

Aluminum Glass & IGU

Design Guidelines

STARLINE
WINDOWS

Quality, Comfort & Peace of Mind



Foreword

This guide design guidelines and specifications on the glass and IGU details used in our aluminum casements, awnings, doors, spandrel glass, 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.

This document subject to change without notice.

Starline Windows reserves the right to change or discontinue this product without notice.

www.starlinewindows.com

Document Number TS-00016

© 2018 Starline Windows

Table of Contents

- Introduction5**
- Insulated Glass Unit (IGU) Size Limits5**
 - IGU size limits for series 4500T, 4503, 5000T, 9000, 9000SSG, 9003, & 9100R5
 - Maximum Area of IGU.....5
 - Aspect Ratio of Glass.....6
 - Maximum Weight of an IGU6
 - How to Determine the Overall Area & Weight of an IGU6
 - Typical Float Glass Weight per Thickness¹6
 - Maximum IGU Area Based on Glass Lite Thickness7
 - Example: Window Wall Fixed Window7
- IGU Size Limits for Unitized Curtain Wall8
 - Maximum IGU Area8
 - How to Determine the Area of an IGU.....8
 - Maximum IGU Area Based on Glass Lite Thickness8
 - Example: Curtain Wall Fixed Window8
- Glass Configurations9**
 - Single Monolithic Glass9
 - Double-Glazed IGU, Available Configurations10
 - Monolithic Exterior and Interior Glass.....10
 - Monolithic Exterior Glass, Laminated¹ Interior Glass.....11
 - Laminated Exterior, Monolithic Interior Glass11
 - Laminated Exterior and Interior Glass12
 - Triple-Glazed IGU, Available Configurations12
 - Monolithic Exterior, Middle, and Interior Glass13
 - Monolithic Exterior, Middle, and Laminated Interior Glass.....13
 - Product Series IGU Thickness14
- Glass Quality Requirements14**
 - Low E Coating Quality.....14
 - Visual Inspection Criteria.....15
 - Allowable Defects15
 - Material and Dimensional Standards.....17
- Glass Cleaning Guidelines18**

Recommended Cleaning Process	18
What Not to Use When Cleaning Glass.....	18
Definitions.....	18
Annealed Glass.....	18
Argon Gas.....	18
Defects in Glass.....	18
Double glazed IGU.....	19
Dual edge seal.....	19
Emissivity.....	19
Insulated glass unit (IGU).....	19
Lambert.....	19
Laminated Glass.....	20
Low E Coating.....	20
Monolithic Glass.....	20
Polyvinyl Butyral (PVB) Interlayer.....	20
Safety Glass	20
Spacer Bar.....	20
Spandrel Glass	20
Tempered Glass	20
Tinted Glass.....	21
Triple Glazed IGU	21

Introduction

Starline Windows's glass manufacturer is Vitrum Glass Group.

Vitrum Industries is a Certified Fabricator of PPG and Guardian glass products. Starline Windows has standard product offerings, as well as additional options available to meet your project-specific design needs, regarding aesthetics, energy performance, acoustical ratings, or other specific design intents.

The information below highlights our standard product offerings, as well as a few of the other options that are available. There are various other combinations available which can be reviewed on a project-specific basis.

Visit the Vitrum Glass Group website at <http://www.vitrum.ca/> for more information.

Insulated Glass Unit (IGU) Size Limits

Glass sizes are limited by the overall area and weight of the IGU. The parameters for the IGU size limits are the same for all of Starline's product series with the exception of Unitized Curtain Wall. Unitized Curtain Wall only looks at the overall area of the IGU and can have a larger area than the other product series.

IGU size limits for series 4500T, 4503, 5000T, 9000, 9000SSG, 9003, & 9100R

Maximum Area of IGU

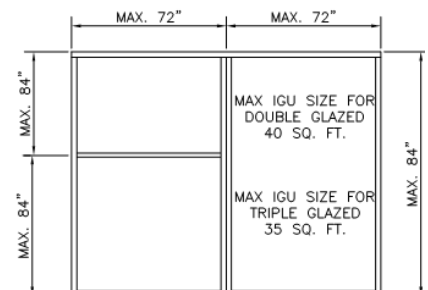
GLASS TYPE	SINGLE LITE	DOUBLE GLAZED			TRIPLE GLAZED		
	6mm	4mm	5mm	6mm & THICKER	4mm	5mm	6mm & THICKER
Annealed	–	30 sq.ft.	40 sq.ft.	40 sq.ft.	30 sq.ft.	35 sq.ft.	35 sq.ft.
Tempered	–	30 sq.ft.	40 sq.ft.	40 sq.ft.	30 sq.ft.	35 sq.ft.	35 sq.ft.
Laminated	–	–	–	28 sq.ft.	–	–	28 sq.ft. ¹
Spandrel	40 sq.ft.	–	–	–	–	–	–
Spandrel IGU ²	–	30 sq.ft.	40 sq.ft.	40 sq.ft.	–	–	–

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

Maximum length for a horizontal T-bar without a vertical coupler is 72”.

Maximum length for a vertical coupler without the use of a horizontal T-bar is 84”.

For window wall series 9000, 9003 & 9100R the maximum length of 84” can be increased with the use of an I-coupler in lieu of Starline's standard coupler. The use of this I-coupler will be considered on a project-specific basis.



