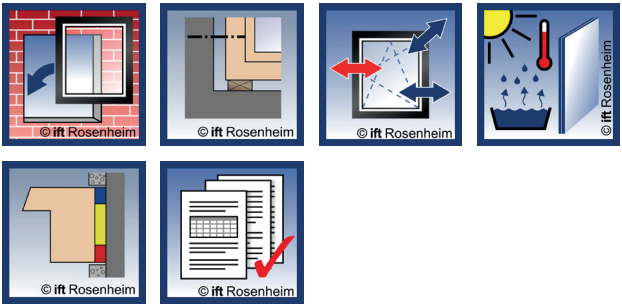
GUIDELINE Installation of windows and external doors
Version: October 2016

Guideline for installation of windows and external doors

Design and construction of installation of windows and external doors for new buildings and renovations



Compiled by
ift Rosenheim
RAL Quality Assurance Association windows, facades and doors e.V.

Content – Installation Guideline

Content chapter 2

2 General Requirements

2.1 Introduction

Windows and exterior doors are multifunctional building components that have several properties depending on the needs of the real estate property. The European product standard EN 14351-1 (Figure 2.1) provides an overview of the range of performance of windows and exterior doors, in which even the different climatic conditions in Europe can also be taken into account. The technically proper installation and the integration in the building shell are important influencing factors for the functionality and durability.

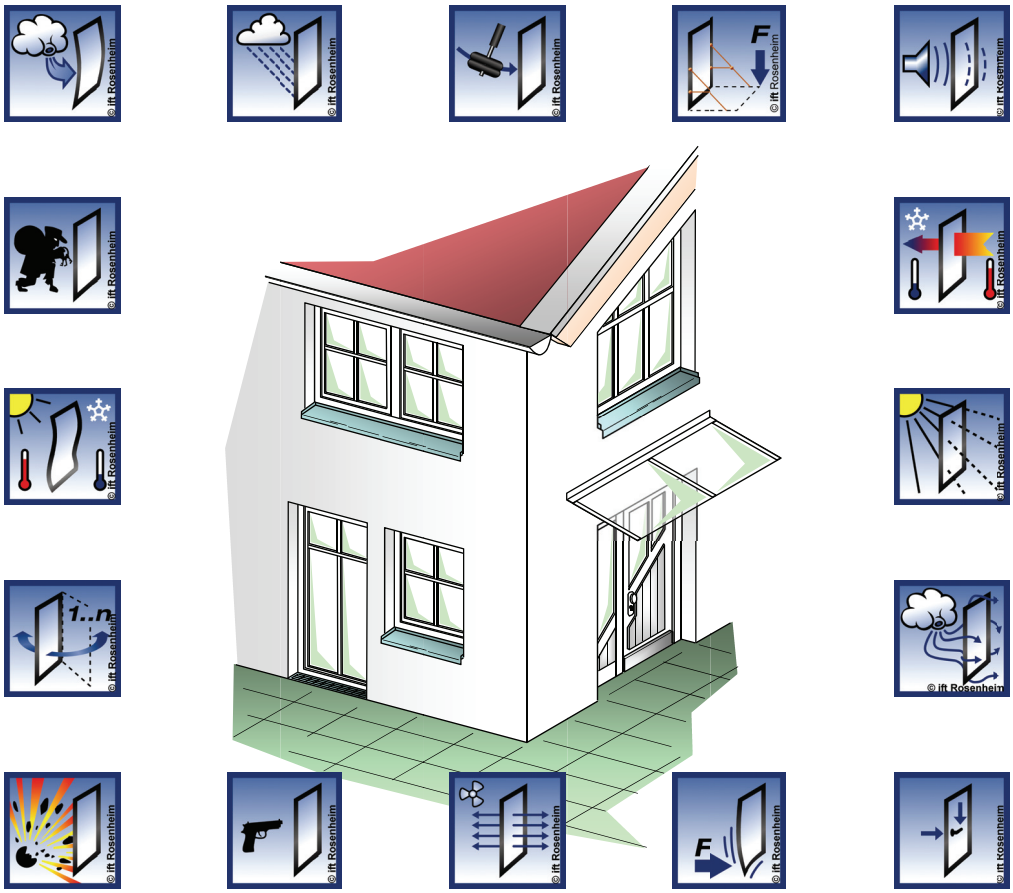


Figure 2.1 Windows and exterior doors as multifunctional building components, selected properties in accordance with Product Standard EN 14351-1

