



**Instytut Techniki Budowlanej**

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Instruction for installation sliding doors PVC company DRUTEX S.A.

N<sup>o</sup>: 02742/15/Z00NK

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**Instytut Techniki Budowlanej**

razem ku przyszłości

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**Work title:** Instruction for installation sliding doors PVC company DRUTEX S.A

**Registry number, field-service department:** 02742/15/Z00NK

**Principal:** DRUTEX Spółka Akcyjna,  
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**Start of the work:**

November 2015

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**Additional information:**

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**Attachment**

## 1. Formal basis

Order of DRUTEX Spółka Akcyjna, ul. Lęborska 31, 77-100 Bytów.

Order registration number at the Building Research Institute - 02742/15/Z00NK.

## 2. Reference documents

The following documents form the basis of the study:

- Construction Law Act. Art. 10(2)(1b) (Dz. U. no 111/97, item 726), [as amended].
- Technical conditions for the performance and commissioning of construction works. Part B: Finishing works, volume 6: Installation of windows and balcony doors 421/2011.
- Regulation of the Minister of Infrastructure of 12 April 2002 on the technical requirements to be met by buildings and their location [as amended].
- PN-EN 14351-1+A1:2010 "Windows and doors. Product standards, performance specifications. Part 1: External windows and doors without fire and/or smoke resistant properties."
- Installation manual titled: Leitfaden zur Montage. Der Einbau von Fenstern, Fassaden und Hausturen mit Qualitätskontrolle durch das RAL- Gütezeichen, RAL- Gutegemeinschaften Fenster und Hausturen, Frankfurt 2010 and 2014.
- Technical documentation.
- Technical conditions for the performance and commissioning of construction works. Part B: Finishing works, volume 6: Installation of windows and balcony doors 421/2011.

## 3. Subject, purpose and scope of the study

### 3.1. Subject and purpose of the study

Development of installation manual for sliding PVC doors intended for installation contractors, designers, consumers, construction inspection authorities.

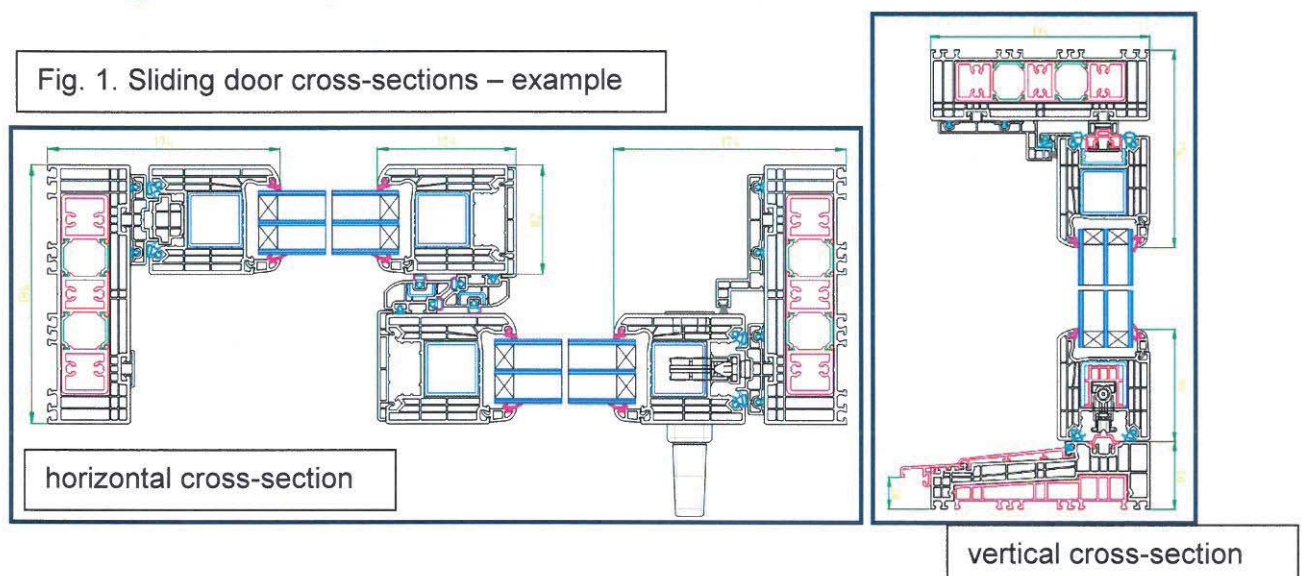
The manual contains schematic diagrams for the installation of sliding doors. Cross-sections of the frames of sliding doors are different, depending on the type of doors: sliding, tilt-and-slide, low-threshold.

### 3.2. Study preparation

- The study is an original document, protected in accordance with the Copyright and Related Rights Act of 4 February 1994.
- The authorisations related to the disposal of substantive copyrights are handed over to the Employer.

## 4. Instruction manual

### 1. Sliding door example – view and cross-sections (vertical and horizontal)



## 2. Door functions

The functions of sliding doors [and any other type of door/window joinery] is to provide thermal, acoustic, air and water insulation as well as safety of use for the building by the separation of the inside of the building from external weather conditions. Other properties should include: durability, reliability, aesthetics, possibility of communication, etc.

