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भाग 1 नालीदार चादरें

( पहला पुनरीक्षण )

*Indian Standard*

LAYING OF ASBESTOS CEMENT SHEETS —  
CODE OF PRACTICE

PART 1 CORRUGATED SHEETS

( *First Revision* )

ICS 91.100.40

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BUREAU OF INDIAN STANDARDS  
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## FOREWORD

This Indian Standard ( First Revision ) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement Matrix Products Sectional Committee had been approved by the Civil Engineering Division Council.

Corrugated asbestos cement sheets are commonly used in this country for providing structural surfaces exposed to weather, such as roofs of industrial, institutional, commercial and residential buildings. Covering of asbestos cement corrugated sheets have many advantages, such as lightness, ease and quickness of construction and durability but to realise full advantages from this type of covering proper selection of various accessories and good workmanship are essential. This code is intended to give guidance in the selection of materials and laying of asbestos cement corrugated sheets for obtaining satisfactory performance.

This standard has been published in two parts. Part 1 covers laying of corrugated sheets and Part 2 covers laying of semi-corrugated sheets conforming to IS 459 : 1992, 'Specification for unreinforced corrugated and semi-corrugated asbestos cement sheets'.

This standard was originally published in 1964. This first revision has been done in the light of experience gained in its use over the years. In this revised version brought out in SI units; important changes have been made in the clauses on design consideration, spacing of purlin, storage and handling at site, safety precautions, besides adding new clauses covering expansion joints, shade protection and recommended work practice.

In the formulation of this standard due weightage has been given to the need for international co-ordination among standards prevailing in different parts of the world. Guidance has been taken from:

ISO 8108 : 1986 Directives for fixing asbestos cement corrugated asymmetrical section sheets and fittings for roofing

BS 5247( Part 14 ) : 1975 Code of practice for sheet roof and wall coverings

IS 11769 ( Part 1 ) : 1987 Guidelines for safe use of products containing asbestos: Part 1 Asbestos cement products

*Indian Standard***LAYING OF ASBESTOS CEMENT SHEETS —  
CODE OF PRACTICE****PART 1 CORRUGATED SHEETS***( First Revision )***1 SCOPE**

This standard ( Part 1 ) lays down the method of laying and fixing corrugated asbestos cement sheets used as covering for roofs and walls.

**2 REFERENCES**

The Indian Standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

**3 TERMINOLOGY**

For the purpose of this standard, the following definitions shall apply.

**3.1 Abutment**

Sloping intersection of a roof surface with a part of the structure which rises above it.

**3.2 Accessories**

Purpose made fittings, such as ridge cappings, north light curves, ridge finials, apron flashing pieces, eaves filler pieces, barge boards, expansion pieces, ventilators, skylights and similar fittings, with which the roof is furnished.

**3.3 Apron Flashing Piece**

Flashing, the lower edge of which is lapped over the roof covering.

**3.4 Asbestos Building Board**

Asbestos cement flat panel used for interior work, that is, ceiling, partition, etc, with a good workability and flexibility.

**3.5 Asbestos Cement**

A material composed of asbestos fibre and Portland cement.

**3.6 Eaves**

The lower edge of an inclined roof.

**3.7 Eaves Filler or Closure Piece**

Asbestos cement accessory used to fill or close the corrugation spaces under the roof sheeting at the eaves.

**3.8 Finial or Ridge End**

Asbestos cement accessory to form waterproof covering at the end of a ridge.

**3.9 Gable**

Part of a wall above the general eaves level at the end of a ridged or partially hipped roof.

**3.10 Gutter**

Any form of roof water channel.

**3.11 Hip**

Raking salient angle formed by the intersection of two inclined roof surfaces.

**3.12 Hip-Ridge or Capping**

Asbestos cement accessory used to form waterproof covering to a hip.

**3.13 Mitre**

Cutting the joining surfaces of two sheets at an angle.

**3.14 Pitch**

Angle of inclination with the horizontal of the rafters or substructure surface on which the roof covering is laid.

**3.15 Ridge**

Line of intersection of two inclined roof surfaces at the apex of a roof.

**3.16 Ridge Capping**

Asbestos cement accessory to form a waterproof covering to a ridge.

**3.17 Valley**

Re-entrant racking angle formed by the intersection of two inclined roof surfaces.

### 3.18 Verge

Free edge of a roof surface finishing at a gable.

## 4 NECESSARY INFORMATION

4.1 For the efficient planning and execution of the work detailed information with regard to the following is necessary:

- a) Roof area to be covered,
- b) Details of sub-structure of roof,
- c) Pitch of the roof, and
- d) Location and size of openings and details of roofing accessories to be fixed.

4.2 All the information stated in 4.1 shall be made available by the appropriate authority responsible for the construction of the whole building to those who are entrusted with the work of laying roof sheeting before the work is started. Necessary drawings and instructions for preparatory work shall also be given where required.

4.3 Arrangements shall also be made for the proper exchange of information between those engaged in laying the roof covering and all other whose work will be affected.

## 5 MATERIAL

### 5.1 Asbestos Cement Sheets

Asbestos cement corrugated sheets shall conform to IS 459.

#### 5.1.1 *Shallow Corrugated*

Asbestos cement sheets shall conform to IS 13008.

5.1.2 Asbestos cement roofing fittings shall conform to IS 1626 ( Part 3 ).

5.1.3 Asbestos cement gutters and gutter fittings shall conform to IS 1626 ( Part 2 ).

### 5.2 Asbestos Cement Building Boards

Asbestos cement building boards where required, shall conform to IS 2098.

5.2.1 Asbestos cement flat sheets shall conform to IS 2096.

5.2.2 Silica asbestos cement flat sheets shall conform to IS 13000.

### 5.3 Fixing Accessories

Fixing accessories, such as J-bolts L-bolts, roof washers, etc, shall conform to IS 730.

5.3.1 Coach screws shall conform to IS 1120.

## 6 DESIGN CONSIDERATIONS

### 6.1 Durability

Asbestos cement corrugated sheets which are untreated on the exposed face will be affected in the following ways when exposed to the atmosphere:

- a) Age will bring about a reduction in resistance to impact but transverse strength of sheets will improve.
- b) Slight expansion, shrinkage or curling may cause cracking if the sheets are fixed too rigidly to the supporting structure.

Asbestos cement sheeting may be regarded as having a normal life of at least 40 years. Durability depends mainly on the degree of acid pollution of the internal or external atmospheres.

Atmospheric pollution is not normally sufficiently concentrated to be harmful. In order to secure a sound and permanent roof with maximum economy the requirements specified in 6.1.1 to 6.1.7 shall be followed.

#### 6.1.1 *Roof Plan*

The roof plan shall be as simple as possible. Formation of hips and valleys should be avoided, as far as possible. Isolated projections above roof should be avoided at the design stage itself, as it is difficult to make the junctions between such projections and the roof sheeting weather proof.

#### 6.1.2 *Pitch of the Roof*

The pitch of roofs shall, wherever possible, be preferably not less than 18°; should it, however, be found desirable to adopt roofs with a pitch less than 18° the values prescribed in 6.1.6 for the end laps between adjacent sheets shall be correspondingly increased and/or the joints suitably sealed in accordance with the manufacturer's recommendations or the instructions of the engineer-in-charge.

#### 6.1.3 *Purlins*

All purlins shall be in one plane and shall be properly anchored to the supporting structure. Special care shall be taken that the sheets do not deflect at the intermediate purlins in an attempt to make the sheets bear on such purlins. The contact surface between the sheets and their supports shall be such that puncturing can be avoided.

##### 6.1.3.1 *Spacing of purlins*

The spacing of purlins shall be arranged to suit the standard lengths of sheets but shall not exceed the following:

Thickness of Sheet mm	Distance Between Purlin Centres	
	For roof covering m	For side cladding m
4 (Shallow corrugations)	0.8	1.35
6 (Medium corrugations)	1.4	1.70

6.1.3.2 Ridge purlins shall be fixed 75 to 115 mm from the apex of the roof, that is, from the bolt point.

6.1.4 Additional trimmers or bridging shall be used between purlins at all points where considerable roof traffic is likely to occur, for example, adjoining valley or box gutters, below glazing and around chimneys, ventilators or other uptakes. This should be done on new roofs and when recovering or repairing existing roofs. Similarly, when a course of sheets of smaller length necessitating closer purlin spacing is required to make up a roof slope it is desirable to arrange the closer purlin spacing at eaves rather than at ridges, as this will bring additional support where it is most required.

6.1.5 Hip and valley runners should be provided, fixed flush with the top face of purlins and spanning between them, to give adequate support to the raking cut edges of roof sheets at hips and valleys. The runners should run parallel to the edge of the sheeting and placed so as to permit the fixing of the sheets and hip covering accessories.

#### 6.1.6 Laps

All the overlaps should be placed on the supports. The sheets shall be laid with a side lap of half corrugation (see Fig. 1). For normal roof pitch (that is, inclinations greater than or equal to  $18^\circ$ ), the end laps (see Fig. 2) in sheets shall not be less than 150 mm. For low roof pitches (that is, inclinations less than  $18^\circ$ ) or for normal pitched roof in exposed position, the end laps shall be increased and it is

desirable to consult the manufacturers in such cases. The side laps shall as far as possible be sheltered from the prevailing wind direction. The free overhang at eaves, measured as the length of sheet from its lower edge to the centre of bolt holes shall not be more than 300 mm for 6 mm thick sheets and 150 mm for 4 mm thick (shallow corrugations) sheets. Wherever four corners of sheets overlap, two of them shall be mitred in the manner described in 9.3.5 in order to secure a perfect fit.

6.1.7 In order to avoid undue width of flashing, the sheets should finish at abutments as far as possible with an upturned edge.

## 6.2 Spacing of Supports and Strength of Sheeting

### 6.2.1 General

The purlins and rails should be spaced to suit the sheet profiles and the standard length available, wherever possible. If ventilators, roof lights are to be used on the roof slope the supporting structure should provide the necessary support without restricting or obstructing the flow of air.

