Tenmat

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Advanced Composite Laminates

Wear Parts and Bearings

Tenmat bearing materials are a range of superior composite laminates. The specialist thermosetting formulations are tailor-made for challenging applications. These bearing parts are thermosetting resins reinforced with engineered fibres, along with evenly dispersed solid lubricants and further additives to ensure the optimum solution is offered for every application.

Wear Components

Product Description

Tenmat's range of bearing materials includes world renowned composites branded as Feroform®, Feroglide™ and Railko™. They are fitted and used by thousands of satisfied customers worldwide. Tenmat bearing materials are extremely versatile and suitable for the most demanding applications in the most arduous environments.

Design engineers can install shorter Tenmat bearings, whilst also being able to apply greater loads onto bearings at higher rotation velocities. A major advantage of Tenmat materials is their ability to withstand high loads with intermittent or oscillating movement. This relies on the significant fibre reinforcement of Tenmat materials, as well as their inherently superior heat resistance. This yields greatly improved operational lifetimes.

Tenmat material grades are self-lubricating, and their exceptional friction coefficients can be further enhanced through external lubrication. Tenmat materials avoid heat generation within bearing units thanks to their reduced friction levels. Lower friction values mean that Tenmat materials last longer in more challenging applications on account of reduced material loss on contact with moving parts. Furthermore, Tenmat materials support higher loads and resist frictional burn thanks to their specialist reinforcement.

Tenmat laminates exhibit very low water swell in comparison to many frequently used thermoplastic materials. Tenmat Grades are able to achieve swell rates as low as 0.05%. Water does not soften them or affect their mechanical properties, meaning they retain a significant dimensional stability in water. All Railko and Feroform material grades can be machined to the highest of engineering tolerances. Their specialist formulation allows tighter running clearances, and Tenmat supplies fully machined components from its highly equipped in-house machine shop.

Product Advantages

Including the hardest wearing materials on the market, the Tenmat range of composite materials has distinct advantages over competitor grades. Their biggest advantages are quality and performance, made possible by their superior mechanical, thermal, and stability properties.

- Low coefficient of friction
- High wear resistance
- High load capacity
- Resistant to most chemicals, oils and greases
- Capable of dry running (dependant on certain operating conditions)
- Lubrication via water (incl. sea and process), oil, or grease
- Damping of vibration
- Tolerant of misalignment
- Easy to fit
- Dimensionally stable
- Good resistance to elevated temperatures
- Does not encourage galvanic corrosion
- Consistent wear and friction properties due to even distribution of lubricants

Test Evidence

Tenmat is approved by all major marine classification societies, together with exclusive approvals from all leading rail authorities worldwide and aerospace bodies such as Airbus, Rolls Royce, BAE and many others. Tenmat is accredited to the BS EN ISO 9001:2015 Quality Standard. Further accreditation is supported by certified internal processes to ensure consistency and full traceability of each component. Quality is qualified by independent third party testing facilities and classification authorities.

Approved Applications

Tenmat materials are trusted in:

- Aerospace
- Automotive
- Rail - incl. Passenger, Freight, Metro, and Tram
- Shipbuilding - Naval and Civil
- Process Equipment
- Pumps
- Valves - incl. wellhead valves
- Lifting and Handling Equipment
- Hydropower
- Agriculture
- Offshore Equipment
- Roller Coverings
- Renewable Energies
- Vacuum Pumps & Compressors

Treatments

Tenmat grades can be offered with the following treatments:

- Suffix '1' added to the grade number (e.g. T111, NF221 etc) is oil treatment to aid running in, reduce friction and aid in counterface corrosion protection. It is normally applied to the finished component.

- Suffix '2' added to the grade number (e.g. T112, NF222 etc) is dry graphite oil treatment to aid running in and reduce friction. It is normally applied to the finished component.

- Suffix '7' added to the grade number (e.g. T117, RG127 etc) is heat treatment to improve high temperature stability. It is normally applied to the base material.

- Suffix '8' added to the grade number (e.g. T118, NF218 etc) is dry MoS2 treatment dressed as breakin lubricant for higher pressures – finished parts only.

- Bedding in paste is supplied in 60ml, 500ml and 1L pots – to aid in initial start up.

Technical Data

		Grade					
Property	Units	AE2	CL47	F21	F363	F3637	JL31/JL33
Density	g/cm^3	1.8	1.38	1.36	1.52	1.54	1.36
Flexural Strength	MPa	460	130	80	175	175	N/A
Flexural Modulus	GPa	23.3	8.0	9.0	7.7	7.7	N/A
Compressive Strength	MPa	440	290	180	320	318	180
Charpy Impact Notched	kJ/m^2	120	32	6.0	90	80	10
Shear Strength	MPa	30	42	50	100	100	35
Compressive Yield @ 68.9 Mpa	%	N/A	N/A	2.2	2.5	2.2	1.8
Brinell Hardness	HB	N/A	N/A	30	35	38	30
Swell in Water (24 hours)							
@20°C	%	<0.02	N/A	0.4	0.3	0.5	0.5
@80°C	%	0.3	N/A	1.8	1.3	1.3	N/A
Coefficient of Thermal Expansion							
Parallel	x 10-^{6}/°C	13	N/A	18	15	19	15
Perpendicular	x 10-^{6}/°C	56	N/A	110	34	30	110
Coefficient of Friction (Unlubricated)		N/A	N/A	0.17-0.23	0.20-0.22	0.13-0.15	0.17-0.23
Operating Temperature							
Continuous	°C	180	130	130	200	280	130
Intermittent	°C	225	150	150	250	300	150
Normal Working Pressure	MPa	110	75	50	75	80	48

