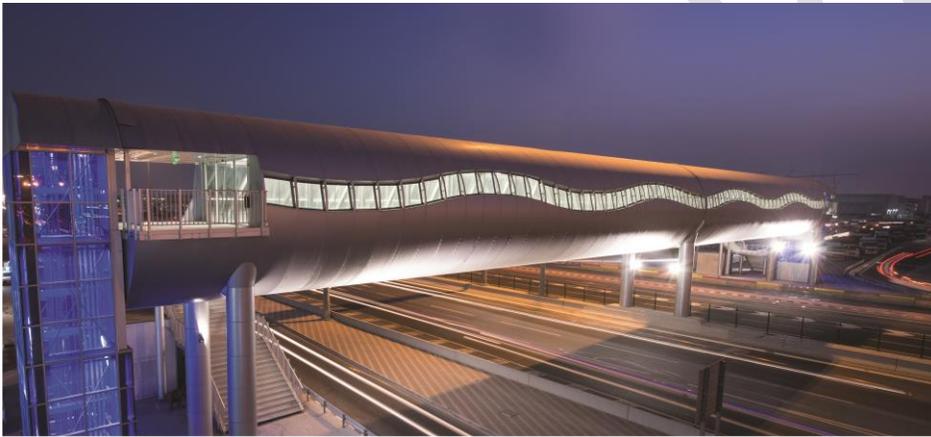


Technical and Processing Manual

etalbond[®]
COMPOSITE MATERIALS



ELVAL COLOUR
Power to imagine

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FINAL DRAFT

etalbond® Product

etalbond® Description

etalbond® is a technologically advanced and innovative Aluminium composite panel suitable for exterior cladding of new buildings and retrofit applications. It consists of a core firmly bonded between fine aluminium facing and backing sheets and it is available in three versions:

etalbond® which is a standard version of etalbond® consisting of a non-toxic polyethylene core.

etalbond® FR is a fire retardant material with a mineral filled (>70%) polymer core, maintaining all the important characteristics of **etalbond®**, such as resistance to weather, flatness and simple forming techniques.

etalbond® A2 has a mineral filled core (>90%), rated as A2-s1,d0: A2 for limited combustibility, s1 for lowest possible smoke emission and d0 for no droplets when the panel is exposed to fire according to the classification per EN13501-1. The A2 fire class makes this new product ideal for use in high-rise, buildings of high occupancy such as shopping malls, airports and train stations and for high sensitivity buildings such as hospitals, elderly care centers, schools, kindergartens and nurseries.

etalbond® composite panels consist of two aluminium alloy sheets EN-AW 3105 (AlMn 0.5 Mg 0.5) H44 / EN-AW 3003 H44 / 3005 H44 / 5005 H44 / 5754 H42, according to EN 573-3, with a thickness of 0.5 mm each, bonded with the core. Bonding of the aluminium and core material is achieved by both chemical and mechanical action, which gives etalbond® remarkable bond integrity. The result is an exceptionally flat, corrosion-resistant panel easy to use.



etalbond® Applications

etalbond® is a highly versatile material that adapts perfectly to all buildings contours and facilitates creative architectural design. The excellent combination of its characteristics such as formability, flatness, stability and weather resistance allows etalbond® to be shaped in a multitude of ways keeping its remarkable bond integrity.

The material is suitable for exterior and interior applications such as wall cladding, fire resistant structures, interior decoration, light supporting structures, exhibition stands, false ceilings, machine coverings and signage. For ventilated facades systems etalbond® panels can be either used as flat riveted sheets or fabricated into cassettes.

Transportation, Handling and Storage of etalbond® panels

Transportation

The following guidelines are provided to ensure the protection of etalbond® composite panels from mechanical damages and the decay from humidity and weather conditions.

- The etalbond® pallets must be handled carefully during transport. Ensure that etalbond® pallets are safely fastened on the track-bed and handled carefully during transport and unloading
- Secure etalbond® panels against slippage during transport.
- The etalbond® pallets must be always closed during loading and unloading
- Upon delivery, the pallets must be always examined for any damages for any shape deformation, damage to the plastic wrapping or any moisture presence (wet panels must be dried to avoid formation of dust spots). Any damage should be immediately reported (by putting a notice on CMR) and confirmed by the forwarding agent or inform insurance company.

Forklift Unloading

When loading or unloading etalbond® panels with the use of a forklift, make sure that the lifts are set to their maximum distance apart by slightly raising the fork and located centrally beneath the pallets. Pallets should be unloaded one by one and placed on even ground.

Crane Unloading

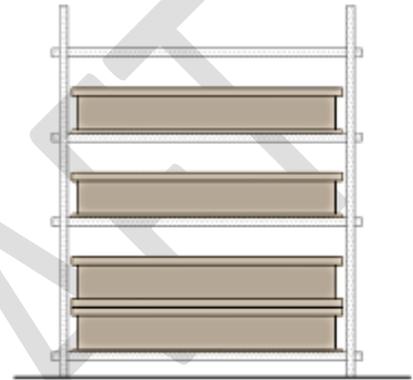
When unloading the panels, always use a spreader bar and slings to prevent damage of sides. Make sure that that lifting slings are always in good condition, placed with protection to the bottom panel and that package is balanced. Ensure that no people are below the pallet during a lifting operation.

Storage

Store etalbond® pallets in dry and well-ventilated areas protected against rainwater, humidity, abrupt temperature fluctuations and avoid condensation (when moving cold panels to warm areas).

- Only pallets of identical size should be stacked, with a maximum of five pallets stacked on top of each other, with the heavier pallets at the bottom and protect against humidity.
- Avoid unpacking etalbond® pallets until use.

- The correct storage of etalbond® panels or pallets is on horizontal racks. Flat storage protects etalbond® panels from warping. Do not store etalbond® in dusty places.
- After unpacking, restore remaining panels horizontally into the palette.
- Store the panels in indoor atmosphere to minimize the degradation of the protective film by the direct sun light.
- Panel storage should not exceed 6 months. In such a case the protective film might become too difficult to remove.
- Do not put anything between successive panels when stacking as the surface might be damaged.



etalbond® packing and unpacking

- Always pack and unpack etalbond® in a clean place.
- Remove any dust or chips from etalbond® and the packing paper. Any hard particles between panels can cause dents to the etalbond®.
- etalbond® panels should always be handled by at least two people and the panels should be carried vertically. Long sheets should be handled by additional people.

Handling

Handling of Panels

- Use clean dry gloves when manually handling etalbond® panels and do not drag sheets over each other.
- Despite of the hardness of the coating and the presence of the protection film, the self-weight of the etalbond® stack is always a potential mechanism of damage.
- Never pull or push panels over the edge during loading or unloading situations, as there is the potential to damage the coated surface. Instead, lift the panels by holding them from both ends.
- Handle panels with caution on a clean worktable and make sure to protect the pre-coated surface from any potential damage. Do not handle etalbond® on the floor.
- Do not expose transport protection films to direct sunshine or to heat for long periods.
- Panels should not be wet during storage, but in case it happens, they need to be dried, in order to avoid corrosion or surface defects.
- Do not use markers or inks on the protective film.

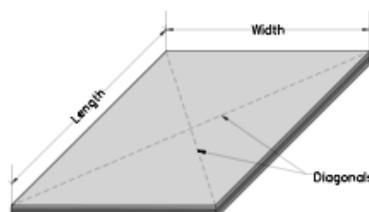
Panel Dimensioning

For dimensioning the etalbond® panels the following information is important.

Panel dimensional Tolerances:

Thickness ± 0.2 mm

Width $-0 / +4$ mm



Length 1000 – 4000 mm -0 / +4 mm

Length 4001 – 6000 mm -0 / +6 mm

Length 6001 – 8000 mm -0 / +10 mm

The etalbond® panels have been produced at a certain temperature and within the above tolerances. When cutting or routing, the temperature is certainly different and this means that due to thermal expansion in the largest dimension, the length must be taken into account to ensure the dimensional accuracy for the assembly.

Before processing, store the panels at room temperature for at least 24 hours.

Panel Trimming

The etalbond® panels have to be trimmed on all 4 sides to ensure perfect rectangularity and precision of cut edges used as such for riveted façade applications.

When dimensioning the panels, always consider the trimming cuts as necessary.

Panel Edges

Due to the tolerances of aluminium sheets in conjunction with the manufacturing process, a lateral misalignment of the cover sheets of 2 mm is possible at the panel edges.

Structural Calculations of Modules

For wind Load tables consult etalbond® product Approvals or ask for details (contact ecs@elval-colour.com).

Panel Protective Film

Protective film ensures panel finish protection during packaging, transportation, processing, shaping and installation. The film must remain on the panels during all phases of processing to prevent scratches and staining. Arrows marked on the film show the direction of coating and should be taken into account during shaping and installation.

Always observe closely the following rules regarding protective film

- To avoid residuals of adhesive on to the surface of the panels due to UV radiation, remove the protective film as soon as possible after the installation. Note that as a rule of thumb, the protective film should not remain on panels positioned on a building longer than 60 days (weathering for a longer period could make the film removal difficult if not impossible).
- The protective films and the panel surfaces should not come in contact with any kind of inks, adhesive tapes, stickers or marking pens, as the lacquered surfaces could be damaged by the included solvents or plasticizers.
- The protective film should not be removed at temperatures below 10°C.

Contact With Other Materials

Aluminium, plastic, zinc and stainless steel may come in direct contact with etalbond®. In any other case, additional protection of the contact area will be necessary. This can be achieved with non-porous coatings such

as aluminum, zinc, organic varnishes, or electrically insulating inserts (washers). The direct contact of etalbond® with metals such as copper, bronze, brass, iron is not allowed.

Protective Equipment

Personal protective equipment should be worn at all times in the workshops and in accordance to safety regulations.

It is necessary to wear gloves for handling the panels at all stages.