Refer to the [How to Determine the Overall Area & Weight of an IGU](#) section for an example on how to calculate the overall area and weight of an individual IGU.

¹ 6mm laminated glass can be to a max area of 28 sq.ft. 8mm Laminated and thicker can be to a max area of 35 sq.ft.

² The Spandrel glass lite is always minimum 6mm thick. In spandrel IGU the other glass lite can be 4mm or thicker.

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.

Maximum Weight of an IGU

The maximum overall IGU weight should not exceed ~ 225 lbs. This is in order to keep an individual overall window module size within Starline’s recommended guidelines of 240 lbs.

Refer to the [How to Determine the Overall Area & Weight of an IGU](#) section below for an example on how to calculate the overall area and weight of an individual IGU.

How to Determine the Overall Area & Weight of an IGU

To keep things simple when determining the IGU size use the heel dimension of the window or door.

If it is a combination window that contains multiple IGU’s divided by horizontal T-Bars and vertical couplers and/or mullions, use the heel to centerline dimensions or centerline to centerline dimensions of the window or door frame.

Since the frame will be included the overall weight of 240lbs not ~225lbs noted in the above **Weight** section will be used in the example on page 7.

Once the window configuration 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 Thickness¹

GLASS LITE THICKNESS	4mm	5mm	6mm	8mm	10mm
Monolithic Glass – Weight (lb/ ft ²)	2.1	2.6	3.1	4.1	5.1
Double Glazed IGU – Weight (lb/ ft ²)	4.1	5.1	6.2	8.2	10.2
Triple Glazed IGU – Weight (lb/ ft ²)	6.2	7.7	9.2	12.3	15.4

Maximum IGU Area Based on Glass Lite Thickness

GLASS LITE THICKNESS ¹	MAXIMUM IGU AREA ²		MAXIMUM WIDTH ³	MAXIMUM HEIGHT ⁴
	DOUBLE GLAZED	TRIPLE GLAZED		
4mm	30 sq. ft.	30 sq. ft.	72"	84"
5mm	40 sq. ft.	35 sq. ft.	72"	84"
6mm and thicker	40 sq. ft.	35 sq. ft.	72"	84"

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.

Example: Window Wall Fixed Window

Step #1 – Determine fixed window size - 60" wide x 84" tall. ^{1,2,3,4}	$(60" \times 84") / 144" = 35 \text{ ft}^2$	✓
Step #2 – Determine glass weight - Based on area, min. 5mm glass required		
- Double glazed - 5mm / Air / 5mm	$= 5.12 \text{ lbs/ft}^2$	✓
Step #3 – Calculate weight per square foot (add window framing 1 lbs/ft ²)		
	$5.12 \text{ lbs/ft}^2 + 1 \text{ lbs/ft}^2 = 6.12 \text{ lbs/ft}^2$	✓
Step #4 – Calculate overall weight		
	$35 \text{ ft}^2 \times 6.12 \text{ lbs/ft}^2 = 215 \text{ lbs}$	✓

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 5mm may be selected based on the charts and it states 5mm glass can be used up to an IGU area that is 40 sq. ft. maximum for double glazed, however structural requirements due to the buildings wind loading may require 6mm glass thickness to be used. 6mm glass is thicker than 5mm glass and weighs more, so the window size may need to be reduced to keep overall weight within Starline windows recommended maximum weight.

² Maximum area for an insulated glass unit (IGU) is dependent on the glass thickness selected. Once the desired IGU area has been determined, refer to [Maximum IGU Area Based on Glass Lite Thickness](#) chart to select required glass thickness.

³ If the width exceeds 72", the addition of a vertical coupler is required, thus creating 2 separate window modules. If the height exceeds 84", the addition of a horizontal T-Bar is required⁴, thus creating a combination window.

⁴ If the IGU height exceeds 84", the addition of a horizontal T-Bar is required when using Starline's standard coupler. For series 9000, 9003 & 9100R the max. height of 84" for an IGU may be able to be increased using an I-coupler in lieu of a standard coupler. This can be reviewed on a project specific basis.

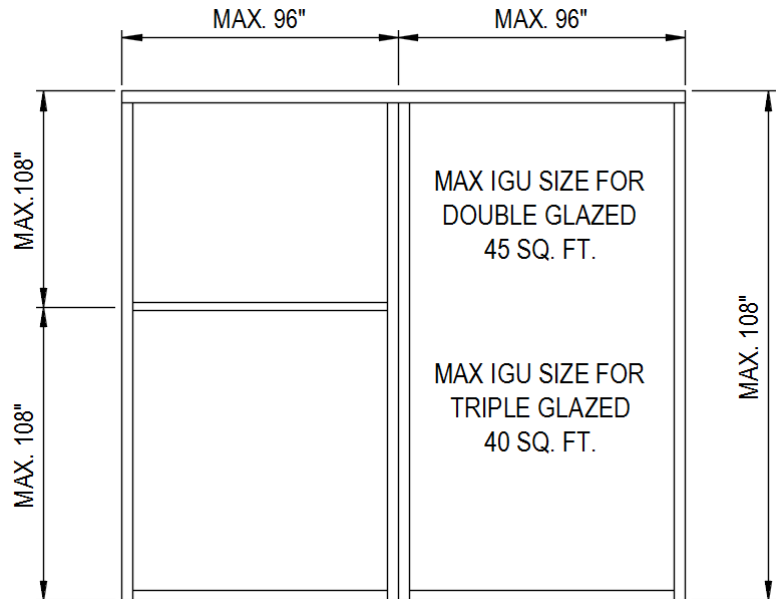
IGU Size Limits for Unitized Curtain Wall

Maximum IGU Area

The maximum area for an individual IGU is 45 square feet for double glazed and 40 square feet for triple glazed.

