BRITISH STANDARD

BS 8218 : 1998

Code of practice for

Mastic asphalt roofing

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ICS 91.060.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee B/546, Flexible sheets for water and water vapour control, to Subcommittee B/546/7, Mastic asphalt for building purposes, upon which the following bodies were represented:

Bitumen Modifiers Association
Department of the Environment
Department of the Environment (Building Research Establishment)
Department of Transport
Low Temperature Coal Distillers Association of Great Britain Ltd.
Mastic Asphalt Producers Association
Society of Chemical Industry

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Contents

Foreword

This British Standard has been prepared by Subcommittee B/546/7. It supersedes CP 144 : Part 4 : 1970, which is withdrawn.

This standard recognizes the increased use of thermal insulation materials in warm roof and inverted roof concepts, indicating, where necessary, the essential detailing for such constructions. It also acknowledges current industry practices for the application of mastic asphalt in roofing.

This British Standard gives guidance on mastic asphalt roofs designed in accordance with BS 6229.

A flat roof typically comprises ceiling, structural supports, roof deck, waterproof covering and surface protection, and incorporates insulation and drainage. It may support ancillary items such as engineering equipment, hand railing, and lightning conductors.

Mastic asphalt is a type of asphalt composed of suitably graded mineral matter and asphaltic cement in such proportions as to form a coherent, impermeable mass, solid or semi-solid under normal temperature conditions, but sufficiently fluid when brought to a suitable temperature to enable spreading by means of a hand float, or by mechanical means.

Mastic asphalt roofing requires the use of ancillary materials and products, most of which are covered by British Standards. Specifiers should satisfy themselves, by reference to manufacturers' information and test results, that materials and products not covered by a British Standard will be suitable for their roofing requirements in particular situations and are compatible with the use of mastic asphalt. All such materials should be installed in accordance with manufacturers' instructions.

It has been assumed in drafting this standard that its application will be carried out by trained personnel under the direction of qualified supervisors.

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 32, an inside back cover and a back cover.

Code of practice

1 Scope

This British Standard gives recommendations for the use of mastic asphalt in roofing for both flat and sloping roofs and covers a variety of applications, including trafficked roofs such as roof top car parks.

2 Normative references

This British Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision.

3 Definitions

For the purposes of this British Standard, the definitions given in BS 6100 : Subsection 1.3.2 apply, together with the following.

3.1 access roof

Roof used to provide foot traffic access to plant or equipment which requires servicing, maintenance, repair or renewal.

3.2 terrace roof

Flat roof for use as an amenity area.

3.3 roof top car park

Flat roof designed for use as a car park.

3.4 cross fall; fall

A slope created in the base for the purpose of shedding water to outlets or gutters.

3.5 substrate

Surface upon which mastic asphalt roofing is laid.

3.6 roof deck

Part of the roof construction which carries the load.

3.7 cold deck roof (cold roof)

Roof in which any thermal insulation is beneath the roof deck.

NOTE. In heated buildings it is essential that any void between deck and insulation is ventilated.

3.8 warm deck roof (warm roof)

Roof in which the principal thermal insulation is placed above the roof deck, but below the waterproof covering.

3.9 inverted roof (upside down roof)

Warm deck roof in which thermal insulation is placed above the waterproof covering.

3.10 thermal insulation

Material laid to prevent heat loss from the building.

3.11 vapour control layer

Layer of vapour resistant material applied specifically to control the passage of moisture vapour.

3.12 spreader

Operative skilled in the laying and finish of mastic asphalt.

3.13 coat

Single layer of mastic asphalt.

3.14 gauge

Wood or metal strips of required thickness, temporarily fixed as boundaries to bays or elsewhere, to assist the spreader in laying the mastic asphalt.

3.15 float

Flat-faced wooden tool, with a handle, used for spreading and finishing the surface of mastic asphalt.

3.16 rubbing

Process by which the last coat of mastic asphalt is given a matt surface finish by the use of clean, coarse sand.

3.17 mechanical asphalt mixer

A mobile container, fitted with heating and powered stirrers, to provide mechanical agitation, used for re-melting mastic asphalt.

3.18 mastic asphalt cauldron

Steel vessel, non-mechanically agitated, fitted with a fire-box and used at the site of works for re-melting mastic asphalt prior to laying.

3.19 insulated dumper

Dumper truck with insulated container and mechanical agitation for the transportation of molten, mastic asphalt to point of laying.

3.20 hot charge transporter

A specially adapted vehicle, fitted with a mechanical asphalt mixer for delivery of ready-to-use mastic asphalt to site.

3.21 bitumen boiler

A vessel similar in construction to a mastic asphalt cauldron, used for the purpose of melting bitumen compound.

4 Exchange of information and time schedule

4.1 General

Consultations and exchange of information between all parties concerned with the building operations should be arranged at an early date, so that each may have full knowledge of the particulars of the work and be able to cooperate in producing the conditions required by the other to complete a satisfactory job.

4.2 Exchange of information

The designer should provide in good time all relevant information to those responsible for laying the roofing and to others whose work may be affected, including whichever of the following are applicable:

a) description, situation and address of site and means of access;

b) those conditions of contract which may practically affect this particular work;

c) location levels and dimensions of the areas to be roofed;

d) the construction, including the deck and any preparations required;

e) falls and drainage arrangements;

f) any penetrations, fixtures or attachments;

g) provision for access;

h) nature of traffic and surface finish required;

i) any vapour control layer;

j) provision for temporary storage of materials and location of plant including limitations of roof loading;

k) any special application (e.g. reservoir roof or roof top garden);

l) date for the completion of preliminary work;

m) dates for the start and completion of various sections of the roof;

n) any conformance testing required;

o) requirements relating to samples of mastic asphalt for testing purposes;

p) requirements for supervision and inspection.

4.3 Provision of utilities, facilities and materials

To prevent misunderstanding, particularly at the tendering stage, and to avoid possible situations detrimental to installation, it should be made clear whether or not the following will be provided and by whom:

a) adequate, clean, dry lockable storage space protected from frost (if necessary);

b) secure storage compound for gas bottles having a fence not less than 2 m high;

c) adequate ventilation in confined areas;

d) adequate artificial lighting if required;

e) provision of a suitable level site for the mixer or mixers, blocks, and where relevant coarse aggregate, as close as is practical to the work;

f) unloading and hoisting facilities if required;

g) provision of scaffolding, hoists, ladders and safety equipment, temporary lighting, power, water and temporary protection;

h) adequate protection of the mastic asphalt against damage prior to and during laying and during the course of subsequent building operations;

i) facilities for removal of rubbish and surplus material.

4.4 Time schedule

In considering the schedule, in addition to the usual intervals between commencement and completion of work by the various trades involved, additional allowances should be made for the curing and drying of the base concrete or screed before the roofing is laid, where appropriate.

5 Materials

5.1 Mastic asphalt

BS 6925 embraces asphalts for roofing, tanking and flooring; type R 988 specifically covers roofing grades.

Asphalt paving is covered by BS 1447.

NOTE. Polymer modified asphalts for roofing and paving are available manufactured by individual companies on a proprietorial basis. There is at present no British Standard for these asphalts.

5.2 Coarse aggregate

Coarse aggregate for paving grades should be crushed rock conforming to **5.3.1** of BS 1447 : 1988.

5.3 Separating membrane

The separating membrane should be one of the following:

a) sheathing felt comprising a base of flax or jute, or other suitable fibres, impregnated with bitumen; or

b) a glass fibre tissue, mass per unit area 50 g/m^2 to 70 g/m^2.

5.4 Isolating membrane

The isolating membrane to be laid over mastic asphalt should be one of the following:

a) a waterproof building paper or a single layer of roofing felt where cementitious materials are to be laid onto mastic asphalt; or

b) a non-woven polyester fleece, mass per unit area 130 g/m^2 to 140 g/m^2 where extruded polystyrene is to be laid onto mastic asphalt in the inverted roof construction.

5.5 Vapour control layer

The vapour control layer should be a single coat of mastic asphalt conforming to type R988 of BS 6925 or a roofing felt in accordance with BS 8217.

5.6 Thermal insulation

5.6.1 *Rigid thermal insulation boards*

Rigid thermal insulation boards used on warm deck roofs and inverted roofs should be supplied and fixed by the roofing contractor.

In a warm deck roof construction it is essential that the choice of thermal insulation, and its method of attachment, is considered in relation to any vapour control layer (see **6.6**).

5.6.2 *Insulating screeds*

Several cementitious screeds are available in the following categories:

a) lightweight aggregate formed from expanded clay or sintered pulverized fuel ash, bonded with a cement binder;

b) cellular aerated concrete.

NOTE. Insulation materials suitable for use in flat roofs are given in BS 6229 (see also annex A).

5.7 Expanded metal lathing

Bitumen coated plain expanded metal lathing, not less than 10 mm short way of mesh and not less than 0.46 mm thick should be used.

5.8 High bond primer

A modified synthetic rubber latex emulsion should be applied to provide key to vertical surfaces.

5.9 Sand for rubbing

Rubbing sand should be clean sand from natural deposits, predominantly passing a 600 μm sieve and retained on a 212 μm sieve.

5.10 Stone chippings (bedded)

Stone chippings for use as a protective topping should be washed, crushed rock, normally 10 mm to 14 mm nominal size aggregate, bedded in a proprietary gritting solution over a mastic asphalt membrane.

5.11 Stone aggregate (loose laid)

Stone aggregate for use as a protective topping should be 20 mm nominal size aggregate loose laid over mastic asphalt, but suitably secured around rainwater outlets, internal and external angles, and roof perimeters.

5.12 Ballast

Ballast for use on inverted roofs should be clean, rounded aggregate graded 20 mm to 40 mm and as free as practicable from fines, in accordance with the insulation manufacturer's recommendations.

5.13 Concrete paving slabs for insulated inverted roof

Concrete paving slabs for use as walkways or as paving on terrace decks should conform to BS 7263.

5.14 Concrete paving slab to cold roofs (uninsulated asphalt)

Concrete paving slabs should be bedded in cement/sand mortar bed on a loose-laid isolating membrane.

5.15 Concrete tiles

Porous concrete tiles should be bedded in hot bitumen in accordance with the tile manufacturer's recommendations.

5.16 Walkway tiles

Tiles for walkways or terrace deck paving should be bedded in a bonding compound, compatible with mastic asphalt, and fixed in accordance with the tile manufacturer's recommendations.

5.17 Solar reflective paint

Solar reflective paint should be free from materials deleterious to mastic asphalt, i.e. metallic pigments, non-compatible solvents or water-based emulsions.

6 Design considerations

6.1 Design of roof

6.1.1 *General*

For each roof, the designer should first determine the form (pitched or flat) and the type (cold deck, warm deck or inverted) before selecting the appropriate deck material, thermal insulation, and means of vapour control.

The design of flat roofs intended to be covered by mastic asphalt waterproofing should conform to the recommendations of BS 6229, with reference to CP 3 : Chapter V : Part 2 and the Building Regulations [2] where applicable.

6.1.2 *Access for inspection*

To facilitate access for regular inspection (as recommended in BS 6229), consideration should be given to provision of a fixed permanent access to all flat roofs. Such access will also be useful for maintenance and repair.

6.1.3 *Roofing details*

The general arrangement details and the principles to be followed at skirtings, upstands, abutments, verges, gutters and expansion joints are shown in figures 1 to 20.

6.1.4 *Selection parameters*

It is important that consideration is given at an early stage to the following:

a) the type of roof construction to be employed;

b) how anticipated movement is to be accommodated and the locations of any movement joints;

c) what trafficking, if any, is anticipated;

d) the means by which the requirements of the Building Regulations [2] are to be met, particularly the maximum thermal transmittance values;

e) how condensation problems are to be prevented;

f) design;

g) roof drainage;

h) what cross falls and/or falls are required to achieve a minimum finished fall of 1:80;

i) how skirting heights and minimum threshold heights are to be incorporated;

j) the correct location of damp-proof courses relative to the mastic asphalt waterproofing;

k) sufficient working space for the application of materials;

l) any other relevant information.

6.2 Design of base

6.2.1 *General*

Surfaces to which mastic asphalt is to be applied should be installed or prepared to a true and even surface free from irregularities such as abrupt changes in levels, hollows, ridges, dips, fins and concrete, mortar or plaster droppings. The specification should, therefore, enable the asphalt to be applied to a reasonably uniform thickness.

All materials should provide a substantial and continuous support to the mastic asphalt roofing and should be able to sustain the loads imposed by traffic both during and after roofing operations.

Any substrate to receive mastic asphalt roofing should be reasonably dry, even, free of dust, laitance, grease, dirt, projecting nail heads, sharp arrises or holes.

The designer should study the need for movement joints in the structure. Movement joints should be continuous through vertical upstands, walls and edges of buildings (see **6.10**).

6.2.2 *Drying out bases*

Concrete slabs and concrete decks cast in situ should be drained downwards through temporary drain holes formed in the area of maximum sag of the roof deck. Subject to checking their effect on structural strength, the holes should be 25 mm diameter, positioned to avoid reinforcement bars in the concrete in accordance with BS 6229. The holes should not be filled before seepage and damp have ceased, before finishing work on the ceiling is commenced. Precast concrete roof decking units with open joints are self-draining and holes are not required, but if the joints are to be subsequently sealed, they should be left open for as long as possible.

6.2.3 *Falls*

The falls should normally be provided in the base on which the roof covering is to be laid. To ensure adequate drainage, allowance should be made for normal construction tolerances and deflections in order to achieve a minimum finished fall of 1:80. Particular attention should be paid to areas subject to pedestrian traffic such as access balconies, drying areas or playing areas.

6.3 Substrates

6.3.1 *Concrete*

For in situ concrete or hollow tile constructions with an irregular surface, all falls except when provided as part of the structure should be formed by a screed as given in BS 6229. The surface should be provided with a float finish to a plane, even surface free from ridges and indentations.

6.3.2 *Precast concrete units*

Precast concrete units should be used and fixed in accordance with the manufacturer's instructions, and finished with a suitable surface to receive mastic asphalt.

Falls should be incorporated in the supporting structure or formed in a suitable screed.

6.3.3 *Cement/sand screeds*

Where a reinforced concrete roof slab is overlaid with a screed to provide falls, such screed should be laid in accordance with BS 6229. The surface should be provided with a float finish, even and smooth, free from hollows and ridges.

The screed should be designed to remain free from cracks.

6.3.4 *Lightweight screeds*

All lightweight screeds should be installed by contractors specializing in such work, laid in accordance with the manufacturer's instructions to a smooth and even surface, free from hollows and ridges.

The screed should be designed to remain free from cracks.