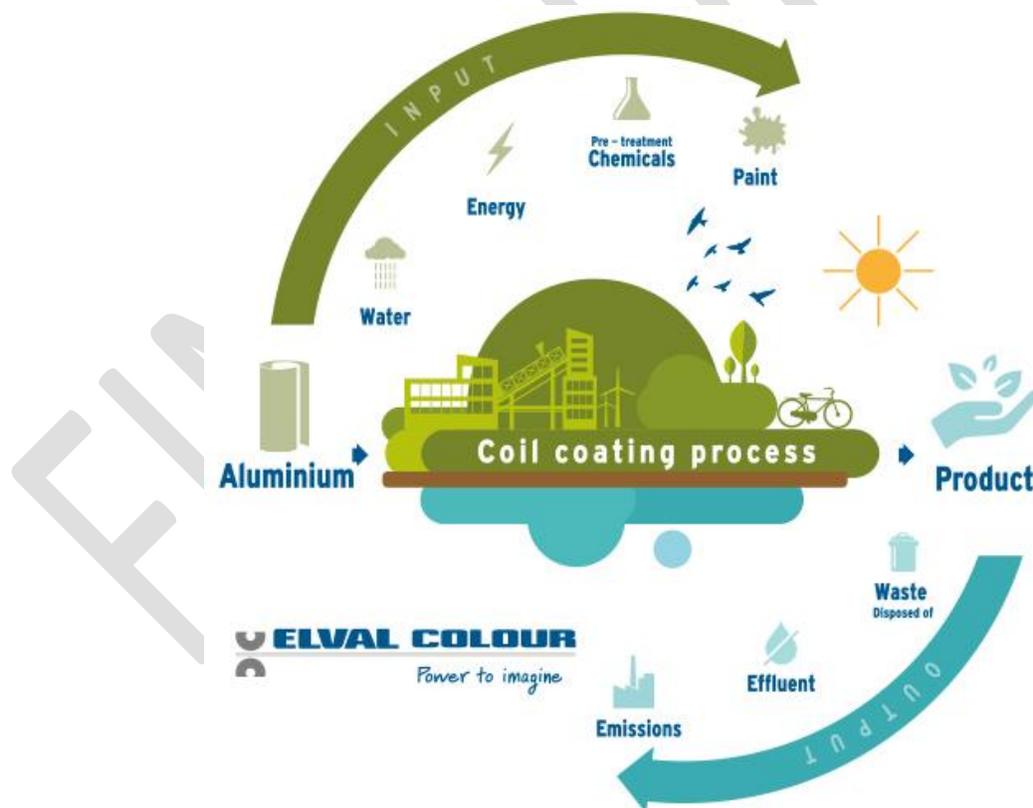
Goggles should be worn at all fabrication stages of the product (sawing, milling, drilling...), as well as ear protection for noisy operations.

Recycling



Aluminium is 100% recyclable without quality loss. In recycling terms, 70% of all aluminium manufactured the last 100 years is still in use today. Recycling aluminium today consumes only 5% of the original amount of energy for producing primary aluminium from bauxite ore.

During etalbond® manufacturing, the scrap produced is systematically reduced and recycled (both aluminium and plastic core), to keep an environmentally friendly operation. The company has in place an environmental management system based on EN14001.



Panel Installation

It is recommended to install the composite panel modules in the same direction as shown on the protective film (for metallic, special effect, dual colours and natural) during the placement of the panels on a façade, to avoid any deflection differences.

Colour variations may occur between panels from different production runs. To ensure unrivalled colour consistency, place the total quantity required for a project in one production run, especially the front façade of a building should be of panels of one production run, recognized from the marking on the back side of the panel and the label on the pallet.



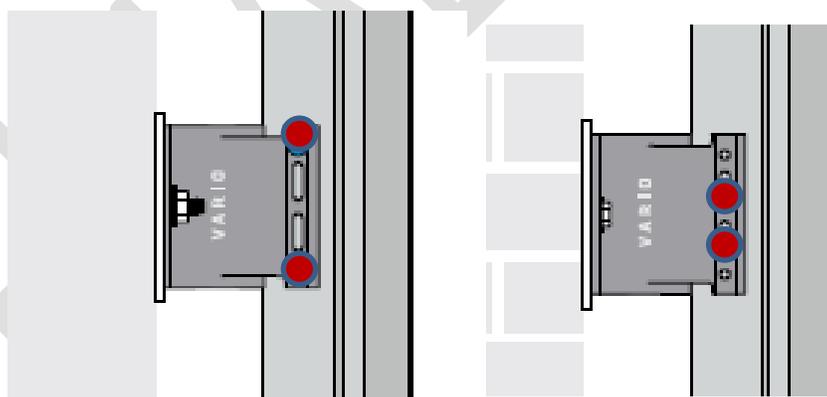
Substructure system Connections – Mounting Fixing Brackets

Depending on the cladding project, several substructure systems are available to choose from.

The choice of the anchors used for the mounting of brackets to the wall is critical and is decided by the Structural Engineer of the project.

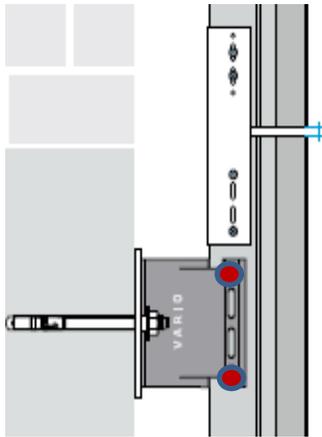
When placing the main supporting profiles on the building wall, attention must be given to the fixed and flexible support connections between the mounting brackets and the main profiles.

One fixed support connection is chosen on each main profile (We recommend the top connection to be chosen as fixed) while all the rest are chosen as flexible (or sliding) connections.



Fixed connection / Flexible or sliding connection

Joining of Main Vertical Profiles



The connection between the main vertical profiles at the expansion joint is made with an aluminium plate that provides the freedom of movement at the expansion joint. Rivets 4.8 x 12mm or screws can be used to fasten the mullions.

The distance from the edge of the Vertical Profile to the uppermost Fixing bracket should not exceed 200 mm.

Installation of etalbond® panels and cassette modules

The thermal expansion of etalbond® panels should always be considered.

Given that the etalbond® is designed to behave well at a temperature range of -20 °C to +80 °C and considering an installation temperature of +20 °C, the maximum anticipated temperature difference is 60°C. Given the linear expansion coefficient of etalbond® to be 2.4 mm/m/100 °C, the expected expansion / contraction per linear meter of panel can be determined.

Always consider the minimum width of the joint which depends on the expected expansion of the panel.

According to the etalbond® German Technical Approval by DIBt (Deutsches Institut für Bautechnik) Z10.3-742, § 3.1.1, the temperature difference of 10°C may be assumed between the supporting profiles and etalbond® in the direction of the supporting profiles, under the condition that the supporting profiles are in direct contact (no thermal separation) with etalbond®.

etalbond® panels

When riveting panels and in order to avoid jamming, the bore holes must be large enough to allow for the anticipated expansion. The rivet shaft shall fit closely to the hole. The fastener head diameter must be at least 2 mm larger than the bore hole.

On each etalbond® panel, two successive points at each direction must be chosen as fixed points, usually at the middle of the panel or its topmost fastening point, and all the rest must be formed as flexible points.

Fixed point means that the drilled bore hole has a diameter equal to the diameter of the rivet plus 0.2 mm allowance.

Sliding point means that the drilled bore hole has a larger diameter than the fixed point and it can be calculated based on the panel dimensions and temperature difference between assembly and extreme temperatures.

$d_{sliding\ hole} = d_{rivet} + 2 \times DL$, where

- $d_{sliding\ hole}$: diameter of the sliding hole
- d_{rivet} : diameter of rivet body

- DL the anticipated elongation / contraction in mm: $DL = L \times \alpha_t \times \Delta T$
- L: maximum length between the fixed and the sliding point in mm
- Coefficient $\alpha_t = 24 \times 10^{-6}$
- ΔT the temperature difference in °C or Kelvin

Fixed points, both on panel and on substructure frame, must be drilled centrally.

The minimum distance of a rivet position from the panel edges is 15 mm for etalbond® / etalbond® FR and 25 mm for etalbond® A2.

Always remove the protective film in the area of the rivet head or screw before placing.

etalbond® cassettes

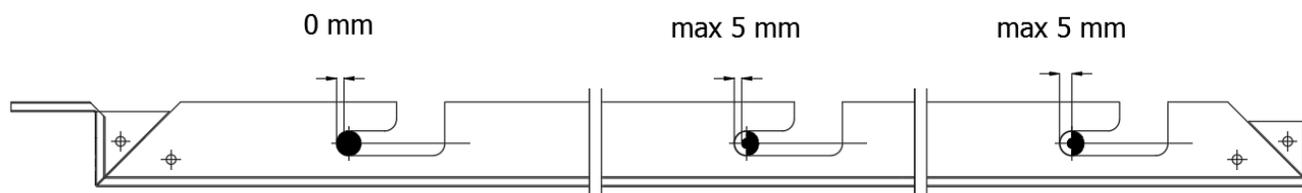
On suspended cassettes, consider to leave a clearance between the cassette and the fixing pintles at the back of the slot (distance between the connecting metal cylinder and the upper end of cassette slot) applicable to all pintles except the most upper one (where E=0).

The spacing for all other pintles is taken as $[E = 3 \text{ (recommended standard)} \pm 2 \text{ (tolerance by mounting)}]$ or $[DL]$, where

$DL = L \times \alpha_t \times \Delta T$ where

- DL the anticipated elongation / contraction in mm
- $\alpha_t = 24 \times 10^{-6}$
- L: length between upper and lower cassette slots in mm

DL should not be greater than 5 mm.



Clearance of suspension rods at the back of slot

For more information on installation instructions of etalbond® cladding systems, request our installation manuals per specific cladding system - contact ecs@elval-colour.com.

Thermal expansion coefficients

Material	Coefficient of linear expansion	Elongation /1 meter / 50°C temperature difference
Aluminum	$23.0 \times 10^{-6}/^{\circ}\text{C}$	1.2 mm
etalbond®	$24.0 \times 10^{-6}/^{\circ}\text{C}$	1.2 mm
Iron	$11.4 \times 10^{-6}/^{\circ}\text{C}$	0.57 mm
Steel	$12 \times 10^{-6}/^{\circ}\text{C}$	0.6 mm
Zinc	$26.3 \times 10^{-6}/^{\circ}\text{C}$	1.32 mm
Titanium	$8.5 \times 10^{-6}/^{\circ}\text{C}$	0.43 mm
Concrete	$12 \times 10^{-6}/^{\circ}\text{C}$	0.6 mm
LDPE	$100-200 \times 10^{-6}/^{\circ}\text{C}$	5.0- 10.0 mm
Acrylic sheet	$50-90 \times 10^{-6}/^{\circ}\text{C}$	2.5 -4.5 mm

