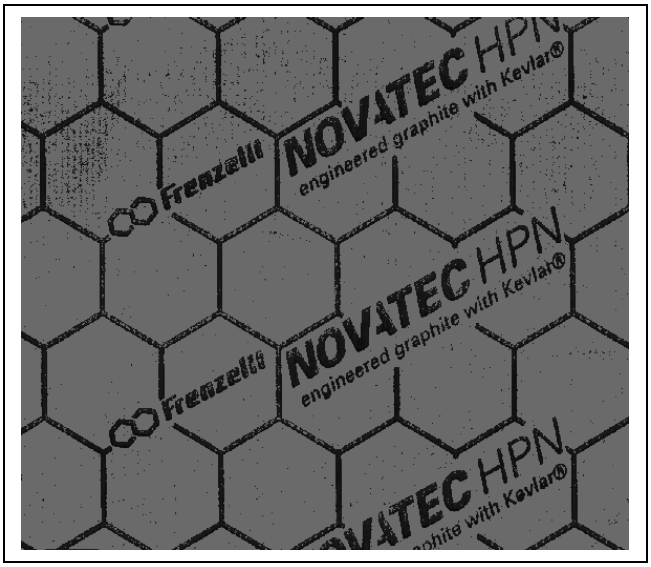
novatec HPN

engineered graphite with Kevlar®

High Performance Graphite Beater (NBR)



Supplier:	**Frenzelit**
Material:	**novatec HPN**
Density g/cm³:	**1.5**
Sample:	**1**
Scale:	**1 : 1**
Position:	**↔ Transverse**
	↕ Longitudinal

- Applications engineering
- Soft material technology
- Typical mechanical properties
- Sealing behaviour
- Test results

GASKETS
TECHNICAL TEXTILES
EXPANSION JOINTS
INSULATION
NEW MATERIALS

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Frenzelit
creating hightech solutions

novatec HPN
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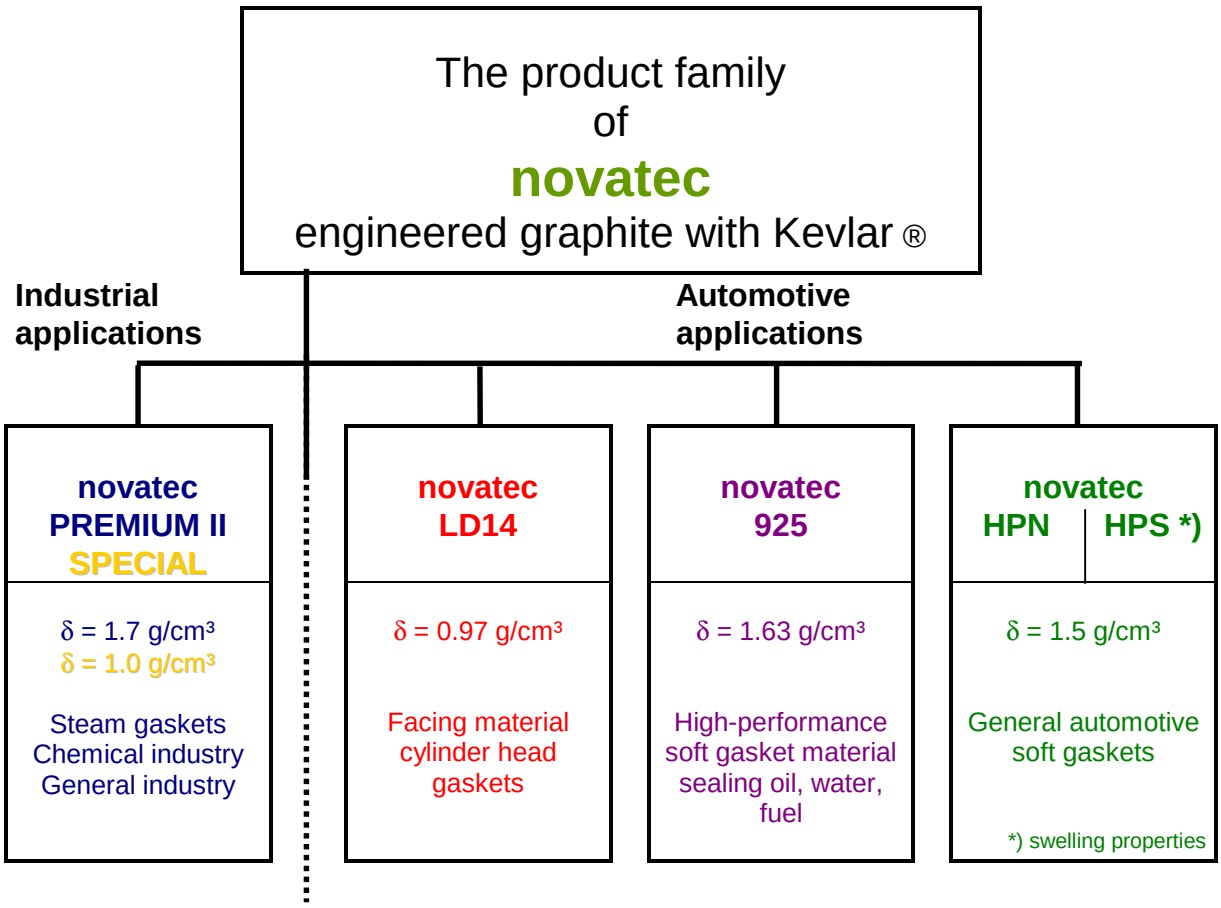
as well as additional information on:



