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EUROPEAN BUILDING FIRE REGULATION:

The European regulation

The last fire disasters (London subway, Düsseldorf airport, and more recently Channel tunnel) pointed out the importance of safety in the event of fire. In the early 1990s, the European Commission, supported by the Group of National Fire Regulators, proposed a completely new classification system, based partially on existing test methods, but partially, and critically for many construction products, on a completely new test, the so-called 'single burning item' (SBI) test.

Remarkably, the development of this new test from zero, including much of the text of the European Standard, was achieved in a shorter timeframe than expected. CEN Technical Committee 127, Fire safety in buildings, finalized the test method.
In consequence, all national classes have been replaced by "Euroclasses" since January 1st, 2001 (the Euroclass system was officially published in February 2000, but the test methods were not agreed until early 2002. After this date, every national classification for construction products will still be recognized on the national market for a period of 3 to 5 years. The exact length of this transitional period has not yet been fixed. At the end of the period, only European classification will be valid, at both national and European level.

According to this new European regulation, products will be rated from A to F according to the performance level observed. Euroclass A will cover products that do not contribute, or contribute only very slightly, to the development of a fire. Euroclass E will cover products that present an acceptable reaction to fire, i.e. they can resist ignition by a small flame for a short period. Euroclass F is for products that have shown no performance criteria.
Also note that 3 parameters will be studied and registered at the same time during experiment: flame spread (from class A to E), dripping (class d0 to d2) and smoke (class s1 to s3).

Table 1: reaction to fire test package

Test	Document	Fire situation of the test
Non-combustibility test	EN ISO 1182	Fully developed fire in a room
Calorimetric bomb	EN ISO 1716	Fully developed fire in a room
SBI	EN 13823	Single burning item in a room
Small flame test	EN ISO 11925-2	Small flame attack
Radiant panel test for floorings	EN ISO 9239-1	Wind-opposed horizontal spread of flame
Samples conditioning and choice of substrate	EN 13238	-
Classification	EN 13501-1	-

Figure 1: 3 fire parameters ranking according to Euroclasses

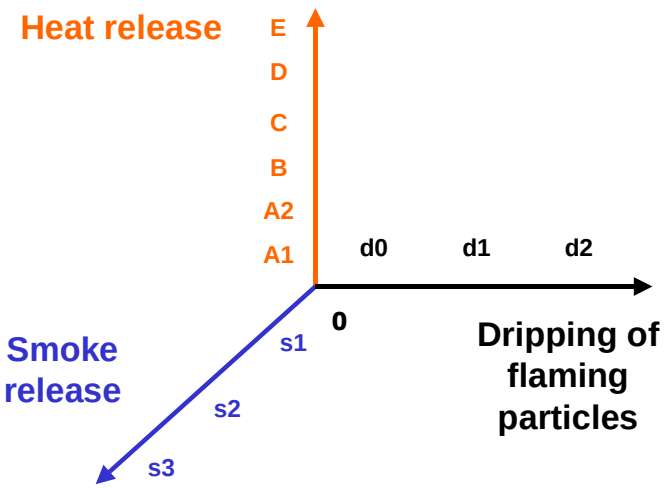


Table 2: Tests specific to all materials excepted the floor coverings

Class	Test method(s)	Classification criteria	Additional classification	
A1	EN ISO 1182 (1); *and*	Δ T $\leq$ 30°C; *and* Δ m $\leq$ 50%; *and* t_f = 0 (i.e. no sustained flaming)	-	
	EN ISO 1716	PCS $\leq$ 2.0 MJ.kg^{-1} (1); *and* PCS $\leq$ 2.0 MJ.kg^{-1} (2) (2a); *and* PCS $\leq$ 1.4 MJ.m^{-2} (3); *and* PCS $\leq$ 2.0 MJ.kg^{-1} (4)		
A2	EN ISO 1182 (1); *or*	Δ T $\leq$ 50°C; *and* Δ m $\leq$ 50%; *and* $t_f \leq$ 20s		
	EN ISO 1716; *and*	PCS $\leq$ 3.0 MJ.kg^{-1} (1); *and* PCS $\leq$ 4.0 MJ.m^{-2} (2); *and* PCS $\leq$ 4.0 MJ.m^{-2} (3); *and* PCS $\leq$ 3.0 MJ.kg^{-1} (4)		

