

AGLAS SAN

- sanitary ware cast acrylic sheets

AKRIPOL

G4 Group



AGLAS SAN



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AGLAS SAN - SANITARY WARE CAST ACRYLIC SHEETS



Aglas SAN is a cast acrylic sheet specially developed for sanitary ware applications. Its cross-linked nature and specific chemical structure enables manufacturing of high quality bathtubs, shower trays and other sanitary appliances.

It offers unique combination of characteristics including aesthetic, durability and very smooth surface finish. It is warm to the touch, easy to clean, UV resistant and fully recyclable.

Aglas SAN can be thermoformed easily, which gives manufacturers creative freedom with their design ideas.

Characteristics of Aglas SAN cast acrylic sheets:

- exceptional glow
- high surface hardness
- long life service
- less weight compared to glass or solid surface
- functionality and aesthetics
- easy processing
- easy cleaning and maintenance
- material meets the acrylic sheet standards EN 7823 and EN 263
- eco-friendly (100 % recyclable)

PRODUCT TYPES

Aglas SAN Standard sanitary grade cast acrylic sheets developed for sanitary ware applications.

Aglas SAN Easy Shaping special sanitary grade cast acrylic sheets modified for higher thermoformability and deep or complex bathtub models. It allows faster production cycles due to shorter heating times and saves energy costs due to lower thermoforming temperatures.

COLOUR RANGE

We produce Aglas SAN sheets in colours according to colour standards of sanitary ceramic. Colour range is available in current trend in the sanitary field. It matches other European manufacturers colours of sanitary grade materials. Aglas SAN is also available in any special colour of your choice, we can make colour matching on your request.

Table 1: Available colours

	Colour	Code
White	European white	051
	French white	055
	Bianco white	056
	Edelweiss	053
	Bianco	059
Orange	Mandarine*	350
Pink	Whisper pink*	451
Pastel	Beige*	550
	Pergamon	553
Green	Ägäis*	651
	Calipso*	652
Blue	Bermuda*	752
	Whisper blue*	753
Grey	Manhattan*	951

* Colours available upon request, minimum quantities required. Alternative colours are available upon request.

Table 2: Colour tolerances

Colour/Parameter	ΔE	ΔL	Δa	Δb
White	1.2	1.2	0.3	0.4
Pastel	1.3	1.2	0.4	0.5
Others	1.6	1.6	0.3	0.6

Aglas SAN sheets fulfill or exceed all requirements of EN ISO 7823-1 and SIST EN 263:2009

STANDARD SIZES

Standard gross sizes of AGLAS SAN sheets are designed to match most standard sizes of bathtubs and shower trays. We produce range of different gross size dimensions, which enables better cutting efficiency.

Table 3: Standard sizes

Size in mm	SAN	SAN EASY SHAPING
1550x1550	*	*
1750x1750	*	*
1950x1950	*	*
2040x1240	*	*
2040x1540	*	*
2240x1120	*	*
2250x1750	*	*
2400x1600	*	*
2400x1750	*	*
2550x1300	*	*
2550x1850	*	*

Cutting tolerances:

The cutting tolerance is evaluated according to European standard ISO 7823-1.

The cutting tolerance for Aglas SAN cast acrylic sheets in thickness range from 3 to 5 mm are:

Table 4: Cutting tolerances

Length or width (mm)	Tolerance (mm)
Up to 1000	0 + 1,5 mm
From 1001 to 2000	0 + 3 mm
From 2001 to 2550	0 + 4,5 mm

STANDARD THICKNESSES

Table 5: Standard thicknesses

Product Type / Thickness in mm	3	3,2	4	5
SAN	*	*	*	*
SAN EASY SHAPING	*	*	*	*

* Other thicknesses are available upon request.

Thickness of the sheets is evaluated according to European standard ISO 7823-1.

The thickness tolerance for Aglas SAN sheets in thickness range from 3 to 5 mm shall be calculated per following formula:

$$\pm (0,4 \text{ mm} + 0,1h),$$

where **h** is the nominal sheet thickness in millimetres.

