



Efectis-France

PROPOSAL - ADAPTING AN EXISTING TESTING METHOD FOR SEATS USED IN BUSES

CONTEXT

- ❑ As part of the revision of UNECE Regulation No 118, it was recommended to revise the requirements concerning the fire reaction of materials used in the construction of vehicles and introducing new requirements with regard to the smoke toxicity released by the combustion of these materials.
- ❑ Several members of the group reported that the test method for R 118 (Annex 6 and 8 - horizontal and vertical) is not sufficient to assess the fire behaviour of products used in vehicles.
- ❑ Feedback shows that once the flames reach the passenger space, fire spread occurs quickly.
- ❑ Several members of the group expressed that introducing new smoke toxicity requirements will be costly.
- ❑ That's why consider that it is necessary to favor the ignitability and propagation of the fire while treating the smoke.

<p>❑ ECE Regul.118-2</p> <p>Horizontal test ECE-R 118 Annex 6</p> <p>Requirement : flame spread < 100mm/min</p> <p>ROAD</p>	 <p>Picture from FTT</p>	<p>Vertical test ECE-R 118 Annex 8</p> <p>"Only for material in a vertical position"</p> <p>Application time of flame : 5s</p> <p>Requirement : flame spread < 100mm/min or flame extinction</p>
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CONTEXT

- ❑ In the previous meetings, several participants have presented how fire safety tests are set up in other domains (railway, marine, airplane) and how products used in the vehicles compare to these standards
- ❑ Looking at previous studies, it seems that the three products that constitute the most fire risk in the passenger compartment **are seats, ceiling coverings and curtains**
- ❑ In this proposal we suggest to focus the seats, because they constitute the most significant risk in term of fuel mass, potential heat released and smoke hazard

Test results according to CEN/TS 45545-2							
<u>Material</u>	<u>Requirement No.</u>	<u>MARHE</u> [kW/m ²]	<u>CIT</u> [l]	<u>D_s(4)/ D_{s,max}</u> [l]	<u>VOF4</u> [min]	<u>Valid for</u>	
						<u>HL1</u>	<u>HL2</u>
Body insulation	R1	334,5	0,3	127,5	260,8	No	No
Floor covering	R9	32,5	6,6	695,4	Not required	No	No
Side panel	R1	64,8	0,6	560,2	1102,7	Yes	No
Flooring	R9	1,6	Not tested				
GRP part	R1	280,9	0,2	1320,0	1843,9	No	No
Ceiling over seats	R1	247,2	1,9	839,5	2389,9	No	No
Ceiling over gangways	R1	307,7	2,9	622,5	2224,8	No	No
Foam of seats	R20	309,2	0,3	100,5	Not required	No	No

MARHE (Heat Released), CIT (smoke toxicity), $D_s(4)/D_{s,max}$ (smoke density), VOF4 (smoke opacity)

Source: Fire safety performance of buses. A. Hofmann & S. Dulsén in 2nd International Conference on Fire in Vehicles, 2012

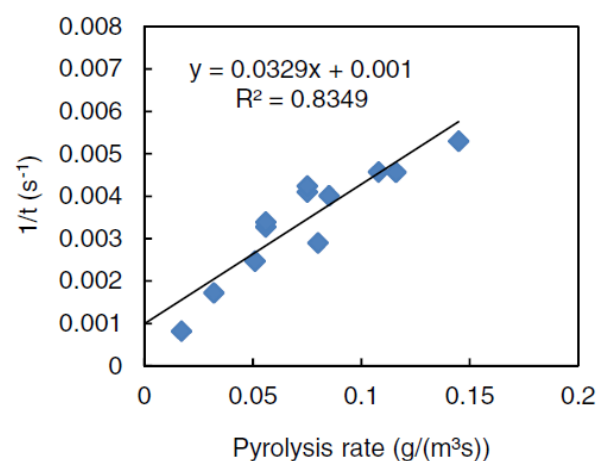
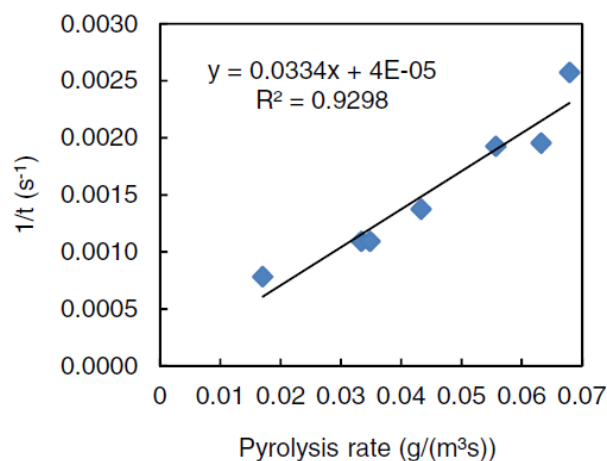
PRESENTATION OF THE NF D 60-013 TEST

