FABRICATION GUIDE

Astari Niagara INTERNASIONAL, pt
CAST ACRYLIC SHEET MANUFACTURER

INTRODUCTION

Astariglas® acrylic sheet has unique physical properties and performance characteristics. Its weight is half that of glass but with 10 times the impact strength yet has equal clarity. It can be worked as easily as timber, can be formed into endless interesting and functional shapes, is resistant to chemicals and industrial fumes and remains stable under sustained exposure to the elements. Astariglas® acrylic sheet is made in over 300 colors and in thicknesses from 1.5 - 50 mm. Because of its light and energy transmission properties architects find Astariglas® acrylic sheet ideal for skylights, sun screens, fascia panels and dome structures. It is a favorite medium of furniture designers and sculptors. Retailers show off their merchandise in displays made from Astariglas® acrylic sheet and sign makers depend on its durability and outdoor weathering properties. Its impact resistance and high light transmission properties makes Astariglas® acrylic sheet an outstanding glazing material. It is used in home furnishings, lighting fixtures, safety equipment, decorating panels, office partitions and appliances of all kinds. And it is a favorite material of the do-it-yourself hobbyist.

CHARACTERISTICS:

Weatherability: Astariglas® acrylic sheet has exceptional weathering characteristics. Clear sheet has a 10 year warranty against yellowing and most colors are suitable for outdoor use.

EXPANSION AND CONTRACTION:

Like most plastics, Astariglas® acrylic sheet responds to temperature changes by expanding or contracting at a far greater rate than glass. When used for outdoor glazing cut the sheet approximately 5 mm per running meter shorter than the frame size.

FLEXIBILITY:

Astariglas® acrylic sheet is much more flexible than glass or many other building materials. When using large sheets for windows, it is important that rabbets or channels be deep enough to provide support against high winds.

CHEMICAL RESISTANCE:

Astariglas® acrylic sheet has excellent resistance to attack by many chemicals but is affected in varying degrees, by benzene, toluene, carbon tetrachloride, methyl alcohol, lacquer thinners, ethers, ketones, esters and other solvents.

ELECTRICAL PROPERTIES:

Astariglas® acrylic sheet is an excellent electrical insulator. Its surface resistivity is higher than that of most plastics. Continuous outdoor exposure has little effect on its electrical properties.

LIGHT TRANSMISSION:

Colorless Astariglas® acrylic sheet has a light transmittance of 92%. It is clearer than window glass and will resist yellowing. Translucent white Astariglas® acrylic sheet diffuses light and is excellent for all types of lighting fixtures and signs. Astariglas® acrylic sheet is available in a large variety of transparent and translucent colors.

FIRE PRECAUTIONS:
All acrylic sheet is combustible. Self-ignition temperatures range from 440-460°C. Protect it from flames and high heat.

CLEANING:

Wash Astariglas® acrylic sheet with a mild soap or detergent and plenty of lukewarm water. Use a clean soft cloth, applying only light pressure. Rinse with clear water and dry by blotting with a damp cloth or chamois. Grease, oil or tar may be removed with a good grade of hexane, aliphatic naphtha, or kerosene. These solvents may be obtained at a paint or hardware store and should be used in accordance with manufacturers' recommendations. Any residue left behind by solvents should be removed immediately by washing.

DO NOT USE: Window cleaning sprays, kitchen scouring compounds, or solvents such as acetone, gasoline, benzene, carbon tetrachloride or lacquer thinner. Static electricity can attract dust to Astariglas™ acrylic sheet. To reduce it, use an anti-static cleaner.

MASKING:

Paper masking: Astariglas® acrylic sheet comes covered on both sides with a low-tack masking paper. It is also available with polyethylene film . The masking protects the sheet from scratching during storage and handling. Be sure to leave the masking in place during all phases of fabrication and installation. Except for intricate detail work, you should remove the masking only when project is completed. You can remove the masking paper with a cardboard tube -- rolling the paper around it. All paper masked Astariglas® acrylic sheet should be kept away from heat, sunlight and water.