- **novatec** is entering a market section with a very strong competition between different kinds of non-asbestos materials, graphite and steel gaskets.
- This new technology of graphite material reinforced by Kevlar® fibers combines the best properties of both gasket technologies - graphite and fiber based - and opens engineers a very wide range of successful applications.
- **novatec**´s technical performance combined with a favourable pricing offers a very good chance of a successful market introduction.
- **Frenzelit** wants to offer help in all cases of application questions and can perhaps give support by special testing in their own test laboratories.
- The exchange of knowledge and experience with the customers is a great chance to optimise present or new products and to develop future material generations suitable for meeting the demands of the market.

novatec HPN
Graphite beater material for automotive soft gaskets

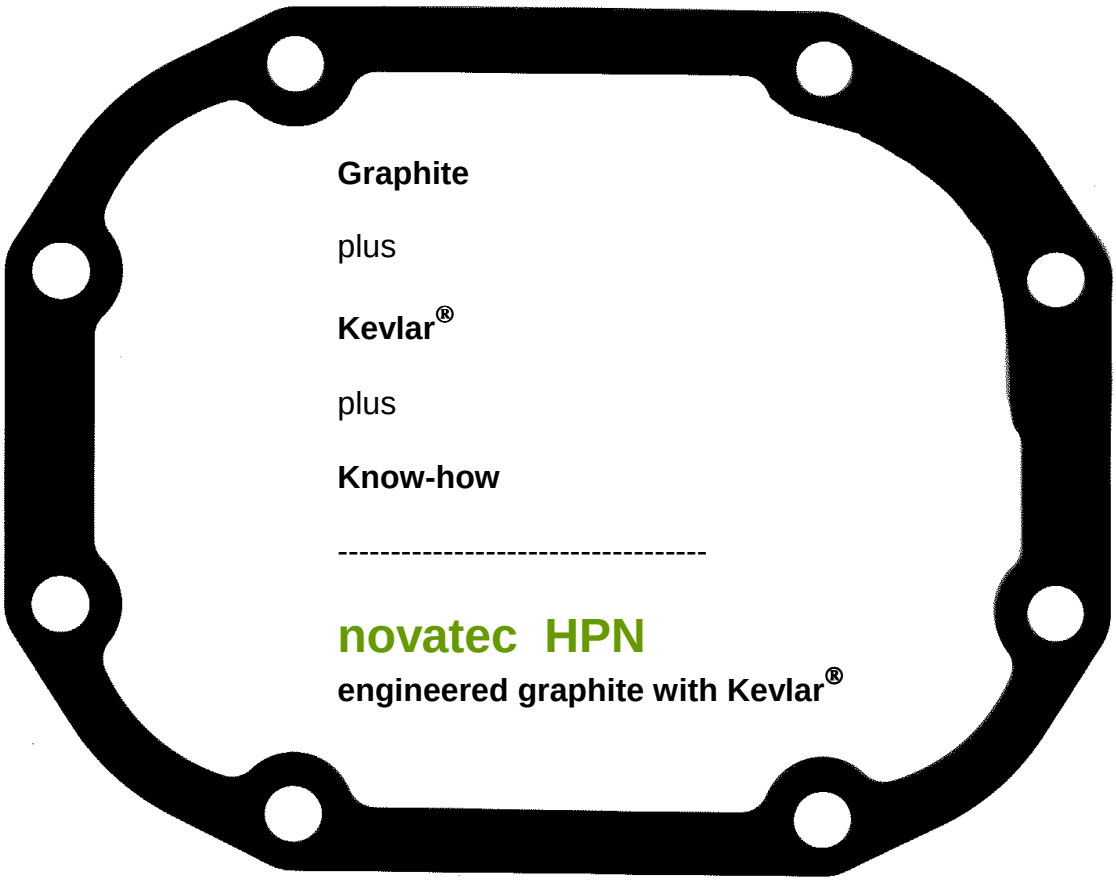
The new fibre-reinforced composite material based on graphite for the automotive sector.

Application as soft gaskets in engines and gears.

Material with excellent adaptability, very good media resistance and a stress relaxation as required in practice.

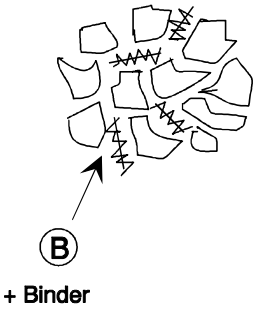
Graphite - state-of-the-art technology combined with suitable gasket materials to perfectly seal off joints.

PTFE anti-stick coating (optional).



novatec HPN
Material Structure

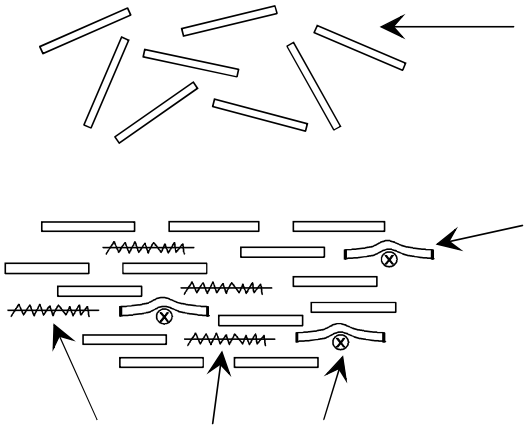
under the electron scan microscope



+ Binder

graphite flakes with Kevlar fibres

In soft gaskets as used up to now **undirected fillers** are used which have to be closed with a high percentage of binder in order to reach a cross-sectional tightness despite high material densities in the remaining pores. Under long-term conditions these additives **make the material brittle** and have a deteriorating effect its the hot creep.



locked-in Kevlar fibres and friction powder

novatec HPN first consists of undirected **graphite lamellae** (75%) which form the material structure as shown in the sketch during calendering together with the reinforcing **Kevlar fibres**, the **friction powder** and a low percentage of high-quality **NBR binder**. The material is tight.

