

Road Emulsion Association Limited

Technical Data Sheet No. 1

BITUMEN ROAD EMULSION

Introduction

Bitumen is a product from the distillation of crude petroleum and is produced in a wide range of grades varying from hard and brittle to soft and fluid, at normal temperatures. Many of these grades are used for road maintenance and construction, and to facilitate use it is necessary to temporarily reduce their viscosity. This reduction can be achieved by the use of solvents, or by applying heat, or by a combination of solvents and heat, or by emulsification.

Bitumen Road Emulsion

Bitumen emulsions are heterogeneous, two-phase systems consisting of two immiscible liquids, bitumen and water, stabilised by an emulsifier. The bitumen is dispersed throughout the continuous aqueous phase in the form of discrete particles, typically 1.0 to 10 microns in diameter, which are held in suspension by electrostatic charges imparted to the bitumen particles by an emulsifier.

Emulsions in which the bitumen particles are positively charged are known as Cationic Emulsions and those in which the particles are negatively charged are Anionic Emulsions. It is vitally important that the two types of emulsion are never mixed as this causes coagulation.

Characteristics

The main advantage of Bitumen Road Emulsions is that the relatively high viscosity of cold bitumen is retained in a form which can be used easily at comparatively low temperature, such that when the bitumen is released from the emulsion the correct grade is made available for its intended purpose.

The process whereby the bitumen is released from the emulsion is known as "breaking" and involves the formation of a continuous film of bitumen from the individual discrete particles originally present in the emulsion. The breaking of anionic bitumen emulsions involves the substantial removal of water, mainly by evaporation but also by absorption through surfaces in contact, particularly those of mineral aggregates. For cationic emulsions a significant factor which contributes towards the breaking, in addition to removal of water, is a physiochemical effect which involves adsorption of positively charged emulsifiers on to negatively charged surfaces in contact, thus assisting in the de-stabilisation of the emulsion. For this reason, cationic emulsions possess good adhesive properties with respect to adhesion of the residual bitumen to mineral aggregates and are the most popular type of emulsion used.

The rate of break of bitumen emulsions is controlled by the careful formulation of the emulsion during manufacture and can be selected to be from very rapid to very slow depending upon the particular application.

Other factors which influence the rate of break include weather conditions and mechanical forces such as rolling, trafficking and mixing operations.

Specifications

In the U.K., the new European Standard BS EN 13808 is used to define the grades of bituminous emulsions. Sections 3.1 Nomenclature and 3.2 Specification of current BS 434 part 1 grades from the draft notes for guidance are given below:

3. Selection of Appropriate Classes from BS EN13808

3.1 Nomenclature

BS EN 13808 uses a maximum of seven terms in the identification of a bituminous emulsion. These terms describe the following properties of the emulsion Particle Polarity; Binder Content; Binder Type and Breaking Behaviour and their use is illustrated in Table 3.1.1.



Table 3.1.1 Denomination of the abbreviation terms

| Position | Letters | Denomination | Supporting document |
|-----------|---------------------|---|--|
| 1 | C | Cationic bituminous emulsion | EN 1430 (particle polarity) |
| 2 and 3 | 2 digit number | Nominal binder content in % (m/m) | EN1428 (water content) or EN 1431(recovered binder + oil distillate) |
| 4,5 and 6 | B P F | Indication of type of binder Paving grade bitumen Addition of polymers Addition of more than 2%(m/m) of flux based on emulsion | EN 12591(specification for paving grade bitumen) |
| 7 | from 1 to 7 | Relative breaking behaviour | EN 13075-1 (breaking value) (Classes 1 to 7) |

Examples for abbreviation terms:

C 69 B 3

Cationic bituminous emulsion with a nominal binder content of 69% produced from paving grade bitumen and having a Class 3 breaking value.

C 69 BP3

Cationic bituminous emulsion with a nominal binder content of 69% produced from bitumen, containing polymers and having a Class 3 breaking value.

C 60 BPF6

Cationic bituminous emulsion with a nominal binder content of 60% produced from bitumen, containing polymers and more than 2% flux and having a Class 6 breaking value.

