British Standard

BRITISH STANDARD

BS 5212-2: 1990

Cold applied joint sealant systems for concrete pavements —

Part 2: Code of practice for the application and use of joint sealants

UDC 625.848.083

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Road Engineering Standards Policy Committee (RDB/-) to Technical Committee RDB/10, upon which the following bodies were represented:

Association of Consulting Scientists
British Adhesives and Sealants Association
British Airports Authority
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)
Institution of Civil Engineers
Institution of Highways and Transportation
Coopted members

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Contents

Foreword

This Part of BS 5212 has been prepared under the direction of the Road Engineering Standards Policy Committee. BS 5212:1975 has been revised in three Parts, namely:

— *Part 1: Specification for joint sealants;*

— *Part 2: Code of practice for the application and use of joint sealants;*

— *Part 3: Methods of test.*

BS 5212-1, BS 5212-2 and BS 5212-3 supersede BS 5212:1975 which is withdrawn.

Hot applied joint sealants are specified in BS 2499.

It has been assumed in the drafting of this standard that the execution of its provisions is entrusted to appropriately experienced people.

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.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, 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 5212 gives recommendations for the preparation of joint sealant slots and for the application and site testing of cold applied joint sealants for use in joints in roads, airfields and other exposed concrete pavements. Although it applies mainly to new work the principles it contains apply to both new work and repairs, and recommendations for resealing are given in clause **8**.

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 5212 the definitions given in BS 5212-1 apply together with the following.

2.1
bond breaker

a film or thin strip material applied at the base of a slot to prevent the bottom of the sealant from adhering

2.2
adhesion

the property of a sealant to stick to the sealant slot surfaces

2.3
ageing

the deterioration of a sealant on exposure to a specific environment

2.4
application life

the time after mixing the components of a sealant within which the material may successfully be applied to a joint at a stated temperature

2.5
cohesion

the property of a sealant to hold together by intermolecular attraction when subjected to tensile strain

2.6
compatibility

the property of a sealant to remain in contact with another material without unfavourable physical or chemical interactions

2.7
cure

irreversible transformation of a sealant from a liquid or plastic-like state into a hardened or rubber-like solid state

2.8
expansion joint

joint with compressible joint filler material placed full depth between pavement slabs to allow the slabs to expand and move closer together, and contract and move apart (see Figure 1)

2.9
contraction joint

joint to allow pavement slabs to contract and move apart, and subsequently expand and move together (see Figure 2)

2.10
tied joint

a joint where differential lateral or vertical displacement between pavement slabs is restrained by a tie, but rotation can occur

2.11
construction joint

joint between pavement slabs which have been constructed at different times where one face is cast against a construction form (see Figure 3)

2.12
longitudinal joint

joint between the edges of pavement slabs (see Figure 3)

3 Joint selection considerations

3.1 General

3.1.1 A seal is formed by applying liquid material into a sealant slot constructed at the top of a joint between concrete pavement slabs. The construction and preparation of the sealant slot is an important part of joint sealant formation, as the slot limits the dimensions and geometry of the sealant, and the joint sides are the surfaces to which the sealant will bond.

3.1.2 The dimensions and geometry of sealants used in road and airfield pavements should be specified and should take account of the length of slabs between joints and whether the joint is a contraction, tied or expansion joint.

3.1.3 When the joint sealant is compressed by closure of the joint it will tend to bulge upwards since the volume of the sealant remains constant. For this reason a sealant should be applied so that its top surface is below the level of the adjacent pavement surface in order that at no time during the joint movement cycle will the sealant extrude above the top surface of the concrete pavement and be subjected to vehicular damage.

3.1.4 The bottom of the sealant should be prevented from bonding to the base of the slot so as to avoid high local stress concentrations when the joint opens or closes. For narrow joint slots which are often formed deeper than the required sealant depth, a compressible joint filler should be used in the bottom of the joint slot and with some types this filler also acts as a debonding layer. For wider slots a bond breaker tape should be used at the base, since the slot is usually formed in the concrete to the required depth.

