Thermoseal®

KLINGERSIL®

Compressed Gasket Material

Flexible Graphite

Milam Laminate

A Tradition of Quality Since 1886

The Klinger Group of independent companies has been a world leader in the development, manufacture and distribution of quality fluid sealing and control products since its inception in 1886 by Austrian engineer Richard Klinger. From the revolutionary development of the compressed fiber gasket in 1877 to the advanced sealing material technology of today, product innovation and a problem-solving philosophy have always been the cornerstones of Klinger's operating policy.

Thermoseal, the exclusive Klinger licensee in North America, continues the tradition by providing a wide variety of fluid sealing materials for industrial and manufacturing applications.

More companies rely on Thermoseal for their fluid sealing and control needs – petrochemical and chemical, paper, mining, steel, shipbuilding and valve manufacturers. These industries know Thermoseal stands behind its products with thousands of hours of scientific development, testing and evaluation, along with unmatched experience and a dedication to customer service.

Meeting Industry Needs ... Today and Tomorrow

Thermoseal offers a diverse range of sealing materials designed to meet virtually any fluid sealing need:

- KLINGERSIL® family of compressed non-asbestos gasket materials
- KLINGERSIL® beater addition composite gasket materials
- KLINGERtop-chem® reinforced PTFE products
- Klinger Flexible Graphite HL, SLS, and PSM
- KLINGER® Maxiprofile composite gaskets
- Thermoseal® soft-chem® expanded PTFE material
- Sealex® Joint Sealant
- Custom formulations

The Competition Is GREEN with Envy

Everyone knows that KLINGERSIL® compressed gasket materials are hard to match ... especially our competitors! They cleverly produce their materials to resemble the KLINGERSIL® green (C-4401). Their color may be close, but not their quality. To ensure you're getting the right material for all your fluid sealing and control needs, always look for the KLINGERSIL® logo on every sheet. Because when you see our name, you'll know you're getting the Original KLINGERSIL® and not some green-eyed imitation. For more information, check out our website at www.thermosealinc.com.

The Original Green
Many Materials are green, Only One is KLINGERSIL®

• The Many, Varied Demands Placed on Gaskets

A common perception is that the suitability of a gasket for any given application depends on the maximum temperature and pressure conditions. This is not the case. Maximum temperature and pressure values alone cannot define a material's suitability for an application. These limits are dependent upon a multiplicity of factors (gasket material, media, pressure, temperature, bolts, flange surface). It is always suggested to consider these factors when selecting a material for a given application.

• Cryogenic Service

In general, KLINGERSIL® gasketing materials have no lower temperature limitation; however, with low temperature applications consider the following:

1) The gasket must be dry and without oil or adhesive when installed and should be stored in a dry atmosphere since the fibers absorb moisture from the air.

2) The gasket should not be subjected to severe thermal expansions at the joint assembly.

3) The required flange loading must be applied at ambient temperature and must not fall below the required minimum value over the whole range of service temperature.

• Gasket Compounds

Do not apply gasket compounds, adhesives or anti-stick lubricants to the gasket surface. These compounds will affect surface friction and may deteriorate material, leading to excessive creep relaxation and possible gasket failure due to reduced gasket stress. Thermoseal can apply a factory coating to KLINGERSIL® gasket materials for ease of release. Ask for NST coating when specifying or ordering gasketing material.

• Gasket Performance

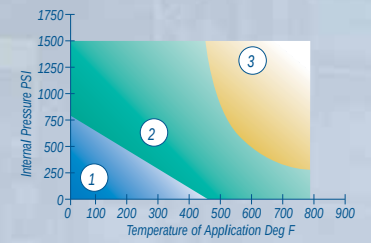
For reasons of safety, we advise against the re-use of gaskets. The performance and life of Thermoseal gaskets depend, in large measure, on proper storage and fitting, which are factors beyond the manufacturer's control. We can, however, vouch for the excellent quality of Thermoseal products.

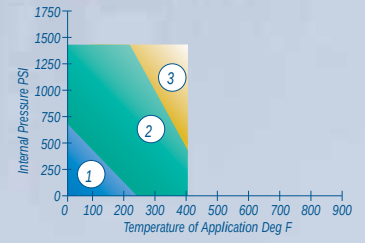
• Thickness Tolerances to ASTM F104

Nominal Thickness	1/64" .016"	1/32" .031"	3/64" .047"	1/16" .062"	3/32" .094"	1/8" .125"
Standard Range of Thickness	.014" .021"	.026" .036"	.042" .052"	.054" .070"	.086" .102"	.117" .133"

To help you easily decide which KLINGERSIL® material is needed, Thermoseal pressure and temperature graphs have been included to help in your gasket material selection process. If there is still an uncertainty about which KLINGERSIL® material is right for a particular application, Thermoseal offers technical support to help you make the right decision the first time. Simply fax a completed technical service questionnaire, found on the inside back cover of this brochure or on our website at www.thermosealinc.com, and we will provide an immediate recommendation.

Pressure and Temperature Graphs



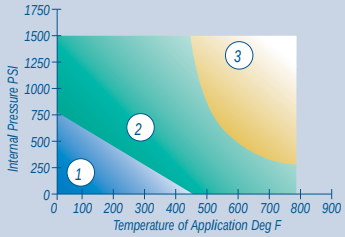
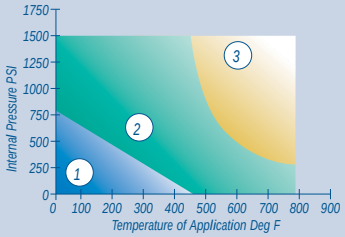
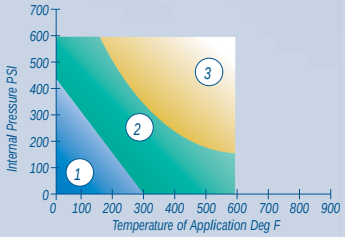
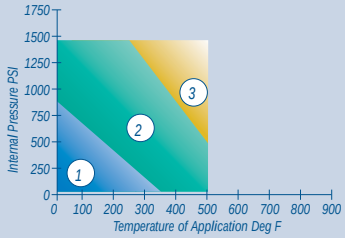
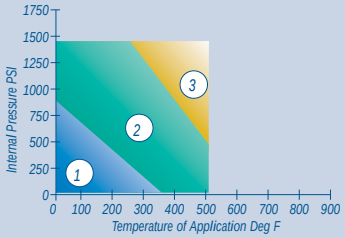
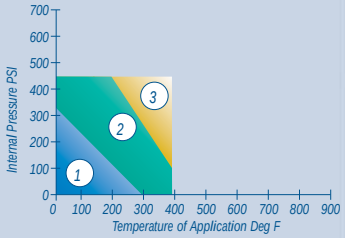


1. *In area one, the gasket material is suitable using common installation practices subject to chemical compatibility.*
2. *In area two, appropriate measures are necessary for the installation of the gasket to ensure maximum performance. Please call or refer to the KLINGER® expert software system for assistance.*
3. *In area three, do not install gaskets in these applications without first referring to the KLINGER® expert software system or contacting Thermoseal's technical support service.*

These graphs were developed from the testing of KLINGER® materials. Do not use them for competitors' materials, since non-asbestos gasketing materials do not have service equivalents.