The tolerances apply within each sheet and from sheet to sheet.

Table 6: Thickness tolerances

Nominal thickness [mm]	Tolerance Δ [mm]	Allowed thickness of sheet [mm]
3.0	$\pm 0,7$	2,3 - 3,7
3.2	$\pm 0,7$	2,5 - 3,9
4.0	$\pm 0,8$	3,2 - 4,8
5.0	$\pm 0,9$	4,1 - 5,9
6.0	$\pm 1,0$	5,0 - 7,0

TECHNICAL PROPERTIES

Table 7: Standard characteristics

Parameter	Value	Meas. units	Requirement	Standard
Elastic modulus	3087	MPa	≥ 3000	ISO 527-1
Elongation at rupture	4.0	%	≥ 4	ISO 527-1
Impact strength (by Charpy without cut)	15	kJ/m ²	≥ 13	ISO 179-1/1eU
Constant working temperature	≤ 70	°C	/	/

Parameter	Value	Meas. units	Standard
Density	1.18	g/cm ³	ISO 1183 A
Bending strength	117	MPa	ISO 178
Deflection temperature under load (HDT)	98	°C	EN ISO 75-2
Coefficient of thermal expansion	6.1×10^{-5}	K ⁻¹	ZAG
Water absorption capacity	0.011	%	ISO 62 method 1
Brinell hardness HB 2.5/30	36	BR	SIST EN ISO 6506-1
Surface gloss	92	GU	EN ISO 2813 ($\angle 60^\circ$)
Surface gloss after thermal treatment	≥ 87	GU	EN ISO 2813 ($\angle 60^\circ$)

Table 8: Additional properties Aglas SAN and EASY SHAPING

Parameter	Value SAN	Value SAN EASY SHAPING	Meas. units	Requirement	Standard
Water absorption capacity	26	21	mg/24 h	≤ 40	SIST EN 263:2009 clause 4.7
Swelling resistance	comply	comply	/	No sign of dissolving or gluing	SIST EN 263:2009 clause 4.6
UV resistance	4/5	4/5	Grey scale	< 3	EN ISO 4892-2:2013
Resistance to hot water	comply	comply	/	No change in colour	SIST EN 263:2009 clause 4.3
Chemical and alkali resistance	comply	comply	/	No change in colour	SIST EN 263:2009 clause 4.4
Resistance to damp and dry friction	comply	comply	/	No changes on the surface	SIST EN 263:2009 clause 4.5
Vicat softening temperature (VST)	105.5	105.3	°C	≥ 105	EN ISO 306 Method B
Rupture strength	70.8	75.7	MPa	≥ 60	ISO 527-1
Thermal stability	comply	comply	/	Without bubbles	SIST EN 263:2009 clause 4.2

Additional properties - SIST EN 263 Sanitary ware - baths and shower trays made of cast acrylic sheets

Appearance of the Aglas SAN cast acrylic sheets:

Aglas SAN cast acrylic sheets have smooth surface without scratches, marks and other visible surface defects. The sheets are protected with one-side thermoformable polyethylene foil.

Each sheet has PVC gasket round the edges. On request we can cut to size.

Allowed mistakes:

On the nice side: In the area of 2 cm from the edge, small dirtiness, other inclusions or chips.

On the back side: defects that have no effect on the appearance on the nice side after thermoforming.

Allowed mistakes should not have any impact on mechanical properties of the sheet.

PROCESSING

Aglas SAN cast acrylic sheets are as other cast acrylic sheets suitable for different kind of treatments.

- thermoforming
- cutting to a relevant size or shape
- laser cutting
- moulding
- milling
- rotating
- drilling
- grinding
- polishing
- adhesion (for example, Novopop)
- Printing/decorating/engraving

Additional technical instructions are available upon request.



THERMOFORMING INSTRUCTIONS

AGLAS SAN

Heating in hot-air ovens

Optimal surface temperatures of acrylic sheets at the start of thermoforming process are between 175 °C and 185 °C. The sheets should be heated as uniformly as possible over the whole thickness of the material. It is useful to control the temperature of the sheet surface by an IR thermometer. We do not recommend using higher temperatures as stated. With overheated material, problems during shaping are more likely to occur. Limitations of using lower temperatures are related to the design and quality of the form.