## 3. General principles of door installation

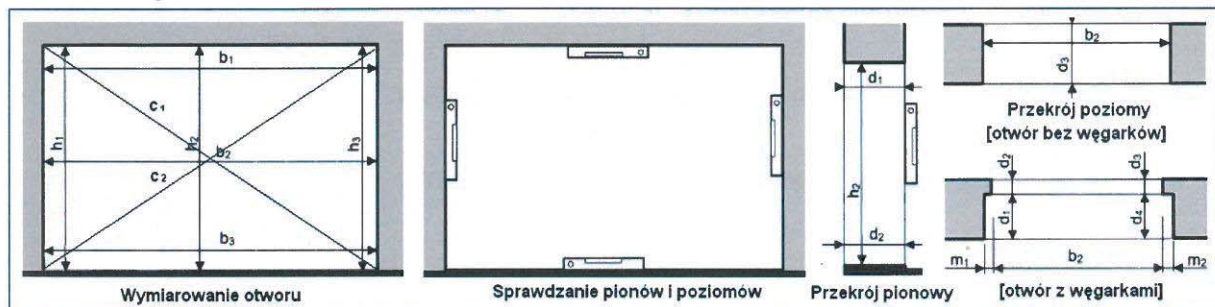
Whether a door performs its general function, requires – apart from the construction in accordance with technical documentation – a correct installation, in particular:

- Correct positioning of the door in the wall, fixing and sealing.
- Determination of the type of installation, applied technology and door position in the opening should be included in the installation design, regardless whether the building is new or this is a replacement in a building which is already in use.
- The determinations should be consulted with the door manufacturer, distributor, representative of the installation contractor company.

Doors are not structural components of the building and cannot resist any mechanical, thermal and operating loads from the structure of the building.

## 4. Sizing doors

Door sizing is to be provided in accordance with the principles listed in fig. 2 and tab. 1.



Wymiarowanie otworu	Opening sizing
Sprawdzanie pionów i poziomów	Checking the levels
Przekrój pionowy	Vertical cross-section
Przekrój poziomy [otwór bez węgarków]	Horizontal cross-section [opening without sideroom]
[otwór z węgarkami]	[opening with sideroom]

Fig. 2. Opening sizing

Maximum size deviations for the height and width of the openings	Opening dimensions	height	width up to 6 m	width over 6 m
	Deviation		± 8 mm	± 12 mm
Maximum size deviations for the diagonals of the openings	Opening dimensions	from 1 to 3 m	from 3 to 6 m	over 6 m
	Deviation		± 10 mm	± 15 mm

Table 1. Opening size deviations

## 5. Checking the dimensions of doors before installation

- Before installing the door, check its dimensions to make sure that the dimensions of the designed door and the opening into which it should be installed match and whether the clearance on the perimeter between the door frame and opening is sufficient to use the sealing and to maintain the required perimeter clearances.

- In case of difficulties with determining the size and type of the door opening, make local breakouts around the existing door so that the type of opening – e.g. with or without sideroom and type of wall can be determined – full brick, full or perforated masonry blocks, hollow clay tiles with vertical openings, cavity wall with internal thermal insulation, made of perforated clay units or a double layer wall with external thermal insulation.

The following must be closely inspected:

- Type of replaced door – single, dual, other – old door may have different external dimensions or structural details [thresholds].
- Dimensions of the door opening with determination of opening type (with/without sideroom, sideroom size) and width of the frame of the replaced door (may be wider than the frame of the new door).
- The location of thermal insulation of walls – single wall, cavity wall with internal thermal insulation, double layer wall with external thermal insulation or wall intended for thermal performance improvement.
- Internal and external floor levels – insulation assumption.

## **6. Preparation of the opening for door installation**

Installation stages – preparation of the opening:

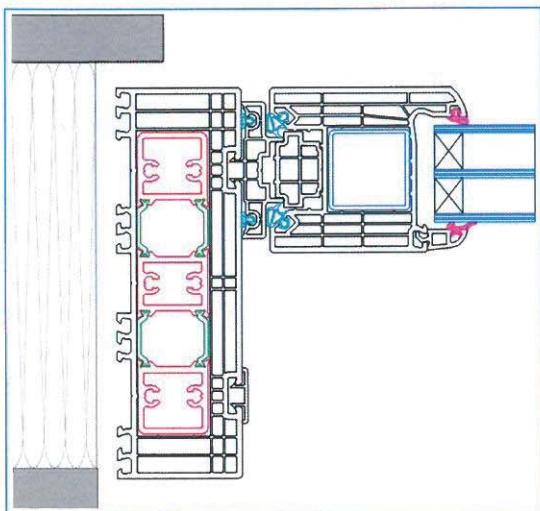
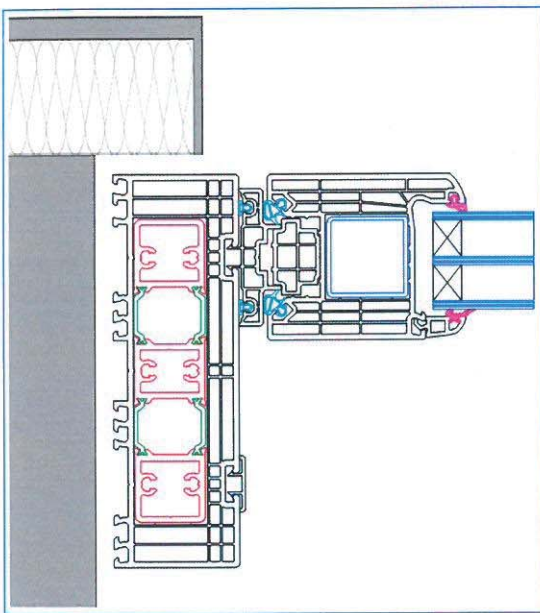
- Clean the opening of loose construction materials, dirt, dust, etc. Opening surfaces should be even and smooth, thermal insulation material in cavity walls (with internal insulation) should reach the edges of the opening.
- Fill any lacks in the opening surfaces, sideroom, lintels and fill cavities with appropriate mortars.
- When replacing doors, remove old plaster and mortars and fill the cavities with appropriate compounds.
- Surfaces with low material cohesion (crumbling) should be reinforced with a priming agent, especially if the installation system applies adhesive materials (insulation foils) or construction mastics.