	EN 13823 (SBI)	FIGRA $\leq$ 120 W.s^{-1}; *and* LFS < edge of specimen; *and* $THR_{600s} \leq$ 7.5 MJ	Smoke production
			s1 = SMOGRA $\leq$ 30m^2.s^{-2} and TSP600s $\leq$ 50m^2 ;
			s2 = SMOGRA $\leq$ 180m^2.s^{-2} and TSP600s $\leq$ 200m^2;
			s3 = not s1 or s2.
				Flaming droplets/ particles (FD/P)
				d0 = No FD/P within 600s;
				d1 = No FD/P persisting longer than 10s within 600s;
				d2 = not d0 or d1;

B	**EN 13823 (SBI);** *and*	FIGRA $\leq$ 120 W.s^{-1}; *and* LFS < edge of specimen; *and* $THR_{600s} \leq$ 7.5 MJ	Smoke production: s1,s2, s3	Flaming droplets/ particles : d0, d1,d2
	EN ISO 11925-2(8): *Exposure = 30s*	Fs $\leq$ 150mm within 60s		
C	**EN 13823 (SBI);** *and*	FIGRA $\leq$ 250 W.s^{-1}; *and* LFS < edge of specimen; *and* $THR_{600s} \leq$ 15 MJ	Smoke production: s1,s2, s3	Flaming droplets/ particles : d0, d1,d2
	EN ISO 11925-2(8): *Exposure = 30s*	Fs $\leq$ 150mm within 60s		
D	**EN 13823 (SBI);** *and*	FIGRA $\leq$ 750 W.s^{-1}	Smoke production: s1, s2, s3	Flaming droplets/ particles : d0, d1,d2
	EN ISO 11925-2(8): *Exposure = 30s*	Fs $\leq$ 150mm within 60s		
E	EN ISO 11925-2(8): *Exposure = 15s*	Fs $\leq$ 150mm within 20s	Flaming droplets/ particles	
F	No performance determined			

Table 3: Tests specific to the floor coverings

Class	**Test method(s)**	**Classification criteria**	**Additional classification**
$A1_{FL}$	EN ISO 1182 (1); *and*	Δ T ≤ 30°C; *and* Δ m ≤ 50%; *and* t_f = 0 (i.e. no sustained flaming)	**-**
	EN ISO 1716	PCS ≤ 2.0 $MJ.kg^{-1}$ (1); *and* PCS ≤ 2.0 $MJ.kg^{-1}$ (2); *and* PCS ≤ 1.4 $MJ.m^{-2}$ (3); *and* PCS ≤ 2.0 $MJ.kg^{-1}$ (4)	
$A2_{FL}$	EN ISO 1182 (1); *or*	Δ T ≤ 50°C; *and* Δ m ≤ 50%; *and* t_f ≤ 20s	
	EN ISO 1716; *and*	PCS ≤ 3.0 $MJ.kg^{-1}$ (1); *and* PCS ≤ 4.0 $MJ.m^{-2}$ (2); *and* PCS ≤ 4.0 $MJ.m^{-2}$ (3); *and* PCS ≤ 3.0 $MJ.kg^{-1}$ (4)	
	EN ISO 9239-1 (5)	Critical flux (6) ≥ 8.0 $kW.m^{-2}$	Smoke production : **s1** = Smoke ≤ 750%.min; **s2** = not s1.
B_{FL}	EN ISO 9239-1 (5) *and*	Critical flux (6) ≥ 8.0 $kW.m^{-2}$	Smoke production : **s1** = Smoke ≤ 750%.min; **s2** = not s1.
	EN ISO 11925-2(8): *Exposure = 15s*	Fs ≤ 150mm within 20s	
C_{FL}	EN ISO 9239-1 (5) *and*	Critical flux (6) ≥ 4.5 $kW.m^{-2}$	Smoke production : **s1** = Smoke ≤ 750%.min; **s2** = not s1.
	EN ISO 11925-2(8): *Exposure = 15s*	Fs ≤ 150mm within 20s	
D_{FL}	EN ISO 9239-1 (5) *and*	Critical flux (6) ≥ 3.0 $kW.m^{-2}$	Smoke production : **s1** = Smoke ≤ 750%.min; **s2** = not s1.
	EN ISO 11925-2(8): *Exposure = 15s*	Fs ≤ 150mm within 20s	
E_{FL}	EN ISO 11925-2(8): *Exposure = 15s*	Fs ≤ 150mm within 20s	-
F_{FL}	No performance determined		

