Spandrel Glass – Types and Recommendations

Introduction

Vitro (formerly PPG Industries) has long offered recommendations regarding alternatives for glass spandrel applications. Over the years these recommendations were included in various publications and several Technical Service Memos all with the goal to help our customers and design professionals make informed decisions regarding the use of glass spandrels.

While Vitro no longer produces the final glass spandrel product, we continue to support our customers and others with recommendations for this important glass application. Accordingly, this document is offered as an update to previous Vitro publications.

What are Glass Spandrels?

Glass spandrels are glass products that are designed to be opaque. Traditionally, the opaqueness is created by applying an opaque coating or film to the indoor surface of the glass. Ceramic enamel frits, silicone based paints, and plastic or metal films are typically used as opacifying materials. In addition to opaque glass spandrels, a technique called "shadow box" spandrels is sometimes used in spandrel applications. This concept involves the use of glass that has no opacifier, combined with a separate light blocking assembly, typically a rigid foil backed insulation material that is taped to the surrounding framing system to block out the light.

Glass spandrels are typically used to prevent visual read-through of objects or features that are behind the spandrel glazing, such as between floors of buildings. They are also sometimes used to create colorful aesthetic design elements in building projects.

It is important to understand that with high light transmitting glasses, with or without non-reflective low-e coatings, it is not possible to create a matching spandrel product. Rather, the almost limitless colors of opacifier materials that are available can be used to create a pleasing "harmonizing" spandrel product.

As the glass substrate becomes darker, or the coatings become more reflective, a closer match between vision and spandrel glass is usually possible.

Vitro recommends that responsible design professionals also review Vitro Technical Document: *TD-138 "Heat Treated Glass for Architectural Glazing"* for additional information related to heat-treated glass.

It is strongly recommended that a full size mockup be viewed early in the design process to determine the acceptability of the vision and spandrel glass aesthetics.

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Glass spandrels can be grouped into the following general categories.

1. ***Monolithic Glass Spandrels*** consist of the glass substrate, coated or uncoated, to which an opacifier is applied as shown in Figure 1.

   Vitro has long recommended that all glass used in monolithic spandrel applications be heat strengthened to provide the additional mechanical strength required to resist wind load and thermal stresses. Also, should the glass break, the inherent break pattern of heat strengthened glass makes it much more likely that the glass will remain in the opening until it can be replaced.

   Insulation is often used in conjunction with spandrel glass. As noted in Figure 1, the insulation may be applied directly to the opacified surface of the spandrel. In those cases, Vitro recommends that specific recommendations be solicited from the glass spandrel fabricator, as well as the adhesive and insulation suppliers regarding compatibility and procedural methods.

2. ***Insulating Glass Unit Spandrels*** consist of insulating glass units which have an opacifier applied to either the #3 or #4 surface of the indoor glass lite as shown in Figure 2. If the outdoor glass lite of the vision units is tinted glass, the outdoor lite of the spandrel typically uses the same tinted glass and a neutral colored opacifier on the air-space surface of the indoor lite of glass (the #3 surface of the unit). Vitro recommends both lites of glass be heat strengthened when used in these types of spandrel applications.

   When using Vitro low-e coated glass in insulating glass unit spandrels, special attention must be given to the surface locations of the low-e coating and opacifier as well as to the potential for elevated glass temperatures. When low-e coatings are used in the IGU then the preferred opacifier location would be the indoor surface of the indoor lite of glass (the #4 surface of the unit). If a Low-E coating is located on the #2 surface and an opacifier on the #3 surface, compatibility of the opacifier with sealants, as well as the potential release of volatiles into the air space must be verified with the manufacturer. Any volatiles condensing on a Low-E coating within the air space may cause coating degradation and void any applicable Low-E warranty.

   In situations where low-e coated glass is used in conjunction with medium to dark colored opacifiers, the potential exists for the interior lite of the IG unit to experience exceedingly high glass temperatures which may lead to elevated levels of thermal stress. The level of stress will be dependant on the specific installed conditions of the spandrel IGU such as the location of any insulation and circulation behind the IGU.

