SIMRIZ PERFLUOROELASTOMERS

High-performance materials for extreme requirements in the processing industry

Freudenberg
Sealing Technologies

SIMRIZ PERFLUOROELASTOMERS

REDUCING EMISSIONS, PREVENTING LEAKAGE, EXTENDING SERVICE INTERVALS AND PROTECTING THE ENVIRONMENT: THE RIGHT SEAL MAKES IT ALL POSSIBLE.

Perfluoroelastomers are the logical consequence of the increasingly high demands placed on sealing solutions. Anyone using Freudenberg's premium compounds in the Simriz® perfluoroelastomer family reduces the risk of leakage and thus the discharge of chemicals into nature or the contamination of foods and pharmaceuticals.

With Simriz perfluoroelastomers (FFKM), special perfluoroinated (low-hydrogen) monomers come into use, providing outstanding thermal and chemical stability due to the high binding energy between carbon and fluorine.

Compared to other highly resistant plastics such as PTFE, they also have rubbery elastic properties. This makes Simriz materials universally employable in static and dynamic applications as well as at high temperatures and pressures and with strong fluctuations in these parameters.

Seals made of Simriz come into use where high chemical and/or thermal requirements prevail, which other elastomers cannot meet or where high safety standards tied to demanding maintenance and service specifications must be observed.

Material	Color	Industry	Temperature range usage	Special features	Applications	Data sheet
75 Simriz 494	Black	Food, pharmaceutical	–15 °C; –59 °F (static) to +230 °C; +446 °F	▪ VO EG 1935/2004 ▪ FDA ▪ USP Class VI (+121 °C; +250 °F) ▪ ADI free	▪ O-rings ▪ Diaphragms on request	
75 Simriz 506	White	Food, pharmaceutical	–10 °C; –50 °F (static) to +230 °C; +446 °F	▪ VO EG 1935/2004 ▪ FDA 21 CFR 177.2600 ▪ USP Class VI (+121 °C; +250 °F) ▪ ADI free	▪ O-rings ▪ Molded parts	
70 Simriz 491	Black	Chemical	–20 °C; –68 °F (static) to +230 °C; +446 °F	▪ ADI free ▪ Standard material	▪ O-rings ▪ Molded parts ▪ Diaphragms	
80 Simriz 492	Black	Chemical	–10 °C; –50 °F (static) to +230 °C; +446 °F	▪ High Shore variant of the standard model	▪ Molded parts	
75 Simriz 495	Black	Chemical	–15 °C; –59 °F (static) to +230 °C; +446 °F	▪ ADI free ▪ Standard material	▪ O-rings	
85 Simriz 496	Black	Chemical	–15 °C; –59 °F (static) to +230 °C; +446 °F	▪ High Shore variant of the standard model	▪ O-rings	
75 Simriz 497	Black	Chemical	–15 °C; –59 °F (static) to +325 °C; +617 °F	▪ High temperature material	▪ O-rings ▪ Molded parts	

APPLICATIONS

WHETHER IN PUMPS, VALVES OR MECHANICAL SEALS – THE LONGEVITY OF SIMRIZ PRODUCTS HAS PROVEN THEIR VALUE. LONGER SERVICE INTERVALS MEAN LONGER OPERATING TIMES AND LOWER COSTS – FOR MAXIMUM EQUIPMENT EFFICIENCY.

O-rings

Due to their structures and easy assembly, O-rings are the most frequently used sealing element, and hardly a design can manage without them. They are suited to static applications such as cover gaskets or, in the dynamic realm, to the sealing of moving rods, pistons or rotating shafts. Diverse national and international standards guarantee good availability. Imperial and metric O-rings are available from stock at Freudenberg. Tooling is also available to produce many non-standard dimensions.

Molded parts

Molded parts are developed to customer specifications and are distinguished by their application-oriented design. Our experts' dimensioning is based on years of experience and the most advanced technologies such as calculations based on the finite element method (FEM). The result is a made-to-measure seal. This allows profile seals for hygienic valves, butterfly valve seals, or complicated molded parts such as bellows to be realized individually.

