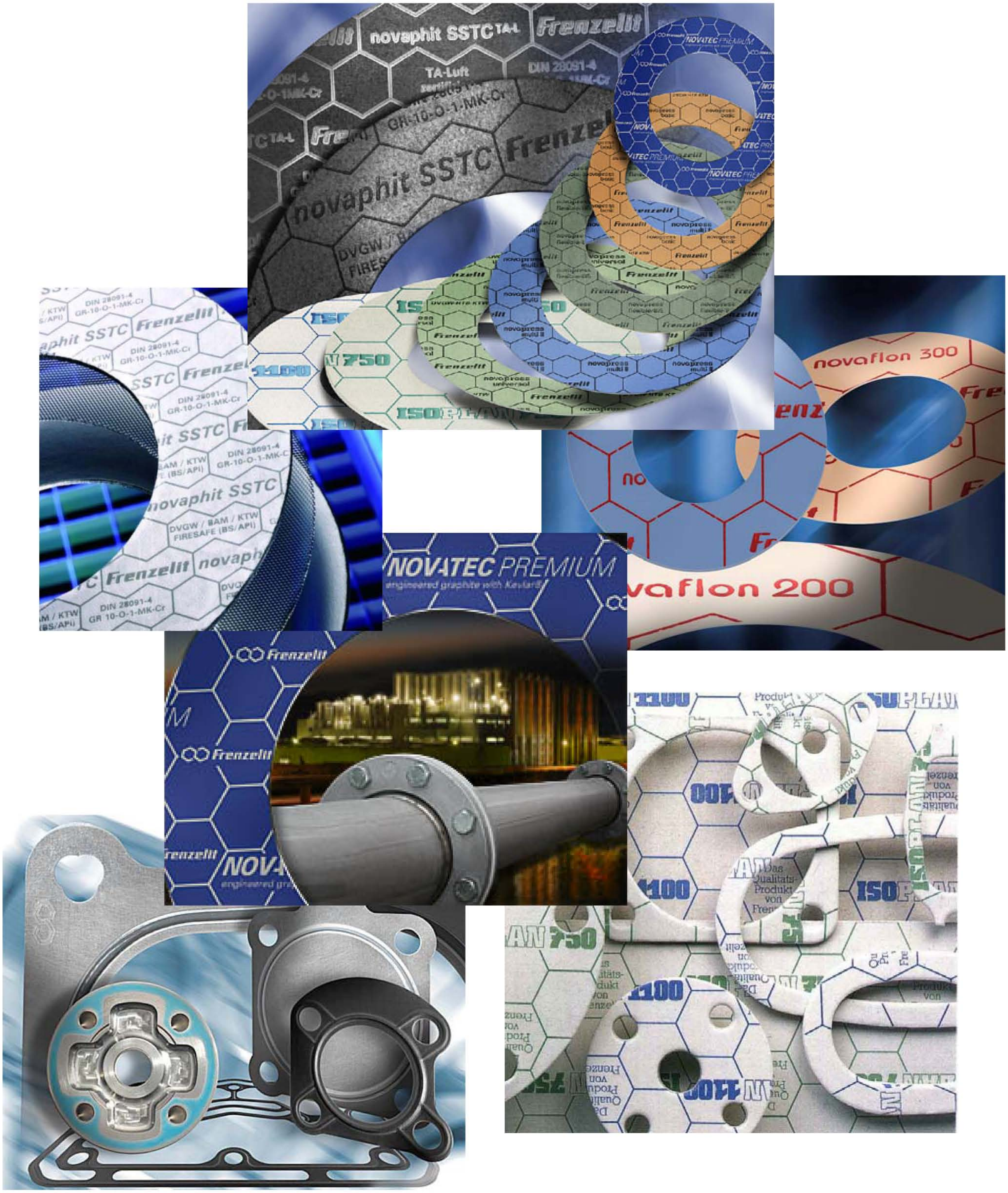

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Innovative Gasket and Insulation Materials

Frenzelit

Sealing Systems

Index

Kevlar® is a trademark registered by Dupont.

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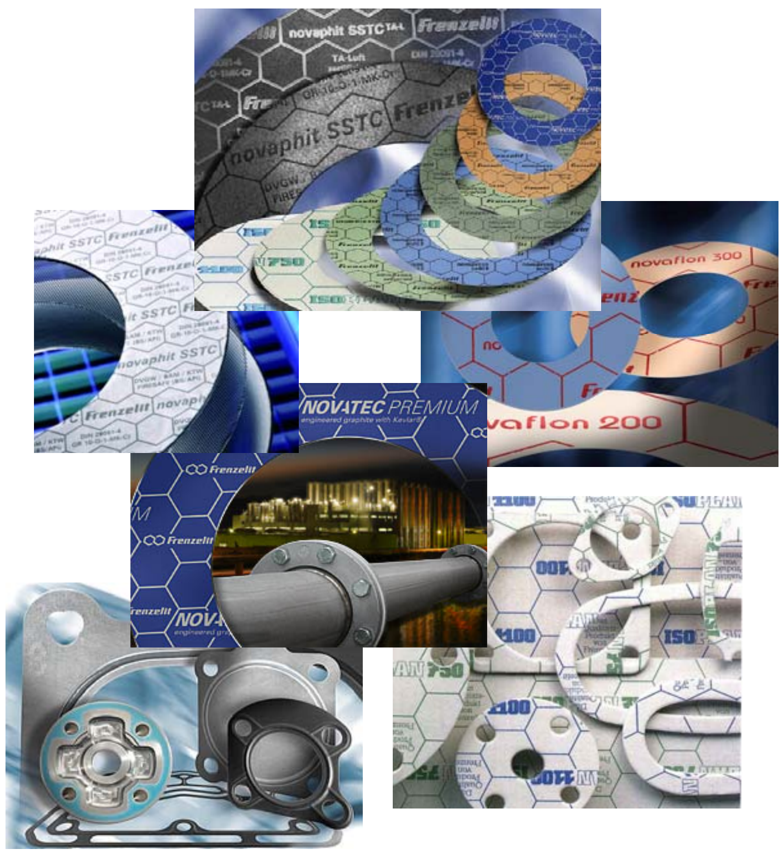
Section 1

About Us



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Frenzelit
Sealing Systems

Frenzelit-Werke GmbH & Co. KG

Frenzelit GmbH, based in Bad Berneck, Germany, has been producing gasket and sealing materials for industrial applications since 1881. As a privately owned company, Frenzelit has earned its reputation in the world market as being an innovator in new technology, as well as a supplier of high quality products for the industrial and automotive markets. Due to its broad production machinery base, Frenzelit has the ability to produce and supply a major portion of the products typical to the gasket fabricator.

Frenzelit Sealing Systems

On January 1st of 2005, Frenzelit Sealing Systems, Inc. was formed to further facilitate Frenzelit's global expansion throughout North America. Frenzelit Sealing Systems, Inc. offers non-asbestos products, including graphite sheet, compressed sheet, millboard, heat shield and beater addition roll goods. Frenzelit Sealing Systems, Inc. is unique in the materials sector of the gasket fabricators network.

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References

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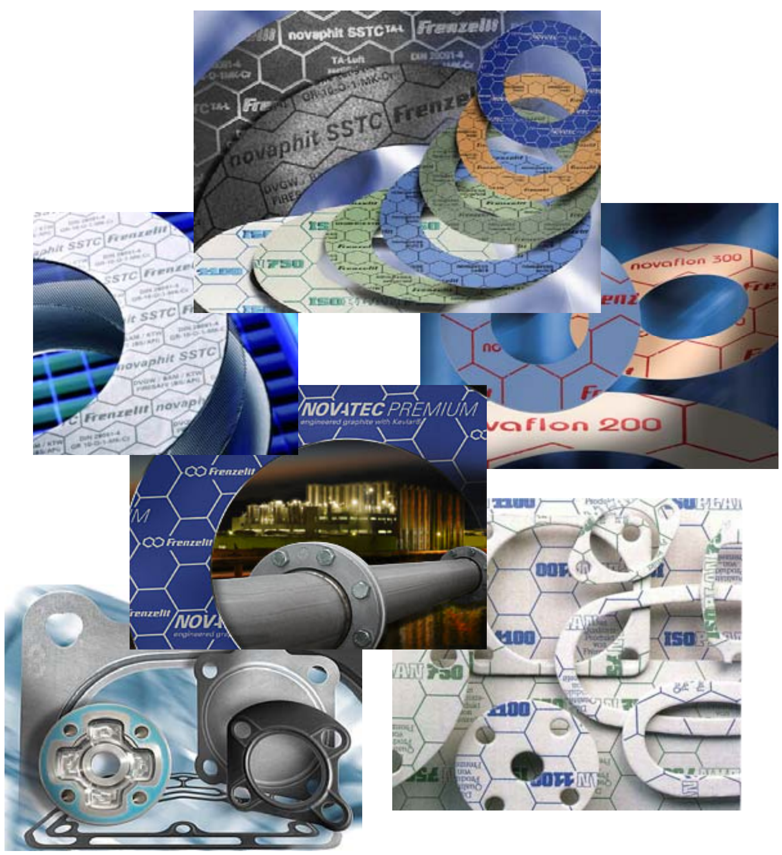
Section 2

Our Product Range



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Novatec – Engineered Graphite with Kevlar®

The Novatec Family has an excellent resistance to temperature and media, by combining the positive gasketing properties of graphite, nitrile rubber and Kevlar®.

- *Novatec* 825F
- *Novatec* 925F
- *Novatec* PREMIUM II
- *Novatec* HPN
- *Novatec* HPS
- *Novatec* FRG/STL

Novaphit

The Novaphit range of materials can be found in applications where the highest safety aspect is combined with absolute application limits. The purity of the graphite used is a least 98% graphite.

- Novaphit VS
- Novaphit SUPER HPC
- Novaphit EXTRA
- Novaphit SSTC
- Novaphit SSTC TRD 40
- Novaphit SSTC TA-L

Novaflon

Frenzelit's latest product range is Novaflon based on modified and multi-directional expanded PTFE materials. Its improved performance compared to conventional PTFE and its superior chemical resistance allow the Novaflon products to be an all purpose material choice in the chemical, petrochemical, pharmaceutical, paper and food industries.

- Novaflon 100
- Novaflon 200
- Novaflon 300
- Novaflon 500

Novapress

The Novapress products are high density, high pressure gasket materials made by Frenzelit using a multiple roll calendaring process. The balance raw material has a combination of high quality aramid fibers, NBR and special fillers.

- Novapress BASIC
- Novapress UNIVERSAL
- Novapress FLEXIBLE 815
- Novapress MULTI II
- Novapress ACTIV
- Novapress MULTI-EG

Novaform

The Novaform family is composed of various types of sealing materials designed for special use applications. Each of the products has their own unique characteristics. Examples are, high swell, high fluid resistance, metal inserted high temperature products and rubber coated steel products.

- Novaform 210
- Novaform 231
- Novaform 220S
- Novaform STF
- Novaform SK
- Novaform GB

Isoplan

Thermal insulation products for applications at high temperatures.

- Isoplan 750
- Isoplan 1100

Novaplan

Novaplan products address the sealing needs of automotive, air cooled engines and moderate duty industrial applications. Frenzelit uses the beater addition method to produce these homogenous products in roll form in a variety of gauges.

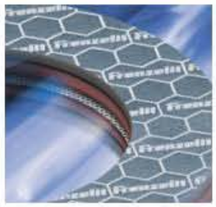
Novaplan Gasket Materials

- Novaplan 70
- N-7729
- N-5408

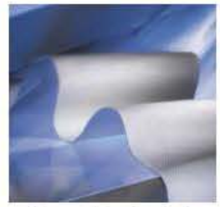
Novaplan Insulation Materials

- Novaplan HT 02980
- Novaplan HT 02816
- Novaplan HT 03000

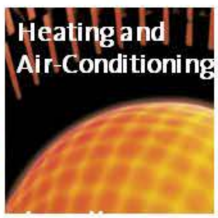
Markets

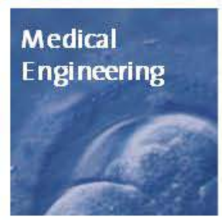

Gaskets


Insulation


New Materials

Customer–oriented high-tech Solutions





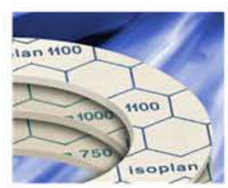
Products


novaphit®
Base material
graphite


novatec®
Base material
reinforced
graphite


novapress®
novaform®
Base material
aramide


novaflon®
Base material
modified PTFE


isoplan®
Base material
mineral fibres


novaform® GB
Base material
metal


novaplan®
Base material
aramide- and
mineral fibres

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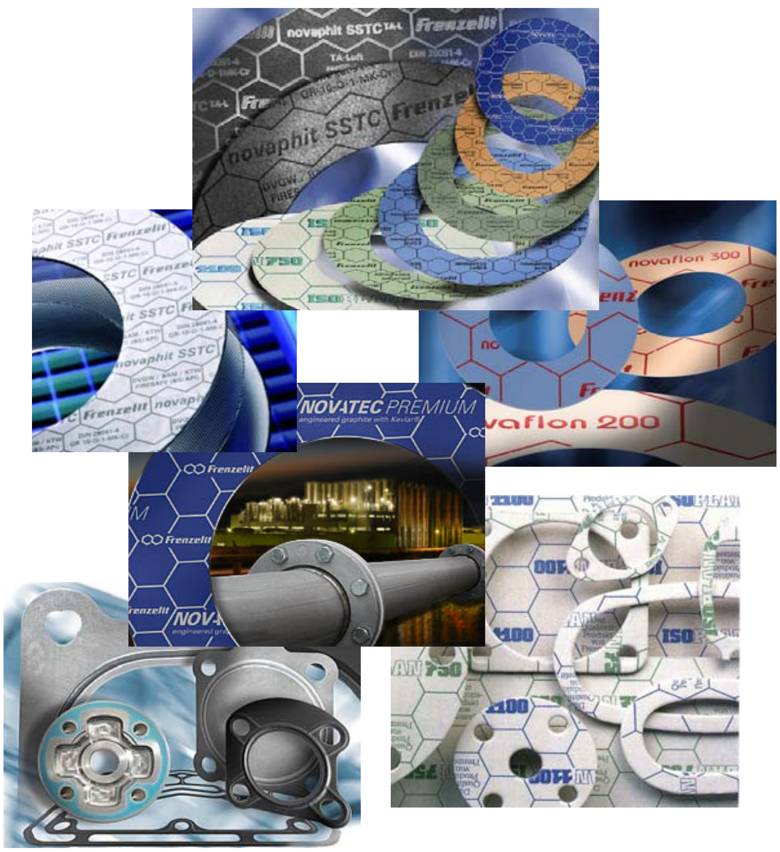
Sealing Systems

Section 3

Novatec®

Engineered Graphite with Kevlar®



Kevlar® is a trademark registered by Dupont.

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Frenzelit
Sealing Systems

NOVATEC- engineered graphite with Kevlar®

Frenzelit created the ***NOVATEC*** family of materials by blending the proven benefits of Kevlar® fiber with the elevated temperature resistant capabilities of graphite. Patented production methods are used in combination with extreme pressure to create a scientifically controlled homogenous mix of ingenuity, technology and chemistry. Kevlar® fiber is used to reinforce the internal strength of graphite containing ***NOVATEC*** products. To complete the chemistry of the ***NOVATEC*** product family, Frenzelit has introduced proprietary additives that address the critical concerns associated with extrusion, stress relaxation and to further enhance sealability.

NOVATEC 825F

Frenzelit *NOVATEC* **825F** is a highly compressible, highly conformable, moderate density member of the *NOVATEC* family. When compared to conventional fiber gasketing material, *NOVATEC* **825F** has a significantly higher resistance to temperature and media. The relatively high compression allows for conformability, adaptability and flexibility that are outstanding. With a 75% pure graphite content, it becomes the perfect solution for elevated temperature applications and poor or irregular flange surfaces.

Color coded "**Cranberry**" anti-stick surface is standard.

NOVATEC 925F

The **925F** is best described as the "standard" member of the *NOVATEC* family. A medium density product that provides the desired balance of elevated temperature resistance, chemical compatibility and is widely recommended for a broad range of applications. The lower compression and higher recovery percentage allows for accurate tolerance control and for use in narrow flange width applications. These attributes allow the **925F** to easily outperform all conventional non-asbestos compressed sheet products. The *NOVATEC* **925F** is setting the new standard for gasket materials worldwide.

Color coded "**Grape**" and anti-stick surface is standard.

NOVATEC PREMIUM II

This ultimate composition of graphite and Kevlar® offers complete new product qualities and easily outperforms any of the competition's non-metallic gasket material. Primarily due to the high percentage of graphite used, its resistance to media and temperature is remarkable. *NOVATEC* **PREMIUM II** offers excellent long term stability and its resistance to stress relaxation exceeds the values of all conventional materials. The high density and high tensile strength enhance the *NOVATEC* **PREMIUM II** by offering excellent torque retention and superior sealability.

Color coded "**Royal Blue**" anti-stick surface is standard.

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NOVATEC – engineered graphite with **Kevlar®.**

*When compared to the traditional clay filled gasket materials, **NOVATEC** products are clean cutting, durable, fabricator friendly gasket products that actually extend die life due to their non-abrasive cutting characteristics. **NOVATEC** products further allow for reduced press tonnage, for multi-layer die-cutting and offer reduced production costs as they virtually eliminate the need for secondary operations to clean up parts prior to use.*

		NOVATEC **825F**	***NOVATEC*** **925F**	***NOVATEC*** **PREMIUM II**
COLOR		Cranberry	Grape	Royal Blue
	UNIT			
TEMPERATURE	°F	-40…825	-50…925	-60…1000
PRESSURE	psi	1500	2000	2500
DENSITY	lb./ft^3	62	98	109
pH		2-14	2-14	2-14
LEACHABLE CHLORIDES	ppm	<100	<100	<100
PxT VALUES Thickness 1/16”		350,000	600,000	650,000
ASTM F104 TESTS				
F38 B CREEP RELAXATION				
22^h @ 212°F	%	15	12	7
22^h @ 392° F	%	35	30	20
F37 A Sealability				
Fuel A @ 14.5 psi/Gasket Load 1000psi	ml/hr	0.25	0.1	0.01
F37 B Sealability				
Nitrogen @ 30 psi/Gasket Load 3000psi	ml/min	0.1	0.075	0.045
F 146 Thickness Increase				
Oil # 3 5^h @ 300°F	%	<3	<2	<1
Fuel B 22^h @ 392°F	%	<4	<1	<0.5
F36 A Compressibility				
5000 psi Gasket Load	%	45	15	10
F36 A Recovery	%	10	40	50
F152 Tensile Strength	psi	600	1500	2300
DIN 3754 48h @ 75°F Thickness Increase				
Sulfuric Acid 65% Concentration	%	7	6	2
Sodium Hydroxide 25% Concentration	%	3	1	0.5
Toluene 100% Concentration	%	5	3	1
Maximum Gasket Load				
DIN 28 090-2	psi	20,000	22,500	25,000
Specific Leak Rate				
DIN 28 090-2	mg/s*m	1	0.1	0.01
THICKNESS RANGE	inch	1/64…1/4	1/64…1/8	1/64…1/8
SHEET SIZE	inch	60 x 60 60 x 80 80 x 80	60 x 60 60 x 80	60 x 80

novatec® PREMIUM II
The standard gasket for industrial applications.

GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

INSULATION

NEW MATERIALS

Frenzelit

creating
hightech
solutions

Your wish ...

- Higher safety standards
- Higher temperature resistance
- Higher media resistance
- All-purpose products
- Maximum design reliability
- Optimised adaptability
- Better handling properties

... is our command.

- novatec® PREMIUM II is the standard gasket.
- novatec® PREMIUM II covers 80% of all industrial applications.

Typical applications for novatec® PREMIUM II

- All-purpose use in many areas of industry in general and the chemical industry in particular
- Oils and greases, acids and alkalis, solvents, refrigerants, water, steam
- Compliance with the German pollution regulations in these areas:
  - Petrochemicals
  - Gerneral industry
  - Chemical industry
  - Plant engineering

Optimum benefits thanks to a unique material composition

Media-resistant at high temperatures

novatec® PREMIUM II is the second generation of the proven novatec® PREMIUM range. The graphite – Kevlar® material combination guarantees an efficiency level that exceeds all standard fibre gaskets on the market. The large proportion of graphite combined with the small proportion of bonding agent provides resistance to about 80% of all the media used commonly for general industrial applications as well as in the chemical industry particularly.

Excellent pressure resistance

novatec® PREMIUM II has long-term resistance properties and guarantees constant reliability throughout the maintenance cycle. Pressure resistance is higher than with all conventional high-pressure gaskets. The long useful life extended maintenance intervals and can therefore be relied on to cut costs.

Optimised adaptability

Due to its material structure, novatec® PREMIUM II compensates for flange unevenness and roughness that are found in old systems in particular.

Unique release properties

The special process used to apply the release coating incorporated in the blue colour makes the coating considerably more effective than conventional fibre gaskets, while the solvent-free formulation means it contributes actively to protection of the environment.

Tool-friendly processing

novatec® PREMIUM II is simple and excellent to process because of the large proportion of graphite it contains.

Better handling properties

Since they are very flexible, even sheets 3.0 mm thick can be shipped inexpensively in tubes. novatec® PREMIUM II proves to be extremely rugged when handled improperly during transport and installation.

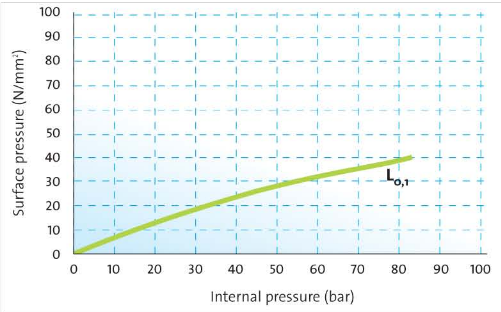
Single-piece gaskets of all sizes and thicknesses

novatec® PREMIUM II is available in large formats and all normal thicknesses. Special dimensions can be produced in a single piece without any complicated processing operations.

Kevlar® is a trademark registered by DuPont.

Technical information about novatec® PREMIUM II

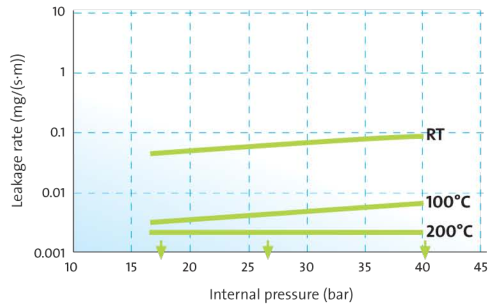
Specific leakage rate



novatec® PREMIUM II remains well below the leakage limits specified by DIN 3535.

Leakage category: L = 0.1 mg/(s·m) · test gas: nitrogen · thickness: 2.0 mm

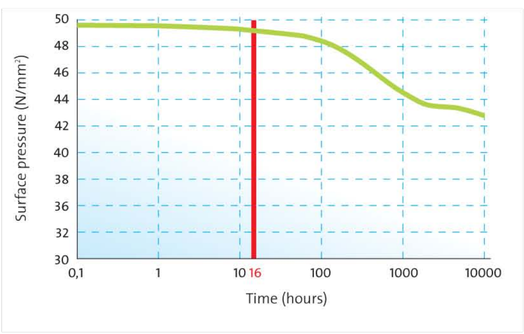
Leakage rate under the influence of temperature



novatec® PREMIUM II is designed for minimum leakage. Microporosity under the influence of temperature and surface pressure is reduced and the gasket material is transformed into a closed, homogeneous structure. Leakage at 200 °C is lower than the detection limit in mass flow rate measurement of 0.001 mg/(s•m).

Surface pressure: σ = 30 N/mm² · specimen dimensions: 90 x 50 x 2 mm
test medium: N_2

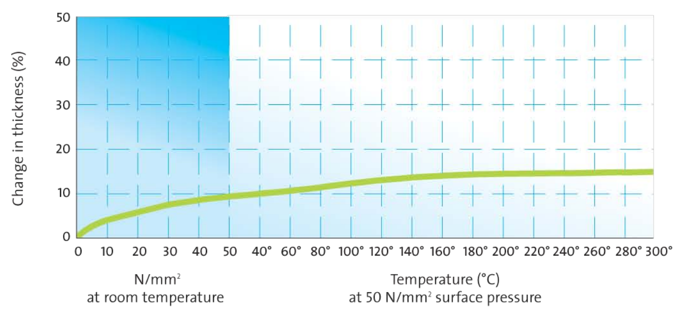
Long-term creep relaxation



novatec® PREMIUM II has very high long-term pressure resistance properties and thus provides constant reliability throughout the maintenance cycle.

Gasket dimensions: 75 x 55 x 1.5 mm · surface pressure: 48 - 50 N/mm²
test temperature: 300 °C · stiffness C: 840 kN/mm

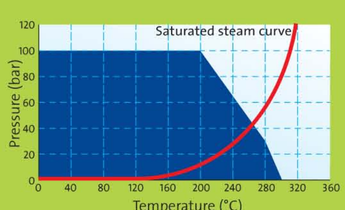
Deformation under temperature 2.0 mm



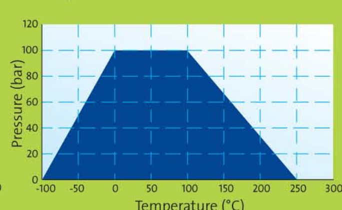
The thickness of novatec® PREMIUM II decreases to a particularly small extent under the influence of temperature. At 300 °C, thickness is only 5 % lower than at room temperature.

Recommendations for use in the most important media groups according to the pressure

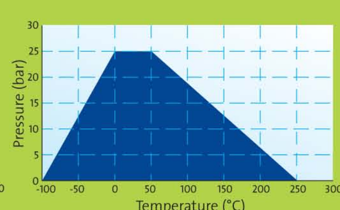
Water/steam



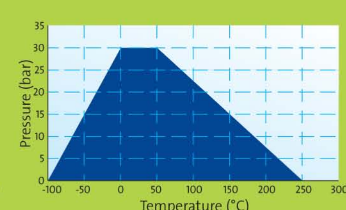
Aqueous solutions



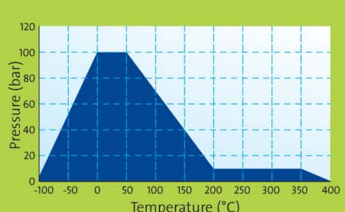
Acids



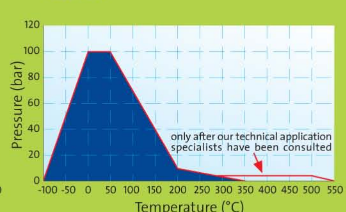
Alkalis



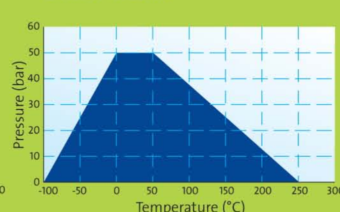
Oils



Gases



Other media



The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges.
Higher stresses are possible when thinner gaskets are used!

Warranty exclusion

In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance.
There is as a result no basis for warranty claims.

Material data

Material profile

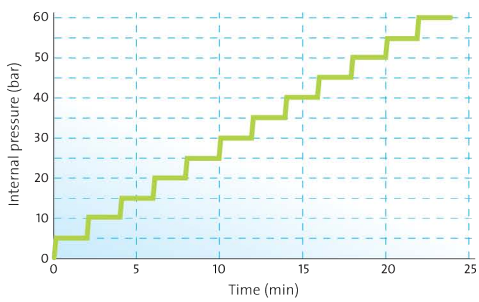
- Very compact gasket material, pressure-resistant, temperature-resistant and with good forming properties
- The main components are graphite and aramide fibres, bonded with NBR.
- State-of-the-art composite material that combines the advantages of graphite and aramide.

