

# THE



# GUIDE TO GOOD LEADWORK

**This booklet has been produced to promote and encourage the correct use of lead sheet flashings, weatherings and gutter linings in building.**

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**Nobody knows more about lead than Calder!**

A background image showing a close-up of a lead sheet being installed on a roof. The lead is being rolled out from a spool and is being secured with a tool. The roof has a decorative stone turret on the left and a window with a lead sheet awning on the right.

***Lead sheet has been in use as a building material for centuries.***

***Lead sheet adorns the roofs of churches, offices, factories, public buildings and homes throughout the United Kingdom because of its durability and ease of use.***



This booklet is a guide to the correct detailing and fixing of lead sheet flashings, weatherings and gutter linings.

The following information conforms with the British Standard for leadwork and the recommendations of the Lead Sheet Association. For more detailed technical information, reference should be made to the LSA's publication entitled 'The Complete Manual' which covers the many applications of lead sheet in building.

## IMPORTANT

Lead sheet is a proven, long-life building material. It is extremely malleable and can be readily dressed to fit the multi-curved contours of many modern building materials, particularly roofing tiles. To ensure this longevity, however, it is essential to follow a few basic rules:

- Individual pieces of lead sheet must not exceed the recommendations set out on page 5. In particular, each piece of flashing must be no longer than 1.5m.
- Fixings should hold the lead securely in position without restricting thermal movement. With flashings, regular expansion joints (laps) will overcome the restriction caused by lead wedging along one side.
- Nails and screws should have a similar life expectancy to that of the lead, therefore use copper, brass or stainless steel, never galvanised or aluminium fixings.
- Joints must allow for thermal movement but also remain weathertight for the position where they are used. For example, do not use laps or welts to join pieces of gutter lining. The correct joint is a drip, as illustrated on page 16.

**Remember, lead sheet is a fine, long-life material . . .**

**. . . but only when used correctly.**

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Note: BS EN12588 replaced BS1178 in August 1999. Calder lead sheet and flashing conforms to the new European Standard.

## The Calder Guide to Good Leadwork

Table 1 Range of thicknesses and weights

<b>LEAD SHEET</b> BS EN12588						
Thicknesses to BS EN12588 tolerances of $\pm 5\%$						
	<b>Code No.3</b>	<b>Code No.4</b>	<b>Code No.5</b>	<b>Code No.6</b>	<b>Code No.7</b>	<b>Code No.8</b>
Kg per square metre:	14.97	20.41	25.40	30.05	35.72	40.26
Thickness in mm:	1.32	1.80	2.24	2.65	3.15	3.55

Table 2 Thickness of lead sheet for various purposes

Use	BS EN12588 Code No.
Soakers	3 or 4
Apron and cover flashings Hip and ridge flashings Pitched valley gutters Weatherings to cornices, parapets etc. Lead slates Chimney flashings - back gutters, apron and side flashings	4 or 5
Parapet, box and tapered gutters	5 to 8

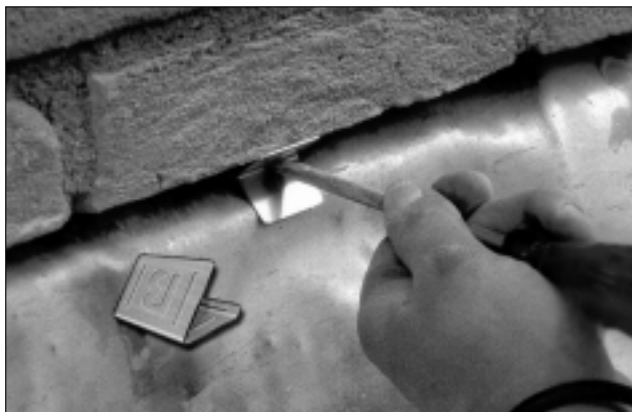
Table 3 Sizing - guidelines to good practice

Recommended maximum sizes of individual pieces of lead for the following applications:		
3a Flashings - apron and cover. Also pitched valley gutter linings		
BS EN12588 Code No.	Uses	Maximum length mm
3	Soakers	1000
4 and 5	Flashings and pitched valley gutters	1500
3b Gutters - box, tapered and parapet		
BS EN12588 Code No.	Maximum length between drips mm	Overall girth Max. mm
4	1500	750
5	2000	800
6	2250	850
7	2500	900
8	3000	1000

# BORRA FIXING CLIP®

the answer to fastening lead flashing

**For busy lead installers, time is money. These easy to use fixing clips will result in time saved.**



Using the clip will securely fasten the lead flashing in place in accordance to BS6915. The standard recommends that fixings are fixed at 450mm maximum centres.

Roger Bisby March 2002, says:  
"These two products will transform the way lead is fixed. I was amazed by just how well the clips work. I doubt that anyone who cares about their professional reputation and wants to avoid callbacks will be using lead wedges in another five years".



# LEAD SHEET SEALANT

the answer to pointing problems!

**Why is it that so many water penetration problems occur at abutments? The answer often is that mortar is not a satisfactory long-term pointing where lead flashings turn into joints in brickwork or masonry.**

The mortar is unable to adhere to both the brick and the lead when subject to changes in temperature. It soon cracks, particularly in sunny exposures, allowing water to penetrate, causing dampness below. In many cases the problem is made worse by poor cleaning out of the joint which results in a wedge-shaped pointing which quickly cracks away from the brickwork.

