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Code of Practice for

Sheet roof and wall coverings —

Part 15: Aluminium — Metric units

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Drafting subcommittee BLCP/4/2 Aluminium roof coverings

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Contents

Foreword

This metric edition of CP 143, which has been designated Part 15, is the metric version of Part 7 which was published in imperial units in 1965. It has been prepared as part of the change to the metric system in the construction industry, giving values in SI units, for further information on which reference should be made to BS 3763, "*The International System of units (SI)*".

While Part 15 is not a technical revision, the opportunity has been taken to make certain changes based on experience gained since the imperial units edition was published. For example, recommendations have been altered regarding underlays, use of clips in cross welts and use of expansion clips in long seams.

Wherever it has been necessary to apply dimensional co-ordination, recommendations of Technical Committee B/94, set out in PD 6432, "*Recommendations for the co-ordination of dimensions in building. Arrangement of building components and assemblies within functional groups*", have been reflected in this metric version.

For further information on dimensional co-ordination reference should be made to 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*", and PD 6444, "*Recommendations for the co-ordination of dimensions in building*", Part 1, "*Basic spaces for structure, external envelope and internal sub-division*".

This Code of Practice represents a standard of good practice; compliance with it does not confer immunity under relevant legal and statutory requirements, including byelaws.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 26, an inside back cover and a back cover.

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

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1 General

1.1 Scope

This Code of Practice gives recommendations for the installation of aluminium fully supported roof and wall coverings in accordance with established practices.

It includes information on appropriate alloys and forms of aluminium, durability, contact with other materials, sizes and weights of sheet and strip, protection and storage. Gutters and flashings are dealt with in so far as they form an integral part of the main roof covering.

The Code deals with coverings, substructures and accessories placed above the rafters or the upper surface of constructional bases, but does not apply to aluminium roof decking or deck units.

NOTE The titles of the British Standards referred to in this Code of Practice are listed on the inside back cover.

1.2 Definitions

For the purposes of this Code of Practice the definitions given in BS 2717, together with the following, apply:

aluminium

aluminium and aluminium alloys complying with the requirements of BS 1470, BS 1471, BS 1473, BS 1474 and BS 1490

butt jointing

edge to edge method of laying felt underlay to provide an even laying surface for the roof covering

corner fillet

triangular tapered fillet or block fixed against an abutment at drips on roofs and in gutters

dovetail battens and blocks

wooden battens and blocks set in concrete roofs to which clips or rolls are secured

dressing

beating of sheet to the required shape

saddle end

the completion of a batten roll covering, or a standing seam against an abutment

springback

amount of elastic recovery after a bending or forming operation

work-hardening

the increase of strength and reduction of ductility produced by cold-working as with bending or forming or by movement in service

1.3 Exchange of information and time schedule

The working drawings and specifications should be prepared in sufficient detail to afford proper guidance in the preparation of estimates and the execution of the work. Where bills of quantities form part of the contract, they should be prepared in accordance with the Standard Method of Measurement for Building Works 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 roofing and the work adjacent to it, in sufficient time to ensure that the covering can be carried out at the scheduled time and that all necessary provision for fixing has been made in advance. Early arrangements should be made on the site for rainwater disposal. Roof covering should be completed before internal finishes are begun and, to avoid damage to finished work, upper roofs should be completed first.

For safety requirements in site work reference should be made to the following.

Factories Act 1961

Health and Safety at Work etc. Act 1974

Construction (General Provisions) Regulations 1961

Construction (Health and Welfare) Regulations 1966

Construction (Lifting Operations) Regulations 1961

Construction (Working Places) Regulations 1966.

Scaffolding shall be provided which permits ready access to all parts of the surfaces of the roof. In addition, suitable ladders or crawling boards should be used when preparing the roofing structure to receive the underlay and when placing the underlay and fixing the roof covering. If required by the Regulations a barrier should be provided at the lower edge of the sloping surface to prevent any person or material falling therefrom. In some circumstances the upper lift of a scaffold may be suitable as an eaves barrier.

2 Materials and fastenings

2.1 Aluminium

The whole of the sheet and strip used for roof covering, including flashings, drop aprons, lining plates, clips, etc., should comply with the requirements of BS 1470, and the tensile strengths of the materials in the tempers recommended for roofing are given in Table 1.

Table 1 — Tensile strength of materials complying with the requirements of BS 1470 in tempers recommended for roofing

Materials and grade in accordance with BS 1470	Temper	Tensile strength	ISO number
		N/mm²	
S1 99.99 grade aluminium	0[a]	up to 65	
	H2[b]	65–85	AL 99.99
	H4	80–95	
S1A 99.8 grade aluminium	0	up to 90	
	H2[b]	77–100	AL 99.8
	H4	95–120	
S1B 99.5 grade aluminium	0	55–95	
	H2[b]	85–108	AL 99.5
	H4	100–135	
S1C 99 grade aluminium	0	70–105	
	H2	95–120	AL 99.0
	H4	110–140	
NS3 aluminium alloy (0.8 % to 1.5 % manganese)	0	90–130	
	H2	120–145	AL Mn 1
	H4	140–175	

NOTE Data on physical properties of aluminium are given in Table 2.
[a] Used for flashings only.
[b] Tempers for roofing sheet not included in BS 1470.

Table 2 — Some physical properties of 99 grade aluminium (S1C)

Density	2 710 kg/m³
Melting point	658 °C
Specific heat (0 °C to 100 °C)	0.917 kJ/(kg °C)
Coefficient of linear expansion	24×10^{-6} °C (between 20 °C and 100 °C)
Thermal conductivity	226 W/(m °C)

Thermal conductivity of aluminium is high, but the reflectivity of its surface to radiant heat is also high and is taken into account in calculating the thermal resistance of roofs.

Roofing sizes of aluminium strip in coil are given in Table 3.

Table 3 — Roofing sizes of strip in coil

Width	450 mm
Thickness	0.8 mm

2.2 Underlays

The felt underlay to be used with timber substructures is Type 4A (ii) brown sheathing felt No. 1, inodorous, complying with the requirements of BS 747.

On concrete and screeded bases, and on materials other than timber, 2 000 gauge clear polyethylene sheeting should be used; see also **3.4**.

2.3 Timber

For structural aspects and the preservation of timber reference should be made to CP 112 and BS 5268-5. The timbers normally used for substructures suitable for aluminium are the European white or red woods. Advice on the use of other woods may be obtained from the aluminium manufacturer.

NOTE Some wood preservative treatments when applied to timber used in association with aluminium may be harmful to the metal. Thus care should be taken to ensure that such treatments, among the considerable number available, are suitable to aluminium in the particular application under consideration.

2.4 Nails

Clout nails used for securing the aluminium clips and felt underlays should comply with the requirements of BS 1202-3. Galvanized steel wire clout nails complying with the requirements of BS 1202-1 may also be used, but aluminium is preferred. Nails for fastening clips should be not less than 25 mm long and not less than 3.25 mm in diameter. Clout nails for fixing the felt underlay should be not less than 20 mm long and not less than 3 mm in diameter. Copper, brass or uncoated steel nails should not be used.

2.5 Screws and bolts

Wood screws used for securing clips should be of aluminium alloy HB15, anodized and lanolin dipped, or of steel, zinc plated or sherardized. Wood screws should comply with relevant requirements of BS 1210 and should be not less than 25 mm × No. 8. Bolts should be not less than 4 mm in diameter and of aluminium alloy or zinc-coated steel; screws and bolts should have countersunk heads.

Screws or bolts for securing wood rolls may be of aluminium or zinc-coated steel.

3 Design considerations

3.1 Characteristics of the material

Aluminium combines ample strength and ductility for roof covering requirements and it does not "creep" on high pitched roofs and steeples. Hand-forming is easiest in the soft tempers and with the higher purity materials; the harder tempers of greater strength are more difficult to work by hand, but are suitable for machine forming. The recommended tempers are given in Table 4.

Aluminium possesses good resistance to corrosion by the atmosphere and corrosive media normally encountered in service. Higher purity aluminium, which provides greater workability, is generally more resistant to corrosion than less pure metal, but has lower tensile strength.

Aluminium and its alloys when in contact with certain other metals in the presence of moisture will set up or suffer electrolytic corrosion. It is important to avoid direct or indirect contact with copper, brass or bronze; components made of these materials should not be used with aluminium roofing. Corrosion is less likely from contact with iron or steel than with copper-base metals but it is recommended that iron and steel be painted when in direct contact with aluminium. Water draining from copper on to aluminium will cause corrosion, but drainage in the opposite direction is harmless, providing there is no direct contact. Water draining from aluminium will not normally stain adjoining materials. Contact with or run-off from galvanized steel, stainless steel and lead is usually harmless, but in industrial and coastal areas these metals should be coated with bitumen-based paints when they drain on to or are in contact with aluminium.

Table 4 — Recommended tempers for aluminium of different purities and NS3 alloy

Material and grade in accordance with BS 1470	Thickness	Temper		
		Long-strip system		Standing seam and batten roll systems (traditional practice)
		Hand formed	Machine formed	
	mm			
S1 99.99 grade aluminium	0.8	H2	H2	H2
S1A 99.8 grade aluminium	0.8	O	H2	O
S1B 99.5 grade aluminium	0.8	O	H2	O
S1C 99 grade aluminium	0.8	O	H2	O
NS3 aluminium alloy (0.8 % to 1.5 % manganese)	0.8	O	H2	O

Expansion pipes to heating systems or overflow pipes should not discharge over aluminium roofs. The weathering of aluminium depends upon the nature of the atmosphere in which it is exposed and the frequency of washing by rain. In rural atmospheres it will maintain its bright natural appearance for long periods, often several years, but will gradually darken in colour, whilst retaining a smooth surface. In industrial areas the darkening process will be much quicker with a tendency to form a rough textured but adherent film, and after some years exposure the metal acquires a dark grey stone-like patina. Marine or coastal environments cause the aluminium to acquire a light and dark grey mottled appearance. The washing action of rain is beneficial; aluminium in sheltered positions, for example under eaves, will tend to weather more rapidly and to take on a darker colour.

The natural bright surface of aluminium has a high reflectivity and low emissivity at all wavelengths of radiation. These properties are generally not seriously impaired by moderate weathering and are of value in reflecting solar radiation and reducing heat losses from buildings.

3.2 Weight of aluminium roof coverings

The approximate weights in kilograms per square metre of aluminium roof coverings are given in Table 5.

Table 5 — Weights of aluminium roof coverings

Roofing system	Weight
	Aluminium 0.8 mm
	kg/m²
a. Standing seam or long strip system (including turn-ups, clips, etc.)	2.9
b. Batten roll system (including cappings, clips, turn-ups, etc.)	3.1

3.3 Substructure

3.3.1 General. The design of the substructure shall be based on the loading recommended in CP 3, Chapter V.

The surface shall be laid to correct and even falls. The preparation of sub-structures of timber and concrete is described below. If materials other than timber or concrete are used they should not contain substances which are harmful to aluminium sheet, fastenings or adjacent materials. If it is proposed to use composition boards for the substructure, the advice of the aluminium manufacturer should be obtained. Where materials other than timber or concrete are used, or if insulation is interposed between the substructure and the aluminium, the method of securing battens and clips shall provide equivalent strength to those specified for timber. In all cases, screws and nails for securing battens and clips shall offer resistance to withdrawal not less than that given for Group II timber in CP 112.

