

Bitumen road emulsions (anionic and cationic) —

Part 1: Specification for bitumen road emulsions

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Committees responsible for this British Standard

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- British Aggregate Construction Materials Industries
- County Surveyors' Society
- Federation of Civil Engineering Contractors
- Greater London Council
- Institute of Petroleum
- Institution of Civil Engineers
- Institution of Highway Engineers
- Institution of Municipal Engineers
- Road Emulsion Association Ltd.
- Society of Chemical Industry
- Coopted member

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Foreword

This revision of this Part of this British Standard, prepared under the direction of the Road Engineering Standards Committee, specifies requirements for anionic and cationic bitumen road emulsions. It supersedes the 1973 edition which is withdrawn. Recommendations for the use of these emulsions for roads and other surfaces are covered by Part 2 of this standard.

No major changes have been made to the previous edition of this standard but the opportunity has been taken to make a large number of minor alterations which have been shown to be necessary as a result of users' experience.

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 16, 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 Scope

This Part of BS 434 specifies requirements for anionic and cationic bitumen emulsions used for the preparation and treatment of road and other surfaces carrying wheeled and foot traffic.

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

2 Definitions

For the purposes of this Part of BS 434, the following definitions apply.

2.1

bitumen

a viscous liquid or a solid, consisting essentially of hydrocarbons and their derivatives, that is soluble in carbon disulphide¹⁾; it is substantially non-volatile and softens gradually when heated. It is black or brown in colour and possesses water-proofing and adhesive properties. It is obtained by refinery processes from petroleum and is also found as a natural deposit or as a component of naturally occurring asphalt in which it is associated with mineral matter

2.2

bitumen road emulsion

a liquid product in which a substantial amount of bitumen is suspended in a finely divided condition in an aqueous medium by means of one or more suitable emulsifying agents. There are two types, anionic and cationic

2.3

anionic emulsion

an emulsion in which the anion of the emulsifier is at the interface with the bitumen particle that is negatively charged and in which the aqueous phase is normally alkaline

2.4

cationic emulsion

an emulsion in which the cation of the emulsifier is at the interface with the bitumen particle that is positively charged and in which the aqueous phase is normally acid

2.5

binder content (including emulsifier)

the difference between 100 % and the percentage water content determined in accordance with appendix F

3 Classification of road emulsions

3.1 Anionic road emulsions. Anionic road emulsions shall be classified in order of stability as follows.

a) *Class A1: labile.* An emulsion characterized by rapid breakdown on application and normally unsuitable for mixing with aggregate; used cold.

b) *Class A2: semi-stable.* An emulsion with sufficient stability to permit mixing with certain grades of aggregate before breakdown occurs; used cold.

c) *Class A3: stable.* An emulsion with sufficient mechanical and chemical stability for all purposes involving mixing with aggregates including those containing large proportions of fines or chemically active materials such as cement or hydrated lime; used cold.

d) *Class A4: slurry seal.* An emulsion formulated for the slurry seal process; used cold.

NOTE Additives may be used at the time of laying if required to adjust the setting time or viscosity of the mix.

This class shall be subdivided as follows.

1) *Class A4: slow setting.* Suitable for mixing in simple mixers for hand laying, in bulk transit concrete mixers or mobile mixing machines.

2) *Class A4: rapid setting.* Suitable for handling in special mobile mixing machines only.

NOTE 1 Classes A1 and A2 are subdivided according to their nominal binder contents (see Table 1).

NOTE 2 Due to the wide variation in chemical activity and physical structure of aggregates from different sources, not all are suitable for the slurry seal process. It is necessary, therefore, to test each aggregate in the laboratory with class A4 emulsion and to subject the mixes with class A4 emulsion to the track abrasion test in accordance with appendix A of Part 2:1984 of this standard. The loss in mass of the specimen after abrasion should not exceed 500 g/m².

3.2 Cationic road emulsions. Cationic road emulsions shall be classified in order of stability as follows.

a) *Class K1: rapid acting.* An emulsion characterized by rapid deposition of binder on contact with road surfaces and aggregates followed by early resistance to rain. Unsuitable for mixing with aggregates; class K1-70 grades used hot, other grades cold.

b) *Class K2: medium acting.* An emulsion in which the rate of deposition of binder is sufficiently delayed to permit mixing with certain clean coarse aggregates before breaking to form a continuous adhesive film without stripping; used cold.

¹⁾ The internationally agreed definition of bitumen relates its solubility to carbon disulphide but in the UK trichloroethylene is used since it is safer than carbon disulphide.

c) *Class K3: slow acting.* An emulsion in which the rate of deposition of binder is sufficiently delayed to permit mixing with certain fine aggregates before breaking to form a continuous adhesive film without stripping; used cold.

Cationic slurry seal emulsions are included in class K3 and are suitable for handling in special mobile mixing machines only.

NOTE 1 Class K1 is subdivided according to its nominal binder content (see Table 2).

