Steel trapezoid profile roofs

Planning information for fire protection

The present publication is non-binding. Insurance providers may in certain cases also accept other safety precautions or installation and maintenance companies at conditions set at their own discretion which do not conform to these technical specifications or guidelines.

Content

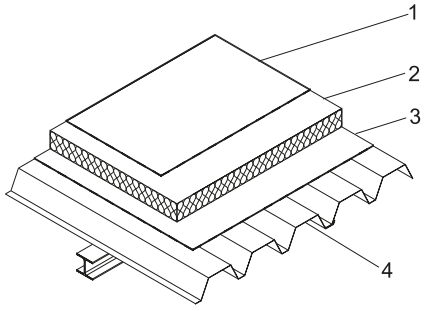
1 Preliminary remarks

The present publication specifies the measures to be taken in the planning stage to prevent flame expansion and spread in the case of steel trapezoid profile roofs. It supplements information sheet VdS 2216 Fire protection measures for roofs, which contains all fundamental information left out of the new edition of VdS 2035.

VdS 2035 a. F., the predecessor of the new publication, was originally prepared in 1984 by the Association for the promotion of German fire protection (vfdb). The basis for this was then the consultation results of a special working group, which was formed by the vfdb to accompany a research plan in Nordrhein-Westfalen

2 Roof structure

Steel trapezoid profile roofs are widely used for extensive industrial and commercial buildings such as production and exhibition halls and are essentially constructed as follows:



1 Roof membrane
2 Thermal insulation
3 possible additional vapour barrier
4 Steel trapezoid profile

Fig. 1: Single-shell steel trapezoid profile warm roof

Since the fire behaviour of the individual functional layers allows only a very limited conclusion to be made about the fire behaviour of the total roof, the roofs must fundamentally be considered as a system in terms of fire protection. Nevertheless individual functional layers as roof materials and components must still be dimensioned and designed in accordance with the risk and the protecting objective.

3 Steel trapezoid profiles

As a supporting shell, steel trapezoid profile panels must be adequately protected, dimensioned and fastened to prevent premature failure of the entire roof structure due to fire effects.

3.1 Corrosion protection

As a regulated building product, steel trapezoid profile panels are to be protected against corrosion at the factory as per building rule list A in ac-

Metal coating	**Coatings**				
Process/type/Thickness	**Binding agent**	**Base Layer[1)]**	**Cover Layer**	**Total rated Layer thickness µm[2)]**	**Corrosion protection class in accordance with DIN 55928-8**
Strip galvanisation in accordance with DIN EN 10147 (Z) or[3)] Alloy galvanization in accordance with DIN EN 10214 (ZA) or[3)] Alloy galvanization in accordance with DIN EN 10215 (AZ)	Polyester resin SP	-	x	12	II[5)]
		x	x	25	III
	High Durable Polymer HDP	x	x	25	III
	Polyurethane PUR	x	x	25	III
	Polyvinylidene fluoride PVDF	x	x	25	III
Requirement[4)] Z 275 g/m² or ZA 255 g/m² or AZ 150 g/m² [8)10)] Rated thickness of the Coating ≈ 20 µm	PVC-Plastisol PVC (P)	x	x	100	III[6)]
	Foils Polyvinyl fluoride PVF (F)	x[7)]	x	45	III
	Powder coating Polyester SP (PO)	x	x	60	III
	Piece coating[9)]	x	x	60	III

1) With agreed binding agent, around 5 µm
2) See section 4.2.5.2, DIN 55928-8
3) Specify when ordering
4) See section 4.2.5.1, DIN 55928-8
5) Only for minimal loading, typically used internally
6) Scope of usage restricted due to temperature (Sun)
7) As adhesive layer of around 10 µm in thickness
8) With 185 g/m² Requirement » 25 µm for alloy galvanisation in accordance with DIN EN 10215 (AZ) Corrosion protection class III is already achieved without organic coating
9) After provision of a factory test certificate
10) Just as the basis for an organic coating, 150 g/m² represent no corrosion protection for corrosion protection class III.

