HECKER®

Gaskets

ENGLISH

1. EDITION 05/1997
2. EDITION 07/2000, unchanged
3. EDITION 01/2001, completely new
4. EDITION 10/2001, new: HTB approval WS 3822 and WS 3815
5. EDITION 12/2001, approvals WS 3820 and WS 3825
6. EDITION 02/2002, new chapter approvals (page 6)
7. EDITION 06/2002, NEW: CELL® WS 3805
8. EDITION 08/2002, NEW: Euraflon® A 3780 and Euraflon® S 3790
9. EDITION 09/2002, NEW: VP 401 approval WS 3820
10. EDITION 10/2002, KTW Approval WS 3805
11. EDITION 11/2002, TA-LUFT Approval Centellen® HD 3822 (VDI-2440)
12. EDITION 12/2002, Gasket materials applicable for the use in sanitary engineering, heating and air technics
13. EDITION 01/2003, NEW: Euraflon® B 3770
14. EDITION 01/2003, new data for WS 3831, 3805, 3815 and 3825
15. EDITION 05/2003, new: installation recommendations for Grafotherm sealings
16. EDITION 07/2003, new: TA-Luft-approval for Euraflon®
17. EDITION 09/2003: TA-LUFT Approval Centellen® WS 3820 (VDI-2440), WrC for WS 3805 and new DVGW-approval for WS 3825
18. EDITION 03/2004: new agencies and WRc-Approval for Centellen® WS 3822
19. EDITION 06/2004: new KTW-approval WS 3855
20. EDITION 10/2004: new KTW-approval WS 3825
21. EDITION 01/2005: TA-Luft approval for Centellen® NP WS 3860

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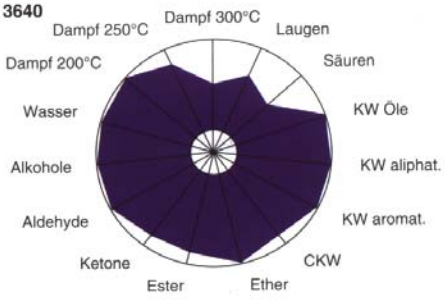
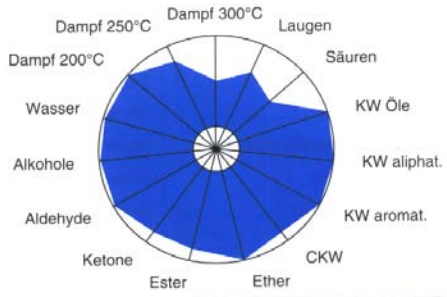
Media resistance

Dampf	Steam	Wasser	water	Alkohole	alcohols
Aldehyde	Aldehydes	Ketone	Ketones	Ester	Esters
Ether	Ethers	KW Öle	Hydrocarbon oils	KW aliphat.	Aliphatic hydrocarb.
KW aromat.	Aromatic hydroc.	CKW	chlorinated hydrocarbons		

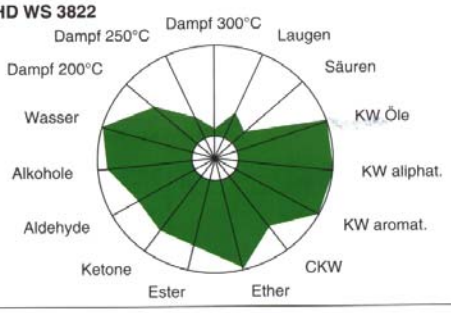
Europil® WS 3640



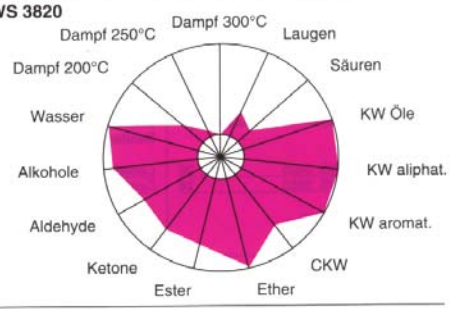
UDP 3620



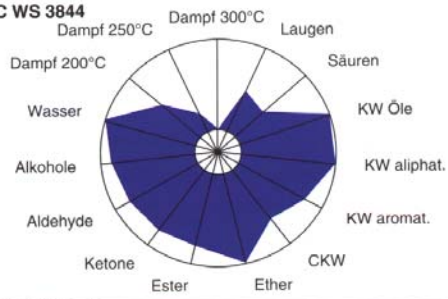
Centellen®-HD WS 3822



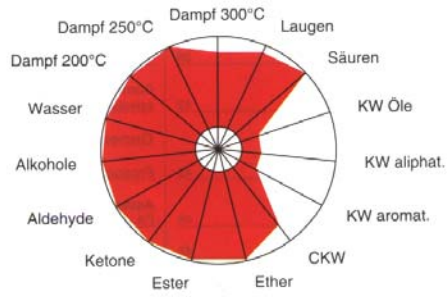
Centellen® WS 3820



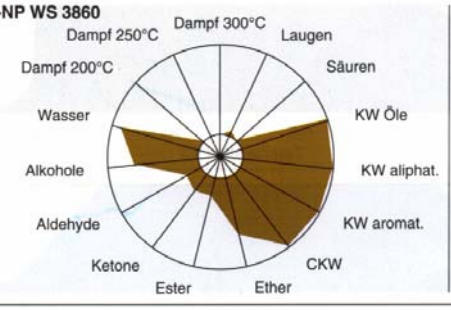
Centellen®-C WS 3844



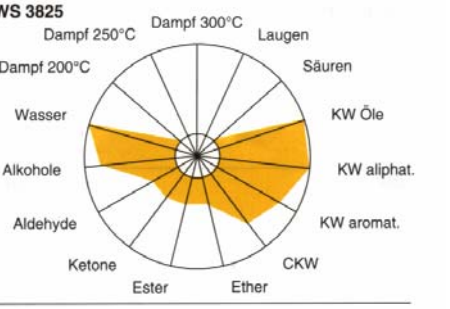
DSL 3670



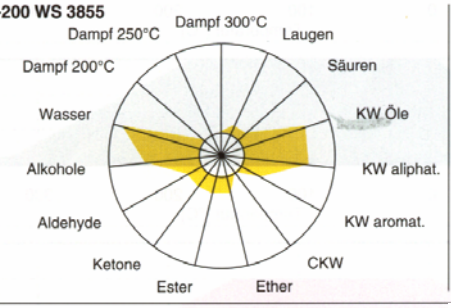
Centellen®-NP WS 3860



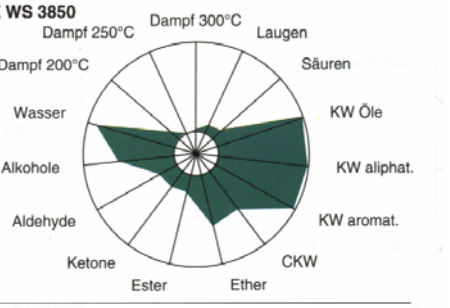
Centellen®-R WS 3825



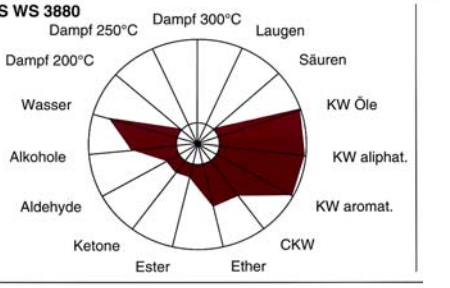
Centellen®-200 WS 3855



Centellen®-OE WS 3850

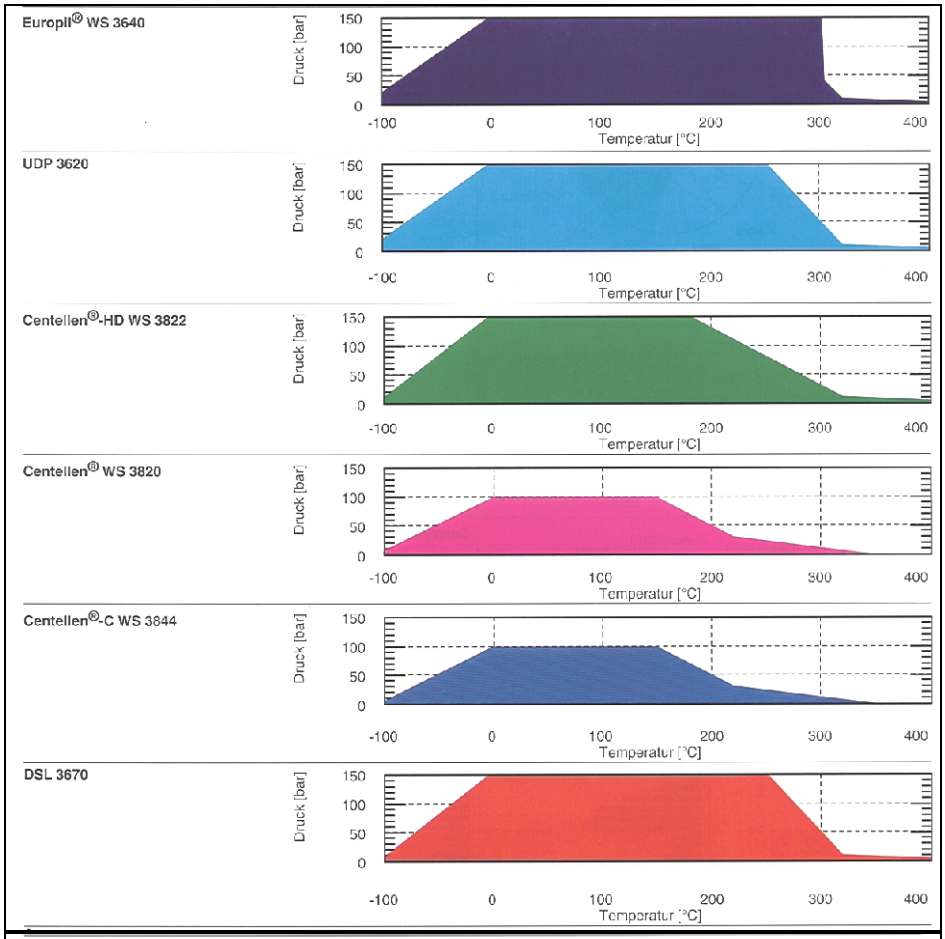


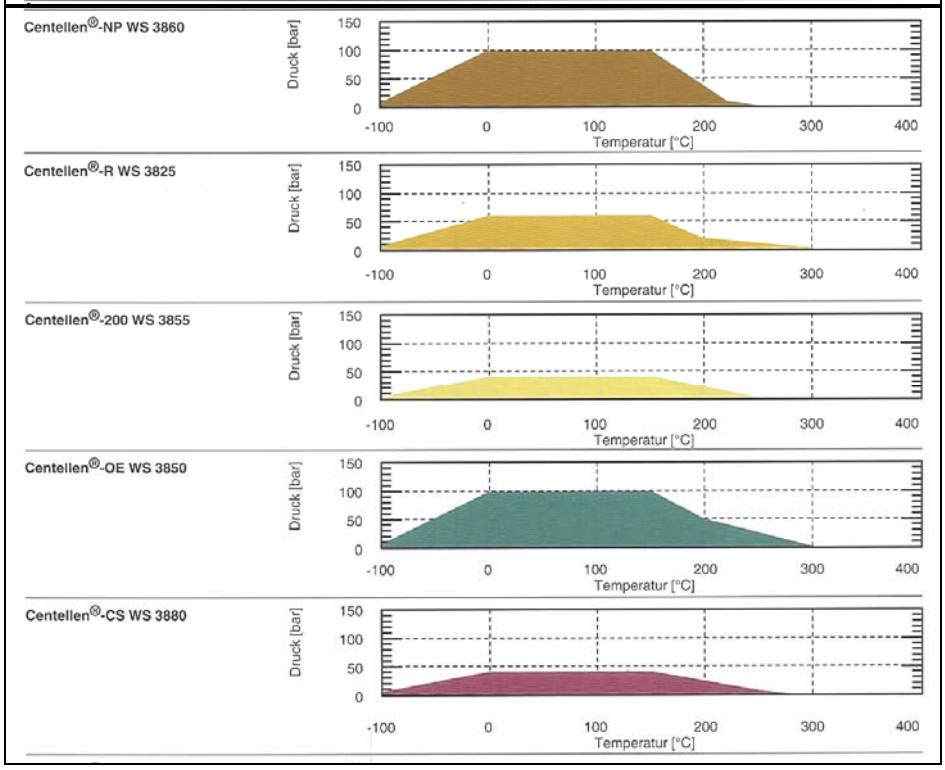
Centellen®-CS WS 3880



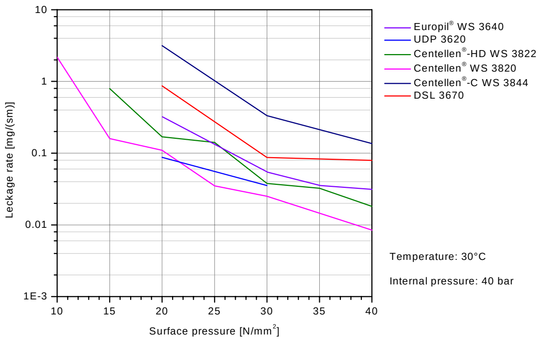
T-/p- diagrams

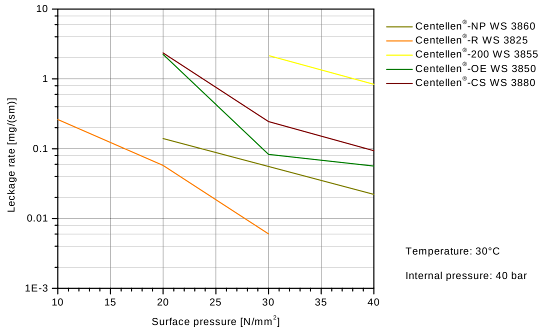
Reference thickness: 2,0 mm
Druck = pressure; Temperatur = temperature

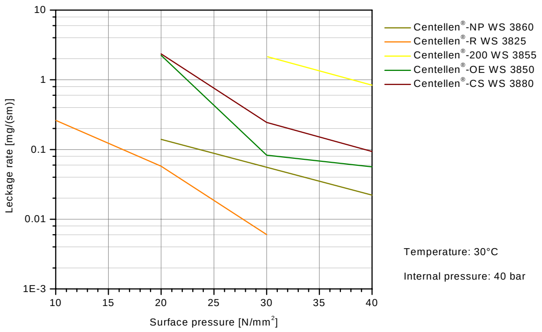


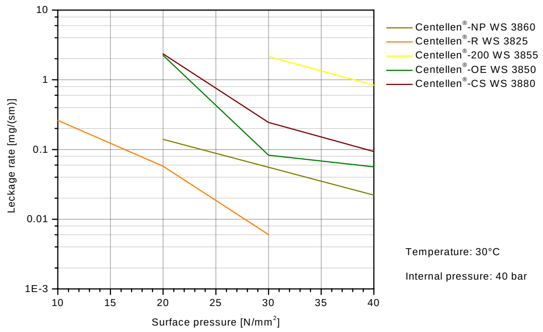


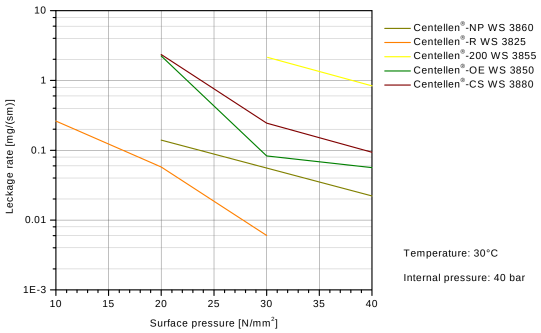
Leakage rate on the basis of DIN 28090

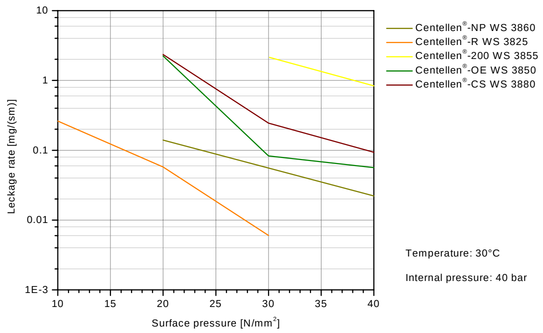






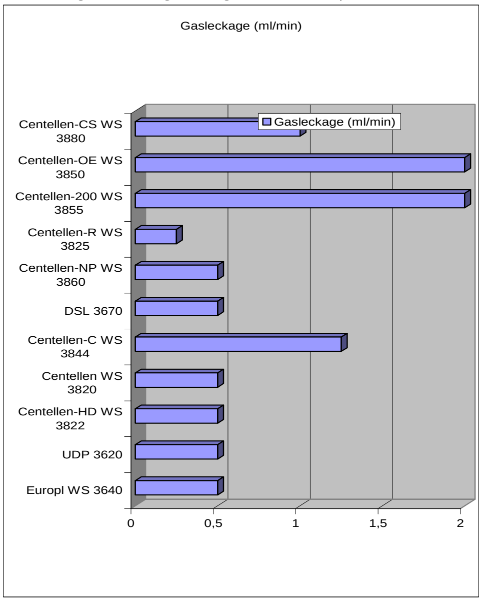






Gas tightness to DIN 3754

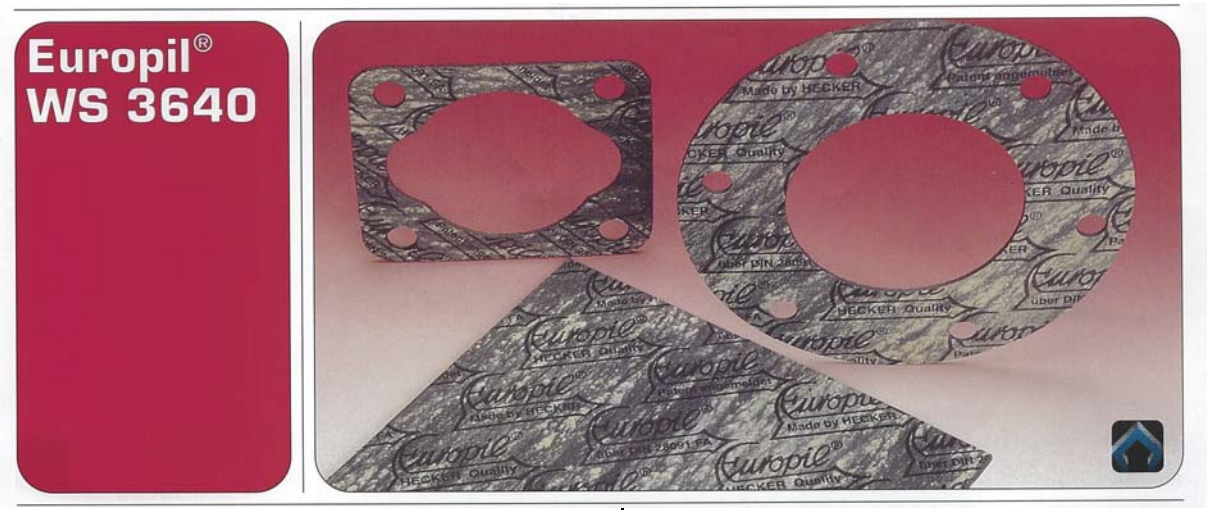
The degree of gas tightness depends on the thickness !!



Releases/Approvals - HECKER® Gaskets

Material	Material No.	BAM	DVGW	DVGW-VP 401	DVGW-VP 401	KTW	WRc	TA-LUFT
				1 bar (HTB)	5 bar (HTB)			VDI 2440
UDP	3620	X				X		
Europil®	3640	X				X		
DSL	3670	X						
CELL®	3805					X	X	
Packing®	3815		X	X		X	X	
Centellen®	3820	X	X	X		X	X	X
Centellen®-HD	3822	X	X		X	X	X	X
Centellen®-R	3825	X	X	X		X		
Centellen®-W	3831							
Centellen®-C	3844	X						
Centellen®-OE	3850	X						
Centellen® 200	3855					X		
Centellen®-NP	3860							X
Centellen®-CS	3880							

Material:	Release	applied for:		Registration No.
UDP 3620	BAM	for gaseous oxygen up to 60° C and 130 bar		Tgb.-No. 4387/94
	KTW	for drinking water up to 90° C, seals D2	KTW-recommendations of the BGA	certificate date 12.April.00
Europil WS 3640	BAM	for gaseous oxygen up to 60° C and 130 bar		Tgb.-No. 7967/95; II-3908
	KTW	for drinking water, seals D2	KTW-recommendations of the BGA	certificate date 29.01.96
		Bestimmung der Wärmeleitfähigkeit	Institut für Wärmeschutz F.3-086a/95	
DSL 3670	BAM	for gaseous oxygen up to 60° C and 130 bar		Tgb.-No. 7668/94; 4-4233
CELL® 3805	KTW	for drinking water, seals D2	KTW-recommendations of the BGA	certificate date 26.09.2002
	WRc	for drinking water up to 85 °C	Great Britain, BS 6920	MA22756/X, dd. 29.08.2003
Packing 3815	DIN-DVGW	gas supply industry	DIN 3535-6 (01.12.99)	NG-5123BL0306 date 25.07.00
	HTB	gas supply industry	DVGW VP 401 – 1 bar	DG-5126BM0232 date 25.07.01
	KTW	for drinking water up to 90° C, seals D2	KTW-recommendations of the BGA	certificate date 21.08.00
	WRc	for drinking water up to 85 °C	Great Britain, BS 6920	MA2454/I date 25.07.01
Centellen WS 3820	BAM	for gaseous oxygen up to 90° C and 100 bar		Tgb.-No. 6336/88; 4-2047 I
	DIN-DVGW	gas supply industry	DIN 3535-6 (01.12.99)	NG-5123BL0021 date 18.02.00
	HTB	gas supply industry	DVGW VP 401 – 1 bar	DG-5126BN0432 date 05.09.02
	KTW	for drinking water up to 60° C, seals D2	KTW-recommendations of the BGA	certificate date15.04.2003
	WRc	for drinking water up to 85 °C	Great Britain, BS 6920	MA2454/I date 25.07.01
	TA-LUFT	high value in the meaning of TA-LUFT	MPA Stuttgart (VDI-2440)	certificate date 05.08.2003
Centellen-HD 3822	BAM	for gaseous oxygen up to 90° C and 100 bar		Tgb.-No. 6336/88; 4-2047 I
	DIN-DVGW	gas supply industry	DIN 3535-6 (12/99)	NG-5123AP1136 date 09.06.99
	HTB	gas supply industry	DVGW VP 401 – **5 bar**	DG-5126BM0231 date 25.07.01
	KTW	for drinking water, seals D2	KTW-recommendations of the BGA	certificate date 12.04.00
	TA-LUFT	high value in the meaning of TA-LUFT	MPA Stuttgart (VDI-2440)	certificate date 11.11.2002
	WRc	for drinking water up to 85 °C	Great Britain,	MA2879/W dd. 11.03.2004
Centellen-R 3825	BAM	for gaseous oxygen up to 65° C and 100 bar		Tgb.-No. 6890/93; 4-3876
	DIN-DVGW	gas supply industry	DIN 3535-6 (12/99)	NG-5123BO0275 dd. 25.08.03
	HTB	gas supply industry	DIN 3374 and DIN 3376	96/150/539/2 date 20.08.96
	KTW	for drinking water up to 90° C, seals D2	KTW-recommendations of the BGA	certificate date 29.09.2004
	WRc	for drinking water up to 85 °C	Great Britain, BS 6920	CH1697/S date 25.07.95
Centellen-C 3844	BAM	for gaseous oxygen up to 80° C and 100 bar		Tgb.-No. 6336/88; 4-2047 II
Centellen-OE 3850	BAM	für gaseous oxygen up to 90° C and 100 bar		Tgb.-No. 6336/88; 4-2047 III
Centellen-200 WS 3855	KTW	for drinking water, seals D2	KTW-recommendations of the BGA	certificate date 10.05.2004
Centellen® NP WS 3860	TA-LUFT	high value in the meaning of TA-LUFT	Amtec No. 30116201	certificate date 17.12.2004



Universal Sealing sheet with extremely high temperature and pressure resistance (DIN 28091 FA-MA 1Z-0)

Technical charakteristics

The material basis of Europil® WS 3640 is comprised of anorganic fibers as well as mineral reinforcement materials, bonded with high quality NBR rubbers.

