



INTERNATIONALE FÖDERATION  
DES DACHDECKERHANDWERKS

INTERNATIONAL FEDERATION  
FOR THE ROOFING TRADE

# FACADE GUIDELINE 2018

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IFD-GUIDELINE FOR THE DESIGN AND  
INSTALLATION OF  
REAR-VENTILATED RAINSCREEN FACADES

## PREAMBLE

by the FVHF on the guideline released by the International Federation for the Roofing Trade (IFD):

### “Design and Installation of Rear-Ventilated Rainscreen Façades” - [International](#)

The IFD guideline (02/2018) is the first European version relating to rear-ventilated rainscreen façades developed in association with national bodies (EMSZ, FVHF, Gebäudehülle Schweiz, IFBS, JSY, NFRC, ÖFHF, SFHF, ZVDH) and contains definitions, principles of responsibility, and general requirements relating to façades, materials, installation, maintenance, and service. The guideline is a revision of the internal IFD façade guideline issued in 2011.

It sets out international minimum standards for the construction of rear-ventilated rainscreen façades and is intended for use outside Germany.

The design and installation of rear-ventilated rainscreen façades in Germany is governed by the German principles of good engineering practice, building regulations (e.g. MBO), German standards (e.g. DIN 18516-1), and regulations (e.g. MVV TB), all of which are reflected in the FVHF’s own guidelines, e.g. the “FVHF Guideline on Planning and Constructing Rear-Ventilated Rainscreen Façades and the “FVHF Guideline on Fire Safety Precautions for Rear-Ventilated Rainscreen Façades in Accordance with DIN 18516-1”.

Nevertheless, the international IFD guideline generally considered within the context of the rules and installation principles of rear-ventilated rainscreen façades, even though it demands careful comparison with national standards, regulations, and laws.

The guideline, “Design and Installation of Rear-Ventilated Rainscreen Façades” – [International](#), is published by, and the responsibility of the International Federation for the Roofing Trade (IFD). Its principles are to be seen as recommendations. Use of this guideline does not release anyone from the obligation to take responsibility for their actions.

Berlin, February 2018

Drawn up and published by the

**International Federation for the Roofing Trade, Marburg, Germany**

This IFD guideline was drawn up by the IFD Facade Committee in collaboration with the following members:



EMSZ- Hungary



FVHF - Germany



Gebäudehülle Schweiz



IFBS - Germany



JSY - Finland



NFRC – UK



ÖFHF - Austria



SFHF - Switzerland



ZVDH - Germany



EURF - Estonia

We thank these members for their active participation.

The IFD President on behalf of the Management Board

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# 1 Introduction

## 1.1 The rear-ventilated rainscreen facade (RVRF)

This guideline for rear-ventilated rainscreen facades is the first European version to be developed in coordination with national bodies (EMSZ, FVHF, Gebäudehülle Schweiz, IFBS, JSY, NFRC, ÖFHF, SFHF, ZVDH), and contains definitions, principles of responsibility and general requirements relating to facade, materials, installation, maintenance and service. The present guideline is a revision of the version from 2011.

When planning and constructing buildings, it is more important than ever to take ecological and economic requirements into account. Energy saving, energy efficiency (even passive houses), cost and attractive appearance are important decision-making criteria. Exterior walls must continuously perform a large number of functions, such as protection from weather, thermal insulation, stability and low maintenance, fire protection and sound insulation. They may serve as design elements and must fulfil numerous ecological requirements. The choice of a rear-ventilated rainscreen facade allows optimal consideration of all these factors.

The advantages of RVRFs include sustainable interaction with the environment, well-being of the inhabitants and lower long-term costs (e.g. construction costs, service life and maintenance expenses). Particularly with respect to design, RVRFs offer many possibilities. Systems for energy generation, such as solar thermal energy and photovoltaic systems, can be integrated. The RVRF system ensures an optimal external wall design in technical, structural and economic terms for both new buildings and those undergoing renovation.

## 1.2 Advantages of rear-ventilated rainscreen facades include in particular:

- Long-term weather protection due to the external cladding
- High degree of structural functionality; rear ventilation keeps the thermal insulation permanently dry
- Energy efficiency (due to insulation materials suitable for RVRFs) and innovative substructures allow almost any desired U-value (overall heat transfer coefficient) to be achieved.
- Simple solutions for uneven and difficult supporting substrate frames thanks to adjustable substructures
- Comfortable indoor/room climate due to vapour-diffusion resistance, which decreases from the inside to the outside
- Protection against heat in summer due to thermal buffering by the rear-ventilation zone (thermal load is dissipated via the rear-ventilation zone)
- Protection against cold in winter due to increased heat transfer resistance in the rear-ventilation zone
- Sustainable construction thanks to long service life, low maintenance costs and separate layers (dismantling and recycling)
- Fire protection through appropriate choice of components and building material classes

- Good sound insulation due to the high absorption capacity of mineral insulation materials combined with the large mass of the cladding
- Lightning protection: metal substructures or metal cladding can be connected to – and thus form part of – a lightning protection system

### 1.3 Aims:

- to provide quality standards for the RVRF system
- to provide a clear regulatory framework and thus create a basis for tendering and contracting
- to improve legal certainty for both client and contractor

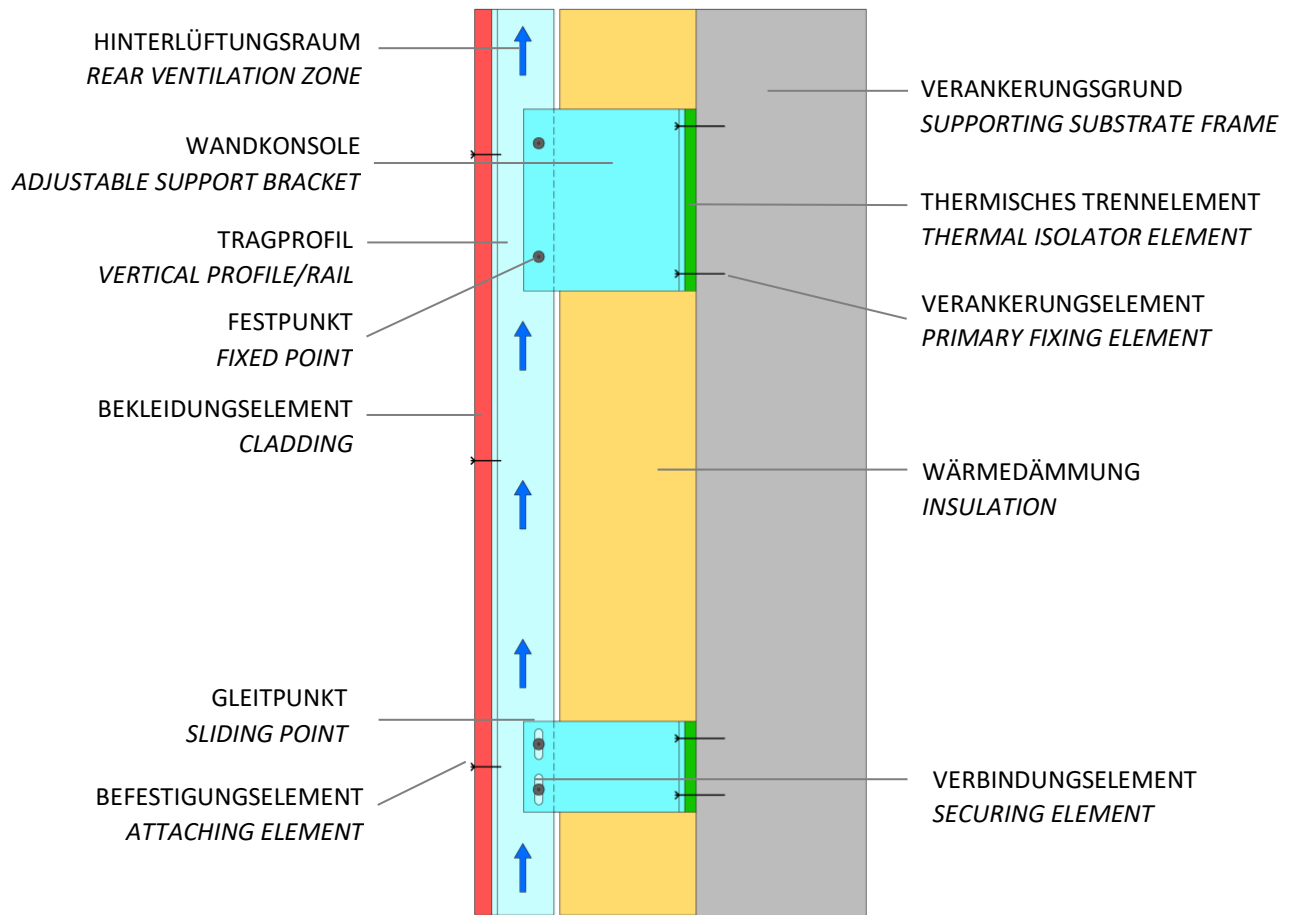
## 2 General

### 2.1 Scope

- (1) This international guideline applies to rear-ventilated rainscreen facades (RVRFs) with substructures, including primary fixing, securing and attaching elements, with or without insulation.
- (2) It presents the minimum requirements for the design and installation of RVRFs.
- (3) This international guideline defines a quality standard for RVRFs that is intended to promote their adoption and help in their installation.
- (4) Individual countries may have legal and technical requirements for the design and installation of RVRFs that exceed those listed here.
- (5) In order to comply with country-specific requirements relating to buildings and components, the respective
  - laws,
  - acknowledged rules of technology,
  - standards,
  - regulations
  - and guidelinesmust be adhered to.
- (6) Following the instructions in this guideline does not absolve the user from the obligation/responsibility to check and confirm that the planned installation conforms to country-specific building regulations and specifications. Applying this guideline does not absolve anyone of responsibility for their own actions. Everyone therefore acts at their own risk.

(Note: Rear-ventilated rainscreen facades are sometimes referred to with different terms, such as facade cladding, wall cladding and ventilated facade).

Figure 1 – Definitions





## 2.2 Definitions

### 2.2.1 Rear-ventilated rainscreen facades (RVRFs)

These are facades with a ventilation zone between thermal insulation and external facade cladding or, in the case of non-insulated and wooden structures, between supporting substrate and facade cladding.

The ventilation zone is connected to the outside air via air-supply openings at the bottom edge and exhaust openings at the top edge of the wall or wall sections (e.g. rear ventilation per floor), which ensures continuous air exchange.

Rear-ventilated rainscreen facades consist of:

- Cladding elements
- Rear-ventilation zone (ventilation gap, back-ventilation gap)
- Substructure
- Attaching elements
- Securing elements
- Primary fixing elements
- Thermal insulation (where appropriate)
- Accessories (where appropriate)

### 2.2.2 Cladding elements

Claddings consist of elements with open or closed/underlaid joints or of abutting or overlapping elements. They function as weather protection and are a feature of the facade design.

### 2.2.3 Rear-ventilation zone

The rear-ventilation zone is a space between the inner face of the cladding and the front face of the wall or the thermal insulation through which outside air flows. Its functions are to protect the layers beneath from moisture, to drain rainwater and condensation, and to reduce heat accumulation in the summer (temperature buffer in both summer and winter).

### 2.2.4 Substructure

RVRF substructures can be made of metal, wood, fibre-reinforced plastics, or combinations thereof.

### 2.2.5 Primary fixing elements

Primary fixing elements anchor the substructure to the supporting structure.

### 2.2.6 Securing elements

Securing elements mechanically interconnect the elements of the substructure.

### 2.2.7 Attaching elements

Attaching elements mechanically attach the cladding to the substructure by means of metal elements or adhesives.

### **2.2.8 Thermal insulation**

The thermal insulation is the thermally insulating layer between supporting substrate frame and rear-ventilation zone. Depending on the material used, the thermal insulation may also fulfil functions related to fire protection and sound insulation.