Figure 2: SBI EN 13823 Test method

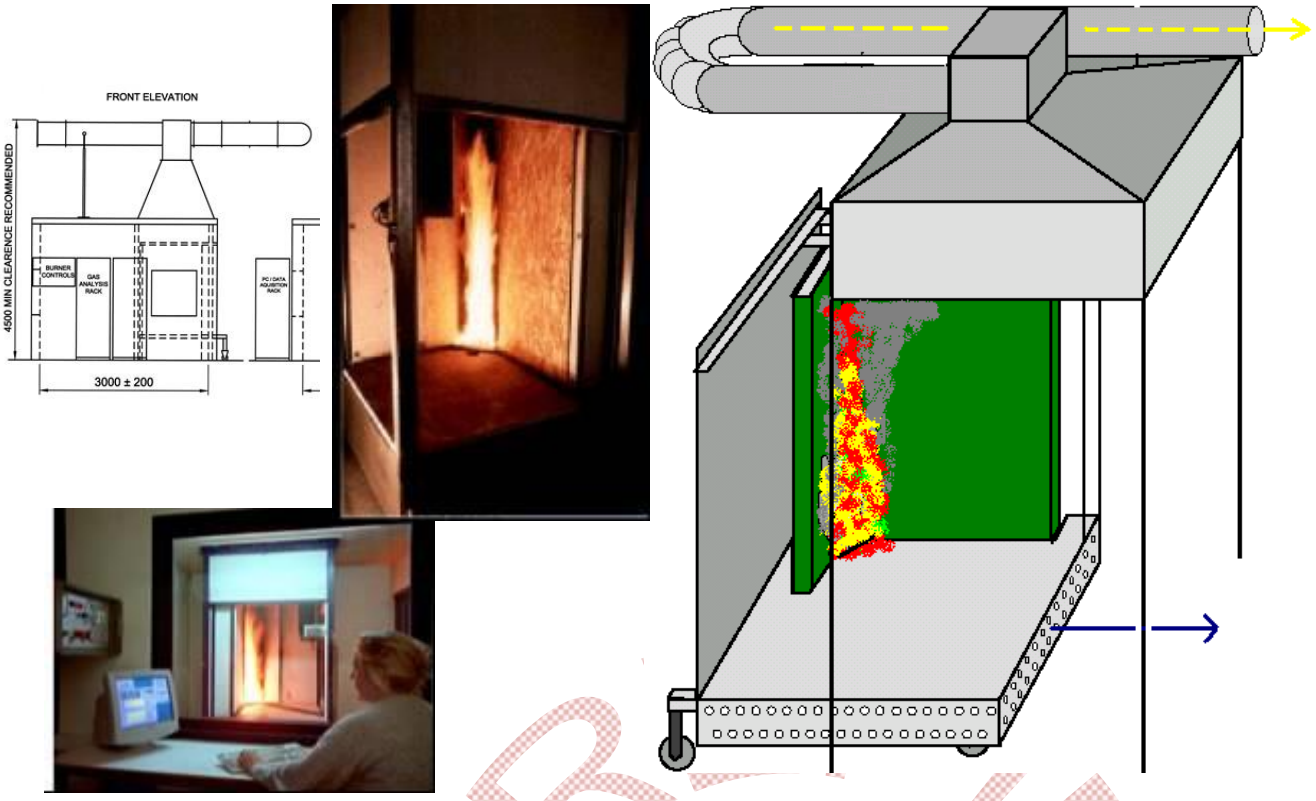
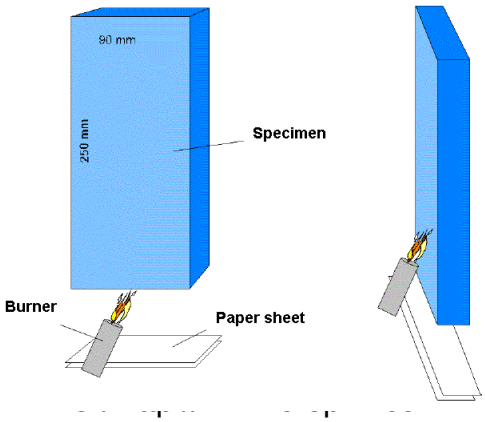


Figure 3: EN ISO 11925-2 test (Ignitability of building products subjected to direct impingement of flame)