As a result, the following meterial profile is achieved:

- high temperature resistance
- high degree of mechanical stability
- very good gas tightness at high temperatures
- good chemical resistance

Production of Europil® WS 3640 is based on calendering process, during which the product is given an anti-adhesive surface with an extremely low coating thickness. The chemical properties remain unchanged thereby.

Applications

Due to this properties, Europil® WS 3640 seals can be employed in situations in which asbestos seals (in particular the former Hecker® quality Europil® WS 3440) were previously needed.

Of particular interest is the improved leakage rate of Europil® WS 3640 over asbestos seals when prevailing conditions involve up to 100 bar and 300°C. (Specific leakage rate according to DIN 28090 part 2. [$\lambda < 0{,}1$ mg/s(s*m)].

Chemical resistance

Resistant to

- hydrocarbons such as oil or solvents,
- alcohols, glycols, aqueous solutions, water and steam
- weak alkaline solutions and organic acids.

Partially resistant to

- ketones and esters,
- chlorinated solvents
- strong alkaline solutions and anorganic acids

Not resistant to

- hydrofluoric acid and concentrated nitric acid.

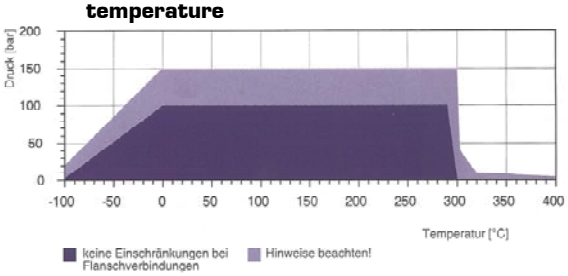
Releases applied for:

BAM: gaseous oxygen up to 60°C and 130 bar (TG-No. 7967/95 2-3908)

KTW: for drinking water according to the KTW recommendations of the BGA, for D2 seals, date of certificate 29.01.1996

Insitute of Wärmeschutz F.3086a/95

Applications depending on pressure and temperature



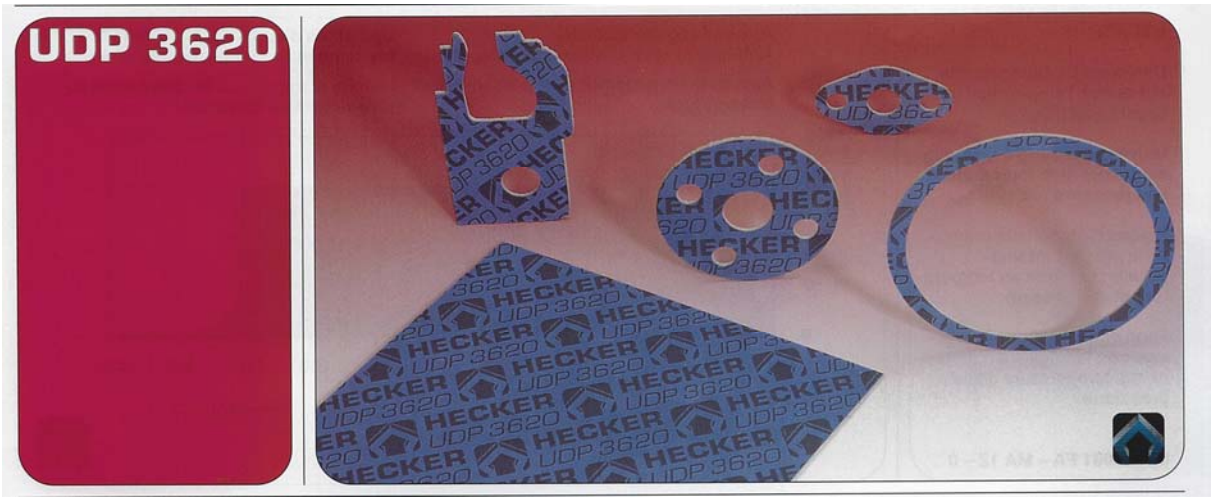
Standard version

Black-white
Anti – adhesive coating OBSW
Delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm
other dimensions on inquiry
Thickness from 0,3 up to 6 mm

Technical data

Density	1,85g/cm³	DIN 28090 part 2
Cold heading value (KSW)	6,0%	DIN 28090 part 2
Cold resiliences value (KRW)	3,1%	DIN 28090 part 2
Warm setting value (WSW)	6,5%	DIN 28090 part 2
Warm resilience value (WRW)	1,2%	DIN 28090 part 2
Spec. leakage rate λ	0,05 mg/s*m	DIN 28090 part 2
Gas-tightness	0,50 cm³/min	DIN 3754
	0,9 cm³/min	DIN 3535/6
compressive strength (16h/175°C, σdE/16)	34 N/mm²	DIN 52913
compressive strength (16h/300°C)	34 N/mm²	DIN 52913
tensile strength transverse	10 N/mm²	DIN 52910
Min. surface pressure (gas) σmin	30 N/mm²	DIN 28090
Min. surface pressure (fluids) σmin	20 N/mm²	DIN 28090
Max. surface pressure σBo(23°C)	> 90 N/mm²	DIN 28090
Max. surface pressure σBo(200°C)	> 90 N/mm²	DIN 28090
Max. surface pressure σBo(250°C)	> 90 N/mm²	DIN 28090
Min. temperature	-200°C	
Max. temperature	300°C	
Max. temperature (temporary)	500°C	
Max. pressure	150 bar	

Constant maximum temperature and maximum pressure should not occure simultaneously !



Universal Sealing Sheet for high temperatures (DIN 28091 FA – MA 1/-0)

Technical Characteristics

The material basis of UDP 3620 consists of anorganic fibers and synthetic aramide fibers as well as mineral reinforcement materials, bonded by high quality NBR rubbers.

Due to this combination of raw materials, the following mateial characteristics are given:

- very good resistance to high temperature
- high mechanical strength
- good chemical resistance
- able to substitute It-C

UDP 3620 is produced according to the calender process and is given a thin anti adhesive surface when produced. The chemical properties are not affected by this process.

Applications

According to the properties of the materials being used, gaskets made of UDP 3620 should be prefered wherever occuring temperatures exceed those covered by the application range of Centellen® WS 3820.

Chemical resistance

Resistant to:

- hydrocarbons such as oils or solvents,
- alcohols, glycols, aqueous solutions, water and steam up to 250°C
- weak alkaline solutions and organic acids

Partially resistant to:

- ketones and esters
- chlorinated solvents
- strong alkaline solutions and anorganic acids

Not resistant to:

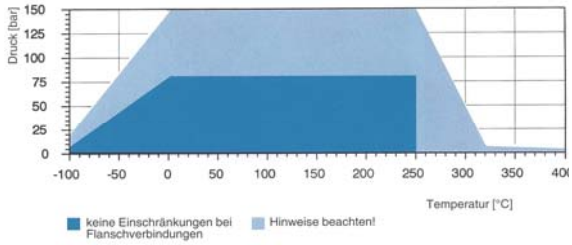
- hydrofluoric acid and concentrated nitric acid.

Releases:

BAM: for gaseous oxygen up to 60°C and 130 bar (Tg-No. 4-4387/94)

KTW: for drinking water up to 90°C according to the KTW recommendations of the BGA, for D2 seals, certificate dd. 12.04.2000

Applications depending on pressure and temperature



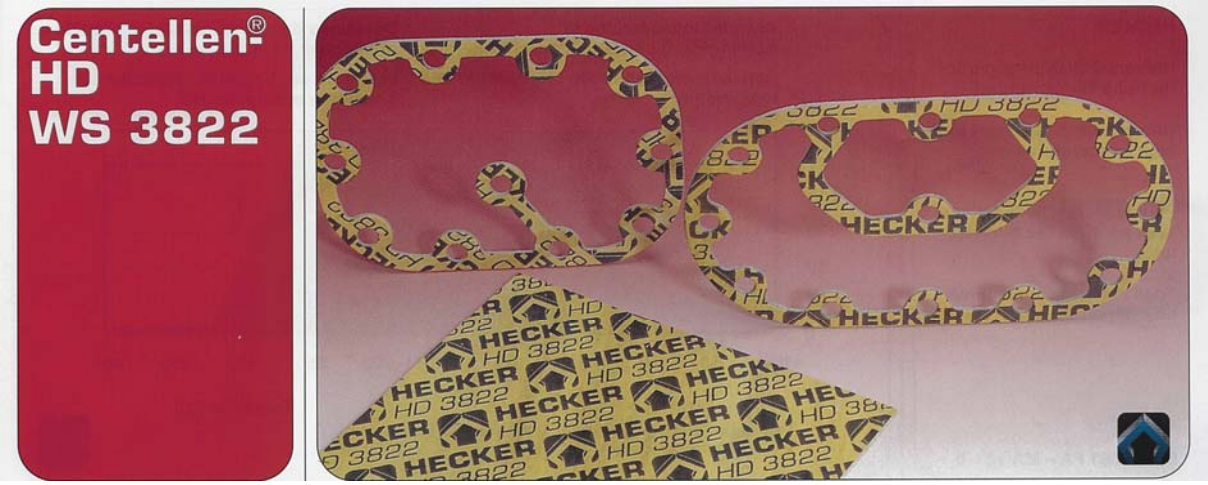
standard version

incolored-blue
anti-adhesive coating OBFB
delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm
others on demand
thickness 0,3 up to 6 mm

technical data

density	1,85g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	5,5%	-> DIN 28090 Part 2
Cold resilience value (KRW)	2,8%	-> DIN 28090 Part 2
Warm setting value (WSW)	6,7%	-> DIN 28090 Part 2
Warm resilience value (WRW)	1,6%	-> DIN 28090 Part 2
Spec. leakage rate λ	0,05 mg/s*m	-> DIN 28090 Part 2
Gas-tightness	0,50 cm³/min	-> DIN 3754
	2,0 cm³/min	-> DIN 3535/6
compressive strength (16h/175°C, σdE/16)	37 N/mm²	-> DIN 52913
compressive strength (16h/300°C)	35 N/mm²	-> DIN 52913
tensile strength transverse	11 N/mm²	-> DIN 52910
Min. surface pressure (gas) σmin	30 N/mm²	-> DIN 28090
Min. surface pressure (fluids) σmin	20 N/mm²	-> DIN 28090
Max. surface pressure σBo(23°C)	> 90 N/mm²	-> DIN 28090
Max. surface pressure σBo(200°C)	> 90 N/mm²	-> DIN 28090
Max. surface pressure σBo(250°C)	> 90 N/mm²	-> DIN 28090
Min. temperature	-200°C	
Max. temperature	300°C	
Max. temperature (temporary)	500°C	
Max. pressure	150 bar	

Constant maximum temperature and maximum pressure should not occur simultaneously !



Special quality for high pressures with good creep resistance and good gas tightness (DIN 28091 FA – MA1/-0)

Technical characteristics

This is a further development of our proventested Centellen® WS 3820. Centellen® HD-3822 was developed particularly for applications that would mechanically overburden our Centellen® WS 3820 quality. Due to the similar structures, the resistance data for Centellen® WS 3820 can be assumed for Centellen® HD 3822 as well. The material basis of Centellen® HD 3822 consits of high quality aramide and anorganic fibers as well as mineral reinforcement materials bonded with NBR rubber. Due to this combination of raw materials, the following material characteristics are given:

- high compressive strength
- very low gas leakage
- very good oil resistance
- good tensile strength

Centellen® HD 3822 is produced according to the calender process and is given a thin anti-adhesive surface when produced. The chemical properties are not affected by this process.

Applications

Due to this material characteristics, seals made of Centellen® HD 3822 can be used wherever extreme conditions in the form of higher pressure and medium temperature strain exist. Typical applications are pipes in the general chemical industry, the systems, apparatures and machines building industry, in the sanitary industry and in the food and beverage industry.

Chemical resistance

Resistant to

- hydrocarbons such as oil or solvents,
- alcohols, glycols, aqueous solutions, water and steam up to 200°C,
- weak alkaline solutions and organic acids

Partially resistant to

- Ketones and esters
- Chlorinated solvents,
- Strong alkaline solutions and anorganic acids

Not resistant to

- hydrofluoric acid and concentraded nitric acid

Releases

DIN-DVGW: as seal for the gas supply industry, type DIN 3535 -FA, gasket material based on synthetic fibers, testing mark NG-5123AP1136 dd. 09.Juni 1999

HTB-VP401 – 5bar: as seal for gascounters under higher thermical conditions, for flanges according to DIN 2543, DIN 2633, DIN 3376-2, DIN EN 1092-1, DIN EN 1092-2, RegNo: DG-5126BM0231, dd 25July2001

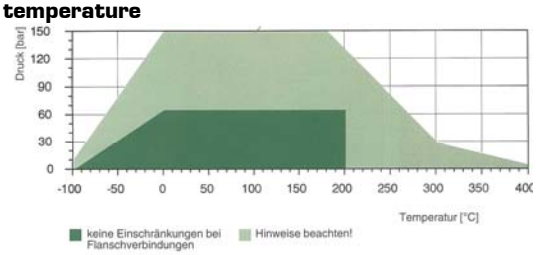
BAM: for gaseous oxygen up to 90°C and 100 bar (TG-No. 6336/88; 4-2047I)

KTW: for drinking water according to the KTW recommendations of the BGA, for D2 seals dd. 12.April2000

TA-LUFT: regulations of VDI 2440, MPA Stuttgart certifies high value in the sense of TA-LUFT. Certificate date 11.November 2002

WRc: for drinking water up to 85°C, Great Britain dd. 11.03.2004, Testing report MA2879/W

Applications depending on pressure and temperature



standard version

green-yellow, anti adhesive coating OBGY

standard delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm

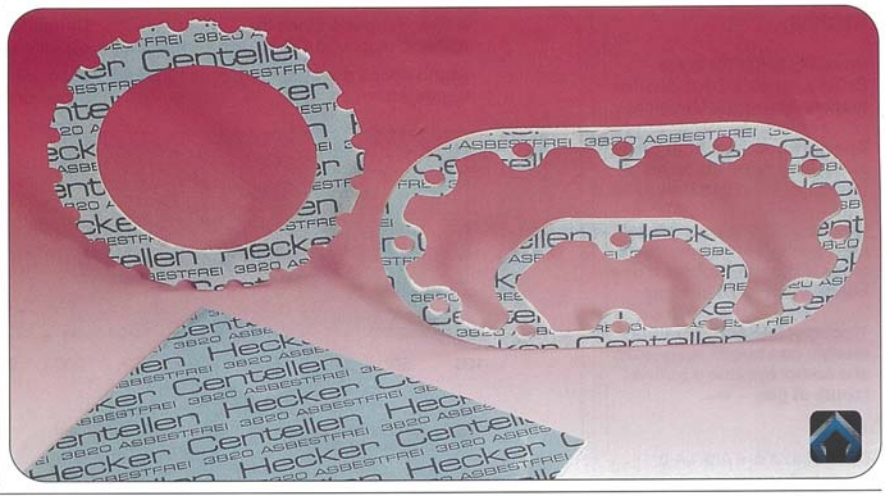
other formats on inquiry, thickness 0,3 up to 6 mm

technical data

density	1,8g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	4,8%	-> DIN 28090 Part 2
Cold resilience value (KRW)	2,0%	-> DIN 28090 Part 2
Warm setting value (WSW)	16,9%	-> DIN 28090 Part 2
Warm resilience value (WRW)	2,2%	-> DIN 28090 Part 2
Spez. Leakage rate λ	0,04 mg/s*m	-> DIN 28090 Part 2
Gas-tightness	0,50 cm³/min	-> DIN 3754
	0,6 cm³/min	-> DIN 3535/6
compressive strength (16h/175°C, σdE/16)	35 N/mm²	-> DIN 52913
compressive strength (16h/300°C)	25 N/mm²	-> DIN 52913
tensile strength transverse	14 N/mm²	-> DIN 52910
Min. surface pressure (gas) σmin	20 N/mm²	-> DIN 28090
Min. surface pressure (fluids) (Flüss.) σmin	10 N/mm²	-> DIN 28090
Max. surface pressure σBo(23°C)	> 90 N/mm²	-> DIN 28090
Max. surface pressure σBo(200°C)	60 N/mm²	-> DIN 28090
Max. surface pressure σBo(250°C)	60 N/mm²	-> DIN 28090
Min. Temperature	-200°C	
Max. Temperature	250°C	
Max. Temperature (temporary)	400°C	
Max. pressure	150 bar	

Constant maximum temperature and maximum pressure should not accur simultaneously !!

Centellen® WS 3820



Universal sealing sheet for use with medium temperature (DIN 28091 FA – A1 – 0)

Technical characteristics

Centellen® WS 3820 is produced according to the calander process. It consists of aramide fibers as well as anorganic reinforcement materials and contains NBR rubber as a bonding agent. The sheets are given a thin anti-adhesive surface when they are produced. The chemical properties are not effected by this process. Centellen® WS 3820 is our universal quality and can substitute IT-400, It-Ö or It-C. WS 3820 has high mechanical resistance values. The gas tightness fulfills the requirements for seals in the gas supply industry.

Chemical resistance

Resistant to

- Hydrocarbons such as oil or solvents,
- Alcohols, glycols, aqueous solutions, water and steam up to 250°C possible, over 250°C please clarify the parameter of application with the manufacturer
- Weak alkaline solutions and organic acids

Partially resistant to

- Ketones and esters
- Chlorinated solvents
- Strong alkaline solutions and anorganic acids

Not resistant to

- Hydrofluoric acid and concentrated nitric acid

Releases

DIN-DVGW: as seal for the gas supply industry, type DIN 3535-6 (01.12.99)gasket material based on synthetic fiber, testing mark NG-5123BL0021

HTB / DVGW VP 401: as seal for gas meter screw fitting under high thermal strain, in based on DIN 3376 (part 1 and part 2); DG-5126BN0432 dd. 05.09.02

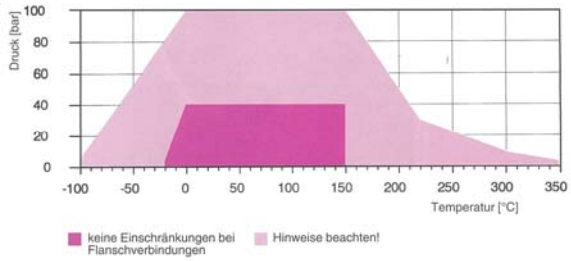
BAM: for gaseous oxygen up to 90°C and 100 bar (TG-No. 6336/88 4-2047 I)

KTW: for drinking water up to 60°C according to the KTW recommendations of the BGA, for D2 seals, dd. 15.04.2003

WrC: for drinking water up to 85°C, test report MA2454/I dd. 25.07.2001 (Great-Britain BS 6920)

TA-Luft: regulations of VDI 2440, MPA Stuttgart certifies high value in the sense of TA-LUFT. Certificate date 05.08.2003

Applications depending on pressure and temperature



Standard version

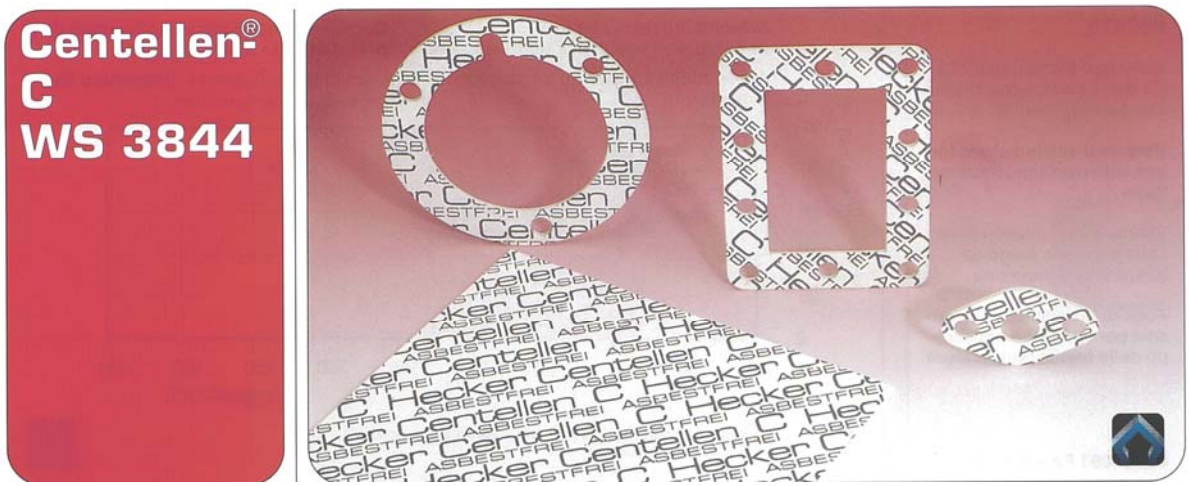
Green-green
Anti-adhesive coating OBG2
Standard delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm
other formats on inquiry
Thickness 0,3 up to 6 mm

Technical data

Density	1,8g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	8,0%	-> DIN 28090 Part 2
Cold resilience value (KRW)	4,0%	-> DIN 28090 Part 2
Warm setting value (WSW)	25,4%	-> DIN 28090 Part 2
Warm resilience value (WRW)	3,2%	-> DIN 28090 Part 2
Spec. leakage rate λ	0,02 mg/s*m	-> DIN 28090 Part 2
Gastightness	0,50 cm³/min	-> DIN 3754
	0,80 cm³/min	-> DIN 3535/6
Compressive strength (16h/175°C, σdE/16)	30 N/mm²	-> DIN 52913
Compressive strength (16h/300°C)	25 N/mm²	-> DIN 52913
Tensile strength transverse	11 N/mm²	-> DIN 52910
Min. Surface pressure (Gas) σmin	20 N/mm²	-> DIN 28090
Min. Surface pressure (Fluids) σmin	10 N/mm²	-> DIN 28090
Max. Surface pressure σBo(23°C)	> 90 N/mm²	-> DIN 28090
Max. Surface pressure σBo(200°C)	55 N/mm²	-> DIN 28090
Max. Surface pressure σBo(250°C)	30 N/mm²	-> DIN 28090

Min. Temperature	-200°C
Max. Temperature	200°C
Max. Temperature (Temporary)	350°C
Max. Pressure	100 bar

Constant maximum temperature and maximum pressure should not accur simultaneously !!



