Aluminum Curtain Wall Systems – Installation Details

1. Factory Production: Left and Right Modules
In the illustration, the left and right vertical frames are produced in the factory as ready-made modules.
Elements processed in the factory:

- Mullion (vertical member) cuts
- Grooves for the seating of transoms (horizontal members)
- EPDM gasket channels
- Connection shoes (brackets) mounted on profile ends where required
- Holes, slots and dimensional tolerances

In this way, error-prone on-site operations such as cutting, drilling and dimensional adjustment are minimized.

2. Pre-Fixed Anchors
The anchors fixed to the concrete slab are clearly visible in the upper part of the illustration.
The logic here:

- All façade lines are kept on the same axis using a laser.
- Anchors are adjusted with ±2–3 mm tolerance to match the module seating dimensions.
- The tension, shear and moment capacities of each anchor are determined according to structural calculations.

This step ensures that the entire installation is built correctly “from the skeleton”.

3. On-Site Installation Sequence (The Flow Shown in the Illustration)

A) First Module (Left Frame) Is Set on the Anchors
The module is slid towards the anchors in the direction indicated by the arrows and locked.
The mullions seat into the slots on the anchors.
The aim here:

- To connect the module to the primary support structure in a single operation
- To ensure exact alignment and plumb in the vertical axis
- To create a reference for the upper modules

B) Transoms Are Installed Between Modules
The horizontal profiles seen between the two modules are assembled on site.
Functions of these transoms:

- Form the horizontal support line for the glass

- Distribute wind suction and pressure loads across the surface
- Guide the fire barrier and insulation system

Technical points to check during this stage:

- Bending and deflection tolerances of the transoms
- EPDM insulation gaskets are installed before assembly
- Condensate channels are aligned correctly

C) The Right-Hand Module Is Installed
The right module is also seated on the anchors in the same way and locked to the transoms.
This component:

- Completes the stiffness of the frame
- Closes the single-unit module logic
- Creates the reference for the next vertical module

4. Glass Installation
Once the structural frame is fully assembled:

- Glass setting blocks are placed on the bottom transom
- IGU units are positioned inside the module using a vacuum lifter
- Glass–aluminum contact surfaces are checked
- Continuity of vertical and horizontal gaskets is ensured

The most critical point at this stage:
The glass load must be transferred only onto the glass setting blocks, not directly onto the aluminum profile.

5. Closing the System (Capped or Silicone Curtain Wall)
Two different applications are possible depending on the system type:

In Capped Curtain Wall Systems:

- Pressure plate screws are tightened
- External cover caps are installed
- The cap lines are checked in both horizontal and vertical directions

In Silicone Curtain Wall Systems:

- Silicone gaskets are compressed
- Silicone joints are left between the exterior glass edges
- Structural silicone is applied according to the manufacturer’s datasheet

Core Logic of the System
This illustration explains the following:
“To reduce on-site workload, all vertical elements are prepared in the factory as modules, and the façade frame is created on site simply by locking these modules together.”

Advantages:

- Reduced error margin
- Increased installation speed
- Quality control is moved to the factory
- On-site workmanship standard is improved

This method provides excellent efficiency especially in:

- High-rise buildings
- Façades with repetitive modules
- Projects with tight mullion spacing

2. Aluminum Curtain Wall Systems – Factory-Cut, Site-Assembled Type

This illustration shows the installation type where aluminum profiles are only **cut, drilled, slotted and machined for brackets** in the production line, but not assembled as modules, and then joined together on site.
We can call this the purest and most common form of the stick system.

1. Factory Preparation Process
This method offers major advantages in the production–supply chain.
Operations carried out in the factory:

- Profiles are cut to exact lengths
- Slots and recesses for seating transoms are machined
- Bracket recesses for anchor connections on mullions are prepared
- Hole locations are processed with CNC according to coordinates
- Condensate channels and EPDM gasket grooves are prepared

Thus, error-free, correctly cut pieces arrive on site; all that remains is assembly.

2. Installation of Structural Anchors on Site
In the illustration, the L-shaped anchors placed under the concrete slab are clearly visible.
Functions of the anchors:

- Transfer wind and vertical loads to the reinforced concrete structure
- Support the mullions in the vertical plane
- Establish the axis and plumb line of the façade

This stage is the primary “skeleton” reference of the entire façade system.

3. Connection of Mullions to Anchors
In the illustration, we see two vertical rows of mullions. These:

- First sit on the lower anchors
- Are then fixed with the upper anchors
- Are aligned for plumb and axis using adjustment screws

The key point here:
The stand-off distance between mullion and anchor requires tolerances up to ±5 mm.
If this adjustment is not done, glass openings shift, panels do not fit and the façade grid is distorted.

