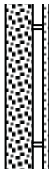
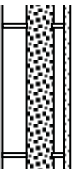
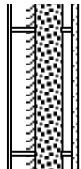


approx. 15%, and installing a heat insulation material behind ALPOLIC increases the insulation effect by more than two times.

Table 2-11 Heat transmission through external wall

Wall system, wall component and its thickness	RC wall only			ALPOLIC cladding			ALPOLIC + Heat insulation		
	out	in		out	in		out	in	
			RC wall (100) Air space (50) Gypsum board (12)			ALPOLIC (4) Air space (100) RC wall (100) Air space (50) Gypsum board (12)			ALPOLIC (4) Air space (75) Glass wool (25) RC wall (100) Air space (50) Gypsum board (12)
Calculated U-value	2.5 W/m ² ·K			2.1 W/m ² ·K			0.92 W/m ² ·K		

Note: We can convert U-value into K-value with the following equation.

$$K\text{-value (kcal/m}^2\text{h}^\circ\text{C)} = 0.86 \times U\text{-value (W/m}^2\text{·K)}$$

(2) Non-permeability

ALPOLICs are non-permeable. Under humid atmospheric conditions, ALPOLICs do not absorb moisture at all. The following is the test result of the freezing and thawing cycle test, which confirms the complete non-permeability of ALPOLICs.

- a. Freezing and thawing test
- b. Exposure cycle: -20°C×1.0hrs for freezing and +10°C×1.5hrs for thawing
- c. Test result:

After 300 cycles, the sample does not show any change in weight, thickness or appearance.

Note: If you use ALPOLICs in a humid condition like in a bathroom where the edge of the panel may be always wet, it is important to design the fixing detail to drain the moisture and to keep the edge dry. Please consult local distributors or our office about practical methods of suitable fixing details.

(3) Fire performance

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.

a. Fire test result of ALPOLIC/fr

We have had extensive fire tests of ALPOLIC/fr in accordance with requirements in various countries. ALPOLIC/fr has passed the following fire tests.

Table 2-12 Fire tests for general and external cladding material

Country	Test standard	ALPOLIC/fr specimen	Results & classification
United Kingdom	BS476 Part 7	4mm, 6mm	Class 1
	BS476 Part 6	4mm, 6mm	Class 0
Germany	DIN4102 Part 1	4mm, 6mm	Class B1
USA	NFPA 259-93 British Thermal Unit	4mm	Passed
	ASTM D1781-76 Climbing Drum Peel Test	4mm, 6mm	Passed
	ASTM E84, Steiner Tunnel Test	4mm, 6mm	Class A / Class 1
	ASTM E-108, Modified	4mm	Passed
	UBC 26-9 & NFPA 285, ISMA Test (Intermediate Scale Multi-story Apparatus)	4mm, 6mm	Passed
Canada	CAN/ULC-S 134-92, Full-scale Exterior Wall Fire Test	4mm	Passed
China	GB8625, GB8626 & GB8627	4mm	Class B1
Japan	Heat Release Test for Non-combustible Material (ISO 5660-1)	4mm, 6mm	Passed. Certificate No. NE-0001

Table 2-13 Fire tests for other categories

Category	Country	Test Standard	ALPOLIC/fr specimen	Results & classification
Fire resistant rating wall	USA	ASTM E119, 1-hr Fire Rating and 2-hr Fire Rating	4mm	Passed
Roof material	USA	ASTM E108, Fire Test for Roof Covering	4mm	Passed Class A
Interior material	USA	UBC 26-3, Interior Room Corner Test	4mm	Passed
		Combustion Toxicity Test, New York State Uniform Fire Prevention and Building Code	4mm	Passed
	Japan	Heat Release Test for Non-combustible Material (ISO 5660-1) & Toxicity Gas Test	3, 4, 6mm	Passed. Certificate No. NE-209

b. Fire test result of ALPOLIC

ALPOLIC passes the following tests for general building materials.

Table 2-14 Fire test result of ALPOLIC

Country	Test Standard	ALPOLIC specimen	Results & classification
U.K.	BS476 Part 6	3mm, 6mm	Class 0
	BS476 Part 7		Class 1
Germany	DIN 4102 Part 1	3mm, 6mm	Class B2
Australia	AS 1530 Part 3	3mm, 6mm	3mm 6mm Ignitability 0 0 Flame spread 0 0 Heat evolved 0 0 Smoke developed 1 0-1
USA	ASTM E84 Tunnel Test	3mm, 6mm	3mm 6mm Flame spread 5 0 Smoke developed 15 10
	ASTM E108, Modified	6mm	Passed

c. Comments on the fire tests of ALPOLIC/fr

(i) External cladding

The ISMA Test (Intermediate Scale Multi-story Apparatus, UBC 26-9 & NFPA 285) is a mandatory test for external cladding in US building codes. This test is a simulation test to check the fire propagation using 2-story mock-up model installed with the building material specimen.

A big concern in external cladding is the upward extension of flames over the vertical exterior wall, as shown in Fig. 2-4. Through the ISMA test in Fig. 2-5, we can evaluate the fire extension performance over the external cladding in a controlled environment. ALPOLIC/fr passes this test and has an approval for external claddings without height restrictions.