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***Insulating Glass Unit Spandrels*-continued**
Insulation is often used in conjunction with insulating glass unit spandrels. Depending upon the glass type, and the recommendation of the insulating glass spandrel fabricator, the insulation may either be applied directly to the glass, or held back 1 to 2 inches from the glass surface. As with monolithic glass spandrels, if the insulation is applied directly to the glass, Vitro recommends that specific recommendations be solicited from the insulating glass spandrel fabricator, as well as the adhesive, and insulation suppliers regarding compatibility and procedural methods. The added insulation can trap the build up of solar energy causing a significant temperature increase in the glass and surrounding components. The elevated temperatures can in turn increase the risk of thermal stress breakage as well as negatively impact the durability of all components in the system.
Proceeding in these situations, the design professional may wish to specify tempered glass for the interior lite of the insulating glass unit spandrel as a way to reduce the probability of breakage due to thermal stress. Vitro continues to recommend that heat strengthened glass be used for the exterior lite of the insulating glass unit spandrel.

3. ***Shadow Box Spandrels*** typically involve the following elements as shown in Figure 3.

- ✓ A monolithic lite of tinted or coated heat treated glass is glazed in the spandrel area. This glass is typically the same type as used in the vision area and has no opacifier. In today's construction an insulating glass unit of the same design as the vision units may also be used in a shadow box spandrel and the comments below also apply as well as the comments for the insulating glass unit spandrel.

- ✓ Black or dark-colored, rigid, foil-backed insulation is installed one or two inches behind the transparent spandrel glass, with the foil facing the indoors.

- ✓ The foil surface of the insulation is secured to interior surfaces of the glazing system, typically with aluminum tape. The intent is to completely seal each spandrel glass perimeter and create a moisture vapor "barrier", and to block off all potential stray interior light from entering the spandrel area.

- ✓ Because the insulation is dark and even in texture, and the glass has reduced light transmittance properties, it is extremely difficult to see the insulation through this "shadow box", except under the most critical daylight or sky viewing conditions.

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Shadow Box Spandrels – continued:
"Shadow box" spandrel glass designs can be appealing to developers and designers due to their lower first costs and slightly better aesthetics, i.e., match to the vision glass. However, there are significant field related issues that have been experienced and that should be considered.

- ✓ ***Condensation –*** When outdoor temperatures are lower than indoor temperatures, the temperature drop across insulation in the shadow box installation causes a moisture vapor pressure difference to occur across the insulation. Rips, tears, or holes in the insulation foil-backing, or the aluminum securing tape, improper tape installation, or other unsealed areas, provide paths for moisture to migrate through the insulation into the "shadow box" airspace. When indoor glass surface temperatures reach the dew point, this moisture will condense on the glass and, under certain critical viewing conditions, this condensate will be visible from the outdoors. Even when a perfect moisture vapor "barrier" is obtained, moisture can still enter the "shadow box" airspace through weep holes, leaks in glazing system joints, or in pressure equalized glazing systems and damaging condensation on glass or coated glass surfaces can result.

  Over a period of time, repeated cycles of condensation and drying can cause residue to accumulate or stain to form on the glass. This may then become a serious aesthetic concern, and may even permanently damage the glass or coating or both.

- ✓ ***Construction Dirt –*** It is possible that between the time that the spandrel glass is glazed and the insulation is installed, windborne dirt, fireproofing materials, or other construction debris can accumulate on the indoor surface of the spandrel glass. Also, water often collects on the concrete deck during construction of the building, becomes contaminated with concrete dust or other alkalies, and subsequently gets onto and runs down the glass. This type of contamination may contain chemicals that can damage the glass or coating and is often difficult to clean from the glass without causing glass or coating damage. Such glass and/or coating damage, or even a faint residue remaining after cleaning, may be visible under critical viewing conditions.

- ✓ ***Glazing Lubricants –*** In "dry" glazing systems, glazing lubricants are typically required to effectively install the indoor glazing wedge. These lubricants, if not properly removed, can leave deposits on the "shadow box" spandrel glass that may be visible from the outdoors under critical viewing conditions.

- ✓ ***Volatile Accumulations –***Sealants, paints, or other materials used in the manufacture or installation of the insulation, as well as glazing sealants, glazing gaskets, and other materials often found in "shadow box" spandrel applications often contain volatiles. These volatiles may be released in "shadow box" air-spaces on sunlit elevations, where temperatures can easily reach 140° to 160° F., or even higher.

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✓ ***Volatile Accumulations – continued:*** These volatiles will then subsequently condense on the glass when temperatures fall. Over time, the accumulation of these deposits may be aesthetically objectionable and may even damage the glass or coating. Accordingly, all materials used in spandrel areas should be tested for volatile release by the material manufacturer and be specifically recommended as appropriate for use in “shadow box” spandrel applications.

