



**Spacer cans
for the pump industry**

FRIALIT®-DEGUSSIT® High-Performance Ceramics

www.friatec.de

FRIALIT®-DEGUSSIT® SPACER CANS **WEAR- AND CORROSION RESISTANT**

The current development of state-of-the-art sealing systems applied in the pump industry focuses on magnetic couplers more and more. Here, spacer cans made of oxide ceramics form the central element. That is because of the unique magnetic, corrosive and mechanical properties ceramic materials offer to realise such applications. In close cooperation with our customers we develop tailor-made solutions meeting their very specific requirements.





FRIALIT-DEGUSSIT
spacer cans
for the pump and
chemical industries.

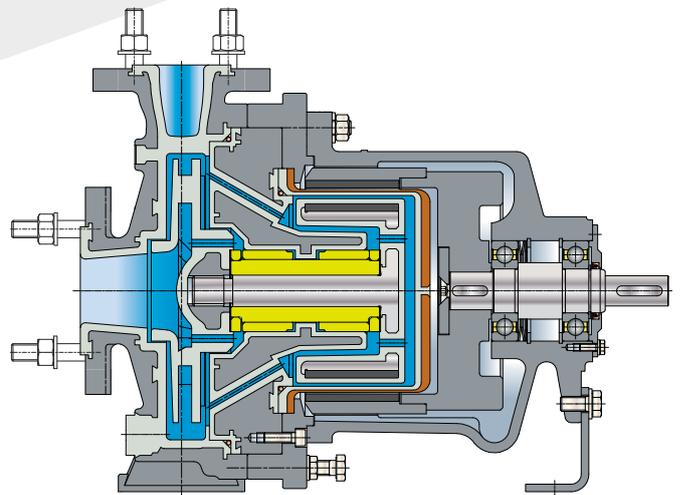
SPACER CANS **HIGH-PERFORMANCE CERAMICS**

Magnetically coupled centrifugal pumps require non-magnetic components highly resistant to mechanical forces and corrosion. High-performance ceramics hold suitable material properties to meet such exceptional combination of requirements.

Magnetic couplers ensure hermetic sealing of the pump against the drive. Minimum maintenance requirements allow for leakage-free operation. This prevents any environmental impact caused by spilt pumping media from the outset.



Meeting
highest
pumping
standards.



Source: Rheinhütte Pumpen

Compared to conventional materials, spacer cans made of FRIALIT FZM high performance ceramics hold the following benefits:

- FRIALIT FZM is non-magnetic – eliminating the creation of performance-impairing eddy currents and reducing electrical drive power by 10 to 15 %.
- FRIALIT FZM is corrosion-resistant – allowing for universal application to virtually all acids and bases.
- FRIALIT FZM offers high mechanical stability – depending on the size of the inner diameter, test pressure conditions exceeding by far 60 bar at temperatures of 450 °C and more can be controlled. A relatively small elastic modulus ensures a certain elastic deformation capacity.

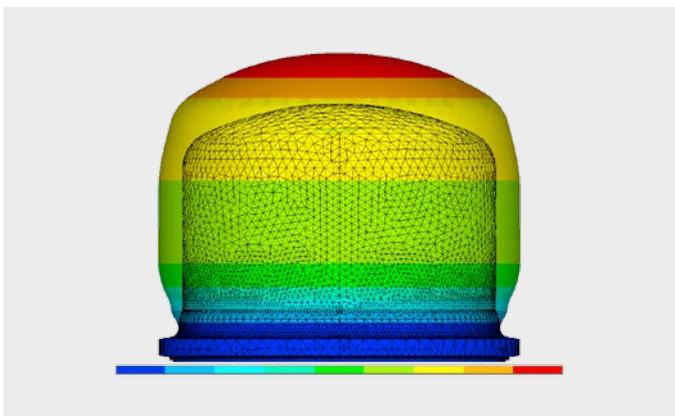
To keep the magnetic split as little as possible the wall thickness in the cylindrical section of the spacer can ranges between 1.5 and 3 mm, only – again depending on the inner diameter.

Thanks to the above-mentioned properties, FRIALIT FZM spacer cans for magnetically coupled pumps stand for the ideal choice for any application in the chemical industry. The design of the spacer can is adapted to the individual pump type specified by our customers.