The **elasticity of the gasket** is guaranteed by the locked-in porosities.

This production technique creates long-term stable gasket properties like **stress relaxation** and **elasticity**.

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Graphite Beater Material

Compressibility / Recovery ASTM F 36 J

These measurements allow information on the mechanical adaptability of gasket materials.
In most applications the materials are also exposed to high temperatures that may lead to a considerable deterioration in their adaptability when the gaskets become brittle. Therefore the standard test acc. to ASTM F36 J has been extended by a second series conducted after tempering 20h / 120°C (212°F).
In the laboratory the following typical values with regard to **compressibility** and **recovery** were measured.

a) **novatec HPN** Graphite beater material, thickness 0.5 mm

Sample	Compressibility		Recovery	
1	14.8%		42.7%	
2	17.2%		41.7%	
average	16.0%	80µm	42.2%	34µm
after tempering	18.2%	91µm	43.1%	39µm

b) **novatec HPN** Graphite beater material, thickness 0.8 mm

Sample	Compressibility		Recovery	
1	17.5%		41.7%	
2	18.5%		44.3%	
average	18.0%	144µm	43.0%	62µm
after tempering	16.3%	130µm	46.0%	60µm

c) **novatec HPN** Graphite beater material, thickness 1.5 mm

Sample	Compressibility		Recovery	
1	16.6%		32.3%	
2	17.4%		35.7%	
average	17.0%	255µm	34.0%	87µm
after tempering	14.9%	224µm	34.8%	78µm

d) **novatec HPN** Graphite beater material, thickness 2.0 mm

Sample	Compressibility		Recovery	
1	13.1%		38.2%	
2	14.9%		42.8%	
average	14.0%	280µm	40.5%	113µm
after tempering	14.2%	284µm	39.0%	110µm

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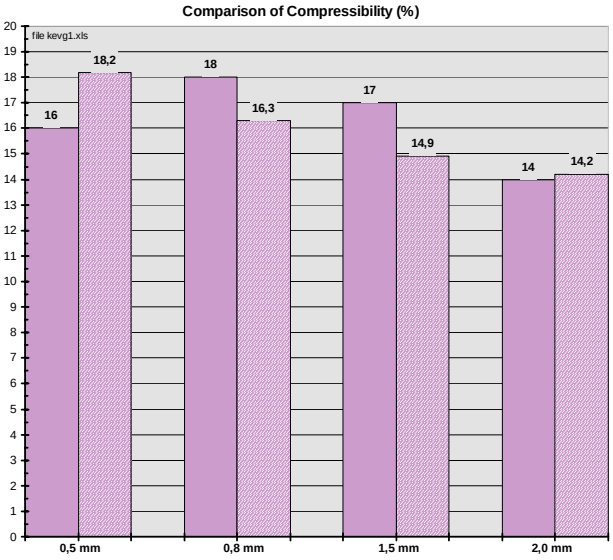
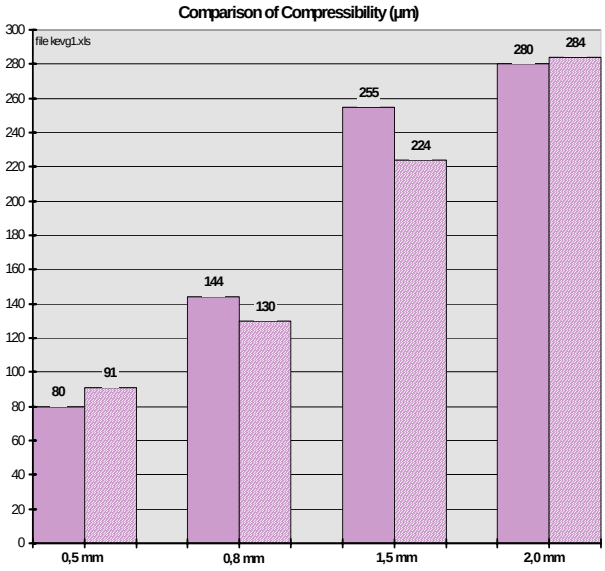
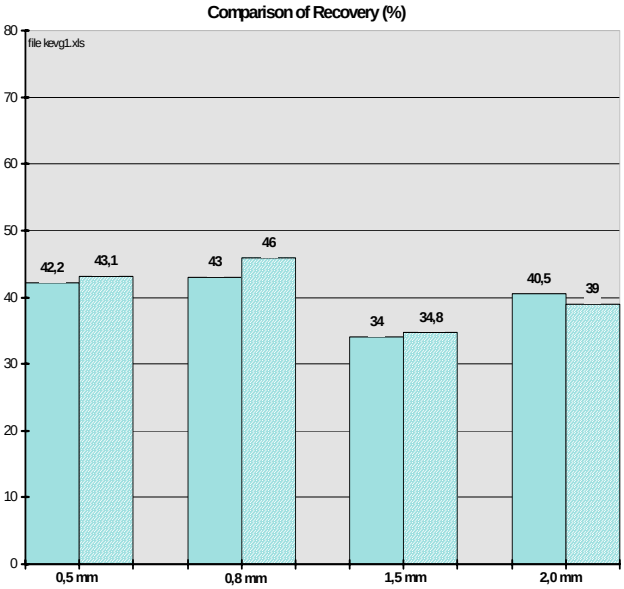
Compressibility / Recovery ASTM F 36 J