When determining the area of the IGU, it is important to keep in mind the maximum length of 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".

Refer to the [How to Determine the Overall Area & Weight of an IGU](#) section below for an example on how to calculate the overall area and weight of an individual IGU.



How to Determine the Area of an IGU

To keep things simple when determining the IGU size use the heel dimension of the Unitized Curtain Wall. If it is a combination window that contains multiple IGU's divided by horizontal T-Bars and vertical couplers and/or mullions, use the heel to centerline dimensions or centerline to centerline dimensions of the window frame.

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 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 for weight of glass.

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 & thicker	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 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.

Example: Curtain Wall Fixed Window

The overall dimensions, square footage and weight below are all ok for double-glazed unit.

- Step #1 – Determine if fixed window is double or triple glazed. = Double Glazed ✓
- Step #2 – Determine fixed window size - 60" wide x 108" tall. ^{1,2,3} (60" x 108") / 144" = 45.00 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.

Glass Configurations

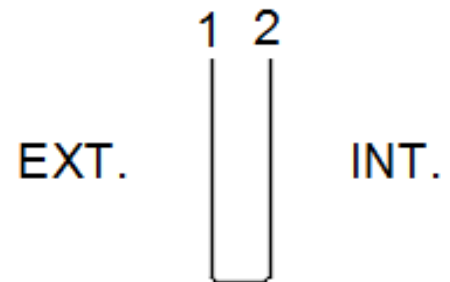
Glass units can be single, double, or triple glazed.

Single Monolithic Glass

Starline offers single monolithic glass. This glass is typically used where spandrel glass with ceramic frit or opaci coating is desired and an IGU may not be suitable. Typically, with respects to fenestration, this situation occurs at bypass conditions.

The standard single monolithic spandrel glass is comprised of the following glass make-up:

- Ceramic frit or opaci coating, located on #2 surface.
- Shall be tempered (always - no exceptions).
- Can be clear or tinted
- Low E is not available for this application

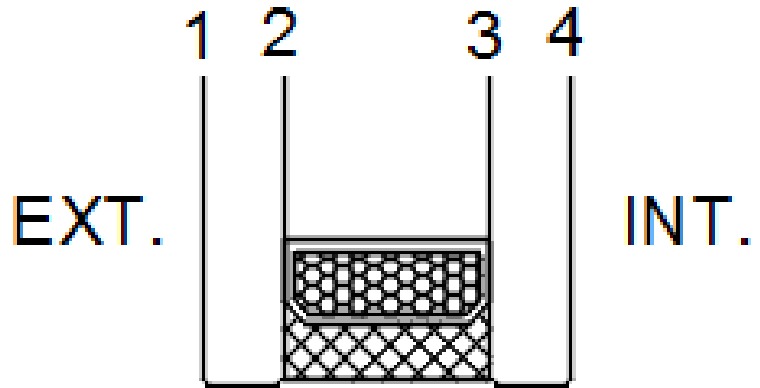


Double-Glazed IGU, Available Configurations

Starline offers double-glazed IGUs. Typically, these IGUs can be used at all locations in the fenestration system except for most bypass conditions and where sandwich panels are desired.

The standard-double glazed IGU comprises the following glass make-up:

- Standard high-performance soft coat (sputtered) Low E which is applied to surface #2.
- Black warm edge spacer bar¹ with air fill.
- Minimum glass thickness is:
 - 4mm for 5000T Punched Window Series
 - 4mm for Window Wall Series. Exceptions are as follows:
 - 6mm for 9000SSG Window Wall Series
 - 6mm for Unitized Curtain Wall.
 - 4mm tempered for Door Series.
- Dual-edge seal

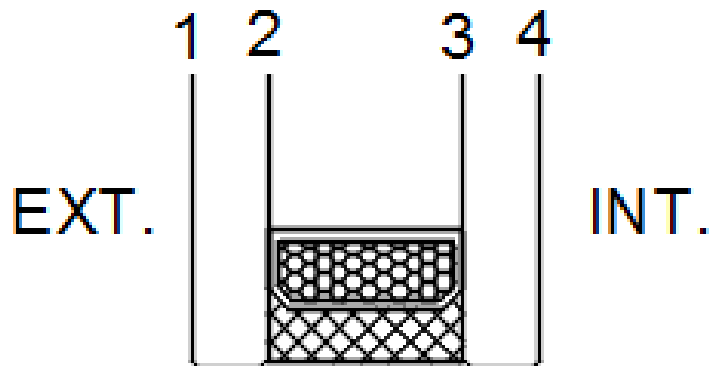


Note: For increased thermal performance, argon gas can be used in lieu of air at an additional cost. Argon gas available in Canada only.

¹Aluminum Mill finish spacer bar is only available for series 9000SSG and 9502 double glazed 37mm IGU and Unitized Curtain Wall when it is not captured on all four sides.

