Aluminum Facade System Details: How to Create Them?

In modern architecture, preparing an aluminum facade detail is not simply “drawing a section.” It means solving load transfer, water–air tightness, thermal bridge control, continuous fire-stopping, and maintenance scenarios at the same time. A properly designed facade detail clarifies the load path from glass to anchor, and from anchor to the main structure—while also safely accommodating building movements such as thermal expansion and inter-story drift.

In this article, using the shared visuals as reference, we explain step-by-step how aluminum facade system details should be created: where each layer starts, how insulation continuity is maintained, what structural logic guides bracket/anchor selection, which tolerances must be provided at glass–profile interfaces, and how to prevent the most common on-site mistakes. With the Arkistral approach, our goal is not a detail that “looks good,” but one that performs, is calculated, and can be applied on site without surprises.



1. Relationship Between the Main Structure and the Facade

The most critical topic in aluminum facade systems is how—and where—the facade elements connect to the primary structure. The facade transfers its self-weight, glass loads, wind pressure, seismic effects, and thermal expansion movements directly to the reinforced concrete or steel structure. For this reason, a facade detail must be treated as a structural scenario before it becomes an architectural drawing.

The structural relationship between the building frame and the facade is typically established through the triangle of **anchor + bracket + vertical profile (mullion)**. These three components define where, in which direction, and in what order facade loads are transferred to the building.

1.1 Load transfer logic (the path from glass to slab)

In a facade system, the load path typically works in this sequence:

- Glass dead load and wind load
- Transfer to horizontal and vertical aluminum profiles
- From profiles to anchor plates
- From anchors to the reinforced concrete slab or beams

Even a small mistake in this chain can cause loads to concentrate in the wrong component. For example, if the glass dead load is transferred directly into the vertical profile instead of being properly supported and distributed, profile deflections increase—leading over time to glass breakage and gasket deformation.

1.2 Dead loads and fixed bearing points

Dead loads (self-weight) must always be carried through clearly defined **fixed bearing points**. Typically, this is solved by:

- Fixed anchors defined at the upper slab, or
- In floor-by-floor systems, each floor having its own load-bearing anchors

A fixed bearing point carries:

- Glass and profile weights
- The total dead load of the facade system
- Compressive forces in long vertical members

If these points are not correctly defined, the facade may “creep” downward under its own weight, causing silicone joint openings, cap movement, and improper glass setting.

1.3 Lateral loads: wind and seismic effects

Wind pressure and suction are considered lateral loads in facade systems. These loads are primarily:

- Resisted by the vertical mullions
- Transferred to the structure through anchor plates

In seismic conditions, the facade must accommodate the building's movement. Therefore:

- Fixed anchors are used in limited number
- The remaining connection points are designed as **sliding**
- Thermal and structural movement allowances are provided at profile–anchor interfaces

Otherwise, during an earthquake the facade resists the frame movement and damage occurs at the weakest point (glass, gasket, fastener, or connection bolt).

1.4 Anchor type must be designed together with the detail

Anchor selection is not a decision made after the facade detail is finished. On the contrary:

- Anchor location
- Plate thickness
- Hole type (slotted / fixed)
- Chemical vs. mechanical anchor choice

must be designed simultaneously with the facade detail.

For example, in a facade with long mullions:

- Lower anchors may be designed as vertically sliding
- Upper anchors as fixed points

This way, thermal expansion and building settlement are accommodated without harming the facade.

1.5 How structural tolerances affect the facade

One of the most common on-site issues is mismatch between structural tolerances and facade assumptions. If slab edge level differences, protrusions, or irregularities are not considered in the detail:

- Anchors get overstressed
- Profile axes shift
- Glass openings are not evenly distributed
- The facade line deviates from the architectural intent

A reliable facade detail must accept real-world structural tolerances, not idealized drawings.

1.6 Arkistral approach

At Arkistral, the structure–facade relationship is not treated as a simple connection sketch. We design it as a combined logic of:
load path + movement scenario + installation sequence.

