

Section 3 Fabrication & installation

1. General

We can process ALPOLIC and ALPOLIC/fr panels with regular machines and tools for aluminum and wood. We can cut the panels with a circular saw, fold them after grooving with a router, and bend them with a 3-roll bender. In order to join aluminum extrusions to ALPOLIC panels, we can choose a suitable joining method from several alternatives. For installation, various types of fixing methods suitable for Aluminum Composite Material (ACM) have been put forward and improved on for years. We will look over basics of the processing methods and installation methods in this section.

ALPOLIC and ALPOLIC/fr are often simply referred to as “ALPOLIC” or “ALPOLIC panels” in this section, because the fabrication and installation methods applicable to ALPOLIC mostly hold true to ALPOLIC/fr as well. Regarding the product dimension and tolerance required for planning (design) work of fabrication and installation, refer to “11: Panel dimension and tolerance” at the end of this section.

2. Handling

ALPOLIC is a rigid panel, but a physical impact may cause an edge deformation. Inclusion of hard particles such as grains of sand and cutting chips caught between ALPOLIC panels may cause visible dent-damages in one or more adjacent panels. Take note of the following precautions while handling ALPOLIC during fabrication and installation.

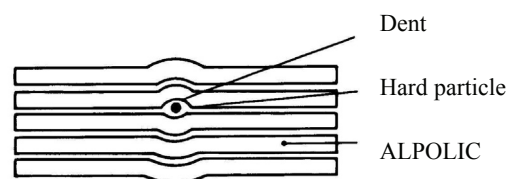


Fig. 3-1 Dent caused by inclusion of particle

(1) Unpacking and repacking

- Do unpacking and repacking works in a clean place.
- Remove dusts and chips from ALPOLIC and the packing paper. Any hard particles between panels will cause a dent-damage on ALPOLIC panels.
- Handle ALPOLIC on a worktable. Do not handle it on the floor.
- ALPOLIC should always be handled by two people with external face upward to avoid possible rubbing of the ALPOLIC surface during handling.

(2) Transport

- For transport, lay the packed ALPOLIC horizontally and do not place heavy goods on it.
- Mark “Handle with Care”, “Keep Dry”, “No Hooks” and “This Side Up” clearly on the packing.

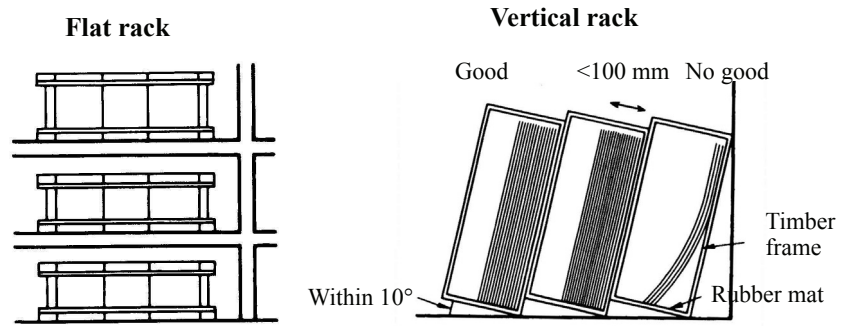
(3) Fabrication

- Prior to fabrication, clean off the worktable, temporary stand and both sides of ALPOLIC.
- Ensure that cutting chips generated from saws, routers and drills are completely removed from the interface between ALPOLIC and tools.

(4) Storage

- Store ALPOLIC panels indoors with a flat rack system or a vertical rack system shown below.
- In a flat rack system, pile the same size of panels on a rigid palette. Do not pile up different sizes together. Our wooden crates can usually be stacked up to four crates high.
- In a vertical rack system, lean panels closely against an inclined backing material within 10° . The total thickness of leaning panels should not exceed 100 mm thick. Use veneer for backing cover and place rubber mat on the bottom. Avoid scratches when pulling out from the rack and restoring it.

Fig. 3-2 Proper storing method



(5) Protective film

The protective film of ALPOLIC, consisting of two polyethylene layers of white and black, withstands outdoor exposure for approx. 6 months. However, store the panels in dry and indoor atmosphere, to minimize the natural-degradation of the protective film by moisture and direct sunlight during storage.

(6) PVC tape

Do not use adhesive tapes made of PVC (polyvinyl chloride) on the surface of protective film at any time during storage, fabrication or installation. The plasticizer (an additive) in PVC tape will permeate the film and attack the Lumiflon coating, which causes a gloss change problem on the coating. Any types of PVC tapes may cause this problem, including duct tape, packing tape and insulation tape.

3. Processing method


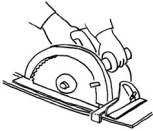
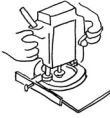

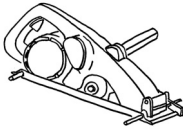
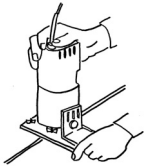
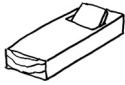
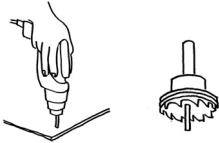
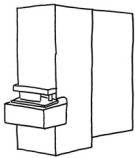
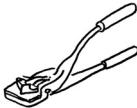

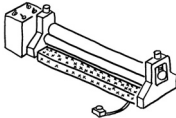
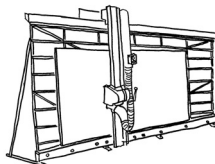
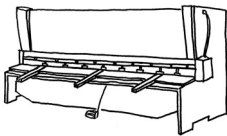
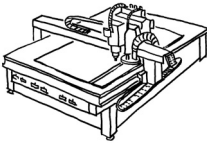
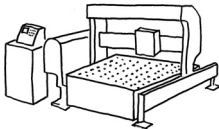
(1) Summary

We can use wide variety of machines and tools to process ALPOLIC panels. We can classify these machines and tools into conventional ones and automated ones. Generally, automated machines enable high efficiency in large quantity analogous work. On the other hand, conventional machines and tools are versatile and flexible. The former requires a costly investment for the machine, and the latter requires skill for good work. The main machines and tools are as shown in the following table.

Table 3-1 Summary of machines and tools

Conventional tools and machines		
Processing	Tools or machines	No.
Cut	Table saw	1
	Hand circular saw	2
	Hand router	3
	Hand jigsaw	4
Groove	Grooving machine	5
	Hand router	3
Chamfer	Hand trimmer	6
	Plane	7
Make hole	Hand drill	8
Punch	Punching machine	9
Notch	Notching tool	10
Bend	Press brake	11
	3-roll bender	12

Automated machines		
Processing	Tools or machines	No.
Cut	Panel saw	13
	Square shear	14
	CNC router	15
Groove	Panel saw	13
	CNC router	15
Perforate	Turret Puncher	16

1. Table saw 	2. Hand circular saw 	3. Hand router 	4. Hand jigsaw 
5. Grooving machine 	6. Hand trimmer 	7. Plane 	8. Hand drill 
9. Punching machine 	10. Notching tool 	11. Press brake 	12. 3-roll bender 
13. Panel saw 	14. Square shear 	15. CNC router 	16. Turret puncher 

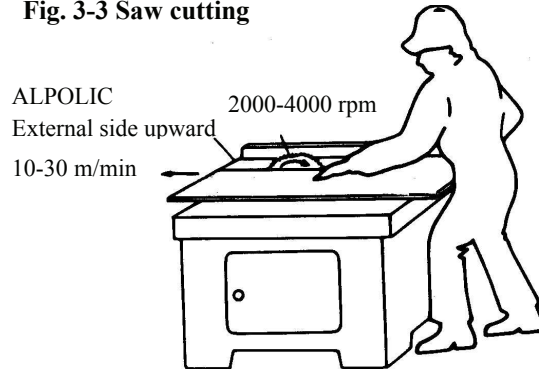
(2) Saw cutting

We can cut ALPOLIC with various types of circular saws such as table saws, hand circular saws and panel saws. A suitable saw blade is a carbide-tipped blade for aluminum or plastic use.

Example of suitable saw blade:

Blade diameter	255 mm
Number of teeth	80 to 100
Cut width	2.0 to 2.6 mm
Rake angle	10°
Tip	Carbide
Operating conditions	
Rotation of saw blade	2000-4000 rpm
Feed speed	10-30 m/min

Fig. 3-3 Saw cutting



Notes on saw cutting:

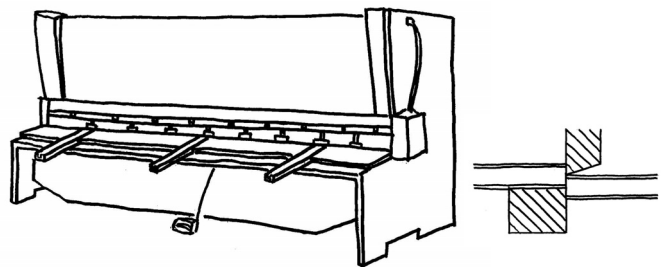
- Do the cutting operation with the external side facing upward to prevent the panel from scratches and the protective film from peeling off.
- Remove cutting chips from ALPOLIC carefully after cut, to avoid dents during storage and assembly.
- Sharpen or replace the saw blade, when it becomes dull. Dull blades will result in a large burr or distortion at the cut edge.

(3) Shear cutting

A square shear permits an efficient sizing work. Generally, the most suitable clearance and rake angle are as follows:

ALPOLIC thickness	Clearance	Rake angle
3mm	0.04 - 0.1mm	1°
4mm	0.04 - 0.1mm	1° 30'
6mm	0.2mm	2° 30'

Fig. 3-4 Shear cutting



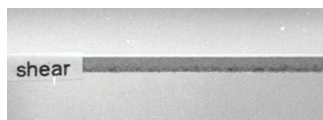
(4) Trimming of cut edge

After saw cutting, a burr appears on both sides of the edges. After shear cutting, either a droop or a burr appears on each edge. If we install the panel with the cut edges exposed, we have to control the edge conditions.

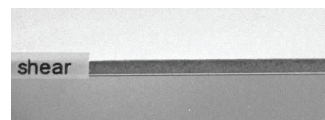
Burr after saw cutting



Droop after shear cutting



Burr after shear cutting



Namely, in saw cutting we should keep the saw blade sharp enough to have a proper edge. In shear cutting, we should adjust the clearance of the die properly. If we need further trimming of the cut edge, we have to trim the edge with a trimmer, plane or sandpaper.

In Solid, Metallic, Sparkling Colors, deep trimming like chamfering may have an aesthetic effect. Use a trimmer with a ball bearing chamfering bit or a plane for woodwork. In working with plane, a guide ruler will help to ensure a uniform edge.

In Stone and Timber, generally, deep trimming is not suitable, because deep trimming harms the appearance of Stone and Timber. If it is possible that passers-by may hurt their fingers on the cut edges in Stone and Timber, make the edges dull with fine sandpaper. Normally, droop edges by shear cutting are mild enough to ensure the safety of cut edges.

(5) Curving cut

Hand routers and trimmers can cut ALPOLIC in curving lines. A guide template will help you to stabilize this work. Jigsaws are also useful for cutting complex shapes.

Notes on guide template:

- Put the guide template on the external side of ALPOLIC, to do the routing work through the guide template.
- Remove the particles caught between the template and ALPOLIC surface, to prevent dents and scratches.

(6) U-grooving

We can fold ALPOLIC after U-grooving in the backside. Two types of machines are available for U-grooving. One is a circular cutter type and the other is a router type. The former includes hand grooving machines and panel saws, and the latter includes hand routers and CNC routers.

Fig. 3-5 Hand trimmer and chamfering bit

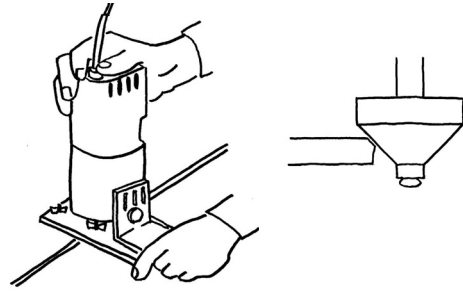


Fig. 3-6 Chamfering with plane

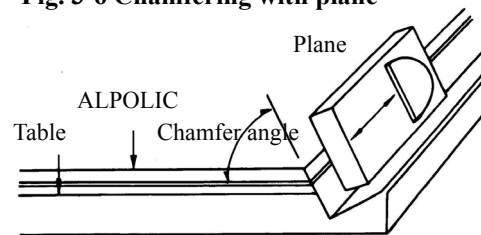
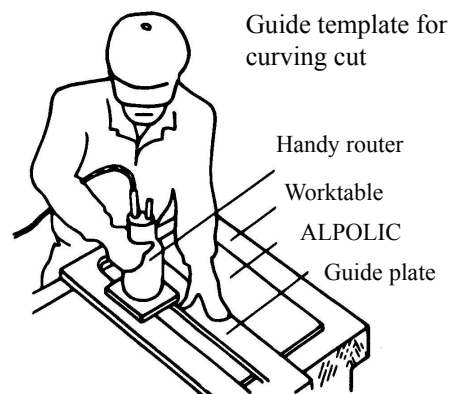
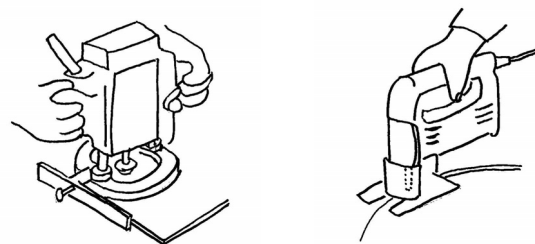


Fig. 3-7 Curving cut

Hand router

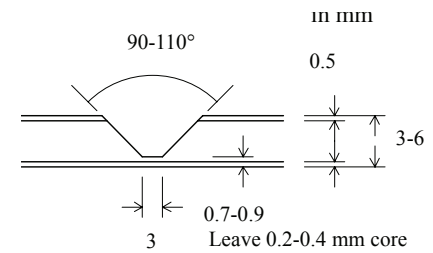
Hand jigsaw



U-groove shape

The diagram (in Fig. 3-8) shows a typical U-groove shape suitable for folding ALPOLIC panels. It is important to leave 0.2-0.4 mm of core. We recommend 90-110° grooves for 90° bending.

