



SECURITY

**Keeping you safe,
no matter what!**



your favourite
glass



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WHO WE ARE



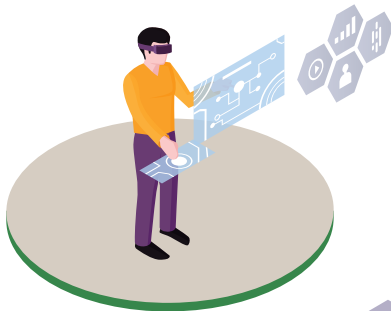


THE NEED FOR SECURITY GLASS

One of our most basic needs is the need to feel safe and secure. Today, extremely robust and secure solutions for glazing and cladding applications are required to meet the high-demanding security requirements of individuals and businesses alike. It may seem counter intuitive, but our speciality glass can play an advanced role in your security and can be more difficult to penetrate than steel! Security glass is especially important in banks, consulates and institutions as they are high-risk locations that are susceptible to attacks at any time.

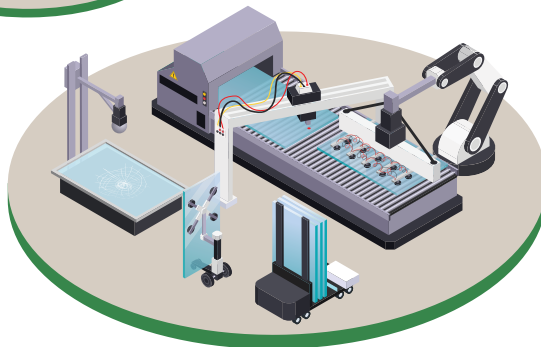
The biggest benefit that security glass provides in such situations is complete transparency while still providing more than adequate protection. While it isn't possible always to predict when an attack may happen, you can guard yourself against it with our wide range of security glass products. We'll help protect you against bullet shots, grenade attacks, bomb blasts, vandalism, and even break-ins. You can pick the glass you need based on your specific requirements and we'll take care of the rest!

HOW WE WORK?



1 DESIGN SERVICES

- Complete design solutions including shop drawings, structural calculations and related technical support



2 GLASS MANUFACTURING

- Advanced machinery to produce the most demanding glass types
- End-to-end control on quality and production



3 GLAZING SERVICES

- Fabrication of steel and aluminum sections
- Powder coating or paint finishes as per your aesthetic needs



4 INSTALLATION SERVICES

- Site surveys
- Installation of glass and framing systems
- Snag resolution
- Complete site handover



5 POST INSTALLATION SUPPORT

- Issuance of performance and quality certificates
- Annual maintenance contracts



OUR EXPERTISE

CONTINUOUS TESTING PROGRAM

At FG, we have an ongoing research and testing program to produce efficient security glazing solutions that meet global standards (BIS, EN, ASTM, NIJ, STANAG, UL and GSA, etc.). This enables us to always stay ahead of the curve, backed up by Kuraray's global expertise in this field.

TESTED AT GLOBALLY RENOWNED INSTITUTES



Wiltshire Ballistic
Services



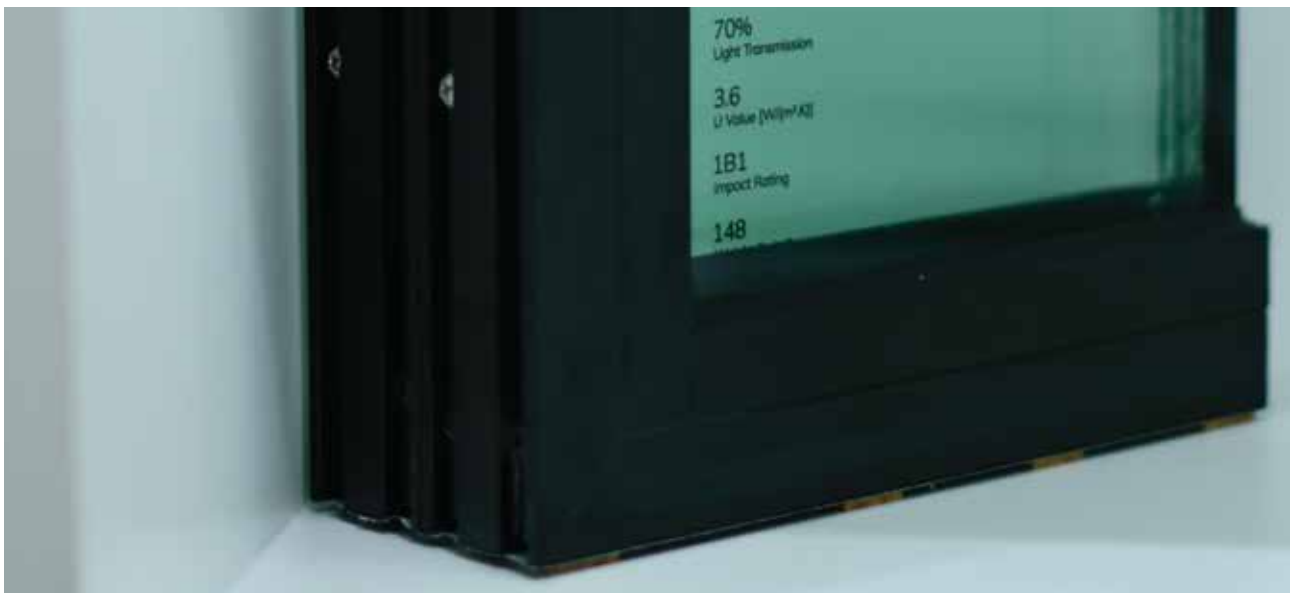
Stazione Sperimentale
del Vetro



HP
White-Intertek



TBRL
GFSU



CUSTOMISED SECURITY GLAZING SOLUTIONS

What's more, as experts in the glazing space, we provide more than just security glass panels. You can rely on us to provide you with complete security glazing solutions that can be customised to provide protection against all forms of bullet, impact, blast and radiation attacks. This is especially important for sensitive buildings such as embassies, consulates and defense structures. When you partner with FG, you will need only one contact point to fulfill all your glass and glazing needs.

Each of our panels can also be combined with ultra clear, tinted or an outer coated glass to meet thermal and aesthetic requirements.

You can choose to get any one of our security glass type or combine two or more types for instance, burglar and bullet resistant glass in the same unit.

All our security glass units are backed up by comprehensive test and performance certificates, exceeding the limits set out by global standards.



+ ***kuraray***

In our endeavor to provide you with nothing but the absolute best when it comes to security glazing solutions, we have partnered with Kuraray of Japan, a global leader in chemicals and glass interlayers to jointly research, develop, test and market products in the security glazing space. With Kuraray, we are able to provide the industry's most advanced bullet, burglar and blast resistant glass solutions, utilising the world's most advanced interlayer technology - SentryGlas™.

With seven production sites and five dedicated R&D centers worldwide, we are able to access the vast resources available at Kuraray and provide reliable, efficient and up-to-date security products to fulfill this demanding application space.

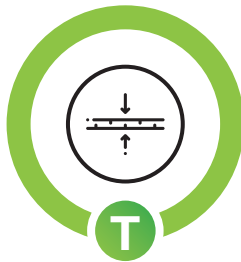
WHY SENTRYGLAS™

The SentryGlas™ interlayer for laminated safety glazing outperforms other current technologies in laminated glass such as EVA, PVB and resins by offering over five times the tear strength and 100 times the rigidity.

Originally developed for the hurricane glazing market, the SentryGlas™ interlayer is used in applications where high-performance glass is required such as security and structural glazing, bomb blast, ballistics and marine vessels.

The SentryGlas™ interlayer is absolutely bespoke in its construction, with thickness possibilities varying from 0.89 mm to over 5 mm, thereby providing sleek and crystal-clear glazing solutions.