- Which anchors carry load, and which ones guide movement?
- Which points are fixed and which ones slide?

- How does the facade behave under seismic drift and temperature changes?

Without answering these questions, no facade detail is considered “complete.”



2. Aluminum Profile Sections and Structural Reading

Profiles used in aluminum facade systems are not merely frames that hold glass—they are structural members that safely carry loads from wind, seismic actions, and self-weight. Therefore, profile selection must be treated as a structural evaluation before an aesthetic choice. The correct section is

the foundation of a system that stays within deflection limits, does not overstress the glass, and maintains facade integrity for many years.

2.1 What is a profile section, and why does it matter?

A profile section—its shape, wall thickness, internal chambers, and geometry—defines its load-bearing capacity. In facade engineering, a profile must answer:

- Can it safely resist the defined wind loads?
- Is deflection under glass span within acceptable limits?
- Is there buckling risk in long vertical members?
- Does it create local stress at connection points?

A profile that cannot answer these questions is not correct—even if it looks thick.

2.2 Moment of inertia and deflection

One of the most critical structural concepts is the **second moment of area** (Ix / Iy). Simply: it defines resistance to bending.

- Higher inertia → lower deflection
- Lower inertia → easier bending

A common mistake is judging only “profile depth.” In reality, rigidity is strongly affected by:

- Number of internal chambers
- Distribution of wall thickness
- Closed-box behavior

This is why multi-chamber, box-like sections often perform far better than open, single-wall sections.

2.3 Structural roles of vertical and horizontal members

Facade profiles generally fall into two main categories:

Vertical profiles (mullions):

- Carry most of the wind load
- Transfer glass weight to anchor points
- Form the primary axis and vertical continuity

Horizontal profiles (transoms):

- Provide the bearing line for glass
- Distribute loads into mullions
- Define the module geometry

A typical mistake is treating transoms as “secondary” and selecting them too weak. Weak transoms cause uneven load distribution, increasing local stresses in mullions.

2.4 Profile length, span, and wind load relationship

Capacity depends not only on the section but also on the span. The same profile may be:

- Acceptable at 1.50 m span
- Overstressed at 2.40 m span

Therefore, profile selection must consider:

- Floor height
- Glass module size
- Wind zone and building height
- System type (capped, structural silicone, stick, unitized)

Selecting a “standard profile” without calculations is one of the most frequent sources of site problems.

2.5 Buckling and local stability risks

For long mullions, buckling risk must be evaluated—not only bending. Especially:

- Thin-walled sections
- Tall floor heights
- Systems with insufficient intermediate restraints

can be vulnerable. Solutions like internal reinforcement, stiffer sections, or floor-by-floor anchoring become part of the structural design.

2.6 Profile–anchor compatibility

If the profile section is not compatible with the anchor detail, the system will not behave as designed. Anchor plates should:

- Work close to the neutral axis when possible
- Avoid local crushing or tearing
- Distribute loads into the profile efficiently

Wrong hole placement can reduce the effective inertia and invalidate calculated performance on site.

2.7 Common site misconception: “thicker profiles solve everything”

Choosing thicker profiles instead of doing structural checks is a typical field error. Thicker profiles:

- Don’t fix wrong spans
- Don’t help when anchor logic is wrong
- Can worsen problems if loads are transferred incorrectly

Without structural reading, the system becomes heavier, not stronger.

2.8 Arkistral approach

At Arkistral, profile selection starts from the load scenario—not from catalog pages.

- Sections are checked against wind and glass loads
- Deflection and buckling limits are verified
- Anchor and installation details are validated together

The goal is not “the thickest profile,” but the **most correct working section**.



3. Thermal Insulation and Layer Continuity

In aluminum facade systems, thermal insulation is not just placing insulation boards. Real performance depends on where insulation begins, how it continues, and where it is interrupted. The key issue in facade details is not the existence of layers, but **continuous and controlled continuity** of those layers.

In a poorly designed detail, even the best insulation material cannot prevent thermal bridging.