## **7. Door position in the opening – wall type**

Door positioning principles:

- The door should be positioned in the opening or protruding from the wall surface [partially or fully] in a way that reduces linear cold bridges which may result in water condensation on the internal surface of the door frame, opening surface or inside the door-wall joint.
- By analysing the temperature distribution on the contact surface between the door and wall, the potential points of water condensation on the internal door surface, opening or inside the door-opening joint can be determined, based on the shapes of isotherms.
- The most advantageous location of the door in the opening is the one in which the 10°C isotherm does not follow the internal surface of the wall (inside room).
- In case the shapes of isotherms are unknown, follow the general principles, i.e.:
  - for a single wall without thermal insulation – in the middle of wall thickness,
  - for a cavity wall with internal thermal insulation – in the insulation layer,
  - for a double layer wall with external thermal insulation – on the structural wall face.

- In energy efficient or passive buildings with a double layer wall with thick external thermal insulation, the door should be partially or fully protruding outside the face of the structural wall.
- Doors fully protruding outside the wall face, installed using systemic solutions, including wall brackets, supports, angles or bearing frames, should be positioned within the thermal insulation layer.
- In the case of openings with sideroom, it is recommended to position the door in such a way that the vertical and horizontal frame members are uncovered by the sideroom no further than half-width.
- The frame members should not be fully covered due to the risk of losing the functionality of the door – e.g. freezing, water seepage under the door leaf.
- The installation diagrams are presented in fig. 3a–c.



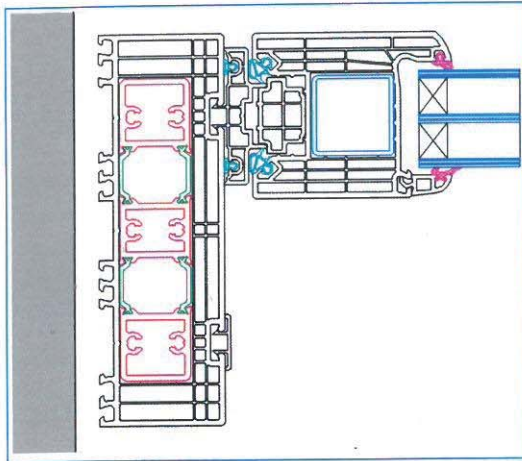
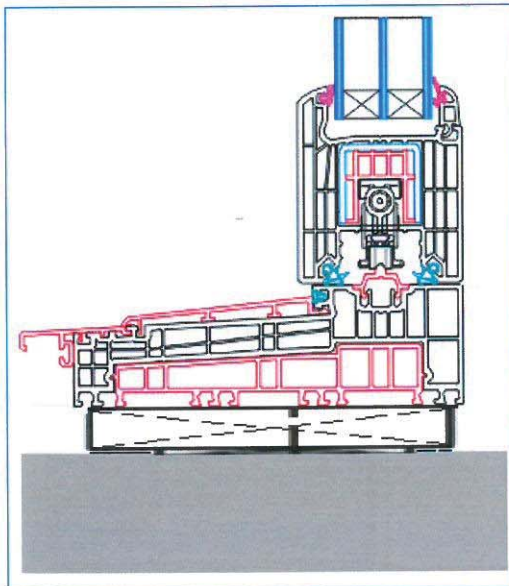


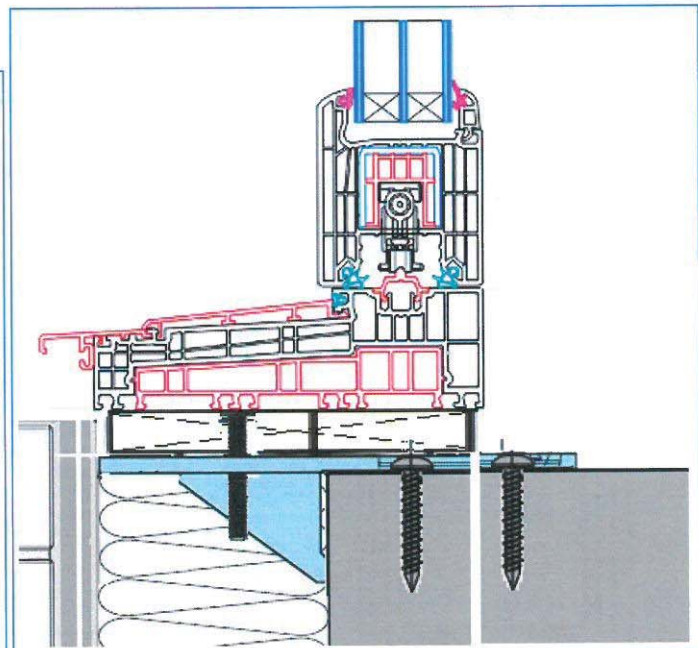
Fig. 3a–c Diagrams of door positions in the opening - a) full single layer wall without thermal insulation, b) cavity wall with internal thermal insulation, c) double layer wall with external insulation