Acting successfully and with a sense of responsibility presumes that the following principles are observed and followed:

- Professional design and planning, and framing the tender for installation
- Compliance with and ensuring the agreed finish in line with the contract
- Professional technical implementation in line with the requirements
- Maintaining the costs by optimised use of material and labour

Based on climate change and rising costs of energy, there are statutory specifications in almost all countries in the world for conserving energy that have to be taken into account and maintained by manufacturers and assemblers.

In the German Energy Saving Regulation (EnEV), Article 26, paragraph 2 states as follows:
"As far as complying with the regulations of this Ordinance is concerned, depending on their respective sphere of activity" (apart from the building owners) "the onus lies even with those persons who are involved on behalf of the building owners in the construction or modification of buildings or the equipment and facilities in buildings."

With respect to energy conservation during the installation of windows and exterior doors is concerned, Chapter 8 of this manual provides a complete range of installation examples for new constructions as well as replacement of windows in existing buildings, including the thermal verifications. These are essentially non-binding and non-obligatory examples of design and execution; in other words, it is possible to have even another detailed configuration, e.g. with respect to the fixture or sealing. The requirements for mounting building components viz. windows and exterior doors are not material-specific but function-oriented.

2.2 Effects on windows and exterior doors in the external wall

In order to be able to determine the requirements, it is necessary to know about the potential effects on the window as an external building component to begin with. These effects are illustrated schematically in Figure 2.2 and they are listed in Table 2.1 with the various stresses and relevant regulations.