6.3.5 *Timber boarding*

Roof decks of timber boarding should be designed in accordance with BS 5268 : Part 2 and BS 6229. The timber should be naturally durable or pre-treated against infestation by wood-boring insects and fungal decay as recommended in BS 5268 : Part 5. Any method of pre-treatment specified should be compatible with the use of bitumen based products.

Boarding should not be less than 19 mm nominal thickness, planed, closely clamped together with tongue and groove joints or closely butted and secured by nailing with heads not protruding. Falls should be formed by firring or sloping the joists, in accordance with BS 6229.

To avoid fungal attack of the timber boarded structures in cold roof constructions, ventilation should be provided within the roof void.

Adjacent to masonry walls, parapets and abutments, a free standing kerb should be securely fixed to the roof deck to allow for differential movement, and fixed so as to leave an air space between the wall and base (see figures 1 and 2).

The timber base should be protected from rainwater during construction. Before any separating membrane or mastic asphalt is laid, any timber affected by dampness should be allowed to dry. Therefore the fixing of ceilings should be delayed as necessary.

In cold roof constructions, ventilation should be provided within the roof void.

6.3.6 *Plywood*

Roof decks of plywood should be designed in accordance with BS 6229 and BS 5268 : Part 2. Falls should be formed by firring or sloping the joists.

The plywood should conform to the relevant requirement of BS 6566 : Parts 1 to 8, should be specified as veneer plywood and should:

a) be WBP bonded in accordance with BS 6566 : Part 8;

b) have a plywood durability of Class M of BS 6566 : Part 7 or higher, or alternatively, be preservative treated at least to the minimum requirement of BS 6566 : Part 7. Any treatment should be compatible with bitumen over prolonged periods.

NOTE. It is not normally necessary to specify a plywood of appearance quality higher than Grade 111 of BS 6566 : Part 6.

Plywood for roof decks may be square-edged or tongue and groove. Longitudinal joints should occur on the centre line of supporting joists. Cross joints should be staggered, and in the case of square-edged boarding, will require additional support, e.g. by noggins. For thinner sheets, stiffness can depend on ply grain direction. Such sheets should where possible be laid to obtain maximum stiffness at right angles to the joists. Panels supported on a timber structure should be fixed using ring shank nails at 300 mm centres.

Panels should be checked with a moisture meter before installation, and if possible, laid at a moisture content of 14 % to 18 %. A joint gap of 1 mm/m of the panel size should be allowed. Plywood should not be laid with a moisture content greater than 18 %.

Adjacent to masonry walls, parapets and abutments, a free standing kerb should be securely fixed to the roof deck to allow for differential movement, and fixed so as to leave an air space between the wall and base (see figures 1 and 2).

The plywood base should be protected from rainwater during construction. Before any separating membrane or mastic asphalt is laid, any plywood affected by dampness should be allowed to dry. Therefore the fixing of ceilings should be delayed as necessary.

All boarding should be protected from weather and should be dry before the mastic asphalt is applied.

In cold roof constructions, ventilation should be provided within the roof void.

6.3.7 *Profiled metal decking*

Proprietary systems of troughed decks to be used in combination with mastic asphalt should be designed in accordance with BS 6229.

The maximum permissible deflection as a multiple of span should be 1/325.

As metal decking does not provide a continuous supporting surface for mastic asphalt roofing the decking should be overlaid with a rigid board or sheet material secured to the crowns of the decking profile.

NOTE. Thermal insulation boards (as described in annex A) are commonly used in this way.

Adjacent to masonry walls, parapets, abutments and metal cladding, a free standing kerb should be securely fixed to the metal decking to allow for differential movement, and so as to leave a space between the abutment and the base (see figure 3).

In circumstances where limited vapour control is required, a vapour control layer may be formed of felt conforming to type 5U of BS 747 or other similar materials bonded or mechanically fastened to the crowns of the deck. Where higher degrees of vapour resistance are necessary, a two layer or a fully supported vapour control layer should be installed.

6.3.8 *Wood wool slabs*

Roof decks of wood wool slabs should be formed from slabs conforming to type SB of BS 1105, not less than 50 mm thick with a pre-screeded surface, fixed in accordance with the wood wool slab manufacturer's instructions.

With pre-screeded channel reinforced wood wool slabs it is only necessary to tape end joints.

Pre-felted wood wool may be used to provide temporary weather protection and a vapour control layer in warm roof construction, and should be used in conjunction with a boarded insulant. Joints should be taped.

Where pre-screeded channel reinforced wood wool slabs are specified, the channel may form a thermal bridge unless protected on the outside by insulation. To reduce the risks of condensation, a warm system should be constructed by applying a suitable insulation over the wood wool slabs with a vapour control layer.

Adjacent to masonry walls, parapets and abutments, a free standing kerb should be securely fixed to the wood wool deck to allow for differential movement.

6.3.9 *Substrates for inverted roofs*

Substrates for inverted roofs are usually designed to be constructed in concrete due to weight considerations. It is possible to lay over other substrates depending on their ability to accommodate the imposed loadings.

6.3.10 *Substrates in warm deck roofs*

Substrates in warm deck roofs will be formed by thermal insulation boards. Thermal insulation thickness and the risk of condensation build-up should be calculated. The provision of a vapour control layer should be considered.

Where warm roofs are installed on substrates with thermal insulation properties, such as wood wool, the insulation manufacturer should be consulted with regard to the provision and positioning of a vapour control layer.

Thermal insulation boards for use in warm roofs should be capable of resisting permanent deformation or damage when subjected to loads.

Roof terraces or balconies subjected to static or pedestrian loads should be designed to accommodate the inverted roof system, or consideration should be given to the incorporation of a suitable light coloured porous tile which will also provide a heat sink layer.

6.4 Keying to vertical and sloping surfaces

When mastic asphalt is applied to vertical and sloping surfaces, including skirtings and upstands against brickwork, stone or concrete, the top of the mastic asphalt should be tucked into a continuous groove of 25 mm × 25 mm formed in the structure and its exposed part should be formed with a splay to shed rainwater, or continued horizontally to form a mastic asphalt capping (see figures 4, 5 and 6).

NOTE. Mastic asphalt will not adhere satisfactorily to vertical and steeply sloping surfaces unless such surfaces afford an adequate key (see **6.11**).

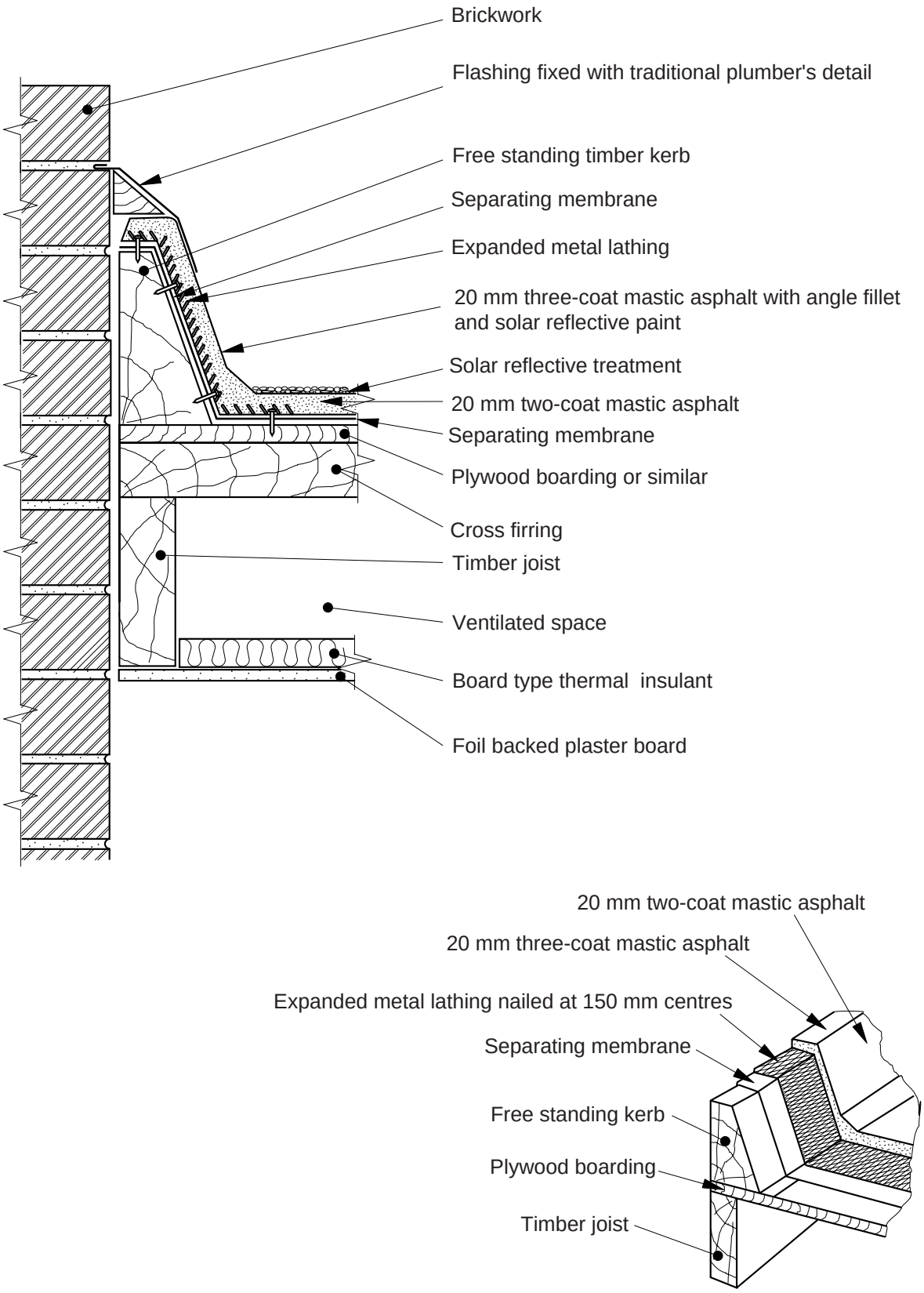

Figure 1. Timber roof deck with free standing kerb (cold roof)

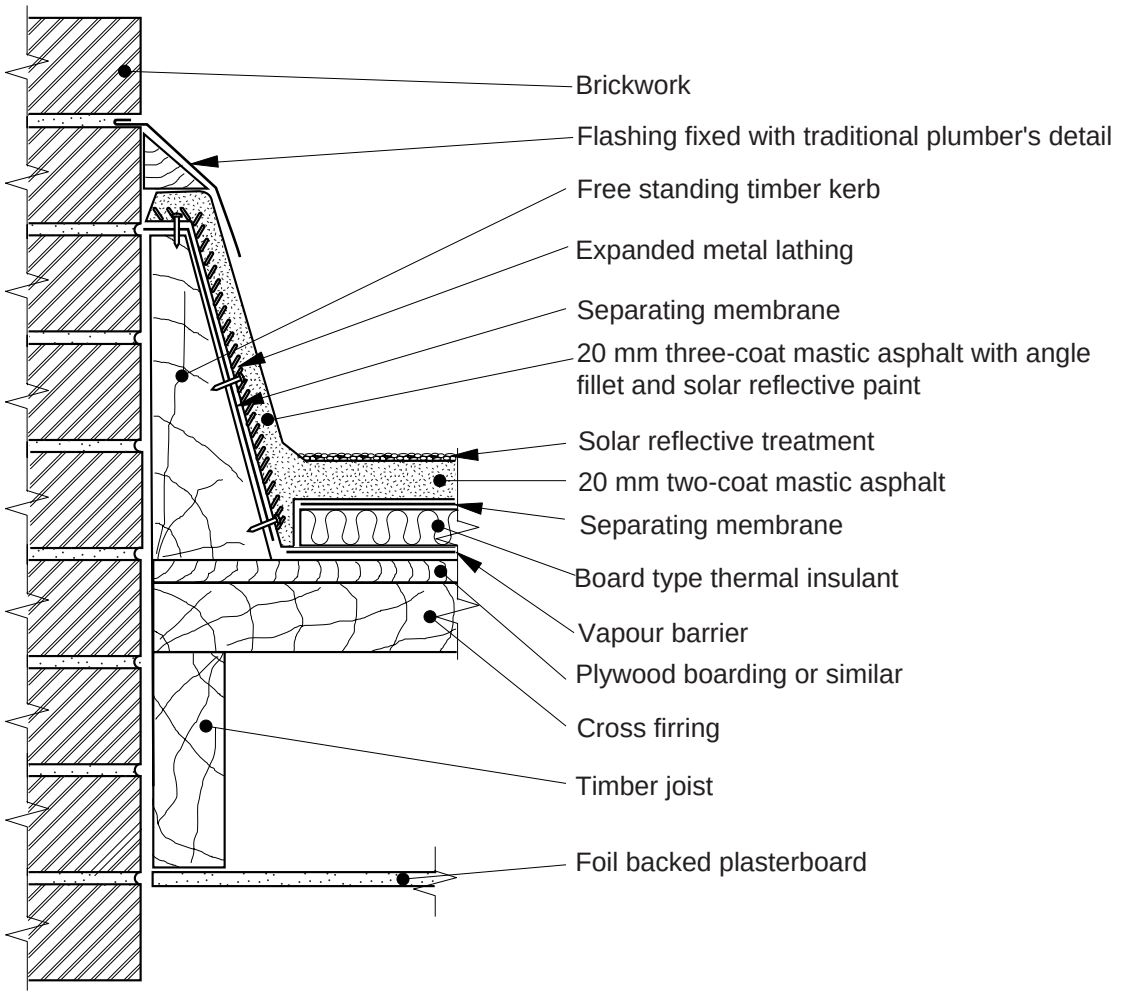

Figure 2. Timber roof deck with free standing kerb (warm roof)

