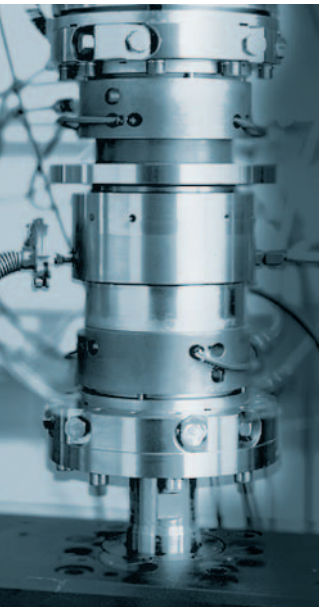
DANA

Compressed Sheet Gasket Materials

Premium Sealing Technology for Industrial Applications

VICTOR REINZ®

Latest fiber composites for excellent sealing properties



Helium leakage rate measurement

Asbestos-free gasket materials

Today's gasket materials consist mainly of a composition of different fibers and inorganic, high-temperature resistant materials, which are bound together with synthetic rubbers.
It is not possible to simply replace the chemical and physical properties of asbestos with other fiber materials. However, the alternative gasket materials exhibit a whole range of outstanding properties that provide numerous advantages for gasket design and construction.

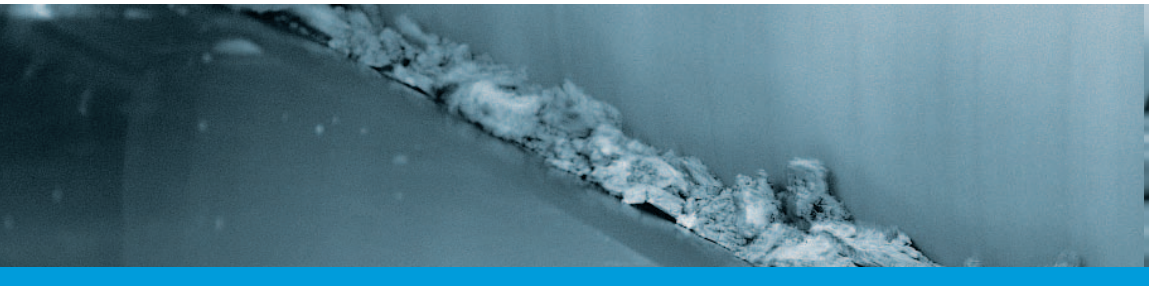
Properties and constructional advantages

Gas tightness: VICTOR REINZ compressed sheet materials exhibit far better gas tightness than asbestos-based materials – in some cases by more than a factor of 10.
Chemical resistance: In practically all cases, and for operating temperatures up to 150 °C (partially 200 °C), the chemical resistance is better than with asbestos-based gaskets.
Corrosion: The chloride content of asbestos-free gasket materials is considerably lower. This prevents corrosion damage to the sealed surfaces, and increases the reliability of the sealed joint.
Conformability: The material's comparatively high compressibility results in good conformability to rough/uneven sealing surfaces. This means a considerable improvement in micro & macro sealing of irregularities in the sealed joint.

Production of compressed sheet materials

Composite materials: Composite gasket material is produced in the form of high-pressure gasket sheets on special calenders with one heated and one cooled roller. For this, the raw composite mix of fibers, filling materials, and binders is first blended in kneaders or agitators before it is applied to the heated roller in thin layers of approx. 0.05 mm until the required material thickness has been achieved.
The calender rolls compress, dry, and vulcanize the material. Consequently, the quality of an asbestos-free material not only depends on its composition, but also on the manufacturing process to a large extent.
Duration and intensity of the initial mixing process, and in particular the roller temperature and pressure as well as the rolling speed have a decisive influence on the physical and chemical properties of the asbestos-free composite gasket material.

