NATIONAL GLASS ASSOCIATION with GANA

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

Considerations for the Appearance of Insulating Glass Unit Edge at the Time of Fabrication

Introduction

This Glass Technical Paper (GTP) is intended to provide guidelines that apply to the appearance of vision and spandrel insulating glass unit (IGU) edges at the time of fabrication. The appearance of the IGU edge is a function of the materials and the fabrication process.

This GTP is not intended to address changes to the IGU edge appearance that may occur over time after fabrication, including, but not limited to, effects due to glazing system design, shipping, handling, storage conditions or installation.

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

Definitions- As-Fabricated

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

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

Insulating Glass Unit (IGU) Sightline Dimension – The distance from the glass edge to the visible surface of the spacer. Refer to Figure 1. 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.

IGU Vision Area - the area bounded by the IGU sightline on all sides of the IGU. Refer to Figure 1.

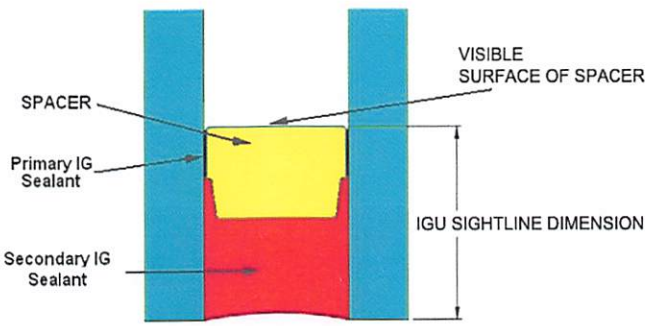

Figure 1: IGU Edge Cross Section

Offset Unit - an IGU designed to have the edge of one lite extend beyond the edge of the other lite on one or more sides of the IGU for functional and/or aesthetic reasons. Also known as a step-glazed unit. Refer to Figures 6, 7 and 8.

Primary Sealant Infringement – occurs when the primary sealant extends beyond the spacer and appears in the IGU vision area.

Structural Silicone Glazing (SSG) - a glazing system wherein a structural silicone sealant is used to transfer loads from a lite of glass, an IGU, or a panel, to the supporting framework on one or more sides, without mechanical fasteners or other methods of attachment.

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

Appearance Guidelines

Glass Edge Quality

There are different viewing conditions and quality criteria for the glass edge compared to the central viewing area of the IGU which may also vary depending on glass type. Non-uniformities may be acceptable if they are within the size and frequency criteria specified in all the relevant ASTM specifications, 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 Spacer

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. Different spacer types could be used on the same project. In addition, corner construction may vary in appearance depending on spacer type. Various spacer corner constructions (such as bent and keyed or extruded) may be used to fabricate IGUs on the same project. This may result in an acceptable visual difference in the corner appearance. Contact the fabricator for options.

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 for additional factors that could affect the appearance of the spacer.

In SSG applications, where IG edges will be exposed to viewing, it is advisable to use a dark colored spacer. This will avoid visibility of the spacer if not fully covered by the edge sealants.

IG Primary Sealant

This section will discuss primary sealants that are mechanically applied to a spacer. Spacer systems exist that are an extruded thermoplastic material that combine the spacer and primary sealant, however this section does not address those systems. The primary IG sealant may extend beyond the IGU sightline into the IGU vision area (Figures 2, 3, and 4).

The primary sealant is typically mechanically extruded onto each side of a spacer. The extrusion rate may vary, causing variation in the appearance of the primary sealant. 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 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 (no voids). Refer to NGA's GANA Glazing Manual for specific dimensions. The edges of primary sealants may be even with, above or below the top/interior visible spacer surface. Primary sealant application to the spacer may result in variations in the primary sealant position at locations including, but not limited to, desiccant fill hole locations (Figure 2) and corners (Figure 3). Such variations are acceptable. Gray primary sealant color may not be uniform; such discoloration is acceptable.