Universal Sealing sheet for the chemical industry (DIN 28091 FA – A13 –0)

Technical characteristics

Centellen® C WS 3844 is produced according to the calander process. It consists of aramide fibers as well as anorganic reinforcement materials and contains a spezial mixture of rubbers as a bonding agent. The sheets are given a thin anti-adhesive surface when they are produced. The chemical properties are not effected by this process.

Chemical resistance

Resistant to

- Aliphatic, aromatic and chlorinated hydrocarbons, mineral oils and mineral oil products,
- Alcohols, glycols, esters, aldehydes and ketones, aqueous solutions, water and steamup to 200°C
- Weak alkaline solutions and organic acids

Partially resistant to

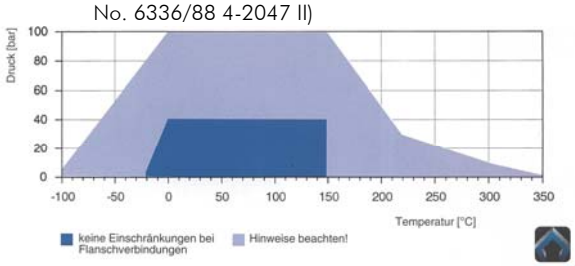
- Up to ca. 50°C to strong alkaline solutions such as sodium bicarbonate and potassium alkaline solutions, acids such as hydrochloric acid, sulphuric acid and pure acedic acid

Not resistant to

- Strong oxidizing acids such as concentrated hydrofluoric acid or nitric acid at high temperatures

Releases

BAM: For gaseous oxygen up to 80°C and 100 bar (TG-No. 6336/88 4-2047 II)



Applications depending on pressure and temperature

Standard version

Clear-clear
Anti-adhesive coating OBF2
Standard delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm
other formats on inquiry
Thickness 0,3 up to 6 mm

Technical data

Density	1,8g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	11,6%	-> DIN 28090 Part 2
Cold resilience value (KRW)	5,6%	-> DIN 28090 Part 2
Warm setting value (WSW)	14,1%	-> DIN 28090 Part 2
Warm resilience value (WRW)	1,5%	-> DIN 28090 Part 2
Spec. leakage rate λ	0,30 mg/s*m	-> DIN 28090 Part 2
Gastightness	1,2 cm³/min	-> DIN 3754
	1,3 cm³/min	-> DIN 3535/6
Compressive strength (16h/175°C, σdE/16)		32 N/mm² -> DIN 52913
Compressive strength (16h/300°C)		25 N/mm² -> DIN 52913
Tensile strength transverse		9 N/mm² -> DIN 52910
Min. Surface pressure (Gas) σmin		20 N/mm² -> DIN 28090
Min. Surface pressure (Fluids) σmin		10 N/mm² -> DIN 28090
Max. Surface pressure σBo(23°C)		70 N/mm² -> DIN 28090
Max. Surface pressure σBo(200°C)		55 N/mm² -> DIN 28090
Max. Surface pressure σBo(250°C)		50 N/mm² -> DIN 28090
Min. Temperature	-200°C	
Max. Temperature	200°C	
Max. Temperature (Temporary)	350°C	
Max. Pressure	100 bar	

Constant maximum temperature and maximum pressure should not accur simultaneously !!

Hecker® Centellen® W 3831

Preliminary technical information 3.2.831-00; GasketDIN 28091; FA - AN 1 - 0

Construction
Hecker® Centellen® W 3831 is produced on calenders. It consists of Aramid and other fibers, mineral reinforcement-materials that is bound by a NBR-rubber. The plates receive an antiadhesive surface-coating with a low coating thickness during the production. The chemical qualities are not changed hereby.

Technical qualities
Hecker® Centellen® W 3831 is a less expensive gasket-quality for thermal sealing with low strain. Because of the flexibility of the material, the sheet is very good for the use in locations with very high leakage demands combined with low surface pressure. The material is resistant against oils and hydrocarbons as well as against aqueous medias and refrigerants. Due to its gas permeability it can be employeed to seal gases.

Chemical resistance
Resistant against:
Hydrocarbons like oils or solvents

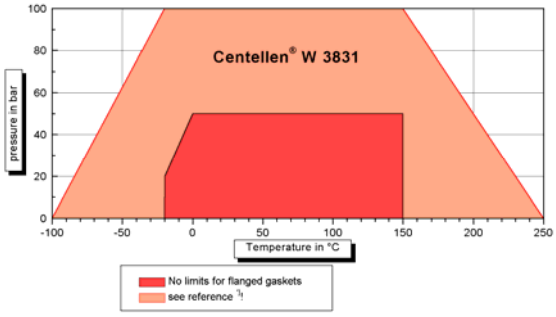
Alcohols, glykols, aqueous solutions

Not resistant against
Strong lyes and acids

Swelling based on DIN 3754
in ASTM 3-oil: calculation in process

in Fuel B: calculation in process

in water: calculation in process



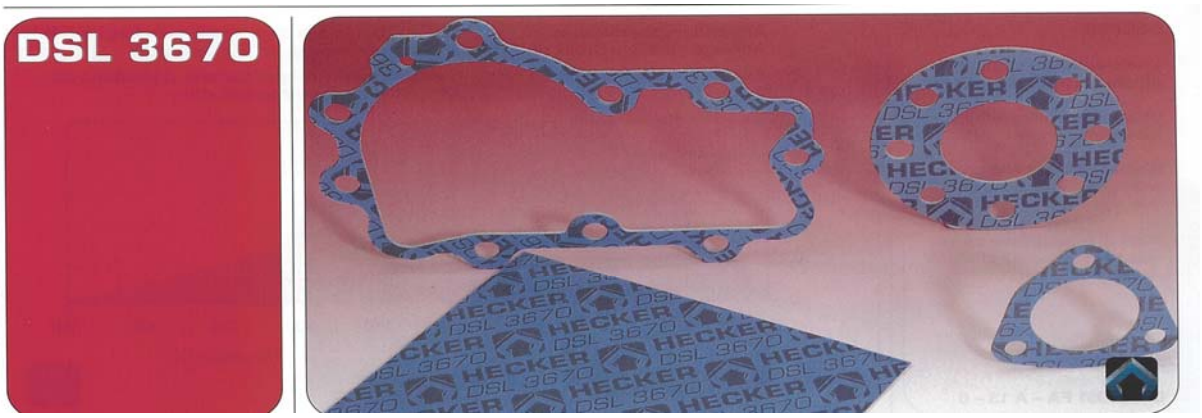
Technical data:
Visual apperance: red/red

Antiadhesive-coating: OBR2

Delivery-format: 1000 x 1500 mm, 1500 x 1500 mm, 1500 x 3000 mm

Standard-thickness: 0,5 up to 3 mm Technical data (thickness 2 mm)	Value	Unit	Standard
Density	1.7	g/cm³	DIN 28 090 part 2
Cold heading value KSW	7-15	%	DIN 28 090 part 2
Cold resilience value KRW	ca. 5	%	DIN 28 090 part 2
Warm setting value WSW	< 50	%	DIN 28 090 part 2
Warm resilience value WRW	1-2	%	DIN 28 090 part 2
Spec. Leakage rate λ	< 0.01	mg/(s·m)	DIN 28 090 part 2
Gas-tightness	< 0.1	cm³/min	DIN 3754
Compressive strength 16 h/175 °C, $\sigma_{dE/16}$	20	N/mm²	DIN 52 913
Compressibility	10-20	%	ASTM F 36 J
Recovery	> 40	%	ASTM F 36 J
Tensile strength transverse	> 10	N/mm²	DIN 52 910
min. surface pressure σ_{min} (Gases)	20	N/mm²	DIN 28 090
min. surface pressure σ_{min} (liquids)	10	N/mm²	DIN 28 090
Max. surface pressure σ_{Bo} (23 °C)	70	N/mm²	DIN 28 090
Max. surface pressure σ_{Bo} (100 °C)	60	N/mm²	DIN 28 090
Min. temperature(*)	- 40	°C	
Max. operating temperature(*)	180	°C	
Max. temperature (temporary)(*)	250	°C	
Max. pressure(*)	50	bar	

(*) Max. operating temperature and max. pressure should not occur simultaneously !



Special quality with very good resistance to steam, acids and alkaline solutions (DIN 28091 FA-MA Z-0)

Technical characteristics

The material basis of DSL 3670 consists of anorganic fibers and synthetic aramide fibers as well as mineral reinforcement materials, bonded by EPDM rubber.

Due to this combination of raw materials, the following material characteristics are given

- very good resistance to steam
- good resistance to polar materials
- adjustable since these materials harden more slowly than other materials
- low setting distance
- higher resistance to changing loads
- can substitute It-S

DSL 3670 is produced according to the calender process. It is given a thin anti-adhesive surface when it is produced. The chemical properties are not affected by this process.

Applications

Due to the characteristics of these materials, the seals made of DSL 3670 are particularly suited for pipes that transport steam or hot water. Becmade ofe of the good resistance the use of this material is also recommended togehter with concentrated acids and alkaline solutions.

Chemical resistance

Resistant to

- concentrated acids, strong alkaline solutions, anorganic and organic acids
- Alcohols, glycols, aqueous solutions, water and steam up to 250°C.

Well-suited

- For use against polar materials such as short-warp ketones and esters

Partially resistant to

- Long-warp Ketones and esters
- Chlorinated solvents

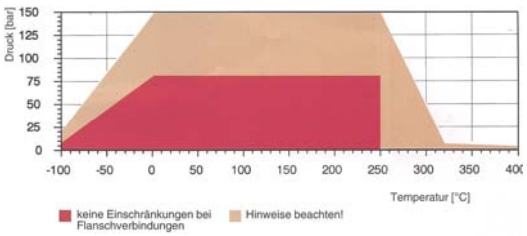
Not resistant to

- Hydrocarbons such as oil or solvents

Releases

BAM: For gaseous oxygen up to 60°C and 130 bar (TG-No. 7668/94; 4-4233)

Applications depending on pressure and temperature



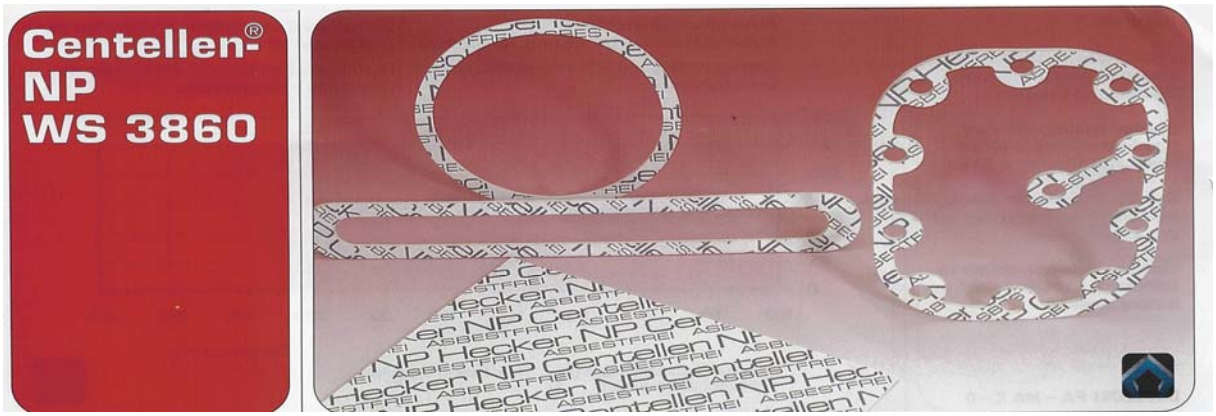
Standard version

Blue-blue
Anti-adhesive coating OBB2
Standard delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm
other formats on inquiry
Thickness 0,8 up to 6 mm

Technical data

Density	1,8g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	6,5%	-> DIN 28090 Part 2
Cold resilience value (KRW)	3,1%	-> DIN 28090 Part 2
Warm setting value (WSW)	6,3%	-> DIN 28090 Part 2
Warm resilience value (WRW)	2,0%	-> DIN 28090 Part 2
Spec. leakage rate λ	0,10 mg/s*m	-> DIN 28090 Part 2
Gastightness	0,5 cm³/min	-> DIN 3754
	2,0 cm³/min	-> DIN 3535/6
Compressive strength (16h/175°C, σdE/16)	36 N/mm²	-> DIN 52913
Compressive strength (16h/300°C)	30 N/mm²	-> DIN 52913
Tensile strength transverse	7 N/mm²	-> DIN 52910
Min. Surface pressure (Gas) σmin	25 N/mm²	-> DIN 28090
Min. Surface pressure (Fluids) σmin	15 N/mm²	-> DIN 28090
Max. Surface pressure σBo(23°C)	> 90 N/mm²	-> DIN 28090
Max. Surface pressure σBo(200°C)	60 N/mm²	-> DIN 28090
Max. Surface pressure σBo(250°C)	60 N/mm²	-> DIN 28090
Min. Temperature	-200°C	
Max. Temperature	250°C	
Max. Temperature (Temporary)	450°C	
Max. Pressure	150 bar	

Constant maximum temperature and maximum pressure should not accur simultaneously !!



Special quality with very good resistance to cooling agents

Technical characteristics

Centellen®-NP WS 3860 ist produced according to the calender process. It consists of aramide fibers as well as anorganic reinforcement materials and contains a mixture of NBR and CR rubbers as a bonding agent. The sheets are given a thin anti-adhesive surface when they are produced. The chemical properties are not effected by this process.

Centellen®-NP WS 3860 is a spezial, gastight quality that has been developed for applications against refrigerants.

Chemical resistance

Resistant to

- Refrigerants such as freones, methylene, chloride, ammonia, etc.
- Hydrocarbons such as oils, glycols, cooling brine,
- Weak alkaline solutions and organic acids

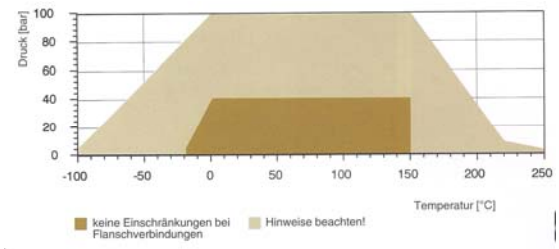
Partially resistant to

- Ketones and esters

Not resistant to

- Concentraded acids or alkaline solutions

Applications depending on pressure and temperature



Releases / Approvals

High value in the meaning of TA-Luft
Amtec, 17.12.2004, No. 30116201

Standard version

Red-clear
Anti-adhesive coating OBRF
Standard delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm
other formats on inquiry
Thickness 0,3 up to 6 mm

Technical data

Density	1,8g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	7,1%	-> DIN 28090 Part 2
Cold resilience value (KRW)	2,4%	-> DIN 28090 Part 2
Warm setting value (WSW)	56,7%	-> DIN 28090 Part 2
Warm resilience value (WRW)	2,1%	-> DIN 28090 Part 2
Spec. leakage rate λ	0,05 mg/s*m	-> DIN 28090 Part 2
Gastightness	0,5 cm³/min	-> DIN 3754
	0,8 cm³/min	-> DIN 3535/6
Compressive strength (16h/175°C, σdE/16)	26 N/mm²	-> DIN 52913
Compressive strength (16h/300°C)	- N/mm²	-> DIN 52913
Tensile strength transverse	9 N/mm²	-> DIN 52910
Min. Surface pressure (Gas) σmin	20 N/mm²	-> DIN 28090
Min. Surface pressure (Fluids) σmin	10 N/mm²	-> DIN 28090
Max. Surface pressure σBo(23°C)	> 90 N/mm²	-> DIN 28090
Max. Surface pressure σBo(200°C)	55 N/mm²	-> DIN 28090
Max. Surface pressure σBo(250°C)	45 N/mm²	-> DIN 28090
Min. Temperature	-200°C	
Max. Temperature	200°C	
Max. Temperature (Temporary)	250°C	
Max. Pressure	100 bar	

Constant maximum temperature and maximum pressure should not occur simultaneously !!

Hecker® Cell 3805

Low Level gasket (low temperatures, low pressure and low price !)

Aufbau

Hecker® Cell 3805 is produced on calenders. It's made of mineral and cellulose fibers and mineral filler. The components are bonded by NBR-rubber. The sheets are equipped with a non adhesive surface.

Chemical resistance

Resistant against:

- Hydrocarbons such as oil or solvents
- Alcohol, glycol, aqueous solutions

Not resistant against:

- Strong alkali and acids

Standard version

Clear / red
Anti-adhesive coating OBRF

Standard delivery formats: 1000*1500mm
1500*1500mm
1500*3000mm
others on inquiry

Thickness standard: 0,3 up to 6 mm

Releases:

KTW: for drinking water, seals D2, after the recommendations of the BGA, certificate date 26.09.2002

WrC: for drinking water up to 85°C, Great Britain, BS 6920, MA2756/X dd. 29.08.03

Constant maximum temperature and maximum pressure should not occur simultaneously !

Technical data (thickness 2 mm)	Value	Unit	Standard
Density	1.7	g/cm³	DIN 28090 / 2
Cold heading value	7-15	%	DIN 28090 / 2
Cold resilience value KRW	~3	%	DIN 28090 / 2
Warm setting value WSW	>30	%	DIN 28090 / 2
Warm resilience value WRW	1-2	%	DIN 28090 / 2
Spec. Leakage rate λ	0,04	mg/(s*m)	DIN 28090 / 2
Gastightness	0,4	cm³/min	DIN 3745
Compressive strength 16h/175°C	20	N/mm²	DIN 52913
Compressibility	10-20	%	ASTM F 36 J
Resilience	>40	%	ASTM F 36 J
Tensile strength transverse	9	N/mm²	DIN 52910
Min. surface pressure σ (Gases)	20	N/mm²	DIN 28090
Min.surface pressure σ (liquids)	10	N/mm²	DIN 28090
Max.surface pressure σ_{B0} (23°C)	>90	N/mm²	DIN 28090
Max. surface pressure σ_{B0} (100°C)	40	N/mm²	DIN 28090
Min. temperature (*)	-40	°C	
Max. operating temperature (*)	120	°C	
Max. temperature (short time) (*)	150	°C	
Max.pressure (*)	20	Bar	

Packing WS 3815

Objective:
WS 3815 is an inexpensive, in Germany produced, alternative to import-qualities already introduced at the market. Released after DVGW, KTW and WRc were applied for. If you have thought until now, that it is not possible to buy "inexpensive" qualities with corresponding approvals with the quality-seal "Made in Germany", then we would like to so prove you the opposite here. Order samples and ask about our prices. You will surely be surprised.

Construction:
WS 3815 is producted on calenders. It consists of Aramid fibres, recycling-material of our high-quality Centellen-quality and mineral reinforcement-materials that is bound by a rubber-mixture. The plates receive an antiadhesive surface-coating with a low coating thickness during the production. The chemical qualities are not changed hereby.

Technical qualities:
WS 3815 is momentarily our less inexpensive gasket-quality for thermal and mechanical sealing with low strain. It is preferentially suitable for use in the sanitary-area. The material is resistant against oils and hydrocarbons as well as against aqueous medias and refrigerants. Due to its gas permeability it can be employeed to seal gases.

