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# Allowable Defects in Polaris Fenestration Products





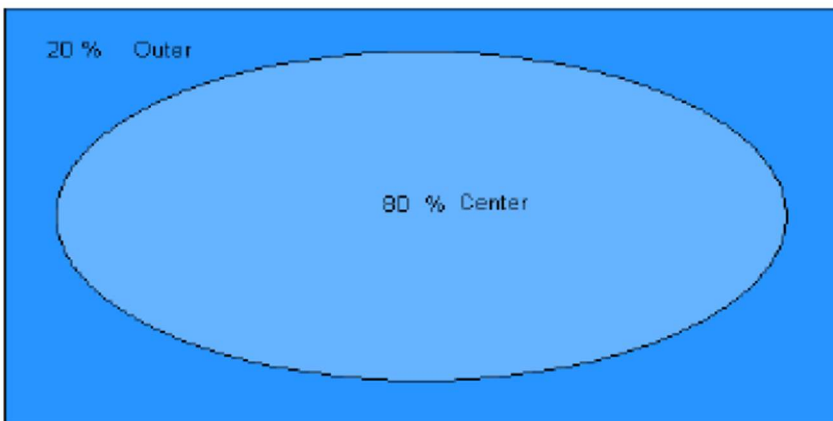
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## Glass

When checking for defects, Polaris Windows and Doors recommends the following steps in accordance with ASTM C1036:

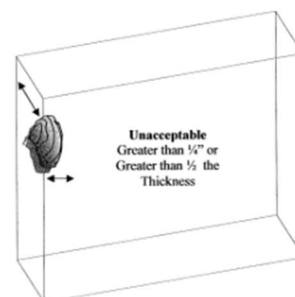
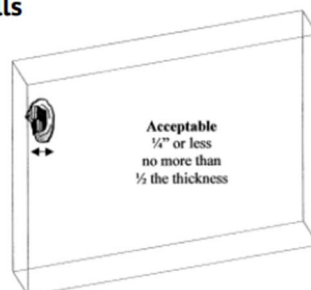
1. Move away from the glass by stepping ten feet back.
2. Face the glass straight on at 90°.
3. View in daylight but not in direct sunlight or direct applied light.
4. Inspect the central 80% of the glass (examples shown below).
5. Inspection should not exceed viewing of more than the following in transmission or reflection.
  - a. 5 seconds for lites up to six square feet.
  - b. 10 seconds for lites up to 35 square feet.
  - c. 20 seconds for lites greater than 35 square feet.



### Single Lites up to 6 square feet.

1. Scratches – Viewable as stated above must be 1" or less. No more than 1 is allowed per lite.
2. Debris, Dirt, Spots – Viewable as stated above, must be 1/16" or less. No more than 1 is allowed per lite.
3. Seeds, Bubbles, Knots, Stones – Viewable as stated above, must be 1/16" or less. No more than 1 is allowed per lite.
4. No more than 1 total viewable defect as described above is allowed per lite.
5. Shells – No more than 1/4" from edge less than 1/2 the thickness of the lite. No more than 1 per side.

### Glass Shells



6. Chips – No more than 1/8" from the edge. No more than 1 per side.

#### Glass Chips



7. Coating – Must be uniform on the lite inspected when viewed in transmission using the inspection criteria previously stated above.
8. The border area is comprised of 2 inches plus 1/2" from each edge of the lite. All other areas are the central area.

#### Single lites 6 to 35 square feet.

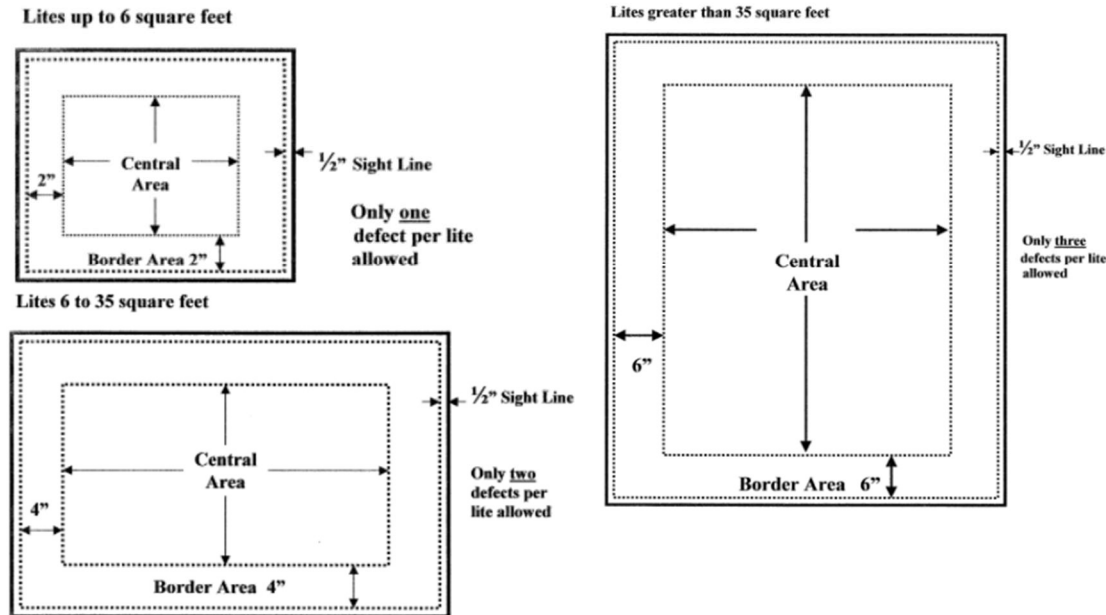
1. Scratches – Viewable as stated above must be 1" or less. No more than 2 are allowed per lite and must be separated by a minimum of 24 inches.
2. Debris, Dirt, Spots – Viewable as stated above, must be 1/16" or less. No more than 2 are allowed per lite and must be separated by a minimum of 24 inches.
3. Seeds, Bubbles, Knots, Stones – Viewable as stated above, must be 1/16" or less. No more than 2 are allowed per lite and must be separated by a minimum of 24 inches.
4. No more than 2 total viewable defects as described above are allowed per lite.
5. Shells – No more than 1/4" from edge less than 1/2 the thickness of the lite. No more than 1 per side.
6. Chips – No more than 1/8" from the edge. No more than 1 per side. (See illustration for chips.)
7. Coating – Must be uniform on the lite inspected when viewed in transmission using the inspection criteria previously stated above.
8. The border area is comprised of 4 inches plus 1/2" from each edge of the lite. All other areas are the central area (see illustration.)