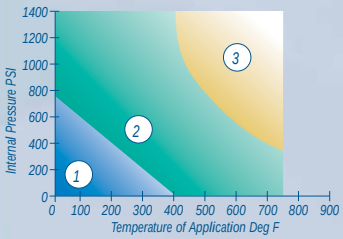
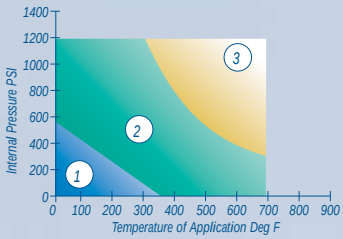
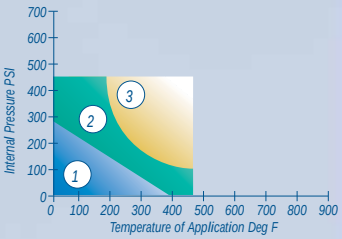
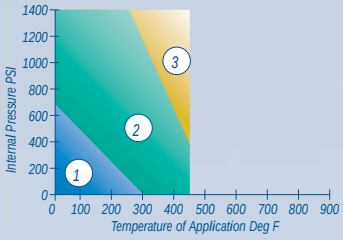
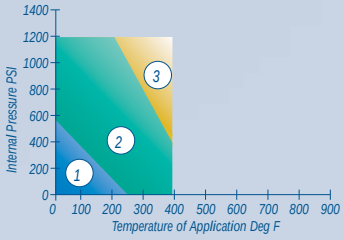
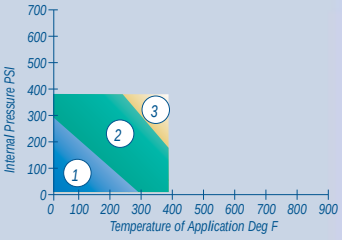
Compressed Inorganic Fiber Gasketing

Distinguishing Characteristics & Applications
See graphs for temperature and pressure limits. Typical values refer to 1/16" material unless otherwise specified.
See pages 16 and 17 for test procedures

	KLINGERSIL® C-4433	KLINGERSIL® C-4430	KLINGERSIL® C-4324
	• Fiberglass, Aramid & Inorganic Fibers • Nitrile Binder • Ultimate Steam Sheet • Outstanding Load Bearing • Excellent Creep Relaxation • Best General Purpose Sheet	• Fiberglass & Aramid Fibers • Nitrile Binder • Excellent Steam Sheet • Excellent Chemical Resistance • Good Creep Relaxation • General Purpose Sheet	• Recycled Fiberglass & Aramid Blend • Nitrile Binder • Low Pressure Steam, Water & Gases • Good for Oils & Fuels
Creep Relaxation ASTM F38B (1/32")	20%	20%	25%
Sealability ASTM F37A (1/32")	< 0.5 ml/hr	< 0.5 ml/hr	< 0.5 ml/hr
Gas Permeability DIN 3535/6	< 0.2 ml/min	< 0.5 ml/min	< 0.5 ml/min
Compressibility ASTM F36J	7%	9%	8%
Recovery ASTM F36J	60% Minimum	50% Minimum	50% Minimum
Klinger Hot Compression Test			
Thickness Decrease 73°F (23°C)	7% Initial	8% Initial	12% Initial
Thickness Decrease 572°F (300°C)	8% Additional	11% Additional	15% Additional
Weight Increase ASTM F146 after immersion in Fuel B 5h/73°F (23°C)	10% Maximum	10% Maximum	12% Maximum
Thickness Increase ASTM F146 after immersion in:			
ASTM Oil 1, 5h/300°F (149°C)	0-5%	0-5%	0-5%
ASTM Oil IRM # 903, 5h/300°F (149°C)	0-4%	0-3%	0-5%
ASTM Fuel A, 5h/73°F (23°C)	0-5%	0-5%	0-5%
ASTM Fuel B, 5h/73°F (23°C)	0-7%	0-5%	0-7%
Dielectric Strength ASTM D149-95a	21 kV/mm	16 kV/mm	13 kV/mm
Leachable Chloride Content F.S.A. Method (Typical)	150 ppm	150 ppm	250 ppm
Density ASTM F1315	112 lb/ft³ (1.8 g/cc)	96 lb/ft³ (1.55 g/cc)	112 lb/ft³ (1.8 g/cc)
Color (Top/Bottom)	Red	White/Green	Green/Grey
ASTM F104 Line Call Out	F712132B3E12K6M5	F712132B3E11K6M5	F712132B4E32K6M4
Pressure and Temperature Graphs Material Thickness: 1/16"			
Liquids			
Gases and Steam			

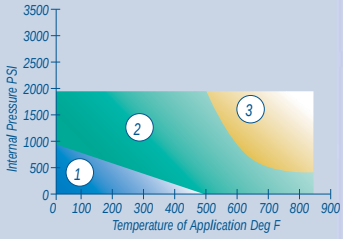
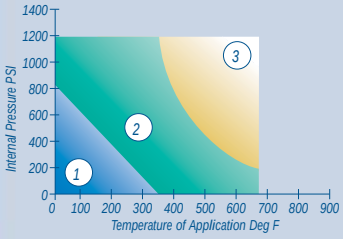
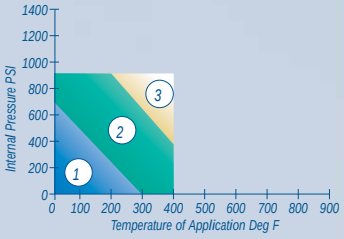
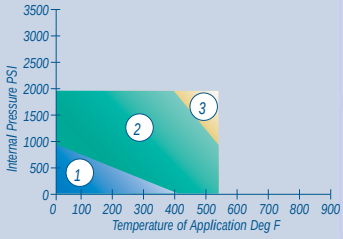
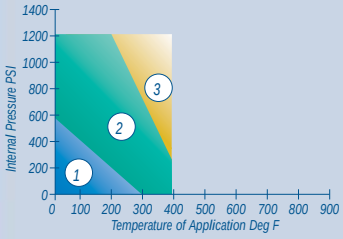
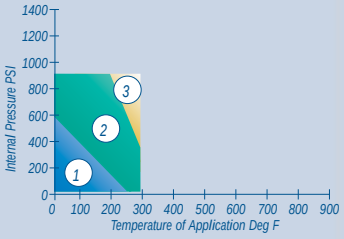
General Application Gasketing

Distinguishing Characteristics & Applications
See graphs for temperature and pressure limits. Typical values refer to 1/16" material unless otherwise specified.
See pages 16 and 17 for test procedures

	KLINGERSIL® C-4401	KLINGERSIL® C-4300	KLINGERSIL® C-4201
	• Synthetic Fiber • Nitrile Binder • Excellent Sealability • Excellent Chemical Resistance • Good Creep Relaxation • Good General Purpose Sheet	• Synthetic Fiber • Nitrile Binder • Good Sealability • Good Chemical Resistance • General Purpose Sheet	• Synthetic Fiber • Nitrile Binder • Excellent Resistance to Oil & Solvents • Good Anti-Stick Properties • Excellent OEM Material
Creep Relaxation ASTM F38B (1/32")	20%	25%	20%
Sealability ASTM F37A (1/32")	< 0.25 ml/hr	< 0.25 ml/hr	< 0.50 ml/hr
Gas Permeability DIN 3535/6	< 0.5 ml/min	< 0.5 ml/min	< 0.5 ml/min
Compressibility ASTM F36J	7%	10%	7%
Recovery ASTM F36J	50% Minimum	50% Minimum	50% Minimum
Klinger Hot Compression Test			
Thickness Decrease 73°F (23°C)	10.5% Initial	10% Initial	11% Initial
Thickness Decrease 572°F (300°C)	17% Additional	25% Additional	19.5% Additional
Weight Increase ASTM F146 after immersion in Fuel B 5h/73°F (23°C)	10% Maximum	10% Maximum	10% Maximum
Thickness Increase ASTM F146 after immersion in:			
ASTM Oil 1, 5h/300°F (149°C)	0-5%	0-5%	0-5%
ASTM Oil IRM # 903, 5h/300°F (149°C)	0-5%	0-5%	0-5%
ASTM Fuel A, 5h/73°F (23°C)	0-5%	0-5%	0-5%
ASTM Fuel B, 5h/73°F (23°C)	0-7%	0-10%	0-5%
Dielectric Strength ASTM D149-95a	14 kV/mm	18 kV/mm	14 kV/mm
Leachable Chloride Content F.S.A. Method (Typical)	100 ppm	200 ppm	200 ppm
Density ASTM F1315	112 lb/ft³ (1.8 g/cc)	100 lb/ft³ (1.6 g/cc)	119 lb/ft³ (1.9 g/cc)
Color (Top/Bottom)	Green	White or Black	White or Black
ASTM F104 Line Call Out	F712121B3E12K6M5	F712111B4E12K6M4	F712121B3E11K6M5
Pressure and Temperature Graphs Material Thickness: 1/16"			
Liquids			
Gases and Steam			

