HONG KONG 16, 17, 18

Railway interiorsexpoasia

Don't let the market leave without you

Our know-how makes your success

Fire safety, standards, implementation and technology afternoon session

TS 45 545 : does new standards mean new materials?

***Franck Poutch**, Technical Director CREPIM*

HONG KONG 16, 17, 18 NOVEMBER 2010

Railway Interiorsexpoasia

Tween teams devoted to developp and test fireproofed material

Testing team leader
Stéphane Boissel
Tel : 00 33 3 21 61 64 04
Mob : 00 33 6 48 26 87 42
Fax : 00 33 3 21 61 64 01
Stephane.boissel@crepim.fr,

Development team leader
Skander Khelifi
Tel : 00 33 3 21 61 64 07
Mob : 00 33 6 81 43 09 55
Fax : 00 33 3 21 61 64 01
Skander.khelifi@crepim.fr

Summary

- Introduction
- TS 45 545-1
- TS 45 545-2
- New parameters
  - FI
  - R
  - ST
- Bold ideas
  - Key drivers
  - Grouping rules
  - Assemblies
- Impacts on material / assemblies design
- Conclusion

Feel free to visit us in the hall 5, at the stand 4040 .... to discover our latest releases.

- The **fire safety** of products for **building, railways,** and **electrical engineering & electronics (E&E)** is addressed by the following directives:
  - **The Construction Products Directive**
  - **The Interoperability of the Trans-European High-Speed Rail System Directive**
  - **The Low Voltage Directive**

Fire issue overview

Fire safety regulation

- **The Construction Products Directive**
- **The Interoperability of the Trans-European High-Speed Rail System Directive**
- **The Low Voltage Directive**

Environment regulation
- LCA
- recycling
- durability

- **WEEE**
- **…**

Impact regulation
- bio accumulation
- Health hazard

- **Reach**
- **RoHS**
- **….**

Basis of CEN TS 45545

- 2 directives
  - **Council Directive 9648EC of 23 July 1996 on the interoperability of the Trans-European high-speed rail system**
  - **Directive 200116EC of the European Parliament and of the Council of 19 March 2001 on the interoperability of the Trans-European conventional rail system**

TS prCEN 45545 & future EU Railways Regulations

Council Directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system

New regulations:

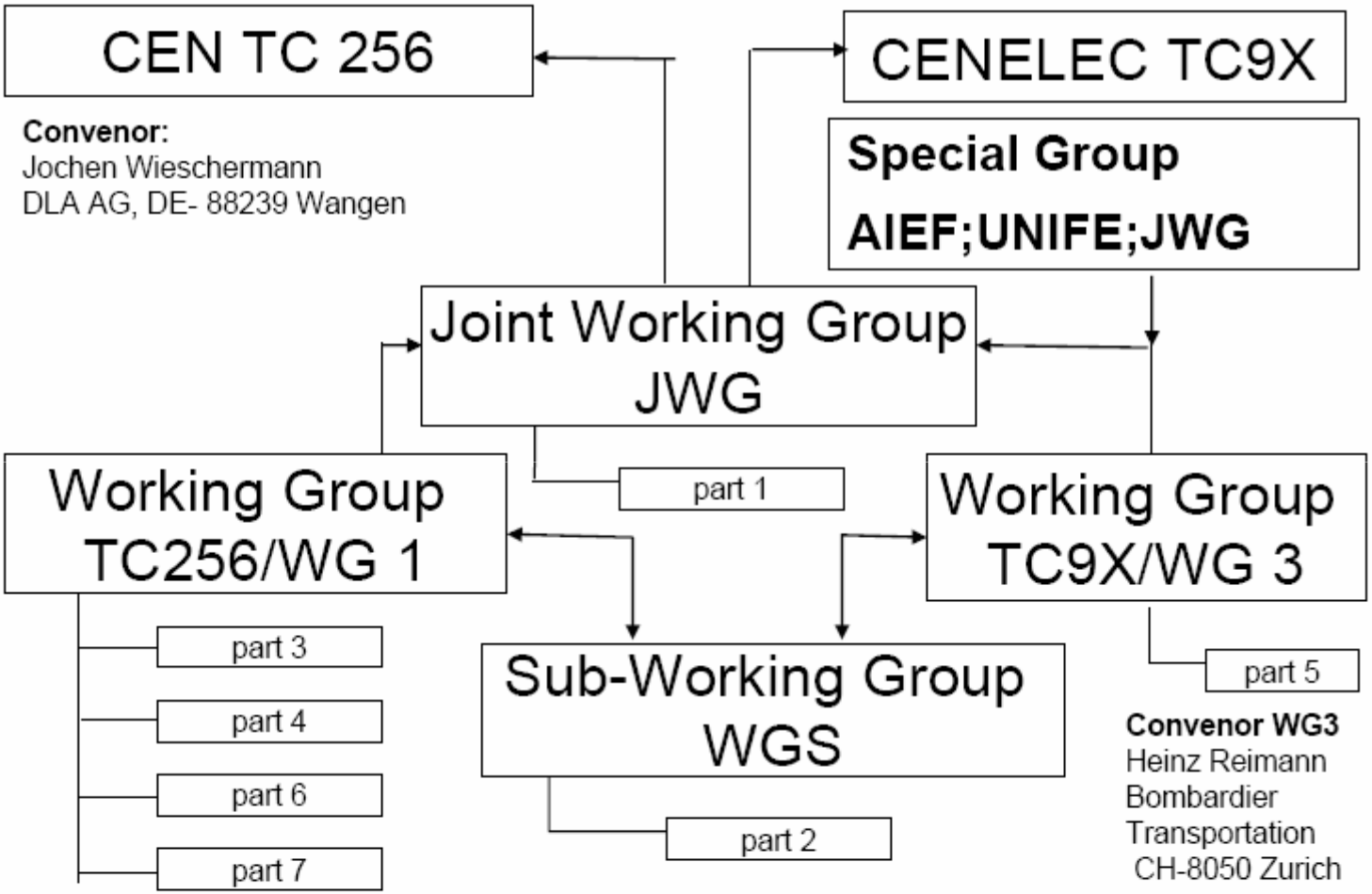
CEN TC 256 WG1

CENELEC TC 9X WG3

European Standard: ***Pr EN 45545***

Deadline: ***2011/12***

Diagram of working process



***European Standard:* Pr EN 45545**

***Deadline:* 2011/12**

Interoperability means…

The ability of the Trans-European high-speed rail system **to allow the safe and uninterrupted movement of high-speed trains** which accomplish the specified levels of performance.

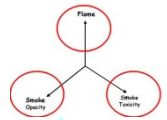
This ability rests on all the regulatory, technical and operational conditions which must be met in order to satisfy essential requirements.

Technical Specifications for Interoperability

- **Essential Requirements**
  - **Safety**
  - Reliability and availability
  - Health
  - Environmental protection
  - Technical compatibility

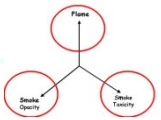
EN 45545 Railway applications - Fire protection on railway vehicles

- Part 1 General
- **Part 2 Requirements for fire behaviour of materials**

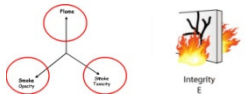


- Part 3 Fire resistance requirements for fire barriers Rejected, revision and partitions

- Part 4 Fire safety requirements for rolling stock design
- Part 5 Fire safety requirements for electrical equipment



- Part 6 Fire control and management systems
- Part 7 Fire safety requirements for flammable liquid and flammable gas installations



Summary

- Introduction
- TS 45 545-1
- TS 45 545-2
- New parameters
  - FI
  - R
  - ST
- Bold ideas
  - Key drivers
  - Grouping rules
  - Assemblies
- Impacts on material / assemblies design
- Conclusion

Feel free to visit us in the hall 5, at the stand 4040 .... to discover our latest releases.

CEN TS 45545 Part 1

- This Part of CEN TS 45545 covers
  - Principal definitions
  - Operation categories
  - Design categories
  - Fire safety objectives
  - General requirements for fire protection measures and their evaluation of conformity

CEN TS 45545 Part 1

- CEN TS 45 545 – 2 :

Railway application – Fire Protection of railway vehicles – Part 2

3 Hazard Level ⇔ Usage of materials

Requirements 25

↓

Fire behaviour test methods 14

4 operation categories

- **1 <u>Vehicles that are not designed or equipped to run on underground</u>** sections, tunnels and/or elevated structures and which may be stopped with minimum delay, after which immediate side evacuation to a place of ultimate safety is possible.
  - Length between tunnel > train length
  - Tunne length < 10% total travel length

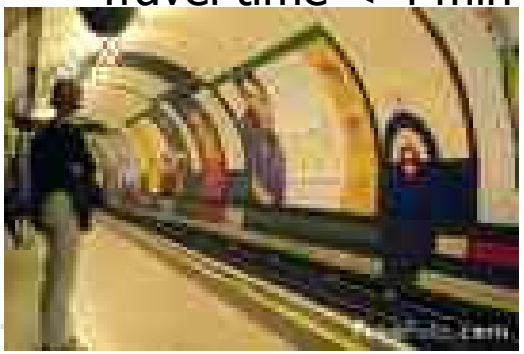
- **2:** Vehicles that **<u>are designed or equipped to run on underground sections</u>**, tunnels and/or elevated structures, with side evacuation available and where there are stations or emergency stations that offer a place of ultimate safety to passengers, reachable **<u>within a short running time</u>**.
  - Tunnel length < 5 km
  - Travel time < 4 min

- **3:** Vehicles that **<u>are designed or equipped to run on underground sections</u>**, tunnels and/or elevated structures, with side evacuation available and where there are stations or emergency stations that offer a place of ultimate safety to passengers, reachable within a long running time.
  - Tunnel length < 20 km
  - Travel time < 15 min

Operating categorie 4 London tube

4:Vehicles that are designed or equipped to run on underground sections, tunnels and/or elevated structures, **without side evacuation available and where there are stations or emergency stations that offer a place of ultimate safety to passengers, reachable within a short running time.**

- Travel time < 4 min






CEN TS 45545 Part 1

Hazard Levels mapping




Design Category / Operation Category	N : Standard vehicles	A : Automatic vehicles having no emergency trained staff on board	D : Double decked vehicle[1)]	DS / S : Sleeping and couchette cars Double decked or single deck
1	HL1	HL1	HI1	HL2
2	HL2	HL2	HL2	HL2
3	HL2	HL2	HL2	HL3
4	HL3	HL3	HL3	HL3

HL1= Tramway
HL2= TGV, TER, Tube, RER…
HL3= Sleeping and couchette cars

Hazard levels

- HL1= Tramway

- **HL2= TGV, TER, Tube, RER…**
  - **90% of the requirements**

- HL3= Sleeping and couchette cars

CEN TS 45545 Part 1

4 types of vehicles

N, A, D, S

+

4 categories of use

1, 2, 3, 4

=

3 Hazard Levels of Fire

HL1, HL2, HL3,

Summary

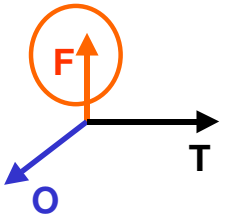
- Introduction
- TS 45 545-1
- TS 45 545-2
- New parameters
  - FI
  - R
  - ST
- Bold ideas
  - Key drivers
  - Grouping rules
  - Assemblies
- Impacts on material / assemblies design
- Conclusion

CEN TS 45545 Part 2

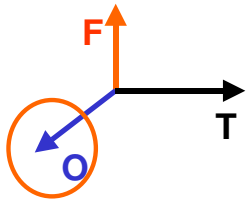
- This Part of CEN TS 45545 covers
  - The generic material classes and the requirement classes
  - Test methods according to the generic material classes
  - Characteristic requirement of the System test
  - Requirements in principle for selection of testing and test samples
- Interior material construction

FIRST! :Key Criteria for Fire Assessment

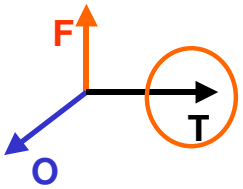
- ✓ *Flame spread F*
- ✓ *Ignatibility I*
- ✓ *Rate of heat release R*



- ✓ *Smoke S*



- ✓ *Toxicity T*



Requirements for fire behavior of materials and components

F I R S T

Material classes	Spread of flame	Ignitability	Rate of heat release	Smoke	Toxicity
Structural surface related products	ISO 5658-2 Radial panel	ISO 5660-1 Cone calorimeter		ISO 5659-2 NBS chamber	
Furniture products	For product testing ISO 9705 Furniture calorimeter			ISO 5659-2 NBS chamber	
	---	For sample testing ISO 5660-1 Cone calorimeter		ISO 5659-2 NBS chamber	
Electro technical products	ISO 4589-2 LOI		---	ISO 5659-2 NBS chamber	
Mechanical products	ISO 4589-2 LOI		---	ISO 5659-2 NBS chamber	

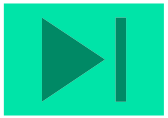
Summary

- Introduction
- TS 45 545-1
- TS 45 545-2
- New parameters
  - FI
  - R
  - ST
- Bold ideas
  - Key drivers
  - Grouping rules
  - Assemblies
- Impacts on material / assemblies design
- Conclusion

Feel free to visit us in the hall 5, at the stand 4040 .... to discover our latest releases.