### 6.2.2 Imposed Roof Loads

#### 6.2.2.1 Sloping roofs

On roofs with a slope of  $10^\circ$  to  $30^\circ$  and with no access provided to the roof (other than that necessary for cleaning and repair) allowance should be kept for an imposed load exerting a force of  $0.75 \text{ kN/m}^2$  measured on plan or a vertical load exerting a force of  $0.9 \text{ kN}$  concentrated on a square with a 300 mm side, measured on slope.

#### 6.2.2.2 Flat roofs

On roofs up to and including  $10^\circ$  where access (in addition to that necessary for cleaning and repair) is provided to the roof allowance should be made for an imposed load including snow exerting a force of  $1.5 \text{ kN/m}^2$  measured on plan or a load exerting a force of  $1.8 \text{ kN}$  concentrated on a square with 300 mm side

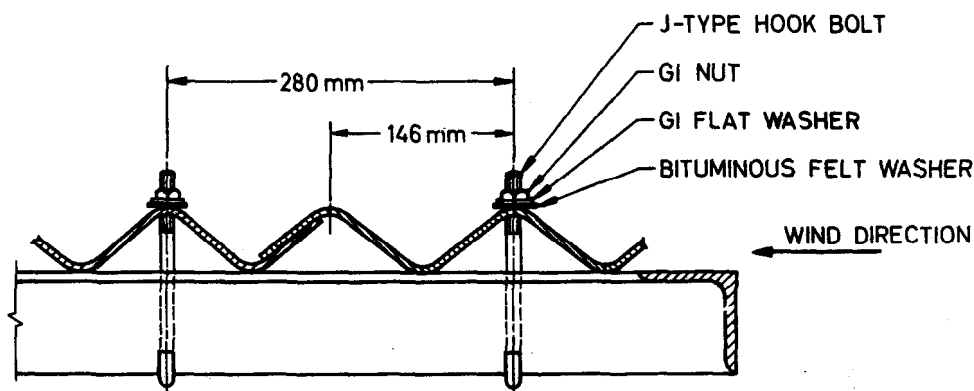


FIG. 1 DETAIL OF SIDE LAP

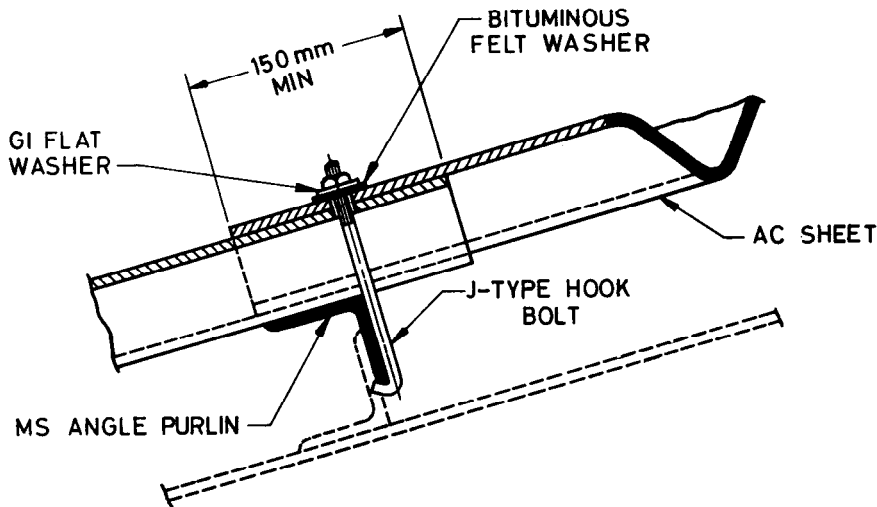


FIG. 2 DETAIL OF END LAP

measured on slope. On roofs up to and including  $10^\circ$  where no access is provided (other than that necessary for cleaning and repair) allowance should be made for an imposed load including snow, exerting a force of  $0.75 \text{ kN/m}^2$  measured on plan or a load exerting force of  $0.9 \text{ kN}$  concentrated on a square with a  $300 \text{ mm}$  side measured on slope.

### 6.3 Wind Loads

Corrugated sheets should be designed to resist the combined effects as well as the separate effects of imposed loads and the wind loads. For details of wind pressures and suction, IS 875 (Part 3) may be referred.

### 6.4 Expansion Joints

When the length of asbestos cement sheeting exceeds  $45 \text{ m}$ , expansion joints should be provided in the roof covering and vertical cladding. These should be designed in relation to another. One expansion joint is to be provided in continuous run of sheeting up to  $75 \text{ m}$  in length and one for each additional  $30 \text{ m}$ . It is essential that expansion joints in asbestos cement be designed to coincide with any such joints provided in the structure. The joints in both the roof and wall covering should be designed to suit the type of sheeting used in conjunction with specially made joint accessories which are available for standard types of sheets.

## 7 STORAGE AND HANDLING AT SITE

7.1 All asbestos cement units shall be protected from damage while stored on site. They shall be carefully stacked in sheltered positions as near as possible to the parts of the building on which they will be fixed.

7.2 Sheets shall be stacked to a height of not more

than one metre on firm and level ground, with timber or other packing beneath them. If, of necessity, they are to be placed in an exposed position, they shall be protected from damage by the winds. While stacking sheets all uplap should be on one side and all downlap should be on the other side, but uplap and downlap should not be mixed.

7.3 Asbestos cement materials of same variety and size shall be stacked together. Damaged material shall not be stacked with sound materials. All damaged materials shall be salvaged as early as possible.

7.4 All sheets and fittings, including gutters and downpipes, brackets, fixing bolts or screws and any accessories required for a particular roof area, shall be on the site or available before the work is commenced.

7.5 The sheets shall be raised to the roof using adequate manual or mechanical means, in particular avoiding impacts.

7.6 During receiving and storing of asbestos cement corrugated sheets and fittings, recommendations given in 4 of IS 11769 (Part 1) shall be followed to ensure minimum release of airborne dust and thus minimum exposure of workers to such airborne asbestos dust.

### 7.7 Shade Protection

If asbestos cement sheets are stored and stacked in the open for long periods without protection from the sun, the sun's rays may make one side of a stack of sheets very hot leaving the other side at shade temperature and thereby setting up stresses which may result in cracking. Hence it may be necessary to protect stacks of sheets from the sun using methods suggested in 7.7.1, 7.7.2 and 7.7.3.

7.7.1 Method 1

Three-metre sheets are laid transversely on a stack of sheets. This method also provides shade to the side of the sheets (see Fig. 3.)

7.7.2 Method 2

Same as in Method 1 and Fig. 3 with addition of one 1.5 m sheet laid at each end of the stack to provide requisite shade (see Fig. 4).

7.7.3 Method 3

Lay 1.5 m sheets around to lean against the stack as indicated in Fig. 5. This method provides shade from all directions. It is recommended that sheets placed in shade protection as demonstrated in the

foregoing illustrations should be prevented from being blown away by suitable means.

8 SAFETY PRECAUTIONS

8.1 No person other than workmen employed shall be permitted access to any area over which the sheeting is being laid. If, however, it is not possible to keep this area clear, protective measures shall be taken during the progress of the work.

8.1.1 Notices warning workmen not to step on to the roof sheeting should be provided in conspicuous positions on the walkways and at all usual points of access to the roof.

