7. FIRE

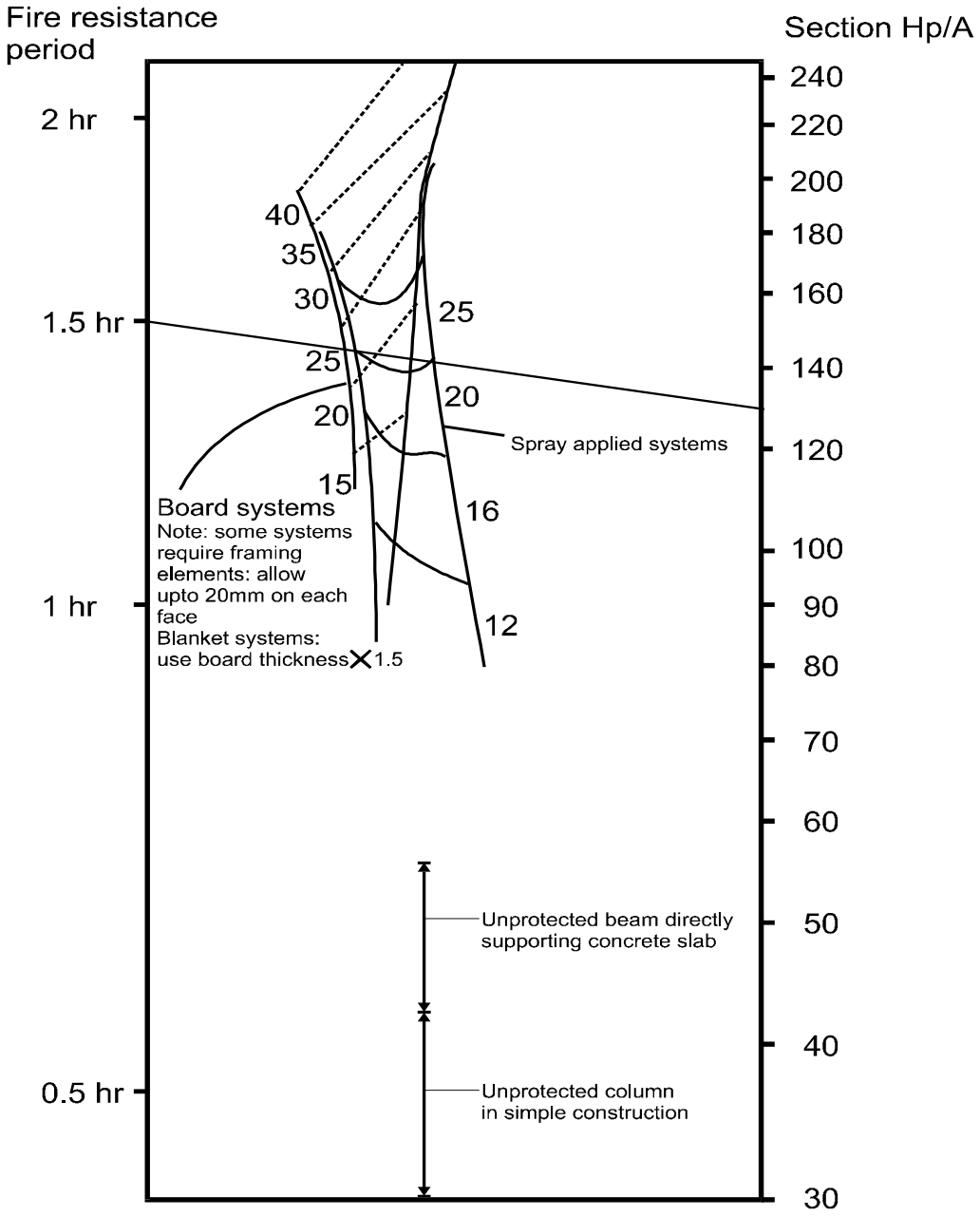
7.1 MINIMUM PERIODS OF FIRE RESISTANCE. (UK Practice only)

Table A2 from the approved document B to Building Regulations (1991). **Other British Standards or Local Acts may set higher standards**.

