

Code of practice for

Mastic asphalt roofing

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Committees responsible for this British Standard

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- 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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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 It supersedes CP 144 : Part 4 : 1970, which is withdrawn.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 proprietary 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/m² to 70 g/m².

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/m² to 140 g/m² 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 furring 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 furring 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).

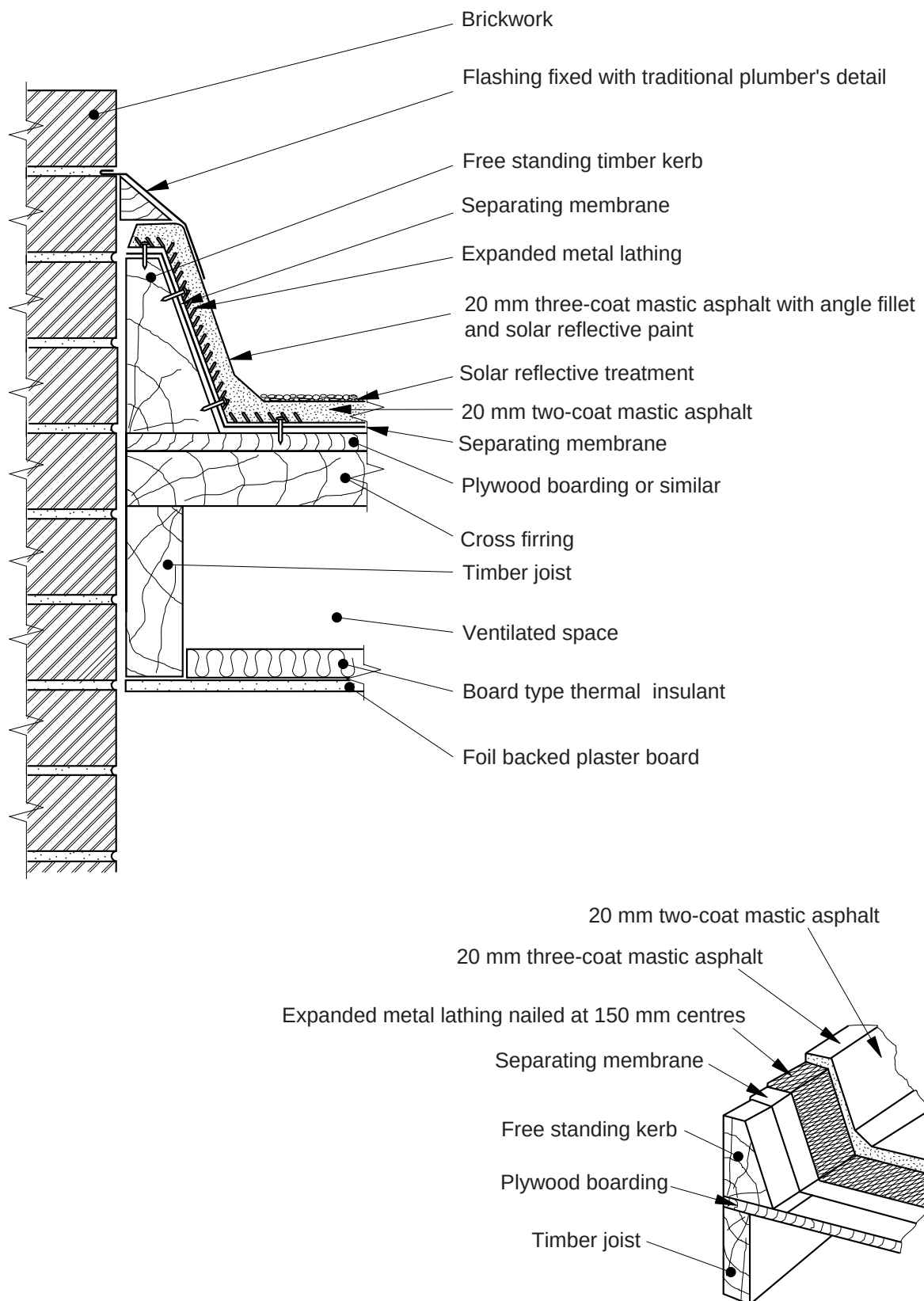


Figure 1. Timber roof deck with free standing kerb (cold roof)

