

ALPOLIC® & ALPOLIC®/fr
INNOVATION • STYLE • PERFORMANCE

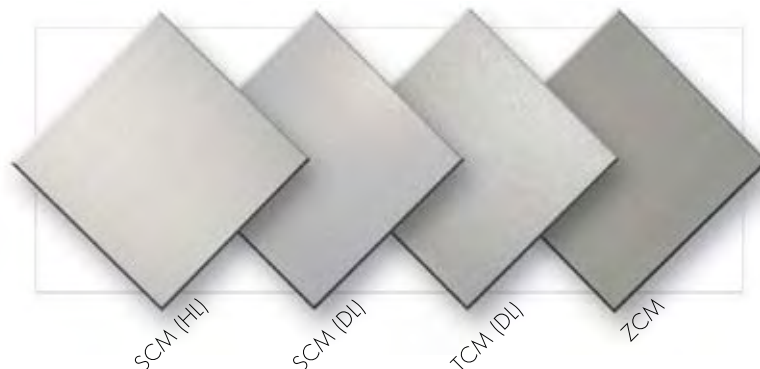
 **MITSUBISHI PLASTICS**
URL <http://www.alpolic.com>

ALPOLIC® & ALPOLIC®/fr

ALPOLIC is a composite material made of aluminum and plastic. In 1971, when we started sample sales, ALPOLIC was mainly used for signboard, housing and vehicles. Around that time, the unique features of ALPOLIC, such as high rigidity and excellent flatness, were already well known. In the 1980s, the introduction of our continuous coil coating line enhanced these features with high-quality finishes. Since the 1990s, when we developed the technology for a fire-retardant core, we have also offered the fire-safe ALPOLIC/fr for all architectural appli-

INNOVATION **STYLE** PERFORMANCE

cations. Nowadays, ALPOLIC/fr is recognized as the most suitable material for external claddings and is used for landmark projects around the world. ■ Aluminum is the most popular metal in the building industry because of its lightness, high corrosion-resistance and workability. But innovative architects are constantly seeking new materials. To meet these demands, we have developed new composite material other than aluminum and have successfully supplied titanium composite material (TCM), stainless steel composite material (SCM) and zinc composite material (ZCM) to customers worldwide. TCM and SCM are used for projects in which longevity is essential, and ZCM offers a nature-oriented finish that features natural weathering.



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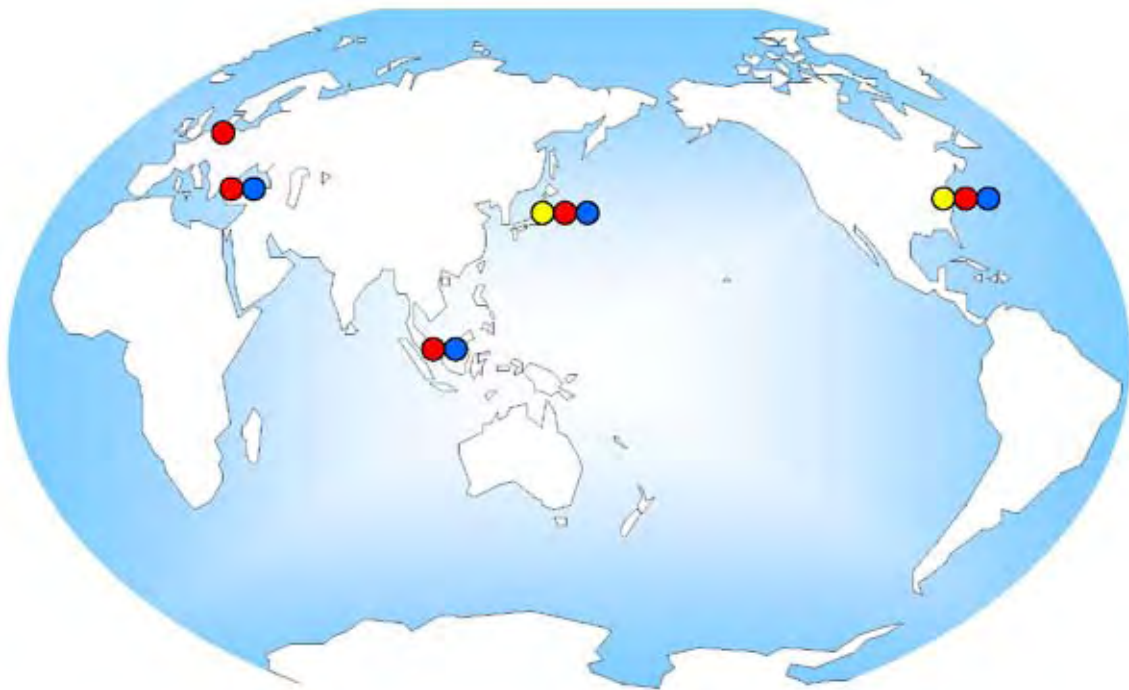
P.5.....Office
P.7.....Airport, Station
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Taipei Arena - Alpolic/fr TCM (DL)
Taipei, Taiwan

ALPOLIC® & ALPOLIC®/fr

 ALPOLIC production plants are located in Japan and the United States. In the plants, we have embraced recycling in order to help protect the environment and curtail production costs. We have worked hard to overcome technical challenges so that we can utilize recycled raw materials while ensuring the reliable performance of our products. ALPOLIC delivers both the composite materials and the expertise to support innovative architects for their creative works. We furnish customer service through the global network of distributors who have a thorough knowledge of the products.