Blow-out test passed easily

Proof of the blow-out resistance of the gasket system is required in addition to leakage testing. According to the latest version of VDI 2200, the gasket has to be able to withstand 1.5 times nominal pressure at very reduced surface pressure levels. The gasket is fitted in a DIN flange DN40/PN40 at 30N/mm^2.

After storage of the flange system at 200 °C for 24 hours, nitrogen is applied gradually at a pressure of up to a maximum of 60 bar. Pressure would drop very rapidly if the gasket failed.

The gasket is then tested at two considerably reduced surface pressure levels. If the test is passed at 10 N/mm^2, a further reduction is made to 7.5 N/mm^2. Even in the most critical case of an extremely low surface pressure level of 7.5 N/mm^2 and maximum pressure of 60 bar, novatec® PREMIUM II demonstrates its impressive blow-out resistance in line with the German pollution regulations – without internal edging. We can provide a certificate confirming this on request.



General data

Binders	NBR
Approvals	DVGW, KTW, WRC, W 270, BAM (max. 120°C/130 bar)
Colour	royal blue
Anti-stick coating	both sides A 310 standard
Tolerances in thickness	according to DIN 28 091-1

Physical properties Gasket thickness 2.0 mm	**Standard**	**Unity**	**Value***
Identification	DIN 28 091-2		FA - A 1 - O
Density	DIN 28 090-2	[g/cm^3]	1.70
Tensile strength	DIN 52 910		
longitudinal		[N/mm^2]	18
transverse		[N/mm^2]	14
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C		[N/mm^2]	37
300 °C		[N/mm^2]	30
Compressibility	ASTM F 36 J	[%]	7
Recovery	ASTM F 36 J	[%]	60
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	6
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	3
Hot creep $\varepsilon_{WSW/200}$	DIN 28 090-2	[%]	6
Hot recovery $\varepsilon_{WRW/200}$	DIN 28 090-2	[%]	2
Recovery R	DIN 28 090-2	[mm]	0.04
Specific leakage rate	DIN 3535-6	[mg/(s·m)]	≤ 0.1
Specific leakage rate $\lambda_{2,0}$	DIN 28 090-2	[mg/(s·m)]	≤ 0.1
Fluid resistance	ASTM F 146		
ASTM IRM903	5h/150 °C		
Weight change		[%]	≤ 10
Thickness increase		[%]	≤ 5
ASTM Fuel B	5h/23 °C		
Weight change		[%]	≤ 10
Thickness increase		[%]	≤ 5
Chloride content	Siemens AV-9-014	[ppm]	≤ 50

* Mode (typical value)

Product data

- Dimensions in mm: 1500 x 1500
  Thicknesses in mm: 0.5/0.8
- Dimensions in mm: 2000 x 1500
  Thicknesses in mm: 1.0/1.5/2.0/3.0
- Further dimensions and thicknesses are available on request

Do you have any questions about your application?

The gasket information service will help you:

info@frenzelitsealing.com

novatec® PREMIUM II
Recommendations for use – media groups

1 Water/steam
2 Aqueous solutions
3 Acids, acid derivatives
4 Lyes, alkalis, amines
5 Oils, Fuels, greases
6 Solvents, ketones, aldehydes
7 Gases, organic and inorganic
8 other media

abietic acid	2
acetal resins	8
acetaldehyde	2
acetamide	4
acetanilide	4
acetic acid	3
acetic acid esters	6
acetic anhydride	3
acetins	6
acetoacetates	6
acetone	6
acetonitrile	6
acetophenone	6
acetyl chloride	6
acetylacetone	6
acetylene	7
acrolein	6
acrylates	2
acrylic acid	3
acrylic esters	6
acrylonitrile	6
adipic acid	3
adiponitrile	5
air	7
alcohol	6
aldehydes	6
alkylamines	6
alkylphenols	6
allyl alcohol	6
allyl bromide	6
allyl chloride	6
allyl isothiocyanate	6
allylamine	6
alum	8
aluminium chloride	2
aluminium sulfate	2
amines	4
amino acids	3
aminobenzenesulfonic acids	3
aminobenzoic acids	3
aminophenols	6
ammonia = R 717	4
ammonium acetate	2
ammonium carbonate	2
ammonium chloride	4
ammonium fluorides	2
ammonium nitrate	2
ammonium phosphates	2
ammonium sulfate	2
ammonium sulfide	2
aniline	6
anisidines	6
antifreezes	6
antimony chlorides	2
antimony oxides	2
argon	7
arsenic acid	3
arsenic sulfides	3
arsenic trichloride	3
asphalts	8
ASTM fuel A	5
ASTM fuel B	5
ASTM fuel C	5
ASTM fuel D	5
ASTM oil NO.1 70 °C	5
ASTM oil NO.1 100 °C	5
ASTM oil NO.2 70 °C	5
ASTM oil NO.2 100 °C	5
ASTM oil NO.3 70 °C	5
ASTM oil NO.3 100 °C	5
AZ 20 (R 32 + R 125)	6
barium chloride	2
barium hydroxide	4
barium nitrate	2
barium oxide	2
barium perchlorate	2
barium sulfate	2
barium sulfide	2
beer	2
benzaldehyde	6
benzamide	4
benzene	6
benzenesulfonic acid	3
benzenesulfonyl chloride	2
benzilic acid	3
benzofuran	5
benzoic acid	6
benzonitrile	6
benzothiazole	6
benzoyl chloride	6
benzyl alcohol	6
benzyl bromide	6
benzylamine	4
benzylchloride	6
benzylphenol	6
biacetyl	6
bisphenol A	6
bitumen (GB)	8
blast furnace gas	7
boiler water	1
borax	2
boric acid	3
boron trichloride	7
brake fluids	5
brine	2
bromoform	6
butadiene	7
butane	7
butanediols	6
butanethiol	6
butanol	6
butanone	6
butenal	6
butene	5
butyl acetates	6
butyl chloride	6
butylamine	4
butylbenzoic acid	3
butyraldehyde	6
butyric acid	3
butyryl chloride	6
cadmium	8
calcium chloride	2
calcium hydroxide	4
calcium nitrate	2
calcium stearate	5
caproic acid	3
caprolactam	6
carbon dioxide	7
carbon monoxide	7
carbonic acid	3
carbonic acid esters	6
castor oil	5
caustic soda < 10 %	4
caustic soda > 10 %	4
caustic soda solution < 10 %	4
caustic soda solution > 10 %	4
cement	8
chloranilic acid	3
chloric acid	3
chloride of lime	4
chlorinated hydrocarbons	6
chlorinated paraffins	5
chloroacetates	6
chloroanilines	6
chlorobenzaldehydes	6
chlorobenzoic acids	3
chlorodinitrobenzene	6
chlorogenic acid	3
chloromethyl ethyl ether	6
chlorophenols	5
chloropropanols	6
chloropyridines	6
chlorotoluenes	6
chocolate	8
choline chloride	2
chrome alum	8
cinnamic acid	3
citric acid	3
cocoa butter	5
coconut oil	5
collodion	8
colza oil	5
compressed air	7
condensate	1
copper salts	2
copper(II) sulfate	2
creosote	5
cresols	6
cumene	6
cyanuric chloride	6
cycloheptane	6
cyclohexane	6
cyclohexanol	6
cyclohexanone	6
cyclohexylamine	4
cyclopentane	6
cyclopentanol	6
cyclopentanone	6
decanal	6
decanol	6
demineralized water	1
dextrin	8
diacetone alcohol	6
diacetyl	6
diaminas	4
dibromobutanone	6
dibromochloropropane	6
dibromoethane	6
dibutyl ether	6
dibutylamine	6
dichloroanilines	6
dichlorobutane	6
dichloroethanes	6
dichloroethylenes	6
dichlorophenols	6
dichloropropanes	6
dicyclohexylamine	4
dicyclopentadiene	6
diesel fuels	5
diethanolamine	6
diethyl carbonate	6
diethyl ether	6
diethyl sulfat	6
diethylamine	4
diethylamino-ethanol	6
diethylaniline	4
diethylene glycol	6
diethylenetriamine	4
diglycolic acid	3
diisopropylbenzene	6
dimethoxybenzenes	6
dimethyl sulfate	6
dimethyl sulfide	6
dimethyl sulfoxide	6
dimethyl terephthalate	6
dimethylacetamide	6
dimethylamine	4
dimethylformamide	6
dimethylheptanone	6
dimethylhydrazine	4
dinitroaniline	6
dinitrobenzenes	6
dinitrophenols	6
dinitrotoluene	6
dioxan(e)	6
dipentene	6
diphenyl	6
diphenyl ether	6
diphenylamine	4
diphenylmethane	6
diphyl	5
dipropyl ether	6
dipropylamines	4
DNOC	6
dodecanol	6
dodecylbenzenesulfonates	2
engine oils	5
epichlorhydrin	6
et(h)acrynic acid	3
ethane	7
ethanol	6
ethanolamines	4
ether carboxylic acids	3
ethers	6
ethyl acetate	6
ethyl acetoacetate	6
ethyl chloride	6
ethyl crotonate	6
ethyl formate	6
ethylaniline	6
ethylbenzene	6
ethylbromide	6
ethylbutanol	6
ethylcellulose	2
ethylene	6
ethylene chlorohydrin	6
ethylene glycol	6
ethylene oxide	6
ethylenediamine	4
ethyleneimine	6
ethylhexanoic acid	3
ethylhexanol	6
evaporated milk	2
fats and oils	5
fatty acids > C 12	3
fatty alcohol sulfates	6
fatty alcohols > C 12	6
feed water	1
fermentation gas	7
fertilizers	8
ferulic acid	5
fiber finishing (for fibers)	8
fish oil	5
fluorosilicic acid	3
formaldehyde	6
formamide	3
formic acid	3
fruit juices	2
fuel oils	5
fuels	5
fumaric acid	3
furan	6
furfurol	6
furfuryl alcohol	6
furfurylamine	4
FX 220 (R 32 + R23 + R 134 A)	6
FX 40 (R 143 A + R 125 + R 32)	6
FX 57 (R 22 + R 142 B + R 124)	6
gallic acid	3
gasoline	5
gear box oil	5
gelatin	2
generator gas	7
glucose	2
glue	8
glutaraldehyde	6
glyceric acid	3
glycerol	6
glycerol acetates	6
glycidic acid	3
glycine	3
glycolic acid	3
glycols	6
gypsum	8
heat transfer oils	5
heating oil	5
helium	7
heptane	5
heptanones	6
heptene	6
hexachlorobenzene	6
hexachlorobutadiene	6
hexamethylene diisocyanate	6
hexane	7
hexanediamine	4
hexanol	6
hexene	6
hloroacetaldehyde	6
HX 4 (R 143 A + R 125 + R 32)	5
hydraulic fluids	5
hydrazine	4
hydrazine hydrate	4
hydrochloric acid (37 %)	3
hydrochloric acid < 10 %	3
hydrochloric acid > 10 %	3
hydrocyanic acid	3
hydrogen	7
hydrogen bromide	7
hydrogen chloride	3
hydrogen cyanide	3
hydrogen peroxide	6
hydrogen sulfide	7
hydrogen sulfites lyes	4
hydroquinone	6
hydroxylamine sulfate	2
hydroxymethylpropionitrile	6
illuminating gas	7
imethyl carbonate	6
imethyl ether	6
iminodiethanol	6
inert gases	7
iodic acid	3
iodine	2
iron alums	2
iron chlorides	2
iron salts	2
isooctane	5
isophorone	6
isopropanole	6
jet fuels	5
kerosene	5
ketones	6
lactatos	6
lactic acid	3
lactic acid esters	6
lanolin	5
latex	2
laughing gas	7
lead acetates	3
lein	3
light oil	5
light petrol	5
lighting gas	7
lignin sulfonates	2
limonene	6
linseed oil	5
liquefied (petroleum) gas (LPG)	7
lithium bromide	2
lithium chloride	2
lithium hydroxide	4
magnesium hydroxide	4
magnesium salts	2
magnesium stearate	8
maleates	6
maleic acid	3
maleic anhydride	6
malic acid	3
malonic acid	3
malt	8
marlotherm	5
mayonnaise	5
melamine	4
melamine resins	8
mercury	8
mercury chlorides	2
mercury nitrates	2
mercury oxides	2
mercury sulfates	2
mercury(II) acetate	2
mesityl oxide	6
mesitylene	3
methacrylates	6
methacrylic acid	6
methane	7
methanol	6
methyl acetate	6
methyl acrylate	6
methyl bromide	7
methyl chloride	5
methyl formate	6
methyl isocyanate	6

methylal	6
methylamine	4
methylcyclohexanols	6
methylpentanone peroxide	6
milk	2
mineral water	1
molasses	2
morpholine	4
motor oils	5
mucic acid	3
naphtha	5
naphthalene	6
naphthenic acids	3
naphthols	6
naphtholsulfonic acids	3
naphthylamines	4
natural gas	7
nickel salts	2
nitric acid < 10 %	3
nitrilotriethanol	4
nitro lacquers	6
nitroanilines	6
nitrobenzene	6
nitrogen	7
nitrogen oxides, nitrous fumes ...	7
nitromethane	6
nitronaphthalenes	6
nitrophenols	6
nitropropanes	6
nitrosamines	7
nitrotoluenes	6
nitrous fumes	7
nonylphenol	6
norbornadiene	6
norbornene	6
octane	7
octanethiol	6
octenol	6
oil of turpentine	5
oleic acid	3
oleoresin	6
olive oil	5
oxalic acid	3
oxygen	7
palm kernel oil	5
palmitic acid	3
pantothenic acid	3
paraffin	5
pentaerythritol	6
pentanal	6
pentanes	7
pentanols	6
pentylacetates	6
perchloric acid < 20 %	3
petrol	5
petroleum	5
petroleum ether	6
phenetidines	4
phenol	6
phenylendiamines	4
phenylhydrazine	4
phosgene	7
phosphonic acid	3
phosphoric acid < 30 %	3
phosphoric esters	6
phosphorus	8
phosphorus bromides	4
phosphorus chlorides	3
photographic emulsions	2
phthalates	6
phthalic acid	3
phthalic acid esters	6
phthalic anhydride	6
phthaloyl chloride	6
picolines	6
picric acid	3
pine gum	6
pinenes	5
piperazine	4
piperidine	4
plasticizers	6
poly(ethylene glycol)s	6
polyacrylic acids	3
polyacrylonitriles	6
polyamides	8
polybutadienes	6
polyester resins	8
polyethers	6
polyethylenes	8
polyimides	8
polymer dispersions	8
potash lye < 10 %	4
potash lye > 10 %	4
potassium acetate	2
potassium bromate	2
potassium bromide	2
potassium carbonate	2
potassium chlorate	2
potassium chloride	2
potassium chromate	2
potassium cyanide	3
potassium dichromate	2
potassium hydroxide	4
potassium iodide	2
potassium nitrate	2
potassium perchlorate	2
potassium permanganate	2
potassium peroxodisulfate	2
potassium phosphates	2
potassium sulfate	2
propane	7
propanediols	6
propanols	6
propionaldehyde	6
propionic acid	3
propyl acetates	6
propylene	6
propylene oxide	6
propylenimine	4
pyridine	6
pyrrolidine	4
quinoline	4
R 10	6
R 11 = Trichlorfluormethan	6
R 12 = Dichlordifluormethan	6
R 12 B 1 = Bromchlordifluormethan	6
R 13 = Chlortrifluormethan	6
R 13 B 1 = Bromtrifluormethan	6
R 14	6
R 20	6
R 21 = Dichlorfluormethan	6
R 22 = Chlordifluormethan	6
R 23 = Trifluormethan	6
R 30 = Dichlormethan	6
R 31	6
R 32	6
R 40 = Chlormethan	6
R 41	6
R 50	6
R 110	6
R 111	6
R 112	6
R 112 A	6
R 113 = Trichlortrifluorethan	6
R 113 A	6
R 114 = Dichlortetrafluorethan	6
R 114 A	6
R 114 B 2 = Tetrafluordibromethan	6
R 115 = Chlorpentafluorethan	6
R 116	6
R 120	6
R 123	6
R 124	6
R 124 A	6
R 125	6
R 133 A	6
R 134 A	6
R 140 A	6
R 142 B	6
R 143 A	6
R 150 A	6
R 152 A	6
R 160	6
R 218	6
R 401 A (22 + 152 A + 124)	6
R 401 B (22 + 152 A + 124)	6
R 402 A (22 + 125 + 290)	6
R 402 B (22 + 125 + 290)	6
R 403 A (22 + 218 + 290)	6
R 403 B (22 + 218 + 290)	6
R 404 A (143 A + 125 + 134 A)	6
R 407 A (32 + 125 + 134 A)	6
R 407 B (32 + 125 + 134 A)	6
R 407 C (32 + 125 + 134 A)	6
R 408 A (22 + 143 A + 125)	6
R 409 A (22 + 142 B + 124)	6
R 500 (12 + 152 A)	6
R 501 (22 + 12)	6
R 502 (22 + 115)	6
R 503 (13 + 23)	6
R 507 (143 A + 125)	6
R 600 A = isobutan	6
R 717 = ammonia	4
R C 316	6
R C 317	6
R C 318 = octafluorcyclobutan	6
R X 3 (125 + ... + ...)	6
rapeseed oil	5
refrigerant (general)	6
resin acids	3
resin oils	5
rosin	6
saccharic acids	3
saccharose	2
salicylic acid	3
salicylic acid esters	6
salt	2
saltpetre (GB)	2
santotherm 66	5
sea water	2
sebacates	6
sebacic acid	3
sebacic acid esters	6
selenic acid	3
silanes	6
silicon chlorides	2
silicone grease	5
silicones	8
silver chloride	2
silver oxides	2
silver salts	2
smoke gas	7
soap solution	2
soaps	2
soda ash	2
soda lye < 10 %	4
soda lye > 10 %	4
sodium acetate	2
sodium benzoate	2
sodium bromate	2
sodium bromide	2
sodium carbonate	2
sodium chlorate < 10 %	2
sodium chlorate > 10 %	2
sodium chloride	2
sodium chlorite	2
sodium chromate(VI)	2
sodium dichromate(VI)	2
sodium disulfite	2
sodium dithionite	2
sodium fluorides	2
sodium hydrogencarbonate	2
sodium hydrogensulfate	2
sodium hydrogensulfide	2
sodium hydrogensulfite	2
sodium hydroxide < 10 %	4
sodium hydroxide > 10 %	4
sodium iodide	2
sodium methoxide	2
sodium nitrate	2
sodium oxalate	3
sodium perborate	2
sodium percarbonate	2
sodium peroxodisulfate	2
sodium phosphates	2
sodium silicates	2
sodium sulfate	2
sodium sulfides	2
sodium sulfite	2
sodium thiosulfate	2
softening (for woven)	8
soja oil	5
solvent naphtha	5
sorbic acid	3
spent acid	3
spindle oils	5
spirits	5
spirits of turpentine	5
stannous sulfate	2
starch solution	2
steam	1
stearates	6
stearic acid	3
stearic acid amide	4
suberic acid	3
succinates	6
succinic acid	3
sucrose	2
sugar acids	3
sugar sirup	2
sulfur (USA)	8
sulfur chlorides	3
sulfur dioxide	7
sulfuric acid < 30 %	3
sulfuric acid > 30 %	3
sulfuric acid conc.	3
sulfurous acid	3
sulfuryl chloride	6
sulphur (GB)	8
sulphur hexafluoride	7
syltherm 800	5
syntrel 350	5
tall oil	5
tannins	3
tar	8
tartaric acid	3
tert.-butyl methyl ether	6
tert.-butyl phenol	6
tetrabromomethane	7
tetrachlorobenzenes	6
tetrachloroethane	6
tetrachloroethylene	6
tetraethyllead	5
tetrahydrofuran	6
tetrahydrophthalic anhydride	8
tetrahydrothiophene	6
Tetralin®	6
tetramethylammonium salts	4
tetramethylsilane	6
tetrapropylenebenzene sulfonate	6
thioacetic acid	3
thiodipropionic acid	3
thioglycolic acid	3
thioglycols	6
thiolates	2
thionyl chloride	3
thiophene	6
thiourea	6
thymine	4
tin chlorides	2
tin(II) sulfate	2
titanium chlorides	8
titanium dioxide	8
tolualdehydes	6
toluene	6
toluene diisocyanates	6
toluenesulfonic acid	3
toluic acids	3
toluidines	6
town gas	7
tributyl phosphate	2
trichloroacetic acid	3
trichlorobenzenes	6
trichloroethanes	6
trichloro-methyl-propanol	6
trichlorophenols	6
tricresyl phosphate	6
triethyl phosphate	6
triethyl phosphite	6
triethylamine	4
triethylene glycol	6
trifluoro acetic acid	3
trimethylamine	4
trimethylpentene	5
trioxane	6
trisodium hydrogen pyrophosphate	2
turbine oil	5
turpentine	6
turpentine substitutes	5
ubricating oils	5
ultramarines	8
undecane	6
urea	4
urea nitrate	6
vanadates(V)	3
vanadium oxide chlorides	2
vanadium oxides	2
vapo(u)r	1
vaseline	5
vegetable fat	5
vegetable oils	5
vinyl acetate	6
vinyl chloride	6
vinyl ethers	6
vinyl polymers	8
vinylidene fluoride	6
vinylpyridines	6
vinylsulfonic acid	3
vinyltoluenes	6
washing agents	2
waste air	7
waste gases	7
waste water	2
water	1
water chlorined	2
water-glass	2
waxes	5
wetting agents	2
white spirits	5
xylenes	6
xylidines	4
zinc chloride	2
zinc nitrate	2
zinc phosphates	2
zinc sulfate	2
zirconium chlorides	2

Good for people and the environment.

Frenzelit has obtained certification that the company complies with the requirements of both ISO/TS 16949 and ISO 14001. This means complete transparency in all areas and a high degree of security for our customers.

Quality management

ISO/TS 16949

Environmental management

ISO 14001

German fugitive emission regulations with clear instructions

The air pollution regulations that have applied in Germany since October 2002 define and specify the commitments for operators of industrial equipment that requires approval.

Clear rules are made there for flange connections. In this context, technically tight flange connections have to be used in accordance with VDI 2440 (issue 11/2000).

novatec® PREMIUM II has been tested extensively at a temperature of 250 °C at MPA Stuttgart and has been classified as a high-quality gasket in accordance with the VDI directive 2440 for the German pollution regulations. The leakage rate of $2.3 \cdot 10^{-5}$ mbar · l/(s·m) is therefore substantially lower than the maximum acceptable limit of 10^{-4} mbar · l/(s·m), which is measured with the help of a helium mass spectrometer at a surface pressure level of 30 N/mm² and with pressure of 1 bar.

Staatliche Materialprüfungsanstalt
Universität Stuttgart

MPA STUTTGART

Zertifikat

Die Flachdichtung vom Typ **novatec PREMIUM II**

der **Frenzelit-Werke GmbH & Co. KG**
Frankenhammer
95456 Bad Berneck

wurde von uns nach den Vorgaben der VDI-Richtlinie 2440 (Ausgabe November 2000) geprüft. Nach 48-stündiger Auslagerung bei 250°C an Luft und anschließender Leckagemessung bei Raumtemperatur und 1 bar Druckdifferenz mittels Helium-Massenspektrometrie erfüllt sie mit

$2.3 \cdot 10^{-5}$ mbar l / (s·m)

das Leckageratenkriterium

10^{-4} mbar l / (s·m)

und gilt damit hinsichtlich des oben genannten Leckagekriteriums als

hochwertig im Sinne der TA Luft.

Dieses Zertifikat gilt nur in Verbindung mit unserem
Prüfungsbericht 950 924 002 Dr.Koc/Hh/Gue vom 09. Mai 2003
und den dort niedergelegten Prüf- und Randbedingungen.

Stuttgart, den 09.05.2003

Dipl.-Ing. R. Hahn
Fachgruppenleiter Dichtungstechnik

Frenzelit Sealing Systems
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Frenzelit

creating hightech solutions

novatec® 925F

The standard gasket material for industrial applications.

GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

INSULATION

NEW MATERIALS

Material profile

- A medium density product that provides the desired balance of elevated temperature resistance and chemical compatibility.
- State-of-the-art material which combines the advantages of graphite and aramid.
- novatec® 925F outperforms all conventional non-asbestos compressed sheet products.
- Uncritical handling and easy, tool-friendly processing.

Typical applications

- novatec® 925F covers the vast majority of applications in the general industry.
- Flanges, pumps, valves, fittings, heat exchangers, lids.

Good for people and the environment

Frenzelit has obtained certification that the company complies with the requirements of both ISO/TS 16949 and ISO 14001. This means complete transparency in all areas and a high degree of security for our customers.

Do you have any questions about your application? The gasket information service will help you:

info@frenzelitsealing.com

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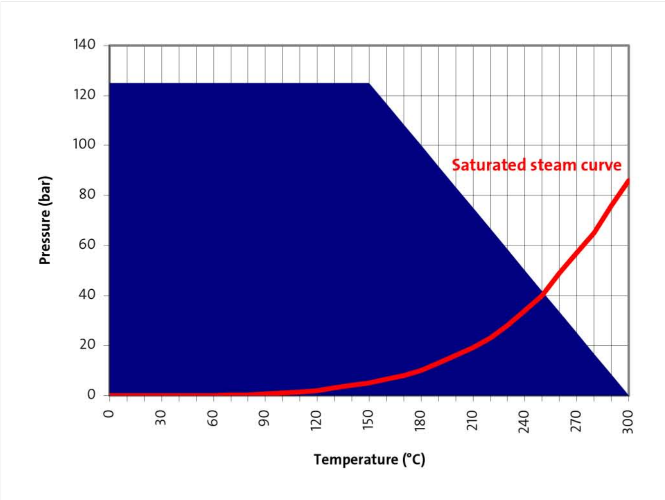
Technical information about novatec® 925F

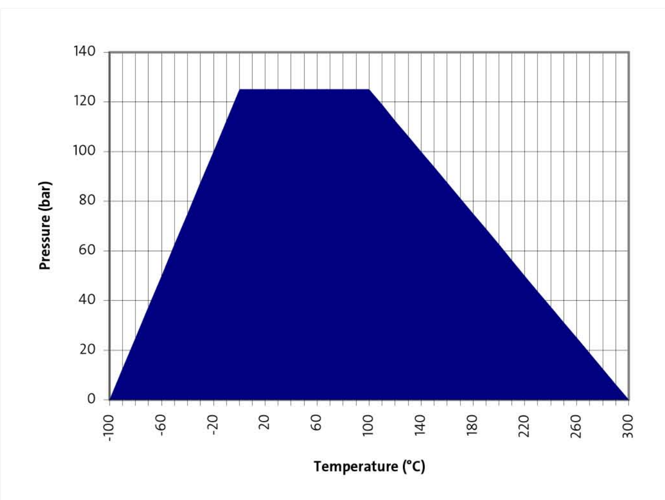
Recommendations for use

according to pressure and temperature

Water/steam



Other media*



The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 1.6 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

*Example for aqueous dilutions, oils, noncritical acids and alkalis. Exact data for specific individual cases are available in the Frenzelit novaDISC programme or contact our application engineering specialists.

Warranty exclusion

In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance.

There is as a result no basis for warranty claims.

