BRITISH STANDARD

BS 8000-4: 1989

Workmanship on building sites —

Part 4: Code of practice for waterproofing

CAWS J20, J21, J30, J40, J41

Confirmed February 2012

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Council for Building and Civil Engineering (B/-) to Technical Committee B/146, upon which the following bodies were represented:

Building Employers' Confederation
Chartered Institute of Building
Consumer Policy Committee of BSI
Department of the Environment (Building Research Establishment)
Department of the Environment (Property Services Agency)
Federation of Associations of Specialists and Sub-Contractors
Institute of Clerks of Works of Great Britain Inc
Institution of Civil Engineers
Institution of Structural Engineers
National Building Specification Ltd.
National Council of Building Materials Producers
National House Building Council
Royal Institute of British Architects
Royal Institution of Chartered Surveyors
Society of Chief Architects of Local Authorities

This British Standard, having been prepared under the direction of the Council for Building and Civil Engineering, was published under the authority of the Board of BSI and comes into effect on 31 October 1989

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Contents

Foreword

This Part of BS 8000 has been prepared under the direction of the Council for Building and Civil Engineering. It makes recommendations and gives guidance on basic workmanship for conventional types of building work.

The recommendations given are not necessarily comprehensive; particular project documents, e.g. project specifications, may need to cover particular recommendations not dealt with by this code of practice.

This code of practice is unique in that unlike other British Standards, it draws together recommendations given in other codes of practice.

The purpose of this code of practice is to encourage good workmanship by providing the following:

a) the most frequently required recommendations on workmanship for building work in a readily available and convenient form to those working on site;

b) assistance in the efficient preparation and administration of contracts;

c) recommendations on how designers' requirements for workmanship may be satisfactorily realized;

d) definitions of good practice on building sites for supervision and for training purposes; this guidance is not intended to supplant the normal training in craft skills;

e) a reference for quality of workmanship on building sites.

It is recognized that design, procurement and project information should be conducive to good workmanship on site.

During the preparation of this code of practice the Building Industry's Co-ordinating Committee for Project Information (CCPI), produced a Common Arrangement of Work Sections (CAWS) for building work. This code of practice has generally been arranged in accordance with the Common Arrangement so that it can be used easily with project specifications and bills of quantities using this arrangement. Other major documents are being restructured in accordance with the Common Arrangement.

NOTE The CCPI was sponsored by the Association of Consulting Engineers, the Building Employers' Confederation, the Royal Institution of Chartered Surveyors and the Royal Institute of British Architects.

When complete BS 8000 will comprise the following Parts.

— *Part 1: Code of practice for excavation and filling;*

— *Part 2: Code of practice for concrete work;*

— *Part 3: Code of practice for masonry;*

— *Part 4: Code of practice for waterproofing;*

— *Part 5: Code of practice for carpentry, joinery and general fixings;*

— *Part 6: Code of practice for roof, slate, tile covering and cladding;*

— *Part 7: Code of practice for glazing;*

— *Part 8: Code of practice for plasterboard partitions and dry linings;*

— *Part 9: Code of practice for cement/sand floor screeds and concrete floor toppings;*

— *Part 10: Code of practice for plastering and rendering*;

— *Part 11: Code of practice for wall and floor tiling;*

— *Part 12: Code of practice for decorative wallcoverings and painting;*

— *Part 13: Code of practice for above ground drainage and sanitary appliances;*

— *Part 14: Code of practice for below ground drainage;*

— *Part 15: Code of practice for hot and cold water services (domestic scale).*

Technical Committees CSB/55, Waterproofing structures below ground level, ECB/44, Damp proof courses, and ECB/7, Flat roofs have also participated in the preparation of this Part of BS 8000 of which the content is based on and consistent with that of CP 102, CP 144-3 and CP 144-4. However, CP 102, CP 144-3 and CP 144-4 cover the subject matter more comprehensively and include design, materials and other related aspects in addition to workmanship on site.

The text of this Part of BS 8000 includes commentaries and figures. These commentaries are separately identified and are intended to be for guidance only and do not form part of the recommendations. They refer, unless otherwise stated, to the clause which immediately precedes each commentary.

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 to iv, the EN title page, pages 1 to 18, 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.

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Section 1. General

1.1 Scope

This Part of BS 8000 gives recommendations on basic workmanship on building sites and covers those tasks which are frequently carried out in relation to waterproofing.

For design aspects of waterproofing reference should be made to CP 102 and CP 144-3 and CP 144-4.

NOTE This code of practice includes supplementary elements in the form of commentaries to assist in its use and understanding. Compliance with the commentaries is not necessary in order to be able to claim conformity with the standard.

1.2 References

1.2.1 Normative references

This Part of BS 8000 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 8000 only when incorporated in it by amendment or revision.

1.2.2 Informative references

This Part of BS 8000 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

1.3 Definitions

For the purposes of this Part of BS 8000, the definitions given in BS 6100-1.3.1:1987, BS 6100-1.3.2:1985, BS 6100-1.3.3:1987, BS 6100-2.2.2[1)], BS 6229:1982, CP 144-3:1970 and CP 144-4:1970 apply.

[1)] In preparation

Section 2. Materials handling and preparation

2.1 Checking, handling and site storage of materials and components

2.1.1 Checking

Check delivery tickets and certificates against the specification. Examine marks and labels and the condition of materials and components. If necessary refer to the supplier immediately and do not use the materials or components until the position is clarified.

COMMENTARY. *Mastic asphalts for tanking and damp-proof coursing (see BS 6925 and BS 6577), roofing (see BS 6577 and BS 6925) and paving (see BS 1446 and BS 1447) can be identified by the manufacturer's mark or name and the British Standard (BS) number of the asphalt blocks delivered to site.*

Rolls of bituminous sheeting for tanking and damp-proof courses (see BS 6398) and bituminous roofing felts (see BS 747) can be identified by the BS number and classification, i.e. A to G, on the roll wrapping.

All other materials covered by a British Standard can be identified by the BS number.

All other proprietary materials not covered by current British Standards material specifications should be identified by the manufacturer's labelling on the products delivered.

A number of tanking membrane and roofing membrane materials not covered by a British Standard are available. In sheet form these are likely to be high performance membranes of bitumen, bitumen polymers or pitch polymers for bonding in hot bitumen or laminates of plastics sheets and self adhesive bitumen, coal tar or pitch and polymeric materials for application of brush, trowel or airless spray.

2.1.2 Handling and site storage

2.1.2.1 *Handling.* Handle all materials and components with care and avoid damage, soiling or contamination.

2.1.2.2 ***Storage***

a) Board materials under cover; support them so as to avoid distortion and protect them against wetting, mechanical damage and contamination.

b) Store rolls of bituminous felt carefully on end on a clean, level surface and protect them against wetting. Store rolls of other proprietary materials similarly unless the manufacturer's sitework instructions specify otherwise.

c) Store asphalt and bitumen blocks separately on a clean base and separated into their various grades.

d) Store chippings and aggregates on a clean, dry base avoiding contamination with other materials and separated according to type and size.

e) Stack pavings and tiles neatly on clean ground or on supports protected from contamination from the earth and from splashing.

f) Store accessories, e.g. paint, trim and expanded metal, under cover and protected from mechanical damage and contamination.

g) Store sealants, primers, liquid solutions and other similar materials under cover and protected from frost. Read and comply with any other particular instructions on labels concerning storage.