### 8. Fixing doors in the openings

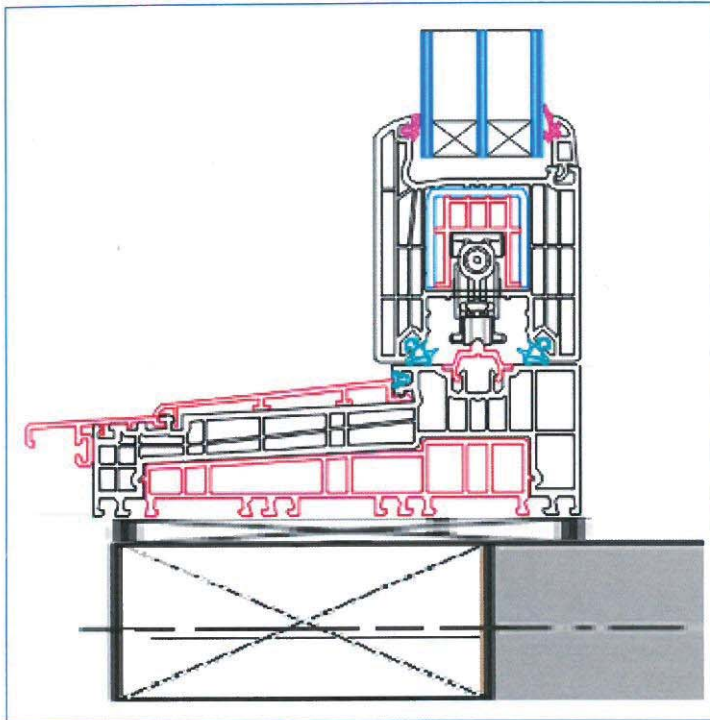
The following methods can be applied for the purpose of fixing the door in the opening: blocks, wedges – of impregnated wood or plastic, beams made of impregnated materials, PCV extension elements, transition mouldings, aluminium profiles, angles, steel brackets and supports, bearing frames. Examples of the fixing methods are presented in fig. 4a–c.



Installation using support blocks



Installation using brackets



Installation using support beams

Fig. 4a–c Installation using support blocks, beams, steel brackets and beam supports for doors positioned in the insulation layer.

### 9. Positioning support and spacing elements

The positions for support and spacing elements depending on the type and size of doors is presented in fig. 5.

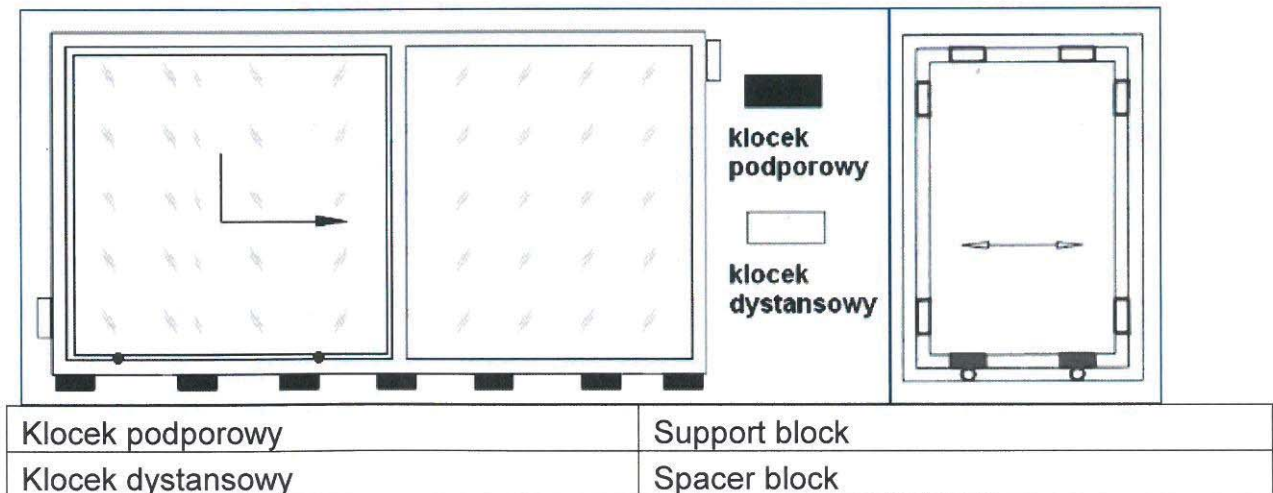


Fig. 5 Positioning support and spacing elements

Principles for positioning support and spacing elements.

- Block supports should be spaced no wider than 30 cm apart.
- Support blocks should be positioned centrally under the vertical elements of the frame and mullions (including floating mullions). Other positions may result in frame threshold bending under the weight of the door.
- Pay close attention that the guide track is stably supported along its whole length, with maximum spacing of blocks up to 20 cm.



## 10. Positioning door to opening anchor points

Positioning door to opening anchor points is presented in fig. 6.