#### Single lites 6 to 35 square feet.

1. Scratches – Viewable as stated above, must be 1" or less. No more than 3 are allowed per lite and must be separated by a minimum of 24 inches.
2. Debris, Dirt, Spots – Viewable as stated above, must be 1/16" or less. No more than 3 are allowed per lite and must be separated by a minimum of 24 inches.
3. Seeds, Bubbles, Knots, Stones – Viewable as stated above, must be 1/16" or less. No more than 3 are allowed per lite and must be separated by a minimum of 24 inches.
4. No more than 3 total viewable defects as described above are allowed per lite.
5. Shells – No more than 1/4" from edge less than 1/2 the thickness of the lite. No more than 1 per side.
6. Chips – No more than 1/8" from the edge. No more than 1 per side. (See illustration for chips.)

7. Coating – Must be uniform on the lite inspected when viewed in transmission using the inspection criteria previously stated above.
8. The border area is made up of 6 inches plus  $\frac{1}{2}$ " from each edge of the lite. All other areas are the central area (see illustration).

## Allowable Defects Visual Aid



Type 1 (Transparent Flat Glass) – Chips on the glass edges shall be viewed at a proximity of 12" without magnification, using localized lighting.

- Shell Chips\*: Shell chips are permitted within the requirements shown in Table 3, if there are no associated cracks, detectable without magnification, as viewed from the edge.
  - o Chip depth  $\leq$  50% of glass thickness.
  - o Chip width  $\leq$  glass thickness or 6mm (1/4 in.) whichever is greater.
  - o Chip length  $\leq$  2 times the chip width.

\* Taken from ASTM C1036-21 Table 3 Allowable Shell Chip Size and Distribution for Cut Size and Stock Sheet Qualities of Type 1—Transparent Flat Glass (Quality-Q3)

Type 1, Class 1 and 2 glass as specified by Section 4 Classification and Intended Use.

- V-Chips are not permitted.
- Dimensional Tolerances for length, width, squareness, and thickness for rectangular shapes shall use the tolerances in accordance with ASTM C1036-21 Table 4.




**TABLE 4 Dimensional Tolerances for Rectangular Shapes of Type 1—Transparent Flat Glass**

Nominal Designation		Thickness Range				Length and Width Tolerance <sup>A</sup>				Squareness (D1–D2)			
SI Designation, <sup>B</sup> mm	Traditional Designation	mm		in.		Cut Size		Stock Sheet		Cut Size		Stock Sheet	
		min	max	min	max	± mm	(± in.)	± mm	(± in.)	mm	(in.)	mm	(in.)
1.0	micro-slide	0.79	1.24	0.031	0.049	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
1.5	photo	1.27	1.78	0.05	0.07	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
2	picture	1.80	2.13	0.071	0.084	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
2.5	single	2.16	2.57	0.085	0.101	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
2.7	lami	2.59	2.90	0.102	0.114	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
3 <sup>C</sup>	double, <sup>1</sup> / <sub>8</sub> in.	2.92	3.40	0.115	0.134	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
4	<sup>5</sup> / <sub>32</sub> in.	3.78	4.19	0.149	0.165	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
5	<sup>3</sup> / <sub>16</sub> in.	4.57	5.05	0.18	0.199	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
6	<sup>1</sup> / <sub>4</sub> in.	5.56	6.20	0.219	0.244	1.6	( <sup>1</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.0	( <sup>5</sup> / <sub>64</sub> )	3.0	( <sup>1</sup> / <sub>8</sub> )
8	<sup>5</sup> / <sub>16</sub> in.	7.42	8.43	0.292	0.332	2.0	( <sup>5</sup> / <sub>64</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	2.8	( <sup>7</sup> / <sub>64</sub> )	6.0	( <sup>1</sup> / <sub>4</sub> )
10	<sup>3</sup> / <sub>8</sub> in.	9.02	10.31	0.355	0.406	2.4	( <sup>3</sup> / <sub>32</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	3.4	( <sup>1</sup> / <sub>8</sub> )	6.0	( <sup>1</sup> / <sub>4</sub> )
12	<sup>1</sup> / <sub>2</sub> in.	11.91	13.49	0.469	0.531	3.2	( <sup>1</sup> / <sub>8</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	4.5	( <sup>11</sup> / <sub>64</sub> )	10.0	( <sup>3</sup> / <sub>8</sub> )
16	<sup>5</sup> / <sub>8</sub> in.	15.09	16.66	0.595	0.656	4.0	( <sup>5</sup> / <sub>32</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	5.7	( <sup>7</sup> / <sub>32</sub> )	12.0	( <sup>1</sup> / <sub>2</sub> )
19	<sup>3</sup> / <sub>4</sub> in.	18.26	19.84	0.719	0.781	4.8	( <sup>3</sup> / <sub>16</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	6.8	( <sup>1</sup> / <sub>4</sub> )	14.0	( <sup>9</sup> / <sub>16</sub> )
22	<sup>7</sup> / <sub>8</sub> in.	21.44	23.01	0.844	0.906	5.6	( <sup>7</sup> / <sub>32</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	7.9	( <sup>19</sup> / <sub>64</sub> )	16.0	( <sup>5</sup> / <sub>8</sub> )
25	1 in.	24.61	26.19	0.969	1.031	6.4	( <sup>1</sup> / <sub>4</sub> )	6.4	( <sup>1</sup> / <sub>4</sub> )	9.0	( <sup>11</sup> / <sub>32</sub> )	18.0	( <sup>3</sup> / <sub>4</sub> )

<sup>A</sup> Length and width of cut size and stock sheets of flat glass include flares and bevels.

<sup>B</sup> These designations apply only to ASTM International and may not reflect other international standards.

<sup>C</sup> Within the 3 mm designation there are some applications that may require different thickness ranges such as DST. (Typical minimum thickness for DST is 0.120 in.)

