International Standard 8108

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Directives for fixing asbestos-cement corrugated and asymmetrical section sheets and fittings for roofing

Directives pour la mise en œuvre des plaques ondulées et nervurées et de leurs accessoires en amiante-ciment pour couvertures

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8108 was prepared by Technical Committee ISO/TC 77, *Products in fibre reinforced cement.*

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Directives for fixing asbestos-cement corrugated and asymmetrical section sheets and fittings for roofing

0 Introduction

This International Standard has been prepared on the basis of experience in laying roofs of corrugated or asymmetrical section sheets.

It has been written in the form of directives and is intended for use by manufacturers in the preparation of instructions for fixing sheets, by installers/contractors engaged in the fixing of sheets, by those responsible for preparing national specifications, by designers, by architects and by engineering departments, etc.

It states general principles[1] for establishing methods for the fixing of sheets and will, therefore, be usefully complemented by taking into account climatic conditions and local usage.

1 Scope and field of application

This International Standard gives guidelines for the design, execution and maintenance of roofs made of asbestos-cement corrugated and asymmetrical section sheets.

It is applicable to the conditions most often found on buildings, wherever they are sited. For special or exceptional laying conditions, particular instructions, additional to those given in this International Standard, are required.

Roofing works, as defined in this International Standard, have to be carried out on load-bearing structures built in accordance with International Standards or national standards.

The sheets are impermeable but, as is the case with all overlapping elements, they depend upon roofing installation properly carried out to ensure watertightness of the roof.

This International Standard does not apply to roofing using corrugated or asymmetrical section sheets as support for other roofing materials; in this case, other rules should be adopted.

2 Design of roofing

2.1 Pitch

The load-bearing structure shall be such that the roof has at least the required pitch for the climatic conditions, length of roof slope, height of sheet corrugations and use of the building.

Unless special precautions are required in order to ensure watertightness, and according to the extent of the longitudinal overlapping[2], the pitch should not be less than 9 % (5°).

2.2 Supports

2.2.1 The centreline spacings between the supports depend on

- the materials to be used : profile and length of the sheets;
- the transverse overlapping of the sheets;
- the applied loads;
- the safety conditions.

2.2.2 The contact surface between the sheets and their supports shall be such that puncturing can be avoided.

2.3 Principles for placing sheets

2.3.1 The sheets should be placed on two or more supports in such a manner that the corrugations are parallel to the greatest slope of the roof.

2.3.2 They shall be placed either

- after cutting the corners (this is called "laying sheets with mitred corners"), or
- without cutting the corners (this is called "laying sheets with staggered junctions")[3].

In the case of laying sheets with mitred corners, the sheets shall be placed from the eave towards the ridge in rows perpendicular to the eave.

In the case of laying sheets with staggered junctions, the sheets shall be placed from the eave towards the ridge in

1) A certain number of these principles are common to all roofs and are independent of the materials used.

2) For example, increasing transverse and longitudinal overlapping (if possible, taking into consideration problems of fixing, compatibility with fittings and constraints due to traffic), addition of a weatherstripping product within overlaps, double roofing or addition of a sub-roof. In all cases, if the slope is less than 9 %, precise verification of the slope is required when laying.

3) This method cannot be used for all profiles. The manufacturer should give relevant information.

rows parallel to the eave, and the corresponding longitudinal overlap of two adjacent rows shall be staggered by one corrugation.

2.3.3 Consecutive sheets in the same tier shall have transverse overlap.

The overlap shall be placed on the supports. The length of the overlap depends on the thickness of the sheets, the height of the corrugations or rib, the pitch, and the climatic conditions [1].

2.3.4 The sheets of two consecutive tiers shall overlap longitudinally. The overlapping width varies according to the category of the sheets and the design of the overlap. Some profiles allow an increment of longitudinal overlap for severe climatic conditions (see the footnote to 2.1).

2.3.5 Rain watertightness is ensured by transverse and longitudinal overlapping. To ensure tightness to other elements (air, dust, snow, etc.), a complementary watertightness, sealant or other similar weatherstripping product shall be put into the transverse and longitudinal overlaps, according to the pitch, climatic conditions and local situation.

