NATIONAL GLASS ASSOCIATION with GANA

Glass Technical Paper **FB27-11 (2015)**

Guidelines for the Appearance of Insulating Glass Unit Edges in Commercial Applications at the Time of Installation

Introduction

This Glass Technical Paper (GTP) is intended to provide guidelines (not standards) that apply to the appearance of vision and spandrel insulating glass unit edges in commercial applications at the time of installation into the glazing system, i.e., at the unitizer, or at the building if site built. It is not intended to address changes that may occur to the IGU edge appearance that take place over time (i.e. primary sealant migration) including, but not limited to, effects due to glass movement from temperature and/or pressure fluctuations, (IGU pumping), improper tightening of pressure plates, and/or incompatible materials.

This GTP is intended to be used for both captured and structural silicone glazed (SSG) commercial glazing systems. Components of IGU edges are discussed, and acceptance criteria provided where appropriate.

NOTE: Dimensions in parenthesis in this document are for information only.

Definitions

Captured – a glazing system in which the glass is held in place at its perimeter by fixed and/or removable stops creating a pocket that is sufficiently deep enough to retain the glass under expected loads, deflections or movements. Most, if not all, of the IGU edge is covered in a captured glazing system and is, therefore, not visible.

Desiccant Hole – hole in the side or back of the spacer used to insert desiccant into the spacer.

Glazed Vision Area – the area that can be seen through after installation of the entire glazing system

Insulating Glass Unit (IGU) Edge – the perimeter area of an IGU including the primary sealant, the secondary sealant, and the spacer.

Insulating Glass Unit (IGU) Sightline - the imaginary line separating the IGU edge from the IGU vision area, running along the visible surface of the spacer.

Insulating Glass Unit (IGU) Sightline Dimension - the measurement from the edge of glass to the visible surface of the spacer (Figure 1).

IGU Vision Area - the area bounded by the IGU sightline (the surface of the spacer facing the air space) on all sides of the IGU. Refer to Figure 1.

Top/Interior Visible

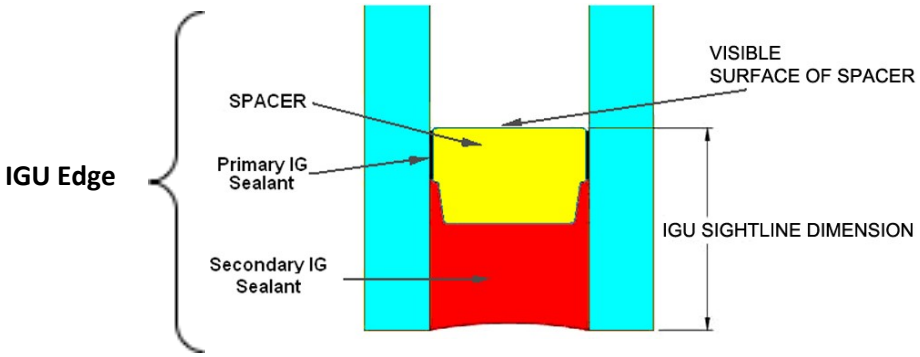

Figure 1. IGU Edge Cross Section

Offset Unit - an IGU designed for functional and/or aesthetic reasons to have the edge of one lite extend be- yond the edge of the other lite on one or more sides of the IGU. Also known as a step-glazed unit.

Note: Each lite is a different size in an offset IGU (Figures 2 and 3); both lites are the same size in a staggered IGU (Figure 4).

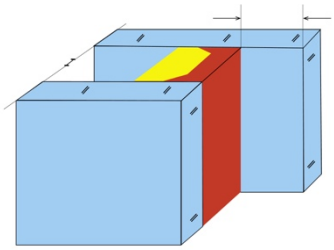

Figure 2
Single Offset IGU

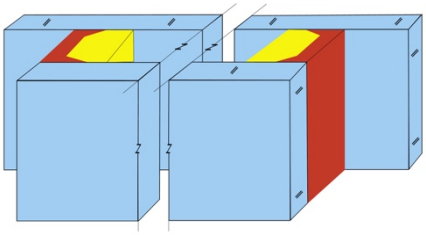

Figure 3
Double Offset IGU

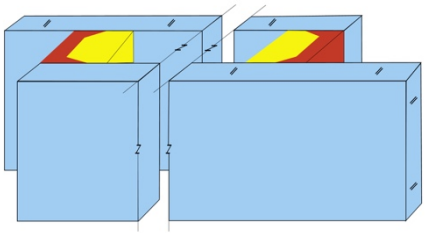

Figure 4
Staggered IGU

Primary Sealant Migration – spreading or creeping of the primary sealant over time, beyond the top of the spacer; allowable primary sealant infringement, into the glazed vision area of the IGU.

