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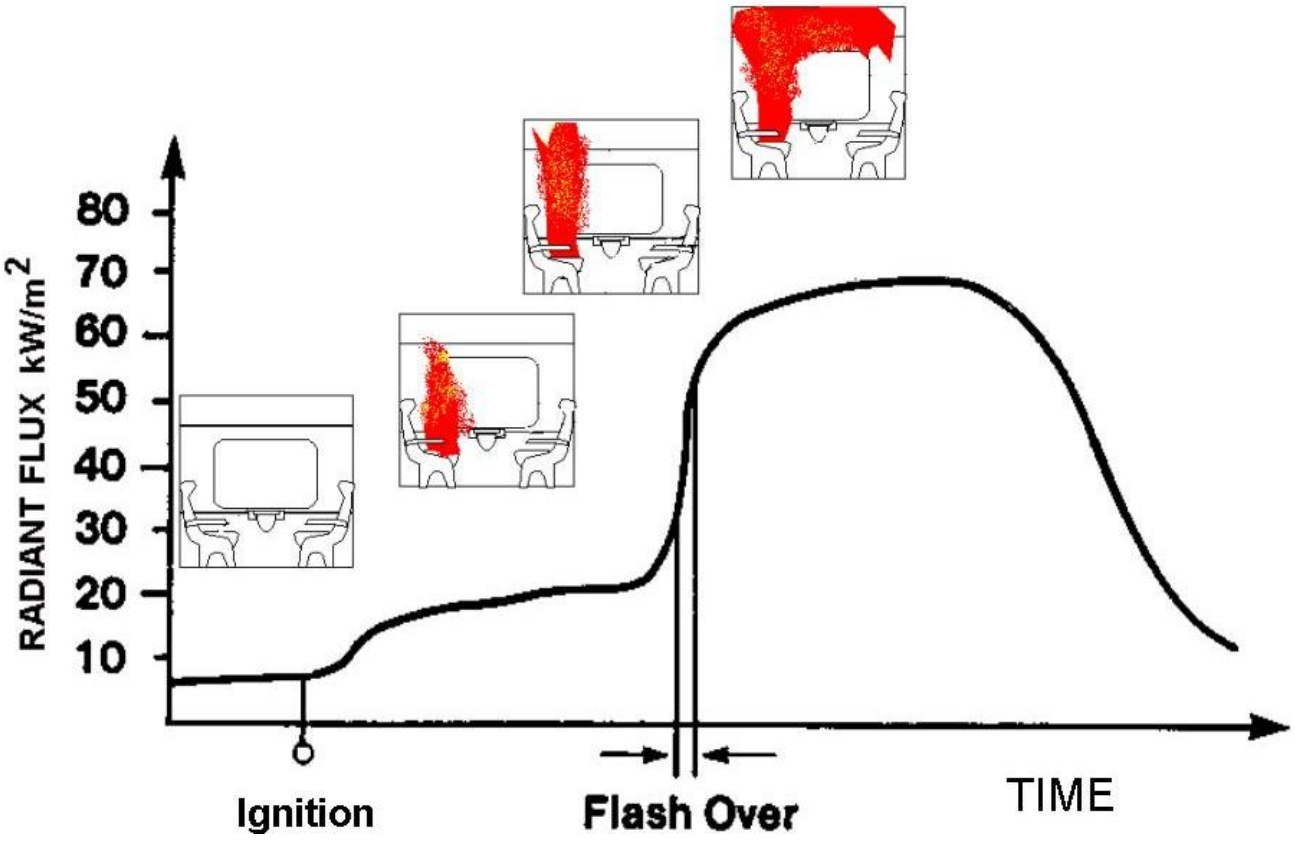
FIRE REGULATION IN FURNITURE

WORLD OVERVIEW

Since many years, comprehensive studies of the ignition hazard of upholstery and covering materials as well as fire performance of furniture have been carried out on behalf of the regulation.

It seems now admitted that the key scenario for fire propagation in mass transport is to simulate the application of open flame on an upholstery furniture bearing in mind the possible cover melting or glowing and charring.