2.3.6 A great variety of methods of fixing sheets is available, and to a large extent the method depends on the load-bearing structure. These methods of fixing shall

— suit the sheet profile;

— resist suction forces caused by the wind, as defined by national standards or, if none exist, by local conditions;

— resist the sliding of sheets due to dead loads and suction forces caused by wind;

— ensure the weathertightness of the roof;

— be durable;

— not create stresses in the sheet which could result in fracture.

2.4 Particular fittings for roofing

Particular fittings for roofing are made in asbestos-cement or other materials, for example :

a) for eaves : asbestos-cement flat or profiled eave pieces;

b) for ridges : profiled two piece ridges or asbestos-cement rigid profiled ridges;

c) for hips : asbestos-cement rigid elements, with a hemi-cylindrical shape, called "hips";

d) for front edges : front edge elements with asbestos-cement corrugated edges, called "front edges";

e) for lateral edges : asbestos-cement elements in the form of rigid valleys, called "lateral edges";

f) for continuous special mouldings : asbestos-cement front wall junctions and lateral wall junctions;

g) for discontinuous special mouldings : either special asbestos-cement profiled sheets intended to contain glass panels to provide natural lighting or to allow the passage of ducts for ventilation, smoke extraction or removal of combustion gases, or glass or plastics sheets to provide daylight to the spaces below the roof.

2.5 Roofing ventilation

It is always desirable to ventilate a roof but, depending on its design, dimensions, the intended purpose of the building and the climatic zone in which the building is situated, it shall be either naturally or artificially ventilated.

2.5.1 Buildings with low and medium humidity [2]

2.5.1.1 Roofing without thermal insulation

Ventilation is generally provided by openings for the entry of air at the eaves with an air exit at the ridge or along the side if the roof slop is long and/or the pitch is low. The openings may be special asbestos-cement pieces.

In some specific cases, if the sheets are laid without sealing mastic or other similar weatherstripping product, the interstices and the transverse overlapping level may be sufficient to provide natural ventilation.

2.5.1.2 Roofing with thermal insulation

Generally, ventilation is provided by two series of openings, at the eaves and at the ridge, and by roof ventilators especially designed for the purpose. If the roof slope is long and the pitch low, one or more series of intermediate openings may be necessary.

2.5.2 Buildings with high humidity [2]

A special study shall be conducted by specialists for such buildings.

2.6 Thermal insulation of roofing

Thermal insulation may be provided in several ways. The following three examples are given for guidance only :

— over purlins : rigid or fixed supports, a vapour barrier, a flexible or semi-rigid insulating material, a means of ventilation and the roof sheeting;

1) The manufacturer should indicate the maximum and minimum values of the overlap.

2) Buildings with high humidity are usually considered to be those in which the quantity of water vapour is more than about 5 g per cubic metre of air in excess of the water vapour content of the external air.

— along purlins : a rigid insulating material, a means of ventilation and the roof sheeting;

— under purlins : suspended ceilings or a sub-roof, a vapour barrier if necessary, a flexible or semi-rigid insulating material, a means of ventilation, the roof sheeting.

In cases where thermal insulation is not the essential purpose, a sub-roof or suspended ceiling without insulating material may be used in order to improve the aesthetic appearance or air-tightness of the roof.

3 Laying

3.1 Storage and handling of sheets

The lots of sheets shall be stored on a flat, sufficiently strong surface, away from risks caused by falling heavy objects and, if possible, in close vicinity to the lifting unit. If the place is not suitable, the lots should be laid level and parallel on two wooden bars of rectangular section, set perpendicular to the direction of the corrugations and at a distance between them of two-thirds of the length of the sheets. The upper sheets of the lot shall be ballasted as protection against high winds.

Coloured sheets shall be protected from rain until they are placed. Sheets in natural colour shall be similarly protected if storage has to be prolonged.

