Window Installation Detail: Technical Guide for Correct Application

Window installation may look like a simple “frame installation”, but in reality it is one of the most complex points of the building envelope. A window opening must manage many parameters at the same time: architecture, structural behaviour, thermal insulation, vapour balance, water drainage, wind action and material expansion. A small detail solved incorrectly can lead to major issues such as water leakage, vapour condensation, thermal bridges, profile deformation or even glass breakage.

In this article, we examine the bottom and side junction details of a window system from a technical perspective. From the mounting surface to the drip flashing, from thermal insulation to drainage paths, all components are analysed with a professional approach. This guide is prepared as a reference for installers, architects and detail designers.

1. Fundamental Logic of Window Installation: Load Transfer and Air–Water Management

A window system is a critical component of the building envelope, both aesthetically and mechanically. Its main role is not only to separate exterior and interior environments; it must also carry wind loads, discharge rainwater, maintain continuous thermal insulation and safely transfer the movements of operable sashes. For this reason, a window installation detail, although it looks like a small application, actually requires a multidisciplinary design approach.

There are three main principles that determine installation performance:

1. Structural load transfer
2. Air and water management
3. Continuity of thermal insulation

These three principles are explained in detail in the following sections.

1.1 Structural Load Transfer

The loads carried by a window system are not limited to the self-weight of the glass. From a structural point of view, the window is considered a “moving component” of the building envelope, and therefore different loads must be safely transferred to the wall.

Types of loads:

1. **Self-weight of the glass**
   Double glazing, insulated units, triple glazing or low-e coated units can reach 25–60 kg/m².
   This load is carried directly on the bottom frame (sill profile).
2. **Wind load**
   Wind load can be positive (pressure) or negative (suction). Especially in high-rise buildings, values of 1200–2400 Pa are common.
   This load is transferred through the window profiles to the anchors.
3. **Movements of operable sashes**
   There are movement loads transferred through hinges, striker plates and the frame.
   If the frame is installed incorrectly, operable sashes start to rub over time.

4. **Thermal expansion movements**
   Aluminium has a relatively high coefficient of thermal expansion.
   Depending on profile length, temperature cycles can create 3–6 mm of movement.

All four types of load must be transferred correctly into the wall.

Why Is the Bottom Frame Bearing Surface So Critical?

Full contact between the underside of the frame profile and the bearing surface is essential for correct load transfer.

If the surface has:

- voids,
- settlement,
- cracked plaster,
- discontinuous support due to hollow bricks,

then loads concentrate on local points.

In that case:

- **Frame sagging:** The bottom frame gradually sinks.
- **Sash rubbing:** Sliding or side-hung sashes begin to rub.
- **Lock and bolt failure:** Security fittings no longer engage properly due to growing gaps.
- **Glass breakage:** This is the most critical condition. Local settlements transfer point loads to a corner of the glass, causing cracking.

For this reason, the bearing surface must always be:

- completely flat,
- sound,
- load-bearing,
- continuous.

If necessary, a levelling screed, repair mortar or reinforced mounting tape is used.

1.2 Air and Water Management

It is not realistic to expect window systems to “never let any water in”. These systems accept that a certain amount of rainwater will enter the internal chambers of the profile in a controlled way, but at the same time prevent water from reaching the interior.

Therefore, modern window profiles are based on two key principles:

1. **Pressure equalisation chambers**
   These chambers allow water entering during rain and wind to be collected temporarily while

equalising pressure.
Their purpose is:

- to store water temporarily,
- to equalise pressure,
- to direct water towards the drainage outlets once the pressure drops.

In a well-designed system, these chambers are located just below the glazing bead.

2. **Drainage channels**
   At the bottom of every profile there are drainage holes opening to the exterior.
   These:
   - discharge water collected inside the profile,
   - allow water pushed in by wind pressure to be redirected outward,
   - prevent water from entering the interior.

If this system is blocked, water will run in under the window and is often misinterpreted as “water coming through the wall”.

Key points for correct air–water management:

- Drainage openings must not be blocked by the external sill or drip flashing.
- Screws used to fix the sill must not create “water-collecting pockets” in the flow direction.
- External brush / gasket seals must press uniformly against the glass surface.
- There must be no architectural protrusions, claddings or profile cuts on the exterior that trap water.
- PU foam must not expand into and block the drainage path.

All of these are among the most common causes of leakage on site.

