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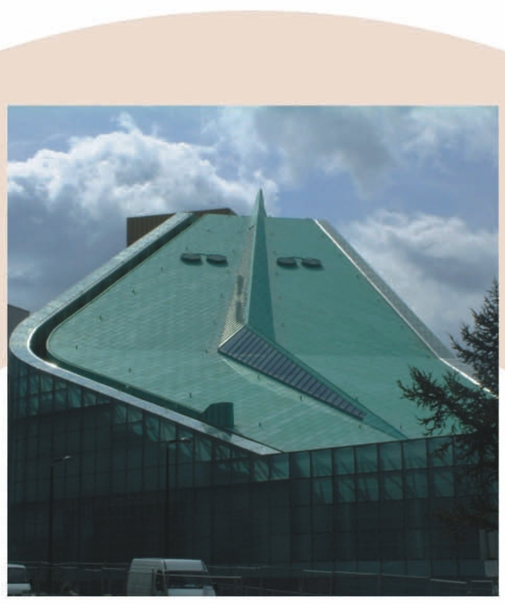
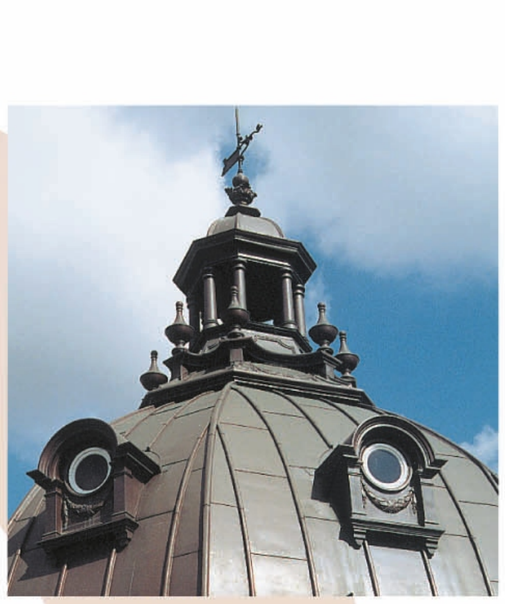
COPPER IN ARCHITECTURE





COPPER ROOFING – IN DETAIL –

CHARACTERISTICS AND USES

Copper sheet or strip has a density of 8930kg/m^3, a melting point of 1083degC, a coefficient of thermal expansion of 1.7mm/m/degC (from -20degC to +80degC) and a minimum tensile strength of 220N/mm^2 to 290N/mm^2 (i.e. soft to hard temper).

For roofing and direct-fixed cladding 'phosphoros deoxidised non-arsenical' copper sheet or strip is used. This has the material designation under BS EN 1172:1997 of 'Cu-DHP', with very good welding, brazing and soldering properties. The old designation of 'C106' under the withdrawn BS 2870:1980 is now superseded by CW024A.

STANDARDS

Copper for roofing and cladding should comply with BS EN 1772:1997 'Copper and Copper Alloys. Sheet and Strip for Building Purposes'. There is also a British Standard Code of Practice CP143:Part 12:1970 'Sheet roof and wall coverings. Copper: metric units', although this is in need of updating.

TEMPER

The malleability of copper sheet, known as 'temper', has traditionally been described as ranging from soft to hard. BS EN 1172 describes three tempers (listed here with their traditional equivalents):

R220 (soft)
R240 (1/2 hard)
R290 (hard)

Appropriate tempers for particular details are shown in the Figures which follow.

Table A

AVAILABILITY AND USE

COPPER SHEET					
thickness (mm)	**BS 1172**	**gauge** (SWG)	**weight** (kg/m^2)	**readily available**	**main use**
0.5	✓	25	4.55	no	N/A
0.6	✓	23	5.45	yes	roofing, direct-fixed cladding, gutter linings
0.7	✓	22	6.35	yes	roofing, direct-fixed cladding, gutter linings, eaves guttering
0.8	✓	21	7.25	yes	gutter linings, eaves guttering
1.0	✓	19	9.12	yes	self-supporting cladding panel systems, gutter linings

Copper strip is manufactured and supplied as a continuous 'coil' or roll of copper. Under BS EN 1172 all copper is flat rolled to thicknesses ranging from 0.5mm to 1.0mm. Their typical uses are shown in Table A above. BS EN 1172 covers copper manufactured in widths up to and including 1250mm. To work economically it is obviously best to plan bay layouts, as much as possible, according to the standard sheet widths available. These are included on Tables E and J (p8 and p11).

Prefabricated self-supporting cladding panel systems used in curtain walling need to be made from thicker copper sheet. Copper is also prefabricated to form flashings, roofing shingles, eaves guttering and rainwater pipes.

ROOF FORMS AND PITCH

Copper is a fully supported sheet roofing material which is easily formed mechanically or by hand, on site or in the factory, to suit virtually any three dimensional shapes – including complex curves and details. Pitches from 1 to 90degrees can be accommodated, as well as negative pitches, such as soffits. Appropriate roof forms include:

- **Conical** – using tapered trays with a minimum bay width at the top of 50mm and maximum at the bottom of 800mm (subject to exposure and fixings).
- **Barrel Vaults** – straight trays can be used without pre-curving for radii over 12m.

- Domes – trays must be pre-curved to match the geometry. Use of a segmental arrangement of bays is the simplest method requiring only straight cutting of trays.
- Pagoda – for concave shapes pre-curving of trays is always necessary (either by crimping or compressing the seams).

LAYING SYSTEMS

There are two systems for laying copper roofing: Traditional and Long Strip. Half hard temper is used for Long Strip and Soft temper for Traditional. The basic difference between the two is that Traditional accommodates thermal movement in the copper roofing by introducing frequent lateral joints to limit the size of each piece of copper, while in Long Strip sliding clips allow the movement. Although the coefficient of thermal expansion was given earlier, the actual effects are more complex: as an approximation for lengths of copper sheet up to 10m, allow 1.1mm/m for expansion and 0.6mm/m for contraction. All the details which follow take into account anticipated thermal expansion and contraction for the UK. The characteristics of each system are summarised on Tables B and C (p6 and p7). Similarly information on joints, acceptable minimum pitches and fixing is given on Tables D to N (p8-12).

Most roofing and cladding details are common to both the Traditional and Long Strip systems. However, details for Long Strip have to be more specific in their allowance for movement. For this reason each drawing included in this publication features a tick-box clarifying the suitability of the detail 'as drawn'. 'Suitable with minor modifications' invariably refers to the standard 10mm of movement provided in Long Strip details but not required in Traditional.

VENTILATION

Copper is not affected by the underside corrosion which can cause premature failure of most other metal roofing materials and does not require complex ventilation measures. It is therefore entirely suitable for use on either unventilated "warm" or ventilated roof constructions. For "warm" roofs adequate vapour control layers should be properly installed with sufficient insulation. For ventilated roofs, ventilation in accordance with the Building Regulations is provided by gaps at upper and lower edges of the roof or, if these are not feasible, by formed copper hoods (see page 84). Special advice may be needed for areas with high humidity or where air conditioning is to be used: contact the CDA Roofing Technical Officer for further information.

SUBSTRATES

Copper roofing and direct-fixed cladding require to be fully supported by a substrate. The substrate must be suitably durable and be able to provide a 'pull-out resistance value' of 560N for the fixings. This is an essential consideration because acceptable bay widths/clip spacings are calculated on that basis. The substrate also needs to be at least 24mm thick if the 25mm x 2.6mm diameter annular ring-shanked nails with a minimum 6mm head now recommended are not to protrude.

While in theory there are several alternative materials possible, in practice exterior quality plywood is by far the most common substrate. It should be specified squared-edged, 'good one side' and laid with this side up to provide a smooth surface for the underlay. The individual sheets should be fixed with a 3mm nominal gap between them so as not to provide a barrier to the movement of water vapour. Also laid staggered with their long side across the fall of the roof, parallel with the gutter, to minimise the number of fixing clips which might otherwise have coincided with an uninterrupted straight run of butt joints. All sheet materials should be laid in this fashion. However, other materials can be used for a substrate provided that clips can be fixed securely, including wood boarding and the appropriate grades of chipboard or cement bonded particle-boards.

With warm roof constructions rigid insulation boards can provide a suitable substrate. However because these cannot provide an adequate 'pull-out resistance value' fixing becomes more complicated. There are two basic approaches: either to provide two layers of insulation, each laid between softwood battens, with the second laid counter-battened to the first, and with the counter-battens at 300mm centres; or to use specially extended fixing clips which pass through the depth of the insulation to an additional nailable substrate beneath.

An underlay is recommended separating the substrate from the copper. This underlay can also allow movement in the copper, provide a temporary weathering for the building during construction, deal with irregularities on the substrate surface and offer some sound absorption. There are two basic types of underlay, non-waterproof and waterproof. In most circumstances, breather membranes or geotextile felts would be preferable and a waterproof breather membrane should be used |with warm roofs. For advice on underlays for particular roof types contact the CDA Roofing Technical Officer.

CORROSION & COMPATIBILITY

The natural electrical potential of copper is comparatively high and it is not affected by other metals on the outside of buildings. However, copper can cause corrosion to some other metals like steel, aluminium or zinc if there is direct contact between the metals and an electrolyte (such as water) is present. If rainwater from copper roofing or cladding runs onto other metals with a lower electrical potential, there may be interaction unless they are protected and maintained by established methods. Metals unaffected by the above are lead, stainless steel and brass. These metals can be joined to copper without any corrosion problems.

Rainwater running off bitumen exposed to the sun can cause corrosion problems for various materials including copper. Certain residues washed out of concrete or mortar can cause copper to take on a blue-green colour. Also, the wash-off from red cedar shingles can cause metals to corrode.

APPEARANCE

The natural development of a patina, with colours changing from gold to chocolate brown, and eventually to the distinctive light green seen on older roofs in our towns and cities, is a unique characteristic of copper. When exposed to the atmosphere, copper oxide conversion films form, changing the surface colour of copper from salmon pink to russet brown within a few days.
As weathering progresses over a number of years, cupreous and cupric sulphide conversion films intersperse with the initial oxide film increasingly darkening the surface to a chocolate brown. Continued weathering results in conversion of the sulphide films to the basic copper sulphate patina which, when complete, gives the distinctive light green colour of older copper roofs. In marine climates, the surface patina will also contain some copper chloride.

The eventual development of the light green patina can take 7 to 9 years in saline climates, 5 to 8 years near heavy industry, 10 to 14 years in urban surroundings and up to 30 years in clean environments. A certain amount of rainwater is necessary to form the green patina and the process takes much longer for vertical surfaces, due to rapid run-off, except in coastal areas. Apart from internal applications, the natural progression of patina cannot be successfully prevented with varnishes and other coatings.

WORKING WITH COPPER

As much of the work as possible is prefabricated in the controlled conditions of the workshop. This will be equipped with an array of cutting, bending, folding and profiling machines. On site adjustable, electrically-powered seaming machines are used for the long repetitive stretches of the job. Some handworking is always necessary and specialised tools have been evolved to cope with every condition: seamers, seaming irons, folders, grips and tongs as well as the more usual pliers, snips and mallets.

Where two pieces of copper need to be joined the specified Cu-DHP designation copper will allow good soft-soldering, brazing (hard-soldering) and welding. The working temperatures of these methods are 400degC, 750degC and 980degC respectively. However, if work of this sort is anticipated insitu, any restrictions on 'hot-working' need to be considered in planning the job. Soft-soldering might prove acceptable because a soldering-iron heated adjacent on the scaffold will hold its heat sufficiently. If not, rivetting might provide a suitable alternative. In the event of any installation problems or blemishes on the copper surface, contact the CDA Roofing Technical Officer.

TRAINING

'Hands on' training in the latest copper roofing techniques is available for roofing contractors through specifically tailored modular courses organised by CDA.

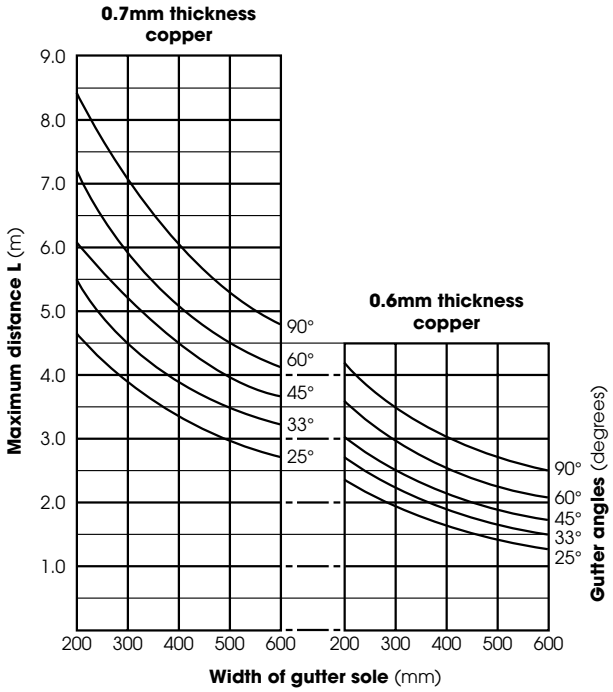
PARAPET GUTTERS

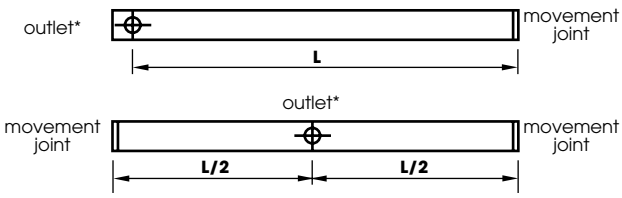
The following information applies to both parapet and central valley gutters. There has not been sufficient space in this publication to cover the sizing of these gutters to BS 6367:1983 nor to illustrate them in detail. However, by referring to Fig 30 (p77-79) and Fig 52 (p118-119) which show recessed pitched valley gutters for double-lock standing seam and batten roll respectively, it will be apparent how they are formed. The flashing details shown in Figs 11a, 11b and 11c (p44-46) will also be useful.

As with other aspects of copper detailing it is important to accommodate movement.
The adjacent nomograms (see right) give the maximum interval allowable from the outlet and they assume, with reference to how the roofing sheets connect to the gutter, that the gutter lining is free to move independently. The nomograms take into account how the frictional resistance of different gutter shapes affects this free movement. The dimension 'L' can also be taken to show the maximum distance allowable between movement joints. Pitched valley gutters are dealt with on Tables P and T (p13).

Falls in these gutters are usually below 10degrees. Movement joints in the fall of the gutter will be either drip-steps 60mm minimum or a vulcanised neoprene strip such as T-Pren. Previous guidance suggested that these gutters could be laid to a fall of less than 1degree, but this is not realistic unless the resulting build-up of debris can frequently be cleared away. While neoprene strips would seem to allow really flat pitches, such gutters will not be self-clearing below 6degrees. A minimum pitch of 3degrees should be the aim. To prevent the gutter lining from creeping down the fall, some sort of 'fixed' clips will be required (see Table L).
The movement joint at the head of the gutter fall will be a capped seam or batten 50 x 50mm, with the capping turn-out engaging the copper of the gutter so that 10mm movement is allowed.

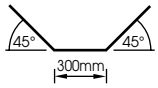
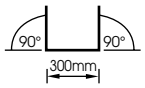
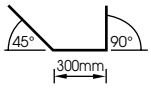
If on a particular project it proves impossible to provide the movement shown, greater intervals can be achieved by using thicker copper for the gutter. Taking a 300mm width / 90degree angle as an example, using 0.8mm copper would increase the interval 'L' to 8.75 metres; and using 1.0mm to 18 metres. Contact the CDA Roofing Technical Officer for further information. This information does not apply where the detailing prevents the gutters from moving. In such cases a drip-step 60mm minimum must be provided so that no section of gutter exceeds 3 metres in length. This joint need not be a movement joint as its purpose is to limit the size of the copper sheet.





** Outlets should be detailed to allow free movement between the spigot and substrate of 5mm in each direction*

EXAMPLES

copper thickness (mm)	 for gutter with both angles at 45 degrees	 for gutter with both angles at 90 degrees	 for gutter with angles of 45 degrees and 90 degrees (ie sum of individual distances ÷ 2)
0.6	***2.5m***	***3.5m***	***3.0m***
0.7	***5.150m***	***7.0m***	***6.075m***

maximum distance L between rainwater outlet and movement joints

Traditional and Long Strip systems

OVERVIEW

The choice between the Traditional and Long Strip roofing systems is largely one of appearance.

The Long Strip system uses a harder temper copper and this, being more rigid, is better able to accommodate the stresses of thermal movement, virtually eliminating the need for lateral joints. In addition, the extensive use of the automatic tools required to form harder copper makes the Long Strip system generally cheaper.

The so-called Traditional system is suited to more complicated work featuring details which can only be formed by hand, and therefore require the use of a softer temper copper. Sizes of copper sheet have to be restricted to dissipate the stresses of thermal movement. The regular repetition of the necessary lateral joints becomes a desirable element of the design.

Traditional system at the London Planetarium

Table B

TRADITIONAL SYSTEM

GENERALLY

- uses Soft or 1/4 Hard copper sheet
- copper thickness 0.6mm or 0.7mm in exposed areas
- chosen where details need hand-forming or where lateral joints are wanted for aesthetic reasons
- final appearance of work more hand-finished with characteristic 'quilting' to bays
- most roofing and cladding details are common to both the Traditional and the Long Strip systems but details for Long Strip allow more movement

BAY SIZES

- longitudinal and lateral joints are planned so that sizes of copper sheet do not exceed 600mm wide or 1800mm long
- because the fixings possible to hold the copper to the substrate are related to bay widths exposure must be considered (see Tables M and N)

LONGITUDINAL JOINTS

- for longitudinal joints three details are possible depending on roof pitch: 'batten rolls': 'double-lock standing seams': 'angle standing seams' (see Table D)
- for flat roofs possible damage from maintenance access might indicate the choice of 'batten rolls'

LATERAL JOINTS

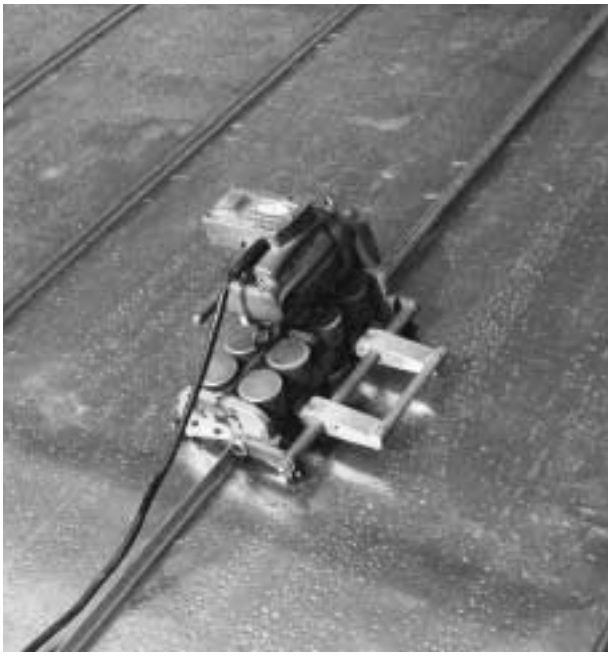
- for lateral joints four details are possible depending on roof pitch: 'double-lock cross welts': 'drip-steps': 'fillet drips': 'single-lock cross welts' (see Table F)

FIXINGS

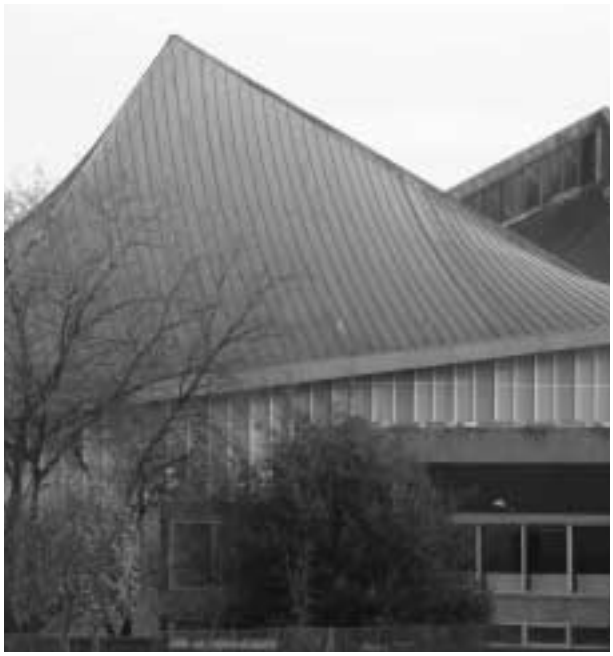
- only 'fixed clips' are used at both longitudinal and lateral joints
- in most detail locations clips are spaced at 300mm centres
- for some details continuous fixing strips are used as this is easier than lining up separate clips
- nails for all types of fixings are commonly 25mm x 2.6mm diameter annular ring-shanked nails with a minimum 6mm head
- nailing for continuous fixing strips, eaves strips or lining plates is at 100mm staggered centres

CLADDING

- basic roofing techniques using batten rolls and standing seams are also used for direct-fixed cladding of vertical surfaces and soffits



Mechanised seaming for the Long Strip System



Long Strip System at the Commonwealth Institute, London

Table C

LONG STRIP SYSTEM

GENERALLY

- uses 1/4 or 1/2 Hard copper strip pre-formed into trays
- copper thickness 0.6mm or 0.7mm in exposed areas
- chosen for cost-effectiveness and where lateral joints are not wanted in the design
- smoother and crisper appearance to finished work
- most roofing and cladding details are common to both the Long Strip and the Traditional systems but details for Long Strip allow more movement

BAY SIZES

- longitudinal joints are planned so that widths of copper strip do not exceed 670mm wide
- lateral joints are planned to limit uninterrupted lengths of copper according to pitch (see Table L)
- if a pattern of bays is required to suit the design unclipped double-lock cross welts can be introduced, but these will be in addition to the lateral joints required by Table L (see Fig. 15)

LONGITUDINAL JOINTS

- for longitudinal joints three details are possible depending on roof pitch: 'batten rolls': 'double-lock standing seams': 'angle standing seams' (see Table H)
- for flat roofs possible damage from maintenance access might indicate the choice of 'batten rolls'

LATERAL JOINTS

- for lateral joints three details are possible depending on roof pitch: 'lap-lock cross welts: 'drip-steps': 'fillet drips' (see Tables K and L)

FIXINGS

- where lengths of copper strip do not exceed 3 metres 'fixed clips' may be used throughout
- where lengths of copper strip exceed 3 metres longitudinal joints must incorporate both 'sliding clips' and 'fixed clips' in accordance with Table L
- to allow for movement consistent with water-tightness, fixing at eaves, drip-steps and gutters involves the use of continuous copper eaves strips or lining plates
- in most other detail locations clips are spaced at 300mm centres
- for some details continuous fixing strips are used as this is easier than lining up separate clips
- nails for all types of fixings are commonly 25mm x 2.6mm diameter annular ring-shanked nails with a minimum 6mm head
- nailing for continuous fixing strips, eaves strips or lining plates is at 100mm staggered centres

CLADDING

- basic roofing techniques using batten rolls and standing seams are also used for direct-fixed cladding of vertical surfaces and soffits

Joints for the Traditional system

Table D

LONGITUDINAL JOINTS – PITCH

JOINT DETAIL	Minimum roof pitch (degrees)				
	1	3	6	25	90
double-lock standing seams h25mm *a) sealed b) not sealed*		a) ●	b) ●		→
angle standing seams h25mm x 12mm angle				●	→
batten rolls h44mm x 44mm	●				→
batten rolls h38mm x 38mm		●			→
tapered batten rolls h38mm x 44mm to 32mm	●				→
conical wood core rolls h48mm x 42mm to 10mm *now obsolete*	●				→

Notes

1) Table D is to be read with Table F Lateral joints Pitch (see opposite), to derive the acceptable minimum pitch for any particular roof.

Table E

LONGITUDINAL JOINTS – BAY WIDTH

JOINT DETAIL	Spacing of longitudinal joints / Bay widths (at mm ctrs) according to standard sheet widths available (mm)							
	sheet widths							
	400	450	500	600	670*	700*	750*	800*
double-lock standing seams h25mm width loss to form joint: 75mm** **80mm using a profiling machine	325	375	425	525	595	625	675	725
angle standing seams h25mm x 12mm angle width loss to form joint: 75mm** **80mm using a profiling machine	325	375	425	525	595	625	675	725
batten rolls h44mm x 44mm width loss to form joint: 75mm	325	375	425	525	595	625	675	725
batten rolls h38mm x 38mm width loss to form joint: 70mm	330	380	430	530	600	630	680	730
tapered batten rolls h38mm x 44mm to 32mm width loss to form joint: 65mm	375	385	435	535	605	635	685	735
conical wood core rolls h48mm x 42mm to 10mm width loss to form joint: 155mm	245	295	345	445	515	545	595	645

Notes

*1) Sheet widths marked thus '*****' are wider than recommended in normal circumstances.*

Table F

LATERAL JOINTS – PITCH

JOINT DETAIL	Minimum roof pitch (degrees)								
	1	3	6	10	14	20	25	45	90
hand-formed double-lock cross welts 18mm *a) sealed b) not sealed*			a)			b)			
pre-formed double-lock cross welts 18mm *a) sealed b) not sealed*			a)			b)			
drip-steps h50mm (standing seams) *a) with sealed standing seam b) where pre-formed straight dog eared upstand is used*		a)					b)		
drip-steps h60mm *a) tapered or b) 38 x 38mm batten rolls*	a)	b)							
drip-steps h65mm *(44 x 44mm batten rolls)*									
fillet drips h50mm x w250mm (standing seams) *a) where pre-formed straight dog-eared upstand is used*							a)		
single-lock cross welts 30mm *(2no clips in welt per bay)*									
single-lock cross welts 18mm *(2no clips in welt per bay)*									

Table G

LATERAL JOINTS – BAY LENGTH

JOINT DETAIL	Spacing of lateral joints / Bay lengths (at mm ctrs) in typical detail locations using sheet length at maximum (mm):
	1800
hand-formed double-lock cross welts 18mm length loss to form joint: 75mm	1725
pre-formed double-lock cross welts 18mm length loss to form joint: 85mm	1715
drip-steps h50mm (standing seams) length loss to form joint: 100mm	1700
drip-steps h65mm (44 x 44mm batten rolls) length loss to form joint: 115mm	1685
fillet drips h50mm (standing seams) length loss to form joint: 100mm	1700
single-lock cross welts 30mm length loss to form joint: 95mm	1705
single-lock cross welts 18mm length loss to form joint: 60mm	1740

Notes

1) Previous guidance allowed drip-steps to be spaced at 3 metre intervals. However this is no longer recommended and a maximum sheet length of 1800mm is now considered the best practice. If it is difficult to provide drip-steps to this standard, and the pitch allows (see Table F above), a combination of drip-steps and sealed double-lock cross welts might be considered. Alternatively the Long Strip details shown in Figs 4e, 4f, 41a, or 41b (see pages 27 and 96) could be used for drips at 3 metre centres (see also Table L note 7).

Joints for the Long Strip system

Table H

LONGITUDINAL JOINTS – PITCH

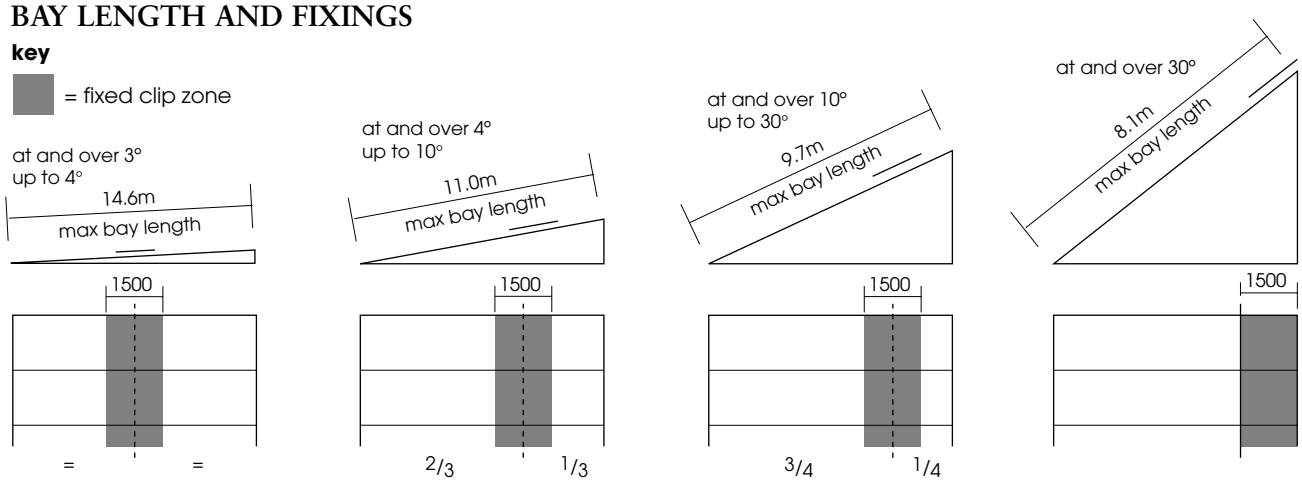
JOINT DETAIL	Minimum roof pitch (degrees)			
	3	6	25	90
double-lock standing seams h25mm *a) sealed b) not sealed*	a) ●	b) ●	- - -	→
angle standing seams h25mm x 12mm angle			● - -	→
batten rolls h44mm x 44mm	●	- - -	- - -	→
batten rolls h38mm x 38mm		●	- - -	→
tapered batten rolls h38mm x 44mm to 32mm	●	- - -	- - -	→

Table L

BAY LENGTH AND FIXINGS

key

= fixed clip zone



Notes

1) A zone of fixed clips is necessary on a Long Strip roof to prevent the copper from elongating over time. This tendency to elongate increases with roof pitch and with bay length. Previous design guidance recommended a maximum bay length for Long Strip roofing of 10 metres, applicable regardless of roof pitch.

In addition, hot weather causes compressive forces in the copper as it tries to expand. The zone's position is varied according to roof pitch. This achieves a balance in the copper tray between the compressive forces created as the bay expands upwards from the zone against gravity; and those created in overcoming frictional resistance as it expands downwards from the zone.

2) For illustrations of fixed and sliding clips with Double-lock standing seams, refer to Figs 1 and 2 (p18).

3) For illustrations of fixed and sliding clips with Batten rolls, refer to Fig 37 (p88).

4) Fixed clips are to be provided at 300mm centres in the shaded area, the 'fixed clip zone'. Dimensions shown are taken in the plane of the roof slope. Below 3degrees all clips can be sliding clips.

5) With Double-lock standing seams at roof pitches at and over 45degrees, fixed clips are to be provided at 250mm ctrs in the 'fixed clip zone'.

6) Sliding clips are to be provided at 300mm ctrs in the unshaded areas.

7) For small roofs with slopes not exceeding 3 metres or where movement joints are provided at 3 metre centres, fixed clips may be used throughout.

8) Table L applies to both double- and mono-pitched roofs.

9) If any transport and site handling problems can be overcome, it might be possible to increase the maximum bay lengths shown. This will require the use of a special sliding clip ('safety clip') and 0.7mm half-hard copper. Special details to accommodate the increased movement might also be needed. Contact the CDA Roofing Technical Officer for further information.

Table K

LATERAL JOINTS – PITCH

JOINT DETAIL	Minimum roof pitch (degrees)				
	3	10	14	25	90
lap-lock cross welts 250mm length loss to form joint: 370mm at sheet top: 335mm at sheet foot: 35mm		●	- - -	- - -	→
drip-steps h50mm (standing seam) length loss to form joint: 115mm at sheet top: 80mm at sheet foot: 35mm *a) where pre-formed straight dog-eared upstand is used*	●	- - -	- - -	a) - - -	→
drip-steps h60mm (tapered or 38 x 38 batten rolls) length loss to form joint: 120mm at sheet top: 85mm at sheet foot: 35mm	●	- - -	- - -	- - -	→
drip-steps h65mm (44 x 44 batten rolls) length loss to form joint: 125mm at sheet top: 90mm at sheet foot: 35mm	●	- - -	- - -	- - -	→
fillet drips h50mm x w250mm (standing seam) length loss to form joint: 115mm at sheet top: 80mm at sheet foot: 35mm *a) where pre-formed straight dog-eared upstand is used*			● - -	a) - -	→

Table J

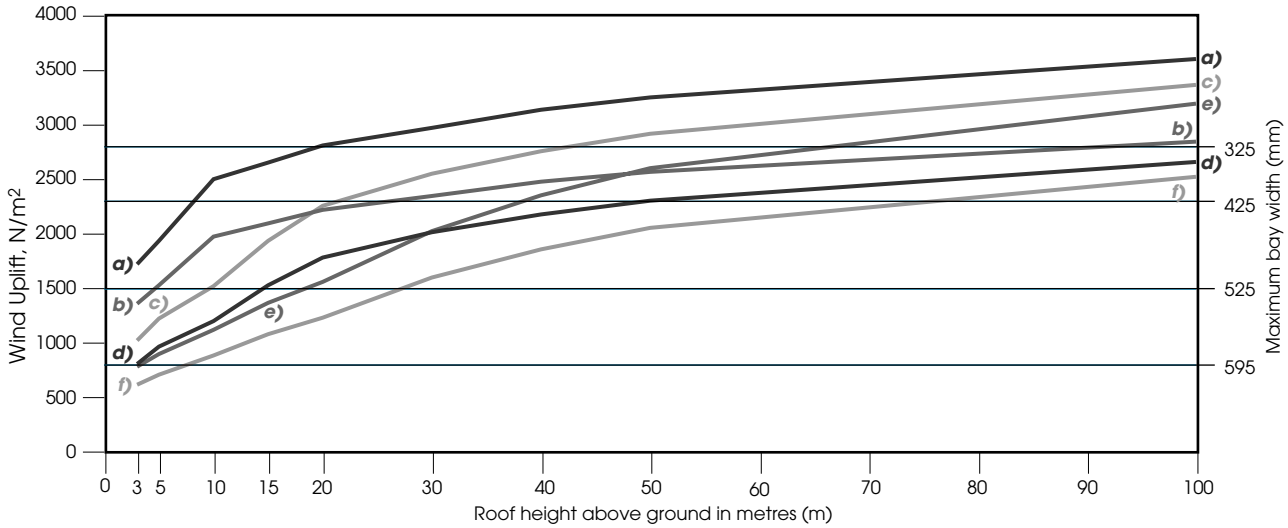
LONGITUDINAL JOINTS – BAY WIDTH

JOINT DETAIL	Spacing of longitudinal joints / Bay widths (at mm ctrs) according to standard sheet widths available (mm)				
	sheet widths				
	400	450	500	600	670
double-lock standing seams h25mm width loss to form joint: 75mm* *80mm using a profiling machine	325	375	425	525	595
angle standing seams h25mm x 12mm angle width loss to form joint: 75mm* *80mm using a profiling machine	325	375	425	525	595
batten rolls h44mm x 44mm width loss to form joint: 75mm	325	375	425	525	595
batten rolls h38mm x 38mm width loss to form joint: 70mm	330	380	430	530	600
tapered batten rolls h38mm x 44mm to 32mm width loss to form joint: 65mm	335	385	435	535	605

Bay width in relation to exposure

Table M

FOR 0.6MM THICKNESS COPPER

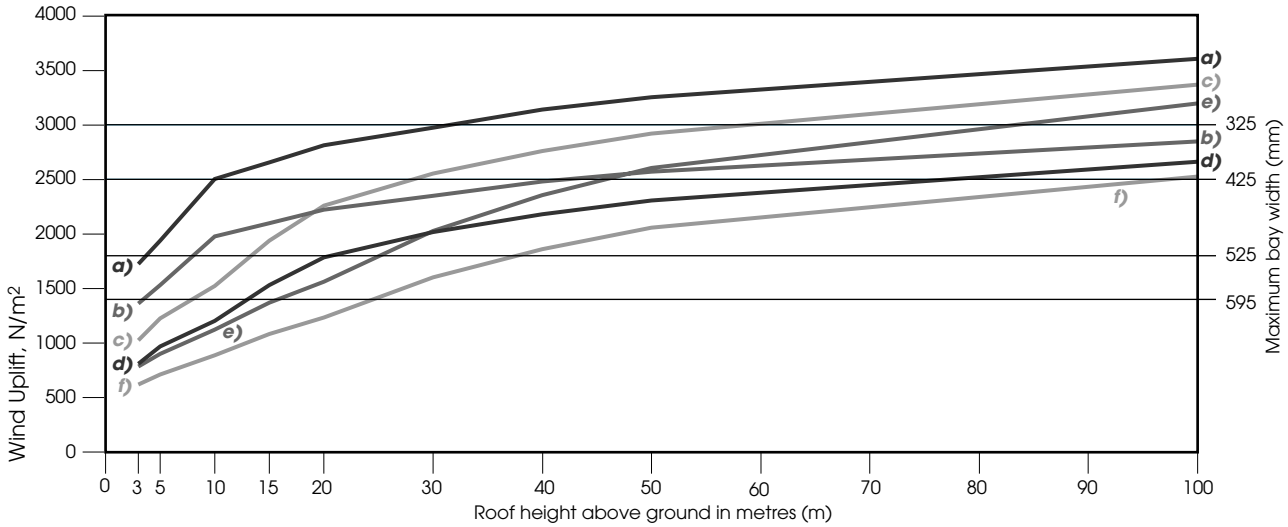


Key for tables M and N

- ***a) = Scotland and Northern Ireland, exposed conditions***
- ***b) = England & Wales, exposed conditions***
- ***c) = Scotland and Northern Ireland, normal conditions***
- ***d) = England & Wales, normal conditions***
- ***e) = Scotland and Northern Ireland, sheltered conditions***
- ***f) = England & Wales, sheltered conditions***

Table N

FOR 0.7MM THICKNESS COPPER



Notes

1) Tables M and N apply to both the Traditional and Long Strip systems.

2) The bay widths shown may be maintained at all parts of the roof. Reduced bay widths, for example, are no longer required at verges.

3) The Tables have been compiled from data obtained from a number of the UK's most experienced specialist roofing contractors. The information was obtained on the basis of CP3 Chapter V: Part 2: 1972 Wind loads and was subject to some simplifying but conservative assumptions. Thus wider bay widths might be possible in central southern England, especially in conurbations or large towns.

4) CP3 Chapter V: Part 2 has been replaced by BS6399: Part 2: 1997 Code of practice for wind loads.

5) Nails for all types of fixings are commonly 25mm x 2.6mm diameter annular ring-shanked nails with a minimum 6mm head.

6) In comparison with previous published guidance, the excellent pull-out strength of the now widely used annular ring-shanked nails has made simpler specification of fixings possible, and applicable to all exposures (see Tables B and C).

7) The effect that the degree of exposure has on the number of fixings required has been accounted for in the maximum bay widths allowable.

8) No clip in a longitudinal joint should be positioned within 75mm of its intersection with a single-lock or double-lock cross welt.

Table P

PITCHED VALLEY GUTTERS

VALLEY DETAIL	Suitable for roofing in / with Traditional	Long Strip	Standing Seam	Batten Roll	Minimum roof pitches (degrees)	Notes Possible lateral joints as listed on Table T shown thus: A B etc
recessed into substrate	yes	yes	yes	yes	4½	See Figs 30 (p78) and 52 (p118) A B C D E F G
with tilting fillets	yes	yes	yes	no	13½	See Fig 31 (p80) B C D E F G
with standing seam edges	yes	no	yes	no	10* or 3	See Fig 32 (p81). The minimum pitch* assumes the gutter exceeds 3m and so needs a cross welt. C E F G
with lap-lock welts to gutter lining edges	yes	yes	yes	no	10	See Fig 33 (p82) B C D E F G
with single-lock welts to gutter lining edges	yes	no	yes	no	25	See Fig 34 (p83) C D E F G

Notes

1) Table P assumes that the gutters are approximately 300mm wide and that they drain roof pitches at and over 10degrees. If for some reason they exceed 400mm or are at a lower pitch, refer to the Copper for Roofing section.

2) Where the detailing of the pitched valley gutter linings allows them to move freely, a movement joint must still be provided so that no section exceeds 10 metres in length.

3) To prevent the gutter lining from creeping down the fall, some sort of 'fixed' clips will be required (see Table L).

4) Where the detailing of the pitched valley gutter linings prevents them from moving, a lateral joint must be provided so that no section exceeds 3 metres in length. Such a joint need not be a movement joint. Its purpose is to limit the size of the copper sheet.

Table T

MOVEMENT / LATERAL JOINTS IN GUTTERS

JOINT DETAIL ** *those shown thus are not movemnt joints*	Minimum gutter pitches (degrees)
A drip-steps h60mm	3
B vulcanised neoprene strips	6
C hand-formed double-lock** cross welts 18mm - sealed	7
D lap-lock cross welts 250mm	10
E hand-formed double-lock** cross welts 18mm - unsealed	20
F single-lock cross welts 50mm	30
G single-lock cross welts 30mm	45

Contents

✔ = suitable as drawn

✓ = suitable with minor modifications

✘ = unsuitable

EXAMPLE | TRADITIONAL ✔ | LONG STRIP ✘ |

Fig 1 Hand-formed double-lock standing seam

This method of forming standing seams was commonly used before the widespread introduction of profiling machines. It is still used for short bay lengths and can be used for both vertical and horizontal joints in cladding.

In roofing its minimum pitch unsealed is 6degrees. With a non-hardening sealing strip such as Illmod, pitches down to 3degrees are possible, depending on exposure. Whether to seal or not should be discussed with the copper roofer. Linseed oil is still preferred as a sealant by some roofers.

If a really precise appearance is required it would be better to specify 'roll-formed' seams as shown in Fig 2 (p18).

For bay widths taken from seam centre to seam centre see Tables E (p8) and J (p10). Also see Tables M and N (p12).

The sequence notes describe the seam being formed using a seaming iron and a wooden seaming mallet. It is equally possible to use a hand-operated angle seamer to Stage 3, with a double seamer to complete Stage 4. This is both quicker and achieves a more consistent seam height.

Temper: soft, quarter- or half-hard
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	✓

* Minimum dimensions shown. Clips are more often 50mm wide.
* In most detail locations clips are spaced at 300mm centres, but see also Table L (p11).

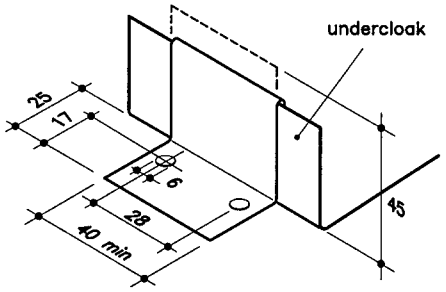
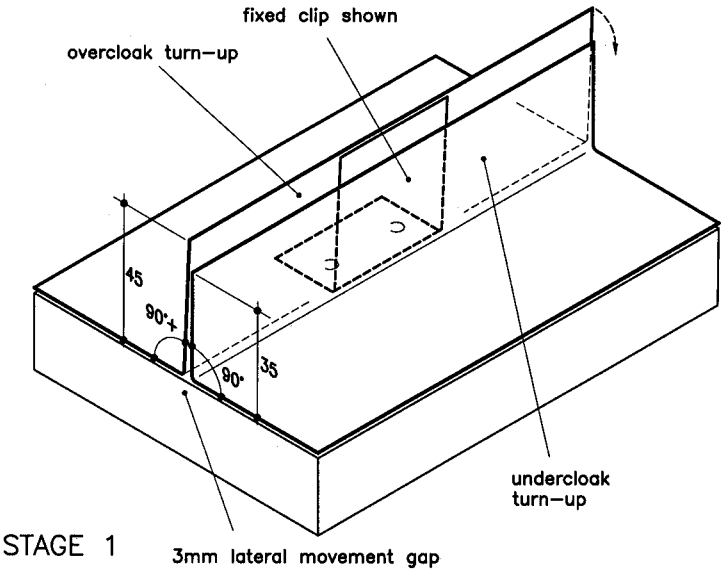


Fig 1a Fixed clips

TRADITIONAL	✓	LONG STRIP	✓



STAGE 1

Stage 1
Form edge turn–ups for overcloak of 45mm and for undercloak of 35mm, using folding machine or universal flat–nosed pliers. The angle at the base of the 45mm turn–up is greater than 90 degrees to allow for lateral movement in the copper sheet.

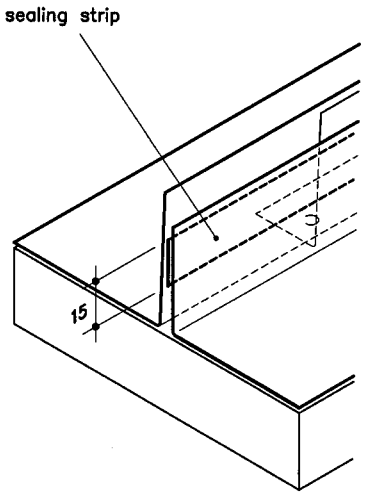


Fig 1c
Sealing strip for pitches below 6degrees

TRADITIONAL	✓	LONG STRIP	✓

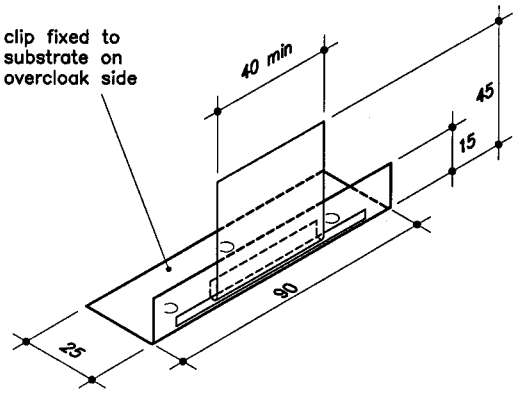
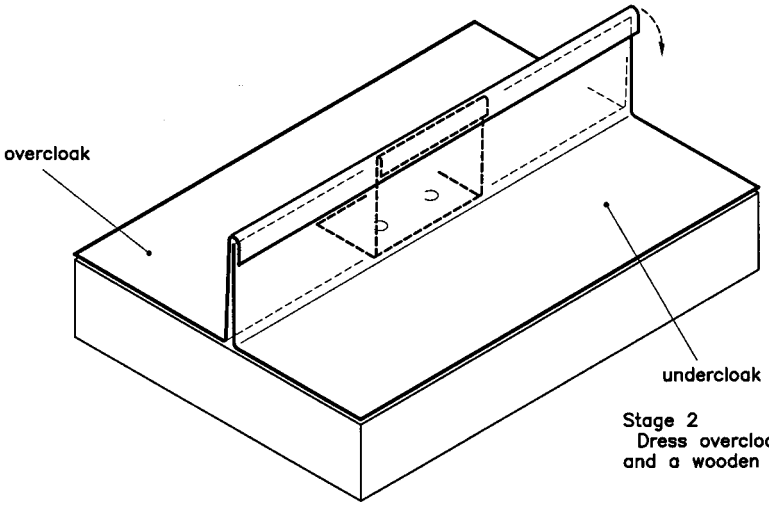


Fig 1b Sliding clip

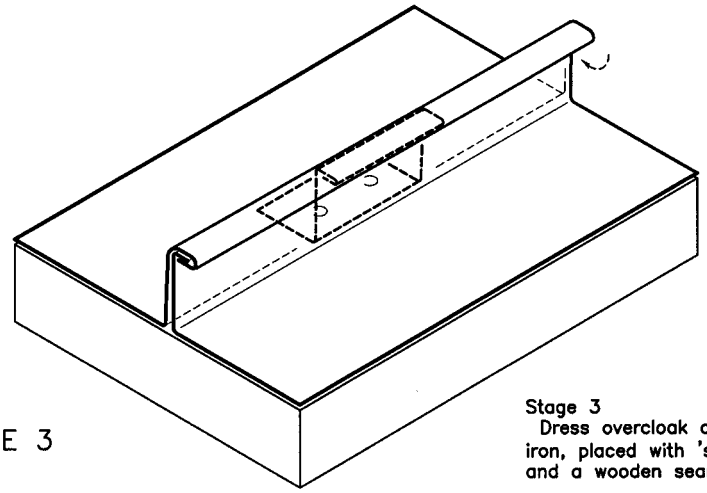
TRADITIONAL	X	LONG STRIP	✓

* For spacing and positioning of clips, see Table L (p11).



STAGE 2

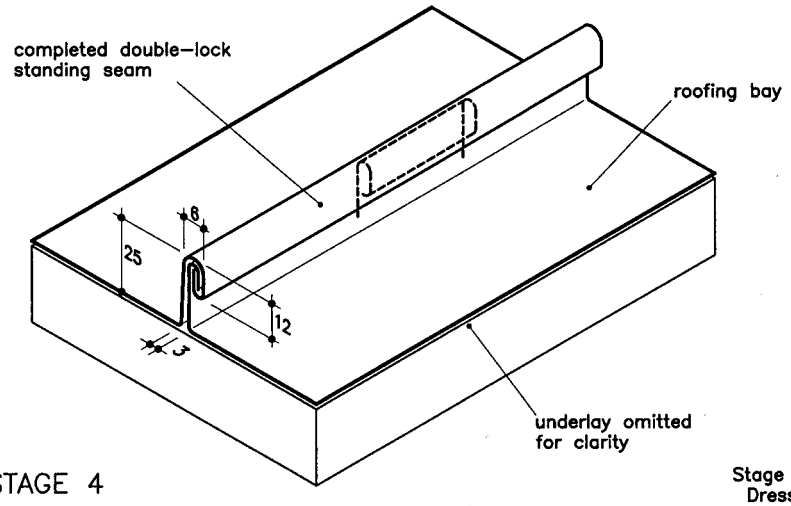
Stage 2
Dress overcloak over and down using a seaming iron and a wooden seaming mallet.



STAGE 3

Stage 3
Dress overcloak and undercloak over using a seaming iron, placed with 'second turn' iron against undercloak, and a wooden seaming mallet.

This is the final stage for the Angle standing seam. Note it can only be used at and over 25degrees roof pitch.



STAGE 4

Stage 4
Dress seam down to complete the joint.

Fig 2 Roll-formed profiled trays

This is the most efficient method of forming standing seams and is therefore used wherever possible. It gives a very consistent and precise appearance to the seam. As seaming machines can work up to the vertical, this quality can be achieved in cladding as well as roofing.

For cladding, horizontal seams are also possible (see Fig 24a) with, of course, the welt turned to the underside of the seam. The 'angle standing seam', which is simply with the seam completed at Stage 2, is often used in cladding because there tends to be less localised distortion or quilting effect to the copper sheet.

In roofing its minimum pitch unsealed is 6degrees. With a closed cell sealing strip such as Illmod, pitches down to 3degrees are possible, depending on exposure. Whether to seal or not should be discussed with the copper roofer. The angle standing seam can only be used at and over 25degrees roof pitch.

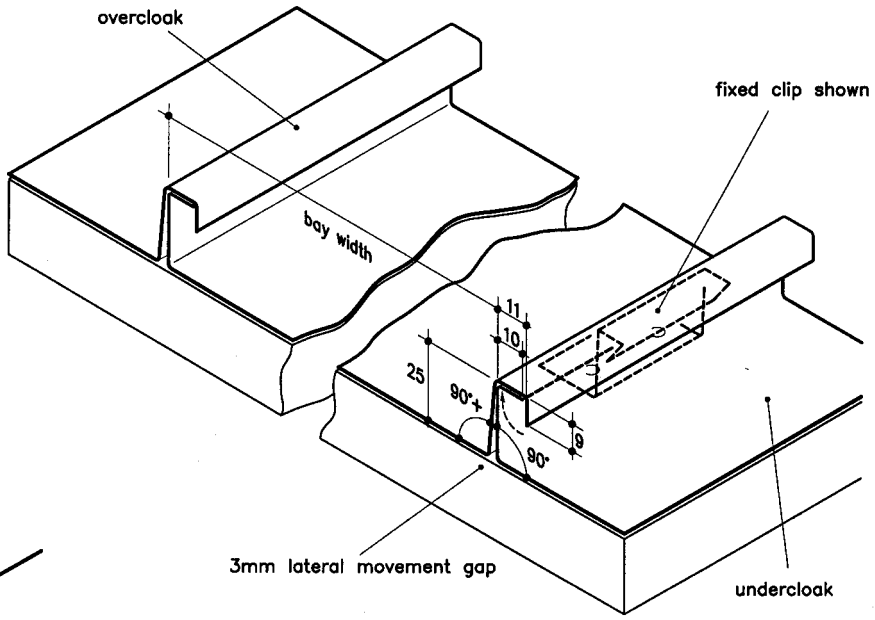
For bay widths taken from seam centre to seam centre, see Table E (p8) and J (p10). Also see Tables M and N (p12).

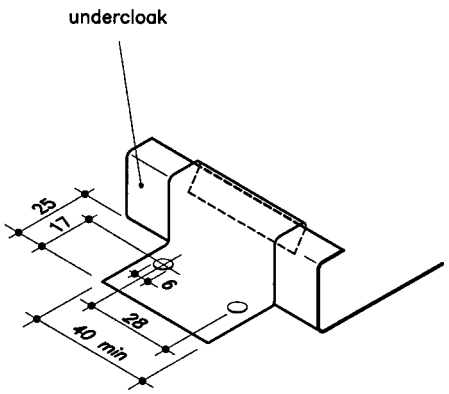
Temper: half-hard
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

Stage 1
Preform tray in the workshop using a profiling machine. This automatically forms the 3mm gap needed to allow for lateral movement in the copper sheet.

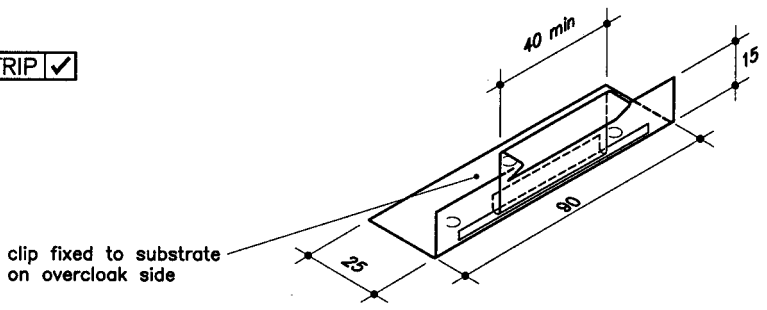
STAGE 1





*** Minimum dimensions shown. Clips are more often 50mm wide.**
*** In most detail locations clips are spaced at 300mm centres, but see also Table L (p11)**

Fig 2b Fixed clip
TRADITIONAL ✓ LONG STRIP ✓



*** For spacing and positioning of clips, see Table L (p11).**

Fig 2c Sliding clip
TRADITIONAL X LONG STRIP ✓

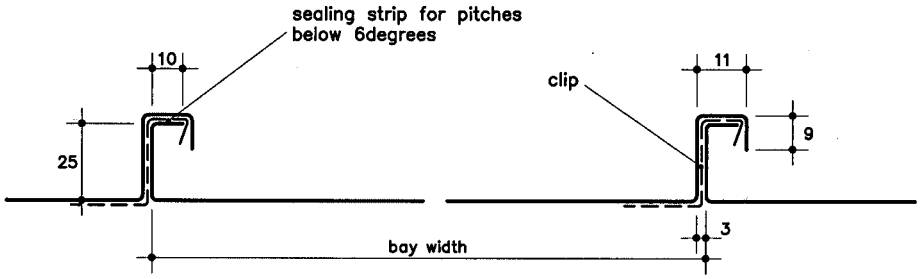
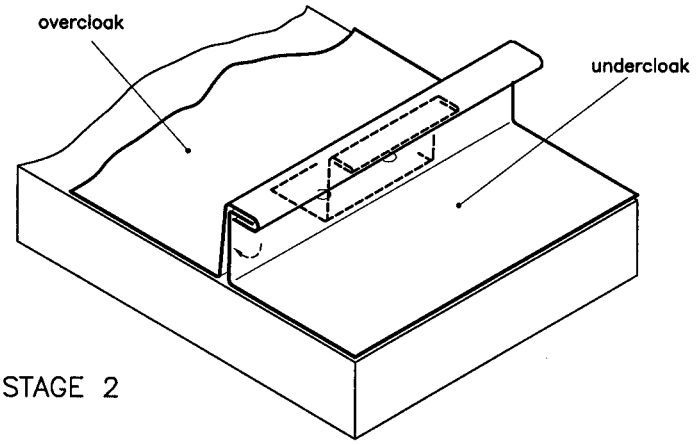


Fig 2a Section across tray

TRADITIONAL	✓	LONG STRIP	✓

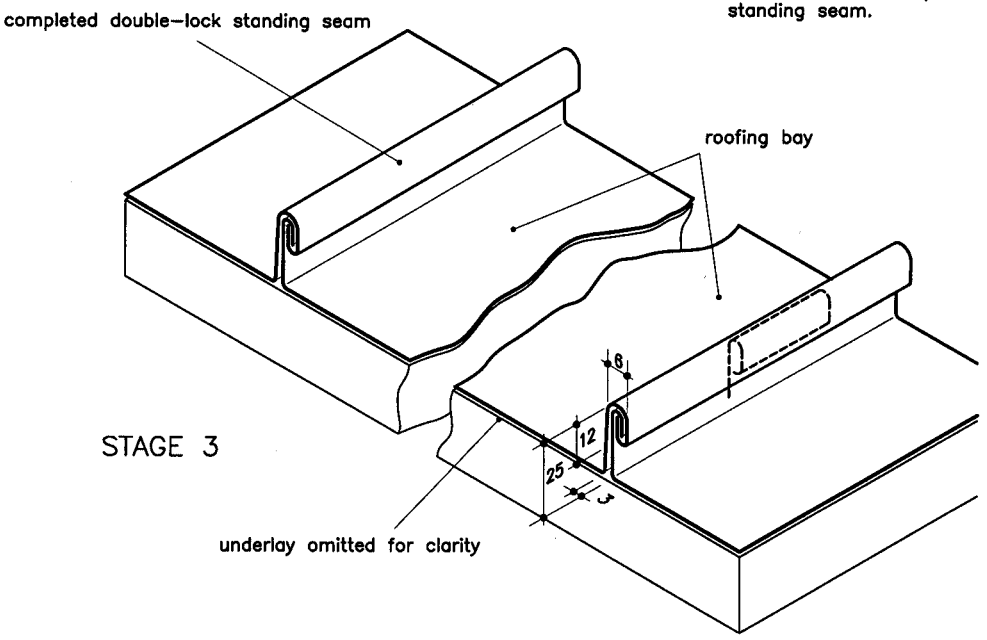


STAGE 2

Stage 2
For Traditional roofing a seaming machine is not possible as it cannot run over the cross welts. Instead a hand–operated angle seamer is used, followed by a double seamer to complete Stage 3.

With Long Strip roofing the bottom 300mm run of the seam is formed using hand–operated seamers. This provides a guide for the seaming machine.

This is the final stage for the Angle standing seam.



STAGE 3

Stage 3
Place the seaming machine at the bottom of the run and work up the seam. This completes the standing seam.

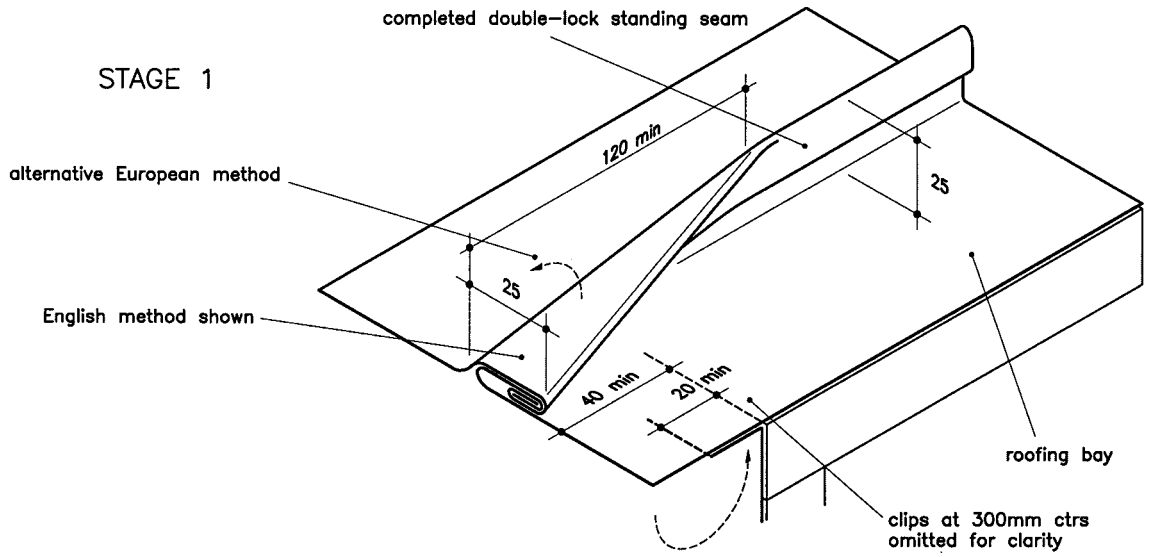
Fig 3 Turned-down standing seam end

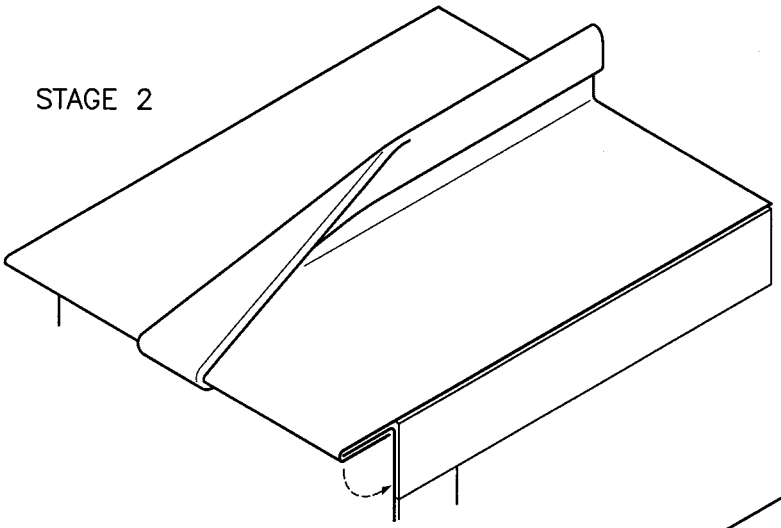
This seam is only possible in Traditional roofing. The form illustrated is using the so-called 'English method'. In the alternative 'European method' the seam is turned over the other way so that the welt in the seam faces uppermost. This allows water to drain out of the welt more effectively.

Temper: soft or quarter-hard, preferably. If half-hard is used the sides of the copper sheet should be cut tapered 10mm maximum, to the start of the splay.
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	X

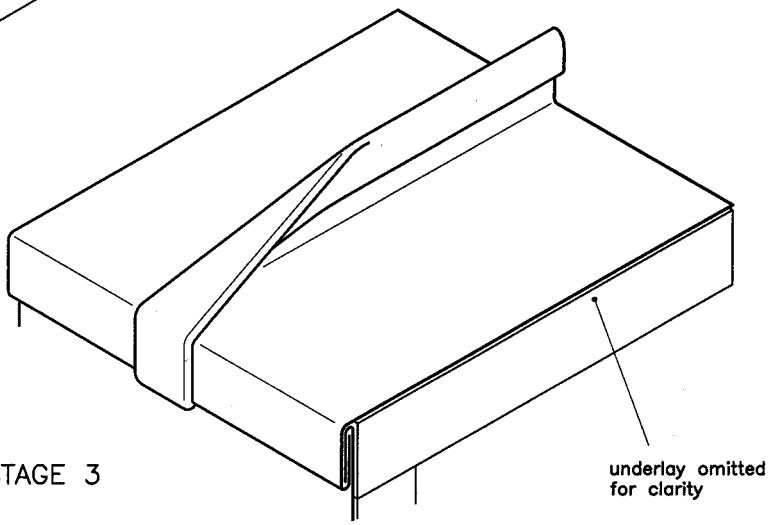
Stage 1
Dress standing seam over using a wooden seaming mallet. When flattening the end support the seam from underneath with a seaming iron. The start of the splay should be 120mm minimum from the edge of the copper sheet. Otherwise it is very difficult to carry out Stage 2 without the copper bunching up. It also puts the copper under less stress.





Stage 2
Fold the flattened seam under the copper sheet which forms the upstand. Eaves folders ('first and second turn') will give a neater finish than a seaming iron and a mallet.

Stage 3
Fold the turn-out down using an eaves folder ('first turn') and finish by hand. Alternatively it can be dressed down with a wooden mallet.



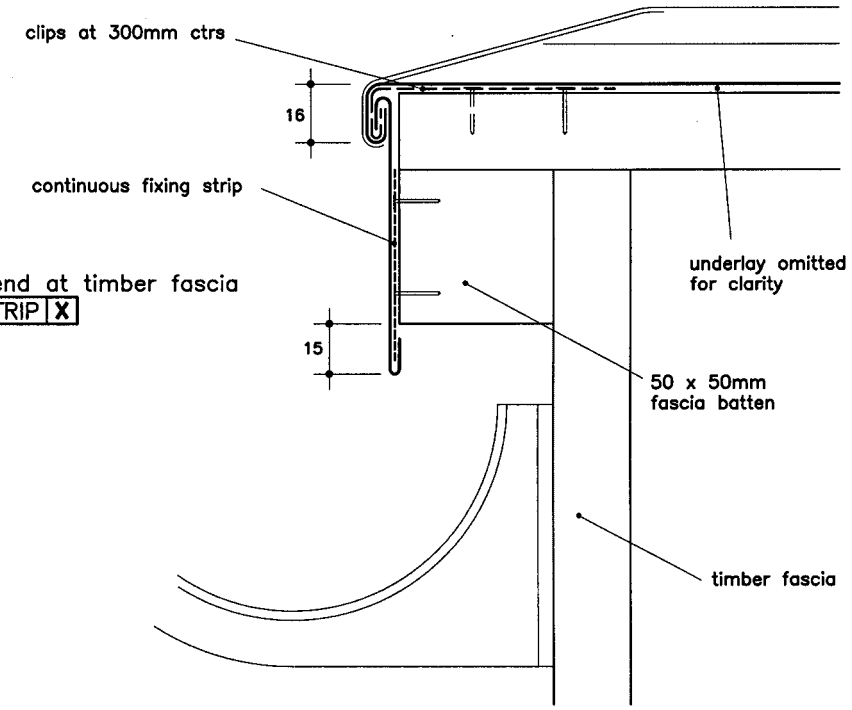


Fig 3a
Turned–down seam end at timber fascia
TRADITIONAL ✓ LONG STRIP ✗

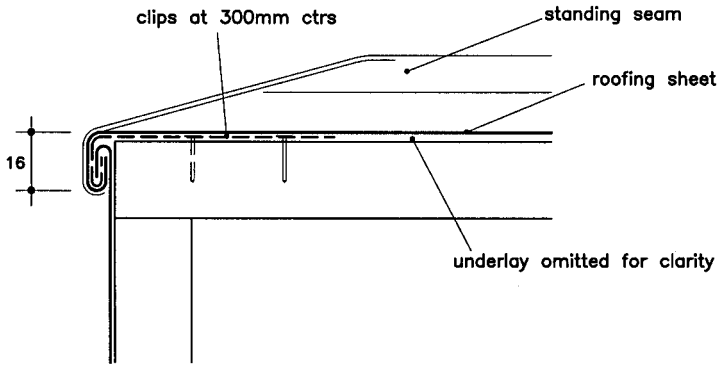


Fig 3b
Turned–down seam end at parapet gutter
TRADITIONAL ✓ LONG STRIP ✗

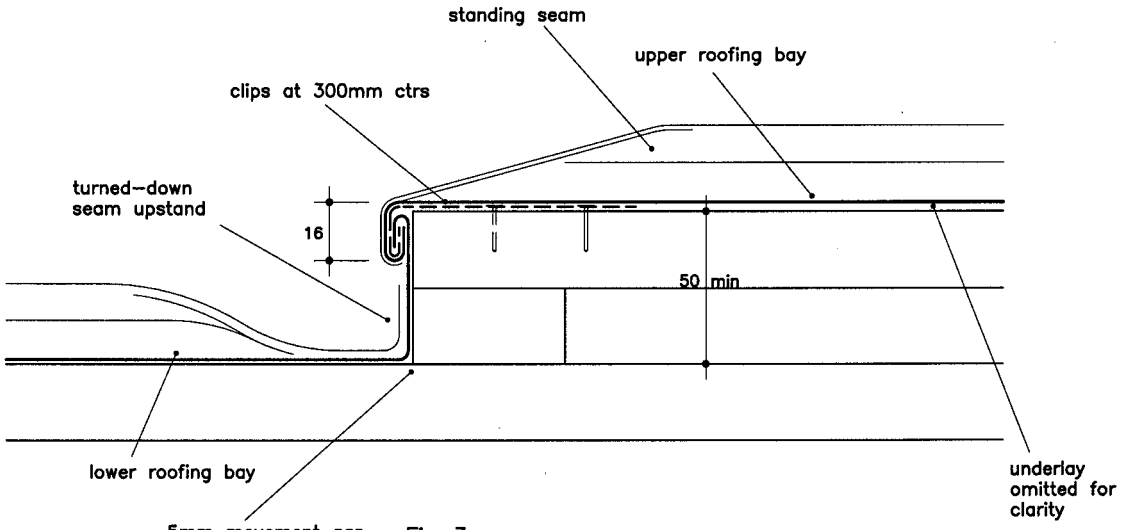


Fig 3c
Turned–down seam end at drip–step
TRADITIONAL ✓ LONG STRIP ✗

Fig 4 Concave-form seam end

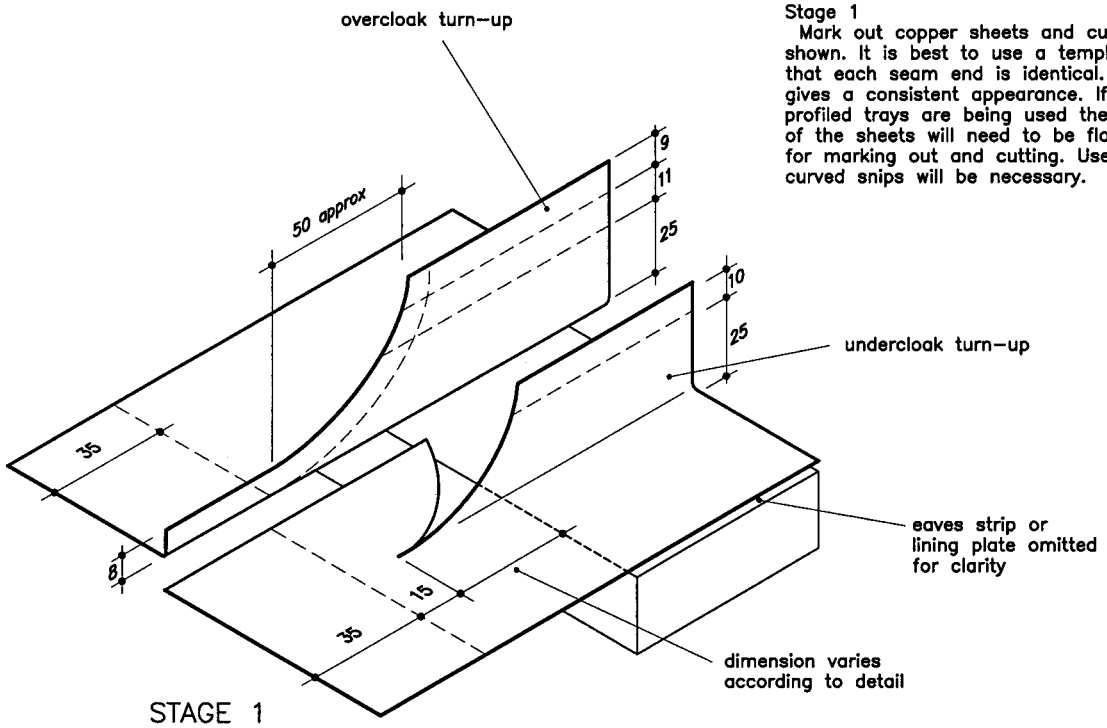
This is the preferred method of finishing a seam end. The Chamfer-form and the Square-form seam ends (see Figs 5 and 6) are alternatives. It can be used to end angle standing seams in roofing. Also to end double-lock standing seams or angle standing seams in cladding.

