

Bullet-Resistant Glass

Bullet-Resistant Glass (BRG)

Thanks to recent advances in laminate and production technology, laminated glass can now provide a high level of security and safety that is affordable and installation-friendly. Although Tristar Glass **HAS NOT BEEN CERTIFIED BY THE UNDERWRITERS LABORATORIES (UL 752)**, they have conducted in-house testing to UL 752 specifications. Below is a list of the weapons and the specifications used during testing.



Image 1: Patrick Boyle holding the Beretta 92 FS used to test level 1: 9mm

Level	Threat	Weight(gr)	Type	Velocity(ft/sec)		# of Shots	Shot Spacing (in)	Shot Pattern
				Min	Max			
1	9mm	124	FMJ	1175	1400	5	3.5	5 in. square
2	.357 Magnum	158	JSP	1350	1450	5	3.5	5 in. square
3	.44 Magnum	240	JSP	1500	1600	5	3.5	5 in. square

Table 5: BRG test parameters

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Things to note when purchasing Bullet-Resistant Glass (BRG):

Size

Depending on where the glass is going to be installed, the thickness and weight of the glass could be an issue. The greater the security threat, the thicker and heavier the BRG. Careful consideration should be taken when sizing BRG to ensure the correct piece is chosen.

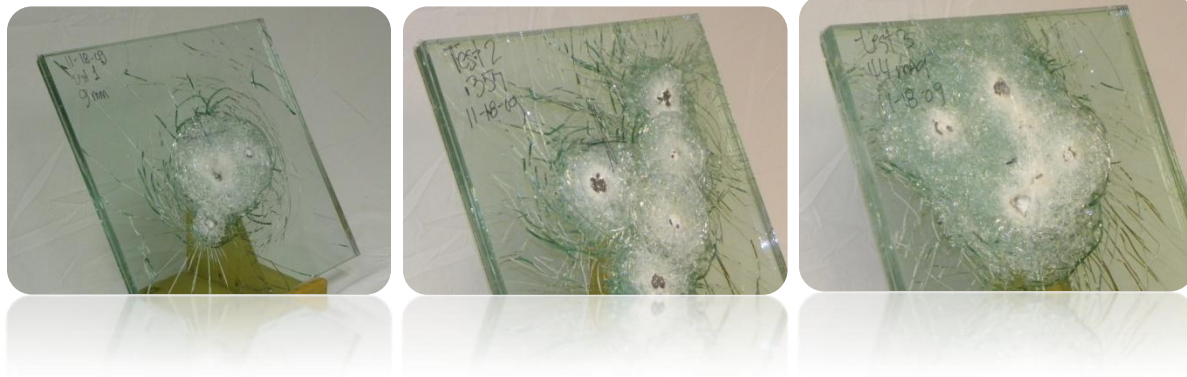
Spalling

Spalling occurs when a piece of safety glass is impacted by an object and glass shards are blown inward towards the occupant of the room or vehicle. A unit with all-glass construction cannot flex and absorb the shock of an impact without splintering. To mitigate this effect there are several options:

- All-glass constructions must add more layers of laminate and glass to help disperse the blow. This, in turn, leads to heavier and thicker pieces of BRG. This, however, is the most common and cost-effective solution.
- Glass-clad constructions use acrylics or polycarbonates in conjunction with glass. When used as the inner-most sheet, these plastics allow the piece to flex without breaking. They tend to be more susceptible to scratching and UV damage and do not have the same optical quality as an all-glass construction. The addition of polycarbonate reduces the thickness and weight required to achieve the same safety level of an all-glass construction but increases the cost of the piece.

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Products Available:



Tristar tested 3 different types of bullet-resistant glass following 3 different recipes. Two are listed below: the first is the standard all-glass, construction, and the typical choice for most glaziers.

Standard All-Glass Construction:

Level	Thickness (in)	Weight (lbs/ft ²)
1	1.129	38.2
2	1.38	46.4
3	1.625	54.8

Table 6: Standard BRG thickness and weight

Standard BRG is the most commonly used bullet resistant product because of its high optical quality and low cost. The product is easier to produce because it uses the standard PVB laminate interlayer.

Pros: Highest optical quality Easy to produce Low cost	Cons: Thickest for corresponding security level Heaviest for corresponding security level All-glass means spalling will occur
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DuPont Suggested Construction w/ Polycarbonate:

Level	Thickness (in)	Wt. (lb/ft ²)
1	1	10.224
2	1.122	11.304
3	1.3	13.248

Table 7: DuPont BRG thickness and weight w/ polycarbonate



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DuPont has suggested a series of BRG constructions that are lighter and thinner than anything available on the market today. This is accomplished by combining multiple layers of DuPont's hurricane strength SGP with a sheet of polycarbonate laminated to the inner most layer of the piece. This technology, however, costs more.

Pros: Thinnest for corresponding security level Lightest for corresponding security level Easier to install	Cons: Polycarb could scratch or fade if handled poorly Difficult to process = longer lead times Higher cost
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Please contact your Tristar sales representative for more information on bullet-resistant glazing.

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