

Unitized Curtain Wall

STARLINE
WINDOWS

Quality, Comfort & Peace of Mind



Foreword

This Design Guide provides design guidelines, manufacturing capabilities and specifications on the Unitized Curtain Wall Series with thermally broken aluminum awnings and fixed windows.

This document is intended to provide information on our standard products. Non-standard designs and applications can be reviewed to determine the feasibility on a project-specific basis.

Please email any project specific enquiries to architectural@starlinewindows.com or technical@starlinewindows.com.

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Stick-Built vs Unitized Curtain Wall

In a stick-built curtain wall system, the majority of the fabrication, glazing and assembly takes place onsite. Essentially the framing members and glass are installed piece by piece, hence the name stick built.

A unitized curtain wall system is fabricated in controlled conditions in a factory. The completed individual curtain wall modules are shipped to site and installed (hung) on the building structure thus forming the building envelope enclosure.

Starline Window Ltd. offers a unitized curtain wall system that is fabricated, assembled and glazed in our climate-controlled manufacturing facility. Thanks to the climate-controlled environment, a high level of quality and tight tolerances are achieved with Starline's unitized curtain wall system.

Another significant advantage to using the unitized curtain wall system when compared to stick-built curtain wall is the speed of installation onsite.

Recommended Size Guidelines

Starline Windows provides maximum guidelines for window module area and weight for new construction and restoration projects.

FINISHES (POWDER COAT)	MAXIMUM WIDTH (FEET)	MAXIMUM HEIGHT (FEET)	MAXIMUM AREA (SQ FT)
Meets AAMA 2603 Specification	8	15	75
Meets AAMA 2604 Specification	8	15	75
Meets AAMA 2605 Specification	8	15	75

Note:

- Limitations are guidelines and depend on site conditions.
- Horizontal coupling is not available.

For instructions and examples on how to calculate area and weight, refer to [Calculate Fixed, Combination, and Vent Window Size and Weight](#).

Diameter for Radius Windows

Starline Windows does not offer radius fixed windows for the Unitized Curtain wall.

Maximum Length of Vertical Coupler and Horizontal T-bar

Maximum length for a horizontal T-bar without a vertical coupler is 96".

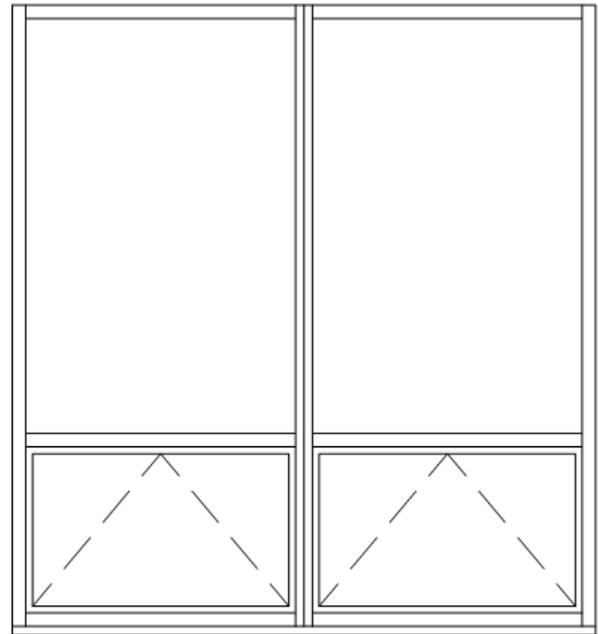
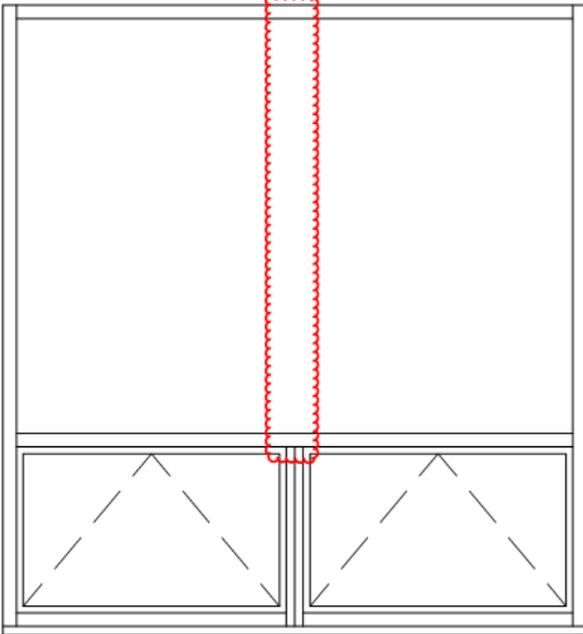
Maximum length for a vertical coupler without the use of a horizontal T-bar is 108".

For an image and further details, refer to [Maximum Area of IGU](#).

Crippled Mullions

Starline cannot manufacture windows and doors with crippled mullions/couplers. All vertical mullions/couplers and horizontal mullions within a window or door module must run full height and width of the window or door module.

VERTICAL COUPLER MUST RUN THE FULL HEIGHT OF THE WINDOW, AS SHOWN IN IMAGE ON THE RIGHT



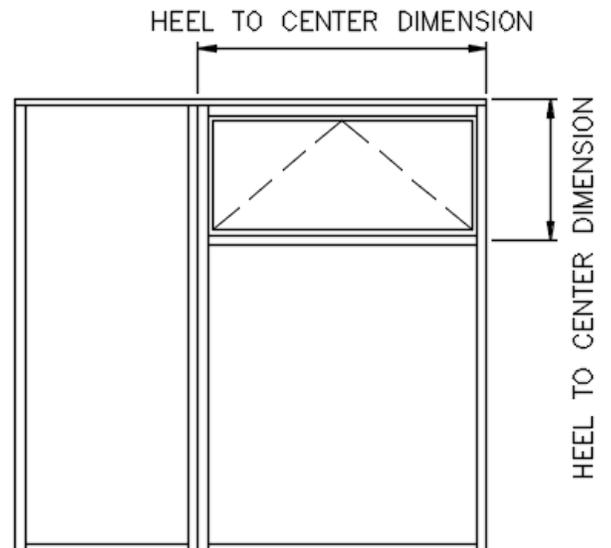
Minimum Vent Size

Sizes are based on heel to center dimensions

HARDWARE	OPERABLE VENT	WIDTH (In)	HEIGHT (In)
Multi-point	Awning	24"	20"
	Casement	N/A	N/A

Note:

- It is Starline's standard to restrict all operable vents to 4".
- Casements are not available for the Unitized Curtain Wall.