3.1 Typical layer sequence in facade sections

A typical aluminum facade section follows this sequence:

- Exterior cladding / glazing system
- Aluminum structural profiles
- Thermal insulation layer (stone wool, glass wool, etc.)
- Vapor control / waterproofing layer
- Reinforced concrete or steel primary structure

Each layer must complete the previous one. Gaps lead not only to heat loss, but also condensation and mold.

3.2 Thermal bridges: invisible but dangerous

Thermal bridges typically occur at:

- Anchors penetrating insulation and touching structure
- Slab edges where insulation continuity is cut
- Direct profile-to-concrete contact surfaces
- Insulation installed with voids behind profiles

These zones create temperature differentials that lead to:

- Interior surface condensation
- Fogging around glazing edges
- Corrosion inside profiles
- Indoor comfort loss

3.3 Insulation selection and placement

Stone wool is widely used because it:

- Performs well in fire conditions
- Allows vapor permeability
- Maintains shape behind facade systems

But placement is as important as material. Insulation should:

- Continue uninterrupted across slab edges
- Wrap around anchor plates without gaps
- Overlap at joints to maintain continuity

Insulation that covers only flat areas while leaving anchors exposed is technically incomplete.

3.4 Vapor control and condensation management

A frequently neglected layer is vapor control. Moisture vapor moving outward can:

- Condense on cold surfaces
- Reduce insulation performance
- Cause mold and corrosion over time

Therefore, the vapor control layer should:

- Be placed on the warm side of insulation (as required by the design logic)
- Be continuous with tapes and overlaps
- Be sealed where penetrated or cut

3.5 Ventilated cavity and thermal performance

Many systems include a controlled air cavity between insulation and cladding. This cavity:

- Reduces overheating in summer
- Prevents moisture accumulation
- Improves overall energy performance

But it must be designed with ventilation inlets/outlets, fire barriers, and drainage logic—not left random.

3.6 Fire barriers and insulation continuity

Thermal continuity must not ignore fire safety. Between floors:

- Mineral wool fire barriers
- Smoke and flame stopping details
- Vertical fire stops behind the facade

must be integrated. Poorly controlled cavities can create chimney effects in fire conditions.

3.7 Common on-site insulation mistakes

Typical problems include:

- Cutting insulation at slab edges
- Leaving anchor plates exposed
- Gaps between insulation boards

- Discontinuous vapor barriers
- Skipping fire barriers

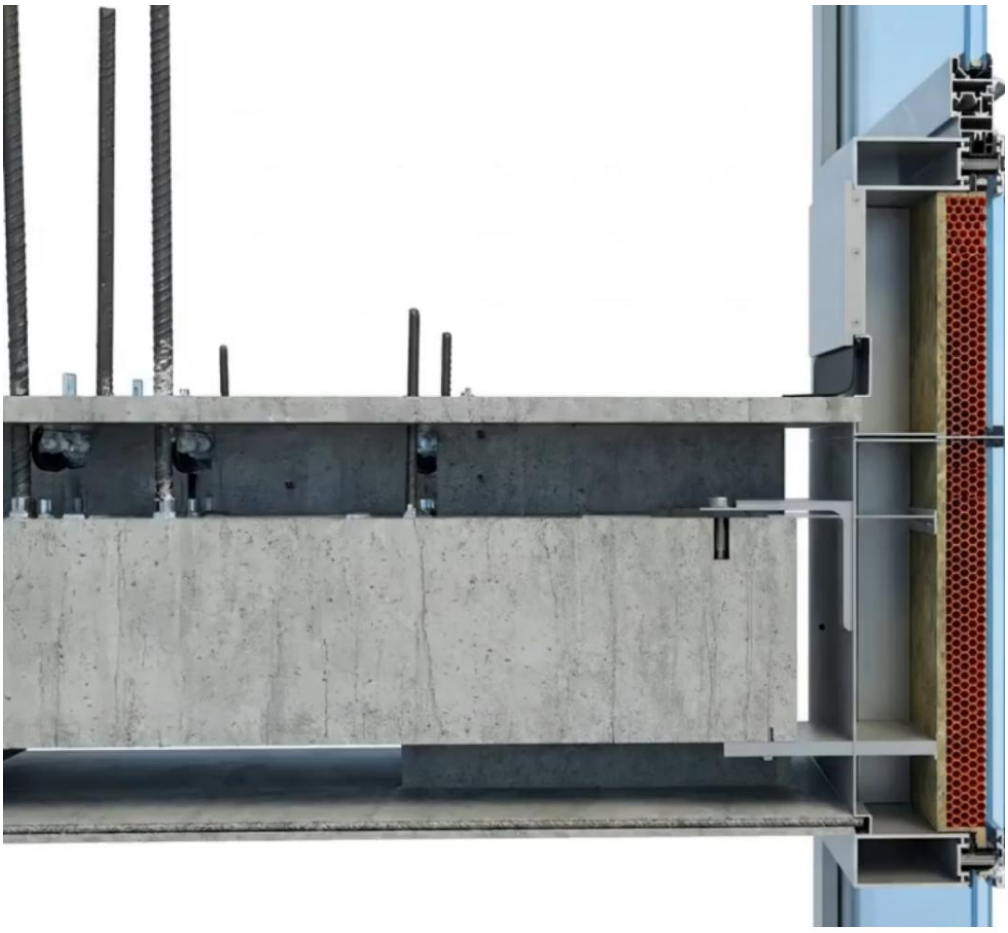
These issues often remain hidden but later appear as high energy use and comfort problems.

