

NORDIC DESIGN PLUS

TECHNICAL INFORMATION INSTALLATION RECOMMENDATIONS



Building Solutions Automotive Industry



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These installation recommendations are for how to plan and proceed with construction connections to guarantee the serviceability for the installed windows over a longer period of time.

The quality of a premium window stands and falls with the construction connection. The professional configuration is therefore of high importance. All building physical forces which have an effect on the window need to be considered (see Graphic 1).

1. Fixing of the elements

1.1 Reaction forces

To guarantee the serviceability of windows, doors and facades over a longer term of time, all active forces which have an impact on the window need to be transferred to the building. The following forces are: - wind load,

- self-load,
- horizontal net-load. Basis is DIN 1055. (wind load)
- Except the given strains, the forces are also influenced through
- $-\,\mbox{the flexural rigidity of the frame profiles},$
- $-\operatorname{the}$ position and number of fixing points,
- the temperature difference inside/outside,
- the thermal expansion of the materials used and
- the movement of the fixtures.



Graphic 1: Impact on the installation connection joint





Graphic 2: Fixing distances for plastic windows

1.2 Load carrying Wind load and horizontal net-load:

The choice of the fixings is mainly dependant on the forces, the construction situation and the wall connector system.

Through the fixings used the wind load and horizontal net-load are mainly transferred into the building. PUR foams, injectable sealing material and other insulation and sealing materials are not proper fixings according to the current best pratice point of view.

The fixings have to be done mechanically!

The assembly of the fixingss is regulated for plastic windows according to graphic 2.

Self-load:

Self-load is the force exerted by the weight of the PVC window/door including glass.

The frames have to be supported by transferring the forces to the building. Moreover they have to be fixed with customary fixings on the building (see graphic 3).

The customary fixings should not be solely expected to transfer loads!



The following needs to considered:

- The blocks must be of no compressive material.
- The assembly of the blocks must not influence the linear expansion, contractions and building distortion of the elements in any way.
- The blocks must stay in the general plane of the masonry to keep their load in a longer period.
- The bearing elements which are fitted in front of the masonry must have suitable steel angles or brackets.
- Precondition is a sufficient flexural rigidity of the frame profile.
- The blocks must not influence the following works on the building e.g. the sealing of the window to the building structure.





Top hung window





Two sash adapter window (the supporting block in the area of the middlemust not influence the functionality of the window)



Side hung window

Top swing window



Fixed light (Supporting blocks with glazing blocks)



Balcony and front doors



Mullion



Coupling



- Supporting blocks

Graphic 3: Packing of the window elements



1.3 Fixings

The selection of the right fixings is important in the particular construction situation. Brickwork and fixings must be adjusted to each other. Therefore please pay attention to the fixing supplier's recommendations, as e.g.

- Advised hinge forces,
- Maximum distance between frame and brickwork: maximum working length d.,
- Anchoring depth h,
- Dowel edge distance,
- Drilling diameter d and drilling hole depth t_d.

Some important fixtures are illustrated in Graphics 5 and 6.

H

Please pay attention to the manufacturer's recommendations! When fixing the outer frame horizontal at the bottom, please use a fixing which does not open the reinforcement chamber (in the direction of the rebate).

If this is not possible the reinforcement chamber needs to be permanently sealed.

The selection of the fixing should be done according to the structure of the brickwork.

When working with a hollow block brickwork, the brickwork has to be filled in the area of the fixing dowels.

(e.g. use of injection grout Fischer FIS VS 150 C)



Graphic 4: Important sizes for a fixing

1.4 General hints for window fixings

- Correct drilling, only use impact/hammer drill into masonry/concrete!
- Pay attention to the load capacity and length of the dowels, screws, anchors according to the wall structure!
- Use appropriate screws, anchors, lugs and installations system for the dowel system!
- Blow out drilling holes!
- The given axis and edge distances must be considered in dependence on the material (advice of the dowel fixing supplier

recommendations)!

- Tighten screws evenly and tension free in terms of the frame (use a screwdriver with torque limiter!).
- Target the combination of supporting blocks and fixings element!
- Using nails is forbidden, even in special versions!