Maximum Vent Size

In order to design an operable vent that is within Starline’s recommended maximum vent size, refer to the chart below:

OPERABLE VENT	MAX. WIDTH (In)	MAX. HEIGHT (In)	MAX. AREA (SQ FT)	MAX. WEIGHT (Pounds)
AWNING 4" RESTRICTED	48	48	16.00	80

Calculating Fixed, Combination, and Vent Window Sizes

You can calculate window sizes using a calculator provided by Starline Windows or using your own calculations.

Using Starline Calculator

Starline has a maximum fixed, combination and vent window size calculator available for use.

Enter the required parameters and the calculator will advise if the window is within Starline’s recommended design guidelines (PASS) or if it exceeds a certain parameter (FAIL).

To obtain a copy of this calculator, contact technical@starlinewindows.com.

Note: This calculator is a tool to assist with the design of basic window configurations. Combination windows can be complicated and some configurations may need to be reviewed and approved by Starline’s Designers and Structural Engineer for feasibility and structural compliance.

For any type of window; fixed, combination and/or vents, there may be certain design and/or structural requirements, building code requirements, by-law requirements, etc. which require consideration and could dictate the size of the window, glass thickness, etc. Final window sizes and configurations will be confirmed during the shop drawing phase, if applicable, and/or ordering of the windows.

Using Manual Calculations

Once the fixed and/or combination window and/or vent style has been selected, along with the frame dimensions (width and height) and the glass thickness, a calculation can be performed to determine the area and weight of the window.

To calculate weight, add the glass weight based on your IGU glass thicknesses + 1 lb/ft² for the window wall framing.

Glass thickness can play a significant factor in determining how large the window can be. The thicker the glass, the heavier the IGU. When thicker glass is selected commonly the maximum weight allowed is reached prior to the maximum area allowed.

Refer to the **Typical Float Glass Weight per Thickness** chart below for weight of glass.

Typical Float Glass Weight per Thickness

GLASS LITE THICKNESS	6mm	8mm	10mm
Monolithic Glass – Weight (lb/ft ²)	3.07	4.10	5.12
Double Glazed IGU – Weight (lb/ft ²)	6.15	8.19	10.24

Maximum IGU Area Based on Glass Lite Thickness

GLASS LITE THICKNESS ¹	MAXIMUM IGU AREA		MAXIMUM WIDTH ²	MAXIMUM HEIGHT ³
	Double Glazed	Triple Glazed		
6mm and up	45 sq. ft.	40 sq. ft.	96"	108"

Note: There are minimum and maximum dimensions as well as overall IGU areas to consider for different types of glass, such as annealed, tempered, laminated, spandrel, etc. Maximum dimensions are as laid out in the above chart, regardless of the glass type.

For all other sizing information please visit the Products tab on the Vitrum Glass Groups website at: <http://www.vitrum.ca/> for the most up to date information.

Note: The following calculations are intended to provide examples on how to calculate window sizes for basic window configurations.

Combination windows can be complicated and some configurations may need to be reviewed and approved by Starline's Designers and Structural Engineer for feasibility and structural compliance. A combination window is a window that has multiple lites, and fixed or operable vents. These lites and vents are divided by T-Bar(s).

For any type of window; fixed, combination and/or vents, there may be certain design and /or structural requirements, building code requirements, by-law requirements, etc. that requires consideration and could dictate the size of the window, glass thickness, etc. Final window sizes and configurations will be confirmed during the shop drawing phase, if applicable, and/or ordering of the windows.

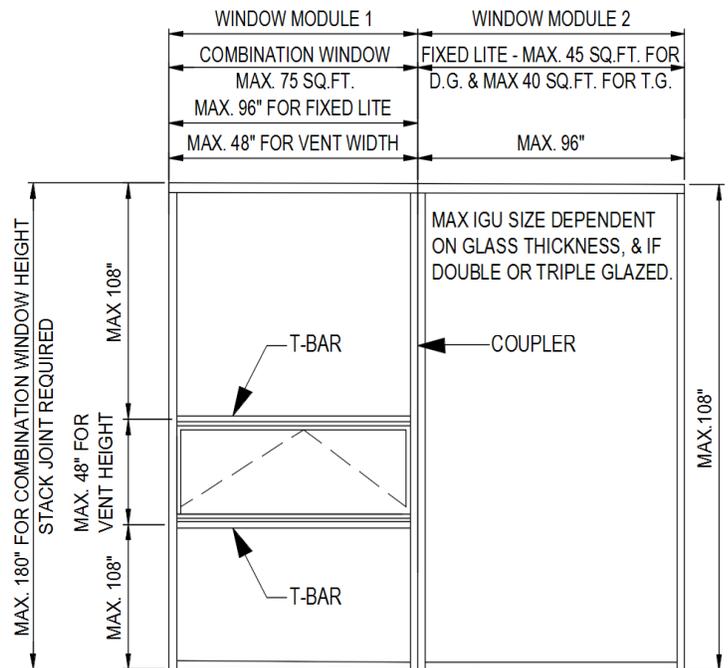
The following examples are intended to provide sample calculations for the following window configurations:

Fixed Window¹

- | | | |
|---|--|---|
| 1. Determine if fixed window is double or triple glazed. | = Double Glazed | ✓ |
| 2. Determine fixed window size ³ 60" wide x 108" tall. | $(60" \times 108") / 144" = 45 \text{ ft}^2$ | ✓ |

Awning (4" restrictor)

- | | | |
|---|--|---|
| 1. Determine awning size - 48" wide x 30" tall. | $(48" \times 30") / 144" = 10 \text{ ft}^2$ | ✓ |
| 2. Minimum 6mm glass weight required for Unitized Curtain Wall | | |
| Double glazed - 6mm / Air / 6mm | = 6.15 lbs/ft ² | ✓ |
| 3. Calculate weight per square foot (add window framing 1 lbs/ft ²) | $6.15 \text{ lbs/ft}^2 + 1 \text{ lbs/ft}^2 = 7.15 \text{ lbs/ft}^2$ | ✓ |
| 4. Calculate overall weight | $10 \text{ ft}^2 \times 7.15 \text{ lbs/ft}^2 = 71.5 \text{ lbs}$ | ✓ |



Unitized Curtain Wall Design Guidelines

Combination Window

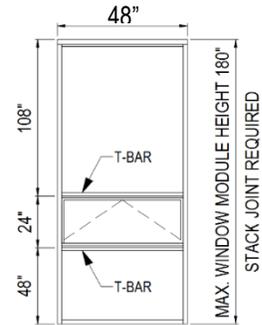
When determining the combination window overall area and weight, first ensure individual fixed lites and vent sizes are within Starline's recommended design guidelines (as demonstrated in Step 1-4).