Additional plant-or site applied coatings improve the corrosion protection

Table 1: Corrosion protection – protection classes and systems based on DIN 55928-8

cordance with DIN 18807 by means of strip galvanization. The layer thickness of the double-sided coating is as a rule 25 µm.

3.2 Dimensioning

The stability of the supporting steel trapezoid profile panel is determined from

- its static system,
- its utilisation level and
- its bearing

Continuous support systems statically have more reserves as one-field systems and are therefore preferable. When measuring sheet thickness, it is recommended to provide static evidence for constant loads, half snow load and other traffic loads as well as for the assembly condition. In the process the maximal deflection of the steel sheet is to be limited to < l / 300 (l = span). The normal static proof for full loading is not affected by this.

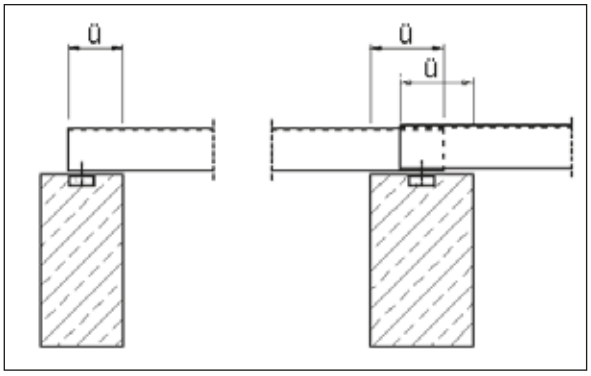


Fig. 2: Projection of the trapezoid profile panel on the support

To prevent slipping of the steel trapezoid profile on the end support due to larger deformations, the projection of the trapezoid profile panels ü, measured from the front edge of the end support to the end of the panel must be at least 80 mm.

3.3 Mounting and fixing

Steel trapezoid profile panels are to be fastened to the interim and end supports, on end flaps and longitudinal joints as well as cross points in such a way that in particular the longitudinal joints and end flaps of the steel trapezoid profiles remain closed against fluid in case of fire so that the outbreak of secondary flames is prevented.

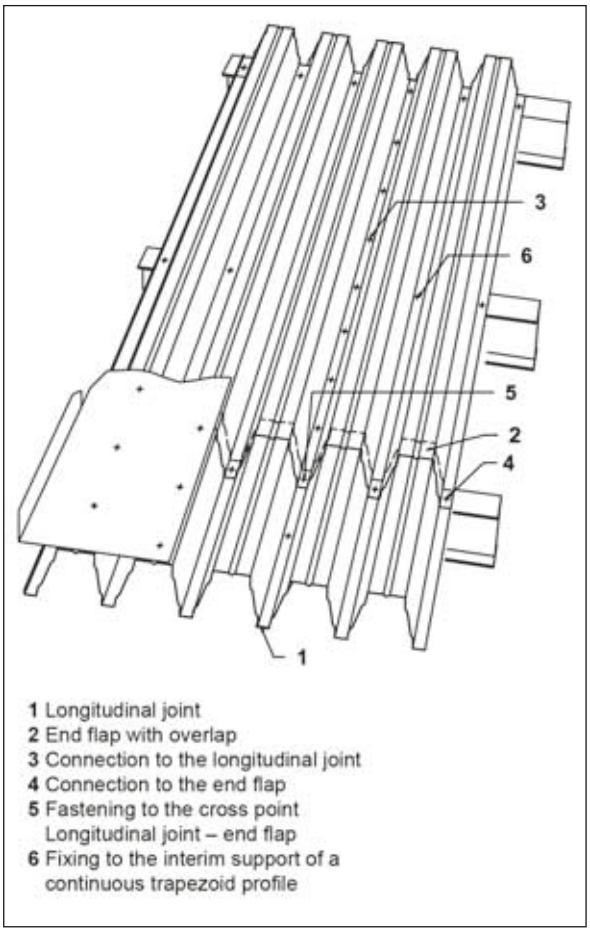


Fig. 3: Fixing in the area of the end flaps and longitudinal joints (s. also IFBS assembly guidelines)

In the area of longitudinal joints, connection agents with a clearance of 330 to 500 mm (i.e. two to three connection agents per running m.) should be arranged near the end flaps in every profile rib.