Primary Sealant Infringement – occurs when the primary sealant extends beyond the spacer and appears in the IGU vision area before installation or appears in the glazed vision area after installation.

Structural Silicone Glazed (SSG) - a glazing system wherein a structural silicone sealant is used to transfer loads between a lite of glass, an IGU, or a panel, and the supporting framework, on one or more sides, without mechanical fasteners or other methods of attachment. The entire IGU edge may be exposed and readily visible from the exterior of the building.

Spandrel IG – an IG unit in a non-vision area of a building, only viewable from the exterior.

Appearance Guidelines

Glass Edge Quality

Captured

Not applicable, as the glass edge is not visible.

Structural Silicone Glazed (SSG)

The edge should appear straight and free from cracks. Typically, there are different viewing and acceptable non-uniformities size criteria for the edge or perimeter area compared to the central viewing area of the unit. Non-uniformities include: seeds, stones, staining, spots, surface damage, shell chips, and flares. In laminated units, trapped air, blow in, delamination or short interlayer may be acceptable if they are within the size and frequency criteria specified by the IGU fabricator, and if they meet the relevant ASTM specification, identified below:

For annealed glass (uncoated):	ASTM C1036 *Standard Specification for Flat Glass*
For heat-treated glass:	ASTM C1048 *Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass*
For laminated glass:	ASTM C1172 *Standard Specification for Laminated Architectural Flat Glass*
For coated glass:	ASTM C1376 *Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass*

IG Secondary Sealant

Captured

Not applicable, as the IGU secondary sealant is not visible.

Structural Silicone Glazed (SSG)

The color of the secondary sealant may vary between units fabricated with the same sealant due to inherent variation of the sealant manufacturing and/or application process.

Typically, there is a color difference between the primary and secondary sealants. This is useful for the fabricator in performing quality checks (identification of voids and skips, etc.). The secondary sealant should be continuous, as skips in the secondary sealant may impact the performance of the unit.

Small separations may exist between the primary and secondary sealants. The size of these separations is based on measurements of the spacer surface that is visible at the separation when viewed perpendicular to the glass surface. The separation width should not exceed 1/16 inch (1.6 mm). For IG units with an IGU sightline dimension of 1/2” (12.7mm) or less, the total combined length of all separations on any edge on any side that is exposed should not exceed 25% of the length of that glass edge, or 2” (50.8 mm), whichever is greater. For IG units with sightlines larger than 1/2” (12.7mm), consult the fabricator for allowable separation dimensions.

IGUs made intentionally with the lites offset from each other may have the secondary sealant covering the offset glass edges strictly for appearance reasons. This should be discussed with the IGU fabricator prior to the start of IGU production.

Because the secondary sealant provides structural support, more secondary sealant may be needed relative to the amount needed for captured units of similar size and location. The amount of secondary sealant needed can be determined using ASTM C 1249. This may result in IGUs with varying sightlines being used on the same job.

Gray secondary sealant may contain discolorations due to the presence of carbon black. Such discolorations are acceptable, provided discolorations are not due to improper mixing that could affect performance.

IG Primary Sealant

Captured

The primary IG sealant may extend beyond the IGU sightline into the IGU vision area (Figures 5, 6, and 7).

Structural Silicone Glazed (SSG)

The primary sealant is typically extruded onto both sides of the spacer. The extrusion rate may vary causing the amount and width of the primary sealant to vary. The placement of the spacer may also contribute to primary sealant non-uniformity when the spacer is pressed to the glass in the fabrication process. Selecting a spacer of similar color to the IGU sealants may minimize visual objections related to dissimilar colors.

The primary sealant may also be applied manually (It comes in a string form and is applied by hand.), which may influence the uniformity of the applied sealant. The primary sealant should be continuous with no skips. Primary sealants may be even with, above or below the top/interior visible spacer surface. IG spacer fabrication may result in acceptable variations in the primary sealant position including, but not limited to, at desiccant hole locations (Figure 5) and at corners (Figure 6). Gray primary sealant may contain discolorations due to the presence of carbon black. Such discolorations are acceptable provided they do not affect performance.

Figure 5
Primary Sealant at Desiccant Hole Location

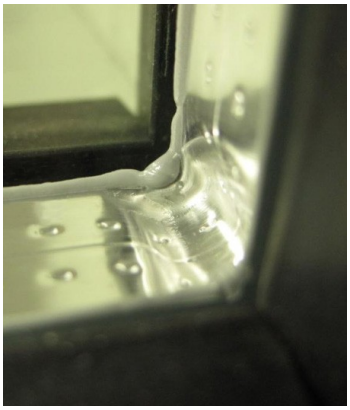

Figure 6
Primary Sealant at Bent Corner

IG Spacer

Captured

The top of the spacer and a portion of the spacer side may be visible under certain viewing conditions.