✓ ***Improper Insulation Installation –*** If the insulation is installed so that it touches the glass, even in a small area, increased glass temperatures or “hot spots” will likely occur. Because temperature gradients cause tension stresses to occur in glass, “hot spots” can cause an increased probability of glass breakage. Also, if the glass is coated, “hot spots” can cause localized coating discoloration or other coating damage.

In addition to “hot spots”, water can accumulate where the insulation touches the glass, causing scum and residue formation or even glass stain.

Summary:

- Several types of glass spandrel designs are available.

- Vitro recommends that glass used in spandrel applications be heat strengthened except for the interior lite of an insulating glass unit spandrel when the application uses a low-e coating and a medium to dark opacifier combined with insulation on or very near the back of the spandrel unit. In these instances, tempered glass for the interior lite of spandrel unit may reduce the probability of breakage due to thermal stresses.

- Review Vitro Technical Document: *TD-138 "Heat Treated Glass for Architectural Glazing"* for additional information related to heat-treated glass.

- Any volatiles condensing on a Low-E coating from an opacifier within the air space may cause coating degradation and void any applicable Low-E warranty

- Matching spandrels are not possible with high light transmitting coated or uncoated glass.

- It is strongly recommended that a full size mockup be viewed early in the design process to determine the acceptability of the vision and spandrel glass aesthetics.

- The use of “shadow box” spandrels requires careful attention to design and installation to minimize the risk of glass or coating damage and the resultant aesthetic problems.

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Figure 1 – Monolithic Spandrel

