

Food and non-food  
packaging

Parts for  
household  
electrical goods

Consumer  
electronics

Household items

Toys

Bath and shower  
screens

Painting, poster  
and photo frames

Glazing

DIY

Displays

Showcases

Lamps and  
ceiling lights

The logo for NUDEC PS, with 'NUDEC' in a dark grey, bold, sans-serif font and 'PS' in a larger, outlined, sans-serif font.

Polystyrene sheets

- Excellent dimensional stability to heat
- High rigidity
- Hardness
- Good mechanical characteristics
- Extraordinary dielectric values, making them excellent electrical insulators that can be used from low to high frequencies
- Low volatile substance content
- Micro-organism resistant
- High brightness level
- 90% visible spectrum (400 - 800 nm) light transmission, with light absorption rapidly increasing in the ultraviolet band
- There no sharp variations in properties at low temperatures
- Low water absorption tendency

# NUDEC® PS

## Properties

### Dimensional stability to heat

NUDEC®PS sheets can be briefly exposed to temperatures of 80°C without deformation or contraction.

Prolonged exposure must not exceed 80 to 85°C.

### Stress cracking

As a consequence of a combination of pressure or stress and chemical attack, fissures may appear over time in function of the stress intensity, the chemical agent and sheet thickness.

#### Stress cracking in the case of bathroom screens

**Stress:** Pressure produced by the aluminium profile on the sheet.

**Chemical agents:** There may be three types:

- External lubricants: Products employed to facilitate the insertion of the sheet into the profile, such as Vaseline, oil or silicone etc.
- Aluminium cleaning agents. Degreasing agents employed to clean the aluminium once the screen has been assembled.
- PVC seal additives. Plastifying agents derived from phthalic acid that are used to provide the PVC with ductility; this plastifying agent migrates to the surface and attacks the PS.

#### Recommendations for preventing the formation of cracking:

- The sheet must not be subjected to any excessive pressure in the joint.
- Clean cutting of the NUDEC®PS sheets
- Lubricants should not be employed to insert the sheets and great care should be taken in cleaning the aluminium

after assembly to employ a product that does not affect the sheet.

- Correct choice of sealing product

#### The following are recommended:

- Polyethylene + ethyl acetate (PE + EVA) seal
- Silicon rubber seal
- Hot bead or fill-in of neutral silicone

#### The following are not recommended:

- PVC seal, especially with plastifying agent deriving from phthalic acid

Better results are achieved using polymer plastifying agents.

### Ageing

NUDEC®PS sheets are stabilised against ageing that can be produced by the oxygen in the air and high temperatures (up to a maximum of 80°C). On premises where there are normal temperature and illumination conditions, the NUDEC®PS sheets maintain their appearance and service qualities for many years.

Under outside weather conditions, deterioration is produced by the UV component of sunlight that directly strikes them, for which reason they are not recommended for prolonged use outside. Ageing shows up as progressive yellowing and the loss of surface brightness, together with a reduction in sheet mechanical properties.

### STANDARD SPECIFICATIONS FOR PS RESIN

	CODE	UNIT	VALUE
<b>PHYSICAL</b>			
Density	ISO 1183	g/cm <sup>3</sup>	1,05
<b>MECHANICAL</b>			
Tensile strength @ yield	ISO 527	MPa	(*)
Tensile strength @ breakage	ISO 527	MPa	59
Elongation @ breakage	ISO 527	%	3
Tensile modulus of Elasticity	ISO 527	MPa	3.250
Flexural strength	ISO 178	MPa	106
Charpy impact strength notched	ISO 179	kJ/m <sup>2</sup>	1.47
Charpy impact strength un-notched	ISO 179	kJ/m <sup>2</sup>	16
Rockwell hardness M/R scale	ISO 2039	MPa	150
<b>OPTICAL</b>			
Light transmission	ASTM D-1003	%	89
Refractive index	ASTM D-542		1,591
<b>THERMAL</b>			
Maximum Service temperature		°C	80
VICAT Softening temperature (10 N)	ISO 306	°C	106
VICAT Softening temperature (50 N)	ISO 306	°C	101
Heat deflection temperature, HDT A (1.8 MPa)	ISO 75-2	°C	86
Heat deflection temperature HDT B (0.45 MPa)	ISO 75-2	°C	98
Coefficient of linear thermal expansion	ISO 75-2	x10 <sup>-5</sup> /°C	8

These data correspond to raw material values.

(\*) Non-applicable

### CHEMICAL RESISTANCE

CHEMICAL PRODUCT	BEHAVIOUR		
	SATISFACTORY	REGULAR	UNSATISFACTORY
Mineral oil		X	
Vegetable oil	X		
Acetone			X
Acetic acid	X		
Water	X		
Turpentine			X
Ammonia	X		
Detergents	X		
Ethanol	X		
Petrol			X
Glycerine	X		
Methanol	X		
Toluene			X

### CERTIFICATIONS

PROPERTY	METHOD	UNIT
Food contact	EN 10-2011, FDA	

A PS safety file is available for any additional type of query.

## Handling

### Cleaning

A solution of water and neutral detergent may be employed. They should always be cleaned and dried with a soft cloth with very little pressure.

### Cutting

#### Important!

Do not remove the protective film from the sheets before cutting, and once this has been accomplished blowing or suction should be employed to eliminate any chips.

#### Manual cutting

Cutting should always be carried out with a fine-blade saw, with the sheet firmly held in place to prevent vibration. The teeth should be well-sharpened.

#### Cutting with a blade

When cutting with a blade, this should be passed several times in order to achieve the desired depth (this should be a minimum of half the thickness), employing a uniform pressure.