If the fixed lite width exceeds 96", the addition of a vertical coupler is required, thus creating two separate window modules.

If the fixed lite height exceeds 108", the addition of another horizontal T-Bar is required.

The overall IGU cannot exceed 45 sq. ft. for double glazed and 40 sq. ft. for triple glazed.

- Determine combination window size¹ - 48" wide x (108+24+48") tall (48" x 180") / 144" = 60 ft² ✓



¹ Glass thickness may be required to be thicker than stated on the Maximum IGU Area Based on Glass Lite Thickness chart due to structural requirements, building code requirements, by-law requirements, etc. As an example: A glass thickness of 6mm may be selected based on the charts and it states 6mm glass can be used up to an IGU area that is 45 sq. ft. maximum, however structural requirements due to the buildings wind loading may require 8mm glass thickness to be used. 8mm glass is thicker than 6mm glass and weighs more, so the window size may need to be reduced to keep overall weight within Starline windows recommended maximum weight.

² If the width exceeds 96", the addition of a vertical coupler is required, thus creating 2 separate window modules.

³ If the height exceeds 108", the addition of a horizontal T-Bar is required, thus creating a combination window. Refer to Example #3 if the window has become a combination window.

Egress Requirements in Bedrooms

Note: The Curtain Wall Series should not be selected if there are window egress requirements.

Starline Windows does not consider awnings for use for egress. Starline's 9000 and 9003 Window Wall Series may be selected for egress as casement windows are offered. Please refer to the 9000 and 9003 product catalogues should egress be required.

Window Hardware

The standard handle for the Series 9000SSG Hybrid Wall and Unitized Curtain Wall awning windows is a die cast aluminum Cremone handle.

1 handle is included per awning window.

This handle has a 180-degree rotation and the windows locks into place when the handle is in the open and closed position.

It is fitted with 2 multipoint sliders at the bottom underside of the awning, that engages or disengages the multipoint locking system when the handle is closed or opened.

The handle is available in black, white, and silver.

The operable vent will be restricted to 4".



Insulation

The standard Series 9000 SSG insulation is as follows:

- R-Matte plus 3 rigid foam plastic insulation, or equivalent is the standard insulation for aluminum and galvanized steel sandwich panel applications. The overall insulation thickness for sandwich panel is 1" in a double glazed unit and 1 1/4" in a triple glazed unit.
- Rockwool Fabrock 30 and / or Rockwool Fabrock LT mineral wool fibre insulation, or equivalent, with an overall thickness of 3" for spandrel glass, aluminum panel and galvanized panel application. The R-value/inch @ 75°F is 4.1 hr.ft².F/Btu.

The insulation will be installed as follows:

- The deflection header clip, seismic jambs and couplers will be insulated onsite.
- The corner posts (except seismic pocket), jambs and heads will be insulated in the factory.
- The sill cannot be insulated due to wicking concerns.

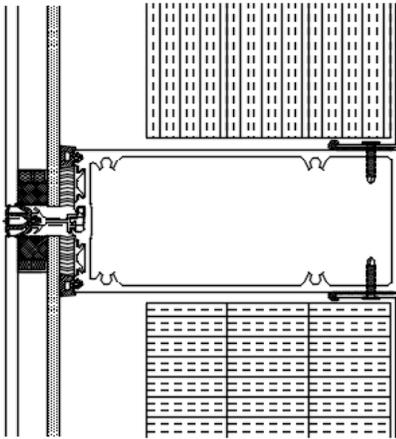
Unitized Curtain Wall Design Guidelines

Exterior and Interior Material for Opaque Areas¹

The following standard exterior and interior material combinations are available for opaque areas:

- Spandrel insulated glass unit (IGU)¹ on exterior with either aluminum panel or galvanized panel on interior
- Sandwich panel² on exterior with either aluminum panel or galvanized panel on interior.

SSG T-BAR



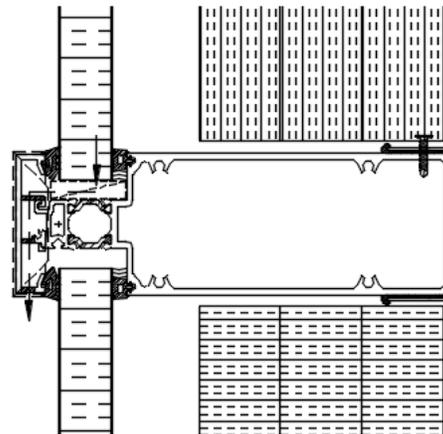
ABOVE T-BAR:

- EXTERIOR: SPANDREL IGU
- INTERIOR: ALUMINUM BACK PAN

BELOW T-BAR:

- EXTERIOR: SPANDREL IGU
- INTERIOR: GALVANIZED BACK PAN

CAPTURED T-BAR



ABOVE T-BAR:

- EXTERIOR: SANDWICH PANEL
- INTERIOR: ALUMINUM BACK PAN

BELOW T-BAR:

- EXTERIOR: SANDWICH PANEL
- INTERIOR: GALVANIZED BACK PAN

Refer to the ***Metal Panel & Spandrel Glass Design Guidelines*** document in the **Miscellaneous** section of the catalogue for further information.

¹ If a spandrel IGU is used in **any** SSG application the use of ceramic frit is required. SSG applications do not allow the use of opaci-coated spandrel glass. All spandrel glass must be tempered.

² Sandwich panels are required to be captured on a minimum of two sides.

Grilles

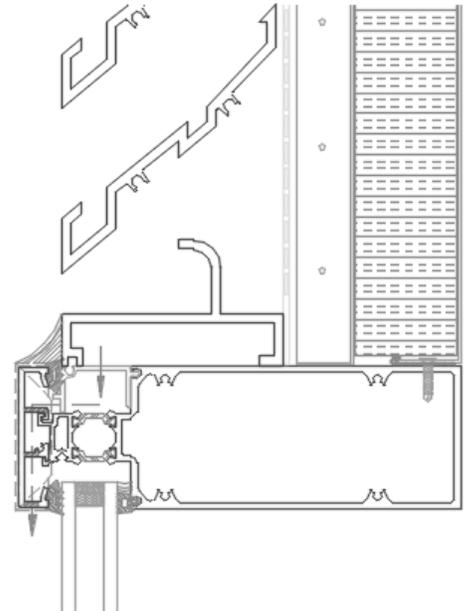
Grilles stay in a stationary position and are manufactured by Starline.

Starline does not provide the flappers (which move), these are typically done by the mechanical trade. Starline Windows does not control, nor take responsibility for how well the flappers seal.

