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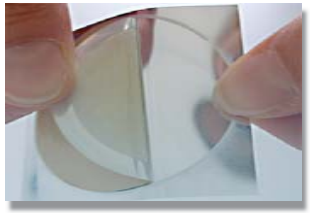
MITSUBISHI POLYESTER FILM

HOSTAPHAN®

General Technical Data

Industrial

Packaging



Medical

Electrical

Imaging

Thermal-Transfer-Ribbons

Hostaphan® films are made of Polyethylene Terephthalate (PET) and characterised by outstanding physical data. They are biaxially oriented and heat-set.

HOSTAPHAN® - THE ADVANTAGES

Hostaphan® films are suited for a variety of applications, due to their excellent properties:

- High tensile strength and tear resistance
- Impact and abrasion resistant
- Dimensionally stable
- Resistant to low as well as high temperatures
- Suitable for printing, metallizing and laminating
- Good barrier against aromas, gases and water vapor
- Resistant to all commonly used organic solvents, oils and fats and to many inorganic substances
- Resistant to fungal and bacterial attack
- Unplasticised, tasteless and odourless
- The base resin is suitable for food contact (Details on request!)
- Excellent electrical insulation properties
- Films available with different physical properties and surfaces

HOSTAPHAN® AT A GLANCE

This documentation provides an overview of Hostaphan®, its areas of application and the typical values of its properties. In addition, this general data information is complemented with data comparing Hostaphan® with other plastic films, data on Hostaphan® packaging materials and Hostaphan® yields with surface/weight conversion details. Please contact us directly for more details.

STORAGE CONDITIONS

The polyester film Hostaphan® is largely unaffected by climatic influences. We recommend that the film is kept in the original packaging until used. A dry dust-free storage room with an ambient temperature below 30°C is of advantage.

Avoid storing the film outdoors for any significant period of time where it will be exposed to harmful influences such as humidity or direct sunlight. The film should be transferred, in the transport packaging, to the processing area or a room with a similar climate at least 24 hours before processing.

We recommend removing the film from the original packaging immediately before processing. After removal, transporting the film roll by means of a steel bar through the core will prevent deformation or damage to the outer layers.

Short-term storage in polystyrene troughs is also an option with Hostaphan® films with a thickness equal or greater than 36 µm. We know of no restriction to the shelf-life of Hostaphan®. Nevertheless, we recommend that the film is processed within a year of delivery.

To increase the surface tension of our film to > 50 mN/m there is the possibility to apply a corona treatment on one surface during the production process . This level of surface energy is guaranteed for 6 month after delivery, provided that the film is kept on the roll in its original packaging.

MANUFACTURING

	Units	PET	PP	PVC
Manufacturing	./.	extrusion	extrusion	calendering
Stretching	./.	biaxial	biaxial	none or additionally transverse
Thickness range	µm	1 to 500	4 to 80	30 to 100 stretched transv. (100 to 600 unstretched)

MECHANICAL TYPICAL VALUES

		Units	PET	PP	PVC
Tensile strength	MD*	N/mm²	200	150	50
	TD*	N/mm²	200	250	50
Elongation at break	MD*	%	100	150	10
	TD*	%	100	50	10
Tensile stress required to cause 5% elongation	MD*	N/mm²	100	./.	./.
	TD*	N/mm²	100	./.	./.
Test standard		./.	ISO 527-1-2	ISO 527-1-2	ISO 527-1-2
Test conditions		./.	Testing rate 100%/min, 23°C, 50% r.h.	Testing rate 100%/min, 23°C, 50% r.h.	Testing rate 100%/min, 23°C, 50% r.h.
Young's modulus	MD*	N/mm²	4.500	2.500	./.
	TD*	N/mm²	4.500	4.500	./.
Test standard		./.	ISO 527-1-2	ISO 527-1-2	ISO 527-1-2
Test conditions		./.	Testing rate 1%/min, 23°C, 50% r.h.	Testing rate 1%/min, 23°C, 50% r.h.	Testing rate 1%/min, 23°C, 50% r.h.