Material data

General Data

Binders	NBR
Color	grape
Anti-stick coating	both sides A 310 standard
Sheet sizes and thickness tolerance	acc. DIN 28 091-1

Physical properties Gasket thickness 1.6 mm	**Standard**	**Unity**	**Value ***
Identification	DIN 28 091-2		FA - A1 - O
Density	DIN 28 090-2	[g/cm^3]	1.63
Tensile strength	DIN 52 910		
longitudinal		[N/mm^2]	11
transverse		[N/mm^2]	8
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C		[N/mm^2]	36
300 °C		[N/mm^2]	33
Compressibility	ASTM F 36 J	[%]	12
Recovery	ASTM F 36 J	[%]	43
Fluid resistance	ASTM F 146		
ASTM IRM 903	5 h/150 °C		
Weight change		[%]	14
Thickness increase		[%]	4.5
ASTM Fuel B	5 h/23 °C		
Weight change		[%]	12
Thickness increase		[%]	4.5
		* = Mode (typical value)	

Product data

- Dimensions in mm: 2000 x 1500
- Thicknesses in mm: 1.0 – 3.2
- Further dimensions and thicknesses are available on request.

GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

INSULATION

NEW MATERIALS

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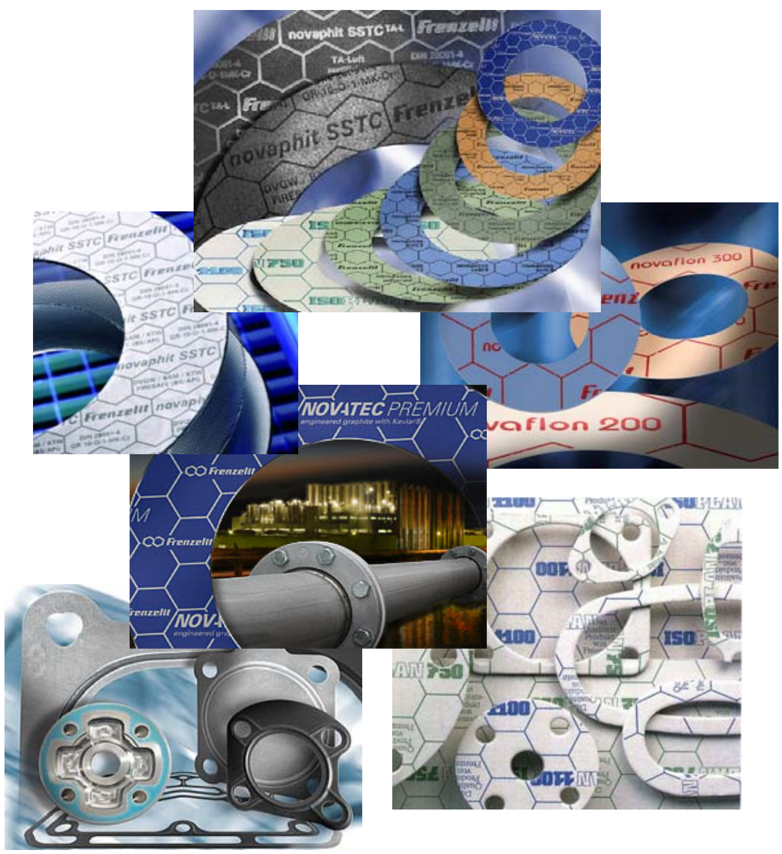
Frenzelit
Sealing Systems

Section 4

Novaphit®

Stainless Steel Reinforced Expanded Graphite



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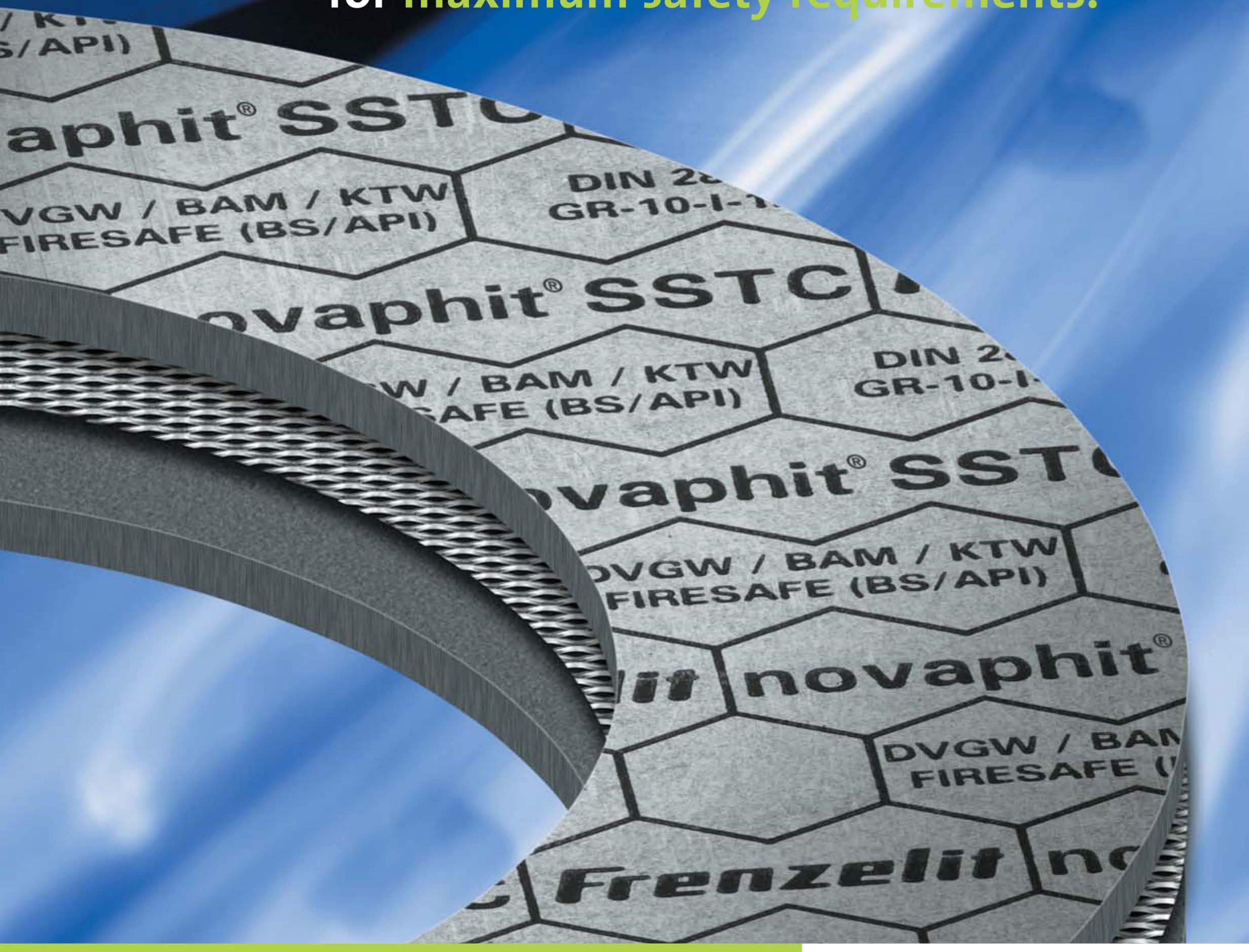
novaphit® – high-pressure gasket material made from expanded graphite for maximum safety requirements.



- GASKETS
- TECHNICAL TEXTILES
- EXPANSION JOINTS
- INSULATION
- NEW MATERIALS

Frenzelit

creating
hightech
solutions

Optimum efficiency thanks to the combination of pure graphite and three-dimensional expanded metal reinforcement.

Unique material profile for maximum safety requirements

- Thoroughly proven material structure consisting of high-quality expanded graphite (purity level at least 99 %) and expanded metal inserts made from acid-proof stainless steel
- Material compound without any bonding and filling agents

High heat and mechanical resistance

- From -240 °C to 550 °C
- Very high operating pressure levels of up to 250 bar (depending on the product)
- Suitable for extreme changing loads and cycles

Standardisation throughout the plant

- Thanks to their material concept, novaphit® products can reduce the variety of different gaskets used in the process industry.

Unique media resistance

- Resistant to practically all organic and inorganic acids, alkalis, oils and solvents
- DVGW, KTW and BAM approvals (depending on the product)
- Firesafe tested in accordance with BS and API (depending on the product)

Expanded metal made from extremely acid-resistant stainless steel

The material is resistant to corrosion and acids (material no. 1.4404/AISI 316L).

Thickness of the expanded metal insert used

Expansion of the stainless steel foil used (0.15 mm) produces a three-dimensional structure with a considerably thicker projected height (about 0.5 mm), as a result of which genuine "chambering" of the gasket core is achieved. Irrespective of the gasket thickness chosen and the surface pressure applied, there is never any contact between the expanded metal insert and the gasket surface.
Minimisation of the danger of injury during handling and processing – no "sharp" cut edges.

Geometry of the stainless steel insert

- No undercutting in the insert material.
- Better use of the surface pressure available to compress the graphite, because no crowns have to be bent. Installation of the gasket is completed more quickly.
- Easy cutting, handling benefits in manual and/or in-house finishing.

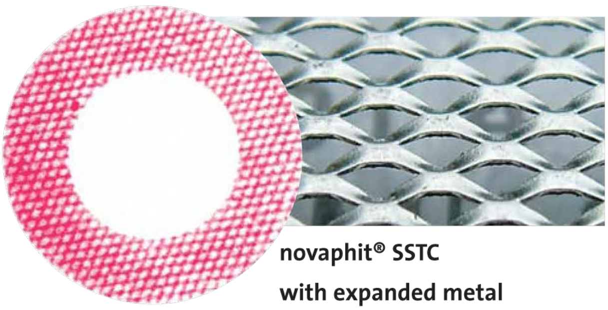
Excellent processing properties

- thanks to optimum choice of parameters and the low mesh size of the expanded metal insert
- novaphit® can be processed very effectively not only with standard die-cutting equipment but also in manual finishing operations and with plotter cutters

Typical application areas for novaphit®

- **Universal use in all areas of the chemical industry**
- **Covers the complete range of classic flat gaskets**
- **Suitable in general for all applications in extreme conditions, including varying loads**
- **Excellent oval closure lid gasket in the special novaphit® SSTC$^{TRD\ 401}$ version approved by the TÜV technical control authorities**

Optimisation of surface pressure distribution is a major advantage of expanded metal inserts over other insert concepts. This is shown impressively by closed lines of increased surface pressure (see the Fuji film picture of novaphit® with expanded metal).



novaphit® SSTC with expanded metal

Graphite gasket with tanged metal

Graphite gasket with smooth metal

- The favourable mesh geometry (mesh aperture = 3.0 mm) makes it possible to produce gaskets with very narrow bridges.
- Considerably less danger of delamination when the gasket is bent. Even in the case of a bent gasket, the graphite foil is pressed into position around the insert again completely when pressure is applied to the gasket during installation in the flange, i.e. larger tolerance with respect to installation faults.
- The "countless" insert flexing operations are irreversible because of strain hardening, i.e. the insert has good recovery properties and participates actively in the sealing process! This guarantees greater gasket reliability, above all at higher surface pressure levels.

Material structure

- Multilayer structure alternating between pure graphite foils and expanded metal inserts
- 2 layers of pure graphite foil and 1 layer of expanded metal are combined in novaphit® SSTC
- To form novaphit® SUPER HPC, up to 5 layers of graphite and up to 3 layers of expanded metal are laid on top of each other alternately – depending on the final thickness required. The metal inserts are placed at right angles to each other to guarantee consistent strength both longitudinally and transversely.

Fuji film pictures

- Sensitivity: medium

novaphit® product family

novaphit® SSTC

The proven plant standard with one expanded metal insert.

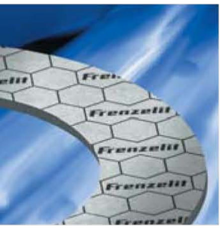
The advantages of novaphit® SSTC are attributable primarily to the use of the expanded metal insert made of stainless steel. This guarantees straight-forward handling before installation and a strong performance in the flange. Whether a standard gasket is chosen or a specially designed gasket with a complicated geometry. Wherever conditions are demanding, the ideal combination of high-quality expanded graphite and a three-dimensional expanded metal insert demonstrates its proven efficiency. novaphit® SSTC is an excellent standard gasket for the entire plant.

novaphit® SUPER HPC

Pure graphite with several expanded metal inserts.

Several inserts made from expanded metal guarantee maximum mechanical resistance in novaphit® SUPER HPC.

Arrangement of the inserts at right angles to each other makes sure that tensile strength is consistent in all directions.



novaphit® VS

Pure graphite without an insert.

For all applications where a stainless steel insert cannot be used. The material is pre-densified during production in order to optimise the handling properties. It is simple to produce even the narrowest gasket widths as a result.

novaphit® SSTC$^{TRD\ 401}$

The TÜV-certified solution for oval closure lid gaskets.

This type of gasket, which is based on the classic novaphit® SSTC product, has become the popular standard for oval gaskets that require official approval since TÜV TRD 401 testing was introduced.

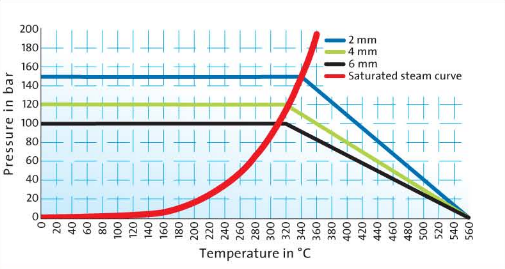
novaphit® SSTC$^{TRD\ 401}$ has been tested and approved by the TÜV technical control authorities in the highest possible category D (250° C/40 bar) in accordance with the directive TRD 401 (test number: TÜV.D.00-004.d).

Oval gaskets 2, 4 or 6 mm thick are produced from the original material (which is 2 mm thick) by certified manufacturers. They cover all the different applications, from the new boiler that is being delivered to the steam generator that has already been in operation for a long time.

novaphit® SSTC$^{TRD\ 401}$'s strength is its particularly good adaptability to unevenness in the gasket surface. This is due to a sufficiently thick graphite layer. The expanded metal inserts are another positive feature, because they have no adverse impact on compression of the gasket. This means that the low surface pressure in the closure lid area for design reasons can be exploited to full effect to form the graphite.

novaphit® SSTC$^{TRD\ 401}$ also has all the properties of novaphit® SSTC and can therefore be used smoothly for all other steam generation application areas too.

Recommendations for use of novaphit® SSTC$^{TRD\ 401}$



Product data

novaphit® SSTC
- Dimensions in mm: 1000 x 1000, 1500 x 1500
- Thickness in mm: 1.0/1.5/2.0/3.0
- Further dimensions and thicknesses are available on request

novaphit® SUPER HPC
- Dimensions in mm: 1000 x 1000, 1500 x 1500
- Thickness in mm: 1.5/2.0/2.5/3.0
- Further dimensions and thicknesses are available on request

novaphit® VS
- Dimensions in mm: 1000 x 1000, 1500 x 1500
- Thickness in mm: 0.5/1.0/1.5/2.0
- Further dimensions and thicknesses are available on request

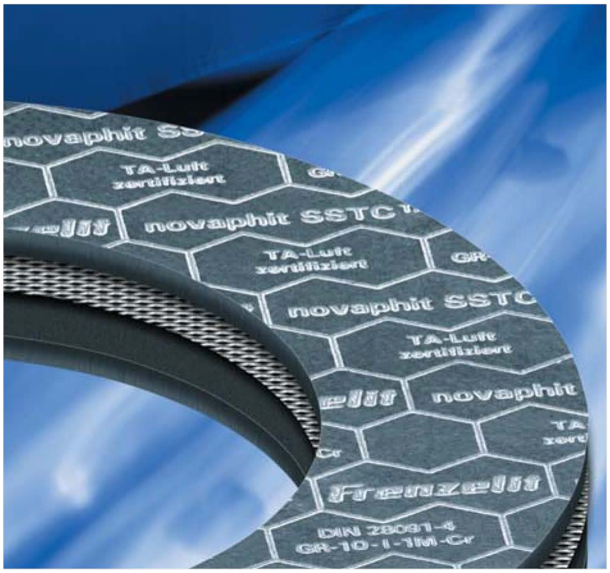
novaphit® SSTC$^{TRD\ 401}$
- Dimensions in mm: 1000 x 1000, 1500 x 1500
- Thickness in mm: 2.0
- Further dimensions and thicknesses are available on request

novaphit® SSTC^{TA-L}

Safety for all plant areas certified in accordance with fugitive emission regulations

The first graphite gasket for which certification has been obtained that it meets the requirements of the fugitive emission regulations directly from the sheet – no matter whether it has an inner eyelet or not.

The basis here is also the proven expanded metal insert made from chrome-nickel steel (material no. 1.4404/AISI 316 L). In order to satisfy the new legal requirements, extremely pure graphite foils processed into a gradient gasket material are used in this case. An additional feature is the internal impregnation, which in turn helps to achieve leakage rates that are already considered to be the new standard in the field of graphite gasket materials.

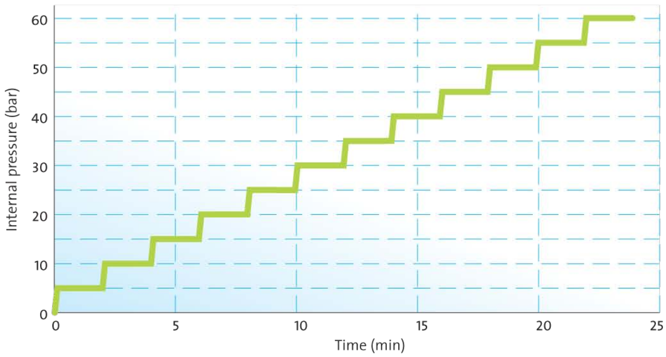


Blow-out test

novaphit® SSTC^{TA-L} demonstrates its efficiency under extreme conditions where blow-out resistance is concerned too:

The gasket even withstands surface pressure of 7.5 N/mm^2 and internal pressure of 60 bar. Measurement is carried out in accordance with VDI 2200 (06/2005 version) following 24-hour storage at 300° C and subsequent application of nitrogen in a DN40/PN40 flange.

novaphit® SSTC^{TA-L} blow-out test



Certification of compliance with German air pollution regulations

The fugitive emission regulations that have applied in Germany since October 2002 define and specify the commitments for operators of industrial equipment that requires approval. Clear rules are made there for flange connections. In this context, technically tight flange connections have to be used in accordance with VDI 2440 (issue 11/2000).

novaphit® SSTC^{TA-L} has been tested by Amtec. The result: classification as a high-quality gasket in accordance with the test criteria of VDI 2440 for the German pollution regulations.

novaphit® SSTC^{TA-L} observes the leakage criterion of the German pollution regulations comfortably with $8 \cdot 10^{-5}$ mbar·l/(s·m).

Further details about novaphit® SSTC^{TA-L} can be found in the novaphit® SSTC^{TA-L} product folder, which can be requested free of charge and is available to be downloaded from the Internet at www.frenzelit.com.

novaphit® SSTC^{TA-L}

- Dimensions in mm: 1000 x 1000
  1500 x 1500
- Thickness in mm: 1.0/1.6/3.0
- Further dimensions and thicknesses are available on request


amtec

ZERTIFIKAT

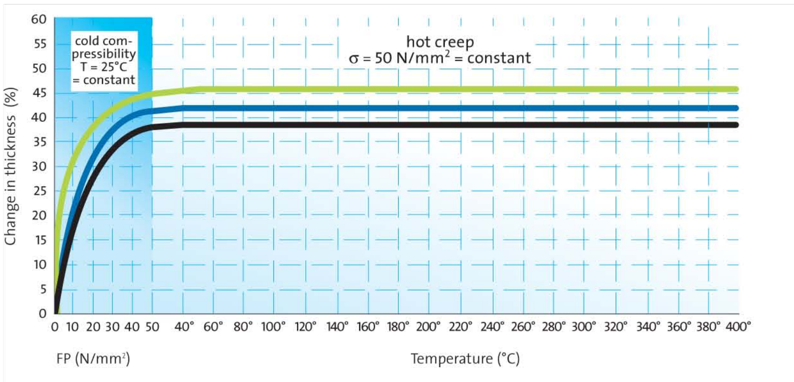
novaphit SSTC TA-L

Frenzelit-Werke GmbH & Co. KG
Frankenhammer, 95460 Bad Berneck

Laufen, 17. Dezember 2004

Typical material properties for products with a gasket thickness of 2 mm

Compression set – temperature test: 50 N/mm² – 400 °C

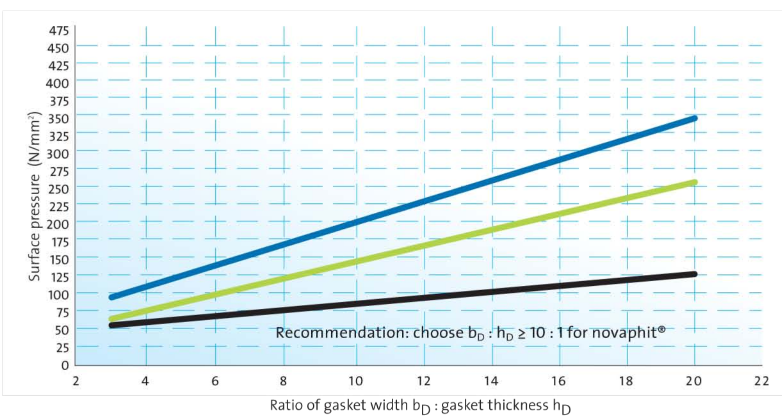


novaphit® SUPER HPC

novaphit® SSTC

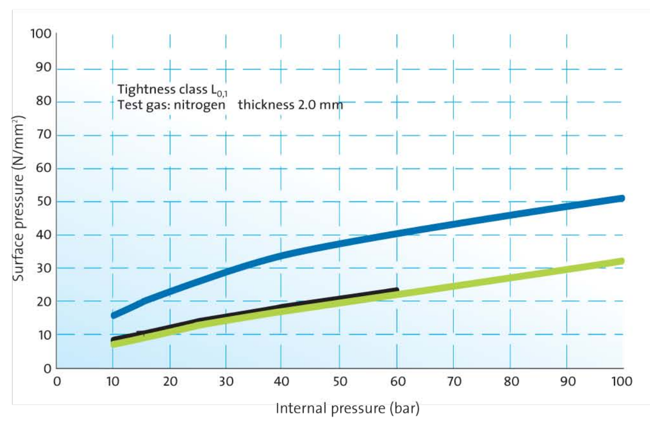
novaphit® VS

Maximum surface pressure when installed σ_{VO} with smooth sealing faces*



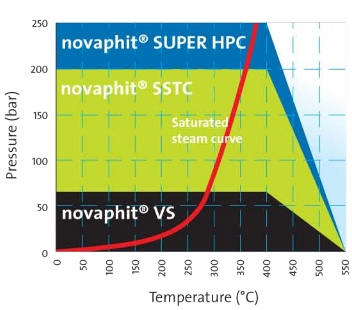
* The maximum surface pressure can be increased by 1.5 in the case of tongue-and-groove flanges.

Necessary minimum surface pressure σ_{VU} σ-p graph

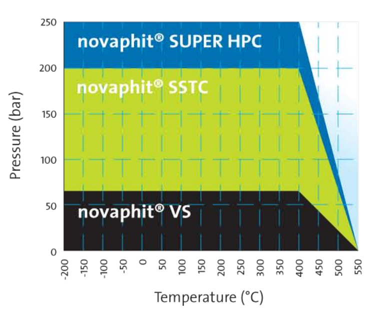


Recommendations for use in the most important media groups according to the pressure and temperature

Water/steam



Other media*



The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

* Example for the most common other media. Exact data for specific individual cases are available in the Frenzelit novaDISC programme or contact our application engineering specialists.

Warranty exclusion

In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance.
There is as a result no basis for warranty claims.

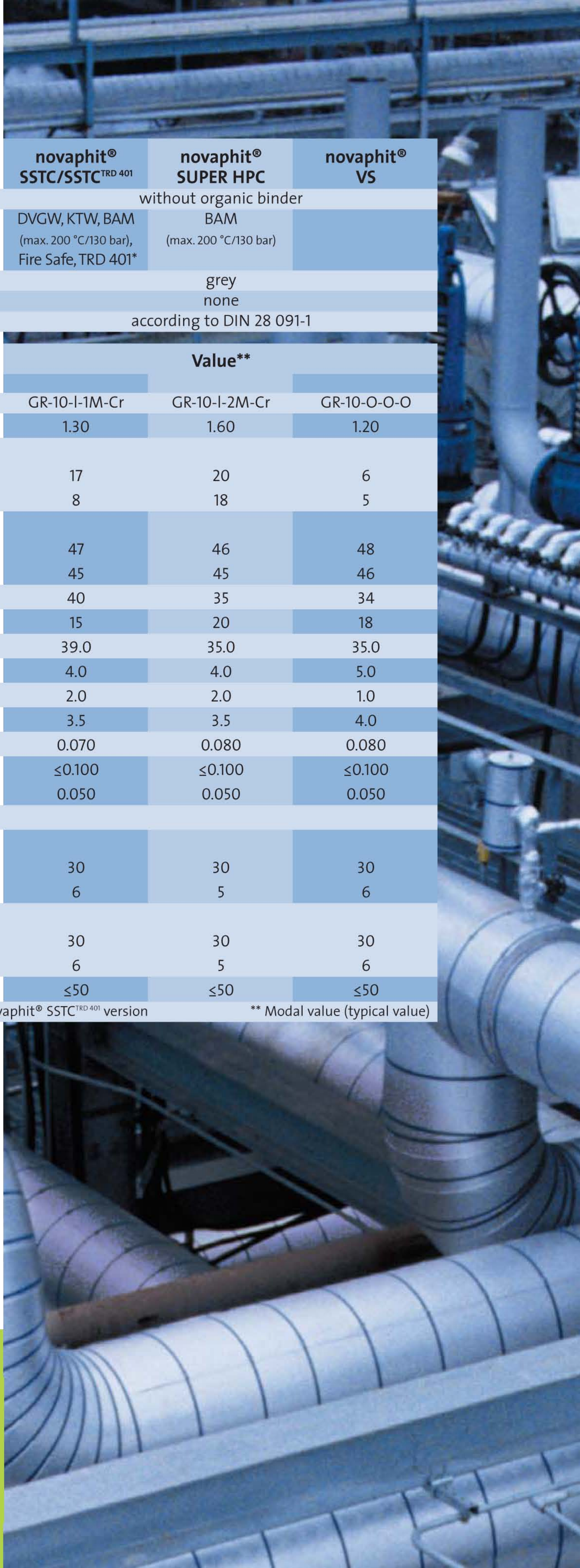
Material data

General information	novaphit® SSTC/SSTC$^{\text{TRD 401}}$	novaphit® SUPER HPC	novaphit® VS
Binders	without organic binder		
Approvals	DVGW, KTW, BAM (max. 200 °C/130 bar), Fire Safe, TRD 401*	BAM (max. 200 °C/130 bar)	
Colour	grey		
Anti-stick coating	none		
Sheet sizes and thickness tolerance	according to DIN 28 091-1		

Physical properties Gasket thickness 2.0 mm	Test standard	Unit	Value**		
Identification	DIN 28 091-4		GR-10-I-1M-Cr	GR-10-I-2M-Cr	GR-10-O-O-O
Density	DIN 28 090-2	[g/cm³]	1.30	1.60	1.20
Tensile strength	DIN 52 910	[N/mm²]			
longitudinal			17	20	6
transverse			8	18	5
Residual stress $\sigma_{dE/16}$	DIN 52 913				
175 °C		[N/mm²]	47	46	48
300 °C		[N/mm²]	45	45	46
Compressibility	ASTM F 36 J	[%]	40	35	34
Recovery	ASTM F 36 J	[%]	15	20	18
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	39.0	35.0	35.0
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	4.0	4.0	5.0
Hot creep $\varepsilon_{WSW/300}$	DIN 28 090-2	[%]	2.0	2.0	1.0
Hot recovery $\varepsilon_{WRW/300}$	DIN 28 090-2	[%]	3.5	3.5	4.0
Recovery R	DIN 28 090-2	[mm]	0.070	0.080	0.080
Specific leakage rate	DIN 3535-6	[mg/(s·m)]	≤0.100	≤0.100	≤0.100
Specific leakage rate $\lambda_{2.0}$	DIN 28 090-2	[mg/(s·m)]	0.050	0.050	0.050
Fluid resistance	ASTM F 146				
ASTM IRM 903	5h/150 °C				
Weight change		[%]	30	30	30
Thickness change		[%]	6	5	6
ASTM Fuel B	5h/23 °C				
Weight change		[%]	30	30	30
Thickness change		[%]	6	5	6
Chloride content	DIN 28 090-2	[ppm]	≤50	≤50	≤50

* Applies to the TÜV-approved novaphit® SSTC$^{\text{TRD 401}}$ version

** Modal value (typical value)



Do you have any questions about your application?

