TECHNICAL INFORMATION

BARLO SAN
ENGLISH

Contents

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1. Product identification

BARLO SAN is the trade name for extruded Styrene Acrylonitrile (SAN) copolymer sheets from Quinn Plastics.
The BARLO SAN programme offers solutions to both in- and outdoor applications.
For external use, BARLO SAN UVP, incorporating UV protection should be used.
As a result of the extrusion and lamination process, Quinn Plastics can offer a variety of designs, as well as the glass clear version.

The almost unlimited application possibilities of BARLO SAN offer the industry new opportunities in order to stimulate creativity.

2. Characteristics

BARLO SAN sheets are characterised by good optical properties and a brilliant surface.
The BARLO SAN range contains sheets that are easy to handle, to vacuum form, and show a very good dimensional stability.
Typical for BARLO SAN sheets are their very good chemical resistance: they are resistant to most fats, dilute acid solutions, oils and common bleaching agents, as well as some solvents and weak alkaline solutions.
The sheets can be used in- and outdoor (in UVP-version) and are resistant to temperature fluctuations.
BARLO SAN products can be used in contact with foodstuffs.

BARLO SAN material also combines the following excellent properties:
- High softening point
- Low water absorption
- High stiffness

3. Applications

- Industrial (door) glazing
- Covers for foodstuffs
- Covers for office equipment
- Screen printing
- Advertising signs
- Fittings for shops and exhibitions
- Displays
- Flat or curved shower screens
- Greenhouse glazing
- Room dividers

4. Fabrication and finishing techniques

BARLO SAN sheets are easy to handle.
Sawing, drilling, gluing, printing, milling/engraving, mechanical polishing, vacuum forming and hot bending do not offer any problems to the BARLO SAN range. More detailed information on these items can be found under point 'USER GUIDE', further in this brochure.

5. Statements

5.1. Food approval statement

BARLO SAN sheets can be used in contact with foodstuffs (except UVP-grade). Therefore, in applications where covers for foodstuffs or fittings for shops etc. are needed, BARLO SAN sheets can offer a perfect solution.

BARLO SAN clear sheets are extruded styrene acrylonitrile sheets produced from raw materials which meet the compositional requirements of the FDA regulation 21 CFR 181.32 relating to the use of articles in contact with food.

This applies only to the non UV stabilized products and does not apply to the UV stabilized grades.

It is the responsibility of the end user to satisfy himself that the product is fit for purpose and meets the approved migrational standards for his application.

5.2. Statement on 10-year guarantee

As stated before, BARLO SAN UVP sheets are applicable for outdoor use.
The 10-year warranty, mentioned below, indicates the 10-year guarantee in West European countries offered by Quinn Plastics.

1. Quinn Plastics warrants that clear and opal BARLO SAN UVP is protected on both surfaces from the adverse effects of UV-radiation and, when exposed to moderate European climates, will not show a significant change in yellowness index and mechanical properties, as described below, for a period of 10 years from the date of sales by Quinn Plastics.

2. This warranty applies exclusively to standard clear and opal BARLO SAN UVP-sheets used correctly as flat sheets which are installed, handled and maintained according to Quinn Plastics' recommendations and instructions. The purchaser is presumed to be informed of said recommendations and instructions. If this is not the case he can obtain said documents through the sales representative or authorised distributor.

3. No warranty will be available for sheets that have been scratched, abraded, cracked or exposed to corrosive materials or environments or if the protective layer of the sheet has been damaged in any manner whatsoever.

4. In the event of a claim against this warranty, the sheet and the original sales receipt must be returned to Quinn Plastics via the sales representative or original authorized distributor.

5. The extent of yellowing will be determined on samples of the sheet in question according to the Yellowness Index Test ASTM D1925 (1977). Multiple samples will be taken from the sheet and cut into sizes suitable for testing, the samples will be cleaned prior to testing. A BARLO SAN UVP sheet showing a change in yellowness index of on average less than 10 Delta units compared to its original value, as defined by Quinn Plastics on the date of manufacturing, will not be subject to any claim.

6. The extent of change in light transmission will be measured according to test method DIN 5036. Multiple samples will be taken from the sheet and cut into sizes suitable for testing, the samples will be cleaned prior to testing. A BARLO SAN UVP-sheet showing a change in light transmission which is less than 10% of the original value, as defined by Quinn Plastics on the date of manufacturing, will not be subject to any claim. This part of the warranty applies to flat BARLO SAN sheets only. Patterned and coloured sheets are not covered by this part of the warranty.