Usage of materials

Listed	Non listed
- Interior - Exterior - Furniture - Electrotechnical Equipment - Mechanical Equipment	- > 0,20 m^2 and interior - > 0,20 m^2 and exterior - < 0,20 m^2 and interior - < 0,20 m^2 and exterior

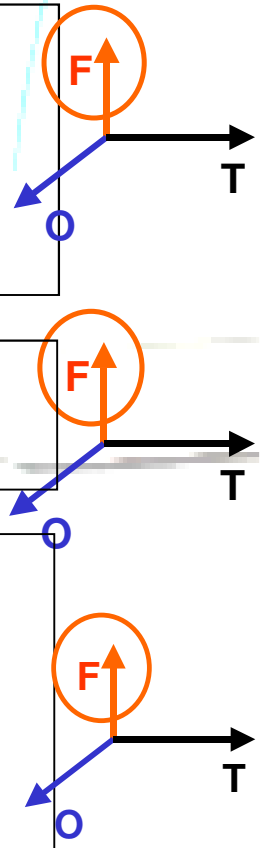


Grouping rules

FI RST

- Flame spread and Ignitiability :

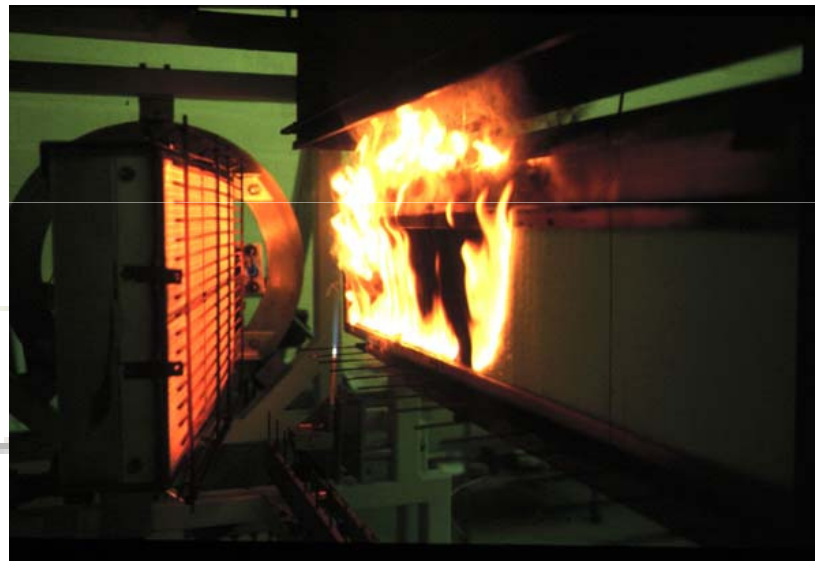
Large surface	EN ISO 5658-2: Vertical Radiant Panel EN ISO 9239-1: Flooring radiant panel
Non listed items and EE	EN ISO 4589-2: Oxygen Index
Cables	« Flame spread cable tests » : EN 60332-1-2 EN 50266-2-4 EN 50305 § 9.1.1 EN 50305 § 9.1.2



FI RST

- EN ISO 5658-2 :

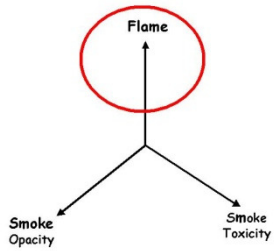
Reaction to fire tests – Spread of flame – Part 2:
Lateral spread on building products in vertical configuration



Key parameter: Flame spread

Measurement of :

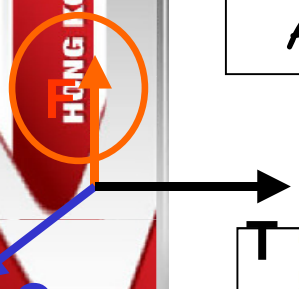
- **C**ritical **H**eat **F**lux at Extinguishment (CHF)



FI R ST

- Rate of heat release:

All listed products	ISO 5660-1: Cône calorimeter
Complete seat	Annex B : Fire test method for seat



FI R ST

- Rate of Heat Release :

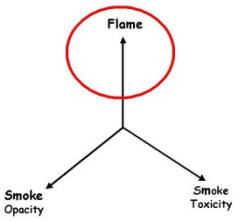
ISO 5660-1: Fire test – Reaction to fire - Part1:
Rate of heat release (Cone calorimeter method)

Measurement of :

- Oxygen consumption

Calculation of :

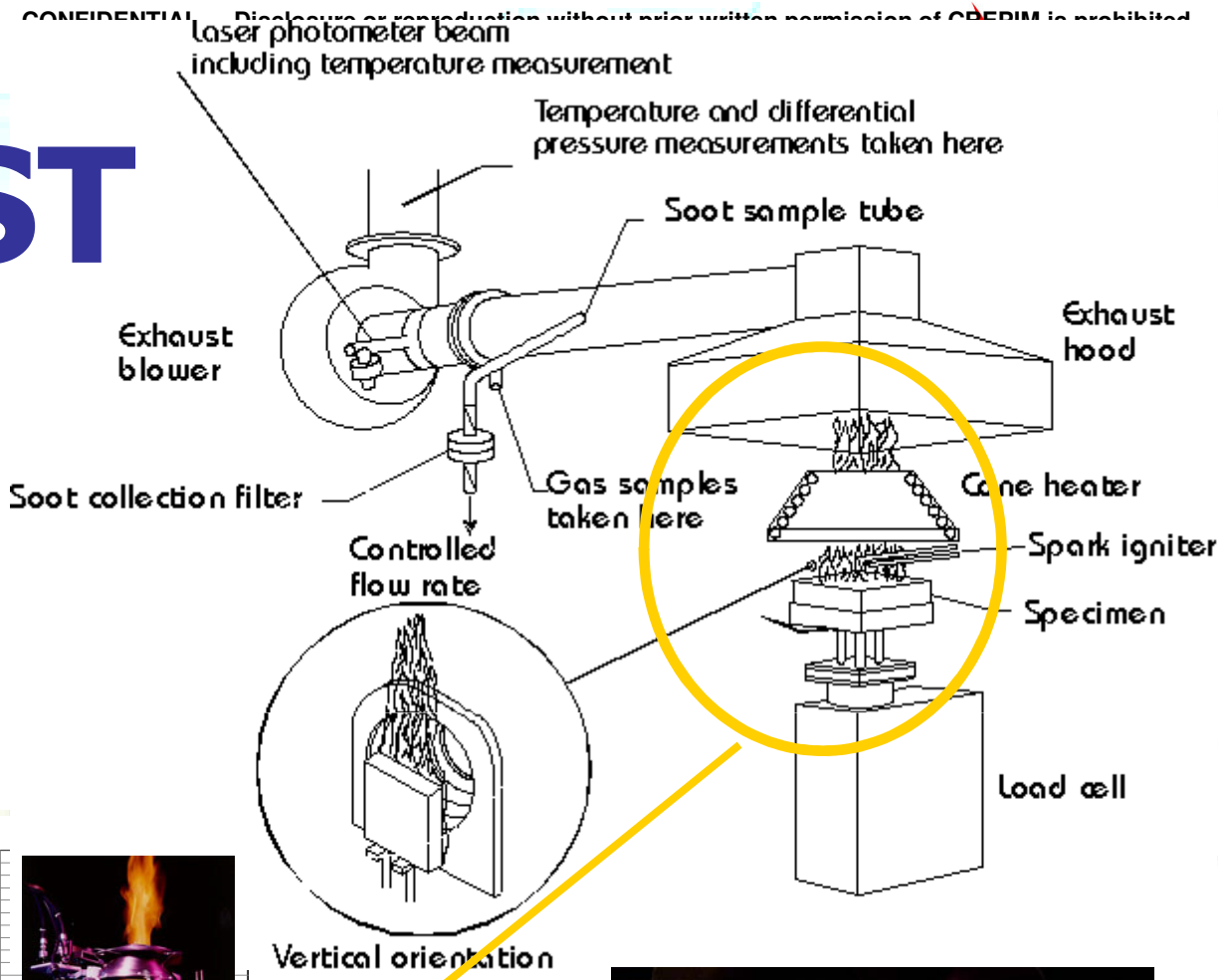
- MAHRE



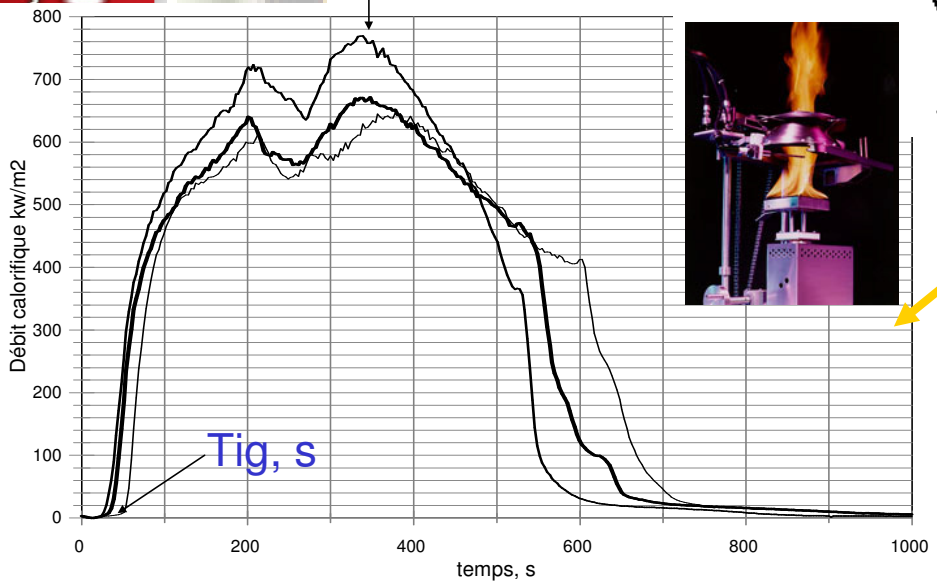
HONG KONG 16, 17, 18 NOVEMBER 2010

FI R ST

ISO 5660-1 cone calorimeter



RHR max : kW/m²



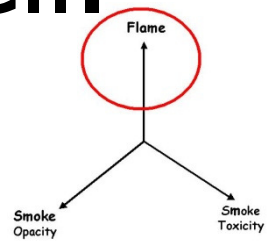
CREPIM F POUTCH

FI R ST

Extent of vandalisation Annex A

- CEN TS 45 545 Annex B:

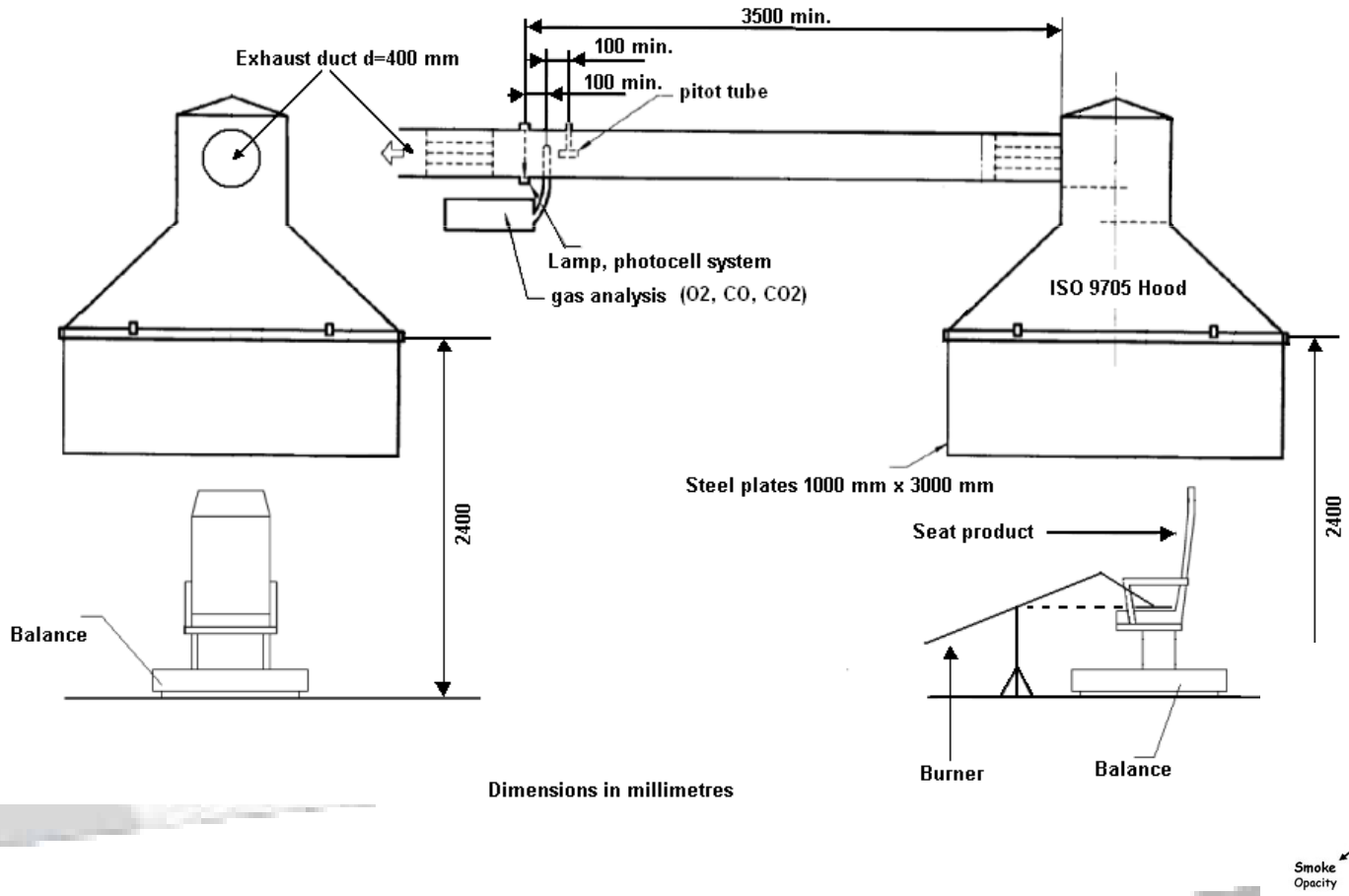
Full passenger seats, appropriately vandalised, shall be tested. The seats shall include arm and head rests, back and base shell.