## Insulated Glass Units

- Insulated glass unit allowable size variance per glass thickness:
  - o  $3/32''$  (2.5mm) = (+/-)  $1/16''$
  - o  $1/8''$  (3mm) = (+/-)  $1/16''$
  - o  $5/32''$  (4mm) = (+/-)  $1/8''$
  - o  $3/16''$  (5mm) = (+/-)  $1/8''$
- Glass Alignment offset in the width or height of the unit to be  $1/16''$  or less.
- Overall unit thickness to be as follows:
  - o Annealed: Double = [+0.010": -0.015"]; Triple [+/- 0.030"].
  - o Tempered: Double = [+0.020": -0.030"]; Triple [+/- 0.030"].
- Bowed Spacer – Out: The master spacer must not extend beyond the edges of the glass anywhere, even if covered by sealant.
- Sealant squeeze out of sealant past the edge of the IG unit is acceptable up to  $1/16''$ . Amounts over  $1/16''$  can make it difficult to insert the IG unit into a sash.
- Intercept (desiccated matrix):
  - o Waviness up to  $1/8''$  is acceptable.
  - o Incidental mark (blemish) up to  $1/8''$  is acceptable.
- Spacer alignment sightline:



**Acceptable Sight-line**

Single Strength - $3/32''$ (2.5mm) Double Strength - $1/8''$ (3mm)			
Spacer Alignment (Sightline)	Edge	Corner	Closing Corner
Intercept	$1/2''$	$1/2''$	$5/8''$
Superspacer	$1/2''$	$1/2''$	$5/8''$
$5/32''$ (4mm) (or greater)			
Spacer Alignment (Sightline)	Edge	Corner	Closing Corner
Intercept	$9/16''$	$5/8''$	
Superspacer	$1/2''$	$1/2''$	

### Intercept Notes:

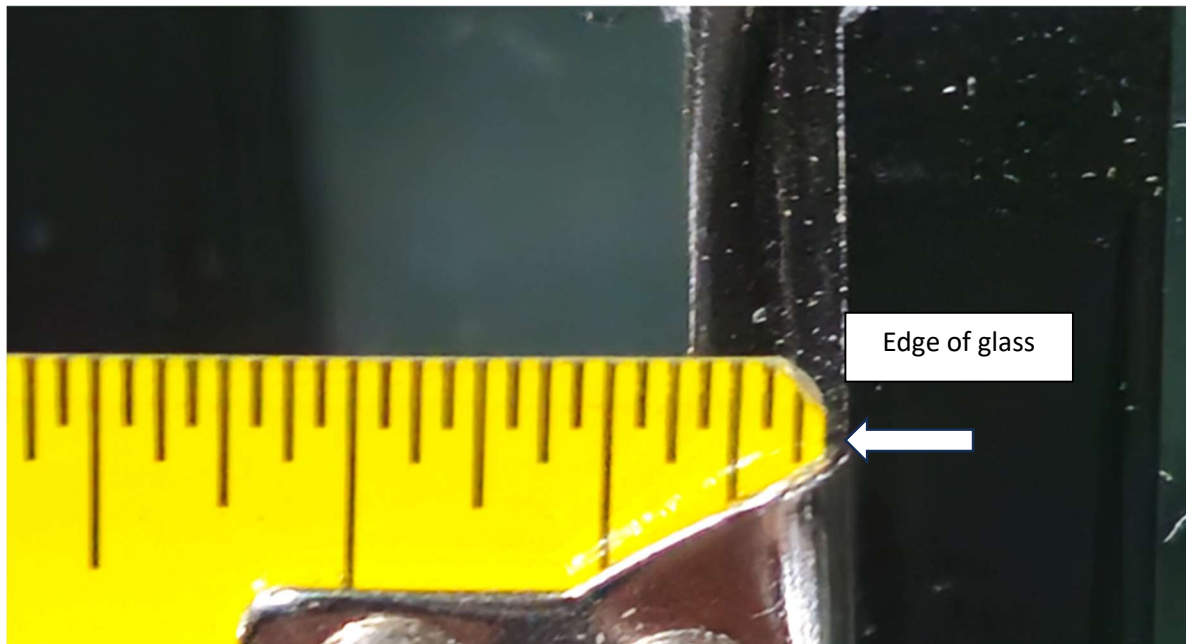
1. Sealant may extend beyond the spacer into the unit but should not exceed site line specifications.
2. Wet out may vary more in width on tempered units but should not be less than  $3/16''$ .
3. Butyl or matrix balls on the spacer lip which may fall into the unit are not acceptable.
4. Excessive hold down roller marks or other markings on the lip may be cause for rejection.

### Superspacer Notes:

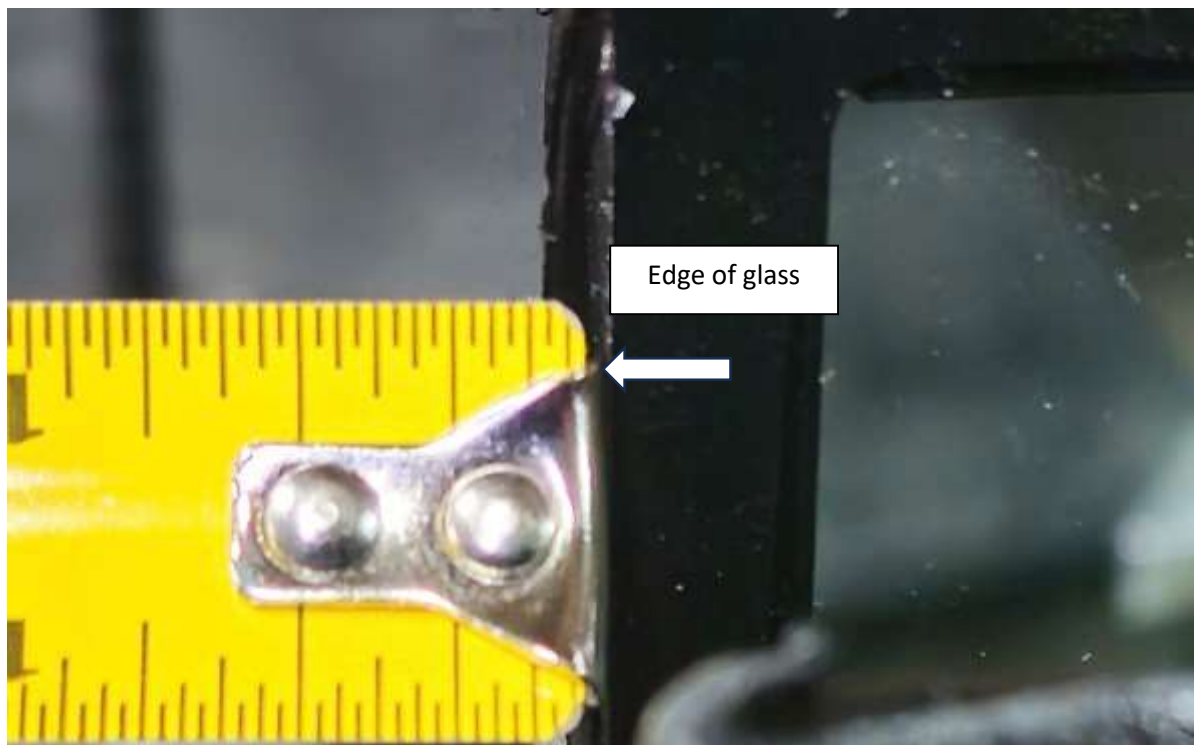
1. Waviness in Superspacer material up to  $1/8''$  is acceptable if sightline is not violated.
  2. Gap at closing corner up to  $1/16''$  is acceptable.
- Sealant squeeze-Out
    - o Sealant past the edges the IG unit can make it difficult to inset the IG unit into a sash:
      - Squeeze-out of sealant less than or equal to  $1/16''$  is acceptable.