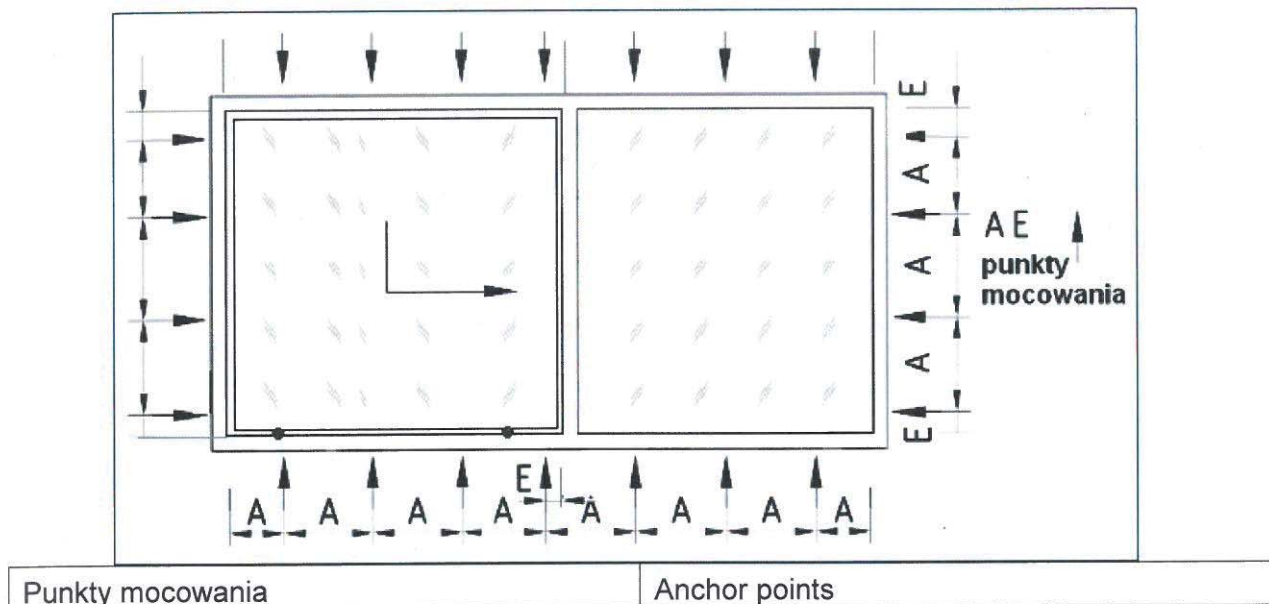


Fig. 6 Positioning door to opening anchor points

Principles for positioning door to opening anchor points.

- The anchor points should be spaced no wider than – 15–20 cm from the corners, 50–70 cm between the anchor points.
- The anchoring should function in such a way that the external loads are carried by the fasteners to the building structure and that the functionality of the door is intact.
- The following anchoring types can be used, depending on the wall type [monolithic, layered] and installation system: expansion bolts/dowels, anchor bolts, screws.

## 11. Basic principles for door positioning and installation

- Do not use support blocks in the case of door installation using brackets, protruding outside the wall face and located in the thermal insulation layer.
- Spacer blocks used for positioning the door in the opening and keeping it steady should be removed after the installation; do not remove support blocks.
- Wedges/washers, temporary supports used for door positioning are not support blocks.
- Door installation using solely expansion bolts, dowels, screws or anchor bolts without the use of support blocks is not sufficient.
- The use of screws for direct door installation may not require the use of support or spacing elements if the screw manufacturer provides testing in this area, and the construction of the door enables maintaining a stable distance between the opening and door frame after the setting of screws.
- Vertical and horizontal deviations for the position of the door in the opening should not exceed 3 mm.

## 12. Determining minimum gaps between door frame and opening

The maximum gap between the door frame and opening should not exceed 40 mm. The sizing of the gaps is presented in fig. 7a and 7b as well as table 2.

In justified cases, larger gaps can be appropriate. Then, the sealing method and materials require an individual approach – e.g. using special mechanical fasteners.

