- CASE STUDY -

NUDEC transparent sheets for pandemic protection
Since its founding in 1980, NUDEC has strengthened its market positioning, year after year, thanks to the efforts of its employees. The quality and service the company offers have made us one of the most important manufacturers of plastic sheets in Europe, and our aim is to ensure that our customers continue to put their faith in us for many years to come.
NUDEC in brief

NUDEC, S. A. is a company created in 1980 located in Polinyà (Barcelona), over an area of 26,545 sq. m with 13,150 sq. m built.

NUDEC works with a range of polymers such as: **PS** (polystyrene), **PMMA** (polymethyl-methacrylate), **SAN** (styrene-acrylonitrile), **PET** (polyethyleneterephthalate), **PETg** (polyethyleneterephthalate + glycol) and **PC** (polycarbonate).

NUDEC counts on a total qualified staff of 125 employees including its own sales organization in the UK, Germany, France, Italy and Spain to cover all European countries, America and Africa.

NUDEC’s turnover in 2019 was of 50,2 million €.

NUDEC sales are distributed between 14,5% Spain and 85,5% export to more than 40 countries.
NUDEC’s product range

**PET**
- Polyethyleneterephthalate
- High impact strength
- Excellent fire resistance
- Recyclable
- Easy to fabricate
- From 0.5 mm to 6 mm

**PETg**
- Polyethyleneterephthalate copolymer
- Breaking similar polycarbonate
- Excellent chemical resistance
- Thermoformable
- From 0.5 mm to 15 mm

**PMMA**
- Polymethylmethacrylate
- Excellent optical properties
- Resistant to outside weather
- Easy to fabricate
- From 1.5 mm to 20 mm

**PS**
- Polystyrene
- Can be patterned
- High rigidity
- Micro-organism resistant
- From 1.5 mm to 5 mm

**PC**
- Polycarbonate
- Excellent impact strength
- High heat resistance
- Good fire resistance
- From 0.75 mm to 15 mm

**SANuv**
- Acrylonitrile styrene
- High rigidity
- Waterproof
- High dimensional stability
- From 2 mm to 6 mm
NUDEC’s product against pandemic

NUDEC is attempting to relieve the ongoing crisis by providing different materials which reduce the spread of Covid-19. For this purpose, production capability has been increased and production schedules have been changed to fulfil the growing demands for protective materials.

Clear transparent sheets are being used for hygienic protection walls, face shields and other solutions in numerous industries to prevent the spread of the virus. NUDEC have an extensive range of high optical quality sheets perfectly suitable for that purpose. Within NUDEC’s range of products, the most appropriate materials are:

- NUDEC™ PMMA
- NUDEC™ PC
- NUDEC™ PET
- NUDEC™ PETg
NUDEC® PMMA sheets show an excellent light transmission and surface brightness. Furthermore, they offer a high stability outdoors, against ultraviolet radiation. They are suitable for a wide variety of outdoor and indoor products, allowing multiple applications, such as sound barriers, given their good noise insulation properties.

**Characteristics**
- Excellent optical properties
- Bright
- High rigidity
- Weather resistant
- Elevated hardness
- Easy to fabricate
- Noise transmission reduction
- Suitable to be polished, etc.
- Lighter than glass
- Suitable for food contact
- Suitable for laser cutting

**Applications**
- Noise barriers
- Lamps and ceiling lights
- Signs and signals
- Glazing elements
- TV and computer filters
- POS and advertising elements
- Roof windows and skylights
Polycarbonate sheets

These sheets are distinguished by their impact strength and their resistance to high temperatures. NUDEC®PC sheets are frequently used in applications related to the construction industry, such as covers and anti-vandal street furniture. They are available in UV version for outdoor applications.

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Excellent transparency and surface brightness</td>
<td>• Machinery protection</td>
</tr>
<tr>
<td>• Resistance to high temperatures</td>
<td>• Automotive articles</td>
</tr>
<tr>
<td>• Excellent impact strength</td>
<td>• Vending machines</td>
</tr>
<tr>
<td>• Thermoformable, after predrying</td>
<td>• Signs and signals</td>
</tr>
<tr>
<td>• Noise transmission reduction</td>
<td>• Protective shields</td>
</tr>
<tr>
<td>• Easy to process</td>
<td>• Security glazing</td>
</tr>
<tr>
<td>• Good fire performance</td>
<td>• Street furniture (anti-vandal)</td>
</tr>
<tr>
<td>o B-s1,d0 (EN 13501-1)</td>
<td>• Construction components</td>
</tr>
<tr>
<td>o HB / V-2 (UL-94)</td>
<td></td>
</tr>
</tbody>
</table>
Polyethylenterephthalate sheets

These sheets are perfect for flat and slightly curved sheets. NUDEC®PET sheets offer good impact strength and fire resistance. They also have excellent chemical resistance. Patterned sheets can be produced upon request.

