Everest Chrysotile Asbestos Cement Corrugated and Semi-corrugated sheets are manufactured to IS-459-1992. Dimensional details are as under:

**Corrugated**

<table>
<thead>
<tr>
<th>Thickness (Nom)</th>
<th>Overall Width</th>
<th>Laid Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 mm + Free, -0.5 mm</td>
<td>1050 mm +10 mm, -5 mm</td>
<td>1010 mm +10 mm, -5 mm</td>
</tr>
<tr>
<td>1050 mm +10 mm, -5 mm</td>
<td>1010 mm +10 mm, -5 mm</td>
<td></td>
</tr>
</tbody>
</table>

2.88 sq. m .............. Actual cover of a 3 m Sheet as laid ..... 2.91 sq. m

100 sq. m laid area requires of Sheeting (allowing for loss by side and end laps with 3 m long sheets) ............... 112.50 sq. m

109.38 sq. m .............. end laps with 1.5 m long sheets) .............. 118.74 sq. m

Weight of 100 sq. m as laid (approx) 1.36 tonnes .......... a) With 3 m sheet 1.45 tonnes .......... b) With 1.5 m sheet

1500, 1750, 2000, 2250, 2500, 2750, 3000 mm Standard lengths +5 mm, -10 mm

Natural grey* .......... Colours available .......... Natural grey

* Also available in other colour options like Teracotta, Off-white and Green.
Other Technical Data

Corrugated Semi-Corrugated

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trafford</td>
</tr>
<tr>
<td>48(^{\frac{3}{4}}) mm</td>
<td>Depth of the Corrugation (Over All)</td>
</tr>
<tr>
<td>146 mm</td>
<td>Pitch of the Corrugation</td>
</tr>
<tr>
<td>27.3 mm</td>
<td>Neutral axis from bottom</td>
</tr>
<tr>
<td>205 Cm(^4)</td>
<td>Moment of Inertia (I) about Neutral axis</td>
</tr>
<tr>
<td></td>
<td>Section modulus (Z)</td>
</tr>
<tr>
<td>75 Cm(^3)</td>
<td>(a) Rough Side under tension</td>
</tr>
<tr>
<td>83 Cm(^3)</td>
<td>(b) Smooth side under tension</td>
</tr>
<tr>
<td>130 Kg/Cm(^2)</td>
<td>Permissible bending stress</td>
</tr>
<tr>
<td>1400 mm</td>
<td>Purlin Spacing (Max.)</td>
</tr>
<tr>
<td>1700 mm</td>
<td>Spacing of Rails for side cladding (Max.)</td>
</tr>
<tr>
<td>150 mm</td>
<td>Horizontal lap (Min.)</td>
</tr>
<tr>
<td>300 mm</td>
<td>Maximum free Overhang</td>
</tr>
</tbody>
</table>

Unit Weight in M. Tonne

<table>
<thead>
<tr>
<th>Sheets</th>
<th>Corrugated</th>
<th>No. Per Tonne</th>
<th>Semi-Corrugated Trafford</th>
<th>No. Per Tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.50 m</td>
<td>0.019650</td>
<td>48</td>
<td>0.018386</td>
<td>51</td>
</tr>
<tr>
<td>1.75 m</td>
<td>0.022925</td>
<td>41</td>
<td>0.021450</td>
<td>43</td>
</tr>
<tr>
<td>2.00 m</td>
<td>0.026200</td>
<td>36</td>
<td>0.024514</td>
<td>38</td>
</tr>
<tr>
<td>2.50 m</td>
<td>0.032750</td>
<td>28</td>
<td>0.030643</td>
<td>30</td>
</tr>
<tr>
<td>3.00 m</td>
<td>0.039300</td>
<td>24</td>
<td>0.036771</td>
<td>25</td>
</tr>
<tr>
<td>Per Sq.M.</td>
<td>0.012476</td>
<td></td>
<td>0.011143</td>
<td></td>
</tr>
<tr>
<td>Per R.M.</td>
<td>0.013100</td>
<td></td>
<td>0.012257</td>
<td></td>
</tr>
</tbody>
</table>

Table 1

<table>
<thead>
<tr>
<th>Covering width</th>
<th>Corrugated</th>
<th>Semi Corrugated (Trafford)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.05 metres</td>
<td>1.10 metres</td>
</tr>
<tr>
<td>2</td>
<td>2.06 metres</td>
<td>2.11 metres</td>
</tr>
<tr>
<td>3</td>
<td>3.07 metres</td>
<td>3.13 metres</td>
</tr>
<tr>
<td>4</td>
<td>4.08 metres</td>
<td>4.14 metres</td>
</tr>
<tr>
<td>5</td>
<td>5.09 metres</td>
<td>5.16 metres</td>
</tr>
<tr>
<td>6</td>
<td>6.10 metres</td>
<td>6.17 metres</td>
</tr>
<tr>
<td>7</td>
<td>7.11 metres</td>
<td>7.18 metres</td>
</tr>
<tr>
<td>8</td>
<td>8.12 metres</td>
<td>8.20 metres</td>
</tr>
<tr>
<td>9</td>
<td>9.13 metres</td>
<td>9.21 metres</td>
</tr>
<tr>
<td>10</td>
<td>10.14 metres</td>
<td>10.23 metres</td>
</tr>
<tr>
<td>20</td>
<td>20.24 metres</td>
<td>20.37 metres</td>
</tr>
<tr>
<td>25</td>
<td>25.29 metres</td>
<td>25.44 metres</td>
</tr>
<tr>
<td>30</td>
<td>30.34 metres</td>
<td>30.51 metres</td>
</tr>
<tr>
<td>40</td>
<td>40.44 metres</td>
<td>40.65 metres</td>
</tr>
<tr>
<td>50</td>
<td>50.54 metres</td>
<td>50.79 metres</td>
</tr>
<tr>
<td>60</td>
<td>60.64 metres</td>
<td>60.93 metres</td>
</tr>
</tbody>
</table>

The above table will assist in estimating Sheet coverage for Everest Sheets and also applicable to corresponding:
1) Ridge Cappings (No. in pairs) 2) Apron Pieces (No. in lengths) 3) Eaves Filler Pieces (Butt-joined) (No. in lengths) 4) Northlight and Ventilator Curves (No. in lengths).

Table 1 shows horizontal length covered
Laying and Fixing of Everest Chrysotile Asbestos Cement Roofing Sheets and Accessories.
(For details please refer to IS : 3007 - Part I & II 1999, “Laying of Asbestos Cement Sheets - Code of Practice”).

A. Corrugated Sheets

1) Before the actual laying of sheets is started, the purlin spacing and the length of the sheets should be checked to ensure that the arrangement of sheets will provide the end lap required and the specified overhang at the eaves and at the ridge.

2) The sheets should be laid with the smooth side facing the weather and the side and end laps as given in Diagram A & B on page 9. The sheets shall be so laid that the corrugations run in continuous straight lines and at right angles to the purlin.

3) Asbestos Cement Corrugated Sheets are normally laid from left to right starting at the eaves (see diagram C on page 9). The first sheet should be laid uncut, but the remaining sheets in the bottom row should have the top left hand corner cut or mitred. The sheet in the second and other intermediate rows should have the bottom right hand corner of the first sheet cut; all other sheets except the last sheet should have both the bottom right hand corner and top left hand corner cut. The last sheet should have only the top left hand corner cut. The last or top row sheets at ridge should all have the bottom right hand corner cut with the exception of the last sheet, which should be laid uncut. Depending upon the prevailing direction of wind, if the sheets are laid from right to left, the whole procedure should be reversed.

4) The mitre described above, is necessary to provide a snug fit where four sheets meet at a lap. It is cut from a point 150 mm (or whatever the length of the end-lap may be) up the vertical side of the sheet, 40 mm along the horizontal edge (or whatever the width of the side lap may be). This cutting can be done with an ordinary wood saw at site.

   a. Alternatively the sheets may be laid in staggered manner.

   b. The first row of sheets, starting from eaves should be laid uncut. In the second row of sheets, the first sheet is laid by staggering two corrugations. These corrugations may be cut off. The third row of sheets are laid similar to the first row. The joints are automatically staggered.

There will be one bolt extra in staggered laps. The top most layer of sheets, should be full width. Where BS 2 ridges and northlight curves are used, this method of laying sheets is not suitable. But, as far as possible, laying of corrugated sheets by Staggering Method should be avoided.

5) The ends of all sheets at the eaves should be supported and the support should be placed as near the margin of the sheets as practicable. The maximum free overhang of the sheets at the eaves should not be more than 300 mm.
6) At least 8 mm diameter hook bolts, crank bolts or square head coach screws; should be inserted through 10 mm diameter drilled holes on the crown of the corrugation. The hole should be covered by a bitumen washer (presently some more improved variety of soft washers are available in neoprene, PVC, rubber, PVC caps, etc.) touching the sheet, with the galvanised iron washer bearing on the other face and pressing the bitumen washer, when tightened by a galvanized iron nut or by the head of the coach screw.

Diagram C

Everest Corrugated Sheets Laid from Left to Right

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

TABLE I

To calculate number and length of bolts required at each purlin for Corrugated Sheets:

<table>
<thead>
<tr>
<th></th>
<th>No. of bolt</th>
<th>length of bolt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) At laps where four sheets/accessories meet:</td>
<td>N x 2</td>
<td>D + 90 mm</td>
</tr>
<tr>
<td>2) Single A.C. Sheet, at intermediate eaves purlins</td>
<td>N x 2</td>
<td>D + 75 mm</td>
</tr>
</tbody>
</table>

N = Number of sheets in a row
D = Depth of purlin in mm.
7) One bolt or screw should be used on each side of the side lap (see diagram A & B on page 9. This distance between bolts should be maintained at all places which will permit easy fixing of Ridges, Northlight Curves and other Chrysotile Asbestos Cement Roofing Accessories. This will also ensure that the side lap is weather-tight. It is recommended to use a template as shown on page 9 to maintain uniformity of laps. Nuts or screws should be tightened lightly at first and then tightened when a dozen or more sheets have been laid. On no account shall the fixing screws or nuts on fixing bolts be screwed down too tightly and at intermediate purlins it should not be tightened in an attempt to make the sheets bear on the purlins.

8) A cat-ladder or roof board should always be used by men working on the roof for safety which would avoid damage to the sheets and provide security to workmen. This precautionary measure is absolutely necessary.

9) All new roofing work or repair work on the roof including fixing of roofing accessories, gutters, gutter accessories should be carried out, using the cat-ladder.

10) While using sheets for side cladding start from bottom in the manner as shown in diagram C on page 9. The maximum overhang at the bottom purlin shall not exceed 300 mm. Mitring of intermediary sheets where four sheets meet is essential for making it weather proof.
B. Semi-Corrugated (Trafford) Sheets

1) The sheet should be laid with the smooth side upwards. All sheets have one end marked “TOP” on the smooth side of the sheet. This end must always point towards the ridge.

Asbestos Cement Semi-Corrugated Sheet should be laid from right to left, starting at the eaves. The first sheet should be laid uncut, but the remaining sheets in the bottom row should have the top right hand corners cut or mitred. The sheets in the second and other intermediate rows should have the bottom left-hand corner of the first sheet cut; all other sheets except the last sheet should have both the bottom left-hand corner and the top right-hand corner cut; the last sheet should have only the top right-hand corner cut. The last or top row sheets should all have the bottom left-hand corners cut with the exception of the last sheet which shall be laid uncut. Depending upon the prevailing direction of the wind, if the sheets are laid from left to right, the whole procedure should be reversed.

<p>| TABLE II |
|---------------------------------|------------------|-------------------------|</p>
<table>
<thead>
<tr>
<th>To calculate number and length of bolts at each purlin for Semi-corrugated (Trafford) Sheets:</th>
<th>No. of bolt</th>
<th>Length of bolt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) At laps where four sheets / accessories meet</td>
<td>2 N + 1</td>
<td>D+90 mm</td>
</tr>
<tr>
<td>2) At laps where two sheets/ accessories meet</td>
<td>N+2</td>
<td>D+75 mm</td>
</tr>
<tr>
<td>3) Single sheet at ridge and eaves</td>
<td>2N+1</td>
<td>D+75 mm</td>
</tr>
<tr>
<td>4) Intermediate purlin</td>
<td>N+1</td>
<td>D+75 mm</td>
</tr>
</tbody>
</table>

N = Number of sheets in a row
D = Depth or purlin in mm.
C. Roofing Accessories

A standard range of Roofing Accessories, is manufactured to suit and match Corrugated and Semi-Corrugated Sheets with ½ corrugation side lap. Special fittings, other than the standard range can be designed to conform to the sheet profile, for which dimensional drawings, considering the fixing and -lapping etc., may be sent to our Zonal Offices.

Roofing Accessories are hand moulded and their strength is not defined by national and international standard. They should not be considered as load bearing elements of building structures and should be secured to the roofing sheets or wall cladding, as far as possible, by the same bolts which secure the sheets.
Roofing Accessories

The nomenclature for roofing accessories for corrugated sheets starts with BS whereas for semi corrugated sheets it starts with TS except for items like TS3, TS4, TS11 and TS17.

Close Fitting Adjustable Ridges: BS.2

These are available in pairs and have socketed ends. A specially designed small valley of each wing should be placed at the side lap of sheets for snug fitting of ridges. This is suitable for a roof where sheets are laid with half corrugation side lap only.

Fixing:

Correct positioning of the sheets is necessary. This diagram illustrates how to fit each wing of the ridge when the sheets are laid either from left to right or right to left. It will be seen from the illustrations that the pitch of the corrugations at the sidelap joint of roofing sheets should be 134 mm. If a template is used, when fixing the roofing sheets, correct fitting of the ridge capping will be automatic (see diagram on page 12).

The laying of ridges shall be started from the left hand verge of the roof. First place the Small Roll Wing R1 (inner) and position the wing so that the first small valley on the right hand side of the ridge wing fits into the valley at the side lap of the roof sheet. It may be necessary to let a piece of the ridge project beyond the verge while fitting, afterwards this portion may be cut off.

The Large Roll Wing R2, (outer) should be positioned so that the first small valley on the left hand side of the ridge wing fits into the valley of the side lap of the roof sheet. The ridge wing is trimmed at the verge to suit requirements.
Corrugated Serrated Adjustable Ridge. BS.10

They are supplied in pairs and are used for Corrugated Sheets. One of the corrugation tip is painted black to register with the valley of side lap of the sheet.

Fixing:

This ridge is available without socketed ends. When the black tip is placed at the side lap of the sheets, the stagger lapping of the two wings is automatic. The end of the roll of each wing of the ridge is designed to snug fit the other when laid.

The laying of the ridge is started from one end of the building. The first (inner) wing R1 should be placed in such a way that the black tipped serration is located in the first side lap of the roofing sheet. The second R1 (inner) wing when placed should keep its black tipped serration in the second side lap of the roofing sheet, and will lap over the black tip of the first R1 wing. Ridge wings overhanging from the verge are to be cut off. Simultaneously, the other wing (outer) R2 is laid, keeping its black tipped serration in the side lap of the roofing sheets, on the other slope. The ridge is secured with the same bolt which is used on the roofing sheet at the ridge purlin. In a case the ridge purlin is at a distance, the ridge is stitched with a mushroom headed roof bolt on the crown of the sheet.
Semi-Corrugated Serrated Adjustable Ridge. TS.2

They are supplied in pairs and are used for Semi-Corrugated (Trafford) sheets.

Fixing

The laying method is as follows:

1. Start at the right laying 3 or 4 R1’s first.
2. Serrations of each should register with the sheets underneath.
3. Each R1 will overlap end of the next by 100 mm.
4. Fix corresponding number of R2s starting at the same end on the slope.
5. 100 mm of the first R2 will overhang at the verge, and this should be cut off by a wood saw.
6. Each R2 Roll must fit its corresponding R1 Roll snugly.
7. Each R2 will overlap end of the next by 100 mm.
8. The fixing accessories holding the top sheets to the top purlins on each slope should also hold the ridges.
9. In a case where the ridge purlin is at a distance, the ridge is stitched with a mushroom headed roof bolt on the crown of the sheet.
Plainwing Adjustable Ridge. TS.4

They are supplied in pairs and are suitable for both types of sheets. This ridge permits a small ventilation space between flat of the ridge and the valley of the roofing sheet.

It is essential that the entire flat wing of ridge rests on the sheet.

The fixing of this ridge is done with the same bolt that is used on the ridge purlin for the roofing sheets. The ridge should be staggered when laid, to get a snug fit of the ridge Roll. Each ridge should be laid with 100 mm end lap.

One Piece Plain Angular Ridge TS.17

This ridge is used with both type of sheets. This ridge also permits a small ventilation space between flat of the ridge and the valley of the roofing sheet.

The fixing is done with the same bolt that is used for the roofing sheet at ridge purlin, however a stitch bolt may be used, where the purlin is at a distance. Each ridge should be laid with 100 mm end laps.
Corrugated Northlight Two-Piece Adjustable Ridge BS.5.

They are supplied in pairs. The outer wing has matching serrations for Corrugated Roofing Sheets and the other is plain, covering the vertical portion of the glazing.

Fixing

The outer wing of the ridge is fitted with a seam bolt to the roofing sheet. If the bolt fitted to the roofing sheet at the ridge purlin can be used for fixing this ridge wing, it may be utilised.

The Inner plain wing should lap the glazing and can be fitted with a hook bolt to the top runner to which the glazing is fixed. Any other metal runner of the glazing if suitably placed where the lapping is possible, may be utilised.

The Roll of the Inner and Outer ridges are bolted with a seam bolt when final adjustments in the ridge wings are completed.

In case of Corrugated Roofing Sheets where this type of ridge is used, the black painted tip of the Outer wing ridge has to be placed in the side lap of the roofing sheets. This will ensure a snug fit to the entire line of the ridge.

The end lap of inner wings should be 100 mm. R1 and R2 wings should be staggered for snug fit.
Semi-Corrugated Northlight Two-Piece Adjustable Ridge. TS.5

They are supplied in pairs. The outer wing has matching serrations for Semi-Corrugated (Trafford) Roofing Sheets and the other is plain, which covers the vertical portion of the glazing.

Fixing

The outer wing of the ridge is fitted with a seam bolt to the roofing sheet. If the bolt fitted to the roofing sheet at the ridge purlin can be used for fixing this ridge wing, it may be utilised.

The Inner plain wing should lap the glazing and can be fitted with a hook bolt to the top runner to which the glazing is fixed. Any other metal runner of the glazing if suitably placed where the lapping is possible, may be utilised.

The Roll of the Inner and Outer ridges are bolted with a seam bolt when final adjustment in the ridge wings is completed.

Unserrated Adjustable Ridge for Hips. TS.3

They are supplied in pairs and used to cover hips of roof. The serrations as desired should be cut at site to fit corrugations at hip slopes.

Fixing

On the hip formation in the slope of a roof, the corrugations of the sheets are not uniform. This should be covered with Unserrated Adjustable hip ridges. The corrugations are marked on site and cut to sit snugly on the sheet. The ridges are fixed with hook bolts that are used for fixing the sheets at hips, or seam bolts are used.
Corrugated Northlight Curves. BS.9

They are used at the apex of a Northlight roof. The curved portion protects the glazing from sun & rain.

Fixing:

The Corrugated Northlight Curves are always laid from left to right (facing eaves) so that the down corrugation of the left end of the curve, laps onto the upturned corrugation of the right hand end of previously laid curve.

When Corrugated Roofing Sheets are laid from left to right, the Northlight Curves are also laid similarly and hence the mitring also has to be done.

When Corrugated Sheets are laid from right to left, the Northlight Curves which are required to be laid from left to right, are staggered. Thus, the mitring is not done and the side lap between Northlight Curves do not fall at the side laps of roofing sheets.

The straight portion of Northlight Curves resting on the rooting sheet is fixed with the same bolt that is used for securing the roofing sheet. In addition to this, an extra seam bolt should be used to stitch the flat portion of the Northlight Curves to the roofing sheets.

When the roof is at a height or the building is in a region of high winds and storm conditions, it is necessary to protect the overhanging curved ends of the Northlight Curves by providing an additional purlin at the curved edge.
Corrugated-Ventilator Curve BS.9

The Corrugated Ventilator Curve is the same article that is called a Northlight Curve.

Fixing

The Corrugated Ventilator Curves are fitted from right to left, facing eaves. Mitring is necessary when roofing sheets are also laid from right to left; treating the Curves as another row of sheet.

In the case where roofing sheets are laid from left to right, the Ventilator Curves are required to be laid from right to left and the side lapping between Curves are staggered and mitring is not necessary.

Semi-Corrugated Northlight Curve TS.9

They are used at the apex of a Northlight roof and fitted on the sheets giving protection to the glazing from sun & rain.

Fixing:

The Semi-Corrugated Northlight Curves are laid from right to left. They have the large corrugation on the right side and hence it covers up the small left hand corrugation of the previously laid Northlight Curve.

When the sheets are laid from right to left, the Northlight Curves are also laid from right to left. The end laps should be mitred, treating Northlight Curves similar to the sheets.

Where roofing sheets are laid from left to right, the Northlight Curves are staggered, but laid from right to left, in which case the mitring is not necessary.
Semi-Corrugated Ventilator Curve. TS.18

They are used at the eaves end of a building and fitted under the sheets giving protection to ventilators near the eaves.

Fixing:

Ventilator Curves are fitted to the eaves purlin of the roof with the same bolt that is used for fixing the roofing sheet. They are fitted under the last sheet at eaves.

The Semi-Corrugated Ventilator Curves are laid from left to right. Mitring is required to be done when roofing sheets are also laid from left to right.

Where the roofings sheets are laid from right to left, the side laps of the Ventilator Curves are staggered and not positioned under the side lap of the roofing sheet, in which case mitring is not necessary.

Corrugated Apron Piece. BS.3-112.6°

It is used for covering the angle formed between the sloping roof with vertical cladding, glazing or walling.
Semi-Corrugated Apron Piece. TS.10-112.6°
Suitable for Roof Slope of 18° to 21°

In the Semi-Corrugated Apron flashing piece, there is no socketed end. Side laps between adjoining pieces are automatic as corrugation are registered over the roof sheeting.