COMMENTARY. *Some roll materials are vulnerable to damage at low temperatures.*

2.2 Preparation of work, materials and components

2.2.1 General

2.2.1.1 *Liaison.* Liaise and agree the timing and sequence of work. Agree requirements for and provision of sufficient working space, plant, hoisting facilities, materials, access, safety, dewatering, if required, and protection.

Ensure that necessary work by other contractors is or will be sufficiently complete and will not delay the continuity of work or leave uncompleted work vulnerable to inclement weather and damage.

2.2.1.2 *Acceptability of substrates.* Before commencing applying waterproofing membranes or roofing, check that for the particular application the following apply.

a) Substrates are sufficiently smooth and even textured.

b) Substrates are free from frost, sufficiently dry, clean and not contaminated with oil or other deleterious materials.

c) For waterproofing membranes the construction permits effective continuity of the membrane. Ensure that surfaces which join vertical and horizontal construction allow for practical lapping and jointing of membranes. Before general laying commences check that any chases required have been cut and service penetrations have been prepared.

d) For roofing the required falls and heights of upstands can be achieved and the levels at which rainwater outlets are set are sufficiently low to drain the surrounding roof efficiently. Check as far as practicable that waterproofing work carried out by other trades and on which the performance of the roofing as a whole is dependent, is or will be satisfactory. Check such items as, for example, cover flashings, cappings and the continuity of damp-proof courses (DPCs) in walls.

2.2.1.3 *Location of plant.* Provide a suitable level site for equipment for heating bitumen and asphalt, as close as practicable to the work position and so sited and protected that materials can be processed safely.

COMMENTARY. *Consideration will need to be given to fencing off plant in public areas and siting plant away from entrances and exits.*

2.2.1.4 *Cauldrons and mixers.* Check that cauldrons and mixers for the on-site preparation of material are empty and free of residue when they are brought onto site.

2.2.1.5 ***Checking materials***

2.2.1.5.1 *On delivery.* Check roofing materials as soon as they are delivered to the site to ensure that:

a) they are in the manufacturer's original wrappers and correctly labelled;

b) they conform to the specification;

c) they are sufficient for the work.

2.2.1.5.2 *Prior to use.* Before using materials ensure that the right materials are used in the correct positions.

2.2.1.6 *Weather.* Do not apply or lay materials on substrates which are frozen or have been affected by frost.

2.2.1.7 *Sequence and timing.* Apply or lay separate layers or coats with the minimum practical delay between successive layers or coats, taking account of any manufacturer's instructions.

COMMENTARY. *It is important not to carry out work on underlays or first coatings too far in advance in a work period. Although such advance work may be convenient for production, it also increases the risk of damage, wetting and trapping of water. If, for reasons of speed or possibility of damage by following trades, it seems more practicable to delay fixing of the final layer, extra care will need to be taken to ensure that water and dirt are removed and damage repaired so as not to impair performance.*

Section 3. Applying and laying tanking, damp-proofing and roofing

3.1 Applying tanking and damp-proofing

3.1.1 General

3.1.1.1 *Protection.* Provide protection against damage to the membranes at all times. Provide or ensure the provision of the permanent protective construction as soon as practicable after completion of the damp-proofing membrane. Keep the area which has been overlaid clear of materials used by other trades.

3.1.1.2 *Membrane support.* Provide full support without voids over the whole of both surfaces of tanking membranes in a sandwich construction. Where the membrane is applied internally to vertical surfaces, ensure that the protecting inner wall is so constructed as to fully support the membrane.

COMMENTARY. *In internal application, the membrane is applied to the wall and floors from the inside of the building space. In external application, the membrane is applied to walls from the side external to the building space [see Figure 1(a)]. Where a masonry skin is built against the membrane, the space between the masonry face and the membrane will contain voids unless it is sufficiently wide to allow it to be conveniently filled with mortar which is essential to support the membrane [see Figure 1(a) and Figure 1(b)].*

3.1.1.3 *Externally applied membrane.* Provide and maintain effective temporary protection to the membrane at the junction of floor and wall [see Figure 1(a)]. Do not drive mechanical fixings through the membrane.

COMMENTARY. *The horizontal and all or most of the vertical membrane will have to be applied at different times as the construction of the wall breaks the continuity of application.*

3.1.1.4 *Temperatures of heated material.* Do not heat bonding bitumens above 260 °C. Do not heat asphalt above 230 °C for prolonged periods. Measure temperatures with thermometers in the heating cauldrons or in the mastic asphalt immediately after it has been removed from a mixer.

COMMENTARY. *Higher temperatures create a greater risk of fire. Bonding bitumen is normally at the correct viscosity for application at a temperature of approximately* 240 °C. *Asphalt will harden on prolonged exposure to temperatures over* 230 °C. *To minimize hardening during remelting it is necessary to keep the mixer as full as possible.*

3.1.2 Proprietary membranes

Apply the membrane and all associated details in accordance with the manufacturer's sitework instructions.

COMMENTARY. *All waterproofing materials will have their own detail characteristics; the workmanship applied to them should be in accordance with the manufacturer's site installation instructions.*

3.2 Roofing: preparatory works for insulation and vapour control layers

3.2.1 General

3.2.1.1 *Loading.* Take care not to overload the roof decking with the materials used for roofing. Before commencing roofing work, clear materials used by other trades from the area to be overlaid. Take care when working on substrates which are vulnerable to damage or breakage; use protective boards or define access routes as appropriate.

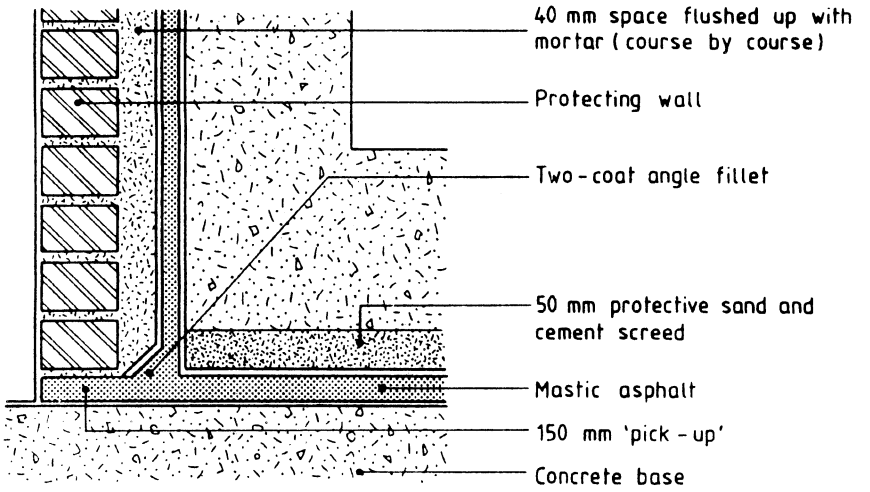
3.2.1.2 *Protection during laying.* Protect installed moisture-sensitive materials by the provision of temporary seals or covers at working edges.