1.3 Logic of Thermal Insulation

Heat transfer is one of the main problems at window openings. A window detail is one of the areas with the highest heat flow and creates three critical thermal break lines:

1. **Wall → Frame junction**
   The wall insulation usually breaks the thermal bridge near the window frame.
   However, if the insulation:
   - does not extend up under the frame,
   - does not fill side cavities,
   - is not combined with correct inner–outer sealant lines,

a cold spot forms in this area.
This cold spot increases the risk of condensation as defined in TS 825.

2. **Frame → Glass junction**
   This is the area where the frame has the highest thermal conductivity.
    - In PVC or aluminium frames, thermal separation between glass and frame is provided by gaskets and setting blocks.
    - In aluminium systems, if the thermal break (polyamide strip) is not of sufficient width, the interior surface becomes very cold.

Weak details here cause:

- fogging on glass surfaces,
- droplets on the inner surface,
- reduced comfort for occupants.

3. **Bottom sill → Interior zone**
   The sill area is the weakest thermal line under the window.
   Incorrect solutions result in:
    - cold sensation at the base of the wall,
    - moisture on the floor–wall junction,
    - significant heat loss.

Under the sill there must always be:

- a thermal insulation strip,
- a capillary break,
- an outward-sloping water discharge.

Thermal bridges and their consequences

A thermal bridge is a path of higher thermal conductivity through which heat energy escapes.

Its consequences:

- **Moist surfaces:** Warm interior air hits a cold surface and condenses.
- **Mould growth:** Moist surfaces, especially at plaster–paint junctions, trigger mould.
- **Energy loss:** Increases boiler and air-conditioning consumption.
- **Condensation on frame surfaces:** Aluminium frames cool down quickly due to high conductivity.

Therefore, the bottom and sides of the window must not be treated merely with PU foam, but resolved according to the principle of continuous insulation.

1.3.1 Most Effective Methods to Prevent Thermal Bridges

- The insulation material (stone wool / EPS / XPS) must approach the frame continuously from the wall side.

- PU foam is only for filling cavities; it does **not** replace proper insulation.
- Inner–outer sealant lines must be airtight.
- If aluminium windows are used, the width of the polyamide thermal break must be sufficient (typically 20–34 mm).
- Under the sill, thermal insulation and the vapour balance line must be designed correctly.

If these principles are ignored, the window detail will continuously generate heat loss.

2. Bottom Window Detail: Relationship Between Drip, Bottom Frame and Insulation

The bottom window detail is the most critical junction that determines the overall performance of a window system, because three different aspects intersect at this point:

- Structural load transfer (glass weight, wind load)
- Water management (drip flashing, drainage, capillary break)
- Continuity of thermal insulation (wall-frame junction)

The example shown in the detail represents the correct relationship between these elements. In this section, we will examine each component individually and explain site problems and correct application principles.

2.1 Bottom Frame (Bottom Window Profile)

The bottom frame is the main load-bearing element of the window system. The entire load of the glass and the frame is transferred to the structure through this profile. Therefore, even a small mistake on the bottom frame can cause significant deformation over time.

Essential conditions for the bottom frame

1. **Full bearing on the surface**
   The underside of the bottom frame must sit fully and continuously on the screed or concrete surface.

If the surface is:

- inclined,
- cracked,
- unfilled,
- weakened due to hollow bricks,

the bottom of the profile acts as a “point support”.
This quickly leads to:

- frame settlement,
- glazing beads opening,

- sash rubbing,
- locks failing to engage.

Professional practice:
The surface is always checked with a straightedge; if necessary, a levelling screed is applied or the surface is corrected with mortar.

2. **Installation on hollow brick**
   Hollow brick alone is not a sufficient bearing surface for the bottom of a window.

Therefore, it is essential to:

- fill the brick cavities with mortar,
- support the surface with an insulation strip,
- seat the profile on a fully bearing surface.

If this is not done, the brick will crack over time and the entire frame will settle.

3. **Drainage channels must remain open**
   Drainage channels in the bottom frame discharge water from inside the profile. These must **not** be blocked by:

   - foam,
   - mortar,
   - the external sill or drip piece,
   - gaskets.

If the drainage channel is blocked, water accumulates inside the profile, moves into the internal chambers and eventually leaks indoors.

4. **Glass carried on EPDM setting blocks and gaskets**
   The glass never sits directly on the metal.
   In every aluminium system, double EPDM setting and support gaskets are used. These:

   - distribute the glass load,
   - prevent direct contact between glass and profile,
   - absorb impact and expansion movements.

