

BRITISH STANDARD CODE OF PRACTICE
CP 143 : Part II : 1970

SHEET ROOF AND WALL COVERINGS

Part II : Lead : Metric units

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THE COUNCIL FOR CODES OF PRACTICE
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SHEET ROOF AND WALL COVERINGS

PART 11. LEAD : METRIC UNITS

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This part of the Code of Practice makes reference to the following British Standards and British Standard Codes of Practice.

- BS 219. Soft solders.
- BS 648. Schedule of weights of building materials.
- BS 747. Roofing felts.
- BS 1178. Milled lead sheet and strip for building purposes.
- BS 1210. Wood screws.
- BS 1521. Waterproof building papers.
- BS 1569. Copper sheet and strip for roofing and other building purposes.
- BS 2717. Glossary of terms applicable to roof coverings.
- CP 3*. Code of basic data for the design of buildings. Chapter V. Wind loads. Chapter V: Part 1. Dead and imposed loads.
- CP 98. Preservative treatment for constructional timber.
- CP 112. The structural use of timber.
- CP 326. The protection of structures against lightning.
- CP 000†. Roof and yard drainage.

* In course of revision.

† In course of preparation.

British Standards and Codes of Practice are revised when necessary by the issue either of amendment slips or of revised editions. It is important that users ascertain that they are in possession of the latest amendments or editions.

The following BSI reference relates to the work on this Code of Practice. Committee reference BLCP/4/3

SUB-COMMITTEE BLCP/4/3

Chair—Vacant

Mr. R. M. Edwards
The Director

Association of British Roofing Felt Manufacturers
Ministry of Public Building and Works—Building
Research Station

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Mr. C. E. Cannons
Mr. L. E. Allen
E.D.3A

Institute of Plumbing
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}

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}

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Royal Institution of Chartered Surveyors

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This Code of Practice represents a standard of good practice and therefore takes the form of recommendations. Compliance with it does not confer immunity from relevant statutory and legal requirements.

BRITISH STANDARD CODE OF PRACTICE CP 143

SHEET ROOF AND WALL COVERINGS

Part 11. Lead : Metric units

FOREWORD

This metric edition of CP 143, which has been designated Part 11, is the metric version of Part 3, published in imperial units in April, 1960.

This metric version of the Code, giving values in SI units, has been prepared as part of the change to the metric system in the construction industry. Although not a full technical revision, Amendment No. 1, PD 4347, 1961, calling for the inclusion of wall covering in the title, has been further extended by reference where appropriate to vertical cladding and the addition of Figs. 12, 14 and 15, giving details of vertical jointing. Materials throughout this version are stated in BS code numbers, as in BS 1178*.

For further information on SI units, reference should be made to BS 3763 and PD 5686†.

Where it has been necessary to apply dimensional co-ordination, recommendations of Technical Committee B/94, Modular Co-ordination in Building, have been reflected in this metric version. For further information on dimensional co-ordination reference should be made to BS 4011, BS 4330, PD 6444 and PD 6445‡.

1. GENERAL

1.1 SCOPE

This Code deals with lead coverings for roofs and walls following normal established practice. Recommendations are given in regard to the whole of the coverings above the wooden rafters for pitched roofs, and above the joists or the upper surface of the constructional base for flat roofs and walls.

Flashings and gutters are dealt with in so far as these are integral parts of the covering.

* BS 1178, 'Milled lead and strip for building purposes'.

† BS 3763, 'International System (SI) units' and PD 5686, 'The use of SI units'.

‡ BS 4011, 'Recommendations for the co-ordination of dimensions in building. Basic sizes for building components and assemblies'.

BS 4330, 'Recommendations for the co-ordination of dimensions in building. Controlling dimensions'.

PD 6444, 'Recommendations for the co-ordination of dimensions in building. Basic spaces for structure, external envelope and internal sub-division'.

PD 6445, 'Tolerances and joints. The derivation of building component manufacturing sizes from co-ordinating sizes'.

