

Authors: R. DENOYELLE, JF.KREMER, D. LUNARDELLI

Business #: DP3722-3723

Customer: Laboratories

EUROCOMPARISON 2020 PLAN

INTERLABORATORY COMPARISON ON RAILWAY FIRE BEHAVIOUR TESTS

Critical Flux at Extinguishment: **CFE**, according to ISO 5658-2,

Critical Heat Flux at Extinguishment: **CHF**, according to EN ISO 9239-1,

Maximum average rate of heat emission: **MARHE**, according to ISO 5660-1,

Specific optical density of smoke at 4 min: **Ds4**, according to EN ISO 5659-2,

Cumulative value of specific optical densities in the first 4 minutes: **VOF4**, according to EN ISO 5659-2,

Conventional Index of Toxicity at 4 and 8 min: **CIT_G**, according to EN 45545-2 Annex C (Method 1),

Conventional Index of Toxicity: **CIT_{NIP}**, according to EN 45545-2 Annex C (Method 2),

Oxygen Index: **OI**, according to EN ISO 4589-2,

Glow wire according to EN 60695-2-11, NF F 16-101 and STM S001,

Cumulative value of specific optical densities in the first 4 minutes: **VOF4**, according to NF X 10-702 (1 to 5), NF F 16-101 and STM S001,

Maximum specific optical density of smoke: **Dm**, according to NF X 10-702 (1 to 5), NF F 16-101 and STM S001,

Maximum flame spread and flaming droplets, according to EN ISO 11925-2,

Seats: Maximum average rate of heat emission: **MARHE** and **maximum RHR**, according to ISO/TR 9705-2,

Cables: **Height of charred zone front side and backside**, according to EN 60332-3-24.

List of successive versions:

Version	Date	Changes
1	03/10/2019	First issue

Table of content

1.	SCOPE	3
2.	NORMATIVE REFERENCES	3
3.	PEOPLE OF CERTIFER INTERVENING IN THE EUROCOMPARISON	4
4.	NATURE OF THE EUROCOMPARISON	4
5.	CRITERIONS TO BE SATISFIED TO PARTICIPATE	5
6.	ATTENDEES	5
7.	TEST SAMPLES.....	5
8.	COMMUNICATION OF RESULTS.....	6
9.	STATISTICAL ANALYSIS	6
10.	EVALUATION OF PERFORMANCES.....	7
11.	DEVIATION SHEET	7
12.	COMMUNICATION OF THE RESULTS TO THE LABORATORIES.....	8
13.	ROUND ROBIN CALENDAR	8

1. Scope

This document plans a round robin exercise in the field of fire behaviour tests, listed in EN 45545-2 and NF F16-101 (STM S001), on products used by railway industry.

Participation to this comparison contributes to satisfy the § 7.2.2.1.e et 7.7.2.b of the standard EN ISO/CEI 17025 “General requirements for the competence of testing and calibration laboratories”.

2. Normative references

For undated references, the latest edition of the publication referred applies.

- EN ISO/CEI 17025 “General requirements for the competence of testing and calibration laboratories”,
- NF F16-101: Rolling stock - Fire behaviour- Materials choosing,
- STM S001: Railway rolling stock - Fire behaviour - Materials choosing
- EN 45545-2 “Railway application – Fire protection on railway vehicles – Part 2: Requirements for fire behaviour of materials and components”,
- ISO 5658-2 “Reaction to fire tests – Spread of flame Part 2 Lateral spread on building products in vertical configuration”, 2006,
- EN ISO 5659-2 “Plastics – Smoke generation Part 2 : Determination of optical density by a single chamber test”,
- ISO 5660-1 “Fire test – Reaction to fire Part1 Rate of heat release (Cone calorimeter method)”,
- EN ISO 4589-2 “Plastics Determination of burning behaviour by oxygen index – Part 2 : Ambient temperature test”,
- ISO 5725 “Application of statistics - Accuracy (trueness and precision) of measurement methods and results”- parts 1 to 6,
- EN ISO 9239-1, Reaction to fire tests for floorings — Part 1: Determination of the burning behaviour using a radiant heat source,
- EN 60695-2-11 Fire hazard testing- Part2-11 : Glowing/hot-wire based tests methods Glow wire flammability test method for end products,
- NF X 70-100-1 Fire tests — Analysis of gaseous effluents — Part 1: methods for analysing gases stemming from thermal degradation,
- NF X 70-100-2 Fire tests — Analysis of gaseous effluents — Part 2: tubular furnace thermal degradation method,
- NF X 10-702-1 Fire test methods - Determination of the smoke opacity in not renewed atmosphere – Part 1: description of the apparatus and the method of check and regulation of the apparatus,
- NX 10-702-2 Fire test methods - Determination of the smoke opacity in not renewed atmosphere – Part 2: Test method applicable to materials not covered by the parts 3, 4 and 5 and the following ones,