Fig. 3-8 Typical U-groove shape



Hand grooving machine

Hand grooving machines can groove ALPOLIC. Use a cutter blade having the proper groove shape as shown in Fig. 3-8. An example of suitable cutter blades and operating conditions are as follows:

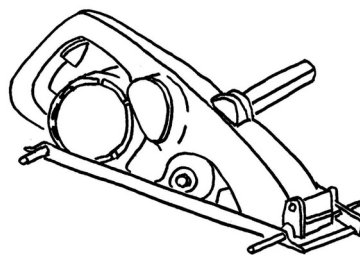
Cutter blade:

Outside diameter	110-120 mm
Number of teeth	4
Material	Carbide tip

Operating conditions

Rotation	5,000-9,000 rpm
Feeding speed	5-20 m/min

Fig. 3-9 Hand groove machine and groove cutter



Hand router

Hand routers can groove both straight lines and curving lines. Use a custom router bit having the groove shape shown in Fig. 3-8. The suitable bit and operating conditions are as follows:

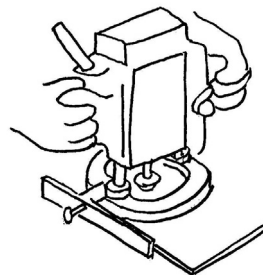
Router bit:

Number of teeth	2-4
Material	Carbide tip

Operating conditions:

Rotation	20,000-30,000 rpm
Feeding speed	3-5 m/min

Fig. 3-10 Handy router and router bit



Panel saw

Panel saws enable efficient and precise grooving. Typical conditions are as follows:

Cutter blade:

Outside diameter	220 mm
Number of teeth	8
Material	Carbide tip

Operating conditions:

Rotation	2,500-5,000 rpm
Feeding speed	30 m/min

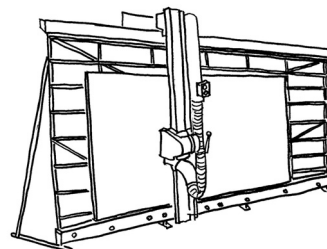
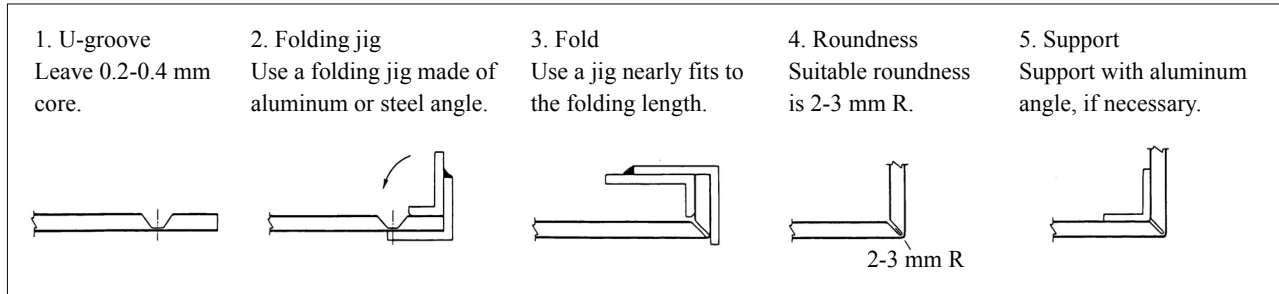


Fig. 3-11 Panel saw and groove cutter

(7) Folding

After U-grooving, we can fold ALPOLIC with a folding jig. The typical folding procedures are as follows.

Fig. 3-12 Folding procedures



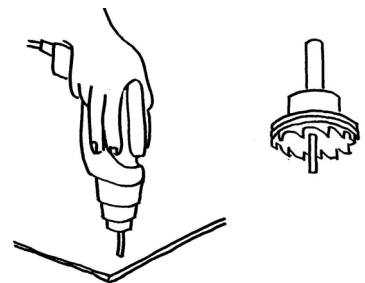
Notes on folding:

- Fold ALPOLIC panels on a flat and rigid worktable, because, if we fold a warping panel, the folding centerline will not be straight.
- The folded corner should have a suitable roundness of 2-3 mm in radius. If the roundness is too small, the coating may have a crack on the folded corner. Check your U-shape and grooving depth.
- Cracks may occur when we carry out the folding work at a low temperature. Have your folding work at 10°C or higher.
- Folding after U-grooving entails slight elongation. The elongation is 0.5-1.0mm per fold. Pre-adjust the position of the grooving line in your fabrication drawing.

(8) Making hole with drill

We can make holes with a hand drill or a drill press, equipped with a drill bit, a hole-saw and a circle cutter. Use drill bit for metals. Making a hole from the external side will reduce the burr.

Fig. 3-13 Making a hole



(9) Punching and notching

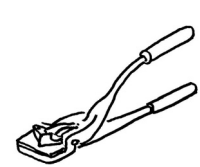
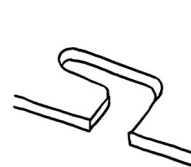
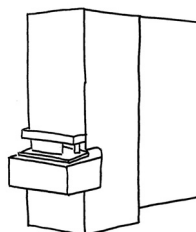
We can use a punching press for notching and cutting out. The suitable clearance between punch and die is 0.1mm or smaller (material thickness × approx. 2%). A small droop will appear at the punched edge. We can also use a notching tool for removing the corner.

Fig. 3-14 Punching press and notching tool

Punching press

Example of punching

Notching tool



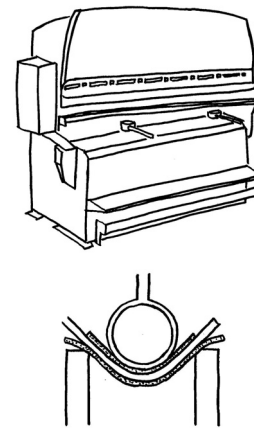
(10) Bending with a press brake

We can bend ALPOLIC/fr and ALPOLIC with a press brake. The bend-ability depends on the thickness and the core material. ALPOLIC/fr has a larger bendable limit than ALPOLIC has. The smallest bendable radius (internal radius) with press brake is as follows:

Table 3-2 Smallest bendable limit with press brake

Thickness	Smallest bendable radius (internal radius) mm			
	ALPOLIC/fr		ALPOLIC	
	Traverse	Parallel	Traverse	Parallel
3mm	50	70	40	55
4mm	80	100	40	55
6mm	100	140	55	80

Fig. 3-15 Press brake bending



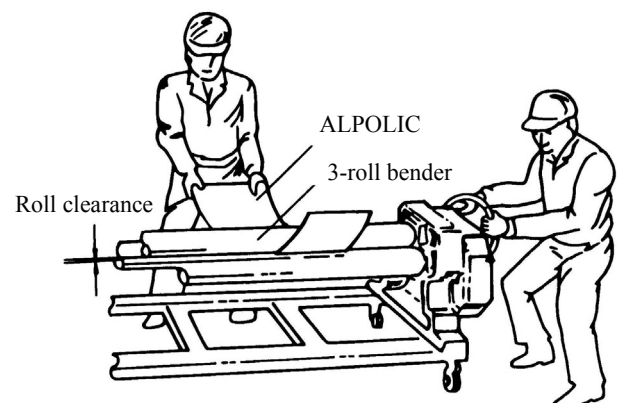
Notes on press brake bending:

- “Traverse” and “Parallel” show the bending direction toward the rolling (coating) direction printed on the protective film.
- The smallest bendable radius means the limit at which visible wrinkles appear on the aluminum surface of ALPOLIC. Cracks will appear at a slightly smaller radius than this value.
- Use the top die (punch) with an almost similar radius to the desired radius. If the radius is much smaller, the bending radius partially goes beyond the above limit, and cracks may occur.
- Use a urethane pad for the bottom die, or place a rubber mat between ALPOLIC and the bottom die.
- Use a scratch-free top die. Polish and wipe the top die. Do the bending work without peeling off the protective film of ALPOLIC.
- When we carry out the bending work at a low temperature e.g. 15°C, the coating surface may change to a haze-like appearance. Warm the panel to 20° or higher, and the haze-like appearance will disappear.
- In metallic colors, slight color difference can be seen between bent and flat surfaces due to the difference of reflection angle.

(11) Bending with 3-roll bender

We can use manual or electric-drive 3-roll benders for bending ALPOLIC. The smallest bendable radius of ALPOLIC 4mm is approx. 300mm in 2500mm long machines. The exact bendable limit depends on the bending roll diameter, roll length and the type of bending machine.

Fig. 3-16 Bending with 3-roll bender



Notes on 3-roll bending:

- Prior to a bending operation, wipe the roll surface carefully.
- Remove any burrs at the ALPOLIC edge that may cause dents while rolling.
- Remove the cut particles stuck on ALPOLIC and smooth any wrinkles on the protective film, which may cause dents.
- Do not constrict ALPOLIC panel between rolls (in thickness direction). Extreme compression may cause a physical damage of the core. Adjust the clearance between rolls to be the panel thickness

- plus some allowance (approx. 0.5 mm).
- If a notch is desired in the panel, cut the notch after bending. Cutting the notch before bending will result in a distorted curving.
 - Generally, small radii will need gradual bending by adjusting the elevation of the bending roll several times.
 - In most 3-roll benders, the curve near the edge tends to be straight. We can reduce this straight portion to some extent by overlapping another auxiliary sheet material and bending together with ALPOLIC. If we require a consistent curve near the edge, we have to do additional edge bending after regular bending. Refer to Fig. 3-17.
 - When we carry out the bending work at a low temperature e.g. 15°C and with small radius e.g. 250mmR, the coating surface may change to a haze-like appearance. Warm the panel to 20° or higher, and the haze-like appearance will disappear.
 - In metallic colors, slight color difference can be seen between bent and flat surfaces due to the difference of reflection angle.

Fig. 3-17 Additional edge bending
Top: Before, Bottom: After

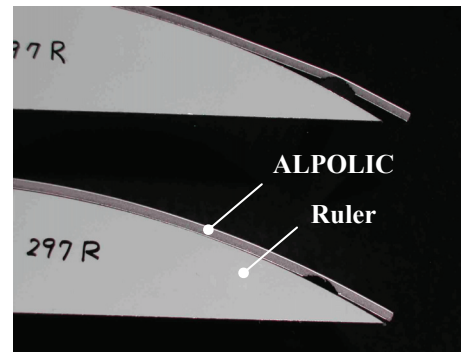
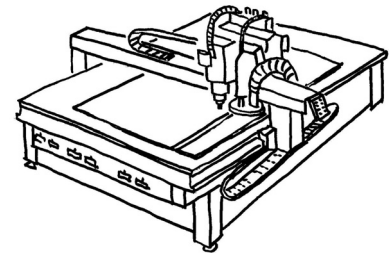


Fig. 3-18 CNC router



(12) CNC router

We can cut and groove ALPOLIC panels with CNC routers. As all the procedures are computer-controlled by a program, CNC router is suitable for repetition of analogous work. The suitable bit and operating conditions are the same as those for hand routers.

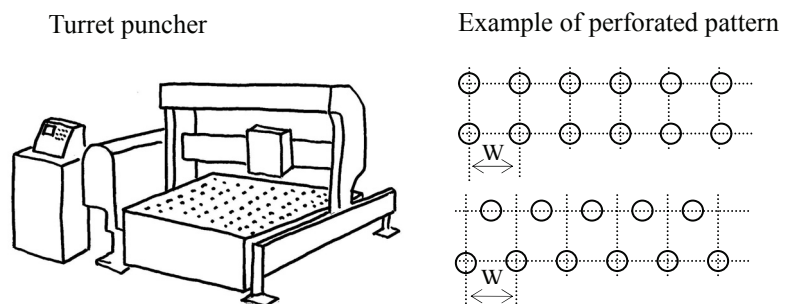
(13) Turret puncher

Turret puncher, also computer-controlled, can be used for perforation of ALPOLIC.

