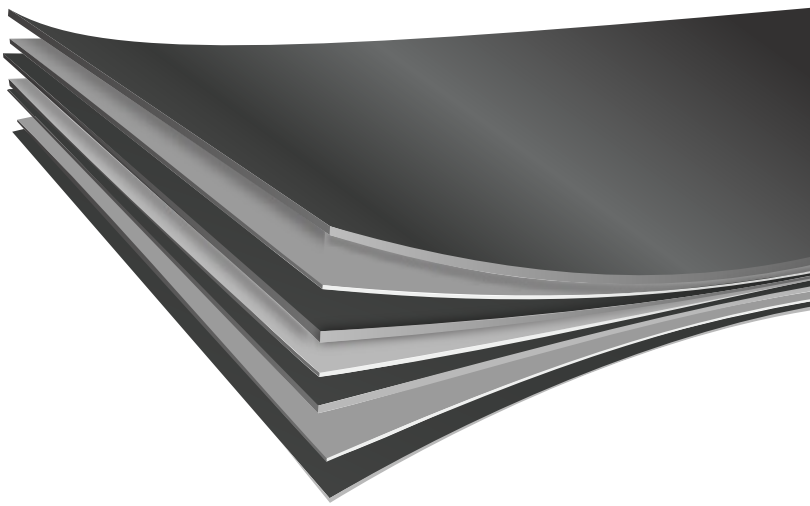
KLINGER Switzerland

KLINGER AG
GRAPHITE PRODUCT MANUAL



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1. GENERAL INFORMATION

GRAPHITE LAMINATE

Klinger graphite laminate is made from expanded graphite layers which are either glued onto plain sheet metal or rolled onto tanged sheet metal. A homogeneous graphite laminate is obtained by adhering homogenous graphite foils together. The adhesive layer is applied by a controlled process which allows

- the volume of adhesive to remain less than 1% of the graphite volume
- an even distribution of the adhesive to be guaranteed

The advantage of this method is that the excellent properties of flexible graphite are retained. As only a low quantity of adhesive is used, the exceptional chemical and thermal resistance of the graphite is not affected.

PROPERTIES OF GRAPHITE

- Graphite is characterised by a number of properties, such as:
- Temperature resistance from – 200 °C to + 450 °C (or higher in an inert atmosphere)
- Exceptional micro-sealing
- Exceptional resistance to temperature fluctuations
- High thermal conductivity
- Very good creep resistance under pressure or temperature loads
- Flexible in the whole temperature range
- No swelling or shrinking under the influence of media
- Unlimited shelf life
- Easy handling
- Non-toxic, no risk to health

ANTI-STICK COATING

In order to prevent the gasket material from sticking to the flange surface (even at high temperatures), the graphite surface can be given a anti-stick coating at the customer‘s request. With this process step, it is a matter of coating the graphite surface and not impregnation.

CHEMICAL RESISTANCE

Graphite is resistant to almost all agents such as acids, alkalis, solvents, fats, oils, gas, vapour and water. Exceptions to this are strong oxidising agents such as concentrated nitric acid, potassium chlorate, permanganate solutions and chloric acid. Details can be found in the chemical resistance table (Item 9). The resistance of the inserts used should also be taken into consideration!

SHELF LIFE

- As a rule, storage temperature, exposure to light, etc. do not have any influence on the shelf life of graphite laminates. However, the following conditions for proper storage should be adhered to in order to achieve a shelf life of > 10 years:
- Temperature range – 20 °C to + 50 °C
- Clean and dry air (no particles of dirt, no aggressive gases or vapours)
- Protection from mechanical damage
- Store flat goods horizontally

APPLICATION PARAMETERS

Because of the high requirements which are placed on the safety of sealing joints and the demands which apply nowadays for the utmost tightness it is necessary to choose and fit the right gasket with the appropriate know-how.

The adjustment to the unevenness of the sealing surface is dependent on the compressibility of the gasket as well as the surface texture of the sealing surface and the surface contact pressure. When choosing the material, it must be ensured that the chemical resistance of the gasket material is also specified under operating conditions. As a rule, gaskets that are compressed well are more resistant than gaskets that are just slightly compressed.

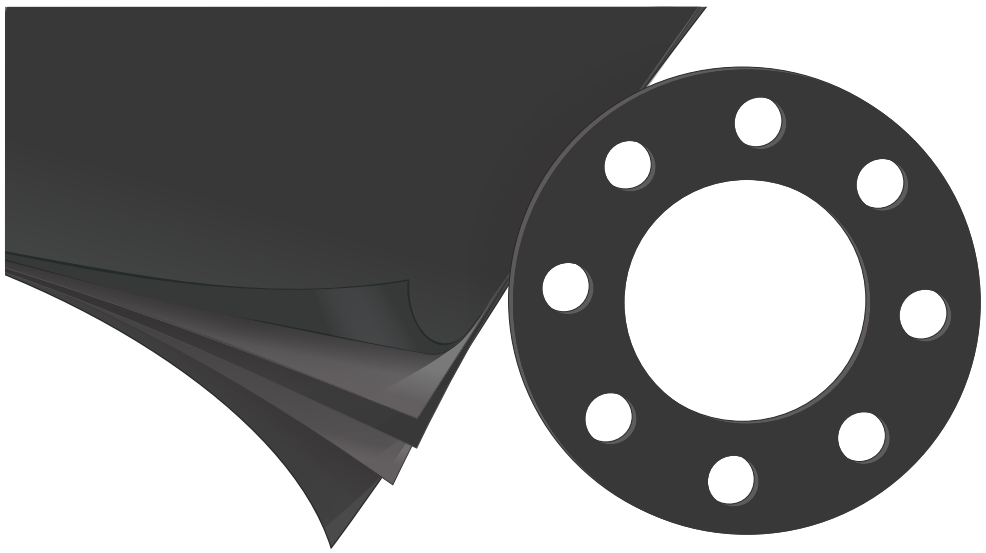
The overall properties regarding strength and statics are determined by the whole gasket system. Subject to the high requirements of the tightness of flange joints, high surface contact pressures must be invoked on the gasket with increasing internal pressure. For such operating conditions it must be checked whether this flanged joint is also able to withstand this load without being mechanically overloaded. In order to seal a joint a minimum surface contact pressure is required. Furthermore, it is exceptionally important for the life span of the gasket that the required minimum surface contact pressure of the gasket is always maintained when the gasket is in operation. Highly compressed, but not overly compressed gaskets have a longer life span than gaskets that are just compressed slightly. If it cannot be guaranteed that gaskets are exclusively statically loaded or, in the case that surface pressure fluctuations are to be expected during discontinuous operation then special gasket materials which do not get brittle at high temperatures should be used for water / vapour applications.

For gaskets which are used in the discontinuous operation of water / vapour circuits, a minimum surface contact pressure during operation of 30MPa is recommended as a general rule. In such cases, the gasket should be as thin as is both technically possible and reasonable.

The tightness is dependent on, amongst other things, the surface contact pressure achieved during installation and the amount which remains during operation. A properly chosen and installed gasket will have a long life span. Re-installing or re-using of gaskets is not recommended due to safety reasons.