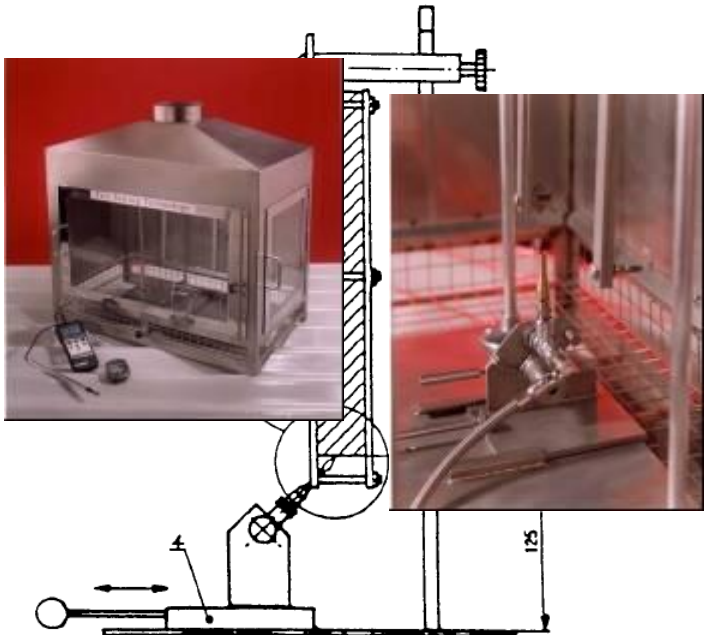


Figure 4: EN ISO 9239-1 Radiant panel test for floorings

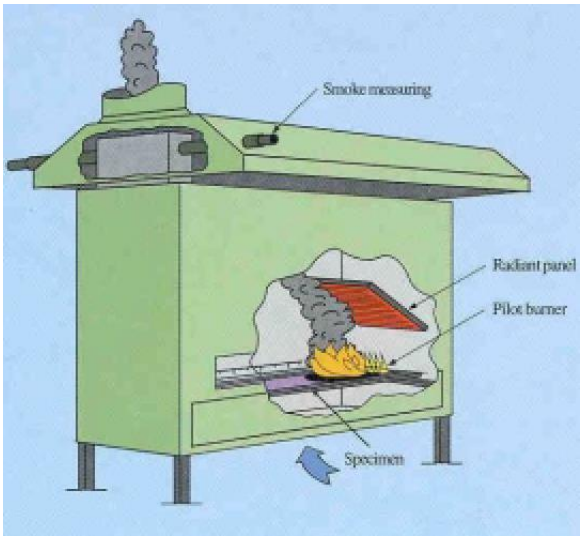
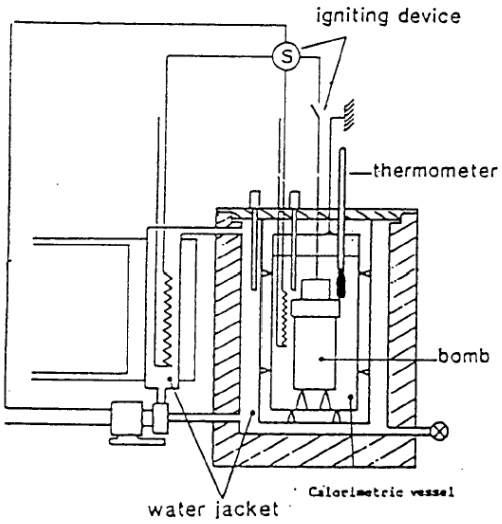
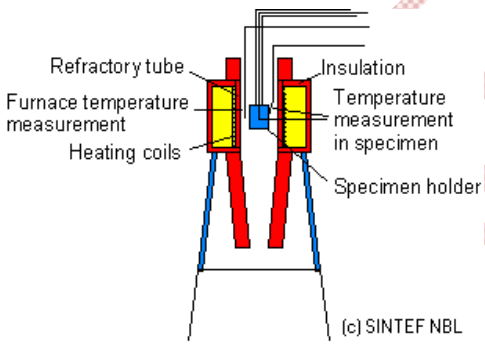