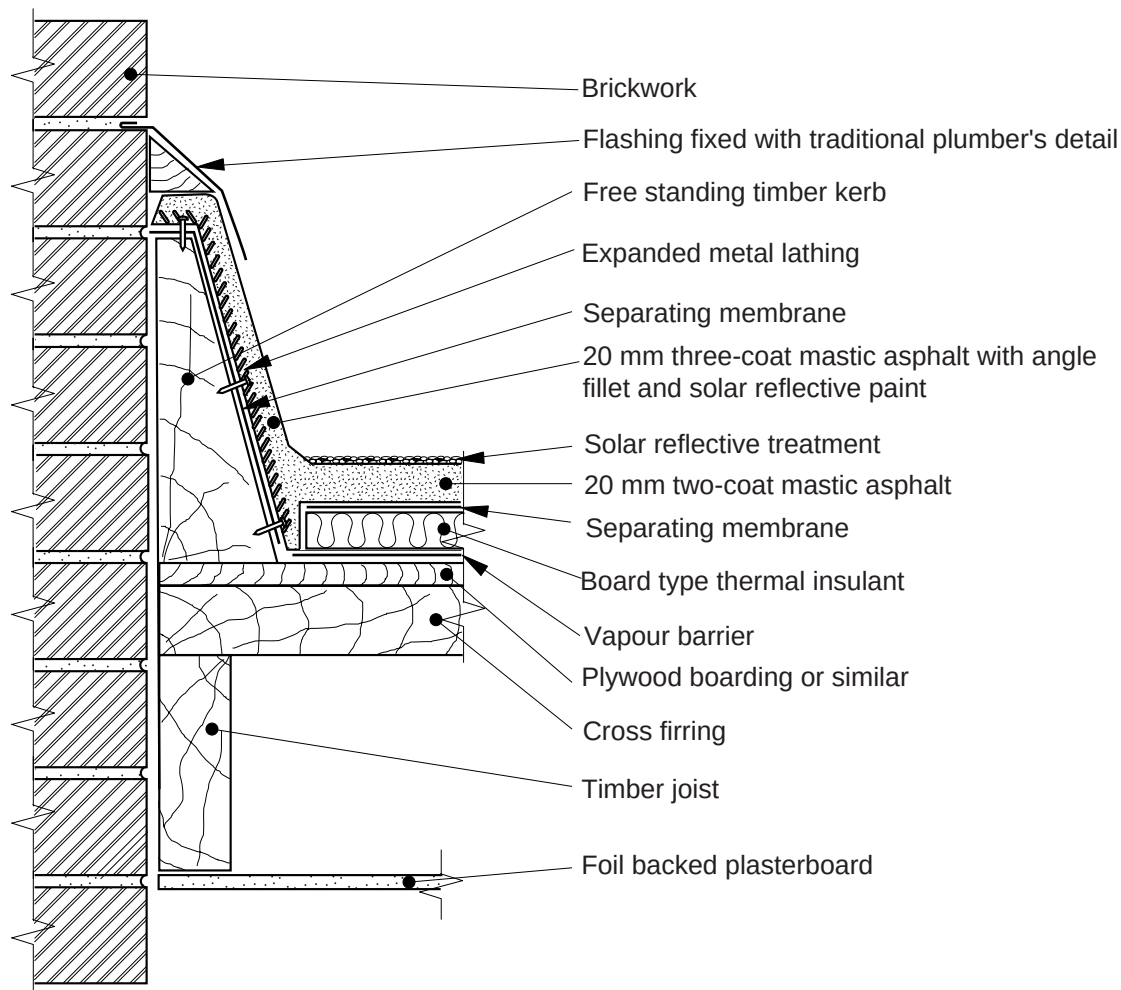


Figure 2. Timber roof deck with free standing kerb (warm roof)