- Squeeze-out of sealant over 1/16" is unacceptable.

Unacceptable Squeeze-out.



Acceptable squeeze-out.





- Desiccated Matrix on Intercept spacers:
  - Acceptable
    - Waviness up to 1/8" amplitude.
    - Incidental mark (blemish) in matrix up to 1/8".
  - Unacceptable
    - Waviness over 1/8" amplitude.
    - Incidental mark (blemish) in matrix over 1/8".
    - Loose matrix balls.

**Acceptable Matrix Imperfection****Unacceptable Matrix Imperfection**

When checking for defects, Polaris Windows and Doors recommends the following steps in accordance with ASTM C1036:

1. Move away from the glass by stepping 10 feet back.
2. Face the glass straight on at 90°.
3. View in daylight but not in direct sunlight or direct applied light.
4. Inspect the central 80% of the glass (examples shown below).
5. Inspection should not exceed viewing of more than the following in transmission or reflection.
  - a. 5 seconds for lites up to 6 square feet.
  - b. 10 seconds for lites up to 35 square feet.
  - c. 20 seconds for lites greater than 35 square feet.

- Hazing: A minimal amount of haze is inherent in insulating glass units (IGU) utilizing Low-E coatings and is NOT a defect. Haze occurs because tiny amounts of light are scattered from the glass and coatings causing a small amount of glare.
- Localized Warp
  - o Localized warp for rectangular glass shall not exceed 1/16" over any 12" span.
- Tong Kink
  - o Any localized kink centered at any tong location shall not exceed 1/16" in a 2" span.
- Point blemishes (dirt, debris, residue, pinholes, spot, fingerprint, etc.)
  - o Maximum size of 1/16" and a minimum of 24" between blemishes if seen at a distance of 10 feet.
- Linear blemishes (scratches, rubs, marks, etc.)
  - o Maximum size of 3" and a minimum of 24" between blemishes if seen at a distance of 10 feet.
- Bow
  - o Deviation in flatness spanning the entire pane of glass. Commonly seen in tempered glass and Insulated Glass Units (IGU). This is not measurable as positive and natural deflection is a natural occurrence with seasonal and barometric pressure cycling.
- Distortion
  - o Localized deviation in flatness that can look like ripples across the glass, or pockets of indentations. Allowed and quite common in tempered glass. Not measurable on site or in an Insulated Glass Unit.
- Strain Pattern
  - o An optical effect that results from the tempering process appearing as a pattern of dark spots on the glass. The intensity of the issue increases when viewed at steep angles to the glass and with polarized sunglasses. This optical issue is characteristic of tempered glass and cannot be completely controlled. It will vary from pane to pane.
- Fringes
  - o An optical effect that appears as a faint, random pattern resembling an oil stain. This is the result of having exactly matched thickness of glass panes in an IGU (less than .0001" difference in thickness).
- Sightline infringement
  - o Allowable 1/8" maximum of an extension into the daylight opening of an Insulated Glass Unit by the sealant, spacer, or area of coating deletion.
- Condensation / Fogging / Newton Rings
  - o Allowable when:
    - Outdoor condensation or frost occurs on the exterior side of the glass. This occurs when the glass temperature falls below the dew point, a clear night sky, still air, high relative humidity. Like dew on lawns and frost on automobiles.