Accessories and fastenings used for securing aluminium sheet coverings to roofs shall be as durable as the roofing metal itself.

3.3.2 Timber. The timber substructure which should be constructed in accordance with the requirements of CP 112, should provide a firm surface free from "spring", and should also be wind-tight.

The boarding shall be prepared, tongued and grooved, of not less than 25 mm nominal thickness, and be from selected timber. For roofs of less than 20° pitch the boards should be laid either diagonally or in the direction of the fall. The boards shall be rigidly fixed to restrain warping: the rafters or purlins should be correctly spaced to avoid undue deflection of the boarding under load.

The heads of nails used for fixing boarding should be punched well below the surface and all screws for securing batten rolls should be counter-sunk well below the surface of the timber.

Existing timber substructures previously covered with other metals may have become impregnated with salts of those metals which could have harmful effects on aluminium. Before re-covering with aluminium all old nails, screws and clips should be removed and the upper face of the timber swept clean and painted with bituminous paint prior to fixing the new underlay.

3.3.3 Concrete. Aluminium clips or rolls should be secured by means of screws or nails driven into wooden dovetailed battens or plugs set into the concrete substructure.

Dovetailed battens should be prepared from 75 mm × 48 mm good quality deal free from infestation and defects.

Dovetailed battens and other timber inserts should be impregnated, to prevent decay, with creosote complying with the requirements of BS 913 or with other preservatives that do not contain copper salts.

Dovetailed battens should be set flush with the finished surface of the concrete across the fall or slope of the roof, at centres corresponding to the pitch of the clips for standing seams, or the pitch of securing points for batten rolls, as the case may be.

If cellular, foamed or aerated concrete is used, the anchorage for dovetailed battens should be by bolts and screws passing through the full thickness of the concrete layer.

3.3.4 Alternative materials. Alternative types of materials may be used provided they are in accordance with the following requirements:

1) The recommendations on roof loading in CP 3, Chapter V.

2) Screws and nails driven into the material for securing clips should be capable of supporting the permissible loads for Group II timber laid down in CP 112. Alternatively, other forms of fastening may be used which provide equivalent anchorage.

3) The materials should not contain substances which have deleterious effects upon the aluminium roof covering or fixings, or upon any other adjacent materials or components.

3.4 Underlays

3.4.1 General. The purpose of an underlay is to provide, where necessary:

1) a sympathetic surface to receive the aluminium;

2) insulation against noise and drumming from hail and heavy rain;

3) isolation of certain types of decking from contact with the aluminium.

The underlay is not provided as a vapour barrier against condensation which should be dealt with by other means such as ventilation (see **3.12**).

3.4.2 Timber substructure. No. 1 inodorous felt Type 4A (ii) brown sheathing felt as specified in BS 747 should be laid butt-jointed and secured by aluminium alloy or zinc-coated steel clout nails. On vertical surfaces and steep slopes the underlay should be securely fastened by nailing before clips or rolls are secured.

3.4.3 Concrete or screeded substructures and composite boards. On substructures of concrete or screeded finishes and on bases of composite boards a layer of 2 000 gauge clear polyethylene sheeting should be laid before fixing the aluminium roofing in order to provide an isolating membrane between the metal and the supporting structure. It should be fixed with simple lapped joints of 50 mm, and secured against wind lift while fixing with aluminium clouts or equivalent means.

3.5 Clips

There are two forms of clip:

1) *Plain clips*. Plain (fixed) clips should be cut from aluminium sheet of the same thickness as the roof covering, i.e. 0.8 mm, to appropriate length and width to suit standing seam or batten roll joints. Standing seam clips are shown in Figure 3 and batten roll clips in Figure 15.

2) *Expansion clips*. Expansion clips consist of two parts free to move in relation to one another in the direction of the seam. They shall be made of aluminium or stainless steel not less than 0.8 mm thick. Two types are shown in Figure 3. These clips are used for standing seams exceeding 3 m in length.

3.6 Roofing systems

The systems in general use are either the traditional or the long strip systems.

The traditional system of two types, standing seam or batten roll, is based on sheets or strips cut to sheet length, and is characterized by longitudinal joints down the roof slope raised above the roof surface in the form of standing seams, as shown in Figure 4, or batten rolls as shown in Figure 15. To make up the length of bay required, sheets down the slope are joined together with flat lock cross joints or a drip running transverse to the fall.

The long strip system is based on aluminium strip used in long length thus avoiding cross joints. It is also characterized by longitudinal standing seam down the roof slope.

The thickness of sheet or strip normally recommended for the long strip method or both of the traditional methods is 0.8 mm. The weights of sheet material per square metre are indicated in Table 6.

Table 6 — Thickness and weight of aluminium sheet and strip

Weights are based on 99 grade aluminium (S1C)

Thickness	Theoretical weight per square metre
mm	kg
0.8	2.17

Practical and aesthetic considerations largely govern the choice of system. For instance, roofs requiring bold lines or those subject to foot traffic are preferably fitted with batten rolls, whereas, for a less conspicuous or light roof, or a straightforward, simple and more economical roof, standing seams would be more appropriate.

3.7 Traditional standing seam and batten roll systems

3.7.1 General. Basically the two traditional methods use joints in the direction of roof fall which stand above the roof surface and are either of the standing seam type or batten roll type formed by dressing the metal up to the batten and welting on a separate capping piece (Figure 15). A feature of the traditional system is the method of forming the cross joints and their distance apart, both of which are controlled by the pitch and length of roof slope (see **3.9**).

The recommended dimensions of sheets are given in Table 7 for pitched roofs over 10° pitch and Table 8 for flat roofs (below 10°).

Table 7 — Pitched roofs over 10° pitch: maximum length of sheet or strip

Thickness of sheet or strip	Width of sheet or strip (unworked)	Maximum length between cross welts
mm	mm	m
0.8	450	2.5

Table 8 — Flat roofs up to and including 10° pitch: maximum length of sheet or strip

Thickness of sheet or strip	Width of sheet or strip (unworked)	Maximum length between drips
mm	mm	m
0.8	450	3.0

The sheet or strip covering is secured to the roof structure by means of clips folded into the joint along the edges of the metal (see **3.7.4**).

In districts subject to high winds the bay widths should be reduced to 300 mm at verges and gables for a distance of not less than 15 % of the length of the roof. This also applies to areas over which the configuration of the buildings might cause above normal suction, such as in the vicinity of towers. Also, in exposed areas, the sheets on either side of the ridge and at the eaves should be not longer than 1 m to the first cross welt. Clips should also be secured by screws instead of nails.

In special cases where, because of the tapering section of the roof, it would be impractical to start off with a 450 mm wide sheet, e.g. for domes, towers, turrets, spires and cupolas, material wider than 450 mm may be used. In these cases it may be necessary to introduce cross welting to join each individual bay horizontally and introduce standing seams at wider centres than for 450 mm wide sheet. Individual attention should be given to the situation in which these roofs occur bearing in mind the height of the roof and wind forces. In these special circumstances no individual sheet should exceed 1 m^2 in area.

3.7.2 Standing seam system. The finished height of standing seams should be not less than 22 mm and the depth of the welt 10 mm (see Figure 4). A batten roll is preferred at the ridge and hips, but standing seams may also be used having a minimum height of 32 mm with the common seams staggered on either side to avoid multiple thicknesses at the intersection. Cross joints described later should also be staggered.

3.7.3 Batten roll system. For batten rolls the height should be not less than 40 mm, width at the base 40 mm and 36 mm across the top (Figure 15). Hip and ridge rolls should be not less than 70 mm high and 63 mm at the base and 36 mm at the top and, in all cases, notwithstanding the slope of the roof, the top should stand not less than 25 mm above the common batten roll at inter-sections with it (Figure 16).

3.7.4 Holding down clips

3.7.4.1 Standing seams are secured either by plain clips or by expansion type clips. Clips are at least 50 mm wide, spaced at 300 mm centre to centre secured to the substructure usually by two nails or screws per clip set in line and as close as possible to the angle of the clip. The base of the clip is turned over afterwards to cover the heads of the nails or screws. Nails used should be clouts not less than 25 mm × 3.25 mm; screws should be not less than 25 mm × No. 8. With some types of substructure which will not hold nails or screws satisfactorily other methods of securing clips of similar strength should be used.

3.7.4.2 Eaves, verges and drips should be secured by clips, similar to those referred to in **3.7.4.1**, folded into the joint and secured to the roof at distances apart not exceeding 300 mm centre to centre.

3.7.4.3 Batten roll roofing is secured by clips placed under the roll and spaced at 300 mm centre to centre. The roll in turn is secured to the substructure by wood screws, spaced at not less than 600 mm centre to centre, or by pairs of skew-driven nails spaced at not less than 350 mm centre to centre. Screws should be not less than No. 14 gauge and nails not less than 3.5 mm in diameter.

3.7.4.4 In all cases the frequency and positions of clips should be agreed beforehand with the roofing contractor.

3.8 Long strip system

3.8.1 General. The long strip system uses standing seams in the direction of fall but with fewer drips than the traditional system. This makes long strip particularly advantageous for roofs either pitched or flat, with a long slope length.

3.8.2 Length of strip. Aluminium strip suitably fixed employing plain and expansion clips as required can be laid in lengths up to 7 m long. On lengths in excess of 7 m provision for expansion is required.

3.8.3 Width of strip. The distance between standing seams should not exceed the widths shown in Table 9, to prevent the sheet lifting under wind suction.

3.8.4 Material. Materials and appropriate tempers for both hand and machine-formed bay trays and welts are given in Table 4. Recommended widths of strip are given in Table 9.

Table 9 — Recommended maximum width of strip for long strip system

Thickness	Maximum width of strip	Approximate centres of standing seams
mm	mm	mm
0.8	450	375

3.8.5 Jointing. Joints in the direction of the fall should be formed as standing seams in accordance with traditional practice, except that the finished height may be greater, depending upon the means of forming. For machine-formed seams the finished height is normally 32 mm incorporating a 13 mm depth of welt. For hand-formed seams, the dimensions are the same as those given in **3.7** for the traditional system.

3.8.6 Fixing clips. Seams up to 3 m long shall be secured with plain clips. With greater lengths a run of about 3 m from the ridge or top of the slope of the roof shall be secured with plain clips and the remainder with expansion clips. This enables thermal movement to take place without overstressing the metal. Both types of clip shall be spaced at about 300 mm centres.

3.8.7 Thermal movement. Transverse joints at eaves and drip edges should be formed so that adequate allowance for expansion of the bays is provided in the direction of the slope or fall of roof (see Figure 11 and Figure 12).

3.9 Falls, drips and cross welts on roofs

3.9.1 General. The fall of an aluminium roof shall in no circumstances be less than 1 in 60. For practical considerations, in order to avoid puddles and ensure proper drainage, a minimum fall of 1 in 40 is normally recommended. There is no upper limit to the steepness of pitch to which aluminium may be laid.

3.9.2 Pitches of 10° or less. The traditional system employs drips at the maximum centres shown in Table 8 (see Figure 12*a*). With the long-strip system drips are not needed for slopes under 7 m long. The depth of the drip should be at least 50 mm for standing seam roofing (Figure 1*a*) and 75 mm for batten roll system (Figure 13).