In this regard, the required overlap should also be observed; the overlaps in the end flap area should be designed in the case of top roof sealing with a length of 50 to 150 mm. In the case of trapezoid profile panels as roof covering, overlaps – depending on the roof slope – up 200 mm in length are required.

The melting point of the materials used to manufacture the connection agent (rivets) must be at least 1000 °C.
Blind rivets, which have lost their pin during assembly must be removed and replaced with new rivets.

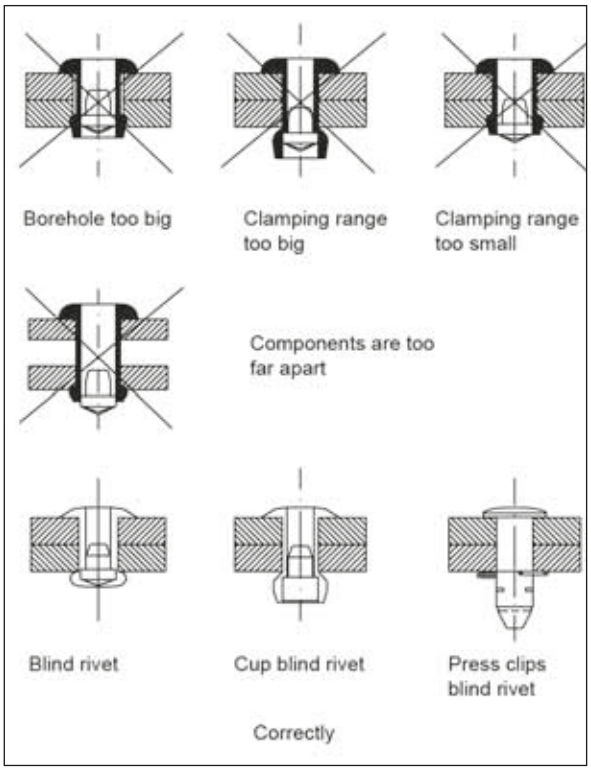


Fig. 4a: Design of rivet connections (s. also IFBS assembly guidelines)

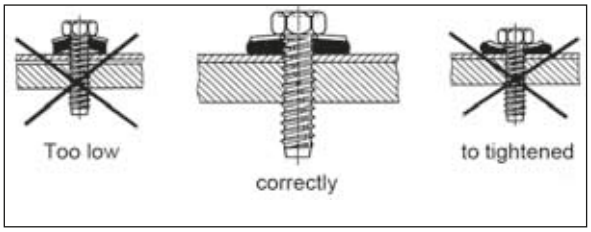


Fig. 4b: Design of screw connections (s. also IFBS assembly guidelines)

3.4 Firestop seal of the cavities

Due to cavities in the corrugation area of the trapezoid profile panel, gaseous decomposition products can expand into the air or liquid decomposition products can flow out. In order to prevent ignition of the decomposition products in the case of fire, these cavities are to be sealed off

- above partitions with a fire resistance of at least 30 minutes and partitions with a resistance of at least 90 minutes, which only lead to the trapezoid profiles,[1)]
- around roof penetrations and
- in the area of the roof connections and ends

at least in a length of 12 cm with prefabricated shaped pieces. For this purpose

- non-flammable building materials with a melting point of at least 1000 °C,
- Phenolic resin hard foam in accordance with DIN 18164-1 or
- expanded mineral construction materials with

usability evidence from the building authorities can be used without particular evidence. The shaped pieces are to be stably inserted. In the area of the partitions, the length of the