- ALPOLIC production plants: Japan 3, USA 1
- ALPOLIC Stock Points: Japan, Singapore, Turkey, Netherland, USA
- ALPOLIC sales or branch offices: Japan, Singapore, Turkey, USA



ALPOLIC Ueda Plant in Japan

Note 1: “fr” in the product name stands for “fire-rated”.

Note 2: To process titanium composite material and stainless steel composite material, suitable special machines and tools are required. Refer to the respective leaflets for details.

Note 3: For more details of technical data, refer to ALPOLIC Technical Manual Excerpt and ALPOLIC Technical Manual (CDR).



1. & 2. Hangzhou Grand Theater
Hangzhou, China, Alpolic/fr TCM (DL)
3. Samsung Center
Singapore, Alpolic/fr SCM (HL)
4. Seravista
Kuala Lumpur, Malaysia, Alpolic/fr SCM (BA)

ALPOLIC® & ALPOLIC®/fr

[OFFICE] • FLAT SURFACE AND CONSISTENT COLOR

The installed surface of ALPOLIC/fr is truly flat. The secret lies in the production process of the composite material. The continuous lamination process enables extreme flatness by eliminating small distortions remaining in the thin aluminum. ■ Another outstanding feature of ALPOLIC/fr is the consistency of the installed color. ALPOLIC/fr is finished with a Lumiflon-based fluorocarbon paint, which is continuously applied to aluminum coils in the coil



1. 126 Phillip Street - Deutsche Bank Place
Sydney, Australia, Silver Metallic
2. Dubai Creek Tower
Dubai, UAE, Custom Solid
3. Shinawatra Building
Bangkok, Thailand, Champagne Metallic

coating process. The high quality coating and consistency of color is maintained in this continuous process. ■ After the coil coating process, the mineral-filled core or low-density polyethylene core is laminated between two coated aluminum coils, resulting in the finished composite material. The finished products are then packed as flat panels into wooden cases and shipped to customers' workshops, where they are processed locally according to project drawings.



4. Ministry of Road & Transportation
Tehran, Iran, Silver Metallic & Aluminum Gray
5. Government Buildings at the Federal Government Administrative Center
Putra Jaya, Malaysia, Silver Metallic
6. Kyu-kan Chikushidori Building
Fukuoka, Japan, Silver Metallic
7. Port & Custom Head Office Building
Ajman, UAE, Silver Metallic

[AIRPORT] • LUMIFLON COATING

ALPOLIC®/fr has a coating finish of Lumiflon-based fluorocarbon paint as standard. This paint is known for its high performance in outdoor applications. In general, polyester, acrylic and polyurethane paints have been popularly used for building industries. These conventional paints are easy to apply and less costly.



1. Central Japan International Airport
Aichi, Japan, Custom White (Perforated panel)
2. Dubai International Airport
Dubai, UAE, Custom Metallic
3. Istanbul-Ataturk Airport
Istanbul, Turkey, Silver Metallic & Custom Solid

But for outdoor applications like external claddings, their appearance tends to deteriorate and they require re-coating every several years. ■ Lumiflon-based fluorocarbon coatings are very durable, lasting much longer without deterioration. They come in a wide range of colors, and in a gloss range between 15 and 80%. They are also easy to repair.

NOTE 1: Lumiflon-based fluorocarbon coating has a coating warranty for 10 years.

NOTE 2: ALPOLIC/fr is finished with Lumiflon-based fluorocarbon paint as standard, but PVDF, polyester and other coatings are also available as an option.



4. New Bangkok International Airport (Concourse Canopy)
Bangkok, Thailand, Custom Metallic
5. Taipei CKS II Airport
Taipei, Taiwan, Champagne Metallic
6. Prague International Airport
Prague, Czech, Custom Metallic

[HOSPITAL•HOTEL] • RIGID COMPOSITE MATERIAL

ALPOLIC®/fr is highly rigid compared to solid aluminum sheet. When pressure is applied to the panel, two sheets of aluminum behave like a small H-section. A 4 mm-thick sheet of ALPOLIC®/fr, which consists of two pieces of 0.5 mm-thick aluminum, delivers the same rigidity as 3.3 mm-



Photo By Satoru Mishima, Nikkei BP

1. Future Inns
Cardiff Bay Cardiff, UK, Silver Metallic & Charcoal
2. Burj Al Arab
Dubai, UAE, Custom Solid
3. Cornelia Deluxe Resort Hotel
Antalya, Turkey, White
4. Holiday Inn
Beirut, Lebanon, Champagne Metallic