3.9.3 Pitches between 10° and 40°. At pitches between 10° and 40° the traditional system is used with double welted cross joints (Figure 6) at maximum centres given in Table 7, and with one clip fixed centrally in each, unless by special agreement with the architect (see **3.7.4**). Drips are not required unless the roof slope exceeds 9 m in length, when they should be formed at distances not exceeding 6 m.

3.9.4 Pitches above 40°. At pitches above 40° single-lock cross welts (Figure 5) are used with two clips in each. No drips are required.

3.9.5 Pitches of 20° or less. Where the pitch is 20° or less, all cross welts should be sealed with boiled linseed oil. This is done by coating the edges of the aluminium with the oil prior to welting.

3.10 Falls and drips in gutters

Gutters should be designed to carry away the rainfall on the roof without overflowing or flooding and the fall in hand-formed aluminium gutters should be not less than 1 in 60. The gutter should be not less than 50 mm deep at the highest point. Table 10 gives recommended lengths and widths of soles for gutters. The minimum depth of drip in gutters of less than 450 mm width should be 50 mm. When the width of the sole of the gutter is more than 450 mm, a longitudinal batten roll should be incorporated not less than 50 mm high when the minimum depth of drip should be 63 mm.

The connection between an aluminium roof and a vertical sided gutter may be either a lap joint or a single-lock welt. Where the gutter side is sloping a tilting fillet should be incorporated on which to position a single-lock welt (Figure 18).

Gutters are generally designed to discharge into a cesspool or sunk chute. This is set at a depth of not less than 75 mm below the sole of the gutter (Figure 23). Where the gutter is laid in a continuous straight line, as for example behind a parapet wall, it can be passed through the parapet wall and discharged into a rainwater head without the need of a cesspool.

Aluminium gutter linings should not contain cross welts and should be free to expand in the width of the sole as well as longitudinally.

3.11 Special details and features

A flat or low pitched aluminium roof on to which rainwater discharges from a tiled or slated roof should be provided with an aluminium flashing. This should be formed or dressed over an edge-tilting fillet and joined to the aluminium roof covering by means of a single welt (Figure 20).

When rainwater from an aluminium roof discharges on to a tiled or slated roof an aluminium drip should be provided. This is formed by welting the vertical upstand of an independent aluminium apron to the edge of the aluminium roofing sheet. The apron should be formed or dressed over the roof slope and securely fixed to avoid uplift or other movement by wind (Figure 21).

Eaves should be finished with a separate aluminium apron piece or gutter (Figure 9).

An aluminium roof enclosed by a parapet wall or abutment should be provided with a box or parapet gutter of aluminium.

Flashings to abutments should consist of separate strips of aluminium, single-lock welted to, or lapped over, the aluminium upstand (Figure 7). On spires a batten roll should be fixed on each hip (see **3.7.3**).

3.12 Condensation

Provisions should be made to ventilate the space or voids beneath the roof structure so as to reduce condensation to the greatest extent. When the surface of the roof substructure consists of a porous material, such as concrete or insulating screeds which may retain moisture for long periods, the interspace between the underfelt and the substructure should be ventilated. Weatherproof vents fitted at intervals over the roof for this purpose should allow moisture to escape to the exterior of the roof from the surface of the substructure without entering into the interspace between the aluminium covering and the underfelt.

3.13 Fire protection

Aluminium sheet is non-combustible and, therefore, it will not itself contribute to fire spread. As a fully-supported covering for pitched and flat roofs aluminium is designated Class AA in BS 476-3. Aluminium is acceptable as a roof covering under Byelaw 1.05(J) of the London Building (Constructional) Amending Byelaws (No. 2) 1964.

3.14 Protection against lightning

Recommendations for the protection of metal roofs against lightning are given in CP 326.

4 Laying procedure

4.1 Storage and protection of aluminium

Sheets and coils of aluminium which are supplied in cases, stillages, etc., should be kept dry both in transit and whilst in storage on site. The surfaces of sheets taken out of closely stacked piles sometimes show dull patches which are due to moisture being held between sheets in contact. The staining is superficial and if required the original bright finish may be recovered by lightly rubbing the patches with fine glass wool or stainless steel wool. Care should be taken in storage and throughout the work to avoid unnecessary marking or scoring of the metal by nailed boots, heavy tools, etc.

Stock should be stored clear of the ground and away from contact with alkaline and other harmful substances. A position should be chosen where the sheets are not liable to receive mechanical damage.

4.2 Preparatory work

Sheet should be prepared in the workshop by cutting, forming and bending to fit the bays of the roof for which it is intended, allowance being made where required for expansion. Sufficient additional material should be allowed for the first and last bays of the roof for forming an upturn against an abutment or welting to a verge apron. An alternative to allowing additional material for upturns or verge welts is to reduce the width of these bays to permit sheet of uniform width to be used.

Proper care with the preparatory work reduces the amount of forming and dressing required on the roof and avoids unnecessary work-hardening of the metal.

4.3 Underlays

It is important that all surfaces to receive the underlay should be firm, smooth and dry at the time of laying, and with concrete or screeded roofs the recommendations in **3.12** should be followed.

Before fixing an underlay the roof substructure should be swept clean and all projections removed.

The type of underlay to be used, and the manner of laying, depends on the type of substructure. On tongued and grooved boarding, inodorous felt should be used and laid with the joints butted. On most other substructures polyethylene sheeting with lapped joints should be used (see **3.4**).

In some cases the underlays may be protected during fixing in wet weather by a temporary waterproof covering such as polyethylene; green tarpaulin, however, should not be used. Alternatively, the area of underlay fitted should be limited to what can be covered with aluminium in a sufficiently short time to avoid its being wetted. It is particularly important that inodorous felt should not be covered whilst in a saturated condition.

At wall abutments and gutters underlays should be carried up to the flashing line so as to prevent contact between alkali-bearing materials and the aluminium covering.

4.4 Technique of laying aluminium sheeting

The aluminium should be laid in the sequence given in **4.5** to **4.9** inclusive.

4.5 Cesspools

Cesspools should be constructed of a single sheet of metal and shaped by dog-eating the corners. The sides should be taken up and welted to, or weathered in with, the adjacent aluminium work (Figure 23).

4.6 Gutters

Gutter cheeks running up to a roof should be jointed to the roof sheeting by means of single-lock welts. Alternatively, the gutter cheek may be left free and weathered by a separate drop-apron which should be welted to the roof sheeting.

All internal corners in a parapet gutter at drips, stopends and upstands, should be made by dog-earing.

Tapered corner blocks should be incorporated in the sole of the gutter where this passes over a drip or discharges into a cesspool (Figure 22).

Recommendations for lengths of gutters between drips are given in Table 10.

4.7 Aprons

Aprons should be made of separate strips of metal not more than 2 m long, jointed as required by single-lock welts. They shall be welted to the roof sheets, and at eaves and verges should be secured by lining plates (Figure 9 and Figure 10).

When the apron passes over the slates or tiles it shall be secured with screws and embossed washers passing through them to a batten underneath.

4.8 Main roof covering

4.8.1 General. The sheeting should be laid flat and true to the surface of the substructure. Laying should be commenced at the more convenient end of the roof. The upturn of sheeting which has been prepared for the end bay should be presented to the abutment, or the appropriate edge should be welted to a verge apron, as the case may be. The sheeting for the next bay should be placed in position and the vertical flanges jointed by a welted standing seam into which are folded the ends of the clips; with batten rolls a separate capping is welted to the upstanding edges. Care should be taken in manipulation to avoid work-hardening by repeated dressing; a few firm blows are better than many lighter ones.

Where a roof incorporates drips upper and lower bays should be welted together by means of a single-lock welt on the drip edge. The corner between the turned up edge of the standing seam or roll and the upturn of the drip should be dog-eared, care being taken that the dog-ear runs in the direction of the fall.

Clips should be incorporated in all cross-welts (see **3.9**) except when strip not more than 500 mm wide is used on roofs in sheltered conditions and when prior agreement has been made by the roofing contractor.

4.8.2 Standing seams. Fixing clips should be secured to the substructure of the roof, carefully aligned and set to coincide with the bay width chosen. The method of making the joint is shown in Figure 4.

4.8.3 Batten-roll system. Care should be taken that the rolls with, the clips in position are properly secured in the substructure, otherwise there is a risk that the rolls may be displaced when dressing the metal into position.

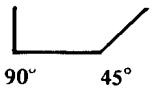
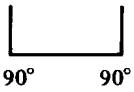
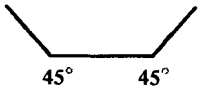
The edges of the sheeting should be dressed up to the sides of the rolls. The upturned edges of the sheeting should project 10 mm above the top of the rolls, and the clips should project 19 mm. The projecting edges of the sheeting and the clips should then be turned outwards flush with the top of the rolls, the ends of the clips being bent round the horizontal flanges so formed. The capping strip should be flanged and dropped into position on to the rolls with the flanges downwards, and afterwards welted and dressed down the side of the rolls (Figure 15).

Joints in the capping should be single-lock cross-welts. At pitches below 20° and on ridge rolls the metal should be coated with boiled linseed oil before closing the welt.

Table 10 — Recommended maximum lengths of linings for gutters of various sizes and widths

Material: As specified for roofing

Maximum width of material (unworked) 900 mm

Width of sole	Gutter profiles in 0.8 mm metal		
			
mm	m	m	m
100	5.50	6.00	4.75
150	4.75	5.25	3.90
200	4.50	4.75	3.75
250	4.00	4.75	3.50
300	4.00	4.75	3.50
350	3.90	4.50	3.40
400	3.90	4.50	3.40
450	3.75	4.40	3.00

4.9 Cover flashings

Flashings should be let into the walls to a minimum depth of 25 mm and provided with a turn-back to act as a water stop. Adjacent lengths should either be lapped 75 mm or joined together with a single welt. The bottom edge of the flashing should be secured to the upstanding edge of the roof sheeting by means of a single welt. The metal should be firmly secured in the wall with folded aluminium sheet wedges at approximately 400 mm centres before pointing is carried out. Aluminium in contact with mortar should be precoated with bituminous paint, preferably after folding.

4.10 Drainage

An aluminium roof covering on completion should be left sufficiently smooth to allow rainwater to discharge freely without leaving pockets of water or puddles.

4.11 Other building operations

If final building operations above the level of the roof are not complete, protection should be provided against damage and against droppings or splashes of mortar or plaster.

5 Inspection and tests

5.1 Materials

Many of the materials mentioned in this Code should comply with requirements of British Standards and the procedure for obtaining certificates of compliance or for making tests is described in each individual standard.

The aluminium sheet or strip should comply with the requirements of BS 1470, and provision is made in Clause **8** of that standard for certificates of compliance. If it is desired to inspect the material at the supplier's works prior to acceptance, Clause **9** provides that notification shall be given at the time of placing the order.

5.2 Substructures

Substructures should be checked to ensure that the surface is of satisfactory finish and laid to correct and even falls. Boarded substructures should be examined to ensure that the boarding is firm and free from undue spring and is wind-tight. Care should be taken that there are no nailheads or other projections. Dovetailed battens should be examined for quality of timber, and checked for type and quality of any preservation treatment. They should be laid flush with the surface of the concrete and be securely fixed. The dimensions of the spacing and layout of the battens should be verified.