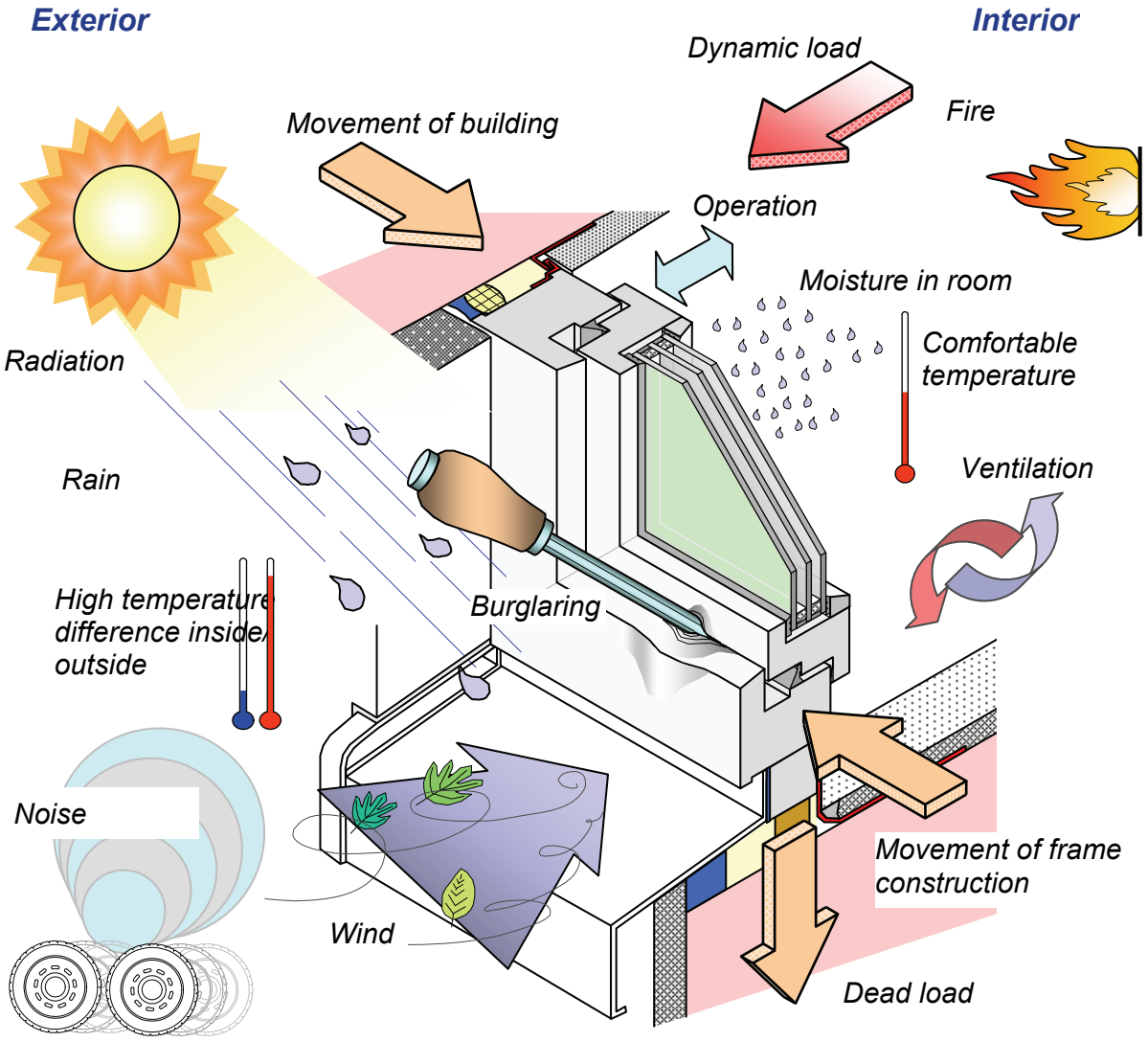


Figure 2.2 Schematic illustration of effects on windows and their joints

Table 2.1 Overview of the effects and impact on the installation of construction elements with important German and European rules and regulations