### **2.2.9 Insulation material holder**

Construction element that secures the position of the thermal insulation.

### **2.2.10 Supporting substrate frame**

The supporting substrate frame is the load-bearing structure of the building. It takes the loads applied by the facade. The substructure is anchored to the supporting structure.

Surface layers (e.g. plaster and coatings) can usually not support loads.

### **2.2.11 Accessories**

Accessories complete the rear-ventilated wall cladding, e.g. profiles for building abutments, plinths, jambs, parapets, vents and attachment points for attaching scaffolding.

### **2.2.12 Open facade cladding**

Open facade claddings have a free cross section extending from the facade cladding through the rear-ventilation zone to the thermal insulation. Open facade claddings are RVRFs that have open joints or have claddings with openings. This includes, for example, structures with perforated plates, expanded metal and metal fabrics, perforated cladding panels, textile fabrics and wood panelling.

### **2.2.13 Facade membranes**

Facade membranes provide long-term protection against weather to both the substructure and the thermal insulation if the facade cladding is unable to do so.

## 2.3 Liability

### 2.3.1 General

- (1) The parties usually involved in the planning and execution of all construction work, including the planning and installation of RVRFs, are:
  - Client
  - Architect / Planner
  - Construction manager
  - Contractor
- (2) The client and all other parties involved in the planning and installation of RVRFs must assume liability for their respective areas of responsibility. Very close coordination between all parties is essential.

Unless otherwise specified in the contract or by law, the following responsibilities and duties usually apply.

### 2.3.2 Client

- (1) The project and every step of construction must be planned and executed in detail. Accordingly, a planner/project planner and a structural engineer must be commissioned (as necessary). These will develop the requirements for the contractor, whose work must be monitored by the construction manager/site supervision (as appropriate).
- (2) After accepting the work, the client becomes responsible for servicing and maintaining the RVRF to ensure its lasting functionality. Timely maintenance can extend the service life and prevent major damage. To this end, RVRFs must be inspected at regular intervals after installation.
- (3) If clients are unable to service and maintain the RVRF themselves, they are advised to sign an inspection and maintenance agreement with a specialised company in order to ensure regular inspection and maintenance of the structural components.

### 2.3.3 Architect/Planner/Project planner

- (1) The task and responsibility of the architect / planner is to specify, in close coordination with the client, appropriate materials and a suitable design for the RVRF. On this basis, a comprehensive descriptive specification of works is then to be drawn up that allows the bidding companies and the ultimately successful contractors to make reliable calculations. This usually requires the following points to be specified or clarified:
  - Proof of the construction's load-bearing capacity and suitability for use
  - Specification of the requirements relating to each layer of the RVRF, taking into account the technical guidelines and recommendations specific to the selected cladding system, including any required proof of stability and official permits
  - Fire protection planning in compliance with local regulations
  - Consideration of structural requirements, also as regards energy efficiency
  - Investigation of the load-bearing capacity of the supporting substrate frame and of its characteristics and dimensional accuracy, including any required proof of stability
  - Determination of the dimensional tolerance of the supporting substrate frame and specification of the dimensional tolerances for the substructure and the finished facade

- Planning of the wall geometry (e.g. cladding panel grid, joint pattern)
- Planning of the details
- Development of a maintenance plan for the client
- The required plans (facade partitioning plan, sections, elevation plans, floor plans) must be provided in a timely manner and in a format suitable for reuse

#### **2.3.4 Construction Manager**

(1) The primary tasks of the construction manager are:

- Specification of suitable reference points and markers for aligning the wall construction
- Coordination of the installation of the individual layers of the wall construction
- Coordination of work between the trades and within the general context of the construction project
- Checking that all construction work conforms to the agreed and planned services
- Acceptance of trade sections so subsequent work can commence (compliance with the requirements relating to the supporting substrate and the interfaces between the trades)
- Documented acceptance and auditing of the works

(2) Construction management can be carried out by the architect/planner/project planner, or a specialist can be employed for this task.

#### **2.3.5 Contractor**

(1) In addition to the actual installation of the RVRF, the tasks of the contractor include:

- Inspection (in close cooperation with the construction manager/site supervision) of any work carried out or layers installed by previous companies
- Documentation during and after the installation of all layers of the RVRF
- Compliance with all safety regulations, including those relating to accident prevention and occupational health and safety
- Documentation of all works performed and description of the necessary maintenance and servicing work

(2) If no architect/planner is involved, the client may commission the contractor to undertake the planning. Planning liability then rests with the contractor alone.

## 2.4 General requirements

### 2.4.1 Design

- (1) RVRFs can be manufactured using a large variety of materials.
- (2) In the planning phase, the choice of
  - materials for the wall cladding (considering their reaction to fire),
  - type of cladding,
  - its dimensions,
  - surface structure and
  - colour

(also in various combinations) should already take visual aspects into consideration that might affect the character of the building. The design should harmonise with its surroundings and enhance or emphasize the style of the building.

- (3) All claddings require the wall surface to be partitioned.

### 2.4.2 Stability

- (1) RVRFs are connected mechanically to the supporting structure and must be stable at all times. In this context, the following loads (as applicable) must be taken into account:
  - dead load
  - wind load (suction and pressure)
  - snow and ice loads
  - impact loads
  - special loads (e.g. seismic forces, advertising boards)
- (2) An itemized structural engineer's report of the RVRF system must be prepared in compliance with the pertinent European and/or national regulations. This proof of stability must be provided in a verifiable form and contain, in particular, the stability calculations for the substructure, the cladding, the primary fixing elements and the securing elements.
- (3) The dead load results from the weight of the cladding and the substructure. Corresponding values can be found, for example, in national regulations and specifications by the manufacturers.
- (4) In the case of wind loads, a distinction must be made between suction and pressure. The parameters to be used in the calculations depend, among other things, on the geometry of the building, the type of facade cladding and the location of the building.
- (5) It may be necessary to take special loads (e.g. thrown balls, impacts) into account (e.g. by closer spacing of the substructure) in areas where special conditions apply, such as road traffic.

### 2.4.3 Fire protection

- (1) RVRFs must conform to the relevant national fire protection regulations. Fire protection planning is the responsibility of a specialist consultant.

#### **2.4.4 Moisture and heat protection**

- (1) National and technical requirements in terms of moisture and heat protection must be fulfilled (see, e.g., “IFD Guideline for the Energy Efficiency of Roofs and Walls” and “IFD Guideline for Optimizing Thermal Bridges in Roofs and Walls”). Any thermal bridges due to the structure or substructure elements must be considered and verified.
- (2) The cladding and the substructure of the facade must be planned and designed such that penetrating rainwater and any condensate that may form can be removed to the outside in a controlled manner. This is to prevent moisture from penetrating into the thermal insulation or the supporting substrate frame or into any wooden parts of the substructure.
- (3) The combination of an RVERF with an additional thermal insulation layer on the outside of the wall is particularly favourable from a building physics standpoint. Furthermore, the rear-ventilation zone allows dispersal of any moisture that might have penetrated joints in the cladding.

#### **2.4.5 Airtightness**

- (1) Any requirements in terms of airtightness of the building envelope must be met by the load-bearing structure of the building. The RVERF has no sealing function and does not contribute to the airtightness of the building. Airtightness is realized, for example, by the interior plaster and by professional installation of doors and windows.

#### **2.4.6 Sound insulation**

- (1) Requirements in terms of sound insulation must be taken into account in the planning of the overall construction and must conform to national regulations. A high level of sound insulation can be achieved due to the substantial absorption capacity of mineral insulation materials in combination with the large mass of the cladding.

#### **2.4.7 Lightning protection**

- (1) Requirements in terms of lightning protection must be considered in the planning by a specialist consultant and must conform to national regulations.
- (2) Consideration must be given to the material compatibility between the parts of the lightning protection system (lightning rods, conductors) and the parts of the facade cladding with which they come into contact.

#### **2.4.8 Deformation**

- (1) Deformations are primarily due to changes in temperature and humidity. Local temperature differences ( $\Delta T$ ) must be taken into consideration (generally between -20°C and +80°C).
- (2) Deformations must neither result in loosening of individual parts of the facade nor impair its stability. Preventive measures include:
  - Dividing the substructure and cladding into sections (e.g. at floor height)
  - Appropriate arrangement of joints

- Unforced assembly and free fit without stresses of the facade cladding and of the substructure, for example, by means of fixed and sliding points or other suitable constructional measures
- (3) Dividing joints between buildings must be taken into consideration in the substructure and the cladding and applied to the same extent.

#### **2.4.9 Tolerances**

- (1) The surface of the wall cladding should be even. Any uneven areas of the supporting structure must already be taken into consideration during planning and, if necessary, compensated for with the substructure. Permissible tolerances relating to the supporting structure or the RVRF must be specified or given by national regulations.

### 3 Materials and requirements

#### 3.1 General

(1) All materials used are to be matched to one another and must not interact unfavourably.

Possible interactions may result from:

- corrosion
- moisture
- emissions
- sound
- temperature

The surface contact ratio may be crucial in the various material combinations (see Table A).

(2) All elements of the RVRF must be suited to their intended use and must conform to the relevant European or national regulations.

##### 3.1.1 Compatibility of metallic materials

Table A

+ suitable 0 conditionally suitable - unsuitable		Material with small area (screw, rivet)					
Material with large area "profiles"	Atmosphere C = Country T = Town I = Industry S = Sea	aluminium alloy	zinc, galvanised steel	carbon steel	stainless steel A2/V2A	stainless steel A4/V4A	copper alloy
Aluminium	C	+	0	-	+	+	0
Aluminium alloys	T,I	+	-	-	0	+	-
	S	+	-	-	-	+	-
Zinc galvanised steel	C	+	+	+	+	+	0
	T,I	+	+	+	0	+	0
	S	+	+	+	-	+	-
carbon steel	C	-	-	+	+	+	0
	T,I	-	-	+	+	+	0
	S	-	-	+	-	+	-
stainless steel	C	-	-	-	+	+	-
	T,I	-	-	-	+	+	-
	S	-	-	-	-	+	-
Copper alloys	C	-	-	-	+	+	+
copper,	T,I	-	-	-	+	+	+
	S	-	-	-	0	+	+

*Note: Table A provides an overview of the compatibility between metallic materials in normal atmosphere. It must be used with caution, as it does not apply (or only to a limited extent) to material combinations in areas with permanently high humidity or otherwise unusual atmospheres.*



## 3.2 Cladding

- (1) Claddings consist of small- or large-sized elements. Cladding elements with a surface area  $\leq 0.4 \text{ m}^2$  and/or  $\leq 5 \text{ kg}$  unit weight are categorised as small-sized cladding.
- (2) The quality of all materials to be used must either be defined by the relevant national or EU standards and approvals, or confirmed by accredited inspection bodies.
- (3) Regarding transportation, storage, handling and installation, product-related recommendations of the manufacturers must be followed.
- (4) The structural properties of the cladding materials must be verified by the manufacturers (standardized structural analyses).
- (5) Materials that can be used for cladding include:
  - fibre-cement panels
  - fibre-concrete panels
  - composites
  - metal
  - wood
  - slate/natural stone
  - ceramic panels
  - roofing tiles (concrete and clay)
  - high-pressure laminate panels
  - plastic (fibre-reinforced)
  - glass (including photovoltaic and solar thermal energy panels)
  - (plaster) baseboards
  - stone-wool slabs
  - terracotta/clay or similar

## 3.3 Substructure

### 3.3.1 General

- (1) The RVRF substructure forms the structural connection between load-bearing exterior wall and facade cladding. The substructure usually consists of support brackets/profiles made of metal (e.g. brackets with sliding and fixed points made of aluminium or hot-dip galvanized/ stainless steel) and/or wood (e.g. counter or base battens, bearing battens, timber formwork, wood composites), or fibre-reinforced plastics.