Spacers may contain IGU supplier information, certification labels, holes for gas filling, connection joints, and perforation holes or seams to allow for desiccant activity.

Spacers are available in a variety of materials, finishes, surface textures, widths and colors. Contact the fabricator for details.

Variations in spacer color from IGU to IGU may exist due to inherent color variations from lot to lot in spacer finish, glass color, thickness and coatings. See Color Variations under Other Visual Edge Effects.

Structural Silicone Glazed (SSG)
The top of the spacer and a portion of the spacer side may be visible under certain viewing and design conditions. For structural silicone glazed systems with deeper sightlines, the IGU edge may extend into the glazed vision area. This should be addressed at the design stage to ensure aesthetic acceptability.

Spacers may contain IGU supplier information, certification labels, holes for gas filling, connection joints, and perforation holes or seams to allow for desiccant activity.

Spacers are available in a variety of materials, finishes, surface textures, widths and colors. Contact the fabricator for details.

Variations in spacer color from IGU to IGU may exist due to inherent color variations from lot to lot in spacer finish, glass color, thickness and coatings. See Color Variations under *Other Visual Edge Effects*.

Various corner constructions (such as bent and keyed) may be used to fabricate IGUs on the same project. This may result in a visual difference in the corner appearance which is acceptable.

Coated Glass Visual Effects – Edge Deletion
Captured
Typically, edge deletion is confined within the captured area, and therefore, not visible. For added clarification, contact the fabricator.

Structural Silicone Glazed (SSG)
Coated glass manufacturers have determined removal of the coating around the perimeter is necessary for certain glass coatings. Due to the multi-layer nature of these coatings and/or the coating removal process, the edge deleted area may have variations in uniformity of color, width, and degree of removal.

Edge deletion is typically targeted to end within the primary sealant. Normally the edge deletion and primary sealant should not extend into the glazed vision area more than 1/8 in (3.2 mm). However, there are specific products and/or coating manufacturers that may require more or less edge deletion. Contact the fabricator for details. The primary sealant color in the edge deleted area may be different than the primary sealant color in the coated area. The degree of color difference will depend on the coating and the edge deletion process. Though primary sealant color differences may be readily visible, they should not be the cause for rejection. Viewing mock-ups is strongly recommended.

Other Visual IG Edge Effects

Captured Color Variations
The apparent color of the IGU edge may vary due to, but not limited to, glass substrate color, sealant color and consistency, spacer, glass thickness, applied coatings, silkscreened patterns, use of patterned or etched glass, sun angle, lighting conditions and building orientation.

Structural Silicone Glazed (SSG) Color Variations
The apparent color of the IGU edge may vary due to, but not limited to, glass substrate color, sealant color and consistency, spacer, glass thickness, applied coatings, glass silkscreened patterns, use of patterned or etched glass, sun angle, lighting conditions and building orientation.

Primary Sealant Infringement

Captured

Primary sealant infringement within the as-fabricated insulating glass unit should not exceed 1/8 inch (3.0 mm) anywhere along the sightline except at corners, where the primary sealant squeeze out may exceed 1/8 inch (3.0 mm). See Figure 7 for an example of primary sealant infringement.

Figure 7
An Example of Primary Sealant Infringement

Structural Silicone Glazed (SSG)

Primary sealant infringement within the as-fabricated insulating glass unit should not exceed 1/8 inch (3.0 mm) anywhere along the sightline except at the corners, where the primary sealant squeeze out may exceed 1/8 inch (3.0 mm).

Sightline Dimension

Captured

Most, if not all, of the IGU edge is covered in a captured glazing system and is, therefore, not visible.

Structural Silicone Glazed (SSG)

Sightline dimension may vary because the silicone dimension varies as needed to meet the specified design loads for a given IGU size and makeup. This may cause IGUs with varying sightlines to be used on the same job. The insulating glass unit sightline dimension may vary +/- 1/8 inch (3.0 mm) along any given edge. Larger variations are typical at the IGU corners.

See ASTM C 1249 for technical information related to calculating the sightline dimension.

Comments

Further considerations may be needed to accommodate new technologies and/or design requirements specific to a given project. Contact the fabricator of the IGU for information on any topics not addressed in this Paper.

References

ASTM (available at www.astm.org)

ASTM C1036 *Standard Specification for Flat Glass*

ASTM C1048 *Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass*

ASTM C1172 *Standard Specification for Laminated Architectural Flat Glass*

ASTM C1249 *Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications*

ASTM C1376 *Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass*