U05 - TIVAR H.O.T.

Ultra High Molecular Weight Polyethylene

		ISO*			ASTM*		
		Test Methods	Unit	Indicative Values	Test Methods	Unit	Indicative Values
THERMAL PROPERTIES (1)	Melting temperature (DSC, 10°C (50°F) / min)	ISO 11357-1/-3	°C	135	ASTM D3418	°F	275
	Glass transition temperature (DMA- Tan δ) (2)		°C			°F	
	Thermal conductivity at 23°C (73°F)		W/(K.m)	0.4		BTU in. (hr.ft².°F)	2.84
	Coefficient of linear thermal expansion (-40 to 150 °C) (-40 to 300°F)				ASTM E-831 (TMA)	µin./in./°F	110
	Coefficient of linear thermal expansion (23 to 100°C) (73°F to 210°F)		µm/(m.K)	200			
	Heat Deflection Temperature: method A: 1.8 MPa (264 PSI)	ISO 75-1/-2	°C	42	ASTM D648	°F	116
	Continuous allowable service temperature in air (20.000 hrs) (3)		°C	110		°F	230
	Min. service temperature (4)		°C	-200		°F	
	Flammability: UL 94 (3 mm (1/8 in.)) (5)			HB			HB
	Flammability: Oxygen Index	ISO 4589-1/-2	%	20			
		Test Methods	Unit	Indicative Values	Test Methods	Unit	Indicative Values
MECHANICAL PROPERTIES (6)	Tensile strength	ISO 527-1/-2 (7)	MPa	19	ASTM D638 (8)	PSI	6800
	Tensile strain (elongation) at yield	ISO 527-1/-2 (7)	%	15	ASTM D638 (8)	%	
	Tensile strain (elongation) at break	ISO 527-1/-2 (7)	%	> 50	ASTM D638 (8)	%	300
	Tensile modulus of elasticity	ISO 527-1/-2 (9)	MPa	700	ASTM D638 (8)	KSI	72.5
	Shear Strength	ASTM D732	MPa	33	ASTM D732	PSI	4800
	Compressive stress at 1 / 2 / 5 % nominal strain	ISO 604 (10)	MPa	6 / 10 / 16			
	Compressive strength				ASTM D695 (11)	PSI	3000
	Charpy impact strength - unnotched	ISO 179-1/1eU	kJ/m²	no break			
	Charpy impact strength - notched	ISO 179-1/1eA	kJ/m²	100P			
	Charpy impact strength - double 14° notched	ISO 21304-2	kJ/m²	130			
	Izod Impact notched				ASTM D256	ft.lb./in	
	Izod Impact double notched				ASTM D4020	ft.lb./in	28.6
	Flexural strength	ISO 178 (12)	MPa	16	ASTM D790 (13)	PSI	3800
	Flexural modulus of elasticity	ISO 178 (12)	MPa		ASTM D790	KSI	80
	Relative volume loss "sand-slurry" (ISO vsTIVAR*1000; ASTM vs1018 Steel)	ISO 15527	Index=100	80	ASTM D4020	Index=100	10
	Shore Hardness D (14)	ISO 868		58	ASTM D2240		68

Bex s.r.l.
Via Liguria, 9/11 - 25031 Capriolo (BS)
Tel. +39 030 5951148 - info@bexsrl.com

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		ISO*			ASTM*		
		Test Methods	Unit	Indicative Values	Test Methods	Unit	Indicative Values
ELECTRICAL PROPERTIES	**Electric strength**	**IEC 60243-1 (15)**	kV/mm	45	**ASTM D149**	Volts/mil	2300
	Volume resistivity	**IEC 62631-3-1**	Ohm.cm	10^14	**ASTM D257**	Ohm.cm	
	Surface resistivity	**ANSI/ESD STM 11.11**	Ohm	10^12	**ANSI/ESD STM 11.11**	Ohm	10^12
	Dielectric constant at 1 MHz	**IEC 62631-2-1**			**ASTM D150**		2.3
	Dissipation factor at 1MHz	**IEC 62631-2-1**			**ASTM D150**		0.001
		Test Methods	**Unit**	**Indicative Values**	**Test Methods**	**Unit**	**Indicative Values**
MISCELLANEOUS	**Colour**			White			White
	Density	**ISO 1183-1**	g/cm³	0.93			
	Specific Gravity				**ASTM D792**		0.94
	Water absorption after 24h immersion in water of 23 °C (73°F)	**ISO 62 (16)**	%	0.1	**ASTM D570 (17)**	%	
	Water absorption at saturation in water of 23 °C (73°F)		%	0.1	**ASTM D570 (17)**	%	
	Wear rate	**ISO 7148-2 (18)**	µm/km	6	**QTM 55010 (19)**	In^3.min/ ft.lbs.hr $X10^{-10}$	
	Dynamic Coefficient of Friction (-)	**ISO 7148-2 (18)**		0.15-0.30	**QTM 55007 (20)**		0.12
	Limiting PV at 100 FPM (safety factor 4)				**QTM 55007 (21)**	ft.lbs/in^2. min	3000
	Limiting PV at 0.1 / 1 m/s cylindrical sleeve bearings		MPa.m/s	0.08 / 0.05			