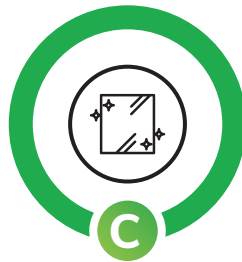
THE TLC ADVANTAGE



THINNEST
(up to 25% thinner)



LIGHTEST
(15-20% lighter)



CLEAREST
(minimum 5% clearer)

OTHER HIGHLIGHTS



99.99% UV
control



Durability



Sound
control



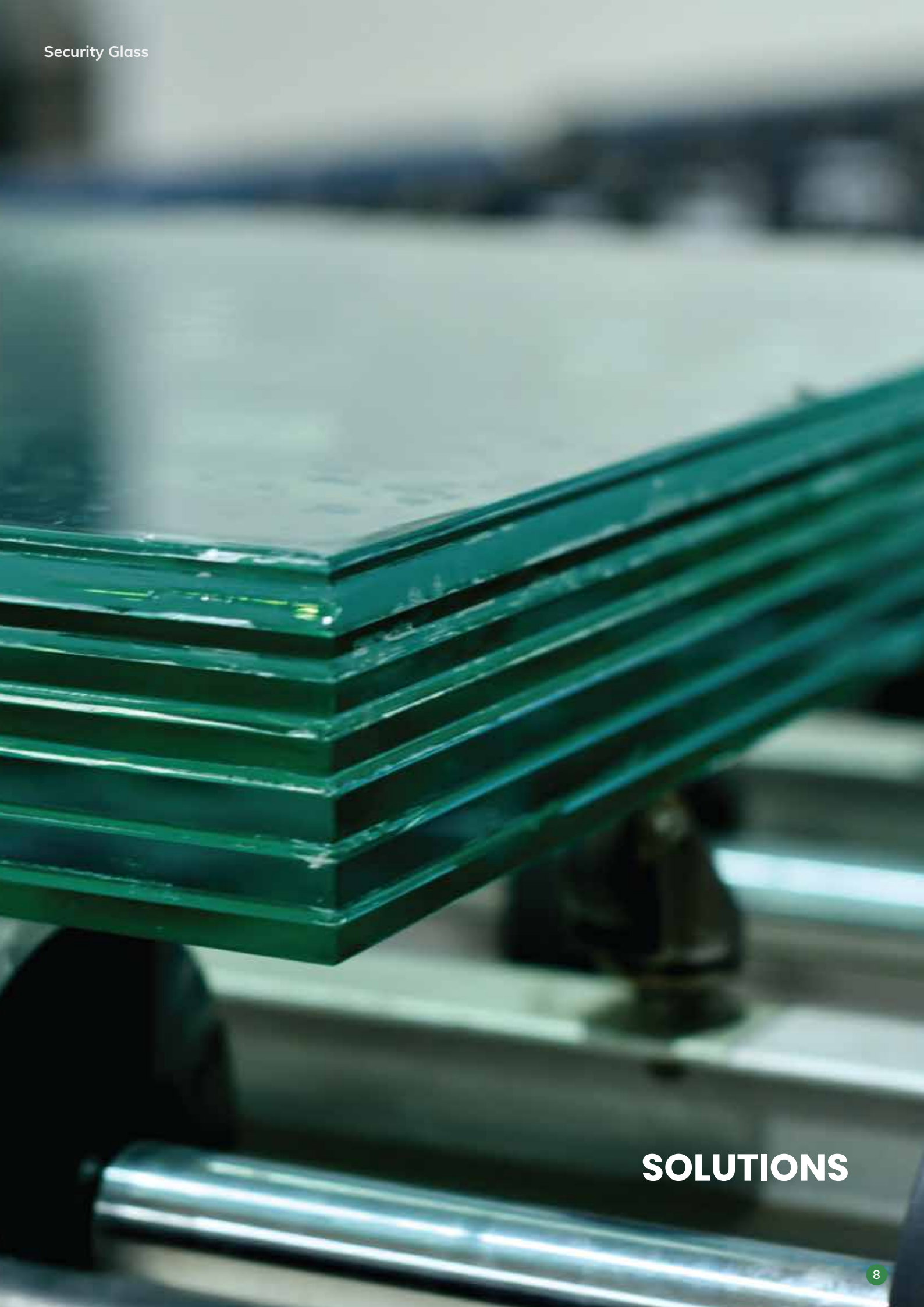
Worldwide
presence



Complete
certified solutions



Crystal clear
appearance



SOLUTIONS

PRODUCT GUIDE



BULLETSHIELD

BL.1 CHOOSE BY

BL.1.1 STANDARDS

15

- BIS
- EN 1063
- UL 752
- NIJ 01.08.01
- STANAG 4569

BL.1.2 AMMUNITION TYPE

15

-  RIFLES
-  PISTOLS
-  SHOTGUNS
-  HANDGUNS

BL.1.3 APPLICATION SPACE

41

- EMBASSIES / CONSULATES
- BANKS
- SHIP WINDOWS AND DOORS
- SECURITY CABINS
- DEFENSE VEHICLES
- POLICE STATIONS AND TRAINING ACADEMIES

BL.2 DEFINE PROTECTION LEVEL

13

- SPALL (VERSION S)
- NON-SPALL (VERSION NS)

BL.3 DEFINE AESTHETICS AND THERMAL PERFORMANCE

14

- FIRST
- CLARITY
- TONE
- SOLAR
- COMBI



BURGLARSHIELD

BR.1 CHOOSE BY







BR.1.1 STANDARDS

23

- EN 356
- BIS 16978 PART I : 2018
- BIS 16978 PART II : 2018
- BIS 16978 PART III : 2018
- ISO 16936-1 : 2005
- ISO 16936-2 : 2005
- ISO 16936-3 : 2005

BR.1.2 WEAPON TYPE

23

-  LEVER TOOLS
-  DRILLING TOOLS
-  HAMMERS
-  AXE
-  RODS
-  STONES

BR.1.3 APPLICATION SPACE

41

- SPATIAL VILLAS AND LIVING SPACES
- JEWELRY AND SHOWROOMS
- POLICE STATIONS AND TRAINING ACADEMIES
- EMBASSIES / CONSULATES
- BANKS
- DEFENSE VEHICLES
- LODGING FACILITIES
- STADIUMS

BR.2 DEFINE PROTECTION LEVEL

21

- SPALL (VERSION S)
- NON-SPALL (VERSION NS)

BR.3 DEFINE AESTHETICS AND THERMAL PERFORMANCE

22

- FIRST
- CLARITY
- TONE
- SOLAR
- COMBI



BLASTSHIELD

BT.1 CHOOSE BY

BT.1.1 STANDARDS

30

- EN 13541
- GSA TS01:2003
- ISO 16933:2007

BT.1.2 THREAT TYPE

30

- PERSON-BORNE IMPROVISED EXPLOSIVE DEVICE
- CHARGE IN CONTACT
- VEHICLE-BORNE IMPROVISED EXPLOSIVE DEVICE
- INDUSTRIAL EXPLOSIONS

BT.1.3 APPLICATION SPACE

41

- SECURITY CABINS | EXCAVATORS AND LOADERS
- POLICE STATIONS AND TRAINING ACADEMIES
- EMBASSIES / CONSULATES
- LODGING FACILITIES
- STADIUMS

BR.3 DEFINE AESTHETICS AND THERMAL PERFORMANCE

29

- FIRST
- CLARITY
- TONE
- SOLAR
- COMBI



RADISHIELD

RS.1 CHOOSE BY

RS.1.1 STANDARDS

37

- IEC61331-1:2014 & IEC61331-2:2014

RS.1.2 LEAD THICKNESS

41

- 1.4 MM TO 12 MM (@ 80KV)