Do not allow, or limit as far as possible, general access until all the work required on flat areas has been completed; if access is unavoidable make special provision for the protection of a defined access route and make good any damage caused.

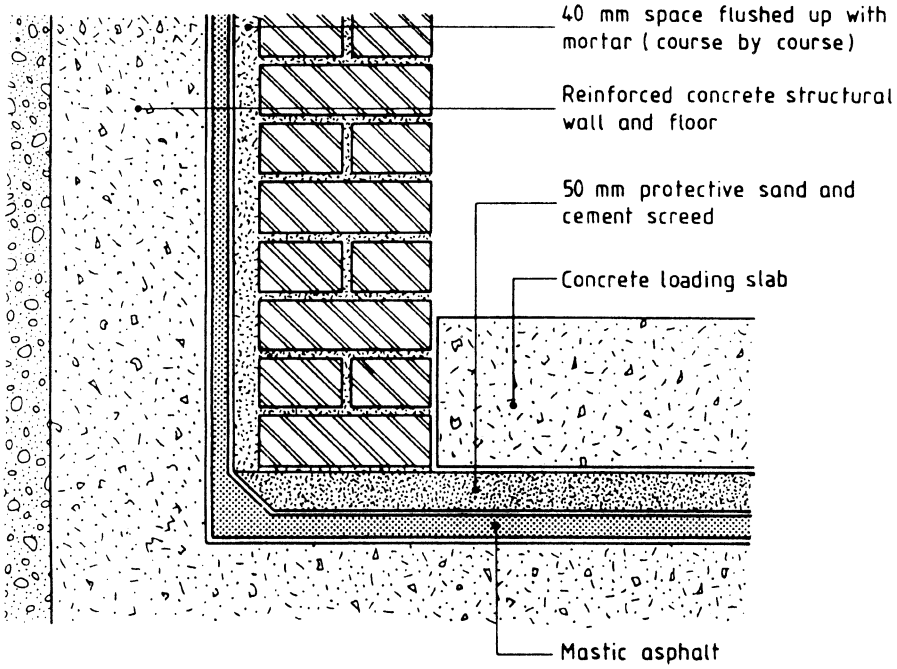
COMMENTARY. *It is important that delays in fixing the final weatherproofing layer are avoided.*

3.2.1.3 *Temporary drainage.* Provide outlets in the substrate and substructure for temporary drainage of construction water and rain as specified. Maintain the drainage until, according to the circumstances, it serves no further useful purpose.

COMMENTARY. *It is necessary to provide temporary drain holes through concrete structural decks at low points so that there are no areas where water can or is likely to pond after rain. These holes are left open for a period after any further substrate and waterproofing is applied in order to drain any free water which collects after roofing work has started. They may then be sealed with cement/sand mortar.*



(a) Typical external application



(b) Typical internal application

NOTE. The application of sheet membrane is similar.

Figure 1 — Typical internal and external tanking installations

3.2.1.4 *Effective fixing.* When insulation layers and roof coverings are being fixed ensure that the fixing will effectively prevent uplift from wind.

COMMENTARY. *Wind gusts in particular create suctions around the perimeters of roofs, especially at corners; this may cause the peeling of inadequately fixed materials. Where the roof deck is permeable the forces of suction outside or pressure inside the building develop on the most impermeable layer in the roof construction. This may be the vapour control layer or the waterproof membrane.*

The strength of the bond of insulation boards to the roof can be tested by a moderate pull of a man of normal strength without damaging the boards. The removal of a board after laying will often reveal substantial patches of the deck untouched by bitumen; this is normal and the important criterion is the overall strength of bond.

When carrying out this test care is needed not to damage the insulation board; it is not a test of the stength of the board itself. If the test is not satisfactory but the workmanship is considered to be satisfactory, seek advice.

3.2.1.5 *Movement joints.* Ensure that clear instructions have been given regarding the formation and installation of joints including ends and junctions.

3.2.1.6 *Temperatures of heated material.* Treat heated materials as in **3.1.1.4**

3.2.2 Proprietary roofing

Lay the roofing including all associated details in accordance with manufacturer's sitework instructions.

3.2.3 Screeds

3.2.3.1 *Cementitious screeds.* Ensure that cement/sand, aerated cement and no-fines screeds are cured and sufficiently dry before applying further materials.

3.2.3.2 *Bitumen bound screeds.* Where the screeding material is water absorbent, lay only as much screed in one day as can be waterproofed in that day, or otherwise follow the manufacturer's instructions. Apply temporary waterproof edge protection at the end of each day's work. Remove the protection before continuing the work.

COMMENTARY. *It is important that cementitious and bitumen bonded screeds are laid to the specified falls as subsequent correction may not be practicable.*

3.2.4 Slab, board and sheet structural substrates

Ensure that the condition of the substrate is suitable for the installation.

3.2.5 Slab and board insulating non-structural substrates

3.2.5.1 *Fixing.* Fix slab or board insulation in accordance with the manufacturer's sitework instructions and guidance for the circumstance. Check the type and thickness of the boards against the specification.

COMMENTARY. *A common fixing is by means of a hot bitumen bonding compound. With polystyrene boards, care needs to be taken to minimize damage to the surface by heat applied for fixing down or subsequent overlaying. Where bedded in hot bitumen, this should be allowed to cool to a tacky surface before bedding polystyrene (see also* **3.5.3.1***).*

3.2.5.2 *Stagger joints.* Generally stagger board end joints.

COMMENTARY. *Where practicable it is preferable to lay the boards diagonally to the direction of the structure in order to stagger positively any jointing pattern between them (see also* **3.5.3.4***).*

Tapered boards can be used to provide falls and are generally installed with joints which are not staggered. Layout drawings should be provided.

3.2.5.3 *Support.* Ensure that the boards are fully or adequately supported by the substrate. Where boards are supported by troughed metal decking do not form cantilever edges at board joints over troughs unless, because of the structural strength of the board being used, the manufacturer's sitework instructions specify otherwise.

3.2.5.4 *Facings.* When laying insulation boards which have different facings, ensure that the boards are laid the right way up. If in doubt seek instructions.

3.2.5.5 *Sequence.* Lay the insulation boards in close sequence with the weather membrane to minimize the risk of the insulation boards and deck becoming wet.

3.2.6 Vapour control layers

3.2.6.1 *Positioning.* Ensure the correct positioning of any material intended to function as a vapour control layer.

3.2.6.2 *Laying.* Lay and bond the vapour control layers with care. Seal all joints and ensure that the whole membrane is imperforate, except for the penetration of mechanical fixings where specified.