Calender roller



Calender for gasket sheet

Material		VR 90	VR 98
			
Characteristics		Best chemical and mechanical resistance	High mechanical stability
Material construction		- Aramid fiber - Nitrile binder	- Aramid fiber - Nitrile binder - reinforcement: galvanized steel mesh
Properties		- Physiologically harmless - Very homogeneous structure - High shear resistance - Particularly gas tight - Universal application - Superior steam sheet[3)]	- High chemical resistance - Very homogeneous structure - High shear resistance - Superior mechanical strength - Good cutting properties
Application		- Chemical plants, refineries, food processing, shipbuilding, power generation, beverage, air conditioning, heating and refrigeration, gas and water installations - Flanges, valves, tanks, radiators, compressors, pumps, plate heat exchangers - Approval: API 607 Applied for	- Chemical plants, refineries, shipbuilding - Flanges, valves, tanks, radiators, compressors, pumps, heat exchangers
Technical data	(typical values refer to 1/16" material unless otherwise specified)		
Tensile strength, transverse	ASTM F 152	> 2610 psi / > 18 N/mm²	> 2900 psi / > 20 N/mm²
Creep relaxation (1/32")	ASTM F 38 B	[2)]	[2)]
Sealability (1/32")	ASTM F 37 B	[2)]	[2)]
Gas permeability	DIN 3535/6	~0.2 ml/min	< 2.5 ml/min
Compressibility	ASTM F 36 J	5 - 8%	> 5%
Recovery	ASTM F 36 J	> 55%	> 60%
VR-Hot compression test (@7250psi):			
Thickness decrease 68°F (20°C)		6%	7%
Thickness decrease additional, at maximum continous application temperature		8% (480°F / 250°C)	7% (480°F / 250°C)
Increase in thickness after immersion in	ASTM F 146		
IRM 903 Oil (replaces ASTM Oil No.3), 5h, 300°F		0 - 7%	0 - 10%
ASTM Fuel B, 5h, 73°F		0 - 10%	0 - 10%
Water/antifreeze 1:1, 5h, 212°F		0- 10%	0 - 5%
Increase in weight after immersion in	ASTM F 146		
IRM 903 Oil (replaces ASTM Oil No.3), 5h, 300°F		7% Maximum	10% Maximum
ASTM Fuel B, 5h, 73°F		10% Maximum	10% Maximum
Water/antifreeze (50:50), 5h, 212°F		10% Maximum	5% Maximum
Density		112-125 lb/ft³ / 1.8-2 g/cm³	131-144 lb/ft³ / 2.1-2.3 g/cm³
ASTM F 104 "line call-out"	ASTM F 104	F711119B9E12K7M6	F711119B9E12M7
Application temperature, max.[1)]	continuous	480°F / 250°C	480°F / 250°C
	temporary	750°F / 400°C	750°F / 400°C
Operating pressure[1)]	maximum	2170 psi / 150 bar	2460 psi / 170 bar
Thickness		0.016in - 0.125in, 1/64" - 1/8"	0.031in - 0.125in, 1/32" - 1/8"

[1)]Maximum operating pressure and maximum operating temperature should not arise concurrently. [2)]Testing in progress [3)]For saturated steam applications consult Target Marketing Inc.

