Laminated Glass with Low-E Coatings

Embedded coating in a glass laminate refers to a Low-E coating touching the interlayer. Depending on the needs of the customer, Cardinal Low-E coatings can be embedded or exposed in a glass laminate.

When used monolithically, embedding the Low-E coating inside the laminate will help prevent damage while maintaining the solar heat gain coefficient (SHGC) of the coating. When used in an IG unit, embedding the Low-E will have the trade-off of negating the U-factor performance advantage of the Low-E coating. Table 1 below illustrates the effects on IG performance.

IG Unit Performance			
Low-E	Placement	U-Factor	SHGC
LoĒ³-366®	Exposed	0.24	0.27
LoĒ³-366®	Embedded	0.44	0.27
LoĒ³-340®	Exposed	0.24	0.19
LoĒ³-340®	Embedded	0.44	0.21

Table 1. All IG units used 8.6 mm laminate to the exterior (3mm/0.090/3mm), 13mm argon filled airspace with 3mm inboard lite.

Embedding the Low-E coating next to the interlayer has the potential to affect the optical properties of the finished laminated glass. Low-E coatings are designed for use in IG units with argon or air next to the coating so placing them in contact with the laminate's interlayer may cause a shift in color. The extent of any color shift is dependent on several factors including the choice of coating used and whether that coating is on surface #2 or surface #3 of the laminate (Figure 1). Therefore, IG units with Low-E coatings embedded inside the laminate may not match units with the same Low-E exposed to the IG airspace. Color shift when using embedded Low-E coatings in laminated glass is not considered a product defect.

In addition to the appearance, orientation of the embedded Low-E will also affect the glazing's solar absorption (illustrated in Figure 1). Placing the Low-E in contact with the exterior side of the interlayer (surface #2) will reduce the SHGC and interior surface temperature of the laminate by reflecting heat away prior to the interlayer absorbing the sun's energy. Placing the Low-E in contact with the room side of the interlayer (surface #3) will increase the SHGC and interior surface temperature of the laminate by reflecting the sun's energy back into the interlayer. This increase in glass temperature will in turn increase the risk of thermal breakage of the glass.

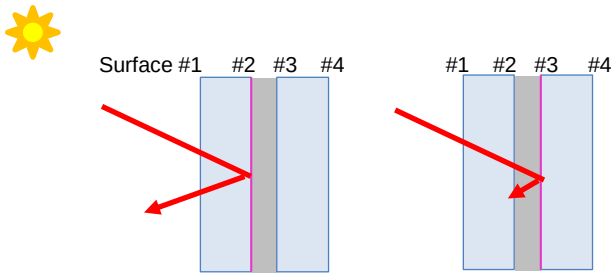

Figure 1. Placement of embedded Low-E coatings in monolithic laminates. (Left) Low-E coating on surface #2. (Right) Low-E coating on surface #3.

8.6 PVB with Embedded LoĒ³-366® Performance		
	LoĒ³-366® on Surface #2	LoĒ³-366®on Surface #3
U-Factor	0.96	0.96
SHGC	0.34	0.36
Inner Surface Temp	101°F	104°F

Table 2. Monolithic laminate performance for 8.6 mm PVB laminate (3mm/0.090/3mm) with embedded LoĒ³-366.

Use of tints and colored interlayers add greater complexity so orientation needs to be tightly controlled in order to limit color variation and potential for thermal breakage.

Cardinal has a number of International Glazing Database (IGDB) certified laminates with embedded Low-E in multiple configurations, with and without tints. These certified laminates can be used to generate the needed performance data in the LBNL WINDOW software. If performance data is needed for a laminate with an embedded Cardinal Low-E coating that isn't IGDB certified, a sample must be made and measured. This is due to the fact that the current LBNL Optics software cannot accurately model glass laminates with embedded coating.

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