The maximum permissible surface contact pressure of the gasket material subject to pressure, temperature and gasket thickness must not be exceeded. The sealing joint remains tight if the surface contact pressure during operation is higher than the required minimum surface contact pressure and the maximum permissible surface contact pressure σBO of the gasket is not exceeded.

A general rule for determining the required gasket thickness does not exist. A thickness of 2 mm is usually sufficient; thinner gaskets permit higher surface contact pressures.



2. GRAPHITE SPECIFICATIONS

PROPERTY	QUALITY	A	B	C
Thickness	mm	0.25 – 1.50	0.25 – 3.00	0.20 – 3.00
Density	g/cm^3	1.00	1.00	1.00
Purity	%	≥ 99.8	≥ 99.0	≥ 98.0
Ash content	%	≤ 0.2	≤ 1.0	≤ 2.0
Chloride	ppm	≤ 20	≤ 40	≤ 50
Fluoride	ppm	≤ 20	≤ 50	≤ 100
Sulfur	ppm	≤ 200	≤ 750	≤ 1000
Compressibility	%	40 – 50	40 – 50	40 – 50
Recovery	%	8 – 15	8 – 15	8 – 15
Tensile strength	MPa	> 4	> 4	> 4
Leakage rate (DIN 3535)	ml/min			
• Foil thickness < 0.63 mm		< 0.25	< 0.25	< 0.40
• Foil thickness 0.63 – 1.00 mm		< 0.40	< 0.40	< 0.70
• Foil thickness > 1.00 mm		< 0.55	< 0.55	< 1.00
Thermal conductivity				
• along length and width	W/mK	180 – 200	180 – 200	180 – 200
• through thickness	W/mK	4 – 6	4 – 6	4 – 6
Specific heat	J/kg/K		710	

Klinger Graphite laminate is usually produced with graphite density 1.00 g/cm^3.

Densities of 0.7 or 1.4 g/cm^3 are available on request.

Exception: PDM with 2 tanged inserts and a graphite density of 1.3 g/cm^3.

Graphite qualities:

A high purity **B standard** **C economy**

KLINGER®Graphite Laminate / Quality	A	B	C
ESM		●	●
G		●	
H	●	●	●
HL	●	●	●
PDM		●	●
PHM		●	●
PIM	●	●	●
PMM	●	●	●
PSM	●	●	●
SAB		●	●
SLA		●	●
SLN		●	●
SLS	●	●	●
SMB		●	●
TSM		●	
XSM		●	

3. PRODUCT OVERVIEW

STANDARD SHEET DIMENSIONS

Sheet format in mm	H	HL	MLX	PDM	PIM	PSM	SLA	SLI	SLN	SLS	TSM	XSM
610x1000					●			●				
910x1000					●			●				
1000x1000	●	●	●	●		●	●		●	●	●	●
1500x1500	●	●	●			●						
Rolls*	●	●					●		●	●		
Thickness in mm												
0.25	●											
0.38	●											
0.60						●	●		●	●		
0.80						●	●		●	●		
1.00	●			●	●	●	●	●	●	●		●
1.50	●	●	●	●	●	●	●	●	●	●	●	●
2.00	●	●	●	●	●	●	●		●	●	●	●
3.00	●	●	●	●	●	●			●	●	●	
4.00		●		●		●				●		
5.00		●		●		●				●		
6.00				●		●				●		

Tolerances:

Length: ± 5 mm

Width: ± 5 mm

Thickness: ± 5 %

*Rolls:

The outer diameter of the core cartridge for graphite foils can be either 105 mm or 150 mm.

Thickness (mm)	Width (mm)	Length (m)	Density (g /cm3)
0.20 –1.00	1000	30 –100	0.70 / 1.00

4. APPROVALS AVAILABLE

KLINGER®Graphite Laminate	DVGW	KTW Guideline Cold water	OXYGEN*	TA-Luft (Clean air)	DNV GL	Fire Safe
H	●					
HL	●					
MLX	●		●	●		●
PDM	●					
PIM	●					
PSM	●	●	●		●	●
SLA	●					
SLI	●					
SLN	●					
SLS	●		●			●
TSM	●		●	●		
XSM	●					
SLF	●					
PSS					●	

More information per request; any certification wish can be available upon request

4.1 ABOUT CERTIFICATION INSTITUTES

BAM is the Federal Institute for Material Research and Testing based in Berlin, Germany. BAM issues testing standards, performs tests and certifies materials according to specific protocols. The BAM has certified that our materials work properly in contact with oxygen.

TA Luft is the main set of regulations aimed at reducing emissions and emissions of air pollutants from facilities that are legally required to have emission control permits.

DIN DVGW is the largest gas and water industry certification body in Europe, covering all the certification procedures required in the gas and water sectors assuring our products are suitable in the gas supply systems.

Fire safe: These tests determine the resistance of fire-safe-valves to a burn under controlled conditions as defined in common industry standards like: ISO 10497, API 607, 6FA, 6FB and 6FD.

TÜV SÜD: TÜV certification ensures that a product, service, or process has been tested for safety and that it complies with the requirements of national, regional, and international regulations.

DNV GL: DNV GL certification ensures the reliability of components and systems in the face of marine hazards. In the marine and offshore sector, this certification serves as an important reference.

KTW and DVGW W270 are certifications that govern the use of materials used in drinking water applications in Germany. Extensive testing ensures that the materials do not impact the smell, taste, clarity and purity of the water. In addition, tests to check the long-term microbiological growth characteristics of the material are performed.

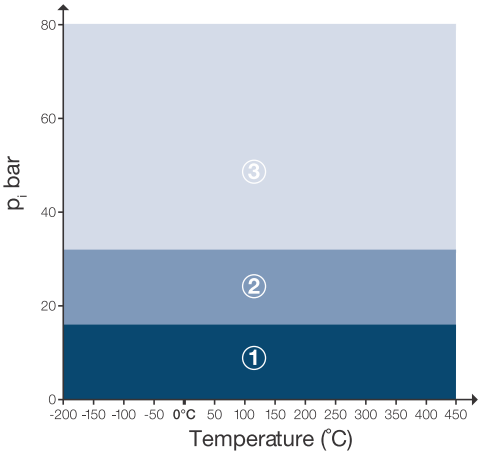
5. OPERATING CONDITIONS

MAXIMUM OPERATING CONDITIONS WHERE THE MATERIAL WORKS NORMALLY SUBJECT TO CHEMICAL COMPATIBILITY.

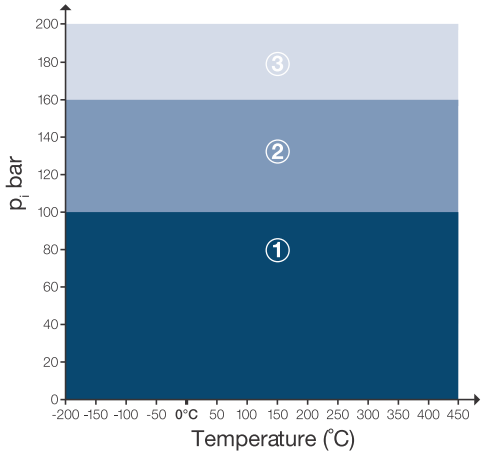
	Max T	Max P
H	450*	17
HL	450*	17
MLX	450	100
PDM	450	100
PIM	450	80
PSM	450*	80
SLA	450*	50
SLI	450	50
SLN	450*	50
SLS	450*	50
TSM	450	80
XSM	550	80
SLF	350	27

* For “C“ graphite quality MAX temp limit of 400°C applies.

