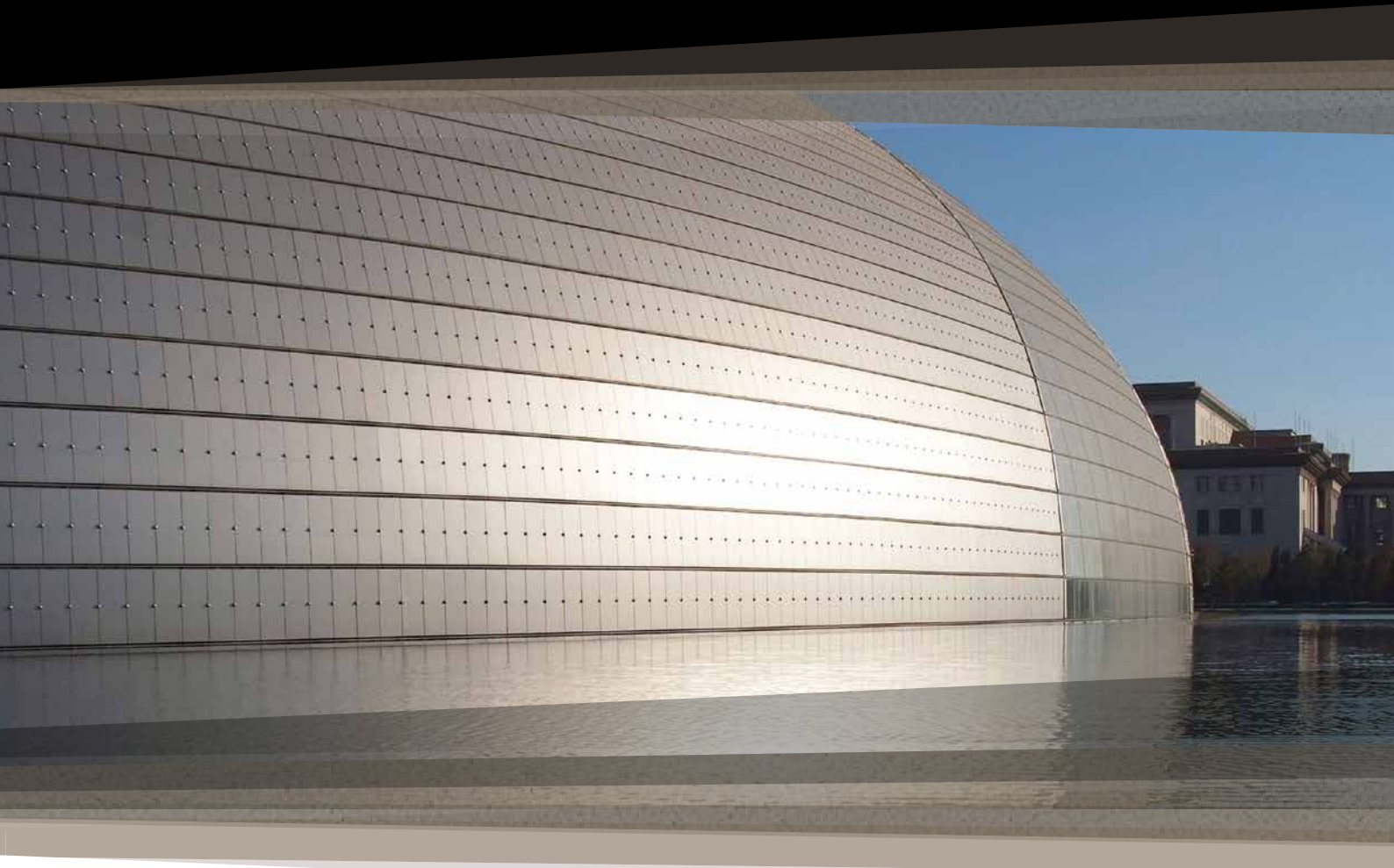


# ALPOLIC™








## PRODUCT INFORMATION & TECHNICAL DATA

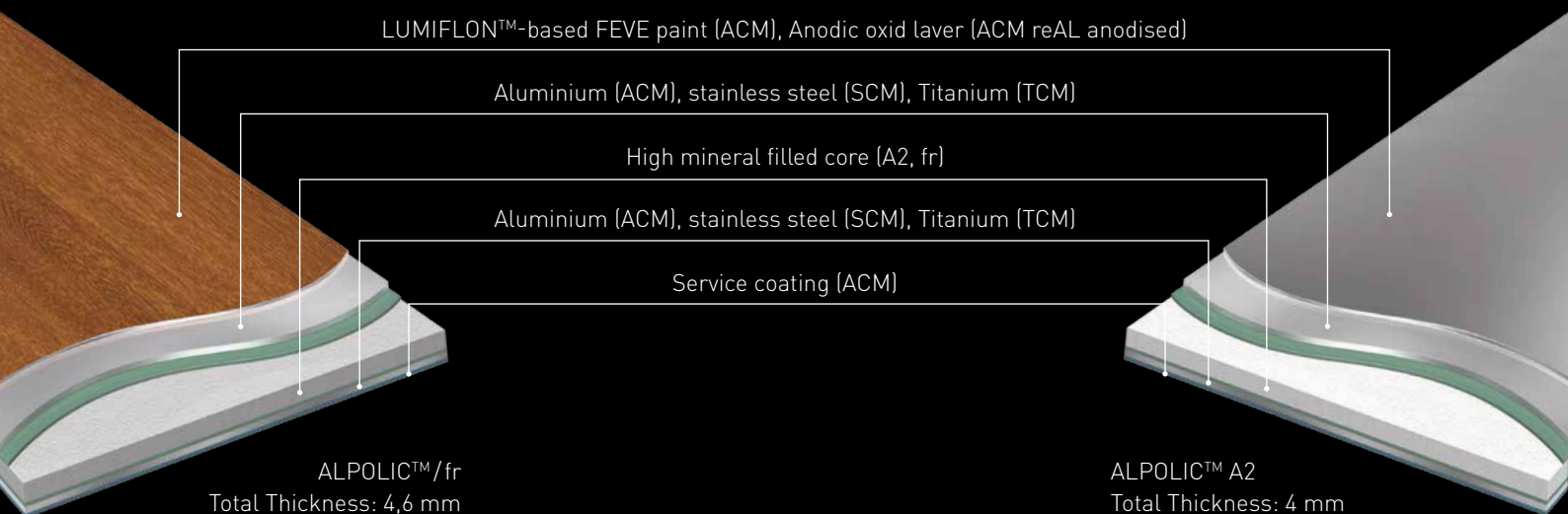
# ALPOLIC™

ALPOLIC™ is an Aluminum Composite Material (ACM) for the worldwide architecture. It is not only a reasonable alternative to solid aluminum sheets, but also a material distinguished by its unique feature: Its light weight, high rigidity, excellent flatness and long-lasting coating qualities as well as a great color diversity offers maximum design freedom for the building façade.

## FEATURES

 <p><b>Flatness</b></p>	Excellent flatness derived from the continous laminating process	 <p><b>Color uniformity</b></p>	The coil coating process ensures complete color consistency	 <p><b>Rigidity</b></p>	ALPOLIC™ is rigid and lightweight
 <p><b>Workability</b></p>	Easy tp process with ordinary fabrication machines and tools	 <p><b>Fire safety</b></p>	With its high mineral-filled core, ALPOLIC™ has been ranked up to class A2 which is one of highest fire-safety grades in accordance with European Norm (EN) standard		

