing for you. We will gladly show you the opportunities and advantages of innovative coating technologies that meet your individual needs.

5.5

TEXTILE COATING

SILICONE PROPERTIES



Hydrophobic, waterproof material

Silicone rubber is a water-repellent material. The contact angle of a drop of water on a smooth silicone surface is approx. 130°, which means that water does not wet textiles coated with silicone. In addition, even very low coating weights produce textiles capable of withstanding water columns of >10 m as described in EN 20811.

Flame resistance

Silicones are inherently flame-resistant polymers. The autoignition temperature of silicone elastomers is approx. 430 °C. In the event of a fire, silicone reverts to silicon dioxide (which accumulates as white ash); the gases formed are non-corrosive and non-toxic. Special additives ensure that silicone-coated textiles also meet highly stringent fire-safety requirements.

UV and weathering resistance

Silicones are extraordinarily resistant to UV radiation. Combined with their hydrophobic properties and considerable chemical resistance, this makes them exceptionally resistant to weathering. The industrial climate test described in DIN 50018 – SFW 2.0 S (2 l sulfur dioxide) has shown that specialty blends withstand 1.5 million cycles with no change in their surface properties. Since silicones absorb short-wave UV light, silicone coatings can also protect textile fibers that would otherwise be more susceptible to UV damage.

Materials with specific properties?

No problem for silicones. They are multifunctional “natural talents” and prove it in diverse application areas – e.g. for textiles, too. Textile materials coated with ELASTOSIL® silicones impress with their high functionality, in such differing areas as architecture, food, lifestyle, as well as functional and protective clothing.

Elasticity

Silicone elastomers are extremely elastic materials, with elongation at break over 1,000% for some grades. As such, they can be reliably used as coatings for highly elastic textiles – such as ELASTAN® – without limiting textile functionality.



Wash resistance

Silicones can form chemical bonds with a large array of substrates, making silicone-coated textiles particularly durable – a characteristic demonstrated by their outstanding wash resistance, for example.

Food contact

When processed properly, many silicones meet Recommendation XV of the German Federal Institute for Risk Assessment (BfR) and requirements of the Food and Drug Administration (FDA) 21 CFR § 175.300 Resinous and Polymeric Coatings. Please note: each individual silicone formulation must be approved for use in food industry applications.

5.5.

TEXTILE COATING

SILICONE PRODUCT GROUPS



WACKER SILICONES offers you a number of silicone systems that differ substantially from each other in terms of processing parameters – regardless of the properties of the cured rubber. The differences lie primarily in the application method, in the curing rate and temperature, and in the number of components. Each product group offers specific processing advantages tailored to particular applications. Contact your technical representative to discuss the selection of system components most suitable for you.

ELASTOSIL® R solid silicone rubber	
Crosslinking mechanism	Peroxide curing
Components	1- or 2-component systems
Solvent	Solvent-free; can be dispersed with solvents
Viscosity	Stiff pastes
Curing	In a drying tunnel, 150 – 200 °C, 1 – 5 min
Processing	Knife coating, calendering, extrusion
Benefits	High resistance to substances that disrupt the curing process, very good mechanical properties, high heat resistance, rapid curing

ELASTOSIL® R <i>plus</i> solid silicone rubber	
Crosslinking mechanism	Addition curing
Components	1- or 2-component systems
Solvent	Solvent-free; can be dispersed with solvents
Viscosity	Stiff pastes
Curing	In a drying tunnel, 130 – 200 °C, 1 – 3 min
Processing	Knife coating, calendering, extrusion
Benefits	Rapid curing, excellent mechanical properties, dry surface

ELASTOSIL® LR liquid silicone rubber	
Crosslinking mechanism	Addition curing
Components	2-component systems
Solvent	Solvent-free; can be dispersed with solvents
Viscosity	10,000 - 500,000 mPas·s
Curing	In a drying tunnel, 130 – 200 °C, 1 – 3 min
Processing	Knife coating, dip coating
Benefits	Very rapid curing, good processability, considerable formulation flexibility

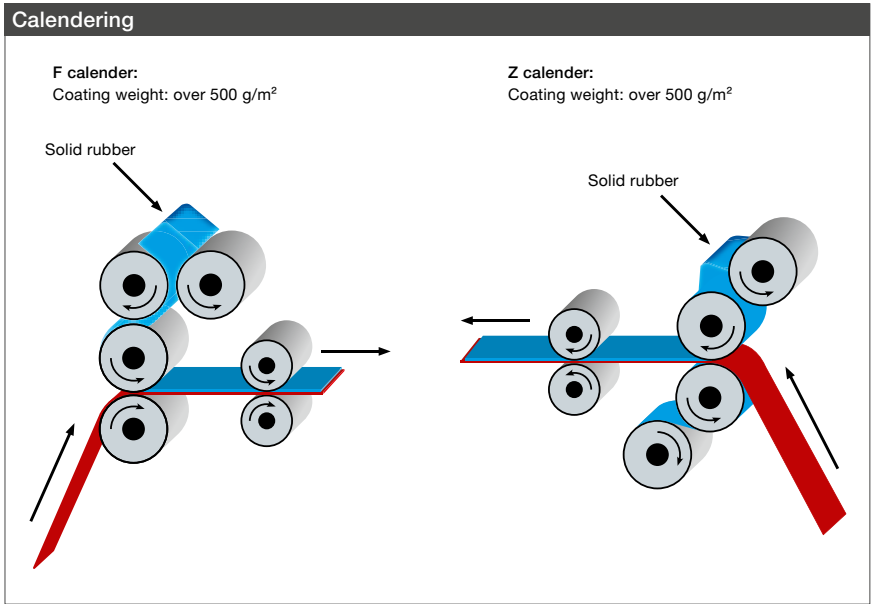
ELASTOSIL® RD dispersion	
Crosslinking mechanism	Addition curing
Components	2-component systems
Solvent	Xylene or petroleum ether
Viscosity	5,000 – 700,000 mPas·s
Curing	Evaporate solvent at no more than 100 °C and then cure for 1 – 3 min at 130 – 200 °C in a drying tunnel
Processing	Knife coating, dip coating
Benefits	Excellent mechanical properties, good processability, considerable formulation flexibility, dry surface, low coating weights possible

ELASTOSIL® E RTV-1 rubber	
Crosslinking mechanism	Condensation curing
Components	1-component systems
Solvent	Solvent-free or solvent-based
Viscosity	50,000 – 350,000 mPas·s
Curing	Skin forms at room temperature after approx. 15 min, fully cured after 1 – 3 days (dependent on atmospheric humidity)
Processing	Knife coating, dispensing, screen printing
Benefits	High resistance to substances that disrupt the curing process, easy processing, good adhesion

5.5.

TEXTILE COATING

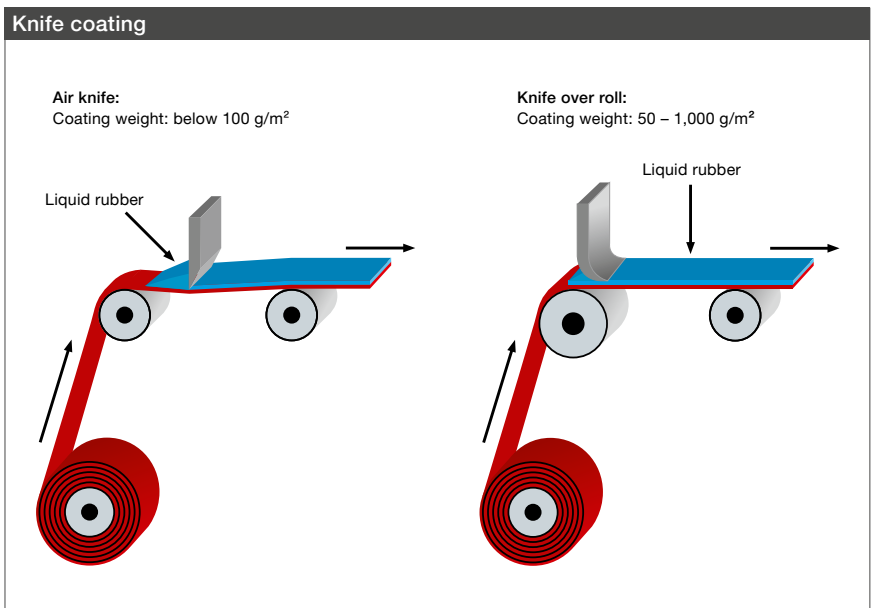
APPLICATION METHODS



Silicones can be applied by all common application methods for coating textiles. The most common methods are knife coating for liquid silicones and calendering for solid silicones. After careful cleaning, coating equipment used for silicones can even serve for processing other coating compounds, such as PVC or acrylates. We recommend aliphatic solvents such as white spirits or isoparaffins as cleaning agents. After cleaning, the heating tunnel should be held at a temperature of at least 150 °C for about an hour before switching over to other materials.

During the calendering process, solid rubber is rolled to the desired film thickness, applied to the textile under pressure and then subjected to thermal crosslinking. Film thicknesses are typically 1 – 2 mm.

Knife coating, by contrast, is ideal for applying thinner films. In this method, liquid silicone pastes are applied, either manually or automatically, in front of a doctor blade. The shear force applied under the blade distributes the silicone rubber evenly and allows it to permeate the



fabric, resulting in a good adhesive bond. The distance between the blade and the textile defines the resulting coating thickness. If the coating weight is very low, the blade (air knife) is pressed directly onto the textile, allowing for coatings as thin as approx. 10 µm. Expertise and fine-tuning of the silicone paste's rheology are key factors in obtaining excellent coating results by knife coating.

SECTION 6:
SECONDARY FINISHING





Contents

Secondary finishing of cured silicone rubber

6.1 Post-curing 66
When, how and why post-curing is important

6.2 Multicomponent technologies 69
Self-adhesive silicone rubber, priming, bonding: step by step

6.1.

POST-CURING

Ideally, silicone rubber articles do not need secondary finishing. But in many cases the material must be post-cured. That involves heating at a high temperature for a defined time.

Why is post-curing necessary?

Post-curing is performed to achieve an improvement in the mechanical properties (e.g. a particularly low compression set), and to remove volatiles (by-products from the crosslinker chemicals and low-molecular polymer components). For e.g. food-contact applications, post-curing is recommended or even essential in order to meet legal requirements.

- Peroxide-curing rubber:

Post-curing serves principally to eliminate by-products from the peroxide curing reaction. When ELASTOSIL® AUX CURING AGENT E, by-products migrate to the cured rubber surface for several hours, and can be seen as white crystal deposits on the surface (blooming). In the case of ELASTOSIL® AUX CURING AGENT C1 or C6, the by-products impart a characteristic odor to the cured rubber, which can be removed by post-curing.

- Addition-curing platinum-catalyzed rubber:

In this case, curing does not form odor containing by-products. But post-curing is still recommended if the silicone article is intended for use in sensitive areas, such as food-contact or medical applications. In such cases the relevant recommendations FDA¹ or BfR² or E.P. 3.1.9³ must be followed.

Removing defects

Other work steps may be necessary in the following cases:

- Correcting flash or defects (cryogenic deflashing or sanding down)
- Removing sprue waste and talc

Our experts will be glad to help you set up your production plant to manufacture products that meet your demands, and eliminate unnecessary production steps, e.g. by means of test series in our pilot plant or on-the-spot advice.

¹ FDA Chapter 21 CFR § 177.2600 Rubber Articles Intended for Repeated Use.
² BfR recommendation XV. Silicones.
³ E.P. 3.1.9: European Pharmacopeia 5.0, Chapter 3.1.9.

Ideally, cured ELASTOSIL® silicone rubbers are free of flash and ready to use with no further production steps

The right way to post-cure

- Fresh-air supply:
Carry out post-curing in a circulating-air oven with a fresh air supply. The volatile components consist predominantly of flammable low-molecular siloxanes and maybe peroxide by-products, which must be removed from the oven during post-curing. To ensure reliable operation, fresh air must be supplied at a rate of 100 – 120 l/min/kg of silicone to prevent a risk of deflagration (observe the explosion limits). Most of the volatile components escape in the first 2 hours. Ensure good ventilation during this time.
- Inserting the cured parts:
Place the parts on a perforated plate or wire mesh, if possible without their touching each other, so that they are not deformed by their inherent weight. To avoid unrestricted air flow, do not place parts one inside the other. Coil up tubes or profiles. In the production of cables, the cable drums should be wound loosely. Single rods between the layers ensure that air can circulate through the cable drum.

- Temperature/time:
Perform tests to assure the optimum conditions for your part. Check the volatiles content by measuring the weight loss¹. The required post-curing time increases with the layer thickness. Sheets 2 mm thick generally require 4 hours at 200 °C. Following the heating-up phase, post-curing should be conducted for at least 4 hours at 200 °C. Never exceed 220 °C or a post-curing time of 8h, since this can lead to undesirable thermal aging of the material and embrittlement. Besides thermal aging, an oxygen deficiency can also cause undesirable reversion (degradation of crosslinks) and the formation of unwanted formaldehyde. Check regularly that the oven is operating at constant conditions (e.g. constant temperature).