IMPORTANT DO'S AND DON'TS

Do's:

* Keep the masking on as long as possible through fabrication operations.
* Always wear safety glasses when working with power tools.
* Use metal-cutting saw blades and drills which are ground for acrylic sheet.
* Make certain all your tools are sharp.
*Use water or an appropriate drilling oil as a coolant for the drills and blades when cutting sheets over 3 mm thick or drilling sheets over 5 mm thick.
* Use the proper thicknesses for glazing blanks.
* Allow 5 mm per linear meter for expansion in glazing applications.
* Ask PT. Astari Niagara Internasional for detailed information.

Don'ts:

*Do not store Astariglas® acrylic sheet near radiators' steam pipes or in direct sunlight.
* Don't remove the masking until all work is finished.
* Don't install large sheet with bolts. Frame them.
* Don't mark with a punch marker.
* Don't use saw blades having side-set teeth. Saw teeth ideally should be ground with zero degrees rake and be of uniform height and shape.
* Don't bring the material in direct contact with heaters.
* Don't subject sheet to high surface temperatures during polishing.
* Don't use glass-cleaning sprays, scouring compounds or solvents like acetone, gasoline, benzene, carbon tetrachloride, or lacquer thinner on acrylic sheet.
* Don't heat Astariglas® acrylic sheet in a kitchen oven.
* In hot weather, don't store masked acrylic sheet in direct sunlight

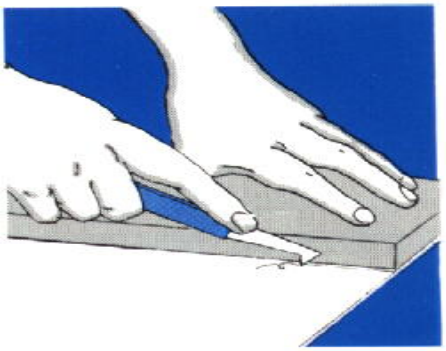
CUTTING:

Astariglas® acrylic sheet can be cut, drilled, scraped, engraved and machined with conventional equipments and techniques. However, in order to prevent excessive heat accumulation it is recommendable to put wax paper or polyethylene film in between the sheet and always blow off swarf and dust when cutting or drilling stacked sheets. For cutting, circular saws, belt saws, scroll saws, jig saws, routers or laser beds are used.

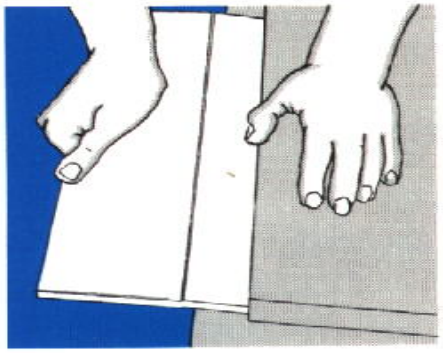
1. CUTTING WITH KNIFE OR SCRIBE:

Astariglas® acrylic sheet up to 3 mm thick may be cut by a method similar to that used for cutting window glass. Use a scribe of some kind -- a scribing knife, a metal scribe, an awl, or even a sturdy craft knife -- to score the sheet.

Draw the scriber several times (7 or 8 times for a 5 mm thick piece) along a straight edge held firmly in place. It is best not to remove the protective masking. Make the cuts carefully using firm, even pressure. For best results make each stroke cleanly off the edge of the sheet. Then, clamp the Astariglas® acrylic sheet or hold it rigidly under a straight edge with the scribe mark facing up and hanging just over the edge of a table. Protect your hands with a cloth, and apply a sharp downward pressure to the top side of the sheet. It will break along the scratch. Scrape the edges to smooth any sharp corners. This method is not recommended for long breaks or thick material.



Always draw the scribing knife along a straight edge.

