

Invision

Product Data and Processing Instructions

General Information

Invision sheets are innovative design elements, made in Germany. Fabrics, metals or organic materials such as grass, leaves or flowers are embedded in polyester (PETG) by means of an especially developed and licensed process.

advantages of <i>Invision</i>	applications of <i>Invision</i>
<ul style="list-style-type: none"> • the sheets can be easily and rapidly thermoformed at low energy consumption without predrying while retaining their frosted surface • good impact strength • available in thicknesses from 3 to 24 mm • other colours and measurements on demand • also available with UV protection • suitable for outdoor usage (with UV protection), highly weatherproof • food proof except for the version with UV protection • exclusive appearance 	<p>applications:</p> <ul style="list-style-type: none"> • interior design: partition walls, furniture, light elements etc. • hotels, trade, industry, offices etc. • booth building: walls, ceilings, floorings, bars, columns etc. • shop-fitting: system concepts and individual solutions • POS for outdoor and indoor usage • displays • kitchen backwalls • lamp covers • advertising pillars • doors, partitions / sliding doors • sculptures • shower cabins

Storage

Store *Invision* sheets in horizontal position on a flat surface and provide adequate support to avoid deformation of the product. It is recommended not to remove the protective film prior to installation. The panels are best stored at room temperature. Avoid exposure to direct sunlight, extreme temperatures and chemical vapours.

OUTDOOR USAGE

If using *Invision* sheets for outdoor applications we recommend the version with UV protection. The edges have to be sealed so that no water or moisture can get into the inside of the sheets.

USAGE IN WET OR HUMID SURROUNDINGS

Certain inlays for *Invision* like organic materials, but also papers and fabrics can have the tendency to absorb moisture over time if submerged in water or exposed to high humidity if they are not adequately sealed. These types of *Invision* should not be immersed in water without first applying an approved edge sealing treatment. This is also applicable for the edges of holes drilled into *Invision* sheets.

glow wire flammability index, IEC 60695-2-12, in °C (*)

	0,5	0,75	1	1,5	2	2,5	3	4
Invision	960	960	900	960	960	960	960	960

TECHNICAL DATA

	test conditions	typical	unit	test method
PHYSICAL				
density		1,27	g/cm ³	ISO 1183-1
moisture absorption	after storage in standard climate 23 °C/50%r. F.	0,2	%	ISO 62-4
	after storage in water at 23 °C until saturation	0,6	%	ISO 62-1
refractive index	20 °C	1,567	-	ISO 489
MECHANICAL				
tensile stress at yield		> 45	MPa	ISO 527-
elongation at yield		4	%	ISO 527-
tensile strength		> 45	MPa	ISO 527-
elongation at break		> 35	%	ISO 527-
elastic modulus		2.000	MPa	ISO 527-2/1B/1
limiting flexural stress		ca. 80	MPa	ISO 178
impact strength	charpy unnotched	ohne	kJ/m ²	ISO 179/1fU
	charpy notched	ca. 7	kJ/m ²	ISO 179/1eA
	Izod notched	ca. 6	kJ/m ²	ISO 180/1A
THERMAL				
Vicat softening temperature	method B50	80	°C	ISO 306
thermal conductivity		0,2	W/m K	DIN 52612
coeff. of linear thermal expansion		0,05	mm/m	DIN 53752-A
heat deflection temperature	method A: 1,80 MPa	63	°C	ISO 75-2
under load	method B: 0,45 MPa	70	°C	ISO 75-2
ELECTRICAL				
dielectric strength		16,1	kV/mm	IEC 60243-1
volume resistivity		1015	Ohm·c	IEC 60093
surface resistivity		1016	Ohm	IEC 60093
dielectric constant	at 103 Hz	2,6		IEC 60250
	at 106 Hz	2,4		IEC 60250
dissipation factor	at 103 Hz	0,005		IEC 60250
	at 106 Hz	0,02		IEC 60250

Processing Instructions

GENERAL REMARKS:

- tools

Invision sheets can be machined using the standard tools commonly used for metal and woodworking. We recommend carbide-tipped tools. Above all, it is important to use sharp cutting tools with the right geometry.

- cooling

No cooling is required during the normal machining of our *Invision* sheets. In the event of local overheating during machining – e.g. when drilling through very thick materials – we recommend cooling with water or oilfree compressed air.

- dimensional accuracy

The coefficient of linear expansion of *Invision* at 0.04 – 0.05 mm/mK, is significantly higher than for metal or glass. For this reason, dimensions should always be checked at room temperature.

- protective foils

Our **standard-protection foils are not suitable for exposure to thermal loads** and do not allow thermoforming. The foil should therefore be removed from the sheets before processes such as drying, hot line bending and/or thermoforming.

- marking

Marking out drill holes, cut edges etc. should be done on the protective foil. If marking is required, use a soft pencil or felt-tip pen. Marking tools should not be used as the tracing mark has a notching effect, and a higher load at this point may cause the sheet to crack.