### 3.3.2 Metal substructures

- (1) Metal substructures can be manufactured from:
  - stainless steel in accordance with EN 10088 (e.g. 1.43xx, commonly called A2 or V2A; 1.44xx, commonly called A4 or V4A)
  - aluminium alloys in accordance with EN 573, EN 755 and EN 485 (e.g. EN AW 6063 T66)
  - combinations of metal and fibre-reinforced plastic
  - galvanized steel in accordance with ISO 1461 or hot-dip galvanized steel in accordance with EN 10346 (e.g. S350 GD) with corrosion protection according to EN 10169 (if necessary)

- (2) Any damaging material interactions, such as contact corrosion and crevice corrosion, must be avoided when using several different metals (see Table A).

### 3.3.3 Wooden substructures

- (1) Elements made of pre-dried wood or bonded wooden elements must be used in the substructure. National regulations for timber treatment must be complied with.

### 3.3.4 Combined substructures

- (1) Substructures can be manufactured from combinations of metal, wood and fibre-reinforced plastics.
- (2) The pertinent regulations regarding metal, wooden and fibre-reinforced plastic substructures – and especially manufacturers' guidelines – must be complied with.

## 3.4 Primary fixing elements

- (1) Substructures must be connected to the supporting substrate frame by means of primary fixing elements. Plastic frame anchors, stud anchors, injection anchors, bolts, setting bolts, or combinations thereof, and embedded anchor rails, etc. may be used as fixing elements.
- (2) The fixing elements must comply with national and/or EU regulations and approvals and the manufacturers' guidelines. The purpose specified in the relevant approvals must match the requirements of the RVRF. Further, corrosion protection measures must be taken, and material compatibility must be considered.

*Note: The primary fixing elements must match the clearance holes of the fixtures in terms of diameter and attachment height/clamping length, and vice versa.*

- (3) Number and type of the primary fixing elements required are provided in the structural engineering report. The major influencing factors are:
  - pull-out resistance
  - shear forces
  - permissible bending moment (particular attention must be paid to non-supporting layers and/or thermal isolation layers)
  - loads (dead load, wind load, and – as applicable – snow, ice and special loads).
- (4) It may be necessary to verify the load-bearing capacity of the primary fixing element on site by means of pull-out tests according to, for instance, EAD 330076-00-0604 or an equivalent test method.

### 3.5 Securing elements

(1) In the case of metal substructures

- bolts or
- rivets,

in the case of wooden substructures

- screws

or combinations thereof may be used as securing elements.

(2) The securing elements must comply with national and/or EU regulations and approvals and the manufacturers' guidelines. The purpose specified in the relevant approval must match the requirements of the RVER. Further, corrosion protection measures must be taken, and material compatibility must be considered.

### 3.6 Attaching elements

(1) The following may be used as attaching elements:

- rivets
- screws
- undercut anchors/ blind-hole anchors
- adhesives/adhesive systems
- brackets/hooks
- nails/pins

(2) The attaching elements must comply with national and/or EU regulations and approvals and the manufacturers' guidelines. The purpose specified in the relevant approval must match the requirements of the RVER. Further, corrosion protection measures must be taken, and material compatibility must be considered.

(3) If the cladding is to be fastened to the substructure by means of adhesives, only tested adhesive systems (with test certificate from an accredited inspection body or equivalent proof of suitability) may be used in accordance with the manufacturers' guidelines.

### 3.7 Thermal insulation

(1) Thermal insulation for RVERs must consist of insulating materials that are suitable for the intended purpose (outer insulation of the wall behind the cladding). The insulating materials must be:

- dimensionally stable
- inherently structurally stable
- water-repellent and vapour-permeable (where applicable)
- non-combustible (where applicable)

(2) For example, the following insulating materials may be used:

- mineral wool
- cellular glass
- rigid foam panels
- wood fibre

- (3) Fleece lamination in the case of mineral fibre insulating material is just for visual effect (shadow gap). Cut edges and front sides do not need extra protection.

### 3.8 Supporting structures

- (1) Supporting structures may consist of standardized substrates (e.g. concrete, masonry bricks steel, wood) or non-standardized substrates. Surface layers, such as plaster and coatings, are not considered to be elements of the load-bearing substrate. These non-load-bearing layers require particular attention (e.g. regarding dowel bending and anchoring depths) during structural dimensioning.

### 3.9 Accessories

- (1) Profiles or similar elements made of metal, (fibre-reinforced) plastic or cladding materials may be used as accessories, for instance, for abutments and junctions. They must fulfil the material requirements and must not impair the functionality of the RVRF.

### 3.10 Facade membranes

- (1) Open facade claddings (see Section 2.2.12) with open joints or a relevant proportion of holes (e.g. expanded metal) as shown Figure 2 may, in accordance with national regulations and climatic conditions, require that suitable membranes be used. Glass fleece laminated onto the thermal insulating material is unsuited for use as a membrane in these cases.
- (2) Since environmental influences such as heat/cold, UV exposure and rain/snow put considerable strain on the membranes, only approved materials that have been shown to be sufficiently durable may be used: The planning team and contractors require a complete declaration in accordance with EN 13859-2 from the supplier in order to select a suitable membrane. The requirements that the membrane must fulfil depend mainly on the type of facade cladding used and its ability to provide protection against weather and mechanical strain, taking local conditions into consideration. The following distinction is made between low, normal and high strain.
  - (2) Low strain on the membrane: for openings that, according to Section 4.3, do not require a membrane.
    - The materials/protective measures used ensure weather protection of the thermal insulation during construction if necessary and fulfil only visual/aesthetic requirements.
  - (3) Normal strain on the membrane: requirement to be fulfilled: resistance to 336 hours of artificial ageing must have been demonstrated. (see Section 4.3)
    - These membranes provide weather protection to the thermal insulation during construction.
  - (4) High strain on the membrane:
    - Resistance to 5000 hours of artificial ageing must have been demonstrated. (\*)
    - Resistance to water penetration must be maintained even after 5000 hours of artificial ageing (class W1 according to EN 13859-2).

(\*) Note: Resistance to artificial ageing for 336 or 5000 hours does not indicate resistance for the same amount of time when the membrane is installed and exposed to weather. These are minimum requirements for laboratory values.

## 4 Installation

### 4.1 General requirements

In principle, national regulations and standards must be complied with in the installation of RVRFs. Where no such regulations exist, the following minimum requirements listed in this guideline must be met.

- (1) All elements of the RVRF must be installed in an unforced manner and fitted without stresses, taking into consideration material-specific changes in length caused by temperature and humidity.
- (2) Prior to installation, the supporting substrate frame must be inspected for load-bearing capacity, alignment, evenness and moisture content by suitable means (e.g. pull-out tests, moisture meter). A reference point is to be applied to the backing wall to help in determining the alignment of the cladding.

The following base surfaces are particularly suitable:

- concrete in accordance with EN 206
- brick in accordance with EN 771
- hollow and solid blocks in accordance with EN 771
- lime-sand brick in accordance with EN 771
- lightweight /aerated concrete in accordance with EN 771
- wood in accordance with EN 14081
- glued laminated timber in accordance with EN 14080
- steel support structures and metal profiles in accordance with EN 1090
- existing brickwork (load-bearing capacity must be verified in pull-out tests)
- the suitability of sandwich elements (e.g. those made of metal, concrete or lightweight concrete) requires separate confirmation

### 4.2 Substructure

- (1) Planning and installation of the substructure must consider the substrate, the loads, the building physics and the chosen cladding, and fulfil all stability requirements.

#### 4.2.1 Metal substructures

- (1) Metal substructures generally consist of:
  - wall bracket/brackets/spacer screws/rod systems
  - thermal isolator elements (as appropriate)
  - fixing elements
  - support profiles (L, T, Z and  $\Omega$  profiles or similar)
  - profile sheets (as needed)
  - securing elements
  - accessories (e.g. clamps, clips, system parts)

- (2) The substructure must be anchored to the supporting substrate frame following the structural engineers report, manufacturers' guidelines and approvals. Particular attention must be paid to:
  - The quality of the supporting substrate frame
  - The minimum depth of anchoring
  - Axis and edge distances
  - Drilling methods and clearing of the drill holes
  - Tightening torque
  - Adequate corrosion protection: galvanized screws in combination with plastic anchoring systems must be protected against moisture ingress by suitable corrosion protection measures
  - The primary fixing elements must be suitable and approved for the supporting substrate frame
  - No slotted holes in the base plate of the support bracket (fixture) in the load direction opposite the primary fixing elements without suitable safeguards (e.g. serrated or grooved washers)
  - In particular, the primary fixing elements must match the clearance holes of the fixtures in terms of diameter and attachment height/clamping length, and vice versa
- (3) The load-bearing capacity of the primary fixing elements may require verification in pull-out tests, for example, according to EAD 330076-00-0604 or an equivalent test method.
- (4) The substructure must be installed in accordance with structural considerations following from the dimensions of the cladding, its maximum attachment spacing and the type of attachment.
- (5) Due to temperature-dependent changes in length, the support profiles must be connected to the wall bracket flanges/brackets in an unforced manner. This is usually achieved by using fixed and sliding point connections in the wall brackets or by other suitable methods.
- (6) Spacers/brackets are connected to the support profiles by means of rivets or bolts in accordance with the manufacturers' specifications. The installation of sliding point connections must be unforced or carried out by other suitable means: in the case of riveted connections by using rivet gauges, and in the case of bolted connections using bolts/screws with an undercut/undersized shank.
- (7) The securing element must be certified or approved for use in an RVER.
- (8) Thermal bridges created by substructure elements (e.g. spacers/brackets) must be reduced by means of thermal isolators.

#### 4.2.2 Wooden substructures

(1) Wooden substructures usually consist of:

- base battens (counter battens)
- fixing elements
- bearing battens (tile battens)
- timber formwork/wood composites
- securing elements

The wooden elements must be connected to one another using suitable screws. Thermal separation and sliding connections are not necessary.

(2) In the case of wooden substructures, full compensation for unevenness in the substrate and the installation of thick insulating materials may not always be possible.

(3) For claddings with open joints, vertical bearing battens with joint tapes or joint profiles are to be used. Joint tapes or joint profiles with sealing lips or with anti-capillary profiles are preferred (e.g. EPDM bands with grooves); simple metal strips without profile are typically not suitable. Backing joint strips and profiles must be secured to avoid slipping off or sliding. Dividing horizontal profiles at the joints of the cladding elements is recommended. Vertical profiles need not be divided.

#### 4.2.3 Combined substructures

(1) Combined substructures combine metal, fibre-reinforced plastic and wood. They may contain the following elements:

- brackets made of metal or fibre-reinforced plastic or combinations thereof
- spacer screws or spacers
- thermal isolator elements
- fixing/anchoring elements
- vertical (support) profiles (L, T, Z and  $\Omega$  profiles and similar)
- securing elements
- bearing battens
- timber formwork/wood composites

(2) Installation must comply with regulations pertaining to both metal and wood constructions.

#### 4.2.4 Thermal insulation

(1) Insulation panels must be installed butted closely together and in units, in particular also at the corners of the building.

(2) They should be as close to the substrate as possible to avoid ingress of air behind them, and must be secured in place.

(3) Entire insulation panels are to be installed as a matter of principle. Adapter elements should be > 150 mm and may only be installed within the wall surface and never at the corners of buildings.

(4) The insulation panels must be fixed securely and seamlessly in place (depending on the substructure by use of dowels, adhesives or clamps/mechanical pressing). Ambient wind forces must be taken into consideration, also during installation. The insulation material must not be pressed down excessively around the insulation material holder.

