BS 3900 : Part F3 : 1971
[Weathering]

Confirmed June 1986
INCORPORATED BY ROYAL CHARTER

BRITISH STANDARD METHODS OF TEST FOR PAINTS

Part F3. Resistance to artificial weathering (enclosed carbon arc)

It is recommended that this Part be read in conjunction with the general information in the Introduction to BS 3900 issued separately.

NOTE. Part F3 describes a procedure based on a method of artificial weathering developed by the Joint Services Research Committee on Paints and Varnishes using a modification of the apparatus described in DEF-1053, Method No. 26,' Resistance to accelerated weathering '. These modifications consist essentially of a higher intensity lamp (i.e. 1600 W compared with 900 W) together with dry periods to give better correlation with natural weathering performance.

1. SCOPE

This Part describes a procedure for determining the resistance of single films or multicoat systems of paints or allied material to artificial weathering.

2. CORRELATION WITH NATURAL WEATHERING

The artificial weathering cycle described in this method was recommended as a result of an extensive study of the behaviour of paint films exposed to natural weathering at several test sites in the UK in comparison with artificial weathering tests. These investigations, which covered several different types of paint systems, indicated that where loss of gloss, chalking, checking, cracking, flaking and water-type blistering occurred during natural weathering in the UK, the same types of failure were induced by exposure to the test conditions described.

Paint systems which have given results which correlate most successfully with natural weathering include oil-modified alkyds and oleoresinous paints. Paints which differ substantially from these types require separate evaluation and considerable discretion should be exercized before accepting comparisons between materials with widely different compositions.

Because of the variations in daylight (intensity and spectral distribution), air temperature, relative humidity, rainfall, periods during which the paint film remains wet, and atmospheric contaminants, it is to be expected that the onset and degree of film failure on natural weathering will show some variation. A precise time scale, therefore, cannot be given for the relationship between natural and artificial weathering.

As a general guide, 12 weeks of continuous exposure to the conditions described in this test method will produce film failure of the types mentioned above, if such failure is likely to occur within three to four years of exposure to natural weathering in the UK.

It has been observed that, as with other artificial weathering cycles, the degree of correlation for colour change with natural weathering can only be established as a result of actual experience.

Where correlation with exposure to special environments is required, modifications to the cycle may be necessary. For example, periods may be included in the cycle for exposure of the test film to moist sulphur dioxide (for comparison with industrial atmospheric pollution) and to salt spray (for comparison with marine atmospheres). The precise modification to be employed in such special cases must be established as a result of experience.

3. SUPPLEMENTARY INFORMATION

The method of test described below requires to be completed, for any particular application, by the following supplementary information. This information is to be derived from the British Standard or other specification for the material under test or, where appropriate, is to be the subject of agreement between the purchaser and the vendor.

(1) Nature of substrate.

(2) Method of preparation of substrate and method of application of test coating to substrate.

(3) Thickness in micrometres of the dry coating and whether it is to be a single film or a multicoat system.

(4) Conditions of drying of coated panel (or conditions of stoving if applicable) and period before testing.

(5) Duration of test, whether operated as a continuous or interrupted period (see Note to Clause 6) and which characteristics of the test coating are to be considered in evaluating its resistance properties.

4. PREPARATION AND COATING OF TEST PANEL

4.1 Unless otherwise stated use a panel, approximately 150 mm × 100 mm, prepared in accordance with BS 3900, Part A3*.

4.2 Coat the panel with the material under test by the appropriate method and dry for the specified time in the specified manner. If normal drying conditions are specified, these should be interpreted as a temperature of 23 ± 2 °C and a relative humidity of 50 ± 5 % with free circulation of air and without exposure to direct sunlight.

* BS 3900, Part A3, ' Standard panels for paint testing '.

4.3 Coat the back and edges of the panel with a good protective paint.

5. APPARATUS

The apparatus is illustrated diagrammatically in Figs. 1 and 2 and consists of the following:

(1) A drum, 1·2 m in diameter, mounted so that it rotates about its axis which is vertical, and with a lid fitted over the top of the drum but not rotating with it, arranged so that the lid can be raised or lowered.

The drum should rotate continuously, completing one revolution every 20 min.

(2) A frame consisting of two galleries for mounting panels under test. The galleries are designed to hold the panels at an angle of 10° to 15° to the vertical, and have provision for drainage.