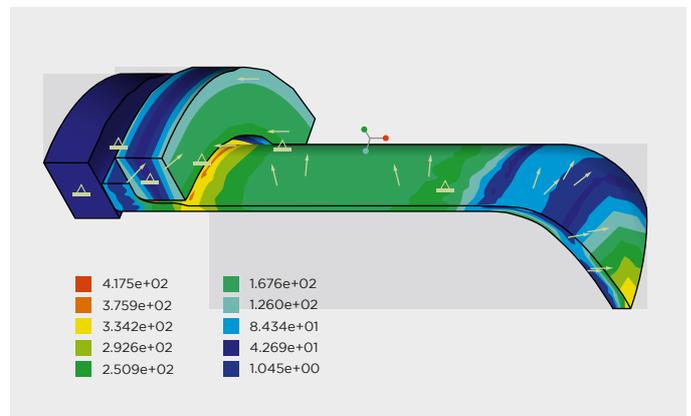
BENEFITS FRIALIT® FZM

FRIALIT FZM has proven itself as an ideal ceramic material characterised by high fracture toughness as well as wear and corrosion resistance. Low thermal conductivity, excellent thermal shock resistance and superb thermal expansion properties comparable to cast iron round off the unique features of the material.

Optimum design of the transition to the bottom end cap and flange hub allow for a low wall thickness of the spacer can and thus a more cost-efficient dimensioning of the integrated magnets.



Global deformation (50-fold stilted presentation)
Pressure: inner pressure 36 bar, inner temperature 250 °C



FE evaluation assembly

Top-drawer
application
results.

MATERIAL PROPERTIES FRIALIT FZM

Properties		Unit	Specific value
Main components		-	ZrO ₂ , MgO
Purity		wt-%	> 99.7
Density		g/cm ³	≥ 5.7
Open porosity		vol.-%	0
Average size of crystallites		µm	50
Bending strength σ_m	DIN EN 843-1	MPa	500
Weibulls modulus		-	> 15
Toughness K_{Ic}	SEVNB	MPa * m ^{0.5}	6.3
Compressive strength		MPa	2000
Young's modulus	static	GPa	185
Poisson's ratio		-	0.3
Hardness	Knoop, 100 g	GPa	16
Maximum service temperature in air		°C	900
Linear coefficient of expansion	20 - 100 °C	10 ⁻⁶ /K	9.3
	20 - 500 °C		10.4
	20 - 900 °C		10.6
Specific heat	20 °C	J/(kg*K)	400
Thermal conductivity	20 °C	W/(m*K)	3
	500 °C		2.3
	900 °C		2
Resistivity	20 °C	Ω*cm	10 ¹⁰
	900 °C		84
Typical colour		-	yellow

The data indicated on this table are in line with the introductory German Industrial Standard DIN 40680 and relate to test specimens from which they were obtained. They are not unconditionally applicable to other forms of the same material. The data must be regarded as indicative only. All data refer to a temperature of 20 °C, unless otherwise specified. The material is extremely resistant to corrosion. We should be pleased to send you brochures about the corrosion resistance of oxide ceramics.

BENEFITS

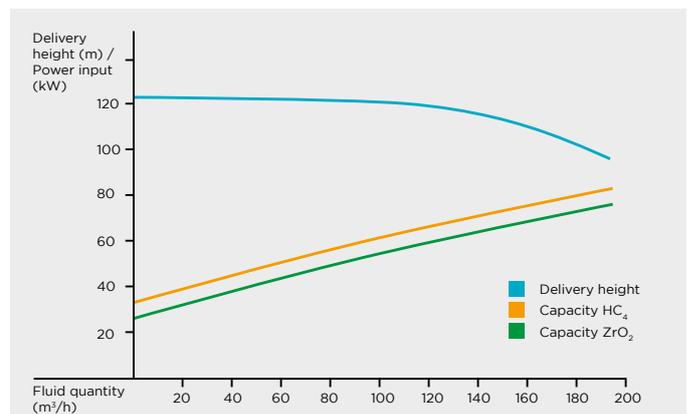
ENERGY-EFFICIENCY

Thanks to the high specific resistance of the FRIALIT FZM ceramic material of $10^{10} \Omega\text{mm}^2/\text{m}$, eddy currents are prevented.

Increasing the energy efficiency of pumps and pumping systems is of great importance. According to an EU survey, pumps account for about 20% of the energy consumption of motor-operated systems. Based on the extrapolation of the German Energy Agency, over 10bn kWh could be saved each year if pumping systems were optimised.