8.2 Cat ladders or roof boards shall invariably be used by men working on the roofs for safety which will

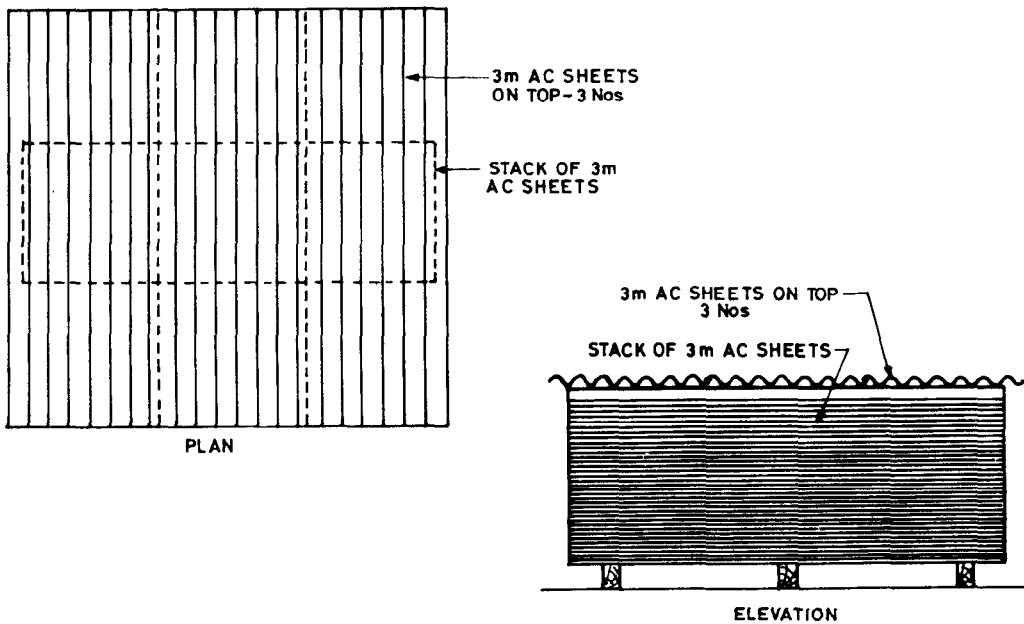


FIG. 3 SHADE PROTECTION METHOD 1

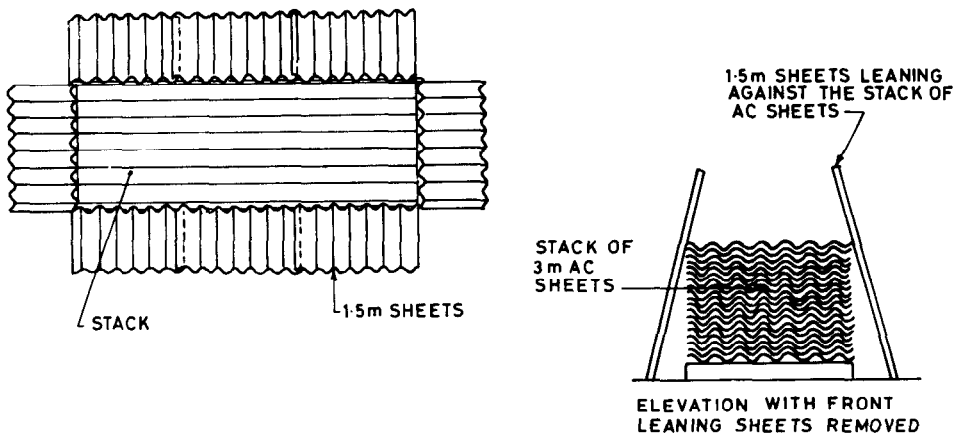


FIG. 4 SHADE PROTECTION METHOD 2

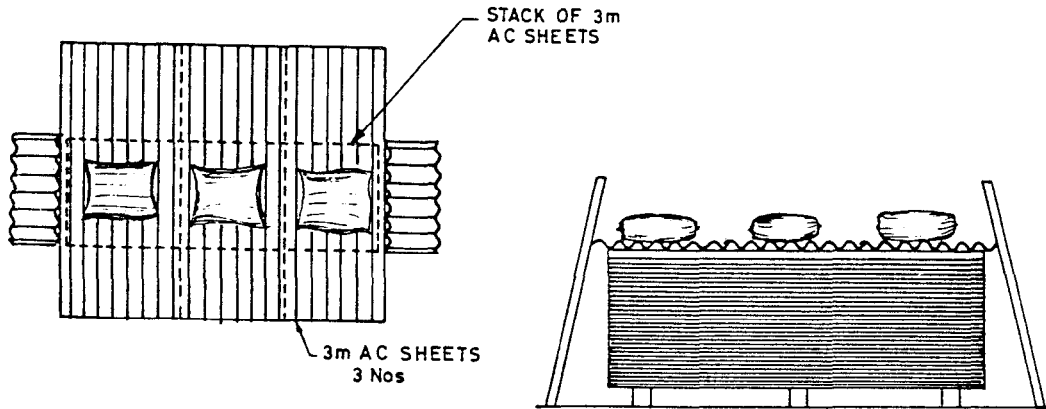


FIG. 5 SHADE PROTECTION METHOD 3

incidentally avoid damage to the roofing materials also. Roof boards shall not be less than 375 mm wide and shall be well constructed to avoid tilting of materials. The battens or crosspieces of roof board shall not project beyond the edges of the board and shall be properly secured to the board.

**8.3** During laying, it is essential that the workmen walk on and work from planks or ladders avoiding the need to step or crawl directly on the sheets. Safety posters warning workmen not to step on the roofing sheeting should be prominently displayed.

**8.4** Supervisors should ensure the proper distribution to and use by the operatives of such safety devices such as access ladders and helmets.

**8.5** It is essential that operatives do not use shoes with slippery soles when laying or fixing roofing sheets.

**8.6** Before leaving the site all sheets on the roof shall be fixed and no loose tools, fasteners or sheets which are not fixed shall be left on the roof.

**8.7** Sheeting operations should be suspended at times of high winds.

**8.8** Asbestos cement products normally contain only small percentage of asbestos and are safe to handle.

Where a limited amount of cutting, such as mitring is done in the open air, the dust level is generally low, but if any doubt exists, IS 11769 ( Part 1 ) may be referred to or clarification should be sought from the manufacturer.

## 9 LAYING AND FIXING OF SHEETS

### 9.1 Sawing and Drilling

Sheets shall be cut as necessary with a wood saw. Holes in the sheets shall be drilled, they shall on no account be punched. The latter method not only splays out the aperture thus weakening the material at vulnerable points, but is also likely to commence a fracture of the sheet which will ultimately open out

in weathering. The holes for fixing shall be 2 mm larger than the diameter of the fixing bolts, and shall always be drilled through the crown of the corrugation and not on the valleys.

**9.1.1** Holes for fixing the sheeting shall be drilled in the centre of the end lap of sheets to suit the purlins, that is, on the centre line of the purlins if these are of timber and square head coach screws are used, or as close as possible to the back of the purlins if J- or L-bolts are used with steel angles or precast concrete or timber purlins. It is recommended, therefore, to drill the holes on the roof with the sheeting laid in the correct position. Drilling of holes must be done at least 75 mm away from edge of sheet.

### 9.1.2 Recommended Work Practices in Sawing and Drilling

In cutting of sheets different tools as mentioned in Table 1 may be used with a view to maintain the dust emission at the lowest practicable level, while taking into account working efficiency and quality of work, but if any doubt exists, clarification should be sought from the manufacturer.

## 9.2 Fixing Accessories

**9.2.1** The satisfactory service of the roofing depends to a great extent upon the efficiency of fixing accessories. It is, therefore, important that particular attention is paid to the proper selection and use of fixing accessories. The fixing accessories shall conform to the requirements of IS 730.

**9.2.2** Galvanized iron J-type hook bolts or cranked hook bolts, and nuts bearing on galvanized iron washers and bitumen washers shall be used for fixing sheets on angle iron purlins.

**9.2.3** Galvanized iron L-type hook bolts and nuts bearing on galvanized iron washers and bitumen washers shall be used for fixing sheets on R.S. joists, precast concrete or timber purlins.



**Table 1 Working Processes and Recommended Tools:  
Corrugated Sheets and Fittings**

( Clause 9.1.2 )

Working Process	Recommended Tools
Mitring	Hand saw, scribe, <sup>1)</sup> jig saw, nibbler, hand guided, band saw, low speed circular saw
Cross cutting	Hand saw, <sup>1)</sup> jig saw, nibbler, low speed, circular saw
Longitudinal cutting	Scriber, jig saw, nibbler, hand saw, low speed circular saw
Cut outs	<sup>1)</sup> Jig saw, hand saw, low speed, circular saw
Drilling	Hand or power operated drill

<sup>1)</sup> Other mechanically operated saws may be used with special precautions. Circular high speed saws are not recommended.

**9.2.4** Galvanized iron coach screws bearing on galvanized iron washers and bitumen washers shall be used for fixing sheets on timber purlins.

**9.2.5** Galvanized iron roof bolts and nuts bearing on galvanized iron flat washers and bitumen washers shall be used for fixing of the sheets, fixtures like ridged cappings, corner pieces, ventilators, northlight curves, etc.

**9.2.6** Where sheets are laid on tubular purlins the fixing bolt should be designed to encompass at least half the tube periphery and precautions should be taken to prevent its rotation. Sections other than angles and tubes may require an adapted form of hook bolt.

**9.2.6.1** Direct fixing of sheets to drilled metal frame work or by stud welding it undesirable as it tends to restrain movement of sheets.

**9.2.7** It is essential that the bolt holes are made watertight by the use of bituminous felt washers in conjunction with suitable galvanized iron washers. These form essential accessories to good fixing work. Fixing bolts and screws shall be 8 mm or more in diameter and nuts of the hook crank bolts (or heads of coach screws) shall bear on galvanized iron washers

(flat, curved or diamond pattern) which in turn shall be embedded on bituminous felt washers (round or diamond pattern) corresponding to the shape of galvanized iron washers. The screws or nuts shall be tightened sufficiently only to seat the bitumen washer over the corrugations, so that natural movement in the sub-structure of the roof may not damage the sheeting.

**9.2.7.1** The length of the J-bolt or crank bolt shall be 75 mm longer than the depth of the purlin for single sheet fixing and 90 mm longer than the depth of the purlin where two sheets overlap or where ridges or other accessories are to be fixed with the sheet. The minimum length of square head coach screw for timber purlins shall be 110 mm. The number and length of bolts and the number of bitumen and galvanized iron washers for fixing asbestos cement corrugated sheets shall be as given in Table 2.

**9.2.8** The galvanized iron flat washer shall generally be 25 mm in diameter and 1.6 mm thick with hole to suit the required size of fixing accessory and the bitumen washer shall be 35 mm in diameter and 1.5 mm thick with hole to suit the required size of fixing accessory.

**Table 2 Number and Length of Bolts and Number of Bituminous Felt and Galvanized Iron Washers**

( Clause 9.2.7.1 )

Sl No.	Situation	No. of Bolts and Bituminous Washers and G.I. Washers	Length of Bolt
i)	At horizontal (end) laps of sheets. At eaves when filler pieces are used. At ridge when corrugated sheets and ridge pieces are secured by the same bolt.	Twice the number of sheets in one horizontal course.	Depth of purlin + 90 mm.
ii)	At eaves when filler pieces are not used. At ridge when corrugated sheets and ridge pieces are not secured by the same bolt.	Twice the number of sheets in one horizontal course.	Depth of purlin + 75 mm.
iii)	At intermediate purlins where horizontal laps do not occur.	Twice the number of sheets in one horizontal course.	Depth of purlin + 75 mm.

For other shapes of galvanized iron and bitumen washers suitable sizes as approved by the engineer-in-charge may be used.

9.2.9 Ridge cappings shall, as far as possible, be secured to the ridge purlins by the same bolts which secure the sheeting. Other asbestos cement accessories such as barge boards, eaves filler pieces and apron flashing pieces, shall be secured either to the supporting structure or to the sheeting by roofing bolts.

### 9.3 Laying the Sheets

9.3.1 Before the actual laying of sheets is started, the purlin spacing and the length of the sheets shall be checked to ensure that the arrangement will provide the laps required and the specified overhang at the eaves.

9.3.2 The sheets shall be laid with the smooth side upwards and with the side and end laps as given in 6.1.6 (see Fig. 1 and 2). The course of sheets shall be so laid that the corrugations run in continuous straight lines.

9.3.3 If a building is in an exposed position and is subject to driving winds and rains, it is advisable to commence laying the sheets from the end opposite to the direction of prevailing winds.

9.3.4 Sheets shall be laid in consecutive tiers starting at the eaves either from left to right or from right to left depending upon the prevailing direction of wind.

9.3.4.1 Order of cutting and fixing the sheets (see Fig. 6 and 7). The following procedure is applicable when laying from left to right. The procedure should be reversed when laying from right to left.

a) *First tier first course*

Fix sheet *A* without mitre. Then cut sheets *B* and *C* at the bottom right hand corner and fix progressively up towards the ridge.

b) *Intermediate tiers*

Mitre sheets *D* at the top left hand corner and fix them. Mitre sheets *E* at the top left hand and bottom right hand corners and fix them. Mitre sheets *F* at the bottom right hand corner and fix them.

c) *Finishing tier*

Mitre sheets *G* and *H* at the top left hand corner and fix them. Fix sheet *I* without mitre.

