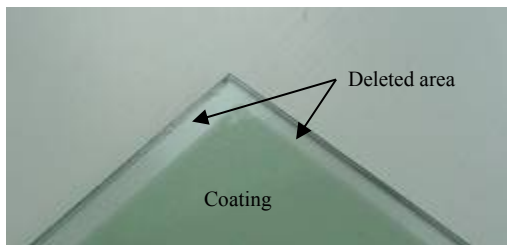


Edge Deletion of Vitro Coated Glass

The following information outlines Vitro’s (formerly PPG Industries) specification for edge deletion, and provides guidance to Vitro’s Authorized Manufacturers and Certified Fabricators for edge deletion of Vitro’s coated glass products.

What is edge deletion?

Edge deletion is the removal of a narrow strip of coating around the perimeter of a cut to size sheet of glass, which will be used to make an insulating glass unit or a laminated glass sandwich.



Vitro Low Emissivity Products & Authorized Manufacturers / Certified Fabricators

Vitro now manufactures many different Sungate® and Solarban® coated glass products for use in both the residential and commercial construction markets. All users of Sungate and Solarban Low-E coated glass containing silver must be qualified via the Authorized Sungate / Solarban Manufacturers Program or one of the Certified Fabricator Programs. Qualification includes analysis of water, cutting fluid, and gloves, as well as an on-site process audit. The success of the Authorized / Certified Fabricator Programs, aimed at assuring customer best practices, cannot be over emphasized. Vitro is committed to ensuring our customer’s success in fabricating Sungate and Solarban coated glass through compliance with these proven programs. Vitro policies concerning edge deletion vary, depending on the specific product and

application involved. Our Sungate and Solarban coated glass is purchased by insulating glass fabricators, who sell their IG units to both residential window manufacturers and to glazing contractors for use in commercial applications. Sungate and Solarban coated glass is also purchased by window manufacturers who internally fabricate their own insulating glass units. Sungate and Solarban coated glass may also be purchased by laminator customers who fabricate laminates for use monolithically or as a component of an IG unit. The table included within this document specifies when edge deletion is required. As shown in the table, **Vitro requires that all MSVD Sungate and Solarban coated glass be edge deleted when used in commercial construction glazing applications.** It may be impossible to make a universal and precise distinction between “residential” and “commercial” applications. Generally, however, substrate thickness and the actual glazing of the product can be used as a guideline. Typically, glass thicknesses of 4mm and less are used for residential applications, where commercial applications utilize 5mm and 6mm, and greater thicknesses. Also, residential applications usually involve a factory glazed sash; on-site glazing is the typical rule in commercial applications. Obviously, judgment will sometimes be required. However, **when in doubt, edge delete the coating.** The choice of whether or not to delete the Sungate and Solarban coated glass ultimately belongs to the customer. Vitro offers an alternative to deletion, but we neither promote nor mandate it. If the customer is not comfortable with not deleting, Vitro encourages the customer to delete the coating.

Deletion Requirement for Commercial Applications

The deletion requirement for commercial applications is based on the following:

Edge Deletion of Vitro Coated Glass

- ✓ The lack of knowledge and control of the end-use application of Vitro’s Sungate and Solarban coated glass products in commercial construction glazing applications.
- ✓ The complex and varied nature of such applications, which expose undeleted coatings to possible chemical interactions with numerous sealants, gaskets, cleaning agents, and rundown from adjacent materials.
- ✓ The practical inability of either Vitro or our customer to evaluate and confirm long term compatibility of its coatings with the numerous materials which are present in commercial applications and which may chemically attack the coating.
- ✓ The practical inability of Vitro to review and comment on glazing details to ensure the proper application of the final product.
- ✓ The very high economic risk associated with commercial project problems – often including labor, penalties, lost rental revenues, and other punitive charges – which can amount to an order of magnitude or more than the value of either Vitro’s or even the customer’s sale.

While we know that Sungate 100 coated glass has been successfully used for over twenty years in insulating glass units for the commercial market, Vitro strongly recommends that its fabricator customers adhere to the deletion requirement. It is clear for the above and other possible reasons that deletion is the most practical way to currently deal with the myriad of unknown factors that could affect the Sungate and Solarban coated glass in commercial applications.