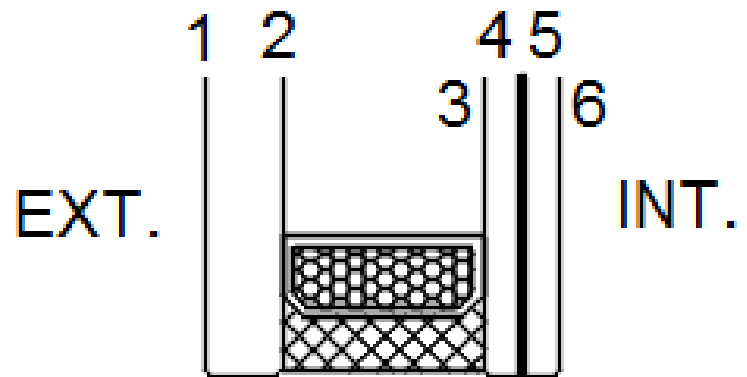
Monolithic Exterior and Interior Glass

- Various high performance soft coat Low E coating which is commonly applied on surface #2, however some Low E coatings may be required to be applied to surface #3.
- Exterior glass is available in:
 - Clear or Tinted
 - If tinted glass is used without Low E coating, the Low E coating can be moved to surface #3.
 - Annealed or Tempered
- Interior glass can be:
 - Clear
 - Annealed or Tempered
- Option for ceramic frit or opaci coat located on Surface #2 or #4. If ceramic frit or opaci coat is located on surface #2 then a Low E coating is not available for this application. Surface #4 is recommended.



Monolithic Exterior Glass, Laminated¹ Interior Glass

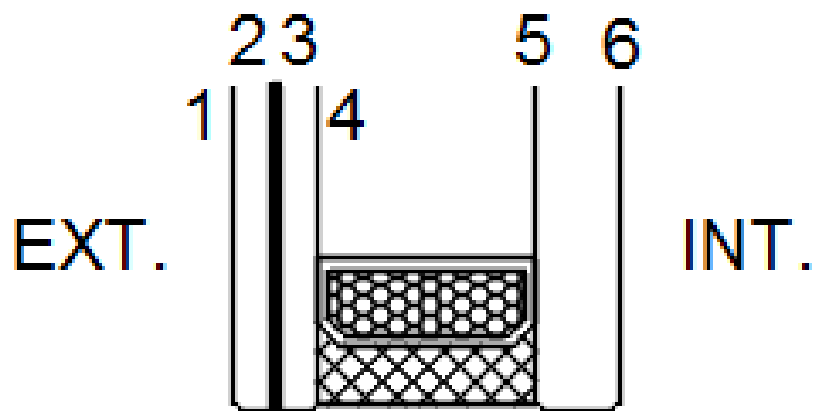
- Polyvinyl Butyral (PVB) interlayer fused between the two layers of glass on surface #4 & #5, to create laminated glass. Starline's standard interlayer thickness is 0.030".
- Various high-performance soft coat Low E coating which is commonly applied on surface #2, however some Low E coatings may be required to be applied to surface #3.
- Exterior glass is available in:
 - Clear or Tinted
 - If tinted glass is used without Low E coating, the Low E coating can be moved to surface #3.
 - Annealed or Tempered



- Interior glass can be:
 - Clear only
 - Annealed only
- PVB interlayer:
 - Standard is clear
 - Other options available
- Option for ceramic frit or opaci coat is located on Surface #2. Low E coating is not available for this application.

Laminated Exterior, Monolithic Interior Glass

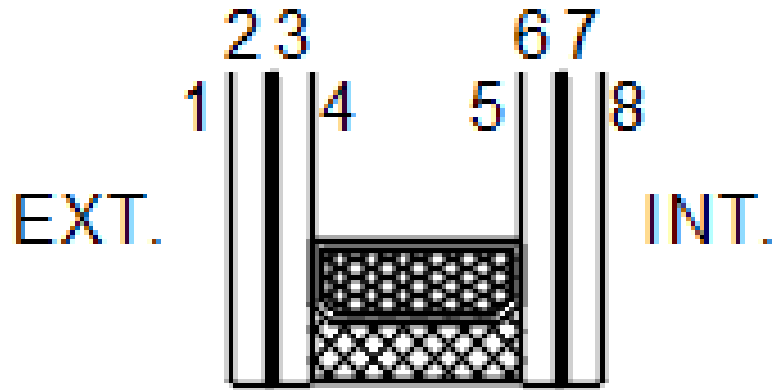
- Polyvinyl Butyral (PVB) interlayer fused between the two layers of glass on surface #2 & #3, to create laminated glass. Starline's standard interlayer thickness is 0.030".
- Various high-performance soft coat Low E coating which is commonly applied on surface #5.