7. The mechanical properties are defined by the flexural modulus (ISO 178), the tensile strength (ISO 527-2). Multiple samples will be taken and a sheet showing a change of less than 10% in the flexural modulus and the tensile strength compared to its original value, as defined by Quinn Plastics on the date of manufacturing, will not be subject to any claim.

8. In the event of a claim against this warranty proving justified, Quinn Plastics will provide a replacement for the material at issue without any other liability for any other additional indemnification whatsoever:
   Up to 5 years time from the purchase date, Quinn Plastics will replace 100% material.
   Between 5-7 years time from the purchase date, Quinn Plastics will replace 60% material.
   Between 8-10 years time from the purchase date, Quinn Plastics will replace 30% material.
   If replacement material cannot be provided within a reasonable period of time, Quinn Plastics may choose to refund the original cost of the material without any other liability for any additional indemnification whatsoever. This warranty does for instance, not cover (re)installation expenses or any other incidental costs which may result from a breakage.

9. There are no express or implied, written or oral warranties and or representations by Quinn Plastics including warranties and representations of merchantability or fitness of purpose, except as set forth herein.

5.3. Safety data statement

This statement indicates all safety rules, to be taken into account when applying BARLO SAN sheet.

Composition/information on ingredients
Chemical nature: Styrene Acrylonitrile sheet (SAN)
Hazardous ingredients: none known

Possible hazards
None

First aid measures
If inhaled:
- On inhalation of decomposition products: keep patient calm, remove to fresh air and request medical help (if required)
- On skin contact: areas affected by molten material should be quickly placed under cold running water
- On contact with eyes: wash affected eyes for at least 15 minutes under running water with eyelids held open
- On ingestion: no special measures necessary

Note to physician:
- On inhalation of decomposition products: treat according to symptoms (decontamination, vital functions), no known specific antidote.

Fire fighting measures
- Suitable extinguishing media: water, dry extinguishing media, foam
- Unsuitable extinguishing media for safety reasons: none
- The following can be given off in a fire: carbon dioxide (CO_2) and steam.
  In addition small quantities of the following substances can be formed: carbon monoxide, monomers, other degradation products
- Special protective equipment: in case of fire, wear a self-contained breathing apparatus

Further information: dispose of fire debris and contaminated extinguishing water in accordance with local regulations

Accidental release measures
Methods for cleaning up: sweep/shovel up

Handling and storage
Handling:
- Gaseous products of degradation can be given off if the product is greatly overheated: monomers, other degradation products
- Avoid inhalation of vapour
- Processing machines must be fitted with local exhaust ventilation

Protection against fire and explosion:
- No special measures necessary

Storage:
- Keep in a dry place

Exposure controls and personal protection
Personal protective equipment
- Normal handling: Eye protection
- Thermal processing: Gloves, eye and/or a face protection

Physical and chemical properties
- Form: solid sheet
- Colour: clear, opal, coloured or translucent

Change in physical state:
- Softening point: > 70°C ISO 306
- Ignition temperature: > 400°C DIN 51794
- Density: 1.08g/cm³ ISO 1183
- Fire promoting properties: none
- Solubility in water: insoluble
- Solubility in other solvents: soluble in aromatic solvents

Stability and reactivity
- Conditions to avoid: to avoid thermal decomposition, do not overheat
- Starts to decompose at temperatures > 270 °C
- Possible thermal degradation products: monomers, other degradation products

Toxicological information
Effects of exposure:
- Inhalation: Low hazards for usual industrial handling or commercial handling by trained personnel
- Eyes: Same as above
- Skin: Molten material may cause thermal burns
- Ingestion: Expected to be a low ingestion hazard

Ecological information
- Extremely low water solubility. Low volatility
- No environmental hazards known

Disposal considerations
- Product: must be disposed of or incinerated in accordance with local regulations

Transport information
- Not classified as hazardous under transport regulations

Regulatory information
- Labelling according to EEC Directives: not subject to labelling

Other information
- The information contained herein is based on the present state of our knowledge and does not therefore guarantee certain properties.
- Recipients of our product must take responsibility for observing existing laws and regulations.