Edge Deletion for Off-Set IG Units and Holes within IG Units

Edge Deletion is a requirement for all Off-set IG Units. The entire surface of the off-set must be edge deleted for all applications

regardless of residential or commercial use. A special process may need to be adapted to ensure an even, entire deletion of the full off-set surface.

Failure to delete the entire off-set surface area could result in long term coating failure in the off-set area. This coating failure could affect the seal in the frame and/or become visually objective as viewed from the outside.

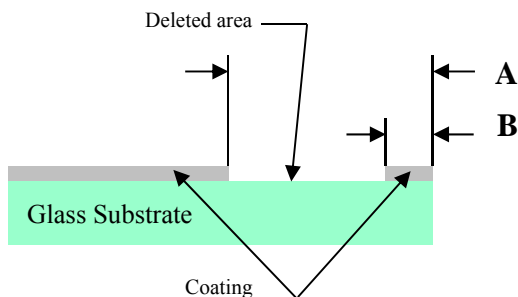


If this Off-set area is low-e coated then the coating must be deleted in its entirety over the exposed area and back to at least 50% through the width of the primary sealant path.

Edge Deletion of Vitro Coated Glass

Some glazing systems incorporate holes and pass through bolts as part of the IG mounting system. If low-e coatings are used within the glazing system and the seal around the holes requires sealant contact with the coated surface, then the requirement for deleting the coating around the periphery also applies to the coating around the holes. If the edges need the coating deleted due to the application, then the coating around the holes must also be deleted. Integrity and quality of the seal must be maintained around the hole as well as around the periphery. The coating must be contained within a hermetically sealed unit.

Edge Deletion Specification



Dimension “A” can be anything, as specified or determined by each individual customer where the minimum Dimension “A” must meet one of the following requirements:

- 1) The deletion width must be a minimum of 3/8”, from the edge of glass to the edge of the coating, (required for CLP laminates with embedded coatings).
- 2) In insulating glass units the minimum deletion width is from the edge of glass to at least 50% through the primary sealant bead width.

Vitro’s standard is 3/8” +/-1/16” for residential applications, and 5/8” +/- 1/8” for commercial applications.

The goal is to delete the coating in from the glass edge a distance that will not allow it to

be in touch with any sealants, and to form a break in the coating so moisture that may come in contact with the IG edge cannot migrate inward and damage the coating or increase the probability of seal failure.

Dimension “B” may be up to 1/16”, but you should strive to completely eliminate the coating in this area as well.

Good deletion means you have completely removed the coating down to bare glass.

Deletion must be complete and continuous around the entire periphery of the glass.

How to check for good deletion

Visual check

A very simple, practical way to check for good deletion in the factory is to place a piece of clear glass of the same thickness as the coated glass next to the edge deleted area, then view a piece white paper through the deleted area and the clear glass together. If you have good deletion, the white paper will appear about the same shade of color through the deleted area as through the clear glass. This can be done at the deletion table, but is best done after the glass is washed, following deletion. This will wash off deletion residues, and will give a cleaner edge deleted area, for a better comparison.

Also, if deletion is incomplete, the small square at the corner of the glass sheet, which is passed over twice by the deletion wheel, will be slightly lighter than the area where the deletion wheel passes only once. If you have this condition, your deletion equipment may need adjustment.

Edge Deletion of Vitro Coated Glass



Photo at Left shows an area with incomplete edge deletion. Edge deletion needs to be complete around the entire periphery of the glass. In laminated glass applications where the coating is in contact with the interlayer material, and in all commercial glazing applications, edge deletion of the coating is required for the coating warranty to be valid.

Continuity check

Another way to check for complete deletion is with a continuity checker, such as a low-e detector. If enough coating remains in the deleted area to set off a low-e detector, then deletion is not satisfactory, and equipment adjustments should be made.