RS.1.3 APPLICATION SPACE

41

- PET SCAN ROOMS
- CT SCAN ROOMS
- X-RAY ROOMS
- GAMMA RAY PROTECTION
- NUCLEAR FACILITIES

RS.2 DEFINE AESTHETICS AND THERMAL PERFORMANCE

41

- COMBI





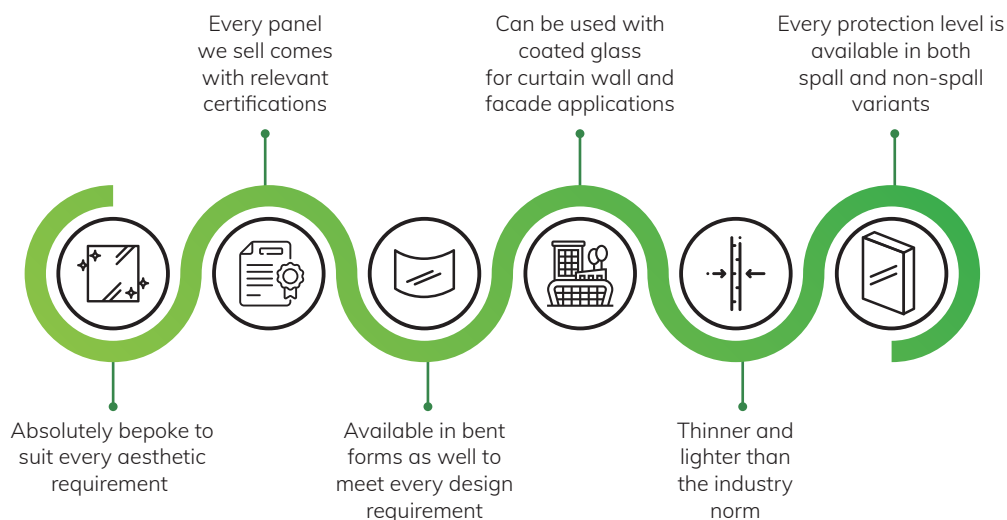
BULLETSHIELD

Keeping You Safe

BULLETSHIELD is an industry-leading glass that is designed to uphold even the most demanding protection requirements with regards to bullet impacts. Our panels are certified as per most global norms (ISO, Indian, European and American), which is why our panels are the first choice for large-scale security glazing contracts. What sets our panels apart is the fact that they are relatively thinner, clearer and lighter as compared to the industry norm, which we have managed to achieve with the use of advanced interlayers.

In order to ensure that these panels are both 100% secure and aesthetically-pleasing, we provide our entire **BULLETSHIELD** range in both spall and non-spall options, as well as in various glass types. But our job doesn't just stop at fabricating this glass. We can also help you engineer and install bullet-resistant framing systems, ensuring the highest possible level of safety, all within one roof.

WHY BULLETSHIELD?



APPLICATIONS

- Structural Glazing And Curtain Walls
- Fully Glazed Doors And Partitions
- Marine And Defence Applications
- Bank Teller Counters
- Embassies And Consulates
- Security Cabins



Project: Shangri-La Hotel
Location: Bangalore, India
Product Used: BULLETSIELD CLARITY

CHOOSE YOUR PROTECTION LEVEL



SPALL

When attacked, a regular bullet-resistant glass has the risk of spall (glass fragments) coming off the last glass sheet which may injure the occupants on the safe side, even though the actual bullet is lodged within the glass. This glass is used in areas where there is little or no proximity of human presence next to the glass.

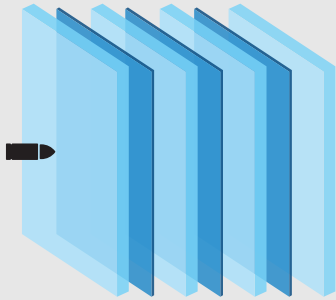


NON SPALL

For non-spall glasses, we add another layer of protection to bullet-resistance. This is achieved through an advanced layering technology that results in the last glass lite holding firm without releasing small fragments which may injure humans. Perfect choice where there is a high probability of human occupancy next the glass, e.g., in armored vehicles.

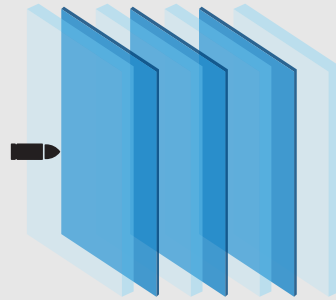


BULLETSHIELD TYPES



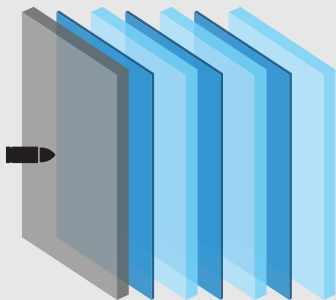
FIRST

Our starting range of bullet-resistant glasses. Made with clear glass assemblies for breakthrough performance, while staying economically viable.



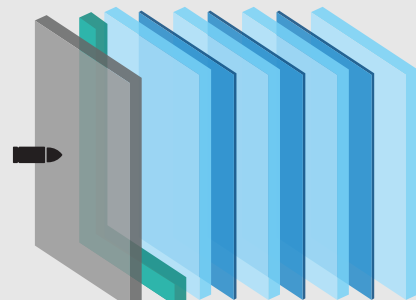
CLARITY

Add enhanced visibility and brightness to your bullet-resistance with our CLARITY range constructed with low-iron ultra clear glasses. Great choice for high-end visual appeal, specially for thicker units.



TONE / SOLAR

Add thermal efficiency and aesthetic uniformity to your facade by using tinted or coated glasses products with our TONE and SOLAR range. Great choice for structural glazing and curtain wall applications.

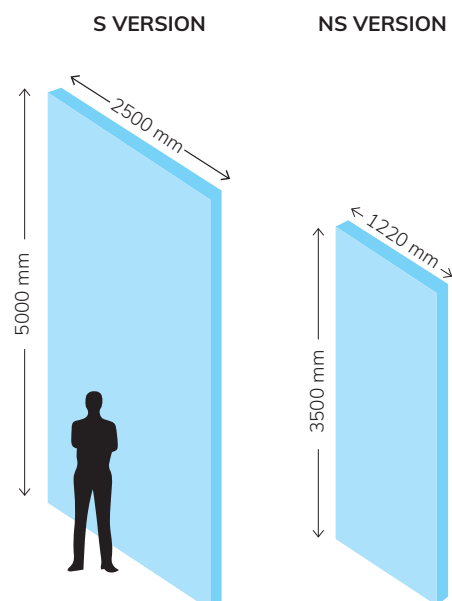


COMBI

Insulated or multi-laminated glass units for multi-tier performance-visual, acoustic, fire, impact and / or blast resistance.

BULLETSHIELD SIZE

Our sophisticated factory infrastructure allows us to provide BULLETSHIELD in a wide size range, from 200 mm X 300 mm to extremely large glass formats, enabling unmatched design flexibility without compromising on the promised protection levels.



BULLET RESISTANT GLASS STANDARDS

EUROPEAN STANDARD (EN 1063)

THREAT LEVEL	AMMUNITION	VELOCITY	THICKNESS
★ BR 2	9 X 19 mm DAG DM11 A1B1 124 g	390 to 410 m/sec	22 to 23 mm
★ BR 3	.357 Magnum Geco FMJ CB 158 g	420 to 440 m/sec	33 to 34 mm
★ BR 4	.44 Magnum FMJ FN 240 g	430 to 450 m/sec	40 to 41 mm
★ BR 5	5.56 X 45 mm SS109 62 g	940 to 970 m/sec	41 to 42 mm
★★★ BR 6	7.62 X 51 mm DAG Steel Jacket	820 to 840 m/sec	40 to 42 mm
★ BR 7	7.62 X 51 mm NATO	820 to 840 m/sec	65 to 67 mm

UNDERWRITERS LABORATORY STANDARD (UL 752)

THREAT LEVEL	AMMUNITION	VELOCITY	THICKNESS
1	9 mm FMJ with Lead Core 124 g	358 to 394 m/sec	21 to 22 mm
2	.357 Magnum Jacketed 158 g	381 to 419 m/sec	22 to 23 mm
★ 3	.44 Magnum 240 g	411 to 441 m/sec	25 to 26 mm
4	.30-60 Caliber Lead Core 180 g	774 to 852 m/sec	36 to 37 mm
★ 5	7.62 mm Rifle Lead Core FMJ 150 g	838 to 922 m/sec	36 to 37 mm
6	9 mm FMJ with Lead Core 124 g	427 to 469 m/sec	36 to 37 mm

Minimum Size: 200 mm x 350 mm | Maximum Size: 1220 mm x 3500 mm for NS Version and 2500 mm X 5000 mm for S Version.
Larger assemblies may be possible on request. The bullet resistance mentioned in the tables apply to glass assembly only and relevant tested frames should be used.