Now there is a practical, long-term alternative to mortar pointing - Lead Sheet Sealant. This one-part, neutral-cure, high-performance silicone-based sealant has been specially formulated for use with lead sheet flashings and its elastic properties make it ideally suited for pointing between lead and brickwork or masonry.

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## Lead Sheet Sealant - The Experts Choice!

- The sealant specifically designed for pointing joints between lead and brickwork or masonry.
- Provides a long term, flexible joint, which can absorb temperature changes.
- Avoids the problems of pointing with wet mortar, particularly in hot or frosty conditions.
- Quicker, cleaner and easier to use than mortar.
- The Lead Sheet Association recommends sealant.



# PATINATION OIL

## protective coating for new lead

### NEW FORMULATION

**Lead sheet continues to be popular as an architectural feature on buildings because of its ease of use, durability and the pleasing grey colour of its protective patina.**



*Roof tiles spoiled by run-off staining.*

Patination oil specifically developed for the industry by Calder on behalf of the Lead Sheet Association, minimises unsightly staining and imparts a pleasing appearance to newly applied lead sheet and flashings. Occasionally the patina formed on lead looks patchy and

unattractive. In rainy or damp conditions new lead will quickly develop an uneven powdery white, non-adherent coating of lead carbonate, a corrosion product, which is aesthetically unacceptable. The staining of tiles and brickwork spoils the overall appearance of the building.

Patination oil will minimise this uncontrolled formation of carbonate, improve the hygiene on the job AND impart a pleasing appearance to the lead both 'before' and 'after' the formation of its final patina.

#### IMPORTANT

- Shake the oil vigorously before use.
- Apply the oil evenly with a soft absorbent cloth. Work horizontally from top to bottom maintaining a wet lower edge. Do not use a circular scrubbing motion.
- Apply the oil to **all** newly installed lead items - large or small.
- Apply the oil before any rain and at the end of the day's work.
- One coat is all that is needed.
- Lift flashings and coat the underside of the lead for about 50mm from the edge.
- Coat the lead *before* turning up clips around the edges.
- Remember to coat between laps.

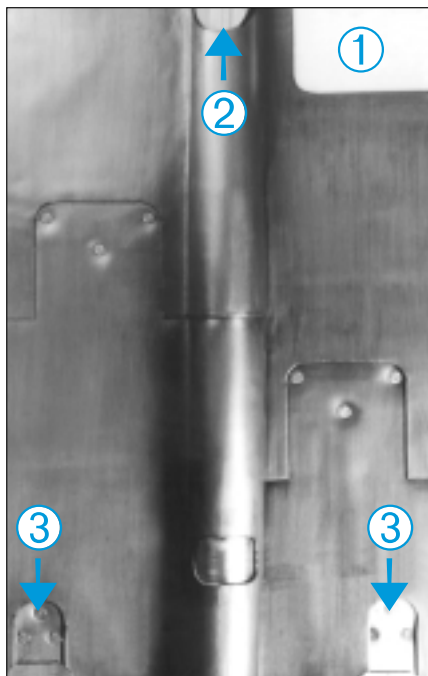


NB: Because of the solvents it contains it is important to keep patination oil away from roof areas where bituminous felt has been laid, any spillage will dissolve the bitumen.

A comprehensive LSA data sheet is available on request.



# GEOTEC UNDERLAY, WOOD CORE ROLL & CLIPS



## **GEOTEC UNDERLAY prevents wear due to thermal movement**

Geotec 220PY underlay is used to isolate sheet metal roofing from substrates allowing metal sheet to expand and contract with temperature changes.

Geotec 220PY is a non-woven, needle punched, polyester textile underlay, weighing 220g/m<sup>2</sup>, conforming to the Lead Sheet Association's requirements.

- ① **GEOTEC UNDERLAY**
- ② **WOOD CORE ROLL**
- ③ **CLIPS**

## **WOOD CORE ROLL as used on ridges, hips and flat roofing**

Wood core roll is to be used to allow for the expansion and contraction in lead sheet and flashing.

Wood core roll is used for joining bays of lead roofing, also on steeply pitched roofs and lead cladding where a bold joint appearance is preferred. It is shaped to prevent wind lift.

## **CLIPS to hold lead permanently in position**

Cut to the required length fixing clips are recommended in rolls, welts, standing seams and for the clipping of lap joints and flashings.

Available in copper, tinned copper and terne coated stainless steel.

# The Calder Guide to good Leadwork

## Clips

Lead clips are only suitable for sheltered exposures. For most situations tinned copper or stainless steel should be used.

Use a minimum of 0.6mm copper or 0.4mm stainless steel for clips.

Use thicker material for exposed positions.

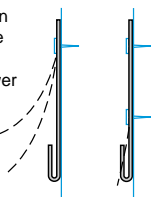
*But why do so many clips fail in high wind conditions?*

Mainly because the fixing position is not suited to the exposure.

Although the spacing of clips is important and the material used should relate to the exposure it is likely to receive, the main consideration must always be the position of the fixing points.

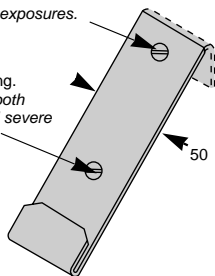
### Clips and Clipping

• The diagrams on the right, illustrate the simple principle: The lower the fixing, the stronger the clip.



Fixing at top.  
For sheltered exposures.