4. Installation of Transoms Between Mullions
This is the main message of the illustration.
The transoms:

- Are cut to exact length in the factory
- Are installed between two mullions on site
- Are usually fixed with “fish-mouth” or T-slot type connections
- Receive their EPDM gaskets afterwards

Functions of the transoms:

- Create the horizontal support line carrying the glass
- Transfer the structural load to the mullions
- Allow condensate water to be drained

Therefore, transoms must not bend or twist and must sit exactly on their axis.

5. System Working Principle
The backbone of this system is the following idea:
“All profiles are prepared in the factory, all assembly is done on site.”

Advantages:

- No need to produce full modules
- Profiles can be supplied more quickly
- You can correct dimensions on site if needed
- Cost is lower than modular systems

Disadvantages:

- More on-site labour and time
- Higher error margin compared to modular systems
- Longer installation time on very tall buildings

However, in Türkiye, the Middle East and the Balkans, this is still the most widely used method, because it is flexible, economical and continuously adaptable.

6. Glass and Exterior Surface Installation
After the vertical + horizontal frame is completed:

1. Glass setting blocks are placed
2. Glass units are installed with a vacuum lifter
3. Pressure plates + caps are mounted
4. For silicone curtain wall, exterior joints between glass panes are filled

At this stage, the façade becomes an envelope that provides air and water tightness.

3rd Item – Mullion Installation from Floor to Slab (Full-Height Mullion Placement Stage)

This illustration explains the installation of the main structural elements of the façade – mullions – from floor to slab in a single length.
This is the fundamental step in all stick, capped, silicone and modular stick curtain wall systems.

In the illustration, we clearly see:

- Lower anchor fixed to the slab
- Upper anchor fixed to the slab above
- A single full-height mullion fixed between them
- Critical connections for plumb, axis and load transfer

This approach ensures that the vertical line continues upwards as a single, continuous axis.

1. Function of the Bottom Anchor
The bottom anchor determines:

- The vertical axis where the mullion will be positioned
- Shear force resistance due to wind pressure
- The starting point that keeps the profile “standing”

The critical aspect here:
The anchor must be positioned on the reinforced concrete slab according to the structural design.
If the bottom anchor is placed incorrectly, the entire façade line will shift.

2. Top Anchor – Main Carrier of Structural Load
The top anchor carries the most critical load in the system.
Typically, the top anchor:

- Carries vertical loads from the glass weight
- Resists wind loads
- Controls the horizontal movement of the mullion
- May include a sliding slot to allow for thermal expansion

Therefore, top anchor installation:

- Must always be checked with a laser
- Must not deviate more than ±2–3 mm
- Must be perfectly aligned for plumb

3. Installing Mullions – "Single-Piece Mullion" Logic
This illustration shows the mullion fixed in a single piece from floor to slab.
This method provides:

1. **Increased stiffness**
   A single-piece mullion instead of two separate pieces means fewer joints and fewer error points.
2. **Perfect plumb line**
   Since it is one element, there is no "misalignment at splice joints".
3. **Straight silicone and cap lines**
   Exterior caps or silicone joints appear as continuous, straight lines.
4. **Healthier load distribution**
   The load is not divided between two profiles; it is transferred directly to the anchors.

4. Installation Sequence – Site Application
The actual on-site workflow is as follows:

1. Façade axes are marked using laser and string lines
2. Bottom anchors are fixed to the slab
3. Top anchors are positioned according to dimensions
4. The mullion is seated on the bottom anchor
5. It is lifted to and fixed at the top anchor
6. Plumb, axis, spacing and verticality are adjusted
7. The system is made ready for transom installation

Once this step is completed, the façade has formed its initial structural skeleton.

5. System Logic – "Load Path"
The purpose of this installation can be summarised in one sentence:
"Load from the glass → mullion → anchor → reinforced concrete slab."

Therefore, the mullion:

- Must not twist
- Must not deviate from its axis
- Must have full contact with top and bottom anchors
- Must be designed to allow thermal expansion

6. Educational Message of This Illustration
For students and site teams, this illustration teaches:
“Façade installation starts with the mullion; the entire system is shaped according to this line.”

In other words, transoms, glass, caps, silicone joints…
All depend on the accuracy of this first step.

4th Item – Mullion Fixing Types (Both Methods Are Compatible with Expansion/Movement Joints)

This illustration shows two different techniques used to connect mullions to anchors.
Both can be used in façades with movement joints and both are correct solutions.
The choice depends on site access conditions, architectural appearance, anchor position and mullion layout.

A) Left Connection: Side-Fixed Anchor (Standard and Most Common Method)
In this method:

- The anchor is connected to the side of the mullion
- The connection plate works from the side of the profile
- The mullion is given the necessary allowance for thermal expansion and building movement

This system:

- Is easy to access on site
- Allows fast adjustment
- Is practical for aligning the profile on axis
- Is the standard solution in most capped and silicone curtain walls

There is no disadvantage in terms of movement joints.
When sliding slots are used inside the mullion or in the connection, thermal expansion and building drift are easily absorbed.

B) Right Connection: Top-Fixed, Center-Axis Mounting (According to Architectural and Structural Preferences)
In this method:

- The anchor plate is placed under the slab
- The profile sits on and is fixed to the anchor from above
- The connection is made along the exact center axis of the mullion

This system is preferred in cases such as:

- Façades where side connections should not be visible in the architectural line
- Grid designs where the anchor must work from the exact center axis
- Façades where transoms must align with the center axis
- Steel–aluminum hybrid structures with top-seated solutions

This method is also fully compatible with movement joints.
Even if the profile is fixed from above, thermal expansion and building movements are accommodated by allowing movement at the bottom connection.

C) Summary: Both Are Correct, the Choice Depends on Conditions
Put simply:
Both connection types are suitable for movement joint solutions.
The difference arises not from movement capacity but from the "installation approach".

- Left connection → side-fix, fastest and most common method
- Right connection → top-seated on the axis, ideal for architectural preferences

Technically, both:

- Allow thermal expansion
- Tolerate building settlement and movement
- Do not create stress on glass and profiles
- Are compatible with capped / silicone / semi-capped systems

Therefore, the choice depends on:

- Architectural concept of the project
- Ease of access to anchors
- Structural calculation results
- Site application conditions
- Aesthetic expectations

5th Item – Floor-by-Floor Anchoring Method (Each Floor Works Independently)

This illustration shows an installation method where mullions are anchored separately to each floor slab, meaning the mullions do **not** continue as a single piece from top to bottom.
This approach is known in façade engineering as the **"floor-independent working principle"**.

In this method:

- Separate anchors are placed at the top and bottom of each floor slab
- Mullions are manufactured to floor height
- The mullion on the upper floor is not structurally continuous with the one below
- Thus, each floor absorbs its own movements within itself

This system is especially preferred in high-rise buildings and seismic regions.

A) Core Logic of This System: "Floors Work Independently from Each Other"
Buildings:

- Sway horizontally during earthquakes

- Experience different interstory drifts between floors
- Undergo micro-movements due to settlement and creep
- Exhibit concrete expansion and contraction due to temperature differences

If the mullion were a single continuous piece and “locked” the floors together:

- Glass would crack
- Profiles would buckle
- Silicone joints would be overstressed
- Cap lines would distort
- Anchors would be overstressed in shear

For this reason, each floor’s mullion is fixed within its own level and does not transfer movement directly to the floor above.

B) Technical Advantages of This Method

1. **Increased Seismic Safety**
   Since floors can move independently, the mullion does not act as a single continuous element; floor-to-floor drift does not overstress the profile.
2. **More Controlled Thermal Expansion**
   A 3 m mullion expands far less than a 6 m member.
   As mullion length decreases, thermal expansion issues are reduced.
3. **Ease of Maintenance and Replacement**
   Because each floor is independent:

- Glass replacement on one floor does not affect the others
- Removal and reinstallation operations are safer
- Repairs are less expensive

4. **Installation Flexibility**
   Dimensional deviations between floors are more easily tolerated in this system.

C) How Does the Connection Detail Work?
Each mullion:

- Has its bottom end fixed to the anchor at the lower floor
- Has its top end fixed to the anchor at the upper floor

These connections:

- Carry vertical loads
- Transfer wind loads to the slab
- Prevent damage to the mullion in horizontal displacement scenarios

The joint between floors is not structurally locked; it is typically covered architecturally with:

- A shadowbox detail
- A cap profile
- A silicone joint
- A box profile
- A railing line or similar feature

D) When Is This System Used?
This method is preferred in projects such as:

- High-rise buildings
- Buildings in seismic regions
- Mixed-use residential + commercial buildings
- New structures where concrete settlement is expected
- Projects where floor slabs work in different directions

In short:
If using a continuous mullion would create risk, working with floor modules is the most appropriate solution.

6th Item – System Where All Floors Work Together (Sliding Bottom Anchor + Fixed Top Anchor)

This illustration shows two types of anchors that together explain a single concept:

- Bottom anchor → vertically movable
- Top anchor → the fixed reference point

This combination allows the mullion to work as a single continuous element along the entire height of the building.

It is particularly used for the following purposes:

- Continuous mullion from bottom to top
- Perfectly straight silicone or cap lines
- Central transfer of horizontal (wind) loads
- Alignment of glass on a single line
- Minimising the number of joints

This anchor type is the main method used in structurally and architecturally high-control façade projects.

A) Bottom Anchor: Vertically Movable (Sliding Base Plate)
As seen in the upper part of the illustration, the bottom anchor:

- Is sliding in the vertical direction

- Allows the mullion to move up and down on the anchor
- Is solved with slotted holes or double-hole sliding plates

Allowing movement at the bottom anchor is necessary for the following reasons:

1. **Thermal Expansion**
   For mullions 6–12 m long, seasonal expansion can reach 8–15 mm.
   This expansion must be absorbed at the bottom connection.
2. **Building Settlement**
   Settlement is most pronounced at ground level and base anchors.
   If the system cannot accommodate this movement:

- Glass breaks due to compression
- Cap lines shift
- Silicone joints tear

3. **The System Works Rigidly Upwards, So the Bottom Must Be Free**
   When the mullion is fixed at the top, the bottom **must** allow movement.

B) Top Anchor: Fixed Point Connection
The lower part of the illustration shows the logic of the top connection.
At the top anchor:

- The holes are slotted horizontally or drilled as fixed points
- The mullion is rigidly connected to the anchor
- A “fixed point = starting point of the load path” is created

Functions of this fixed point:

1. Act as the main reference for all vertical loads
   Glass weight + mullion self-weight are transferred here.
2. Act as the main transfer point for wind loads
   Suction and pressure on the mullion are transferred to the structure through this anchor.
3. Stabilise façade alignment along the building height
   This anchor keeps the façade on the same axis across all floors.

C) Structural Logic Created by This Method
With this anchor combination, the mullion becomes:

- Fixed at the top
- Free (sliding) at the bottom
- Fixed or controlled-slotted at intermediate floors
- An element that transfers all loads to the fixed point at the top
- A single continuous, rigid vertical structural member along its length

In other words:
“The system does not work floor by floor; it behaves like a single bar along the entire building height.”

This is widely used in façade types where high stiffness is required.

D) When Is This Method Used?
This anchoring type is typically used in:

- High-performance curtain wall systems
- Silicone curtain walls
- Box-type façades
- Projects where cap lines must be perfectly straight
- High-rise buildings
- Buildings in seismic regions where fixed-point control is desired
- Façades where architectural modules are continuous

In such projects it is often mandatory or highly advantageous.

7th Item – Anchor Installation System (Step-by-Step Application Guide)

This illustration explains how to install an anchor on a reinforced concrete surface in six stages.
Each step is critical in terms of both structural safety and installation accuracy.
The following explanations are not just a mounting recipe;
they summarise the technical principles of **how to transfer loads correctly**.

Stage 1 – Drilling the Concrete Surface (Correct Diameter – Correct Depth)
In the first frame:

- A hole is drilled into the concrete surface with a drill bit matching the anchor diameter.
- Hole depth is determined according to the “embedment depth” value of the anchor used.

Points to consider at this stage:

- The hole must be drilled perpendicular to the surface (angled holes disturb load transfer).
- Concrete strength should be at least C25.
- No cracks should form around the hole edges.

This step is the basic preparation for the anchor to grip safely.

Stage 2 – Cleaning the Hole (Removing Dust and Debris)
In the second frame, the inside of the hole is cleaned using a cleaning pump or compressed air.
This step is often skipped but is one of the most critical:

- If dust remains, the anchor can pull out
- Bond strength is reduced
- Tension and shear capacities decrease

Correct cleaning → correct load capacity.

Stage 3 – Placing the Anchor in Concrete (Chemical or Mechanical Anchor)
In the third frame, two types of applications are shown:

- Steel expansion anchor (mechanical)
- Chemical capsule (injection anchor)

The choice here is made based on:

- Required load capacity
- Concrete class
- Façade weight
- Wind pressure
- Shear and tension demands

Chemical anchors are especially preferred where high tensile capacity is required.

Stage 4 – Fixing the Anchor and Preparing the Plate
In the fourth frame, steel rods placed in the anchors and the base plate that will sit on them are visible.
At this stage, the anchor:

- Integrates with the concrete
- Forms the primary load path
- Provides the seat for the fixing plate

For installation convenience, the plate holes can be slotted.

Stage 5 – Tightening the Anchor Plate with Nuts (Completing the Structural Load Path)
In the fifth frame:

- The plate is placed over the anchors
- Washers are fitted
- Nuts are tightened according to the specified torque value

The critical point here:
Tightening must be done with a torque wrench.

If over-tightened:

- Hole deformation occurs
- The plate can bend
- The anchor capacity is reduced

If under-tightened:

- Loosening under wind loads

- Mullion movement
- Loss of system integrity

Correct torque → correct load transfer.

Stage 6 – Seating the Mullion on the Anchor (Completing the System)
In the final frame:

- The mullion (vertical aluminum profile) is seated on the anchor
- The profile is fixed through the holes in the anchor plate
- Installation is completed

At this point, the system:

- Can now carry wind loads
- Is ready for glass installation
- Is ready for cap/silicone applications