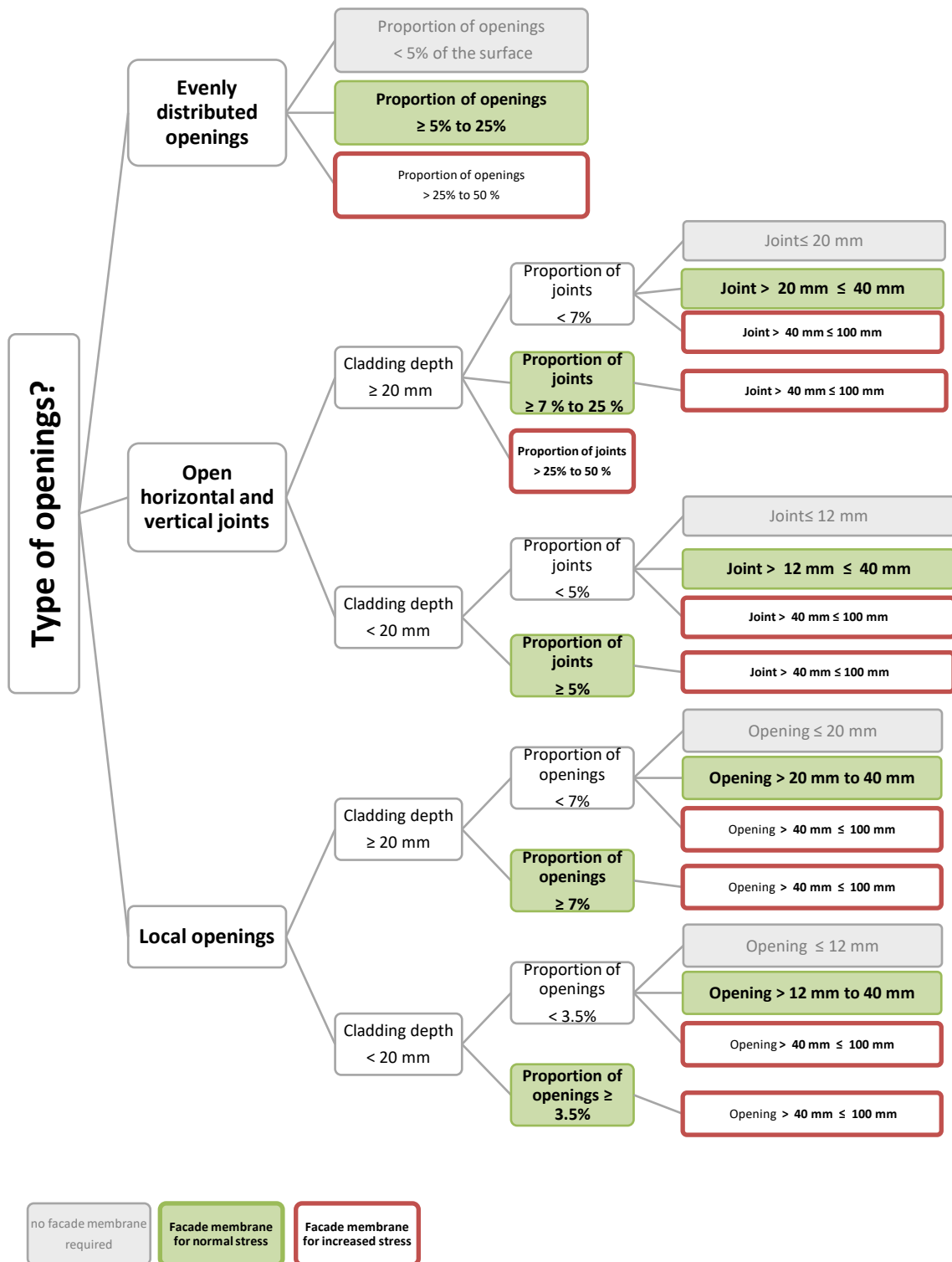
- (5) Thermal insulation must be laid carefully at the penetration points of the substructure.
- (6) Moisture-resistant insulation materials must be used in areas subject to splashing water/road spray.
- (7) All relevant national regulations and installation specifications of the insulation manufacturer must be complied with as a matter of principle.

### **4.3 Facade membranes**

- (1) National regulations specify the cases in which facade membranes must be installed.
- (2) Since their ability to provide protection (e.g. against water ingress or UV irradiation) may be limited, open facade claddings (cf. Section 2.2.12) may change the constructional requirements.
- (3) In the absence of suitable protective measures, open facade claddings may lead to ingress of moisture to the construction. Protection against moisture can be achieved either constructionally (e.g. by using drip profiles or by increasing the rear-ventilation zone) or by using membranes.
- (4) In these cases, membranes are to protect the structure from weather. If necessary, they can also be used to protect the thermal insulation during construction.
- (5) Membranes are not required if the facade system is correctly planned and installed and features openings that do not exceed the maximum dimensions specified below, such that moisture (rain, snow, etc.) penetrating the openings is drained via the rear-ventilation zone and no damage due to UV exposure is to be expected according to Table B and Figure 2.

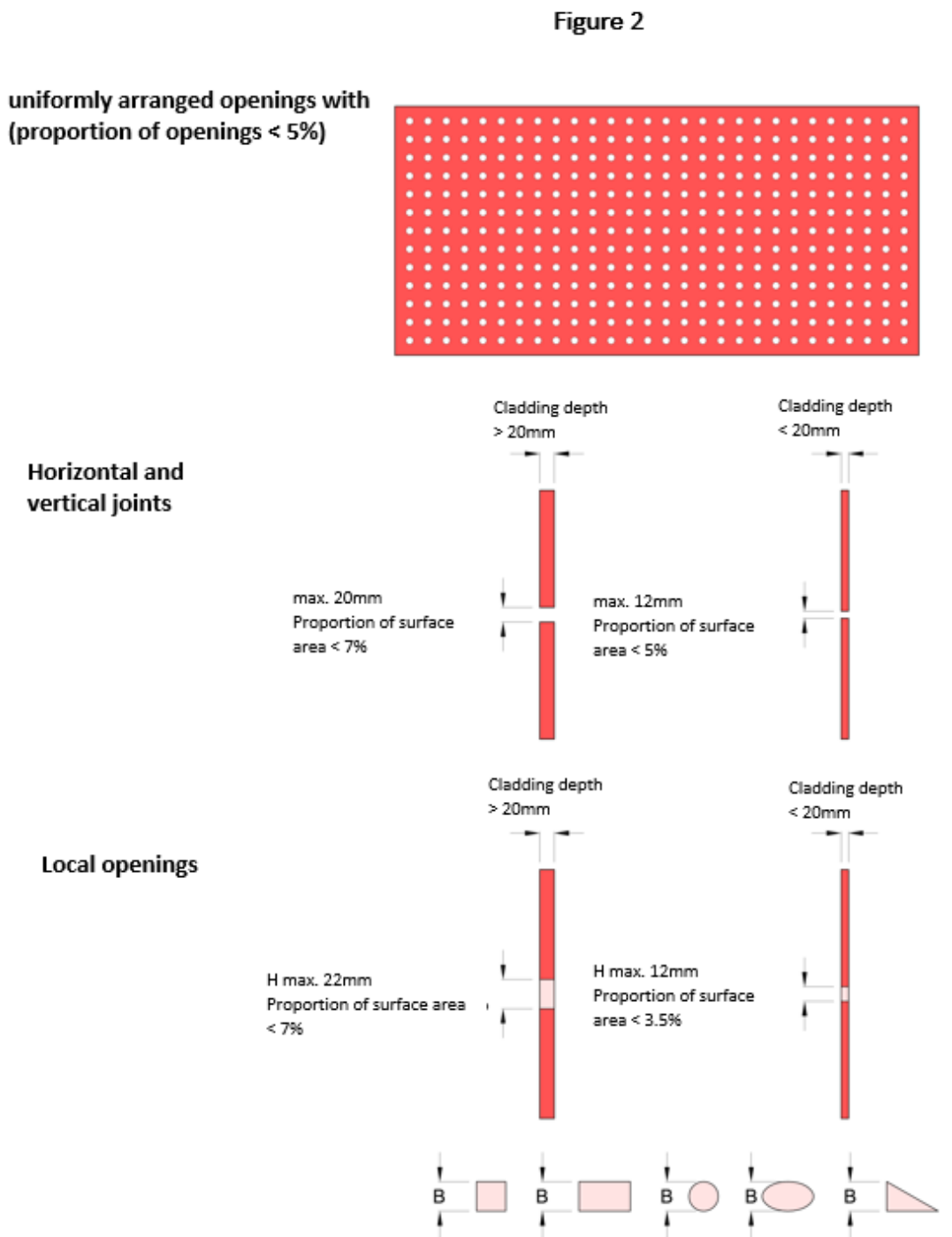


**Table B - Decision Tree**



Where the proportion of openings/joints exceeds 50%, or when in doubt, particularly where openings are arranged in an irregular pattern, or, for example, in the case of transparent facade claddings, the manufacturer's specifications must be taken into account.

Figure 2



*Note: The joint widths stated above are planned joint widths. Tolerances as per Section 5.2, which occur due to the cladding materials or installation, must not be included in the joint widths stated above. The actual measurements generated by these tolerances have no impact on the use of facade membranes. The planned joint widths must form the basis for determining the use of facade membranes.*

*The depth of the cladding corresponds to the width of the shade-providing edge of the cladding element (e.g. shadow gap or upstand in the case of metal elements/coffers).*

- (6) When used as protection during construction, facade membranes (or similar) suitable for low strain can usually be employed, as the facade cladding will take over their function in due course.
- (7) In the case of local openings, local installation of membranes may suffice, but there must be sufficient overlap with the opening, and draining of water must be guaranteed.
- (8) The membrane joints must be laid overlapping in the direction in which water would flow. The joints must be fully sealed. Membranes attached to other parts of the building and penetrations (window connections) must also be fully sealed.
- (9) The substructure must be designed with at least two layers if facade membranes are to be used (see Figures 3 and 4).

Figure 3

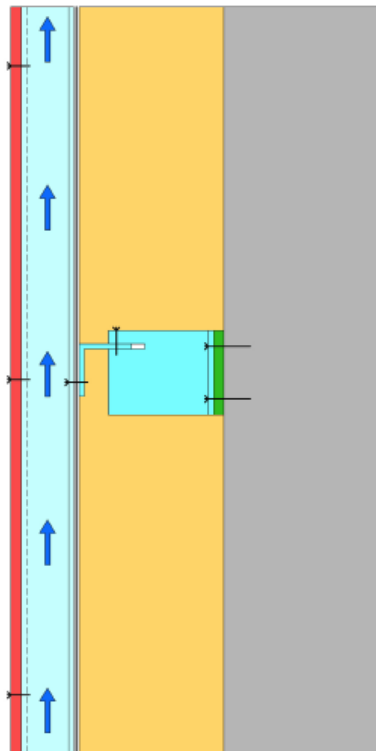
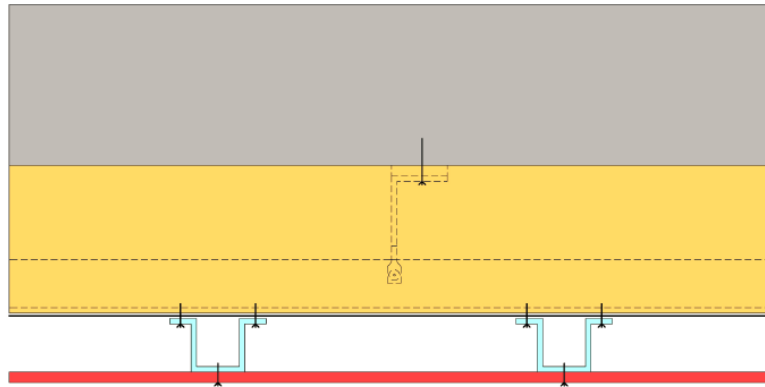


Figure 4



#### 4.4 Rear-ventilation zone

- (1) The rear-ventilation zone between the inner side of the cladding, including any formwork, and the outer wall or the thermal insulation must measure at least 20 mm.
- (2) *Recommendation: In the case of claddings with open joints, the rear-ventilation zone should be at least 40 mm.*
- (3) In the case of vertically arranged corrugated sheets or trapezoidal profiles, the cladding can be installed in strips while ensuring that the free horizontal ventilation cross section amounts to at least 200 cm<sup>2</sup>/m.
- (4) For wooden constructions, the decrease in cross section due to the wood part must be taken into account.
- (5) The ventilation zone may be reduced locally to 5 mm, for example, due to the substructure or in cases of unevenness in the wall.
- (6) Free aeration and ventilation openings (at least 50 cm<sup>2</sup>/m wall length; Switzerland: at least 100 cm<sup>2</sup>/m) are required to ensure rear ventilation. Decreases in cross section due to, for instance, ventilation grilles for keeping out small animals must be considered. Supply and exhaust air openings with a gap width larger than 10 mm (Germany: larger than 20 mm) must be covered with ventilation grilles; hole sizes of 5 to 8 mm in diameter are recommended. Aeration and ventilation must be constructed such that functionality is guaranteed.
- (7) Generally, there must be air supply and exhaust air openings for all interruptions in the walls (windows, doors, etc.) in the lintel area and underneath the windowsills. For openings with a width of up to 1.5 m, supply and exhaust openings can be omitted provided that sufficient cross-ventilation is guaranteed.