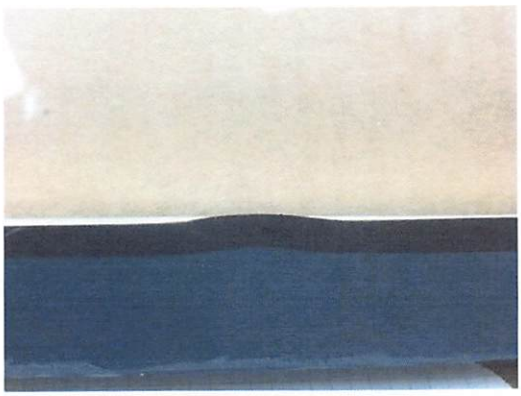

Figure 2:
Primary Sealant (black) at Desiccant Fill Hole

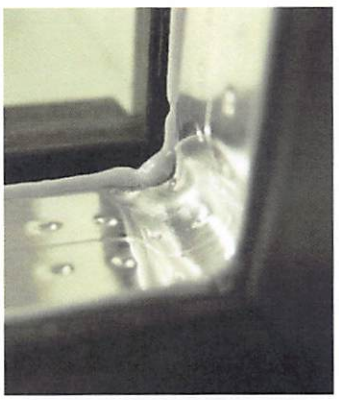

Figure 3:
Primary Sealant (gray) at Bent Corner

Figure 4:
An Example of Primary Sealant Infringement

Primary Sealant Infringement

Primary sealant infringement within the as-fabricated IGU should not exceed 1/8 inch (3.0 mm) beyond the IGU sightline dimension anywhere along the perimeter except within 1 inch (25.4 mm) of the corner, where the primary sealant infringement may exceed 1/8 inch (3.0 mm). See Figure 4 for an example of primary sealant infringement.

Refer to TB-1250-19 *PIB Primary Sealant in Insulating Glass Units* for more information.

IG Secondary Sealant

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 voids in the secondary sealant may impact the performance of the unit.

Small separation gaps may exist between the primary and secondary sealants. A separation gap is the visible gap between the primary and secondary sealant where the spacer surface is visible when viewed perpendicular to the glass surface (see Figure 5). The separation gap area shall not exceed 0.2 in^2 (129 mm^2) and the separation gap width shall not exceed 1/16-inch (1.6 mm), except within 1 inch (25.4 mm) of the corner where the separation gap width may be larger. Any two gaps shall be separated by a minimum of 18 inches (457 mm) (refer to Table 1).

Table 1: Separation Gap Allowance

	In main viewing area of IGU	Within 1-inch (25.4 mm) of the corner of the IGU
Separation gap area, maximum	0.2 in^2 (129 mm^2)	0.2 in^2 (129 mm^2)
Separation gap width, maximum	1/16-inch (1.6 mm)	Larger widths allowed
Distance between two gaps, minimum	18 inches (457 mm)	18 inches (457 mm)

