

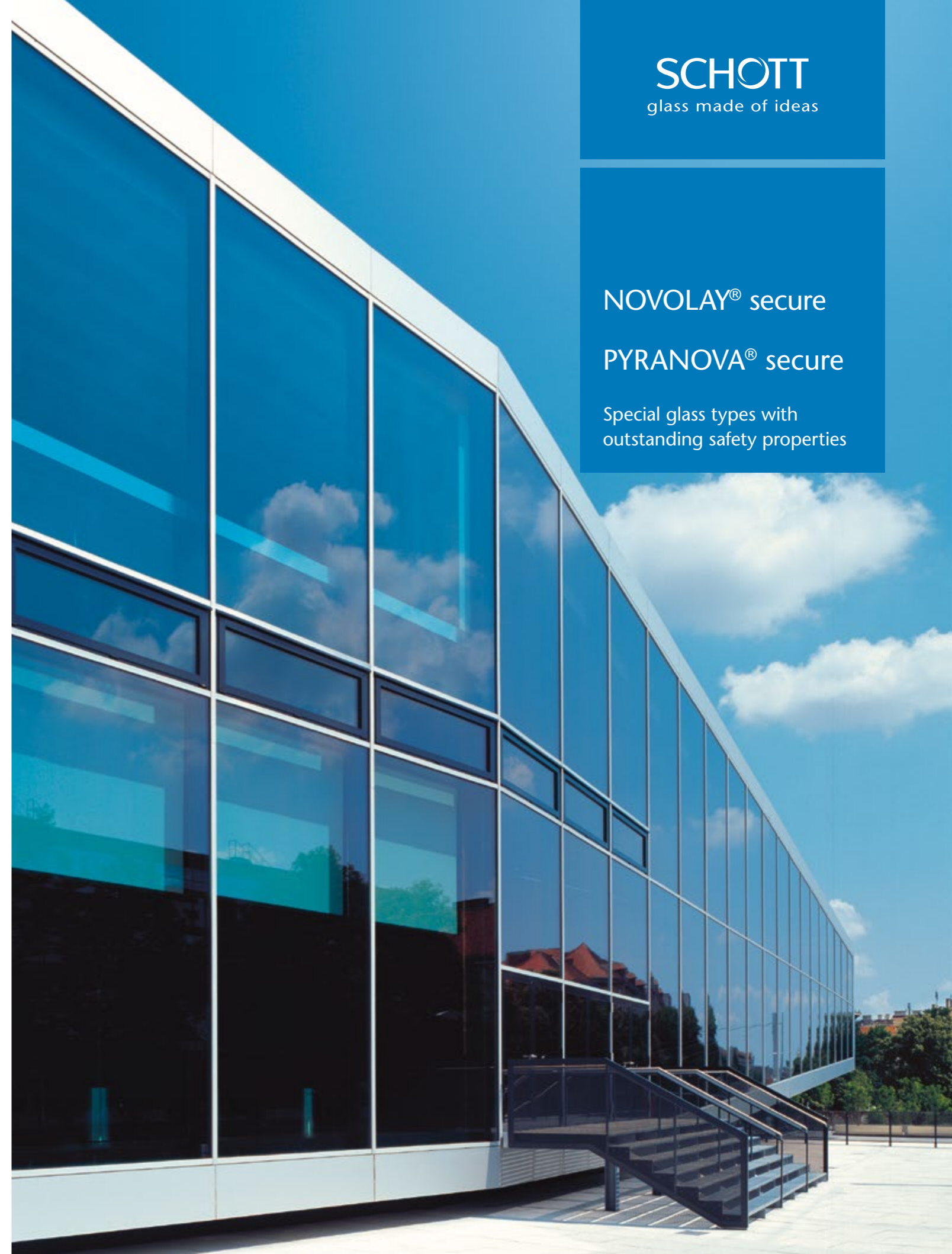
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SCHOTT
glass made of ideas

NOVOLAY® secure

PYRANOVA® secure

Special glass types with
outstanding safety properties



SCHOTT is a leading international technology group in the areas of specialty glass and glass-ceramics. With more than 130 years of outstanding development, materials and technology expertise we offer a broad portfolio of high-quality products and intelligent solutions that contribute to our customers' success.