NATIONAL INSTITUTE OF JUSTICE STANDARD (NIJ 0108.01)

THREAT LEVEL	AMMUNITION	NOMINAL BULLET MASS	VELOCITY	THICKNESS
		g (GRAINS)	UPS (FPS)	
I	.22 Long Rifle High Velocity Lead	2.6 (40)	320 +/- 12 (1050 +/- 40)	12 to 13 mm
	.38 Special Round Nose Lead	10.2 (158)	259 +/- 15 (850 +/- 50)	
II-A	.357 Magnum Jacketed Soft Point	10.2 (158)	381 +/- 15 (1250 +/- 50)	19 to 21 mm
	9 mm Full Metal Jacket	8.0 (124)	332 +/- 12 (1090 +/- 40)	
II	.357 Magnum Jacketed Soft Point	10.2 (158)	425 +/- 15 (1395 +/- 50)	19 to 21 mm
	9 mm Full Metal Jacket	8.0 (124)	358 +/- 12 (1175 +/- 40)	
★ III-A	.44 Magnum Semi-wadcutter Gas Checked	15.5 (240)	430 +/- 15 (1400 +/- 50)	23 to 24 mm
	9 mm Full Metal Jacket	8.0 (124)	430 +/- 15 (1400 +/- 50)	
★ III	7.62 mm (.308 Winchester) Full Metal Jacket	9.7 (150)	838 +/- 15 (2750 +/- 50)	42 to 43 mm

TESTED AT

- ★ Wiltshire Ballistic Services Ltd., UK
- ★ HP White-Intertek Laboratory, Inc, USA
- ★ Gujarat Forensic Sciences University, India



INDIAN STANDARD

CLASSIFICATION OF BULLET RESISTANCE – HANDGUNS AND RIFLES

CLASSIFICATION	WEAPON/ CALIBRE	BULLET	MASS, G	VELOCITY, M/S	NO. OF STRIKES	MINIMUM RANGE, M	KINETIC ENERGY, J
HG1	9mm luger	FJ(2)/RN /LC	8±0.1	380	3	5	578
HG2	0.357 magnum	JSP/FS /CB/SC	10.2±0.1	425	3	5	921
HG3	0.44 magnum	FJ(2)/FN /SC	15.6±0.1	440	3	5	1510
R1	5.56× 45 mm	FJ(2)/PB /SCP	4±0.1	920	3	10	1693
R2	7.62× 51 mm	FSJ/PB /SC	9.5±0.1	830	3	10	3272
R3	7.62× 51 mm	FSJ/PB /HC1	9.8±0.1	820	3	10	3295

FSJ – Full Steel Jacket (Plated) | FN – Flat Nose | JSP – Jacketed Soft Point | FJ(2) – Copper Alloy Jacket | SC – Soft Core | PB – Pointed Bullet | RN – Round Nose | LC – Lead Core | SCP – Soft Core Lead with Steel Penetrator | HC1 – Steel Hard Core of Mass 3.7±0.1g, Hardness more than 63 | HRC (see IS 1586 (part 1) | CB – Coned Bullet

CLASSIFICATION OF BULLET RESISTANCE – SHOTGUNS

CLASSIFICATION	WEAPON/ CALIBRE	BULLET	MASS, G	VELOCITY, M/S	NO. OF STRIKES	MINIMUM RANGE, M	KINETIC ENERGY, J
SG1	Shotgun 12/70	Brenneke slug	31 ±1	420±10	1	10	2734
SG2	Shotgun 12/70	Brenneke slug	31 ±1	420±10	2	10	2734
SG3	Shotgun 12/70	Brenneke slug	31 ±1	420	3	10	2734

CLASSIFICATION OF BULLET RESISTANCE – OPEN CLASS

CLASSIFICATION	WEAPON/ CALIBRE	BULLET	MASS, G	VELOCITY, M/S	NO. OF STRIKES	MINIMUM RANGE, M	KINETIC ENERGY, J
O	Open	a	a	a	a	a	a

To be specified, together with tolerances where appropriate, before the test is undertaken



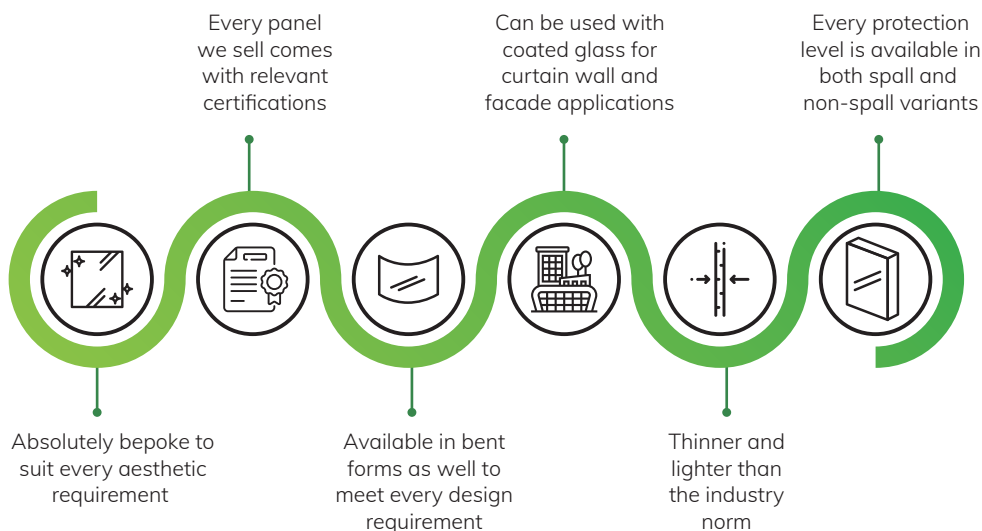


BURGLARSHIELD

Resists Every Kind Of Blow

BURGLARSHIELD is our range of impact-resistant panels that can withstand forced penetration attacks from hammers, saws, axes and even rods! The panel has a strong interlayer that holds the assembly together for a sufficient amount of time, allowing you to take remedial or punitive action. Our panels are ranked at the top in the industry, especially since they are relatively thinner and clearer, something we have achieved with the use of unique recipes and use of advanced interlayers. **BURGLARSHIELD** panels can be fabricated with ultra-clear glasses or even coated glasses to create well-lit and airy spaces that are safe and look great too.

WHY BURGLARSHIELD?



APPLICATIONS

- Military And Vip Vehicals
- Ministries
- Security Cabins
- Prisons
- Villas And Spatial Living Spaces
- Jewelry Stores
- Bank Teller Counters
- Embassies



CHOOSE YOUR PROTECTION LEVEL



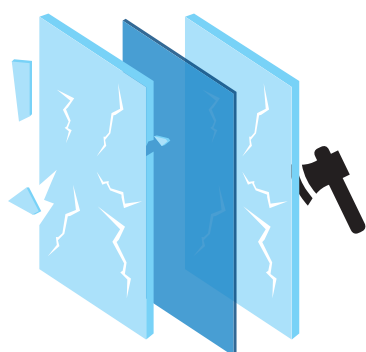
SPALL

When attacked, a regular burglar-resistant glass has the risk of spall (glass fragments) coming off the last glass sheet after a prolonged duration. This is the product of choice when there is no requirement of object protection placed next to the glazing.

