BRITISH STANDARD

BS 3136-2: 1972

Specification for

Cold emulsion spraying machines for roads —

Part 2: Metric units

Co-operating organizations

The Road Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Asphalt and Coated Macadam Association*
Association of Consulting Engineers
British Quarrying and Slag Federation*
British Tar Industry Association*
Cement and Concrete Association
Concrete Society (Design and Development Divisional Committee)
Contractors' Plant Association
County Surveyors' Society*
Department of the Environment*
Department of the Environment, Road Research Laboratory*
Federation of Civil Engineering Contractors*
Federation of Manufacturers of Construction Equipment and Cranes*
Greater London Council*
Institute of Petroleum
Institute of Quarrying
Institution of Civil Engineers*
Institution of Highway Engineers*
Institution of Municipal Engineers*
Institution of Structural Engineers
Ministry of Defence, Army Department*
Sand and Gravel Association of Great Britain
Society of Chemical Industry

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this standard:

Chemical Industries Association
Liquefied Petroleum Gas Industry Technical Association (UK)
Mastic Asphalt Council and Employers' Federation
Road Emulsion Association Ltd.
Road Surface Dressing Association

This British Standard, having been approved by the Road Engineering Industry Standards Committee, was published under the authority of the Executive Board on 25 January 1972

The following BSI references relate to the work on this standard:
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Foreword

This standard makes reference to the following British Standards:

BS 21, *Pipe threads.* Part 1: *Jointing threads.*

BS 434, *Bitumen road emulsion (anionic).*

This British Standard has been prepared under the authority of the Road Engineering Industry Standards Committee using metric dimensions as part of the national policy to change to the metric system. As normal replacements for emulsion spraying machines occur, it is recommended that they be to this standard; BS 3136 "*Cold emulsion spraying machines for roads.* Part 1: *Imperial units*", will remain in existence, however, until the changeover has been substantially completed and there is no further requirement for machines designed to the former inch system.

This standard applies to pressure-operated machines for spraying, whether by hand or mechanically, emulsions used in the surface treatment of roads, including surface dressing and grouting. These emulsions are covered by BS 434 "*Bitumen road emulsion (anionic)*" and BS 2542 "*Recommendations for the use of bitumen emulsions for roads*".

An important feature is a test for the uniformity of transverse distribution of emulsion by mechanical sprayers, since even distribution at the specified rate is essential both for good results and for economy. This test may be usefully applied to types of sprayer other than those covered by the standard.

The standard is complementary to BS 1707 "*Hot binder distributors for road surface dressing*". Hence, the prefix "Cold" has been included in the new title for this standard. Machines for spraying hot cationic emulsions should comply with BS 1707.

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 6, an inside back cover 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 General

1.1 Scope

This Part of this British Standard specifies the essential mechanical requirements of the following types of machines for spraying emulsions in the surface treatment of roads; the machines may be either mobile or transportable:

1) Tanks and spraying equipment for hand-spraying, with manually operated or mechanically operated pressure systems.

2) Mechanical tank-spraying units provided with a series of nozzles fixed to a transverse header holding emulsion under pressure.

It also deals with the nominal capacities and other characteristics of tanks and with marking. Requirements are given for the speed control and the uniformity of transverse distribution of emulsion by mechanical sprayers.

NOTE The titles of the British Standards referred to in this standard are listed on the inside back cover.

1.2 Definitions

For the purposes of this Part of this British Standard, the following definitions apply:

1.2.1
emulsion

an emulsion of bitumen complying with the requirements of BS 434, or an emulsion of bitumen or tar of a type accepted within the industry for application to surface dressing, grouting, retread, tack-coat, mist-spray curing concrete, or concrete slip-coat

1.2.2
rate of spread

the number of litres of emulsion covering one square metre

1.2.3
mobile sprayers

sprayers capable of travelling considerable distances on roads at speeds up to the statutory limits, as well as comparatively short distances at low speeds while in action. They may be either trailers or self-propelled vehicles

1.2.4
transportable sprayers

sprayers intended only for travelling short distances at low speeds; they would normally be carried to any distant site on another vehicle

NOTE Hand sprayers are usually transportable, mechanical sprayers usually mobile.

1.3 Nominal capacities

The nominal capacities of sprayers shall be as follows:

Hand sprayers	250 litres
Mechanical sprayers	5 000 litres

NOTE Sprayers of other capacities may be supplied at the request of the purchaser.