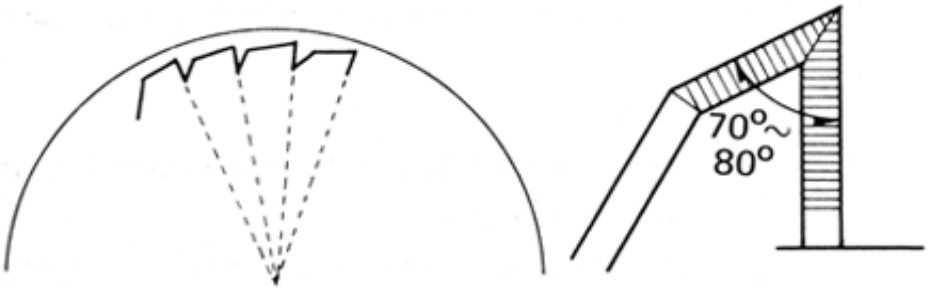


Break sheet over edge of table after scribing.

2. CIRCULAR SAW CUTTING:

In general saw blades should run at high speeds and be sharp. For general purpose use they should have the largest number of teeth possible and be carbon tipped.

Opening	150~350mm
	opening should be larger as the thickness of sheet increases.
Trimming width	2.6~3.0mm
Teeth	Minimum 2 unset/ cm
Operating r.p.m.	3,000~5,000 r.p.m.
Saw speed	2,400~3,600 m/ min.
Feeding rate	3~7 m/ min.
	if too fast, chipping on the cut edge can result.



3. BELT SAW CUTTING:

Used for moderate curves and trimming of molded product. Compared with circular saws the condition of cut end and cutting speed is not as good. The following conditions are given below.

Thickness mm	Teeth per cm	Saw Speed m/min.
1.5~3	6	1,500
4~10	4	1,000
13~30	3	700

4. CUTTING WITH SCROLL SAW:

The number of teeth for a rough-teeth saw is determined according to the thickness of the sheet, e.g. 2mm --> 6/ cm, 5 mm --> 4/ cm, 10mm --> 3/ cm.

5. JIG-SAW CUTTING:

The machine itself is compact and portable, with an advantage of easy curve cutting but cut end is a bit rough and may necessitate finishing.

6. ROUTER CUTTING:

This is used for trimming, curve cutting, cut outs and for processing of taper edge. Compared with scroll saw and jig-saw, it is efficient for fine-cutting. When cutting larger amounts of the same shaped products, NC-automatic routers are available.

7. LASER CUTTING:

Equipment is expensive but precise finding application for repetitive detailed work requiring a good edge finish.. Inner stress is generated near the cut area, which can cause cracking when cemented.

DRILLING:

Astariglas® acrylic sheet may be drilled A stationary drill press is the preferred tool because it gives better control and greater accuracy. But a drill press won't be applicable in all instances, and with a little care, proper technique, and a correctly-ground drill bit, you can get good results with an ordinary hand drill.

For best results use drills designed specifically for acrylics. Regular twist drills can be used, but the cutting edges must be modified to prevent the blade from grabbing and fracturing the plastic. Astariglas® acrylic sheet is relatively soft. Your drill should have an edge that cuts with a scraping action. To obtain this, you can modify your drill bit by grinding small "flats" onto both cutting edges with a medium or fine-grit grinding wheel, or a pocket stone. The flats can be parallel to the length of the drill and about 0.8 mm wide. Tip angle should be between 60 and 90°. For the best possible finish inside the hole, use a drill with smooth, polished, slow-spiral flutes which will clear the hole of all shavings without marring or burning the walls. If the drill is correctly sharpened and operated at proper speed, two continuous spiral chips or ribbons will emerge from the hole. When drilling a hole three times deeper than the diameter of the drill, a lubricant or coolant should be used. This will help remove chips, dissipate heat, and improve the finish of the hole. Rough, irregular, or fuzzy holes can lead to cracking and breaking months after the piece has been completed.

FINISHING:

SCRAPING:
If it is necessary to smooth and square the edge of the sheet which has been cut you can do this by a number of different techniques, depending on the finish desired. The first step, and perhaps easiest technique, is scraping. A scraper can be almost any piece of metal with a sharp, flat edge. The back of a hacksaw blade, the back of a knife blade, or a tool steel blank are ideal. Whatever tool you use must have a sharp, square edge.