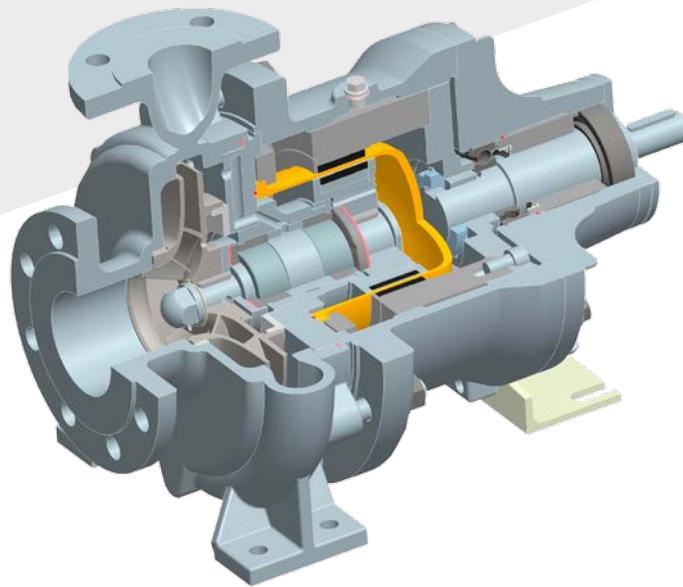


Comparison of efficiency ceramics/steel; Source: Klaus Union



Comparison of power input ceramics/steel; Source: Klaus Union

Cost reduction through ceramics.



Source: Klaus Union

The costs accruing over the total life cycle e.g. of water-conveying pumping systems are composed as follows:

- Acquisition costs approx. 8%
- Maintenance, upkeep and other costs approx. 10%
- Energy costs approx. 82%

Against that backdrop, magnetic coupling pumps with metal spacer cans take centre stage more and more often. The dissipation loss generated in these systems has a negative effect on the efficiency of the pumps and accounts for a major share of the incurring energy costs. Modern ceramic materials such as FRIALIT FZM prevent the generation of eddy currents and contribute to energy-efficient operation.

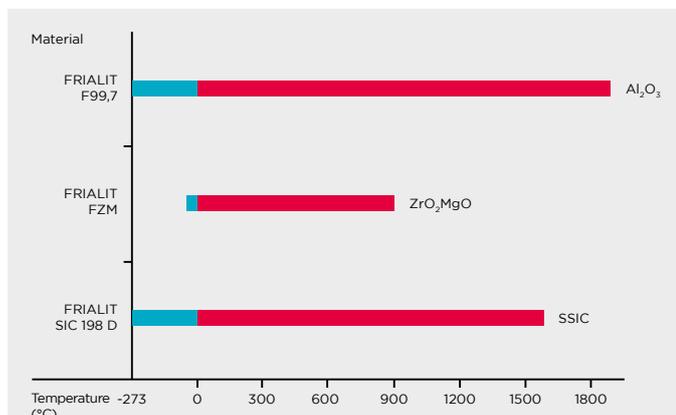
BENEFITS ALSO CONCEIVED FOR AGGRESSIVE PUMPING MEDIA

Spacer cans made of zirconium oxide FRIALIT FZM are used for pumping widely varying and – in particular – very aggressive media.

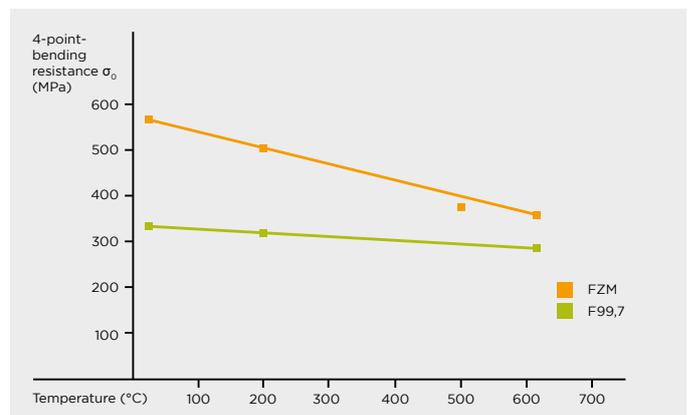


Such media include e.g. heat transfer oil at temperatures of up to 350 °C, heavy fuel oil up to 160 °C, methanol, acrylamide, propane, ethylene oxide, nitric acid, phenol, etc., the latter chemicals being pumped at temperatures ranging between -30 °C and 250 °C.

To protect the ceramic material against the extremely aggressive hydrofluoric acid (HF) the inner surface of the spacer can may be coated with a chemically resistant and pore-free lining.



Operating temperature of FRIALIT-DEGUSSIT materials applied in oxidizing atmosphere



Bending resistance in relation to temperature

Excellent
materials
containing
corrosion.



EXCERPT FROM CORROSION RESISTANCE LIST

Agent	Chemical formula	Concentration (%)	Temperature (°C)	FRIALIT F99,7	FRIALIT FZM
Methanol	CH ₃ OH	all	Rt	A	A
Phenol	C ₆ H ₅ OH	pure	Rt	A	A
Nitric acid	HNO ₃	7	Rt	A	A
Hydrochloric acid	HCl	0.5	Rt	A	A
Sulfuric acid	H ₂ SO ₄	2	Rt	A	A

A resistant
Rt room temperature

BENEFITS **EXPLOSION PROOFNESS**

Directive 94/9/EC on equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) does not provide for any limitation for integrating ceramic spacer cans into any Group II Category 2 equipment for application in Zone 1.