The actual capacity shall be at least 5 % greater than the nominal capacity.

1.4 Roadworthiness

All mobile sprayers shall comply with the Motor Vehicles (Construction and Use) Regulations, 1969 or any subsequent revision.

1.5 Tanks

When the sprayer is fitted with a tank to which the emulsion is transferred before spraying:

1) The tank shall be totally enclosed so that the emulsion cannot be contaminated accidentally, and shall be so constructed as to prevent the emulsion from coming into contact with loose rust, scale, jointing, lagging or other substance likely to cause coagulation.

NOTE Care should be taken in the design to ensure that the tank can be effectively flushed out without leaving any pockets where residual material may be trapped so that successive incompatible types of emulsion can be used.

2) The tank filling opening shall be fitted with an efficient cap and a strainer of mesh size not greater than 5 mm which is readily accessible for cleaning.

3) The tank shall have a dipstick clearly marked with the serial number of the tank to which it belongs. The dipstick shall fit into a guide or be positively located by other means, and shall be calibrated and clearly marked to show the contents of the tank at any level with an accuracy of ± 1 % of the nominal capacity.

4) If a pressure tank is employed it shall be fitted with a safety valve and pressure gauge. The gauge shall have a range of 2 to 3 times the working pressure and shall have a dial of not less than 100 mm diameter. The gauge shall be accurate to within ± 5 %.

The tank shall comply with the relevant Board of Trade regulations for pressure vessels.

1.6 Compliance with british standards

Materials shall comply with appropriate British Standards. Pipe unions and screw threads shall comply with BS 21.

1.7 Marking

Each sprayer shall have firmly attached to it a marking plate bearing the following minimum information:

1) Maker's name.

2) The nominal capacity of the tank.

3) Tank serial number.

NOTE Attention is drawn to certification facilities offered by BSI; see the back cover of this standard.

2 Additional requirements for hand-spraying equipment

2.1 Pump

The pump, if fitted, shall be of a type which does not cause breakdown of the emulsion by excessive shearing between moving parts with small clearances. The pumping system shall be so designed that there are no visible pulsations at the spray nozzles.

Washers and mechanism shall be of durable materials, resistant to the effect of emulsion and solvents.

To assist in clearing the system, provision shall be made either for pumping air through the nozzle pipe or for admitting air to it at the pump end.

The capacity of a hand-operated pump shall be such that not more than 45 revolutions or double strokes per minute are required for the normal output of the spray nozzle.

2.2 Strainer

A strainer in which the maximum dimension of any aperature is not more than half the minimum dimension of the smallest aperature or passage in the nozzle, shall be provided in the pipe system between the tank and the nozzle. The strainer shall be easily removable for cleaning.

2.3 Flexible pipe and spray pipe

The flexible pipe and spray pipe shall be not less than 13 mm bore. The flexible pipe shall be not less than 3.0 m long and shall be made of a material that will resist deterioration from the solvents used for cleaning. The pipe and its unions shall be capable of withstanding four times the maximum pressure that can be developed in the system.

2.4 Spray lance

The spray lance shall be fitted with a shut-off valve between the pump and the spray nozzle and with a suitable handle to facilitate manipulation.

2.5 Spray nozzle

The spray nozzle shall be of a type which delivers the emulsion in a fine spray of well defined shape.

2.6 Pressure gauge

When a pressure tank is incorporated in the machine a suitable gauge, reading to at least double the normal working pressure, shall be fitted.

3 Additional requirements for mechanical sprayers

3.1 Speed control

Mechanical sprayers or the vehicles which tow them shall be fitted with an accurate means, independent of the normal vehicle speedometer, of indicating road speed when the vehicle is travelling at operational speeds. The road speed indicator shall be:

1) So designed that the scale reading for 0.5 km/h (or its approximate equivalent in other applicable units) measured on the periphery of the scale is not less than 7.0 mm;

2) So placed that the driver can read it with the least possible distraction from driving the vehicle or operating the plant;

3) Tested and certified as accurate to within ± 5 %;

4) Marked with a serial number.

If the speed indicator is in effect an engine tachometer, then the gear for which it gives correct road speeds shall be clearly marked.

3.2 Uniformity of distribution

3.2.1 Sprayers shall be tested and proved capable of complying with (2) below at any rate of spread from 5.5 litres/m^2 to 0.25 litres/m^2 by varying the pressure, nozzle spacing, type of nozzle and road speed.

