

Bitumens for building and civil engineering —

Part 1: Specification for bitumens for roads and other paved areas

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Committees responsible for this British Standard

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Association of British Roofing Felt Manufacturers
 Bitumen Roof Coatings Manufacturers' Association
 British Aggregate Construction Materials Industries
 British Tar Industry Association
 County Surveyors' Society
 Department of the Environment (Property Services Agency)
 Department of Transport
 Department of Transport (Transport and Road Research Laboratory)
 Flat Roofing Contractors Advisory Board
 Institute of Asphalt Technology
 Institute of Petroleum
 Institution of Civil Engineers
 Institution of Highways and Transportation
 Mastic Asphalt Council and Employers' Federation
 Refined Bitumen Association Ltd.
 Road Emulsion Association Ltd.
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Foreword

This Part of BS 3690 has been prepared under the direction of the Road Engineering Standards Policy Committee and supersedes BS 3690-1: 1982 which is withdrawn.

All types of bitumen for building and civil engineering are covered in BS 3690 as follows.

BS 3690, *Bitumens for building and civil engineering*:

- *Part 1: Specification for bitumens for roads and other paved areas;*
- *Part 2: Specification for bitumens for industrial purposes;*
- *Part 3: Specification for bitumen mixtures.*

Part 1 is based on normal practice in the United Kingdom and relates only to the climate, conditions and road surfacing techniques encountered here. It specifies the particular properties known to be important, and proven test methods.

This edition introduces technical changes to bring the standard up-to-date but it does not reflect a full review of the standard, which will be undertaken in due course. The main change from the previous edition is the adoption of a uniform level of permittivity of 2.630 across the range of bitumens from 35 pen to 100 pen. Details of permittivity tests are given in the 1980 editions onwards of the Institute of Petroleum Standards.

A system of grades and nomenclature is given; the nomenclature is based on the mid-point of the permissible penetration or viscosity range as appropriate. It is considered that this makes specifying and ordering easier.

It is not the function of this standard to specify which grades of bitumen should be used for individual road operations; appropriate British Standard specifications are BS 434, BS 594, BS 1446, BS 1447, and BS 4987.

Other publications are:

- ¹⁾Road Note 39 Recommendations for road surface dressing (Transport and Road Research Laboratory, Department of the Environment)
- ¹⁾Specification for road and bridge works (Department of Transport)

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, 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⁾ Available from HMSO.

1 Scope

This Part of BS 3690 specifies the requirements for penetration grade bitumens and cut-back bitumens which are suitable for use in road construction and maintenance in the United Kingdom. The bitumens are classified into a number of grades for each of which an appropriate designation and properties are specified.

This Part of this standard does not cover bitumen emulsions or bitumen mixtures containing lake asphalt, coal tar or pitch; such materials are specified in the appropriate materials standard (see foreword).

Advice on handling and packaging, and on sampling and testing is given in appendices A and B.

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 3690 the following definitions apply.

bitumen

a viscous liquid, or a solid, consisting essentially of hydrocarbons and their derivatives, which is soluble in trichloroethylene and is substantially non-volatile and softens gradually when heated. It is black or brown in colour and possesses waterproofing 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

cut-back bitumen

bitumen whose viscosity has been reduced by blending with a suitable volatile diluent. It is highly viscous at ambient temperatures and will require heating before mixing and spraying

3 Classification

Penetration and cut-back grades of bitumen specified in this Part of this standard are designated by numbers representing the mid-point of the penetration and viscosity ranges respectively. Penetration grade bitumens shall have the suffix "pen" and cut-back bitumens shall have the suffix "secs". The 40 pen grade shall have the additional suffix HD.

4 Penetration grade bitumens

Penetration grade bitumens shall comply with the requirements set out in the appropriate column of Table 1 when tested by the methods shown in that table.

5 Cut-back bitumens

Cut-back bitumens shall comply with the requirements set out in the appropriate column of Table 2 when tested by the methods shown in that table.

6 Sampling

If sampling is desired for demonstrating compliance with this standard, samples shall be taken in accordance with appendix B.

Table 1 — Properties of penetration grade bitumens

Property	Test method	Technically identical with	Grade										
			15 pen	25 pen	35 pen	40 pen HD ^a	50 pen	70 pen	100 pen	200 pen	300 pen	450 pen	
Penetration at 25 °C	BS 2000-49	ASTM D 5 - 86 IP 49	15 ± 5	25 ± 5	35 ± 7	40 ± 10	50 ± 10	70 ± 10	100 ± 20	200 ± 30	300 ± 45	450 ± 65	
Softening point °C	BS 2000-58	IP 58	(min.)	63	57	52	58	47	44	41	33	30	25
			(max.)	76	69	64	68	58	54	51	42	39	34
Loss on heating 5 h at 163 °C	BS 2000-45	IP 45	a) Loss by mass % (max.)	0.1	0.2	0.2	0.2	0.2	0.2	0.5	0.5	1.0	1.0
			b) Drop in penetration % (max.)	20	20	20	20	20	20	20	20	25	25
Solubility in trichloroethylene % by mass (min)	BS 2000-47	IP 47	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	

^a See note to B.2.

