

VENTOGUARD® MATERIALS



Ventoguard premium class materials for long, trouble-free plant operation

To improve the technical prowess and functionality of wind turbines, we have developed a new generation of materials: Ventoguard.

In addition to providing longer service life and excellent dependability, Ventoguard premium materials also offer clear cost advantages. It's well known that seals in wind power plants are exposed to demanding conditions—extreme weather in the different regions of operation and exposure to greases, salt air, and ozone.

With Ventoguard, Freudenberg Sealing Technologies—the world's leading supplier of sealing technology—has now developed a new generation of premium materials, tailored to various applications in wind turbines. For a long, trouble-free plant operation.

VENTOGUARD MATERIALS

Ventoguard 453

In addition to an excellent relaxation behavior, as well as a very good long-term resistance to a variety of greases, Ventoguard 453 is characterized by its excellent low-temperature behavior. The material retains its low-temperature flexibility even at temperatures of -55°C (statical range).

Ventoguard 454

The most important feature of Ventoguard 454 is its compatibility with all common greases. The NBR material is both cold- and ozone-resistant and has an aging behavior that may permit a doubling of the durability at the same temperature (see fig. 2). Also significant is the better resilience of Ventoguard 454 compared with standard materials.

Ventoguard 461

The FKM profile material Ventoguard 461 impresses by a maximum resistance to weather, heat, and media. The long-term stability of the material ensures reliable and economic operation of the wind turbine on a sustainable basis. This is especially true for applications in high temperature areas.

VALUES FOR THE CUSTOMER

Ventoguard delivers a range of benefits:

- Significantly better relaxation behavior than previous materials over the long term and at higher temperatures
- Particularly resistant to weathering and greases
- Excellent ozone resistance
- Very good abrasion resistance
- Can be used in a wide temperature range
- Long-term sealing reliability
- Contaminant-free according to Freudenberg Sealing Technologies standards

Ventoguard 467

An excellent resistance to wear and tear and outstanding resistance to UV light, ozone and aging are the prominent features of the HN BR material Ventoguard 467. With operating temperatures of up to 120°C , it builds a bridge between NBR and FKM variants. Ventoguard 467 is used especially in the sealing of main bearings and gears and wind turbines.

Ventoguard 471

Due to its high weathering resistance, the EPDM material Ventoguard 471 is typically used in nacelle seals. Ventoguard 471 can be used at temperatures between -40°C and $+80^{\circ}\text{C}$ (for short periods at up to $+100^{\circ}\text{C}$) and is resistant to ozone.

Ventoguard 472

On account of its excellent relaxation behavior and salt water resistance, this material is used, for example, to seal the fittings at the transition between pile and foundation of wind turbines. Ventoguard 472 was specifically designed to satisfy narrower tolerance limits and to ensure a flawless seal effect for many years.

VENTOGUARD PROPERTIES

Figure 1. Laboratory results of the continuous tensile stress relaxation, unlubricated elastomer rings in warm air at 20% elongation

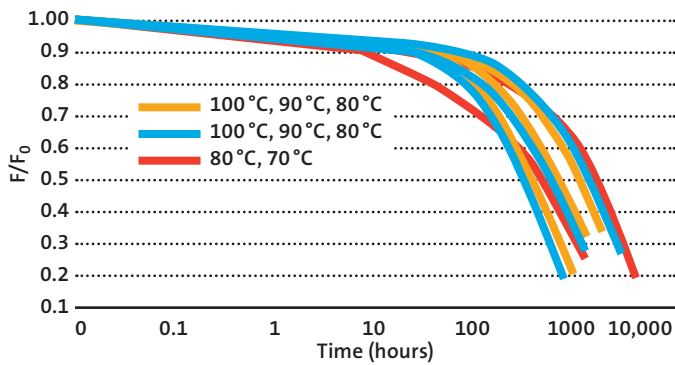


Figure 2. Estimate of the service life on the basis of measurements analogous to laboratory conditions from Figure 1