5.4. Statement on thermal insulation

BARLO SAN sheets used in glazing applications result in considerable energy cost savings by preventing excessive heat loss in winter and blocking heat entry in summer. The heat loss factor, normally referred to as the K-value, of BARLO SAN is significantly lower than for glass at the same thickness. Some examples of the heat insulation performance of BARLO SAN in single and double glazing systems are given below and compared to glass.

Advantages of BARLO SAN to glass

At the same thickness:
- Improvement of the K-value
- Weight saving

Single glazing:
- Improvement K-value:
  Glass 5 mm: K-value = 5.74 W/m²°C
  BARLO SAN 5 mm: K-value = 5.01 W/m²°C
  ΔK-value = 0.73 W/m²°C = 12.7%
- Weight saving
  Glass 5 mm: 12.5 kg/m²
  BARLO SAN 5 mm: 5.4 kg/m²
  Δ = 7.1 kg/m² = 56.8%

Double glazing:
- Improvement K-value
  2 x glass 4 mm with 5 mm air gap: K-value = 3.57 W/m²°C
  2 x BARLO SAN 4 mm with 5 mm air gap: K-value = 3.15 W/m²°C
  ΔK-value = 0.42 W/m²°C = 11.8%
- Weight saving
  2 x glass 4 mm with 5 mm air gap: 20.0 kg/m²
  2 x BARLO SAN 4 mm with 5 mm air gap: 8.64 kg/m²
  Δ = 11.36 kg/m² = 56.8%

At the same K-value:
- Weight saving
- Volume saving

Single glazing:
Glass 10 mm: K-value = 5.60 W/m²°C
BARLO SAN 2 mm: K-value = 5.50 W/m²°C
- Weight saving
  Glass 10 mm: 25.0 kg/m²
  BARLO SAN 2 mm: 2.16 kg/m²
  Δ = 22.84 kg/m² = 91.4%
- Volume saving
  Δ = 8 mm

Double glazing:

2 x glass 5 mm with 15 mm air gap:	K-value = 3.05 W/m²°C
2 x BARLO SAN 5 mm with 5 mm air gap:	K-value = 3.04 W/m²°C

- Weight saving

2 x glass 5 mm with 15 mm air gap:	25.0 kg/m²
2 x BARLO SAN 5 mm with 5 mm air gap:	10.8 kg/m²
Δ = 14.2 kg/m² = 56.8%	

- Volume saving

Glass 2 x 5 + 15:	25 mm
BARLO SAN 2 x 5 + 5:	15 mm
Δ = 10 mm	

K-values for costumer specific glazing systems can be provided upon request. For more information contact one of the sales offices of Quinn Plastics.

6. Technical information

6.1. Technical data sheet BARLO SAN

■ GENERAL			
Property	**Method**	**Units**	**BARLO SAN**
Density	ISO 1183	g/cm³	1.08
Rockwell Hardness	ISO 2039-2	M scale	83
■ OPTICAL			
Property	**Method**	**Units**	**BARLO SAN**
Light Transmission	DIN 5036-3	%	86
Refractive Index	ISO 489		1.57
■ MECHANICAL			
Property	**Method**	**Units**	**BARLO SAN**
Flexural Modulus	ISO 178	MPa	3750
Flexural Strength	ISO 178	MPa	105
Tensile Modulus	ISO 527-2	MPa	3900
Tensile Strength	ISO 527-2	MPa	60
Elongation	ISO 527-2	%	1.8
■ THERMAL			
Property	**Method**	**Units**	**BARLO SAN**
Vicat Temp. (B)	ISO 306	°C	106
Heat Deflection Temp. (A/B)	ISO 75	°C	98/101
Specific Heat Capacity	ASTM D-2766	J/gK	1,38
Coefficient of linear thermal expansion	DIN 53752	$K^{-1}x10^{-5}$	5-7
Thermal conductivity	DIN 52612	W/mK	0.17
Degradation temperature		°C	>280
Max. service temperature		°C	85
Sheet forming temp. range		°C	165-190
■ IMPACT STRENGTHS			
Property	**Method**	**Units**	**BARLO SAN**
Izod (notched)	ISO 180	kJ/m²	1.3
Charpy (unnotched)	ISO 179-1	kJ/m²	13
■ ELECTRICAL			
Property	**Method**	**Units**	**BARLO SAN**
Volume Resistivity	IEC 6093	Ω.m	10^{14}
Surface Resistivity	IEC 6093	Ω	$\geq 10^{15}$