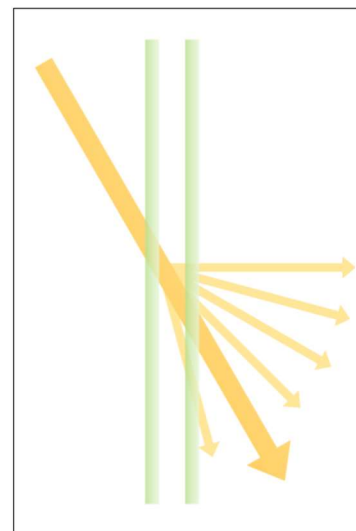


FIG 01: Depiction of light scattering causing haze



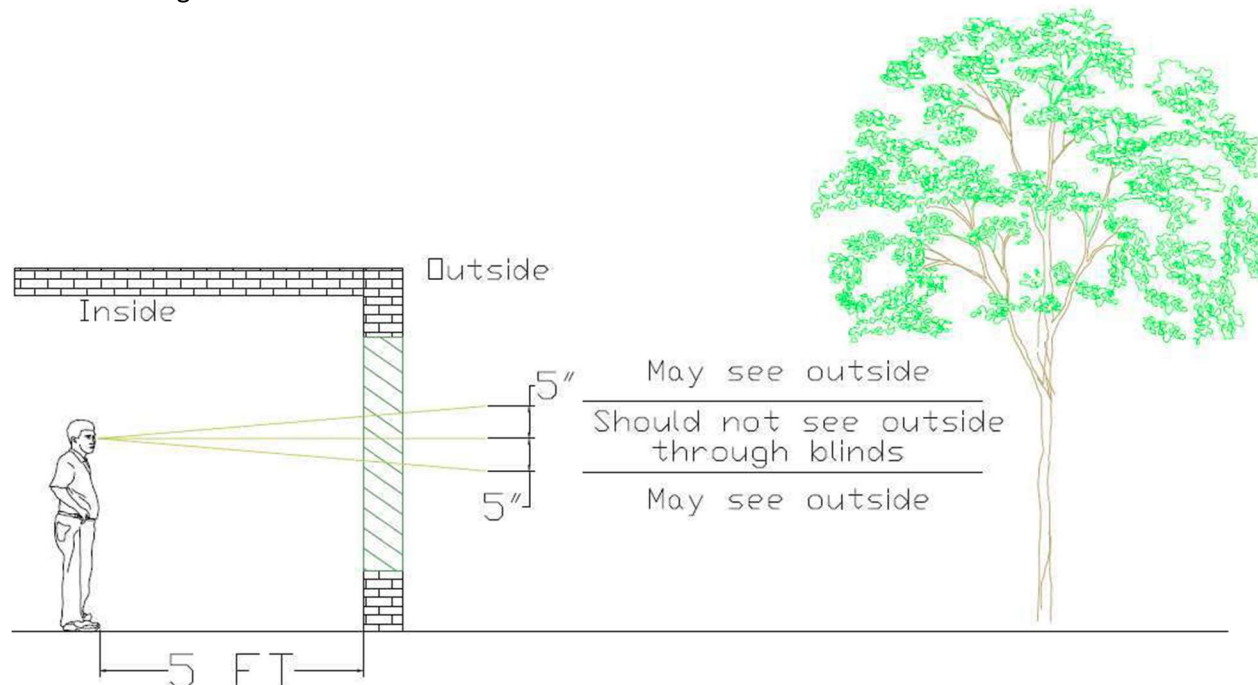
- Indoor condensation or glass sweating on the room side surface of the glass.  
This typically occurs during the wintertime when there is high humidity inside of the room and the indoor glass temperature is below the dew point of the room side air.
- Defective when:
  - Airspace condensation (between the panes of glass). Insulating glass units experiencing condensation in the airspace are usually due to a failure of the insulating glass seal. Airspace condensation can also be caused by a small crack in the glass that is sometimes not immediately evident. The outdoor and indoor glass surfaces should be cleaned to make certain the condensation is in the airspace and not on the outdoor or indoor glass surfaces.
- Needs to be Evaluated when:
  - Condensation (Newton) Rings on the Indoor Glass Surface Condensation. Condensation rings occur when the glass lites touch in the glass center because there is a reduced insulating value, and the indoor glass temperatures are closer to the outdoor glass temperatures. This increases the potential for condensation on the room side pane and becomes evident when the room side glass temperatures fall below the dew point temperature of the room side air. The condensation only occurs in the center of the glass because the spacer keeps the edges of the glass apart maintaining the airspace's insulating properties.

## Blinds Between Glass (BBG) Units

Venetian blinds between glass (BBG) units are sold as Sun Shading Devices and not Privacy Blinds.

Important facts regarding BBG units:

- A small amount of daylight will be seen during the day around the blind, edges/slats or through the ladder holes.
- When viewed from the outside, they will not completely block vision of the interior as a small amount of vision can be seen when near the BBG unit around the slats, when looking at the same angle as the slats are tilted or through ladder holes.
- Tilt Only BBG is a blind system that uses an externally mounted magnetic control to adjust the tilt angle of the blind slats.

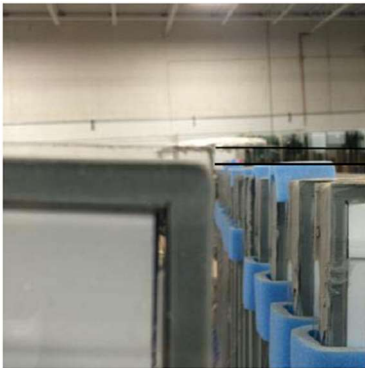


Specifications:

- Overall units' size (W x H)
  - o Glass thickness of 1/8" (3mm), 5/32" (4mm), and 3/16" (5mm) will have an allowable variance of (+/-) 1/8".
- Warp and Bow Tolerances – Units

Glass Thickness	Length						
	0 – 20"	21 – 35"	36 – 47"	48 – 59"	60 – 71"	72 – 80"	81 – 90"
3 mm 1/8"	3.0 mm	4.0 mm	5.0 mm	6.0 mm	8.0 mm	11.0 mm	-
4 mm 5/32"	3.0 mm	4.0 mm	5.0 mm	6.0 mm	8.0 mm	11.0 mm	13.0 mm
5 mm 3/16"	3.0 mm	4.0 mm	5.0 mm	6.0 mm	8.0 mm	11.0 mm	13.0 mm
6 mm 1/4"	2.0 mm	3.0 mm	4.0 mm	5.0 mm	6.0 mm	8.0 mm	11.0 mm

- Overall Straightness
  - o Blinds are to be inspected visually first. Any blind that appears to be out of alignment shall then be measured using a tape measure. Blinds out of alignment are indicated by the location of the glass regarding how straight the sides are and how level the top is (Figure 1). Two measurements shall be taken for each blind slat that is questionable. Take measurements from the edge of glass to both ends of the blind slat in question (Figures 2 & 3 on page 15).



(Figure 1)



(Figure 2)



(Figure 3)

- Measurements shall always be taken beginning at the edge of the glass to the blind, not from blind to blind. The maximum differences between the two measurements given above shall be: 0.063" (1/16") for slats less than 12 inches long, 0.093" (3/32") for slats greater than 12 inches long.

#### Blind Appearance Criteria

- All visual inspection must take place from the units inside looking out position. Inspections shall be done for Tilt Only BBG in the down position and Lift and Tilt BBG in the down and open slat position.