Compliance with requirements for the use of other materials as substructures, agreed between the parties concerned, should be checked.

5.3 Underlays

The surface of the roof should be inspected for freedom from dirt and extraneous matter and for acceptable dryness before the underfelt is laid.

Inodorous felt used for boarded substructures should be examined for adequate nailing and to ensure that joints are butted and not lapped.

Polyethylene sheeting should be fixed smoothly without creases and lapped in the direction of the fall.

5.4 Final inspection

Care should be taken to ensure that all requirements and recommendations of this Code have been carried out.

It is important that the following items are verified:

1) That all welted seams are correctly formed and that dog-ears have been formed without causing cracks in the metal, and are folded in the proper direction.

2) That the covering is laid true with the substructure.

3) That all aprons and flashings are secured against lifting by the wind.

4) That all pointing to flashings has been completed and is secure and free from cracks.

5) That the surface of the covering has been properly cleared of all debris including nails or other objects which could be trodden into and injure the sheeting.

5.5 Maintenance

No maintenance should be necessary to properly designed and installed aluminium roof coverings beyond keeping them free from accumulations of leaves and dirt.

It is desirable to protect areas of roofs subject to traffic against denting and abrasion. Duckboards made of aluminium, or of timber impregnated with preservatives which are not corrosive to aluminium, should be used. Duckboards should not impede normal drainage.

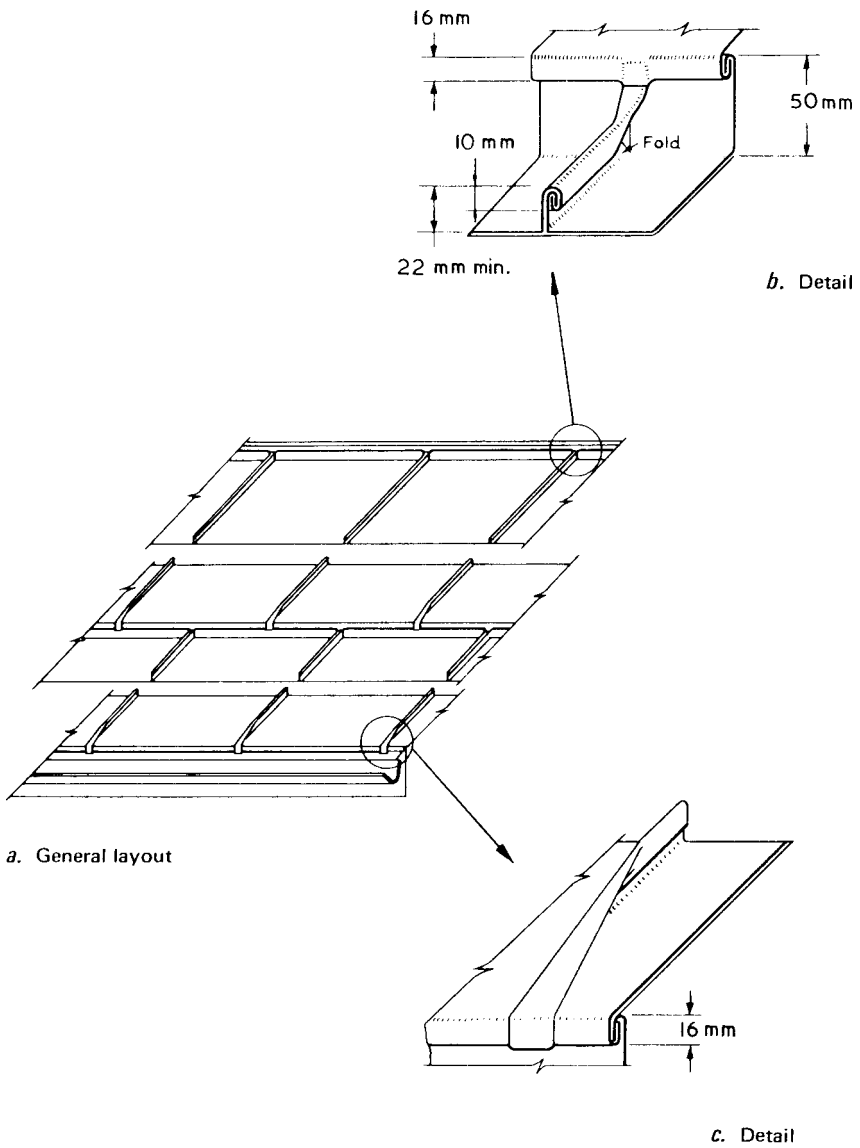


Figure 1 — General layout and details of the standing seam system applied to flat roofs

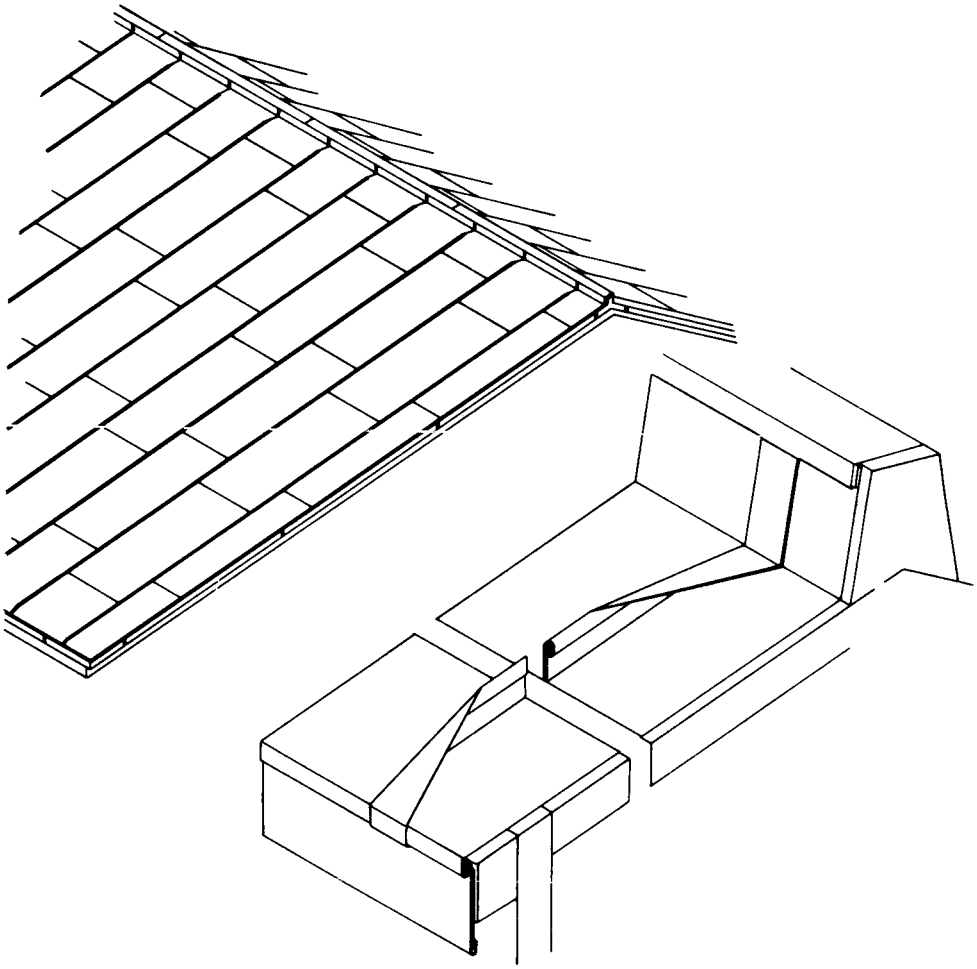


Figure 2 — General layout and details of the standing seam system applied to pitched roofs