Purpose group of building	Minimum periods (hours) for elements of structure in a:					
	Basement storey(●) including floor over		Ground or upper storey			
	Depth (m) of a lowest basement		Height (m) of top floor above ground, in building or separating part of building.			
	more than 10	not more than 10	not more than 5	not more than 20	not more than 30	more than 30
1. Residential (domestic):						
(a) flats and maisonettes	1½	1	½*	1**	1½**	2**
(b) & (c) dwelling houses	not relevant	½*	½*	1	not relevant	not relevant
2. Residential:						
(a) Institutional (~)	1½	1	½*	1	1½	2#
(b) other residential	1½	1	½*	1	1½	2#
3. Office:						
- not sprinklered	1½	1	½*	1	1½	not permitted
- sprinklered (2)	1	1	½*	½*	1	2#
4. Shop and commercial:						
- not sprinklered	1½	1	1	1	1½	not permitted
- sprinklered (2)	1	1	½*	1	1	2#
5. Assembly and recreation:						
- not sprinklered	1½	1	1	1	1½	not permitted
- sprinklered (2)	1	1	½*	1	1	2#
6. Industrial:						
- not sprinklered	2	1½	1	1½	2	not permitted
- sprinklered(2)	1	1	½*	1	1½	2#
7. Storage & other non-residential:						
a. building or part not described above:						
- not sprinklered	2	1½	1	1½	2	not permitted
- sprinklered (2)	1½	1	½*	1	1½	2#
b. Car park for light vehicles:	not	not				
i) open sided park (3)	applicable	applicable	¼*+	¼*+	¼*+	1
ii) any other park	1½	1	½*	1	1½	2#

- ● The floor over a basement (or if there is more than 1 basement, the floor over the topmost basement) should meet the provisions for the ground and upper storeys if that period is higher.
- * Increased to a minimum of 1 hour for compartment walls separating buildings
- ** Reduced to ½ hour for any floor within a maisonette, but not if the floor contributes to the support of the building
- # Reduced to 1½ hours for elements not forming part of the structural frame
- \+ Increased to ½ hour for elements protecting the means of escape
- ~ Multi-storey hospitals designed in accordance with the NHS Firecode documents should have a minimum 1 hour standard

7.2 FIRE PROTECTION TO STEEL ELEMENTS (UK Practice only)



Approximate thickness (mm) of protection for fully loaded steel members based on a **range** of manufacturers' test data (Fire protection for structural steel in buildings, ASFPCM, (1988), also see revised 2nd edition (1992))

For the example line given:	H_p / A = 130
	Fire resistance period = 1½ hours
Line intersects zones:	Board 20 and 25
	Spray 20 and 25
Solution:	Spray 20mm to 25mm depending on system used
	Board 25mm to 30mm depending on system used
	Blanket 38mm to 45mm depending on system used

7.3 FIRE PROTECTION FOR REINFORCED CONCRETE

For cover details, see Section 4.2 Reinforced Concrete

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7.4 FIRE PROTECTION FOR MASONRY (UK Practice only)

See Table 16, BS 5628: Part 3.
A 100mm unplastered wall or leaf of a cavity wall will give 2 hour fire resistance in all materials and loading conditions (sometimes conservatively) except:

- Fired-clay bricks/blocks with voids or perforations (75-100% solid - use min. 170mm thickness);
- Hollow concrete blocks with gravel or natural stone aggregate (limestone OK) - min. 200mm thickness with vermiculite-gypsum plaster.

7.5 FIRE REQUIREMENTS FOR TIMBER (UK Practice only)

The requirement of the Building Regulations with respect to timber fall under two headings:

- (B2) Spread of flame
- (B3 - (1)) Period of fire resistance

Spread of flame
The Regulations define spread of flame classes for walls and ceilings for various building purpose groups and sizes. Spread of flame is determined by tests described in BS 476: Parts 6 & 7 which allocate materials into classes, related to the extent of travel of a flame front under standard conditions in a given time. Most timber (>400kg/m^3) falls into Class 3. A lower class rating can be achieved by impregnation, or by surface treatment. Structural elements, because of their size, are generally given surface coatings. Many are moisture sensitive, and can discolour if they get wet.

Period of fire resistance
The Regulations also define specific periods of fire resistance for elements of structure (although generally no period is required for roofs). This requirement is often satisfied for walls and floors by applying protective materials to the frame, and these are described in BS 5268: Part 4; Section 4.2.

Alternatively, the fire resistance of the members themselves may be calculated by the method given in BS 5268: Part 4; Section 4.1, based on charring rates. Timber will ignite when subjected to temperatures of around 270°C, if a pilot flame is present to ignite the gases given off during the 'cooking' process. The insulation value of the outer charred layer, however, means that timber which is just a few millimetres inside the burning zone is only warm. Thus timber burns at a predictable speed, known as the 'charring rate', which, for common softwoods with a density of about 450kg/m^3 is defined in section 4.1 as 20mm (or 25mm for columns), in 30 minutes.

The reduced section (ie. the full section minus the charred zone) is checked for strength and deflection. Increased stresses are allowed (of the order x2 to x2.25), together with more generous deflection limits (1/30 span). The charring rates quoted for solid timber may be applied without modification to glulams made with the conventional adhesives.

In addition, it is necessary to look at the overall stability of the charred structure, and to protect any metal (including bolts) which forms part of the structural system, either by ensuring that the component lies with the residual section, or that it is suitably protected by a fire resistant cladding or sacrificial timber.

7.6 FURTHER INFORMATION

The requirements above relate to standard furnace tests, and assume the member is fully stressed. If the fire load is small and/or the member is lightly stressed, significant improvements may be obtained. Contact Arup Fire for more information.