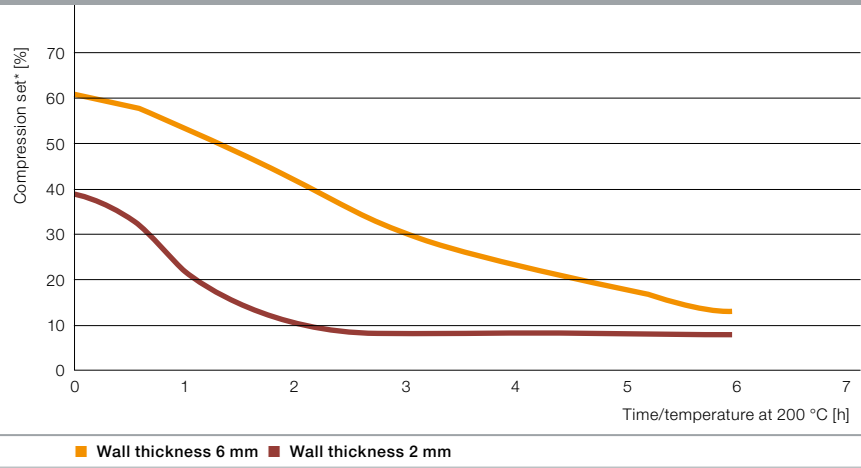
Important!

Never post-cure platinum-curing grades in contact with peroxides or their degradation products. The presence of such substances in the ventilation air can affect the basic properties of the rubber. Avoid contact with volatile components of organic rubber to prevent cross contamination. Clean the post cure ovens and exhaust system regularly, and replace the pipes in certain intervals.



¹ BfR tests require drying over calcium chloride prior to weight loss determination.

Influence of post-curing time on compression set of ELASTOSIL® LR 3003/50 at various wall thickness



* Measurement of compression set at 22h/175 °C in compliance with DIN ISO 815-B

Post-curing for technical applications

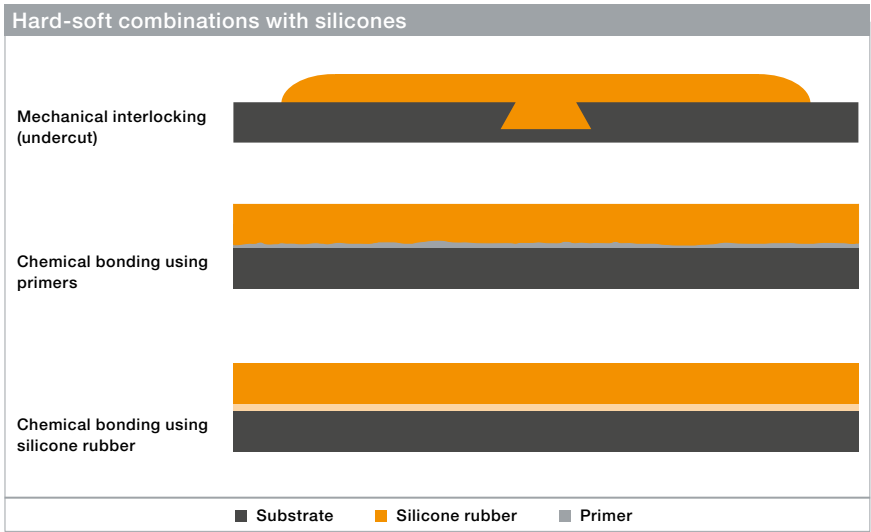
Post-curing can also be used to achieve particular technical properties. For example, the compression set of cured ELASTOSIL® silicone rubber depends very significantly on the post-curing time. In the case of ELASTOSIL® LR 3003/50, non-post-cured products have a compression set of 60 – 70%, which can be improved by post-curing. The non-post-curing grades ELASTOSIL® LR 3005, ELASTOSIL® LR 3015, ELASTOSIL® LR 3065 and ELASTOSIL® R 701 are designed for a particularly low compression set even without post-curing. However, they are generally restricted to use in technical applications.

ELASTOSIL® AUX CURING AGENT E and ELASTOSIL® AUX STABILIZER R

- Many HCR extrusion grades (e.g. for window profiles) do not need to be post-cured if Stabilizer R is added to the silicone rubber. The stabilizer prevents the blooming of by-products in ELASTOSIL® AUX CURING AGENT E and improves the compression set.
- Large-volume parts require post-curing and the addition of Stabilizer R. Here, incomplete migration of dichlorobenzoic acid, a primary by-product of ELASTOSIL® AUX CURING AGENT E, chemically ages the rubber by acid attack from the rubber bulk (softening it). Stabilizer R binds the by-products and significantly restricts this reaction.

6.2

MULTICOMPONENT TECHNIQUES



Silicone rubber can bond either mechanically or chemically to other substrates. The mechanical bond is produced by interlocking, for example by overmolding of openings or undercuts in the hard component. Chemical bonding generally offers several advantages: there are various ways of achieving this.

Chemical bonding techniques

Chemical bonding techniques include:

- Use of self-adhesive silicone rubber
- Vulcanizing onto a primer-treated substrate
- Bonding of premolded individual parts
- Physical (e.g. plasma) or mechanical treatment of the substrate surface

Advantages of chemical bonding

Chemical bonding generally offers price and performance advantages:

- Lower mechanical loading
- Lower tendency of the bond to fatigue
- Lower weight
- Bonds and seals simultaneously
- Can be bonded to shock-sensitive substrates (e.g. glass)
- Can be bonded to electrochemically sensitive metals

6.2

MULTICOMPONENT TECHNIQUES

SELF-ADHESIVE SILICONE RUBBER



Injection molding machine for 2K materials

Self-adhesive silicone rubber grades such as ELASTOSIL® R plus 4070 or ELASTOSIL® LR 3070 adhere directly to a substrate during vulcanization.

Adhesion to metals such as steel, aluminum or brass is generally very good. The same applies to many thermoplastics and thermosets. Silane-based products are generally used in the rubber as internal adhesion promoters. They are compatible with the uncured rubber but incompatible with the cured rubber, and therefore diffuse to the surface during vulcanization, forming a chemical bond.

Injection molding

The following processing methods can be used here (for details, see section 5, pages 56 – 57):

- Insertion process
- 2K process on an injection molding machine
 - Mold with rotary table
 - Transfer within the mold by a handling robot
- 2K injection molding process with two IM machines
 - Two different molds linked via a handling robot

Extrusion

For extrusion applications, coextrusion can be used to produce extrudates from different materials in one step (for details, see section 5, page 46).

Advantages

The advantages of self-adhesive silicone rubbers ELASTOSIL® R plus and LR are especially clear:

- Only one step (no application of primer, no cleaning of the substrate, no undercuts)
- Rapid curing and therefore short contact time with the mold
- Easily demoldable, even from uncoated steel
- Rapid build-up of adhesion strength to the substrate
- No adhesion to the mold

Please note

- Always check that the silicone rubber is compatible with the substrate (metal, glass, PA, PBT, PET, etc.)
- The melting point of the substrate should be as high as possible
- Extensive information about tested material combinations and adhesion values is available from our technical service. We will be pleased to perform tests in house on your behalf

6.2

MULTICOMPONENT TECHNIQUES

PRIMER/ADHESIVE

Primers				
Primer	Dynamic viscosity in mPa•s	Special characteristics	Suitable for	Recommended coating technique
WACKER® PRIMER G 790 TOLUENE FREE	1	General purpose	Platinum curing rubber	Spraying
WACKER® PRIMER G 791 A+B	4000	Silicone-on-silicone curing	Platinum curing rubber	Brushing or dipping
ELASTOSIL® AUX G 3242	5	General purpose	Peroxide curing rubber	Spraying
ELASTOSIL® AUX G 3243	550	General purpose	Peroxide curing rubber	Spraying or brushing
ELASTOSIL® AUX G 3244	300	Red color heat stabilized	Peroxide curing rubber	Spraying or brushing
ELASTOSIL® AUX G 3246	2600	General purpose	Peroxide curing rubber	Brushing or dipping

ELASTOSIL® AUX PRIMERS G serve as adhesion promoters between silicone elastomers and other substrates like metals, glass and thermoplasts. ELASTOSIL® AUX PRIMERS G are solvent based and contain a mixture of reactive silanes and siloxanes.

Special characteristics

- Provide excellent adhesion onto various substrates.
- Solvent based – Different viscosities available for various coating techniques like dipping, brushing or spraying.
- Further dilution in organic solvents possible.

Application

ELASTOSIL® AUX PRIMERS G are used to pretreat metallic, ceramic, glass or other polymeric substrate surfaces to enable excellent adhesion towards subsequent vulcanized ELASTOSIL® R, R *plus* or LR silicone elastomers.

Step by step

- The substrate to be primed must be dry and free of grease, oils or other contaminants. Very smooth surfaces must be roughened, for example thoroughly cleaned by sandblasting or with glass beads, and degreased with solvents such as white spirit or acetone.
- Apply primer by spraying, dipping or brushing (thin coat with no bubbles). For absorbent surfaces, repeat priming several times

- Dry primed metal parts in air for at least 15 minutes.
- Store the pretreated surfaces in a clean and dust-free place for maximum 24 hours drying time.
- So that the primer film is not damaged by high shearing forces during vulcanization, in the case of large-area coatings and for the production of rollers or rubberized metal parts by injection molding, the primer should be baked in the press. For example: 20 to 40 minutes at 100 to 140 °C.

Please note

Primers are based on moisture-sensitive compounds. Therefore, only open the containers briefly during processing and do not return residues to the vessel.

6.2

MULTICOMPONENT TECHNIQUES

BONDING OF PREMOLDED INDIVIDUAL PARTS

Adhesive		
Adhesive	Dynamic viscosity in mPa•s (Brookfield)	Special characteristics
ELASTOSIL® E41 TF	100.000	General purpose, solvent based
ELASTOSIL® E43 N	300.000	For food contact applications
ELASTOSIL® E47	Non-slump	Fast curing at elevated temperatures
SILPURAN® 4200	300.000	For medical applications

WACKER supplies one and two-component room-temperature-curing systems for bonding vulcanized silicone rubber parts or bonding silicone rubber to other substrates.

One-component adhesive

One-component room-temperature-vulcanizing (RTV-1) silicone rubber compounds are supplied ready to process in tubes, cartridges and pails. The compounds cure on exposure to atmospheric moisture. ELASTOSIL® E43 N is a solvent-free, heat-resistant transparent adhesive that does not use tin-containing catalysts. ELASTOSIL® E41 TF is a solvent-containing one-component dispersion that is easier to handle due to its improved flow properties. However, ELASTOSIL® E43 N is better for large-area bonding of relatively thin silicone rubber parts. The warping caused by the swelling effect of the solvent can be avoided in this case.

- Step by step:
 - Clean the rubber parts or substrate carefully and degrease if necessary
 - Apply the silicone rubber 1-component adhesive (RTV-1) to a thickness of at least 0.5 mm
 - Miter cut the ends of cords or profiles obliquely before bonding to give the biggest possible bonding area
 - Press together the parts to be bonded and fix them in position until the adhesive has cured
 - Depending on the air humidity, the optimum bond strength at room temperature is achieved within 12 to 15 hours. It is much faster at temperatures between 50 and 100 °C and high humidity

Two-component systems

Two-component systems (RTV-2) are an economically attractive alternative for larger production runs and large-area bonds. They cure rapidly even under lower air exposure.

- Step by step:
 - Apply the paste thinly to the cut surface and fix the bond in position under pressure
 - Cure by direct heating, with a hot-air gun or in a drying cabinet
 - The time depends on the heating method and thermal capacity of the parts to be bonded. At about 170 °C, the bond cures within 20 to 30 seconds

Bonding of metal

- ELASTOSIL® E one-component silicone rubber compounds release acetic acid when they cure causing corrosion to some metals
- Therefore, pretreat metals with primer G 790 TOLUENE FREE; the primer also improves adhesion
- With very corrosion-sensitive metals, we recommend using amine-curing (ELASTOSIL® A) or neutral (ELASTOSIL® N) systems



SECTION 7:
SERVICE





Contents

How we support you along the entire process chain

7.1 Technical support and advice	76
Technical centers, pilot plant and applications labs	
7.2 SILMIX®	78
Ready-to-use silicone compounds to your specifications	
7.3 Customer service/e-business	79
The direct route to the right contact/tailored solutions from electronic ordering to the vendor managed inventory	
7.4 Regulatory support	80
Qualified support in approval procedures according to national and international standards	
7.5 WACKER ACADEMY	81
Seminar and training programs covering the world of silicone rubber	

7.1.

TECHNICAL SUPPORT AND ADVICE



What we offer

- Preliminary material selection tests
- Production of 2K samples especially for adhesion testing and other test purposes
- Extruding profiles, tubing, round strands, cables of different geometries and silicone rubber materials for test purposes
- In-site production of prototypes and sample series using the client's own tooling for screening tests, approval or subsequent use by the end customer
- Joint development of specific products
- Training and instruction
- System consulting, particularly process design and utilization of machines/tooling in new applications and projects
- In-site process optimization
- Analysis and simulation of problems occurring in processing and production
- Individual problem solving and ensuring process stability

We offer you technical support at various levels to ensure the success of our products at every stage in your process chain.