- ❑ In France, there is a regulation (AM 18) for upholstered seats used in public buildings such as cinemas, theatres and concert halls
- ❑ The tests are carried out in accordance with the provisions of standard NF D. 60-013
- ❑ The purpose of this test, carried out using a propane burner, is to simulate the ignition of the seat by a flaming paper with an initial mass of 20 g
- ❑ The source is close to a UITP method and former prEN1021-3 test. It is lower than UIC564-2 annex 13 source.
- ❑ The lengths burned and the mass loss of the seat are evaluated
- ❑ Upholstered seats must meet the two criteria :
 - Maximum destroyed side lengths on the backrest and seat must be ≤ 200 mm on either side of the median axis;
 - Mass loss ≤ 300 g



PRESENTATION OF THE NF D 60-013 TEST

- ❑ These criteria were established according to a relationship determined between the mass loss and the smoke released by the furniture in a room of 30 m³ and was adapted to large volumes
- ❑ Under these conditions, it was considered that burning 300 g in such a volume would not lead to untenable conditions for the occupants, regardless of the composition of the seat
- ❑ Most importantly, the relationship between time to disability and mass loss is independent of the composition of the seat and the source of ignition, suggesting that the incapacitation is directly related to mass loss
- ❑ Such approach could be adapted for buses, considering their volume and need of evacuation delay



Results for the lethality (left) and incapacitation (right) adapted from Sainrat and Le Tallec

COMPARISON EXISTING FLAMMABILITY TESTS FOR SEATS

	Test standard	Test description	Requirement				Type of samples	Severity
Aircraft FAR/JAR/CS 25.853*	Fire propagation FAR 25-72 § 853(b), app. F part II	Post-crash scenario, about 120 kW/m ² for 2 min (simulates kerosene torch).	Mas loss <10% Burn length < 432 mm				Full seat	+++
	Flammability FAR 25-72 § 853(a), app. F part I(a) 1	12s vertical Bunsen burner (about 35kW/m ²)	burn length < 203 mm flame time < 12 s flame time of drips < 5 s				Full seat	++
Public buildings (AM18)	Flammability NF D 60-013	Gas burner equivalent to 20 g paper cushion (2 min)	Fire spread ≤ 200 mm mass loss ≤ 300 g				Full seat	+
Railway (EN 45545-2)*	Heat release ISO 9705-2 Furniture Calorimeter	Room corner test (7 kW burner, about 35 kW/m ²)		HL1	HL2	HL3	Full seat	++
			MAHRE (kW)	75	50	20		
			RHR Peak (kW)	350	350	350		
	Heat release ISO 5660-1 Cone calorimeter	Heat flux at 25 kW/m ²		HL1	HL2	HL3	Small samples but additional tests are required for other parts	
MAHRE (kW)			75	50	50			
Maritime IMO (FTP code 2010 and HSC 2000)*	Flammability FTP code part 8 (EN 1021]	Propane burner (20s) Cigarette (1h)	No ignition by match No ignition by cigarette				Full seat	++
	Heat release ISO 5660-1	Heat flux at 50 kW/m ² for 20 min	TIG >20s	HRR <60kW/m ²	THR <20MJ/m ²	SPRavg <0.005m ² /s	Small samples	++

*additional smoke density and toxicity test are required

PROJECT PROPOSAL

☐ Methodology:

1. Seat testing according to NF D. 60-013
 - Fire ignition and spread
 - Mass loss
 - Additional measurements:
 - Heat Release Rate (HRR) according to ISO 9705-2
 - Gas measurements according to ISO 19702
2. Comparison with seats used in public buildings
3. Estimation of the conditions of tenability in a bus (using HRR, gas analyses and existing studies)
4. Adaptation of mass loss criteria with regard to volume of passenger compartment

☐ Estimation:

- 4-5 full seats representative of available on the market
- Price: 10 k€
- Duration: 10 days including testing and analyses