Fixing:
Apron flashing pieces are available for Corrugated and Semi-Corrugated Sheets and both are laid from Left to Right, facing eaves. The plain end of the apron piece is located behind the vertical cladding sheet, or glazing; and touching the inner surface. There should not be any gap left between them, which would permit rainwater from splashing in.

The other end with corrugations should be laid over the roofing sheet and the fixing done with the same bolt used for the roofing sheet. However, a stitch bolt may be used when this is not possible.

In case of the Corrugated Apron flashing piece, one end is socketed and has a small corrugation at the other end. This corrugation shall be placed at the side lap joint of the sheet for snug fitting of Apron pieces to the roof sheets. The socketed end covers the adjoining piece and provides a lap.

These Apron Pieces are used with roof slope between 18° to 21°. Other angles can be manufactured against special orders.

Eaves Filler and Flashing Piece
This is used to prevent rain water splashing inside the building from gutter. When gutters are given slope, the gap between roofing sheet and gutter increases. This article covers this gap and also closes the gap between corrugations of sheet and the purlins.
Eaves Boards:
This is a similar article as Eaves Filler Flashing Piece. It has a longer flat end. It is used at free end of the Eaves. The fixing is similar to the Eaves Filler Flashing Piece.

Corrugated Eaves Filler Piece. BS.4

Semi-Corrugated Eaves Filler Piece. TS.8
These are used for closing the corrugations at eaves. They are butt joined and fitted under the sheets at eaves purlin with the same bolt which is used for fixing the sheet. This prevents entry of birds.

Bargeboard/Cornet Piece TS.6
These are used to finish the verges of the roof. They are also used to finish corners of Asbestos Cement Sheet walling.
Fixing:

When Barge Boards are fitted to sloped roofing sheets, the underlap of the Barge Boards should butt against the overlapping of the sheets. They are placed on the top of the sheets and fixed with seam bolts. The end laps of the Barge Board should be equal to 150 mm. The spacing of bolts should be kept at 450 mm. When Barge Boards are fitted with a Ridge Finial, the finial is placed over the Barge Board and bolted, so that Finial, Barge Board and Roofing Sheets are held together. The direction of end laps should be similar to the roofing sheets.

The fixing of Corner Pieces to the corner of buildings with AC Sheet cladding is also similar. Seam Bolts are used on both the wings to fix the Corner Pieces to the Sheet Walling. The end laps of Corner Pieces should be 150 mm.

Curved Bargeboards for Northlight Curves
Left Hand TS.15 - BS.15
Right Hand TS.16 - BS.14

These are used at the gable end of Northlight roof. It is shaped to match with Northlight Curves.

These Barge Boards are available with left hand and right hand. This is ascertained by facing the eaves. Both these are fitted to North Light roofs, similar to Barge Boards; with seam bolts. The end lap with straight Barge Boards should be 150 mm.
‘S’ Type Louvre BS.13

These louvres are available in three lengths 3 m/1.83 m & 1.75 m. The vertical surface of a building through which the ventilation is required is attained by using rows of ‘s’ type louvres. This is common in Monitor and North Light roofs. The spacing between each row is uniformly achieved by keeping equal spacing between fixing bolts.

In a situation where there is a possibility of rain water directly entering the ventilator, a sheet louvre baffle may be designed which gives protection against this, at the same time ‘S’ type louvres provide necessary ventilation. The end lap between louvres is 100 mm and shall always be located at vertical supports. For 3 m long louvres additional vertical support should be provided in the centre. The top end of the top-most row of ‘S’ type louvres is fitted to supports with 50 mm long, 6 mm diameter bolts and nuts with bitumen washer and GI washer on the external surface. All other fixing bolts are 270 mm long having 10 mm diameter. They are used between two rows of ‘S’ type louvres. One end of the bolt secures the louvre to the vertical support, and the other holds the lower end of the louvre above.

Line diagram Showing Lapping of Louvre and Supports.
Corrugated Rooflight-CABR & ABR

Rooflights integral with roofing sheets are available and suitable for use at 1.35 m purlins centres only.

<table>
<thead>
<tr>
<th>Length*</th>
<th>Size of wired glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABR</td>
<td>1.50 m 800 mm x 580 mm x 6 mm</td>
</tr>
<tr>
<td>ABR</td>
<td>1.83 m 1130 mm x 580 mm x 6 mm</td>
</tr>
</tbody>
</table>

* Also available in 1.6 m length to suit 1.4 m purlin spacing.

Semi-Corrugated Rooflight-CATR & ATR

<table>
<thead>
<tr>
<th>Length*</th>
<th>Size of wired glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATR</td>
<td>1.50 m 800 mm x 580 mm x 6 mm</td>
</tr>
<tr>
<td>ATR</td>
<td>1.83 m 1130 mm x 580 mm x 6 mm</td>
</tr>
</tbody>
</table>

* Also available in 1.6 m length to suit 1.4 m purlin spacing.

Rooflights

Rooflights are used to obtain light from the roof. They can also be used in a northlight roof for north light glazing. The design of the rooflight is such that there is a channel formation below the glass, which drains off the water collected during the rain. It is let out through a weep hole provided in the rooflight at the bottom end.
Fixing

Rooflights for Corrugated and Semi-Corrugated Sheets are fixed on the roof, like a normal roofing sheet. One end of the glass receiving frame is marked “Top”. It should always point towards the apex. Mitring necessary for sheets also applies to Rooflights. The length of mitre should be equal to the length of the end lap of the roofing sheets.

For Rooflights of Corrugated Sheets, the end corrugations at both sides are up turned. This permits the Rooflight to be laid on the roof where the sheets are laid from either side. The extra corrugation is trimmed off before fixing the Rooflight.

A.C. Rooflights used as Northlight Glazing

The area of opening admitting light is approximately 30% & 36% for 1.5 m & 1.83 m Asbestos Cement Sheet respectively as laid. By comparison with full glass glazing the advantages of an A.C. Rooflight used as glazing are the elimination of glazing tees, putty, split pins, clips and beadings.

When Rooflights are used as a north light glazing, the fixing bolts are secured to runners. The glass is placed in the rebate from the top end of the frame. There is a covered rebate at the bottom in which the glass is slid. The weep holes and notches should be cleaned and dirt removed after fixing the rooflight.
Ridge Finial BS.7
This item is used for closing the end of the ridge line and used only with the close fitting adjustable ridge BS.2

Fixing
At the verge of the roof, on the gable end, the ridge finial is fixed inside the roll of the close fitting adjustable ridge; by means of a single bolt.

Ridge Finial TS.11
This article is suitable for all Ridges except BS.2

Fixing
This is available in pairs which are fitted to the ridge ends at the gable end of the building. The inner piece R1 is covered by the outer piece R2 and are located over the ridge ends. The fixing is done with one stitch bolt in the roll of the finial.
Cowl Type Ventilator for Corrugated Sheets BS. 12

Used when a small opening for ventilation is desired through the slope of the roof.

Cowl Type Ventilator for Semi-Corrugated (Trafford) Sheets TS.12

Fixing:

Cowl type Ventilators suitable for Corrugated and Semi-Corrugated Sheets should preferably be fitted at the ridge purlin, as hot air and smoke will accumulate at this point. The top end of the Cowl type Ventilator is fixed with the same bolt that is used for fixing the sheet to the ridge purlin. Care should be taken to place the ridge wing on the top of the Cowl type Ventilator end at ridge. The lower end of this article is fitted to the roofing sheet with a seam bolt along with Bitumen and G.I. washers.

Before fixing Cowl type Ventilators, the ventilator is placed in position and the opening required to be cut in the sheet is marked through the dome. Along the marking line, drill a couple of holes and cut the opening with a wood saw. Sometimes wire gauze is placed inside the dome and bolted to the dome, which prevents the ingress of birds.
Expansion Joint for Semi-Corrugated Sheets. TS.14
This is used when the roof is more than 60m in length. These joints should be placed at every 35 m.

The expansion Joints for the sheets are available in 3m length and are used with Semi-Corrugated Sheets. The roofing sheets are kept apart leaving a gap of 20 mm and the Expansion Joint is placed over them. The fixing is done by bolting the Expansion Joint to the purlin. The end laps and the Expansion Joint is placed over them. The fixing is done by bolting the Expansion Joints shall be the same as that of the roofing sheets. The end lap of the Expansion Joint can be secured by means of a bolt fitted to the purlin. In case the end laps do not occur at purlin, they should be stitched with a seam bolt.

Expansion Joint for Ridge. TS.7
They should be used with Serrated Adjustable Ridges TS.2

Available in pairs, they have a matching profile to that of the Expansion Joint for sheets. They are fitted on the Expansion Joint for sheets, keeping a 20 mm gap between ridges, by means of a hook bolt secured to the ridge purlin.

Expansion Joint for Northlight Curves. TS.13
They have a similar profile to suit Northlight Curves

These are fitted over the Semi -Corrugated Northlight Curves. The Northlight curves are kept apart leaving a gap of 20 mm. The fixing of the Expansion Joint for Northlight Curves should be to the top-most purlin and a purlin at the curved end of the Northlight Curves.
Special North Light Curves

To prevent dust entering through the Northlight, Special Northlight Curves are used.

Notes on Fixing:

Special Northlight Curves are always laid from left to right. They are mitred when roofing sheets are also laid from left to right. The mitring is not necessary when sheets are laid from right to left. The straight end resting on the roofing sheets has to be fitted to the Purlin by means of bolts. It is also necessary to fix a bolt at the other free end to the glazing runner. This is required to prevent uplift of the curve due to wind, which is always severe at the apex of the roof. It may be necessary to provide a special runner in case other structural member is not provided for bolting this end.

The corrugations are closed with Eaves Filler Pieces and the flat end of Eaves Filler Piece would be touching the glazing. The lapping at glass gives protection against rain.

If the situation so demands, due to intense wind, a wind tie of M.S. Flat 40mm x 6mm to be provided on top of the Special Northlight Curves for the full length of the building and securely bolted to the apex purlin. The fixing bolt used for Roofing Sheets and curve may be extended in length to accommodate this wind tie. No additional bolts are required for fixing wind ties.
Range of Accessories
For Everest Chrysotile
Asbestos Cement Roofing Sheets

NORTHLIGHT CURVE : BS-UT.9

CURVED BARGEBOARD : LEFT HAND
BS-UT 15/RIGHT HAND BS-UT.15

S TYPE LOUVRE : BS-UT.13

PLAINWING ADJUSTABLE RIDGE : TS-UT.4

CLOSE FITTING ADJUSTABLE RIDGE : BS-UT.2

SEPARATED ADJUSTABLE RIDGE : BS-UT.10

RIDGE FINIAL : TS-UT.11
EAVES BOARD
ROOF LIGHT : CABR-UT
COWL-TYPE
VENTILATOR : BS-UT.12
APRON PIECE : BS-UT.3/112.6
BARGEBOARD/CORNER PIECE : TS-UT.6
UNSERRATED ADJUSTABLE RIDGE FOR HIPS : TS-UT.3
Design Considerations

For Everest Chrysotile Asbestos Cement Roofing Sheets & Accessories

In order to obtain a sound and permanent roof with maximum economy, the following should be considered:-

1) Roof Plan
   The roof plan should be as simple as possible. Sheets of standard lengths should be selected. Hips and Valleys should be avoided as far as possible.

2) Pitch of Roof
   The pitch of the roofs should wherever possible, be preferably not less than 18 degrees. Should it be necessary to adopt roofs with a pitch less than 18 degrees, the end laps and joints should be suitably increased or sealed.

3) Purlins
   All purlins should be in one plane and parallel to each other. They should be properly anchored to the supporting superstructure by approved methods. If there is any, uneven settlement in a purlin, the roofing work, will exert a pull on the roofing bolts, producing cracks near the bolt hole.

4) Spacing of Purlins
   While designing a roof, the purlins spacing should be arranged to suit the sheets but should not exceed 1400 mm for the standard lengths of roof covering and 1700 mm for side cladding.
   Ridge purlins should be fixed 75 mm to 115 mm from the apex of the rafter.
   The free overhang at eaves should not be more than 300 mm. This is measured from the lower edge of the sheet to the centre of the bolt hole.
   Additional trimmers or bridging should be used between purlins where considerable roof traffic is likely to occur, for example, adjoining valley or box gutters, below glazing and around chimneys, ventilators or other uptakes. When smaller lengths of sheets are used which require closer purlin spacings, it is desirable to use these at eaves, as this would bring necessary support where traffic on the roof is expected.

5) Mitre
   Wherever four corners of sheets over lap, the intermediate two Sheets must be mitred in order to secure a perfect fit. The length and breadth of mitre should be equal to the length of the end lap and the breadth of the side lap of the roofing sheets.
   For the weather performance of the roofing, it is recommended that the gap between mitres should be minimum 3 mm to maximum 6 mm.
   All mass-produced building products have dimensional tolerances. This applies to both
corrugated / semi corrugated asbestos cement roofing sheets and steelworks. Because of these, permitted variations in dimensions may occur. Regular checks should be carried out on measurements at mitres and adjustments to be made as and when necessary.

As an alternative to mitring, the side lap joints in two adjacent rows staggered; so that four corners of the sheets do not lap at one point. Cutting of corners is eliminated and the roof laid with this method is equally effective against weather.

**Laying of sheets without Mitring**

Mitring or cutting of corners of sheets is necessary where four corners of the sheets meet. There is an alternative method to this; in which, sheets are staggered and four corners of the sheets do not meet at one point.

*Where B.S. 2 ridges and northlight curves are used, this method of laying sheets is not suitable.*

6) **End laps**

For a roof with an inclination of 18 degrees or more, the end laps should not be less than 150 mm. For low pitched roofs (i.e. less than 18 degrees) and for roofs in exposed positions, the end lap should be increased.

The end lap in a pitched roof must be related to the slope and the wind pressure, because water can be driven uphill by the wind into the joints. The end laps required can be worked out from the following equation –

\[ E = \frac{V^2}{167 \times \sin \phi} \]

where \( E \) is endlap in mm,
\( V \) is velocity of wind in Km per hour and
\( \phi \) is the inclination of the roof, in degrees.

7) **Side laps**

The side laps should, as far as possible, be sheltered from the prevailing wind directions. This can be done by changing the direction of laying of roofing sheets. The minimum side lap should be 40 mm or half corrugation. *Where weather conditions are severe, it is advisable to lay corrugated sheets with one and a half corrugations.* In windy regions it is advisable to use M.S. Flat of 40 mm x 6 mm thickness minimum as wind tie as the eaves of the roof.

*Note: Depending upon the expected degree of exposure and type of site the table on page 36 can be referred to arrive at the End/Side laps and their related treatment:*


<table>
<thead>
<tr>
<th>Sheltered &amp; Moderate Sites</th>
<th>Sheltered</th>
<th>Sheltered/Moderate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum End Lap</td>
<td>Lap Treatment</td>
<td></td>
</tr>
<tr>
<td>Roof Pitch</td>
<td>mm</td>
<td>End Laps</td>
</tr>
<tr>
<td>18° and above</td>
<td>150</td>
<td>Unsealed</td>
</tr>
<tr>
<td>15° to 18°</td>
<td>*</td>
<td>Unsealed</td>
</tr>
<tr>
<td>10° to 15°</td>
<td>*</td>
<td>sealed</td>
</tr>
<tr>
<td>Severe Exposure Sites</td>
<td>Moderate/Severe</td>
<td>Severe</td>
</tr>
<tr>
<td>Minimum End Lap</td>
<td>Lap Treatment</td>
<td></td>
</tr>
<tr>
<td>Roof Pitch</td>
<td>mm</td>
<td>End Laps</td>
</tr>
<tr>
<td>18° and above</td>
<td>150</td>
<td>Sealed</td>
</tr>
<tr>
<td>15° to 18°</td>
<td>*</td>
<td>Sealed</td>
</tr>
<tr>
<td>10° to 15°</td>
<td>300</td>
<td>Sealed</td>
</tr>
</tbody>
</table>

* Please refer to the formula for End lap given page no. 35.

**Note**: The table above is based upon BS.5247, Part 14, 1975 and applies to roof slopes not exceeding 32 m.

1. Where buildings stand above their surroundings, or are situated in open country with no windbreaks within about 1 km (including sites on or near the sea coast or hilltop sites which are above the general level of trees etc.), they must be considered subject to severe exposure.

2. Low Roof Pitches with Sheltered and Severe Sites are of 5° to 10° with 300 mm end lap, having maximum slope length 15 metres, end laps double sealed and side laps sealed. On roof pitches below 10° workmanship as regards positioning and placing of bitumen washer is more critical and greater care is necessary with lap sealing.

8) **Hips and Valleys**

They should be provided with runners fixed flush with the top face of the purlin to give adequate support to the raking cut edges of roofing sheets. These 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.
9) **Embedding**

In cases where sheets finish at the abutment, or sheets are required to be embedded in the wall, the jointing requires the following considerations:-

a) Where corrugations of the sheets are at a right angle to the abutting wall and slope away from the wall, the top end is finished with apron piece, bolted to the sheets, and the upstand of the apron piece is covered with metal or asphalt flashing embedded in the wall.

b) Where the corrugations of the sheets are not at a right-angle to the abutting wall and sloping away from the wall, the embedded sheets should be covered with metal or asphalt flashing neatly finished on the corrugations and valleys of the sheet and taken upwards on the wall, with top edges embedded in the wall.

c) When the side of a sloping sheet is embedded in a gable wall, at least one full corrugation of the sheet preferably the crown and not the valley of corrugation should be embedded into the wall.

d) Alternatively when the side of the sloping sheet meets the gable/eaves wall, at least one full corrugation of the sheet are to be covered with RCC/PCC or brick work using mastic / bituminous or polysulphide water proofing material as sealant at the edges.

10) **Laying**

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

11) **Fixing accessories**

It is extremely important that the highest quality of Bitumen Washers are used with the roofing sheets fixing accessories to ensure a leakproof roof. To ignore this important accessory can undo all the good work otherwise accomplished.

12) **Expansion Joints**

In a large roof, there are chances of expansion and contraction taking place in the roof structure. It is more evident in steel work and hence, expansion joints are provided in the structure, as well as in the roof, particularly to the purlins. The purlins in such circumstances will tend to move in a longitudinal direction.

i) This expansion does not affect Corrugated Sheets. Any movement in the structure is taken care of at the side lap joints.
ii) In Semi-Corrugated Sheets, the side lap joint is a lock joint, and its movement is restricted, hence expansion joints are required.

13) Wind Ties
In windy regions, it is advisable to use a M.S. Flat 40 mm x 6 mm thick minimum as Wind Tie at the eaves of the roof. These wind ties are placed above the sheets. The fixing bolts of the sheet passes through the wind ties and the nut for the hook bolt is tightened over it. The holes in the M.S. Flat should be of oblong shape to allow for expansion and contraction as indicated in the diagram.

14) Durability
Slight expansion, shrinkage or curling may cause cracking if the sheets are fixed too rigidly to the supporting structure. The risk of cracking and fracture is small if the sheeting is not fixed too rigidly, i.e., the bolt should not be overtightened.

Everest Chrysotile Asbestos Cement Corrugated Sheets 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 sufficiently harmful. Measures shall be taken to prevent corrosion of fixing accessories.

15) Condensation
Condensation on the under surface of the sheet may occur in many industrial processes because of variations in conditions inside and outside buildings. This condensation may be minimised by providing adequate ventilation in the building.

Points to Remember
1) Don't stack more than 120 sheets in a stack.
2) Smooth surface of the sheet should be upwards.
3) Never punch holes – drill them.
4) Drill holes in sheets – at least 2 mm larger than fixing bolts.
5) Be sure sheets are mitred by cutting with a saw.
6) Be sure sheets are mitred correctly.
7) Nuts should be screwed lightly first and tightened only after 13 or 14 sheets are laid.
8) Tighten the nuts evenly allowing the bitumen washer to merely seal the space between the holes and bolts.
9) Don't overtighten the nuts. Allow for the movement of structure.
10) Don't exceed purlin spacing of 1.4 metres for roofing and 1.7 metres for side claddings.
11) Provide a purlin at every end.
12) Don't exceed free overhang of 300 mm at eaves.
13) Distance between outlets in gutter line should not exceed 15 metres.
Design of Everest Chrysotile Asbestos Cement Roofing Sheets against Windload:

Over the years Everest Chrysotile Asbestos Cement Roofing Sheets have established themselves as an ideal building material for roofing and cladding. It has been found stable under all normal (and in many cases abnormal) wind conditions. Now, however, it is necessary to take into account factors involving building shape, location, etc. to define precisely the loading which will be imposed in all specific cases.

For designing roofing and cladding with Everest Chrysotile Asbestos Cement Roofing Sheets please refer to IS : 875 (Part 3, second revision) – 1987 reaffirmed 1997. There are six different zones of wind pressures for Indian conditions and are marked on a map in this Code of Practice with different screens.

The basic wind pressure for each zone is given below, as described in the map in Kg/m² upto a height of 30 m, above the mean retarding surface.

![Figure 1](image_url)
Notes on Wind Speed and Pressure
(For details please refer to IS : 875 (Part 3, II revision) - 1987 reaffirmed 1997)

1 Nature of Wind in Atmosphere - In general, wind speed increases with height from zero at ground level to a maximum at a height called the gradient height and is usually associated with a slight change in direction (Ekman effect). The variation with height depends primarily on terrain conditions. However, the wind speed at any height never remains constant and it has been found convenient to resolve its instantaneous magnitude into an average or mean value and a fluctuating component around this average value. The average value depends on the averaging time employed in analyzing the meteorological data and this averaging time varies from a few seconds to several minutes. The magnitude of fluctuating component of the wind speed which is called gust, depends on the averaging time. In general, smaller the averaging interval, greater is the magnitude of the gust speed.

2 Basic Wind Speed - Figure 1 on page 39 gives basic wind speed map of India, as applicable to 10 m height above mean ground level for different zones of the country. Basic wind speed is based on peak gust velocity averaged over a short time interval of about 3 seconds and corresponds to mean heights above ground level in an open terrain. Basic wind speeds presented in Figure 1 have been worked out for a 50 year return period.

