CODE OF PRACTICE

CP 143-10: 1973

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Sheet roof and wall coverings —

Part 10: Galvanized corrugated steel — Metric units

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Sub-committee BLCP/13/2
Galvanized corrugated steel roofing

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Contents

Foreword

This metric edition of Part 2 of CP 143, which has been designated Part 10, is the metric version of that published in imperial units in 1961.

Part 10 has been prepared as part of the change to the metric system and gives values in SI units; it is not a complete technical revision.

PD 6030, "*Programme for the change to the metric system in the construction industry*", outlines a programme for sizing building components and assemblies in order to achieve the co-ordination of dimensions where appropriate.

According to the recommendations of Technical Committee B/94 set out in PD 6432, "*Dimensional co-ordination in building. Arrangement of building components and assemblies within functional groups*," corrugated sheet materials are classified as grade B components.

In recognition of the wide variety of materials and profiles used as roof and wall cladding a special investigation panel B/-/12 was set up charged with the task of formulating recommendations for the long- and short-terms, recognizing that long-term changes would involve new profiles and of necessity be spread over a period of several years.

Long-term recommendations laid stress on the importance of "cover width" as the co-ordinating dimension and, to assist as far as possible until sheets are manufactured to such dimensionally co-ordinated widths, metric equivalents given include the cover widths for the existing profiles, as a first stage towards the use of the "cover width" for dimensional co-ordination.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 14, an inside back cover and a back cover.

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

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1 General

1.1 Scope

This Code deals with the use of galvanized corrugated steel sheets for roofing and cladding in building. It does not refer to standardized forms of building which are already covered by other British Standards, e.g. in BS 1754.

Recommendations are given on materials and design, construction and maintenance, together with information on weathertightness, durability, thermal insulation, fire hazard, rainwater drainage from roofs and other characteristics.

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

1.2 Definitions

The terms used throughout this Code have the meaning assigned to them in BS 2717.

1.3 Exchange of information and time schedule

The working drawings and specification should be prepared in sufficient detail to afford proper guidance in the preparation of estimates and the execution of the work. Where bills of quantities form part of the contract, they should be prepared in accordance with the Standard Method of Measurement for Building Works or the Scottish Mode for the Measurement of Building Works, as appropriate. There should be a full exchange of information between all concerned with the roofing and the work adjacent to it in sufficient time to ensure that the covering can be carried out at the proper time and that all necessary provisions for fixing have been made in advance. Early arrangements should be made on the site for rainwater disposal. Roof covering should be completed before internal finishes are begun.

2 Materials, appliances and components

2.1 Galvanized corrugated steel sheets

Galvanized corrugated steel sheets used in constructing roofs and sides of buildings in accordance with the recommendations of this Code are to comply with the requirements of BS 3083. Where a profile other than a corrugated sheet is required, the quality requirements are to comply with BS 3083.

2.2 Profiles and dimensions of galvanized corrugated steel sheets

The most commonly used profile is the 76.2 mm corrugation with either eight or ten corrugations per sheet; the profiles are shown diagrammatically in Figure 1. The dimensions and the net width covered per sheet of galvanized corrugated steel are given in Table 1. Any profile, however, may be used that provides adequate strength for the particular loading conditions and for the purlin spacing adopted.

2.3 Accessories and fittings

A wide range of galvanized steel sheet roofing accessories are made by the sheet producers and can be obtained from them or through builders' merchants.

Special fittings to meet specific purposes may be obtained from constructional and sheet metal engineers.

Where continuously galvanized steel sheet is used to construct these accessories it should comply with the requirements of BS 2989.

2.4 Fixing accessories

Hook bolts, drive screws, bolts, nuts, rivets and washers should comply with the requirements of BS 1494. Any other fixings required should be of similar quality, and care should be taken in their design to ensure that they do not impair the efficiency of the roof or side covering.

2.5 Sealing material

Where flexible seals are required, a bituminous mastic or other material of similar characteristics is recommended.

2.6 Flashings

Where zinc and lead sheets are used for flashings they should comply with the following requirements:

1) *Zinc*. BS 849 and not lighter than 0.813 mm (14 zinc gauge).

2) *Lead*. BS 1178 and not less than the following thicknesses

a) gutters: BS Gauge No. 6.

b) flashings: BS Gauge No. 4.

Table 1 — Dimensions and net width covered per sheet of galvanized corrugated steel

Designation	Overall width of sheet after corrugation	Pitch of corrugation	Depth of corrugation, crown to valley	Cover width including laps.								
				1 Corrugation			1½ Corrugations			2 Corrugations		
				Min.	Work size	Max.	Min.	Work size	Max.	Min.	Work size	Max.
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
8/3 in	660.4	76.2	19	605	610	615	567	572	577	528	533	538
10/3 in	812.8	76.2	19	757	762	767	719	724	729	681	686	691
12/3 in	966.2	76.2	19	908	914	920	870	876	882	832	838	844
5/5 in	711.2	127	32	630	635	640	—	—	—	—	—	—
6/5 in	838.2	127	32	757	762	767	—	—	—	—	—	—

NOTE *Length*. Galvanized corrugated steel sheets are normally stocked in lengths from 1 200 mm rising in intervals of 150 mm to 3 650 mm. Longer lengths up to 7 600 mm may be specially obtained.

2.7 Galvanized rainwater goods

Galvanized rainwater goods should comply with the requirements of BS 1091.

Where manufactured from continuously galvanized sheet, material should comply with the requirements of BS 2989.

2.8 Walkways

Permanent walkways, where required, should be of durable material and designed to take a maintenance load equivalent to 890 N concentrated centrally to produce the worst conditions of loading.