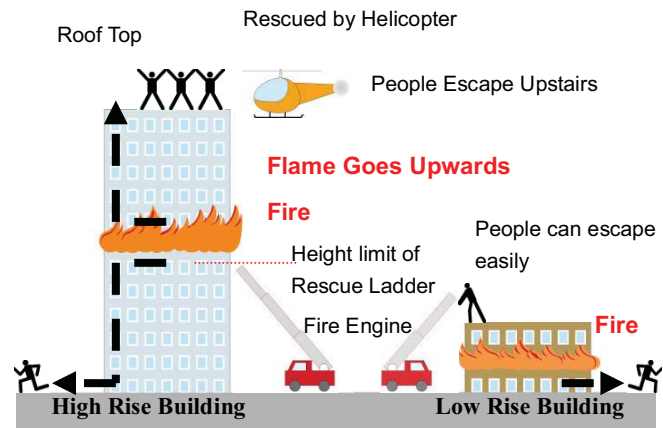
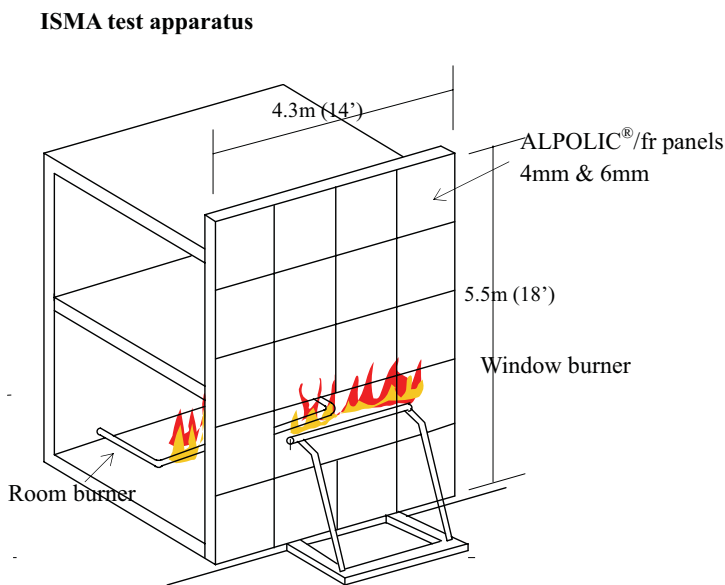


Fig. 2-4 Evacuation from fire

Fig. 2-5 Intermediate-scale Multistory Apparatus



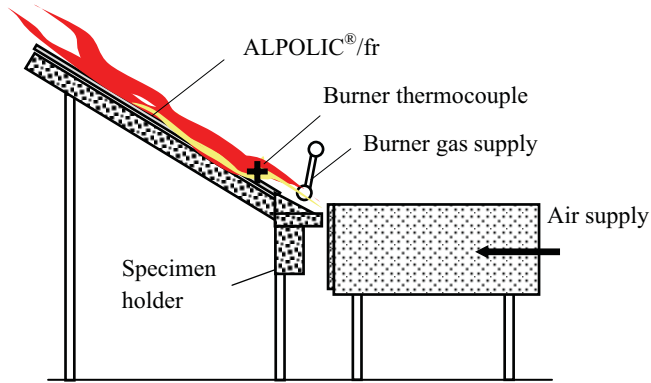
25 minutes after ignition



(ii) Roof covering material

ALPOLIC/fr passes the fire tests in ASTM E108, which examines the fire performance as roof covering materials. It consists of three types of fire tests: a burning brand test, an intermittent flame test and a spread of flame test.

Fig. 2-6 ASTM E108 Fire test for roof covering
Intermittent flame test & spread of flame test



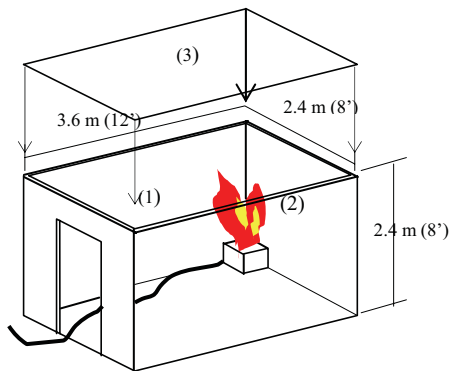
Burning brand test



(iii) Interior material

UBC26-3 Interior Room Corner Test is a fire test that verifies the hazardous flashover performance of interior finishing materials. If a fire is generated at a corner of a room, the flame will grow gradually until a certain critical point called a flashover. When the fire has reached the flashover point, it suddenly expands toward the opening door like an explosion. This test simulates this phenomenon and examines the flashover performance of interior finishing materials.

Fig. 2-7 UBC26-3 Interior Room Corner Test



Testing conditions:
 Heater: Gas burner or 30lb wood crib
 Time: 15 min
 The interior is finished with the testing material
 (1) Side wall, (2) Front wall, (3) Ceiling: Optional

Example of Interior Room Corner Test



(iv) Fire approval in Japan

ALPOLIC/fr passes Japan's cone calorimeter test ISO5660-1, a standard fire test for building material classification. It also passes Japan's toxicity gas test and has approval as a non-combustible material for external cladding, roof covering and interior with Certificate Nos.NE-0001 and NE-209.