FI R ST

- CEN TS 45 545 Annex B:

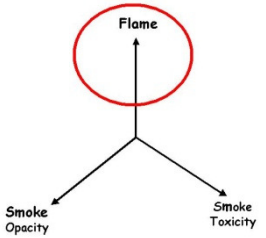
Extent of vandalisation determined by Annex A

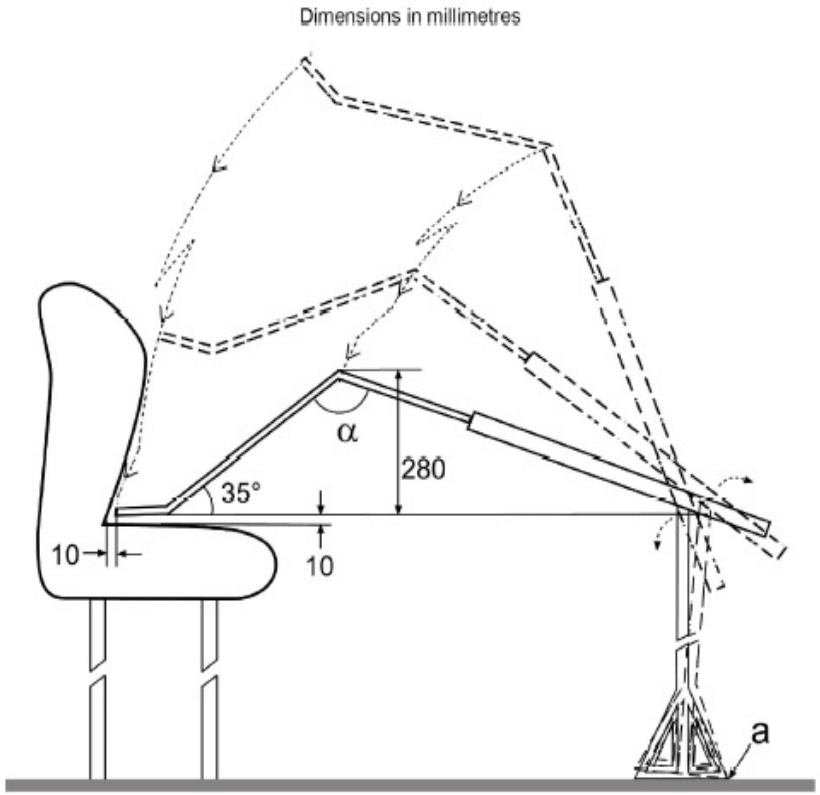


FI R ST

- CEN TS 45 545 Annex B:

Extent of vandalisation determined by Annex A

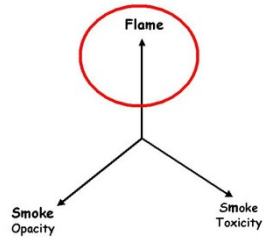


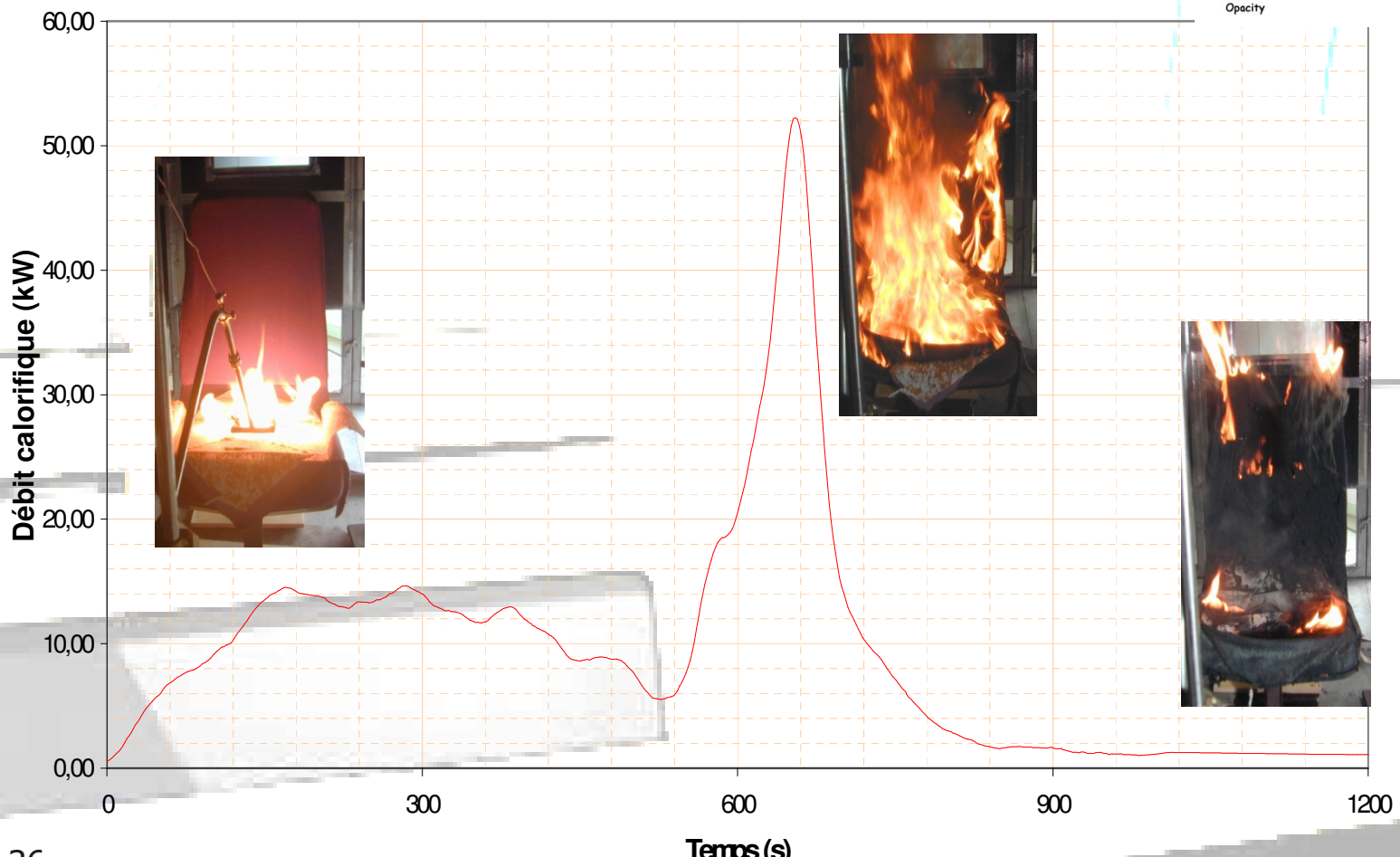


FI R ST : 7 kW; 180s, 121 cm²

- CEN TS 45 545 Annex B:

Extent of vandalisation determined by Annex A





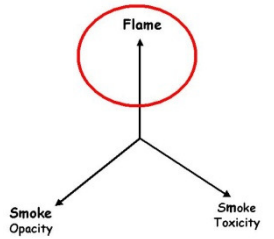
FI R ST

Extent of vandalisation Annex A

- CEN TS 45 545 Annex B:

Extent of vandalisation determined by Annex A

Annex A
(normative)
Standard vandalisation test for seat coverings



FI R ST

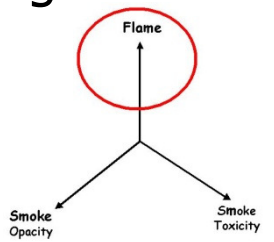
Extent of vandalisation Annex A

·How to proceed?

This smale scale test determines **the ability of the seat to resist** vandalism with a blade prior to an arson attempt.

The test shall be performed by the fire laboratory before the fire test for vandalised seating (Annex B) to determine the extent of vandalisation that shall be reproduced on the fire test specimens.

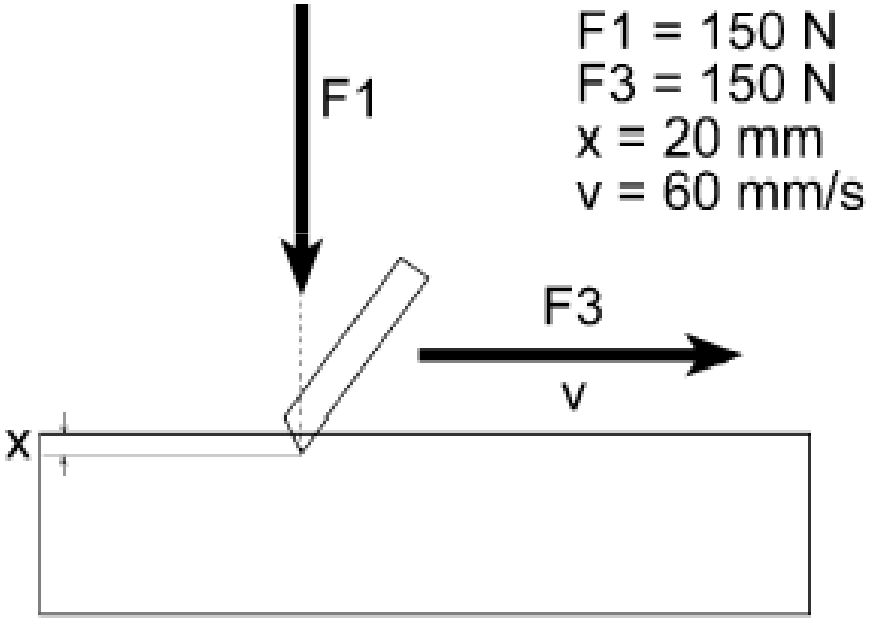
A representative sample is obtained from the seat having dimensions of 300 mm × 450 mm, in full thickness if lower than 50 mm, or 50 mm thick if higher than 50 mm. The edges of the test specimen shall be completely covered by the seat covering.

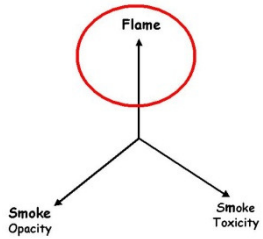


FI R ST

Extent of vandalisation Annex A

- CEN TS 45 545 Annex B:





FI R ST

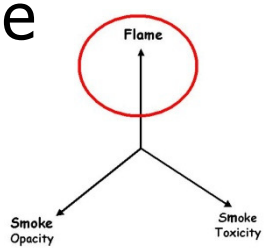
Extent of vandalisation Annex A

- CEN TS 45 545 Annex B:

The penetration test involves applying **a vertical force F1** onto the lever to allow the tip of the blade to penetrate the seat covering.

The lever shall be kept in this position by the blocking system.

The laceration test consists in applying **a traction force** onto the trolley by means of the traction device and a speed of traction of **(60 ± 5) mm/s**. The duration of the test shall be **(5 ± 1) s.**



FI R ST

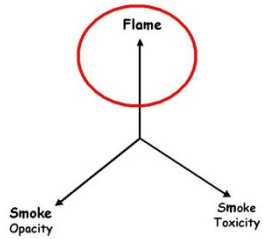
Extent of vandalisation Annex A

- CEN TS 45 545 Annex B:

Remove the specimen from the vandalisation test apparatus and put the specimen on a flat surface.

Report the layers (textile, under layer, foam) that have been fully cut through to more than 50 mm laterally.

A cut of less than 50 mm is considered as non-vandalised according to the requirements for the preparation of the test specimen



FI R ST

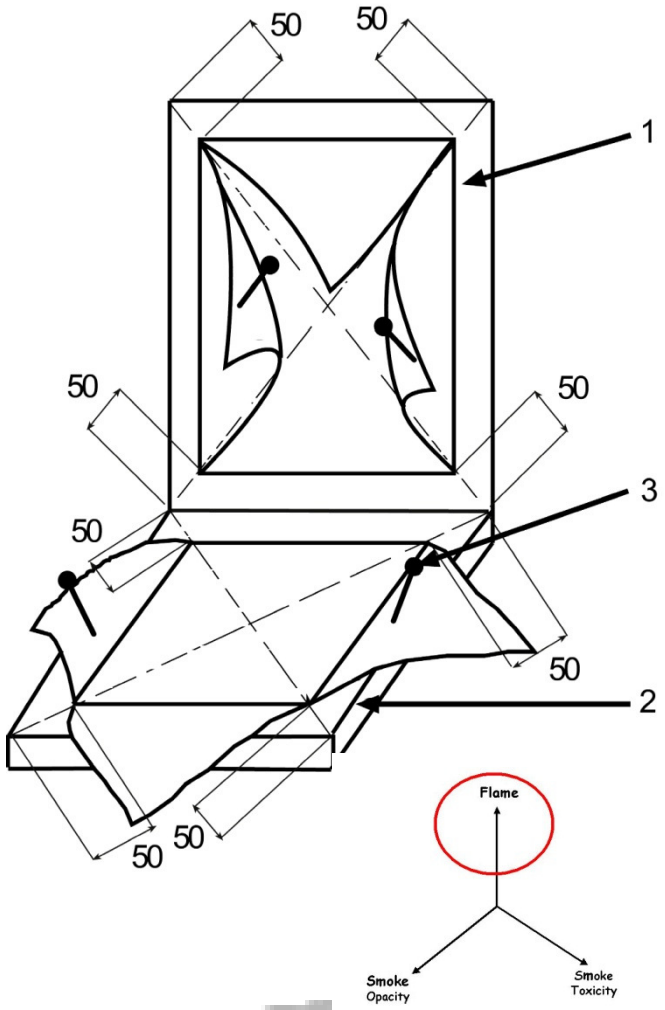
Extent of vandalisation Annex A

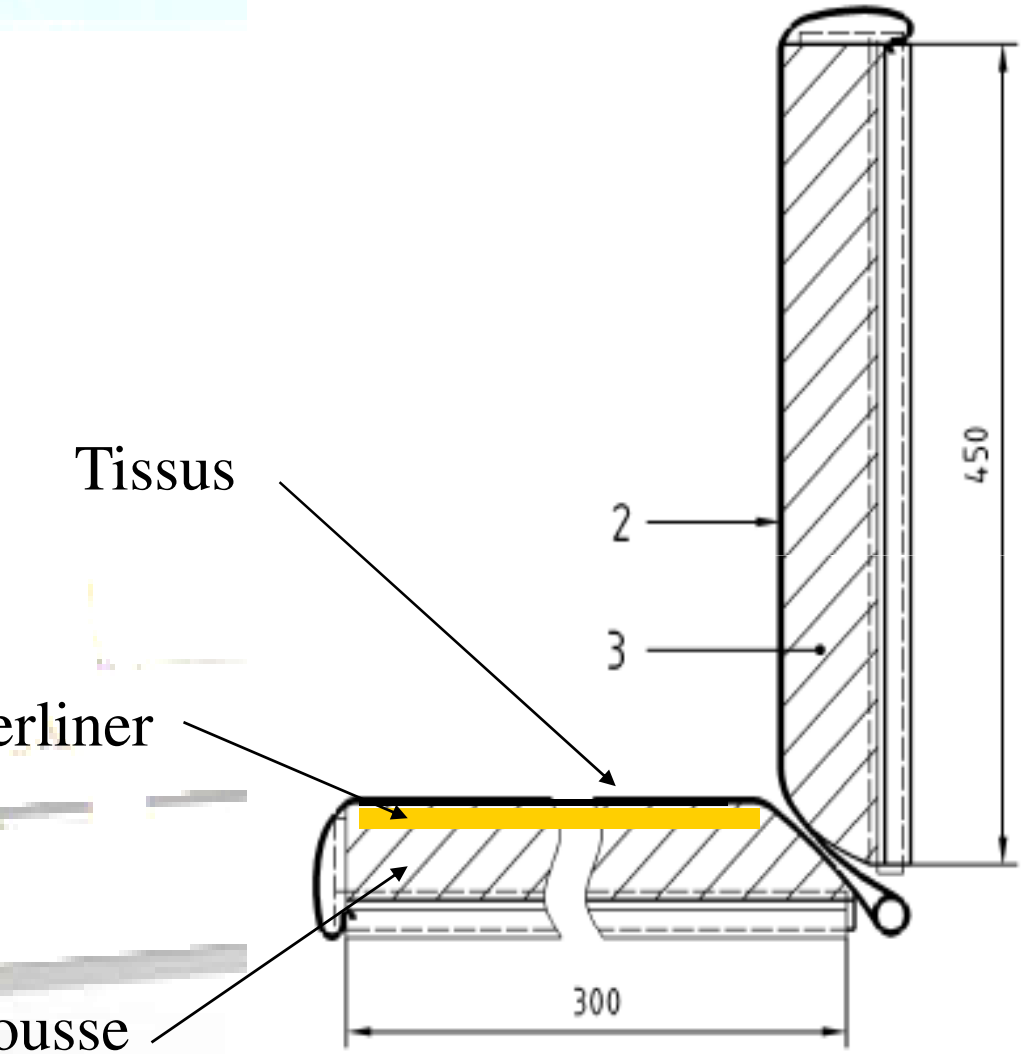
The level of vandalisation determined during the test of Annex A shall be reproduced in the following way:

The layers that were cut or perforated for a **longer distance than 50 mm** shall be cut along the diagonals **beginning 50 mm from the corners**.