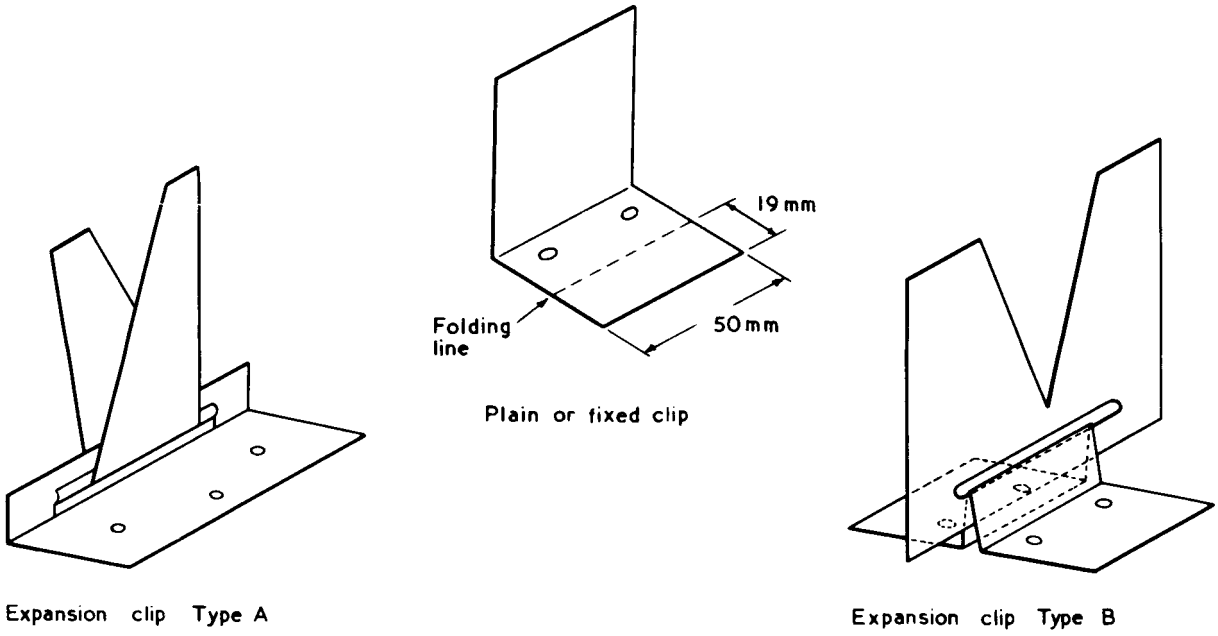


Figure 3 — Plain clips and expansion clips

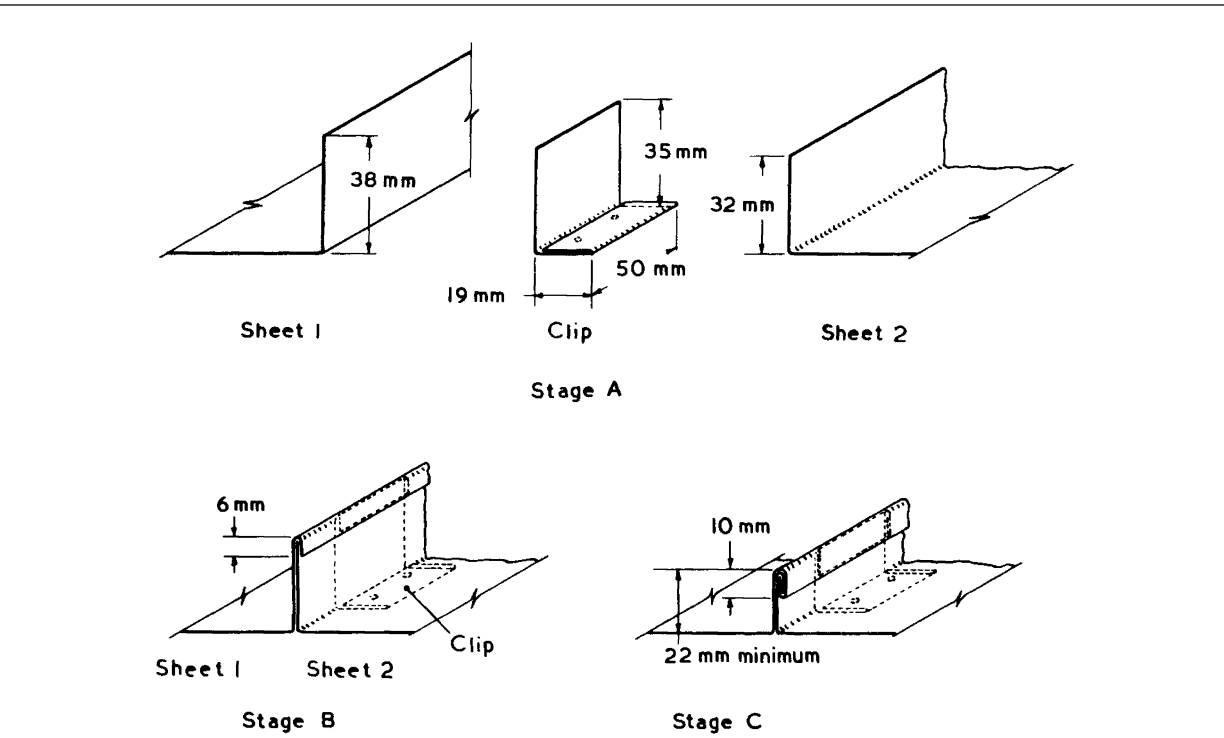


Figure 4 — Stages in forming standing seam

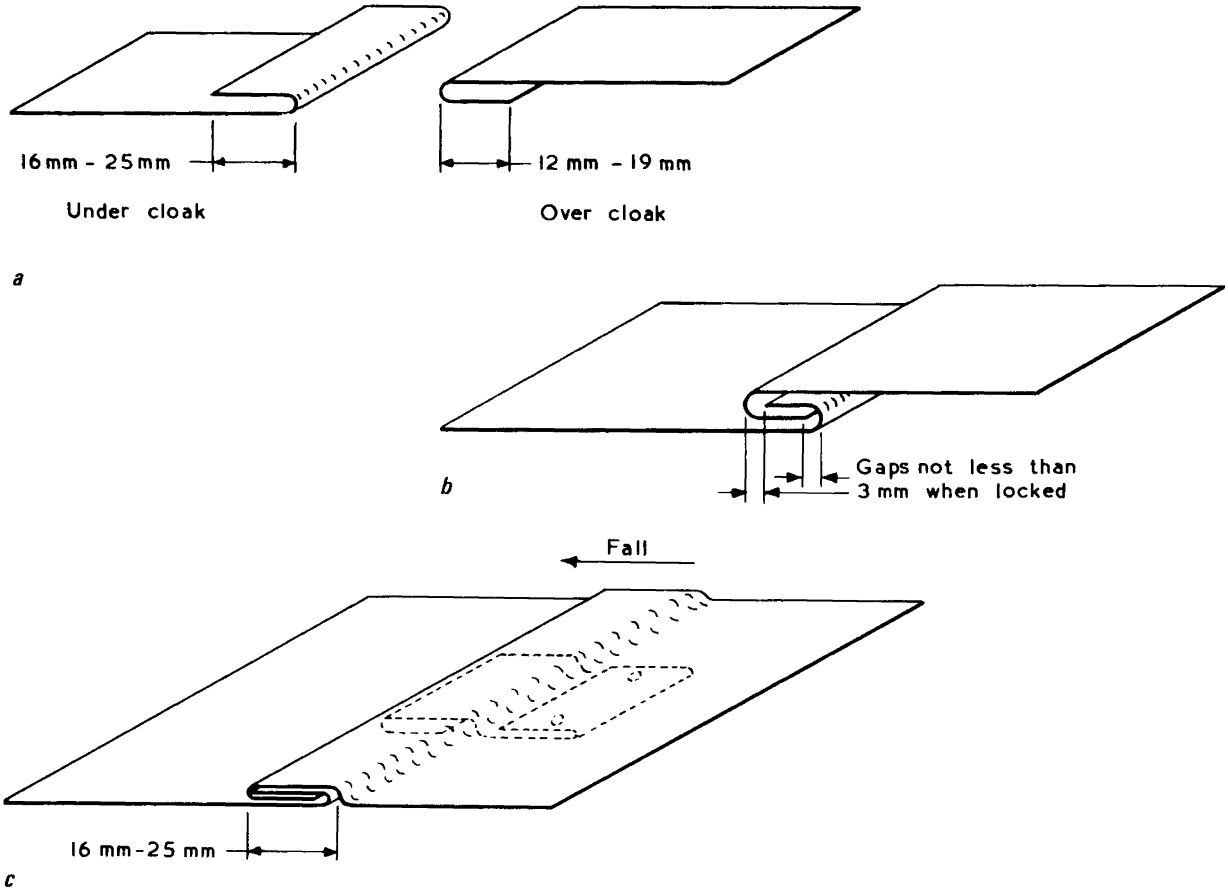


Figure 5 — Single-lock welt

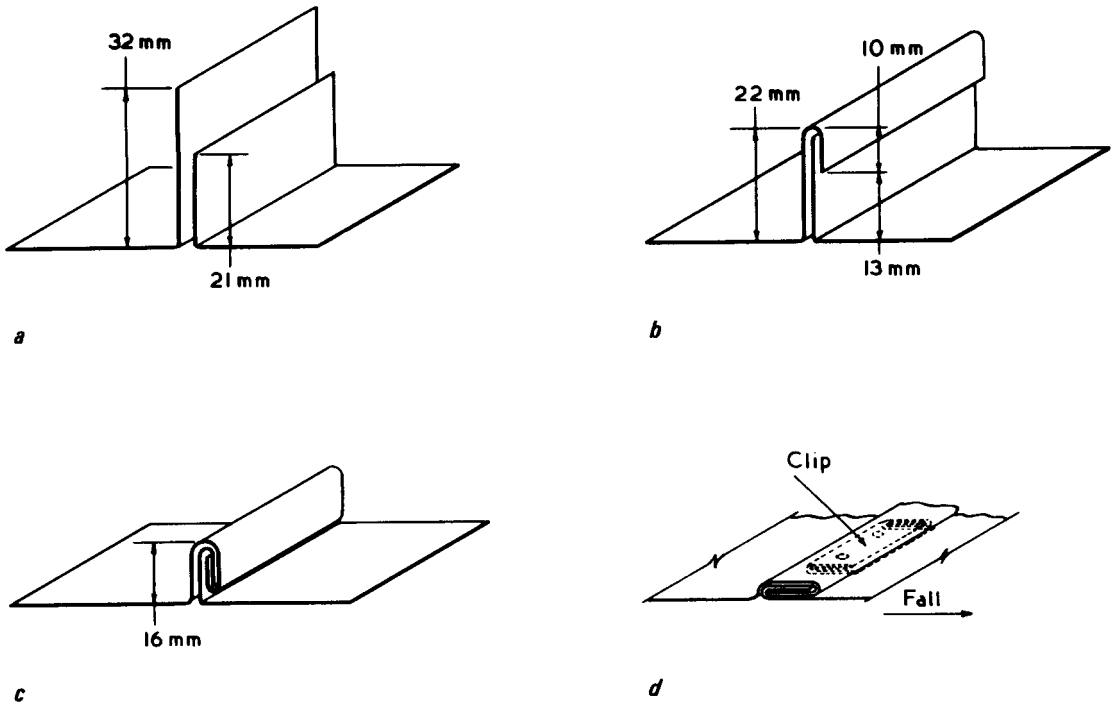


Figure 6 — Double-lock welt

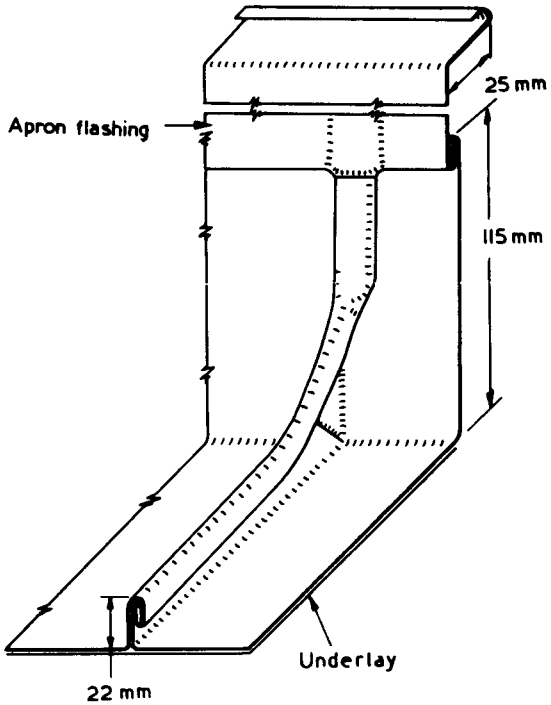


Figure 7 — Standing seam: upstand at wall abutment

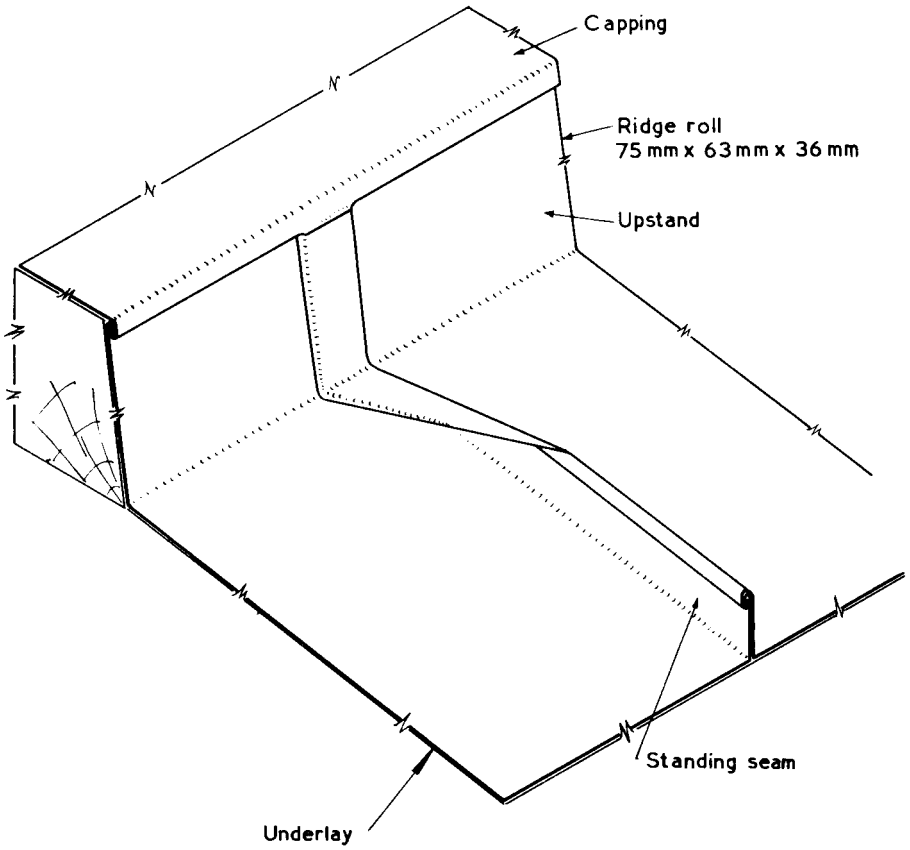


Figure 8 — Detail: standing seam at ridge roll; traditional and long strip systems