In practice it is usual (in ovens with intensive circulation of hot air) to reach the corresponding temperature of 4 mm Aglas sheets in 12 – 13 minutes (air temperature 175 °C) or in 11 – 12 minutes (air temperature 180 °C). As the heating of acrylic sheets depends on circulation of the air and uniformness of the temperatures in the oven, it is recommended to check the temperature of the acrylic sheets before choosing a certain temperature cycle.

Heating with the IR heaters

With this kind of heating it is recommended again that the acrylic sheet surface is heated to 175 °C – 185 °C for the best thermoforming results. Thermoforming by

automatic machines with IR heaters means there are higher temperature differences across the sheet than by thermoforming sheets that were previously heated in an air oven. These differences may be higher than 10 °C. Some parts of the sheets (for instance bathtub bottom) may be heated to less than 165 °C. Heating too much over 185 °C is not recommended, even for critical parts of bathtubs.

As there are various different IR heaters (depending heat power and the depth of heating) and a lot of different combinations of set-up of the heaters, it is not possible to advice an exact optimum "recipe" for heating with this type of thermoforming machines.

Optimal heating combinations can be found after a series of tests, considering advice of the producer of the machine.



AGLAS SAN EASY SHAPING

Heating in hot-air ovens

Optimal surface temperatures of acrylic sheets at the start of thermoforming process are between 155 °C and 165 °C. The sheets should be heated as uniformly as possible over the whole thickness of the material. It is useful to control the temperature of the sheet surface by an IR thermometer. We do not recommend using higher temperatures as stated. With overheated material, problems during shaping are more likely to occur. Limitations of using lower temperatures are related to the design and quality of the form.

In practice it is usual (in ovens with intensive circulation of hot air) to reach the corresponding temperature of 4 mm Aglas SAN easy shaping heets in 10 – 11 minutes (air temperature 175 °C) or in 9 – 10 minutes (air

temperature 180 °C). As the heating of acrylic sheets depends on circulation of the air and uniformness of the temperatures in the oven, it is recommended to check the temperature of the acrylic sheets before choosing a certain temperature cycle.

Heating with the IR heaters

Whit this kind of heating it is recommended again that the acrylic sheet surface is heated to 155 °C – 165 °C for the best thermoforming results. Thermoforming by automatic machines with IR heaters means there are higher temperature differences across the sheet than by thermoforming sheets that were previously heated in an air oven. These differences may be higher than 10 °C. Some parts of the sheets (for instance bathtub bottom) may be heated to less than 155 °C. Heating too much over 165 °C is not recommended, even for critical parts of bathtubs.

As there are various different IR heaters (regarding heat power and the depth of heating) and as there are lot of different combinations of set-up of the heaters, it is not possible to advice an exact optimum “recipe” for heating with this type of thermoforming machines.

Optimal heating combinations can be found after a series of tests, considering advice of the producer of the machine.



GENERAL ADVICE for thermoforming

Generally it is advised to:

- avoid overheating of the acrylic,
- use heating cycles with minimal necessary heat input,
- control temperatures on acrylic surface before forming by IR thermometer,
- reduce heating times rather than surface temperatures of heaters.

Cooling of the formed elements is an important factor. Cooling conditions shall be maintained in such a way that the surface of the product is cooled all over, particularly, for clamping system. In such a manner the internal stress of the material, which occur during the treatment, is released. After forming, the product is cooled to a temperature 60 °C, so that the resulting form is saved. This is to prevent a breakage or a deformation of the model after its extraction from the mould.

Fibres from the clothes, which remain on the surface of the sheets may sublime through the protective layer of sheets during thermoforming, causing unremovable stains on the sheets. We recommend that you wear light (white, grey) cotton protective uniforms.

When sliding one sheet over the other, the edges may cause damage to the protective polyethylene layer. Let at least two persons move the sheets when handling, or use the manipulator.