Chemical resistance
Resistant against:
hydrocarbons like oils or solvents, alcohols, glykols, aqueous solutions, water up to 105°C

not suitable against:
cetones and esters, chlorinated solvents, strong lyes and acids

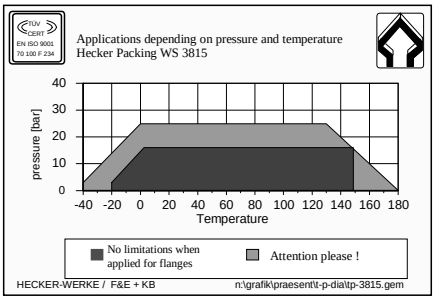
releases
DIN-DVGW: as sealings for gas supply, type DIN 3535-FA, gaskets on basis of synthetic fibers, register-No. NG-5123BL0306 (25.07.2000)
HTB-VP401 – 1 bar: as seal for gascounters under higher thermical conditions, for flanges according to DIN 3376-1, Reg.no. DG-5126BM0232 (25.07.2001)
WrC: For drinking water up to 85°C (Great Britain, BS 6920; MA2454 dd. 25.07.2001)
KTW: for drinking water up to 90°C in accordance to KTW recommandation of the BGA, for sealings D2 (21.08.2000)

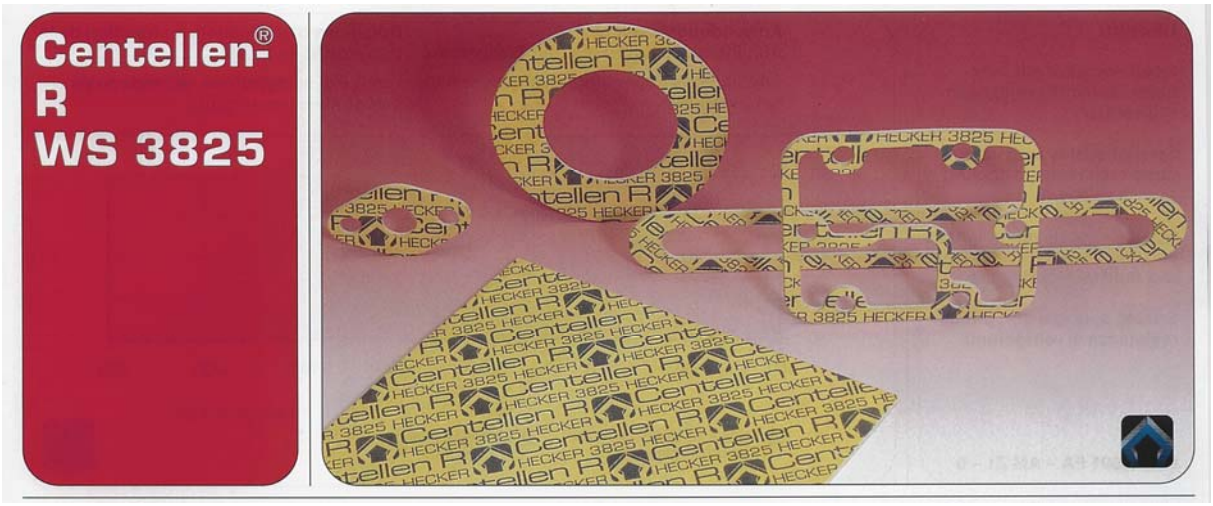
Technical data:
visual appearance: red/red
Antiadhesive-coating: OBR2
Delivery-format: 1000 x 1500 mm, 1500 x 1500 mm, 1500 x 3000 mm
Standard-thickness: 0,5 up to 5,0 mm

Technical data (2 mm)	Value	Unit	Standard
Density	1,8	g/cm³	DIN 28090P 2
Cold heading value	10-20	%	DIN 28090P 2
Cold resilience value	ca. 5	%	DIN 28090P 2
Warm setting value	< 30	%	DIN 28090P 2
Warm resilience value	1-2	%	DIN 28 09 P 2
Spec leakage rate λ	< 0,1	mg/(s.m)	DIN 28090P 2
Gas thightness	< 1	cm³/min	DIN 3754
Compressive strength 16h/175°C, $\sigma_{d\ E16}$	> 20	N/mm²	DIN 52 913
Compressibility	10-20	%	ASTM F 36 J
Recovery	> 40	%	ASTM F 36 J
Tensile strength transverse	> 5	N/mm²	DIN 52 910
Min. Temperature(*)	- 40	°C	
Max. operating temp.)	150	°C	
Max. temperature (*) (TEMPORARY)	180	°C	
Max. pressure(*)	25	bar	

Max. surface pressure $\sigma_{\beta 0}$ (23°C) > 90 N/mm² (DIN 28090)
Max. surface pressure $\sigma_{\beta 0}$ (150°C) 60 N/mm² (DIN 28090)

*)Max. operating temperature and max. pressure should not occur simultaneously !





Sealing sheet with extremly high gas tightness

Structure
Centellen® R WS 3825 is produced according to the calender process. It consists of aramide fibers, anorganic fibers and recycled material from our high aramide qualities as well as mineral reinforcement materials that are bonded with a rubber mixture. The sheets are given an anti-adhesive surface when they are produced. The chemical properties are not effected by this process.

Technical characteristics
Centellen®-R WS 3825 is our spezial quality that displays best gas tightness and good compressive strength at temperatures up to 200°C. This quality was developed especially to meet the requirements of the sanitare and sewage industries and for the apparatus and machine-building industry.

Chemical resistance
Resistant to
- Hydrocarbons such as oil or solvents
- Alcohols, glycols, aqueous solutions, water and steam up to150°C
- Gas (with the exception of extremely acidic gases)

Not resistant to
- Ketones and esters, chlorinated solvents
- Strong alkaline solutions and acids.

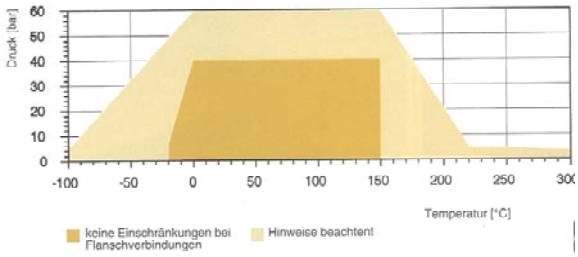
Swelling based on DIN 3754

In ASTM 3-oil	< 10 Vol%
In Fuel B	< 13 Vol%
In Water	< 3 Vol%

Releases

DIN-DVGW:	as seal for the gas supply industry, type DIN 3535-6, gasket material based on synthetic fibers, test mark: NG 5123AO0275 dd. 25.08.03
BAM:	For gaseous oxygen up to 65°C and 100 bar (TG-No. 6890/93 4-3876)
KTW:	for drinking water up to 90°C according to the KTW recommendations of the BGA, for D2 seals (29.09.2004)
HTB:	gas supply industry; DIN 3374 and DIN 3376; 96/150/539/2, dd. 20.08.1996
WRc:	for drinking water up to 85°C, Great Britain BS6920, CH1697/S, dd. 25.07.1995

Applications depending on pressure and temperature



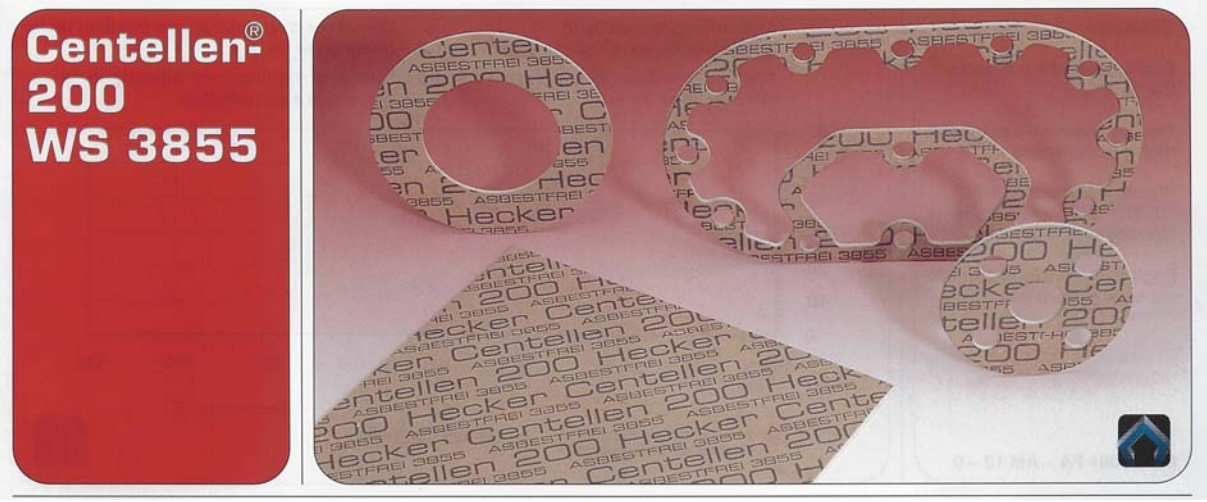
Standard version

Yellow-yellow	
Anti-adhesive coating OBY2	
Standard delivery formats	1000 x 1500 mm
	1500 x 1500 mm
	1500 x 3000 mm
other formats on inquiry	
Thickness 0,3 up to 6 mm	

Technical data

Density	1,8g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	8,0%	-> DIN 28090 Part 2
Cold resilience value (KRW)	5,0%	-> DIN 28090 Part 2
Warm setting value (WSW)	27,0%	-> DIN 28090 Part 2
Warm resilience value (WRW)	4,0%	-> DIN 28090 Part 2
Spec. leakage rate λ	0,01 mg/s*m	-> DIN 28090 Part 2
Gastightness	<0,3 cm³/min	-> DIN 3754
	<0,8 cm³/min	-> DIN 3535/6
Compressive strength (16h/175°C, σdE/16)		>25 N/mm² (DIN 52913)
Tensile strength transverse		>6 N/mm² (DIN 52910)
Min. Surface pressure (Gas) σmin		20 N/mm² (DIN 28090)
Min. Surface pressure (Fluids) σmin		10 N/mm² (DIN 28090)
Max. Surface pressure σBo(23°C)		70 N/mm² (DIN 28090)
Max. Surface pressure σBo(175°C)		40 N/mm² (DIN 28090)
Min. Temperature		-100°C
Max. Temperature		200°C
Max. Temperature (Temporary)		300°C
Max. Pressure		60 bar

Constant maximum temperature and maximum pressure should not accur simultaneously !!



Sealing sheet for applications that are thermally and mechanically not critical

Structure
Centellen® 200 WS 3855 is produced according to the calender process. It consists of aramide and other fibers, as well as anorganic reinforcement materials and contains special rubber as a bonding agent. The sheets are given a thin anti-adhesive surface when they are made. The chemical properties are not effected by this process.

Technical characteristics
Centellen®-R WS 3855 is our inexpensive quality for joints that are subject to little thermal and mechanical stress.

Chemical resistance
Resistant to

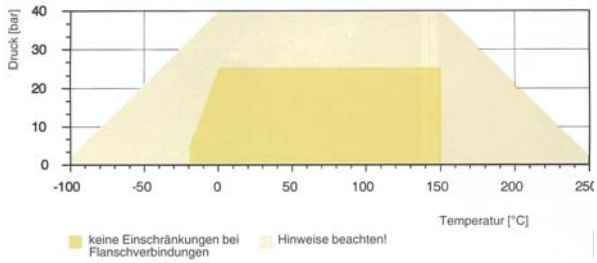
- Hydrocarbons such as oil or solvents
- Alkohols, glykols, aqueous solutions
- Water and steam up to 150°C
- Weak alkaline solutions and acids

Not resistant to

- Ketones and esters, chlorinated solvents
- Strong acids or alkaline solutions

Releases
KTW: for drinking water according to the KTW recommendations of the BGA, for D2 seals (10.05.2004)

Applications depending on pressure and temperature

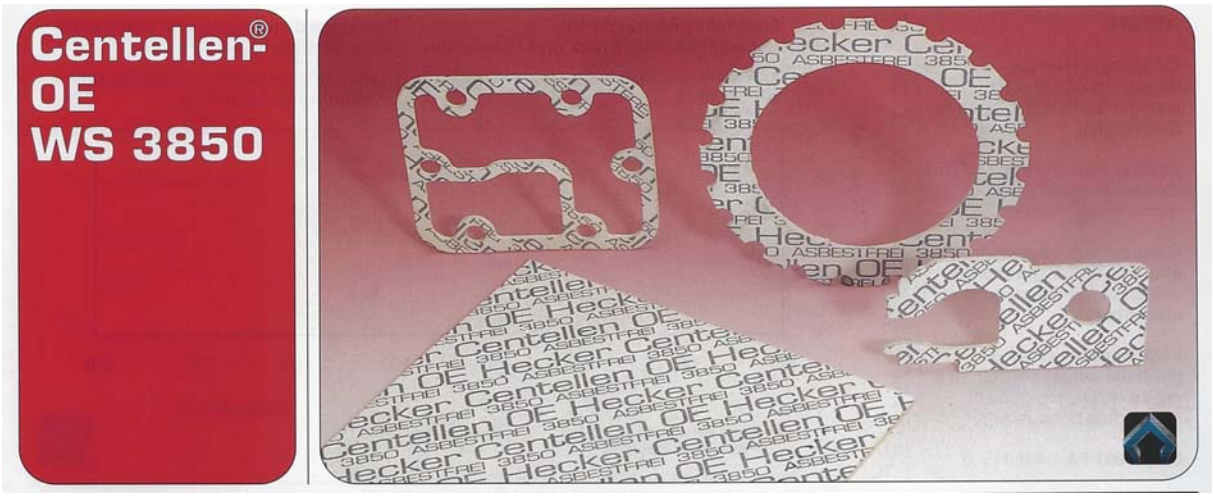


Standard version
Red-red
Anti-adhesive coating OBR2
Standard delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm
other dimensions on inquiry
Thickness 0,3 up to 6 mm

Technical data

Density	1,8 g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	8,9%	-> DIN 28090 Part 2
Cold resilience value (KRW)	4,4%	-> DIN 28090 Part 2
Warm setting value (WSW)	34,2%	-> DIN 28090 Part 2
Warm resilience value (WRW)	2,0%	-> DIN 28090 Part 2
Spec. leakage rate λ	2,3 mg/s*m	-> DIN 28090 Part 2
Gastightness	2 cm³/min	-> DIN 3754
	- cm³/min	-> DIN 3535/6
Compressive strength (16h/175°C, σdE/16)	25 N/mm²	-> DIN 52913
Compressive strength (16h/300°C)	15 N/mm²	-> DIN 52913
Tensile strength transverse	7 N/mm²	-> DIN 52910
Min. Surface pressure (Gas) σmin	20 N/mm²	-> DIN 28090
Min. Surface pressure (Fluids) σmin	10 N/mm²	-> DIN 28090
Max. Surface pressure σBo(23°C)	>90 N/mm²	-> DIN 28090
Max. Surface pressure σBo(200°C)	60 N/mm²	-> DIN 28090
Max. Surface pressure σBo(250°C)	55 N/mm²	-> DIN 28090
Min. Temperature	-200°C	
Max. Temperature	180°C	
Max. Temperature (Temporary)	250°C	
Max. Pressure	40 bar	

Constant maximum temperature and maximum pressure should not accur simultaneously !!



Special quality for use with oils

Structure
Centellen® OE WS 3850 is produced according to the calender process. It consists of aramide and other fibers, anorganic reinforcement materials and contains NBR rubber as a bonding agent. The sheets are given a thin anti-adhesive surface whenn they are produced. The chemical properties are not effected by this process.

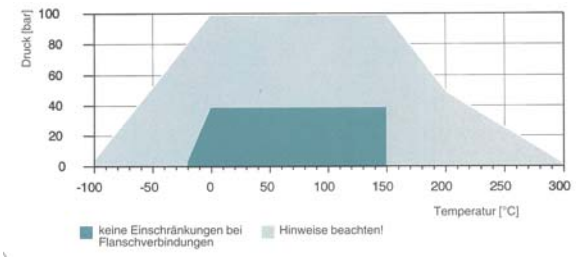
Technical characteristics
Centellen®-OE WS 3850 is oil resistant and can replace It-Ö.

Chemical resistance
Resistant to
- Hydrocarbons such as oil or solvents
- Alkohols, glycols, acqueous solutions
- Water and steam up to 200°C
- Weak alkaline solutions and organic acids

Partially resistant to
- Ketones and esters
- Chlorinated solvents

Not resistant to
- Strong alkaline solutions and anorganic acids

Releases
BAM: for gaseous oxygen up to 90°C and 100 bar (Tg-No. 6336/88-2047 III)

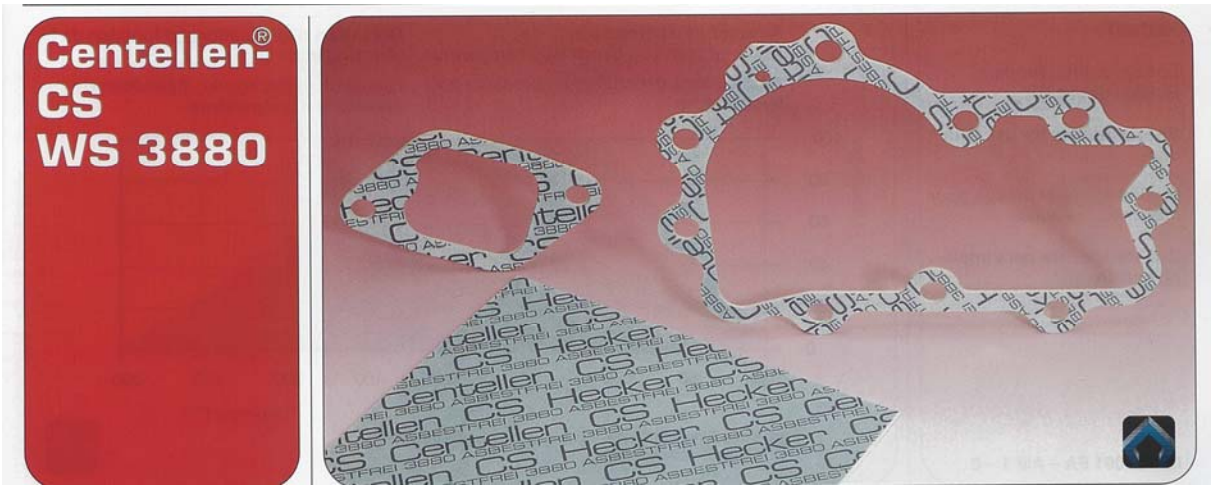
Applications depending on pressure and temperature


Standard version
Green-clear
Anti-adhesive coating OBGF
Standard delivery formats 1000 x 1500 mm
1500 x 1500 mm
1500 x 3000 mm
other formats on inquiry
Thickness 0,3 up to 6 mm

Technical data

Density	1,8 g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	12,7%	-> DIN 28090 Part 2
Cold resilience value (KRW)	6,5%	-> DIN 28090 Part 2
Warm setting value (WSW)	20,1%	-> DIN 28090 Part 2
Warm resiliences value (WRW)	2,1%	-> DIN 28090 Part 2
Spec. leakage rate λ	0,08 mg/s*m	-> DIN 28090 Part 2
Gastightness	2 cm³/min	-> DIN 3754
	1,2 cm³/min	-> DIN 3535/6
Compressive strength (16h/175°C, σdE/16)	27 N/mm²	-> DIN 52913
Compressive strength (16h/300°C)	22 N/mm²	-> DIN 52913
Tensile strength quer	8 N/mm²	-> DIN 52910
Min. Surface pressure (Gas) σmin	20 N/mm²	-> DIN 28090
Min. Surface pressure (Fluids) σmin	10 N/mm²	-> DIN 28090
Max. Surface pressure σBo(23°C)	>90 N/mm²	-> DIN 28090
Max. Surface pressure σBo(200°C)	55 N/mm²	-> DIN 28090
Max. Surface pressure σBo(250°C)	45 N/mm²	-> DIN 28090
Min. Temperature	-200°C	
Max. Temperature	200°C	
Max. Temperature (Temporary)	300°C	
Max. Pressure	100 bar	

Constant maximum temperature and maximum pressure should not accur simultaneously !!



Sealing sheet with specific swelling properties

Structure
Centellen® CS WS 3860 is produced according to the calander process. It consists of aramide and other fibers as well as anorganic reinforcing materials and contains spezial rubber as a bondig agent. The sheets are given a thin anti-adhesive surface when they are produced. The chemical properties are not effected by this process.

Technical characteristics
Centellen®-CS WS 3860 is a spezial quality to be used against oils for joints with low or uneven surface pressure. Concentraded swelling in oils makes the joint leakageproof even when there is uneven surface pressure.

Chemical resistance
Resistant to
- Hydrocarbons such as oil or solvents
- Aclohols, glykols, aqueous solution
- Weak alkaline solutions and organic acids

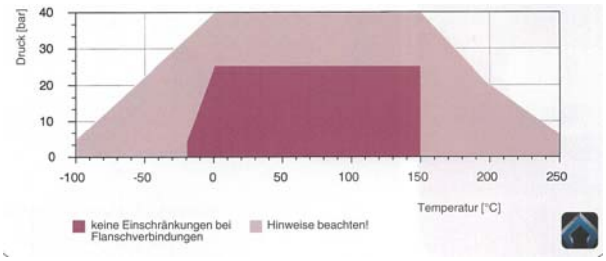
Partially resistant to
- Ketones and esters

Not resistant to
- Strong alkalines and solvents
- Chlorinated solvents

Swelling based on DIN 3754

In ASTM 3-oil:	< 30 Vol.%
In Fuel B:	< 42 Vol.%

Applications depending on pressure and temperature



Standard version
Red-green
Anti-adhesive coating OBRG

Standard delivery formats	1000 x 1500 mm
	1500 x 1500 mm
	1500 x 3000 mm

other formats on inquiry
Thickness 0,3 up to 6 mm

Technical data

Density	1,7 g/cm³	-> DIN 28090 Part 2
Cold heading value (KSW)	8,1%	-> DIN 28090 Part 2
Cold resiliance value (KRW)	4,4%	-> DIN 28090 Part 2
Warm setting value (WSW)	51,0%	-> DIN 28090 Part 2
Warm Resilience value (WRW)	0,5%	-> DIN 28090 Part 2
Spec. leakage rate λ	0,25 mg/s*m	-> DIN 28090 Part 2
Gastightness	1 cm³/min	-> DIN 3754
	0,3 cm³/min	-> DIN 3535/6
Compressive strength (16h/175°C, σdE/16)	25 N/mm²	-> DIN 52913
Compressive strength (16h/300°C)	- N/mm²	-> DIN 52913
Tensile strength transverse	8 N/mm²	-> DIN 52910
Min. Surface pressure (Gas) σmin	20 N/mm²	-> DIN 28090
Min. Surface pressure (Fluids) σmin	10 N/mm²	-> DIN 28090
Max. Surface pressure σBo(23°C)	>90 N/mm²	-> DIN 28090
Max. Surface pressure σBo(200°C)	50 N/mm²	-> DIN 28090
Max. Surface pressure σBo(250°C)	30 N/mm²	-> DIN 28090
Min. Temperature	-200°C	
Max. Temperature	150°C	
Max. Temperature (Temporary)	250°C	
Max. Pressure	40 bar	

Constant maximum temperature and maximum pressure should not accur simultaneously !!