Chemical resistance at 20°C

Acetone	-	Glycols	+
Acids (weak soln)	+	Glycerine	+
Alcohols		Hexane	+
Ethyl	+	Methylenechloride	-
Isopropyl	+	Methylethylketone	-
Methyl	+	Mineral Oil	+
Ammonia (weak soln)	+	Paraffin	+
Benzene	-	Toluene	-
Carbon tetrachloride	-	Sodium Chloride (aq)	+
Chloroform	-	Sodium Hydroxide (aq)	+
Ethyl Acetate	-		

- = Attacked
+ = Not attacked

6.2. Product range BARLO SAN

As a standard we produce BARLO SAN only in its UVP grade.

6.2.1. BARLO SAN flat sheets

BARLO SAN sheets are laminated on both sides with a PE-film.

Thickness Range
From 1.5 mm up to 6 mm

Widths cut-on-line

min. 2000 mm	
max. 2000 mm	≥ 1.50 mm
max. 2030 mm	≥ 2.00 mm
max. 2050 mm	≥ 3.00 mm

Lengths cut-on-line

min.	1000 mm
max.	3050 mm

Thickness tolerances (at 20°C)

1.50 - 2.50 mm	± 10 %
> 2.50 mm	± 5 %

Cut-on-line tolerances (at 20°C)

≤ 1000 mm	-/+ 1.5 mm
1001 - 2000 mm	-0/+6 mm
>2000 mm	-0/+9 mm

Cut-to-size tolerances (at 20°C)
± 1.00 mm

Min. production runs for

special thickness	2.000 kg
special pattern	5.000 kg
special colour	5.000 kg

Other thicknesses, size and tolerances on request. For the standard stock program see our product overview brochure.

6.2.2. BARLO SAN patterned sheets

BARLO SAN patterned sheets are laminated only on the smooth side with a PE-film.

Thickness Range
From 2.0 mm up to 5 mm

Widths cut-on-line

min. 1000 mm	
max. 1250 mm	for thickness < 2.00 mm
max. 1350 mm	= 2.00 – 2.2 mm
max. 1500 mm	> 2.20 mm

Lengths cut-on-line

min.	1000 mm
max.	3500 mm

Thickness tolerances (at 20°C)
+/- 0.1mm
Thickness tolerances for patterns to be measured on highest point of pattern

Cut-on-line tolerances (at 20°C)

≤ 1000 mm	-/+ 1.5 mm
1001 – 2000 mm	-0/+6 mm
> 2000 mm	-0/+9 mm

Cut-to-size tolerances (at 20°C)
± 1.00 mm

Min. production runs for

special thickness	1.000 kg
special pattern	5.000 kg (1 ton per thickness)
special colour	5.000 kg (1 ton per thickness)

Other thicknesses, size and tolerances on request. For the standard stock programme see our product overview brochure

7. User guide

7.1. Introduction

The manufacture of plastic articles from BARLO SAN copolymer sheet normally involves secondary fabrication operations, including sawing, drilling, bending, decorating and assembling. This guide covers the properties and characteristics of BARLO SAN that need to be taken into account if secondary operations are to be performed successfully.
BARLO SAN is a sheet material made from styrene acrylonitrile copolymer.

7.2. Fabricating

7.2.1. Machining guidelines

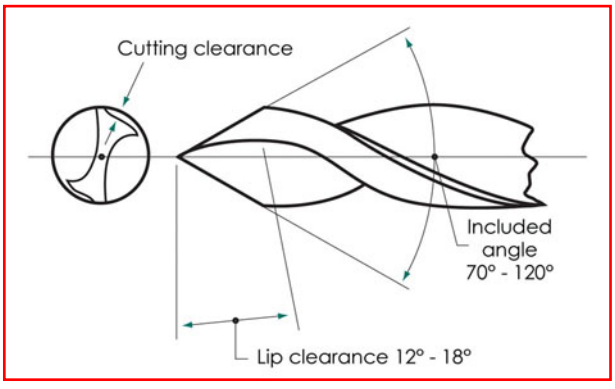
BARLO SAN sheet can be worked with most tools used for machining wood or metal. Tool speeds should be such that the sheet does not melt from frictional heat. In general the highest speed at which overheating of the tool or plastic does not occur will give the best results.
It is important to keep cutting tools sharp at all times. Hard, wear-resistant tools with greater cutting clearances than those used for cutting metal are suggested. High speed or carbon-tipped tools are efficient for long runs and provide accuracy and uniformity of finish.
Since plastics are poor heat conductors, the heat generated by machining operations must be absorbed by the tool or carried away by coolant. A jet of air directed on the cutting edge aids in cooling the tool and in removing chips.
Plain water or soapy water is sometimes used for cooling unless the trim scrap is to be reused.
The protective film of Quinn Plastic sheets should not be taken off during handling and machining in order to prevent scratches or damaging the surface of the sheet. Machining of plastic materials will result in stress build-up in the material. For applications where the treated surface is in contact with active solvents e.g. decorating and cementing, it is recommended to anneal the parts prior to this secondary step.