3 Design considerations

3.1 General

To secure maximum economy the roof plan should be simple, and hips and valleys should be avoided. Sheets of standard size should be used wherever possible.

3.2 Durability

Galvanized corrugated steel sheets provide a strong, rigid, non-porous and durable roofing and siding material. To obtain an indefinite life, particularly in polluted or damp atmospheres, they should be painted at regular intervals of time. (See Section **6**.)

Four weights of zinc coating are specified in BS 3083; see Table 2. Selection of a suitable weight of zinc coating should take account of the service conditions of the cladding and local atmospheric conditions which should be stated when ordering the sheets, and the manufacturer's advice obtained.

Table 2 — Types of material and weights of zinc coating

Type	Weight of zinc coating[a]	
	Min.	Max.
	g/m²	g/m²
125	381	455
150	458	548
180	550	608
200	610	762

[a] The weight of coating is the total amount of zinc on both sides of the sheet before corrugating, expressed as a weight per square metre of the flat sheet and not per square metre of corrugated surface.

3.3 Weathertightness

Galvanized corrugated steel sheet roofs provide good weathertightness. The principal factors affecting weathertightness of roofs covered with the material are as follows.

1) *End lap*. End laps should be a minimum of 150 mm for slopes of 20° and over with a minimum of 100 mm for vertical falls. Flatter slopes, especially on wide buildings and where exposed to driving rain, may require end lap greater than 150 mm and sealing with mastic.

2) *Side lap*. Side laps should be formed on the side of the sheet away from the prevailing winds.

Where conditions are severe, a side lap of two corrugations is recommended for the 76.2 mm corrugation. Where weather conditions are moderate, a lap of one-and-a-half corrugations may be used by turning alternate sheets upside down. In sheltered conditions, a side lap of one corrugation tightly closed is suitable.

The net width covered per sheet is given in Table 1.

3) *Accessories*. Whenever possible, accessories should be chosen from stock patterns; special fittings, if required, should be designed to fit closely. Accessories should be carefully fitted to make a weathertight joint.

4) *Rainwater discharging on the roof*. No gutter or rainwater pipe should be allowed to discharge on to the roofing.

3.4 Thermal insulation

Galvanized corrugated steel sheeted roots can be insulated thermally to suit all requirements. The thermal transmittance can be adjusted to any required value by the use of insulating material laid either between the purlins and the sheeting or under the purlins, thus incorporating an air gap.

For information regarding heat losses through roofs see Appendix A.

3.5 Fire hazard

Galvanized corrugated steel roofing sheets are non-combustible and would make no contribution to a fire. Structures incorporating galvanized corrugated steel sheet may be designed to give any desired fire resistance when combined with suitable materials.

3.6 Condensation

Condensation may occur under certain weather conditions but may be avoided by ensuring adequate ventilation of the under side of the roof. This may be effected by laying the sheets with a gap between them made weathertight by increasing the overlaps or by employing specially louvred sheets.

When the roof is lined with thermal insulation board, the possibility of interstitial condensation should not be overlooked and it is generally advisable to provide a water vapour barrier at the surface facing the interior of the building. This can be an impervious membrane or a sprayed "cocoon". The additional precaution of providing ventilation through the sheets will also reduce condensation and will not greatly reduce the thermal insulation of the lining.

The application of special surface treatments, such as anticondensation paint, may, under certain conditions, also be effective in reducing condensation.

3.7 Weight of sheeting

The approximate weight of galvanized sheeting as fixed, including side and end laps, is given in Table 3.

Table 3 — Approximate weight of sheeting for 76.2 mm and 127 mm corrugations per square metre as fixed (including side and end laps)

Gauge	Weight
	N/m^2
16	180
17	165
18	145
19	130
20	115
21	105
22	95
23	85
24	75
25	65
26	60

NOTE 1 This table is intended for design considerations, not for quantities.
NOTE 2 Add 4.7 N/m^2 for hook bolts, seam bolts and washers.

3.8 Purlin spacing and strength of sheeting

The purlin spacing for roofs covered with galvanized corrugated steel sheets should preferably be arranged with a view to using standard sheets of uniform length throughout. Ridge purlins should be as near to the ridge as possible, having regard to the type of ridge capping to be used and the manner in which it is to be fixed. If ventilators are to be situated along the ridge, care should be taken that the ridge purlins do not obstruct the passage of air.

A roof will have to withstand wind and snow loads as well as any concentrated loads that may arise during maintenance. CP 3:Chapter V-2 gives guidance on loadings for various degrees of exposure, height of building and slope of roof.

The resistance of a sheet to bending varies with its thickness and profile. The strength of a sheet in terms of the extreme fibre stress permissible is a function of the section modulus, while the deflection is a function of the moment of inertia. The choice of criterion depends on the maximum values of stress, and section moduli and moments of inertia are given in Table 4 for various gauges of galvanized, corrugated steel sheets. The maximum permissible stress in galvanized sheet may be taken as 115.8 MN/m^2 for 14-gauge and 86.9 MN/m^2 for 26-gauge. Values for intermediate thicknesses of sheet may be obtained by interpolation.

Table 4 — Properties of corrugated sheets

Pitch of corrugation[a]	Gauge to BS 3083	Approximate moment of inertia C^4 per 300 mm width	Approximate modulus of section C^3 per 300 mm width
mm			
76.2	14	3.196	3.387
	15	2.868	3.065
	16	2.540	2.742
	17	2.294	2.419
	18	2.007	2.097
	19	1.803	1.936
	20	1.598	1.613
	21	1.434	1.500
	22	1.270	1.339
	23	1.147	1.210
	24	1.024	1.081
	25	0.901	0.952
	26	0.819	0.855
127	14	9.136	5.726
	15	8.112	5.097
	16	7.169	4.516
	17	6.473	4.065
	18	5.695	3.581
	19	5.080	3.194
	20	4.506	2.839
	21	4.056	2.548
	22	3.605	2.274
	23	3.236	2.032
	24	2.909	1.823
	25	2.663	1.677
	26	2.417	1.516

[a] This dimension is designated as nominal to cover the slight differences between the results obtained by the various types of plant used by manufacturers

Table 5, in which allowance has been made for the dead weight of the sheeting, gives the maximum permissible pans for various limiting stresses, deflection and superimposed loads.