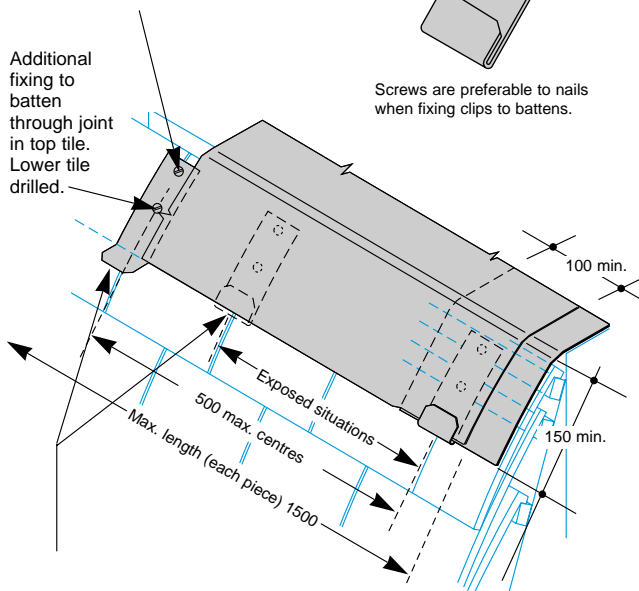
Additional fixing.  
Essential for both moderate and severe exposures.



Top fixing to batten.

Additional fixing to batten through joint in top tile. Lower tile drilled.

Screws are preferable to nails when fixing clips to battens.



Apply patination treatment to lead before turning clips. See page 8.

### A few basic rules . . .

Space clips at 300mm to 500mm intervals to suit the exposure.

Don't fix clips with galvanised steel nails. Use copper or stainless steel.

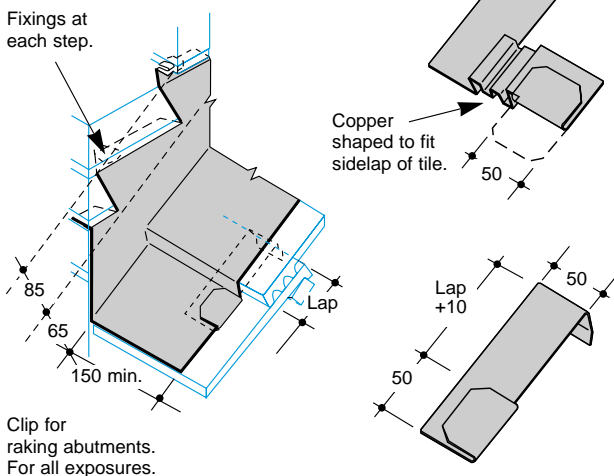
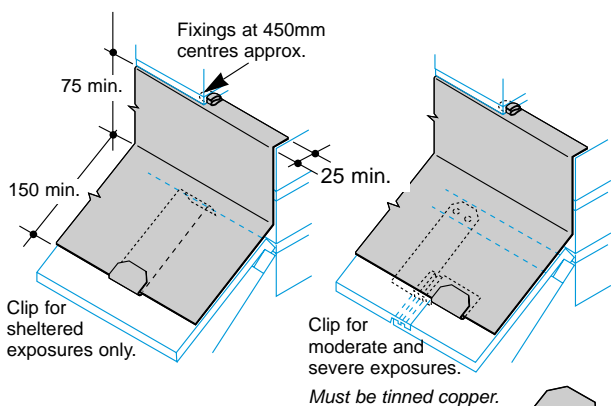
Lead clips should only be used in sheltered situations.

If in any doubt about exposure, use additional fixings.

Where extra fixings cannot be used, e.g. flashings over glazing, use a thicker gauge clip material.

*(When using lead dome fixings, ensure there is no restriction of thermal movement.)*

### Clips to single lap tile roofs



## Cover Flashings

Cover flashings are used where a felt or similar roof covering turns up against a wall. Code 4 lead sheet is normally used for this work and it is important that the length of each piece of flashing does not exceed 1.5m. Laps between pieces should not be less than 100mm.

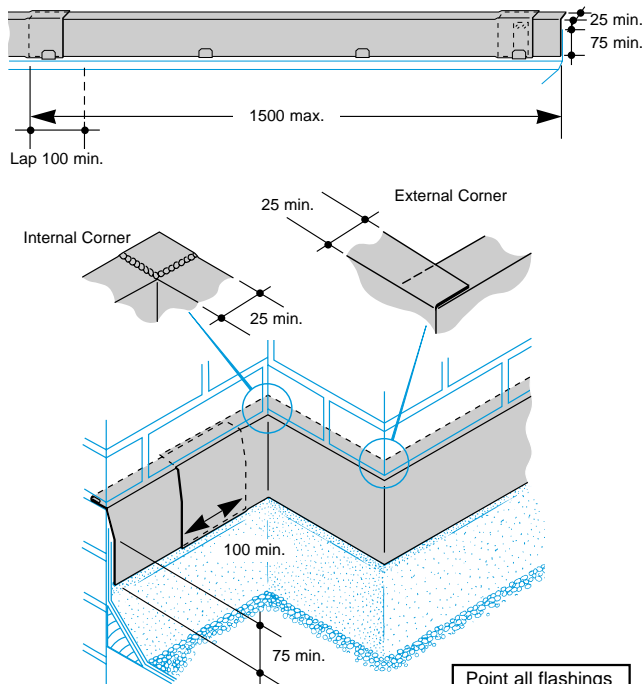
Use a straight piece of batten to mark a line 25mm from the top edge of each flashing piece and then bend the lead with the use of the dresser to form a 25mm turn into the brickwork. Each piece of flashing is secured into a joint in the brickwork as per BS6915 at 450mm maximum centres, see page 6.