## COMPOSITION OF ALPOLIC™/fr AND ALPOLIC™ A2



## Products

Product	Description	Standard Surface Finish	Fire Classification (EN 13501-1:2010)
ALPOLIC™ A2 ACM	ALUMINIUM Composite Materials	LUMIFLON™ based FEVE paint (coil coated)	A2, s1-d0
ALPOLIC™ /fr ACM	ALUMINIUM Composite Materials	LUMIFLON™ based FEVE paint (coil coated)	B,s1-d0
ALPOLIC™ /fr ACM reAL anodised	ALUMINIUM Composite Materials	Anodic oxide layer (coil anodised)	B,s1-d0
ALPOLIC™ /fr SCM	STAINLESS STEEL Composite Materials	* Dull (DL) * Hair Line (HL) * Mirror (MR) * Linen (LN)	B,s1-d0
ALPOLIC™ /fr TCM	TITANIUM Composite Materials	Dull (DL)	B,s1-d0

## Dimension (Standard)

		ALPOLIC™ A2 ACM	ALPOLIC™ /fr ACM	ALPOLIC™ /fr ACM reAL anodised	ALPOLIC™ /fr SCM	ALPOLIC™ /fr TCM
<b>Thickness (tolerance: ± 0.2 mm)</b>		4 mm	3 mm, 4 mm, 6 mm	3 mm, 4 mm, 6 mm	4 mm	4 mm
<b>Metal skin (thickness)</b>	<b>Surface</b>	Aluminium (0.5 mm)	Aluminium (0.5 mm)	Aluminium (0.5 mm)	Stainless steel (0.3mm)	Titanium (0.3 mm)
	<b>Back</b>	Aluminium (0.5 mm)	Aluminium (0.5 mm)	Aluminium (0.5 mm)	Stainless steel (0.3 mm)	Stainless steel (0.3 mm)
<b>Standard width (tolerance: ± 2.0 mm)</b>		1,250 mm, 1,500 mm	1,285 mm, 1,535 mm	1,270 mm	DL, HL MR LN	1,000 mm, 1,219 mm
<b>Maximum width</b>		1,575 mm	2,050 mm	1,575 mm	Standard width only	Standard width only
<b>Length (tolerance: ± 4.0 mm)</b>		1,800 mm – 7,300 mm	1,800 mm – 7,300 mm	1,800 mm – 7,300 mm	DL, HL, LN MR	1,800 mm – 7,200 mm 1,800 mm – 5,000 mm
<b>* Remarks</b>		Up to 2,050 mm width will be possible upon request		A2 core is possible upon request	DL: Dull HL: Hair Line MR: Mirror LN: Linen	Dull finish only
<b>(Bow tolerance)</b>		± 5 mm/m (0.5 %) of the length and/or width				
<b>(Squareness tolerance)</b>		± 5.0 mm				

## Characteristics (4 mm thick)

	(4 mm)	Method	Unit	ALPOLIC™ A2 ACM	ALPOLIC™ /fr ACM	ALPOLIC™ /fr reAL anodised	ALPOLIC™ /fr SCM	ALPOLIC™ /fr TCM
<b>Physical properties</b>	Weight	-	kg/m <sup>2</sup>	8.4	7.6	7.6	10.2	9.3
	Thermal expansion	ASTM D696	x 10 <sup>-6</sup> /°C	19	24	24	10.4	10.4
	Thermal conductivity	ASTM D696	W/(m.K)	0.63	0.45	0.45	0.40	0.40
	Thermal resistance	ASTM D976	m <sup>2</sup> .K/W	0.15	0.16	0.16	0.16	0.16
	Deflection temperature	ASTM D648	°C	110	116	116	117	112
<b>Mechanical properties of composite material</b>	Tensile strength	ASTM E8	MPa, N/mm <sup>2</sup>	43	49	49	84	69
	0.2 % proof stress	ASTM E8	MPa, N/mm <sup>2</sup>	41	44	44	69	60
	Elongation	ASTM E8	%	3.8	5.0	5.0	12.6	11.1
	Flexural elasticity, E	ASTM C393	GPa, kN/mm <sup>2</sup>	38.5	39.8	39	70.6	49.0
	Flexural rigidity, EI	ASTM C393	kN.mm <sup>2</sup> /mm	204	137	137	372	265
	Punching shear resistance	ASTM D732	MPa, N/mm <sup>2</sup>	37	32	32	55	48
<b>Sound transmission loss</b>	ASTM E413		dB	27	27	27	30	25
<b>Metal thickness with equivalent rigidity</b>				Aluminium 3.3 mm	Aluminium 3.3 mm	Aluminium 3.3 mm	Stainless Steel 2.9 mm	Titanium 3.1 mm
<b>Minimum bendable radius</b>				600 mm	100 mm	Not applicable	100 mm	100 mm