The data given in Table 5 apply to uniformly distributed loads, such as those resulting from wind and snow. For concentrated loads, galvanized corrugated steel sheeting has considerable transverse strength which enables it to transfer part of the load to adjacent corrugations. Sheeting, correctly designed for wind and snow loads and with side laps well secured, should withstand the concentrated loads of 900 N on a 300 mm square as stipulated in CP 3: Chapter V-2.

3.9 Methods of fixing the sheeting

3.9.1 General. The sheets are fastened to steel angle purlins by galvanized hook bolts; to tubular steel purlins by U-bolts at lap joints and eaves, with J-bolts at intermediate purlins. Shot fired bolts and other specialized fixing methods may be used in conjunction with all types of steel purlins. The manufacturers should, however, be consulted to ensure that the strength is equivalent to orthodox fixings. See **4.6**.

Side laps or seams may be secured by galvanized steel bolts and washers. See **4.6**.

For timber purlins the sheets should be fixed with sherardized drive screws directly on to the purlins.

The fasteners should be capable of resisting the effects of the wind as specified in CP 3:Chapter V-2.

3.9.2 Eaves and verges. The ends of all sheets should be supported, and the support should be placed as near to the margin of the sheet as practicable.

Galvanized steel sheets may be employed to secure the edges of the sheeting at verges, see Figure 2. Provision should be made in any case to secure the sheeting against uplifts by wind.

3.9.3 Top edges and abutments. At a horizontal intersection of the roof with a wall, galvanized steel apron flashing pieces may be used. If the wall consists of vertical sheeting, the wall sheeting should lap over the upstand of the galvanized flashing pieces, and the apron should lap over the roof sheeting. Alternatively, lead or zinc flashing pieces may be used.

At a sloping intersection, if the direction of the corrugation is parallel to the wall face, lead or zinc flashings may be used. The flashing should be dressed as an apron over the roof sheeting to cover at least one corrugation of the sheeting and, in any case, be not less than 150 mm wide. The upstand should be provided with cover flashings or should itself be turned into and secured to the wall.

If the corrugations or flutes run into the wall face, the edge of the sheeting should be kept back at least 12.5 mm clear of the wall face, and a suitable gutter should be provided. If the corrugations or flutes run away from the wall face, normal flashings as for square abutments may be used. In both cases, lead or zinc flashings are required.

Table 5 — Maximum permissible purlin spacings for limiting stress and deflection for pitched roofs

Gauge	Total imposed load normal to roof slope (N/m²)									
	478.80		718.20		957.61		1197.01		1436.41	
	Corrugation		Corrugation		Corrugation		Corrugation		Corrugation	
	76.2 mm	127 mm	76.2 mm	127 mm	76.2 mm	127 mm	76.2 mm	127 mm	76.2 mm	127 mm
	Purlin spacings									
	m	m	m	m	m	m	m	m	m	m
14	3.43	4.80	3.05	4.34	2.82	4.04	2.67	3.81	2.51	(3.58)
16	3.20	4.57	2.90	4.11	2.67	3.81	2.58	3.53	2.36	(3.20)
18	2.97	4.27	2.67	(3.73)	(2.44)	(3.28)	2.29	(3.05)	(2.21)	(2.82)
20	2.82	(3.89)	(2.51)	(3.28)	(2.21)	(2.90)	(1.98)	(2.59)	(1.83)	(2.44)
22	2.74	(3.43)	(2.29)	(2.97)	(1.98)	(2.59)	(1.83)	(2.36)	(1.68)	(2.13)
24	2.44	(3.20)	(2.06)	(2.68)	(1.75)	(2.29)	(1.60)	(2.06)	(1.45)	(1.90)
26	(2.21)	(2.90)	(1.03)	(2.44)	(1.60)	(1.83)	(1.45)	(1.90)	(1.30)	(1.75)

NOTE 1 The loadings in Table 5 include the dead weight of the sheeting but not that of any thermal insulation or applied surface finish to the sheets. The permissible purlin spacings are calculated on the assumption of a moment ($M = WL/10$). Limiting deflections are taken as 1/100 of the span, assuming that the deflection equals $\frac{3WL^3}{384EI}$

Where the area covered consists of a single row of sheets i.e. a single span, the ends of the sheets are in effect, simply supported. To allow for this the spans indicated in the Table 5 for given loadings should be decreased by 10 %.

NOTE 2 Figures enclosed in brackets are governed by stress values. The remainder are governed by deflection values.

NOTE 3 This table does not apply to curved roofs, for which wider spacing of purlins is permissible.

3.10 Pipes, etc., passing through roofing

The positions of any necessary perforations should be considered during the design stage in relation to the position of the horizontal laps so that the length of lead or zinc flashing above the pipe outlet will not be unduly long.

As an alternative to zinc flashing, special steel sheet soaker flange may be fabricated and, where necessary, galvanized after manufacture.

3.11 Roof ventilators and roof lights

Permanent ventilation of the roof may be effected by using galvanized steel accessories such as louvre ventilators, purpose-made ventilators or extractors. Particulars may be obtained from the manufacturers of such accessories.