The detail on its own is not weathertight. It also needs an eaves strip or lining plate underneath it, extending 130mm minimum up the roof slope (see Figs 26 and 28). This is shown on the accompanying details (see Figs 4a, 4b, 4c, 4d, 4e and 4f). Joints in eaves strips or lining plates are either 150mm lapped joints or, more usually and preferably, 50mm lapped and sealed. They must be positioned at least 150mm from standing seams, but a convenient rule is to make such joints mid-bay.

The eaves strip or lining plate should project sufficiently, so that the turn-under of the roofing sheet can engage it by 20mm and still have 10mm for movement. In Traditional roofing the 10mm movement gap is not required. In effect, in Long Strip roofing the roofing sheets are cut 40mm beyond the end of the eaves strip; and in Traditional roofing 20mm beyond.

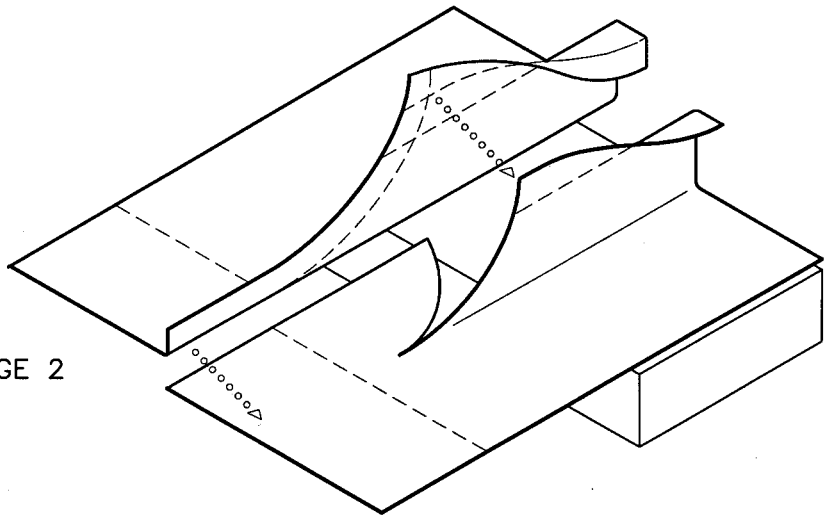
Temper: half-hard preferably, although it does take more working at Stage 3 than softer copper.
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓



STAGE 1

Stage 1
Mark out copper sheets and cut as shown. It is best to use a template so that each seam end is identical. This gives a consistent appearance. If profiled trays are being used the ends of the sheets will need to be flattened for marking out and cutting. Use of curved snips will be necessary.

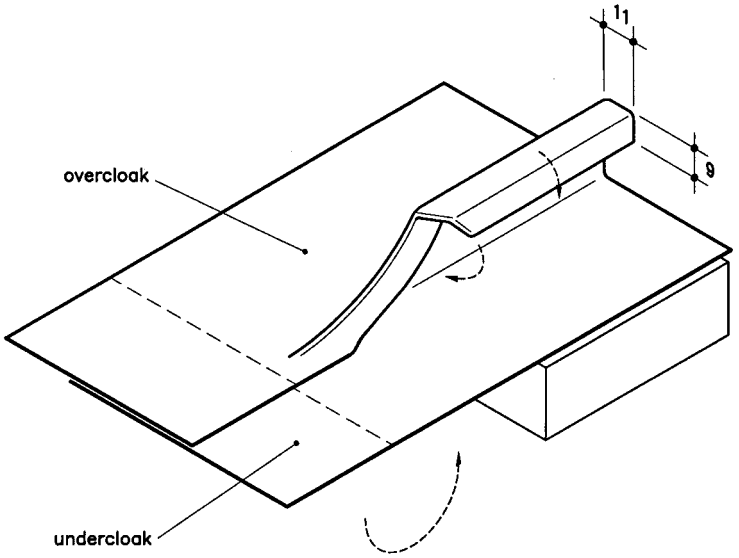


STAGE 2

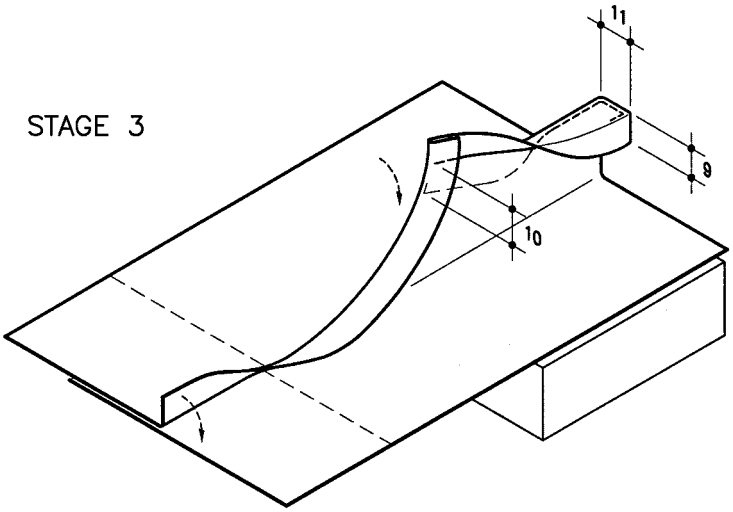
Stage 2
Bring copper sheets together.

Stage 4
Fold the standing seam copper over to regain the shape of the profiled tray, flattened out for Stage 1. Then fold the 9mm turn–down of the overcloak around the 10mm turn–out of the undercloak, using cranked seaming pliers.

STAGE 4

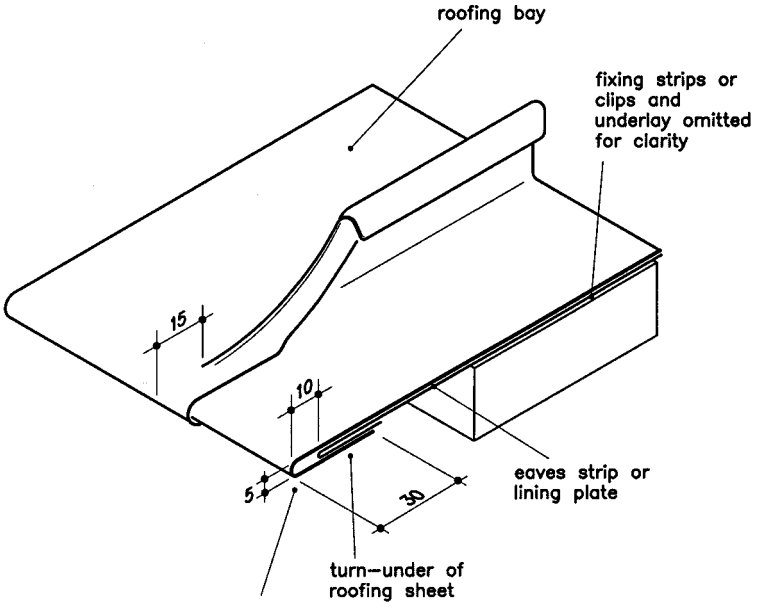


STAGE 3



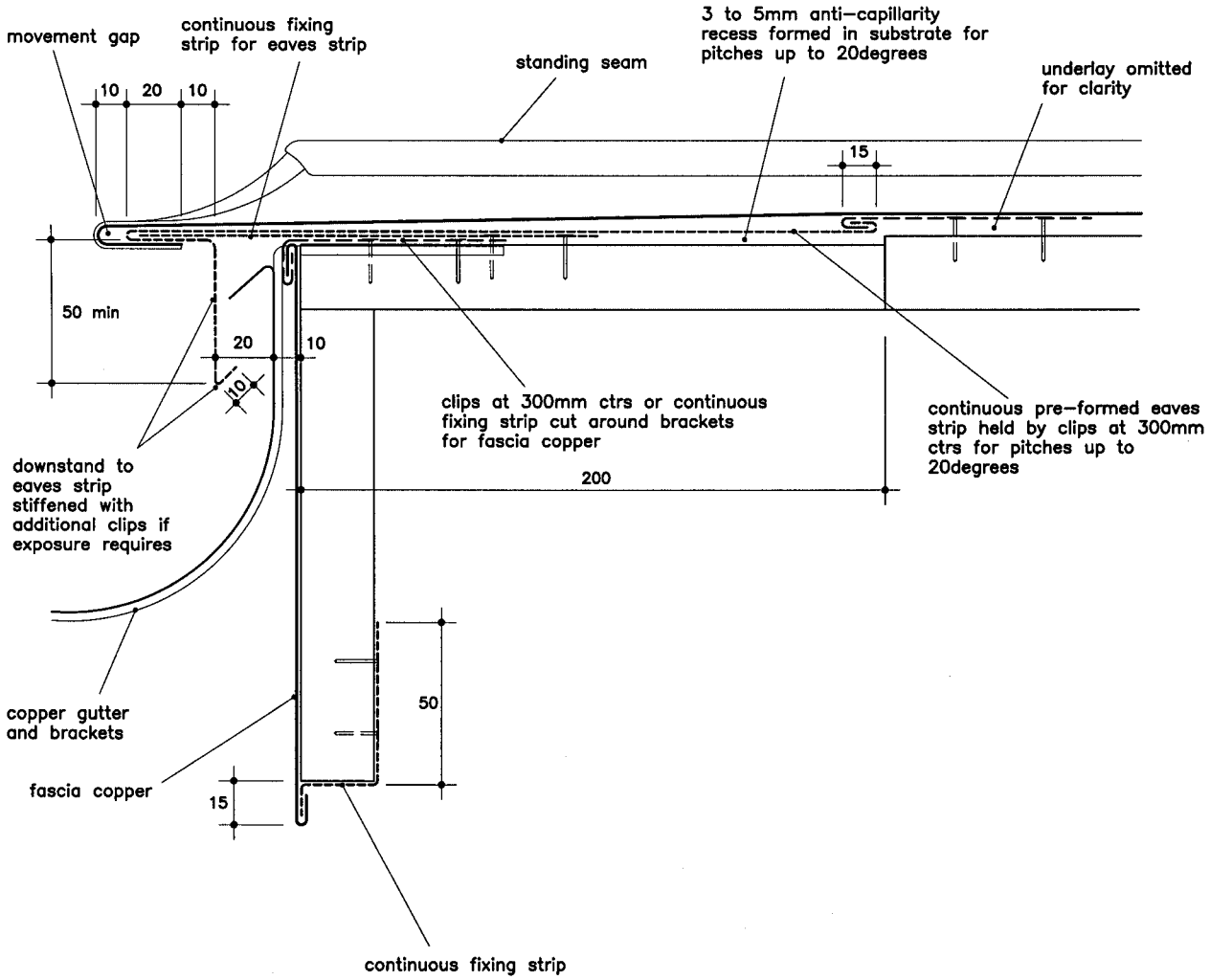
Stage 3
Work overcloak at curve over undercloak using a small mallet. The overcloak is then flattened back against the undercloak which is supported by a seaming iron.

STAGE 5



Stage 5
Dress seam down to complete the joint. Then fold the ends, now united, of the copper sheets around the projecting eaves strip or lining plate, according to detail. This will have been nailed in place beforehand. Eaves folders ('first and second turn') should be used. In Long Strip roofing a 10mm gap is left for movement.

Fig 4 Concave-form seam end



* Fascia copper can be simply nailed at the top edge as an alternative to clips.

Fig 4a
Seam end at copper clad fascia

TRADITIONAL	✓	LONG STRIP	✓

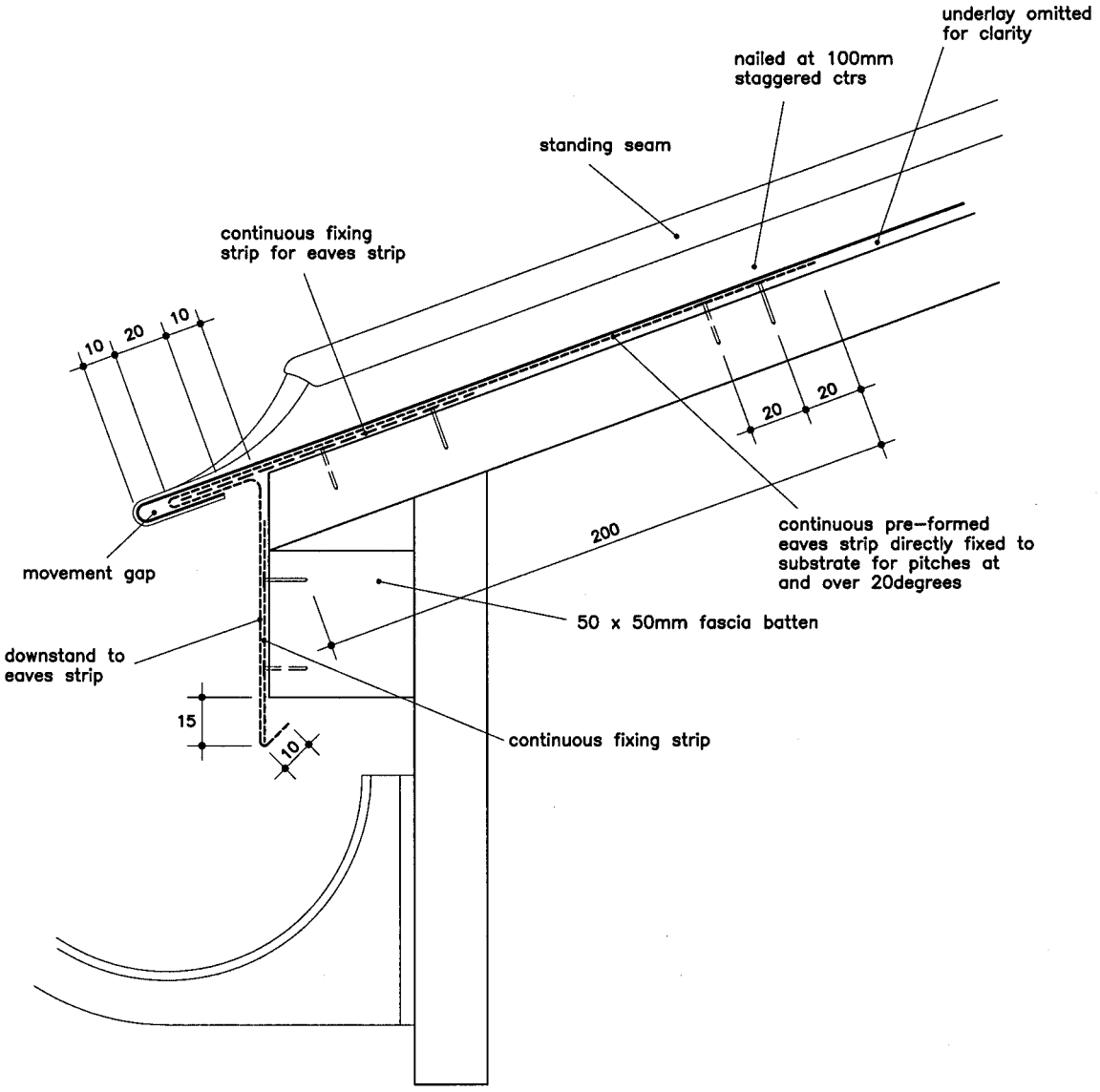


Fig 4b
Seam end at timber fascia
TRADITIONAL ✓ LONG STRIP ✓

Fig 4 Concave-form seam end

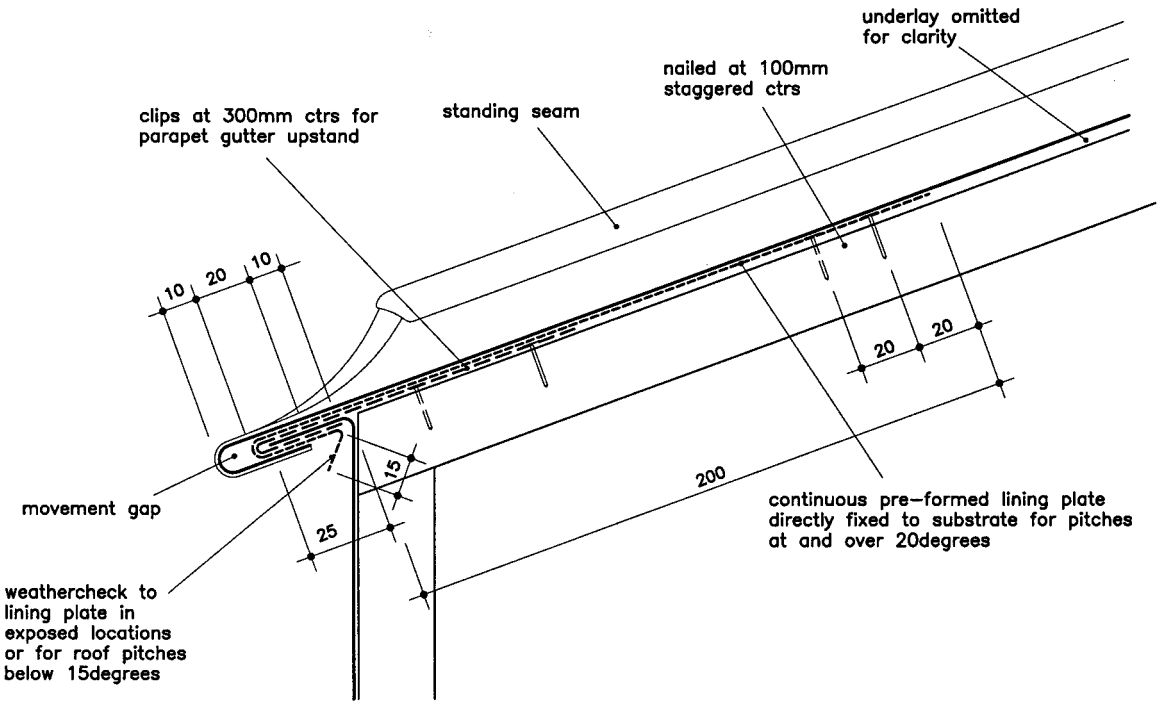


Fig 4c
Seam end at parapet gutter showing weathercheck to lining plate

TRADITIONAL	✓	LONG STRIP	✓

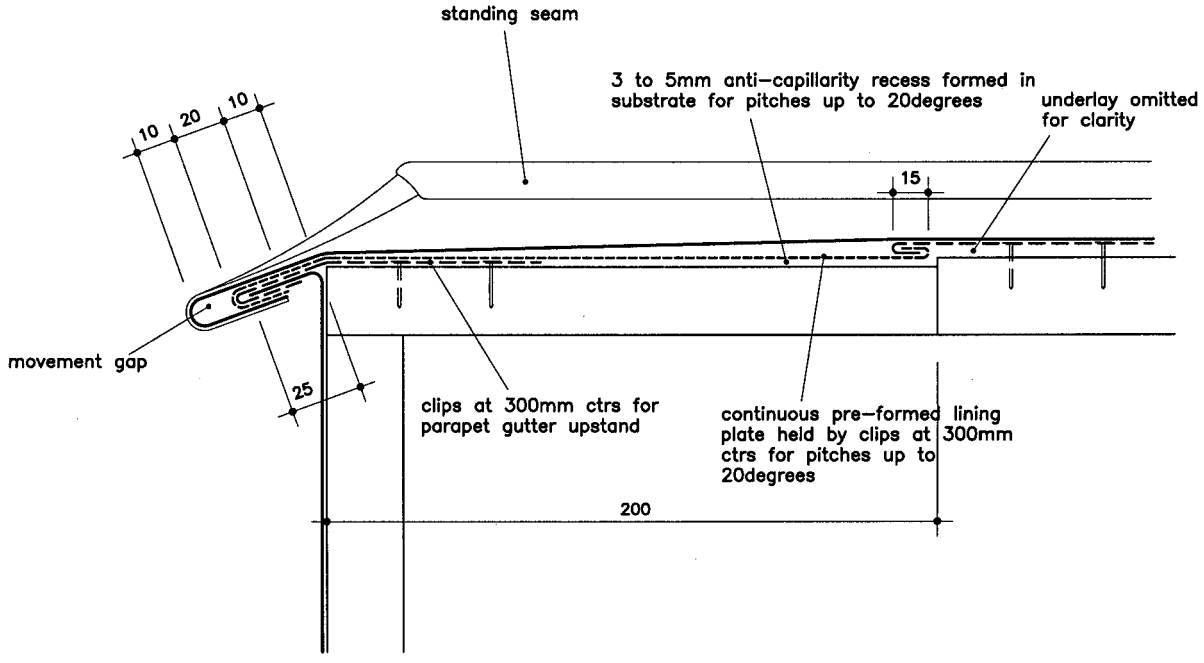


Fig 4d
Seam end at parapet gutter showing tilted edge

TRADITIONAL	✓	LONG STRIP	✓

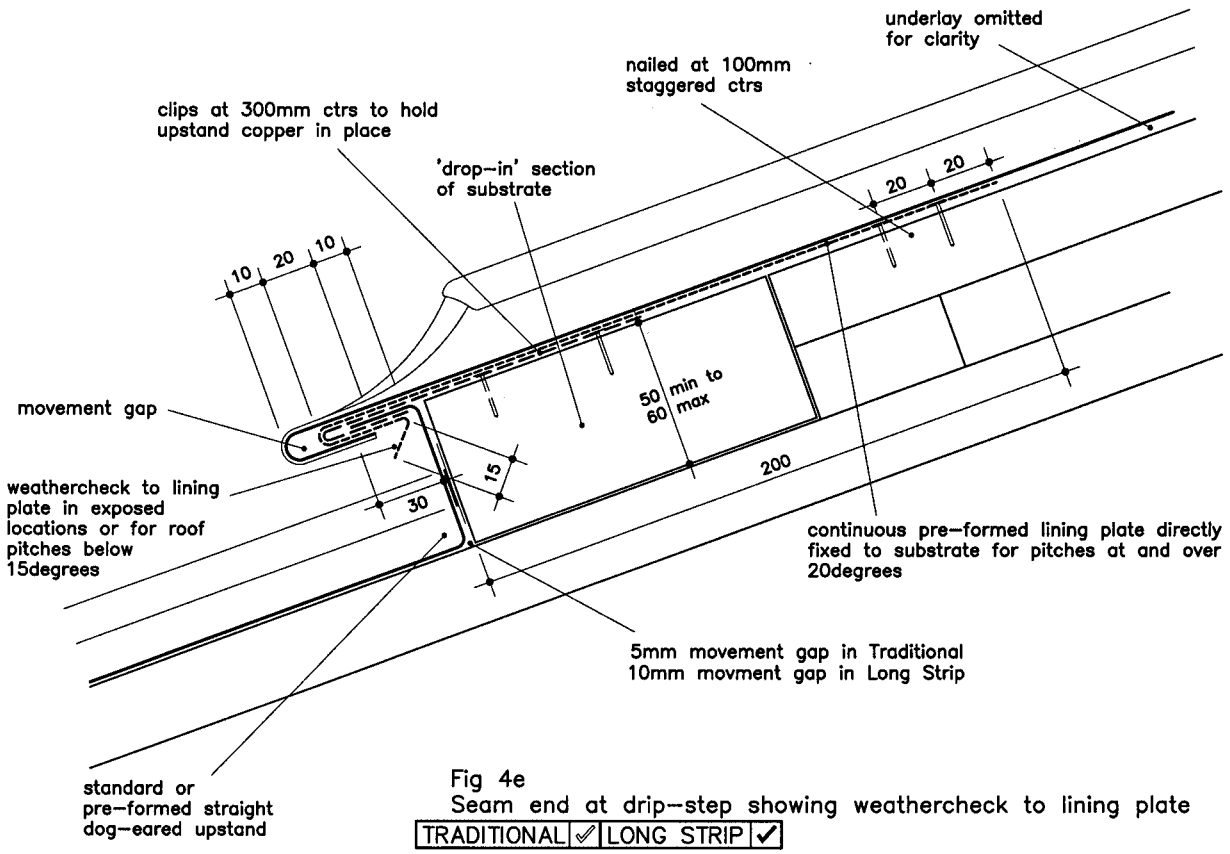


Fig 4e
Seam end at drip-step showing weathercheck to lining plate
TRADITIONAL ✓ LONG STRIP ✓

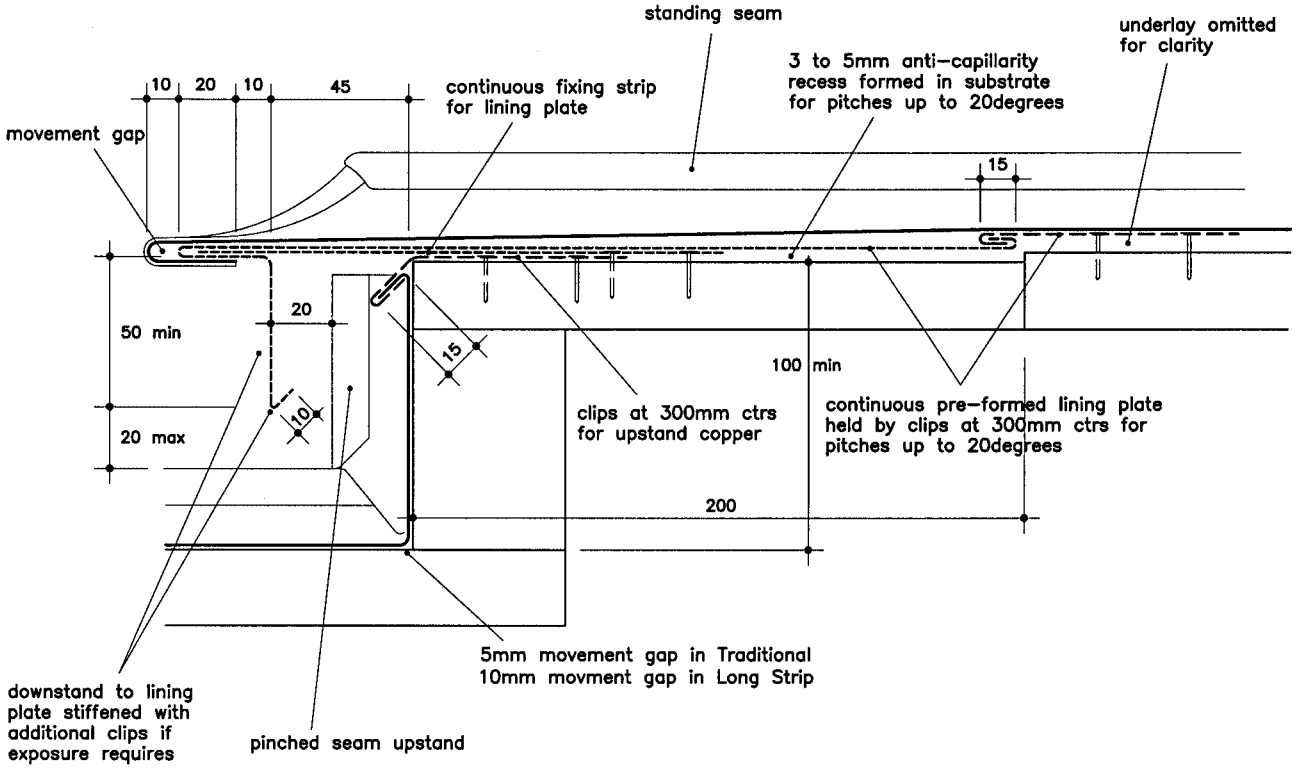


Fig 4f
Seam end at drip-step showing downstand to lining plate
TRADITIONAL ✓ LONG STRIP ✓

Fig 5 Chamfer-form seam end

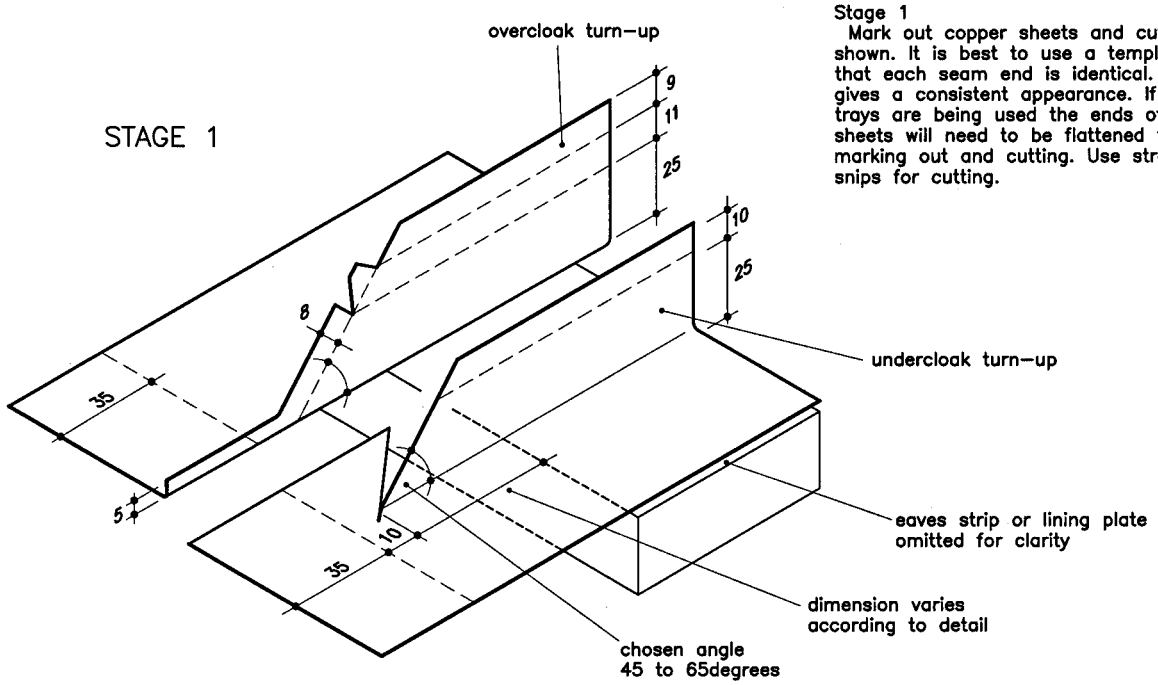
This is sometimes referred to as a 'splayed edge seam end'. The Concave-form and the Square-form seam ends (see Figs 4 and 6) are alternatives. It can be used to end angle standing seams in roofing. Also to end double-lock standing seams or angle standing seams in cladding.

The detail on its own is not weathertight. It also needs an eaves strip or lining plate underneath it, extending 130mm minimum up the roof slope (see Figs 26 and 28). This is shown on the preceding details (see Figs 4a, 4b, 4c, 4d, 4e and 4f). Joints in eaves strips or lining plates are either 150mm lapped joints or, more usually and preferably, 50mm lapped and sealed. They must be positioned at least 150mm from standing seams, but a convenient rule is to make such joints mid-bay.

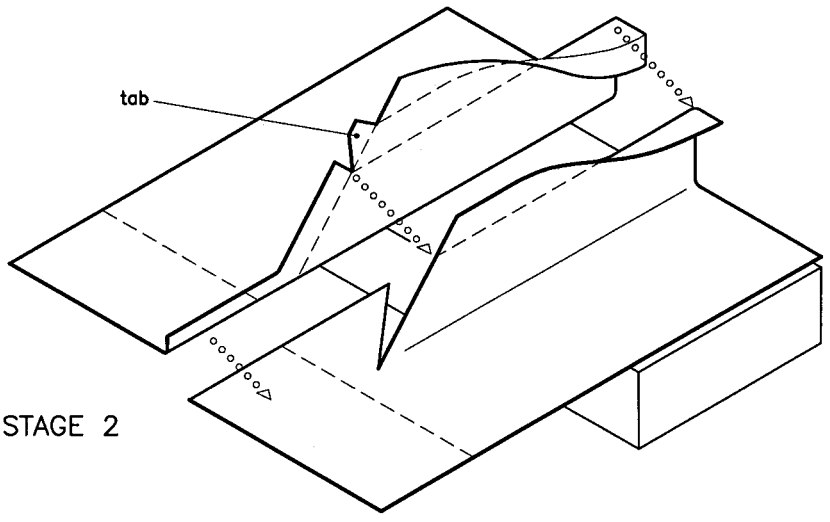
The eaves strip or lining plate should project sufficiently, so that the turn-under of the roofing sheet can engage it by 20mm and still have 10mm for movement. In Traditional roofing the 10mm movement gap is not required. In effect, in Long Strip roofing the roofing sheets are cut 40mm beyond the end of the eaves strip; and in Traditional roofing 20mm beyond.

Temper: half-hard preferably, although it does take more working at Stage 3 than softer copper.
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	✓



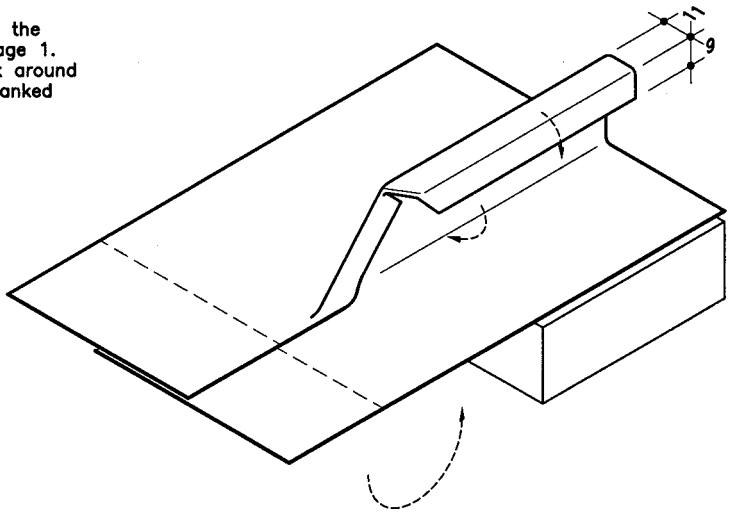
Stage 1
Mark out copper sheets and cut as shown. It is best to use a template so that each seam end is identical. This gives a consistent appearance. If profiled trays are being used the ends of the sheets will need to be flattened for marking out and cutting. Use straight snips for cutting.



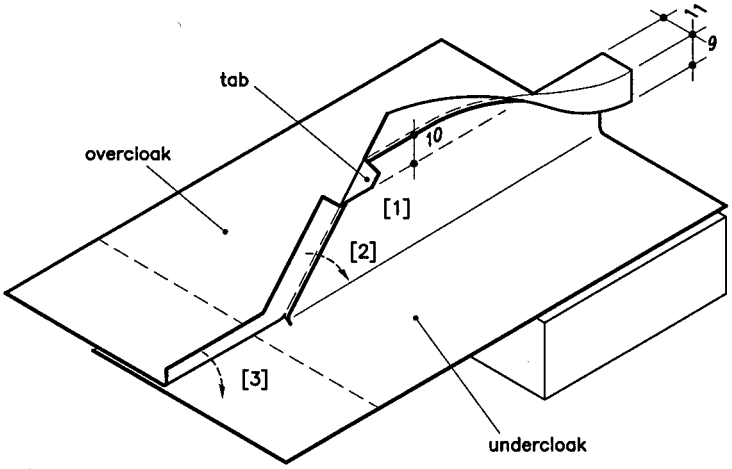
Stage 2
Bring copper sheets together.

Stage 4
Fold the standing seam copper over to regain the shape of the profiled tray, flattened out for Stage 1. Then fold the 9mm turn–down of the overcloak around the 10mm turn–out of the undercloak using cranked seaming pliers.

STAGE 4

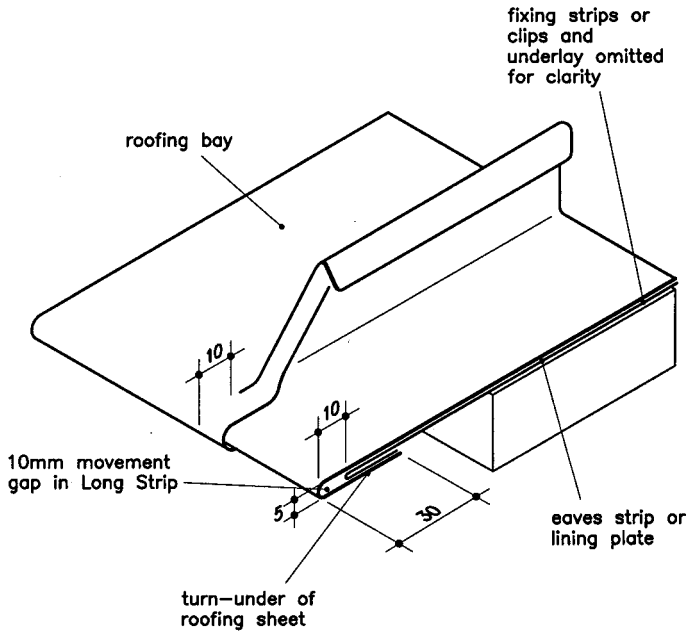


STAGE 3



Stage 3
Tuck the tab [1] at the top of the seam around the end of the undercloak. Work overcloak at the chamfer over undercloak [2] using a small mallet. The overcloak is then flattened back against the undercloak [3] which is supported by a seaming iron.

STAGE 5



Stage 5
Dress seam down to complete the joint. Then fold the ends, now united, of the copper sheets around the projecting eaves strip or lining plate, according to detail. This will have been nailed in place beforehand. Eaves folders ('first and second turn') should be used. In Long Strip roofing a 10mm gap is left for movement.

Fig 6 Square-form seam end

This seam end is the least preferred due to the small hole which occurs at the top of the seam at the very end. This has no effect on its weathertightness because eaves strips or lining plates are always to be provided. It is a matter of appearance. The Concave-form and the Chamfer-form seam ends (see Figs 4 and 5) are alternatives. It can be used to end angle standing seams in roofing. Also to end double-lock standing seams or angle standing seams in cladding.

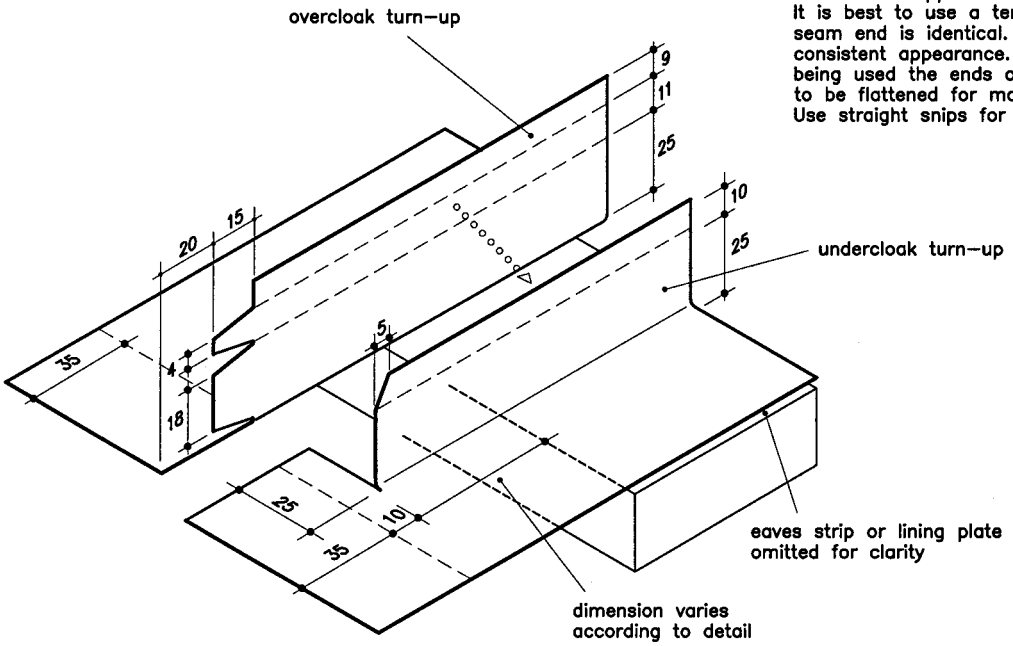
The detail on its own is not weathertight. It also needs an eaves strip or lining plate underneath it, extending 130mm minimum up the roof slope (see Figs 26 and 28). This is shown on the preceding details (see Figs 4a, 4b, 4c, 4d, 4e and 4f). Joints in eaves strips or lining plates are either 150mm lapped joints or, more usually and preferably, 50mm lapped and sealed. They must be positioned at least 150mm from standing seams but a convenient rule is to make each joint mid-bay.

The eaves strip or lining plate should project sufficiently, so that the turn-under of the roofing sheet can engage it by 20mm and still have 10mm for movement. In Traditional roofing the 10mm movement gap is not required. In effect, in Long Strip roofing the roofing sheets are cut 40mm beyond the end of the eaves strip; and in Traditional roofing 20mm beyond.

Temper: half-hard
Thickness: 0.6mm or 0.7mm

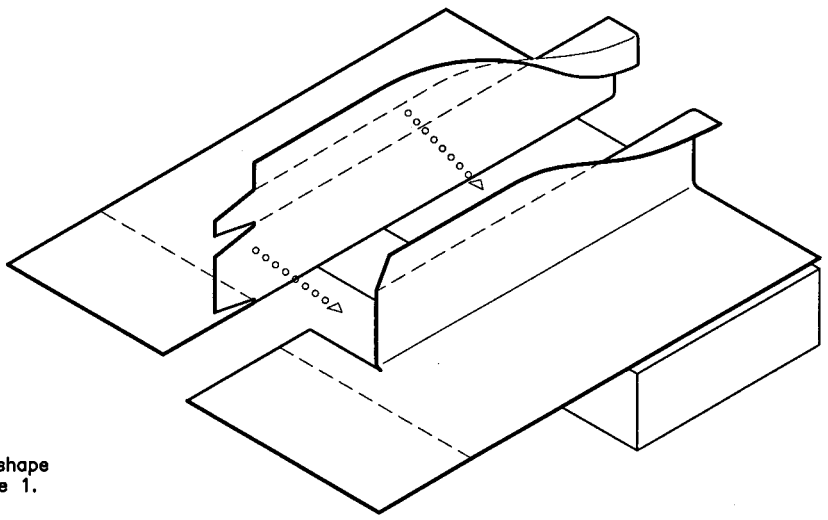
TRADITIONAL	✓	LONG STRIP	✓

Stage 1
Mark out copper sheets and cut as shown. It is best to use a template so that each seam end is identical. This gives a consistent appearance. If profiled trays are being used the ends of the sheets will need to be flattened for marking out and cutting. Use straight snips for cutting.



STAGE 1

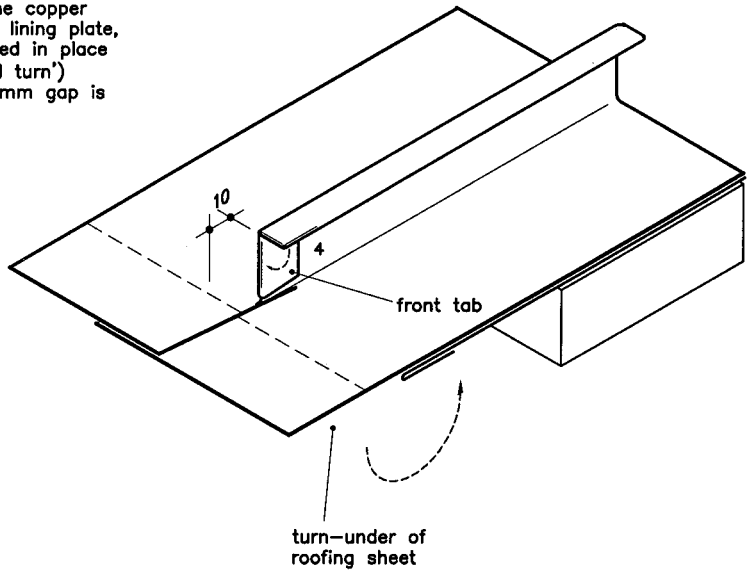
STAGE 2



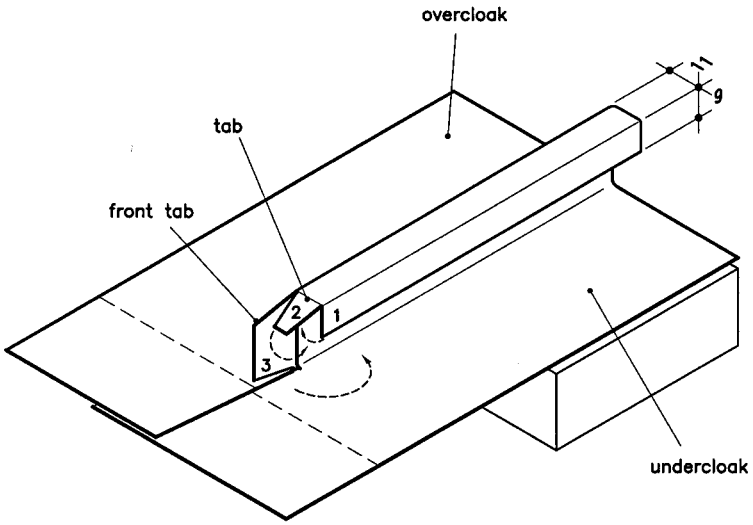
Stage 2
Bring copper sheets together folding the standing seam copper over to regain the shape of the profiled tray, flattened out for Stage 1.

Stage 4
Dress turn–out of seam [4] down to complete the joint. Then fold the ends, now united, of the copper sheets around the projecting eaves strip or lining plate, according to detail. This will have been nailed in place beforehand. Eaves folders ('first and second turn') should be used. In Long Strip roofing a 10mm gap is left for movement.

STAGE 4

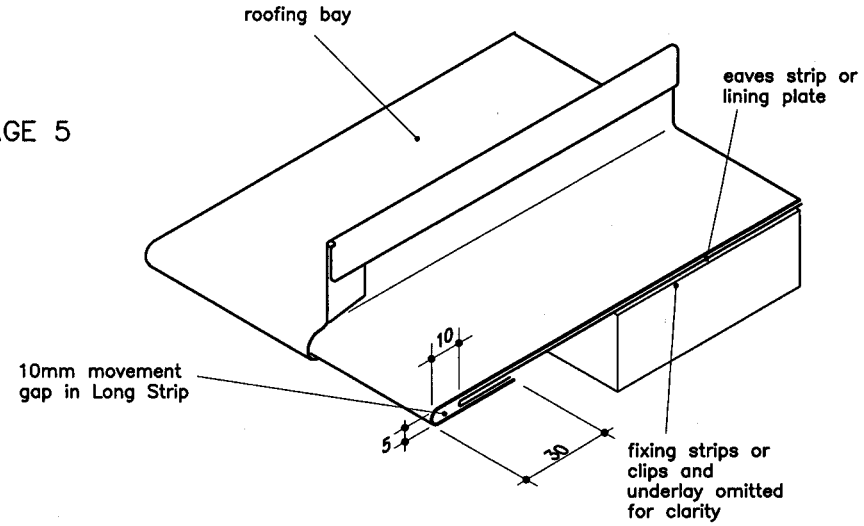


STAGE 3



Stage 3
Fold the 9mm turn–down [1] of the overcloak around the 10mm turn–out of the undercloak using cranked seaming pliers. Tuck the tab [2] at the top of the seam around the end of the overcloak/undercloak. Then fold the front tab [3] around the end of the overcloak/undercloak.

STAGE 5



Stage 5
The seam end is complete.

Fig 7 Sweep standing seam upstand

Although possible in theory this detail is rarely used for long bays, because, as can be seen from Stage 1, the sheet edges require cutting away for almost their entire length to form the sweep.

It is not easy to make the upstand less than 150mm. This means the detail can only be used for abutments (see Fig 7a). For lesser upstands and drip-steps the Pinched seam or Straight dog-eared upstands (see Figs 8 and 9) are preferred. These are generally easier and quicker to form.

Refer to Table E (p8) and J (p10) for bay widths. Forming the seam takes up about 125mm.

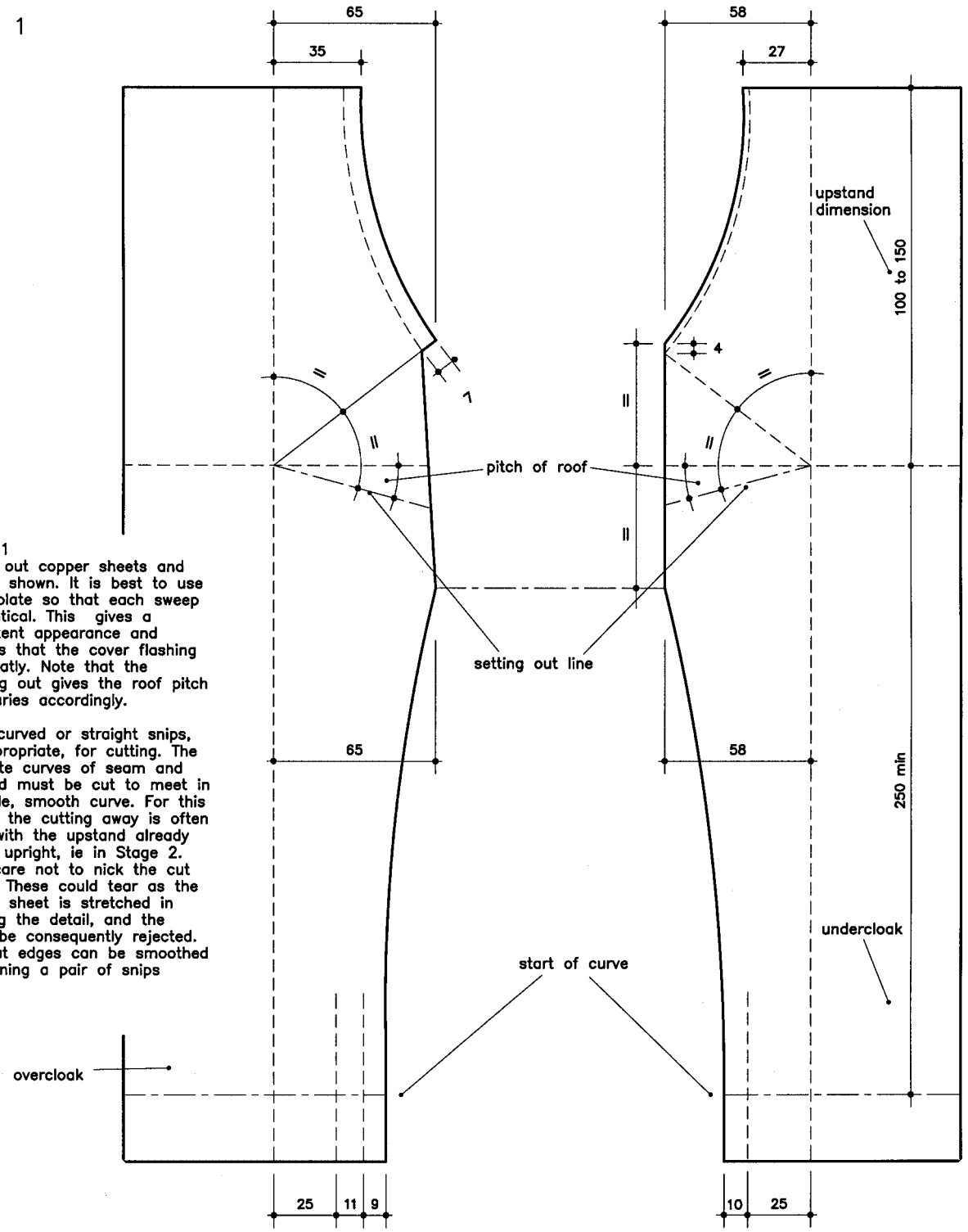
Old manuals show the upstand seam folded over. This restricts lateral movement and is no longer regarded as good practice in either Traditional or Long Strip roofing.

The Sweep standing seam should not be confused with the 'graduated standing seam' used at external corners (see Fig 18). Here only the undercloak is formed with a dog-ear fold. The overcloak is merely turned up and cut to a swept shape.

Temper: easier in soft or quarter-hard, but can be done in half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	✓

STAGE 1



Stage 1
Mark out copper sheets and cut as shown. It is best to use a template so that each sweep is identical. This gives a consistent appearance and ensures that the cover flashing fits neatly. Note that the marking out gives the roof pitch and varies accordingly.

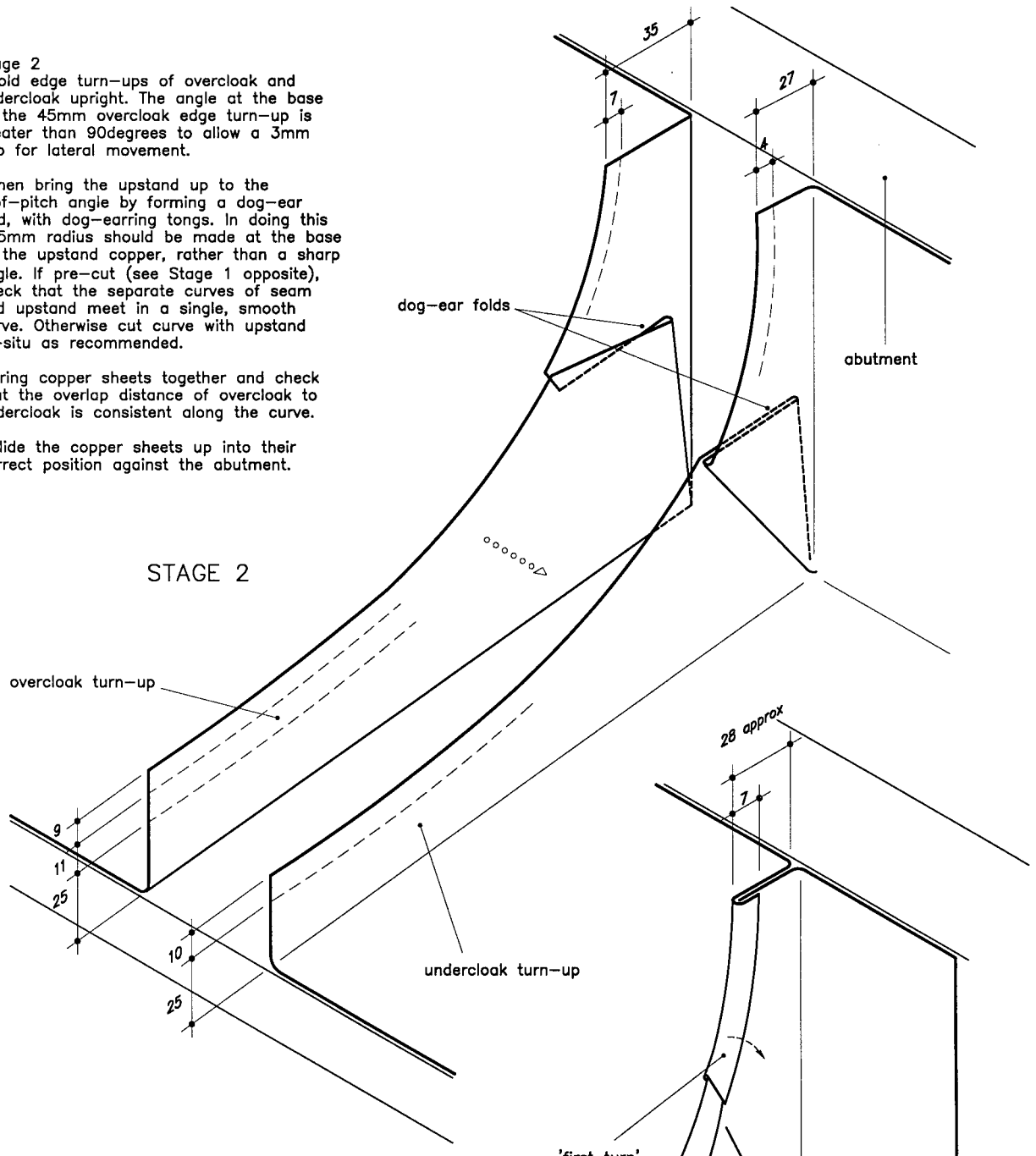
Use curved or straight snips, as appropriate, for cutting. The separate curves of seam and upstand must be cut to meet in a single, smooth curve. For this reason the cutting away is often done with the upstand already folded upright, ie in Stage 2. Take care not to nick the cut edges. These could tear as the copper sheet is stretched in forming the detail, and the sheet be consequently rejected. The cut edges can be smoothed by running a pair of snips along.

Stage 2
Fold edge turn–ups of overcloak and undercloak upright. The angle at the base of the 45mm overcloak edge turn–up is greater than 90degrees to allow a 3mm gap for lateral movement.

Then bring the upstand up to the roof–pitch angle by forming a dog–ear fold, with dog–earring tongs. In doing this a 5mm radius should be made at the base of the upstand copper, rather than a sharp angle. If pre–cut (see Stage 1 opposite), check that the separate curves of seam and upstand meet in a single, smooth curve. Otherwise cut curve with upstand in–situ as recommended.

Bring copper sheets together and check that the overlap distance of overcloak to undercloak is consistent along the curve.

Slide the copper sheets up into their correct position against the abutment.



Stage 3
Cobble the overcloak over the undercloak using a sweep hammer against a sweep seaming iron. Then flatten the overcloak against the undercloak. This completes the 'first turn'.

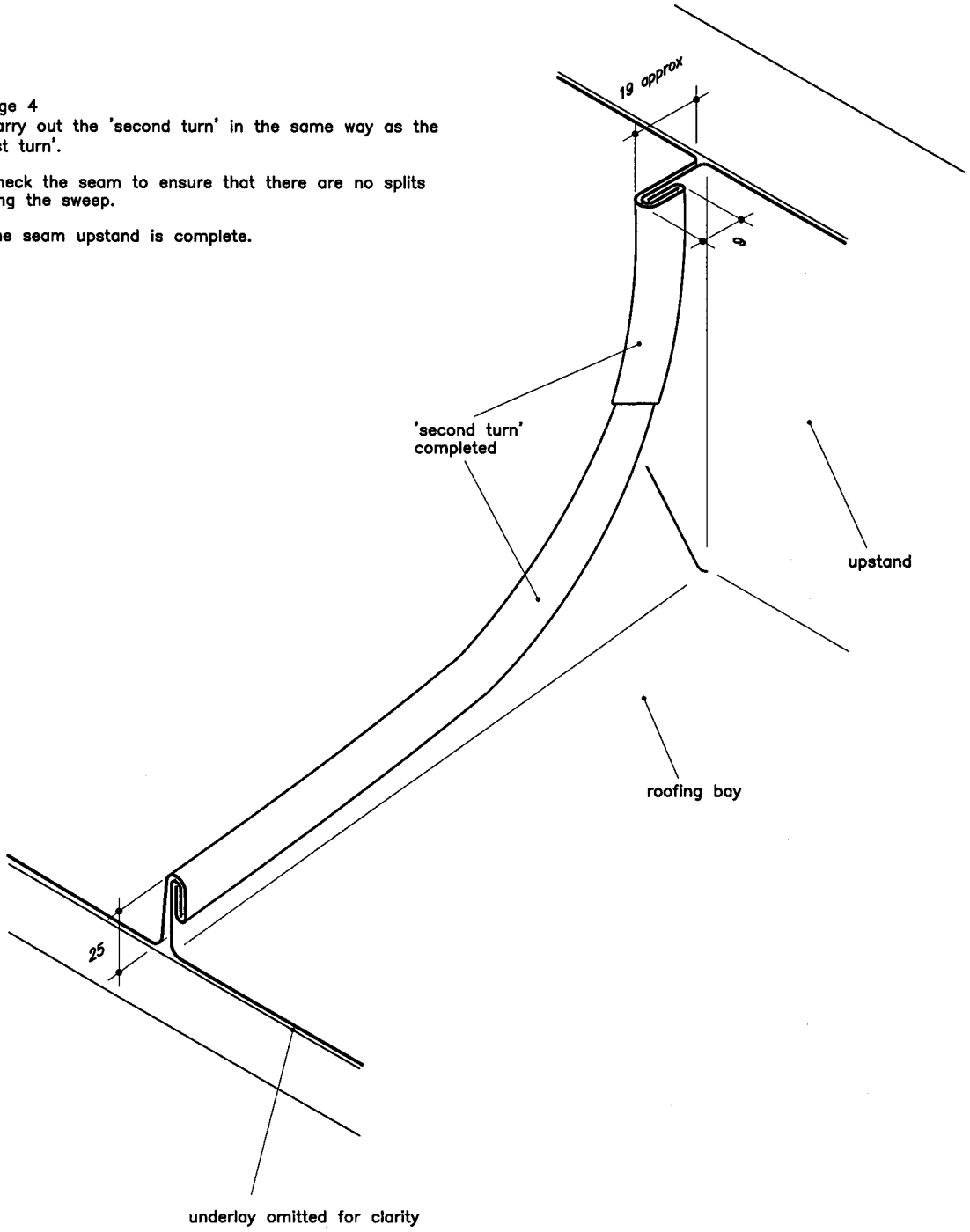
Fig 7 Sweep standing seam upstand

STAGE 4

Stage 4
Carry out the 'second turn' in the same way as the 'first turn'.

Check the seam to ensure that there are no splits along the sweep.

The seam upstand is complete.



* The continuous fixing strip is fixed to the brickwork with 32mm No8 round head screws at 300mm centres, together with washers and plugged.
* Joints in the continuous fixing strip are butt jointed.
* Joints in cover flashing should be at 2m maximum centres. They can be made with lapped joints: either 150mm or 50mm with a check and sealed; or with single– or double–lock welts, according to exposure (see Figs 12b, 11a, 11b and 11c). Double–lock welts will be difficult to form in this situation and should be pre–formed.
* The turn–up of the cover flashing engaging the fixing strip is cut away at 45degrees at joints in the run. Similarly at the check edge in the brick course.

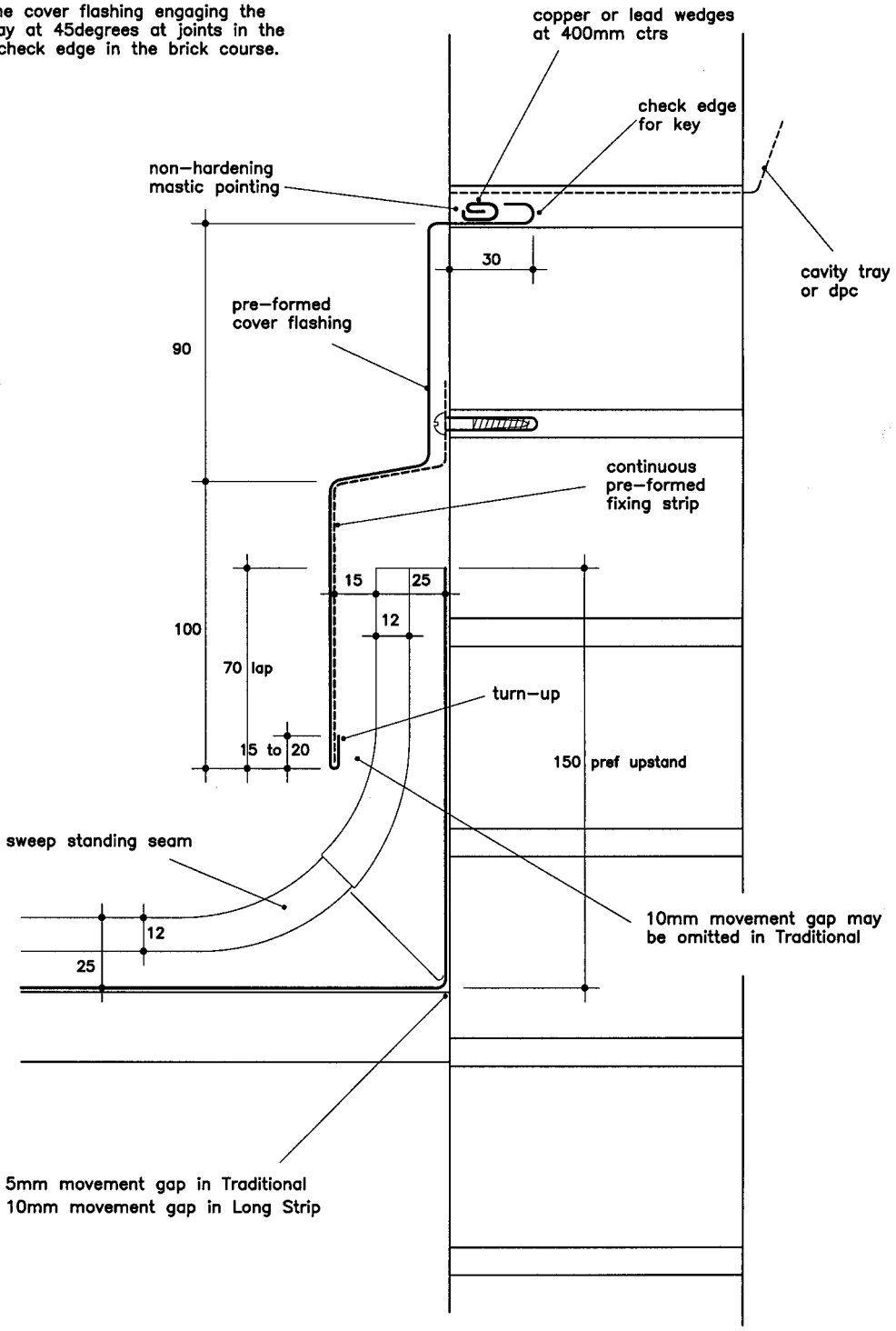


Fig 7a
Vertical upstand with horizontal cover flashing to brickwork

TRADITIONAL	✓	LONG STRIP	✓

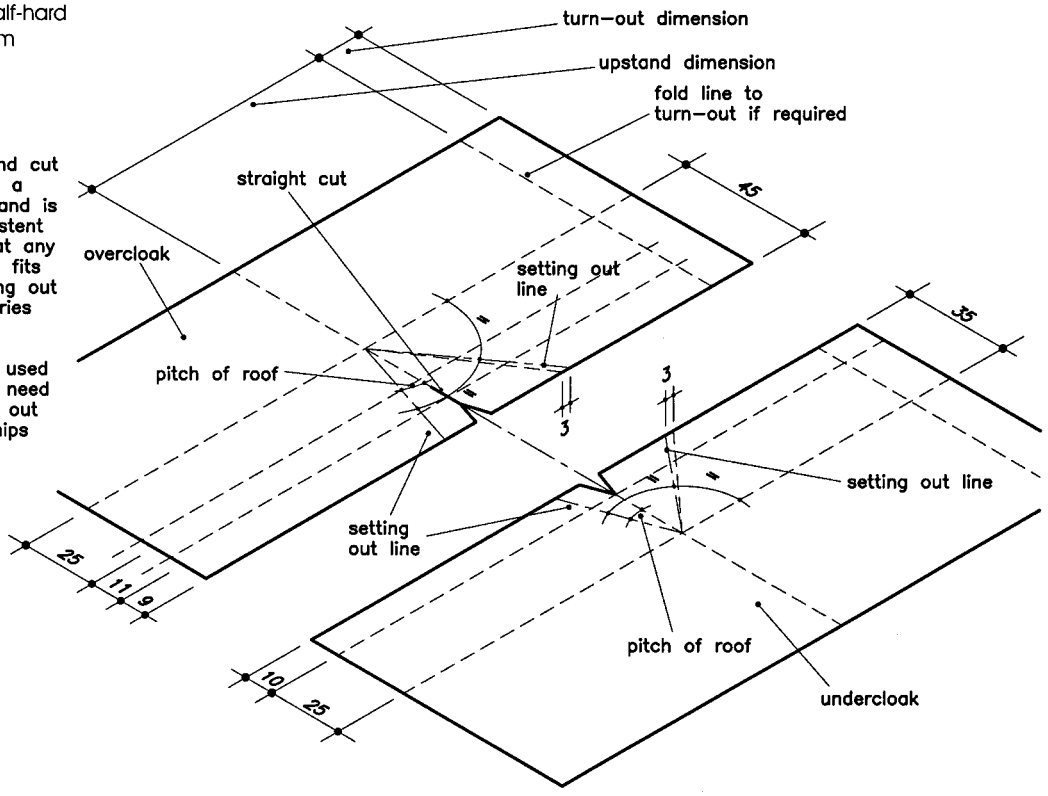
Fig 8 Pinched seam upstand

This is the preferred detail for abutments and ventilated ridges (see Figs 12, 13 and 20). It can also be used for drip-steps with a minimum upstand of 100mm (see Fig 4f). The maximum upstand height is only restricted by handling considerations, say 350mm.

As all work to complete the joint can be done in-situ against the drip-step or abutment, it is an easily formed and therefore quick detail.

TRADITIONAL ✓ LONG STRIP ✓

Temper: soft, quarter- or half-hard
Thickness: 0.6mm or 0.7mm

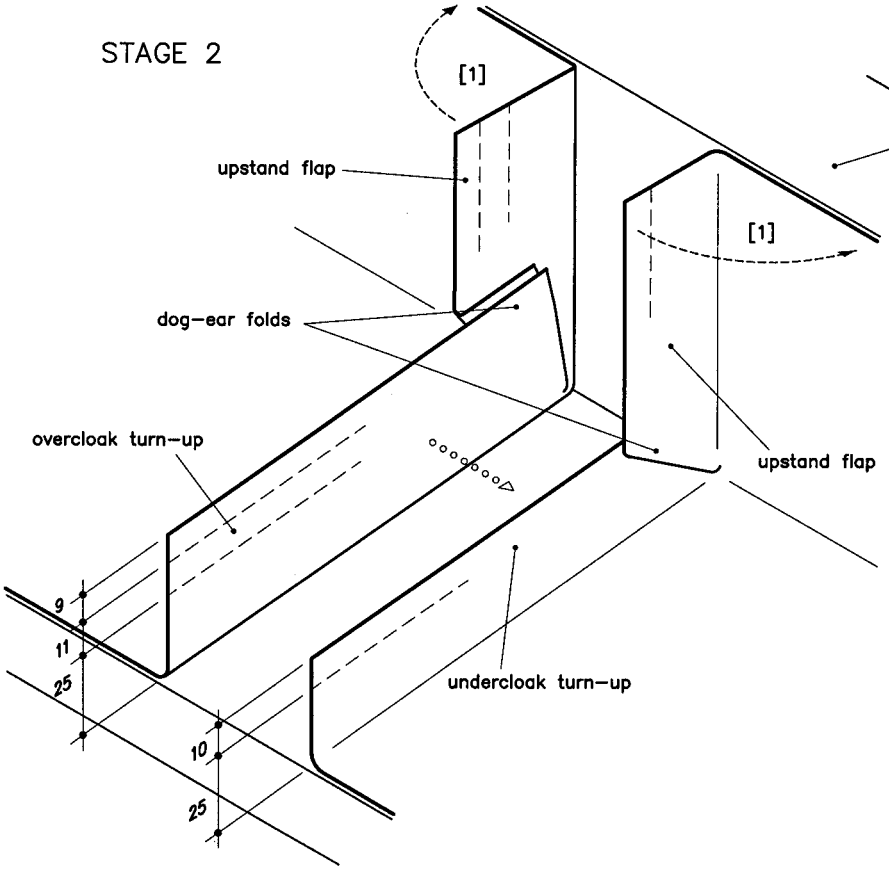


STAGE 1

Stage 1
Mark out copper sheets and cut as shown. It is best to use a template so that each upstand is identical. This gives a consistent appearance and ensures that any cover flashing or downstand fits neatly. Note that the marking out gives the roof pitch and varies accordingly.

If profiled trays are being used the ends of the sheets will need to be flattened for marking out and cutting. Use straight snips for cutting.