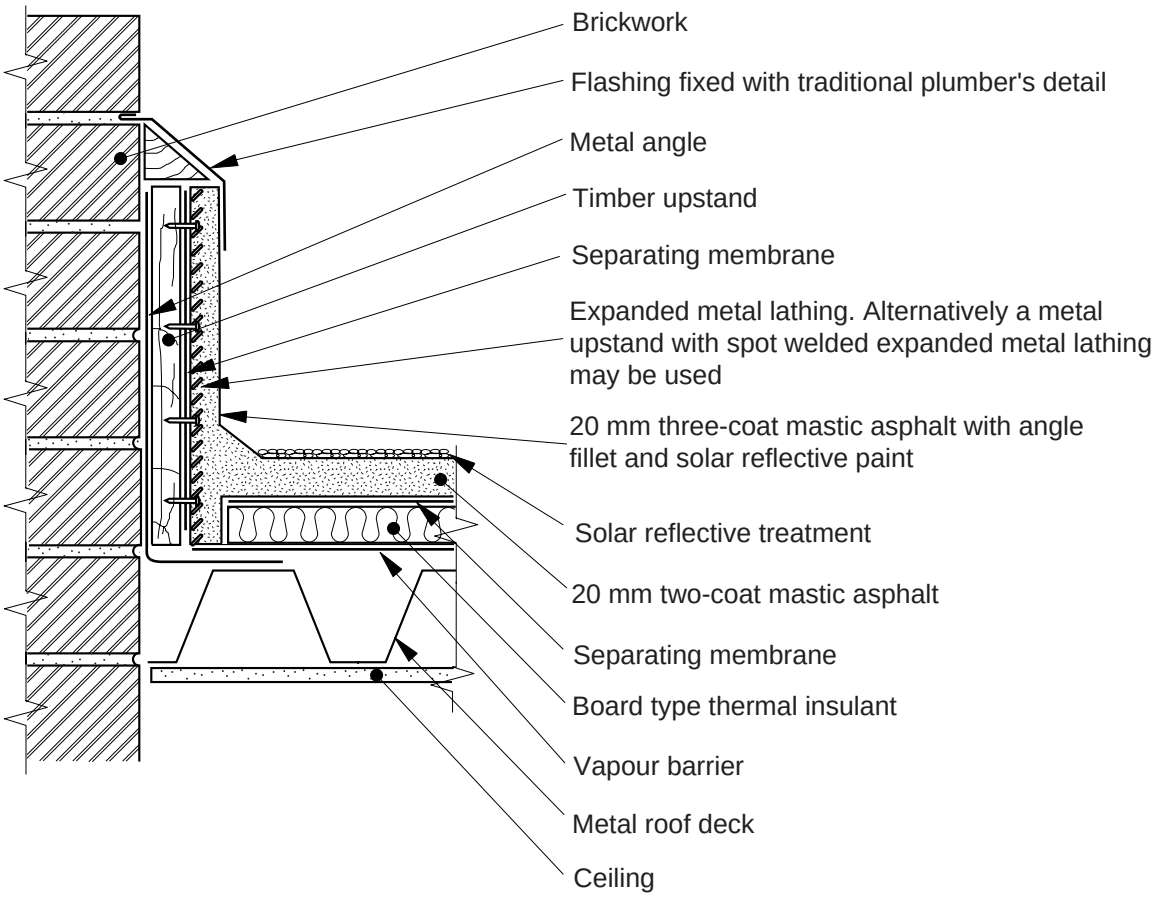

Figure 3. Metal roof deck with free standing kerb (warm roof)

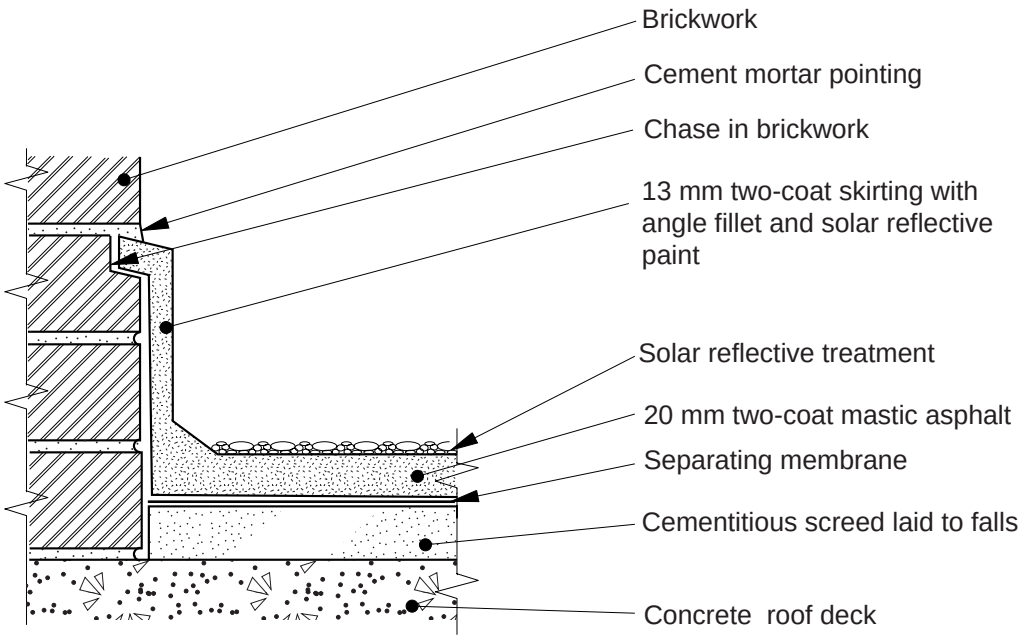

Figure 4. Concrete roof deck and skirting (cold roof)

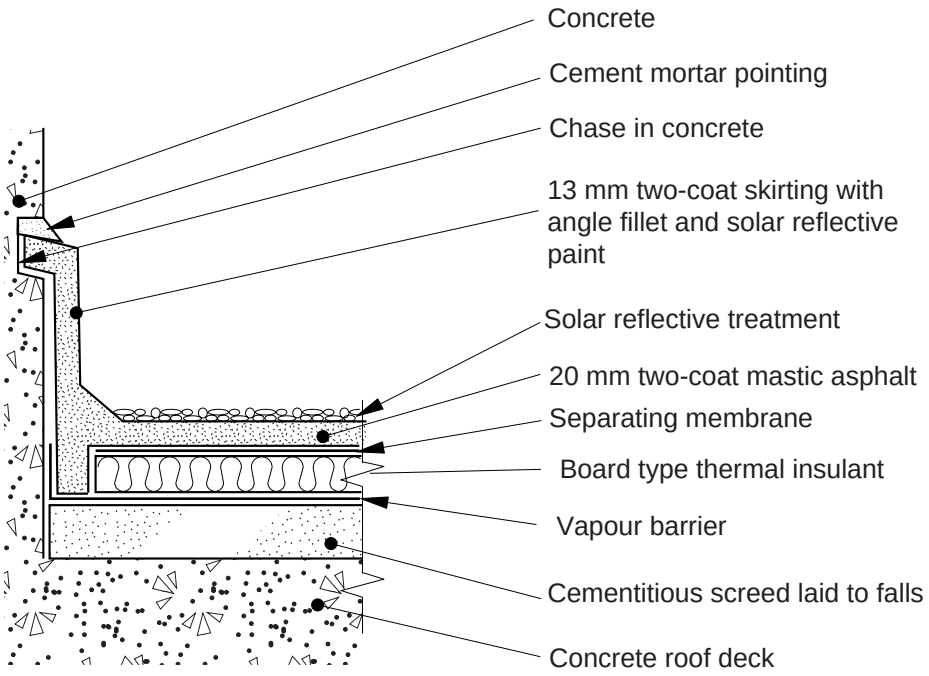

Figure 5. Concrete roof deck and skirting (warm roof)

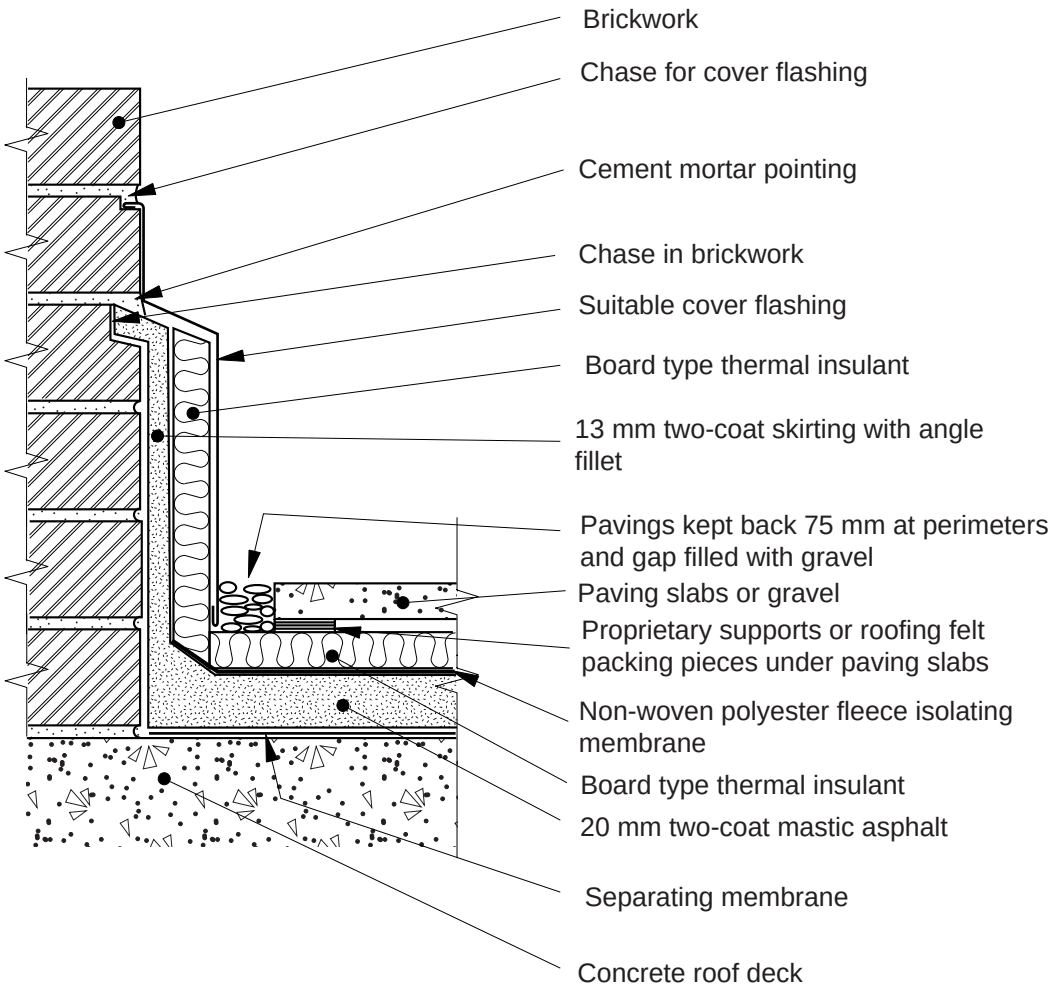

Figure 6. Concrete roof deck and skirting (inverted roof) with external insulant

6.5 Control of water vapour

Any provision required to control interstitial condensation within the roof should be determined as recommended in BS 6229, but with the calculation method modified to conform to BS 5250.

NOTE. BS 5250 is a later publication than BS 6229 and gives an improved calculation method. BS 6229 is currently being revised.

6.6 Attaching thermal insulation boards in warm deck roofs

The boards should be bedded in hot bitumen to the vapour control layer with joints close butted and cross joints staggered.

An adequate margin should be provided between insulation boards and all skirtings and abutments to allow for an infill (see **6.15** and figures 2, 3, 5 and 13).

6.7 Mastic asphalt

6.7.1 *General*

The number of coats should be appropriate to the waterproofing requirements and traffic conditions of the roof.

Due to the molten nature of mastic asphalt, the nominal thicknesses given are indicative rather than precise. Any irregularities in the horizontal substrate will be reflected in the final surface with accompanying inconsistencies of thickness.

In general, difficulties can be experienced in laying mastic asphalt directly over insulants to surfaces over 5° pitch.

6.7.2 ***Horizontal surfaces up to and including 10° pitch (5° if laid on insulation)***

On horizontal surfaces up to and including 10° pitch, the mastic asphalt should be laid in two coats to a thickness of 20 mm on a separating membrane of sheathing felt.

6.7.3 ***Sloping and vertical surfaces over 10° pitch, other than timber or lightweight concrete and excluding skirtings***

On sloping and vertical surfaces over 10° pitch, the mastic asphalt should be laid in three coats to a thickness of 20 mm without a separating membrane.

6.7.4 ***Sloping and vertical surfaces of timber or lightweight concrete over 10° pitch, excluding skirtings***

On sloping and vertical surfaces of timber or lightweight concrete, the mastic asphalt should be laid in three coats to a thickness of 20 mm on expanded metal lathing over a separating membrane of sheathing felt.

6.7.5 ***Horizontal surfaces subject to foot traffic***

On horizontal surfaces subject to foot traffic, such as access balconies, the mastic asphalt should be laid in two coats to a thickness of 25 mm, the first coat 10 mm thick laid on a separating membrane followed by a directly applied second coat 15 mm thick incorporating 10 % to 15 % of additional 3 mm coarse aggregate (see figure 7).

6.7.6 ***Horizontal surfaces designed as roof gardens, reservoirs or buried waterproofing***

On horizontal surfaces designed as a roof garden, reservoir or as a buried waterproofing membrane, the mastic asphalt should be laid in three coats to a thickness of 30 mm over a separating membrane of glass fibre tissue (see figures 7, 8 and 9).

6.7.7 ***Mastic asphalt vapour barrier***

A mastic asphalt vapour barrier should be laid in one coat not less than 10 mm thick on a glass fibre tissue.

6.7.8 ***Skirtings and upstands other than timber or lightweight concrete***

On skirtings and upstands up to 300 mm high, the mastic asphalt should be applied in two coats to a thickness of 13 mm (see figures 4, 5, 6, 7, 10 and 11).

On skirtings and upstands over 300 mm high, the mastic asphalt should be applied in three coats to a thickness of 20 mm.

NOTE. Two-coat work may be permissible to vertical upstands in excess of 300 mm in areas not exposed to the elements, such as tank rooms, mechanical service areas etc., where the appearance of the finished work is not of paramount importance.

6.7.9 ***Skirtings and upstands of timber or lightweight concrete***

On skirtings and upstands of timber or lightweight concrete the mastic asphalt should be applied in three coats to a thickness of 20 mm, on expanded metal lathing over a separating membrane of sheathing felt (see figures 1, 2 and 3).

6.7.10 ***Skirtings and upstands on expanded metal lathing to concrete, brick or blockwork***

In certain circumstances it may be necessary to incorporate expanded metal lathing to concrete, brickwork or blockwork. In these situations the mastic asphalt should be applied in three coats to a thickness of 20 mm, including a separating membrane of sheathing felt where required.

6.7.11 ***Staircases: treads, risers and strings***

6.7.11.1 *Treads*

Treads should be laid in two coats to a thickness of 25 mm, the first coat being 10 mm thick and the second coat being 15 mm thick incorporating 10 % to 15 % of additional 3 mm coarse aggregate, excluding a separating membrane.

6.7.11.2 *Risers*

Risers should be applied in two coats to a thickness of 13 mm.