Thermal expansion and contraction coefficients for different materials

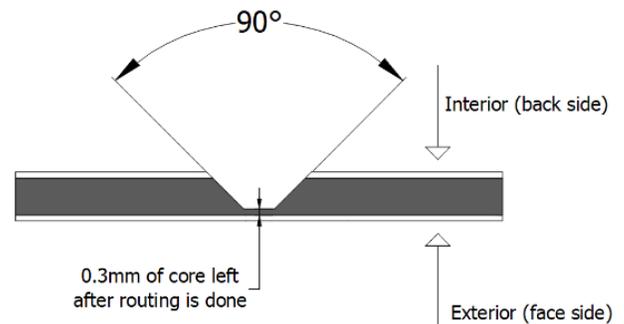
Temperature difference	Length of panel							
	1m	2m	3m	4m	5m	6m	7m	8m
[° C]	Change in length in [mm]							
- 30	-0,72	-1,44	-2,16	-2,88	-3,60	-4,32	-5,04	-5,76
- 20	-0,48	-0,96	-1,44	-1,92	-2,40	-2,38	-3,36	-3,84
- 10	-0,24	-0,48	-0,72	-0,96	-1,20	-1,44	-1,68	-1,92
0	0	0	0	0	0	0	0	0
10	0,24	0,48	0,72	0,96	1,20	1,44	1,68	1,92
20	0,48	0,96	1,44	1,92	2,40	2,88	3,36	3,84
30	0,72	1,44	2,16	2,88	3,60	4,32	5,04	5,76
40	0,96	1,92	2,88	3,84	4,80	5,76	6,72	7,68
50	1,20	2,40	3,60	4,80	6,00	7,20	8,40	9,60
60	1,44	2,88	4,32	5,76	7,20	8,64	10,08	11,52
70	1,68	3,36	5,04	6,72	8,40	10,08	11,76	13,44
80	1,92	3,84	5,76	7,68	9,60	11,52	13,44	15,36

Expansion in length of Aluminium in mm

etalbond® processing

Routing instructions for etalbond® / etalbond® FR panels

etalbond® / etalbond® FR can be routed by using conventional equipment (CNC machines). For accurate and precise manual folding of the etalbond® composite panels, resulting in a good finish, we route the rear side of the panels and extract the aluminium strip and part of the core. To achieve the desired result, CNC machines use rotating milling cutters. CNC machines can produce all kinds of linear and curvilinear cuttings in one pass following exactly a given CAD drawing. Vacuum CNC tables are recommended.

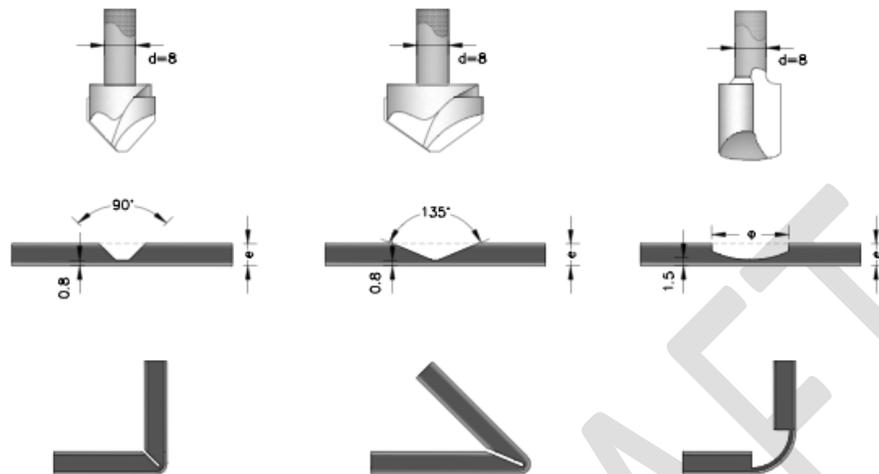


- Before processing, etalbond® panels should be stored at room temperature for at least one day.
- The total thickness of remaining material should be 0.5 mm (aluminium) plus 0.3 mm (core) ± 0.15 mm. At the routing side, the aluminium strip should never be visible.

Steps for routing using a CNC machine

- Make sure the table surface is clean.
- Put carefully the panel on the CNC table with the coated surface downwards.
- Define a point 0 by squaring the panel on the CNC table
- Place the milling cutter in contact with the surface to be milled
- Deduct the value of the milling cut by using the depth adjustment wheel. Modifications in milling depth might be necessary in order to obtain the correct routing depth.
- Make a trial to verify the proper routing depth (0.3 mm of the core is left on the backside of aluminium).
- The optimum thickness of remaining core for a V shaped route is 0.3 mm otherwise if bigger the fold will not close correctly and if less it might break when folding.
- Keep CNC table clean at all times.
- Cutting and routing lines should be free of dust and aluminium remnants.

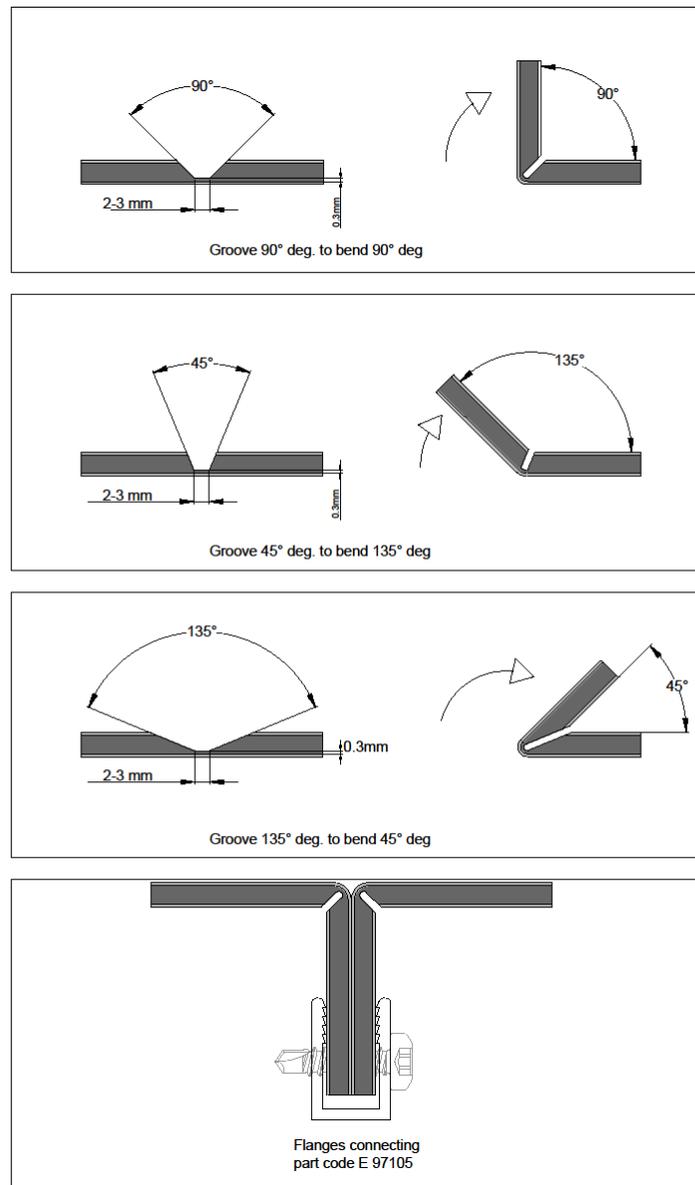
For etalbond® / etalbond® FR routing, the following mechanical equipment can be used.



The spindle speed is recommended to be 21000 rpm and the feed rate according to the following table:

Cutting tool diameter (mm)	Feed Rate (m / min)
4	4
5	5
6	6

For sharper edges (down to 45° degrees), a V-groove of 135° is required. The base of the groove should always be flat and about 2 to 3mm wide. In general, the folding radius is determined by the shape and depth of the groove. It is advisable that several trials are made before start, to insure the required folding radii in etalbond® cassettes.



Summary

Before the processing of any panel, it is obligatory to make the corresponding calculations for the cutting dimensions. This will have as a result the achievement of the best possible tolerances. In generally ± 1 mm are the accepted tolerances in fabricated elements for cladding applications. Trials should also be carried out before processing campaign.

Routing instructions for etalbond® A2

etalbond® A2, due to its high content of inorganic ingredients, requires special handling and tools for its cutting and routing process. For this purpose, the usage of polycrystalline diamond (PCD) tools is highly recommended.

Cutting tools

The Frezite A831.012.109.12 polycrystalline diamond (PCD) cutting tool is suitable for etalbond® A2.

CNC machine recommended settings:

Feed rate: 8-10 m/min, Rotate: 21000 rpm

For orders please contact info@frezite.com

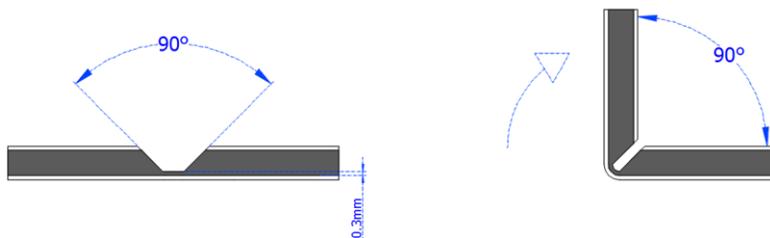


Routing tools

90° routing

The Frezite A829.018.113.16 polycrystalline diamond (PCD) V-grooving tool is recommended for 90 degrees routing on etalbond® A2.

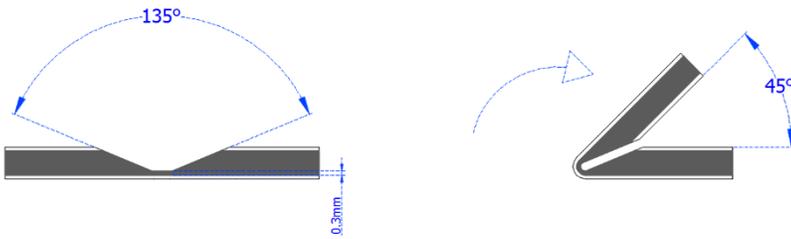
Recommended CNC settings: Feed rate: 5-6 m/min, spindle speed: 21000 rpm



135° routing

The Frezite A829.018.108.16 polycrystalline diamond (PCD) V-grooving tool is recommended for 135 degrees routing on etalbond® A2.

Recommended CNC settings: Feed rate: 5-6 m/min, Rotate: 21000 rpm

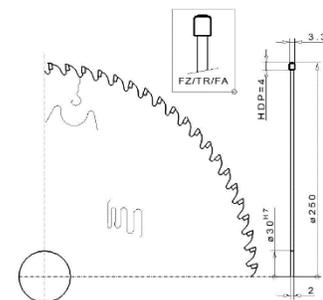


Rectangular grooving is not recommended for etalbond® A2.

Vertical saw for cutting

A suitable blade for the vertical saw has code 3AK0308 from the company Cruing. The maximum rotational speed should not exceed 7600 rpm.

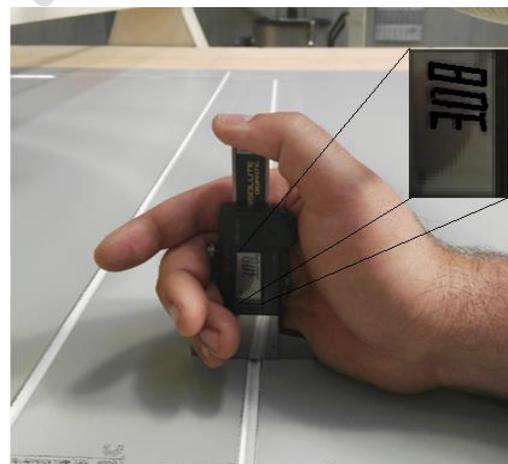
For orders please contact info@cruing.de.