FILING:

It is easy to file Astariglas® acrylic sheet to a surface ready for final polishing. The filing, however, must be done correctly and carefully. Almost any commercial file can be used. But the quality of the finish will depend on your choice of file coarseness. A 5 cm smooth-cut file is recommended for filing edges. File in only one direction. Keep the teeth flat on the surface of the sheet, but let the file slide at an angle to prevent the teeth from cutting unwanted grooves in your work. Always keep your files clean and sharp. Wire brush them often to prevent the teeth from filling up. And don't use your acrylic files for working metal or other materials that might dull the teeth. For small work, try clamping the file in a vise and rubbing your work across the file.

SANDING:

Before Astariglas® acrylic sheet is ready to be polished, it should be sanded to a smooth, satin finish. As with filing, the quality of the final finish will depend on the grades of sandpaper used. The finer the final grit, the smoother the finish. It will usually take at least three steps to get a good finish. If there are scratches deep enough to require it, start with coarse grit No. 60 sandpaper. Use it dry. When the original scratches are completely removed, sand with a medium grit paper - 220 is good - to remove the scratches from the coarse paper. Use the medium grit paper dry as well. Finally, sand to a satin finish with a fine grit, wet-or-dry No. 400 paper. Fine grit paper should always be used wet to keep the paper from clogging and obtain a smoother finish. Rinse the paper frequently. Grits as fine as 600 may be used. Always wipe your work clean when changing to a finer grit. Be sure all deep scratches have been removed .

Sanding by Hand: Hand sanding Astariglas® acrylic sheet is very much like hand sanding wood. Most of the same techniques apply. But sanding acrylic must be done with far greater care. You should always use a timber sanding block. When removing scratches, be sure to sand an area that is slightly larger than the scratch. This will help prevent low spots. Sand with a circular motion. Use light pressure and plenty of water with wet-or-dry papers. As you get the feel of working with Astariglas™ acrylic sheet, your own observations and experience will be your best guide to determining how coarse a grade to start with on each particular job and how many different grades will be needed to do the job most efficiently. Don't be afraid to experiment with different sanding techniques and different types of blocks. You'll learn a lot of new tricks -- perhaps the very one you'll need to help solve your next problem.

Sanding with power sanders: Almost any commercial power sander can be used. Naturally, different types of sanders are preferred for different operations. As a basic rule, use them as you do when sanding wood. They should, however, be operated with lower pressure, and at slower speeds. Experiment on scrap pieces. All wet- or-dry machine sanding should be done wet especially with grit sizes of 150 or finer.

POLISHING:

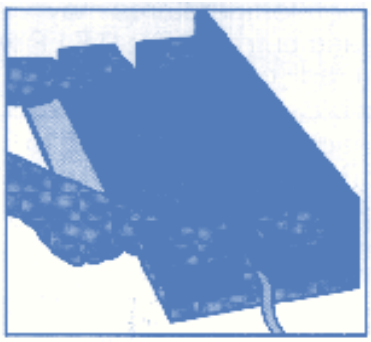
The original high luster of Astariglas® acrylic sheet can be restored to the edges and surfaces by polishing with a power driven buffer. It is quite possible to polish Astariglas® acrylic sheet by hand using a soft cloth and a very fine abrasive. But hand buffing is an extremely tedious process. Power-driven buffing tools are recommended almost without exception. Because inexpensive buffing wheels are available as an attachment for any electric drill, equipment should not be a problem.
A good buffing wheel for Astariglas® acrylic sheet will consist of layers of 5 mm carbonized felt or layers of unbleached muslin laid together to form a wheel between 2 and 7mm thick. The larger the wheel the better. Caution: Don't use one too large for your equipment. The wheel should reach a surface speed of at least 40 metres per minute. Solidly stitched wheels with rows of concentric stitching should be avoided. They are often too hard and may burn the acrylic. Never use a wheel that has been used to polish metal. Traces of the metal may remain to scratch the Astariglas™ acrylic sheet. Use a commercial buffing compound of the type used for polishing softer metals such as silver or brass. Or you can use a non-silicone car polish that has no cleaning solvents in it. First, however, tallow should be applied to the wheel as a base for the buffing compound. Just touch the tallow stick to the spinning wheel. Then, quickly apply buffing compound. To polish, move the piece back and forth across the wheel until you get a smooth, even polish. Be careful not to apply too much pressure. Keeping the work constantly moving across the wheel will help prevent heat buildup which can mar the surface by burning or smearing. It also prevents overheating that will later develop into stress. Always wear safety glasses and be extremely careful. Begin polishing approximately one-third of the way down the sheet, and keep moving it back and forth until you've reached the bottom edge. Then turn the sheet around and repeat the process on the other half.

