

Assessment of the fire behavior of automotive components

Automotive fire classification for LANXESS Thermoplastics*

EU Directive R 95/28/EC

US-FMVSS 302

Company standards

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1. Introduction

In order to ensure the safety of vehicles in the event of a fire, flammability requirements are imposed on the materials and components that are used in the vehicles. This will enable occupants to leave the vehicle in the event of an initial fire and/or to at least delay the spread of fire in the event of smaller primary ignition sources.

The requirement for a limited horizontal burning rate is imposed on all the interior fitting materials used in

the passenger compartments of vehicles and buses on a worldwide basis.

Within the European Community, motor coaches holding more than 22 occupants (vehicle class M3) are subject to additional requirements on the melting behavior of materials used for roof liners and adjacent materials, as well as on the vertical burning rate of curtains, blinds and other draped materials.

Safety glazing and windshield materials for vehicles and vehicle trailers must be assessed in accordance with the requirements of Directive 92/22/EEC.

Directive 2000/8/EC additionally stipulates requirements on the plastic fuel tanks fitted in vehicles.

2. Test methods, standards, regulations

Directive 95/28/EC (Official Journal EC No. L 281) supplements and replaces national regulations and legislation within the European Community.

Directive 95/28/EC also contains the method that is applied internationally for determining the horizontal burning rate of components to be used in vehicle interiors. Deviations occur in the different national requirements as a result of rounding errors in relation to the American system of units, but these are not significant.

Directive 95/28/EC, which comprises a total of 6 Annexes, describes tests for determining burning behavior in Annexes IV, V and VI.



- Annex IV: Test to determine the horizontal burning rate of materials, comparable with
 - FMVSS 302
USA Federal Register §571.302;
Federal Motor Vehicle Safety Standard
 - U.T.A.C. 18-502 T1
France
 - ISO 3795
International
(description of the test method, no limits specified)
 - DIN 75200
Germany
(description of the test method, no limits specified)
 - Manufacturers' Works Standards (e.g.)
BMW: GS 97038; DaimlerChrysler: DBL 5307;
Ford: FLTM-BN 24-2;
General Motors: GM 6090 M;
Mazda MES DF 050D;
Mitsubishi: ES-X60410; Porsche: PTL 8501;
Renault: D45 1333; Volvo: STD 5031,1;
VW: TL 1010

- Annex V: Test to determine the melting behavior of materials, comparable with
 - NF P92-505
France
(fire test from the construction sector with alternative radiator intensity)

- Annex VI: Test to determine the vertical burning rate of materials, comparable with
 - EN ISO 6941
International
(description of the test method, no limits specified)

3.1 Determination of the horizontal burning rate (Directive 95/28/EC Annex IV)

Interior fitting materials and components, such as those used for the upholstering of seats and their accessories, for interior trim and for heat and noise insulation, and also light fittings, must meet up to the requirements of this test. At least five samples are to be tested; these must correspond to the finished form in which the material or component will be used. Anisotropic materials are to be assessed in the direction in which the highest burning rate is measured.

The sample dimensions are 356 mm x 100 mm x max. 13 mm. In the case of samples which are more than 60 mm wide, the length can be reduced to 138 mm. Thicker samples must be cut down to 13 mm on the side not facing the occupants. Prior to the test, the samples are to be conditioned for at least 24 h at 23 °C and 50 % relative humidity.