3.8 Arkistral approach

At Arkistral, insulation is assessed by continuity, not just thickness.

- Insulation is read continuously along the facade
- Anchors, profiles, and slab edges are solved together
- Fire, condensation, and energy performance are evaluated at the same time

The target is not only code compliance, but long-life and sustainable facade systems.



4. Glass + Facade Interaction

In aluminum facade systems, glass is not merely a transparent infill—it is an active component that directly determines system performance. Glass thickness, build-up, edge detailing, and its interface with profiles define safety, tightness, and long-term durability. This makes glass–facade interaction one of the most critical and unforgiving parts of facade detailing.

4.1 Structural role of glass in facades

Facade glazing carries or transfers:

- Dead load (self-weight)
- Wind pressure and suction
- Thermal expansion effects

But load transfer is not direct—it occurs through setting blocks, gaskets, pressure elements, and support systems. If these loads are misrouted, edge stresses increase and breakage risk rises significantly.

4.2 Glass thickness and module sizing

Glass thickness cannot be selected in isolation. It must consider:

- Glass span (width and height)
- Floor height and wind zone
- Building height
- System type (capped, silicone, stick, unitized)
- Glass build-up (single, IGU, laminated)

Wrong glass selection causes:

- Excessive deflection
- Edge pressure
- Overstressed seals
- Long-term risk of spontaneous failure

4.3 Setting blocks: the beginning of the load path

Setting blocks define the proper load path. Glass weight must be transferred through:

- Properly positioned load-bearing blocks
- Into mullions and then anchors
- From anchors into the primary structure

Common site mistakes include random block placement, using blocks with insufficient hardness, or allowing direct glass-to-aluminum contact—leading to point stresses and breakage.

4.4 Gaskets, tightness, and movement allowances

The interface between glass and aluminum is not only structural—it is also about tightness and controlled movement. A correct detail requires:

- Continuous EPDM gaskets
- Proper corner sealing
- Channels that do not over-compress the glass
- Adequate clearance for glass thermal expansion

Gaskets don't only stop water—they ensure safe glass behavior within the frame.

4.5 Special case: structural silicone glazing

In structural silicone systems, glass is bonded to the frame by structural silicone rather than mechanical fixing. This requires:

- Proper glass edge preparation
- Correct silicone geometry (width/depth)
- Controlled curing conditions
- Correct support block placement

Incorrect structural silicone application can cause facade failure and serious safety risks.