Alternatively, if a wide continuous ventilating space at the ridge is required, the ridge capping may be omitted, the upper course of roofing sheets may have up-curved ends and the gap at the ridge may be roofed over at a higher level with segmental or down-curved sheets.

If roof lights are required, purpose-made roof lights integral with sheets of standard corrugations may be used. These may be obtained as dead lights or as opening skylights. Their use avoids forming weatherproof joints between the roof sheeting and the up-standing kerbs or independent roof lights.

3.12 Gutters and rainwater pipes

3.12.1 General. The average intensity of storm rainfall recommended as a basis for general design purposes for eaves guttering is 75 mm per hour. This gives the flow load in litres per minute as

$$\frac{125}{100} \times \text{actual roof area in square metres.}$$

The shape, size and position of the outlet and downpipe all affect the flow capacity of a gutter.

Round-cornered outlets give a smoother flow than sharp-cornered ones and this has a marked effect on gutter capacity with the smaller outlet sizes.

Table 6 gives the calculated flow capacities of various sizes and shapes of straight level gutters with an outlet at one end. If the outlet is not at the end, the gutter capacity required will be a fraction L_1/L of the total flow load, where L_1 is the length of the longer arm of a gutter of total length L. The figures apply strictly only to the gutters specified. For other shapes of gutters approximating to the half-round or ogee type, the flow capacity Q may be calculated from the formula given at the head of Table 6.

Table 6 — Flow capacities for level gutters with outlet at one end *Q* (flow capacity in l/min = 1.15*A*, where *A* is the area of cross section in mm²

Half-round gutter		Ogee gutter	
Gutter size	True half-round gutter to BS 1091	Gutter size	Pressed steel to BS 1091
mm	l/mm	mm	l/mm
75	25	100	57
100	50	112	82
112	68	1.25	105
125	91	150	159
150	141	—	—

After allowing for the position of the outlet as above, allowances for other factors that affect the flow should be made as follows

1) *Slopes:* for slopes of 1 in 600 or greater the capacities may be increased by 40 %.

2) *Bends with 1 800 mm of outlet:* Level gutters: sharp-cornered bend, 20 % reduction, round-cornered bend, 10 % reduction. Sloping gutters: 25 % reduction.

3) *Bends within 1.8 – 3.3 m of outlet:* half the above reductions.

4) *Length:* for sloping gutters up to 6 m long, 10 % reduction.

Details of appropriate downpipe sizes, that do not restrict flow are given in Table 7.

Table 7 — Recommended downpipe sizes (diameters) for level and sloping gutters

Half-round gutter size	Sharp-cornered (S.C.) or round-cornered (R.C.) outlet	Outlet at one end of gutter	Outlet not at one end of gutter
mm		mm	mm
75	S.C.	50	50
	R.C.	50	50
100	S.C.	62	62
	R.C.	50	50
112	S.C.	62	75
	R.C.	50	62
125	S.C.	75	87
	R.C.	62	75
150	S.C.	87	100
	R.C.	75	100

The formula relating quantity of water to area of gutter has not been verified experimentally for larger gutters, but it should give guidance on the appropriate cross-sectional area of larger haft-round gutters. For gutters of rectangular or trapezoidal section the ratio of depth to width affects the capacity, but the formula will give guidance where the ratio of gutter width to gutter depth is about two to one.

3.12.2 Open valley gutters. Open valley gutters should be of such a width that the edges of the sheeting at each side of the gutter are at least 225 mm apart. In localities where heavy snowfalls are common, it may be necessary to provide wide gutters, and the best local practice should be observed.

3.12.3 Internal or parapet gutters. The width of internal or parapet gutters, including tapering gutters, should be not less than 225 mm.

3.12.4 Box receiver. A box receiver (cesspool outlet) at an internal or a parapet gutter should be not less than 225 mm × 225 ×150 mm deep.

3.12.5 Supports. Pressed steel gutters should be supported by a bracket at each joint and each length in excess of 1.2 m should be provided with an intermediate bracket. If other materials are used the manufacturer's recommendations should be observed.

3.13 Walkways and roof-boards

3.13.1 General. Where a roof is likely to need periodical attention, properly constructed walkways or roof-boards should be provided to give access to roof lights or other places to prevent injury to workmen and damage to the roof sheeting. Reference should be made to the Construction (Working Places) Regulations 1966, Regulations Nos. 35 and 36.

3.13.2 Permanent walkways. Permanent walkways should be properly designed and securely fixed to the roof structure. They should be at least 430 mm wide and should be supported clear of the roof sheeting. Handrails, if supported, should be at least 900 mm high above platform level.

3.13.3 Roof-boards. If permanent walkways are not provided, roof-boards or cat ladders should be available for use at any time that inspection or repairs to the roof are necessary. They should be so designed, constructed and supported that there is no risk of displacement or tilting. They should be at least 375 mm wide, and the battens or steps should on no account project beyond the edges of the boards, stringers or bearers.

Adjacent roof-boards should not be butted end to end but should be lapped or staggered, preferably over a purlin.

4 Application

4.1 Safety precautions

As far as is practicable no persons other than workmen employed by the roofing contractor should be permitted access to any area over which the sheeting is being laid. Provision should be made in the contract for the provision of adequate safety precautions in accordance with the requirements of the Construction (Working Places) Regulations, 1966, Regulations Nos. 35 and 36.

4.2 Ladders, scaffolding and hoists

To avoid unnecessary erection of plant for roof-covering work, use should be made of any suitable scaffolding, ladders or hoists that have been erected for other building operations. The responsibilities for the provision and use of plant should be agreed before the contract is made.