Diversion of electrostatic charges through coating.



In collaboration with the National Metrology Institute of Germany (Physikalisch-Technische Bundesanstalt) in Braunschweig extensive measurements were conducted to determine the antistatic discharge capability as per IEC 60093 and IEC 60167. Eventually, it was established that only an additional external coating could considerably underrun the limits for surface resistivity and discharge resistance ($RA < 106\Omega$).

Hence, a modified ceramic spacer can be operated in contact with all inflammable media and in any explosive atmosphere.

COATING EXAMPLE

Properties	Unit	Specific value
Coating thickness	μm	approx. 3
Service temperature	$^{\circ}\text{C}$	< 450
Micro hardness	HV 0.05	2300 ± 400
Density	g/cm^{-3}	5.2
Thermal conductivity	$\text{Wm}^{-1}\text{K}^{-1}$	30
Resistivity	$\mu\Omega \text{ cm}$	25
Colour	-	gold

FRIALIT®-DEGUSSIT® HIGH-PERFORMANCE CERAMICS **CERAMIC INNOVATIONS SINCE 1863**

FRIATEC manufactures components made of high-performance ceramics according to customer specifications, as well as a comprehensive standard program.

An experienced team of innovative application engineers and resourceful production specialists alongside painstaking quality controls supports our customers in their choice of ceramic material, design and project execution. More than 150 years of experience in the field of ceramic manufacturing and our individual brand of materials, combined with innovative engineering, form the pillars of our company's successful development.

Our products, made of aluminium oxide, zirconium oxide, silicon carbide and silicon nitride, are used predominantly in the following areas:

ELECTRICAL ENGINEERING

- Single and multiple feedthroughs
- High-pressure feedthroughs for onshore/offshore technology
- Insulation tubes
- Standoffs
- Accelerator components for research and development apparatus
- Sensor components for pressure, temperature, oxygen levels, etc.

HIGH TEMPERATURE TECHNOLOGY

- Tubes and insulating rods for protection and insulation of thermocouples
- Tubes for gas inlet and outlet
- Grooved and heating tubes for construction of electrically heated furnaces
- Diffusion tubes for the semi-conductor industry
- Multibore tubes
- Crucibles, boats, combustion trays and plates

MECHANICAL ENGINEERING

- Pistons for dosing pumps (fitted pistons/cylinder units)
- Plungers for high-pressure pumps
- Spacer cans for the chemical industry
- Glide rings, glide bearings, shaft protection sleeves
- Nozzles
- Shaped parts for wear-and-tear use
- Drawing cones and guide elements for the wire industry

SURFACE FINISHING

- Fine-grinding tools for surface finishing of ultra-hard materials in various shapes and dimensions

FRIATEC

INNOVATIVE SOLUTIONS FOR THE GLOBAL MARKET

INNOVATIONS FOR MORE THAN 150 YEARS

The company was founded in 1863 in Mannheim, Germany, as a brickyard and succeeded in developing its first pathbreaking innovation, chemical stoneware, in 1888. Numerous new developments followed. Among other things, the company started in the mid of the past century processing plastics and combined modern and traditional materials when producing chemical devices and facilities. The following years were characterised by the expansion in the core business and the opening up of more and more new business segments. As Deutsche Steinzeug and later as Friedrichsfeld GmbH, the company, which has been operating under the name FRIATEC AG since 1993, continuously developed to become an internationally active, diversified company.

SPECTRUM OF INNOVATIVE SOLUTIONS

As such, FRIATEC AG today offers a spectrum of innovative solutions for many industries, e.g. jointing technology for pipe systems, special pumps for aggressive, volatile or explosive media, but also ceramic components which are used in laboratory and electrical engineering but also in medical engineering. With its sophisticated solutions, FRIATEC AG is not only among the most well-known and well-established companies in the metropolitan region Rhine-Neckar but is also one of the global market leaders of its industry.

PARTNER OF A POWERFUL COMMUNITY

Since 2003, FRIATEC AG has been a member of the ALIAXIS group of companies with headquarters in Brussels. ALIAXIS is the worldwide largest producer of plastic pipe systems for the construction industry, the industry and utilities.

**FRIATEC AG is a specialist
company for products made
of non-corroding and
wear-resistant materials.**

Aliaxis

UTILITIES & INDUSTRY

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WEBLINK
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