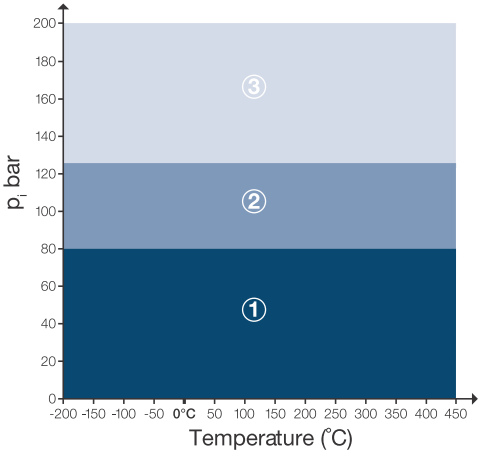
Graphite H and HL



PDM and MLX



PIM, PSM, TSM and XSM



The area of the P-T diagram

① In area one, the gasket material is normally suitable subject to chemical compatibility.

② In area two, the gasket material may be suitable but a technical evaluation is recommended.

③ In area three, do not install the gasket without a technical evaluation.

Always refer to the chemical resistance of the gasket to the media.

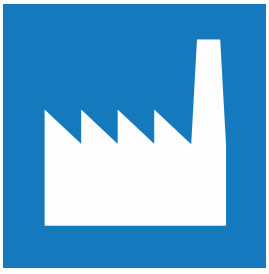
Technical evaluation with the manufacturer is required above 450°C

6. APPLICATIONS

INDUSTRY	COMPONENTS	H / HL	SLS	SLA	PSM	PDM	MLX	PIM / PHM	XSM
TA-Luft							●		
Automotive	Exhaust Systems			○	●				
	Cylinder Head Gasket				●				
	Accessory Gaskets			●	○				
Chemical industry	Standard flanges	○	○		●	○	●	○	
	Vessel / equipment flanges				○				
	Gaskets up to Ø 1500 mm				●		●		
	Glass / plastic / enamel	●					●		
	Highly corrosive media	●						○	
	High gasket pressure				○	●	●		
	Mechanical shear movement				○	○	●		
	Temperatures up to 550°C								●
Gas technology					●		●		
Power station technology	Fittings		○		●				
	Vessels / equipment				○	●	●		
	Pipework				○	○	●		
	Inspection glasses				○	●	●		
	Waste gas purification		○		●		●		
Engine building			●						
Food industry		○							
Water supply		○			○				

● Recommended

○ Suitable



7. PARAMETERS IN ACCORDANCE WITH DIN EN 13555

GASKET PARAMETER $Q_{min(L)}$

The gasket parameter Qmin(L) is defined in DIN EN 13555 as the minimum required surface contact pressure on the gasket when being installed at room temperature so that by adjusting the gasket to the roughness of the flange gasket surfaces and sealing the internal leakage paths, the required tightness class L for the specified internal pressure is achieved.

GASKET PARAMETER $Q_{Smin(L)}$

The gasket parameter QSmin(L) is defined in DIN EN 13555 as the minimum required surface contact pressure under operating conditions, this means following pressure relief in operation at the operating temperature so that the required tightness class L for the specified internal pressure is maintained.

GASKET PARAMETER Q_{Smax}

In DIN EN 13555, the gasket parameter QSmax is defined as the maximum surface contact pressure with which the gasket can be loaded at the specified temperature without the gasket collapsing or failure occurring as a result of compressive strain.

GASKET PARAMETER P_{QR}

This characteristic is defined as a factor for taking into consideration the relaxation influence (settling properties, thickness reduction) on the gasket load after the screws are tightened and the long-term effect of the operating temperatures.

SECANT MODULUS E_G

Secant modulus of the gasket (pressure relief) in [MPa].

GASKET PARAMETERS ACCORDING TO DIN EN 13555

PRODUCT	Q_{min} (MPa) p_i = 40bar RT, He		Q_{Smin} (MPa) p_i = 40 bar, RT, He Q_A (MPa)				Temp (°C)	Q_{Smax} (MPa)	P_{QR} Q = 50 MPa
			20	40	60	80			
ESM150B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	200	0.99
	$L_{0.1}$	13	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	30	–	10	< 10	< 10	300	200	0.95
ESM200B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	200	0.99
	$L_{0.1}$	18	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	37	–	30	11	< 10	300	200	0.95
ESM300B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	100	0.98
	$L_{0.1}$	21	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	46	–	–	19	< 10	300	80	0.89
H1000B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	220	0.99
	$L_{0.1}$	10	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	46	–	–	24	11	300	160	0.96
H1500B HL150B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	160	0.99
	L0.1	11	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	49	–	–	32	15	300	100	0.96
H2000B HL200B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	100	0.99
	$L_{0.1}$	16	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	58	–	–	54	23	300	80	0.96
PDM150B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	220	0.99
	$L_{0.1}$	16	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	47	–	–	24	13	300	220	0.96
PDM200B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	220	0.99
	$L_{0.1}$	20	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	61	–	–	–	30	300	160	0.92
PSM100B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	220	0.99
	$L_{0.1}$	17	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	43	–	–	13	< 10	300	220	0.97
PSM150B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	220	0.99
	$L_{0.1}$	14	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	49	–	–	31	15	300	220	0.95
PSM200B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	220	0.99
	$L_{0.1}$	15	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	56	–	–	51	25	300	160	0.95
PSM300B	$L_{1.0}$	10	< 10	< 10	< 10	< 10	RT	120	0.99
	$L_{0.1}$	19	19	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	64	–	–	–	31	300	100	0.95

PRODUCT	Q_{min} (MPa) p_i = 40bar RT, He		Q_{Smin} (MPa) p_i = 40 bar, RT, He Q_A (MPa)				Temp (°C)	Q_{Smax} (MPa)	P_{QR} Q = 50 MPa
			20	40	60	80			
SLS100B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	220	0.99
	$L_{0.1}$	< 10	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	31	–	–	17	< 10	300	220	0.94
SLS150B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	200	0.99
	$L_{0.1}$	<12	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	46	–	–	20	< 10	300	180	0.93
SLS200B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	140	0.99
	$L_{0.1}$	16	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	53	–	–	39	14	300	140	0.93
TSM150B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	100	0.98
	$L_{0.1}$	< 10	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	12	< 10	< 10	< 10	< 10	300	100	0.93
TSM200B	$L_{1.0}$	< 10	< 10	< 10	< 10	< 10	RT	220	0.99
	$L_{0.1}$	< 10	< 10	< 10	< 10	< 10	–	–	–
	$L_{0.01}$	20	< 10	< 10	< 10	< 10	300	120	0.93