## 4.5 Cladding

### 4.5.1 General requirements

In addition to the requirements in terms of weather protection, structural physics, fire protection and stability, the following points require particular consideration during design/planning:

- Type, colour and shape of the attachment hardware (visible or concealed attachment of the cladding)
  - Joint geometry (element size, joint grid, expansion joints, etc.) – the RVRF can be constructed using open, underlaid or closed joints
  - For large-sized cladding elements, the joints should typically have a width of 8 – 10 mm; the exact width depends on the material and the dimensions of the elements, and may have to be increased
  - Type of substructure
  - Material reflections and mirroring
  - Colour differences between different production batches of material
  - Alignment of the cladding elements
  - Abutments and junctions according to the manufacturers' specifications
- (1) All types of cladding require the wall areas to be partitioned. The dimensions of the cladding elements in the vicinity of penetrations (e.g. windows) may differ from those within the remaining wall area.
  - (2) Claddings consist of small- or large-sized elements. Cladding elements with a surface area  $\leq 0.4 \text{ m}^2$  and/or  $\leq 5 \text{ kg}$  unit weight are categorised as small-sized cladding.
  - (3) A distinction is generally made between claddings with overlapping elements (wall coverings) and claddings with open or closed joints.
  - (4) The attachment of the cladding may be visible or concealed.
  - (5) Number and type of attaching elements to be in accordance with the structural engineering report. The arrangement of the attaching elements must be taken into account in the structural engineering report, which must also comply with the minimum edge spacing and maximum axis spacing specified by the manufacturer.
  - (6) The cladding must be installed in an unforced manner, for example, by using sliding and fixed points. The joint width must take into account the expected changes in dimensions, considering also the installation temperature.
  - (7) Riveted connections are to be established in an unforced manner by means of drilling and riveting gauges.
  - (8) Bolted connections are to be established in an unforced manner, for instance, by means of a depth stop, torque, or bolts with an unthreaded area at the head.
  - (9) Prior to using adhesives, the joint parts must be cleaned of oil and dirt; the manufacturers' instructions regarding pre-treatment, temperature, etc. must be followed.
  - (10) In the case of hooking systems (e.g. with undercut anchor), possible movement of the substructure and its effect on the cladding elements must be taken into account (displacement of the elements).
  - (11) Cleaning the finished cladding in accordance with the manufacturer's specifications is recommended.

#### **4.5.2 Cladding with open or closed joints**

- (1) Large-sized cladding elements are preferable for claddings with open or closed joints.
- (2) If the horizontal joints are to be closed, water-draining profiles must be used and installed without overhang.
- (3) Claddings with underlaid joints must be secured to avoid slipping off or sliding. Dividing horizontal profiles at the joints of the cladding elements is recommended. Vertical profiles need not be divided.

#### **4.5.3 Overlapping cladding (wall coverings)**

- (1) Overlapping claddings can consist of small- or large-sized cladding elements.
- (2) Typical roof covering materials attached to the facade are often used as covering elements. However, special-purpose wall coverings are available.
- (3) Generally, small-sized claddings are installed in accordance with national trade regulations or manufacturers' specifications. They are attached by means of nails/pins, screws or brackets/hooks and cleats. Depending on the type of installation, this may be realised
  - concealed in the covered area,
  - visibly, or
  - as a combination of both.
- (4) Large-sized overlapping claddings are generally manufactured as lapped cladding or interlocking systems. Installation typically follows manufacturers' specifications. The attachments may be visible and/or concealed and must be installed in an unforced manner (using fixed and sliding point attachments if necessary). Screws, rivets or brackets are typically used for attachment.

#### **4.5.4 Transportation and storage**

- (1) During transportation and in storage, all facade-cladding materials must be protected from moisture, the formation of condensate, rapid temperature changes, and direct sunlight. Instructions by the manufacturers must be followed.

## 5 Tolerances of the finished product

### 5.1 Principles/General

Tolerances are permissible deviations of a (partial) service/work from the planned target.

- (1) Tolerances are unavoidable in construction works, and result from the sum of substrate-, product- and installation tolerances. In most cases, they relate to dimensions and position, but they may also relate to surface characteristics, the degree of gloss, colour and other properties of components.
- (2) Tolerances must be distinguished from dimensional changes or deformations resulting from temperature changes, load change or moisture absorption. These are determined by the physical and chemical properties of the building materials. They cannot be prevented and must therefore be taken into account in addition to the tolerances.
- (3) In order to avoid arguments between client and contractor relating to deviations of the finished services/works from the agreed or planned specifications, the permissible tolerances and the methods of measurement must be clearly agreed upon beforehand. This applies particularly to cases in which smaller tolerances than those specified in the pertinent regulations are to be achieved.
- (4) The product-, substrate- and installation tolerances must be taken into account when specifying the permissible tolerances for the finished wall and roof surfaces.
- (5) Unless otherwise specified, a standard viewing method is to be used when assessing the visual appearance of visible surfaces. This means that lighting and viewing distance and angle must match the conditions under which the building is normally used.
- (6) The visual appearance of surfaces and colours depends on the type and thickness of the coating as well as the direction in which the cladding elements were installed.
- (7) Assessments must be carried out in diffuse light and under no circumstances in side light or in direct sunlight.
- (8) To avoid differences in surface and colour, client and contractor must agree that the material for particular sections or for the complete work should come from the same production batch.
- (9) With certain colours (particularly glazed or metallic colours), colour differences may occur even within one production batch. Guidelines by the manufacturer are to be followed in this context.

### 5.2 Recommendations on agreed tolerances

- (1) Tolerances must already be considered and agreed upon in the planning stage.
- (2) When deciding on the permissible tolerances of the finished surfaces, the sum total of substrate-, product-, cutting-, and installation tolerances must be taken into account. Compensatory allowances must be considered in the construction.

- (3) For the following points, the permissible tolerances and their methods of measurement in the finished works must be agreed upon:
- Lengths and widths of the cladding elements
  - Deviations from specified alignments and heights
  - Joint width, misaligned joints: The tolerances of the finished joint widths comprise the sum of temperature- and material-induced dimensional changes and the permissible production and installation tolerances, and should amount to at least  $\pm 20\%$  of the joint width. Example: 10 mm joint  $\pm 20\%$  results in 8 to 12 mm joint width. The impression of a regular joint pattern is to be achieved.
  - Evenness of the facade: The surface of the facade should be even. Any unevenness in the supporting substrate frame must be considered in the planning phase and compensated for by the substructure. The tolerances to be agreed upon depend on the cladding material used. Waviness is generally unavoidable in thin metal sheets and therefore not to be regarded as a defect (see IFBS-guidelines for light-weight metal construction | Planning and Installation).
  - Colour, gloss, surface: Samples are useful in this context. Ideally, boundary samples should be agreed upon, within the limits of which the colour and gloss may vary (IFBS guidelines for light-weight metal construction | Basic principles).



## 6 Wall/Attachment details

### 6.1 General requirements

- (1) The design of the wall details must guarantee the functionality of the RVRF.
- (2) The design of the wall/attachment details may require cladding elements that deviate from those within the wall area and that may require on-site processing.

### 6.2 Lower termination

- (1) The lower termination of the wall cladding must be realised taking the required ventilation openings into consideration. In this context, the distance between the lowermost edge of the cladding and the ground/soil must be sufficiently large (usually between 150 and 300 mm).
- (2) If no water drip profile (e.g. Z profile) is installed as lower termination of the cladding, the cladding elements must extend beyond the lower edge of the substructure. If water drip profiles are used, their direct contact with cladding elements must be avoided.
- (3) Free aeration and ventilation openings (at least 50 cm<sup>2</sup>/m wall length; Switzerland: at least 100 cm<sup>2</sup>/m) are required to ensure rear ventilation. Decreases in cross section due to, for instance, ventilation grilles for keeping out small animals, must be considered. Supply and exhaust air openings with a gap width larger than 10 mm (Germany: larger than 20 mm) must be covered with ventilation grilles; hole sizes of 5 to 8 mm in diameter are recommended. Aeration and ventilation must be constructed such that functionality is guaranteed.
- (4) At the lower termination, overlapping cladding elements must be underlaid to achieve the same inclination as for the surrounding cladding elements.
- (5) The plinth must be constructed such that the RVRF is not damaged by splashing water/road spray or prolonged exposure to moisture due to snow.

### 6.3 Outer and inner corners

- (1) The corners of buildings can be constructed with a projection, mitre joints or suitable profiles.

### 6.4 Lateral termination

- (1) Lateral terminations are needed when a wall cladding does not extend past the outer or inner corner of a building.
- (2) Lateral terminations can be done similar to outer corners, using suitable profiles or cladding elements. The profiles and cladding elements must be attached separately.

### 6.5 Upper termination (e.g. edge of roof, gable slope, cornice)

- (1) Another structural element may overhang the upper termination of an RVRF, or it may terminate with a cover. The formation of a drip edge must be accommodated in the design.

- (2) In the case of overhanging structural elements (e.g. cornice, overhanging roof), no additional measures are necessary at the upper termination of the cladding.
- (3) If there are no overhanging structural elements, the rear-ventilation zone and the cladding must be covered. Metal profiles (e.g. wall copings or windowsills) and formwork (e.g. verge tiles or angled plates) can be used for this purpose.
- (4) Depending on the type of cladding, additional terminating profiles may be necessary.
- (5) Installation of the wall cladding, including the substructure, at upper terminations must take the ventilation openings into consideration. The distance between the upper edge of the cladding and the overhanging structural element must be sufficiently large.
- (6) The installation of ventilation grilles or the like is recommended (analogously to the case of lower terminations). These must not reduce the minimum ventilation cross section.

## 6.6 Abutments and junctions

### 6.6.1 General

- (1) RVRFs can be attached to
  - openings (e.g. windows, doors)
  - penetrations (e.g. pipe sockets, ventilation pipes)
  - components (e.g. anchoring elements for scaffolding, canopies, advertisement boards)

Additional substructure elements may be necessary in the abutment and junction areas.

- (2) A distinction is made between
  - upper,
  - lower and
  - lateral

abutments and junctions.

- (3) The ventilation openings must be taken into consideration when installing the wall cladding, including the substructure, in the abutment and junction areas. The installation of ventilation grilles or the like is recommended.
- (4) Components must be anchored to the supporting wall and penetrate the cladding. Corresponding connections must be realised depending on the size of the penetration.

### 6.6.2 Lower abutments/connections

- (1) Lower connections are to be realised in the same way as upper terminations (see Section 6.5).