REEL CORES

Core material	Applications/width	Inner ø/mm
Cardboard core	for general applications	76,5 / 152,4
Cardboard core	large width from approx. 2.000 mm	200
Polystyrene core	On request	76,5 / 152,4

FILM YIELDS*

Thickness [µm]	Weight [g/m²]	Yield [m²/kg]
4,5	6,3	159,0
6,0	8,4	120,0
8,0	11,0	90,0
10,0	14,0	72,0
12,0	17,0	60,0
15,0	21,0	48,0
19,0	27,0	38,0
23,0	32,0	31,0
25,0	35,0	29,0
30,0	42,0	24,0
36,0	50,0	20,0
50,0	70,0	14,0
75,0	105,0	9,6
96,0	134,0	7,5
100,0	140,0	7,2
125,0	175,0	5,7
175,0	245,0	4,1
190,0	266,0	3,8
250,0	350,0	2,9
300,0	420,0	2,4
350,0	490,0	2,0
500,0	700,0	1,4

**) valid for all film types with a density of 1,4 g/cm³*

PERFORMANCE IN MANY MARKET SECTORS

Industrial

- Adhesive tapes
- Document lamination
- Furniture films
- Hot stamping foils
- Labels & Liners
- Metallic yarns
- Outdoor applications
- PET-cards
- Photoresist films
- Photovoltaik
- Pre Preg
- Protection & Safety
- Release film
- Siliconizing
- Steel lamination
- Transfer print

Packaging

- Anti slip films
- Barrier films
- Films for lamination
- Films for metallization
- Films for printing
- Heat sealable films
- Lidding films
- Peelable films

Medical

- Diagnostic sticks
- Medical packaging
- Therapeutic systems

Electrical

- Cable and wire insulation
- Flexible conductors/Flat cables
- Flexible printed circuits
- Insulation for electrical machines (motors, transformers)
- Membran touch switches

Imaging

- Advertising print
- Drafting and engineering films
- Films for printing plates
- Graphic arts and optical print
- Montage films

Thermal-Transfer-Ribbon

- Barcode print
- Fax print
- Label print
- Portable printer
- Ticketing machines

Comparative data for plastic films

ELECTRICAL TYPICAL VALUES

	Units	PET	PP	PVC
Dielectric constant	./.	3.3	2.2	4.2
Dielectric dissipation factor	./.	0.002	0.0002	0.02
Test standard	./.	DIN 40634	DIN 40634	DIN 40634
Test conditions	./.	23°C, 50 Hz	23°C, 50 Hz	23°C, 50 Hz

DIMENSIONAL STABILITY

		Units	PET	PP	PVC
Shrinkage	MD*	%	1 to 3 (150°C)	3 to 5 (120°C)	4 to 7 (140°C)
	TD*	%	0 to 2 (150°C)	0 to 2 (120°C)	-0,5 to 2 (140°C)
Test standard		./.	DIN 40634	DIN 40634	DIN 40634
Test conditions		./.	150°C, 15 min	120°C, 15 min	140°C, 15 min

**) MD = machine direction, TD = transverse direction*

PERMEABILITY

Gases	Units	Typical values*	Test standard	Test conditions
Air	$cm^3/m^2 \times d \times bar$	30**	DIN 53380	23°C
Ammonia, dry	$cm^3/m^2 \times d \times bar$	4.000**	In-house method	23°C
Argon	$cm^3/m^2 \times d \times bar$	25**	DIN 53380	23°C
Carbon dioxide	$cm^3/m^2 \times d \times bar$	240**	DIN 53380	23°C
Chlorine	$cm^3/m^2 \times d \times bar$	60**	DIN 53380	23°C
Ethylene oxide	$cm^3/m^2 \times d \times bar$	650***	In-house method	23°C
Frigen 11	$cm^3/m^2 \times d \times bar$	< 4***	DIN 53380	24.5°C
Frigen 12	$cm^3/m^2 \times d \times bar$	12***	DIN 53380	20°C
Frigen 13	$cm^3/m^2 \times d \times bar$	14***	DIN 53380	20°C
Frigen 21	$cm^3/m^2 \times d \times bar$	7***	DIN 53380	20°C
Frigen 22	$cm^3/m^2 \times d \times bar$	7***	DIN 53380	20°C
Frigen 114	$cm^3/m^2 \times d \times bar$	6***	DIN 53380	20°C
Frigen 502	$cm^3/m^2 \times d \times bar$	< 6***	DIN 53380	23°C
Helium	$cm^3/m^2 \times d \times bar$	2.000**	DIN 53380	23°C
Hydrogen	$cm^3/m^2 \times d \times bar$	1.100**	DIN 53380	23°C
Hydrogen sulphide	$cm^3/m^2 \times d \times bar$	500**	In-house method	23°C
Methyl bromide	$cm^3/m^2 \times d \times bar$	50**	DIN 53380	23°C
Nitrogen	$cm^3/m^2 \times d \times bar$	20**	DIN 53380	23°C
Oxygen	$cm^3/m^2 \times d \times bar$	70**	DIN 53380	23°C
Phosgene	$cm^3/m^2 \times d \times bar$	50**	DIN 53380	23°C
Prussic acid	$cm^3/m^2 \times d \times bar$	8.000**	DIN 53380	23°C
Sulphur dioxide	$cm^3/m^2 \times d \times bar$	1.000**	In-house method	23°C