SCHOTT works closely with architects and designers to extend the boundaries of design and create new opportunities for building culture – in terms of design and space, indoors and outdoors, for solar power and fire protection, aesthetics and functionality – sustainable and custom-tailored. That's what makes SCHOTT a qualified partner for architecture and design.



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- 6 Impact, manual attack and bullet resistant
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After achieving the maximum fire resistance classes in fire protection, SCHOTT is also setting standards in the protection of people and property.

Special glass types from SCHOTT with outstanding properties. For critical situations of all kinds.

Fire resistant glass can now be used in the protection of people and property as attack resistant glazing, fulfilling the additional requirements of protection against impact, burglary and bullet penetration. SCHOTT has developed highly effective and compact, multifunctional laminates for these special applications.

Function

Safety glass with multifunctional laminates from SCHOTT provide protection against mechanical attack. The special float glass types from SCHOTT resist attacks. In addition, SCHOTT PYRANOVA® secure provides an effective barrier against thermal radiation with its enclosed transparent fire resistant layers that intumesce in the event of fire.

Areas of application

Attack resistant glass is used primarily in the public and commercial area, but can also be of interest for domestic users. Some examples of application are:

- Prisons
- Embassies
- Military facilities
- Jewelry stores
- Ministries
- Museums
- Banks
- Residential buildings

Keep a clear view. With maximum safety and minimum weight. The advantages of NOVOLAY® secure and PYRANOVA® secure.

Safety glass from SCHOTT for protecting people and property offers clear advantages in comparison with other glass composites:

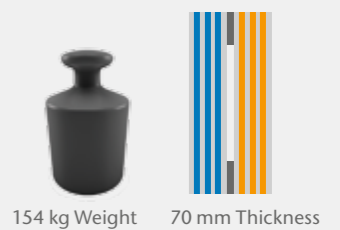
- Lower thickness: can be less than half the thickness of comparable glass composites (28 to 70 mm)
- Lower weight: can be less than half the weight of comparable glass composites (60 to 154 kg)
- High transparency: low iron glass quality
- Thermal resistance

Comparison of PYRANOVA® secure with a competitive product

PYRANOVA® 30 secure BR4NS



Competitive product



Light Transmission (LT) examples

EN 1063	Product name	Article number	Thickness	LT (%)
BR2NS	NOVOLAY® secure BR2NS	1.4.5	24	89
BR4NS	NOVOLAY® secure BR4NS	15.3.0	20	87
BR4NS	NOVOLAY® secure BR4NS	1.5.4	44	88
BR6NS	NOVOLAY® secure BR6NS P8B	1.5.7	63	86
BR7NS	NOVOLAY® secure BR7NS P8B RC3	1.1.2	74	85

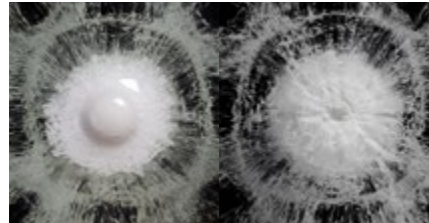
Impressive transparency

Left: a competitor's product, right: NOVOLAY® secure. In the same safety classes (BR4NS and P8B) NOVOLAY® secure has higher light transmission and significantly clearer, untinted transparency.



As secure as in a safe. In brilliant glass quality.

Special glass types with especially high safety properties.



Certificated ballistic resistance
NOVOLAY® secure's outstanding quality is guaranteed by extensive quality controls including both internal and external fire and ballistic tests.

Windows, doors, etc. must meet the relevant safety requirements as complete building elements. Depending on the specific requirements, the resistance classes for building elements are classified as RC 2 to RC 6 (formerly WK 2 to WK 6). The standard EN 1627 lists the conditions for testing windows, door and shutters.