On the other side of the ridge, fix the sheets in the same manner but lay from right to left to ensure that corrugations on both sides coincide.

The method of fixing shall not create stresses in the sheet which could result in fracture.

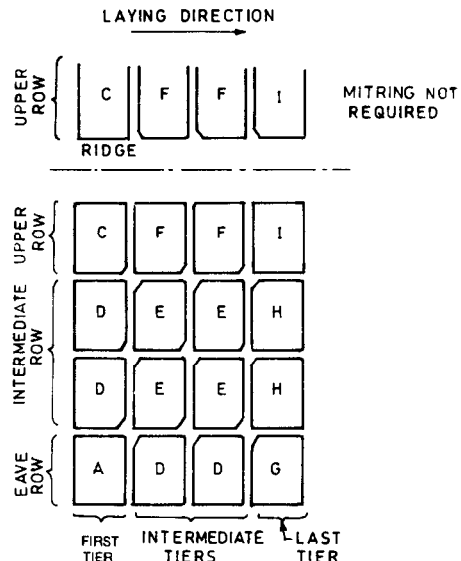


FIG. 6 ORDER OF CUTTING OF SHEETS

9.3.5 Mitring of corners is necessary to provide a snug fit where four sheets meet at lap. Mitred corner is limited by the length of the end lap and width of side lap. The choice of the corner to be cut depends on the laying direction and on the position of the sheet in the roof. Details of mitring are shown in Fig. 8. Mitring of sheets should always be done on ground but never on the roof.

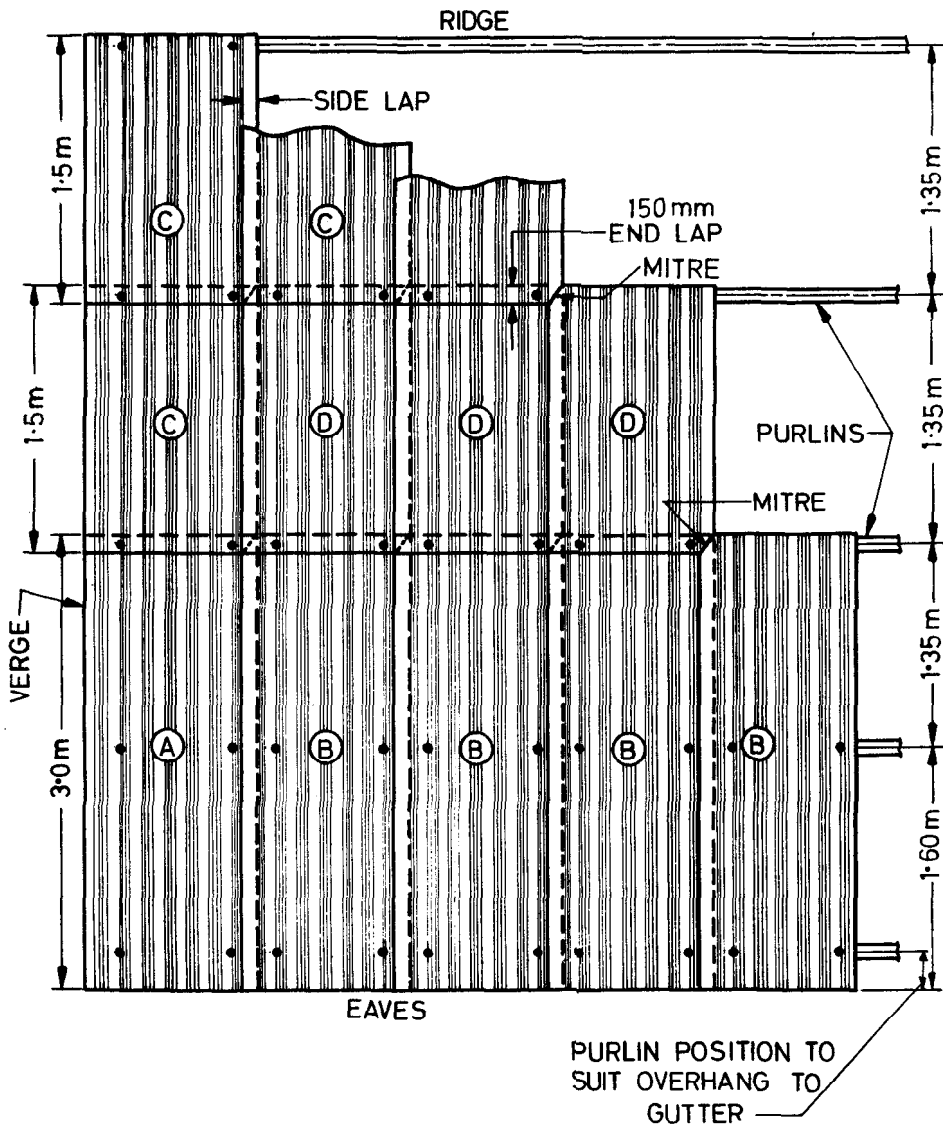
9.3.6 The ends of all sheets at the eaves shall be supported and the support shall be placed at near to the margin of the sheets as practicable. The maximum free overhang at the eaves shall be not more than the limits specified in 6.1.6.

In coastal areas where velocity of wind is more than 150 kmph the sheet is to be protected by fixing M. S. strips of 50 mm width at the eaves end so that the sheet is prevented from being blown away.

9.3.7 For fixing accessories may be referred.

9.3.8 Sheets should be secured at eaves and through end laps by at least two bolts or screw fixings. At intermediate purlins where no end laps occur one bolt or screw fixing should be used for wind suction loadings up to 1 000 N/mm<sup>2</sup>, otherwise a minimum of two bolts or screw fixings should be used. (Regarding details of wind suction loading consult manufacturer).

Where wind suction load exceed 1 500 N/m<sup>2</sup> the manufacturer's advice should be sought regarding the need for extra fixings or reduced purlin spacings. Roof sheeting should be fixed only through the crowns of



- A = Uncut sheet
- B = Top left-hand corner cut
- C = Bottom right-hand corner cut
- D = Top left-hand corner and bottom right-hand corner cut

FIG. 7 FIXING DETAIL

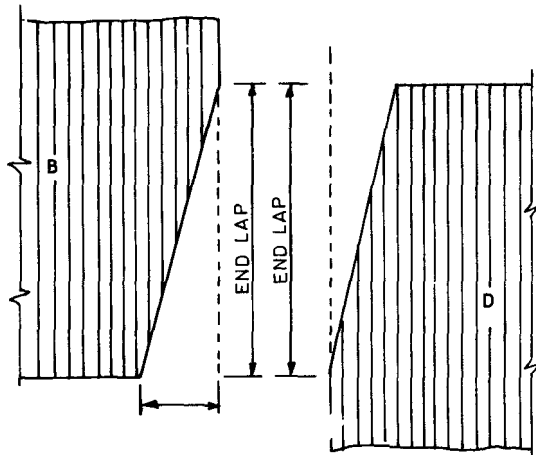


FIG. 8 LAYING OF SHEETS

corrugations. Where sheets finish against the upper or lower edge of roof glazing, they are usually secured to metal purlins by specially formed juggle bar clips being secured to the sheeting by roofing bolts. Clips should not be relied on as the principal means of fixing if other methods are possible.

## 10 FIXING OF ACCESSORIES

### 10.1 General

Moulded asbestos cement accessories should be selected as far as possible from the range of standard patterns conforming to IS 1626 ( Part 3 ). Special fittings, if required should be designed to conform closely to the sheet profile. When the use of moulded accessories is impracticable, other methods as approved by the engineer-in-charge may be employed.

10.1.1 Roofing accessories should be secured to the roof or wall cladding as far as possible, by the same bolts which secure the sheets.

### 10.2 Ridge Capping

Ridge capping should also be secured to the ridge purlins as far as possible by the same bolts which secure the sheets. Where this is not possible, each wing of the ridge capping should be adequately secured to the sheets by roofing bolts.

#### 10.2.1 Close Fitting Adjustable Ridge Capping

The close fitting adjustable ridge capping shall be designed to fit the corrugation of standard sheets laid with sidelap of half corrugation, and shall be secured with the fixing accessories used to fasten the sheets to the ridge purlins (*see* Fig. 9). Correct positioning of the sheets is necessary, and Fig. 10 illustrates how to fit each wing of the ridge when sheets are laid either from left to right or from right to left. It will be seen from the illustrations that the pitch of the corrugations at the side lap joint of roof sheets shall be 134 mm as in Fig. 1. Correct fitting of the ridge capping will be automatic, if a template is used when fixing the roofing sheets.

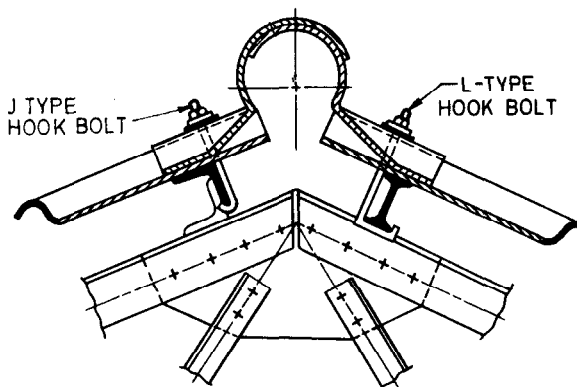
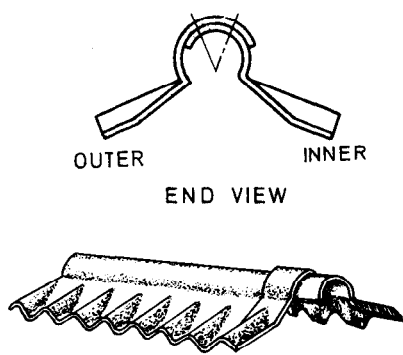


FIG. 9 TYPICAL CLOSE FITTING ADJUSTABLE RIDGE

The work shall be started from the left hand verge, placing first small roll wing inner and positioning it in such a way that the first valley on the right hand side of ridge wing fits into the valley at side lap of roof sheeting. It may be necessary to let a piece of ridge project beyond the verge whilst fitting and cut off the unrequired portion afterwards. In the case of large roll wing, the wing shall be positioned so that the first valley on the left hand side of the ridge wing fits into the valley at the side lap of the roof sheeting. The ridge wing shall be trimmed at verge to suit requirements.