7.2.2. Milling

Sheet manufactured from BARLO SAN can be machined with standard high-speed milling cutters for metal, provided they have sharp edges and adequate clearance at the heel.

7.2.3. Drilling

Figure 1
Suggested drill-point design for drilling plastic sheet



Drills designed especially for plastics are available, and their use is suggested. Standard twist drills for wood or metal can be used; however they require slower speeds and feed rates to produce a clean hole. Twist drills for plastics should have two flutes, a point with an included angle of 70° to 120°, with the smaller angles for small holes and the larger angles for larger holes. The lip clearance should be between 12° and 18°, as shown in figure 1.
Wide, highly polished flutes are desirable since they expel the chips with low friction and thus tend to avoid overheating and consequent gumming. Drills should be backed out often to free chips, especially when drilling deep holes. Peripheral speeds of twist drills for plastics ordinarily range from 30 to 61 m per minute.

NOTE:
When drilling, be sure to back the panel with a piece of wood and to hold or clamp the part securely to prevent it from cracking or slipping.

7.2.4. Sawing

Following types of sawing operations can be used to saw thermoplastic materials: band saw, circular saw and jig saw as well as hand operated saws.
It is recommended that new or well sharpened tools are used. At very high cutting speeds, the saw blade should be cooled with water or an alternative appropriate cooling emulsion.

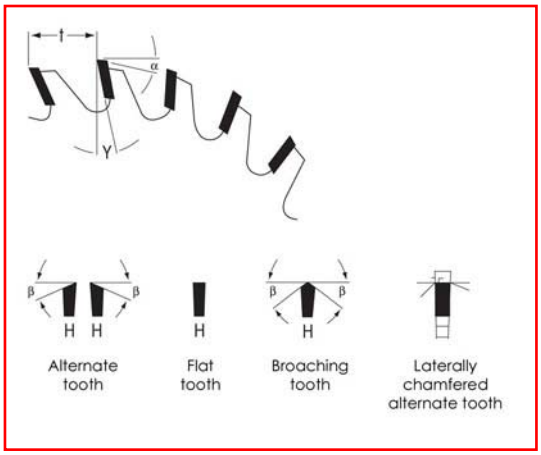


Figure 2
Example of Sawblades

Table 1
Sawing Recommendations

Settings	Band saw	Circular saw
Tooth distance	sheet thickness below 3 mm, 1 to 2 mm	8 to 12 mm
	sheet thickness 3 to 12 mm, 2 to 3 mm	8 to 12 mm
Clearance angle a	30 to 40°	15°
Rake angle ψ	15°	10°
Tooth angle β	-	15°
Cutting speed	1200 - 1700 m/min	2500 - 4000 m/min
Feed speed	-	20 m/min

7.2.5. Laser cutting

BARLO SAN sheet can be cut by laser beam in a thickness up to 10 mm. However, the cutting edge is not smooth and clean and needs to be polished afterwards.

7.2.6. Routing

BARLO SAN sheet can be routed using the following guidelines:

Diameter of the router	4 - 6 mm
Feed speed	ca.1.5 m/min
Rpm	18 - 24.000

Table 2: Routing Recommendations

7.3. Forming

7.3.1. Hot bending

BARLO SAN sheets need to be bent on a small radius by preheating an area on both sides with an electric strip heater and then quickly bending the sheet along the heated line. Thicker gauges above 3 mm may need to be turned periodically during the heating cycle. The side of the sheet that is to form the inside angle should be heated first and the outer side last. When the optimum sheet temperature is reached (>101°C) and a slight resistance to bending is noticeable, the part can be readily formed. If bending is performed too cold, stresses will be created that will result in a brittle part; however, overheating can cause bubbles in the bend area.
BARLO SAN sheets do not have to be pre-dried prior to hot bending.