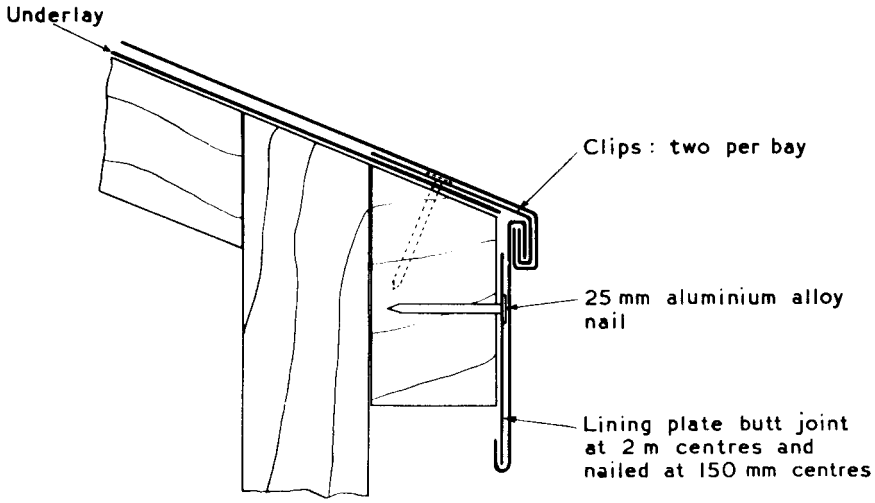


Figure 9 — Eaves detail: traditional systems

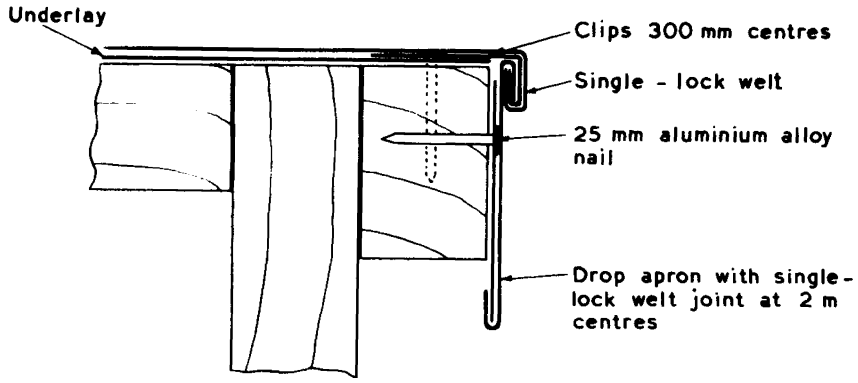


Figure 10 — Verge detail: traditional and long strip systems

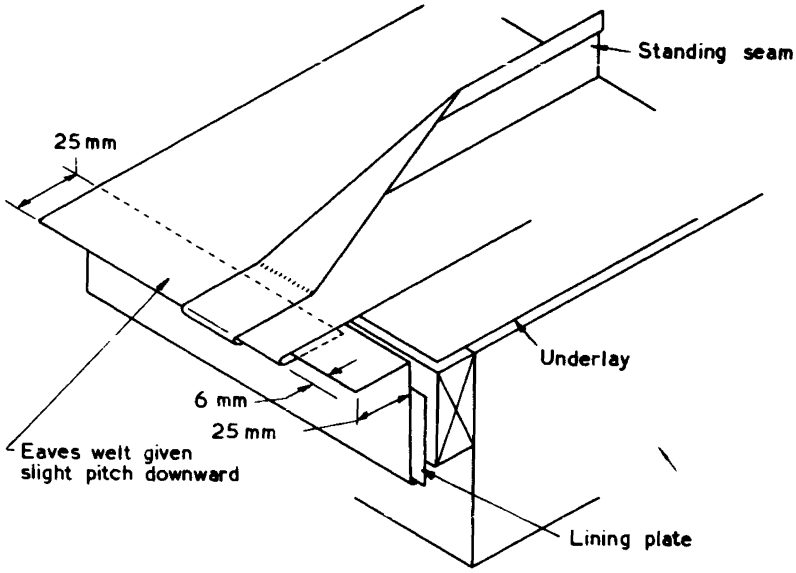
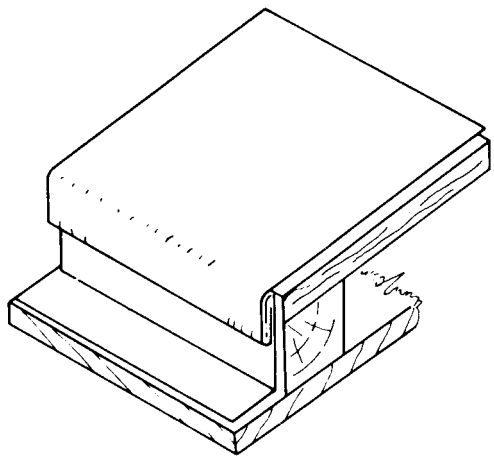
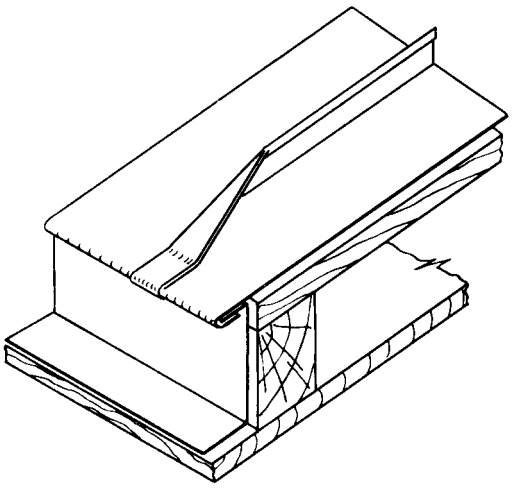


Figure 11 — Expansion detail at eaves: long strip system



a. Traditional system



b. Drip with expansion joint; long strip system

Figure 12 — Detail of drip

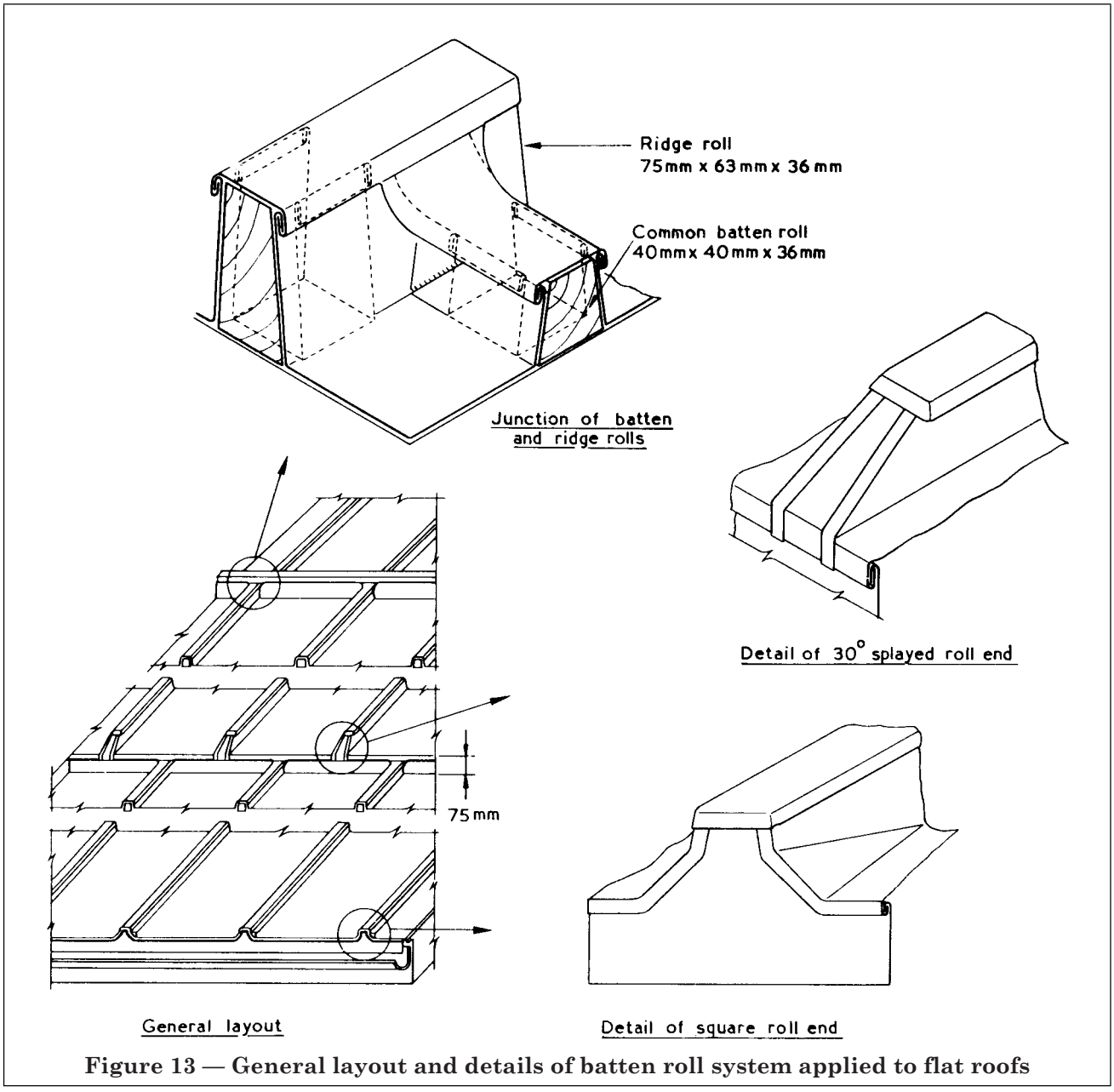
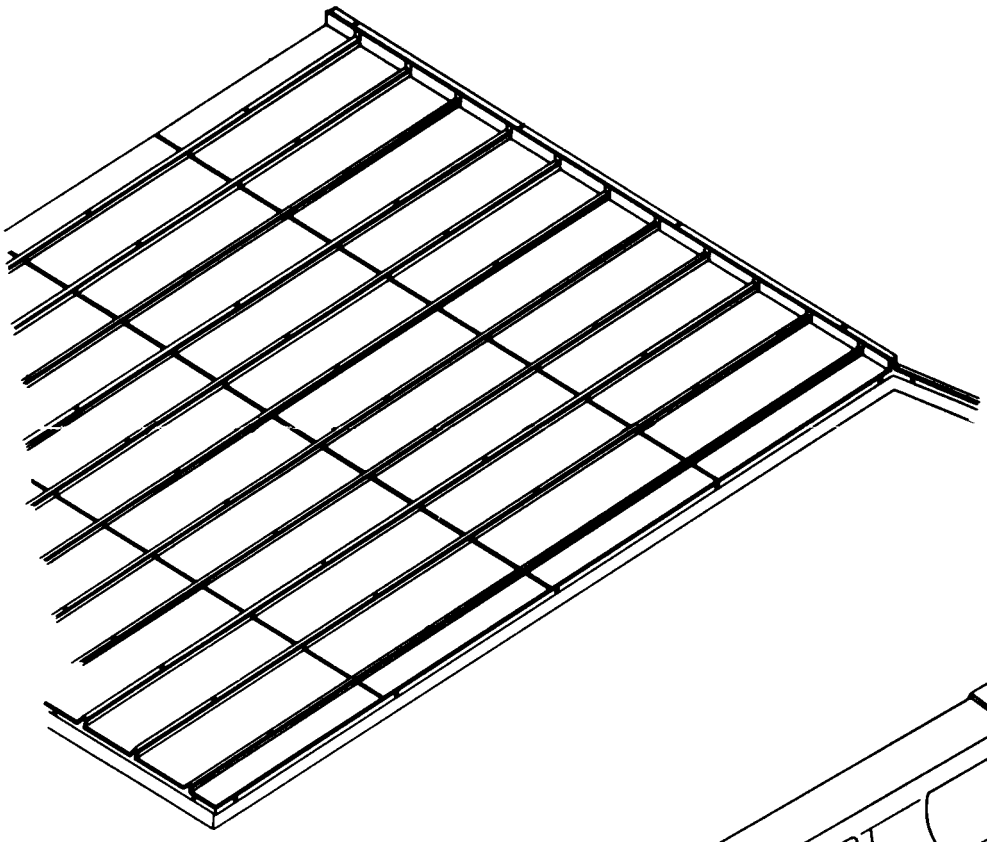
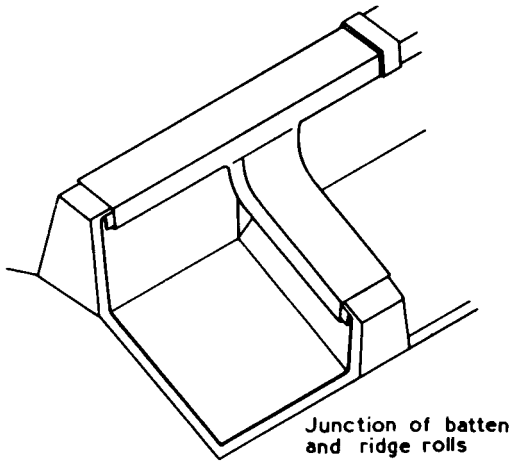