Walnut

## FIRE PERFORMANCE

ALPOLIC™ A2 and ALPOLIC™/fr is a safe exterior cladding material, passing most of all mandatory requirements for exterior wall applications in the following countries and test standards. The main ingredient of the core material does not permit the proliferation of flame and restricts the development of smoke detrimental to evacuation activities. Always consult local building codes before actual use.

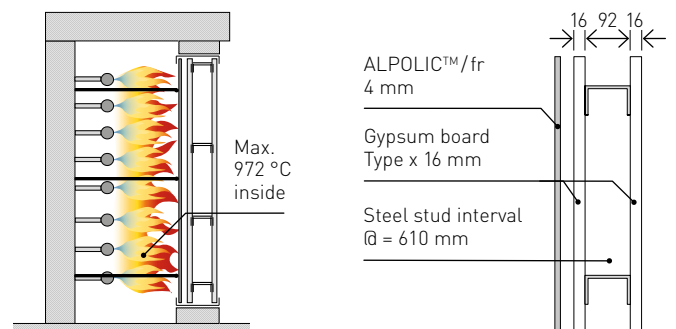
### Example of fire tests



EN 13823 (EU)



TsNNIISK Natural Fire Test (Russia)



ASTM E119 (1-hr and 2-hrs fire rating)



Test duration:  
1hr



Allowable temperature to pass:  
139 °C + room temperature






Actual peak temperature during the test: 109 °C

## Fire test standards in the world applicable for ALPOLIC™ A2 and/or ALPOLIC™ /fr

Country	Test Standard
EU (applicable in Europe, Switzerland and Turkey)	EN 13823, EN ISO 11925-2, EN 13501-1
United Kingdom	BS 476 Part 6 & 7
Poland	PN/B-02867
Czech Republic	CSN 73 0862, CSN 73 0863
Hungary	MSZ 14800-6:2009
Austria	OENORM B 3800-5
Russia	GOST 30244-94 method II, SNIP 21-01-97*, TsNIISK Natural Fire Test
USA	NFPA 259-93 (British Thermal Unit), ASTM D1781-76 (Climbing Drum Peel Test), ASTM E-84 (Tunnel Test), ASTM E-108 Modified, UBC 26-9 & NFPA 285 (ISMA Test), ASTM E108 (Fire Test for Roof Covering), ASTM E119 (1-hr and 2-hrs Fire Rating), UBC 26-3 (Interior Room Corner Test), Combustion Toxicity Test New York State Uniform Fire Prevention and Building Code
Canada	CAN/ULC-S 134-92 (Full-scale Exterior Wall Fire Test)
Japan	ISO 5660-1 (Heat Release Test for Non-combustible Material)
China	GB8625, GB8628, GB8627
Singapore	BS 476 Part 6 & 7, Local fire regulation
Malaysia	BS 476 Part 6 & 7, ISO 9705:1993, Local fire regulation