The fully cut layers shall be rolled up and pinned as shown in the figure. The rolling and pinning shall be done so that there is no interference with the burner trajectory.

To make sure that the requirements of burner position are fulfilled, the rolled up flaps shall be cut off.





Section verticale

FI R ST

Extent of vandalisation Annex A

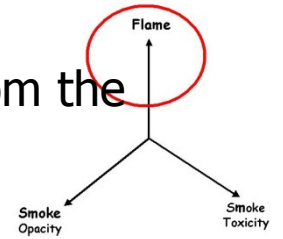
CEN TS 45 545 Annex B:

If one of the fully cut through layers is bonded to an underlayer, when the bonded layer is lifted and turned back there are several possible occurrences:

•when pulling the bonded layer back it remains integral (**e.g. woven glass layer bonded to a core foam)** and brings with it some additional material from the underlying layer. In this circumstance **the underlying material that comes away during the process is left bonded to the pulled back layer;**

•. when pulling the bonded layer back it tears easily within itself, (**e.g. a weak felt bonded to a core foam)** no underlying material is lifted with it and it is not possible to remove any significant area of the layer in a single action. **In this circumstance the (weak) layer shall be scraped away until only well bonded material remains;**

•. if it is not possible to pull back the damaged layer(s) away from the upholstery foam, **leave the surfacelayer(s) as cut in the vandalisation test.**



Requirements for refurbishment of passenger seats

- composition;
- colour;
- shape;
- thickness, density, mass;
- .supplier.

For minor changes in these parameters on the cushions of passenger seats, specifies the test requirements.

Parts	Parameters changed	Requirements
Cover	Colour only (the material shall be the same)	None
	Supplier only	R20
Interlayer (fire barrier)	Supplier only	R20
Glue	Composition nature, supplier	R20
Foam	Certified thickness difference less than ± 15 %	None
	Certified thickness difference more than ± 15 %	R17

Refurbished passenger seats which have changes to more than one of the parameters listed in Table above shall be tested to the full requirements.

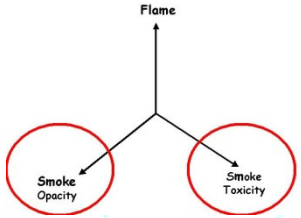
Seat requirements

Description	Requirements	Test method	Test method parameter	HL1	HL2	HL3
Complete passenger seat	R17	T06	EN ISO 9705 vandalised - MARHE	75	50	20
Upholstery and head rest	R20	T03.02	ISO 5660-1: 25kWm^{-2} - MARHE	75	50	50
Arm rest – vertical and downwards facing surfaces	R22*	T10.03 T11.02	ISO 5659-2 : 25kWm^{-2} - D_S(max) - CIT at 4 and 8 min	300 1,2	250 0,9	200 0,75
Arm rest – upwards facing surfaces	R21	T03.02	ISO 5660-1: 25kWm^{-2} - MARHE	75	50	50
Back shell and base shell of passenger seats	R5* *additional fire integrity test necessary	T03.01	ISO 5660-1: 50kWm^{-2} - MARHE	90	90	60
		T10.01 T10.02 T11.01	ISO 5659-2 : 50kWm^{-2} - D_S(4) - VOF4 - CIT at 4 and 8 min	600 1200 1,2	300 600 0,9	150 300 0,75

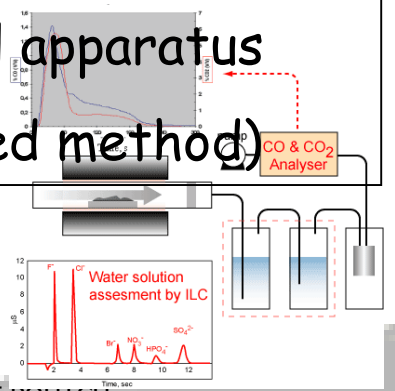
Requirements and test methods *HL – Hazard Level*

Smoke ST

- Smoke opacty and toxicity:

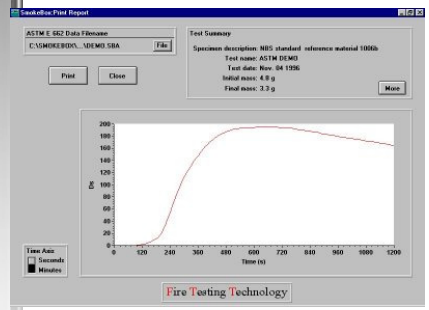


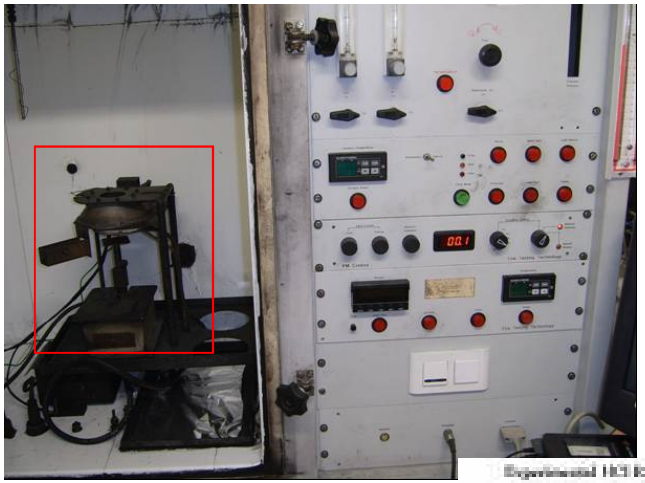
Large surface	EN ISO 5659-2: SDC – Horizontal apparatus CEN TS 45 545 Annex C: Testing methods for determination of toxic gases from railway products (area based method)
Non listed items and cables	EN ISO 5659-2: SDC – Horizontal apparatus NF X 70-100 : Toxicity (mass based method)

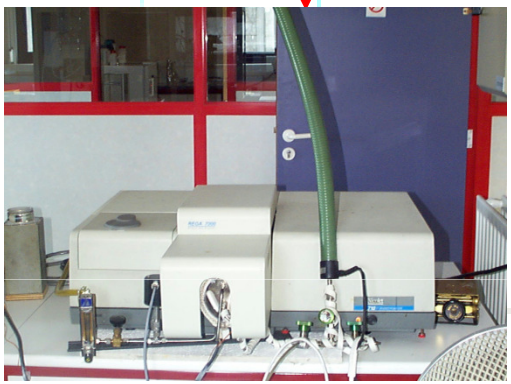


FI R ST

- CEN TS 45 545 Annex C : 4 and 8 min sampling of gas
  Heated sampling line



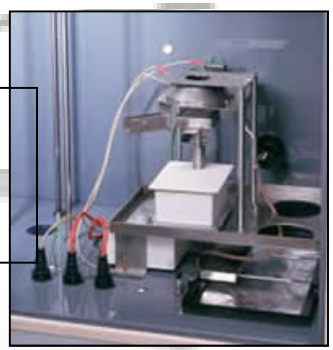


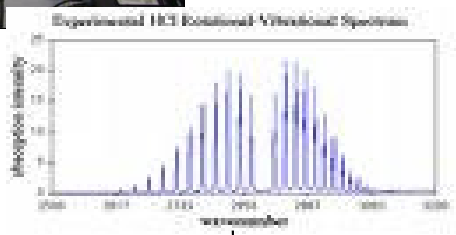


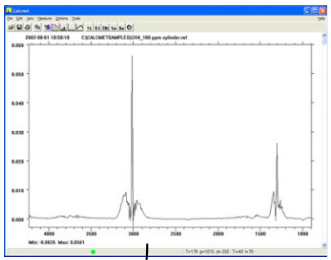
Ds (4)
Dm
VOF4

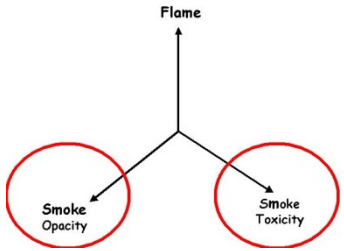
25 kw m^{-2} with pilot flames

50 kW m^{-2} without pilot fames



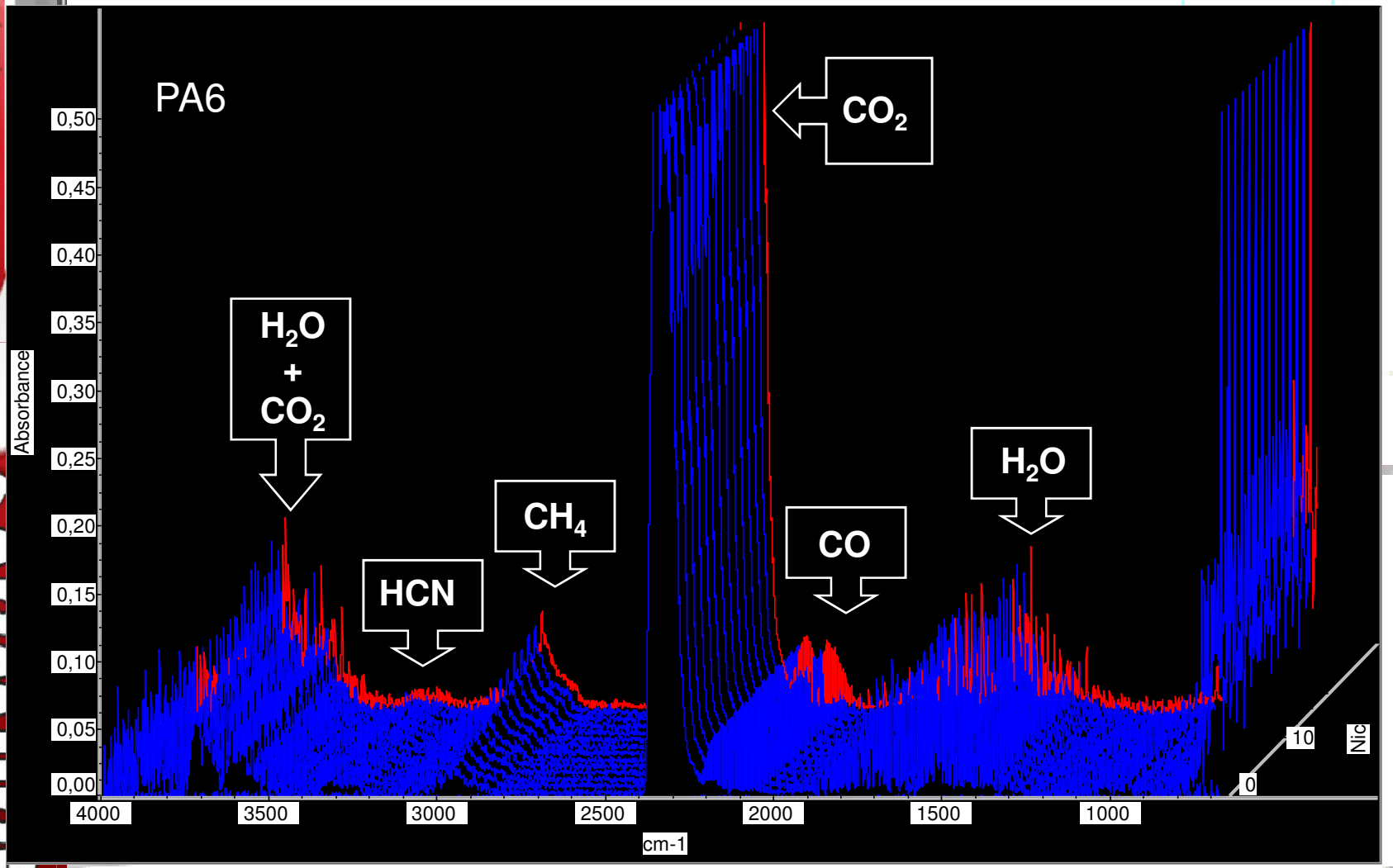






CIT

Analyse en mode dynamique



- ISO 5659-2 + IRTF
  - Testing that develops more realistic fire scenarios than NF X 70-100
  - KFS: Surface treatment that protects from flame spread delays the smoke and toxic release

Summary of test methods

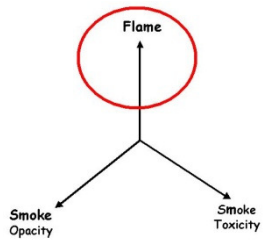
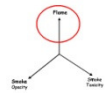
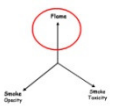
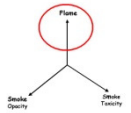
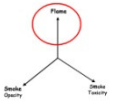
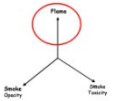
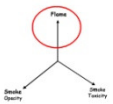
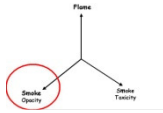


Table 8 — Summary of test methods

Ref.	Standard	Short description	Parameter	Unit	Requirement Definition	Additional explanation
T01	EN ISO 4589-2	Determination of burning behaviour by oxygen index Part 2: Ambient temperature test	OI	% Oxygen	Minimum	OI is the abbreviation for Oxygen Index
T02	ISO 5658-2	Lateral flame spread	CFE	kW m^{-2}	Minimum	CFE is the abbreviation for Critical Flux at Extinguishment
T03.1	ISO 5660-1	Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method)	MARHE	kW m^{-2}	Maximum	The data collection interval shall be 2 s and data collection shall be terminated at 20 min heat flux 50 kW/m^2
T03.2	ISO 5660-1	Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method)	MARHE	kW m^{-2}	Maximum	The data collection interval shall be 2s and data collection shall be terminated at 20 min Heat flux 25 kW/m^2
T04	EN ISO 9239-1	Radiant panel test for horizontal flame spread of floorings	CHF	kW m^{-2}	Minimum	CHF (Critical Heat Flux at extinguishment)
T05	EN ISO 11925-2	Ignition when subjected to direct impingement of flame	30 s flame application		No spread > 150 mm within 60 s	
T06	ISO/TR 9705-2	Furniture calorimeter vandalised seat	MARHE	kW	Maximum	Annex B