6.7.11.3 *Strings*

Strings should be applied in two coats to a thickness of 13 mm, dressed into a continual 25 mm × 25 mm chase, constructed either parallel to the pitch of the stairs or stepped vertically and horizontally to follow the line of the treads and risers.

Strings over 300 mm high should be applied in three coats to a thickness of 20 mm.

6.7.12 ***Paving grade mastic asphalt***

Mastic asphalt paving should conform to BS 1447.

Where mastic asphalt waterproofing is to be overlaid with paving grade mastic asphalt, the work should be arranged so that the overlaying is undertaken as a continuous operation, and precautions should be taken to prevent contamination of the surface of the waterproofing prior to laying the paving.

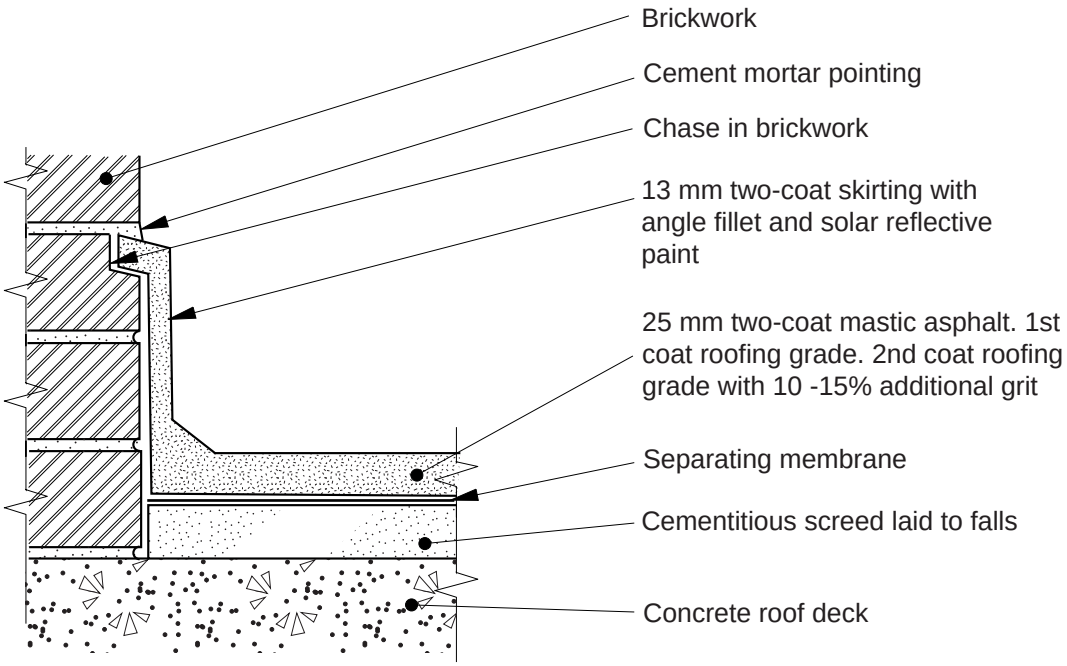

Figure 7. Access decks, drying and playing areas (cold roof)

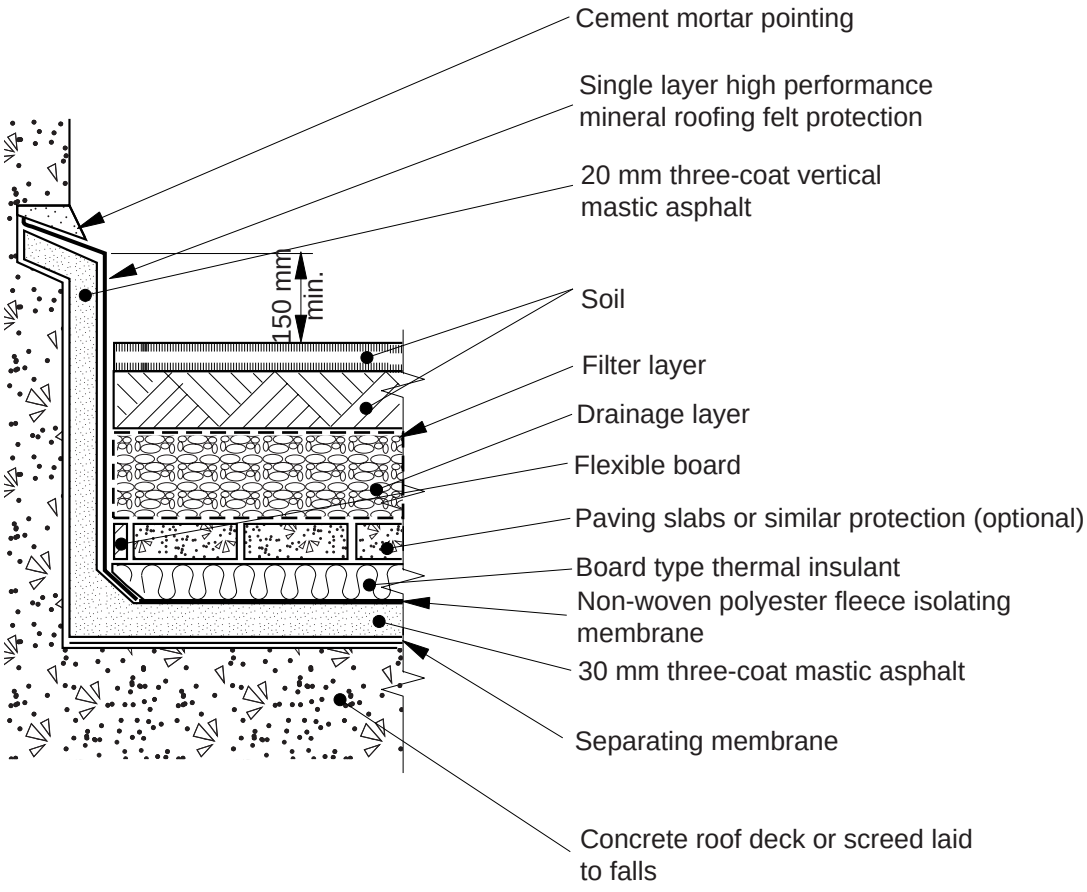

Figure 8. Waterproofing to roof garden (partly insulated)

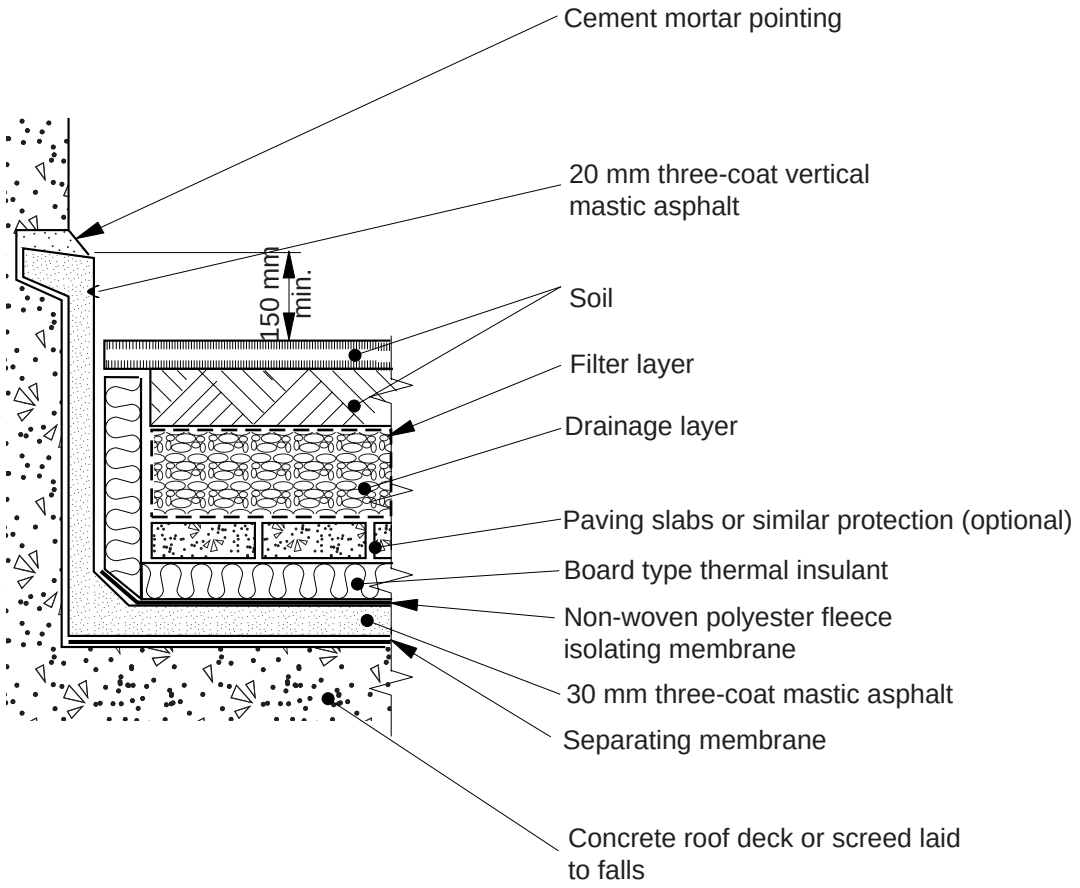

Figure 9. Waterproofing to roof garden (fully insulated)

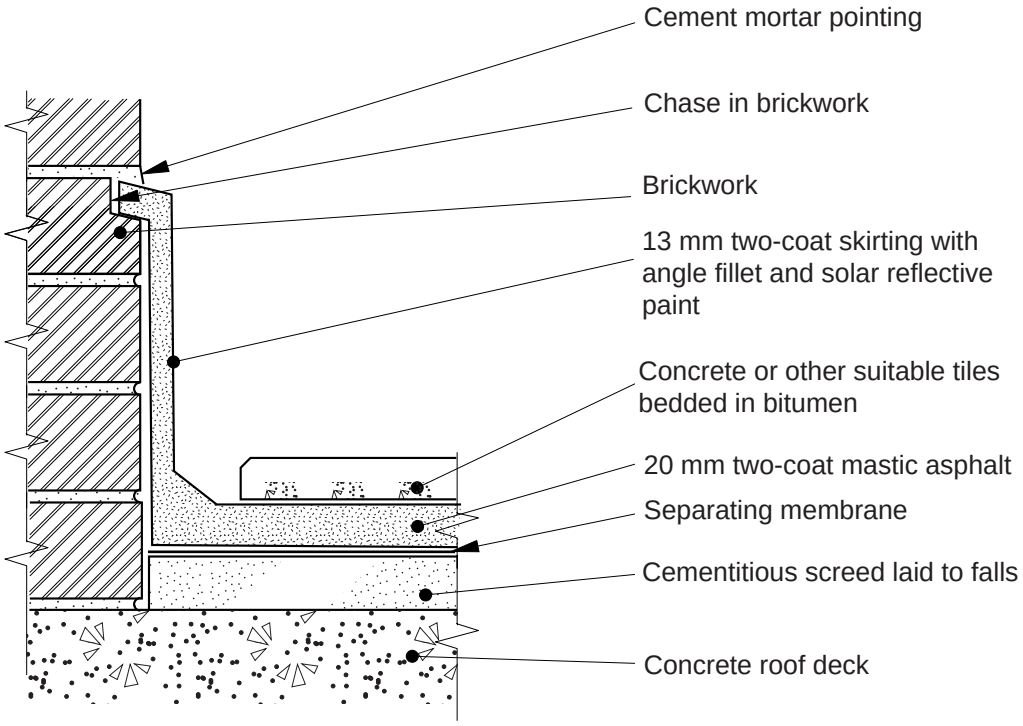

Figure 10. Private balconies with tiles (bitumen bedded)

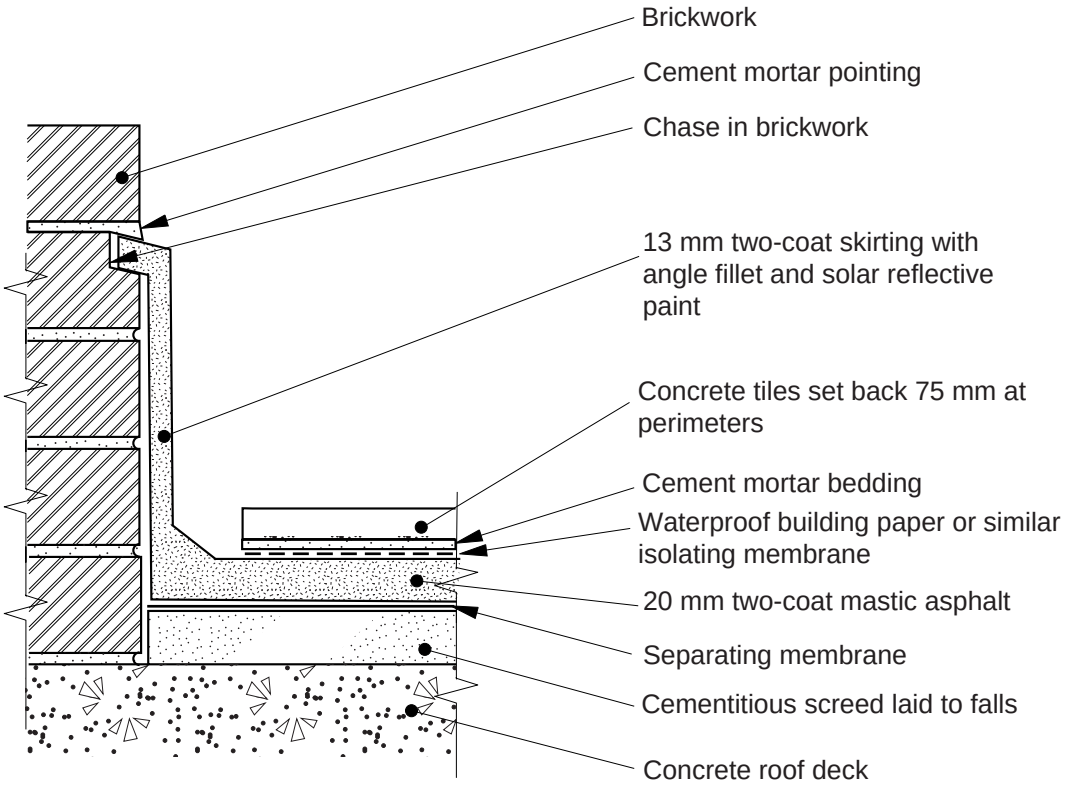

Figure 11. Private balconies and podia with tiles (cement mortar bedded)

6.8 Surface protection

6.8.1 *General*

All asphalt roofing, including upstands, should be protected against static point loading and mechanical damage.