The suitable clearance between punch and die is 0.1mm or smaller (material thickness \times 2%). A small droop will appear at punched edge.

Regarding the perforated panels of ALPOLIC, refer to “Appendix 3: Perforated panel” in Section 4.

Fig. 3-19 Turret puncher and perforation



(14) Others

Water-jet cutting: A plunge cut (piercing at the starting point) in water-jet cutting may cause a certain degree of de-lamination between the aluminum skin and the core material. Therefore, we have to plunge at a disposable area or start at panel edge. After penetrating through panel, a water jet can cut ALPOLIC.

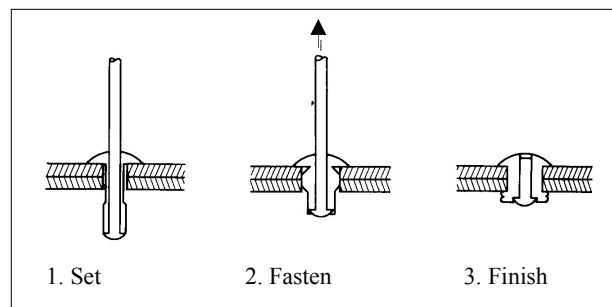
Laser cutting: According to our tests, we have so far concluded that ALPOLIC is not suitable for laser cutting, because the fumes generated from ALPOLIC might harm the sophisticated optical instrument in the laser system.

4. Joining method

(1) Rivet and bolt/nut

We often use rivets, bolts/nuts and tapping screws for joining between ALPOLIC and other material like aluminum extrusions. For rivets, use aluminum blind rivets. We can do riveting work from one direction as shown in Fig. 3-20. For screws, use bolts/nuts and tapping screws made of aluminum or stainless steel.

Fig. 3-20 Rivet work with blind rivet

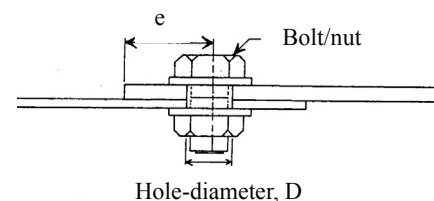


Strength of joining hole

A joining hole of 4mm in diameter withstands approx. 500-800 N (50-80kgf) per point depending on ALPOLIC thickness. The strength of the joining point depends on the position of the hole. The joining hole located near the panel edge will easily tear and will not show a sufficient strength.

According to our test, the distance from the panel edge to the hole-center (e) should be larger than twice the hole-diameter (D) for sufficient strength, which is expressed with the equation, $e > 2D$. In actual assembly work, we have to choose the position of the joining holes based on this idea. Refer to “Appendix 6: Strength of joining hole” in Section 4 for details.

Fig. 3-21 Proper position of joining hole



In the installation of interior, countersunk rivets and screws will be used more often than round-headed ones. The strength may lessen with countersunk rivets and screws.

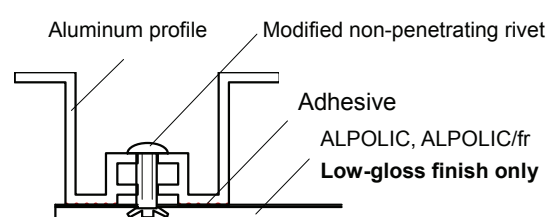
Prevention from galvanic corrosion

If ALPOLIC contacts a dissimilar metal in a humid atmosphere, the galvanic (electrolytic) corrosion may accelerate the corrosion of aluminum skin. To prevent this, the contact surface of the dissimilar metal like steel should have a paint coating thicker than 25 microns, galvanized coating or electric insulation, before fixing ALPOLIC panel onto the metal surface.

(2) Modified non-penetrating rivet

A non-penetrating rivet is applicable for joining if the surface finish is low-gloss (30% gloss or less). Non-penetrating rivets are an alternative method to double-sided tapes and adhesives, but this rivet

Fig 3-22 Modified non-penetrating rivet



functions like a mechanical fixing, ensuring the design strength of approx. 300 N/piece. Therefore, this rivet is suitable for areas where a reliable fixing is indispensable even in the event of fire or other accidents.

It is important that this non-penetrating rivet is usable only on low-gloss finishes as shown in Table 3-3, because the fastened trace is visible from the front side in medium and high-gloss finishes. Refer to “Appendix 7: Modified non-penetrating rivet” in Section 4 for details.

Table 3-3 ALPOLIC products suitable for non-penetrating rivet

ALPOLIC thickness	Applicable gloss level
4mm, 6mm	Low-gloss only (30% gloss or less)
3mm	Matte finish only (polyester coating)

(3) Adhesives

We can use a wide variety of commercial adhesives for joining and assembling ALPOLIC. However, some types of adhesives may corrode aluminum and do not suit ALPOLIC. For example, vinyl acetate type, widely used for timber and styrene foam, corrodes aluminum. The main adhesives suitable to adhesion between ALPOLIC and other materials are as follows.

Table 3-4 General adhesives applicable to ALPOLIC

Adhesive type		Epoxy	Chloroprene	Silicone RTV	Cyano-acrylate
Example of commercial brand		Araldite	Contact Cement	All Purpose Silicone	Aron Alpha
Material to be adhered	Metal	S	S	S	S
	Timber	S	S	S	S
	Gypsum board	S	S	No	No
	Styrene foam	S	No	No	No

S: Suitable No: Not suitable

Apart from the above adhesives, we have successfully used the following adhesives for fabrication and assembly work of ALPOLIC. However, these adhesives are only locally available in Japan. If you are interested in these adhesives, please contact local distributors or our office.

Table 3-5 Adhesives used for assembling work of ALPOLIC in Japan

Brand name	Adhesive type	Manufacturer	Remarks
Diabond SG350	Acrylic	Nogawa Chemical	2-part, 5-15 min curing
Super X No.8008	Silyl-modified	Cemedine	1-part, 1-2 hrs curing

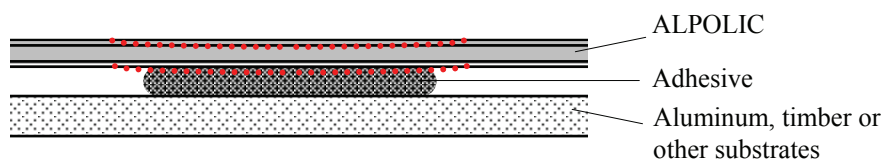
Notes on adhesives:

- Prior to adhesion work, remove all the foreign matter such as dust, particles, grease, water, etc. from the area to be adhered.
- Select the most appropriate adhesive that ensures the necessary adhesion power in the atmospheric

conditions. The adhesion power depends on the surface conditions of the substrate. Follow the adhesive manufacturer's instructions.

- c. When ALPOLIC is adhered to a dissimilar material, it is possible that ALPOLIC will show a deflection due to the thermal expansion difference or dimension change of the material. Pre-test the adhesive before fabrication and installation.
- d. Some adhesives may cause a distortion after hardening, as shown in the diagram. Some epoxy adhesives, polyurethane adhesives and silicone adhesives may show this kind of distortion. This distortion is usually very slight, and its visibility depends on the gloss level of the finish, the visual angle and the circumstances.

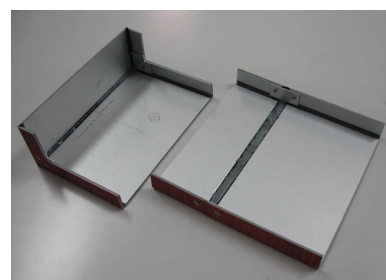
Fig. 3-23 Distortion due to adhesive



(4) Welding of core

One end of ALPOLIC can be adhered to another end of ALPOLIC by welding the core with hot melt adhesive (glue). Prior to heating a glue stick, we have to preheat the core surfaces for good adhesion. Normally, mechanical reinforcement is necessary after welding.

Fig. 3-24 Welding of core with hot melt glue



(5) Double-sided tape

Double-sided tape like 3M's VHB tape is widely used in assembling work of ALPOLIC. Generally, VHB tape simplifies the joining work.

The thicker ones even allow movement of the adhered two materials to some extent. The adhesion test shows that 3M's VHB Y-4920 (0.4mm thick) is compatible with both topside and backside of Lumiflon-based fluorocarbon coated ALPOLIC.

(6) Hook/loop fastener

Hook/loop fasteners like Velcro tape is useful for guide signs and displays. This type of fastener is removable and restorable.

(7) Sealing material

In order to ensure waterproofing of joints between panels, normally a sealing material is used. The sealing material shall meet the performance required for the atmospheric conditions.

Table 3-6 below shows general performance of sealing materials. Silicone, modified silicone and polysulfide sealant are often used for outdoor installation. The compatibility tests with these sealing materials have shown a good adhesion with Lumiflon-based fluorocarbon coated ALPOLIC, but some of the sealing materials need primer for good adhesion. In addition, some are 2-component type that consists of a base component and a curing agent. Regarding the joint design such as proper joint width and thickness, please follow the sealant manufacturer's specifications.

Note: Gloss increase due to plasticizer of modified silicone and polyurethane sealant

In tooling work of modified silicone and polyurethane sealant, do not smear the protective film of ALPOLIC with surplus sealant. The plasticizer, an additive in these sealing materials, permeates the protective film and causes a gloss increase on the Lumiflon-based fluorocarbon coating.

Table 3-6 General performance of sealing materials

General performance		Sealing Materials			
		Silicone	Modified silicone	Polysulfide	Polyurethane
Restoring ability		A	A-B	B	B
Degradation	Due to aging	VS	S-M	M	M
	Due to temperature	VS	S-M	M-L	M
Shrinkage after filling		S	S	S	S
Serviceable temperature (long-term)		-40/120°C	-30/90°C	-20/80°C	-20/70°C
Weather-ability		A	A-B	A-B	B
Fatigue resistance		A	A-B	B	A-B

Note 1: A: Excellent B: Good C: Normal

VS: Very small S: Small M: Medium L: Large

Note 2: The above is excerpt from Sealing Material Handbook, Japan Sealant Manufacturers' Association.

5. Surface processing

(1) Screen-printing

In screen-printing, 1-component vinyl type or 2-component polyurethane type inks are suitable for all the finishes of ALPOLIC. We obtain normal adhesion with these inks after drying at 80°C for 30 min and curing at room temperature for 24 hrs. The typical printing procedures are as follows:

- Remove all dust and dirt with a soft cloth. Oily dirt, if remaining, causes printing defects.
- Cure or dry under proper conditions. Follow instructions from the ink manufacturer.

Notes on screen-printing:

- Keep the curing temperature below 90°C for less than 30 min. If the curing temperature is higher, deflection of the panel may occur.
- Select the ink suitable for the atmospheric conditions where the panel is to be located.

(2) Cutting film

Various types of cutting films are applicable to the ALPOLIC surface. If you are going to fold the ALPOLIC panel after you apply

Fig. 3-25 Screen-print on ALPOLIC



“Three-F” convenience store, interior sign, Japan



Guide sign in subway stations, Tokyo

Fig. 3-26 Cutting film on ALPOLIC



Mobile phone company's shop front sign, Japan

the film, the film may change color at the folded corner. Confirm it with pre-testing.

