

Specification for

Design and construction of fully supported lead sheet roof and wall coverings

UDC [692.415 + 692.2]:[691.74 + 691 – 415]:691.88:72.011:001.4

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The preparation of this British Standard was entrusted by the Elements and Components (of Diverse Materials) for Buildings Standards Committee (ECB/-) to Technical Committee ECB/47, upon which the following bodies were represented:

- Association of British Roofing Felt Manufacturers
- British Lead Manufacturers' Association
- Building Employers' Confederation
- Department of the Environment (Building Research Establishment)
- Department of the Environment (Property Services Agency)
- Institute of Plumbing
- Lead Development Association
- Metal Roofing Contractors' Association
- National Federation of Roofing Contractors
- Royal Institute of British Architects

This British Standard, having been prepared under the direction of the Elements and Components (of Diverse Materials) for Buildings Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 August 1988

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First published as CP 143-3 (imperial units) April 1960
Published in metric form as CP 143-11 October 1970
First revision as BS 6915 August 1988

The following BSI references relate to the work on this standard:
Committee reference ECB/47
Draft for comment 85/11514 DC

ISBN 0 580 16331 8

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
0 Introduction	1
1 Scope	1
2 Definitions	1
3 Materials and accessories	2
3.1 Lead sheet	2
3.2 Clips	2
3.3 Nails	3
3.4 Screws	3
3.5 Battens	3
3.6 Underlay	3
3.7 Solder	3
4 Roof construction: substructure	3
4.1 General	3
4.2 Timber	3
4.3 Concrete, screeds and masonry	3
4.4 Thermal insulation boards	3
5 Design considerations	3
5.1 Lead covering	3
5.2 Fixings	4
5.3 Gutters	5
5.4 Ancillary details	5
5.5 Preformed panels and wall coverings	6
6 Methods of laying and workmanship	6
6.1 Condition of substrate	6
6.2 Technique of laying	6
6.3 Wood-cored rolls	6
6.4 Hollow rolls	6
6.5 Welts	6
6.6 Standing seams	6
6.7 Drips	6
6.8 Laps	6
6.9 Flashings	6
6.10 Ridges and hips and apron flashings	6
6.11 Torus rolls	6
6.12 Staining	7
6.13 Completion	7
Appendix A General information	8
Figure 1 — Wood-cored roll (with splash lap)	9
Figure 2 — Wood-cored roll (with splash lap turned under)	9
Figure 3 — Hollow roll	9
Figure 4 — Welt	10
Figure 5 — Standing seam	10
Figure 6 — Drips	11
Figure 7 — Laps	13
Figure 8 — Box gutters	14
Figure 9 — Catch pits	15

	Page
Figure 10 — Chute outlet to box gutter	15
Figure 11 — Internal outlets to gutters	16
Figure 12 — Roll end at eaves	16
Figure 13 — Cover flashings at abutments	16
Figure 14 — Apron flashing at head of lean-to roof	17
Figure 15 — Lapped rolls	18
Figure 16 — Torus rolls	18
Figure 17 — Preformed lead-faced panels	19
Figure 18 — Preformed cladding: panels mounted in position	20
Figure 19 — Preformed cladding: typical fixing details	21
Figure 20 — Abutments: external and internal corners	21
Figure 21 — Junction of cladding with flat roof	21
Figure 22 — Head fixings	22
Figure 23 — Retaining clips	22
Figure 24 — Intermediate fixings	23
Figure 25 — Leadwelded clip	24
Table 1 — Flat roofs: maximum spacing of joints for roof slopes up to and including 10°	4
Table 2 — Pitched roofs: maximum spacing of joints for roof slopes above 10° up to and including 80°	4
Table 3 — Wall, vertical and near vertical: maximum spacing of joints for roof slopes above 80°	4
Table 4 — Gutters: lead dimensions	5
Publications referred to	Inside front cover

Foreword

This British Standard has been prepared under the direction of the Elements and Components (of Diverse Materials) for Buildings Standards Committee. The standard supersedes CP 143-11, which was published in 1970 as the metric revision of CP 143-3:1960 and which is withdrawn. It gives requirements for the design and construction of coverings of milled lead sheet complying with BS 1178 applied to external wall and roof surfaces and fixed in accordance with conventional practice based on traditional methods.

Note has been taken of the direct casting method of manufacturing lead sheet. An extensive programme of work is in hand to evaluate material produced by this method and, when this work is complete, it may be necessary to issue an amendment to the standard concerning this material.