#### 10.2.2 Serrated Adjustable Ridge

Serrated adjustable type ridges are supplied in pairs, the inner and the outer being made easily distinguishable (*see* Fig. 11). These ridges have certain serrations suitably painted for distinction and when fixing, these serrations shall be arranged at side lap joints of the sheets, in which case the stagger lapping of the two wings of this ridge will be automatic. Figure 12 indicates the method of laying and fixing these ridges.

10.2.3 Fixture with a typical northlight two-piece adjustable ridge is illustrated in Fig. 13.

### 10.3 Ridge Finial

One-piece ridge finial should be secured by one roofing bolt through the crown. Two-piece ridge finial should be secured to the ridge capping and roof sheeting by one bolt through each wing of the fittings; in addition, they should be secured to the ridge capping by one roofing bolt at the crown (*see* Fig. 14).

### 10.4 Hip Capping or Hip Tiles

The roof sheeting at hips should be cut to the required mitre and be close butted. The hip joint may be covered with two-piece plain wing hip tiles, (*see* Fig. 15), one-piece socketed plain wing angular hip tiles, or heavy half-round hip tiles. Alternatively, an apron type of capping may be used for scribing on site, over the

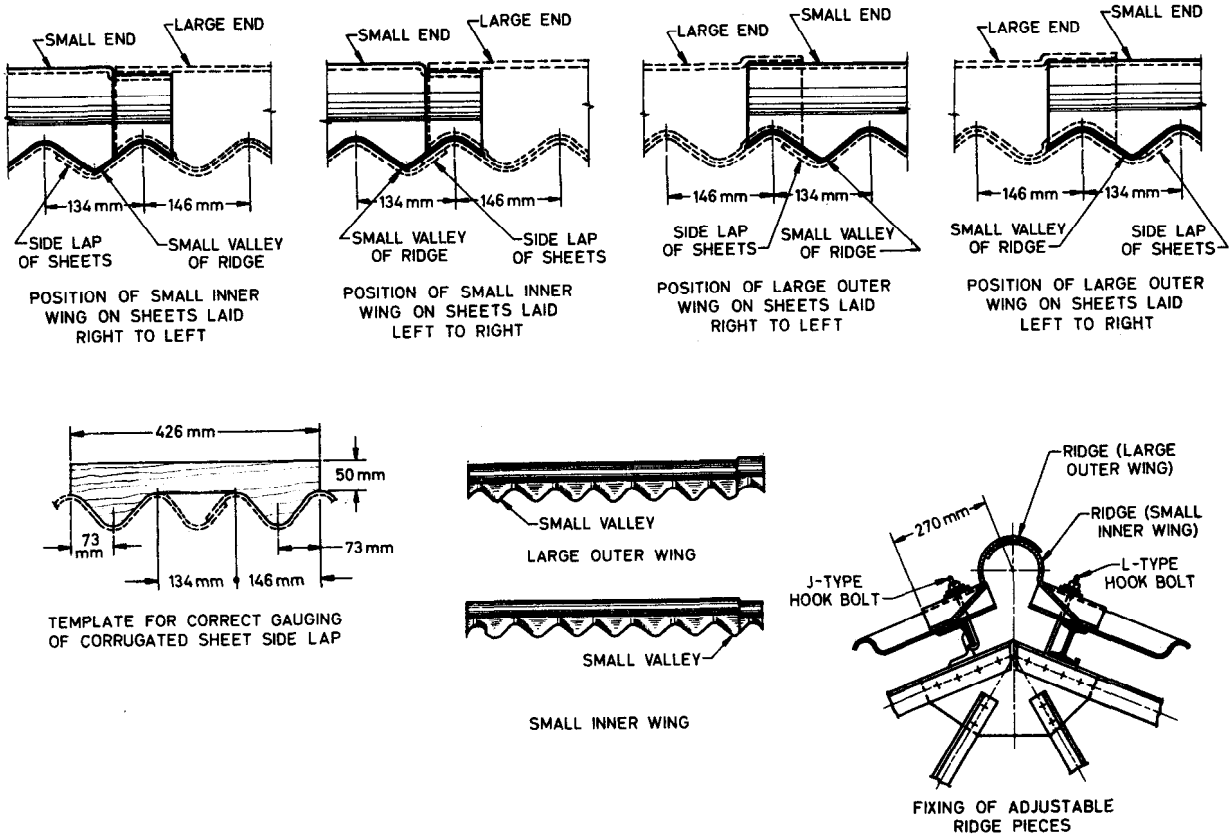
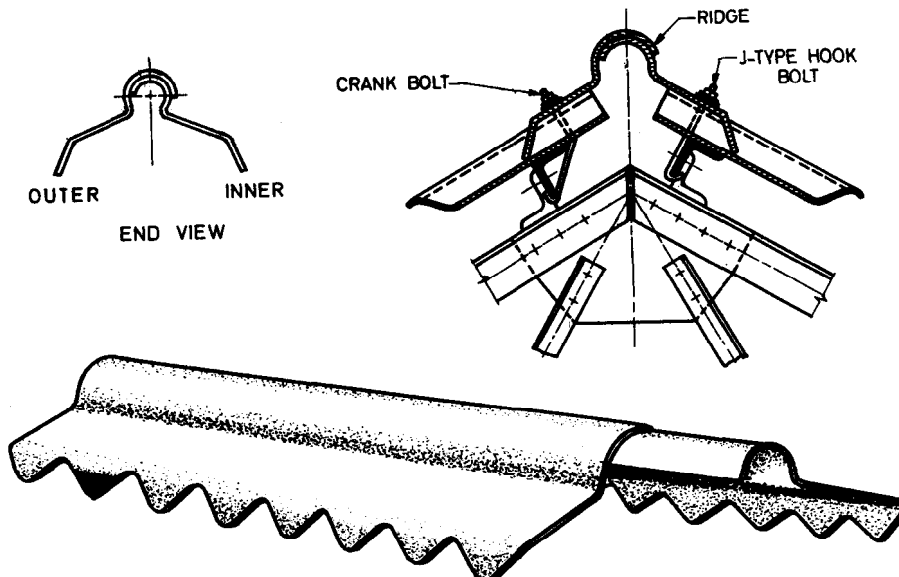


FIG. 10 DETAILS SHOWING METHOD OF FIXING CLOSE FITTING ADJUSTABLE RIDGE PIECES

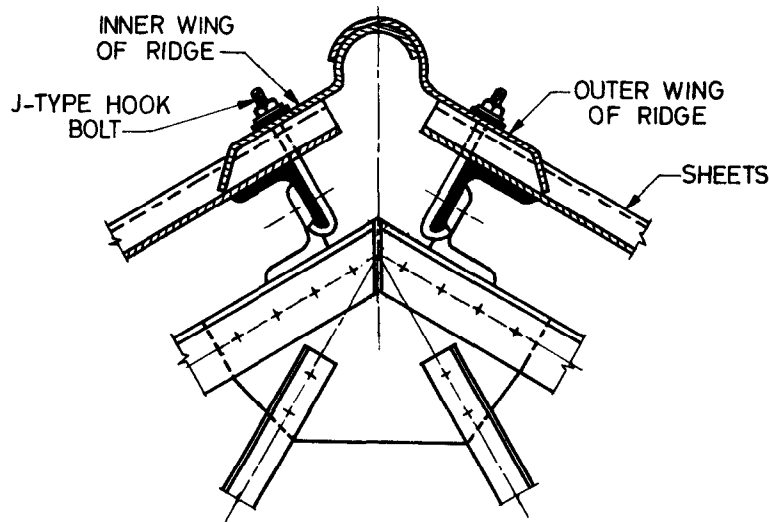
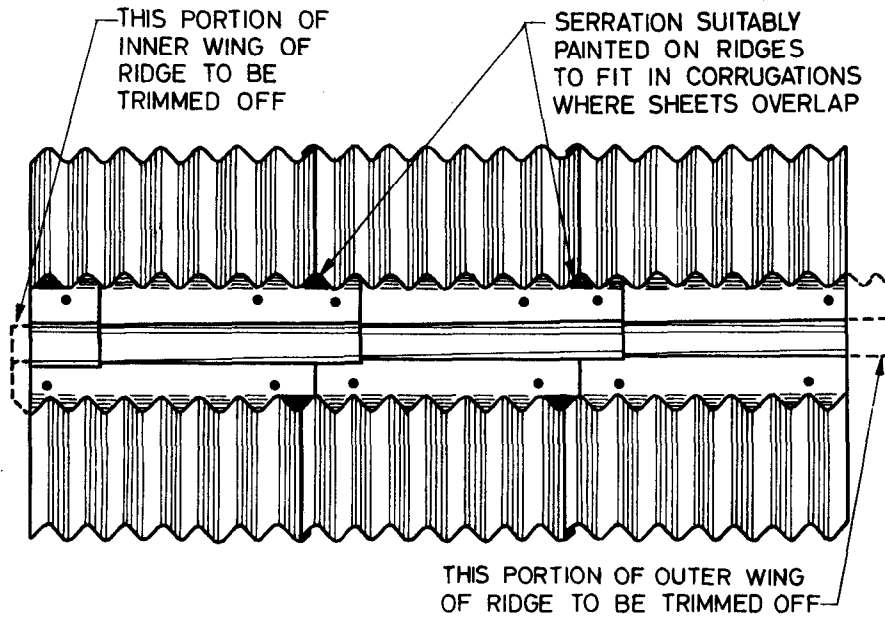


NOTE — Serrations to suit corrugated sheets conforming to IS 459.