1.2 DEFINITIONS

For the purposes of this Code the following definitions apply:

- (1) *Bay*. A unit of sheet covering as laid between rolls, standing seams or drips.
 - (2) *Anti-capillary groove*. A horizontal groove in a vertical face into which the lead undercloak is dressed.
 - (3) *Clip*. A metal strip shaped for the purpose of securing the roof sheeting with one end fixed to structure.
 - (4) *Drip*. A step formed in a flat roof or gutter across the direction of fall.
 - (5) *Lead-capped dot*. Brass screw and washer fixing with lead-burned cap.
 - (6) *Soldered dot (wiped soldered dot)*. Fixing for lead sheet coverings on timber boarded surfaces by means of a brass screw and washer sunk in a depression formed in the surface and wiped over with solder.
 - (7) *Lead dot*. As soldered dot, with filling loaded by lead-burning and finished flush.
 - (8) *Lap (or passing)*. The distance which sheets lap over adjoining pieces in valley gutters, flashings, ridge coverings, etc.
 - (9) *Patina*. The thin, stable film of oxide or other metallic compounds which forms on metal surfaces on exposure to air.
 - (10) *Roll*. A shaped core against the sides of which the roof coverings are dressed or are turned up. Batten roll, conical roll, ridge roll, round topped roll and square roll are variations of the above.
 - (11) *Secret tack*. A method of supporting lead when fixed vertically, e.g. dormer cheeks, a lead tack being soldered or lead-burned to the back of the lead sheet, passed through a slot cut in the boarding and secured on the inside.
 - (12) *Tack, lead or other metal*. A strip used to secure any free edge of the flashing and coverings.
 - (13) *Torus roll*. A wooden roll covered with lead sheet at the intersection formed by the change in pitch of a mansard roof.
 - (14) *Undercloak*. The part of the lower sheet overlapped by the upper at a drip, roll, seam or welt.
 - (15) *Wedge lead*. A tapered piece made either by casting or by beating folded pieces of lead, used to secure flashings to masonry, brickwork or concrete.
 - (16) *Welt*. A method of joining by folding over the edges of metal sheets, engaging the folded portions and dressing down flat.
- Any other roofing terms used in this Code have the meaning assigned to them in BS 2717*.

1.3 EXCHANGE OF INFORMATION AND TIME SCHEDULE

The working drawings and specification should be prepared in sufficient detail to afford proper guidance in the preparation of estimates and the execution of

* BS 2717, 'Glossary of terms applicable to roof coverings'.

the work. Where Bills of Quantities form part of the Contract, they should be prepared in accordance with the Standard Methods of Measurement in building work, or the Scottish Mode for the Measurement of Building Works, as appropriate. There should be a full exchange of information between all concerned with the cladding and the work adjacent to it in sufficient time to ensure that the covering can be carried out at the proper time and that all necessary provision for fixings have been made in advance. Early arrangements should be made on the site for rainwater disposal. Cladding should be completed before internal finishes are begun.

The dimensional co-ordination recommendations of Technical Committee B/94, Modular Co-ordination in Building, are embodied where appropriate to the Code.

2. MATERIALS, APPLIANCES AND COMPONENTS

2.1 MILLED LEAD SHEET

Milled lead sheet for roof and wall covering as dealt with by this Code should conform to the requirements of BS 1178*. The metric version of this standard, published in 1969, provided for a range of six sizes of lead sheet defined by their thickness in millimetres. In order to make smoother the transition period, and for easy identification, code numbers which correspond to weight (lb) per square foot sizes of the earlier edition have been introduced. The substance of lead sheet is specified by its BS Code Number, or thickness in millimetres, e.g. Code No. 4, lead (thickness 1.80 mm), Code No. 8, lead (thickness 3.55 mm). The standard width of milled lead is 2.40 m, and of lengths 3 m, 6 m and 9 m. Sheets and strips cut to dimensions as required are supplied by the manufacturers.

2.2 CAST LEAD SHEET

There is no British Standard for this type of lead sheet, the making of which remains a craft operation. Cast lead sheet is made on an open sand casting table and the available size of sheets is therefore determined by the size of the table used. Sizes in common use in recent years vary from 2.75 m × 1 m to 5.5 m × 2 m. Sheets can be cast to an accuracy of 0.2 mm thickness in a range of substances corresponding to standard range for milled lead sheet given in BS 1178* for milled lead sheet.

2.3 COPPER CLIPS

Copper clips (tacks) should be cut from rolled copper sheet of dead soft temper, not thinner than 0.60 mm thickness and conforming to BS 1569†.

* BS 1178, 'Milled lead sheet and strip for building purposes'.

† BS 1569, 'Copper sheet and strip for roofing and other building purposes'.

