

NEUKASIL RTV-2 C silicone rubber systems

General and Chemical Structure

NEUKASIL RTV-2 C is a designation for 2-component silicone rubber systems vulcanizing at room temperature based on reactive silicone polymers with special fillers. All NEUKASIL RTV-2 C types are combinations the basis of which forms the typical framework of silicium and oxygen.

The organic residues R are mainly methyl groups (-CH₃). The number (n) of the chain element is a size for the chain length of the silicone rubber. The bigger the number (n) the higher is the viscosity; (n) can accept values from 0 to 10.000 and more.

Due to a small number of reactive groups being integrated besides the methyl residues, the NEUKASIL RTV-2 C types obtain their special properties.

Reactive groups

Condensation systems :	-OH	(hydroxyl-) groups
Addition systems :	-CH=CH ₂	(vinyl) groups

Most of the NEUKASIL RTV-2 C types are mixtures (free from solvents and plasticizers) of a reactive silicone polymer and special mineral fillers and pigments.

Special properties are obtained by means of chain lengtheners and the particularly formulated cross-linkers.

The present printscript covers general statements of the properties and the processing of NEUKASIL RTV-2 C silicone rubbers.

For possible restrictions or additional information, please refer to the particular data sheets.

Type series

The NEUKASIL RTV-2 C silicone rubber systems are divided into two different type series.

Condensation systems

These systems are marked by **odd** initial numbers (1,3,5 etc.). The cross-linker (hardener) is marked by the letter C.

Addition systems

These systems are marked by **even** initial numbers (2,4,6 etc.). The cross-linker (hardener) is marked by the letter A.

The two type series distinguish themselves by their chemical cross-linking behaviour.

Type series 1,3,5 etc. (condensation systems)

These type series are condensation cross-linking compounds which generate cleavage products (ethyl alcohol, propyl alcohol) during the vulcanization. If the vulcanized material is exposed to an immediate heat load, these cleavage products may lead to a softening of the vulcanized material. (For more detailed information, please refer to the chapter "heat resistance").

Type series 2,4,6 etc. (addition systems)

This type series constitutes addition-cross-linking compounds which cross-link without elimination of volatile ingredients (for more detailed information, please refer to the chapter "heat resistance").

Condensation systems are incompatible with the addition systems, and they must on no account be mixed with each other as this could lead to vulcanization disturbances.

Vulcanization

Vulcanization means the conversion of free-flowing or brushable NEUKASIL RTV-2 C silicone rubbers into the high elastic state. The vulcanization begins immediately after addition of a NEUKASIL cross-linker (increase in viscosity) and takes place at room temperature. The NEUKASIL RTV-2 C silicone rubber types cure evenly even if it deals with thick layers.

The most important properties of the vulcanized material

The chemical structure of NEUKASIL RTV-2 C silicone rubbers confers to the vulcanized material made of it the following known properties of the silicones:

- high heat resistance
- good resistance to low temperatures and high flexibility in the cold
- resistance to weathering and rays
- chemical resistance (see table)
- high release effect and hydrophobicity
- relatively high gas permeability
- excellent electrical behaviour over a wide temperature range
- extensive non-toxicity

Heat resistance under air admission

Vulcanized materials of NEUKASIL RTV-2 C silicone rubbers can be exposed to an action of heat ranging from 180 to 200 °C (depending on the type) without changing their characteristic features considerably. When being exposed to temperatures of up to 250 °C, the vulcanized material of NEUKASIL RTV-2 C silicone rubber will get brittle after many hours only. Short-term actions of heat of 250 °C to 300 °C are possible. Here, the temperature indications refer to dry hot air. In an atmosphere containing steam or solvents the product will see – depending on the working conditions – a decrease in the heat resistance which can be noticed at a clear deterioration of the mechanical properties.

Heat resistance under exclusion of air

Under the entire exclusion of air, vulcanized materials of NEUKASIL RTV-2 C silicone rubber condensation systems can resoften in case of a longer action of heat ranging from 150 to 200 °C (depolymerization). The risk of resoftening, however, can be reduced to a minimum by a thermal treatment which follows the termination of the cross-linking time. Under air admission, the vulcanized material is subjected to a temperature cycle. For this, the silicone rubber is brought – under the access of air and through a temperature cycle beginning at approx. 50°C – in steps of approx. 25°C and for a period of 2 – 3 hours each to the highest possible temperature of use coming into consideration and then kept at this temperature for at least 5 hours.

