

## Fire Classification

The new European fire classification system is currently being introduced . This guide deals with 3 subjects:

- 6 Building materials' and building components' reaction to fire
- 6 Building materials' and building components' fire resistance
- 6 Interrelation between the new European system and the existing Danish fire classification system.

### Building materials' and building components' reaction to fire

#### Primary classes

The classification comprises a primary class and in some cases also one or more additional classes.

|           |                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>F</b>  | Products for which no reaction to fire performances are determined or which cannot be classified in one of the classes A1, A2 , B , C , D , E . This means that the product is not documented and does not live up to any classification demands. Consequently it is not possible to combine it with any additional class.                                                                |
| <b>E</b>  | Products capable of resisting, for a short period, a small flame attack without substantial flame spread. The class may exist on its own or may be combined with additional class for burning droplets d2                                                                                                                                                                                 |
| <b>D</b>  | Products satisfying criteria for class E and capable of resisting a small flame attack - for a longer period - without substantial flame spread. In addition, they are also capable of undergoing thermal attack by a single burning item with sufficiently delayed and limited heat release The class is always combined with an additional class for smoke (s) and burning droplets (d) |
| <b>C</b>  | As class D but satisfying more stringent requirements. Building materials which, to a limited extend, contribute to fire. The class is always combined with an additional class for smoke (s) and burning droplets (d)                                                                                                                                                                    |
| <b>B</b>  | As class C but satisfying more stringent requirements. Building materials having a very moderate fire contribution. The class is always combined with an additional class for smoke (s) and burning droplets (d)                                                                                                                                                                          |
| <b>A2</b> | Satisfying the same criteria as class B for the SBI-test according to EN 13823. In addition, under conditions of a fully developed fire these products will not significantly contribute to the fire load and fire growth. The class is always combined with an additional class for smoke (s) and burning droplets (d)                                                                   |
| <b>A1</b> | Class A1 products will not contribute in any stage of the fire including the fully developed fire. For that reason they are assumed to be capable of satisfying automatically all requirements of all lower classes. Cannot be combined with additional classes                                                                                                                           |

Click her to see some examples of materials in the different classes mentioned

### Additional classes

Additional classes for smoke and burning droplets are:

|           |                                                          |
|-----------|----------------------------------------------------------|
| <b>s1</b> | very limited amount of smoke developed                   |
| <b>s2</b> | limited amount of smoke developed                        |
| <b>s3</b> | no demands to the amount of smoke developed              |
| <b>d0</b> | no burning droplets or particles                         |
| <b>d1</b> | limited amount of burning droplets or particles          |
| <b>d2</b> | no demand to the amount of burning droplets or particles |

### Building materials' and building components' fire resistance

#### Capacity criteria:

The fire resistance of a building material and a building component can be described on the basis of the following capacity criteria:

|                                      |                                                                                                                                                                                                                                                                                                |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>R</b> – for load bearing capacity | Is relevant for <b>load bearing</b> building components: The requirements are related to deformation and deformation speed.                                                                                                                                                                    |
|                                      |                                                                                                                                                                                                                                                                                                |
| <b>E</b> – for integrity             | Is relevant for <b>separating</b> building components. Three aspects are evaluated:<br><br>1. Cracks and crevices exceeding certain dimensions.<br>2. The ignition of a piece of cotton fabric on the unexposed side.<br>3. Continuous flaming for more than 10 seconds on the unexposed side. |
|                                      |                                                                                                                                                                                                                                                                                                |
| <b>I</b> – for insulation            | Is relevant for <b>separating</b> building components. As a general rule the temperature increase on the unexposed side must not exceed:<br>- 140 °C at average<br>- 180 °C average at any point.                                                                                              |

### Classification of building components

The registered time span for maintaining capacity criteria at a standardised fire test is indicated in minutes, for example 30, 60, 90, 120. The classification is described below:

| Load bearing building components |                                                                                                       |
|----------------------------------|-------------------------------------------------------------------------------------------------------|
| REI - time                       | the time span where all three criteria, load bearing capacity, integrity and insulation are fulfilled |
| RE - time                        | the time span where the two criteria, load bearing capacity and integrity, are fulfilled              |
| R - time                         | the time span where the criteria load bearing capacity is fulfilled.                                  |

| Non load bearing building components |                                                                           |
|--------------------------------------|---------------------------------------------------------------------------|
| EI - time                            | time span where the two criteria, integrity and insulation, are fulfilled |
| E - time                             | the time span where the criteria integrity is fulfilled                   |