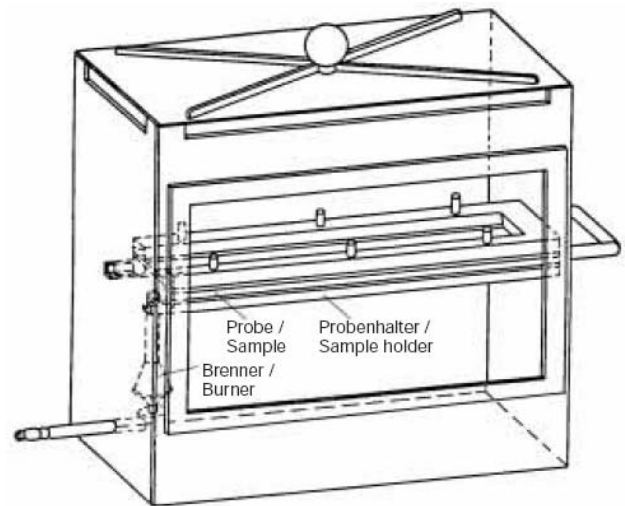


Figure 1 Diagram of the test cabinet burning rate

The sample is marked at a distance of 38 mm and 292 mm from its front edge and pushed horizontally into the combustion chamber in a U-shaped sample holder. A Bunsen burner flame 38 mm long is directed towards the underneath of the sample for 15 s. The distance between the upper edge of the nozzle and the underneath of the sample must be 19 mm. Either the burning time required by the flame between the two markings (burnt distance) is measured, or the time between the flame passing the first mark and the extinction of the sample. If the sample is extinguished before the flame reaches the second mark, the distance that has been burnt must be established.

Burning rate B is calculated by:

$$B = \frac{s}{t} \cdot 60$$

s – „burnt distance [mm]“ as of the 1st mark
t – „burning time [s]“ on the burnt distance



If the samples do not burn any further once the burner has been extinguished or if the flames do not reach the first measuring mark, the burning rate is to be specified as 0 mm/min.

Materials that bend or soften are to be kept in a horizontal position with support wires. ISO 3795 makes provision for support wires to be used as a matter of course.

The requirement for a limited horizontal burning rate is imposed on all interior fitting materials and components used in the passenger compartment of motor vehicles and buses worldwide.

Directive 95/28/EC specifies that, for class-M3 vehicles, the burning rate may not exceed 100 mm/min. The burning rate is not calculated as a criterion if the flames do not reach the last measuring point, or do not reach the end of the sample in the case of shorter samples.

FMVSS 302 and CMVSS 302 specify that the burning rate may not exceed 102 mm/min. This limit also applies if the samples do not burn over the entire marked distance. Samples with a burning time of less than 60 seconds, and a burnt distance of 51 mm or less, similarly fulfill the requirements of this standard irrespective of the burning rate.

The manufacturers' works standards are generally based on the limits contained in the FMVSS 302 Standard.

In the case of plastic-coated safety glass and glass/plastic safety glazing, the burning rate is required to be no more than 250 mm/min, in deviation from the limits for interior fittings as per Directive 92/22/EEC.

3.2 Determination of the melting behavior of materials (Directive 95/28/EC Annex V)

Materials to be used for roof liners and adjacent components must fulfill the requirements placed on the melting behavior. At least four samples are required, taken from the finished products as they will be used and measuring 70 mm x 70 mm x max. 13 mm are to be tested. If the two sides of the sample are different, then both sides are to be tested.

Prior to the test, the samples are to be conditioned for at least 24 h at 23 °C and 50 % relative humidity.

The sample is placed horizontally on a grate beneath the radiator. The radiator is an electric heater located 30 mm above the samples and set to an intensity of 30 kW/m. During the test, the dripping and ignition behavior of the sample and the cotton wool located 300 mm beneath it is observed.