Technical Data

		Grade					
Property	Units	F44	F57	F573	JLX75	NF21/22	PR18/RG22
Density	g/cm^3	1.75	1.2	1.2	1.45	1.64	1.28
Flexural Strength	MPa	300	165	115	80	45	N/A
Flexural Modulus	GPa	16	6	5.6	7.8	5.7	N/A
Compressive Strength	MPa	420	380	260	130	190	260
Tensile Strength	MPa	220	135	90		30	
Charpy Impact Notched	kJ/m^2	72	70	45	6	32	33
Shear Strength	MPa	N/A	115	80	35	40	N/A
Compressive Yield @ 68.9 Mpa	%	0.8	2	3.1	2.2	2.3	2.5
Brinell Hardness	HB	40	30	25	28	23	20
Swell in Water (24 hours)							
@20°C	%	0.1	0.4	0.3	0.4	0.2	0.05
@80°C	%	0.1	0.8	0.6	1.8	0.5	N/A
Coefficient of Thermal Expansion							
Parallel	x 10^{-6}/°C	12	10	6	19	43	N/A
Perpendicular	x 10^{-6}/°C	42	43	40	110	43	93
Coefficient of Friction (Unlubricated)		N/A	N/A	0.27-0.38	0.04-0.07	A) 0.04-0.08 *Typical wet* B) 0.34-0.42 *Typical dry*	0.08-0.12
Operating Temperature							
Continuous	°C	200	200	200	120	120	100
Intermittent	°C	225	250	250	140	140	120
Normal Working Pressure	MPa	105	100	65	45	55	65

Notes

Suffix 7 is not applicable on material grades F57 and CL47

Technical Data

		Grade					
Property	Units	RG1/RG11	RG2/RG12	T11	T127	T14	T814
Density	g/cm^3	1.31	1.35	1.31	1.3	1.29	1.31
Flexural Strength	MPa	110	100	N/A	N/A	N/A	N/A
Flexural Modulus	GPa	4.8	5.6	N/A	N/A	N/A	N/A
Compressive Strength	MPa	280	240	295	270	310	310
Tensile Strength	MPa	70	65	80	85	90	90
Charpy Impact Notched	kJ/m^2	35	35	65	70	85	75
Shear Strength	MPa	80	65	70	62	65	72
Compressive Yield @ 68.9 Mpa	%	2.2	2.1	4.2	4.3	3.6	3.8
Brinell Hardness	HB	30	30	17	18	20	20
Swell in Water (24 hours)							
@20°C	%	0.4	0.6	0.2	0.2	0.2	0.2
@80°C	%	0.6	0.6	0.4	0.5	0.5	0.4
Coefficient of Thermal Expansion							
Parallel	$x\ 10^{-6}/°C$	30	15	33	20	25	36
Perpendicular	$x\ 10^{-6}/°C$	52	40	50	50	70	45
Coefficient of Friction (Unlubricated)		0.28-0.32	0.25-0.30	0.06-0.13	0.08-0.19	0.08-0.15	0.04-0.28
Operating Temperature							
Continuous	°C	200	200	100	100	100	100
Intermittent	°C	220	220	120	120	120	120
Normal Working Pressure	MPa	80	63	65	75	75	75

Standard Base Material Dimensions

Sheets	Width Maximum	Length Maximum	Thickness	
			Minimum	Maximum
NF21	660	1150	4	182
JL/RG/F Grades	1220	1220	3	100
T Grades	1220	1220	3	100

Tubes / Rods	Internal Diameter				External Diameter				Length
	Rods		Tubes		Rods		Tubes		
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Maximum
NF22	0	0	16	560	25	200	25	760	640
PR18/RG22	N/A	N/A	20	940	N/A	N/A	30	1110	1200
JL/RG/F Grades	0	0	20	940	25	158	30	1175	1200
T Grades	0	0	20	940	25	158	30	1175	1200

Note:

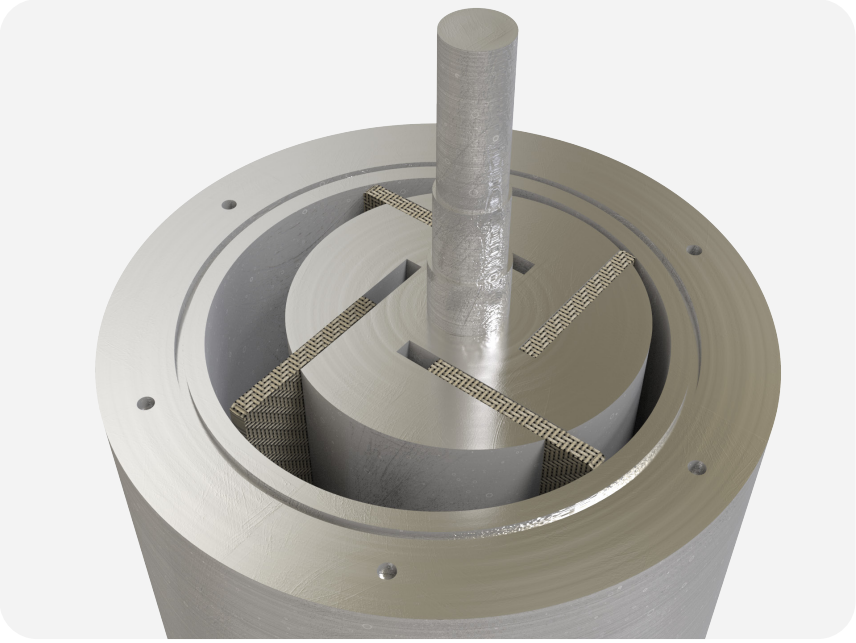
- All sizes in mm
- Special sizes available on request
- Some NF22 tubes are 550mm long
- PR18/RG22 tubes supplied with ‘as wrapped’ finish
- Rods & NF22 tubes supplied with ‘as moulded’ finish
- JLX75 / F43 / F44 are sheet only
- PR/RG22 Grades are tube only

Fitting Instructions

Tenmat composite bearings can be fitted by various methods. Cylindrical parts are preferably fitted with an interference fit on the outer diameter. They should be pressed under steady continuous load into the housing, and fully supported over the length where resultant wall pressure ensures safe fitment. Other fitment methods for cylindrical and flat parts include clip fit, freeze fit, mechanical fitting (keys, screws, countersink bores). For highly loaded parts, keeper plates or metal washers should be used to provide a more secure fixing method. For detailed information, please contact Tenmat direct.

Intended use

Tenmat composite laminate materials are intended for use as various self-lubricating wear protection components in challenging, high demanding working environments where external lubrication for metal bearings is prohibited or low-strength plastics should be avoided.



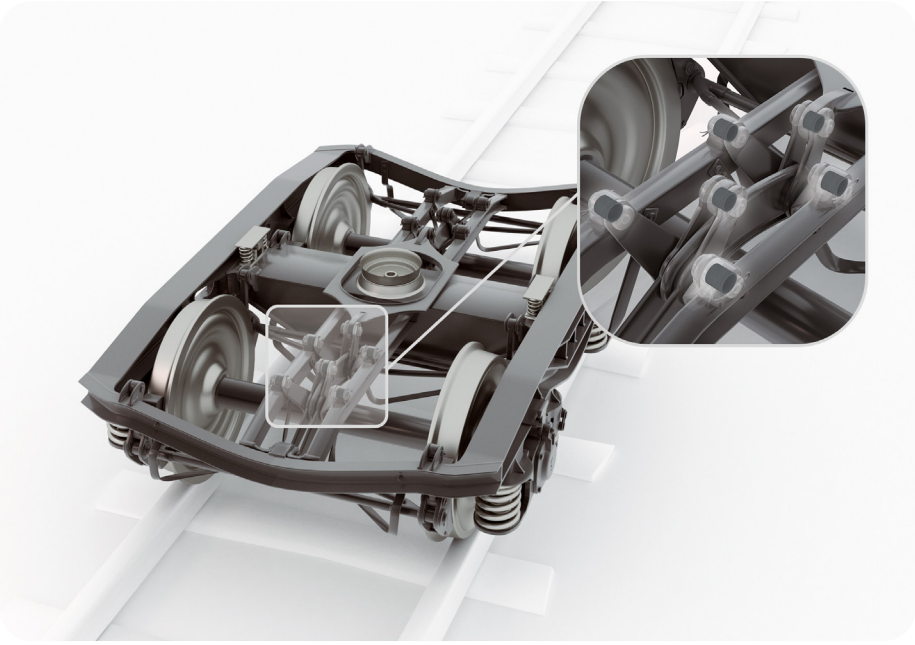
Application Example: *Highly durable Vacuum Pump Rotor Vanes*

Maintenance

Tenmat composite wear parts significantly reduce maintenance requirements in many challenging applications. Tenmat products are typically "fit and forget" as long as working conditions keep to design specifications.

Storage

Store in a cool dry place. Take care not to exceed safe working loads and heights for storage on shelves and racks.



Application Example: *Brake Linkage Bushes for Freight undercarriage*

Notes

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