### 6.6.3 Lateral abutments and junctions

- (1) Lateral abutments and junctions can be constructed with a projection, mitre joints or suitable profiles.
- (2) In this context, lateral connections at window reveals are to be realised in the same way as outer corners (see Section 6.3) or lateral terminations (see Section 6.4) and, in the case of penetrations, in the same way as inner corners (see Section 6.3).

#### 6.6.4 Upper connections

- (1) Upper connections are to be realised in the same way as lower terminations (see Section 6.2).
- (2) Metal connecting sheets or the like may be necessary in the case of penetrations. These must either be designed as part of the penetration or attached separately.

## 7 Service and maintenance

Like buildings and their elements, RVRFs must be inspected at specific intervals.

- (1) It is recommended that clients sign a maintenance agreement with a specialised company. Care and maintenance measures are necessary to allow timely detection of any changes, damage or consequential damage to the RVRF.
- (2) The sooner any damage is detected, the lower the costs for repairs and maintenance and the effort for eliminating consequential damage.
- (3) The following measures are particularly important:
  - visual inspection of the exhaust air and air supply openings (removal of dirt, encrustation, etc. to clear the openings)
  - visual inspection of the fastening/fixing elements (refastening or replacement if necessary)

## 8 Annex A- Schematic diagrams

The following diagrams show details of the RVRF and are examples of possible realizations.

They are not to scale, and their purpose is to illustrate the individual methods and textual descriptions.