Mortar is not a satisfactory long term pointing. The mortar is unable to adhere to both the brick and the lead - when subject to changes of temperature it cracks allowing water to penetrate. The Lead Sheet Association recommends the use of a silicon sealant for pointing.

Copper or stainless steel clips are positioned along the lower edge of the flashing to suit the exposure of the building, see pages 10 and 11.

At internal and external corners the turn-in is cut and the flashing folded. Note that the lap joint is adjacent to the corner and NOT in the corner. The turn-in on the external corner is simply folded as shown whereas it is necessary to insert a small piece of lead in the internal corner to ensure a weathertight joint. This can be achieved by either lead welding or soldering.

### Cover flashings



Apply patination treatment. See page 8.

Point all flashings with Lead Sheet Sealant. See page 7.

Where the roof incorporates an expansion joint the flashings are detailed as shown. Without the timber fillet the lead would sag onto the top of the kerb. This will create a section of horizontal lap through which water will seep into the area below. The timber fillet also provides a positive fixing for the clips.

**Important basic rules . . .**

Individual pieces of lead must be no longer than 1.5 metres.

Fixings should hold the lead securely in position without restricting thermal movement.

Nails and screws should have a similar life expectancy to that of the lead, therefore use copper, brass or stainless steel, never galvanised or aluminium fixings.

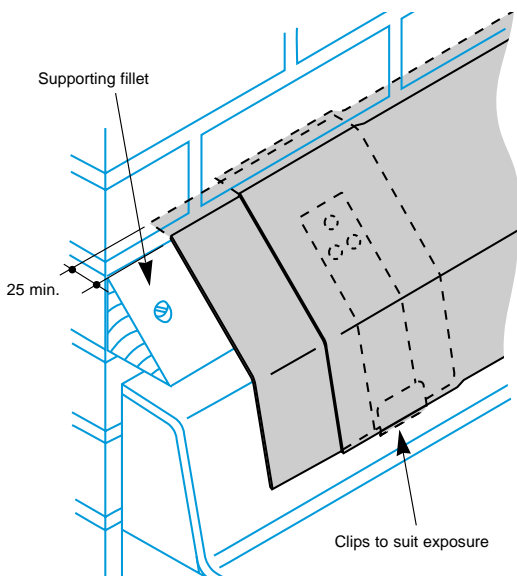
The turn-in at internal corners requires a small gusset to ensure a weathertight joint.

Use Lead Sheet Sealant for pointing.

Apply patination treatment to all surfaces including under lap joints.

Lift flashings and coat the underside of the lead for about 50mm from the edge.

**Cover flashings**



Apply patination treatment. See page 8.

Point all flashings with Lead Sheet Sealant. See page 7.

## Abutment flashings

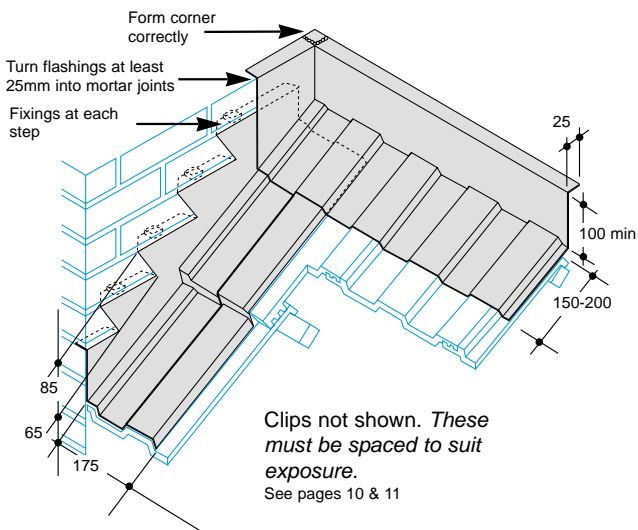
Horizontal and raking abutment flashings should extend out over the tiles - or slates - for not less than 150mm.

Where plain (uncontoured) concrete tiles are used at low pitches, a cover of 200mm is preferable, particularly in exposed positions. Alternatively, a secret gutter can be used. See page 21.

Space fixings at about 450mm centres for cover flashings and at each step for raking abutment flashings.

### Abutment flashings

Point all flashings with Lead Sheet Sealant.  
See page 7.



### Remember to . . .

Turn all lead flashings at least 25mm into mortar joints.

Clip free edges of flashings to suit exposure (see pages 10 & 11)

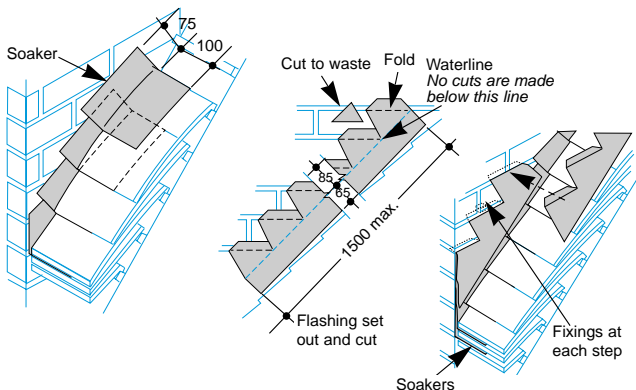
Apply patination treatment. See page 8.