3 Design Wind Speed (Vz) - The basic wind speed (Vb) for any site shall be obtained from Fig.1 and shall be modified to include the following effects to get design wind speed (Vz) at any height, for chosen structure:
   a) Risk level;
   b) Terrain roughness, height and size of structure; and
   c) Local topography.

   It can be mathematically expressed as follows:
   \[ V_z = V_b \times k_1 \times k_2 \times k_3 \]

   Where
   - \( V_z \) = design wind speed at any height \( z \) in m/s;
   - \( k_1 \) = probability factor (risk coefficient)
   - \( k_2 \) = terrain, height and structure size factor and
   - \( k_3 \) = topography factor

   \textbf{Note} - Design wind speed upto 10m height from mean ground level shall be considered constant.

4 Design Wind Pressure – The design wind pressure at any height above mean ground level shall be obtained by the following relationship between wind pressure and wind speed:
   \[ P_z = 0.6 \times V_z^2 \]

   where
   - \( P_z \) = design wind pressure in N/m\(^2\) at height \( z \), and
   - \( V_z \) = design wind speed in m/s at height \( z \).

   \textbf{Note} - The coefficient 0.6 (in SI units) in the above formula depends on a number of factors and mainly on the atmospheric pressure and air temperature. The value chosen corresponds to the average appropriate Indian atmospheric conditions.
**Internal Pressure Coefficients**

Internal air pressure in a building depends upon the degree of permeability of cladding to the flow of air. The internal air pressure may be positive or negative depending on the direction of flow of air in relation to openings in the buildings.

In the case of buildings where the claddings permit the flow of air with openings not more than about 5 percent of the wall area but where there are no large openings, it is necessary to consider the possibility of the internal pressure being positive or negative. Two design conditions shall be examined, one with an internal pressure coefficient of +0.2 and another with an internal pressure coefficient of – 0.2.

The internal pressure coefficient is algebraically added to the external pressure coefficient and the analysis which indicates greater distress of the member shall be adopted. In most situations a simple inspection of the sign of external pressure will at once indicate the proper sign of the internal pressure coefficient to be taken for design.

*Note - The term normal permeability related to the flow of air commonly afforded by claddings not only through open windows and doors, but also through the slits round the closed windows and doors and through chimneys, ventilators and through the joints between roof coverings, the total open area being less than 5 percent of area of the walls having the openings.*
Stepwise method to determine Wind Pressure (with examples)

A. Wind Pressure on Roof

The design wind pressure on roof is taken as a resultant effect of average
(a) external wind pressure,
(b) internal air pressure of the building. Due consideration should also be given to
(c) the direction of wind in relation to the building, e.g., wind blowing at right angle to the
building or parallel to the building; and
(d) local effect.

(i) External Wind Pressure

For flat and pitched roofs, the wind pressure normal to the surface due to wind blowing at
right angles to the ridge in terms of ‘p’ is given in the table below-

<table>
<thead>
<tr>
<th>Slope of roof on Windward side (°)</th>
<th>External Wind Pressure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Windward Slope</td>
<td>Leeward Slope</td>
</tr>
<tr>
<td>0°</td>
<td>- 1.00 p</td>
<td>- 0.50 p</td>
</tr>
<tr>
<td>10°</td>
<td>- 0.70 p</td>
<td>&quot;</td>
</tr>
<tr>
<td>15°</td>
<td>- 0.55 p</td>
<td>&quot;</td>
</tr>
<tr>
<td>18°</td>
<td>- 0.46 p</td>
<td>&quot;</td>
</tr>
<tr>
<td>20°</td>
<td>- 0.40 p</td>
<td>&quot;</td>
</tr>
<tr>
<td>30°</td>
<td>- 0.10 p</td>
<td>&quot;</td>
</tr>
<tr>
<td>40°</td>
<td>+ 0.10 p</td>
<td>&quot;</td>
</tr>
<tr>
<td>50°</td>
<td>+ 0.30 p</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

The wind pressures to be assumed over intermediate roof slopes may be interpolated linearly.

Note: In the case of a flat roof, windward slope means windward half of the roof.

ii) Internal Air Pressure:

Internal air pressure in a building depends upon the degree of permeability of the cladding
to the flow of air. It may be positive pressure or suction, depending upon the direction of
flow of air in relation to the openings in the building.

a) Buildings of normal permeability:

The building which permits the flow of air but has no large openings, the internal air
pressure of ± 0.2 p acting normal to the wall and roof should be taken in to account in
addition to the external wind pressures.
The normal permeability means that flow of air afforded due to open windows, doors, slits round closed windows and doors, through chimneys, ventilators and through joints in roof coverings.

b) Building with large openings:

Buildings with openings larger than 20 percent of wall area such as hangers, sheds, the internal pressure of ± 0.5 p acting normal to the wall and roof surface should be considered in addition to the external wind pressure.

c) Buildings of open type:

Buildings having roofs but no walls such as Butterfly roofs having inclination of ± 10° and ±30°, the internal pressure is given in Table III.

<table>
<thead>
<tr>
<th>Slope of roof on windward side (°)</th>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Windward Slope</td>
<td>Leeward Slope</td>
</tr>
<tr>
<td>10°</td>
<td>- 0.55 p</td>
<td>- 0.55 p</td>
</tr>
<tr>
<td>30°</td>
<td>+ 1.30 p</td>
<td>+ 0.40 p</td>
</tr>
</tbody>
</table>

For pressure on intermediate inclination it is deduced by linear interpolation.

iii) Direction of wind:

External pressure described in (i) is applicable when wind is at right angle to the ridge. When wind blows at normal to gable ends, the average external pressure may be assumed for both slopes as follows.
- 0.6 p on both slopes of the roof over a length from gable and equal to mean height of the roof from the surrounding ground level.
- 0.4 p over the remaining length of the roof.

iv) Local effects:

a) Pressure and suctions derived by i), ii), and iii) are average values and may be exceeded locally. It shall be increased numerically by 0.3 p.

b) All fastening for roof sheetsing should withstand pressures as mentioned in iv(a). Fastenings within a distance of 15 percent of the length of the roof from the gable shall withstand suction of 2.0 p on the area of roof sheetsing they support.
B. Wind Pressure on Side Cladding:
When the walls form an enclosure, it should be sufficiently strong to resist the total average pressure as follows:

<table>
<thead>
<tr>
<th></th>
<th>Windward</th>
<th>Leeward</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Normal permeability</td>
<td>+ 0.70 p</td>
<td>- 0.70 p</td>
</tr>
<tr>
<td>2) Large openings and walls exposed to wind on both faces.</td>
<td>+ 1.00 p</td>
<td>- 1.00 p</td>
</tr>
</tbody>
</table>

Local effects:
Pressures and suctions specified in ‘B’ are average and may be exceeded locally. Due account should be taken by increasing the value by 0.1 p.

Permissible pressure and suction on Everest Chrysotile Asbestos Cement Corrugated and Semi-Corrugated Roofing Sheets (Trafford) are given as below:

<table>
<thead>
<tr>
<th>Type of Sheet</th>
<th>Roofs</th>
<th>Walls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Purlin Centre</td>
<td>Permissible positive pressure</td>
</tr>
<tr>
<td>Corrugated</td>
<td>1.4 M</td>
<td>Kg/m² +400</td>
</tr>
<tr>
<td>Trafford</td>
<td>1.4 M</td>
<td>+ 620</td>
</tr>
</tbody>
</table>

Should the actual wind pressure or suction be above the permissible load the purlin/rail spacing must be reduced. The reduced spacing is obtained from the following expression:

**Reduced Purlin/Rail spacing (m)**

\[
\text{Reduced Purlin/Rail spacing (m)} = \frac{\text{Permissible Pressure/ Suction Kg/m}^2}{\text{Max. Purlin/Rail spacing (m)} \times \text{Actual Pressure/Suction} (\text{Kg/m}^2)}
\]

Design of Fasteners:
All fastenings for roof sheetings shall be capable of resisting the pressure specified below.

Failure load of 8mm dia. hook bolts = 250 Kg.
Permissible load = 125 Kg. (F.O.S. = 2)

If the actual load is more than permissible load, increase the number of bolts.
Example:

Data:

i) Height of the Shed 40 m above the mean retarding surface;

ii) Slope: 18°;

iii) Region: M.P. (i.e. From IS: 875 Table - Basic wind pressure 158 Kg/m²)

iv) Normal permeability.

To ascertain, which profile of sheet is suitable.

1. Roof:

A. Wind blowing normal to the ridge.

<table>
<thead>
<tr>
<th>Windward slope</th>
<th>Leeward slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) External Wind Pressure:</td>
<td>- 0.46 p</td>
</tr>
<tr>
<td>b) Internal Air Pressure</td>
<td>± 0.2 p</td>
</tr>
<tr>
<td>c) Local effect</td>
<td>- 0.3 p</td>
</tr>
</tbody>
</table>

(a+b+c) = Extreme Situation: - 1.0 p = 1 x 158 = - 158 Kg/m² ............(1)

B. Wind Blowing normal to Gable:

Both windward and leeward slopes:

a) Max. external wind pressure = - 0.6 x p

b) Internal air pressure = - 0.2 x p

c) Local effect = - 0.3 x p

Total (a+b+c) = - 1.1 p = - 1.1 x 158 = - 173.8 Kg/m² .......(2)

Compare (1) & (2) with figures in Table V. Both the profiles are adequate.

8 mm bolts are inadequate, hence increase one bolt per sheet per purlin.

2. Walls: (Normal permeability)

<table>
<thead>
<tr>
<th>Windward</th>
<th>Leeward</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Pressure on wall</td>
<td>+ 0.7 p</td>
</tr>
<tr>
<td>b) Local effect</td>
<td>+ 0.1 p</td>
</tr>
</tbody>
</table>

Total (a+b) = + 0.8 p = ± 0.8 x 158 = ± 126.4 Kg/m²

Both the profiles are adequate as also 8 mm dia. bolts.
Notes on Fixing of Everest Chrysotile Asbestos Cement Roofing Sheets & Accessories:
A. Sawing and Drilling:

1. Preferably sheets should be cut at ground level on suitable rigid supports using hand or powered saws. Sheets should be wet at the cutting portion. Powered saws should be of the reciprocating saw type and NOT disc or circular blade devices. Experience has shown that hand or powered saw blades having 3 to 3.5 mm teeth pitch are most suited.

2. The corners of the sheets when mitred, must be sawn and not broken with sharp implements. Holes for receiving fixing bolts and screws must be drilled and NEVER PUNCHED. The holes for fixing should be 2 mm larger than the diameter of the fixing bolts or screws and should always be drilled through the crown of the corrugation and never on the flats or valleys.

3. Holes are positioned either 4 mm up from the heal of the purlin to ensure that the hook/crook bolts are in line with the back of the purlin, or central in the timber purlin when coach screws are used.

4. Care must be taken to ensure that drills are kept perpendicular to the surface of the sheeting to prevent bolts being misaligned. All drilling swarf must be removed from the area of the fixing.

5. Holes for fixing the sheeting should be drilled in the centre of the end-lap to suit the purlins, that is; on the centre line of the purlin if these are of timber and square head coach screws are used, or as close as possible to the back of purlins if ‘J’ or ‘L’ bolts are used with steel angles, tubular steel or steel channels and I sections; 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. No holes should be nearer than 40 mm to any edge.

6. In case of roofs below 18 degrees where bigger end laps are required, bolting should be done as if the lap is 150 mm.

7. The fixing should be installed and appropriate washer and nut applied. Finger tightening of the nut should be used to ensure that the washer and nut are centralised on the clearance hole. Nuts should then be tightened until resistance is felt and washer/threads are not distorted.

8. Final tightening should not take place until an area of roofing is complete and staging/scaffold is to be removed.

9. All sheets should be aligned properly and spacings between purlins checked to see that they run parallel. This would give uniform end laps. At no place should the end laps be less than specified. A small error in alignment can reduce or increase the end lap considerably when extended further, as the work progresses.
B. Translucent Sheeting

Generally translucent sheeting, either site or factory assembled are installed in the same manner as the Everest Chrysotile Asbestos Cement sheeting. The main differences are that translucent material is thinner and requires more frequent fixing.

Translucent sheeting is laid unmitred and here the problem of compound layers at end lap situations does not occur and the Everest Chrysotile Asbestos Cement sheets are left unmitred.

All four edges of a translucent sheet or area should have rigid foam supports/closures provided at the lap with Everest Chrysotile Asbestos Cement Roofing material. Additionally, where translucents pass over intermediate purlins, support pieces must be installed.

End laps should be sealed with 10 mm diameter extruded mastic sealant strips with 6 mm sealant used on side laps.

Side laps should be secured to the Everest Chrysotile Asbestos Cement sheeting at 300-400 mm c/c with 8 mm diameter roofing bolts having curved metal washers on the underside.

End laps are fixed in every corrugation with the same fixing component as the Everest Chrysotile Asbestos Cement sheeting.

For other details approved translucent sheet manufacturer’s guidelines should be carefully observed.

C. Sealing Laps

Where it is necessary to seal the end laps and/or side laps a 6 mm diameter extruded mastic / bituminous / polysulphide sealing strip should be used (10 mm for translucent end laps). It is essential that the sealant is placed in the correct position to effect a weatherproof construction - for details see diagram below.

It is important to select a good quality sealant. Interior sealants can lead to cracking, chalking and failing in use. For best results choose a pre-formed, mastic ribbon of butyl or a polyisobutylene based material which has a rubbery, tacky characteristic and which will adhere to both surfaces when sheets are overlapped.
D. Preparation

Before sheeting commences, a responsible person should check that all steelwork purlins and rails are connected adequately. Measurement should be taken to ensure the structure and purlins are true and level to receive the sheeting. Especially check that purlin centers are spaced correctly for the right end lap and that the eaves purlin provides an overhang into the gutter not exceeding 300 mm.

With some pre-sheeting planning, especially on a complex roof, positioning of the verge sheets with upward sloping edges enhances the weather protection and can reduce the width of flashings.
Fixing Accessories

A. Galvanised Iron Materials:

A roof that gives long service and is trouble free, greatly depend upon the efficiency of fixing accessories. It is therefore important that attention must be paid particularly to the proper selection and use of fixing accessories. The use of inferior quality accessories must be avoided. The G.I. fixing accessories should conform to the requirements of IS:730-1978. Most roofing propositions can be accommodated with the range of fixing accessories listed below. (All bolts and screws should be galvanised and should have proper threading to match with that of the nuts). Fixing bolts and coach screws should be 8 mm or more in diameter depending upon the depth of the purlin.

1) Galvanized Iron ‘J’ type hook bolt or cranked iron nuts and galvanised iron nuts bearing on galvanised iron washers and bitumen washers should be used for fixing sheets on angle-iron-purlins.

2) Where rooting sheets are laid on tubular purlins, the fixing bolt is required to encompass at least half the tube periphery and precautions should be taken to prevent its rotation.

3) Galvanised Iron U type bolt or crank bolt and galvanised iron nuts bearing on galvanised iron washers and bitumen washers should be used for fixing sheets on R.S. Joists or Channels, pre-cast concrete or timber purlins.

4) Galvanised Iron coach screws bearing on galvanized iron washers and bitumen washers should be used for fixing sheets on timber purlins.

5) Galvanised iron seambolts and galvanized iron nut, both bearing on two galvanised iron, washers and one bitumen washer, which is used on the weathering face of the rooting sheets should be used for stitching the sheets, A.C. roofing accessories like ridge capping, corner pieces and barge boards, ventilator and northlight curves etc.

6) Galvanised iron special bolts are used for fixing sheets to ZED purlins. These bolts are designed to match the profile of the purlins. Galvanised iron nut bearing on galvanized iron washers and bitumen washers should also be-used with these types of bolts. These bolts are available with manufacturer of ZED purlins.

7) The bitumen washer is 25 mm in diameter and 3 mm thick with hole suitable for 6 mm, 8 mm and 10 mm diameter fixing bolts and screws.

8) The galvanised iron washer is 25 mm in diameter and 1.6 mm thick with hole to suit 6 mm, 8 mm and 10 mm diameter fixing bolts and screws.

Purlins with different shapes may require an adapted form of hook bolt.

Direct fixing of the sheets to drilled metal frame work or by stud welding is undesirable as it tends to restrain movement of sheets.
It is essential that bolt holes are made water tight by using Bitumen Washers in conjunction with suitable galvanized iron washers. These form essential accessories to good fixing. Fixing bolts and screws should be 8 mm in diameter or more and the nuts of bolts or heads of screws should bear on galvanized iron washers which in turn are embedded on bitumen washers. The screws or nuts or the bolts should be tightened sufficiently only to seat the bitumen-washers over the corrugations. Overtightening of the nut can damage the sheet.

On intermediate purlins, where sheets do not have end laps, the bolts are likely to be overtightened, so as to make the sheet rest on the purlin. This must be discouraged - as this puts the sheets under undue stress and may cause damage to sheets.
In windy regions, it is advisable to use a M.S. Flat 40 mm X 6 mm thick minimum as a wind tie at the eaves of the roof. These wind ties are placed above the sheets. The fixing bolt of the sheet passes through the wind ties and the nut for the hook bolt is tightened over it.

Ridge cappings should as far as possible, be secured to the ridge purlins by the same bolt which secure the sheeting. Other A.C. accessories such as barge boards, eaves filler pieces and apron pieces should be secured either to supporting structure or to the sheeting by roofing bolts.

To arrive at a number and length of bolts and the number of bitumen washers required for fixing a Corrugated Sheet Roof, details given in Table I on page 9 should be followed. Details given in Table II of page 11 should be followed for Semi-Corrugated Roofing Sheets.
B. Others:

Ordinary bolts usually catch rust and over a period of time drop on their own or let the sheets blow off. Nowadays polymer coated bolt systems provide long term remedy to such perennial leakage problems. The system consists of - Seal Washer, Thrust Washer, Polymer Cap, Polymer Coated Bolt & Galvanised Nut.

These Polymer Caps, Seal and Thrust Washers are made from properly blended virgin polymer to resist seasoning, hardening & cracking due to weather, Ultra Violet & Ozone effects.

Polymer Cap - Push fit type, tested for UV radiation, skirting covers assembly to avoid leakages & prevents entry of corrosive fumes. Accommodates square nut.

NUT - Galvanised square nut.

FLAT/THRUST WASHER - Use FLAT washer for TROUGH/CORRUGATED sheets. These hard washers exert thrust on sealing ring of polymer washer on tightening the nut.

Ensure CURVATURE of THRUST washer DOWN

POLYMER WASHER - Drill hole as in table to allow washer pass through sheet.

POLYCOATED BOLT - Threads rolled, polycrcoating on Galvanised bolt up to half thread length to ensure presence of polymer on tightening the nut.

Open threads are coated chemically to avoid corrosion.

FOR POLY WASHER

<table>
<thead>
<tr>
<th>DIA</th>
<th>DIA OF DRILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/16&quot;</td>
<td>12.5 mm</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>13.0 mm</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>8.5 mm</td>
</tr>
</tbody>
</table>
## List of Everest Chrysotile Asbestos Cement Roofing Accessories and their corresponding weights

### Corrugated Sheets

<table>
<thead>
<tr>
<th>Name of Accessory</th>
<th>Symbol</th>
<th>Weight of each article M. Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close Fitting Adjustable Ridge</td>
<td>BS.2</td>
<td>0.010978</td>
</tr>
<tr>
<td>Serrated Adjustable Ridge</td>
<td>BS.10</td>
<td>0.007896</td>
</tr>
<tr>
<td>Unserrated Adjustable Ridge for Hips</td>
<td>TS.3</td>
<td>0.010150</td>
</tr>
<tr>
<td>Plain Wing Adjustable Ridge</td>
<td>TS.4</td>
<td>0.008496</td>
</tr>
<tr>
<td>Northlight Adjustable Ridge</td>
<td>BS.5</td>
<td>0.008103</td>
</tr>
<tr>
<td>One piece Plain Angular Ridge</td>
<td>TS.17</td>
<td>0.006823</td>
</tr>
<tr>
<td>Ridge Finial for BS.2 Ridge only</td>
<td>BS.7</td>
<td>0.001805</td>
</tr>
<tr>
<td>Ridge Finial for all Ridges except BS.2 and TS.1</td>
<td>TS.11</td>
<td>0.001880</td>
</tr>
<tr>
<td>Apron Piece</td>
<td>BS.3</td>
<td>0.005488</td>
</tr>
<tr>
<td>Eaves Filler Piece</td>
<td>BS.4</td>
<td>0.003760</td>
</tr>
<tr>
<td>Northlight Curves</td>
<td>BS.9</td>
<td>0.011269</td>
</tr>
<tr>
<td>Cowl Type Ventilator</td>
<td>BS.12</td>
<td>0.005264</td>
</tr>
<tr>
<td>‘S’ Type Louvre 1.75 m long</td>
<td>BS.13/1.75</td>
<td>0.007641</td>
</tr>
<tr>
<td>‘S’ Type Louvre 3.00 m long</td>
<td>BS.13/3</td>
<td>0.014049</td>
</tr>
<tr>
<td>Corner Piece or Barge Board 1.83 m long</td>
<td>TS.6/6</td>
<td>0.007519</td>
</tr>
<tr>
<td>Corner Piece or Barge Board 2.44 m long</td>
<td>TS.6/8</td>
<td>0.010711</td>
</tr>
<tr>
<td>Left Hand Curved Barge Board for Northlight Curves</td>
<td>BS.15*</td>
<td>0.003806</td>
</tr>
<tr>
<td>Right Hand Curved Barge Board for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northlight Curves</td>
<td>BS.14*</td>
<td>0.003806</td>
</tr>
<tr>
<td>Rooflight</td>
<td>CABR</td>
<td>0.034352</td>
</tr>
</tbody>
</table>

### Semi-Corrugated Sheets

<table>
<thead>
<tr>
<th>Name of Accessory</th>
<th>Symbol</th>
<th>Weight of each article M. Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serrated Adjustable Ridge</td>
<td>TS.2</td>
<td>0.008648</td>
</tr>
<tr>
<td>Unserrated Adjustable Ridge for Hips</td>
<td>TS.3</td>
<td>0.010150</td>
</tr>
<tr>
<td>Plain Wing Adjustable Ridge</td>
<td>TS.4</td>
<td>0.008496</td>
</tr>
<tr>
<td>Northlight Adjustable Ridge</td>
<td>TS.5</td>
<td>0.008572</td>
</tr>
<tr>
<td>One piece Plain Angular Ridge</td>
<td>TS.17</td>
<td>0.006823</td>
</tr>
<tr>
<td>Ridge Finial for all Ridges except BS.2 and TS.1</td>
<td>TS.11</td>
<td>0.001880</td>
</tr>
<tr>
<td>Apron Piece</td>
<td>TS.10</td>
<td>0.004437</td>
</tr>
<tr>
<td>Eaves Filler Piece</td>
<td>TS.8</td>
<td>0.002556</td>
</tr>
<tr>
<td>Northlight Curves</td>
<td>TS.9</td>
<td>0.010544</td>
</tr>
<tr>
<td>Ventilator Curves</td>
<td>TS.18</td>
<td>0.010544</td>
</tr>
<tr>
<td>Cowl Type Ventilator</td>
<td>TS.12</td>
<td>0.005264</td>
</tr>
<tr>
<td>‘S’ Type Louvre 1.75 m long</td>
<td>BS.13/1.75</td>
<td>0.007641</td>
</tr>
<tr>
<td>‘S’ Type Louvre 3.00 m long</td>
<td>BS.13/3</td>
<td>0.014049</td>
</tr>
<tr>
<td>Corner Piece or Barge Board 1.83 m long</td>
<td>TS.6/6</td>
<td>0.007519</td>
</tr>
<tr>
<td>Corner Piece or Barge Board 2.44 m long</td>
<td>TS.6/8</td>
<td>0.010711</td>
</tr>
<tr>
<td>Left Hand Curved Barge Board for Northlight Curves</td>
<td>TS.15*</td>
<td>0.003761</td>
</tr>
<tr>
<td>Right Hand Curved Barge Board for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northlight Curves</td>
<td>TS.16*</td>
<td>0.004230</td>
</tr>
<tr>
<td>Expansion Joint for Northlight Curves</td>
<td>TS.13*</td>
<td>0.002407</td>
</tr>
<tr>
<td>Expansion Joint For Sheets</td>
<td>TS.14/10</td>
<td>0.010145</td>
</tr>
<tr>
<td>Expansion Joint for Ridges</td>
<td>TS.7*</td>
<td>0.007144</td>
</tr>
<tr>
<td>Rooflight</td>
<td>CATR</td>
<td>0.034604</td>
</tr>
</tbody>
</table>

### Important

Items marked * are ‘special’ and cancellation of orders cannot be accepted after manufacturing has commenced.
Everest Chrysotile Asbestos Cement Corrugated Curved Roofing Sheets:

The arch is the most economical form of construction for large spans. Of this, the semi-circular arch is more stable. Everest Chrysotile Asbestos Cement Curved Roofing Sheets are designed to form a semi-circular arch. The maximum span is obtained by using 3 sheets of length 3048 mm, in a semi-circular arch of radius 2743 mm. The end laps of the curved sheets are 406 mm. The side laps of the curved sheets are one and a half corrugations which give complete protection against rain.

