



ALUMINUM COMPOSITE PANEL

FIRE TESTS FIRE TESTS

INFORMATION BOOKLET



APRIL 2014





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WHAT IS BURNING?

As a result of the reaction of the combustion substance (a chemical compound) with heat and oxygen
It is a chemical reaction that occurs. After the combustion event, heat is produced.

Oxygen itself is a gas that does not burn, but does burn. air too

There is an average of 21% Oxygen. A combustion event can take place.

The presence of 16% oxygen in the environment is sufficient for this. The triangle formed by these three factors that cause combustion is called the Fire Triangle.

(Figure 1) If any of the three elements forming the fire triangle is absent
or if it is not found in sufficient quantity, the combustion event will not occur.

The heat exchanger is the difference in temperature at two points

It is an energy exchange that occurs. Heat transfer;
conduction takes place in the form of convection and radiation.

occurs mostly on the burning surface and

occurs as a spread on the surface. Thick

has a greater effect on substances.

and its effect is greater than radiation.

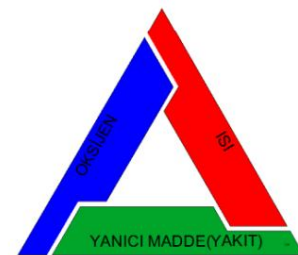


Figure 1. Combustion Triangle

transport; with the decrease in the density of the heated gases,

It happens with the right movement. My radiation is from flame and smoke

k is due to kt d.

Heat convection has a natural effect on the environment with the high temperature of the waste gases.

It spreads rapidly by the effect of convection. wind speed, fire location conditions and

temperature increase can become more effective within the framework of atmospheric conditions.

Within the scope of the Regulation on the Protection of Buildings from Fire in our country

While determining the fire resistance of the building elements, the fire curve in Figure 2 should be considered.

Tests to be applied are considered within the scope of this curve.



It is not enough for the building elements to have fire resistance alone.

What is important is the international with the relevant detail and structural element standards, by accredited laboratories within the scope of international acceptance is to be tested and approved that it provides the relevant fire resistance.

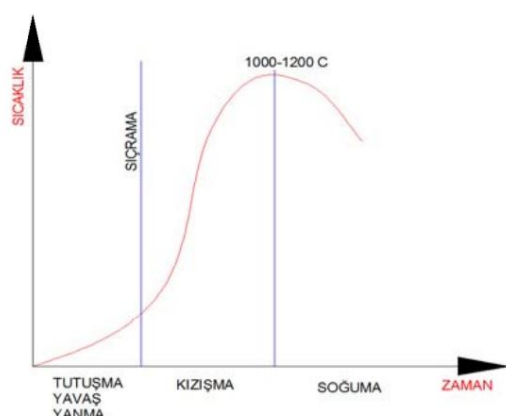


Figure 2. Standard Fire Curve

All firestop products,

to the relevant standards together with the transition detail.

when tested according to the fire curve
the highest fire

reaches a temperature of 1000 – 1200 °C
peak of range

test by providing temperature values
is being done.

FIRE LOAD IN BUILDINGS

fire load; all combustible materials and

as a result of the sum of the product of the masses of the elements and their heating values

It is a quantity obtained by dividing the value found by the area on the plan. well

All materials used in the building and which may be in it,

depending on the effect it will have on the burning intensity and spreading rate in case of

It is an important factor that helps the grouping of structures. Building style

and fire load varies from structure to structure according to the materials used.

shows show. The fire load of each building is unique to itself. The fire load is too high

The probability of occurrence of fire risk and the speed of its spread are high.



EXTERNAL IN TURKEY WITHIN THE SCOPE OF FIRE PROTECTION REGULATIONS FACADE INSULATION AND COATING MATERIALS

Facade materials for fire protection in Turkey

Although it is partially covered in the regulations, it is a fire regulation in itself.

The first fire regulation was issued in 1992, with the approval of the Istanbul Metropolitan Municipality Council, to cover only Istanbul. The first to cover the whole of Turkey

The regulation was issued in 2002 with the decision of the Council of Ministers and revised in 2007. and it was partially revised in 2009. The subject is still revised.

work continues.

