IGC Bullet Resistant Datasheet

Bullet resistant glass is manufactured from several layers of glass of various thickness bonded together with tough polyvinyl butyral (PVB) interlayers. The overall thickness is governed by the “threat level” specified, but on attack the front layers of glass are designed to shatter thereby absorbing the initial impact energy, subsequent glass layers and PVB absorb the lower level shock waves.

Spall

Spall is the term given to the fragments of glass ejected from the rear of the glass when hit by a bullet or similar projectile. Depending on the standard and/or application required, spall may be acceptable but in many instances spall either has to be reduced (low spall) or eliminated altogether (no spall).

Conventional Laminated Glass

This option is very effective as a bullet resistant material but the inner most layer of glass is prone to shattering as the energy of projectile is absorbed into the body of the glass. The spall created is a hazard and could potentially injure anyone who is in close proximity to the glass. The material is therefore suitable only if there is a suitable stand-off distance from the glass. In most instances however, people are likely to be close to the glass so to reduce the risk of injury there is a ‘low spall’ option, which incorporates a very thin layer of glass to the rear surface which will break into much smaller fragments thereby reducing the risk of injury.

Glass/Polycarbonate

Polycarbonate is the strongest glazing material available with an impact resistance many times greater than float or toughened glass. Glass processors have combined the inherent strength of this material with the energy absorbing qualities of conventional glass. The result is a zero spall option which provides superior bullet resistance, enabling overall glass thickness to be reduced by up to 40%, thereby reducing weight and enhancing light transmission and glass clarity. This option also prolongs physical resistance and has excellent low temperature performance.

International Glass Consultants
Business Works, Rolling Mill Road, Jarrow, Tyne & Wear, NE32 3DT
+44 191 4283319
info@internationalglassconsultants.co.uk

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Test Standards

Bullet-resistant materials are tested by using a gun to fire a projectile from a set distance into the material in a set pattern. Levels of protection are based on the ability of the target to stop a specific type of projectile traveling at a specific speed. Experiments suggest that polycarbonate fails at lower velocities with regular shaped projectiles compared to irregular ones (like fragments), so that testing with regular shaped projectiles probably gives a conservative estimate of its resistance. When projectiles do not penetrate, the depth of the dent left by the impact can be measured and related to the projectile's velocity and thickness of the material. Some researchers have developed mathematical models based on results of this kind of testing to help them design bulletproof glass to resist specific anticipated threats.

EN 1063 standards for categorizing ballistic resistance include the following (*indicative thickness and weights):

Threat	Conventional Glass		Conventional Glass		Glass Polycarbonate		Gun	Calibre	Bullets
	Splinters(S)		No Splinters (NS)		No Splinters (NS)				
	Thickness	Mass	Thickness	Mass	Thickness	Mass			
	mm	kg/m^2	mm	kg/m^2	mm	kg/m^2			
BR 1	15	36	ND	ND	13	27	Rifle	.22 in LR	Lead (x3)
BR 2	20	48	ND	ND	17	36	Hand gun	9 mm Luger	Ball (x3)
BR 3	26	63	ND	ND	17	36	Hand gun	.357 in Magnum	Ball (x3)
BR 4	32	77	54	130	24	52	Hand gun	.44 in Magnum	Ball (x3)
BR 5	42	101	58	140	35	66	Rifle	5.56 mm x 45	Ball with steel penetrator (x3)
BR 6	62	152	71	170	38	83	Rifle	7.62 mm x 51	Ball (x3)
BR 7	83	200	81	195	74	170	Rifle	7.62 mm x 51	Armour piercing (x3)
SG 1	34	78	54	130	24	52	Shot gun	12 bore x 70	Solid lead slug (x3)
SG 2	42	103	71	170	38	83	Shot gun	12 bore x 70	Solid lead slug (x1)

Other Standards include:

- UL752 - Levels 1 -10 & Shotgun
- National Institute of Justice (NIJ) 018.01 - Levels I, II, IIA, III, IIIA, IV
- State Department SD-STD-02.01
- ASTM F-1233
- HP White Laboratories HPW-TP 0500.02
- British Standards Institution BS 5051
- Councils of Standards Australia / New Zealand AS/NZ 2343
- German Deutche Institut fur Normung (DIN) 52-290

**Overall glass makeup thickness and weight depends on glass processor*
**Maximum sizes available on request*

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