Edge Deletion Equipment

There are many options for accomplishing the edge deletion. These include:

- ✓ In-line deletion as part of the optimizer or insulating glass assembly process, an option offered by some suppliers of optimizer systems and automated insulating glass assembly systems. Suppliers of in-line deletion equipment that Vitro can recommend are:

BILLCO Manufacturing, Inc.
100 Grandview Boulevard
Zelienople, PA 16063—9799
Telephone: 724-452-7390 FAX: 724-452-0217
Internet: <http://www.billco-mfg.com/>

GED Integrated Solutions
9280 Dutton Drive
Twinsburg, OH 44087-1967
Telephone: 330-963-5401 FAX: 330-425-8741
Internet: [GED Home Page](#)

- ✓ Table deleters, using both fixed single head and motor driven traversing dual head systems. There are a number of suppliers of such edge deletion tables. One supplier of table deleters that Vitro can recommend is:

ALKAB Contract Manufacturing, Inc.
843 Industrial Boulevard
New Kensington, PA 15068—6428
Telephone: 724-335-7050 FAX: 724-335-7055
Internet: www.alkab.com

- ✓ Hand-held deleters. This is the least attractive method and one that Vitro does not recommend. The use of hand held deleters can be unsafe, both physically and ergonomically. Consistent deletion is often difficult to achieve and the risk of glass damage is high.

There are several potential sources for deletion wheels that are used on the above equipment. Consult the manufacturer of the deletion equipment for recommendations. Vitro can offer two types of wheels for consideration;

- 3M Scotch-Brite™ SST Unitized Wheel (8" x ½" x 3")
- Norton Bear-Tex Convolute Wheel (200 x 10 x 76.2)

Edge Deletion of Vitro Coated Glass

Regardless of the deletion process used, the equipment must be equipped with a collection system that includes a HEPA filter and/or the operators and persons in the vicinity may be required to wear appropriate respirators. For additional information, refer to the Environmental, Health, and Safety Statement below and to the Sungate and Solarban Coated Glass Material Safety Data Sheet available from Vitro Technical Services.



Photo of Deletion Wheel and Dust Collection Enclosure on a Table Deleter.
Photo courtesy of ALKAB Contract Manufacturing.

Environment, Health, and Safety Information Statement

Vitro is required under the OSHA Hazard Communication Standard to distribute Material Safety Data Sheets (MSDS) to our Sungate® and Solarban® coated glass customers who perform edge deletion. This is necessary because these products contain a very small percentage of silver metal, and Vitro has determined that employees involved in the edge deletion process can be exposed to silver dust in excess of the OSHA Permissible Exposure Limit (PEL) of 0.01 mg/m³.

Long-term overexposure to silver dust (both airborne and skin contact) may cause a permanent bluish-gray discoloration of the eyes, mucus membranes, and skin. Product warning labels will also appear on incoming pallets of Sungate® and Solarban® coated glasses as required by Hazard Communication. The silver metal contained in Sungate® and Solarban® coated glasses is not classified as a hazardous material according to the Canadian Workplace Hazardous Material Information System (WHMIS).

Inhalation of coating dust should be prevented by using a local exhaust ventilation system. Vitro recommends an exhaust ventilation system with a shroud at the deletion head to remove the silver particulate. The ventilation system should be equipped with a HEPA (High Efficiency Particulate Air) filter with efficiency greater than 99.9%. As with any control device, the ventilation system must be utilized by employees, and maintained to effectively control the workplace environment. The need for respiratory protection should be based upon a workplace evaluation. Glass products and silver containing dusts generated during edge deletion may be recycled. The disposal requirements for waste edge deletion dust should be based upon testing conducted in accordance with federal, provincial, state, and local requirements.

Recommended work practices, personal protective equipment, and environmental considerations, including disposal of edge deletion particulate, are addressed in the MSDS. You should review and communicate the information contained in the MSDS as required by federal, state, and provincial requirements, and conduct a safety, health, and environmental assessment to evaluate your workplace.

Edge Deletion of Vitro Coated Glass

It is important to emphasize that the silver particulate exposure and waste disposal concerns refer only to the deletion process; there is no chemical risk with the product otherwise. This means that it is not necessary for you to provide an MSDS or warning labels with your window products to your customers.

General Handling Guidelines

During the edge deletion process, follow all of the usual careful handling procedures for coated glass.