An optimal degree of temperature stability under air exclusion offer those NEUKASIL RTV-2 C silicone rubber types which cure according to the addition principle so that it is recommended to use these special types in case of continuous temperature stress ranging from 200 °C to 250 °C. If it deals with still higher temperatures, the addition-cross-linking silicone rubbers, too, may resoften.

Mechanics

Basically, we also make a difference between the vulcanized materials of silicone NEUKASIL RTV-2 C "low strength" and the vulcanized materials of silicone NEUKASIL RTV-2 C "high strength".

For the production of moulds and/or negatives with big undercuts one should at all events use "high strength" NEUKASIL RTV-2 C silicone rubber types.

These types stand out for high elongations and resistances to tear propagation with a good crack locking tendency.

Chemical resistance

Vulcanized materials of NEUKASIL RTV-2 C silicone rubbers are resistant to diluted lyes and acids. The resistance, however, decreases with an increase in the concentration and temperature. Boiling water does practically not affect vulcanized materials of NEUKASIL RTV-2 C silicone rubbers, but steam of a temperature of 100 °C or more degrade them slowly. The behaviour of vulcanized materials of NEUKASIL RTV-2 C silicone rubbers to some chosen substances can be taken from the following table. The indications refer to vulcanized materials of condensation systems (C) and addition systems (A) with a Shore A-hardness of approx. 50.

Swell behaviour of vulcanized materials of NEUKASIL RTV-2 C to chemicals

(Duration of test: 8 days)

Chemical	Test temperature ° C	RTV series	Change in Shore hardness in %	Swelling in %
Acetone	20	C	-20	10
		A	-12	7
Ammonia aqueous conc.	20	C	-5	3
		A	-3	2
Aniline	100	C	-5	3
		A	-3	1
Ethanol	20	C	-8	3
		A	-5	2
Baysilon oil M 100	150	C	-60	35
		A	-20	20
Benzene	20	C	-50	70
		A	-40	55
n-butanol	20	C	-5	3
		A	-3	0

Swell behaviour of vulcanized materials of NEUKASIL RTV-2 C to chemicals

(Duration of test: 8 days)

Chemical	Test temperature ° C	RTV series	Change in Shore hardness in %	Swelling in %
Chloroform	20	C	-70	145
		A	-55	115
Cyclohexane	20	C	-50	75
		A	-45	60
Glacial acetic acid	20	C	-5	3
		A	-5	0
Ethyl acetate	20	C	-25	30
		A	-18	25
Glycol	20	C	0	0
		A	0	0
Methyl alcohol	20	C	-15	7
		A	-7	5
Methyl ethyl ketone	20	C	-25	15
		A	-20	12
Methylene chloride	20	C	-60	100
		A	-50	85
Mineral oil ASTM no. 2	100	C	-10	3
		A	-5	0
Mineral oil ASTM no. 3	100	C	-20	10
		A	-10	8
Motor oil SAE 30	100	C	-5	4
		A	-2	2
Soda lye 20 %	20	C	-5	0
		A	-5	0
Olive oil	100	C	-5	0
		A	-3	0
Petroleum ether	20	C	-40	30
		A	-25	20
Phosphoric acid 50 %	20	C	-5	0
		A	-5	0
Nitric acid 20 %	20	C	-12	5
		A	-5	0
Hydrochloric acid 20 %	20	C	-5	0
		A	-3	0
Sulfuric acid 20 %	20	C	-5	0
		A	-5	0
Carbon tetrachloride	20	C	-55	140
		A	-50	130
Trichlorethylene		C	-75	160
		A	-70	150
Vaseline	100	C	-5	5
		A	-5	5
Petroleum benzine	20	C	-60	70
		A	-40	50
Xylene	20	C	-40	65
		A	-25	25

Properties

Freeze resistance:

The vulcanized materials of NEUKASIL RTV-2 C silicone rubbers can be exposed alternately to high and low temperatures. They maintain their elastic properties up to -50 °C.