Technical centers

We maintain technical centers in all key regions to assist you in any technical matters. From adjusting formulations to individual requirements, to property testing of rubber compound and cured material. The technical centers are equipped to perform all relevant analytical techniques and lab tests for you according to international and local standards and regulations. You have access not only to our locally based experts but also to our globally networked knowledge from over 50 years of market experience.

For example, our pilot plant in Burghausen forms the interface between product and applications expertise. It is equipped with a lab and test facilities, as well as production systems (extrusion and injection molding) for HCR and LSR silicone rubber, and 2K combinations. At our pilot plant, we put our ELASTOSIL® product series through a range of practical tests as part of their development, testing, modification and optimization. At the same time, we offer extensive advice at every step in the supply chain, and put our pilot plant and all the necessary tools at your disposal. Or we work on your premises at your production plant.



Applications labs

For technical support, our application chemists work closely with our customers, dealing with specific questions from the field. We will support you by finding the optimum product for your specific requirements and supporting your product development from material selection through to industrial production – worldwide. Our laboratories deal with key issues from specific industrial sectors (such as medical and automotive applications and cables). They have thereby built up special expertise and know-how in these application fields.

Some of our services

- Technical consultancy for product selection to your specific requirements
- Joint development of specific products
- Testing the chemical resistance of materials
- Thermal storage tests
- Providing samples and sheet samples
- Color matches
- Advice on questions about material processing

7.2.

SILMIX®: CUSTOM SILICONE RUBBER COMPOUNDS



Best quality

SILMIX® compounds are manufactured to the same quality standards as all WACKER silicone rubber grades. Thanks to its integrated silicon production system, WACKER is highly backward-integrated and produces the necessary raw materials itself, from the polymer base upwards. This ensures highly consistent good quality.

With SILMIX®, we offer you ready-to-use silicone rubber compounds tailored to your specifications.

Flexible and globally represented

At our SILMIX® plants at various sites around the world, we develop custom compounds to your specifications.

Direct and versatile

Our ready-to-process SILMIX® products allow you to manufacture a wide variety of silicone rubber articles directly by various processes, such as pressing, transfer molding, injection molding and extrusion. Applications range from automotive gaskets, through cable insulation, to rubber-coated rolls for photocopiers.

Interested?

You can find further information on our website: www.wacker.com/silmix

7.3.

CUSTOMER SERVICE E-BUSINESS

Customer service

For customer service and sales contacts, please visit our website www.wacker.com/contact

You can select your country and product and will be redirected to a specialist who can answer your question.

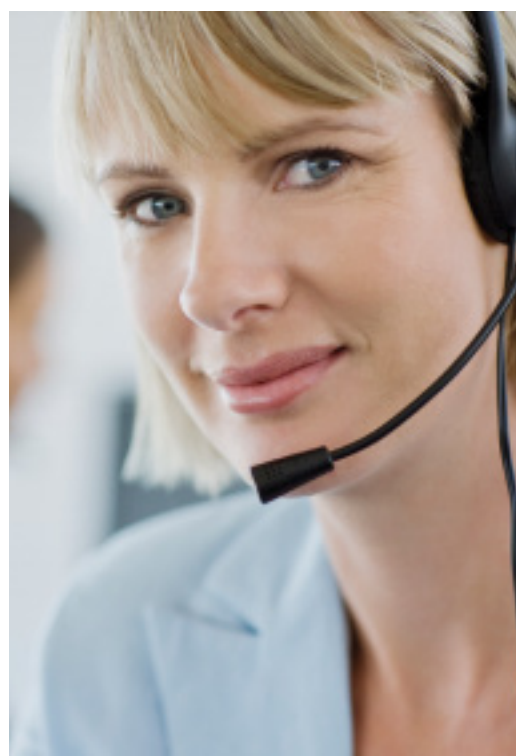
E-business

WACKER e-solutions simplify communication with customers and suppliers, and offer many new possibilities: from global searches to expedited order processing via the web platform or Hub2Hub, to vendor managed inventory – just as you wish. We compile a tailored service package for you. Exactly tailored to the size of your company, your profile and the wishes of each contact.

You can gain considerably greater efficiency through:

- “Clean orders”
- Fewer order changes
- Faster processing with a greatly reduced proportion of errors
- Maximum planning reliability and
- Full transparency

WACKER e-solutions support you exactly where human error is most common. However, they supplement rather than replace human interactions, by bringing the right people together. Our partners value the direct line to our experts in R&D, supply chain management, sales support and technical customer service.



And you can

- Call up any industry and product information you want
- Order easily, quickly and reliably – 24/7
- Carry out paperless invoicing
- Automatically process all orders
- Automatically check and complete your inventories

7.4.

REGULATORY SUPPORT



To ensure product safety, we – of course – offer you regulatory support. Our experts will deal with your enquiries about environmental, health and regulatory matters.

This includes, for example, the following topics:

- Food contact applications (e.g. BfR, FDA)
- Drinking water approval (e.g. KTW, WRAS, ACS)
- Pharmaceutical and medical applications (e.g. European Pharmacopeia and U.S. Pharmacopeia USP)
- National and international regulations and provisions (e. g. EU directive 2002/95/EC – RoHS, REACH)
- Requirements of specific industries (e.g. GADSL, IMDS, automotive industry)
- Specific customer requirements (e.g. banned-substance and substance-avoidance lists)
- Toxicology and ecotoxicology
- Risk assessment
- Organizational assistance

Just ask us!

Call us if you have any questions about food approvals, REACH or other regulatory issues. Please ask our sales managers first, who are your direct contacts. They will pass your questions on to our experts and send you our reply to your specific question!

7.5.

THE WACKER ACADEMY



To transfer its own expertise and market experience, WACKER has founded a unique institution, the WACKER ACADEMY. Here, at a number of sites worldwide, you can take advantage of a versatile, industry-specific seminar program.

This includes:

- Introductory chemistry seminars
- Training programs on particular application fields
- Introductory seminar on silicone rubber for newcomers to the field
- General seminars, e.g. on intercultural communication or innovation management

You can find the current program at: www.wacker.com/wacker-academy. The WACKER ACADEMY is headquartered at our largest production plant, which is in Burghausen, Germany. Further WACKER ACADEMY centers located in different regions exemplify our policy of making global expertise available right on your doorstep. As a result, we can offer you a seminar program that is tailored to you and your specific markets.

All our seminars are held by experienced specialists – chiefly in-house experts. To make our program even more attractive and ensure it remains up to date, we work closely with universities and research institutes.

SECTION 8:
RUBBER SOLUTIONS A-Z
FACTS AND FIGURES ABOUT SILICONE





Contents

A list of frequently used technical terms is given below.

Coefficient of expansion	84
Compression set	84
Density	84
Dielectric constant	84
Dielectric strength	84
Dissipation factor	84
Fire behavior	84
Flame resistance	84
Gas permeability	85
Hardness	85
High-energy radiation	85
Hot-air resistance	85
Ozone resistance	85
Rebound resilience	85
Reversion	85
Solvent and chemicals resistance	86
Shrinkage	86
Surface resistance	86
Tear propagation and notch resistance	86
Tear strength and elongation at break	86
Temperature behavior	87
Thermal conductivity and specific heat capacity	87
Tracking resistance	87
Volume resistivity	87
Water and steam resistance	87
Weathering and UV resistance	87

8.

RUBBER SOLUTIONS A-Z

FACTS AND FIGURES ABOUT SILICONE

Coefficient of expansion (linear)

- Linear thermal coefficient of silicone rubber is approx. $2 - 4 \cdot 10^{-4} \cdot K^{-1}$
- Shrinkage of the final parts needs to be taken into consideration.
- Tool steel approx. $1.5 \cdot 10^{-6} \cdot K^{-1}$.

Compression set

- Determination of the compression set as per ISO 815-1 (ASTM D395 B-2) by storage for 22h/175 °C, or 22h/125 °C in the case of self-adhesive grades.
- Compression set describes the elastic recovery of a cured rubber, an important characteristic for gasket applications.
- Typical values for silicone rubber: 5 – 25%.

Density

- Determination as per ISO 1183-1 A (buoyancy method).
- Typical range for specific density $1.05 - 1.60 \text{ g/cm}^3$.
- When using additional inactive fillers (e.g. quartz), values up to 1.75 g/cm^3 can be achieved, e.g. to improve swelling resistance.

Relative permittivity

- Determination of relative permittivity as per IEC 62631-2-1.
- Typical values for silicone rubber: $\epsilon = 2.7 - 3.3$ (at 25 °C and 50 Hz).
- This property can be increased up to 150 by the use of suitable fillers.

Dielectric strength

- Determination of dielectric strength per IEC 60243-1.
- Typical value for ELASTOSIL® silicone rubber > 20 kV/mm (measured on a 1 mm sheet).

Dissipation factor $\tan \delta$

- Determination of the dissipation factor as per IEC 62631-2-1.
- Typical values for loss angle $\tan \delta \sim 10^{-3}$. $\tan \delta$ is raised by increasing the filler content/density.

Fire behavior

- The auto-ignition temperature of cured products is about 430 °C.
- Silicone rubber burns to form a white non-toxic ash of silicon dioxide
- The resultant combustion gases are usually non-corrosive.
- Specialty grades for high-safety cables form a ceramic layer in the case of fire.

Flame resistance

- Determination of the flame resistance acc. to test standard ASTM D 2863 by determining the limiting oxygen index (LOI) or acc. to Underwriters Laboratory fire standard (UL 94).
- Typical LOI values of flame retardant grades 27 to 35%
- Standard grades normally achieve UL 94 HB (0.5 – 1.0 mm thickness*)
- Specialty grades with additives reach UL 94 V0 (0.75 – 4.0 mm thickness*).
- In the case of solid silicone rubber, the addition of 2.2% ELASTOSIL® AUX BATCH SB-2 improves the flame resistance considerably.

* dep. on grade

Gas permeability

- Determination as per DIN 53 536
- Very high gas permeability compared to other elastomers, e.g. for air 30 times higher than for natural rubber (NR) or 400 times higher than butyl rubber (IIR) (measured at 25 °C)
- The absolute value of a 50 Shore A grade for air at 20 °C and 80 °C is 570 and 1.330 cm³ · mm · m⁻² · h⁻¹ · bar⁻¹ (volume of air measured in cm³, that penetrates a membrane of 1 m² area per hour at a pressure difference of 1 bar and 1 mm thickness)
- Technical advantage, e.g. for contact lenses, textile coatings and for some medical applications
- At high temperatures, silicone has similar values to organic elastomers

Gas permeability	
Gas	Relative permeability at 25 °C [%]
Air	100
Hydrogen	190
Oxygen	170
Nitrogen	80
Carbon dioxide	1.000
Ethylene	390

Hardness

- Determination of the hardness of silicone rubber in Shore A (ISO 48-4) or in IRHD units (ISO 48-1 method M).
- Typical bandwidth 3 – 90 Shore A.

High-energy radiation

- Outstanding resistance of silicone rubber (VMQ, PVMQ) to high-energy radiation in combination with hot-air resistance in comparison to other elastomers.
- With VMQ silicone rubber grades, only high radiation doses of 400 – 800 kGy lead to a reduction of 50% in the elongation at break.
- Phenyl-containing PVMQ silicone rubber, such as ELASTOSIL® R 490/55, has higher resistance.
- Properties not severely affected by gamma and beta radiation (25 – 75 kGy), as widely used for sterilization of medical equipment.
- Very good resistance to microwaves, since silicone parts are not microwave-active and therefore not heated.

Hot-air resistance

- The mechanical properties of WACKER silicone rubber are retained even at high temperature loading (hot air).
- As a result, the hot-air resistance is clearly superior to that of most organic elastomers (cf. ASTM Chart D2000)

Ozone resistance

- Outstanding resistance of silicone rubber to ozone
- Determining ozone resistance as per DIN 53509

- For selected products of the ELASTOSIL® R 401 and ELASTOSIL® LR 3003 series, a cracking level of 0 was obtained after 96h at an ozone concentration of 200 pphm (temperature: 40 °C, r.h. 55%, elongation 80%)

Rebound resilience

- Determination of rebound resilience as per ISO 4662
- Also commonly known as “snap”
- Measured on 6 mm samples as a ratio of rebound height to the drop height of a pendulum
- Typical values 30 – 70%.

Reversion

- By reversion is meant in general degradation of the crosslinking network in the cured rubber as a result of chemical or thermal effects, which leads to a permanent decrease of hardness (softening)
- In silicone rubber, at high temperatures (> 200 °C) traces of moisture or free hydroxyl groups in fillers cause cleavage of the Si-O bond in the polymer chain and ultimately the above-mentioned decrease in hardness due to depolymerization
- This process is inhibited by the presence of air
- High heat resistance therefore requires unrestricted access of atmospheric oxygen
- In the case of thick parts, where oxygen diffusion is difficult, this process is inhibited by the use of Stabilizer R.