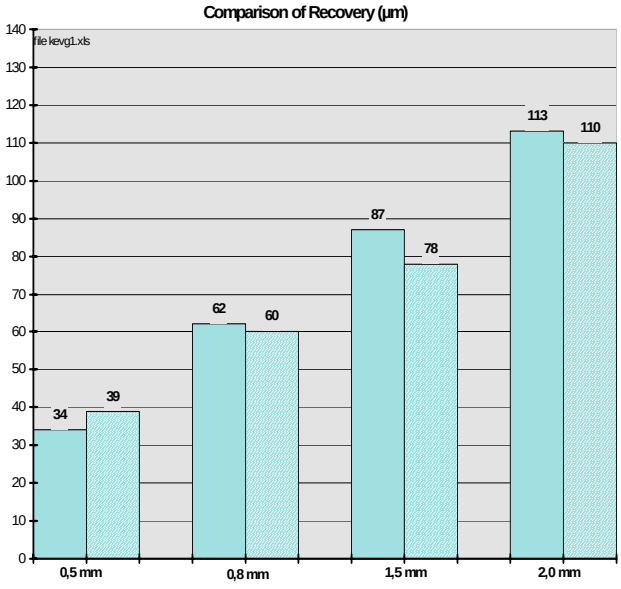
Samples: **novatec HPN Graphite Beater Material** installation thickness **0.5 / 0.8 / 1.5 / 2.0 mm**, with optional PTFE coating

new after production and after ageing 20h / 120°C:









(typical values)

Result :

- Good adaptability and recovery, these properties remain despite tempering.
- The mechanical properties correspond to **novatec LD14** in tendency when rolled onto tanged metal.

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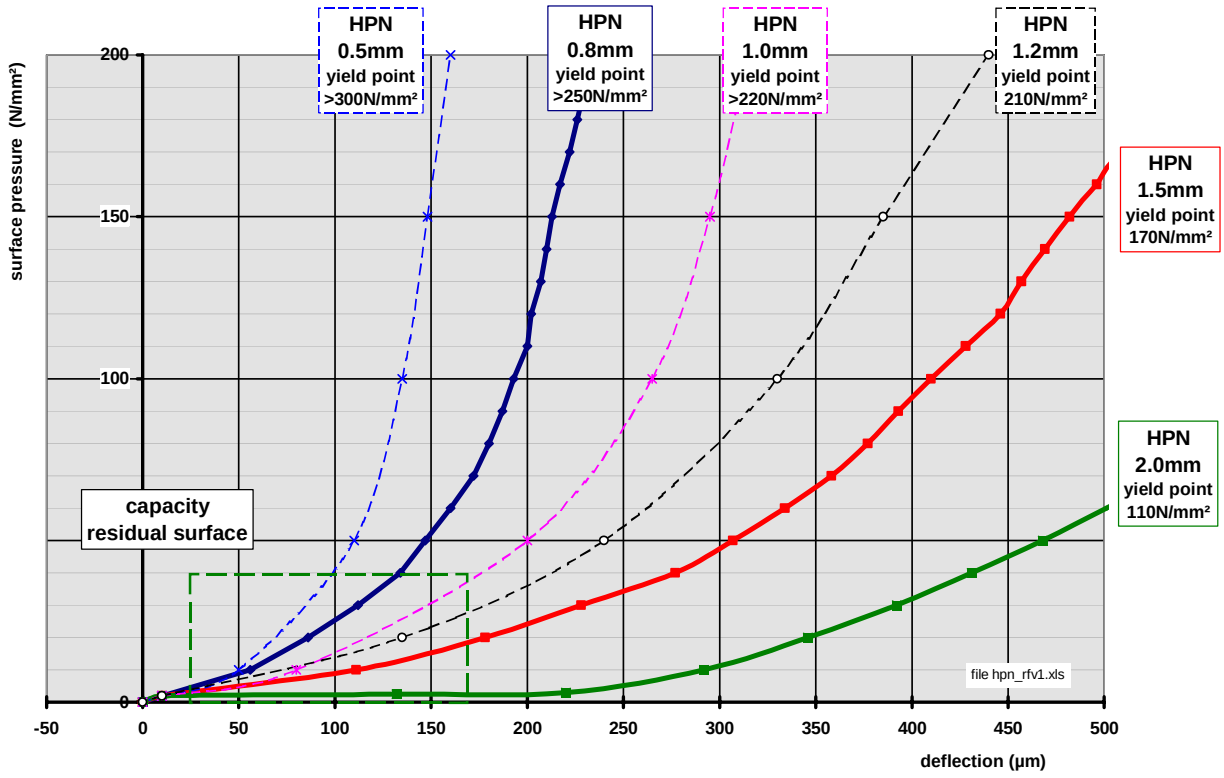
Deformation curves (cold)

Samples:

- Installation thickness **0.8 / 1.5 / 2.0 mm**
  (0.5 / 1.0 / 1.2mm extrapolated or interpolated)
- Density 1.5g/cm³
- With **Frenzelit** branding; without coating

Test :

- **Frenzelit** load / deformation curve
- 3 samples 33.3 mm x10 mm = 1000 mm²
- p = 1 – 200 N/mm²,
- Sliding cold forming at more than 50 min.
- Comparison of values after compensation of system correction factors!
- The yield point represents a function of the height/width relation of the sample



(typical values)

Result :

- **novatec HPN** shows a good adaptability as a soft gasket with an installation thickness of 0.8 to 1.6 mm.
- A gasket with a thickness of 0.8 mm does not start to flow even at pressures above 200 N/mm² and can thus be used in applications with very high punctual pressures.