2.4 NAILS

Nails should be made of copper and be of the type described as cut copper nails. They should have large flat heads so that they can be driven home with a firm hold on the lead sheet. The nails should not be less than 25 mm long and should be of a substance to weigh not less than 1.6 kg per 1000 for nails of that length.

2.5 SCREWS

The screws should be made of gunmetal conforming to the requirements of BS 1210*. They should be of suitable length and gauge.

2.6 UNDERLAY

Underlay for lead coverings should be of such a material that it will not become tacky or sticky and will remain perfectly free on both surfaces. Suitable underlays are those conforming to the requirement of BS 1521, Class A, and BS 747, Type 4A (ii), *Brown* No. 1, Inodorous†, or a similar felt which will not adhere to the metal or understructure under temperature changes.

2.7 SOLDER

Solder should be of Grade D or Grade F, conforming to the requirements of BS 219‡.

3. DESIGN CONSIDERATIONS

3.1 CHARACTERISTICS OF LEAD

Lead is extremely resistant to corrosion by town, country and marine atmosphere. When exposed to the atmosphere lead forms a strongly adhering protective film, the composition of which is primarily lead carbonate. This patina gives lead a light grey appearance unless it is masked by a surface deposit of dirt. It is highly insoluble in atmospheric moisture, and water draining from lead sheet roof and wall covering will not stain surrounding masonry.

Electrolytic corrosion does not normally occur when lead is used in contact with other metals in roof covering work.

Lead sheet is noted for its malleability, which enables it to be worked easily without need of annealing. It has moderate mechanical properties, but when due allowance is made for these by using the fixing methods given in this Code, lead sheet roof and wall covering will normally have an exceptionally long life, which will be equal to and often longer than the other building materials forming the fabric of permanent buildings.

* BS 1210, 'Wood screws'.

† BS 1521, 'Waterproof building papers' and BS 747, 'Roofing felts', Part 2, metric units.

‡ BS 219, 'Soft solders'.

A slight difference in mechanical properties may be found between milled and cast forms of lead sheet, but not of a significance to warrant any variation in the methods of using the two materials for roof coverings. When used in a similar manner, milled lead sheet and cast lead sheet can be expected to have a similar life.

The method of making cast lead sheet gives the material an even textured surface on the side that is in contact with the sand bed and a mainly smooth surface on the other side. It is generally fixed with the textured surface exposed.

For weights of lead sheeted roofs reference should be made to BS 648 and CP 3, Chapter V, 'Loading'*, for allowances for imposed loads.

3.2 SUBSTRUCTURE

3.2.1 General. It is important that the fixings for sheet lead coverings to roofs are as permanent as the metal itself.

Cellular or foam concrete does not present a good fixing for items such as screws or nails that secure copper clips for rolls, drips or welts. Suitably treated wood rolls and drip edges, firmly cross spiked to the concrete, should be used.

Where a layer of hardboard is used to cover poorly surfaced timber or over rough faced concrete, the fixings for the sheet lead must penetrate the hardboard and be secured to the substructure.

Where lead sheet is laid on insulating material such as compressed cork or open textured fibreboard, the method of securing the insulating material and the lead sheet should be agreed with the lead roofing contractor.

3.2.2 Timber. For structural aspects and decay of timber, reference should be made to CP 112 and CP 98†.

Boarding on which lead sheet is to be laid should be wrought, tongued and grooved. It should be properly seasoned to obtain maximum resistance to warping. For flat roofs, the boarding should be laid either diagonally or in the direction of the fall. An underlay should be provided on boarded surfaces. An underlay should also be provided in all cases where lead coverings are fixed to timber members formed in hardwoods such as oak and elm, which, when moist, may be corrosive to lead.

The heads of nails used for fixing boarding and other timber members should be well punched below the surface and similarly all screws should be countersunk. Sharp arrises of external angles of timber members to be covered with lead should be removed.

* BS 648, 'Schedule of weights of building materials' and CP 3, 'Code of basic data for the design of buildings'.

† CP 112, 'The structural use of timber' and CP 98, 'Preservative treatment for constructional timber'.

3.2.3 Concrete. The surface should be laid to even falls and have a smooth finish. An underlay should be provided to allow the lead to move freely following temperature changes. The underlay is also necessary to isolate the lead from Portland cement concrete, which until it has dried out and carbonated may stimulate a corrosive attack on lead.