Solvent and chemical resistance

- The chemical resistance of WACKER silicone rubber generally depends on the crosslinking density, filler used, and filler content.
- With higher filler levels in the silicone rubber, swelling tendency decreases and resistance is therefore improved.
- High swelling tendency to non-polar liquids such as hydrocarbons, mineral oils and greases.
- Low swelling tendency to polar liquids, such as polyhydric alcohols, low-molecular ketones, and therefore no negative effect on seal quality.
- Strongly attacked by concentrated acids and alkalis, particularly by oxidizing acids such as sulfuric or nitric acid.
- Silicone rubber has good resistance to aqueous solutions of weak acids, alkalis or salts, which are commonly used as cleaning solutions for lines/tubing at 70 – 80 °C in the food industry.

Shrinkage

- Linear shrinkage of approx. 2 – 4% falls with increasing Shore hardness and lower vulcanization temperature
- The higher the filler content or density, the less is the shrinkage of the cured parts.
- Very strong dependency on processing parameters and material grades
- For precision parts, fine tuning is necessary by means of preliminary tests.

Surface resistance

- Determination of the surface resistivity per IEC 62631-3-2.
- Typical values for insulating ELASTOSIL® LR compounds: approx. 10^{12} – 10^{13} Ω.

Tear propagation and notch resistance

- Tear strength depends on which particular standard is used.
- Typical values when determined as per ASTM D 624 B (crescent): 5 – 55 N/mm.
- Values are up to 30% lower when measured by ISO 34-1, method B-b (Graves).
- ISO 34-1 method A (trouser) yields values about 50% lower.

Tensile strength and elongation at break

- Determination as per ISO 37
- Standard test on type 1 bar. In exceptional cases also measurements on small type 2 and type 3 test specimens, though the values deviate correspondingly
- Typical values for tensile strength: approx. 5 – 12 N/mm² (or MPa)
- Typical values for elongation at break: approx. 100 – 1.100%

Temperature behavior

- The change in the mechanical properties is only small compared to organic elastomers. ASTM D2000.
- Typical service temperature range: –50 to +250 °C.
- The material hardens at very low temperatures (–40 °C) due to reversible crystallization.
- At high temperatures (> 180 °C), the organic side groups attached to the silicon atom undergo free-radical cleavage. The resulting free radicals cause post-curing of the polymer chains, with an increase in hardness together with a decrease of tensile strength and elongation at break (embrittlement).
- The simultaneous weight decrease of the vulcanizate leads to shrinkage.
- The lifetime of the vulcanizate can be increased by the use of heat stabilizers H1 – H6 or of FL color pastes.
- Excellent stable long-term behavior for insulation at high temperatures is obtained, as oxidative degradation produces quartz-like properties.

Thermal conductivity and specific heat capacity

- Determined as per DIN EN 993-15 and ISO 22007-4
- The thermal conductivity depends on the type and amount of fillers used.
- Typical value at 100 °C: approx. $0.2 - 0.3 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$.
- Special thermally conductive compounds achieve values of about $0.1 - 1.2 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$.
- Typical values for specific heat capacity: approx. $1.25 \text{ kJ} \cdot \text{kg}^{-1} \cdot \text{K}^{-1}$.

Tracking resistance

- Standard silicone rubber generally provides excellent electrical insulating properties and features high tracking resistance, as per IEC 60112, the highest class CTI 600 with an erosion depth of less than 1 mm can be achieved.
- Silicone rubber can be adapted to reach outstanding tracking and erosion resistance as per IEC 60587, the highest class 1 A 4.5 with an erosion depth of less than 1 mm can be achieved.

Volume resistivity

- Determination as per IEC 62631-3-1
- Typical values for insulating silicone rubber grades approx. $10^{15} \Omega \cdot \text{cm}$.
- Typical values for conductive grades approx. $2 - 150 \Omega \cdot \text{cm}$.
- Lower temperature dependency in the case of platinum-catalyzed grades compared to peroxide-cured systems.

Water and steam resistance

- Excellent resistance to boiling water.
- Volume decrease in boiling water below 1%, even after prolonged action.
- Steam sterilization (as per ISO 17665, DIN EN 868-8 at 500 cycles at 134 °C, 5min.) leads to only a slight worsening of mechanical properties.

Weathering and UV resistance

- Silicone rubber articles are generally insensitive to UV radiation.
- Properties only change slightly even in long-term tests (several years of weathering).
- Unlike with organic elastomers, weathering resistance can be achieved without additives (e.g. organic antioxidants, UV stabilizers, etc.).

YOUR NOTES



EXPERTISE AND SERVICE NETWORK ON FIVE CONTINENTS



WACKER is one of the world's leading and most research-intensive chemical companies, with total sales of €5.7bn. Products range from silicones, binders and polymer additives for diverse industrial sectors to bioengineered pharmaceutical actives and hyperpure silicon for semiconductor and solar applications. As a technology leader focusing on sustainability, WACKER promotes products and ideas that offer a high value-added potential to ensure that current and future generations enjoy a better quality of life, based on energy efficiency and protection of the climate and environment.

Spanning the globe with 4 business divisions, we offer our customers highly-specialized products and comprehensive service via 27 production sites, 21 technical competence centers, 14 WACKER ACADEMY training centers and 48 sales offices in Europe, North and South America, and Asia – including a presence in China. With a workforce of some 16,600, we see ourselves as a reliable innovation partner that develops trailblazing solutions for, and in collaboration with, our customers. We also help them boost their own success. Our technical competence centers employ local specialists, who assist

customers worldwide in the development of products tailored to regional demands, supporting them during every stage of their complex production processes, if required. WACKER e-solutions are online services provided via our customer portal and as integrated process solutions. Our customers and business partners thus benefit from reliable service and comprehensive information to enable projects and orders to be handled fast, reliably and highly efficiently. Visit us anywhere, anytime around the world at: **www.wacker.com**

All figures are based on fiscal 2024.



WACKER

CREATING TOMORROW'S SOLUTIONS

ELASTOSIL®

WACKER

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www.wacker.com

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6709C en/08.25 replaces 6709C e/09.22

PRODUCT OVERVIEW

PEROXIDE-CURING SOLID SILICONE RUBBER

Multi-purpose · high green strength · high tear resistance ·
low compression set

The data presented in this medium are in accordance with the present state of our knowledge but do not absolve the user from carefully checking all supplies immediately on receipt. We reserve the right to alter product constants within the scope of technical progress or new developments. The recommendations made in this medium should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies' raw materials are also being used. The information provided by us does not absolve the user from the obligation of investigating the possibility of infringement of third parties' rights and, if necessary, clarifying the position. Recommendations for use do not constitute a warranty, either express or implied, of the fitness or suitability of the product for a particular purpose.

Main characteristics	Brand	Product	Hardness Shore A ISO 48-4	Specific gravity [g/cm³] ISO 1183-1A	Tensile strength [N/mm²] ISO 37 Typ 1	Elongation at break [%] ISO 37 Typ 1	Tear resistance [N/mm] ASTM D 624 B	Compression set [%] (22 h/175 °C) DIN ISO 815-1	Data obtained with curing agent	Food contact – BfR ¹	Food contact – FDA ²	Flame retardancy – UL94 listing (C1, C6 and E)	Molding	Extrusion	Appearance	Typical applications
Multi-purpose	ELASTOSIL®	R 401/10 oH	13	1.07	5.5	1,100	20	33	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 401/20 oH	24	1.11	8.0	900	23	32	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 401/30 S	28	1.10	10.0	910	28	15	C1	X	X	HB (0.75; 3 mm)	X		Transparent	Production of molded parts, e.g. seals, valves or spark plug boots
	ELASTOSIL®	R 401/30 oH	33	1.11	9.5	700	19	20	E	x	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts, e.g. tubes, cables or profiles
	ELASTOSIL®	R 401/40 S	41	1.11	9.5	580	23	36	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 401/50 S	51	1.15	11.0	520	23	34	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 401/55 S	57	1.14	10.0	400	20	35	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 401/60 S	60	1.15	11.0	440	24	31	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 401/60 KX S	59	1.18	11.0	460	25	25	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts, e.g. tubes, cables or profiles
	ELASTOSIL®	R 401/70 S	70	1.18	11.5	460	28	40	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 401/80 S	77	1.20	10.0	440	30	60	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 401/90 oH	87	1.22	7.5	270	22	38	E	X	X	HB (0.75; 3 mm)		X	Transparent	Production of extruded parts (tubes, cables, profiles)
	ELASTOSIL®	R 510/60 S	60	1.14	10.5	430	22	31	E					X	Translucent	Production of silicone-insulated cables and wires
	ELASTOSIL®	R 510/70 S	69	1.21	10.0	350	22	48	E					X	Translucent	Production of silicone-insulated cables and wires
	ELASTOSIL®	R 402/65 oH	66	1.17	11.0	450	24	29	E	X	X			X	Transparent	Production of extruded parts, e.g. precision profiles and dimensionally accurate tubes
	ELASTOSIL®	R 402/75 S	72	1.20	9.0	490	34	70	E	X	X			X	Transparent	Production of extruded parts, e.g. precision profiles and dimensionally accurate tubes
	ELASTOSIL®	R 416/70 mH	70	1.18	11.3	580	32	20	C1						Black, red	Calendering and extrusion
	ELASTOSIL®	R 760/70 mH	70	1.17	10.7	530	27	9	C1					X	Black, red	Calendering and extrusion, e.g. production of turbocharger hoses
	High tear resistance	ELASTOSIL®	R 420/30 oH	32	1.10	630	24	28	E	X	X			X	Transparent	Production of extruded parts with excellent tear resistance, e.g. tubes or profiles
		ELASTOSIL®	R 420/40 S	44	1.12	630	31	34	E	X	X			X	Transparent	Production of extruded parts with excellent tear resistance, e.g. tubes or profiles
	ELASTOSIL®	R 420/50 S	51	1.14	10.5	620	39	31	E	X	X			X	Transparent	Production of extruded parts with excellent tear resistance, e.g. tubes or profiles
	ELASTOSIL®	R 420/60 S	60	1.17	10.0	600	44	34	E	X	X			X	Transparent	Production of extruded parts with excellent tear resistance, e.g. tubes or profiles
	ELASTOSIL®	R 420/70 S	64	1.19	9.5	660	48	59	E	X	X			X	Transparent	Production of extruded parts with excellent tear resistance, e.g. tubes or profiles
	Low compression set	ELASTOSIL®	R 865/40 S	43	1.10	500	14	10	C6	X	X		X		Translucent	Production of molded parts, e.g. keypads
		ELASTOSIL®	R 865/50 S	51	1.12	460	17	12	C6	X	X		X		Translucent	Production of molded parts, e.g. keypads
		ELASTOSIL®	R 865/60 S	62	1.16	370	17	9	C6	X	X		X		Translucent	Production of molded parts, e.g. keypads
		ELASTOSIL®	R 865/70 S	70	1.19	380	18	9	C6	X	X		X		Translucent	Production of molded parts, e.g. keypads

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¹ BfR recommendation XV (silicones); (BfR = Bundesinstitut für Risikobewertung).

² FDA CFR 21 § 177.2600 "Rubber articles intended for repeated use" (FDA = Food and Drug Administration).

³ Categories on request.