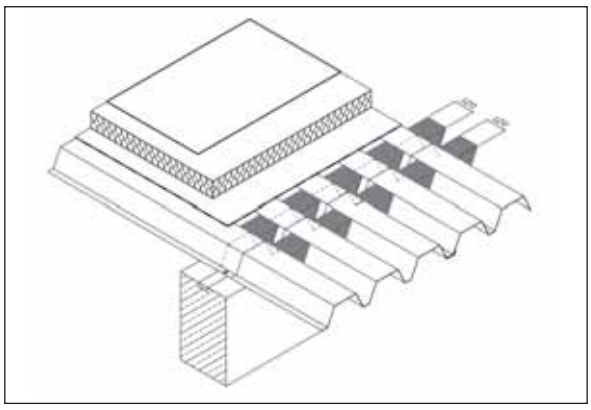


Fig. 5: Fire-stopping of the cavities

In the area of the partition walls, the length of the corrugation sealing must be at least the thickness of the partion walls. If an end flap of the steel profile sheet is located above the partition then the corrugations should be sealed separately on both sides of the joint.

4 Vapour barrier

The vapour-blocking effect must be achieved to the greatest possible extent by the installed steel trapezoid profile panels – possibly with the additional arrangement of sealing strips in the longitudinal joints and cross flaps and also by closing the open corrugations on the ends of the profile panels.

5 Thermal insulation and its fixing

Thermal insulation materials which are barely affected by fire or which only partially or slowly decompose can significantly limit the risk of fire expansion or burn-through. Therefore if possible, only such insulation materials should be used which are non-combustible or melt-proof and do not tend toward prolonged independent glowing. Otherwise supplementary measures are required such as gravel as a heavy surface protection.

1) Cavities beneath the trapezoid profile panel are to be sealed accordingly.

Fig. 6: Thermal insulation – mechanical fixing

For the fixing of the thermal insulation, but also of the vapour block and roof sealing mechanical connection agents or non-combustible adhesive should be used if possible. Insofar as both physical structurally possible as well as possible according to the specification of the thermal insulation manufacturer, connection agents of metal materials can be replaced by connection agents consisting of a combination of plastic and metal for reasons of corrosion protection. This fixing can be mounted with the aid of an automated device in one step.

6 Roof fire-stopping

Roofings should fundamentally be designed at least to be resistant to flying sparks and radiating heat (hard roofing), so that fire expansion is restricted in the case of external fire influences.

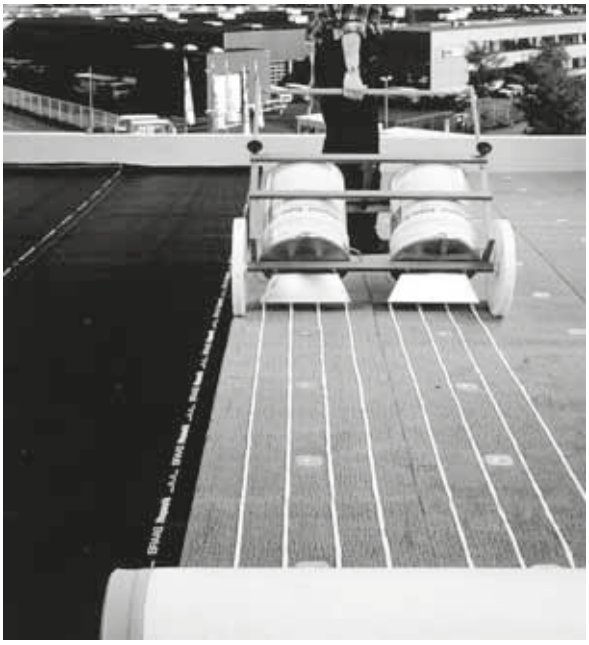


Fig. 7: Thermal insulation – adhesion

7 Roof penetrations

In order to prevent flame expansion through roof openings such as roof drains, pipe inlets, light domes, as well as smoke/heat exhaust devices, these areas must be protected against both direct fire effects and the spread of gaseous or liquid decomposition products. This protection can be achieved, for example, with the aid of non-combustible thermal insulation materials and shaped pieces. Additional design hints are provided in DIN 18234-3 and DIN 18234-4.