The gasket information service will help you:

info@frenzelitsealing.com

Good for people and the environment.

Frenzelit has obtained certification that the company complies with the requirements of both ISO/TS 16949 and ISO 14001. This means complete transparency in all areas and a high degree of security for our customers.

Quality management
ISO/TS 16949

Environmental management
ISO 14001

GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

INSULATION

NEW MATERIALS

Frenzelit Sealing Systems
16550 West Ryerson Road
New Berlin, Wisconsin 53151
Phone: (262) 786-5300
Fax: (262) 786-5503
info@frenzelitsealing.com
www.frenzelitsealing.com

Frenzelit

creating
hightech
solutions

novaphit® SSTC TA-L
Lowest costs – highest value.
Best Available Techniques (BAT) for strictest fugitive emission regulations.

- GASKETS
- TECHNICAL TEXTILES
- EXPANSION JOINTS
- INSULATION
- NEW MATERIALS

Frenzelit

creating
hightech
solutions

Lowest costs – highest value

novaphit® SSTC^{TA-L} is the first flat gasket material for universal application which fulfils the requirements of plant engineering and the chemical/petrochemical industry. It therefore sets a new standard for all gasket requirements in plants, combining maximum safety with enormous cost-saving potential.

The EU IPPC Directive, the US Clean Air Act or the Kyoto Protocol are just some of the fugitive emission regulations that companies have to observe. IPPC stands for Integrated Pollution Prevention and Control. The objective of the European IPPC Directive is to minimise pollution throughout the European Union. Germany has already implemented the Directive with the latest amendments to the TA Luft and VDI 2440 on emission reduction at oil refineries. Other European countries have to introduce similar national regulations by 2007.

novaphit® SSTC^{TA-L} fulfils the strict German fugitive emission regulation TA Luft, as has been proved by two independent testing facilities. It does not matter whether it has an inner eyelet or not; it can be made directly from sheet.

novaphit® SSTC^{TA-L} is the foolproof plant-wide standard gasket that complies in full with the Best Available Techniques (BAT) according to Council Directive 96/61/EC and low or zero emission requirements.

- no leakage
- observes global fugitive emission regulations
- one fits all – standardise your gasket diversity
- maximise your plant safety
- speed up availability – get your tailor-made gasket within 5 minutes
- very forgivable in terms of overcoming flange surface imperfections
- reduce your costs

Unique material profile for maximum safety requirements

- Gradient gasket material made from expanded graphite (purity level at least 98 %), with an internal impregnation and an acid-proof expanded metal insert made from chrome-nickel steel (material no. 1.4404/AISI 316 L)
- Material compound without any binders and fillers

High heat and mechanical resistance

- From -240 °C to +550 °C
- Very high operating pressure levels of up to 200 bar

Excellent properties

- Outstanding handling properties thanks to optimum choice of the components and the low mesh size of the expanded metal insert
- novaphit® SSTC^{TA-L} can be processed very effectively not only with standard die-cutting equipment but also in manual finishing operations and with CNC-plotters

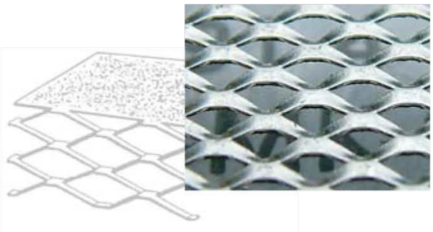
Unique media resistance

- Resistant to practically all organic and inorganic acids, alkalis, oils and solvents

Typical application areas for novaphit® SSTC^{TA-L}

- **The gasket concept for the tougher safety requirements and fugitive emission regulations that have to be observed today**
- **All-purpose use in industry in general**
- **Covers the complete range of classic gaskets**
- **Suitable for all applications in extreme conditions, including changing loads**
- **Compliance with TA-Luft in all areas:**
  - **Petrochemical industry**
  - **Chemical industry**
  - **Plant engineering**

Advantages of the expanded metal insert used



Expanded metal made from extremely acid-proof stainless steel

The material is resistant to corrosion and acids (material no. 1.4404/AISI 316 L).

Thickness of the expanded metal insert used

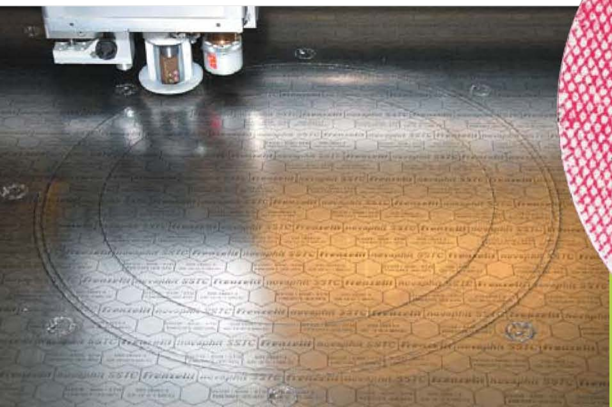
Expansion of the stainless steel foil used (0.15 mm) produces a three-dimensional structure with a considerably thicker projected height (about 0.5 mm), as a result of which genuine "chambering" of the gasket core is achieved.
Minimisation of the danger of injury during handling and processing – no "sharp" cut edges.

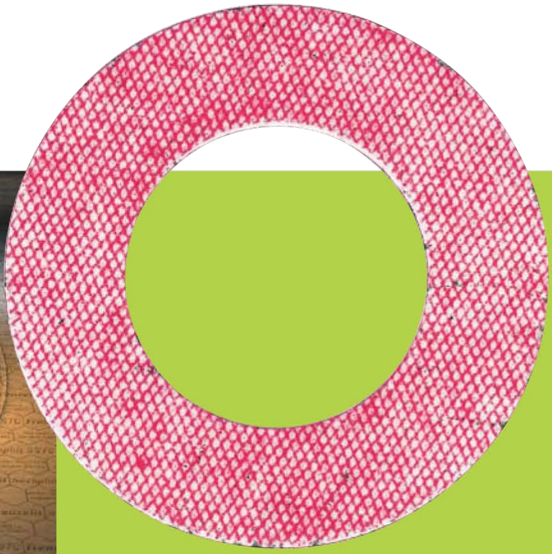
Geometry of the stainless steel insert

- Better use of the surface pressure available to compress the graphite, because no "crowns" have to be bent.
- No undercutting in the insert material.

The graphite foil covers and surrounds the insert almost completely. The main advantage is the creation of closed lines of increased surface pressure (for this effect please see the Fuji film projection).

- The favourable mesh geometry (mesh size = passo 3.0 mm) makes it possible to produce gaskets with very narrow projections.
- Easy cutting, handling benefits in manual and/or in-house finishing.
- Considerably less danger of layer separation when the gasket is bent. Even if bending does occur, the graphite foil is pressed into position around the insert again completely when pressure is applied to the gasket during installation in the flange, i.e. larger tolerance with respect to installation faults.
- The "countless" bends in the insert are irreversible because of strain hardening, i.e. the insert has a good recovery and participates actively in the sealing process! This guarantees greater gasket reliability, above all at higher surface pressure levels.
- The new novaphit® SSTC^{TA-L} performs impressively in a direct comparison with smooth metal inserts thanks to its open insert design principle too. Due to this principle, not just the external graphite layer but also a considerably greater thickness is available to compensate flange damage.



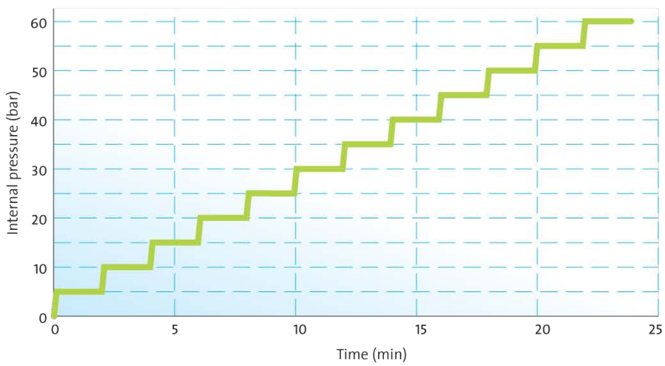


Fuji film picture

- Gasket thickness: 1.6 mm
- Sensitivity: medium

Technical information about novaphit® $SSTC^{TA\text{-}L}$

Blow-out test passed easily

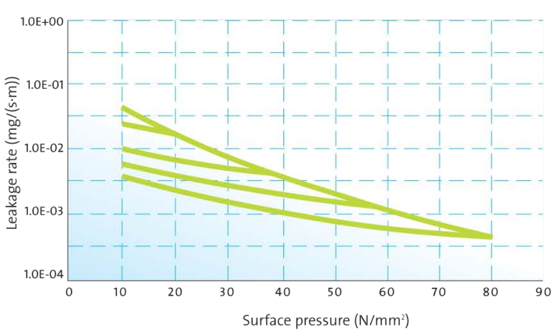


Proof of the blow-out resistance of the gasket system is required in addition to leakage testing. According to the latest version of VDI 2200, the gasket has to be able to withstand 1.5 times nominal pressure at very reduced surface pressure levels. The gasket is fitted in a DIN flange PN40/DN40 at 30 N/mm².

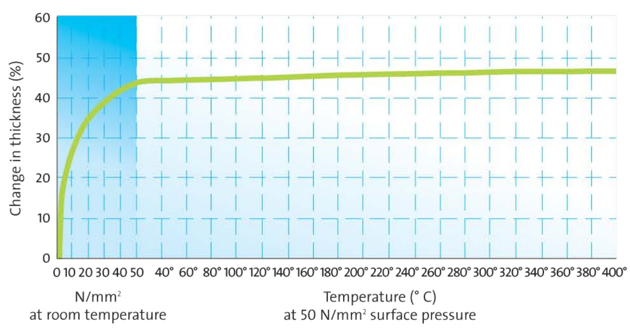
After storage of the flange system at 300 °C for 24 hours, nitrogen is applied gradually at a pressure of up to a maximum of 60 bar. Pressure would drop very rapidly if the gasket failed.

The gasket is then tested at two considerably reduced surface pressure levels. If the test is passed at 10 N/mm², a further reduction is made to 7.5 N/mm². Even in the most critical case of an extremely low surface pressure level of 7.5 N/mm² and maximum pressure of 60 bar, novaphit® $SSTC^{TA\text{-}L}$ demonstrates its impressive blow-out resistance in line with the German pollution regulations – without internal edging. We can provide a certificate confirming this on request.

Leakage-surface pressure (L, σ) according to DIN EN 13555

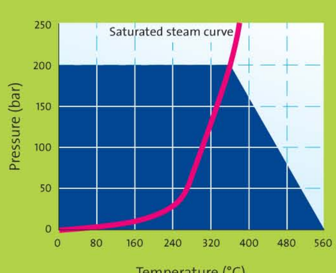


Deformation under temperature 1.6 mm

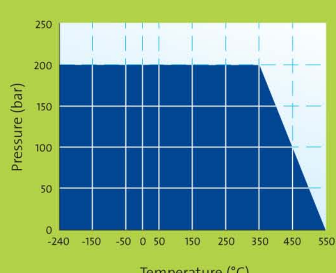


Recommendations for use according to the pressure and temperature

Water/steam



Other media

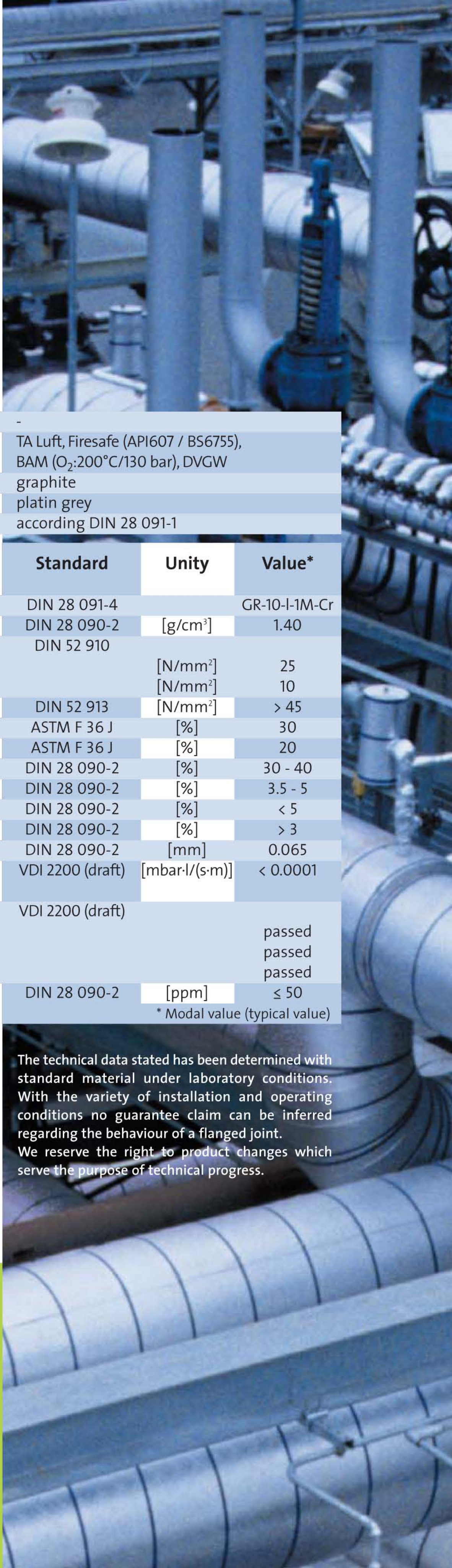


The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 1.6 mm and smooth flanges.
Higher stresses are possible when thinner gaskets are used!

Warranty exclusion

In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance.
There is as a result no basis for warranty claims.

Material data



Installation instructions

- Clean the contact areas, remove old gasket material without damaging the surface of the flange.
- Check whether the flange surfaces are parallel and even and make adjustments if necessary.
- Check gaskets that have been stored in a dry place for cracks, surface damage and dimensional accuracy before installing them. In the case of gaskets with holes in them, make sure the hole pattern coincides with the holes in the flange.
- Do not use any auxiliary sealing agents!
- Check whether the screws are working properly before installing the gaskets and use new screws if necessary.
- Uniform and careful initial installation by hand.
- Use a torque wrench to tighten the screws diagonally in 3 stages (first of all with about 50 % torque, then with about 80 % and finally with 100 %).

General data

Binders	-
Approvals	TA Luft, Firesafe (API607 / BS6755), BAM (O_2:200°C/130 bar), DVGW
Colour	graphite
Printing	platin grey
Sheet sizes and thickness tolerance	according DIN 28 091-1

Physical properties Gasket thickness 1.6 mm	**Standard**	**Unity**	**Value***
Identification	DIN 28 091-4		GR-10-I-1M-Cr
Density	DIN 28 090-2	$[g/cm^3]$	1.40
Tensile strength	DIN 52 910		
longitudinal		$[N/mm^2]$	25
transverse		$[N/mm^2]$	10
Residual stress $\sigma_{dE/16}$ 300°C	DIN 52 913	$[N/mm^2]$	> 45
Compressibility	ASTM F 36 J	[%]	30
Recovery	ASTM F 36 J	[%]	20
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	30 - 40
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	3.5 - 5
Hot creep $\varepsilon_{WSW/300}$	DIN 28 090-2	[%]	< 5
Hot recovery $\varepsilon_{WRW/300}$	DIN 28 090-2	[%]	> 3
Recovery R	DIN 28 090-2	[mm]	0.065
Leakage (TA Luft) Flangetest 30 MPa, 300°C, 1 bar Helium	VDI 2200 (draft)	[mbar·l/(s·m)]	< 0.0001
Blow-out test	VDI 2200 (draft)		
Class A (30 MPa, 60 bar, N_2)			passed
Class B (10 MPa, 60 bar, N_2)			passed
Class C (7.5 MPa, 60 bar, N_2)			passed
Chloride content	DIN 28 090-2	[ppm]	≤ 50

* Modal value (typical value)

The technical data stated has been determined with standard material under laboratory conditions. With the variety of installation and operating conditions no guarantee claim can be inferred regarding the behaviour of a flanged joint.
We reserve the right to product changes which serve the purpose of technical progress.

Product data

- Dimensions in mm: 1000 x 1000
- Thickness in mm: 1.6
- Further dimensions and thicknesses are available on request

Do you have any questions about your application?

The gasket information service will help you:

info@frenzelitsealing.com

Good for people and the environment.

Frenzelit has obtained certification that the company complies with the requirements of both ISO/TS 16949 and ISO 14001. This means complete transparency in all areas and a high degree of security for our customers.

Quality management
ISO/TS 16949

Environmental management
ISO 14001

TA Luft

Since October 2002 plant operators have had to observe the drasstically tightened threshold values on diffuse emissions – that's what the revised German Fugitive Emission Regulation TA Luft requires which have thus been adjusted to the new European regulation (Council Directive 96/61/EC) as well as to new environmental and technical standards.

novaphit® SSTC$^{TA\text{-}L}$ has been certified by the independent company Amtec. The result: Classified as a high quality sealing system according to the test criteria VDI 2440 and TA Luft.

novaphit® SSTC$^{TA\text{-}L}$ meets the TA Luft criteria easily with a measured helium leakage rate of **$8 \cdot 10^{-5}$ mbar·l/(s·m)**.

Firesafe Test

novaphit® SSTC$^{TA\text{-}L}$ is approved acc. to API 607 and BS 6755.

GASKETS
TECHNICAL TEXTILES
EXPANSION JOINTS
INSULATION
NEW MATERIALS

Frenzelit Sealing Systems
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Fax: (262) 786-5503
info@frenzelitsealing.com
www.frenzelitsealing.com

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creating
hightech
solutions

novaphit® EXTRA

The high-pressure gasket material made of expanded graphite with stainless steel wire mesh reinforcement

Material profile

Gasket material made of expanded graphite (purity 99 % min.) with a stainless steel wire mesh insert (material no. 1.4301/AISI 304).

Typical applications

- **High thermal and mechanical loads as well as frequently changing loads.**
- **All-purpose use in wide areas of the chemical industry.**
- **Pumps, fittings, pipelines with flanges in the general and chemical industry.**

Excellent workability

novaphit® EXTRA can be processed very effectively with standard die-cutting equipment. Due to the thin stainless steel wire mesh and the low mesh size novaphit® EXTRA can be cut with scissors directly at site. The XL sheet size 1500 x 1500 mm offers added value with regard to large size gaskets made from one piece.

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GASKETS

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INSULATION

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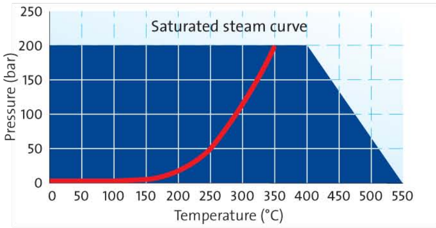
Technical information about novaphit® EXTRA

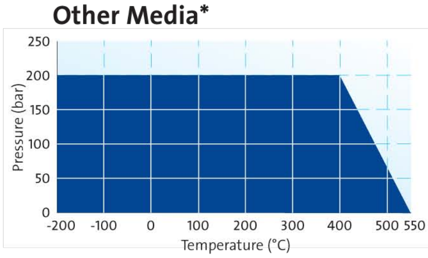
Recommendations for use

according to pressure and temperature

Water/steam



Other Media*



The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

*Example for the most common other media. Exact data for specific individual cases are available in the Frenzelit novaDISC programme or contact our application engineering specialists.

Warranty exclusion

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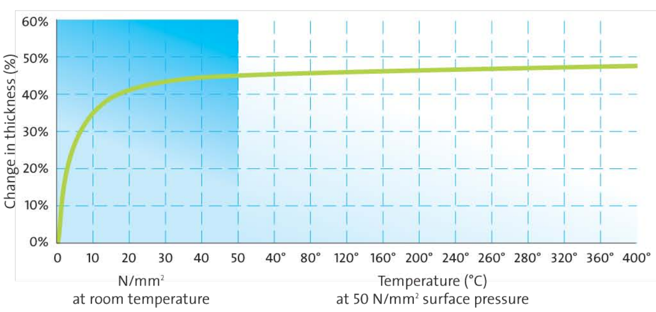
Deformation under temperature 2.0 mm



Material data

General Data

Binders	without organic binder
Colour	graphite
Sheet sizes and thickness tolerance	acc. DIN 28 091-1

Physical properties Gasket thickness 2.0 mm	**Standard**	**Unity**	**Value***
Identification	DIN 28 091-4		GR-10-I-1M-Cr
Density	DIN 28 090-2	[g/cm³]	1.20
Tensile strength	DIN 52 910		
longitudinal		[N/mm²]	8
transverse		[N/mm²]	7
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C		[N/mm²]	46
300 °C		[N/mm²]	45
Compressibility	ASTM F 36 J	[%]	40
Recovery	ASTM F 36 J	[%]	10
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	40
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	4
Hot creep $\varepsilon_{WSW/300}$	DIN 28 090-2	[%]	2.5
Hot recovery $\varepsilon_{WRW/300}$	DIN 28 090-2	[%]	3
Recovery R	DIN 28 090-2	[mm]	0.060
Chloride content	DIN 28 090-2	[ppm]	≤ 50

* = Mode (typical value)

Product data

- Dimensions in mm: 1500 x 1500
- Thicknesses in mm: 0.5/0.8/1.0/1.5/2.0/3.0
- Further dimensions and thicknesses are available on request

Installation instructions

- Clean the contact areas, remove old gasket material without damaging the surface of the flange.
- Check whether the flange surfaces are parallel and even and make adjustments if necessary.
- Check gaskets that have been stored in a dry place for cracks, surface damage and dimensional accuracy before installing them. In the case of gaskets with holes in them, make sure the hole pattern coincides with the holes in the flange.
- Do not use any auxiliary sealing agents!
- Check whether the screws are working properly before installing the gaskets and use new screws if necessary.
- Uniform and careful initial installation by hand.
- Use a torque wrench to tighten the screws diagonally in 3 stages (first of all with about 50 % torque, then with about 80 % and finally with 100 %).

GASKETS

TECHNICAL TEXTILES

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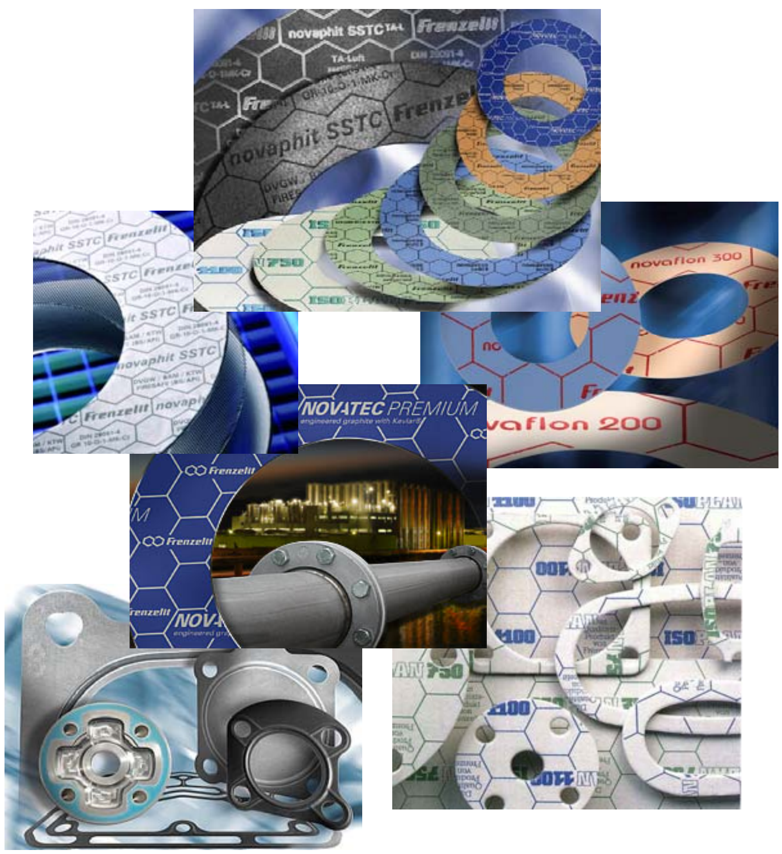
Section 5

Novaflon®

Modified PTFE Composite



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novaflon®
PTFE gaskets for
industrial applications.

- GASKETS
- TECHNICAL TEXTILES
- EXPANSION JOINTS
- INSULATION
- NEW MATERIALS

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hightech
solutions

At a glance: the benefits of novaflon®

novaflon® combines decisive advantages over conventionally manufactured PTFE:

- Excellent media resistance to most lyes and acids throughout the pH range (pH levels 0-14)
- High residual stress
- Resistant to cold flow
- High mechanical resistance
- Wide temperature range from -210 °C to 260 °C
- Unlimited shelf life
- Excellent leakage properties: Meets German fugitive emission regulation TA Luft [leakage rate < 10^{-4} mbar·l/(s·m)]
- Compliance with FDA 177.1550 Perfluorocarbon regulation

Typical application areas for novaflon®

- All-purpose use in the chemical, petrochemical, pharmaceutical, paper and food industries
- Oils and greases, acids and alkalis, solvents, refrigerants, water, steam
- Compliance with the German fugitive emission regulation TA Luft in these areas:
  - Petrochemicals
  - Chemical industry
  - Pharmaceutical industry
  - Food industry

The better choice: novaflon®– gaskets made from PTFE

novaflon® 100

Modified PTFE with hollow glass micro-spheres

Thanks to its extremely high compressibility, novaflon® 100 is eminently suitable for use in stress-sensitive flanges, such as glass, ceramic and FRP flanges.

Very good anti-stick properties are an outstanding feature of the all-purpose gasket made from modified PTFE. Downtime is minimised as a result, while machine reliability and availability are increased. Another advantage: novaflon® 100's impressive adaptability enables it to compensate for minor damage or unevenness in the flange surface.

Excellent media resistance mades novaflon® 100 the ideal solution for use in the chemical industry.

novaflon® 200

Modified PTFE with barium sulphate

novaflon® 200 has the best chemical resistance to strong alkalis.

High mechanical resistance, high pressure resistance (vacuum to 83 bar) and strongly optimised creep properties are convincing features of the all-purpose flat gasket made from modified PTFE.