These regulations are also for facade insulation and coating materials; both in the "Istanbul Metropolitan Municipality Fire Regulation" that came into force in 1992 and "About Fire Protection of Buildings" which entered into force in 2002.

In the Regulation, "Fronts are in the nature of vertical external fire compartments. facade exterior It is essential that the coating is made of non-combustible material." provision was made in 2007.

In the renewed regulation, this condition is "incombustible materials and other materials in high-rise buildings. in buildings, for high-rise buildings, from the least difficult flammable material"

has been preserved and other buildings have been stretched for buildings. In the change made in 2009,

"It is made of hardly flammable materials in high-rise buildings and the least difficult flammable material in other buildings.

It has also been stretched for high-rise buildings in the form of "made of material". exterior of a building

There are three ignition sources for the coating to be exposed to fire. These are;

- Exterior facade of a fire inside the building by passing through the wall gaps.
ignite insulation and coating,
- Exterior of combustion products formed in a fire adjacent to or near the building.
reaching the façade and igniting the façade material,
- Again, the heat generated from a fire that occurred at a close distance across the building.
reaching the siding with radiation, causing the façade to burn,
will be in the form.



REGULATION ON FIRE PROTECTION OF BUILDINGS

FLAMMABILITY CLASSES OF MATERIALS WITHIN THE SCOPE

on 19 December 2007 by the Ministry of Internal Affairs and the Ministry of Public Works and Settlement.

"Buildings from Fire", which was published jointly and entered into force on the date of publication.

"Regulation on the Protection of the Buildings", according to the TS EN 13501 series.

"Response to Fire" criteria and building

determines the "Fire Resistance" criteria for building elements, thus

sets out the basic requirements for 'passive fire safety' of buildings. in buildings

especially used as coating material on facility roofs and facades.

materials and the load-bearing properties of these materials, and

Elements of the building are the fire facility, the outside of the facility, and the fire facility.

It is to play a decisive role in order to be protected from fire.

In article 27 of the fire regulation ; "Exteriors are difficult in high-rise buildings.

flammable material and in other buildings from the least difficult flammable material.

must be. Facade elements and gaps where flames can pass.

The intersections of floors that do not exist, prevent the flames from jumping to neighboring floors.

The floor is insulated for a period of time to provide fire resistance.

Two floors are like windows to prevent the flames from passing from one floor to another.

between unprotected spaces, at a height of at least 100 cm vertically.

A surface filled with durable façade element is created or the interior of the façade is mostly

Sprinkler heads at a maximum distance of 1.5 m from the facade at 2 m intervals

The façade is protected by an automatic sprinkler system.

• TURKEY REGULATION ON FIRE PROTECTION OF BUILDINGS

The "Regulation on the Protection of Buildings from Fire" published in the Official Gazette dated 19.12.2007 and numbered 26735 with the decision of the Bk la ar K l ur on 27.11.2007 and numbered 2007/12937 and the Council of Ministers dated 10.08.2009 and numbered 2009/15316 The provisions of the "Regulation on the Amendment of the Regulation on the Protection of Buildings from Fire" published in the Official Gazette dated 9.09.2009 and numbered 27344 with the decision of

Official Gazette 19 December 2007 Wednesday No: 26735 Official Gazette 9 September 2009 Wednesday No: 27344



High building according to the regulation; building height from 21.50 m, building height

It is defined as structures greater than 30.50 m. In this case

As stated in paragraph 1 of Article 27 of the regulation, the height of the building

In buildings with a building height of more than 21.50 m and a building height of more than 30.50 m, exterior facades,

the least difficult flammable material and in other structures,

material is emphasized. Facade cladding materials

For this purpose, the following criteria are valid:

• At least according to EN 13501-1 in facilities with a building height of less than 21.5 m.