(3) An enclosed d.c. arc lamp, mounted with its axis vertical, 215 ± 15 mm from the axis of the drum, and at such a height that the centre of the arc is approximately 25 mm above the centre of the panels on the upper gallery. The arc is enclosed in a clear borosilicate glass cylinder 178 mm long, diameter 127 mm and thickness 1·5 mm to 3 mm (see Fig. 1).

The arc is formed between two uncored carbons, each 15 mm in diameter, the upper (positive) carbon being 305 mm long when fitted. The power consumption across the arc is 1600 ± 50 W, the voltage being controlled between 130 V and 145 V. The burning rate for the positive carbon should not exceed 4 mm/h. A burning rate in excess of this figure can usually be traced to an air leak in the lamp.

Care should be taken to ensure that the base of the lamp does not cast a shadow on the test panels on the lower gallery.

(4) An assembly of two water atomizers centrally placed by means of which the panels are sprayed with fresh distilled water which shall be drained away from the bottom of the drum and not recirculated. Each atomizer discharges about 1500 ml of water per hour at an air pressure of approximately 48 kN/m² in such a way that the whole of the surface of each specimen is evenly wetted with a fine spray approximately a quarter of a revolution before it comes in closest proximity to the lamp.

A suitable assembly is illustrated in Fig. 3.

In storage and in passage to the atomizers, the water shall not come into contact with any material other than stainless steel, glass, polymethyl methacrylate, polythene or other inert material. The water issuing from the jets shall comply with the following limits:

Total solids	Not more than 5 p.p.m.
Iron as Fe	Not more than 0·25 p.p.m.
Copper as Cu	Not more than 0·20 p.p.m.
Silica	Not detectable
pH	6 to 7

The temperature of the water in the atomizers should not exceed 30 °C.

NOTE. The water system should be cleaned regularly to ensure that the jets and water flow system are free from algal growth and bacterial slime.

(5) A ventilating fan fitted in the lid so arranged as to blow air into the drum at a rate of approximately 500 m³/h.

The fan is fitted into the lid diametrically opposite to the direction of the sprays, with its axis 300-350 mm from the axis of the drum.

6. PROCEDURE

NOTE. It is preferred that the full test period is carried out as a continuous exposure but where breaks occur due to failure of the equipment and difficulties in operating over the weekend, it has been found that there is no significant deviation of results if the required number of hours are added on to make up for the time lost. The use of the equipment as an interrupted cycle may be permitted subject to agreement between the parties.

Maintain the temperature of the room in which the apparatus is operated at 20 ± 2 °C.

Fit the lamp with a new pair of carbons and a clean borosilicate glass cylinder free from cracks or chips.

Start the apparatus and expose the panel for the specified period, operating the apparatus in cycles of 24 h as follows:

(1) 4 h with atomizers on and fan off.

(2) 2 h with atomizers off and fan on.

(3) 10 h with atomizers on and fan off.

(4) 2 h with atomizers off and fan on.

(5) 5 h with atomizers on and fan off.

(6) 1 h with atomizers off and fan off and apparatus stopped.

During the last period of 1 h, change the carbons, clean the glass and prepare to recommence the cycle.

At intervals of 7 days, remove the panel, allow it to dry and examine the film for change of colour, loss of gloss and blistering. Then examine under a lens giving a × 25 magnification for checking, cracking, etc. (see BS 2015*). Also examine for signs of chalking, by wiping a small area of the surface of the film with a piece of clean velvet of contrasting colour.

After the specified period of exposure, remove the panel and repeat the above examination. Where appropriate, carefully remove a portion of the film, 150 mm × 50 mm, with a non-corrosive paint remover† and examine the exposed metal for signs of corrosion. This area should be protected by a suitable lacquer for reference purposes.

7. REPORT OF TEST

The test report shall contain at least the following information:

(1) Identification of material under test.

(2) The British Standard, product specification or other document setting out the supplementary information required for the test (see Clause 3 above).

(3) Any deviation, by agreement or otherwise, from the standard test procedure.

(4) The results of the test in terms of the stated requirements.

(5) Date of test.

* BS 2015, ' Glossary of paint terms '.
† BS 3761, ' Non-flammable solvent-based pain tremover '.