Optimising thermoforming conditions of sanitary grade acrylic sheets depends on the thermoforming equipment. Multiple tests are required to achieve optimal results, Akripol can provide sheets for testing.

Tolerances by thermoforming process:

Gloss after forming: min 87 GU (measuring angle 60°). Smaller value means a hidden defect.

Voids or impurities in the acrylic can cause rupture during forming. If these defects are found in ruptured acrylic, rupture is considered as a hidden defect.

Thermoforming trouble shooting guide for fiber glassing problem

PROBLEM	CAUSE	SOLUTION
Cracking and swelling.	Air bubble between the acrylic and polyester resin. High temperature of the resin in polymerization.	Use multiple thin layers of fiberglass. Remove trapped air by rolling out layers. Use suitable polyester resin for each season. Adjust the catalyst concentration.
Bad mixing of resin and fiberglass.	Shortage of polyester resin. Viscosity of the resin too high. Wrong type of glass roving.	Adjust the concentration of fiberglass against resin to 20–35 %. Select a fiberglass treated with a silane that is compatible with the polyester resin. Adjust the viscosity of the resin.
Insufficient polymerization.	Concentration of catalyst too low. Atmospheric temperature too low.	Increase catalyst concentration. Raise and control atmospheric temperature.
Pits or pimples.	Vacuum holes too large. Vacuum rate too high. Dirt or mold or sheet.	Use smaller holes. Decrease vacuum rate or level. Clean mold and/or sheet.
Mark-off.	Dirt on sheet. Dirt on mold. Dirt in atmosphere.	Clean sheet. Clean mold. Clean vacuum forming area. Isolate area if necessary and supply filtered air. Reduce heat and heat more slowly.
Distortion in finished part.	Part removed too hot. Uneven heating. Mold design.	Increase cooling before removing part. Check temperature profile. Correct mold design-stiffen to eliminate.
Tearing of part	Mold design. Sheet too hot.	Increase radius of corner. Decrease heating time or temperature.
Bridging	Mold design. Sheet too hot.	Add take-up blocks to pull out wrinkles. Reduce time heaters, heating temperature, or reduce voltage. Move heater further away. Use screening if localized.
Poor definition of detail.	Sheet too hot.	Increase heat input to sheet
Incomplete forming.	Low vacuum. Low air pressure.	Check for leaks in vacuum system. Increase number and/or size of vacuum holes. Add vacuum capacity, increase volume and/or pressure.
Extreme wall thickness.	Uneven sheet heating. Mold too cold. Sheet slipping. Stray air currents.	Check temperature profile. Change heaters to provide higher uniform mold surface temperature Check cooling system for scale or plugs. Adjust clamping frame to provide uniform pressures. Provide protection to eliminate drafts.
Excessive sag.	Sheet too hot.	Reduce time or temperature
Part sticking to mold.	Rough mold surface. Undercuts too deep. Not enough draft.	Reduce time or temperature. Polish mold Reduce undercut. Increase draft of mold.

CHEMICAL RESISTANCE

CHEMICAL	no attack	limited attack	strong attack
Acetic acid, 10 %		*	
Acetic acid (glacial)			*
Acetone			*
Amyl acetate			*
Ammonium chloride	*		
Ammonium hydroxide	*		
Aniline		*	
Benzene			*
Calcium chloride			*
Carbon tetrachloride		*	
Chloroform			*
Chromic acid, 10 %		*	
Chromic acid (conc.)			*
Cyclohexane			*
Dibutyl phthalate			*
Diethyl ether			*
Dimethyl formamide			*
Diethyl phthalate		*	
Ethyl acetate			*
Ethyl alcohol, 10 %	*		
Ethyl alcohol, 30 %		*	
Ethyl alcohol, 95 %			*
Ethylene dichloride			*
Ethylene glycol	*		
Formic acid			*
Gasoline		*	
Glycerin	*		
Hexane	*		
Hydrochloric acid, 20 %	*		
Hydrofluoric acid			*
Hydrogen peroxide, 3 %	*		
Isooctane	*		
Isopropyl alcohol		*	
Kerosene	*		
Lacquer thinner			*
Lanoline	*		
Methyl acetate			*
Methyl alcohol, 10 %	*		
Methyl alcohol, 30 %		*	