Resistance to weathering and irradiation as well as resistance to ageing:

The physical properties of the vulcanized materials of NEUKASIL RTV-2 C silicone rubbers do not change even after many years of weathering. The moisture absorption is extremely unimportant. In addition to this, the vulcanized materials are resistant to ozone and UV rays. An exposure to radioactive rays with a dose of 1-10 Mrad does not lead to a substantial change in the mechanical properties of the vulcanized material of silicone rubber. Exposures to rays of a greater extent result in a hardening combined with a decrease in the elongation and tensile strength.

Release effect and hydrophobicity:

The surfaces of vulcanized materials of NEUKASIL RTV-2 C silicone rubbers show a very strong hydrophobicity combined with antiadhesive properties. Therefore, there is no release agent necessary for the production of elastic casting moulds. Consequently, the demoulding of castings (positives) do not require – apart from some special cases – the use of additional release agents (please see “additional information”).

Gas permeability:

In comparison with other elastomers and plastics, vulcanized materials of NEUKASIL RTV-2 C silicone rubbers have a remarkable gas permeability. Conditioned by its nature, it is dependent on the kind of gas and on the conditions of use.

Generally, the gas permeability of vulcanized materials of NEUKASIL RTV-2 C silicone rubbers is by the factor 10 – 50 higher than that of other elastomers as for example natural rubber, buna N.

Electrical properties:

The electrical properties of vulcanized materials of NEUKASIL RTV-2 C silicone rubbers correspond to those of other very good insulating materials. Insulations of vulcanized materials of NEUKASIL RTV-2 C silicone rubbers can even be exposed permanently to actions of heat of 200 - 250 °C without their electrical values changing substantially. In case of electrical breakdowns, there is no conductive carbon left behind, but non-conductive silica.

General electrical values:

Spec. resistance DIN 53 482 Ω cm min.	Dielectric strength DIN 53 481 KV/mm min.	Dielectric constant ε at 25 °C DIN 53 483 50 Hz - 3GHz approx.	Dissipation factor tan σ at 25 °C DIN 53 483 approx.	Arc resistance DIN 53 480 KA	Test solution A. and F. KC
5 -10 ¹³	22	3.0	0.006	3c	> 600

Physiological properties:

NEUKASIL RTV-2 C vulcanized materials are chemically inert and to a large extent harmless as a result of which there are no special measures of precaution to be taken when handling the rubbers and the vulcanized materials. Although most of the cross-linkers contain metallo-organic combinations, there has no disadvantageous physiological effect become known so far that results from the influence of a NEUKASIL cross-linker.

Precondition, however, is an appropriate handling of the cross-linker types. Any contact of the pure cross-linkers with the eyes or the mouth has to be avoided. In case of skin contact wash thoroughly with water and soap. In case of irritant effects we recommend to consult a doctor.

Due to their chemical structure, NEUKASIL RTV-2 C vulcanized materials are a bad nutritive substratum for micro-organisms and thus extensively resistant to bacteria and fungal attack. When special NEUKASIL RTV-2 C silicone rubber types are produced and handled appropriately, the vulcanized materials produced thereof come up to the requirements of the German Foodstuff Act.

Main fields of application

Mould making:

NEUKASIL RTV-2 C silicone rubber serves as material for the production of elastic moulds for the manufacture of hard and elastic parts of polyurethane foam, castings and decorative parts of polyester, epoxies and other casting resins, structured elements of conventional building materials as for example plaster or cement, wax and low melting point alloys, high-frequency impressions in the leather industry, Levacast process.

Production of negatives for prototypes and pilot lots.

Accurate replica of the surface finish of a material, e. g. for the documentation of damages caused by corrosion or abrasion, reproduction of fossils, archaeological finds and finds on the spot or in the museum, fabrication of models in art and technique.

Electrical insulation:

Vulcanized material of NEUKASIL RTV-2 C silicone rubber is a permanently elastic, temperature-resisting material with excellent electrical properties for:

Insulation of electrical component parts, casting of large electrical appliances such as transformers, motors and switchboard plants, embedding and sealing of component parts being stressed by temperature, high-voltage parts being exposed to the danger of glowing and corona discharging as for example line transformers, permanent protection of electrical plants and component parts against atmospheric and hygric influences, production of electrically insulating sheets and tapes, sealing of cables and cable terminal boxes.