- Exterior glass is available in:
 - Clear only
 - Annealed only
- Interior glass can be:
 - Clear only
 - Annealed or tempered
- PVB interlayer:
 - Standard is clear
 - Other options available
- Option for ceramic frit or opaci coat is located on Surface #6. Low E coating is not available for this application

Laminated Exterior and Interior Glass

- Polyvinyl Butyral (PVB) interlayer fused between the two layers of glass on surface #2 & #3, and #6 & #7 to create a double laminated IGU. Starline's standard interlayer thickness is 0.030".
- Various high-performance soft coat Low E coating which is commonly applied on surface #4 or #5.
- Exterior glass is available in:
 - Clear or Tinted
 - If tinted glass is used, the Low E must be on surface #7.
 - Annealed only
- Interior glass can be:
 - Clear only
 - Annealed only
- PVB interlayer:
 - Standard is clear
 - Other options available

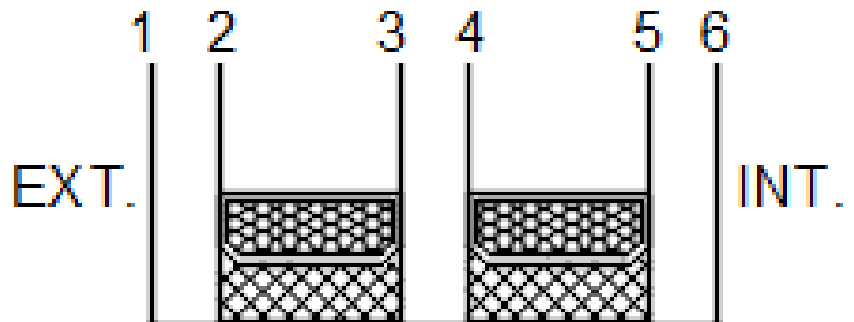


Triple-Glazed IGU, Available Configurations

Starline offers triple-glazed IGUs. Typically, these IGUs can be used at all locations in the fenestration system, except for bypass conditions and where sandwich panels are desired.

The standard triple-glazed IGU comprises the following glass make-up:

- Standard high-performance soft coat (sputtered) Low E which is applied to surface #2.
- Black warm edge spacer¹ with air fill.
- Minimum glass thickness is:
 - 4mm tempered for 5000T Punched Window Series
 - 4mm tempered for Window Wall Series. Exception is 9000SSG Series which uses 6mm tempered.
 - 6mm tempered for Unitized Curtain Wall.
 - 4mm tempered for Door Series.
- Dual-edge seal

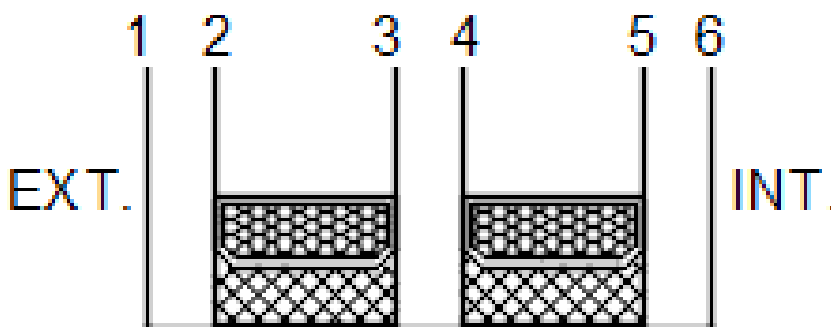


Note: To further increase thermal performance, a second Low E coating can be applied to surface #4 and / or using argon gas in lieu of air. These options are available at an additional cost. Argon gas available in Canada only.

¹Aluminum Mill finish spacer bar is only available for series 9000SSG and 9502 double glazed 37mm IGU and Curtain Wall when it is not captured on all four sides.

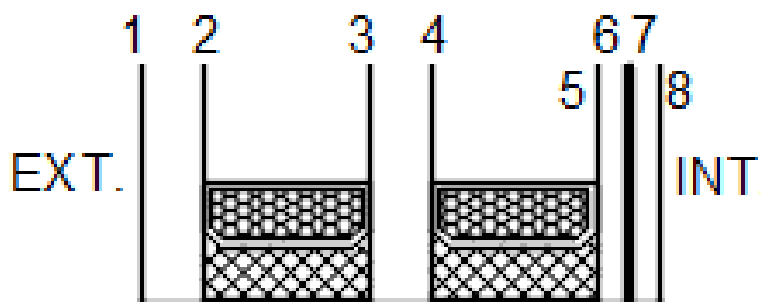
Monolithic Exterior, Middle, and Interior Glass

- Various high-performance soft coat Low E coating which is commonly applied on surface #2, however some Low E coatings may be required to be applied to surface #3.
- Exterior glass is available in:
 - Clear or Tinted
 - If tinted glass is used without Low E coating, the Low E coating can be moved to surface #3.
 - Tempered
- Middle glass can be:
 - Clear only
 - Tempered
- Interior glass can be:
 - Clear only
 - Tempered
- Option for ceramic frit or opaci coat located on Surface #2 or #6. If ceramic frit or opaci coat is located on surface #2 then a Low E coating is not available for this application.



Monolithic Exterior, Middle, and Laminated Interior Glass

- Various high-performance soft coat Low E coating which is commonly applied on surface #2, however some Low E coatings may be required to be applied to surface #3.
- Exterior glass is available in:
 - Clear or Tinted
 - If tinted glass is used without Low E coating, the Low E coating can be moved to surface #3.
 - Tempered
- Middle glass can be:
 - Clear only
 - Tempered
- Interior glass can be:
 - Clear
 - Annealed only
- Option for ceramic frit or opaci coat located on Surface #2 or #6. If ceramic frit or opaci coat is located on surface #2 then a Low E coating is not available for this application.