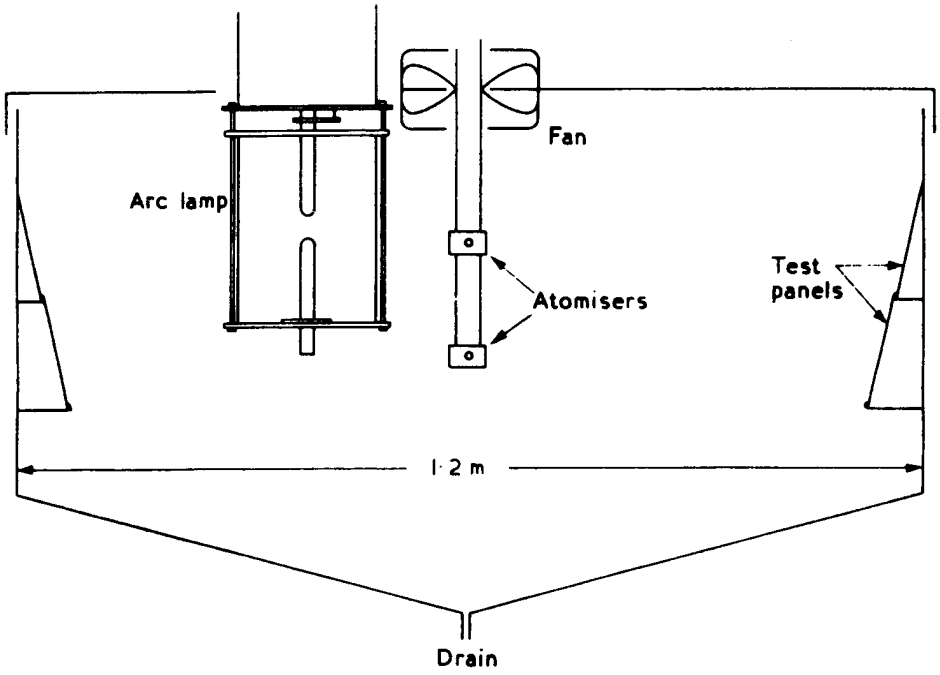


Fig. 1. Diagram of artificial weathering apparatus

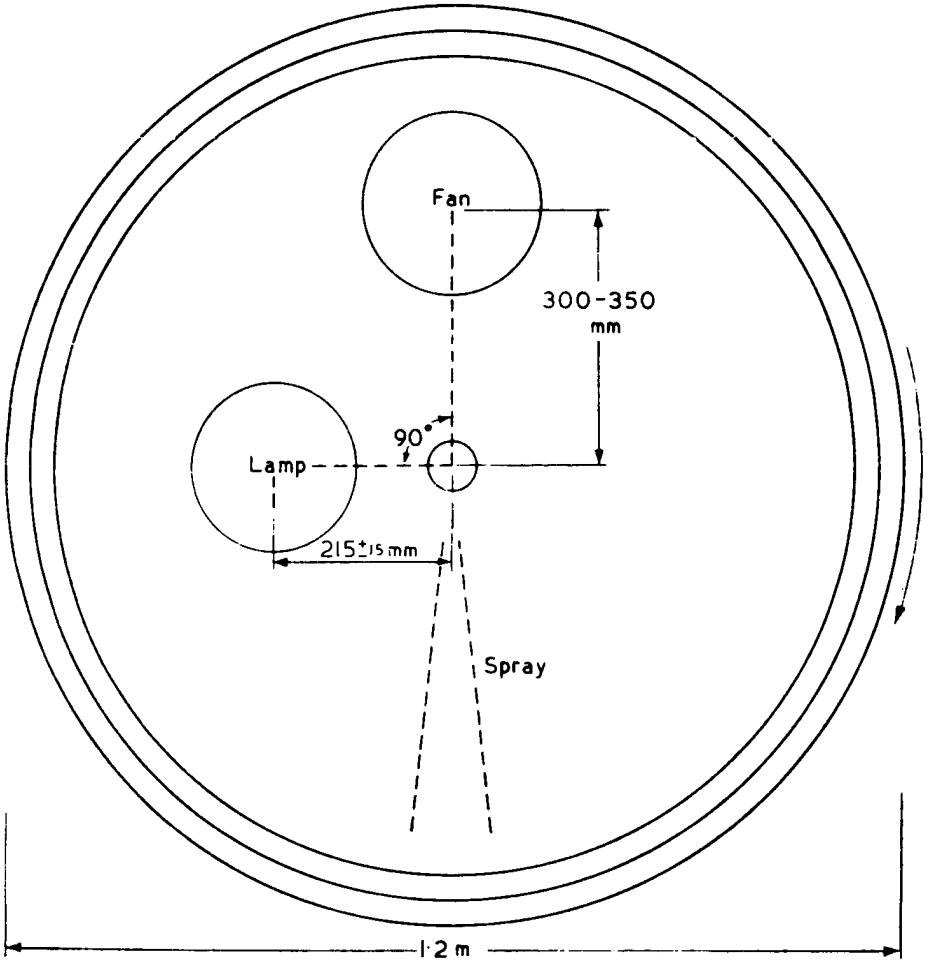
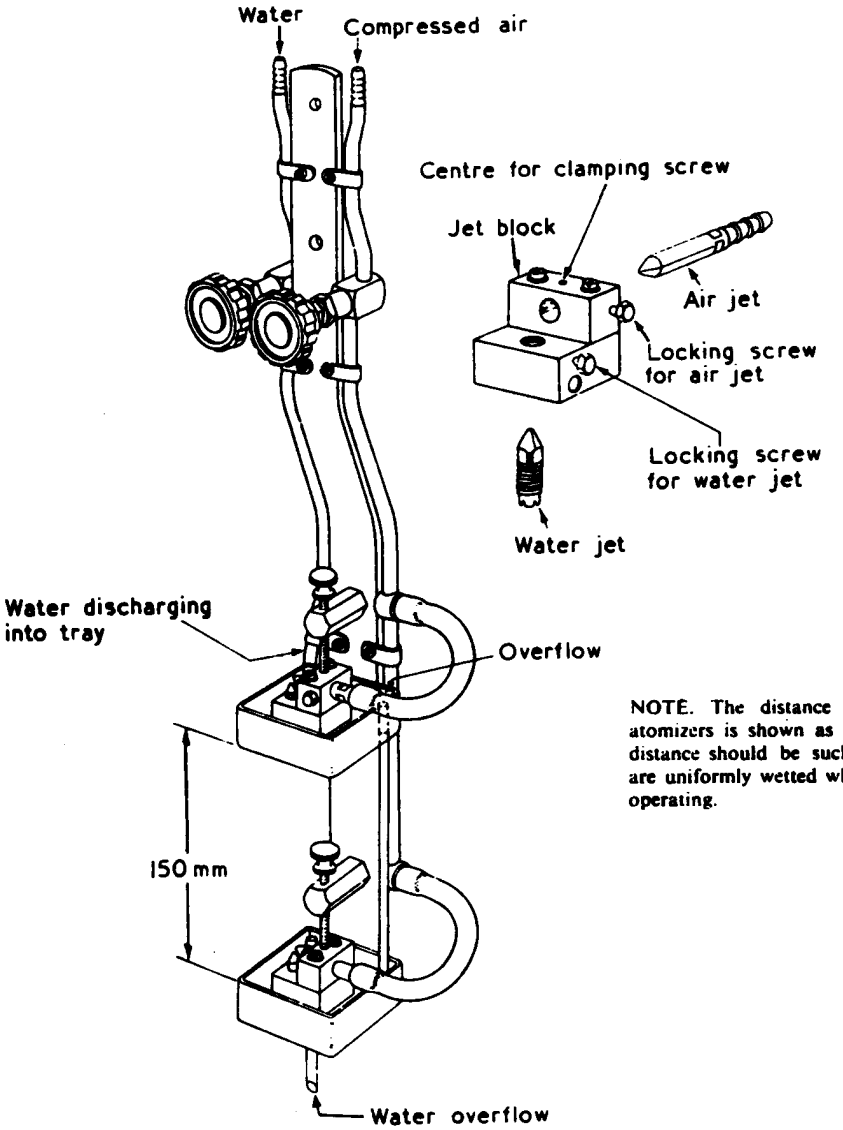


Fig. 2 .Plan view of artificial weathering apparatus



NOTE. The distance between the two atomizers is shown as 150 mm, but this distance should be such that the panels are uniformly wetted when the sprays are operating.

Fig. 3. Water atomizers for use in artificial weathering apparatus

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