Carbon Fiber Gasketing

Chemical Resistant Gasketing

	KLINGERSIL® C-4500	KLINGERSIL® C-7400	KLINGERSIL® C-8200
Distinguishing Characteristics & Applications See graphs for temperature and pressure limits. Typical values refer to 1/16" material unless otherwise specified. See pages 16 and 17 for test procedures	• Carbon Fiber • Nitrile Binder • High Temperature • High Internal Pressure • Good Steam Sheet • Suitable for a Wide Range of Chemical Applications	• Synthetic Fiber • EPDM Binder • Moderate Caustics & Acids • Good Oil Swell Characteristics • Excellent Aging Properties • Good in Light Duty Steam	• Synthetic Fiber • Hypalon® Binder • Acid Resistant • Good Oil-Fuel Resistance • Good Gas Sealability • No Color Added
Creep Relaxation ASTM F38B (1/32")	20%	25%	30%
Sealability ASTM F37A (1/32")	< 0.30 ml/hr	< 0.30 ml/hr	< 0.30 ml/hr
Gas Permeability DIN 3535/6	< 1.0 ml/min	< 0.5 ml/min	< 0.5 ml/min
Compressibility ASTM F36J	12%	7%	9%
Recovery ASTM F36J	60% Minimum	50% Minimum	50% Minimum
Klinger Hot Compression Test		(tested at 3,625-psi gasket stress)	(tested at 3,625-psi gasket stress, and to 392°F [200°C])
Thickness Decrease 73°F (23°C)	10% Initial	9% Initial	7% Initial
Thickness Decrease 572°F (300°C)	15% Additional	5% Additional	17% Additional
Weight Increase ASTM F146 after immersion in Fuel B 5h/73°F (23°C)	10% Maximum	15% Maximum	10% Maximum
Thickness Increase ASTM F146 after immersion in:			
ASTM Oil 1, 5h/300°F (149°C)	0-5%	0-15%	0-5%
ASTM Oil IRM # 903, 5h/300°F (149°C)	0-3%	15-30%	5-10%
ASTM Fuel A, 5h/73°F (23°C)	0-5%	0-20%	0-5%
ASTM Fuel B, 5h/73°F (23°C)	0-5%	5-20%	0-10%
Dielectric Strength ASTM D149-95a	1.5 kV/mm	22 kV/mm	9 kV/mm
Leachable Chloride Content F.S.A. Method (Typical)	200 ppm	200 ppm	N/A
Density ASTM F1315	87 lb/ft³ (1.4 g/cc)	94 lb/ft³ (1.5 g/cc)	106 lb/ft³ (1.7 g/cc)
Color (Top/Bottom)	Black	White/Grey	Off White
ASTM F104 Line Call Out	F712122B3E11K6M5	F712441B4E24K6M5	F712100B5E22K6M5
Pressure and Temperature Graphs Material Thickness: 1/16"			
Liquids			
Gases and Steam			

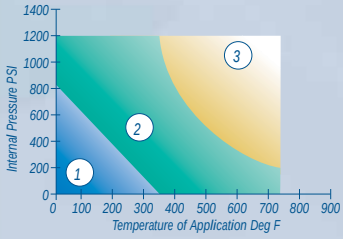
Neoprene and SBR Binder Gasketing

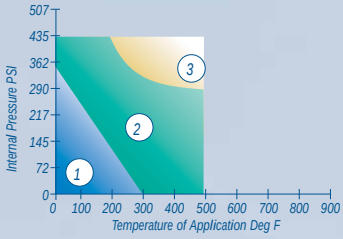
Distinguishing Characteristics & Applications
See graphs for temperature and pressure limits. Typical values refer to 1/16" material unless otherwise specified.
See pages 16 and 17 for test procedures

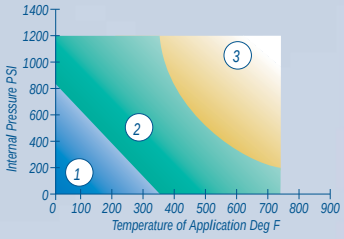
	KLINGERSIL® C-5400	KLINGERSIL® C-6327	KLINGERSIL® C-6400
	• Synthetic Fiber • Neoprene Binder • Chemically Stable • Good Anti-Stick Properties	• Synthetic Fiber • Modified SBR Binder • Controlled Swell • Use for Low Temperatures & Low Pressures • Good with Low Bolt Loads	• Synthetic Fiber • SBR Binder • Good Anti-Stick Properties • Good Steam Sheet
Creep Relaxation ASTM F38B (1/32")	20%	35%	20%
Sealability ASTM F37A (1/32")	< 0.20 ml/hr	< 0.20 ml/hr	< 0.20 ml/hr
Gas Permeability DIN 3535/6	< 0.5 ml/min	< 0.5 ml/min	< 0.3 ml/min
Compressibility ASTM F36J	8%	15%	8%
Recovery ASTM F36J	50% Minimum	40% Minimum	50% Minimum
Klinger Hot Compression Test		(tested to 392°F [200°C])	
Thickness Decrease 73°F (23°C)	11% Initial	16% Initial	12% Initial
Thickness Decrease 572°F (300°C)	21% Additional	25% Additional	11% Additional
Weight Increase ASTM F146 after immersion in Fuel B 5h/73°F (23°C)	15% Maximum	35% Maximum	25% Maximum
Thickness Increase ASTM F146 after immersion in:			
ASTM Oil 1, 5h/300°F (149°C)	0-5%	0-10%	0-10%
ASTM Oil IRM # 903, 5h/300°F (149°C)	5-20%	30-40%	10-25%
ASTM Fuel A, 5h/73°F (23°C)	0-5%	0-15%	0-5%
ASTM Fuel B, 5h/73°F (23°C)	0-10%	20-35%	0-10%
Dielectric Strength ASTM D149-95a	18 kV/mm	13 kV/mm	16 kV/mm
Leachable Chloride Content F.S.A. Method (Typical)	500 ppm	150 ppm	200 ppm
Density ASTM F1315	106 lb/ft³ (1.7 g/cc)	100 lb/ft³ (1.6 g/cc)	112 lb/ft³ (1.8 g/cc)
Color (Top/Bottom)	White or Black	White	White or Black
ASTM F104 Line Call Out	F712232B3E22K6M5	F714532B6E56K6M4	F71341B3E42K6M5