Impact resistance

Glazing is classified as impact resistant when it prevents the penetration of thrown or hurled objects. Impact resistance is classified according to EN 356 in the resistance classes P1A to P5A. The test methods simulate the impact of heavy projectiles by dropping 4.11 kg metal balls with a diameter of 10 cm in free fall. The sample is considered to have passed the test when no ball penetrates the glass.

Manual attack

Glazing is classified as burglary resistant, i.e. resistant to forced entry or exit, when it delays the creation of an opening in accordance with EN 356 and EN 1627. The basic classifications are specified as P6B, P7B and P8B. These glazings often use a combination of glass/polycarbonate rather than glass alone in order to minimize the weight. The testing procedure requires that a 2 kg axe be mechanically swung at the glazing. The number of hits necessary to create a 400 mm x 400 mm opening determines the resistance classification.

If a small puncture of the glass allows the opening of any building elements, (e.g. as in the case of doors with panic bars) both the building element and the glass must be checked for compliance with the appropriate standards.

The relevant safety requirements for bullet resistance classification applies to the whole building part or building element. Resistance classes, FB 1 to FB 7, are defined according to the specific requirements of EN 1522.

Bullet resistance

Glass is classified as bullet resistant (BR 1 to BR 7) when it stops the penetration of projectiles in accordance with EN 1063. The testing procedure requires that the test specimen be shot at 3 times with the appropriate weapon and calibre bullet. The test specimen must withstand the attack. The test not only determines the resistance class but also whether or not there has been splintering on the inner face.

First class in every resistance class.

Classifications.

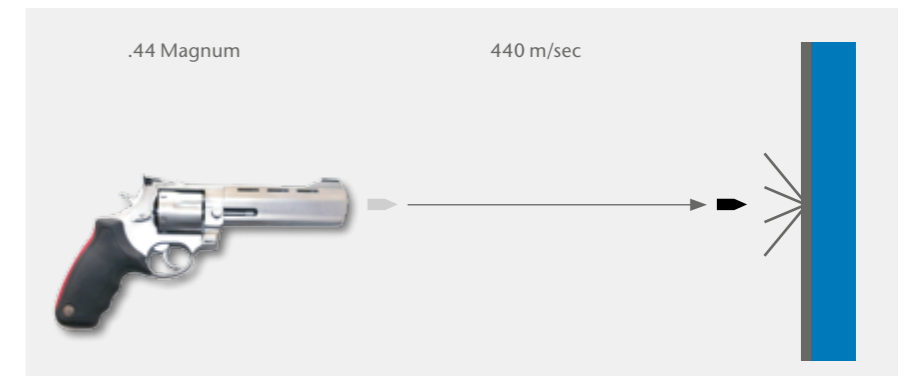
Manual attack resistant glasses are classified in different resistance classes depending on their properties. The standard EN 1627 describes the necessary requirements for manual attack resistant windows, doors and shutters and classifies them in 5 different resistance classes:

Resistance class	Glazing according to EN 356	Type of burglar and assumed break-in method
RC 2	P4A	Occasional burglar with simple lever tools
RC 3	P5A	Experienced burglar in a targeted attack on property using lever tools
RC 4		Experienced burglar in targeted attack on property regardless of noise level (lever-, strike- and drilling tools / cordless)
RC 5	P7B*	Experienced burglar in targeted attack on property with mechanical and electric tools
RC 6	P8B*	As in RC 5, but with more time and more powerful electric tools (angle grinder diameter Ø 230 mm)

* Certification to EN 356 is not possible if the opening is larger than 400 mm x 250 mm. Therefore, additional testing to EN 1627 using the appropriate tool set will be required.

The standard EN 1522 applies to all bullet resistant building elements and includes all components. This means that SCHOTT glasses are tested and classified as complete structures in accordance with this standard.