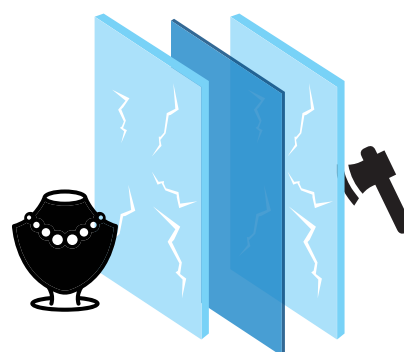


NON SPALL

These are the most sophisticated burglar-resistant glasses available today and provides a much-needed spall protection layer on the non-impact side, protecting any valuables or artifacts from getting damaged. A great and mandatory choice for display cases for museums and showrooms.



**SPALL AND
NON SPALL
GLASS**



BURGLARSHIELD TYPES



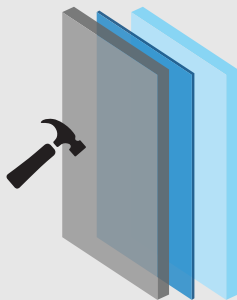
FIRST

Our starting range of burglar-resistant glasses. Made with clear glass assemblies for breakthrough performance, while staying economically viable.



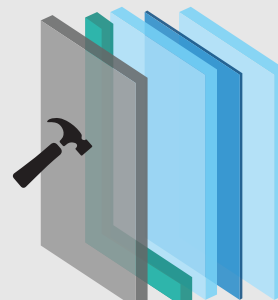
CLARITY

Add enhanced visibility and brightness to your secure glazing with our CLARITY range constructed with low-iron ultra clear glasses. Great choice for high-end visual appeal specially for thicker units.



TONE / SOLAR

Add thermal efficiency and aesthetic uniformity to your facade or windows by using tinted or coated glasses products with our TONE and SOLAR range. Great choice for villa cladding and curtain wall applications.



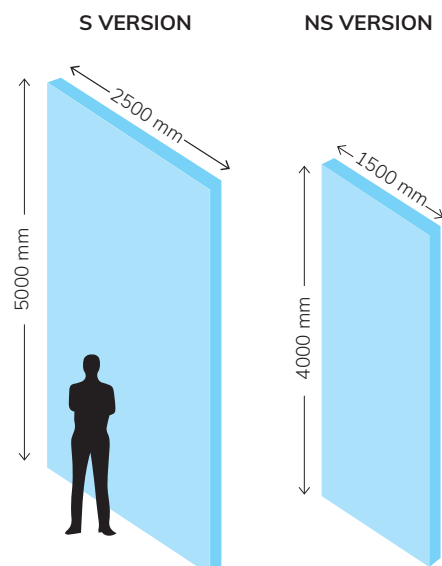
COMBI

Our entire BURGLARSHIELD glass range can be constructed as multi-laminated and/ or insulated glass units for superior protection against fire, blasts and bullets.

BURGLARSHIELD SIZES


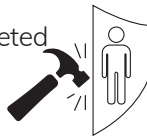
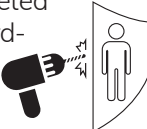

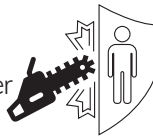
Our sophisticated factory infrastructure allows us to provide BURGLARSHIELD in a wide size range, from 200 mm X 300 mm to extremely large glass formats, enabling unmatched design flexibility.

Availability of glasses in such large sizes allows for use in villas with floor-to-ceiling single pane formats, which looks aesthetically stunning and provides unobstructed views to the outside.



BURGLAR RESISTANT GLASS STANDARDS

EUROPEAN STANDARD (EN 356)

THREAT LEVEL	RESISTANCE CLASS	STRIKES			TOTAL THICKNESS	TYPE OF BURGLAR & BREAK-IN METHOD
		HAMMER STRIKES	AXE STRIKES	TOTAL STRIKES		
★ P4 A	RC 2	3 steel ball drops from 1500 mm			11 mm	Occasional burglar attacks with simple lever tools 
★ P5 A	RC 3	9 steel ball drops from 9000 mm			11 mm	Experienced burglar, targeted attacks on property using lever tools 
★ P6 B	RC 4	20	23	43	15 mm	Experienced burglar, targeted attacks on property regardless of noise level (lever strikes and drilling tools) 
P7 B	RC 5	20	45	65	16 mm	Experienced burglar, targeted attacks on property with mechanical and electrical tools 
★ P8 B	RC 6	20	98	118	17 mm	As in RC5, but with more time and more powerful electric tools (angle grinder with 230 mm diameter) 

Minimum Size: 200 mm x 300 mm | Maximum Size: 1500 mm x 4000 mm for NS Version and 2500 mm X 5000 mm for S Version. Larger assemblies may be possible on request. The burglar-resistance mentioned in the tables apply to glass assembly only and relevant tested frames should be used.

TESTED AT

★ Stazione Sperimentale del Vetro, Italy



INDIAN STANDARD (IS 16978)

THREAT LEVEL	IMPACT TYPE	THICKNESS
P1A	3 steel ball drops from 1500 mm	11 mm
P2A	3 steel ball drops from 3000 mm	11 mm
P3A	3 steel ball drops from 6000 mm	13 mm
P4A	3 steel ball drops from 9000 mm	13 mm
P5A	3 steel ball drops from 9000 mm	15 mm
P1B	30 to 50 axe and hammer strikes	15 mm
P2B	50 to 70 axe and hammer strikes	16 mm
P3B	Over 70 axe and hammer strikes	17 mm

ORDINARY LAMINATED GLASS IS NOT ENOUGH!

We want to put this on record-ordinary laminated glass simply is not adequate in providing impact resistant capabilities as per the required standard norms! This is a common misconception in the market, fueled by the availability of cheaper and untested glazing systems, and can prove risky if relied upon for security glazing.

To demonstrate, we conducted an in-house test (scan the QR code to see the full video) that shows the stark difference and performance characteristics of an ordinary laminated glass and our P8B level **BURGLARSHIELD** glass, both in 16 mm thickness, fabricated in the same dimensions and installed in the same glazing system. While the laminated unit was penetrated in less than a minute, our **BURGLARSHIELD** glass remained impenetrable even after twenty minutes of continuous hammer and axe strikes!

So next time you want to select an appropriate glazing solution for your high-risk security application, ensure that you select a tested and proven product, backed up by an authentic test evidence from an accredited test institute.





Scan the QR code and
watch the demo video!