HECKER® GRAFOTHERM - Gasket Materials made of Expanded Graphite

Aufbau

Grafotherm consists of pure graphite which has been expanded by means of a spezial procedure. This material is compressed to foils or sheets without using any binders or fillers.

The graphite jointing sheets are available in various designs. Besides sheets are available in various designs. Besides sheets of pure graphite, sheets with a spezial resin impregnation of the surfaces, with an intermediate smooth stainless steel or needled steel sheet layer are available.

Technical Characteristics

- since Grafotherm consists of pure graphite without any bonding agents, gaskets made of this material can be used up to 500°C without loss of material quality or durability.
- Grafotherm gaskets do not settle as a result of temperature changes. It is not necessary to re-tighten gaskets that have been fitted.
- Gaskets made of Grafotherm do not harden. They display a compression and resilience behaviour that is constant regardless of temperature. Grafotherm is therefore suited for use in situations involving frequent temperature fluctuations.
- The high compressibility and the low minimum surface pressure of the grafotherm gaskets make them suited for use in sensitive glass or enamel flanges.

Peculiarities of the impregnated and metal reinforced grafotherm gaskets

- Grafotherm gaskets are very susceptible to surface damages such as scratches, bending and tearing. For this reason great care must be taken when installing them. We therefore recommend the use of the impregnated or metal-reinforced types, especially in case of difficult repair or installation circumstances.
- Impregnation of the surface improves resistance to scratching. The use of the impregnated types is therefore preferable in any case. The durability and the gas tightness is thereby increased. Impregnation also reduces the problem of adherence to the flange, thereby facilitating the subsequent removal of the gasket.
- Reinforcement with a glued-in, smooth sheet metal, with a metal spike or with several glue-free stainless steel foils generally leads to improved handling, especially in case of gaskets with a large diameter. The sealing characteristics of the gasket are decreased somewhat due to the layer of glue.
- Grafotherm gaskets with a layer of needled metal spike or several glue-free stainless steel foils are particularly recommendable for high pressures and high surface pressures.

HECKER® GRAFOTHERM - Gasket materials out of Expanded Graphite

Technical data of the Grafotherm materials for 2mm sheet thickness and an apparent density of the grafotherm of 1,0 g/cm³

Material	Reinforcement	Thickness In mm	Impregnation	Density g/cm³	Ash %	Chloride ppm	Thicknesses mm
3000	None	-	None	1,0	<0,15	<20	0,25/0,35/0,5/0,8/1,0/1,5/2,0
3200	None	-	None	1,0	<2,0	<50	0,25/0,35/0,5/0,8/1,0/1,5/2,0
3250	None	-	Furane resin	1,0	<=2,0	<=50	1,0/1,5/2,0
3204	Smooth Sheet metal cover made of 1.4401	0,05	None	1,0	<=2,0	<=50	1,0/1,5/2,0/3,0/4,0
3054	Several Stainless steel foils made of 1.4401	0,05	Furane resin	1,1	<=0,15	<=20	1,0/1,5/2,0/3,0/4,0
3112	sheet metal cover made of 1.4401	0,10	None	1,0	<2,0	<50	1,0/1,5/2,0/3,0
3202	sheet metal cover made of 1.4401	0,10	None	1,0	<2,0	<50	1,5/2,0/3,0
3252	sheet metal cover made of 1.4401	0,10	Furane resin	1,0	<=2,0	<=50	1,5/2,0/3,0

Material-No.	Gas permeability DIN 3535 T.4 cm³/min	Compressive strengths DIN 52913 N/mm²	KSW %	KRW %	WSW %	WRW %	Compressibility ASTM F36 A-66 %
3000	<1,2	>48	40-50	3-4	<3	3-4	40-50
3200	<1,6	>48	40-50	3-4	<3	3-4	40-50
3250	<=0,8	>47	40-50	3,5-4,5	<4	2,5-3,5	40-50
3204	<=0,6	>45	35-45	3,5-4,5	<5	3-4	40-50
3054	<0,5	>48	30-40	4-6	2-3	3-5	30-40
3112	<1	>48	-	-	-	-	35-45
3202	<0,8	>48	35-45	5-6	2-4	3-5	30-40
3252	<=1,0	>45	35-45	4-6	<4	2-5	30-40

Material-No.	Resilience ASTM F36 A-66 %	Max. Temperature (DIN 2690)	Max. Pressure (DIN 2690)
3000	10-15	500	40
3200	10-15	500	40
3250	10-15	500	40
3204	10-15	500	25
3054	15-20	500	250
3112	10-20	500	100
3202	15-20	500	100
3252	15-20	500	100

HECKER® GRAFOTHERM - Gasket Materials out of expanded Graphite

Releases

BAM for liquid oxygen, no prescriptions concerning pressure or temperature for gaseous oxygen up to 200°C and 130 bar.
WS 3000Tg.No. 4411/91 , 4-1763

BAM for propylene oxide and ethylene oxide up to 60°C
WS 3202Tg.No. 4.2-377/92

DVGW as gaskets used for the gas supply type DIN 3535-GR, gasket material out of pure graphite.
WS 3202Reg.No. 89.01e 618

KTW for gaskets D2 contacting food
WS 3200

WS 3054
BAM, DVGW, MPA-Stuttgart, Germanischer Lloyd, US Coastgard, Fire Safety BS 6755, TA-Luft

WS 3204
BAM, DVGW

WS 3250
BAM, DVGW, KTW

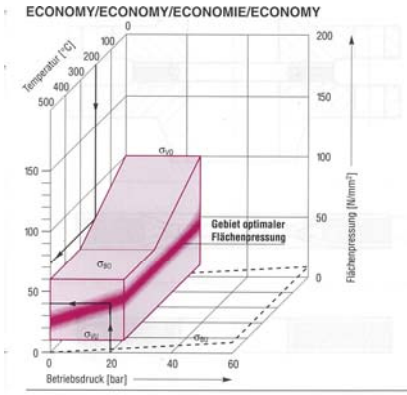
WS 3252
BAM, DVGW, Fire Safety BS 6755, Germanischer Lloyd

Dimensions and shapes available

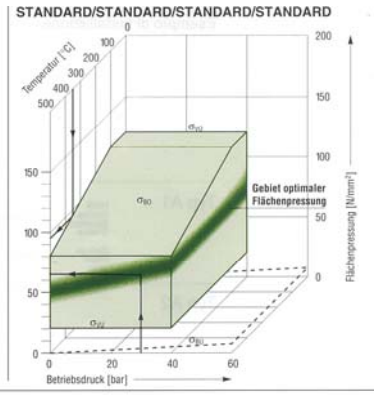
Sheets at a dimension of 1000 x1000 mm
rings up to Da = 990 mm
rings exceeding Da = 990 mm in joined design
punched gasket materials as per DIN standards, according to customers drawings or samples

Recommended application for Grafotherm seals according to DIN 2690

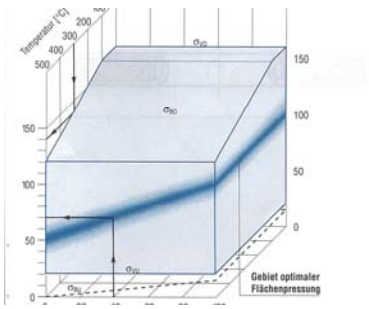
WS 3204



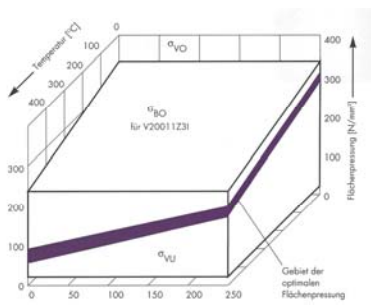
WS 3250



WS 3252 – UNIVERSAL



WS 3054 – High-pressure



Euraflon® B 3770, A 3780 and Euraflon® S 3790

Euraflon® A 3780 and Euraflon® S 3790 are PTFE-Gasket-Sheet materials manufactured by a unique process which provides a high fibrillation level to overcome the creep relaxation and cold flow problem associated with normal (skived or moulded) PTFE sheets. Euraflon® A 3780 is produced from virgin PTFE resin filled with Barium Sulphate. Euraflon® S 3790 is produced from virgin PTFE resin filled with Silica.

Euraflon® B 3770 is a structured PTFE-Gasket-Sheet manufactured by a unique process which provides a high level of fibrillation to overcome the creep relaxation and cold flow problems associated with normal (skived or moulded) PTFE sheets. Euraflon® B 3770 is produced from virgin PTFE resin filled with hollow glass micro spheres.

Applications:
Euraflon® A 3780 is suitable for general service with a wide variety of fluids, strong caustics, moderate acids (including hydrofluoric), chlorine, gaaes, water, steam, hydrocarbons, hydrogen and aluminium fluoride.

Euraflon® S 3790 is suitable for services with high pressures and temperature, especially in chemical processing and hydrocarbon plants in strong acids (except hydrofluoric), solvents, hydrocarbons, water, steam and chlorine.

Euraflon® B 3770 is suitable for service with a wide variety of aggresisive fluids, including hydrocarbons, acids and caustics, solvents, water, steam, hydrogen-peroxide, refigerants etc. The high compressibility of B 3770 makes it particularly suitable for use with stress sensitive and/or fragile flanged joints, e.g. glass, ceramics, plastic etc.

Availability:
Sheets of 1500 x 1500 mm in 1,5mm, 2,0mm and 3,0mm thickness

EURAFLON®
PTFE-PRODUKTE
VON HECKER®

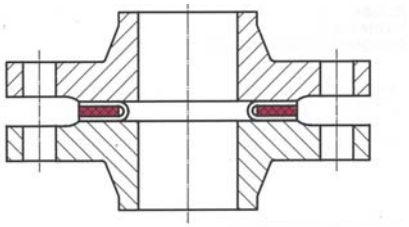
	Euraflon® B 3770	Euraflon® A 3780	Euraflon® S 3790	Test method
colour	blue	white	fawn	
pH-Range	0-14	0-14	0-14	
pressure	max. 55 bar	max. 83 bar	max. 83 bar	
temperature	.-210°C up to +260°C	.-210°C up to +260°C	.-210°C up to +260°C	
p x t max (bar x °C)	12.000 (1,5 mm thickness)	12.000 (1,5 mm thickness)	12.000 (1,5 mm thickness)	
	8.600 (3,0 mm thickness)	8.600 (3,0 mm thickness)	8.600 (3,0 mm thickness)	
FDA-conformity	no	yes	yes	
technical data:				
compressibility 350 bar	min. 30	4 up to 10	7 up to 12	ASTM F 36 A
Recovery 350 bar	30	40	40	ASTM F 36 A
Tensile strength (Mpa)	14	14	14	ASTM 152
Density g/cm³	1,7	2,9	2,1	ASTM D 792
Creep Deformation (%)	40	11	18	ASTM F 38
Sealability (ml/h, 7bar)	0,12	0,04	0,2	ASTM F 37A
Sealability (cm³/min)	<0,015	<0,015	<0,015	DIN 3535
Releases		BAM - DVGW - FDA	BAM - DVGW - FDA	
	TA-Luft	TA-Luft	TA-Luft	VDI-2440

DIN test ist based on 1,5 mm thickness
ASTM tests are based on 0,8mm thickness

Combination and Special seals

Euraflon® (PTFE) coated gasket materials ED-RE1

Example of installation:

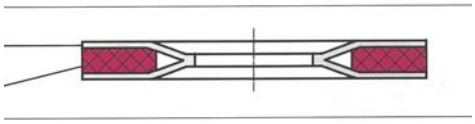


Gasket materials, whose resistance is not sufficient to the medium that is to be sealed, can be given a PTFE protective coating. Rour standard model is "inside closed, Types A1-A4".

Type A1

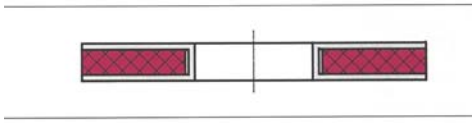
Casing

Insert



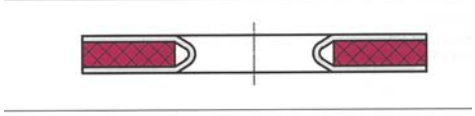
Coating cut of pipe, up to a nominal diameter of 600

Type A2



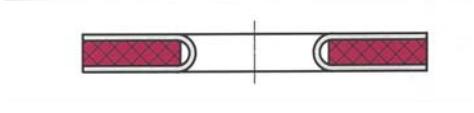
Coating is twisted, the edge is cylindrical, up to a nominal diameter of 600

Type A3



Coating is made of welded foil, up to an outer diameter of 2500 mm

Type A4



Coating is twisted, the edge is rounded and, upon request, reinforced, up to a nominal diameter of 600

Special models such as "coating outside closed" or "coating inside and outside closed" are also available.

Standard materials:
Coating = WS 7010(PTFE virginal) or WS 7060 (TFM)
Insert = FA materials according to DIN 28091, part 2

The use of a PTFE coating limits the maximal application data to 180°C at 10 bar and a surface pressure of 35N/mm².
For slightly diffusing media we recommend the type 4 with diffusion block (edge reinforcement).

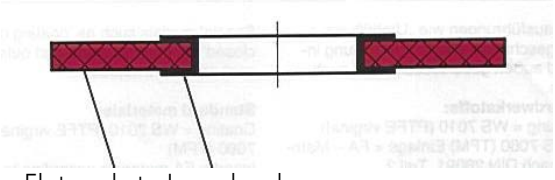
Gaskets with inner flange

Gasket materials are equipped with an inner flange in order to increase the creep resistance and the blow-out safety. We use stainless steel 1.4571 as a standarfd flange material. Other materials are available upon request. The flange width ranges between 3-9 mm depending on the size of the seal. The gasket inserts are available in fiber (FA), graphite (GR) or PTFE (TF) materials. Available dimensions: according to DIN 2690 and ASME (ANSI) B16.21 specifications and according to customer specification. Maximum outer diameter: 860 mm

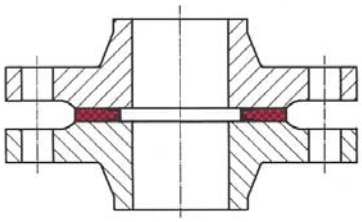
Flanged model:

- seamless: Gaskets according to DIN 2690 DN15 – DN 300 and DN 400. Gaskets according to ASME (ANSI) B 16.21 DN ½" – DN 12"
- welded: Gaskets according to DIN 2690 all dimensions > DN 250 available.

Example of installation:



Flat gasket Inner border

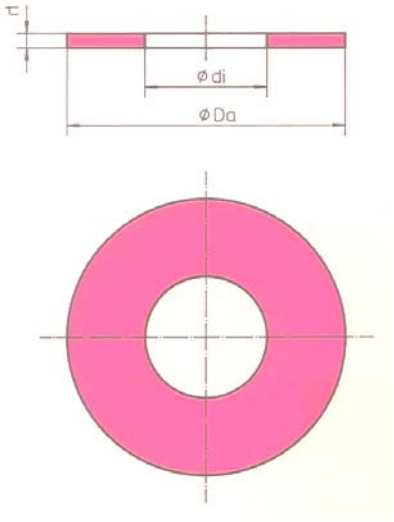


Machining tolerances for gaskets

No generally valid information can be given regarding tolerances for gasket materials. The actual dimensional accuracy depends on various factors, e.g. the machining procedure, material thickness, punching tools etc.

As an example, punched seals (in the case of smaller dimensions) can be produced with a higher accuracy than larger seals, which are manually cut.

For our machining procedure, please refer to the following table of tolerances.



Tolerances for inside and outside diameter (Di and Da):

Di/Da	Tol.
10-30	+/- 0,5
11-100	+/- 0,8
101-300	+/- 1
301-700	+/- 1,5
701-1500	+/- 2,5

Tolerances for thicknesses:

thickness in mm	0,5	1,0	1,5	2,0	3,0	4,0
Tol. (+/-)	0,1	0,1	0,15	0,2	0,3	0,4

If smaller tolerances are required, please contact us.

Information concerning the application of asbestos-free gasket materials

Technical information TI 3.1.002 09

For a safe handling and right mounting of our sealants stands this information to your disposal. To your advice, we give you on agreement also gladly one of our application-technicians to your disposal.

Please order our technical information regularly. The technical informations are adapted on the newest stand regularly. The in each case current piece of information is available to your disposal at our homepage..

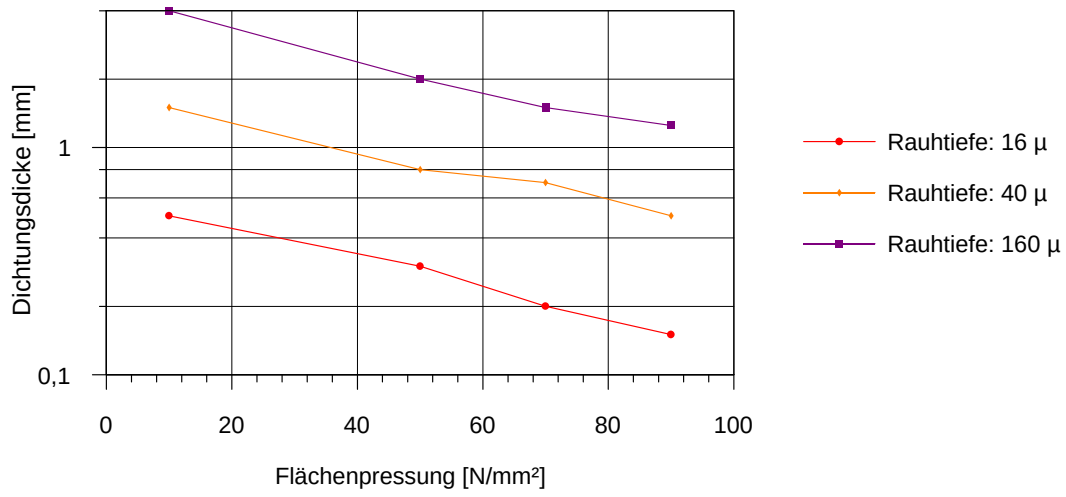
CONTENT:

1. Interpretation of the sealing-connection

1.1 flange-qualities

Thin seals have more compressive strength as thick seals. The seals should be therefore preferably thin. With given Compressibility of the sealing, rough dense-surfaces necessitate thick seals to prevent surface-leakage in order to achieve an optimal bracing of the seal in the surface (illustration 1).

Illustration 1: minimum-seal-thickness for Centellen®-Materiale as function of the rough-depth and of the surface-compression



The optimal rough-depth of a dense-surface lies in the area R_Z = 12,5 - 50 µm.[1]

1.2 Thickness of the seal

With corresponding rough-depth of the seal-surface, the right surface-compression and with reserves at that screw-strengths, the

[1] This rough-depth can be achieved by following production parameters:
depth of cut a = 0,05 mm; Radius the divorce-top at the trick-steel e = 1,6 mm; stuck out between the groove s = 0,8 mm/U. The flange-grooves should not be no helix.

seal-thickness can be reduced with the exchange from asbestos-containing against asbestos-free seals - at least in the upper thickness-area -.

As plates are standard in the strengths 0,3 mm, 0,5 mm, 0,8 mm, 1,0 mm, 1,5 mm, 2,0 mm, 3,0 mm up to 4,0 mm available; on wish, also plates until 6,0 mm can be manufactured. Exception: DSL 3670 only can be delivered from 0.8 mm. Following formats are available as standard-measurements:

1000 x 1500 mm 1500 x 1500 mm 1500 x 3000 mm

The Compressive strength of the seal higher with bigger width/thickness relation of a seal. Provided it is possible, the seal-width should be increased therefore.

Table 1: recommended seal-thickness

Asbestos seal	FA-Seal
0.5 mm	0.5 mm
0.8 mm	0.8 mm
1.0 mm	0.8 mm
1.5 mm	1.0 mm
2.0 mm	1.5 mm
3.0 mm	2.0 mm

1.3 maximum use-temperatures of asbestos-free sealing sheets

In all Centellen®-Types and in HD 3822 the aramide fibre is used as reinforcement firbre.. Because of the sensibility of the aramide fibres at hydrolisis mediums is the maximum use temperature in steam lower than in water-free surroundigs.

DSL 3670, especially made for steam, and UDP 3620, made for high temperature and high pressure can be used at higher steam temperatures.

sheet 2: maximum temperatures for asbestos free sealing sheets

material	$T_{recommended}$ [°C]	T_{max} (long time) [°C]	T_{max} (short time) [°C]
UDP 3620	250	300	500
Europil® WS 3640	300	300	500
DSL 3670	250	250	450
Centellen® WS 3820	150	200	350
Centellen®-HD WS 3822	200	250	400
Centellen®-R WS 3825	150	200	300
Centellen®-C WS 3844	150	200	350
Centellen®-OE WS 3850	150	200	300
Centellen®-200 WS 3855	150	180	250
Centellen®-NP WS 3860	150	200	250
Centellen®-CS WS 3880	150	200	250

Look at relations between temperature and Pressure (look at 1.5)!