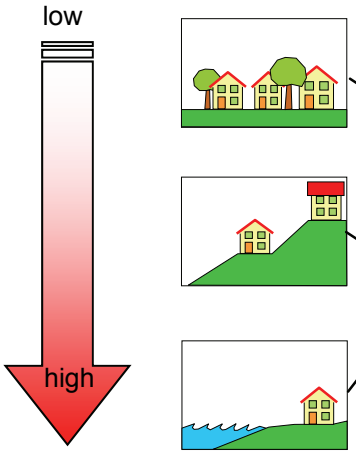
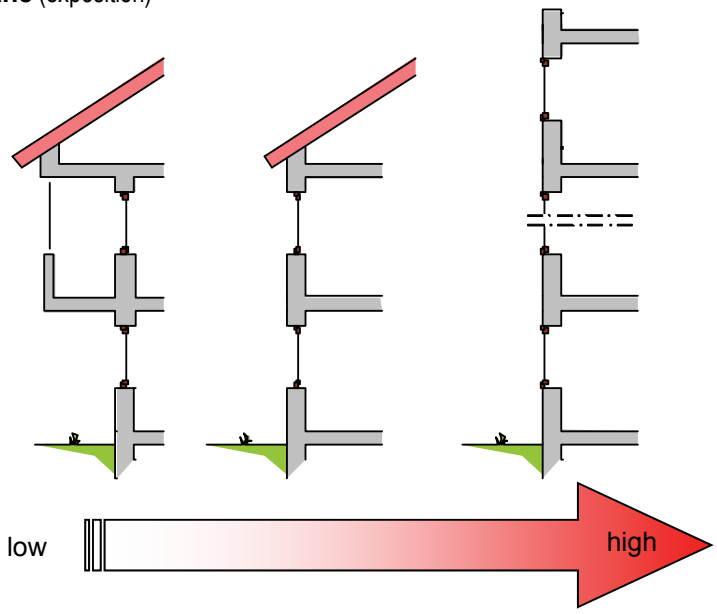
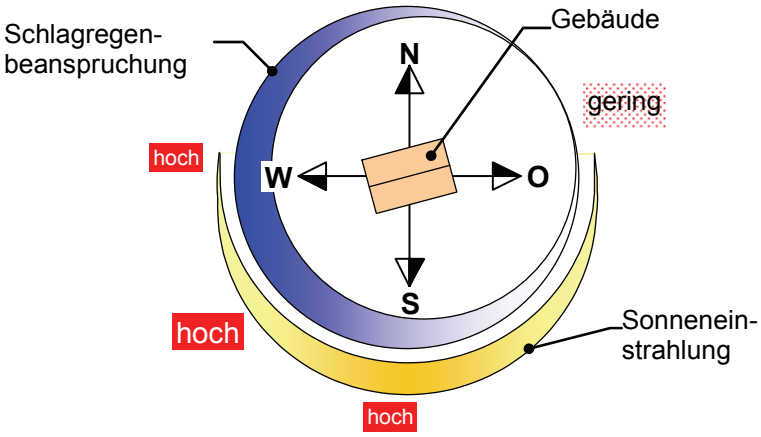
Effects / Requirements		Rules and Regulations Windows, External Doors
– from the outside	rain, wind	EN 12207 EN 12208 EN 12210 DIN 18055 Eurocode 1
	Changes of temperature /dampness solar radiation sound (external noise)	EN 13420 EN 12219 DIN 4109
	possibly mechanical attacks during a burglary; possibly aggressive environmental impacts	EN 1627
– from the interior side	room air temperature, room atmospheric humidity	DIN 4108
– from the structure	structural movements, tolerances	DIN 18202 DIN 18203, Parts 1 to 3
– from the component	changes in length, deformations forces from self-weight	DIN 1055 Eurocode 1
– from use	forces from use	EN 13115
	impact loads	EN 13049
	freedom from barriers	DIN 18040, Part 1 and 2
	safety barrier	TRAV, DIN 18008-4, ETA regulation "Components that offer protection from falling from a height"

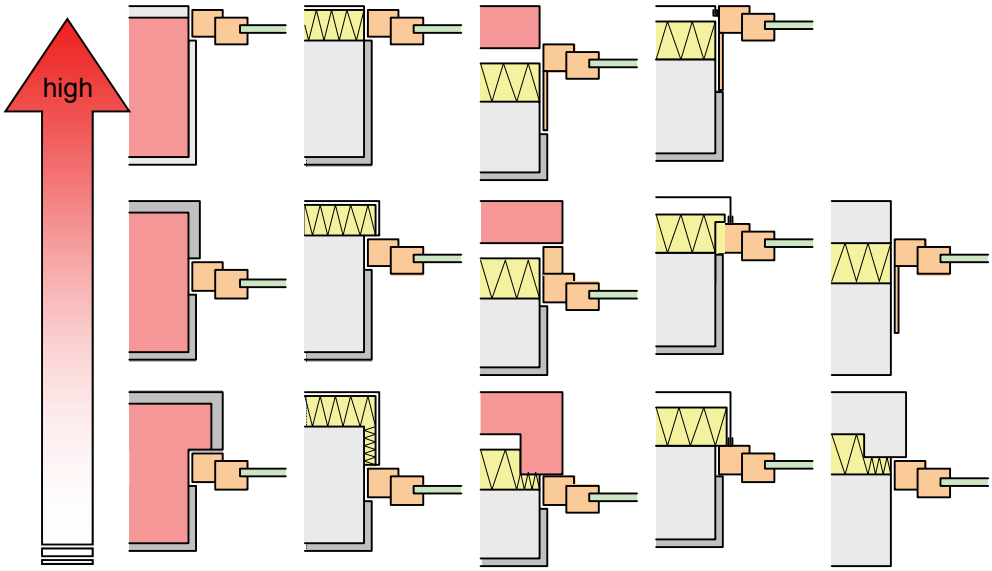
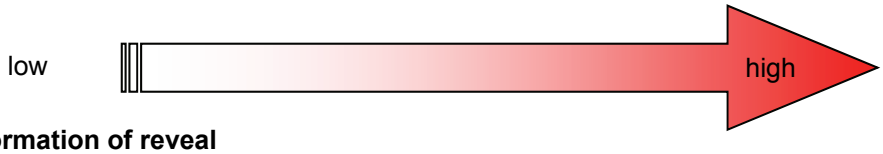
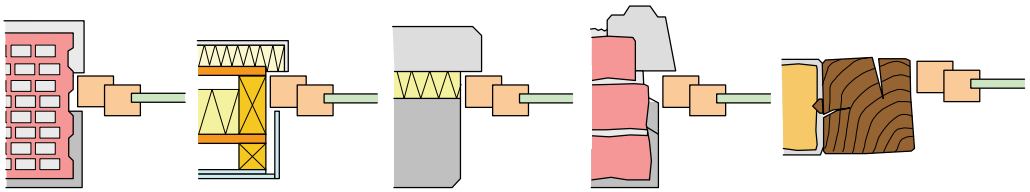
The architect or designer has the job of implementing the requirements based on the property-specific characteristics in sufficiently detailed design specifications (spectrum of work, regulation details), so that an unambiguous requirements profile is obtained both for the window/exterior door construction and for mounting of building components.

