

TECHNICAL BULLETIN

CLASSIFICATION OF REACTION TO FIRE

An EU classification serves as the standard of evaluation for the reaction to fire of construction and building materials. The European classification system for fire protection was approved in the year 2001 by the European Committee for Standardisation (CEN) with the EN 13501 series of standards. It establishes uniform Europe-wide requirements for fire protection in order to facilitate the unrestricted trade of construction products throughout Europe.

In the EN 13501 Part 1 series of standards, the reaction to fire of construction and building materials is divided into several classes (Euroclass A1, A2 and B through F).

For complete building elements (wall, window or door) on the other hand, fire resistance is defined as the decision criterion in the 13501 Part 2 standard. The classes REI 30, REI 60 and REI 90 specify the time a building element has to last in case of fire – 30, 60 or 90 minutes. The performance of a building element can be derived from this classification (load capacity – R, impermeability to smoke and flame – E, insulating effect – I). Evidence is provided in the form of a fire test conducted on the complete building element with a corresponding test certificate according to EN 13501 Part 2.

EUROCLASS according to EN 13501 Part 1

The EU classification system for building products according to EN 13501 Part 1 calls for a total of seven Euroclass classifications (Euroclass A1, A2 and B through F), based on various test procedures and a so-called reference scenario.

The former national test standards for the reaction to fire of materials are replaced by the new European classification system.

Key characteristics for the assessment of reaction to fire are:

- Inflammability
- Combustibility
- Flame propagation
- Smoke development
- Dropping while burning

The Euroclass classifications are segmented into no flammability, low flammability, normal flammability and high flammability. The distinctions between the various classes are based on the time that elapses up to a fully developed fire, the flashover point. Class A1, A2 and B construction products do not lead to flashover.

The additional requirements for smoke development and dropping while burning are defined in three intensity levels:

- Smoke development: s1,s2,s3
- Dropping while burning:
 - d0 – no dropping
 - d1 – no dropping while burning that lasts longer than a specified time
 - d2 – neither d0 no d1

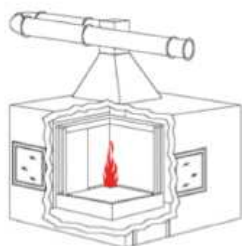
Building authority requirements	Euroclass according to EN 13501-1	Uniform board thickness	
		No smoke	No dripping / dripping while burning
No flammability	A1	x	x
	A2 - s1, d0	x	x
Low flammability	B - s1, d0	x	x
	C - s1, d0		
	A2 - s2, d0		
	A2 - s3, d0		
	B - s2, d0		x
	B - s3, d0		
Normal flammability	C - s2, d0		
	C - s3, d0		
	A2 - s1, d1		
	A2 - s1, d2		
	B - s1, d1	x	
	B - s1, d2		
High flammability	C - s1, d1		
	C - s1, d2		
	A2 - s3, d2		
	B - s3, d2		
	C - s3, d2		
	D - s1, d0		
Low flammability	D - s2, d0		x
	D - s3, d0		
	E		
	D - s1, d2		
Normal flammability	D - s2, d2		
	D - s3, d2		
	E - d2		
High flammability	F		

TESTS TO DETERMINE REACTION TO FIRE

The following tests are conducted for the classification of building products (i.e. wood-based materials):

- EN 13823 (2002) thermal load from a single burning object
- EN ISO 11925-2 (2002) Inflammability of building products with direct exposure to flames

The core of the new system is the SBI test (single burning item). Building materials in Euroclass A2 through D have to pass the SBI test. In this test, a source of fire is set up in a corner of the room, approximately simulating a burning waste basket or similar object.



Flame exposure » 30 KW; the SBI test measures:

- The release of energy (THR – total heat release)
- The spread of flames (LFS – longitudinal flame spread)
- The speed at which the fire spreads (FIGRA – fire growth rate)
- Smoke development (SMOGRA – smoke growth rate)
- Dripping / dropping while burning

Classification in the classes A2 through D is based on the results of the SBI test. However, the SBI test alone is not sufficient for the classification. All required tests and limit values are found in the following table:

Class	Test procedure	Classification criteria	Additional classification
B	EN 13823 and	FIGRA \leq 120 W/s and LFS < edge of the specimen and THR _{600 s} \leq 7.5 MJ	Smoke development and dripping / dropping while burning
	EN ISO 11925-2 load = 30 s	F _s \leq 150 mm (5.91") within 60 s	
C	EN 13823 and	FIGRA \leq 250 W/s and LFS < edge of the specimen and THR _{600 s} \leq 15 MJ	Smoke development and dripping / dropping while burning
	EN ISO 11925-2 load = 30 s	F _s \leq 150 mm (5.91") within 60 s	
D	EN 13823 and	FIGRA \leq 150 W/s	Smoke development and dripping / dropping while burning
	EN ISO 11925-2 load = 30 s	F _s \leq 150 mm (5.91") within 60 s	
E	EN ISO 11925-2 load = 15 s	F _s \leq 150 mm (5.91") within 20 s	Smoke development and dripping / dropping while burning

CLASSIFICATION WITHOUT ADDITIONAL TESTS (CWFT) ACCORDING TO EN 13986

In order to reduce the testing and classification effort under the new EN 13501 standard, the European Commission offers a classification without further testing (CWFT) for building products with a known reaction to fire and defined material properties (such as density and thickness).

According to EN 13986, wood chipboard produced in accordance with EN 312 at a raw density of \geq 600 kg/m³ and a thickness of \geq 9 mm (0.35") is automatically included in fire behaviour category D, s2-d0.

Further classifications without additional evidence for wood-based materials are found in the following tables (according to EN 13986, table eight):

Product	EN product standard	End use	Minimum raw density (kg/m ³)	Minimum thickness [mm (inch)]	Class (without floor covering)	Floor covering class
Chipboard	EN 312	Without air space behind the wood-based material	600	9 (0.35)	D-s2, d0	D-s1
MDF	EN 622-5					
OSB	EN 300					
Chipboard	EN 312	With closed or open air space of max. 22 mm (0.87") behind the wood-based material	600	9 (0.35)	D-s2, d2	-
MDF	EN 622-5					
OSB	EN 300					
Chipboard	EN 312	With closed air space behind the wood-based material	600	15 (0.59)	D-s2, d1	D-s1
MDF	EN 622-5					
OSB	EN 300					
Chipboard	EN 312	With open air space behind the wood-based material	600	18 (0.71)	D-s2, d0	D-s1
MDF	EN 622-5					
OSB	EN 300					
Chipboard	EN 312	No restrictions	600	3 (0.12)	E	E
MDF	EN 622-5		400	3 (0.12)		
OSB	EN 300		250	9 (0.35)		

However, the classification of wood-based materials can also be improved to Euroclass B and Euroclass C through specific treatment. The entire element has to be tested and classified as a matter of principle, even in case of subsequent upgrading.

EUROCLASS AND FORMER NATIONAL CLASSIFICATION

Euro class	Typical materials Examples	Former national classification																
		AT	BE	DK	FI	FR	DE	GR	IE	IT	NL	NO	PT	SK	ES	SE	CH	GB
B	Low flammability wood-based materials	B1	A2	A	1/l	M1	B1	3	0,1	1	2	In1	M2	B	M1 / M2	I	-	0/1
C	Wall cladding made of drywall	>B1	A3/A4	-	1/II	M2	-	3	1	2	3	In2	M3	B	M3	II	-	1
D	Untreated wood and wood-based materials	B2, B1	A3/A4	B	1/-	M3 / M4	B2	4	3	3	4	In2	M4	C2	M3 / M4	III	-	3
E	Low-density fibreboard	B3 (B2, B1)	A4	U	U	M3 / M4	B3/ B2	4	4	4	4/5	U	-	C3	M4	U	-	4

The reaction to fire of building materials is classified according to EN 13501-1 and DIN 4102-1 in Germany. The building materials classes according to DIN 4102-1 are shown in the table:

Building authority requirements	Building material class according to DIN 4102
Building materials that are not inflammable	A A 1 A 2
Building materials that are inflammable Low flammability building materials Normal flammability building materials High flammability building materials	B B 1 B 2 B 3