SAWING

- hand saws

Standard hand saws may be used to cut sheets. A saw with fine spacing between the teeth should be used.

- circular saw

Using a circular saw is the easiest way to cut *Invision* sheets. Experience has shown that carbide-tipped circular saw blades produce the cleanest cuts. The spacing varies from fine for thin sheets to coarse for thicker materials. Ensure that no shavings are left on the cutting surface as these could damage the protective foil and scratch the sheets.

- ribbon saw

Ribbon saws are ideal for curved cutting or formed parts of irregular shapes. To achieve a clean cut edge it is important to work on a solid cutting surface. A wide spacing is required when working with thick materials. For higher quality cut edges, circular saws or milling cutters achieve a better result than ribbon saws.

- trouble-shooting:

fused cut edge:

- check tool sharpness
- check cutting speed and reduce if necessary
- check rate of advance and reduce if necessary
- cool if necessary

notched cut edge:

- check tool sharpness
- check tool geometry
- improve cutting surface (use an underlay if necessary)

DRILLING

Standard drills used for metalworking are perfectly suitable for machining *Invision* sheets.

Make sure that the cutters on the drill are sharp. Cooling during drilling is generally not necessary.

When working with relatively large drilling depths we recommend using compressed air and/or regularly withdrawing the drill from the hole to reduce heat and remove shavings.

Oil/water emulsions or cutting oils should not be used when drilling through *Invision* sheets. Standard circle-cutting equipment (e.g. circle cutters or compass saws) is suitable for large-scale drilling.

The drill holes should be smooth and as free as possible of notches or rough areas to ensure secure fastening.

recommended angles for drilling:

point angle ϕ	110° - 130°
Helix angle β	19° - 40°
cutting speed	30 - 60 m/min.
feed	0,1 - 0,3 mm/U

The distance between whole and sheet edge should be at least 1.5 times of the diameter of the whole.

MILLING

Invision sheets are easy to process using milling machines. The choice of milling machine depends on the type of machining required.

Some of the *Invision* sheets with special inlays e.g. metal structures can only be cut by water jet.

Please ensure that your tool has good chip clearance and sharp cutters.

SURFACE TREATMENT

- flame polishing

Propane, butane or other types of gas burner may be used for flame polishing. This technique can produce excellent results but requires experience and ongoing practice. Make sure that the material does not crystallize. Cracks may appear in the polished area in the long term.

- polishing

Medium-density riding polishing wheels with a peripheral velocity of 20 to 30 m/s can be used to polish *Invision* sheets with alkalifree polishing pastes. A clean polishing wheel without polishing paste is then used to complete the polishing process. Large-surface polishing should be avoided.

- decorating

Before treating polish *Invision* sheets – e.g. by coating, screen printing or thermoforming – recommend removing any loose particles of dirt or dust adhering to the surface using ionized air.

The **matt side of *Invision* sheets is not suitable** for printing.

- transfer printing

Sheets and finished parts can be printed using transfer printing.

- screen printing

Invision sheets may be printed with standard screen printing equipment and inks suitable for thermoplastic polyesters (PET). The ink manufacturer's recommendations should be followed.

Invision sheets can be printed with UV-cured inks. The short-term UV radiation has no impact on the physical properties. The maximum application temperature of 65° C should not be exceeded during the drying process.

- coating

Once cleaned, *Invision* sheets may be coated without any other pre-treatment. Care should be taken to ensure that the coatings and printing inks are chemically compatible with *Invision*.

FORMING

- thermoforming

Protective foil: Our standard protective foils are not suitable for exposure to thermal loads, and do not allow thermoforming. The foil should be removed from the sheets before processes such as drying, hot line bending and/or thermoforming.

- pre-drying

Invision sheets do not have to be predried.

- hot line bending

Hot folding is a relatively easy forming process for the production of uniaxially formed parts. *Invision* sheets simply require local heating to approximately 100 °C.

The *Invision* sheets are heated in a linear manner. As soon as the ideal temperature is reached, the sheet is removed from the heating element, folded, placed in the mold and clamped into position. The desired shape should be fixed until the material rigidifies. If using one-sided heating, the *Invision* sheets must be turned over several times to guarantee even heating on both sides. With sheet thicknesses of 2 mm or more and when producing large numbers of units, we recommend simultaneous heating appliance. By adjusting the heating width using the shields, various different bending radii can be achieved, although a minimum bending radius of 3 times the sheet thickness should not be undershot.

When constructing forming molds, allowance should be made for shrinkage of 0.4%. Special materials are available for producing porous forming tools without vents.

- male and female tools:

The decision on whether to use a male or female tool depends on the application. To achieve a better surface quality on the outer side of the finished part, use of a female tool is recommended to attain greater detail.

- free blowing or free drawing

This technique is used to form domes. Blowing without a countermold involves working with air pressure, whilst the thermoforming process without a countermold is carried out in a vacuum.

molding temperature *Invision*: 120 - 140°C

Attention: not all inlays for *Invision* can be thermoformed!