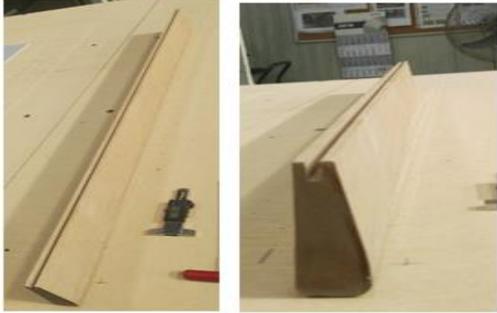
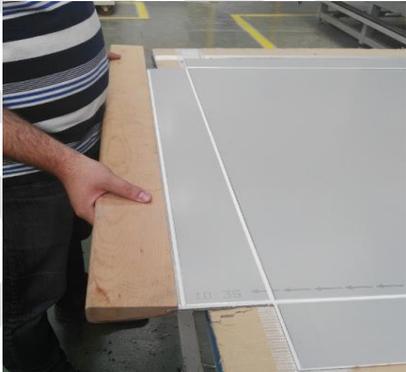
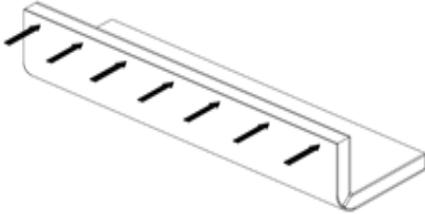


Recommendations for the Bending Process

As the etalbond® A2 core is by nature more brittle than the core of etalbond® FR and etalbond®, the cassette formation should be performed with extra caution. The folding must be performed slowly and gently, and the applied force should be equally distributed along the length / width of the cassette.

Suggested routing depth → 3.08 - 3.30 mm (for etalbond®, etalbond® FR, etalbond® A2)



Basic Steps for Bending:		
<p>Step 1</p>	<p>Bending should be performed using a tool, preferably wooden, having a slot with minimum depth equal to the size of the flap to be bent.</p>	
<p>Step 2</p>	<p>The tool used should cover the whole length of the flap of the cassette to be bent.</p>	
<p>Step 3</p>	<p>The bending should be performed gently and by applying the same force along the cassette length.</p>	

Fold and reverse fold

Folding can be achieved either by hand or by using special tools. CNC routing devices allows the production of a wide variety of shapes and sizes for all standard etalbond® surfaces.

Between the fold and the reverse fold, the methodology is different.

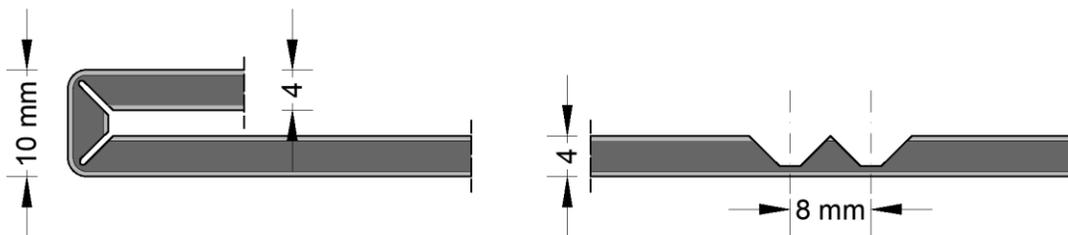
In all cases keep working on the back side of the panel regardless if the fold is inside or reversed.

In the reverse fold the routing axis is again in the middle of the groove, but the bend is done outwards of that axis. As a result the core is stretched.

The ambient and material temperature during folding should be higher than 15 °C.

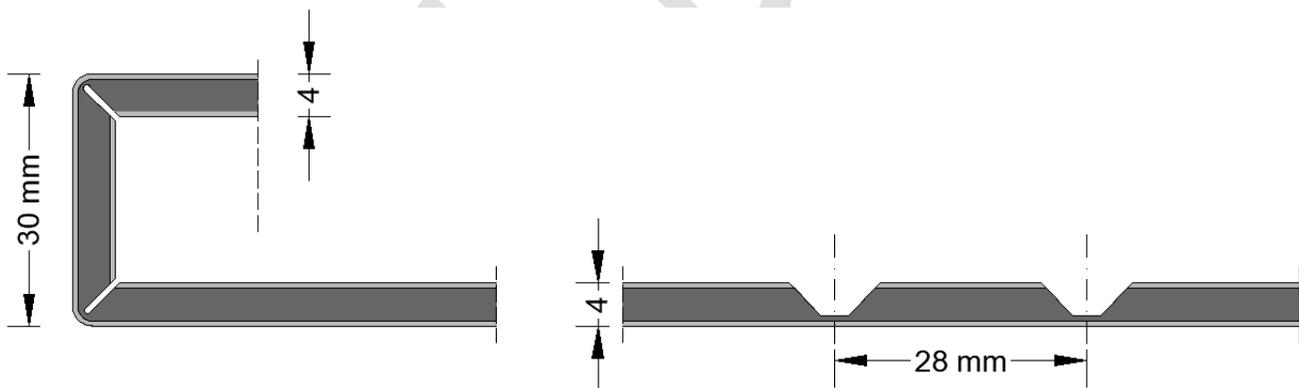
Using a groove cutter with a 2-3 mm flat surface, the difference in the exterior final dimension is reduced by approximately 1 mm.

When a V-groove is bent at 90° angle, the bending radius R of the final product will be 2-3 mm.



Minimum routing and folding distances for etalbond® / etalbond® FR 4mm

For etalbond® / etalbond® FR with thickness of 4 mm, the minimum suggested distance between folds is 10 mm while for A2 it is 30 mm.



Minimum routing and folding distances for etalbond® A2 4mm

Summary

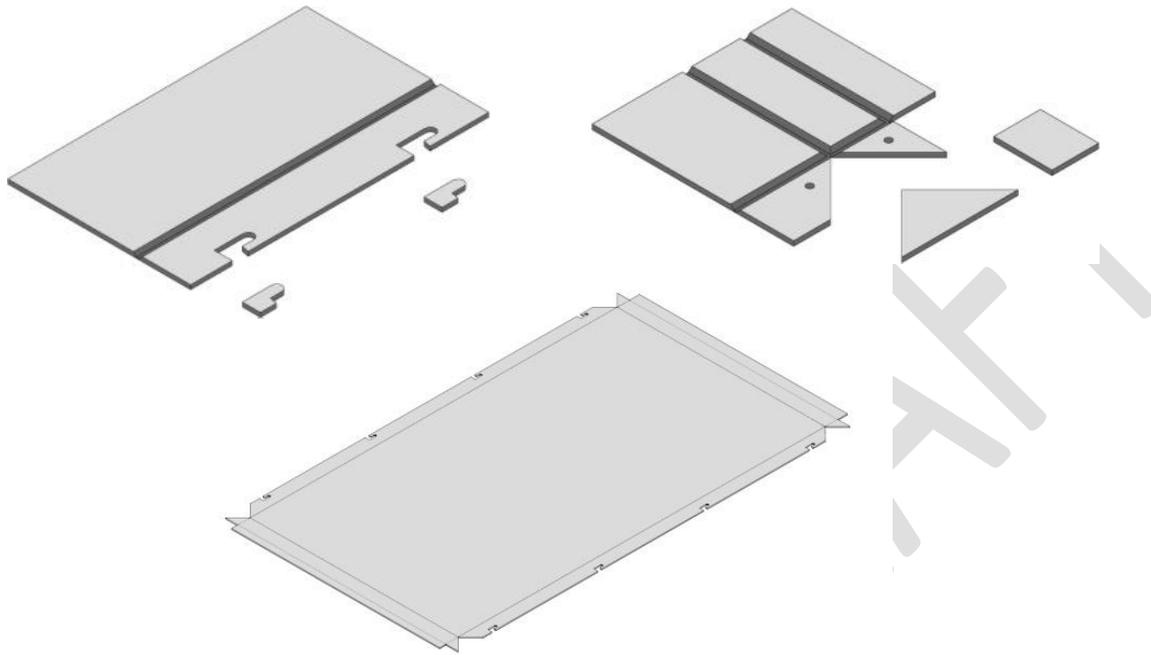
Before the production of any panel, it is obligatory to make the corresponding calculations for the cutting dimensions. This will have as a result the achievement of the best possible tolerances. In generally ± 1 mm are the accepted tolerances in fabricated elements, using a milling cutter of a 2-3 mm flat surface.

Important Note: Perform trial tests before start of any production campaign to make sure and verify that all works correctly.

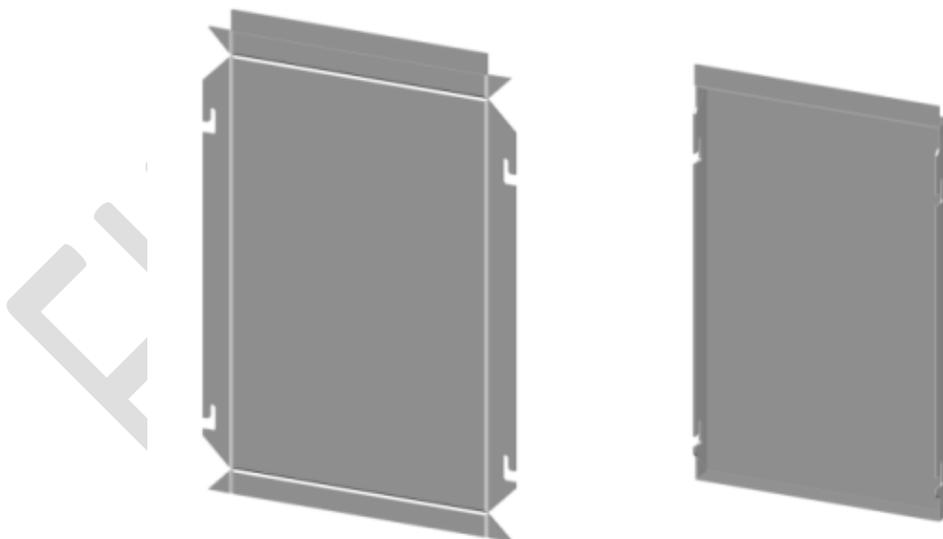
Cassette Fabrication

Fabrication detailing

Form hanging points and edge detailing:



Unfolded and folded view of the cassette



Top Double Folding

The second top turn is normally 40 mm.