### Figure Index

Fig. 5 Vertical cross section

Fig. 6 Horizontal cross section

Fig. 7 Lower termination

Fig. 8 Outer/inner corner with backing profile

Fig. 9 Outer/inner corner with visible profile

Fig. 10 Lateral termination

Fig. 11 Upper termination

Fig. 12 Lower/upper connection

Fig. 13 Lateral connection (e.g. window reveal) with backing profile

Fig. 14 Lateral connection (e.g. window reveal) with visible profile

Figure 5 – Vertical cross section

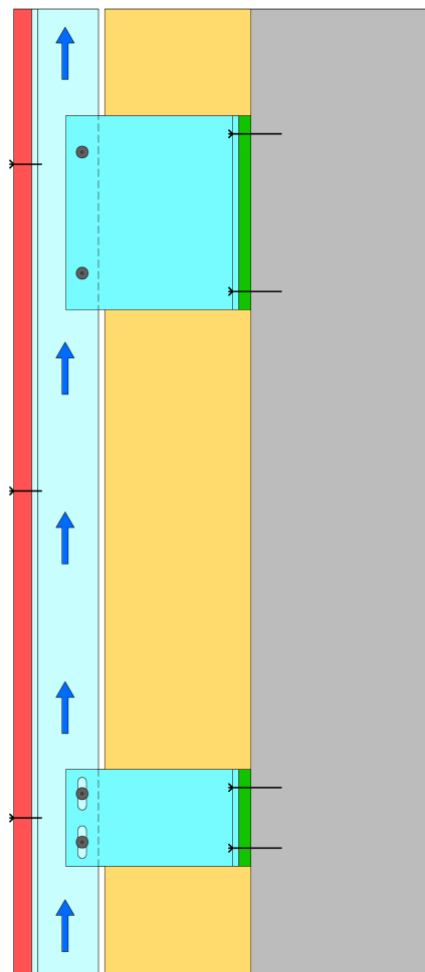


Figure 6 – Horizontal cross section

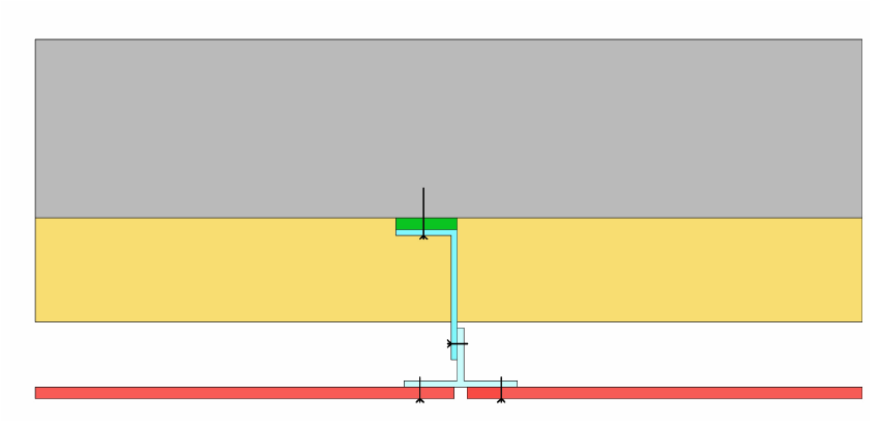


Figure 7 – Lower termination

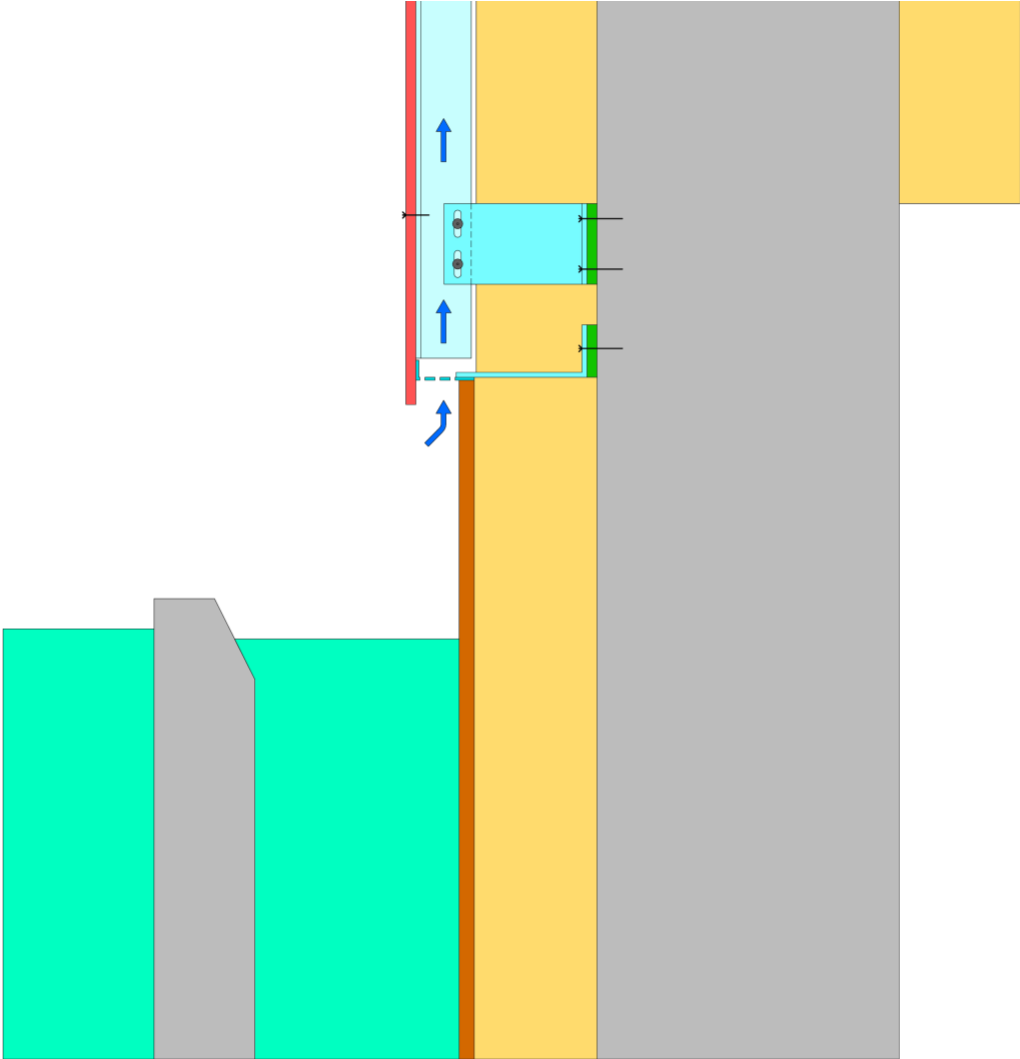


Figure 8 – Outer/inner corner with backing profile

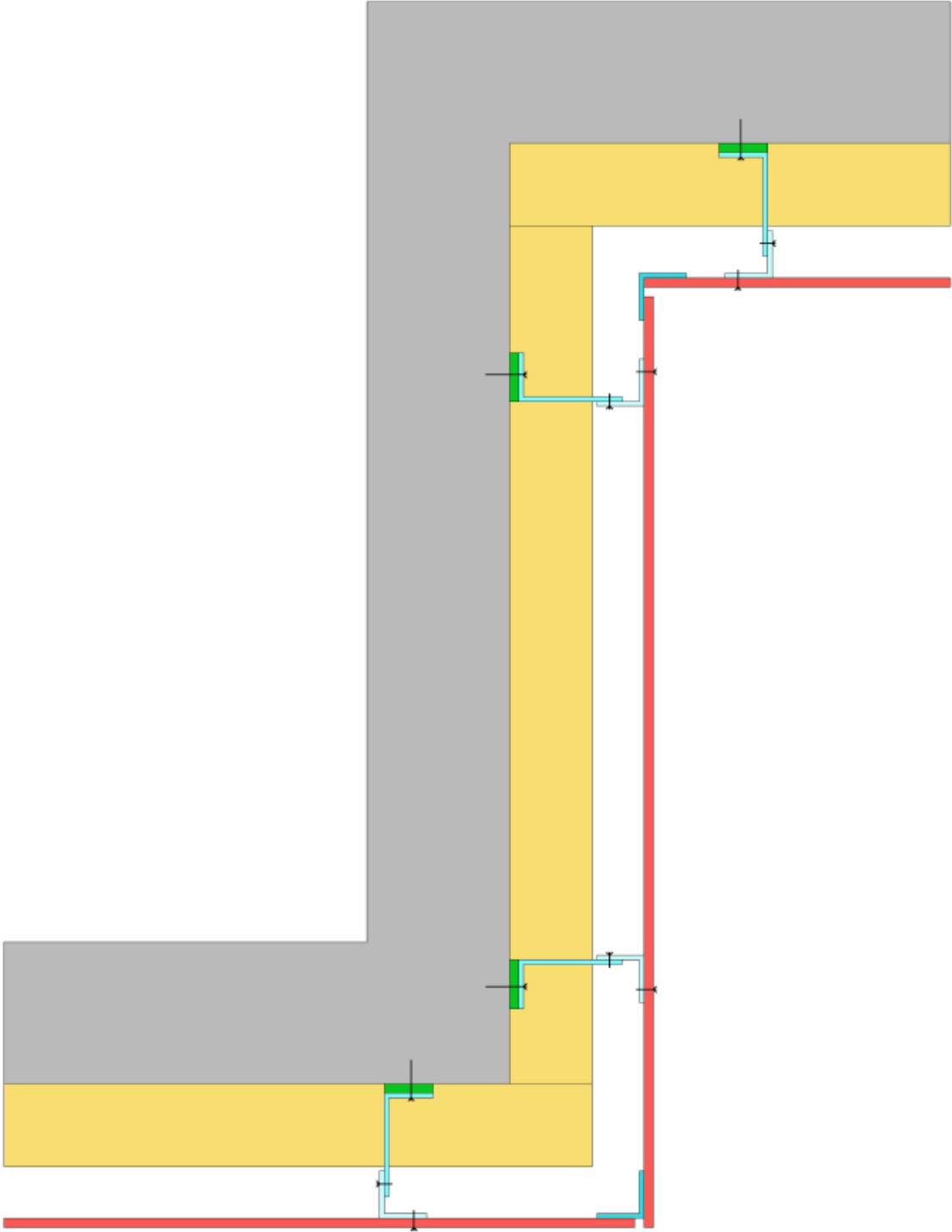


Figure 9 – Outer/inner corner with visible profile

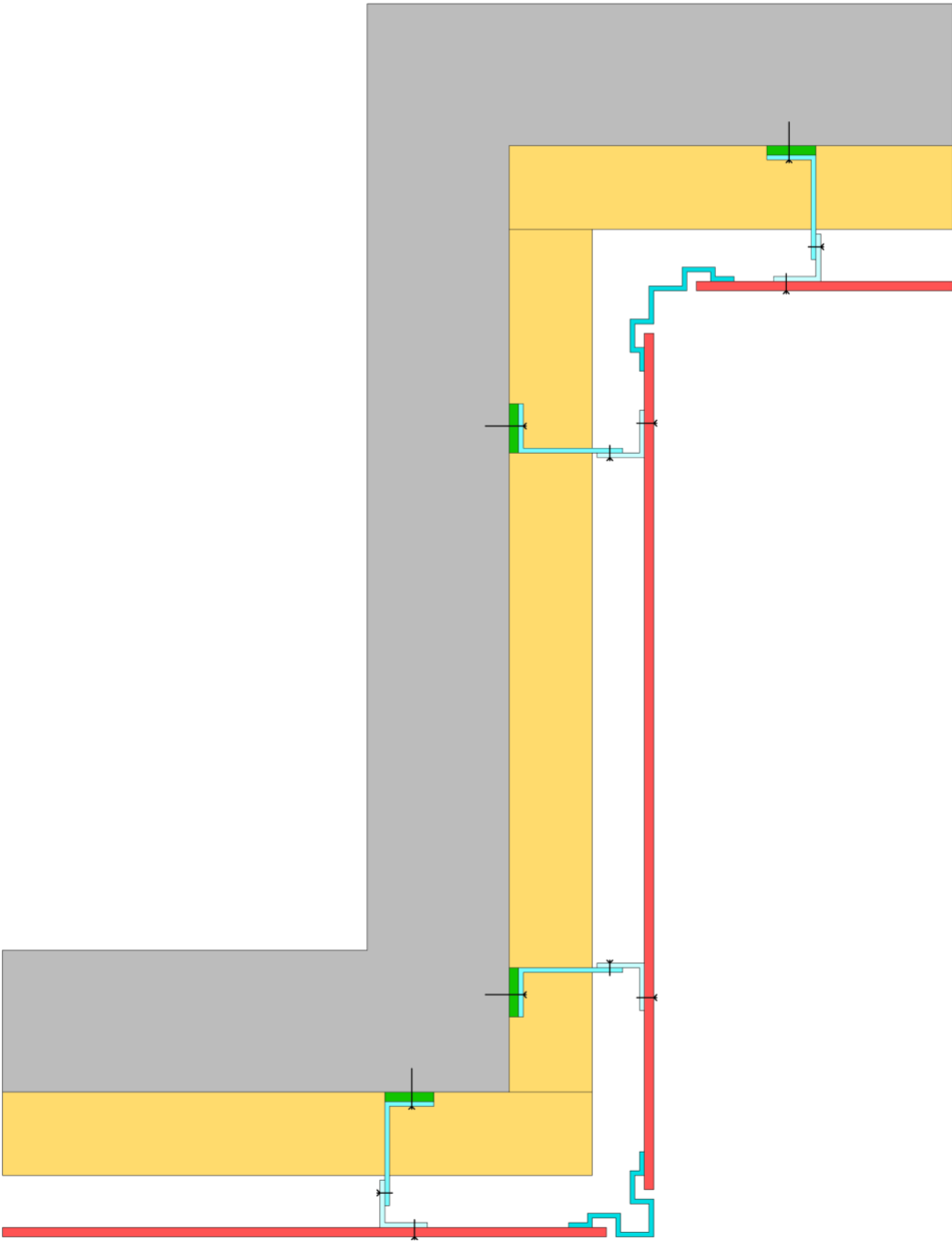


Figure 10 – Lateral termination

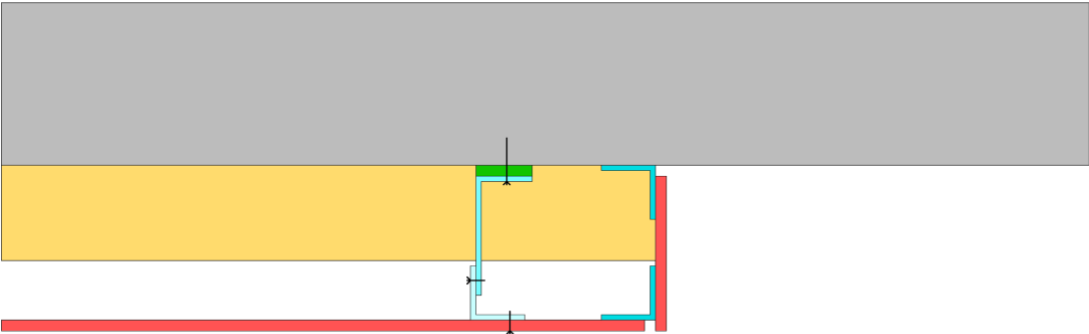


Figure 11 – Upper termination

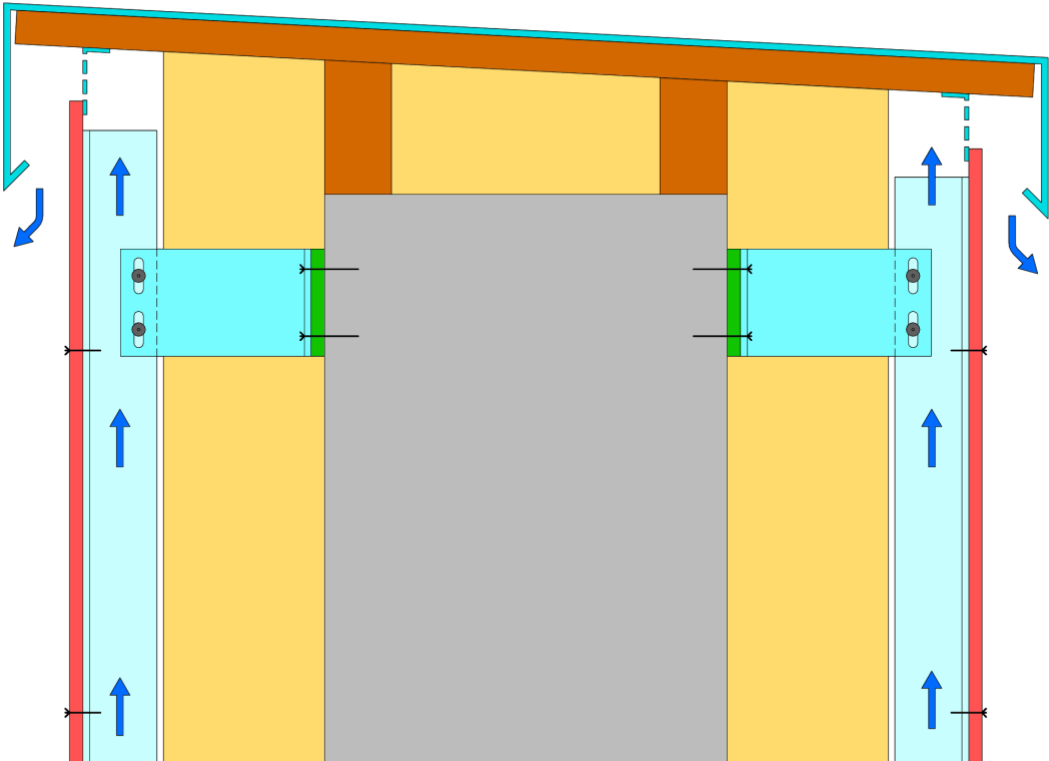




Figure 12 – Lower/upper connection

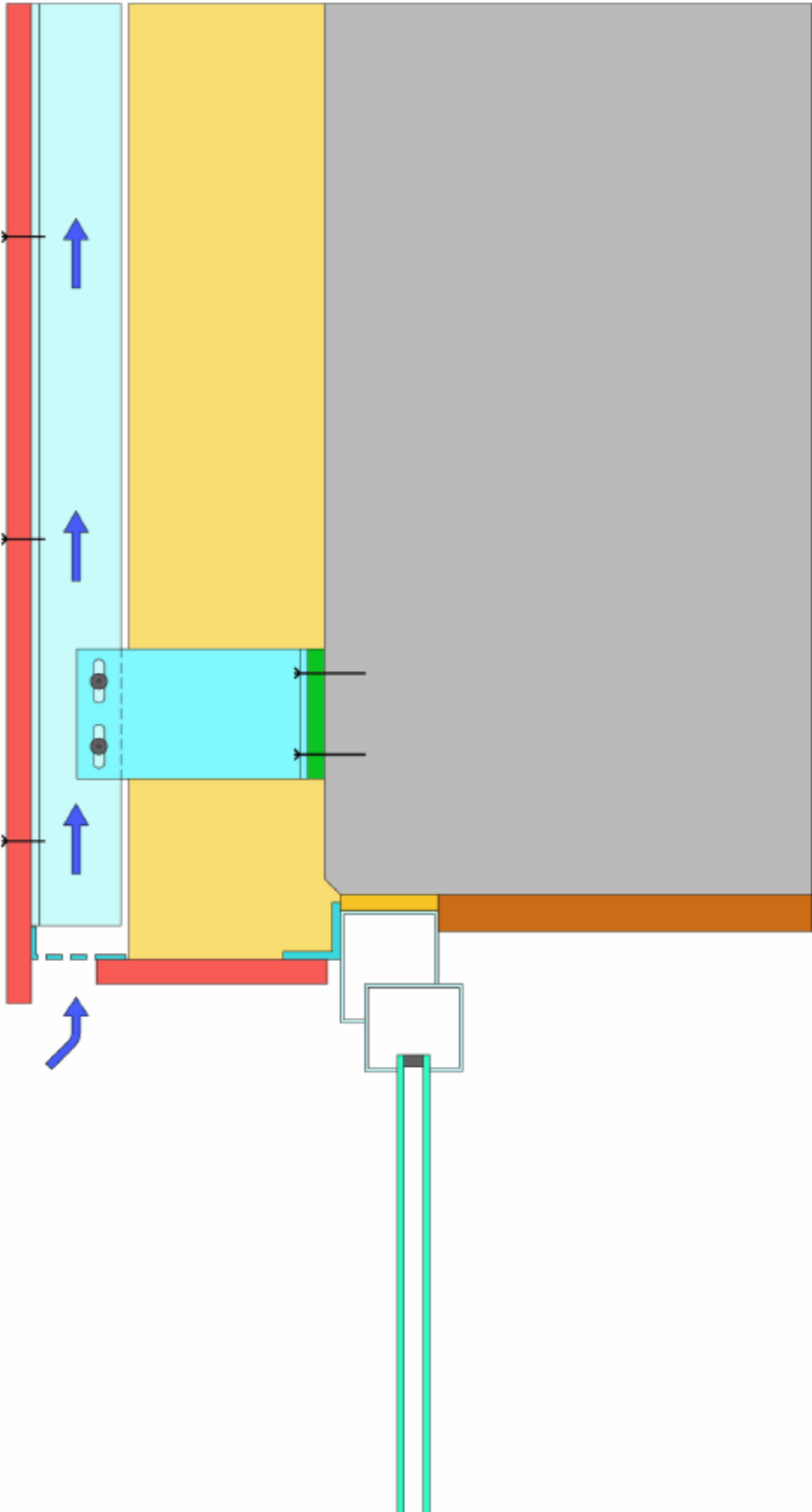


Figure. 13 – Lateral connection (e.g. window reveal) with backing profile

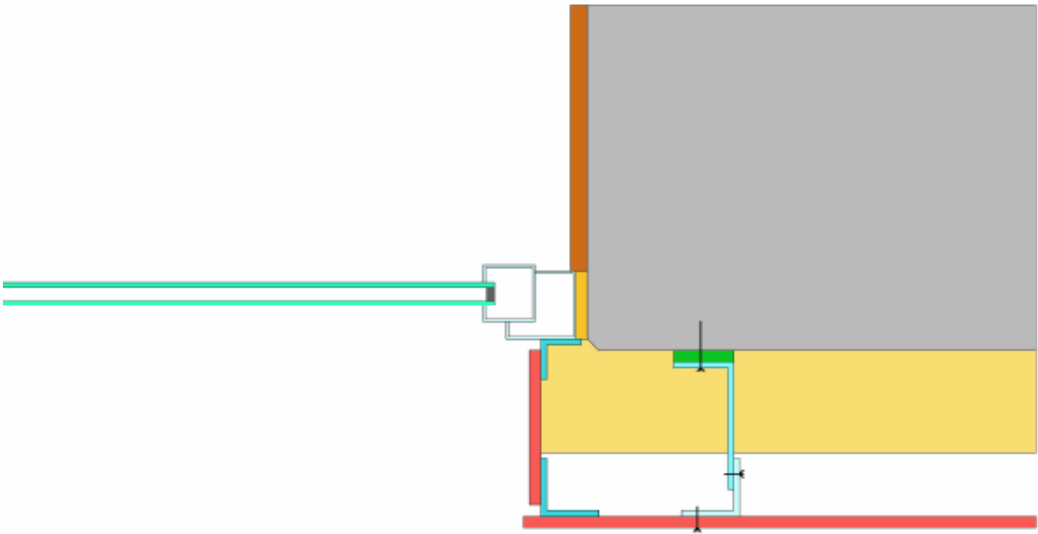
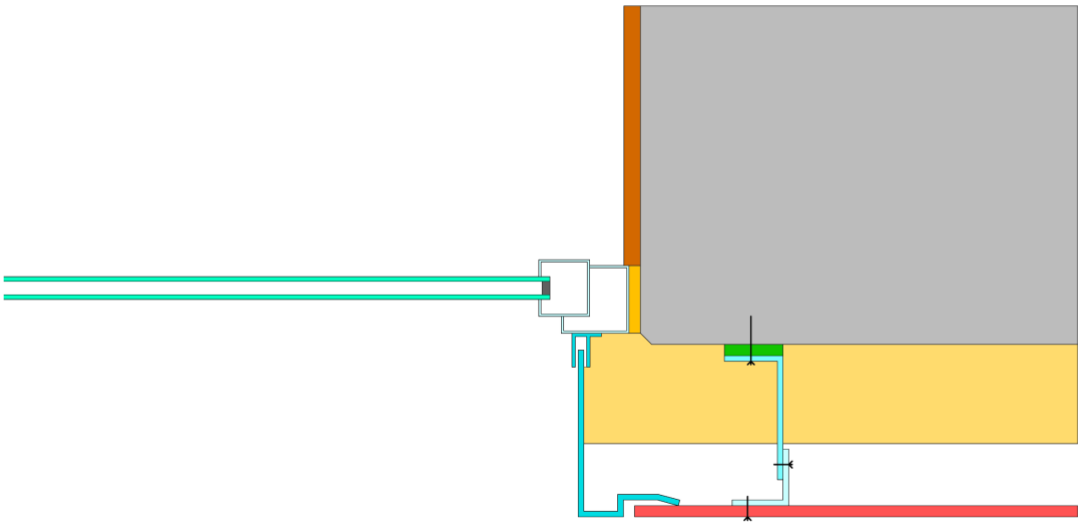


Figure. 14 – Lateral connection (e.g. window reveal) with visible profile



## 9 Annex B Literature

### General Guidelines

Ref. No., Short Title	Title
Europäisches Parlament und der Rat der Europäischen Union	EU-Bauproduktenverordnung
EN 1991-1-3	Eurocode 1 - Einwirkungen auf Tragwerke - Teil 1-3: Allgemeine Einwirkungen, Schneelasten
EN 1991-1-4	Eurocode 1: Einwirkungen auf Tragwerke - Teil 1-4: Allgemeine Einwirkungen - Windlasten
EN 1999-1-1	Eurocode 9: Bemessung und Konstruktion von Aluminiumtragwerken - Teil 1-1: Allgemeine Bemessungsregeln
EN 1993-1-1	Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau
EN 1993-1-4	Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-4: Allgemeine Bemessungsregeln - Ergänzende Regeln zur Anwendung von nichtrostenden Stählen
EN 1995-1-1	Eurocode 5: Bemessung und Konstruktion von Holzbauten - Teil 1-1: Allgemeines - Allgemeine Regeln und Regeln für den Hochbau
EN 62305-3	Blitzschutz - Teil 3: Schutz von baulichen Anlagen und Personen (IEC 62305-3:2010, modifiziert);
IFD	Richtlinien für die Luftdichtheit und IFD Empfehlung für die Winddichtheit von Dach und Wand
	Richtlinien für die Energieeffizienz von Dach und Wand
	Richtlinien zur Optimierung von Wärmebrücken an Dach und Wand

## Austria

Ref. No., Short Title	Title
ÖNORM B 2219:2011-04-15	Dachdeckerarbeiten, Werkvertragsnorm*
ÖNORM B 3419: 2011-04-15	Planung und Ausführung von Dacheindeckungen und Wandverkleidungen*
ÖNORM B 3521: 2012	Planung und Ausführung von Dacheindeckungen und Wandverkleidungen aus Metall, Teil 1: Bauspenglerarbeiten — handwerklich gefertigt
Bundesinnung der Dachdecker, Glaser und Spengler	Fachregeln für Bauspenglerarbeiten
ÖFHF	Planung und Ausführung von Vorgehängten Hinterlüfteten Fassaden
ÖFHF	Brandschutz bei Hinterlüfteten Fassaden
ÖFHF	Merkblatt Klebetechnik
ÖFHF	Merkblatt für VHF auf Holzunterkonstruktion
ÖNORM B 1999-1-1	Eurocode 9: Bemessung und Konstruktion von Aluminiumtragwerken - Teil 1-1: Allgemeine Bemessungsregeln - Nationale Festlegungen zu ÖNORM EN 1999-1-1, nationale Erläuterungen und nationale Ergänzungen
ÖNORM B 1995-1-1	Eurocode 5: Bemessung und Konstruktion von Holzbauten - Teil 1-1: Allgemeines - Allgemeine Regeln und Regeln für den Hochbau - Nationale Festlegungen zur Umsetzung der ÖNORM EN 1995-1-1, nationale Erläuterungen und nationale Ergänzungen
ÖNORM B 1991-1-4	Eurocode 1: Einwirkungen auf Tragwerke - Teil 1-4: Allgemeine Einwirkungen - Windlasten - Nationale Festlegungen zu ÖNORM EN 1991-1-4 und nationale Ergänzungen
ÖNORM B 1991-1-3	Eurocode 5: Bemessung und Konstruktion von Holzbauten - Teil 1-1: Allgemeines - Allgemeine Regeln und Regeln für den Hochbau - Nationale Festlegungen zur Umsetzung der ÖNORM EN 1995-1-1, nationale Erläuterungen und nationale Ergänzungen