(3) Digital print with ink jet printer

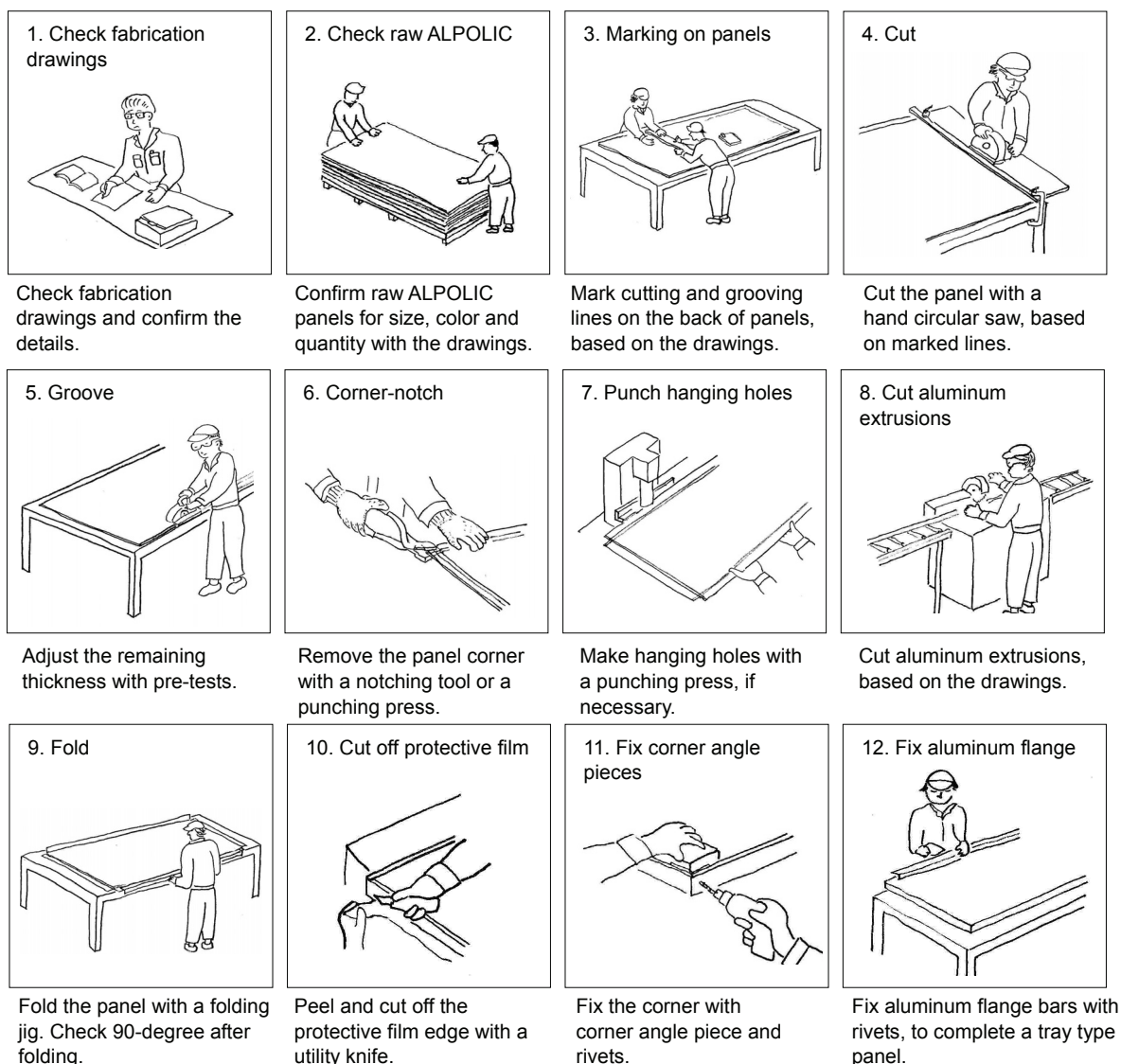
Various types of decorative films and wallpapers printed with ink jet printers can be applied on ALPOLIC. Confirm the fire approval conditions of the film. Direct digital printing is also possible with special ink jet printers.

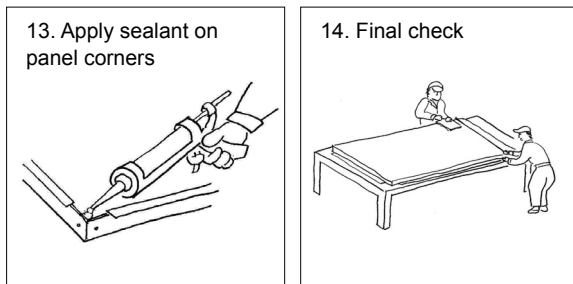
6. Overall fabrication works

(1) Typical fabrication process

Actual fabrication work of an ALPOLIC panel is an integrated work consisting of various machining procedures, assembling and inspection. Fig. 3-27 is a typical fabrication process for a standard tray type (rout and return) ALPOLIC panel.

Fig. 3-27 Typical fabrication process





Apply sealant on panel corners from the back, if necessary.

Inspect the completed panels.

Fig. 3-27 (Continued) Typical fabrication process

(2) Fabrication drawing

We have to prepare fabrication drawings prior to every fabrication work. Fabrication drawings specify details of processing and assembly method of each ALPOLIC panel. Normally, we specify the following items in fabrication drawings.

- Raw ALPOLIC panel (thickness, color, dimension) to be used for the fabrication
- Panel name, shape, dimensions and quantity of the completed panel
- Cutting, grooving and other processing details including its coating direction

Fig. 3-28 Example of fabrication drawing

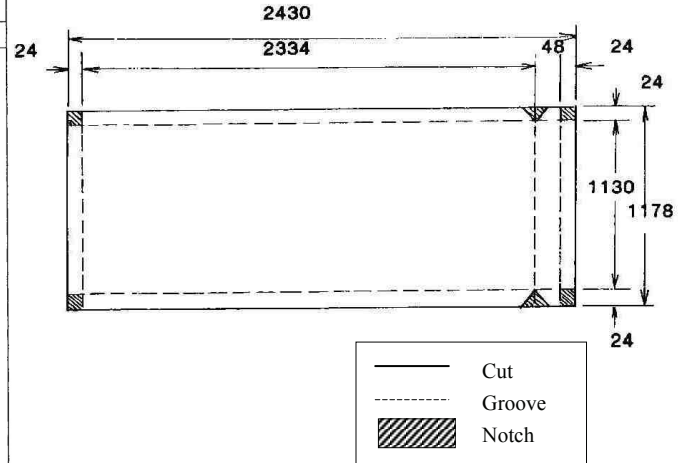
Fabrication Drawing Form

Project name	Mitsubishi Chemical Infonics			P. No.	3
Thickness	4mm	Color	Champagne Metallic 30%G		

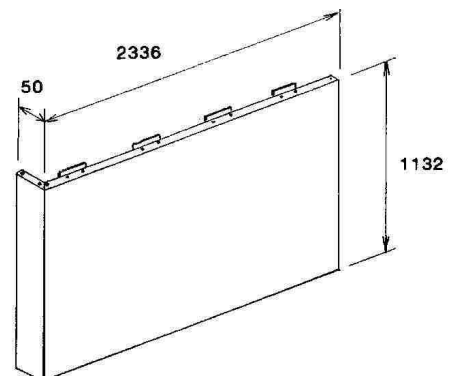
Reference elevation

Panel No.	Panel size (PW×PH)	Pieces	m ²	Remarks
ND7	(50+2336)×1132	10	27.00	Bend

Actual processing method based on the drawing



Completed panel based on the drawing



In addition to the above items, we can get unspecified information about subsidiary materials from fabrication drawings through simple calculations. Thus, we can use fabrication drawings not only for processing and assembly of ALPOLIC panel but also for preparation of subsidiary materials, final inspection work of completed panels and some office work including inventory control of raw ALPOLIC panels.

Fig.3-28 above shows an example of a fabrication drawing and the actual panels based on the drawing. Fabrication drawings are normally prepared for internal use, and so, many other forms are successfully used. However, every form should facilitate the drawing work and should be easily understood without confusion.

(3) Adjustment of dimensions

ALPOLIC panels elongate through folding and bending. Generally, we find the following elongations:

In folding after grooving; 0.5-1.0 mm per point

In 3-roll bending; 0.3-0.4 % of arc length (300-700 mm R)

In order to compensate the elongation, we have to adjust (shorten) the cutting and grooving position based on the fabrication drawing. Thus, the actual cutting and grooving dimensions are smaller than those of the complete panel. As the elongation values depend on the grooving shape and bending method, we have to determine the exact values by pre-testing.

(4) Panel details

When we work with fabrication drawings, we have to determine the fabrication details of ALPOLIC panels. Normally, the details applicable to ALPOLIC are slightly different from solid aluminum panels, mainly because ALPOLIC panels are pre-coated products, while solid aluminum panels are post-coated products. Some panel details may need approval from customers with the fabricated samples showing the details. We will look over some of the main details below.

Corner detail

In a tray type (rout and return) panel, we can select a corner detail from two alternatives: 90 deg square and 45 deg diagonal. After cutting, grooving and notching 4-corners in the respective manner below, fold the perimeter and fix the four corners with aluminum angle pieces and aluminum rivet. Refer to Fig.3-29 below.

Fig.3-29 Corner detail of tray type panel

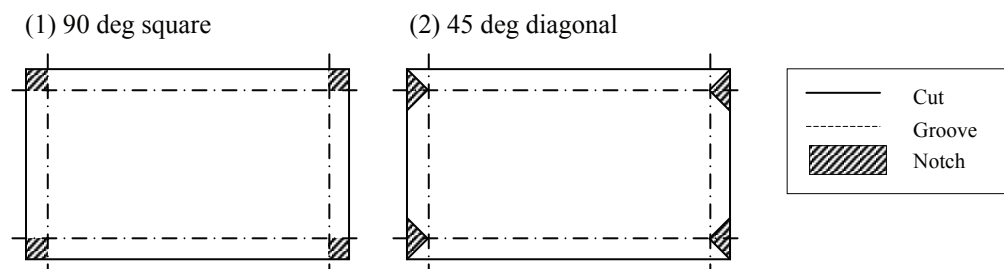
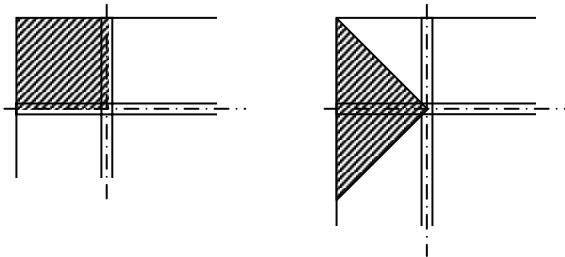
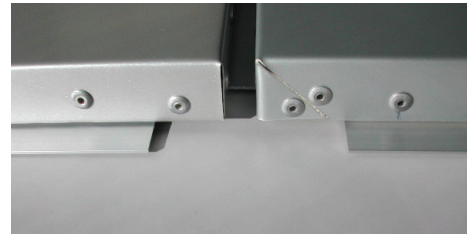


Fig.3-29 Corner detail of tray type panel (Continued)

(1) Notch for 90 deg square (2) Notch for 45 deg diagonal



90 deg square (left) and 45 deg diagonal



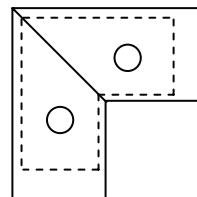
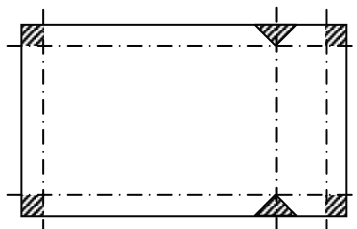
Outside angle

In outside angle panels, we need additional notches at the top and bottom of the outside angle line. After assembling the grooved panel in the same manner as a regular tray panel, we finally fold the outside angle line. Check the folding angle and reinforce the outside angle with support plates made of aluminum on the top and bottom of the outside angle line. Refer to Fig.3-30 below.

Fig. 3-30 Outside angle

Notching for outside angle

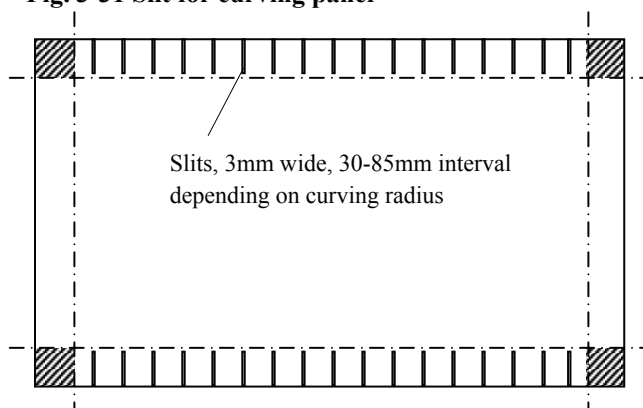
Support with aluminum plate



Curving panel

There are several alternative methods for designing curved panels, depending on the curve radius. However, the slit method below is versatile and applicable to a wide range of curving radii from 300 to 3000 mm R. In this method, prior to bending, we make 3mm-wide slits on the top and bottom at a certain interval. The suitable interval depends on the curving radius and it is 30 to 85 mm (in 300 to 3000 mm R). We use an equation to calculate the suitable interval of slits. If the curving radius is larger than 3000 mm R, we can bend the panel without slits with a regular 3-roll bender. Refer to Fig.3-31 below.

Fig. 3-31 Slit for curving panel



Special panel details

We sometimes encounter unusual designs including 3-dimensional shapes. Mostly, the required quantity is only several pieces, but we wish to try to fabricate the ALPOLIC panels in such a manner that they achieve long-lasting performance with satisfactory appearance. Several examples are attached in “Appendix 8: Examples of complicated panels” in Section 4 for your reference. If you have similar difficulties in an actual project, please contact local distributors or our office. We would like to study together.

7. Examples of fixing method

As for the installation of Aluminum Composite Material (ACM), many advanced methods have been proposed and improved on for years. We will introduce some of the most common methods suitable for ALPOLIC below.