3.2 Types of sealant

Sealants should comply with BS 5212-1.

Fuel resistant sealants should be used in locations where spillage or leakage is likely from parked aircraft or vehicles, or where aircraft or vehicles regularly come to a halt. Fuel resistance should be assessed against the standard test fuel specified in **10.3** of BS 5212-3:1990. Should resistance to other types of spillage be required, e.g. hydraulic oil, diesel, etc., separate assessment against the spillage should be made using the test methods described in clause **10** of BS 5212-3:1990.

3.3 Factors affecting joint movement

3.3.1 The movement to which a sealant will be subjected with given joint spacing and concrete constituents depends principally upon the following factors.

a) The temperature range, which will equal the difference between the maximum and minimum average slab temperature that the concrete pavement will experience throughout its life. Generally this will be related to the difference between the highest expected summer air temperature and the lowest expected winter air temperature. The temperatures adopted for the design of the joint should be based on meteorological records for the area in which the pavement is to be constructed.

b) The ambient temperature at the time of sealing. Generally, for joints sealed in the summer, when they will be closed, the sealant will tend to be in tension for the majority of its life. Conversely for joints sealed in the winter, when they will be open, the sealant will tend to be in compression for the majority of its life. These seasonal movements should also be taken into account when designing the joint.

3.3.2 Joints in pavements with short slabs may not all move equally and some may not move at all. This effect is dependent upon many factors, for example:

a) variation in friction between slab and sub-base;

b) variation in resistance to movement of dowel bars;

c) differential temperatures between night and day during construction;

d) gradient of pavement;

e) shrinkage and thermal movement;

f) position of the joint relative to the ends of the concrete pavement,

and therefore the design and construction of the joints should seek to achieve uniformity of condition wherever possible.

3.3.3 The recommendation in **5.3** that joints should not be sealed within 14 days of construction of the slab will normally result in the concrete to which the sealant has to bond being of adequate strength and without excessive free water. In situations where joints are to be sealed in concrete that has been locally repaired or replaced, it may be possible to seal joints in less than 14 days but the sealant manufacturer should be consulted if this is proposed.