Fixings - examples



Round frame dowel ø 10



Lug fixing strap (forbidden for front doors)

Graphic 5: fixings



1.5 Special connections Front doors

Front doors are often subject to dynamic strain (e.g. strong slamming of the door) rather than to static loads. Furthermore a front door has less closing points than a window. For that reason there is a need for additional fixtures to the general fixture points (see graphic 6).

When using multiple front doors with mullion or connected single elements, the reinforced profiles have to be fixed additionally (see graphic 7).



- Additional fixing at the brickwork
- ---- Fixing distances referring to the installation of the window
- Front door hinge with drilled hole
- Supporting block
- Grapic 6: Fixing of a front door





Graphic 7: Fixing of a multiple front door



Couplings, element expansion joints

To achieve the safe transference of the forces to the brickwork, some measure must be taken. When using element or expansion joints, the reinforcements (served to bracing) have to be fixed on the building. In this process it is important that the reinforcement must not be clamped too tight. The use of a fixed or movable bearing (according to Graphic 8 and 9) shall ensure the compensation of building movements.

Window width	Length variation $\Delta I \text{ [mm]}$ at $\pm 30^{\circ}\text{C}$ with $\mathbf{a}_{\text{window}} = 0.42 \cdot 10^{-4} / \text{K}$
1500	± 1.9
2500	± 3.2
3500	± 4.4
4000	±5.0

Table 1: Length variation of white PVC window because of thermal expansion

When using large element widths or heights, the horizontal and vertical expansion of the profile must be taken through the expansion joint. The expansion of white profiles is illustrated in table 1. That means when dimensioning the joint/seam width for white windows a length variation of +-1.25 mm per m profile length has to be considered. For non-white windows this figure is doubled.



Graphic 8: Element couplings

Maximum profile length for elements:

- White coloured profiles: 4,0 m,
- Non-white coloured profiles: 3,0 m.

For profiles lengths greater than the above, the outer frame couplings have to be constructed as expansion joints. These expansion joints must not be spanned with frames, supporting profiles etc. Furthermore the profiles must not be restricted in their movement.

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	3	Ę	9	
	-		-	

Maximum profile length for single piece fixed glazing:

- White coloured profiles: 3,0 m,
- Non-white coloured profiles: 2,5 m.



Fixing of the installation angles in element direction Fixing of the installations angles in 90° angle to the element direction





Α-



Graphic 9: element expansion joint



2. Sealing and insulation

2.1 Joint sealing

Windows and doors including the connecting joints must sustain permanently the impacts which are given in Graphic 1. To fulfil this requirement, the masonry joint has to be done correctly, also in respect to the joint geometry, insulation and sealing.

Water is always present and it is the general cause for most building damage because of its different appearances (gaseous, fluid, and solid). Such damage can appear through a direct penetration from outside (e.g. rain water) or through condensation of diffused water vapour (from inside).

Windows and its connected joints always affected by driving rain and by the high relatively air moisture of the interior and the condensation that results from that. Therefore the following principles are important for the correct sealing of the connecting joint:

- The protection against rain water must be ensured on the exterior of the building. No rain water is allowed in the connecting joint. In the case there is nevertheless some moisture in the joint, this should be allowed to be vented to the outside.
- Through the correct sealing in the interior, an intrusion of the humid air from the inside shall be prevented.

These main requirements induce a joint construction according to graphic 10:



Graphic 10: The section example

Section level 1:

Separation of interior and exterior climate:

Air-tight, steam diffusion sealing should be higher than the exterior one.The parting plane from interior and exterior climate must be visible on the whole surface on the inside of the outer wall. It is forbidden to interrupt it. Its temperature must be above the dew point temperature of the room.

Section level 2:

Insulation level: Warmth and noise insulating material. In this area the features warmth and noise protection must be ensured in a certain period of time.

To guarantee these features, the area must "stay dry" and separated from the room climate by all means.

Section level 3:

Outer sealing - shelter against the weather

Watertight, open to steam diffusion, UV-opaque material. The level of the shelter against the weather must avoid from the outside the intrusion of diving water and lead the invaded rain water outside again.