Summary of test methods

Ref.	Standard	Short description	Parameter	Unit	Requirement Definition	Additional explanation
T07	EN ISO 12952-3/-4	Burning behaviour of bedding products Part 3/4: Ignitabilty by a small open flame	After burning time	s 	Maximum	Sustained flaming less than 10 s and no flames reaching any edge of the specimen means no ignition
T08	IEC/TS 60695-1-40	Guidance for assessing the fire hazard of electrotechnical products – Insulating liquid	Class K Fire point	°C 	Minimum	
T09.1	EN 60332-1-2	Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame	Height of burned zone and height of unburned zone	mm 	Length of unburned cable > 50 mm	Preliminary test for all cables Definitions of the "burned part" and "unburned part" in Annex A of the test method
T09.2	EN 50266-2-4	Common test methods for cables under fire conditions- Test for vertical flame spread of vertically-mounted bunched wires or cables Part 2 to 4: Procedures – Category C	Height of burned zone front side and backside	m 	Maximum 2,5	Test for cables with $D \geq 12$ mm
T09.3	EN 50305, 9.1.1	Railway applications – Railway rolling stock cables having special fire performance – Test methods	Height of burned zone front side and backside	m 	Maximum 2,5	Test for cables with 6 mm $< D <$ 12 mm
T09.4	EN 50305, 9.1.2	Railway applications – Railway rolling stock cables having special fire performance – Test methods	Height of burned zone front side and backside	m 	Maximum 1,5	Test for cables with $D \leq 6$ mm
T10.01	EN ISO 5659-2	Plastics – Smoke generation Part 2 determination of optical density by a single-chamber test	Ds (4) see 3.1.2	dimensionless 	Maximum	Heat flux 50 kW/m^2 without pilot flame

Summary of test methods

Ref.	Standard	Short description	Parameter	Unit	Requirement Definition	Additional explanation
T10.02	EN ISO 5659-2	Plastics – Smoke generation Part 2 determination of optical density by a single-chamber test	VOF4 see 3.1.3	min	Maximum	Heat flux 50 kW/m^2 without pilot flame
T10.03	EN ISO 5659-2	Plastics – Smoke generation Part 2 determination of optical density by a single-chamber test	*Ds* max see 3.1.2	dimensionless	Maximum	Heat flux 25 kW/m^2 with pilot flame
T10.04	EN ISO 5659-2	Plastics – Smoke generation Part 2 determination of optical density by a single-chamber test	*Ds* max see 3.1.2	dimensionless	Maximum	Heat flux 50 kW/m^2 without pilot flame
T11.01	CEN/TS 45545-2 Annex C	Gas analysis in the smoke box EN ISO 5659-2, using FTIR technique	CIT_G at 4 and 8 min	dimensionless	Maximum	Heat flux 50 kW/m^2 without pilot flame
T11.02	CEN/TS 45545-2 Annex C	Gas analysis in the smoke box EN ISO 5659-2, using FTIR technique	CIT_G at 4 and 8 min	dimensionless	Maximum	Heat flux 25 kW/m^2 with pilot flame
T12	NF X70-100-1 NF X70-100-2	Gas analysis for the 8 gases described on 3.1.5	CITc; CIT_{NLP}	dimensionless	Maximum	Furnace Temperature 600 °C
T13	EN 61034-2	Measurement of smoke density of cables burning under defined conditions - Part 2 Test procedure and requirements	Transmission	%	Minimum	Apparatus used is described in EN 61034-1
T14	EN 13501-1	Fire classification of construction products and building elements - Part 1 Classification using test data from reaction to fire tests	Table 1	dimensionless classification	Minimum	Classification according EN ISO 1182 and EN ISO 1716:2002 A.1 and A.2

Summary

- Introduction
- TS 45 545-1
- TS 45 545-2
- New parameters
  - FI
  - R
  - ST
- Bold ideas
  - Key drivers
  - Grouping rules
  - Assemblies
- Impacts on material / assemblies design
- Conclusion

Feel free to visit us in the hall 5, at the stand 4040 .... to discover our latest releases.

Bold ideas

Key drivers

- a homogeneous product meeting a requirement **at two different thicknesses** complies with the requirement by definition at all intermediate thicknesses;
- a test which qualifies any product or surface **shall also qualify any product or surface which differs only in colour.** A test which qualifies any product or surface shall also qualify any product or surface which differs only in the nature of the patterned surface;
- **interior and exterior coatings shall be tested in end use condition.** Where a coating is applied to aluminium or steel in the end use condition and where the thickness of the metal is greater than those defined in Table below it is sufficient to test the coating on the reference substrate defined in table below.
- Where a product has a continuous aluminium or steel surface in the end use condition and where the thickness of the metal is greater than defined in Table below, it is sufficient to test the product with the thickness given in Table below;

Nature	Nominal density [kg/m^3]	Thickness [mm]
Steel sheet	7 850 ± 50	0,8 ± 0,1
Aluminium sheet	2 700 ± 50	1,0 ± 0,2

Key drivers

- products which comply with the highest level of reaction to fire performance by definition and therefore need no further testing are:
  - products classified as A1 according EN 13501-1;
  - all products described in commission decision 96/603/EC (as amended) with the exception **of laminated glass;**

Key drivers

- mechanical or electrical products, which are contained in a technical cabinet according to the following rules are permitted to comprise unclassified products;
  - either the technical cabinet is made from E10 fire barrier and the enclosed volume is ≤ 2 m3;
  - or the technical cabinet is made from **E15 I15** fire-barrier
  - or the technical cabinet is protected by an automatic fire detection and fire extinguishing system;

Key drivers

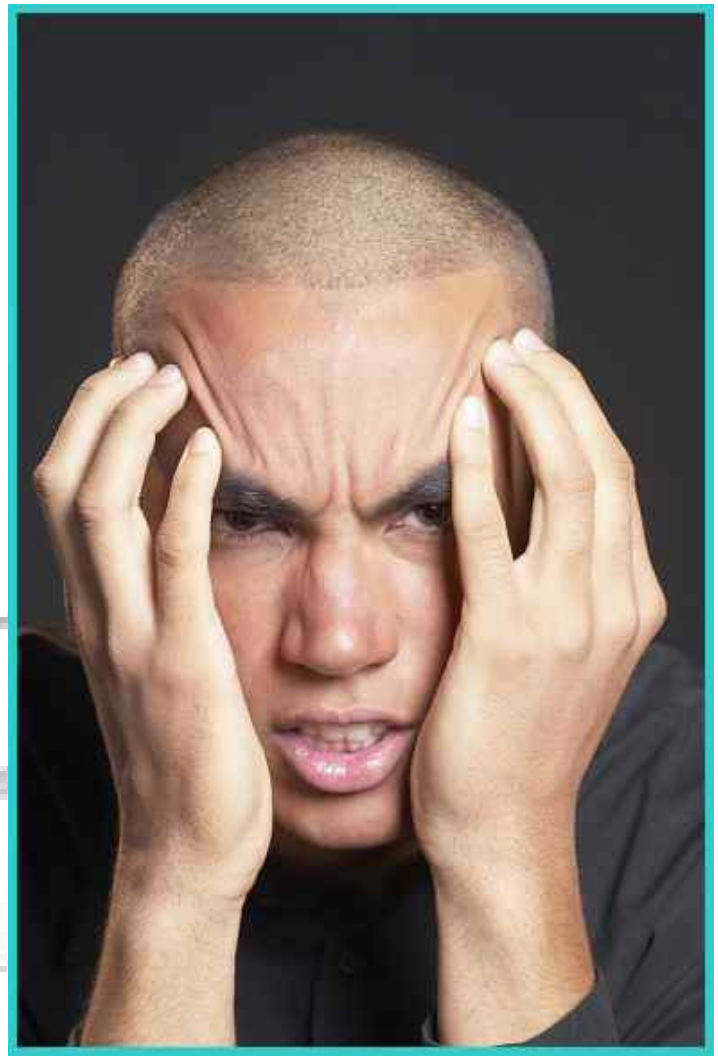
- where a product has a continuous glass surface in the end use condition it shall be possible to qualify related products without testing from the qualification of one product subject to the following rules:
  - the glass thickness on the exposed surface is not greater than the glass thickness of the assessed product;
  - the glass on the exposed surface has the same generic composition as the glass of the assessed product;
  - the glass on the exposed surface has the same generic stress levels; defined generically as "annealed", "heat strengthened (semi-tempered)" and "toughened" (fully tempered)";
  - the plastic layer immediately below the exposed surface glass is of the same generic chemical type;
  - the thickness of the plastic layer immediately below the exposed surface is not less than the thickness of the same layer of the assessed product;

Summary

- Introduction
- TS 45 545-1
- TS 45 545-2
- New parameters
  - FI
  - R
  - ST
- Bold ideas
  - Key drivers
  - Grouping rules
  - Assemblies
- Impacts on material / assemblies design
- Conclusion

Feel free to visit us in the hall 5, at the stand 4040 .... to discover our latest releases.

Grouping rule



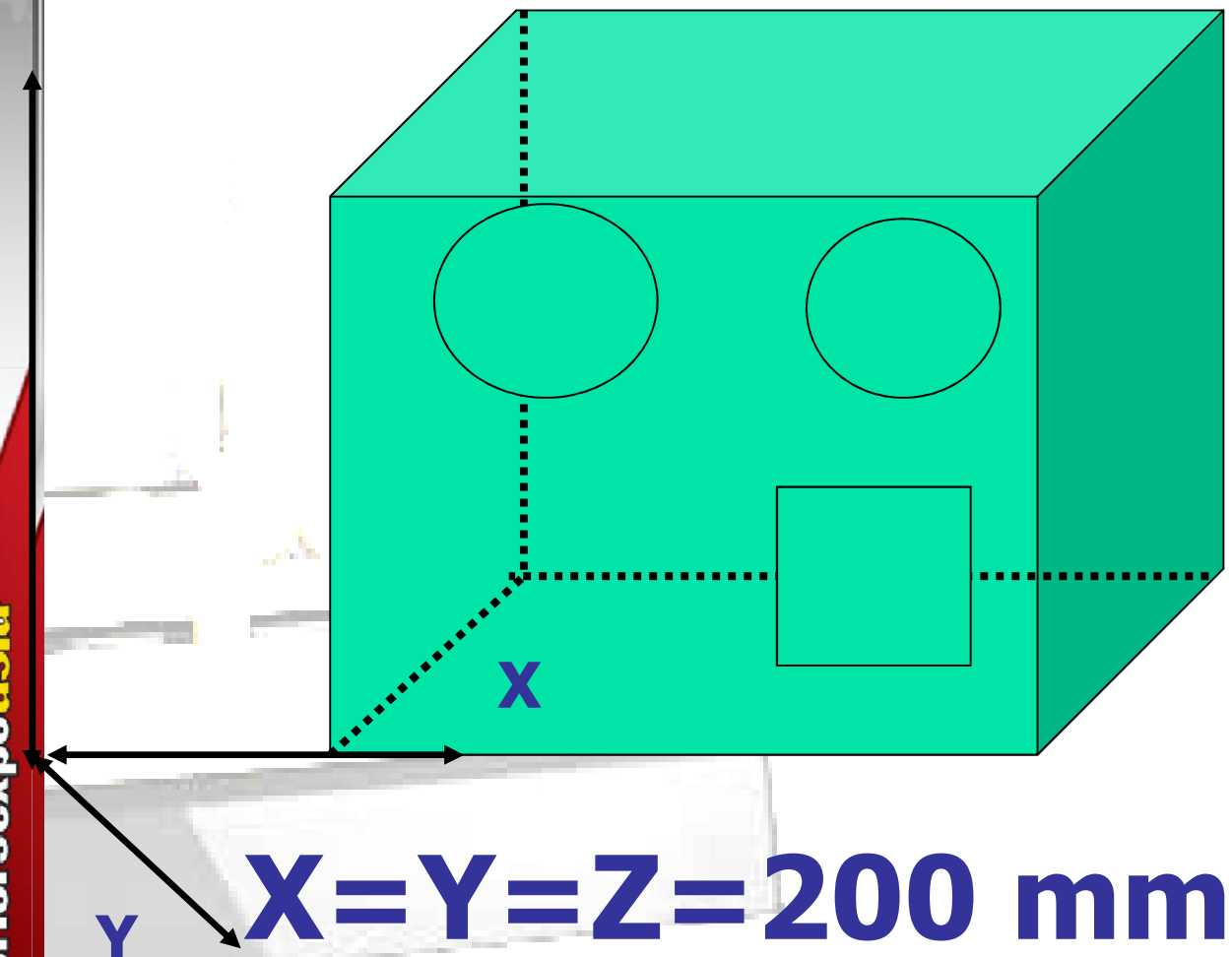
Requirements for non-listed products according to the exposed area and location in the vehicle

Exposed area	Location	Requirement set in Table 7
> 0,20 m²	interior	R1
> 0,20 m²	exterior	R6
≤ 0,20 m²	interior	R23
≤ 0,20 m²	exterior	R24

Grouping rule ex Interior "non-listed products"

- Non-listed products shall be considered as grouped when
  - their horizontal distance from each other is less than 20 mm and
  - their vertical distance from each other is less than 200 mm.
  - the products are within a cubic space of side 200 mm.

Grouping rule
ex Interior "non-listed products"

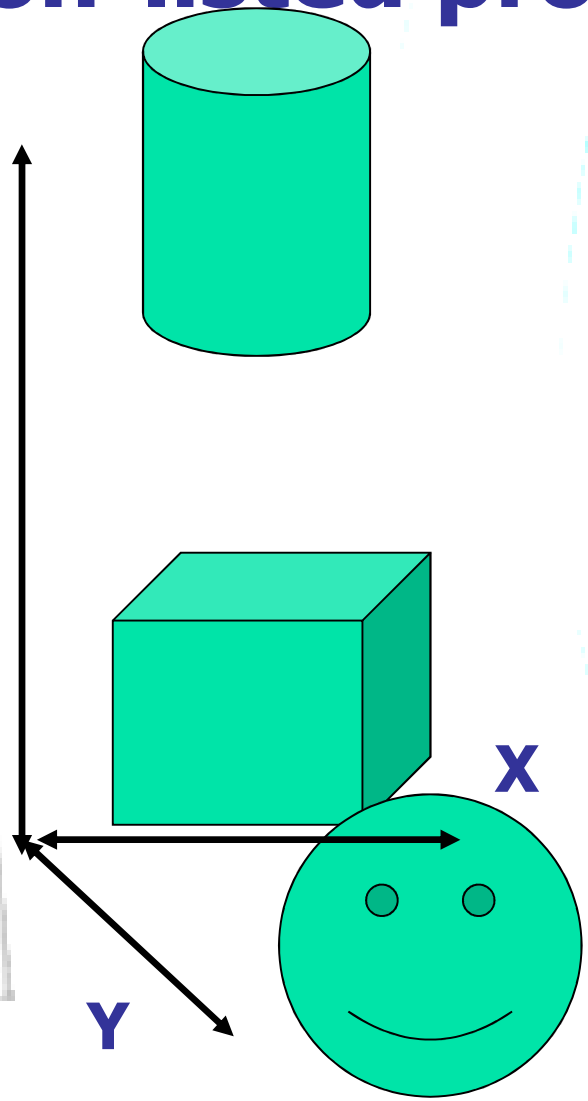


X=Y=Z=200 mm

Grouping rule ex Interior "non-listed products"

X & Y < 20mm

Z < 200 m



"Requirement free" cases

- It is permitted to have up to 100 g of products with no requirements for each group.
- It is permitted to have up to 500 g of products that are compliant at least to the requirement R25 (LOI measurment) for each group.