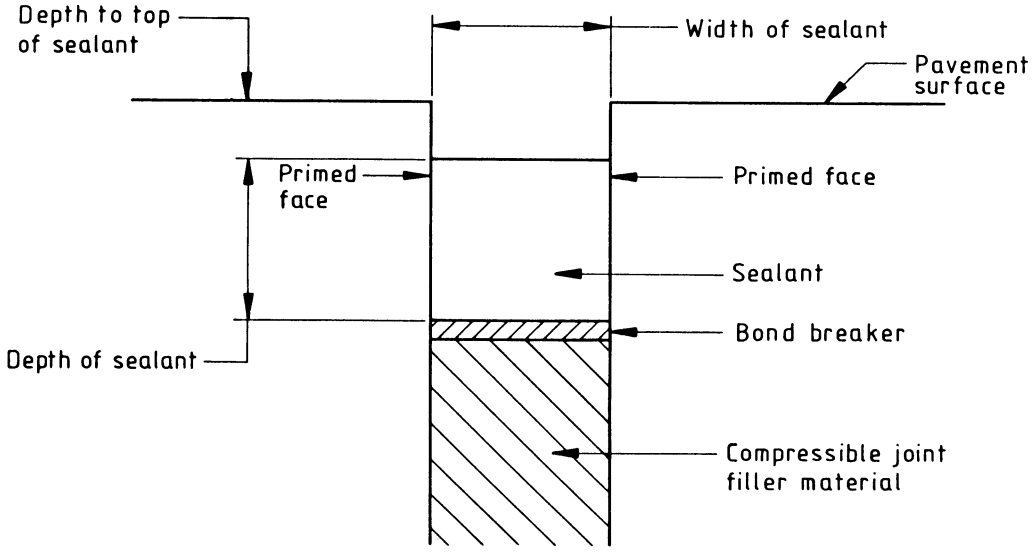
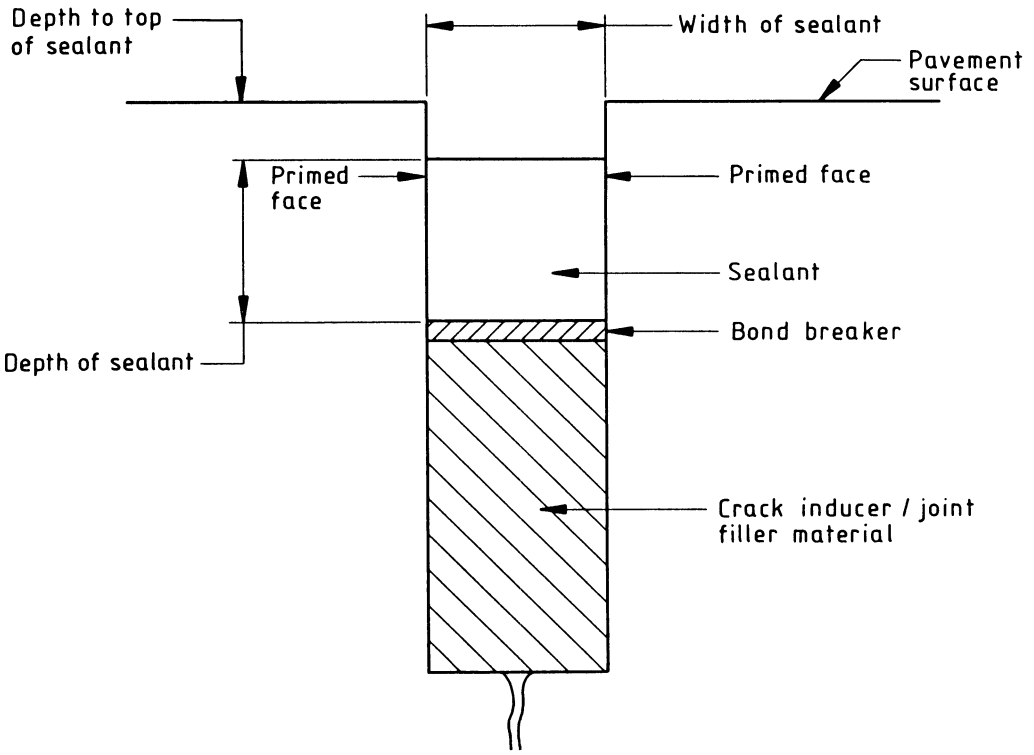
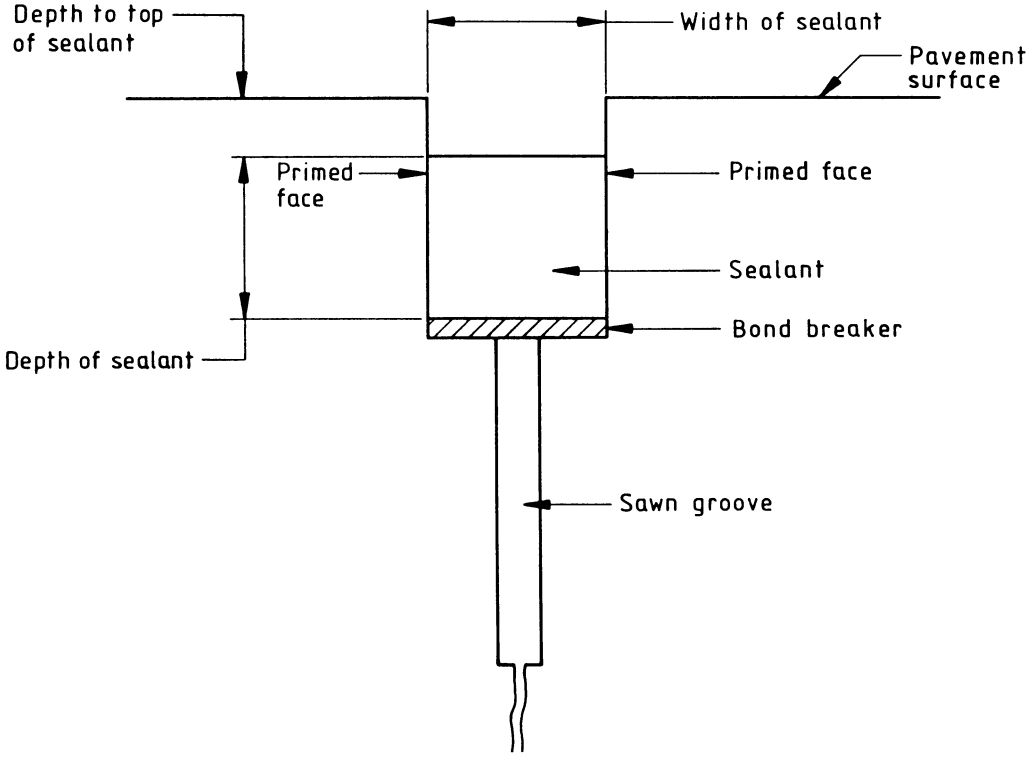