Pressure and Temperature Graphs
Material Thickness: 1/16"

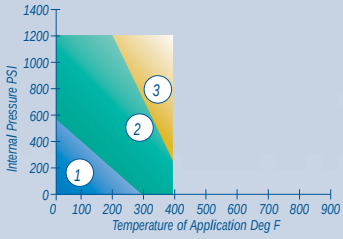
Liquids

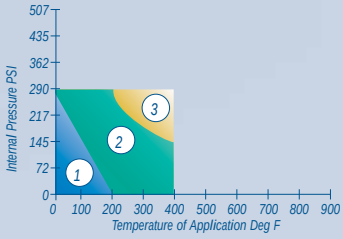


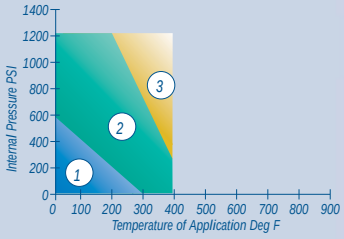




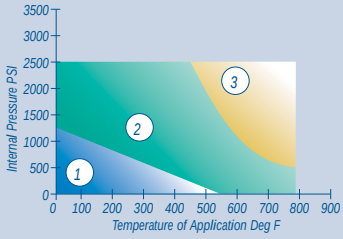
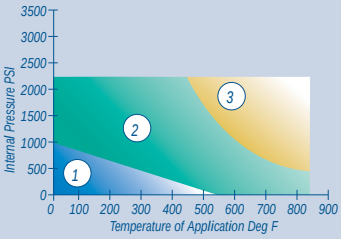
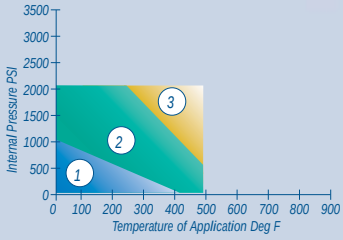
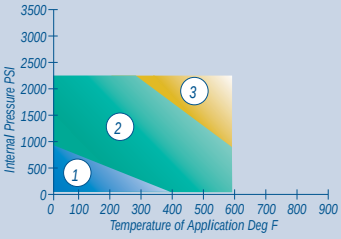
Gases and Steam



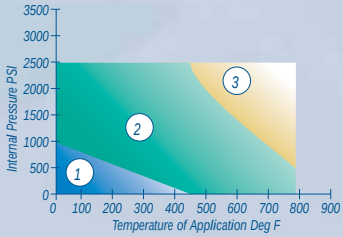
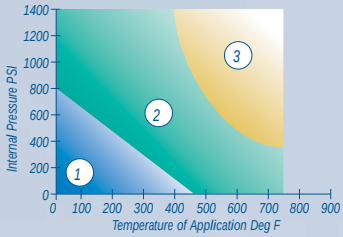
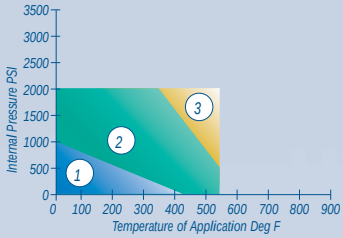
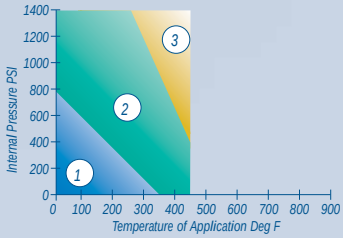




Metal Reinforced Gasketing

	EXPANDED METAL REINFORCED KLINGERSIL® C-4439	EXPANDED METAL REINFORCED KLINGERSIL® C-4509
Distinguishing Characteristics & Applications See graphs for temperature and pressure limits. Typical values refer to 1/16" material unless otherwise specified. See pages 16 and 17 for test procedures	• Fiberglass, Aramid & Inorganic Fibers • Nitrile Binder • High Temperature & Stress • Vibration • Galvanized Low Carbon Steel Insert	• Carbon Fiber • Nitrile Binder • Good in High Load Applications • Vibration • Galvanized Low Carbon Steel Insert
Creep Relaxation ASTM F38B (1/32")	20%	20%
Sealability ASTM F37A (1/32")	N/A	N/A
Gas Permeability DIN 3535/6	N/A	N/A
Compressibility ASTM F36J	7%	12%
Recovery ASTM F36J	50% Minimum	70% Minimum
Klinger Hot Compression Test		
Thickness Decrease 73°F (23°C)	8% Initial	9% Initial
Thickness Decrease 572°F (300°C)	4% Additional	7% Additional
Weight Increase ASTM F146 after immersion in Fuel B 5h/73°F (23°C)	9% Maximum	10% Maximum
Thickness Increase ASTM F146 after immersion in:		
ASTM Oil 1, 5h/300°F (149°C)	0-5%	0-5%
ASTM Oil IRM # 903, 5h/300°F (149°C)	0-5%	0-3%
ASTM Fuel A, 5h/73°F (23°C)	0-5%	0-5%
ASTM Fuel B, 5h/73°F (23°C)	5-10%	0-5%
Dielectric Strength ASTM D149-95a	10 kV/mm	N/A
Leachable Chloride Content F.S.A. Method (Typical)	150 ppm	N/A
Density ASTM F1315	131 lb/ft^3 (2.1 g/cc)	125 lb/ft^3 (2.0 g/cc)
Color (Top/Bottom)	Red	Black
ASTM F104 Line Call Out	F712112B3E12K6M8	F712112B3E11M8
Pressure and Temperature Graphs Material Thickness: 1/16"		
Liquids		
Gases and Steam		

Metal Reinforced Gasketing

	EXPANDED METAL REINFORCED KLINGERSIL® C-4409	WIRE REINFORCED KLINGERSIL® C-4408
Distinguishing Characteristics & Applications See graphs for temperature and pressure limits. Typical values refer to 1/16" material unless otherwise specified. See pages 16 and 17 for test procedures	• Synthetic Fiber • Nitrile Binder • High Temperature & Stress • Excellent in Hot Gases • Replaces Spiral Wounds • Vibration • Galvanized Low Carbon Steel Insert	• Synthetic Fiber • Nitrile Binder • High Temperature & Stress • Fluctuating Temperatures & Pressures • Vibration • Low Carbon Steel Woven Mesh Insert
Creep Relaxation ASTM F38B (1/32")	20%	20%
Sealability ASTM F37A (1/32")	N/A	N/A
Gas Permeability DIN 3535/6	N/A	N/A
Compressibility ASTM F36J	7%	8%
Recovery ASTM F36J	50% Minimum	50% Minimum
Klinger Hot Compression Test		
Thickness Decrease 73°F (23°C)	10% Initial	10% Initial
Thickness Decrease 572°F (300°C)	10% Additional	22% Additional
Weight Increase ASTM F146 after immersion in Fuel B 5h/73°F (23°C)	10% Maximum	10% Maximum
Thickness Increase ASTM F146 after immersion in:		
ASTM Oil 1, 5h/300°F (149°C)	0-5%	0-5%
ASTM Oil IRM # 903, 5h/300°F (149°C)	0-3%	0-5%
ASTM Fuel A, 5h/73°F (23°C)	0-5%	0-5%
ASTM Fuel B, 5h/73°F (23°C)	0-5%	0-5%
Dielectric Strength ASTM D149-95a	N/A	N/A
Leachable Chloride Content F.S.A. Method (Typical)	N/A	N/A
Density ASTM F1315	125 lb/ft^3 (2.0 g/cc)	119 lb/ft^3 (1.9 g/cc)
Color (Top/Bottom)	Green	Black
ASTM F104 Line Call Out	F712112B3E11M8	F712112B3E11M6
Pressure and Temperature Graphs Material Thickness: 1/16"		
Liquids		
Gases and Steam		

Assessment of Chemical Compatibility KLINGERSIL®

The information in this chart should only be used as a general rule to the selection of a suitable material.