Figure 1: fire steps in a train from the initial stage to the developed stage



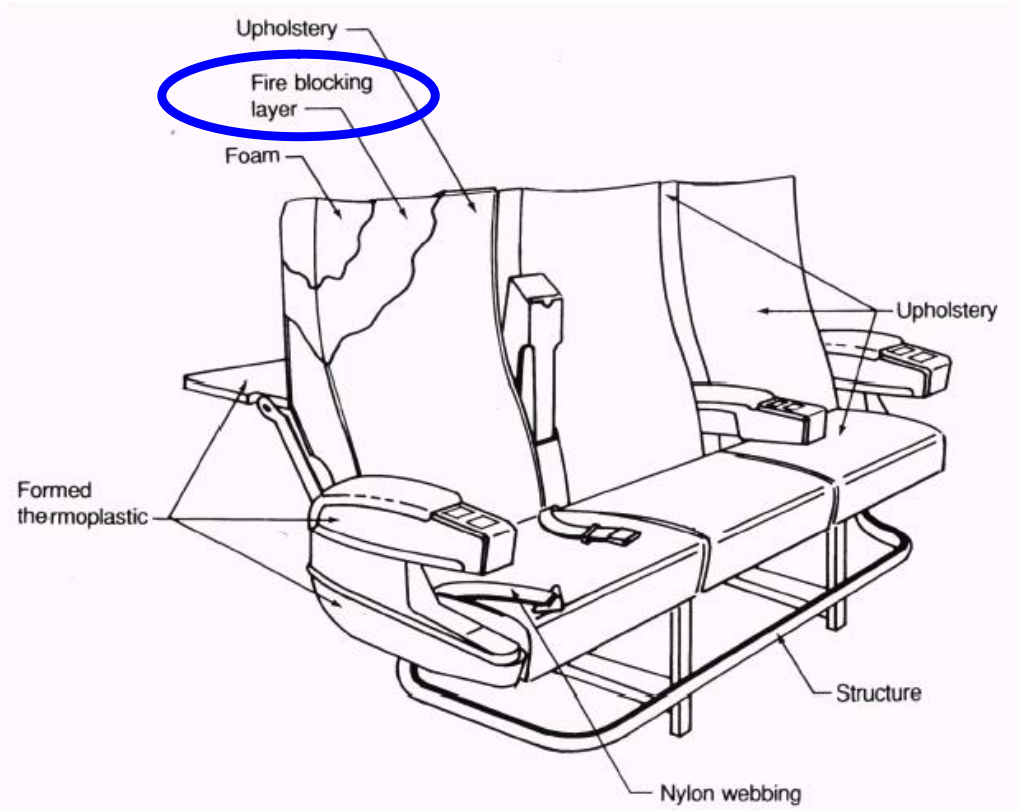
On the other hand, even if fire requirement are applied in mass transport on each seat components, a final test has generally to be lay out in order to validate the assembly in relation to the risk of vandalism, puncture, cutting, or other acts which may expose the individual components of the assemblies.

For railways application in Europe, the complete seats are evaluated using the test method in UIC 564-2. Components of the seats are also evaluated (separately) for toxicity and smoke opacity. For example, in France, the complete seat has to pass the NF F 16-201 paper cushion test. In Deutschland, the seats (original seats with complete equipment) are submitted to a test according to the DIN 54 341 test and the supplementary conditions given in DIN 5510-2 and TL 918433 (similar to UIC 564-2 annex 13). In Italy, mattress and pillow is provided the UNI 9175. Moreover the complete seat is submitted to Fiche UIC 564-2 Annex 13 (paper cushion test). In

USA, the testing of a complete seat or mattress assembly (including cushions, fabric layers, upholstery) according to ASTM E 1537-98 is done with application of pass/fail criteria of California Technical Bulletin 133.

The design of the seat integrates fire-blocking layer in high performance fabrics (blend of p-aramid with natural or synthetic fibres like FR viscose) in order to prevent the smouldering combustion and flame spread in case of fire risks.