Imperfection (Room side only)	Maximum Allowable Dimensions	
	Decimal	Fraction
Burrs and Metal Shavings	0.016" X 0.062"	1/64" X 1/16"
Vinyl Dust or debris	0.031" X 0.031"	1/32" X 1/32"
Dent (Dia)& Crease(length)	0.125"	1/8"
Paint Chips & marks/spots	0.031"	1/32"
Scratches, Hairline, <.008	1.00"	1"
Scratches, Wide, >.008	0.250"	1/4"
Straightness Extrusions	0.250"	1/4"
Extrusion gaps	0.046"	3/64"
Extrusion Blemish	0.063"	1/16"

- Unpainted end cuts of the blinds are allowable.
- Maximum allowable defects in the same vicinity not to exceed 2 within a 1" square area, no more than 3 defects within a 4" Radius of other defects.
- This unit is gear driven. Therefore, it is acceptable to feel the belt during operation.
- This unit is gear driven. Therefore, it is acceptable to hear the belt during operation.



- Slat Marks on side rail and intercept cap appearing at top of unit are normal occurrences which appear during shipping, units normal operating position is fully down.

#### Operation

- Lift and Tilt BBG. Sliding the Operator magnet up will lower the blind. When initially sliding the operator up, the slat will rotate closed with the slat crown facing outside. Sliding the Operator down will raise the blind. When initially sliding this side down the slat will rotate closed with the slat crown facing the inside. Small adjustments by moving the outside operator up or down will enable optimum slat tilting positioning.

#### Blinds – Up

- When blinds are fully up, if you cannot see through the blinds, this is acceptable. Total length from top of glass to bottom of slat rail can deviate up to 1/4" within an individual unit. For units that are side by side such as in a patio door assembly may vary 3/4" between units.



Blinds in full up position

#### Bottom Rail – Suspended / Down

- The bottom rail, when suspended or fully down may have some bow. For units  $\leq 36$ " wide may bow up to 1/8" and for units  $> 36$ " wide up to 3/16".

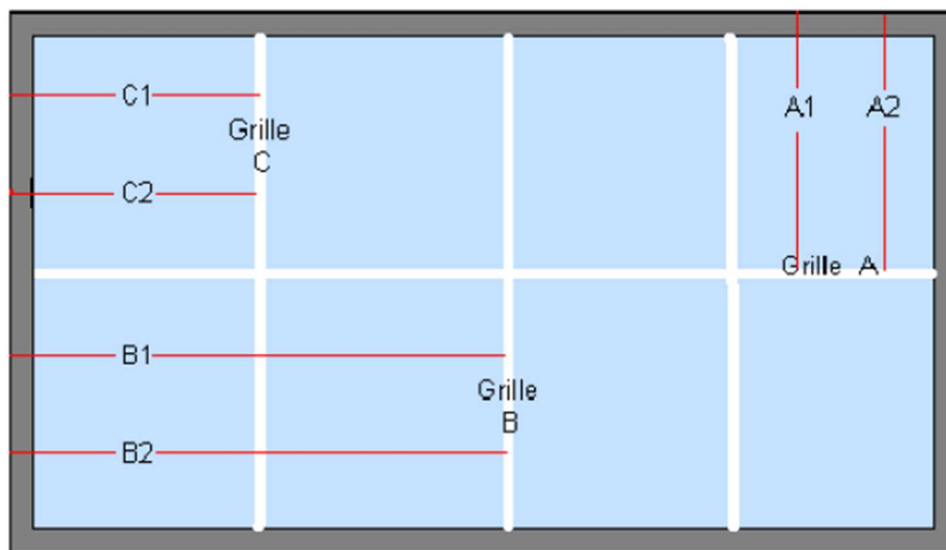
## Muntin Specifications

### Muntins-Between Glass Straightness

- Muntins are to be inspected visually first. Any muntin that appears to be out of alignment shall then be measured using a tape measure. Two measurements shall be taken for each muntin section that is questionable. Measure from the edge of glass to both ends of the muntin section in question. Straightness of muntin can be measured between each muntin intersection regardless of whether the muntin is continuous or non-continuous.
- Measurements shall always be taken from beginning at the edge of the glass to the muntin, not from muntin to muntin. The only exception to this is when the glass has a curved section to it. For these curved products, measurements can be made from muntin to muntin.
- Maximum allowable difference:
  - o Grilles up to 4" long = 1/32" (0.031").
  - o Grilles over 4" long = 1/16" (0.062").

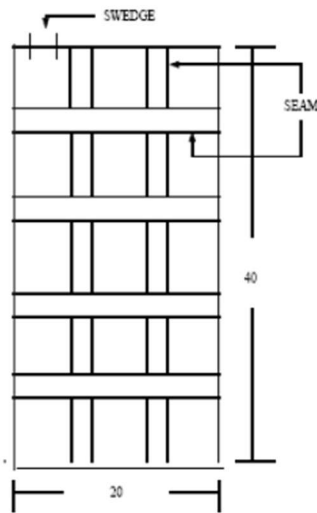
### Muntin Straightness

Note: Always measure from edge of glass to the muntin in question.



Length				Net Difference	Result (Allowable Difference)
A1	4"	A2	4 1/32"	1/32"	Acceptable ( $\leq 1/32"$ )
B1	8"	B2	8 1/8"	1/8"	Unacceptable ( $\leq 1/16"$ )
C1	5 1/2"	C2	5 9/16"	1/16"	Acceptable ( $\leq 1/16"$ )

- Each muntin bar has a seam on one edge of the muntin. This seam shall always be oriented down on horizontal muntins. Vertical muntins are allowed to have seam orientation left or right but not mixed (some left, some right) within any IG unit. Standard orientation is to the right when viewing from surface four.



\*As viewed from the inside of the house (surface #4), for colonial muntins, the horizontal component will appear to be the continuous component with the seams facing down. The vertical component will appear to be interrupted with the seams facing to the right, See Figure #1.

The distance from the edge of the glass to the center of the 1st vertical muntin bar and the distance between muntins must be a minimum of 4" for flat and contour muntins.