A: Generally suitable. B: Generally suitable with sufficient surface stress – do not expose to free immersion.**
*C: Critical application – do not use without contacting manufacturer. *= When proper assembly rules are followed.*

	C-4201	C-4300 C-4401	C-4408 C-4409	C-4324	C-4433 C-4430	C-4439	C-4500	C-4509	C-5400	C-6327 C-6400	C-7400	C-8200
Acetaldehyde	B	B	B	B	B	B	B	B	C	B	B	A
Acetic Acid 100%	A	A	A	A	A	C	A	C	B	B	B	A
Acetic Acid 10%	A	A	C	A	A	C	A	C	A	A	A	A
Acetic Ether	B	B	B	B	B	B	B	B	B	B	B	B
Acetone	B	B	B	B	B	B	B	B	B	A	A	A
Acetylene	A	A	A	A	A	A	A	A	A	A	A	A
Adipic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Air	A	A	A	A	A	A	A	A	A	A	A	A
Alum	A	A	B	A	A	B	A	B	A	A	A	A
Aluminum Acetate	A	A	B	A	A	B	A	B	A	A	A	A
Aluminum Chloride	A	A	B	A	A	B	A	B	A	A	A	A
Ammonia	A	A	A	A	A	A	A	A	A	B	A	A
Ammonium Bicarbonate	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium Chloride	A	A	C	A	A	C	A	C	A	A	A	A
Ammonium Diphosphate	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium Hydroxide	B	B	B	A	A	B	A	B	B	B	B	A
Amyl Acetate	B	B	B	B	B	B	B	B	A	B	B	B
Aniline	C	C	C	C	C	C	C	C	C	B	B	C
Aviation Fuels	A	A	A	A	A	A	A	A	A	C	C	A
Barium Chloride	A	A	A	A	A	A	A	A	A	A	A	A
Benzene	A	A	A	A	A	A	A	A	B	C	C	A
Benzoic Acid	B	B	B	B	B	B	A	B	A	B	B	A
Boiler Feeder Water	A	A	A	A	A	A	A	A	A	A	A	A
Boric Acid	A	A	A	A	A	A	A	A	A	A	A	A
Butane	A	A	B	A	A	B	A	B	A	C	C	A
Butanone (MEK)	B	B	B	B	B	B	B	B	C	C	C	B
Butyl Acetate	B	B	B	B	B	B	B	B	B	B	B	B
Butyl Alcohol (Butanol)	A	A	A	A	A	A	A	A	A	A	A	A
Butyric Acid	A	A	A	A	A	A	A	A	A	A	A	A
Calcium Chloride	A	A	B	A	A	B	A	B	A	A	A	A
Calcium Hydroxide	A	A	A	A	A	B	A	B	A	A	A	A
Calcium Hypochlorite	A	A	C	A	A	C	A	C	B	A	A	A
Carbon Dioxide	A	A	A	A	A	A	A	A	A	A	A	A
Carbon Disulfide	C	C	C	C	C	C	B	C	B	C	C	C
Carbon Tetrachloride	B	B	B	B	B	B	B	B	C	C	C	C
Castor Oil	A	A	A	A	A	A	A	A	A	B	B	A
Chlorine (Dry)	A	A	C	A	A	C	A	C	A	B	B	A
Chlorine (Wet)	C	B	C	B	B	C	C	C	C	B	C	B
Chloroform	B	B	B	B	B	B	C	B	C	C	C	C
Chromic Acid	C	B	C	C	C	C	B	C	C	C	C	B
Citric Acid	A	A	C	A	A	C	A	C	A	A	A	A
Clophen T64	B	B	B	B	B	B	B	B	A	C	C	B
Condensate	A	A	A	A	A	A	A	A	A	A	A	A
Copper Sulfate	A	A	A	A	A	A	A	A	A	A	A	A
Creosote	C	C	C	C	C	C	C	C	B	B	B	C
Cresol	B	B	B	B	B	B	B	B	B	B	B	B
Cyclohexanol	A	A	A	A	A	A	A	A	A	B	B	A
Decalin	A	A	A	A	A	A	A	A	B	C	C	A
Dibenzylether	C	C	C	C	C	C	C	C	C	C	C	C
Dibutylphthalate	A	A	A	A	A	A	A	A	B	C	C	A
Diesel Oil	A	A	A	A	A	A	A	A	B	C	C	A
Dimethylformamide	C	C	C	C	C	C	C	C	C	C	C	C
Diphyl (Dowtherm A)	A	A	A	A	A	A	A	A	B	C	C	A

Assessment of Chemical Compatibility
KLINGERSIL®

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	C-4201	C-4300 C-4401	C-4408 C-4409	C-4324	C-4433 C-4430	C-4439	C-4500	C-4509	C-5400	C-6327 C-6400	C-7400	C-8200
Dye Liquors (Alkaline, Neutral, Acid)	B	A	A	B	A	C	A	C	A	A	A	A
Ethane	A	A	C	A	B	C	A	C	A	A	A	A
Ethyl Acetate	B	B	B	B	B	B	B	B	B	B	B	B
Ethyl Alcohol (Ethanol)	A	A	A	A	A	A	A	A	A	A	A	A
Ethyl Chloride	B	B	B	B	B	B	B	B	B	C	C	B
Ethylene	A	A	C	A	A	C	A	C	A	A	A	A
Ethylene Chloride	C	C	C	C	C	C	C	C	B	B	A	A
Ethylene Glycol	A	A	A	A	A	A	A	A	A	A	A	A
Ethyl Ether	B	A	C	A	B	C	A	C	A	B	B	A
Freon 12	A	A	A	A	A	C	A	C	A	C	C	A
Freon 22	B	A	C	A	B	C	A	C	A	C	C	A
Formaldehyde	A	A	A	A	A	A	A	A	A	A	A	A
Formic Acid 10%	A	A	C	A	A	C	A	C	A	A	A	A
Formic Acid 85%	C	B	C	B	B	C	B	C	B	B	B	A
Glycerine	A	A	A	A	A	A	A	A	A	A	A	A
Heating Oil	A	A	A	A	A	A	A	A	B	C	C	A
Heptane	A	A	A	A	A	A	A	A	A	C	C	A
Hydraulic Oil (Glycol Base)	A	A	A	A	A	A	A	A	A	A	A	A
Hydraulic Oil (Mineral)	A	A	A	A	A	A	A	A	A	C	C	A
Hydraulic Oil (Phosphate Ester Based)	B	B	B	B	B	B	B	B	B	B	B	B
Hydrochloric Acid 20%	C	B	C	B	B	C	B	C	B	C	C	A
Hydrochloric Acid 37%	C	C	C	C	C	C	C	C	C	C	C	A
Hydrofluoric Acid 10%	C	C	C	C	C	C	C	C	B	C	C	A
Hydrofluoric Acid 40%	C	C	C	C	C	C	C	C	C	C	C	C
Hydrogen	A	A	C	A	A	C	A	C	A	A	A	A
Hydrogen Peroxide (Up to 6% W.W.)	A	A	C	A	A	C	A	C	A	A	A	A
Hydrogen Chloride (Dry)	A	A	C	A	A	C	A	C	A	A	A	A
Iso-octane	A	A	A	A	A	A	A	A	A	B	B	A
Isopropyl Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
Kerosene	A	A	A	A	A	A	A	A	A	C	C	A
Lactic Acid 50%	A	A	C	A	A	C	A	C	A	A	A	A
Linseed Oil	A	A	A	A	A	A	A	A	A	B	B	A
Magnesium Sulfate	A	A	A	A	A	A	A	A	A	A	A	A
Malic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Methane	A	A	C	A	A	C	A	C	A	A	A	A
Methyl Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
Methyl Chloride	B	B	B	B	B	C	B	C	B	C	C	B
Methylene Chloride	C	C	C	C	C	C	C	C	C	B	C	B
Methyl Ethyl Ketone	B	B	B	B	B	B	B	B	B	C	C	B
Mineral Oil	A	A	A	A	A	A	A	A	A	C	B	A
Mineral Oil, ASTM 1	A	A	A	A	A	A	A	A	A	B	B	A
Monochloromethane	B	B	C	B	B	C	B	C	B	C	C	B
Nitrogen	A	A	A	A	A	A	A	A	A	A	A	A
Naphtha	A	A	A	A	A	A	A	A	B	C	C	A
Nitric Acid 20%	C	C	C	C	C	C	C	C	C	C	C	A
Nitric Acid 40%	C	C	C	C	C	C	C	C	C	C	C	A
Nitric Acid 96%	C	C	C	C	C	C	C	C	C	C	C	C
Octane	A	A	A	A	A	A	A	A	B	C	B	A
Oleic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Oxalic Acid	B	B	B	B	B	B	B	B	B	C	C	A