Note: 1 g/cm³ = 1,000 kg/m³ ; 1 MPa = 1 N/mm² ; 1 kV/mm = 1 MV/m

NYP: there is no yield point

This table, mainly to be used for comparison purposes, is a valuable help in the choice of a material. The data listed here fall within the normal range of product properties of dry material. However, they are not guaranteed and they should not be used to establish material specification limits nor used alone as the basis of design. See the remaining notes on the next page.

TIVAR H.O.T.
Ultra High Molecular Weight Polyethylene
TIVAR H.O.T (higher operating temperature) is a premium grade that is formulated to help finished components maintain key performance properties in an extended temperature range.
TIVAR H.O.T. excels in a variety of industrial manufacturing environments where temperatures reach up to 135°C (275°F). Furthermore, TIVAR H.O.T. components are compliant with FDA requirements, making this material the ideal, longer life thermoplastic for wear parts in dairy, bakery, poultry/meat and other food processing industries where higher temperatures or frequent chemical wash downs shorten part life.

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Notes, see datasheet on page 1-2

1. The figures given for these properties are for the most part derived from raw material supplier data and other publications.
2. Values for this property are only given here for amorphous materials and for materials that do not show a melting temperature (PBI & PI).
3. Temperature resistance over a period of min. 20,000 hours. After this period of time, there is a decrease in tensile strength – measured at 23 °C – of about 50 % as compared with the original value. The temperature value given here is thus based on the thermal-oxidative degradation which takes place and causes a reduction in properties. Note, however, that the maximum allowable service temperature depends in many cases essentially on the duration and the magnitude of the mechanical stresses to which the material is subjected.
4. Impact strength decreasing with decreasing temperature, the minimum allowable service temperature is practically mainly determined by the extent to which the material is subjected to impact. The value given here is based on unfavourable impact conditions and may consequently not be considered as being the absolute practical limit.
5. These estimated ratings, derived from raw material supplier data and other publications, are not intended to reflect hazards presented by the material under actual fire conditions. There is no 'UL File Number' available for these stock shapes.
6. Most of the figures given for the mechanical properties are average values of tests run on dry test specimens machined out of rods 40-60 mm when available, else out of plate 10-20mm. All tests are done at room temperature (23° / 73°F).
7. Test speed: either 5 mm/min or 50 mm/min [chosen acc. to ISO 10350-1 as a function of the ductile behaviour of the material (tough or brittle)] using type 1B tensile bars.
8. Test speed: either 0.2"/min or 2"/min or [chosen as a function of the ductile behaviour of the material (brittle or tough)] using Type 1 tensile bars.
9. Test speed: 1 mm/min, using type 1B tensile bars
10. Test specimens: cylinders Ø 8 mm x 16 mm, test speed 1 mm/min
11. Test specimens: cylinders Ø 0.5" x 1", or square 0.5" x 1", test speed 0.05"/min
12. Test specimens: bars 4 mm (thickness) x 10 mm x 80 mm ; test speed: 2 mm/min ; span: 64 mm.
13. Test specimens: bars 0.25" (thickness) x 0.5" x 5" ; test speed: 0.11"/min ; span: 4"
14. Measured on 10 mm, 0.4" thick test specimens.
15. Electrode configuration: Φ25 / Φ75 mm coaxial cylinders ; in transformer oil according to IEC 60296 ; 1 mm thick test specimens.
16. Measured on discs Ø 50 mm x 3 mm.
17. Measured on 1/8" thick x 2" diameter or square.
18. Test procedure similar to Test Method A: "Pin-on-disk" as described in ISO 7148-2, Load 3MPa, sliding velocity= 0,33 m/s, mating plate steel Ra= 0.7-0.9 μm, tested at 23°C, 50%RH.
19. Test using journal bearing system, 200 hrs, 118 ft/min, 42 PSI, steel shaft roughness 16±2 RMS micro inches with Hardness Brinell of 180-200.
20. Test using Plastic Thrust Washer rotating against steel, 20 ft/min and 250 PSI, Stationary steel washer roughness 16±2 RMS micro inches with Rockwell C 20-24.
21. Test using Plastic Thrust Washer rotating against steel, Step by step increase pressure, Test ends when plastic begins to deform or if temperature increases to 300°F, a 4:1 safety factor has been applied to the posted value.

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