Figure 1 — Expansion joint sealing slot



(a) Wet-formed



(b) Sawn

Figure 2 — Contraction joint sealing slot

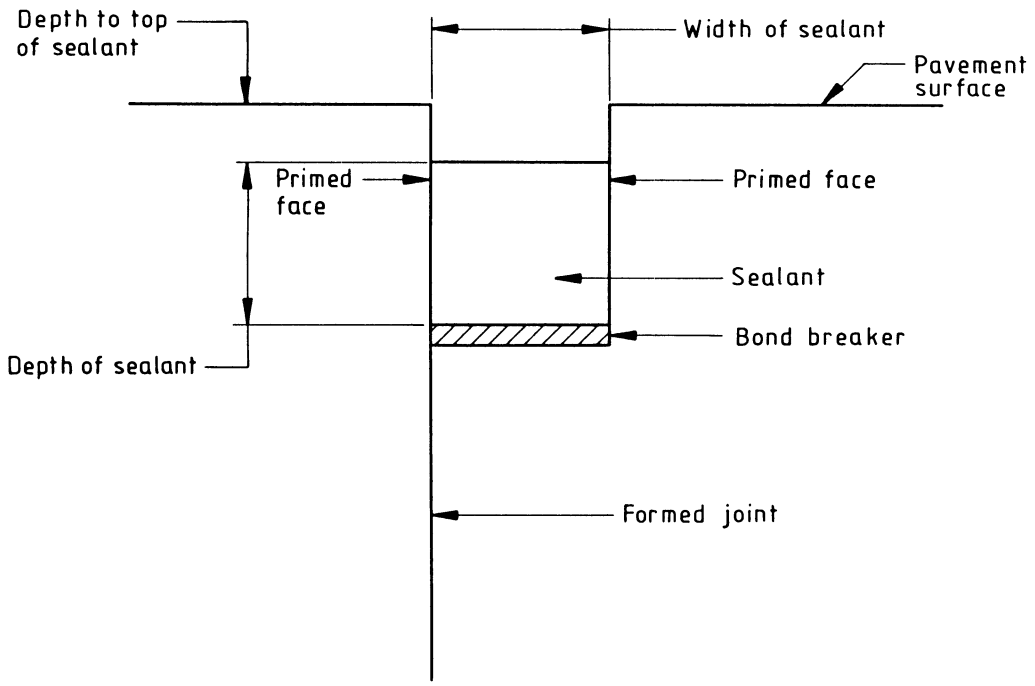


Figure 3 — Longitudinal joint/transverse construction joint sealing slot

3.4 Methods of formation of joint slots

3.4.1 *Wet-formed joints*

In the production of a wet-formed contraction joint, a slot should be formed in the plastic concrete at the time of construction, usually by vibrating a bar vertically into the concrete. A joint former should be inserted into the slot produced and the concrete should be recompacted against the joint former to give dense concrete surfaces on either side. The former may act as a temporary sealer and should be removed with care before preparing the joints for sealant application. The joint former should be tapered to avoid spalling the concrete on removal. Often the joint former is in two sections, the top section being removable for sealing and the lower section remaining as a crack inducer.