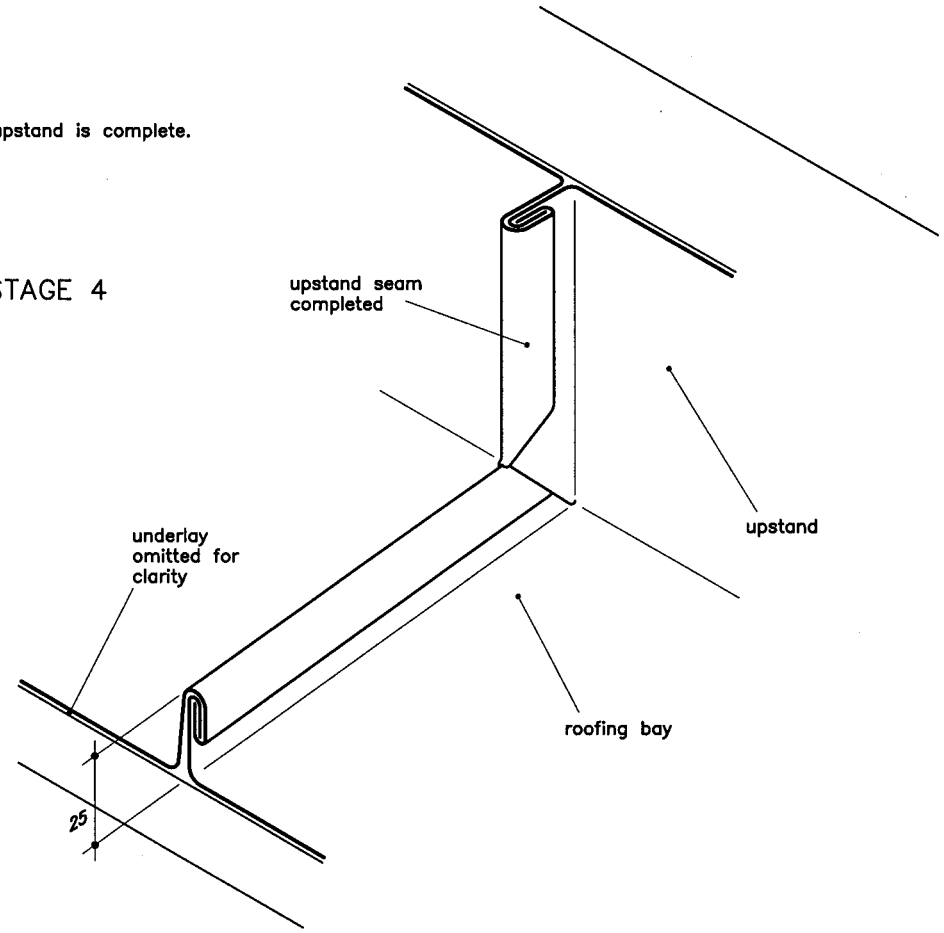
STAGE 2

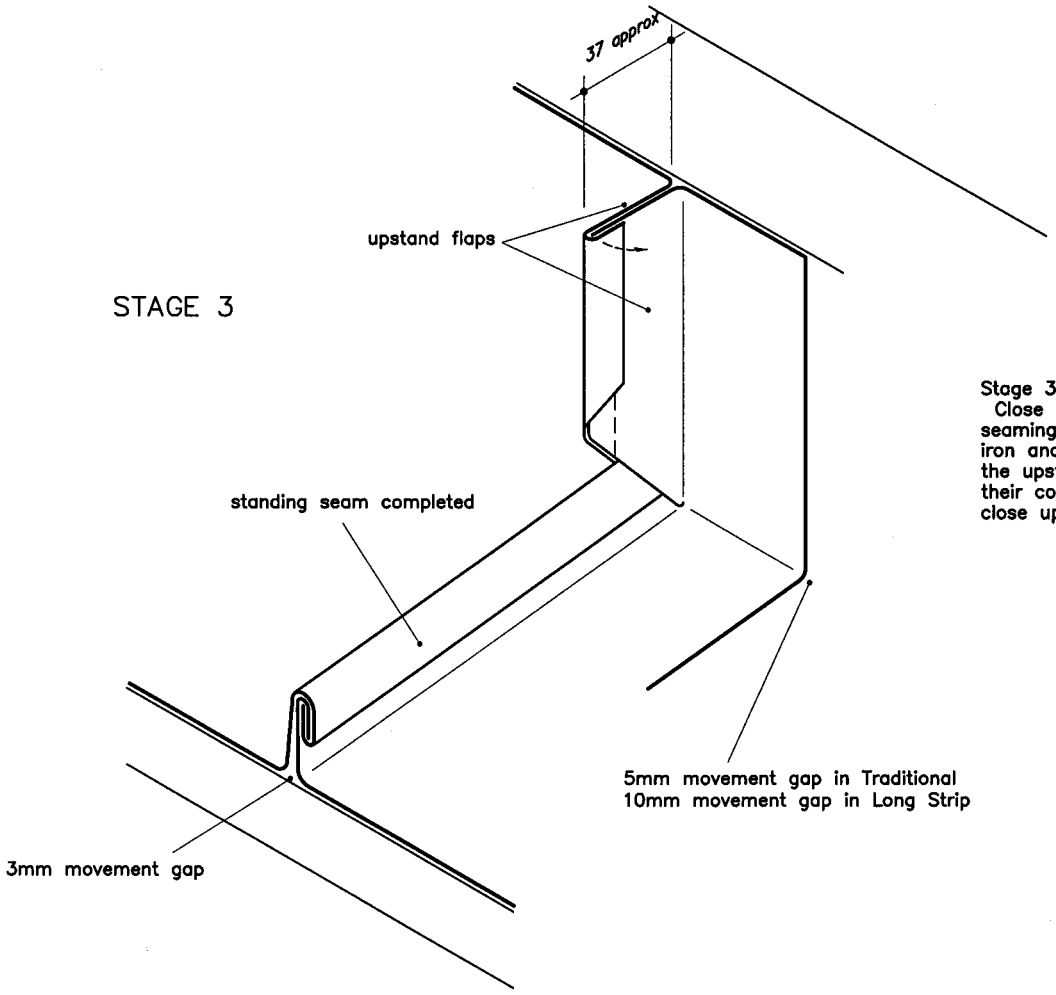


Stage 2
Fold edge turn–ups of overcloak and undercloak upright. The angle at the base of the 45mm overcloak edge turn–up is greater than 90degrees to allow a 3mm gap for lateral movement. Then bring the upstand up to the roof–pitch angle by forming a dog–ear fold, with dog–earring pliers. In doing this a slight radius should be made at the base of the upstand copper, rather than a sharp angle.

Slide the copper sheets up into their correct position against the drip–step or abutment. The upstand flaps [1] are then flattened back temporarily against the drip–step or abutment to allow the roofing seam to be finished.

Stage 4
The seam upstand is complete.





Stage 3
Close up roofing seam using seaming pliers or a seaming iron and a mallet. Then fold the upstand flaps forward to their correct position and close up the upstand seam.

Fig 9 Standard straight dog-eared upstand

Sometimes known as the 'Manchester fold', this is the preferred detail for drip-steps, batten ridges and batten hips. Because access behind the upstand is needed to complete the joint, a 'drop-in' section of substrate, say 120mm wide, is required at drip-steps. Similarly, the battens for ridges and hips are post-fixed.

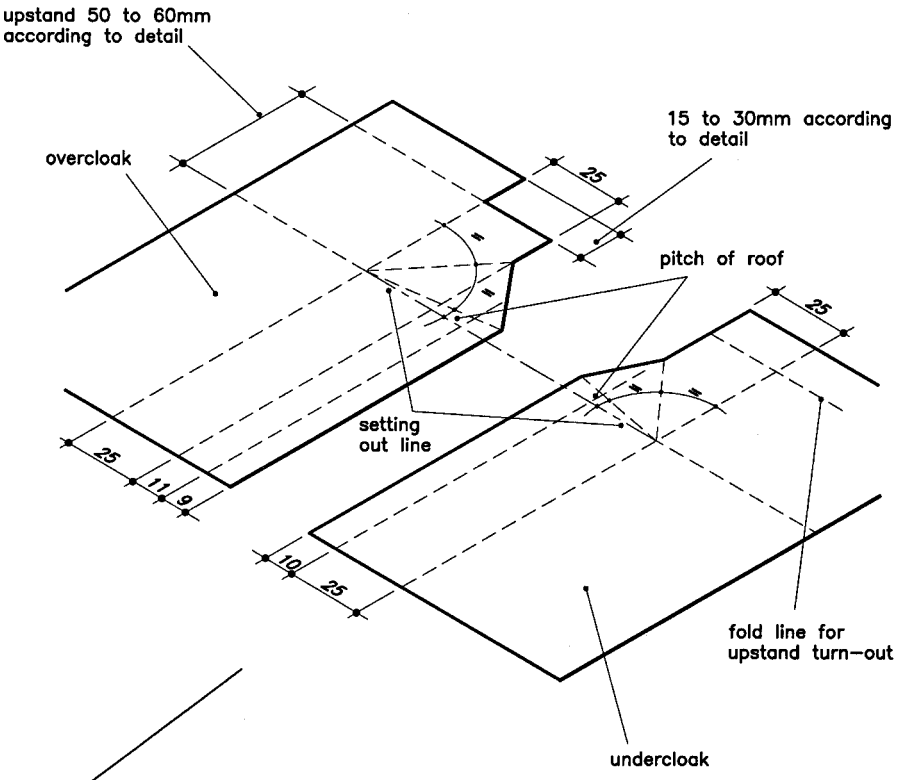
The upstand height is limited to 60mm maximum. This is to limit the exposure of the vertical joint which, simply being a fold, is not entirely weathertight.

Temper: soft, quarter- or half-hard
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

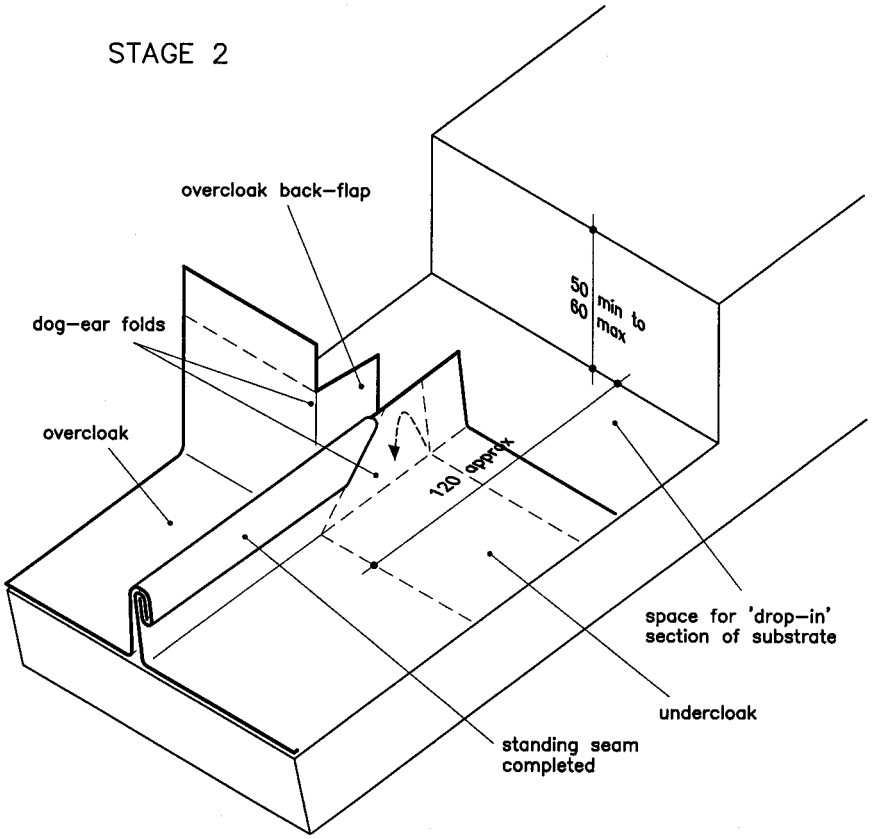
Stage 1
Mark out copper sheets and cut as shown. It is best to use a template so that each upstand is identical. This gives a consistent appearance and ensures that any cover flashing fits neatly. Note that the marking out gives the roof pitch and varies accordingly.

If profiled trays are being used the ends of the sheets will need to be flattened for marking out and cutting. Use straight snips for cutting.



STAGE 1

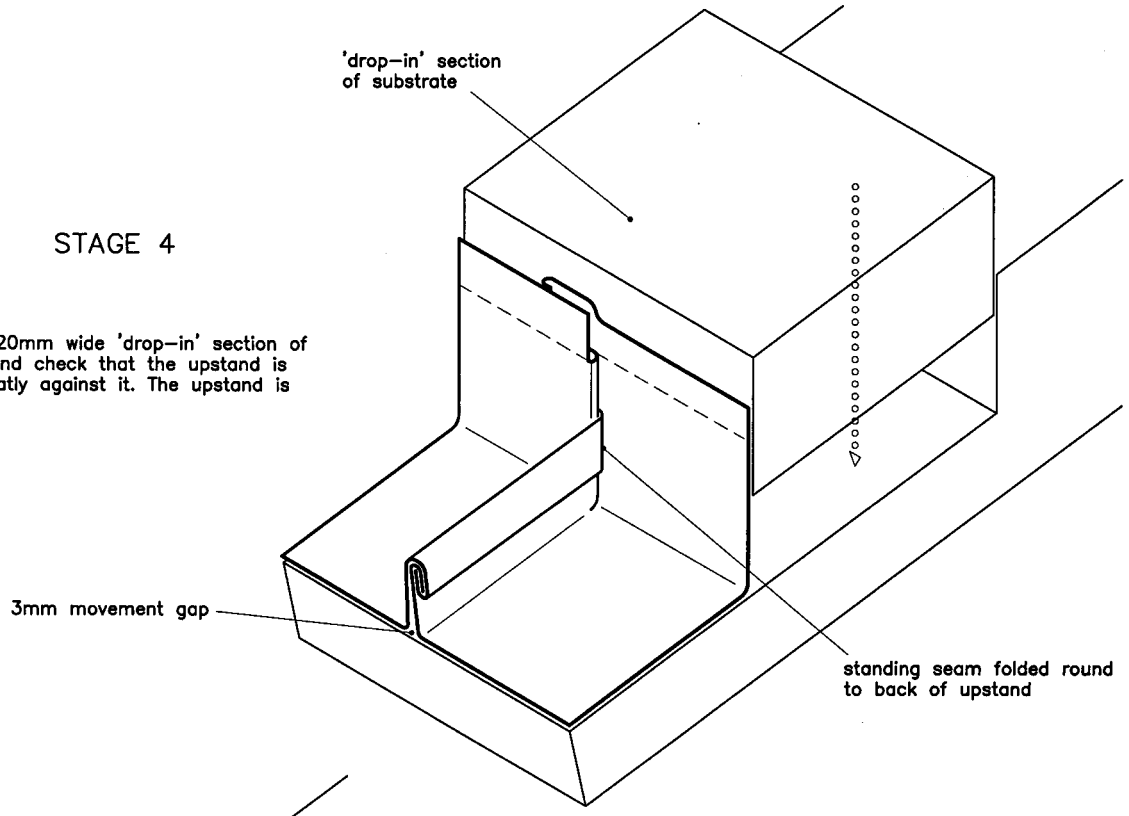
STAGE 2



Stage 2
Because access behind the upstand is needed to complete the joint, a 'drop–in' section of substrate, say 120mm wide, is required. For this reason the copper sheets can be placed in their correct position before working.

Fold edge turn–ups of overcloak and undercloak upright. The angle at the base of the 45mm overcloak edge turn–up is greater than 90degrees to allow a 3mm gap for lateral movement. Close up roofing seam using seaming pliers or a seaming iron and a mallet.

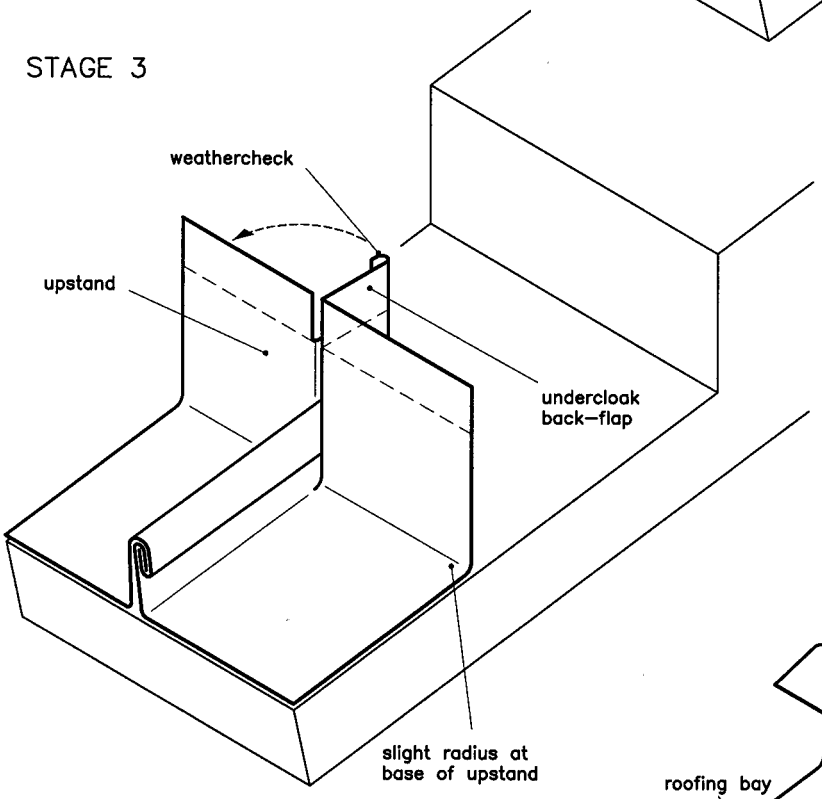
Then bring the overcloak upstand up to the roof–pitch angle with straight flat–nosed pliers, thus forming a dog–ear fold. In doing this a slight radius should be made at the base of the upstand copper, rather than a sharp angle. The folding creates a back–flap standing in line with the seam.



STAGE 4

Stage 4
Fix the 120mm wide 'drop–in' section of substrate and check that the upstand is dressed neatly against it. The upstand is complete.

STAGE 3



Stage 3
Now bring the undercloak upstand up to match the other, also with a dog–ear fold.

For additional weathertightness, a small weathercheck can be provided by cobbling round the back edge of the undercloak back–flap.

Both back–flaps are turned together against the back of the copper upstand, using small cranked seaming pliers. They are then dressed tight against the upstand with a mallet or hammer.

STAGE 5

Stage 5
Form the turn–out to receive clips, lining plate, roofing copper to upper bay, capping etc, according to detail (see Figs 4e, 16, 16a, 19, 21, 23 and 23a).

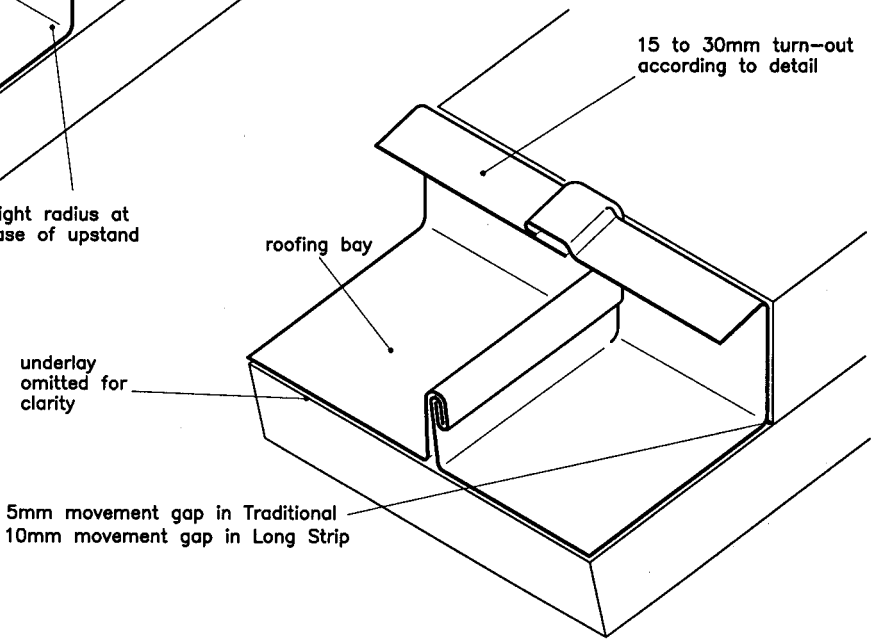


Fig 10 Pre-formed straight dog-eared upstand

This is a variant of the standard Straight dog-eared upstand (see Fig 9). It is an easy detail to form and allows most of the folding to be done in the workshop. It is a useful detail for drip-steps, batten ridges and batten hips.

The seam does not carry round the back of the upstand as in the standard version. This makes the detail less weathertight and for this reason is not recommended for roof pitches below 25degrees.

Unlike the standard version, access is not needed behind the upstand to complete the joint, so no 'drop-in' section of substrate or batten is required.

The upstand height is limited to 60mm maximum. This is to limit the exposure of the vertical joint.

As the trays will usually have been preformed in the workshop, the profiling machine automatically provides the 3mm gap needed to allow for lateral movement in the copper sheet.

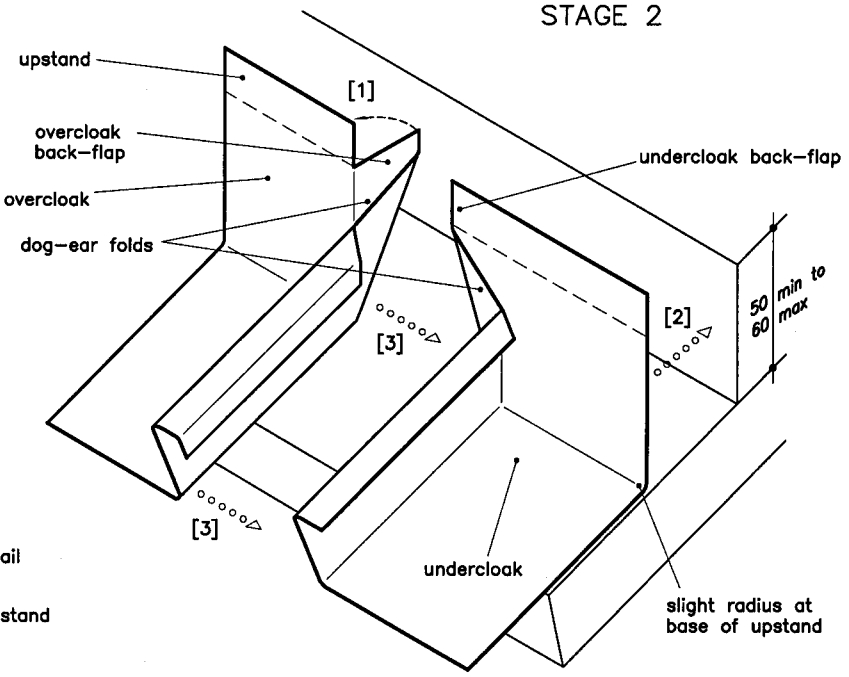
TRADITIONAL	✓	LONG STRIP	✓

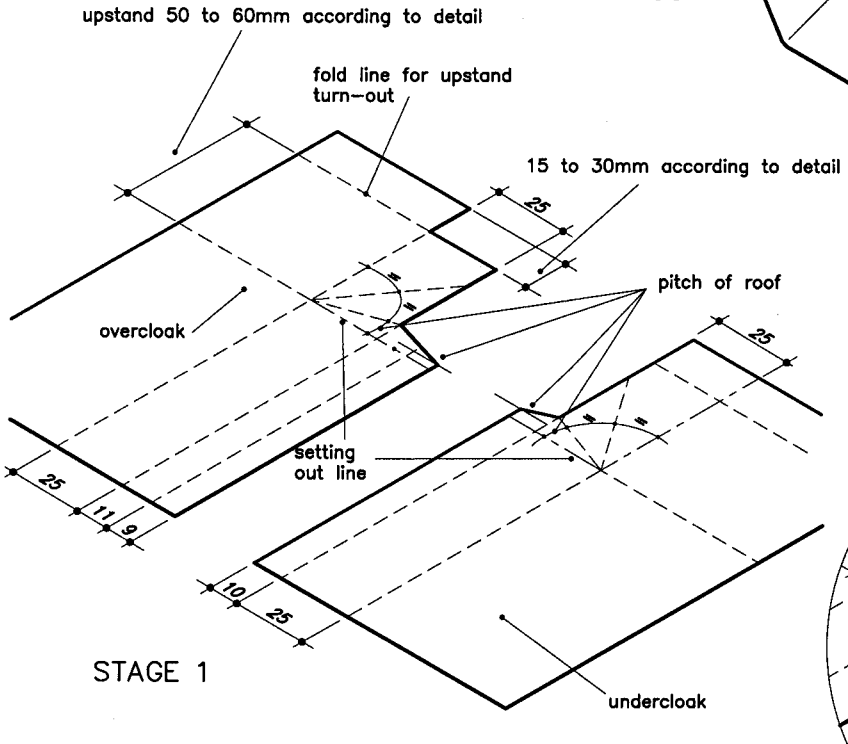
Temper: soft, quarter- or half-hard
Thickness: 0.6mm or 0.7mm

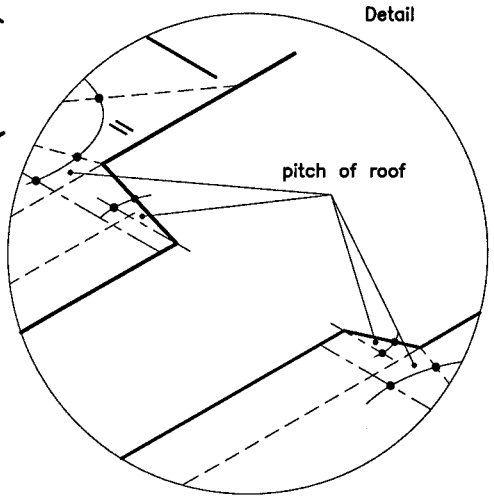
Stage 2
With the roofing sheets in position, bring the overcloak upstand up to the roof–pitch angle with straight flat–nosed pliers, thus forming a dog–ear fold. In doing this a slight radius should be made at the base of the upstand copper, rather than a sharp angle. The folding creates a back–flap standing in line with the seam. Then fold the back–flap round behind the upstand using pliers and dress tight against an 'H' seaming iron with a mallet [1].

Now bring the undercloak upstand up to match the other, also with a dog–ear fold. The back–flap for the undercloak automatically forms in line with the upstand.

Slide the undercloak into its correct position against the step [2]. Engage the overcloak with the undercloak [3] and close up roofing seam using seaming pliers or a seaming iron and a mallet.



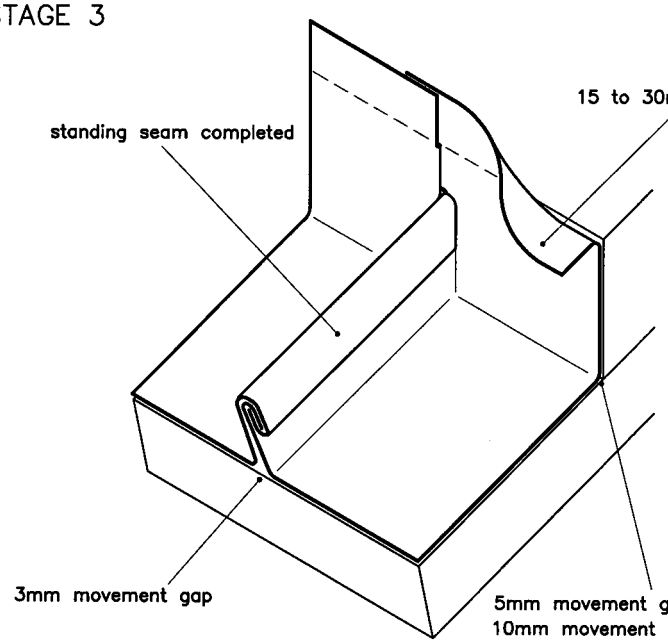




Stage 1
In the workshop mark out copper sheets and cut as shown. It is best to use a template so that each upstand is identical. This gives a consistent appearance and ensures that any cover flashing fits neatly. Note that the marking out gives the roof pitch and varies accordingly.

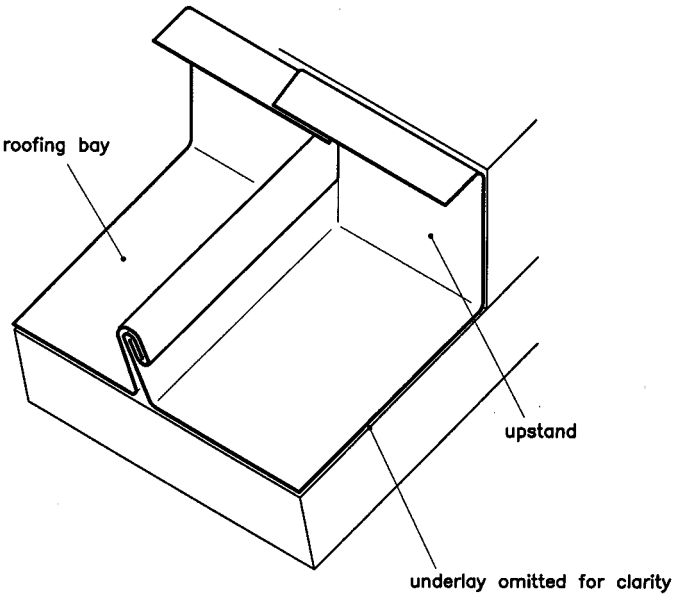
Use straight snips for cutting.

STAGE 3



Stage 3
Form the turn–out to receive clips, lining plate, roofing copper to upper bay, capping etc, according to detail (see Figs 4e, 16a, 19, 21, 23 and 23a).

STAGE 4



Stage 4
The seam upstand is complete.

Fig 11 Turned-down seam upstand

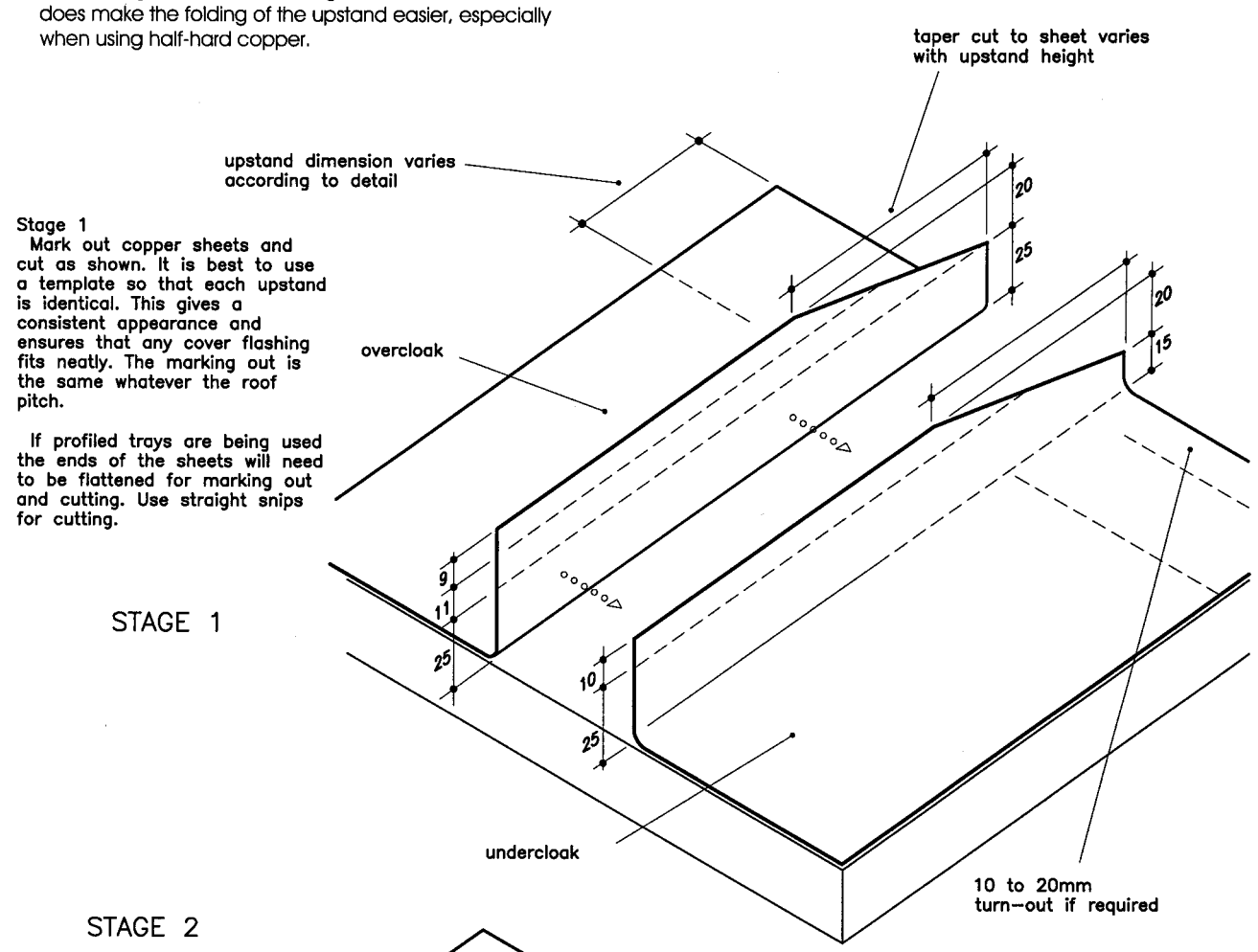
This upstand is only possible in Traditional roofing. The copper sheets are worked and joined on the surface of the substrate and pushed up against the drip or upstand fully formed. The maximum sheet length of 1800mm now permissible makes this a practical proposition.

The minimum upstand dimension that can be formed, excluding any turn-out, is 50mm.

The cutting away shown at Stage 1 is not essential, but it does make the folding of the upstand easier, especially when using half-hard copper.

Temper: soft or quarter-hard, preferably. If half-hard is used the sides of the copper sheet must be cut tapered to the start of the splay as shown.
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	X

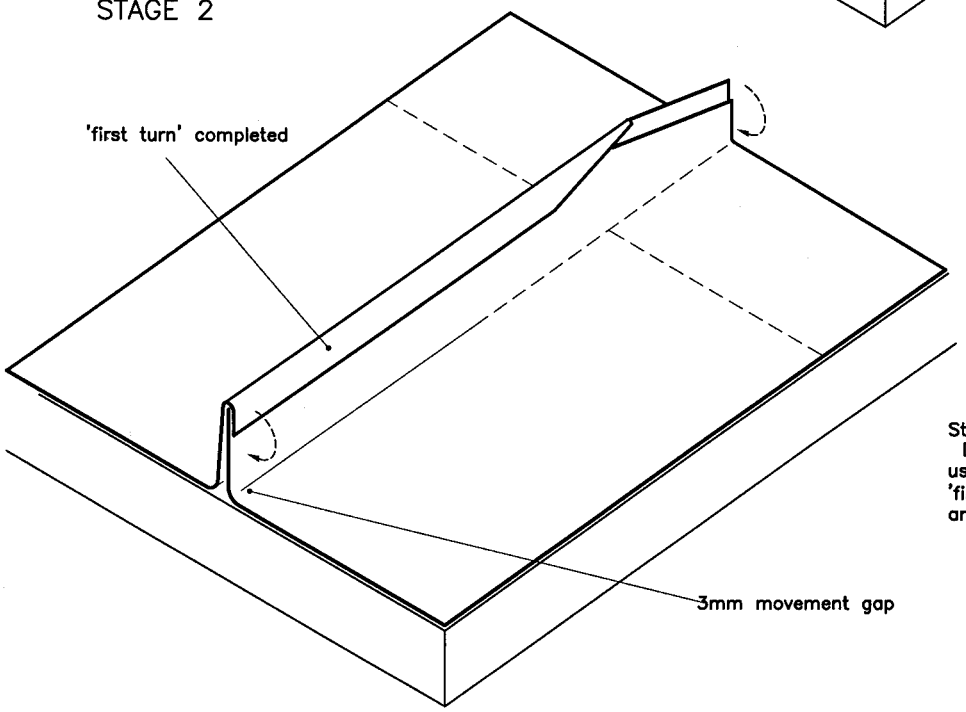


Stage 1
Mark out copper sheets and cut as shown. It is best to use a template so that each upstand is identical. This gives a consistent appearance and ensures that any cover flashing fits neatly. The marking out is the same whatever the roof pitch.

If profiled trays are being used the ends of the sheets will need to be flattened for marking out and cutting. Use straight snips for cutting.

STAGE 1

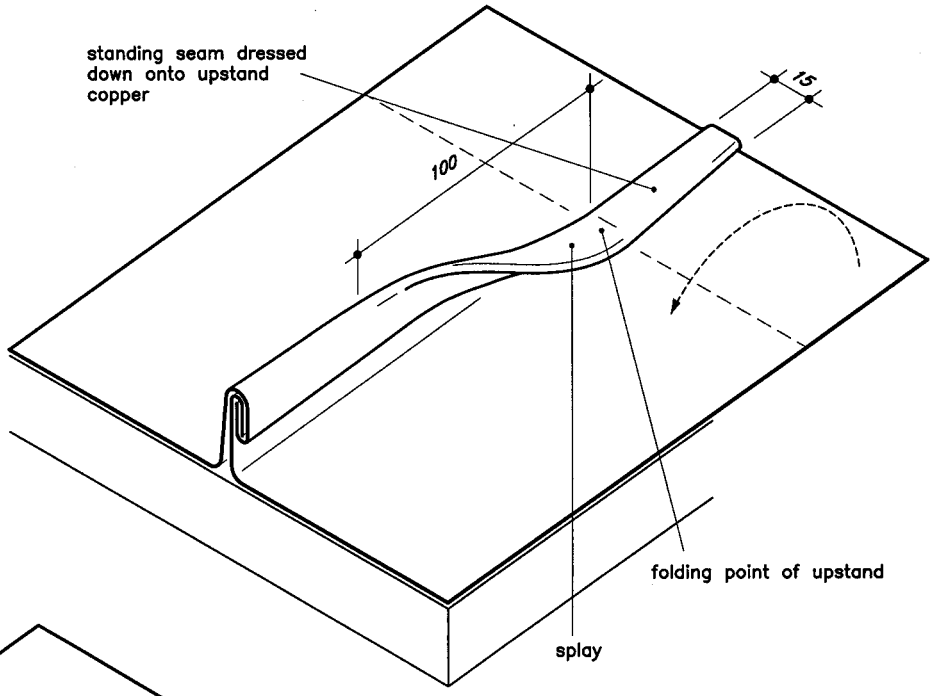
STAGE 2



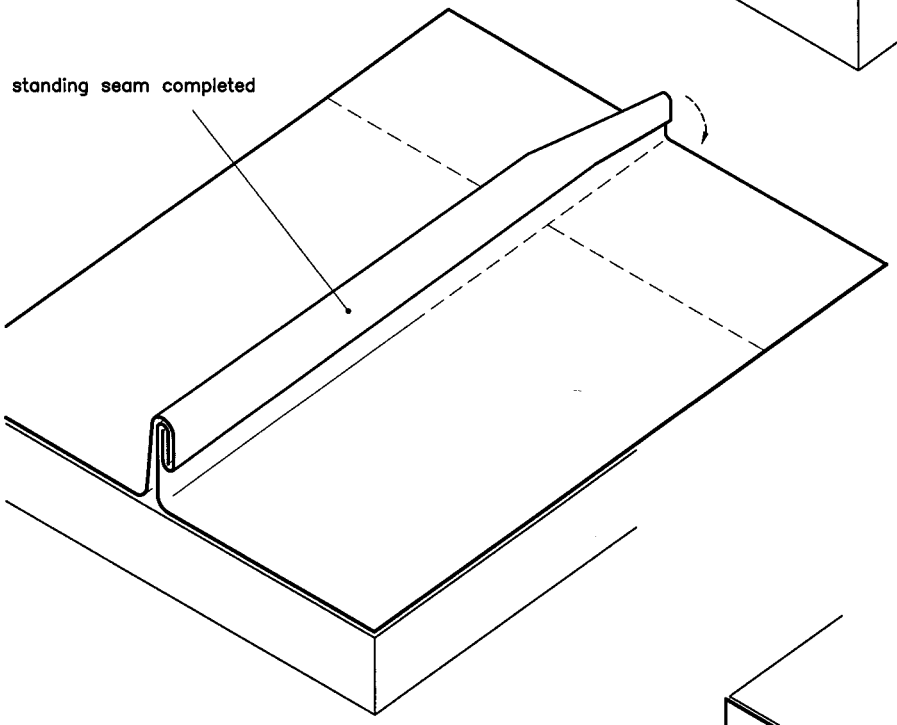
Stage 2
Dress overcloak over and down using a seaming iron, placed with 'first turn' iron against undercloak, and a wooden seaming mallet.

Stage 4
Dress standing seam over onto copper upstand using a wooden seaming mallet. Make sure that all seams are turned down from the same point to achieve a neat appearance. This will be 100mm minimum from the upstand fold.

STAGE 4



STAGE 3



Stage 3
Dress overcloak and undercloak over and down to complete the joint.

STAGE 5

Stage 5
Fold the upstand into the upright position. In doing this a radius 5mm minimum should be made at the base of the upstand copper, rather than a sharp angle. It will be necessary to indent the seam at the folding point with the blade head of a hammer to start the fold.

Slide the roofing sheets into their correct position against the step.

Form the turn-out to receive clips, lining plate, roofing copper to upper bay, capping etc, according to detail.

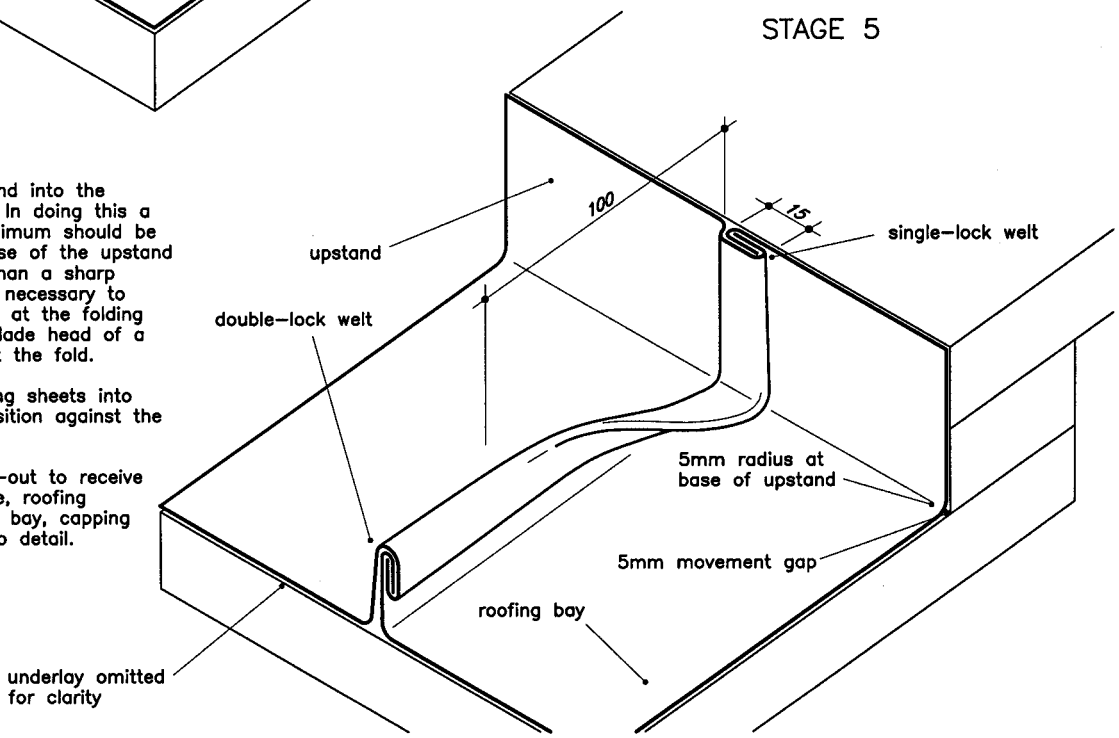
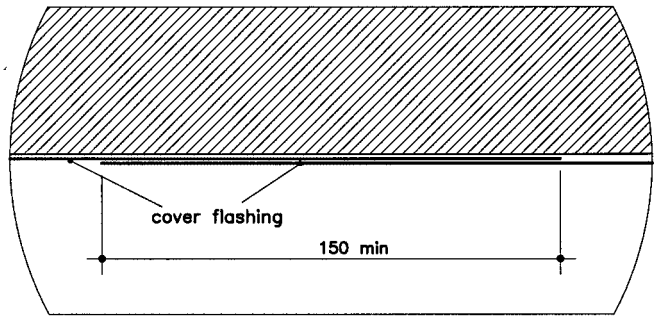


Fig 11 Turned-down seam upstand

* In Traditional roofing the Turned-down seam upstand (see Fig 11) or a sweep-type standing seam upstand folded over (see Figs 7 and 18) is used.
* In Long Strip roofing this sort of welted flashing detail is not possible. Instead use the Sweep standing seam (see Fig 7a) or the Pinched seam upstand (see Fig 12a).
* Joints in cover flashings should be at 2m maximum centres. They are made with lapped joints: either 150mm as shown; or 50mm with a check and sealed (see Fig 12b).
* The turn-up of the cover flashing is cut away at 45degrees at joints in the run. Similarly at the check edge in the brick course.



Plan

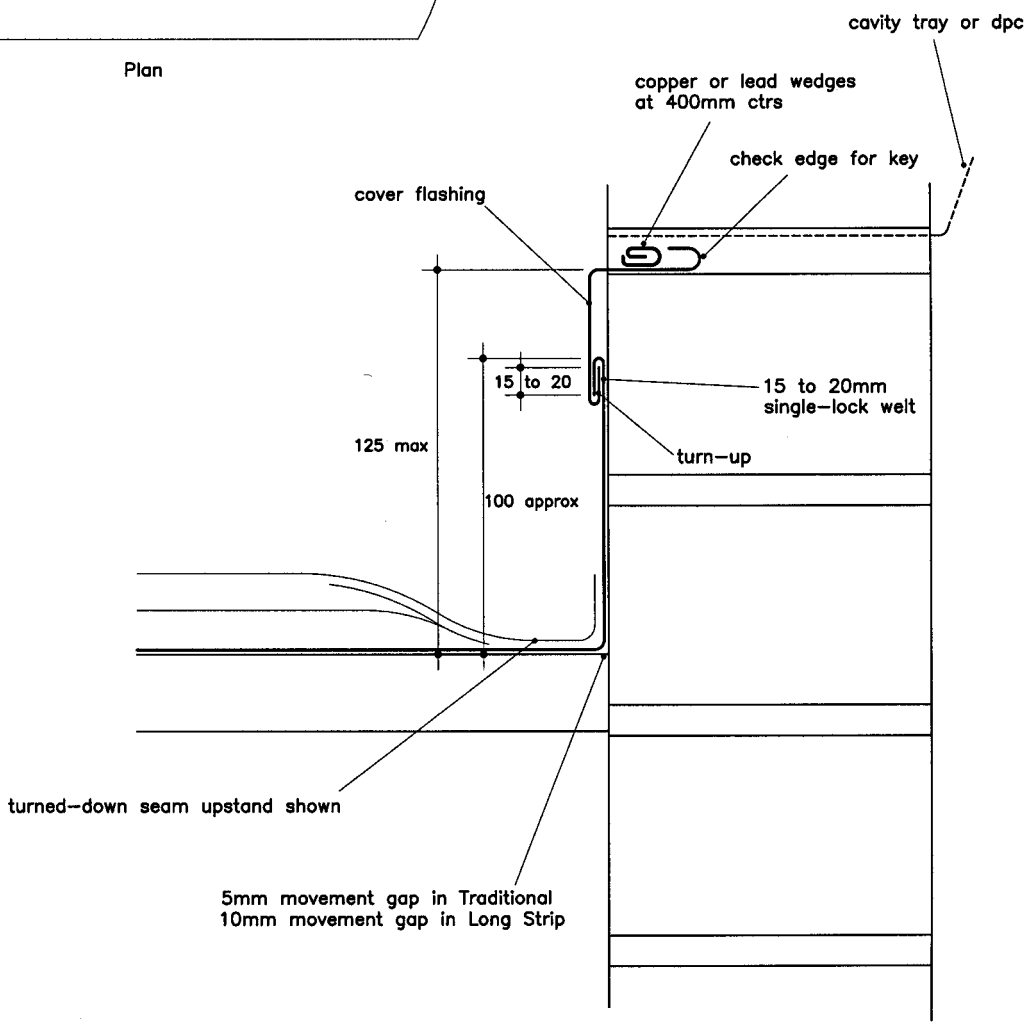
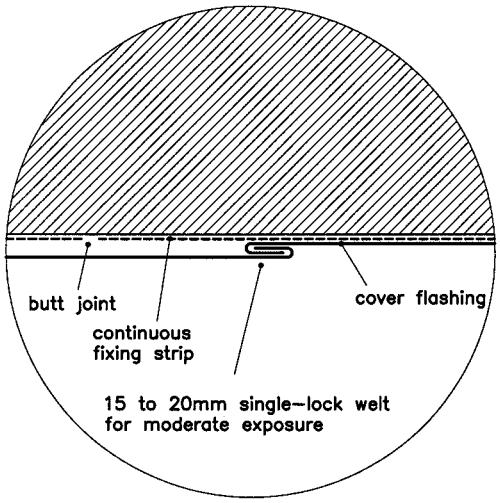


Fig 11a
Vertical upstand 125mm max with horizontal cover flashing to brickwork

TRADITIONAL	✓	LONG STRIP	X

* For Traditional roofing see Note to Fig 11a opposite.
* For Long Strip roofing see Note to Fig 11a opposite.
* The continuous fixing strip is fixed to the brickwork with 32mm No8 round head screws at 300mm centres, together with washers and plugged.
* Joints in the continuous fixing strip are butt jointed.
* Joints in cover flashings should be at 2m maximum centres. They can be made with lapped joints: either 150mm or 50mm with a check and sealed; or with single– or double–lock welt, according to exposure (see Figs 11a, 11c and 12b). Double–lock welts will be difficult to form in this situation and should be pre–formed.
* The turn–up of the cover flashing is cut away at 45degrees at joints in the run. Similarly at the check edge in the brick course.



Plan

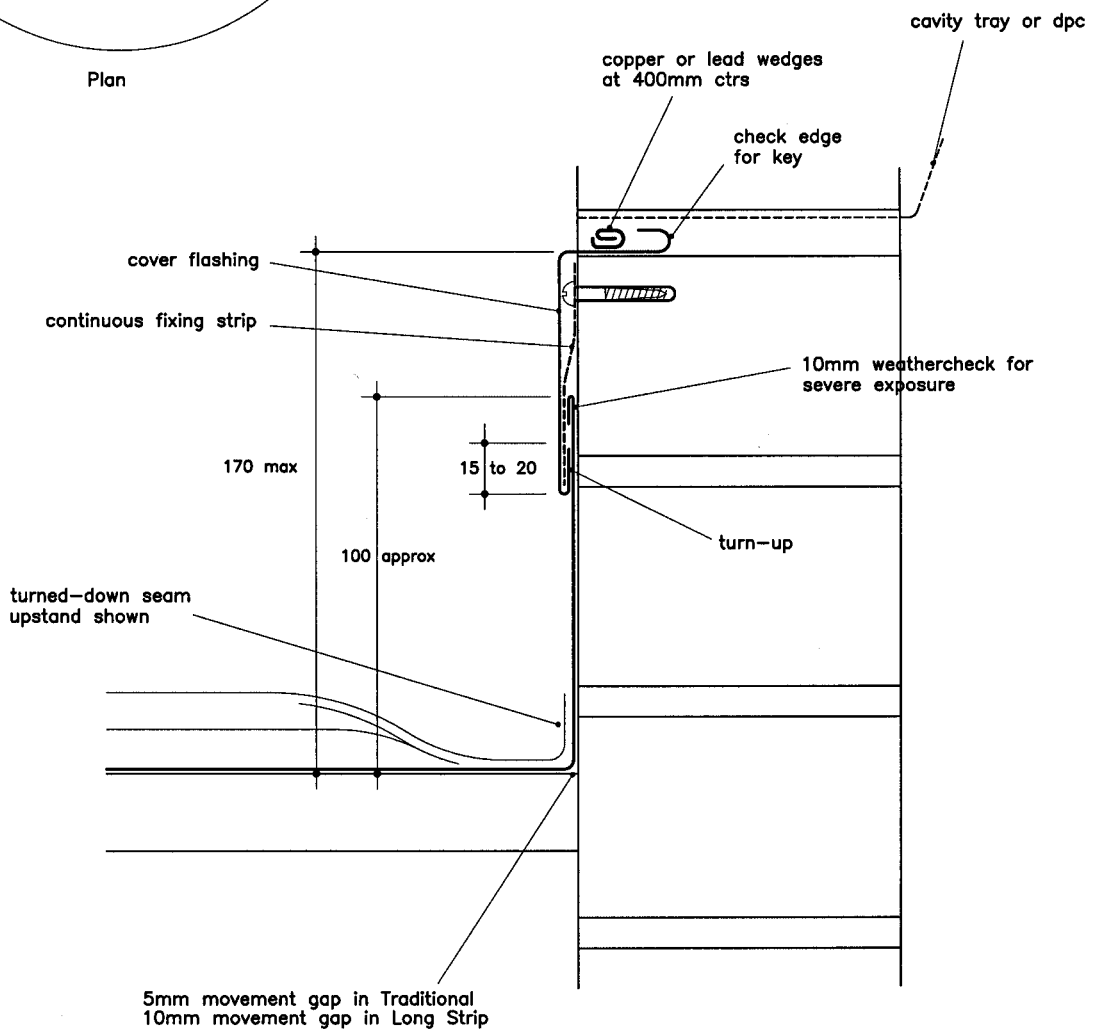
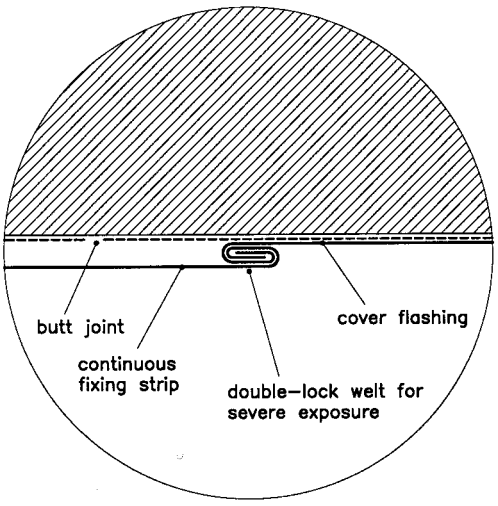


Fig 11b
Vertical upstand 170mm max with horizontal cover flashing to brickwork

TRADITIONAL ✓ | LONG STRIP ✗

Fig 11 Turned-down seam upstand

* For Traditional roofing see Note to Fig 11a (p44).
* For Long Strip roofing see Note to Fig 11a (p44).
* The continuous fixing strip is fixed to the brickwork with 32mm No8 round head screws at 300mm centres, together with washers and plugged.
* Joints in the continuous fixing strip are butt jointed.
* Joints in cover flashings should be at 2m maximum centres. They can be made with single– or double–lock welts, according to exposure (see Fig 11b). Double–lock welts will be difficult to form in this situation and should be pre–formed.
* The turn–up of the cover flashing is cut away at 45degrees at joints in the run. Similarly at the check edge in the brick course.



Plan

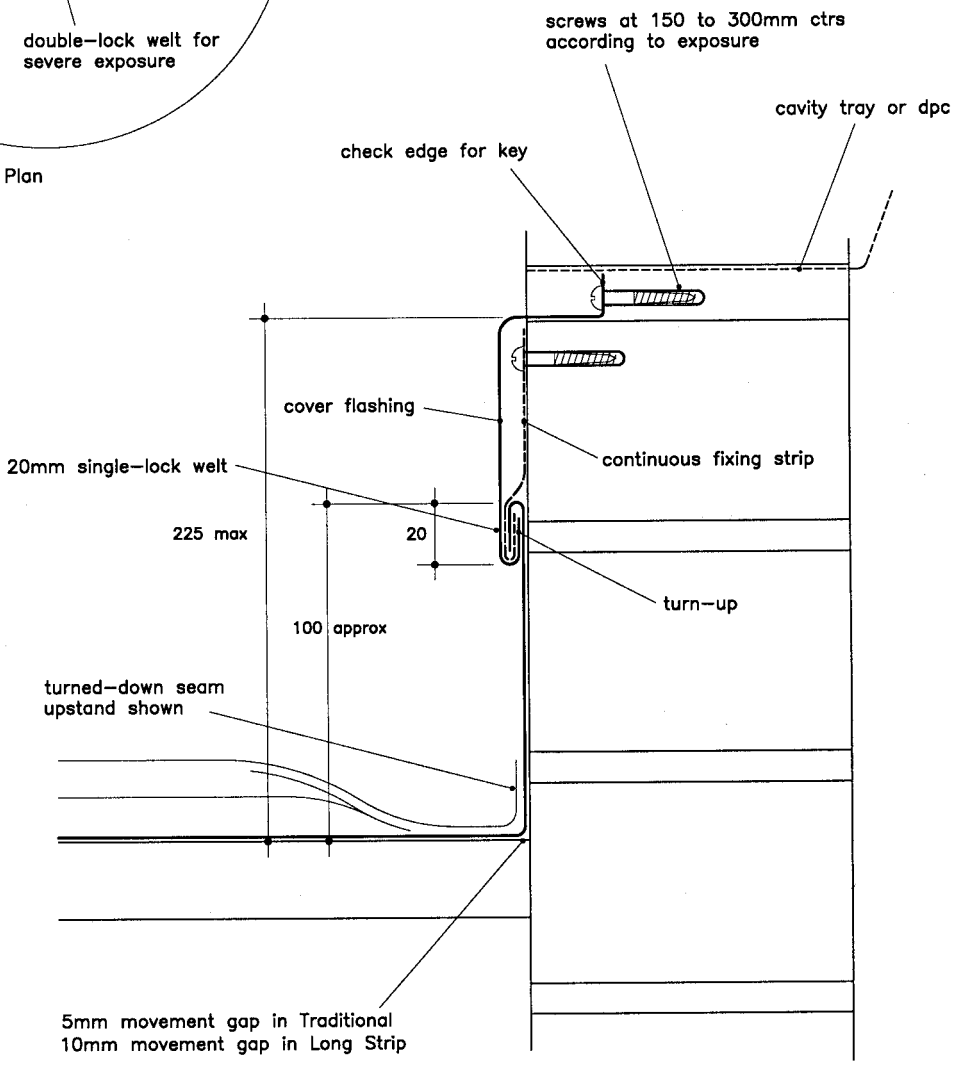


Fig11c
Vertical upstand 225mm max with horizontal cover flashing to brickwork

TRADITIONAL	✓	LONG STRIP	X

Fig 12 Pinched seam upstand against horizontal abutment

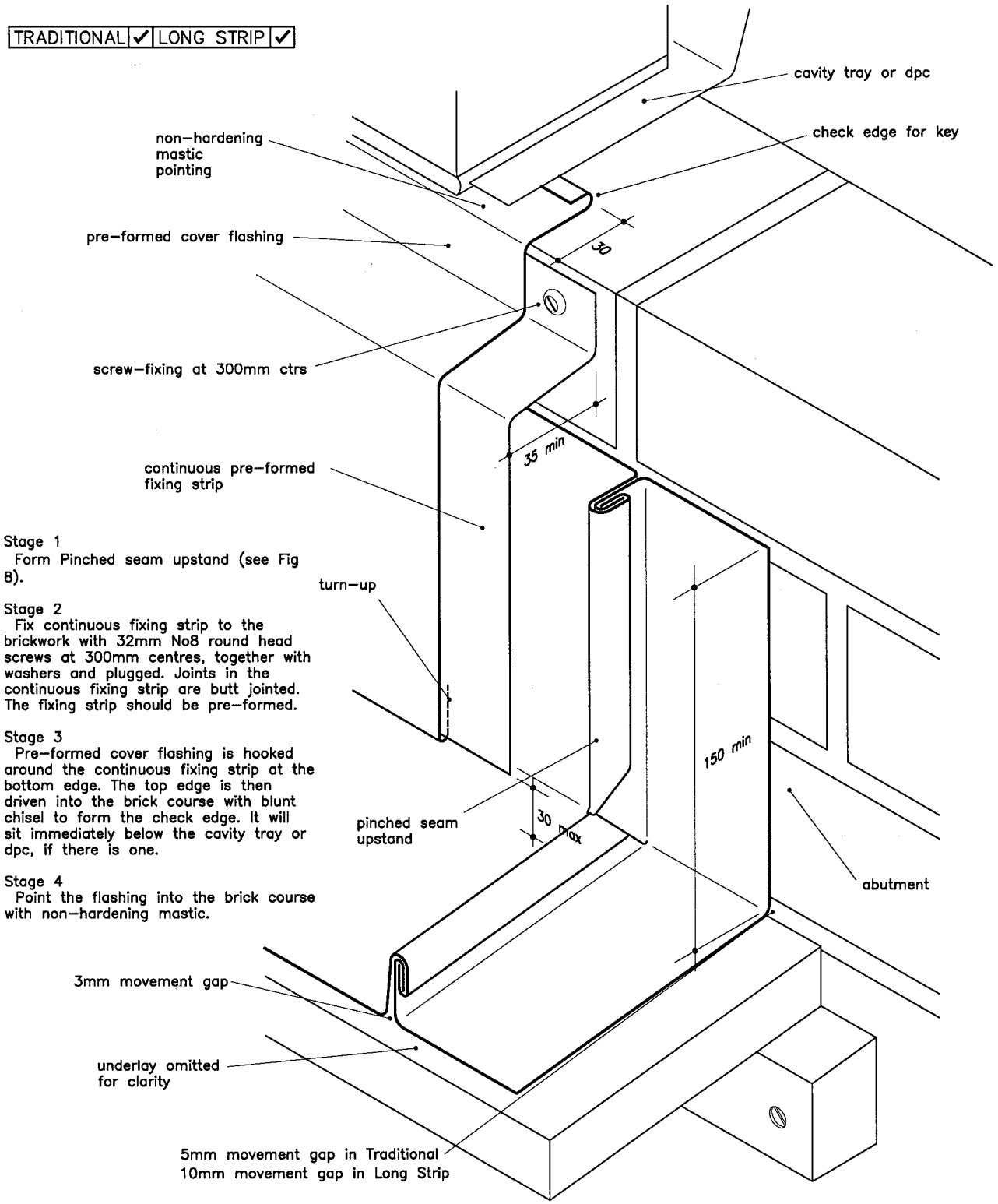
The minimum upstand height is usually 150mm. Where this is difficult to achieve, the height can be reduced to 100mm if the top of the upstand is turned out 15mm, as shown on Fig 12a (p48).

Joints in cover flashings should be at 2m maximum centres. They can be made with lapped joints: either 150mm or 50mm with a check and sealed; or with single- or double-lock welts, according to exposure (see Figs 12b, 11a, 11b and 11c). The return folds of the welts are formed before the cover flashing is bent to shape. Double-Lock welts will be difficult to form in this situation.

With lapped joints, the check edge in the brick course is cut away from the undercloak for the length of the lap. With welted joints, the undercloak corner is cut away at 45degrees to reduce the bulk of the copper; similarly the corner of the turn-up to the cover flashing.

As drawn the detail is only suitable for warm roofs, ie un-ventilated.

Temper: Pinched seam upstand; soft, quarter- or half-hard.
Pre-formed cover flashing etc; half-hard.
Thickness: 0.6mm or 0.7mm



Stage 1
Form Pinched seam upstand (see Fig 8).

Stage 2
Fix continuous fixing strip to the brickwork with 32mm No8 round head screws at 300mm centres, together with washers and plugged. Joints in the continuous fixing strip are butt jointed. The fixing strip should be pre–formed.

Stage 3
Pre–formed cover flashing is hooked around the continuous fixing strip at the bottom edge. The top edge is then driven into the brick course with blunt chisel to form the check edge. It will sit immediately below the cavity tray or dpc, if there is one.

Stage 4
Point the flashing into the brick course with non–hardening mastic.

Fig 12 Pinched seam upstand against horizontal abutment

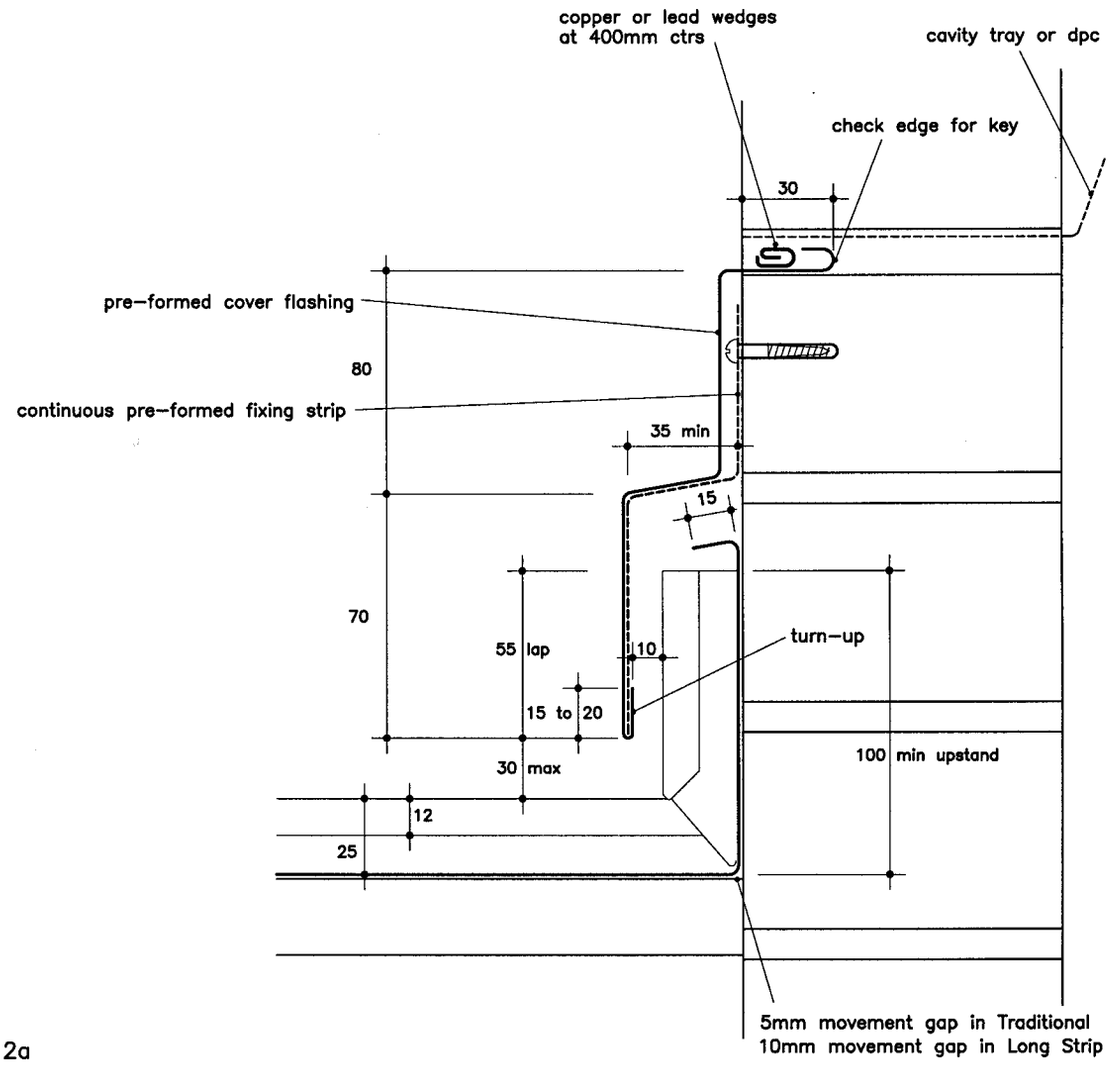
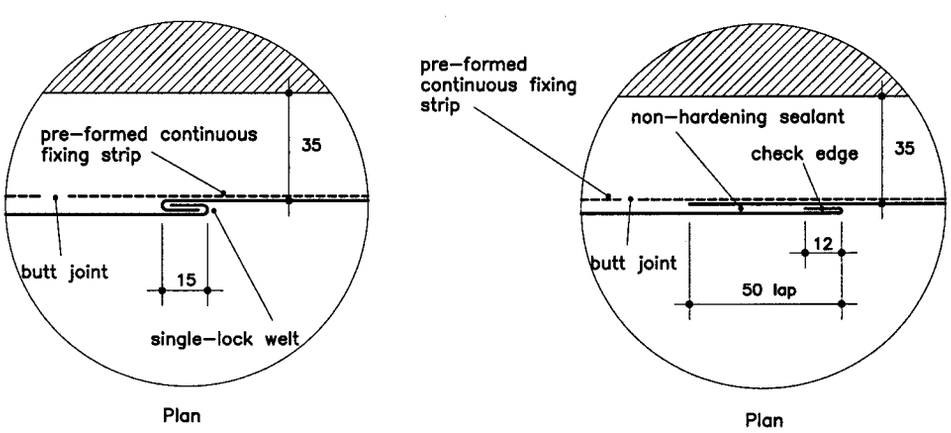


Fig 12a
Pinched seam with minimum upstand
TRADITIONAL ✓ LONG STRIP ✓



* See also Figs 11a, 11b and 11c.

Fig 12b
Joints in cover flashings
TRADITIONAL ✓ LONG STRIP ✓

Fig 13 Pinched seam ventilated upstand against horizontal abutment

Stage 1
Screw the support brackets to the underside of the weathered timber section. The brackets should be housed in to provide a flush surface for the insect mesh to fit against. Plug and screw the brackets to the wall.

Then plug and screw the substrate upstand to the wall via timber blocks.

Nail the pre–formed insect mesh at 100mm centres to the front edge of the timber section and the substrate upstand.

Stage 2
Form Pinched seam upstand (see Fig 8).

Stage 3
Nail the continuous fixing strip to the timber section. Joints in the continuous fixing strip are butt jointed. The fixing strip should be pre–formed.

Stage 4
Pre–formed cover flashing is hooked around the continuous fixing strip at the bottom edge. The top edge is then driven into the brick course with blunt chisel to form the check edge. It will sit immediately below the cavity tray or dpc, if there is one.

Joints in cover flashings are described with Fig 12 (p47).

Stage 5
Point the flashing into the brick course.

The minimum upstand height is usually 150mm. Where this is difficult to achieve, the height can be reduced to 100mm if the top of the upstand is turned out 15mm, as shown on Fig 12a (p48).

The detail is necessary for roofs which require ventilating to avoid the risk of condensation.

