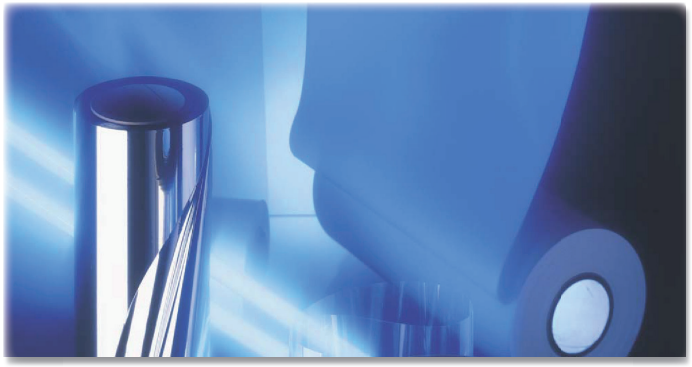

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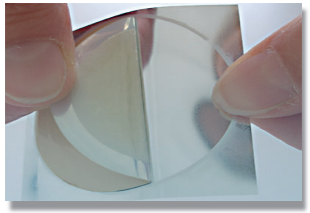
MITSUBISHI POLYESTER FILM

# 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.

# Comparative data for plastic films

## 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 |