VR 80	VR 70	VR 60	VR 50	VR 30 CS
				
Multiple-use application	Standard quality, cost-effective	HVAC, water and foodsafe applications	Economical sheet	Controlled swelling sheet
- Aramid fiber - Nitrile binder	- Aramid fiber - Nitrile binder	- Aramid fiber - Nitrile binder	- Aramid and synthetic fiber - Nitrile binder	- Aramid fiber - SBR binder
- Good conformability - Excellent gas tight - Well suited for applications with high thermal and mechanical load	- Well suited for applications with thermal and mechanical requirements load	- Physiologically harmless - Very adaptable - Soft - Gas tight - Well suited for applications with low to medium thermal and mechanical load	- Good conformability - Well suited for applications with low to moderate mechanical load	- Purposely made to swell in mineral oils and many biodegradable oils, such as biodiesel, bio-oils etc. - High mechanical strength despite swelling properties
- Mechanical engineering, shipbuilding, automobile production, power generation - Flanges, pumps, casings, compressors, gas meters, plate heat exchangers, oil pans, transmission covers	- Mechanical engineering, shipbuilding, apparatus and transformer construction, chemical plants - Flanges, compressors, pumps, casings	- Food industry, beverage, air conditioning, heating and refrigeration, HVAC installations, mechanical engineering, apparatus construction, drinking water supply, hot water boilers - Flanges, pumps, transmissions, containers	- Mechanical engineering, shipbuilding, apparatus and engine production - Flanges, casings, oil pans, transmission covers	- Mechanical engineering, automobile production - Oil pans, valve covers, casings, transmissions
> 1740 psi / > 12 N/mm²	> 1160 psi / > 8N/mm²	> 1010 psi / > 7N/mm²	> 1010 psi / > 7 N/mm²	> 2030 psi / > 14N/mm²
2)	2)	2)	2)	2)
2)	2)	2)	2)	2)
< 1 ml/min	< 1 ml/min	~0.5 ml/min	< 1 ml/min	< 1 ml/min
7 - 15%	7 - 15 %	9 - 18%	8 - 15%	8 - 15%
> 50%	> 50%	> 55%	> 50%	> 55%
11% 8% (480°F / 250°C)	10% 17% (480°F / 250°C)	12% 22% (430°F / 220°C)	14% 24% (390°F / 200°C)	11% 10% (390°F / 200°C)
0 - 10% 0 - 10% 0 - 5%	0 - 10% 0 - 10% 0 - 5%	10 - 25% 10 - 25% -	0 - 15% 0 - 15% 0 - 10%	10 - 30% 10 - 30% -
10% Maximum 10% Maximum 10% Maximum	15% Maximum 10% Maximum 10% Maximum	20% Maximum 20% Maximum -	20% Maximum 15% Maximum 15% Maximum	30% Maximum 30% Maximum -
109-122 lb/ft³ / 1.75-1.95 g/cm³	119-131 lb/ft³ / 1.9-2.1 g/cm³	112-125 lb/ft³ / 1.8-2 g/cm³	106-119 lb/ft³ / 1.7-1.9 g/cm³	97-109 lb/ft³ / 1.55-1.75 g/cm³
F712119B9E12M5	F712119B9E12M4	F712339B9E35M4	F712139B9E23M4	F712449B9E35M6
480°F / 250°C 750°F / 400°C	480°F / 250°C 750°F / 400°C	430°F / 220°C 570°F / 300°C	390°F / 200°C 570°F / 300°C	390°F / 200°C 750°F / 400°C
1450 psi / 100 bar	1450 psi / 100 bar	870 psi / 60 bar	1160 psi / 80 bar	1740 psi / 120 bar
0.016in - 0.125in, 1/64" - 1/8"	0.016in - 0.125in, 1/64" - 1/8"	0.016in - 0.125in, 1/64" - 1/8"	0.016in - 0.125in, 1/64" - 1/8"	0.016in - 0.125in, 1/64" - 1/8"

Medium Tables[1)]

	VR 90, VR 98	VR 80	VR 70	VR 60	VR 50	VR 30 CS
Acetaldehyde	●	●	●	●	●	●
Acetic acid	●	●	●	○	○	○
Acetic acid anhydride	●	●	●	●	●	○
Acetone	●	●	●	●	●	●
Acetylene	●	●	●	●	●	●
Aluminium salts[1)]	●	●	○	●	●	●
Alums	●	●	●	●	●	●
Ammonia	●	●	●	●	●	●
Ammonium salts[1)]	●	●	●	●	●	●
Aniline	●	●	●	○	○	▲
Asphalt	●	●	●	●	●	●
Benzaldehyde	●	●	●	●	●	●
Benzene	●	●	●	●	●	▲
Bleaching alkaline, dilute	●	●	●	●	●	●
Borax	●	●	●	●	●	●
Boric acid	●	●	●	●	●	●
Butane	●	●	●	●	●	●
Butanol	●	●	●	●	●	●
Butylacetate	●	●	●	●	●	●
Butyric acid	●	●	●	●	●	●
Calcium hydroxide	●	●	●	●	●	●
Calcium salts[1)]	●	●	●	●	●	●
Carbon disulphide	●	●	●	○	○	○
Carbon tetrachloride	●	●	●	●	●	●
Chlorine water	●	●	●	●	●	●
Chloroacetic acid	●	●	●	▲	▲	▲
Chlorobenzene	●	●	●	○	○	▲
Chlorodiphenyl	●	●	●	●	●	○
Chloroform	●	●	●	●	●	●
Chromic acid	▲	▲	▲	▲	▲	▲
Chromium salts[1)]	●	●	●	●	●	●
Citric acid	●	●	●	●	●	●
Cresol	●	○	●	▲	▲	○
Cyclohexane	●	●	●	●	●	●