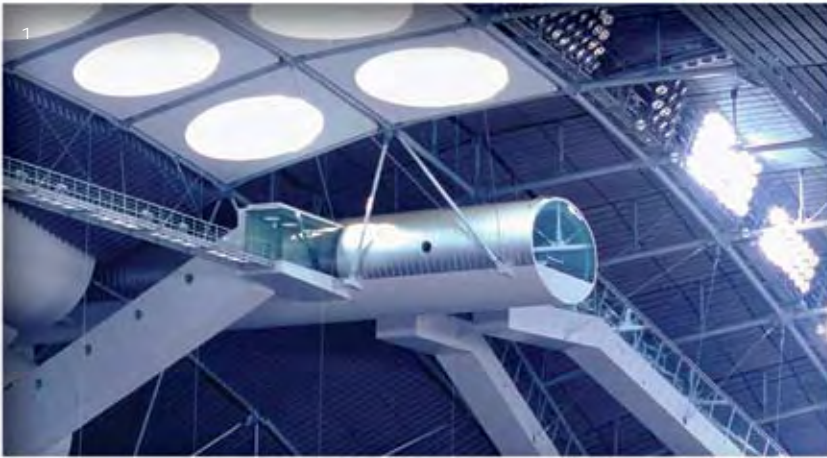
thick aluminum sheet. ■ Compared to solid aluminum sheet, ALPOLIC/fr uses less aluminum to achieve the same rigidity, which leads to its light weight. The thinness of aluminum sheet in ALPOLIC/fr brings another essential advantage: namely, we can use the continuous coil coating process instead of the spray coating that is normally used for solid aluminum sheet.



- 5. CJW Medical Center-Chippenham Campus
Richmond, VA, USA, Custom Solid
- 6. Royal Children's Hospital
Brisbane, Australia, Custom Solid
- 7. Apollo Hospital
Colombo, Sri Lanka, Silver Metallic

[PUBLIC•STADIUM] • FIRE-SAFETY

The fire-safety of building finishing materials is regulated by regional building codes. ALPOLIC/fr is a fire-safe material that passes mandatory requirements for exterior and interior uses in most countries. Though the core material does contain a small amount of combustible polyethylene, the main ingredient



1. Sapporo Dome
Sapporo, Japan, Custom Metallic
2. The Challenger Exhibition Center
Nonthaburi, Thailand, White, Silver, & Sparkling White
3. Palyoung Gymnasium
Jeollanam-do, Korea, Silver Metallic

of the non-combustible mineral does not permit the proliferation of flame and restricts smoke. ■ The core of ALPOLIC/fr consists mainly of a non-combustible mineral that may seriously lower the production efficiency. Overcoming extensive technical challenges, we finally developed the technology that allows us to efficiently produce ALPOLIC/fr and supply it to our customers at a competitive price.



- 4. Harbin Science & Technology Hall
Harbin, China, Silver Metallic
- 5. National Library Board
Singapore, Custom Solid

ALPOLIC® & ALPOLIC®/fr

[FACTORY • LAB] • COATING TECHNOLOGY

ALPOLIC®/fr finished with Metallic Colors creates a surface that's perfectly suited to the external cladding of advanced laboratories, factories and other facilities. We employ "Die Coater," a unique coating technology developed by Mitsubishi Chemical, in the coil coating process. This coating device permits direct coat on aluminum



1. Clean Room Ceiling System
Outside Manila, Philippines, Custom Solid
2. Applied Material
Singapore, Silver Metallic
3. Shanghai Aurora Footwear Co Ltd
Shanghai, China, Silver Metallic & Flemish Blue
4. Ascendas
Singapore, Silver White Metallic & Dark Gray Metallic

surface and ensures smooth and fine finishes. ■ When ALPOLIC/fr is used for clean rooms, the interior space can be more tightly sealed. Electrically conductive fluorocarbon coating is also available as an option, as is matte finish with a polyester coating.



5. Applied Research Building
Newport News, VA, USA, Silver Metallic
6. LKT Precision Engineering Factory
Penang, Malaysia, Milk White, Red & Blue
7. Motorola Factory
Penang, Malaysia, Silver Metallic

[COMMERCIAL • RESIDENCE] • APPEARANCE

Building facades finished with ALPOLIC/fr are eye-catching. ALPOLIC/fr has a variety of surface finishes, and Lumiflon-based fluorocarbon coating has four types of colors: Solid (Enamel) Colors, Metallic Colors, Sparkling Colors and Stone-Timber-Metal Series. All are produced in the coil coating process with Lumiflon-based fluorocarbon paints, ensuring consistent coating performance and durability. ■ Aluminum is known for its workability – but ALPOLIC/fr is even easier to work



1. Q1
Gold Coast, Australia Silver Metallic, Custom Solid & Metallic
2. 21st Century Tower
Dubai, UAE, Custom Metallic
3. Wow Shopping Mall
Seoul, Korea, Silver Metallic

with. ALPOLIC/fr panels can be cut with a circular saw, folded after grooving, and curved with a 3-roll bender. It can be fabricated to various shapes with regular aluminum working and woodworking machines and tools. ■ ALPOLIC/fr is ideal for retrofit of buildings, too. Panels, being pre-coated, can be installed immediately after fabrication. Its lightness minimizes the additional load on the structure for retrofit, thus making it possible to renew the building with a minimal extra-burden in a short construction period.



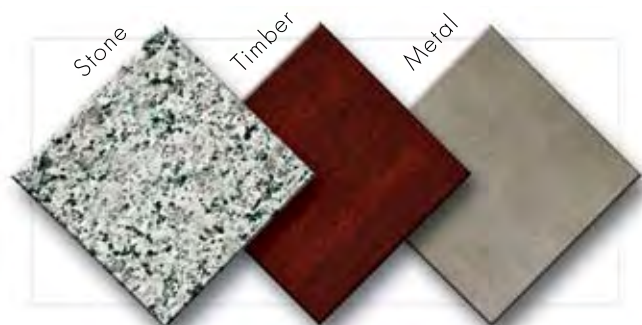
4. The Gallery
(CRC Tower) Bangkok, Thailand, Custom Solid
5. Century the Movie Plaza
Bangkok, Thailand, Solid & Metallic
6. Children's City
Dubai, UAE, Custom Solid

[STONE • TIMBER • METAL]

Our Stone-Timber-Metal Series was developed as an alternative to natural granites, timbers and metals. The authentic looking patterns are produced with a unique image transfer process. The coating is the same Lumiflon-based fluorocarbon coating produced in the coil coating line. The finishes are highly decorative, but they have the same coating performance as our plain color products, like Solid (Enamel), Metallic and Sparkling Colors.