COMMENTARY. *Side laps are normally at least* 50 mm *and end laps at least* 75 mm *with the vapour control layers enveloping the insulation at its edges.*

3.3 Mastic asphalt tanking and roofing

3.3.1 General

3.3.1.1 *Laying asphalt.* Ensure that the correct grade of mastic asphalt is used. Use timber or metal gauge battens for thickness and edge forming as necessary. Lay each coat as evenly as possible using a hand float; avoid undue delay between successive coats in order to reduce the risk of contamination. Do not lay more of the undercoat than can be conveniently finished with topping coats in a day. Pierce any blows as they appear and make good whilst the asphalt is still warm.

3.3.1.2 *Joining coats.* Join an asphalt coat approximately 150 mm away from the location of a join in the preceding coat. When joining a coat, first warm the edge with hot asphalt, remove the edge when it has melted, then lay in new work. Discard the material from the melting operation. Do not hammer or chisel asphalt to remove it.

COMMENTARY. *It is necessary to clean the edge and to bond in new material so that the membrane has as few joins as possible.*

3.3.1.3 *Asphalt fillets.* Form fillets at all internal joins in the asphalt membrane. Ensure that the asphalt surfaces at these joins are clean. First brush or scrape away loose particles, then warm the join with hot asphalt. Remove the temporary mastic asphalt together with the surface of the existing mastic asphalt. Apply the permanent mastic asphalt fillet in two coats to the freshly exposed and warm surfaces so that the fillet has a face dimension of approximately 40 mm and the face of the fillet is at an angle of approximately 45° to the horizontal.

3.3.1.4 *Maintaining thickness.* Maintain the full thickness of asphalt coating at external corner junctions, chases, and tuck-ins.

COMMENTARY. *Excessive rounding off of asphalt at corners is likely to reduce the thickness of the coating. If the asphalt corner is rounded, the substrate should also have been rounded or cut back.*

3.3.1.5 *Keying.* Key asphalt by one of the following means.

Fix expanded metal lathing in situ to provide a mechanical key, with nails or screws at approximately 150 mm centres. On timber apply the expanded metal lathing over sheathing felt.

Where mastic asphalt is to be applied direct to the substrate, e.g. brick, render and concrete, ensure that the surface is clean and firm and then prime it with a suitable primer.

3.3.1.6 *Priming metals.* Prime all metals with bitumen where an adhesive bond with asphalt is required.

3.3.2 Mastic asphalt tanking

3.3.2.1 *Isolating membrane.* Use an isolating membrane under horizontal asphalt only where specified or instructed.

COMMENTARY. *As the asphalt is sandwiched by construction and in an internal environment, allowance for differential thermal movement is not normally necessary. An isolating membrane, where used, may help to counteract "blowing" due to vapour entrapment arising from moisture in the substrate.*

3.3.2.2 *Service penetrations.* If a design for sealing around service penetrations is not provided, seek instructions and agree a method.

3.3.3 Mastic asphalt roofing

3.3.3.1 *Isolating membrane.* Use an isolating membrane to avoid direct contact between mastic asphalt and the substrate and lay it as follows.

a) Ensure that the surfaces over which the separating layer is placed have no significant lips, steps or depressions which will form a mechanical key between the substrate and the asphalt.

b) Lay sheathing felt over horizontal areas and areas of shallow slope. Lay the felt loose on the substrate and lap joints 50 mm.

c) Lay sheathing felt over timber and other surfaces where specified. Use expanded metal lathing to key asphalt over sheathing (see **3.3.1.5**).

COMMENTARY. *Sheathing felt is normally specified as type 4A(i) of BS 747 which is a black bituminous felt. The lap joints become sealed with the heat of the asphalt. The bituminous fibre sheathing felt provides a good frictional bond with the asphalt. It nullifies the effect of cyclic differential movement between asphalt and substrate by allowing slippage and also allows a lateral path for dispersion of vapour. An underlay of glass fibre tissue may be specified for roofing or paving grade asphalt where vehicle or other heavy traffic is expected since such tissue provides a less compressible interlayer within the construction.*

3.3.3.2 *Slip membrane.* Where specified, lay a single or double non-bituminous slip membrane under the sheathing felt to prevent adhesion to bituminous surfaces.

3.3.3.3 *Surface finish.* Where specified, sand-rub the surface whilst it is still warm with a clean sharp sand using a wooden float. Do not sand-rub vertical surfaces or the finished surface of roofing asphalt which is to be surfaced with paving asphalt.

COMMENTARY. *The object of sand-rubbing is to reduce the bitumen richness of the surface which can oxidize and craze.*

3.3.3.4 *Paving grade upstands.* Make the junctions of paving and roofing grade asphalts at upstands using roofing grade material for the upstands and two fillets of roofing grade mastic asphalt (see Figure 2).

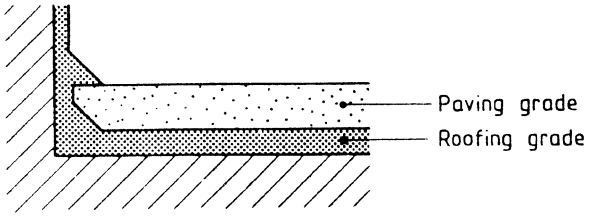


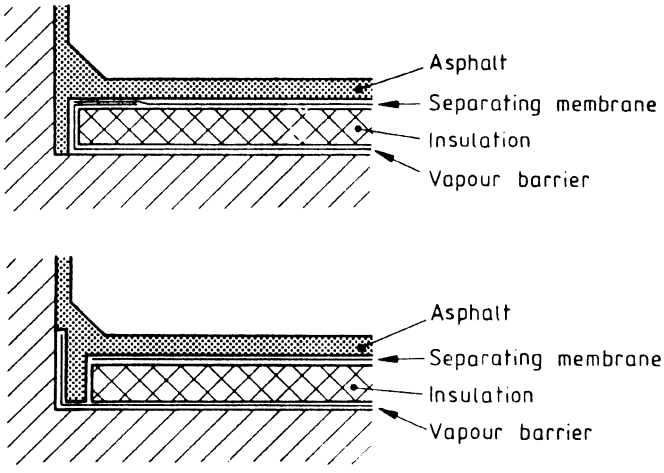
Figure 2 — Paving grade asphalt upstand junction

3.3.3.5 *Asphalt upstand tops.* Ensure full adhesion of the tuck-in at the tops of upstands; ensure protection and continuity of any DPC and flashing which has been fixed immediately above the upstand. Maintain the full thickness of asphalt at the tuck-in.

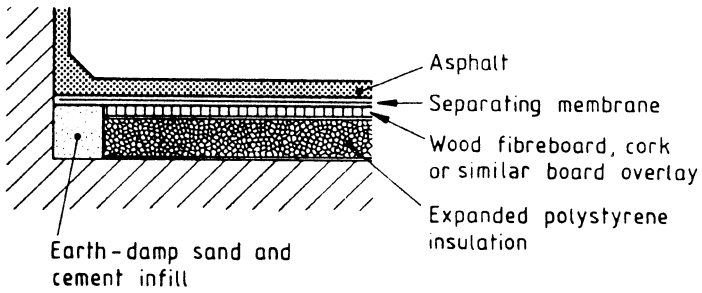
3.3.3.6 *Asphalt upstand support.* Provide sufficient support at the base of asphalt upstands.