7.3.2. Thermoforming

There are a number of different thermoforming techniques that can be used to form BARLO SAN sheet, once heated, into the shape of a mould by mechanical, air pressure, or vacuum forces. Both male (plug) and female (cavity) moulds are used. Tooling can range from low cost plaster moulds to expensive water cooled steel moulds, but cast aluminium is more commonly used. Other materials including wood, gypsum, and epoxy can also be used. Forming processes to be discussed include straight vacuum, drape, matched mould, pressure-bubble plug-assist, plug-assist pressure, vacuum snap-back, pressure-bubble vacuum snap-back, trapped-sheet contact-pressure, free, and mechanical. Items produced by thermoforming include light fixtures, instrument panel components, tote trays, housewares, toys, and a variety of different transparent enclosures.

Following processing parameters are recommended for BARLO SAN sheet:

Sheet temperature	130 - 170°C
Mould temperature	55 - 90°C
Demoulding	immediately after the part becomes rigid
Mould shrinkage	0.4 - 0.7 %

Table 3
Recommended forming parameters

BARLO SAN does not need to be pre-dried prior to thermoforming.

7.3.3. Straight vacuum forming

Vacuum forming is the most versatile and widely used forming process. The equipment costs less and is simpler to operate than most pressure or mechanical techniques. In straight vacuum forming, BARLO SAN is clamped in a frame and heated. When the hot sheet is in an elastic state, it is placed over the female mould cavity. The air is then removed from the cavity by vacuum, and atmospheric pressure then forces the hot sheet against the contours of the mould. When the BARLO SAN sheet has cooled sufficiently, the formed part can be removed. Thinning at the upper edges of the part usually occurs with relatively deep moulds. The hot sheet being drawn to the centre of the mould first causes thinning. Sheeting at the edges of the mould must stretch the most and thus becomes the thinnest portion of the formed item. Straight vacuum forming is normally limited to simple, shallow designs.
See figure 3

7.3.4. Drape forming

Drape forming is similar to straight vacuum forming except that after the BARLO SAN sheet is framed and heated, it is mechanically stretched, and a pressure differential is then applied to form the sheet over a male mould. In this case, however, the sheet touching the mould is close to its original thickness. It is possible to drape-form items with a depth-to-diameter ratio of approx. 4 to 1; however the technique is more complex than straight vacuum forming. Male moulds are easier to build and generally cost less than female moulds; however, male moulds are more easily damaged. Drape forming can also be used with gravitational force alone. For multi-cavity forming, female moulds are preferred because they do not require as much spacing as male moulds.
See figure 4

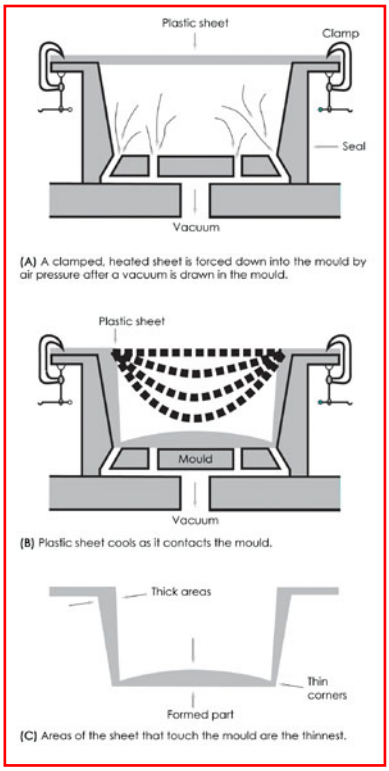


Figure 3
Straight Vacuum Forming

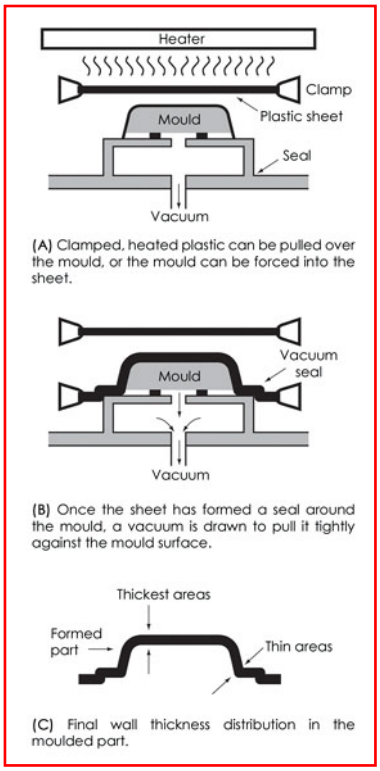


Figure 4
Drape Forming

7.3.5. Matched-mould forming

Matched-mould forming is similar to compression moulding in that heated BARLO SAN sheet is trapped between male and female dies made of wood, plaster, epoxy or some other material. Although they cost more, water-cooled matched moulds produce more accurate parts with close tolerances.