Figure 2: Typical Seat Installation in aircraft



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Example 1 : the UK regulation

In view of the annual UK Fire Statistics, the upholstered furniture safety regulation has been introduced in 1980 in Great Britain. This regulation is applied to upholstered seating sold commercially and stipulates that the specification of the BS 5852 must be met.

The objective of this standard is to measure the ignitability of upholstered furniture composite. Eight ignition source are specified:

Table 1: seven ignition sources of the BS 5852

Source	Combustion type	Ignition source	Details	Energy inputs, Kw.h
0	Smouldering	Cigarette	-	-
1	Flaming	Burner	45 ml/min butane	0.001
2	Flaming	Burner	160 ml/min butane	0.004
3	Flaming	Burner	350 ml/min butane	0.016
4	Flaming	Crib	8.5 g	0.04
5	Flaming	Crib	17 g	0.08
6	Flaming	Crib	60 g	0.28
7	Flaming	Crib	126 g	0.59

Figure 3: the eight ignition source of the BS 5852 test method

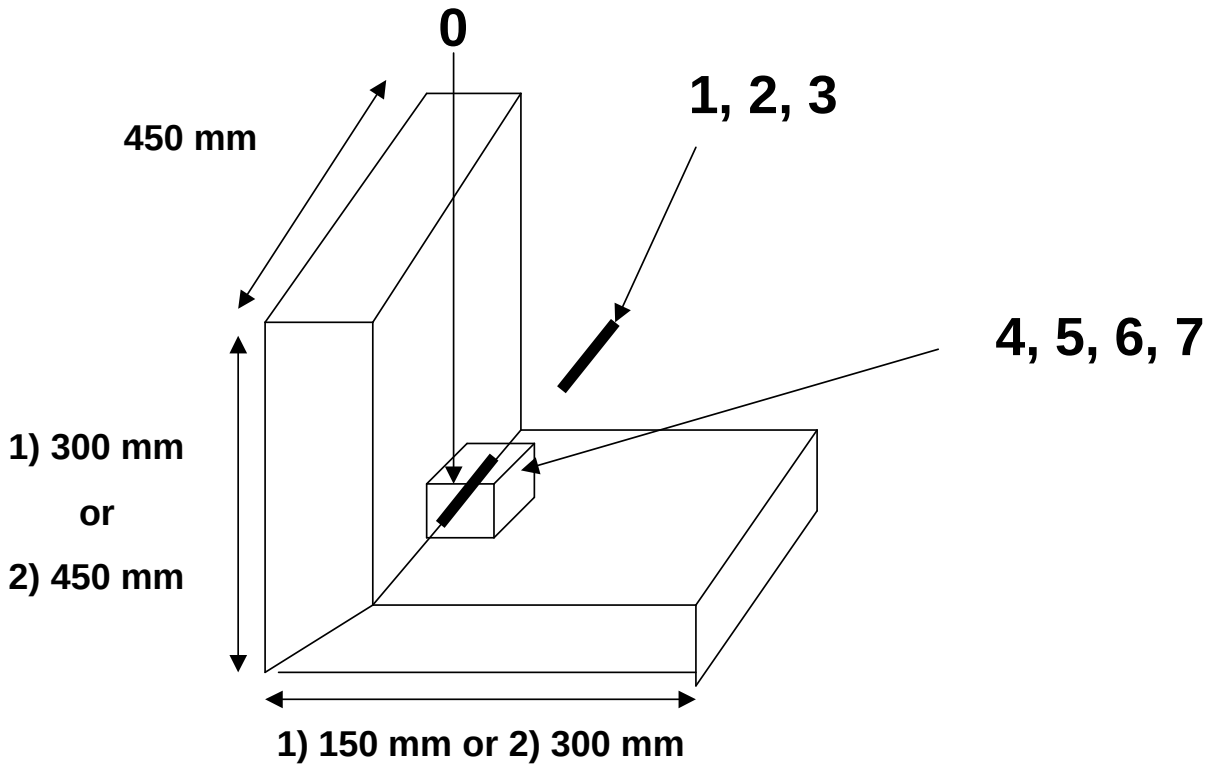
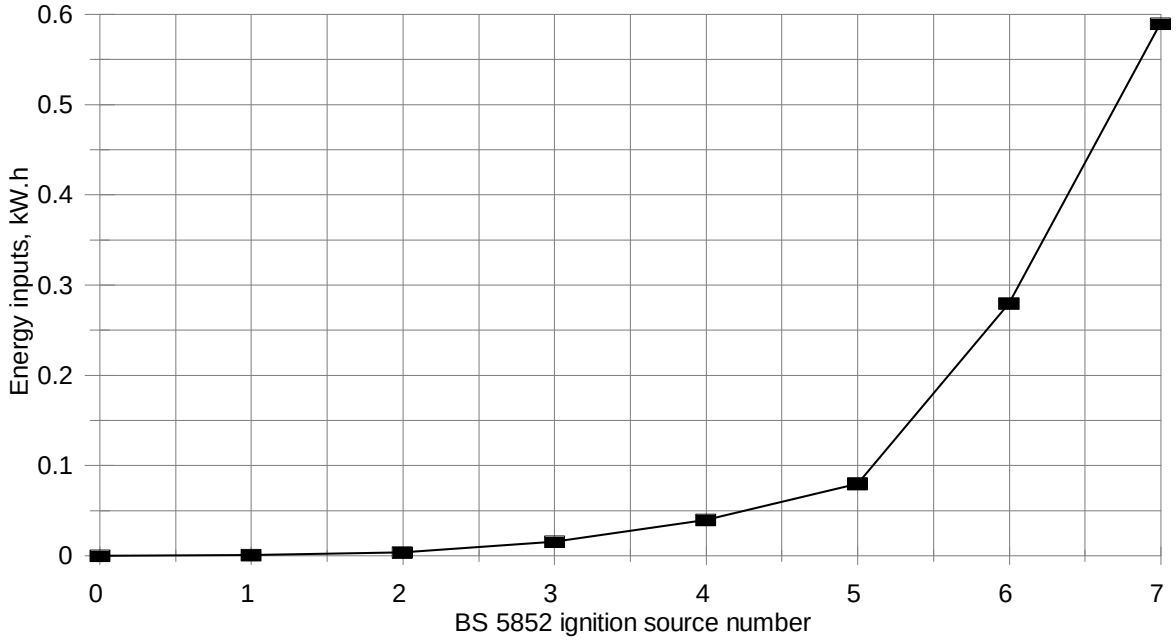