COMMENTARY. *The type of support depends on the construction and materials but essentially is achieved either by providing a firm bearing at the base of the upstand or by reinforcing the junction. Alternative methods are indicated in Figure 3.*

3.3.3.7 *Flashings.* Ensure that the top edges of flashings are effectively shielded by surrounding constructions by tucking them into a chase, lapping and fixing them to the horizontal surfaces of upstand kerbs, or by overlapping cladding.



(a) Asphalt leg support. Two examples of vapour barrier perimeter termination



(b) Support with protection for heat sensitive insulation material

Figure 3 — Alternative methods of upstand support

Where flashings are tucked into a chase in masonry or concrete walls, ensure that the chases are of sufficient height and depth.

Do not use the wall DPC as a counter-flashing and do not set the tuck-in of the flashing below the wall DPC.

On completion, point the chase with mortar (cement : sand 1 : 3) containing an additive to restrain shrinkage and increase adhesion.

Apply lead and copper counter-flashings as follows:

a) joint lengths at intervals no greater than 1.5 m for lead and 1.0 m for copper;

b) lap joints a minimum 100 mm;

c) check welt flashings at chase edge and lower edge;

d) wedge in the chase with lead wedges at 450 mm centres.

3.3.3.8 *Eares.* Form drip edges at gutters and other roof water discharge edges according to the design and the following procedure.

a) Where lead aprons are used, fix the lead firmly over a roofing felt underlay at close centres. Welt the rear edge and maintain the full thickness of asphalt over the apron. Limit the lengths of apron pieces to 1 m. Butt the sheathing felt to the roofing felt underlay (see Figure 4).

b) Where asphalt aprons are used, form an apron of required depth with a drip edge with an undercut profile (Figure 5).

COMMENTARY. *The edge profile forms a mechanical key to lock the asphalt in place.*

c) Where proprietary trims are used, ensure they are firmly fixed to the structure in accordance with the manufacturer's sitework instructions.

3.3.3.9 *Verges and check kerbs.* Form types of verges and check kerbs according to the treatment required (see Figure 6).

3.3.3.10 *Rainwater outlets.* Maintain a full thickness of asphalt over the flange of the outlet which is mechanically fixed.

3.3.3.11 *Gutters.* Ensure good adhesion of asphalt to gutter sides of substrate.

3.3.3.12 *Pipes and sleeves perforating the roof.* Provide a key for the asphalt upstand against the sleeve or pipe with a high bond primer or by expanded metal lathing securely fixed in position as specified. Asphalt the upstand in two coats to the required height and form a two coat angle fillet at the base.

3.4 Damp-proofing near ground level

NOTE For damp-proofing within walls, see BS 8000-3; for applying tanking and damp-proofing near ground level, (see also **3.1**). This clause does not include damp-proofing which is itself also the finishing material.

3.4.1 Damp-proofing within floors

3.4.1.1 *Tanking materials.* If tanking materials of mastic asphalt bituminous sheeting or proprietary membranes are used for damp-proofing membranes near ground level, refer to and apply all the recommendations in **3.3.1**, **3.3.2**, **3.5.1**, and **3.5.2**.