The sheets shall be raised to the roof using adequate manual or mechanical means, in particular avoiding impacts. The use of a crane is not recommended unless the work site is extensive, in which case it is essential that the crane be fitted with an adequate compensation bar.

3.2 Working on asbestos-cement sheets and fittings

3.2.1 Fixing holes made in sheets or fittings shall have a diameter

— greater than the diameter of the shank of the fastener to allow for expansion;

— less than the diameter of the sealing washer.

Drilling by percussion is not permitted.

3.2.2 Sheets and, if necessary, their corners, shall be cut, if this has not been done at the factory, at ground level on a rigid and fixed support by means of a hand or powered saw, nippers, or jig saw.[1)] The mitring of the corners can be facilitated by using a template allowing the manufacturer's indicated dimensions to be respected.

3.3 Laying sheets

3.3.1 Laying sheets with mitred corners

3.3.1.1 Definition of a mitred corner

The mitred corner (or the diagonal cut) is limited by the length of the transverse overlap and the width of the longitudinal overlap. The choice of the corner (or corners) to be cut depends on the laying direction and on the position of the sheet in the roof.

3.3.1.2 Laying direction

The sheets may be delivered with mitred corners. In this case, the manufacturer shall indicate the transverse and longitudinal overlap and the laying direction.

Sheets shall be laid in consecutive tiers, either from left to right or from right to left. The laying direction may depend on the atmospheric conditions; if this is the case, it should be contrary to the predominant wind direction.

3.3.1.3 Order of cutting and fixing the sheets (see figure 1)

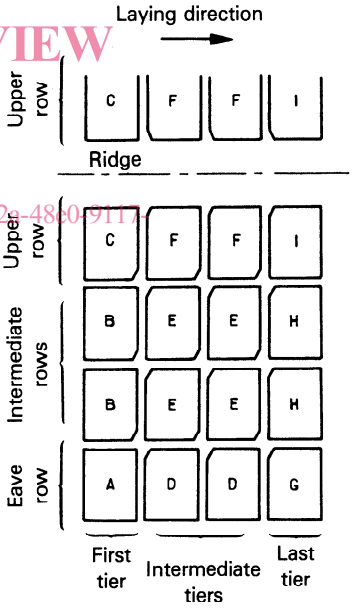

Figure 1

The following procedure is applicable when laying from left to right. The procedure should be reversed when laying from right to left.

a) First tier of first course

Fix sheet A without mitre.

Cut sheets B and C at the bottom right-hand corner and fix progressively up towards the ridge.

1) For cutting on site, see [6].

b) Intermediate tiers

Mitre sheets D at the top left-hand corner and fix them.

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

c) Finishing tier

Mitre sheets G, H and I at the top left-hand corner and fix them.

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

Certain types of ridge do not require mitring of the top tier of sheets.

The adjustment of the longitudinal overlap, if it is equal to a partial corrugation, shall be made by means of a laying gauge (see figure 2).

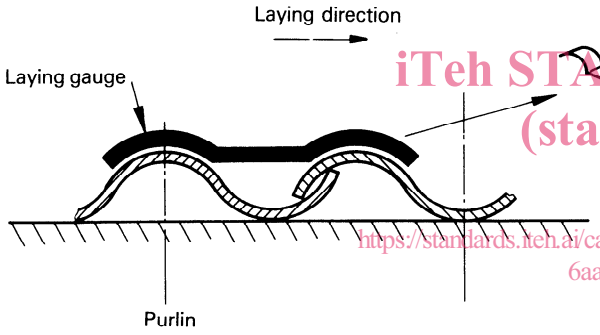

Figure 2

3.3.2 Laying sheets with staggered junctions (see the footnote to 2.3.2)

3.3.2.1 Laying direction

Sheets shall be laid in consecutive tiers, either from left to right, or from right to left. The direction of laying may depend on the atmospheric conditions.

3.3.2.2 Order of laying (see figure 3)

The first row at the eave consists of complete sheets.