As a rule of thumb there can be mentioned that thin seals with a large relation between wide and thickness can be used at higher temperatures than thick seals o seals with a small relationship between wide and theickness (looak at 1.4)

1.4 The optimum surface pressure for the preconditioning of the seal, σ_{opt}

The formula to get the neccesary best surface pressure for the preconditioning σ_{opt} depends on the following factors:

* a minimum pressure σ_{min}, to stick the seal at the flange and to close the pores of the seal and
* the part of the inner pressure $m \cdot p$, m is a constant factor for the relation of inner pressure and surface pressure.

$$\sigma_{opt} = \sigma_{min} + m \cdot p$$

for liquids:

$\sigma_{opt} = 10 + 3 \cdot p$ Centellen®-materials

$\sigma_{opt} = 15 + 3 \cdot p$ DSL 3670

$\sigma_{opt} = 20 + 3 \cdot p$ UDP 3620

$\sigma_{opt} = 20 + 3 \cdot p$ Europil® WS 3640

for gases:

σ_{opt} = 20 + 4 · p Centellen®-Materials

σ_{opt} = 25 + 4 · p DSL 3670

σ_{opt} = 30 + 4 · p UDP 3620

σ_{opt} = 30 + 4 · p Europil® WS 3640

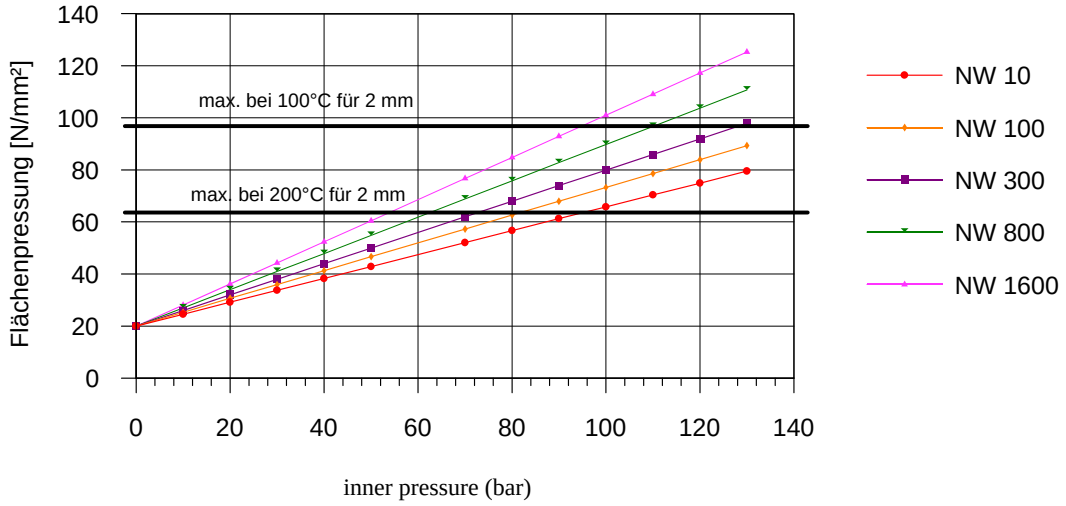
p	:	Innerpressure to be sealed	[N/mm²] *(1 N/mm² ≈ 10 bar)*
m	:	relation between surface and inner pressure	[-]
σ_{opt}	:	optimized surface pressure for preconditioning	[N/mm²]
σ_{min}	:	minimum pressure for preconditioning	[N/mm²]

The dependency of the surface pressure from the inner pressure and the nominal diameter of the seals at a smooth flange (dimensions according to DIN 2690) as shown in picture 2.

The seal has to be covered with the minimum pressure - σ_{min} – also at very low inner pressure -, to close the pores and to guarantee that the seal fits to the flange cover and to hold seal by the flange.

A lot of studies have shown, that the leakage of the seal is lower, if the seal got strong pressure. This lower leakage even exists if the pressure will come down later.

picture 2: surface pressure for Centellen®-Materials -> DIN 2690 as a function of inner pressure (at gases)



We learn, that the seal should get a strong pressure, but you have to look at the maximum surface pressure combined with the maximum operating temperature. For the operating situation you should try to get the following value σ_B for the surface pressure:

$$\sigma_B = m \cdot p$$

table 3: Maximum surface pressure at operating conditions σ_{BO}

Material	ϑ = 23°C	ϑ = 200°C	ϑ = 250°C
UDP 3620	> 90	> 90	> 90
Europil® WS 3640	> 90	> 90	> 90
DSL 3670	> 90	60	60
Centellen® WS 3820	> 90	55	30
Centellen®-HD WS 3822	> 90	60	60
Centellen®-R WS 3825	70	35 (175°C)	-
Centellen®-C WS 3844	70	55	50
Centellen®-OE WS 3850	> 90	55	45
Centellen®-200 WS 3855	> 90	60	55
Centellen®-NP WS 3860	> 90	55	45
Centellen®-CS WS 3880	> 90	50	30

1.5 Limits for pressure and temperature

The shown values for maximum temperature and maximum pressure should not occur simultanesously !

It is not possible to create a simple pressure/temperature formula for the limits of each material. The reason is the dependancy

on diverse parameters e.g. the absolutely thickness, the relationship of wide- and thickness and the relationship of diameter and wideness of the seal, the roughness of the surface to be sealed and the surface pressure. At a pressure of 40 bar seals according to DIN 2690 20 up to 150 have a relationship of wideness/thickness of the seal from 8 up to 14 and a diameter/thickness relationship from 2,7 up to 7. The widenesses are from 16 up to 28 mm.

1.6 Tightening of the seal

For the use of the seal at pressures more than 16 bar we recommend to tight the seals in cold state. When it is possible you can tighten the seals after a few hours again, but not before a time of 30 minutes and not after a time of 60 minutes after first use. If you tighten the seal at any later time the seal may brake.

1.7 The surface covering system OBS

Table 4: Standard versions of surface coverings

Material	OBF	Colours
UDP 3620	OBFB	white / blue
Europil® WS 3640	OBSW	Black / white
DSL 3670	OBB2	Blue / blue
Centellen® WS 3820	OBG2	Green / green
Centellen®-HD WS 3822	OBGY	yellow / green
Centellen®-R WS 3825	OBY2	Yellow / yellow
Centellen®-C WS 3844	OBF2	Clear / clear
Centellen®-OE WS 3850	OBGF	Green / clear
Centellen®-200 WS 3855	OBR2	Red / red
Centellen®-NP WS 3860	OBRF	red/clear
Centellen®-CS WS 3880	OBRG	jred/green

On your desire we can deliver the seals with an one side anti-adhesive-coating ore with an anti-adhesive-coating on both sides. The following surface coverings are possible:

Table 5: possible versions of surface coverings

covering	Marking	
	Only on one side	Both sides
Graphite	G 1	G 2
Alu-Bronce	OBA 1	OBA 2
Blue	OBB 1	OBB 2
Clear	OBF 1	OBF 2
Green	OBG 1	OBG 2
Red	OBR 1	OBR 2
Yellow	OBY 1	OBY 2

For your individual order please give us the above mentioned marking added after the material name.

Example: Centellen®-HD WS 3822, graphite-covered on one side::
-> Centellen®-HD WS 3822 G 1

2.3 Self adhesive seals

Very difficult mounting conditions can be solved at using self adhesive seals. All Hecker® materials can be delivered with an self adhesive foil.

Assembly instructions for FA Gasket materials

Technical information TI 3.1.004-09

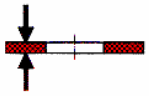
Assembly instructions for (Centellen® - HD WS 3822 / WS 3820 / DSL 3670 / UDP 3620 / Europil® WS 3640)

- for flanges with smooth surface and a nominal pressure up to 40

1. The following should be observed before assembly

- **The correct thickness of the seal**

The seal thickness of Centellen® materials should be reduced with relation to IT.



It-(asbestos) Seal	FA-Seal
< 0,8 mm	< 0,8 mm
1,0 mm	0,8 mm
1,5 mm	1,0 mm
2,0 mm	1,5 mm
3,0 mm	2,0 mm

UDP 3620, DSL 3670 and Europil® WS 3640 are similar to It materials with respect to their behaviour. (DSL is available in thicknesses of 0,8 mm and thicker).

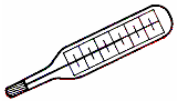
- **The surface treatment of the seal**

The standard form of delivery of the seals is an anti-adhesive-coating on both surfaces (OBS). Other coatings are possible (e.g. graphite).

Seals that have been treated with an anti-stick coating must not be retreated by the customer.

2. Temperature resistance

The application limitations for the individual sealing materials should be observed !



Material	$T_{empf.}$ [°C]	T_{max} (long term) [°C]	T_{max} (short-term) [°C]
UDP 3620	250	300	500
Europil® WS 3640	300	300	500
DSL 3670	250	250	450
Centellen® WS 3820	150	200	350
Centellen®-HD WS 3822	200	250	400
Centellen®-R WS 3825	150	200	300
Centellen®-C WS 3844	150	200	350
Centellen®-OE WS 3850	150	200	300
Centellen®-200 WS 3855	150	180	250
Centellen®-NP WS 3860	150	200	250
Centellen®-CS WS 3880	150	200	250

3. Surface to be sealed

- The quality of the surface of the flange or casing to be sealed

For opposite seal surfaces (flange, casing), a surface roughness of R_Z = 12,5 and 50 µm is recommended. When the surface roughness R_Z is 160 µm, the seal thickness should not be less than 1,5 mm.

The grooves of the flange should not be in a spiral form. The grooves should be seperated !

4. Necessary seal pressure

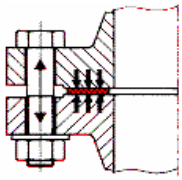
Tightening of the Centellen® Seal at an inner pressure of 25 bar and a temperature of 200°C.

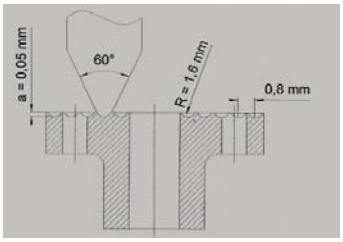
The informations are not binding guidelines for shaft screws -> DIN 13, Part 13, μ_{ges}= 0.14 at the use of 80% of the shaft-screw-border. Screw-thread and female-nut are pasted (look at the limit temperature of the paste).

***** At the calculation for the best density the maximum twisting moment is overstepped. Because of this fact the basis for the calculation is the maximum twisting moment or the screw. The result is a little lower surface pressure for the sealing. But this surface pressure is much higher than the required minimum surface pressure.
[For the calculation values of the „BSK-Schraubenwähler (Bauer+ Schaurte Karcher GmbH, Further Str. 24-26, 41462 Neuss) have been used.]

For our sealing-types DSL 3670, UDP 3620 and Europil® WS 3640 there are higher surface pressures recommended.

The upper sheet shows the tightening pressures for two different kinds of screwing materials. For customer use we would be pleased to give you more sheets with your screwing-material and the recommended tightening pressure.

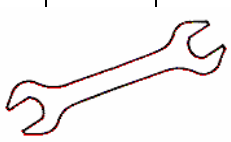




DN	screw	Tightening pressure [Nm]			
		Gas		Liquids	
		8.8	5.6	8.8	5.6
10	4 M12	16,6	16,6	9,7	9,7
15	4 M12	20,9	20,1	11,7	11,7
20	4 M12	33,6	33,6	19,6	19,6
25	4 M12	44,3	*39,8* *	25,9	25,8
32	4 M16	72,3	72,2	42,2	42,1
40	4 M16	91,2	91,2	53,2	53,2
50	4 M16	114,0	*98,4* *	66,5	66,5
65	8 M16	76,4	76,4	44,6	44,6
80	8 M16	93,4	93,4	54,5	54,4
100	8 M20	139,3	139,1	81,3	81,2
125	8 M24	197,9	197,8	115,4	115,4
150	8 M24	242,7	242,6	141,6	141,5
200	12 M27	319,4	319,6	186,3	186,4
250	12 M30	465,1	465,2	271,3	271,5
300		49		,3	289,4

5. Maintaining the Seal pressure

- **-tightening of Centellen® sealings**



Centellen® should be tightened when cold several hours after assembly.

Is a tightening in cold conditions not possible, you should tighten the screws 30 to 60 minutes after the warming.

UDP 3620/DSL 3670 and Europil® WS 3640 can be tightened at higher temperatures and for a longer period of time.

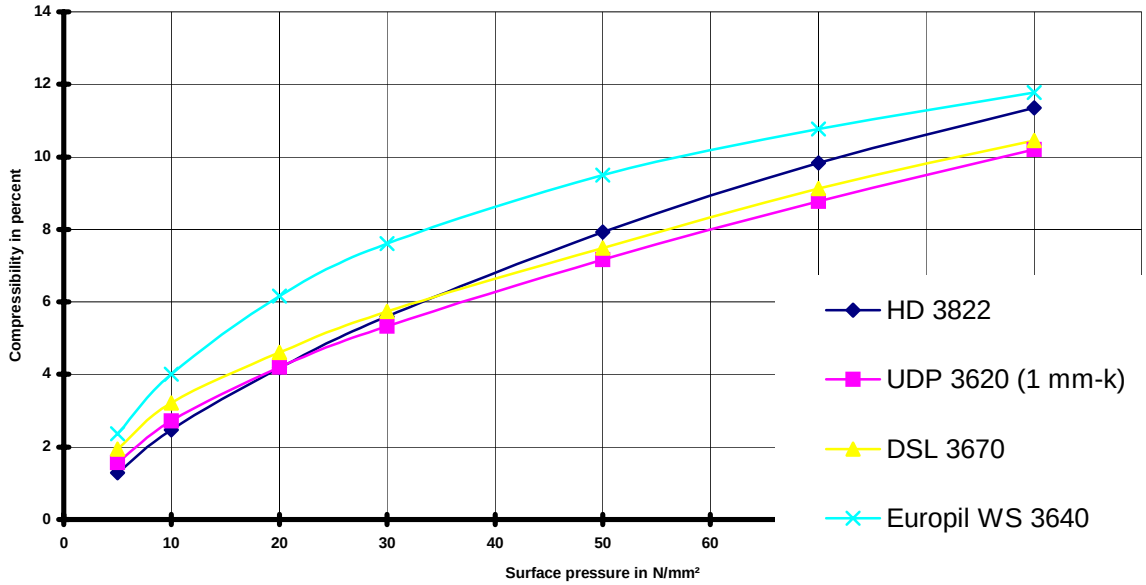
Compressibility and Resilience of the seals

The following table shows values of compressibility and resilience of the materials based on ASTM F 36A. The results are based on a seal thickness of 2 mm.

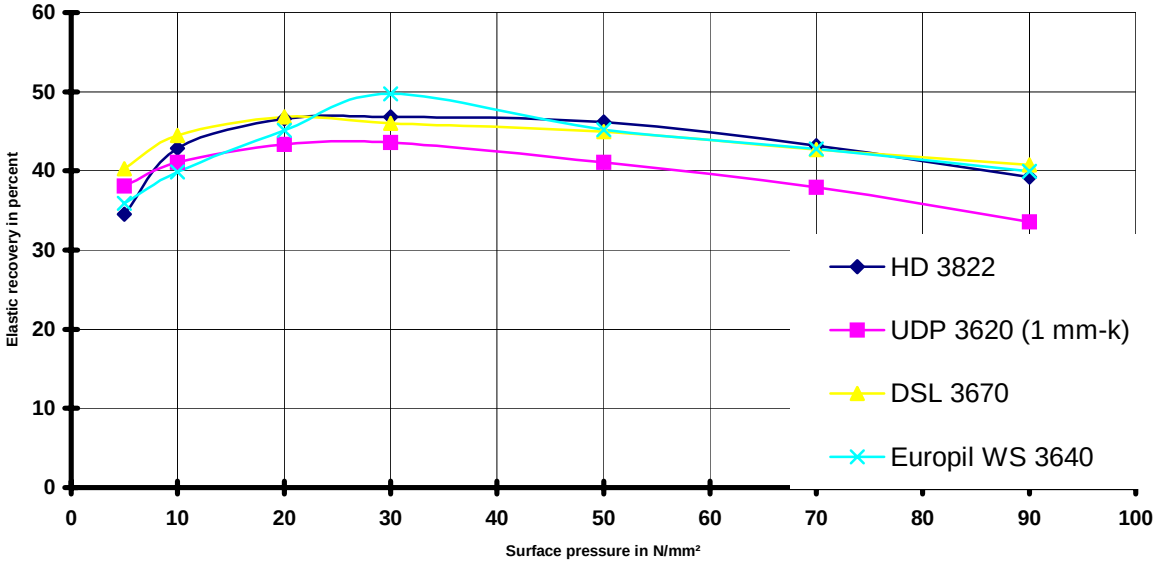
Material	Compressibility [%]	Resilience [%]
UDP 3620	5	55
DSL 3670	5	50
Europil® WS 3440 (Asbest)	8	50
Europil® WS 3640	5	50
WS 3815	12	55
Centellen® 3820	6	55
Centellen®-HD WS 3822	5	60
Centellen® R 3825	10	70
Centellen® C 3844	8	50
Centellen® OE 3850	10	50
Centellen® 200 3855	10	50
Centellen® NP 3860	8	50
Centellen® CS 3880	10	50

Compressibility / Resilience of HECKER® Materials

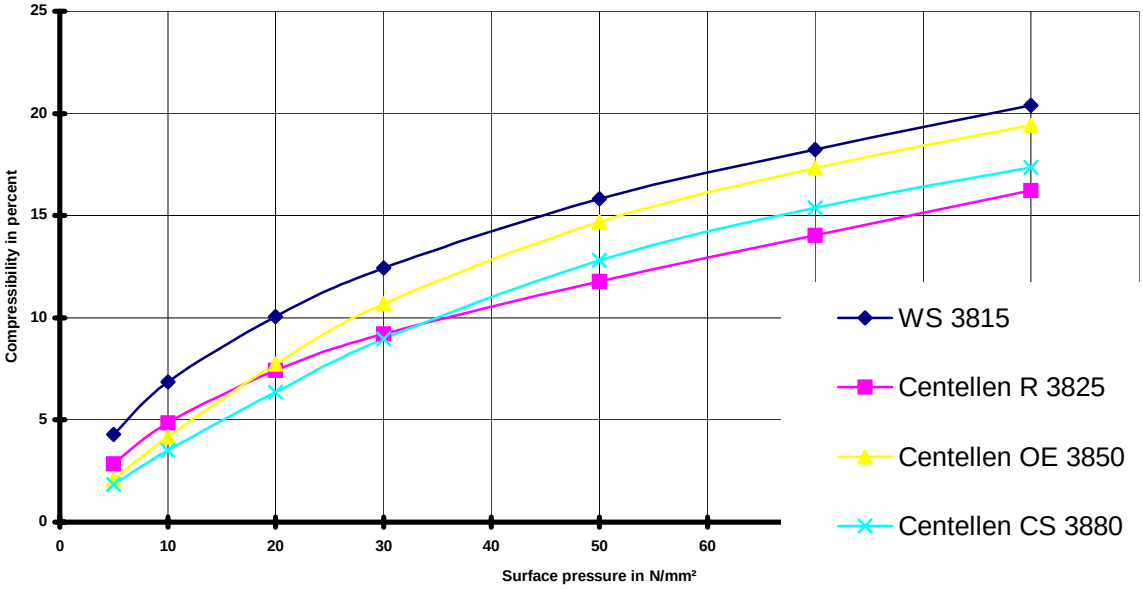
Compressibility



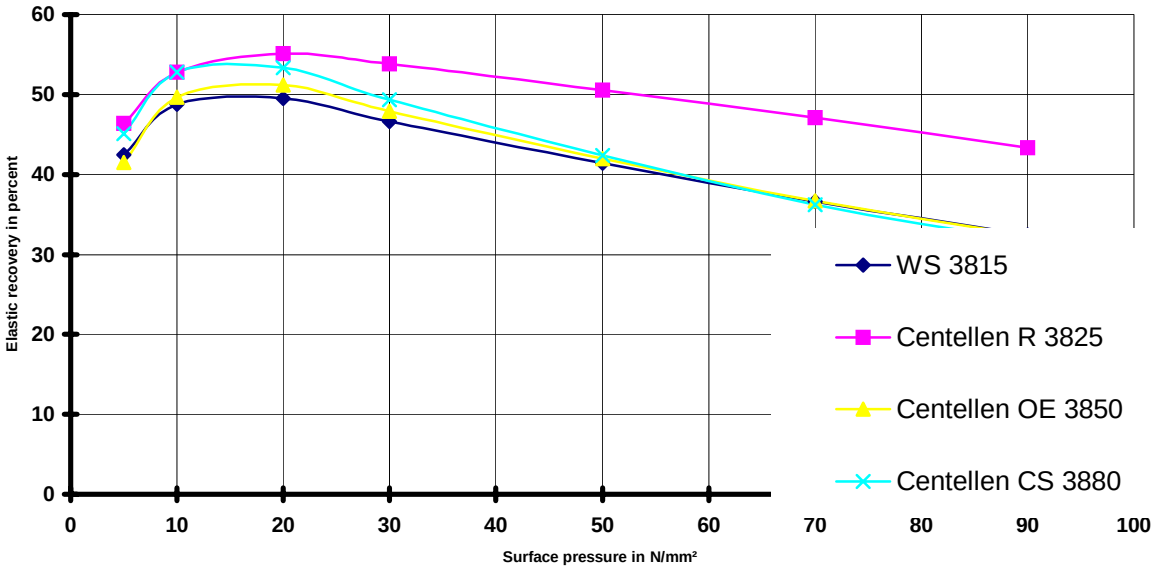
Elastic recovery



Compressibility



Elastic recovery



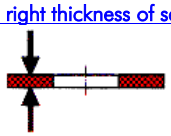
Installation recommendations für Grafotherm sealings

Specification TI 3.1.007-04

Installation recommendations for asbestos-free Grafotherm flat seals made of expanded graphite
- for flanges with a smooth sealing ledge, up to a nominal pressure of 40 bar

To be considered before installation:

The right thickness of sealing



Grafotherm gaskets are very susceptible to surface abrasion as well as to bending and tearing.

When these gaskets are installed, the utmost caution is advised !

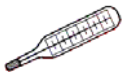
In case of the conversion from convetional lt-material to Grafotherm, the thickness can be reduced up to 25%.

Separating pastes or sealing compounds are not allowed to be used.

Surface treat of sealings

The sealing is under no circumstances to be conditioned with oil or grease !

Only dry sealings shall be used.