Assessment of Chemical Compatibility KLINGERSIL®

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Palmitic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Pentane	A	A	A	A	A	A	A	A	A	C	C	A
Perchlorethylene	B	B	B	B	B	B	B	B	B	C	C	B
Petroleum	A	A	A	A	A	A	A	A	A	B	B	A
Petroleum Ether	A	A	A	A	A	A	A	A	A	B	B	A
Phenol	C	C	C	C	C	C	C	C	B	B	B	B
Phosphoric Acid	A	A	A	A	A	A	A	A	A	A	B	A
Phthalic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Acetate	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Carbonate	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Chlorate	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Chloride	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Cyanide	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Dichromate	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Hydroxide	C	B	B	C	B	B	A	A	B	B	B	A
Potassium Hypochlorite	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Nitrate	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Permanganate	A	A	A	A	A	A	A	A	A	A	A	A
Producer Gas	A	A	C	A	B	C	A	C	A	B	A	A
Propane	A	A	C	A	B	C	A	C	A	B	B	A
Pydrol	A	A	A	A	A	A	A	A	A	C	C	B
Pyridine	C	C	C	C	C	C	C	C	C	B	B	C
Rape Seed Oil	A	A	A	A	A	A	A	A	A	B	B	B
Silicone Oil	A	A	A	A	A	A	A	A	A	A	A	A
Sea Water	A	A	B	A	A	B	A	B	A	A	A	A
Sodium Aluminate	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Bicarbonate	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Bisulphite	A	A	B	A	A	B	A	B	A	A	A	A
Sodium Chloride	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Hydroxide	C	B	B	C	B	B	A	A	B	B	A	A
Sodium Silicate	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Sulphate	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Sulphide	A	A	A	A	A	A	A	A	A	A	A	A
Steam	C	B	A	B	A	A	A	A	B	B	B	B
Stearic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Sulphur Dioxide	C	C	C	C	C	C	B	C	B	B	B	A
Sulphuric Acid 20%	C	C	C	C	C	C	C	C	B	C	C	A
Sulphuric Acid 50%	C	C	C	C	C	C	C	C	C	C	C	A
Sulphuric Acid 96%	C	C	C	C	C	C	C	C	C	C	C	A
Sulphurous Acid	C	B	C	C	C	C	B	C	B	B	B	B
Tannic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Tartaric Acid	A	A	A	A	A	A	A	A	A	A	A	A
Tetrachlorethane	B	B	B	B	B	B	B	B	B	C	C	B
Tetralin	A	A	A	A	A	A	A	A	B	C	C	A
Toluene	A	A	A	A	A	A	A	A	B	C	C	A
Town's Gas	A	A	C	A	A	C	A	C	A	B	B	A
Transformer Oil	A	A	A	A	A	A	A	A	A	B	B	B
Trichlorethylene	B	B	B	B	B	B	B	B	B	C	C	B
Turpentine	A	A	A	A	A	A	A	A	B	C	C	B
Vinyl Acetate	A	A	A	A	A	A	A	A	B	C	C	A
Water	A	A	A	A	A	A	A	A	A	A	A	A
White Spirit	A	A	A	A	A	A	A	A	A	C	C	A
Xylene	A	A	A	A	A	A	A	A	B	C	C	A

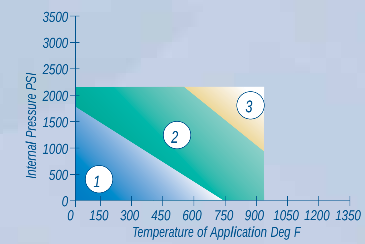
Graphite

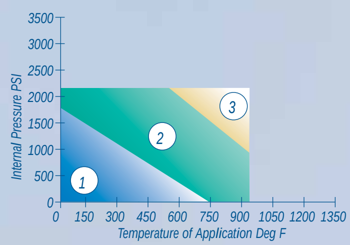
		KLINGER FLEXIBLE GRAPHITE **HL***	KLINGER FLEXIBLE GRAPHITE **SLS***	KLINGER FLEXIBLE GRAPHITE **PSM***
Distinguishing Characteristics & Applications *Within the given temperature and pressure limits. Please see graphs. Typical values refer to 1/16" material unless otherwise specified.* *See pages 16 and 17 for test procedures*		• Standard Industrial Grade Graphite • Superior Chemical Resistance • Highly Compressible & Compactible • Low Gas Permeability • Low Electrical Resistance • Unlimited Shelf Life	• Graphite Adhesively Bonded to a .002" 316 Stainless Steel Foil • Highly Compressible & Compactible • Excellent Anti-Stick Properties • Low Gas Permeability • Low Electrical Resistance	• Graphite Mechanically Clinched to a .004" 316 Stainless Steel Tang Core • Highly Compressible & Compactible • Excellent Anti-Stick Properties • Low Gas Permeability • Low Electrical Resistance
Metal Insert		N/A	0.002" 316 Stainless Steel Foil Adhesive bonded	0.004" 316 Stainless Steel Tang No adhesive
Creep Relaxation	ASTM F38B (1/32")	10%	10%	7%
Sealability	ASTM F37A (1/32")	0.5 ml/hr	0.5 ml/hr	0.5 ml/hr
Compressibility	ASTM F36A	40-50%	40-45%	28-42%
Recovery	ASTM F36A	10-15%	10-15%	13-19%
Purity of Graphite		95% Minimum	95% Minimum	95% Minimum
Leachable Chloride Content F.S.A. Method (Typical)		50 ppm	50 ppm	40 ppm
Density	DIN 3754	70 lb/ft^3 (1.1 g/cc)	70 lb/ft^3 (1.1 g/cc)	70 lb/ft^3 (1.1 g/cc)
Color	(Top/Bottom)	Silver	Silver	Silver

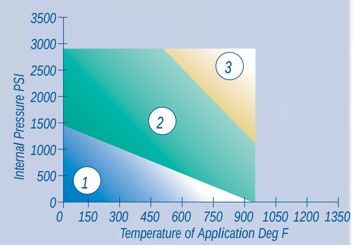
* *All flexible graphite is available with Anti-Stick Coating.*
Call Thermoseal at 1-800-990-7325 for further data.

