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Methods of test for motor vehicle paints —

Part 12: Resistance to accelerated weathering

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Contents

Foreword

This Part of this British Standard has been prepared under the authority of the Automobile Industry Standards Committee and is based on Information Sheet No. NM – 5Q of the Society of Motor Manufacturers and Traders Ltd. (SMMT).

Tests for paints for general purposes are given in BS 3900[1)] and, wherever possible, reference to that standard has been made.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1) BS 3900, "*Methods of test for paints*".

Introduction

For many years, a considerable amount of research by individual companies has been devoted to establishing the means of carrying out accelerated weathering tests on paint films which, it was hoped, would correlate satisfactorily with the breakdown of the paint film exposed outdoors in a variety of climatic environments. In recent years, it has become clear that these development programmes had many quite different starting and finishing points, although the basic data required are essentially the same.

In the light of this information, the Society of Motor Manufacturers and Traders Ltd. initiated, and carried out, a programme of investigation, in order to compare the degree of correlation between the results given by various accelerated weathering tests generally in use and the breakdown experienced with different samples exposed at a number of tropical and sub-tropical sites overseas, together with rural, industrial and marine sites in this country. The results of this 4 year co-operative development programme are incorporated as recommendations in this standard.

It is important that the following points should be appreciated:

1) The SMMT committee responsible for this work consists of representatives of vehicle manufacturers, as users, as well as those of paint manufacturers.

2) The present level of correlation has been achieved with the types of paint listed in item 6) below; it should not be assumed that paints of a different type will give a similar degree of correlation.

3) Investigation will continue, so that when changes in test procedures or equipment are made, amendments to this standard will be issued.

4) Two accelerated test procedures are recommended in this standard in order to cover, as far as practicable, the various properties which it is currently desired to measure. These are changes in gloss; assessment of chalking, assessment of micro checking (surface breakdown and/or erosion) and assessment of colour change. The last mentioned property achieved a fairly high order of correlation in the range of colours tested, although it should be noted that accelerated fading tests of the kind which were carried out are not normally considered reliable. The actual degree of correlation achieved for a particular property is not necessarily the same for each test method. Thus it can be generally indicated that Test 1 gives good correlation for chalking, gloss and colour change, but is somewhat less satisfactory in terms in the agreement reached for micro-breakdown. Conversely Test 2 gives a heavier degree of micro-breakdown, which in turn shows improved correlation for this property, with those paints in which it is likely to occur. Chalking in this instance is less satisfactory.

It will be realised that, at this stage of development, it is virtually impossible to achieve a high degree of correlation for all properties and a number of different test sites, in one test procedure.

However, the results obtained from the test procedures given in this standard have proved to be an acceptable guide to outdoor exposure for 12 month periods at a number of oversea stations. It should be noted that deterioration is much less severe in temperate climates, such as the United Kingdom, than in tropical or sub-tropical climates. This should be taken into account in assessing results. Performance in temperate climates can be expected to be at least twice that experienced in tropical or sub-tropical climates. From the work carried out, the test times indicated in the respective test procedures will give results that correlate acceptably with those from 12 months exposure in tropical or sub-tropical conditions. It must not be assumed that a lengthening of the test time in the weathering apparatus will necessarily indicate a correspondingly longer service life.

5) Test panels were exposed at the following sites:

a) Oversea:	Florida, Calcutta, Colombo, Singapore, Hong Kong and Guyana.
b) United Kingdom:	Coventry, Birmingham, Stowmarket and Torquay.

6) The following types of paint materials were used for correlation purposes:

a) Air dried nitro-cellulose enamels.

b) Low bake enamel, stoved at approximately 83 °C the composition being nitro/cellulose/nitrogen resin/alkyd and other plasticizers.

c) Synthetic enamels stoved at approximately 120 °C comprising blends of alkyds and nitrogen resins.

d) Metallic and pigmented versions of all the above. Paints which differ substantially from these will need to be separately evaluated.

1 Scope

This Part of this British Standard describes methods of carrying out accelerated weathering tests on motor vehicle paints and illustrates the apparatus required to perform them.

2 Test procedures

NOTE It is recognized that the following test procedures may not be entirely suitable for the evaluation of new paint formulations which have recently become generally available. This matter is under investigation which may lead, subsequently, to the issue of amendment or extension of this standard.

2.1 Panels 150 mm × 100 mm, or other convenient size, specified and pretreated in accordance with the requirements of BS 3900, Part A3[2] (note particularly Clause **2.2**) shall be coated in accordance with the requirements of BS 3900, Part A4[2], with the paint system to be tested.

Panels shall be aged, under normal laboratory conditions, for 7 days before testing, unless otherwise agreed.

2.2 Test No. 1

2.2.1 *Equipment.* The apparatus consists essentially of a water-cooled central vertical mercury arc of source of ultraviolet[3] around which rotates a test panel carrier, at a radial distance of 610 mm. One rotation is completed every 86 s. Surrounding the arc tube at its upper and lower extremities and facing the test panels are two banks of 240 V infrared lamps which are controlled at a black body temperature of 74 °C. A jet of demineralized water at 25 ± 1 °C sprays the test panels at the rate of 90 l/h for a traverse distance one panel width. The whole apparatus is shrouded in a metal casing, in order to prevent the egress of ultraviolet light and hot air.

The principal features of the equipment are shown in Figure 1 to Figure 4.

2.2.2 *Method.* Panels are exposed to 3 successive cycles, each consisting of:

1) 4 h infrared, plus ultraviolet emission, plus water spray.

2) 1 h water spray only.

3) 4 h infrared, plus ultraviolet emission, plus water spray.

Total test time = 27 h.

2.2.3 *Environmental control.* It is important that the following environmental limits are maintained:

1) *Ultraviolet emission.* The emission of the mercury arc tube shall not decrease by more than 10 % of the original value.

2) *Test panel temperature.* The temperature within the apparatus is controlled in the range 74 ± 1 °C by a mercury-in-glass thermometer with a blackened bulb, coupled with a suitable controller, at a point diametrically opposite to the water spray, and as near to the test panels as practicable.

3) *Water spray to panels.* A flat jet delivers 90 ± 2 l/h of demineralized water pH 7.0–7.2 with a conductivity not more than 1×10^{-6} mho at 25 °C. It is most important that the water should be free from iron, copper and silica.

NOTE In this test, humidity is not directly controlled.

2.3 Test No. 2

2.3.1 *Equipment.* The apparatus is similar to that used for Test No. 1, and consists essentially of a central vertical water cooled mercury arc of ultraviolet[4] around which rotates a test panel carrier, at a radial distance of 610 mm. One rotation is completed in 80 s. Surrounding the arc tube at its upper and lower extremities, and facing the test panels, are two banks of 240 V infrared lamps which are controlled at a black body temperature of 60 °C.

Distilled water is atomized by 6 gravity fed spray heads, equidistantly spaced around the perimeter. Two adjacent spray heads impinge on to the panels from a distance of approximately 200 mm; the remaining 4 are directly downwards. Relative humidity in the air space surrounding the test panels is maintained in the range of 45 % to 85 % r.h. The apparatus is shrouded in order to minimize the egress of ultraviolet light and hot air.

[2] BS 3900, "*Methods of test for paints*",
Part A3, "*Preparation of panels prior to painting*",
Part A4, "*Notes for guidance on paint application*".
[3] A Hanovia 1 kW 240 V Type 8750 instrument has been found suitable.
[4] A Hanovia 1 kW 240 V Type 6750 tube has been found suitable.