1. ALLSON Hotel
Singapore, Red Granite
2. Maros
Ljubljana, Slovenia, Mahogany
3. Swiss Hotel
Moscow, Russia, Custom Granite
4. Sky City
Taipei, Taiwan, Red & Pink Granite



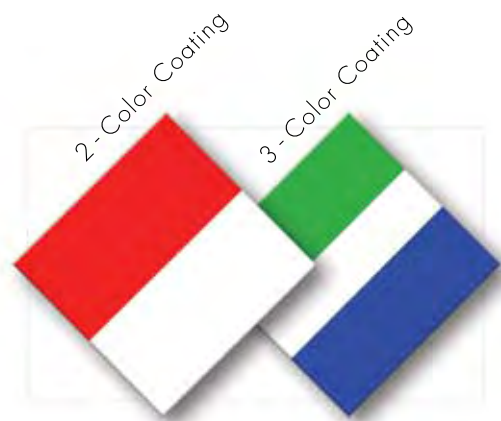
* Refer to color chart.

[SIGNAGE]

The corporate fascia signs of retail shops are part of the scenery in towns and cities everywhere. ALPOLIC has been used for shop-front and directory signboards since its inception. Since the 1980s, when we introduced our coil coating with Lumiflon-based fluorocarbon paints, ALPOLIC has become more and more popular in the field of corporate signage. Color, gloss and shape are all important factors in expressing a unified corporate image, as are color consistency and durability. Lumiflon-based fluorocarbon coating is available in a wide range of colors and in glosses between 15 and 80%. Today ALPOLIC is used extensively for corporate signs in industries of all types.



1. Honda Dealership Pylon Sign
2. Exxon Mobil Service Station
3. Shell Service Station
4. Acura Dealership
5. Honda Dealership Fascia Sign
6. Nissan Dealership



[CIVIL WORK · HOUSING · VEHICLE]

Aluminum is a lightweight metal that's easy to process, but ALPOLIC is more lightweight per equivalent rigidity and even easier to process. That's why ALPOLIC has been used for civil works, housings and vehicles as an alternative to aluminum. In most of these applications, ALPOLIC is used as a practical component that has a special function.



1. Linkway Roof at Marine Crescent Precinct, Singapore
2. Blind Panel under Handrail in Balcony
3. Cargo Truck Compartment Interior Wall
4. Electric Cable Cover
5. Ceiling of Shinkansen Train "Hayate" by East Japan Railway Company
6. Carport Side Wall

[OTHER APPLICATIONS]

ALPOLIC and ALPOLIC/fr have been used for a wide variety of uses and applications, as the following excellent examples illustrate.



- | | |
|---|--|
| 1. Noise insulation panel of express way, louver-processed | 9. Gate of residence, both sides of swing door |
| 2. Tunnel partition for pedestrian sidewalk | 10. Wall panel for light weight embankment made of styrofoam |
| 3. Framing door bottom panel Top panel: sheet glass | 11. Overhead console box cover of railway car |
| 4. Rotatable shop sign indicating "We are open" | 12. Fascia sign of coin-operated rice polisher |
| 5. Belt-conveyor cover, corrugated and roll-bent | 13. Showcase of cosmetics manufacturer |
| 6. Ventilation duct for tunnel construction | 14. Temporary office external wall |
| 7. Shower booth partition, both sides | 15. Road sign for construction work |
| 8. Snow slide panel of road bank A: Installed, B: Not installed | |

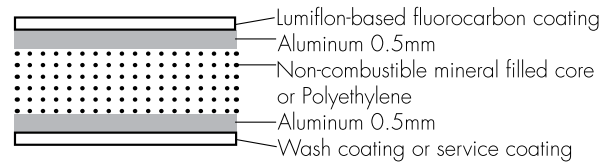
ALPOLIC® & ALPOLIC®/fr

1. OUTLINE OF PRODUCTS

Refer to the ALPOLIC Technical Manual (CDR) for details about the product and the processing method. Refer to each leaflet for details of TCM, SCM, and ZCM.

(1) **ALPOLIC and ALPOLIC/fr** - ALPOLIC is an Aluminum Composite Material (ACM), mainly used for signage. ALPOLIC/fr is a fire-rated ACM widely used for external claddings and some interior surfaces. Both materials are also used for other applications such as civil work, housing and vehicles.

(2) **MATERIAL COMPOSITION** - ALPOLIC/fr is composed of a non-combustible mineral filled core and two skins of 0.5 mm thick aluminum. ALPOLIC is composed of low-density polyethylene core and two skins of 0.5 mm thick aluminum. Topside is finished with a paint called Lumiflon-based fluorocarbon paint as standard and backside is finished with a thin polyester coating (wash coating) or a service coating. The topside is covered with a protective film.