- X 10-702-3 Fire test methods - Determination of the smoke opacity in not renewed atmosphere – Part 3: Test method for materials used in the upholstery furniture,
- X 10-702-4 Fire test methods - Determination of the smoke opacity in not renewed atmosphere – Part 4: Test method for used materials as covers of wall,
- X 10-702-5 Fire test methods - Determination of the smoke opacity in not renewed atmosphere – Part 5: Test method for materials used in the constituent panels(signs) of walls or partitions of arrangement,
- ISO 5725 Application of statistics - Accuracy (trueness and precision) of measurement methods and results”- parts 1 to 6,
- EN ISO 11925-2, Reaction to fire tests — Ignitability of products subjected to direct impingement of flame —Part 2: Single-flame source test,
- ISO/TR 9705-2 Reaction-to-fire tests — Full-scale room tests for surface products — Part 2: Technical background and guidance ISO 11054, Cutting tools — Designation of high-speed steel groups,
- EN 60332-3-24 Tests on electric and optical fibre cables under fire conditions — Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables — Category C,

3. People of CERTIFER intervening in the Eurocomparison

Laboratories’ contact

- Jean-François Kremer

Assessment Leader:

- Daniel Lunardelli

Assessors:

- Yohan Pion
- To be defined

Statistical analysis:

- Daniel Lunardelli (preparation)
- Rudy Denoyelle (validation)

4. Nature of the Eurocomparison

The inter-laboratory Eurocomparison includes the above tests for the determination of:

- Critical Flux at Extinguishment (CFE) according to ISO 5658-2,
- Critical Heat Flux at Extinguishment (CHF) according to EN ISO 9239-1,
- Maximum average rate of heat emission (MARHE) according to ISO 5660-1,
Heat flux 50 kW/m². The data collection interval will be 2s and data collection will be terminated at 20 minutes

Note: The Laboratories must strictly comply with paragraph 7.5 of the standard concerning possible intumescence or deform of specimens.

- Specific optical density of smoke at 4 min D_s (4) according to EN ISO 5659-2,

Heat flux 50 kW/m2 without pilot flame

- Cumulative value of specific optical densities in the first 4 minutes of the test (VOF4) according to EN ISO 5659-2,

Heat flux 50 kW/m2 without pilot flame

- Conventional Index of Toxicity at 4 and 8 min (CIT_G) according to EN 45545-2 Annex C: Method 1,

Heat flux 50 kW/m2 without pilot flame

- Conventional Index of Toxicity (CIT_{NIP}) according to EN 45545-2 Annex C: method 2,
- Oxygen Index (OI) according to EN ISO 4589-2: **Specimen type will be precise later**
- Ignition temperature according to EN 60695-2-11
In the framework of this round robin exercise, laboratories shouldn't stop the determination of ignition temperature, even if the result seems to be out of the EN 45545-2 requirements (850°C).
- Cumulative value of specific optical densities in the first 4 minutes: VOF4, according to NFX 10-702 (1 to 5), NF F 16-101 and STM S001,
- Maximum specific optical density of smoke: Dm, according to NF X 10-702 (1 to 5), NF F 16-101 and STM S001,
- Maximum average rate of heat emission (MARHE) and maximum RHR on seat according to ISO/TR 9705-2: Real seat base and back placed on a metallic chair will be used
- Height of charred zone front side and backside to EN 60332-3-24.
- Maximum flame spread and flaming droplets, according EN ISO 11925-2,

5. Criteria to be satisfied to participate

Any laboratory can participate, after sending an order accepted by CERTIFER.

6. Attendees

They will be known later, after the receipt of orders.

Each laboratory will be assigned an identification letter by CERTIFER, to ensure confidentiality during the inter-laboratory comparison.

7. Test samples

For the inter-laboratory comparison tests, the tested material will be issued from the railways industry. It will be confidentially chosen by CERTIFER.

Each laboratory will receive:

- **EN ISO 4589-2**
 - 1 sample of size 210mm x 290 mm
- **EN 60695-2-11**
 - 1 sample of size 210mm x 290 mm
- **EN ISO 9239-1**
 - 3 samples of size 230 mm x 1050 mm
- **ISO 5658-2**
 - 6 samples of size 155 mm x 800 mm

- **ISO 5660-1**
 - 6 samples of 100 mm x 100 mm
- **EN ISO 5659-2 + CIT_G EN 45545-2 Annex C method 1**
 - 1 sample of size 210mm x 290 mm
- **EN 45545-2 Annex C: method 2 (CIT_{NIP}) and NF X 10-702 Part 1 to 5**
 - 1 sample of size 210mm x 290 mm
- **NF X 10-702 (1 to 5) VOF4 and Dm**
 - 1 sample of size 210x 290mm
- **EN ISO 11925-2**
 - 6 sample of size 250mm x 90 mm
- **ISO/TR 9705-2**
 - 3 base and back seats
- **EN 60332-3-24**
 - Sufficient length of cables for 3 tests

On each package, the following references will be indicated: « CERTIFER ».