FORMING:

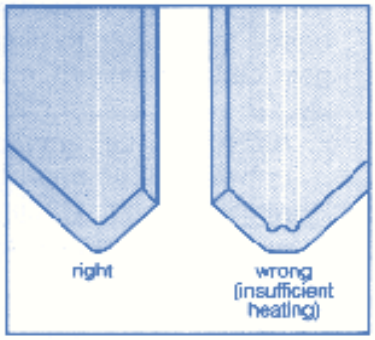
When heated in the range 140-165°C Astariglas® acrylic sheet becomes soft and pliable, almost like a sheet of flexible rubber. It may then be formed into almost any shape. As the sheet cools, it hardens and retains the formed shape, provided it has been held in place during the cooling process. Do not exceed 185°C for more than one hour. Excessively high temperatures may cause the sheets to blister and burn.

FORMING WITH A STRIP HEATER:

A strip heater, heats only the area to be formed -- there's no need to heat the entire sheet if you only intend to make a straight line bend. It heats quickly. And with a little care you'll get excellent results, because the rest of the piece stays cool. First, remove the masking paper from the line of the bend. The rest of the masking paper should be left in place to protect the unheated area. Then, lay the sheet on the heater with the bend line directly above the exposed heating element so that the bend will be made away from the heated side. The length of heating time will vary according to the thickness of the sheet. Astariglas® acrylic sheet thicker than 5 mm should be heated on both sides for a proper bend. Heat the sheet until it begins to sag at the bend line. Don't try to bend the sheet before it is fully heated, or after it has partially cooled. This will result in irregular and creased corners and high internal stress. Heat the bend line very carefully. Uneven heating can cause bowing along the line of the bend. Sometimes this is difficult to avoid -- especially with pieces over 60 cm long. Bowing can be minimized, however, by holding the just-formed material in a clamp or jig until it has cooled. Forming jigs and clamps should be used for best results. They can be very simply made of wood and used over and over. Make preformed jigs for certain angles or even special shapes for individual projects. Variable angle jigs can be made with two pieces of wood hinged together and held at the desired angle with a variable brace. Felt, flannel, or flocked rubber should be used to line any surfaces that may come into contact with the heated acrylic. Wear heavy cotton gloves when handling heated Astariglas™ acrylic sheet. They'll protect your hands, as well as the sheet. The area either side of the strip heater can be cooled with cold water running through piping and that will result in a sharp bend.



Heating acrylic sheet with a strip heater.



Correct and incorrect bends.

Astariglas® acrylic sheet may be formed into almost any shape. But specialized heating and forming equipment is usually required for all but the simplest projects. And while many of the forms and jigs required for two and three dimensional forming can be easily made out of wood in the home shop, such projects are beyond the scope of this document. However, many excellent books are available covering all types of acrylics forming. They deal with techniques such as drape forming, plug and ring forming, surface molding, blow and vacuum forming, and even the design, construction, and use of ovens for heating acrylic sheet.