- Process the glass with the coated side up.
- Wear approved gloves when handling the glass (see TD-147 for the approved glove list).
- Avoid touching the coated surface. Handle glass by the edges as much as possible. Even approved gloves can scratch the coatings if the gloves are dirty or contain embedded debris.
- Do not stack one piece of coated glass on top of another during handling.
- Do not put two pieces of glass in the same slot in a harp rack, to avoid scratching.
- Maintain good glass edge cut quality to avoid flare and bevel which can result in chipped edges when glass comes in contact with stops on the deletion table.
- Wash the glass soon after deletion to remove handling smudges, fingerprints, grease or oil contaminants, and deletion residues.

Non-Edge Deletion Policy

The non-edge deletion policy for specific Vitro Sungate and Solarban coated glass as listed in the table below is based on:

- ✓ A patented coating layer structure: Vitro owns patents covering several of the coating layers to which competitive manufacturers do not have access. The proprietary overcoat and barrier coats, which “sandwich the pure silver layers, are both more chemically resistant than those used by competitive products.
- ✓ Extensive testing done at Vitro’s Glass Business & Discovery Center.
- ✓ The reality of the in-service application of the IG units.

Vitro’s Non-Edge Deletion Policy Requirements

- ✓ All uses of Sungate and Solarban coated glass must be qualified via the Authorized Sungate / Solarban Manufacturers Program or one of the Certified Fabricator Programs.
- ✓ Receipt by Vitro of the signed Non-Edge Deletion Agreement.
- ✓ Insulating glass units must be fabricated with approved Sungate and Solarban compatible sealants (see TD-146 for a list of approved sealants).
- ✓ The resulting insulating glass units are not exposed to prolonged moisture or saturated water vapor, such as the conditions typical of coastal applications and pool enclosures where the glass units will be subject to persistent moisture spray and condensation.
- ✓ Where indicated in the table below, the insulating glass unit must be installed in an adequately weeped glazing system. The glazing rabbet must be weeped to prevent moisture contact with the edge of the coated glass.

Edge Deletion of Vitro Coated Glass

Vitro Sungate® & Solarban® Low-E Coated Glass Edge Deletion Requirements		
NOT Required = Edge Deletion Not Required if All Stipulations are Satisfied per Residential Qualified Manufacturer (RQM) and Residential Qualified Tempering (RQT) programs Required = Edge Deletion Required		
Customer & Application	Specific Sungate or Solarban Coated Glass	
	Sungate 400, Sungate 400VT, Solarban 60, Solarban 60VTII, Solarban 70XL and Solarban 70XLVT	Solarban 67, Solarban 67VT, Solarban 72VT, Solarban z50, Solarban z50VT, Solarban z75, Solarban z75VT, Solarban 90, Solarban 90VT and Solarban R100VT
<i>IGU Fabricator</i>		
For Residential Windows	Required	Required
For Commercial Applications	Required	Required
<i>Window Manufacturer who fabricates IG units for internal consumption</i>		
For Residential Applications	NOT Required ^{1,2}	Required
For Commercial Applications	Required	Required
<i>Laminated Sungate / Solarban glass where the coating is directly adjacent to the approved interlayer material</i>		
Monolithic Laminates	Required ³	Required ³
As an Outboard Lite of an IG Unit	Required ³	Required ³
As an Inboard Lite of an IG Unit	Required ³	Required ³
1 Insulating glass units must be fabricated with approved Sungate & Solarban compatible sealants. (See TD-146)		
2 May be used non-edge deleted only with an adequately weeped glazing system and upon receipt by Vitro of the signed Non-Edge Deletion Agreement and acceptance of the Non-Edge Deletion Policy.		
3 Edge Deletion of the Coating is required for all Vitro MSVD low-E coated glass when used adjacent to interlayer or film materials. The minimum deletion width for laminates with embedded coatings is 3/8" as measured perpendicular from the edge of glass to the edge of the non-deleted coating.		

NOTE: The edge deletion process is an abrasion process. In abrading away the coating, micro scratches are made in the glass surface. The process may also cause chips in the edges of the glass sheet. Both of these phenomena weaken the glass, and increase the chance that it could break during further processing, or when the IG unit is exposed to field conditions, such as wind loads and changes in temperature and atmospheric pressure.