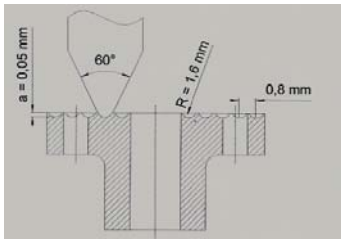
Temperature constancy

The limits of application for our Grafotherm materials WS 3000, WS 3200, WS 3250, WS 3204, WS 3054, WS 3102, WS 3202 and WS 3252 are respectively in each case at a maximum temperature of 500°C.

Surface which will have to be sealed

Surface qualitäy of the counter faces which have to be sealed

Graphite has the adaptability to the smallest survace roughness. In case of surface roughnesses up to RZ 160 µm the sealing thickness is not allowed to be below 1,5 mm. Flange grooves should not be executed as helix. Grooves should be separated from each other.



We recommend a surface roughness RZ between 12.5 and 50 µm in case of sealing counter faces (flanges, housings).

Required sealing pressure

Tightening of a Grafotherm flat seal with a steel sheet layer and an impregnated surface

Design for an internal pressure of 40 bar and a temperature of 200°C. All these specifications are not binding standard values determined for set screws according to DIN 13, part 13, mges = 0.14 at a level of 80% of the utilization of the yielding point of a screw. Screw threads and nut coat will be lubricated with screw paste. (The temperature constancy has to be considered.)

* In this case if the optimal tightness is calculated, the maximum moment of torsion will be passed over.

That's why the maximum moment of torsion is the basis and a bit lesser surface pressure for the packing junction will be calculated.

This calculation remains however by far above the minimum surface pressure which is demanded at minimum.

(Values were taken out of the BSK-Screw Selector (Fa. Bauer + Schaurte Karcher GmbH, Further Str. 24 – 26, 41462 Neuss) for the calculation). This table shows exemplarily the attraction moments for two screw materials. Following upon other customers' requests further tables with data of attraction moments can be demanded and prepared.

DN	Screws	Attraction moment [Nm] For gases	
		8.8	5.6
10	4 M12	38,8	38,8
15	4 M12	46,9	*35,8 **
20	4 M12	78,5	*35,8 **
25	4 M12	*76,5 **	*35,8 **
32	4 M16	168,6	*88,6 **
40	4 M16	*189,0 **	*88,6 **
50	4 M16	*189,0 **	*88,6 **
65	8 M16	178,3	*88,6 **
80	8 M16	*189,0 **	*88,6 **
100	8 M20	325,0	*179,1 **
125	8 M24	461,7	*307,8 **
150	8 M24	566,3	*307,8 **
200	12 M27	745,3	*464,4 **
250	12 M30	1085,3	*611,7 **
300	16 M30	1157,1	*611,7 **

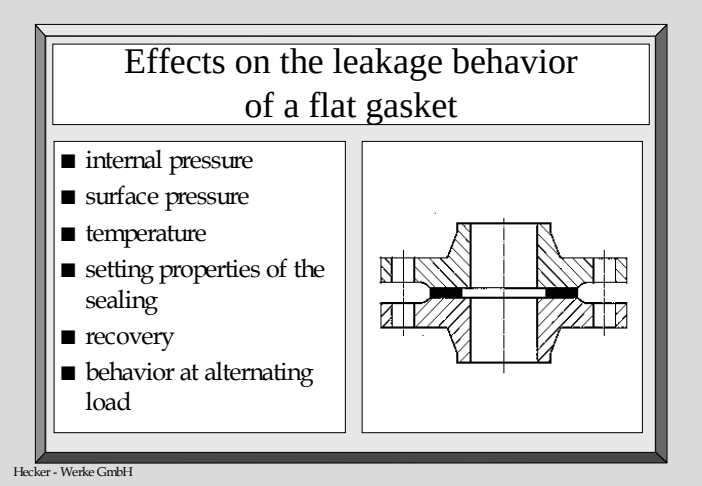
Retention of the sealing pressure

Gaskets out of Grafotherm do not subside under thermal fluctuation. A retightening of the adapted gasket is therefore not necessary!

NEW SEALING MATERIALS AND LEAKAGE BEHAVIOUR

1. Effects on the leakage of a sealing

A sealing is subject to different effects during its application.



It has to be so strong that it could resist the surface pressure, but also so flexible, that it operates compensational at alterations of internal pressure, temperature or surface pressure.

Owing to the temperature not only the mechanical parameters to the sealing are changing, but also the sealing itself will obviously be influenced. It subsides, indurates and is subject to aging.

Repeated application of stress could increase the setting capacity or even the failure tendencies of the sealing.

Therefore our researches deal with the mechanical stability on the one hand and on the other with the leakage, if there will be stability.

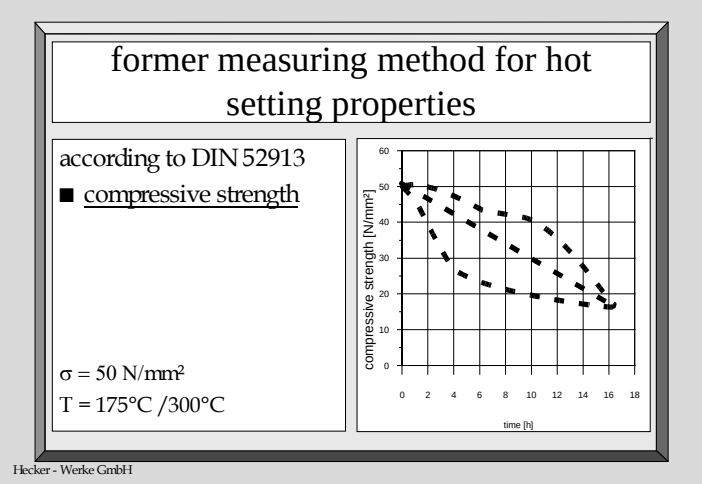
The mechanical behavior of a flat gasket is consequently to be described by a complexe operation in dependence on internal pressure, surface pressure, temperature and - in compliance with our experiences - also in dependence on the intensity of the alternating load. Measuring is technical only possible to achieve plottable results, if the tests will be concentrated respectively on one effect under stabilization of the other parameters.

2. Possibilities for the research of gasket materials

The classical method for the valuation of the hot setting properties of an It-sealing was the measurement of the pressure stability according to DIN 52913.

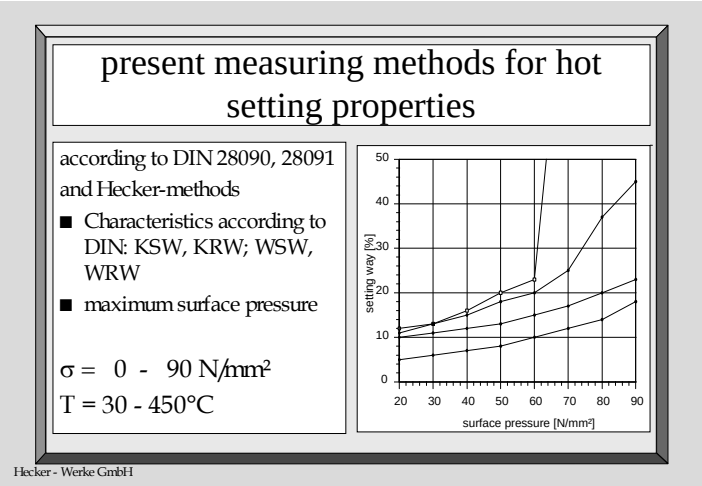
In this test the sealing will be loaded with a tension of 50 N/mm^2 and the residual stress will be defined after a duration of test of usually 16 hours.

The disadvantage of this method lies in that point, that the behavior of the sealing will not be specified until the obtaining of the final value.
Has the final value been reached by a constant decrease? Or has the sealing itself stabilized quickly and does the final value represent a stable niveau? Or is it a value, which has been measured accidentially at the failure of the sealing?



With the equipment, which Hecker has purchased for the measurement according to DIN 28090 and 28091, essential tests are now possible.

On the one side we are able to determine the necessary characteristics as the cold crusher index (KSW), the cold recovery (KRW), the hot setting properties value (WSW) and the hot recovery (WRW).



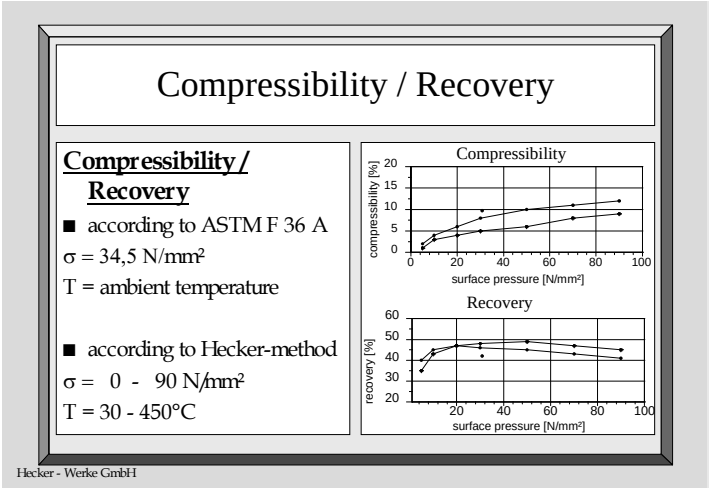
Furthermore tests for the determination of the maximum surface pressure are possible. The diagram shows an example for the determination of this value. In this case the temperature is kept constant and the surface pressure is increased continously.

The other principle: constant surface pressure and variation of the temperature is also possible. The duration of test is to be varied, too. Therefore it is now possible to characterize in detail the loading capacity of a material by surface pressure and temperature and to measure the limiting values of the loading capacity.

Another method for the judgement of the mechanical characteristics of a sealing was the measurement of compressibility and recovery according to ASTM F 36 A.

This method has however the decisive disadvantage, that it will be measured only in ambient temperature and only for one certain surface pressure. Relative comparisons are of course possible with that, but statements about the behavior at conditions of use could not be derived.

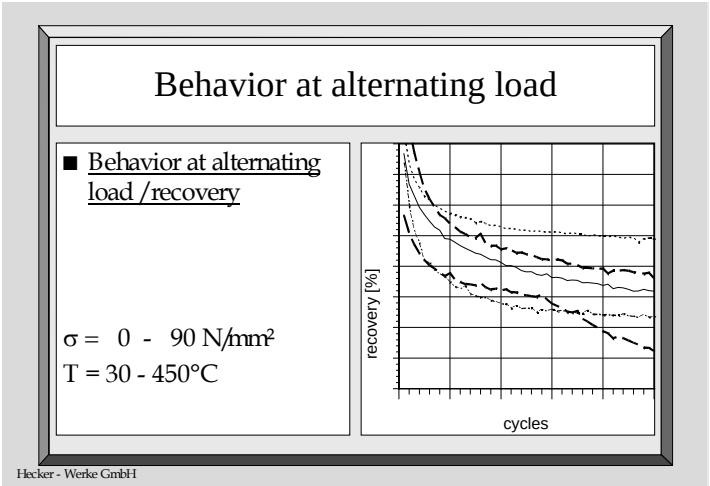
With the purchased equipment, which is necessary according to DIN 28090, it is possible at Hecker's to carry out comparable measurements within a large range of temperature from ambient temperature up to 450°C. The surface pressure can be besides this varied in a range of 1 up to 90 N/mm^2, so in a range, which exceeds the normal range of application of gaskets.



The diagram shows as an example for two materials, curves of the dependence of compressibility and recovery of the surface pressure for a constant temperature.

A further important aspect of our point of view is the alteration of the recovery behavior by the material aging.
Therefore many of our researches deal not only with the behavior of compressibility and recovery, but also with the alteration of this behavior at test repetitions.

To some extent differences obviously appear in this case between the materials, which will not attract attention in simple tests, but which are somewhat representative for the behavior in the practice and could supply explanations for many of the so far inexplicable failures.

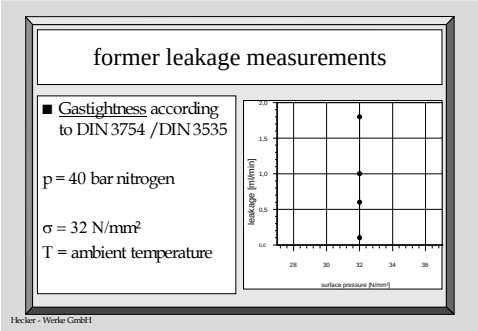


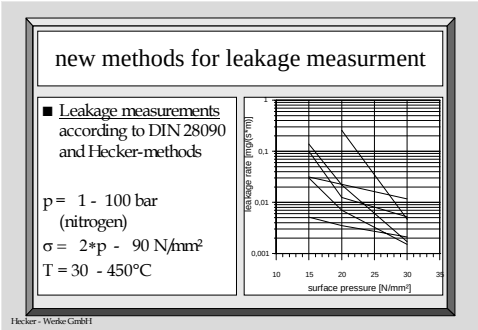
The curves in the image show exemplarily, that in case of repeated loading, the recovery decrease in case of all materials.
Good materials as DSL 3670 or Europil® WS 3640 reach then a plateau, which will be retained over many cycles.
In comparison with it, in case of less alternating load firm materials, the recovery decreases with each cycle.
Unstable materials show then after some cycles even an always faster decreasing recovery.

The definition of the mechanical characteristics of a sealing show only one part of the image. Important is in fact the proportion of leakage, which turns up under certain operation conditions. This proportion of leakage is now also a complexe operation of the internal pressure, the surface pressure, which works

against it, the temperature and the medium, only to state the most important parameters.

Let us a short look on the measuring methods and their advantages:





The method for It-sealings was only provided for the measurement at ambient temperature for an internal pressure, that is 40 bar nitrogen and at a surface pressure of 32 N/mm^2.

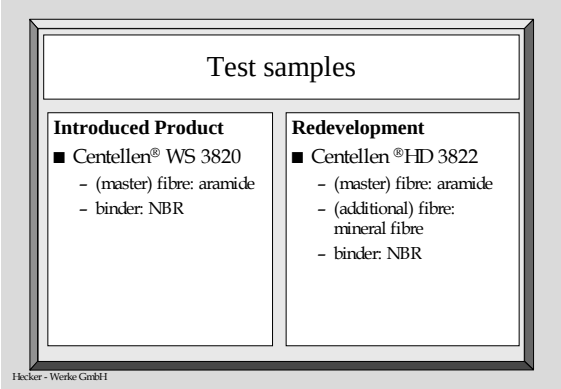
The value of this method was above all in the comparison of materials, in the diagram indicated as single test points for the different materials. However, it was not possible to get statements for the practice, e.g. about the leakage at operating temperature.

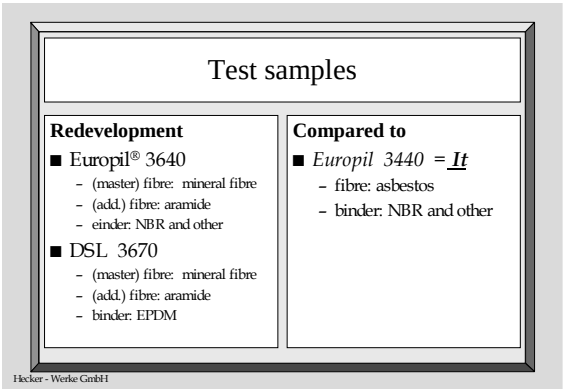
On the contrary with the equipment according to DIN 28090 we are able to measure within the whole range of temperature up to 450°C and besides this, to vary the internal pressure from 1 up to 100 bar, the surface pressure from a safety technical minimum value of the double internal pressure up to 90 N/mm^2.

The results of measurement which are found with this, allow statements about the real behavior of sealings in case of application. As an example, curves are shown in the diagram for the dependence of the proportion of leakage on the surface pressure.

We are able to measure such curves for the different materials, but also for one material at different temperatures.

3. Tested gasket materials and results

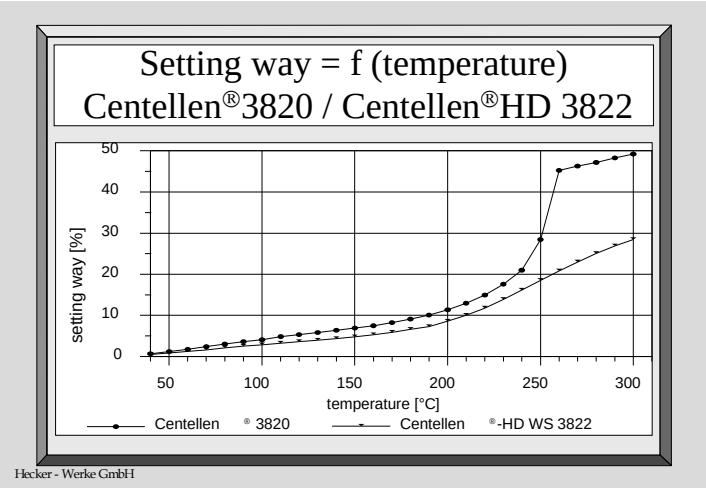




As test subject was on the one side chosen Centellen® WS 3820. As a short notice for the structure of the material should be mentioned, that the Centellen® materials contain aramid as fibre and NBR as binder.

As a development, Centellen® WS 3820, which is the approved material, is Centellen®-HD WS 3822 to be set against. The difference in the prescription lies only in the additional proportion of mineral fibre in Centellen® -HD WS 3822.

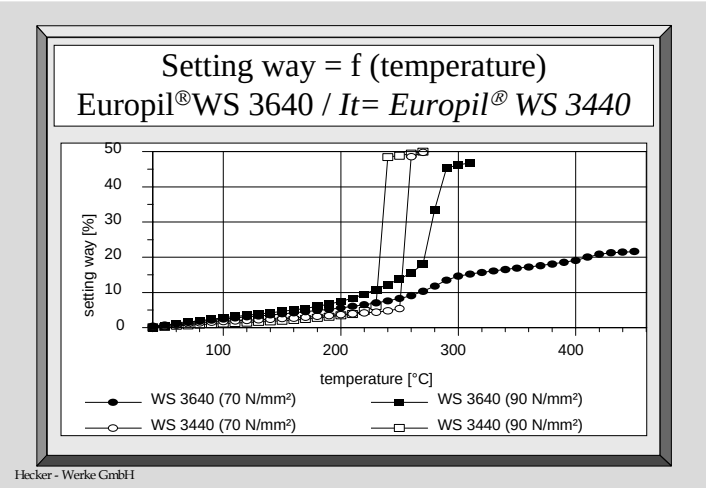
The materials Europil® WS 3640 and DSL 3670 are parts of a new fibre sealing generation. In this case the mineral fibre is the most important compound. The temperature stability of this fibre is as well a reason for the essentially extended range of application at higher temperatures. The range of application of these materials is seen at higher temperatures up to 300°C and at higher surface pressures. Also measurements with asbestos gaskets (It), our old material Europil® WS 3440, will in this case to some extent be used for comparison.



In the diagram the setting way of the materials Centellen® WS 3820 and Centellen®-HD WS 3822 is described as a function of the temperature and at a constant surface pressure of 50 N/mm².
In the range up to 200°C the materials differ only a little, the new material is in a minimum stronger. From 200°C the setting way of the materials increases obviously. In case of Centellen® WS 3820 the increase is progressive and at about 250°C, the material fails at a surface pressure of 50 N/mm².

In contrary Centellen®-HD WS 3822 shows up to 300°C no failure, but creeps at increasing load.

For the practice this difference has the effect in the behavior, that at the overheating of a sealing, the old material could suddenly fail. In contrary in the case of the new material, it is only to estimate with an increasing setting.

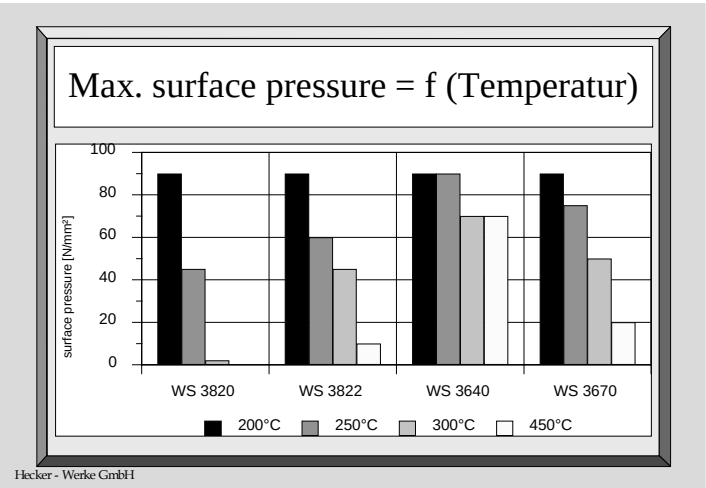


The mineral fibre materials are in the contrary to the generation of the aramid fibre materials stable at surface pressures ≤ 50 N/mm² up to 450°C. The image will differentiate not till higher surface pressures, so that the curves are not shown for 50 N/mm².

At **70 N/mm²** the new material shows a little rised setting values, which however only reach 20% in maximum. The asbestos material already failed at 70 N/mm² at about 250°C.

At **90 N/mm²** the load limit below 300°C is also reached for the new material. Of course under these conditions the It-material was already destroyed at about 230°C.

Out of a variety of such measurements, we now derive our datas of the maximum surface pressures.

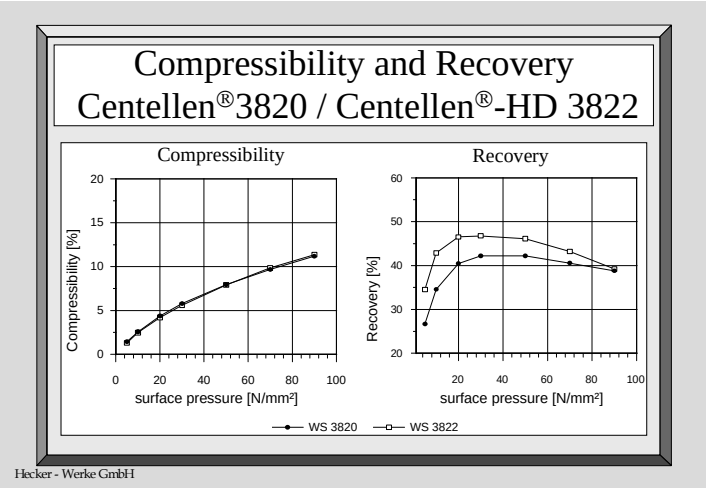


The **former** material Centellen ® WS 3820 is having a load capacity up to 200°C. At 250°C it loses obviously on stability and from 300°C, there is no more load capacity.