Product Series IGU Thickness

PRODUCT SERIES	OVERALL IGU THICKNESS DOUBLE GLAZED	OVERALL IGU THICKNESS TRIPLE GLAZED
4500T	13/16" (21 mm)	Not Available
4503	1" (25 mm)	1 7/16" (37 mm)
5000T	7/8" (23 mm)	1 3/8" (35 mm)
9000	7/8" (23 mm)	Not Available
9000SSG	1" (25 mm)	Not Available
9003	Not Available	1 3/4" (46 mm)
9100R	1" (25 mm)	Not Available
9502	1" (26 mm) OR 1 7/16" (37 mm)	1 7/16" (37 mm)
UNITIZED CURTAIN WALL	1" (25 mm)	1 13/16" (45 mm)

Note: The overall IGU thickness is based on nominal dimensions. Actual dimensions will vary slightly.

Glass Quality Requirements

As required by the Building Code, glass products used by Starline Windows Ltd. meets the AAMA/WDMA/CSA 101/I.S.2/A440-08 Standard/Specification for windows and doors as follows (per ASTM C1036, CAN/CGSB 12.2 & 12.3):

Low E Coating Quality

Glass products used by Starline Windows Inc. conform to the following standards:

- ASTM C1036-91 (Standard Specification for Flat Glass) Q3/Glazing Select specifications or better
- ASTM C1048-92 (Standard Specification for Heat Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass) specifications using Q3 quality or better
- ASTM C1379-97 (Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass) Kind CV specifications or better.

Visual Inspection Criteria

Glass shall be inspected in transmission and reflection at a distance of 10 feet from the observer.

Utilizing a viewing angle of 90 degrees from the glass, with suitable background light (day light without direct sunlight or a range of 500 to 1000 foot Lamberts).

If a lighting box is used as the light source, the diffusing plate shall be parallel to and at a distance of 10 feet from the glass.

Inspection should not exceed viewing of more than 5 seconds for lites up to 6 square feet, 10 seconds for lites up to 35 square feet, and 20 seconds for lites larger than 35 square feet, either in transmission or reflection. If defects are visible beyond what is allowable as listed by sizes (square feet) below using the inspection criteria, the glass may be rejected.

Allowable Defects

1. Single (individual) lites up to 6 square feet:
 - a. Scratches – viewable as stated above, must be 1 inch or less. No more than one is allowed per lite viewed at a distance of 10 feet from the observer.
 - b. Debris, Dirt, Spots – viewable as stated above, must be 1/16" or less. No more than one is allowed per lite.
 - c. Seeds, Bubbles, Knots, Stones – viewable as stated above, must be 1/16" or less. No more than one is allowed per lite.
 - d. No more than one total viewable defect as described above is allowed per lite.
 - e. Shells – no more than ¼" from edge less than ½ the thickness of the lite. No more than one per side.
 - f. Chips – no more than 1/8" from edge. No more than one per side.
 - g. Coating – must be uniform on the lite inspected, when viewed in transmission using the inspection criteria previously stated above.
 - h. The border area is comprised of 2 inches plus ½" from each edge of the lite. All other area is the Central area.
2. Single (individual) lites 6 to 35 square feet
 - a. Scratches – viewable as stated above, must be 1 inch or less. No more than two are allowed per lite and must be separated by a minimum of 24 inches viewed at a distance of 10 feet from the observer.
 - b. Debris, Dirt, Spots – viewable as stated above, must be 1/16" or less. No more than two are allowed per lite and must be separated by a minimum of 24 inches.
 - c. Seeds, Bubbles, Knots, Stones – viewable as stated above, must be 1/16" or less. No more than two are allowed per lite and must be separated by a minimum of 24 inches.
 - d. No more than two total, viewable defects as describes above as allowed per lite.
 - e. Shells – Same as for point 1.e.
 - f. Chips – Same as for point 1.f.
 - g. Coating – Same as for point 1.g.
 - h. The border area is comprised of 4 inches plus ½" from each edge of the lite. All other area is the Central area.

3. Single (individual) lites over 35 square feet
 - a. Scratches – viewable as stated above, must be 1 inch or less. No more than three are allowed per lite and must be separated by a minimum of 24 inches viewed at a distance of 10 feet from the observer.
 - b. Debris, Dirt, Spots – viewable as stated above, must be 1/16” or less. No more than three are allowed per lite and must be separated by a minimum of 24 inches.
 - c. Seeds, Bubbles, Knots, Stones – viewable as stated above, must be 1/16” or less. No more than three are allowed per lite and must be separated by a minimum of 24 inches.
 - d. No more than three total, viewable defects as describes above as allowed per lite.
 - e. Shells – Same as for point 1.e.
 - f. Chips – Same as for point 1.f.
 - g. Coating – Same as for point 1.g.
 - h. The border area is comprised of 6 inches plus ½” from each edge of the lite. All other area is the Central area.

Material and Dimensional Standards

1. Tolerance on length or width dimensions as specified in the below table and are applicable to rectangular shapes only.