Resistance class	Glazing according to EN 1063	Weapon/Caliber
FB 1	BR 1	Rifle 22 LR
FB 2	BR 2	9 mm Parabellum
FB 3	BR 3	.357 Magnum
FB 4	BR 4	.357 Magnum + .44 Rem. Magnum
FB 5	BR 5	Rifle 5,56 x 45
FB 6	BR 6	Rifle 5,56 x 45 + Rifle 7,62 x 51
FB 7	BR 7	Rifle 7,62 x 51 (Hard steel core projectile)

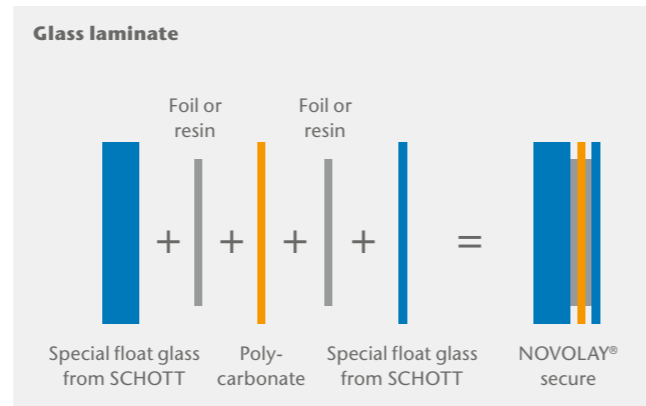


Outstanding bullet resistance
The safety glazings from SCHOTT guarantee safety from hand gun projectiles.

And you think that glass with the highest safety ratings can't offer first-class optical quality?

Then it's time you meet NOVOLAY® secure.

NOVOLAY® secure is manufactured in a microfloat process with cutting-edge technology. A special float glass from SCHOTT with outstanding properties provides the basis for a wide variety of safety applications. In addition to its excellent homogeneity, it displays impressive optical quality – even surpassing low iron glass – while remaining low in specific weight. NOVOLAY® secure is suitable for impact and manual attack resistant glass in accordance with DIN EN 356 and bullet resistance in accordance with DIN EN 1063.



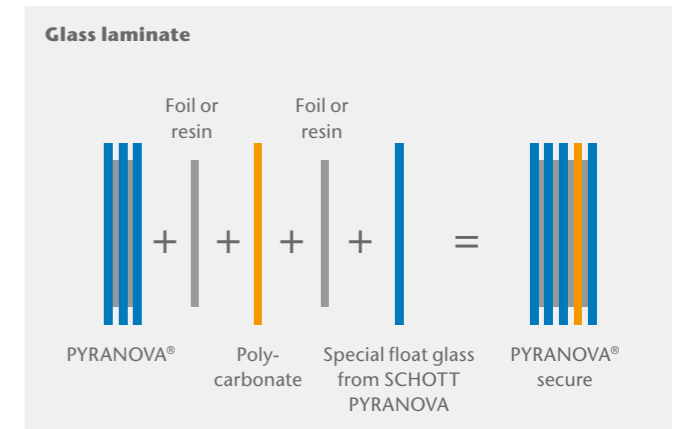
Police Headquarter Straubing, Germany

You think that a glass that protects against fire should also protect against manual attack and bullets?

So do we: PYRANOVA® secure.

The tried and proven fire resistant special glass PYRANOVA® manufactured in its special structure as PYRANOVA® secure meets not only the highest standards in fire protection but also displays outstanding safety properties.

PYRANOVA® used in standard laminates refers to a compact multi-pane composite glass which meets the requirements of fire resistance class EI. In case of fire, it provides effective protection against passage of fire, hot gases and smoke, as well as heat radiation, for up to two hours. PYRANOVA® secure effectively combines fire protection with resistance to impact and manual attack in accordance with DIN EN 356 and resistance to bullet attack in accordance with DIN EN 1063.



Dresden airport
Architects of the planning company Bles & Kampmann have created a bright and open airport terminal out of a empty airplane hangar. In so doing they have transformed the steel structure of the 50's into a unique architectural building.



Safety against combined attacks

Even after mechanical stress from bullets, blows or impact, SCHOTT PYRANOVA® secure guarantees effective fire protection.

How much safety does your project require?

NOVOLAY® secure and PYRANOVA® secure at a glance.

Standard products | Manual attack resistance in accordance with EN 356/1627 for internal and external applications

EN 356	EN 1627	Product name	Resistance class	Article-number	Fire resistance class	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
P4A		NOVOLAY® secure P4A	RC 2	2.4.2	E 60	10	23	
P5A		NOVOLAY® secure P5A	RC 3	3.13.10	-	11	23	
P6B		NOVOLAY® secure P6B	RC 4	2.2.2	-	15	27	
P6B		NOVOLAY® secure P6B	RC 4	13.3.15	-	7	11	
P7B		NOVOLAY® secure P7B	RC 5**	2.9.3	-	18	33	
P8B		NOVOLAY® secure P8B	RC 6**	1.9.3	-	18	32	
P8B	RC 5	NOVOLAY® secure RC5	RC 5	1.3.8	-	61	126	PC
P8B	RC 5	NOVOLAY® secure BR7 RC5	RC 5	1.9.9	-	66	140	NG
P8B	RC 6	NOVOLAY® secure BR7 RC6	RC 6	1.3.10	-	66	134	PC
P8B	RC 6	NOVOLAY® secure BR7 RC6	RC 6	1.9.10	-	75	150	NG

** Note: Maximum size limited by test standard PC = Polycarbonate NG = Glass

Special products (suitable for panic doors RC 2 – RC 4) | Manual attack resistance in accordance with EN 356/1627 for internal and external applications

EN 356	EN 1627	Product name	Resistance class	Article-number	Fire resistance class	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
P8B	RC 2	NOVOLAY® secure P8B RC2	RC 2	1.5.10	-	20	33	
P8B	RC 3	NOVOLAY® secure P8B RC3	RC 3	7.11.5*	-	34	58	
P8B	RC 4	NOVOLAY® secure P8B RC4***	RC 4	7.12.0**	-	50	85	
P8B	RC 4	NOVOLAY® secure BR4 RC4***	RC 4	7.13.14	-	55	98	

* Suitable for panic door RC 2+3 ** Note: Maximum size limited by test standard *** Hand hole opening

Standard products | Fire protection & manual attack resistance in accordance with EN 356/1627 for internal and external applications

EN 356	EN 1627	Product name	Resistance class	Article-number	Fire resistance class	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
P4A		PYRANOVA® secure 30 P4A	RC 2	5.4.2	EI 30	21	52	
P5A		PYRANOVA® secure 30 P5A	RC 3	5.10.2	EI 30	22	52	
P6B		PYRANOVA® secure 30 P6B	RC 4	1.1.6	EI 30	20	45	
P7B		PYRANOVA® secure 30 P7B	RC 5**	1.2.6	EI 30	21	46	
P8B		PYRANOVA® secure 30 P8B	RC 6**	1.3.1	EI 30	24	48	

** Note: Maximum size limited by test standard

Special products (suitable for panic doors RC 2 and RC 3) | Fire protection & manual attack resistance in accordance with EN 356/1627 for internal and external applications

EN 356	EN 1627	Product name	Resistance class	Article-number	Fire resistance class	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
P8B	RC2	PYRANOVA® secure 30 P8B RC2	RC 2	1.9.7	EI 30	30	60	
P8B	RC3	PYRANOVA® secure 30 P8B RC3	RC 3	1.8.2*	EI 30	35	65	

* Suitable for panic door RC 2+3

Standard products | Fire protection & bullet resistance in accordance with EN 1063 for internal and external applications

EN 1063	EN 356	Product name	Resistance class	Article-number	Fire resistance class	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
BR2NS		PYRANOVA® secure 30 BR2NS		2.1.1	EI 30	19	42	PC
BR2NS		PYRANOVA® secure 30 BR2NS		10.0.12	EI 30	34	75	NG
BR4NS		PYRANOVA® secure 30 BR4NS		1.1.9	EI 30	28	61	PC
BR4NS	P8B	PYRANOVA® secure 30 BR4NS	RC 6	10.0.10	EI 45 / EW 60	56	124	NG
BR4NS	P8B	PYRANOVA® secure 30 BR4NS	RC 6	9.0.11	EI 45 / EW 60	52	114	NG
BR6NS	P8B	NOVOLAY® secure BR6NS	RC 6	1.5.7	EI 30 / EW 60	63	137	
BR7NS	P8B	NOVOLAY® secure BR7NS **	RC5 / RC3*	1.1.2	EI 45 / EW 60	74	162	