The high purity of the gasket material, which is physiologically harmless, makes novaflon® 200 the ideal solution for use in the food and pharmaceutical industry.

novaflon® 300

Modified PTFE with silica

novaflon® 300 offers a very good balance between chemical resistance and reduced creep properties. The flat gasket is not affected by concentrated acids either (except for hydrofluorides). The all-purpose gasket made from modified PTFE is therefore the product of choice for process industry applications.

High mechanical resistance at both high pressure (vacuum to 83 bar) and high temperatures makes novaflon® 300 the ideal solution for use in the chemical and petrochemical industry.

novaflon® 500

100 % multi-directional expanded PTFE

novaflon® 500 offers a universal chemical resistance (pH 0-14).

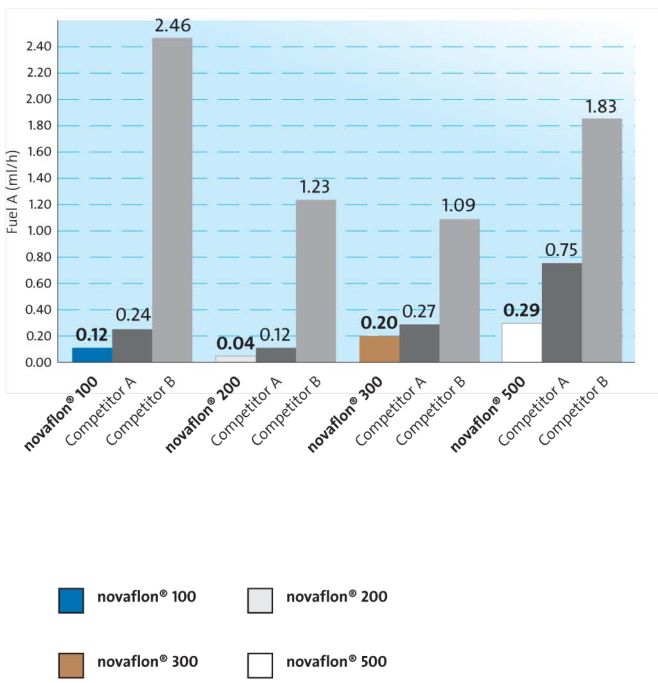
Due to its unique production process novaflon® 500 shows an extremely good resistance to creep and cold flow.

The gasket material compensates low bolt forces as well as flange irregularities and moreover stands out by extremly high pressure resistance (vacuum up to 200 bar).

These properties predestine novaflon® 500 for the application in the pharmaceutical industry, the food and beverage industry, especially suitable for glass lined flanges and FRP equipment or in reactors in the process industry.

Technical information about novaflon®

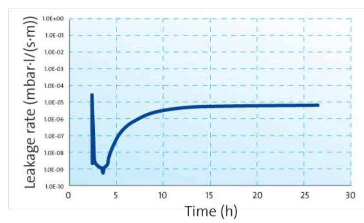
Leakage measurement – ASTM F 37 A



novaflon® meets the German fugitive emission regulation TA Luft

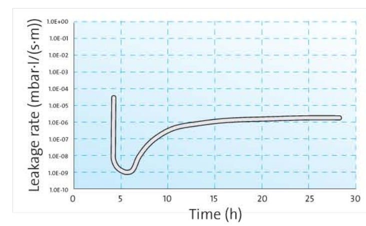
novaflon® 100

Leakage rate λ 5.8·10^{-6} mbar·l/(s·m)



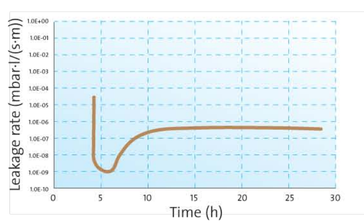
novaflon® 200

Leakage rate λ 1.7·10^{-6} mbar·l/(s·m)



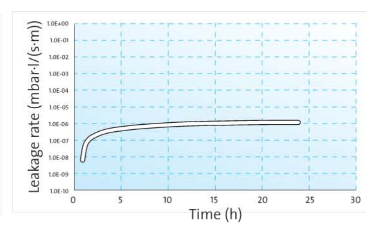
novaflon® 300

Leakage rate λ 5,4·10^{-7} mbar·l/(s·m)



novaflon® 500

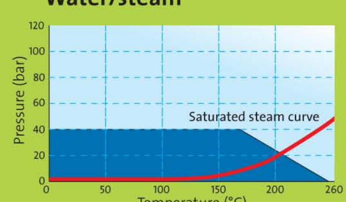
Leakage rate λ 1,2·10^{-6} mbar·l/(s·m)



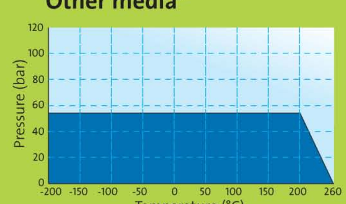
Recommendations for use according to the pressure and temperature

novaflon® 100

Water/steam

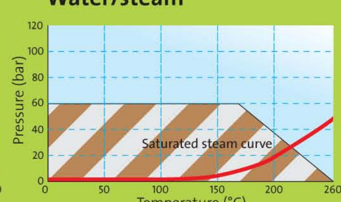


Other media*

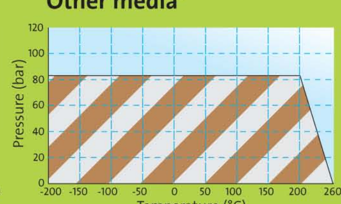


novaflon® 200/300

Water/steam

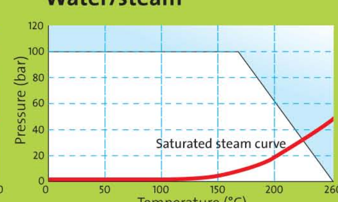


Other media*

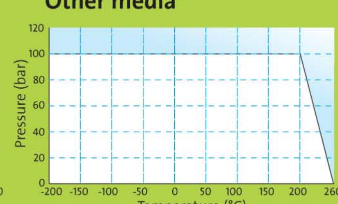


novaflon® 500

Water/steam



Other media*



The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

*Example for the most common other media. Exact data for specific individual cases are available in the Frenzelit novaDISC programme or contact our application engineering specialists.

Warranty exclusion

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Material data

Blow-out test passed easily

Proof of the blow-out resistance of the gasket system is required in addition to leakage testing. According to the latest version of VDI 2200, the gasket has to be able to withstand 1.5 times nominal pressure at very reduced surface pressure levels. The gasket is fitted in a DIN flange DN40/PN40 at 30 N/mm².

After storage of the flange system at 150 °C for 24 hours, nitrogen is applied gradually at a pressure of up to a maximum of 60 bar. Pressure would drop very rapidly if the gasket failed.

The gasket is then tested at two considerably reduced surface pressure levels. If the test is passed at 10 N/mm², a further reduction is made to 7.5 N/mm². Even in the most critical case of an extremely low surface pressure level of 7.5 N/mm² and maximum pressure of 60 bar, novaflon® gaskets demonstrate their impressive blow-out resistance in line with the German fugitive emission regulation TA Luft – without internal edging. We can provide a certificate confirming this on request.

General data

General data	novaflon® 100	novaflon® 200	novaflon® 300	novaflon® 500
Approvals	FDA, TA Luft	FDA, TA Luft, DVGW, BAM	FDA, TA Luft, DVGW, BAM	FDA, TA Luft
Colour	light blue	white	fawn	white
Tolerances in thickness		acc. DIN 28 091-1		

Physical properties Sample thickness 2.0 mm	Test standard	Unit	Value*	Value*	Value*	Value*
Identification	DIN 28 091-3		TF - G - O	TF - M - O	TF - M - O	TF - O - O
Density	DIN 28 090-2	[g/cm³]	1.70	2.90	2.10	0.90
Tensile strength	DIN 52 910	[N/mm²]	16	18	17	26
Residual stress $\sigma_{dE/16}$ 150°C, 30 N/mm², 16h	DIN 52 913	[N/mm²]	12	14	16	18
Compressibility	ASTM F 36 J	[%]	25	3	5	50
Recovery	ASTM F 36 J	[%]	40	45	45	10
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	20	3	3	40
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	4	1	1	3
Hot creep $\varepsilon_{WSW/150}$	DIN 28 090-2	[%]	45	40	20	15
Hot recovery $\varepsilon_{WRW/150}$	DIN 28 090-2	[%]	6	4	3	2
Leakage	DIN 3535-6	[mg/(m·s)]	≤ 0.015	≤ 0.015	≤ 0.015	≤ 0.015
Specific leakage rate (TA Luft) Helium, 1bar, 30 MPA	VDI 2440/TA Luft	[mbar·l/(m·s)]	$5.8 \cdot 10^{-6}$	$1.7 \cdot 10^{-6}$	$5.4 \cdot 10^{-7}$	$1.2 \cdot 10^{-6}$

* Modal value (typical value)

Product data novaflon® 100/200/300

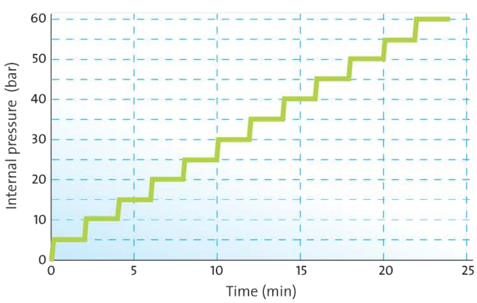
- Dimensions in mm: 1200 x 1200 (for thickness 1.0 mm)
  1500 x 1500 (from thickness 1.5 mm)
- Thicknesses in mm: 1.0/1.5/2.0/3.0

novaflon® 500

- Dimensions in mm: 1500 x 1500
- Thicknesses in mm: 0.5 to 9.0

Further dimensions and thicknesses are available on request.

Blow-out test



novaflon® XXL

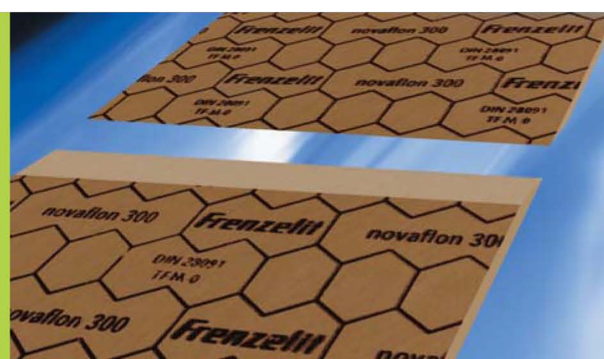
Large novaflon® gaskets can be supplied with scarfed edges and welded in one piece. Ideal for large gasket dimensions in use with corrosive media, for example in heat exchanger applications.

- Optimised leakage properties compared with PTFE dovetail joints
- Uncritical handling
- Less installation work
- Shorter downtime

Do you have any questions about your application?

The gasket information service will help you:

info@frenzelitsealing.com



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Quality management
ISO/TS 16949

Environmental management
ISO 14001

IPPC directive and TA Luft

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All novaflon® products observe the strict leakage criteria of the German fugitive emission regulation TA Luft comfortably.

GASKETS
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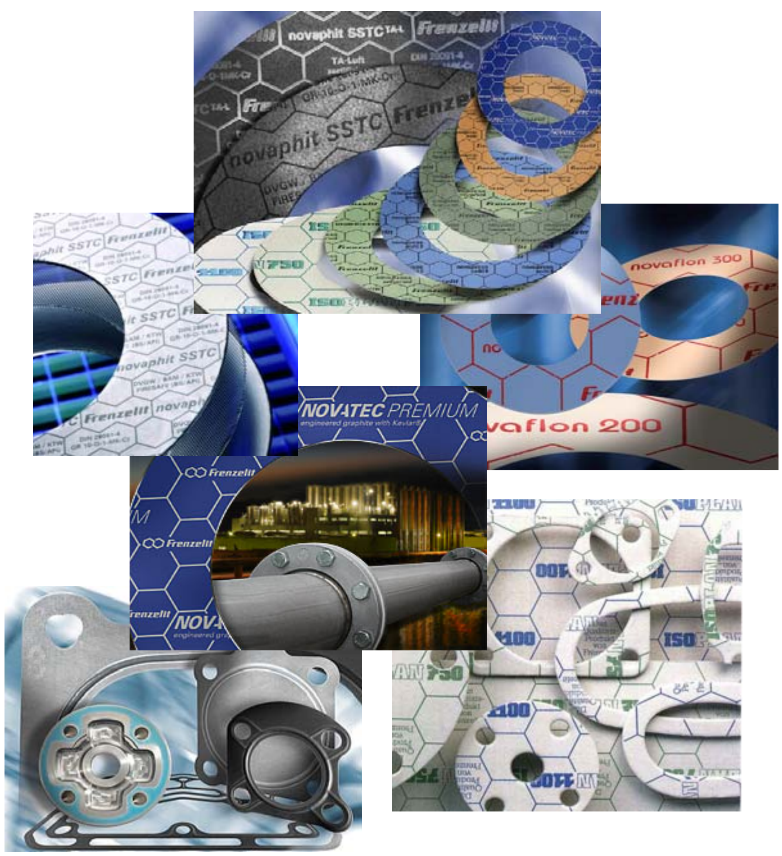
Section 6

Novapress®

High Pressure / High Temperature Gasket Materials



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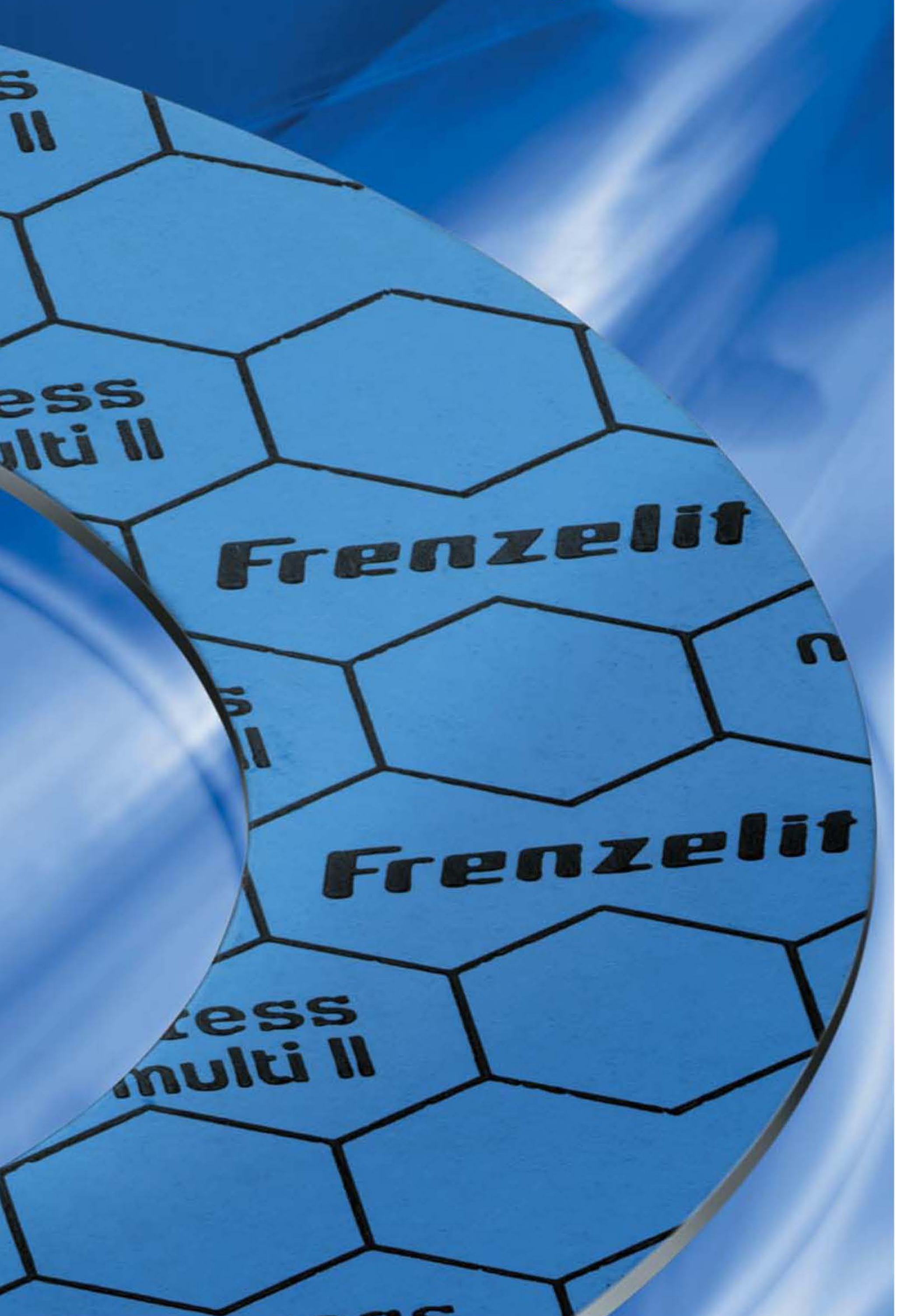
novapress® MULTI II
The high-pressure gasket for use under changing loads.



Material profile

The patented combination of aramide fibres, high-quality graphite filler and particularly oil-resistant **n**itrile **b**utadiene **r**ubber (**NBR)** gives novapress® MULTI II the following special properties:

- **Gas tightness as specified in the standard**
- **Excellent stress relaxation**
- **Excellent safety reserves under changing loads**
- **High adaptability**
- **Graphite structure gives the material unique flexibility**

Identification colour: blue

novapress® MULTI II is also available with a wire mesh (material no. 25/018) under the name novapress® MULTI II EG.

Application areas

novapress® MULTI II is the ideal choice for use with saturated steam up to 250° C and 40 bar – it is considered to be – the "steam gasket". Good resistance to oils, petrol, lubricants and gaseous media make it suitable for other applications as well.

- **Power stations (gas and water supply)**
- **General industry**
- **Plant engineering and equipment manufacturing**
- **Chemical industry**

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GASKETS

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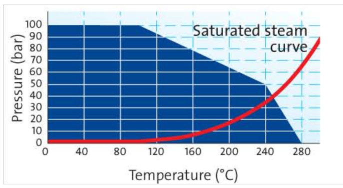
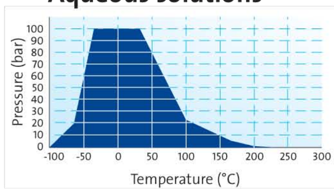
Recommendations for use in the most important media groups according to the pressure and temperature

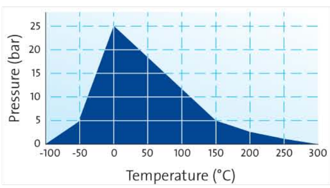
Water/steam



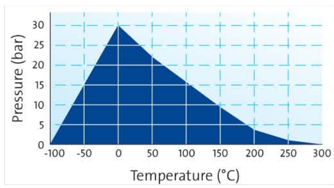
Aqueous solutions



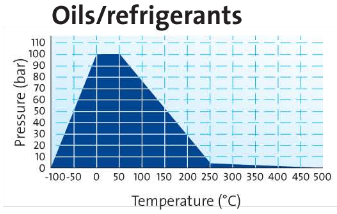
Acids



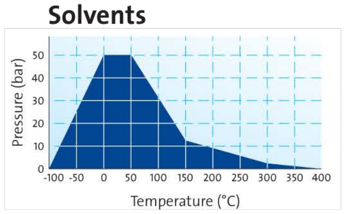
Alkalis



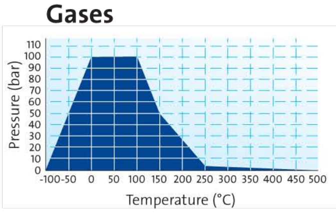
Oils/refrigerants



Solvents



Gases



The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

Warranty exclusion

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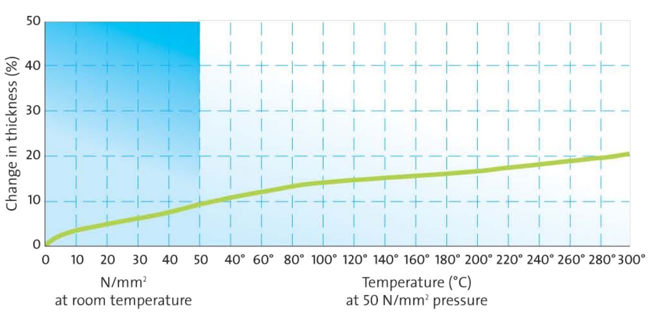
Deformation under temperature 2.0 mm



Material data

General data

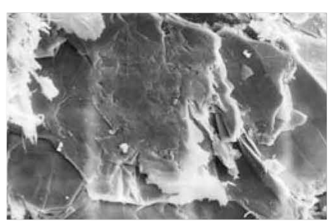
Binders	NBR
Approvals	DVGW, BAM (up to max. 60°C/130 bar)
Colour	both sides blue
Anti-stick coating	both sides A 310
Sheet size and thickness tolerance	according 28 091-1

Physical properties Gasket thickness 2.0 mm	**Standard**	**Unity**	**Value***
Identification	DIN 28 091-2		FA - AM 1 - O
Density	DIN 28 090-2	[g/cm³]	1.50
Tensile strength	DIN 52 910		
longitudinal		[N/mm²]	28
transverse		[N/mm²]	12
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C		[N/mm²]	32
300 °C		[N/mm²]	22
Compressibility	ASTM F 36 J	[%]	7
Recovery	ASTM F 36 J	[%]	63
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	6
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	3
Hot creep $\varepsilon_{WSW/200}$	DIN 28 090-2	[%]	10
Hot recovery $\varepsilon_{WRW/200}$	DIN 28 090-2	[%]	2
Recovery R	DIN 28 090-2	[mm]	0.040
Specific leakage rate	DIN 3535-6	[mg/(s·m)]	≤0.100
Specific leakage rate $\lambda_{2,0}$	DIN 28 090-2	[mg/(s·m)]	0.100
Fluid resistance	ASTM F 146		
ASTM IRM 903	5h/150°C		
Weight change		[%]	6
Thickness increase		[%]	2
ASTM Fuel B	5h/23°C		
Weight change		[%]	8
Thickness increase		[%]	4
Leachable Chloride content	Siemens AV-9-014	[ppm]	≤ 150

* Mode (typical value)

Product data

- Dimensions in mm: 1000 x 1500
  1500 x 1500
  3000 x 1500
- Thicknesses in mm: 0.3/0.5/0.75/1.0/1.5/2.0/3.0/4.0
- Further dimensions and thicknesses are available on request



Further dimensions and thicknesses are available on request novapress® MULTI II magnified 400 times shows the blend of fibrous and flaky elements and the layering associated with them that leads to the achievement of special slip effects as a precondition for dynamic stress.

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www.frenzelitsealing.com

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Technical Data Sheet

Novapress MULTI II EG

Material profile:

- Gasket material reinforced with a wire mesh insert made of AISI 304 stainless steel. Nitrile Butadiene Rubber is blended with graphite and Aramid fibers to produce a very unique elevated pressure / elevated temperature sealing solution.

Typical applications:

- Sealed joints for increased thermal and mechanical loads, changing loads.

Supply data:

- Sheet sizes in inch: 40x60 / 60x60 / 120x60
- Sheet sizes in mm: 1000x1500 / 1500x1500 / 3000x1500
- Thickness in inch: 1/32" / 1/16" / 1/8"
- Thickness in mm: .80 / 1.60 / 3.20
- Special sheet size upon request
- Other thicknesses upon request

General data		
	Binders:	NBR
	Color:	Both sides grey
	Anti-stick coating:	Both sides A300
	Sheet size and thickness tolerance	acc. ASTM F104-03

	Property	Standard	Unit	Values*
Physical properties (Gasket thickn. 0.8mm / 1/32") Physical	Density	DIN 28 090-2	[lbs/ft3]	120
			[g/cm3]	1.9
	Tensile Strength	ASTN F152		
	longitudinal		[psi]	5655
			[N/mm²]	39
	transverse		[psi]	4060
			[N/mm²]	28
	Creep Relaxation	ASTM F38B	[%]	21
	Compressibility	ASTM F 36 J	[%]	9
	Recovery	ASTM F 36 J	[%]	45
	Sealability	ASTM F37	[ml/h]	0.03
	2000 psi / Fuel A 14.5 psig			
	Gas permeability			
	Specific leakage rate	DIN 3535-6	[cc/min]	≤ 0.5
	4640 psi / nitrogen 580 psig			
	Specific leakage rate	DIN 28 090-2	[cc/min]	≤ 0.25
	4640 psi / nitrogen 580 psig (flange)			0.040
	Fluid resistance	ASTM F 146		
	ASTM IRM903	5h / 150°C		
	Weight change		[%]	15
	Thickness increase		[%]	10
	ASTM FUEL B	5h / 23°C		
	Weight change		[%]	14
	Thickness increase		[%]	9
	Leachable Chloride content	Siemens AV-9-014	[ppm]	£ 150

ASTM test results in accordance with ASTM F104; properties based on 1/32" (0.8mm) gasket thickness

*** = Mode (typical value)**

Issue: 12.04

Modifications: 7

The technical data stated has been determined with standard material under laboratory conditions. With the variety of installation and operating conditions no guarantee claim can be inferred regarding the behavior of a flanged joint.
We reserve the right to product changes which serve the purpose of technical progress.

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novapress® FLEXIBLE/815
The adaptable high-pressure gasket with excellent oil resistance.

Material profile

The larger proportion of **n**itrile **b**utadiene **r**ubber (**NBR)** than normal combined with aramide fibres gives novapress® FLEXIBLE/815 the following special properties:

- **Superior oil resistance**
- **Minimum swelling in oils and fuels**
- **Ideal adaptability**
- **Lowest gas leakage at minimum surface pressure**

Identification colour: green/natural colour

Application areas

novapress® FLEXIBLE/815 is the ideal choice for use in "light" flange structures as well as for all applications where particularly good oil resistance is a high priority.

- **Gas and water supply**
- **Plant engineering and equipment manufacturing**
- **Pipeline construction**

Good for people and the environment

Frenzelit has obtained certification that the company complies with the requirements of both ISO/TS 16949 and ISO 14001. This means complete transparency in all areas and a high degree of security for our customers.

Do you have any questions about your application? The gasket information service will help you:

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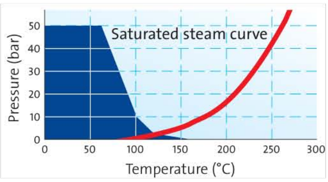
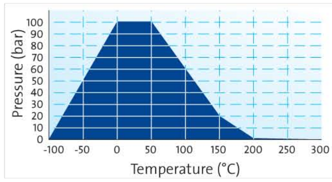
Technical information about novapress® FLEXIBLE/815

Recommendations for use in the most important media groups according to the pressure and temperature

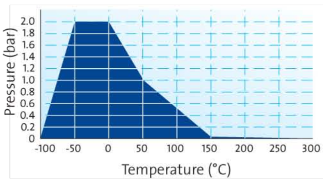
Water/steam



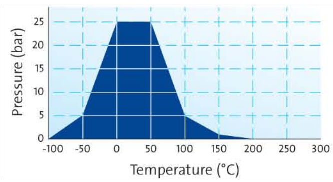
Aqueous solutions



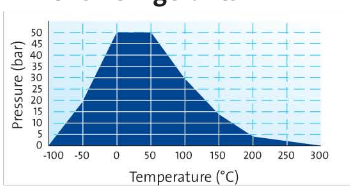
Acids



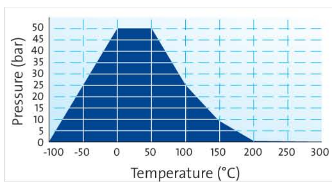
Alkalis



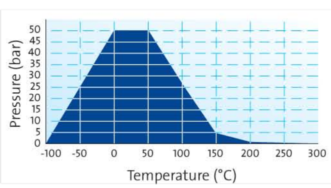
Oils/refrigerants



Solvents



Gases

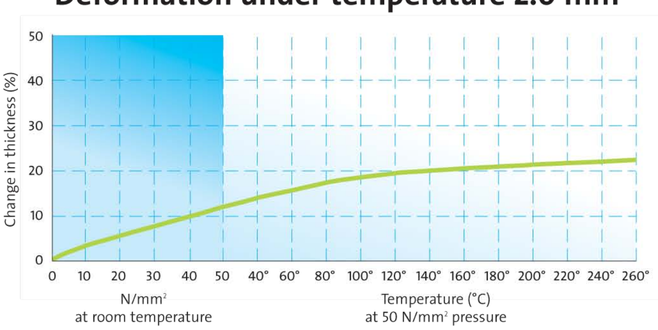


The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

Warranty exclusion

In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance. There is as a result no basis for warranty claims.