Tipp Useful aids for planning and design are available at www.ift-service.de.

The following Table 2.2 gives an overview of the stresses or the tendential impact, respectively, on the required scope and effort of installing windows from the building location, utilisation, window construction and planned wall connection.

Table 2.2 Building-specific characteristics and the expected stress/impact on the mounting of building component

Characteristic	Stress / Tendential Impact
1 Building Location	**Wind load – Terrain Category** 
2 Installation Situation	**Installation plane** (exposition)  **Orientation**  (Specifications are valid only for the Northern hemisphere and must be reversed for the Southern hemisphere)

Characteristic	Stress / Tendential Impact
5 Formation of Joint	**Construction of the exterior wall** – Location of the reveal   **Formation of reveal**  

All requirements mentioned so far and movements from the frame construction and from the construction work must be incorporated and accommodated in the installation gap/seals.

The integration of windows and exterior doors in the building shell must be planned in order to avoid damage to the connection area.

This is why professional design of the installation gap, i.°e. construction, joint geometry, fixing, insulation and sealing, assumes great significance. The fitness for use of the building elements assumes a proper wall connection meeting the complete requirements profile apart from a construction meeting the requirements.

2.3 Plane model and principles of a wall connection

The plane model illustrated in the following is appropriate for better understanding about which basic construction needs to be considered with respect to the building component (window, exterior door, skylight window etc.) – joint – wall.