3.2.2 When tested by a method which complies with the general requirements described in Appendix A the amount of emulsion collected on any strip of surface 50 mm wide within the effective width, the length of the strip being parallel to the direction of travel of the distributor, shall not differ from the average over the effective width by more than 15 %. Furthermore, the mean of the amount of emulsion collected in any group of four adjacent trays shall not vary by more than 10 % from the mean within the effective sprayed width.

For the purpose of calculating the average amount collected, the effective width shall be the whole sprayed width less 150 mm at each side.

The amount of emulsion received on the 150 mm margin at either side of the effective width of the spray shall be not less than 50 % nor more than 100 % of the mean amount per 150 mm of the effective sprayed width.

3.2.3 A certificate of compliance with the requirements of this clause shall be supplied with each machine. The certificate shall bear the date of the test.

3.2.4 Instructions shall be supplied with each machine to enable the operator to ensure that the specified rate of spread is obtained.

4 Additional requirements for mechanical sprayers with pressure feed

4.1 Feed system

The rate of spread shall normally be controlled by keeping the pressure constant in the spray-bar by maintaining air pressure in the tank, and controlling the speed of the vehicle.

The supply system to the nozzles shall be such that all nozzles in use commence spraying simultaneously with a full spray at the start of a run and shut off simultaneously and cleanly at the end of a run.

Means shall be provided to control and maintain the pressure within the limits between which the nozzles function, without the necessity for frequent adjustment.

A strainer, in which the maximum dimension of any aperture is not more than half the minimum dimension of the smallest aperture or passage in the nozzles shall be provided on the outlet pipe from the tank. The total area of the apertures shall not be less than seven times the cross sectional area of the pipe to which the strainer is fitted. The strainer shall be close fitting in the pipe or chamber and easily removable for cleaning.

Means shall be provided for clearing all nozzles and pipes after spraying.

Provision shall be made for the fitting of a thermometer.

Provision shall be made for fitting a draw-off cock to which a pressure hand-spraying lance may be attached.

4.2 Spray-bar

A pressure gauge shall be fitted to the spray-bar. The gauge shall have a range of 2 to 3 times the working pressure and shall have a dial of not less than 100 mm diameter and shall be accurate to within ± 5 %.

Provision shall be made for varying the number of nozzles in use to suit variations in the width of road to be covered.

The design of the nozzles shall be such that they are accurately reproducible by normal manufacturing methods.

Nozzles shall be so mounted that their correct alignment is positively set and maintained. Plain screwed connections shall not be used unless supplemented by some positive locking device, to ensure that the correct alignment is maintained.

The characteristics of the nozzles shall be such that zones of spray from adjacent nozzles combine to give a film of the required uniformity on the road (see **3.2**) when the spray-bar is at any operational height above the road.

If the nozzles produce a finely atomized spray liable to be diverted by wind, a protective hood shall be provided covering the spraying attachment and extending close to, but not touching, the ground and not impeding the spray.

Appendix A Test for uniformity of transverse distribution of emulsion

A.1 General

This standard includes requirements and tolerances for uniformity of distribution of emulsion across the surface being sprayed. A standard method for determining the transverse uniformity of distribution has been developed, the essential requirements of which are given below.

1) Spraying machines are tested with those grades of emulsion for which they are to be used.

2) The conditions prevailing during the test are comparable with those occuring during normal operations as regards:

a) Viscosity of emulsion.

b) Height of nozzle orifice above the test surface.

c) Pressure in the distribution system.

3) The test surface is divided into 50 mm strips, the length of the strips being parallel to the direction of travel of the sprayer.

4) The test is so arranged that the sprayer can operate for a sufficient period to obtain the normal working conditions, and when this has been achieved the test surface is exposed to the discharge for a suitable period.

5) The amount of emulsion delivered on each 50 mm strip is then measured and the result expressed as a percentage deviation from the mean for all the 50 mm units over the effective width. The effective width is defined as the sprayed width less the 150 mm margin at each side.

6) The result of the test is recorded in the form indicated in Figure 1. A suitable record sheet is shown at Figure 2.

A.2 Depot tray test

The apparatus consists of a wheeled trolley, carrying removable containers. Each container is 50 mm × 1 000 mm × 150 mm deep, made of 0.9 mm mild steel sheet, and of approximately 7.50 litres capacity. The containers extend to a width 150 mm greater than the full width of the sprayer, there being six containers per 300 mm of spray width. The rim of each container on one side is lipped in order that the containers will overlap and prevent emulsion escaping.