Industrial puposes:

Vulcanized material of NEUKASIL RTV-2 C silicone rubber can serve as temperature-resisting, adhesive and water repellent material.

Production of separating and interleaving fabrics, coating of asbestos fabrics, covering of rolls with the casting method, sealings formed at the place of use. All the other fields of application mentioned under mould making and electrical industry.

Processing and vulcanization:

The processing of NEUKASIL RTV-2 C silicone rubbers is relatively easy and possible without or with little mechanical expenditure only.

Add the prescribed quantity of NEUKASIL cross-linker to the type of NEUKASIL RTV-2 C silicone rubber to be processed and mix the compound in a vessel until an even distribution of the cross-linker is obtained. Cross-linkers which have been adjusted to be coloured (on request) allow an optimal mixing control.

The tools to be used shall be dry and clean. Mixing can be made by hand and also by machine. Take care that the least possible quantity of air gets into the compound during the mixing process. To obtain a bubble-free vulcanized material, it is recommended for the more viscous, free-flowing types to deaerate the cross-linker-containing batch in a vacuum chamber prior to its continued processing.

During the deaeration process, the mixture expands to three to four times its volume while the formation of bubbles is visible.

The vacuum (negative pressure max. 20 mbars) shall be maintained until the bubbles collapse (approx. 5 minutes, max. 10 minutes) and the batch has reobtained its original volume. The period of time being available for the processing of a cross-linker-containing batch varies - depending on the type of NEUKASIL RTV-2 C silicone rubber, the kind of cross-linker, the quantity of cross-linker used and the temperature involved - between a few minutes and several hours.

More detailed information on the addition of NEUKASIL cross-linkers and the pot lives and/or vulcanization times are given with the description of the individual types (**particular data sheet**). If it deals with the fabrication of elastic moulds of NEUKASIL RTV-2 C silicone rubbers, the demoulding can take place after achievement of tack-freeness at the earliest. Prior to being used, the moulds should be stored in the air for approx. 48 hours in order to complete the cross-linking process to a large extent. This measure prolongs the working life of a mould.

For the NEUKASIL RTV-2 C silicone rubber types curing according to the principle of addition, the cross-linking process can be accelerated considerably by increasing the temperature. Condensation cross-linking types of NEUKASIL RTV-2 C silicone rubber show in principle the same behaviour, but above 50 °C, undesirable secondary reactions might occur.

Recommendable for both type series is at all events a cross-linking at room temperature. With a decrease in temperature both the pot life and the curing time extend considerably. When it deals with storing cross-linker-containing batches, which cannot be processed immediately, one can take advantage of this circumstance by cooling down the batch as much as possible and keeping it at this temperature.

Shrinkage:

During the cross-linking of condensation cross-linking NEUKASIL RTV-2 C silicone rubbers, cleavage products are liberated, and a shrinkage takes place which depends on the quantity and type of the NEUKASIL cross-linker used. Increasing quantities of NEUKASIL cross-linker result in higher shrinkages. Furthermore, there will be a post-shrinkage of the vulcanized material during the storage. This post-shrinkage, however, will reach its maximum after some time and not change further during the storage at room temperature (see shrinkage values of the individual types). By tempering the vulcanized material at elevated temperatures, one can shorten the time that passes until the final point of shrinkage is achieved.

Condensation cross-linking NEUKASIL RTV-2 C silicone rubbers have (depending on the type involved) a shrinkage of 0.2 - 1 %.

Addition cross-linking NEUKASIL RTV-2 C silicone rubbers cross-link with a little shrinkage only (max. 0.2 % at room temperature) and without the formation of cleavage products.

Additional information

Release agents

When NEUKASIL RTV-2 C silicone rubber is used as mould making material (fabrication of negatives), there is no release agent required for the demoulding. Should there still be problems, we recommend our NEUKADUR release agent SE, release agent N or NEUKADUR release spray P 6.