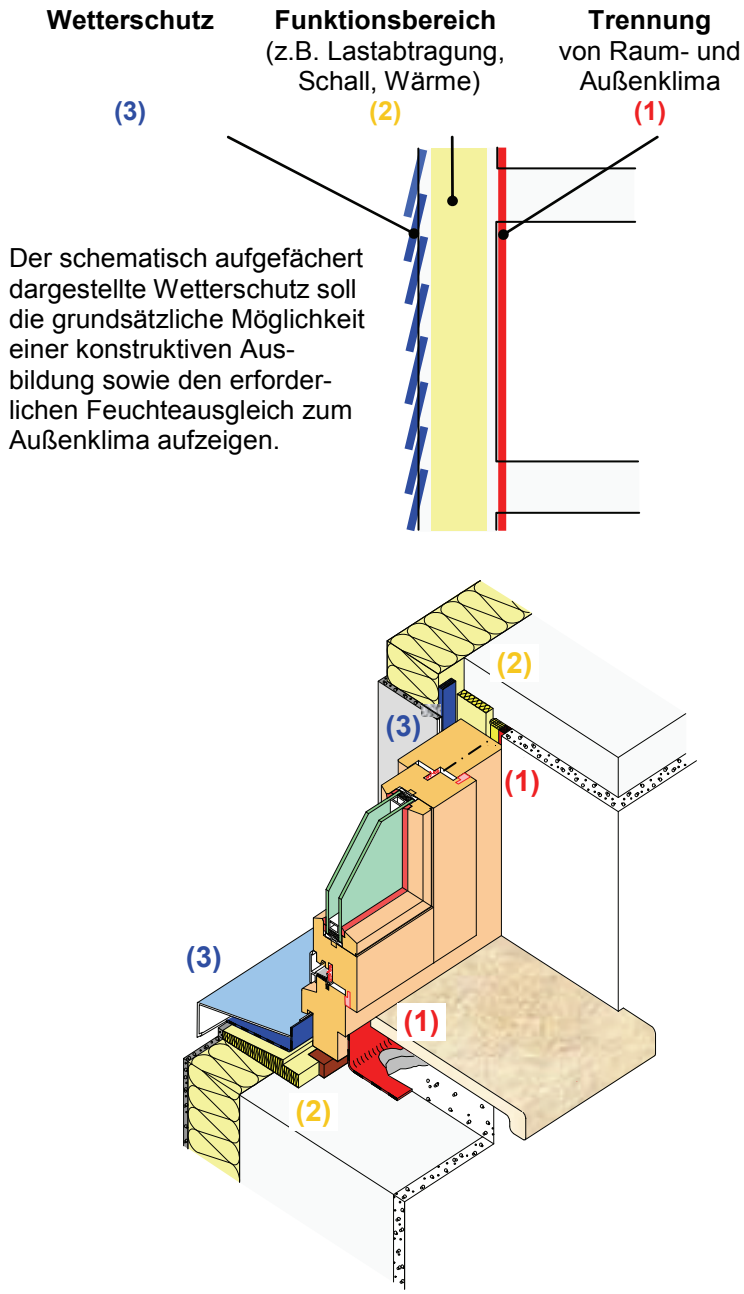


Figure 2.3 The plane model and transfer to the installation gap (applicable only conditionally to tropical/sub-tropical climatic zones.

The fundamental, physical construction-related requirements are met in two separate functional levels, whereas the functions in the area in between are summarised and converted to technical characteristics. These individual levels and the area must be specified unambiguously in the construction and they must be practically executable.

If the functions of various levels are consolidated in one product (e.g. multi-function sealing tapes), the characteristics must be verified completely by the manufacturer of the product.

Plane (1) Separation of room and outdoor climate (Air tightness plane)

Non-specified air flows are prevented with the air tightness plane. With this, the occurrence of draught, ventilation heat losses, dew formation in the structure and in the connection as well as water transport phenomena is minimised. These must lie in one plane whose temperature lies above the critical temperature (80°% humidity criterion) of the room climate for the growth of moulds. The plane must be identifiable across the entire surface of the exterior wall and should not be interrupted.

Assuming, for example, a standardised room climate of 20 °C, 50 % relative humidity and an outdoor temperature of -5 °C in Germany, the separation in the connection area must be above 12.6 °C. Thus, under the assumed conditions, dew is avoided on the room-side surface and the risk of mould formation is minimised. The assessment of the risk of dew and mould formation can be done based on examples of planning and design, on thermal bridge catalogues or calculation of the isotherm curve.

Area (2) Functional area

All forces occurring via the fixing must be dissipated safely in the supporting structure in this area. Moreover, the properties of thermal insulation and sound reduction are ensured over an economically reasonable period of time in this area. In closed systems such as e.g. insulating glass units, sandwich panels, the rebate area, and in open systems such as e.g. coupled windows and cold facades, the entire system must be connected via the protection against bad weather with the outdoor climate.

In general terms, this means that the functional area must "remain dry" and be isolated from the room climate.