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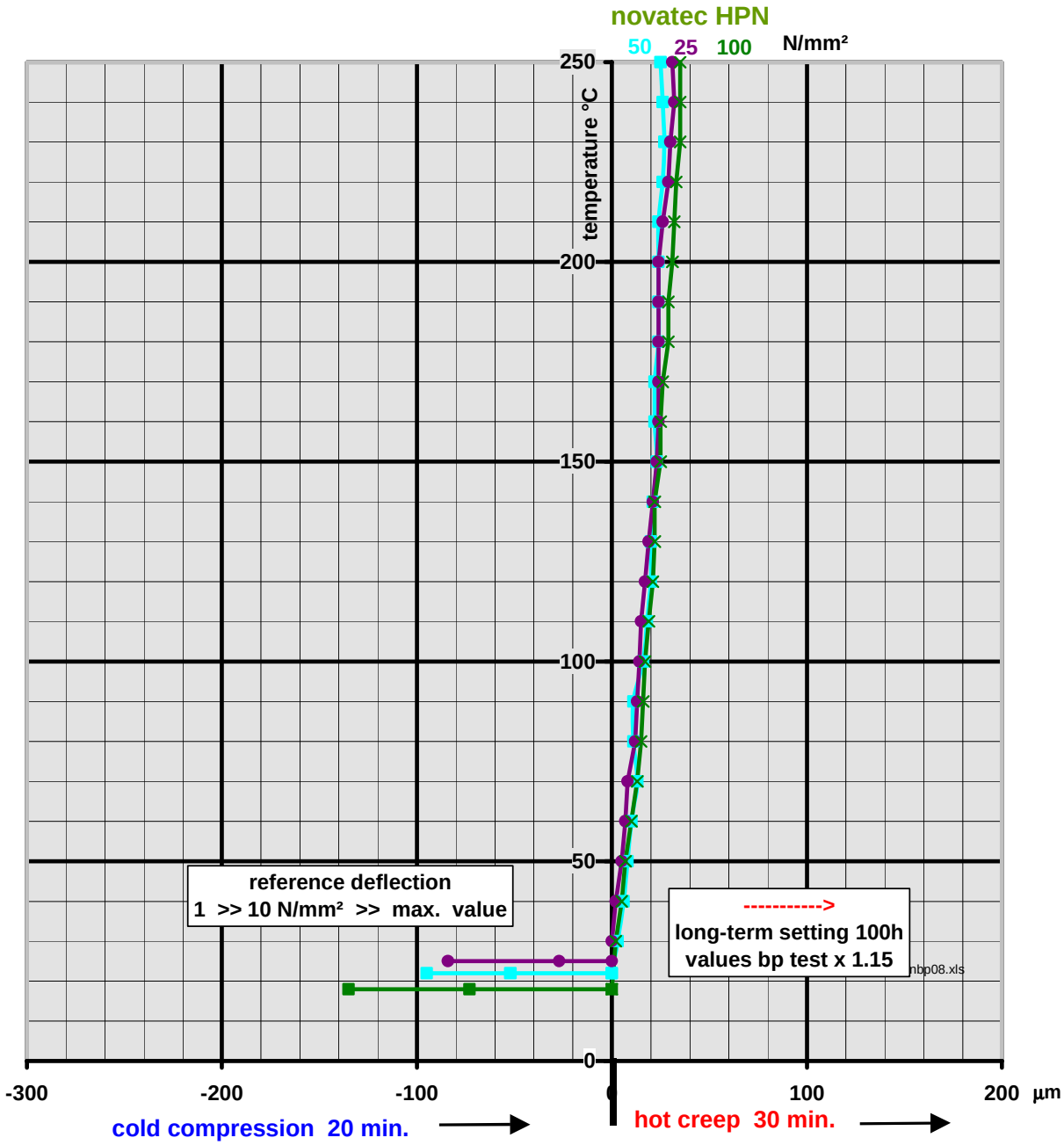
Performance graph

Break point test 250°C with different surface pressures
Thickness 0.5 mm

surface 3 times 10 mm x 33.3 mm = 1000 mm²
surface pressure 1 > 10 > max. value N/mm²