4.6 Drainage and condensation management

Facade systems are not "waterproof"—they are designed to manage water. Therefore:

- Drainage channels must remain open
- Weep holes must not be blocked
- Water must not accumulate beneath glass

Otherwise, condensation, leakage, and internal profile corrosion become unavoidable.

4.7 Common on-site glass installation mistakes

Typical issues include:

- Tight openings without tolerances
- Missing or mispositioned setting blocks
- Broken gasket continuity
- Silicone joints with incorrect dimensions
- Blocked drainage holes

These may not be visible during installation, but create major costs after occupancy.

4.8 Arkistral approach

At Arkistral, glass is not the "last installed" element—it is the first calculated component.

- Glass thickness and module sizes are defined early
- Profile sections and anchors are designed around them
- Setting blocks, gaskets, and drainage are solved as one system

The goal: a facade where glass works without stress—tight, safe, and long-lasting.

5. Ventilated Facade Logic

Ventilated facade systems are not just an alternative in aluminum facade design—they are a strategic approach for thermal control, moisture management, and building envelope durability. The principle is to create a micro-climate behind the cladding through a controlled air cavity between exterior skin and insulation. The aim is passive protection and improved facade performance.

5.1 What is a ventilated facade?

A ventilated facade has an air channel that is open at the bottom and top, between the exterior cladding (glass, ACP, ceramics, stone, etc.) and the building envelope. This channel:

- Enables natural airflow
- Reduces heat buildup
- Removes moisture and condensation

The core mechanism is the **chimney effect**.

5.2 Chimney effect and airflow principle

When solar radiation heats the facade, air in the cavity warms and rises. This draws cooler air in from the bottom and exhausts warmer air at the top. This continuous airflow:

- Prevents heat accumulation
- Keeps insulation dry
- Allows the envelope to “breathe”

But this only works with correctly designed intake and exhaust openings—random gaps do not create a true ventilated facade.

5.3 Relationship between insulation and cavity

Insulation is fixed to the structural wall and placed on the warm side of the cavity. This setup:

- Protects insulation from direct exterior exposure
- Prevents wetting and performance loss
- Significantly reduces condensation risk

The cavity becomes an active performance layer.

5.4 Sizing of the air cavity

The cavity is not arbitrary. In general:

- Minimum 30–40 mm
- Larger cavities may be required for tall buildings or dark cladding

If the cavity is too small:

- Airflow becomes weak
- Heat is trapped
- Ventilated facade logic fails

5.5 Fire safety in ventilated facades

A key risk is that the chimney effect can accelerate fire spread. Therefore, details must include:

- Fire barriers at floor levels
- Mineral wool-based horizontal and vertical fire stops
- Controlled cavity closures where needed

When properly designed, ventilated facades can meet fire safety requirements reliably.

5.6 Drainage and moisture control

The exterior cladding manages water rather than fully blocking it. Thus:

- Rainwater entering the cavity
- Condensation moisture
- Water from cleaning processes

must be drained in a controlled manner. Drain paths at the bottom must work together with insulation and fire barriers.

5.7 Common on-site mistakes in ventilated facades

Typical errors include:

- Filling the cavity with insulation
- Closing inlet/outlet openings
- Skipping fire barriers
- Blocking drainage paths
- Breaking cavity continuity

These mistakes eliminate the system's advantages and effectively turn it into a standard facade.

5.8 Arkistral approach

At Arkistral, a ventilated facade is not "a facade with a gap"—it is a system where thermal, moisture, fire, and maintenance scenarios are solved together.

- Cavity dimensions are defined and verified

- Fire barriers are integrated into the natural logic of the detail
- Insulation and drainage continuity are checked
- No hidden risks are left behind the cladding

The goal: facades that perform throughout the building's life, with low maintenance cost and high energy efficiency.

6. Common On-Site Mistakes

Despite detailed design, the most common field problems are:

- Anchors installed against the project details
- Insulation continuity cut at slab edges
- Ignoring glass installation tolerances
- Blocking drainage and discharge paths

These errors turn a facade system into not only an aesthetic risk, but also a legal and financial one.