The next row starts with a sheet the width of which has been reduced by one corrugation. Successive rows similarly have the width reduced until a minimum width of three corrugations is reached. When the minimum width of the first sheet is reached, the next row shall again be started with a complete sheet. The other sheets of each row are complete sheets with the exception of the last, which shall be adjusted to the dimension of the roof.

After aligning the first sheet of the eave row, parallel and perpendicular, respectively, to the line of the eave, the other sheets shall be aligned using a chalk line.

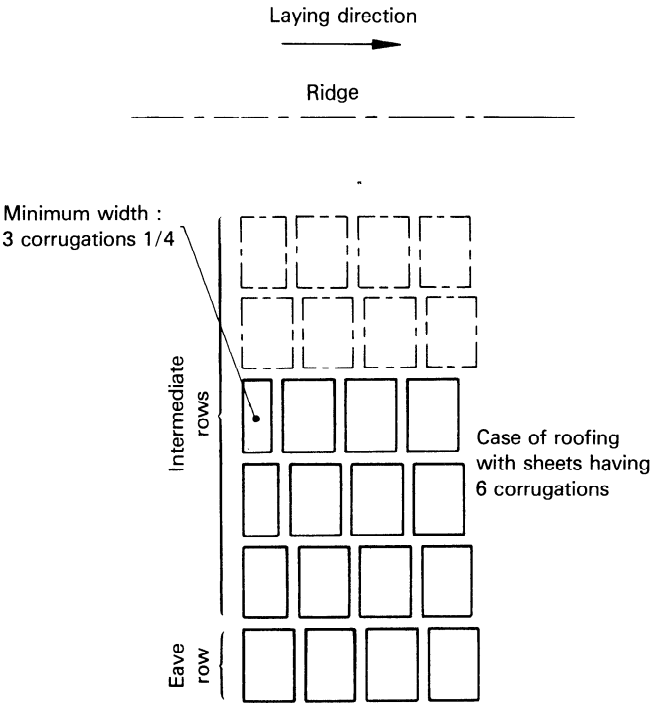

Figure 3

3.4 Fixing sheets

3.4.1 Fastening system

The sheets shall be fastened to the load-bearing structure through the crown of the corrugations, using a suitable fixing system.

In general, the fasteners shall be positioned 50 mm from the upper edge of overlapped sheets.

In certain cases, the fixing of a sheet on an intermediate purlin may require a thickness spacer at the level of the purlin.

Fasteners shall be tightened just sufficiently to ensure that the sealing washer is firmly seated on the sheet and that the sheet is not under stress. In order to achieve this, the tightening may need to be done in two operations.

3.4.2 Number of fasteners per sheet and position

Information on the number of fasteners per sheet and their positions shall be provided by the manufacturer.

3.4.2.1 Laying sheets with mitred corners

In general, one or two fasteners per sheet and per support are sufficient, depending on the position of the sheet in the roof and the dimensions of the sheet (width and length).

The ridge, end and eave sheets shall have at least two fasteners per sheet and per support. Sheets resting on three supports may require only one fastener, on the middle support. Only one

fastener may also suffice if the supports are close together and the lifting forces are slight (see figure 4).

