sedak

sedak factsheet

Bullet-proof glass

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As the saying goes: Fortune and glass soon break, alas. But as is often the case, this is only partly true: Properly produced, a transparent pane does not break even when fired at with rifles and ammunition with a hardened steel core. This is of particular interest for structures that must be representative and safe. DIN EN 1063 defines seven bullet-resistant classes. NATO has even higher resistance values using STANAG levels.

Seats of government and embassies, banks, event buildings or airports and increasingly more frequently exclusive private homes with a high need for protection: There are many structures that need to be protected against armed attacks. This places high demands on transparent surfaces in particular. Whereas a concrete wall can be made bullet-proof (technically correct term: bullet-resistant) relatively easily, a great deal of know-how goes into making bullet-proof glass.

1 Standardized protection classes

DIN EN 1063 defines seven protection classes for the bullet resistance of glass (BR1 to BR7, see table). Classes BR2 to BR4 are based on firing by handguns such as pistols or revolvers. The higher firing classes BR5 to BR7 must be able to with-stand shots from long rifles such as hunting rifles or military rifles (e.g., G36 or G3). In the highest class, a pane can even withstand attacks with armor piercing ammunition (with a hardened steel core). The suffix "S/ NS" stands for splintering (S = "spall") or "shatter-proof" (NS = no spall).
NATO defines five separate classes, the so-called STANAG levels ("Stanag" stands for Standardization Agreement). Level 1 starts as a resistance class against rifles up to caliber 7.62 x 51mm and is therefore already at around BR5/BR6. Level 2 ranges up to caliber 7.62 x 39mm with armor-piercing incendiary composition API ("Armor Piercing Incendiary"). For orientation purposes: this is not even possible with a Kalaschnikow AK47. Level 3: Rifles with caliber 7.62 x 51mm / 7.62 x 54R, each with special armor-piercing, even heavier tungsten carbide ammunition. This can therefore be considered as significantly higher than BR7.

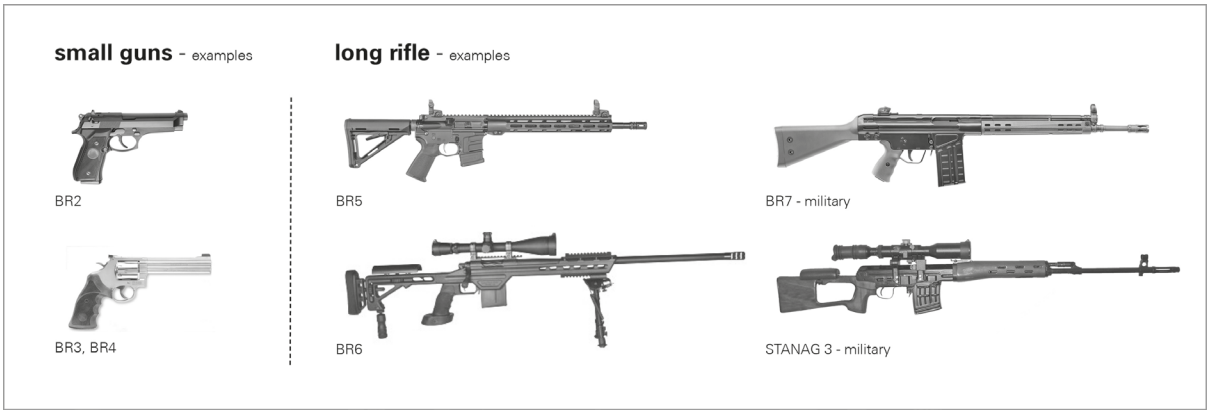

Figure: Exemplary firearms

Testing levels according to DIN EN 1063 bulletproof glazing

			Ammunition typ			Test conditions	
Test level	**Type of weapon**	**Calibre**	**Descriotion of projectile type***	**Projectile mass in gramm / grain**	**Energie in joule/ foot-pund**	**shot distance in meter / foot**	**Bullet velocity in m/s / fps**
BR1	long rifle	.22 lr	L/RN	2,6 / 40	168 / 124	10 / 33	360 / 1181
BR2	handgun	9 mm Luger	FMJ/RN/SC	8,0 / 124	689 / 508	5 / 16 $^{1}/_{2}$	400 / 1312
BR3	handgun	.375 Magnum	FMJ/CB/SC	10,2 / 158	943 / 696	5 / 16 $^{1}/_{2}$	430 / 1411
BR4	handgun	.44 Magnum	FMJ/FN/SC	15,6 / 240	1510 / 1114	5 / 16 $^{1}/_{2}$	440 / 1444
BR5	long rifle	5,56 x 45 mm	FMJ/PB/SCP	4,0 / 62	1805 / 1332	10 / 33	950 / 3117
BR6	long rifle	7,62 x 51 mm	FMJ/PB/SC	9,5 / 147	3289 / 2426	10 / 33	830 / 2723
BR7	long rifle	7,62 x 51 mm	FMJ/PB/HC	9,6 / 148	3261 / 2405	10 / 33	820 / 2690
Testing levels according to NATO AEP-55 STANG 4569							
Level 3	long rifle	7,62 x 54 mm R	FMJ/PB/HCI	10,4 / 160	3846 / 2837	10 / 33	854 / 2802
Level 3	long rifle	7,62 x 51 mm	FMJ/PB/WC	8,4 / 130	3633 / 2680	10 / 33	930 / 3052