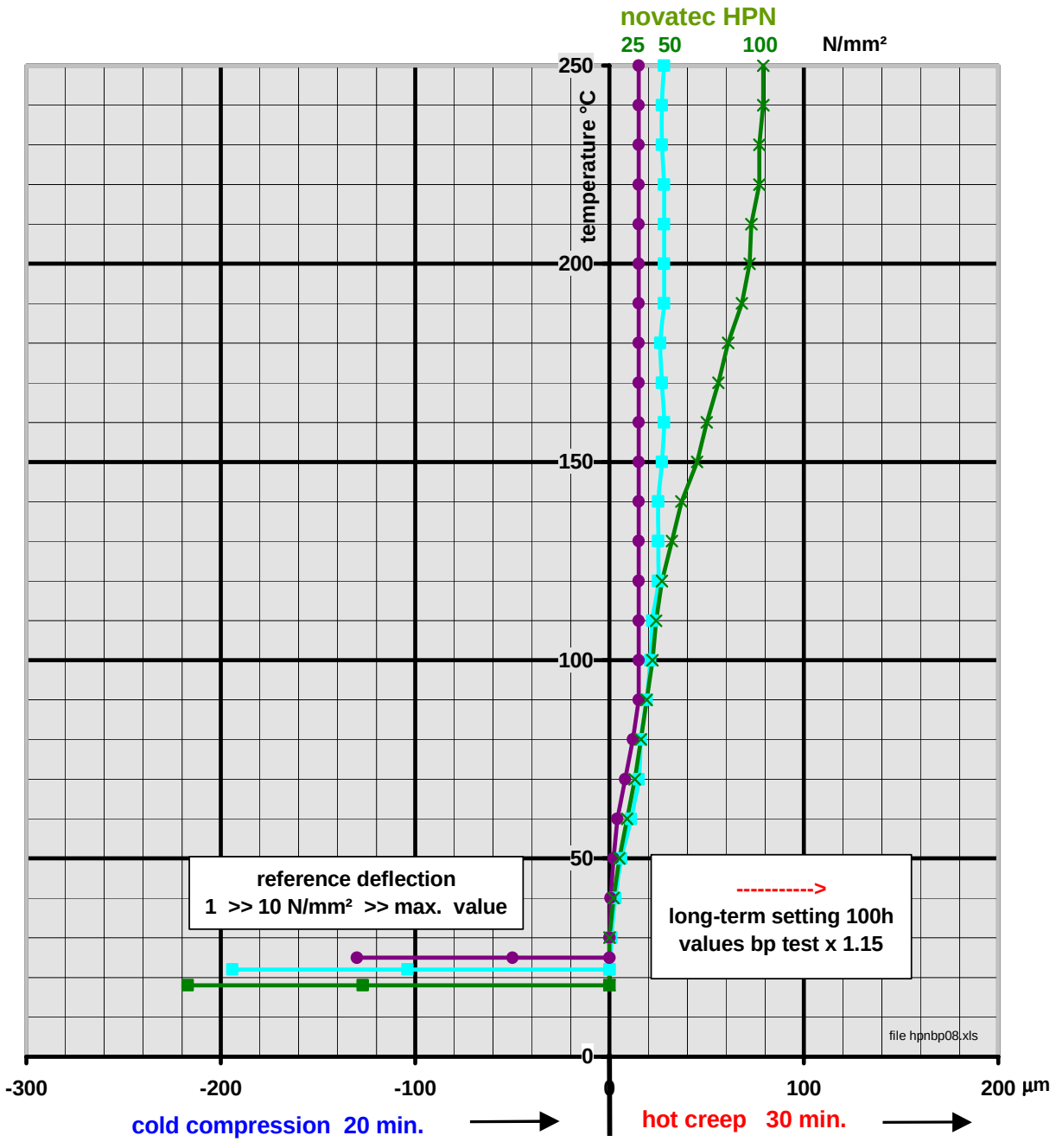
(typical values)

novatec HPN

Performance graph

Break point test 250°C with different surface pressures
Thickness 0.8 mm

surface 3 times 10 mm x 33.3 mm = 1000 mm²
surface pressure 1 > 10 > max. value N/mm²



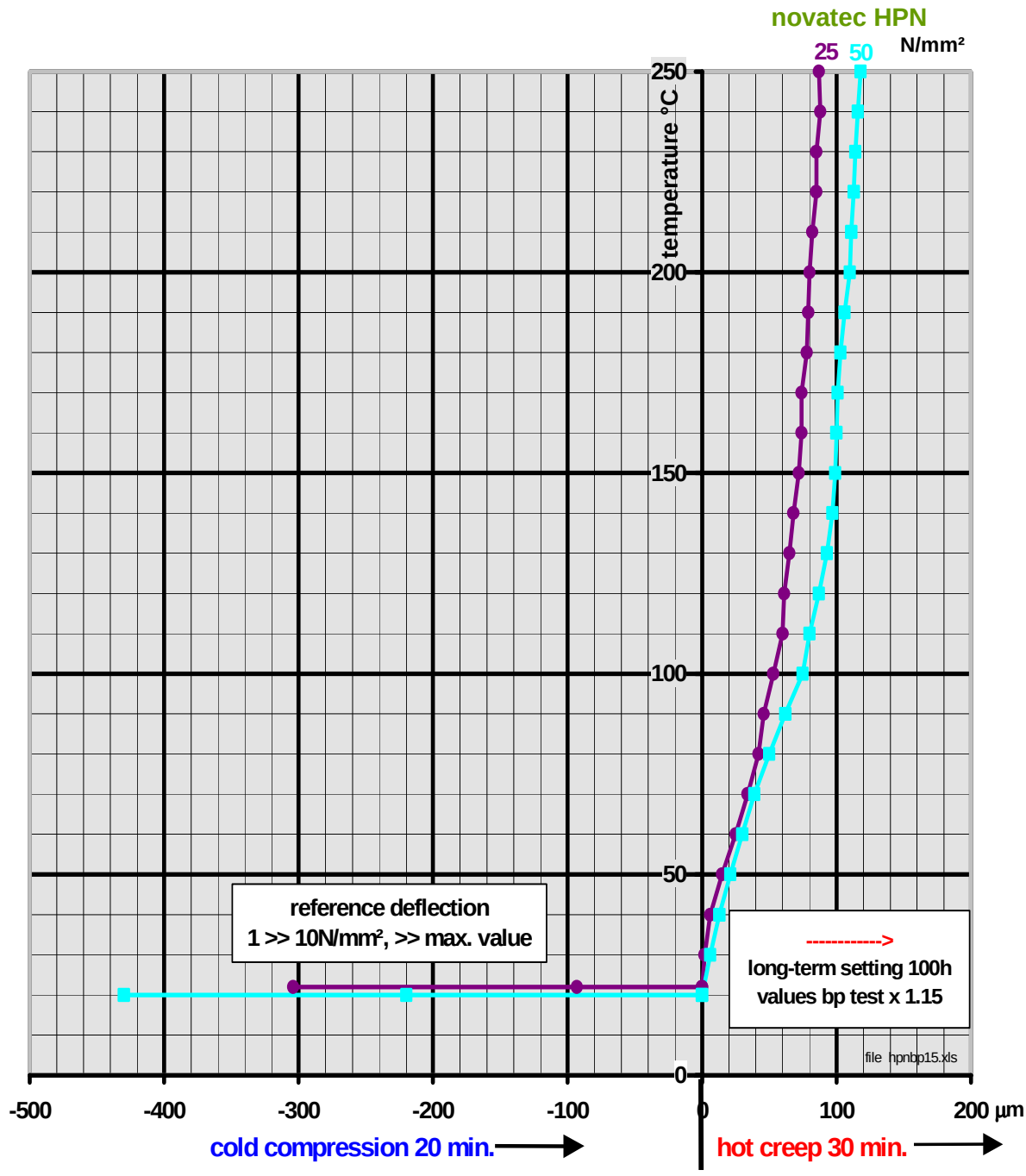
(typical values)