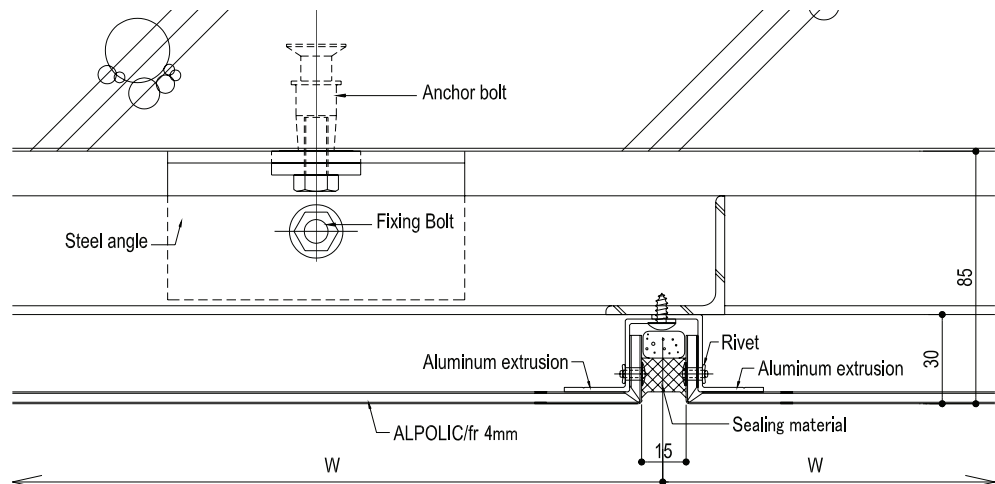
Contents of drawing:

- (1) External wall cladding – wet sealant joint
- (2) External wall cladding – hanging method
- (3) External wall cladding – dry gasket joint
- (4) External wall cladding – narrow open joint
- (5) Roof covering
- (6) Back panel of glass curtain wall
- (7) Sunshade or cornice
- (8) Ceiling panel with non-penetrating rivet
- (9) Parapet and soffit, renovation
- (10) Corporate shop front signboard
- (11) Roof of pedestrian passage

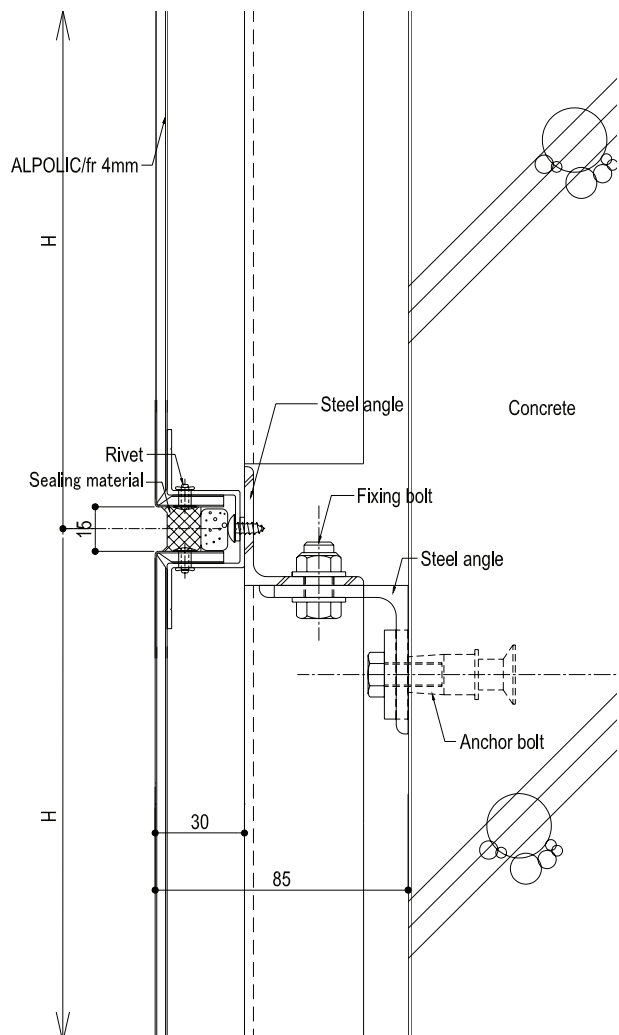
(1) External wall cladding - wet sealant joint

This installation system, with tray type (rout and return) panels and sealing joints, is one of the most common methods and it is available for a wide range of new buildings and renovation projects. After fixing ALPOLIC panels on the substructure, we apply a suitable sealing material to the joints in order to ensure water-tightness.

Horizontal
section



Vertical section



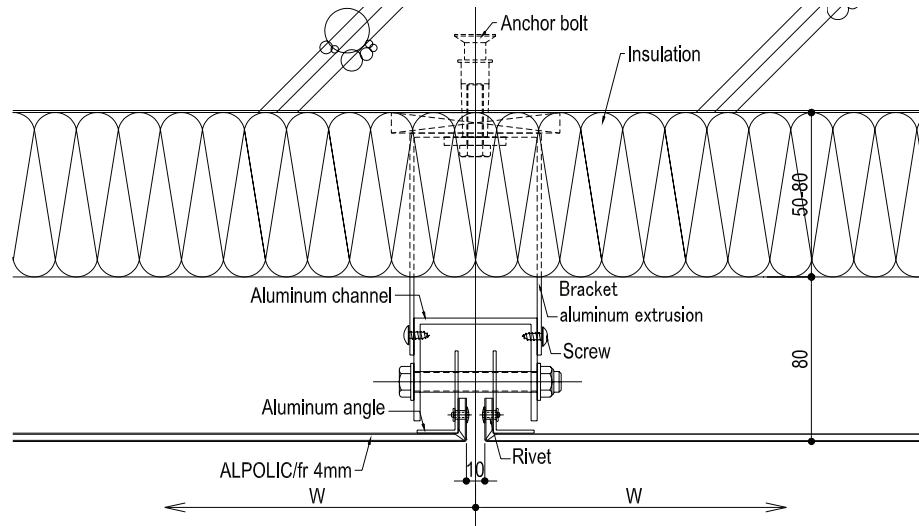
Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk.

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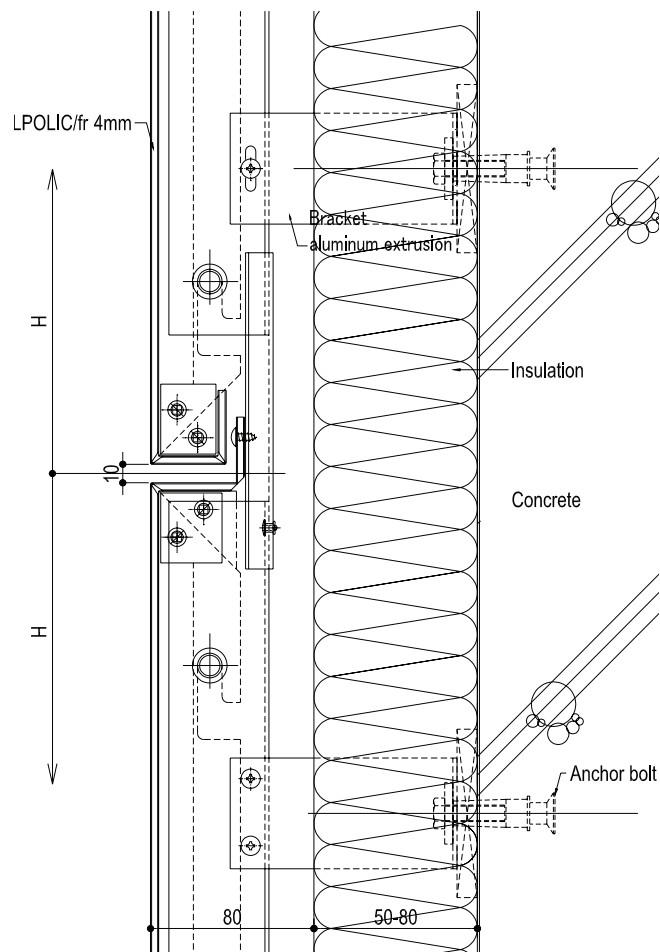
(2) External wall cladding - hanging method

The hanging system is also one of the most common fixing methods. It simplifies the installation work at the construction site and hence we can shorten the installation period. It is easy to loosen the movement due to thermal expansion/contraction with this method, because panels are not tightly fastened to the sub-frame but are simply suspended.

Horizontal section



Vertical section



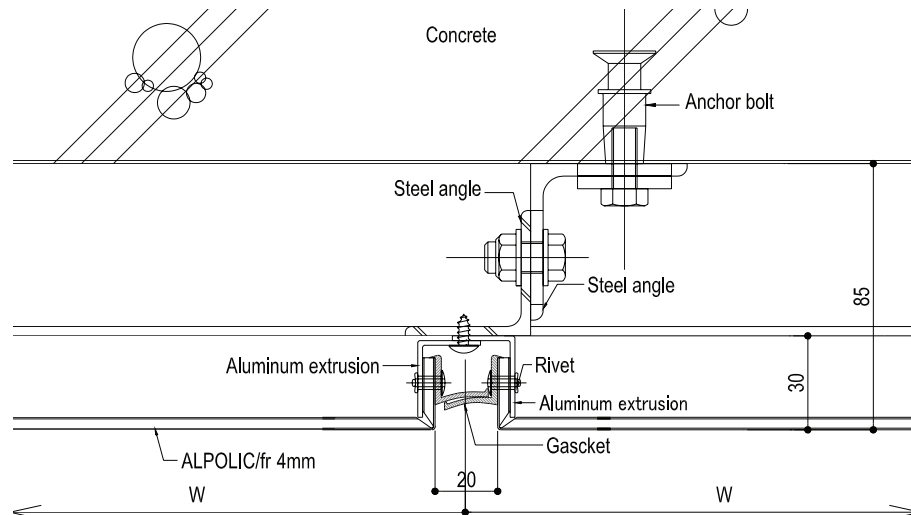
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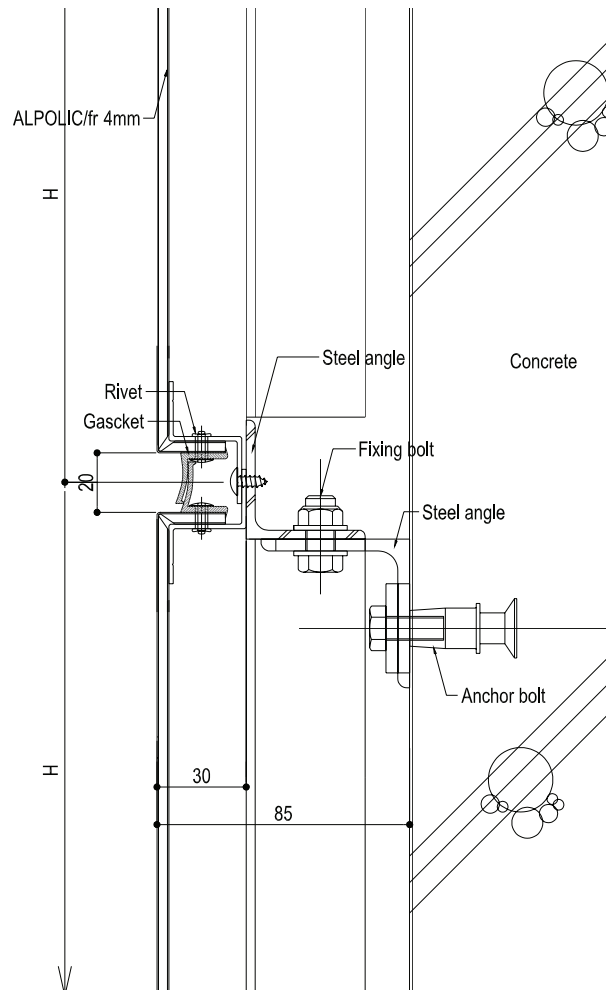
(3) External wall cladding - dry gasket joint

In this method, we use gaskets in the joints instead of sealants. The durability of EPDM gaskets is comparable to that of the sealant, in addition, the gasket joint reduces the amount of dirt or stain on ALPOLIC surface.