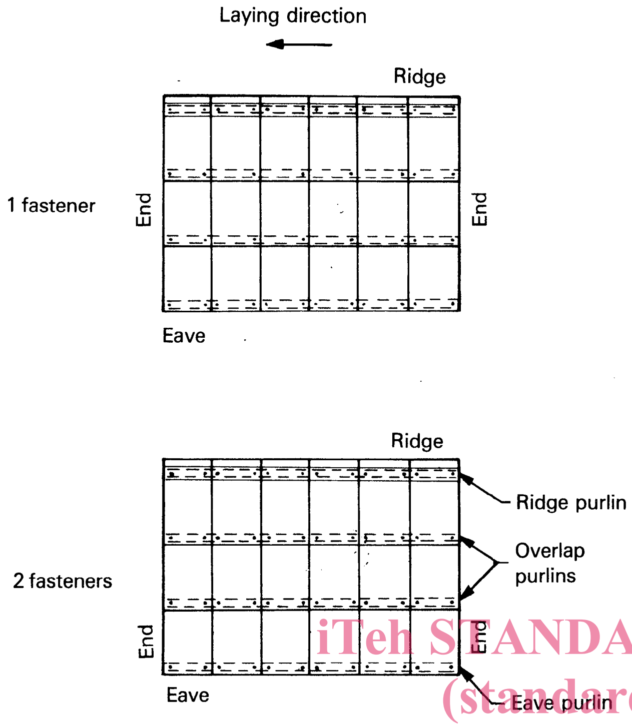

Figure 4

3.4.2.2 Laying sheets with staggered junctions

Sheets with three or four corrugations shall be fixed on each support by means of a fastener. Other types of sheet shall be fixed on each support by means of two fasteners one of which shall be situated at the longitudinal overlap (see figure 5).

Sheets on three supports may require a fastener on the middle support (see figure 5).

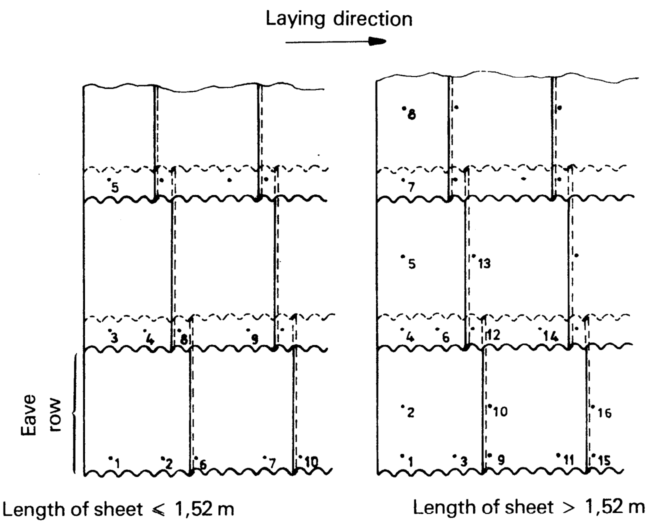

Figure 5

3.5 Projection at the eave

Roofing projection at the eave shall be defined in relation to the pitch and local climatic conditions (overloading due to snow, wind pressure).

3.6 Laying weatherstripping products

3.6.1 Weatherstripping products (sealant or similar product)

The products to be used shall be chosen in relation to the surface condition of the sheets just before laying and the nature of the sheets providing lighting.

3.6.2 Transverse overlapping weatherstripping

The weatherstripping product shall be applied as a strip along the sheet profile, between 80 and 100 mm from the upper edge of the sheet to be covered (see figure 6).

Dimensions in millimetres

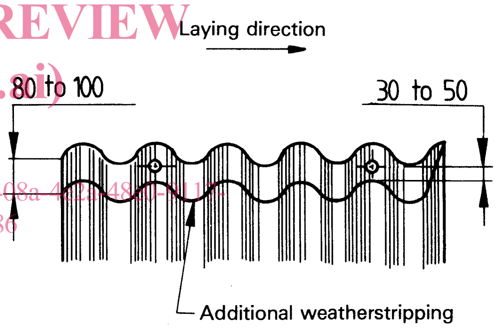

Figure 6

The ends of the strip shall be raised on each side of mitred corners on sheets with ascending and descending side corrugations (see figure 7).

Dimensions in millimetres

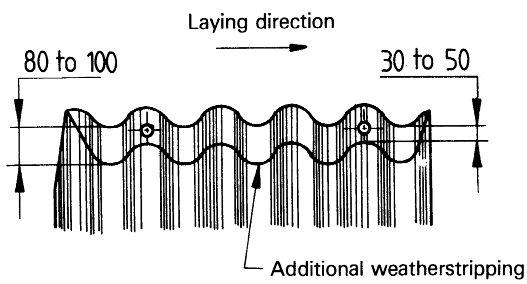

Figure 7

For sheets with two descending corrugations, the strip shall intersect with the mitred corner on the crown of the corrugation.