stiffness 500 kN/mm

GASKET PARAMETERS ACCORDING TO DIN EN 13555

PRODUCT	Temp (°C)	SECANT MODULUS OF THE GASKET (PRESSURE RELIEF) EG (MPa) Q (MPa)						
		20	40	60	80	100	120	140
ESM150B	RT	856	2222	3459	4570	5300	6257	6987
	–	–	–	–	–	–	–	–
	300	820	2148	3218	3920	4642	4970	5390
ESM200B	RT	617	1559	2357	3484	4250	5180	5812
	–	–	–	–	–	–	–	–
	300	588	1218	2068	2917	3545	4288	4942
ESM300B	RT	483	1177	2026	2886	3663	–	–
	–	–	–	–	–	–	–	–
	300	596	1034	1726	3463	–	–	–
H1000B	RT	544	1938	4632	8581	7245	6265	6163
	–	–	–	–	–	–	–	–
	300	1005	2118	5686	6960	5701	5873	6584
H1500B	RT	473	1428	2764	3770	5077	5871	6205
H2000B	RT	476	1425	2687	3761	4610	–	–
HL150B	–	–	–	–	–	–	–	–
	300	616	1461	3019	4654	4283	–	–
HL200B	–	–	–	–	–	–	–	–
	300	654	1446	2968	3685	–	–	–

stiffness 500 kN/mm

PRODUCT	Temp (°C)	SECANT MODULUS OF THE GASKET (PRESSURE RELIEF) EG (MPa) Q (MPa)						
		20	40	60	80	100	120	140
PDM150B	RT	627	1382	2152	2865	3250	3906	4464
	–	–	–	–	–	–	–	–
	300	833	1386	1997	2800	3373	4156	4187
PDM200B	RT	575	1392	2318	3166	3813	4586	5138
	–	–	–	–	–	–	–	–
	300	686	1379	2285	3425	3610	4608	5157
PSM100B	RT	788	2259	4910	8489	6215	5846	6005
	–	–	–	–	–	–	–	–
	300	1771	2382	5756	4532	5797	4892	6078
PSM150B	RT	594	1571	3431	4476	4378	4918	4456
	–	–	–	–	–	–	–	–
	300	822	1809	3618	4579	5427	5919	4409
PSM200B	RT	523	1316	2419	3411	4249	4411	5091
	–	–	–	–	–	–	–	–
	300	654	1306	2884	3667	4376	4625	5123
PSM300B	RT	480	1293	2353	2896	3853	4356	–
	–	–	–	–	–	–	–	–
	300	542	1217	2115	3335	3849	–	–
SLS100B	RT	532	1811	2528	3307	3993	3125	3733
	–	–	–	–	–	–	–	–
	300	1093	1499	2402	3407	3312	3655	3914
SLS150B	RT	577	1806	3381	5420	5007	5945	6689
	–	–	–	–	–	–	–	–
	300	827	1432	2673	3578	5825	5962	6507
SLS200B	RT	507	1438	2877	4138	5327	6082	7679
	–	–	–	–	–	–	–	–
	300	613	1407	2634	3088	5343	5173	6790
TSM150B	RT	478	1208	2254	3029	4494	–	–
	–	–	–	–	–	–	–	–
	300	437	844	1393	2094	3098	4006	–
TSM200B	RT	438	1251	2819	3888	4326	5999	5931
	–	–	–	–	–	–	–	–
	300	518	1135	2237	3545	4307	5721	–

stiffness 500 kN/mm

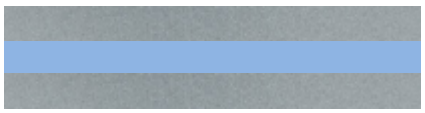
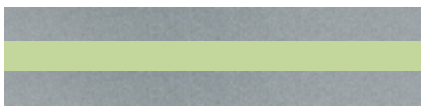
8. MATERIAL SPECIFICATIONS

8.1 DEFINITIONS

$\sigma_{VU/0.1}$	Minimum surface contact pressure for achieving leakage class L0.1 (in accordance with DIN 28090-1)
σ_{BU}	Minimum surface contact pressure during operation, whereby σBU is the product of operating pressure p and the sealing factor m for the test and operating state (σBU = p . m)
σ_{VO}	Maximum permissible surface contact pressure at RT
$\sigma_{BO,\ 300°C}$	Maximum permissible surface contact pressure during operation
m	σ_{BU}/p_i
m-factor	Similar to m, however defined according to ASTM and therefore a different numerical value
y-factor	Minimum surface contact pressure in MPa
k_0	in mm, parameter of the effective width of a gasket
k_1	in mm, empirical parameter of a fictive gasket width
K_D	in N/mm², deformation resistance of the gasket material
ε_{KSW}	Compression and compressibility under a surface contact pressure of 35 N/mm²
ε_{KRW}	Springback following a pressure relief of 35 N/mm² to 1 N/mm²
ε_{WSW}	Creep of the gasket under a surface contact pressure of 50 N/mm² at 300 °C after 16 h
ε_{WRW}	Springback following a pressure relief of 50 N/mm² to 1 N/mm²

The percent thickness changes of εKSW, εKRW, εWSW und εWRW relate to the initial thickness of the gasket.

The formulae for calculating the gasket parameters in accordance with AD data sheet B7 are:
$k_0 . K_D = \varepsilon_{VU} . b_D$
$k_1 = m . b_D$

Homogeneous foil or laminate			
Glued laminate		Graphite Adhesive Insert Adhesive Graphite	Insert options: Stainless steel, CRS, Aluminum, Nickel, Monel, Hastelloy, Inconel, Polymer, expanded metal, titanium, fiberglass mesh
Mechanically bonded laminate		Graphite Foil Tanged Insert Graphite Foil	Insert options: Stainless Steel, CRS

8.2 HOMOGENEOUS GRAPHITE FOIL

Graphite foil, manufactured from natural graphite, is a homogeneous material with no added bonding agents. It has a long service life in comparison to other gasket materials and does not exhibit any noteworthy change in properties in use. Inhibitors can be used to increase the flexible graphite's resistance to oxidation and corrosion. Furthermore, graphite foils can be given a non-stick surface to prevent the gasket material from sticking to the flanged surface.

GRAPHITE QUALITY		A	B	C
Standard bulk density	g/cm^3		0.70 – 1.30	
Ash content (DIN 51903)	%	≤ 0.20	≤ 1.00	≤ 2.00
Leachable chloride	ppm	≤ 20	≤ 40	≤ 50
Thermal conductivity at 20 °C In plane	W/mK		180 – 200	
Through plane	W/mK		4 – 6	
Electrical resistance at 20 °C In plane	Ωm		250 x10^{-8} – 500 x10^{-8}	
Through plane	Ωm		3x10^{-3}	
Tensile strength	MPa		≥ 4	
Elongation at break	%		≥ 1	
Maximum acceptable compressive stress Sample: 20 x 20 mm x thickness 0.35 mm	MPa		220	
0.50 mm	MPa		200	
1.00 mm	MPa		140	
Residual stress (DIN 52913) σD 16 h, 300 °C, 50MPa	MPa		≥ 45	

Homogeneous graphite

Type	Insert	Size (mm)	Thickness
H	-	roll	0.20 – 1.00 mm
H	-	1000x1000	0.50 – 3.00 mm
HL	-	1000x1000 1500x1500	1.50 – 5.00 mm