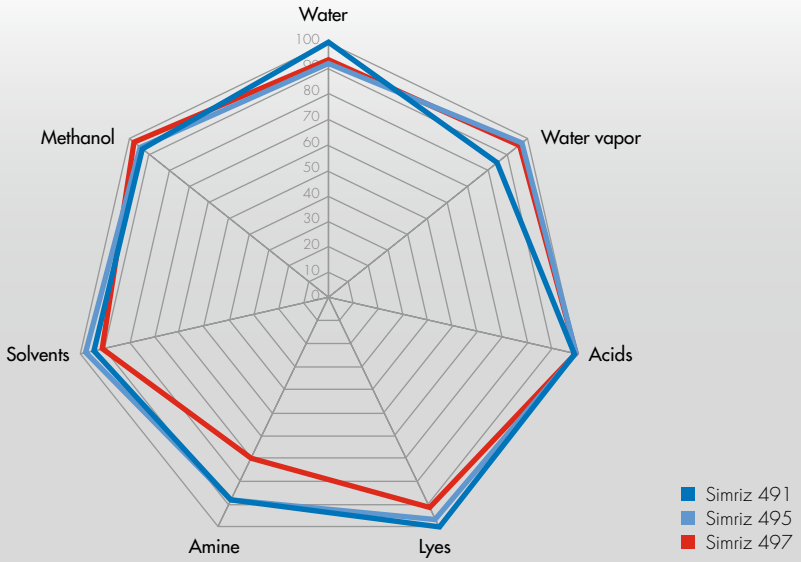
Diaphragms

If designers need to connect components with one another flexibly, to separate spaces between them and to simultaneously create an impervious separating wall for certain applications, the task can almost always be solved with the use of a diaphragm made of elastic materials. With Simriz, all the basic forms such as flat, plate-shaped, bead and rolling diaphragms can be realized. In addition to a purely elastomer construction, variations with pressure-strengthened fabric or a connection to metal are achievable.

SIMRIZ IN THE CHEMICAL INDUSTRY

SIMRIZ 491, 492, 495, 496 AND 497

EQUIPMENT MAKERS AND OPERATORS EXPECT LEAK-FREE OPERATION WITH A MAXIMUM OPERATING LIFE AND LONG SERVICE INTERVALS. SIMRIZ PERFLUOROELASTOMERS ARE DISTINGUISHED BY A NEARLY UNIVERSAL CHEMICAL RESISTANCE, ENSURING TROUBLE-FREE PROCESSES EVEN WHEN AGGRESSIVE MEDIA ARE USED OR IN HIGH TEMPERATURE RANGES.



Network diagram for chemical resistance

Simriz 491 and 495

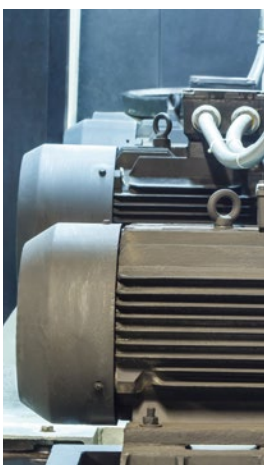
Simriz 491 and Simriz 495, standard materials from the Simriz material family, are designed to provide the greatest possible chemical resistance. The two materials differ from each other mainly in their hardness and in their processing options. The somewhat softer Simriz 491 is primarily used for customer-specific precision molded parts, while Simriz 495, which is five Shore harder, is mainly processed into O-ring material.