Excluded from grouping rule

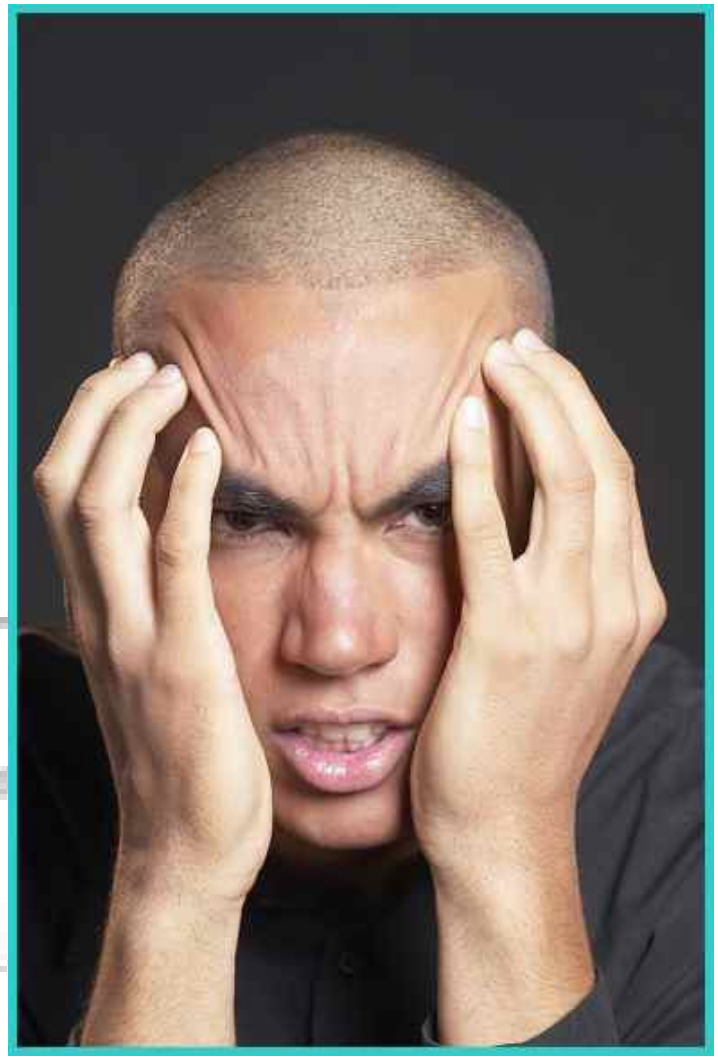
- no requirements apply to non-listed products with a mass of **< 10 g not in touching** contact with another non-listed product with a mass < 10 g;
- non-listed products with a total exposed area **of ≤ 0,20 m² shall be considered compliant** if they are **within the mass limits** as stated below when grouped together;
- non-listed products fully separated by a product compliant with the fire resistancy requirement (ex E15 I15) shall not be considered as grouped.

Summary

- Introduction
- TS 45 545-1
- TS 45 545-2
- New parameters
  - FI
  - R
  - ST
- Bold ideas
  - Key drivers
  - Grouping rules
  - Assemblies
- Impacts on material / assemblies design
- Conclusion

Feel free to visit us in the hall 5, at the stand 4040 .... to discover our latest releases.

Assemblies



Assemblies

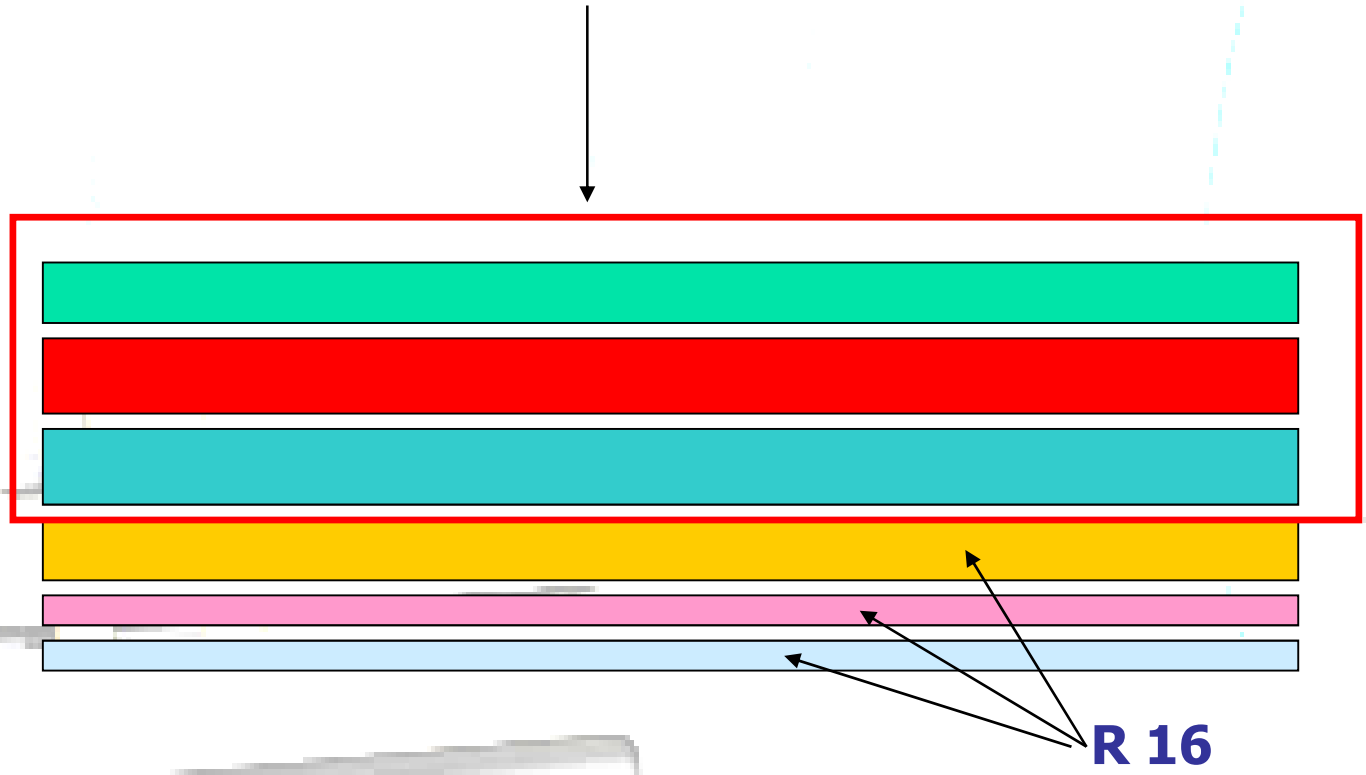
- Unit or structure composed of a combination of materials or products or both.
- **These shall be tested at their full thickness**. If the full thickness is greater than the maximum thickness that can be tested in the applicable standard, **then the thickness shall be reduced by cutting away the excess part from the rear face** of the sample that is from the face that is not exposed to the ignition source.
  - ISO 5659-2: **25 mm**
- The exposed surface of the test specimen shall be the same as in the end use condition.

Assemblies

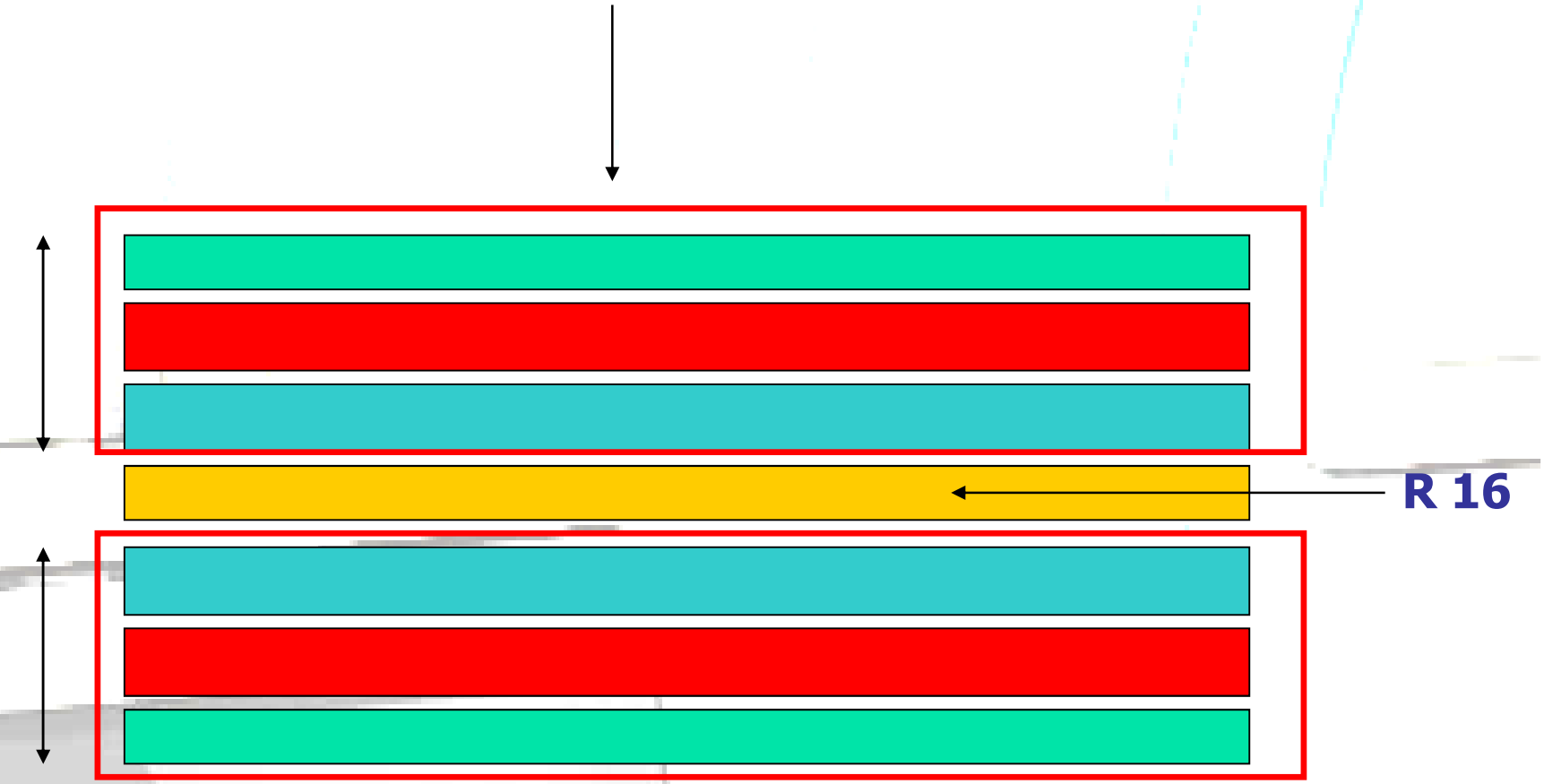
- Any material which is part of an assembly, but does not form part of all fire test pieces, shall be separately tested to the requirement set, R16.

- If there is an air gap, surfaces facing the air gap shall be tested to the requirement set, R16.