7.3.6. Pressure-bubble plug-assist vacuum forming

The pressure-bubble plug-assist vacuum forming technique can be used when BARLO SAN sheet is to be formed into deep articles that must have a good thickness uniformity. The sheet is placed in a frame and heated, and controlled air pressure is used to create a bubble. When the bubble has been stretched to a predetermined height, the male plug-assist (normally heated) is lowered to force the stretched sheet into the cavity. Plug speed and shape can be varied for improved material distribution; however, the plug is made as large as possible so that the plastic material is stretched close to the shape of the finished product. The plug should penetrate 75 to 85% of the mould cavity depth. Air pressure is then applied from the plug side while a vacuum assist is being drawn on the cavity. The female mould must be vented to allow the escape of trapped air.

7.3.7. Plug-assist pressure forming

Plug-assist pressure forming is similar to plug-assist vacuum forming in that a plug forces the hot BARLO SAN co polyester sheet into a female cavity. Air pressure applied from the plug then forces the plastic sheet against the walls of the mould. Plug design and plug speed can be varied to optimise material distribution.

7.3.8. Plug-assist vacuum forming

Corner or periphery thinning of cup- or box-shaped articles can be prevented by use of a plug-assist to mechanically stretch and pull additional plastic material into the female cavity. The plug should be 10 to 20% smaller than the mould and should be heated to just under the forming temperature of the sheet. Once the plug has forced the hot sheet into the mould cavity, air is drawn from the mould to form the part.
Plug-assist vacuum forming and plug-assist pressure forming (see previous section) allow deep drawing and permit shorter cooling cycles and good wall thickness control. Both processes require close temperature control and are more complex than straight vacuum forming.

7.3.9. Free forming

In free forming, air pressure is used to blow a hot BARLO SAN sheet through the silhouette of a female mould. Air pressure causes the sheet to form a smooth bubble-shaped article such as used in skylight panels or window well covers. Since only air touches each side of the part, there will be no mark-off unless a stop is used to form a special contour in the bubble.

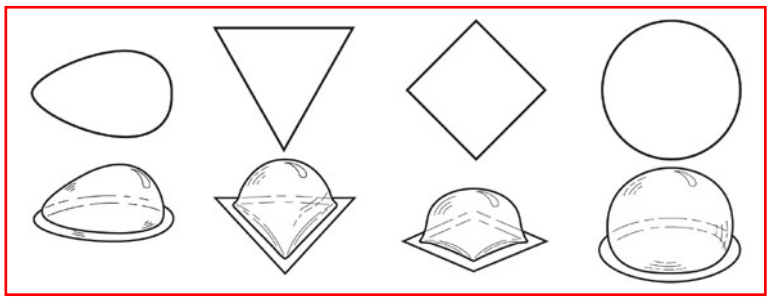


Figure 5
Examples of free-form shapes that can be obtained with openings

7.4. Assembly

BARLO SAN sheet can be fabricated into a variety of shapes and articles with solvent, cement (a polymer dissolved in a solvent), or adhesive bonds. In general, when the surfaces to be joined are irregular, a cement is preferred over a solvent.
Solvents and cements are not the best choice when bonding BARLO SAN sheet to other thermoplastics. Adhesives, including cyanoacrylates, two-part acrylics, hot melts, and polyurethanes are more effective when bonding BARLO SAN to dissimilar plastics and can be used to bond BARLO SAN to itself.

7.4.1. Assembly guidelines

The following guidelines should be observed when bonding BARLO SAN sheeting:

- The sheet edges must be clean and free from contamination.
- The surfaces must be smooth and accurately aligned.
- A solvent or cement must be sufficiently active to soften the mating surfaces for some flow to occur when pressure is applied.
- Fixture pressure must be maintained to prevent movement of the joint until it is solid.
- Good ventilation is required when working with solvents. Exposure levels must be controlled according to OSHA guidelines.