Figure 4: Energy inputs of the BS 5852 ignition sources



The BS 5852 requirements specify :

-For Smouldering ignition:

- ✓ any test specimen that produces externally detectable amounts of smoke, heat or glowing 60 min after ignition of the crib,
- ✓ -any test specimen that, on final examination, shows evidence charring within the filling more than 100 mm in any direction, apart from upwards, from the nearest part of the original position of the source.

-For Flaming ignition:

- ✓ any test specimen that continues to flame for more than 10 min after ignition of the crib,
- ✓ any test specimen on which any flame front reaches the extremities of the specimen other than the top of the vertical part of the test specimen or passes through the full thickness of the specimen within the duration of the test.

Table 2: UK legislation requirements

Hazard level	**Low**	**Medium**	**High**
BS 5852 for upholstered furniture			
Ignition source	0 and 1	0 and 5	0 and 7
BS 6807 for mattresses			
Ignition source	0 and 1	0, 1 and 5	0, 1 and 7
Applications			
	Domestic Schools Offices	Public places Public halls Theatres restaurants cinemas	Hospitals Hostels Sleeping accommodation

However, more drastic requirements have been set in force by the Furniture and Furnishings Fire Safety Regulations 1988 (Statutory Instrument 1988 No. 1324, PART I: Ignitability test for polyurethane foam in slab or cushion form).