⁴ Non-postcured

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6709D en/08.25 replaces 6709D en/09.22

PRODUCT OVERVIEW

PEROXIDE-CURING SOLID SILICONE RUBBER

Media resistant · high rebound resilience · low temperature resistance ·
high heat resistance · ceramifying · electrically conductive · flame
retardant · low rebound resilience · superheated steam resistance ·
magnetisable

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Main characteristics	Brand	Product	Hardness Shore A ISO 48-4	Specific gravity [g/cm ³] ISO 1183-1A	Tensile strength [N/mm ²] ISO 37 Typ 1	Elongation at break [%] ISO 37 Typ 1	Tear resistance [N/mm] ASTM D 624 B	Compression set [%] (22 h/175 °C) DIN ISO 815-1	Data obtained with curing agent	Food contact – BfR ¹	Food contact – FDA ²	Molding	Extrusion	Appearance	Typical applications
Media resistant	ELASTOSIL®	R 700/40 ⁴	40	1.09	7.5	470	14	11	C1	X	X	X		Translucent	Production of industrial molded parts, e.g. rollers or seals and gaskets in contact with oil
	ELASTOSIL®	R 700/80 ⁴	79	1.39	8.0	250	16	15	C1	X	X		X	Beige	Production of industrial molded parts, e.g. rollers or seals and gaskets in contact with oil
	ELASTOSIL®	R 701/40	40	1.10	8.0	520	14	8	C1			X		Opaque	Production of industrial molded parts, e.g. rollers or seals and gaskets in contact with oil
	ELASTOSIL®	R 701/50	51	1.16	8.0	470	20	9	C1				X	Beige	Production of industrial molded parts, e.g. rollers or seals and gaskets in contact with oil
	ELASTOSIL®	R 701/60	60	1.24	8.0	360	16	7	C1				X	Beige	Production of industrial molded parts, e.g. rollers or seals and gaskets in contact with oil
	ELASTOSIL®	R 701/70	71	1.30	8.0	280	17	8	C1				X	Beige	Production of industrial molded parts, e.g. rollers or seals and gaskets in contact with oil
	ELASTOSIL®	R 701/80	81	1.39	7.5	200	16	19	C1				X	Beige	Production of industrial molded parts, e.g. rollers or seals and gaskets in contact with oil
	ELASTOSIL®	R 780/80 oH	89	1.72	6.0	70	8	15	E	X	X		X	Beige	Masterbatch for compounding inert fillers
	ELASTOSIL®	R 861/60 S	57	1.16	8.5	370	18	23	E	X	X		X	Translucent	Production of extruded or molded parts, e.g. seals with low compression set
	ELASTOSIL®	R 861/70 S	69	1.19	9.0	340	17	27	E	X	X		X	Translucent	Production of extruded or molded parts, e.g. seals with low compression set
High rebound resilience	ELASTOSIL®	R 101/25 oH	23	1.07	7.0	890	14	13	C1	X	X	X		Translucent	Production of molded parts, e.g. vibration damping elements
	ELASTOSIL®	R 101/35 oH	35	1.09	8.0	700	16	10	C1	X	X	X		Translucent	Production of molded parts, e.g. damping elements for engine mounts
	ELASTOSIL®	R 101/45 oH	47	1.10	8.0	540	18	10	C1	X	X	X		Translucent	Production of molded parts
	ELASTOSIL®	R 101/65 oH	65	1.13	8.0	200	16	10	C1	X	X	X		Translucent	Production of molded parts with excellent durability in long-term stress applications, e.g. vibration damping elements for engine mounts
Low temperature resistance	ELASTOSIL®	R 490/55 oH	50	1.17	11.0	500	33	39	E	X	X		X	Transparent	Production of extruded parts with very good low temperature resistance
High heat resistance	ELASTOSIL®	R 750/40 oH	38	1.12	11.0	650	26	26	E				X	Transparent	Production of extruded parts with good resistance to dry heat
	ELASTOSIL®	R 750/50 oH	48	1.14	11.0	530	28	20	E				X	Transparent	Production of extruded parts with good resistance to dry heat
	ELASTOSIL®	R 756/40 oH	41	1.10	8.0	570	18	8	C1	X	X	X		Transparent	Optimized for high temperatures
	ELASTOSIL®	R 756/50 oH	47	1.11	9.0	560	19	5	C1	X	X	X	X	Transparent	Optimized for high temperatures
	ELASTOSIL®	R 756/60 oH	58	1.15	10.5	490	23	10	C1	X	X	X	X	Transparent	Optimized for high temperatures
	ELASTOSIL®	R 756/70 oH	67	1.18	10.5	400	24	11	C1	X	X	X	X	Transparent	Optimized for high temperatures
Ceramifying. ash-stable	ELASTOSIL®	R 502/75 oH	72	1.28	9.0	400	25	56	C6				X	White	Production of safety cables and wires that assure circuit integrity in case of fire
	ELASTOSIL®	R 512/70 oH	66	1.37	7.0	400	18	41	E				X	White	Production of safety cables and wires that assure circuit integrity in case of fire
Electrically conductive	ELASTOSIL®	R 570/50 oH	52	1.11	8.0	370	14	37	C1			X		Black	Production of electrically conductive molded parts
	ELASTOSIL®	R 570/60 oH	62	1.13	7.5	290	12	28	C1			X		Black	Production of electrically conductive molded parts
	ELASTOSIL®	R 570/70 oH	70	1.16	6.3	165	13	29	C6			X		Black	Production of electrically conductive molded parts
Flame retardant	ELASTOSIL®	R 501/75 oH	69	1.22	7.5	470	36	93	E				X	Translucent	Production of flame-retardant cable insulations for household, automotive, railway, marine and aerospace applications
	ELASTOSIL®	R 770/50 oH	46	1.14	9.5	700	38	16	E				X	White	Applications with high demands on fire safety, e.g. door profiles in trains or floor profiles in airplanes
	ELASTOSIL®	R 770/60 oH	64	1.49	4.0	400	14	38	E				X	White	Applications with high demands on fire safety, e.g. door profiles in trains or floor profiles in airplanes
	ELASTOSIL®	R 770/75 oH	77	1.55	4.0	270	15	39	E				X	White	Applications with high demands on fire safety, e.g. door profiles in trains or floor profiles in airplanes
Low rebound resilience	ELASTOSIL®	R 752/50 oH	50	1.18	9.9	770	32	38	C1	X	X	X		Translucent	Production of molded parts with good damping properties, e.g. vibration damping elements in the automotive industry
	ELASTOSIL®	R 752/70 oH	70	1.22	8.5	460	22	19	C1	X	X	X		Translucent	Production of molded parts with good damping properties, e.g. vibration damping elements in the automotive industry
Superheated steam resistance	ELASTOSIL®	R 755/60 oH	58	1.18	7.7	330	15	16	C1			X		Opaque	Production of molded parts with good resistance to water vapor
Magnetisable	ELASTOSIL®	R 781/80	83	2.33	3.3	50	18	64	E	X	X	X	X	Black	Production of magnetic molding articles

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6709E en/08.25 replaces 6709E en/10.22

PRODUCT OVERVIEW

LIQUID SILICONE RUBBER

Multi-purpose · high tear resistance · media resistance ·
heat resistance · low coefficient of friction

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Main characteristics	Brand	Product	Further characteristics	Hardness Shore A ISO 48-4	Specific gravity [g/cm ³] ISO 1183-1A	Tensile strength [N/mm ²] ISO 37 Typ 1	Elongation at break [%] ISO 37 Typ 1	Tear resistance [N/mm] ASTM D 624 B	Compression set [%] (22 h/175 °C) DIN ISO 815-1	Food contact – BfR ¹	Food contact – FDA ²	Flame retardancy – UL 94 Listing	Cure system	Appeareance	Typical applications
Multi purpose	ELASTOSIL®	LR 3003/03		3	1.01	1.3	700	3	16				Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/10 TR		12	1.07	4.2	760	13	13			HB (0.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/20 TR		22	1.09	8.3	870	24	17	X	X	HB (0.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/30		30	1.09	7.0	610	21	10	X	X	HB (0.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/40		40	1.13	10.0	610	30	11	X	X	HB (0.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/50		50	1.13	10.3	490	26	13	X	X	HB (0.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/60		60	1.13	9.8	340	27	16	X	X	HB (0.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/70		70	1.13	9.3	290	20	16	X	X	HB (0.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/80		77	1.15	8.3	240	12	17	X	X	HB (0.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
Fast cure	ELASTOSIL®	LR 3003/85		85	1.14	6.5	130	11	14	X	X		Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3003/90		90	1.13	7.0	50	8	16	X	X		Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, valves, gaskets, membranes, O-rings
	ELASTOSIL®	LR 3004/30		30	1.10	7.1	620	24	10	X	X	HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3004/40		40	1.13	9.1	610	29	10	X	X	HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3004/50		50	1.13	10.0	480	27	15	X	X	HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3004/60		60	1.13	9.6	380	25	18	X	X	HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3004/70		70	1.14	9.9	310	20	11	X	X	HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3005/30	Fast cure	30	1.10	6.0	610	16	13			HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of technical molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3005/40	Fast cure	40	1.13	7.8	600	22	16			HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of technical molded parts, e.g. seals, O-rings, valves, gaskets, membranes
Low comp. set npc ⁴	ELASTOSIL®	LR 3005/50	Fast cure	50	1.12	8.7	500	24	15			HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of technical molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3005/60	Fast cure	60	1.13	9.5	380	28	15			HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of technical molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3005/70	Fast cure	70	1.14	8.5	330	23	19			HB (1.5 mm)	Platinum (1:1 A/B)	Transparent	Production of technical molded parts, e.g. seals, O-rings, valves, gaskets, membranes
	ELASTOSIL®	LR 3040/30	Fast cure	30	1.12	9.8	740	35	14	X	X		Platinum (1:1 A/B)	Transparent	Economic production (fast cure) of molded parts, e.g. baby-bottle or pacifier teats
	ELASTOSIL®	LR 3040/40	Fast cure	40	1.12	9.0	600	36	11	X	X		Platinum (1:1 A/B)	Transparent	Economic production (fast cure) of molded parts, e.g. baby-bottle or pacifier teats
	ELASTOSIL®	LR 3040/50	Fast cure	50	1.12	9.2	500	40	11	X	X		Platinum (1:1 A/B)	Transparent	Economic production (fast cure) of molded parts, e.g. baby-bottle or pacifier teats
	ELASTOSIL®	LR 3040/60	Fast cure	60	1.14	9.4	380	38	15	X	X		Platinum (1:1 A/B)	Transparent	Economic production (fast cure) of molded parts
	ELASTOSIL®	LR 3040/70	Fast cure	70	1.14	8.0	370	40	15	X	X		Platinum (1:1 A/B)	Transparent	Economic production (fast cure) of molded parts
	ELASTOSIL®	LR 3043/40		40	1.14	9.8	680	36	25	X	X		Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. baby-bottle nipples or pacifiers
High tear resistance	ELASTOSIL®	LR 3043/50		50	1.13	9.4	460	46	25	X	X		Platinum (1:1 A/B)	Transparent	Production of molded parts, e.g. baby-bottle nipples or pacifiers
	ELASTOSIL®	LR 3043/60		60	1.13	9.2	390	47	20	X	X		Platinum (1:1 A/B)	Transparent	Production of molded parts
	ELASTOSIL®	LR 3043/70		70	1.13	9.5	280	21	22	X	X		Platinum (1:1 A/B)	Transparent	Production of molded parts
	ELASTOSIL®	LR 3015/50	Oil resistant, less abrasive, low comp. set, npc ³	50	1.34	5.4	470	12	18				Platinum (1:1 A/B)	Beige	Technical parts, e.g. valves, seals and O-rings in contact with oil
	ELASTOSIL®	LR 3015/70	Oil resistant, less abrasive, low comp. set, npc ³	70	1.36	6.1	280	15	16				Platinum (1:1 A/B)	Beige	Technical parts, e.g. valves, seals and O-rings in contact with oil
	ELASTOSIL®	LR 3016/65	Oil resistant, non abrasive, low comp. set, npc ³ , improved mechanical properties	65	1.17	8.7	350	26	17				Platinum (1:1 A/B)	White	Technical parts, e.g. valves, seals and O-rings in contact with oil
	ELASTOSIL®	LR 3020/60	Steam resistant	60	1.13	6.1	280	13	10	X	X		Platinum (1:1 A/B)	Opaque	Production of molded parts, such as gaskets, valves, membranes and seals
	ELASTOSIL®	LR 3022/60	Coolant resistant	61	1.13	6.1	270	14	7				Platinum (1:1 A/B)	Opaque	Technical parts, e.g. valves, seals and O-rings in contact with coolant
	ELASTOSIL®	LR 3023/60	Coolant resistant, low comp. set, npc ³	60	1.12	6.4	300	15	11				Platinum (1:1 A/B)	Opaque	Technical parts, e.g. valves, seals and O-rings in contact with coolant
Heat resistance	ELASTOSIL®	LR 3025/40	Fuel cell gaskets	40	1.11	7.0	500	31	11					Transparent	
	ELASTOSIL®	LR 3092/65	Low comp. set	66	1.15	10.0	330	25	10			HB (0.5 mm)	Platinum (1:1 A/B)	Black	Post-cured technical parts in contact with high temperatures
	ELASTOSIL®	LR 3093/65	Ultra low comp. set	63	1.12	8.5	330	24	7				Platinum (1:1 A/B)	Black	Post-cured technical parts in contact with high temperatures
Low coefficient of friction	ELASTOSIL®	LR 3065/30	Low comp. set, npc ³ , technical appl.	30	1.12	7.5	650	24	17			HB (0.5; 1.5; 3 mm)	Platinum (1:1 A/B)	Transparent	Technical molded parts with low coefficient of friction, e.g. weather packs, mat seals, connector pads for the automotive industry
	ELASTOSIL®	LR 3065/50	Low comp. set, npc ³ , technical appl.	50	1.12	9.0	460	31	15			HB (0.5; 1.5; 3 mm)	Platinum (1:1 A/B)	Transparent	Technical molded parts with low coefficient of friction, e.g. weather packs, mat seals, connector pads for the automotive industry
	ELASTOSIL®	LR 3066/30	Food contact	30	1.10	7.8	660	31	12	X	X		Platinum (1:1 A/B)	Transparent	Molded parts with low coefficient of friction for food contact applications
	ELASTOSIL®	LR 3066/40	Food contact	40	1.12	9.3	580	32	12	X	X		Platinum (1:1 A/B)	Transparent	Molded parts with low coefficient of friction for food contact applications
	ELASTOSIL®	LR 3066/50	Food contact	50	1.12	8.9	440	31	16	X	X		Platinum (1:1 A/B)	Transparent	Molded parts with low coefficient of friction for food contact applications
	ELASTOSIL®	LR 3066/60	Food contact	60	1.13	9.3	330	24	19	X	X		Platinum (1:1 A/B)	Transparent	Molded parts with low coefficient of friction for food contact applications
	ELASTOSIL®	LR 3066/70	Food contact	70	1.13	8.3	270	18	17	X	X		Platinum (1:1 A/B)	Transparent	Molded parts with low coefficient of friction for food contact applications
	ELASTOSIL®	LR 3066/80	Food contact	77	1.13	6.9	180	11	13	X	X		Platinum (1:1 A/B)	Transparent	Molded parts with low coefficient of friction for food contact applications

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A tighter specification regarding Sh-A hardness can be possible for selected products on demand (+/-1, +/-2, +/-3).