On inverted roofs, the ballast and insulation will provide protection to the mastic asphalt. The insulation and ballasting should be installed immediately on completion of the laying of the mastic asphalt or as soon as is practically possible. Care should be taken to provide adequate protection at upstands.

6.8.2 *Sand rubbing*

On horizontal and slightly sloping surfaces, immediately after completion of laying and whilst the mastic asphalt is still warm, clean, sharp sand should be rubbed evenly into the surface of the mastic asphalt with a wooden float.

6.8.3 *Solar protection*

Various methods of reducing solar gain may be adopted, and this should follow the laying of the mastic asphalt without undue delay.

In a warm roof construction it is essential to provide efficient solar protection to the mastic asphalt which, on horizontal surfaces, should be by the application of one of the following:

a) stone chippings of limestone, granite, gravel, calcined flint, calcite, feldspar or similar, of 14 mm nominal size, free from dust, bedded in a suitable compound (see **5.10**);

b) stone aggregate of 20 mm nominal size, loose laid, but secured around outlets, etc. (see **5.11**);

c) light coloured pedestrian tiles bedded in a compound in accordance with the tile manufacturer's recommendations, particularly where continuous foot traffic is expected (see **5.15** and **5.16**);

d) concrete paving slabs bedded in cement/sand mortar bed on a loose-laid isolating membrane (see **5.14**);

e) solar reflective paint, applied in accordance with the manufacturer's recommendations (see **5.17**).

On horizontal surfaces it is recommended that a), b) or c) above are used. However, if a solar reflective coating in accordance with e) above is preferred, any necessary maintenance should be in accordance with the paint manufacturer's recommendations.

Before a solar protection is applied, the roof surface should be completely dry and free of dirt.

6.8.4 *Cold roof construction*

On a cold deck terrace/balcony roof where point loading is anticipated, a suitable tile or paving slab should be used, laid in a cementitious bedding on an isolating membrane (see **5.14**), or bedded in hot bitumen (see **5.15** and figures 10 and 11).

6.8.5 *Vertical and sloping surfaces*

On vertical and sloping surfaces, exposed upstands, kerbs etc., a suitable solar reflective paint may be used.

6.9 Detail considerations

Whilst ponding is not detrimental to the life of mastic asphalt, it is generally desirable that falls are incorporated in flat roofs to assist in the discharge of rainwater and to minimize ponding.

All flat roof surfaces should be laid to cross falls and/or falls to ensure proper drainage, as recommended in BS 6229. Rainwater outlets should be sited at low points in the general roof area well clear of other penetrations, where possible.

6.10 Movement joints

It is normally only necessary to provide movement joints in a mastic asphalt roof membrane where one is provided in the structure. The high points of the falls should always be located at any movement joints.

Where it is considered necessary to provide movement joints in the roof structure, these should be of the twin kerb type with a suitable metal or butyl rubber capping (see figures 12 and 13).

Flush movement joints in mastic asphalt should be avoided where possible. Where they are unavoidable, care should be taken to ensure that a secure connection can be made between the joint and the roof covering.

The roof deck on either side of the movement joint should be adequately stiffened to avoid excessive differential deflection. The movement joints should be continuous through vertical upstands, walls and edges of buildings.

If a proprietary flush movement joint is used on car park or pedestrian walkways/terraces, it should be capable of accepting the expected type of traffic and degree of movement, its materials should be compatible with mastic asphalt and it should be possible to make a secure joint between it and the mastic asphalt, installed in accordance with the expansion joint manufacturer's recommendations.

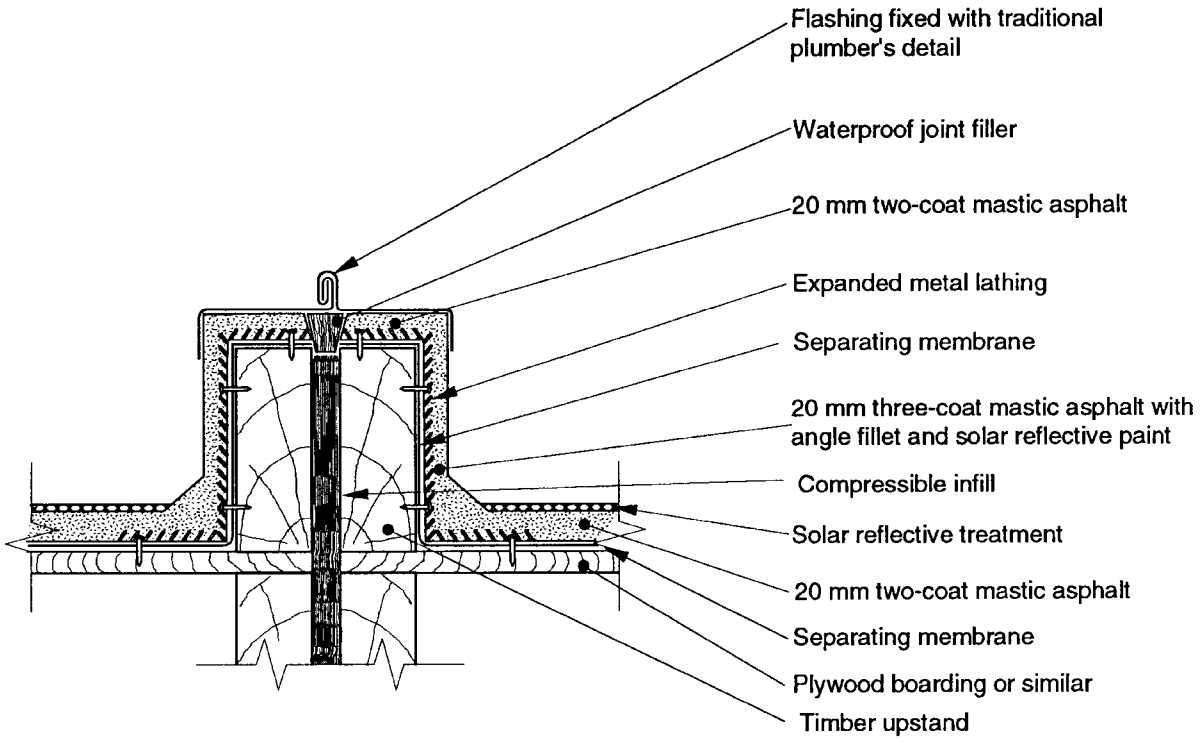

Figure 12. Timber upstand expansion joint (cold roof)

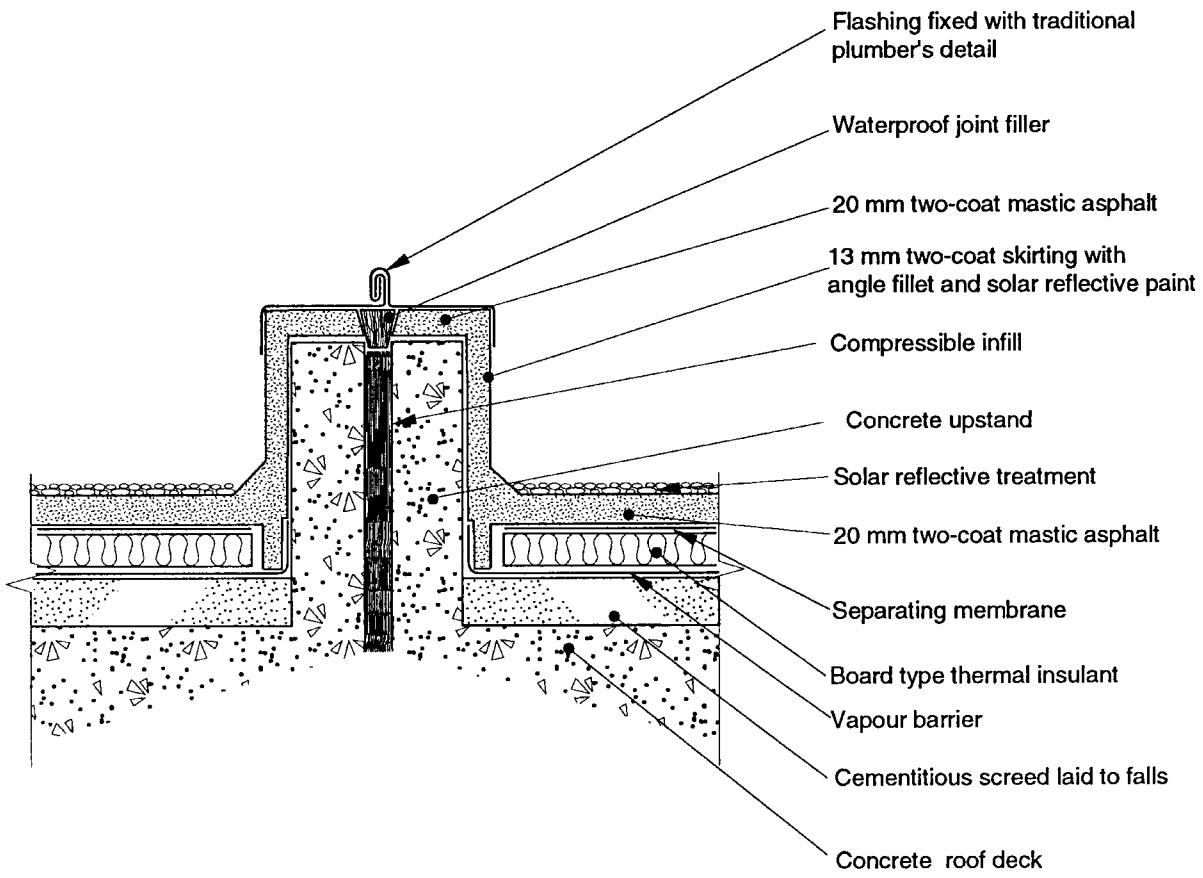

Figure 13. Concrete upstand expansion joint (warm roof)

6.11 Keying to vertical surfaces

6.11.1 *Keying to vertical and sloping concrete surfaces*

Where smooth formwork has been used, the laitance, or any release agent from the formwork, should be removed by needle gun, wire brushing or other suitable mechanical means. Prior to asphalting, the prepared surface should be treated with an application of a suitable proprietary high bond primer in accordance with the manufacturer's instructions.

Alternatively, expanded metal lathing fixed to smooth concrete may be used to provide the necessary key.

On lightweight aggregate concrete and lightweight concrete blockwork, mechanically fixed expanded metal lathing, on sheathing felt, should be used to provide the necessary key (see table 1).

6.11.2 *Keying to brickwork surfaces*

The horizontal joints in the brickwork should be flush pointed and the brickwork treated with an application of a suitable proprietary high bond primer in accordance with the manufacturer's instructions.

Engineering bricks do not provide an adequate key for mastic asphalt and should only be used in association with an application of a suitable proprietary high bond primer to the manufacturer's instructions, and mechanically fixed expanded metal lathing (see table 1).

Where mastic asphalt is to be applied to old brickwork, the surface should be cleaned and a high bond primer applied.

Where blistering or loss or bond is encountered, the use of sheathing felt and expanded metal lathing, mechanically fixed at not greater than 150 mm centres, should be considered.

6.11.3 *Keying to stonework surfaces*

The type of key required depends entirely on the kind of stone and on the type of stonework. The surface of the stone, where possible, should be lightly roughened in order to provide a suitable key, or the use of a proprietary high bond primer should be considered.

6.11.4 *Keying to timber surfaces*

To provide an adequate key for mastic asphalt laid on vertical timber surfaces and those of slope greater than 10°, and also at junctions formed with such surfaces, a continuous layer of metal lathing should be securely fixed by means of nails or staples. The expanded metal lathing should be fixed over the sheathing felt at maximum 150 mm centres in all directions (see figure 14).

6.11.5 *Keying to metal surfaces*

All metal surfaces such as pipes, metal standards etc. should be treated with a suitable proprietary high bond primer in accordance with the manufacturer's instructions. Alternatively, expanded metal lathing, strapped or spot welded, may be used to provide the necessary key.

Where pipes penetrate timber, metal or wood wool roof decks, or where pipes carry hot materials or require to be isolated, an appropriate sleeve should be provided in order to isolate the mastic asphalt from the pipe (see figure 15).

6.12 Skirtings

Skirtings should be executed in roofing grade mastic asphalt as given in **5.1**. Skirtings should be tucked into a chase or groove at the top edge, and should be a minimum 150 mm above all roof finishes (see **6.7.8**).

Skirtings over 300 mm are regarded as vertical work and should be applied in three coats (see **6.7.8**).

Table 1. Treatments for vertical and sloping surfaces to receive mastic asphalt

Substrate	High bond primer[1)]	Expanded metal lathing	Expanded metal lathing on sheathing felt
Smooth concrete (alternative treatments)	×[2)]	×[3)]	
Textured concrete (coarse aggregate)	×		
Lightweight aggregate concrete			×
Lightweight concrete blockwork			×
Facing bricks[4)]	×		
Engineering bricks	×	×[5)]	
Timber			×
Metal (alternative treatment)	×	×	

[1)] Suitable primer applied in accordance with the manufacturer's instructions.
[2)] Applied to concrete with a mechanically prepared surface.
[3)] Fixed to concrete with an unprepared surface (not a preferred option).
[4)] With flush pointed joints (see **6.11.2**).
[5)] Brickwork should be primed prior to fixing expanded metal lathing (see **6.11.2**).

On old or irregular brickwork or blockwork it is usually necessary for the skirtings to be applied in three coats; the first coat being a 'dubbing out' coat to correct irregularities in the wall followed by the standard two coat work. The total thickness should be between 15 mm and 20 mm.

Particular care should be taken to ensure proper adhesion of the first coat of mastic asphalt. The exposed uppermost part of the mastic asphalt skirting should be formed with a splay to shed rainwater, even though a metal flashing may be fixed to cover the exposed part. A splayed arris is formed when mastic asphalt is continued through the wall to form a horizontal damp-proof course.

6.13 Fillets

Fillets should be formed with a solid angle of roofing grade mastic asphalt, in two coats, with a minimum of 40 mm on the face, at approximately 45°.

6.14 Chases

Chases should be provided in brickwork and concrete and should be 25 mm × 25 mm. The lower nib of the chase should be carefully removed in order to maintain a full thickness of mastic asphalt at this point. The chase should be pointed as soon as practical after asphalting using a cement/sand mortar containing a suitable polymer admixture such as styrene butadiene rubber or acrylic.

6.15 Margin infill

A minimum 25 mm margin should be created between the edges of the thermal insulation boards and the skirting/upstands in a warm roof construction. The margin should be solidly filled to provide support to the skirting and angle fillet, and to eliminate voids at these junctions.