CHEMICAL	no attack	limited attack	strong attack
Methyl alcohol, 100 %			*
Methyl ethyl ketone			*
Methylene chloride			*
Mineral acids (conc.)			*
Nitric acid, 10 %	*		
Nitric acid, 100 %			*
N-I-heptane	*		
Oils (Diesel, Mineral, Olive)	*		
Phenol, 5 %			*
Potassium hydroxide	*		
Sodium carbonate	*		
Sodium chloride	*		
Sodium hydroxide, 10 %	*		
Sodium hydroxide, 50 %	*		
Sodium hypochlorite	*		
Sulfuric acid, 3 %	*		
Sulfuric acid (conc.)			*
Tetrahydrofurane		*	
Toluene			*
Trichloroethylene			*
Turpentine	*		
Water (distilled)	*		
Xylene			*

* NO ATTACK: Acrylic material is inert to chemical.

** LIMITED ATTACK: Chemical can cause permanent coloring or crazing.

*** STRONG ATTACK: Chemical causes dissolving of acrylic material.

PROTECTION AND PACKAGING

Standard protection for AGLAS SAN is a clear thermoformable PE film (several types are available) on the top face of the sheet, other side is not protected. Sheets are packed on wooden pallets protected with multiwall polystyrene on the bottom and on the top of the pallet. Edges of the palette load are protected by cardboard and wrapped with PE stretch foil, secured by plastic belts.

Each pallet has its own batch number, they are equipped with data about the goods (colour, thickness, dimension, quantity) on the pallet and shipment (address of receiver, date and order number). The maximum number of sheets per pallet is proportional to the sheet weight. Allowed weight limit is 1000 kg.

HOW TO STORE AND HANDLE THE SHEETS

An incorrect storage position can lead to permanent deformation. Sheets must be stored in a dry place away from direct sunlight, rain, high humidity and temperature as it can have a negative effect on protective PE film adhesion. When only a few sheets have been used, make sure that the rest are repacked. If sheets are stored for longer period of time in a humid place foil can cause trouble by thermoforming and damages on end product.

If possible, sheets should be handled with clean leather gloves due to sharp edges. Do not wear fluffy, brightly coloured clothes, as the sheets could be polluted by them, causing stains or marks after thermoforming. We advise to wear white or grey cotton overalls when working with Aglas SAN sheets.

Do not move sheets causing them to slide past each other, as that could damage PE protective film causing marks after thermoforming.

QUALITY CONTROL

Akripol's quality control department performs quality control of all incoming raw materials used in the production. Quality assurance and control is our main concern, so our production process, thermal and mechanical properties of our products are daily tested according to certified QA system. We offer technical support with testing our sheets and fast response times for claims resolution.

MAINTENANCE AND CLEANING

Small accidental scratches can be removed by polishing. If the damage is extensive, Akripol supplies repair kits in the desired colour. These are used to repair the material on the damaged spot.

Use only water and non-aggressive agents and water (alkaline solution pH < 12), 3 % phosphorus acid or usual detergents for cleaning. Due to the surface scratch sensitivity do not use abrasive cleaning sponges. Do not use aerosol cleaners (e.g. window cleaners), aggressive kitchen cleaners, solvents with benzene, alcohol, carbon tetrachloride and solvent for paints, as well as gasoline. These agents will cause irreversible damage to the surface.

REPAIR SETS

Repair sets can be ordered for all colours in Akripol colour range. Contact Akripol sales office for minimum ordered quantity and availability. Acrylic Repair set is packed in plastic tin can (20 g) together with accelerator N in a carton box!

They must be mixed and used according to the instructions available in the box. Please note that the delivery is exclusively combined with the delivery of Akripol sheet.



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Certificates:

- EN ISO 7823-1
- EN 263



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