Horizontal section



Vertical section



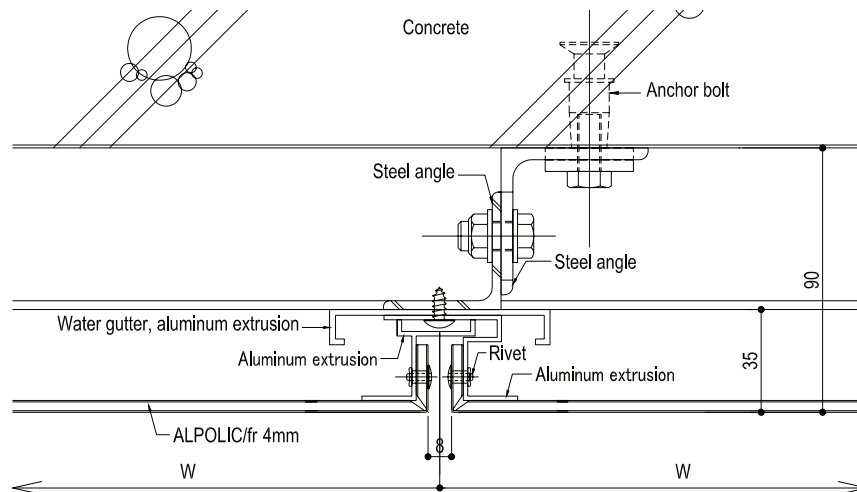
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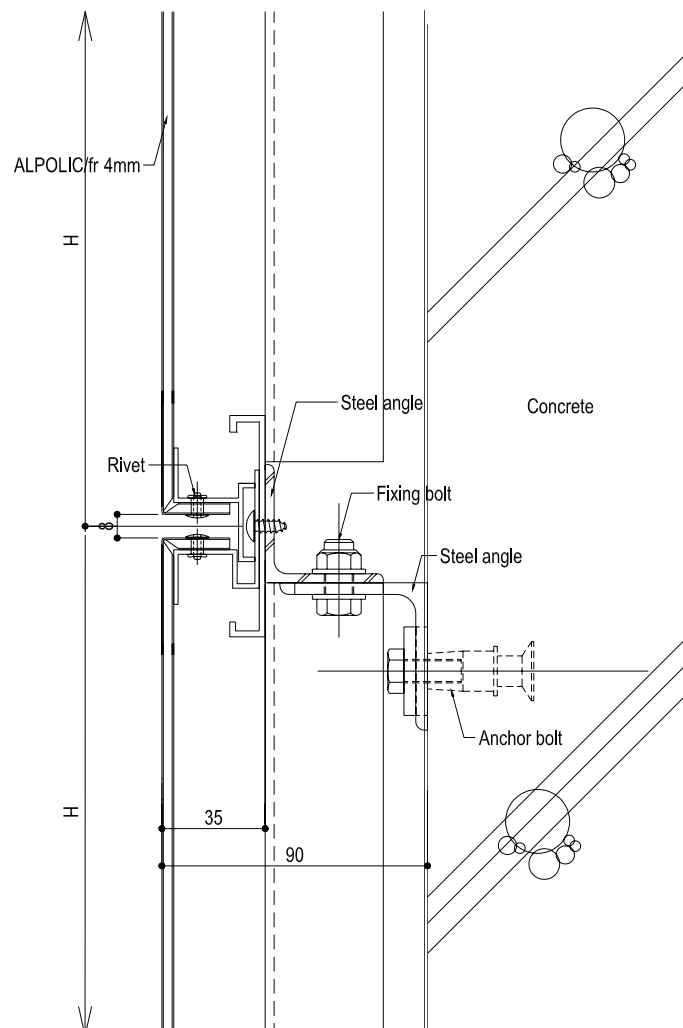
(4) External wall cladding – narrow open joint

Generally, this kind of method is suitable for Stone and Timber-patterned ALPOLIC panels in which narrow joints between the panels are aesthetically effective. According to need, we apply a sealing material or EPDM gasket to the joints.

Horizontal section



Vertical section



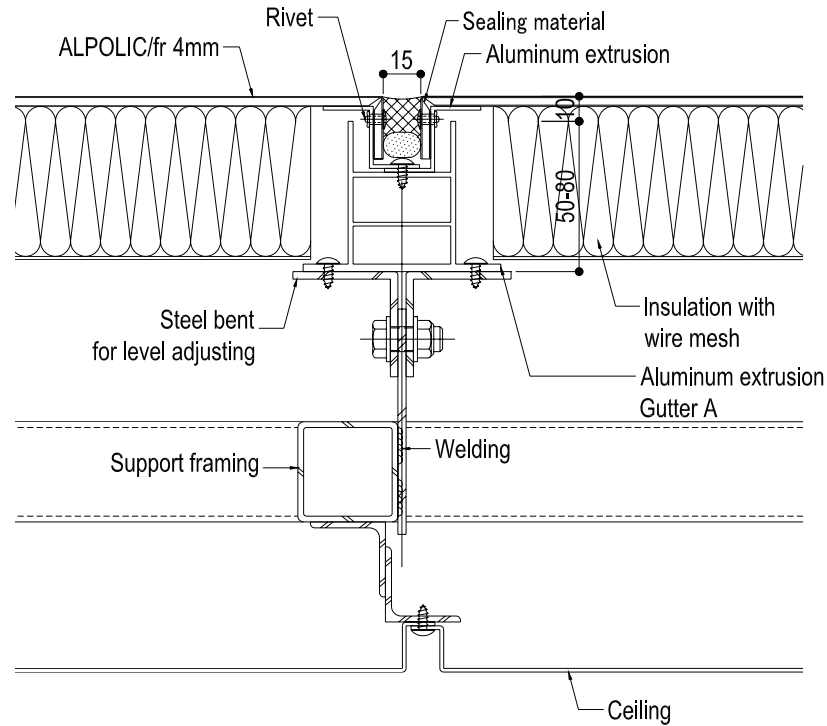
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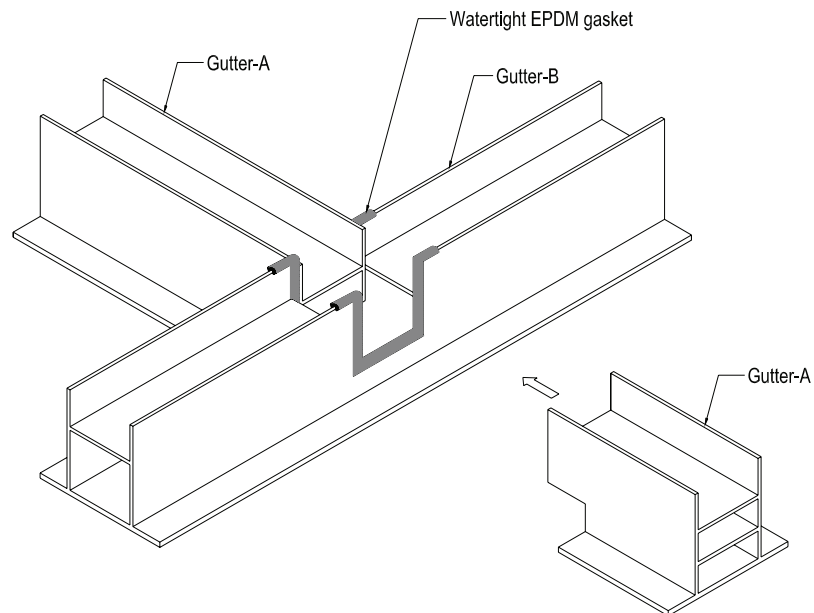
(5) Roof covering

ALPOLIC has been used for roof covering in prestigious projects such as airports and stadiums. In roof applications, we install a water gutter or waterproof sheets behind ALPOLIC panels so that leaked water can drain outside.

Typical section



Gutter system



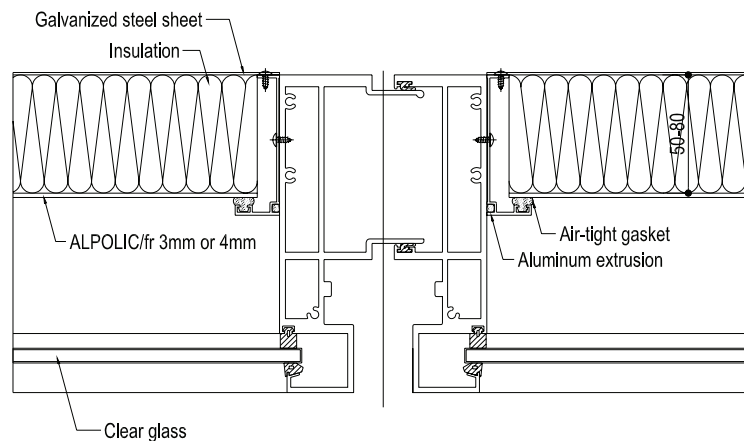
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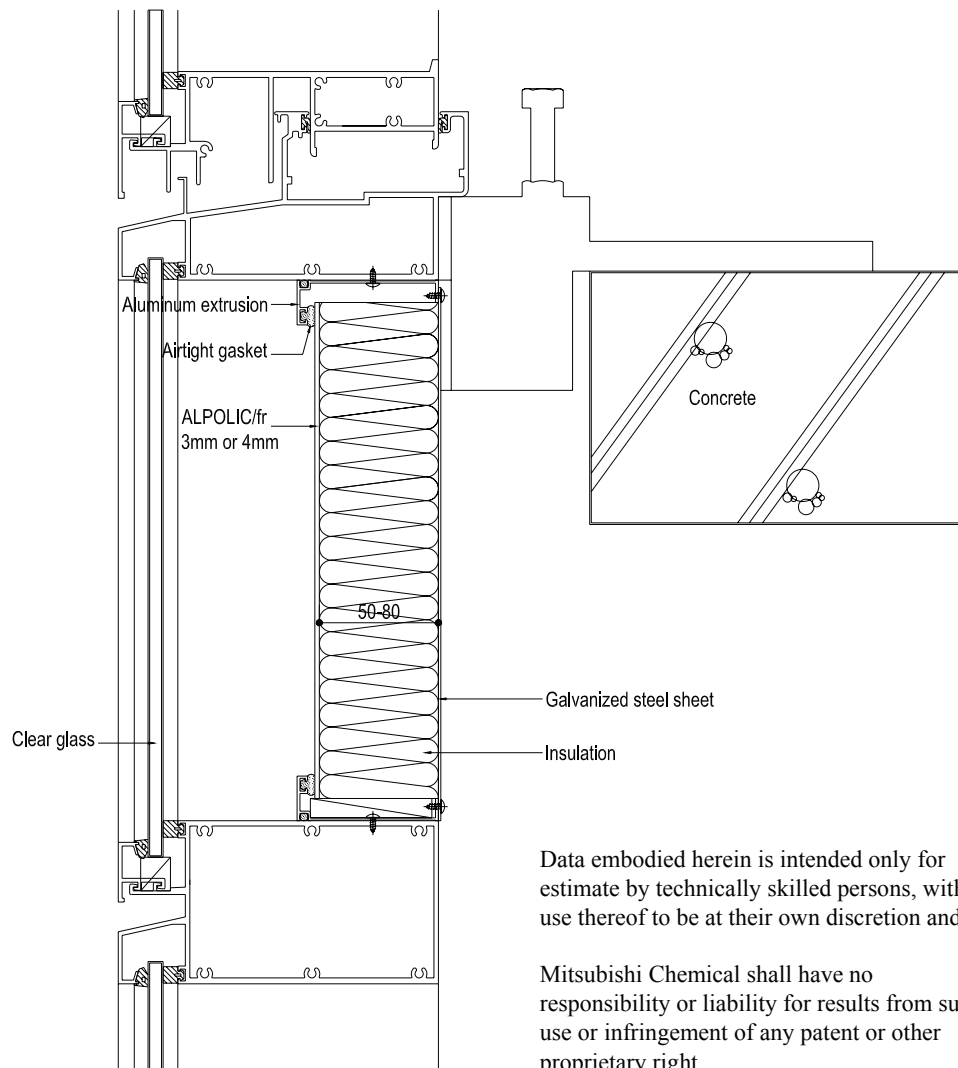
(6) Back panel of glass curtain wall

Glass curtain walls sometimes need an opaque spandrel panel (back panel) behind glass for aesthetic and energy-saving purpose. The spandrel back panels behind the glass must be very durable especially to UV exposure, because it is hard to replace them after the building is completed. ALPOLIC is the perfect material for such applications.