Inappropriate support blocks or gaskets can load the corners of the glass and cause cracking.

2.2 Drip Flashing Connection

The drip flashing (or external sill profile) is one of the least visible but most critical components of the bottom detail. Its function is not only to discharge water; it also acts as a protective shield for the bottom frame, the interior and the wall surface.

Main functions of the drip flashing

1. **Diverting rainwater away from the wall**
   This prevents water from clinging to the wall surface and moving upwards or inwards by capillary action.
2. **Opening the bottom frame drainage to the exterior**
   If the drainage path is not functioning correctly, water leakage during rain is inevitable.
3. **Protecting the underside of the sill and insulation**
   Continuous wetting under the sill, particularly in systems with EPS, leads to degradation and decay in the external insulation.

What happens if the drip flashing is installed incorrectly?

- Water runs between the bottom frame and the brick.
- The profile chambers fill up and water leaks into the interior.
- Water can travel by capillary action along the underside of the flashing and enter the wall.
- The insulation strip becomes damp and mould develops.

On site, approximately 60% of leakage problems are due to incorrect drip flashing details.

Criteria indicating a correct drip detail in the example

- **20–40 mm projection:** Water drops off without touching the façade surface.
- **5–10° slope:** Water does not accumulate anywhere.
- **Screw axis not aligned with the water flow:** Screw heads do not collect water; screw holes do not become fountains.
- **Drainage openings are not blocked:** The drainage path is fully active.

This configuration represents a modern, standard-compliant “capillary break + projecting drip flashing” design.

2.3 Thermal Insulation (Stone Wool / EPS / XPS)

The window bottom is the weakest thermal line of the building. Therefore, insulation at this point must be continuous and free of gaps.

The thermal bridge is most likely to form in this area. The reason is simple:
Wall insulation often does not extend under the window, and PU foam is **not** a thermal insulation material.

Correct principles of thermal insulation

1. **Insulation layer must be continuous**
   EPS or stone wool must run from under the sill up to the underside of the window frame.
2. **It must rise up to the bottom of the frame**
   There must be no voids under the frame.
   Any gap will become a condensation line.

3. **Wall cavities must be filled**
   Open cavities in hollow brick walls are zones where warm interior air meets a cold surface.
   Persistent moisture appears in these regions.

If the insulation is not done correctly, what happens at the window bottom?

- A cold surface is formed.
- It becomes a condensation hotspot.
- Musty smell appears in the room.
- Dark staining is observed at the floor–wall junction.
- Energy loss increases due to a constant heat-leak path.

All these problems arise from poor detailing, not from the material itself.

2.4 Preparation of the Mounting Surface

“Installation on a flat surface” is the most fundamental yet most neglected rule in the industry.

For a window to be durable and long-lasting, preparation of the mounting surface is more important than the installation itself.

Correct preparation of the bottom surface includes:

1. **Surface levelling**
   The brick or concrete surface is checked with a straightedge.
   If there are depressions or protrusions:
   - a levelling screed,
   - fine repair mortar,
   - or synthetic repair compound
     is used to correct them.
2. **Completing the insulation**
   Between the wall insulation and the window opening:
   - stone wool,
   - EPS,
   - or a special insulation strip
     is placed.
     This step is critical for interior comfort.
3. **Filling with mortar**
   If hollow bricks are present, internal cavities are filled.
   Without this, the installed window is supported not by the brick but by its voids.
4. **Moisture barrier layer**
   The bottom and sides of the window are the weakest points in contact with external air.
   Possible solutions include:

- vapour balance tape,
- bituminous waterproofing,
- liquid membrane,
- EPDM waterproofing strip.

This layer prevents water from reaching the wall surface and condensing inside.

3. Side Frames and Wall Junctions

At the side junctions, the load-bearing system, the air–water barrier and the insulation all come into play together.

3.1 Screw Connections

At side connections:

- Screw spacing should be 30–40 cm,
- Closer spacing is required at corners,
- Screws must always anchor into a load-bearing wall element,
- Screws must not be driven directly into hollow brick.

Where necessary, chemical anchors or steel reinforcement plates are used.

3.2 Foam + Sealant Line

The side gap of the window is filled in three stages:

1. PU foam (for insulation and cavity filling)
2. UV-resistant exterior sealant
3. Interior acrylic sealant / tape

The aim is to ensure:

- thermal insulation,
- air tightness,
- acoustic performance.

Single-sided sealant is considered a “temporary solution” and causes problems in the long term.

