Saflex™ and Vanceva™ Security Glazing meeting ASTM E2395

The trend toward using more glass in building design has created opportunities to design for enhanced performance in many areas, but a concentration on safety and security are current focus area. Laminated glass, two or more pieces of glass held together by an interlayer, has long been used as safety glazing however certain configurations are also being designed for security applications. These glass units tend to have more penetration resistance capability than basic laminated safety glass and can range in performance from simple impact to multi-assault resistant glazing.

For interior and exterior glazing, special precautions against injury and loss must be considered. That's because ordinary glass windows can result in serious injuries when broken, causing dangerous flying, or falling shards. Unlike monolithic glass, however, laminated glazing made with Saflex™ and Vanceva™ Color PVB interlayers reduce the risk of injury because glass tends to adhere to the interlayer after impact—this ability for the laminate to break but stay essentially intact also adds to protecting the integrity of the building envelope.

Of course, glass can always be broken by accidental or natural causes. However, today's building and construction professional must also consider protection against manufactured threats, such as forced-entry and forced-exit, ballistics, and blasts—whether caused by nefarious sources or combustible industrial, materials during production or transfer.

While no single product offers complete protection from intentional attacks, laminated glass with Saflex PVB interlayers in properly designed systems can be a critical line of defense. These strong protective interlayers act to deter or delay attackers from gaining entry while protecting people and property from injury and damage. In recent years, interest has continued to grow rapidly especially regarding educational, industrial, and commercial building applications.

ASTM International E2395 test standard is used to evaluate glazing configurations with simulated forced-entry and forced – exit type of attacks.

Burglary and forced-entry or forced-exit attacks commonly use repetitive blunt strikes to weaken and penetrate the glazing. This test method is meant to simulate reach-and-grab, reach-for-release, or full walk-through entry or exit. In reach and grab or reach-for-release attempts, an opening only needs to be big enough to allow a gloved hand to fit through with little force, thus grabbing goods or releasing a latch to open a door or window. The glazing configurations needed for these types of attacks vary with the attack type, but typically start with 1.52 mm Saflex Clear PVB interlayer and grow in thickness when increased impact resistance is needed. Saflex composite interlayers, like Saflex Storm PVB interlayers, are able to be used as thinner layers to reach similar or higher performance levels than Saflex Clear PVB interlayer.

Eastman has completed testing on various Saflex interlayer combinations according to ASTM E2395 **Standard Specification For Voluntary Security Performance Of Window And Door Assemblies With Glazing Impact.** These tests are performed on glass only in a fixed or neutral frame and are conducted typically on 3 mm (0.125 inch) thick annealed glass. To achieve appropriate protection, the selection of glass, glazing details and framing system are important as the performance of the glazed system as installed is what delivers the security protection. Specific risks, threats, vulnerabilities, facility design and placement are aspects of security that also need to be considered.

ASTM E2395 outlines an attack methodology which is used to evaluate the forced entry/forced exit resistance of glazing. The impact is mechanically driven using and air cannon and steel balls or 2 x 4-dimensional lumber at various lengths and weights. The glazing systems are pre-qualified to forced entry and security standards appropriate to the type of system being evaluated as defined in the standard. Table 1 shows the impact requirements for the various performance levels, note that Level 3 – 5 use the same missile, however the forced entry requirements on the system differ (not shown). Level 5 is the most stringent and includes two hits with the lumber (one center, one corner) followed by 10 strikes at the

corner impact with a ball peen hammer. Table 2 shows the performance of select interlayer combinations in laminated glass when tested for forced entry in accordance with this standard. Note that any Saflex Clear (R series) or Storm (VSO2) interlayer at 1.52 mm (0.060 inch) or greater is capable of passing Level 5. Products based on Saflex R series PVB interlayer such as Saflex Acoustic, Saflex FlySafe 3D, Saflex Solar, Saflex UV and Saflex Vanceva, when used at 1.52 mm (0.060 inch) or greater can be expected to exhibit the same performance.

ASTM E2395 - Attack Requirements (Glass only)

Level	Missile	Speed	Total impacts
L1	2-gram steel balls	39.62 m/s (130 f/s)	30
L2	910g (2 lb.) 2 x 4-dimensional lumber	15.25 m/s (50 f/s)	2
L3	2050k (4.5 lb.) 2 x 4-dimensional lumber	12.19 m/s (40 f/s)	2
L4	2050k (4.5 lb.) 2 x 4-dimensional lumber	12.19 m/s (40 f/s)	2
L5	2050k (4.5 lb.) 2 x 4-dimensional lumber + 10 hits with ball peen hammer	12.19 m/s (40 f/s)	12

ASTM E2395 – Saflex™ Product Performance (Glass Only)

Interlayer Name	Thickness (nominal)		Level 1	Level 2	Level 3	Level 4	Level 5
	mm	inch					
Saflex™	1.52	0.060	✓	✓	✓	✓	✓
Saflex™	2.29	0.090	✓	✓	✓	✓	✓
Saflex™	2.67	0.105	✓	✓	✓	✓	✓
Saflex™	3.05	0.120	✓	✓	✓	✓	✓
Saflex™	3.43	0.135	✓	✓	✓	✓	✓
Saflex™	3.81	0.150	✓	✓	✓	✓	✓
Saflex™	4.19	0.165	✓	✓	✓	✓	✓
Saflex™	4.58	0.180	✓	✓	✓	✓	✓
Saflex™ Storm (VS02)	1.97	0.077	✓	✓	✓	✓	✓
Saflex™ Storm (VS02*2)	3.89	0.154	✓	✓	✓	✓	✓
Saflex™ Storm (VS02*2)	3.89	0.154	✓	✓	✓	✓	✓
Saflex™ Storm (VS02*3)	5.91	0.231	✓	✓	✓	✓	✓

Keywords: ASTM E2395, forced entry, forced exit, laminated, Saflex, Security, Vanceva.