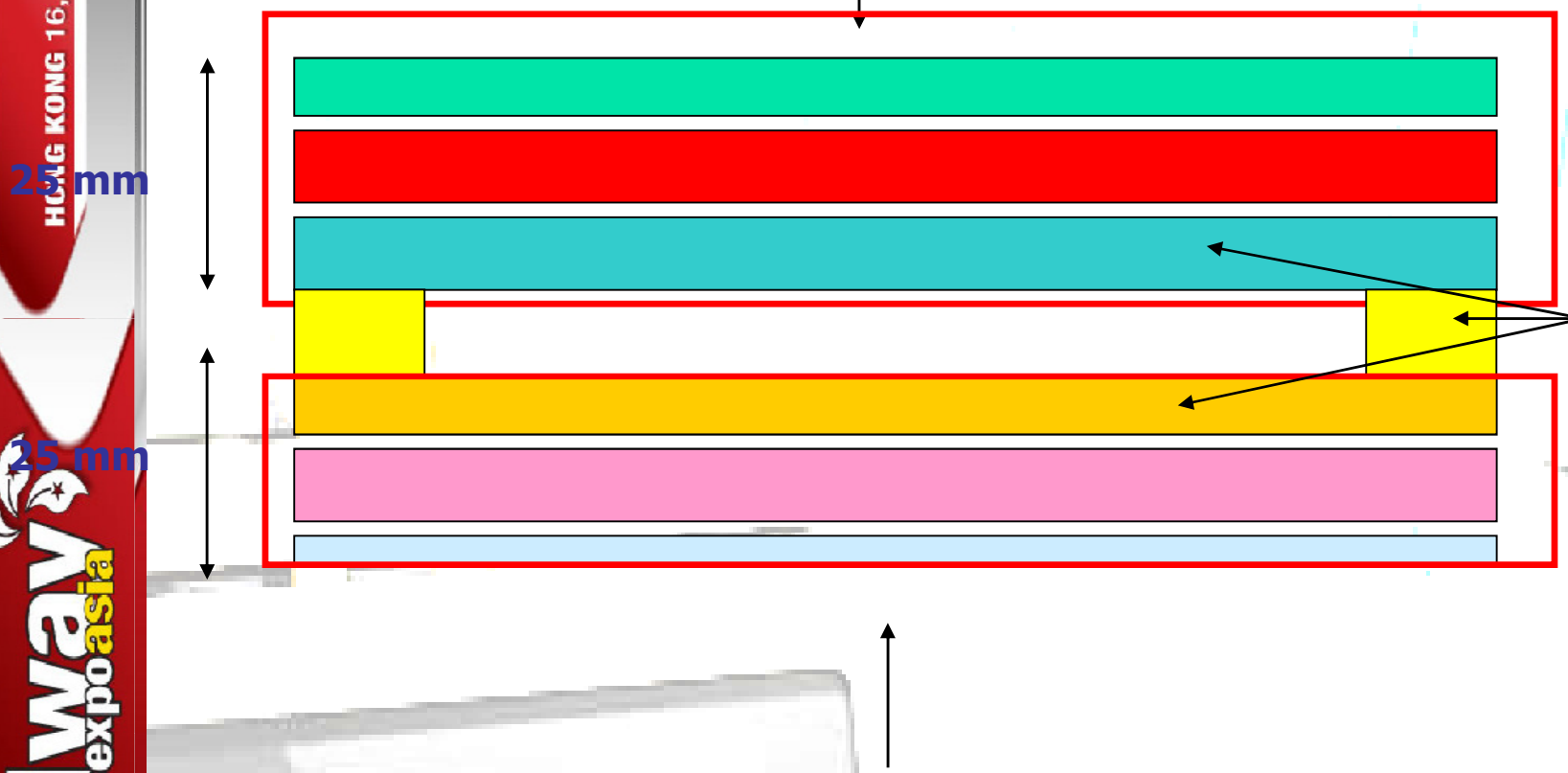
Case studies



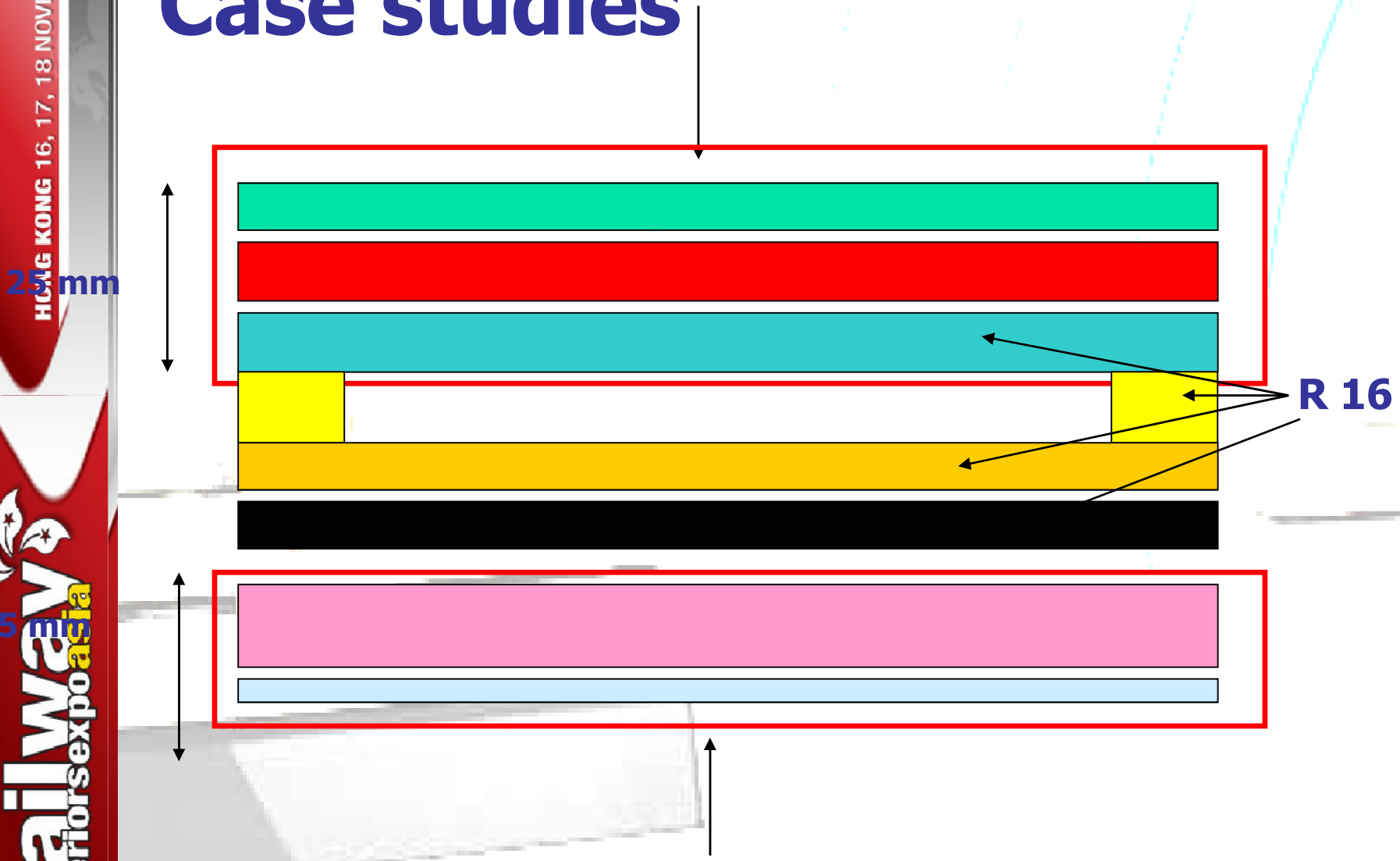
Case studies



Case studies



Case studies



Case study

Product No	Name	Description	Require-ment	Remark
IN	Interiors			
IN1	Interior components – horizontal downward facing surface; horizontal upwards facing; surfaces within cavities, walls – vertical surfaces	Interior components (structure and coverings) such as ceiling panelling as also flaps, boxes, hoods, louvers, insulation material and the body shell in this area. Interior components (structure and covering) such as side walls, front walls / end-walls, partitions, room dividers, as also flaps, boxes, hoods, louvers, in this area, interior doors, interior lining of the front-/end-wall doors and external doors, luggage compartment, windows (plastics, glazing with foils) also body shell in this area; kitchen interiors surfaces (except those of kitchen equipment)	R1	

Then fit with requirements

Short name of requirement set (used for)	Test method reference	Parameter Unit	Requirement Definition	HL1	HL2	HL3
R1 (IN1; IN 4; IN 5; IN6A; IN7; IN8; IN10B; IN12; IN13; IN15; F7B; E3; E2A 5.4.1; 6.3.4	T02 ISO 5658-2	CFE kWm^{-2}	Minimum	20 [a]	20 [a]	20 [a]
	T03.01 ISO 5660-1: 50 kWm^{-2}	MARHE kWm^{-2}	Maximum	[a] -	90	60
	T10.01 EN ISO 5659-2: 50 kWm^{-2}	$D_s(4)$ dimensionless	Maximum	600	300	150
	T10.02 EN ISO 5659-2: 50 kWm^{-2}	VOF4 min	Maximum	1200	600	300
	T11.01 EN ISO 5659-2: 50 kWm^{-2}	CIT_G dimensionless	Maximum	1,2	0,9	0,75

[a] If flaming droplets/particles are reported according 6.3.6 during the test ISO 5658-2, or for the special case of materials which do not ignite in ISO 5658-2 and are additionally reported as unclassifiable, the following additional tests shall be added:

— MARHE value for HL1,2,3 is 90 kw/m^2;

— test according test method EN 11925-2 with the request 30 s flame application no spread > than 150 mm within 60 s and shall not have burning droplets/particles.

Part 2 Requirements for fire behaviour of materials

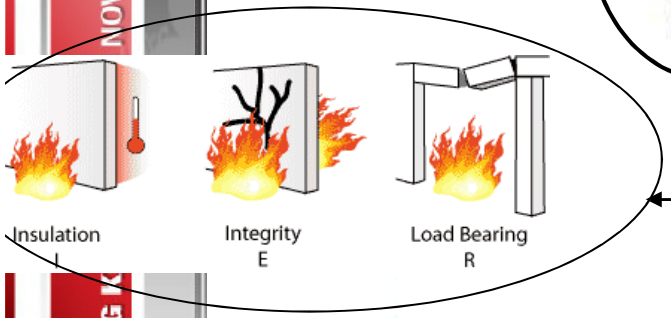
- Deployment by january 2009
  - Experimental standards
- 3 years of co existence with the national regulations
  - UK
  - FR
  - Ger
  - Pd
- Then should be adopted after adjustments by 2012…

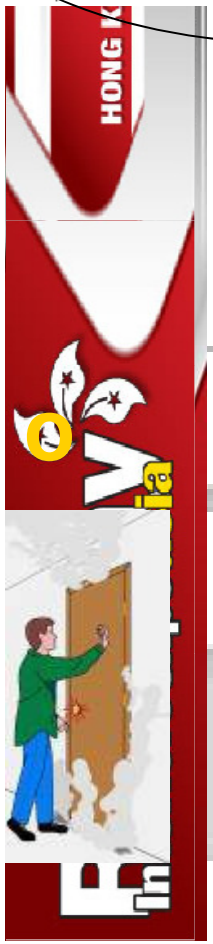
Summary

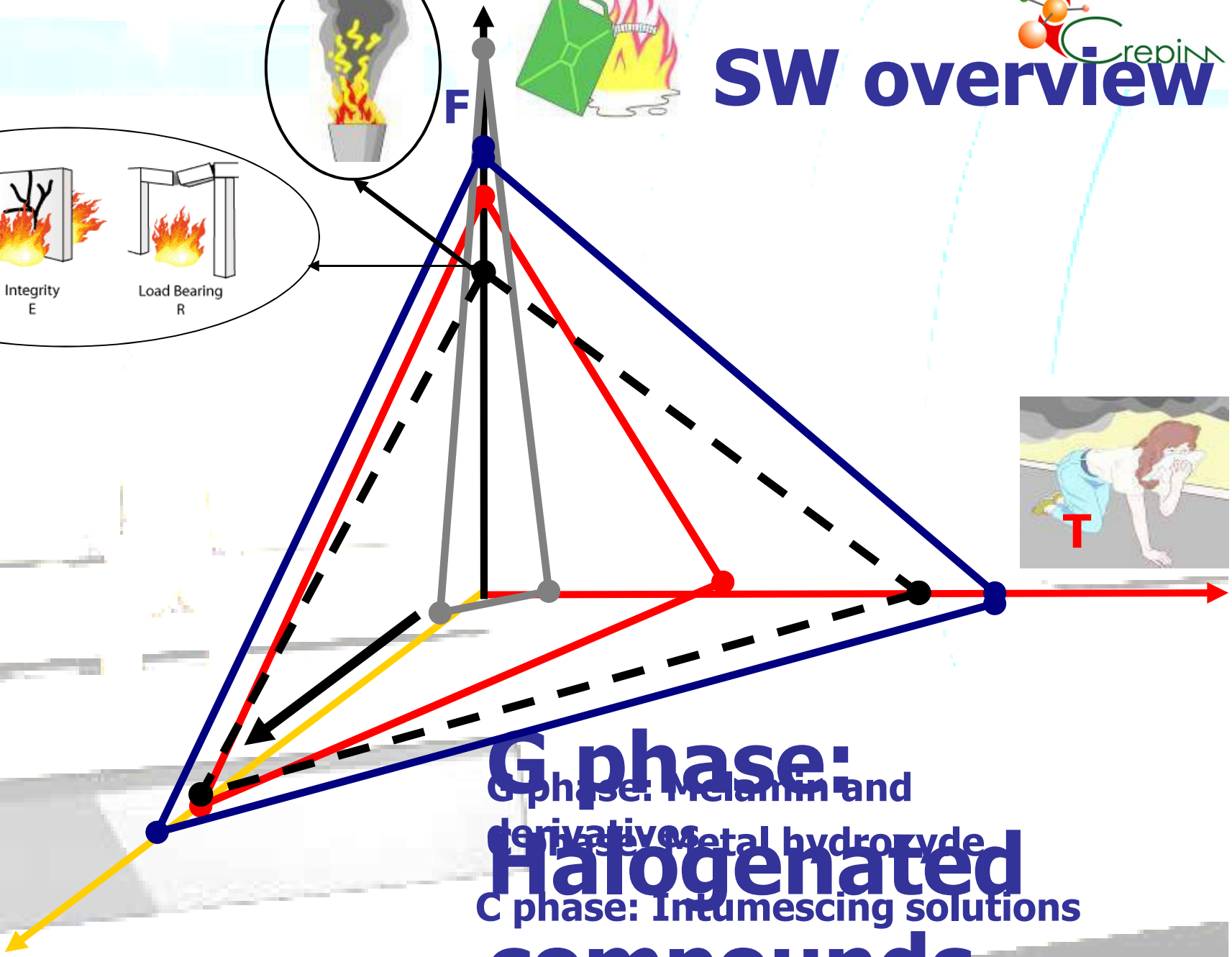
- Introduction
- TS 45 545-1
- TS 45 545-2
- New parameters
  - FI
  - R
  - ST
- Bold ideas
  - Key drivers
  - Grouping rules
  - Assemblies
- Impacts on material / assemblies design
- Conclusion

Feel free to visit us in the hall 5, at the stand 4040 .... to discover our latest releases.