The grille can be placed above or below the slab and can be used in conjunction with any of the various bypass panel options at the slab

Starline does not offer a rated grille with respects to air infiltration and exfiltration or water penetration resistance.

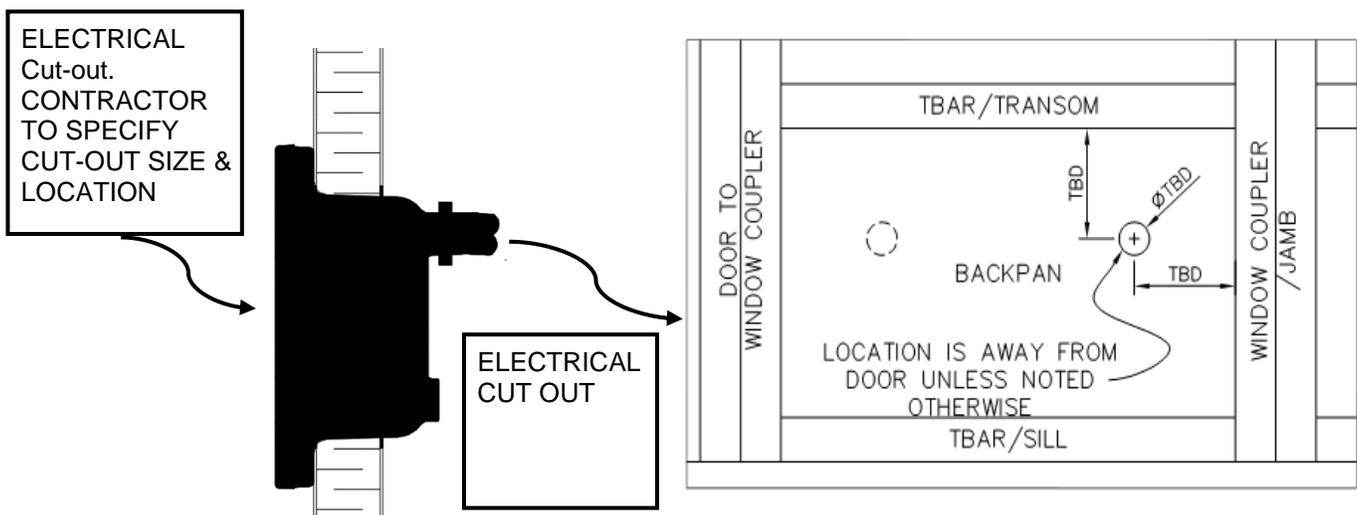
Maximum width of 36" and maximum area of 10 sq. ft. overall are the recommended size guidelines for grilles.



Electrical, Mechanical, and other Penetrations

Electrical, mechanical and other cut-outs can be made in sandwich panels and aluminum or top hat panels. Cut-outs cannot be made into spandrel glass. It is Starline's recommendation that a top hat panel is used for all penetrations where possible.

If the cut outs are shown on Starline's approved shop drawings, Starline will manufacturer the cut outs in the factory. If the cut outs are not shown on the shop drawings the specific trade will be required to make the cut-out in the field (on site). The specific trade that requires the cut out will be responsible for making the cut-out air and water tight (collars, fittings, sealant, etc.) and are to provide a localized warranty at the cut-out.



Finishes (Powder Coating)

Starline uses a thermoset coating specifically designed for architectural systems. This coating complies with the American Architectural Manufacturers Association (AAMA) 2603 specification standard which covers pigmented organic coatings on aluminum extrusions.

There are options to upgrade the powder to meet the AAMA 2604 or AAMA 2605 specification on the exterior which is noted in the **Options** section below.

Options

There is an option to upgrade the powder coating to meet a the following AAMA standards:

- A thermoset super durable coating which complies with the AAMA 2604 specification standards. The AAMA 2604 standard demands advanced levels of weather resistance, gloss and colour retention, and corrosion resistance, among other increased standards when compared to the AAMA 2603 specification standard.
- A thermoset fluorocarbon coating which is a superior coating that complies with the AAMA 2605 specification standard. The AAMA 2605 standard demands advanced levels of weather resistance, gloss and colour retention, and corrosion resistance, among other increased standards when compared to the AAMA 2603 and AAMA 2604 specification standards.

Note: AAMA 2604 or AAMA 2605 specification standard on exterior of frames may be required in some building codes, bylaws, jurisdictions, etc.

Semi-standard colours are available.

Custom colours may be available on a project-specific basis.

Dual frame colour is available.

Items listed in this **Options** section are available at an additional cost.

Color Options

The following **standard colours** are available in AAMA 2603, AAMA 2604 and AAMA 2605 specification standards:

White Black Brown Silver¹ Grey

¹Silver is available for an additional cost.

The following **semi-standard colours** are available in AAMA 2603, AAMA 2604 and AAMA 2605 specification standards:

Graphite Grey Grey Velvet Iron Mountain Grey Metal Shavings Grey Beige
Kendall Charcoal Black Charcoal

Note: Semi-standard colours are available for an additional cost and may require up to a 4-week lead time.

Custom colours are also available. Virtually any colour can be matched or very closely matched. The scope of work and overall custom colour quantity will be reviewed by Starline on a project specific basis to determine the feasibility of the custom colour request.

Note: Custom colours are available for an additional cost premium. An approximate 12-week lead time is required to procure custom colour requests.

Refer to the **Aluminum Finishes (Powder Coating)** document in the Miscellaneous section of the catalogue for images of the standard and semi-standard colours available, a comparison of some attributes which are tested for in the AAMA 2603, AAMA 2604 and AAMA 2605 specification standards, information on colour retention, and details to consider when selecting colours.

Glazing

Starline Windows standard insulated glass unit (IGU) will be comprised of the following glass make-up:

- Double glazed, double sealed IGU with an overall thickness of 1" (25 mm).
- Standard high performance soft coat (sputtered) Low E which is applied to surface #2.
- Spacer Bar
 - If glass is SSG for any framing member, an aluminum spacer bar is used.
 - If glass is captured on all 4 sides a black warm edge spacer is used.
- Minimum glass thickness is 6mm.

OPTION - There is an option to upgrade to a triple glazed IGU, which will provide enhanced energy performance. The triple glazed IGU will be comprised of the following glass make-up:

- Triple glazing, double seal insulated glass unit with an overall thickness of 1 13/16" (45 mm).
- Standard high performance soft coat (sputtered) Low E which is applied to surface #2.
- Spacer Bar
 - If glass is SSG for any framing member an aluminum spacer bar is used.
 - If glass is captured on all 4 sides a black warm edge spacer is used.
- Minimum glass thickness is 6mm.