FIG. 11 TYPICAL CORRUGATED SERRATED ADJUSTABLE RIDGES

corrugations. Where the sub-structure is of metal or concrete, the plain wing ridge should be secured through the roof sheets to the hip runners by one bolt on each side immediately above the socket. Each

half-round hip tile should be secured with a single bolt at the centre, the bolt being secured at its lower end by a metal bridging plate whose ends bear on the underside of the sheeting. On a timber roof, the hip



( Sheets laid from left to right )

FIG. 12 DETAILS SHOWING FIXING OF SERRATED ADJUSTABLE RIDGES

tile should be fixed to the rafter by means of coach screws. A neat three way mitre should be made at the intersection of the two hips with the ridge and the joint made waterproof by the provision of a lead saddle.

**10.5 Eaves, Verges and Gable Ends**

Overhanging verges should be supported by purlins for the full width of sheet. Bearing in mind that these are areas where maximum wind suction occurs, sheets should be adequately secured to withstand expected uplift. Asbestos cement accessories like eaves filler piece may be used to close the corrugations at eaves ( see Fig. 16), above glazing and at the bottom of vertical sheeting. Alternatively, sheeting at the eaves may be bedded in mortar if the walls of the building are of

brick, block, or similar construction.

**10.6 Top Edges and Abutments**

At top edges against walling, asbestos cement apron flashing pieces should generally be used ( see Fig. 17). If the wall consists of vertical sheeting, it should lap over the upstand of the flashing piece, and the apron should lap over the roof sheeting, no metal flashing is required. If however, the wall is of brick or masonry, the apron should be secured to the sheeting, and metal or felt cover flashing should be used over the upstand of the flashing piece. At a sloping abutment, if the direction of the corrugations, is parallel to or running a way from the wall face, metal or felt flashings may be used. The flashing should be dressed as an apron

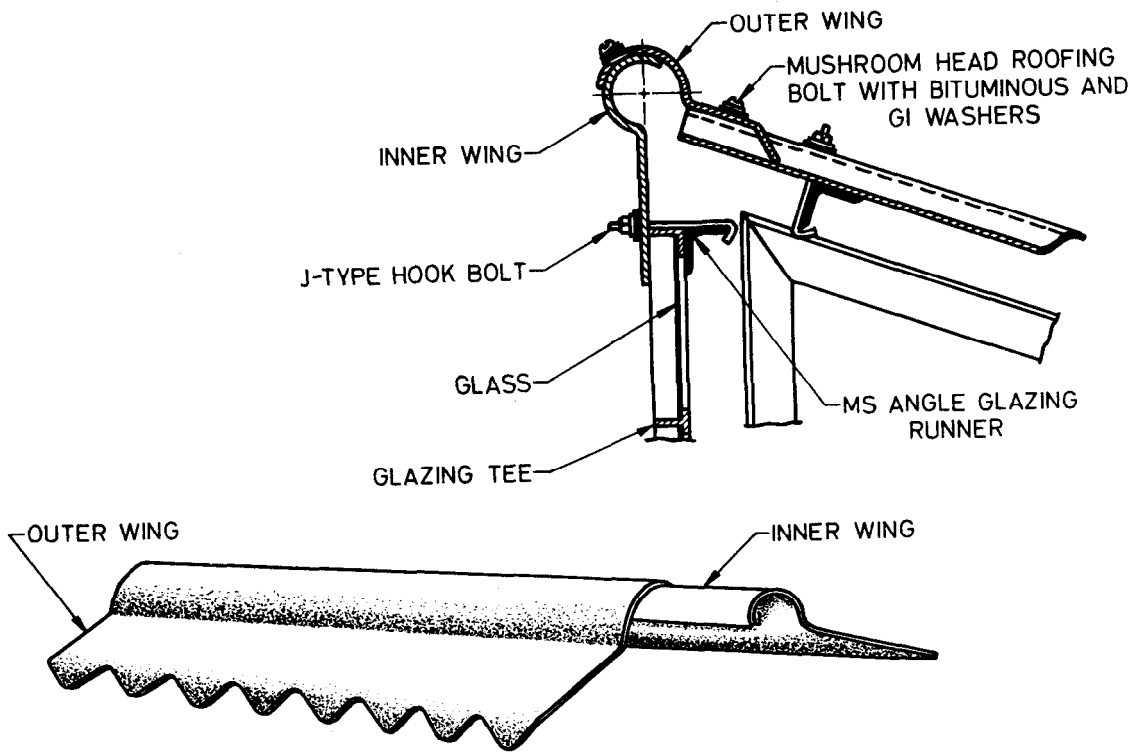


FIG. 13 TYPICAL NORTHLIGHT TWO-PIECE ADJUSTABLE RIDGE

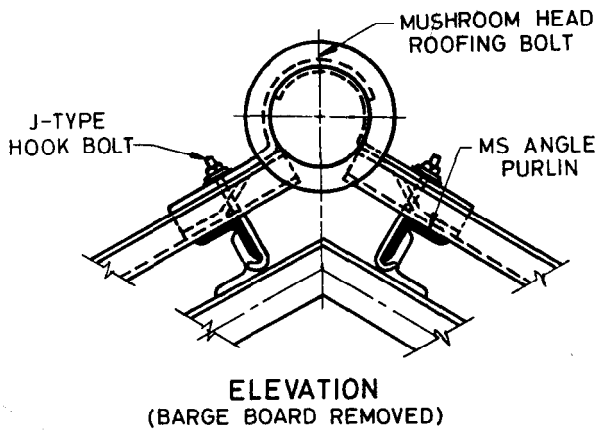
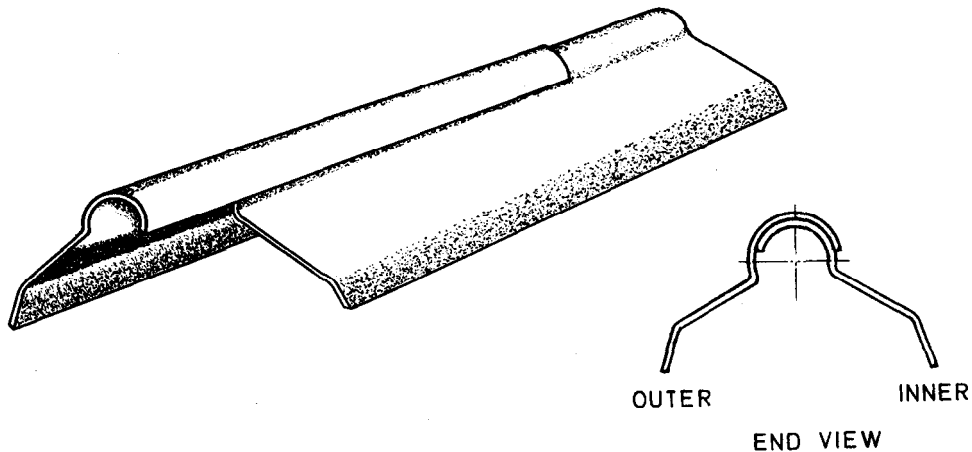


FIG. 14 TYPICAL RIDGE FINIAL



NOTE — Serrations, as desired, should be cut at site to fit corrugations at hip slopes.

FIG. 15 TYPICAL UNSERRATED ADJUSTABLE RIDGE FOR HIP

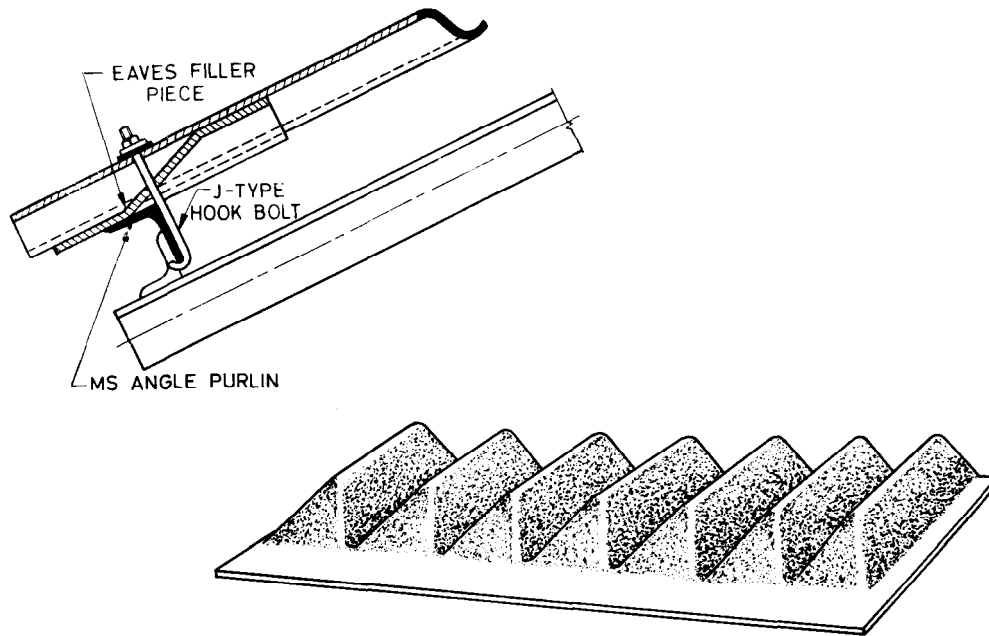


FIG. 16 TYPICAL EAVES FILLER PIECE

over the roof sheeting to cover at least the first full corrugation of the sheeting and should be not less than 150 mm wide; the upstand should be provided with cover flashing or should be turned into the secured to the wall. If the corrugations run into the wall face, the edge of the sheeting should be kept back at least 125 mm clear of the wall face and a suitable gutter should be provided.

### 10.7 Ventilators and Lights

Permanent ventilation through roofs and walls may be affected by the use of specially moulded asbestos cement accessories which include northlight curve continuous ridge ventilators, wing type ventilating ridge cappings louvres, louvres ventilators, purpose made ventilators and extractors (see Fig. 18, 19 and 20). Alternatively, if a wide continuous ventilating space at the ridge is required, the normal type of ridge capping may be omitted, the upper course of roof sheets on each slope may have up-turbed 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 standard size sheets may be used and are available as fixed skylights or as adjustable skylights (see Fig. 21 and 22). Alternatively, corrugated glass may be used.

### 10.8 Other Fittings

Other asbestos cement accessories such as corner rolls and barge board (see Fig. 23) should be secured

either to the structure or to the sheeting with the help of roofing bolts. Typical fixing method of plain wing ridge (see Fig. 24), one-piece plain angular ridge (see Fig. 25) and apron pieces (see Fig. 17) is shown.