	VR 90, VR 98	VR 80	VR 70	VR 60	VR 50	VR 30 CS
Cyclohexanol	●	●	●	●	●	●
Cyclohexanone	●	●	●	●	●	●
Dibutyl phthalate	●	●	●	●	●	●
Diesel oil	●	●	●	●	●	●
Diethyl amine	●	●	●	○	▲	●
Diethyl ether	●	●	●	●	●	●
Diethyl glycol	●	●	●	●	●	●
Dimethylether	●	●	●	●	●	●
Dimethyl formamide	●	●	●	○	▲	▲
Dioxane	●	●	●	●	●	●
Diphenyl methane	●	●	●	●	●	●
Ethane	●	●	●	●	●	●
Ethanol	●	●	●	●	●	●
Ethanolamine	●	●	●	●	●	●
Ether	●	●	●	●	●	●
Ethyl acetate	●	●	●	●	●	●
Ethyl benzene	●	●	●	●	●	●
Ethylene	●	●	●	●	●	●
Ethylene glycol	●	●	●	●	●	●
Fatty acids from C 10	●	●	●	●	●	●
Fluoric acid	▲	▲	▲	▲	▲	▲
Formaldehyde	●	●	●	●	●	●
Formic acid	●	●	●	▲	▲	●
Freons, CFC's	●	●	●	●	●	●
Gelatine	●	●	●	●	●	●
Glycols	●	●	●	●	●	●
Heating oil	●	●	●	●	●	●
Heat conducting oils, synth.	●	●	●	●	●	▲
Hexane	●	●	●	●	●	●
Hydraulic fluids (Mineral oil based)	●	●	●	●	●	●
Hydraulic fluids (Ester based)	●	●	●	○	○	●

● Resistant
○ Partly resistant: testing under operational conditions recommended
▲ Not resistant

[1)] **Salts are:** nitrates, nitrites, sulphates, sulphides, chlorides, acetates, tartrates, cyanides, phosphates, oxalates, etc.

	VR 90, VR 98	VR 80	VR 70	VR 60	VR 50	VR 30 CS
Hydrochloric acid, conc.	○	●	●	▲	▲	●
Hydrochloric acid, dilute	○	●	●	○	▲	●
Hydrogen	●	●	●	●	●	●
Hydrogen peroxide, dilute	●	●	●	●	●	●
Hydrogen sulphide	●	●	●	●	●	●
Isopropyl alcohol	●	●	●	●	●	●
Iron salts[1)]	●	●	●	●	●	●
Kerosene (Petroleum)	●	●	●	●	●	○
Lead salts[1)]	●	●	●	●	●	●
Lubricating oils	●	●	●	●	●	●
Machine oils RT	●	●	●	●	●	●
Machine oils 100°C	●	●	●	●	●	●
Magnesium hydroxide	●	●	●	●	●	●
Methane	●	●	●	●	●	●
Methyl alcohol	●	●	●	●	●	●
Methyl chloride	●	○	○	●	○	○
Methylene chloride	●	●	●	●	●	●
Methylethylketone (Butanone)	●	●	●	●	●	●
Motor oils RT	●	●	●	●	●	●
Motor oils 100°C	●	●	●	●	●	●
Naphtha	●	●	●	●	●	○
Natural gas	●	●	●	●	●	●
Nickel salts[1)]	●	●	●	●	●	●
Nitric acid, conc.	▲	▲	▲	▲	▲	▲
Nitric acid, dilute	●	●	●	○	▲	●
Nitrobenzenes	●	●	●	○	▲	▲
Oxalic acid	●	●	●	●	●	●
Oxygen	●	●	▲	▲	▲	▲