Deformation under temperature 2.0 mm



Material data

General data

Binders	NBR
Approvals	DVGW, BAM (up to max. 75°C/100 bar)
Colour	one side green, one side natural coloured
Anti-stick coating	non standard
Sheet size and thickness tolerance	according DIN 28 091-1

Physical properties Gasket thickness 2.0 mm	**Standard**	**Unity**	**Value***
Identification	DIN 28 091-2		FA - A 1 - O
Density	DIN 28 090-2	[g/cm³]	1.35
Tensile strength	DIN 52 910		
longitudinal		[N/mm²]	26
transverse		[N/mm²]	9
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C		[N/mm²]	30
300 °C		[N/mm²]	19
Compressibility	ASTM F 36 J	[%]	8
Recovery	ASTM F 36 J	[%]	64
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	9
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	4
Hot creep $\varepsilon_{WSW/200}$	DIN 28 090-2	[%]	16
Hot recovery $\varepsilon_{WRW/200}$	DIN 28 090-2	[%]	2.5
Recovery R	DIN 28 090-2	[mm]	0.050
Specific leakage rate	DIN 3535-6	[mg/(s·m)]	0.050
Specific leakage rate $\lambda_{2,0}$	DIN 28 090-2	[mg/(s·m)]	0.020
Fluid resistance	ASTM F 146		
ASTM IRM 903	5h/150°C		
Weight change		[%]	9
Thickness increase		[%]	3
ASTM Fuel B	5h/23°C		
Weight change		[%]	11
Thickness increase		[%]	5
Leachable Chloride content	Siemens AV-9-014	[ppm]	≤ 150

* Mode (typical value)

Product data

- Dimensions in mm: 1000 x 1500
  1500 x 1500
  3000 x 1500
- Thicknesses in mm: 0.3/0.5/0.75/1.0/1.5/2.0/3.0/4.0
- Further dimensions and thicknesses are available on request

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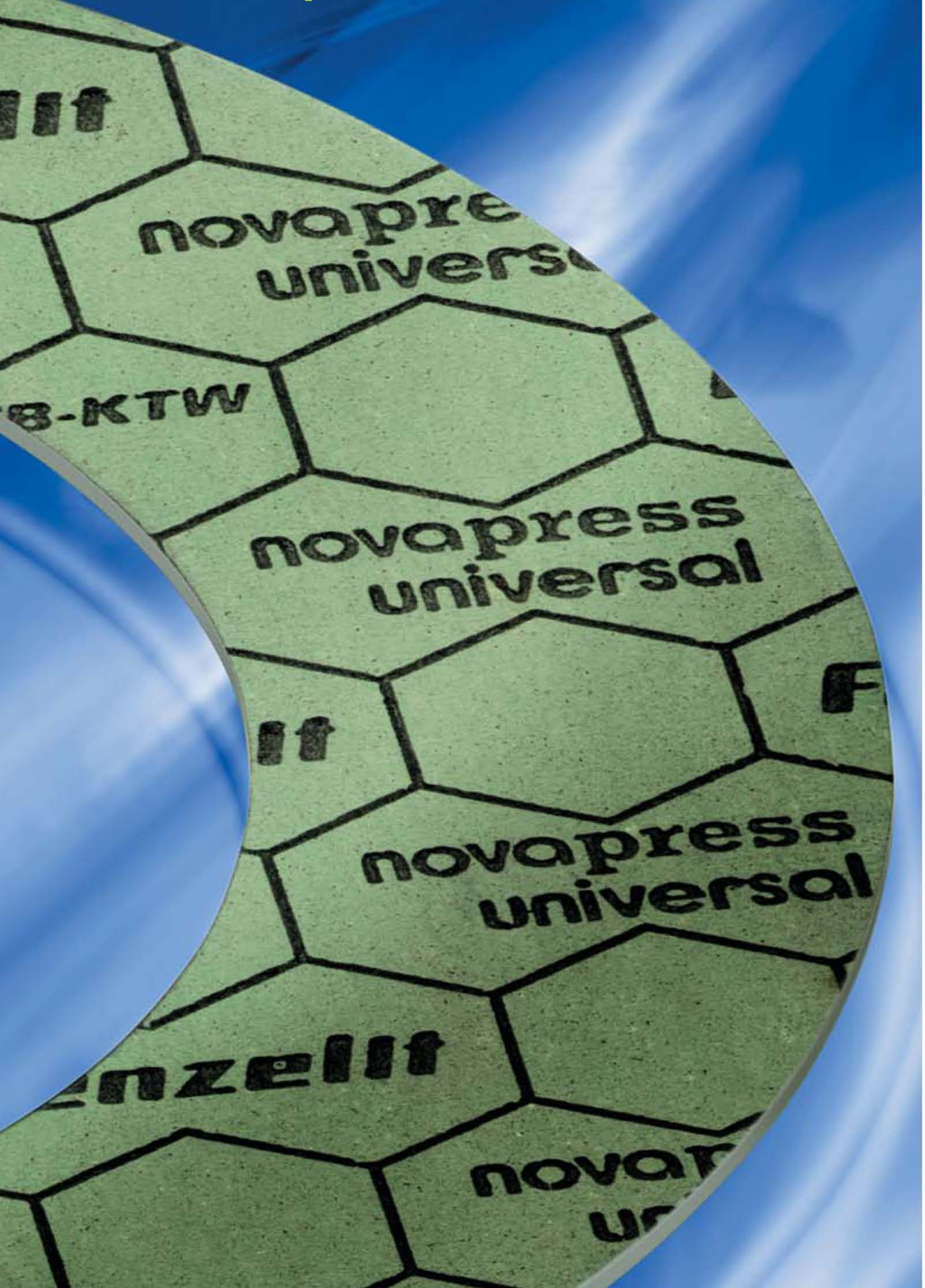
novapress® UNIVERSAL
The all-round high-pressure gasket for higher technical requirements.



Material profile

The balanced raw material combination, consisting of high-quality aramide fibres and special functional fillers bonded with **n**itrile **b**utadiene **r**ubber (**NBR**), gives novapress® UNIVERSAL the following special properties:

- **Good tensile strength**
- **Excellent stress relaxation**
- **Very low gas leakage**
- **Very good oil resistance**

Identification colour: green

Application areas

novapress® UNIVERSAL is the ideal choice for use under higher temperature and pressure conditions as well as with uncritical gaseous and liquid media.

- **Pipeline construction**
- **Chemical industry**
- **Plant engineering, machine and equipment manufacturing**
- **Beverage and food industry**

Good for people and the environment

Frenzelit has obtained certification that the company complies with the requirements of both ISO/TS 16949 and ISO 14001. This means complete transparency in all areas and a high degree of security for our customers.

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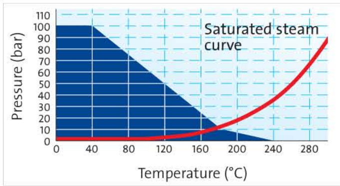
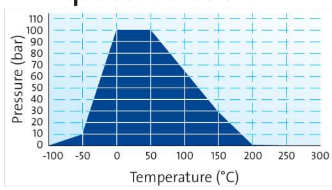
Technical information about novapress® UNIVERSAL

Recommendations for use in the most important media groups according to the pressure and temperature

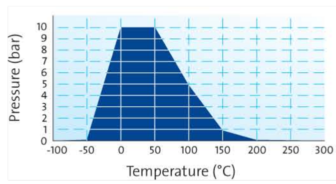
Water/steam



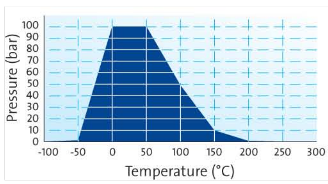
Aqueous solutions



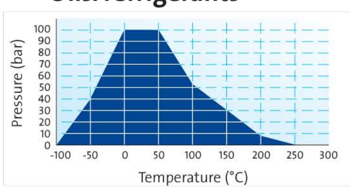
Acids



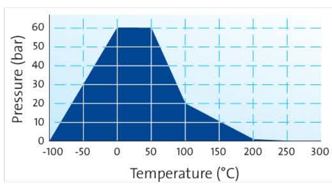
Alkalis



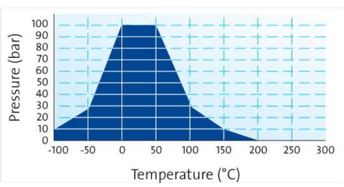
Oils/refrigerants



Solvents



Gases

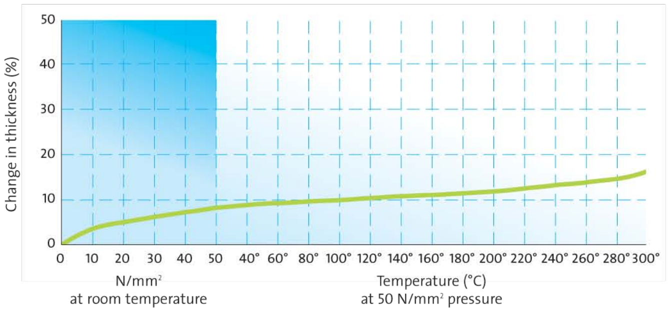


The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

Warranty exclusion

In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance. There is as a result no basis for warranty claims.

Deformation under temperature 2.0 mm



Material data

General data

Binders	NBR
Approvals	DVGW, HTB, KTW, WRC, BAM (up to max. 60°C/130 bar)
Colour	both sides light-green
Anti-stick coating	both sides PTFE
Sheet size and thickness tolerance	according DIN 28 091-1

Physical properties Gasket thickness 2.0 mm	Standard	Unity	Value*
Identification	DIN 28 091-2		FA - MA 1 - O
Density	DIN 28 090-2	[g/cm³]	1.80
Tensile strength	DIN 52 910		
longitudinal		[N/mm²]	27
transverse		[N/mm²]	10
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C		[N/mm²]	39
300 °C		[N/mm²]	25
Compressibility	ASTM F 36 J	[%]	7
Recovery	ASTM F 36 J	[%]	65
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	6
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	3
Hot creep $\varepsilon_{WSW/200}$	DIN 28 090-2	[%]	5.5
Hot recovery $\varepsilon_{WRW/200}$	DIN 28 090-2	[%]	2
Recovery R	DIN 28 090-2	[mm]	0.040
Specific leakage rate	DIN 3535-6	[mg/(s·m)]	≤ 0.100
Specific leakage rate $\lambda_{2,0}$	DIN 28 090-2	[mg/(s·m)]	0.100
Fluid resistance	ASTM F 146		
ASTM IRM 903	5h/150°C		
Weight change		[%]	6
Thickness increase		[%]	2
ASTM Fuel B	5h/23°C		
Weight change		[%]	7
Thickness increase		[%]	6
Leachable Chloride content	Siemens AV-9-014	[ppm]	≤ 150

* Mode (typical value)

Product data

- Dimensions in mm: 1000 x 1500
  1500 x 1500
  3000 x 1500
- Thicknesses in mm: 0.3/0.5/0.75/1.0/1.5/2.0/3.0/4.0
- Further dimensions and thicknesses are available on request

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novapress® BASIC
The high-pressure gasket for standard applications.

Material profile

The balanced raw material combination, consisting of high-quality aramide fibres, special fillers and **n**itrile-**b**utadiene-**r**ubber (**NBR**), gives novapress® BASIC the following special properties:

- **Good media resistance**
- **Good stress relaxation**
- **High pressure resistance**
- **Excellent value for money**

Identification colour: orange

Application areas

novapress® BASIC is the ideal choice for use under average temperature and pressure conditions.

- **Sanitary engineering (gas and water supply)**
- **Pipeline construction**
- **Plant engineering**
- **Machine manufacturing**

Good for people and the environment

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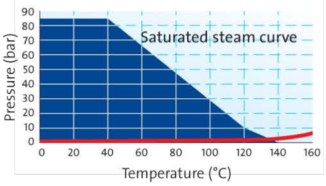
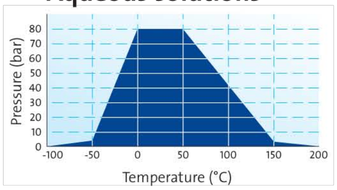
Technical information about novapress® BASIC

Recommendations for use in the most important media groups according to the pressure and temperature

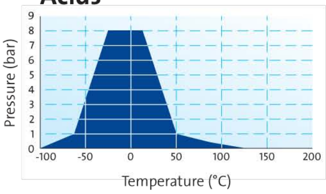
Water/steam



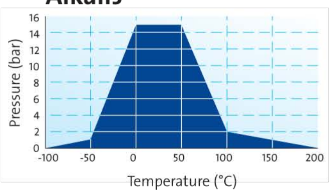
Aqueous solutions



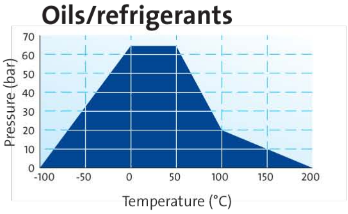
Acids



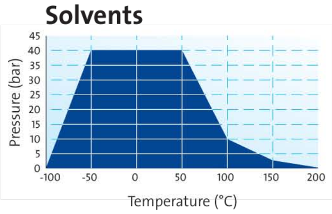
Alkalis



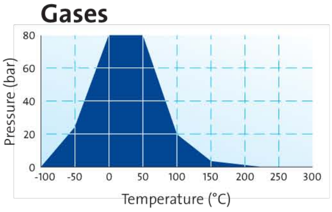
Oils/refrigerants



Solvents



Gases

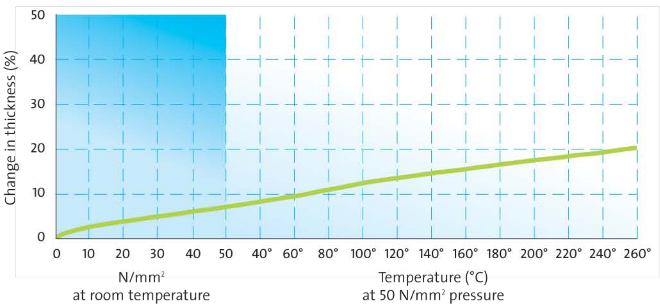


The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

Warranty exclusion

In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance. There is as a result no basis for warranty claims.

Deformation under temperature 2.0 mm



Material data

General data

Binders	NBR
Approvals	DVGW, HTB, KTW, VP-401, WRC
Colour	both sides orange
Anti-stick coating	serially one side anti-stick coating
Sheet size and thickness tolerance	according DIN 28 091-1

Physical properties Gasket thickness 2.0 mm	Standard	Unity	Value*
Identification	DIN 28 091-2		FA - MA1 - O
Density	DIN 28 090-2	[g/cm³]	1.75
Tensile strength	DIN 52 910		
longitudinal		[N/mm²]	14
transverse		[N/mm²]	6
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C		[N/mm²]	30
300 °C		[N/mm²]	17
Compressibility	ASTM F 36 J	[%]	8
Recovery	ASTM F 36 J	[%]	60
Cold compressibility ε_{KSW}	DIN 28 090-2	[%]	8
Cold recovery ε_{KRW}	DIN 28 090-2	[%]	3
Hot creep $\varepsilon_{WSW/200}$	DIN 28 090-2	[%]	22
Hot recovery $\varepsilon_{WRW/200}$	DIN 28 090-2	[%]	2
Recovery R	DIN 28 090-2	[mm]	0.040
Specific leakage rate	DIN 3535-6	[mg/(s·m)]	≤ 0.100
Specific leakage rate $\lambda_{2,0}$	DIN 28 090-2	[mg/(s·m)]	0.100
Fluid resistance	ASTM F 146		
ASTM IRM 903	5h/150°C		
Weight change		[%]	7
Thickness increase		[%]	2
ASTM Fuel B	5h/23°C		
Weight change		[%]	7
Thickness increase		[%]	4
Leachable Chloride content	Siemens AV-9-014	[ppm]	≤ 150

* Mode (typical value)

Product data

- Dimensions in mm: 1000 x 1500
  1500 x 1500
  3000 x 1500
- Thicknesses in mm: 0.3/0.5/0.75/1.0/1.5/2.0/3.0/4.0
- Further dimensions and thicknesses are available on request

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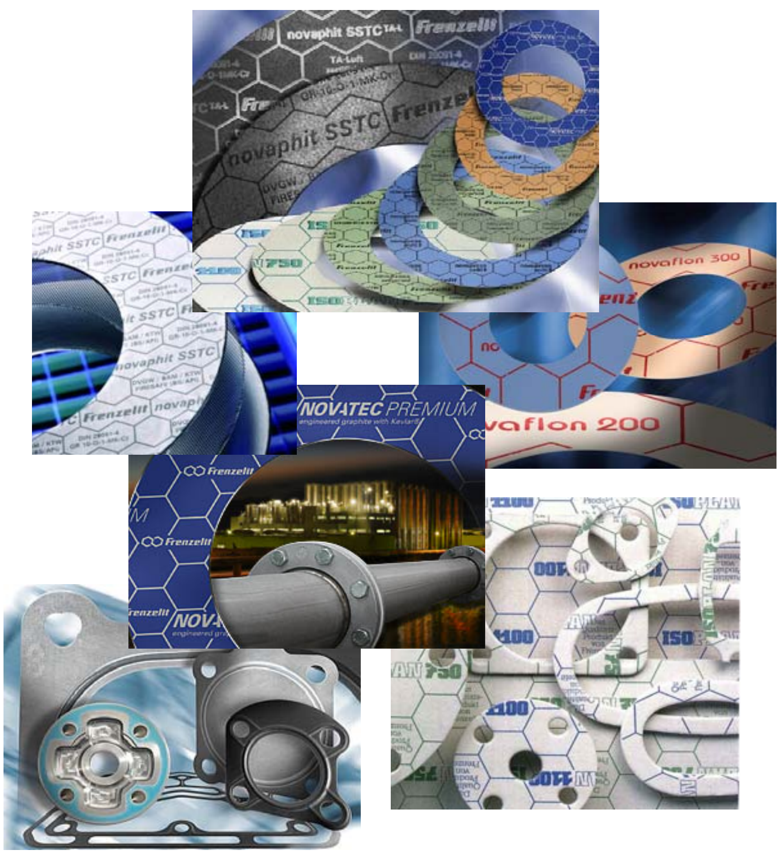
Section 7

Novaform®

High Temperature Materials



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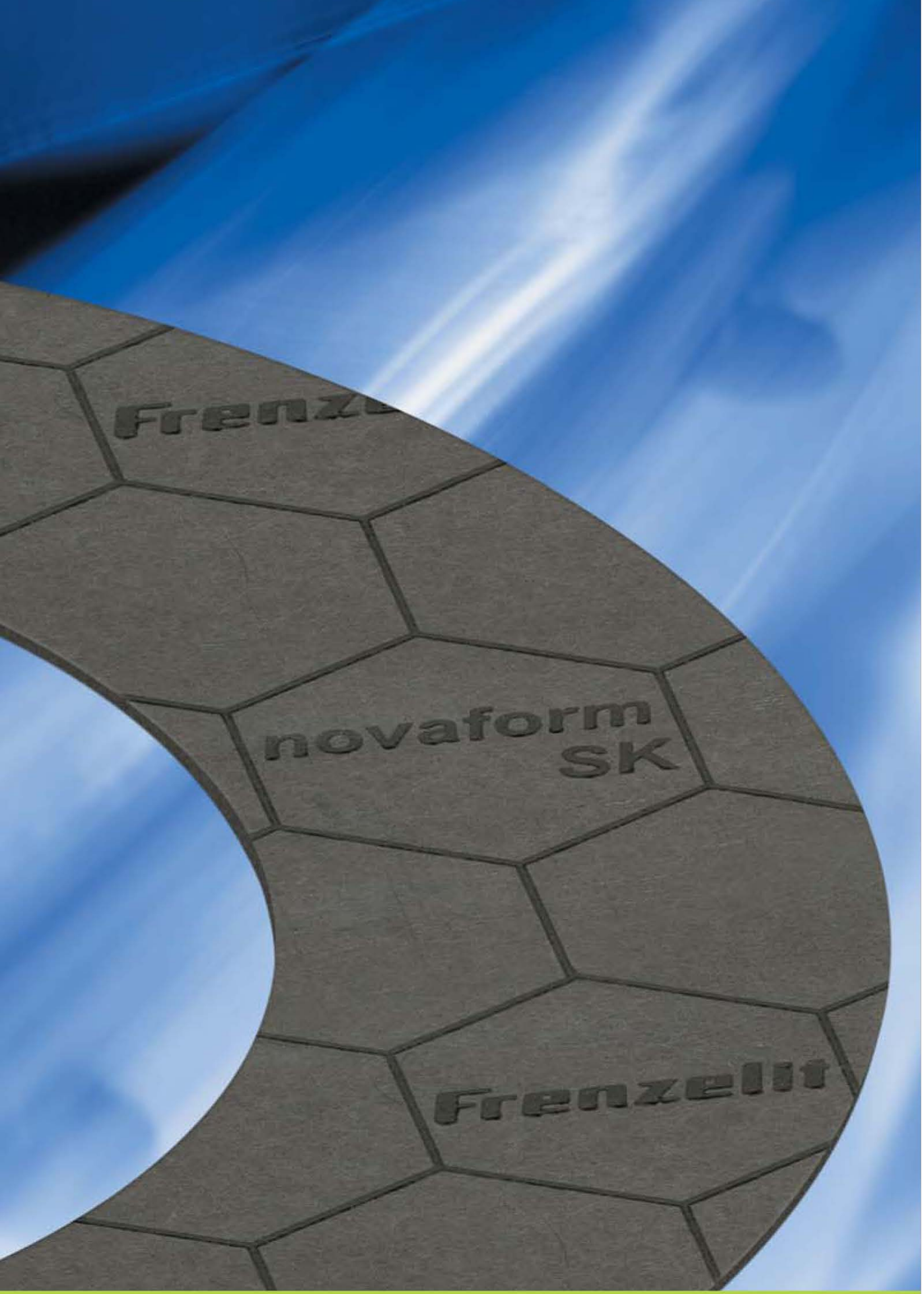
novaform® SK
The industrial exhaust gasket for extremely tough mechanical conditions.



Material profile

High-quality aramid fibres and functional fillers are the basic materials used to manufacture novaform® SK, reinforced by a galvanised zigzag twill fabric (1.0314), homogeneously embedded in an NBR matrix.

Materials with excellent properties are produced from this raw material blend:

- **extremely high tensile strength**
- **outstanding pressure resistance**
- **maximum temperature stability**
- **unique mechanical resistance and reliability**
- **stable long-term sealing properties, even under extreme conditions**

Application areas

novaform® SK is the ideal choice for use in the exhaust section of diesel engines, for example in shipbuilding:

- **for extreme thermal and mechanical conditions, particularly for hot exhaust fumes, e.g. for exhaust systems, exhaust turbochargers, compressors**
- **can be combined very effectively with inner eyelet to improve performance**

Good for people and the environment

Frenzelit has obtained certification that the company complies with the requirements of both ISO/TS 16949 and ISO 14001. This means complete transparency in all areas and a high degree of security for our customers.

Do you have any questions about your application? The gasket information service will help you:

info@frenzelitsealing.com

GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

INSULATION

NEW MATERIALS

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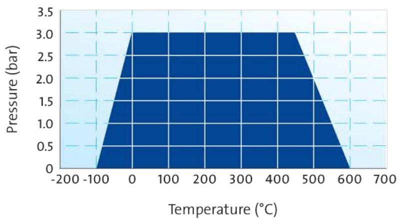
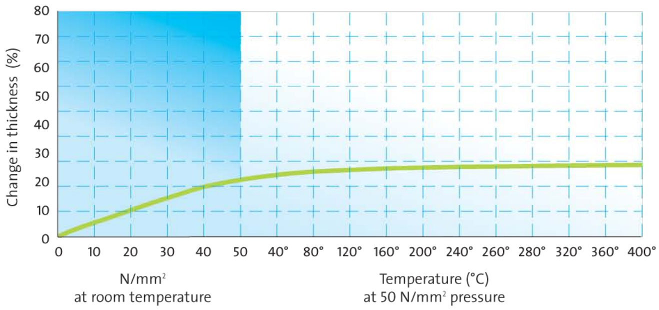
Technical information about novaform® SK

Recommendation for hot exhaust fumes



Deformation under temperature 2.0 mm



The temperature and pressure recommendations in the graphs apply to gaskets with a thickness of 2.0 mm and smooth flanges. Higher stresses are possible when thinner gaskets are used!

Exact data for specific individual cases are available in the Frenzelit novaDISC programme or contact our application engineering specialists.

Warranty exclusion
In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance. There is as a result no basis for warranty claims.

Material data

General Data

Binders	NBR
Colour	rolled-on graphite layer
Anti-stick coating	both sides black (dark grey)
Sheet size and thickness tolerance	acc. DIN 28 091-1

Physical properties Gasket thickness 2.0 mm	**Standard**	**Unity**	**Value***
Identification	28 091-2		FA-A 13-St
Density	DIN 28 090-2	[g/cm³]	1.90
Tensile strength	DIN 52 910		
longitudinal		[N/mm²]	20
transverse		[N/mm²]	19
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C		[N/mm²]	41
300 °C		[N/mm²]	40
Compressibility	ASTM F 36 J	[%]	20
Recovery	ASTM F 36 J	[%]	32
Fluid resistance	ASTM F 146		
ASTM IRM 903	5h/150 °C		
Weight change		[%]	25
Thickness increase		[%]	2
ASTM Fuel B	5h/23 °C		
Weight change		[%]	20
Thickness increase		[%]	2
Coolant/Water (50:50)	5h/100 °C		
Weight change		[%]	30
Thickness increase		[%]	3

* = Mode (typical value)

Product data

- Dimensions in mm: 1000 x 1000 as roll section
- Thicknesses in mm: 0.8/1.0/1.2/1.5/2.0/3.0
- further dimensions and thicknesses are available on request

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Technical Data Sheet

Novaform STF

Material profile:	Typical applications:
• Asbestos-free special material with a solid insert made of galvanized iron expanded metal (material-no. 1.0338) • Anti-stick coating available upon request	• For extreme mechanical and thermal applications, especially hot exhaust fumes, as in exhaust systems, exhaust turbo-chargers, compressors • Preferably used in combination with a metal envelope

Supply data:

- Sheet sizes in mm: 1000x1000 as roll section
- Thickness in mm: 0.60 / 0.80 / 1.00 / 1.20 / 1.50 / 1.80 / 2.00
- Special sheet sizes upon request
- Other thicknesses upon request

General data	Binders: Anti-stick coating: Color:	NBR / NR rolled-on graphite layer/both faces A300 blue upon request both faces black (dark grey) / both faces blue		
	Property	**Standard**	**Unity**	**Value ***
Physical properties (Gasket thickn. 1.20mm)	Density	DIN 28 090-2	[g/cm³]	1.80
	Tensile strength	DIN 52 910		
	longitudinal		[N/mm²]	9
	transverse		[N/mm²]	22
	Residual stress $\sigma_{dE/16}$	DIN 52 913		
	175°C		[N/mm²]	45
	300°C		[N/mm²]	44
	Compressibility	ASTM F 36 J	[%]	15
	Recovery	ASTM F 36 J	[%]	44
	Fluid resistance	ASTM F 146		
	<u>ASTM IRM903</u>	5h/150°C		
	Weight change		[%]	27
	Thickness increase		[%]	2
	<u>ASTM Fuel B</u>	5h/23°C		
	Weight change		[%]	21
	Thickness increase		[%]	2
	<u>Coolant/Water (50:50)</u>	5h/100°C		
	Weight change		[%]	32
	Thickness increase		[%]	4

***** = Mode (typical value)
Issue: 02.04
Modifications: 7

The technical data stated has been determined with standard material under laboratory conditions. With the variety of installation and operating conditions no guarantee claim can be inferred regarding the behavior of a flanged joint.
We reserve the right to product changes which serve the purpose of technical progress.