## 11 GUTTERS AND RAIN-WATER PIPES

11.1 Gutters and rain-water pipes shall be fixed in accordance with the recommendations of relevant Indian Standard Codes of practice.

For pipes passing through roofs and walls, soaker flange sheet suitable for the different pipe diameters and roof pitches may be used. When such accessories are not suitable for the specific purpose, the positions of any necessary perforations of the sheeting should be considered in relation to the position of the end laps so that the length of flashing above the pipe outlet will not be unduly extended.

11.2 No rain-water gutter or rain-water pipe should discharge on to the sheeting.

## 12 MAINTENANCE OF ROOFING

The roof supports and roof covering shall be periodically examined. All the accumulated dust and mass shall be removed. Maintain in good condition the rain water discharge elements. Any broken units shall be replaced promptly and flashings redressed, if necessary. Roof covering which have been painted or coated to protect atmosphere shall be repaired from time to time.



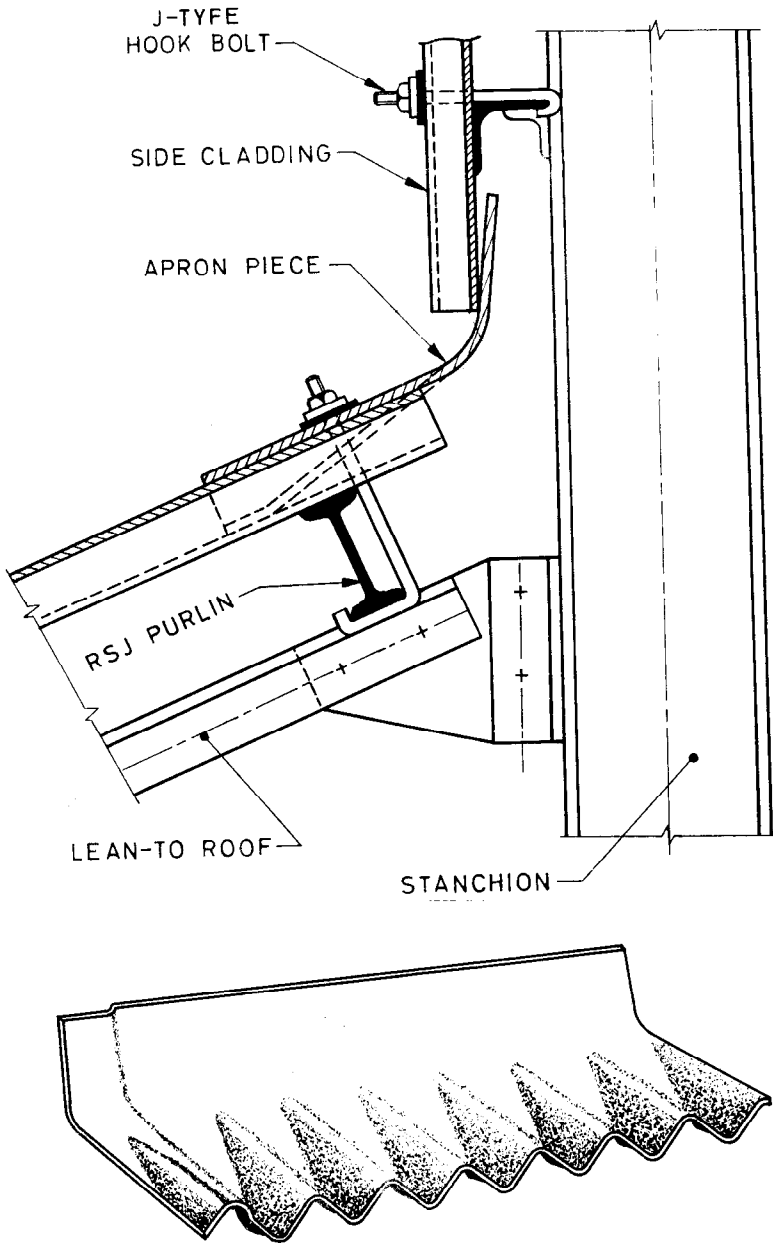


FIG. 17 CORRUGATED APRON PIECE

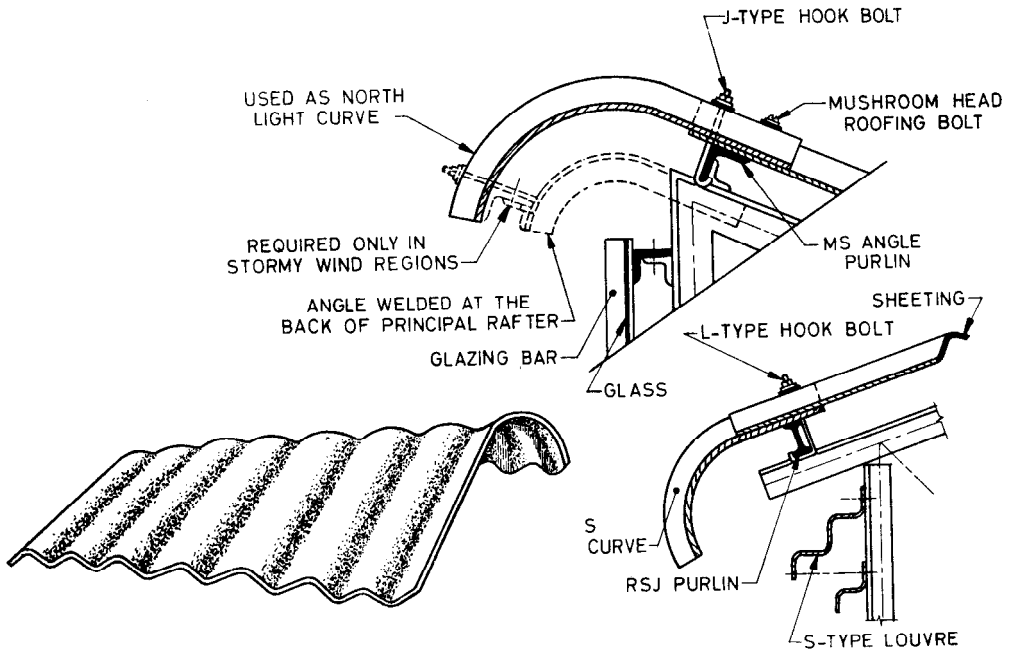


FIG. 18 TYPICAL CORRUGATED NORTHLIGHT CURVES

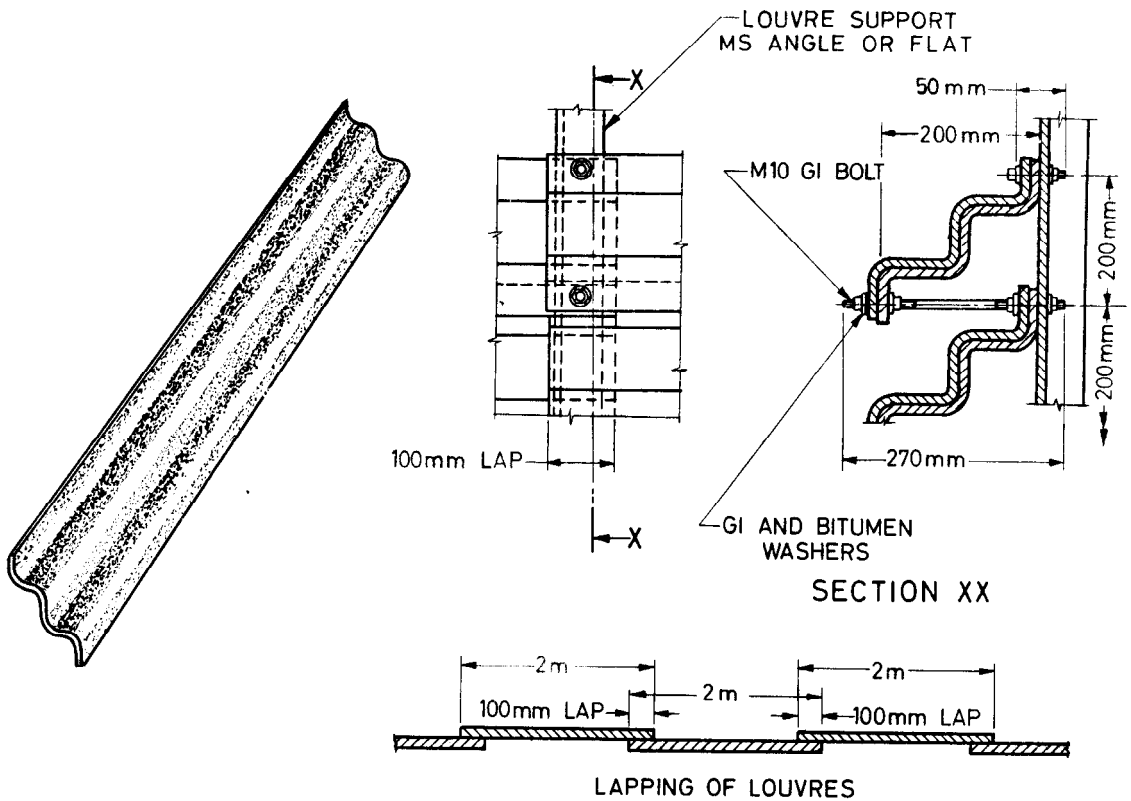


FIG. 19 TYPICAL 'S' TYPE LOUVRE

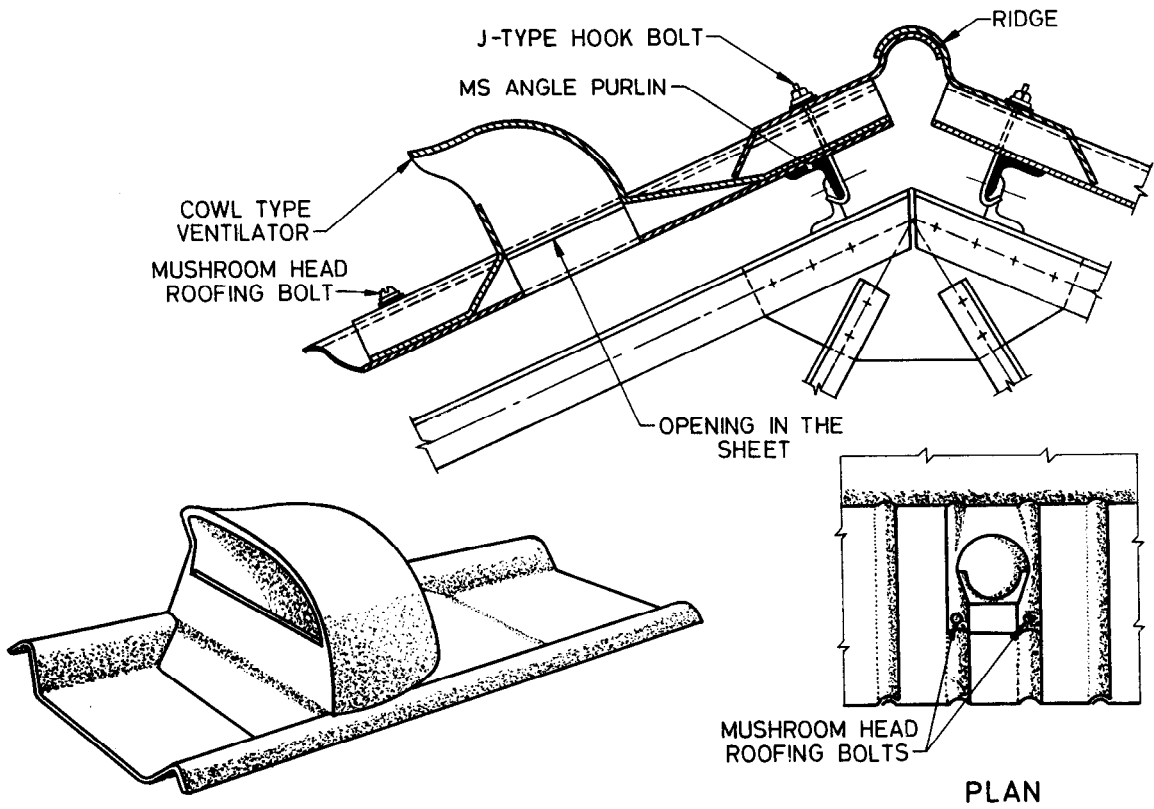


FIG. 20 TYPICAL COWL TYPE VENTILATOR

OPENING TO SUIT WIRED GLASS OF SIZES:  
680x400x6 mm OR 800x580x6 mm

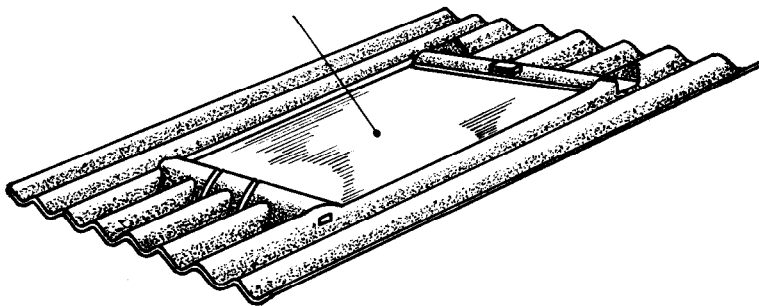


FIG. 21 TYPICAL ROOFLIGHT

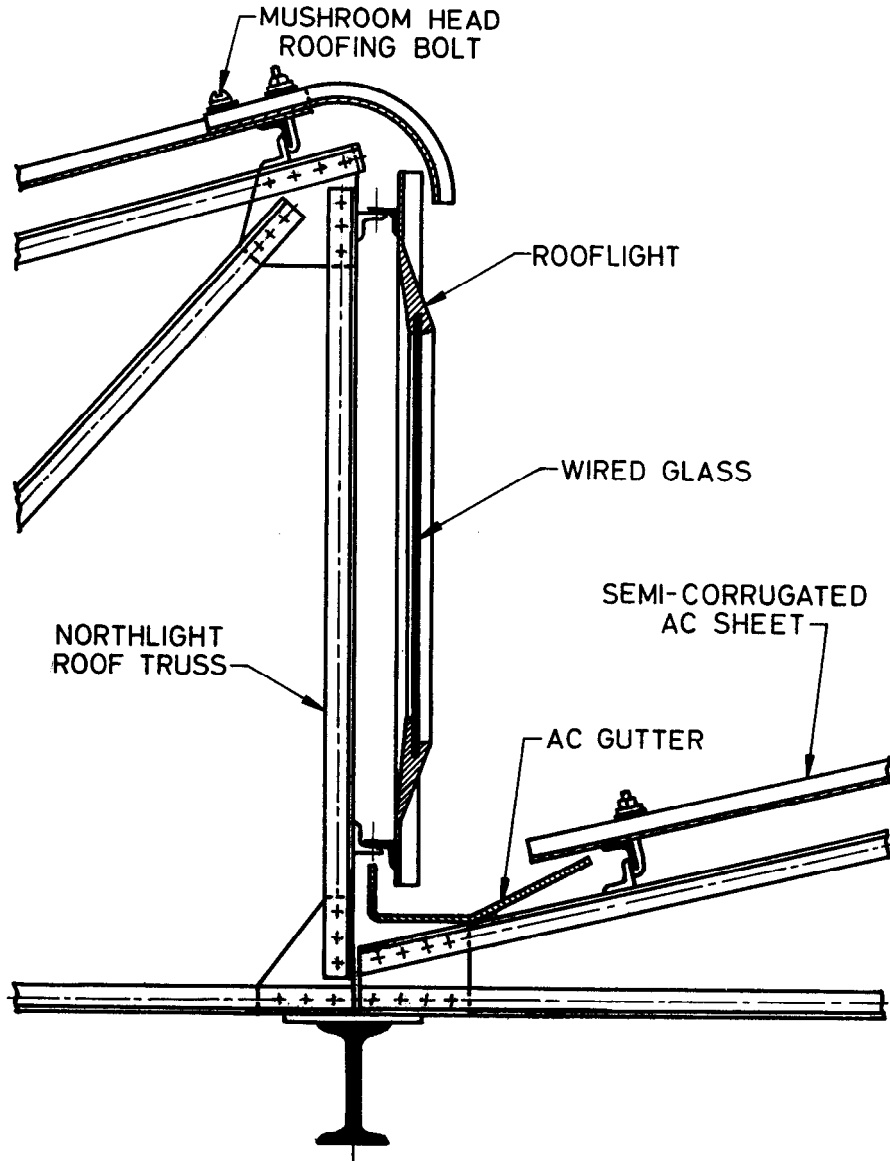


FIG. 22 TYPICAL ROOFLIGHT USED AS NORTHLIGHT GLAZING

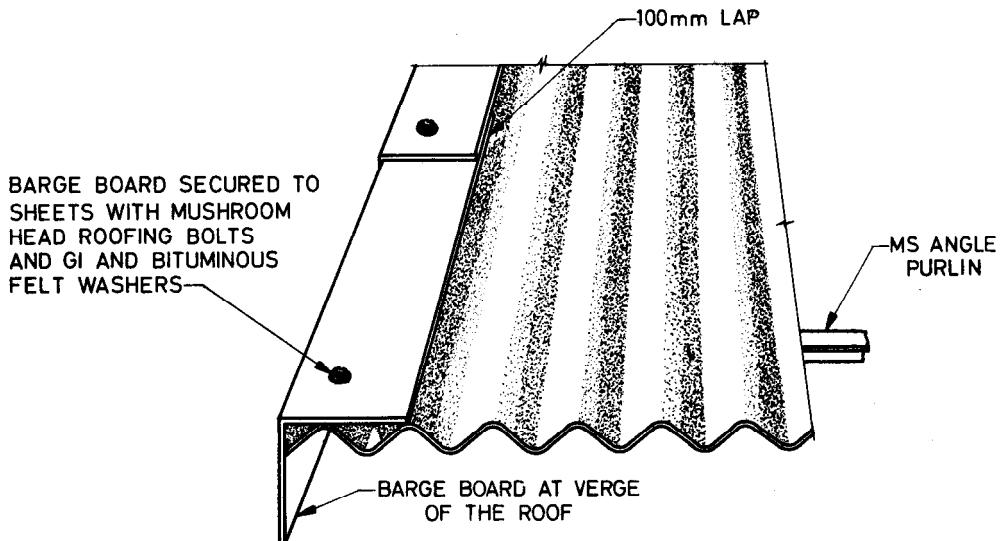