### Interrelationship between European and existing Danish fire classification.

| Existing Danish classification                          | European class      |
|---------------------------------------------------------|---------------------|
| <b>Materials</b>                                        |                     |
| Non combustible                                         | A2 - s1, d0         |
| Class A                                                 | B - s1, d0          |
| Class B                                                 | D - s2, d2          |
| <b>Coverings</b>                                        |                     |
| Class 1                                                 | K B - s1, d0        |
| Class 2                                                 | K D - s2, d0        |
| <b>Load bearing, non separating building components</b> |                     |
| BS - 30                                                 | R 30 A2 - s1, d0    |
| BS - 60                                                 | R 60 A2 - s1, d0    |
| BS - 120                                                | R 120 A2 - s1, d0   |
| BD - 30                                                 | R 30                |
| BD - 60                                                 | R 60                |
| <b>Load bearing, separating building components</b>     |                     |
| BS - 30                                                 | REI 30 A2 - s1, d0  |
| BS - 60                                                 | REI 60 A2 - s1, d0  |
| BS - 120                                                | REI 120 A2 - s1, d0 |

|                                                         |                    |
|---------------------------------------------------------|--------------------|
| BD - 30                                                 | REI 30             |
| BD - 60                                                 | REI 60             |
| <b>Non load bearing, separating building components</b> |                    |
| BS - 30                                                 | EI 30 A2 - s1, d0  |
| BS - 60                                                 | EI 60 A2 - s1, d0  |
| BS - 120                                                | EI 120 A2 - s1, d0 |
| BD - 30                                                 | EI 30              |
| BD - 60                                                 | EI 60              |
| F - 30                                                  | E 30               |
| F - 60                                                  | E 60               |

Fire classification is indicated as for example: " Building component class R 60 A2 - s1, d0"  
= BS – building component 60.

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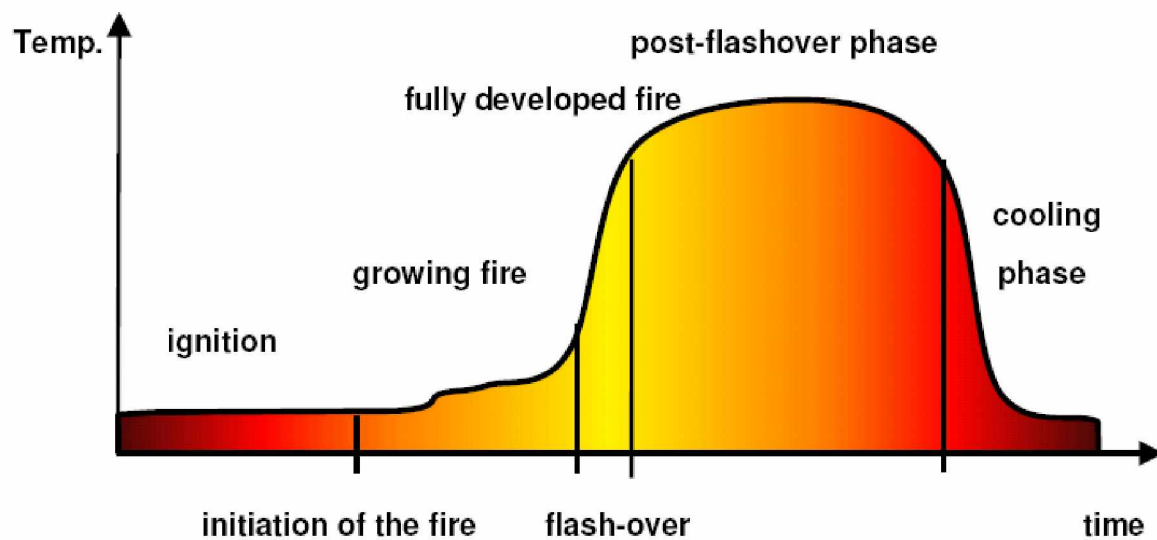
Translation and adaptation by Karsten Lundager

## Some Common materials and likely Euro classes

| Example Materials                                                                                                                               | Euroclass<br>Flashover Potential |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Concrete<br>Brick Stone<br>Rockwool                                                                                                             | <b>A1</b><br>No                  |
| Plasterboard<br>Cement particle board<br>Glass Wool<br>Rock Wool                                                                                | <b>A2</b><br>No                  |
| Painted gypsum board<br>Some fire resistant MDF<br>Some Birch plywood<br>Fully impregnated WOOD<br>Wood wool cement slabs<br>Fibre gypsum board | <b>B</b><br>No                   |
| Most fire resistant MDF<br>Some European Plywoods<br>Phenolic foam (foil faced)                                                                 | <b>C</b><br>Yes                  |
| Expanded polystyrene type A<br>Polyisocyanurate foam (foil faced)<br>Extruded polystyrene                                                       | <b>D</b><br>Yes                  |
| Polyurethane Foam (lamine faced)<br>Polyisocyanurate foam (sprayed)<br>Wood fibre board (vacuum pressed)                                        | <b>E</b><br>Yes                  |
| Expanded polystyrene type N<br>Untested or fails Euro class E                                                                                   | <b>F</b><br>Yes                  |

What is  
flashover?  
Click here to find  
out

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*Fig. 1 : fire model (after Troitzsch [5], Beard [6] et.al.)*

- First stage includes initiation of the fire by ignition of a building product, with a small flame, within a limited area of the product.
- Second stage addresses fire growth eventually reaching final flashover situation with heat release  $> 1 \text{ MW}$  to  $2 \text{ MW}$  and temperature levels of  $800 - 1200 \text{ }^{\circ}\text{C}$ .

This stage generally is simulated for building products by a single burning item in the corner of a room, creating a heat flux onto the adjacent surfaces within the room. For floorings, a fire is seen to grow in the room of its origin, creating a heat flux on the floorings in an adjacent room or corridor, through a door opening. Smoke development and smoke density have as well to be taken in account.

- In the post-flashover phase all combustible building products present finally are contributing to the fire load (fully developed fire). |

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