**Fig. 1 Standard Muntin**  
(Viewed from inside of the house)

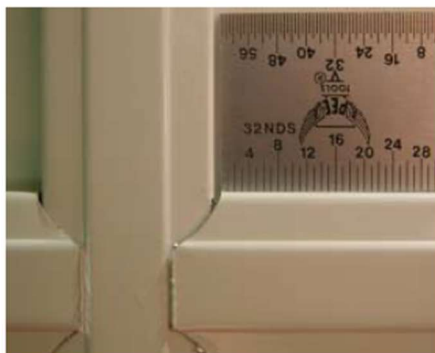
Muntin Appearance Criteria (visible at 36" or more):

- Unpainted ends are allowable.

Imperfection (Room side only)	Maximum Allowable Dimensions		Reference Figure
	Decimal	Fraction	
Burrs and Metal Shavings	0.016" X 0.062"	1/64" X 1/16"	2
Fold over or "Dog Ears"	0.031" X 0.031"	1/32" X 1/32"	2
Dent (Dia) & Crease(length)	0.125"	1/8"	N/A
Paint Chips & Marks/Spots	0.031"	1/32"	N/A
Scratches, Hairline, <.008	1.00"	1"	N/A
Scratches, Wide >.008	0.250"	1/4"	N/A

Contour Grid Machine Criteria

Imperfection (Room side only)	Maximum Allowable Dimensions		Reference Figure
	Decimal	Fraction	
Burrs and Metal Shavings	0.016" X 0.062"	1/64" X 1/16"	2
Fold over or "Dog Ears"	0.031	1/32"	2
Gap/rib of Intersection grill	0.031	1/32"	3,6.a
Gap/mitered corner intersection	0.031"	1/32"	3,6.a
Gap/Seam Intersections	0.031"	1/32"	4,5,6.a



**Acceptable Gap 1/32" or less**



**Unacceptable Gap >1/32"**

## Router Machine Contour Muntin Criteria

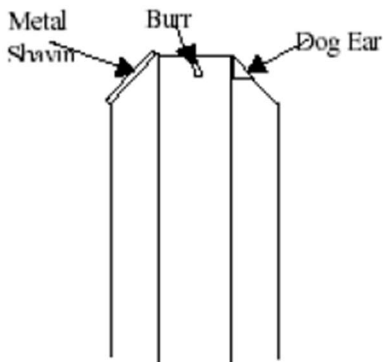
Imperfection (Room side only)	Maximum Allowable Dimensions		Reference Figure
	Decimal	Fraction	
Burrs and Metal Shavings	0.016" X 0.062"	1/64" X 1/16"	2
Fold over or "Dog Ears"	0.031" X 0.031"	1/32" X 1/32"	2
Gap/seam intersections	0.031"	1/32"	6.b



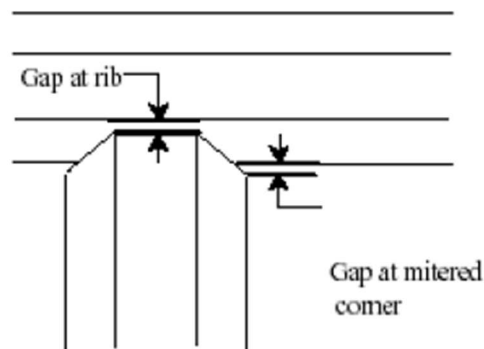
**Acceptable Gap 1/32" or less**



**Unacceptable Gap >1/32"**



**Figure 2  
Muntin Imperfections**



**Figure 3  
Muntin Imperfections**



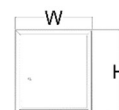
**Acceptable - 1/32" or less  
Figure 4**



**Unacceptable – Greater than 1/32"  
Figure 5**

## Window Screens

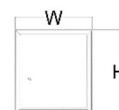
- Height and Width
  - Have a tolerance of (+/-) 1/16" when measured with a tape measure.
- Squareness
  - Have a tolerance of (+/-) 1/2" when measured with a tape measure from one corner to the opposite corner.
- Hourglass
  - Have a tolerance of (+/-) 1/16" when measured with a tape measure when measured horizontally across the top, middle and bottom of the screen.
- Flat Rack
  - Less than 2" if the screen is smaller than 150 UI.
  - Greater than 1" if the screen is larger than 150 UI.
    - Measure by placing the screen on a flat surface, hold one corner down and measure the opposite corner with a ruler / tape measure.
- Hardware drill holes
  - No drill burr greater than 1/16" when measured with a 1/16" feeler gauge.
- Miter Corner Gap
  - 1/32" or less either across entire length of cut on tip or base of cut measured with a 1/32" feeler gage.
- Miter cut tips alignment.
  - Tips of opposing pieces must align with in 1/32" or less gap measured with a 1/32" feeler gauge.
- Hardware actuation
  - Hardware must move freely up, down, or side to side within the punched or drilled hole. Checks are performed by physical actuation testing of the hardware after installation.
- Window spring alignment
  - Spring must sit securely on the edge of material and be able to be compressed and released without falling off edge.
- Window Spreader bar location
  - (+/-) 1/16" from customer specified dimension measured with a tape measure.
- Warning Label
  - No more than 1/8" misalignment from edge of frame measured with a tape measure.
- Cosmetic Scratch or dent
  - Defect visible of any size within a 4' viewing distance. Defects with a repeated pattern are to be rejected. Perform visual inspection at 4 feet under ample (normal) lighting.
- Cloth cuts / tears
  - No cuts or tears on the viewing surface. No more than one thread per 12" can be cut at spline channel edge. Inspect by viewing surface at arm's length. Spline channel viewing up to 6" from surface.
- Punch Deformation
  - No more than 1/32" visible deformation to the punch surface or adjoining edges appearing as a dimple, depression, or flair.