Pressure and Temperature Graphs
Material Thickness: 1/16"

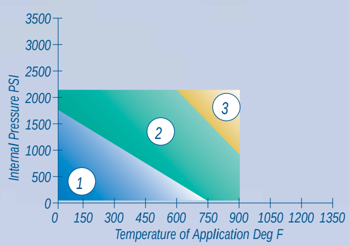
Liquids

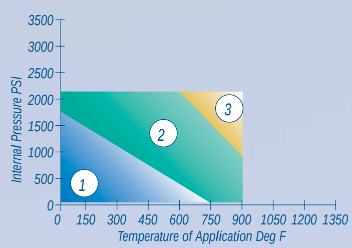


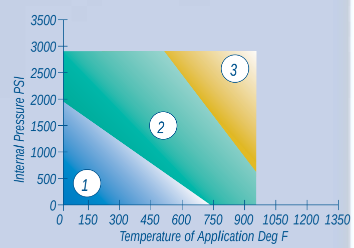




Gases and Steam







Klinger Flexible Graphite Chemical Compatibility

Exhibits a high resistance to most agents including inorganic and organic acids and bases, solvents, hot wax and oils. Exceptions are strong oxidizing compounds such as concentrated nitric acids, highly concentrated sulfuric acid, chromium (VI) and permanganate solutions, chloric acids and molten alkaline and alkaline earth metals.

Medium	Concentration	Temperature
Inorganic Acids		
Hydrochloric Acid	all	boiling point
Hydrofluoric Acid	all	boiling point
Phosphoric Acid	all	boiling point
Sulphuric Acid	0-70%	boiling point
Chromic Acid	0-10%	392°F (200°C)
Nitric Acid	0-10%	185°F (85°C)
Nitric Acid	10-20%	140°F (60°C)
Nitric Acid	over 20%	104°F (40°C)
Organic Acids		
Phenylsulfonic Acid	60%	boiling point
Acetic Acid	all	boiling point
Acetic Anhydride	100%	boiling point
Chloracetic Acid	all	boiling point
Amino Acid	all	boiling point
Alkalis		
Caustic Soda	all	boiling point
Sodium Hydroxide	solid	melting point
Solvents		
Benzene & Homologues	0-100%	boiling point
Ethers	0-100%	boiling point
Alcohols	0-100%	boiling point
Esters	0-100%	boiling point
Ketones	0-100%	boiling point
Halogenated Hydrocarbons	0-100%	boiling point
Vinyl Chloride	0-100%	boiling point
Mineral Oils	0-100%	boiling point

Improve Gasket Performance with Anti-Stick Coating

Only Thermoseal provides Klinger Flexible Graphite gasket materials with an industry-proven Anti-Stick Coating. Our exclusive “AS” coating keeps gaskets from sticking, promotes higher gasket performance by reducing graphite build-up, aids in easy gasket removal and helps keep flanges cleaner. The anti-stick properties of our coating are independent of temperature and stress. Plus, it can help save you both time and money by reducing downtime and the cost of cleaning the flanges. Don’t get stuck with inferior gasket materials – choose KLINGER® for a smooth flowing operation, every time.

Milam Laminate

See pages 16 and 17 for test procedures

Compressibility	ASTM F36A
Recovery	ASTM F36A
Ignition Loss	DIN 52911
Stress Relaxation 50 MPa / 300°C	DIN 52913
Stress Relaxation 40 MPa / 300°C	DIN 52913
Tang Insert Stainless Steel Thickness	
Continuous Service Temperature	
Gas Leakage	DIN 3535/6
Stress	
Thickness	
Thickness Tolerance	
Sheet Sizes (Nominal)	
Color	

KLINGER®

PSS 130

12-15%
38-45%
<5%
4,786 psi
4,061 psi
AISI 316
.004"
1,652°F Maximum
>100 ml/min
14,503 psi Maximum
.051"
±5% of nominal thickness
47" x 40"
Metallic Tan

KLINGER®

PSS 150

PSS 130,150 and 300 all offer:

- *Type PSS*
- *High Quality Mica Sheet*
- *Laminated on Pegged Stainless Steel Insert*

12-16%
40-50%
<5%
5,801 psi
4,641 psi
AISI 316
.004"
1,652°F Maximum
>100 ml/min
13,050 psi Maximum
.059"
±5% of nominal thickness
47" x 40"
Metallic Tan

KLINGER®

PSS 300

18-23%
48-53%
<15%
4,351 psi
2,900 psi
AISI 316
.004"x 2
1,652°F Maximum
>100 ml/min
11,602 psi Maximum
.125"
±5% of nominal thickness
47" x 40"
Metallic Tan

All milam laminates are suitable for use in hot, dry gas applications such as exhaust manifolds, turbines, turbo chargers and air heat exchangers.

Test Procedures

ASTM F37, Test Method for Sealability

Summary: This test provides a means of evaluating the sealing properties of sheet, composite and form-in-place gasket materials with two test methods. The typical mediums used to check leak rates are nitrogen and Fuel A, each tested at ambient (70 – 85°F) temperature and conditioned in accordance with ASTM F104.

Usage: This test method is designed to compare sealing characteristics of gasket materials under controlled conditions by providing a precise measure of leakage rate at different external flange loads.

The actual gasket stress and internal pressures are not defined; many published values have slightly different conditions. Thermoseal's test parameters for Fuel A are: 1,000 psi (7 N/mm^2) external pressure and 14.7 psi (1 bar) internal pressure.

This test method is in the middle of a revision. For an update, please contact Thermoseal.

DIN 3535 Test Method for Gas Permeability

Summary: Test specimens are conditioned in a desiccator for 24 hours. Possible leakage between the gasket and the platens is eliminated by using polyethylene foils. The gasket is placed between platens and is subjected to 4,640 psi (32 N/mm^2) external pressure and an internal pressure of 580 psi (40 bar) nitrogen. After two hours, the amount of gas escaping through the gasket in a period of 20 minutes is measured.

Usage: This test method is designed to compare gasket material under defined conditions and to provide a precise measure of the permeability of the gasket material.

The mating surfaces of the platens are very smooth and do not represent the increase in tightness that is experienced with a serrated or rough finish.

The test should be carried out at the defined external stress and internal pressure of 4,640 psi (32 N/mm^2) and 580 psi (40 bar) nitrogen so comparisons can easily be made.

The test is carried out at ambient temperatures. Many gasket materials show an increase in tightness with elevated temperatures.

ASTM F38, Test Method for Creep Relaxation

Summary: This test method provides two test procedures. One measures the creep with the use of a calibrated strain gage, and the other measures the creep relaxation by means of calibrated bolt and dial indicator. Typical values are provided using 6000 lbf (27 kN) for the various types and classes of material.

These tests are run with conditioned test specimen per ASTM F104 and subject the gasket material to a compressive stress between two platens, with the stress applied by a nut and a bolt. The specimen unit is placed in a hot air circulating oven for 22 hours at 212°F ± 5°F (100 ±2°C). The test specimen unit is removed from the oven and measured once it has cooled to room temperature.

Usage: These procedures provide a means to compare related materials under controlled conditions and their ability to maintain a given compressive stress as a function of time.

These procedures specify a defined nominal thickness as 0.03 in (0.8 mm) for all material except fluorocarbon polymer which shall not have a nominal thickness above 0.07 in (1.78 mm).