Soakers and step flashings are used to weather a raking abutment where the roof is covered with slates or plain tiles. While Code 3 is suitable for soakers, Code 4 is the minimum thickness to use for all flashings.

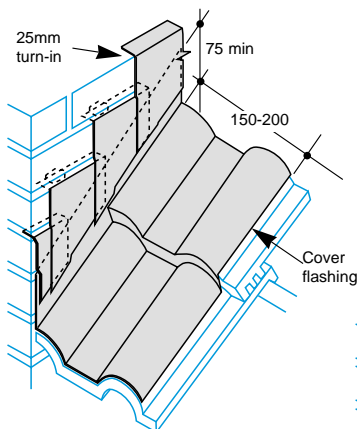
The setting-out and cutting of the steps (see below) is the same for both flashings with soakers and for combined step-and-cover flashings over single-lap tiling.

An alternative method for more exposed situations is a single-step flashing which can be used over soakers, cover flashings or secret gutters.

### Abutment flashings with soakers

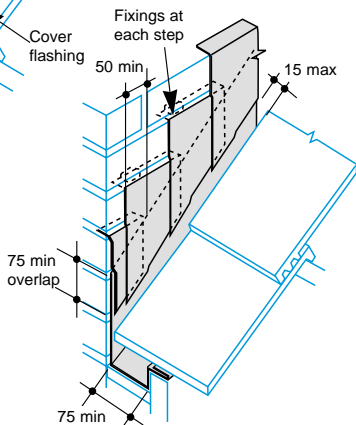


### Single steps with cover flashing



Point all flashings with Lead Sheet Sealant.  
See page 7.

### Single steps with secret gutter



## Roll ends and drips

Roll ends and drips can be formed either by bossing or leadwelding.

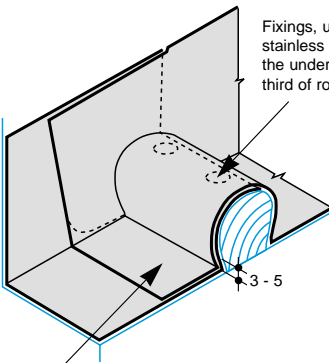
When a wood-cored roll is used to divide a wide gutter, the undercloak should only be nailed, using copper or stainless steel nails, to the roll for the upper third of its length.

The end of the wood roll is usually splayed and it is important for the base of the roll to finish at the drip edge, thereby avoiding a horizontal lap in front of the roll, through which water could penetrate.

Drip undercloaks should be rebated into the decking, otherwise rainwater will 'pond' near the front edge of the drip.

Splash laps can be omitted if an adequate lap is maintained at roll ends and drip abutments.

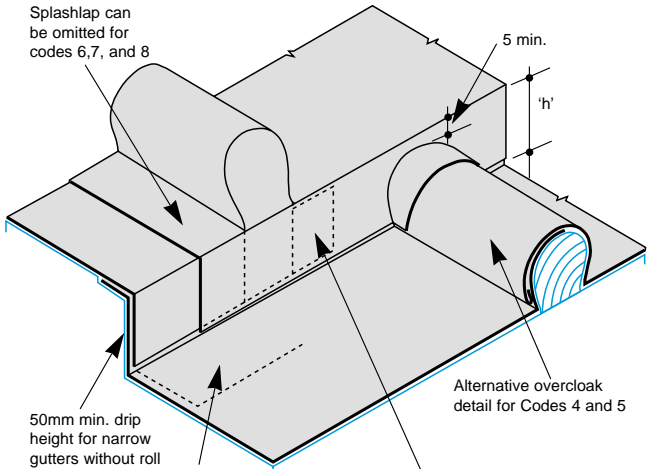
### Roll ends and drips



Fixings, using copper or stainless steel nails, to the undercloak - upper third of roll length only

BS EN12588 Code No.	Min drip height 'h'
4	55mm
5	55mm
6	55mm
7	60mm
8	60mm

Splashlap can be omitted for codes 6,7, and 8



50mm min. drip height for narrow gutters without roll

Splashlap optional for gutter linings

Extend undercloak 40mm min. when splashlap on roll overcloak is omitted

Alternative overcloak detail for Codes 4 and 5

Apply patination treatment. See page 8.



## Ridges and hips

Lead ridges and hips are normally used on slated roofs. A wood roll is required and should be fixed as shown in the diagram below. The flashings must extend over the slates or tiles a minimum of 150mm on each side.

A practical method of fitting the flashings that will avoid thinning at the corners is to form the lead into a trough. The lead is pressed down over the roll to fit closely to both the roll and the roof surfaces. Use a minimum of Code 4 lead sheet for both ridge and hip flashings and again, the maximum length of each piece should not exceed 1.5m.