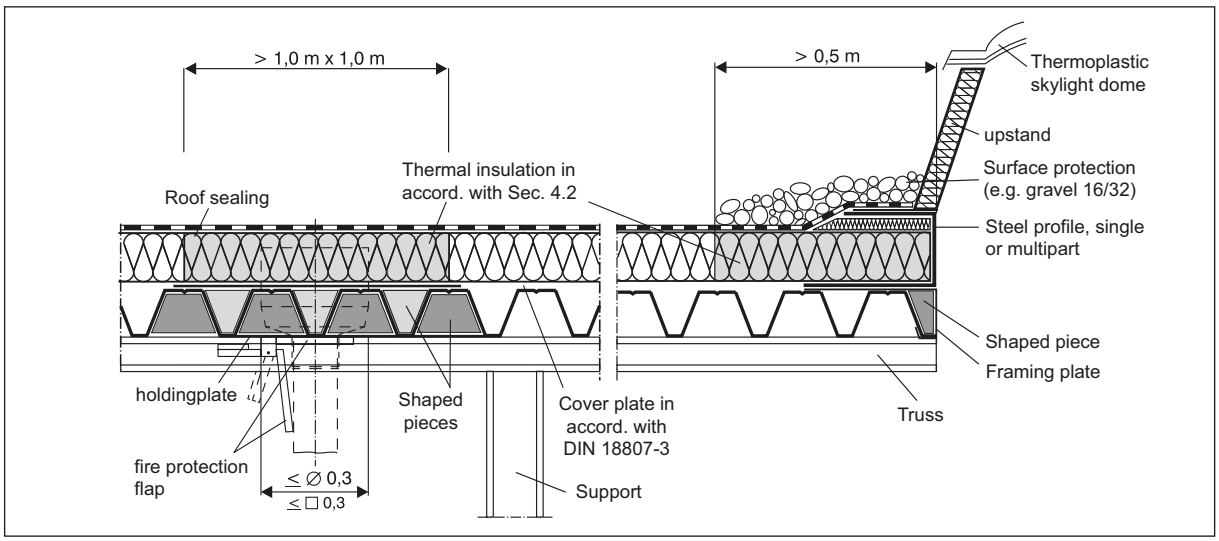


Fig. 8: Design example of a roof penetration

8 Literature

Standards

DIN EN 10147 Continuous fire-galvanised structural steel strip and sheet – Technical delivery conditions

DIN EN 10214 Continuous hot-dip refined steel strip and sheet with zinc-aluminium coatings (ZA) – Technical delivery conditions

DIN EN 10215 Continuous hot-dip refined steel strip and sheet with aluminium-zinc coatings (ZA) – Technical delivery conditions

DIN V 18164 Foam plastics as thermal insulation materials for the building industry

- Part 1: Insulation materials for thermal insulation

DIN 18234 Structural fire protection of expansive roofs, fire exposure from below

- Part 3: terms, requirements and tests for roof penetrations, connections and ends
- Part 4: Table of roof sealers, ends and connections, which fulfil the requirements of DIN18234-3 without additional evidence

GDV/VdS-Publications

VdS 2216 Fire protection measures for roofs; Instructions for planning and design

VdS Damage Prevention publisher Amsterdamer Strasse 174, 50735 Cologne Internet: www.vds.de

Technical rules and recommendations

IFBS Info 8.01 Guideline for the assembly of steel profile panels for roof, wall and ceiling designs

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