Figure 5: EN ISO 1182 Non-combustibility test





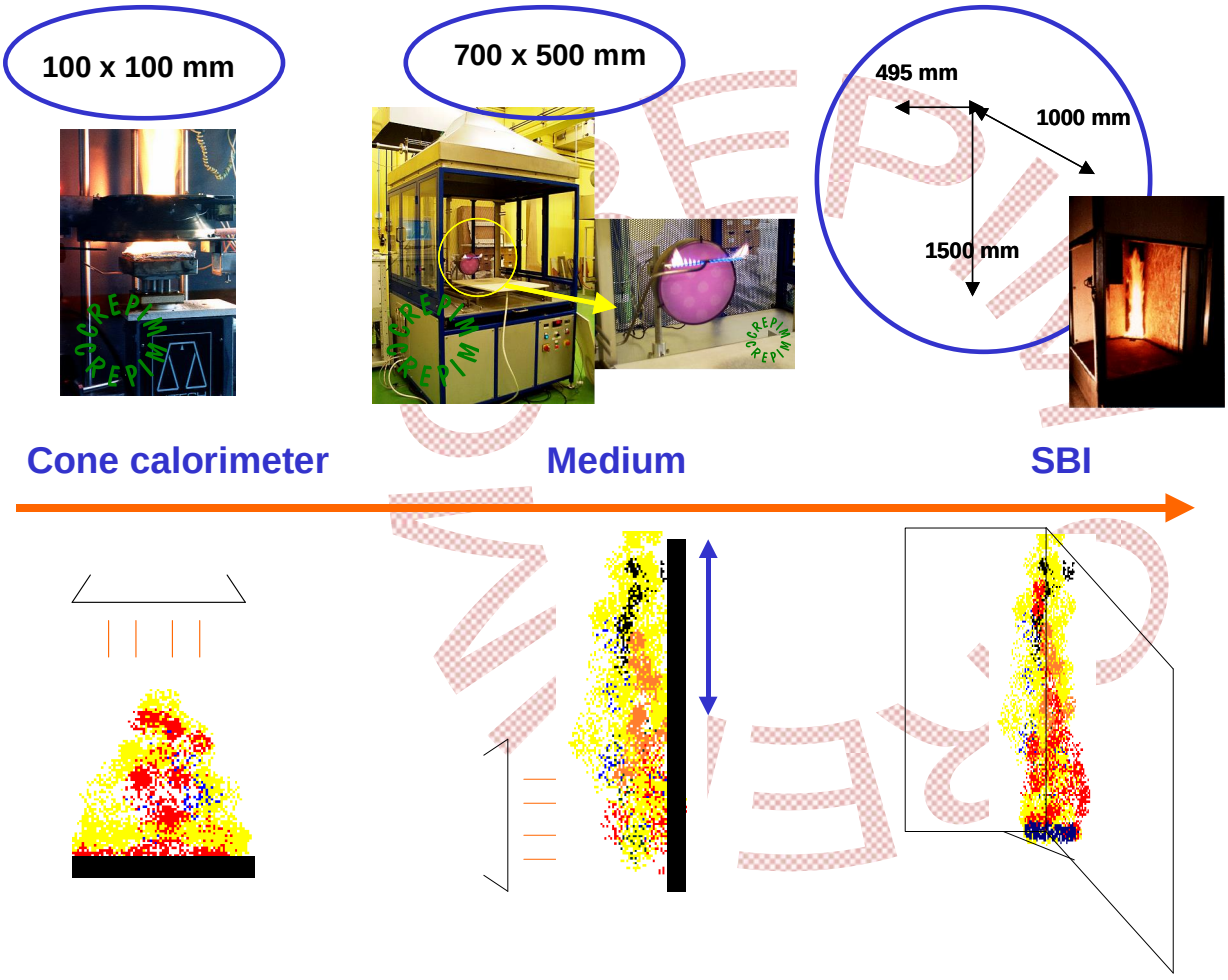
Development of fire predictive small scale tests

The single SBI test is a large test requiring large-scale samples. For evident cost and time saving advantages, predictions taking the form of simple correlations are developed with small-scale test apparatus like cone calorimeter and medium. These two apparatus are based on depletion oxygen calorimetry and give to scientist a powerful tool to assess finished product and material.

Some cone-based models have been recently developed to predict the initial part of the SBI heat release curve from cone calorimeter test results. The major classification parameter for the classification system is the fire growth rate index or FIGRA. This is calculated from the initial part of the heat release rate time history curve of the product and can be calculated from the model.

A new concept of apparatus has been settled up by the Laboratoire National d'Essai (LNE) in France and proposes a reasonable medium sized apparatus for fire testing laboratories, for research institutes and for quality control tests performed by industrial laboratories. A shown in Figure 6, the Medium uses the same kind of vertical specimen holder that the SBI test.

Figure 6: geometric characteristics of the 3 apparatus



Round Robin is in progress at this moment in France between industrial partners, including CREPIM and some other institutes dealing with building applications
The aim of cone calorimeter and Medium apparatus is to provide easy end use models assuming that the SBI flame spread can be described by the shaped curve representing the area of the burning product as a function of time with these two testing apparatus.

Please feel free to contact CREPIM for further information :

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