Self supporting curved roofing constructions do not require purlins, rafters or trusses and hence the entire super structure is eliminated. This is a quick and dry construction which permits immediate occupation of the building. These are also advantageous because they are easily transported to location where building materials are hard to find and difficult to transport.

**Dimensional Data**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Thickness (Nom.)</td>
<td>6.00 mm</td>
</tr>
<tr>
<td>2.</td>
<td>Overall width</td>
<td>1050 mm</td>
</tr>
<tr>
<td>3.</td>
<td>Laid width</td>
<td>876 mm</td>
</tr>
<tr>
<td>4.</td>
<td>Standard lengths</td>
<td>2050/2743/3048 mm</td>
</tr>
<tr>
<td>5.</td>
<td>Weight of each sheet</td>
<td>26.18/35.94/39.93 kgs</td>
</tr>
<tr>
<td>6.</td>
<td>Standard radius (Nom.)</td>
<td>1800/2743/2743 mm</td>
</tr>
<tr>
<td>7.</td>
<td>END lap</td>
<td>406 mm</td>
</tr>
<tr>
<td>8.</td>
<td>SIDE lap</td>
<td>174 mm</td>
</tr>
<tr>
<td></td>
<td>(1½ corrugations)</td>
<td></td>
</tr>
</tbody>
</table>

1) Number of 50 mm long 8 mm Dia bolts
   = 10 (N-1)

2) Number of hook bolts fitted to M.S. runner.
   = (N+1) x 2

where N = No. of Sheets per row.

**Covering Width**

<table>
<thead>
<tr>
<th>No. of Sheet</th>
<th>Metric Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.05 m</td>
</tr>
<tr>
<td>2</td>
<td>1.93 m</td>
</tr>
<tr>
<td>3</td>
<td>2.80 m</td>
</tr>
<tr>
<td>4</td>
<td>3.68 m</td>
</tr>
<tr>
<td>5</td>
<td>4.56 m</td>
</tr>
<tr>
<td>6</td>
<td>5.43 m</td>
</tr>
<tr>
<td>7</td>
<td>6.31 m</td>
</tr>
<tr>
<td>8</td>
<td>7.19 m</td>
</tr>
<tr>
<td>9</td>
<td>8.06 m</td>
</tr>
<tr>
<td>10</td>
<td>8.94 m</td>
</tr>
<tr>
<td>20</td>
<td>17.70 m</td>
</tr>
<tr>
<td>25</td>
<td>22.08 m</td>
</tr>
<tr>
<td>30</td>
<td>26.46 m</td>
</tr>
<tr>
<td>40</td>
<td>35.23 m</td>
</tr>
<tr>
<td>50</td>
<td>43.99 m</td>
</tr>
<tr>
<td>60</td>
<td>52.75 m</td>
</tr>
</tbody>
</table>

Everest Chrysotile Asbestos Cement Corrugated Curved Sheet which are self supporting structures are used for wide varieties of structures including Agricultural, Industrial, Domestic and temporary site offices and for storage of implements and garages.

Being a semi-circular arch, the load is directly transferred to support, and have a better performance against windy conditions. These structures can be erected by unskilled labour, and for temporary sheds, no foundations are required.

Where insulation is desired, a second skin of the curved sheet can be mounted above the first skin with M.S. rectangular/square hollow section/G.I. pipe spacers between the two skins; without any other support to the structure. Alternatively, internal lining of E-Board can be fitted to the inside of the curved roof by fixing necessary M.S./G.I./timber sections.
Detail of Everest Chrysotile Asbestos Cement Corrugated Curved Sheets Construction

Railway Sleeper Base

Alternative Details at 'A'

Section Through Industrial Shed

Sheets Bolted to M.S. Runner

Cleat Grouted in R.C.C. Beam

Other Dimensions to Suit

R.C.C. Channel Beam

Anchoring of Sheets Against Uplift.
Detail of Everest Chrysotile Asbestos Cement Corrugated Curved Sheets Construction

Everest Chrysotile Asbestos Cement Corrugated Curved Sheets

Grouting 90 mm

PCC Slabs 225 mm

Inside of Building Brice Wall

Section EF

Everest Chrysotile Asbestos Cement Corrugated Curved Sheets

Grouting 35 mm

Section G.H.

C Mortar Grouting to Slope toward Gable Ends

R.C.C. Slab for Intermediate Wall Reinforcement to Suit

Grouting to be cut here (At side Laps of Sheets) in case of Single Skin only

Plan End Wall

Everest Chrysotile Asbestos Cement Corrugated Curved Sheet

Plan Intermediate Wall

Everest Chrysotile Asbestos Cement Corrugated Curved Sheet

Holes For Single Skin only

R.C.C. Slab

MS Angle Runner

R.C.C. Channel Beam

Details Showing Side Lap: Mitre Cut and Position of Bolts in Relations to Side Lap

1½ Corr.

End Lap

End Lap

50 x Steel Pipe

Planks 100 x 300 x 30 Joints 150 x 150 Vertical Support Center 100 x 100

Radial Point of Sheet

Corner 1020 x 300 x 30 Joints 150 x 150 Vertical Support Center 100 x 100

Joints 150 x 150 Vertical Support Center 100 x 100

Details of Sheets

Plan End Wall

Plan Intermediate Wall

Plan of Sheets Showing Mitring

1 4 7 10 13

3 6 9 12 15

2 5 8 11 14

Wooden Platform

R.C.C. Channel Beam

1 3

50 x Steel Pipe
Design Considerations:

In order to obtain a sound and weather-proof roof with maximum economy, the following should be considered:

1. The sides where the ends of the Everest Chrysotile Asbestos Cement Corrugated Curved Roofing sheets rest should be level and parallel to each other.

2. On the intermediate supports where two Everest Chrysotile Asbestos Cement Corrugated Curved Roofing Sheets rest, uniform spacing between sheets of two opposite curves must be maintained for the entire length of the roof. The channel shaped R.C.C. slab should have sufficient space for resting the sheets and the space between two curved sheets should be finished with lean concrete or mortar giving sufficient slope for the rainwater to drain off effectively.

3. Intermediate support channels should have sufficient cross sectional area to take care of rainwater and provision should be made for rainwater down takes at suitable intervals.

4. Curved roofing sheet at supports are grouted with mortar or concrete. For structures in windy regions these ends may be bolted to a M.S. purlin, which is secured at the base slab.

5. On the external wall where single curvature of the roofing sheets is resting, it is advisable to cut the grouting at side laps of the sheets forming a notch. This would effectively drain off whatever rainwater is collected in the side lap.

Similarly on intermediate supports, holes in the valley of overlapping sheet at lap joint, should be drilled to drain off accumulated water from the side lap of the sheets. These holes are drilled above the level of the grouting for effective drainage.

6. It is a good practice to use T.W. fixing frame for laying Everest Chrysotile Asbestos Cement Corrugated Curved Roofing Sheets. This method ensures correct laying of the roof.

7. Wherever four corners of sheets overlap, two of them must be mitred. In order to secure a perfect fit, there is no alternative to this rule. The length of the mitre should be 406 mm and the breadth should be equal to one and a half corrugations.

8. End laps of Everest Chrysotile Asbestos Cement Corrugated Curved Sheets should be 406 mm and should be fixed with bolts as shown.

9. Side laps for Everest Chrysotile Asbestos Cement Corrugated Curved Sheet should be one and a half corrugation.

10. The formation of hips and valleys in a self-supporting Everest Chrysotile Asbestos Cement Corrugated Curved Sheet Construction must be avoided.

11. It is extremely important that the highest quality of bitumen washers are used with G.I. bolts to ensure a leak-proof roof. This would ensure a trouble-free roof with a long life.
Notes on Fixing

1. Place 150 mm x 150 mm timber joists on R.C.C. channel with 100 mm x 100 mm central vertical supports. Wooden planks 1020 mm x 300 mm x 30 mm are fixed on the joists making two platforms.
   Erect fixing frames on the platform and cross tie the frame with 1, 2, 3 & 4 long pipes at top and bottom.

2. Commence laying sheet no. 1 with the down lap of the sheet on the left hand side (looking from inside the building), one end resting on the concrete slab and the other on the purlin 3.35 m long of the fixing frame.

3. Next lay sheet no. 2 on the opposite side of the wall similarly resting on the slab and purlin of the fixing frame.

4. Place the crown sheet no. 3 on top of sheet nos. 1 and 2 and set so that the end laps are equal on both sides. Be sure to line up all the sheets so that the corrugations are vertical to the concrete slab.

5. Mark and cut the mitres on the corners of sheet no. 3 (see details on page 53).

6. Drill and bolt together sheets nos. 1, 2 and 3 with 8 mm dia. 50 mm long G.I. bolts, nuts, with 2 G.I. washers and a bitumen washer.

7. Lay side sheets nos. 4 and 5 lapping sheet nos. 1 and 2 by 1½ corrugations and mark and cut mitres to register with mitres already cut on corners of sheet no. 3.

8. Place crown sheet nos. 6 (with mitred corners similar to sheet no. 3) on top of sheet nos. 3, 4 and 5.

9. Complete drilling and bolting the sheets with bolts 8 mm dia, 50 mm long and also drill and bolt sheet nos. 1, 4 and 2, 5 with single bolts passing through the laps at a distance of approx. 380 mm from the top of concrete slab.

10. Fix hook bolts for M.S. runner at every side lap joint. Free end of the last sheet should also be secured with hook bolt.

11. Follow the above procedure for the entire roof.

12. The fixing frame is moved forward as fixing of sheets proceed.

13. Remove fixing frame after completing the root.

14. Put cement mortar grouting on the concrete slab. Drill holes at side laps on outer sheets only on intermediate slabs as shown on page 56.

15. Cement mortar grouting on concrete slab of external wall to be cut where side lap of sheets occur.

16. The cross and longitudinal partition walls should be constructed as soon as the roofing over the required space in finished.
In factories and industrial buildings, provision for ventilation becomes necessary for dilution of inside air to prevent vitiation by causes such as body odour, to remove contaminants in the air released during manufacturing processes and to maintain satisfactory thermal environments. The application of ventilation should be considered with other measures to control heat given off during industrial processes.

Where close control of the rate of air supply and its distribution or the rate of extraction is essential, a mechanical system is normally adopted. For most buildings, however, NATURAL VENTILATION is adequate, provided of course, the areas of opening are sufficient. The calculation of openings is made in terms of the two forces causing natural air flow, i.e.

1. The difference in wind pressures on exposed surfaces, and
2. The flue or stack pressure due to a difference in the temperatures of the air inside and outside the building.

But due to certain difficulties, it may not always be possible to provide adequate openings to take care of the total extraction load. Here, Everest A.C. Extractor plays a vital role. It takes care of the additional load.

Everest A.C. Extractor are scientifically designed to give a very high percentage of efficiency and to exert a strong pull on the inside air. The efficiency of an extractor depends on its ability to make use of the kinetic energy of passing winds to create an extracting effect on the atmosphere beneath. There are a number of factors which affect the functioning of an extractor, the chief ones being:

(a) design,
(b) difference in temperature between the inside and outside atmosphere,
(c) the velocity of passing winds and
(d) the area of the extractor stack.

Items (b) and (c) are liable to considerable variation, according to weather conditions and the type of building to be ventilated.

Items (a) and (d) are factors which have been carefully studied in designing Everest A.C. Extractors.

The exhaust capacities of Everest A.C. Extractors which are supplied in two sizes 457 mm and 610 mm are indicated in the tables. The outline dimensions and simple methods of fixing are illustrated on page 70.

Ventilation by natural means can be found by following the procedures given on the next page.
Design Considerations:

Step 1:
Find out the volume of air inside the shed in m³

Step II:
Time for air changes varies from situation to situation. Table 1 provides recommended air changes under different situations. Consult this table and obtain the time for the particular situation.

<table>
<thead>
<tr>
<th>Situation</th>
<th>Time for air changes (minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly Halls</td>
<td>10-15</td>
</tr>
<tr>
<td>Bakeries</td>
<td>2-3</td>
</tr>
<tr>
<td>Boiler Houses</td>
<td>2-3</td>
</tr>
<tr>
<td>Canteens</td>
<td>10-15</td>
</tr>
<tr>
<td>Cinemas</td>
<td>4-6</td>
</tr>
<tr>
<td>Club Rooms</td>
<td>6-7½</td>
</tr>
<tr>
<td>Dance Halls</td>
<td>7½-10</td>
</tr>
<tr>
<td>Dye Works</td>
<td>2-3</td>
</tr>
<tr>
<td>Engine Rooms</td>
<td>2-3</td>
</tr>
<tr>
<td>Factories (general)</td>
<td>6-10</td>
</tr>
<tr>
<td>Foundries</td>
<td>2-3</td>
</tr>
<tr>
<td>Garages</td>
<td>7½-10</td>
</tr>
<tr>
<td>Hospitals</td>
<td>10-15</td>
</tr>
<tr>
<td>Kitchens</td>
<td>3-4</td>
</tr>
<tr>
<td>Laboratories</td>
<td>10-15</td>
</tr>
<tr>
<td>Laundries</td>
<td>2-3</td>
</tr>
<tr>
<td>Machine Shops</td>
<td>6-10</td>
</tr>
<tr>
<td>Paint Shops</td>
<td>1-2</td>
</tr>
<tr>
<td>Pig Houses</td>
<td>6-10</td>
</tr>
<tr>
<td>Poultry Houses</td>
<td>6-10</td>
</tr>
<tr>
<td>School Classrooms</td>
<td>20-30</td>
</tr>
<tr>
<td>Theatres</td>
<td>4-6</td>
</tr>
<tr>
<td>Plant Buildings (fumes &amp; moisture)</td>
<td>2-5</td>
</tr>
<tr>
<td>Galvanizing Plants</td>
<td>1½-3</td>
</tr>
<tr>
<td>Heat Treatment Rooms</td>
<td>½ - 1</td>
</tr>
<tr>
<td>Waiting Rooms</td>
<td>15</td>
</tr>
<tr>
<td>Warehouses</td>
<td>10-30</td>
</tr>
<tr>
<td>Forge Shops</td>
<td>1-3</td>
</tr>
<tr>
<td>Swimming Baths</td>
<td>2-3</td>
</tr>
</tbody>
</table>
Step III:
Find out the air to be extracted per minute.

\[ V_R = \frac{\text{Volume of air (in m}^3/\text{min.)}}{\text{Time for air changes}} \]  \quad (1)

Step IV:
Based on the knowledge of inlet area, outlet area, wind velocity, stack height and temperature
difference, apply the following formula. Find out the volume of air that can be extracted per
minute by natural ventilation: \( V_N \)

Follow the following procedures:

(a)
Obtain ventilation due to wind effect alone; the formula being:

\[ V_1 = 10 \ AV \]  \quad (i)

Where \( V_1 \) = air flow in m\(^3\)/min. \\
A = inlet area in m\(^2\) \\
V = wind velocity in kmph

Formula (i) is based on outlet/inlet = 1

If the ratio differs, consult table 2 and multiply by the factor to get \( V_1 \)

(b)
Obtain ventilation due to convection effects arising from temperature difference alone, applying
the following formula:

\[ V_2 = 10.5 A \sqrt{hdt} \]  \quad (ii)

Where \( V_2 \) = air flow in m\(^3\)/min. \\
A = inlet area in m\(^2\) \\
h = stack height between inlets & outlets in m \\
dt = temp. diff. in °C

This formula is also based on outlet/inlet = 1

If the ratio differs, it should be multiplied by the factor given against the ratio in table 2 to get \( V_2 \)

(c) Combined effect:

To obtain the combined effect of natural ventilation, get both \( V_1 \) & \( V_2 \) Express \( V_2 \) as
percentage of \( V_1 + V_2 \)

From table 3 get the factor against this percentage. Multiply \( (V_1 + V_2) \) by this factor to get \( V_N \)

i.e.

\[ V_N = K(V_1 + V_2) \]  \quad (2)
### Table 2

<table>
<thead>
<tr>
<th>Outlet/Inlet</th>
<th>Multiplying Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>1.27</td>
</tr>
<tr>
<td>3</td>
<td>1.35</td>
</tr>
<tr>
<td>4</td>
<td>1.38</td>
</tr>
<tr>
<td>5</td>
<td>1.40</td>
</tr>
<tr>
<td>¾</td>
<td>0.86</td>
</tr>
<tr>
<td>½</td>
<td>0.63</td>
</tr>
<tr>
<td>¼</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Intermediate factors may be interpolated.

### Table 3

<table>
<thead>
<tr>
<th>Flow due to temp. diff. as percentage of total V₂ x 100 i.e. ( \frac{V₂}{V₁+V₂} )</th>
<th>Multiplying Factor (K) to the total flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>0.77</td>
</tr>
<tr>
<td>20</td>
<td>0.80</td>
</tr>
<tr>
<td>30</td>
<td>0.75</td>
</tr>
<tr>
<td>40</td>
<td>0.64</td>
</tr>
<tr>
<td>50</td>
<td>0.65</td>
</tr>
<tr>
<td>60</td>
<td>0.68</td>
</tr>
<tr>
<td>80</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Intermediate factors may be interpolated.

### Step V:

Having obtained the natural flow due to combined effect i.e. \( Vₙ \), deduct this flow from \( Vₚ \) obtained in step III. The balance, if any, to be extracted by Everest A.C. Extractor or in other words:

\[
Vₑ = Vₚ - Vₙ \quad \text{......... (3)}
\]

where \( Vₑ \) = Volume to be extracted by Everest A.C. Extractor in m³/min.

Now, the capacity of Everest A.C. Extractor is governed by the following formula:

\[
J = 4.9 \, D²V + 7.5D² \sqrt{H} \, dt \quad \text{......... (4)}
\]
Where, \( J \) = exhaust capacity of one extractor i.e. m\(^3\)/min.
\( D \) = Diameter of extractor in m
\( H \) = Stack height between inlet and Extractor in m.
\( dt \) = temp. diff. between inside and outside in °C.
\( V \) = Velocity of Wind in kmph

**Step VI:**
Having found the capacity of one Extractor, divide \( V_E \) to get the number of Extractors required i.e.

\[
N = \frac{V_E}{J} \quad \text{(5)}
\]

**Example:**
Length of the shed = 55 m

**Example:**

![Diagram of a shed with dimensions labeled]

**Foundry:**
Wind Velocity = 6.44 kmph
Temp. diff. = 4.44°C
\( H \) = 7.75 m
\( h \) = 3 m

Each longer side have 4 m\(^2\) opening at high level; and 16 m\(^2\) opening at lower level. Gable walls have 1 m\(^2\) opening at high level and 4 m\(^2\) opening at lower level.

**Step 1:**
Volume of air inside the shed
\[
= 15 \times 55 \times (5+1.875)
\]
\[
= 15 \times 55 \times 6.875
\]
\[
= 5672 \text{ cubic metres}
\]

**Step II:**
From table 1, time for air changes in foundry is 3 mins.

**Step III:**
Volume of air to be extracted per minute
\[
\frac{5672}{3} = 1891 \text{ m}^3/\text{min} \quad \text{(1)}
\]
Step IV:

a) Natural Ventilation due to Wind alone.