Horizontal section



Vertical section



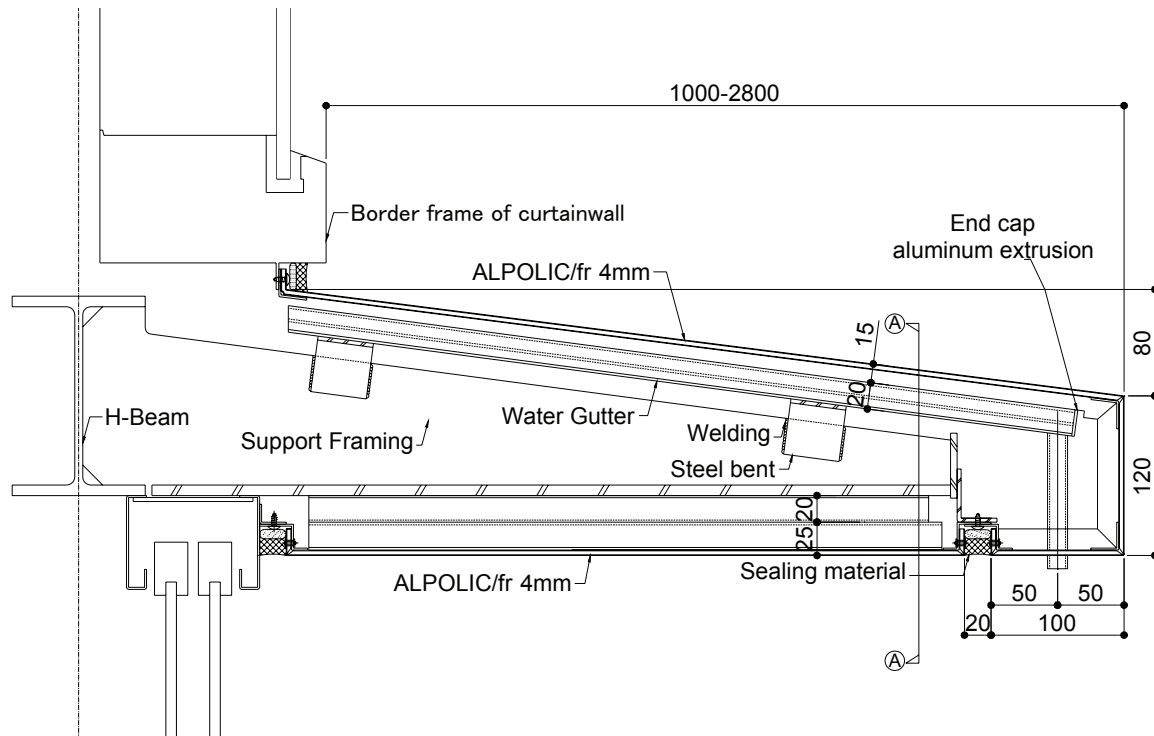
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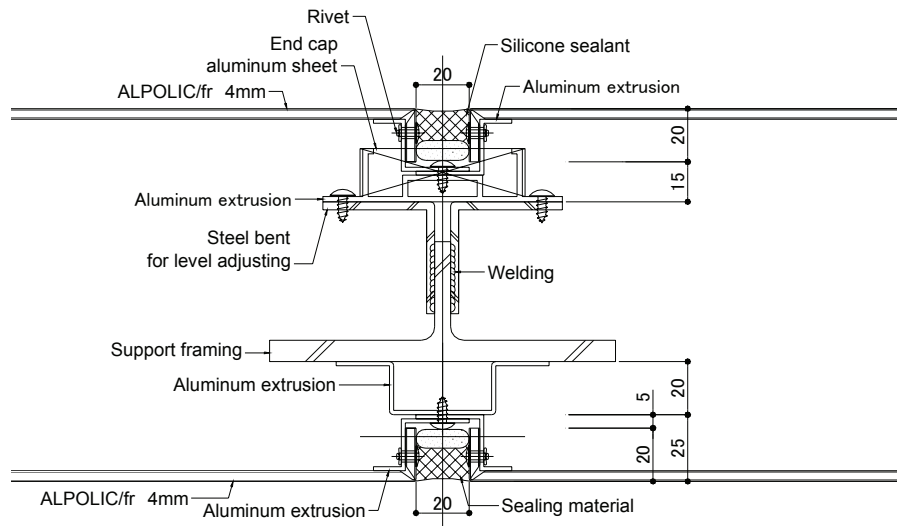
(7) Sunshade or cornice

ALPOLIC is sometimes used for sunshade or the cornice of a building wall. In this type of application, normally steel or aluminum frames are used as reinforcement behind ALPOLIC.

Typical section



A-A section

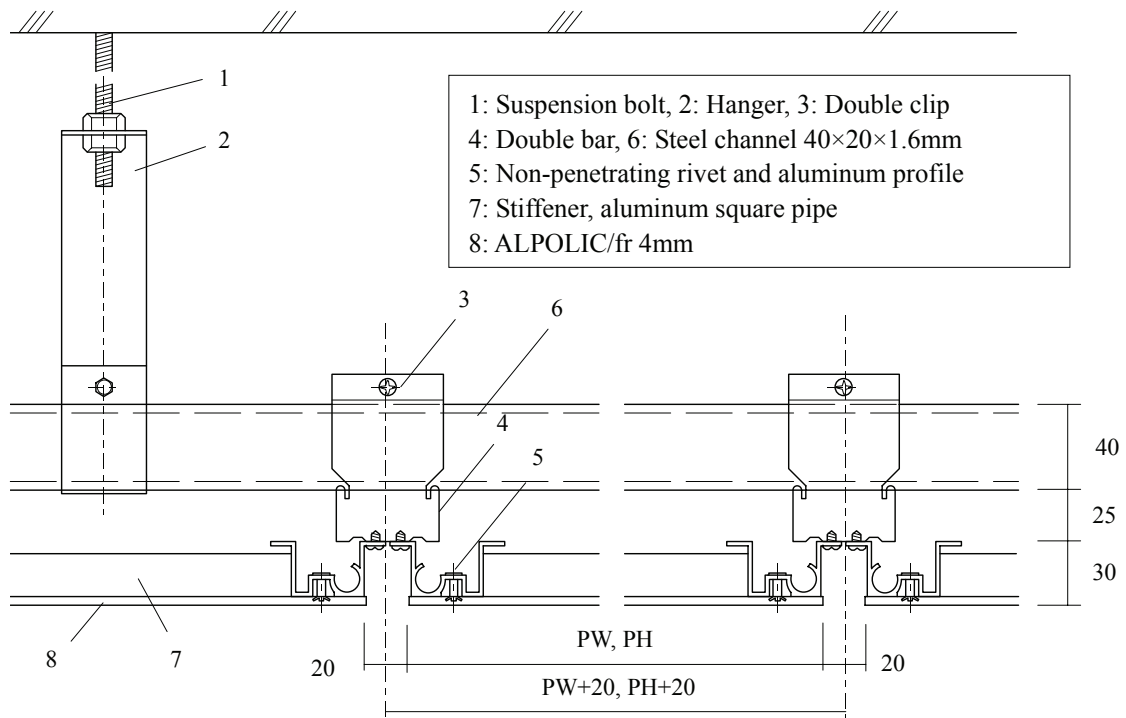


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(8) Ceiling panel with non-penetrating rivet

When we use ALPOLIC for indoor ceilings or soffits, non-penetrating rivets simplify the panel details. Non-penetrating rivets are usable **only on low-gloss finishes (30% or less)**. If we use these rivets on medium to high gloss products, the trail of the concealed rivet is visible from front. The design strength of the non-penetrating rivet is approx. 300 N/piece not including the safety factor. Refer to “Appendix 7: Modified non-penetrating rivet” in Section 4. In this method, we install fabricated ALPOLIC panels on lightweight suspension bar ceiling systems.

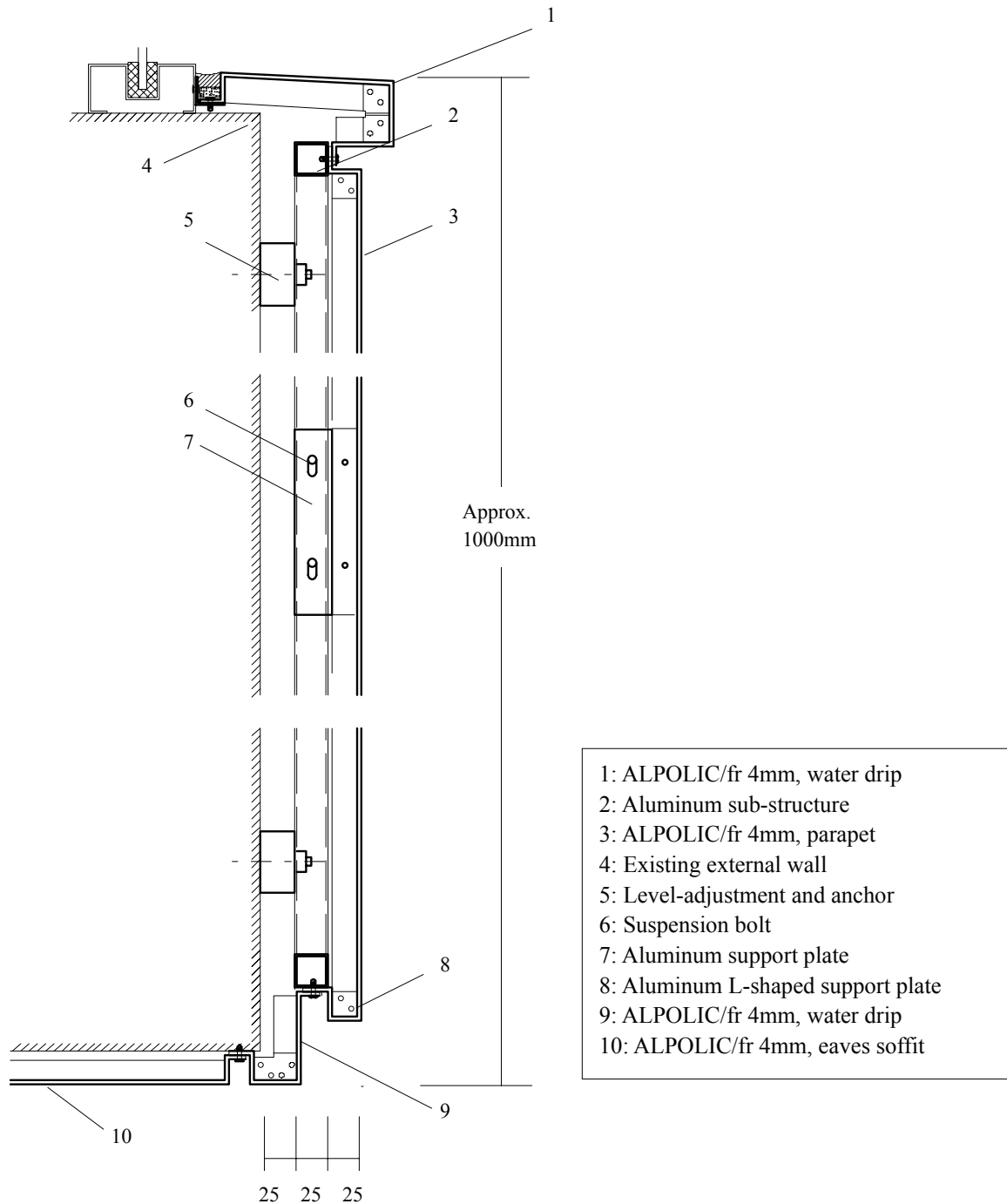


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(9) Parapet and soffit, renovation

ALPOLIC is widely used for parapets and soffits in building renovation. ALPOLIC is used for the water drip, parapet and soffit in the following detail.



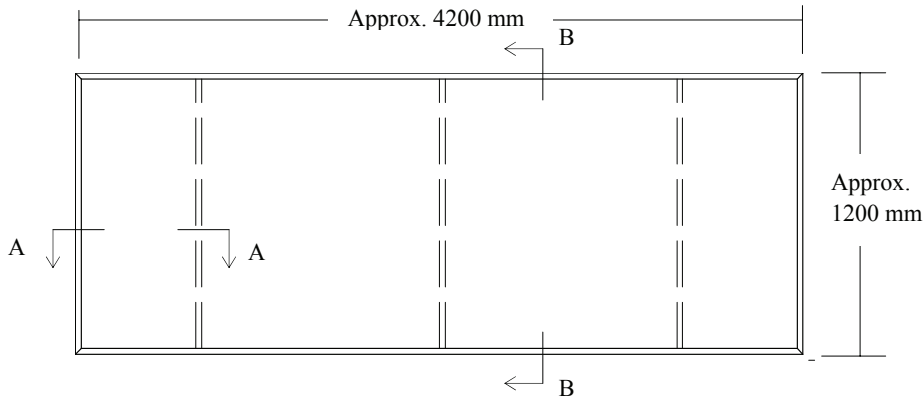
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(10) Corporate shop front signboard

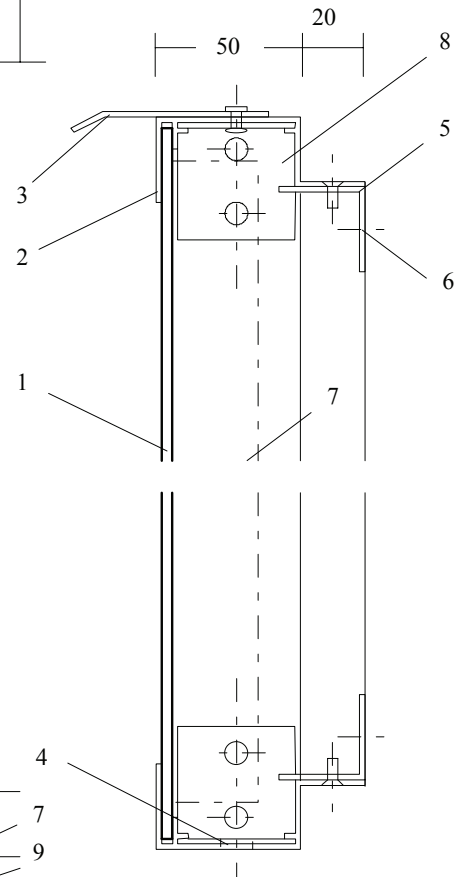
This corporate signboard is a shop front sign of a countrywide newspaper company in Japan. The signboard has signs by 3M's Scotchcal film. The aluminum flanges are coated with the same color as ALPOLIC.