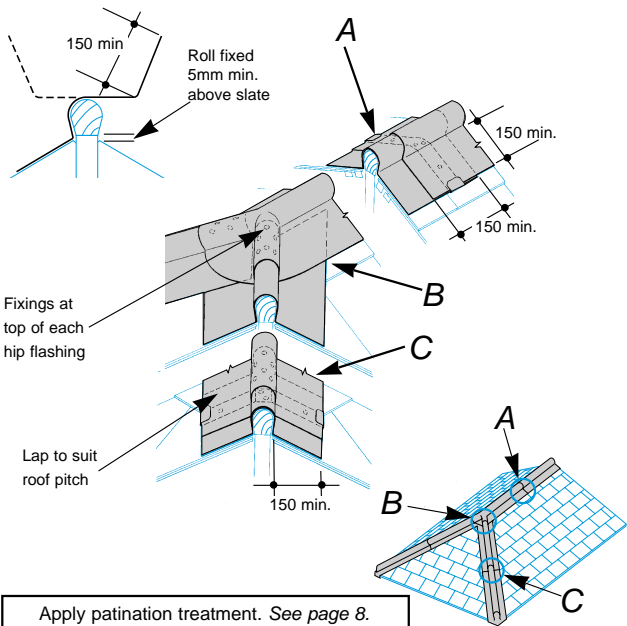
Laps between pieces should not be less than 150mm - although for pitches below 30° the hip laps should be increased to 200mm.

It is important to fix the top of each piece of hip flashing to the wood roll with copper or stainless steel clout nails. Nails are not required at the ridge laps.

Clip fixings along the sides of the flashings are absolutely essential and should be spaced to suit the exposure of the building - see pages 10 and 11. Note the extra fixings in the clips shown on both the ridge and hip laps. In all but very sheltered exposures these fixings will be required.

At the junction between ridge and hip flashings and also where the roll terminates at the hip end, the lead will need to be dressed to fit or alternatively can be formed by leadwelding or soldering.

## Ridges and hips



## Chimney flashings

Flashings for a chimney consist of a front apron, side flashings and a back gutter with cover flashings. When a chimney is sited at the ridge, the back gutter is replaced by a saddle at each side.

Depending upon the type of tiles or slates, the side flashings will either be detailed with soakers or as step-and-cover flashings. (See pages 14 & 15).

Chimney flashings can be fabricated by leadwelding or bossing. Code 4 is the minimum thickness to use, but if bossing is the method used, then Code 5 is preferable for the back gutter.

For roof pitches above 30° (or above 20° in sheltered or moderate exposures) the side flashings can be finished 10mm back from the front corner (see figure A). When this detail is used, however, it is essential that the front apron is properly turned at the corner so that an adequate lap is provided where the side flashing covers the apron.

### Chimney flashings

25 min. turn-in  
 Fixings not shown (but still required)  
 See page 12

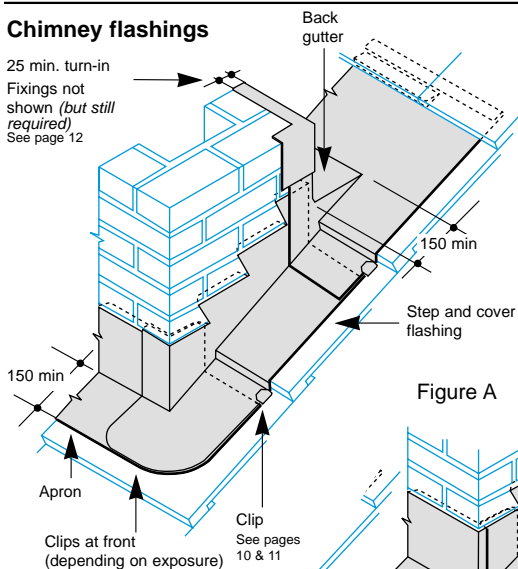
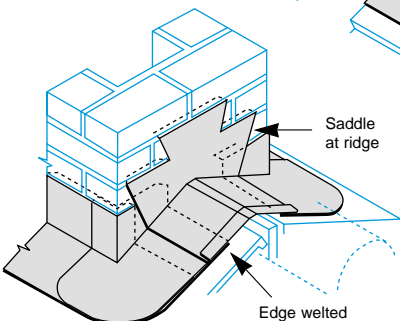
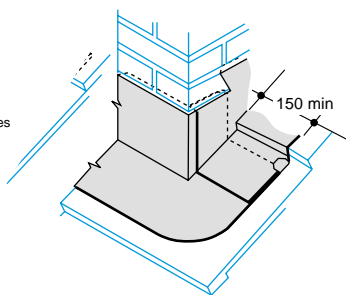


Figure A



Point all flashings with Calder Lead Sheet Sealant. See page 7.

Note: *Minimum* cover over tile = 150mm

Apply patination treatment. See page 8.

## Pitched valley gutters

To provide a weathering life equal to that of the tiles or slates which overhang on each side, lead sheet pitched valley gutter linings should be fixed in lengths not exceeding 1.5m. Each piece should be fixed across the top with two rows of copper or stainless steel clout nails.

Valley boards should be level with the tops of the rafters so that tiling battens and tilting fillets are the same height. With traditional roofing the valley boards can be recessed into the rafters; but when roof trusses are used the boards must be cut to fit between the rafters. For pitches of 30° and above the lap between pieces should be 150mm, increasing to 220mm for a pitch of 20°.

