

R65 BULLET PROOF

NOKIAN
PROFILES

1.1 Introduction

Bulletproof windows and doors installed at facilities which are under threat of armed attack. Windows and glazed facades are weakest places of the building. That is why the main attention must be paid to windows, doors and glazed facades reliability and resistance during safety design process of the whole building. Also these structures have a higher risk of being attacked because being transparent these structures give possibility to aim through them.



Figure 1.1 Police building of western administrative district of Moscow equipped with R65-BP system.

In addition to bulletproof properties, windows, doors and facades must have other important functional characteristics. First of all it is important that the bulletproof structure does not attract intruder's attention and does not spoil the facade and interior design. Another important factor is that the bulletproof structure performs the functions of a usual translucent structure, such as thermal insulation and functions of opening.

1.2 History overview

Nokian Profiles appeared as an architectural systems' division of Nordic Aluminium which is the leading manufacturer of aluminum products in Finland

nowadays. Nordic Aluminum was an aluminum department of Nokia AB concern which was established in 1966. Since 1990 this department became a separate company and since 1996 its name is Nordic Aluminium. In year 2010 Nokian Profiles became a separate company.

Nokian Profiles produce a solid aluminum bulletproof profile system which consists of window, door and fixed facade systems. It could be used for facades, windows, doors and partition walls of public buildings, banks, tribunals and other buildings which are needed to be protected.

R65-BP is a bulletproof profile system for doors and windows developed from the usual old R65 system. R65 was one of the first systems developed at the time of Nokia AB concern. R65-BP system has appeared in Russian market in 1997.

Bulletproof facade system is developed from a widespread R54 facade system. It has the same physical properties like a usual system. Bullet resistance is achieved by adding armor steel plates.

1.3 Architectural properties of aluminum bulletproof profiles

Windows, doors and facades made of aluminum are modern and perspective products. Nowadays architects and builders increasingly use windows, facades and other constructions made of aluminum profiles because of its strength, reliability, durability, resistance to external influences and lightness.

High rigidity and high load capacity of bulletproof profiles makes it possible to produce large-size products with the size of leafs up to 2000(height)x1200 mm.

The service life of aluminum is over 80 years. All fittings, rubber parts could be upgraded or changed during the entire lifetime.

Because of good bullet resistance without weak zones bulletproof windows made of R65-BP profile could be installed in a row. To disguise the building's protection properties or save the architectural meaning of the building it is possible to install bulletproof windows in a second row. In this case exterior windows could be opened through bulletproof windows.

In esthetical mind, products made of R65-BP are almost the same as systems made of usual profiles and usual glazing. It can be anodized as most of aluminum profiles or painted in any color in accordance with RAL universal scale.

Bulletproof profiles R65-BP of 2-5 bulletproof classes do not have internal reinforce steel plates, this means greater strength of cross section and absence problems with the accumulation of moisture inside the profile.

R65 is the only one aluminum bulletproof system which has a balanced weight of the cross section. This allows to use them for the manufacture of structures with high stiffness and high load capacity.

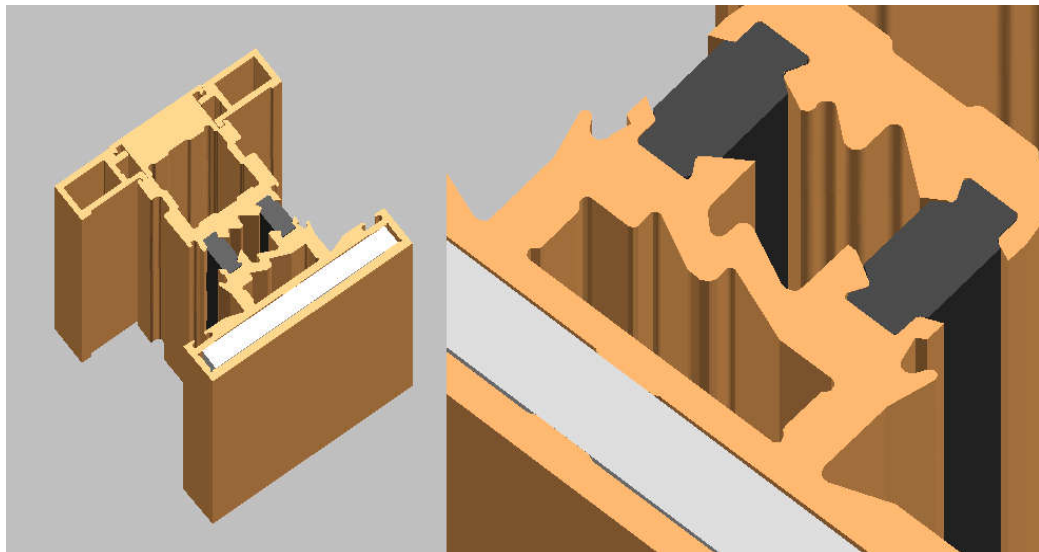


Figure 1.1 General view and cross section of R65-BP frame element

Nokian Profiles has all necessary range of bulletproof profiles for windows, doors and facades including all necessary accessories and unique angle elements.

1.4 Bullet resistance properties

The main feature of bulletproof profiles is a section which could withstand bullets not only because of material thickness and its strength but also because of the special shape of its cross section. The cross section consists of air gaps and partitions which have a zigzag form to make a bullet to change the angle of incidence a little. When a bullet takes a tilted direction its path through a

structure becomes longer and the energy of a bullet decreases more effectively. It is much harder to produce such section shape which is made of armor steel because of another production technology. Aluminum has advantages in terms of production of such complex forms because of production technology of aluminum profiles called extrusion. Extrusion is a process of making objects of fixed cross-sectional profile. The material in cold or hot condition is pushed or drawn with special tools which are needed to cut or shape material with pressure.