C s3 d2 (lower limit value for difficult flammable class)

• At least EN 13501-1 in facilities with a building height of more than 21.5 m.

according to A2 s1 d0 (lower limit value for difficult flammable class)

of the material flammability Feature	Smoke No Occurrence	Do not burn drips /No Particles	European Class (According to TS EN 13501-1)	Buildings from Fire About Protection regulation
Never Burns Never Burns	X	X	A1	A1
Hardly Flammable	X	X	A2 - s1, d0	A2
Hard Flammable	X	X	B, C - s1, d0	B1
		X	A2 - s2, d0 A2, B, C A2, B, C - s3, d0	
	X		A2, B, C A2, B, C - s1, d1 A2, B, C A2, B, C - s1, d2	
			A2, B, C A2, B, C - s3, d2	
(minimum)			A2, B, C A2, B, C - s3, d2	
No trace flaming		X	B1 - s1, d0 D - s2, d0 D - s3, d0	B2
			D - s1, d2 D - s2, d2 D - s3, d2	
			E - d2	
			F	
(minimum)			E - d2	
Easy flaming			F	B3

Reaction to Fire Performance Classes for Construction Materials Except Flooring With Relevant EU Commission Decisions
Reaction to Fire Classes of Building Materials, which have been set forth,
Equivalence of Building Materials According to Flammability Classes specified in the Regulation on Conservation



SMALL FLAME TEST (SFI – Ignitability Small Scale Test) TS EN 11925-2

With this test method, the product is exposed to small flame conditions.

It is applied to evaluate its flammability. B, C, D class products 30 sec.

They are subjected to a small flame source for a period of time. Products that pass this test are subject to the SBI test.

They are subjected to a small flame test for E class products for 15 seconds.

The time is applied until the ignition or the fire exceeds 150 mm.

According to the test results, D, E potentially F classification

Materials belonging to classes B, C, D are subject to additional SBI test after this test.

they are kept.

FIRE REACTION TO FIRE TESTS (SBI-Sign e B i urn ng Item T t) es TS EN 13823

With this test method, the reactions of B, C, D class materials to fire

It is determined by directing the 30 KW flame source to the material.

Test sample dimensions are as shown in Figure 3.

Temperature, oxygen consumption, CO₂

output values are determined.

The total released in the sec section

heat(THR) and fire growth

ratio(FIGRA) datas get

Afterwards, for 20 minutes

whether the fire travels laterally

(LFS) If the flame is long edge

If he walks along this material D

class called the test.

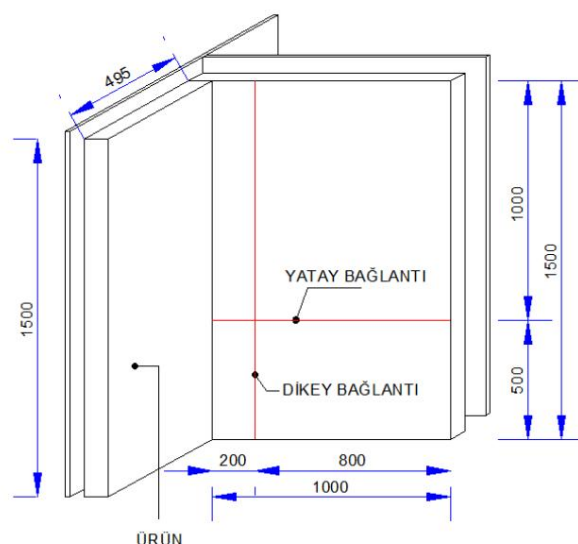


Figure 3. SBI Test Sample dimensions

The device with which it was carried out is shown in Figure 4.

shown.