The sheet must be firmly secured to prevent sliding. Afterwards, the sheet should be placed on a flat surface and gentle pressure applied until it breaks. Sandpaper may be employed to eliminate any burrs.

#### Sawing

##### Cutting recommendations for NUDEC®PS sheets

- Disc diameter: 350 - 400 mm
- Number of teeth: 84 - 106
- Rotation speed: 2,800 - 4,500 rpm
- Advance speed: 12 - 18 m/min

#### Type of teeth

Alternate teeth or combined straight and trapezoid.

The sheet must be firmly secured to prevent them rising up and causing cracks when the disc passes.

The translation speed should be as uniform as possible.

The disc must be regularly sharpened.

### Polishing

Pre polishing is required to eliminate any marking caused by the cutting disc.

#### The following may be used:

- Rotating rigid fabric discs with buffing paste.
- Rotating soft fabric discs with buffing paste for the final finish.

### Drilling

Metal and wood drill bits may be employed. The larger the diameter, the lower the speed.

A hole diameter that is approximately 1.5 mm larger than that of the screw to be used should be drilled to take sheet dilation into account.

The sheet must be firmly secured to prevent breaking. A sharp object can be employed to start the hole. In addition, air or water can be used for cooling purposes.

### Gluing

#### Important!

To prevent air bubbles, the glue should be allowed to stand for a while before application, until none can be seen.

#### Solvents

Various solvents can be used in the bonding of NUDEC®PS sheets. The most common is MEK (methyl-ethyl-ketone). In general, aromatic solvents can be used. These solvents can be applied using a syringe or

fine paintbrush. An ideal adhesive is a mixture of two parts methyl chloride and one part toluene. To facilitate gluing, 10% PS chips can be added to the mixture to thicken the adhesive.

Before carrying out the actual gluing operation the surfaces to be glued must be cleaned with alcohol.

#### Glues

These are solvent-free adhesives, with two components based on polyurethanes. They are transparent, odour-free and do not attack the plastic. They permit different types of plastic to be joined together and also plastics to other materials, such as glass, aluminium and steel etc.

#### Welding

NUDEC®PS sheets may be welded together using ultrasound or heat pulses. The welding quality will increase when the distance between the sonotrodes is decreased. High frequency welding is not possible because the material has low dielectric losses.

### Thermoforming

The stresses that can be produced during this process must be controlled since they could produce heavy stress-related cracking.

The thermoforming vacuum temperatures must be above 120°C, with prior pneumatic or mechanical stretching.

*All NUDEC products use film to protect the surface from possible damage during production and transport. This protective film is not prepared to withstand high temperatures and must be removed prior to thermoforming or hot-bending.*

### Bending

The sheet should be locally heated with an electrical element and then quickly bent. It is a good idea to cool the part of the sheet that is closest to the bending line.

When bending thick sheets, it is recommended that both sides are heated, with the sheet being firmly secured after bending in order to maintain the exact position. Over time, it is possible for small cracks to appear in the area of the bend. We recommend that the smallest radius be twice the sheet thickness.

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### Decoration

The sheet surface must be clean and free from grease, demoulding agents and any other contamination. Degreasing can be performed using a 50/50 mixture of isopropane and isobutanol.

NUDEC®PS sheets are easily printed, lacquered and painted using a wide range of products. They can also be decorated by means of silk-screening, lithography, metallisation or hot-marking. It should be ensured that the NUDEC®PS sheet will not be attacked by solvents incorporated in the lacquers or varnishes and paint manufacturers should be consulted about products designed to cover PS.

#### Vacuum metallisation

NUDEC®PS sheets can be vacuum metallised. It must be stressed that the obtained finish will depend of the surface shine of the sheet before this process is carried out.

*The print film should be removed just prior to printing to prevent the surface from damage.*

## Responsibility clause

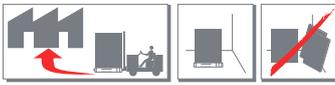
- NUDEC, S. A. supplies its products in accordance with the indications prepared by the purchaser with respect to the ordered material and quality. In this sense, NUDEC, S. A. provides its customers with all available professional and technical information deriving from its product analyses.
- Once the material has been delivered by NUDEC, S. A., the purchaser is fully responsible for all subsequent application, treatment, use and/or utilisation of this same material, whether by the actual purchaser or by third parties, with complete indemnity for NUDEC, S. A.
- The purchaser is wholly and solely responsible for carrying all tests or analyses, of any nature, which are required to verify that the product can be effectively applied for the purpose sought by the purchaser or by any third parties to whom the purchaser supplies the product or for whom it is installed.
- NUDEC, S. A. is exempt from any responsibility deriving from any inadequate or defective application of its products by the purchaser or subsequent third parties, and only accepts damages deriving directly from possible defects of its products at origin.



## Transport

Dirt and sharp angles may damage the surface in the case of friction.

- During transport, stable, flat pallets should always be used and the sheets secured to prevent sliding.
- The sheets must not be allowed to slide over each other during loading and unloading operations.
- They should be lifted by hand without any dragging or by suction-cup lifting equipment.



## Storage

An incorrect storage position can lead to permanent deformation.

- The sheets should be stored in closed premises that guarantee normal environmental conditions.
- The sheets should be stored one on top of the other on flat horizontal surfaces and fully supported over their total area.
- The topmost panel should be covered with a sheet of polyethylene or cardboard etc.
- NUDEC®PS sheets must not be stored in direct sunlight or under conditions of high humidity and/or temperature as this can have a negative effect of protective film adhesion.