4.3 Storage and handling of sheets at suppliers stores or on site

4.3.1 General. Galvanized steel sheets will store almost indefinately in a warm, dry, clean atmosphere. It should be emphasized that if moisture is allowed to condense between the sheets it will cause white rust, which will reduce their resistance to corrosion. Therefore, it is advisable to separate the sheets and stack them on end on timber battens. Pretreatment can be specially ordered and will reduce the risk of white rust.

Care should be taken that sheets and fittings are not damaged during handling or transport. They should be kept clear of dirt and harmful chemicals.

4.3.2 On site. All sheets and fittings should be stacked as described in **4.3.1** in dry, sheltered positions as near as possible to the parts of the building on which they will be fixed. All sheets and fittings including gutters and downpipes fixing bolts and screws and any accessories required should be on site or available before the work is commenced.

Sheets should preferably be kept on timber battens in the bundles or packs in which they leave the works. Where slings or grabs are used they should be suitably arranged to avoid sheet edges.

4.4 Preparation of sheet for roofing and vertical cladding

The holes for the fixing bolts should be made through the crown of the corrugation and should be either punched or drilled. They should be 1.5 mm larger in diameter than the bolts or fixing screws used.

Holes for fixing the sheets should be in exact positions to suit the purlins, i.e. as close as possible to the back of the purlin of steel angles are used, or on the centre of the purlins if they are of timber.

No hole for a fixing bolt should be nearer than 38 mm to the end of a sheet.

4.5 Layout of the sheeting

The purlin spacing and the length of the sheets should first be checked to see that the arrangement will provide the specified overhang at the eaves and the laps.

The eaves course should be laid first and work should start at the leeward end of the building, so that the side laps will have the better protection from rain driven by the prevailing wind.

The top edges or eaves sheets should extend at least 38 mm beyond the back of steel angle purlins or 75 mm beyond the centre line of timber purlins.

At side laps, where the edge corrugations of the sheets are to opposite hand, the underlapping sides should finish with an upturned edge and the overlapping sides with a downturned edge.

At abutments, the sheets should finish with an upturned edge, where possible, to save an undue width of flashing.

Arrangements for laying sheets are shown in Figure 3; Method A is customarily used.

Curved sheets, if used, should be laid in a similar manner, but on the upper and flatter parts of the roof where the pitch is less than 20°, end laps should be increased according to the degree of exposure and, if necessary, bedded with mastic

4.6 Fixing the sheets

Galvanized corrugated steel sheets are normally fixed to steel angle purlins by hook bolts, or to timber purlins by mushroom-headed drive screws. Where sheets finish against the upper or lower edge of roof glazing, they are usually held in position by special joggle-bar clips if steel angle purlins are used. Hook bolts and drive screws are of either 8 mm or 9 mm nominal diameter, spaced at intervals of not more than 375 mm. Sheets should be secured at every purlin by at least two bolts. Fixings to tubular purlins should be of equivalent strength (see **3.9**).

Where single side laps are used on sheets thinner than 0.7 mm the seams should be secured by means of galvanized steel bolts or self-tapping screws of 6 mm diameter and washers spaced at intervals of not more than 450 mm.

The nuts of hookbolts, or the heads of drive screws, should bear on purpose-made washers to render the bolt hole weatherproof. Washers are to be of galvanized steel (diamond shape for hook bolts) bedded on bituminous felt or other plastics limpet washers. The screw or bolt should be tightened sufficiently to seat the washers over the corrugation. All holes for fixing, if punched in position, should be supported on the reverse side.

4.7 Fixing of accessories

4.7.1 General. Accessories should be secured, where possible, by the same bolts that secure the sheeting. If this is not practicable, bolts may be used to secure the accessory to the sheeting.

4.7.2 Ridge cap. The ridge cap may be secured to the ridge purlins by the same bolts that secure the sheeting; if the ridge purlin is not sufficiently near the ridge to permit this, the capping should be secured to the sheeting by 8 mm roofing bolts, two roofing bolts to each wing of the capping at centres not further apart than the bolts used for securing the sheeting. The lap of the cap along the ridge should be not less than 150 mm and so arranged to protect the joint from the prevailing wind.

4.7.3 Hip cap. The roof sheeting at hips should be cut to the required mitre and be close butted. The hip joint may be covered with plain ridge cap, which should be secured through the roof sheets or the hip runners by one bolt on each side at the same spacing as for the roof sheeting. Hip caps should have a 150 mm lap. With timber purlins, the hip cap should be fixed to the rafter by means of drive screws.

At the intersection of two hips with the ridge, the sheeting should be mitred and close butted, the intersection at the junction being covered with a lead saddle. The ridge and hip capping should be mitred together and secured with bolts as previously described in **4.7.2**.

4.7.4 Other fittings. Other galvanized steel accessories should be securely bolted either to the structure or to the sheeting.

5 Inspection

5.1 Inspection on site

Before sheeting is commenced, the structure should be inspected to see that all purlins and sheeting rails are in a true plane, correctly spaced and securely fixed. All structural steelwork should be painted or otherwise protected from corrosion.

During progress of construction the work should be inspected to see that all units are correctly laid as regards bearing on supports and that the minimum laps are provided. All fixing bolts, screws and washers should be of the specified type and size, and should be in correct position and secure.

The sheets should be checked for alignment; corrugations of the sheeting should be in line from eaves to ridge; all flashings should be secure and close fitting, with ample lap.

6 Maintenance

6.1 General

The sheeting should be examined periodically; any damaged units should be replaced or repaired promptly, and flashings re-dressed, if necessary.

6.2 Need for painting

Provided that the conditions of **4.3** have been complied with and that proper care has been taken to ensure arrival of the sheets on site in good condition, it is not generally necessary, in clean atmospheres, to paint galvanized corrugated steel sheet roofing. In certain atmospheres corrosion would commence at the overlaps and in such conditions overlaps should be painted before laying. Under severe conditions regular attention to painting will ensure indefinite life.