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6709F en/08.25 replaces 6709F en/10.22

PRODUCT OVERVIEW

LIQUID SILICONE RUBBER

Self-adhesion · oil-bleeding · low viscosity ·
electrically conductive · high transparency · flame retardant ·
low volatile content without post-curing

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Self-adhesion	ELASTOSIL®	LR 3070/20	Adhesion on PA, PBT, PET, technical appl.	20	1.09	6.6	820	15	43 ⁴			HB (0.75 mm)	Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET), e.g. cable connectors
	ELASTOSIL®	LR 3070/30	Adhesion on PA, PBT, PET, technical appl.	30	1.10	7.7	730	18	38 ⁴				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET), e.g. cable connectors
	ELASTOSIL®	LR 3070/40	Adhesion on PA, PBT, PET, technical appl.	40	1.12	8.7	670	24	37 ⁴				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET), e.g. cable connectors
	ELASTOSIL®	LR 3070/50	Adhesion on PA, PBT, PET, technical appl.	50	1.11	9.2	490	20	22 ⁴				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET), e.g. cable connectors
	ELASTOSIL®	LR 3070/60	Adhesion on PA, PBT, PET, technical appl.	60	1.12	9.1	460	23	21 ⁴				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET), e.g. cable connectors
	ELASTOSIL®	LR 3071/30	Food contact	30	1.09	7.9	780	20	40 ⁴	X	X		Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET) for food contact
	ELASTOSIL®	LR 3071/40	Food contact	40	1.11	8.5	660	22	40 ⁴	X	X		Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET) for food contact
	ELASTOSIL®	LR 3071/50	Food contact	50	1.11	8.2	560	25	50 ⁴	X	X		Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET) for food contact
	ELASTOSIL®	LR 3071/60	Food contact	60	1.12	9.1	520	27	53 ⁴	X	X		Platinum (1:1 A/B)	Transparent	Hard-soft composite parts (silicone on PA, PBT, PET) for food contact
	ELASTOSIL®	LR 3072/30	Oil-bleeding	30	1.11	7.4	710	17	27 ⁴				Platinum (1:1 A/B)	Opaque	Hard-soft composite parts with oil-bleeding properties, e.g. mat seals or weather packs for the automotive industry
	ELASTOSIL®	LR 3072/40	Oil-bleeding	40	1.12	8.8	620	21	21 ⁴				Platinum (1:1 A/B)	Opaque	Hard-soft composite parts with oil-bleeding properties, e.g. mat seals or weather packs for the automotive industry
	ELASTOSIL®	LR 3072/50	Oil-bleeding	50	1.12	8.6	510	23	12 ⁴				Platinum (1:1 A/B)	Opaque	Hard-soft composite parts with oil-bleeding properties, e.g. seals or weather packs for the automotive industry
	ELASTOSIL®	LR 3074/60	Coolant resistant	60	1.13	6.8	360	14	19 ⁴				Platinum (1:1 A/B)	Opaque	Hard-soft composite parts with coolant-resistant properties, e.g. seals for the automotive industry
	ELASTOSIL®	LR 3076/70	Oil resistant, less abrasive, low comp. set, npc ³	70	1.31	4.7	230	14	14 ⁴				Platinum (1:1 A/B)	Beige	Hard-soft composite parts with oil-resistant properties, e.g. seals for the automotive industry
	ELASTOSIL®	LR 3078/20	Adhesion on PC	20	1.09	5.3	720	11	65				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with oil-resistant properties, e.g. seals for the automotive industry
	ELASTOSIL®	LR 3078/30	Adhesion on PC	30	1.09	5.9	660	12	48				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with oil-resistant properties, e.g. seals for the automotive industry
	ELASTOSIL®	LR 3078/40	Adhesion on PC	40	1.12	7.6	600	19	50				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with oil-resistant properties, e.g. seals for the automotive industry
	ELASTOSIL®	LR 3078/50	Adhesion on PC	50	1.13	8.2	490	21	36				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with oil-resistant properties, e.g. seals for the automotive industry
	ELASTOSIL®	LR 3078/60	Adhesion on PC	60	1.14	8.9	460	27	40				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with oil-resistant properties, e.g. seals for the automotive industry
	ELASTOSIL®	LR 3078/70	Adhesion on PC	70	1.15	7.7	350	25	34				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with oil-resistant properties, e.g. seals for the automotive industry
	ELASTOSIL®	LR 3170/40	Flame retardant, UL 94, V0 black	45	1.12	9.2	590	23	34 ⁴			V-0 (3 mm); HB (0.5; 0.8 mm)	Platinum (1:1 A/B)		Hard-soft composites with flame-retardant properties
	ELASTOSIL®	LR 3671/30	Low coefficient of friction, food contact	30	1.12	8.9	770	29	33	X	X		Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with low coefficient of friction
	ELASTOSIL®	LR 3671/40	Low coefficient of friction, food contact	40	1.12	8.8	680	26		X	X		Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with low coefficient of friction
	ELASTOSIL®	LR 3675/30	Low coefficient of friction	30	1.12	8.0	760	25	14 ⁴				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with low coefficient of friction
	ELASTOSIL®	LR 3675/50	Low coefficient of friction	50	1.12	7.8	410	33	12 ⁴				Platinum (1:1 A/B)	Transparent	Hard-soft composite parts with low coefficient of friction
Oil-bleeding	ELASTOSIL®	LR 3803/50	Very low comp. set, npc ³ , in contact with UL 94 V-0 thermoplastics	50	1.13	7.5	460	39	10				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 3 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3814/30	Low comp. set, npc ³ , in contact with UL 94 V-0 thermoplastics	30	1.13	6.8	680	20	18				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 4 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3814/50	Low comp. set, npc ³ , in contact with UL 94 V-0 thermoplastics	50	1.13	8.5	450	34	15				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 4 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3833/50	Ultra low comp. set, npc ³	50	1.13	7.5	460	38	7				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 3 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3841/50	Low comp. set, npc ³	50	1.13	9.0	490	30	13				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 1.5 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3834/50 Ultra	Low comp. set, npc ³	50	1.12	7.5	420	20	9				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 4 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3842/40	Low comp. set, npc ³	40	1.12	8.0	610	25	13				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 1.5 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3842/50	Low comp. set, npc ³	50	1.13	8.5	460	37	12				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 2 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3842/60	Low comp. set, npc ³	60	1.14	9.2	420	32	13				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 2 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3842/70	Low comp. set, npc ³	68	1.14	8.5	350	28	16				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 2 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3843/30	Low comp. set, npc ³	30	1.12	8.0	680	22	16				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 3 % oil), e.g. mat seals, single wire seals
	ELASTOSIL®	LR 3844/30	Low comp. set, npc ³	30	1.12	7.2	700	22	15				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 4 % oil), e.g. mat seals, single wire seals
	ELASTOSIL®	LR 3844/40	Low comp. set, npc ³	40	1.13	8.0	550	24	13				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 4 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3844/50	Low comp. set, npc ³	50	1.13	8.5	500	36	14				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 4 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3846/20	Low comp. set, npc ³	21	1.09	6.1	800	16	16				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 6 % oil), e.g. mat seals, connector pads
	ELASTOSIL®	LR 3846/30	Low comp. set, npc ³	30	1.13	7.0	750	19	15				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 6 % oil), e.g. mat seals, connector pads
	ELASTOSIL®	LR 3851/50	Low comp. set, npc ³ , very good cut resistance	48	1.13	9.5	530	40	13				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 1.8 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3852/50	Low comp. set, npc ³ , very good cut resistance	48	1.13	8.5	560	40	19				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 2.5 % oil), e.g. connector seals, single wire seals
	ELASTOSIL®	LR 3856/20	Low comp. set, npc ³ , very good cut resistance	21	1.10	6.2	850	16	18				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 6 % oil), e. g. mat seals, connector seals with excellent cut resistance
	ELASTOSIL®	LR 3856/30	Low comp. set, npc ³ , very good cut resistance	32	1.11	6.5	600	25	14				Platinum (1:1 A/B)	Opaque	Oil-bleeding molded parts (around 6 % oil), e. g. mat seals, connector seals with excellent cut resistance
Low viscosity	ELASTOSIL®	LR 3153		60	1.08	7.4	170	14					Platinum (1:1 A/B)	Transparent	Coating of textile braided cables
Electrically conductive	ELASTOSIL®	LR 3162		54	1.12	5.6	340	14	17				Platinum (1:1 A/B)	Black	Fabrication of electrically conductive molded parts, e.g. copy rollers
High transparency	LUMISIL®	LR 7601/70		70	1.05	10.0	90	10		X	X		Platinum (1:1 A/B)	Highly transparent	Molded parts with excellent transparency
Flame retardant	ELASTOSIL®	LR 3001/55 FR		55	1.36	6.3	300	15	13			V-0 (0.75 and 3 mm)	Platinum (1:1 A/B)	Dark gray (similar to RAL 7015)	Flame retardant molded parts, e.g. anode caps
	ELASTOSIL®	LR 3011/50 FR	Low inflammability, short curing times	50	1.13	10.0	510	28	13			V-0 (0.75 and 3 mm)	Platinum (1:1 A/B)	Dark gray/black	Lamp holder, seals in electronic equipment, low inflammability components
Low volatile	ELASTOSIL®	LR 5003/50	Non post-cured for sensitive applications	50	1.14	9.2	500	27		x	x		Platinum (1:1 A/B)	Transparent	Molded parts for food contact
	ELASTOSIL®	LR 5003/60	Non post-cured for sensitive applications	60	1.14	9.8	400	30		x	x		Platinum (1:1 A/B)	Transparent	Molded parts for food contact
	ELASTOSIL®	LR 5003/70	Non post-cured for sensitive applications	70	1.14	10	390	28		x	x		Platinum (1:1 A/B)	Transparent	Molded parts for food contact
	ELASTOSIL®	LR 5040/20	Non post-cured for sensitive applications	20	1.12	7.9	940	31		X	X		Platinum (1:1 A/B)	Slightly bluish	Molded parts for baby care, food contact and medical applications
	ELASTOSIL®	LR 5040/30	Non post-cured for sensitive applications	30	1.12	8.6	860	32		X	X		Platinum (1:1 A/B)	Slightly bluish	Economic manufacturing without post cure of molded parts, e.g. baby bottle teats and pacifiers
	ELASTOSIL®	LR 5040/40	Non post-cured for sensitive applications	40	1.13	8.3	580	37		X	X		Platinum (1:1 A/B)	Slightly bluish	Molded parts for baby care, food contact and medical applications
	ELASTOSIL®	LR 5040/45	Non post-cured for sensitive applications	45	1.12	9.0	560	41		X	X		Platinum (1:1 A/B)	Slightly bluish	Molded parts for baby care, food contact and medical applications
	ELASTOSIL®	LR 5040/50	Non post-cured for sensitive applications	50	1.13	9.1	490	54		X	X		Platinum (1:1 A/B)	Slightly bluish	Molded parts for baby care, food contact and medical applications
	ELASTOSIL®	LR 5040/60	Non post-cured for sensitive applications	60	1.13	9.0	400	50		X	X		Platinum (1:1 A/B)	Slightly bluish	Molded parts for baby care, food contact and medical applications
	ELASTOSIL®	LR 5040/70	Non post-cured for sensitive applications	70	1.13	9.5	370	33		X	X		Platinum (1:1 A/B)	Slightly bluish	Molded parts for baby care, food contact and medical applications

These figures are only intended as a guide and should not be used in preparing specifications.
A tighter specification regarding Sh-A hardness can be possible for selected products on demand (+/-1, +/-2, +/-3).

¹ BfR recommendation XV (silicones); (BfR = Bundesinstitut für Risikobewertung).
² FDA CFR 21 § 177.2600 "Rubber articles intended for repeated use" (FDA = Food and Drug Administration).
³ Non-postcured.

Please contact us for in-depth technical consulting to select the right product for your individual demands.
Please contact us if you are interested in products with specific characteristics or if you need products from our basic portfolio in other hardnesses.



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6709G en/08.25 replaces 6709G e/09.22

PRODUCT OVERVIEW

ADDITION CURING
SOLID SILICONE RUBBER

Multi-purpose · high tear resistance · low compression set ·
high elasticity · low coefficient of friction · self-adhesion · high heat
resistance · oil bleeding · electrically conductive

The data presented in this medium are in accordance with the present state of our knowledge but do not absolve the user from carefully checking all supplies immediately on receipt. We reserve the right to alter product constants within the scope of technical progress or new developments. The recommendations made in this medium should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies' raw materials are also being used. The information provided by us does not absolve the user from the obligation of investigating the possibility of infringement of third parties' rights and, if necessary, clarifying the position. Recommendations for use do not constitute a warranty, either express or implied, of the fitness or suitability of the product for a particular purpose.