JOINING:

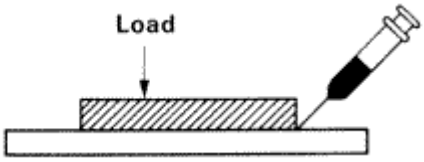
Astariglas® acrylic sheet can be joined with solvent cements to form strong, durable, transparent joints. But the ultimate strength and appearance of your joints will depend on how carefully you make them. Getting really good joints requires a lot of care and considerable skill. Practice on scrap pieces. The more experience you have, the better your work will be.
Observe these basic precautions when working with acrylic solvents:

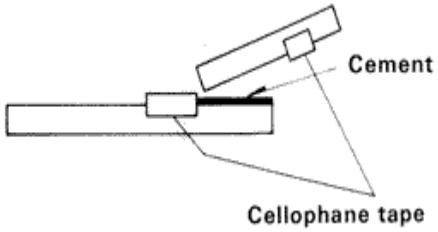
* Always work in a well-ventilated area.
* Do not smoke -- solvents are highly volatile and may be flammable.
* Protect skin from contact with cement and solvents.
* Do not attempt to cement Astariglas® acrylic sheet in temperatures under 15° C.
Temperatures from 20° to 25°C are ideal.
•Always follow the cement manufacturer's recommendations.
•Always wear goggles for complete eye protection.

CAPILLARY CEMENTING:

Capillary cementing is probably the most popular method of joining Astariglas™ acrylic sheet. It works because of the ability of a low-viscosity solvent-type cement to flow through a joint area by capillary action. Properly done, it yields strong, perfectly transparent joints. But capillary cementing won't work at all if the parts do not fit together perfectly. We can recommend the ones that are best for your particular projects. First make sure the parts fit together properly. Then join the pieces together with masking tape. Or clamp them to a form that will support the pieces and hold them firmly in place. It is important that the joint be kept in a horizontal plane, or the cement will run out of the joint. Apply the cement carefully along the entire joint. Apply it from the inside edge, whenever possible on a box-corner type joint, and from both sides, if possible, on a flat piece. If the cement does not flow completely into the joint, try tilting the vertical piece very slightly (about 2 cm) towards the outside. This should allow the solvent to flow freely into the entire joint. Always let the joint dry thoroughly before removing tape or clamps. Maximum bond strength will not be reached for 24 to 48 hours.

Horizontal Cementing:

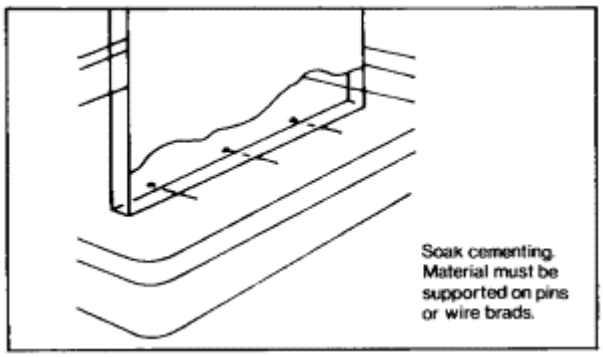




DIP OR SOAK CEMENTING:

This method of cementing Astariglas® acrylic sheet involves dipping the edge of one of the pieces to be joined directly into the solvent. It is very important that only the very edge be dipped. Exposing too much area to the solvent will result in a weak, slow-setting point. You'll need a shallow tray in which to dip the acrylic. The tray can be made of aluminum, stainless steel, galvanized steel, or glass. Do not use plastic, the solvent may dissolve it. Place short pieces of wire, pins, or brads into the tray to keep the edge of the Astariglas® acrylic sheet from touching the bottom of the tray. The tray must be almost perfectly level. Pour solvent cement into the tray so that it just covers all the brads and covers them evenly. Now, carefully place the edge to be cemented into the tray so that it rests on the brads. You can hold the piece upright by hand, but it is better to use some kind of support to hold the piece in place while it soaks. A couple of padded clamps attached to the sheet, and resting on the edge of the tray are fine. Heavy pieces of wood placed against each side of the sheet will also work. Slotted wooden supports are usually used for production work, but anything that will hold the piece firmly upright is sufficient. The Astariglas® acrylic sheet should be left in the solvent from 1 to 2 minutes, depending on the thickness of the sheet, the type of solvent used, and the bond strength required. Soaking time should be long enough to allow the edge of the sheet to swell into a "cushion" As soon as an adequate cushion is formed, the piece must be removed. Hold it for a few seconds at a slight angle to allow the excess solvent to drain off. Then carefully, but quickly, place the soaked edge precisely into place on the other part to be joined. Hold the parts together for about 30 seconds without applying any pressure. This will allow the solvent to work on the surface of the other piece. After 30 seconds you can apply some pressure to squeeze out any air bubbles. But be very careful not to squeeze out the cement. When the pieces are joined, the part should be placed in a jig or clamp to maintain firm contact for 10 to 30 minutes. Do not allow the parts to move during this critical time. Allow the joint to set for another 8 to 24 hours before doing any further work on it.