Temper: Pinched seam upstand; soft, quarter- or half-hard. Pre-formed cover flashing etc; half-hard.
Thickness: 0.6mm or 0.7mm

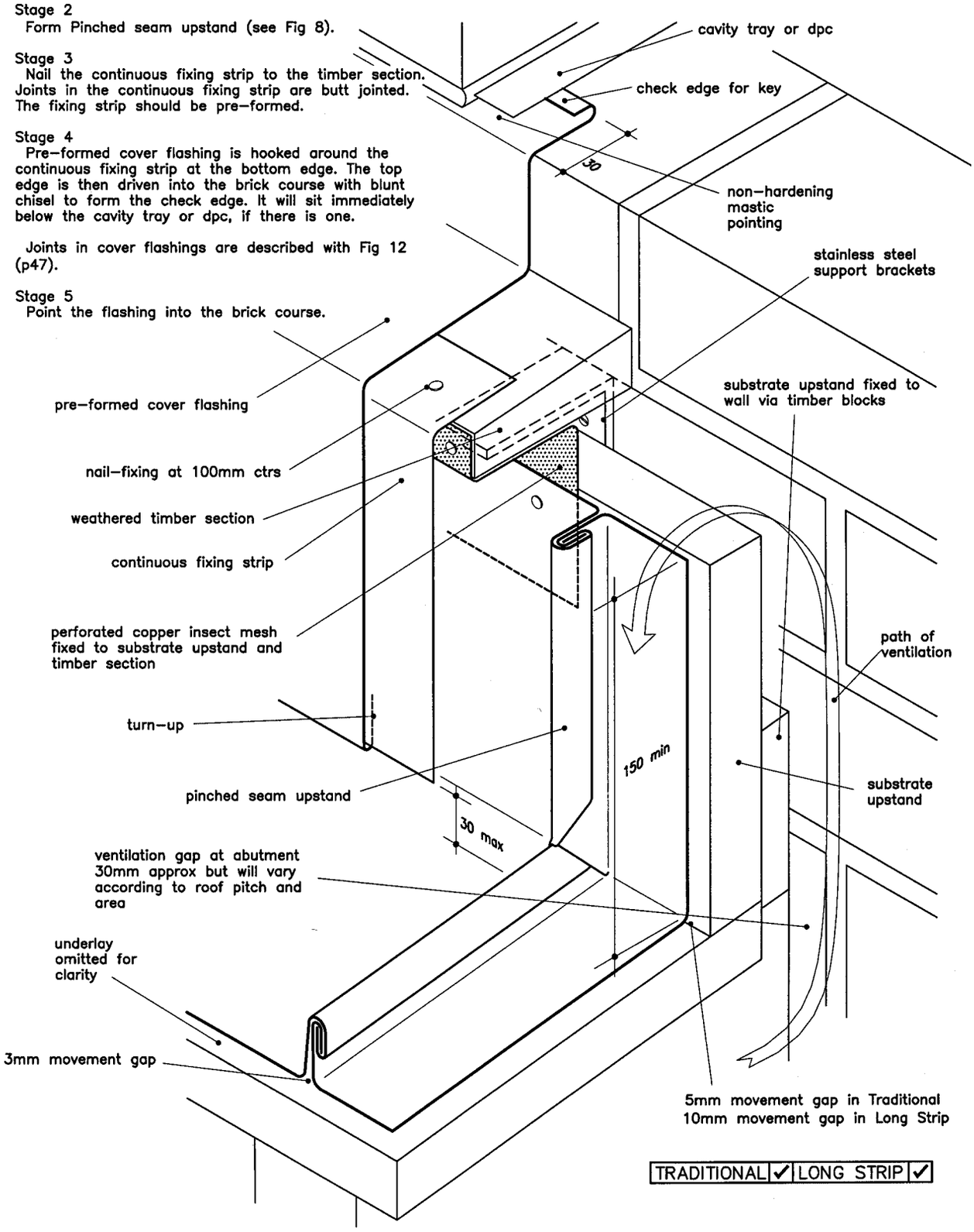


Fig 14 ... junction with hand-formed double-lock cross welt

This detail is mainly for use in Traditional roofing because it allows no longitudinal movement. However, with the cross welt not clipped, it is sometimes used in Long Strip roofing as described with Fig 15 and shown on Fig 15b (p52).

When pre-patinated copper sheets have been specified, it is better to use the pre-formed cross welt as some of the patina will be lost in the hand-forming (see Figs 15 and 15a). The pre-formed version also tends to give cleaner lines.

In both Traditional and Long Strip roofing, the double-lock cross welt can only be used with roof pitches at and over 20degrees. If sealed they can be used with roof pitches down to 6degrees.

In Traditional roofs the cross welts will occur at 1725mm centres maximum (see Table G, p9).

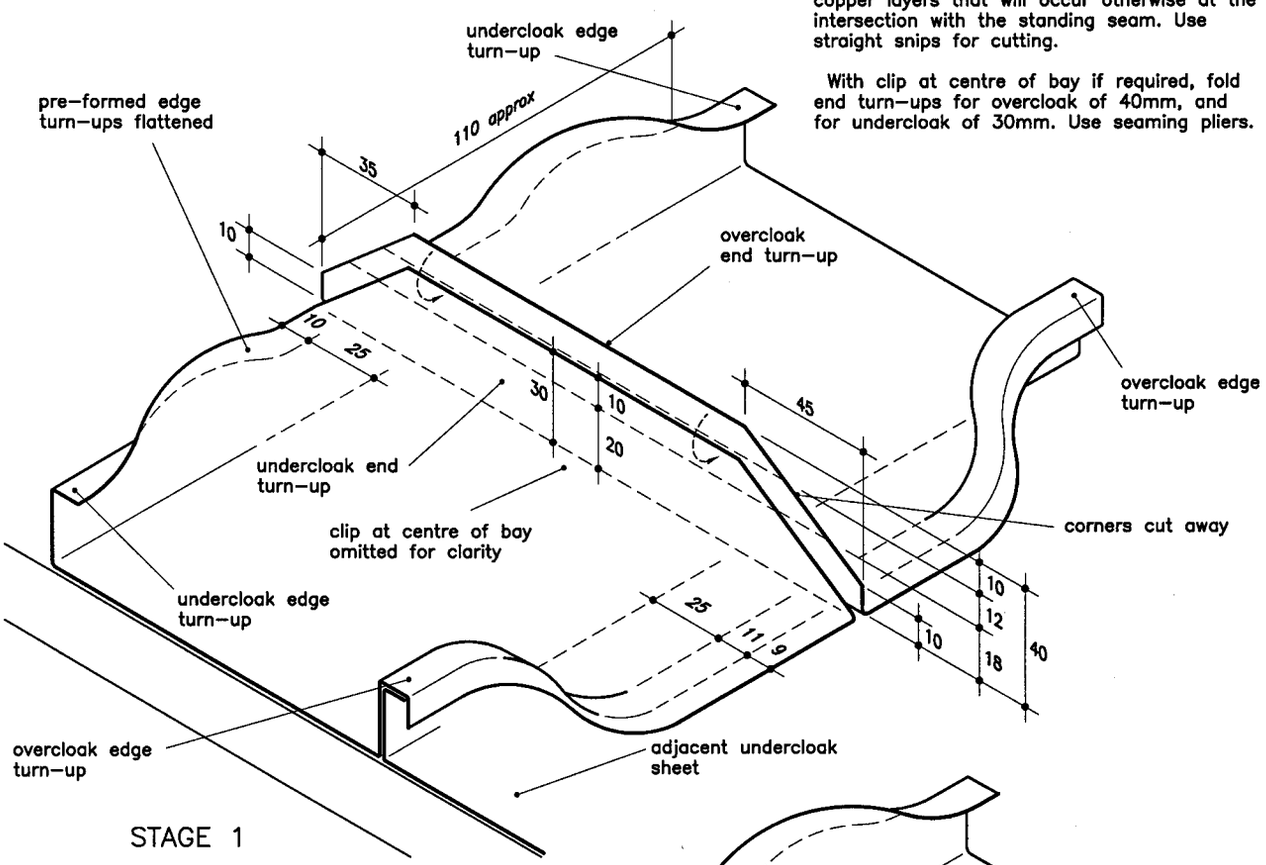
Temper: soft, quarter- or half-hard. With quarter- or half-hard the clip at the centre of the bay is not required; and in Long Strip roofing must not be provided.
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

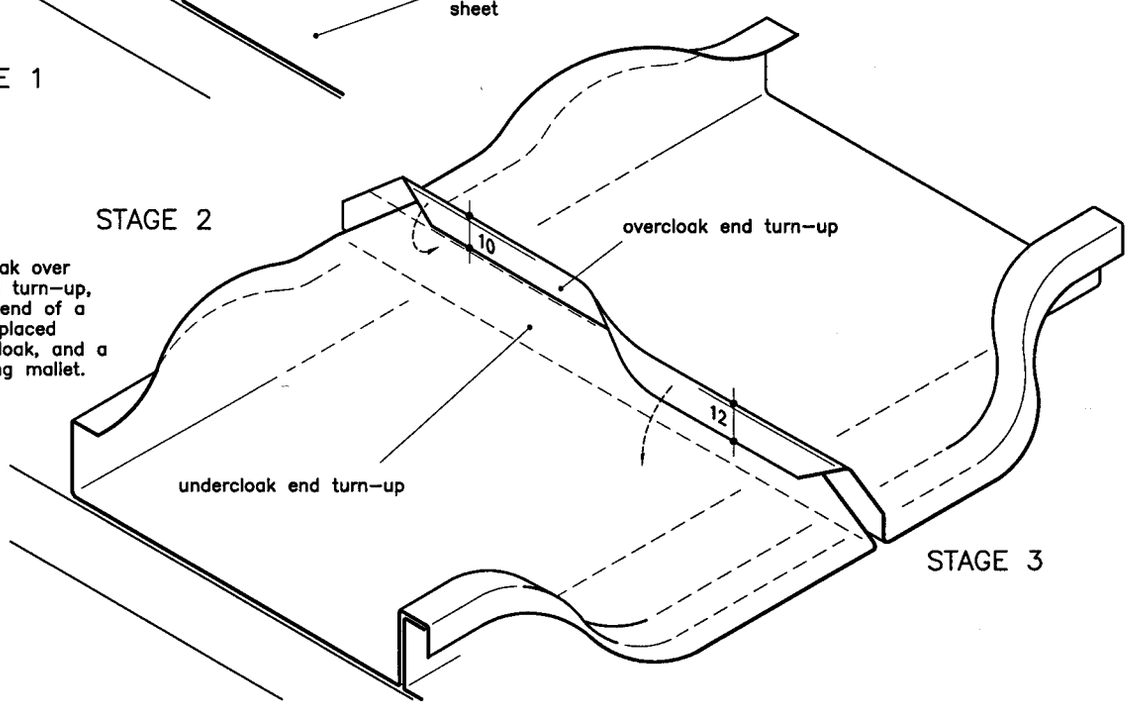
Stage 1
Flatten pre-formed edge turn-ups of overcloak and undercloak at the ends of the sheets or trays to be joined, to allow marking out and cutting.

Cut away the corners to reduce the bulk of copper layers that will occur otherwise at the intersection with the standing seam. Use straight snips for cutting.

With clip at centre of bay if required, fold end turn-ups for overcloak of 40mm, and for undercloak of 30mm. Use seaming pliers.



STAGE 1



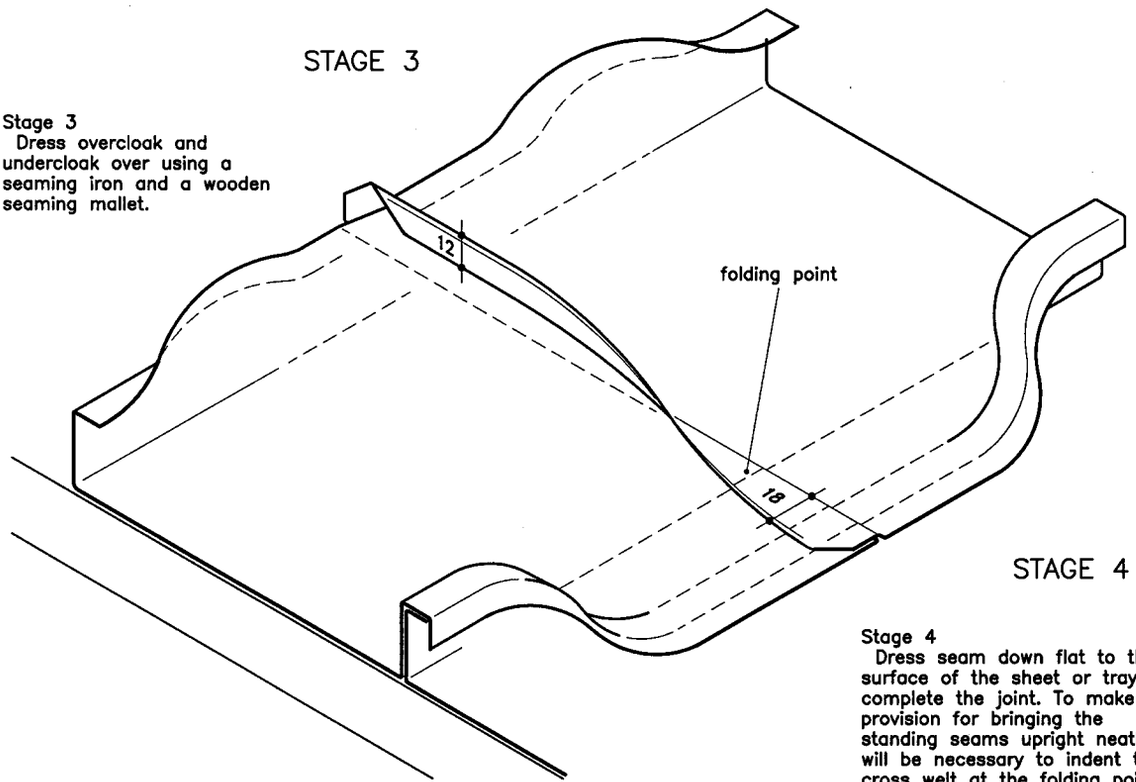
STAGE 2

Stage 2
Dress overcloak over undercloak end turn-up, using the flat end of a seaming iron, placed against undercloak, and a wooden seaming mallet.

STAGE 3

STAGE 3

Stage 3
Dress overcloak and undercloak over using a seaming iron and a wooden seaming mallet.



STAGE 4

Stage 4
Dress seam down flat to the surface of the sheet or tray to complete the joint. To make provision for bringing the standing seams upright neatly, it will be necessary to indent the cross welt at the folding point with the blade head of a hammer, to start the fold.

Stage 5
Reform the edge turn–ups flattened for Stage 1 and complete the double–lock standing seams (see Figs 1 and 2).

In reality the adjacent undercloak sheet or tray would be in position beneath the overcloak edge turn–up, but for clarity this has been omitted from the description. As drawn the copper roofing would be completed in sequence, working from right to left.

STAGE 5

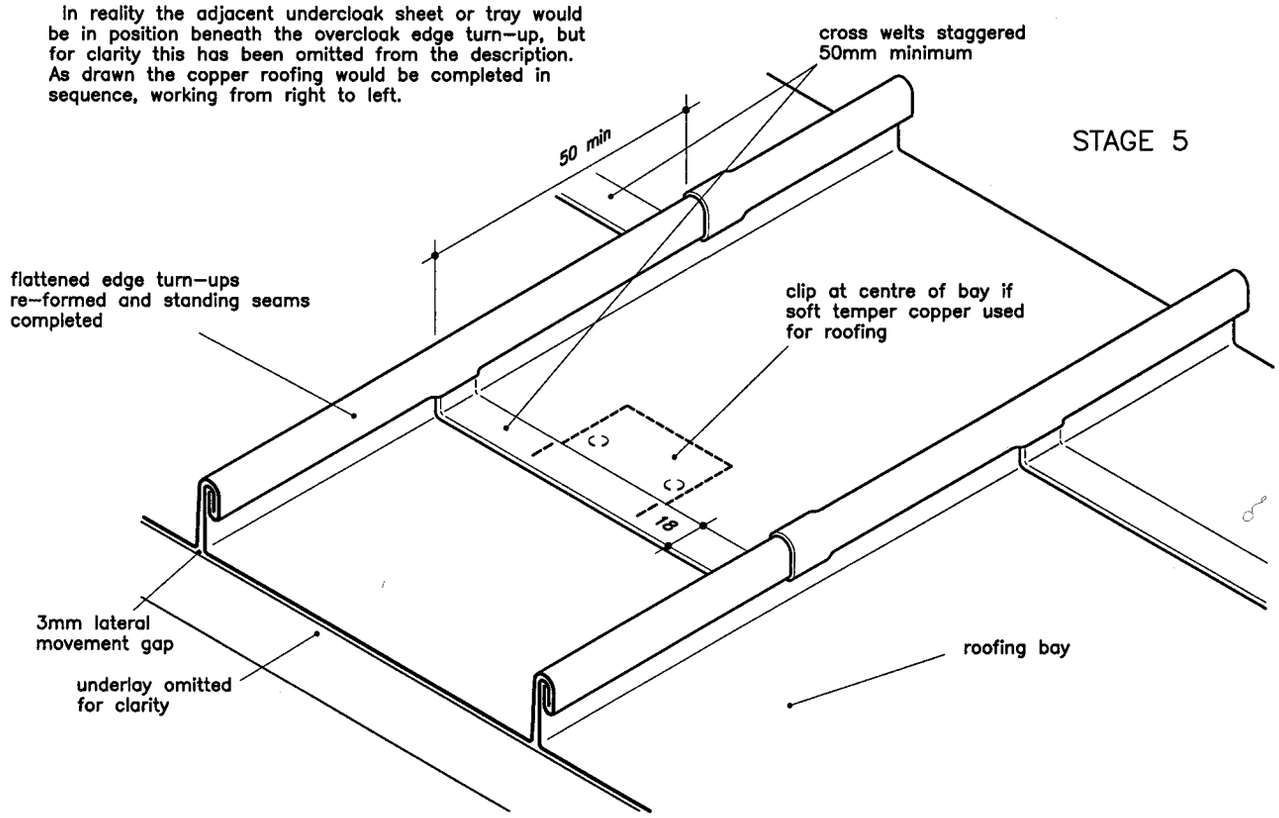


Fig 15 ... junction with pre-formed double-lock cross welt

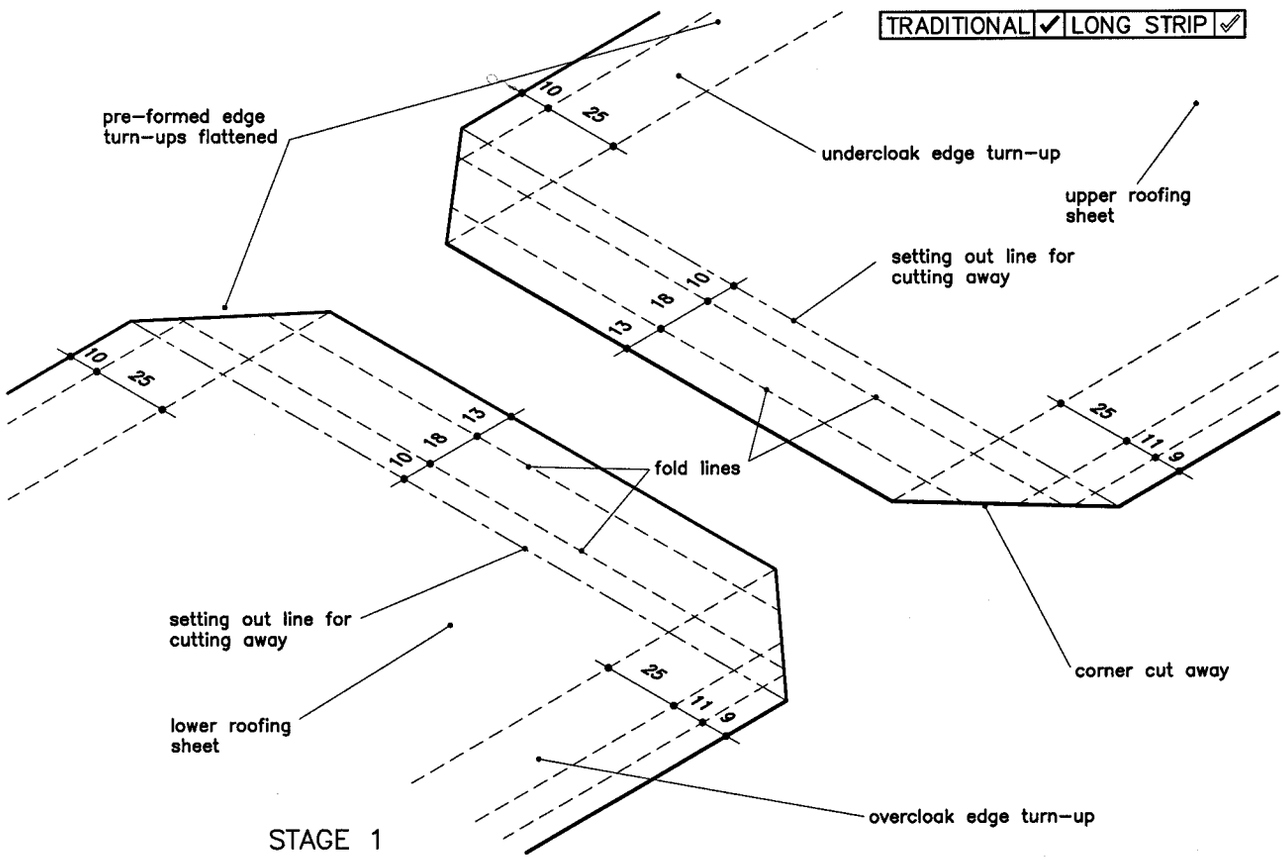
This detail is mainly for use in Traditional roofing because it allows no longitudinal movement. However, it is sometimes used in Long Strip roofing where the form of the roof requires a transition from a straight to a curved section (see Fig 15b).

It can also be used in Long Strip if the appearance of cross welts is required. In this case, from the point of view of acceptable bay sizes, the presence of the cross welts is ignored; and lateral joints for movement must be provided, or overall bay sizes limited, in accordance with Table L . Sliding clips, of course, must also be provided as shown on Table L (p11).

When pre-patinated copper sheets have been specified, it is better to use this pre-formed cross welt as some of the patina will be lost in the hand-forming (see Fig 15a). The pre-formed version also tends to give cleaner lines.

In both Traditional and Long Strip roofing, the double-lock cross welt can only be used with roof pitches at and over 20degrees. If sealed they can be used with roof pitches down to 6degrees.

Temper: quarter- or half-hard copper must be used, as no clip is possible at centre of bay.
Thickness: 0.6mm or 0.7mm



Stage 1
Flatten pre–formed edge turn–ups (see Fig 14) of overcloak and undercloak at the ends of the sheets or trays to be joined, to allow marking out and cutting.

Cut away the corners to reduce the bulk of copper layers that will occur otherwise at the intersection with the standing seam. Use straight snips for cutting.

Form open double–lock welts along fold lines, to the ends of both sheets. This can be done with a special folding machine or by bending the copper around a 4mm thick aluminium section.

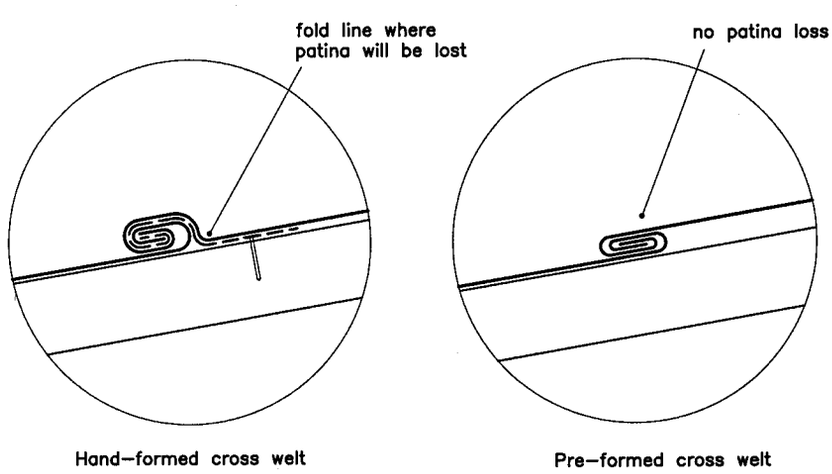
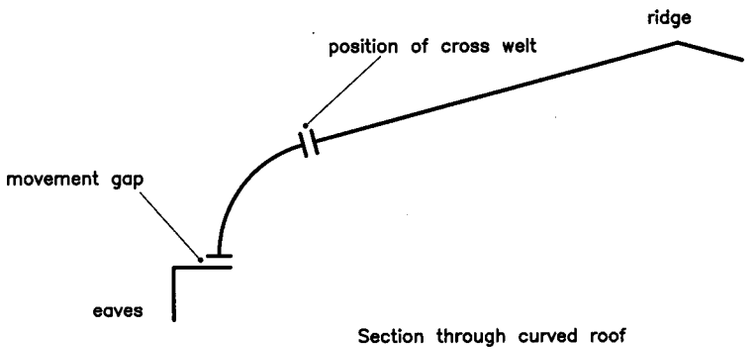


Fig 15a
Cross welt for pre–patinated sheet
TRADITIONAL ✓ LONG STRIP ✓



Section through curved roof

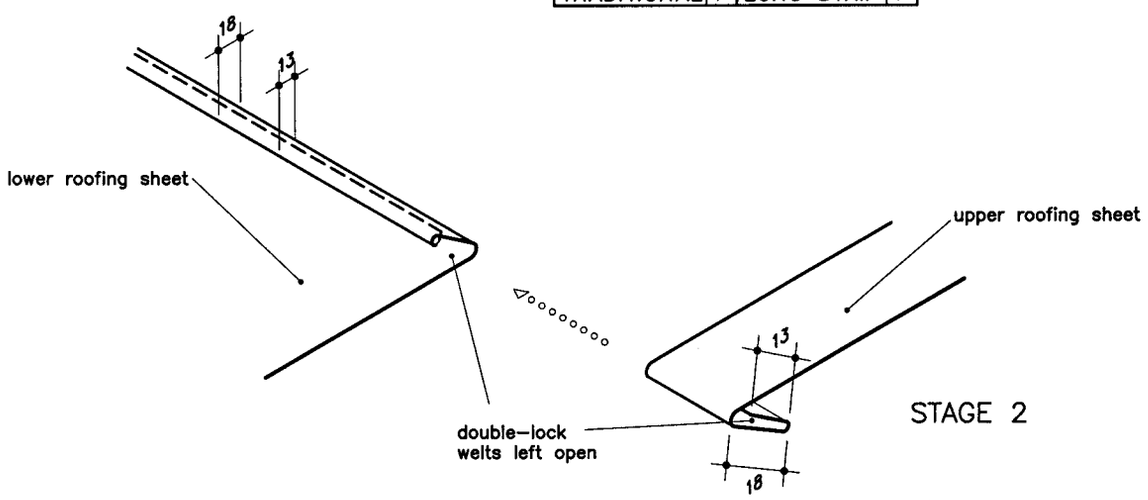
Fig 15b
Cross welt as transition from straight to curved tray

TRADITIONAL	✓	LONG STRIP	✓

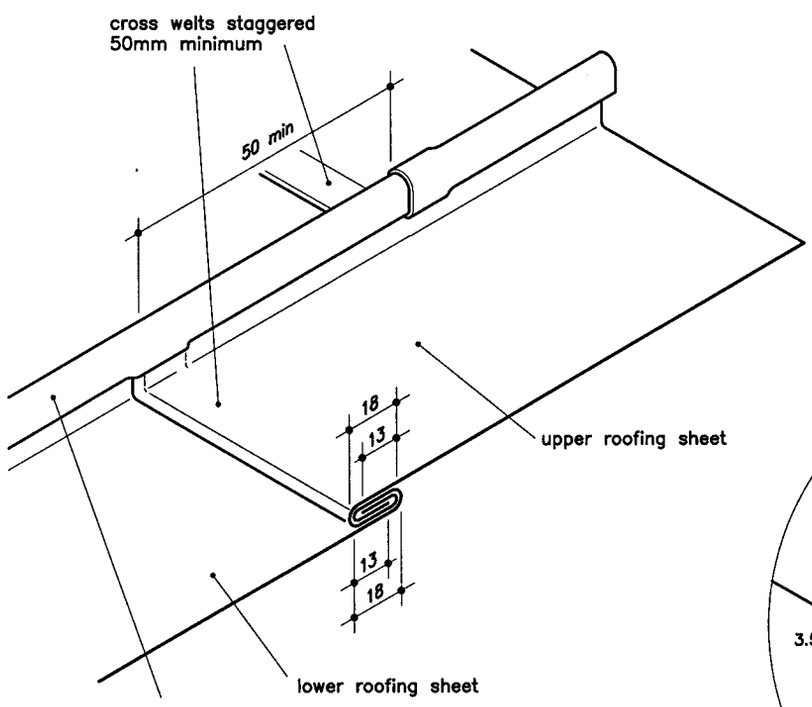
Stage 2
Slide the open welts together and adjust the sheets until they line up.

Dress seam down flat to the surface of the substrate to complete the joint. To make provision for bringing the standing seams upright neatly, it will be necessary to indent the cross welt at the folding point with the blade head of a hammer, to start the fold.

Reform the edge turn–ups flattened for Stage 1 and complete the double–lock standing seams (see Figs 1 and 2).



STAGE 2



STAGE 3

Stage 3
The cross welt is complete.

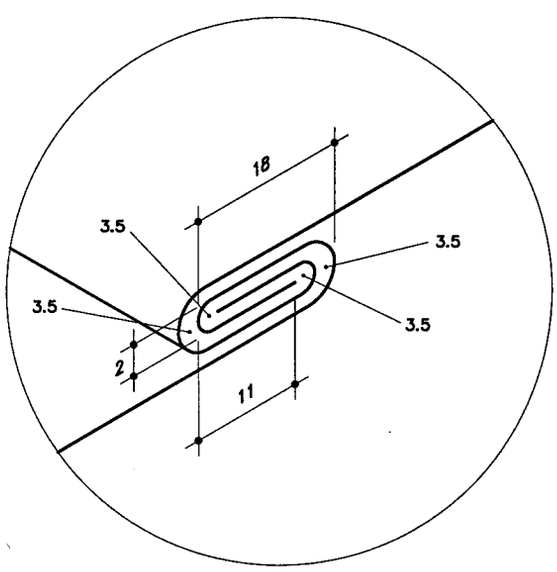


Fig 16 Double-lock standing seam junction with drip-step

This detail is one of the three methods of providing movement joints in Long Strip roofing. The lap-lock cross welt (see Fig 17) and the fillet drip (see Fig 16a) are the others.

With both versions of the dog-eared upstand, the minimum step height acceptable for drip-steps and fillet drips is 50mm.

The Pinched seam upstand can also be used, but the minimum step height must be increased to 100mm (see Fig 4f). This is because there is a projecting upstand seam to be accommodated, and the weathering of this with a downstand to the lining plate requires 50mm minimum of cover.

In Long Strip roofing lateral joints for movement must be provided, or overall bay sizes limited, in accordance with Table L. Sliding clips, of course, must also be provided as shown on Table L (p11).

Sometimes in Long Strip roofing the Traditional appearance of double-lock cross welts is required. This is described with Fig 15 (p52).

In Traditional roofing drip-steps can provide the lateral joints generally for roofs with a minimum pitch of 3degrees (see Tables D and F). Drip-steps will be required at 1700mm centres, and their minimum step height will be 50mm (see Fig 4e). The same applies if fillet drips are used instead but these can only be used for roof pitches at and over 14degrees, or 25degrees if the Pre-formed straight dog-eared upstand is used. The 10mm movement gap shown on the drawing at the end of the upper roofing sheet is not required for any of these situations.

Alternatively the Turned-down seam upstand can be used instead (see Fig 3c).

Temper: soft, quarter- or half-hard
Thickness: 0.6mm or 0.7mm

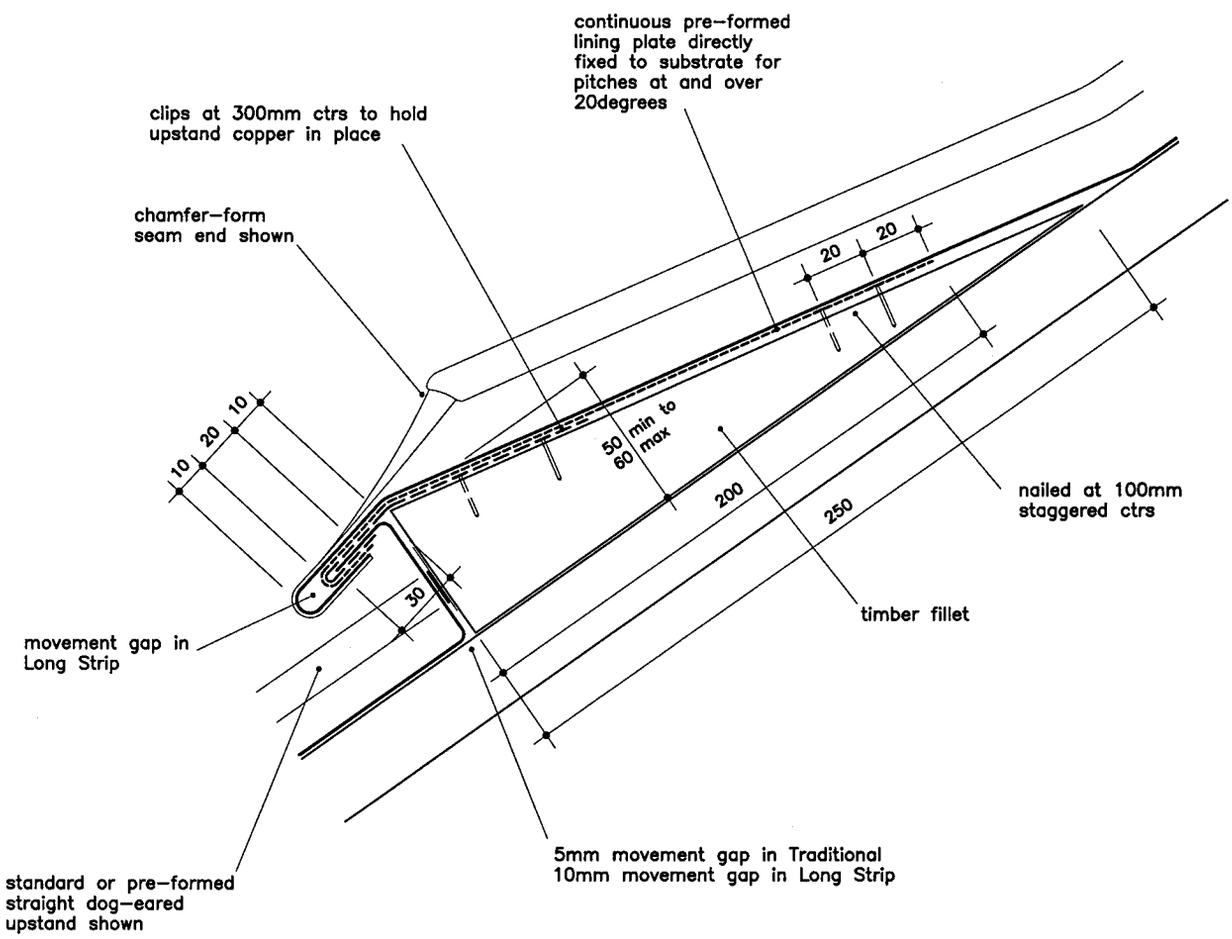
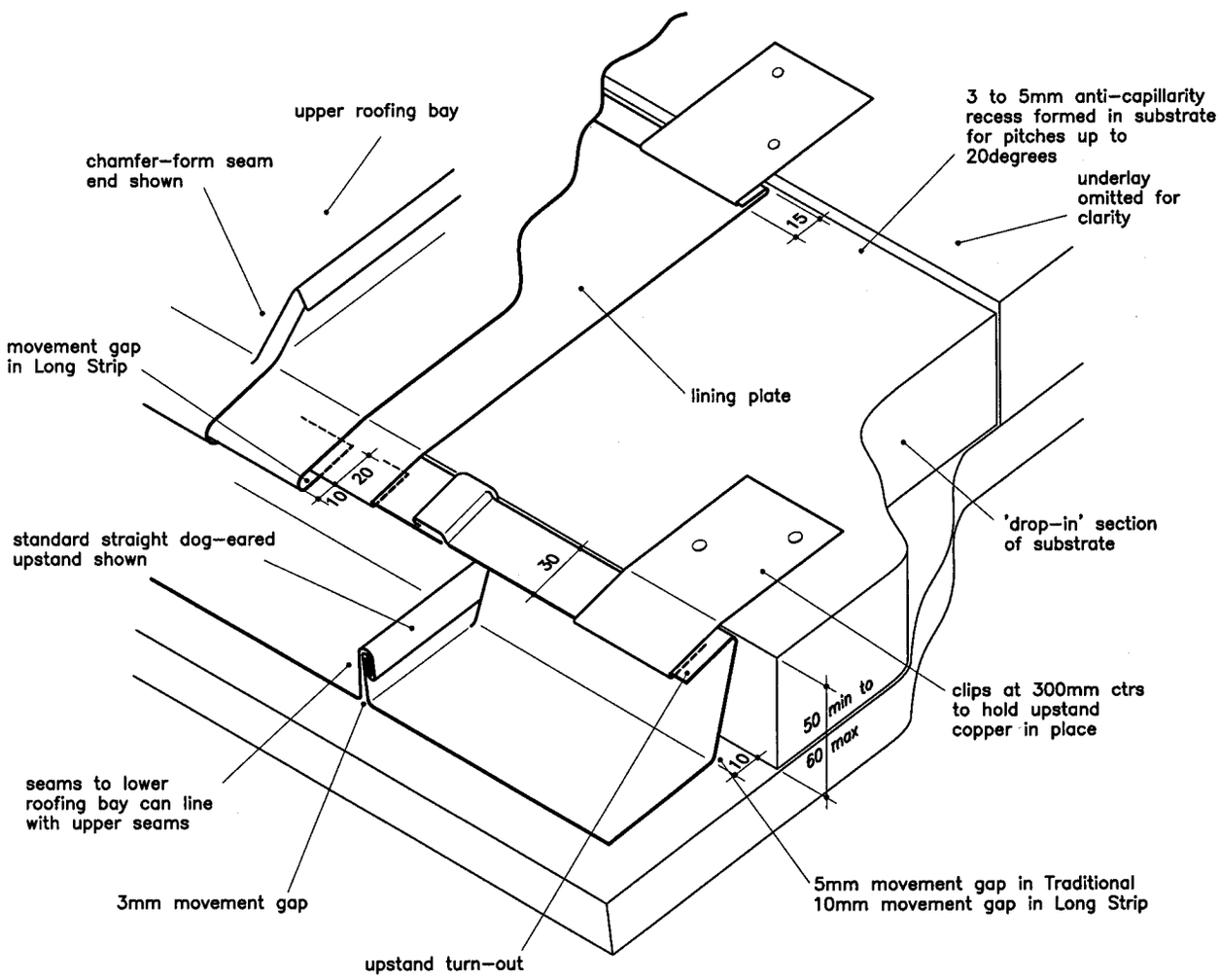


Fig 16a
Fillet drip
TRADITIONAL ✓ | LONG STRIP ✓

TRADITIONAL ✓ | LONG STRIP ✓

Stage 1
Complete the Straight dog–eared upstand (see Figs 9 and 10) against the drip–step with a 30mm turn–out and a 10mm movement gap at its base. The Standard version requires a 'drop–in' section of substrate. For pitches up to 20degrees a 3mm to 5mm anti–capillarity recess (see also Fig 4e) needs to be accommodated in this section.

The Pre–formed straight dog–eared upstand can only be used with roof pitches at and over 25degrees. It requires no 'drop–in' section of substrate, and no recess at that pitch.



Stage 2
Clip the upstand turn–out to hold it in position for the fixing and turning under of the lining plate. The lining plate will project 30mm minimum from the top edge of the drip–step, so that the turn–under of the upper roofing sheet can engage it by 20mm and still have 10mm for movement.

Fig 17 Double-lock standing seam junction with lap-lock cross welt

This detail is one of the three methods (see Figs 16 and 16a) of providing movement joints in Long Strip roofing. It has the advantages of being less apparent and does not require any change in the substrate.

In Long Strip roofing lateral joints for movement must be provided, or overall bay sizes limited, in accordance with Table L. Sliding clips, of course, must also be provided as shown on Table L (p11).

It can only be used for roof pitches at and over 10degrees.

Temper: quarter- or half-hard
Thickness: 0.6mm or 0.7mm

TRADITIONAL	X	LONG STRIP	✓

Stage 1
Complete the double–lock standing seam to the lower roofing sheet (see Figs 1 and 2). The last 250mm run of the seam is tapered so that its height is reduced from the usual 25mm to 16mm. The top of the sheet has been cut to allow a 15mm check edge which is now folded over. This is used to fix the top edge to the substrate, via clips located on each side of the seam.

Stage 2
A continuous fixing strip is soldered or rivetted to the lower roofing sheet 250mm down from the top edge. The bottom edge of the upper roofing sheet is then hooked around the fixing strip. The bottom of the upper sheet has been cut and pre–formed with a 30mm turn–under to achieve this. A 10mm movement joint is provided.

Stage 3
Complete the double–lock standing seam to the upper sheet, taking care that the upper seam is not formed tightly over the lower as this might impair longitudinal movement.

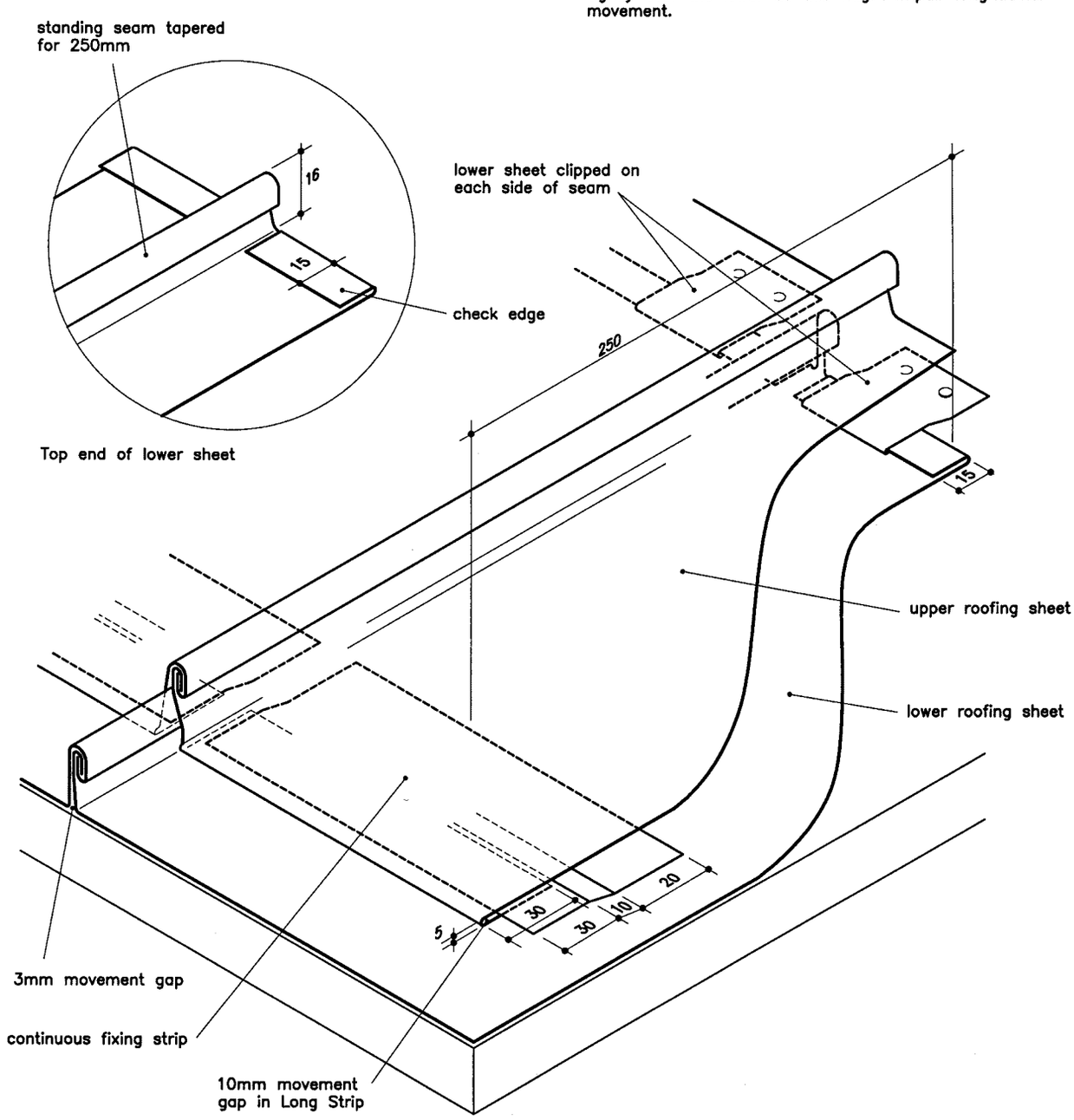


Fig 18 Double-lock standing seam at external corners

This detail uses a sweep type detail called the 'graduated standing seam'. The undercloak is formed as the Sweep standing seam upstand (see Fig 7), using curved cutting and a dog-ear fold to achieve the sweep. The overcloak has no folding but is simply cut from the sheet with the shape of the curve. This is then folded over the undercloak to make a double-lock standing seam in the usual way.

The run of the seam is kept to a minimum, say 450mm down from the abutment, by introducing a double-lock cross welt (see Figs 14 and 15). This is for two reasons. Firstly, the seam has to be folded over to retain the return upstand against the abutment, thus restricting lateral movement. Secondly, it reduces the wastage that results from the cutting away of the sheet edges, necessary to form the sweep.

The abutment corner with its graduated standing seam affects the spacing of the adjacent bays. The layout of the bays, therefore, needs to be thought out beforehand. Refer to Tables E (p8) and J (p10) for bay widths. Forming the seam takes up about 125mm.

In Long Strip roofing, the Pinched seam upstand (see Figs 8 and 12) is used where the other standing seams meet the general run of the abutment. The cover flashing detail (see Fig 12a) needs to allow 10mm for longitudinal movement.

In Traditional roofing, the Sweep standing seam upstand (see Fig 7) or the Turned-down seam upstand (see Fig 11) is used where the other standing seams meet the general run of the abutment. In both cases the seam is folded flat against the abutment. For cover flashing details see Figs 11a,11b,11c (p46) and 12b (p48). Stepped cover flashings are shown in Figs 18a, 18b and 18c (p59).

Temper: Roofing sheet; easier in soft or quarter-hard, but can be done in half-hard. Pre-formed cover flashing etc; half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	✓

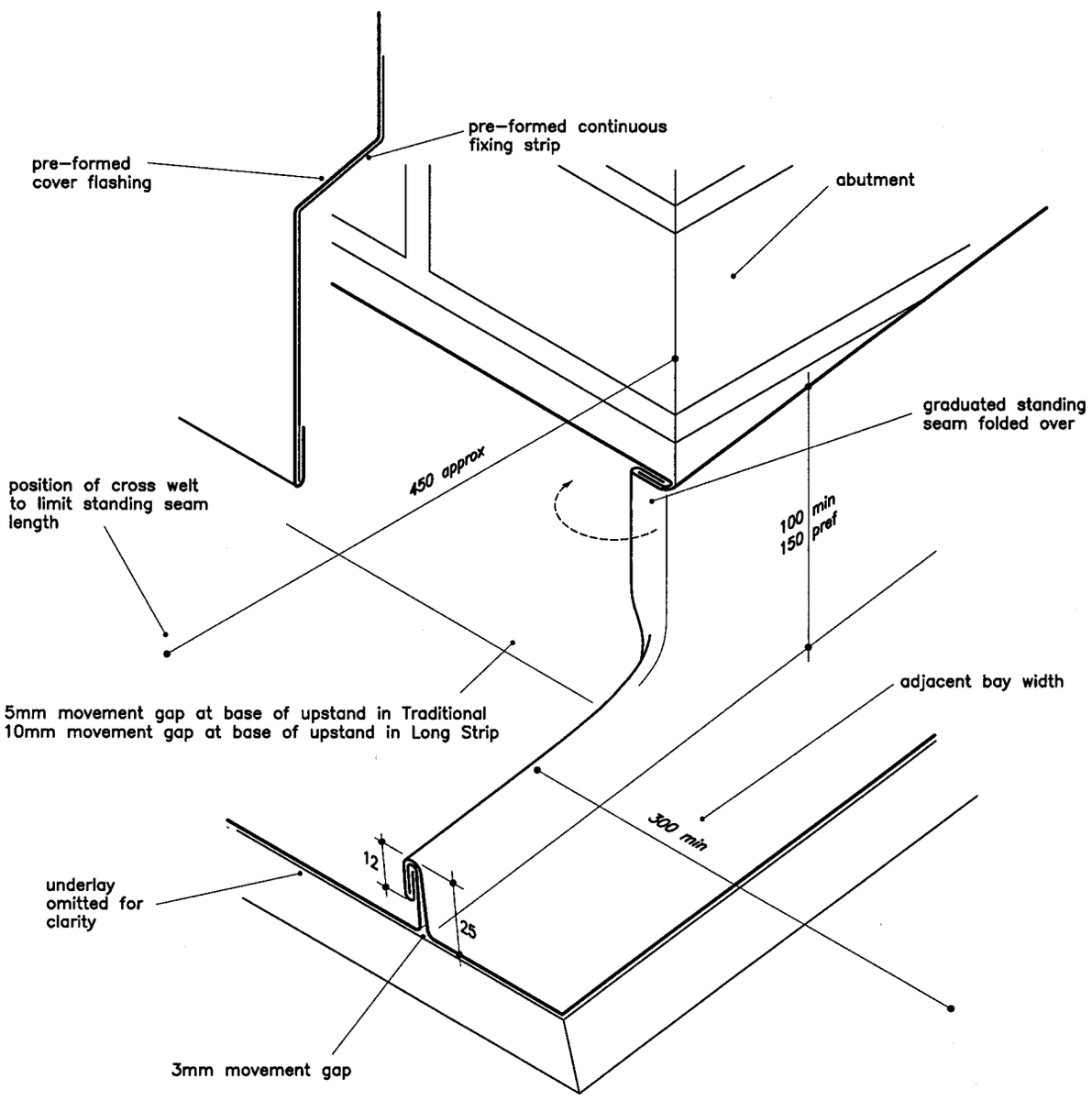


Fig 18 Double-lock standing seam at external corner

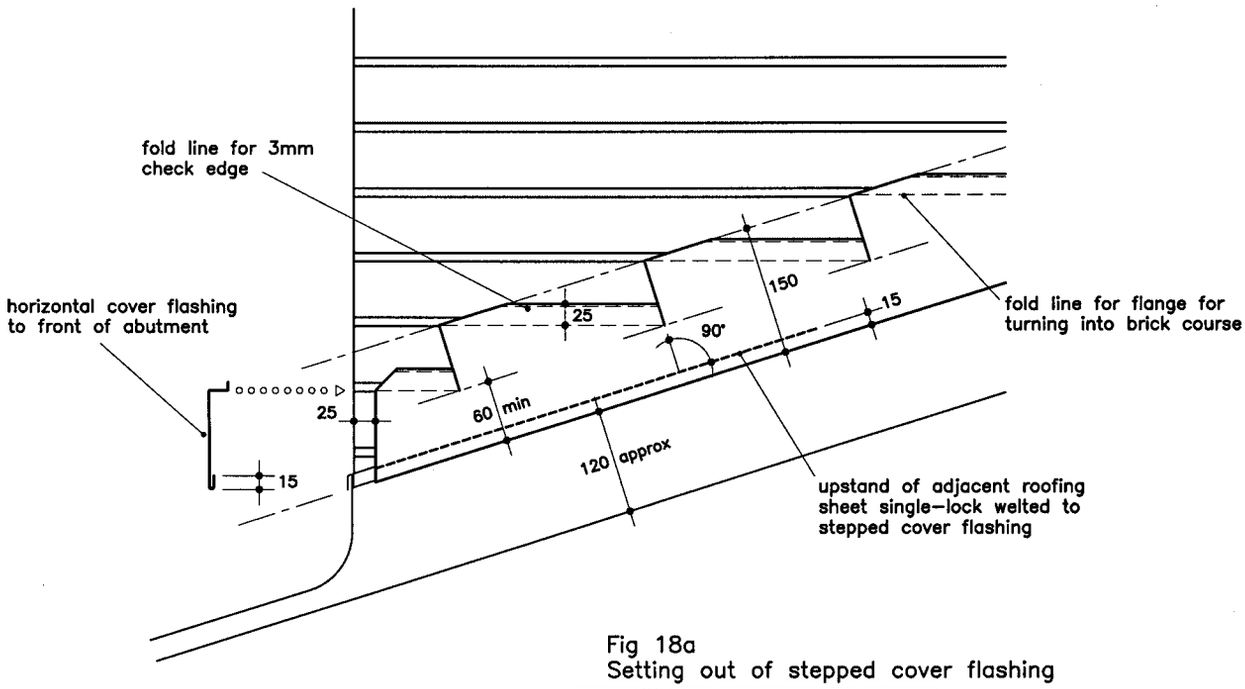


Fig 18a
Setting out of stepped cover flashing

TRADITIONAL ✓ | LONG STRIP ✓

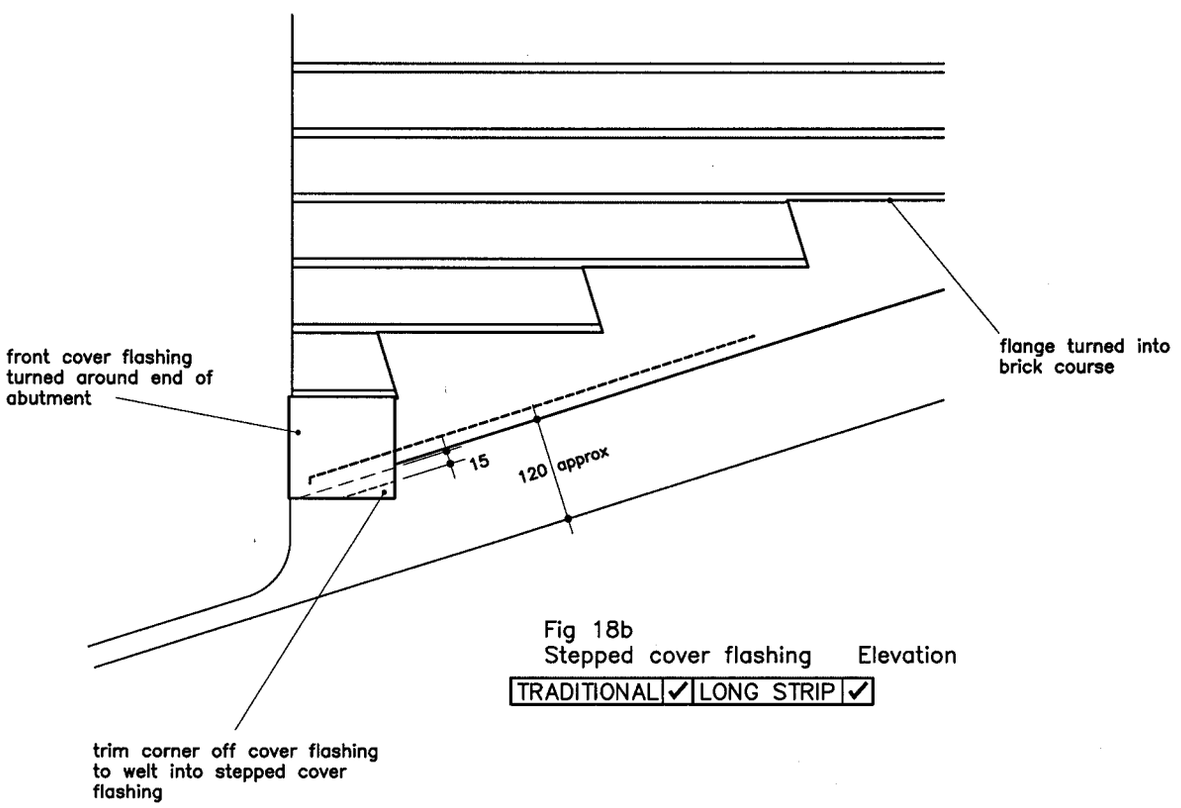


Fig 18b
Stepped cover flashing Elevation

TRADITIONAL ✓ | LONG STRIP ✓

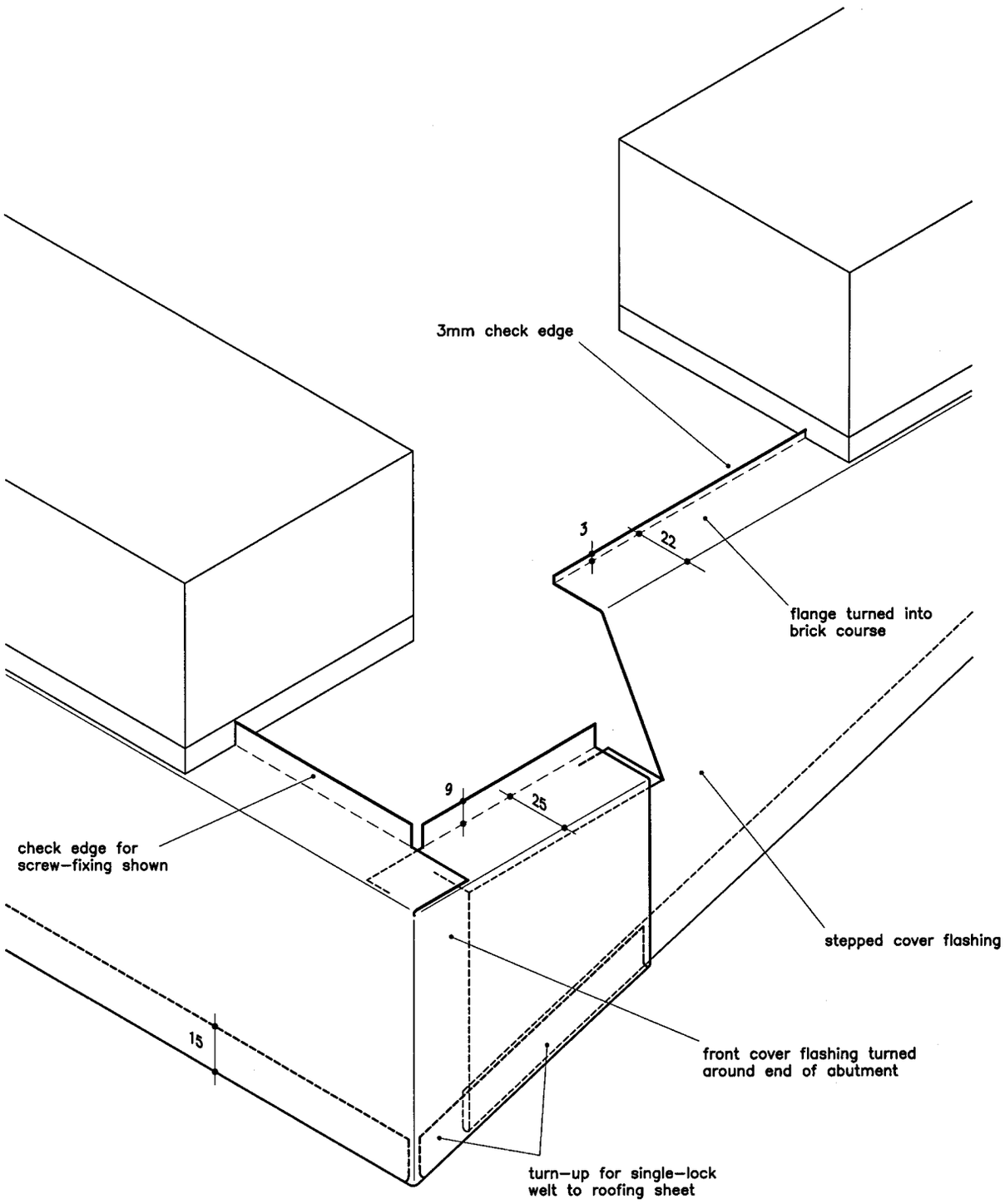


Fig 18c
Stepped cover flashing junction with horizontal flashing

TRADITIONAL	✓	LONG STRIP	✓

Fig 19 Double-lock standing seam to batten ridge or hip

Because the straight dog-eared upstand can be formed down to a minimum height of 40mm (but more usually 50mm), it is ideal where standing seams are required to abut battens. It is the preferred method for ridges and hips on warm roofs, and for hips on cold roofs. The detail also separates the copper on different roof slopes, allowing independent movement.

The Preformed straight dog-eared upstand can only be used where roof pitches are at or over 25degrees.

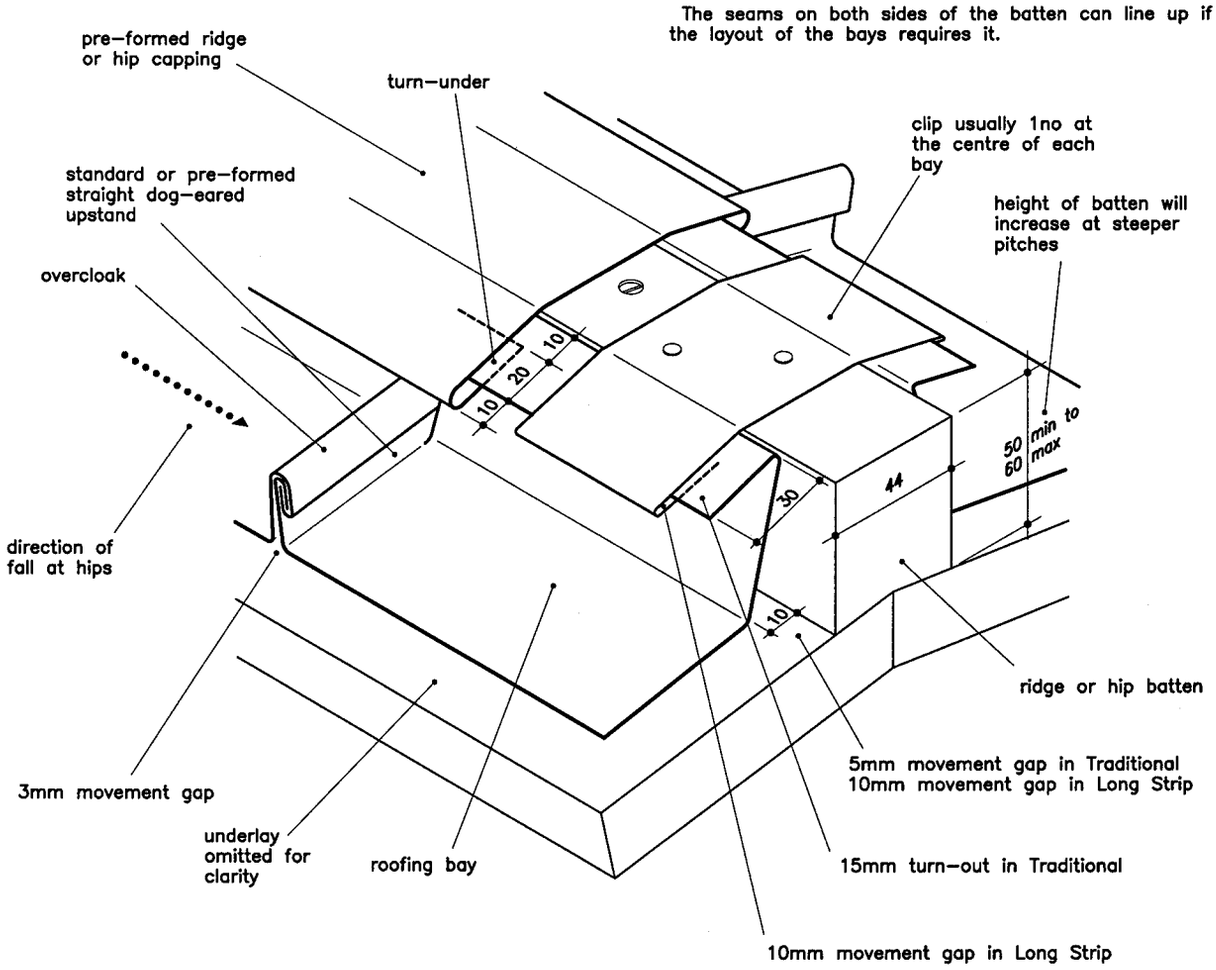
In Long Strip roofing the base of the upstand needs to allow 10mm for longitudinal movement. Similarly the ridge capping turn-under needs to allow 10mm for movement.

If the roof pitch is over 47degrees the height of the batten will need to be increased so that the upstand detail can be formed properly.

With standing seams at hips the overcloak must be folded over in the direction of down the hip ie in the direction of fall.

Temper: Straight dog-eared upstand; soft, quarter- or half-hard. Pre-formed capping; half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓



Stage 1
Form the chosen version of a straight dog–eared upstand (see Figs 9 and 10) on each side of the ridge or hip. If the Standard version is chosen the batten will be dropped in afterwards; if the Preformed version, the upstands can be formed with the batten in place.

The batten is screw–fixed with the screws well countersunk.

The seams on both sides of the batten can line up if the layout of the bays requires it.

Stage 2
Clip the 30mm turn–out at the head of each roofing bay to the batten. Usually 1no clip is provided, located at the centre of each bay.

Stage 3
Hook the pre–formed batten capping around the turn–outs to complete the detail.

Joints in ridge cappings are described with Fig 23 (p64).

Fig 20 Double-lock standing seam to ventilated ridge

The detail is quite involved, but is necessary for roofs which require ventilating to avoid the risk of condensation.

In sheltered conditions it is possible to omit the clips and simply nail the copper upstand to the substrate upstand.

Joints in ridge cappings are described with Fig 23 (p64).

Temper: Pinched seam upstand; soft, quarter- or half-hard.
Pre-formed capping; half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

Stage 1
Fix the substrate upstands at the ridge to timber blockings off the the roof structure. Nail the insect mesh at 100mm centres to the top of the upstands. Similarly screw the 100mm long timber spacer–blocks, placed over the mesh at 1m approximate centres.

Stage 2
Nail clips for the roofing copper to the substrate upstand, at 1no or 2no per bay. Form Pinched seam upstand (see Fig 8), and secure the turn–out with the clips.

Stage 3
Screw the weathered timber ridge–section to the spacer–blocks, and nail the continuous fixing strips in place. Joints in the continuous fixing strip are butt jointed. Finally hook the pre–formed ridge capping around the continuous fixing strip on one side, and complete the fixing with seaming pliers on the other.

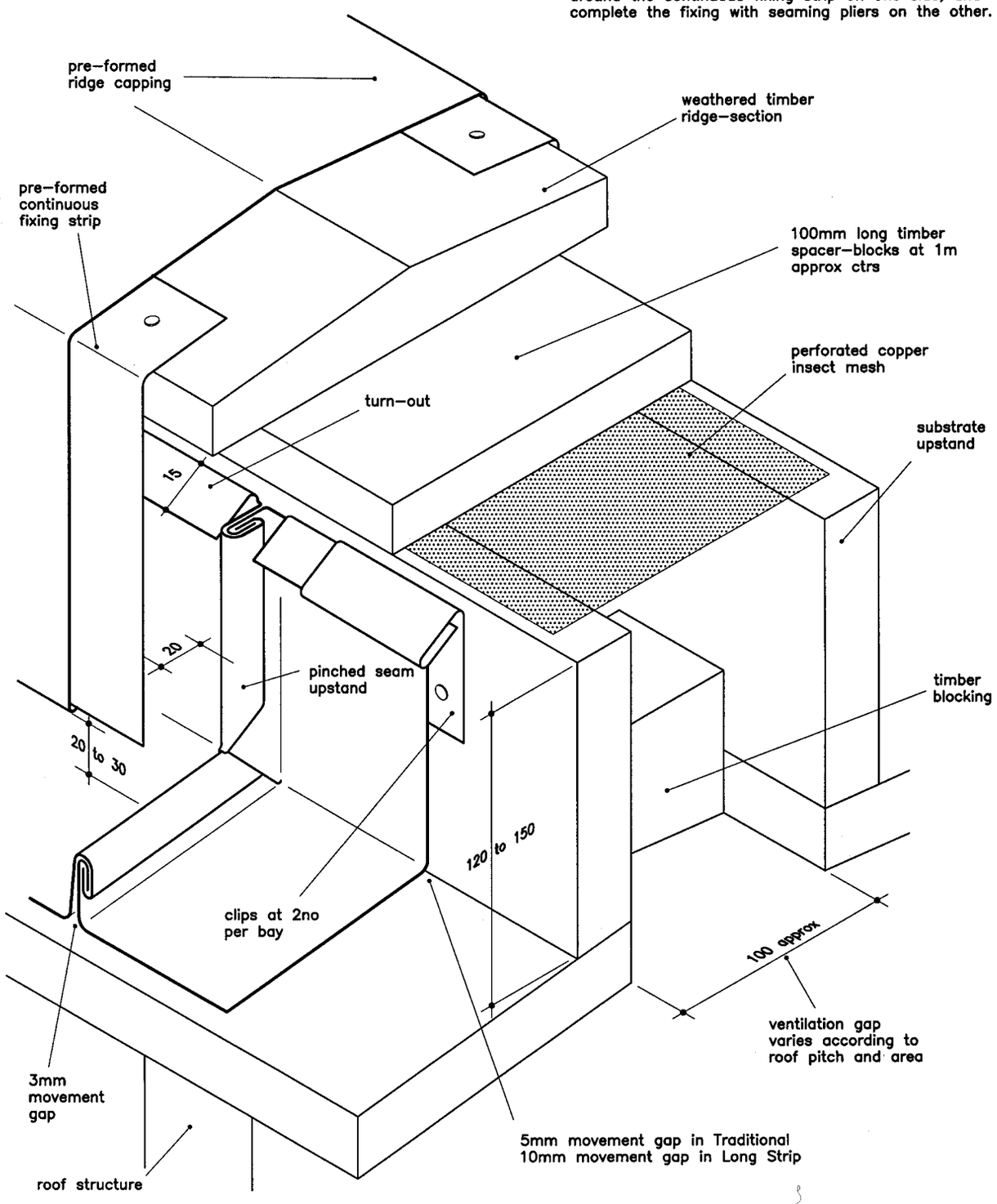


Fig 21 Double-lock standing seam to T-seam ridge

This detail is almost identical in appearance to a batten ridge (see Fig 19) and, because it is difficult to keep straight, the batten ridge is usually preferred. Like the batten type, it can also be used for hips. The minimum upstand that can be formed is 40mm, but is more usually 50mm.

In Long Strip roofing, a 10mm movement gap is provided between the base of the upstand and the clip; and where the capping engages the turn-out.

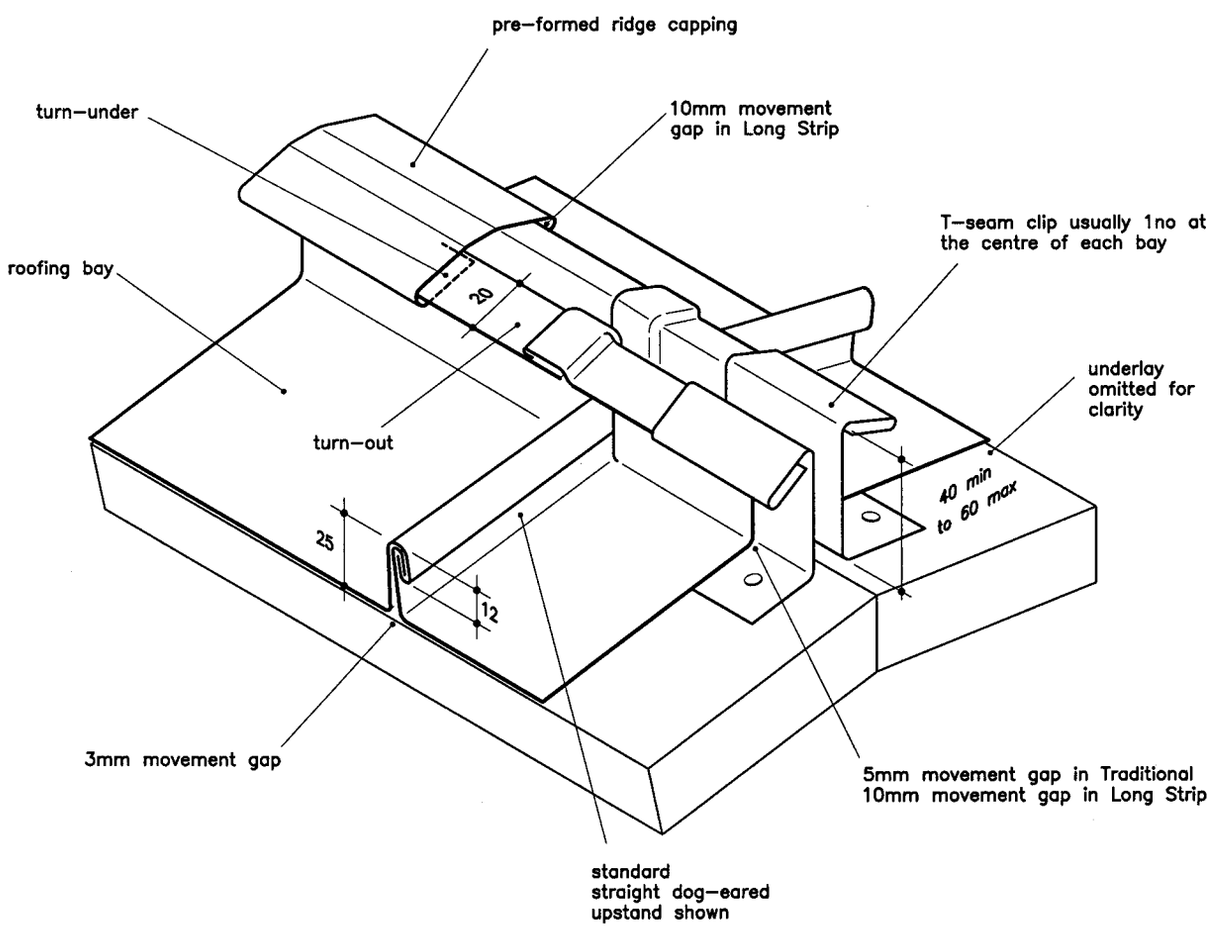
Single-lock welts could be used instead of laps to joint the ridge capping, but they need a lot of care to finish neatly (see Fig 11b).