(3) DIMENSIONS

Panel thickness:..... 3, 4 and 6 mm
 Panel width:..... 965, 1270 and 1575 mm
 Panel length:..... Less than 7200 mm

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

(4) CHARACTERISTICS

a. Physical properties

Physical properties	Method	Unit	ALPOLIC/fr			ALPOLIC		
			3mm	4mm	6mm	3mm	4mm	6mm
Specific gravity	-	-	1.99	1.90	1.81	1.52	1.38	1.23
Weight	-	kg/m ²	6.0	7.6	10.9	4.6	5.5	7.4
Thermal expansion	ASTM D696	×10 ⁻⁶ /°C	24	24	24	24	24	24

b. Rigidity of ALPOLIC compared with solid aluminum sheet

	Unit	ALPOLIC/fr			ALPOLIC		
		3mm	4mm	6mm	3mm	4mm	6mm
Solid aluminum sheet with equivalent rigidity	mm	2.7	3.3	4.5	2.7	3.3	4.5
Weight ratio, Solid aluminum sheet = 100%	%	82	85	89	63	62	61

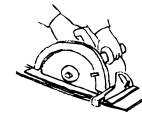
(5) **FIRE SAFETY** - ALPOLIC/fr is a fire-safe material that passes mandatory requirements for exterior and interior use in most countries. Although the core material does contain a small amount of combustible polyethylene, the main mineral ingredient does not permit the proliferation of flame and restricts the development of smoke detrimental to evacuation activities. ALPOLIC, on the other hand, is composed of 2 skins of aluminum that retard the rapid spread of fire although less effectively than ALPOLIC/fr.

(6) **SURFACE FINISHES** - ALPOLIC and ALPOLIC/fr have a coating of Lumiflon-based fluorocarbon paint as standard. This paint is known for its high performance in outdoor applications and lasts for a long time without deterioration. Lumiflon-based fluorocarbon coating has a coating warranty for 10 years. Lumiflon-based fluorocarbon coating has four types of colors: Solid (Enamel) Colors, Metallic Colors, Sparkling Colors and Stone-Timber-Metal Series. Refer to the Color Chart. All types of colors are produced in our continuous coil coating line with Lumiflon-based fluorocarbon paints. In addition to Lumiflon-based fluorocarbon coating, PVDF, polyester and other coatings are also available as an option.

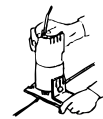
2. PROCESSING METHOD

ALPOLIC and ALPOLIC/fr (hereafter, ALPOLIC) can be processed with regular machines and tools for aluminum and wood. We can cut ALPOLIC panels with a circular saw, fold them after grooving and curve them with a 3-roll bender. In order to join aluminum extrusions on ALPOLIC panels, we can choose a suitable joining method from several alternatives.

(1) **CUTTING** - ALPOLIC can be cut with various types of circular saws such as table saws, hand circular saws and panel saws. Also, we can use a square shear for cutting, which permits an efficient sizing work. To cut ALPOLIC in curving lines, we use hand routers or trimmers.

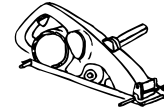


hand circular saw



hand trimmer

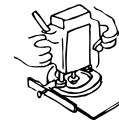
(2) **U-GROOVING** - ALPOLIC can be folded after U-grooving in the backside. Two types of machines are available for U-grooving. One is a circular cutter type and the other is a router type. The former includes hand grooving machines and panel saws, and the latter includes hand routers and CNC routers.



hand groove machine



groove cutter



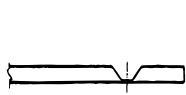
hand router



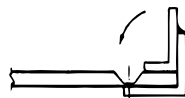
router bit

(3) FOLDING

After U-grooving, ALPOLIC can be folded with a folding jig.



a. U-groove



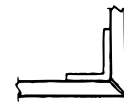
b. use a folding jig



c. fold



d. check the roundness



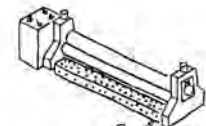
e. support if necessary

(4) BENDING WITH PRESS BRAKE AND 3-ROLL BENDER

ALPOLIC can be bent 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. We can also use manual or electric-drive 3-roll benders for curving ALPOLIC.



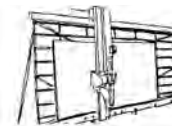
press brake



3-roll bender

(5) AUTOMATED MACHINES

- In addition to the above conventional machines, we can use automated machines including panel saws and CNC routers for cutting and grooving. These machines enable efficient and precise work, especially suitable for repetition of analogous work.



panel saw



CNC router

(6) **JOINING** - We often use rivets, bolts/nuts and tapping screws for joining ALPOLIC and other materials like aluminum extrusions. In order to prevent from possible galvanic corrosion in a humid atmosphere, use blind rivets made of aluminum. Use screws and bolts/nuts made of aluminum or stainless steel.