8.3 HOMOGENEOUS GRAPHITE / GRAPHITE LAMINATE

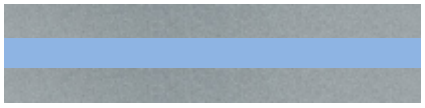
PRODUCT			H1000	HL150	HL200	HL300
Thickness		mm	1.00	1.50	2.00	3.00
Residual stress (DIN 52913) $\sigma_{D\ 16\ h,\ 300\ °C,\ 50MPa}$		N/mm²	≥ 45			
Gasket characteristics (DIN28090-1)	σVU/0.1	N/mm²	20	20	20	25
	σVO		150	100	80	70
	σBU/0.1		20	20	20	25
	σBO 300 °C		130	90	70	60
Compression factors (DIN 28090-2) Compressibility at 20 °C	εKSW	%	35 – 50			
Recovery at 20 °C	εKRW	%	3 – 6			
Hot creep during operation	εWSW	%	< 3			
Recovery at 300 °C	εWRW	%	2 – 5			
ASTM	«m»-factor	MPa	2			
	«y»-factor	MPa	6			
Compressibility	ASTM F36	%	40 – 50			
Recovery	ASTM F36	%	8 – 15			

TECHNICAL DATA - Typical values for a thickness of 2.0 mm for "B" quality graphite		H	HL
Density of the graphite layer	DIN 28090-2	1.0	1.0
Purity of graphite	DIN 51903	≥ 99.0	≥ 99.0
Compressibility	ASTM F36 A	40 - 50	40 - 50
Recovery	ASTM F36 A	8 - 15	8 - 15
Stress relaxation DIN 52913	16 h/ 50 MPa/ 300°C	≥ 46	≥ 46
Klinger cold/hot compression 50 MPa	Thickness decrease at 23°C	40 - 50	40 - 50
	Thickness decrease at 300°C	1 - 3	1 - 3
Specific leak rate	DIN 28090-2	< 0.10	< 0.10
Chloride content of graphite layer	DIN 28090-2	≤ 40	≤ 40

8.4 GRAPHITE LAMINATE WITH SMOOTH STAINLESS STEEL INSERT, GLUED

PRODUCT			SLS100	SLS150	SLS200	SLS300
Thickness		mm	1.00	1.50	2.00	3.00
Reinforcing data		mm	plain stainless steel			
Insert material	material number		1.4401 / 1.4404			
	thickness	mm	0.05			
	number		1	1	1	1
Residual stress (DIN 52913) 2 $\sigma_{D\ 16h,\ 300\ °C,\ 50MPa}$		N / mm	≥ 45			
Gasket characteristics (DIN28090-1)	σVU/0.1	N / mm²	20	20	20	25
	σVO	N / mm²	220	150	110	85
σBU/0.1	N / mm²		20	20	25	25
σBO 300 °C	N / mm²		110	110	80	70
Compression factors (DIN 28090-2) Compressibility at 20 °C	εKSW	%	35 – 50			
Recovery at 20 °C	εKRW	%	4 – 6			
Hot creep during operation	εWSW	%	< 3			
Recovery at 300 °C	εWRW	%	2 – 5			
ASTM	«m»-factor	MPa	2			
	«y»-factor	MPa	6			
Compressibility	ASTM F36	%	40 – 50			
Recovery	ASTM F36	%	10 – 15			

Plain inserts



Type	Insert		Size (mm)	Thickness
SLA	Aluminium	0.10 mm	roll	0.60 – 1.00 mm
SLA	Aluminium	0.10 mm	1000 x 1000 1000 x 2000	0.60 – 3.00 mm
SLI	Inconel 625	0.10 mm	600 x 1000	1.00 – 3.00 mm
SLM	Monel 400	0.10 mm	600 x 1000	0.80 – 2.00 mm
SLN	nickel	0.01 mm	roll	0.60 – 1.00 mm
SLN	nickel	0.01 mm	1000 x 1000	0.60 – 3.00 mm
SLS	1.4401	0.05 mm	roll	0.45 – 1.00 mm
SLS	1.4401	0.05 mm	1000 x 1000 1500 x 1500 1000 x 2000	1.00 – 6.00 mm
SLW	carbon steel	0.20 mm	1000 x 1500	0.80 – 3.00 mm
SDS	1.4401	0.05 mm	1000 x 1000	1.50 – 3.00 mm
SML	Polyester	0.01 mm	1000 x 1000	0.60 – 3.00 mm

8.5 GRAPHITE LAMINATE WITH PERFORATED STAINLESS STEEL INSERT

PRODUCT			PSM100	PSM150	PSM200	PSM300
Thickness		mm	1.00	1.50	2.00	3.00
Insert Material			perforated stainless steel			
	material number		1.4401 / 1.4404			
	thickness	mm	0.10			
	number		1	1	1	1
Residual stress (D IN 52913)						
$\sigma_{D\ 16\ h,\ 300\ °C,\ 50MPa}$	N / mm²		≥ 46			
Gasket characteristics (DIN28090-1)	σVU/0.1	N/mm²	25	25	25	25
	σVO	N/mm²	220	180	150	100
	σBU/0.1	N/mm²	25	25	25	25
	σBO 300 °C	N/mm²	200	160	120	85
Compression factors (DIN 28090-2)						
Compressibility at 20 °C	εKSW	%	30 – 45			
Recovery at 20 °C	εKRW	%	4 – 6			
Hot creep during operation	εWSW	%	< 3			
Recovery at 300 °C	εWRW	%	2 – 5			
ASTM	«m»-factor	MPa	2			
	«y»-factor	MPa	6			
Compressibility	ASTM F36	%	25 – 45			
Recovery	ASTM F36	%	10 – 20			

Graphite Quality

TECHNICAL DATA - Typical values for a thickness of 2.0 mm			MLX	PDM	PIM	PSL	PSM	SLA	SLI	SLN	SLS	TSM	XSM
Density of the graphite layer	DIN 28090-2	g/cm³	1.1	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Purity of graphite1)	DIN 51903	%	≥ 99.75%	≥ 99.0%	≥ 99.0%	≥ 98.0%	≥ 99.0%	≥ 99.0%	≥ 99.0%	≥ 99.0%	≥ 99.0%	> 99.0%	≥ 99.0%
Metallic reinforcement	Metal type		AISI 316 (L)	AISI 316 (L)	Inconel 625	AISI 316 (L)	AISI 316 (L)	Aluminium	Inconel alloy 625	Nickel	AISI 316 (L)	AISI 316 (L)	AISI 316 (L)
	Thickness	mm	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.013	0.05	0.10	0.10
	Number of inserts		3	2	1	1	1	1	1	1	1	1	1
Compressibility	ASTM F36 A	%	30 - 50	15 - 25	35 - 45	35 - 45	35 - 45	35 - 50	35 - 45	35 - 50	35 - 50	35 - 45	35 - 45
Recovery	ASTM F36 A	%	10 - 25	35 - 45	12 - 18	12 - 18	12 - 18	10 - 15	11 - 16	10 - 15	10 - 15	15 -25	12 - 18
Compression creep DIN 52913	16 h/ 50 MPa / 300°C	MPa	≥ 45	≥ 48	≥ 46	≥ 46	≥ 46	≥ 45	≥ 45	≥ 45	≥ 45	≥ 45	≥ 46
Klinger cold/hot compression 50 MPa	Thickness decrease at 23°C	%	35 - 45	15 - 25	35 - 45	35 - 45	35 - 45	40 - 50	35 - 45	40 - 50	40 - 50	35 - 45	35 - 45
	Thickness decrease at 300°C	%	1 - 3	1 - 3	1 - 3	1 - 3	1 - 3	1 - 4	1 - 3	1 - 4	1 - 4	1 - 3	1 - 3
Specific leak rate	DIN 28090-2	mg/ s x m	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.05	< 0.10
Chloride content of graphite layer[2)]	DIN 28090-2	ppm	≤ 40	≤ 40	≤ 40	≤ 40	≤ 40	≤ 40	≤ 40	≤ 40	≤ 40	≤ 40	≤ 40