The minimum roof pitch for the Pre-formed straight dog-eared upstand is 25degrees.

Temper: Straight dog-eared upstand; soft, quarter- or half-hard. Pre-formed capping; half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

Stage 1
Fix T–seam clips along the ridge, at 1no per bay located at the centre. Form Standard or Pre–formed straight dog–eared upstand (see Figs 9 and 10), with a 20mm turn–out at the head of each roofing bay.



Stage 2
Hook the pre–formed ridge capping around the turn–outs on one side, and complete the fixing with seaming pliers on the other. Joint the ridge capping with lap joints at 2m maximum centres: either 50mm with a check edge and sealed (see Fig 12b), or 150mm simple laps (see Fig 11a).

Fig 22 Double-lock standing seam to standing seam ridge

This ridge detail can only be used on small roofs, say 3m x 3m maximum, because it restricts movement in the copper sheet. Its use therefore is very limited, but it is useful for dormers etc.

An alternative shown in Fig 22a below has a dressed down single-lock welt forming the ridge. This can only be used in sheltered positions. A variation with the double-lock standing seam ridge turned down is possible for more exposed situations.

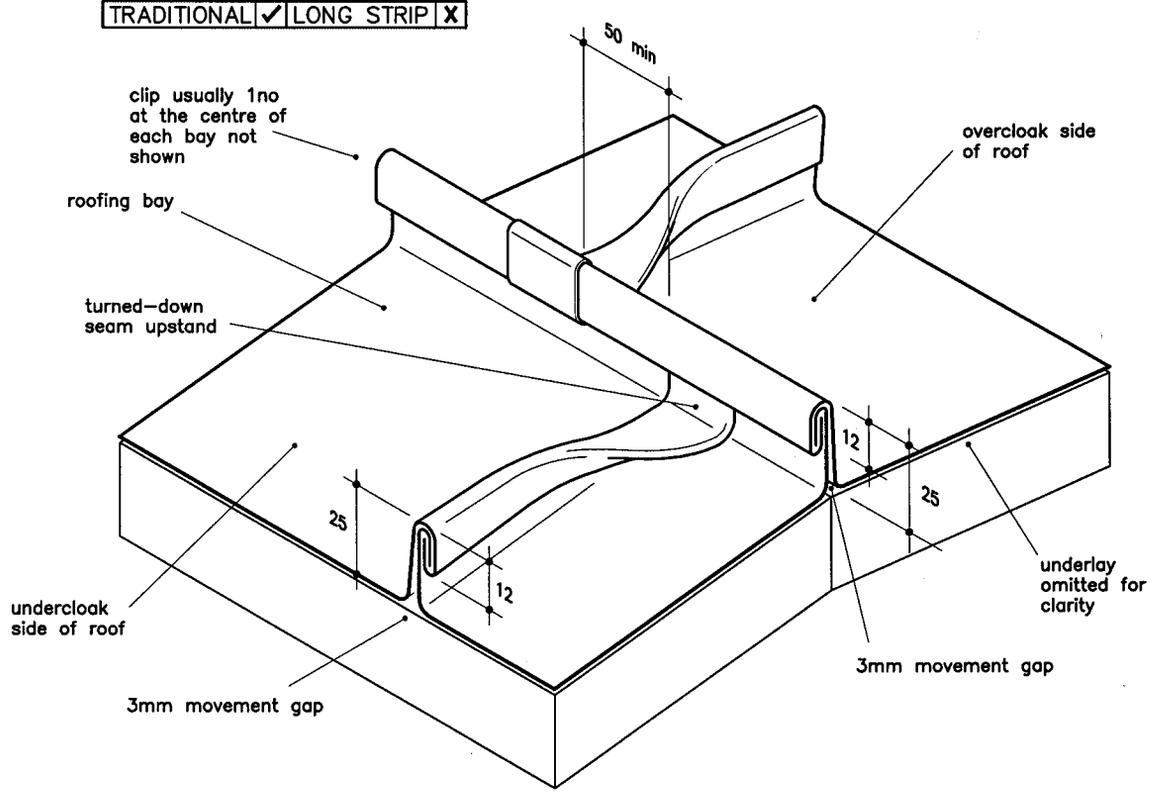
Temper: Turned-down seam upstand; soft or quarter-hard, preferably. If half-hard is used the sides of the copper sheet must be cut tapered to the start of the splay (see Fig 11).
Thickness: 0.6mm or 0.7mm

Stage 1
Form turned–down seams to the roofing bays (see Fig 11), starting with the undercloak side. The roofing sheets should be taken 35mm beyond the ridge line, and then folded back carefully to match the roof pitch of the opposite slope. Use seaming pliers.

Stage 2
Form turned–down seams to the roofing bays on the overcloak side, taking the roofing sheets beyond the ridge line by 45mm. These will now be lying on the undercloak upstand folded back in Stage 1.

Stage 3
Fold both overcloak and undercloak back upright on the ridge line. Then form the standing seam joint along the ridge using hand seaming irons, or a seaming 'H' iron and a seaming mallet.

TRADITIONAL ✓ LONG STRIP X



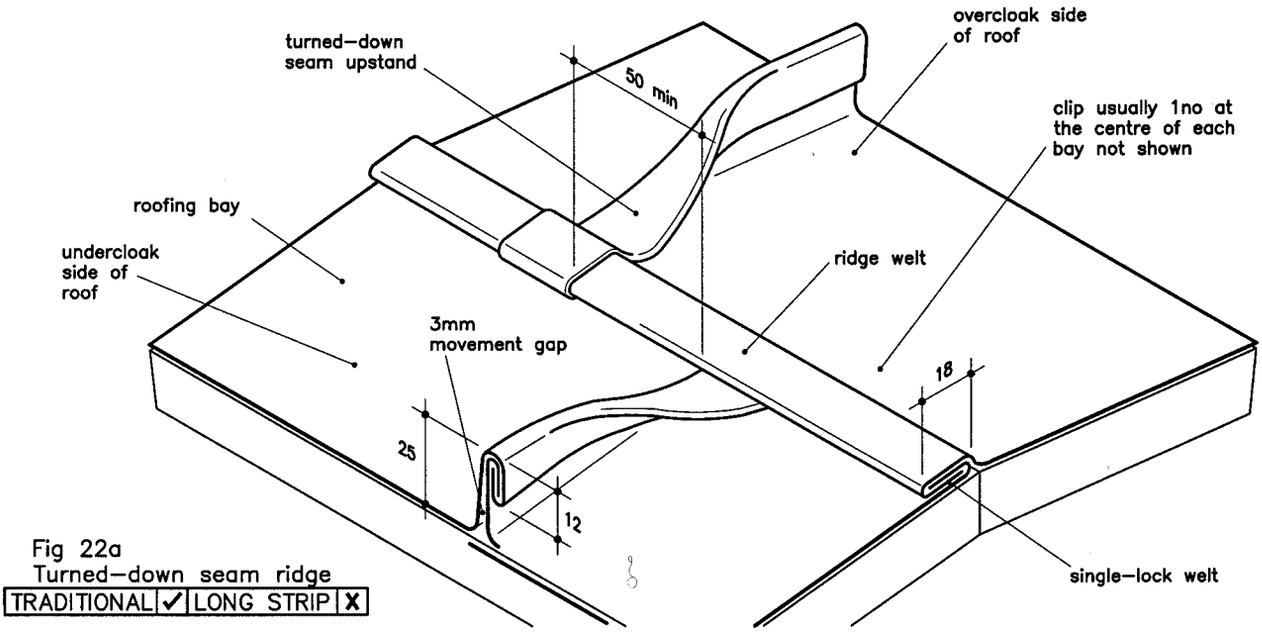


Fig 22a
Turned–down seam ridge

TRADITIONAL ✓ LONG STRIP X

Fig 23 ... to ventilated monopitch roof over direct-fixed cladding

This detail is necessary for roofs which require ventilating to avoid the risk of condensation.

In Long Strip roofing (see Fig 23a below) the detail is basically the same but the roofing clips are formed to allow longitudinal movement.

Joints in fascias and ridge cappings are the same as for cover flashings. They should be at 2m maximum centres. They can be made with lapped joints: either 150mm or 50mm with a check edge and sealed; or with single- or double-lock welts, according to exposure and depth (see Figs 12b, 11a, 11b and 11c). With fascias where the depth is over 100mm, and with deep cappings such as that shown in Fig 20, welted joints are recommended to hold the copper neatly in line. The return folds of the welts are pre-formed. Double-lock welts in particular will be difficult to form in this situation and should be pre-formed.

More detail on direct-fixed cladding is given in Fig 29 (p76)

Temper: Roofing sheet with straight dog-eared upstand; soft, quarter- or half-hard. Pre-formed fascia; half-hard.
Cladding; quarter- or half-hard.
Thickness: 0.6mm or 0.7mm

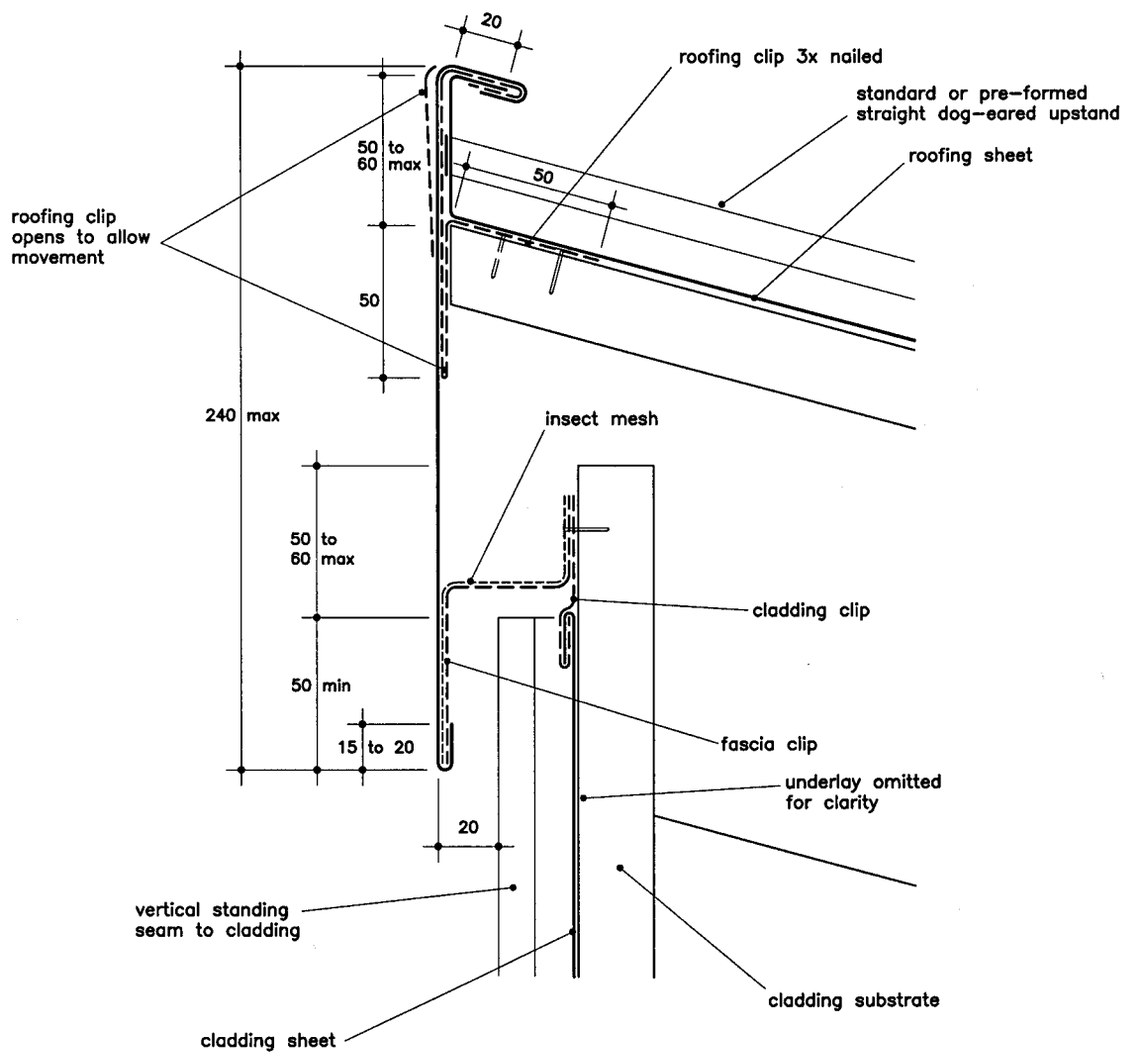


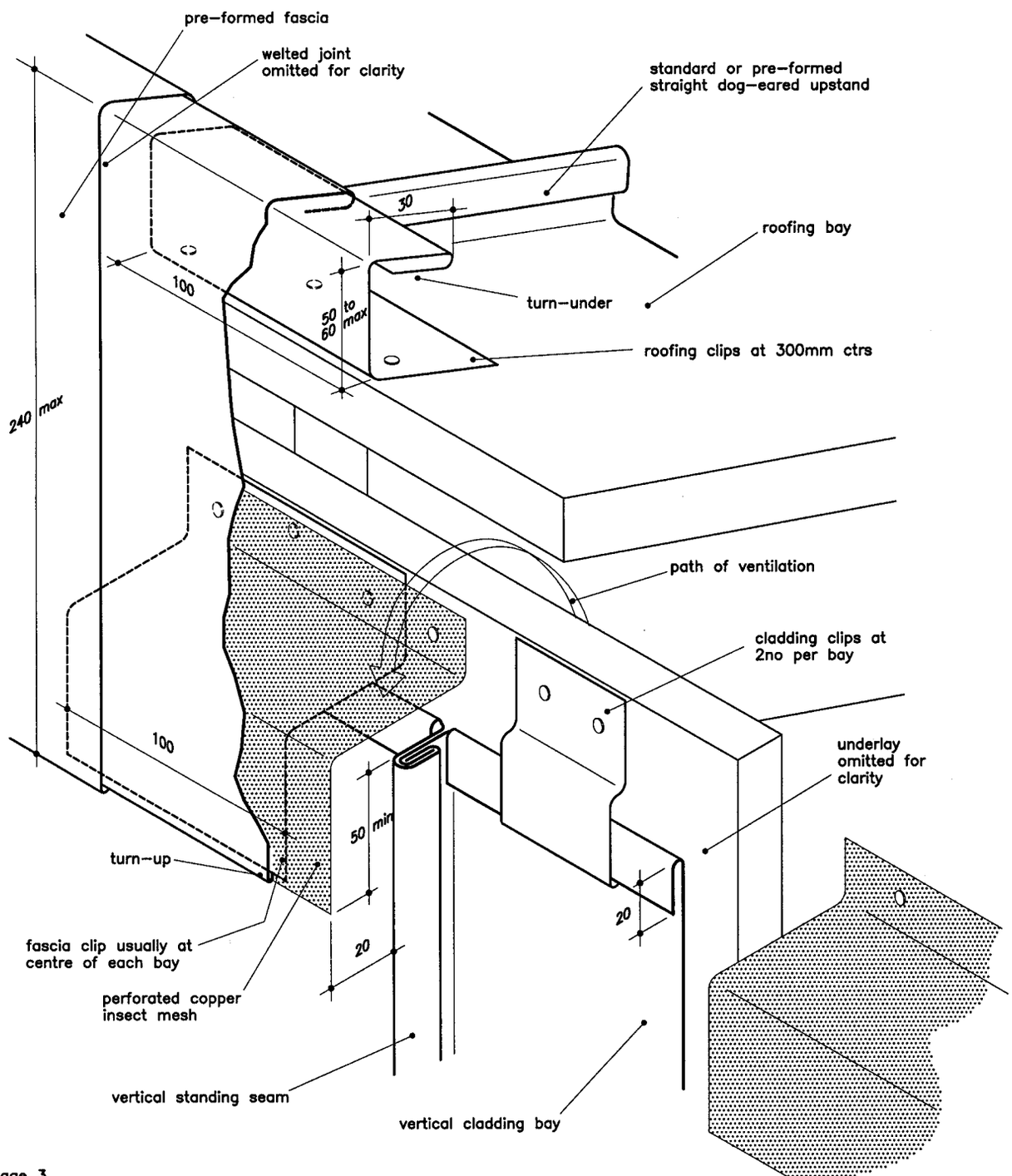
Fig 23a
Showing movement clip used in Long Strip roofing

TRADITIONAL [X] LONG STRIP [✓]

Stage 1
Finish off the direct–fixed vertical cladding with a 15 to 20mm turn–down, to engage cladding clips at 2no per bay. Use cranked seaming pliers. Nail pre–formed fascia clips to the substrate, at 1no per bay located at the centre. Then nail in place the pre–formed insect mesh at 100mm centres.

TRADITIONAL ✓ LONG STRIP ✓

Stage 2
Nail roofing clips at 300mm centres along the ridge line. Finish off the roofing sheets to engage these clips with the chosen version of a straight dog–eared upstand (see Figs 9 and 10).



Stage 3
Hook the bottom edge of the pre–formed fascia around the fascia clips; and, using seaming pliers, complete the fixing at the top with a turn–under to engage the upstand already formed.

Fig 24 ... with batten verge over direct-fixed cladding

Joints in fascias are described with Fig 23 (p64). Where the depth of a fascia exceeds 100mm, welted joints are recommended to hold the copper neatly in line.

In Long Strip roofing (see Figs 24c and 24d) the detail is basically the same but sliding clips are provided, fixed to the substrate, next to the verge batten. Note that this only applies outside the 'fixed clip zone' (see Table L, p11). Inside the fixed clip zone sliding clips are never provided.

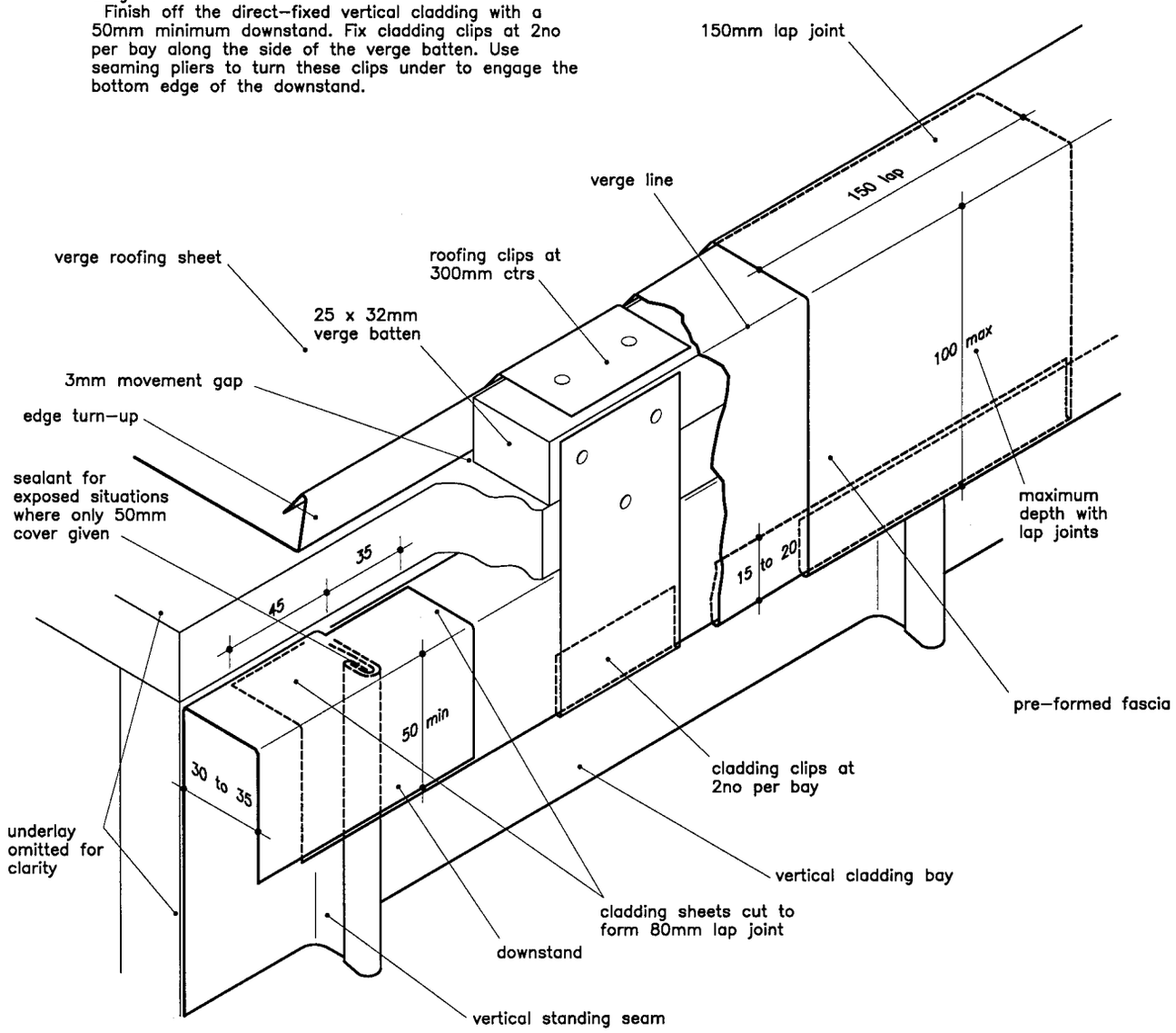
More detail on direct-fixed cladding is given in Fig 29 (p76).

Temper: Roofing sheet; soft, quarter- or half-hard.
Pre-formed fascia; half-hard. Cladding; quarter- or half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

Stage 1
Finish off the direct–fixed vertical cladding with a 50mm minimum downstand. Fix cladding clips at 2no per bay along the side of the verge batten. Use seaming pliers to turn these clips under to engage the bottom edge of the downstand.

Stage 2
Nail roofing clips at 300mm centres along the top of the verge batten. The clips will now lie over the edge turn–up of the verge roofing sheet.



Stage 3
Hook the bottom edge of the pre–formed fascia around the bottom edge of the downstand. Complete the fixing at the top with a double–lock welt to the edge turn–up of the verge roofing sheet.

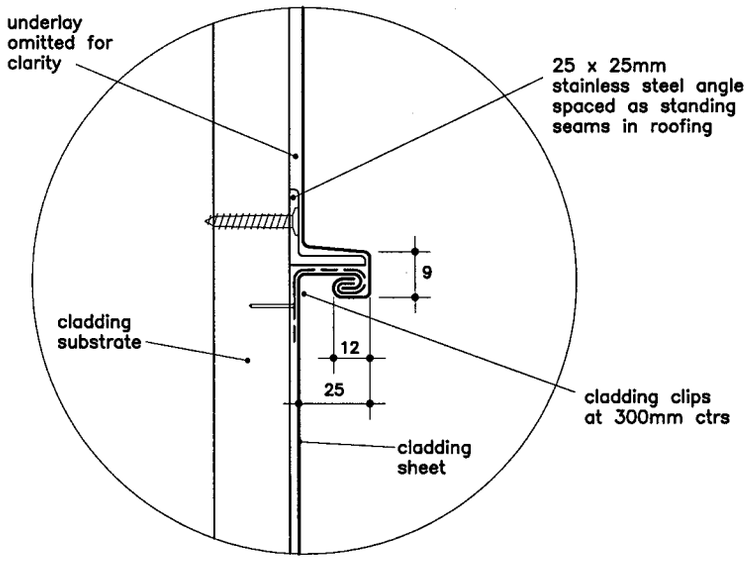


Fig 24a
Horizontal direct–fixed cladding joint
TRADITIONAL ✓ LONG STRIP ✓

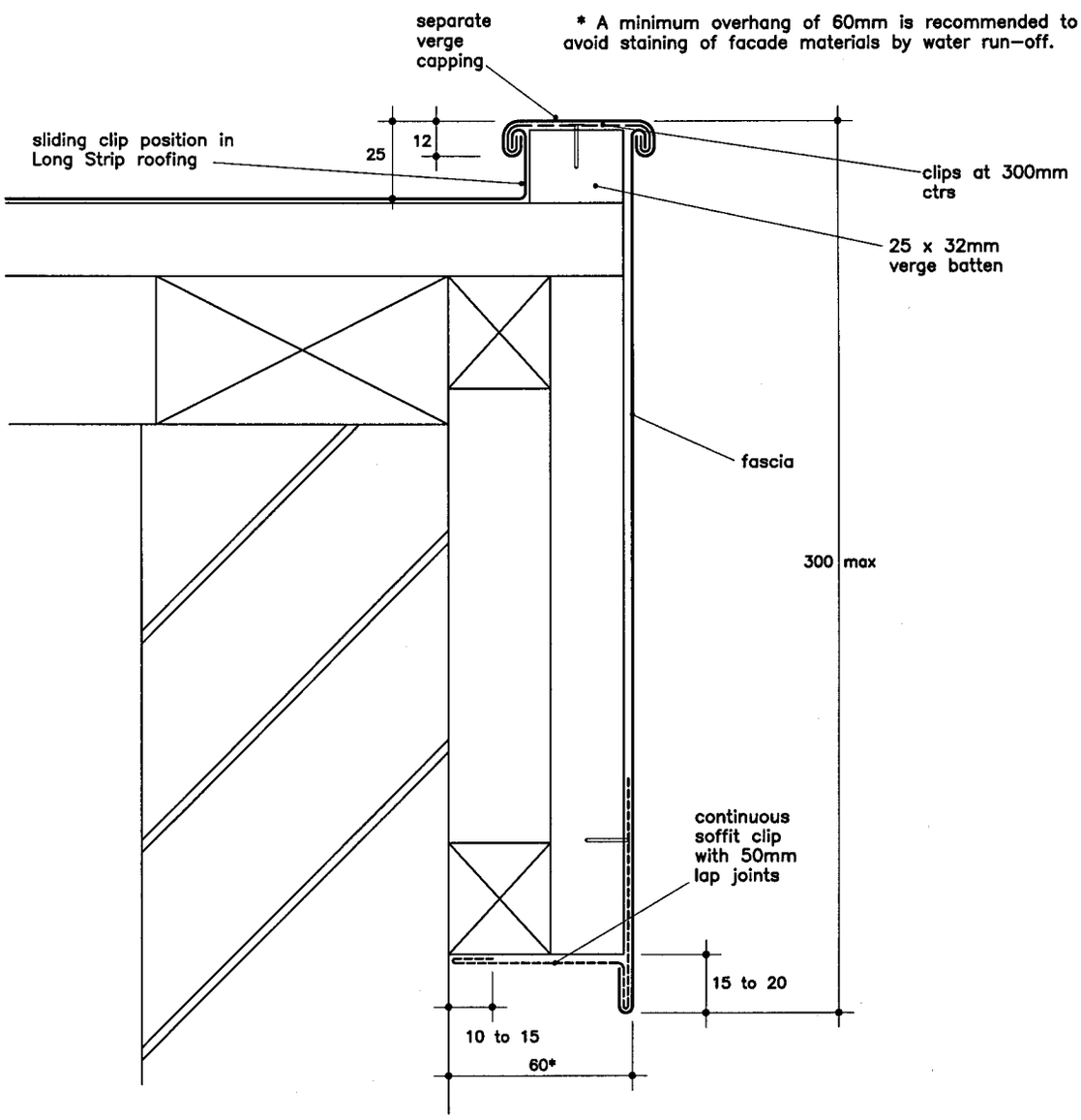
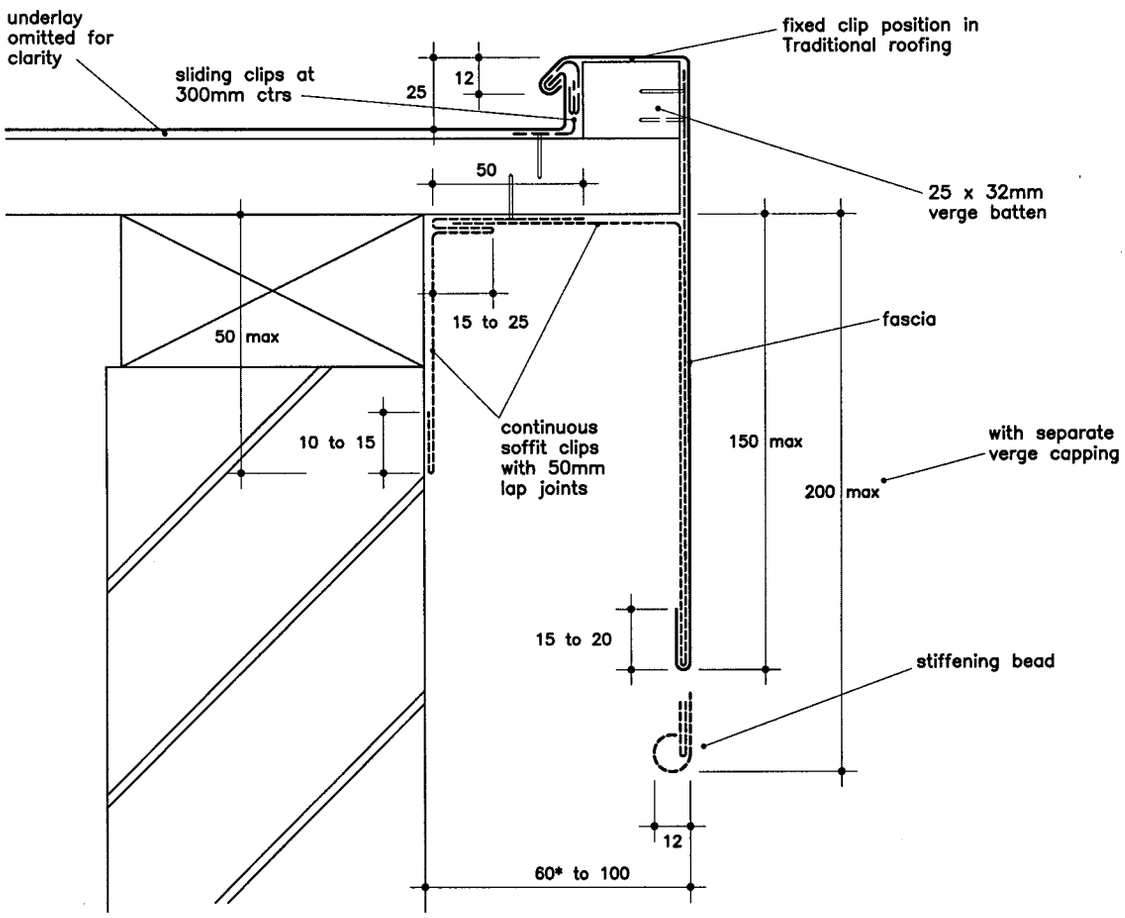


Fig 24b
Batten verge over brickwork with copper clad timber fascia up to 300mm deep, 60mm overhang
TRADITIONAL ✓ LONG STRIP ✓

Fig 24c
Batten verge over brickwork with copper fascia up to 250mm deep, maximum 100mm overhang

TRADITIONAL	✓	LONG STRIP	✓



* A minimum overhang of 60mm is recommended to avoid staining of facade materials by water run-off.

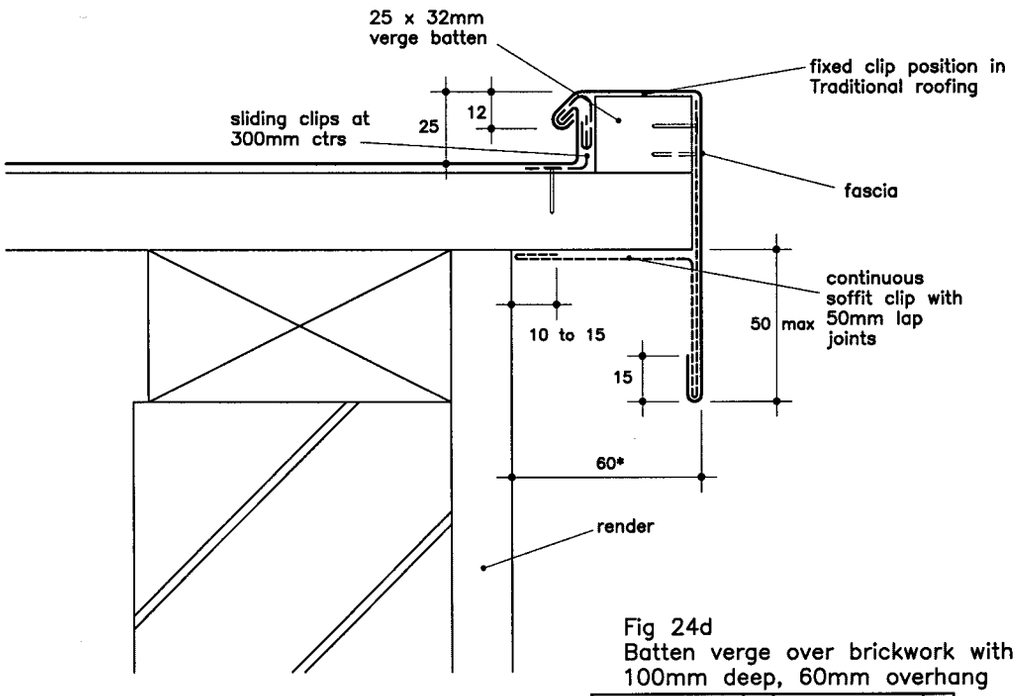


Fig 24d
Batten verge over brickwork with copper fascia up to 100mm deep, 60mm overhang

TRADITIONAL	✓	LONG STRIP	✓

Fig 25 ... with standing seam verge over brickwork

With the detail as drawn the wallplate and the substrate at the soffit will be exposed. Their finished appearance therefore needs to be considered. Alternatively the copperwork can be designed to finish the soffit gap. A minimum overhang of 60mm is recommended to avoid staining of facade materials by water run-off.

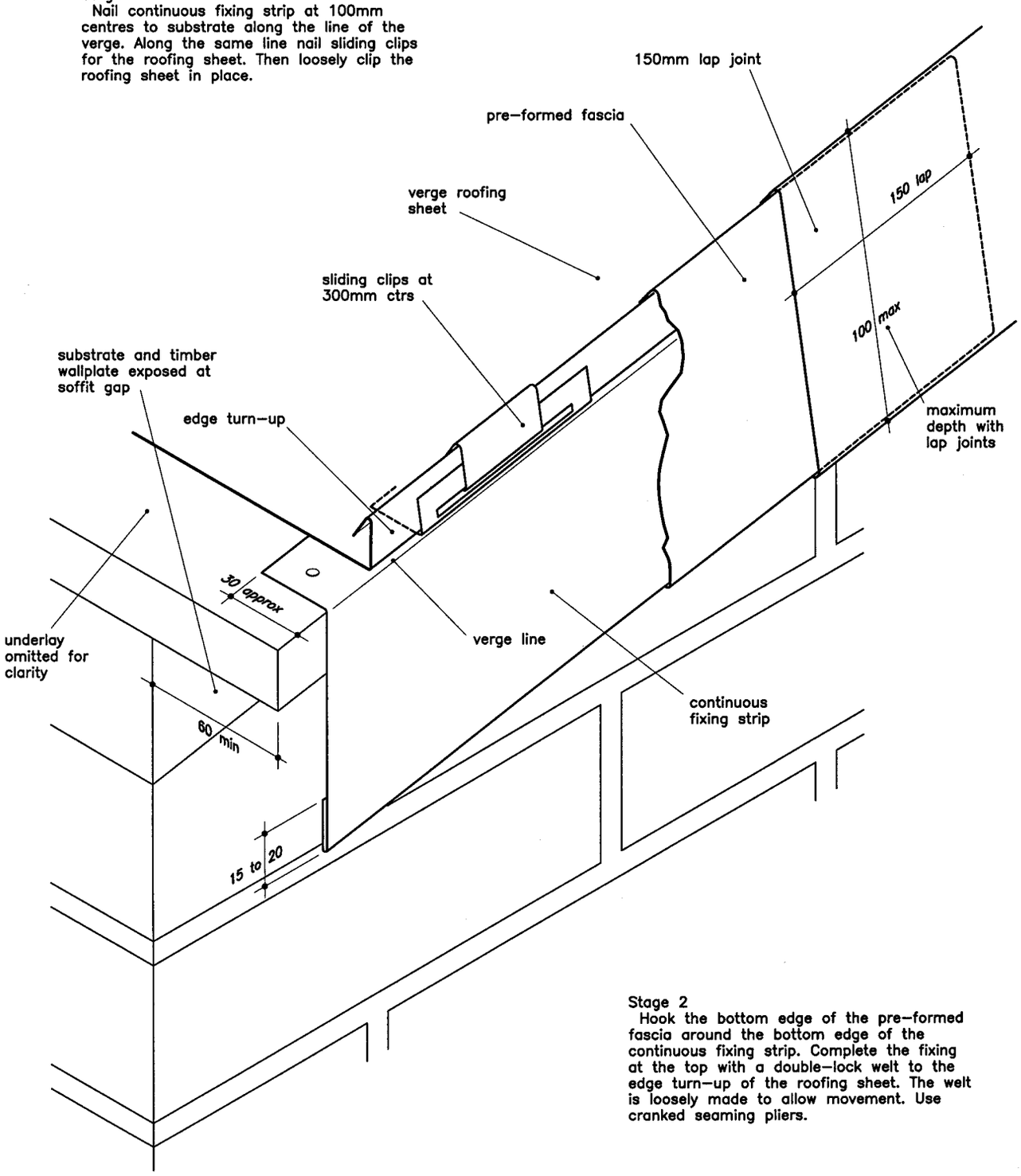
In Traditional roofing (see Figs 25b and 25c) the detail is basically the same but fixed clips are provided. Note that in Long Strip roofing sliding clips are only provided outside the 'fixed clip zone' (see Table L, p11). Inside the fixed clip zone sliding clips are never provided.

Joints in fascias are described with Fig 23 (p64). Generally, where the depth of a fascia exceeds 100mm, welted joints are recommended to hold the copper neatly in line.

Temper: Roofing sheet; soft, quarter- or half-hard. Pre-formed fascia; half-hard. Cladding; quarter- or half-hard.
Thickness: 0.6mm or 0.7mm

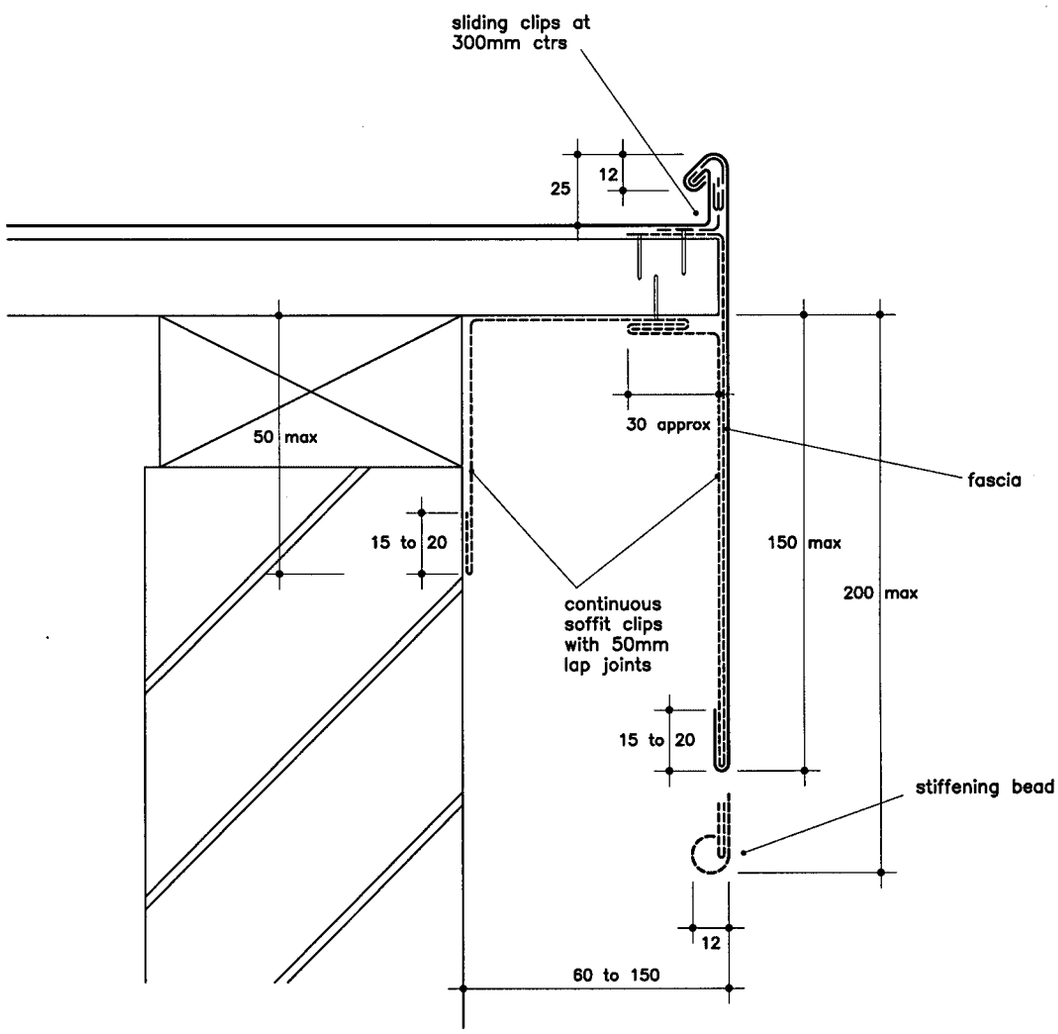
TRADITIONAL ✓ LONG STRIP ✓

Stage 1
Nail continuous fixing strip at 100mm centres to substrate along the line of the verge. Along the same line nail sliding clips for the roofing sheet. Then loosely clip the roofing sheet in place.



Stage 2
Hook the bottom edge of the pre–formed fascia around the bottom edge of the continuous fixing strip. Complete the fixing at the top with a double–lock welt to the edge turn–up of the roofing sheet. The welt is loosely made to allow movement. Use cranked seaming pliers.

Fig 25 … with standing seam verge over brickwork



* A minimum overhang of 60mm is recommended to avoid staining of facade materials by water run–off.

Fig 25a
Standing seam verge over brickwork with copper fascia up to 250mm deep, maximum 150mm overhang

TRADITIONAL	✓	LONG STRIP	✓

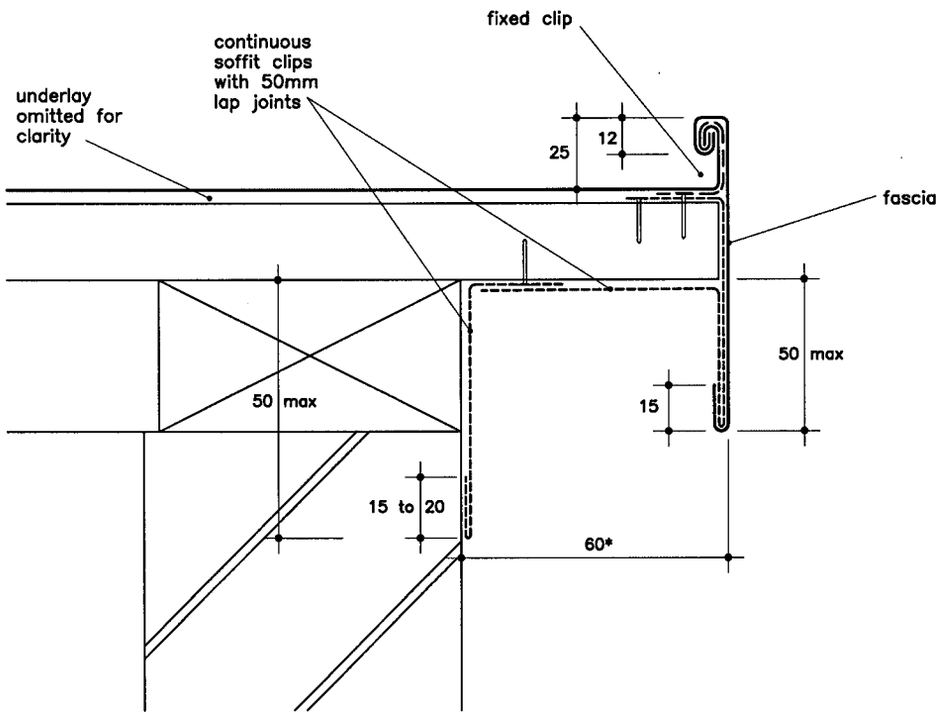
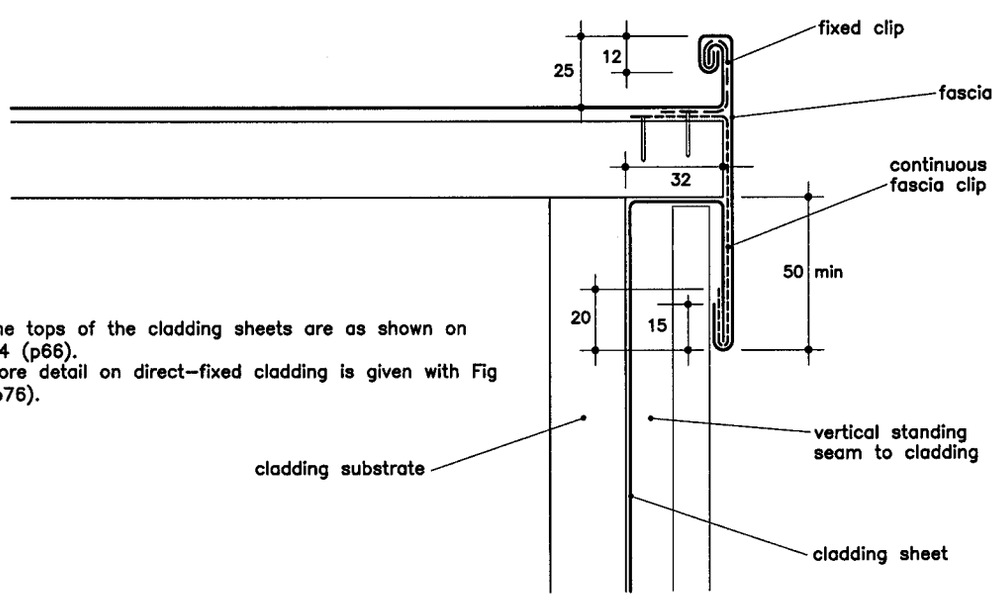


Fig 25b
Standing seam verge over brickwork with copper fascia up to 100mm deep, 60mm overhang
TRADITIONAL ✓ LONG STRIP ✓



* The tops of the cladding sheets are as shown on Fig 24 (p66).
* More detail on direct-fixed cladding is given with Fig 29 (p76).

Fig 25c
Standing seam verge over direct-fixed cladding with copper fascia up to 200mm deep
TRADITIONAL ✓ LONG STRIP ✓

Fig 26 ... at eaves with roof pitch up to 20degrees

This detail, together with Fig 26a, illustrates the essentials of forming an eaves detail in Long Strip roofing. And in Traditional roofing where either the Concave-form seam end (see Fig 4), the Chamfer-form seam end (see Fig 5) or the Square-form seam end (see Fig 6) is chosen. Only the Turned-down seam end (see Fig 3) allows the roofing sheets to be tightly welted down, thereby achieving weathertightness on its own. This welting down allows no movement and so, of course, is only possible in Traditional roofing.

For roof pitches up to 20degrees, a 3mm to 5mm anti-capillarity recess is formed in the substrate to accommodate the eaves strip. The eaves strip should go up the roof slope 130mm minimum from the front edge of the substrate. The 200mm shown is a good dimension to work to and gives a measure of tolerance. Its top edge is held by welting to clips at 300mm centres.

For roof pitches at and over 20degrees, a recess is not required for the eaves strip; nor is it welted to clips along its top edge. It is simply nailed to the substrate at 100mm staggered centres.

Whatever the pitch the detail at the front edge is the same. The eaves strip is folded back to form a 'hook'. This engages with either individual clips at 300mm centres, or, as is often easier in practice, with a continuous fixing strip, nailed to the substrate at 100mm staggered centres. With some details it is possible to omit these fixings because there is some other well-fixed profile of copper available for the eaves strip to hook around (see Fig 29, p76).

A 10mm to 15mm weathercheck is formed in the eaves strip for exposed situations or for roof pitches below 15degrees.

In Long Strip roofing, a 10mm movement gap is allowed when the roofing sheets are turned under the eaves strip. To achieve this the roofing sheets are cut to project 40mm beyond the finished eaves strip. When folded under they engage the eaves strip by 20mm, ensuring that even in expansion they remain well retained.

In Traditional roofing no movement gap is required. The roofing sheets are cut to project 20mm beyond the finished eaves strip, giving an engagement of 15mm approximately.

Lengths of eaves strip should not exceed 2m maximum. Joints in the run of the eaves strip are either 150mm lapped or, more usually and preferably, 50mm lapped and sealed. Note that joints in eaves strips must be positioned at least 150mm from standing seams, but a convenient rule is to make such joints mid-bay. Therefore, the setting out of the eaves strip needs to take the roofing bays into account.

Underlays generally are discussed in Copper for roofing (see p3). There are two broad categories: waterproof and non-waterproof. Waterproof underlays are laid to lap over the eaves strip. Non-waterproof underlays can be laid to butt up to the top edge of the eaves strip.

Temper: Roofing sheet with chamfer-form seam end; half-hard preferably. Pre-formed eaves strip and drop apron; half-hard.
Thickness: 0.6mm or 0.7mm

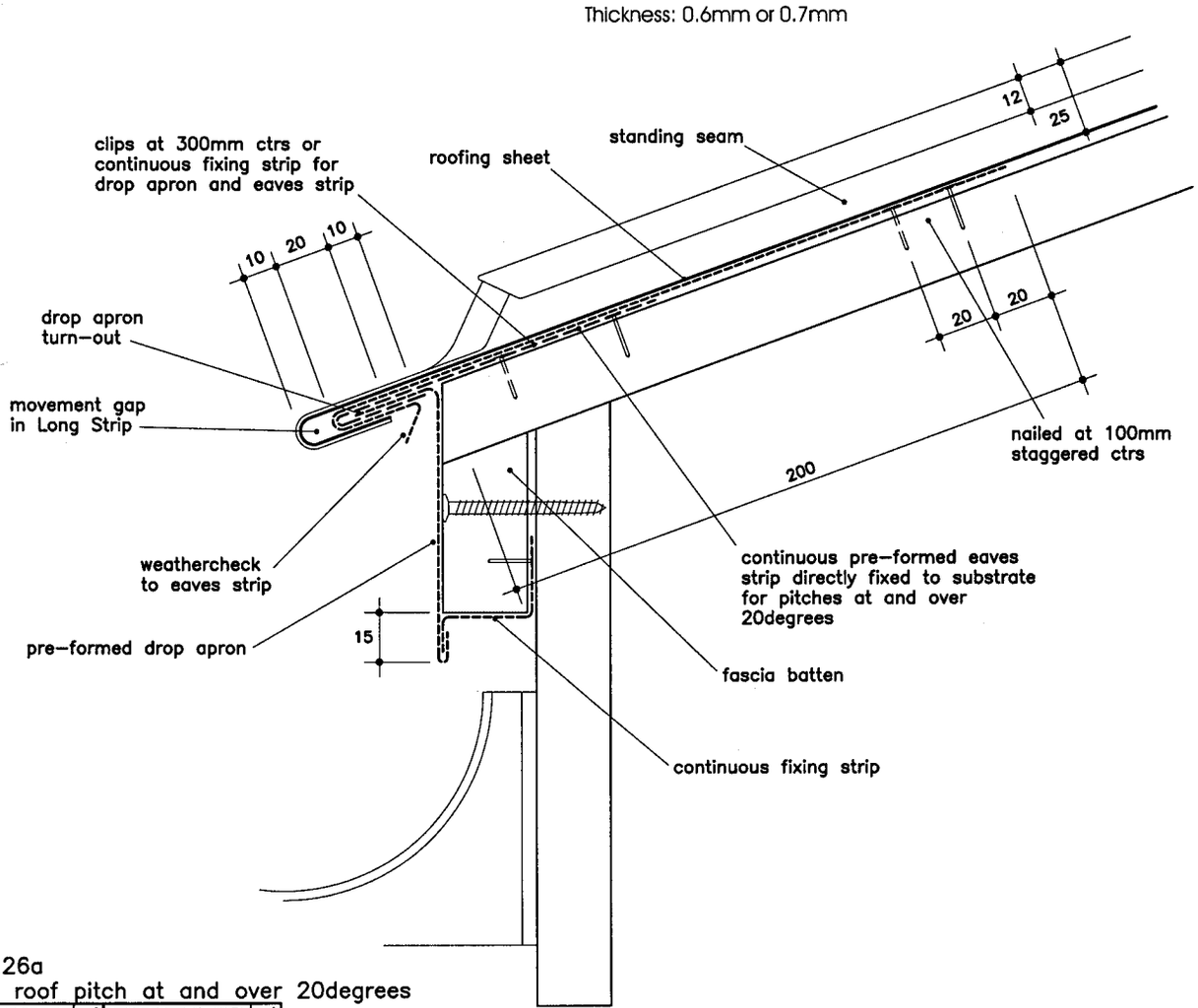
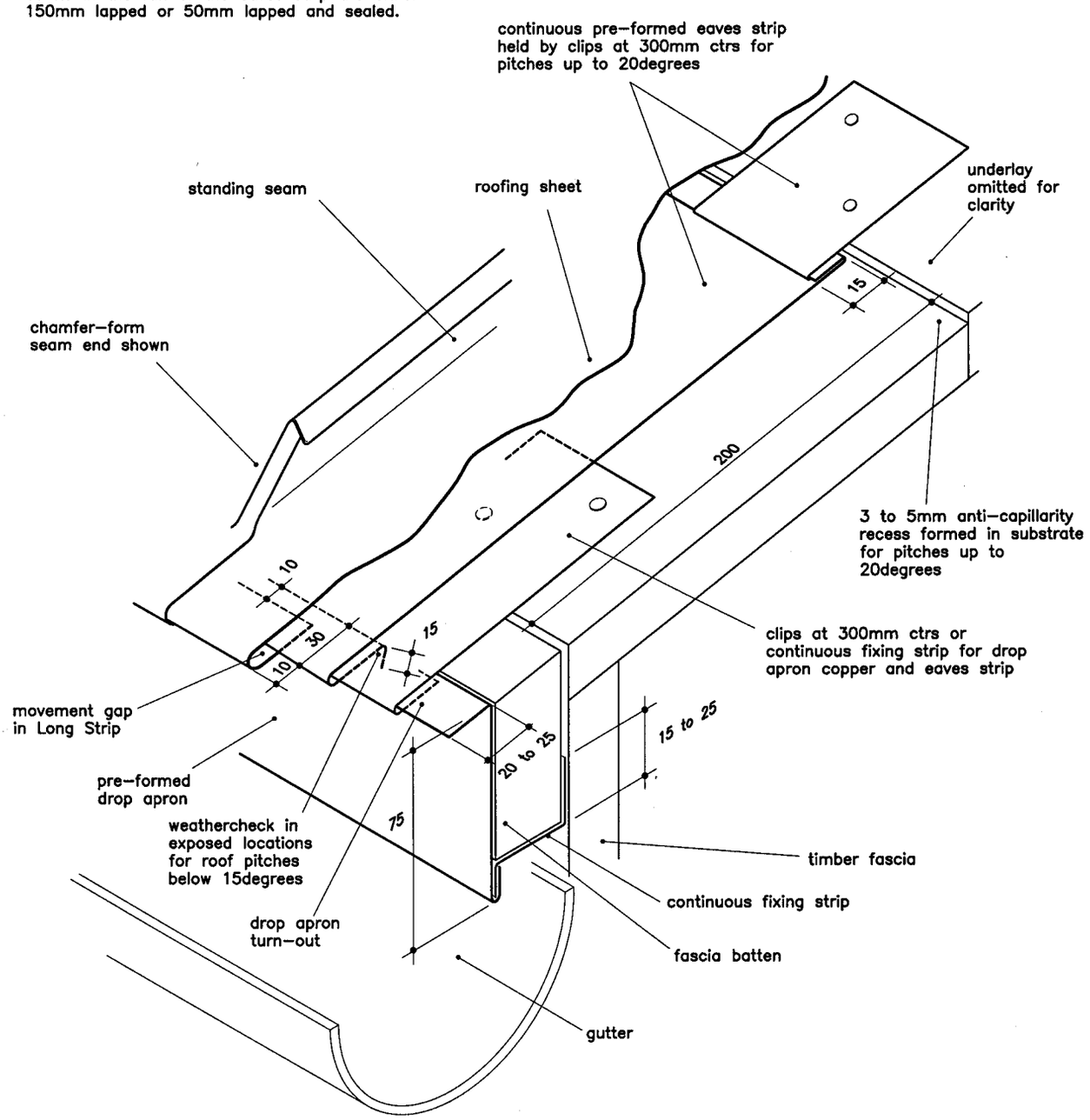


Fig 26a
with roof pitch at and over 20degrees
TRADITIONAL ✓ LONG STRIP ✓

TRADITIONAL ✓ LONG STRIP ✓

Stage 3
Hook the front edge of the continuous pre–formed eaves strip around the turn–out of the drop apron. Fix the top edge of the eaves strip with clips at 300mm centres. Lengths of eaves strip should not exceed 2m maximum. Joints in the run of the eaves strip are either 150mm lapped or 50mm lapped and sealed.

Stage 4
Fix the roofing sheets in place, forming the chosen seam end as described in Figs 4 (p22), 5 (p28) and 6 (p30). Then fold the ends of the roofing sheets, now united, under the eaves strip. Eaves folders ('first and second turn') should be used.



Stage 1
Nail the continuous fixing strip, for holding the bottom edge of the drop apron, to the back of the fascia batten at 100mm centres. Screw the fascia batten in place making sure that its top surface is flush with the main substrate. Alternatively it can be designed to fit under the main substrate carried forward, as shown on Fig 26a opposite.

Stage 2
Hook the bottom edge of the pre–formed drop apron around the fixing strip and retain its top edge with clips at 300mm centres. Joints in the run of both the fixing strip and the drop apron are 50mm lapped joints.

Fig 27 ... at eaves with alternative fixing plate for eaves strip

The fixing plates are designed to engage both the 'hook' of the eaves strip and its downstand. They are used to give extra rigidity to the downstand, if this is required because of exposure. However, because it is quicker to install, the continuous fixing strip is a more common detail, in spite of the fact that it uses more copper.

More detail on eaves strips and their installation is given in Figs 26 and 26a (p72).

In Long Strip roofing, a 10mm movement gap is allowed when the roofing sheets are turned under the eaves strip. When folded under they engage the eaves strip by 20mm, ensuring that even in expansion they remain well retained.

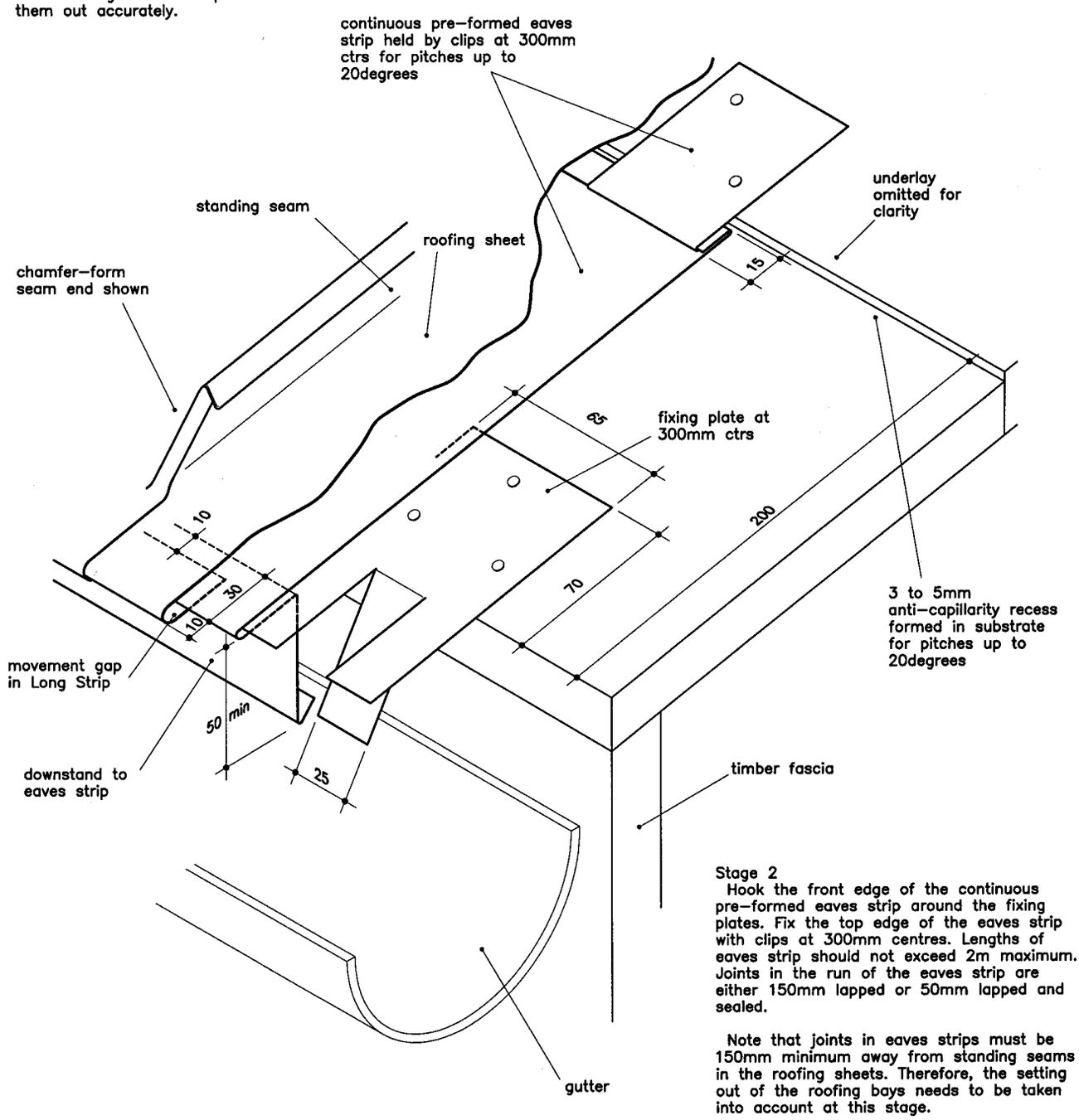
In Traditional roofing no movement gap is required. The roofing sheets are cut to project 20mm beyond the finished eaves strip, giving an engagement of 15mm approximately.

Temper: Roofing sheet with chamfer-form seam end; half-hard preferably. Pre-formed eaves strip with downstand; half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

Stage 1
Nail fixing plates in position at 300mm centres along the eaves line. A string line will help to set them out accurately.

Stage 3
Fix the roofing sheets in place, forming the chosen seam end as described in Figs 4 (p22), 5 (p28) and 6 (p30). Then fold the ends of the roofing sheets, now united, under the eaves strip. Eaves folders ('first and second turn') should be used.



Stage 2
Hook the front edge of the continuous pre–formed eaves strip around the fixing plates. Fix the top edge of the eaves strip with clips at 300mm centres. Lengths of eaves strip should not exceed 2m maximum. Joints in the run of the eaves strip are either 150mm lapped or 50mm lapped and sealed.

Note that joints in eaves strips must be 150mm minimum away from standing seams in the roofing sheets. Therefore, the setting out of the roofing bays needs to be taken into account at this stage.

Fig 28 ... at eaves with roof pitch at and over 20degrees

If a copper clad fascia is required (see Fig 4a) it must be completed before the gutter brackets are fixed. The cladding is usually held with a continuous fixing strip along its bottom edge, and nailed directly to the substrate along its top edge.

With different brackets it is possible to fix the copper gutter to the fascia board rather than the substrate.

More detail on eaves strips and their installation is given in Figs 26 and 26a (p72).

TRADITIONAL ✓ | LONG STRIP ✓

In Long Strip roofing, a 10mm movement gap is allowed when the roofing sheets are turned under the eaves strip. When folded under they engage the eaves strip by 20mm, ensuring that even in expansion they remain well retained.

In Traditional roofing no movement gap is required. The roofing sheets are cut to project 20mm beyond the finished eaves strip, giving an engagement of 15mm approximately.

Temper: Roofing sheet with chamfer-form seam end; half-hard preferably. Pre-formed eaves strip with downstand; half-hard.
Thickness: 0.6mm or 0.7mm

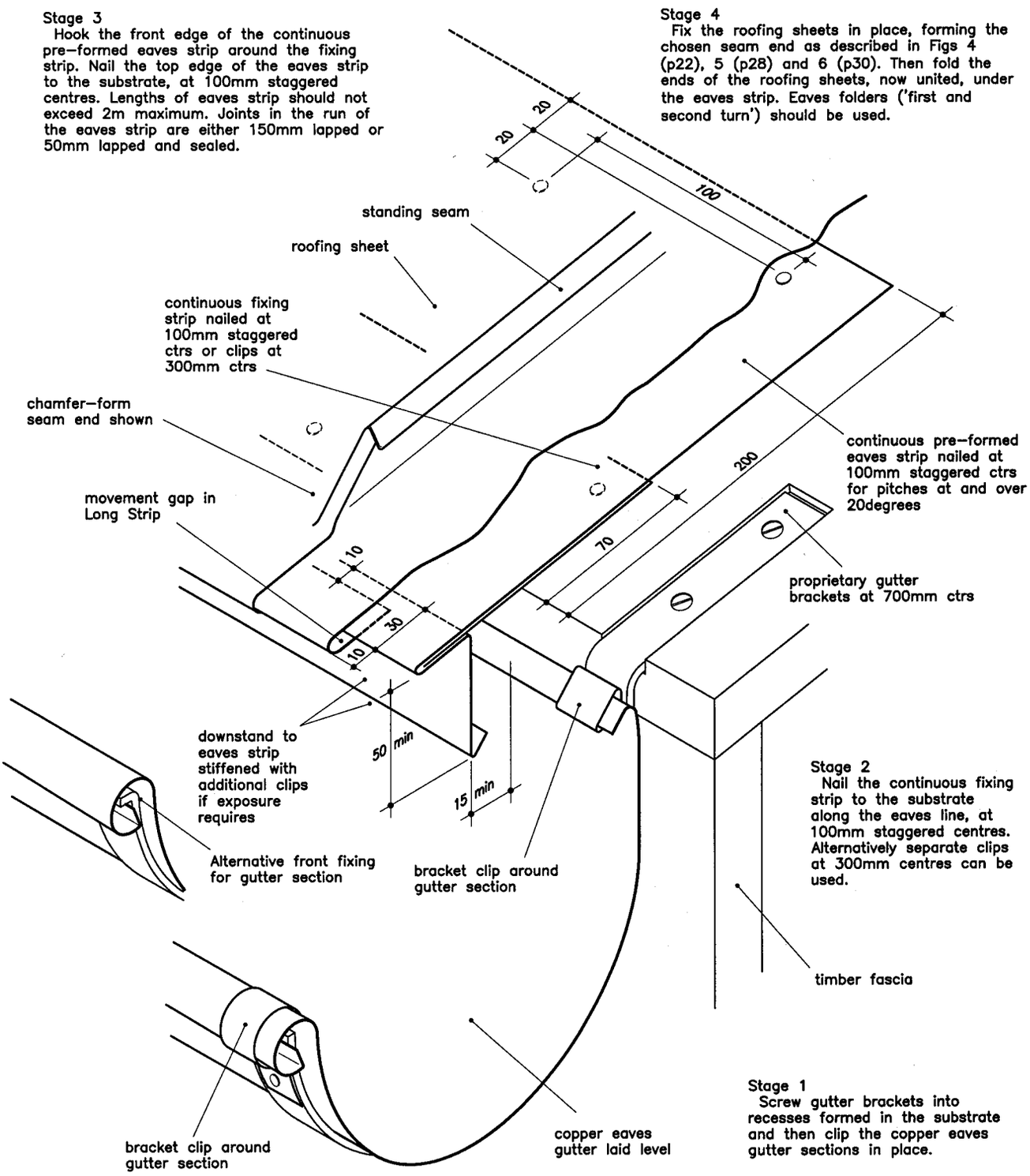


Fig 29 ... at eaves above direct-fixed cladding

The detail shows an eaves strip suitable for roof pitches at and over 20degrees. For roof pitches up to 20degrees and more detail on eaves strips see Figs 26 and 26a (p72)

In Long Strip roofing, a 10mm movement gap is allowed when the roofing sheets are turned under the eaves strip. When folded under they engage the eaves strip by 20mm, ensuring that even in expansion they remain well retained.

In Traditional roofing no movement gap is required. The roofing sheets are cut to project 20mm beyond the finished eaves strip, giving an engagement of 15mm approximately.

Cladding sheets are most commonly produced as roll-formed profiled trays (see Fig 2), using half-hard temper copper. This is the most efficient method of forming standing seams. It also gives a very consistent and precise appearance to the seam. As seaming machines can work up to the vertical, both speed and quality can be achieved.

The 'angle standing seam', which is simply the seam without the final turn in the welt being made, is often used in cladding because there tends to be less localised distortion or quilting effect to the copper sheet.

The acceptable width for cladding bays is determined in the same way as for roofing bays, by taking into account exposure and roof height (see Tables M and N, p12).

In Long Strip cladding the spacing of horizontal joints will range from 3m to 6m maximum, the latter being determined more by the practicalities of handling rather than any other consideration. Joints can usually be avoided when columns or other similar features are to be clad.

In Traditional cladding the maximum spacing of horizontal joints is 3 metres. Where the vertical joints are double-lock standing seams, the horizontal joints must be staggered 50mm minimum and are most likely to be single-lock welts.

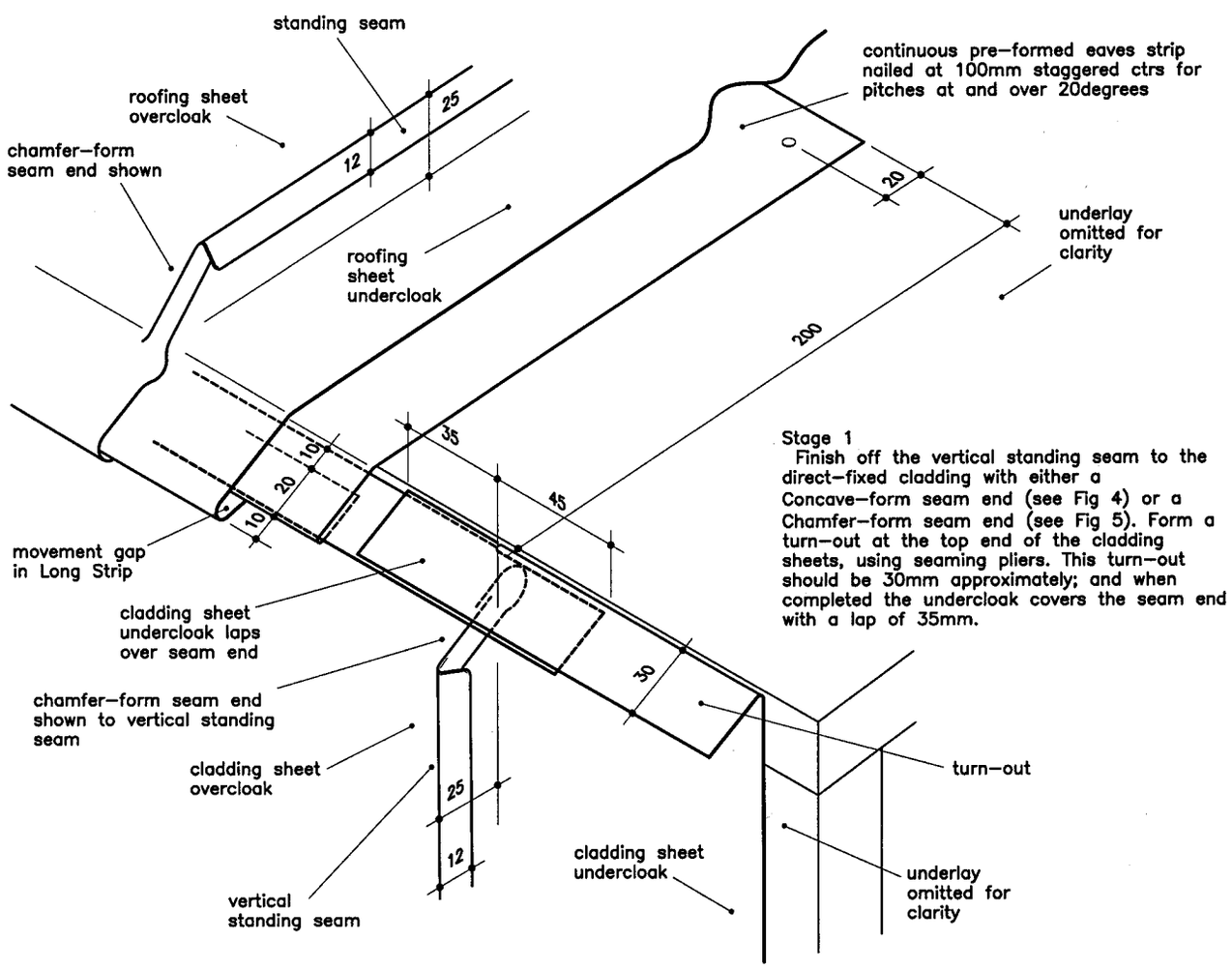
For other details featuring cladding see Figs 23 (p65), 24 (p66) and 25c (p71).