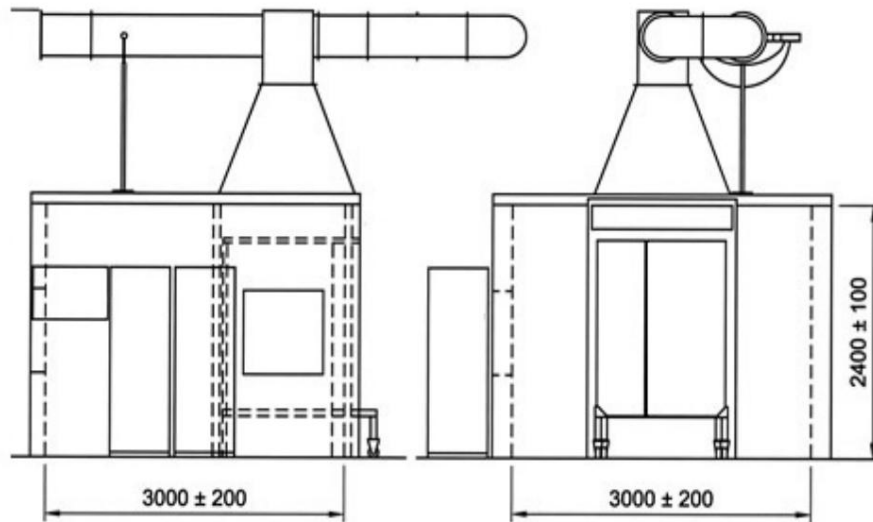


Figure 4. Test Device Dimensions for SBI Testing

whether there is dripping during the first 600 sec.

drip class according to whether particles burn for more than 10 seconds

determined.(d0,d1,d2) Likewise, within the first 600 sec.

determination of total smoke production (TSP) and smoke growth rate (SMOGRA)

According to the determination, it is called s1, s2 and s3 class.

Calorific Potential Test (EN ISO 1716)

In this test method, when the product is burned regardless of the end use

It is applied for the determination of the highest energy that occurs. With this experiment, both the total determination of calorific potential (TKP,PCS) and net calorific potential (NKP,PCI) is done.



$\ddot{y}T$	temperature rise
$\ddot{y}m$	Mass loss
t_f	exacerbation time
PCS	Gross calorie value
FIGRA	Fire Growth Rate
THR600s	Total heat released (Total Heat Release)
LFS	Lateral Flame Spread
SMOGRA	Smoke Growth Rate
TSP600s	Total smoke production (Total Smoke Production) p
F _s	flame spread

Definitions

Material: A single main ingredient or a uniformly dispersed mixture of materials, e.g. metal, stone, wood, concrete, mineral wool with a uniform binder, polymers.

Homogeneous material: A material consisting of a single material with equal specific gravity and composition throughout the material.

Inhomogeneous material: Not having the properties of a homogeneous material. material. One or more of the main and/or secondary components in its formation material consisting of component (Composite).

Major component: The material that forms the most important part of an inhomogeneous material. A layer with a mass of $\ddot{y}$ 1.0 kg/m² per unit area and a thickness of $\ddot{y}$ 1.0 mm is considered as the main component.

Secondary component: Material that does not form the most important part of an inhomogeneous material. A layered billet component with a mass of < 1.0 kg/m² per unit area and a thickness of < 1.0 mm is considered corrugated.

Two or more secondary layers adjacent to each other (ie, with no major component(s) between layers) are adopted as a single minor component. Thus, the resulting subcomponent must meet the requirements that a layer must fulfill.

For secondary components, the separation of internal and external minor components is as follows:

Inner secondary component: A minor component covered on both sides with at least one major component (both edges covered with at least one main component).

External subsidiary sub-component: one side that is covered even a main component on one side component (secondary component not covered by the parent material).

