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British Standard Automobile Series : Method for

Determination of the windscreen fogging characteristics of organic trim materials in motor vehicles

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Méthode de la détermination de la tendance à voiler le pare-brise des matériaux
de garniture organiques dans les automobiles

Verfahren zur Bestimmung der Verschleierungseigenschaften von organischen
Zierstoffen bei Windschutzscheiben in Kraftfahrzeugen

Foreword

This British Standard has been prepared under the direction of the Plastics Standards Committee and the Rubber Standards Committee after consultation with the Automobile Standards Committee. The method measures the intensity of windscreen fogging which arises from the volatilization of ingredients of organic composite materials and their subsequent condensation and deposition on the inner side of motor-car glass windscreens. Such deposits reduce visibility and, in certain circumstances, can constitute a hazard to road safety.

This standard provides a quality control method for comparing the intensity of fogging which may arise from the volatile ingredients in plastics and rubber materials used in the internal trim of motor vehicles, and hence a guide to the pre-selection of these materials as a contribution to the reduction of the potential hazard.

0. introduction

Windscreen fog is the deposit of greasy material which accumulates on the insides of windscreens of cars under hot conditions. This is believed to be caused largely by the evaporation of slightly volatile ingredients from organic materials within the passenger compartment and their condensation on the cooler windscreen. These volatile ingredients may include high boiling solvents, plasticizers, stabilizers and other additives used in the manufacture of rubber, paint, PVC and other plastics materials. The effect of windscreen fog is most clearly observed when travelling towards the rising or setting sun or the headlights of other cars.

A number of methods have been proposed for determining the fogging propensity of car trim materials. These methods are all based on heating the material in one part of a closed container, condensing the vapours evolved on a glass



2005年5月1日

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surface and measuring the opacity of the fog layer on the glass surface.

The test material may be heated by lamps, air (oven) heat or a liquid bath. The method described here uses a thermostatically controlled liquid bath since it has been found easiest to control its temperature to the required degree of accuracy. Using this method the colour of the test material has no effect on the result, whereas with radiant heating the colour strongly affects surface temperature and hence the severity of fogging.

The glass fog plate may be cooled by exposure to air at room temperature, by a jet of air or by a condenser through which water passes at a controlled temperature. The first method has been adopted here since it is the simplest and because the ambient air temperature has been shown not to be critical.

The degree of fogging may be measured by loss of transmitted or reflected light. The latter method has been chosen as it is more sensitive and gives a wider range of readings.

1. Scope and field of application

This British Standard specifies a method for measuring the degree of fogging by measurement of reflected light in the range of approximately 25 % reflectance for a heavily fogged plate to 100 % for a non-fogged plate. These figures correspond to fog numbers of 75 and 0 respectively. It is advisable not to make measurements close to either of these limits.

The standard is suitable for measurements on car trim materials, foams and the liquid and solid raw materials used in the manufacture of these components. Tobacco smoke and traffic fumes drawn in by the car ventilation system may also contribute to windscreen fogging but are not covered by this test method.

Under conditions of very heavy fogging, coalescence of droplets may occur, leading to good visibility through the glass and spuriously good test results.

2. References

This standard makes reference to the following standards publications.

- BS 509 Acetone
- BS 1995* Di-(2-ethylhexyl) phthalate
- BS 3978 Water for laboratory use

3. Reagents

The following reagents are required.

- 3.1 *Acetone*, complying with the requirements of BS 509.
- 3.2 *Di-(2-ethylhexyl) phthalate*, complying with the requirements of BS 1995.
- 3.3 *Silicone oil*, heat stabilized grade†.
- 3.4 *Higher alkyl phthalate plasticizer*.
- 3.5 *Water*, complying with the requirements of BS 3978.

4. Apparatus

The following apparatus is required.

- 4.1 *Thermostatically controlled oil bath*, minimum dimensions 550 mm × 270 mm × 160 mm in depth, for use over the temperature range 60 °C to 120 °C. Fitted with a temperature over-ride cut-out to prevent overheating in the event of thermostat failure, a stainless steel false bottom and an efficient oil circulator to maintain the temperature throughout the bath to within ± 0.5 °C of the set temperature.
- 4.2 *Six tall-form 1 litre beakers*, of heat-resistant glass, without spout, height 190 mm, diameter 92 mm. The rim to be ground flat.
- 4.3 *Six circular soft rubber gaskets*, diameter 127 mm, hole diameter 76 mm, thickness 6 mm.
- 4.4 *Seven glass fogging plates*, 115 mm square, made from 2 mm thick window glass. One plate is to be chosen to be retained as a standard plate and the remaining plates shall have a reflectance of within ± 1 % of that of the standard plate.
- 4.5 *Heavy gauge glass*, one sheet, 280 mm × 250 mm × 6 mm in thickness.
- 4.6 *Aluminium sheet*, minimum dimensions 490 mm × 280 mm × 2.5 mm in thickness, with six 99 mm diameter circular holes with 135 mm between centres.
- 4.7 *Silicone rubber tubing*, six pieces, length 317.5 mm, bore 10 mm, wall thickness 3 mm.
- 4.8 *Reflectance meter*, 60° specular glossmeter‡.

5. Procedure

5.1 Preparation and assembly of test equipment

5.1.1 Wash the glass fogging plates (4.4), gaskets (4.3), beakers (4.2) and heavy gauge glass sheet (4.5) in acetone (3.1) followed by a solution of strong detergent and rinse thoroughly with water. Place the glass fogging plates in clean water, wipe dry and polish using a clean cloth. Dry the gaskets for 1 h at a temperature of 100 °C. Allow the beakers to drain and dry in air.

5.1.2 Stand the empty oil bath (4.1) on a level surface. Place the aluminium sheet (4.6) on top of the oil bath and fit the glass beakers through the holes in the sheet so that they rest on the false bottom. Adjust the height of the false bottom so that the beakers project 65 mm above the aluminium sheet.

5.1.3 Remove the beakers, fit the slit silicone rubber tubing (4.7) round the holes in the aluminium sheet (see figure 1) and replace the beakers. Place the rubber gaskets on the beakers and the heavy gauge glass sheet over the beakers and gaskets. Fill up the oil bath with silicone oil (3.3) or higher alkyl phthalate plasticizer (3.4) until the depth above the false bottom is 63.5 mm. Then remove the beakers.

* Contained in the publication BS 573, 574, 1995, 1996, 2535, 2536, 3647 'Specifications for plasticizer esters'.

† Hopkin and Williams grade OC/550 is a suitable silicone oil.

‡ A glossmeter complying with ASTM D523-67 'Standard method of test for specular gloss' is suitable.