NOTE 2 Due to the wide variation in chemical activity and physical structure of aggregates from different sources, not all are suitable for the slurry seal process. It is necessary, therefore, to test each aggregate in the laboratory with class K3 emulsion and to subject the mixes with class K3 emulsion to the track abrasion test in accordance with appendix A of Part 2:1984 of this standard. The loss in mass of the specimen after abrasion should not exceed 500 g/m².

4 Composition

4.1 General. Road emulsions shall contain bitumen, modified if necessary as specified in 4.2, emulsifying agents and water. Small amounts of surfactants and additives shall be permitted to modify performance, as in slurry seal and other emulsions for special purposes.

4.2 Bitumen. The bitumen used for the manufacture of the emulsion shall comply with BS 3690 and shall be selected from the range grade 70 penetration to grade 300 penetration, as defined therein.

NOTE 1 The bitumen may be modified by the addition of fluxing agents ranging from light volatile distillates to heavy oils, the amount of fluxing agent used normally being not more than 5 % by mass of the bitumen for anionic emulsion and 10 % for cationic emulsion, or as agreed between the purchaser and the manufacturer of the emulsion.

NOTE 2 If required by the purchaser, the supplier should provide a typical sample of the penetration bitumen used as the basic ingredient of the emulsion and/or should disclose the nominal viscosity of the bitumen/flux mixture used.

NOTE 3 Attention is drawn to the fact that bitumen originally complying with BS 3690 may not give the same test results on analysis after extraction from the emulsion.

4.3 Toxicity. Any drainings, washings or the like, passing from the work into streams, ponds, rivers, etc., shall not, after dilution by these waters, have any toxic effect upon plant, animal or fish life.

5 Particle charge

When tested in accordance with appendix C, anionic emulsion shall deposit on the anode, indicating that the particles have a negative charge and cationic emulsions shall deposit on the cathode, indicating that the particles have a positive charge.

NOTE The character and amount of deposit will depend on the class of emulsion under test.

6 Properties of emulsions

After sampling in accordance with appendix A, emulsions shall be tested in accordance with appendices B to J. The properties of anionic road emulsions shall be as given in Table 1 and the properties of cationic road emulsions shall be as given in Table 2.

7 Containers and marking

7.1 Containers. No corrosion or attack shall occur between the emulsion and the container or bung and the emulsion shall not be adversely affected by the container or bung.

NOTE The use of light metals or their alloys may lead to the evolution of hydrogen and the subsequent explosion of the container.

7.2 Marking. Containers shall be legibly labelled with the following minimum information:

- a) the name or trade mark of the manufacturer or supplier of emulsion;
- b) the date of filling;
- c) the number of this British Standard, i.e. BS 434/1:1984²⁾;
- d) the class of emulsion and nominal binder content (see Table 1 and Table 2);
- e) the mass of contents in kilograms or volume in litres;
- f) the word "Anionic" or "Cationic" on the head of the container which shall be coloured black for Anionic and green for Cationic;
- g) the instructions to roll the drums before use, particularly in the case of 40 % binder content emulsions;
- h) an instruction to protect from frost.

Documents relative to bulk deliveries shall provide similar relevant information.

²⁾ Marking BS 434/1:1984 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, Quality Assurance Division, British Standards Institution, Linford Wood, Milton Keynes MK14 6LE in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

Table 1 — Properties of anionic road emulsions

Property	Appendix or clause	Class of anionic road emulsions						
		A1-60	A1-55	A1-40	A2-57	A2-50	A3	A4
Particle charge	C	neg.	neg.	neg.	neg.	neg.	neg.	neg.
Residue on 710 µm BS sieve (% (<i>m/m</i>), maximum)	D.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Residue on 150 µm BS sieve (g per 100 mL, maximum)	D.2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Stability to mixing with coarse aggregate (% coagulation)	E.1	20 to 80	20 to 80	20 to 80	< 40	< 40	< 5	< 5
Stability to mixing with cement (% coagulation)	E.2	—	—	—	> 2	> 2	< 2	—
Binder content (% (<i>m/m</i>), minimum)	F	58	53	38	55	48	55	56
Viscosity (degrees Engler (°E) at 20 °C) ^a	G.1	6 to 9	5 to 8	4 max.	8 max.	5 max.	9 max. ^b	8 max. ^b
Coagulation of emulsion at low temperature	H	nil	nil	nil	nil	nil	nil	nil
Storage stability (short period test) (inversions to clear sediment, maximum)	J.1	60	60	60	60	60	60	60
Storage stability (long period test) (% water content difference, maximum)	J.2	2	2	—	2	2	2	2
NOTE In special circumstances, class A1-60 emulsion with a higher viscosity can be used for hand application provided that the emulsion complies with all the other requirements of this standard.								
^a The viscosities given in the table are suitable for use in bulk spreaders complying with BS 1707 or BS 3136 or for use in hand operated sprayers complying with BS 3136. As a general guide, a maximum viscosity of 9°E at the temperature of the spraying is considered to be suitable.								
^b These viscosity values are intended to serve as a guide only and other values may be agreed between the purchaser and the supplier.								