Joint arrises may be radiused or chamfered if required.

A wet-formed construction joint occurs where a pavement slab is placed against an adjacent slab that has already hardened. The joint former should be fastened at the top of the vertical surface of the adjacent hardened slab before the slab is cast. As the joint former has been fastened to one face it cannot easily be pulled out, and should generally be removed by sawing. Where appropriate a similar slot may be produced using a vertical shutter with a joint slot former incorporated into the top edge.

3.4.2 *Sawn joints*

To produce a contraction joint, a slot should be formed in the hardened concrete using a powered disc cutter. A deep narrow saw cut should be made at each joint very soon after casting to act as a crack inducer. To form a sealed contraction joint the cut should be subsequently widened by sawing to form the sealant slot at the top of the joint. Some hard aggregates like flint gravel are more difficult to saw, especially for the initial crack inducing saw cut when the concrete strength is low and there is a risk of the aggregate plucking out.

3.5 Geometry and size of sealant

3.5.1 *Width of sealant*

Due to the nature of concrete construction there will be some variation in the joint slot section to be sealed. Slots may need to be widened by sawing to remove areas of unsound concrete on the faces of the joint slot, or because of misalignment of the joint former. Joints may have opened after the joint was constructed. The joint slot sides may also be tapered due to the formation process. For these reasons it is normal to specify a minimum width of joint slot only. A width of 13 mm should be regarded as a minimum value that allows sufficient space for joint slot preparation, inspection and sealant application. Normally the maximum width of joint slot used in new construction should be 30 mm.

3.5.2 ***Depth of sealant***

The depth of sealant is controlled by the placing of the joint filler and the level to which the sealant is poured. A depth of 15 mm should be regarded as a minimum value that will allow adequate bond to the joint slot surfaces for cold applied sealants.

3.5.3 ***Depth to top of sealant***

The depth to the top of the sealant, described in **3.1.3** to prevent damage to the sealant from tyres, will depend upon the width of the joint, and the use of the pavement. A depth of 5 mm is regarded as suitable for normal vehicle and aircraft traffic. For joints wider than 25 mm in roads, this value should be increased to 7 mm and to 10 mm if sealing takes place in cold weather.

4 Joint slot preparation

4.1 Joint slot formation

4.1.1 The joint slot faces should be of sound dense concrete. The joint slot should be widened if defective or contaminated concrete is encountered in the original joint slot faces.

4.1.2 The resulting joint slot faces should be plane and within 10° of the vertical. The maximum difference in width between joint slot faces at depths coinciding with the top and bottom levels of the sealant should be 2 mm. The joint slot width when measured at any point coinciding with the top level of the sealant should be not less than the minimum specified.

4.2 Joint slot surface preparation

4.2.1 Debris from the formation of the joint slot should be removed e.g. by water-jetting. Slurry remaining after sawing concrete can harden if left to dry out and should therefore be removed as soon as possible.

4.2.2 Temporary caulking material should be inserted into joints that have been prepared but not sealed, to prevent debris from entering the induced crack or formed joint.

4.2.3 Joint slot faces to which the sealant will bond should have any laitance removed and, since they are likely to be smooth and polished, should always be roughened to provide a surface which the primer and sealant can key into. A surface with a texture resembling that of fine sandpaper is ideal.

4.2.4 The following methods of joint face roughening are suitable for removing laitance and providing a toughened surface.

a) *Dry abrasive blasting*. The abrasive dust may be a hazard where sealing joints in close proximity to aircraft or vehicles. The hazard should be avoided by the use of vacuum equipment.

b) *Grinding*. This is often considered a suitable method of surface preparation but it can polish hard aggregates like flint gravel at the joint surfaces rather than roughen them.