SW overview







G phase: Halogenated compounds

G phase: Melamin and derivatives

G phase: Metal hydroxyde

C phase: Intumescing solutions

Strengths and weaknesses

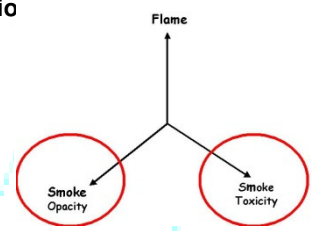
Polyphosphate - intumescing	Double action : **fire retardancy & fire resistancy** Compounds – all in- easy to process available	**Highly ionic– compounding science** **Complex interaction – timing of events** **Thermal inertia**
Organic Phosphorous	Easy incorporation and processing Relatively little detrimental effect on physical properties Good UV stability	**Lack of permanency** and hygroscopic of inorganic for textile applications
Red phosphorous	Effective at low concentration Relatively little detrimental effect on physical properties Good UV stability	Red colour Handling conditions during processing have to be closely monitored

Impact on the material design

Breakthrough needed:

- **Smoke density** according to ISO 5659-2 @ 50 kW/m²
- **MAHRE value < 60 and 90 kW/m²** according to ISO 5660
- **Critical heat flux > 20 kW** according to ISO 5658
- **Vandalized seats** that passes the CEN TS 45 545 Annex B requirements **in term of MAHRE value < 75, 50 or 20 kW/m²**

FI R ST



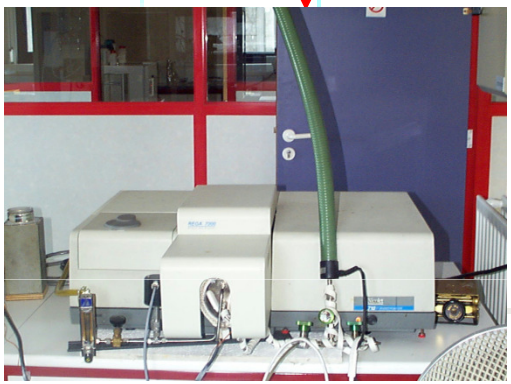
TS 45 545 Annex C :

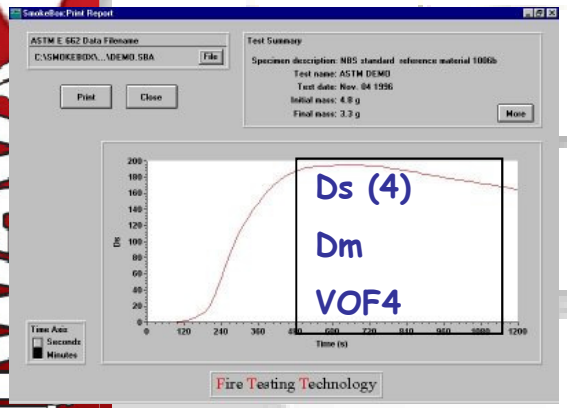
4 and 8 min sampling of gas

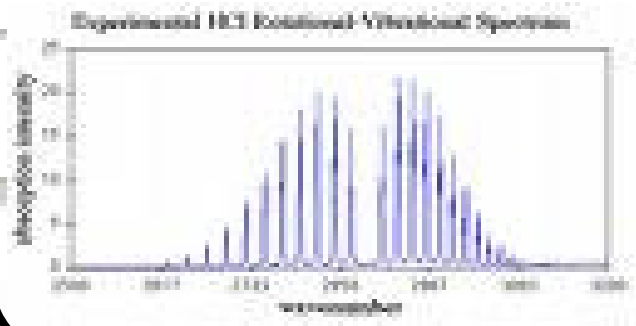
Heated sampling line

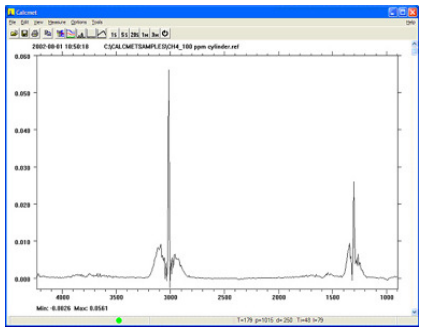
25 kw m² with pilot flames

50 kW m² without pilot fames



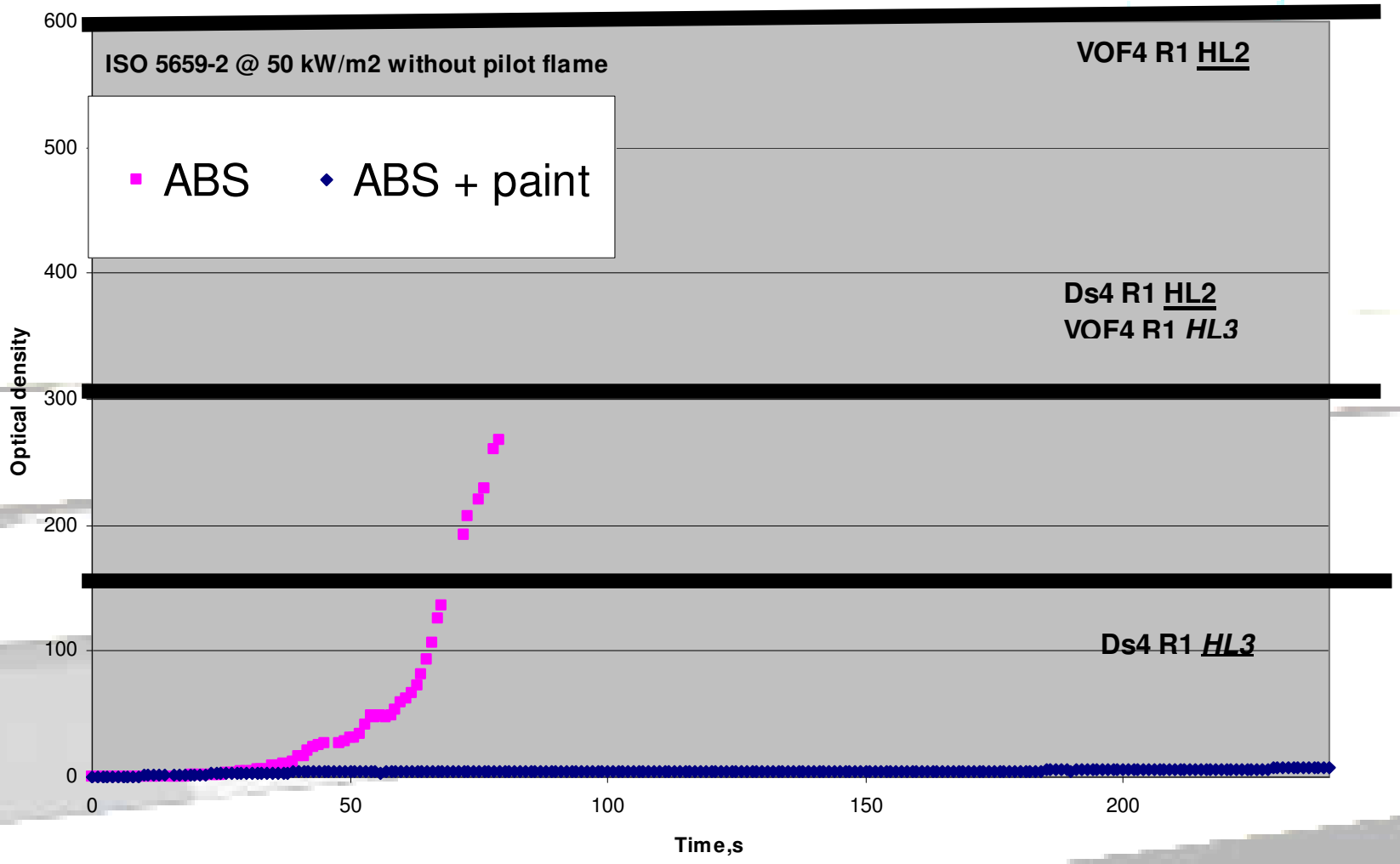




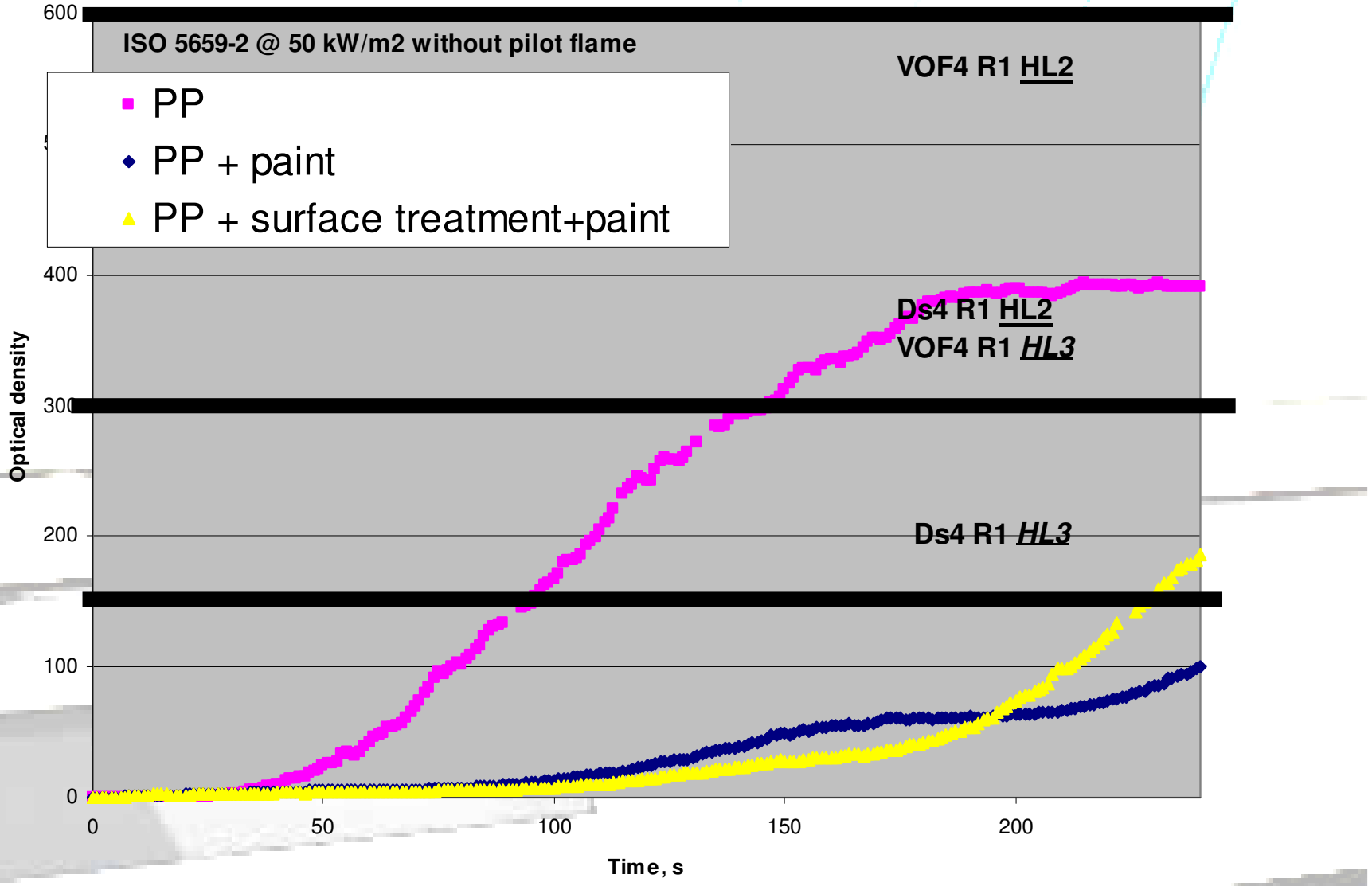


CTI based on CO, CO_2, NOx, HCN, HCl, HBr, HF, SO_2

ABS case study



PP case study



Fire is a surface phenomenon

- concentration of the FR additive @ the surface
  - Surface treatment
  - Coating, Gel coat
  - Over moulding
  - .....
- Response to lightweight material
- Response to multifunctional approach

HONG KONG 16, 17, 18 NOVEMBER 2010

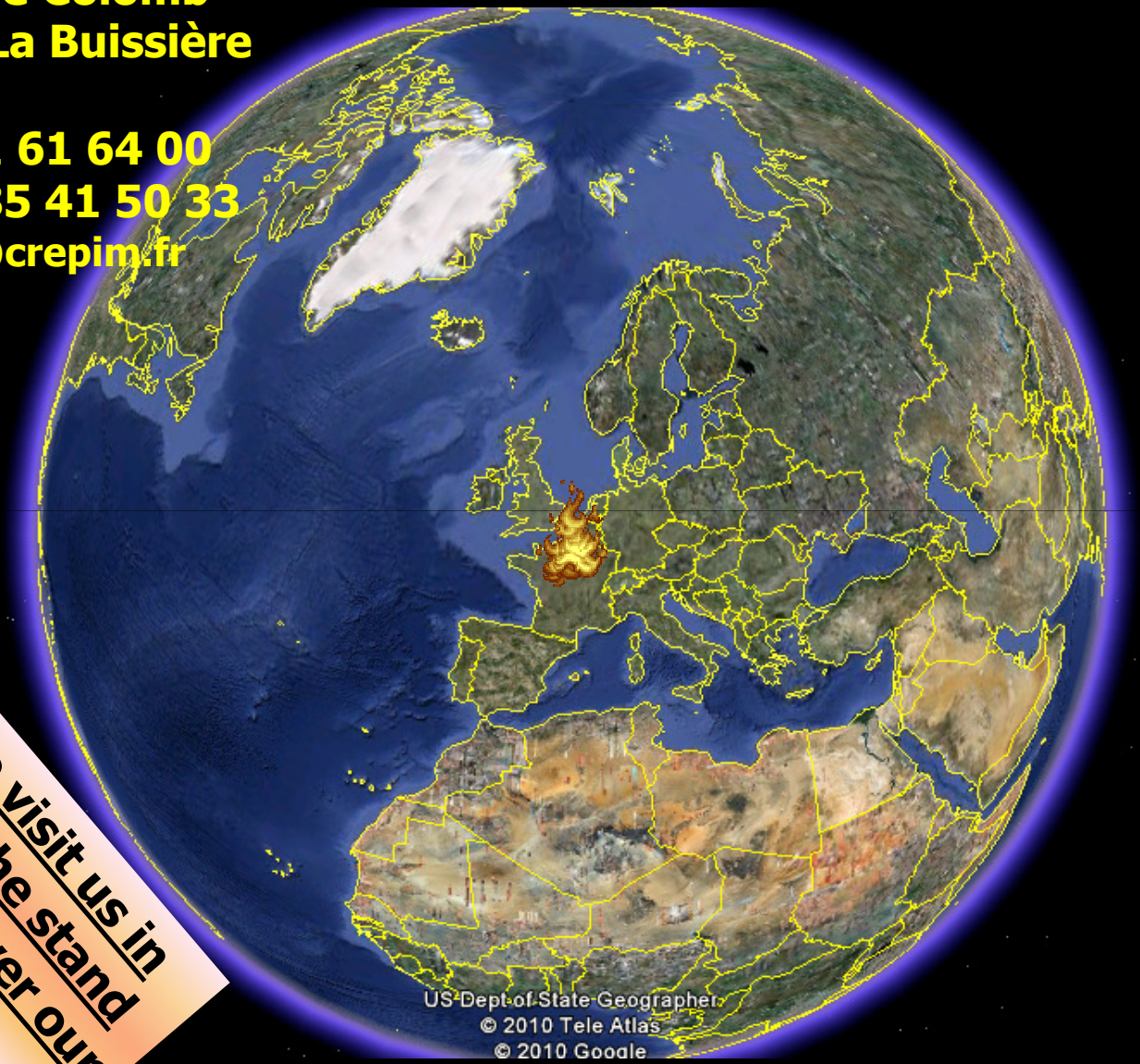
Railway Interiorsexpo asia

www.crepim.com

HONG KONG 16, 17, 18 NOVEMBER 2010

Railway interiorsexpo asia

CREPIM
Parc de la Porte Nord
Rue Christophe Colomb
62700 Bruay La Buissière
FRANCE
Tel 00 33 3 21 61 64 00
Mob 00 33 6 85 41 50 33
Franck.poutch@crepim.fr



Feel free to visit us in the hall 5, at the stand 4040 .... to discover our latest releases.

HONG KONG 16, 17, 18 NOVEMBER 2010

Questions?

Feel free to visit us in the hall 5, at the stand 4040 ….. to discover our latest releases.