Additional options are available for an additional cost.

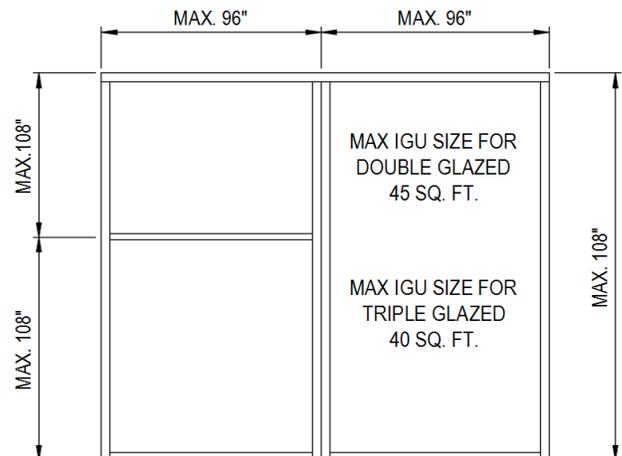
Maximum area of IGU

The maximum area for an individual IGU is 45 square feet for double glazed and 40 square feet for triple glazed using any type of glazing which is available for this product series.^{1,2}

When determining the size of the IGU, it is important to keep in mind the maximum length allowable for the vertical coupler and horizontal T-Bar, as these lengths can drive the overall dimensions and size of the IGU.

Maximum length for a vertical coupler without the use of a horizontal T-bar is 108".

Maximum length for a horizontal T-bar without a vertical coupler is 96".



¹ Laminated glass is not available for SSG applications

² If a spandrel IGU is used in **any** SSG application the use of ceramic frit is required. SSG applications do not allow the use of opaci-coated spandrel glass. All spandrel glass must be tempered.

Aspect Ratio of Glass

The maximum width to height ratio is 5:1 for any glass selected, less single lite spandrel glass which is 8:1.

Captured vs SSG Glass Placement

The glass for the Unitized Curtain Wall series can be positioned in 2 different locations within the frame. Either on the outermost face (SSG) or recessed 13/16" back from outer most face (Beaded/Captured).

The following bullet points provide which window wall framing members are Captured, SSG or can be Captured or SSG. This is as per Starline's recommended design guidelines. The placement of the glass can be reviewed on a project specific basis.

- The glass is always captured at the head, jambs, sill, T-bar, and stack joint locations.
- The glass can be either Captured or SSG at the mullion and couplers.
- The glass is always SSG for all 4 sides of the awning window and exterior glass corner conditions.

Option: To have the horizontals captured directly above and below the awning windows.

IGU Chart

CURTAIN WALL DOUBLE GLAZED IGU: 25mm Overall thickness of primary seal (Butyl): 0.8mm

EXTERIOR		SPACER		INTERIOR	
mm	inch	mm	inch	mm	inch
6	1/4	12.6	1/2	6	1/4
6	1/4	12.6	1/2	6LAM .030	1/4 .030
6LAM .030	1/4 .030	12.6	1/2	6LAM .030	1/4 .030

CURTAIN WALL TRIPLE GLAZED IGU: 45mm Overall thickness of primary seal (Butyl): 0.8mm

EXTERIOR		SPACER		CENTRE		SPACER		INTERIOR	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
6	1/4	13.6	9/16	6	1/4	13.6	9/16	6	1/4
6	1/4	13.6	9/16	6	1/4	13.6	9/16	6LAM .030	1/4 .030
6LAM .030	1/4 .030	12.6	1/2	6	1/4	12.6	1/2	6LAM .030	1/4 .030

Note: The IGU, glass thickness and spacer bar size are based on nominal dimension. Actual dimensions will vary slightly.

There are other glass make-up combinations available other than noted in the above chart. Charts purpose is to provide a few examples. There are various other combinations available that can be reviewed on a project specific basis.

Acoustical Ratings

25mm double glazed IGU

GLASS EXT.	GAP	GLASS INT.	TEST NUMBER	STC	OITC
6mm Ann.	15mm AIR	6mm Ann.	TL7223	35	29
6mm Ann.	12mm AIR	8mm Ann.	TL7222	37	32
6mm Ann.	10mm AIR	10mm Ann.	TL7221	37	33

Clear Openings

As Starline Windows Ltd and Starline Windows USA LLC does not consider awnings for egress and no casements are available for the Unitized Curtain Wall, clear opening diagrams have not been provided.

The Unitized Curtain Wall should not be selected if there are window egress requirements.

Starline's Series 9000, 9003 & 9100R Window Wall may be selected for egress as casement windows are offered.

Please refer to the Series 9000 Window Wall catalogue should egress and clear opening diagrams be required.

Product Specification 08 44 13 – Glazed Unitized Aluminum Window Wall



Note: Bolded text in this specification are options that are highlighted for the specifier to select or to list requirements.

Part 1 - General

A high-quality thermally broken aluminum unitized curtain wall system.

The glass will be captured at the head, sill and stack joint locations.

The glass will be **captured and/or SSG** at the mullion, coupler and T-bar locations.

The glass is always SSG for all 4 sides of the awning window ¹ and exterior glass corner conditions.

¹ Note to specifier: Option to capture horizontals directly above and below awning window. Refer to [2.7.F](#) for this option.

1.1 Summary

A. Section Includes: Glazed Unitized Aluminum Curtain Wall:

1. Aluminum Curtain Wall system shall be Starline Unitized Curtain Wall series manufactured by Starline Windows with **fixed glazing and / or awning operable vents**.
2. Work included: Furnish labor, material and other services to complete the fabrication and installation of the windows, including all materials and fitments required for the operation of the units in the manner, direction and performance shown on the shop drawings and specified herein.

Work not included: Structural support of window framing, interior trims. (**Specifier list others**).

Related work specified elsewhere: (**Specifier to list**).

B. Related Sections: (**Specifier to select the following related sections**)

1. 07 27 00 – Air Barriers
2. 07 60 00 – Flashing and Trim
3. 07 92 00 – Joint Sealants
4. 08 13 16 – Aluminum Doors (Outswing Aluminum Framed Glass Door)
5. 08 32 13 – Sliding Aluminum-Framed Glass Door
6. 08 46 13 – Glazed Aluminum Curtain Wall
7. 08 51 13 – Aluminum Windows
8. 08 80 00 – Glazing

1.2 Quality Assurance

- A. Drawings and specifications for Work of this Section are based upon the Unitized Curtain Wall Series manufactured by Starline Windows. Whenever alternative products are offered, submit supporting technical literature, samples, drawings and performance data for comparison 10 days prior to closing date. Test reports must be made available on request.
- B. Unitized Curtain Wall Series shall be tested and conform to the ASTM and AAMA specification.
- C. Manufacturer Qualifications:
 - 1. Manufacturer to have a minimum 10 years of documented experience.
 - 2. Manufacturer capable of providing an aluminum window system that meet or exceed the performance requirements indicated.
 - 3. Manufacturer capable of providing field representation during window installation.
- D. Installer Qualifications: Installer performing the Work in this Section to have a minimum of 3 years documented experience and approved by the manufacturer.
- E. Mock-Up: If requested by Consultant, a mock up is to be provided and installed at project site. Mock-up to include acceptable products and manufacturer approved installation methods. Obtain Owner's and Consultant's acceptance of finish color, and workmanship standard.