With a majority of thermal insulation materials, the margin should be infilled with mastic asphalt. However, where temperature susceptible materials are used, an earth damp cement/sand mix should be used.

Where substantial thicknesses of thermal insulation boards are used, the width of the margin should be increased as necessary to ensure that a solid infill is achieved.

6.16 Verges

6.16.1 *Eaves trims*

Suitable pre-formed roof edge trims may be applied at edges of roofs, using a section in a material compatible with and designed for use with mastic asphalt. Materials adversely affected by thermal movement should be avoided.

6.16.2 *Undercut drip*

A mastic asphalt apron with an undercut drip may be provided on masonry constructions, the mastic asphalt being applied in two coats to a thickness of 13 mm (see figure 16).

For timber details incorporating expanded metal lathing, it will be necessary to apply mastic asphalt in three coats (see **6.7.4** and figure 17).

6.16.3 *Eaves gutters*

Where the roof falls into an eaves gutter, the asphalt should be finished over a lead or other suitable flashing set into a rebate in the substructure. The flashing should be welted at the back and the depth of rebate should allow for the full thickness of mastic asphalt to be maintained over the welt (see figures 18 and 19). Pre-formed edge trims would not normally be used at this detail.

A lead detail should be designed and installed in accordance with The Lead Sheet Manual, *A guide to good practice* Volume 1 [1].

6.17 Fixing accessories

6.17.1 *Rainwater outlets*

Rainwater outlets should be no higher than the immediate surrounding finish and should be mechanically secured to prevent movement. Adequate provision should be made for surface water run-off before the waterproof membrane is completed.

The type of outlet used should be suitable for use in conjunction with mastic asphalt (see figure 20).

6.17.2 *Roof vents*

Roof vents may be specified to assist the drying process of lightweight cementitious screeds although reliance should not be placed on them (see BS 6229).

6.18 Tank room floors

Where water storage is located in a tank room at or near roof level, the flooring is essentially a waterproof lining serving a similar function to that of the mastic asphalt roofing. The amount of usage may be no more than that on an average roof and will involve occasional light maintenance traffic. For this reason a standard roofing grade specification is appropriate, unless special traffic or environmental conditions have to be considered, when the mastic asphalt manufacturer should be consulted.

6.19 Oil-resisting mastic asphalts

Oil-resisting mastic asphalts are no longer available and adequate protection should be provided where oil spillage is anticipated. Normally a suitable oil-resisting coating over the mastic asphalt will be required.

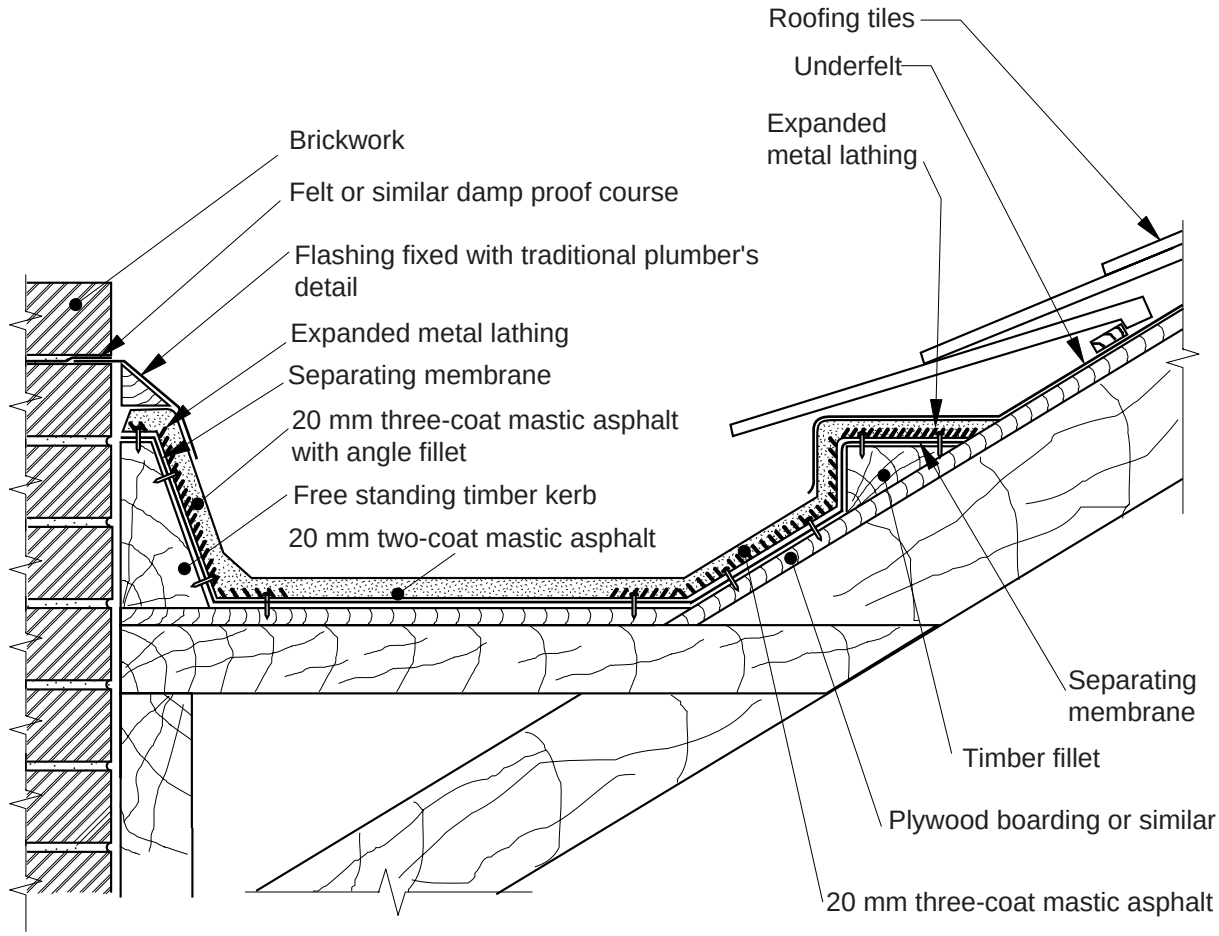

Figure 14. Timber valley gutter and brick parapet

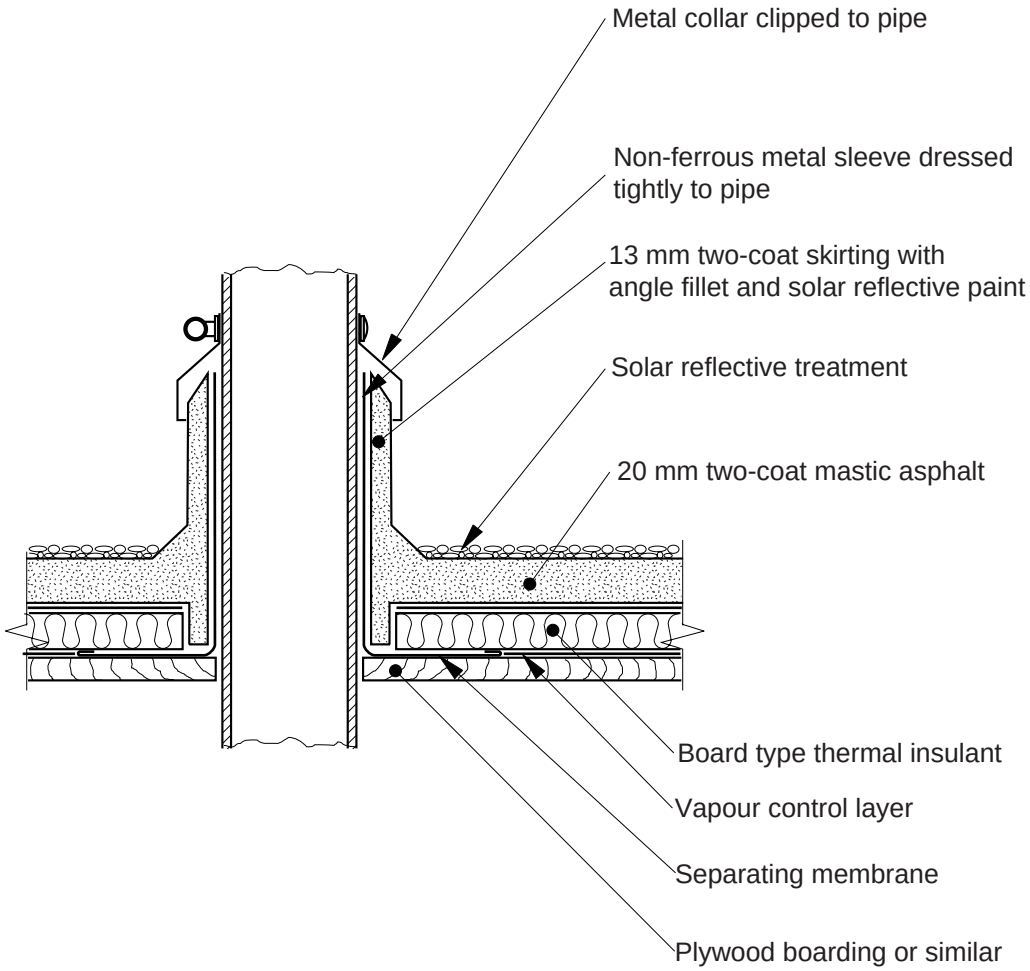

Figure 15. Sleeved pipe passing through roof (warm roof)

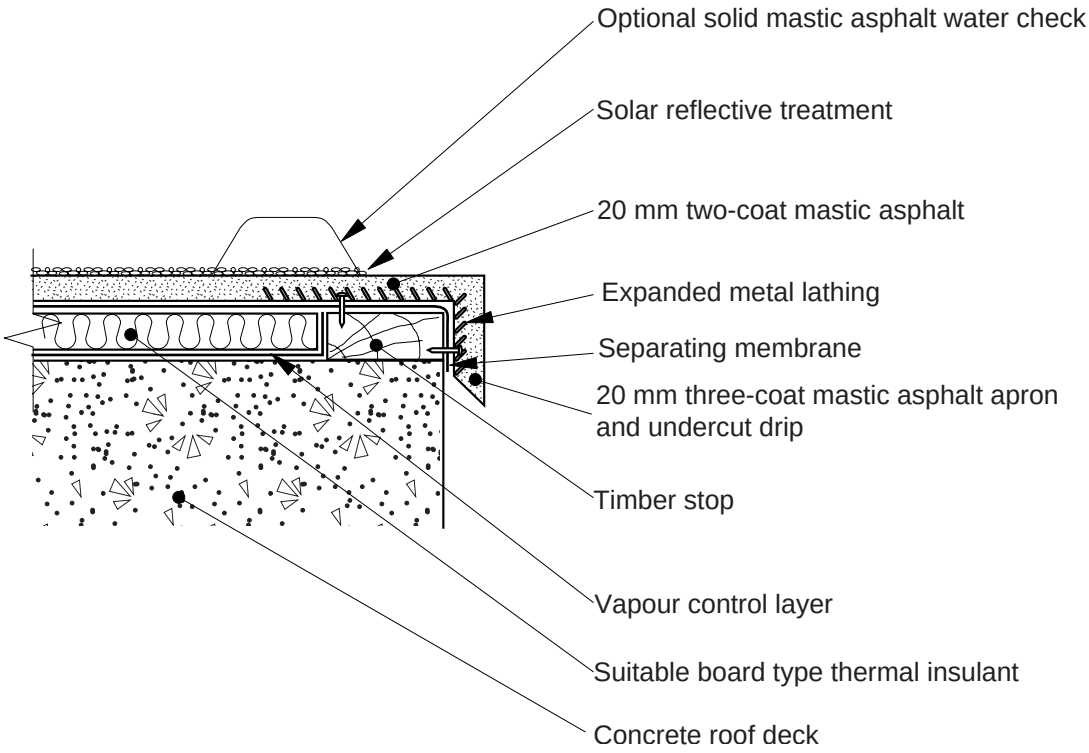

Figure 16. Apron and drip to concrete (optional water check)

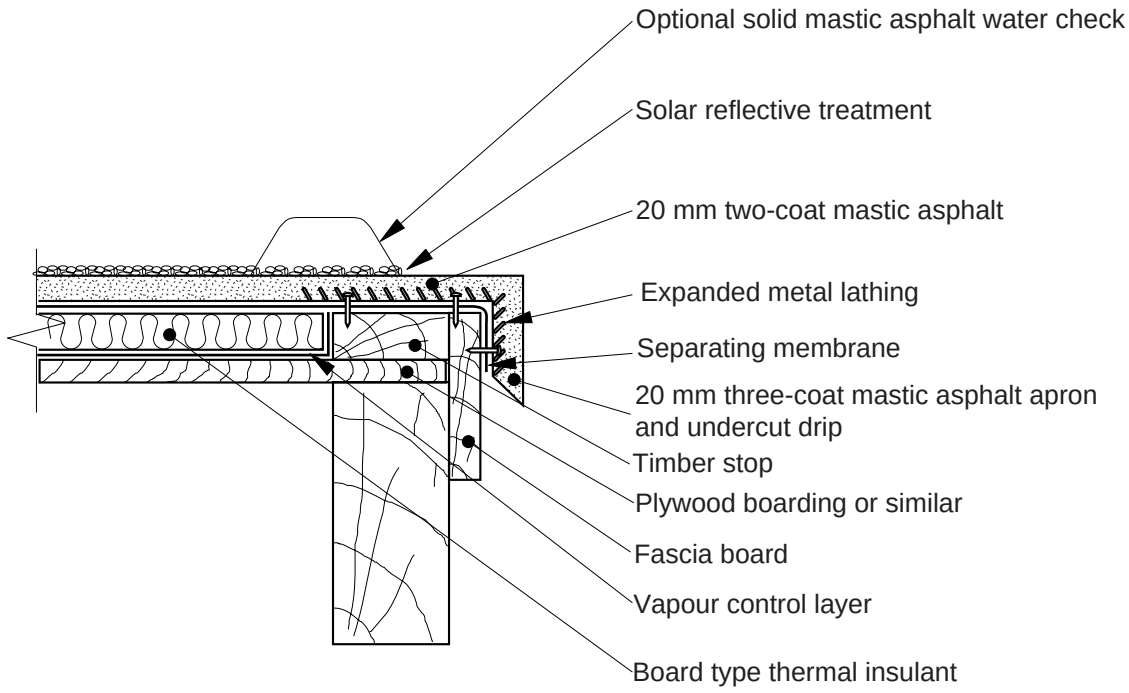

Figure 17. Apron and drip to timber (optional water check)