* Suitable for panic door RC3 ** Attack resistance from both sides PC = Polycarbonate NG = Glass

Standard products | Bullet resistance in accordance with EN 1063 for internal and external applications

EN 1063	EN 356	Product name	Resistance class	Article-number	Fire resistance class	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
BR2NS		NOVOLAY® secure BR2NS		1.2.3	-	17	32	PC
BR2NS		NOVOLAY® secure BR2NS		1.4.5	EW 30 / E60	24	52	NG
BR3NS		NOVOLAY® secure BR3NS		1.7.4	-	29	64	NG
BR4NS		NOVOLAY® secure BR4NS		15.3.0	-	20	41	PC
BR4NS		NOVOLAY® secure BR4NS		1.7.5	-	39	88	NG
BR4NS	P8B	NOVOLAY® secure BR4NS	RC 4*	7.13.14	-	55	98	
BR6NS		NOVOLAY® secure BR6NS		1.3.5	-	37	80	PC
BR6NS	P8B	NOVOLAY® secure BR6NS	RC 6	1.5.7	EI 30 / EW 60	63	137	NG
BR6NS		NOVOLAY® secure BR6NS		1.7.8	-	59	130	NG
BR7NS	P8B	NOVOLAY® secure BR7NS	RC 3*	1.1.2	EI 45 / EW 60	74	162	NG
BR7NS		NOVOLAY® secure BR7NS		4.9.8	-	59	132	NG
BR7NS	P8B	NOVOLAY® secure BR7 RC5	RC 5*	1.9.9	-	66	140	NG
BR7NS	P8B	NOVOLAY® secure BR7 RC6	RC 6*	1.3.10	-	66	134	PC
BR7NS	P8B	NOVOLAY® secure BR7 RC6	RC 6*	1.9.10	-	75	150	NG
BR4NS		ISO NOVOLAY® secure BR4NS		1.6.5	-	50	93	
BR4NS		ISO NOVOLAY® secure BR4NS		1.6.6	-	60	94	

* according 1627 PC = Polycarbonate NG = Glass

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SCHOTT Glass laminates – Protection against consecutive multiple attacks

The world's first special glass products that successfully withstand consecutive fire and ballistic attacks

SCHOTT's new safety laminates now offer the possibility to reliably protect buildings against multiple and combined attacks. Such situations may occur, for example, when glass panes are first exposed to fire from a Molotov cocktail and then fired upon.

Other safety glasses available on the market to date, have offered protection against various types of attacks, but always

against only one form of attack in the event of an emergency. The unique thing about the new PYRANOVA® secure and NOVOLAY® secure laminates is that they successfully withstand successive and simultaneous attacks: A glass laminate damaged by gunshot will still provide reliable protection against fire. In the same manner, the laminated panel will still stand up to gunshot after being exposed to fire.

Standard products | Consecutive multiple attacks: Fire protection¹ after bullet resistance²

Ballistic class ²	Fire resistance class ¹	Product name	Type number	Fire resistance class ¹ after ballistic attack ²	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
BR2NS	EI 30	PYRANOVA® secure MC BR2NS	14.0.1	EI 30 after BR2NS	34	79	Glass
BR4NS	EI 30	PYRANOVA® secure MC BR4NS	14.0.2	EI 30 after BR4NS	52	114	Glass
BR6NS	EI 30	PYRANOVA® secure MC BR6NS	14.0.3	EI 30 after BR6NS	76	168	Glass
BR2NS	EI 30	PYRANOVA® secure 30 BR2NS	14.0.4	EI 30 after BR2NS	52	114	Glass
BR2NS	EI 30	PYRANOVA® secure 30 BR2NS	14.0.5	EI 30 after BR2NS	36	80	PC
BR4NS	EI 30	PYRANOVA® secure 30 BR4NS	14.0.6	EI 30 after BR4NS	68	149	Glass
BR6NS	EI 30	PYRANOVA® secure 30 BR6NS	14.0.7	EI 30 after BR6NS	75	170	Glass