Assuming one long side facing wind; where area of openings.

= 16 + 4 = 20m² acts as inlet.

Rest of openings in other three walls act as outlet viz

= 20 + 5 + 5 = 30m²

\[ V_1 = 10 \times A \times V \]  
\[ = 10 \times 20 \times 6.44 \]  
\[ = 1288 \text{ m}^3/\text{min}. \]

Ratio of outlet/inlet

\[ \frac{30}{20} = 1.5 \]

From table 2, the multiplying factor is 1.18 (by interpolation)

Hence \[ V_1 = 1.18 \times 1288 = 1519 \]

\[ = 1520 \text{ m}^3/\text{min}. \]

b) Natural Ventilation due to convection effects arising from temp. difference alone.

All openings at lower level act as intake.

= 16 + 16 + 4 + 4 = 40m²

High level openings act as outlet.

= 4 + 4 + 1 + 1 = 10m²

\[ V_2 = 10.5 \times A \times \sqrt{h \times dt} \]  
\[ \text{where } A \text{ is inlet at low level.} \]

\[ = 10.5 \times 40 \times \sqrt{3 \times 4.44} \]  
\[ = 1533 \text{ m}^3/\text{min}. \]

Ratio of outlet/inlet = \( \frac{10}{40} = \frac{1}{4} \)

From table 2 against this ratio the multiplying factor is 0.35

Hence \[ V_2 = 1533 \times 0.35 \]

\[ = 536.55 \text{ m}^3/\text{min}. \]

c) Combined Effect \( V_2 \) as percentage of \( V_1 + V_2 \)

\[ \frac{536.55}{1520 + 536.55} \times 100 = 26\% \]

From table 3 against 26% the multiplying factor is 0.79 (by interpolation). Hence, the volume to be extracted per min. by combined natural ventilation is

\[ V_N = K \times (V_1 + V_2) \]  
\[ = 0.79 \times (1520 + 536.55) \]  
\[ = 1625 \text{ m}^3/\text{min}. \]
Step V

Volume to be extracted per minute by Everest A.C. Extractor is:
\[ V_E = V_R - V_N \] ........................ (3)
\[ = 1891 - 1625 \]
\[ = 266 \text{ m}^3/\text{min.} \]

Step VI

Capacity of Everest A.C. Extractors, type Ex. 4 under this parameter:
\[ J = 4.9 D^2 V + 7.5 D^2 \sqrt{H} \, \text{dt} \]
\[ = \left[ 4.9 \times \left( \frac{1.5}{3.28} \right)^2 \times 6.44 \right] + \left[ 7.5 \times \left( \frac{1.5}{3.28} \right)^2 \sqrt{7.75 \times 4.44} \right] \]
\[ = [4.90 \times 0.209 \times 6.44] + [7.5 \times 0.209 \times 5.87] \]
\[ = 6.60 + 9.20 = 15.80 \text{ m}^3/\text{min.} \]

No. of Everest A.C. Extractors Ex. 4 required:
\[ N = \frac{V_E}{J} = \frac{266}{15.80} = 16.83 \]
\[ = 17 \text{ Nos. Say} \]

Exhaust Capacity of Everest A.C. Extractors

<table>
<thead>
<tr>
<th>Temperature Difference Celsius</th>
<th>Height of Ventilator Above Intake in Meters</th>
<th>WIND VELOCITY IN KILOMETERS PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cubic Meters per Minute Extracted EX.4</td>
<td>Cubic Meters per Minute Extracted EX.5</td>
</tr>
<tr>
<td>6.44</td>
<td>12.87</td>
<td>19.31</td>
</tr>
<tr>
<td>15.24</td>
<td></td>
<td>13.25</td>
</tr>
<tr>
<td>30.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.62</td>
<td>16.76</td>
<td>23.90</td>
</tr>
<tr>
<td>15.24</td>
<td>20.73</td>
<td>27.75</td>
</tr>
<tr>
<td>30.48</td>
<td>25.94</td>
<td>32.96</td>
</tr>
<tr>
<td>7.62</td>
<td>20.27</td>
<td>27.30</td>
</tr>
<tr>
<td>15.24</td>
<td>26.28</td>
<td>33.30</td>
</tr>
<tr>
<td>30.48</td>
<td>34.09</td>
<td>41.12</td>
</tr>
<tr>
<td>7.62</td>
<td>24.13</td>
<td>31.15</td>
</tr>
<tr>
<td>15.24</td>
<td>30.47</td>
<td>37.49</td>
</tr>
<tr>
<td>30.48</td>
<td>40.21</td>
<td>47.23</td>
</tr>
</tbody>
</table>

65
### Dimensions In mm

<table>
<thead>
<tr>
<th>Symbol No</th>
<th>Dia. Of Extractor</th>
<th>Inside of Base</th>
<th>Overall Frame</th>
<th>Inside of Base</th>
<th>Centres of Holes</th>
<th>Centres of Holes</th>
<th>Centres T.W. Lugs</th>
<th>Height Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex. 4</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>G</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>457</td>
<td>711</td>
<td>686</td>
<td>267</td>
<td>51</td>
<td>165</td>
<td>118</td>
<td>979</td>
</tr>
<tr>
<td>Ex. 5</td>
<td>610</td>
<td>940</td>
<td>914</td>
<td>356</td>
<td>51</td>
<td>254</td>
<td>149</td>
<td>1372</td>
</tr>
</tbody>
</table>

### Weight in Kgs

<table>
<thead>
<tr>
<th>Symbol</th>
<th>With full Ring</th>
<th>With Segmented Ring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX.4</td>
<td>101.30</td>
<td>108.19</td>
</tr>
<tr>
<td>EX.5</td>
<td>190.97</td>
<td>200.72</td>
</tr>
</tbody>
</table>

### Assembling the Extractor

Everest A.C. Extractor are despatched as loose components. Each component is marked for easy assembly. Cadmium plated bolts, nuts and washers are supplied with each unit, to be used for assembly. Long bolts are used to fix ring to the clamp.

Rings of Extractors are supplied in segments, having one end with Socket. They are assembled to form a complete ring.

### List of Bolts, Nuts & Washers

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Dia.</th>
<th>Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring assembly</td>
<td>50 mm</td>
<td>10 mm</td>
<td>8</td>
</tr>
<tr>
<td>Ring to Clamp</td>
<td>65 mm</td>
<td>10 mm</td>
<td>8</td>
</tr>
<tr>
<td>Clamp to Dome</td>
<td>50 mm</td>
<td>10 mm</td>
<td>8</td>
</tr>
<tr>
<td>Clamp to Base</td>
<td>50 mm</td>
<td>10 mm</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Threaded length 20 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extractor to Steel Work</td>
<td>65 mm</td>
<td>10 mm</td>
<td>4</td>
</tr>
</tbody>
</table>
Fixing

1. The frame work, supporting the base of the Extractor should be firmly secured to the superstructure. The top of the frame should be horizontal and in level.

2. The square base of the Extractor is fitted to the frame work with 8 mm dia. bolts. For the steel frame work 10 mm dia. holes should be drilled first. The holes in the base of the Extractor are drilled when it is positioned.

3. The open frame-work facing the weather below the square base of the Extractor is covered up with A.C. flat sheets, bolted to the frame-work. Care should taken to under lap the flat sheet to the base by 150 mm.

4. The angle forming between the vertical sides of the base and the adjoining sloping roofing sheets should be made water proof.

   This is done by using either lead sheets, or plain G.I. sheets to form a suitable flashing. The flashing should cover the adjoining sheets without any leakage through the joint and efficiently drain off the rain water.

Method of Fixing

Everest Extractor to Steel Roof  
Everest Extractor to Timber Roof

Methods of Fixing

Everest Extractors are supplied with square “box” bases. These bases are intended for fitting over purpose-made boxes, which can be erected on trimmers between the purlins. The diagrams illustrate various fixing methods. As a general rule it will be found easier to erect extractors just below the ridge line rather than on the actual apex. The efficiency of extractors is not in any way impaired by doing so.

For R.C.C. roofs, a square box of masonry or R.C.C. is made having dimensions suitable to the base frame, where extractors are fitted.
Everest A.C. Radial Exhaust

Everest A.C. Radial Exhausts have been specially designed to take maximum advantage of differences in the temperature velocity of passing winds. This results in efficient extraction of spent or foul air from inside the building.

![Image of Everest A.C. Radial Exhaust]

**Dimensions (in mm)**

<table>
<thead>
<tr>
<th>Size (in mm)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>PCD</th>
<th>Tees (Nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>381 (DIA.)</td>
<td>381</td>
<td>952</td>
<td>102</td>
<td>305</td>
<td>165</td>
<td>330</td>
<td>121</td>
<td>775</td>
<td>6</td>
</tr>
<tr>
<td>762 (DIA.)</td>
<td>762</td>
<td>686</td>
<td>152</td>
<td>406</td>
<td>229</td>
<td>457</td>
<td>127</td>
<td>1270</td>
<td>8</td>
</tr>
</tbody>
</table>

**Radial Exhaust-cum-Rooflight**

With an optional Fibre Reinforced Plastic lid, the Everest A.C. Radial Exhaust also serves as an effective rooflight.

**No Power Consumption**

Since Everest A.C. Radial Exhausts use the kinetic energy of passing winds, they require no electricity or other sources of energy.

**Readymade, Light-weight and easy to install**

Since Everest A.C. Radial Exhausts are readymade, they do not require any elaborate fixing.
**Maintenance-free**

The generic properties of fibre cement make Everest A.C. Radial Exhausts resistant to all kinds of corrosion. They're also fire and water resistant. Everest A.C. Radial Exhausts have no mechanised components and so there is no possibility of breakdowns. That’s why Everest A.C. Radial Exhausts last you a life-time.

**Technical Information**

**Extraction capacity of Everest A.C. Radial Exhausts**

<table>
<thead>
<tr>
<th>Temperature Difference (Celsius)</th>
<th>Height of Ventilator (metres)</th>
<th>Extraction Capacity (m³ per min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size: 381 mm. dia.</td>
<td>Size: 762 mm. dia.</td>
</tr>
<tr>
<td></td>
<td>(RE/15)</td>
<td>(RE/30)</td>
</tr>
<tr>
<td>0°</td>
<td>7.62</td>
<td>6.44* 12.87* 19.31* 25.75*</td>
</tr>
<tr>
<td></td>
<td>15.24</td>
<td>5.83 11.65 17.49 23.32</td>
</tr>
<tr>
<td>5.6°</td>
<td>7.62</td>
<td>5.03 7.00 8.96 10.93</td>
</tr>
<tr>
<td></td>
<td>15.24</td>
<td>6.29 8.26 10.22 12.19</td>
</tr>
<tr>
<td>11.1°</td>
<td>7.62</td>
<td>6.27 8.24 10.20 12.17</td>
</tr>
<tr>
<td></td>
<td>15.24</td>
<td>8.06 10.03 11.99 13.96</td>
</tr>
<tr>
<td>16.7°</td>
<td>7.62</td>
<td>7.25 9.22 11.18 13.15</td>
</tr>
<tr>
<td></td>
<td>15.24</td>
<td>9.44 11.41 13.37 15.34</td>
</tr>
</tbody>
</table>

* Wind velocity in km/hr.

**It’s as simple as this**

The velocity of the wind creates natural ventilation, so the Radial Exhaust should be positioned at the highest point—the peak of the roof to achieve maximum efficiency.

An Everest A.C. Radial Exhaust mounted on the slope where the Exhaust clears the peak of the roof also gives maximum exhaust, irrespective of the wind direction.

When the wind is in a certain direction, an Everest A.C. Radial Exhaust mounted on the slope, but not clearing peak, can provide only limited efficiency.
Methods of Fixing
Fixing to Everest Chrysotile Asbestos Cement Roof
Soaker Flange

The soaker flange sheet for RE/30 is a full length sheet, laid and bolted on the roof as a normal sheet, after mitring. The additional upturned corrugation should be trimmed-off to suit the layout of the sheet. The soaker flange sheet for RE/15 is not a full length sheet and, hence, should be mounted on a roofing sheet. The top end of the sheet should be secured to the purlins. The bottom end should be secured to the sheet by means of two 8 mm dia.-50 mm long G.I. seam bolts, with G.I. and bitumen washers. The main roofing sheet should be marked, holes drilled on the periphery of the opening and cut with a wood saw.

Body and Tees

The body is placed on the soaker flange and levelled. Tees are fitted with nuts and bolts to the sockets in the body.

Fixing to terrace or R.C.C. roof

Here, the soaker flange sheet is not required. The body with tees and G.I. mesh should be mounted on the curb-wall made of either R.C.C. or brickwork. This wall should be kept sufficiently high to prevent surface water from entering the opening.
Fixing to Everest Chrysotile Asbestos Cement Corrugated Curved Sheet roof
Soaker flange

The curved soaker flange sheet is mounted on the top of the central sheet. Ends of the sheet should be fixed with 50 mm G.I. seam bolts, two G.I. and one bitumen washer each, on the crowns of all corrugations.

The main sheet should be marked, holes drilled on the periphery of the opening and cut with a wood saw.
Everest Chrysotile Asbestos Cement Gutters & Gutter Fittings

Everest Chrysotile Asbestos Cement Gutters are manufactured in three varieties. The standard range of gutters and gutter fittings are discussed here. Gutters and gutter fittings, other than standard designs, are also manufactured to suit individual requirements. All standards gutters are manufactured in 1.83 m lengths.

Domestic Gutters:

Half round gutters are used for domestic building purposes. They are manufactured with a socket at one end. The socket has holes to suit the holes of the spigot for jointing of the gutter line. Different fittings matching the gutter are available. For taking an outlet from the gutter, a suitable fitting is used which is available with outlets of different diameters.

Industrial Gutters:

Boundary Wall or Eaves Gutters and Valley Gutters are used in industrial structures. These gutters are plain ended with matching holes for jointing. Both the ends of the gutter have holes for jointing bolts. Union clips are used in jointing gutters and accessories. Different fittings for the gutters are available. Fittings with different diameter outlets are available for all sizes of the gutters.
Socketed gutters are 1.83 m long excluding length of Socket

Gutter Fittings:

a) Gutter Fittings for Half Round Gutters

1. Dropends
At the end of the gutter length where outlets are required, Dropends are used. They are made to suit the standard gutters and are available with different diameters of outlets. One end has a dead end and the other has either socket or spigot.

Dropends with Socket
It is used to fit over the spigot end of the gutter. For jointing bolts it has suitable holes to match with the holes in the spigot end of the gutter.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>NOMINAL SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Weight in Kgs</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG 11</td>
<td>152.4</td>
<td>152.4</td>
<td>76.2</td>
<td>9.5</td>
<td>8.036</td>
</tr>
<tr>
<td>HG 21</td>
<td>228.6</td>
<td>228.6</td>
<td>114.3</td>
<td>9.5</td>
<td>13.111</td>
</tr>
<tr>
<td>HG 31</td>
<td>304.8</td>
<td>304.8</td>
<td>152.4</td>
<td>9.5</td>
<td>14.888</td>
</tr>
</tbody>
</table>

* B & C stands for outlet dia. of 101.6 mm & 152.4 mm respectively.
**Dropend with Spigot:**

It is used to fit inside the socket of the gutter. For jointing bolts it has suitable holes to match the holes in the socket of the gutter.

<table>
<thead>
<tr>
<th>Size in mm</th>
<th>Gutter Size</th>
<th>152.4</th>
<th>228.6</th>
<th>304.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet</td>
<td>101.6</td>
<td>101.6</td>
<td>152.4</td>
<td>101.6</td>
</tr>
<tr>
<td>Symbol</td>
<td>HD 12/B</td>
<td>HD 22/B</td>
<td>HD 22/C</td>
<td>HD 32/B</td>
</tr>
<tr>
<td>Weight in Kgs</td>
<td>1.718</td>
<td>4.124</td>
<td>4.653</td>
<td>5.499</td>
</tr>
</tbody>
</table>

* B & C stands for outlet dia of 101.6mm & 152.4 mm respectively.

**2. Stopends:**

Where the end of the gutter is required to be closed, stopends are used.

They are made to suit the standard gutters.

**Stopend for Spigot:**

It is used to fit over the spigot end of the gutter. For jointing bolts it has suitable holes to match with the holes in the spigot end of the gutter.

<table>
<thead>
<tr>
<th>Size in mm</th>
<th>152.4</th>
<th>228.6</th>
<th>304.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>HS 12</td>
<td>HS 22</td>
<td>HS 32</td>
</tr>
<tr>
<td>Weight in Kgs</td>
<td>0.602</td>
<td>1.481</td>
<td>1.548</td>
</tr>
</tbody>
</table>

**Stopend for Socket:**

It is used to fit inside the socket of the gutter. For jointing bolts, it has suitable holes to match the holes in the socket of the gutter.
3. Nozzles

Outlets at any point in a straight length of the gutter can be provided by the use of the nozzle. Nozzles are made with sockets at both the ends and to suit the standard gutter. For jointing bolts, the sockets have suitable holes to match the holes in the spigot end of the gutter.

<table>
<thead>
<tr>
<th>Size in mm</th>
<th>152.4</th>
<th>228.6</th>
<th>304.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>HS 11</td>
<td>HS 21</td>
<td>HS 31</td>
</tr>
<tr>
<td>Weight in Kgs</td>
<td>0.428</td>
<td>1.374</td>
<td>1.141</td>
</tr>
</tbody>
</table>

4) Union Clips

Union Clips or sockets are manufactured to suit standard gutters. They are used to connect two cut lengths of the gutter or at a broken socket of the gutter. The holes for jointing bolts should be drilled on site on the gutter ends to suit the Union Clip.

<table>
<thead>
<tr>
<th>Size in mm</th>
<th>152.4</th>
<th>228.6</th>
<th>304.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>HN 11/B</td>
<td>HN 21/B</td>
<td>HN 21/C</td>
</tr>
<tr>
<td>Weight in Kgs</td>
<td>2.262</td>
<td>4.102</td>
<td>5.075</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size in mm</th>
<th>152.4</th>
<th>228.6</th>
<th>304.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>HU 11</td>
<td>HU 21</td>
<td>HU 31</td>
</tr>
<tr>
<td>Weight in kgs</td>
<td>0.656</td>
<td>1.586</td>
<td>2.115</td>
</tr>
</tbody>
</table>
Boundary Wall or Eaves Gutters

Dimension in mm

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Nominal Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>R</th>
<th>Weight in Kgs</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG10</td>
<td>279.4 x 127.0 x 177.8</td>
<td>279.4</td>
<td>127.0</td>
<td>177.8</td>
<td>9.5</td>
<td>12.7</td>
<td>13.957</td>
</tr>
<tr>
<td>EG 20</td>
<td>304.8 x 152.4 x 228.6</td>
<td>304.8</td>
<td>152.4</td>
<td>228.6</td>
<td>12.7</td>
<td>12.7</td>
<td>21.994</td>
</tr>
<tr>
<td>EG 30</td>
<td>457.2 x 152.4 x 304.8</td>
<td>457.2</td>
<td>152.4</td>
<td>304.8</td>
<td>12.7</td>
<td>12.7</td>
<td>27.492</td>
</tr>
<tr>
<td>EG 40</td>
<td>508.0 x 152.4 x 254.0</td>
<td>508.0</td>
<td>152.4</td>
<td>254.0</td>
<td>12.7</td>
<td>12.7</td>
<td>27.492</td>
</tr>
</tbody>
</table>

All Gutters are supplied in 1.83 m lengths.

b) Gutter Fittings for Boundary Wall Gutters

All fittings are plain ended having suitable holes to be fitted with Union Clips. Left hand and right hand for Dropends and Stopends are identified by facing splayed side of these gutter fittings.

1. Dropends

Dropends are used at the end of the gutter lengths, where outlets are required. They are made to suit the standard gutters and are available with different diameters of outlet. They are of two types; (i) Left Hand-Dropend and (ii) Right Hand Dropend. One end of the Dropend is a dead end. Union Clip is used for jointing.
### 2. Stopend

Stopends are made to suit the standard gutters. They are used where the gutter is required to be closed. For jointing bolts, they have suitable holes to match with the plain end of the gutter, and they are fitted over the gutter ends. Union Clips are not required for jointing.

<table>
<thead>
<tr>
<th>Used with Gutters</th>
<th>EG 10</th>
<th>EG 20</th>
<th>EG 30</th>
<th>EG 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol R.H.</td>
<td>ED13/B</td>
<td>ED13/C</td>
<td>ED23/B</td>
<td>ED23/C</td>
</tr>
<tr>
<td>Weight in Kgs.</td>
<td>4.335</td>
<td>4.880</td>
<td>6.661</td>
<td>7.190</td>
</tr>
<tr>
<td>Symbol L.H.</td>
<td>ED14/B</td>
<td>ED14/C</td>
<td>ED24/B</td>
<td>ED24/C</td>
</tr>
<tr>
<td>Weight in Kgs.</td>
<td>4.547</td>
<td>4.867</td>
<td>7.190</td>
<td>7.250</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Used with Gutters</th>
<th>EG 10</th>
<th>EG 20</th>
<th>EG 30</th>
<th>EG 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol L.H.</td>
<td>ES 13</td>
<td>ES 23</td>
<td>ES 33</td>
<td>ES 43</td>
</tr>
<tr>
<td>Weight in Kgs.</td>
<td>1.576</td>
<td>2.522</td>
<td>2.993</td>
<td>2.877</td>
</tr>
</tbody>
</table>
3. Nozzle

Outlets from any point in a straight length of the gutter can be provided by using the Nozzles. They are made to suit the standard gutters, with different diameters of outlet. Union Clips are used for jointing.