**Characteristics**
- Good optical properties
- Excellent chemical resistance
- High impact strength and resistance to breakage
- Thermoformable, pre-drying is not required
- 100% Recyclable within its own waste category 1
- Suitable for food contact
- Excellent fire resistance
  - B-s1,d0 (EN 13501-1)
  - HB (UL-94)

**Applications**
- Glazing
- Signs and signals
- Machinery protection
- Vending machines
- Displays and other publicity elements
- Street furniture
- Construction elements
- Food trays
- Digital printing
Polyethylenterephthalate copolymer sheets

These sheets are ideal for thermoforming applications, as they are easy to shape and mold. Unlike other materials, pre-drying is not required. NUDEC®PETg sheets also offer a good impact strength and fire resistance.

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Good optical properties</td>
<td>• Pop-up displays</td>
</tr>
<tr>
<td>• High impact strength</td>
<td>• Industrial protection</td>
</tr>
<tr>
<td>• Good chemical resistance</td>
<td>• Molded pieces</td>
</tr>
<tr>
<td>• Easily thermoformable including</td>
<td>• Vending machines</td>
</tr>
<tr>
<td>complex shapes</td>
<td>• Orthopedic parts</td>
</tr>
<tr>
<td>• Easily recyclable</td>
<td>• Medical components</td>
</tr>
<tr>
<td>• Suitable for food contact</td>
<td>• Food packaging</td>
</tr>
<tr>
<td>• Good fire performance</td>
<td>• Cycling helmets</td>
</tr>
<tr>
<td>o B-s1,d0 (EN 13501-1)</td>
<td>• Mannequins</td>
</tr>
<tr>
<td>o V-2 / HB (UL-94)</td>
<td></td>
</tr>
</tbody>
</table>
Technical processing of NUDEC materials

NUDEC sheets can be easily manipulated to new shapes, sizes and finishes as stated in following chart:

<table>
<thead>
<tr>
<th>NUDEC materials</th>
<th>Density (g/cm³)</th>
<th>Service temp. (°C)</th>
<th>Fire resistance</th>
<th>Food contact (only clear versions)</th>
<th>Weather resistance</th>
<th>Impact resistance</th>
<th>Digital printing</th>
<th>Hot bending</th>
<th>Cold bending</th>
<th>Thermofor.</th>
<th>Bonding</th>
<th>Welding</th>
<th>Drilling</th>
<th>Saw cutting</th>
<th>Die cutting</th>
<th>Guillotine cutting</th>
<th>Laser cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUDEC PET</td>
<td>1.34</td>
<td>From -15 °C to +60 °C</td>
<td>Very good</td>
<td>UV version (non-standard)</td>
<td>NON-UV version</td>
<td>A primer prior to printing might be required</td>
<td>Attention: Crystallisation!</td>
<td>Min. radius = thickness x 150</td>
<td>Pre-drying not required</td>
<td>Check bonding document for further info</td>
<td>Check drilling document for further info</td>
<td>Check cutting document for further info</td>
<td>Up to 2 mm thick</td>
<td>Attention: Crystallisation! Rough edges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUDEC PETs</td>
<td>1.27</td>
<td>From -20 °C to +60 °C</td>
<td>Good</td>
<td>UV version (non-standard)</td>
<td>NON-UV version</td>
<td>Min. radius = thickness x 150</td>
<td>Pre-drying required</td>
<td>Check bonding document for further info</td>
<td>Check drilling document for further info</td>
<td>Check cutting document for further info</td>
<td>Up to 2 mm thick</td>
<td>Up to 2 mm thick</td>
<td>Up to 2 mm thick</td>
<td>Rough edges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUDEC PC</td>
<td>1.20</td>
<td>From -30 °C to +120 °C</td>
<td>Medium</td>
<td>UV version</td>
<td>NON-UV version</td>
<td>Min. radius = thickness x 150</td>
<td>Pre-drying required Approx. 120 °C</td>
<td>Check bonding document for further info</td>
<td>Check drilling document for further info</td>
<td>Check cutting document for further info</td>
<td>Up to 2 mm thick</td>
<td>Up to 2 mm thick</td>
<td>Fumes generation Rough and metal edges</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUDEC PMMA</td>
<td>1.19</td>
<td>From -40 °C to +80 °C</td>
<td>Bad</td>
<td>Hi grades</td>
<td></td>
<td>A primer prior to printing is recommended</td>
<td>Min. radius = thickness x 330</td>
<td>Pre-drying required Approx. 70 °C</td>
<td>Check bonding document for further info</td>
<td>Check drilling document for further info</td>
<td>Check cutting document for further info</td>
<td>Polished finishing Even thick gauges</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This data is supplied for informational purposes, so it is recommended to carry out tests reproducing the end-use conditions. NUDEC, S. A. is exempt from any responsibility in the case of an unsuitable use of the materials.
Transparent sheets solutions against Covid-19