novatec HPN

Performance Graph

Break Point Test 250°C with different surface pressures
Thickness 1.5 mm

surface 10 mm x 33.3 mm = 1000 mm²
surface pressure 1 > 10 > max. value N/mm²



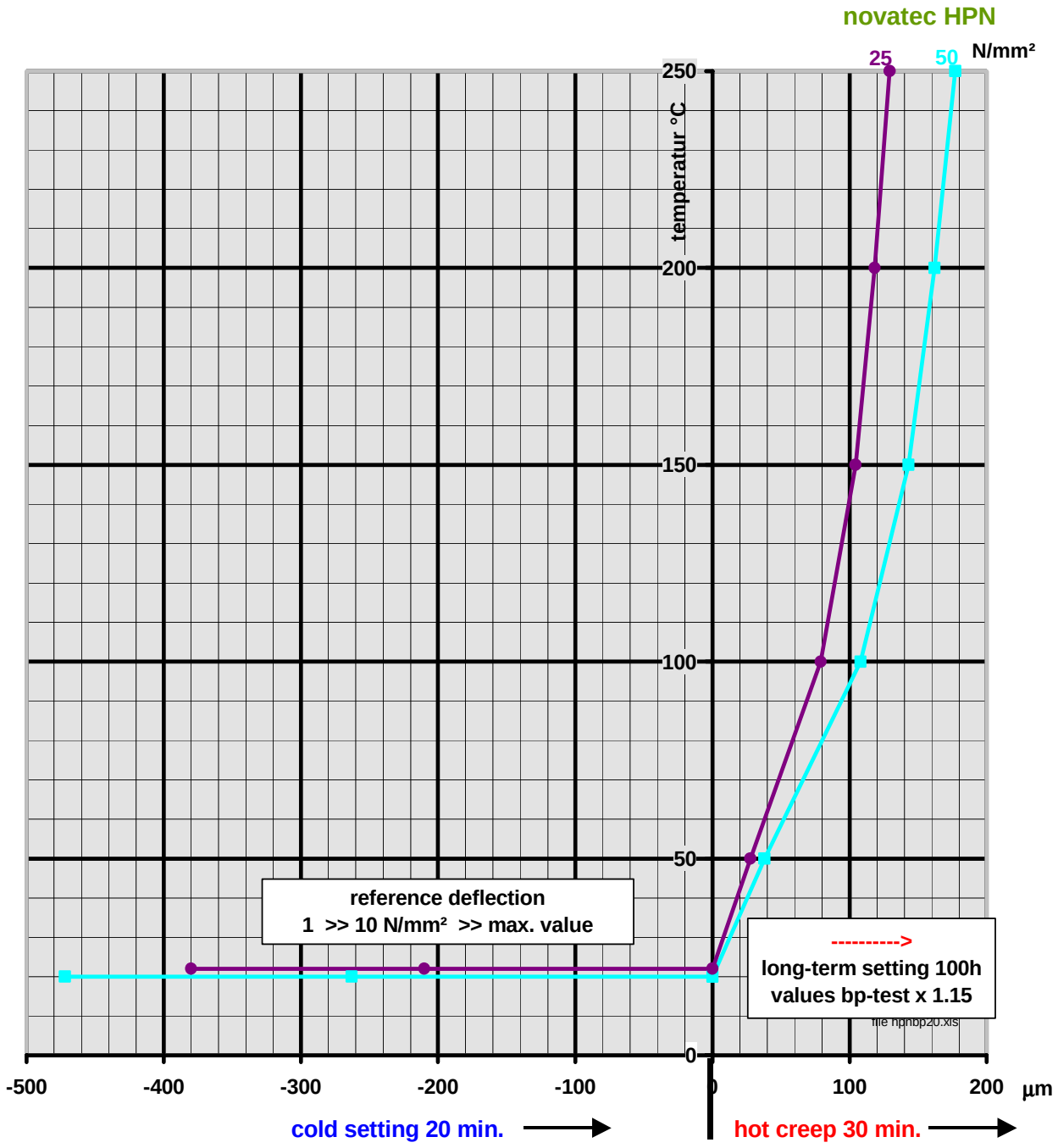
(typical values)

novatec HPN

Performance Graph

Break Point Test 250°C with different surface pressures
Thickness 2.0 mm

surface 10 mm x 33.3 mm = 1000 mm²
surface pressure 1 > 10 > max. value N/mm²



(typical values)