The technical service documents of the industry/matrix (Eternit) apply in Austria if no normative regulations have been issued.

## Switzerland

Ref. No., Short Title	Title
Norm SIA 232/2	Norm SIA 232 / 2 Hinterlüftete Bekleidungen von Aussenwänden
Wegleitung zur Norm SIA 232/2 Gebäudehülle Schweiz	Wegleitung zur Norm SIA 232/2 Hinterlüftete Bekleidung von Aussenwänden
SIA 261	Einwirkung auf Tragwerke
SIA 180	Wärmeschutz, Feuchteschutz und Raumklima in Gebäuden
SIA 181	Schallschutz im Hochbau
Ventilator SFHF	Diverse Ventilatoren
Merkblätter Gebäudehülle	Merkblätter der Gebäudehülle Schweiz

## Netherlands

Ref. No., Short Title	Title
NEN 6702	Technical rules for maximum load of building constructions and pressure distribution in constructions
NEN 2778	Waterproofing for buildings, determination methods
NPR 2652	Practical guide for methods of waterproofing for buildings
NEN 2686	Airtightness of buildings, determination methods
NEN 7120	Energy performance of buildings (EPC norm), determination methods
BRL 4708	National guidelines for waterproofness or water resistance of membranes for sloping roofs and facades
NEN 5128	Energy performance of residential buildings
	Directive of the European Parliament and of the Council on the energy performance of buildings

## Germany

Ref. No., Short Title	Title
Baurechtliche Vorgaben des Bundes und der Länder	Bauordnung des jeweiligen Bundeslandes
	Energieeinsparverordnung
	Energieeinspargesetz
	Technische Baubestimmungen des jeweiligen Bundeslandes
	Muster Verwaltungsvorschrift Technische Baubestimmungen
DIN 18008	Glas im Bauwesen - Bemessungs- und Konstruktionsregeln Teil 1-3
DIN 18202	Toleranzen im Hochbau
DIN 18299	VOB C ATV Allgemeine Regelungen für Bauarbeiten jeder Art
DIN 18351	VOB - Teil C – ATV Vorgehängte Hinterlüftete Fassaden
DIN 18516-1	Außenwandbekleidungen, hinterlüftet – Teil 1: Anforderungen, Prüfgrundsätze
DIN 18516-3	Außenwandbekleidungen, hinterlüftet – Naturwerkstein, Anforderungen, Bemessung
DIN 18516-5	Außenwandbekleidungen, hinterlüftet – Betonwerkstein Anforderungen, Bemessung
DIN 4102-1	Brandverhalten von Baustoffen und Bauteilen
DIN 4102-2	Brandverhalten von Baustoffen und Bauteilen
DIN 4102-20	Brandverhalten – Besonderer Nachweis für das Brandverhalten von Außenwandbekleidungen
DIN 4108-2	Mindestanforderungen an den Wärmeschutz
DIN 4108-3	Klimabedingter Feuchteschutz
DIN 4108-7	Luftdichtheit von Gebäuden
DIN 68800	Holzschutz Teil 1-3
DIN EN 13162	Wärmedämmstoffe für Gebäude – werkmäßig hergestellte Produkte aus MW
DIN EN 13501-1	Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten

Ref. No., Short Title	Title
DIN EN 1991-1-3/NA	EC 1 – Einwirkungen auf Tragwerke – Teil 3 Schneelasten / NA
DIN EN 1991-1-4/NA	EC 1 – Einwirkungen auf Tragwerke – Teil 4 Windlasten / NA
DIN EN 1993-1-1/NA	EC 3 – Bemessung und Konstruktion von Stahlbauwerken
DIN EN 1995-1-1/NA	EC 5 – Entwurf, Berechnung und Bemessung von Holzbauwerken /NA
DIN EN 1999-1-1/NA	EC 9 – Aluminiumkonstruktionen unter vorwiegend ruhender Belastung / NA
FVHF	Richtlinie: Bestimmung der wärmetechnischen Einflüsse von Wärmebrücken bei Vorgehängten Hinterlüfteten Fassaden
	Leitlinie: Brandschutztechnische Vorkehrungen für Vorgehängte Hinterlüftete Fassaden
	Leitlinie Planung und Ausführung von Vorgehängten Hinterlüfteten Fassaden
Regelwerk des Dachdeckerhandwerks	Grundregel für Dachdeckungen, Abdichtungen und Außenwandbekleidungen
	Hinweise für Hinterlüftete Außenwandbekleidungen
	Fachregel für Außenwandbekleidungen mit Schiefer
	Fachregel für Außenwandbekleidungen mit ebenen Faserzement-Platten
	Fachregel für Außenwandbekleidungen mit Faserzement-Wellplatten
	Regel für Außenwandbekleidungen mit Holzschindeln
Klempnerfachregeln	Richtlinien für die Ausführung von Klempnerarbeiten an Dach und Fassade
Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e. V.	Empfehlungen für Planung, Bau und Instandhaltung der Übergangsbereiche von Freiflächen zu Gebäuden