## Classification of fire behavior – the core material and the paint layers determine the fire classifications

Classification in accordance with DIN 4102	European Classification in accordance with EN 13501-1			Remarks	General	Product reference	Appx. Portion of combustible ingredients within the core material	Heat potential of the core material
	General grade	Smoke emission grade	Droplets grade					
A2	A2	s1	d0	The highest fire classification for ACM, without any building height limitation	"Non-combustible" "Limited combustibility" (UK)	ALPOLIC™ A2	< 10 % 	< 3 MJ/kg
B1	B	s1	d0	Regular ACM for the building façades with fire safety	"Hard to burn" "Very low flammability" (UK)	ALPOLIC™ /fr	< 30 % 	< 15 MJ/kg
B1 with remarks	A2, B, C	s2/s3	d1/d2	Remarks of smoke and/or flaming droplets		ACM core with more combustible ingredients		
B2	D, E	s1/s2/s3	d0/d1/d2	Not recommended or restricted in terms of fire safety for the building facades	"Flammable"	ACM core with 100 % plastics (combustible ingredients)	100 % 	> 45 MJ/kg

Note: Mitsubishi Polyester Film GmbH is not responsible for terminology or accuracy information. Always follow the local fire code regulations.

## Fire retardant mechanism – chemical reaction of ALPOLIC™ /fr during combustion

Ingredient	Ratio	Chemical Reaction	Status
Polyethylene	≅ 30 %	$\text{PE} + \text{Fire} \rightarrow \text{Carbon Dioxide} + \text{Water}$ $[-\text{CH}_2-] + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ (combustion = oxidization) (in case of perfect combustion)	Heat Generation
Aluminium Hydroxide	≅ 70 %	$\text{Aluminium Hydroxide} \rightarrow \text{Alumina} + \text{Water}$ $2\text{Al}(\text{OH})_3 \rightarrow \text{Al}_2\text{O}_3 + 3\text{H}_2\text{O}$ (decomposition)	Heat Absorption

## Comparison of melting point of various metals

Metal	Titanium	Stainless Steel	Copper	Aluminium	Zinc
Melting Point	1,668 °C	1,424 °C	1,084 °C	660 °C	420 °C

Note: The same core material is used for ALPOLIC™ /fr SCM, TCM, CCM and ZCM, as ALPOLIC™ /fr ACM



## PAINT SYSTEM (ACM Standard)

ALPOLIC™ panels offer coatings with a variety of colors and patterns, including a wide gloss range from 15 % to 80 % at 60 degree. LUMIFLON™ based FEVE (Fluoro Ethylene Vinyl Ether) coil coated paint is applied to ALPOLIC™ as the standard coating system. LUMIFLON™ based paint systems are considered to be the best in the world, not only exceeding PVDF 70/30 (70 % PVDF + 30 % Acrylic) in durability standards, but also offering a wide Gloss and Color range and the availability of repair coatings to be applied at normal temperature.