For the production of multipiece moulds and for the prevention of an adhesion of NEUKASIL RTV-2 C vulcanized materials to each other, the release agents N or P 6 are used. The surface of the already vulcanized part of the mould is treated with release agent. Then, the second part of the mould is cast.

The moulding of porous surfaces with NEUKASIL RTV-2 C silicone rubbers may result in the fact that the rubber sticks to the mould which leads to problems with the demoulding of the model. In these cases, too, the above mentioned release agents are used and applied in such a way that the pores of the surface to be mould are closed.

If it deals with processing polyester resins and the mould is used for a longer period of time, the self-releasing effect of NEUKASIL RTV-2 C silicone rubbers will decrease slowly. For polyester we recommend to store the mould in the air for several hours after having used it to allow the ingredients having penetrated the surface of the mould to escape. In addition to this, one can use release agents – obtainable from Altropol - which are particularly suited for this application.

When polyurethane is foamed in moulds of vulcanized materials of NEUKASIL RTV-2 C silicone rubbers, the use of a release agent is absolutely essential for the achievement of a great piece number. Particularly suitable are those release agents which are obtainable under the designation „release lacquer" or "Barrier-Coat".

Cleaning

Liquid silicone ingredients as well as release agents based on wax can be removed with NEUKASIL silicone and wax remover.

NEUKADUR modelling compound, yellow

This product is completely harmless in handling and contains neither solvents nor heavy metals. It serves as sealant for moulds and patterns.

Adhesion and glueing:

When NEUKASIL RTV-2 C silicone rubber shall be applied onto metal, plastics or ceramics under the requirement of achieving a safe adhesion, it is necessary to pretreat the substrate with a NEUKASIL primer. NEUKASIL RTV-2 C silicone rubber condensation systems are used together with our NEUKASIL primer Z, and NEUKASIL RTV-2 C silicone rubber addition systems are used together with our NEUKASIL primer Z 3042. First of all, the substrate coming into question is thoroughly cleaned and degreased by washing it with a solvent - plastics and smooth surfaces are roughened by sandblasting or grinded with emery, if necessary - and then a thin, even layer of the NEUKASIL primer is applied by dipping, spraying or painting.

When the primer is dry, the cross-linker containing rubber is applied. The optimal stage of the adhesion is only achieved when the vulcanization is finished to a large extent, that means after 48 hours at the earliest. NEUKASIL RTV-2 C silicone rubber can adhere to a vulcanized material of the same type if the surface is absolutely dry and clean.

To polyethylene, polytetrafluor ethylene and similar plastics it is impossible to obtain an adhesion. To plastics containing plasticizers one obtains an insufficient adhesion only.

Suitable for the glueing of vulcanized NEUKASIL RTV-2 C rubber to NEUKASIL RTV-2 C rubber, i. e. also to itself or to other materials, is single-component silicone rubber or cyanoacrylate. The parts to be joined are provided with a thin coat of these products and pressed together. Depending on the type of adhesive used, a good glueing effect is obtained after 1 to 24 hours. Beside glueing, damages to a vulcanized material can also be repaired by using the same type of NEUKASIL RTV-2 C silicone rubber. For this, the damaged point is cleaned thoroughly and the required quantity of cross-linker containing NEUKASIL RTV silicone rubber is fed.

Thixotropic agent:

For special condensation cross-linking and addition cross-linking NEUKASIL RTV-2 C silicone rubber types we have liquid thixotropic agents available after the addition of which one obtains a brushable to primable consistency (**particular data sheet**).

Compatibility with other materials :

NEUKASIL RTV-2 C silicone rubber – condensation cross-linking – is compatible with almost all materials in both the non-cross-linked and the cross-linked state. Condensation cross-linking systems even cross-link under unfavourable conditions whilst addition cross-linking types require cleanness and special measures of precaution when being processed.

NEUKASIL RTV-2 C silicone rubbers which cure according to the addition principle, are well compatible with the usual pattern making materials such as wood, gypsum, metals and most of the plastics and yield perfect mouldings.