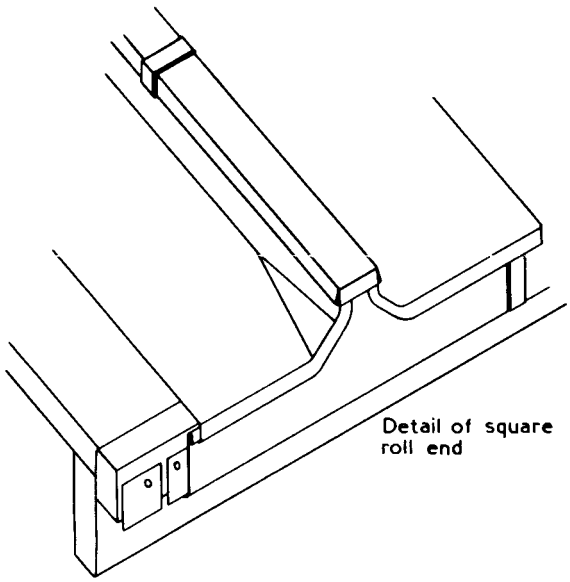
Figure 13 — General layout and details of batten roll system applied to flat roofs



General layout



Junction of batten and ridge rolls



Detail of square roll end

Figure 14 — General layout and details of batten roll system applied to pitched roofs