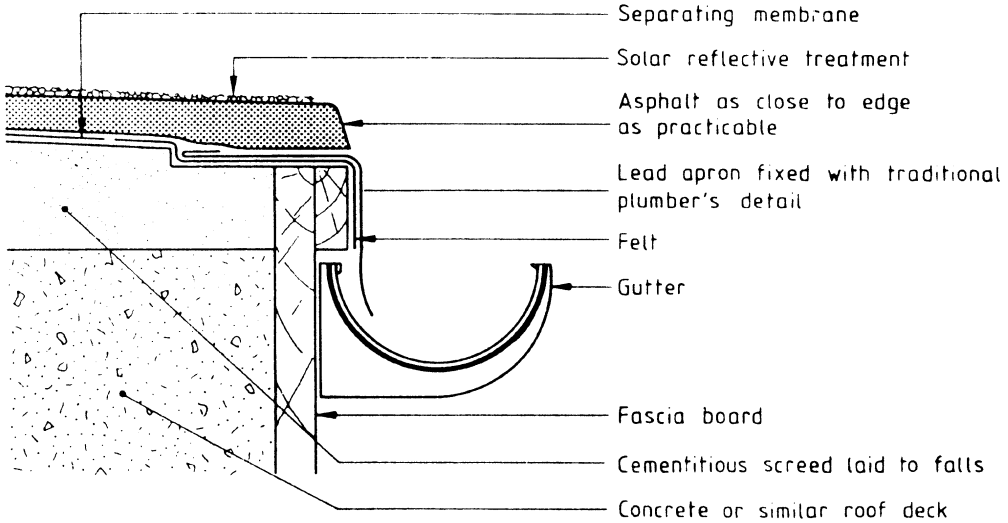


Figure 4 — Typical lead apron

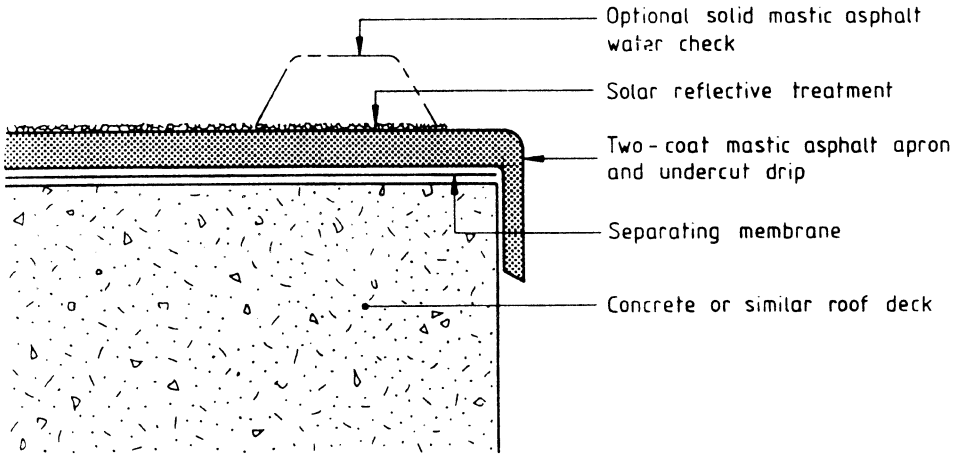


Figure 5 — Typical asphalt apron

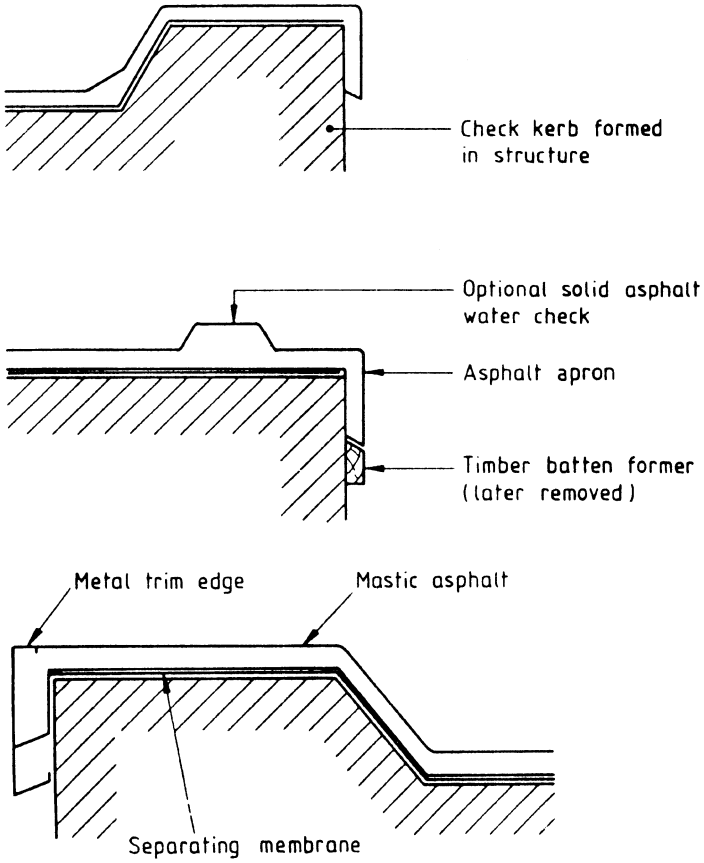


Figure 6 — Typical verge and check kerb treatments

3.4.1.2 *Cold applied liquids.* Ensure that the surfaces to which damp-proofing is applied are thoroughly clean and free of loose particles and dust. Apply cold liquid as follows.

a) Apply the liquid evenly and fully to build up to the specified or recommended thickness in the specified number of coats.

b) Do not apply cold liquids to wet surfaces. Where surfaces are damp, prime them before applying solvent based material where required by the manufacturer's sitework instructions. Apply water based emulsions directly to dry or to damp surfaces but not to wet surfaces.

c) Apply the liquid by means of brush or airless spray according to the type of compound and area to be covered.

d) Do not apply cold liquids at near freezing temperatures.

e) Allow the surfaces to dry between coats and before being covered by construction.

f) Protect the surfaces or exclude traffic between laying and covering with construction.

3.4.1.3 *Hot applied liquids.* Ensure that the surfaces to which damp-proofing, e.g. bitumen and pitch, is applied are thoroughly clean and free of loose particles and dust. Prime surfaces before application of hot liquids.

Apply the hot liquid evenly and fully to build up to the specified thickness in the required number of coats.

3.4.1.4 *Polyethylene film.* Lay polyethylene film on a smooth bed free of all sharp projections. Lap for at least 150 mm; if the specification requires the film to be sealed, either seal the lap interface with mastic sealant and lap the edge with adhesive jointing tape or seal the lap with double adhesive-sided jointing tape.If welting is required, form double welts with 300 mm seams folded twice and held down temporarily with jointing tape or weights (see Figure 7).

Cut the main membrane neatly and as tightly as practicable around the service penetrations. Form additional seals with offcut squares of polyethylene cut tightly to the service penetration and lapped and sealed to it and the main membrane with adhesive jointing tape.

Lay the membrane sufficiently loosely against upstands so that it is not stretched or torn when further construction is applied.

COMMENTARY. *The choice of membrane depends on the likely degree of ground moisture, the type of construction, the sensitivity of the floor finish to moisture and the general suitability of materials to the circumstances.*

The cold applied liquids that might be used are mainly blends of bitumen, coal tar or pitch and polymeric material. Liquids normally contain the damp-proofing material either dissolved in solution or emulsified in water. The solvents or water need time to evaporate.

3.4.2 Connections to wall DPC: continuity

Ensure the floor membrane connects with the wall DPC. Where membranes in floors are not at the same level as adjacent DPCs in walls, apply the damp-proofing to the wall in such a way that they are connected and the damp-proofing is continuous.

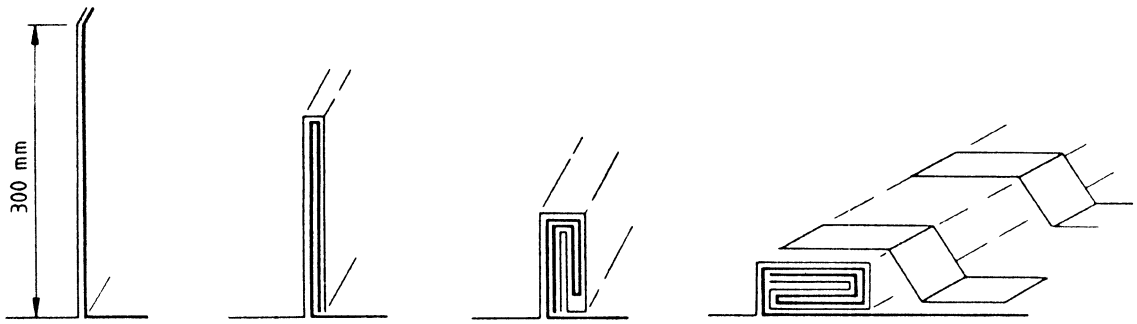


Figure 7 — Double welted joint of polyethylene damp proof member (DPM)

3.5 Bitumen sheet tanking and built up bituminous roofing

3.5.1 General

3.5.1.1 *Priming.* First clean, then brush the bitumen primer fully and evenly over the substrate surfaces to be bonded, including metals, and allow to dry.

3.5.1.2 *Nailing.* Where the first layer is fixed by nailing use galvanized nails with extra large flat heads at spacings in accordance with the specification.

3.5.1.3 *Pour and roll bonding.* For horizontal surfaces lay a length of membrane loosely in position and firmly roll back one end half-way. Pour hot bitumen from a container on to the substrate in front of the roll and roll out the membrane, smoothing out surplus bitumen with a scraper as work proceeds so as to cover the whole of the felt surfaces. Repeat with the other half of the roll.

For vertical surfaces unroll the membrane up from the base whilst applying hot bitumen from a container carefully in front of the roll.

To enable excess bitumen flowing from lap and end joints to be removed from a mineral surfaced top layer, either use water to wet the edge of the layer to be overlapped just beyond the edge of the lap or use other suitable means which prevent adhesion of the bitumen. Ensure that water does not get into the lap joint itself; when the lap has been formed, remove any excess bitumen. Do not re-use excess bitumen.

3.5.1.4 *Mopping.* Apply the bitumen by mop instead of pouring it from a container. Proceed with the application of the membrane as for pour and roll bonding.

3.5.1.5 *Torching.* Torch membranes which are made to be bonded by this method to substrates in accordance with the manufacturer's sitework instructions.