Elevation

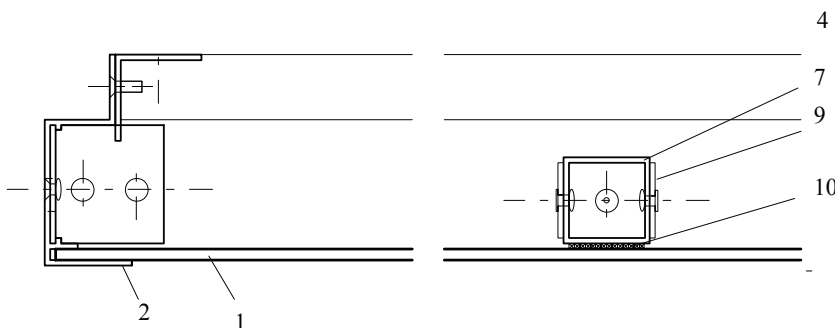


1. ALPOLIC 4mm having signs (logotype, letterings) by Scotchcal film
2. Aluminum flange coated with the same color of ALPOLIC
3. Water drip
4. Drain hole
5. Steel sub-structure, L-30×30, coated
6. Anchor
7. Stiffener, aluminum square pipe, 30×30×2
8. Corner support plate, aluminum L-40×40
9. Aluminum channel (top & bottom only)
10. VHB tape

B-B section



A-A section



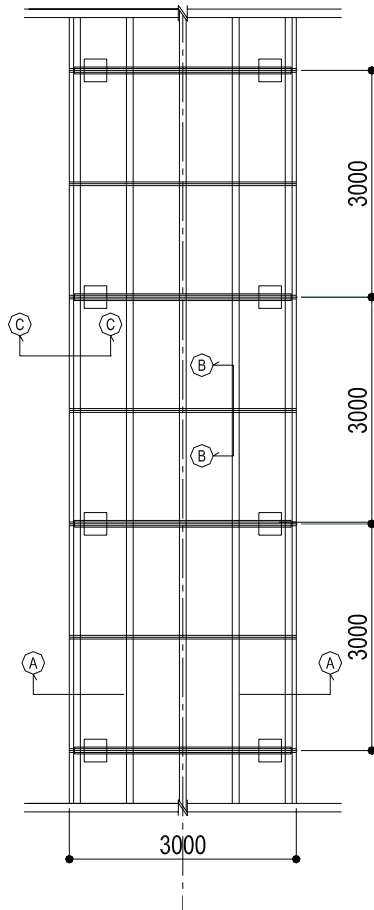
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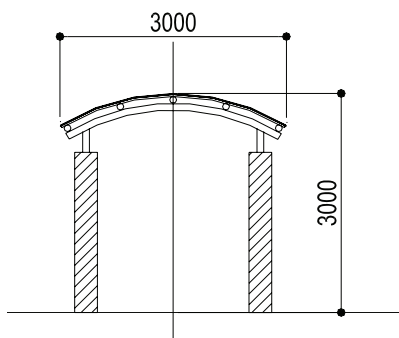
(11) Roof of pedestrian passage

ALPOLIC has been used as roof panels of public pathways and bus stations. Refer to an application photograph in P. 11. ALPOLIC panels are just clamped between sub-frames and aluminum extrusions. In most projects, the curving panels can be naturally curved without a mechanical bending.

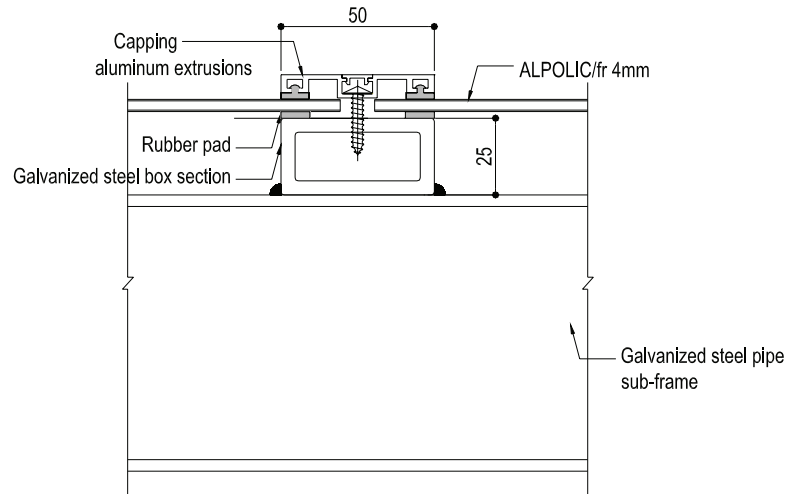
Plan



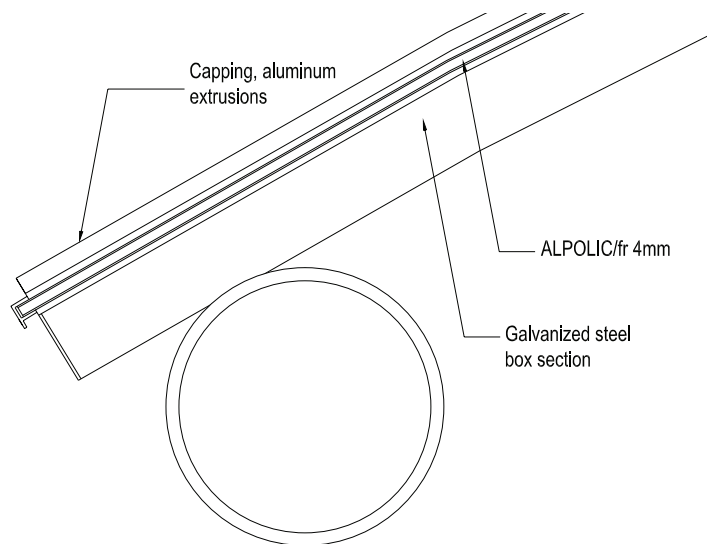
A-A section



B-B section



C-C section



Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk.

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8. Overview of installation work

(1) General

Installation work accounts for a substantial part of the entire ALPOLIC work. Supposedly, the best installation procedures will be chosen from many aspects including quality, construction period and its cost. In this chapter, we would like to look over the basics of installation procedures of ALPOLIC, taking a small to medium scale external cladding project as an example.

When we install fabricated panels at project site, we implement the installation work in accordance with the drawings and specifications of the project. In the event that we find some discrepancy between drawings and the actual conditions at project site, we have to report to and consult with the project controller.

(2) Installation procedures

General installation work consists of the following procedures:

Installation procedures	Equipment at project site
Unloading	Truck and crane
Marking	Scaffold
Substructure work	Ditto
Rust inhibiting coating	Ditto
ALPOLIC work	Ditto
Accessories work	Ditto
Joint sealing	Ditto
Clearing and cleaning	Dismantle scaffold

(3) Comments on each procedure

a. Unloading

Unload ALPOLIC panels on the roof, on each floor or suitable places on site. The unloaded panels on each floor will be just those required for the relevant floor. Fasten the panels together with rope and a covering sheet for protection.

b. Marking

Confirm the reference line in the presence of a superintendent. Mark the installation line, based on the reference line and the approved shop drawing.

c. Substructure work

In order to install the substructure, weld steel bracket pieces onto hole-in anchors (example of bracket: L-50×50×4mmt, L=70mm). Weld continuous steel angles onto the brackets (example of continuous angle: L-40×40×3mmt). All the angles will be finished with rust inhibiting coating, which conforms to the project standard. To prevent fire during welding, pay attention to sparks that drop on the cover sheet and veneer. During the substructure work, check the level with a flush thread and plumb-bob line, or water level, if necessary.

d. Rust inhibiting coating

Apply rust inhibiting paint onto all the welded points including the back and edge. The paint and coating thickness must conform to the project standard

e. ALPOLIC work

Mark the installation line in accordance with the shop drawing. Fix ALPOLIC panel onto the substructure with self-tapping screws, 4mm in diameter, after confirming the position of the panel (left, right, top and bottom). The fixing interval will be normally 300-400mm depending on the strength calculation. After confirming the fixed conditions, peel off the protective film and clear the removed film.

f. Accessories work

Bring the accessories to the scaffold passage, as indicated in the shop drawing. The quantity of accessories brought to the scaffold passage must be kept to a minimum to avoid dropping and other accidents. Lay large accessories diagonally on scaffold passage.

Mark the installation line onto the substructure to meet the position of the window frame. Fix the accessory with self-tapping screws, 4mm in diameter, with @=300mm interval. After installation, check the installed level and precision. After the check, peel off the protective film. Clear the removed film.

g. Joint sealing

Use the sealing material as specified in the project and apply the joint design (width and height) as instructed from the sealant manufacturer. Typical sealing work includes cleaning of the joints, inserting back-up material, applying masking tape, applying primer, filling with sealant, tooling with palette knife, removing masking film and curing. As improper sealing work will affect the appearance and the waterproofing performance of the joint, the sealing work must be conducted exactly based on the instructions from sealant manufacturer.

h. Clearing and cleaning

Clear and clean the working area everyday after work. Especially, when the work is complete in a zone, clear, clean and transfer the area smoothly to the next location, in order to avoid hindering the next stage. Collect and clear unnecessary remains to the dump point everyday or transport out of the

site immediately.

9. Touch-up coating method

When we need to repair scratches on the coating surface of ALPOLIC, we can repair (touch-up) them at room temperature. We use an air-cured type of Lumiflon-based fluorocarbon paint for repair coating. The air-cured type paint consists of 2 components: main agent and hardener. Mix them with 13:1 ratio (main agent : hardener) and stir the mixture before use.

After application, the air-cured type paint will reach surface dry in 1 hour and will show a satisfactory coating performance in a couple of weeks. However, the touched-up portion may show a slightly different appearance, because the coating appearance depends on the coating method. Especially in Metallic Colors and Sparkling Colors, even an exactly matched paint may show a slightly different appearance. In Stone, Timber and Metal finishes, we use an intermediate solid color diluted with a clear paint for touch-up. The suitable dilution rate is, depending on the color, 10-90% of clear content. Regarding the touch-up procedures, refer to “Appendix 9: Touch-up coating method” in Section 4.

10. Cleaning method

(1) Removal of light surface soiling

Prior to applying a cleaner, we recommend a forceful water rinse cleaning from top to bottom. Low water volume with moderate pressure is better than considerable water volume with little pressure. Simultaneous physical rubbing is also effective. Use a soft sponge or soft rags fully soaked in water.

- a. Apply a water rinse with moderate pressure to dislodge the soiling. If this does not remove the soiling, test a simultaneous water rinse with a sponge. If the soiling is still adhering after dry, test a diluted mild detergent.
- b. When you use a diluted mild detergent, use it with soft sponges or soft rags. Wash the surface with uniform pressure and clean the surface in a horizontal motion first and then in a vertical motion.
- c. Minimize the drip and splash of the mild detergent and rinse the rundown immediately to avoid streaking. Clean the surface from top to bottom and follow with a thorough rinse with clean water.

(2) Cleaning of medium to heavy surface soiling

In order to remove medium to heavy soiling caused by grease and sealing material, some type of alcohol such as IPA (Isopropyl Alcohol), ethanol or N-hexane is used. Dilute these alcohols by 50% with water. Strong solvents or solvents-containing cleaners may have a detrimental effect on the coating surface. Do a spot test on a small unseen area. Wash the residues with mild soap and rinse with water.

(3) Caution

- a. Strong solvents and strong cleaner may cause damage to the coating. Do a spot test on a small unseen area.

- b. Avoid abrasive cleaner. Do not use household cleaners containing abrasives.
- c. Do not rub excessively as it may change the coating appearance.
- d. Avoid drips and splashes. Remove the rundown as soon as possible.
- e. Avoid extremely high and low temperatures. Extremely high temperatures will accelerate the chemical reaction, evaporate water from the solution and cause streaking. Extremely low temperatures will result in a poor cleaning effect. Perform cleaning work on a shaded side of the building under moderate temperatures.
- f. Do not use paint removers, strong alkali or acid cleaners. Do not use strong organic solvents such as MEK (Methyl Ethyl Ketone), MIBK (Methyl Isobutyl Ketone), Treclene (Tri-chloroethylene) or thinner.
- g. Make sure that cleaning sponges and rags are grit free.
- h. Do not mix cleaners.

(4) Practical cleaning method

Cleaners and detergents are normally local products. A cleaner or a detergent widely available in one country may not be available in another country. We attached an example of a practical cleaning method in “Appendix 10: Example of practical cleaning method” in Section 4. To confirm the harmlessness of your cleaner, contact local distributors or our office. We will perform a test with your cleaner sample.

11. Panel dimension and tolerance

For your planning (design) work of fabrication and installation, we excerpt the panel dimensions and tolerances here from the product specifications.

(1) Product dimension

	ALPOLIC/fr			ALPOLIC		
Thickness	3mm	4mm	6mm	3mm	4mm	6mm
Weight	6.0 kg/m ²	7.6 kg/m ²	10.9 kg/m ²	4.6 kg/m ²	5.5 kg/m ²	7.4 kg/m ²
Width ^{Note 1}	965, 1270 or 1575mm (for user's selection)					
Length	Less than 7200mm (for user's selection)					

Note 1: Custom width is available between 914 mm and 1575 mm subject to minimum quantity. Contact local distributors or our sales office.

Note 2: (Edge condition) ALPOLIC has cut edges without aluminum sheet displacement or core protrusion.

(2) Product tolerance

Width:	±2.0 mm
Length:	±4.0 mm
Thickness:	±0.2 mm in 3 and 4 mm thick, ±0.3 mm in 6 mm thick
Bow:	Maximum 0.5% (5mm/m) of the length or width
Diagonal difference:	Maximum 5.0 mm