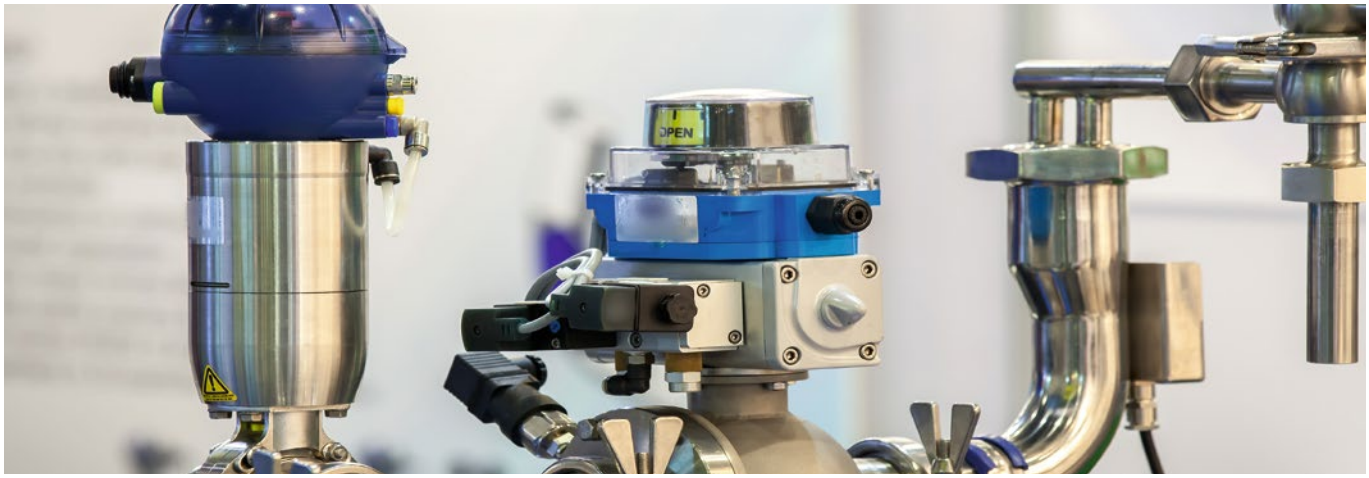
In the test lab at Freudenberg research services, investigators have explored the changes in the properties of perfluoroelastomers when they are in contact with media common in the chemical industry, including amines, lyes and acids.

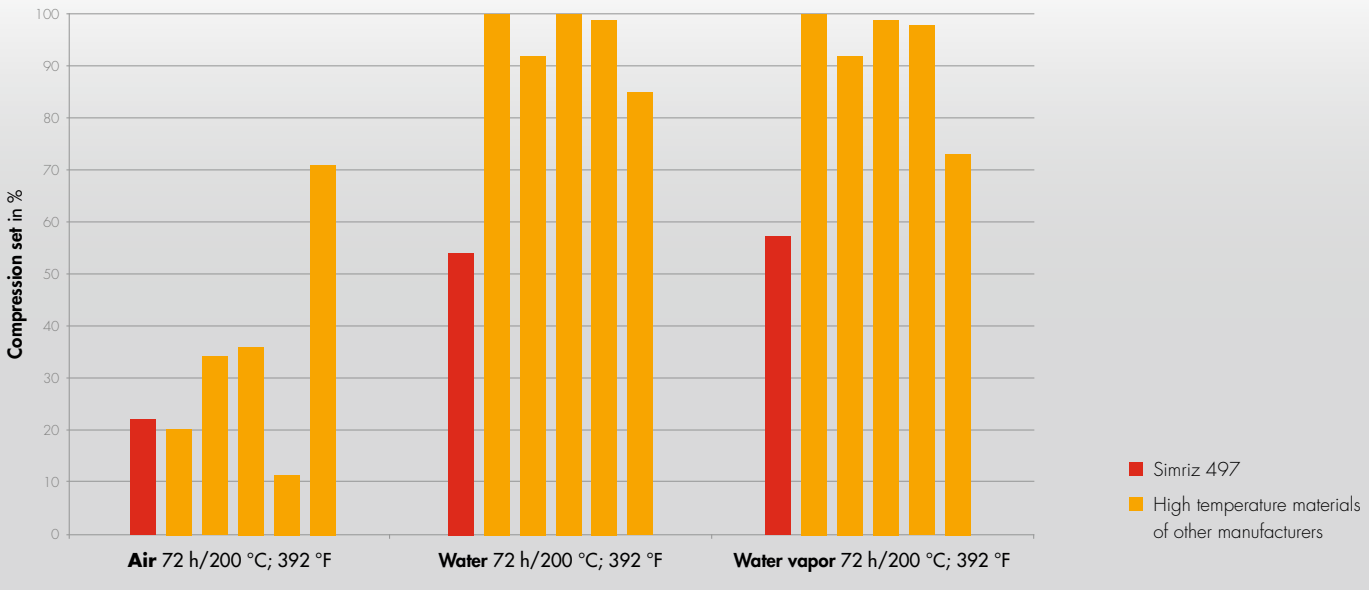
Part of this test involved immersion in various aggressive media based on DIN ISO 1817 at temperatures around their respective boiling points, with a subsequent determination of changes in volume and hardness.