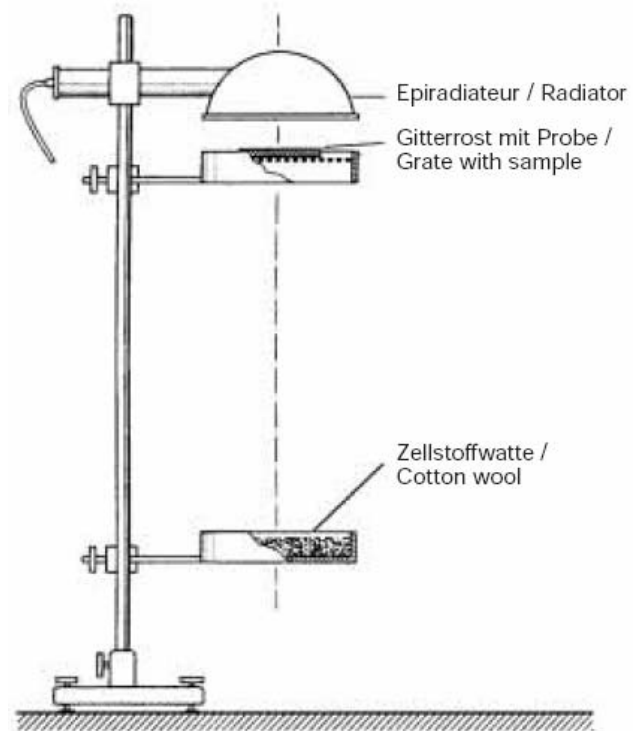


Figure 2 Diagram of Epiradiateur drip test

If the sample ignites during the first five minutes of the test, the radiator is moved away after a period of three seconds until such time as the flame goes out. After the test has been underway for five minutes, or after the flame has extinguished, the thermal stressing is maintained for a further five minutes, irrespective of any ignition.

Within the EU, requirements are imposed on the melting behavior of the roof liner and adjacent materials for Class-M3 vehicles.

The requirements of the test to Annex V are fulfilled if no drops fall in any test which ignite the cotton wool positioned 300 mm beneath the sample.



3.3 Determination of the vertical burning rate (Directive 95/28/EG Annex VI)

Materials for curtains, blinds and other draped materials must comply with the requirements of the test for determining the vertical burning rate. Three samples, or in the case of anisotropic materials, six samples, of dimensions 560 mm x 170 mm are to be tested. Prior to the test, the samples are to be conditioned for at least 24 h at 23 °C and 50 % relative humidity.

A burner flame, 40 mm in length, is directed towards the edge of the sample for five seconds. If no ignition occurs, a further set of samples will have the flame applied to them for 15 seconds. The time from the application of the igniting flame to the severance of the three marker threads is recorded. The highest burning rate is assessed.

Within the EU, requirements are placed on the burning rate for draped materials for Class-M3 vehicles. The requirements of the test as per Annex VI are fulfilled if the vertical burning rate does not exceed 100 mm/min taking the worst result.

4. Fuel tanks

Directive 2000/8/EC and ECE Regulation No. 34 apply in the case of passenger cars with engines driven by liquid fuel. The rulings that they contain cover the technical characteristics of the fuel system and also vehicle approval in respect of the avoidance of fire hazards.

The fire resistance of plastic fuel tanks is proven by testing a tank 50 % filled with fuel in an open flame. The tank is to be fitted into a test frame in a similar way to which it is fitted in a car. The test counts as having been passed if no liquid fuel merges.

5. Vehicle body parts

It must not be possible for a vehicle to be set on fire from the outside through small ignition sources. In Germany, the requirements on body parts in plastic are based on the guidelines issued by the special FKT committee on "Fire Safety".

This requires flat, large-area structural parts to comply with the specifications for Class F1 in the case of closed vehicles and Class F2 for open vehi-

cles when tested to DIN 53438-3. The same requirements apply to plastic glazing.

6. Test conditions

The test results may be conditioned by the sample thickness and the color.

The test methods described make provision for the test to be conducted on samples removed from finished parts. The data in the results table have been obtained primarily from injection molded parts in accordance with the test standards set out. Different burning rates may result in combination with different materials.

When determining the horizontal burning rate, the test setup (use of support wire), which is not governed by uniform rulings, also has a decisive impact on the result. As a general rule, thermoplastics bend downwards when a flame is applied to them, so that support wire will generally be required; support wire is specified in ISO 3795 on principle.

In France, melting behavior is determined on the basis of NF P 92-505 in the case of construction materials; the method is comparable with that used for the automotive sector, although there are differences in respect of the radiator power. For this reason, results that have been achieved on the basis of NF P 92-505 cannot be used for an assessment in accordance with Directive 95/28/EC

7. Classification of LANXESS Thermoplastics

Based on the evaluation of many automotive products it can be assumed that the required burning rate of less than 100 mm/min according to R 95/28/EC, respectively according to FMVSS 302 will not be exceeded by all relevant grades

- Durethan®
- Pocan®

at a test specimens wall thickness > 1 mm.

Ratings for some specific grades are available in the associated product data sheets.



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