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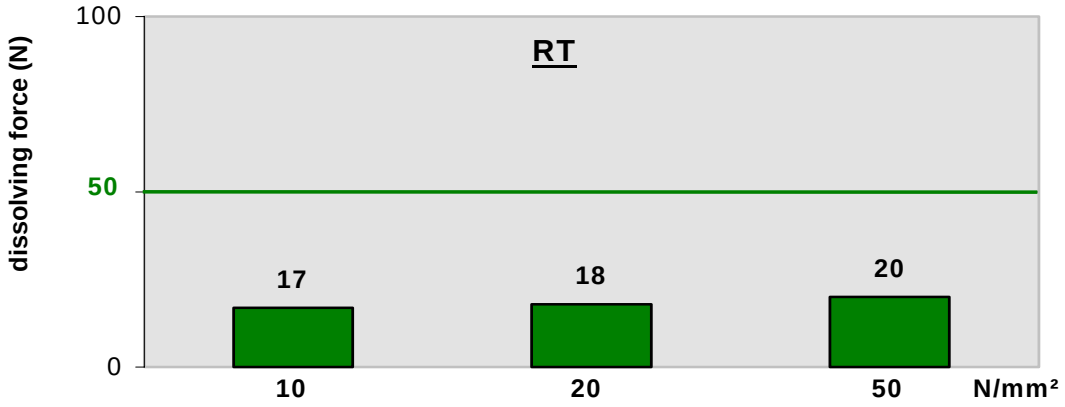
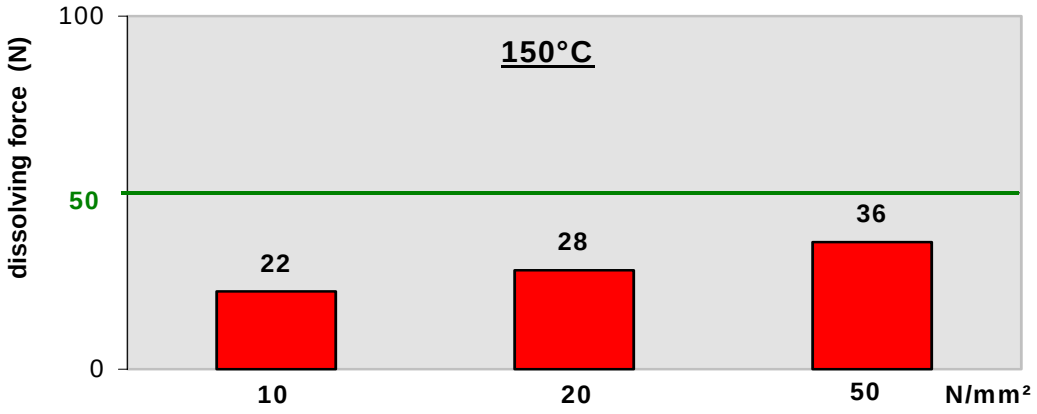
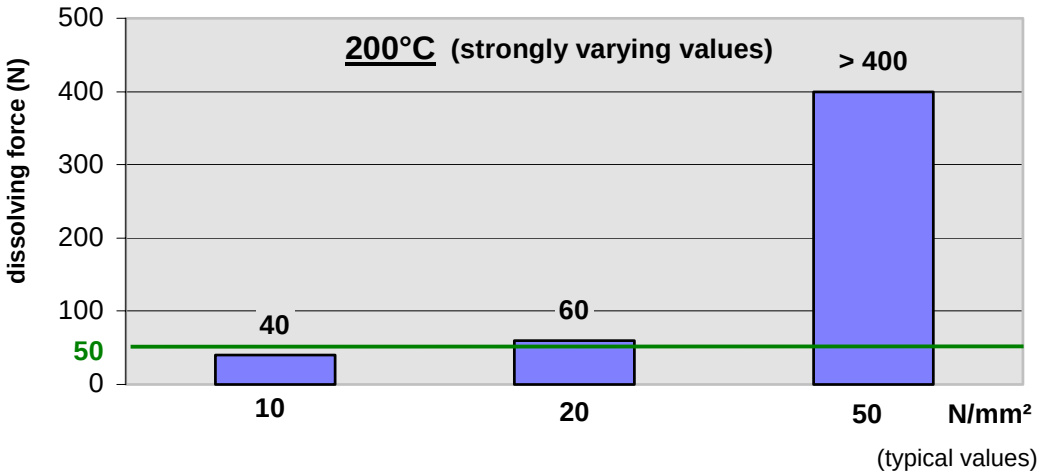
Anti-stick effect of the PTFE coating

Test:
- **Frenzelit** flanges, 50 x 130 mm
- 1h of tempering
- as well as anti-stick test in the adhesion tester







(typical values)

Standard values for evaluation:

< 50N/mm² limit of adhesion, very easy to remove
> 200N/mm² traces on the surface, still easy to remove
> 1000N/mm² strong traces on the surface, additional devices necessary for removing