Simriz 491 and Simriz 495 are among the few materials that were able to pass all the tests with a swelling of under 10 %.

With regard to chemical resistance, the network diagram, where the number 100 represents the highest achievable immersion results, shows only slight differences between the materials being investigated. Both standard perfluoroelastomers hold up at temperatures of +230 °C; +446 °F (short-term up to +260 °C; +500 °F) in continuous operation with air as the medium.







Benchmark for compression set based on DIN ISO 815

Simriz 492 and 496

Freudenberg offers two high Shore material types, 80 Simriz 492 and 85 Simriz 496, for uses under high pressure. The latter material is the hardest variant in the Simriz family.

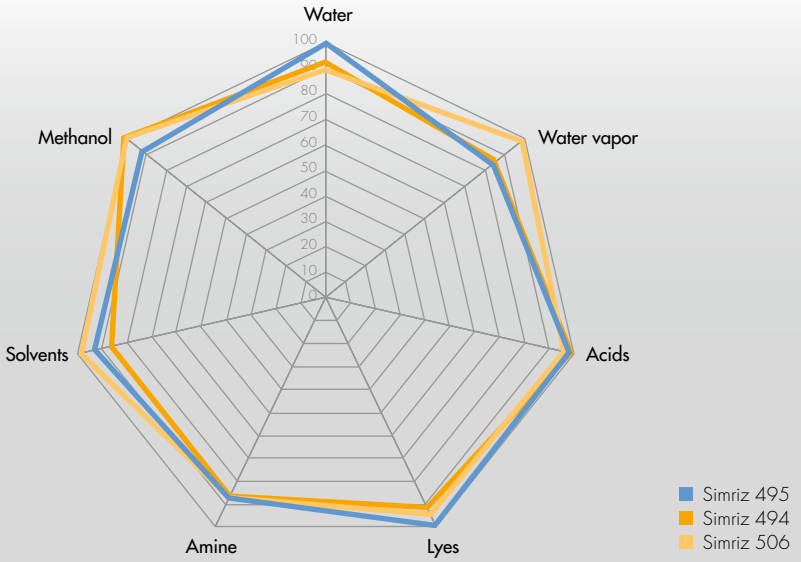
Simriz 497

With a maximum temperature of +325 °C; +617 °F, 75 Simriz 497 has by far the greatest operating temperature range among Simriz materials. In aggressive media, the swell values are somewhat higher than those for the standard materials. Still, Simriz 497 can be reliably used in most chemicals. It stands out for its high elasticity, surpassing the high temperature materials available on the market. This is shown by its compression set, which quantifies a material's recovery properties after compression. The bar chart shows the compression set values of various perfluoroelastomers, measured according to DIN ISO 815, with a compression of 25 %. The compressed O-rings were exposed to air, water or water vapor at a thermal load of +200 °C; +392 °F. Simriz 497 shows outstanding properties compared to other materials on the market, exhibiting the best elasticity and thus the longest operating life in water and water vapor. Simriz 497 also performs extremely well with air as the medium.