LENGTH OR WIDTH	SIZE TOLERANCE IN ASSEMBLED UNIT
For up to 30" (762mm)	+/- 1/16" (1.5875mm)
For 30" to 60" (762mm to 1524mm)	+ 1/8" – 1/16" (3.75mm – 1.5875mm)
For 60" to 84" (1524mm to 2133.6mm)	+ 5/32" – 1/16" (3.9688mm – 1.5875mm)

2. Overall thickness of IGU's can have variances. Refer to the below table for acceptable variances.

OVERALL IGU THICKNESS	MINIMUM IGU THICKNESS DUE TO VARIANCE	MAXIMUM IGU THICKNESS DUE TO VARIANCE
7/16" (11.11mm)	0.41" (10.414mm)	0.49" (12.446mm)
1/2" (12.7mm)	0.48" (12.192mm)	0.55" (13.97mm)
9/16" (14.29mm)	0.54" (13.716mm)	0.63" (16.002mm)
5/8" (15.875mm)	0.6" (15.24mm)	0.7" (17.78mm)
11/16" (17.4625mm)	0.66" (16.764mm)	0.76" (19.304mm)
3/4" (19.05mm)	0.70" (17.78mm)	0.81" (20.574mm)
13/16" (20.6375mm)	0.74" (18.796mm)	0.88" (22.352mm)
7/8" (22.225mm)	0.83" (21.082mm)	0.95" (24.13mm)
15/16" (23.8125mm)	0.86" (21.844mm)	0.99" (25.146mm)
1" (25.4mm)	0.94" (23.876mm)	1.06" (26.924mm)
1 1/16" (26.9785mm)	1.00" (25.4mm)	1.12" (28.448mm)
1 1/8" (28.575mm)	1.06" (26.924mm)	1.19" (30.226mm)
1 3/16" (30.1625mm)	1.13" (28.702mm)	1.25" (31.75mm)
1 1/4" (31.75mm)	1.18" (29.972mm)	1.31" (33.274mm)

3. Primary seal must be continuous without any gaps, should not exceed beyond the inner edge of the spacer bar and must be bridged at corners.
4. Secondary seal must contain the proper mix, be continuous with no exposed spacer bar and 3/16" +/- 1/16" thick. It must be trimmed evenly at the edge and there should be no sealant on the outer surface of the unit.
5. Spacer bar must be clean and made of corrosion resistance material.
6. Desiccant in molecular sieves type and can be filled either in the two long sides or one long and one short.
7. Sight line should not vary by more than 1/8" from corner to corner and should not vary by more than 1/16" in any 12" span. This applies only to rectangular shapes.
8. Airspace Thickness – the airspace between the glass surface of sealed double glazing shall be at least 6mm wide. The airspace between the glass surfaces of sealed triple-glazing shall be at least 6mm wide for each airspace unless otherwise specified.
9. Safety logos on both lites should be in the same corners (mirror image).

Glass Cleaning Guidelines

Architectural glass products can be damaged through improper cleaning. In order to keep the glass clean and free of damage, Starline recommends the following cleaning guidelines:

Recommended Cleaning Process

Remove grease and film deposits with mild soap detergent (one part detergent to 2000 parts by volume of water) followed by a clean rinsing with cold or lukewarm water.

Remove grease and film deposits with a mild soap detergent (one part detergent to 2000 parts by volume of water) followed by a clean rinsing with cold or lukewarm water. After washing and rinsing, the glass should be dried with a clean squeegee, airflow or a clean soft cloth.

What Not to Use When Cleaning Glass

- Abrasives, alkaline salts, fluoride salt or hydrogen fluoride producing compounds, inorganic alkalines (other than ammonia), strong acids (less than pH9). Note: CGSP 2-GP-55m standard for glass cleaner sets an allowable pH range of 7.0 to 10.0 (pure water has a pH balance of 7.0).
- Water under high pressure, as this can cause leaks and damage to both the sealant in the sealed joints and the trim details on the window.
- Razor blades, scrapers, steel wool or abrasive cleaning pads.

Definitions

Annealed Glass

To make annealed glass, the glass is heated up above the critical or re-crystallization temperature. Once that is complete the glass is then slowly cooled to relieve residual internal stresses introduced during manufacture.

When annealed glass is broken it will break off into large, sharp shards. This can pose safety risks. Care should be taken when choosing locations to install annealed glass. Due to this, building codes, by-laws, etc. will not permit the use of annealed glass in certain conditions and will typically specify that tempered or laminated glass be used in its place.

Argon Gas

Argon is an inert, non-toxic and colourless gas that is used in lieu of air in between the panes of glass in an insulated glass unit. Argon is less conductive than air, therefore reduces heat transfer and improves energy efficiency.

Defects in Glass

An imperfection in the glass. Below are definitions of some of the defects that may occur in glass. There are a certain size and quantity of defects allowed in the glass which varies depending on the overall square footage of the glass lite. Refer to the [Allowable Defects](#) section of this document for more detailed information on the allowable defects.

Bubble - gas inclusions in any glass. These inclusions are almost always brilliant in appearance.

Chip - a mark or flaw made by the breaking off or gouging out a piece of the glass.

Debris/Dirt/Spots - small particles of foreign matter imbedded in the surface of the glass.

Knot - a transparent area of incompletely assimilated glass having an irregular knotty or tangled appearance

Scratch - marking or tearing caused by the movement and contact of an object across the glass surface.

Seed - minute bubble. There are both fine and coarse seeds. Fine seeds are generally only visible upon close inspection and usually appear as small specs. These tend to be an inherent defect even in the best quality of glass.

Shell - a mark or flaw made by the breaking off or gouging out a piece of the glass.