3.5.1.6 *Partial bonding.* Lay type 3G (group 1) perforated underlays or proprietary membranes in accordance with the manufacturer's sitework instructions or, if specified, partially bond unperforated underlays by spot bonding or frame bonding to provide a regular 10 % minimum area of bond.

COMMENTARY. *Partial bond can be achieved by mopping or by the pour and roll method with a controlled flow of hot bitumen. Where a perforated underlay is used for partial bond, this layer is laid loose with the mineral side down, long edges lapped and ends butted. The succeeding layer is fixed by the pour and roll method which partially bonds the underlay through its perforations. Mopping is used more for detailed work than for laying on general areas*

3.5.1.7 *Bonding detail work.* Apply hot bitumen to bond detail work at upstands, corners, etc. or torch as appropriate.

3.5.2 Bitumen sheet tanking

3.5.2.1 *Lap dimensions.* Lap side joints at least 100 mm and lap end joints at least 150 mm on adjoining sheets.

3.5.2.2 *Breaking joint.* Lay the succeeding layer(s) of the membrane to break joint with the layer(s) beneath, either ½ roll width for two layer work or $^{1}/_{3}$ roll width for three layer work.

3.5.2.3 *Internal angles.* Lay a strengthening sheet strip 300 mm wide to internal angles well bedded and bonded into hot bitumen into the angle. Interleave this strengthening strip with adjacent layers of membrane.

3.5.2.4 *Service penetrations.* If a design is not provided seek instructions and agree a method for sealing around service penetrations.

3.5.3 Built up bituminous roofing

3.5.3.1 *Type of attachment to substrate.* Unless the specification or the manufacturer's sitework instructions require otherwise, attach built up roofing membranes to substrates as follows.

a) *Cement sand screeds or lightweight screeds.*

1) Prime surfaces and allow to dry.

2) Either partially bond first layer, or fully bond vapour barrier under dry insulation substrate.

b) *Metal decking.*

1) Bitumen prime contact surfaces where specified.

2) Either bond with hot bitumen to contact surfaces of metal decking or use cold bituminous adhesive where appropriate.

c) *Timber boarding.* Nail first layer to boarding.

d) *Plywood and prefelted chipboard.*

1) Where and as specified apply 150 mm strips of underlay bonded over joints.

2) Partially bond the first layer to plywood and chipboard.

e) *Granulated cork board, cellular glass slab and fibreboard.* Fully bond the first layer to boards or slabs.

f) *Mineral fibre boards and similar.*

1) Fully bond the first layer to boards.

2) Where required or appropriate, mechanically fasten the first layer to the substrate through the insulating layer.

g) *Polyurethane board and polyisocyanurate board.* Partially bond the first layer to boards.

h) *Polystyrene board.* Do not lay the membrane in hot bitumen direct to board or prefelted board but interpose a layer of fibre-board or cork to provide a shield from excessive heat and to absorb large thermal movements. Bed the shield in hot bitumen by coating its contact face and pressing this into the polystyrene board.

For slopes over 10°, in addition to fixing or bonding described in a) to h), mechanically fasten the layer(s) at the tops of slopes in accordance with the built up roofing manufacturer's sitework instructions unless otherwise specified.

3.5.3.2 *Lap dimensions.* Allow side lap dimensions of at least 50 mm and end lap dimensions of at least 75 mm.

3.5.3.3 *Breaking joint.* Lay succeeding layers of built up roofing so as to break joint with the layer beneath.

3.5.3.4 *Direction of jointing.* Lay the side jointing in the most convenient direction in relation to the direction of fall on flat roofs. Where practicable, ensure that the water flow on the general area is not directed into the head of the joint of the top layer. On sloping roofs locate the side jointing from ridge to eaves.

3.5.3.5 *Upstands.* Bond layers to surfaces with hot bitumen. Ensure that the correct specified grade of bitumen is used.

COMMENTARY. *Layers of built up roofing may either be counter-flashed separately or tucked into chases or returned over kerbs. See* **3.5.3.6**. *It is preferable to lap at least one layer of cap sheet over the top surfaces of upstand kerbs where practicable to provide additional fixing. Independent upstands should always be counter-flashed separately.*

3.5.3.6 *Flashings.* Ensure that the top edges of flashings are effectively shielded by surrounding constructions, either by tucking them into a chase, by lapping and fixing them to horizontal surfaces of upstand kerbs, or by overlapping cladding.

If flashings are tucked into a chase in masonry or concrete walls, ensure the chases are of sufficient height and depth.

Do not use the wall DPC as a counter-flashing. Set the tuck-in of the flashing below the wall DPC.

On completion, point the chase with cement mortar or a sealant according to the specification.

Use lead and copper counter-flashings as follows:

a) joint lengths at intervals no greater than 1.5 m for lead and 1.0 m for copper;

b) welt or lap joint the flashings to a minimum 100 mm;

c) wedge the flashings in the chase or fasten as specified.

3.5.3.7 *Eaves.* Form type of eaves at gutters and other roof water discharge edges according to the design and materials used, in detail in accordance with the manufacturer's sitework instructions, and the following general procedure.

a) *Welted membranes.* Use strips of the specified mineral surfaced membrane of sufficient width to provide a lap on the horizontal surface of 100 mm and to form downstand welts at least 50 mm, i.e. strips of 250 mm minimum width which allows for bends. Either bond or nail the tail of the welt to the drip face of the substrate. Bond the welt together and interleave the lap in the layers of roofing (see Figure 8).

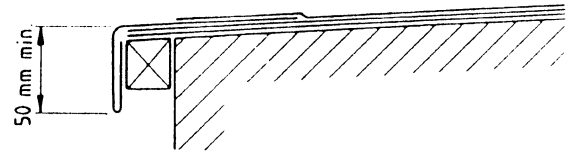


Figure 8 — Typical welted drip

b) *Metal trims.* Fix metal trims firmly to the structure with fixings at least at 300 mm centres. Incorporate butt straps at joints and arrange them so that the trim is fixed to one side of the strap. Allow a gap of 2 mm between the lengths and restrict the lengths to 3 m. Lay the fixed tail end of the trim so that at least one layer of the built up roofing is laid underneath.

c) *Lead and copper aprons.* Interleave the rear tail of the apron into the layers of roofing. Unless otherwise specified, do not welt this tail edge. Nail down the tail firmly and at close centres. Lap joints 100 mm or welt as required. Use lengths of lead or copper not greater than 1 m.

d) *Other proprietary rigid trims.* Fix proprietary trims in accordance with manufacturer's sitework instructions.

3.5.3.8 *Verges and check kerbs.* Form type of verge and check kerb according to design and materials, in detail in accordance with the manufacturer's sitework instructions and the following general procedure.

a) *Profile.* Form any check kerb to the specified height with an angle fillet at the rear of the kerb (see Figure 9).