Before each test, the containers are examined for damage likely to affect results and are replaced if necessary.

For spray-bars of standard width the trolley runs on steel rails 3 m apart fastened to the top of a 1 500 litre catch tank, 3.0 m × 1.0 m × 0.6 m deep, the rails being horizontal and parallel to the 1.0 m side of the tank and sufficiently long to allow the trolley to lie clear of the spray before the test. The top rims of the containers, when fitted on the trolley, are the same distance below the nozzles as the road surface under normal working conditions.

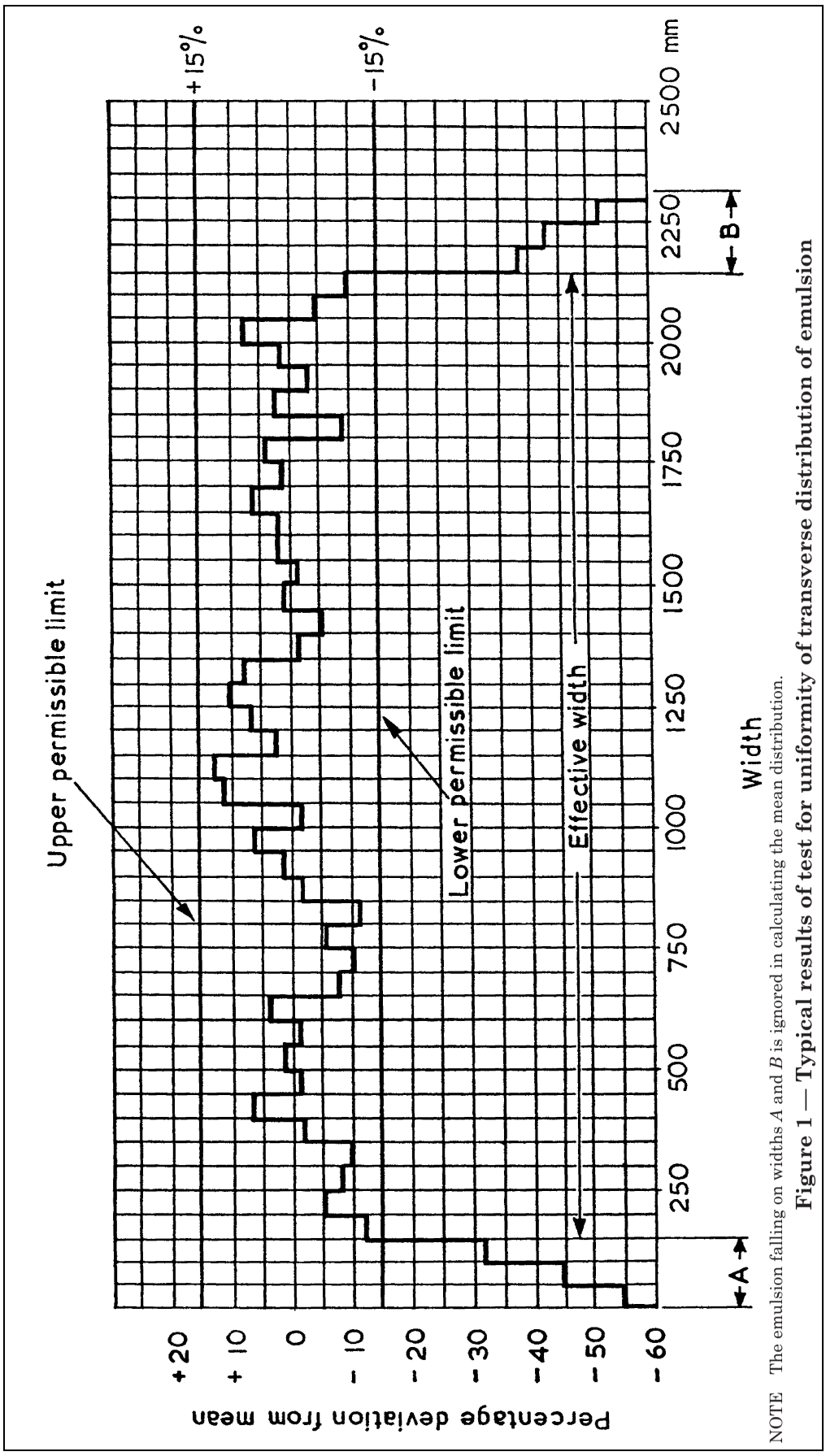
The sprayer is backed into position with the spray-bar over the catch tank, precautions being taken to see that the spray-bar is horizontal and at right-angles to the rails. A short preliminary spray is made to ensure that all nozzles are functioning and that the machine is otherwise in normal working condition.