.



VISCOUS CEMENTING:

Viscous cements are used to cement joints that can't be easily cemented by capillary or soak solvent methods -- either because they are difficult to reach, or because the parts don't fit properly together. Viscous cement is thick. It will fill small gaps, and can make strong, transparent joints where solvent cements can't. You can make your own viscous cement by dissolving chips of clear Astariglas® acrylic sheet in a small amount of solvent. Let the solution stand overnight.

Remove the masking material from around the joint area, and carefully apply a small bead of cement to one side of the joint. Then gently join the pieces as described under "Soak Cementing" Masking tape may be applied to protect the area around the joint. But it should be removed carefully after about 5 minutes, while the cement is still wet. Don't touch the parts at all for the first critical 3 minutes, or the joint will not hold. The part may be carefully moved after 10 minutes, but don't do any additional work on it for 12 to 24 hours.

POLYMERIZABLE CEMENTING:

Superior joints are achieved using polymerizable, or "two part" cements. These cements must be mixed prior to use and must be used immediately, as they "set up", or harden.

TROUBLESHOOTING (CEMENTING):

Problem	Cause	Solution
Bubbles in Joint	Uneven surface	Check joint preparation for squareness
		Use viscous cement
Crazing	Stresses in material	Use water cooling when sanding, etc.
		Anneal head bent areas
		Dry before flame polishing
		Use proper ventilation when cementing
Whitening of joint	Water in the cement	Replace cement
(solvent cement)	Fast evaporation of cement	Reduce evaporation rate by adding *glacial acetic acid (1-3%)
Weak joints	Uneven surface	Check joint preparation for squareness
		Use viscous cement
	Cement problem	Check cement storage methods. Solvent evaporation can change cement properties.

*Do not allow glacial acetic acid to contact the skin or severe burning will result.

GLAZING:

Astariglas® acrylic sheet is lighter, more transparent, and far more break resistant than glass. Thus glazing with Astariglas® acrylic sheet is safe and easy. Important: Astariglas® acrylic sheet expands and contracts at a much greater rate than glass. To compensate, remember to allow approximately 5 mm per running meter shorter than your frame size. The sheet thickness you need depends on the size of your window. For windows smaller than 60 cm, use an elastic glazing compound which is compatible with acrylic sheet. For windows over 60 cm: it is important that you select the proper rebate depth to allow for expansion and contraction.

Sheet size ----------Rabbet depth
Up to 60 x 90 cm ---------13 to 16 mm
Up to 90 x 120 cm--------16 to 19 mm
Up to 120 x 180 cm-------19 to 25 mm

Use a continuous removable stop, and caulk with a polysulfide sealant or butyl tape. If it is necessary to bolt a small panel to a frame, drill mounting holes larger than the diameter of the bolts or screws. Use round-head screws with rubber EPDM against the Astariglas® acrylic sheet and stainless steel washers against the screw head. After tightening, back off 13 mm turn. Do not use counter-sunk, flat-head screws. They will fracture the acrylic sheet.

FIRE PRECAUTIONS:

Astariglas® acrylic sheet should be protected from flames and high heat because it is a combustible material. The products of combustion are carbon dioxide and water if sufficient air is present. If not, toxic carbon monoxide will be formed. Users should follow building codes and exercise good judgment in the use of this material. Access panels may be required for evacuation of areas glazed with Astariglas™ acrylic sheet. The combustibility properties of Astariglas® acrylic sheet are described as follows - Self Ignition Temperature by ASTM D 1929 for Astariglas® acrylic sheet is 860° F. Rate of burning 1/8" thickness as measured by ASTM D 635 is 1.0 inches per minute.