TEST RESULTS




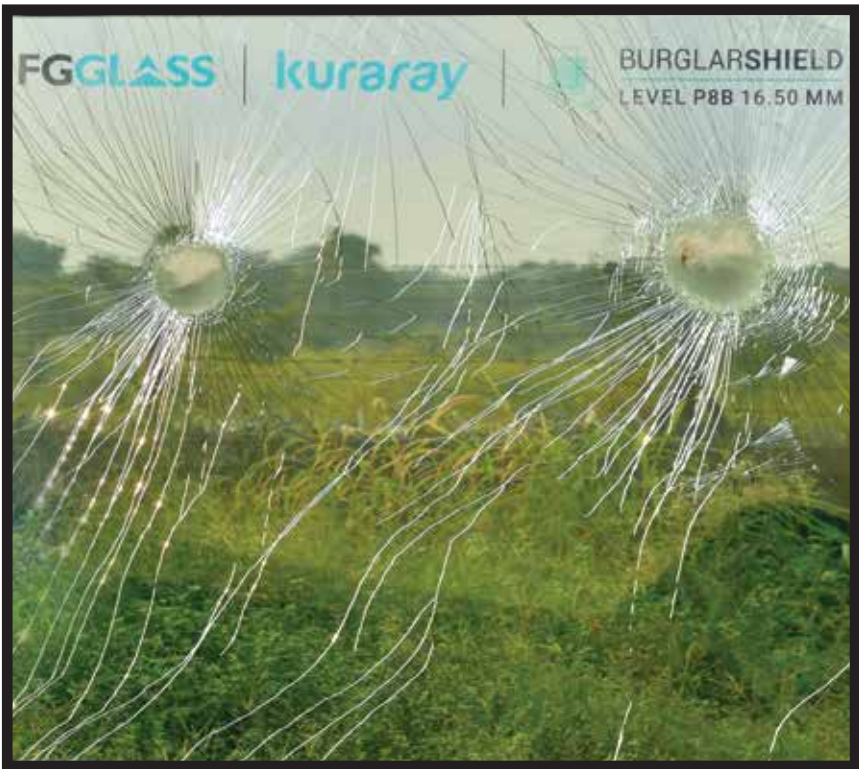
ORDINARY GLASS

 : 01:07:25


 : 13


 : 9


 **Penetration**




BURGLARSHIELD

 : 09:38:06

 : 127

 : 197

 **No Penetration**



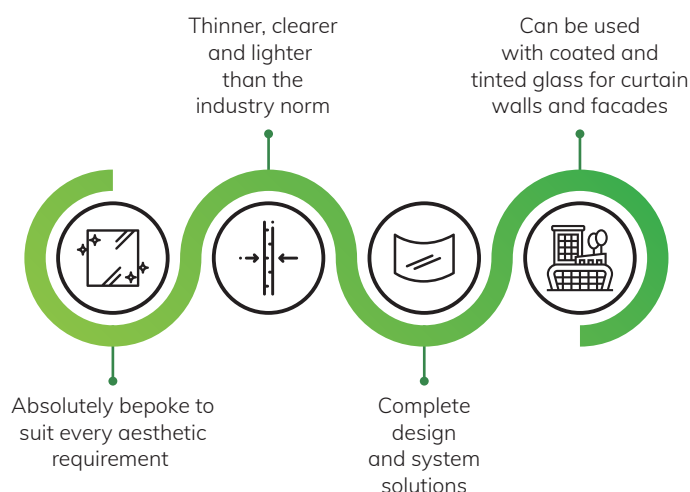


BLASTSHIELD

Comprehensive Protection Against Every Blast

Specially configured to withstand bomb and grenade attacks, our **BLASTSHIELD** units are designed to hold firm in the unfortunate and life-threatening event of a blast. It is important to note however, that blast-resistant windows do not function in isolation—they only work as part of a system. The system involves the glass, the framing system, the anchoring system and even the structure of the building. If the framing or anchoring system is not blast-resistant, it may be unable to hold the glazing in the event of a blast, which may cause the glass panel to fail. We will provide you with a qualified blast engineer who will help you create the ideal design for your blast-resistant project.

WHY BLASTSHIELD?

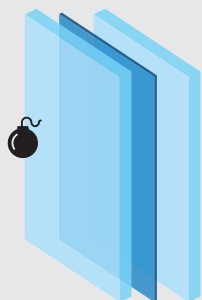


APPLICATIONS

- Embassies And Consulates
- Structural Glazing And Curtain Walls
- Vehicles, Excavators And Loaders
- Security Cabins

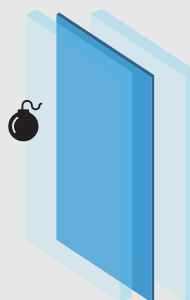


BLASTSHIELD TYPES



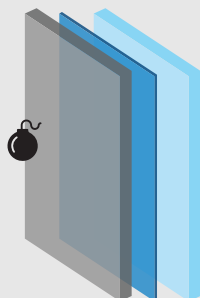
FIRST

Our starting range of blast-resistant glasses. Made with clear glass assemblies for breakthrough performance, while staying economically viable.



CLARITY

Constructed with low-iron, ultra-clear glasses for unbeatable clarity and aesthetics



TONE / SOLAR

Can be combined with ultra clear, tinted or coated glasses for architectural conformance



COMBI

Can be combined with insulated and multi-laminated glasses for multi-tier protection-acoustics, solar control, burglar resistance, bullet resistance and fire resistance.

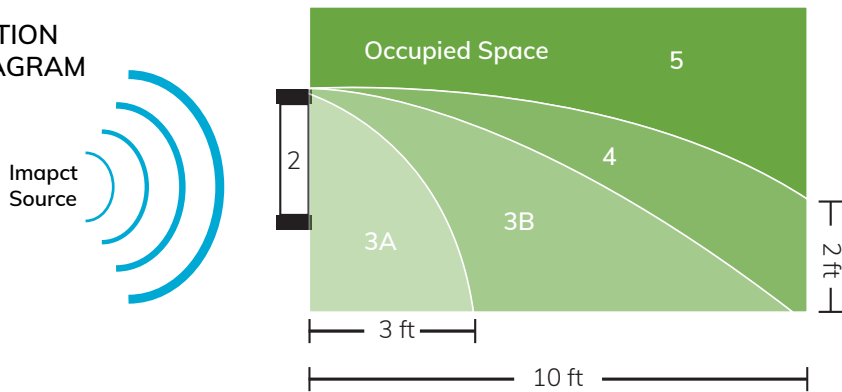
BLAST RESISTANT GLASS STANDARDS

BLAST DESIGN

The design of a blast window system involves very detailed areas of design. First the peak pressure must be determined from the size of the charge and the set back distance from that charge. Then a positive phase duration must be known to determine the impulse of the blast wave. Finally a performance condition must be specified to determine the expected performance level. With this information a computer model can be constructed to determine the specific thickness or layers of material needed to contain the blast within the specified performance criteria. See the chart below for performance conditions. (GSA Test Protocol: GSA- TS01-2003).

It is important to note that a blast resistant window operates as a system. It involves not only the glass itself, but also the framing system, anchoring system and even the structure of the building. A frame that is not designed for blast or that is not anchored properly may not hold the glazing during a blast situation causing unnecessary failure and possible injury. A qualified blast engineer should be consulted for the design of each project.

WINDOW PERFORMANCE CONDITION
AND GLASS FRAGMENTATION DIAGRAM



PERFORMANCE CONDITION	PROTECTION LEVEL	HAZARD LEVEL	DESCRIPTION OF WINDOW GLAZING RESPONSE
1	Safe	None	Glazing does not break. No visible damage to glazing or frame.
2	Very High	None	Glazing cracks but is retained by the frame. Dusting or very small fragments near sill or on floor acceptable.
3A	High	Very Low	Glazing cracks and fragments enter space and land on the floor, no further than 3.3 feet from the window.
3B	High	Low	Glazing cracks and fragments enter space and land on the floor, no further than 10 feet from the window.
4	Medium	Medium	Glazing cracks and fragments enter space and land on the floor and impact a vertical witness panel at a distance of no more than 10 feet from the window and at a height no greater than 2 feet above the floor.
5	Low	High	Glazing cracks and window system fails catastrophically fragments enter space, impacting a vertical witness panel at a distance of no more than 10 feet from the window and at a height no greater than 2 feet above the floor.