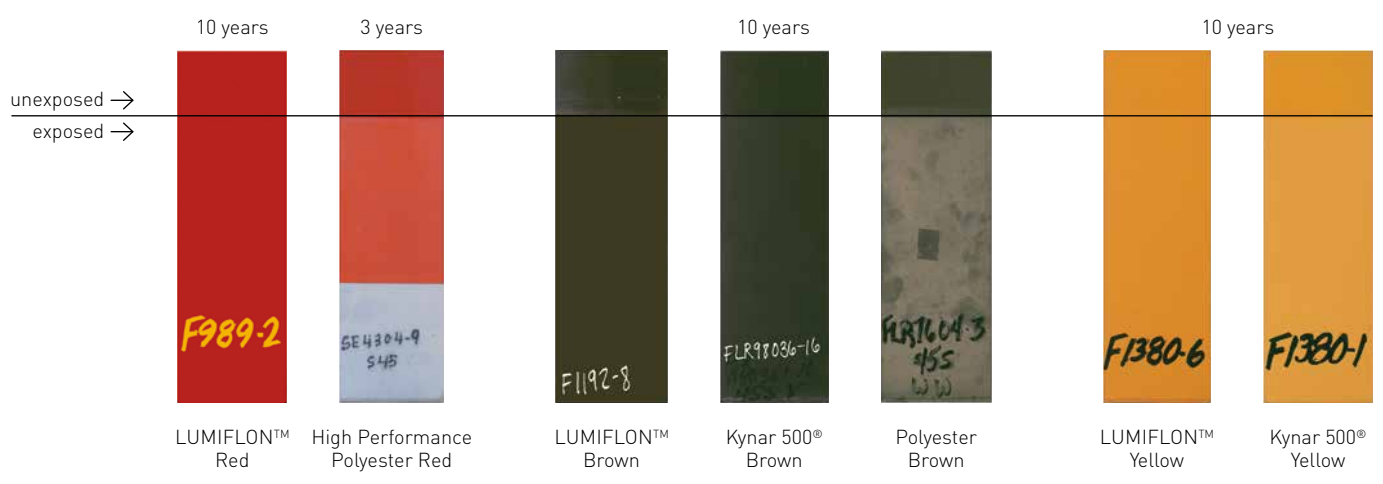


During transportation, fabrication or installation of the panels, there is always the risk for scratches. So far repairing these scratches at the job site has been difficult or even impossible with a high temperature curing paint system. LUMIFLON™ paint system allows you to repair or even overcoat a whole panel under normal temperatures. Room temperature cured type repair spray cans (for small scratch repair) and/or UL cans (for over coating wider area by spray guns) can be provided upon request.

### General comparison between conventional paints and LUMIFLON™

	LUMIFLON™ for ALPOLIC™	PVDF 70/30	Polyester
Weatherability	20 years	20 years	3 – 5 years
Gloss	15 – 80 %	25 – 35 %	25 – 90 %
Color Range	Wider	Limited	Wider
Repair Coating	Can be done	Difficult	Can be done
Pencil Hardness	H – 2H	F	2H
Bendability	2T	1T	2T

### South Florida exposure test panels





Custom White

Long lasting project in a harsh environment (UV + Salt spray + Sand blast)

- Project: Burj Al Arab
- Location: Dubai, UAE
- Qty: 55,000 m<sup>2</sup>
- Completion: 1999

ALPOLIC™ Paint Coating is usually evaluated with chamber tests such as accelerated weathering test, salt spray etc, but it is also checked regularly by means of actual exposures over decades in the harsh climate coastal areas (Numazu, Japan and Florida, USA).

### Accelerated weathering test 1

Solar radiation energy (M Langley)	Gloss retention				
	0	0.5	1.0	1.5	2.0
LUMIFLON™ (for ALPOLIC™)	100 %	95 %	90 %	85 %	83 %
PVDF 70/30	100 %	85 %	70 %	60 %	58 %
Acrylic urethane	100 %	70 %	15 %	–	–
Baked acryl	100 %	18 %	–	–	–

Natural light condensing type: Emmaqua test in Arizona, USA Irradiation of 2 million Langley (amount of lights is equivalent to irradiation for 20 years)

### Accelerated weathering test 2

Exposure time (hours)	Gloss retention				
	0	2,000	4,000	6,000	8,000
LUMIFLON™ (for ALPOLIC™)	100 %	95 %	95 %	83 %	82 %
PVDF 70/30	100 %	85 %	70 %	60 %	58 %
Acrylic urethane	100 %	70 %	15 %	–	–
Baked acryl	100 %	70 %	15 %	–	–
Polyester	100 %	18 %	–	–	–

Sunshine Weather-O-Meter (SWOM)



Natural exposure test in Florida, USA

## ALPOLIC™/fr reAL ANODISED

The surface is finished with an anodic oxide layer by continuous process on an aluminium coil. Continuous anodising builds and enhances the surface oxidation using an electro-chemical process under precisely controlled conditions. Anodised finish has a long history and a quite normal finish in the architectural application. Generally, the thickness of anodised layer from 18 to 25 µm is required for the exterior application when the batch anodising process is applied. ALPOLIC™/fr reAL anodised is applied with very unique continuous anodising process for thinner aluminum web, and only 8 micron anodised layer can achieve the good quality for the exterior application. This method improved the color consistency against batch process.