Main characteristics	Brand	Product	Hardness Shore A ISO 48-4	Specific gravity [g/cm ³] ISO 1183-1A	Tensile strength [N/mm ²] ISO 37 Typ 1	Elongation at break [%] ISO 37 Typ 1	Tear resistance [N/mm] ASTM D 624 B	Compression set [%] (22 h/175 °C) DIN ISO 815-1	Food contact – BfR ¹	Food contact – FDA ²	Molding	Extrusion	Cure system	Appearance	Typical applications
Multi-purpose	ELASTOSIL®	R <i>plus</i> 4001/20	20	1.10	8.0	1300	34	30	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. seals, membranes, baking molds
	ELASTOSIL®	R <i>plus</i> 4001/30	30	1.10	11.5	1090	43	37	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. seals, membranes, baking molds
	ELASTOSIL®	R <i>plus</i> 4001/40	40	1.11	11.8	930	38	22	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. seals, membranes, baking molds
	ELASTOSIL®	R <i>plus</i> 4001/50	50	1.13	11.5	830	35	20	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. seals, membranes, baking molds
	ELASTOSIL®	R <i>plus</i> 4001/60	60	1.14	11.0	710	30	18	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. seals, membranes, baking molds or spark plug boots
	ELASTOSIL®	R <i>plus</i> 4001/70	70	1.17	10.3	660	38	30	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. seals, membranes, baking molds or spark plug boots
	ELASTOSIL®	R <i>plus</i> 4001/80	82	1.20	8.0	570	29	45	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. seals, membranes, baking molds
High tear resistance	ELASTOSIL®	R <i>plus</i> 4001/90	88	1.20	6.2	225	21	43	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. seals, membranes, baking molds
	ELASTOSIL®	R <i>plus</i> 4000/40	40	1.12	9.3	860	46	35	X	X	X		Platinum (100:1.5 base + catalyst)	Transparent	Molded parts, e.g. baby-bottle teats or pacifiers
	ELASTOSIL®	R <i>plus</i> 4000/50	50	1.13	9.1	900	51	43	X	X	X		Platinum (100:1.5 base + catalyst)	Transparent	Molded parts, e.g. baby-bottle teats or pacifiers
	ELASTOSIL®	R <i>plus</i> 4000/60	60	1.16		750	50	23	X	X	X		Platinum (100:1.5 base + catalyst)	Transparent	Molded parts, e.g. baby-bottle teats or pacifiers
	ELASTOSIL®	R <i>plus</i> 4000/70	70	1.16	9.3	640	58	19	X	X	X		Platinum (100:1.5 base + catalyst)	Transparent	Molded parts, e.g. baby-bottle teats or pacifiers
	ELASTOSIL®	R <i>plus</i> 4020/40	39	1.12	13.0	1000	46	29	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. baby-bottle teats or pacifiers
	ELASTOSIL®	R <i>plus</i> 4020/50	49	1.13	11.0	810	45	26	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. baby-bottle teats or pacifiers
	ELASTOSIL®	R <i>plus</i> 4020/60	59	1.18	11.9	850	48	18	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. baby-bottle teats or pacifiers
	ELASTOSIL®	R <i>plus</i> 4020/70	71	1.20	10.4	660	51	22	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. baby-bottle teats or pacifiers
	ELASTOSIL®	R <i>plus</i> 4303/60	60	1.16	9.6	650	38	12	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes for contact with portable water or profiles
	ELASTOSIL®	R <i>plus</i> 4303/70	70	1.18	9.0	600	37	16	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes for contact with portable water or profiles
	ELASTOSIL®	R <i>plus</i> 4303/80	80	1.19	7.7	300	20	16	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes for contact with portable water or profiles
	ELASTOSIL®	R <i>plus</i> 4305/30	30	1.11	11.8	1100	43	8	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes or profiles
	ELASTOSIL®	R <i>plus</i> 4305/40	40	1.12	9.8	830	27	7	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes or profiles
	ELASTOSIL®	R <i>plus</i> 4305/50	50	1.14	8.8	770	35	7	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes or profiles
Low compression set	ELASTOSIL®	R <i>plus</i> 4305/60 S	57	1.17	9.9	630	38	13	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes or profiles
	ELASTOSIL®	R <i>plus</i> 4305/70	70	1.18	9.1	600	39	14	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes or profiles
	ELASTOSIL®	R <i>plus</i> 4305/80	80	1.19	7.8	310	21	17	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes or profiles
	ELASTOSIL®	R <i>plus</i> 4305/90	90	1.20	6.4	150	17	30	X	X		X	Platinum (100:1.5 base + catalyst)	Transparent	Extruded parts, e.g. tubes or profiles
	ELASTOSIL®	R <i>plus</i> 4060/50	50	1.15	8.0	500	25	9	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. gaskets
	ELASTOSIL®	R <i>plus</i> 4060/60	64	1.15	7.5	310	20	16	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts, e.g. gaskets
	ELASTOSIL®	R <i>plus</i> 4061/60	60	1.15	9.5	520	32	13			X		Platinum (1 component, ready to use)	Black	Molded parts, e.g. spark plug boots
High elasticity	ELASTOSIL®	R <i>plus</i> 4360/60	60	1.15	8.4	380	18	10	X	X		X	Platinum (100:1.3 base + catalyst)		Extruded parts, e.g. profiles with low compression set
Low coefficient of friction	ELASTOSIL®	R <i>plus</i> 4066/60	60	1.15	8.0	620	42	27	X	X	X		Platinum (1 component, ready to use)	Transparent	Molded parts with low coefficient of friction, e.g. seals
	ELASTOSIL®	R <i>plus</i> 4366/60	60	1.15	7.6	550	41	20	X	X		X	Platinum (100:2 base + catalyst)	Transparent	Extruded parts, e.g. profiles with low compression set, special tubes or flat seals
	ELASTOSIL®	R <i>plus</i> 4361/60	60	1.15	9.5	520	32	13			X		Platinum (1 component, ready to use)	Black	Molded parts, e.g. spark plug boots
Self-adhesion	ELASTOSIL®	R <i>plus</i> 4070/20	24	1.07	7.9	1200	35	65			X		Platinum (1 component, ready to use)	Translucent	Hard-soft composite molded parts
	ELASTOSIL®	R <i>plus</i> 4070/30	34	1.11	10.5	1200	50	69 ³			X		Platinum (1 component, ready to use)	Translucent	Hard-soft composite molded parts
	ELASTOSIL®	R <i>plus</i> 4070/60	62	1.17	10.0	770	39	83 ³			X		Platinum (1 component, ready to use)	Translucent	Hard-soft composite molded parts
	ELASTOSIL®	R <i>plus</i> 4370/40	40	1.14	10.9	1000	39	43 ³ (pc:21)				X	Platinum (100:1.5 base + catalyst)	Translucent	Extruded or coextruded parts
	ELASTOSIL®	R <i>plus</i> 4370/50	48	1.14	10.6	900	42	43 ³ (pc:21)				X	Platinum (100:1.5 base + catalyst)	Translucent	Extruded or coextruded parts
High heat resistance	ELASTOSIL®	R <i>plus</i> 4050/55	58	1.13	8.4	400	23	6	X	X	X		Platinum (100:1.5 base + catalyst)	Transparent	Molded parts, e.g. spark plug boots
	ELASTOSIL®	R <i>plus</i> 4050/55 mH	56	1.13	8.8	460	23				X		Platinum (1 component. ready to use)	Black	Molded parts, e.g. spark plug boots
	ELASTOSIL®	R <i>plus</i> 4350/55	58	1.13	8.2	350	18	10	X	X		X	Platinum (100:1.5 base + catalyst)	Translucent	Extruded or co extruded parts
Oil bleeding	ELASTOSIL®	R <i>plus</i> 4806/20	23	1.05	6.3	880	15	14			X		Platinum (1 component, ready to use)	Opaque	Oil-bleeding molded parts, e.g. mat seals, connector pads, weather packs for the automotive industry
	ELASTOSIL®	R <i>plus</i> 4846/30	30	1.11	10.8	1100	34	19			X		Platinum (1 component, ready to use)	Opaque	Oil-bleeding molded parts, e.g. mat seals, connector pads, weather packs for the automotive industry
Electrically conductive	ELASTOSIL®	R <i>plus</i> 573/50	49	1.11	5.5	340	13	30				X	Platinum (A/B component)	Black	Production of electrically conductive cable components and profiles
	ELASTOSIL®	R <i>plus</i> 573/70	71	1.16	6.5	260	14	29				X	Platinum (A/B component)	Black	Production of electrically conductive cable components and profiles

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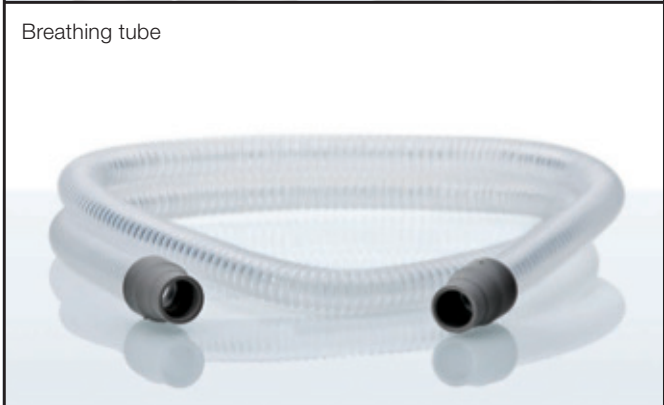
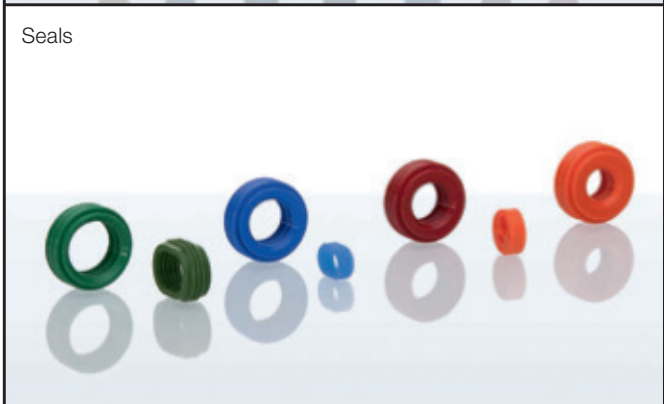
¹ BfR recommendation XV (silicones); (BfR = Bundesinstitut für Risikobewertung).

² FDA CFR 21 § 177.2600 "Rubber articles intended for repeated use" (FDA = Food and Drug Administration).

³ Not post-cured, other values in this column after 4h/200 °C post-curing.

Please contact us for in-depth technical consulting to select the right product for your individual demands.

Please contact us if you are interested in products with specific characteristics or if you need products from our basic portfolio in other hardnesses.

Valves 	Interfaces for infant nasal breathing tubes 
Breathing tube 	Ventilation mask 
Handles for surgical instruments 	Ventilation bag 
Seals 	Catheter 
Valve 	Syringe seals 

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CREATING TOMORROW'S SOLUTIONS



6709H en/08.25 replaces 6709H e/10.22

PRODUCT OVERVIEW

SILICONE RUBBER FOR MEDICAL APPLICATIONS

Liquid silicone rubber · multi-purpose · high tear resistance · low coefficient of friction · non-healing · self-adhesion
solid silicone rubber · multi-purpose · high tear resistance · low coefficient of friction