A comparatively small amount of sand cast lead sheet is produced, mainly for replacement work on old and historic buildings and for ornamental lead work. Historical evidence has shown that, apart from surface texture and less accuracy in consistency of thickness, there are, for all practical purposes when the composition of the metal is similar, no significant differences between the properties and working of sand cast lead sheet and of milled lead sheet. The fixing requirements in this standard would be suitable for sand cast lead sheet.

Attention is drawn to BS 6229, which gives recommendations for the design of flat roofs with continuously supported coverings.

Additional information concerning specific detailing of lead sheet roof and wall coverings is given in the Lead Development Association publication "Lead sheet in building"¹⁾.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 24, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ Obtainable from the Lead Development Association, 34 Berkeley Square, London W1X 6AE.

0 Introduction

In order that the work covered in this standard can be executed efficiently and expeditiously, it is desirable that the following pre-contract exchange of information takes place between the parties concerned.

a) *General information*

There should be a full exchange of information between all concerned with the lead work 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 provisions for fixings have been made in advance.

General information should include the following:

- 1) description and precise location of the site and any unusual conditions or circumstances relating to access to the site;
- 2) storage facilities for materials;
- 3) availability of temporary lighting, power and water;
- 4) hoisting and scaffolding facilities;
- 5) safety measures to be provided.

b) *Working drawings and specifications*

The working drawings and specifications should be prepared in sufficient detail to afford proper guidance in the preparation of estimates and execution of the work. They should include details of the construction of the roof and of its covering and finishes in relation to any requirements which may affect them such as:

- 1) area and position of roofs to be covered;
- 2) height of roofs above ground;
- 3) the gradient and direction of falls;
- 4) thickness of the lead sheet;
- 5) special conditions, e.g. traffic, degree of exposure;
- 6) nature and type of substrate;
- 7) any unusual method of fixing, including the specification of any proprietary fixings;
- 8) details and treatment of flashings, eaves, verges and abutments.

In the case of existing buildings a site inspection should normally be carried out.

1 Scope

This British Standard specifies requirements for the design and construction of fully supported coverings of milled lead sheet applied to external wall and roof surfaces. The requirements apply primarily to fixing the lead in situ and cover the design and fixing of the whole of the covering above the substructure that supports it, including the design and fixing of gutters and flashings.

References are made to coverings that are based on the use of preformed panels to which the main principles of design also apply. General information on the properties of lead roof coverings is given in Appendix A.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1

substrate

roof construction element over which the lead sheet is laid and to which it is attached

2.2

anti-capillary groove

horizontal groove in a vertical face into which the lead underclock is dressed

2.3

bay

unit of sheet covering as laid between rolls, standing seams or drips

2.4

clip

narrow strip of metal used in roll joints, standing seams and double welts for securing sheet roofing

2.5

drip

step formed in a flat roof or gutter across the direction of fall

2.6

lead capped dot

fixing for securing lead sheet roofing by means of screw and washer covered with a cap, leadwelded to the sheet [see Figure 24(b)]

2.7

soldered dot

fixing, wiped with solder, for securing lead sheet roofing by means of screw and washer sunk into a depression formed in the surface [see Figure 24(d)]

2.8**lead dot**

fixing for securing lead sheet roofing to masonry, achieved by pouring molten lead through a dot into a dovetailed sinking in masonry

2.9**lead button (lead dome)**

fixing composed of a hemispherical die cast lead dome which is secured by a fixing tool to a serrated brass washer held by a screw [see Figure 24(c)]

2.10**lead wedge**

tapered piece made by either casting or folding pieces of lead, used to secure flashings to masonry walls

2.11**lap (passing)**

distance which sheets lap over adjoining pieces

2.12**overcloak**

upper layer of sheet roofing at a drip, roll joint seam or welt

2.13**undercloak**

layer of sheet roofing below an overcloak

2.14**patina**

thin, stable film of oxide or other metallic compounds forming on metal surfaces exposed to air

2.15**core roll**

shaped section, usually of wood, around which sheet roofing is dressed

2.16**roll joint**

joint that accommodates movement between two pieces of sheet roofing, usually metal; a core roll may be used

2.17**hollow roll joint**

roll joint without core roll

2.18**solid roll joint**

roll joint with core roll

2.19**secret tack**

tack soldered or leadwelded to the back of lead sheet roofing and passed through a slot cut in the substrate on its inside