Fold the longitudinal sides of the cassette at 90°

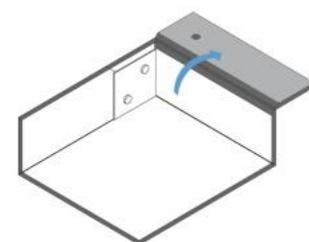
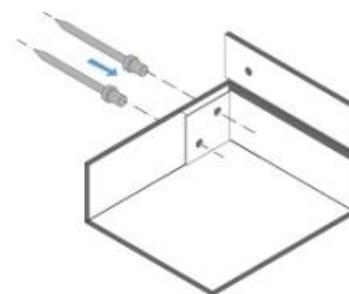
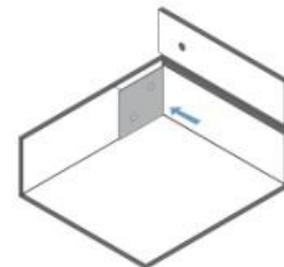
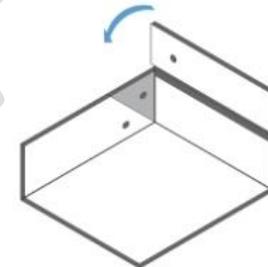
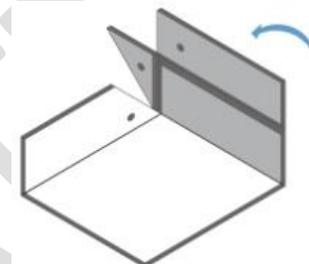
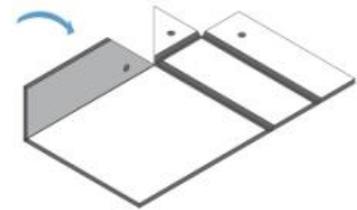
Fold the upper part of the cassette more than 90° (this will help to “lock” the folded parts afterwards)

Fold back to a little more than 90° and slightly fold the triangle. Fold the triangle together with the longitudinal edge

Adjust the aluminium plate for fixing the corner

Secure the cassette corner and aluminium plate with rivets

Reverse fold of the upper part of the cassette



FINAL DRAFT

Single folded cassette (Formation of the lower end of the cassette)

Fold the cassette longitudinal sides at 90°

Fold the lower part of the cassette more than 90°

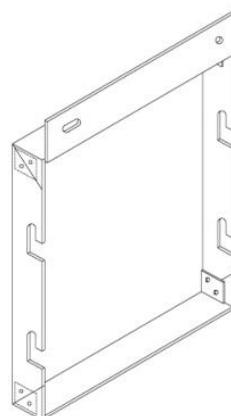
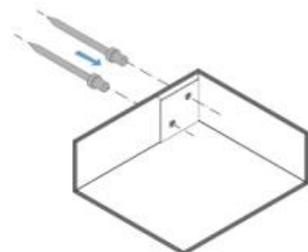
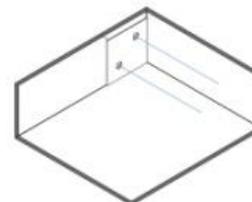
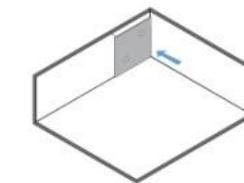
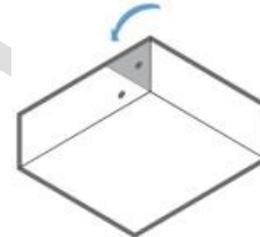
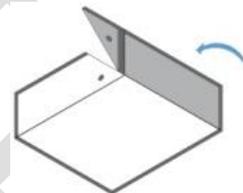
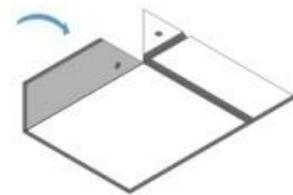
Fold back to a little more than 90° and slightly fold the triangle
Fold the triangle together with the longitudinal edge

Adjust the aluminium plate for fixing the corner

Drilling holes to the aluminium plate

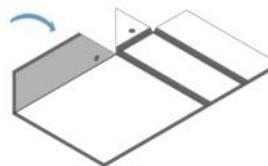
Secure the cassette corner and aluminium plate with rivets

Axonometric depiction of a single folded cassette

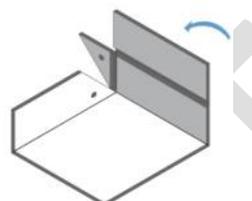


Double folded cassette (Formation of the lower end of the cassette)

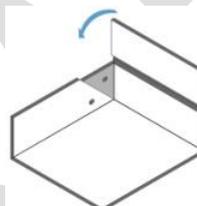
Fold the cassette longitudinal sides at 90°



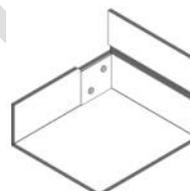
Fold back to a little more than 90° and slightly fold the triangle



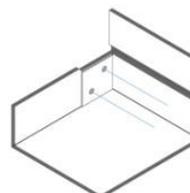
Fold the triangle together with the longitudinal edge



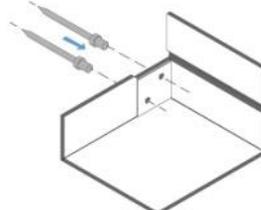
Adjust the aluminium plate for fixing the corner



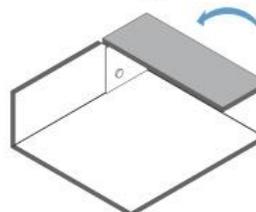
Drilling holes to the aluminium plate



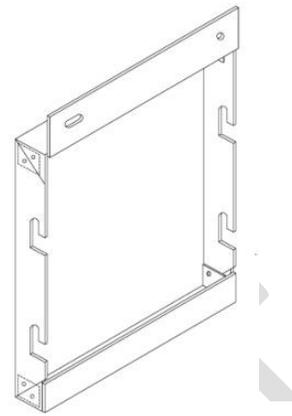
Secure the cassette corner and aluminium plate with rivets



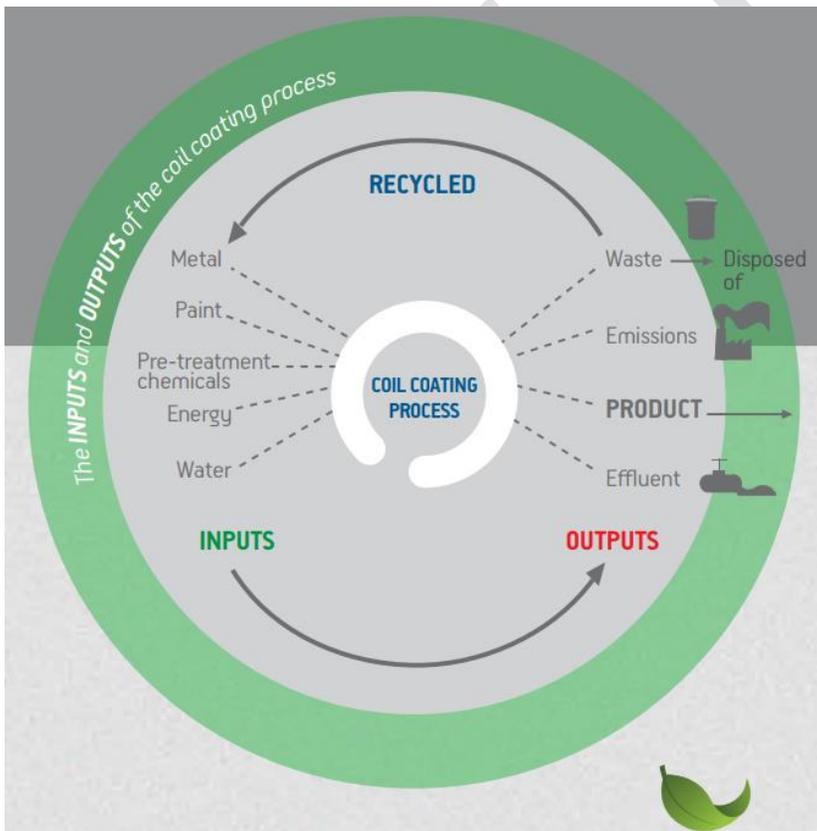
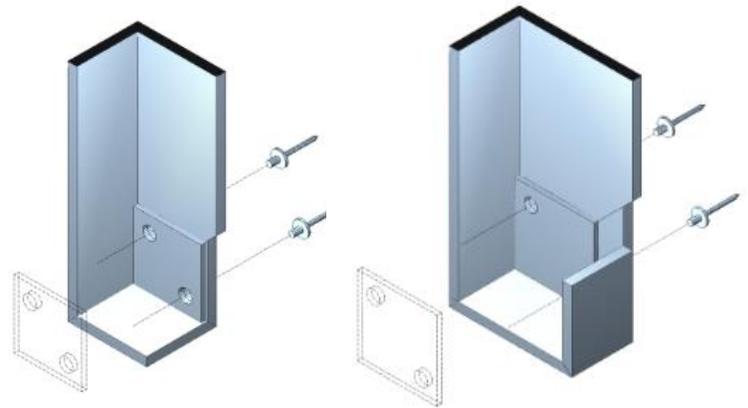
Closing the remaining lower part of the cassette



Axonometric depiction of a double folded cassette



Corner detail for single and double folded cassette



Anodized etalbond® panels

etalbond® panels with anodized surface will present surface micro cracks when bended or folded, e.g. etalbond® cassettes. This process is due to the very hard anodizing layer and affect the aesthetic results locally which in any case is common to all anodized materials used in the market.

On the other hand, etalbond® Anodised Look / etalbond® FR Anodised Look panels coated with organic coatings do not present any cracking when bended or folded, due to the fact that organic coatings are far more elastic than the aluminium layer itself and can follow any deformation of the substrate. Therefore the aesthetic result is not affected when bending coated products.

Jointing - Fixing Techniques

General

Standard processes used in metal and plastics industry can also be utilized for joining etalbond®. If etalbond® is to be joined to extrusion profiles or structural framing then tapping screws, rivets, bolts / nuts can be used. Structural adhesives and double faced high strength tapes can also be used in conjunction with mechanical fastenings.

Allow a minimal spacing of 15 mm to position the rivet from panel edges.

When using threaded fasteners or bolts caution should be taken not to over tighten the fastener.

Riveted joints have high strength and endurance and are well suited for joints, which may be subjected to frequent jolting and vibration. Use a large head with a washer to allow for a better load transmission.

To avoid material tearing due to tension occurring in the connections, the fasteners must be tension-free.