In contrary to that the **new** material Centellen®-HD WS 3822 shows clear safety resists. At 250°C the maximum surface pressure with 60 than 45 N/mm² is a little improved.
Even clearer is the difference at 300°C; where still a maximum surface pressure of 45 N/mm² is beared, so much as by the old material at 250°C. Even at 450°C there will be a residual stability at about 10 N/mm².

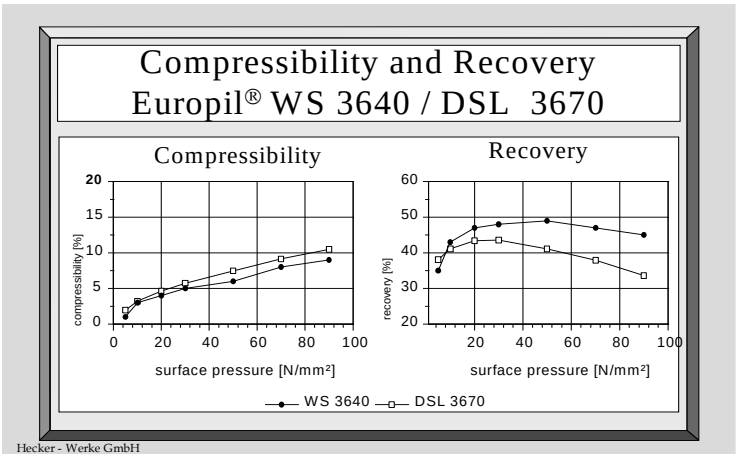
The mineral fibre sheet **Europil ® WS 3640** has a load capacity with the whole 90 N/mm² up to 250°C, unless there will be higher setting values or even a failure of the sealing. Above 250°C the maximum surface pressure will be at 70 N/mm².

DSL 3670, the mineral fibre material, which is bound to EPDM, shows a clear dependence of the stability on the temperature. In the interesting range of up to 300°C, the maximum surface pressure is ≥ 50 N/mm² and even at 450°C still remains a maximum surface pressure of 20 N/mm².



Both of the diagram parts are to be read parallel: e.g. to the value of compressibility at a surface pressure of 40 N/mm^2 belongs the recovery at 40 N/mm^2.
We have tested the compressibility and the recovery of the materials Centellen® WS 3820 and Centellen®-HD WS 3822 within the whole range of measurement up to 90 N/mm^2. In this case it becomes apparent, that both materials in the background of the accuracy of measurement, have nearly identical compressibility curves.

However the recovery values differ obviously. In this case the new material Centellen®-HD WS 3822 shows within the whole range better values. The difference is above all obvious in the range of about 30 N/mm^2, which is important for the practice. The combination of the same stability, but also better flexibility, means, that the material is able to compensate alterations of tension better. The behavior will also become hereby more safe.



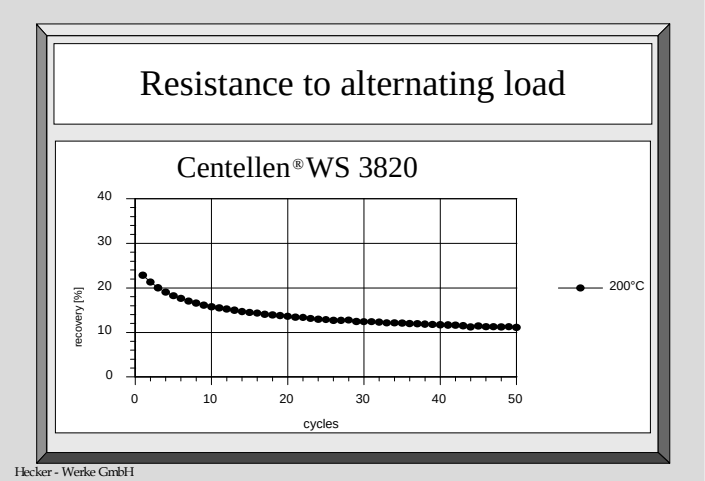
The mineral fibre materials Europil® WS 3640 and DSL 3670 are very strong and show up to 90 N/mm^2 only a low compressibility.

The materials differ above all in the case of the recovery. Europil® WS 3640 shows up to the highest pressure only an insignificant decrease of the recovery, whereas the flexibility of the EPDM-bound material DSL 3670 from 40 N/mm^2 obviously decreases.
This difference is largely subject to the binding material, because both of the materials are in other respects rather similiar.

The just talked over measuring method examines only the behavior of the gasket materials at ambient temperature. Because however above all the flexibility is a decisive material characteristic, we have also been looking for a resarch method for that.

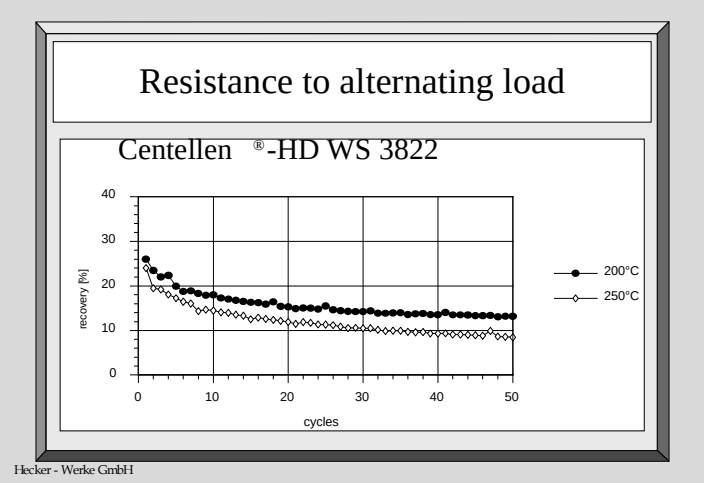
The determination of the stability against alternating load shows the desired conclusions. To reach as soon as possible obvious effects of measurement, the load at the tests on alternating load was fixed high:

A cycle consists the load reversal of 1 N/mm^2 to 50 N/mm^2 and back to 1 N/mm^2.



Centellen® WS 3820 is stable up to 200°C also at such extreme load reversals.

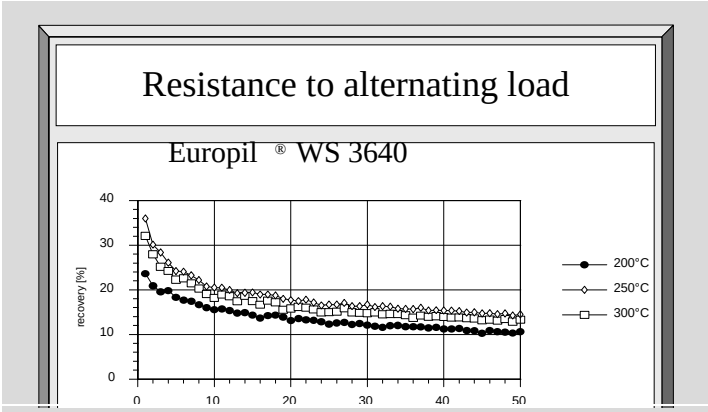
At 250°C and higher the sealing fails indeed so fast, that no generally curves are measureable and because of that not shown.



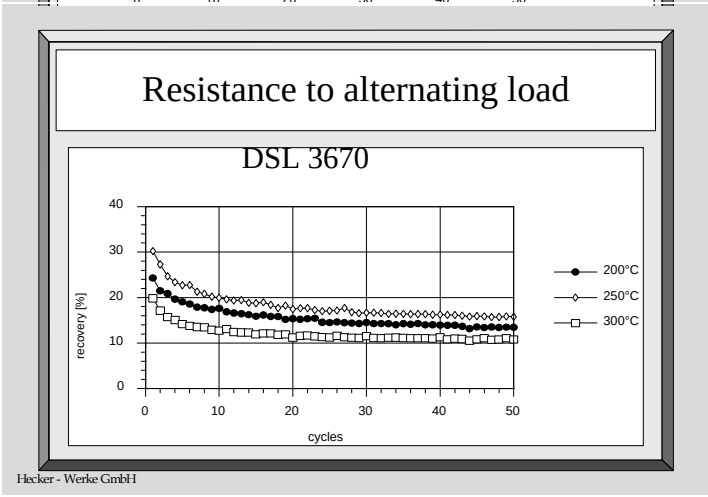
The improved stability of Centellen®-HD WS 3822 is shown also in this case: the curve for 200°C lies on a higher niveau than Centellen® WS 3820.

The curve for 250°C lies only a minimum lower that the curve for Centellen® WS 3820 at 200°C.

The new material generation of the mineral fibre sheets shows also the obviously improved characteristics of stability and recovery.



The curves at 200°C and 250°C for Europil® WS 3640 lie on a higher niveau than for the Centellen® materials.
The 300°C-curve corresponds to the curve of Centellen® WS 3820 at 200°C. In the contrary to the Centellen®-materials the range of application of this new gasket material at about 100°C is according to these measurements expansible.



DSL 3670, the material on the basis of mineral fibre with EPDM as a binder, shows in contrary to Europil® WS 3640 a little weeker values of recovery.

Conspisuous at the curve for 300°C is, that in this case after about 20 cycles, a constant value will be reached.
Additional measurements with multiple passage of these 50 cycles have shown, that these values seem to be really constant and in the background of our possibilities of measurement was no final decrease found.

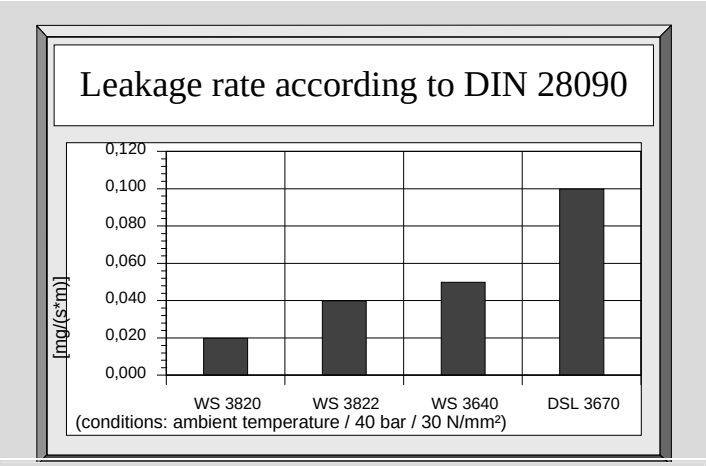
The material DSL 3670 was designed as a gasket for steam conduits and the, in this case found, stability of alternating load pretermined it for the application in steam conduits also by altering application datas.

The proportion of leakage λ according to DIN 28090 is defined as *mg nitrogen per second and metre peripheral length* of the flange.

During the preliminary test according to DIN 28090 the leakage of a gasket will be determined at an internal pressure of 40 bar and a surface pressure of 30 N/mm^2 at ambient temperature.

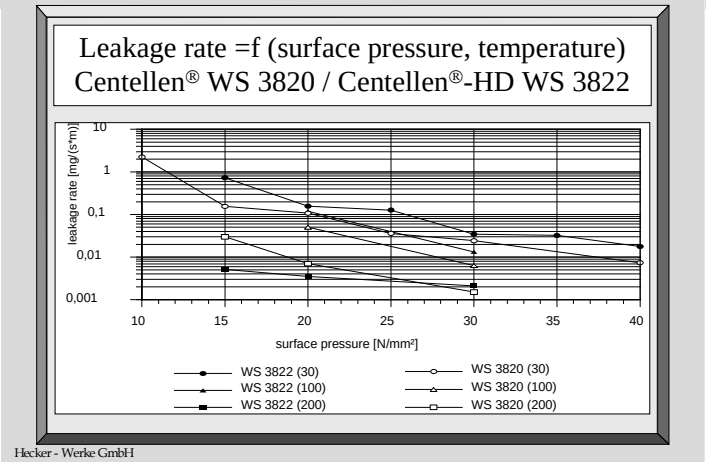
In this case there is shown, that the new material Centellen®-HD WS 3822 has a higher proportion of leakage than the old material Centellen® WS 3820.

The **mineral fibre materials** Europil® WS 3640 and DSL 3670 show in each case still higher values.



It has to be considered, that the limiting value according to DIN 28091, part 2, for FA-gaskets is at 0.1 mg nitrogen per second and metre peripheral length of the flange.

This limiting value will be kept by the Centellen® materials and Europil® WS 3640, DSL 3670 lies exactly at the limit.



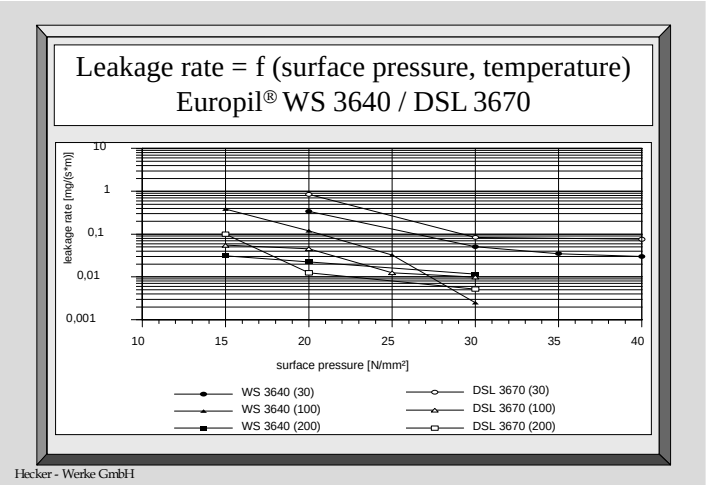
These results will however be relativated, if the proportion of leakage in dependence on the surface pression and the temperature will be tested:
At ambient temperature (index 30) the difference in the necessary pressure for the obtaining of the leakage criterion of 0.1 mg/(s*m) is about 5 N/mm^2.

This difference is however so small, that the range of the, at the even flanges usual surface pressures, will still be covered by the new material.

With increasing temperatures, the measured proportions of leakage decrease. The effect proceeds at 100°C parallel for the old and the new material.
At 200°C, at surface pressures about 20 N/mm^{2,} the proportions of leakage of the materials approach more and more and are practically identical at quite usual 30 N/mm^2.

The proportions of leakage are for all temperatures below the limiting value of 0.1 mg/s*m.

The new mineral fibre materials as Europil® WS 3640 and DSL 3670 are optimized for the application at high temperatures and loads:



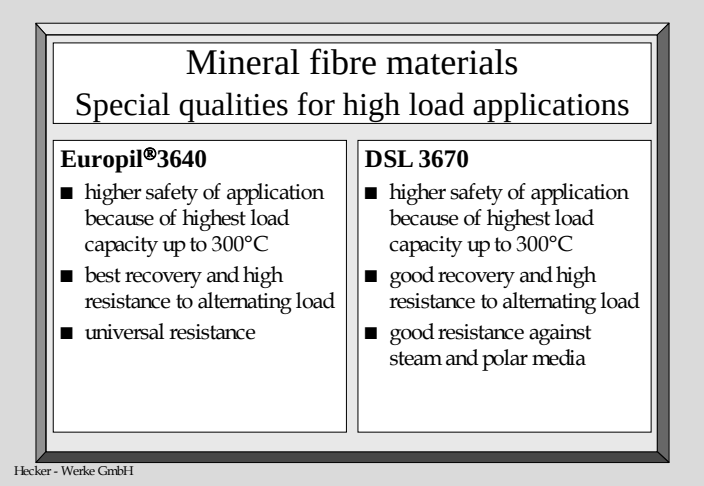
They show a high stability and because of that, it is also not possible to gain, with the high surface pressure of 40 N/mm^{2,} a proportion of leakage, which lies obviously below the limiting value.

However in case of increasing temperatures, the situation improves: the leakage of Europil® WS 3640 is already at 20 N/mm^2 below the limiting value at 100°C, in case of the EPDM-material DSL 3670 the leakage is basically below.

At 200°C the proportions of leakage are once again lower. At 30 N/mm^2 the limiting value of both materials will be underbidden by the factor about 10.

4. Result

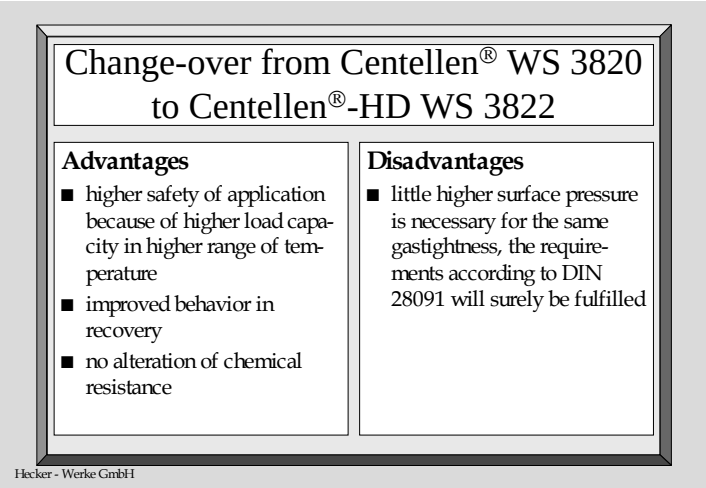
The new generation of mineral fibre materials could not be directly compared with former non asbestos materials.



The mineral fibre materials extend the range of application of non-asbestos fibre sheets up to 300°C.

The materials bear high surface pressures. In that case Europil® WS 3640 shows a good recovery. The flexibility of DSL 3670 is lower, but therefore it remains constant at alternating load. This characteristic is important for the application in steam conduits, where there are often alternating operating conditions.

Europil® WS 3640 is a material with universal chemical stability. The leakage behavior of bothe materials is optimum in the range of 200°C up to 300°C, here the lowest leakage values are shown. Centellen®-HD WS 3822 was tested among others by the BASF, our values of measurement were verified and the material was released for internal use.



The only disadvantage of the new material, which became conspicuous during our researches, is the little higher surface pressure, which is necessary for the realization of the same impermeability of gas values. The limiting value according to DIN 28091 will certainly be met.
An important advantage is the obviously increased loading capacity of the new material at higher temperatures, which is shown in the decreased setting values and in higher maximum surface pressures.

Furthermore Centellen®-HD WS 3822 shows an improved behavior of recovery and an improved alternating load behavior at the same compression behavior, what on the other hand increases the operating safety.

As the material combound is only extended by a large inert component - the mineral fibre - at the transfer from Centellen® WS 3820 to Centellen®-HD WS 3822, nothing is changed on the chemical stability of the material. In the cases where up to now Centellen® WS 3820 has been stable, Centellen®-HD WS 3822 will also be stable.

Gasket materials applicable for the use in sanitary engineering, heating and air technics

Technical information 3.1.026-01

HECKER manufactures different asbestos-free gasket materials. They are applicable for the use in sanitary engineering, heating and air technics.

All these materials are manufactured according to the calender technique and are based on a similiar material concept. They essentially consist of fibre materials (aramide fibres, mineral fibres), caoutchouc (NBRE, EPDM etc.) as well as inorganic reinforcing materials.

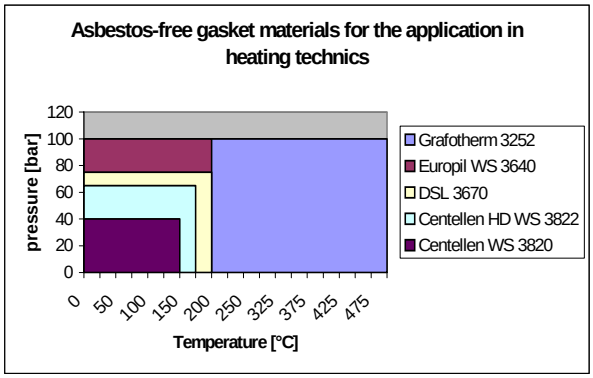
Grafotherm 3252 is conceived for the highest temperature load and compressive stress. It consists of graphite with a sheet metal layer.

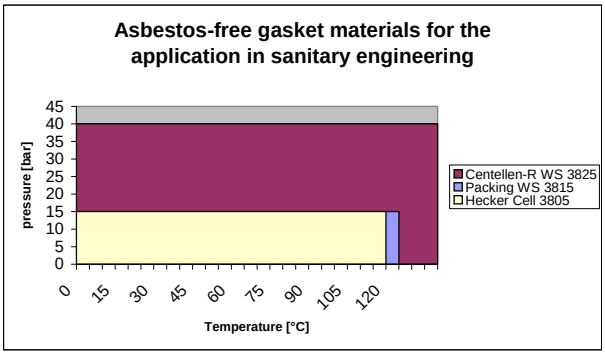
In the following table you will see materials which can be used in sanitary engineering, heating and air technics. The gasket materials are listed downwards according to the increasing loading capacity.

Table 1:

Material	Field of Application	Admissions
Hecker Cell®3805	sanitary	KTW
Packing WS 3815	sanitary	DIN-DVGW, HTB-VP401 – 1 bar, KTW, WRc
Centellen®-R WS 3825	sanitary	DIN-DVGW, KTW, HTB
Centellen® WS 3820	heating	DIN-DVGW, HTB-VP401 – 1 bar, KTW, WRc, BAM
Centellen®-HD WS 3822	heating	DIN-DVGW, HTB-VP401 – 5 bar, KTW, WRc, BAM, TA – air according to VDI 2440
DSL 3670	heating	BAM
Europil® WS3640	heating	KTW, BAM
Grafotherm 3252	heating	DVGW, BAM, fire safety

The material DSL 3670 (water vapour, acids, alkaline solutions) is to be especially emphasized. As a material which is based on EPDM-caoutchouc, it is almost predestinated for the application in sanitary engineering, heating and air technics.
You can see in the following picture the materials which are the best for each applications parameter. We, however, want to remark that the present fields of application **don't** show the maximum limits of application of each material but on the contrary the field, where the sealing which is manufactured of the stated material and if all applications parameter and the price are taken into account can be optimally applied.





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