SIMRIZ IN THE FOOD AND PHARMACEUTICAL INDUSTRIES

SIMRIZ 494 AND 506

ULTRAPURE, HYGIENICALLY INNOCUOUS PRODUCTION PROCESSES ARE THE INDISPENSABLE FOUNDATION FOR PRODUCTS THAT ARE MARKET-DRIVEN AND SUBJECT TO NUMEROUS REGULATIONS. THE SECTOR-SPECIFIC COMPOUNDS SIMRIZ 494 AND SIMRIZ 506 ARE ALSO PART OF THE SIMRIZ FAMILY. WITH THEIR PURITY AND LEGAL COMPLIANCE, THEY OFFER THE GREATEST POSSIBLE SAFETY FROM A PUBLIC HEALTH STANDPOINT.



Network diagram for chemical resistance

Approvals and Compliance

In the food and pharmaceutical industries, seals must above all meet three legal standards to ensure hygienic production.

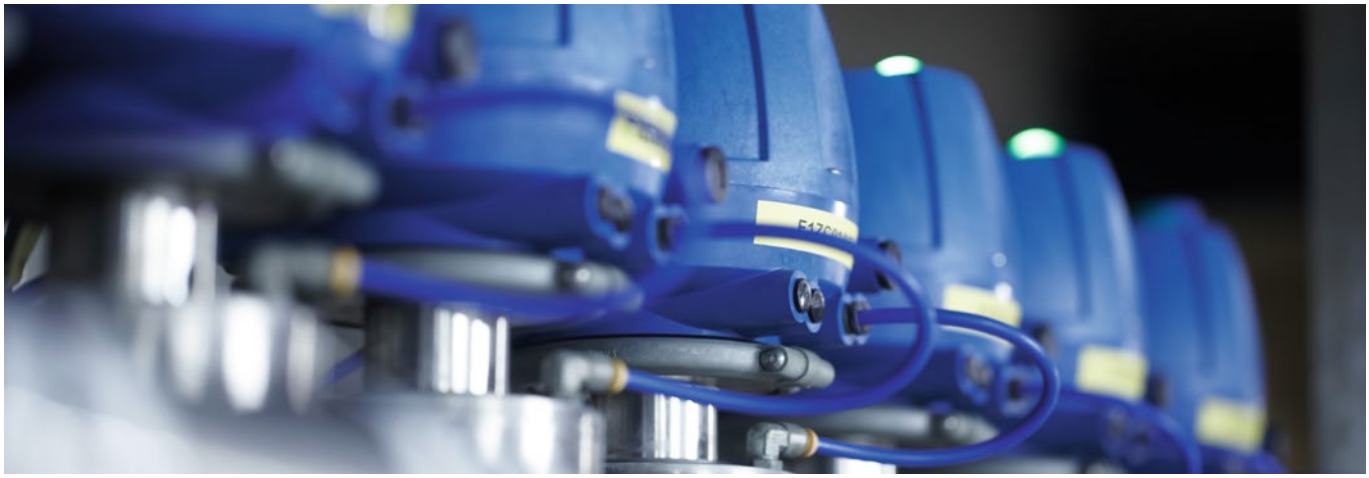
In addition to the permissible ingredients, the U.S. FDA (Food and Drug Administration) also sets the maximum extraction values in specified media. Simriz falls under the scope of application of the "Code of Federal Regulations" 21 CFR 177.2600.