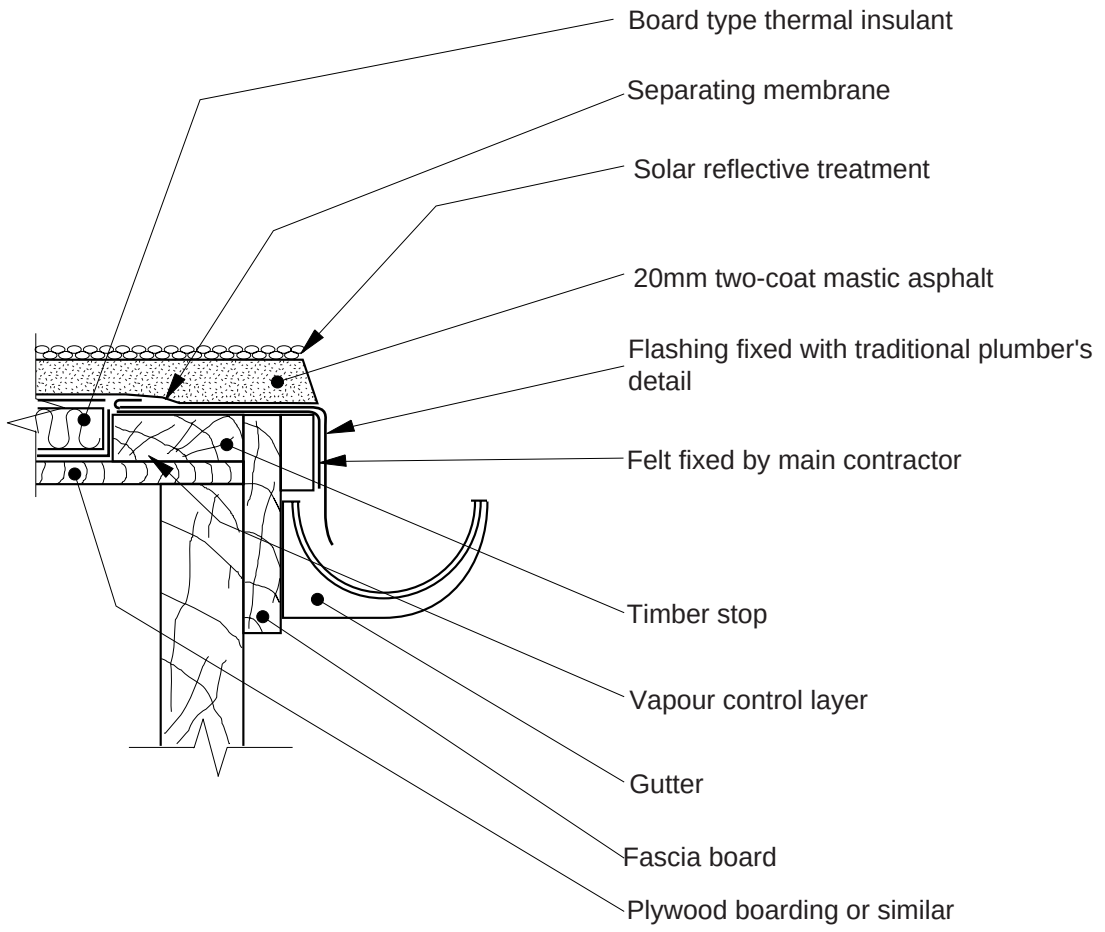

Figure 18. Timber roof eaves gutter (warm roof)

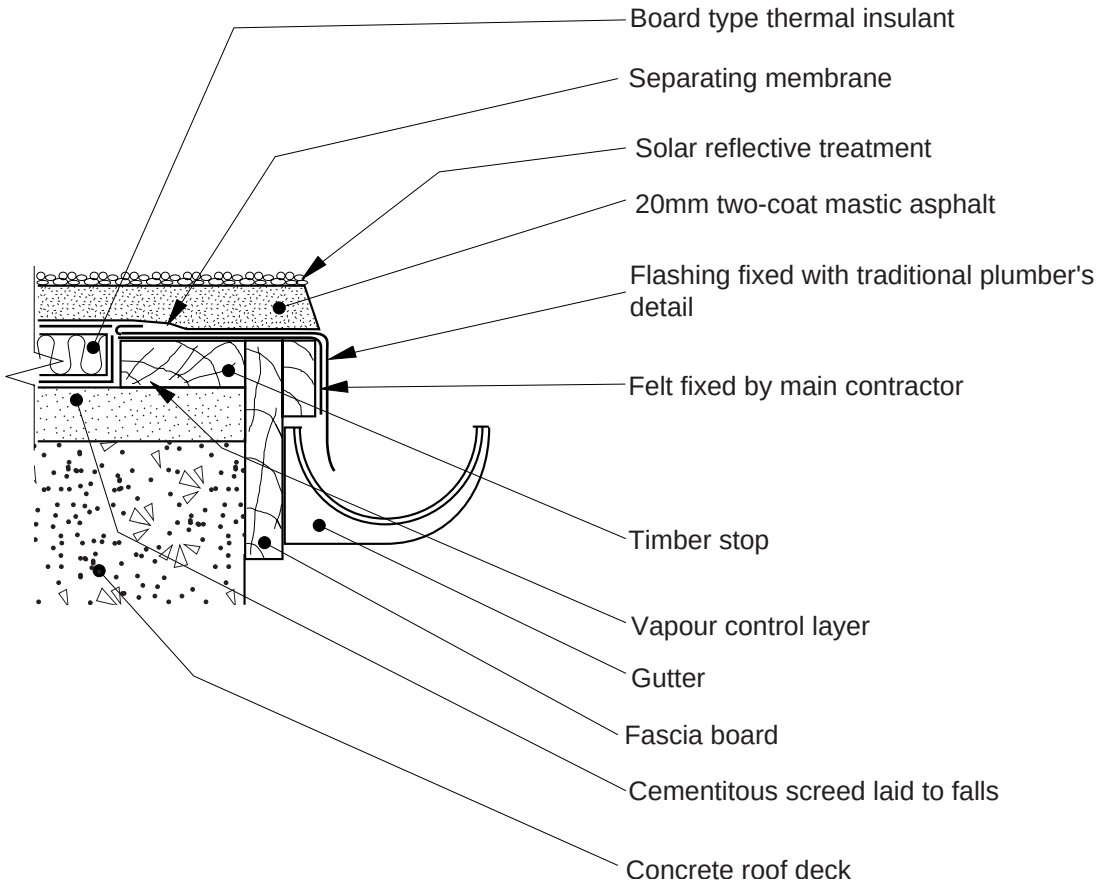

Figure 19. Concrete roof eaves gutter (warm roof)

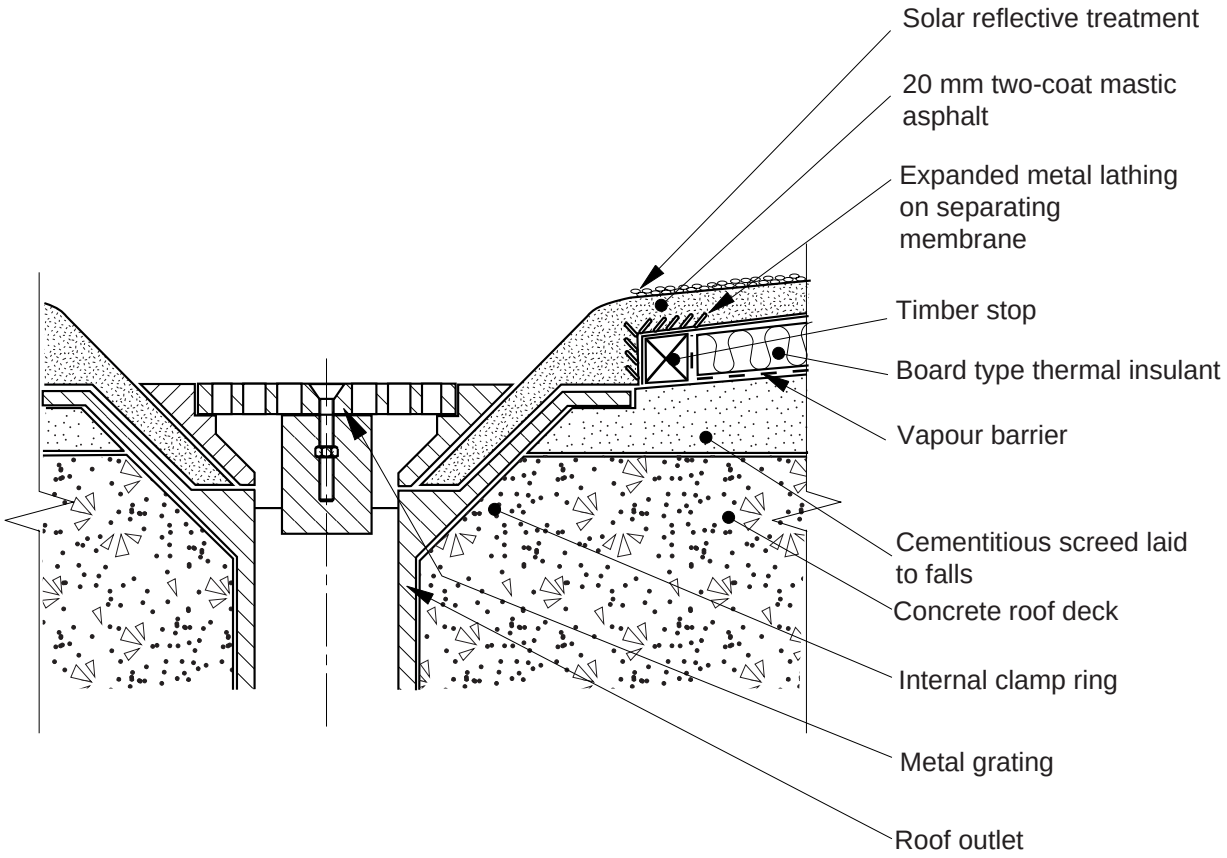

Figure 20. Clamping cone type outlet

7 Site work

7.1 Preparatory sitework prior to asphalting

Before commencing laying the mastic asphalt, the following should be checked:

a) the base has been properly laid to the specified falls, tolerances and finishes; the equivalent of a wood float finish being required on horizontal concrete screeds or slab;

b) all chases have been properly cut;

c) all outlets have been installed, fixed and located at the correct height relative to the base;

d) vertical surfaces have been correctly prepared;

e) movement joints have been correctly installed.

7.2 Achieving the required quality of work

In order to achieve the required quality of roofing, steps should be taken to ensure that:

a) design and specification decisions are taken, recorded and transmitted by the designer;

b) the design intentions are understood and achievable in the given circumstances;

c) the work is regularly monitored to assure conformance.

7.3 Documentation and preparation

Full documentation should be prepared as described in **4.1** and there should be a full exchange of information as described in **4.2** before work begins on site.

Any queries should be resolved before roofing begins. Clear instructions on all aspects of the work involved should be given to personnel.

Before roofing work begins, all necessary scaffolding should be in position together with sufficient hoisting facilities and measures appropriate for the protection of personnel and the public. It is particularly important that all roofs be provided with safety rails and all openings adequately protected.

The deck should be in an adequate condition to receive the mastic asphalt and all necessary builder's work should have been completed.

Only sufficient materials for the day's requirements should be taken out of store and placed convenient to the area being worked; they should only be unwrapped immediately prior to use and all wrapping materials should be disposed of carefully.

Equipment should be sited as close as is practicable to the area being worked.

7.4 Receiving and checking materials

Roofing materials should be checked upon arrival on site to ensure that they:

a) are correctly marked and/or, where applicable, are in the manufacturer's original wrappers;

b) conform to the specification;

c) are sufficient for the work.

Goods that do not meet requirements should be removed from site.

8 Workmanship

8.1 Re-melting

Strict temperature control should be maintained throughout the re-melting process. Generally, the temperature of the mastic asphalt should not exceed 230 °C.

Re-melting should be carried out in mechanically agitated mixers, and cauldrons should only be used in exceptional circumstances, governed by site conditions and the areas of roofing to be laid.

8.2 Transport of molten material

When the material is sufficiently molten to be workable, it should be carried in appropriate containers or insulated mobile dumpers to the point of laying. To prevent the molten material from sticking to the containers etc., they should be sprinkled inside with a minimum quantity of inorganic powder such as limestone dust.

8.3 Setting out and planning the work

The design of the roof and the number of operatives engaged determine, at the discretion of the spreader, the setting out and the size of the bays. The dimensions of each bay should be such that easy control by the spreader is ensured during the process of laying and rubbing. Mitred bays may be laid dependent upon the nature of the falls provided.

The whole structure should be rigid. In a timber construction, the construction should minimize the effects of shrinkage, warping or displacement or relative movement of the timber. Care should be taken to guard against any conditions which might allow decay, partly through the moisture already in timber or resulting from the ingress of water from other parts of the structure or from abnormal condensation.

Immediately after all work on preliminary activities has been completed, installation of the mastic asphalt roofing will proceed according to the project specification.

8.4 Laying vapour control layers

Whenever a vapour control layer is specified the spreader should ensure its integrity, any damage being made good before the insulation boards are applied.

Particular care should be taken at all detail work to ensure the insulation is completely enclosed and protected against water vapour from below.

8.5 Laying thermal insulation boards

8.5.1 *Warm roof construction*

Boards should be fully bedded to the vapour control layer in hot bitumen in a brick bond pattern and with edges firmly pushed together in accordance with the board manufacturer's instructions.

The thermal insulation should be laid with a margin between the edges of the boards and all skirtings and abutments. The margin should be subsequently filled, prior to laying the first coat of horizontal mastic asphalt (see **6.15**).

8.5.2 *Inverted roof construction*

Thermal insulation boards should be loose-laid in a brick bond pattern with edges pushed firmly together, on a loose-laid non-woven polyester fleece, of mass 130 g/m^2 to 140 g/m^2, with an overlap of 200 mm to 300 mm, in accordance with the board manufacturer's instructions.

8.6 Laying the separating membrane

8.6.1 *Horizontal work*

On all flat roofs a separating membrane should be laid loose with not less than 50 mm lapped joints beneath the mastic asphalt as a partial separator and to obviate blistering.

8.6.2 *Sloping or vertical lightweight concrete or timber*

A sheathing felt should be used in conjunction with expanded metal lathing mechanically fixed at not greater than 150 mm centres in all directions.

8.7 Laying the roofing

8.7.1 *Horizontal work*

Mastic asphalt roofing should be laid in bays generally in two coats.

Each coat of each bay should be spread evenly and uniformly by means of a float, to the recommended thickness, onto the previously prepared surface, the separating membrane or the preceding coat. Timber or metal gauges should be used in order to ensure accuracy.

Each coat of mastic asphalt should be followed by the succeeding coat as soon as is practicable, since exposure to contamination, for example by dust or dirt, might impair adhesion and cause blistering.

If 'blowing' occurs, the bubbles should be stabbed and the area affected carefully made good while the mastic asphalt is still hot.

8.7.2 *Junctions*

Special care should be taken in laying mastic asphalt to form an efficient junction with the edge of a bay already laid. The hot mastic asphalt is taken over the edge of the existing bay and allowed to remain for a sufficient period of time to ensure complete fusion between the two bays. When the edge of a mastic asphalt bay is contaminated it should be cleaned by a temporary application of hot mastic asphalt.

Where bays of mastic asphalt have been left open due to phasing of the contract, or for other reasons, the edges of previously laid bays should be warmed and cleaned by the application of hot mastic asphalt before the joint with the new material is made.

Care should be taken to arrange that the junction between the two adjacent bays of a coat of mastic asphalt should not be less than 75 mm from a corresponding junction in a preceding coat.

This procedure should also be adopted at junctions between the roof finish and skirtings or fillets.

8.7.3 *Skirtings*

Skirtings should be executed in not less than two coats, particular care being taken to ensure proper adhesion of the first coat to the base. The first coat should be applied with a steel trowel or a small wooden float, with the second, and any specified subsequent coats, being applied with a wooden float.

8.7.4 *Angle fillets*

At the internal intersection of two planes, and after the mastic asphalt has been laid to each face, the final coat of mastic asphalt should be warmed and cleaned by the temporary application of hot mastic asphalt

A solid angle fillet of mastic asphalt should be formed in two coats with a face of not less than 40 mm.

8.7.5 *External angles*

Special care should be taken that the full thickness of mastic asphalt is maintained at all external angles formed by intersecting planes, whether horizontal, sloping or vertical.

8.7.6 *Surface finishes*

The horizontal surface of the mastic asphalt roofing should be sand rubbed.

Whilst the mastic asphalt is still warm, horizontal surfaces should be well rubbed with a wooden float, using clean, sharp sand. Special attention should be given to the junction between bays. All surplus material should be removed after rubbing is completed.

9 Protection

9.1 Completion of laying

The roof finish should not be subjected to traffic until the material has cooled to the temperature of the surrounding atmosphere.

9.2 Prior to handover

Prior to handover, it is essential that mastic asphalt roofing is fully protected from:

a) mechanical and impact damage, including damage from contractors' plant, equipment and materials;

b) careless handling of scaffolding or other builder's accessories;

c) trafficking by following trades;

d) contamination by spillage of solvents, diesel fuel and paints;

e) concrete, mortar, cement grout or plaster mixed directly on mastic asphalt finish.

10 Inspection, sampling and testing

10.1 Inspection

The work should be inspected before asphalting is commenced, while in progress, and after completion, special attention being paid to the following:

a) general condition of the base;

b) correct laying of the isolating membrane;

c) cleanliness of plant for re-melting;

d) correct temperature of the material prior to laying;

e) use of the correct kind of dust to assist removal of material from the buckets, wheelbarrows etc.;

f) making good all 'blows';

g) correct thickness;

h) correct treatment of junctions and skirtings;

i) removal of all mastic asphalt tailings;

j) correctness of finished level and specified finish.

10.2 Samples

Sampling of mastic asphalt where required should be carried out in accordance with BS 5284.

10.3 Testing

Testing of mastic asphalt should be carried out in accordance with BS 5284.

The requirements of samples for testing should be agreed between the parties concerned during the exchange of information (see **4.2**).

11 Maintenance and repair

11.1 General

A flat roof which has been designed and installed in accordance with the recommendations of this British Standard can be expected to provide trouble-free service provided it is properly maintained.

Maintenance inspections should be carried out regularly by persons knowledgeable in mastic asphalt work.

A flat roof should be inspected annually, preferably in the autumn, to clear leaves, debris and dirt which may prevent proper drainage or cause deterioration, and to identify at an early stage any signs of failure. Where the roof is in an area of high dust or pollution, or in close proximity to trees, more frequent inspection may be necessary.

Inspection should be carried out both externally and internally. Particular attention should be given externally to roof covering abutments, joints, gutters, and outlets; and internally to corners, abutments and penetrations. Observations by occupants of the buildings should be noted.

11.2 Checklist

During the course of regular maintenance inspections the whole of the roof should be systematically checked and a note made of any items requiring attention. The following checklist should be used.

a) *Surface finishes and solar reflectors*

Check that surface chippings are evenly distributed and unaffected by wind scour and that ballast has not been displaced. Note any cracked or damaged tiles and slabs. Where a reflective paint has been used, assess the necessity for renewal, taking into account the roof's age and its formation, i.e. the presence and type of insulation etc.

b) *Skirtings, kerbs and turndowns*

Check that upstands are intact and fully adhered. Note any blistering, distortion or slumping. Pay particular attention to fillets and arrises for cracks from movement or impact. Where skirtings are tucked into a chase in concrete or brickwork, check the condition of the pointing.

c) *Edge trims*

Check for signs of movement displacement or stress, particularly at the joints between adjacent section of trim, and for retraction between asphalt and back edge of trim.

d) *Drainage*

Ensure that all gutters, rainwater outlets and discharge points are clean and that the water discharge from the roof is uninterrupted. Carefully examine the junction between the asphalt and rainwater outlet. Note any apparent defects or signs of silting or ponding.

e) *General area*

Examine the whole of the general roof area, note any areas of stress or blistering and any signs of hollowing denoting failure of insulant or timber. Record the extent and type of any defects.

11.3 Repair procedures

Repairs should only be carried out after the type and extent of any defects have been noted and their underlying cause identified. The intention of repair work should be to restore the asphalt to its original condition and ensure its continuing performance. All repairs should therefore be carried out using materials, accessories and a standard of workmanship comparable with the original installation.

Any surface treatment that has been damaged or displaced should be made good to match the existing surface.

Defective pointing should be broken out and renewed. Split or broken non-ferrous metal cover flashings should be repaired or renewed as necessary.

Excessive blistering may be indicative of more serious underlying problems and should be cut out and the substrate examined to establish the cause.

All repair work to a mastic asphalt surface should be performed by a qualified mastic asphalt operative. If it is necessary to remove an area of mastic asphalt, the line of the cuts should be covered with molten mastic asphalt until the underlying material has softened. The mastic asphalt should not be removed until this has taken place. In no circumstances should a hammer and chisel be used to cut cold mastic asphalt. Alternatively, a disc cutter may be used to remove mastic asphalt.

When the area is sufficiently soft, it should be removed carefully. When jointing new mastic asphalt to existing mastic asphalt, the principle of the lapped joint should be observed. The perimeter of existing mastic asphalt should be softened to permit removal of material to a depth of half its thickness for a width of not less than 75 mm. Due to the hardness of mastic asphalt paving, electrical or mechanical disc cutters may be used in the removal of defective areas.

The use of a forced flow hot air torch, or the controlled use of a gas gun may be acceptable for specific requirements; in the case of the latter extreme care should be taken to avoid continuous contact between the naked flame and the mastic asphalt.

Annexes

Annex A (informative)
Rigid thermal insulation boards

A.1 General

This annex contains recommendations for the selection and installation of rigid thermal insulation boards for use in warm roofs and inverted roofs to be covered with mastic asphalt. The following materials are commonly used:

a) granulated compressed cork;

b) cellular foamed glass slabs;

c) perlite boards;

d) expanded polystyrene (bead) boards;

e) polyisocyanurate foam;

f) high density mineral wool;

g) extruded polystyrene.

NOTE 1. Extruded polystyrene can only be used in an inverted roof situation.

NOTE 2. Thermal insulation is not recommended for use directly beneath mastic asphalt in sloping or vertical situations.

NOTE 3. Expanded polystyrene should be suitably protected by a heat barrier board, such as granulated compressed cork or perlite boards.

A.2 Compressed cork

The boards should consist of pure granulated cork, compressed into slab form and held together by natural cork gum. The density should be not less than 110 kg/m^3 and the minimum compressive strength not less than 135 kN/m^2.

NOTE. There is at present no British Standard for this material.

A.3 Cellular foamed glass slabs

Cellular foamed glass slabs should have a density between 120 kg/m^3 and 130 kg/m^3 and a minimum compressive strength of 700 kN/m^2. Where used in situations subjected to pedestrian or vehicular trafficking, a higher density of approximately 200 kg/m^3 should be specified (minimum compressive strength 900 kN/m^2). The slabs should be fully bonded in hot bitumen in accordance with the manufacturer's recommendations.

NOTE. There is at present no British Standard for this material.

A.4 Perlite boards

Perlite thermal insulation boards should have a density of between 170 kg/m^3 and 180 kg/m^3 (minimum compressive strength 250 kN/m^2).

NOTE. There is at present no British Standard for this material.

A.5 Expanded polystyrene (bead boards) pre-felted

Expanded polystyrene boards should be pre-felted both sides and should conform to BS 3837 : Part 1 (HD or EHD grade, type A). Due to its heat sensitivity, it is not possible to lay mastic asphalt directly over this material. A heat sink board of cork or perlite not less than 20 mm in thickness should be bonded to the pre-felted expanded polystyrene before the application of the mastic asphalt. Bitumen used in bonding the chosen heat sink should be applied at a temperature as recommended by the manufacturer of the expanded polystyrene boards. The boards should have a minimum compressive strength of 110 kN/m^2.

A.6 Rigid polyisocyanurate foam

Thermal insulation boards of rigid polyisocyanurate foam should conform to BS 4841 : Part 3 and should have a reinforcing facing of glass tissue autohesively bonded to the foam during the manufacturing process. Boards should be fully bonded in hot bitumen in accordance with the manufacturer's instructions and should have a minimum compressive strength of 150 kN/m^2.

A.7 High density mineral wool

Mineral wool roofing boards should have a mean compressive stress, at 10 % deformation, or a compressive strength, whichever is the smaller, of not less than 140 kN/m^2, with no single value less than 100 kN/m^2. The boards, faced with a glass tissue, should be fully bonded in hot bitumen using a staggered joint arrangement, in accordance with the manufacturer's instructions.

NOTE. There is at present no British Standard for this material.

A.8 Extruded polystyrene

Extruded polystyrene should conform to grade SHD, type A of BS 3837 : Part 2. Extruded polystyrene is only recommended for use in inverted warm roof constructions. When used for this application the boards should be laid loose and ballasted in accordance with the manufacturer's instructions. The minimum compressive strength should be 300 kN/m^2.

A.9 Thermal insulation to slopes and verticals under mastic asphalt

Due to the nature of mastic asphalt it is not practicable to lay over insulation boards on slopes over 5° or verticals.

Alternatives should be sought in consultation with the asphalt specialist.

Annex B (informative)
Characteristics of mastic asphalt

B.1 Control of water vapour

The vapour resistivity of mastic asphalt can be assumed to be not less than 100 000 MN·s/(g·m). For condensation control calculations a factor of 20 000 MN·s/(g·m) may be taken (i.e. the ratio of the vapour resistivity of the material to that of still air).

B.2 Compressive strength

When mastic asphalt is fully confined it has the same compressive strength as the containing material. When not confined, the compressive strength is dependent upon a number of factors, including the temperature to which it may be subjected. Advice on individual cases should be sought from mastic asphalt manufacturers.

B.3 Fire

Mastic asphalt, because of its high mineral content, is virtually incombustible.

Mastic asphalt fulfils all the external fire resistance required for a roof covering and achieves the highest rating (P60) when tested as described in BS 476 : Part 3.

B.4 Thermal

Mastic asphalt has a thermal conductivity λ of between 0.43 W/(m·K) and 1.15 W/(m·K). A value of 0.50 W/(m·K) may be assumed for design purposes.

B.5 Toxicity

Mastic asphalt is non-toxic and is generally suitable for use in contact with potable water.

B.6 Odour

Mastic asphalt is odourless after laying.

List of references (see clause 2)

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 476	*Fire tests on building materials and structures*
Part 3 : 1975	*External fire exposure roof test*
BS 1105 : 1981	*Specification for wood wool cement slabs up to 125 mm thick*
BS 1447 : 1988	*Specification for mastic asphalt (limestone fine aggregate) for roads, footways and paving in buildings*
BS 3837	*Expanded polystyrene boards*
Part 1 : 1986	*Specification for board manufactured from expandable beads*
Part 2 : 1990	*Specification for extruded boards*
BS 4841	*Rigid polyurethane (PUR) and polyisocyanurate (PIR) foam for building applications*
Part 3 : 1994	*Specification for two types of laminated boards (roofboards) with auto-adhesively bonded reinforcing facings for use as roofboard thermal insulation for built-up roofs*
BS 5250 : 1989	*Code of practice for control of condensation in building*
BS 5284 : 1993	*Methods of sampling and testing mastic asphalt used in building and civil engineering*
BS 5268	*Structural use of timber*
Part 2 : 1996	*Code of practice for permissible stress design, materials and workmanship*
Part 5 : 1989	*Code of practice for the preservative treatment of structural timber*
BS 6100	*Glossary of building and civil engineering terms*
Section 1.3.2 : 1989	*Roofs and roofing*
BS 6229 : 1982	*Code of practice for flat roofs with continuously supported coverings*
BS 6566	*Plywood*
Part 1 : 1985 (1991)	*Specification for construction of panels and characteristics of plies including marking*
Part 2 : 1985	*Glossary of terms*
Part 3 : 1985	*Specification for acceptance levels for post-manufacture batch testing including sampling*
Part 4 : 1985	*Specification for tolerances on the dimensions of plywood panels*
Part 5 : 1985	*Specification for moisture content*
Part 6 : 1985	*Specification for limits of defects for the classification of plywood by appearance*
Part 7 : 1985	*Specification for classification of resistance to fungal decay and wood borer attack*
Part 8 : 1985	*Specification for bond performance of veneer plywood*

BS 6925 : 1988	*Specification for mastic asphalt for building and civil engineering (limestone aggregate)*
BS 7263 Part 1 : 1994	*Precast concrete flags, kerbs, channels, edgings and quadrants Specification*
BS 8215 : 1991	*Code of practice for design and installation of damp-proof courses in masonry construction*
BS 8217 : 1994	*Code of practice for built-up felt roofing*
CP 3 Chapter V : Part 2 : 1972	*Code of basic data for the design of buildings Wind loads*

Other references

[1] *Lead Sheet Manual — A guide to good building practice — Lead sheet flashings — Volume 1*, published by The Lead Sheet Association, St John's Road, Tunbridge Wells, Kent TN4 9XA.

[2] The Building Regulations 1991, published by The Stationery Office.

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