FIG. 23 TYPICAL DETAILS OF BARGE BOARD OR CORNER PIECE (VIEW FROM EAVES)

## ANNEX A

## ( Clause 2 )

## LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
459 : 1991	Specification for unreinforced corrugated and semi-corrugated asbestos cement sheets ( <i>second revision</i> )	1626 (Part 3) : 1980	Specification for asbestos cement building pipes and pipe fitting, gutters and gutter fittings and roof fittings : Part 3 Roofing accessories ( <i>first revision</i> )
730 : 1978	Hook bolts for corrugated sheet roofing ( <i>second revision</i> )	2096 : 1992	Specification for asbestos cement flat sheets ( <i>first revision</i> )
875 (Part 3) : 1987	Code of practice for design loads ( other than earthquake ) for buildings and structures : Part 3 Wind loads ( <i>second revision</i> )	2098 : 1964	Specification for asbestos cement building boards
1120 : 1975	Coach screws ( <i>first revision</i> )	11769 (Part 1) : 1987	Guidelines for safe use of products containing asbestos: Part 1 Asbestos cement products
1626 (Part 2) : 1980	Specification for asbestos cement building pipes and pipe fitting, gutters and gutter fittings and roof fittings : Part 2 Gutters and gutter fittings ( <i>first revision</i> )	13000 : 1990	Specification for silica asbestos cement, flat sheets
		13008 : 1990	Specification for shallow corrugated asbestos cement sheets

**ANNEX B**

( *Foreword* )

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SHRI J. K. PRASAD

Addl Director (Civ Engg), BIS

( *Continued on page 21* )

( Continued from page 20 )

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### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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