4. Detailing of the Water Drainage System

In many buildings, the drainage system of the window is one of the most problematic areas because it is often detailed incorrectly.

4.1 Bottom Profile Drainage Chambers

At the bottom of each aluminium profile there are:

- pressure equalisation chambers,
- water collection cavities,
- drainage openings.

These openings should be:

- at least two in number,
- unobstructed in the direction of wind and water flow,
- not covered inside the drip or sill detail.

4.2 Sill and Drip Drainage

The sill:

- must project at least 2 cm outward,
- must have a slope of about 5°,
- must not direct water back onto the façade,
- must have a capillary break at the underside.

4.3 Water Barrier

The goal is not to make the system completely impermeable, but to discharge water in a controlled way.

The principle is always:
“Water will enter; what matters is discharging it correctly.”

5. Thermal Bridge Problems and Solutions

Thermal bridging is the area where most mistakes are made in window installation.

Incorrect detailing causes:

- droplets on the interior surface,
- seasonal condensation,
- mould growth,
- condensation on the interior faces of aluminium frames,
- cold spots.

5.1 Correct Connection Strategy

To prevent thermal bridges:

- The insulation layer must rise up under the frame.
- Stone wool / EPS must be applied continuously.
- Hollow brick cavities must be filled.
- PU foam must not be left as the only “insulation”.
- Inner–outer sealant lines must be fully airtight.

This approach follows the principle of **“continuity of the building envelope”.**

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6. Material Expansion and Movement Allowances

Aluminium profiles change dimensions with temperature variations.

Therefore:

- Profiles must not be excessively clamped by screws.
- The drip flashing must be fixed with allowance for movement.
- Glass gaskets must not be overstretched.
- PU foam must be applied so that it does not over-expand and force the frame.

Otherwise:

- glass breakage,
- profile distortion,
- malfunction of locking hardware

may occur.

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7. Requirements According to Brick + Insulation + TS 825

In the example detail, the system is solved with:

- hollow brick,
- thermal insulation (stone wool / EPS),
- plaster layer,
- window profile,
- drip flashing connection.

According to TS 825:

- continuity of thermal insulation is mandatory,
- risk of interior surface condensation must be minimised,
- thermal bridges must be reduced to the lowest possible level.

Since the bottom and sides of the window are the most critical points for heat transfer, they must be detailed professionally.

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8. Common Mistakes in Window Installation

The 8 most frequent on-site mistakes:

1. Installing the window on an unlevelled surface
2. Blocking drainage channels with the drip flashing or sill
3. Incorrect slope on the drip or sill
4. Insulation not extending continuously into the wall opening
5. Relying solely on PU foam as “insulation”
6. Incorrect screw spacing
7. Discontinuous inner–outer sealant lines
8. Air leakage between the side wall and the frame

The cost of these mistakes often appears within the first year; some cause serious damage only after 2–3 years.

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9. Step-by-Step Application Guide for Correct Installation

1. Levelling the mounting surface
2. Completing the thermal insulation
3. Filling hollow brick cavities
4. Levelling the frame bearing line
5. Placing the bottom frame
6. Installing the drip flashing connection
7. Fixing side screws and anchors
8. Applying PU foam
9. Applying exterior sealant
10. Applying interior sealant / tape
11. Checking drainage openings
12. Adjusting operable sashes

These 12 steps are the “gold standard” for long-lasting and trouble-free installation.

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10. Arkistral Approach: Professional Detail Design and Application Control

At Arkistral, we evaluate window details in three stages:

10.1 Technical Detail Design

- Correct profile selection
- Correct junction details
- Water management analysis
- Thermal bridge assessment
- Check of glass load-bearing capacity

10.2 Project Application Guidance

To ensure that site teams work according to standards, we prepare:

- installation sequence,
- screw spacing schedule,
- drainage control plan,
- insulation completion details.

10.3 Application Control and Reporting

Each stage is documented with photos and reported to the client.
This guarantees that the details will work correctly.

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11. Correct Window Installation Is the Key to Building Performance

The window installation detail is the intersection of waterproofing, thermal insulation, mechanical strength and architectural comfort. An incorrectly resolved bottom or side detail directly affects the overall performance of the building.

The principles described in this guide form the basis of a modern, durable window system.

In particular, the following points must be handled with great care:

- bearing surface of the bottom frame,
- drip flashing / sill connection,
- continuity of thermal insulation,
- drainage openings,
- side fixing screws and anchors.