In common with other roofing materials, painting is essential where the metal is in contact with building materials containing alkalis (e.g. concrete and mortar) or with hardwoods containing acids (e.g. oak) or with other metals.

6.3 Paints suitable for galvanized sheets

6.3.1 On new galvanized sheets it is preferable to use paints that will adhere without the application of mordant solution. Among others, paints pigmented with zinc dust, zinc oxide, calcium plumbate or zinc chromate are suitable for the purpose.

6.3.2 In addition to the paints mentioned in **6.3.1**, paints may be used consisting of pigmented mixtures of zinc chromate and red oxide of iron; red lead; mixtures of red lead and white lead.

For a finishing coat, if specified, any good paint based on a drying oil, oleo-resinous, synthetic, bituminous or other suitable medium may be used. Some suitable finishing paints are pigmented with aluminium, red oxide, tinted white lead or zinc oxide.

Such paint systems are suitable for severe exposed conditions as occur in industrial or marine atmospheres.

Lead-based paints should be avoided when rainwater drains into storage vessels.

6.4 Further information

Further information on the painting of galvanized corrugated steel sheet is given in CP 231 and PD 420.

Appendix A Thermal transmittance (*U* value)

Data are given below by means of which the loss of heat through a galvanized corrugated steel sheet roof may be estimated for various methods of construction.

The actual rate of heat loss depends upon the difference in temperature between the inside and outside air, and on the thermal transmittance, *U*, of the construction. The thermal transmittance is defined as the number of watts transmitted through one square metre of the construction when a temperature difference of 1 °C exists between the air on the two sides of the construction.

Approximate values of *U* are given below for various types of roof construction. These values may be used for most situations in this country. The colour of the paint, if any, or whether the surface is dirty or clean has little effect on the thermal transmittance of a galvanized steel sheet roof.

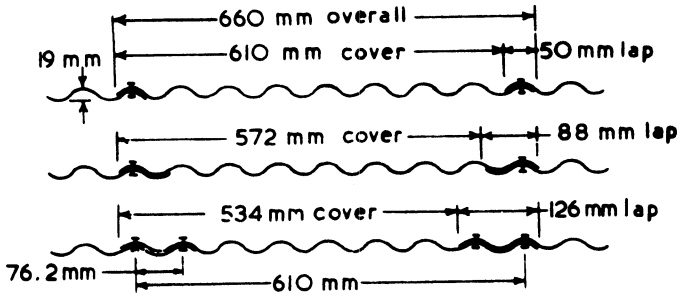
For vertical cladding, the *U* value for galvanized corrugated steel sheet may be taken as **6.8**. When insulated the values can be taken, for practical purposes, as those given below for a roof.

Apart from certain types of building which can claim exemption, all new factory buildings are subject to the Thermal Insulation (Industrial Buildings) Act, 1972.

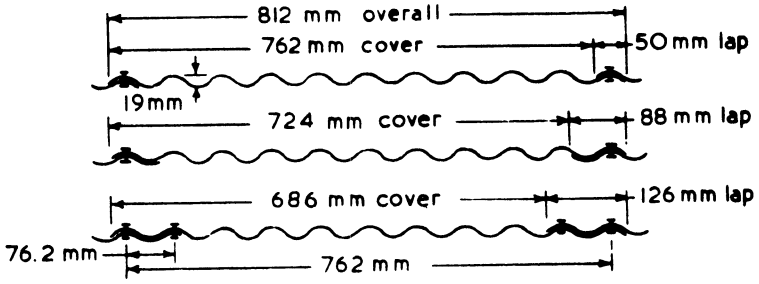
Manufacturers of proprietary thermal insulating materials and fixing systems will supply full details of the insulating and other properties of their product if required.

The following example is intended as an approximate guide:

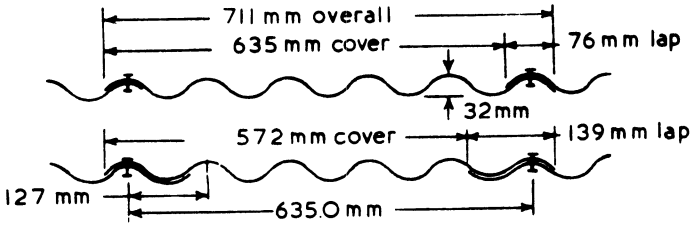
Method of roof construction	***U* value W/(m² °C)**
Uninsulated galvanized corrugated steel sheet	8.5
Galvanized corrugated steel sheet with an air gap (25 mm minimum) provided by:	
Insulation board 6 mm thick	2.30
Insulation board 12 mm thick	1.70
Insulation board 25 mm thick	1.25
NOTE 1 unit (R) ft² H °F/BTU × 0.1761 = 1 unit m² °C/W. 1 unit (U) BTU/ft²h °F × 5.678 = 1 unit W/(m² °C.)	