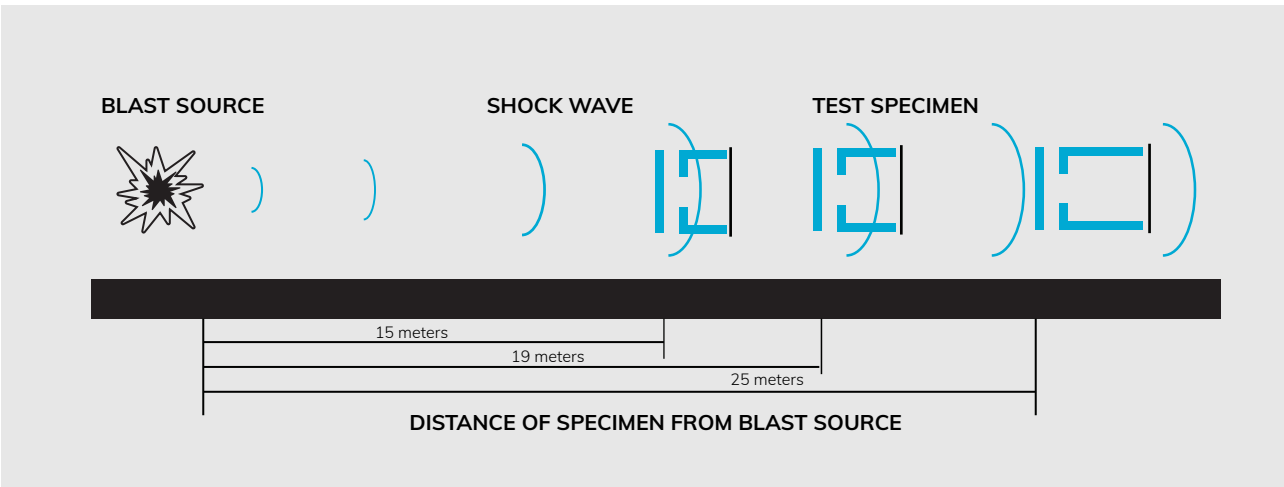


SHOCK TUBE TESTING

Loadings in shock-tube tests are an idealised one-dimensional part of a spherical blast wave generated through either a sudden release of gas into the shock tube or the detonation of a small explosive charge. The blast parameters are specified to represent the required loading scenario. These tests are conducted in-house in a laboratory.

ARENA TEST

Loading in an arena test is provided by the detonation of a charge of a certain mass and a certain distance to the structure. The blast parameters are specified to represent the required loading scenario. These are conducted in an outdoor environment.



ISO 16933 CLASSIFICATION

CLASSIFICATION	PEAK PRESSURE OF SHOCK WAVE (KPA)	POSITIVE IMPULSE (KPA-MS)
EXV45(X)	30	180
EXV33(X)	50	250
EXV25(X)	80	380
EXV19(X)	140	600
EXV15(X)	250	850
EXV12(X)	450	1200
EXV10(X)	800	1600





RADISHIELD

Blocking Out Harmful Rays

Our RADISHIELD glass that has a high barium and lead content, providing optimum protection from harmful radiation in hospitals. These panels offer excellent visible clarity and can be fitted into sealed double-glazed units to offer higher protection. These glass vision panels can be used on doors that lead to X-ray rooms, angiography rooms, MRI scan rooms, and CT and PET scan rooms. They are also ideal for laboratory windows, airport security X-ray screens and even the lenses of safety goggles.

WHY RADISHIELD?

Can be laminated with advanced interlayers for extra security



Can be fitted into sealed double-glazed units

APPLICATIONS

- Vision Panels In Hospital X-Ray
- Ct Scan And Pet Scan Rooms
- Airport Scanning Machines



PRODUCT FEATURES

DIMENSIONS

RADISHIELD is supplied as polished plates from 3.5 mm to 20 mm thickness with dimensions up to 1400 mm x 2400 mm (55" x 94")

This allows architects to design viewing windows with a wider field of vision to maximize the observation requirements of the diagnostic operators.

Smaller sizes can be cut to meet most application requirements.

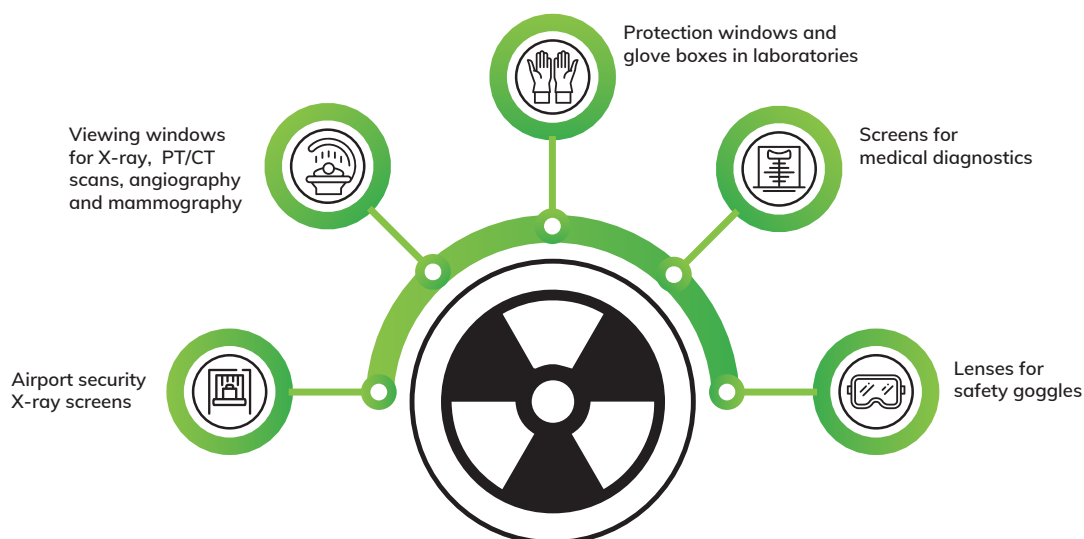
All cut edges are ground and finished with safety chamfers.

BESPOKE CONSTRUCTION

RADISHIELD is suitable for laminating using polyvinyl butyral (PVB) and SentryGlas™ interlayers and can also be fitted into sealed, double-glazed units for insulation purpose. These can even be customised to provide multi-tier protection such as fire-resistance and impact-resistance.

APPLICATIONS

RADISHIELD is compatible with a large range of installations and other viewing applications such as:



ISO STANDARD PRODUCTION

The production of RADISHIELD is strictly controlled and is manufactured in accordance with the Quality Standard ISO 9001, the environmental Standard ISO 14001 and Health & Safety Standard OHSAS 18001. The glass is produced to conform to AERB (Atomic Energy Regulatory Board) standards.

RADIATION RESISTANT GLASS STANDARDS

SHIELDING CHARACTERISTICS

Data provided by the UK health protection agency. N/A = X-Ray transmission below level of detection.

GLASS THICKNESS	MINIMUM LEAD EQUIVALENCE (MM) FOR STARTED X-RAY TUBE VOLTAGE							MAX. PLATE MASS
min	80kV	100kV	110kV	150kV	200kV	250kV	300kV	kg/m²
4.0 to 5.5	1.4	1.4	1.3	1.2	1.0	1.0	1.0	26.4
5.0 to 6.5	1.7	1.7	1.7	1.5	1.3	1.3	1.3	31.2
5.7 to 7.0	1.9	1.9	1.9	1.7	1.5	1.5	1.5	33.6
7.0 to 8.5	2.3	2.3	2.3	2.1	1.8	1.8	1.8	40.8
8.5 to 10	2.7	2.8	2.9	2.6	2.1	2.1	2.2	48.0
10 to 12	3.2	3.2	3.3	2.9	2.1	2.1	2.6	48.0
11.0 to 13.0	3.6	3.5	3.6	3.2	2.8	2.8	2.9	62.4
12.0 to 14.0	4.0	3.8	4.0	3.5	3.0	3.1	3.2	67.2
14.0 to 16.0	4.7	4.5	4.6	4.1	3.5	3.6	3.7	76.8
16.0 to 18.0	5.3	5.1	5.3	4.7	4.0	4.1	4.3	86.4
18.0 to 20.0	6.0	5.7	5.9	5.2	4.4	4.6	4.8	96.0

PHYSICAL PROPERTIES

Optical Properties

Refractive Index n_d	1.76
Transmission % @ 55nm through 5 mm path	≥85.0

Chemical Properties

Lead (Pb)	52%
Barium (Ba)	17%

MECHANICAL PROPERTIES

Density (g/cm ³)	4.8
Knoop Hardness (kg/mm ²)	409
Young's Modulus (GPa)	62.6
Torsion Modulus (GPa)	24.8
Poisson's Ratio	0.26
Coefficient of Thermal Expansion (x10 ⁻⁷ /°C)	78.8







SECUREBUILD

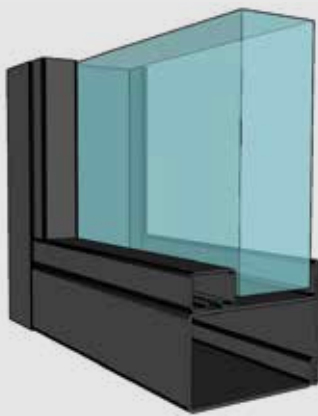
When it comes to dealing with security glass, it is critical that the glass does not work in isolation. It's only when the glass is properly installed with the help of secure glazing that it can withstand the impact of bullets, blasts and blows. To give our customers complete peace of mind, we have introduced **SECUREBUILD**, our very own framing systems solutions.