8.6 GRAPHITE LAMINATE WITH PERFORATED STAINLESS STEEL INSERT, HIGH-DENSITY GRAPHITE

PRODUCT			PDM100	PDM150	PDM200	PDM300
Thickness		mm	1.00	1.50	2.00	3.00
Graphite density		g / cm³		1.30		
Insert Material				perforated stainless steel		
	material number			1.4401 / 1.4404		
	thickness	mm		0.10		
	number		2	2	2	2
Residual stress (DIN 52913) $\sigma_{D\ 16\ h,\ 300\ °C,\ 50MPa}$		N/mm²		≥ 48		
Gasket characteristics (DIN28090-1)	σVU/0.1	N/mm²	25	25	25	30
	σVO	N/mm²	>220	180	135	105
	σBU/0.1	N/mm²	25	25	25	30
	σBO 300°C	N/mm²	>220	150	115	95
Compression factors (DIN 28090-2) Compressibility at 20 °C	εKSW	%		15 – 30		
Recovery at 20 °C	εKRW	%		4 – 6		
Hot creep during operation	εWSW	%		< 4		
Recovery at 300 °C	εWRW	%		2 – 5		
ASTM	«m»-factor	MPa		3		
	«y»-factor	MPa		25		
Compressibility	ASTM F36	%		15 – 30		
Recovery	ASTM F36	%		20 – 45		

Tang inserts

Type	Insert		Size (mm)	Thickness
PDM	1.4401	0.10 mm	1500x1500	1.50 – 6.00 mm
PDM	1.4401	0.10 mm	1000x1000 1000x2000	1.50 – 6.00 mm
PHM	Hastelloy	0.10 mm	1000x610	1.00 – 3.00 mm
PIM	Inconel 625	0.10 mm	1000x610 1000x910	1.00 – 3.00 mm
PKM	1.4401	0.10 mm	1000x1000	1.50 – 3.00 mm
PSM	1.4401	0.10 mm	1000x1000 1000x2000 1500x1500	0.60 – 6.00 mm
TSM	1.4401	0.10 mm	1000x1000	1.50 – 3.00 mm
XSM	1.4401	0.10 mm	1000x1000	1.00 – 2.00 mm

9. CHEMICAL RESISTANCE OF GRAPHITE LAMINATES

CHEMICAL RESISTANCE CHART

Simplified overview of the chemical resistance depending on the most important groups of raw materials:

A: small or no attack B: weak till moderate attack C: strong attack

	Alkane	Motor fuel	Aromates	Chlorinated hydrocarbon fluids	Motor oil	Mineral lubricants	Alcohol	Ketone	Ester	Water	Acid (diluted)	Base (diluted)
H/HL	A	A	A	A	A	A	A	A	A	A	B	B
MLX	A	A	A	A	A	A	A	A	A	A	B	B
PDM	A	A	A	A	A	A	A	A	A	A	B	B
PIM	A	A	A	A	A	A	A	A	A	A	A	A
PSL	A	A	A	A	A	A	A	A	A	A	B	B
PSM	A	A	A	A	A	A	A	A	A	A	B	B
SLA	A	A	A	A	A	A	A	A	A	A	B	B
SLI	A	A	A	A	A	A	A	A	A	A	B	B
SLN	A	A	A	A	A	A	A	A	A	A	B	A
SLS	A	A	A	A	A	A	A	A	A	A	B	B
TSM	A	A	A	A	A	A	A	A	A	A	B	B
XSM	A	A	A	A	A	A	A	A	A	A	B	B

C: Not suitable / B: Conditional / A: Suitable

media name	Graphite homogeneous	Graphite laminate with ..... insert								
		Alumnium	Hastelloy C 276	Inconel 625	Monel 400	Nickel 200	Steel 1.033	Titanium Grade 2	EN no 1.4401	SLF
acetaldehyde	A	A	A	A	A	A	A	A	A	B
acetamide	A	A	A	A	A	A	A	A	A	A
acetic acid	A	B	A	A	B	B	C	B	A	A
acetic acid ester	A	A	A	A	A	A	A	A	A	B
acetone	A	A	A	A	A	A	A	A	A	B
acetylene	A	A	A	A	A	A	A	A	A	A
acrylic acid	A	B	A	A	B	B	C	B	A	B
adipic acid	A	B	A	A	B	B	C	B	A	A
air	A	A	A	A	A	A	A	A	A	A
allyl chloride	A	C	A	A	A	A	C	A	A	B
alum	A	B	A	A	B	B	C	B	B	A
aluminium acetate	A	A	B	A	A	A	B	A	A	A
aluminium chlorate	A	A	A	A	B	B	C	A	A	A
aluminium chloride	A	C	B	B	B	B	C	B	C	A
aluminium formiate	A	B	A	A	B	B	C	B	B	B
aluminium sulfate	A	B	A	B	B	B	C	A	B	A
aminopentane	A	B	A	A	A	A	B	A	A	B
ammonia	A	A	A	A	B	B	B	A	A	A