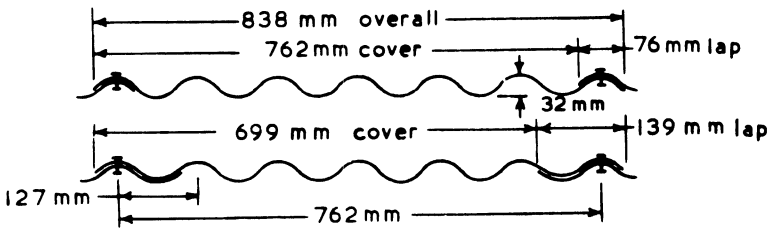
8/76.2 mm corrugated steel sheeting



10/76.2 mm corrugated steel sheeting



5/127 mm corrugated steel sheeting



6/127 mm corrugated steel sheeting

Figure 1 — Typical sheets and side laps

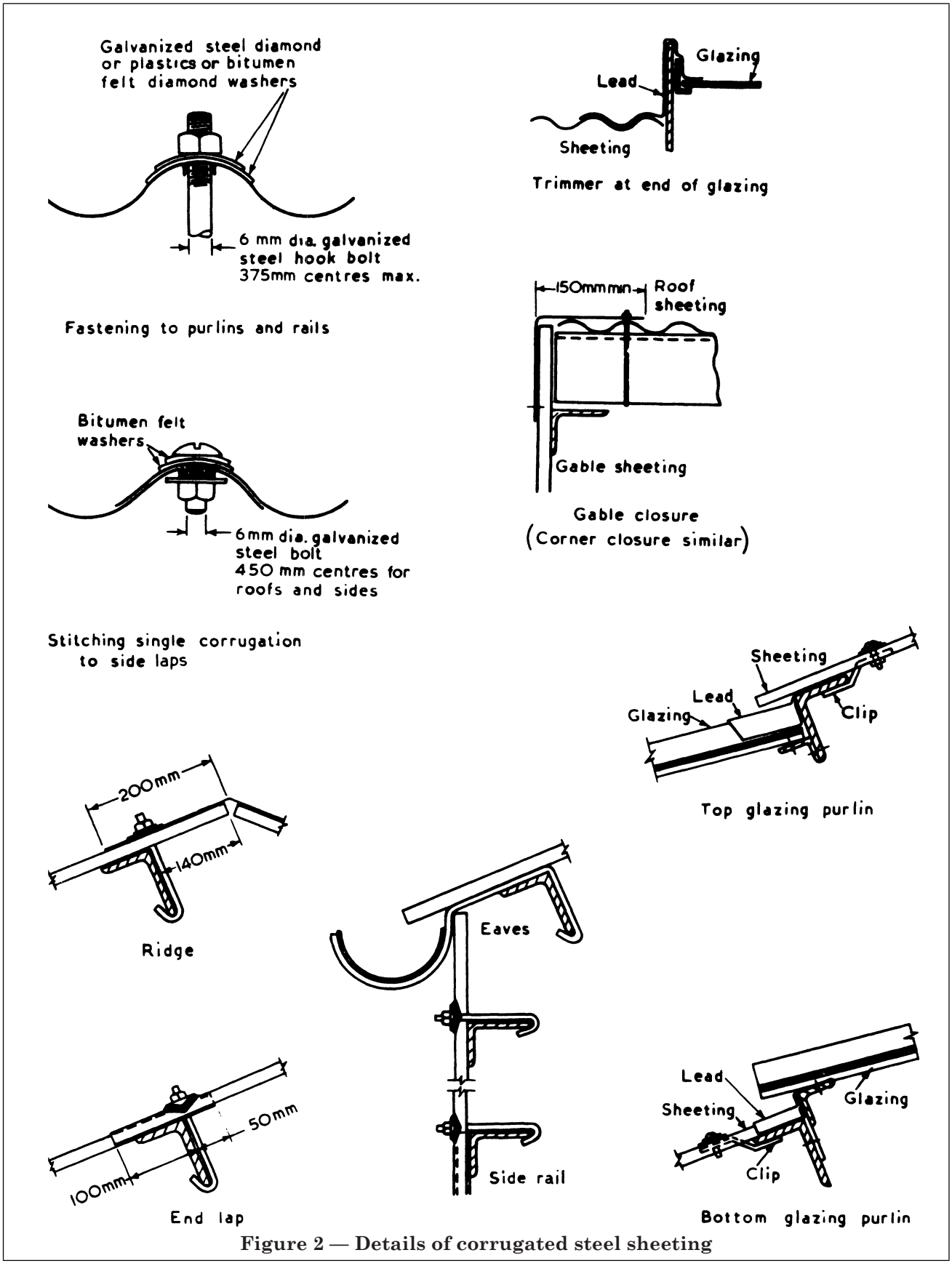


Figure 2 — Details of corrugated steel sheeting

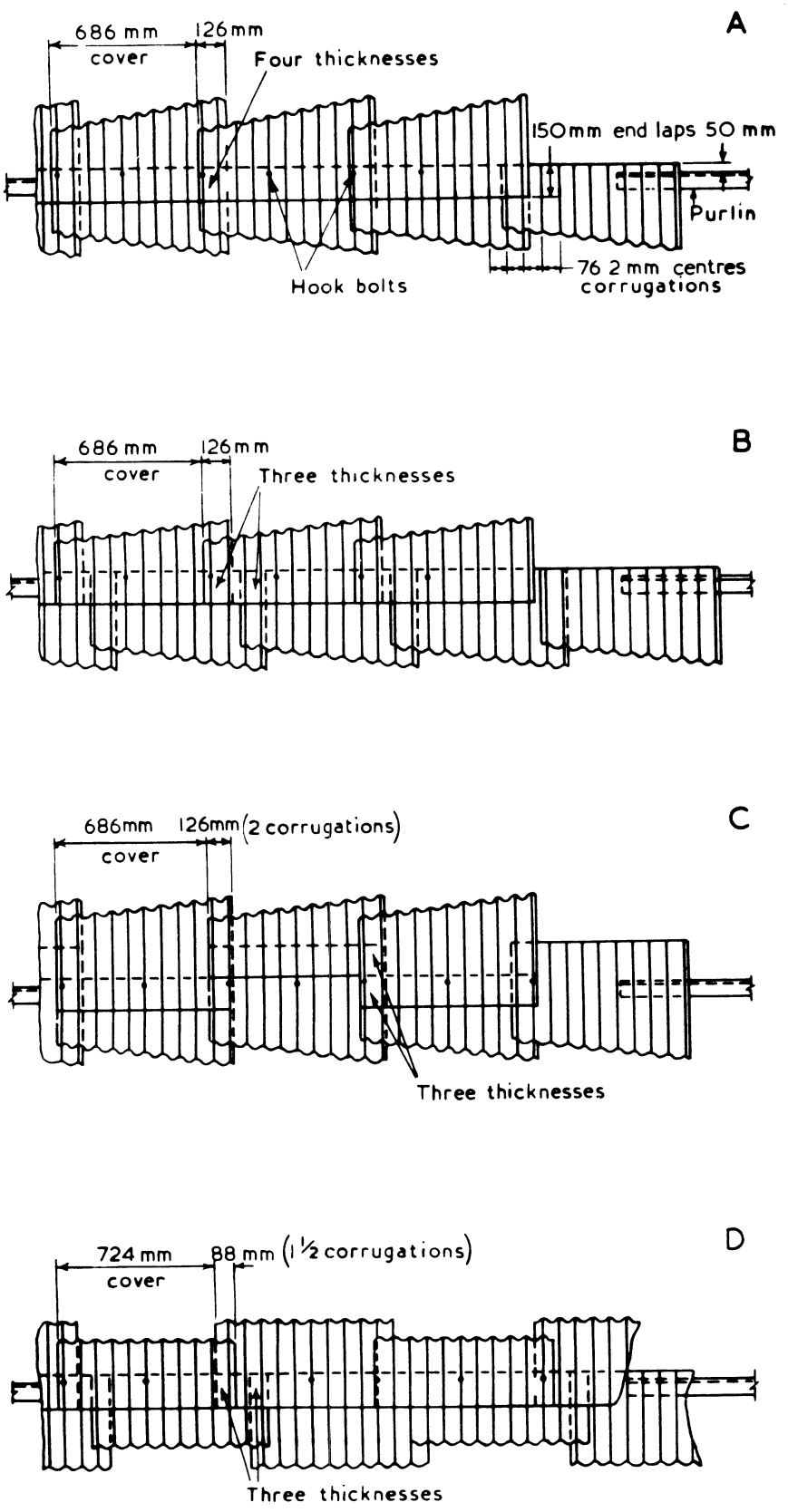


Figure 3 — Typical layouts and end laps of 10/76.2 mm corrugated steel sheeting *(continued)*

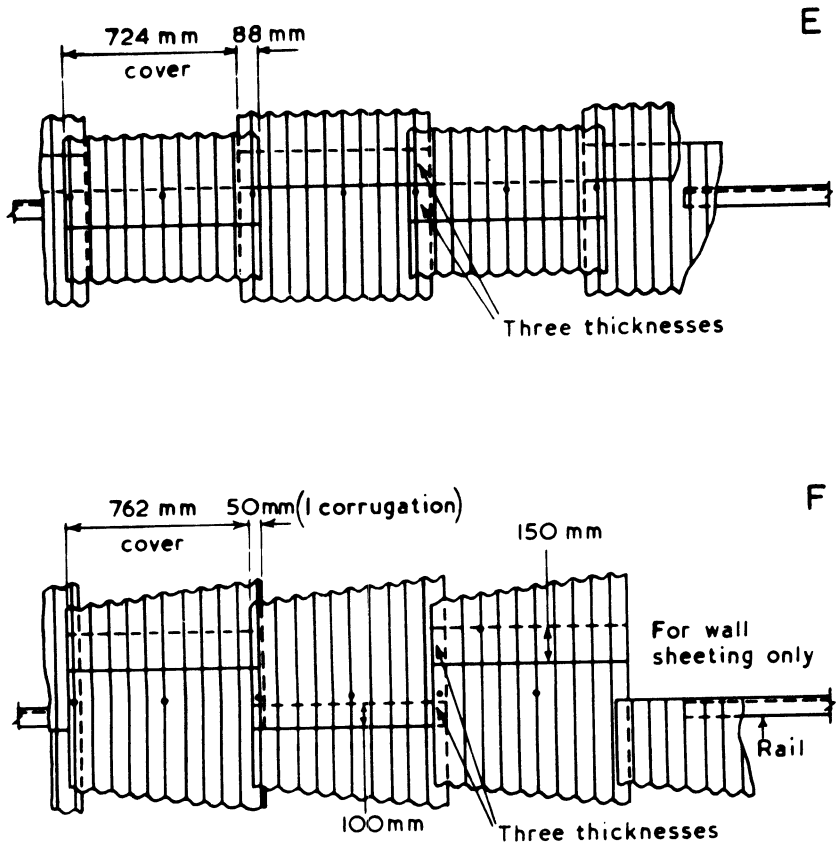


Figure 3 — Typical layouts and end laps of 10/76.2 mm corrugated steel sheeting *(concluded)*

Publications referred to

This code makes reference to the following British Standards:
BS 849, *Plain sheet zinc roofing.*
BS 1091, *Pressed steel gutters, rainwater pipes, fittings and accessories.*
BS 1178, *Milled lead sheet and strip for building purposes.*
BS 1494, *Fixing accessories — for building purposes.*
BS 1754, *Steel barns with curved roofs.*
BS 2717, *Glossary of terms applicable to roof coverings.*
BS 2989, *Hot-dip galvanized plain steel sheet and coil.*
BS 3083, *Hot-dipped galvanized corrugated steel sheets — for general purposes.*
CP 3, *Code of basic data for the design of buildings.*
CP 3:Chapter V, *Loading — Part 2: Wind loads.*
CP 231, *Painting of buildings.*
PD 420, *Methods of protection against corrosion for light gauge steel used in buildings.*

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