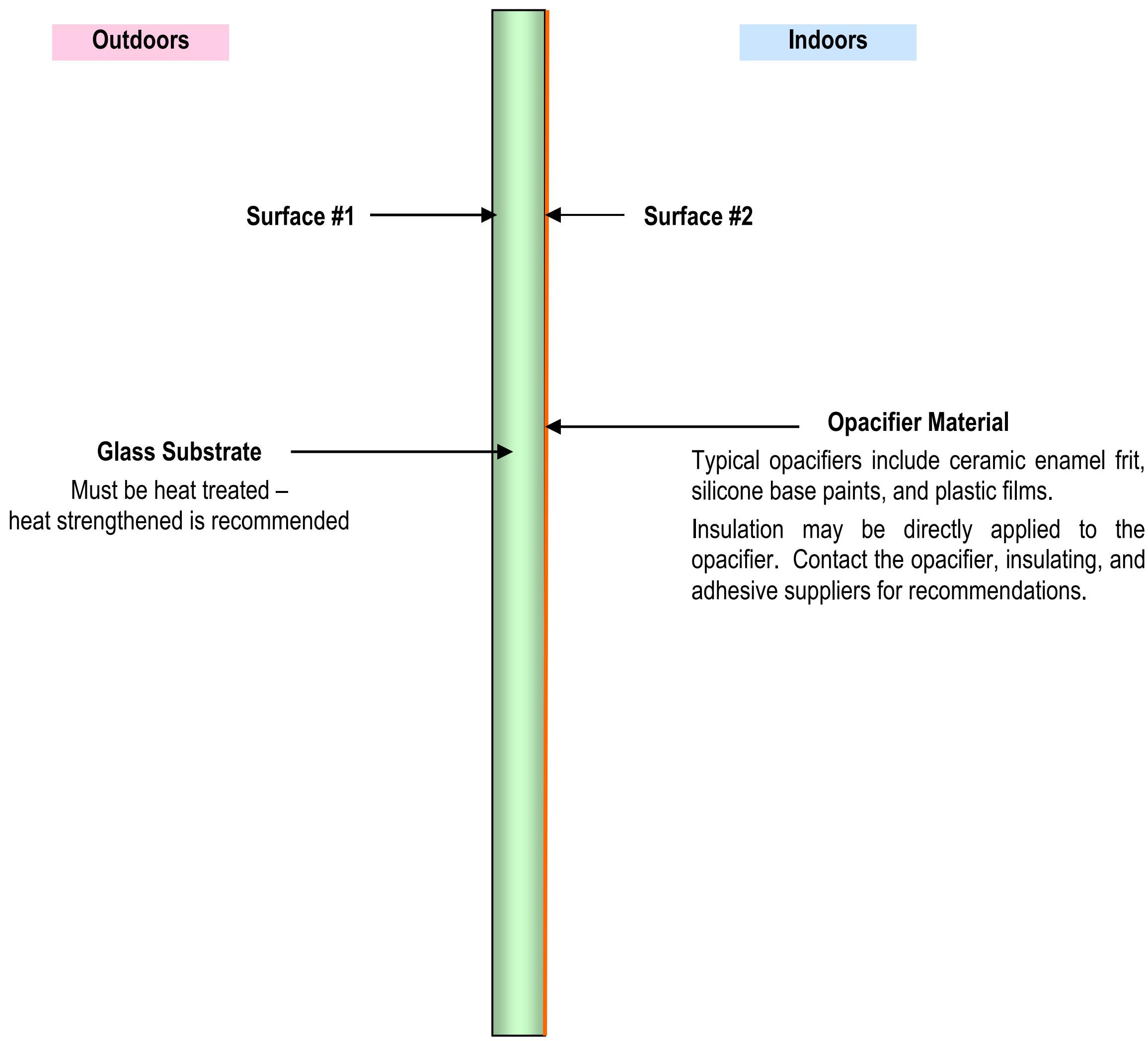

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Figure 2 – Insulating Glass Spandrel Unit