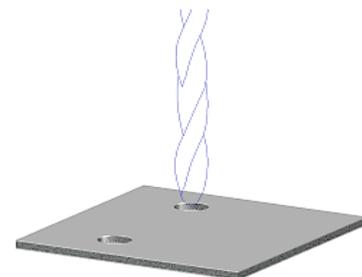
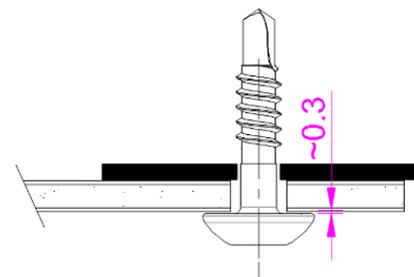
When fastening etalbond® with rivets or screws, use a step drill to ensure coaxial drilling of panel and substructure. Always make trials before starting actual work.

Always use rivets or screws with heads at least 2 mm larger than the etalbond® drilled hole diameter and also provide a working play (about 0.3 mm) between the etalbond® panel and the rivet or screw head.

For outdoor use, fasteners should be made of stainless steel or aluminium to avoid corrosion.

Drilling

Drilling jigs are tools for drilling holes through the etalbond® panels using rivets or screws. In case of a face front fixing system (visible fixation), special attention should be given in the fixation of rivets or screws upon the etalbond® panel and the substructure to avoid damaging the coated side. Always remove the protective film in the area of the rivet or screw prior to riveting or screwing.



Riveting

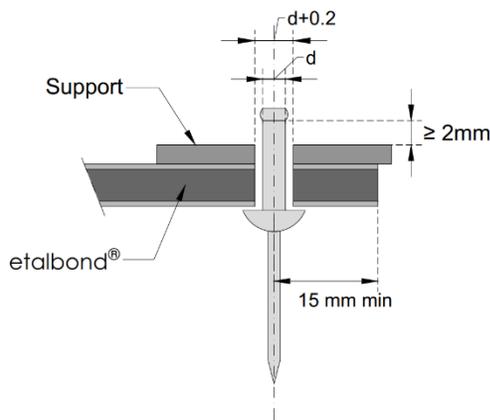
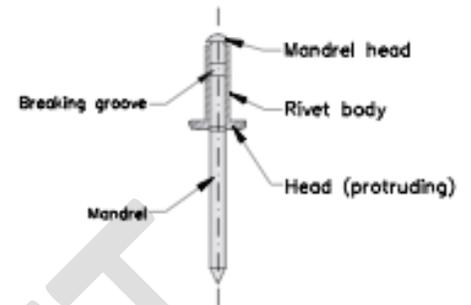
etalbond® / etalbond® FR / etalbond® A2 panels can be fastened together or joined to aluminium - extruded elements using stainless steel, aluminium or coated¹ steel blind rivets or bolts.

If blind rivets are to be used make use of special wide closing heads or tightly fitting washers for the protection of etalbond® surface. The suggested rivet shaft diameter should be 5 mm while the rivet head diameter should be between 9 and 14 mm.

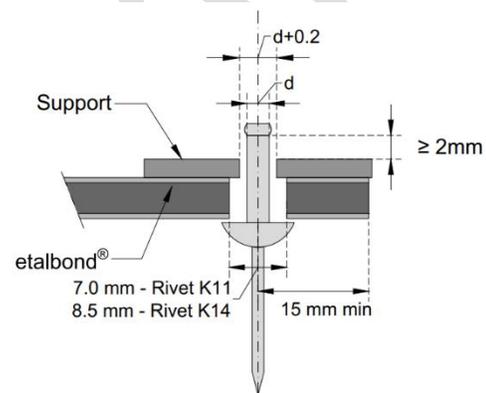
Either multistep drills or hole gauges having corresponding diameters and allowing for a tolerance of 0.2 mm should be used for fitting the rivet on center. It is important to remove the protective film from the affected region prior to riveting.

Always make a test prior to any application as many factors can influence correct riveting.

The clamping length should be higher the total thickness of the fastened materials plus 2 mm.



Fixing connection



Sliding or flexible connection

Recommended rivets for flat sheet cladding applications: Gesipa ASO-D14-50xL or similar (etalbond® German DIBt approval DIBT Z10.3-742).

Fastening using screws

Where connections with screws are concerned, the same technical requirements apply as with rivet connections. In selecting screw material, care should be taken to ensure that the connectors do not corrode. For this reason, aluminium or stainless steel screws are used. Screws are installed through pre drilled holes.

Use countersunk screws for indoor use only.

The following screws are suitable for etalbond®: EJOT JT4-LT-XT-3H/6-5,5x25 and SFS SLA3/6-4.8x19.

For aluminium to aluminium fastening, such as the SZ20 horizontal cassette system, the following screws are suggested:

¹ Coated with zinc, aluminium or cadmium

EJOT JT3-6-5,5x25 E16, drilling screw with sealing washer or SFS SX5/8-A12-5,5x31, drilling screw with sealing washer. Refer to the respective screw manufacturer for installation instructions and details.

For roofing applications, neoprene sealing washers or similar are suggested.

Bolting

Bolts can be used to join two etalbond® / etalbond® FR / etalbond® A2 panels to metallic elements.

Stainless steel or aluminium bolts, nuts and washers should be used to avoid metal corrosion (between dissimilar metals).

When bolts are used for joining etalbond®, extra precaution should be taken not to deform the aluminium skin of etalbond® because of over torqueing.

To be on the safe side use lock nuts or double nuts with washers to prevent the nut from loosening over the time.

A manual torque wrench which incorporates a gauge or other method to indicate the amount of torque transferred to the nut or bolt is recommended when tightening a bolt to etalbond® PE/ FR / A2 panels.

Adhesives and double face tape for fastening

Adhesives can be used along with double face tape (3M-VHB) for fastening etalbond® temporary on flat surfaces such as wall, ceiling, furniture, coverings etc.

Yet a wide variety of commercial adhesives for joining and assembling etalbond® can also be used except those which may corrode the aluminium substrate. Vinyl acetate - type adhesives corrode aluminium.

Suitable adhesives for adhering etalbond® on different substrates

Adhesive type	Substrate			
	Metal	Wood	Plaster Board	Styrene foam
Epoxy	*	*	*	*
Acrylate	*	*	*	
Chloroprene	*	*	*	
Silicone	*	*	*	
Cyano acrylate	*	*	*	

For high strength and elastic connections for internal applications, we recommend the usage of SIKATAK PANEL or equivalent.

Epoxy Primer

In order to use adhesives and double face tape for fastening etalbond® / etalbond® FR / etalbond® A2 panels or cassettes, epoxy primer is required instead of the commonly used primer. Always consult Elval Colour when etalbond® / etalbond® FR / etalbond® A2 will be used with adhesives or double sided tapes.

The epoxy primer has been successfully tested by SIKA using the following configurations:

1. Sika Activator-205 + SikaTack Panel (successful result)
2. Sika Activator-205 + SikaTack Panel NL (successful result)
3. Sika Activator-205 + SikaTack Primer + SikaTack Panel (successful result)

Nevertheless, the curing time of each stage as well as the conditions of the application may affect the successful result of the application of the adhesive. Therefore, it is highly recommended before adhesive application on the building to consult the local SIKA partner for application detailed instructions. The respective DIBt German technical approval for etalbond® with sika tack panel system is Z-10-8-408 ([link](#)).

Gluing guidelines:

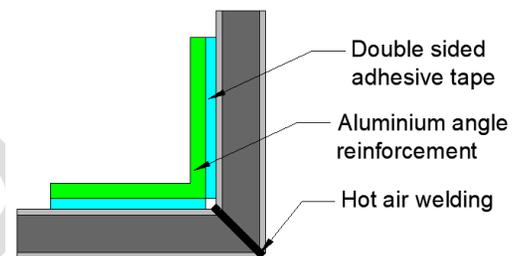
1. Epoxy primer is suggested for the back side of aluminium composite panel (which will be glued).
2. etalbond® FR system with Sika Tack Panel achieves lower fire classification than B-s1,d0.
3. The combination of mechanical fixations is highly recommended (the extend depends on the application and the structural engineer of the project should approve the design taking into account local and national requirements)
4. Prior to any adhesion work, clean carefully the area to be adhered.
5. Consult the gluing system manufacturer and the respective approvals and follow the guidelines on gluing application (i.e grinding with abrasion pad, cleaning with Sika Activator-205, priming with Sika Tack Panel primer and bonding with the Sika Tack Panel adhesive), conditions (e.g. humidity, temperature) during application of adhesion, frequency of inspections, etc.
6. The horizontally aligned gluing application is not recommended to avoid possible corrosion, consult gluing manufacturer for details.
7. Adhesives do not adhere to core and the etalbond® / etalbond® FR / etalbond® A2 cut edges.
8. For sensitive buildings (such as schools, hospitals, nursery homes etc.) the applicable fire requirements are more severe and the local fire code requirements must be applied.
9. For glued stiffeners at the back of the cassette for larger cassette formats
 1. Combination with mechanical fixation is recommended
 2. Omega shaped profiles are recommended
 3. Gluing alternatives for epoxy primer: SIKA tack panel system, 3M™ VHB W20F, tesa ACX^{plus} 70200, Dow Corning® 896 PanelFix, Aderis® 8141 or similar may be used.

Hot Air Welding (etalbond® with PE core)

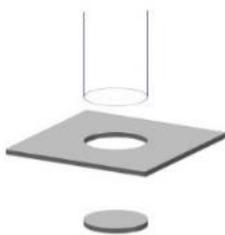
One of the major advantages of thermoplastic substances is their heat weldability. The thermoplastic material, when heated sufficiently, temporarily changes from a solid to a semi-solid state enabling separate sheets or panels to be fused together and return to a solid upon cooling providing a watertight, permanent bond. A plastic rod of same properties as polyethylene core is utilized provided that the etalbond® parts should have chamfered edges to the corresponding angle of the finished part allowing an exposed polyethylene surface on the welded side. At the end, a scraper blade is used to remove the remaining welding material and get a smooth seam as soon as it has cooled down. Hot air welding is typically done just on polyethylene (PE) core material.

Preparation and requirements for a welding joint

- Before folding and welding etalbond® grooves have to be drawn onto the panels by appropriate milling cutters.
- The welding temperature should be kept at about 265° C ± 5°C during the whole process.
- The applied pressure to the nozzle shoe during the process should be about 3 kg.
- The welding rode should be low-density polyethylene type in black colour and a diameter 3-4 mm.
- Angle reinforcement should be used at corner connections, using double sided appropriate adhesive tape or gluing systems.



Punching



The punching of flat etalbond® / etalbond® FR parts is performed exactly the same way as in the aluminium sheets by using evenly cut ground tools and the smallest possible cutting gap. Punching with a press for notching and cutting out causes shear drop in the aluminium surface. To reduce aluminium edge roundness work the clearance of punch and die to be minimal (panel thickness x 0.05). Multi-station machines can also be used.