Temper: Roofing sheet with chamfer-form seam end; half-hard preferably. Pre-formed eaves strip; half-hard. Cladding; quarter- or half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

Stage 2
Hook the front edge of the continuous pre-formed eaves strip around the turn-out. Nail the top edge of the eaves strip to the substrate, at 100mm staggered centres. Lengths of eaves strip should not exceed 2m maximum. Joints in the run of the eaves strip are either 150mm lapped or 50mm lapped and sealed, preferably the latter.

Stage 3
Fix the roofing sheets in place, forming the chosen seam end as described in Figs 4 (p22), 5(p28) and Fig 6 (p30). Then fold the ends of the roofing sheets, now united, under the eaves strip. Eaves folders ('first and second turn') should be used.



Stage 1
Finish off the vertical standing seam to the direct-fixed cladding with either a Concave-form seam end (see Fig 4) or a Chamfer-form seam end (see Fig 5). Form a turn-out at the top end of the cladding sheets, using seaming pliers. This turn-out should be 30mm approximately; and when completed the undercloak covers the seam end with a lap of 35mm.

Fig 30 ... at recessed pitched valley gutter

This detail, Fig 30 (p78), together with Figs 30a and 30b, illustrates the essentials of forming a recessed pitched valley gutter in Long Strip roofing. And in Traditional roofing where either the Concave-form seam end (see Fig 4), the Chamfer-form seam end (see Fig 5) or the Square-form seam end (see Fig 6) is chosen.

Only the Turned-down seam end (see Fig 3) allows the roofing sheets to be tightly welted down, thereby achieving weathertightness on its own. This welting down allows no movement and so, of course, is only possible in Traditional roofing.

In Traditional roofing when the Turned-down seam end (see Fig 3) is being used, the tight welting around the gutter lining prevents it from moving. Therefore, sections of gutter lining should not exceed 3 metres. These are joined with a drip-step, a hand-formed double-lock cross welt or a single-lock cross welt, dependent on the gutter pitch (see Tables P and T, p13). The roofing sheets are clipped along the top edge of the gutter recess, with clips 150mm approximately above each standing seam. Because the roofing and lining are tightly welted, the depth of the gutter recess can be reduced to 32mm.

In Long Strip roofing, or in Traditional roofing where the seam ends referred to above are used, the gutter lining is free to move. However, some movement joints are still needed, so that no section of gutter exceeds 10 metres in length.

The most common way of forming a movement joint is to use a vulcanised neoprene strip such as T-Pren. These have been in use for 25 years and their record so far has been trouble-free. The neoprene strip should be protected from ultra-violet by a copper cover-piece which is welted over the gutter turn-out and held in place by the lining plate. This also improves its appearance. In hot weather the neoprene tends to distort, creating an interruption to the water flow; so to avoid the risks with debris building up, the minimum pitch of the valley gutter should be 6degrees and the depth of the gutter recess increased to 150mm.

The vulcanised neoprene strip is factory bonded between two strips of copper. On site these are soft-soldered to the gutter lining sections, sometimes with the addition of copper rivets. The working temperature of soft-soldering is 400degC. If the underlay is susceptible to damage at this temperature, it must be protected. Brazing or hard-soldering is also possible but, as the working temperature is 750degC, it might not be allowed on certain buildings if hot working is restricted.

Other movement joints are possible (see Tables P and T, p13).

Apart from movement joints, gutter linings should be laid in one piece. Individual sections are joined by brazing, or soft-soldering with the joint strengthened by copper rivets.

For roof pitches up to 20degrees, a 3mm to 5mm anti-capillarity recess is formed in the substrate to accommodate the lining plate. The lining plate should go up the roof slope 130mm minimum from the edge of the recess. The 200mm shown is a good dimension to work to and gives a measure of tolerance. Its top edge is held by welting to clips at 300mm centres.

For roof pitches at and over 20degrees, a recess is not required for the lining plate; nor is it welted to clips along its top edge. It is simply nailed to the substrate at 100mm staggered centres (see Fig 30b).

Whatever the pitch the detail at the front edge is the same. The lining plate is folded under to form a 'hook'. This engages with either the individual clips at 300mm centres retaining the gutter turn-out; or, as is often easier in practice, with a continuous fixing strip, nailed to the substrate at 100mm staggered centres.

A 10mm to 15mm weathercheck is formed in the lining plate against wind driven rain or rainwater splashing up in storm conditions.

In Long Strip roofing, a 10mm movement gap is allowed when the roofing sheets are turned under the lining plate. To achieve this the roofing sheets are cut to project 40mm beyond the finished lining plate. When folded under they engage the lining plate by 20mm, ensuring that even in expansion they remain well retained.

In Traditional roofing no movement gap is required. The roofing sheets are cut to project 20mm beyond the finished lining plate, giving an engagement of 15mm approximately.

Lengths of lining plate should not exceed 2m maximum. Joints in the run of the lining plate are either 150mm lapped or, more usually and preferably, 50mm lapped and sealed. Note that joints in lining plates must be positioned at least 150mm from standing seams, but a convenient rule is to make such joints mid-bay. Therefore, the setting out of the lining plate needs to take the roofing bays into account.

With a recessed gutter it makes no difference which way the standing seam undercloaks face, but they usually face down the gutter. This is because the gutter is laid from the bottom up.

Underlays generally are discussed in Copper for Roofing (see p3). There are two broad categories: waterproof and non-waterproof. Waterproof underlays are laid to lap over the lining plate. Non-waterproof underlays are laid to butt up to the top edge of the lining plate. Where the valley gutter discharges into a parapet gutter, waterproof underlays are laid to drain over in the normal way.

A waterproof underlay is recommended under the gutter lining. It is carried up the sides of the recess and onto the substrate, where it is held in position by the gutter clips.

A recessed gutter with batten roll is shown in Fig 52 (p118).

Temper: Roofing sheet with chamfer-form seam end; half-hard preferably. Pre-formed gutter lining and lining plate; half-hard.
Thickness: 0.6mm or 0.7mm

Fig 30 ... at recessed pitched valley gutter

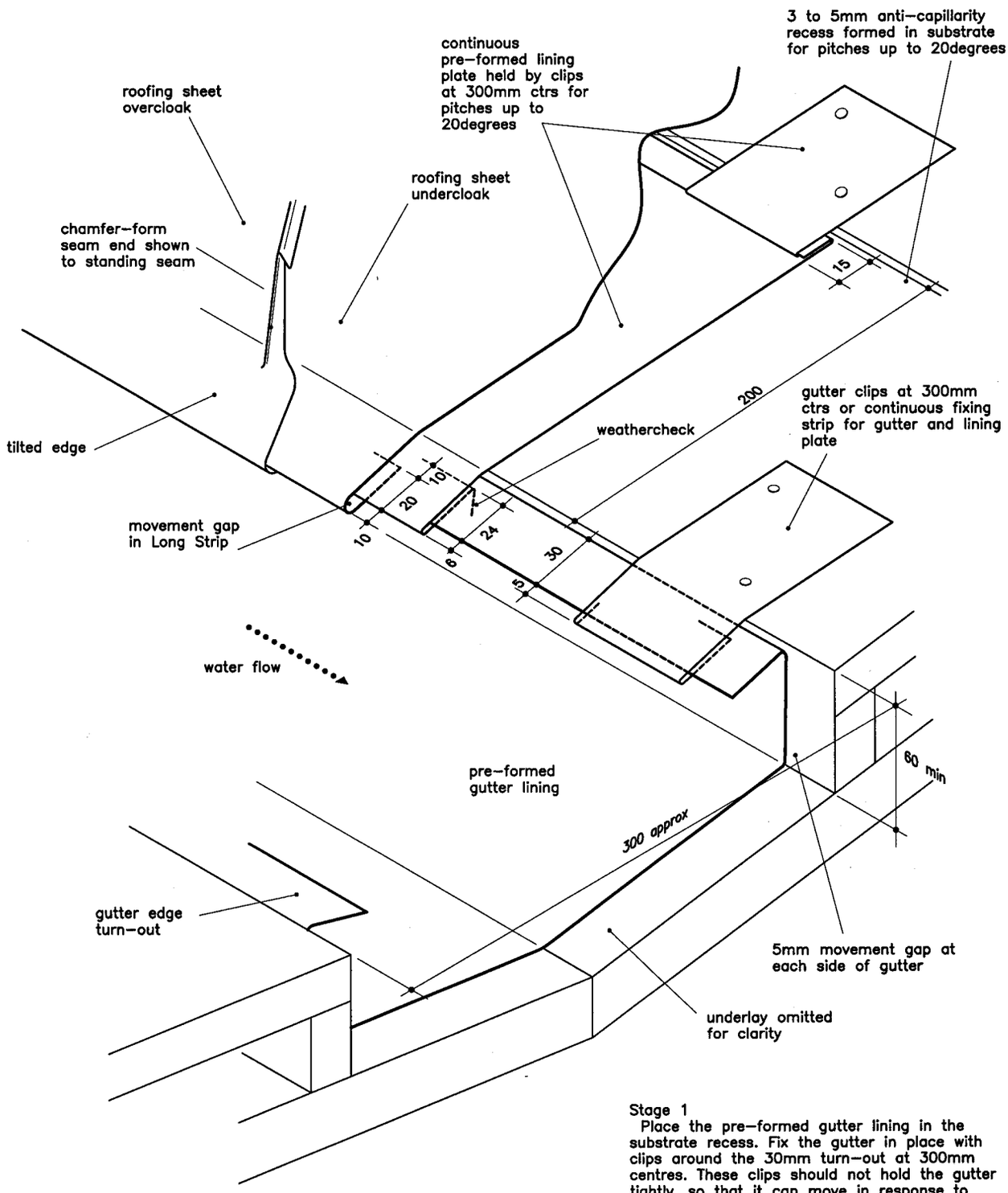
Stage 2
Hook the front edge of the continuous pre–formed lining plate around the turn–out of the gutter lining. As with the clips, the lining plate should not hold the gutter tightly. Fix the top edge of the lining plate with clips at 300mm centres. Lengths of lining plate should not exceed 2m maximum. Joints in the run of the lining plate are either 150mm lapped or 50mm lapped and sealed, preferably the latter.

Note that joints in lining plates must be 150mm minimum away from standing seams in the roofing sheets. Therefore, the setting out of the roofing bays needs to be taken into account at this stage.

TRADITIONAL ✓ | LONG STRIP ✓

Stage 3
Fix the roofing sheets in place, forming the chosen seam end as described in Figs 4 (p22), 5 (p28) and 6 (p30). Then fold the ends of the roofing sheets, now united, under the lining plate. Cranked seaming pliers should be used.

With a recessed gutter it makes no difference which way the standing seam undercloaks face.



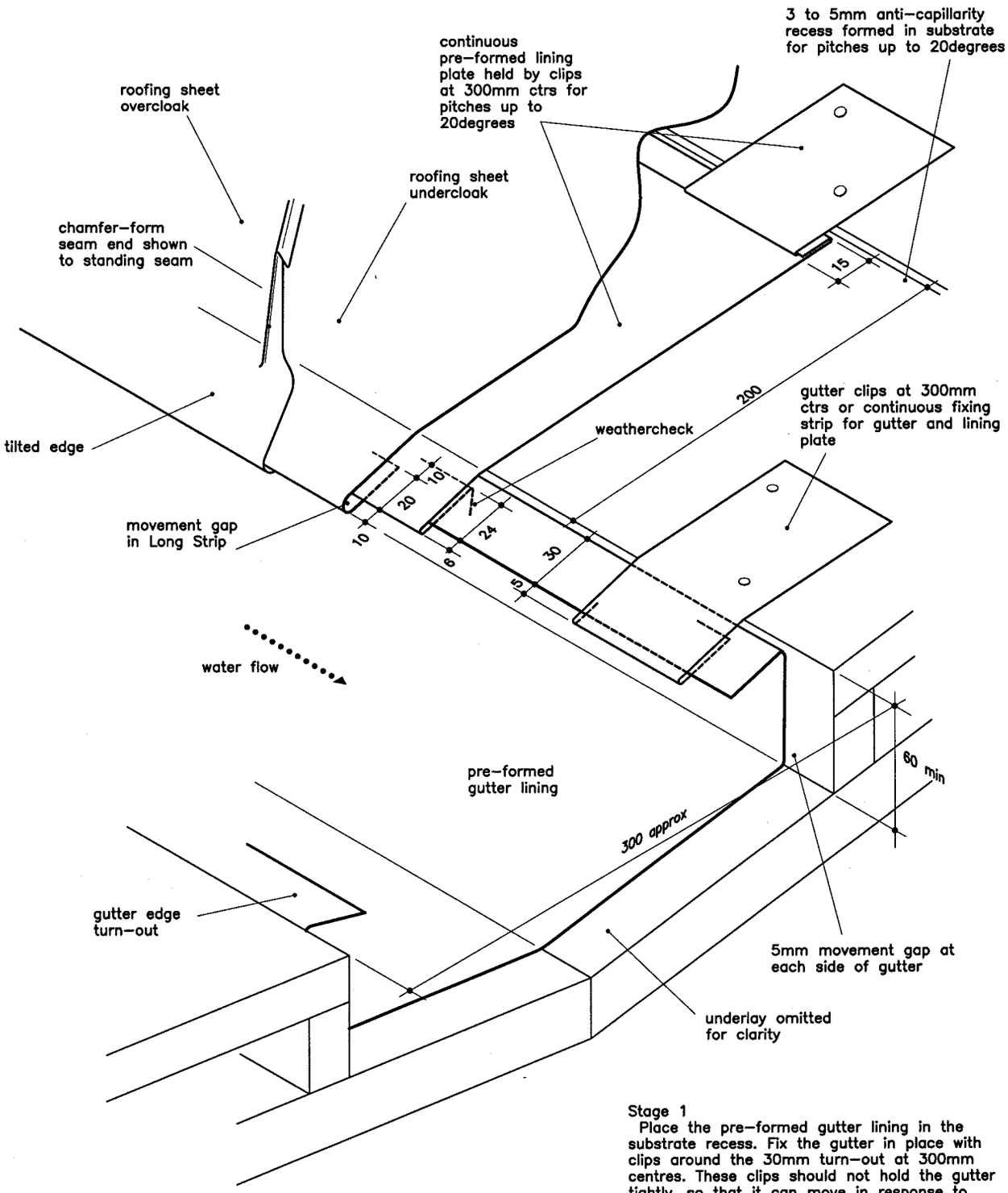
Stage 1
Place the pre–formed gutter lining in the substrate recess. Fix the gutter in place with clips around the 30mm turn–out at 300mm centres. These clips should not hold the gutter tightly, so that it can move in response to changes in temperature. Also the width of the gutter lining is made 10mm less than the width of the recess, allowing free movement.

with the clips, the lining plate should not hold the gutter tightly. Fix the top edge of the lining plate with clips at 300mm centres. Lengths of lining plate should not exceed 2m maximum. Joints in the run of the lining plate are either 150mm lapped or 50mm lapped and sealed, preferably the latter.

Note that joints in lining plates must be 150mm minimum away from standing seams in the roofing sheets. Therefore, the setting out of the roofing bays needs to be taken into account at this stage.

Stage 3
Fix the roofing sheets in place, forming the chosen seam end as described in Figs 4 (p22), 5 (p28) and 6 (p30). Then fold the ends of the roofing sheets, now united, under the lining plate. Cranked seaming pliers should be used.

With a recessed gutter it makes no difference which way the standing seam undercloaks face.



Stage 1
Place the pre–formed gutter lining in the substrate recess. Fix the gutter in place with clips around the 30mm turn–out at 300mm centres. These clips should not hold the gutter tightly, so that it can move in response to changes in temperature. Also the width of the gutter lining is made 10mm less than the width of the recess, allowing free movement.

Fig 31 ... at pitched valley with tilting fillets

This detail can be used where the pitches of the roofs discharging into the gutter are at or over 13.5degrees. This is based on maintaining a fall over the fillet of 6degrees, the acceptable minimum pitch for unsealed double-lock standing seams; and on the width of the fillet being 250mm. This gives a minimum pitch to the valley gutter of 9.5degrees. Note the cut face of the fillet faces upwards, so that the angle between the gutter sole and the edge upstand is 90degrees.

The tilting fillets form what is, in effect, a recessed gutter. Recessed gutters are dealt with in detail in Fig 30 (pp77 and 78). Note that the lining plate detail will change for pitches up to 20degrees, as shown in Figs 30 and 30a.

The Concave-form seam end (see Fig 4), the Chamfer-form seam end (see Fig 5) or the Square-form seam end (see Fig 6) can all be used with this detail; and in both Long Strip and Traditional roofing.

The Turned-down seam end (see Fig 3) is also possible, but only in Traditional roofing.

Apart from movement joints (see Fig 30 and Tables P and T, p13), gutter linings should be laid in one piece. Individual sections are joined by brazing, or soft-soldering with the joint strengthened by copper rivets. Alternatively the gutter lining is formed from one length of copper.

In Long Strip roofing, a 10mm movement gap is allowed when the roofing sheets are turned under the lining plate. To achieve this the roofing sheets are cut to project 40mm beyond the finished lining plate. When folded under they engage the lining plate by 20mm, ensuring that even in expansion they remain well retained. It is important to check that the fillet is wide enough to allow the standing seam to move freely over the change of pitch angle.

In Traditional roofing no movement gap is required. The roofing sheets are cut to project 20mm beyond the finished lining plate, giving an engagement of 15mm approximately.

A waterproof underlay is recommended under the gutter lining. It is carried up the sides of the 'recess' and over the fillet, where it is held in position by the gutter clips.

Temper: Roofing sheet with chamfer-form seam end; half-hard preferably. Pre-formed gutter lining and lining plate; half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	✓

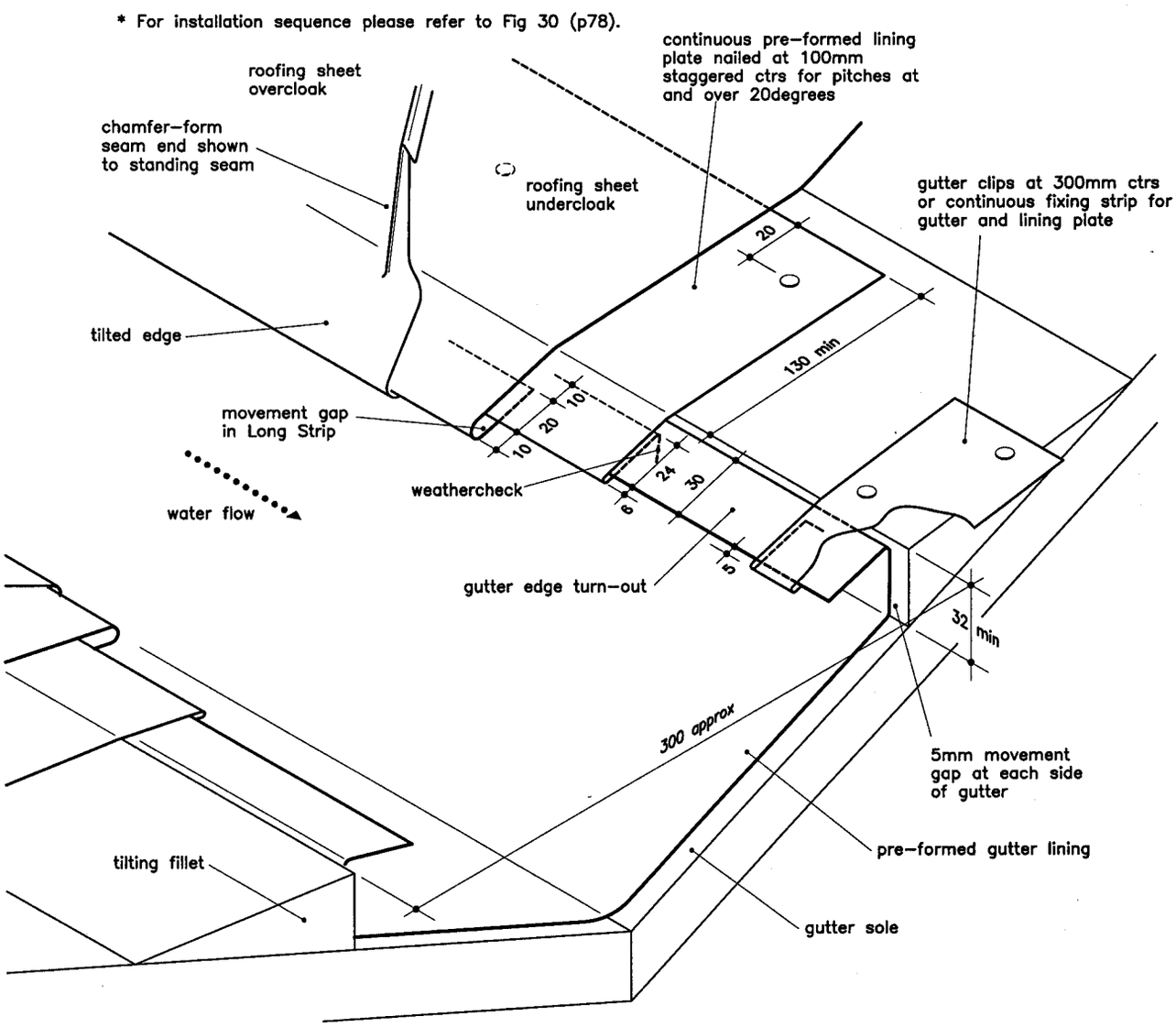


Fig 32 ... at pitched valley with standing seam edges

This type of gutter is used to join subsidiary roof features to the main roof. Its most usual application is with pitched-roof dormers. For such small gutters a minimum width of 200mm is possible, but the wider the gutter the easier it is to manipulate the tools. For longer gutters a minimum width of 300mm is recommended for ease of laying, and future maintenance access.

Note that the water from the adjacent roofing sheets does not drain into the gutter itself but is stopped by the standing seams. It drains over the seam ends and so it is essential that these are turned over in the direction of the water flow. Also that the welts of the longitudinal seams face into the gutter. Where the gutter pitch is less than 20degrees, the seam ends should be sealed for 200mm up the standing seam from the start of the turn-down.

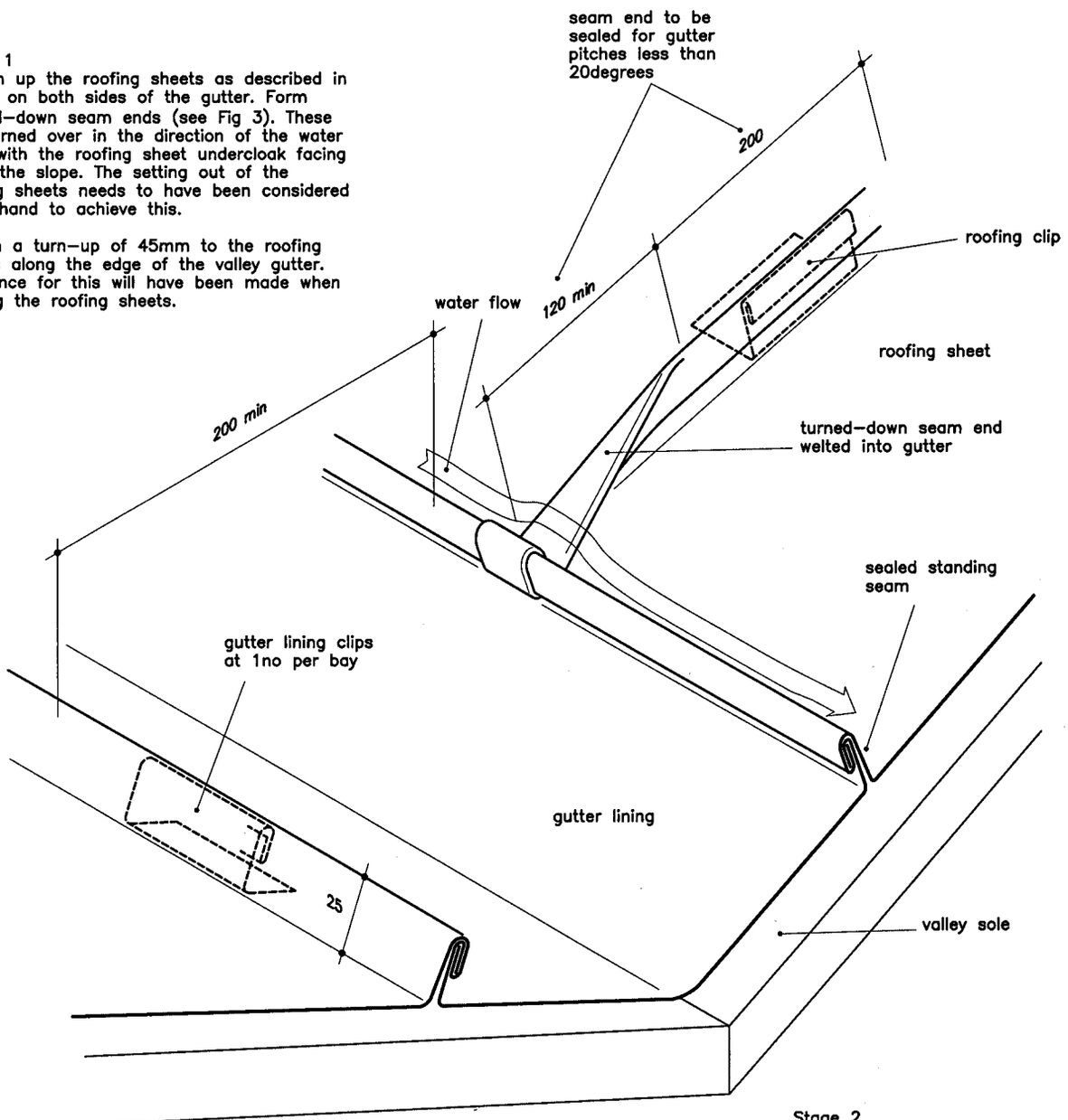
Where, exceptionally, this detail is needed for longer gutters, sections of gutter lining should not exceed 3 metres. They are joined using a hand-formed double-lock cross welt (see Figs 14 and 34), or a single-lock cross welt, dependent on the gutter pitch (see Tables P and T, p13).

Temper: Roofing sheet with turned-down seam end; soft, preferably. Gutter lining; soft. Dormer roofs etc, if applicable; soft.
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	X

Stage 1
Seam up the roofing sheets as described in Fig 1, on both sides of the gutter. Form Turned–down seam ends (see Fig 3). These are turned over in the direction of the water flow, with the roofing sheet undercloak facing down the slope. The setting out of the roofing sheets needs to have been considered beforehand to achieve this.

Form a turn–up of 45mm to the roofing sheets along the edge of the valley gutter. Allowance for this will have been made when cutting the roofing sheets.



Stage 2
Measure and cut the valley gutter lining. This should have a width of 200mm minimum and have turn–ups along each edge of 35mm. Apply a sealing strip, running along the top of the outside face of the turn–ups.

Nail clips for gutter standing seam to substrate at 1no per bay.

Stage 3
Place the gutter lining in position between the 45mm turn–ups of the roofing sheets. Welt the roofing sheets to the gutter lining, forming a sealed double–lock standing seam.

Fig 33 ... at pitched valley with lap-lock to gutter lining

This detail can be used where the pitches of the roofs discharging into the gutter are at or over 10degrees. This gives a minimum pitch to the valley gutter of 7degrees.

In Traditional roofing no movement gap is required. The roofing sheets are cut to project 20mm beyond the fixing strip, giving an engagement of 15mm approximately.

In both Long Strip and Traditional roofing the gutter lining is free to move. However, some movement joints are still needed, so that no section of gutter exceeds 10 metres in length (see Tables P and T, p13). The most common way of forming such a joint is to use a vulcanised neoprene strip such as T-Pren. This type of movement joint is described in more detail in Fig 30 (p77). The lap-lock cross welt is also frequently used.

Apart from movement joints, gutter linings should be laid in one piece. Individual sections are joined by brazing, or soft-soldering with the joint strengthened by copper rivets. Alternatively the gutter lining is formed from one length of copper.

A waterproof underlay is recommended under the gutter lining. It should be carried up the roof for 450mm on each side of the centreline, to meet the main roofing sheet underlay.

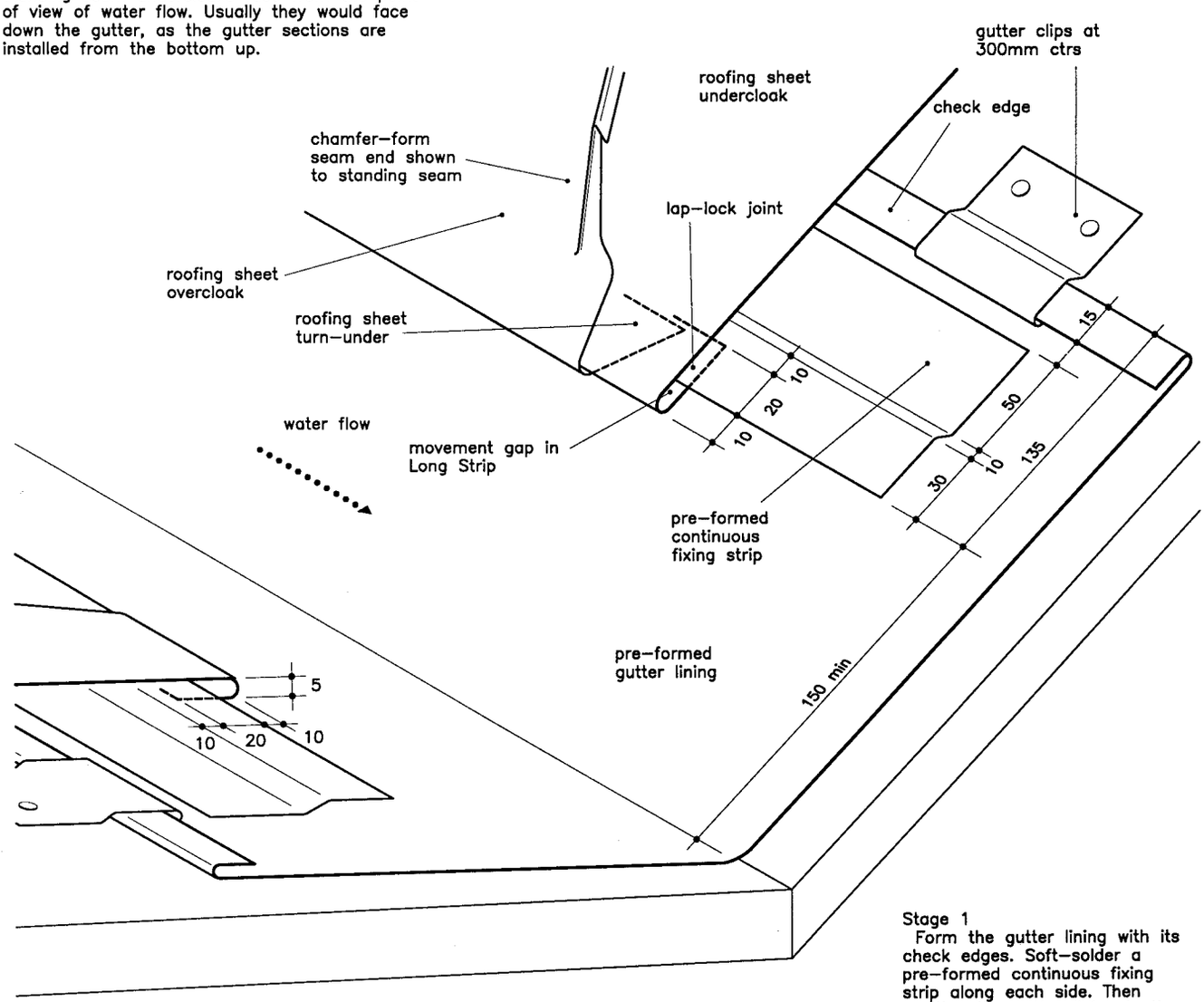
Temper: Roofing sheet with chamfer-form seam end; half-hard preferably. Pre-formed gutter lining etc; half-hard.
Thickness: 0.6mm or 0.7mm

TRADITIONAL	✓	LONG STRIP	✓

Stage 3
Hook the roofing sheets in position to engage with the continuous fixing strip. Seam up the roofing sheets as described in Fig 1 or Fig 2, on both sides of the gutter, and complete with the appropriate seam end.

It makes no difference which way the standing seam undercloaks face from the point of view of water flow. Usually they would face down the gutter, as the gutter sections are installed from the bottom up.

Stage 2
Mark out the roofing sheets to the line of the gutter and for forming the chosen seam end as described in Figs 4 (p22), 5 (p28) and 6 (p30). Cut and cut away accordingly. Form the 30mm turn-under to the end of the roofing sheets, along the line of the gutter.



Stage 1
Form the gutter lining with its check edges. Soft-solder a pre-formed continuous fixing strip along each side. Then position the gutter lining in the valley and clip it to the substrate. These clips should not hold the gutter tightly, so that it can move in response to changes in temperature.

Fig 34 ... with pitched valley single-lock welted to roofing sheets

This detail can only be used in Traditional roofing. In Long Strip roofing the lap-lock detail shown in Fig 33 (see opposite) would be used.

It is used where the pitches of the roofs discharging into the gutter are at or over 25degrees. This gives a minimum pitch to the valley gutter of 18.25degrees.

The roofing sheets are finished with a variation of the Concave-form seam end (see Fig 4) or the Turned-down seam end (see Fig 3).

If joints in the gutter are made using double-lock cross welts, they need to be at 3m maximum centres. The cross welts are clipped and longitudinal movement in the gutter is restricted. The clips along the edge of the gutter lining can be made to hold it tightly. The cross welts must be sealed with gutter pitches up to 20degrees.

TRADITIONAL ✓ | LONG STRIP ✗

However, ideally, gutter linings should be laid in one piece. Individual sections are joined by brazing, or soft-soldering with the joint strengthened by copper rivets. Alternatively the gutter lining is formed from one length of copper. Movement joints are needed, so that no section of gutter exceeds 10 metres in length (see Tables P and T, p13).

The most common way of forming such a joint is to use a vulcanised neoprene strip such as T-Pren. This type of movement joint is described in more detail in Fig 30 (p77). The lap-lock cross welt is also frequently used. It is important that the clips along the edge of the gutter should not hold it tightly, so that it can move in response to changes in temperature.

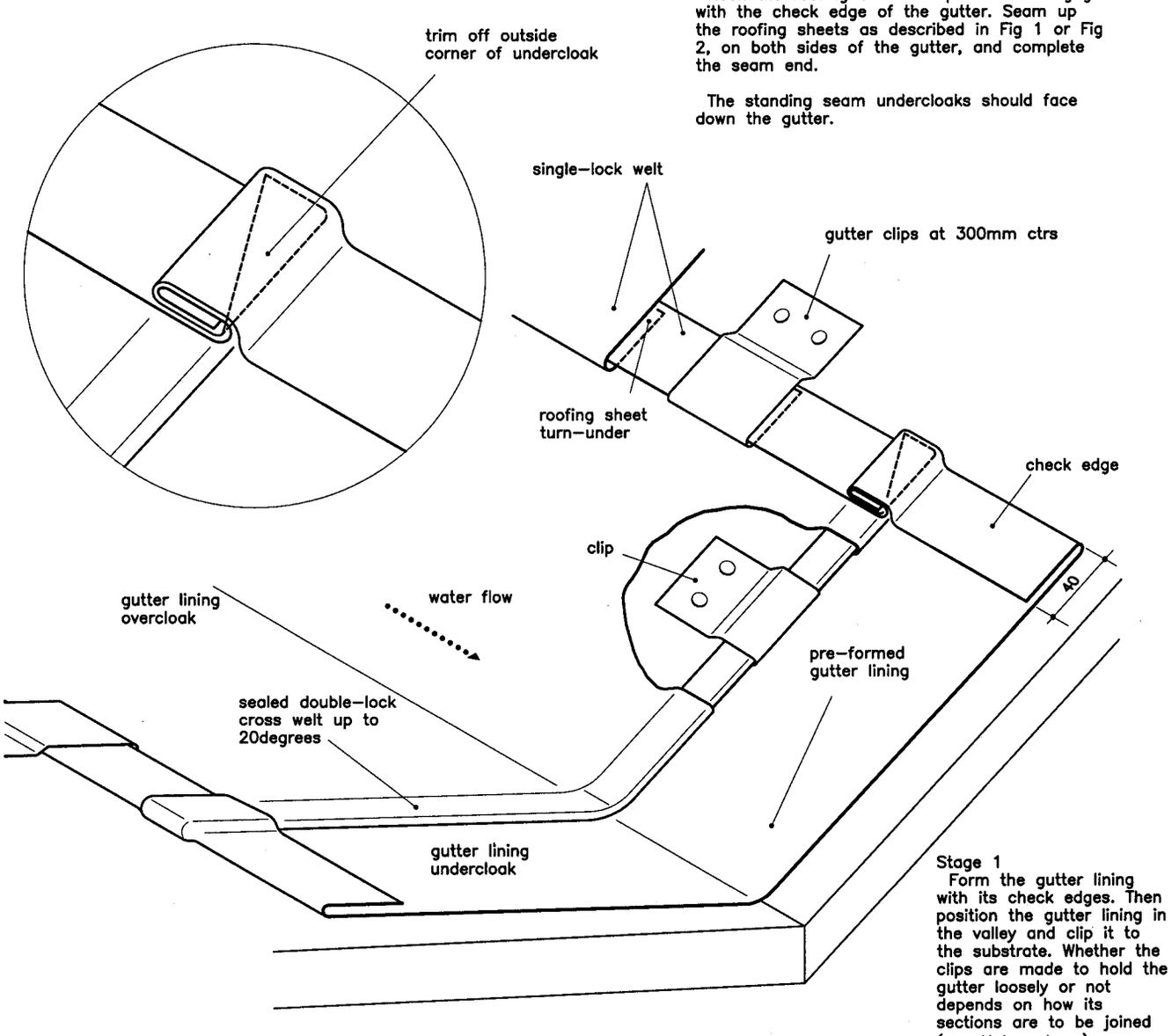
A waterproof underlay is recommended under the gutter lining. It should be carried up the roof for 450mm on each side of the centreline, to meet the main roofing sheet underlay.

Temper: Roofing sheet and gutter lining; soft or quarter-hard preferably, but half-hard is also possible.
Thickness: 0.6mm or 0.7mm

Stage 2
Mark out the roofing sheets to the line of the gutter for forming the chosen seam end. Cut and cut away accordingly. Form a 30mm turn-under to the end of the roofing sheets, along the line of the gutter.

Stage 3
Hook the roofing sheets in position to engage with the check edge of the gutter. Seam up the roofing sheets as described in Fig 1 or Fig 2, on both sides of the gutter, and complete the seam end.

The standing seam undercloaks should face down the gutter.



Stage 1
Form the gutter lining with its check edges. Then position the gutter lining in the valley and clip it to the substrate. Whether the clips are made to hold the gutter loosely or not depends on how its sections are to be joined (see Notes above).

Fig 35 Ventilation hood

This detail will only be required on roofs which need ventilating to avoid the risk of condensation; and in particular where some element of construction obstructs the free flow of air. This most commonly occurs at hips, pitched valley gutters and dormers. Ridges and abutments can quite easily be designed to accommodate more continuous ventilation slots, see Figs 13 (p49), 20 (p61) and 23 (p65).

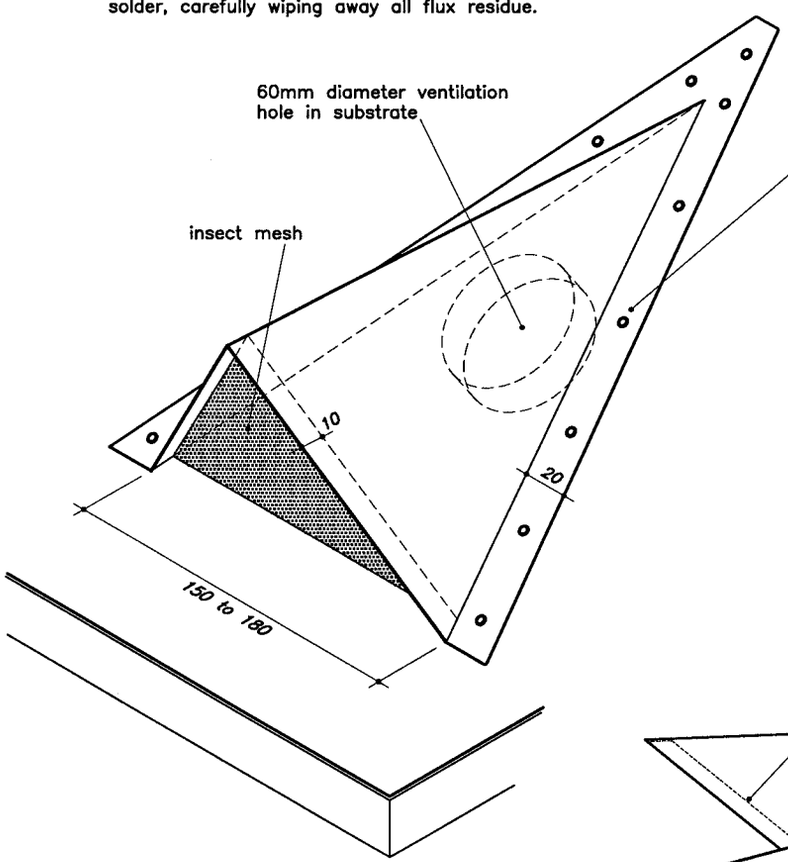
Perforated copper insect mesh is available as a 40% perforated sheet. Copper or brass mesh is also available.

The ventilation hood is applicable to both Double-lock standing seam and Batten roll roofs.

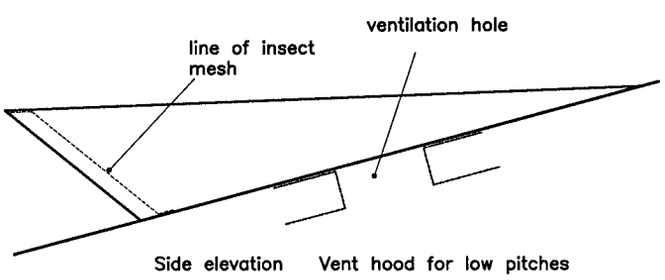
Temper: quarter- or half-hard
Thickness: 0.6mm or 0.7mm

TRADITIONAL ✓ LONG STRIP ✓

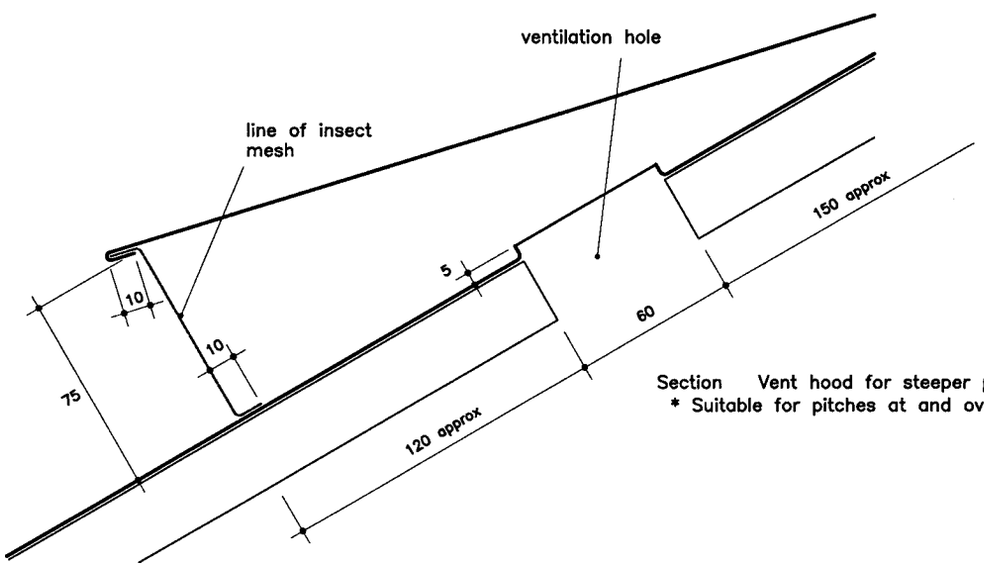
Stage 2
Fix the ventilation hood to the roofing sheet with copper rivets at 50mm centres. Alternatively use soft solder, carefully wiping away all flux residue.



Stage 1
The hole, about 60mm in diameter, will already have been made through the substrate. After laying the roofing sheet, cut a circular hole through the copper with a diameter 10mm less than the hole through the substrate. Use curved snips. With a mallet, work the edge up to form a 5mm high lip.

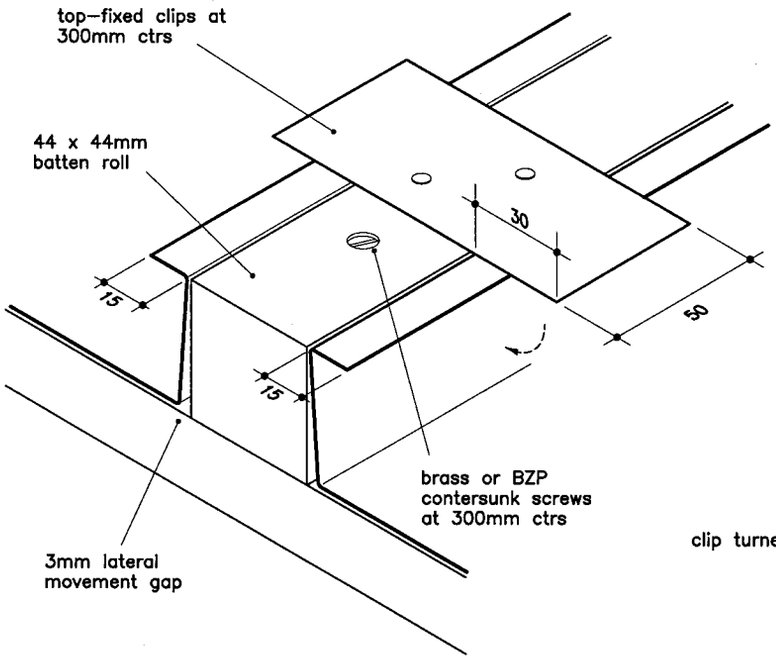


Side elevation Vent hood for low pitches
*** Suitable for pitches up to 30degrees.**



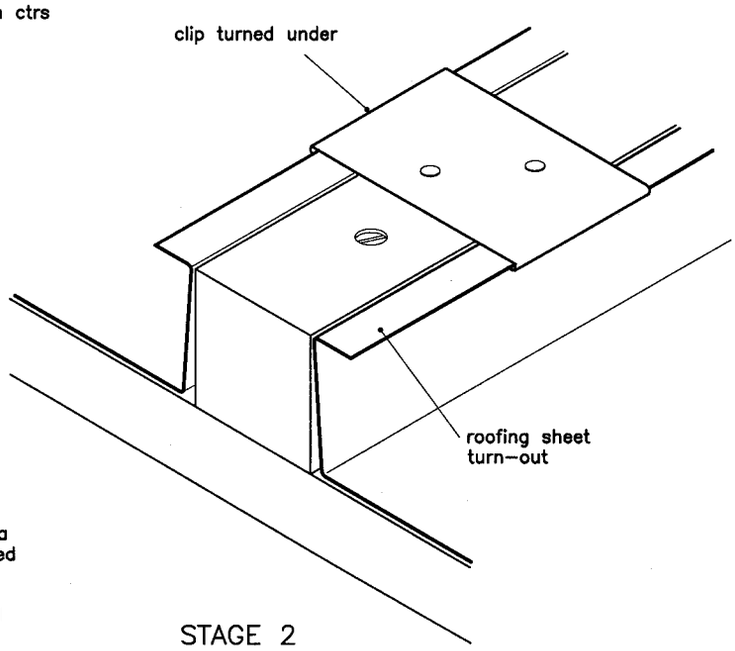
Section Vent hood for steeper pitches
*** Suitable for pitches at and over 30degrees.**

Fig 36 Batten roll joint in Traditional



STAGE 1

TRADITIONAL ✓ LONG STRIP X



STAGE 2

* The 44 x 44mm batten is nowadays preferred as a cost–effective alternative to the more traditional tapered batten. Details for both at intersections are the same.
* In Traditional roofing, the 44 x 44mm and the tapered batten are weathertight at roof pitches at and over 1degree.
* Under batten clips may be used instead of top–fixed clips.
* For on–site efficiency roofing sheets and cappings can be pre–formed in the workshop.

Temper: soft, quarter– or half–hard
Thickness: 0.6mm or 0.7mm

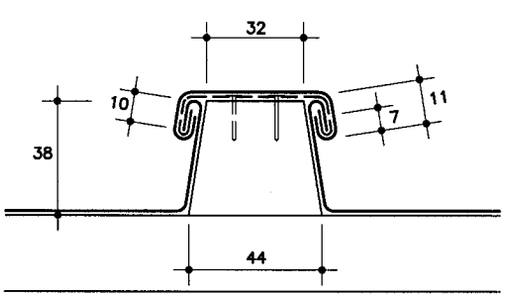


Fig 36a
Section tapered batten

TRADITIONAL ✓ LONG STRIP X

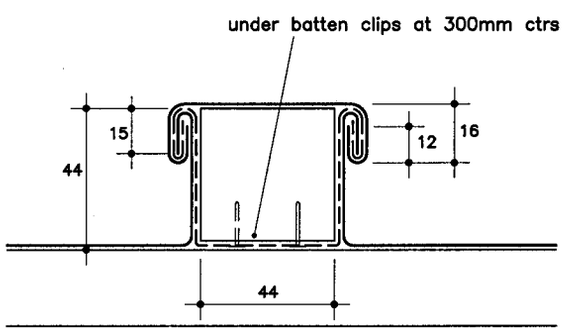
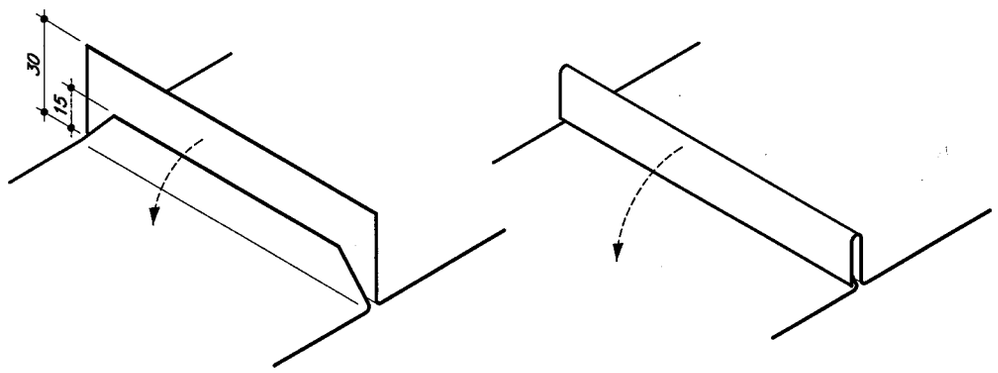
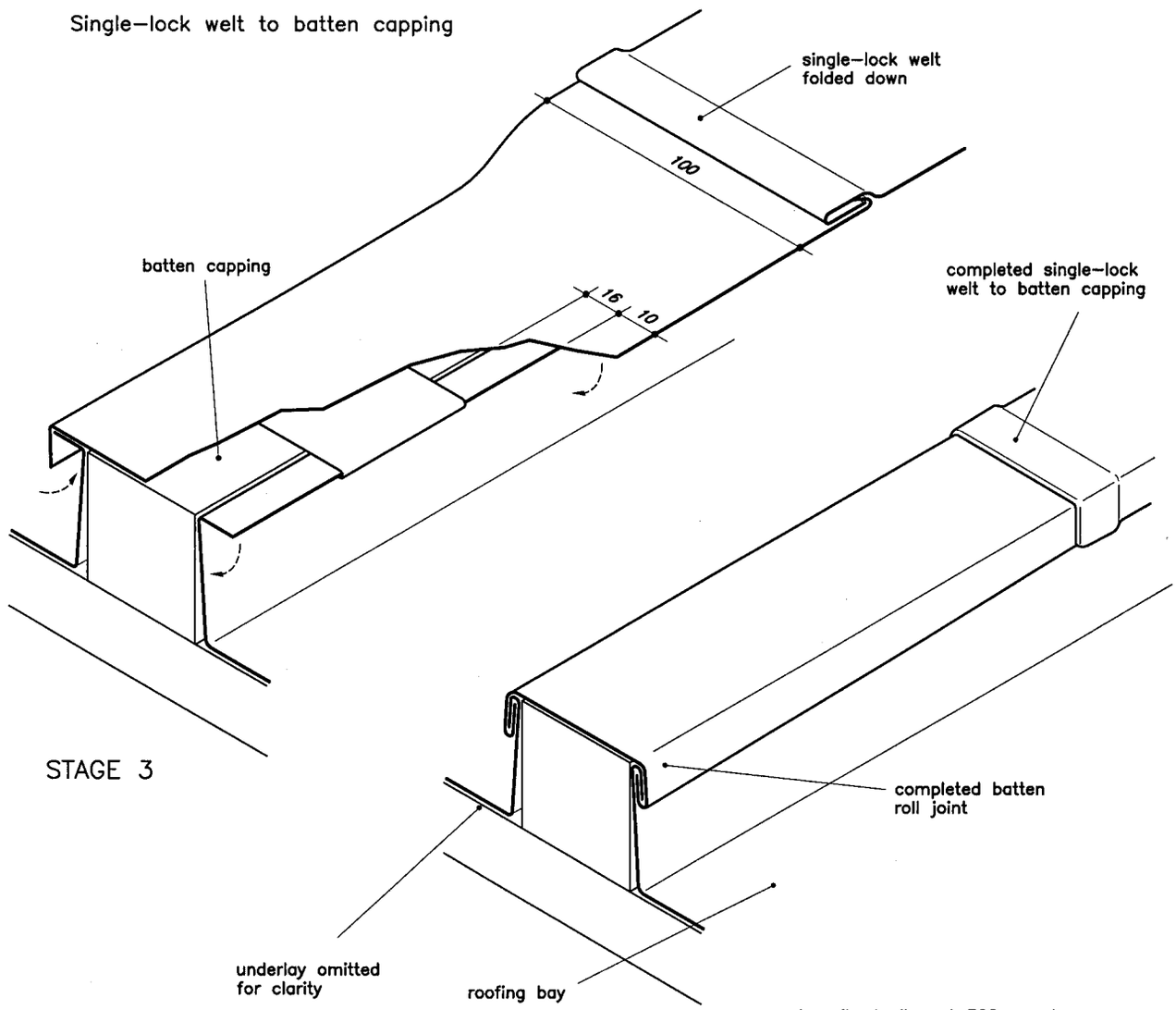


Fig 36b
Alternative with under batten clip

TRADITIONAL ✓ LONG STRIP X



Single–lock welt to batten capping



STAGE 3

STAGE 4

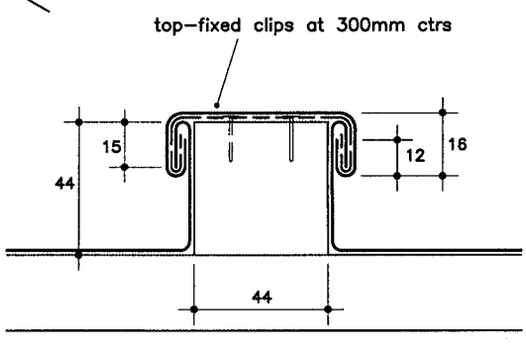


Fig 36c
Section completed joint

TRADITIONAL	✓	LONG STRIP	X

Fig 37 Batten roll joint in Long Strip

TRADITIONAL ✗ | LONG STRIP ✓

* In Long Strip roofing, the 44 x 44mm batten is weathertight at roof pitches at and over 3degrees.
* Fixed and sliding clips should be provided as set down in Table L p11. For small roofs in Long Strip roofing ie where roofing sheets do not exceed 3m, fixed clips may be used throughout.
* Joints in the batten capping are made with single-lock welts as shown in Fig 36 (p87).
* For on-site efficiency roofing sheets and cappings can be pre-formed in the workshop.

Temper: quarter- or half-hard
Thickness: 0.6mm or 0.7mm

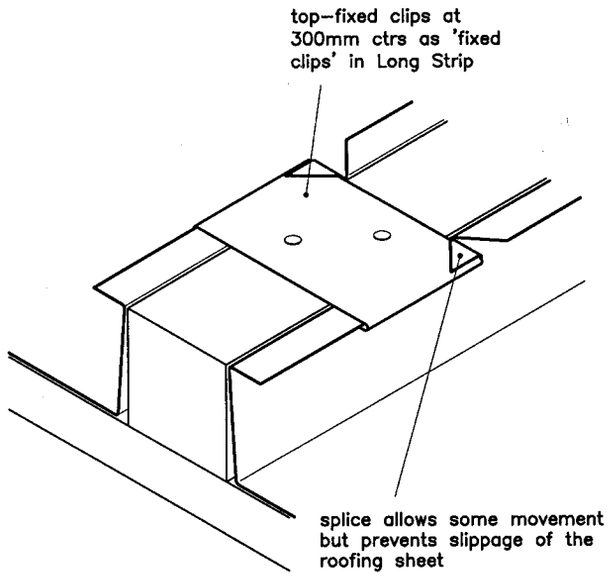
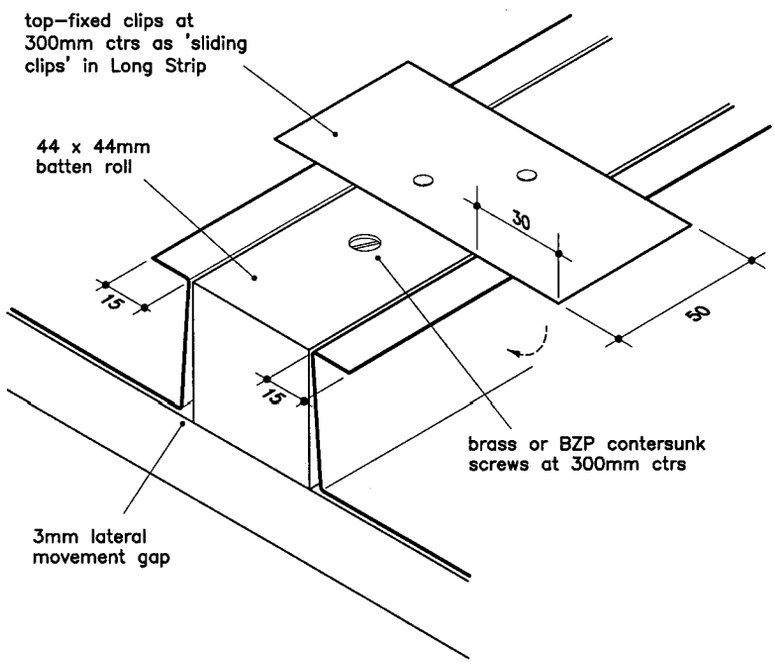
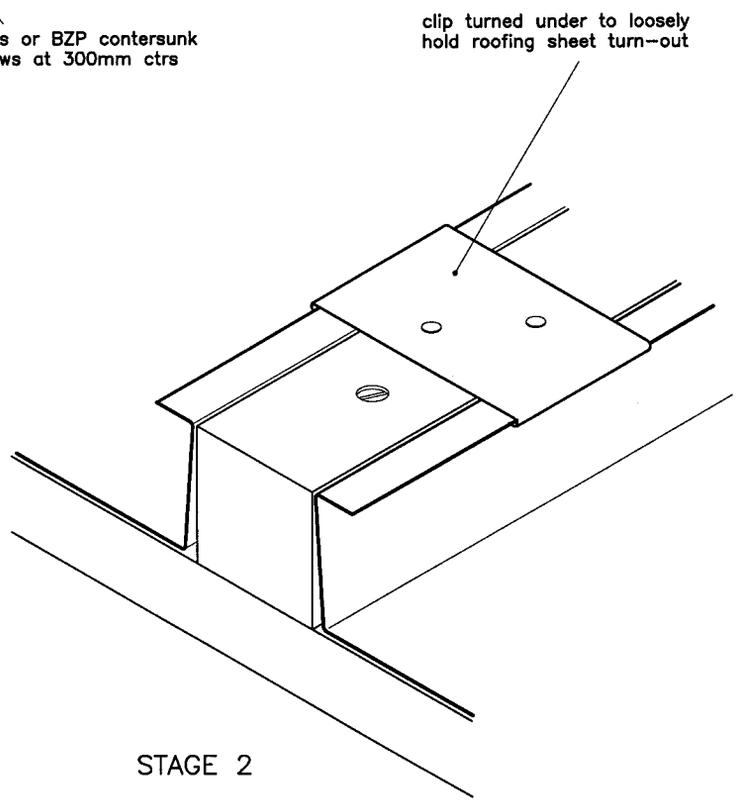


Fig 37a
Top batten clip as 'fixed clip'

TRADITIONAL ✗ | LONG STRIP ✓



STAGE 1



STAGE 2

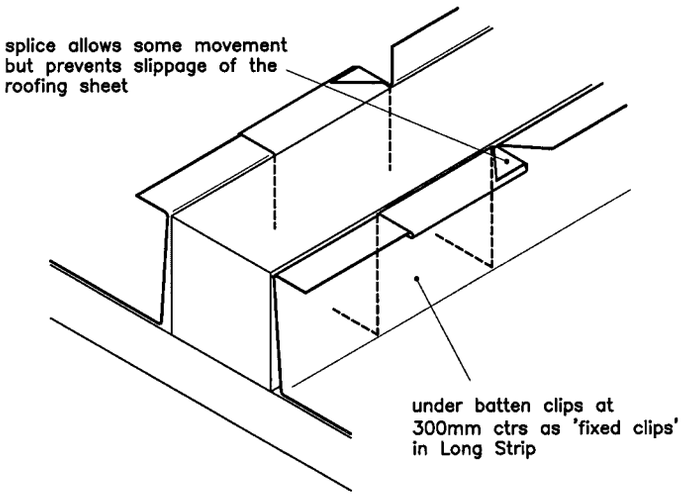


Fig 37b
Under batten clip as 'fixed clip'
TRADITIONAL | X | LONG STRIP | ✓

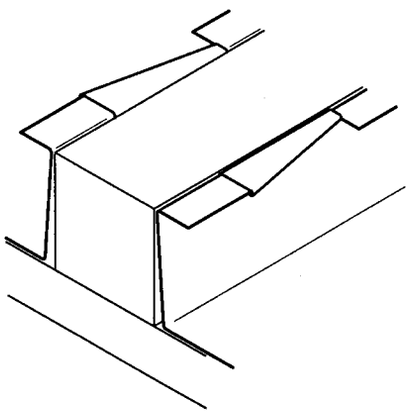
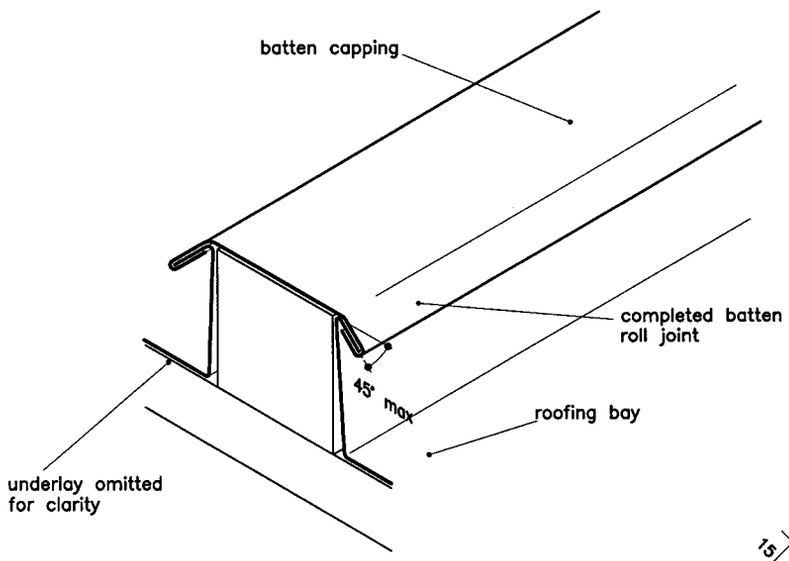


Fig 37c
Alternative under batten clip as 'fixed clip'
TRADITIONAL | X | LONG STRIP | ✓



STAGE 3

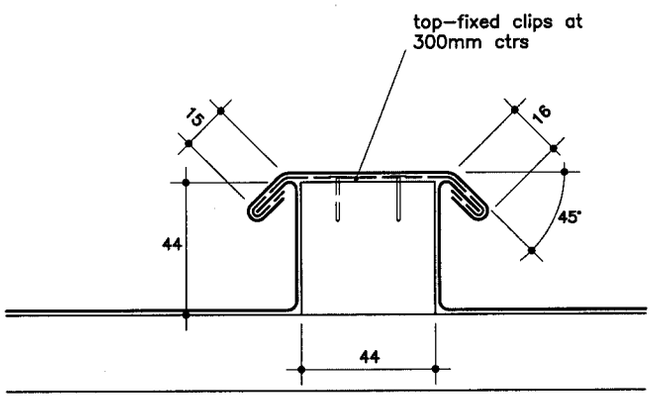


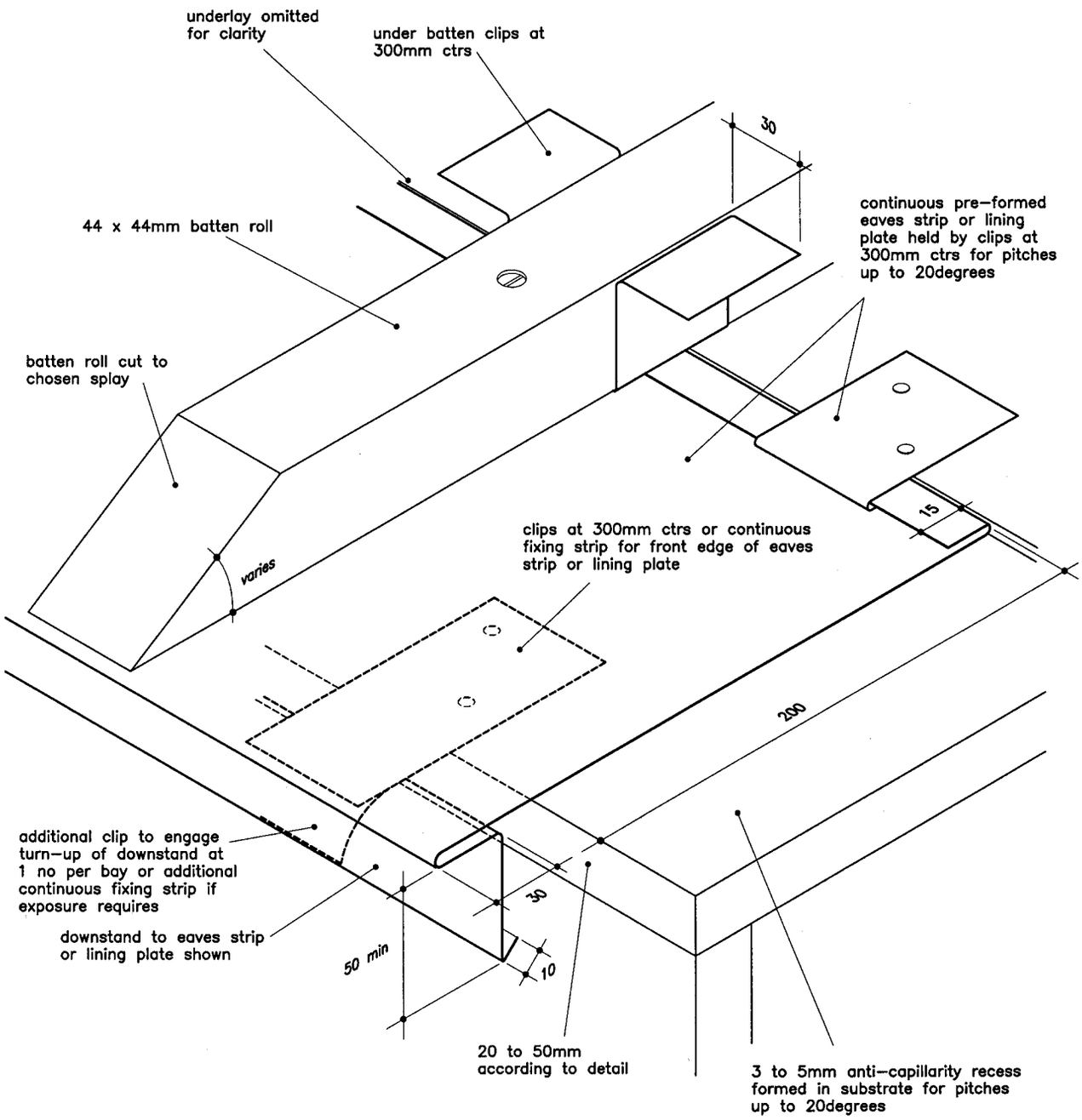
Fig 37d
Section completed joint
TRADITIONAL | X | LONG STRIP | ✓

Fig 38 Splayed batten roll end with dog-ear fold

TRADITIONAL ✓ LONG STRIP ✓

* The detail shown can also be used in Traditional roofing, except that the 10mm movement gap at the roofing sheet turn–under is not required. The capping turn–outs can be dressed down in Traditional.
* For joints in eaves strips and lining plates see Fig 26 (p72).