Plane (3) Protection against bad weather

The plane of protection against bad weather prevents the ingress of rain water (driving rain) from outside to the maximum extent. Rainwater that has penetrated inside must be controlled and discharged outside directly. At the same time, the moisture from the functional area must be able to escape outside.

This yields the diversification of the plane of protection against bad weather, the proven basic elements that have been modelled, e.g. on a roof covering.

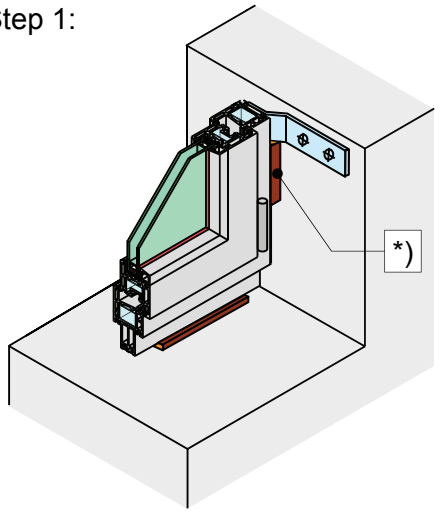
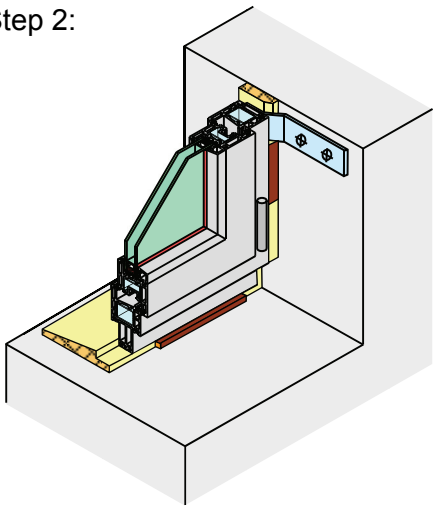
The model described is adapted to **Central European climatic conditions** (or comparable climate) and rooms with normal indoor climate. In cooled or air-conditioned rooms, the system must be checked with respect to the building.
The consideration and evaluation must involve the entire exterior wall. The model is **not applicable** to cooled rooms and **to buildings in tropical latitudes**.

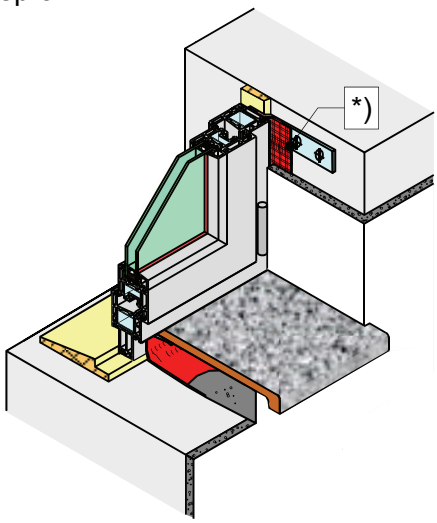
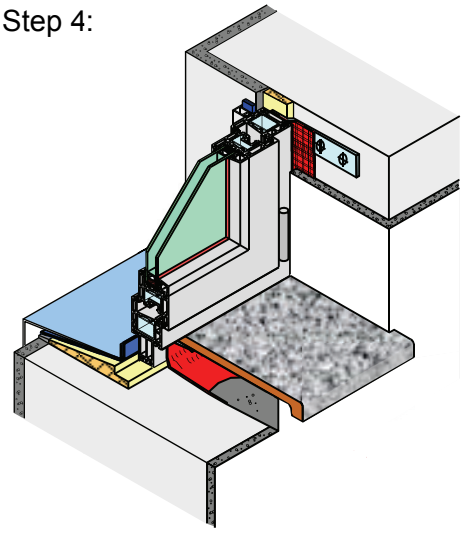
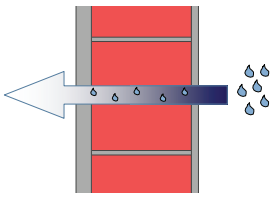
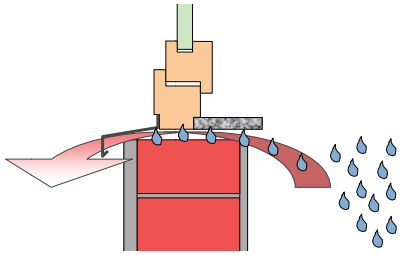
By meeting the physical construction-related requirements at the connection area, significant prerequisites are achieved,