## Patio Door Screens

- Height and Width
  - Have a tolerance of (+/-) 1/16" when measured with a tape measure.
- Squareness
  - Have a tolerance of (+/-) 1/2" when measured with a tape measure from one corner to the opposite corner.
- Hourglass
  - Have a tolerance of (+/-) 1/16" when measured with a tape measure when measured horizontally across the top, middle and bottom of the screen.
- Flat Rack
  - Less than 2" if the screen is smaller than 150 UI.
  - Greater than 1" if the screen is larger than 150 UI.
    - Measure by placing the screen on a flat surface, hold one corner down and measure the opposite corner with a ruler / tape measure.
- Hardware drill holes
  - No drill burr greater than 1/16" when measured with a 1/16" feeler gauge.
- Miter Corner Gap
  - 1/32" or less either across entire length of cut on tip or base of cut measured with a 1/32" feeler gage.
- Miter cut tips alignment.
  - Tips of opposing pieces must align with in 1/32" or less gap measured with a 1/32" feeler gauge.
- Hardware actuation
  - Hardware must move freely up, down, or side to side within the punched or drilled hole. Checks are performed by physical actuation testing of the hardware after installation.
- Window spring alignment
  - Spring must sit securely on the edge of material and be able to be compressed and released without falling off edge.
- Window Spreader bar location
  - (+/-) 1/16" from customer specified dimension measured with a tape measure.
- Warning Label
  - No more than 1/8" misalignment from edge of frame measured with a tape measure.
- Cosmetic Scratch or dent
  - Defect visible of any size within a 4' viewing distance. Defects with a repeated pattern are to be rejected. Perform visual inspection at 4 feet under ample (normal) lighting.
- Cloth cuts / tears
  - No cuts or tears on the viewing surface. No more than one thread per 12" can be cut at spline channel edge. Inspect by viewing surface at arm's length. Spline channel viewing up to 6" from surface.
- Punch Deformation
  - No more than 1/32" visible deformation to the punch surface or adjoining edges appearing as a dimple, depression, or flair.





- Door Handle Location
  - (+/-) 1/16" from customer specified location <80" door height (subtract) center handle. Over 80" = door height (subtract) 40" center or per customer's specification measured with a tape measure.
- Wheel adjustment hole clearance
  - Hole must be clear of all plastic or metal debris to head of adjustment screw, clearly visible, and accessible.
- Wheel secure
  - All wheels must be contained in wheel slot and engaged on corner retention ears. Verify by performing a physical push / pull test.

## **Definitions**

- Associated Distortion — alteration of viewed images caused by variations in glass flatness or inhomogeneous portions within the glass.
- Azimuth - The angle subtended between two planes, one being the plane passing through the position of the sun and normal to the earth's surface and the other being the plane aligned to true north and normal to earth's surface.
- Bevel — angled surface at the edge of a lite of glass.
- Blemish — imperfection in the body or on the surface of the glass; for the purpose of this specification, blemishes are divided into two categories; blemishes not specifically mentioned shall each be compared to the blemish that they most closely resemble.
- Linear Blemish — scratches, rubs, digs, and other similar imperfections, which may be straight or curved in nature; if curved, the length of such a blemish is to be measured from end to end along the curve.
- Point Blemish — crush, knots, dirt, stones, gaseous inclusions, tin drip, and other similar imperfections.
- Bow — the deviation in flatness of a lite of glass, expressed over the entire width or length dimension of the lite or over a smaller, local span.
- Breather / Capillary Tube - A tube providing an intentional breach of the insulating glass (IG) seals to allow for pressure equalization.
- Cellular Shades - A fenestration attachment product that has a cellular structure. This attachment can be horizontal or vertical.
- Chip — indentation in the glass edge because of breakage of a small fragment; chips fall into two categories:
  - o shell chip — any chip other than a v-chip.
  - o v-chip — a chip forming an acute angle, located at the edge(s) of a glass lite and which may cause a crack in the glass.
- Chip Depth — measured distance of a chip from the glass surface into the thickness.
- Chip Length — maximum distance parallel to the edge of the glass from one edge of a chip to the other.
- Chip Width — maximum perpendicular distance from the edge of the glass to the inner edge of the chip, as measured on the glass surface.
- Cladding - An applied rigid or semi-rigid roll-formed or extruded covering that is placed over or is attached to and follows the contour of the interior or exterior framing member for the primary purpose of protection from environmental elements and/or aesthetics. Cladding adds no structural integrity to the framing member.
- Clear Glass — glass formulated to have transmittance in the visible spectrum greater than 82 % (reference to NFRC 300 measurement method) at a standard thickness of 6 mm (1/4 in.) with lack of color as compared to tinted glass of the same thickness.
- Crush — pitted condition with a dull appearance.
- Cut Size — glass ordered cut to its final intended size.
- Dew Point Temperature - Temperature at which water vapor condenses to liquid water at a given relative humidity (RH).

- Dig — a deep scratch in the glass surface.
- Dirt — small particle of foreign matter embedded in the surface of flat glass.
- Fire Crack — small, sometimes microscopic fissure in the edge of wired or patterned glass.
- Flare — protrusion on the glass edge or corner of an otherwise rectangular surface.
- Gaseous Inclusion — round or elongated bubble in the glass.
- Knot - inhomogeneity in the form of a vitreous lump.
- Low-iron Glass — glass formulated to have transmittance in the visible spectrum higher than that of clear glass of the same thickness; edge color can vary, so the glass manufacturer should be consulted regarding an application where edge color is an aesthetic consideration.
- Patterned Glass — rolled flat glass having a pattern on one or both surfaces.
- Ream — linear distortion because of nonhomogeneous layers of flat glass.
- Rub — abrasion of a glass surface producing a frosted appearance.
- Scratch — an abrasion of a glass surface in the form of a curved line, a straight line, or both.
- Stock sheets — glass ordered in sizes intended to be cut to create final or cut size (that is, uncut, intermediates, jumbos, and lehr ends).
- Stone — crystalline inclusion in glass.
- String — straight line or curled blemish, usually on the surface, often resulting from slow melting of a large grain of sand or foreign material.
- Tin drip — droplet of oxidized tin that falls onto, and bonds to, the top surface of float glass within the tin bath.
- Tinted Glass — glass formulated to have a uniform color throughout the glass, often with the purpose of reducing one or more of the following: glare, solar heat gain, or ultraviolet (UV) transmittance.
- Vision Interference Angle — viewing angle at which distortion in transmission first appears.



## **References**

ASTM C1036-21 – Standard Specification for Flat Glass

Intigral Quality Specifications Custom Insulated Glass – Final Assembly QS 23.100\_5 Rev 2

Quanex Building Products – Window Screen Quality Tolerances - Rev 3/2016

Quanex Building Products – Patio Door Screen Quality Tolerances – Rev 3/2016

“Official ASTM Glass Imperfection Standards” – Glass Contractors LLC

“Glass Inspction for the Homeowner” – Fenestration & Glazing Industry Alliance

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