In narrow slots each face should be treated separately unless special nozzles are used.

4.2.5 During final preparation for sealing, the joint slot should be thoroughly cleaned using oil-free compressed air at a maximum pressure of 0.5 N/mm^2.

4.3 Joint filler

4.3.1 A joint filler or bond breaker tape or both, as recommended by the sealant manufacturer, should be inserted without twisting and should be firmly located so as not to become displaced before or during sealant application. A selection of joint fillers of different dimensions may be required as the widths of joints at the time of sealing are likely to be variable. Where bond breaker or joint filler is applied after cleaning and priming, contamination of the slot faces should be prevented.

4.3.2 The depth of the top surface of the placed joint filler should equal the required sealant depth plus the required distance between the top surface of the sealant and the adjacent pavement surface, within a tolerance of ± 2 mm.

4.3.3 The primer and sealant should be compatible with the bond breaker tape or joint filler material used.

5 Priming

5.1 The primer used should be as named on the certificate required by clause **7** of BS 5212-1:1990. It should provide a visual indication of its presence.

5.2 Primer should be applied to the joint faces by spray or brush as soon as possible after surface preparation. The primer should be applied carefully so that the joint surfaces are evenly coated. Pools of excess primer should be avoided, as these may be detrimental to the subsequent performance of the sealant.

5.3 At the time of priming the joint slot should be clean and dry, with toughened surfaces of sound concrete. Priming and sealing should not be carried out when the air temperature is below 10 °C except on a rising temperature when it may be carried out at 8 °C and above. Joint slots should not be primed and sealed within 14 days of the construction of the concrete slab.

5.4 When condensation occurs in the joint slots following cool nights or when the joint slots are wet due to recent rain, suitable dry conditions for sealing may be achieved by the application of heat to the joint by hot compressed air or by infra-red heaters. The method used should not heat the concrete to such temperatures as would damage either the concrete or any plastic groove formers, and should not leave combustion deposits or unburnt fuel on the concrete that might adversely affect the bond of the sealant. Heating the concrete in cold weather to raise its temperature to a suitable level for sealing is not recommended because the heat will quickly be lost, and at low temperatures there is an increased risk of condensation in the joint slot. The curing time of the sealant may still be considerable under such circumstances even though adequate adhesion is achieved.

5.5 The primed joint slot should be protected from weather, dust and any other contamination until the sealant is applied.

6 Sealant application

6.1 The sealant should be applied to the primed joint slot within the times stated by the sealant manufacturer for the primer used. Where this is not possible the joint slot faces should be reprimed before sealant application in accordance with the manufacturer's instructions.

6.2 The sealant should be applied in accordance with the manufacturer's instructions using meter mix dispense equipment specifically designed for that purpose. Alternatively, a power mixer should be used for sufficient time to produce a homogeneous mix without entrapped air, the sealant being subsequently applied into the joint slot by pouring or by using an application gun.

6.3 After mixing, the sealant should be applied into the sealant slot within the times stated by the sealant manufacturer for the application life of the sealant.

6.4 The sealant should be applied so that the top surface of the cured sealant is the required distance below the surface of the adjacent pavement surface within a tolerance of ± 2 mm. Where the pavement surface is textured, the distance should be measured from the lowest point of the textured surface.

6.5 The average depth of the sealant should be not less than the specified depth.

6.6 The sealant should be protected from damage due to weather, dust and any other contamination until fully cured. When necessary the sealant may be trafficked at the end of the tack-free period but guidance should be obtained from the manufacturer.

The cure times of sealants are likely to vary according to ambient temperature. Automatic mixer/dispenser machines allow sealants with very short cure times to be used which is advantageous in reducing the time during which the sealant needs to be protected.