*L = Lead, FMJ = Full Metal Jacket, RN = Round Nose, CB = Coned Bullet, FN = Flat Nose, PB = Pointed Bullet, SC = Soft Core, SCP = Soft Core with Steel Penetrator, HC = Hard Core, HCI = Hard Core with Incendiary, WC = Tungsten Carbide Core

Chart: Overview of ballistics classes

2 Safety

…by combining glass and films

Preventing a hit from destroying a pane requires a specific structure consisting of several panes and special films. Standard structures offer bullet resistance for the exterior and have a film on the inside. Conventional solutions use a polycarbonate system here. The objective of the sedak development was to devise a bullet-proof insulating glass in which the structure is made of glass both on the façade side and on the room side. As a result, the pane would meet particularly high aesthetic requirements. It should also meet the energy requirements of a modern insulating glass.

…with insulating glass

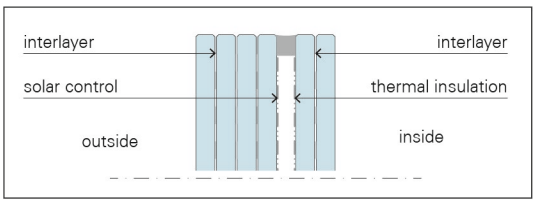

Figure: Sample construction of a bullet-proof insulating glass

The innovative bullet-proof sedak isosecure insulating glass is certified in classes BR2 NS to BR 7 NS. Despite its high resistance, sedak isosecure does not require the usual polycarbonate system; the clever pane structure always provides glass on both outer faces. This reduces the fire load and maintains the glass appearance on both sides. sedak isosecure is available with all standard solar and heat protection coatings and is certified for float and heat strengthened glass (TVG). This glass combines safety, aesthetic transparency and building physics functionality – even in very large glass surfaces up to a maximum format of 3.6 x 20 meters.

…with monolithic safety glass

Bullet-proof glass panes normally provide protection for an attack from only one side - which is usually entirely sufficient. In special cases, protection from both sides is useful, for example, where crowds of people flow past each other and it cannot be predicted from which side an act of violence might originate (passenger flows at airports, etc.). For this application, sedak offers safety glass (sedak secuprotect) with a monolithic structure. Its symmetrical design provides certified bullet resistance from both sides. This safety glass is certified for the highest firing class BR7 NS and even reaches STANAG Level 3.

3 Slim aesthetics

Bullet-proof insulating glass is already available with a very slim glass structure of 64mm at BR4, depending on the level of safety; at BR7 it is 100mm (example applies to sedak isosecure). Glass of this quality is also available curved starting at a radius of one meter.
This means that a highly transparent architecture can now be achieved with a level of security that previously was only possible with solid walls. Maximum protection with great freedom of design – and despite the high level of protection, the glass remains a slim protective shield.

4 Side note: Ballistic testing

DIN EN 1063 defines the test methods for bulletss-resistant glazing. Certification is carried out by means of ballistics testing in accordance with the standard. Glass in the format 500 x 500mm is attached in a frame, then fired at three times in the cen-ter from a distance of five or ten meters, depending on the class. (The hits form a twelve centimeter isosceles triangle). If the projectile does not penetrate, the glass has passed the test.

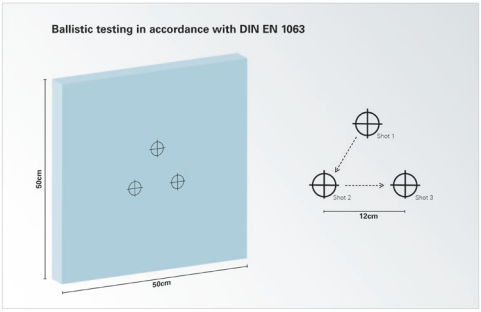

Figure: Schematic illustration of the ballistic test