

## Assessment of the fire behavior of automotive components

### Automotive fire classification for LANXESS Thermoplastics

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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; Daimler AG: 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 Directive 95/28/EC

#### 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.

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.

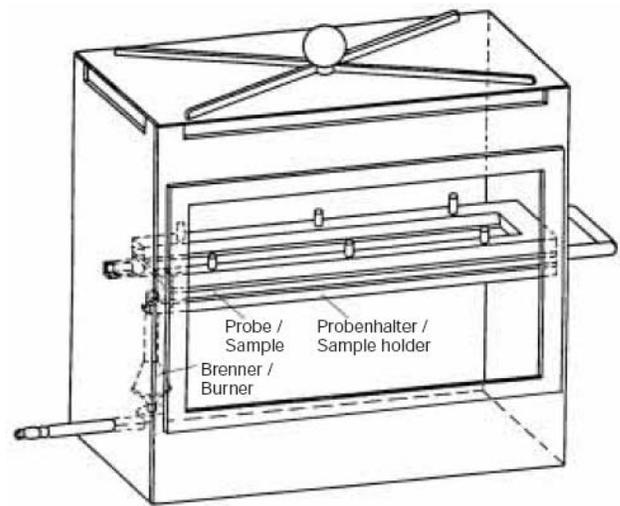


Figure 1 Diagram of the test cabinet burning rate

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.

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.

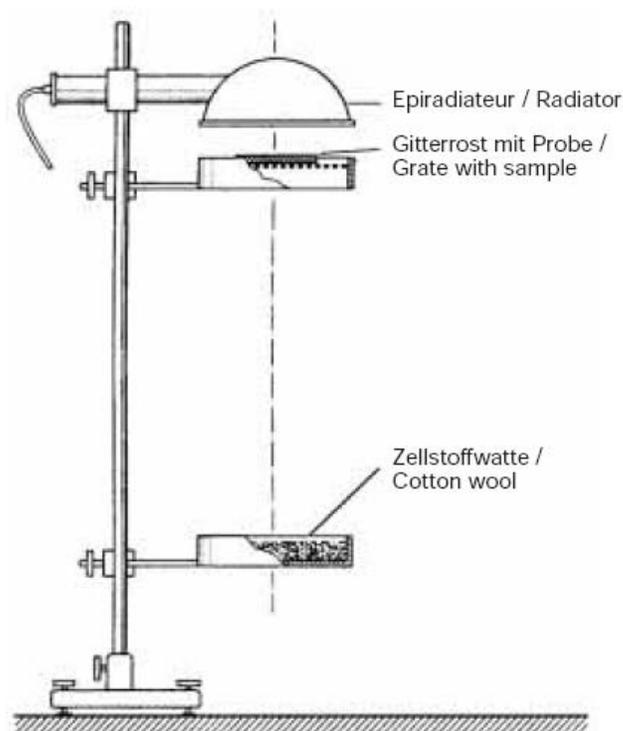


Figure 2 Diagram of Epiradiateur drip test

### 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 vehicles 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 ac-

cordance 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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The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations, are beyond our control. Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee, and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.

#### Developmental Product

Any product designated as a developmental product is not considered part of the LANXESS Corporation line of standard commercial products. Complete commercialization and continued supply are not assured. The purchaser/user agrees that LANXESS Corporation reserves the right to discontinue this product without prior notice.

#### Typical Properties

Property data is provided as general information only. Property values are approximate and are not part of the product specifications.

#### Flammability

Flammability results are based on small-scale laboratory tests for purposes of relative comparison and are not intended to reflect the hazards presented by this or any other material under actual fire conditions.

#### Health and Safety

Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling LANXESS products mentioned in this publication. Before working with these products, you must read and become familiar with the available information on their hazards, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets (MSDS) and product labels. Consult your LANXESS Corporation representative or contact the Product Safety and Regulatory Affairs Department at LANXESS. For materials that are not LANXESS products, appropriate industrial hygiene and other safety precautions recommended by their manufacturer(s) must be followed.

#### Regulatory Compliance

Some of the end uses of the products described in this brochure must comply with applicable regulations, such as the FDA, NSF, USDA and CPSC. If you have any questions on the regulatory status of any LANXESS engineering thermoplastic, consult your LANXESS Corporation representative or contact the LANXESS Regulatory Affairs Manager.

#### Regrind

Where end-use requirements permit, regrind may be used with virgin material in quantities specified in individual product information bulletins, provided that the material is kept free of contamination and is properly dried (see maximum permissible quantities and drying conditions in product information bulletins). Any regrind used must be generated from properly molded/extruded parts, sprues, runners, trimmings and/or film. All regrind used must be clean, uncontaminated, and thoroughly blended with virgin resin prior to drying and processing. Under no circumstances should degraded, discolored, or contaminated material be used for regrind. Materials of this type should be discarded. Improperly mixed and/or dried regrind may diminish the desired properties of a particular LANXESS product. It is critical that you test finished parts produced with any amount of regrind to ensure that your end-use performance requirements are fully met. Regulatory or testing organizations (e.g., UL) may have specific requirements limiting the allowable amount of regrind. Because third party regrind generally does not have a traceable heat history or offer any assurance that proper temperatures, conditions, and/or materials were used in processing, extreme caution must be exercised in buying and using regrind from third parties. The use of regrind material should be avoided entirely in those applications where resin properties equivalent to virgin material are required, including but not limited to color quality, impact strength, resin purity, and/or load-bearing performance.

#### Color and visual effects

Type and quantity of pigments or additives used to obtain certain colors and special visual effects can affect mechanical properties.

#### Note:

The information contained in this publication is current as of February, 2011. Please contact LANXESS Corporation to determine if this publication has been revised.