<table>
<thead>
<tr>
<th>Used with Gutters</th>
<th>EG 10</th>
<th>EG 20</th>
<th>EG 30</th>
<th>EG 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet in mm</td>
<td>101.6</td>
<td>152.4</td>
<td>101.6</td>
<td>152.4</td>
</tr>
<tr>
<td>Symbol</td>
<td>EN10/B</td>
<td>EN10/C</td>
<td>EN20/B</td>
<td>EN20/C</td>
</tr>
<tr>
<td>Weight in Kgs.</td>
<td>5.118</td>
<td>5.347</td>
<td>7.033</td>
<td>7.774</td>
</tr>
</tbody>
</table>

4. Union Clips

Union Clips or sockets are manufactured to suit standard gutters. They are used to connect gutters and fittings. With each gutter length and fitting, one Union Clip is used except with Stopends where Union Clips are not required. When making a joint with cut lengths of the gutter, holes to the gutter ends should be made on site to match with that of the Union Clips.

<table>
<thead>
<tr>
<th>Used with Gutters</th>
<th>EG 10</th>
<th>EG 20</th>
<th>EG 30</th>
<th>EG 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>EU 11</td>
<td>EU 21</td>
<td>EU 31</td>
<td>EU 41</td>
</tr>
<tr>
<td>Weight in Kgs.</td>
<td>2.326</td>
<td>3.278</td>
<td>4.018</td>
<td>4.230</td>
</tr>
</tbody>
</table>
Valley Gutter

Dimension in mm.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Nominal Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>R</th>
<th>Weight in Kgs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VG 10</td>
<td>406.4 x 127.0 x 254.0</td>
<td>406.4</td>
<td>127.0</td>
<td>254.0</td>
<td>12.7</td>
<td>25.4</td>
<td>22.839</td>
</tr>
<tr>
<td>VG 40</td>
<td>457.2 x 127.0 x 152.4</td>
<td>457.2</td>
<td>127.0</td>
<td>152.4</td>
<td>12.7</td>
<td>25.4</td>
<td>23.263</td>
</tr>
<tr>
<td>VG 20</td>
<td>609.6 x 152.4 x 228.6</td>
<td>609.6</td>
<td>152.4</td>
<td>228.6</td>
<td>12.7</td>
<td>25.4</td>
<td>27.492</td>
</tr>
<tr>
<td>VG 30</td>
<td>914.4 x 203.2 x 228.6</td>
<td>914.4</td>
<td>203.2</td>
<td>228.6</td>
<td>12.7</td>
<td>25.4</td>
<td>42.296</td>
</tr>
</tbody>
</table>

All Gutters are supplied in 1.83 m lengths.

c) Gutter Fittings for Valley Gutter

All fittings are plain ended having suitable holes to match with Union clips for jointing.

1. Dropends

When outlets are required at the end of the gutter, Dropends are used. They are available to suit the standard gutters and are made with different diameters of outlet.

<table>
<thead>
<tr>
<th>Used with Gutters</th>
<th>VG10</th>
<th>VG 20</th>
<th>VG 30</th>
<th>VG 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet in mm</td>
<td>101.6</td>
<td>152.4</td>
<td>101.6</td>
<td>152.4</td>
</tr>
<tr>
<td>Symbol</td>
<td>VD12/B</td>
<td>VD12/C</td>
<td>VD22/B</td>
<td>VD22/C</td>
</tr>
</tbody>
</table>
2. Stopends

Stopends are made to suit the standard gutters. They are used where the gutter is required to be closed. For jointing bolts they have suitable holes to match with the plain end of the gutter and they are fitted over the gutter ends.

<table>
<thead>
<tr>
<th>Used with Gutters</th>
<th>VG 10</th>
<th>VG 20</th>
<th>VG 30</th>
<th>VG 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>VS 12</td>
<td>VS 22</td>
<td>VS 32</td>
<td>VS 42</td>
</tr>
<tr>
<td>Weight in Kgs</td>
<td>2.495</td>
<td>3.077</td>
<td>5.085</td>
<td>2.543</td>
</tr>
</tbody>
</table>

3. Nozzle

Outlets from any point in a straight length of the gutter can be provided by using Nozzles. They are made to suit the standard gutters with different diameters of outlet.

<table>
<thead>
<tr>
<th>Used with Gutters</th>
<th>VG10</th>
<th>VG 20</th>
<th>VG 30</th>
<th>VG 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet in mm</td>
<td>101.6</td>
<td>152.4</td>
<td>101.6</td>
<td>152.4</td>
</tr>
<tr>
<td>Symbol</td>
<td>VN10/B</td>
<td>VN10/C</td>
<td>VN20/B</td>
<td>VN20/C</td>
</tr>
</tbody>
</table>
4. Union Clips

Union Clips or sockets are manufactured to suit standard gutters. They are used to connect gutters and fittings. With each gutter length and fittings, one Union Clip is used except with Stopends where Union Clips are not required. When making a joint with cut lengths of the gutter, holes to the ends should be made on site to match with that of the Union Clips.

<table>
<thead>
<tr>
<th>Used with Gutters</th>
<th>VG 10</th>
<th>VG 20</th>
<th>VG 30</th>
<th>VG 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>VU 11</td>
<td>VU 21</td>
<td>VU 31</td>
<td>VU 41</td>
</tr>
<tr>
<td>Weight in Kgs.</td>
<td>3.172</td>
<td>4.230</td>
<td>5.921</td>
<td>3.383</td>
</tr>
</tbody>
</table>
**Special Gutters:**

The cross section of the gutter is larger than standard gutters. This increases the carrying capacity of the gutter, with the result larger area of roots can be drained off by using outlets at greater distance than the standard normal practice.

The outlet (9"=228 mm) is also of larger diameter which is advantageous against standard outlet (maximum of which is 150 mm).

There are three different sizes to select from, to suit the individual requirement. These gutters are manufactured in 2 m and 2.44 m lengths.

The clip provided to this gutter prevents back splash of rain water from the roof.

These gutters are plain ended and jointing between gutters and/or accessories is done with the use of union clips.

The method of laying and fixing of gutters is common to that of standard range of gutters.

---

**Dimensions in mm**

<table>
<thead>
<tr>
<th>Type of Gutter</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>457.2</td>
<td>177.8</td>
<td>254</td>
<td>25.4</td>
</tr>
<tr>
<td>B</td>
<td>457.2</td>
<td>203.2</td>
<td>254</td>
<td>50.8</td>
</tr>
<tr>
<td>C</td>
<td>457.2</td>
<td>228.6</td>
<td>254</td>
<td>76.2</td>
</tr>
</tbody>
</table>

Gutters and fittings are plain ended and fitted with Union Clips.
Design Considerations

Gutter Sizes:
Roof drainage calculations can usually be based on a rate of 100 mm rainfall per hour but it is recommended to observe the best local practice always.

Flow Load:
The rate of run off from a roof is the product of the design rate of rainfall from (usually 100 mm/hour) and the effective roof area (1 mm of rainfall on an area of one square metre is one litre of water). To meet the conditions due to the strength of wind and the angle of descent of the wind-driven rain, it is suggested that the effective roof area should be taken as the plan area plus half the elevation area, see diagram. This applies to Gutters used at free end of eaves. For slopes other than free eaves, i.e. in valley or between Northlight, only plan area should be considered.

The rate of run-off for 100 mm/hour rainfall on one square metre area will get 100 litres per hour i.e. 1.67 litre per minute. (It is convenient to calculate the flow load per metre run at the eaves). Table 1 & 3 on pages 92 and 93 give the flow capacity of a level gutter with an outlet at one end. These tables also give the maximum roof area that can be drained where the rainfall is 100 mm per hour. A fall in the gutter increases the rate of flow and should be regarded as an increase in the safety margin against overflow. The following examples will illustrate the use of the table:

i) Gutter at Free End of Eaves:
Example:
Calculate the size of the Half Round eaves gutter required to drain a roof 40 m long x 10 m (ridge to eaves) with 30 degrees pitch.

Calculate the roof area per metre run of eaves. By calculation or measurement from drawings, plan length ridge to eaves is 8.65 m. The height of ridge from eaves is 5 m. Plan length + half the height

$$= 8.65 + \frac{5.0}{2}$$
$$= 11.15 \text{ m}.$$
The effective roof area is thus 11.15m² per m of eaves.

With rainfall at 100 mm/hour. (1.67 ltr. / min. sq. m) the rate of run off will be —11.15 x 1.67=18.62 ltr. / min.

From Table 3, a 152.4 mm half round gutter could cope with the flow from a length of eaves of—
\[\frac{142}{18.62} = 7.62 \text{ m}... \text{(i)}\]

Alternatively a 228.6 mm half round gutter could cope with the flow from a length of eaves of—
\[\frac{393}{18.62} = 21.10 \text{ m}... \text{(ii)}\]

Outlets will be needed at not more than double these distance apart viz. 15.2 m or 42.2 m for the two sizes of gutters. In no case should the distance between outlets exceed 15 m. So use 152.4 mm Half Round Gutters.

ii) Gutters at valley

Example:

Calculate the size of Valley Gutter required to drain a roof 40 m long x 20 m (two slopes of 10 m from eaves to ridge) with 21 degree pitch.

Calculate the roof area per metre run of eaves. By calculation or measurement from drawing, plan length ridge to eaves is 9.34 m Two slopes equals 18.68 metres.

The effective root area thus =18.68 m² of 1 m length of eaves.

With rainfall at 100 mm/hour (1.67 ltr./min. sq.m.) The rate of run-off will be:-

\[18.68 \times 1.67 = 31.19 \text{ ltr.}/\text{min}\]

From Table 1 VG. 10 (406.4 x 127 x 254 mm) Valley Gutter could cope with the flow from a length of eaves of:
\[\frac{208}{31.19} = 6.67 \text{ m}... \text{(1)}\]

Alternatively VG.20 (609.6 x 152.4 x 228.6 mm) Valley Gutter could cope with the flow from a length of eaves of:-
\[\frac{368}{31.19} = 11.79 \text{ m}... \text{(2)}\]

Outlet will be needed at not more than double these distance apart viz.= 13.34 m or 23.58 m for the two sizes of Gutters. In no case should the distance between outlets exceed 15 m. So use VG. 10 (406.4 x 127 x 254 mm) Valley Gutters.
III) Boundary Wall Gutter between Northlight Roof:-

Example: - 1

Calculate the size of Boundary Wall Gutter required to drain a roof 40 m long x 12 m (from eaves to ridge) with 21 degrees pitch.

Calculate the roof area per metre run of eaves. By calculation or measurement from drawing, plan length ridge to eaves is 11.2 m.

The effective roof area thus = 11.2 m² of 1 m length of eaves.

With rainfall at 100 m/hour (1.67 ltr. / min. sq.m). The rate of run-off will

\[ 11.2 \times 1.67 = 18.70 \text{ ltr. / min.} \]

From Table 1 EG. 10 (279.4 x 127 x 177.8 mm) Boundary Wall Gutter could cope with the flow from a length of eaves of –

\[ \frac{146}{18.7} = 7.80 \text{ m... (1)} \]

Alternatively EG.20, (304.8 x 152.4 x 228.6 mm) Boundary Wall Gutter could cope with the flow from a length of eaves of:

\[ \frac{337}{18.7} = 18.02 \text{ m... (2)} \]

Outlet will be needed at not more than double these distance apart viz. 15.60 m or 36.04 m for the two sizes of Gutters. In no case should the distance between outlets exceed 15 m.

So use EG.10, (279.4 x 127 x 177.8 mm) Boundary Wall Gutter.

For examples given above, a suitable size of down-take pipe may be selected from the table given on page 92 & 93.

For outlets other than the two extreme ones, the Gutter capacity shown in the table be doubled and will drain double the roof area.

However, the following method may be used as a general guide to determine the size of Gutter and rain water pipes suitable for 100 mm/hour rainfall.

Nomogram

The nomogram provides a simple guide for determining the sizes of Gutter and rainwater pipes from the length of a roof eaves line drained by each outlet and the length of its upslope (including both slopes of a roof valley).

To use the nomogram, join the appropriate points on Scales A and C with straight line and read off the required gutter and rainwater pipe sizes at the intersection point on Scale B.

NB : Always select gutter and pipe sizes above the intersection point, not below it.

Example. To find the required size of gutter and rainwater pipes for two roof slopes each with a 10 M upslope and each 36 m long, draining into a common valley.

Total upslope length = 2 x 10 M = 20 m (Scale C).

Assume each rainwater pipe drains 15 M of gutter (Scale A).
Drawing the appropriate line on the nomogram gives an intersection point on Scale B indicating that a 457.2 x 127.0 x 152.4 mm valley gutter (VG - 10) with 150 mm diameter rainwater pipe is required.
**Support for Gutters:**

1) To facilitate fabrication of gutter brackets, tables of dimensions for all gutters and fittings are given on page 98 & 99.

2) Brackets should be so fabricated and fixed that they permit the necessary slope to be given to the gutter line.

3) When the gutter is between two roof slopes or a Northlight roof or at tiff parapet at eaves of the Northlight roof, the supporting roof structure should be such as to have sufficient room for the gutter lines to be raised or lowered to obtain a positive slope towards the outlet of the gutter.

4) The outlet of the gutter should be at the lowest point of the gutter slope, so that the highest point of the slope is centered between two outlets.

5) The outlet of the gutter should preferably be near the vertical support in the structure along which a down take pipe can be fixed.

6) The design of the roof structure should allow the roofing at the eaves to project into the gutter:
   (i) by about 75 mm in case of the half round gutters
   (ii) by about 100 mm in case of the Eaves or Boundary Wall and Valley Gutters.

7) For efficient functioning, the length of a gutter between two outlets should be kept within 15 metres. However, if the situation warrants an increase in the distance, the gutter section should be designed suitably.

8) The position of the gutter outlets should be determined at the design stage keeping in view that it is efficiently functional to have more outlets of smaller diameters than to have a lesser number of large diameter outlets.

9) No gutter should be allowed to discharge on to the roofing.

10) Full length gutters should be used at outlets, and a cut length make up piece arranged in the centre of the gutter.

11) In case where gutter is laid to a slope, the gap between the top of the gutter and the roofing sheet should not exceed 25 mm, otherwise the rainwater may splash outside the gutter creating damage.

**Notes on Jointing and Fixing:**

1) Socketed gutters should be supported with a bracket close to the socket and one in the centre of the gutter (see diagram on page 100).

2) Plain ended gutter and fittings should be supported with a bracket on either side of the Union Clip. For gutters one extra supporting bracket in the centre of the gutter should be provided (see diagram on page 96).

3) Gutters and Fittings to be jointed should be perfectly dry. The sockets and spigot ends that are to be jointed should be cleaned thoroughly. Asbestos Rope of 6 mm dia. smeared
with Bitumastic Jointing Compound should be placed on both sides of the socket or Union Clip 12 mm inside from the edge along its inner contour (see diagram on page 100).

4) The intervening space between the ropes shall be filled with Bitumastic Jointing Compound and levelled to the height of the rope.

5) In case of the socketed gutters, the spigot end of the gutter or the fitting is placed into the next socketed gutter or fitting within the prepared socket (see diagram on page 100).

6) In case of the plain-ended gutters, the gutters and fittings are placed in position with 1.5 mm space between the butt-joints and the prepared Union Clip is fixed underneath the butt-joint (see diagram on page 100).

7) From the inside of the Gutter insert 8 mm dia. G.I. Seam Bolt in the ready drilled holes with a Bitumen washer adjacent to the Gutter, and a G.I. Flat Washer over it. On the outside of the Gutter place a Bitumen Washer next to the Gutter with a G.I. Flat Washer on top of it and then secure with a G.I. Nut.

8) The Bolts should be positioned so that the Bitumen Washers are correctly centred on the holes in the gutter as also on the Union Clip/Socket.

9) The nuts should be tightened evenly. Over tightening of nuts may damage the Gutter or Fitting. The Bitumastic Jointing Compound must come out from the joint which means that the joint is fully covered with the compound which should be cleaned off.

10) After a complete Gutter line has been fixed in position, adjust all uniform slope towards the Gutter outlets. After two or three weeks, check all the nuts for tightness.

**Testing of Gutters:**

The Gutter line must be tested for a positive slope towards the outlet. It must also be tested for water tightness after jointing. All outlets should be plugged and the entire length of the Gutter line filled with water. Long runs may be divided into sections for testing. Allow the water to remain in the Gutter for 24 hours. Adjustment in slopes and defects in the joint are to be made good.

In areas where rainfall is particularly heavy or the area of roof is large it is sometimes advisable to cut an overflow Notch at the dead-end of the Gutter line, i.e., the Dropend or the Stopend of the Gutter (see diagram on page 96).

Approximate quantity of jointing materials required per joint is shown in Table (see on page 97).
### Table-1

**Sizing Gutters** Flow capacity of level gutter with outlet at one end.

<table>
<thead>
<tr>
<th>Type</th>
<th>Size (mm)</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>HO (mm)</th>
<th>Area (mm²)</th>
<th>Capacity ltr./min.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( \sqrt{\frac{\text{Area}^3}{\text{B}}} \times 10^4 \times 60 )</td>
</tr>
<tr>
<td><strong>Boundary Wall Gutters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EG 10</td>
<td>279.4 x 127.0 x 177.8</td>
<td>177.8</td>
<td>198.5</td>
<td>26.0</td>
<td>4892</td>
<td>146</td>
</tr>
<tr>
<td>EG 20</td>
<td>304.8 x 152.4 x 228.6</td>
<td>228.6</td>
<td>247.9</td>
<td>38.7</td>
<td>9213</td>
<td>337</td>
</tr>
<tr>
<td>EG 30</td>
<td>457.2 x 152.4 x 304.8</td>
<td>304.8</td>
<td>343.5</td>
<td>38.7</td>
<td>12531</td>
<td>454</td>
</tr>
<tr>
<td>EG 40</td>
<td>508.0 x 152.4 x 254.0</td>
<td>254.0</td>
<td>318.4</td>
<td>38.7</td>
<td>11053</td>
<td>391</td>
</tr>
<tr>
<td><strong>Valley Gutter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VG 10</td>
<td>406.4 x 127 x 254.0</td>
<td>254.0</td>
<td>285.2</td>
<td>26.0</td>
<td>7009</td>
<td>208</td>
</tr>
<tr>
<td>VG 20</td>
<td>457.2 x 127 x 152.4</td>
<td>152.4</td>
<td>214.3</td>
<td>26.0</td>
<td>4767</td>
<td>135</td>
</tr>
<tr>
<td>VG 20</td>
<td>609.6 x 152.4 x 228.6</td>
<td>228.6</td>
<td>324.2</td>
<td>38.7</td>
<td>10697</td>
<td>368</td>
</tr>
<tr>
<td>VG 30</td>
<td>914.4 x 203.2 x 228.6</td>
<td>228.6</td>
<td>450.6</td>
<td>64.1</td>
<td>21767</td>
<td>908</td>
</tr>
</tbody>
</table>

Maximum roof area drained to one outlet for different gutters for varying heads (Hₒ), where the rainfall is 100 mm per hour.

![Diagram of gutter system with measurements]

### Table-2

**Sizing Pipes**

Sizes of outlets in different gutter fittings, showing capacity to drain roof area in m² where the rainfall is 100 mm per hour.

<table>
<thead>
<tr>
<th>Fittings</th>
<th>Dropend</th>
<th>Nozzle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet in mm</td>
<td>101.6</td>
<td>152.4</td>
</tr>
<tr>
<td>Type of Gutters</td>
<td>101.6</td>
<td>152.4</td>
</tr>
<tr>
<td>Area of Roof in m²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EG 10</td>
<td>95</td>
<td>145</td>
</tr>
<tr>
<td>EG 20</td>
<td>115</td>
<td>260</td>
</tr>
<tr>
<td>EG 30</td>
<td>115</td>
<td>260</td>
</tr>
<tr>
<td>EG 40</td>
<td>115</td>
<td>260</td>
</tr>
<tr>
<td>Fittings</td>
<td>Dropend</td>
<td>Nozzle</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>Outlet in mm</td>
<td>101.6</td>
<td>152.4</td>
</tr>
<tr>
<td>VG 10</td>
<td>95</td>
<td>145</td>
</tr>
<tr>
<td>VG 40</td>
<td>95</td>
<td>145</td>
</tr>
<tr>
<td>VG 20</td>
<td>115</td>
<td>260</td>
</tr>
<tr>
<td>VG 30</td>
<td>149</td>
<td>335</td>
</tr>
</tbody>
</table>

**Type of Gutters**

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Capacity ltr/min. 0.0016 A^{1.25}</th>
<th>Roof area m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG 11</td>
<td>152.4 dia</td>
<td>142</td>
<td>85</td>
</tr>
<tr>
<td>HG 21</td>
<td>228.6</td>
<td>393</td>
<td>237</td>
</tr>
<tr>
<td>HG 31</td>
<td>304.8</td>
<td>807</td>
<td>486</td>
</tr>
</tbody>
</table>

**Table-3**

**Half round Gutters**

Flow capacity of level gutters with outlet at one end. Gutter running full

<table>
<thead>
<tr>
<th>Type</th>
<th>Size (mm)</th>
<th>Cross Section Area (mm²)</th>
<th>Capacity ltr/min. 0.0016 A^{1.25}</th>
<th>Roof area m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG 11</td>
<td>152.4 dia</td>
<td>9121</td>
<td>142</td>
<td>85</td>
</tr>
<tr>
<td>HG 21</td>
<td>228.6</td>
<td>20522</td>
<td>393</td>
<td>237</td>
</tr>
<tr>
<td>HG 31</td>
<td>304.8</td>
<td>36483</td>
<td>807</td>
<td>486</td>
</tr>
</tbody>
</table>

Tables based on BRS Digest 188, April 1976, 189 May 1976.