Private house building, Belgium



Reflective Natural



# reAL ANODISED COLORS



DE-AM0102  
Mill Natural



DE-AM0240  
Mill Gold 40



DE-AM0350  
Mill Copper 50



DE-AB0103  
Brushed Natural



DE-AB0410  
Brushed Bronze 10



DE-AB0480  
Brushed Bronze 80

## Key benefits continuous anodised layer of 8 µm\*

- |                                             |                                           |
|---------------------------------------------|-------------------------------------------|
| ✓ Enhanced anodic layer for ALPOLIC™ panels | ✓ Wide range of colors                    |
| ✓ No filiform corrosion                     | ✓ Excellent adhesion properties           |
| ✓ No peeling/blistering                     | ✓ Flexible anodic layer for sharp bending |
| ✓ No chalking                               | ✓ Excellent corrosion resistance          |
| ✓ Long-term guarantee                       | ✓ Color and gloss stability               |



Reflective Natural

\* ALPOLIC™ A2 reAL anodised will also be available upon request

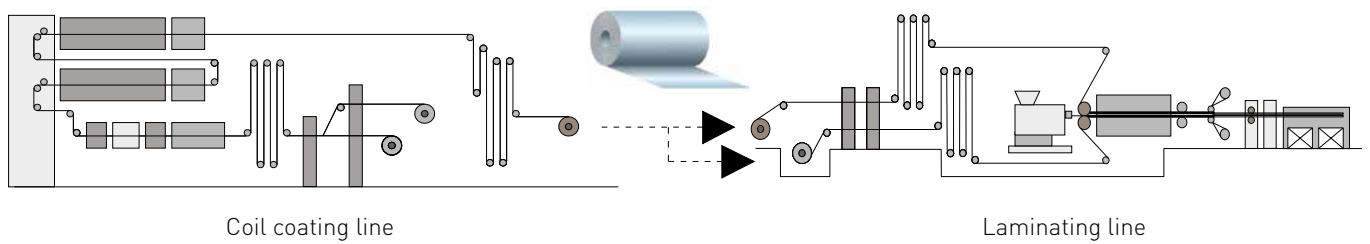
## Comparison continuous 8 µm vs. batch 25 µm

Continuous anodised 8µm for ALPOLIC™/fr reAL anodised	Batch anodised 25 µm
Special sealing quality: < 15 mg/dm <sup>2</sup>	Sealing quality: ≤ 30 mg/dm <sup>2</sup>
Enhanced anodic layer with special sealing	Standard anodic layer 25 µm
Excellent color and gloss stability	Color and gloss uniformity more difficult to manage
Open porous cell structure -> easier to color	Dense porous cell structure
Flexible and hard anodic layer	Hard anodic layer with soft top layer
Easy to bend, fold, perforate	Cracking of anodic layer with bending, folding
No reduction of anodic layer	Fading of anodic layer within time (1 µm/year)