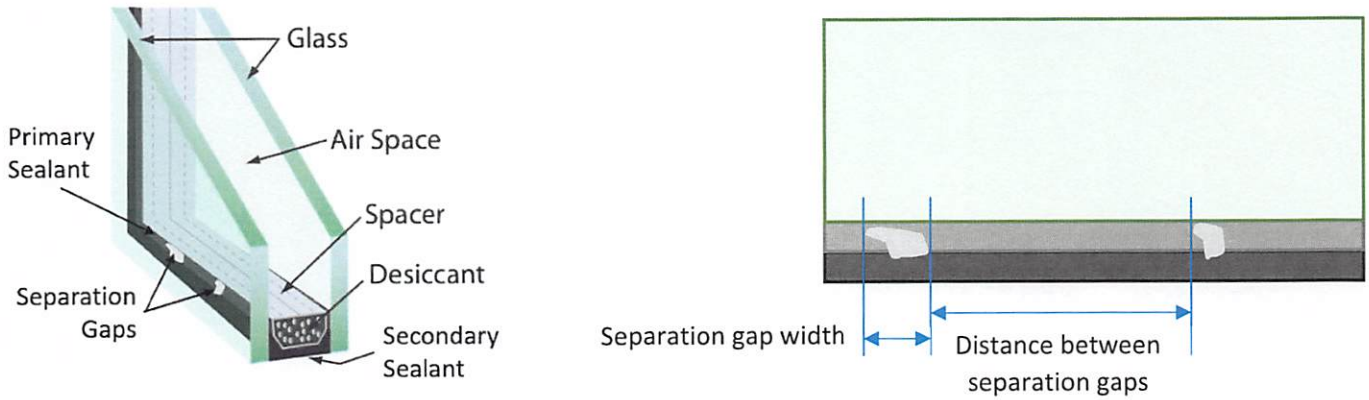

Figure 5: Separation gaps, overview (left) and detail of separation gaps (right)

IGUs made intentionally with the lites offset from each other may have the secondary sealant as shown in Figures 6, 7 and 8, however the secondary sealant may cover some or all the offset edge for various reasons. Coated glass edge deletion may also affect the appearance of the offset edge (see also below section on edge deletion). A mock-up or small sample is recommended as a visual aid. This should be discussed with the IGU fabricator prior to IGU production.

Note: Each lite is a different size in an offset IGU (Figures 6 and 7). Both lites are the same size in a staggered offset IGU (Figure 8) when both offsets are the same size; lites are different sizes when the offsets at either end are different.

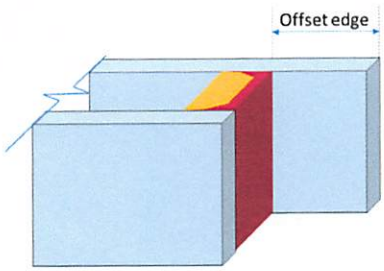

Figure 6:
Single Offset IGU

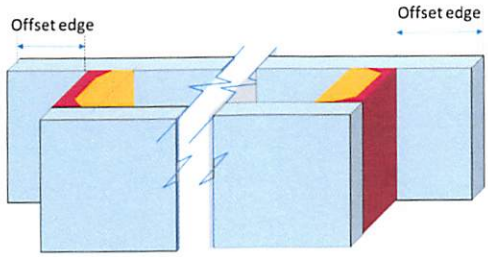

Figure 7:
Double Offset IGU

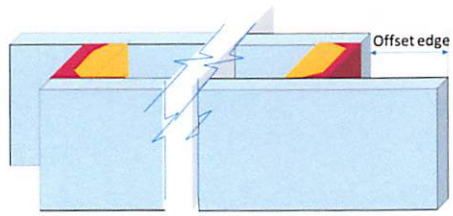

Figure 8:
Staggered Offset IGU

Because the silicone secondary sealant provides structural support in an SSG application, more secondary sealant may be needed in SSG units relative to the amount needed for captured units of similar size and location. The amount of silicone secondary sealant needed should be determined using ASTM C1249. This may result in IGUs with varying sightlines being used on the same job. See ASTM C1249 for technical information related to calculating the silicone secondary sealant contact width required to resist wind loads in a SSG application.

Gray secondary sealant color may not be uniform. Such discoloration is acceptable, provided it is not due to improper mixing that could affect performance.

Coated Glass Visual Effects – Edge Deletion

Coated glass manufacturers have determined removal of the coating around the perimeter (edge deletion) 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 vary in uniformity of color, width, and degree of removal.

Edge deletion is typically targeted to end within the primary sealant. Normally the edge deletion should not extend into the IGU 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 appear 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

The apparent color of the IGU edge may vary due to factors including, but not limited to, glass substrate color, sealant color, glass thickness, applied coatings, silkscreened patterns, use of patterned or etched glass, viewing angle, and lighting conditions.

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*

NGA's GANA Glazing Manual IYOG Edition

TB- 1250-19 PIB Primary Sealant in Insulating Glass Units