C: Not suitable / B: Conditional / A: Suitable

	Graphite homogeneous	Graphite laminate with ..... insert								
		Alumnium	Hastelloy C 276	Inconel 625	Monel 400	Nickel 200	Steel 10.330	Titan Grade 2	EN no 1.4401	SLF
	A	B	B	A	A	A	B	A	A	A
ammonium chloride	A	C	A	A	B	B	B	A	B	A
ammonium fluoride	A	C	A	B	B	B	B	B	B	B
ammonium hydroxide	A	B	A	A	C	C	A	A	A	A
ammonium persulfate	A	C	A	A	C	C	C	A	C	A
ammonium phosphate	A	B	A	A	B	B	C	A	A	A
amyl acetate	A	A	A	A	A	A	B	A	A	B
amyl chloride	A	A	A	A	A	A	B	A	A	B
aniline	A	B	A	A	B	B	A	A	A	C
antbracene	A	A	A	A	A	A	A	A	A	A
antimony pentachloride	B	B	B	B	C	C	C	B	A	B
asphalt	A	A	A	A	A	A	A	A	A	A
aviation fuel	A	A	A	A	A	A	A	A	A	A
barium chloride	A	B	A	A	B	B	B	A	A	A
benzene	A	A	A	A	A	A	A	A	A	A
benzoic acid	A	B	A	A	B	B	C	B	A	B
benzyl alcohol	A	A	A	A	A	A	A	A	A	A
biodiesel	A	A	A	A	A	A	B	A	A	A
blast furnace gas	A	A	A	A	B	B	B	A	A	A
bleach	A	C	B	B	B	B	C	A	C	A
boiler feedwater	A	B	A	A	A	A	B	A	A	A
borax	A	A	A	A	A	A	A	A	A	A
boric acid	A	B	A	A	A	A	B	A	A	A
brake fluid	A	A	A	A	A	A	B	A	A	A
brine	A	B	A	A	A	C	C	A	B	A
butane	A	A	A	A	A	A	A	A	A	A
butanol	A	A	A	A	A	A	A	A	A	A
butanone	A	A	A	A	A	A	A	A	A	B
butyl acetate	A	A	A	A	A	A	A	A	A	B
butyl acetyl ricinoleate	A	A	A	A	A	A	A	A	A	B
butyl glycol	A	A	A	A	A	A	A	A	A	A
butylamine	A	A	A	A	A	A	A	A	A	B
butyl alcohol	A	A	A	A	A	A	B	A	A	A
butyric acid	A	B	A	A	B	B	C	B	A	A
calcium chloride	A	B	A	A	B	A	B	B	B	A
calcium hydroxide	A	B	A	A	A	A	A	A	A	A
calcium hypochlorite	A	C	B	B	B	B	C	A	C	A
calcium sulphate	A	A	B	A	A	A	A	A	A	A
carbon dioxide	A	A	A	A	B	B	B	A	A	B
carbon disulphide	A	A	A	A	B	A	A	A	A	A
carbon tetrachloride	A	A	A	A	A	A	A	A	A	A
castor oil	A	A	A	A	A	A	A	A	A	A
chlorethane	A	A	A	A	A	A	A	A	A	A
chlorine dry	A	A	A	A	A	A	B	C	A	A
chlorine moist	B	C	B	C	B	B	C	B	C	B
chlorine water	B	C	B	C	B	B	C	B	C	B

C: Not suitable / B: Conditional / A: Suitable

media name	Graphite homogeneous	Graphite laminate with ..... insert								
		Alumnium	Hastelloy C 276	Inconel 625	Monel 400	Nickel 200	Steel 10.330	Titan Grade 2	EN no 1.4401	SLF
chlorocetaldehyde	A	A	A	A	A	A	A	A	A	A
chloroform	A	A	A	A	A	A	A	A	A	B
chloromethane	A	C	A	B	B	B	B	A	A	B
chloropropene	A	A	A	A	A	A	A	A	A	A
chlorotrifluoride	C	C	C	C	C	C	C	C	C	C
chlorpentane	A	A	A	A	A	A	A	A	A	A
chromic acid	B	B	B	B	C	C	C	B	B	B
citric acid	A	B	A	A	B	B	C	B	A	A
coal tar	A	A	A	A	A	A	A	A	A	A
copper acetate	A	C	A	A	B	B	C	A	A	A
copper carbonate	A	C	A	A	B	B	C	A	A	A
copper sulphate	A	C	A	A	B	B	C	A	A	A
creosote	A	A	A	A	A	A	A	A	A	A
cresole	A	B	A	A	A	A	C	A	A	B
crotonaldehyde	A	A	A	A	A	A	A	A	A	B
crude oil	A	A	A	A	A	A	A	A	A	A
cyanogen	A	A	A	A	A	A	A	A	A	A
cyclohexanol	A	A	A	A	A	A	A	A	A	A
cyclohexanone	A	A	A	A	A	A	A	A	A	C
cyclopentane	A	A	A	A	A	A	A	A	A	A
decahydronaphthalen	A	A	A	A	A	A	A	A	A	A
dibenzyl ether	A	A	A	A	A	A	A	A	A	A
dibutyl fumarate	A	A	A	A	A	A	A	A	A	B
dibutyl phthalate	A	A	A	A	A	A	A	A	A	A
dichlorbutene	A	A	A	A	A	A	A	A	A	B
dichloroacetic acid	A	B	A	A	B	B	A	B	C	B
dichloromethane	A	C	A	A	A	A	A	A	A	B
diesel fuel	A	A	A	A	A	A	A	A	A	A
diethanolamine	A	A	A	A	A	A	A	A	A	B
diethyl carbonate	A	A	A	A	A	A	A	A	A	B
diethyl phthalate	A	A	A	A	A	A	A	A	A	A
diethylene dioxide	A	A	A	A	A	A	A	A	A	B
diisopropylbenzene	A	A	A	A	A	A	A	A	A	B
diisopropylidene acetone	A	A	A	A	A	A	A	A	A	B
dimethyl formamide	A	A	A	A	A	A	A	A	A	B
dimethylaniline	A	A	A	A	A	A	A	A	A	B
dioctylamine	A	A	A	A	A	A	A	A	A	A
dioxane	A	A	A	A	A	A	A	A	A	B
dipentylamine	A	A	A	A	A	A	A	A	A	A
dodecylbenzene	A	A	A	A	A	A	A	A	A	A
ethane	A	A	A	A	A	A	A	A	A	A
ethanol	A	A	A	A	A	A	B	A	A	A
ethyl acetate	A	A	A	A	A	A	A	A	A	A
ethyl chloride	A	B	A	A	B	B	B	A	A	B
ethyl ether	A	A	A	A	A	A	A	A	A	A
ethylbenzene	A	A	A	A	A	A	A	A	A	A

C: Not suitable / B: Conditional / A: Suitable

media name	Graphite homogeneous	Graphite laminate with ..... insert								
		Alumnium	Hastelloy C 276	Inconel 625	Monel 400	Nickel 200	Steel 10.330	Titan Grade 2	EN no 1.4401	SLF
ethylene	A	A	A	A	A	A	A	A	A	A
ethylene chloride	A	A	A	A	A	A	A	A	A	B
ethylene glycol	A	A	A	A	A	A	A	A	A	A
ethylenediamine	A	A	A	A	A	A	B	A	A	C
fatty acid esters	A	A	A	A	A	A	A	A	A	A
fluorine gaseous	C	C	C	C	C	C	C	C	C	C
fluorobenzene	A	A	A	A	A	A	A	A	A	B
formaldehyde	A	A	A	A	A	A	B	A	A	A
formamide	A	A	A	A	A	A	A	A	A	A
formic acid	A	B	A	A	B	B	C	B	B	B
glycerine	A	A	A	A	A	A	A	A	A	A
heating oil	A	A	A	A	A	A	A	A	A	A
helium	A	A	A	A	A	A	A	A	A	A
heptane	A	A	A	A	A	A	A	A	A	A
hexafluorosilicic acid	A	A	B	B	A	B	C	C	C	C
hydraulic oil	A	A	A	A	A	A	A	A	A	A
hydrazine hydrate	A	A	A	A	A	A	B	A	A	B
hydrochloric acid	A	C	B	B	B	B	C	B	C	C
hydrofluorid acid	A	C	B	B	A	B	C	C	C	C
hydrogen	A	A	A	A	A	A	B	C	A	A
hydrogen acid	A	C	B	B	B	B	C	B	C	C
hydrogen peroxide	B	B	B	B	B	B	C	B	B	B
isoocetane	A	A	A	A	A	A	A	A	A	A
isopentyl acetate	A	A	A	A	A	A	A	A	A	A
isopropyl alcohol	A	A	A	A	A	A	A	A	A	A
isopropylamine	A	A	A	A	A	A	A	A	A	A
kerosene	A	A	A	A	A	A	A	A	A	A
lactic acid	A	B	A	A	B	B	C	B	B	A
lead acetate	A	C	A	A	A	A	C	A	A	A
limewater	A	B	A	A	A	A	A	A	A	A
linseed oil	A	A	A	A	A	A	A	A	A	A
magnesium sulphate	A	A	B	B	B	B	B	A	A	A
malic acid	A	B	A	A	B	B	C	B	A	A
methane	A	A	A	A	A	A	A	A	A	A
methanol	A	B	A	A	A	A	B	A	A	A
methoxypropanol	A	B	A	A	A	A	B	A	A	A
methyl chloride	A	C	A	B	B	B	B	A	A	B
methyl iodide	A	A	A	A	A	A	A	A	A	B
methyl isobutyl ketone	A	A	A	A	A	A	A	A	A	A
methylpentylketon	A	A	A	B	B	B	B	A	A	B
mineral oil	A	A	A	A	A	A	B	A	A	A
naphtha	A	A	A	A	A	A	A	A	A	A
natural gas	A	A	A	A	A	A	A	A	A	A
nitric acid	B	B	B	B	C	C	C	B	B	C
nitrobenzene	A	A	A	A	A	A	A	A	A	C
nitrogen	A	A	A	A	A	A	A	A	A	A