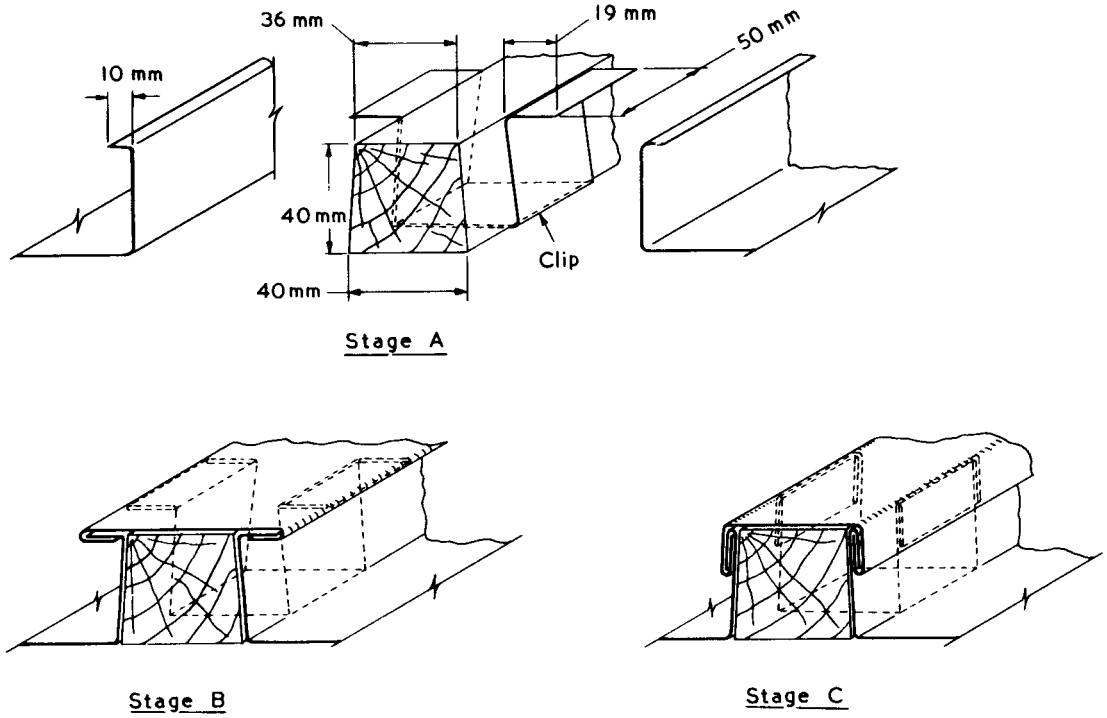


Figure 15 — Stages in forming batten roll

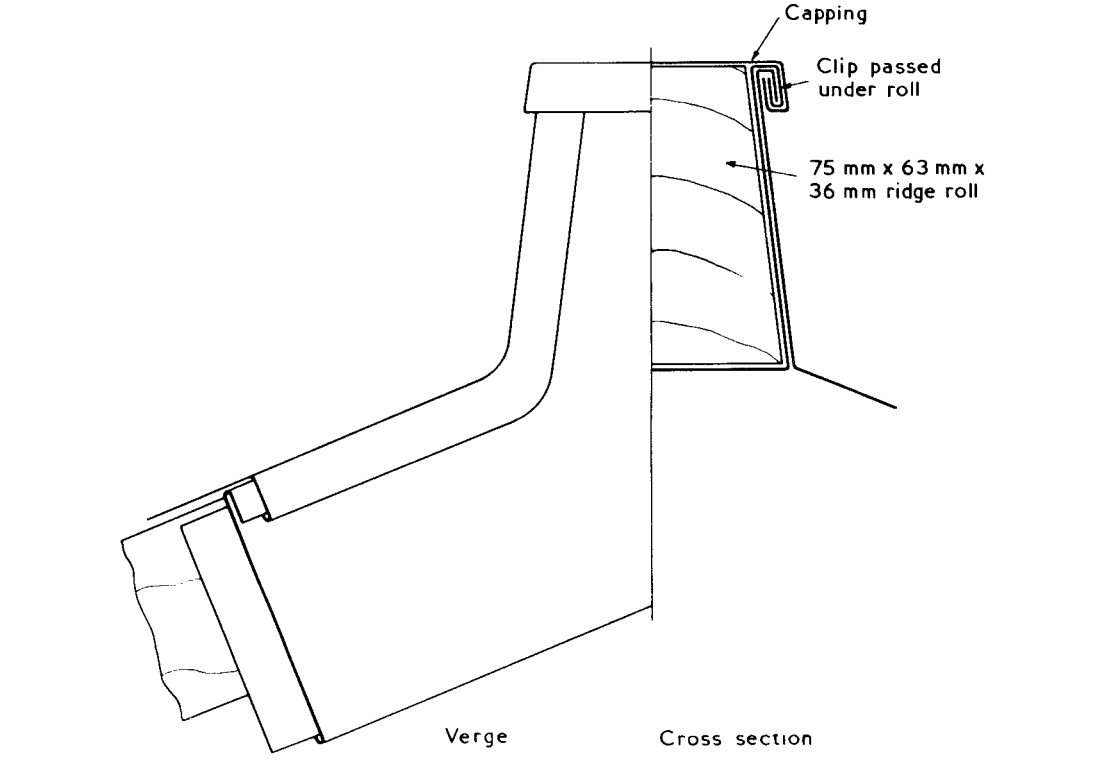


Figure 16 — Detail of ridge roll

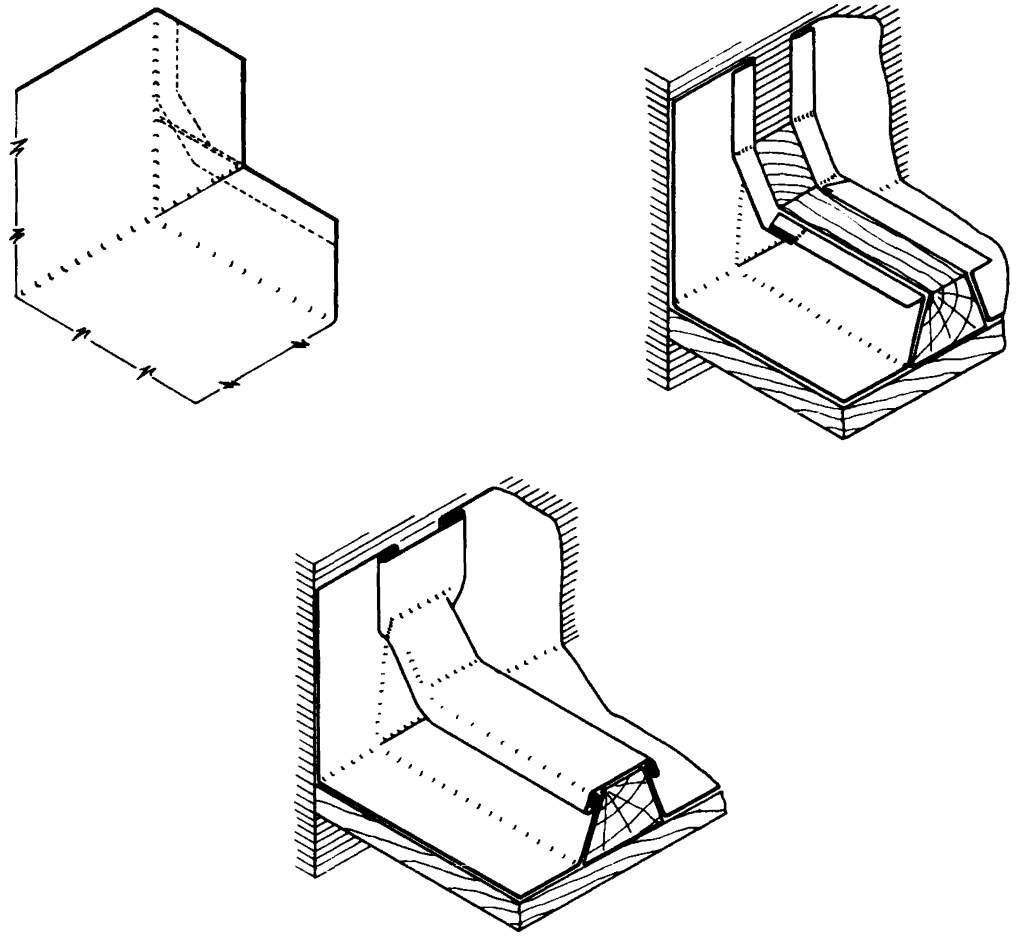


Figure 17 — Stages in forming batten roll at upstand

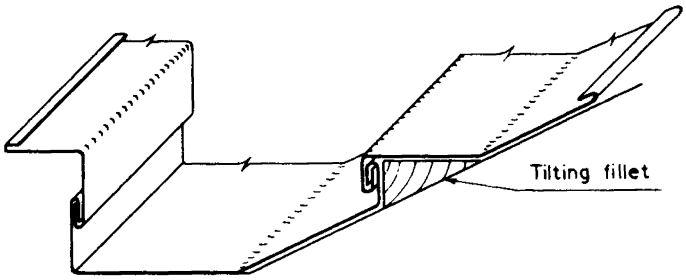


Figure 18 — Gutter for slated or tiled roof

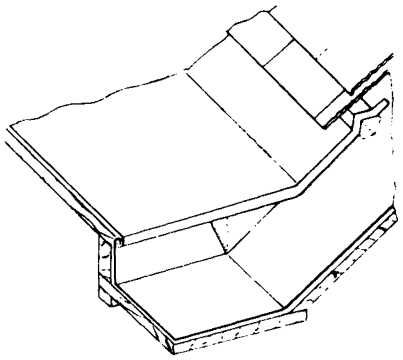


Figure 19 — Gutter between slated roofs

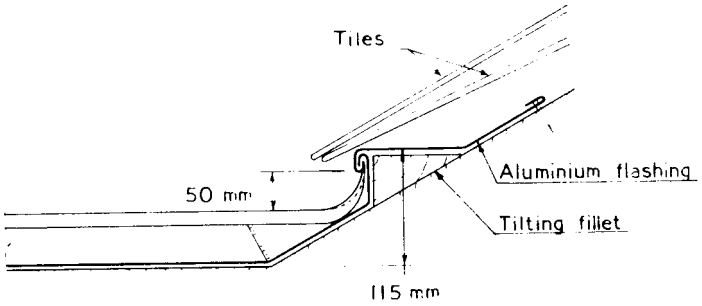


Figure 20 — Slated or tiled roof discharging on to aluminium flat roof

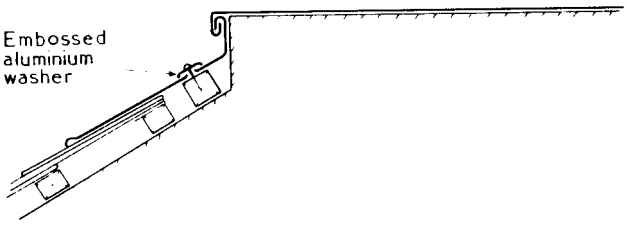


Figure 21 — Aluminium roof discharging on to slated or tiled roof

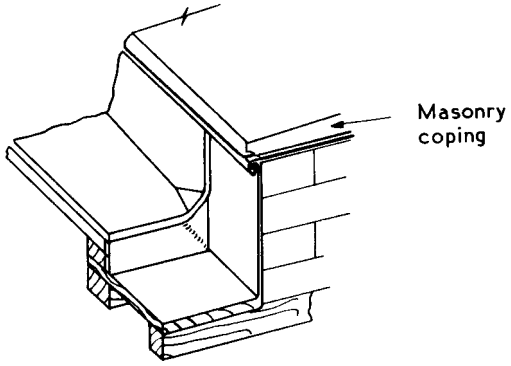


Figure 22 — Parapet gutter

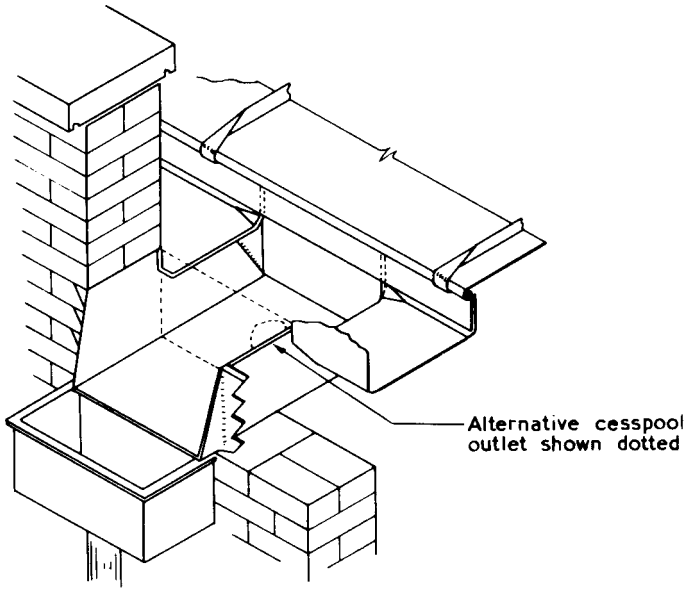


Figure 23 — Parapet gutter and chute or cesspool outlet

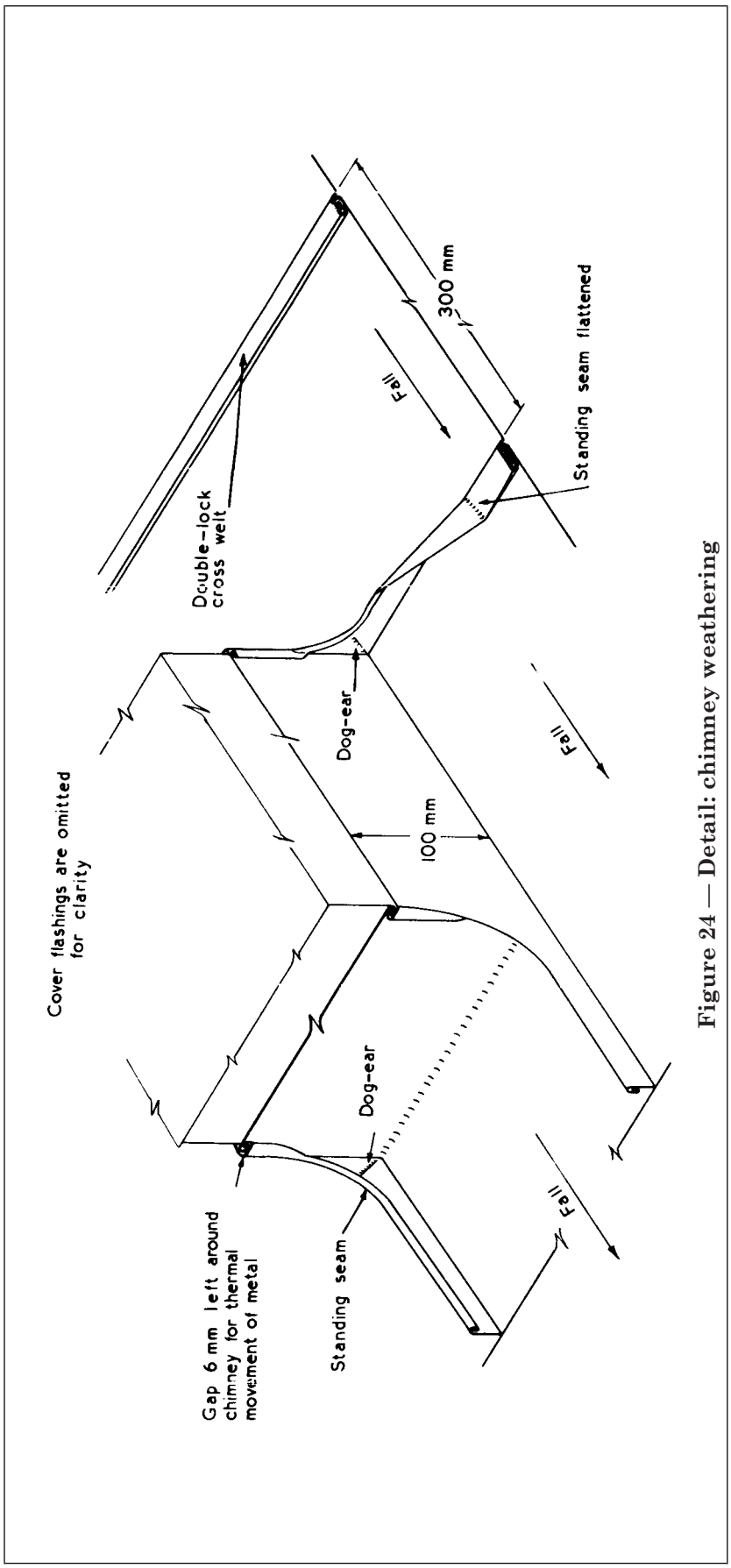


Figure 24 — Detail: chimney weathering

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Publications referred to

This Code of Practice makes reference to the following British Standards:

BS 747, *Specification for roofing felts.*

BS 913, *Pressure creosoting of timber.*

BS 1202, *Nails.*

BS 1202-1, *Steel nails.*

BS 1202-3, *Aluminium nails.*

BS 1210, *Wood screws.*

BS 1470, *Wrought aluminium and aluminium alloys for general engineering purposes. Plate, sheet and strip.*

BS 1471, *Wrought aluminium and aluminium alloys for general engineering purposes. Drawn tube.*

BS 1473, *Wrought aluminium and aluminium alloys for general engineering purposes. Rivet, bolt and screw stock.*

BS 1474, *Wrought aluminium and aluminium alloys for general engineering purposes. Bars, extruded round tube and sections.*

BS 1490, *Aluminium and aluminium ingots and castings.*

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

BS 5268, *Code of practice for the structural use of timber.*

BS 5268-5, *Preservative treatments for constructional timber.*

CP 3, *Code of basic data for the design of buildings.*

CP 3:Chapter V, *Loading.*

CP 112, *The structural use of timber.*

CP 112-2, *Metric units.*

CP 326, *The protection of structures against lightning.*

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