Poisonings

Certain substances prevent or slow down the vulcanization of addition cross-linking NEUKASIL RTV-2 C silicone rubbers. This fact can be noticed from tacky or blowy surfaces. Organic rubbers, plasticizers, amines, heavy metal combinations and sulphureous substances, a high air humidity and water can also lead to these disturbances. Under unfavourable circumstances, surfaces that got into contact with the mentioned substances as well as certain kneading compounds may lead to disturbances of the vulcanization. In case of doubt it is recommended to execute a pretest on a small scale.

Types of the same cross-linking principle are compatible with each other and can be mixed in any ratio desired.

Condensation cross-linking systems in the non-cross-linked state are absolutely compatible with addition cross-linking systems, and they must on no account be mixed nor brought into contact with each other as otherwise vulcanization disturbances will occur.

Additions to the mixture:

Each type of NEUKASIL RTV-2 C silicone rubber has already been adjusted by chosen filler combinations with regard to its processibility and properties. Subsequent additions to the mixture involve a modification of the properties which is often not desired. Therefore, they should only be made after extensive trials.

a) Pigmenting and colouring:

The colouration of NEUKASIL RTV-2 C silicone rubbers can be made with the most different kinds of dyestuff as far as the material is not stressed by elevated temperatures. In case of heat stress, only temperature-resisting, inorganic pigments can be considered as dyestuff. A pigment addition with a concentration of 1 to 3 weight % has no or only a very little influence on the properties of the vulcanized material of NEUKASIL RTV-2 C silicone rubber.

ALTROPOL supplies special dye pastes or pigments on request.

b) Plasticizers and diluents:

Sometimes it is requested to reduce the Shore A-hardness and / or the viscosity of NEUKASIL RTV-2 C silicone rubbers. Special NEUKASIL plasticizers and diluents are available at ALTROPOL.

c) Solvents:

Due to its content of insoluble fillers, NEUKASIL RTV-2 C silicone rubber is not really solvable, but in most of the aliphatic, aromatic and chlorinated hydrocarbons, higher alcohols, ketones and esters it is easily dispersable. Mixing of NEUKASIL RTV-2 C silicone rubbers into solvents leads to cold cross-linkable dispersions. After a longer period of rest, particularly when it deals with low-solids dispersions, a partial deposit of the filler might occur which can however be removed easily by stirring. Solvent containing batches have a longer pot life and vulcanization time than undiluted NEUKASIL RTV-2 C silicone rubber.

Storage:

NEUKASIL RTV-2 C silicone rubber and NEUKASIL C and A cross-linkers shall be stored in clean, dry and closed receptacles at temperatures of 10 °C up to max. 25 °C. The allowed storage time depends on the individual type involved and is indicated in the respective particular data sheets. NEUKASIL RTV-2 C silicone rubber and NEUKASIL cross-linkers that have been stored longer than stipulated are still usable in most cases. By means of a pretest on a small scale you can easily find out whether it still functions well.

Usual shelf life at 20 - 25 °C

NEUKASIL RTV 2 K-silicone rubber, NEUKASIL crosslinking agent C

NEUKASIL crosslinking agent C, NEUKASIL Thixotropic agent

NEUKASIL primer

NEUKASIL primer 6 months

NEUKASIL silicone and wax remover unlimited

Packaging units (special sizes on request)

NEUKASIL silicone rubber	1 kg, 5 kg, 25 kg
NEUKASIL C cross-linker (Condensation system)	30 g, 50 g, 150 g, 750 g, 1.250 g
NEUKASIL A cross-linker (Addition system)	100 g, 500 g, 2,5 kg
NEUKASIL thixotropic agent	50 g, 1 kg
NEUKASIL silicone and wax remover	800 g (1 ltr.), 4 kg (5 ltr.)
NEUKASIL primer	85 g (100 ml), 850 g (1 ltr.)

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Our technical service – in words, in writing or by trials – is given according to the current state of our knowledge. It does however not relieve you from the duty to check by yourselves if the products supplied by us are suitable for the intended processes and purposes. Application, use and processing of the products take place beyond our control possibilities and lie therefore exclusively in the area of responsibility of the processor. Any existing property rights of third parties are to be considered. We guarantee the perfect quality of our products in accordance with our general terms and conditions of business. When handling our products, you have to observe the legal rules and the rules for the industrial hygiene. As for the rest, we refer to the corresponding safety data sheets.
State: 2008-02-15