**) Measured on HOSTAPHAN® RN 25*

***) Unless otherwise indicated, the values have been converted for normal pressure and temperature*

****) Values not converted to reflect normal conditions*

PHYSICAL AND CHEMICAL STABILITY

Aldehydes	Acetaldehyde	resistant
	Formaldehyde	resistant
Alcohols	Benzyl alcohol	partially resistant
	Cyclohexanol	resistant
	Ethyl alcohol	resistant
	Glycerine	resistant
	Glycol	resistant
	Isopropyl alcohol	resistant
	Methyl alcohol	resistant
Chlorinated hydro-carbons	Carbon tetrachloride	partially resistant
	Chlorinated biphenyls	partially resistant
	Chloroform	resistant
	Trichloroethylene	resistant
Esters	Ethyl acetate	resistant
Hydrocarbons	Aliphatic hydrocarbons	resistant
	Benzene	resistant
	Gasoline (petrol)	resistant
	Mineral oils	resistant
	Toluene	resistant
	Xylene	resistant
Acids	Acetic acid (all concentrations)	resistant
	50% formic acid	resistant
	10% hydrochloric acid	resistant
	30% hydrochloric acid	partially resistant
	10% and 35% hydrofluoric acid	resistant
	10% nitric acid	resistant
	65% and 100% nitric acid	not resistant
	30% and 85% prosphoric acid	resistant
	20% sulphuric acid	partially resistant
	Sulphur dioxide gas, dry	resistant
	80% and above sulphuric acid	not resistant
Salt solutions	Alkaline carbonates	resistant
	Bichromates	resistant
	Cyanides	resistant
	Fluorides	resistant
Other organic solutions	Acetone	resistant
	Diethylether	resistant
	Nitrobenzene	not resistant
	Phenol	not resistant
Miscellaneous substances	Chlorine	resistant
	Hydrogen peroxide	resistant
	Oxygen	resistant
	Water*	resistant
Aqueous alkaline solutions	Ammonium hydroxide	not resistant
	Calcium hydroxide	partially resistant
	Sodium hydroxide	not resistant

*)At elevated temperatures (approx. >100°C) and in the presence of water (vapor), polyester films such as HOSTAPHAN ® tend to become brittles as a result of hydrolysis.

Test specimens of Hostaphan® 12 µm films were immersed in the indicated substances for 4 weeks at room temperature. The criteria applied for evaluation were swelling (expansion), weight loss and change of elongation at break. Hostaphan® is stable in the presence of the commonly employed polyester and epoxy-based insulating resins and varnishes. In addition, Hostaphan® is resistant to polyurethane varnishes and isocyanates. The films can be damaged by some phenolic resin types that give off free phenol or phenol derivatives when exposed to high temperatures or moisture.

MECHANICAL DATA

		Units	Typical values**	Test standard	Test conditions
Flexing cycles		./.	> 100 000	./.	./.
Edge tear resistance	MD*	N	150	DIN 40634	23°C, 50% r.h.
	TD*	N	150	DIN 40634	23°C, 50% r.h.
Coefficient of friction		./.	0.4	DIN 53375	23°C, 50% r.h.
Impact resistance	MD*	mJ/mm²	1.400	DIN 53448	23°C, 50% r.h.
	TD*	mJ/mm²	1.800	DIN 53448	23°C, 50% r.h.
Tear propagation strength	MD*	N/mm	240	DIN 53363	23°C, 50% r.h.
	TD*	N/mm	240	DIN 53363	23°C, 50% r.h.

*) MD = machine direction, TD = transverse direction
**) measured on 12 µm film

Comparative data for plastic films

THERMAL TYPICAL VALUES

	Units	PET	PP	PVC
Melting point	°C	260	166	200 bis 220
Glass transition temperature	°C	70	-20	80
Test standard	./.	Differential scanning calorimetry	Differential scanning calorimetry	Differential scanning calorimetry
Test conditions	./.	3K/min	3K/min	3K/min

BARRIER DATA

100 µm thickness, 23°C	Units	PET	PP	PVC
Oxygen (0% r.h.)	$cm^3/m^2 \times d \times bar$	17	250	40
Test standard	./.	DIN 53380	DIN 53380	DIN 53380
Test conditions	./.	23°C	23°C	23°C
Water vapor (85% r.h.)	$g/m^2 \times d$	2	0.25	3
Test standard	./.	DIN 53122	DIN 53122	DIN 53122
Test conditions	./.	23°C	23°C	23°C