	VR 90, VR 98	VR 80	VR 70	VR 60	VR 50	VR 30 CS
Perchloroethylene	●	●	●	●	●	●
Petrol	●	●	●	●	●	○
Petroleum ether	●	●	●	●	●	○
Petroleum oil	●	●	●	●	●	●
Phenol	●	●	●	▲	▲	○
Phenylether	●	●	●	●	●	●
Phenylhydrazine	●	●	●	○	○	●
Phosphoric acid	●	●	●	●	●	●
Phthalic acid anhydride	●	●	●	●	●	●
Potassium hydroxide	●	●	●	▲	▲	●
Potassium salts[1)]	●	●	●	●	●	●
Pyridine	●	●	●	○	▲	▲
Salicylic acid	●	●	●	●	●	●
Sea water	●	●	●	●	●	●
Steam 130°C	●	●	●	○	○	●
Styrene	●	●	●	●	●	▲
Sulphuric acid, conc.	▲	▲	▲	▲	▲	▲
Sulphuric acid, dilute	●	●	●	○	▲	●
Sulphurous acid	●	●	●	●	●	●
Sodium hydroxide (Caustic soda sol.)	●	●	●	▲	▲	●
Terpentine	●	●	●	●	●	●
Toluene	●	●	●	●	●	▲
Transformer oils	●	●	●	●	●	●
Transmission oil	●	●	●	●	●	●
Trichloroethylene	●	●	●	●	●	●
Triethanolamine	●	●	●	●	●	●
Vegetable oils	●	●	●	●	●	●
Water	●	●	●	●	●	●
Zinc salts[1)]	●	●	●	●	●	●

Choice of suitable sealing materials
The Medium Tables are designed to simplify your choice of a suitable sealing material. These recommendations are based on the current status of our knowledge.

Determination of chemical resistance
To determine chemical resistance, the gasket materials were suspended freely in the respective media for 70 hours (if not specified otherwise).
A 10 % solution was used for diluted acids, lyes, and salts, whereas saturated solutions were used for media with lower solubility.

Please note:
Mixtures or non-aqueous solutions could produce a different result for the chemical resistance evaluation. The thermo-mechanical operating conditions should also be taken into account when selecting a sealing material, as these also influence the resistance of a material to a medium.

For this reason, the recommendations in the Medium Tables are to be considered as a guideline. No warranty can be granted for the use of any material. In case of doubt please consult us and give exact details of the operating conditions.

Recommendations for flat gaskets

Correct installation is an essential prerequisite for reliable gasket operation. Sealing surfaces and clamping bolts must be selected according to the minimum required and maximum permitted surface pressures for the respective gasket. Please make sure that:

- ¬ Only new, undamaged and dry gaskets are used. Also pay attention to the storage conditions (see below).
- ¬ Clean the sealing surfaces thoroughly, without scratching them. Dry the surfaces.
- ¬ Position the gaskets centrally. Do not apply any additives (grease, releasing agent or sealing compound) to the gasket or the sealing surfaces.
- ¬ Do not use corroded bolts, nuts, or washers. Calculated and achieved surface pressure must coincide, therefore lubricate the bolt threads and nut faces lightly.
- ¬ Mount the mating sealing surface plane-parallel, and tighten the bolts by hand.
- ¬ To ensure an even pressure distribution, torque the bolts «crosswise» to the specified value in at least 3 steps. Example:
  1st step: 20% of final torque.
  2nd step: 60% of final torque.
  3rd step: 100% of final torque.
- ¬ All bolts must be torqued to the same specified value.
- ¬ Every gasket will set, especially after a lengthy downtime. Therefore, retorque the bolts to the 100% value before commissioning.
- ¬ Fiber-based or PTFE gaskets that have already been at operating temperature should only be retorqued in the cold condition using great care, and in several steps, as there is a considerable risk of destroying the gasket (especially fiber-based gaskets that have already hardened).

Storage conditions for fiber-based gaskets and sheet material
(FA to DIN 28 091-2) Maximum storage time is 2 to 3 years under the following conditions:

- ¬ Temperature < + 20°C/68ºF
- ¬ Relative humidity 30% to 60%
- ¬ No exposure to direct sunlight
- ¬ No exposure to artificial light with high UV levels
- ¬ No exposure to ozone
- ¬ Stress-free storage

Large deviations from the above conditions will reduce the permissible storage time. With critical (e.g. toxic) gases, a storage time of one year should not be exceeded. If necessary, the gaskets or gasket material should be enclosed in suitable packaging (airtight and protected from light).

Warning:

Properties/applications shown throughout this brochure are typical. Your specific application should not be implemented without independent study and evaluation for suitability. For specific application recommendations please consult Target Marketing. Failure to select the proper sealing products could result in material damage and/or serious personal injury.
Performance data published in this brochure is based on field tests, customer field reports and/or in-house testing. Field conditions will affect gasket performance.
While utmost care has been taken while compiling this brochure, we assume no responsibility for errors. Specifications are subject to change without notice. We point out that this method for gasket selection is merely a general guide and should not be the sole means for selecting or rejecting a product.