3.2 Specification of BS434 Part1 Grades

As can be seen from the above examples denomination of the emulsion goes some way to specifying it since it gives the polarity of the emulsion, the type and content of the binder and the stability (breaking value) of the emulsion.

Using the above nomenclature and Table 3 from BSEN 13808 the current grades of cationic emulsion given in BS 434 Part 1 become:

BS434 Part 1

K1-70
K1-60
K1-40
K2

BS EN 13808

C69 B 3 or C69 BF3
C60 B 3 or C60 BF3
C40 B 4 or C40 BF4
C55 B 5 or C55 BF5



Note

BS434 Part 1 does not specify flux content so either of the two BS EN 13808 grades shown above would be equivalent to the corresponding BS434 Part 1 grade.

BS EN 13808 is only applicable to Cationic grades of emulsion and Anionic grades continue to be specified in BS434 Pt1

3.3 Polymer Modified Emulsions

The use of Polymer Modified Bitumen Emulsions has increased dramatically in the road maintenance industry, and in the absence of a British Standard has been supplied as proprietary products complying with specifications devised by the supplier. In view of this situation, the Specification for Highway Works Clauses 918, 919, 920, 922, and their Notes for Guidance have specified properties for emulsions for Slurry Surfacing, Surface Dressing and Bond Coats, Tack Coats & other Bituminous Sprays. The introduction of BS EN 13808 finally provides a single specification to adequately categorise these materials.

Uses

Table 1 provides a summary of the various processes in which emulsions are normally used and gives references to the descriptions of these processes in B.S.434 Pt2. In addition, the REAL have supplemented this information by way of Technical Data Sheets.

Table 1 TYPICAL USES OF ROAD EMULSIONS

| Use | Purpose | REAL Data Sheet No |
|------------------------------------|---|--------------------|
| Bond Coat | Provision of an adhesive film between surfaces | No. 5, 7 |
| Coated Stone | Production of macadam for stockpiling | No. 11 |
| Concrete Curing | Curing of pavement quality concrete | No. 6 |
| Grouting | In-situ stabilisation of surfacings | No. 7, 8 |
| Lean Mix Curing | Curing of lean mix and other cementitious bases | No. 6 |
| Mist Spraying | Rejuvenation of deteriorating surfaces | No.12 |
| Patching | General repairs | No. 8 |
| Pre-mixing | Production of macadam for immediate use | No. 11 |
| Re-treading | In-situ recycling of existing surfacing | No. 7,10 |
| Sealing of Formation and Sub-bases | Means of maintaining moisture equilibrium | No. 6, 7 |
| Slurry Surfacing | Production of slurry for surface sealing | No. 7, 9, 12 |
| Surface dressing | Sealing and re-texturing of surfacings | No. 4, 7, 8 |

Advantages for using Bituminous Emulsions

These include:-

1. High viscosity bitumen is retained in a form which may be used at low temperatures.
2. Because of the low temperature of application and of storage, the possibility of heat degradation of the binder is minimised.
3. Emulsions have "built-in" wetting and adhesion agents.
4. The low temperature of application & storage minimises hazards from fuming and improves safety.
5. Fire risk is minimised.
6. Energy use is minimised by the low temperature of storage & application.

Emulsions can and are being further developed to play an ever important role in an increasingly energy conscious age. The Road Emulsion Association is actively involved in this programme.

For further information see Summary and Reference Sheets on the Association's website www.rea.org.uk

Note: Descriptions of emulsion grades in accordance with BS EN 13808 may change when UK Guidance document PD6690 is finalised. During the transition period in changing from BS434 Pt1 to BS EN 13808, typical BS EN 13808 grade descriptions are used in the text of this data sheet, followed by the BS434 Pt1 description in brackets. Technical Data Sheet No1 gives a basic interpretation of grade descriptions from BS EN 13808, but for a full understanding of the specification and variations in grade descriptions, reference should be made to PD 6690 when it is available.

Revised by the Technical Committee July 2006



Road Emulsion Association Limited