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Technical Data Sheet

Novaform 210

Material profile:

- Universally acceptable gasket material for standard applications in all types of media.
- The main components are high quality fillers, organic fibers, bound with a vulcanized Nitrile Butadiene Rubber (NBR).

Typical applications:

- Soft gaskets for general use. Low and medium loads.

Supply Data:

Sheet size in inches:	40" x 80"	**Thickness in inches:**	**0.040 / 0.060 / 0.080 / 0.120**
Sheet size in mm:	1000 x 2000	**Thickness in mm:**	**1.00 / 1.50 / 2.00 / 3.00**

Other thickness' available upon request.

Material Characteristics:

General Data	Binders:	NBR
	Color:	Black
	Surface:	with A310 Black Anti Stick & Branding

	Property	Standard	Unity	Value *
Physical properties for sample thickness <u>0.062"</u> <u>1.5mm</u>	Density	DIN 28 090-2	[g/cm³]	1,60*
		ASTM F-104	(lbs/ft)	100
	Tensile Strength	ASTM F-152	[psi]	1500
	Creep Relaxation @ 175 C	DIN 52 913		
	Retained Stress		[N/mm²]	≈ 32*
	Compressibility @ 5000 psi	ASTM F 36 J	[%]	≈ 15*
	Recovery	ASTM F 36 J	[%]	≥ 50
	Fluid Resistance	ASTM F 146		
	ASTM IRM903	5 h / 300 °F		
	Weight Change		[%]	≈ 14*
	Thickness Increase		[%]	≈ 6*
	ASTM FUEL B	5 h / 73 °F		
	Weight Change		[%]	≈ 14*
	Thickness Increase		[%]	≈ 6*
	COOLANT : WATER (50:50)	5 h / 212 °F		
	Weight Change		[%]	≈ 30*
	Thickness Increase		[%]	≈ 15*
	Sealability			
	ASTM F37A	2000 psi	[ml/hr]	0.24

***** = Mode (typical value)
Issue: 02.04
Modifications: 2

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Technical Data Sheet

Novaform 231

Material profile:
- Asbestos-free material with high oil resistance and very low compression set under pressure and temperature

Typical applications:
- Secondary gasket with medium mechanical load
- valve cover gasket

Supply data:
- Sheet sizes in mm: 1000x1500 / 1500x1500 / 3000x1500
- Thickness in mm: 0.50 / 1.00 / 1.50 / 2.00
- Special sheet sizes upon request
- Other thicknesses upon request

General data	Binders:	NBR		
	Anti-stick coating:	non standard		
	Color:	one side green, one side yellow with branding		
	Property	**Standard**	**Unity**	**Value ***
Physical properties (Gasket thickn. 1.50mm)	Density	DIN 28 090-2	[g/cm³]	1.60
	Tensile strength	DIN 52 910		
	longitudinal		[N/mm²]	37
	transverse		[N/mm²]	10
	Residual stress $\sigma_{dE/16}$	DIN 52 913		
	175°C		[N/mm²]	38
	300°C		[N/mm²]	30
	Compressibility	ASTM F 36 J	[%]	8
	Recovery	ASTM F 36 J	[%]	60
	Fluid resistance	ASTM F 146		
	ASTM IRM903	5h/150°C		
	Weight change		[%]	12
	Thickness increase		[%]	4
	ASTM Fuel B	5h/23°C		
	Weight change		[%]	12
	Thickness increase		[%]	6
	Coolant/Water (50:50)	5h/100°C		
	Weight change		[%]	11
	Thickness increase		[%]	2

***** = Mode (typical value)
Issue: 02.04
Modifications: 2
Supersedes all prior versions

The technical data stated has been determined with standard material under laboratory conditions. With the variety of installation and operating conditions no guarantee claim can be inferred regarding the behavior of a flanged joint. We reserve the right to product changes which serve the purpose of technical progress.

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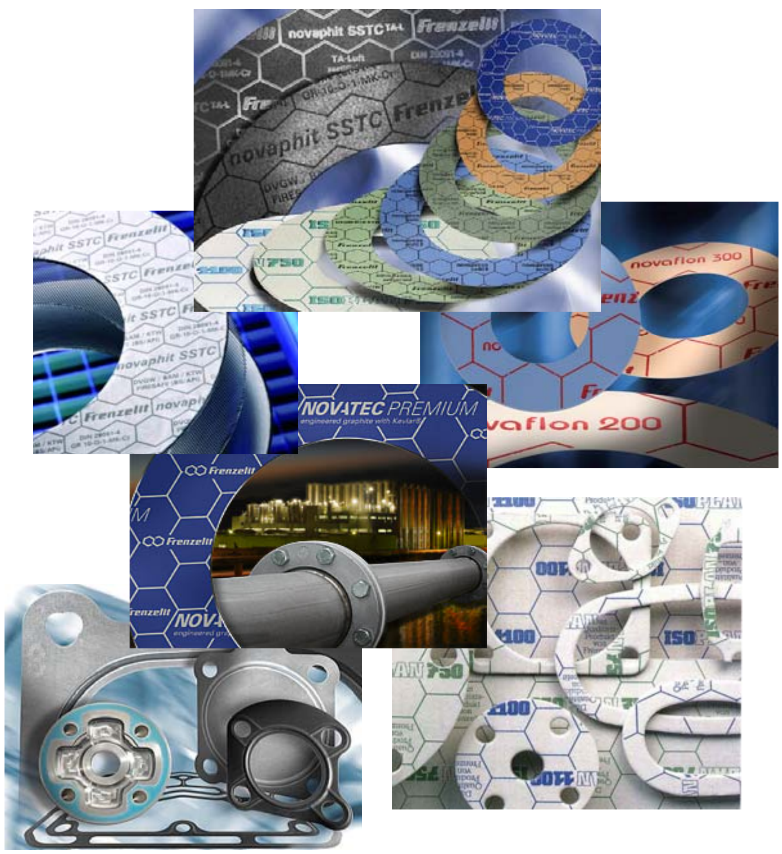
Section 8

Novaform® GB

High Performance Rubber Coated Metal



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novaform® GB
High Performance
Metal Bead Gaskets

GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

INSULATION

NEW MATERIALS

Material profile

High performance metal bead gaskets novaform® GB consist of thin sheet metal with or without elastomeric coating applied in a coil-coating process. The gaskets are stamped and embossed in a sequential cutting machine.

- **For small bridges**
- **Even at low surface pressures**
- **Almost no setting – permanently tight**

Preformed beads in novaform® GB ensure the macro adaptation of the metal gaskets to the sealing surfaces. A special elastomer coating on the steel sheet ensures the gaskets' micro sealing. The combination of different materials guarantees that the joint is permanently tight even with low bolt loads or unfavourable thermal and mechanical conditions.

Application areas

- **Automotive secondary gaskets**
  - **passenger vehicle engines**
  - **commercial vehicle engines**
  - **engine components**
  - **exhaust systems**
  - **powertrain**
- **Industrial applications**
  - **gearboxes**
  - **compressors**
  - **pumps**
  - **motors**
  - **other aggregates**

Good for people and the environment

Frenzelit has obtained certification that the company complies with the requirements of both ISO/TS 16949 and ISO 14001. This means complete transparency in all areas and a high degree of security for our customers.

Do you have any questions about your application? The gasket automotive information service will help you:

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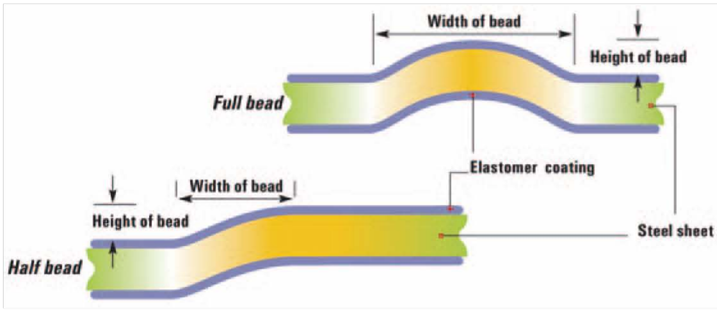
Technical information about novaform® GB

Design

The material consists of a steel sheet and an elastomer coating on both sides.



Design possibilities

Base material

Materials	Base materials	Thicknesses
novaform® GBS	carbon steel	0.25 mm
novaform® GBC	stainless steel, rolled to higher tensile strength	0.20/0.25/0.30 mm

Further base materials and thicknesses are available on request.

Coatings

Coatings	Thicknesses of coating	
NBR	25 / 35 / 50 µm	black, optional with green covering colour
FPM	20 / 30 µm	with blue covering colour on one side
HTC	10 / 20 µm	high-temperature coating

Further thicknesses of coating and materials are available on request.

Example

novaform® GBS – bs NBR TYP 25/XX

General data

Colour	black
Material no	1.0330
Anti-stick coating	standard PTFE based coating on both sides

Physical properties Gasket thickness 0.33 mm	Standard	Unit	Value*
Thickness of base material		[mm]	0.25
Thickness tolerance	B acc. DIN EN 10 140		
novaform® GBS-bs NBR TYP 25 / 50			
total thickness of coating		[mm]	0.060 ± 0.010
total thickness		[mm]	0.37
novaform® GBS-bs NBR TYP 25 / 35			
total thickness of coating		[mm]	0.042 ± 0.007
total thickness		[mm]	0.33
novaform® GBS-bs NBR TYP 25 / 25			
total thickness of coating		[mm]	0.032 ± 0.007
total thickness		[mm]	0.31
Tensile strength	EN 10002 T1	[N/mm²]	565 ± 75
Temperature resistance (following the automotive specification)	Frenzelit 0110019	[°C]	-25/+160
Chemical resistance	ASTM F 146		
Engine Oil SAE 10 W 40	5 h / 150 °C		
Change in thickness		[%]	1*
Change in weight		[%]	1*
ASTM Fuel B	5 h / 23 °C		
Change in thickness		[%]	10*
Change in weight		[%]	2*
Water / Glycol (50:50)	5 h / 100 °C		
Change in thickness		[%]	7*
Change in weight		[%]	2*

* Mode (typical value)

Material profile

- Cold rolled strip DC 01 C490 to DIN EN 10140, steel thickness 0.25 mm
- Steel sheet with highly oil and fuel resistant NBR coating as well as anti-stick coating
- To be used as cut gaskets and/or gaskets with beads
- Available with half or full beads with a typical height of 100 to 400 µm and a width of 1.5 to 2.5 mm

Engineering and Service

Frenzelit is specialised in manufacturing gaskets to specification. With state-of-the-art technical systems at hand, e.g. various CAD systems and a FEM simulation software, the required products can be adjusted to the exact requirements of the applications in question. Prototypes for testing purposes are manufactured in small lot sizes and at short notice. In this way we are able to develop the best possible solutions for all kinds of flat gasket applications for and together with our customers.

GASKETS
TECHNICAL TEXTILES
EXPANSION JOINTS
INSULATION
NEW MATERIALS

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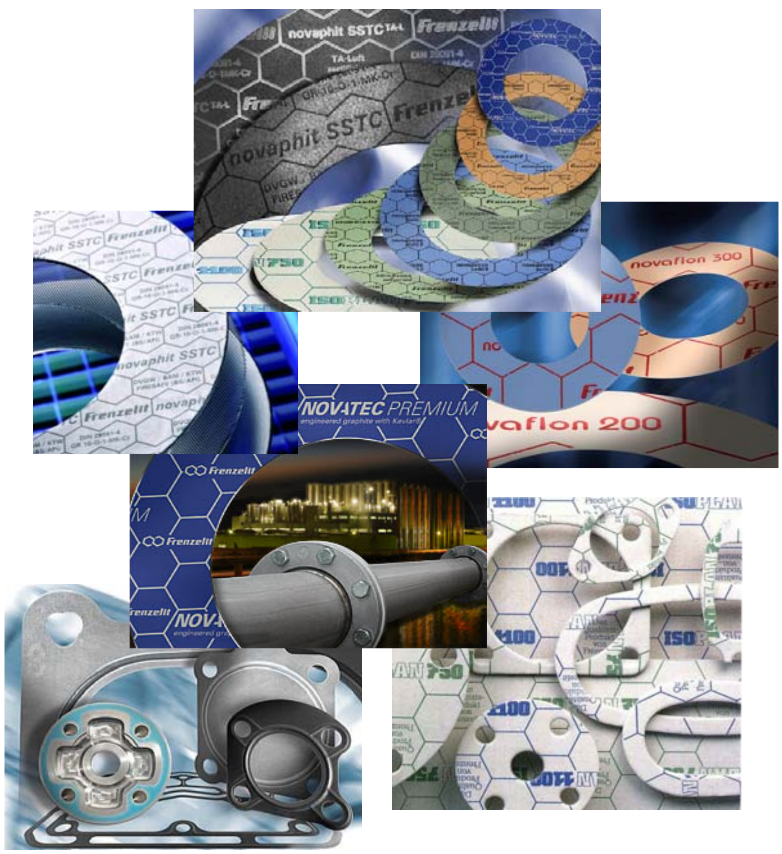
Section 9

Isoplan®

Thermal Insulation Materials



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isoplan®

Innovative, environmentally friendly insulation materials.

GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

INSULATION

NEW MATERIALS

Material profile

Special high-performance biodegradable, mineral and ceramic fibres are the basic material used to manufacture isoplan® products. When combined with appropriate fillers and binders, the result is high continuous temperature resistance which leads to low heat conductivity and very good insulation properties.

The organic binding agents escape in the temperature range between 300° C and 400° C and a sintering process takes place (isoplan® 750/1000 at about 600° C, isoplan® 1100 at about 750° C), which guarantees long-term material strength in high-temperature applications. The discolouration of the material associated with this disappears again at higher temperatures. It is advisable to enclose the material when it is being used for insulation applications in unsupported or vibrating systems.

Application areas

The very high application temperature limits and the low heat conductivity properties determine the application areas for isoplan® as an insulation material and flat gaskets. The following list includes a number of typical examples of the many possible uses:

- **Steel industry**
- **Foundries**
- **Industrial furnace and boiler manufacturing**
- **Hearth flaps, fireproof doors**
- **Heating and drying equipment**
- **Machine and equipment manufacturing**
- **Electrical equipment**
- **Glass industry**

Good for people and the environment

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Do you have any questions about your application?
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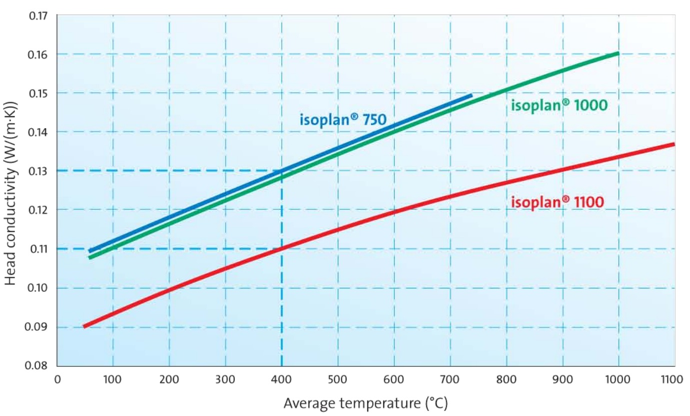
Technical information about isoplan®

Insulation materials and flat gaskets made from isoplan®

isoplan® products have a homogeneous material structure and are suitable not only for high-temperature insulation applications but also to provide sealing against inert gases up to 500 mbar.

When isoplan® is used as an insulation material, surface pressure levels of 10 N/mm² should not be exceeded. Higher surface pressure can be exerted in applications as a flat gasket in high-temperature ranges.

Heat conductivity – the property that counts

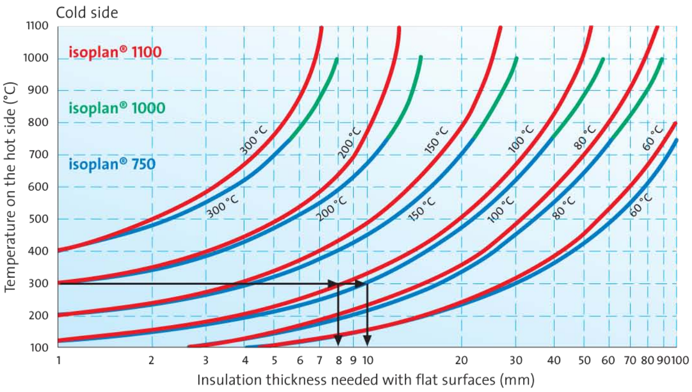


The key criterion for evaluation of an insulation material apart from high temperature resistance is heat conductivity. The heat conductivity level indicates the heat (in watts) that flows through a material 1 m thick with a surface area of 1 m² and with a temperature difference between the surfaces of 1 Kelvin (unit: W/(m·K)).

The lower this figure, the better the insulating properties a material has.

The changes in the heat conductivity level can be seen in the graph – they are taken from the test reports issued by the heat insulation research institute, Munich.

Insulation graph



With the help of the curves in this graph, the insulation thickness needed for a specific product at defined temperatures on the "hot" and "cold" side of a flat surface can be determined.

In the example shown, the thicknesses required are 8 mm for isoplan® 1100 and 10 mm for isoplan® 750 and isoplan® 1000.

Material characteristics

General information	isoplan® 750	isoplan® 1000	isoplan® 1100
Temperature limit	750 °C	1000 °C	1100 °C
Colour	white	white	white
Tolerance in thickness	± 10 %	± 10 %	± 10 %

Physical properties Sample thickness 5.0 mm	Standard	Unit	Value*	Value*	Value*
Density	DIN 28 090-2	[g/cm³]	0.94	0.94	0.91
Tensile strength	DIN 52 910				
longitudinal		[N/mm²]	3.5	4	4
transverse		[N/mm²]	1,5	2	2
Compressibility	ASTM F 36 K	[%]	≤ 25	≤ 25	≤ 25
Recovery	ASTM F 36 K	[%]	≥ 25	≥ 30	≥ 30
Loss on ignition	DIN 52 911	[%]	17	17	17
Decrease in thickness	1h/800 °C	[%]	≤ 2.5	≤ 7.5	2.5
Shrinkage by surface	1h/800 °C				
longitudinal		[%]	≤ 2	≤ 2	≤ 2
transverse		[%]	≤ 2	≤ 2	≤ 2
Heat conductivity at 400 °C		[W/(m·K)]	0.13	0.13	0.11

* Modal value (typical value)

Product Data

- Dimensions in mm: 1000 x 1000
- Thicknesses in mm: 1.5/2.0/3.0/4.0/5.0/6.0/8.0/10.0
- Further dimensions and thicknesses are available on request

Packaging

Products with the standard dimensions of 1 000 x 1 000 mm are packaged in corrugated board cartons containing 100 kg each. The product name, thickness number of sheets and weight are indicated clearly on the carton.

Warranty exclusion
In view of the variety of different installation and operation conditions and application and process engineering options, the information given in this prospectus can only provide approximate guidance. There is as a result no basis for warranty claims.

GASKETS
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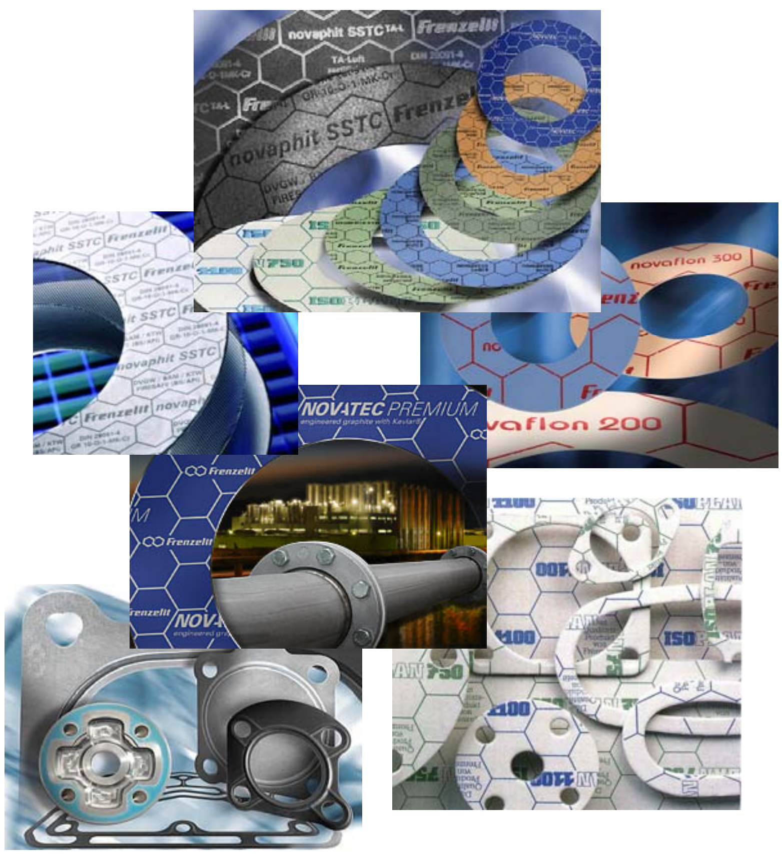
Section 10

Novaplan® 70 / N-5408 / N-7729

Beater Addition Cellulose Fiber Reinforced Gasket Materials



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N-5408

Frenzelit has developed a gasket material composed of multiple fiber types, which are then chemically blended with multiple elastomer types to address the industrial markets need for a universal conformable product. The result is a high performance sealing solution that is used in a wide range of applications. Frenzelit uses the beater addition method to produce this homogenous product in roll form in a variety of gauges.

Thickness Tested	0.031"	0.8mm
Temperature Rating	400F	210 C
Density	80 lb./ft 3	1.3 g/cm 3
Tensile ASTM F 152-87	1000 psi	6.0 MPa
Compression 5000 psi / 34.5 MPa	20%	20%
Recovery ASTM F36 A	40%	40%
Creep Relaxation ASTM F38 B / 22h 212 F.	25%	25%
Fluid Immersions ASTM F 146 Thickness Increase		
ASTM FUEL B 5 hrs. @ 70 Degrees F.	25%	25%
ASTM Oil # 3 5 hrs. @ 300 Degrees F.	27%	27%
Water / Coolant 50/50 72 hrs. @ 212 F.	25%	25%

Sealability / ASTM F37			
1000 psi 30 in Hg, ml/hr	Fuel A	1.0	6.9 Mpa 762mm Hg, ml/hr
1000 psi / 60 psi cc/min	Nitrogen	24.0	6.9 Mpa / 0.4MPa cc/min

The numbers shown above are the results of tests performed on multiple production runs. Due to the extensive variations in potential application and operating conditions, no warranties are offered or implied. Published data is offered as a guideline for anticipated performance. It is strongly suggested that tests be performed in an application environment to determine suitability for use.

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N-7729

The Frenzelit N-7729 offers excellent torque retention, resistance to extrusion and superior sealability. Nitrile rubber and Kevlar® fibers are combined to create an economic solution to a myriad of demanding applications. The N-7729 is further recommended for use in flanges that require a soft conformable gasket material and where the typical application environment includes elevated temperatures and significant loading.

Thickness Tested	0.031“	0.8mm
Density lbs./ ft.3	91 lb/ft3	1.5 g/cm3
Tensile ASTM F-152-87	2000 psi	13.8 MPa
Compression 5000 psi / 34.5 Mpa	12%	12%
Recovery ASTM F36	64%	64%
Creep Relaxation ASTM F38 B @ 22h 212 F.	18%	18%
Fluid Immersions ASTM F146		
ASTM FUEL B 5 hours @ 70 F		
Weight Increase	13%	13%
Thickness Increase	4%	4%
ASTM Oil # 3 5 hours @ 300 F		
Thickness Increase	3%	3%
Sealability / ASTM F37		
1000 psi 30 in Hg ml/hr Fuel A	1.7	6.9 MPa 762mm Hg, ml/hr.
1000 psi / 60 psi cc/min Nitrogen	6.8	6.9 MPa / 0.4MPa cc/min

The numbers shown above are the results of tests performed on multiple production runs. Due to the extensive variations in potential application and operating conditions, no warranties are offered or implied. Published data is offered as a guideline for anticipated performance. It is strongly recommended that tests be performed in an application environment to determine suitability for use.

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Technical Data Sheet

Novaplan 70

Material profile:
- Facing material for cylinder head gaskets
- The main components are fibers, high-quality fillers, bound with NBR rubber
- can be used without impregnation
- compatible with all known materials for silk screening / top coating

Typical applications:
- Steel-reinforced soft material for tanged metal / flat sheet technology especially for the aftermarket
- Secondary gaskets
- intake manifold
- Otto carburetor engines

Supply data:

Rolls	• 1000 / 1010 or 2000 / 2020mm	Thickness	• from 0.50 to 1.60mm
Outer diameter	• 700mm	Weight / unit area	• 600 - 1825g/m² (± 4%)
Coils	• from 150 to 2020mm wound on paper coils - inner diameter 70mm or 100mm • Special sizes upon request		

General data	Binders:	NBR, sulphur-free
	Branding	without branding
	Anti-stick-coating	optional Anti-Sticking-Coating, A310 black
	Color:	dark-grey
	State of vulcanization:	vulcanized

	Property	Standard	Unity	Value *
Physical properties (Gasket thickn. 0.80mm)	Density	DIN 28 090-2	[g/cm³]	1.15
	Tensile strength	DIN 52 910		
	longitudinal		[N/mm²]	7.5
	transverse		[N/mm²]	4.5
	Residual stress $\sigma_{dE/16}$	DIN 52 913		
	175°C		[N/mm²]	42
	Compressibility	ASTM F 36 J	[%]	35
	Recovery	ASTM F 36 J	[%]	20
	Loss on ignition	DIN 52 911	[%]	31
	Fluid resistance	ASTM F 146		
	ASTM IRM903	5h/150°C		
	Weight change		[%]	30
	Thickness increase		[%]	3
	ASTM Fuel B	5h/23°C		
	Weight change		[%]	25
	Thickness increase		[%]	2.5
	Coolant/Water (50:50)	5h/100°C		
	Weight change		[%]	45
	Thickness increase		[%]	7

***** = Mode (typical value)
Issue: 11.05
Modifications: 4
Supersedes all prior versions

The technical data stated has been determined with standard material under laboratory conditions. With the variety of installation and operating conditions no guarantee claim can be inferred regarding the behavior in a specific application.
We reserve the right to product changes which serve the purpose of technical progress.

