

STEEL CURTAIN WALL GLAZING SYSTEMS

1. WHAT IS THE COST DIFFERENTIAL BETWEEN STEEL CURTAIN WALL SYSTEMS AND A REINFORCED ALUMINUM SYSTEM?

Generally speaking, given their higher performance, steel curtain wall systems have a price premium compared to standard aluminum assemblies. However, there are several material and installation factors that can help offset the greater initial cost. From a material standpoint, steel systems do not require cladding or the associated fabrication and material shipping costs. Because steel systems have fewer materials to install, installation time and labor costs can be reduced. As a comparison, in a reinforced aluminum curtain wall installation, contractors set the vertical structural steel tubes and the horizontal steel assemblies, then clad the assemblies. With SteelBuilt Curtainwall® Systems from Technical Glass Products (TGP), the structural elements are also the finished materials, so installation is more straightforward and less labor intensive.

2. WHAT FINISHES ARE AVAILABLE FOR STEEL CURTAIN WALL SYSTEMS? ARE THERE ANY SPECIAL COATINGS REQUIRED TO PREVENT CORROSION?

SteelBuilt Curtainwall Systems can be either powder- or wet-coated to match any desired color scheme, using any coating suitable for Architecturally Exposed Structural Steel (AESS). The exterior caps or interior back mullions can be made from stainless steel to match other building elements. With stainless steel, brushed and bead-blast finishes are the most common, while exotic stainless finishes such as angel hair, swirl patterns, etc. can be incorporated at a higher price.

TGP provides steel framing with high anti-corrosion protection, such as double-sided pre-galvanization, which is then top-coated with a durable primer and finish color. Gaskets help isolate water from contacting the steel components. No special coatings beyond these are required to prevent corrosion.

While field painting is an option, TGP recommends against it as factory painting helps protect the steel during transportation and installation on the jobsite.

3. ARE THERE ANY ISSUES WITH DISSIMILAR METALS WHERE ALUMINUM COVER CAPS CONNECT WITH STEEL BACKING?

Typically there is no direct contact between steel and aluminum components so galvanic action is not an issue. In SteelBuilt Curtainwall Systems, the aluminum pressure plates are connected to the steel back members only through the stainless steel pressure plate screws. Because these metals (stainless steel and aluminum, and stainless steel and carbon steel) are close proximity to each other in anodic polarity, they tend not to corrode in saltwater environments as fast as metals that are further apart on the electromotive scale. Also, if one of the metals is coated with a non-conductive paint or finish, this effectively isolates the two materials.

4. WHAT IS THE TYPICAL MAXIMUM HEIGHT ALLOWED FOR A STEEL CURTAIN WALL INSTALLATION?

The maximum height allowed depends on many aspects of the building design, but multi-story applications can readily be used. The primary factor influencing maximum height is where the dead load weight of the wall will bear on the structure. If the entire dead load can be applied to one floor, then no open-splice joints are required. If the wall is supported by multiple floors, then the live load deflection of individual floors has to be accommodated, and open splice joints will be needed in the curtain wall members (whether they are steel or aluminum). This affects the face dimensions of the system ultimately detailed. For example, the horizontal above the mullion splices will typically be at least 3-4" wide to accommodate anything more than 3/8" live load deflection. Another factor impacting the curtain wall height is thermal expansion and contraction. While steel has a lower thermal expansion coefficient than aluminum, over large distances this movement must be accommodated. The building structural engineer and frame supplier can work with the architect to address structural performance in concert with the aesthetic intent of the design.

5. WHAT ELEMENTS ARE REQUIRED FOR THE SYSTEM TO EARN A FIRE RATING?

To receive a UL fire rating, the curtain wall system components are required to be tested as an assembly. This includes the glass, exterior caps, back framing members, seals, fire-safing, etc. of the particular system configuration. The design options are more limited for fire-rated curtain walls; the shapes and details shown in most manufacturers' literature is the limit of selection available. Custom systems typically require additional testing. It is also important to note that fire-rated curtain wall must be anchored into surrounding fire-rated construction and that there are code limits on the sizes of individual glass lites. An intumescent coating is not required for fire-rated applications. Because fire-rated curtain walls have additional code requirements compared to non-rated applications, it is important to discuss your project needs early with TGP to determine what solutions are possible.

6. WHAT IS THE AVAILABILITY OF LARGE LITES OF GLASS AND WHAT IS THE GLASS FABRICATOR'S ABILITY TO ACHIEVE HIGH PERFORMANCE COATINGS ON THESE LARGE SIZES?

For SteelBuilt Curtainwall Systems, TGP is the framing supplier and the glazing must be sourced from a glass manufacturer (this differs only for fire-rated installations, where TGP supplies both glass and framing for a fire-rated system). The specific glass lite sizes will thus depend on the capabilities of those manufacturers. As a general indication, Viracon and Oldcastle, two of the larger, more recognized glass fabricators, publish 84" x 144" as the largest sizes they will produce for any of their standard fabrication, including Low-E coatings, constructing insulating glass units, laminating, etc. Other manufacturers, such as Rochester Glass, will produce larger lites, which typically must be thicker. Contact a glazing manufacturer in your area for details on what glass lite size options are available.

7. WHAT ELEMENTS ARE INCLUDED IN THE SYSTEM TO PROTECT AGAINST MOISTURE INTRUSION?

The system includes a continuous gasket across the full width of the frames, which prevents water from coming into direct contact with the steel back members. To further prevent water intrusion, the installer must seal the lapped joints at the horizontal-to-vertical connections.