**Everest A.C. Special Eaves Gutters**

![Diagram of Everest A.C. Special Eaves Gutters]

R for type A = 2.54 cm
B = 5.08 cm
C = 7.62 cm

<table>
<thead>
<tr>
<th>Type of Gutter</th>
<th>Size (cm)</th>
<th>A (cm)</th>
<th>B (cm)</th>
<th>H₀ (cm)</th>
<th>Area cm²</th>
<th>Capacity ltr/min</th>
<th>Roof Area m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>45.72 x 17.78 x 25.40</td>
<td>25.40</td>
<td>32.25</td>
<td>5.14</td>
<td>148.16</td>
<td>582.41</td>
<td>348.75</td>
</tr>
<tr>
<td>B</td>
<td>45.72 x 20.32 x 25.40</td>
<td>25.40</td>
<td>33.95</td>
<td>6.41</td>
<td>190.22</td>
<td>825.78</td>
<td>494.48</td>
</tr>
<tr>
<td>C</td>
<td>45.72 x 22.86 x 25.40</td>
<td>25.40</td>
<td>35.64</td>
<td>7.68</td>
<td>234.39</td>
<td>1102.40</td>
<td>660.12</td>
</tr>
</tbody>
</table>

Maximum roof area drained to one outlet for varying Heads (H₀) where rainfall is 100 mm/hour.
Tables of Dimensions For Gutter Accessories  
(All sizes in millimetres)

**Half Round Gutter**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>Length of outlet 'K' for Diameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG 11</td>
<td>146.1</td>
<td>88.9</td>
<td>171.5</td>
<td>241.3</td>
<td>69.9</td>
<td>79.4</td>
<td>127.0</td>
<td>101.6</td>
</tr>
<tr>
<td>HG 21</td>
<td>190.5</td>
<td>190.5</td>
<td>210.3</td>
<td>308.0</td>
<td>97.6</td>
<td>107.2</td>
<td>195.3</td>
<td>101.6</td>
</tr>
<tr>
<td>HG 31</td>
<td>190.5</td>
<td>190.5</td>
<td>210.3</td>
<td>308.0</td>
<td>97.6</td>
<td>107.2</td>
<td>195.3</td>
<td>101.6</td>
</tr>
</tbody>
</table>

**Boundary Wall (or Eaves Gutter)**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>L</th>
<th>R.H. OR L.H.</th>
<th>P</th>
<th>Length of Outlet ‘R’ For Diameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>N</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>EG 10</td>
<td>292.1</td>
<td>200.0</td>
<td>308.0</td>
<td>123.8</td>
</tr>
<tr>
<td>EG 20</td>
<td>292.1</td>
<td>203.2</td>
<td>308.0</td>
<td>127.0</td>
</tr>
<tr>
<td>EG 30</td>
<td>292.1</td>
<td>203.2</td>
<td>308.0</td>
<td>127.0</td>
</tr>
<tr>
<td>EG 40</td>
<td>292.1</td>
<td>203.2</td>
<td>308.0</td>
<td>127.0</td>
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</tbody>
</table>
## VALLEY GUTTER

<table>
<thead>
<tr>
<th>Symbol</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Length of Outlet ‘R’ For Diameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>101.6</td>
<td>152.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VG 10</td>
<td>292.1</td>
<td>203.2</td>
<td>308.0</td>
<td>127.0</td>
<td>254.0</td>
<td>98.4</td>
</tr>
<tr>
<td>VG 40</td>
<td>292.1</td>
<td>203.2</td>
<td>308.0</td>
<td>127.0</td>
<td>254.0</td>
<td>98.4</td>
</tr>
<tr>
<td>VG 20</td>
<td>292.1</td>
<td>203.2</td>
<td>308.0</td>
<td>127.0</td>
<td>254.0</td>
<td>98.4</td>
</tr>
<tr>
<td>VG 30</td>
<td>292.1</td>
<td>203.2</td>
<td>308.0</td>
<td>127.0</td>
<td>254.0</td>
<td>98.4</td>
</tr>
</tbody>
</table>

![Diagram of VALLEY GUTTER symbols and dimensions](image-url)
Position of Gutter Brackets

Preparation of Joints

Jointing of Socketed Gutter

Jointing of Plain Ended Gutter

Overflow Notch for Dropends & Stopends
## Approximate Quantities of Jointing Material Required Per Joint

<table>
<thead>
<tr>
<th>Type of Gutter</th>
<th>Symbol No.</th>
<th>6 mm dia. Asbestos Rope (Metres)</th>
<th>Bitumastic Jointing Compound (gms.)</th>
<th>8 mm dia. G.1 Bolts and Nuts (Nos.)</th>
<th>G.I. Washer 25 mm. dia. (Nos.)</th>
<th>Bitumen Washers 25 mm. dia. (Nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.G.</td>
<td>HG. 11</td>
<td>0.58</td>
<td>170</td>
<td>1</td>
<td>45</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>HG. 21</td>
<td>0.84</td>
<td>507</td>
<td>3</td>
<td>45</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>HG. 31</td>
<td>1.07</td>
<td>709</td>
<td>3</td>
<td>45</td>
<td>6</td>
</tr>
<tr>
<td>E.G.</td>
<td>EG. 10</td>
<td>0.99</td>
<td>737</td>
<td>8</td>
<td>45</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>EG. 20</td>
<td>1.17</td>
<td>851</td>
<td>8</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>EG. 30</td>
<td>1.40</td>
<td>1021</td>
<td>8</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>EG. 40</td>
<td>1.45</td>
<td>1049</td>
<td>10</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>V.G.</td>
<td>VG. 10</td>
<td>1.14</td>
<td>851</td>
<td>8</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>VG. 40</td>
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<td>851</td>
<td>8</td>
<td>50</td>
<td>16</td>
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<tr>
<td></td>
<td>VG. 20</td>
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<td>50</td>
<td>16</td>
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<td></td>
<td>VG. 30</td>
<td>2.11</td>
<td>1531</td>
<td>12</td>
<td>50</td>
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</tbody>
</table>
**Everest A.C. Refuse Disposal System**

Refuse and garbage from domestic buildings, particularly with the increasing number of multi-storeyed buildings in major cities, require a suitable method for collection and removal. Local authorities normally provide for a periodic collection of garbage from domestic buildings. However, attention is to be paid for disposal of garbage from individual flats, so that insanitary conditions are avoided. It is more hygienic to dispose off the garbage through a shaft located near the flat than to carry buckets of garbage all the way to ground level.

**Dimensional Data:**

The Everest A.C. Refuse Disposal System is designed for the floor heights of 3.2 m. It can also be suitably made for other heights. The system consists of Pipes, Junctions and M.S. Hoppers. The diameters available are 229 mm, 305 mm, 381 mm and 457 mm. The M.S. Hopper is standard for all diameters.

**Definitions:-**

a) **Chute:-**

A vertical pipe system passing from floor to floor provided with ventilation and inlet openings for receiving refuse from successive flats; and ending at the ground level on the top of the container in collecting chamber.

b) **Inlet Hopper**-

A receptacle fitting made of M.S. for receiving refuse from each flat and dropping into the chute.

c) **Collection Chamber**:-

A room at ground level at the lower end of the chute for collecting and housing the refuse during the period between two successive clearings.
### All Dimensions in Millimetres

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<th>305</th>
<th>381</th>
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### Symbol Nos. and Weight

#### Diameters mm

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</table>
Assembly & Installation of Everest A.C. Refuse Disposal System

Enlarged Details

PLAN

SECTION
Access for Cleaning
Opening for Flushing Purpose
A.C. Pipe Piece Terrace Floor
152.4 mm Dia. 112
Single Equal Junction
152.24 mm Dia. A.C.
Single Socketed Pipe
A.C. Adaptor
A.C. Refuse Junction
12th Floor
A.C. Refuse Pipe
Brick Wall
A.C. Refuse Junction
11th Floor
305 mm Dia.
A.C. Refuse Pipe
M.S. Hopper
A.C. Refuse Junction
1st Floor
A.C. Refuse Pipe
M.S. Hopper
A.C. Refuse Junction
Gr. Floor
Sliding Shutter
Trolley
R.C.C. Jali
A.C. Adaptor
M.S. Hopper
A.C. Refuse Junction
12th Floor
A.C. Refuse Pipe
Brick Wall
A.C. Refuse Junction
11th Floor
305 mm Dia.
A.C. Refuse Pipe
M.S. Hopper
A.C. Refuse Junction
1st Floor
A.C. Refuse Pipe
M.S. Hopper
A.C. Refuse Junction
Gr. Floor
R.C.C. Slab
Door
Cement Concrete
R.C.C. Jali
White Glazed Tiles on walls & lined to Sump and Curb wall
Refuse Disposal
Junction
9” BK wall
M.S. Hopper to be bolted to Everest A.C.
Refuse Disposal
Junction
Everest A.C.
Refuse Disposal
Junction
Cement concrete
to house A.C. Junction
1.1/2” x 1/4” thick M.S.
Flat encircling the pipe and screwed to the wall.
1.5 m
75 cm
30 cm
Brick Curb Wall
M.S. Hopper
When Open
Floor Level
267 thick
wall
Opening
3200
A
Everest A.C.
Refuse Junction
B
Everest A.C.
Refuse Pipe
M.S. Hopper
When Open
Floor Level
3200
Opening
Everest A.C.
Refuse Junction
D
Cement Concrete
Sectional Details
Showing Arrangement
of Refuse Pipe and Junctions
Design Considerations:

a) Chute:-

1) The number of chutes depends upon the convenience of the user. The location shall mostly be determined by the position of inlet hopper at various floor levels and the collection chamber at the ground level. It should preferably be away from the living rooms to avoid odour nuisance and noise.

2) It is essential to provide the Refuse Disposal Shaft in a freely ventilated position. The upper end of the shaft should be terminated 2 m to 2.5 m above the top of the roof/terrace level.

3) The refuse pipe stack should be straight and should not have any offset or bend between inlets. There must be a junction on the top most end of the shaft to permit periodical flushing of the shaft.

b) Inlet Hopper-

1) It is recommended to provide the hopper at 750 mm from the floor level for easy disposal of garbage.

2) A self-closing Everest Hopper should be provided at the inlet junction. It has a rubber seal along the shutter to prevent odour nuisance and has a handle with a stopper to firmly close the shutter. The Hopper is suitable for all the diameters of shaft.

3) The frame and the shutter of the M.S. Hopper may be painted to suit the surroundings.

c) Collection Chamber

The refuse is handled in different ways:

i) Refuse discharged directly on the floor.

ii) Refuse discharged in containers, either baskets or metal buckets.

iii) Refuse collected in containers mounted on trolleys.

1) The capacity of the chamber is designed, based on the collection of refuse between two consecutive clearings. It may be recommended to provide a minimum capacity of 0.054 cubic metre per family or household per day.

2) Collection chamber at ground level should be easily accessible from outside for clearing purposes. The floor and wall should have impervious finishes.

3) There should be a gully trap with grating to drain off water when the shaft and the chamber are cleaned with water.

4) In case where refuse is collected in containers, sufficient space should be provided for stand by bins, and full bins to meet contingencies.
5) It is suggested to use metal bins with perforations which drain off liquid from garbage and would facilitate handling of it. The size of the bins should be such that two persons should be able to unload it.

6) The distance between the bottom of the chute and the container may be kept 350 mm. This permits the formation of a heap without blocking the shaft. (see diagram on page 104).

7) It is suggested to provide a sliding M.S. Plate at the end of the shaft to close the aperture when the containers are being changed.

Trolley mounted containers are more convenient to handle. The trolley with rubber tyres is pulled out of the chamber for changing the bin.

**Notes on Fixing:-**

Everest A.C. Refuse Disposal System consists of Pipes and specially moulded Junctions. These Junctions are inlet points to receive refuse from each floor. They are fitted with specially designed M.S. Hopper which are self closing.

1) The Junctions should be fixed at a convenient height for operational ease. The square opening of the junction is housed in masonry or in cement concrete.

   The M.S. Hopper is fitted with bolts and nuts to this square opening. The adjustment to the M.S. Hopper frame can be made to accommodate the wall finishing.

2) This system is designed for the floor height of 3.2 metres. Any adjustment for different heights can be made by either trimming of the spigot end of pipes or an addition of the cut piece of the pipe or by using the pipes of special lengths as required.

3) The pipes and junctions have socket at one end. The annular space between the socket and spigot is caulked to about 25 mm in depth with a hemp or jute gasket saturated with Bitumastic Jointing Compound. The remaining gap may be grouted with a stiff cement mortar of 1:2 cement and sand in volume.

4) The fixing to wall is suggested to be done with M.S. Flats 6 mm thick encircling the pipe or junction below the socket and fixed to the wall with two screws on each end of the M.S. Flat. Any other alternative fixing method may be followed but care should be taken to provide support below the socket.

   It, is recommended to provide lining of tiles to the walls around the inlet hopper. This can be washed periodically to clear spilt garbage, a small sump maybe created near the inlet hopper, lined with tiles or other impervious washable lining (see diagram on page 105).
Other Usages

This system is ideal for multi-storeyed buildings. It can be used for various purposes.

In hospitals, to dispose of dressings or dirty linen which is collected and disposed off at ground floor.

For departmental stores, purchases made at various points and dispatched through this system may be collected at one place for the final delivery. For offices, final collection point may be used for dispatches of mails, etc.
Everest A.C. Septic Tanks

There are a number of residential colonies in urban, semi-urban and rural areas, where underground sewage system is not available. Everest A.C. Septic Tank system is an ideal method of disposing of wastes in places where adequate water supply is available from pipes, wells or any other source for conveyance of domestic wastes to treatment unit and also functioning of the unit.

Everest A.C. Septic Tanks are compact units and must be used by connecting with W.Cs. equipped with flushing systems. Each tank consists of top piece with cover and a bottom piece. They are separate components and match with each other. The capacity of the tank can be increased by inserting another component, an extension piece, between the top piece and the bottom piece.

### TABLE

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<th>Description</th>
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Design Considerations:

1) Everest A.C. Septic Tank is used for small houses and flats where number of users does not exceed twenty persons.

2) The capacity of the Everest A.C. Septic Tank can be increased with the use of extension pieces.

3) When the number of users exceed twenty persons, it may be necessary to provide more number of W. Cs. The outlets from W. Cs. should be led to separate septic tanks, so that the effluents do not exceed the capacity of the septic tank.

4) The effluents from the septic tanks should be discharged into a soakpit or trench.

5) Surface and subsoil water should be excluded from finding the way into the septic tank. Waste water from kitchen, bath and washing place should be connected through a gully trap and led to soakpit. It must not be connected to the septic tank as the detergents used will harm the bacteria in the tank.

6) The sewage from W.C. is led by means of asbestos cement pipes into the septic tank. The pipe should be in a slope towards the septic tank.

7) The use of disinfectants or antiseptics, such as concentrated soap water, phenyle and other chemicals for cleaning the W.C. or septic tank should be discouraged, since the effect is likely to be injurious to the bacterial action of the tank.
8) Everest A.C. Septic Tanks should never be connected in a series, that is outlet of one tank to the inlet of the other. In this case, the first tank would act as a receptacle only and efficiency would be lost.

9) For the purpose of ventilation and the escape of the foul gas from the Septic Tank, the vent pipe provided at the W.C. outlet point and taken above the roof level provide the outlet. However, the last manhole chamber may be provided with a vent pipe connection taken similarly along the wall and capped with vent cowl (see diagram on page 105). This will also prevent the disturbance of water seal in the W.C.

**Fixing:-**

1) It is essential to locate Everest A.C. Septic Tanks as near to the W.C. as possible. This would curtail the pipelines and fittings.

2) The ground where the Everest A.C. Septic Tanks is to be placed should be excavated up to the depth where inlet of the tank can easily be connected to the effluent pipe, maintaining the gradient. The bottom of the tank should rest on level hard ground. It is not necessary to provide concrete or other foundations.

3) There should be a fall to the pipe line leading from the outlet of the septic tank to the soakpit. The outlet pipe is never more than half full of effluent thus allowing free ventilation. There is a baffle plate inside the tank behind the outlet pipe which prevents scum from entering and blocking it. The effluent from the outlet of tank should be discharged into a soakpit or trench which should not be closer than 15 m to an underground source of water supply i.e. well.

4) To permit inspection and periodic cleaning, the component parts of Everest A.C. Septic Tanks should not be cemented. Provided the lid is left free for ease access the remaining parts may be sealed with Bitumastic Jointing Compound, if desired.

5) The Everest A.C. Septic Tanks ST/3 has an interchangeable sewage inlet which can be adjusted at site to suit directional inflow of sewage.

6) The Everest A.C. Septic Tanks and connecting pipe line should be securely bedded and covered with earth. Care should be taken to locate the tank where there is no heavy traffic, alternatively, to protect the lid, precast R.C.C. slabs, or metal manhole cover may be provided with supporting masonry work where traffic is expected.

7) Before installation of Everest A.C. Septic Tanks check all bolts and nuts of flanges at inlet, outlet and blank end. It is essential to check bitumen gasket being properly packed between these flanges.

8) It is suggested that inlet and outlet connections to the Everest A.C. Septic Tanks are made with spigot ends of pipes as it is easier to grout from outside.

The diameter of inlet flange is designed to take 101.6 mm A.C. pipe. The outlet flange can accommodate 76.2 mm dia. A.C. pipe.

The Everest Chrysotile Asbestos Cement Septic Tanks require periodic cleaning. It is difficult to recommend how frequently this should be done, as this largely depends upon its usage. Many tanks have functioned very satisfactorily for 10 to 20 years without cleaning, but it is recommended that they should be inspected at least once every three years.
Handling & Storage Instruction

A. Everest Chrysotile Asbestos Cement Roofing Sheets & Accessories

We take every precaution to load only 100% sound materials and carefully pack them in railway wagons or lorries to ensure that the materials reach their destination in good condition. It is important that personnel at sites and stores should be thoroughly instructed in the correct methods of storing and stacking of Everest Chrysotile Asbestos Cement materials. Careful handling, stacking and storing of Everest Chrysotile Asbestos Cement materials will eliminate damage and prevent wastage. Special care should be exercised when transporting them from railhead to store and site.

In the pages which follow are illustrated methods of stacking which have been developed over long experience. These methods, if carefully followed, will prevent damage to the articles. Everest Chrysotile Asbestos Cement materials should be stacked on FIRM LEVEL GROUND and if they are to be held in store for any length of time it is recommended that cover be provided.

Furthermore, Everest Chrysotile Asbestos Cement materials of the same variety and size should be stacked together. Damaged materials should not be stacked with sound materials. All damaged materials should be salvaged as early as possible.

ALWAYS STACK ON FIRM LEVEL GROUND

Storage Instructions:

Corrugated Sheets:

Sheets with smooth side facing upwards shall be stacked on firm level ground. Each stack shall have polythene lined gunny bags filled with saw dust/rice husk/hay bundle, placed equi-distant under it. The length of this tightly filled pillow shall not be more than 880 mm and about 150 x 150 mm in size. The pillow SHOULD NOT PROJECT OUT OF THE STACK, especially at up lap corrugation. The number of pillows required shall be as under.

3 m sheets — 6 bags
2.75/2.5 m sheets — 5 bags
2 m sheets — 4 bags
1.75/1.5 m sheets — 3 bags

When the material is stacked on a project site, to prevent accidental damage due to movements of truck and other vehicles, it is necessary to locate stacks away from roadways. The height of stack should be limited to 120 sheets.

Semi Corrugated (Trafford) Sheets:

Sheets with rough side facing upwards shall be stacked on firm level ground. Each stack shall have polythene lined gunny bags filled with saw dust/rice husk/hay bundle, placed equi-distant under it. The length of this tightly filled pillow shall not be more than 1015 mm and about 150 mm x 150 mm in size. The pillow SHOULD NOT PROJECT OUT OF THE STACK. The number of pillows required shall be similar to that of corrugated sheets.
The height of stack should be limited to 120 sheets. One side corrugation of semi-corrugated sheet is larger than the other. Ensure that all large corrugations are laid to coincide. Both types of sheets, when stacked in the open, must be covered with white polythene cover, with ends tucked at the bottom of the stack.

Ridges
Suitable for smaller quantities and should be limited to a maximum of 10 pairs. Suitable method for stacking medium quantities is leaning then against a wall. Suitable for large quantities is binding with coir rope. This method conserves space.
Curved Sheets

Curved sheets must be stored on their edges, on bedding of straw, with down corrugation at bottom as illustrated. They should also be bound with coir rope near the top to prevent them from falling.

Rooflight and Cowl type Ventilators

Vertical stacking against the side of a building or wall is the best and safest method.

Northlight Curves

Not more than 20 curves should be stacked on top of each other.

Half Round Gutters

Half Round Gutters must be stacked as illustrated on three timber battens placed 150 mm to 230 mm from the ends and one in the centre of the gutter layer. All the sockets should be on one side. Subsequent layers should be placed alternately crosswise and lengthwise. The height of the stack should not be more than 1.22 m.
**Eaves or Boundary Wall Gutters**

Eaves or Boundary Wall Gutters should be stacked on three timber battens. In each layer the gutters should be placed alternately right side up and upside down, with the sides of each gutter fitting flush against the sides of the next i.e., splayed side as illustrated.

**Valley Gutters**

Valley Gutters should be stacked on three timber battens placed 150 mm to 230 mm inside from the ends and one in the centre of the gutter layer. In each layer the gutters should be placed alternately right side up and upside down, with the sides of each gutter fitting flush with sides of the gutter on either side. Subsequent layers are placed alternately crosswise and length wise. The height of the stack should not be more than 1.22 m.

**Valley Gutters**

Large Valley Gutters should be stacked on three timber battens placed 150 mm to 230 mm inside from the ends and one in the centre. Timber chocks should be fixed on battens to prevent wobble. In addition three length of coir rope 10 mm dia. should be laid between each gutter, as illustrated.

**Union Clips**

Union Clips should be stacked on straw-bedding on their edges each fitting into the next Union Clip. Two layers may be placed one on top of the other.
Dropends and Nozzles

Dropends and Nozzles should be stacked on straw-bedding as illustrated. Please note how the timber battens are placed at higher end of the Dropends and Nozzles to separate each layer from the next.

Note: The handling and storage instruction for grey Everest Life Guard – Corrugated Chrysotile Asbestos Cement Roofing systems with safety strips are same as with Everest Chrysotile Asbestos Cement Roofing Sheets and Accessories, while for coloured ones follow the handling & storage instruction for ETERNIA - Coloured.

B. Handling and Storage Instructions For ETERNIA – Coloured Asbestos Free Roofing System with Safety Strips

ETERNIA - Grey

1. Sheets will be received in lorry with stacks oil coated at the edges and stretch wrapping to be opened and sheets to be unloaded manually a single sheet at a time.