1.3 Structural requirements

- A. Structural performance shall be based on CSA Standard CSA S157-05 "Strength Design in Aluminum".
- B. Limit mullion deflection to L/175.
- C. Allow for deflection of building structure. Aluminum window frames with a head deflection channel and seismic compensation channel shall be designed, fabricated and installed to withstand slab edge vertical differential deflections of maximum 3/4"¹ and seismic inter-story lateral drift movements of elastic +/- 3/4"¹ without significant damage to the fenestration system or in-elastic +/- 2 1/2"¹ with significant damage expected but framing to be designed to remain anchored to the structure.

¹ Note to specifier: Values may change based on the configuration of the windows. Values to be specified by a Professional Engineer.

1.4 Test and Performance Requirements

Specifier to select from the following performance requirements.

- A. Fixed window wall shall meet performance class PG50¹:
 - 1. Air Infiltration: Fixed window air infiltration shall not exceed 0.01 cfm/ft² (A3) when tested in accordance with ASTM E 283 with a pressure difference of 6.24 psf / 300 Pa.
 - 2. Water Penetration Resistance:
 - i. There shall be no water infiltration for fixed windows when tested in accordance with ASTM E547 with a pressure difference of 15.04 psf / 720 Pa (Laboratory Test).
 - ii. There shall be no water infiltration for fixed windows when tested in accordance with AAMA 502-08 with a pressure difference up to a maximum of 10.4 psf / 500 Pa (Field Test) ²
 - iii. During a 15 minute test period, the collection of up to 15 cubic centimeters / 0.5 fluid ounces on top of an interior stop, stool or pan flashing which is integral to the curtain wall system shall not be considered water leakage.

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3. Uniform Load Deflection Test: The deflection of fixed window shall not exceed $L/175$ and there shall be no permanent set when tested in accordance with ASTM E330 with a design pressure of 50 psf / 2400 Pa, positive and negative.
4. Uniform Load Structural Test: There shall be no damage to hardware, accessories, fasteners, or any other damage that would render the window inoperable when tested in accordance with ASTM E330 with a structural test pressure of 75.19 psf / 3600 Pa, positive and negative.
5. Forced Entry Resistance: Fixed window shall meet grade 20 when tested to ASTM F588.
6. Thermal Performance³
 - i. U-value: The maximum fixed window thermal transmittance U-value shall be 0.36 BTU/ hr*ft²*°F (2.02 W/m²*k) when tested in accordance with AAMA 1503.1 and CAN/CSA-A440.2. Door shall be tested and labeled to N.F.R.C. standard 100 & 200.
 - ii. Solar Heat Gain Coefficient: A (**maximum or minimum**) of 0.34.
 - iii. Visible Light Transmittance: A (**maximum or minimum**) of 0.60.
- B. Awning window (ventilator) shall meet performance class **CW-PG50**¹:
 1. Air Infiltration: Awning window air infiltration shall not exceed 0.01 cfm/ft² (A3) when tested in accordance with ASTM E 283 with a pressure difference of 6.24 psf / 300 Pa.
 2. Water Penetration Resistance:
 - i. There shall be no water infiltration for fixed windows when tested in accordance with ASTM E547 with a pressure difference of 15.04 psf / 720 Pa (Laboratory Test).
 - ii. There shall be no water infiltration for fixed windows when tested in accordance with AAMA 502-08 with a pressure difference up to a maximum of 10.4 psf / 500 Pa (Field Test)²
 - iii. During a 15 minute test period, the collection of up to 15 cubic centimeters / 0.5 fluid ounces on top of an interior stop, stool or pan flashing which is integral to the curtain wall system shall not be considered water leakage.
 3. Uniform Load Deflection Test: The deflection of awning window shall not exceed $L/175$ and there shall be no permanent set when tested in accordance with ASTM E330 with a design pressure of 50 psf / 2400 Pa, positive and negative.
 4. Uniform Load Structural Test: There shall be no damage to hardware, accessories, fasteners, or any other damage that would render the window in operable when tested in accordance with ASTM E330 with a structural test pressure of 75.19 psf / 3600 Pa, positive and negative.
 5. Forced Entry Resistance: Operable window shall meet grade 20 when tested to ASTM F588.
 6. Awning windows shall meet performance criteria for Operating Force and Force to latch when tested to ASTM E2068.
 7. Thermal Performance³
 - i. U-value: The maximum awning window thermal transmittance U-value shall be 0.41 BTU/ hr*ft²*°F (2.35 W/m²*k) when tested in accordance with AAMA 1503.1 and CAN/CSA-A440.2. Door shall be tested and labeled to N.F.R.C. standard 100 & 200.
 - ii. Solar Heat Gain Coefficient: A **maximum or minimum** of 0.30.
 - iii. Visible Light Transmittance: A **maximum or minimum** of 0.52.

¹ Note to specifier: Performance class result is based on lab testing and will vary by configuration and glass type. Contact Starline Windows for information on how the product can be engineered to achieve higher performance class than specified above.

² Note to specifier: 500Pa / 10.4 psf is the maximum field test result that can be achieved. Should the Project Specifications state a water penetration resistance field test pressure of a lesser value, the project specified values shall govern. The water penetration resistance field tests follow the criteria and testing procedures as outlined in the AAMA 502-08 specification standard.

³ Note to specifier: Thermal performance depends on glass specified. For double glazed values the above test was performed using 25mm double glazed insulated glass unit (6mm/Air/6mm) with Standard high performance soft coat (sputtered) Low E which is applied to surface #2, air filled with aluminum spacer bar. Please note: A second low E coating can be applied to surface #4 to further increase the thermal performance. The NFRC test sizes were 79" x 79" (2000mm x 2000mm) for fixed curtain wall and 59" x 24" (1500mm x 600mm) for an awning window.