Reaction to Fire Performance Classes for Building Materials Except Floors



CLASS	TEST METHOD	CLASSIFICATION CRITERIA	I CLASSIFICATION
A1	TS 1912 (EN ISO 1182) ~~(1)~~ ve	300°C and $\dot{m} \leq 50 \text{ g/s}$ tf (eg: non-lasting flame)	
	TS 1913 (EN ISO 1716) ~~(2)~~ ve	PCS $\leq 2.0 \text{ MJ/kg-1}$ (1) ve PCS $\leq 2.0 \text{ MJ/kg-1}$ (2) (2a) ve PCS $\leq 1.4 \text{ MJ/m-2}$ (3) ve PCS $\leq 2.0 \text{ MJ/kg-1}$ (4)	
A2	TS 1912 (EN ISO 1182) ~~(1)~~ ve	300°C ve $\dot{m} \leq 50 \text{ g/s}$ tf $\leq 20 \text{ s}$	
	TS 1913 (EN ISO 1716) ~~(2)~~ ve	PCS $\leq 3.0 \text{ MJ/kg-1}$ (1) ve PCS $\leq 4.0 \text{ MJ/m-2}$ (2) ve PCS $\leq 4 \text{ MJ/m-2}$ (3) PCS $\leq 3.0 \text{ MJ/kg-1}$ (4)	
	TS EN 13823 (SBI) FIGRA $\leq 120 \text{ Ws-1}$ ve LFS < edge of sample and THR600s $\leq 7.5 \text{ MJ}$		smoke generation(5) and burning drips /particles(6) ~~(7)~~
B	TS EN 13823 (SBI) and FIGRA $\leq 120 \text{ Ws-1}$ and LFS < edge of sample and THR600s $\leq 7.5 \text{ MJ}$		smoke generation(5) and drips burning /particles (6)
	TS EN ISO 11925-2 (8) ~~(7)~~ Exposure time = 30s	Fs $\leq 150 \text{ mm}$ in 60s	
C	TS EN 13823 (SBI) and FIGRA $\leq 250 \text{ Ws-1}$ and LFS < edge of sample and THR600s $\leq 15 \text{ MJ}$		smoke generation(5) and burning drips t /particlepai(6) (6)
	ISO 1925-2 (8) ~~(7)~~ 150mm in 60s Exposure time = 30s	Fs $\leq 150 \text{ mm}$ in 60s	
D	TS EN 13823 (SBI) ve FIGRA $\leq 750 \text{ Ws-1}$		smoke generation(5) and burning drips /particles(6)
	TS EN ISO 11925-2 (8) ~~(7)~~ Exposure = 30s	Fs $\leq 150 \text{ mm}$ in 60s	
AND	TS EN ISO 11925-2 (8) ~~(7)~~ Exposure time = 15s	Fs $\leq 150 \text{ mm}$ in 20s	burning drips /particles(7) ~~(8)~~
F	There is no set performance value		



Applications for some material families are currently under review and may require a change in this decision.

It is present in the TSE work program and will be accepted as a TS EN norm in 2004.

(1) For homogeneous materials and major components of inhomogeneous (composite) materials

(2) For any external secondary component of non-homogeneous (composite) materials

(2a) Alternatively, if a material with a PCS of $\geq 2.0 \text{ MJ.m}^{-2}$ of any of its outer secondary components fulfills the criteria of TS EN 13823 (SBI): FIGRA $\geq 20 \text{ Ws 1}$; and LFS $< \text{edge of sample}$, and THR600 $\geq 4.0 \text{ MJ}$ and s1 and d0.

(3) For any internal secondary component of non-homogeneous materials

(4) For the entire material

(5) s1 = SMOGRA $\geq 30 \text{ m}^2.\text{s}^{-2}$ ve STP600s $\geq 50 \text{ m}^2$; s2 = SMOGRA $\geq 180 \text{ m}^2.\text{s}^{-2}$ ve TSP600s $\geq 200 \text{ m}^2$; s3 = s1 veya s2 olmayan

(6) According to EN 13823 (SBI) within 600s d0 = No combustion drips/particles; According to EN 13823 (SBI), no burning drips/particles lasting longer than d1 = 10s within 600s; d2 = d0 and non-d1; Ignition of paper results in d2 classification according to EN ISO 11925-2.

(7) Pass = paper not burned (classless); Failed = paper burned (d2 class)

(8) Surface exposed to flame is the face and, if the end application of the material is the application of the material under conditions of exposure to flame, also from the side, if appropriate,