Tests such as ASTM F38 do not measure creep alone, both creep deformation and stress relaxation are measured simultaneously. Such tests are of relatively short duration in comparison with the anticipated service life of the gasket.

ASTM F146, Test Method for Fluid Resistance

Summary: Test specimens are subjected to complete immersion in test fluids. The test, based on time and temperature, measures the physical property of the material before and after immersion. Samples are cut in accordance with ASTM standards, and conditioning occurs according to ASTM F104.

The test specimen properties are measured before immersion into the specified liquid and then again after immersion into the test median.

Usage: This test method provides a standardized procedure to measure the effect of immersion in specified fluids under definite conditions of time and temperature.

The result of this test is not intended to give any direct correlation with the service conditions in view of the wide variations in temperature and special uses encountered in gasket applications.

The free immersion testing is not comparable to the chemical resistance a gasket exhibits in a stressed gasket (in flange) situation.

KLINGER® Hot Compression Test Method

Summary: Typical external load is 7,250 psi (100 kN) and typical temperature is 572°F (300°C). Heating rate is 50°F (10°C) per minute. A high-temperature test can be performed up to 840°F (450°C). No conditioning of the material is required.

A ring is compressed between the heated platens of a hydraulic press. The external load of 7,250 psi (100 kN) remains constant, and the temperature is increased at an incremental rate of 50°F (10°C) per minute. The decrease of thickness is measured during the test.

Usage: This test method provides a measure of the gasket under load and/or temperature. The hot compression test serves as a "real-world" type test.

This test method was developed by Klinger Group and is not currently an ASTM standard.

The test equipment is manufactured and maintained by the Klinger Group.

This test method is recognized and performed by most gasket manufacturers.

ASTM F36, Test Method for Compressibility and Recovery

Summary: A total of eight procedures is now included for different gasket types such as cork, rubber, fluorocarbons, non-asbestos compressed, etc. These procedures cover specific penetrative diameters, conditioning requirements and defined stresses for pre-load and major load.

After conditioning, a pre-load is applied to the gasket for 15 seconds and thickness is measured. The major load is then applied for 60 seconds and thickness is recorded. The original pre-load is then applied for 60 additional seconds and recovered thickness is recorded.

Usage: This test method gives an indication of the compressibility of the material at defined gasket stress and, therefore, can indicate the suitability of a material to fill in voids and scratches, the required surface finish, the final thickness of the material after assembly, etc.

This test method is carried out at ambient temperatures. Because rubber bound materials continue to cure at elevated temperatures, these characteristics will no doubt change in application.

Beware of comparing different material results, such as compressed non-asbestos vs. cork and rubber. These materials have completely different loads and conditioning requirements.

ASTM F104, Standard Classification System

Summary: Provides a means for specifying or describing pertinent properties of commercial nonmetallic gasket materials. It is intended to encourage uniformity in reporting properties; to include a common language for communications between suppliers and consumers. It is based on the principle that nonmetallic gasket materials should be described in terms of specific physical and mechanical characteristics, and that an infinite number of such descriptions can be formulated by use of one or more standard statements based on tests.

Usage: A "line call-out" of the descriptions of the material and/or characteristic is used to define the material. Each numeral of the call-out represents a performance level of each property or characteristic.

FSA-NMG-204 Standard Test Method for Performance in High Pressure, Saturated Steam

Summary: This test method provides a means of assessing the performance of various gasket materials in saturated steam service under controlled conditions. This test method can be run in a "steam phase," with the gasket not in contact with the liquid, or in "wet phase," with the gasket being in contact with the liquid.

Usage: This test method uses "cycling" of the flange assemblies to simulate real-life application. It measures the loss of fluid in the flange assembly similar to what would be seen in an application with steam.

Gasket Assembly Stress Recommendations

The recommended assembly stress for all KLINGERSIL® materials differs from their corresponding "M" and "Y" values. "M" and "Y" do not take factors such as flange condition and blowout resistance into account.

"M" and "Y" data is to be used for *flange designs only* as specified in the ASME Boiler and Pressure Vessel Code Division 1, Section VIII, Appendix 2. *They are* ***not*** *meant to be used as gasket seating stress values in actual service.*

For individual "M" and "Y" data on any of our KLINGERSIL® materials, please contact Thermoseal.

KLINGER® Expert Is the Reliable Route to Successful Gasketing

With the increasing concern for safety and environmental issues, reducing leaks from flanged assemblies has become a high priority. Never has it been more important for companies that use gaskets to choose the correct gasketing material, and install and maintain it to ensure optimum performance. The development of the KLINGER® expert gasket design software program, the most comprehensive engineering program available today, is one more way Thermoseal helps customers choose the right gasket material for a reliable and safe flange connection. For more information, call 1-800-990-SEAL (7325).

It is the aim of KLINGER® expert to provide solutions to your gasketing problems based on experience and technical information.

This innovative software takes your specifications and suggests the right KLINGERSIL® compressed gasket grades, graphite laminates, and KLINGERtop-chem® PTFE products for the application.

To your right is the Thermoseal Inc. sealing technical service fax sheet. For quick and accurate help in gasket selection, fill in your information and fax the form to our technical service department.

Contact us today, or find the form on our website, to see just how easy choosing a reliable gasket can be!

Call or Visit Our Website for Information on More of Thermoseal Inc.'s Products

Sealex®

- High-quality PTFE joint sealant.

KLINGERtop-chem®-2000/2003/2005/2006

- Non-creep PTFE sealing element.

Thermoseal® soft-chem®

- Expanded PTFE material with excellent corrosion resistance and impermeability.

Limited Warranty

All goods are sold according to Thermoseal Inc.'s terms and conditions which include a 30-day limited warranty. For product safety information, refer to the Material Safety Data Sheet (MSDS). A copy of the MSDS information and Thermoseal Inc.'s terms and conditions of sale are available upon request and are subject to change without notice.

The information in this brochure supersedes all previous issues.

Thermoseal Sealing Technical Service

If you would like us to advise you on your gasket application, please provide the details requested below and fax the form to Thermoseal Inc.: (937) 498-4911. This form is also available on our website at www.thermosealinc.com.

I would like a visit from a Thermoseal Inc. sales representative. *Yes* ❒ *No* ❒

DUTY

Medium _____

Concentration _____

Max. Pressure _____

Max. Temperature _____

Liquid or Gas _____

Any other comments (cycling, vibrations, food, hazardous)

_____

_____

FLANGES

Pressure Rating _____

Nominal Size _____

Flange Material _____

Surface Finish _____

Type _____

If non-standard, please give dimensions

_____

_____

BOLTS

Quality/Grade _____ *Number* _____

Diameter/Length _____

Lubrication/Type _____

GASKET DETAILS *(Dimensions)*

1. Full Face

Outside Diameter _____

Inside Diameter _____

Number of Holes _____

Hole Diameter _____

– OR –

2. Ring

Outside Diameter _____

Inside Diameter _____

– OR –

3. Special Design

Please provide drawing, and/or stressed gasket area.

Current application material and thickness

_____

_____

_____

Reason for material change (e.g. leaks, blow out)

_____

_____

Contact _____

Company _____

Address _____

Phone _____

Fax _____

Email _____

Thermoseal Inc.
2350 Campbell Road
Sidney, OH 45365

Ph: (937) 498.2222
Fx: (937) 498.4911
Toll Free: (800) 990.SEAL (7325)
www.thermosealinc.com

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Thermoseal®

2350 Campbell Road
Sidney, Ohio 45365
Ph. (937) 498.2222
Fx. (937) 498.4911
www.thermosealinc.com

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