3. TCM, SCM & ZCM

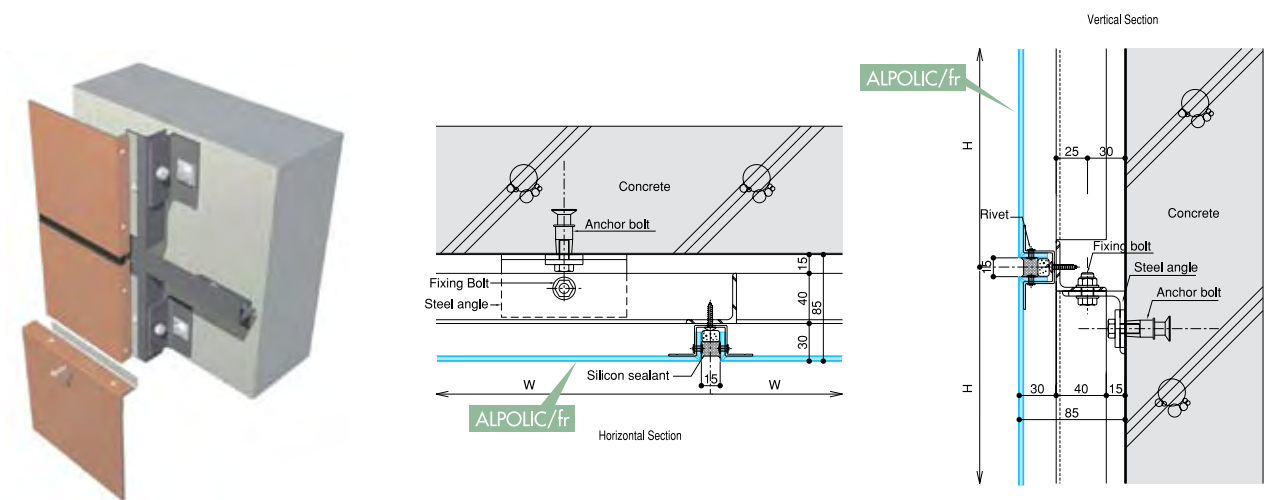
ALPOLIC/fr composed of different metal skin is available as TCM, SCM and ZCM.

ALPOLIC/fr TCM has a titanium sheet on the top and features unparalleled corrosion resistance. ALPOLIC/fr SCM has a highly rust-resistant ferric stainless steel on the topside and is suitable for exterior walls and roofs of buildings. But, in order to process TCM and SCM, we need different processing method due to the lower machinability of titanium and stainless steel. Refer to each leaflet. ALPOLIC/fr ZCM has a chemically-weathered zinc sheet on the topside, of which appearance will be gradually changed through natural weathering.

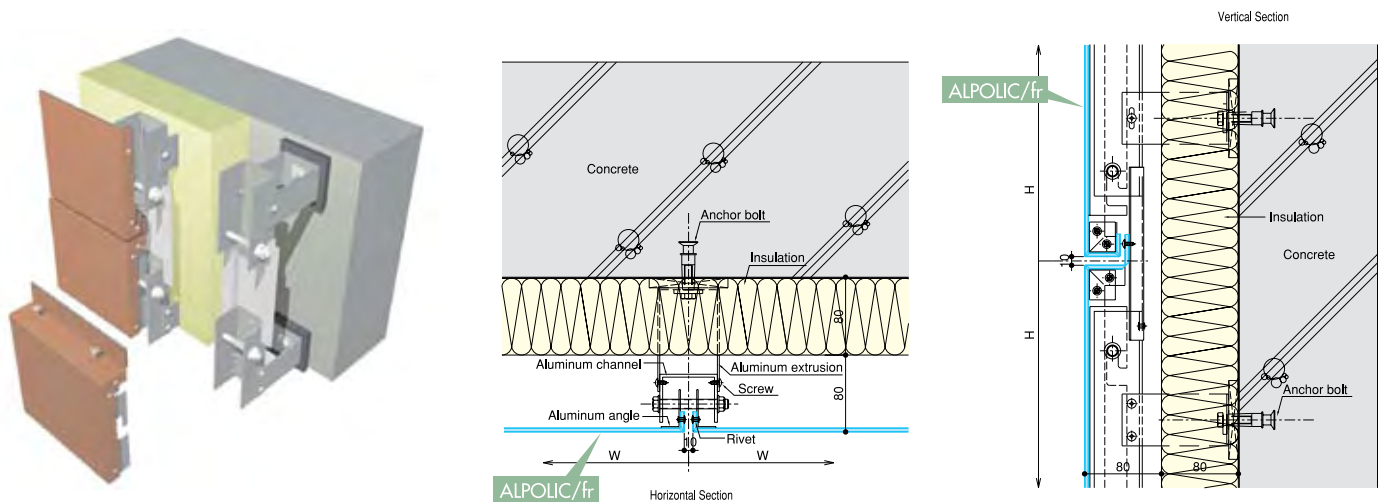
4. EXAMPLES OF FIXING METHODS

We are introducing typical examples of fixing methods below. Refer to the ALPOLIC Technical Manual (CDR), "Section 3 Fabrication & Installation" for the details.