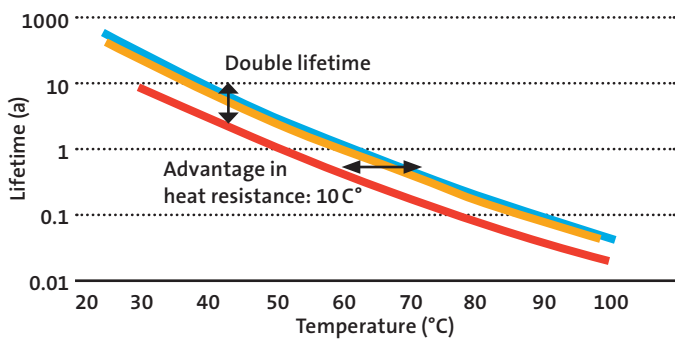
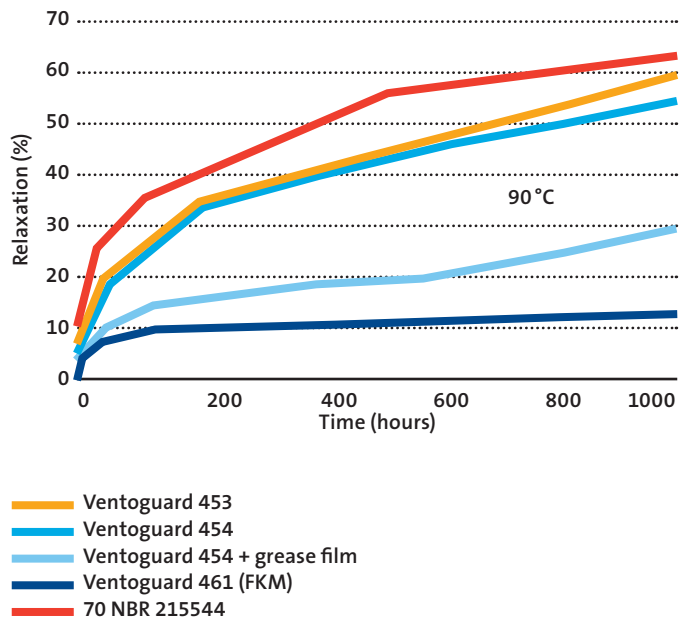


Figure 3. Laboratory results of the compression stress relaxation pursuant to DIN ISO 3384-A at 90 °C



Materials	70 NBR 215544	Ventoguard 453	Ventoguard 454	Ventoguard 461	Ventoguard 467	Ventoguard 471	Ventoguard 472
Typical applications properties	Profiles for pivot bearings, dust seals				Radial shaft seal ring for gears, main bearings	Profiles for nacelle seals	
Density, g/cm ³	1.23	1.20	1.24	1.87	1.26	1.13	1.15
Hardness, ShA	71	72	75	76	75	70	73
Modulus 100%, N/mm ²	5.7	6.4	6.1	5.7	7.0	5.2	8.9
Tensile strength, N/mm ²	19.9	16.3	19.0	11.0	20.0	15.0	16.6
Elongation at break, %	255	225	270	305	306	290	150
Compression set, % (24 hours @ 70 °C)	23	15	14	13	15	28	9
Ozone resistance (50 pphm), cracking	0	0	0	0	0	0	0
Glass transition, temperature Tg (DSC), °C	-32	-49	-38	-18	-21	-49	-56
Operating conditions, °C (static)	-40 to +70	-55 to +80	-45 to +80	-25 to +200	-50 to +120	-50 to +80	-40 to +120
Operating conditions, °C (dynamic)	-30 to +70	-45 to +80	-35 to +80	-20 to +200	-20 to +120	-40 to +80	-50 to +120

The information contained herein is believed to be reliable, but no representation, guarantees or warranties of any kind are made to its accuracy or suitability for any purpose. The information presented herein is based on laboratory testing and does not necessarily indicate end product performance. Full scale testing and end product performance are the responsibility of the user.

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