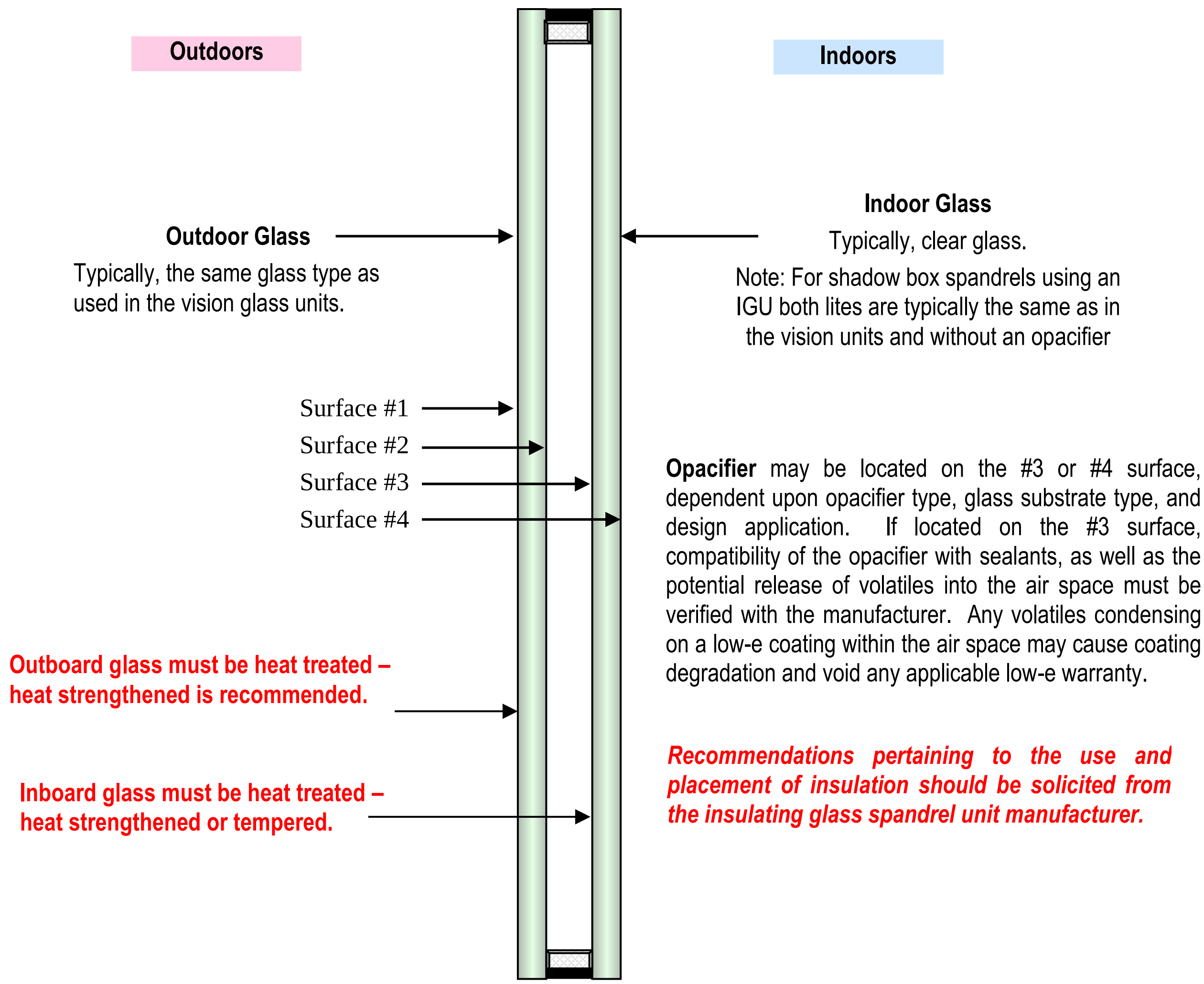

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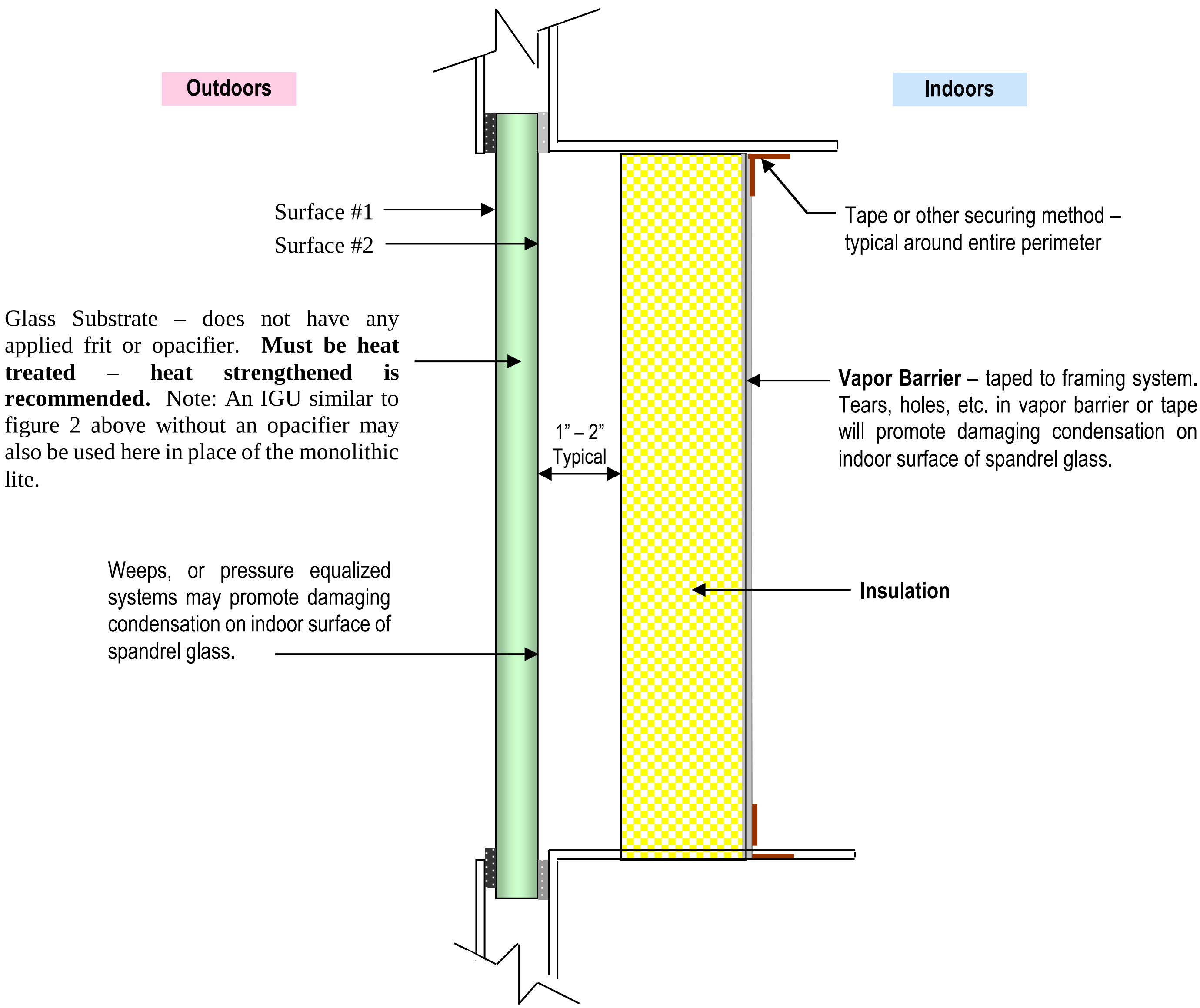
Figure 3 – Shadow Box Spandrel Concept



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HISTORY TABLE		
ITEM	DATE	DESCRIPTION
Original	04/17/2007	Revise and transfer to website
Revision 2	03/15/2010	Added comments pg2, final summary, Revise Fig 2, Spandrel IG.
Revision 3	10/14/2011	Updated language for IGU spandrel applications
Revision 4	2016-10-04	Updated to Vitro Logo and format