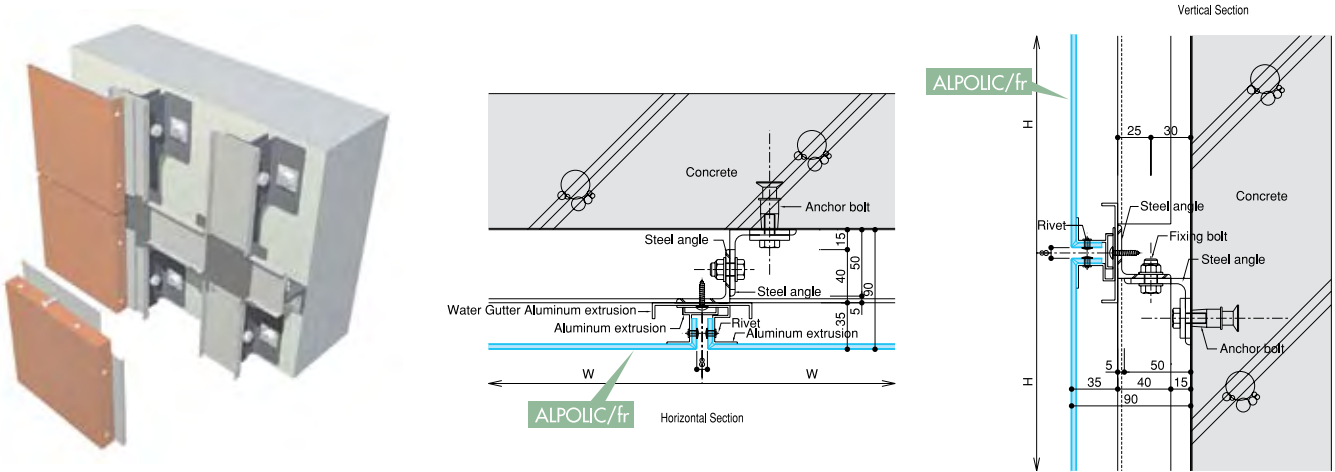
(1) **External wall cladding - wet sealant joint** - This installation system, with tray type (rout and return) panels and sealing joints, is one of the most common methods and it is available for a wide range of new buildings and renovation projects. After fixing ALPOLIC/fr panels on the substructure,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



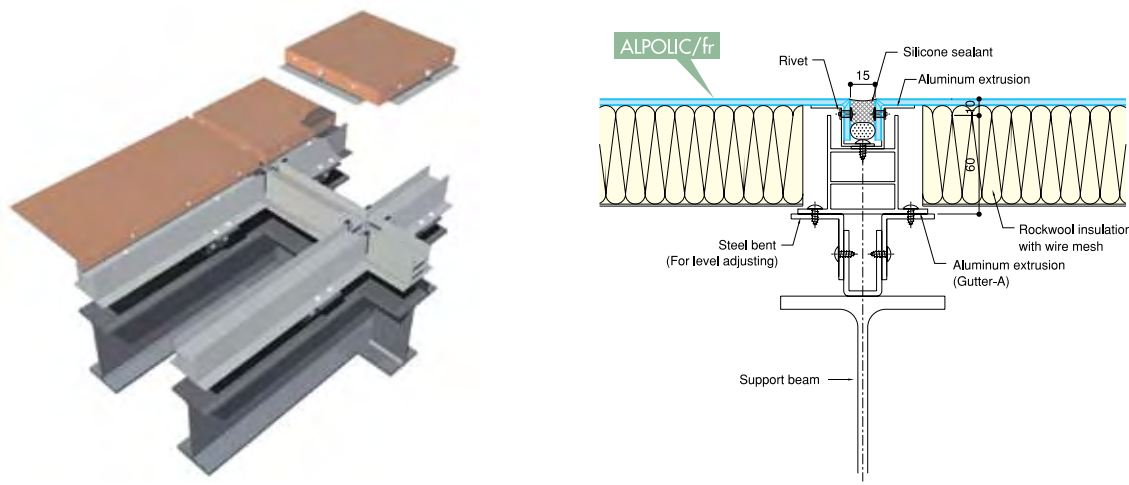
(2) **External wall cladding - hanging method** - The hanging system is also one of the most common fixing methods. It simplifies the installation work at the construction site and hence we can shorten the installation period. It is easy to loosen the movement due to thermal expansion/contraction with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



(3) External wall cladding - narrow open joint - Generally, this kind of method is suitable for Stone and Timber-patterned ALPOLIC/fr 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.



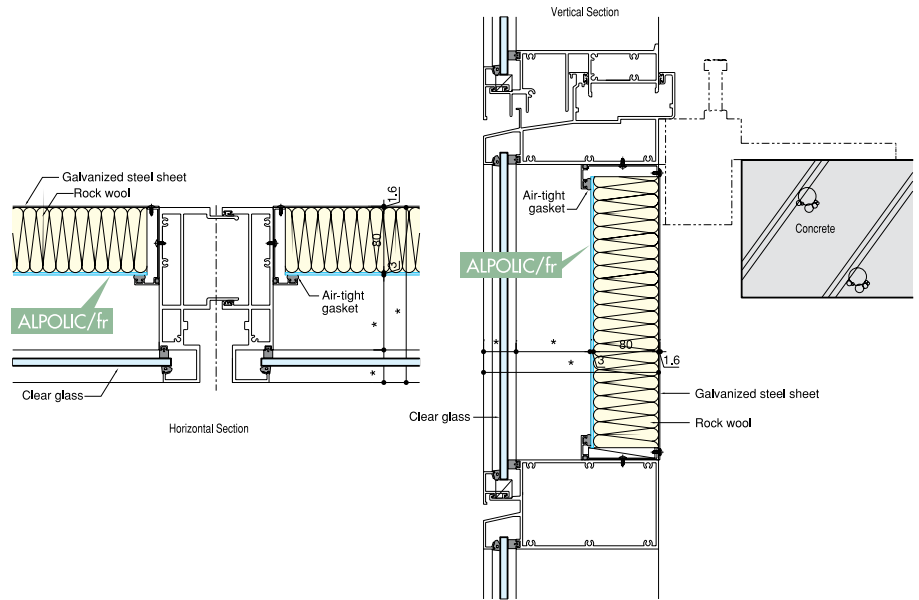
(4) Roof covering - ALPOLIC/fr has been used for roof covering in prestigious projects such as airports and stadiums. In roof applications, we install a water gutter or waterproof sheets behind ALPOLIC/fr panels so that leaked water can drain outside.