C: Not suitable / B: Conditional / A: Suitable

media name	Graphite homogeneous	Graphite laminate with ..... insert								
		Alumnium	Hastelloy C 276	Inconel 625	Monel 400	Nickel 200	Steel 10.330	Titan Grade 2	EN no 1.4401	SLF
nitrous oxide	A	A	A	A	A	A	A	A	A	A
ocetane	A	A	A	A	A	A	A	A	A	A
oleanolic acid	A	A	A	A	A	A	A	A	A	A
oxalic acid	A	A	A	A	A	A	B	A	A	A
oxalic acid	A	B	A	A	B	B	C	B	B	B
oxygen	A	A	A	A	A	A	B	A	A	A
ozone	C	C	C	C	C	C	C	C	C	C
palmitic acid	A	B	A	A	A	A	B	A	A	A
pentane	A	A	A	A	A	A	A	A	A	A
pentylacetate	A	A	A	A	A	A	A	A	A	A
petrol	A	A	A	A	A	A	A	A	A	A
petroleum	A	A	A	A	B	B	A	A	A	A
phenol	A	C	A	A	B	A	C	A	A	A
phorone	A	A	A	A	A	A	A	A	A	A
phosphoric acid	A	C	B	B	B	B	C	C	B	A
phosphorus trichloride	A	B	A	A	A	A	C	A	B	A
phthalate	A	A	A	A	A	A	A	A	A	A
phthalic acid	A	B	A	A	B	B	C	B	A	A
potassium acetate	A	A	A	A	A	A	A	A	A	A
potassium carbonate	A	C	B	B	A	A	B	A	A	A
potassium chlorate	B	B	B	B	C	C	C	B	B	B
potassium chloride	A	B	A	A	A	A	C	A	C	A
potassium cyanide	A	C	A	A	B	B	C	A	A	A
potassium dichromate	B	B	B	B	C	C	B	B	B	B
potassium hydroxide	A	C	B	A	A	A	A	B	A	B
potassium hypochlorite	A	C	B	B	B	B	C	A	C	A
potassium iodide	A	B	A	A	A	A	A	A	A	A
potassium nitrate	B	B	B	B	C	C	C	B	B	B
potassium permanganate	A	B	A	A	C	C	C	A	A	A
propane	A	A	A	A	A	A	A	A	A	A
pyridine	A	A	A	A	A	A	A	A	A	C
r-134a	A	A	A	A	A	A	A	A	A	A
r23	A	A	A	A	A	A	A	A	A	A
rapeseed methyl ester	A	A	A	A	A	A	A	A	A	A
rape seed oil	A	A	A	A	A	A	A	A	A	A
salicylic acid	A	A	A	A	A	A	A	A	A	A
sea water	A	A	A	A	A	C	C	A	B	A
silicon oil	A	A	A	A	A	A	A	A	A	A
soap	A	A	A	A	A	A	A	A	A	A
sodium bicarbonate	A	B	A	A	A	A	B	A	A	A
sodium bisulphite	A	B	A	A	B	B	C	A	A	A
sodium carbonate	A	B	B	B	B	A	C	A	A	A
sodium chloride	A	B	A	A	A	B	C	A	A	A
sodium cyanide	A	B	A	A	A	B	C	A	A	A
sodium hydroxide	A	B	A	A	A	A	B	B	B	B
sodium hypochlorite	A	C	B	B	B	B	C	A	C	A
sodium silicate	A	A	A	A	B	A	A	A	A	A

C: Not suitable / B: Conditional / A: Suitable

media name	Graphite homogeneous	Graphite laminate with ..... insert								
		Alumnium	Hastelloy C 276	Inconel 625	Monel 400	Nickel 200	Steel 10.330	Titan Grade 2	EN no 1.4401	SLF
sodium sulfide	A	B	A	A	B	B	A	A	A	A
sodium sulphate	A	A	A	A	A	A	C	A	A	A
starch	A	A	A	A	A	A	A	A	A	A
steam	A	A	A	A	A	B	B	A	A	A
stearic acid	A	A	A	A	A	A	B	A	A	A
sugar	A	A	A	A	A	A	A	A	A	A
sulphur dioxide	A	B	A	A	B	A	C	A	B	A
sulphuric acid	B	B	B	B	C	C	C	B	C	C
sulphurous acid	A	B	A	A	B	A	C	A	A	B
tannic acid	A	A	A	A	A	A	A	A	A	A
tannin	A	A	A	A	A	A	A	A	A	A
tar	A	A	A	A	A	A	A	A	A	A
tartaric acid	A	B	A	A	B	B	C	B	A	A
tetrachloro ethylene	A	A	A	A	A	A	A	A	A	C
tetrachloroethane	A	A	A	A	A	A	A	A	A	B
tetrahydrofurane	A	A	A	A	A	A	A	A	A	B
tetrahydronaphthale	A	A	A	A	A	A	A	A	A	B
titantetrachloride	A	B	A	A	A	C	C	A	B	A
toluene	A	A	A	A	A	A	A	A	A	A
natural gas	A	A	A	A	A	A	A	A	A	A
transformer oil	A	A	A	A	A	A	A	A	A	A
trichloroethylene	A	A	A	A	A	A	A	A	A	B
triethanolamin	A	B	A	A	A	A	B	A	A	B
triethanolamine	A	B	A	A	A	A	B	A	A	B
turpentine	A	A	A	A	A	A	A	A	A	B
urea	A	A	A	A	A	A	A	A	A	A
vinyl acetate	A	A	A	A	A	A	A	A	A	A
water	A	A	A	A	A	A	B	A	A	A
xylene	A	A	A	A	A	A	A	A	A	A
xylidine	A	B	A	A	A	A	B	A	A	B

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