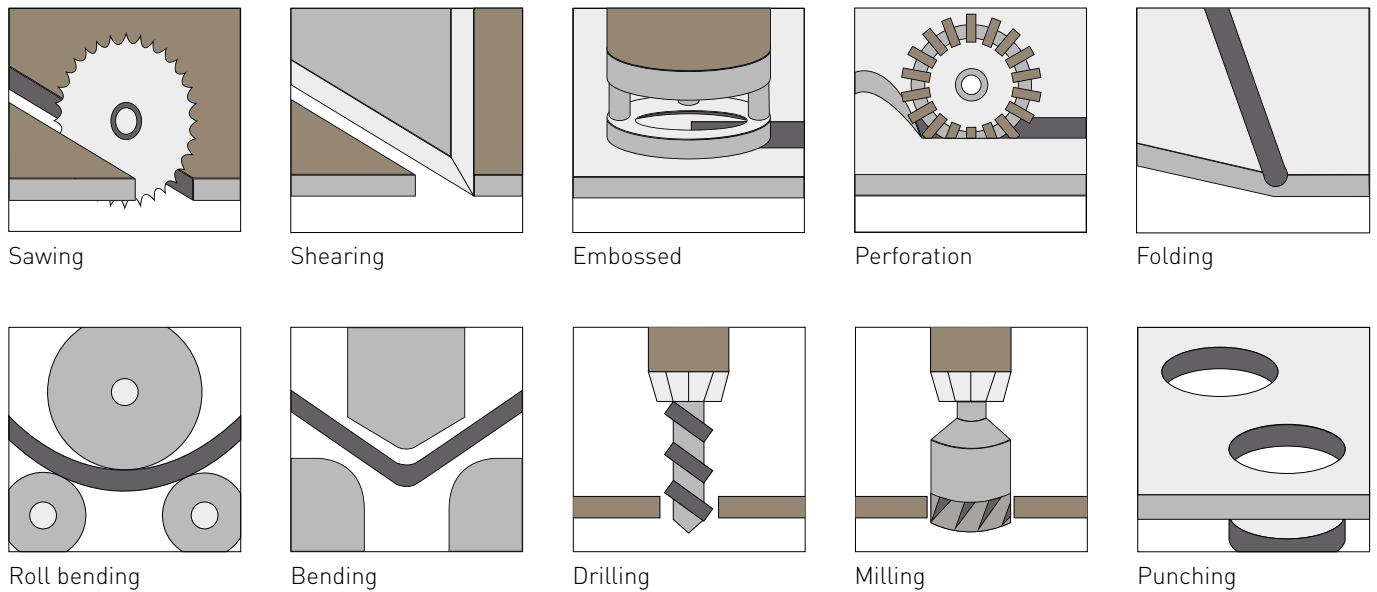
# PRODUCTION PROCESS AND FABRICATION



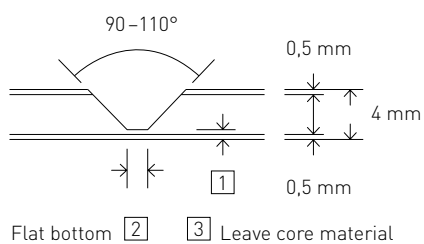
## Production process



## Fabrication methods



## U-grooving shape



	ALPOLIC™ /fr	ALPOLIC™ A2
<b>1</b>	0,7 mm - 0,9 mm	0,65 mm - 0,75 mm
<b>2</b>	3 mm	3 mm - 4 mm
<b>3</b>	0,2 mm - 0,4 mm	0,15 mm - 0,25 mm

# INSTALLATION METHODS

## Typical examples of fixing methods



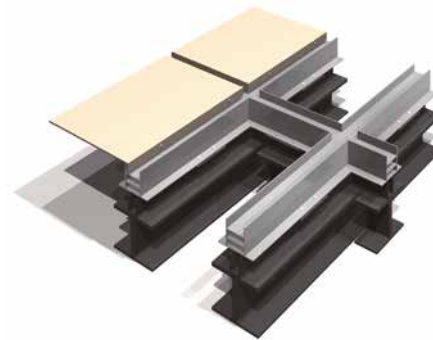
External wall cladding  
Visible Rivet System  
(Face Fixed)



External wall cladding  
(non visible  
cassette system)



External wall cladding  
(non visible hanging  
cassette system)



Roof covering



Unitized Curtain  
Wall System



Back panel of  
Glass Curtain  
Wall System

Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk. Mitsubishi Polyester Film shall have no responsibility or liability for results from such use or infringement of any patent or other property right.

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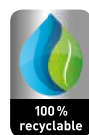
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Quality  
made in  
Germany



### Recycling

Our materials are almost 100% recyclable. Even waste from ALPOLIC™ plants is collected and recycled.



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