2. Each sheet should be handled by 4 persons and should not be handled from the corners.

3. Unloaded sheets should be stacked on a firm level ground with sawdust pillow under the stacks.

4. If stored for prolonged periods over 3 days, sheets should be stored preferably in a covered area or covered with a tarpaulin covers.

5. The stacks should be a maximum of 65 sheets and on unloading the stacks should be re-stretch wrapped (with the extra stretch wrapping supplied along with the lorry) around the four sides. The stretch wrapping should be taken 3 times around the stack and should be firm and tight. This stretch wrapping is to be removed only when sheets are ready to be laid on the roof.

ETERNIA - Coloured

1. Sheets will be received in lorry with stacks, interlayer between each sheet. The sheets to be unloaded manually a single sheet at a time.

2. Each sheet should be handled by 4 persons and should not be handled from the corners.

3. While unloading colored sheets at the project site, the sheets are to be lifted individually without scratching/sliding or scrapping on the bottom colored sheet.
4. On unloading sheets should be stacked on a firm level ground with sawdust pillows under the sheets.

6. If stored for prolonged periods over 3 days, sheets should be stored preferably in a covered area or covered with a tarpaulin covers.

7. The stacks should be of a maximum of 65 sheets and on unloading the stacks should be re-stretch wrapped (with the extra stretch wrapping supplied along with the lorry) around the four sides and also restacked with interlayers. The stretch wrapping should be taken 3 times around the stack and should be firm and tight. This stretch wrapping is to be removed only when sheets are ready to be laid on the roof.

8. In the case the bottom surface is to be coated, approved paints as per recommended procedure is to be applied. While drying please ensure that the sheets are kept in a stack with the factory painted surface facing each other with the plastic interlayer in between. Please do not dry the sheets individually for more than 30 minutes.

9. Extra packing supplied with each Eternia lorry for re-interlayer and re-stretch wrapping at customer site to protect the material. After unloading of Eternia, collect packing material from lorry driver.

10. Extra Interlayer Film - 10 metre.
    Extra Stretch Wrapping Film : 2 kg.
Shade Protection for Everest Chrysotile Asbestos Cement Roofing Sheets

When stacked or stored in the open for a long period. Especially applicable in districts of extreme climatic conditions.

Everest Chrysotile Asbestos Cement Roofing Sheets are naturally intended to be fixed on a roof in accordance with the Company’s instructions, and if properly fixed will not crack in situ as a result of extreme heat or variation in temperature. Trouble, however, can arise if Everest Chrysotile Asbestos Cement Sheets are stored and stacked in the open for long periods without protection from the sun.

This is not an extraordinary phenomenon, because 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. Whereas on a roof an A.C. sheet is free to expand and contract, this natural movement is impeded in the case of a stack of sheets.

The answer is to protect stacks of sheets from sun and the following are three suggestions.

**Method & Diagram 1**

Three 3 m sheets (either Corrugated Sheets or semi-Corrugated Sheets) are laid transversely on a stack of sheets. This method also provides shade to the side of the sheets.

![Diagram 1 Elevation X](image)

**Method & Diagram 2**

Sheet laid at each end of the stack to provide requisite shade.

Same as in Method & Diagram 1 with the addition of one 1.5 m sheet laid at each end of the stack to provide requisite shade.
Method & Diagram 3

Lay 1.5 m sheets around to lean against the stack as indicated in the diagram. This method provides shade from all directions.

It is recommended that sheets placed as shade protection as demonstrated in the foregoing illustrations, should be weighted or bound by ropes to prevent them being blown away.

In hot and dry climatic conditions, the following methods should be followed;

i) The stacks should be covered with polyethylene lined hessian bags or tarpaulins or grass thatties. In case of hessian bags or tarpaulins, both the sides of the sheets are to be made wet and then covered. It is preferable that polyethylene covers used are kept as tight as possible round, the stacks. If polyethylene covers are not available, it is recommended that grass thatties are kept on the top and at the sides of the sheets and watered twice or thrice a day.

ii) When sheets are stacked without any covering, it is recommended that the sides of the sheets are kept wet every morning.
ETERNIA - Coloured Asbestos Free Roofing System with Safety Strips

ETERNIA, developed through international expertise is a major advancement in Roofing and Cladding technology which takes care of Safety, Durability, Eco-friendliness, Aesthetics and Corrosion.

Eternia has already become a rage in Europe and other developed nations. In India Eternia has been successfully installed in all the major industry sectors:

- Food
- Pharma
- Petrochemicals
- Hotel & Resorts
- Educational Institutions
- Housing
- Agro-chemicals
- Engineering

Product Features

A. Safety Strips

ETERNIA - Coloured Asbestos Free Roofing Sheets have additional safety reinforcement with polypropylene strips inserted along precisely engineered locations which run the full length of the sheet in six corrugation, thus providing maximum reinforcement strength with no loss of durability in service.

B. Top of line colour coating

ETERNIA - Coloured Asbestos Free Roofing Sheets are coated with the top of the line imported exterior coating - pure water based acrylic coating specially developed and tropicalised for the Indian environment. This coating provides resistance to ultra violet rays, resist any fungal/algae attack and above all provides long lasting aesthetics to the product.

C. Colour Options

The ETERNIA - Coloured Asbestos Free Roofing Sheets and Accessories are available in Terracotta Red, Green and Off-white colours and also in Natural Grey colour.

ETERNIA colour range will appear darker when applied over larger areas. Actual samples are available on request.

D. Advance Features

High Impact Resistance & Work of fracture or Integrated Modulus of Rupture gives the product better hand-ability, better ability to take dynamic loads and point loads.
### THE PERFECT 10 BENEFITS

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>Roofing Materials</th>
<th>PVC/PLASTIC</th>
<th>METAL ROOFING</th>
<th>ETERNIA</th>
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<tbody>
<tr>
<td>1. Resistance to natural weathering/corrosion</td>
<td></td>
<td>Fair</td>
<td>Poor</td>
<td>Excellent</td>
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<tr>
<td>2. Thermal insulation</td>
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<td>Poor</td>
<td>Excellent</td>
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<tr>
<td>3. Sound insulation</td>
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<td>Fair</td>
<td>Poor</td>
<td>Excellent</td>
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<tr>
<td>4. Chemical resistance</td>
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<td>5. Aesthetics</td>
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<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
</tr>
<tr>
<td>6. Combustibility / Fire resistance</td>
<td></td>
<td>Poor</td>
<td>Poor</td>
<td>Excellent</td>
</tr>
<tr>
<td>7. Vapour permeability / Condensation control</td>
<td></td>
<td>Fair</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>8. Safety on roof tops</td>
<td></td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>9. Dimensional stability</td>
<td></td>
<td>Poor</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>10. Advanced evaluation parameters</td>
<td></td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>– IMOR</td>
<td></td>
<td>Poor</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>– Impact resistance</td>
<td></td>
<td></td>
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</tbody>
</table>

ETERNIA - coloured asbestos free roofing system conforms to ISO 9933-1995E (Class 7) & IS14871 : 2000

### Dimensional & Technical Specifications**

<table>
<thead>
<tr>
<th>Dimensional Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>+free; -0.5mm</td>
</tr>
<tr>
<td>Overall width</td>
<td>+10mm; -5mm</td>
</tr>
<tr>
<td>Laid width</td>
<td>+10mm; -5mm</td>
</tr>
<tr>
<td>Depth of corrugation</td>
<td>+3mm; -5mm</td>
</tr>
<tr>
<td>Pitch of corrugation</td>
<td>+6mm; -2mm</td>
</tr>
<tr>
<td></td>
<td>(Measured at the extreme corrugations)</td>
</tr>
<tr>
<td>Weight per unit area</td>
<td>12.48kg/sq.m</td>
</tr>
<tr>
<td>Standard lengths</td>
<td>+5mm; -10mm</td>
</tr>
<tr>
<td>Number of strips per sheet (Running along the length of the sheet)</td>
<td>6 Nos.</td>
</tr>
<tr>
<td>Distance between strips</td>
<td>146mm (± 20mm)</td>
</tr>
<tr>
<td></td>
<td>except at side laps</td>
</tr>
<tr>
<td>Weight of 100 sq. m as laid</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>a) with 3m sheets</td>
<td>1.20 Tonnes</td>
</tr>
<tr>
<td>b) with 1.5m sheets</td>
<td>1.27 Tonnes</td>
</tr>
</tbody>
</table>

**Installation Criteria**

<table>
<thead>
<tr>
<th>Side lap (min)</th>
<th>40mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>End lap (min)</td>
<td>150mm</td>
</tr>
</tbody>
</table>

| Actual cover of 3m sheet as laid (allowing for loss by side lap of 40 mm and end lap of 150 mm) | 2.88sq.m |

<table>
<thead>
<tr>
<th>Sheeting required for 100 sq. m as laid a) using 3m sheets with side and end lap loss</th>
<th>109.38sq.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) using 1.5m sheet with side and end lap loss</td>
<td>115.88sq.m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Purlin spacing for roofing (max)</th>
<th>1400mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runner spacing for side cladding (max)</td>
<td>1700mm</td>
</tr>
<tr>
<td>Maximum free overhang at eaves</td>
<td>300mm</td>
</tr>
<tr>
<td>Minimum slope of the roof</td>
<td>18° (for lower slopes laps need to be increased or sealed.)</td>
</tr>
</tbody>
</table>

Surface Texture of Eternia Coloured Asbestos Free Roofing sheets is externally smooth and internally rough. Slight shade variations may occur in the natural grey tone depending upon the source of cement. Sheets may also exhibit rippling of the weather face, downlap warping, presence of dampness on non-weathering side of the sheet during summer or rainy season and fissuring to the underside, a normal occurrence which in no way implies impairing of performance.
Laying and Fixing of ETERNIA – Coloured Asbestos Free Roofing System with Safety Strips

Notes: For laying & fixing of ETERNIA - Coloured Asbestos Free Roofing Sheets and Accessories, please follow the same instructions as given for Everest Chrysotile Asbestos Roofing Sheets & Accessories. Additionally it can also be fixed with self driving fastening system.

Following steps are to be followed while fixing ETERNIA with self driving fastening system.

The screws are to be fixed at right angles to the purlins, never leaning up the roof slope. Therefore, correct fixing position must be ensured by marking through with a chalk line or straight edge.

The self driving screws are only to be installed with the recommended power driven screw driver. Initial adjustment of the depth location is to be made as per the power driven screw driver manufacturer’s instruction manual.

The correct fastener is snapped into the nose piece of the recommended power driven screw driver and the screws are fixed on the crown of the roof corrugation. The use of the machine’s variable speed trigger will aid identifying the location of the fixing at the center of the crown of the corrugation.

After initial location the full speed of the machine is used to drill through the ETERNIA Fibre Cement Sheets as quickly as possible. When the drill point has passed through the sheets less pressure is required to prevent damage to the drill point on contact with the steel. Less pressure is also required when drilling the steelwork. Excessive pressure at this time will damage the drill point.

The screw is driven into the steelwork and the sealing washer compressed to provide full surface contact as illustrated in the power driven screw driver manual. The initial fastenings should be adjusted for tightness as required and the power driven screw driver depth location device, once set up should not need readjusting. Do not overtighten.

Visually examine installed fasteners to ensure continued correct tightness of screw as illustrated.

After completion, if settlement of roof materials has occurred, re-tightening of the screws by hand can be made after a suitable period.

At present different improved varieties of washers and fixing accessories are available in mastic, neoprene, PVC, rubber, PVC caps, etc.

Do not let the screw loose
Correct position
Do not over tighten the screw
Everest Life Guard – Corrugated Fibre Cement Roofing System with Safety Strips
Designed to outstrip alternatives

What is revolutionary about Everest Lifeguard?

New addition to the Eternit Everest’s ever expanding range of products - Everest Lifeguard fibre cement sheets are:

- Non corrosive
- Dimensionally stable
- Non-reactive
- Provides good heat and sound insulation

Along with all this, it offers safety on the roof by addressing the issue of fragility, thus making the product unique.

How does Everest Life Guard compare aesthetically?

Available in Natural Grey and a choice of colours, using top-of-the-line pure acrylic coatings specially suited for the substrate, and tropicalised to suit Indian environmental conditions.

Safety on the roof-top

What is unique about Everest Lifeguard?

Everest Lifeguard is a high strength asbestos-cement roofing sheet with polypropylene reinforcement strips inserted along precisely engineered locations which run for the entire length of the sheet in each corrugation. These strips form a kind of safety net that prevents loss of life and minimises accidents, and provides maximum reinforcement strength with no loss of durability in service.

Does Everest Life Guard meet international standards?

Yes, the product has been developed in conformance with the French standard N F P 33-303 of 1988 - break through resistance in accordance with this standard.

What is the test for safety?

Everest Lifeguard addresses the fragility issue by building in a suitable reserve strength as a margin of safety in the event of an accident at heights.

The test consists in evaluating the capability of a sheet fixed on two supports to withstand the breakthrough of a 50 kg bag falling at the centre of this sheet from a 500 mm height, which develops an amount of energy equivalent to that of an average man falling on a roof.

Another high quality product from the worldwide favourite among architects, building experts and home makers.
Who benefits with Everest Lifeguard?
The occupier of the industrial unit who is liable for any violation in safety norms arising out of roofing accidents.

Why do violations in safety norms take place?
Due to lack of training and knowledge of workmen, cost cutting or improper supervisions.

What are the consequences on violations of safety norms?
- Fatal or crippling injuries to the worker
- Heavy compensation, legal penalties and harassments to the occupier
- Production hindrances.

Notes: For Everest Lifeguard Roofing Sheets and Accessories design, dimensional, installation details are same as with Everest Chrysotile Asbestos Cement Roofing Sheets and Accessories.
Painting


Asbestos Cement roofing sheets and accessories and other Asbestos Cement products do not need painting. But should painting be decided upon, care in the selection of a suitable, paint is very important.

Painting weather-exposed surfaces of Asbestos Cement poses the same problems as in the case of concrete and cement plaster, and broadly speaking the procedures that are suitable for cement will be no less suitable for Asbestos Cement.

Decorative surfaces exposed to the weather require to be especially resistant to the elements, but in the case of Asbestos Cement surfaces, they require additionally to be resistant to alkali.

In such circumstances satisfaction can never be guaranteed, but the following types of paint give, in general good results:

Cement based paints
Chlorinated rubber paints
Plastic emulsion paints (oil free)

**Lime washing of Corrugated sheets on the under (unexposed) surface:**

1) Only slaked lime should be used (soaked in water for more than 8 hours).

2) The surface of the sheet is to be cleaned with dry cloth, to remove any loose particles.

3) Apply one coat of lime and after drying of the surface, second coat should be given.

4) The sheets should be stacked, immediately after drying and should not be spread.

**Painting of Corrugated sheets on the under surface (unexposed surface):**

1) Only water based cement primer is to be used.

2) Clean the surface with emery paper to remove any abnormal undulations or loose particles.

3) Apply one coat of the primer and after drying, apply the second coat.

4) After drying of the surface stack the sheets, take care not to drag the sheets.

5) The consumption of the primer is about 175 to 200 gms / m$^2$ at a viscosity of 30 sec. at 25$^\circ$C.

Non Asbestos Fibre Cement products embody excellent weather resistant qualities but it also requires protective coatings for both decorative and aesthetic finished appearance.

The colored building products faces more difficulties and complications and these problems are often due to wrong selection of paints, the effect of thinning or improper surface preparation of algae / fungus treatments, additives added in order to reduce drying time, complex drying of paint film, complex chemical reaction, varying conditions of paint applications and the degree of skill exercised by individual painters and lack of experience of painting process.

Color selection is extremely important, call for utmost care and consideration, as irrespective of the nature of the resins, pigments stability varies so widely under identical conditions of external exposure.
General Guidelines on Painting:

1) Paint Composition

Paint consists of pigments, resin and additives.

Primarily, the normal function of paint is a) Protection b) decoration. Aesthetic effect become increasingly important, due to a growing recognition of the psychological value of surface colour and texture in industrial and domestic applications.

The term pigment covers the general variety of bulk materials in a composition of paints. It may contain any one or variety of colors; designed to achieve the finished shade required. Most of the inorganic pigments are suitable for the paints.

The second element resin is the liquid medium, in which the pigments are carried. The liquid dries out to form a film, which binds together the pigment particles and adheres continuously and evenly to the surface being painted.

Additives are surface-active agents, biocide, and fungicides, which gives special property to the paint. The selection of all additives depends on the final use of paint for a special requirement of surface of product or area.

2) Surface Preparation

Normal preparation including cleaning is necessary when painting fibre-cement surfaces, from which all loose and powdery material must be completely removed before paint is applied. If lichen moss on roofs, or algae on damp area has appeared on the external face of the sheet to be painted, a fungicidal wash such as 1-3% solution of fungicide / bactericide must be applied and deposit removed by brushing, twenty - four hours after application of the fungicide.

Back painting may be undertaken if there is any possibility of moisture reaching the reverse face of fibre cement materials due to factory environment such as food processing industry, milk / vegetable processing industry, pharma or seed manufacturing industry where lot of vapour / fume generated while production. Exposure of the reverse face to humidity / fumes / vapour is sufficient to warrant protective coating must be applied.

3) Repainting and General Surface Preparation

If repainting is carried out while existing paint film is still sound, standard painting practice should be followed. Careful adherence to the original specification is vital, if possible; the original brand of paint should be used. If the existing coating shows of failure or has reached an advanced stage of weathering, the entire film should be removed by sanding.

Where large areas are involved and in cases where the old paint is powdery or in loose flakes, mechanical methods of removal. e.g. power driven wire brushes are labour - saving and speedy. Acid treatments are not recommended for removal of old paint from fibre - cement surfaces. When the old coating has been completely removed, the surface should be repainted in accordance with the principle already outlined.
4) Factory - Applied Finishes for Fibre - Cement Product

Mindful of the difficulties, which may be encountered by industry due to the incorrect painting of fibre - cement products, we have developed a specialised factory - applied paint finish in different colour options like Terracotta, Green & Off white.

This special finish is ideally suitable for tropical weather conditions & offers a high immunity to acid attack with strong alkali resistance and is unaffected by intimate contact with a wide range of solvents, normally harmful to the average type of paint film. Fibre - cement products treated with this particular type of finish may subsequently be painted over, if repainting require in same shade. Overprinting can be carried out with complete success as this finish acts as a base coat for later paint film. This hard semi gloss, decorative and durable finish is available a wide range of traditional and contemporary colours as mentioned above.

For painting the underside of fibre cement products, cement based primer or water based acrylic emulsion paints are only to be used. Oil based primer/Oil based paints are not recommended.
SAFETY

As Chrysotile Asbestos Fibre is ‘locked-in’ firmly into the cement matrix during manufacture, there is no risk to health in the use of Asbestos Cement Building Materials. However the following precautions should be taken during installation:-

1) To keep dust levels down, cutting and drilling operations must be carried out in the open or well ventilated areas.

2) Use hand-operated tools such as drills, hand saws etc.

3) Use of pneumatic/electric power-tools, and abrasive discs is not recommended.

4) Any waste created during work operations should be collected after damping, in impervious bags and buried underground.

There is no scientific evidence that any one in the general public has ever contracted any disease as a direct result of using asbestos products in their homes or from exposure to the very small amounts of asbestos released into the atmosphere through the application, use, wearing or weathering of finished asbestos products.

Notes on Safety

1) The structure should be adequately inspected and prepared for sheet laying to commence. All purlins and rails should be positioned correctly and adequately restrained on the main structure.

2) When sheet laying operations commence, the roof should not be used as a working platform for other activities.

3) Additionally areas directly below the roof operations should be cordoned off.

4) Roof installers should wear:
   i. Safety belt, Helmet, Safety shoes
   ii. Loose clothes should not be worn

5) Observe the relevant provisions of the Health and Safety at Work Act., and any other relevant legislation.

6) Ensure that there is proper access up to the roof. Avoid ‘make-do’ ladders.

7) Remove all loose material from the roof, as work proceeds.

8) Do not step on side lap corrugations.

9) Do not leave tools on the roof surface.

10) Always fix sheets fully as the work proceeds.

11) Always carry out the sheet laying in accordance with the approved sequence.
12) Lay sheets in layers from eaves to ridge. Handling of sheets as well as laying of the eaves course and the sheets above rooflights always needs two men.

13) Beware of the weather and take special care during windy, rainy or frosty weather.

14) Take extra care on Eternia Colour coated sheets whose whole surface will be more slippery than natural grey material.

15) Where regular access is required to reach rooflights, ventilation and service ducts, properly constructed walkways should be provided.

16) When heavy loads, such as industrial ventilators are carried over the sheeting adequate crawling boards must be used.

17) Cracked sheets cannot be satisfactorily repaired. They can however be salvaged to smaller sound lengths. The only satisfactory manner of dealing with a cracked sheet is to replace it with a sound sheet.

18) Fixing accessories should be inspected at intervals dependent upon the type and degree of exposure.

19) It is advisable to salvage a cracked sheet as early as possible.
Service

We have been manufacturing Everest Chrysotile Asbestos Cement Roofing Sheets, Accessories and other items in India since 1934. These are available all over India through a wide network of authorised stockists and sales depots.

The correct choice of products and their correct application is extremely important. Everest Chrysotile Asbestos & Non Asbestos Cement roofing products correctly installed will give you life long satisfaction.

If you have any problems let us help you. Our technical sales representatives located at various zonal and regional offices are always available for consultation and their services can be availed free of charge.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Specification No.*</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>IS : 730</td>
<td>Hook bolts for Corrugated Sheet roofing</td>
</tr>
<tr>
<td>3.</td>
<td>IS : 875</td>
<td>Code of Practice for design loads (other than earthquake) for building and structures</td>
</tr>
<tr>
<td>10.</td>
<td>IS : 5913</td>
<td>Methods of tests for A.C. Products.</td>
</tr>
<tr>
<td>13.</td>
<td>IS : 14871</td>
<td>Products in fibre reinforced cement - long corrugated or asymmetrical section sheets and fittings for roofing and cladding - specifications.</td>
</tr>
</tbody>
</table>

* Refer to the latest amendment.