At the same time some invaded moisture should be able to escape outside.

From this awareness the following principle can be formed: "Better sealing on the inside than on the outside".



Also the position of the window in the brickwork influences the condensation on the profile surface and in the brickwork rebate area due to the temperature of the inner building component surface. In DIN4108 (see esp. Part 7 and supplementary sheet 2) and DIN EN ISO 10211-2 the installation situation is regulated.

According to the mentioned standards the installation needs a proper planning in advance.

According to the principle "Better sealing on the inside than on the outside" the sectionlevel 1 and 3 are combined (see graphics 11 and 12). The producer's details must be noticed. Detailed illustrations are given in the IVD fact sheet no. 9 "Sealing material in the connection joint for windows and outer doors – principles for planning and installation".

The section level 3 must be watertight. The section level 1 supports the separation of interior and exterior climate. In the section level 1 the sealing materials have to be put in that they are closed all round. When having non-smooth surfaces, use pasty adhesive. Foils with bitumen are forbidden. The sealing level has also to be set up on the side of the sill connection (graphic 13).

The selection of the sealing material is defined through the outer wall system, i.e. the construction connection.

The selection criteria are the joint geometry as well as the material of the building construction (brickwork). The instruction from the manufacturer about the sealing material needs to be followed, e.g. the processing principles for the correct use of injectable sealing material. This is especially important for the surface humidity, compressive strength, temperature, suitability for the use on most surfaces and the surface adhesion. Depending on the state a treatment must be done in advance.



For refurbishment works:

Pay attention to the present plaster quality!

Graphic 11: Examples for the joint sealing on the outside



according to DIN 18542





Injectable joint sealing material between outer frame and brickwork



Injectable joint sealing material between outer frame/insulation and plastering



Graphic 12: Examples for joint sealing on the inside



Injectable joint sealing material between outer frame/insulation and plastering



Injectable joint sealing material between outer frame and brickwork



Butyl hinge, can be plastered over



Window foil



Graphic 13: Sealing in the area of the side of the sill connection

When using injectable sealing material a correct dimensioning of the joint is a precondition for a long life sealing (graphic 14).

Graphic 14: Dimensioning of a joint while using an injectable sealing material





PVC is subject to expansion or shrinkage in terms of thermal expansion (see table 1). The masonry joints must be planned in the way that the sealing materials can compensate the outer frame movements without being pulled out from the sealing area. The minimum width of joints can be seen in table 2 and 3 according to the used sealing system. Also when considering the minimum width of joints, the manufacturer's recommendations in terms of sealing material and sealing hinges must be noted.

Additionally no stress cracks are allowed to appear on the welded outer frame egdes.



Table 2: minimum width of sealing joints

	Joint formation with sealant by element length						
		b					
	< 1.5 m	< 2.5 m	< 3.5 m	< 4 m	< 2.5 m	< 3.5 m	< 4 m
white	10 mm	15 mm	20 mm	25 mm	10 mm	10 mm	15 mm
non-white	15 mm	20 mm	25 mm	-	10 mm	15 mm	-

Table 3: minimum width of sealants



3. Site measurements

To avoid mistakes the current conditions need to be analysed directly on the site. That includes the real construction situation and the site measurement of all window building openings. In the VOB/B § 4, No. 3 the inspection of the building by the contractor is necessary as well as the note of any doubts. For the monitoring of the structural state and the notification of defects to the planner or the customer, the following steps are advisable:

- The structure of the outer walls and the materials used are the basis for the selection of the necessary fixings.
- The type and the status of panelling (plaster, brick, etc.) is significant for the choice of the inner and outer sealing system.
- The wall structure influences the choice of the connection and of the installation level.
- The expected movements of windows and building are essential for the choice of the connection profiles and the formation of expansion joints.
- Are height reference points (cutting check) available?
- Are thermal bridges and moisture penetrations visible?
- Are the openings of the wall conform to DIN 18202 "tolerances in building construction"?
- Are all joints and/or vertical cavities closed and smoothed.