The samples will be sent only once, to each laboratory involved in the inter-laboratory comparison. Each laboratory has to confirm their reception to CERTIFER.

8. Communication of results

The laboratories will address the results to CERTIFER:

- in the particular Excel file (supplied by CERTIFER), by e-mail,
- **and** 'usual commercial' test reports by post, or PDF file by email, before the date indicated in the clause § 13.

The presentation of information and laboratories' results will be complying with the appendix 1 and 2 of the present document (The Excel file will be addressed by CERTIFER to each registered laboratory, at the same time as the shipment of samples).

Before addressing the compilation to the person in charge of statistical analysis, CERTIFER will check that except the identification letter of the laboratory, the results won't precise any mention of the identity of the laboratory (initial letter, name of persons, language used...).

9. Statistical Analysis

The results obtained by the different laboratories will be assembled and treated on the following way:

- Determination of average and standard deviation for the different laboratories, the repeatability and reproducibility,
- 2σ preliminary test: each *extreme value must be included in less than 2 Standard deviations (2σ) above or below the average of other laboratories (the Standard deviation is determined without the extreme values), if not the value is excluded,*
- Search of aberrant value according to ISO 5725 with Mandel test during the first determination,
- Determination of the repeatability and reproducibility values without aberrant value.

Note1:

The statistic analysis will be conducted also without 2σ preliminary test and presented as additional information in the Eurocomparison report.

Note 2:

For the toxicity test method EN 45545-2 Annex C, method 1, when a gas is present in small quantity the following method will be applicable:

Laboratories founding 0 (Not detected or value less than or equal to their own laboratory's LOD) have to indicate 0.

Laboratories founding a value greater than their own laboratory's LOD and less than their own laboratory's LOQ have to indicate the value with an asterisk.

The statistical analysis will be not conduct if the average of the values found by laboratories is lower than standard's LOD (see above) as statistic analysis are not reliable in this case.

In this case, if a laboratory found a value higher than standard's LOD (and higher than their own LOQ), a deviation will be sent only in case of *2σ exclusion*.

EN 45545-2 Annex C Method 1									
	CO2	CO	HF	HCl	HBr	SO ₂	HCN	NO	NO ₂
LOD 25kW/m² (mg/m³)	483	15	11	20	44	35	15	16	25
LOD 50kW/m² (mg/m³)	455	14	10	19	42	33	14	16	33

10. Evaluation of performances

Any value positive in 2σ preliminary test, or aberrant value detected in inter-laboratory variability for the tests will lead to a deviation sheet. All the suspect values detected in inter-laboratory variability, and all the suspect or aberrant values detected in intra-laboratory variability will be signalled but will not lead to a deviation sheet.

Deviations against standardised methods or against common sense (examples: no carbon monoxide detected, or 0mg/0mg/4500mg...), when evident in results, will lead to deviation sheets too.

11. Deviation sheet

The deviation sheet will be established according to the CERTIFER form N°61101.

The laboratory will return to CERTIFER the deviation sheet completed. It must especially communicate a detailed description of the identified causes of the deviation, **the corrective action engaged** and the results of the possible new test.

The answer of the laboratory will be examined by the assessment team and the deviation sheet closed if the answer is judged correct. Every unclosed deviation sheets at the limit

date will be noted in the Eurocomparison report and the corresponding laboratories won't be recorded in the list of fire laboratories approved by CERTIFER .

12. Communication of the results to the laboratories

After reception of deviation sheets' answers, Certifer will communicate to each laboratory the draft of Eurocomparison report including:

- The results of all laboratories designed by their identifying,
- The details of the statistical analysis with and without 2σ preliminary test

Results will be presented and commented during a final meeting in Levallois.

13. Round Robin Calendar

Action	deadline
Reception of laboratories registrations (<u>or intentions</u>) by CERTIFER	07 December 2019
Shipment of samples to the laboratories	30 MARCH 2020 <i>or 8 days after late registration</i>
Transmission of laboratories' results to CERTIFER	30 JUNE 2020
Transmission of suspect and aberrant values + deviation sheets to the laboratories	15 SEPTEMBER 2020
Return to CERTIFER of deviation sheets completed by the laboratories	31 OCTOBER 2020
Broadcasting of the draft final report to laboratories	13 NOVEMBER 2020
Final meeting	29 JANVIER 2020