TS EN 13501-1 and DIN 4102 FIRE REACTION CLASSES COMPARISON TABLE*



MATERIAL FLAMMABLE FEATURE	SMOKE FORMATION NONE	DO NOT BURN DROP /PARTICLE NONE	TS EN 13501-1 BY E FIRE REACTION CLASSES	DIN 4102 IS BY FIRE REACTION CLASSES
NEVER FIRE	+	+	A1	A1
HARD FLAMMABLE	+	+	A2 S1 D0	A2
DIFFICULT FIRE	+	+	B S1 D0	B1
		+	C S1 D0	
			A2 S2 D0	
			A2 S3 D0	
			B S2 D0	
			B S3 D0	
			C S2 D0	
			C S3 D0	
	+		A2 S1 D1	
			A2 S1 D2	
			B S1 D1	
			B S1 D2	
			C S1 D1	
			C S1 D2	
			A2 S3 D2	
			B S3 D2 B S3 D2	
			C S3 D2	
NORMAL FLAMMABLE C _y		+	D S1 D0	B2
			D S2 D0	
			D S3 D0	
			AND	
			D S1 D1	
			D S2 D1	
			D S3 D1	
			D S1 D2	
			D S2 D2	
			D S3 D2	
			D2	
EASY FLAMMABLE			F	B3

*Since TS EN 13501-1 and DIN 4102 are different standards, direct comparison may not give accurate results. The comparison is for information purposes only.



BUILDING MATERIALS REACTION TO FIRE CLASS / STANDARD / DEVICES USED



EN ISO 1182 / Flammability Test
(Non Combustibility Test)



EN ISO 1716 / Calorific Potential Test
(Calorific Potential Test)



EN 13823 / Test with Single Flame Hood
(Single Burning Item Test SBI)



EN 11925 / Small Flame Test
(Ignitability Small Scale Test)



REACTION TO FIRE CLASS EU MEMBER COUNTRY AND EU CLASS COMPARISON TABLE

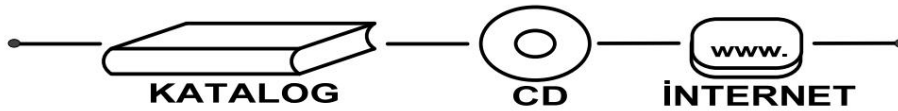
EU Member States	Current National Classes	AB Classes (Euroclasses)	Application Processes	Explanation
Austria	Class A	Part of A1yA2yB	Önorm 3806 (2001y04y23) (See 1)	1
	Class B1	Part of ByCyDy E		
	Class B2	Part of CyDyE		
	Class B3	F		
Belgium	A0	A2ys1	by the Belgian Ministry There is no decision taken (See 2).	2
	A1	Bys3 or Cys2		
	A2	Cys3		
	A3	Dys3		
	A4	F		
Czech Republic	A	A1	EU Commission decision July Adapted in 2002.	
	B	A2		
	C1	B		
	C2	C or D		
	C3	E or F		
Estonia			No information	No information
Denmark	NonCombustible	A2ys1,d0	EU Commission decision 1 March Adapted in 2002.	3
	Class A	Bys1,d0		
	Class B	Dys2,d2		
	Combustible (Bkz.03)	All other products		
Finland	NonCombustible	A2-s1,d0 or A1	The new regulation is in effect on 1 July 2002.	4
	Limited Combustible	A2ys1,d0 (Bkz.04)		
	Lining Class I/I /	Bys1,d0		
	Lining Class I/II ve I	Cys2,d1		
	Lining Class 2	Dys2,d2		
	Lining Classyy/y	F		
France	Non combustible	A1	Annex-4 of the Decision of 31 October 2002, March became active in 2003 has been brought.	
	M0	A1 or A2ys1,d0		
	M1	A2ys1/2/3,d0/1 or Bys1/2/3,d0/1		
	M2	Cys1/2/3,d0/1		
	M3	Dys1/2/3,d0/1		
	M4 (nonygouttant)	Dys1/2/3,d0		
	M4	All classes except Eyd2&F		
	Unclassified	Eyd2&F		
Ireland			Picture published so far there is no application.	
Italy			Two different drafts to discuss There is no decision made.	
Lithuania			No information	No information
Latvia			No information	No information
Portugal			No information	No information
Cyprus			No information	No information
Slovakia			No information	No information
Luxembourg			No information	No information
Greece			No information	No information
Malta			No information	No information
Holland	Non Combustible	A1	In the Dutch Official Journal June 2003 NENyEN 13501-1 Published as.	8
	Class 1	A2ys2		
	Class 2	Bys2		
	Class 3	Cys2		
	Class 4	Dys2		
Germany	Non-flammable	A1&A2ys1,d0	Done. Official DIBt Jan 2002 also announced.	
	flame retardant/	Bys1,d0&Cys1,d0		
	No smoke, no droplets			
	flame retardant/	A2ys2/3,d0 &		
	Smoke, no droplets	B + Cys2/3,d0		
	flame retardant/	A2ys1,d0/2 &		
	Droplets, no smoke	B+Cys1,d1/2		
	flame retardant/	A2ys3,d2&		
	Smoke & droplets	B+Cys3,d2		
	Normalentflammbar/	Dys1/2/3,d0 ve E		
	Smoke, no droplets			
	Normalentflammbar/	Dys1/2/3,d2 ve Eyd2		
	Smoke & droplets			
	Highly flammable	F		