Perforating (for interior applications only)

For etalbond® / etalbond® FR:

- It is recommended that a maximum percentage of 35-40% of open area should be kept
- The minimum recommended diameter of perforation holes is 4 mm for punching and the minimum width of the web between hole edges is 4 mm
- It is recommended the perforation to be done with CNC routing-drilling machine and not with a common punching machine, as the latter method may deform the panel's surface
 - A special protective polymer (such as BeckryPair 6000 by Beckers) should be applied at the exposed edges at chemically aggressive environment

For etalbond® A2, please contact us at ecs@elval-colour.com.

Drilling

etalbond® / etalbond® FR can be drilled with standard twist drills used for aluminium and plastics on machinery common for metals. Holes can be made on etalbond® / etalbond® FR with a hand drill or a drill press with a drill bit or circle cutter.

Drill Bit specifications: Twist drill, High speed steel (HSS).

Swarf removal during drilling process can be performed by using a high rpm low feed and by occasionally lifting up the drill.

Bending

etalbond® products can be bended easily using the press bending process or roll bending machines.

In general, the minimum bendable radius r_{min} is 15 times the panel thickness for etalbond® / etalbond® FR.

For anodized etalbond® / etalbond FR coated surfaces or anodized, the minimum recommended radius is 60 mm.

For etalbond® / etalbond® FR mirror, the minimum recommended radius is 200 mm.

When bending anodized / mirror surfaces, the bend area is slightly brighter.

Thickness	etalbond® / etalbond® FR / Anodised	etalbond® Mirror	etalbond® A2
4	60	200	Consult Elval Colour

All values in mm.

For etalbond® A2, consult ecs@elval-colour.com

The spring back effect should be taken into consideration in the process.

The protective film should not be removed during the bending process, in order to protect the sheets from any damage. If necessary, plastic pads may be used for additional protection.

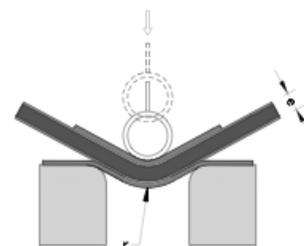
etalbond® panels can be bended by the following methods:

Bending with press brake

The formed bending radius and the angle are depending on the size of the upper punch and the width of the die.

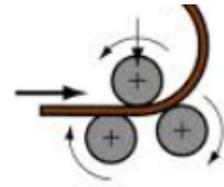
To avoid damage of aluminium skin it is recommended that the center of the die be filled with flexible rubber up the top edges and on both sides of the panel.

We recommend always to make trials before start a production run.



Bending with roll-bending machine

A roll-bending machine can be used in order to bend etalbond® / etalbond® FR panels to the desired radius. Always ensure that the feeder rolls do not press too tight and distort the composite material. The minimum bendable limit is achieved progressively (several panel passes) and depends on the machine type used and the length of bender. Trials can



be used to determine the number of passes and the position of rollers.

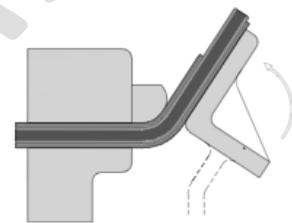
As with any fabrication technique, always make trial bends before any actual fabrication is undertaken.



Note that at the beginning and at the end of the etalbond® sheet to be curved, a small area with micro-cracks might appear, due to the bending process. There should be a provision to remove those portions if required.

Bending with a folding press

In order to bend etalbond® with the use of a folding machine, the work piece has to be clamped between two beams. The projected edge is bent around the upper beam, using the movable swivel bar. Different bending radii could be formed by using interchangeable folding tools attached to the upper sheet holder.



Processing of etalbond® / etalbond® FR can be done with a wide variety of tools and machinery used for aluminium or wood, ranging from inexpensive hand-held tools to state-of-the-art CNC machines. At all cases, trial test bends are recommended to find the proper adjustments.

Shearing

etalbond® / etalbond® FR can be easily sheared by using rotary shears or guillotine shears with advanced cutting technology.

The most suitable cutting method for large panels is by square cutting. The tolerance between the shearing blades must be adjusted to prevent excessive edge rounding of the upper side of the panel.

The down-holders can be equipped with rubber pads if necessary.

In general, cutting of etalbond® / etalbond® FR can be done using conventional tools.

Circular saw

For the processing of etalbond® using circular saw, a suitable routing disk can be used.

etalbond® / etalbond® FR panels are cut in the same way as solid aluminium plate.

For etalbond® A2 refer to the next chapter.

Necessary considerations:

- Work area must be clean at all times

- Cutting operation shall be performed on the back side of the panel
- Circular saw exhaust system must be in operation during cutting
- When cutting on a bench, use plastic pads to ensure that no swarf is accumulated on the coated side of the panel.
- Use circular saws with guides to ensure straight cuttings

Vertical Panel Saw

etalbond® panels may be processed using vertical panel saw, equipped with special shaped routing or cutting saw blades.

Cutting operation shall be performed on the back side of the panel. Place the stops on the saw frame to the one side of the sawing mechanism.

Description of the operation

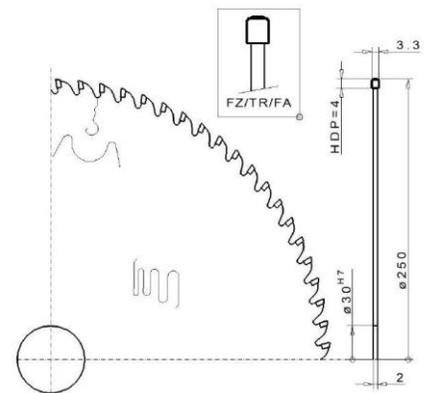
Make a horizontal cut at the upper panel edge in order to obtain a straight edge.

- Turn panel 180° so that the straight edge taken as reference rests on the rollers of the machine
- Make a vertical cut on the right side of the panel

The panel now has straight edges and is ready to undergo the cutting procedure. It is possible to cut many panels simultaneously when stacked together.

Trial cuts must be performed before any production starts.

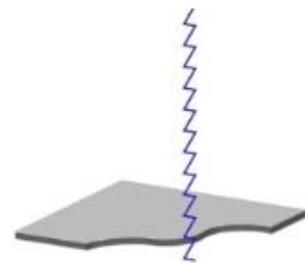
For etalbond® A2 use special polycrystalline (PCD) blades for cutting. Example: Cruing 3AK0308, recommended maximum rotational speed 7600 rpm.



Jig saw

Jig saws are handy tools for cutting etalbond® / etalbond® FR. The most important part of the saw is the blade. Blades are classified by the number of the teeth they have. The larger the number of the teeth, the smoother the finished cut will be. The material of the blade effects performance. High Steel (HSS) blades or Cobalt steel blades (which are harder than HSS) are used and last longer.

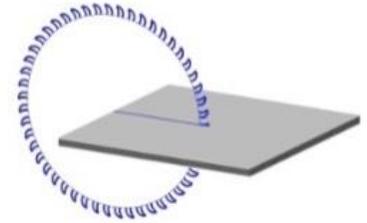
For etalbond® A2 refer to the next chapter.



Portable / hand circular saw

A conventional Portable Circular Saw can be used for cutting etalbond® / etalbond® FR more conveniently at work site. It should be combined with a guide rail, in order to ensure straight-line cutting. All circular saws can be adjusted in two ways: for depth of cut (top) and for angle of cut (bottom). Reducing the depth of cut allows to cut grooves and slots across the face of a panel. Adjusting the angle makes bevel cuts possible, usually up to 45°. Always unplug the saw when making adjustments.

For etalbond® A2 refer to the next chapter.



Hand routing machines

Hand routing machines for usual aluminium machining may be used for etalbond® / etalbond® FR, such as Makita 4-5/8" Aluminum Groove Cutter or similar.

Mobile dust extractors

Mobile dust extractors may be used for etalbond® / etalbond® FR, for portable circular saws or hand routing machines.

Water jet cutting

Water jet cutting is feasible with etalbond® products. When the start of cutting is in the middle of panel, pre-drill is needed at the start location. CNC routing is advised for optimal edge cuts.

Finishing cut surfaces

A sheet of etalbond® can be cut to an unlimited variety of shapes and sizes.

In case burr occurs on the cut edges or the edges need to be rounded, a common hand-held scraper can be used to smooth out the edges.

Thermal Characteristics

The thermal resistances of etalbond® panels are shown in the table below.

Material	Thickness (mm)	Thermal Resistance R (m ² ·K/W)	Thermal Conductivity λ (W/m·K)
etalbond®	3	0.0087	0.35
	4	0.0123	0.34
	6	0.0190	0.32
etalbond® FR	4	0.00614	0.694
	6	0.00855	0.667
etalbond® A2	4	0.00506	0.826

etalbond® cladding can be combined with proper thermal insulating materials in order to form an appropriate insulating system as required by the local building codes.

The U value of etalbond® FR and etalbond® A2 of 4 mm thickness according to DIN EN ISO 6946 is 5.7 W/(m²·k).

Cleaning and Maintenance

etalbond® / etalbond® FR / etalbond® A2 panels are factory coil coated with PVDF or VHDPE paint Finish and should be regularly cleaned at least once per year to protect the coating and restore panels to their original appearance. The finish should be washed gently with a mild solution of soap or mild detergent and lukewarm water (1/3 cup mild detergent per gallon of lukewarm water). Using a soft cloth or sponge, gently wash the coated surface to loosen dirt and rinse well with clean water. To minimize streaking, wash from bottom to top. An adequate rinse should be assured to cleanse the finish and also further dilute the solution. To prevent water spotting, thoroughly dry with cellulose sponge. Avoid the use of abrasive cleaners, squeegees and/or other cleaning implements that may mar or gouge the coating. Elval Colour recommends AAMA's "Voluntary Guide Specification for Cleaning and Maintenance of Painted Aluminium Extrusions and Curtain wall Panels", Publication 610.1-79, as a suitable reference.



Instructions for etalbond® / etalbond® FR / etalbond® A2 cleaning

Removal of light surface soil

An initial step recommended is the rinse cleaning with forceful water starting from the top to down the building wall. Low water volume with moderate pressure is a good practice to start with in order to dislodge excess dust, soil and fumes from the etalbond® surface. Next light rubbing of the etalbond® surface with soft sponges or soft rags dipped in water with a mild detergent agent (pH 6-7 up to 15%) should take place. Contact supplier for details and always test clean small areas first to make sure that the mild soap used does not cause any problem on the etalbond® surface. Keep in mind that cleaners should not be used indiscriminately. Follow manufacturer's cleaning and safety guidelines.