1.5 Submittals

- A. Product Data: Submit complete product data on system being used.
- B. Shop Drawings: Submit complete shop drawings which include floor plans, elevations, window schedule, and product components including anchorage, fasteners, accessories and finish colour.
- C. Samples: Submit glass and frame colour(s) samples.
- D. Close-out Submittals:
 - 1. Warranty: Submit executed Manufacturer's warranty which provides a guarantee for the complete installation provided under this section against defective material and workmanship which appears within a period of two years from the date of substantial completion.
 - 2. Project Record Documents: Submit operation and maintenance data for installed product in accordance with General Conditions

1.6 Project Conditions

- A. Field Measurements: Verify actual measurements / openings by field measurements prior to fabrication, until it is agreed upon in writing between the Window Manufacturer and the General Contractor that floors become "typical". Once typical the windows can be ordered off the previous field measurements.
- B. Indicate field measurements on shop drawings.

Part 2 – Products

2.1 Manufacturers

- A. Acceptable Manufacturers: Starline Windows
 - 1. Glazed Aluminum Curtain Wall: Unitized Aluminum Curtain Wall
- B. Substitutions: Approved alternates

2.2 Material

- A. Aluminum Extrusion: Frame member and intermediate bars are extruded from aluminum sections of 6063 alloy, T5 temper with a minimum thickness of 0.064".
- B. Fasteners: Stainless steel and of sufficient size and quantity to perform their intended function.
- C. Glazing Gaskets: Silicone.
- D. Exterior Glazing Tape (used only at operable vent): Tremco Polyshim II
- E. Two Part Structural Glazed Silicone: DOWSIL 983

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- F. Glass Setting Blocks & Edge Blocks: Silicone with an 80 to 90 ± Shore A durometer hardness. Block material shall be compatible with sealed unit edge sealant.
- G. Glazing bead (at required locations): Extruded aluminum and glazed from the exterior.
- H. Thermal break (at required locations): Polyamide.

2.3 Fabrication

- A. Fabricate framing from extrusions of size and shape shown on shop drawings.
- B. Interior and exterior extruded aluminum framing sections shall be integrated with a Polyamide thermal break to form a rigid composite assembly without the use of fasteners or other thermal bridging elements. Dry shrinkage of polyamide thermal break shall not exceed 0.10% of the framing member length.
- C. Main framing extrusions shall be butt corner construction.
- D. Operable sash (ventilator) extrusions shall be mitre corner construction.
- E. All framing profiles shall be straight and free of deformations and defects.
- F. Joints shall be accurately machined, fitted and sealed.
- G. Coupling mullions shall be designed to provide a functional split to permit modular construction and allow for thermal expansion.
- H. Framing Members shall have a minimum wall thickness of .064" (1.60mm) and be thermally broken.
 - 1. Captured glazed members (less awning window) shall be 8" deep (includes glass).
 - 2. SSG glazed members (less awning window) shall be 7 1/4" deep (includes glass).
 - 3. Awning window shall be 4 1/16" deep (includes glass depth).
- I. All frame corners are mechanically joined by stainless steel screws.
- J. All interior joints and interior screw heads shall be sealed with a non-hardening sealant.
- K. All glazing pockets shall be vented, pressure equalized, and drained to the outside.
- L. Glass bead shall be aluminum.
- M. Continuous structural silicone.

2.4 Glazing¹

- A. Double glazed, double seal insulated glass unit with an overall thickness of 1" (25 mm).
- B. Standard high-performance soft coat (sputtered) Low E applied to surface #2.
- C. Aluminum spacer with argon fill.
- D. Glass thickness shall be 6mm. Glass thickness and quality shall conform to the requirements of the U.S.A. and Canadian Code for commercial construction, current edition.
- E. Where practical, glazing shall be installed at the factory before shipping to site.

¹ Note to specifier: Glazing noted above is based on Starline Windows standard product offering. There are various other options available. See [2.7.A.](#) of this specification.

2.5 Hardware¹

- A. Hardware for the aluminum operable sash (ventilator) and window frames shall be furnished by the window manufacturer.
- B. Where practical, all hardware fittings shall be installed at the factory before shipping to site.
- C. Handle is a die cast aluminum cremone right hand handle complete with two multipoint sliders located at the bottom of the awning. Handle available in black, white, and silver.
- D. Operable vent restricted to 4”.

2.6 Finishes (Powder Coating)

- A. All exposed surfaces of aluminum door and framing members shall be free of scratches and other serious surface blemishes.
- B. Finishes¹.
 - 1. **Thermoset coating specifically designed for architectural systems. Coating to comply with AAMA 2603 specification and / or**
 - 2. **Upgrade to a thermoset super durable coating which complies with the AAMA 2604 specification standards. The AAMA 2604 standard demands advanced levels of weather resistance, gloss and colour retention, and corrosion resistance, among other increased standards when compared to the AAMA 2603 specification standard.**
 - 3. **Upgrade to a thermoset fluorocarbon coating which is a superior coating that complies with the AAMA 2605 specification standard. The AAMA 2605 standard demands advanced levels of weather resistance, gloss and colour retention, and corrosion resistance, among other increased standards when compared to the AAMA 2603 and AAMA 2604 specification standards.**
- C. Colour Options².
 - 1. Standard colours are as follows. **(Specifier to select from the standard colour(s) listed below). These standard colours are available in the AAMA 2603, AAMA 2604 and AAMA 2605 specification.**

White	Black	Brown	Silver³	Charcoal Grey
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 - 2. Semi-standard colours⁴ are as follows. **(Specifier to select from the semi-standard colour(s) listed below). These semi-standard colours are available in the AAMA 2603, AAMA 2604 and AAMA 2605 specification.**

Graphite Grey	Grey Velvet	Iron Mountain Grey	Metal Shavings Grey
Black Charcoal	Kendall Charcoal	Beige	

¹ Note to Specifier: Select 2.6.B.1 and/or 2.6.B.2 and/or 2.6.B.3. Option to have dual frame colour and / or AAMA 2603 coating on interior and AAMA 2604 or AAMA 2605 coating on exterior is available, if standard and / or semi-standard and / or custom colour is selected. Refer to [2.7.F.1](#) of this specification. AAMA 2604 or AAMA 2605 specification standard on exterior of frames may be required in some building codes, bylaws, jurisdictions, etc.

² Note to Specifier: Refer to [2.7.F.2](#) of this specification for Custom Colours.

³ Note to Specifier: Silver is available for an additional cost.

⁴ Note to Specifier: Semi-standard colours are available for an additional cost. May require up to a 4-week lead time.