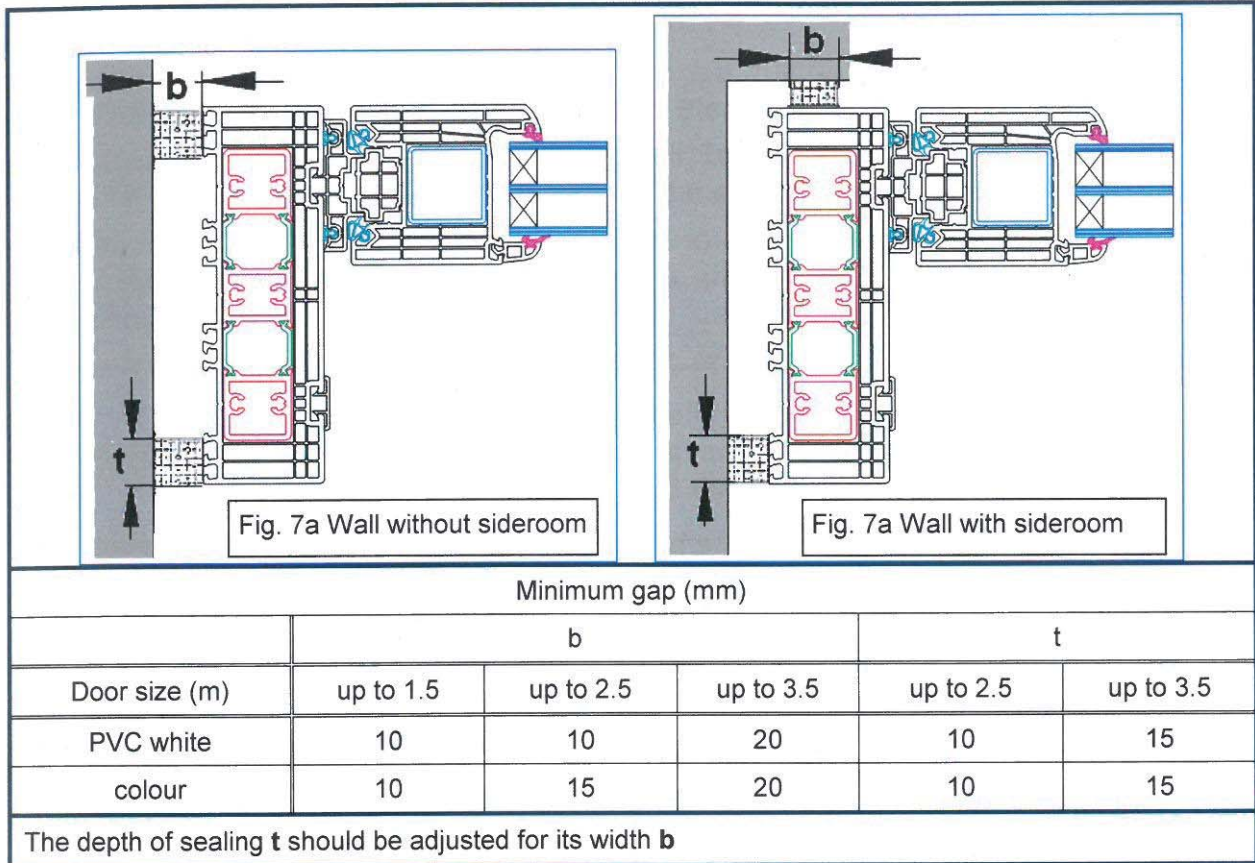


Table 2. Opening gap sizes

### 13. Types of anchoring [mechanical fasteners]

Door installation should be provided with mechanical fastening in the opening, either directly or indirectly, using various types of fasteners – screws, dowels, steel anchor bolts. Examples of fasteners are presented in fig. 8a and 8b.

NOTE: Use special anchor bolts in case of this method of fastening.

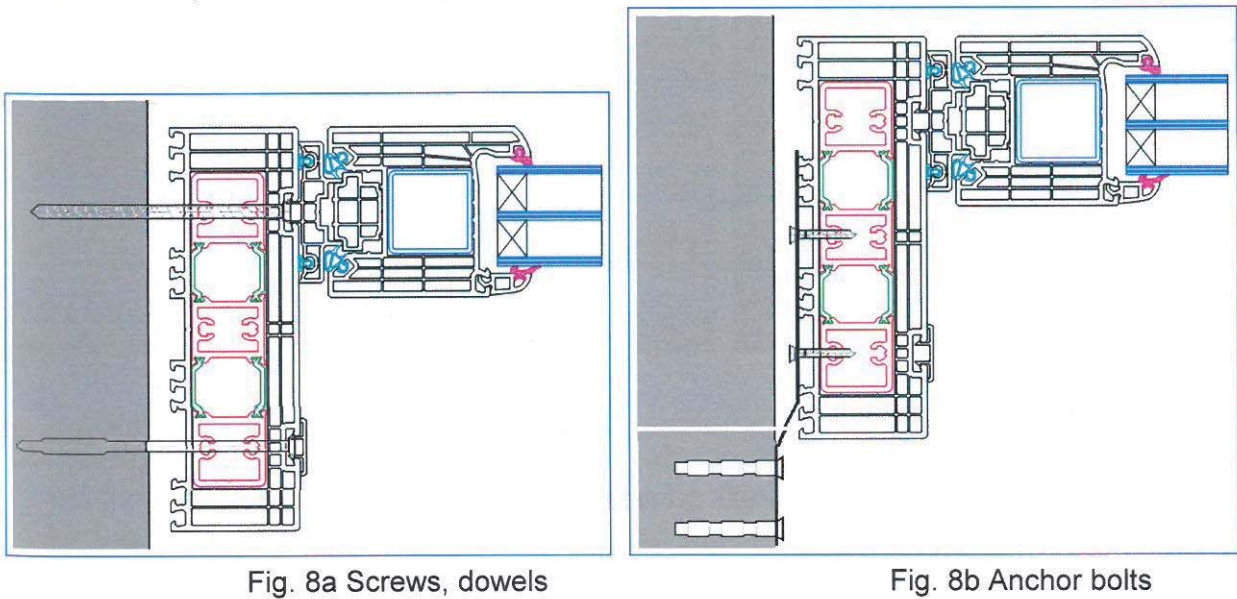


Fig. 8a Screws, dowels

Fig. 8b Anchor bolts

#### 14. Principles for using mechanical fasteners

- Expansion bolts [dowels] are used for concrete, full brick, silicate, perforated brick, cement and clay hollow tiles, aircrete, stone, etc.
- Bolts used for anchoring in concrete, full brick, silicate, perforated brick, light concrete, wood, etc. should be selected for the opening surface type.
- Construction anchor bolts should be used in places where the gap between the opening and the frame is too large to use dowels, e.g. for the bottom-threshold installation.
- The installation should be followed by signing an acceptance report.