– which enable the user to enjoy a comfortable and healthy room climate,
– to protect the building construction from damage caused by climate and
– to reduce energy consumption.

The generally applicable requirements listed in Table 2.3 need to be met to transfer the model to the installation of windows and exterior doors in the surrounding exterior wall. In general, the work steps illustrated for a sample window need to be executed provided that nothing to the contrary has been agreed upon. Thus, for example, based on the progress of the building-specific construction, it may make sense to assign the services of installation to another subsystem (cf. Section 3, Table 3.1).

Table 2.3 Transferring the plane model to the mounting of building components; general requirements and work steps necessary for window installation

General Requirements	**Work Steps** (examples)
- **Specific fixing and load transfer** In other words, with the help of suitable setting blocks adapted to the exterior wall system and the installation plane and mechanical fixing elements or brackets and, similar, with installation positions outside the load-bearing wall construction, generally all around and taking the principles described in section 5 into consideration for execution. *) If the load transfer at the window plane is also ensured via the mechanical means of fixing, e.g. for gap fixing, the requirement of setting blocks can be omitted.	Step 1: 
- ***Adequate thermal insulation of the installation gap*** In other words, complete filling up as far as possible of the remaining cavity between the window and the wall with suitable insulating material taking the requirements of the minimum thermal protection into consideration (for this purpose, refer to detailed information in Section 3, Table 3.1 and Section 4). For refurbishment in existing buildings, if necessary, additional, accompanying insulation measures are necessary in order to prevent the formation of dew and moulds on surfaces on the room side (refer to detailed information for this purpose in Section 4, Table 4.4).	Step 2: 

General Requirements	**Work Steps** (examples)
- **Circumferential air-tight joint closure** In other words, a sealing system capable of absorbing sufficient movement (joint sealing tapes/films, sealants, sealing films, directly or in combination with profiles or bars) must be used here (see Section 6). In doing so, the air-tight joint closure must generally be arranged on the room side. Apart from the physical construction-related requirements, this is also justified with the generally more favourable conditions regarding the design options (corners and crossovers), the lower stress (room climate) and the associated lower incidence of loss or damage. *) For non-plastered reveals, the wall anchors must be sealed/covered with tape completely.	Step 3: 
- **Driving rain-proof connection** This means that based on the installation situation (facade orientation, installation plane), if driving rain stresses are expected, the exterior connection must be formed in such a manner that no rainwater can penetrate into the structure uncontrollably. In the process, protection against bad weather is divided into wind barriers and rain barriers that can either be designed in one plane or separate from one another. In doing so, the rain barrier, depending on the stress, can be provided by constructional measures or by using sealing systems (refer to Section 6). The sealing on the room side can also take over the function of the wind barrier simultaneously.	Step 4: 
- **Avoiding impermissible moisture accumulation in the connection area** What is critical here is also the moisture-related behaviour of the adjacent construction materials. With "good-natured" masonry (e.g. brick) and multiple skin exterior wall construction with back ventilation, the risk of harmful moisture level as a consequence of water vapour diffusion (not to be confused with moisture entry as a consequence of air flow via leakages = water vapour convection) is generally low. If these properties are missing (e.g. concrete, no back ventilation), it must be ensured that in European (or similar) climate, the joint structure on the room side is designed to be more impervious to vapour diffusion and more permeable outside (refer to Sections 4 and 6).	water vapour diffusion  water vapour convection: 

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