Smoke density as measured by ASTM D 2843 is 3% to 15%. While this text data is based on small-scale laboratory tests frequently referenced in various building codes, these tests do not duplicate actual fire conditions .

ANNEALING:

Annealing is the process of relieving stresses in molded or formed plastics by heating to a predetermined temperature, maintaining this temperature for a set period of time, and slowly cooling the part.

The following procedure can be used:

1. Place the parts in an air-circulating oven

2. Raise the temperature at 18 degrees C per hour to 90 Deg C

3. Annealing time in hours is 1/3 x sheet thickness mm

4. Cool at a rate of not more than 12 Deg C per hour

Chemical Resistance

Reagent	Change in appearance
Acetone	Dissolved
Aniline	Dissolved
Aluminium chloride	None
Aluminium oxalate	None
Aluminium sulphate	None
Amonia	None
Aniline	Dissolved
Arsenic	None
Benzene	Dissolved
Bromine	Dissolved
Calcium chloride	None
iso-Octane	None
Ethyl Alcohol (<95%)	None
Ethyl Alcohol (<50%)	None
2-ethylhexylsebacate	None
Hydrochloric acid (s.g. 1.19)	Orange Peel
Hydrochloric acid (<10%)	None
Sodium chloride (<10%)	None
Oleic acid	None
Olive oil	None
Hydrogen peroxide (<28%)	None
Hydrogen peroxide (<3%)	None
Citric acid (<10%)	None
Chromic acid (40%)	Rough surface and yellowish, discoloring
Mineral oil	None
Acetic acid (<5%)	None
Acetic acid (s.g. 1.05)	Dissolved
Ethyl acetate	Dissolved
Carbon tetrachloride	Whitening
Nitric acid(s.g. 1.42)	Dissolved
Sodium hypochlorite	None
Diethyl ether	Crazing
Diemethyl formamide	Dissolved
Ammonium hydroxide(s.g. 0.9)	None
Ammonium hydroxide (10%)	None
Soap aqua solution(1%)	None
Turpentine	None
Toluene	Dissolved
Kerosene	None
Ethylene dichloride	Dissolved
Hydrofluoric acid (<40%)	Swollen,whitening
n-Heptane	None
Phenol	Dissolved
Phenolic solution (<5%)	Swollen slightly

Reagent	Change in appearance
Glycol	None
Heptane	None
Hexane	None
Iodine	None
Magnesium sulphate	None
Magnesium chloride	None
Manganese sulphate	None
Mercury	None
Methanol, absolute	Dissolved
Methyl Ethyl Keton	Dissolved
Milk of Lime	None
Monobromonaphthalene	None
Nickel sulphate	None
Nitric Acid (<20%)	None
Nitric Acid (20-70%)	Slightly dissolved
Nitric Acid (>70%)	Dissolved
Oxalic acid	None
Perchloroethylen	Dissolved
Petroleum ether	None
Potassium carbonate	None
Potassium chloride	None
Potassium cyanide	None
Potassium dichromate	None
Potassium hidroxide	None
Potassium nitrate	None
Potassium permanganate	None
Silver nitrate	None
Soap solution	None
Soda	None
Sodium bisulphite	None
Sulphur	None
Sulphuric acid (<30%)	None
Tartaric acid	None
Thionyl chloride	None
Xilene	Dissolved
Ferric chloride	None
Ferrous chloride	None
Ferrous sulphate	None
Glycerol	None
Sodium hydroxide (<48%)	None
Sodium hydroxide (<10%)	None
Sodium hydroxide (1%)	None
Sodium carbonate(20%)	None
Sodium carbonate(2%)	None

IMPORTANT NOTICE:

The information and statements herein are believed reliable but are not to be construed as a warranty or representation for which AN or ASTARI NIAGARA INTERNASIONAL assume legal responsibility. Users should undertake sufficient verification and testing to determine the suitability for their own particular purpose of any information or products referred to within this document. No warranty of fitness for a particular purpose is made. Nothing within this document is to be taken as permission, inducement or recommendation to practice any patented invention without a license