Spot - a small particle of foreign matter imbedded in the surface of the glass.

Stone - any opaque or partially melted particle of rock, clay or batch ingredient imbedded in the glass.

Double glazed IGU

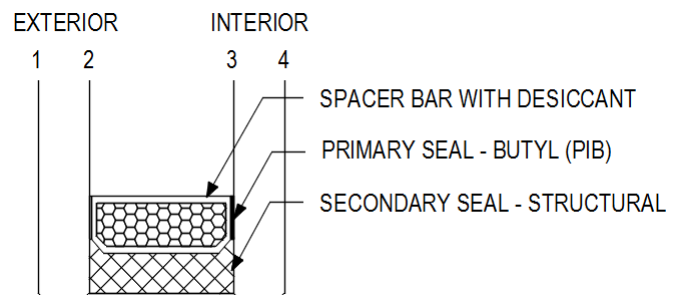
A double glazed IGU consists of two panes of glass, separated by a desiccant filled spacer bar and double edged sealed to form a complete sealed IGU. Air (or an inert gas such as argon in some cases) is trapped between the panes of glass and forms a layer of insulation helping to enhance the thermal performance of the IGU.

Dual edge seal

Starline uses IGU's that have dual edge seal, a primary and secondary seal. The fundamental purpose of an IGU edge seal system is to provide a moisture and gas barrier, as well as to provide a structural bond between two or more panes of glass.

The primary seal is polyisobutylene (PIB). This seal provides the moisture and gas barrier.

The secondary seal is an elastomeric material such as polysulfide, silicone, etc. This seal ensures the structural integrity of the IGU.



Emissivity

The ability of a material to radiate heat and/or light energy. When heat and/or light energy is absorbed by glass, typically from the sun or HVAC system, it is either convected away by moving air or re-radiated by the glass surface.

Insulated glass unit (IGU)

Two or more lites of glass separated by desiccant filled aluminum or warm edge spacer bar(s) and then hermetically sealed to form a dual-glazed unit with an air space between each lite. The air space may or may not be filled with an inert gas, such as argon.

Lambert

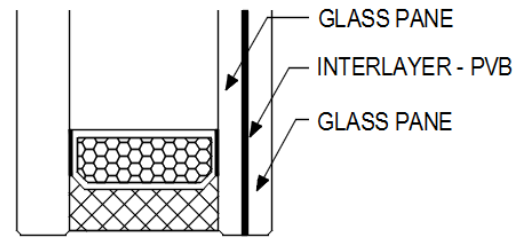
Lambertian reflectance is the property that defines an ideal "matte" or diffusely reflecting surface. The apparent brightness of a Lambertian surface to an observer is the same regardless of the observer's angle of view.

Laminated Glass

Laminated glass is often used for enhanced safety and security and its acoustical properties. Laminated glass consists of two or more sheets of glass with a plastic interlayer. The interlayer is typically made of polyvinyl butyral (PVB).

In the event of breakage, the glass is bonded to the interlayer and does not shatter into shards of glass, providing a safer and more secure piece of glass.

Laminated glass will provide a higher Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC) rating when compared to annealed or tempered glass of the same thickness.



Low E Coating

Low-emissivity glass, commonly referred to as a Low E coating, uses a low-emittance material which is fused onto the glass surface and acts like a thermal mirror.

The purpose of the Low E coating is to reflect heat and/or light energy thus improving the U-value of the glazing.

Monolithic Glass

A single lite of float glass.

Polyvinyl Butyral (PVB) Interlayer

Polyvinyl butyral is a resin mostly used for applications that require strong binding and optical clarity. It is tough and flexible at the same time. It is commonly used as the protective interlayer in laminated glass.

Safety Glass

A strengthened or reinforced glass that is less subject to breakage or splintering and less likely to cause injury if broken. Building codes, bylaws, etc. requires glass in doors and certain locations for windows to be some type of safety glazing product, such as tempered or laminated glass.

Spacer Bar

A component placed at the perimeter of an insulated glass unit to separate the two lites of glass. Starline offers aluminum and warm edge spacer bars. Warm edge spacer bars offer a lower thermal conductance than traditional aluminium spacer bars thus providing an improvement in energy performance.

Spandrel Glass

Spandrel Glass, either opaci-coat or ceramic frit, is an opaque glass (not vision glass) used to conceal structural building components such as columns, floors, HVAC systems, electrical wires, plumbing, etc., so they cannot be seen from the exterior.

To reduce the probability of glass breakage due to thermal stress, spandrel glass must be tempered. Spandrel panels can be used monolithically or in an IGU, depending on the application.

Tempered Glass

Glass manufactured to withstand greater than normal forces on its surface. When it breaks, it shatters into small pieces to reduce hazard

Tinted Glass

Tinted glass products are produced by small additions of metal oxides to the float or rolled glass composition. These small additions colour the glass but do not affect the basic properties of the glass except with respects to the energy properties. Tinted glass can be heat strengthened or tempered just like regular annealed glass.

Triple Glazed IGU

A triple glazed IGU consists of three panes of glass. Each pane is separated by a desiccant filled spacer bar and double edged sealed to form a complete sealed IGU. Air (or an inert gas such as argon in some cases) is trapped between the panes of glass and forms a layer of insulation helping to enhance the thermal performance of the IGU.