FRENZELIT SEALING SYSTEMS, INC.
16550 West Ryerson Road - New Berlin, WI 53151
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Technical Data Sheet

Novaplan 02816

Material profile:

- Soft material with open pores for cylinder head gaskets
- The main components are aramid fibers, mineral fibers and inorganic fillers
- Suitable for saturation with oils and silicone

Typical applications:

- Steel-reinforced soft material for tanged metal / flat sheet technology
- Secondary gaskets with high demands on stress relaxation and temperature resistance
- Otto carburetor engines
- Diesel engines

Supply data:

Rolls	• 1000 / 1010 or 2000 / 2020mm	Thickness	• from 0.75 to 1.5mm
Outer diameter	• 700mm	Weight / unit area	• 600 - 1200g/m² (± 4%)
Coils	• from 150 to 2020mm wound on paper coils - inner diameter 100mm		
	• Special sizes upon request		

General data	Binders:	NBR, sulphur-free		
	Branding:	without branding		
	Anti-stick-coating:	non standard		
	Color:	grey		
	State of vulcanization:	vulcanized		
Physical properties (Gasket thickn. 0.80mm)	**Property**	**Standard**	**Unity**	**Value ***
	Density	DIN 28 090-2	[g/cm³]	0.80
	Tensile strength	DIN 52 910		
	longitudinal		[N/mm²]	2.2
	transverse		[N/mm²]	1.6
	Compressibility	ASTM F 36 K	[%]	32
	Recovery	ASTM F 36 K	[%]	34
	Loss on ignition	DIN 52 911	[%]	14

***** = Mode (typical value)
Issue: 09.01
Modifications: 2
Supersedes all prior versions

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Novaplan 03000

- **An efficient insulation barrier for use in thermal reduction.**
- **An effective sound deadener to accomplish noise reduction.**
- **An excellent elevated temperature electrical insulator.**

Typical applications:
As a heat shield insulation product. Can be used as a lining when mechanically combined with metallics and non metallics.
Measurable decibel reduction when used as a sound reduction barrier.
Electrical insulation values measurable in kilovolts per mm.
Fire resistant. Self extinguishing. Will not support an open flame.

Supply data: Rolls or sheets.
Produced in rolls up to 80” wide. Standard width is 40”.
Cut to size sheets or slit coils available to customer specification.
Thickness range from 0.015” through 0.045”. Thickness tolerance: +/- 7%.
Standard thickness available: 0.020” / 0.031” / 0.039”.
Standard color: White.

Physical properties.	Density		67 lb./ft3
Test results based	Tensile Strength		>500 psi
@ 0.039“ thick.	Compression @ 1000 psi	ASTM F36K	23 %
	Recovery	ASTM F36K	21 %
	Ignition loss @ 1500 F		15 +/-2 %
Physical properties.	Tensile Strength		>400 psi
Test results after	Compression @ 1000 psi	ASTM F36 K	14 %
sustained exposure to	Recovery	ASTM F36 K	28 %
400 F for 22 hours.	Reduction in mass		3 %
	Thermal Conductivity @ 750 F		.13 W/(m.K)
	Electrical Insulation Value		3.4 kv/mm

The raw materials used in the production of ***Novaplan* 03000** are composed of special mineral fibers blended with proprietary fillers and binders. The ***Novaplan* 03000** offers elevated temperature resistance, low thermal conductivity combined with electrical insulation and acoustic insulation values.

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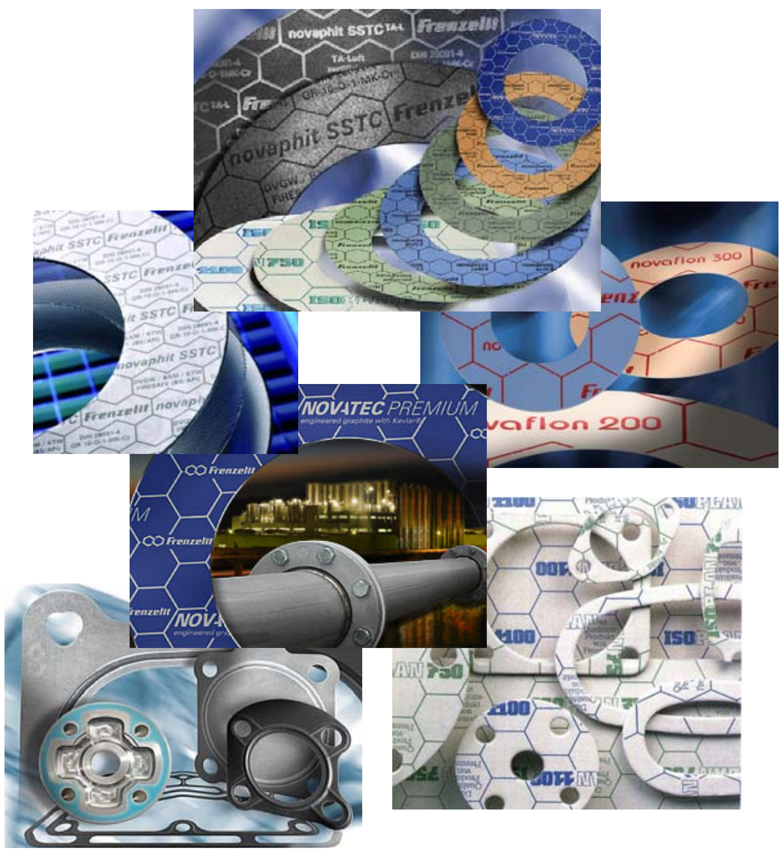
Section 11

Novatec® FRG-LD-14 / HPN / HPS

Beater Addition Kevlar® Fiber Reinforced Gasket Materials



Kevlar® is a trademark registered by Dupont.

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Technical Data Sheet

Frenzelit

Novatec LD14 engineered graphite with Kevlar®

Material profile:

- Highly adaptable soft material for cylinder head gaskets with open pores
- The main components are graphite and aramid fibers, bound with NBR (vulcanized)
- can be impregnated with all dilute bonding materials
- state-of-the-art material which combines the advantages of graphite and aramid

Typical applications:

- Steel-reinforced soft material for tanged metal/ flat-sheet technology
- Automotive gasket with high demands to its adaptability
- Otto carburetor engines
- air-cooled motors

Supply data:

Rolls	• 1010 or 2020 mm	Thickness in mm:	• 0.5 bis 1.3 mm ± 7%
Outer diameter	• 700mm	Weight/unit area:	• 500 - 1300 g/m² ± 4%
Coils	• from 150 to 2000mm wound on paper coils - inner diameter 100mm • Special sizes upon request		

General data raw material	Color: Surface: State of vulcanization:	black without coating or branding vulcanized		
	Property	**Standard**	**Unity**	**Value ***
Physical properties raw material for sample thickness 0.8 mm	Density	DIN 28 090-2	[g/cm³]	0.97
	Tensile strength	DIN 52 910		
	longitudinal		[N/mm²]	3.6
	transverse		[N/mm²]	3.0
	Compressibility	ASTM F 36 J / K	[%]	42 / 24
	Recovery	ASTM F 36 J / K	[%]	8 / 21
	Density	DIN 28 090-2	[g/cm³]	1.45
Physical properties after compression to application recommendation (without metal inlay and impregnation)	Thickness	ASTM F102	[mm]	0.55
	Tensile strength	DIN 52 910		
	longitudinal		[N/mm²]	6.0
	transverse		[N/mm²]	5.0
	Compressibility	ASTM F 36 J	[%]	24
	Recovery	ASTM F 36 J	[%]	20
	Creep / Relaxation 150°C / 22h	ASTM F 38 B	[%]	22
	Compress. at ambient temperature			
	1 > 10 N/mm²	Frenzelit - Test	[%]	12
	1 > 50 N/mm²	Frenzelit - Test	[%]	28
	yield point	Frenzelit - Test	[N/mm²]	> 250
	Compress. high temp. Break Point Test 50 N/mm² / 120°C / 100 h	Frenzelit - Test	[%]	6
Compressed material on sheet iron	Leakage:	Under operating conditions no traces of oil or coolant detectable in the engine test.		
	Media resistance:	The material selection and processing guarantee an exceptional media resistance.		
	Properties can vary depending on the rolling technique applied			

***** = Mode (typical value)
Issue: 03.03
Modifications: 2
Supersedes all prior versions

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Novatec FRG/STL

The materials development team of FRENZELIT SEALING SYSTEMS, INC. has combined the proven benefits of aramid fiber, the conformability and thermal characteristics of graphite with the strength of perforated steel to create its, FRG/STL. A unique product designed to address the requirements of Cylinder Head, Exhaust as well as demanding Industrial applications. Ultimate density may be varied to compensate for irregular flanges and/or the varied thermal expansion rates of dissimilar metals.

TYPICAL PROPERTIES		Standard	
Density as Tested	90 lb. min.	80 lb. min.	70 lb. min.
Compression @ 5000 psi	10 - 20 %	15 - 25%	30 - 45%
Recovery / Min.	40%	30%	10%
Creep Relaxation @ 150 C / Max	25%	30%	35%
Fluid Immersions ASTM Fuel B - 22 Hours @ Room Temp.			
Thickness Change / Max.	15%	15%	15%
Compression @ 5000 psi	15 - 25 %	20 - 30%	35 - 50%
ASTM Oil # 1 - 5 Hours @ 150 C			
Thickness Change / Max.	10%	10%	10%
Compression @ 5000 psi	15 - 25 %	20 - 30%	35 - 50%
ASTM Oil # 3 - 5 Hours @ 150 C			
Thickness Change / Max.	10%	10%	10%
Compression @ 5000 psi	15 - 25 %	20 - 30%	35 - 50%
Coolant / Water (50/50) - 22 hours @ Boiling			
Thickness Change / Max.	15%	20%	25%
Compression @ 5000 psi	20 - 30 %	25 - 35%	40 - 50%
Heat Aging - 22 Hours @ 250 C			
Weight Change / Max.	-3%	-3%	-3%
Compression @ 5000 psi	10 - 20 %	15 - 25%	30 - 45%
Recovery / Min.	40%	30%	35%
Sealabilty - Fuel A			
1000 psi load / 15 psi internal pressure	0.10 ml/hr	0.15 ml/hr	0.25 ml/hr
1500 psi load / 15 psi internal pressure	0.06 ml/hr	0.10 ml/hr	0.15 ml/hr
2000 psi load / 15 psi internal pressure	0.04 ml/hr	0.06 ml/hr	0.12 ml/hr

The numbers indicated above are the statistical results of multiple tests performed in a controlled laboratory environment. While they can be used as a basis for analysis, actual application testing is strongly recommended to determine suitability for use.

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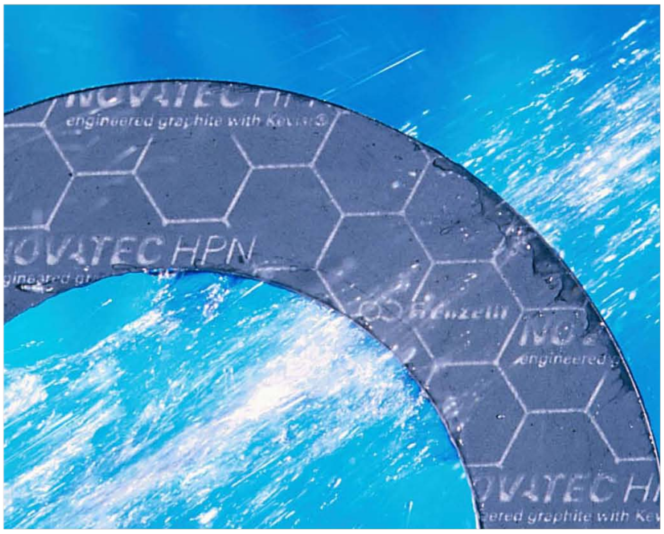
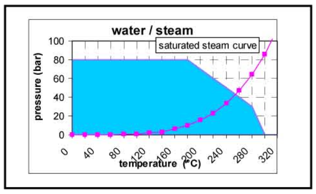
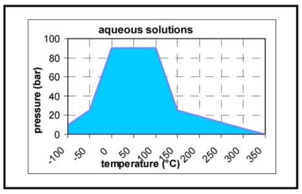
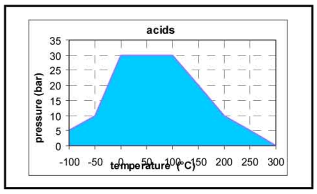
novatec® HPN - Engineered graphite with Kevlar®

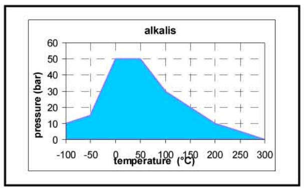


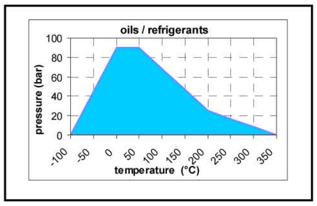
novatec® HPN, the tried and tested combination of graphite and Kevlar®, guarantee its extraordinary resistance to temperature and media together with its low percentage of NBR binder and its high density. The gasket's good adaptability to flange irregularities as well as its excellent features in cutting and handling are further excellent properties of novatec® HPN.

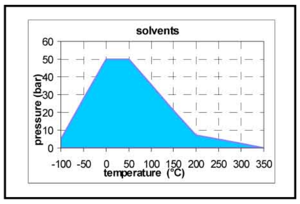


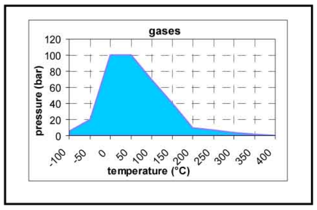












The application recommendation for temperature and pressure in the diagrams are applicable for a gasket thickness of 1.5 mm and even flanges. Peak-to-valley height 40 - 160 µm.
When using a gasket less than 1.5 mm thick the pressure and temperature limits may be higher.

Kevlar® is a trademark registered by DuPont.

Material data

General data

Binders	NBR
Approvals	WRC
Colour	black
Surface	both sides A310 black, with branding, optional with PTFE
Sheet sizes and thickness tolerance	Thickness: ± 7 %

Physical properties Gasket thickness 1.5 mm	**Standard**	**Unity**	**Value ***
Identification	DIN 28 091-2		FA – A1 - O
Density	DIN 28 090-2	[g/cm^3]	1.50
Tensile strength	DIN 52 910		
longitudinal		[N/mm^2]	9
transverse		[N/mm^2]	7.5
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 °C, 16h, 50 N/mm^2,		[N/mm^2]	38
175 °C, 16 h, 25 N/mm^2,		[N/mm^2]	15
Compressibility	ASTM F 36 J	[%]	15
Recovery	ASTM F 36 J	[%]	30
Fluid resistance	ASTM F 146		
ASTM IRM 903	5h / 150 °C		
Weight change		[%]	20
Thickness increase		[%]	7
ASTM Fuel B	5h / 23 °C		
Weight change		[%]	18
Thickness increase		[%]	6
Coolant/Water (50:50)	5h / 100 °C	[%]	
Weight change		[%]	25
Thickness increase		[%]	6

* = Mode (typical value)

With the variety of installation and service conditions as well as of application and process engineering, the data of this sheet can only be taken as a non-binding guide.

Applications

- pipeline construction
- plant construction
- apparatus construction

Product data

In Sheets

- Dimensions in mm: 2000 x 1000
- Thicknesses in mm: 0.4/1.0/1.2/1.5/2.0/2.5/3.0

In Rolls

- Rolls: 1000 or 2000 mm
- Thicknesses in mm: 0.4 to 1.0 mm

Further dimensions and thicknesses avialable on request

Quality Management

ISO/TS 16949

Environmental Managment

ISO 14001

GASKETS
TECHNICAL TEXTILES
EXPANSION JOINTS
INSULATION
NEW MATERIALS

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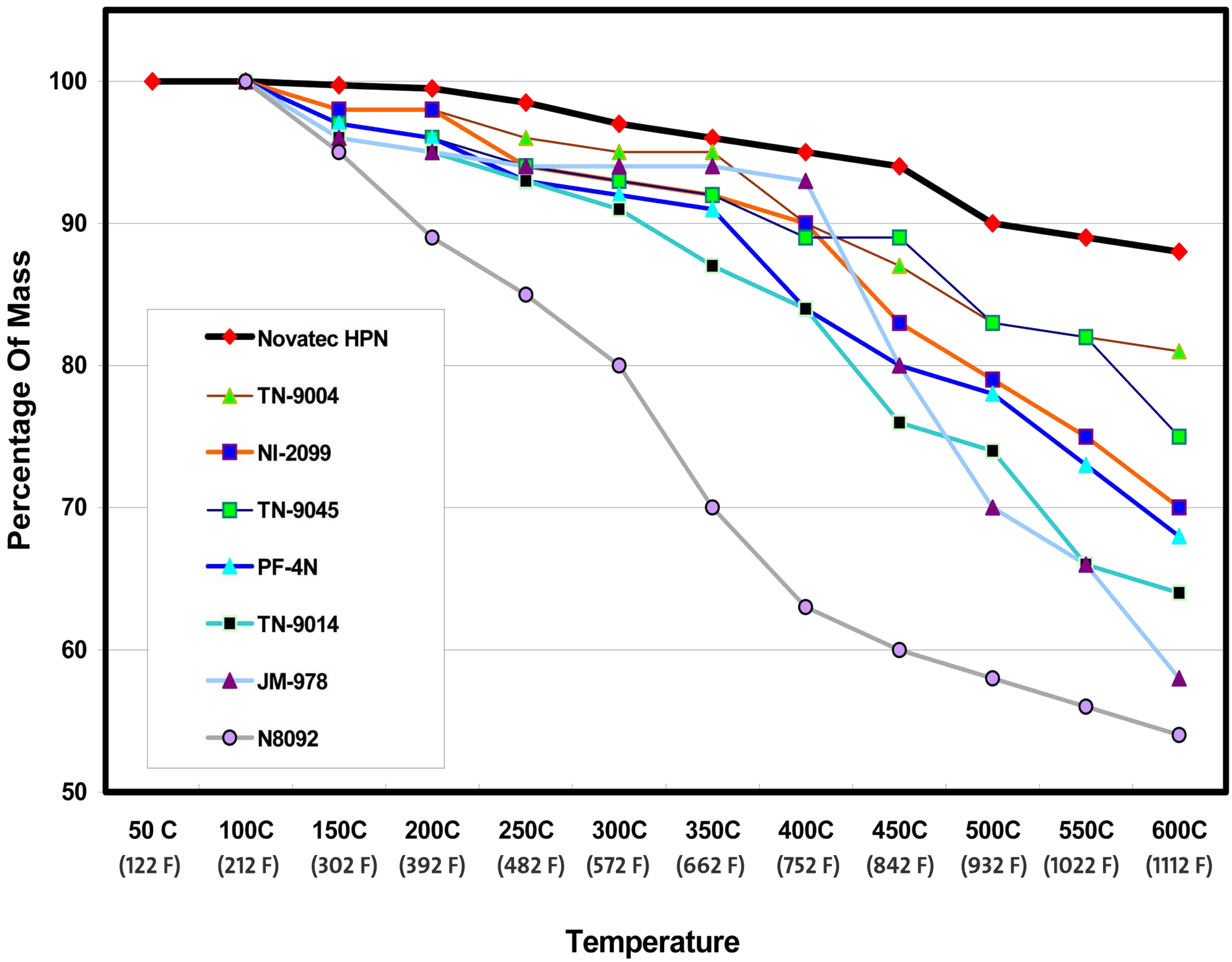
Frenzelit

creating hightech solutions

novatec®HPN - Engineered graphite with Kevlar®

Loss of Mass at Elevated Temperatures



GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

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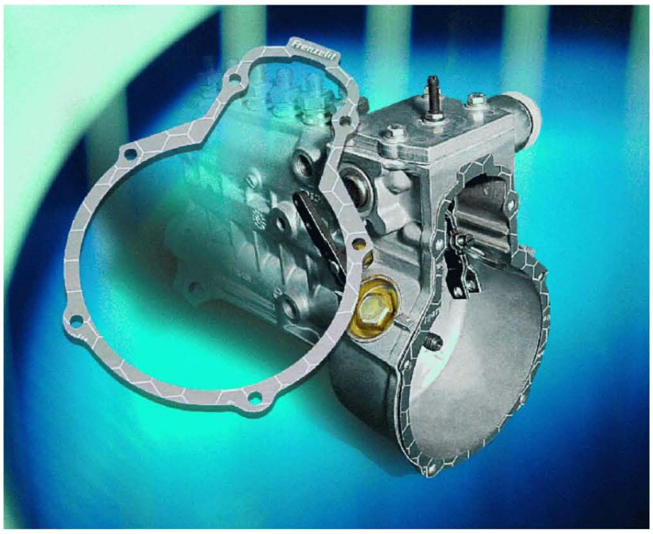
creating hightech solutions

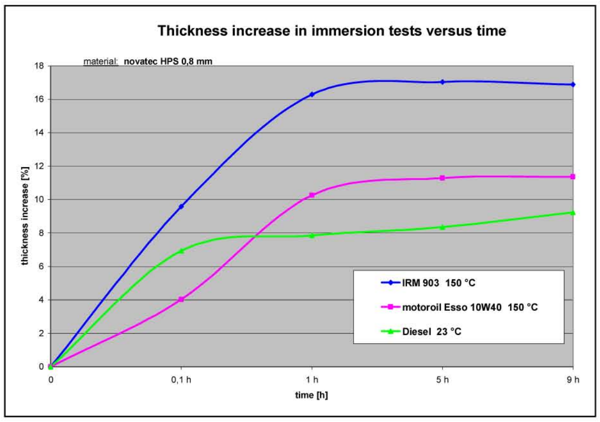
novatec® HPS- Engineered graphite with Kevlar®



novatec® HPS is synonymous for a high temperature, high performance beater addition product bound with SBR with controlled swell in oils and fuels.

The unique composition of engineered graphite with Kevlar® is our proven concept for excellent flexibility and high temperature resistance. Due to the SBR (styrene butadiene rubber) binding system with its controlled swelling properties novatec® HPS offers a reliable solution wherever severe demands like flange irregularities, uneven surface pressure and high temperatures are a topic.

Due to its superior qualities this gasket material is universally applicable and now available in rolls in a variety of widths from 150 to 2000 mm and thickness 0.3 to 1.0 mm.



Kevlar® is a trademark registered by DuPont.

Material data

General Data

Binders	SBR
Colour	black
Anti-Stick	without coating / alternatively with PTFE
Sheet sizes and thickness tolerance	Width: ± 1 mm / Thickness: ± 7 %

Physical properties Gasket thickness 0.8 mm	**Standard**	**Unity**	**Value ***
Density	DIN 28 090-2	[g/cm³]	1.47
Tensile Strength	DIN 52 910		
longitudinal		[N/mm²]	3.5
transverse		[N/mm²]	3
Residual stress $\sigma_{dE/16}$	DIN 52 913		
175 ° C		[N/mm²]	45
300 ° C		[N/mm²]	43
Compressibility	ASTM F 36 J	[%]	20
Recovery	ASTM F 36 J	[%]	34
Media resistance	ASTM F 146	[%]	30
ASTM IRM 903	5h / 150 °C		
Weight change		[%]	40
Thickness increase		[%]	20
ASTM Fuel B	5h / 23 °C		
Weight change		[%]	30
Thickness increase		[%]	15

* = Mode (typical value)

Applications

- oil pans
- axle bearings
- valve covers
- gearboxes
- gearbox cases

Product data

- Rolls: 1000 or 2000 mm
- Coils: from 150 to 2000 mm wound on paper coils
- Thicknesses in mm: 0.3 – 1.0 mm
- Further dimensions and thicknesses are available on request

Quality Management

ISO/TS 16949

Environmental Management

ISO 14001

GASKETS

TECHNICAL TEXTILES

EXPANSION JOINTS

INSULATION

NEW MATERIALS

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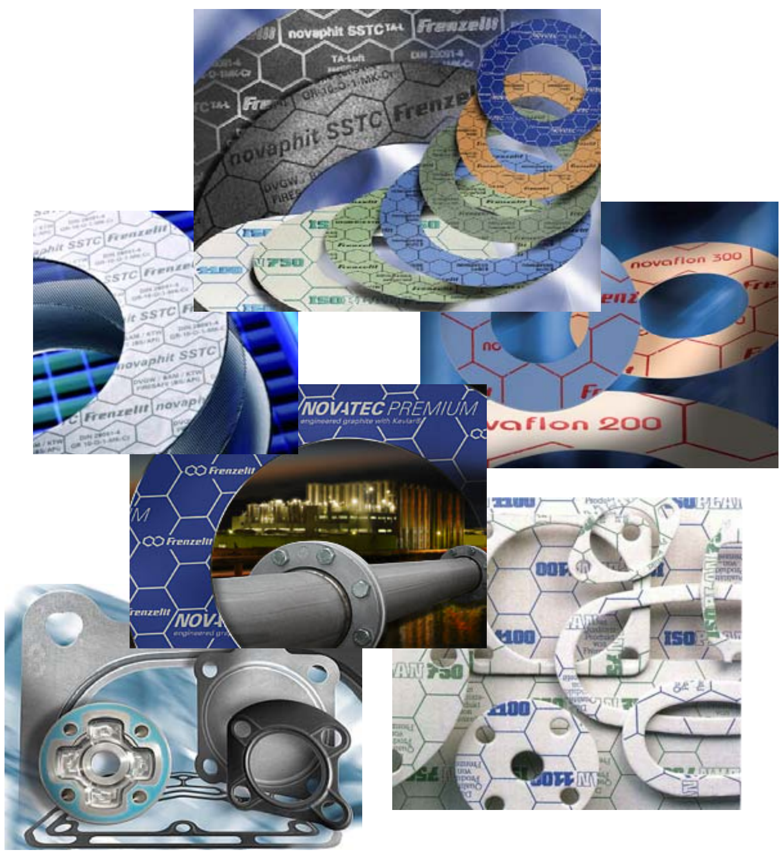
Section 12

Certificates

ISO/TS 16949 / ISO 14001



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CERTIFICATE

TÜV CERT

Management system as per

ISO/TS 16949:2002

(2nd edition, 2002-03-01)

Evidence of conformity with the above standard has been furnished and is certified in accordance with TÜV CERT procedures for

Frenzelit

Frenzelit - Werke GmbH & Co. KG
Frankenhammer 7
95460 Bad Berneck
Germany

and the location
Industriestraße 4
95502 Himmelkron
Germany

Scope

Development and production of gasketing materials, gaskets and technical textiles

IATF Registration No. 0051304
Certificate Registration No. 44 111 061726

Valid from 2007-06-01
Valid until 2010-05-31

TÜV CERT Certification body
at TÜV NORD CERT GmbH

Essen, 2007-06-01

This certification was conducted in accordance with the TÜV CERT auditing and certification procedures and is subject to regular surveillance audits.

TÜV NORD CERT GmbH Langemarckstrasse 20 45141 Essen www.tuev-nord-cert.com

IATF

02-IAO-QMC-01021

TÜV NORD

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD
Management Service

CERTIFICATE

The Certification Body
of TÜV Management Service GmbH

certifies that

Frenzelit

Frenzelit-Werke GmbH & Co. KG
Frankenhammer 7
D-95456 Bad Berneck

has established and applies
an Environmental Management System for

Development, production and sales of
gasketing materials, gaskets,
technical textiles and expansion joints

Sites:
Bad Berneck and Himmelkron

An audit was performed, Report No. **70007788**

Proof has been furnished that the requirements
according to

ISO 14001: 2004

are fulfilled. The certificate is valid until **2008-07-17**

Certificate Registration No. **12 104 4244 TMS**

TÜV SÜD

M. Nagel

Munich, 2005-08-01

Deutscher Akkreditierungs Rat
DAR
TGA-ZM-07-92