In addition to pass fail criteria of BS 5852: 82, weight loss of polyurethane foam in slab or cushion form in the ignitability test is limited to 60 g when testing with the ignition source n° 5.

Also note that if failure against the criteria of clause of BS 5852 part 2 has occurred but only by way of damage exceeding the limits and provided that the resultant mass loss (initial mass less final mass) is less than 60 g, the foam passes the ignitability test.

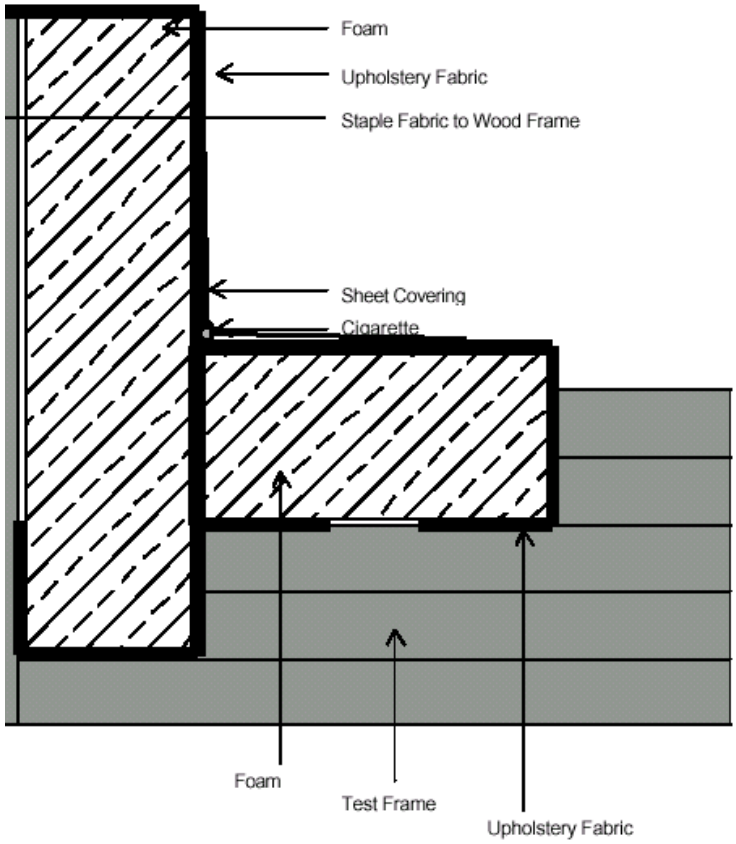
At the European level, standards based on fire assessment function of fire hazards applications are in progress (EN 1021 for upholstered seats and EN 597 for mattress).

Example 2 USA

Technical bulletin form California State describe test method to assess the ignitability of upholstered furniture :

Technical bulletin 117:2000 evaluates the foam assessing the non-smouldered residue which shall remain superior to 80 % of the entire test specimen mass.

Figure 5: California technical Bulletin 117 test method set up *Erreur ! Source du renvoi introuvable.*



Technical bulletin 133:91 that describes procedure for testing furniture in public occupancies. Seating furniture fails to meet the requirements of this test procedure if any of the following criteria are exceeded in a room test:

By using the room instrumentation:

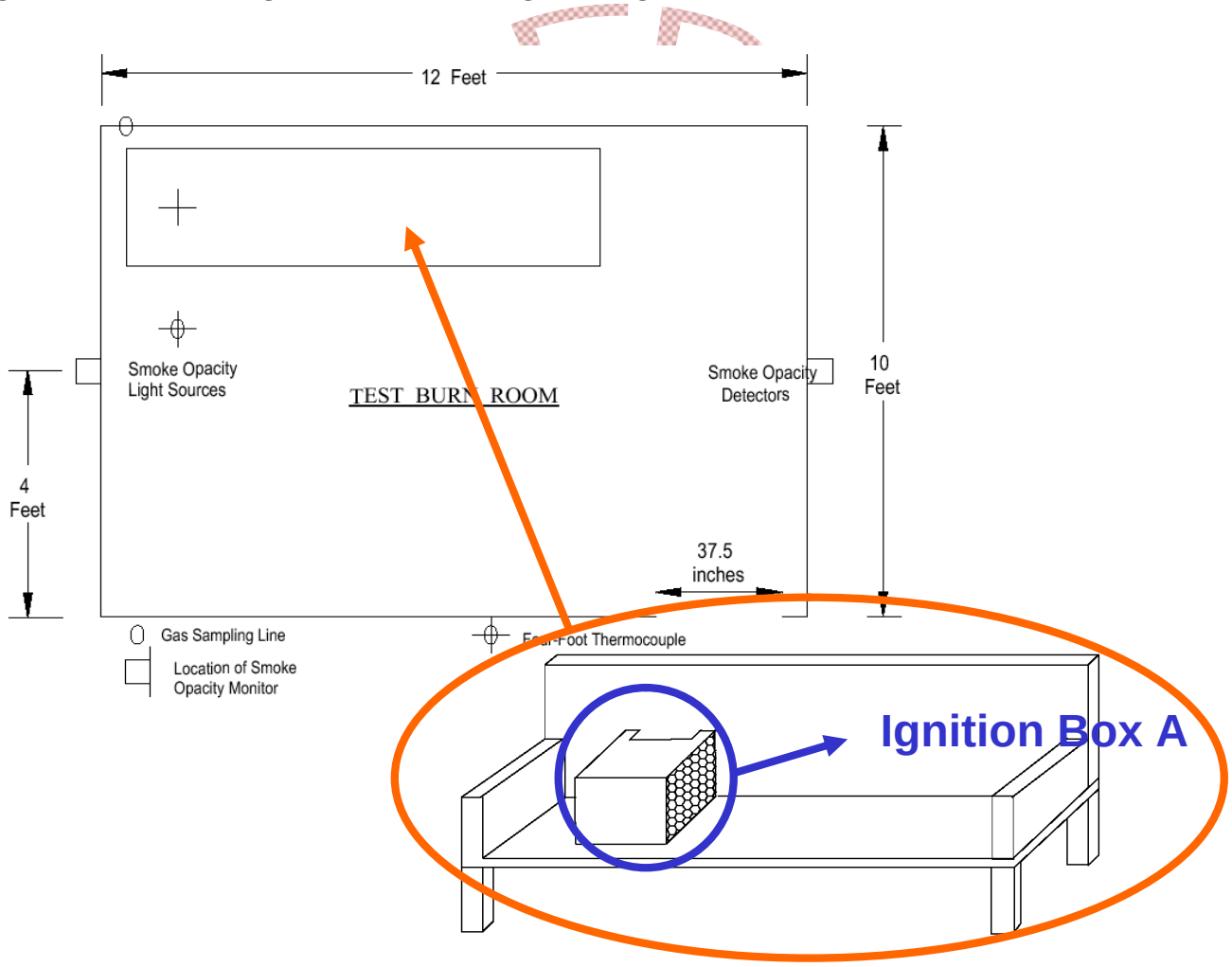
- ✓ A temperature increase of 200°F or greater at the ceiling thermocouple,
- ✓ A temperature increase of 50°F or greater at the 4-foot thermocouple,
- ✓ Greater than 75% opacity at the 4-foot smoke opacity monitor,
- ✓ Carbon monoxide concentration in the room of 1000 ppm vol or greater for 5 minutes,

- ✓ Weight loss due to combustion of 3 pounds or greater in the first 10 minutes of the test.

By using oxygen consumption calorimetry:

- ✓ A maximum rate of heat release of 80 kW or greater,
- ✓ A total heat release of 25 MJ or greater in the first 10 minutes of the test,
- ✓ Greater than 75% opacity at the 4-foot smoke opacity monitor,
- ✓ Carbon monoxide concentration in the room, of 1000 ppm vol or greater for 5 minutes.

Figure 6: room configuration for testing seating items more than 40 inches across



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