The washing should be performed by applying uniform pressure, cleaning first with a horizontal motion and when finished the cleaning, the same should be repeated with a vertical motion. Follow with a thorough rinsing with clean water. This way the panel surface will be cleaned adequately and uniformly. Rundown of cleaner to the lower part of the buildings should be minimized and these areas should be kept wet and next adequately rinsed to lessen stains from the unavoidable rundown. In low elevation buildings, it is suggested to clean from bottom up and rinse from top to bottom. Always test clean small areas first to make sure that the mild soap used does not cause any problem on the etalbond® surface. Keep in mind that cleaners should not be used indiscriminately. Do not use excessive and abrasive rubbing as may alter or change the surface gloss. Always rinse thoroughly with clean water after finishing with cleaning.



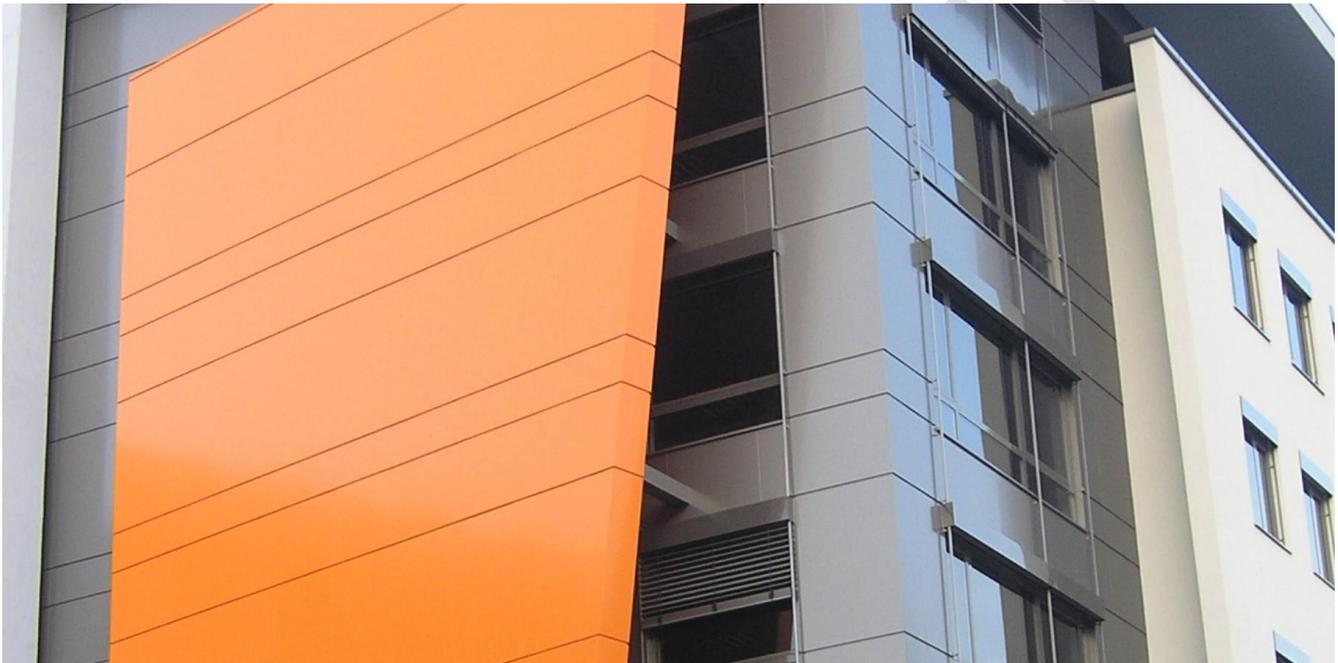
Removal of heavy surface soil, accumulated dust and heavy fumes

In this case, some type of mild solvent such as Isopropyl alcohol, ethanol or N-hexane may be needed to remove caulking compounds, grease or sealant. Stronger solvents may be detrimental to the coated surface. To prevent any damage to the finish these solvents should be spot-tested at a small invisible area. Remaining residues should be washed with mild soap and rinsed with water. Avoid strong solvents or strong concentrations of other cleaners as they can damage the etalbond® coated surface.

Remove rundown soapy waters as soon as possible. Never use on etalbond® coated surface any paint removers, aggressive alkali, acid or abrasive cleaners. Never use strong organic solvents on etalbond®. Follow manufacturer's recommendations for diluting cleaners.

etalbond® maintenance

All aspects of the building work are to be maintained as per manufacturer recommendations and or available technical information. The performance of the maintenance in respect to the etalbond® facades is the responsibility of the existing owner to carry out. It is also the responsibility of the building owner to ensure that any future owners are fully aware of their responsibilities in respect to carrying out the required maintenance provided in the etalbond® maintenance instructions. The nature and extent of the etalbond® maintenance will depend on the material or system, its geographical location, its position on the building and can include the replacement of components or parts subjected to wear.

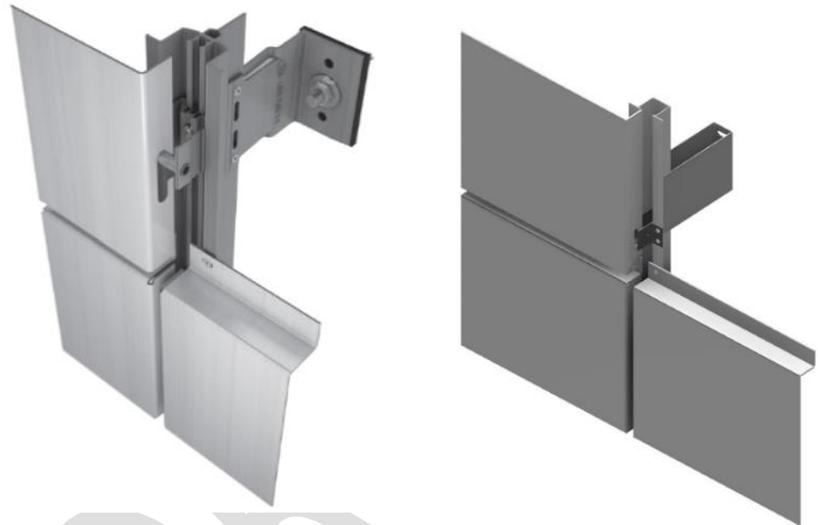


Maintenance of building elements include but are not limited to the following.

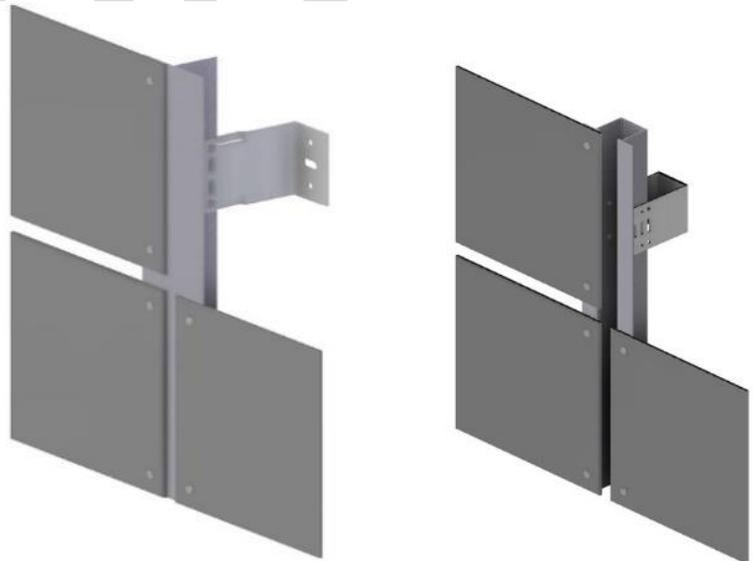
- Inspect regularly at least once per year and replace system components like joint sealants where required
- Test panel stability by both visual inspection for loose or corroded connections and applying pressure and suction on the panel surfaces
- Washing down surfaces regularly at least once per year is recommended
- When elements added to the building façade at a later stage exist, like signage, light fittings or penetrations that have not been initially considered by the supplier, take note that this could affect the material itself and its weather tightness. Maintenance does not include any type of upgrading of building elements to meet new aesthetics or increased environmental expectations of users.

etalbond® Cladding Systems

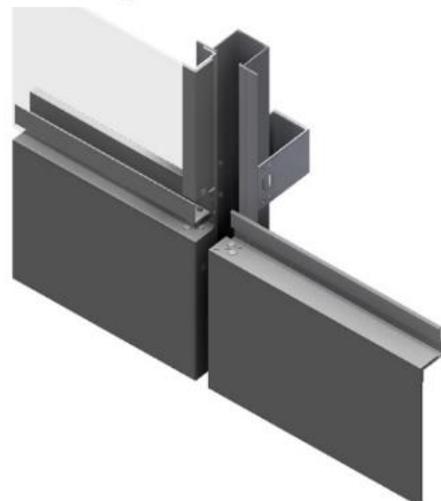
- Suspended cassettes: tray panels suspended on bolts, used with Omega / U / W shaped fixing profiles, for vertical cassettes alignment



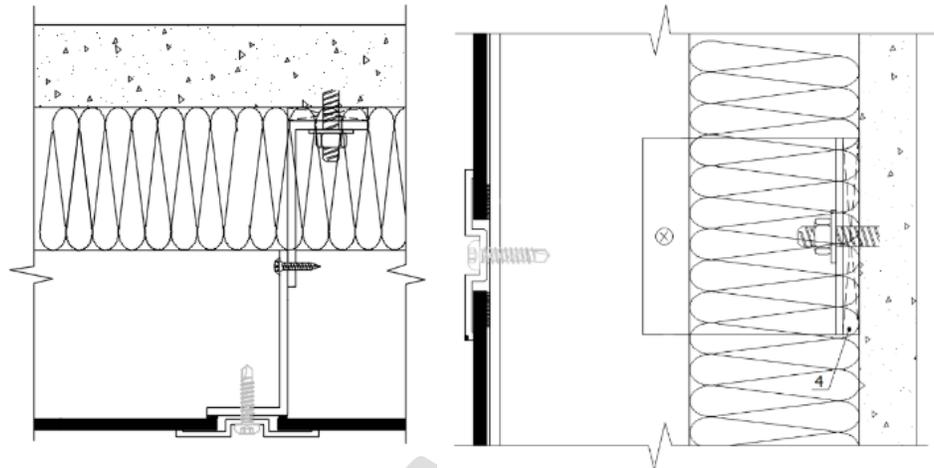
- Riveted panels on T or omega profiles with open or closed joints, for horizontal or vertical alignment



- Tray panels SZ20, for horizontal cassettes



- Clamped connections: etalbond® can be clamped using top hat sections by following specifications according to approved drawings



Alternative systems may be used, including reinforcements, according to wind load resistance needs.

For each cladding system, respective technical catalogues containing construction detailing and installation manuals including reinforcing detailing are available, contact ecs@elval-colour.com for additional information.

Important Note:

Due to technical progress, product changes may occur without notice. All information is provided to the best of our knowledge, but without any obligation. Nothing contained in this document intended to or shall be interpreted as a warranty. National and local building regulations should be considered before use. V 01/21