**Polyurethane foam and other insulation [sealing] materials do not have anchoring properties and should only be used to seal and insulate the gaps between the door frame and the wall.**

#### 15. Elements for the mechanical fastening of sliding doors

For the purpose of door frame installation, use corrosion-protected steel fasteners – anchor bolts, frame dowels, special screws – selected for the anticipated load which could be applied to the door and for wall material.

The following fastening elements can be used:

- Frame screws – special with a nominal thread diameter of 7.5 mm, fully threaded with conical, cylinder, flat or lenticular head.
- Steel expansion bolts and dowels with a metal expansion sleeve or steel bolts with plastic sleeves.
- Dowels with plastic expansion element used in perforated materials, e.g. clay hollow tiles.
- Steel anchors made of a flat strip of metal, 1.5 – 2.5 mm in thickness, with holes for screws/dowels. Anchors do not have the functionality of transferring perpendicular loads. The purpose of the anchors is the indirect installation of the door in the frame to compensate for suction and wind pressure loads.

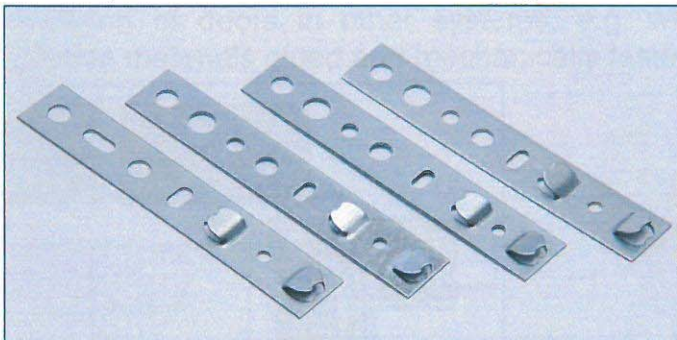


Fig. 9a Steel anchors



Fig. 9b Dowels

- Brackets and supports – steel elements transferring the load from the installed door. Used for the installation of doors fully or partly protruding outside the wall face – into the thermal insulation layer. The load bearing capacity of the bracket is determined for the planned distance of protrusion from the wall. The bracket is mounted to the bottom part of the door frame or to additional profiles, e.g. widening elements.

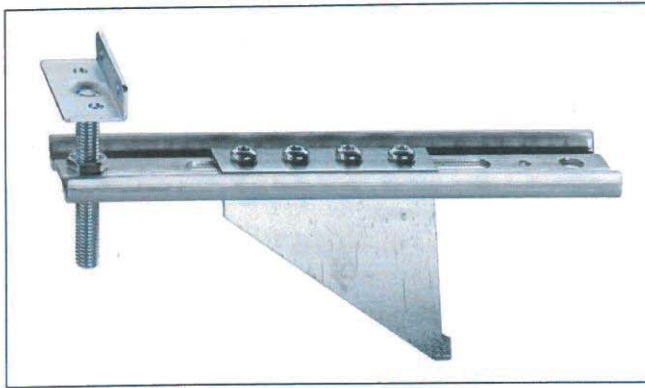


Fig. 10a Steel bracket with adjustment

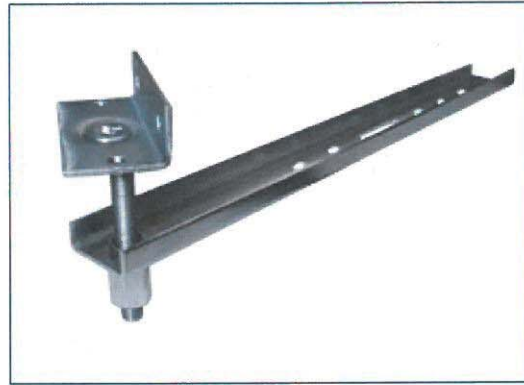


Fig. 10b steel support

- Angles made of steel or a special durable plastic for installation on the outside of the wall. The top surface is used as a foundation for the door which is partially or fully protruding outside the wall face.

### 16. Installation of doors protruding outside the wall face

- The installation of doors protruding partially or fully outside the wall face can be provided using supports and brackets or steel angles.
- The installation requires appropriate selection of the brackets, supports, angles / fasteners required for transferring the external loads applied to the door and its weight. Brackets, supports or angles should be placed around the entire door perimeter and fixed to the walls with appropriate fasteners – in accordance with general principles.
- The bracket is holding the full weight of the door [can be treated as a support block] and provides the anchor point.
- Top and side supports transfer the forces applied to the door from wind load and leaf opening to the wall structure. There are not any requirements for the types of walls to which these elements can be applied.

### 17. Other systems of door installation

Installation of doors in other systems, e.g. with special profiles (frames) made of insulation materials glued and mechanically fastened to the walls. Fig. 11.