The trolley and containers are then pushed underneath the spray hood, spraying is commenced, and maintained for a period of time sufficient almost to fill the containers. The trolley is then withdrawn to the previous position.

The depth of emulsion in each container is measured by dipping with a steel rule graduated in millimetres. Each container is dipped in the same position, a convenient place being some 300 mm from one end. Dipping shall not take place until froth has settled.

A.3 Dippings

If dips can be read with the ruler in position, wet the ruler with paraffin to give a flat meniscus; alternatively, if the ruler has to be withdrawn in order to read off the dip, dampen it with soft soap solution to ensure a clear line of demarcation.



NOTE The emulsion falling on widths *A* and *B* is ignored in calculating the mean distribution.

Figure 1 — Typical results of test for uniformity of transverse distribution of emulsion

Container No.	Dip mm	Deviation from mean	
		mm	%
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
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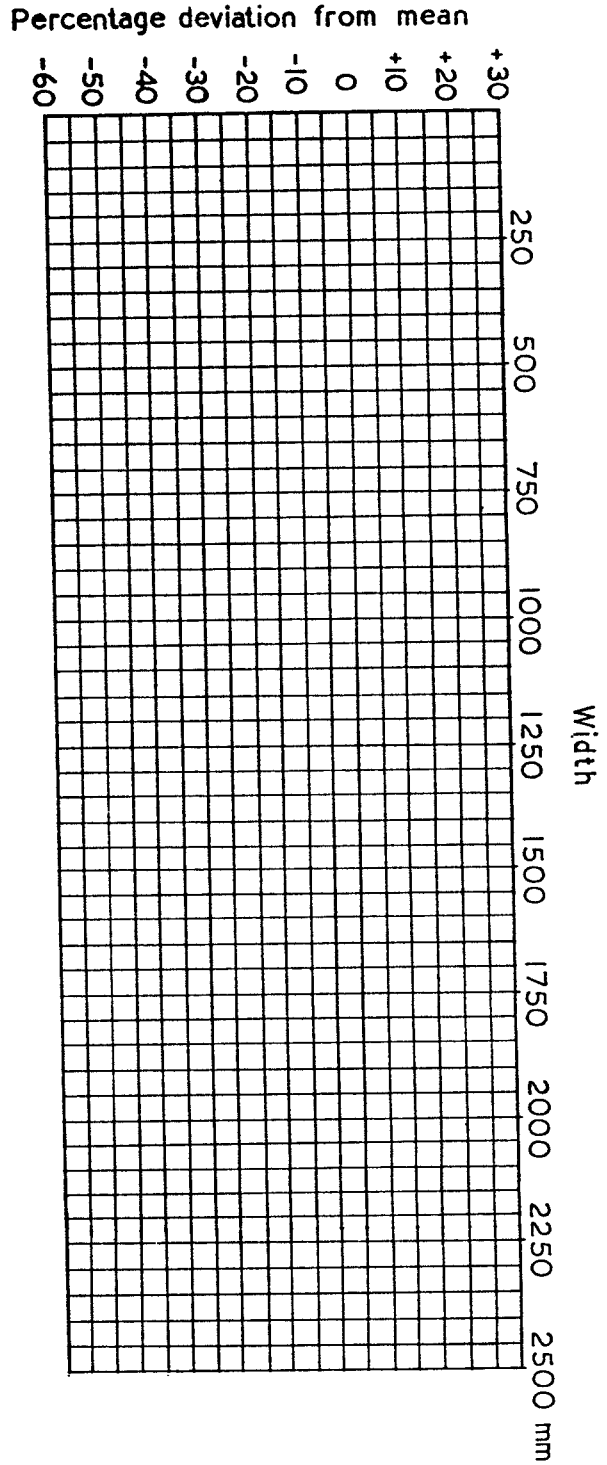

Total
Mean
Effective width
Litres/min
Date of test

Emulsion
Pressure
Spray height
Duration of test
Signature, etc.

Figure 2 — Record card for test for transverse distribution of emulsion

British Standards

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