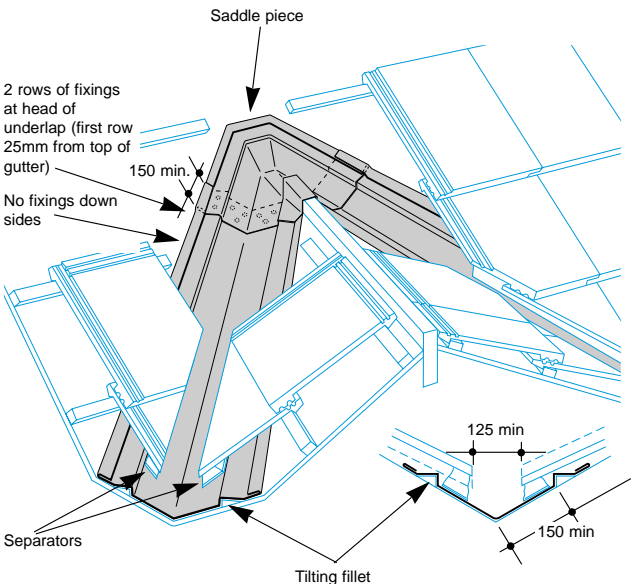
### Some important points . . .

Don't nail down the sides as this will restrict free thermal movement and result in failure.

Don't lay sarking felt under the lead. It will cause the lead to stick to the boards in hot weather.

Use copper or stainless steel nails to fix the lead - *not galvanized steel or aluminium.*

## Pitched valley gutters



Apply patination treatment. See page 8.

## Box and tapered gutters

For these gutters the joints between each piece of lining must always be formed by drips. *Welts or lap joints are not suitable.*

Use copper or stainless steel nails to fix the underlap across the top of the drip and, if necessary, along the top third(s) only at the sides. Never fix them completely at the sides as this will restrict thermal movement which, in turn, will cause cracking.

For tapered gutters where the overall girth exceeds the maximum shown in Table 3b, page 5, use a wood-cored roll to divide the bay longitudinally.

Check the fall before laying the lining. It must be at least 1:80 (25mm in 2m), otherwise 'ponding' will occur.

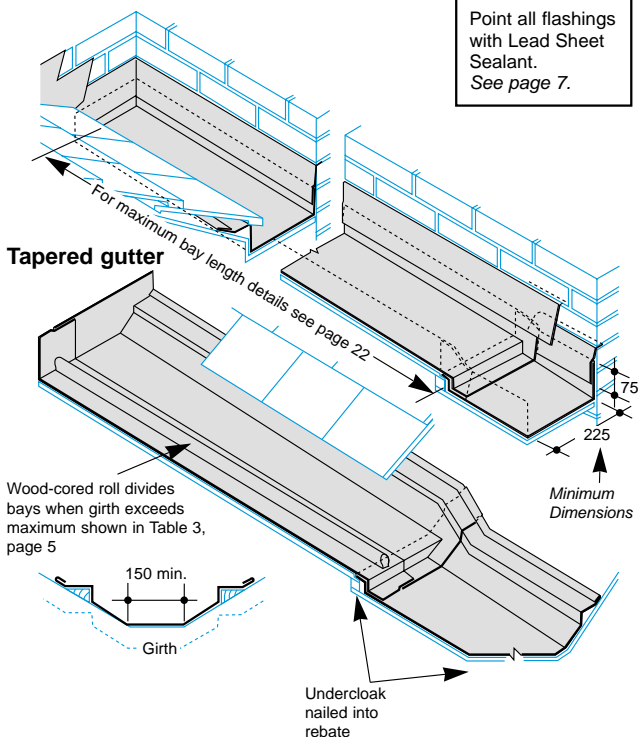
Remember that cover flashings (see page 12) must lap gutter upstands by at least 75mm.

Do not exceed the bay sizes shown on page 22.

### Box gutter

Apply patination treatment. See page 8.

Point all flashings with Lead Sheet Sealant. See page 7.



## Secret gutters

Renewal of roof coverings on terraced housing often results in a situation where different tiles abut over a party wall. A practical method of weathering these intersections is to use a secret gutter. The sizing and fixing of the linings is similar to that for pitched valley gutters, as shown on page 19.

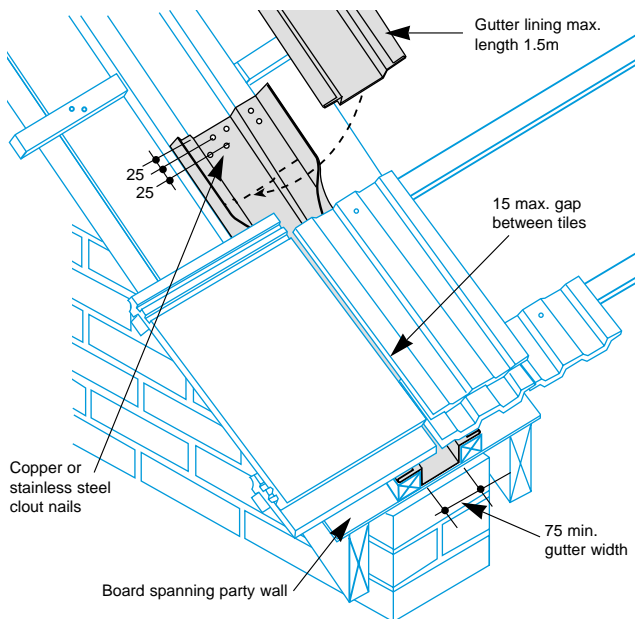
The methods shown below are superior alternatives to the bedded hip tiles commonly used. The use of lead sheet in these situations gives the following advantages:

It allows for both structural and thermal movement between adjacent properties without risk of water penetration.

Tiles and slates on either side of the junction can be readily repaired or renewed without disturbance to the adjoining property.