6.7 The flow requirements in BS 5212-1 help to ensure sealants are self-levelling on crossfalls up to 2.5 %, and do not flow downhill unduly in normal application conditions. Where the crossfall is steeper than this, e.g. on superelevated road pavements, measures should be taken to prevent the sealant flowing along the joint. Flow is also likely to occur with joints wider than 20 ± mm. Methods of application in these conditions should include one or more of the following.

a) Placing material in thin layers and allowing each layer to stiffen before placing the next layer. Care is required to protect the surface and ensure the layers bond to each other and the primed joint faces.

b) Forming dams at intervals along the joint to restrict the flow. The dams need to be cut out and replaced with sealant.

c) Using automatic mixer/dispenser machines and sealants with very short cure times.

d) Using sealants of stiffer formulation, and tooling the surface to the required profile. In this case the purchaser will need to agree that the flow requirements in BS 5212-1 can be modified. Care should be taken with stiffer materials to avoid entrapped air.

The purchaser should include details as given in Appendix A of BS 5212-1:1990, at the time of enquiry or order, where the crossfall is steeper than 2.5 % or the joints are wider than 20 mm.

7 Site testing

7.1 Samples of the sealant components may be taken by the purchaser at any time and should comply with BS 5212-1.

7.2 Where required by the purchaser, samples of mixed sealant should be taken at the point of application to check that the components have been combined correctly. The sampling rate should generally be not less than one per 1 000 m of joint, or not less than one per day. Samples should be collected in appropriate test containers in accordance with clause **6** of BS 5212-3:1990 and placed in the controlled enclosure within 24 h. The samples should comply with the penetration and recovery requirements of **5.6** of BS 5212-1:1990.

7.3 Samples of applied sealant should be cut from joints to check that the sealant has been applied correctly. Joints should be sampled at a rate of not less than one per 1 000 m of joint, or not less than one per day's run of sealing. Samples should comply with **6.5** when tested in accordance with Appendix A.

7.4 Depth measurements should be taken to the top surface of the installed bond breaker or joint filler, and the top surface of the sealant and should comply with **4.3.2**, **6.4** and **6.5**. Measurements should be taken at three locations along a transverse joint, or at 1 m spacing. The locations should be marked so that measurements before and after sealant application are taken at the same position. The rate should be not less than one every 10 transverse joints, or every 50 m. The depth should be measured mid-width of the joint to an accuracy of ± 0.5 mm using a metal ruler and a 150 mm straight edge placed centrally across the joint and perpendicular to it.

8 Resealing

8.1 The manufacturer's recommendation should be sought regarding the installation of the new sealant system.

8.2 The old sealant should be removed as far as possible and surfaces reprepared to the conditions recommended in **4.2**.

8.3 The new sealant system should be compatible with the old sealant to avoid problems of adverse reaction which can arise if any part of the old sealant remains on the joint slot faces.

8.4 Where it is apparent that the degree of movement in a joint has been sufficient to overstress the existing sealant, it may be appropriate to increase the joint slot width so as to reduce the strain in the replacement sealant. It may also be necessary to increase the depth of the slot (see **3.5**).

8.5 The joint should be resealed as recommended in clauses **5** and **6**.

Appendix A Measurement of depth of sealant cut from joints

Three samples of sealant should be cut from a transverse joint, or at 1 m spacing. Samples should be taken not less than 300 mm from the ends of joints. A thin sharp-bladed knife should be used to cut along the sides and across the width of the joint. Cutting and removal should be carried out carefully so as not to deform the sealant. Samples should be nominally 75 mm long. Sealant depth should be measured in three places along the sample at mid-width to an accuracy of 0.5 mm using calipers. The average of the three measurements should be taken as the sealant depth for the sample.

Publications referred to

BS 2499, *Specification for hot applied joint sealants for concrete pavements*[1)].
BS 5212, *Cold applied joint sealant systems for concrete pavements.*
BS 5212-1, *Specification for joint sealants.*
BS 5212-3, *Methods of test.*

[1)] Referred to in the foreword only.

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