EU Member States	Current National Classes	AB Classes (Euroclasses)	Application Processes	Explanation
Poland	Non combustible, and d It no droplets	A1& A2s1,d0	Implementation by the end of 2003 According to annex PN EN 13501-1 being done	8
	Non combustible	A1&A2		
	Not flammable, and no droplets	Bys1/2/3,d0		
	Not flammable	C ve D1s1,d1/2/3		
	Hard ignitable	D1s2 ve E ve F		
	Easy ignitable	—		
	Self extinguishing	—		
Hungary	A1 (non combustible)	07	New regulation development is in the process. end date as May 2004 determined	7
	A2 (almost not combustible)			
	B1 (hard combustible)			
	B2 (easy combustible)			
	B3(easy combustible)			
	C0 (no melting)			
	C1 (melting, no droplets)			
	C2 (burning droplets/ignition)			
	F0 (no smoke)			
	F1 (moderate smoke)			
Slovenia (See 05)	Non combustible	A1&A2	Information about the application there is none.	5
	Class 1	B		
	Class 2	C		
	Class 3	D		
	Class 4	—		
Spain	M0	All classes used EC It is according to 2000/147. old and among the new classes all installed requirements There is no equivalence table for	The application is at the end of 2003.	
	M1			
	M2			
	M3			
	M4			
Sweden	Non combustible	A2ys1,d0	The application is in October 2002.	
	Class I	Bys1,d0		
	Class II	Cys1,d0		
	Class III	Dys2,d0		
United Kingdom (England+Wales)	Non combustible	A1 or need test A1 features without catering	Building Regulations 2002 With the fix is in practice.	
	Limited Combustible	A2ys3,d2 or better		
	Class 0	Bys3,d2 or better		
	Class 1	Cys3,d2 or better		
	Class 2	Dys3,d0 or better		
United Kingdom (Scotland)	Non combustible	Need A1 or A2 and test A1 features without catering	Was implemented in 2001. It	
	Class 0	B		
	Class 1	C		
	Class 3	D		
EFTA(*) Member States	Current National Classes	AB Classes	Application processes	Explanation
Iceland			No information	No information
Liechtenstein			No information	No information
Norway	Non combustible	A2ys1, d0	on 14 May 2003 has been published.	
	Limited Combustible	A2ys1, d0		
	Combustible	All Other Products		
Switzerland			See 6	6
1. Smoke generation and (combustion droplets)/particles classification according to ON 3806, Anhang B (for information purposes) 2. It seems that Belgium will follow the "German Approach" and will not translate. 3. The "Flammable" (or C class) class is not available in the official document. 4. Just for the escape route 5. The Slovenian standard JUS UJI 040 for non-flammability is similar to ISO 1183 and the Slovenian standard for flame propagation JUS UJI BS 482, part 7 is similar. 6. There is no viable final solution. 7. Hungarian Standard Series MSZ 595 on fire is implemented in the National Legislation. 8. Details on smoke formation and combustion drips/particles are not available in the final form.				
(*) (EFTA)European Fair Trade Association): European Free Trade Association				



/ A2 S1 D0



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