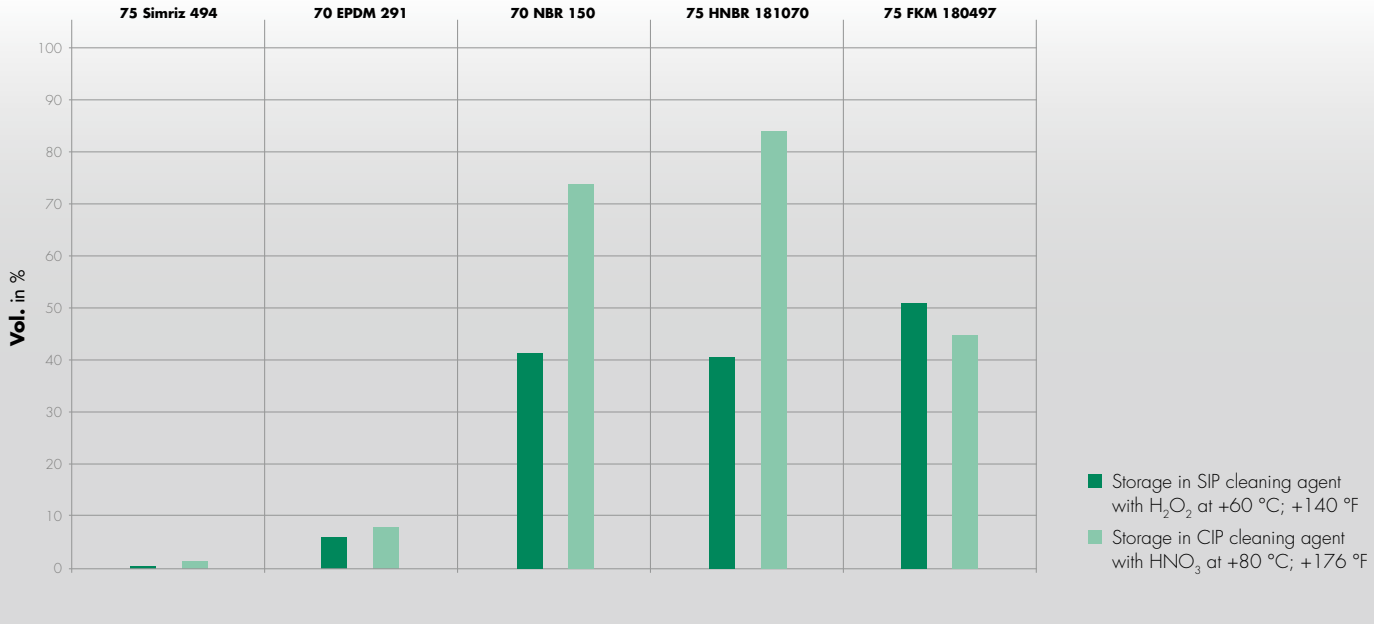
In Chapter 88 of the USP (United States Pharmacopeia Convention Inc.), the test conditions for elastomers and plastics are specified. If a material is classified as USP, it is considered biocompatible without limitation.

The European regulation "VO EG 1935/2004" stipulates that no component of a seal is permitted to cross over to the production material if it could change the composition of the food in an unacceptable way.

Simriz 494 and 506

The black Simriz 494 and the white Simriz 506 meet all these specifications. The carbon-black-free white variant is mainly selected when especially strict attention is paid to hygiene. In contrast to competitive white materials and despite its mineral filler, Simriz 506 offers nearly the same mechanical attributes as its black counterpart. The network diagram shows the performance of Simriz 494 and Simriz 506 compared to the standard material Simriz 495 in various chemicals. The number 100 represents the best possible immersion results. The stability of the material is comprehensive and very good in all media despite some slight differences.





Volume change after immersion in cleaning media over a 168-hour period

Challenges in the food and pharmaceutical industries

At first glance, Simriz seems "overengineered" for the current requirements in the food and pharmaceutical industries. Its cost-effectiveness, however, becomes clear when maintenance and downtime costs are considered. The danger of costly waste due to seal leakage can also be an argument for the use of Simriz. It comes into use when the stability of traditional elastomers such as EPDM or FKM is no longer sufficient, yet rubbery elastic behavior is urgently needed, so there is no plastic that can be used. Thanks to its minimal volume expansion, Simriz seals meet the requirements of hygienic design, which prescribes narrow grooves with no dead space. So if high temperatures, challenging media such as flavors, or aggressive solvents are present, it is definitely possible that Simriz alone will be considered as a sealing material. Cleaning with the CIP/SIP process (Cleaning In Place, Sterilization In Place), without dismantling the equipment, is also characteristic of the food and pharmaceutical industries. The use of Simriz makes sense in dosing systems that contain CIP/SIP media as concentrates.

The bar diagram shows examples of the swell values for Simriz 494 in CIP/SIP media. The swell values for Simriz are much smaller than those for common elastomers such as EPDM and FKM.

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