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2.7 Optional Items

Specifier to select from the following options

- A. Glazing
 - 1. 6mm and greater thickness available. (**Specifier to select glass thickness required**)
 - 2. Tinted, obscured & reflective glass
 - 3. Spandrel glass
 - 4. Laminated glass
- B. Sandwich panels.
- C. Corner conditions
 - 1. 90° exterior corner
 - 2. 270° interior corner
- D. Grill.
- E. Capture horizontals directly above and below awning window(s).
- F. Finishes (Powder Coating)
 - 1. Dual frame color – 1 color on exterior and 1 color on interior (refer to [2.6.C](#) for color options)
 - i. Finish to comply with AAMA 2603 standard on both interior and exterior.
 - ii. Finish to comply with AAMA 2604 standard on both interior and exterior.
 - iii. Finish to comply with AAMA 2605 standard on both interior and exterior.
 - iv. Finishes to comply with AAMA 2603 standard on interior and AAMA 2604 standard on exterior.
 - v. Finishes to comply with AAMA 2603 standard on interior and AAMA 2605 standard on exterior.
 - 2. Custom colours¹. (**Specifier to state custom colour**) Virtually any colour can be matched or very closely matched. The scope of work and overall custom colour quantity will be reviewed by Starline on a project specific basis to determine the feasibility of the custom colour request.

¹ Note to Specifier: Custom colours are available for an additional cost premium. An approximate 12-week lead time is required to procure custom colour requests.

Part 3 - Execution

3.1 Examination

- A. Installer to examine openings, structural support, substrates and any other conditions that would affect the installation, for compliance with manufacturer's instructions.
- B. Verify rough opening dimensions.
- C. Verify sill is within tolerance of levelness to ensure adequate shimming to obtain proper drainage.

3.2 Installation

- A. Install manufacturer's system in accordance with manufacturer's approved shop drawings.
- B. Windows shall be installed and adjusted by experienced personnel in accordance with the manufacturer instructions and approved shop drawings.
- C. All items in this section shall be set in their correct location and shall be set level, square, plumb and at proper elevations and in alignment with other work.
- D. The windows are installed at site with a maximum variance to plumb of +/- 0.25%. (+/- 1/4" / 96").

3.3 Field Quality and Control

- A. Manufacturer's Field Services: Upon Owner and/or Consultants written request, provide manufacturer's field service representative for site visit to inspect installation and to ensure accordance with manufacturer's instruction and approved shop drawings.
- B. Field Tests: Owner and/or Consultant may choose to conduct tests for water penetration and air infiltration.
 - 1. Testing Standard per AAMA 502.
 - 2. Field testing shall be performed by a qualified independent testing agency.
 - 3. Field testing should not occur until the window has been installed and the caulking is cured. Ensure the products used to complete the building envelope tie in (membrane, caulking, flashing, cladding, etc.) are installed complete and have cured.

3.4 Protection and Cleaning

- A. Protection:
 - 1. Windows shall be protected with blue poly during and after installation until acceptance by the General Contractor. Thereafter, it shall be the responsibility of the General Contractor to protect the installed product from construction damage.
 - 2. Windows shall be isolated from concrete, mortar, plaster and dissimilar metals with bituminous paint or other isolation coatings.
- B. Cleaning: It shall be the responsibility of the General Contractor to maintain protection and provide final cleaning.

Note: This specification is intended to be used by a qualified Specifier and will require modifications for the project specific requirements. This specification is not intended to be use verbatim as the project specific specification.

Laws, building and safety codes governing the design and use of this product vary widely. Starline Windows does not control the selection and use of this product and assumes no responsibility therefor.

UCW NFRC Product Energy Chart

DOUBLE GLAZED (27mm IGU)	GLAZING (Ext/Gap/Int)	U VALUE (W/M ² k)	U VALUE (Btu/hft ² F)	Shading Coefficient	Solar Heat Gain Coefficient	Visible Light Transmittance	CPD (Certified Product Directory)
Center of Glass (COG)	6mm AG43* (#2) / 6mm Clear	1.50	0.27	0.35	0.31	0.43	
	6mm SB60 (#2) / 6mm Clear	1.43	0.25	0.44	0.38	0.70	
	6mm SN68 (#2) / 6mm Clear	1.44	0.25	0.43	0.37	0.67	
	6mm SNX51/23* (#2) / 6mm Clear	1.40	0.25	0.26	0.22	0.51	
	6mm SNX62/27* (#2) / 6mm Clear	1.40	0.25	0.30	0.26	0.61	
	6mm SN68 (#2) / 6mm IS20* (#4)	1.19	0.21	0.41	0.36	0.66	
Fixed Window	6mm AG43* (#2) / 6mm Clear	2.07	0.36	0.33	0.29	0.38	STL-A-27-00069-00001
	6mm SB60 (#2) / 6mm Clear	2.00	0.35	0.41	0.36	0.63	STL-A-27-00071-00001
	6mm SN68 (#2) / 6mm Clear	2.02	0.36	0.39	0.34	0.60	STL-A-27-00068-00001
	6mm SNX51/23* (#2) / 6mm Clear	1.98	0.35	0.24	0.21	0.45	STL-A-27-00073-00001
	6mm SNX62/27* (#2) / 6mm Clear	1.98	0.35	0.28	0.25	0.55	STL-A-27-00070-00001
	6mm SN68 (#2) / 6mm IS20* (#4)	1.78	0.31	0.39	0.34	0.59	STL-A-27-00081-00001
Awning	6mm AG43* (#2) / 6mm Clear	2.40	0.42	0.29	0.25	0.33	STL-A-33-00069-00001
	6mm SB60 (#2) / 6mm Clear	2.35	0.41	0.36	0.32	0.54	STL-A-33-00071-00001
	6mm SN68 (#2) / 6mm Clear	2.35	0.41	0.35	0.30	0.52	STL-A-33-00068-00001
	6mm SNX51/23* (#2) / 6mm Clear	2.32	0.41	0.22	0.19	0.39	STL-A-33-00073-00001
	6mm SNX62/27* (#2) / 6mm Clear	2.32	0.41	0.25	0.22	0.47	STL-A-33-00070-00001
	6mm SN68 (#2) / 6mm IS20* (#4)	2.21	0.39	0.34	0.30	0.51	STL-A-33-00081-00001
I.G.U. (Insulated Glass Unit)	GLASS		SPACER		GAS FILL		
	Guardian AG43*, IS20*, SN68, SNX51/23*, SNX62/27*, Vitro SB60		15.6mm (5/8") Aluminum		90% Argon & 10% Air		

Based on NFRC CPD - Certification Date: March 2020 Expiration Date: October 2024

Fenestration = Frame, mullions, sash and vision glass. Refer to www.nfrc.org for more information.

* Available at a cost premium.



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