¹ based on EN 13501-2

² based on EN 1063

PC = last layer polycarbonate

Standard products | Consecutive multiple attacks: Bullet resistance² after fire protection^{1,3}

Ballistic class ²	Fire resistance class	Product name	Type number	Ballistic attack ² after fire (Classification according to 1063)	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
BR2NS	MC ³	PYRANOVA® secure MC BR2NS	14.0.1	BR2NS after MC ³	34	79	Glass
BR4NS	MC ³	PYRANOVA® secure MC BR4NS	14.0.2	BR4NS after MC ³	52	114	Glass
BR6NS	MC ³	PYRANOVA® secure MC BR6NS	14.0.3	BR6NS after MC ³	76	168	Glass
BR2NS	EI 30 ¹	PYRANOVA® secure 30 BR2NS	14.0.4	BR2NS after EI 30 ¹	52	114	Glass
BR2NS	EI 30 ¹	PYRANOVA® secure 30 BR2NS	14.0.5	BR2NS after EI 30 ¹	36	80	PC
BR4NS	EI 30 ¹	PYRANOVA® secure 30 BR4NS	14.0.6	BR4NS after EI 30 ¹	68	149	Glass
BR6NS	EI 30 ¹	PYRANOVA® secure 30 BR6NS	14.0.7	BR4NS after EI 30 ¹	75	170	Glass

¹ based on EN 13501-2

² based on EN 1063 (Unlike standard test, samples are fired upon immediately after fire test while still hot.)

³ Fire exposure based on Molotov cocktail (high temperature, short exposure)

PC = last layer polycarbonate



Standard products | Consecutive multiple attacks: Explosion resistance⁴ after ballistic attack²

Ballistic class ²	Physical attack class	Product name	Type number	Blast/ Shock tube general	Shock tube ⁴ after ballistic attack ²	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
BR2NS	P6B	NOVOLAY® secure BR2NS	1.4.5	ER4NS	ER4NS after BR2NS	24	52	Glass
BR4NS	P8B	NOVOLAY® secure BR4NS	1.5.4	ER4NS	ER4NS after BR4NS	44	94	Glass
BR6NS	P8B	NOVOLAY® secure BR6NS	1.5.7	ER4NS	ER4NS after BR6NS	63	137	Glass
BR7NS	P8B	NOVOLAY® secure BR7NS	1.1.2	ER4NS	ER4NS after BR7NS	74	162	Glass

² based on EN 1063

⁴ based on EN 13541

Standard products | Consecutive multiple attacks: Fire protection¹ after ballistic attack² and explosion resistance⁴

Ballistic class ²	Fire resistance class	Product name	Type number	Blast/ Shock tube general	Shock tube after ballistic attack	Thickness in mm	Weight in kg/m ²	Last layer (safe side)
BR2NS	EW 30 / EW 60	NOVOLAY® secure BR2NS	1.4.5	ER4NS	E 60 after BR2NS und ER4NS	24	52	Glass
BR4NS	EI 20 / EW 30 / E 60	NOVOLAY® secure BR4NS	1.5.4	ER4NS	E 60 after BR4NS und ER4NS	44	94	Glass
BR6NS	EI 30 / EW 30 / E 60	NOVOLAY® secure BR6NS	1.5.7	ER4NS	EI 30 / E 60 after BR6NS und ER4NS	63	137	Glass
BR7NS	EI 45 / EW 60 / E 60	NOVOLAY® secure BR7NS	1.1.2	ER4NS	EI 30 / E 60 after BR7NS und ER4NS	74	162	Glass

¹ based on EN 1363

² based on EN 1063

⁴ based on EN 13541



Test: Large fire test after gun shots



Test: Gun shots after small fire test

Fire resistance test methods:

Two different types of test methods are used to rate the fire resistance times of safety glass. In the uniform-temperature-time-curve test, the glass reaches a temperature of over 500°C after only 5 minutes in a large furnace. In the second test using a Molotov cocktail, the glass panes are exposed to temperatures exceeding 700 °C after only 5 minutes.

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SCHOTT
glass made of ideas