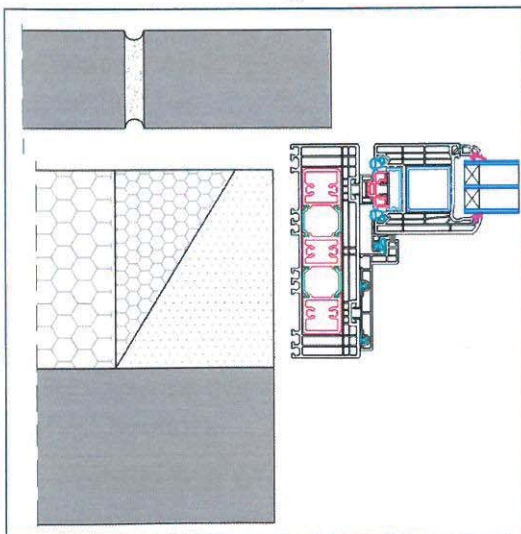


Fig. 11 Installation in the thermal insulation layer

In this type of installation, a bearing frame based on widening profiles is applied to the outside of the wall. The door is mounted in the frame, fastened with long screws and insulated with the three-layer method, i.e. vapour barrier tape from the inside,

polyurethane foam in the middle and breathing tape from the outside (or multi-purpose expanding tape with the width matching the width of the installed frame).

This installation type should be described in details with specification of allowable load-bearing capacity and instructions.

### 18. Principle of three-layer sealing

Vapour barrier/permeable tapes and membranes, butyl membranes for interior sealing, expanding tapes of porous foam, single and multi-purpose tapes (vapour barrier and breathing, general use – vapour barrier and breathing) should be applied in accordance with the guidelines of the manufacturers and requirements for the preparation of substrates.

- Internal sealing. The internal sealing between the door frame and opening should prevent the permeation of water vapour from the room into the gap between the door frame and building wall, i.e. prevent water condensation in the gap (i.e. points with temperatures below dew point). **Basic sealing principle – “tighter seal on the inside”**. This enables the diffusion of vapour from the joint.
- Middle layer (thermal insulation). The gap between the frame and wall should be completely filled with thermal insulation. At the same time, the door frame cannot be deformed.
- External sealing. The external sealing between the frame and wall should prevent gap penetration by precipitation water while enabling vapour permeability.
- Sealing materials. The following materials can be used for sealing: polyurethane foams, porous foams and tapes, mineral wool, fibreglass etc., vapour barrier/permeable membranes, impregnated expansion tapes, butyl sealing tapes, non-hardening mastics (neutral silicones), construction spacing strings, compressible materials.
- Application principle. Follow the guidelines of the manufacturer when providing sealing, taking into account: ■ chemical compatibility of materials, ■ cleaning the adhesion surface, ■ priming the adhesion surface (depending on material type), ■ application requirements due to humidity and temperature

### 19. Combining sliding doors

Combining sliding doors requires individual verification for wind load resistance as well as water and air tightness. The combinations should be designed individually, depending on the installation conditions. The requirements for construction stability (resistance to wind pressure and suction) and the thermal expansion of the elements of the combined doors must be taken into consideration.

- Select the type of fasteners, depending on the requirements. The elements can be rigidly jointed with some play.
- Combining a door with other door/window in a horizontal [vertical] arrangement requires the installation of an element between the frames and sealing the joint.
- Principle of door combination: - impregnated expansion tape, - aluminium-reinforced PVC section.

### 20. Installation of roller shutters and sliding doors

There are two types of external roller shutters – adapted shutters installed in a ready building inside the door opening or on the facade above the opening and top-mounted shutters installed during building construction.

The roller shutters are not considered to be parts of the door. The size, dimensions and construction should follow the construction design. Check roller shutter type and method of installation, taking into account:

- Mechanical fastening of roller boxes and the possible requirement to use reinforcement elements – static joints, posts, girts, due to the size, width and static loads.
- If there is a need to seal the door and roller shutter.
- If the installation provides stress compensation, e.g. by expansion joints.
- If the roller shutters can deform the door, leaf frames and provide excessive load to the structure, if the installed door can be easily opened with the weight of the roller shutter.
- If the joint between the roller box and door/lintel is water- and air-tight, if the thermal and acoustic insulation is sufficient.
- Install the roller shutters using fasteners matching the type of lintel – reinforced concrete / full brick and walls – hollow tiles, perforated brick, aircrete.
- The roller boxes are to be installed to even surfaces.
- When providing external and internal sealing of the roller box, the following principle is to be applied: “tighter seal on the inside”; inside – vapour barrier, outside – breathing sealing.

## **21. Commissioning of temporarily visible works**

During the commissioning of doors, check the following:

- Correct support of the door frame threshold.
- Correct fastening of the entire perimeter of the door frame.
- Correct thermal insulation of the gap between the door frame and the opening, particularly the insulation under the frame threshold.
- External and internal sealing of the gap between the door frame and the opening, particularly the types of sealing materials and technological guidelines applied.
- Correct threshold installation.

## **22. Commissioning of installed doors**

Check the correct installation and functionality of the installed balcony doors before finishing works; follow these requirements:

- vertical and horizontal level deviation for elements up to 3000 mm in length should not exceed 1.5 mm/m,
- the difference in the diagonal dimensions of the door frame and leaf should not exceed 2 mm – for elements up to 2 m in length, 3 mm – for elements over 2 m in length,
- opening and closing the doors should be unobstructed,
- an open leaf should not open or close by itself,
- a closed leaf should evenly adhere to the frame, providing a tight seal,
- deformations should not exceed 1.5 mm/m,
- deformations, including changed shapes and dimensions of windows / balcony doors should not noticeably impede their operation (functionality),
- deformations cannot result in damaging window elements – pulling out hardware and gaskets, damaging the frame, corroding hardware,

- deformations in the surface (cradling, hourglass-shape) cannot affect hardware functionality,
- in case of problems, adjust the hardware, correcting the position of the leaf in relation to the frame,
- deformations should be measured with leafs closed.

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