Edge Deletion of Vitro Coated Glass

Seal Durability Testing of Non-Edge Deleted Glass

- Glass with non-edge deleted coatings will typically have exposed coating at the edge of the IGU. This exposed coating is subject to attack from corrosive agents such as, but not limited to, chlorine or chloride components. *ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation* currently has no requirement for the quality of the water used in the course of the testing. Water utilized during the ASTM testing that has measurable levels of chlorine or chloride components will likely cause coating corrosion of non-edge deleted coatings during the testing. This corrosion can be minimal to severe, even to the point of causing the units to fail the evaluation.
- With the good intention of reducing or eliminating the mineral build-up on the IGU's caused by hard water during the ASTM testing, some test facilities have added localized water treatment. Water softeners used to treat the water for the ASTM E2190 test may introduce Chloride (Cl) and / or Sodium Chloride and/or Potassium Chloride, usually during inappropriate or malfunctioning regeneration or back flushing of the softening beads. As discussed above, the chlorine or chloride components can attack the silver in the low-E coating and cause coating corrosion during the testing.
- IGU's in normal in-service applications would not encounter exposure to Cl at the same levels and under the same conditions as seen when the ASTM E2190 testing is conducted with water containing measurable levels of Cl.
- The ASTM E2190 test protocol specifies 30 minutes of water spray in every 6 hour cycle. Vitro offers the following consideration for water supply based on experience to maintain glass cleanliness, minimize operating cost and exposure concerns. Pipe the water supply source for the test apparatus to utilize tap water for the first 25 minutes of the 30 minute cycle and switch to de-mineralized water for the last 5 minutes of the cycle that has a water quality with Total Dissolved Solids content of $TDS \leq 20\text{ppm}$, or conductivity of $\leq 40 \mu\text{S/cm}$. The low PPM final rinse water will minimize any mineral build-up and unwanted chemical deposits on the glass. Vitro has utilized this water configuration very successfully for many years on its internal ASTM E2190, (formerly E773/774) test apparatus.

Vitro's recommendation for ASTM E2190 testing of IGU's with silver based low-E coated glass:

- ✓ *Test non-edge deleted units only with test apparatus using final rinse water with a $TDS \leq 20\text{ppm}$.*
- ✓ *Test fully edge deleted units with test apparatus using any type of water.*

Edge Deletion of Vitro Coated Glass

HISTORY TABLE		
ITEM	DATE	DESCRIPTION
Original Publication	1/4/2002	TD-502
Revision 1	12/08/2005	Move to TD-141; Include Solarban 65, 70, & 80 products
Revision 2	5/22/2007	Updated referenced TD numbers, moved Solarban 70XL to Solarban 60 column, added section for off-set IGU's & IGU's with holes, rearranged some text.
Revision 3	6/22/2007	Added footnote 2 to Sungate 100, 100VT
Revision 4	7/18/2008	Revised Deletion Specification Text
Revision 5	7/20/2010	Added deletion wheel types on pg 4, updated non-delete requirements on pg 6, added SG400 to table on pg7 and ASTM E2190 water quality comments on pg 8.
Revision 6	1/4/2013	Added SB67 and SB72 to table on pg7 and moved SG400 to column 2 header from 3.
Revision 7	3/13/2014	Modified table on page 7, deleted SG100, SB65 & SB80 and added SBz50, SBz75 & SBR100. Moved SB70XLVT to column 1. Deleted footnote 4. Added no coastal applications to requirement of NED Policy.
Revision 8	4/5/2017	Updated to Vitro Logo and format, changed program names and added SB90 and SB90VT to table on page 7.

This document is intended to inform and assist the reader in the application, use, and maintenance of Vitro Flat Glass products. Actual performance and results can vary depending on the circumstances. **Vitro makes no warranty or guarantee as to the results to be obtained from the use of all or any portion of the information provided herein, and hereby disclaims any liability for personal injury, property damage, product insufficiency, or any other damages of any kind or nature arising from the reader's use of the information contained herein.**