The security and durability of the fixings will have an important effect upon the life of a lead roof covering. Any materials set in concrete to receive fixing nails or screws should not be subject to decay through retained moisture or condensation.

3.3 LEAD COVERINGS, PRIMARY CONSIDERATIONS

In the design of lead roof and wall coverings the comparatively high coefficient of linear expansion of the metal and also its moderate mechanical strength are factors that should be taken fully into account. Lead roof and wall coverings should be designed to consist of separate pieces of lead sheet of limited size and with weather-tight joints and fixings that permit freedom at edges, so that thermal movement can take place without risk of distortion, buckling or similar effects with which the lead will be subjected to fatigue conditions.

Fixings, where flat roofs are concerned, are required to retain the covering in position on its fully supporting substructure, and they can be conveniently incorporated in the joints. With vertical and near vertical surfaces and pitched roofs, the fixings should give support to the covering and their spacing should be considered with this in mind. Intermediate fixings, as well as fixings at edges, may be required according to the width of the piece of lead.

3.4 JOINTS

3.4.1 Rolls. Two types of roll are used for the primary purpose of providing joints running with the fall of the roof. These are the wood roll and the hollow roll. The wood roll is formed by dressing the edge of the lead sheet over a wooden core of section as illustrated in Fig. 1*a*. The edge of underlap is nailed. The edge of the overlap should extend on to the surface of the adjoining bay to form a splash lap. According to the pitch of the roof and the width of the bays, additional fixings in the form of copper clips may be required to be incorporated in wood rolls.

The hollow roll is made by first forming a standing welt, with copper clips as fixings, and then turning this into a roll (see Fig. 1*b*).

It is essential to use wood rolls on roofs likely to be subject to foot traffic, which would damage a hollow roll.

3.4.2 Welts. These joints are formed by folding the edges of the adjoining sheets together and incorporating copper clips at intervals as fixings. The welt is finished folded flat to the surface of the covering (see Fig. 2). The commonly used welt so

formed requires two folds. Welts may be used for joints running with the fall of the roof surface where it is anticipated that the depth of flow of water will not exceed the depth of the welt.

3.4.3 Drips. Joints across the fall of flat and low pitched roofs up to 15° are formed with drips (see Fig. 3). The step should normally be not less than 50 mm. Where the anticipated depth of flow of water permits, the step may be a minimum of 40 mm, but it is essential that an anti-capillary groove is incorporated, into which the undercloak of the lead should be dressed (or chased). The edge of the step should be rebated to receive the underlapping sheet, which should be nailed to it.

3.4.4 Laps. Joints across the fall of pitched roof surfaces are formed with laps. For slopes of 15° or steeper, drips may be omitted and the two sheets lapped to give a cover of at least 75 mm, measured vertically, or 150 mm along the slope. The following lengths of lap are recommended:

for 15° pitch 300 mm,
for 20° pitch 225 mm,
for 25° pitch 175 mm,
for 30° pitch 150 mm.

Fixing at laps is by means of nailing at the head with large headed copper nails. Copper clips may be required according to the width of the lapped joint to hold down the free edge of the overlap and to provide support.

3.5 RETAINING FREE EDGES

Free edges of lead roof coverings should be retained at intervals of 750 mm with lead tacks or copper clips.

3.6 FLAT ROOF COVERINGS

The maximum size of a piece of lead sheet used for the covering of roofs of up to 15° pitch or for lining gutters should not exceed 2.25 m^2 in area nor 2.5 m in length. Joints in the direction of the fall of the roof should be by means of wood rolls and joints across the fall by means of drips. A convenient spacing for rolls is 675 mm intervals and for drips 2250 mm and the overall size of the piece of lead sheet for one bay, allowing for joints, would be $900 \text{ mm} \times 2400 \text{ mm}$ (see Fig. 4). The spacing for rolls should not exceed 600 mm for Code No. 5, roof coverings.

Lead sheet may be laid on a horizontal plane, but for drainage purposes CP 000* recommends that a fall of 1 in 120 is required.

At abutments the lead covering should be turned up to a height of not less than 150 mm. The edge of the upstand should be covered to a minimum depth of 50 mm with a flashing fitted in maximum lengths of 2400 mm with laps of

* CP 000, 'Roof and yard drainage' (in course of preparation).