OTHER

	Units	PET	PP	PVC
Density	g/cm^3	1.4	0.9	1.4
Test standard	./.	ASTM D 1505-68 method C	ASTM D 1505-68 method C	ASTM D 1505-68 method C
Test conditions	./.	23°C	23°C	23°C
Water absorption	%	0.5	< 0.1	0.5
Test standard	./.	DIN 53472 and ASTM D 570	DIN 53472 and ASTM D 570	DIN 53472 and ASTM D 570
Test conditions	./.	Immersed in water for 4 days at 23°C	Immersed in water for 4 days at 23°C	Immersed in water for 4 days at 23°C

THERMAL DATA

	Units	Typical values	Test standard	Test conditions
Flammability (no flammable gases occur up to...)	°C	400	DIN 40634 or VDE 0345	./.
Low temperature resistance*	°C	-196	DIN 53372	tested to -196°C
Specific heat	J/kg x K	1.300	./.	./.
Thermal conductivity	W/m x K	0.13	VDE 0304/part 1	./.
Approved insulating class for electrical machinery	./.	B	DIN 57530 or VDE 0530/main list	./.
Heat of combustion	kJ/kg	25.000	DIN 5190	./.
Vicat-Softening temperature	°C	> 230	DIN EN ISO 0306	Method B 50

PHYSICAL AND CHEMICAL DATA

	Units	Typical values	Test standard	Test conditions
Frigen®-extract, measured on films RN and WN 190	%	0.05	DIN 8944	Cold extraction
Conductivity of aqueous extract	µS/cm	2	DIN 40634 or VDE 0345	1 kHz
Trichloroethylene-extract measured on films RN und WN 190	%	0.2	DIN 8943	Extracted in Soxhlet apparatus for 2 h. Boiled down for 15 h at 105 °C

PERMEABILITY

Aromas	Units	Typical values*	Test standard	Test conditions
Camphor	g/m² x d	< 3 x 10^{-6}	In-house method	20°C
Cinnamaldehyde	g/m² x d	50.000 x 10^{-6}	In-house method	20°C
Diphenylmethane	g/m² x d	4.000 x 10^{-6}	In-house method	20°C
Eucalyptol	g/m² x d	8.000 x 10^{-6}	In-house method	20°C
Eugenol	g/m² x d	160 x 10^{-6}	In-house method	20°C
Geraniol	g/m² x d	130 x 10^{-6}	In-house method	20°C
Menthol	g/m² x d	700 x 10^{-6}	In-house method	20°C
Vanillin	g/m² x d	10 x 10^{-6}	In-house method	20°C

Vapors	Units	Typical values*	Test standard	Test conditions
Acetone	g/m² x d	< 0.1	In-house method	23°C
Benzene	g/m² x d	< 0.1	In-house method	23°C
Carbon disulphide	g/m² x d	3	In-house method	23°C
Carbon tetrachloride	g/m² x d	0.2	In-house method	23°C
Ethyl acetate	g/m² x d	< 0.1	In-house method	23°C
Ethyl alcohol	g/m² x d	0.005	In-house method	23°C
Formaldehyde (30% solution)	g/m² x d	0.003	In-house method	23°C
Hexane	g/m² x d	< 0.1	In-house method	23°C
Methyl alcohol	g/m² x d	0.7	In-house method	23°C
Water	g/m² x d	8	DIN 53122	23°C

**) measured on HOSTAPHAN® RN 25*

ELECTRICAL DATA

	Units	Typical values	Test standard	Test conditions
Electrolytic corrosion effect	./.	A1	DIN 53489 or VDE 0303/ part 6	./.
Behaviour under the influence of glow discharges on surfaces (measured on films of thickness 36 µm)	min	900	DIN 53485 or VDE 0303/ part 7	Contact method 40kV / mm
Mandrel test	./.	one-layer (RN 100) 3-layer (RN 23, RN 50)	EN 61558-1/1997 Section 26.3	./.

DIMENSIONAL STABILITY

	Units	Typical values	Test standard	Test conditions
Moisture expansion coefficient	(% r.h.)$^{-1}$	0.7 x 10^{-5}	In-house method	40 - 80% r.h.
Coefficient of linear thermal expansion	K^{-1}	2 x 10^{-5}	In-house method	20 - 50°C
Dimensional stability under pressure with rising temperature	°C	240	DIN 40634 or VDE 0345	./.
Dimensional stability under tension with rising temperature	°C	240	DIN 40634 or VDE 0345	./.

OPTICAL DATA

	Units	Typical value	Test standard	Test conditions
Refractive index	./.	1.6	DIN 53491	λ = 589nm, 25°C