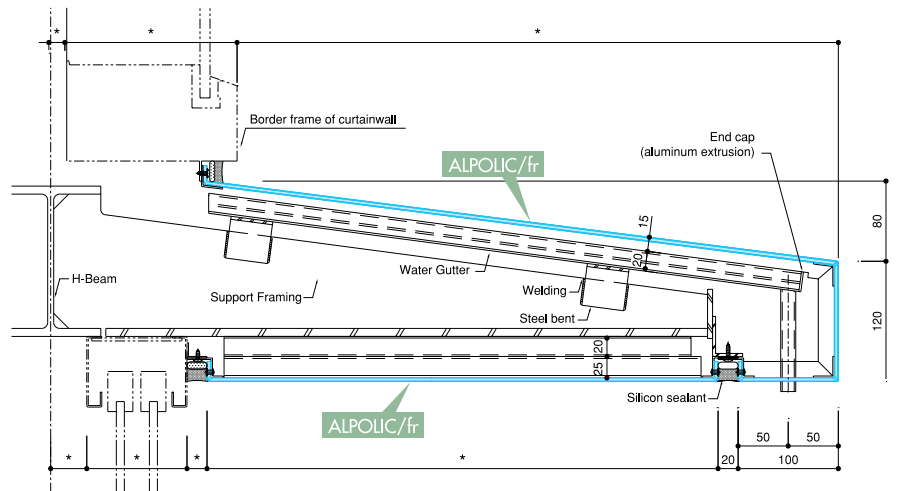
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ALPOLIC® & ALPOLIC®/fr

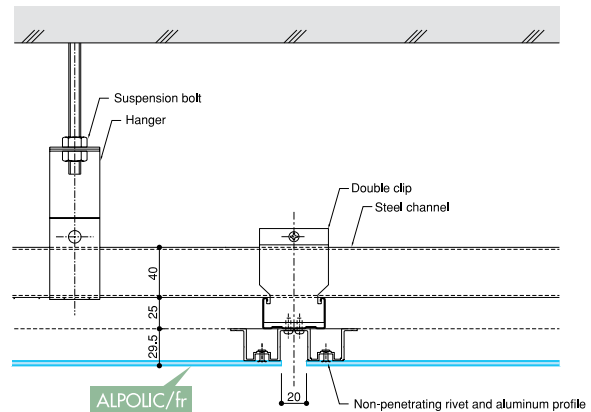
(5) **Back panel of glass curtain wall** - Glass curtain walls sometimes need an opaque spandrel panel (back panel) behind glass for aesthetic purpose. The spandrel back panels behind the glass must be very durable especially to UV exposure, because it is hard to replace them after the building is completed.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



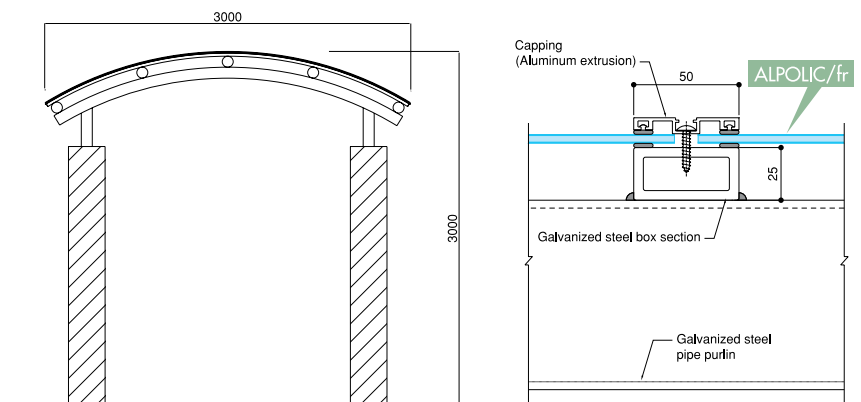
(6) **Sunshade or cornice** - ALPOLIC/fr is sometimes used for sunshade or the cornice of a building wall. In this type of application, normally steel or aluminum frames are used as reinforcement behind ALPOLIC/fr.



(7) Ceiling with non-penetrating rivet - When we use ALPOLIC/fr 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. In this method, we install fabricated ALPOLIC/fr panels on lightweight suspension bar ceiling systems.



(8) Roof of pedestrian passage - ALPOLIC/fr has been used as roof panels of public pathways and bus stations. ALPOLIC/fr panels are just clamped between sub-frames and aluminum extrusions. In most projects, the curving panels can be naturally curved without a mechanical bending.



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 Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

RECYCLABLE MATERIAL:

ALPOLIC and its affiliated materials are 100% recyclable. Scraps generated from ALPOLIC plants are collected and brought to the recycling facility for recycling.

ISO 9001: 2000 CERTIFIED

ALPOLIC's design, development, manufacturing and sales are managed with ISO 9001: 2000.

ISO 14000

ALPOLIC and its affiliated materials are produced in the plant that has ISO 14000 certificate.

DISTRIBUTED BY:

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