The dimensions of window brickwork openings have to be taken directly at the building site. Thereto the openings of the windows are measured three times in the height (left, middle, right) and the width (at the top, middle, at the bottom). The smallest dimension for the manufacturing is taken!

The cutting check must be available in each storey and should not be situated further away than 10 m from the installation place.

Changing or additional measures are necessary when the tolerances are exceeded according to DIN 18202 or other building concerning differences appear. These must be corrected before the start of the installation.

In principle objections have to be recorded in written form.

For front and window doors, the sill structure has to be decided in advance.

4. Transport and storage

When transporting the elements and storing them on the site, the following points need to be noticed:

- Guarantee solid and secure position of the elements,
- Vertical transport and storage of the elements,
- Protection against damage through shifting, twisting, canting and deflection of elements.
- Protection against mechanical damages and grime,
- Prevention of direct and mutual touching,
- Easing of the hinges for bigger elements through the use of the supporting profiles (guide block IPA).

5. General installation instructions

The windows have to be installed horizontal, perpendicular and flush. Deviations should be agreed in written form.

Window installation below 5°C the specific material features have to be considered.

Direct impact on the frame and sash pieces should be avoided.

The protection foil must be removed immediately from the profiles after the installation. Adhesive remaining on the windows from the installation foams have to be removed before hardening.

According to VOB/B § 4 No. 5 the contractor is responsible for the protection of the installed window against damage until the official transfer. Individual measure are advised to be taken with the customer e.g. for the protection when foaming later on. When plastering the surfaces of the profile must be protected via certain coverages.

After finishing the installation, the functionality of all opening parts has to be checked and recorded according to its function.



6. Quality management

To sum up the following criteria should be taken care of while installation:

Planning:

- Kind of brickwork,
- Significant fixings,
- Expected movement,
- Joint geometry,
- Sealing (eligibility and compatibility)
- Installation level,
- Weather protection,
- Reaction forces,
- Fixing,
- Insulations,
- Additional installations.

Manufacturing control:

- LV requirements fulfilled?
- Correct elements?
- Appropriate ancillaries?
- Detail drawings?

Construction control before installation:

- Bare brickwork tolerances?
- Walls straight?
- Smoothed?
- Masonry stop?
- Brickwork opening in the area of sealing units even?
- Connecting elements flawless?
- Installation for a model home necessary?

Guidance for installers:

- According to detail drawings,
- Attention to critical details,
- Discussion about the installation instruction and employment of a responsible construction manager,
- Only installation of flawless windows!
- Before installation check opening sizes!
- Placing of the window control!
- Is the necessary joint width of 10 20 mm existent?
- Are the fixings sufficient?
- How are the sealing levels installed?

Acceptance of construction work:

- The acceptance of construction work has to be realised in any case.
- Are noise protection measurements necessary? If yes, only with the installation manager.

Standard reveal, inside silicone joint - outside silicone joint for unrendered masonry for visible brickwork
needs to be adapted to country specific requirements.
Status: 07.2012







With surrounding outer sealing with injectable sealing material, the sealing level has to be interrupted to be aerated the functional level. With surrounding outer sealing with imposted sealing. The opening should be situated at a wind and weather protected position.

Installation instructions - Installation drawing
 Checked reveal, inside silicone joint - outside sealing taped

to be adapted to country specific requirements. Status: 07.2012





7. Installation instructions - Installation drawing Standard reveal, inside foil - outside silicone joint







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With surrounding outer sealing with injectable sealing material, the sealing level has to be interrupted to be aerated the functional level. The opening should be situated at a wind and weather protected position. to be adapted to country specific requirements. Status: 07.2012

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MASTER TEMPLATE needs to be adapted to country specific requirements. Status: 07.2012



Beskill cord Injectable joint sealing

7. Installation instructions - Installation drawing Sill connection, outside cant brick sill - inside PVC sill

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A mistallation instructions - Installation drawing Sill connection, outside cant brick sill - inside brick reveal cladding with plate bolding profile 3 needs to be adapted to be adapted to the status: 07.2012 541341 Construction foil, impermeable Backfill cord <u>م</u>رد Injectable joint sealing 1m



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