Temper: soft, quarter– or half–hard
Thickness: 0.6mm or 0.7mm



STAGE 1

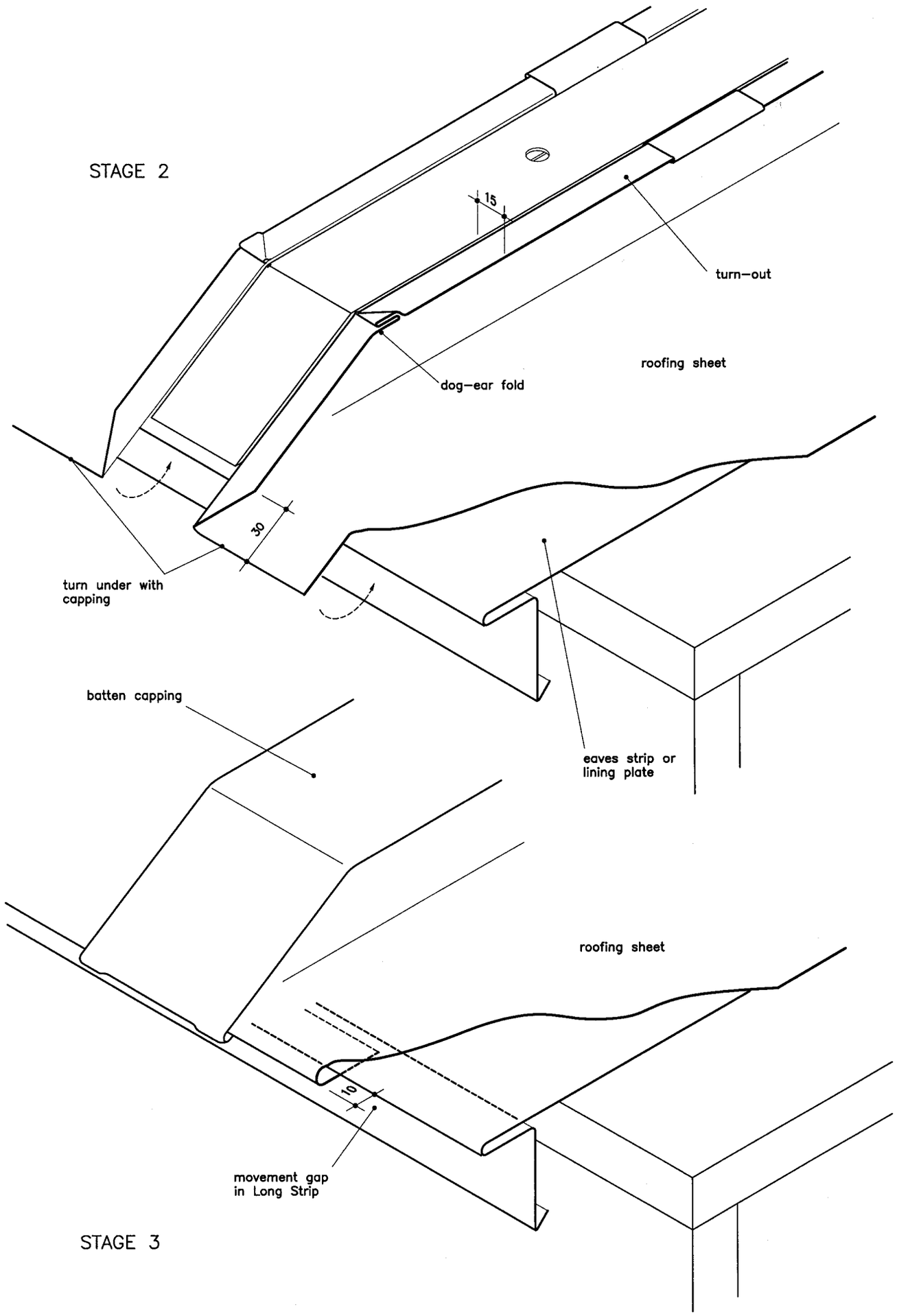
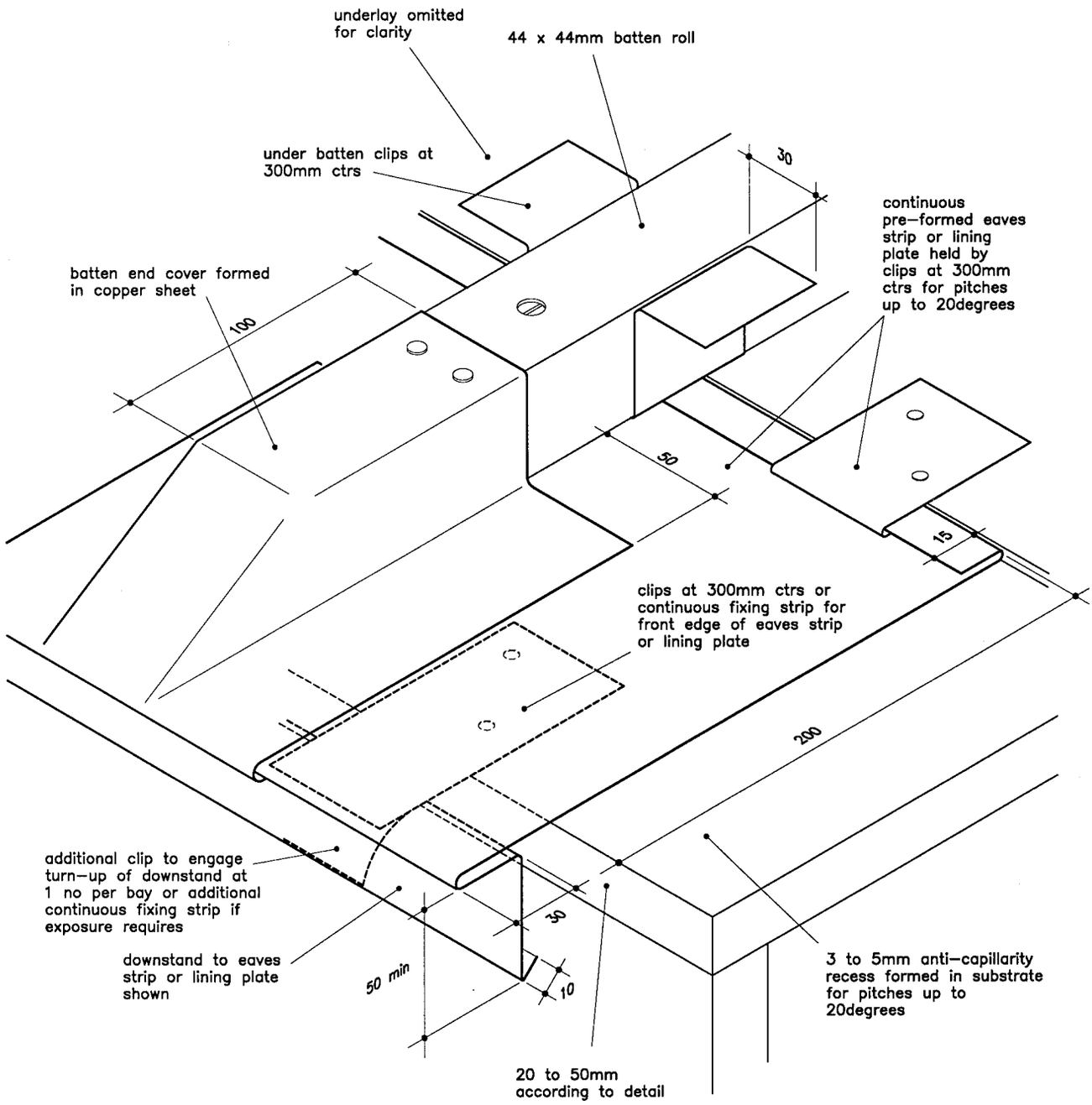

STAGE 2
15
turn–out
roofing sheet
dog–ear fold
30
turn under with capping
batten capping
eaves strip or lining plate
roofing sheet
10
movement gap in Long Strip
STAGE 3

Fig 39 Splayed batten roll end with additional batten end cover

TRADITIONAL ✓ | LONG STRIP ✓

* This alternative to Fig 38 is easier to form because the dog–ear fold can be avoided by simply making a cut in the turn–out. However it does require the batten end cover to ensure that water does not penetrate to the batten.
* The detail shown can also be used in Traditional roofing, except that the 10mm movement gap at the roofing sheet turn–under is not required. The capping turn–outs can be dressed down in Traditional.
* For joints in eaves strips and lining plates see Fig 26 (p72).

Temper: soft, quarter– or half–hard
Thickness: 0.6mm or 0.7mm



STAGE 1

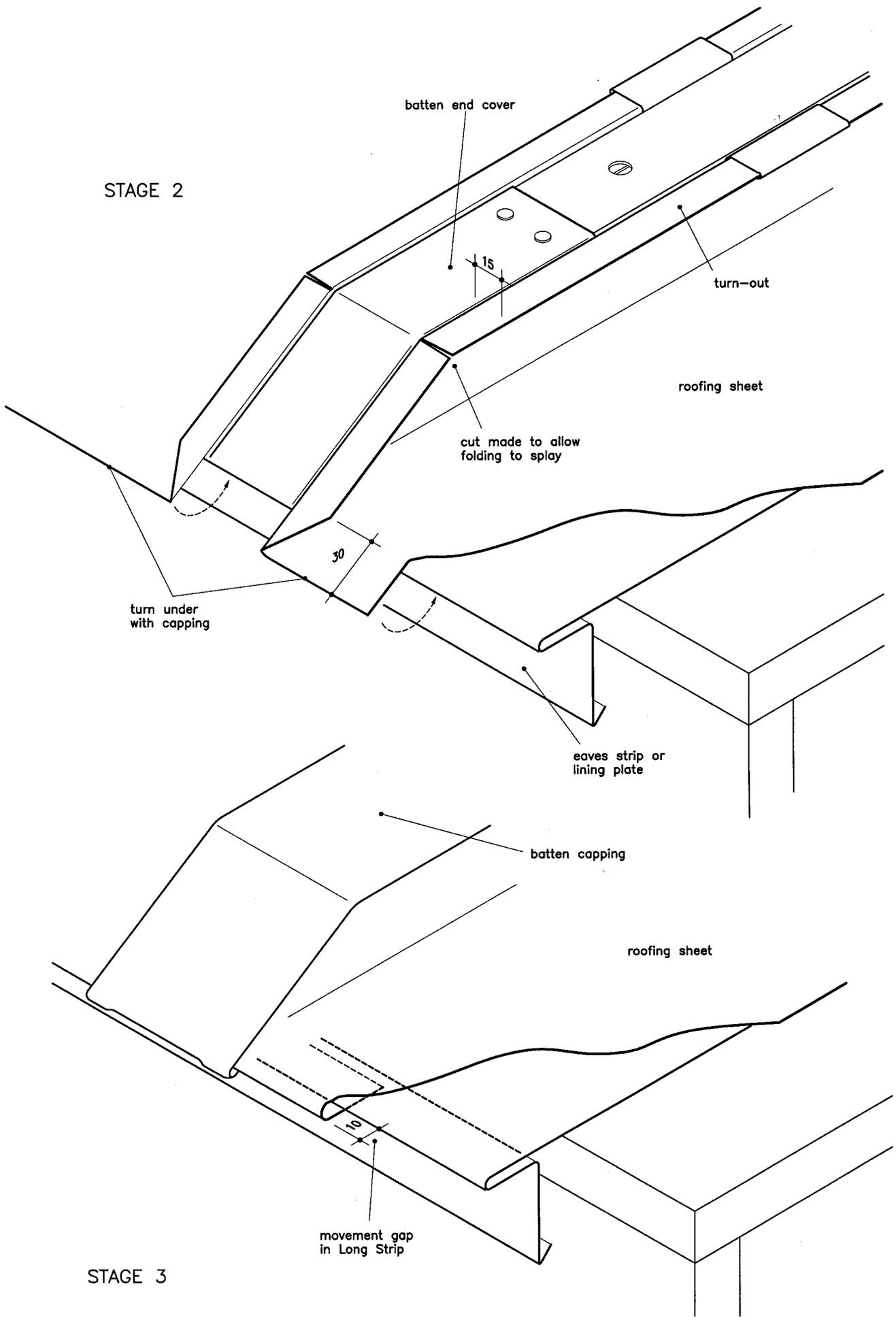

STAGE 2
batten end cover
15
turn–out
roofing sheet
cut made to allow
folding to splay
30
turn under
with capping
eaves strip or
lining plate
batten capping
roofing sheet
10
movement gap
in Long Strip
STAGE 3

Fig 40 Splayed batten roll end at fascias

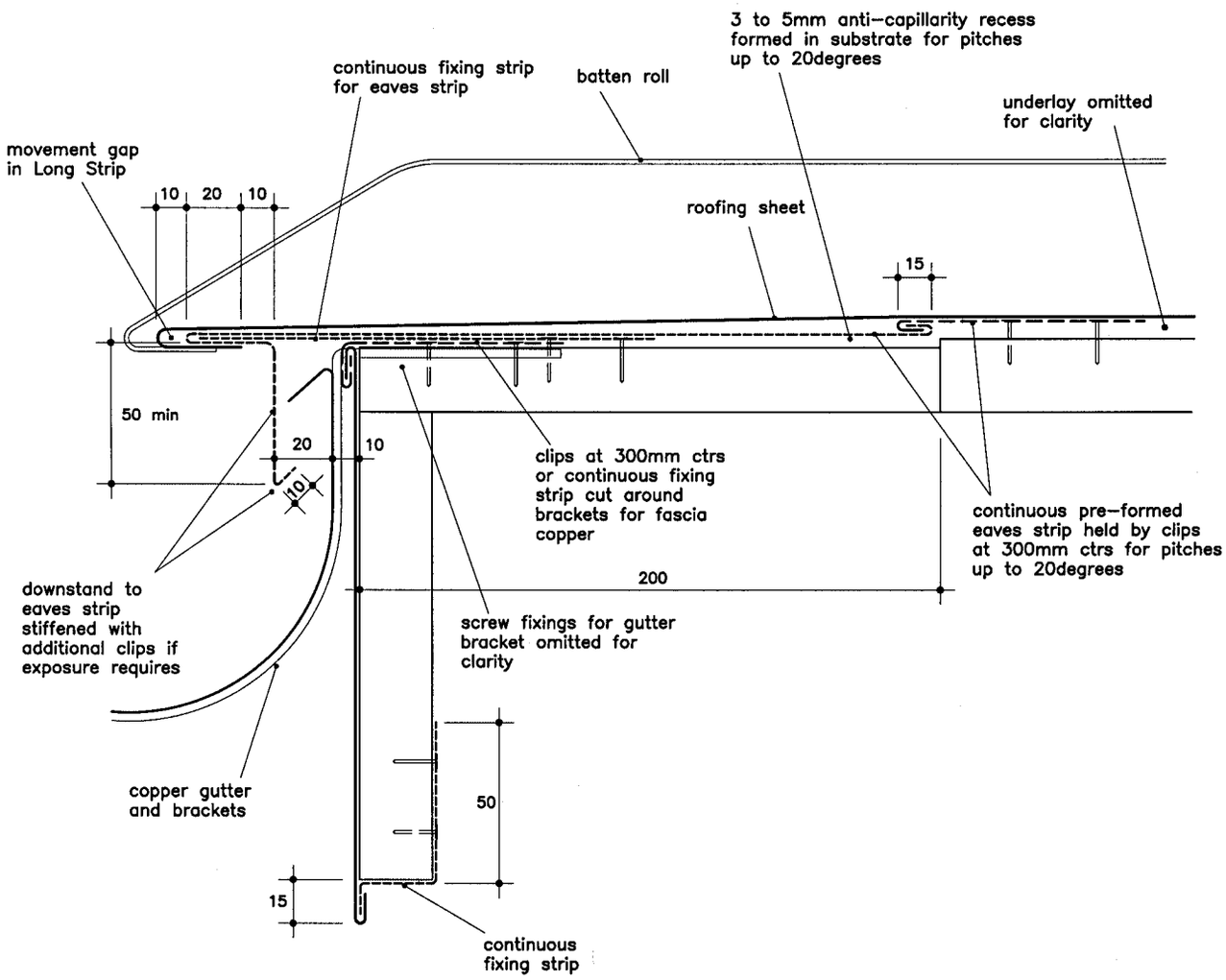


Fig 40a
Splayed batten roll end at copper clad fascia

TRADITIONAL	✓	LONG STRIP	✓

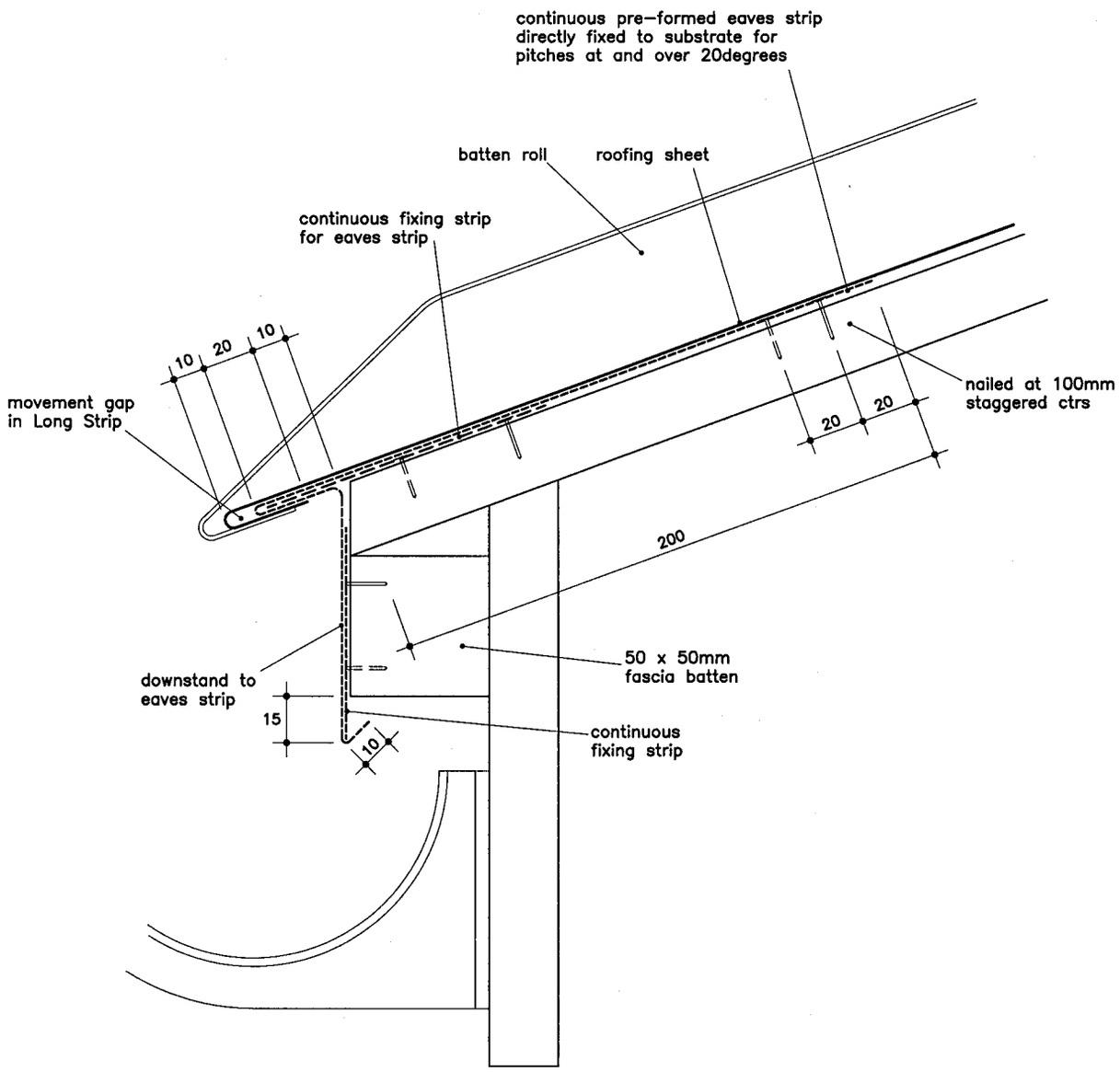


Fig 40b
Splayed batten roll end at timber fascia
TRADITIONAL ✓ LONG STRIP ✓

Fig 41 Splayed batten roll end at drip-steps

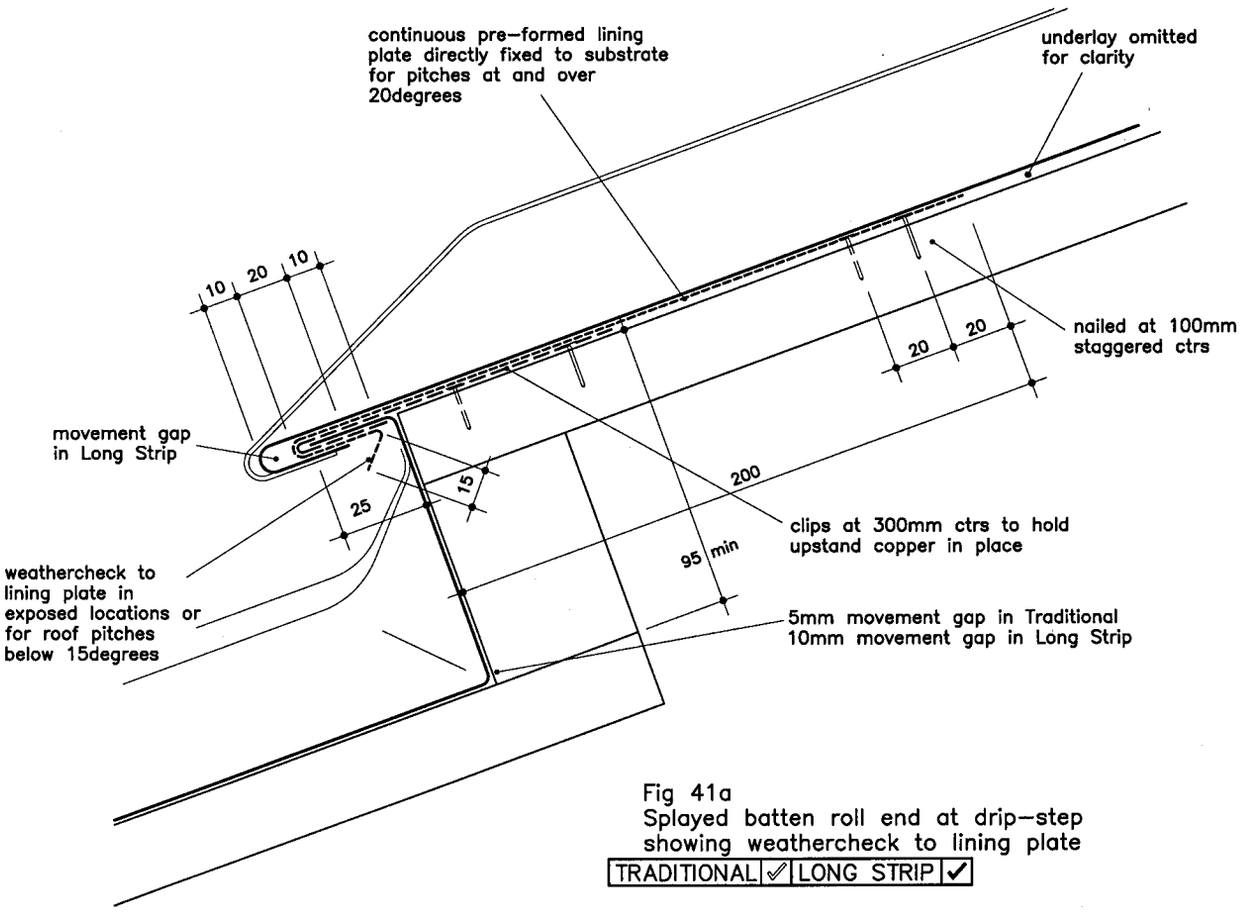


Fig 41a
Splayed batten roll end at drip–step showing weathercheck to lining plate

TRADITIONAL ✓ | LONG STRIP ✓

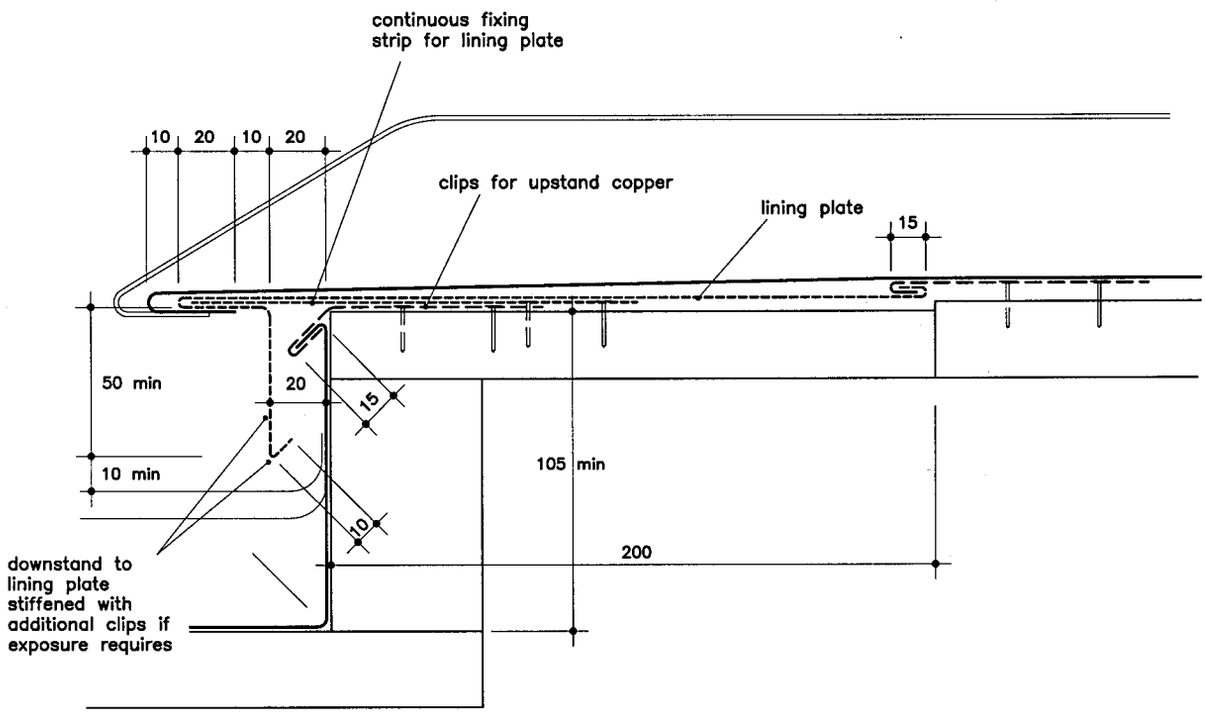
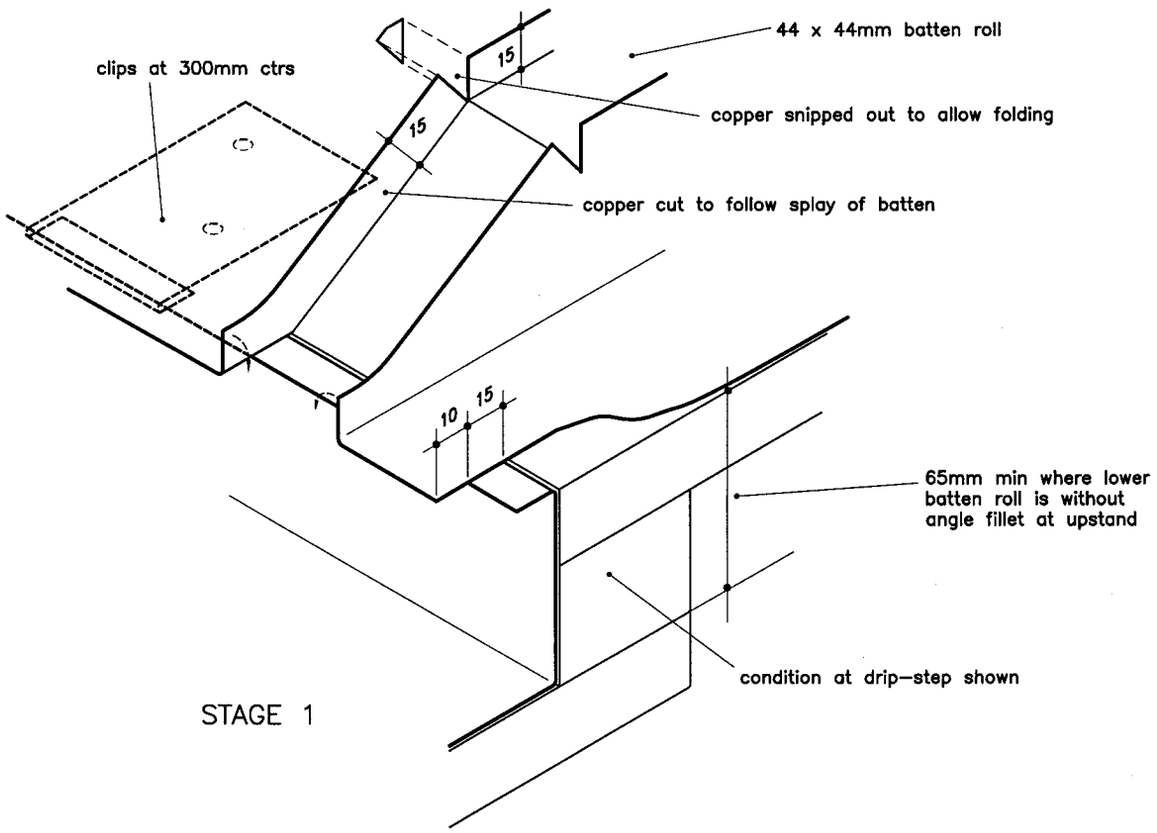


Fig 41b
Splayed batten roll end at drip–step showing downstand to lining plate

TRADITIONAL ✓ | LONG STRIP ✓

Fig 42 Splayed batten roll end with separate end capping

TRADITIONAL ✓ LONG STRIP X

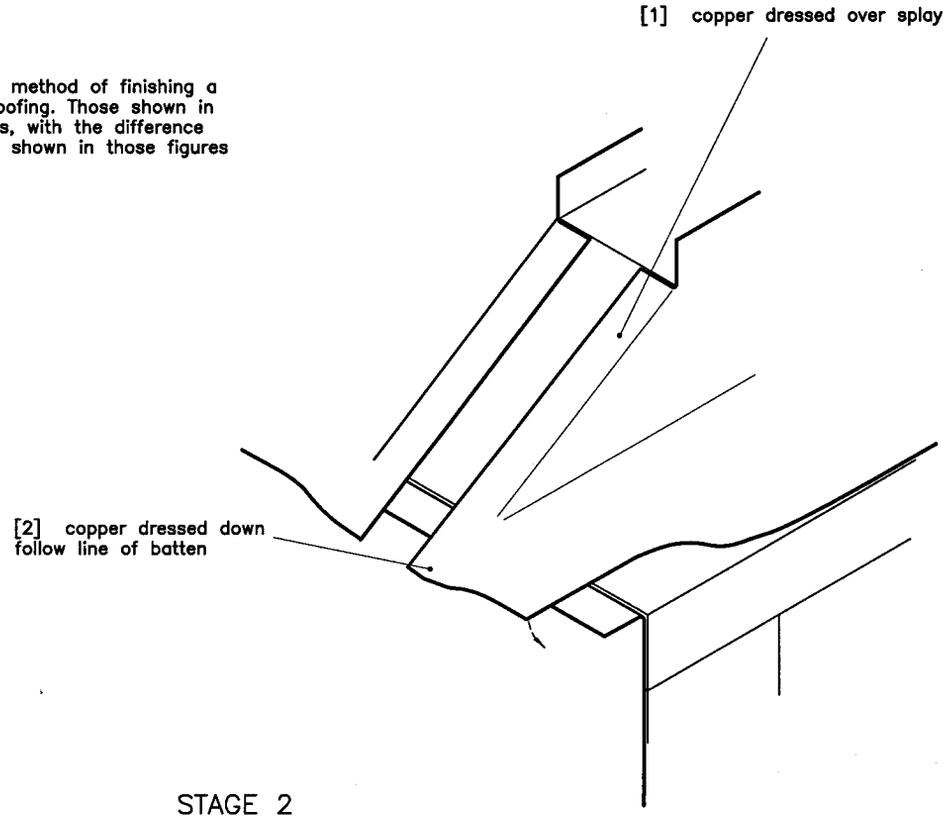


STAGE 1

[1] copper dressed over splay

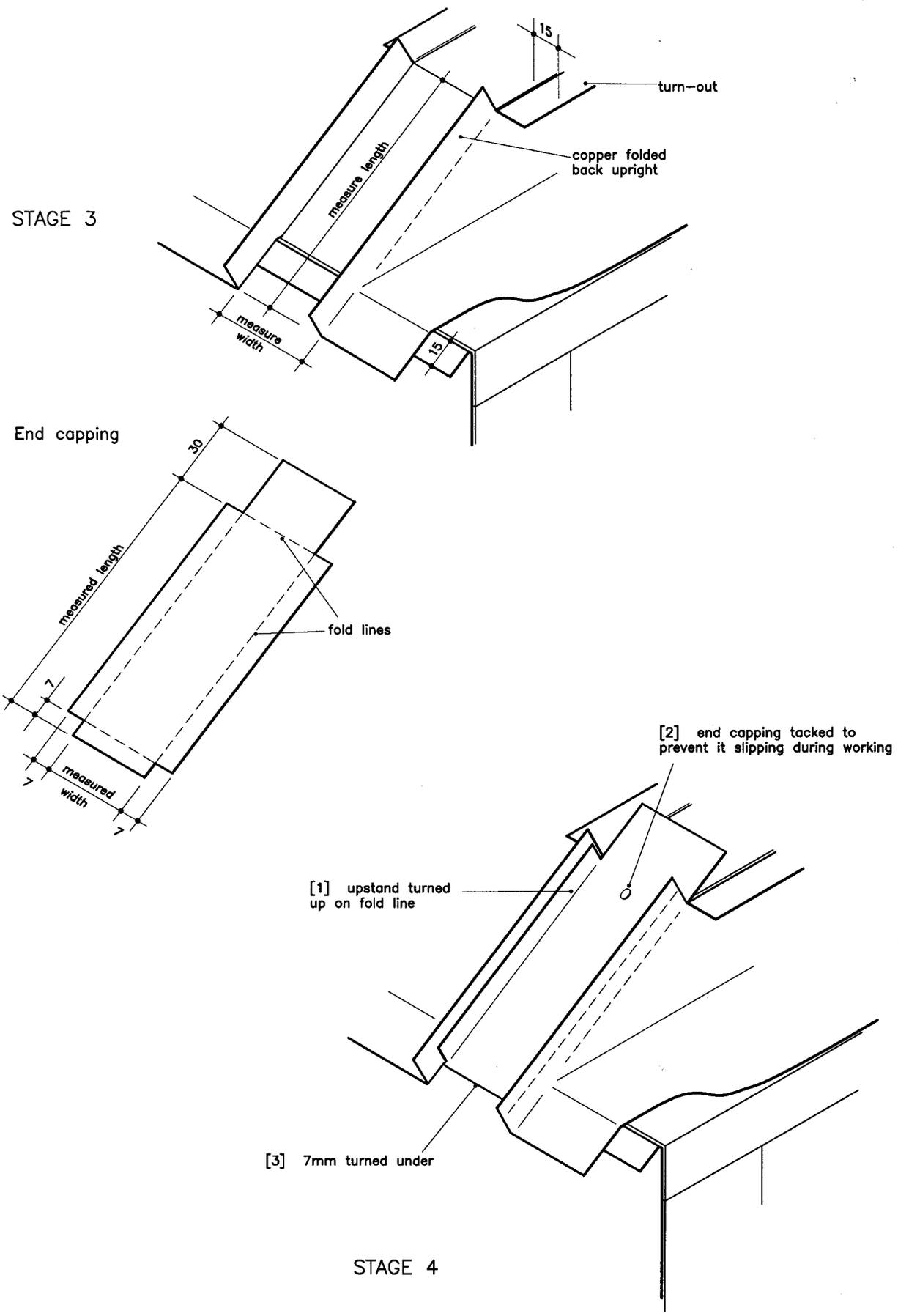
* This detail shows the usual method of finishing a batten roll end in Traditional roofing. Those shown in Figs 38 and 39 are alternatives, with the difference that the 10mm movement gap shown in those figures is not required.

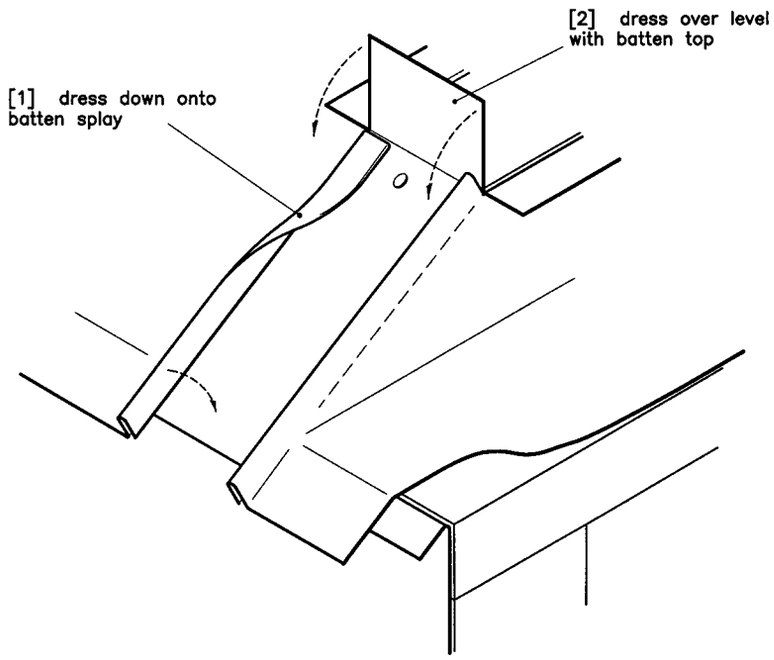
Temper: soft or quarter–hard
Thickness: 0.6mm or 0.7mm



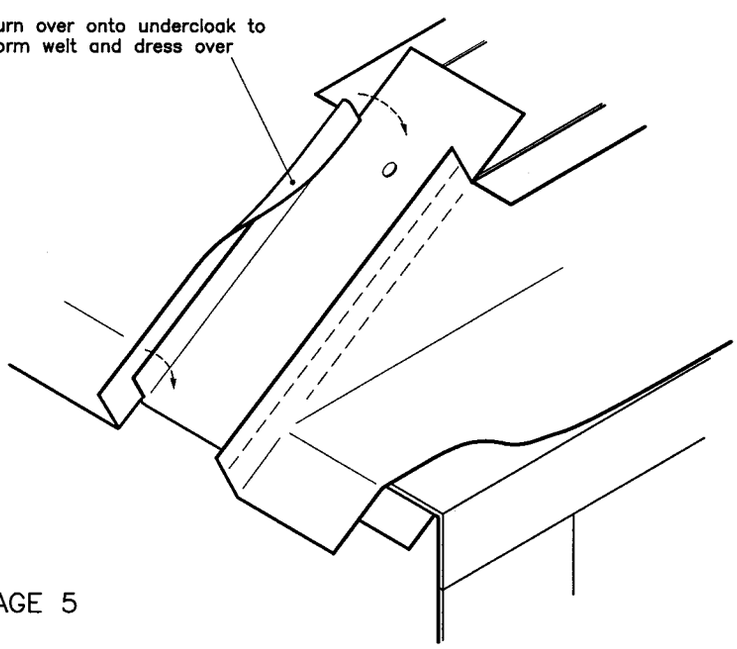
STAGE 2

Fig 42 Splayed batten roll end with separate end capping



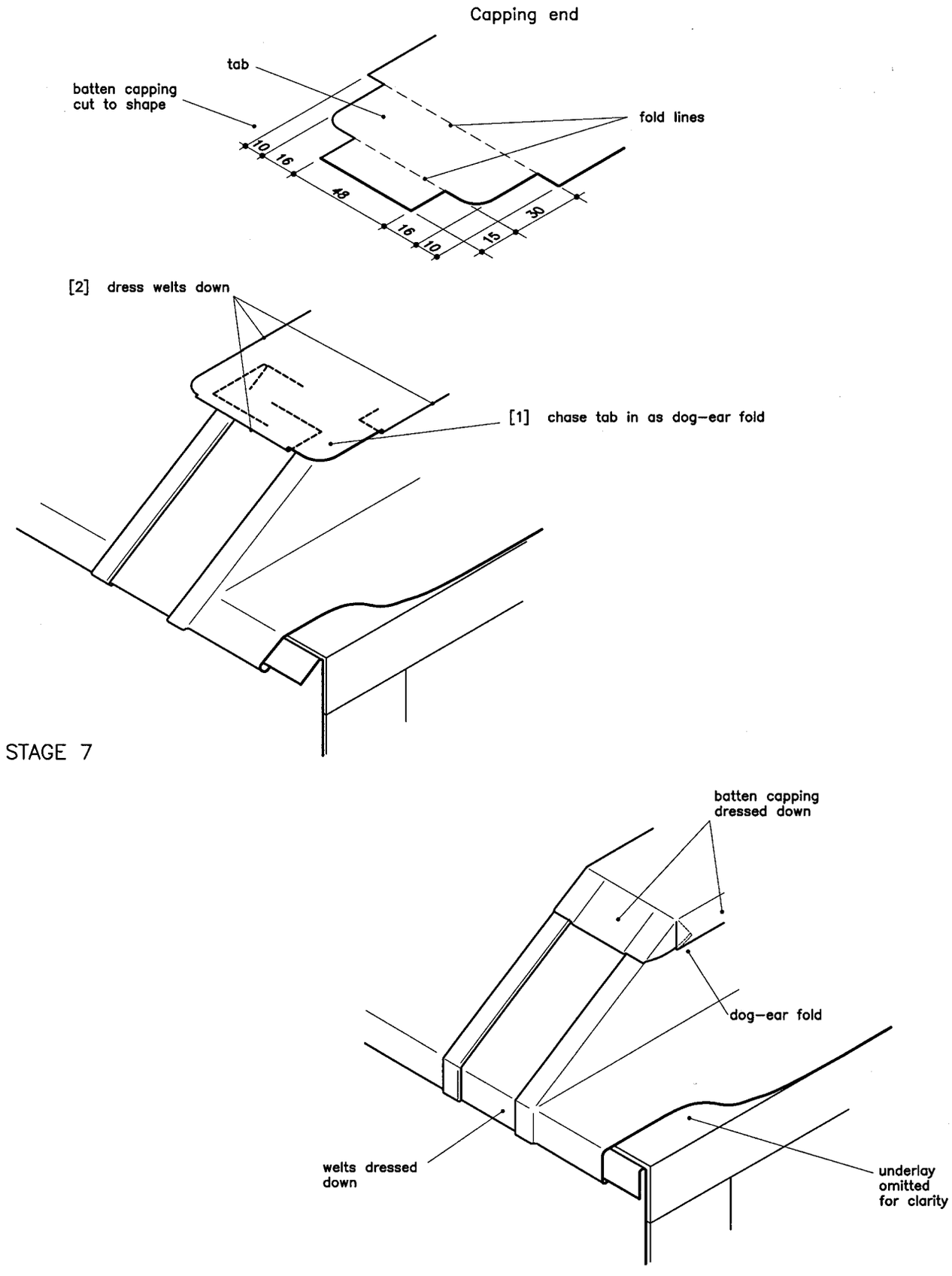


STAGE 6



STAGE 5

Fig 42 Splayed batten roll end with separate end capping



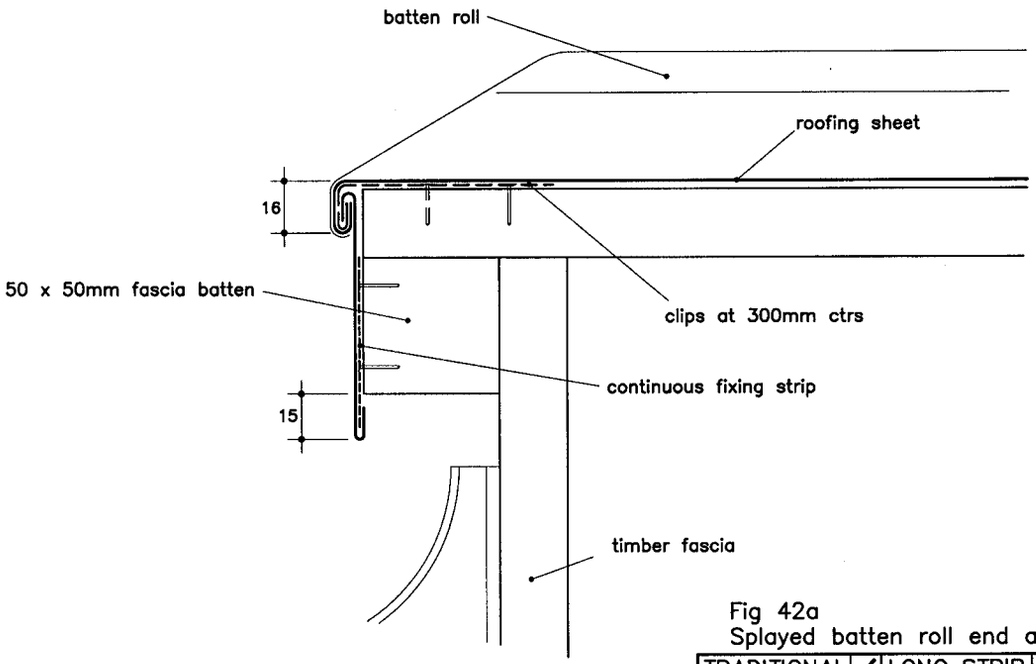


Fig 42a
Splayed batten roll end at timber fascia
TRADITIONAL ✓ LONG STRIP X

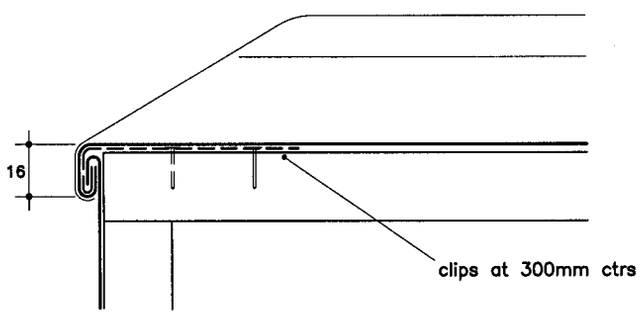


Fig 42b
Splayed batten roll end at parapet gutter
TRADITIONAL ✓ LONG STRIP X

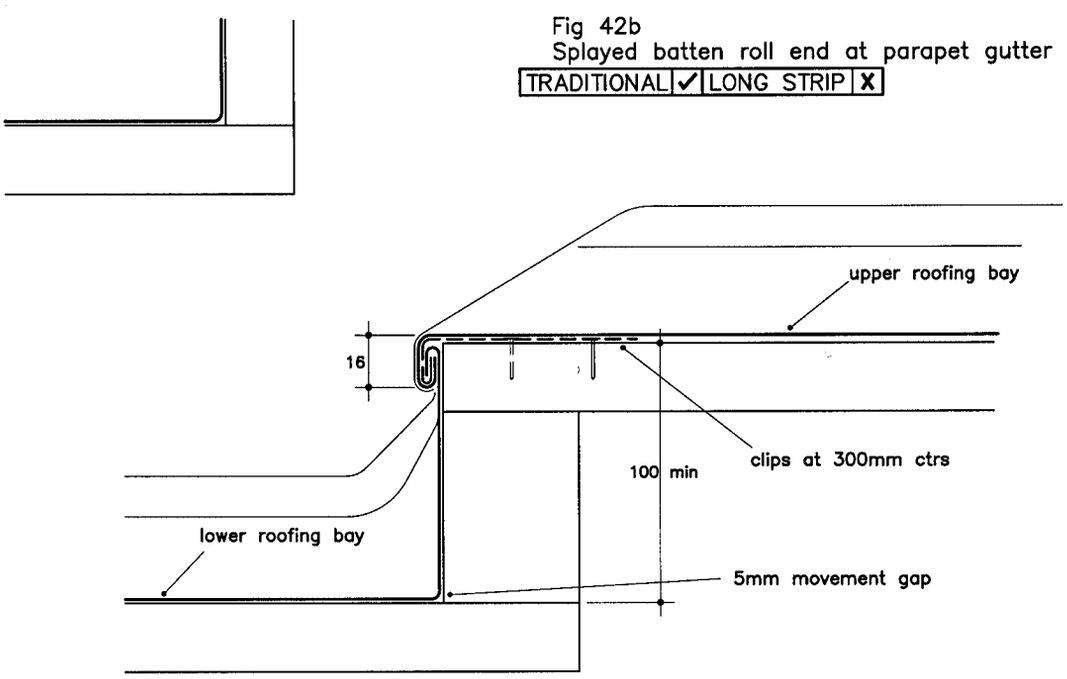
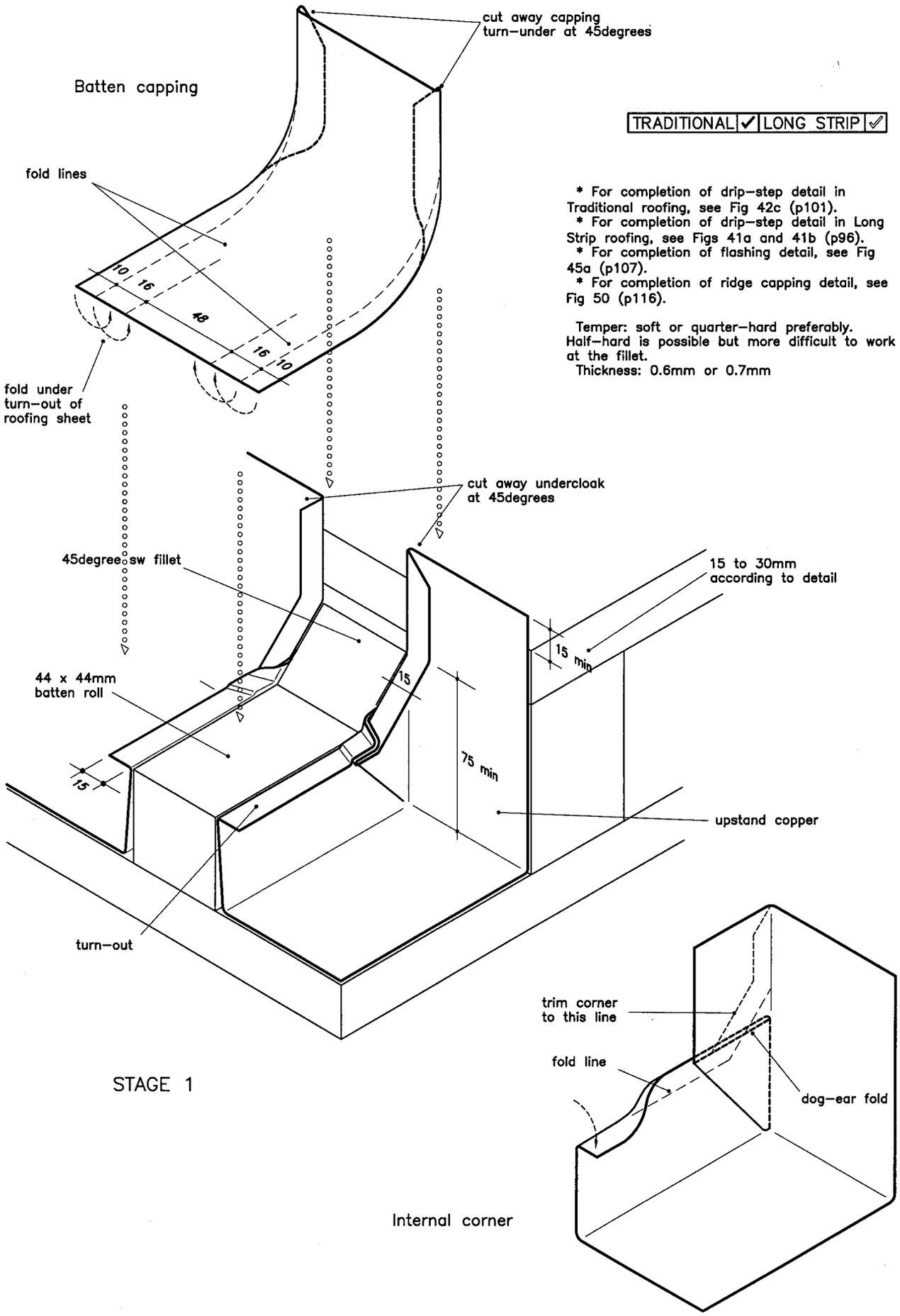
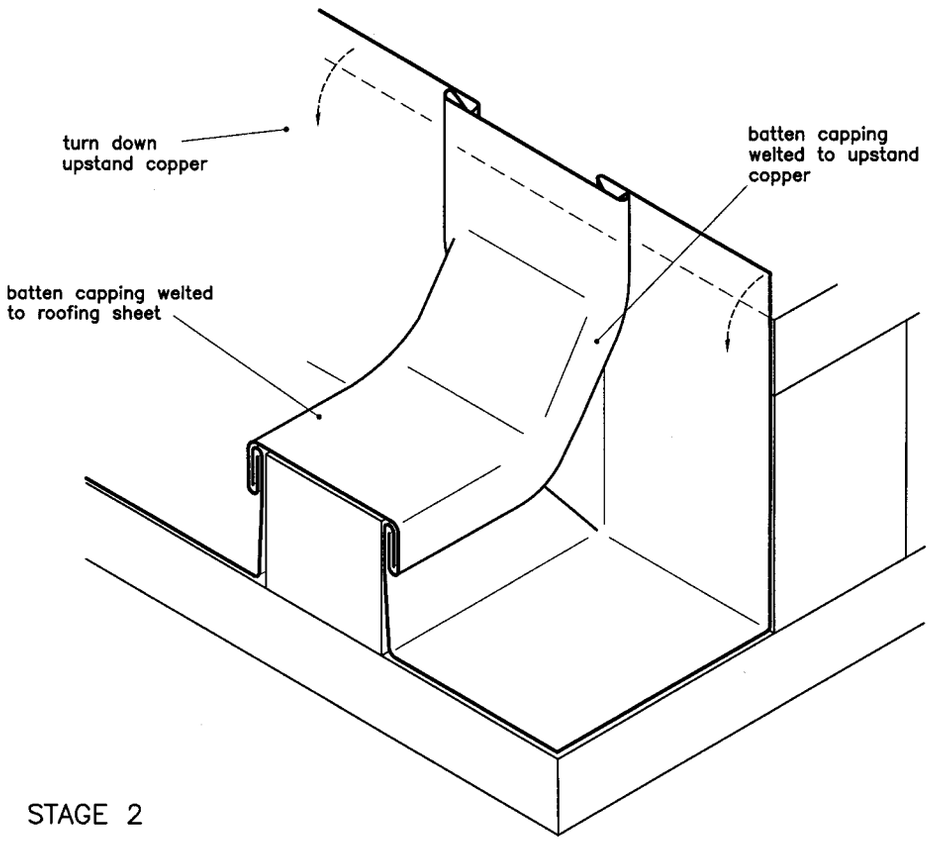


Fig 42c
Splayed batten roll end at drip-step
TRADITIONAL ✓ LONG STRIP X

Fig 43 Batten roll with 45degrees fillet at vertical upstand





STAGE 2

STAGE 3

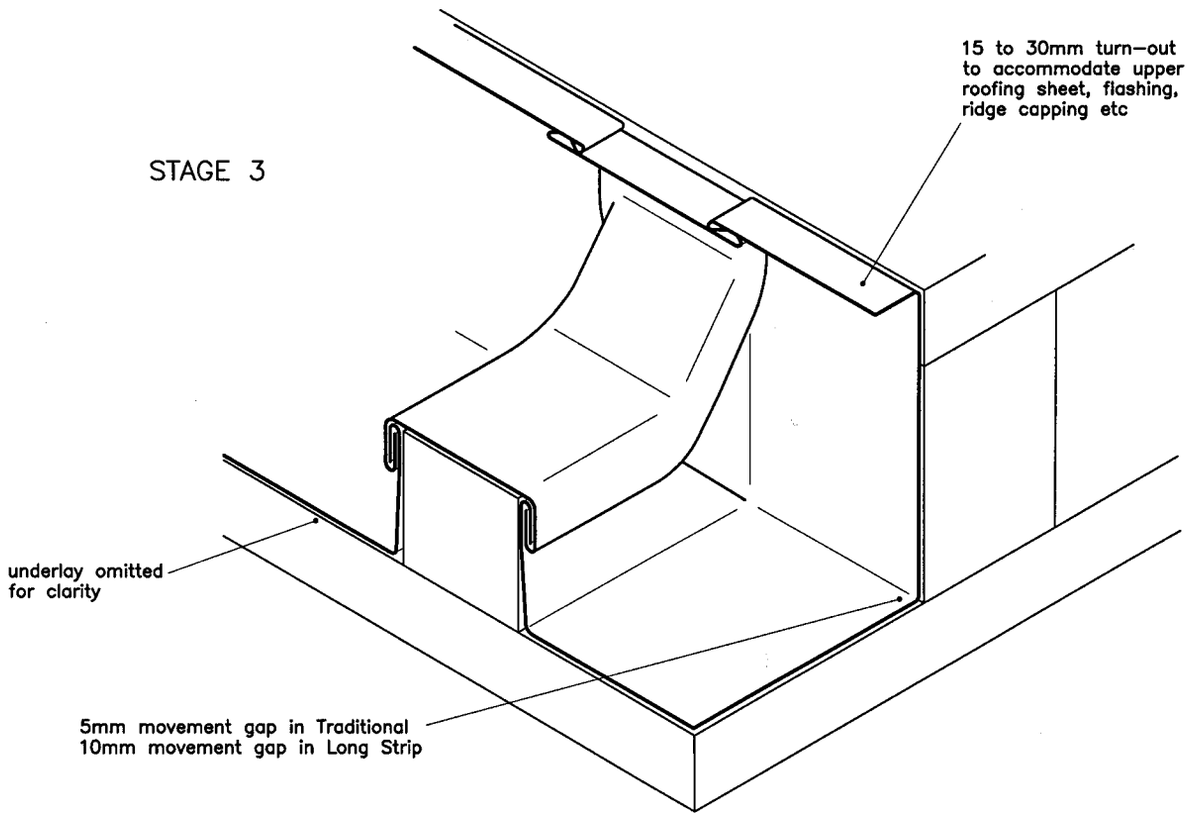
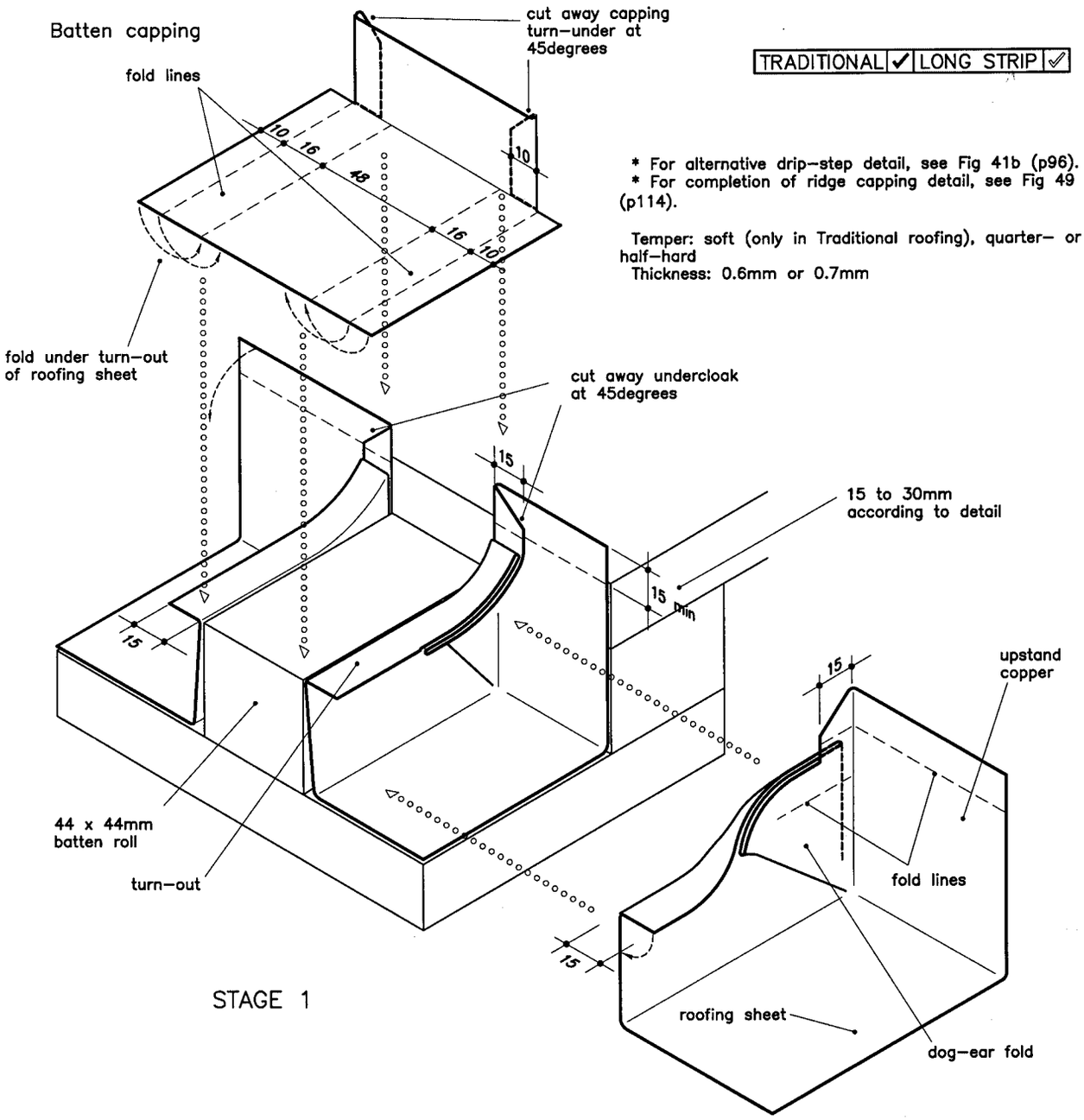


Fig 44 Batten roll without angle fillet at vertical upstand



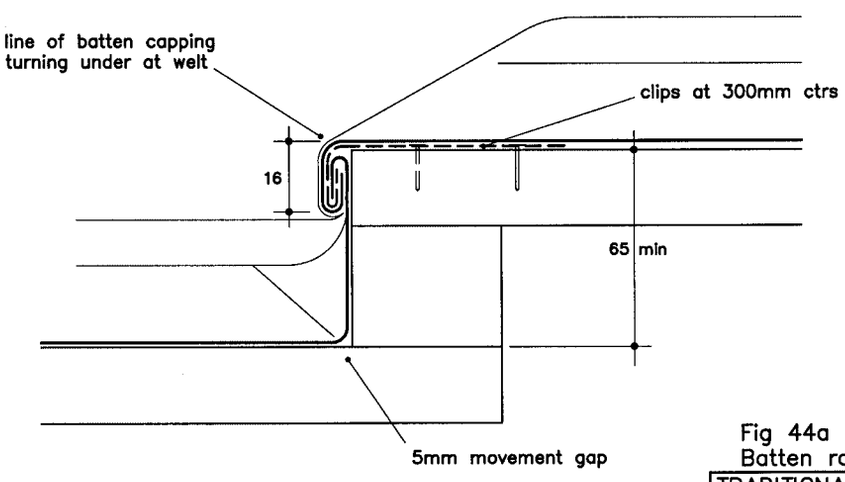
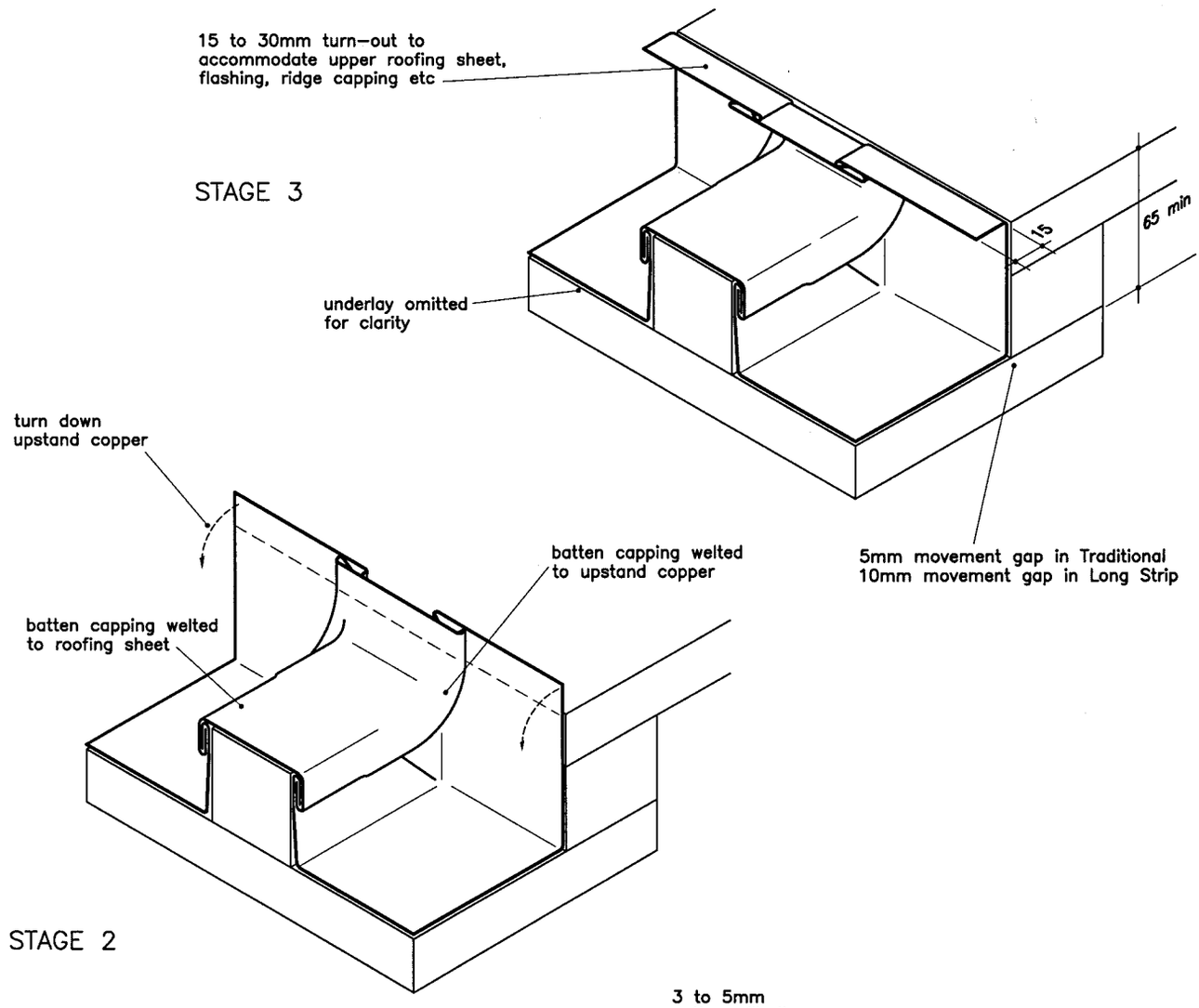


Fig 44a
Batten roll without fillet at drip–step
TRADITIONAL ✓ LONG STRIP ✗



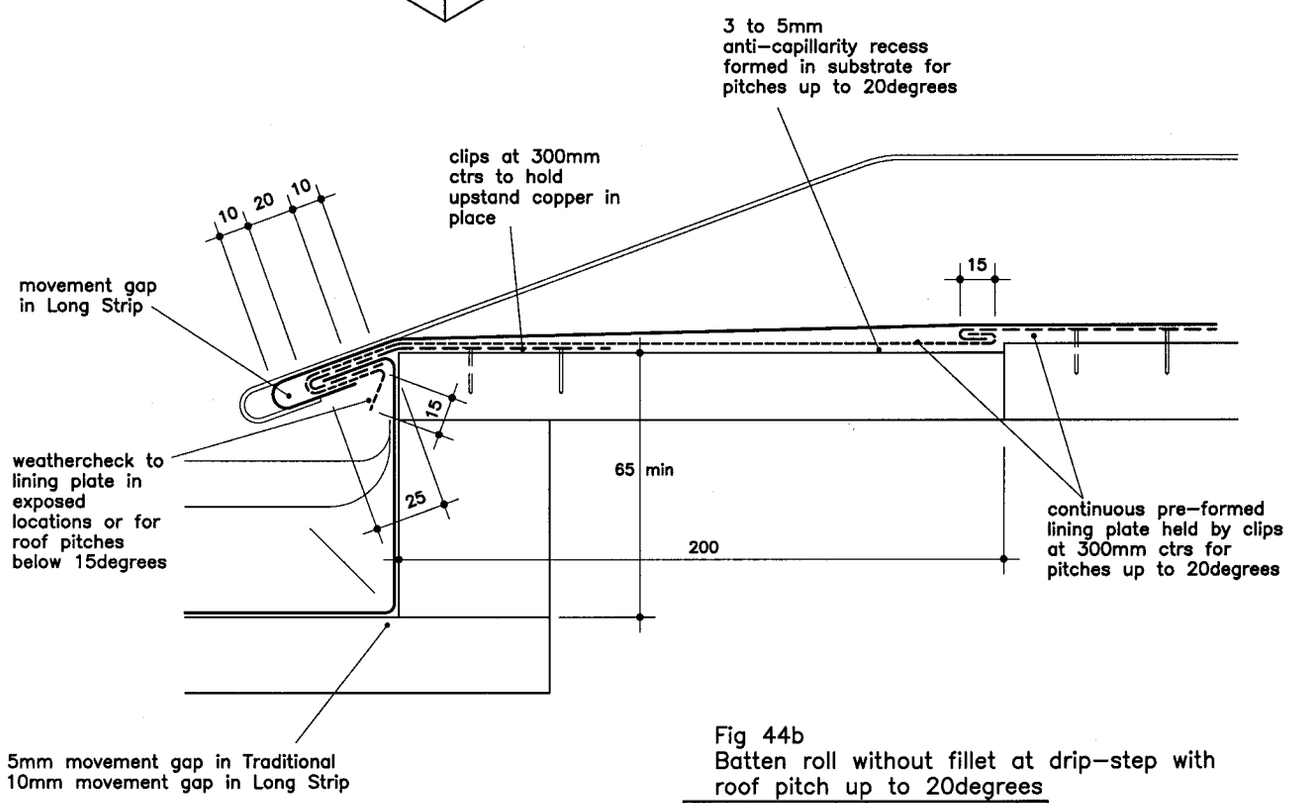
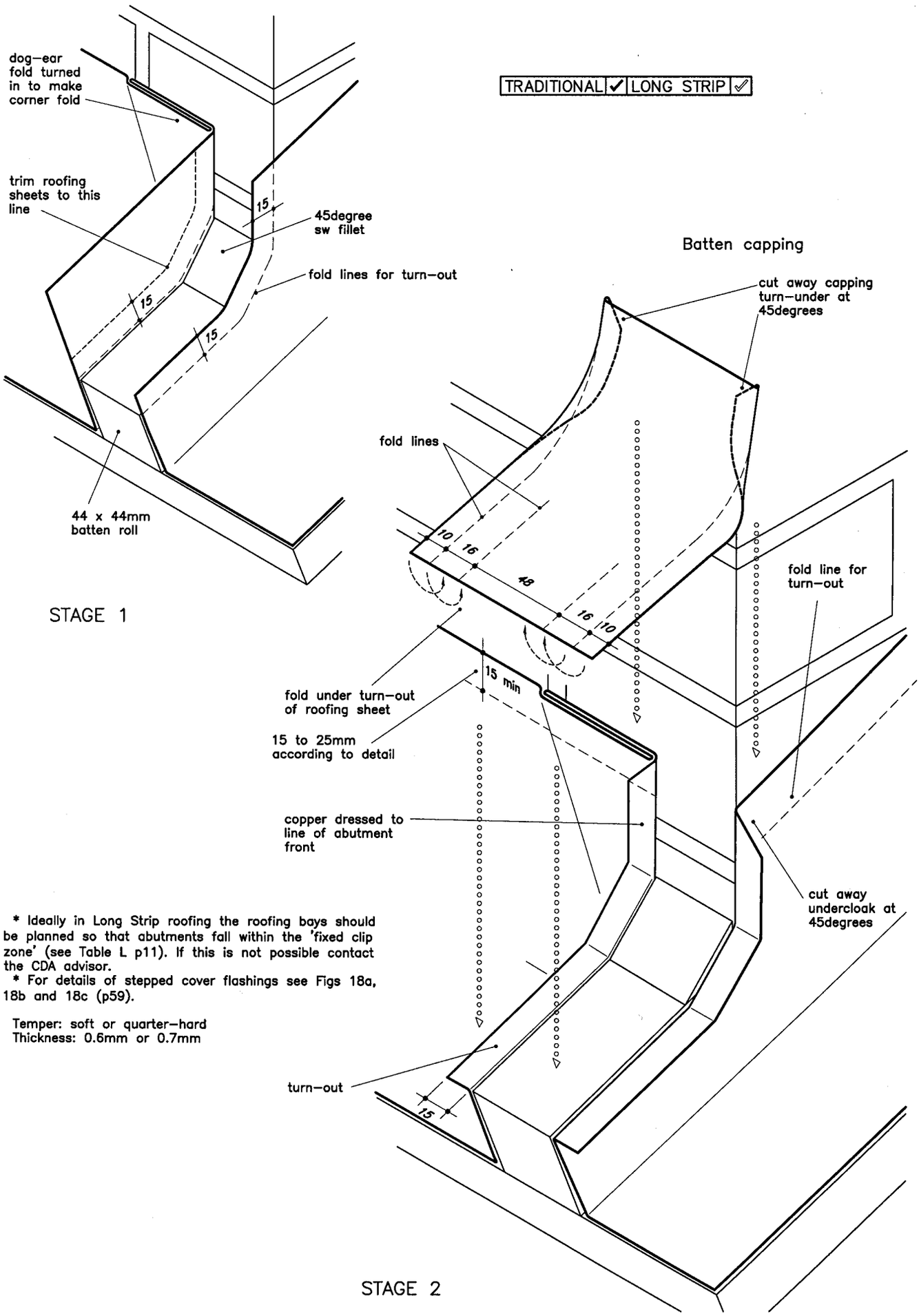


Fig 44b
Batten roll without fillet at drip–step with roof pitch up to 20degrees

TRADITIONAL	✓	LONG STRIP	✓

Fig 45 Batten roll at external corner



* Ideally in Long Strip roofing the roofing bays should be planned so that abutments fall within the 'fixed clip zone' (see Table L p11). If this is not possible contact the CDA advisor.
* For details of stepped cover flashings see Figs 18a, 18b and 18c (p59).