We provide high-quality steel framing systems that have been tested to Indian and International standards.

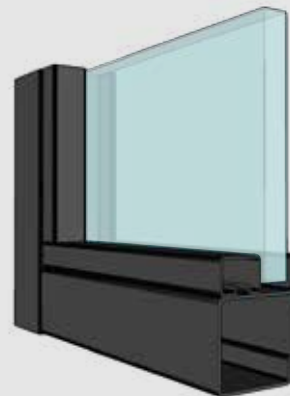
Our glazing solutions ensure that our glasses are installed correctly and are able to offer you the safety and security that you need.

We also understand the need for aesthetically-pleasing facades, so we offer our **SECUREBUILD** range in a variety of materials and finishes.

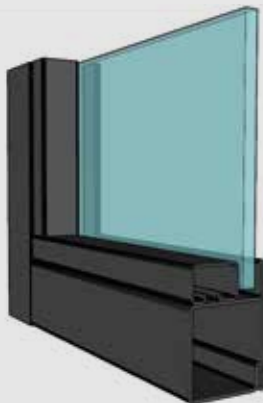
With FG, you never have to worry about a compromise. We provide the highest quality products while ensuring that the beauty of the structure remains intact.



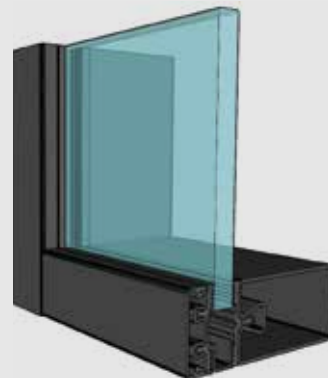
BULLET: SECUREBUILD BL



BURGLAR: SECUREBUILD BR



BLAST: SECUREBUILD BT



RADI: SECUREBUILD RF



APPLICATIONS

Project - Indian Embassy
Location - Tanzania, Dar Es Salam
Product Used - BULLETSHIELD COMBI

WHERE IS SECURITY GLASS USED?

VILLAS AND SPATIAL LIVING SPACES

We all aspire to live in a light-infused space with large openings that are protected by nothing but clear glass. Our impact-resistant glasses can withstand some of the most crushing impacts that are the result of a forced intrusion. At the highest level, our glass can be more difficult to penetrate than steel! And, for better clarity, we can create these glasses with ultra-clear lites for unmatched aesthetics. We've been in the industry for a long time and we leverage our wide glazing knowledge to create beautiful living spaces that are incredibly safe.

Recommended Product: **BURGLARSHIELD**





BANK TELLER COUNTERS

In a banking establishment, there's no denying the fact that bank teller counters are one of the most sensitive locations. This is why they need to be protected against bullets and forced intrusion. We can offer you custom-designed solutions that will suit individual counter requirements.

Recommended Products

BURGLARSHIELD
BULLETSHIELD



SECURITY CABINS

Almost every security cabin you see today is encased in glass. Sadly, this can make security staff vulnerable to attacks, especially if the glazing is not intrusion-resistant. We believe that all security cabins and structures should be glazed with at least P6B intrusion-resistance to protect all security personnel. For enhanced aesthetics, we can provide you with curved safety glass for your security cabins.

Recommended Products

BURGLARSHIELD, BULLETSHIELD



MILITARY AND VIP VEHICLES

Military and other personnel often require their cars to be as safe and secure as their homes and offices. In order to fulfil this need, we have partnered with Kuraray to bring lightweight security panels to India. The advanced interlayers are the lightest, clearest and safest in the industry, which makes the vehicles themselves faster and provides better mileage as well.

Recommended Products: **BULLETSHIELD, BURGLARSHIELD, BLASTSHIELD**



OIL REFINERIES AND GAS STATIONS

Oil refineries and gas stations are very vulnerable to blasts and similar disasters, owing to the very flammable nature of their products. Control rooms, security rooms and other sensitive locations need to be glazed with appropriate blast-resistant protection to ensure that these places remain safe and non-fatal for human lives in the event of such disasters.

Recommended Product: **BLASTSHIELD**





SHIPS

Marine applications demand varying levels of protection-both with security and fire-resistance. Any ship or sailing vessel needs to be self-sufficient to handle any potential disaster. Vertical and horizontal prevention of events such as fire or blasts are possible with advanced glazings. Our bespoke solutions can be customized to cater to the stringent SOLAS and other international norms for the marine industry.

Recommended Products

BULLETSHIELD COMBI
BLASTSHIELD COMBI

EMBASSIES AND CONSULATES

Embassies and consulates are unarguably a nation's most protected spaces on foreign soil. Every entry point, door and security cabin in these spaces need to be completely protected so as to withstand any and all kind of terrorist attacks, including blasts, intrusions, bullets and even fires. Our team has the experience required to advise you on the kind of security glass you need based on your location and the level of protection you'd like. What's more, given our extensive glazing experience, we can provide uniform facade solutions that offer a mix of both security panels and regular glass panels.

Recommended Products

BULLETSHIELD, BLASTSHIELD
BURGLARSHIELD



HOSPITALS

All modern PET scan rooms, CT scan rooms, X-ray rooms and MRI rooms in every hospital need to ensure that there's a total blockage of harmful radiation to the outside. Traditionally, these rooms have been built with just metal doors. But now, thanks to the advances being made in glass technologies, it's possible to incorporate vision panels in these doors for better visibility and control. Our RADISHIELD glass is lined with lead metal of varying thicknesses to ensure radiation of various levels can be controlled.

Recommended Product: **RADISHIELD**



Pet Scan Rooms



X-Ray Rooms



MRI Rooms



1976

Group Founding Year

11

Factories and Offices

5 Million

Panels Installed

35

Countries Exported to

700

Projects Successfully Executed

1000+

Family Strength

650,000

Square Feet Factory Area

6

Group Companies

Project: Leela Hotel
Location: Gandhinagar, India
Product Used: BULLETSIELD COMBI

WHO WE ARE

Part of the Fishfa Group, FG is among the world's leading architectural glass manufacturers. Over the last two decades, we have successfully completed a wide range of projects in more than 35 countries across 5 continents. Our rigorous quality standards and robust project management processes have been key factors in ensuring that our projects are delivered on time and on budget.

We have a well-established supplier network in Europe and the America and state-of-the-art manufacturing facilities in India and the UAE, which has enabled us to leave our footprint in multiple locations across the globe. We're constantly working on setting new standards in the glass industry and this has led to us being the glass supplier of choice for businesses around the world. Our partnership with Kuraray, a leading Japanese brand, has allowed us to bring the thinnest, clearest and fully-certified security glass to India.



FG GLASS INDUSTRIES PVT. LTD.

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fgglass.com/security