Table 2 — Properties of cut-back bitumens

Property	Test method	Technically identical with	Grade		
			50 secs	100 secs	200 secs
Viscosity (STV ^a) at 40 °C, 10 mm cup	BS 2000-72	IP 72	50 ± 10	100 ± 20	200 ± 40
Distillation	BS 2000-27	ASTM D 402 - 76 (87) IP 27	1	1	1
			8 to 14	6 to 12	4 to 10
b) Penetration at 25 °C of residue from distillation to 360 °C	BS 2000-49	ASTM D 5 - 86 IP 49	100 to 350	100 to 350	100 to 350
Solubility in trichloroethylene (% by mass min.)	BS 2000-47	IP 47	99.5	99.5	99.5

^a Standard tar viscometer.

Appendix A Handling and packaging

Bitumens are normally supplied hot in bulk either by road tanker or rail car, and handling procedures should be in accordance with the latest version of the Institute of Petroleum Model Code of Safe Practice, Part 11, Bitumen Safety Code.²⁾

Excessive heating of cut-back bitumen can lead to loss of volatile diluent and consequent non-compliance with the specification.

Bitumen may also be supplied in sealed drums or cartons, and suppliers' recommendations should be sought with regard to appropriate handling procedures.

Appendix B Sampling and testing

B.1 Sampling locations

B.1.1 If it is desired to sample for the purposes of establishing compliance with this standard, bitumen samples shall be taken from whichever of the following locations is appropriate:

- a) from the tanker, in the case of bulk delivery by road or rail, immediately before discharge;
- b) from the storage tank (or the feed pipe to the mixer) of a manufacturer of mixtures of bitumen and mineral matter, immediately before mixing;
- c) from the tank or the spray-bar of a binder distributor used for surface dressing immediately before spraying.

B.1.2 The procedures involved in handling the binder for surface dressing may lead to some loss of volatile constituents from the cut-back bitumen without necessarily impairing the performance of the surface dressing. Where a sample of cut-back bitumen has been taken from one of the locations listed in **B.1.1(c)** it shall be assumed that the viscosity requirements of the standard have been complied with provided the viscosity (STV) *s* at 40 °C is as given in Table 3.

Table 3 — Viscosity limits

Property	Grade		
	50 secs	100 secs	200 secs
Viscosity (STV) <i>s</i> at 40 °C	50 ⁺¹⁵ ₋₁₀	100 ⁺³⁰ ₋₂₀	200 ⁺⁵⁰ ₋₄₀

B.2 Sampling procedure

When sampling bitumen it is essential that the purchaser obtains a sample of not less than 5 kg which represents the material delivered by the supplier. The sample shall immediately be divided into three approximately equal sub-samples which shall be placed in clean and dry metal containers capable of being securely closed. Each sub-sample shall be clearly labelled with the names of the supplier and purchaser, details of the grade of bitumen, time and date of sampling and identification of the sampling location.

It is essential that the purchaser uses only one of the sub-samples for his own tests, the remaining two sub-samples being retained by him to be used in case of dispute.

NOTE 1 It is recommended that routine checking of bitumen should be based mainly on the penetration test in the case of grades covered by Table 1, except for 40 pen HD where softening point is more relevant, and the viscosity test for grades covered by Table 2. Experience indicates that checking other specified properties on a routine basis is only necessary when there are reasons to suspect the quality of the material.

NOTE 2 To ensure valid comparison between the test results of purchaser and supplier, it is essential that the purchaser should test the material within 7 days after sampling.

²⁾ Obtainable from the Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR.

Publications referred to

- BS 434, *Bitumen road emulsions (anionic and cationic)*³⁾.
- BS 434-1, *Specification for bitumen road emulsions.*
- BS 434-2, *Code of practice for use of bitumen road emulsions.*
- BS 594, *Hot rolled asphalt for roads and other paved areas*³⁾.
- BS 594-1, *Specification for constituent materials and asphalt mixtures.*
- BS 594-2, *Specification for the transport, laying and compaction of rolled asphalt.*
- BS 1446, *Mastic asphalt (natural rock asphalt fine aggregate) for roads and footways*³⁾.
- BS 1447, *Mastic asphalt (limestone fine aggregate) for roads and footways*³⁾.
- BS 2000, *Methods of test for petroleum and its products.*
- BS 2000-27, *Distillation of cut-back asphaltic (bituminous) products.*
- BS 2000-45, *Loss on heating of bitumen and flux oil.*
- BS 2000-47, *Solubility of bituminous binders.*
- BS 2000-49, *Penetration of bituminous materials.*
- BS 2000-72, *Viscosity of cut-back bitumen and road oil.*
- BS 3690, *Bitumens for building and civil engineering.*
- BS 3690-2, *Bitumens for industrial purposes*³⁾.
- BS 3690-3, *Bitumen mixtures*³⁾.
- BS 4987, *Coated macadam for roads and other paved areas*³⁾.
- ASTM D 5 - 86, *Standard test method for penetration of bituminous materials.*
- IP 27, *Standard method of test for distillation of cut-back asphaltic (bituminous) products.*
- IP 45, *Loss on heating bitumen and flux oil.*
- IP 47, *Solubility of bituminous binders.*
- IP 49, *Standard method of test for penetration of bituminous materials.*
- IP 58, *Softening point of bitumen ring and ball.*
- IP 72, *Viscosity cut-back bitumen and road oil.*
- IP 357, *Permittivity of bitumen.*
- Institute of Petroleum Model Code of Safe Practice, Part 11, Bitumen Safety Code.*

³⁾ Referred to in the foreword only.

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