SteelBuilt Curtainwall Systems are generally weeped through the sill of the verticals only. There are no zone dams in these steel systems, as is typical with aluminum pressure plate systems. This eliminates the need for the steel system to be weeped at every horizontal member.

Condensation resistance in steel systems is better than aluminum assemblies since there is no metal in the glazing pocket, as compared to aluminum systems that typically have tongues in the unheated space that can conduct heat through the wall. Heat transfer through steel is also lower than through aluminum. For an additional barrier to heat transfer, the steel system does not have metal in the cold space of the glazing pocket that is kept completely behind the air and water gasket barrier. Depending on the glass, the Condensation Resistance Factor (CRF) for steel curtain wall ranges from 40 (45 mm wide system, stainless caps, 1" IGU / clear glass) up to 63 (triple glazed Solarban 60, argon gas-filled air spaces).

8. WHAT THERMAL BREAKS ARE INCLUDED WITHIN THE STEEL CURTAIN WALL ASSEMBLY?

SteelBuilt Curtainwall Systems are thermally broken with no connectivity between the exterior pressure plates and the interior framing members, except through pressure plate screws located 9" to 12" on-center. This limits the available paths for heat transfer.

9. ARE INTERIOR WELDS VISIBLE IN A STEEL CURTAIN WALL SYSTEM?

The system's horizontal-to-vertical connections are not welded, but are typically joined with hidden shear blocks and concealed fasteners in most applications, including fire-rated curtain walls. For the profiles themselves, the rolled "standard" curtain wall profiles there are no visible welds. On the laser-welded profiles that can be used as back members with a SteelBuilt Curtainwall Infinity™ System, the welds are only visible on the inside corner of I-beams or T-profiles. Such beads are less than 1/32" in diameter and are continuous and smooth with no gaps, they are typically only visible at a very close distance. On corners of tubes or certain other shapes where a weld might be seen, if it is accessible, TGP will grind the weld smooth so it is not visible after the profile is finished.

10. WHAT IS A TYPICAL WALL EFFECTIVE U-VALUE FOR A STEEL GLAZED CURTAIN WALL?

The glass, more than the framing, is the primary driver of the overall assembly's U-value. NFRC testing is based on a standard window size. Due to the fact that a project's curtain wall glass sizes are larger in the real world application, the ratio of glass to framing is much higher, and U-values are lower than the tested specimens.

TGP's rolled profiles, under NFRC testing, have been measured as high as 0.51 $\text{btu}\cdot\text{hr}\cdot\text{F}\cdot\text{ft}^2$ with 1" IGU comprised of clear glass and non-gassed airspace, and as low as 0.19 $\text{btu}\cdot\text{hr}\cdot\text{F}\cdot\text{ft}^2$ with triple glazing, Solarban 60 clear with argon filled airspaces. The laser-welded profiles, under Therm modeling, have been calculated at 0.36 $\text{btu}\cdot\text{hr}\cdot\text{F}\cdot\text{ft}^2$ using clear glass with Viracon VE1-2M coating on #2 surface with a fully captured system. Using a laser welded profile and rolled horizontals, only structurally glazed (and not captured), resulted in a U-value of 0.39 $\text{BTU}\cdot\text{hr}\cdot\text{ft}^2\cdot\text{F}$.

11. HOW DOES EXPANSION AND CONTRACTION AFFECT CURTAIN WALLS WITH STEEL AND ALUMINUM COMPONENTS?

The steel in the SteelBuilt system is located completely on the building interior once the wall is enclosed, thus it is not exposed to the temperature range of 180° F that most specifications require for design / performance value. Although the aluminum pressure plate is on the exterior, it typically is not in direct sun given the system configuration. As a result, while some heat transfer may take place between the pressure plate and the exterior cap, the differential movement between the materials is not substantial enough to adversely impact the wall performance.

For instances in which the cap and pressure plate are made of different metals, there typically will be some differential movement between them. However, since the cap is snap-fitted onto the pressure plate, any temperature differential between the two usually allows the parts to readily slide along that fitting. An expansion joint in the cap may be required, depending on the overall length, to allow for any differential movement between them.

12. HAS THERE BEEN ANY RESEARCH ON HOW STEEL CURTAIN WALL SYSTEMS PERFORM FOR BALLISTIC BLAST RESISTANCE?

No ballistic or blast-resistance testing has been completed to date for SteelBuilt Curtainwall Systems, but in projects where analytical calculations have been done, the steel performs at an acceptable level. As an example of steel's performance, the portion of the Pentagon that came under attack on 9/11 had just completed a remodel with steel-framed windows from another manufacturer that demonstrated the effectiveness of such an installation. Once the plane penetrated the exterior wall and the jet fuel ignited, the steel windows and their glazing remained in place as designed.

13. WHAT TESTING HAS BEEN PERFORMED ON THE STEEL SYSTEMS?

SteelBuilt Curtainwall Systems have been subjected to an extensive array of tests addressing air leakage, water penetration and other factors. These include:

ASTM E283-04: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

ASTM E547-00: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Cyclic Static Air Pressure Difference

ASTM E331-00: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Air Pressure Difference

ASTM E330-02: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

The rolled profiles have undergone additional computer thermal modeling in accordance with:

NFRC 100: Procedure for Determining Fenestration Product U-Factors (2004)

NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence (2004)

14. WHAT DESIGN SUPPORT DOES TGP PROVIDE?

TGP offers a wide range of design support, including project consultation, product specifications, CAD drawings and rapid-response quoting. Our curtain wall experts are available to help size framing members, discuss aesthetic issues and options, and assist in reviewing details during any stage of the project development. Design and building professionals can access all of our BIM models through our website, tgpamerica.com.