Temper: soft or quarter–hard
Thickness: 0.6mm or 0.7mm

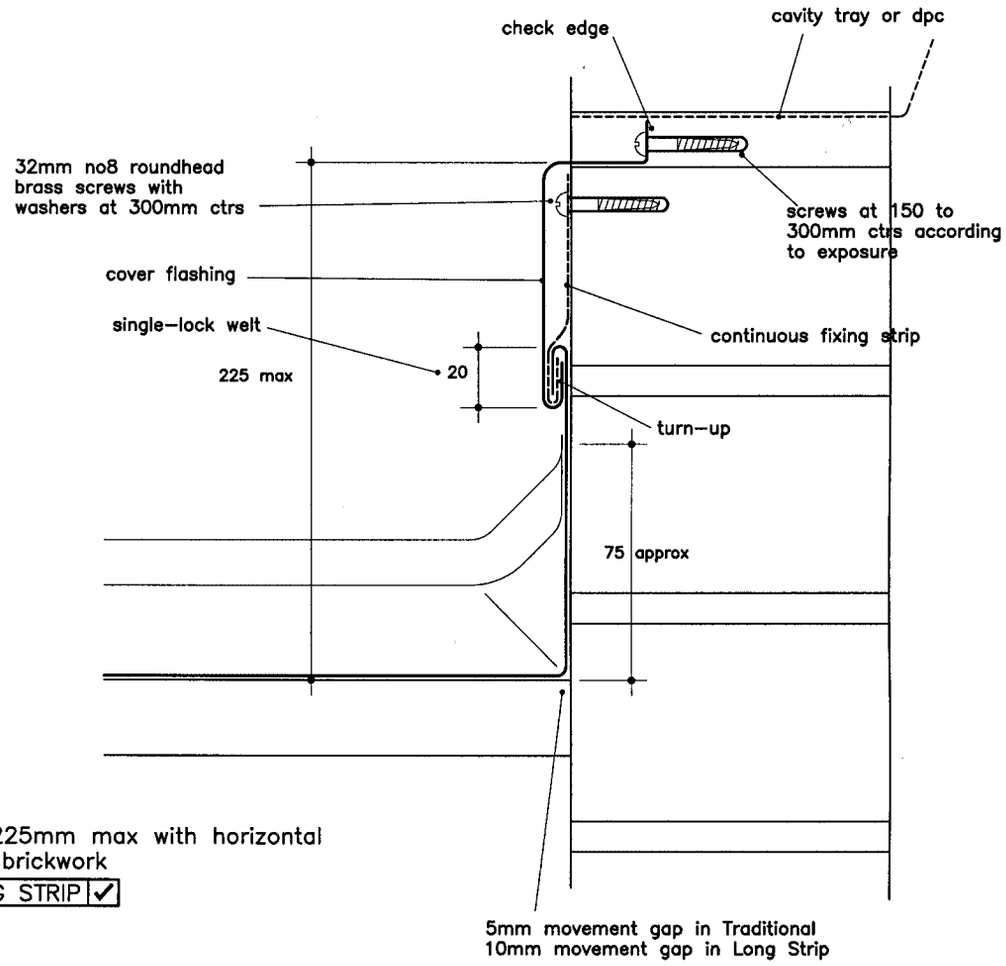


Fig 45a
Vertical upstand 225mm max with horizontal cover flashing to brickwork

TRADITIONAL	✓	LONG STRIP	✓

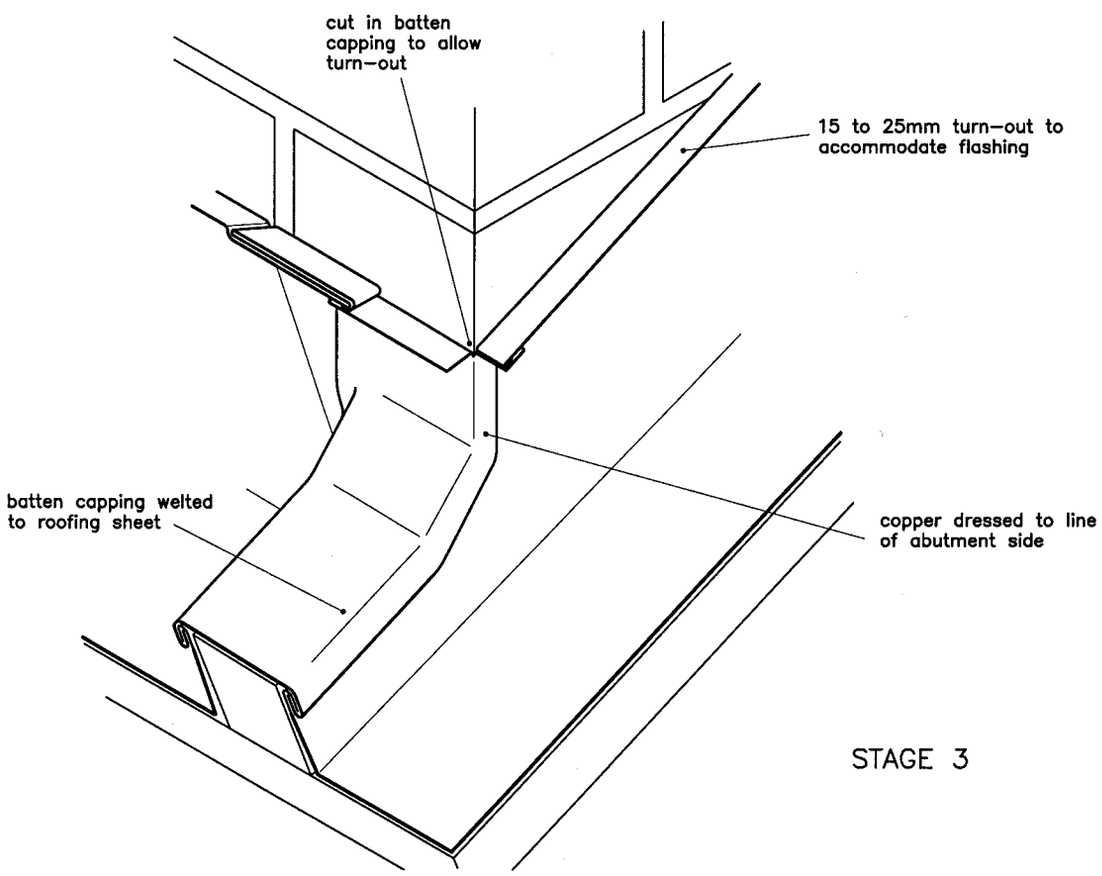
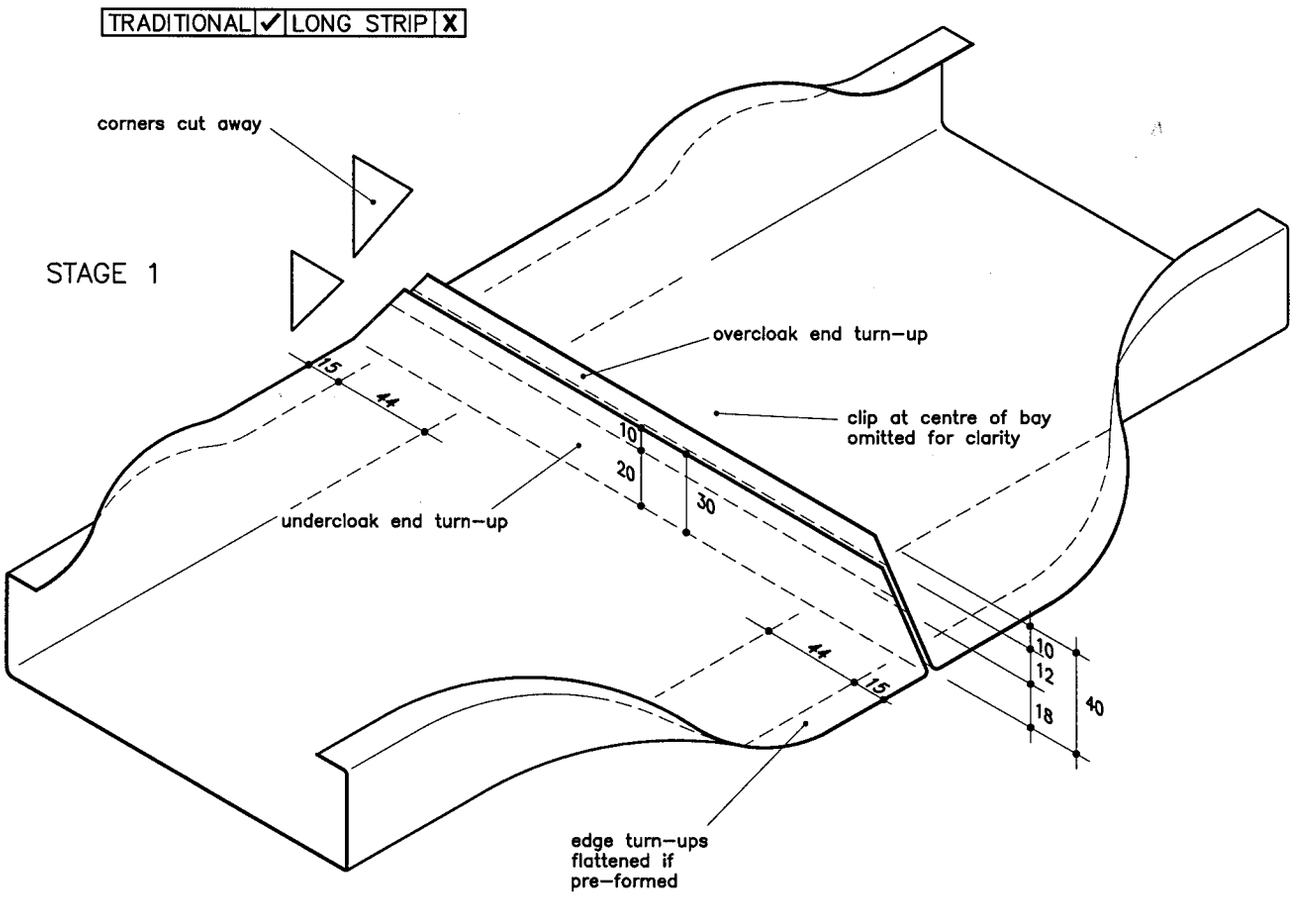
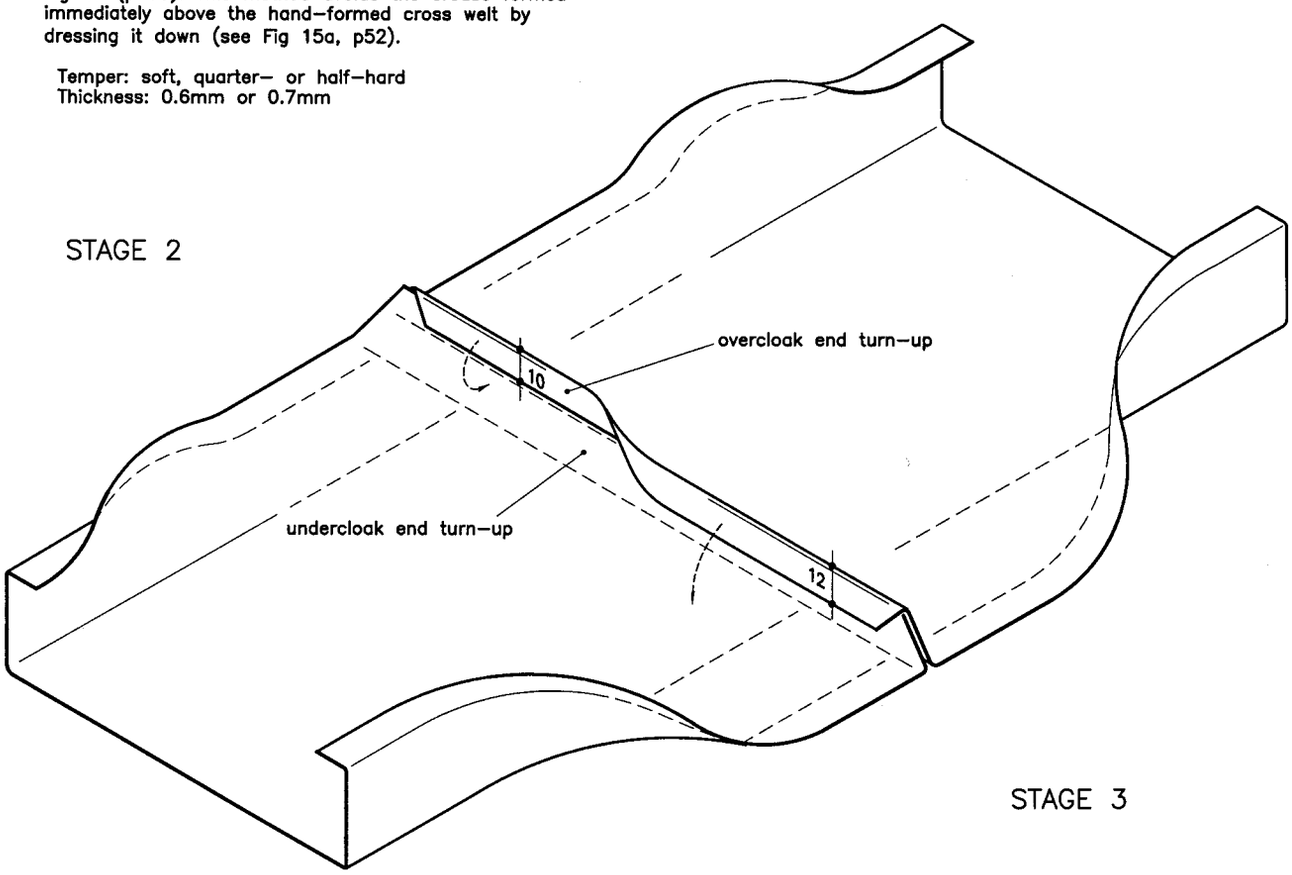


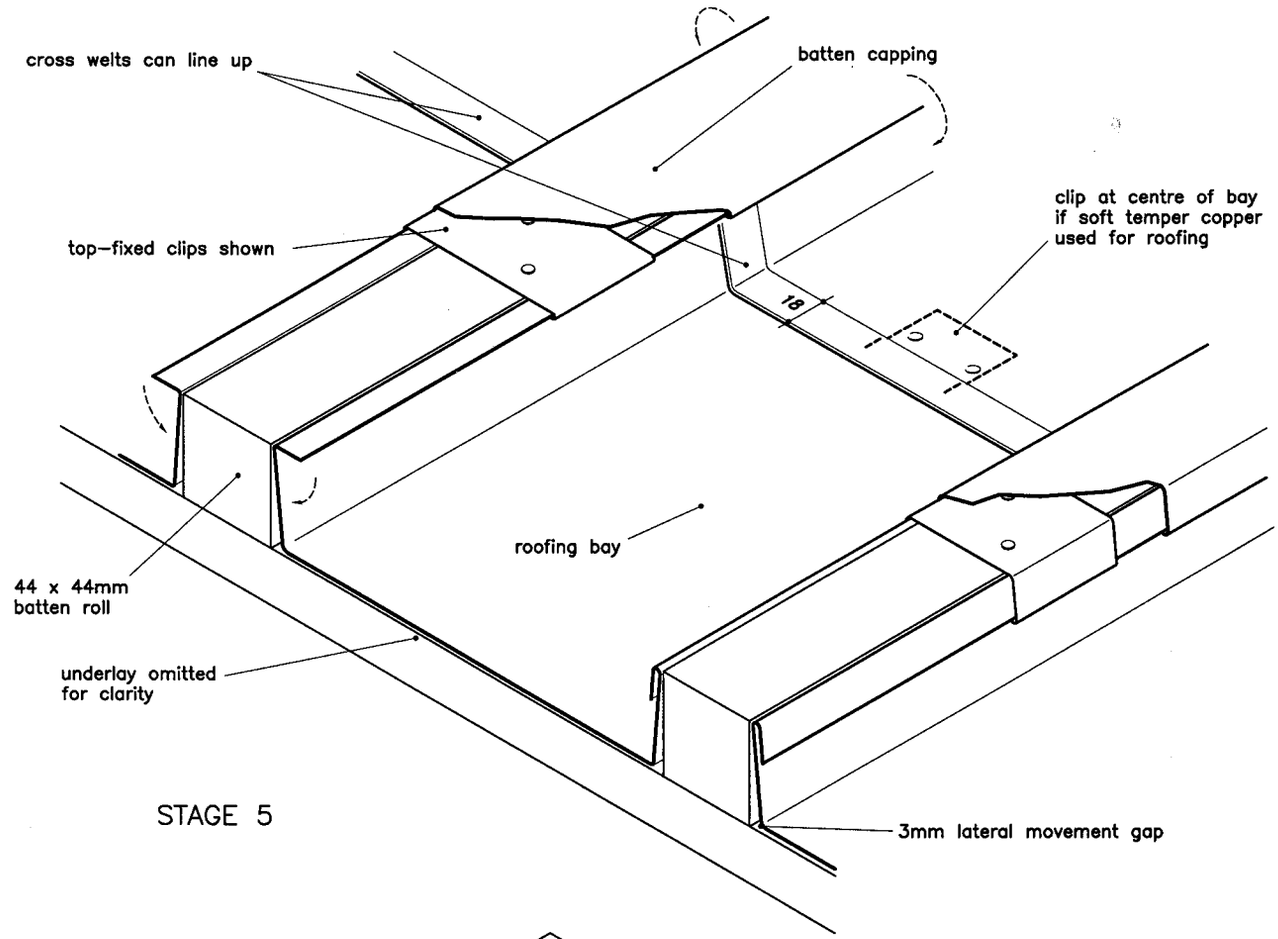
Fig 46 Batten roll junction with hand-formed double-lock cross welt



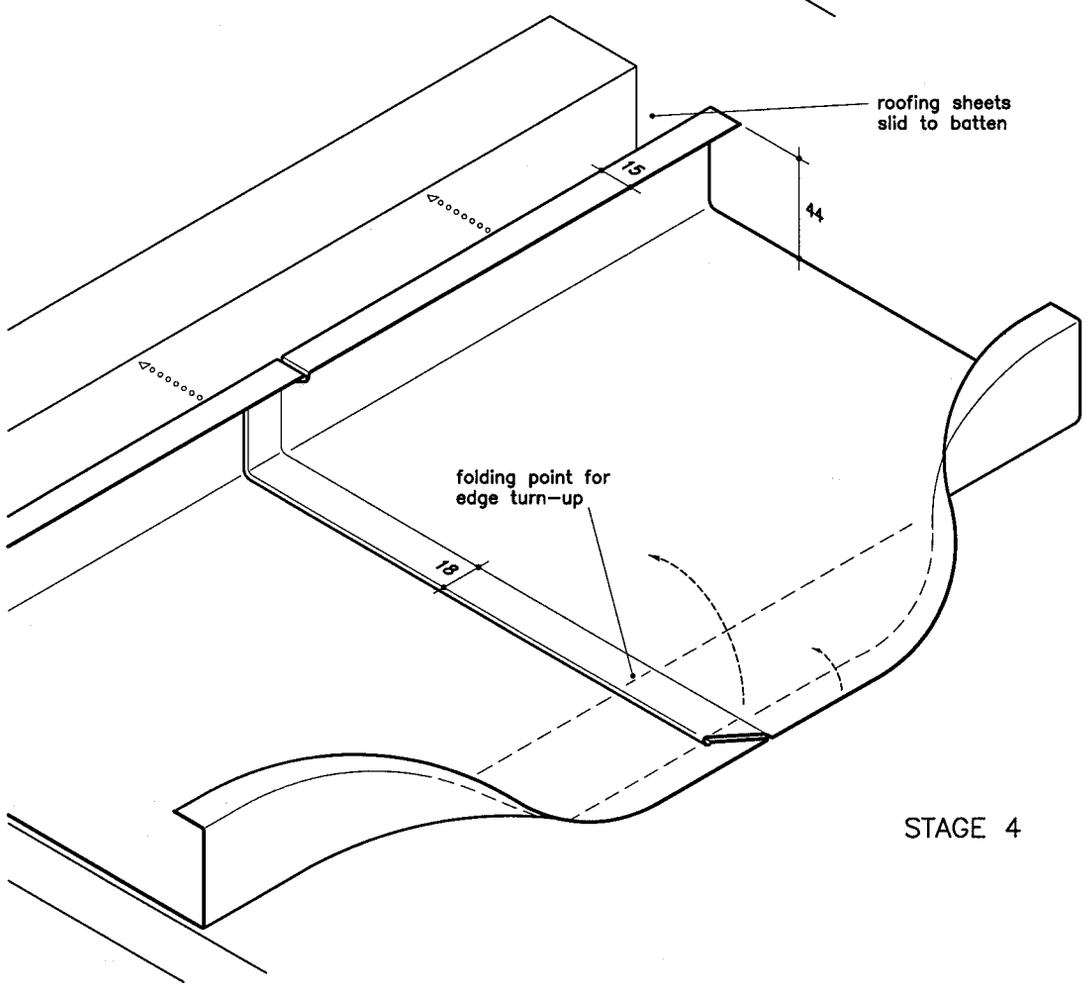
* The alternative 'pre–formed cross welt' is shown in Fig 47 (p110). This method avoids the crease formed immediately above the hand–formed cross welt by dressing it down (see Fig 15a, p52).

Temper: soft, quarter– or half–hard
Thickness: 0.6mm or 0.7mm



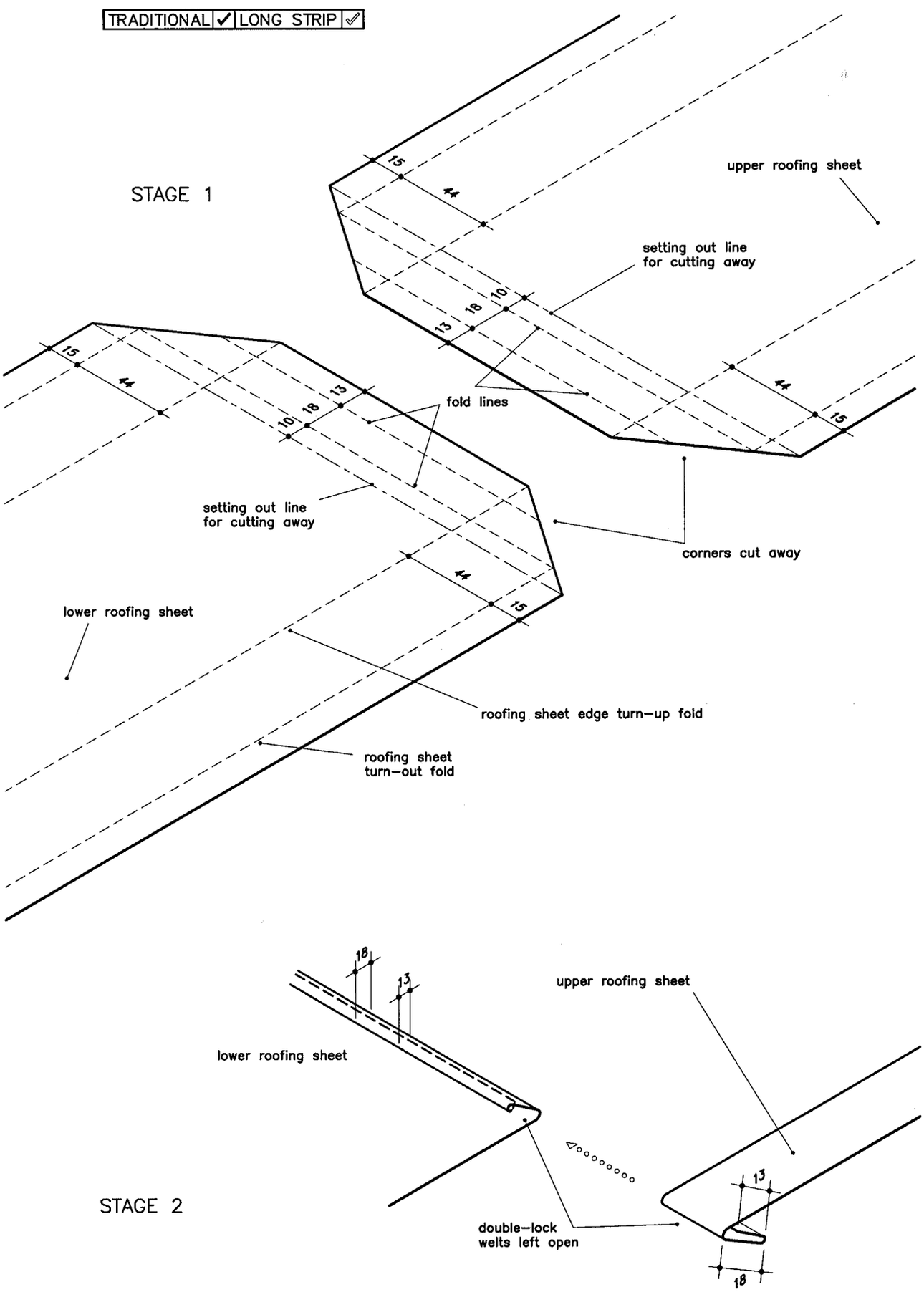


STAGE 5



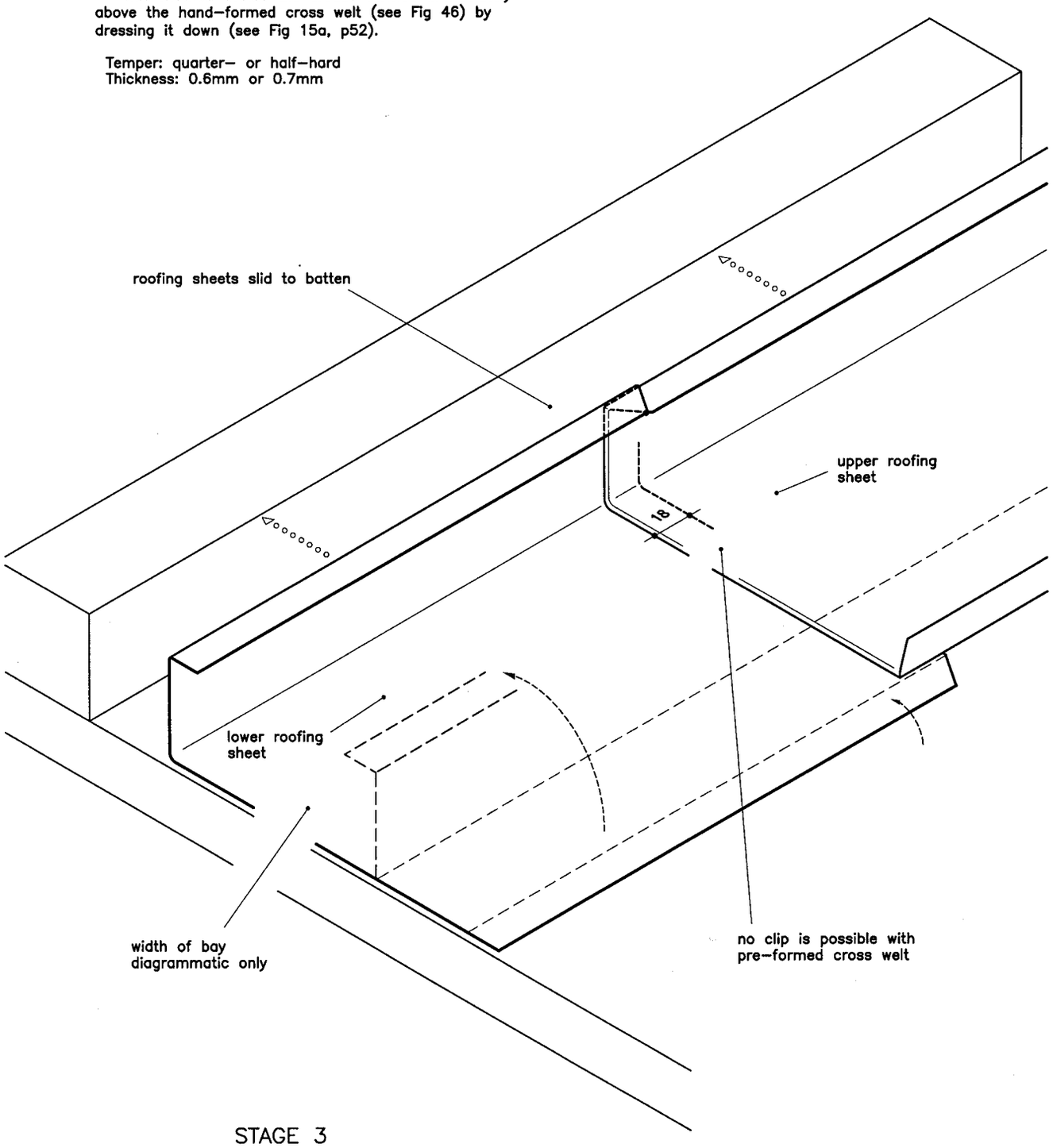
STAGE 4

Fig 47 Batten roll junction with pre-formed double-lock cross welt



* This method avoids the crease formed immediately above the hand–formed cross welt (see Fig 46) by dressing it down (see Fig 15a, p52).

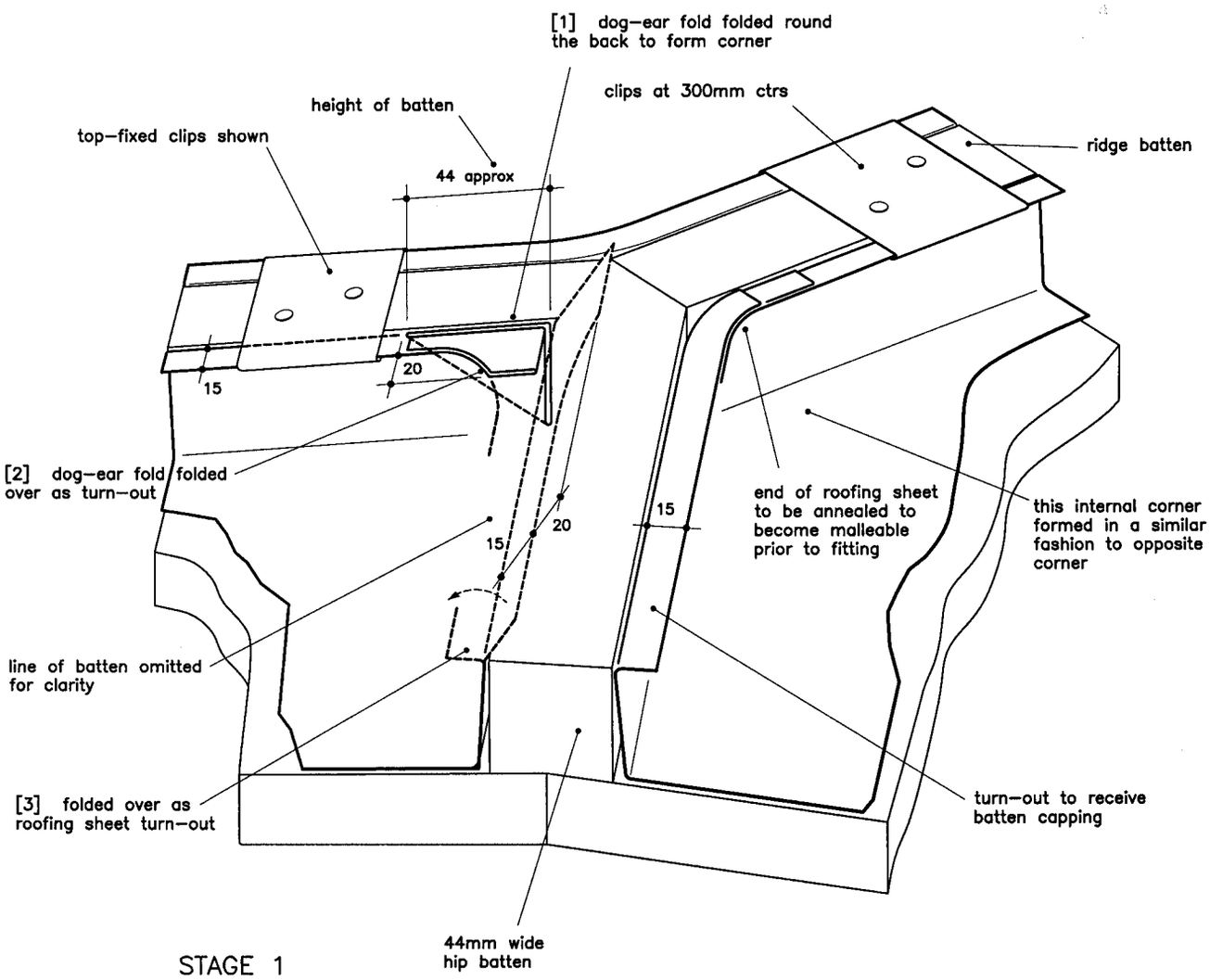
Temper: quarter– or half–hard
Thickness: 0.6mm or 0.7mm



STAGE 3

Fig 48 Batten ridge flush to batten hip

TRADITIONAL ✓ LONG STRIP ✓



STAGE 1

* In all but the most exposed situations, the top layer of the dog–ear fold folded over in [2] can be snipped off. This reduces the number of copper thicknesses to be worked and therefore makes the job easier.

* The detail can also be used in Long Strip roofing, the only difference being the allowance for movement shown in Fig 48b opposite.

* Ridge and hip battens are often used with double–lock standing seam roofing as shown in Fig 19 (p60).

* As far as the setting out of roofing bays is concerned, both batten roll and double–lock standing seams can line up on either side of the batten ridge or hip.

* Joints in cappings are covered with Fig 23 (p64) and in Fig 12b (p48).

Temper: soft or quarter–hard preferably. Half–hard is possible but more difficult to work neatly in this situation.

Thickness: 0.6mm or 0.7mm

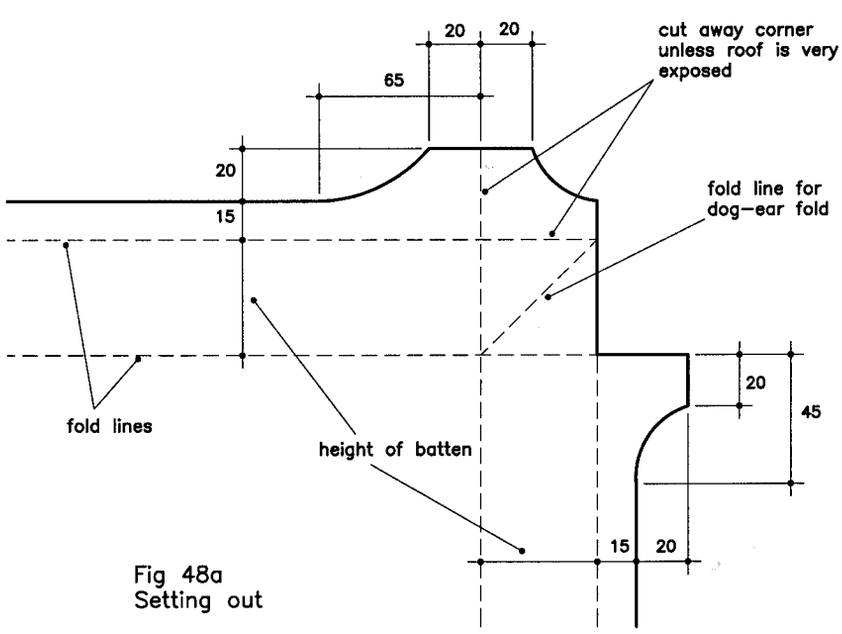
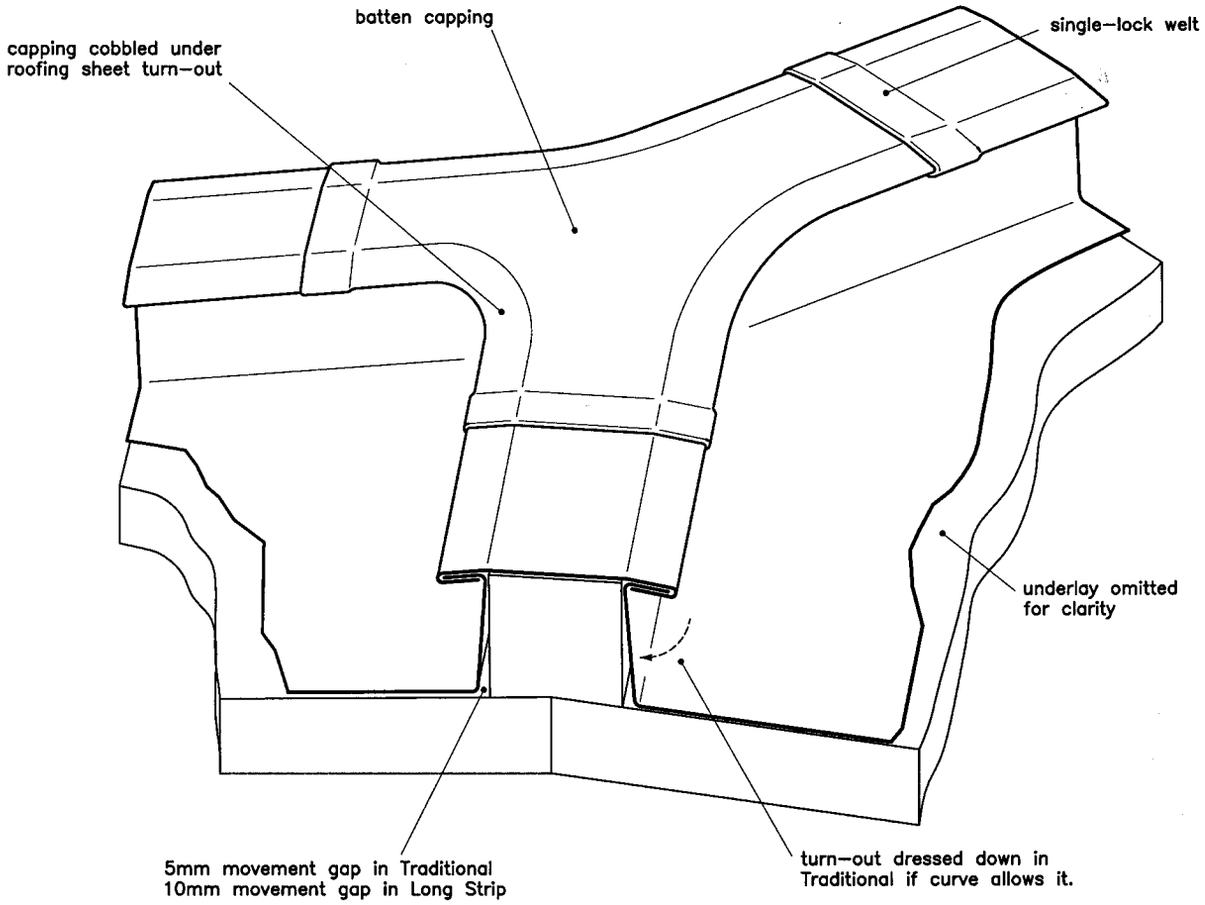


Fig 48a
Setting out



STAGE 2

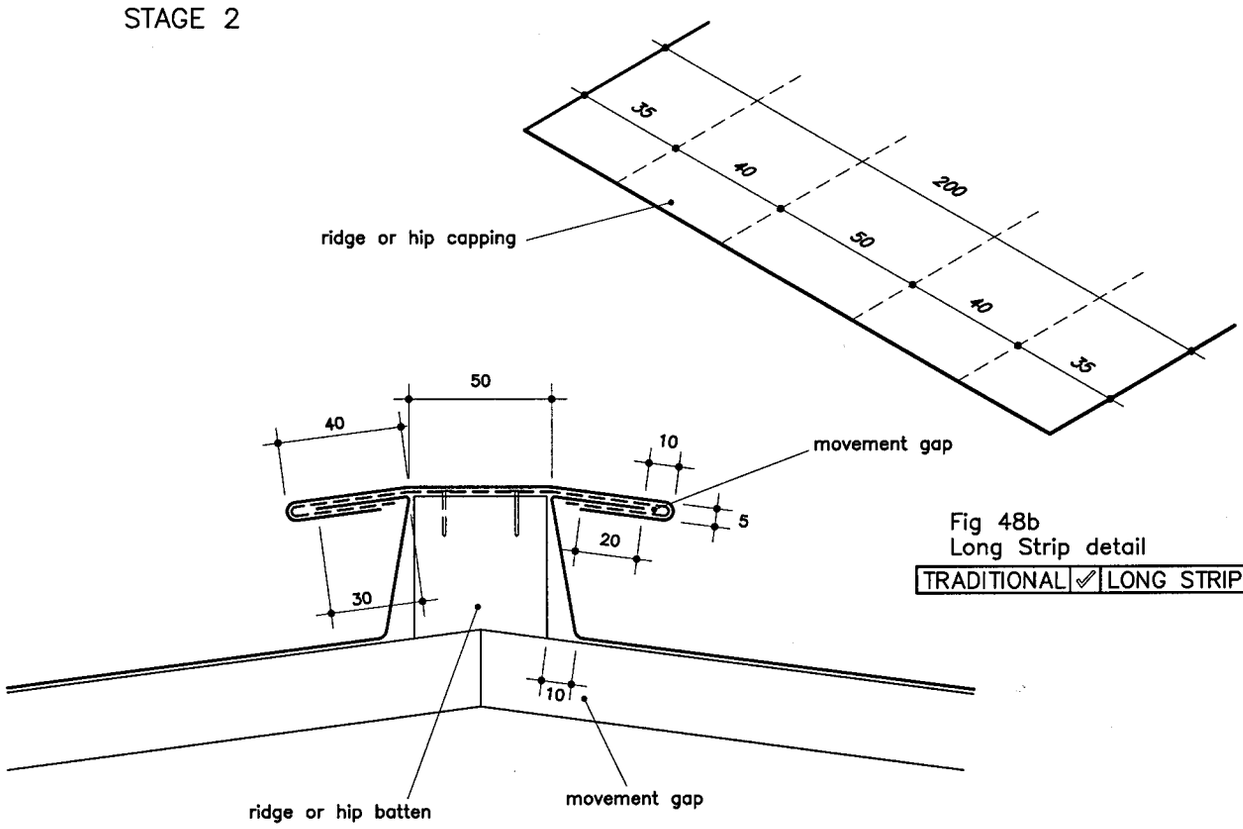


Fig 48b
Long Strip detail

TRADITIONAL	✓	LONG STRIP	✓

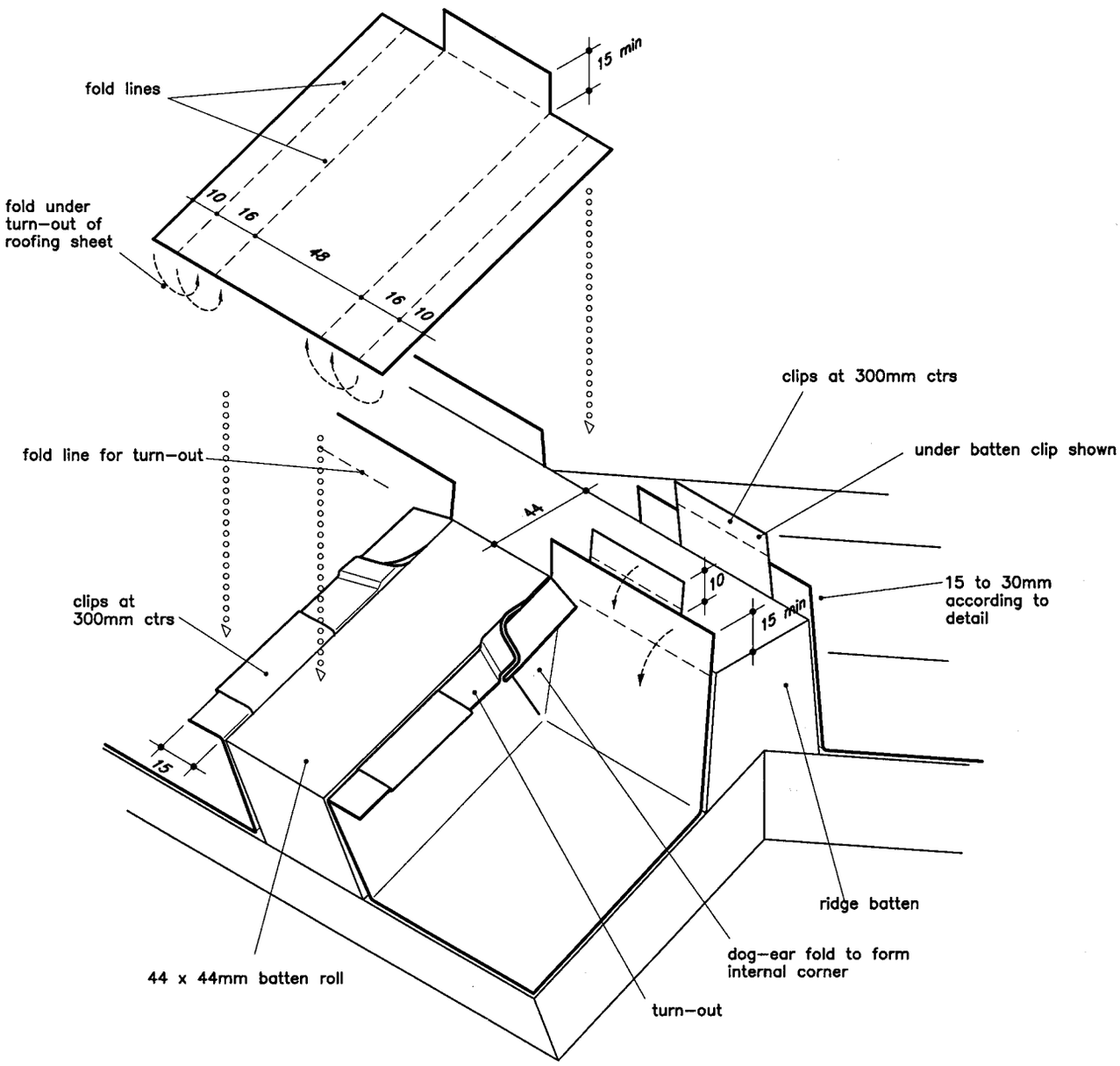
Fig 49 Batten ridge flush to batten roll

TRADITIONAL ✓ LONG STRIP ✓

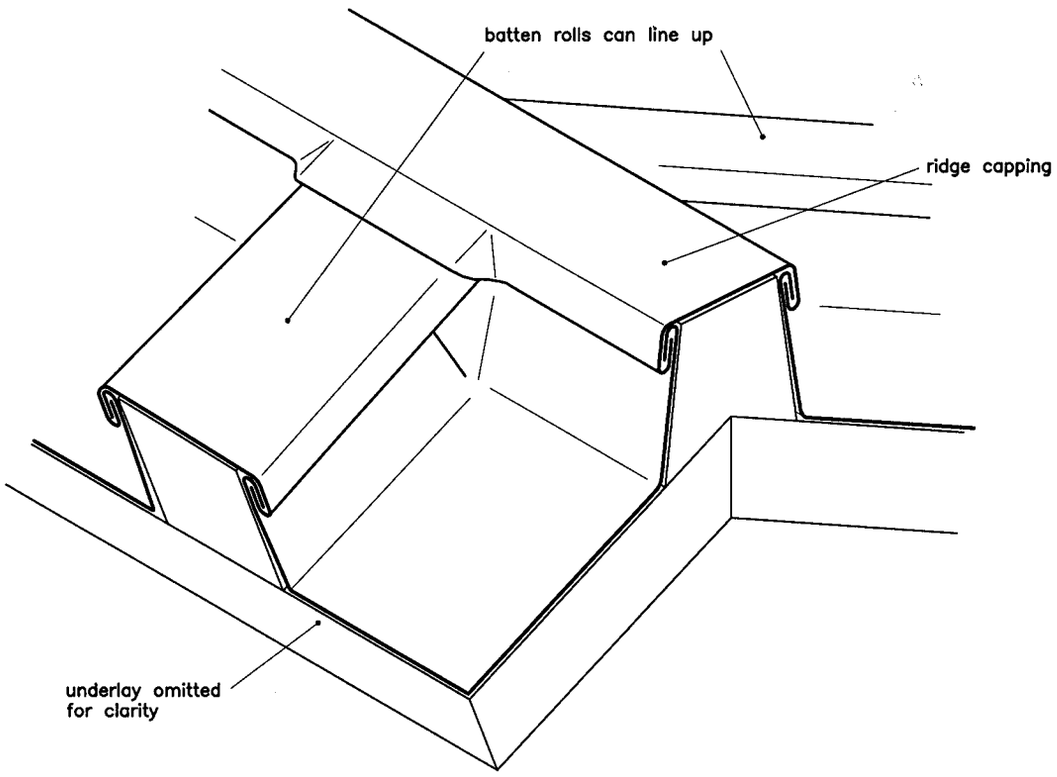
* The detail can also be used in Long Strip roofing, the only difference being the allowance for movement shown in Fig 48b (p113).
* For forming the internal corner, see Fig 44 (p104).
* Joints in cappings are covered with Fig 23 (p64) and in Fig 12b (p48).

Temper: soft (only in Traditional roofing), quarter– or half–hard
Thickness: 0.6mm or 0.7mm

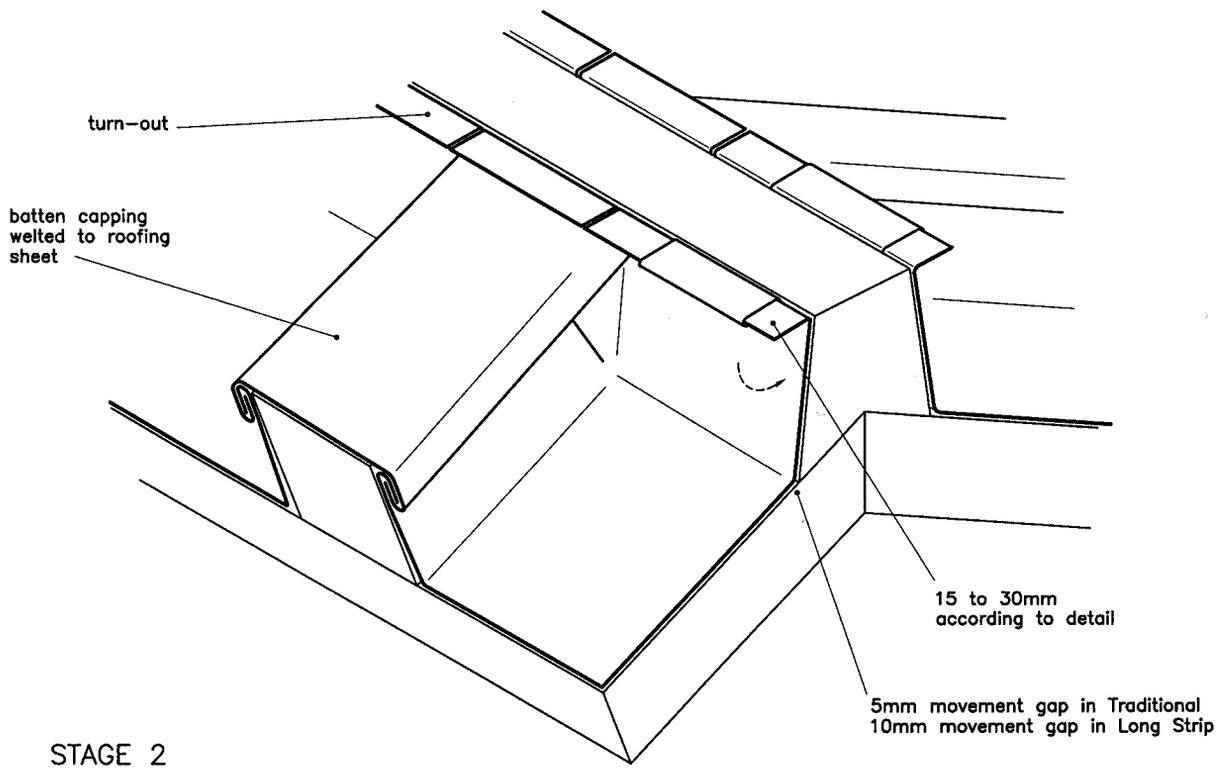
Batten capping



STAGE 1



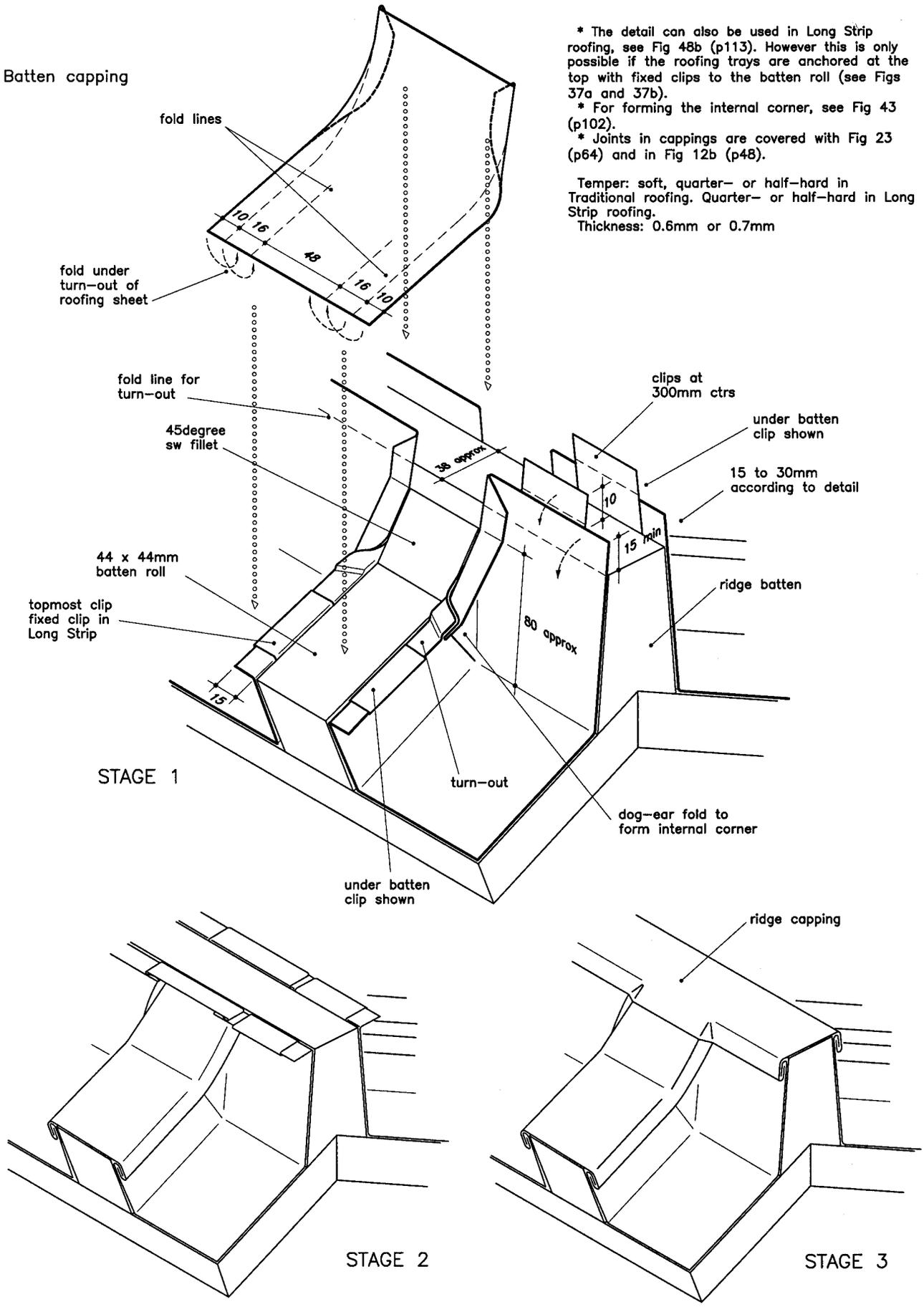
STAGE 3



STAGE 2

Fig 50 Batten ridge to batten roll with angle fillet

TRADITIONAL ✓ | LONG STRIP ✓



* The detail can also be used in Long Strip roofing, see Fig 48b (p113). However this is only possible if the roofing trays are anchored at the top with fixed clips to the batten roll (see Figs 37a and 37b).

* For forming the internal corner, see Fig 43 (p102).

* Joints in cappings are covered with Fig 23 (p64) and in Fig 12b (p48).

Temper: soft, quarter– or half–hard in Traditional roofing. Quarter– or half–hard in Long Strip roofing.
Thickness: 0.6mm or 0.7mm

Fig 51 Ventilated ridge to batten roll

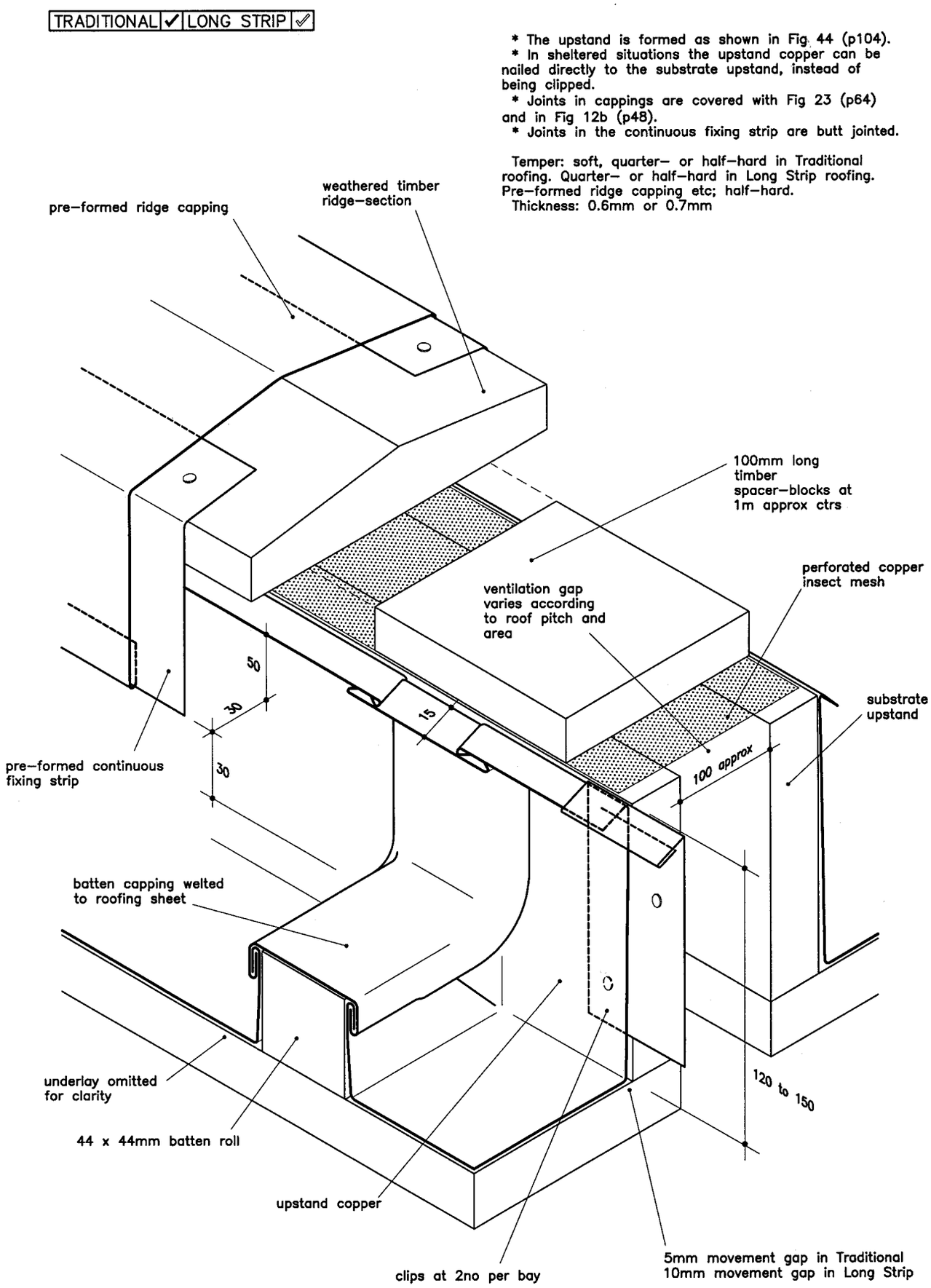
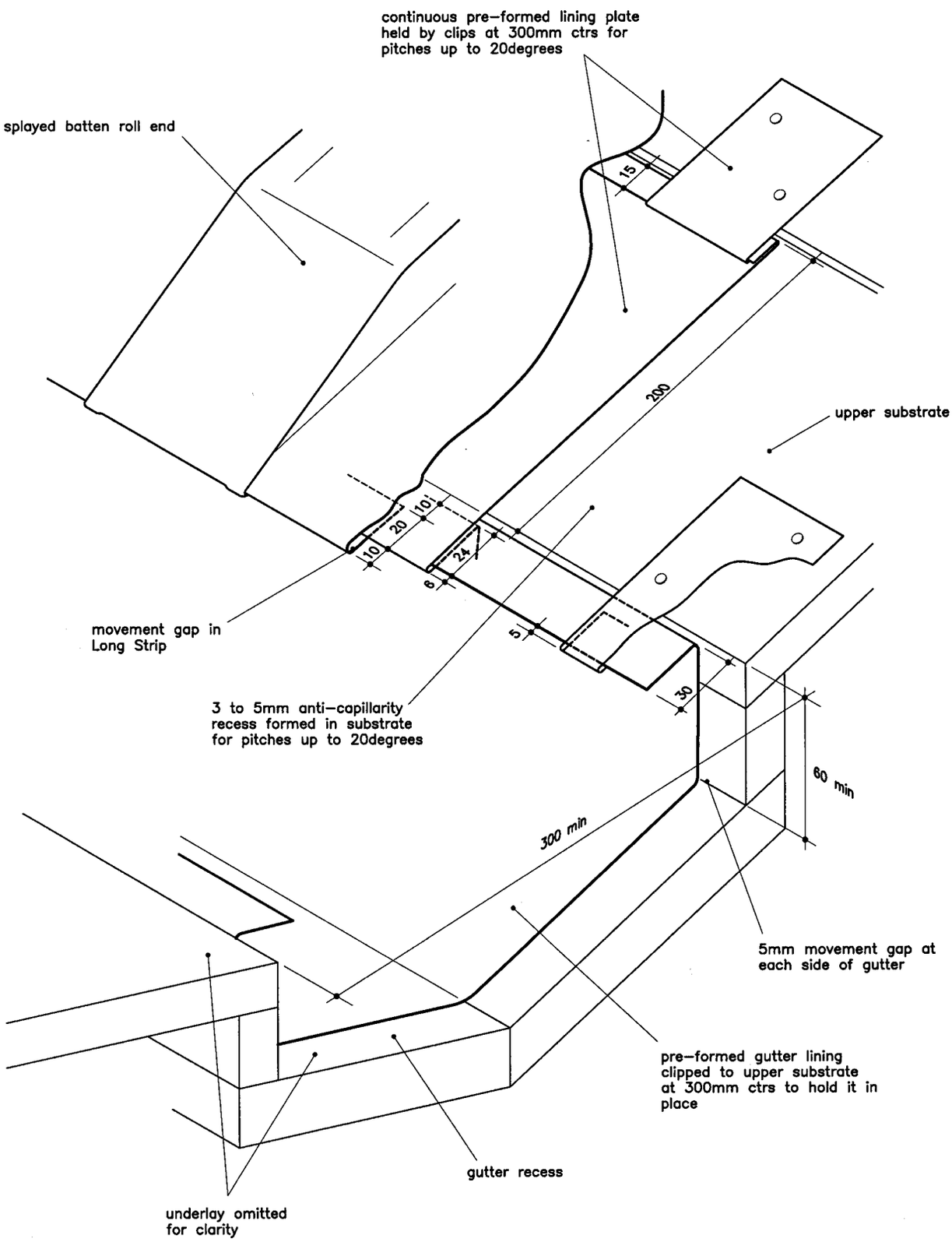


Fig 52 Recessed pitched valley gutter to batten roll

TRADITIONAL ✓ LONG STRIP ✓



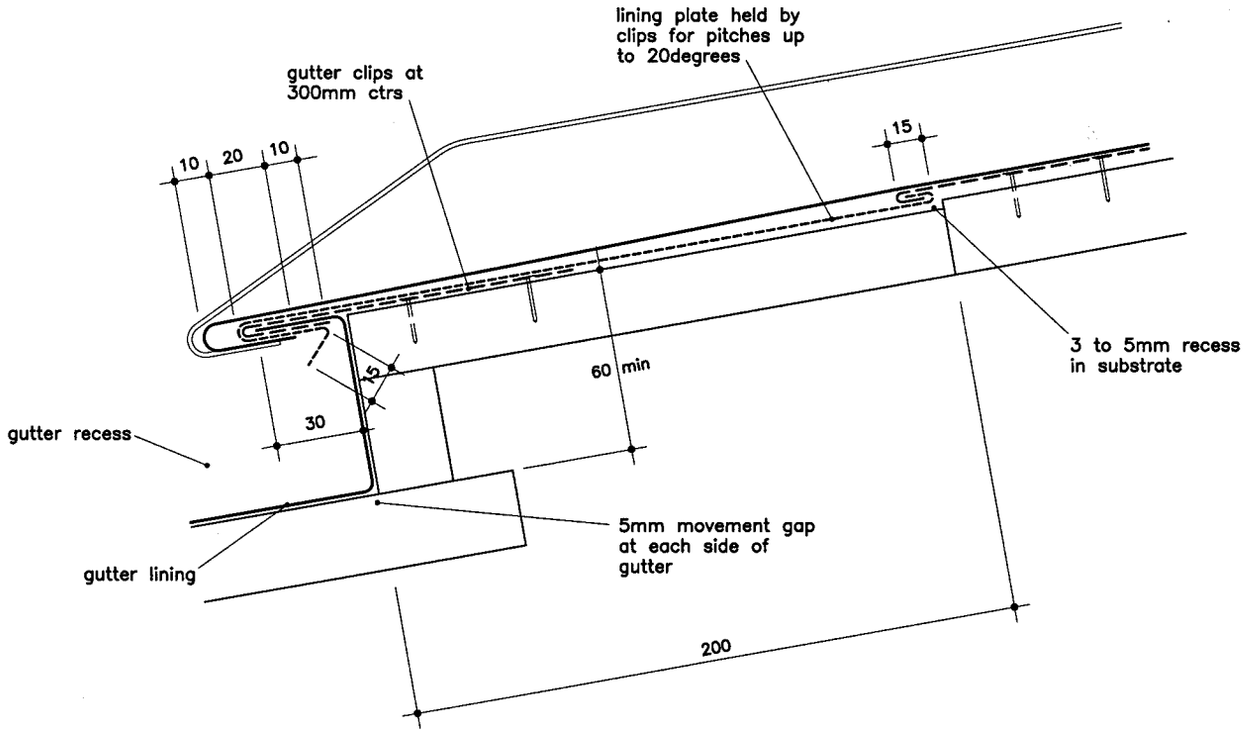


Fig 52a
Section Long Strip

TRADITIONAL	✓	LONG STRIP	✓

* A recessed pitched valley gutter is the only option with batten rolls because forming the roll end needs a change in level. Also the use of batten roll implies low pitch roofing, and flush pitched valley gutters cannot be used at low pitches.

* Should the roof pitches draining into the pitched valley gutter be at or over 20degrees, the lining plate can be nailed directly to the substrate without a recess, as shown in Fig 41a (p96).

* The roll end is formed as shown in Fig 38 (p90), 39 (p92) or 42 (p97).

* Pitched valley gutters in general are covered with Fig 30 (p77) and Tables P and T (p13).

Temper: soft, quarter– or half–hard in Traditional roofing. Quarter– or half–hard in Long Strip roofing. Pre–formed gutter lining and lining plate; half–hard.
Thickness: 0.6mm or 0.7mm

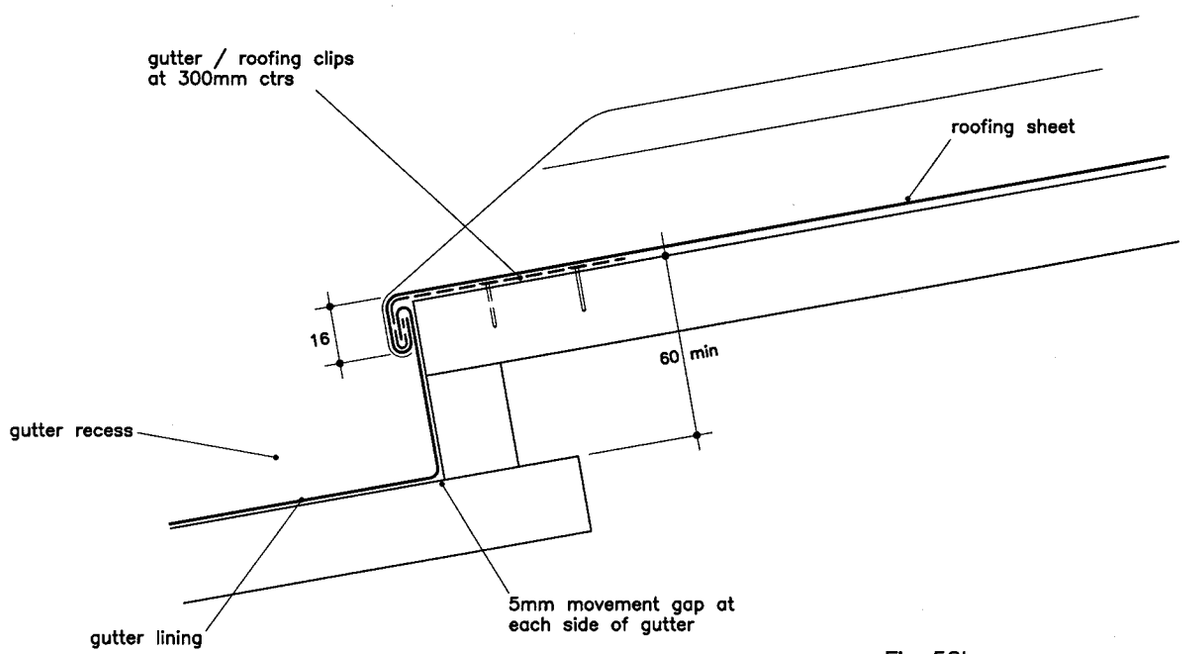


Fig 52b
Section Traditional

TRADITIONAL	✓	LONG STRIP	X