7.4.2. Bonding techniques: solvents, cements and adhesives

Small articles with flat surfaces can be joined by placing the pieces together and applying the appropriate bonding agent (solvent, cement, or adhesive). Care should be taken to ensure that the joints are uniformly coated; a solvent can be effectively applied with a needle applicator. The assembly should be clamped into position until the bond is set. When larger articles are to be solvent bonded, it is best to immerse the joining surfaces in a solvent bath until the material is softened and then clamp them into position until the bond has set. A constant level of solvent immersion should be maintained in a shallow pan with a support pad, screens, and other means to ensure part-to-part uniformity.

List with several solvents, cements, and adhesives that provide strong bonds with good clarity when used in BARLO SAN sheeting fabrication operations.

Material	Bond Type
Methyl Ethyl Ketone (MEK)	Solvent
Methylene Chloride	Solvent
Mixture of SAN in a 50/50 mixture toluene/MEK (300g SAN/1000g mixture)	Solvent
Super Glue	Cyanoacrylate Adhesive

7.4.3. Mechanical fastening

BARLO SAN sheet can be fabricated with mechanical fasteners into attractive joints. The diameter of the holes should be oversized to allow movement of the assembly caused by thermal expansion.
Screws and rivets provide permanent assembly.
Standard nuts, bolts, and machine screws are used in many instances; in addition, special screws and rivets specifically designed for use with plastics are available. Springs, clips, and nuts are low cost, rapid, mechanical fasteners. Hinges, knobs, catches, and dowels are some other devices used in mechanical assemblies.

7.5. Finishing

7.5.1. Sanding

BARLO SAN sheet is best sanded wet to avoid the frictional heat build-up that is characteristic of dry sanding techniques. If water coolants are used, the abrasive lasts longer and the cutting action increased. Progressively finer abrasives are used; for example, rough sanding with 80-grit silicon-carbide would be followed by finer sanding with 280-grit silicon-carbide, wet or dry. The final sanding may be with 400 or 600-grit sandpaper. After the sanding is finished and the abrasives removed, additional finishing operations may be required.

7.5.2. Joining

A standard woodworking jointer-planer will produce an accurately aligned and good quality finished edge on BARLO SAN copolymer sheeting. Carbide or high speed blades, which have longer life, will provide a uniform finish as well.

7.5.3. Filing

When many thermoplastics, including BARLO SAN, are filed, a light powder that tends to clog some files is produced. Therefore, aluminium Type A, shear-tooth, or other files that have coare, single-cut teeth with an angle of 45° are preferred.

7.5.4. Polishing techniques

Mechanical Polishing
After grinding, surfaces of BARLO SAN sheet can be polished in order to obtain a high surface finish. Burnishing wheels of cloth or fleece and felt polishing bands, together with a suitable polishing wax, give good results. Experience has shown that material surface temperatures should not increase too much, as these can be responsible for a later appearance of fine cracks.

Diamond polishing
BARLO SAN can be diamond polished resulting in an excellent surface quality that does not need further treatment, no pre-grinding step is required prior to the polishing step with a diamond tool.

Solvent polishing
The appearance of saw-cut edges can be improved by first sanding and then solvent polishing with MEK or methylene dichloride. It may be necessary to add a slow drying component such as diacetone alcohol to prevent humidity blush after drying. Complete removal of all surface scratches and edge sand marks is not likely with solvent polishing since BARLO SAN has good chemical resistance.

NOTE:
When using solvents, proper ventilation of the area is essential. Follow all precautions listed on the Material Safety Data sheet supplied with the solvent being used.

7.5.5. Printing

BARLO SAN sheeting can be printed with conventional equipment; however, the ink does not penetrate a plastic as it does with paper and cloth and is therefore subject to damage by abrasion. This can be minimized by applying a light coat of clear lacquer over the printing.
There are a number of different methods used when printing on plastics including letterpress, letter flex, dry offset, offset lithography, rotogravure, stencilling, and a commonly used silk screen process. In silk screening, the ink is forced through a fine metallic or fabric screen onto the product, and a squeegee is used to force the ink through the screen that is blocked off in areas that are not to be printed.
Since each application may require a different type of ink, it is suggested that an ink manufacturer be consulted for recommendations.