Main characteristics	Brand	Product	Product type / cure system	Hardness Shore A ISO 48-4	Specific gravity [g/cm³] ISO 1183-1A	Tensile strength [N/mm²] ISO 37 Typ 1	Elongation at break [%] ISO 37 Typ 1	Tear resistance [N/mm] ASTM D 624 B	Compression set [%] (22 h/175 °C) DIN ISO 815-1	Food contact – BfR ¹	Food contact – FDA ²	Medical. pharma. biotech – USP Class VI ³	Medical pharma. biotech – ISO 10993 ⁴	Molding	Appearance	Typical applications
Liquid silicone rubber																
Multi purpose	SILPURAN®	6000/05	LSR, platinum (1:1 A/B)	5	1.04	2.5	700	6	15			X	X	X	Transparent	Molded parts for the medical and pharma industry
	SILPURAN®	6000/10	LSR, platinum (1:1 A/B)	10	1.07	4.2	740	12	15			X	X	X	Transparent	Molded parts for the medical and pharma industry
	SILPURAN®	6000/20	LSR, platinum (1:1 A/B)	20	1.08	8.0	850	21	17	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry
	SILPURAN®	6000/30	LSR, platinum (1:1 A/B)	30	1.10	8.6	650	25	13	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry
	SILPURAN®	6000/40	LSR, platinum (1:1 A/B)	40	1.12	9.6	600	29	11	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry
	SILPURAN®	6000/50	LSR, platinum (1:1 A/B)	50	1.13	10.0	480	30	14	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry
	SILPURAN®	6000/60	LSR, platinum (1:1 A/B)	60	1.13	10.0	350	27	14	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry
	SILPURAN®	6000/70	LSR, platinum (1:1 A/B)	70	1.15	9.5	290	22	11	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry
Low coefficient of friction	SILPURAN®	6600/40	LSR, platinum (1:1 A/B)	40	1.12	9.4	550	32	14	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry with a low coefficient of friction
	SILPURAN®	6600/50	LSR, platinum (1:1 A/B)	50	1.12	8.9	440	31	13	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry with a low coefficient of friction
	SILPURAN®	6600/60	LSR, platinum (1:1 A/B)	60	1.12	9.0	310	26	14	X	X	X	X	X	Transparent	Molded parts for the medical and pharma industry with a low coefficient of friction
Reduced healing	SILPURAN®	6610/40	LSR, platinum (1:1 A/B)	40	1.21	7.2	510	20	12	X	X	X	X	X	White	Needle free valves, slit membranes where healing needs to be avoided
	SILPURAN®	6610/50	LSR, platinum (1:1 A/B)	50	1.23	8.0	450	25	12	X	X	X	X	X	White	Needle free valves, slit membranes where healing needs to be avoided
	SILPURAN®	6610/60	LSR, platinum (1:1 A/B)	60	1.23	7.0	300	20	15	X	X	X	X	X	White	Needle free valves, slit membranes where healing needs to be avoided
Self adhesion	SILPURAN®	6700/40	LSR, platinum (1:1 A/B)	40	1.11	8.2	640	23		X	X	X	X	X	Transparent	Hard-soft composite parts for the medical and pharma industry (silicone on PA. PBT)
	SILPURAN®	6700/50	LSR, platinum (1:1 A/B)	50	1.12	8.5	590	24		X	X	X	X	X	Transparent	Hard-soft composite parts for the medical and pharma industry (silicone on PA. PBT)
	SILPURAN®	6700/60	LSR, platinum (1:1 A/B)	60	1.12	9.6	490	26		X	X	X	X	X	Transparent	Hard-soft composite parts for the medical and pharma industry (silicone on PA. PBT)
	SILPURAN®	6740/40	LSR, platinum (1:1 A/B)	40	1.10	8.8	710	27	10	X	X	X	X	X	Transparent	Hard-soft composite parts for the medical and pharma industry (silicone on PA. PBT)
	SILPURAN®	6760/50	LSR, platinum (1:1 A/B)	50	1.10	8.4	600	27		X	X	X	X	X	Transparent	Hard-soft composite parts for the medical and pharma industry (silicone on PA. PBT)
X-ray opaque	ELASTOSIL®	LR 34004/50		50	1.23	7.8	450	26				X	X	X	White	Radioopaque LSR
Solid silicone rubber																
Radioopaque additive	SILPURAN®	AUX 8250 RO								X	X	X	X		White	Medical tubes
	SILPURAN®	AUX 8251 RO								X	X	X	X		White	Medical tubes

All SILPURAN® products are produced in accordance to WACKER CLEAN OPERATIONS standards.
These figures are only intended as a guide and should not be used in preparing specifications.

1 BfR recommendation XV (silicones); (BfR = Bundesinstitut für Risikobewertung).

2 FDA CFR 21 § 177.2600 "Rubber articles intended for repeated use" (FDA = Food and Drug Administration).

3 Systemic / intracut. toxicity, implantation test (additional tests on request).

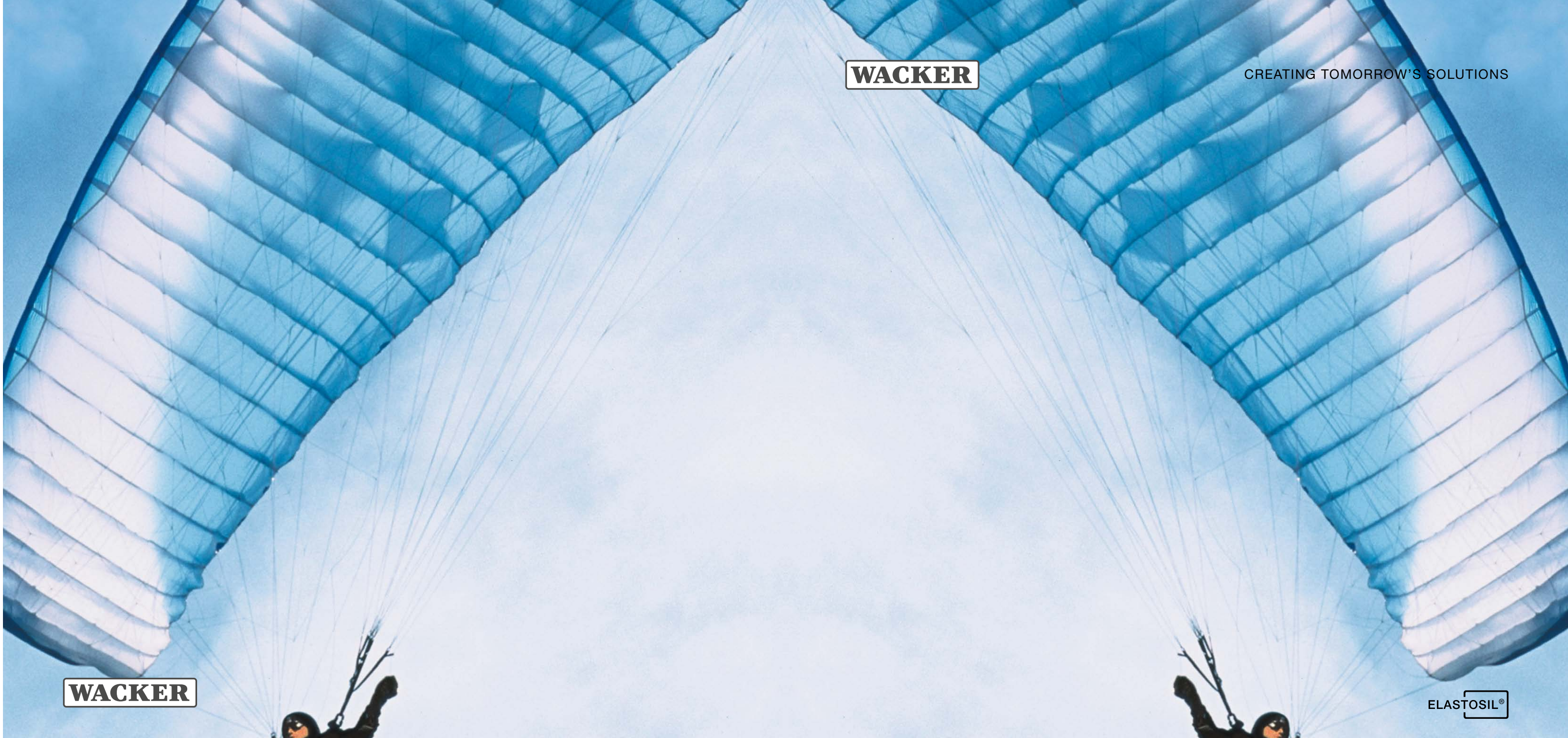
4 Cytotoxicity, sensitization as per LLNA, pyrogenicity (additional tests on request).

Please contact us about the compliance of our SILPURAN® grades with European Pharmacopoeia, Chapter 3.1.9 "Silicone elastomers for closures and tubing".

Please contact us for in-depth technical advice on selecting the right product for your individual needs.

Please contact us if you are interested in products with specific characteristics or if you need products from our basic portfolio in other hardnesses.

Device Master Files listed at FDA.



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6934en/07.25 replaces 6934e/09.22

PRODUCT OVERVIEW

SILICONE RUBBER FOR TEXTILE COATING

Rubber dispersions · high temperature curing silicone rubber ·
room temperature curing silicone rubber · top coats

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Product	Curing mechanism	Characteristics	Color	Viscosity at 1/sec [mPas] DIN EN ISO 3219/ 25 °C	Viscosity at 10/sec [mPas] DIN EN ISO 3219/ 25 °C	Hardness shore A ISO 48-4	Tensile strength [N/mm²] ISO 37 Typ 1	Elongation at break [%] ISO 37 Typ 1	Tear resistance [N/mm] ASTM D 624 B	Processing	BfR XV. silicones*	FDA 175.300 coatings*
Rubber dispersions												
ELASTOSIL® RD 6600 F	Addition	Dry surface, solvent-based (60% xylene)	Transparent	115,000	45,000	60	5.5	350	12.0	Addition of 3% ELASTOSIL® CROSSLINKER 525 or 1% WACKER® CROSSLINKER W required	-	-
WACKER® FINISH CT 51 L	Condensation	Silky and flexible coatings, solvent-based (75% toluene)	Transparent	31,000	19,000	-	-	-	-	Addition of WACKER® INHIBITOR PT 88 and 1% WACKER® CATALYST C05 required	+	+
High temperature curing silicone rubber												
ELASTOSIL® LR 3001/55 FR A/B	Addition	Flame retardant (UL 94: V-0)	Gray	250,000	140,000	55	6.3	300	15.0	A/B-System, mixing ratio A:B = 1:1	-	-
ELASTOSIL® LR 6200 A/B	Addition	Low viscosity, dry surface	White	15,000	9,000	40	2.8	210	4.6	A/B-System, mixing ratio A:B = 1:1	-	-
ELASTOSIL® LR 3003/20 TR	Addition	General purpose, excellent mechanical properties	Transparent	360,000	210,000	22	8.3	870	24.0	A/B-System, mixing ratio A:B = 1:1	+	+
ELASTOSIL® LR 3003/30	Addition	General purpose, excellent mechanical properties	Transparent	210,000	100,000	30	7.0	610	21.0	A/B-System, mixing ratio A:B = 1:1	+	+
ELASTOSIL® LR 6240 A/B	Addition	Good flexibility, high modulus	Transparent	30,000	20,000	30	1.7	290	4.9	A/B-System, mixing ratio A:B = 1:1	+	+
ELASTOSIL® LR 6250 F	Addition	General purpose	Transparent	53,000	32,000	36	5.0	350	10.4	Addition of 3% ELASTOSIL® CROSSLINKER 525 or 1% WACKER® CROSSLINKER W required	-	+
ELASTOSIL® LR 6260 A/B	Addition	High dielectric strength	Ivory	57,000	31,000	39	5.1	380	8.9	A/B-System, mixing ratio A:B = 1:1	-	+
ELASTOSIL® LR 6320 F	Addition	General purpose, low viscosity also with adhesion promoter	Transparent	28,000	23,000	36	3.2	250	4.8	Addition of 3% ELASTOSIL® CROSSLINKER 525 or 1% WACKER® CROSSLINKER W required	+	+
ELASTOSIL® LR 6360 F	Addition	General purpose	Transparent	38,000	28,000	60	5.0	150	6.1	Addition of 5% WACKER® CROSSLINKER W required	+	+
ELASTOSIL® NT 76	Addition	Newtonian rheology	Transparent	40,000	40,000	20	0.7	160	2.3	Addition of 3% ELASTOSIL® CROSSLINKER 525 required	+	+
ELASTOSIL® R 401/40	Peroxide	General purpose	Transparent	n. a.	n. a.	41	10.0	580	23.0	Addition of 1.5% ELASTOSIL® AUX CURING AGENT E or 0.7% ELASTOSIL® CURING AGENT C1 required	***	***
ELASTOSIL® R plus 4001/40	Addition	General purpose	Transparent	n. a.	n. a.	40	11.8	930	38.0	Ready to use system	+	+
Room temperature curing silicone rubber												
ELASTOSIL® E43 N	Condensation	General purpose, excellent adhesion, tin-free	Transparent	250,000	150,000	30	7.8	450	12.5	Ready to use system	+	+
ELASTOSIL® E50 N	Condensation	General purpose, self leveling, tin-free	Transparent	63,000	53,000	35	1.5	150	5.0	Ready to use system	+	+
ELASTOSIL® E91	Condensation	Anti-slip surface, fast curing with steam, tin-free	Transparent	100,000	60,000	20	1.2	350	-	Ready to use system	-	-
ELASTOSIL® E92 N	Condensation	Anti-slip surface, fast skin formation at room temperature, tin-free	Transparent	160,000	90,000	20	1.5	350	-	Ready to use system	-	-
Top coats												
ELASTOSIL® 47007	Addition	Low coefficient of friction, solvent-free	Ivory	16,000	7,000	-	-	-	-	Addition of 3% WACKER® CROSSLINKER W required	-	-
ELASTOSIL® RD 3151 F	Addition	Glossy varnish, easy to clean, solvent-based (50% white spirits)	Transparent	20,000	3,500	-	-	-	-	Addition of 3% WACKER® CROSSLINKER W required	-	-
ELASTOSIL® RD 6620 F	Addition	Matt varnish, solvent-based (50% xylene)	Colorless, opaque	330,000	75,000	-	-	-	-	Addition of 1% WACKER® CROSSLINKER W required	-	-

* Valid for the silicone base. Additives have to be evaluated separately!
** Valid after post-curing (4h/200 °C)



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