2.20**standing seam**

joint in metal sheet roofing in which the adjoining edges are turned up perpendicular to the surface, welted together and left upstanding

2.21**torus roll**

solid roll joint at the intersection formed by the change of pitch in a mansard roof [see Figure 16(a) and Figure 16(b)]

2.22**welt**

method of joining by folding over the edges of metal sheets, engaging the folded portions and dressing down flat

2.23**box gutter**

gutter, with parallel sides, not less than 150 mm wide and 100 mm deep [see Figure 8(a) and Figure 8(b)]

2.24**tapered valley gutter**

gutter where the pitched roof merges into the sole of the gutter, and widens towards the highest point

2.25**catch pit**

box formed at the low point of a gutter which allows a small pressure head of water to build up and increase the flow of the rainwater to the downpipe

2.26**chute outlet**

form of outlet discharging through a parapet wall into a hopper head and external downpipe

2.27**leadwelding (leadburning)**

fusion welding of pieces of lead without the use of solder or flux

2.28**splash lap**

part of the lead overcloak of a drip or roll joint extending on to the flat surface of an adjoining roofing sheet

3 Materials and accessories**3.1 Lead sheet**

Lead sheet for roof and wall coverings in accordance with this standard shall comply with BS 1178.

3.2 Clips

3.2.1 General. Clips shall be of copper, tinned copper, stainless steel or lead.

3.2.2 Copper clips. Copper or tinned copper clips shall be not less than 50 mm wide and shall be cut from copper sheet of not less than 0.60 mm thickness, complying with BS 2870 and of $\frac{1}{4}$ H temper.

3.2.3 Stainless steel clips. Stainless steel clips shall be cut from 50 mm wide fully annealed stainless steel strip of not less than 0.375 mm thickness. The strip shall comply with grade 304S11, 304S15, 304S16, 304S31, 316S11, 316S13, 316S31 or 316S33 of BS 1449-2 if terne coated or grade 316S11, 316S13, 316S31 or 316S33 of BS 1449-2 if uncoated.

3.2.4 Lead clips. Lead clips shall be not less than 50 mm wide and shall be not less than the thickness of the lead sheet used for the roofing and cladding work.

3.3 Nails

3.3.1 General. Nails shall be of copper or stainless steel.

3.3.2 Copper nails. Copper nails shall be annular ring, helical ring or serrated shank nails complying with Table 2 of BS 1202-2:1974, shall be not less than 20 mm long, with a shank diameter of not less than 3.35 mm and with a head diameter of not less than 6 mm.

3.3.3 Stainless steel nails. Stainless steel nails shall be of austenitic stainless steel, excluding free machining grades, and shall be annular ring, helical ring or serrated shank nails not less than 19 mm long, with a shank diameter of not less than 2.65 mm and with a head diameter of not less than 6 mm.

3.4 Screws

Screws shall be brass or stainless steel screws complying with BS 1210 and not less than 19 mm long and 3.35 mm in diameter.

3.5 Battens

Battens for fixing to concrete, brickwork and blockwork substrates shall be of softwood treated to protect them from the effects of moisture by a method of pressure impregnation and shall have the following minimum dimensions:

- a) across the fall 75 mm × 25 mm;
- b) with the fall 50 mm × 25 mm.

3.6 Underlay

Underlays for lead coverings shall be one of the following:

- a) waterproof building paper complying with class A of BS 1521;

- b) brown sheathing felt (inodorous) complying with type 4A (ii) of BS 747. The felt shall not cause adhesion between the lead and the substrate under service conditions.

3.7 Solder

Solder shall comply with grade D or grade J of BS 219.

NOTE Generally solder is only used for soldered dots or where lead welding or bossing is impracticable.

4 Roof construction: substructure

NOTE The overall design of flat roofs should comply with BS 6229. Particular attention should be paid to the recommendations for prevention of condensation and for minimum finished falls.

4.1 General

Substrates for lead sheet coverings shall offer a continuous surface free from spring and strong enough to support the lead and hold the fixings permanently, as specified in 4.2, 4.3 or 4.4 as appropriate.

NOTE If the potential life of the lead covering is to be achieved all elements of the construction should have a similar life span capability.

4.2 Timber

The timber substrate for lead coverings fixed in situ shall be softwood boarding or plywood of bond type WBP in accordance with BS 6566-8 and of minimum thickness 19 mm.

Where lead is laid on a hardwood substructure, precautions shall be taken to avoid contact between the hardwood and the lead and the penetration of the acid vapours from the timber to the underside of the lead.