Bulletproof system is developed from the R65 system and made of AW 6060 alloy. Bulletproof profiles are available in full aluminum versions or steel reinforced versions with armor steel parts. Special bulletproof aluminum system R65BP could provide bullet resistance of large products of all classes of protection at sites of different functionality.

To evaluate the bullet resistance special tests were made according to Russian and European norms. Possible classes are 3, 5, 5a according to GOST R 51112-97, GOST R 50941-96 and classes FB2,FB5 and FB6 according to EN 1522.

Table 1.1 Possible bulletproof classes according to GOSTs.





Class	Weapon	Test Bullet	Bullet weight	Bullet speed	Test range
3	 AK74	5,45 mm, steel, non heat-treated	3,4 g	890-910 m/s	5-10 m
	 AKM	7,62 mm, steel, non heat-treated	7,9 g	710-740 m/s	5-10 m
5	 Dragunov Sniper Rifle	7,62 mm, steel, non heat-treated (57-H-323C)	9,6 g	820-840 m/s	5-10 m
	 AKM	7,62 mm, steel, heat-treated	7,9 g	710-740 m/s	5-10 m

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5a	 AKM	7,62 mm, special (57- Б3-231)	7,4 g	720- 750 m/s	5-10 m
6a	 Dragunov Sniper Rifle	7,62 mm, special (7-Б3- 3)	10,4 g	800- 835 m/s	5-10 m

Bulletproof profiles R65-BP has received a Certificate of Compliance which confirms accordance to GOST R 51112-97, GOST R 51072-97 and GOST R 50941-96. It means that during ballistic test bullets did not break through any part of the structure.

Table1.2 Possible bulletproof classes according to UNI EN 1522.

Class	Weapon	Test Bullet	Bullet weight	Bullet speed	Test range
FB2	 Handgun	9 x 19 mm Luger, steel jacketed/round nose/soft core	8,0 g	390- 410 m/s	4,5- 5,5 m
FB5	 Rifle	5.56 x 45 mm, copper alloy jacketed/pointed bullet/soft core steel penetrator	4,0 g	940- 960 m/s	9,5- 10,5 m
FB6	 Rifle	5.56 x 45 mm, copper alloy jacketed/pointed bullet/soft core steel penetrator	4,0 g	940- 960 m/s	9,5- 10,5 m
	 Rifle	7,62 x 51 mm, steel jacketed/pointed bullet/soft core	9,5 g	820- 840 m/s	9,5- 20,5 m

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Bulletproof profile R65-BP has received high marks and recommendations for technical strengthening of cashier booths and operational barriers in the biggest Russian bank Sberbank of Russia.

Special bulletproof glazing which is used with bulletproof profiles made with all of following technological processes: glass tempering, tempered glass connection between them using a special polymer composition and coating the material with special protective membrane. Protection degree depends on material thickness. For example material thickness about 20 mm provides protection against pistol bullets of small calibers and a thickness of 40 mm could protect against machine gun bullets. Glazing must have the same class of bullet resistance, as well as a profile with which it applies.

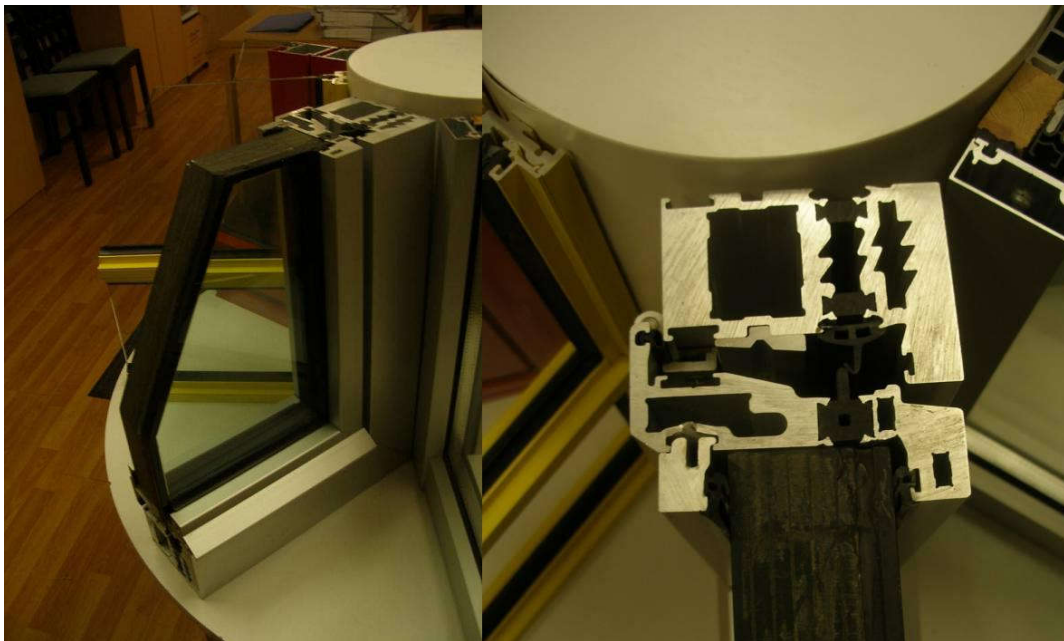


Figure 1.3 General view and cross section of R65-BP structure with glass.

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