NUDEC is contributing to fight against Covid-19 in the following projects that are being realized with its materials:

- **Barriers**
- **Face shields**
- **Medical applications**
Barriers

Many companies are using NUDEC®PET, NUDEC®PETG, NUDEC®PC and NUDEC®PMMA sheets from 3,0 to 6,0 mm thicknesses for hygienic protection walls to prevent the further spread of the virus. Transparent barriers for customer and employee protection who can’t avoid direct contact. Even NUDEC®SAN and NUDEC®PS are suitable for this application.
Barriers

Office

Supermarket
Barriers

Installing clear panels of NUDEC®PC sheets help protect transportation professionals such as taxi drivers, etc. and their customers. Polycarbonate sheets show high impact strength which make them ideal for partitions and barriers in cars, buses and trains.
Cathedrals and churches from different European countries have been equipped with PMMA partitions to distribute communion at Mass. These barriers allow the priest to give the Sacred Host, in hand, to the faithful with security for both.
NUDEC has contributed in the fight against Covid-19 through the fabrication of thermoplastic sheets that have become aerosol boxes and some parts of emergency breathers in hospitals.

Aerosol boxes can effectively isolate viruses to prevent infections of doctors and nurses in hospitals.

**NUDEC®PMMA** are fully transparent, thus the doctor can treat the patient through the isolation cover. The perfect visual window effectively reduces the spread of the virus, whilst not hindering the rescue work.

Furthermore, **NUDEC®PMMA** has also been used for some components of emergency breathers, thus helping save lives.
Face shield

Many companies are currently producing face shields using NUDEC®PET and NUDEC®PETg sheets from 0,5 to 1,50 mm thicknesses, to protect medical staff such as doctors, nurses, etc. Even NUDEC workers are using these face shields to protect themselves from direct contact with others.
Cleaning

NUDEC®PET, NUDEC®PETg, NUDEC®PMMA and NUDEC®PC present relatively non-adherent inert soil to bacteria. When cleaning or sanitizing those sheets proper procedures should be taken. To minimize the risk of damage, use only compatible products and correct cleaning procedures as stated in the next chart:

<table>
<thead>
<tr>
<th>Chemical agent for disinfectant</th>
<th>NUDEC®PET</th>
<th>NUDEC®PETg</th>
<th>NUDEC®PC</th>
<th>NUDEC®PMMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Ethyl alcohol</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>3% Hydrogen peroxide</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>10% Sodium hydroxide</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>10% Ammonium hydroxide</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>5% Acetic acid</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>30% Sulfuric acid</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>10% Hydrochloric acid</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>Iodine solution</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>Acetone</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
</tbody>
</table>

This data have been obtained in specific conditions (constant exposure at 20 ºC).
It should be noted that the chemical resistance of NUDEC sheets depends on the concentration of the cleaner/disinfectant, contact time, temperature, and stress level.
Cleaning recommendations

Following these recommendations may result in reducing the survival of bacteria and viruses on the sheets environments.

**Recommended tips:**

- Wear disposable gloves when cleaning surfaces. Gloves should be discarded after each use.
- Use of microfiber clothes or non-abrasive lint-free cleans much better than comparable cotton towels and reduces the risk of scratching the surface of the sheets.
- Allow enough contact time after applying the disinfectant. If the contact time is too short, the surface will not be properly disinfected. However, be careful about leaving cleaning liquid on sheet for long periods (20 seconds should be enough).

**Do not:**

- Use scrapers, squeegees or razors.
- Apply cleaners in direct sunlight or at elevated temperatures.
A guide to cleaning thermoplastic sheets

How do you clean NUDEC sheets in your establishment?

Follow these easy tips and your plastic sheets will continue to look like new for a long time:

1. Wear disposable gloves and handle your plastic sheet by its edges.
2. Put your plastic sheet on a clean area free of dust.
3. Only use a microfiber cloth.
4. Sweep your cloth over both sides of your plastic sheet to remove any dirt and debris.
5. Use a water solution with neutral soap on a soft microfiber cloth. Gently clean your plastic surface until the cleaner is completely gone. Use another clean microfiber cloth if necessary.
6. Rinse with clean water.
7. Let your plastic sheet dry and handle by its edges to put it back into use.
NUDEC is ready to help and assist customers to find the right material and to fight against the virus together.

Please stay safe and take care.