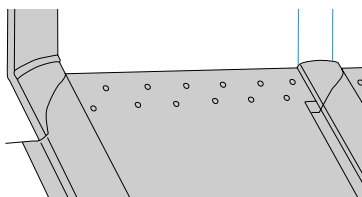
**Properly detailed and installed, the leadwork will have a durability at least equal to that of the best tiles or slates.**

### Secret gutter over party wall



### Nail details

Note spacing.  
Do not create a perforated edge.



## Flat roof coverings

Lead sheet is the ideal material for weathering projections and canopies over windows and doors.

Large lengths and areas can be divided into bays by wood-cored rolls so that no piece of lead exceeds the recommended dimensions.

Front and side edges should be clipped to suit the exposure.

### A few tips . . .

Don't use an underlay which could cause adhesion to the substrate during hot weather. Use a building paper or a geotextile underlay.

Don't nail or tack the edges to prevent wind lift. Use clips.

Never oversize the bays. Divide them with wood-cored roll or, alternatively, use a thicker sheet.

## Flat roof coverings

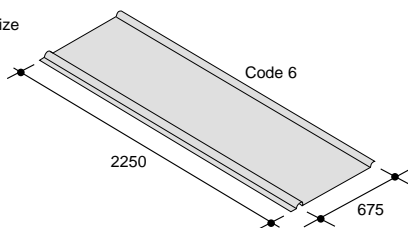
Recommended *maximum* dimensions.

Illustrations are diagrammatic

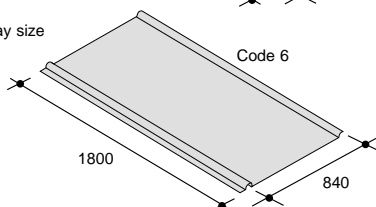
Apply patination treatment.  
See page 8.

BS EN12588 Code No.	Maximum spacing of joints with the fall (mm)	Maximum distance between drips (mm)
4	500	1500
5	600	2000
6	675	2250
7	675	2500
8	750	3000

a. Max bay size



b. Alternative bay size



## Window flashings

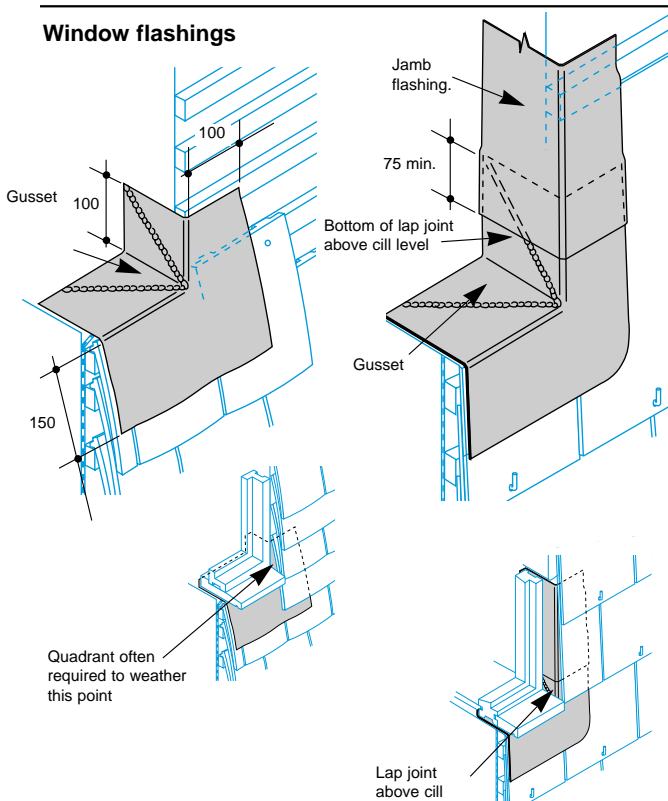
Window flashings are most often required where windows are fixed into walls that are covered with tiles or slates but are also used with other cladding e.g. timber or PVC weatherboarding. In all cases the detailing of the flashings is similar and as with all lead flashings the maximum length when using Code 4 lead sheet is 1.5m.

Although a corner can be dressed or bossed to shape it is more practical to introduce a gusset as shown which can be leadwelded or soldered before the cill flashing is placed in position. For windows that are wider than 1.5m, 100 - 150mm laps should be used between cill flashing pieces depending on the exposure.

In cases where the window is set back from the wall covering, a jamb flashing will be required to prevent water from penetrating down behind the cill upstand. The length of flashing pieces should not exceed 1.5m. Laps between pieces of cill flashing should be 100mm - 150mm depending on the exposure and laps between jamb flashings and cill flashings should not be less than 75mm.

The apron extends 150mm down the face of the wall covering and this is often cut to a scalloped pattern to suit the spacing of the tiles or slates.

### Window flashings



Apply patination treatment. See page 8.

## Health and Safety Precautions

To ensure your well-being, Calder Industrial Materials Limited have produced Health and Safety Data Sheets. Ask your builders merchant to obtain copies for you.



## Caring for the environment



Both old lead and new lead off-cuts can be recycled. Calder Industrial Materials Limited's rolled lead to BS EN12588 is manufactured using recycled lead

**Copies of this booklet are available FREE from your merchant with purchases of Calder Quality Lead.**



Produced by Calder Industrial Materials Limited  
[www.caldergroup.co.uk](http://www.caldergroup.co.uk)  
E-mail: [info@caldergroup.co.uk](mailto:info@caldergroup.co.uk)