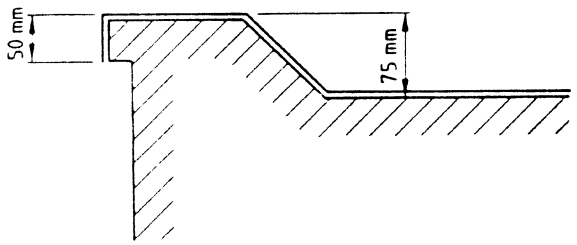


Figure 9 — Typical profile of verge and check kerb

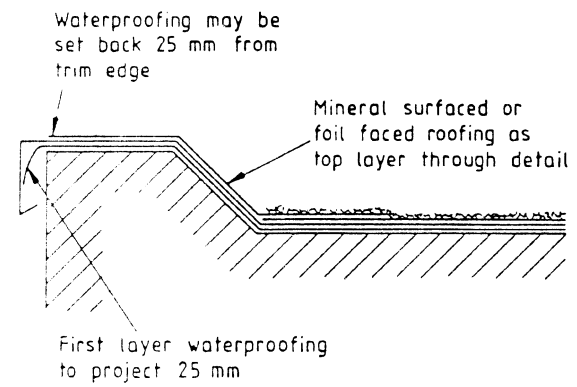


Figure 10 — Typical profile of verge and kerb with aluminium trim

b) *Aluminium trims.* Fix aluminium trims as for eaves (see item b) of **3.5.3.7** and see Figure 10).

c) *Lead and copper aprons.* Fix lead and copper aprons as for eaves (see item c) of **3.5.3.7**).

d) *Other proprietary rigid trims.* Fix proprietary trims in accordance with manufacturer's sitework instructions.

3.5.3.9 *Rainwater outlets.* Seal roofing membranes carefully in hot bitumen around and into outlet flanges. Set outlet flanges within the layers of built up roofing. Fix the outlet to the decking to prevent it being pushed upwards by the rainwater pipe.

3.5.3.10 *Gutters.* Lap built up roofing layers in accordance with manufacturer's sitework instructions.

COMMENTARY. *It is advisable to lay and finish felt at the edges and soles of gutters so that laps are made in the direction of water flow. This will generally be achieved by starting the finishing layers at the lowest points, i.e. outlets and gutters.*

3.5.3.11 *Cold pipe perforations.* Form star-cuts carefully in successive layers of built up roofing around cold pipes and bond in hot bitumen. Bond a collar of top layer membrane in hot bitumen around the pipe (see Figure 11). Do not apply hot bitumen direct to the pipe if it will soften the pipe material. Where the seal is made to a flanged pipe sleeve, incorporate the sleeve in the layers of built up roofing and seal to the flange with hot bitumen.

3.5.3.12 *Hot pipe perforations and flues.* Fix, or ensure the fixing of, independent sleeves to ensure a clear gap or space for insulation. Gap and seal built up roofing to the sleeve in accordance with **3.5.3.11**. Do not apply bitumen to hot pipes and flues.

3.6 Surface protection for built up roofing and asphalt

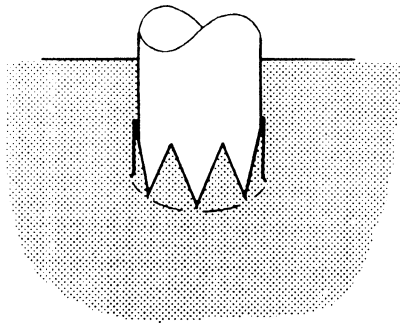
3.6.1 Timing

Apply any required additional surface protection as soon as practicable after completion of preceding work.

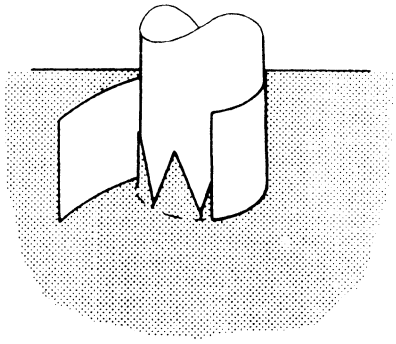
3.6.2 Stone chippings and aggregate

Apply stone chippings and aggregate of the required size, type and quantity at an even depth; where specified to be bonded, ensure that the required quantity is used and the bonding is even over all parts of the roof area. Remove any surplus.

COMMENTARY. *Chippings for bonding are normally* 10 mm *or* 14 mm *single size. In the case of built up bituminous roofing, chippings may be required to provide a surface and penetration fire designation of AA. Chippings are generally not site applied to surfaces on slopes of* 10° *or more. Aggregate of greater depth and size, e.g.* 20 mm*, may normally be applied unbonded. This acts as a loading for loose laid material including inverted roofs.*



(a) Roofing star cut. Successive layers staggered



(b) Collar of roofing forms upstand

Figure 11 — Seal to cold pipe

3.6.3 Around outlets and roof edges

Trim or terminate surface protection securely and neatly around outlets and roof edges.

3.6.4 Rigid tiles

Unless otherwise specified, bed rigid tiles in a thick coating of hot bitumen. Pour sufficient bitumen so that only a small amount is squeezed out at the sides of the tile. Coat the contact surface of the tiles with bitumen primer and allow to dry before bedding. Remove any bedding on the top surface of the tile when cold.

Either lay tiles with gaps of 1 mm to 2 mm all round each tile or provide wider gaps dividing bays of 3 m length and width.

Check that tiles do not rock.

3.6.5 Concrete slabs

Bed evenly on overall bedding materials or proprietary supports so that the slabs are held in a stable position.

3.6.6 Proprietary reflective coatings

Apply any proprietary reflective coatings in accordance with manufacturer's sitework instructions.

Index

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List of references (see 1.2)

Normative references

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BRITISH STANDARDS INSTITUTION, London

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BS 6100-1, *General and miscellaneous.*
BS 6100-1.3, *Parts of construction works.*
BS 6100-1.3.1:1987, *Walls and cladding.*
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BS 6229:1982, *Code of practice for flat roofs with continuously supported coverings.*
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BS 747:1977, *Specification for roofing felts.*
BS 1446:1973, *Specification for master asphalt (natural rock asphalt fine aggregate) for roads and footways.*
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BS 6398:1983, *Specification for bitumen damp-proof courses for masonry.*
BS 6577:1985, *Specification for mastic asphalt for building (natural rock asphalt aggregate).*
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BS 8000-5, *Code of practice for carpentry, joinery and general fixings*[2)].
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BS 8000-8:1989, *Code of practice for plasterboard partitions and dry linings.*
BS 8000-9:1989, *Code of practice for cement/sand floor screeds and concrete floor toppings.*
BS 8000-10:1989, *Code of practice for plastering and rendering.*

[2)] In preparation

BS 8000-11, *Code of practice for wall and floor tiling.*
BS 8000-11.1:1989, *Ceramic tiles, terrazzo tiles and mosaics.*
BS 8000-11.2, *Natural stone*[3)].
BS 8000-12:1989, *Code of practice for decorative wallcoverings and painting.*
BS 8000-13:1989, *Code of practice for above ground drainage and sanitary appliances.*
BS 8000-14:1989, *Code of practice for below ground drainage.*
BS 8000-15, *Code of practice for hot and cold water services (domestic scale)*[3)].

[3)] In preparation

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