4.3 Concrete, screeds and masonry

The surface of concrete, screeds and masonry shall have a smooth finish. An underlay shall be provided to isolate the lead from the substrate.

4.4 Thermal insulation boards

Insulation boards shall be of sufficient rigidity to withstand toe and knee pressures during the laying of the lead sheet.

Softwood battens of equal thickness to the insulation board shall be provided where required for fixing the lead sheet.

5 Design considerations

5.1 Lead covering

5.1.1 General. Lead roofing, wall coverings and gutter linings shall be designed as separate pieces of lead sheet of limited size with weathertight joints and fixed to allow for thermal movement.

5.1.2 Flat roofs (up to and including 10° slope).

According to the thickness of lead used, the maximum spacing of joints shall be as shown in Table 1. Joints in the direction of the fall shall be wood-cored or hollow rolls. Drips shall be used for the joints across the fall.

5.1.3 Pitched roofs (over 10° slope) and wall

claddings. According to the thickness of lead being used and the slope of the surface, the maximum spacing of joints shall be as shown in Table 2 or Table 3 as appropriate. Joints in the direction of fall shall be wood-cored rolls, hollow rolls, welts or standing seams. Laps shall be used for the joints across the fall.

Standing seams shall only be used for pitched roofs of slope 80° and above and on vertical surfaces.

Welts shall only be used on pitched roofs where there is no risk of their being submerged by the flow of rainwater.

Table 1 — Flat roofs: maximum spacing of joints for roof slopes up to and including 10°

Thickness code no. (see BS 1178)	Joints with fall	Joints across fall
	mm	mm
8	750	3 000
7	675	2 500
6	675	2 250
5	600	2 000
4	500	1 500

Table 2 — Pitched roofs: maximum spacing of joints for roof slopes above 10° up to and including 80°

Thickness code no. (see BS 1178)	Joints with fall	Joints across fall
	mm	mm
Roof slope above 10° to 60°		
8	750	2 500
7	675	2 400
6	675	2 250
5	600	2 000
4	500	1 500
Roof slope above 60° to 80°		
8	750	2 250
7	675	2 250
6	675	2 250
5	600	2 000
4	500	1 500

Table 3 — Wall, vertical and near vertical: maximum spacing of joints for roof slopes above 80°

Thickness code no. (see BS 1178)	Joints with fall	Joints across fall
	mm	mm
6	600	2 250
5	600	2 000
4	500	1 500

5.2 Fixings

5.2.1 General. For coverings on flat roofs up to and including 3° slope, the sheet shall be fixed in the drip undercloak and the roll as shown in Figure 1, Figure 2 and Figure 6(a). With roof slopes over 3° up to and including 10°, extra fixings shall be incorporated as shown in Figure 6(d).

For roof slopes above 10°, the individual bays shall be fixed at the head (see Figure 7(b) and Figure 22) and when using wood-cored rolls, for one-third of their length from the head down the undercloak.

Fixings in hollow rolls, welts or standing seams shall be 50 mm wide copper or stainless steel clips spaced at 450 mm maximum centres.

When using intermediate fixings, i.e. lead dots, lead capped dots, lead buttons, soldered dots or secret tacks, the fixings shall be positioned so as not to restrict thermal movement of the lead sheet [see Figure 24(a), Figure 24(b), Figure 24(c), Figure 24(d) and Figure 24(e)].

Free edges other than roll and drip overcloaks shall be secured by retaining clips which shall be spaced from 250 mm to 500 mm centres [see Figure 23(a) and Figure 23(b)]. The length between the fixing point and free edge of the lead sheet shall be kept to the minimum. In conditions of severe exposure a continuous clip shall be used [see Figure 23(c)]. Except in sheltered conditions, lead clips shall only be used where they can be leadwelded to the underlapping lead sheet (see Figure 25).

5.2.2 Fixing to softwood battens and timber substrates. Fixings for clips to battens and timber substrates shall be two screws or three nails of brass, copper or stainless steel. Fixings shall not penetrate completely through the substrate but shall penetrate not less than 80 % of the thickness of substrates up to 25 mm thick.

5.2.3 Direct fixing to concrete, brickwork and blockwork substrates. Fixings direct into dense concrete, brickwork or dense blockwork shall be stainless steel screws, with washers into polyamide or similar plastics plugs, to achieve a minimum of 40 mm penetration into the substrate.