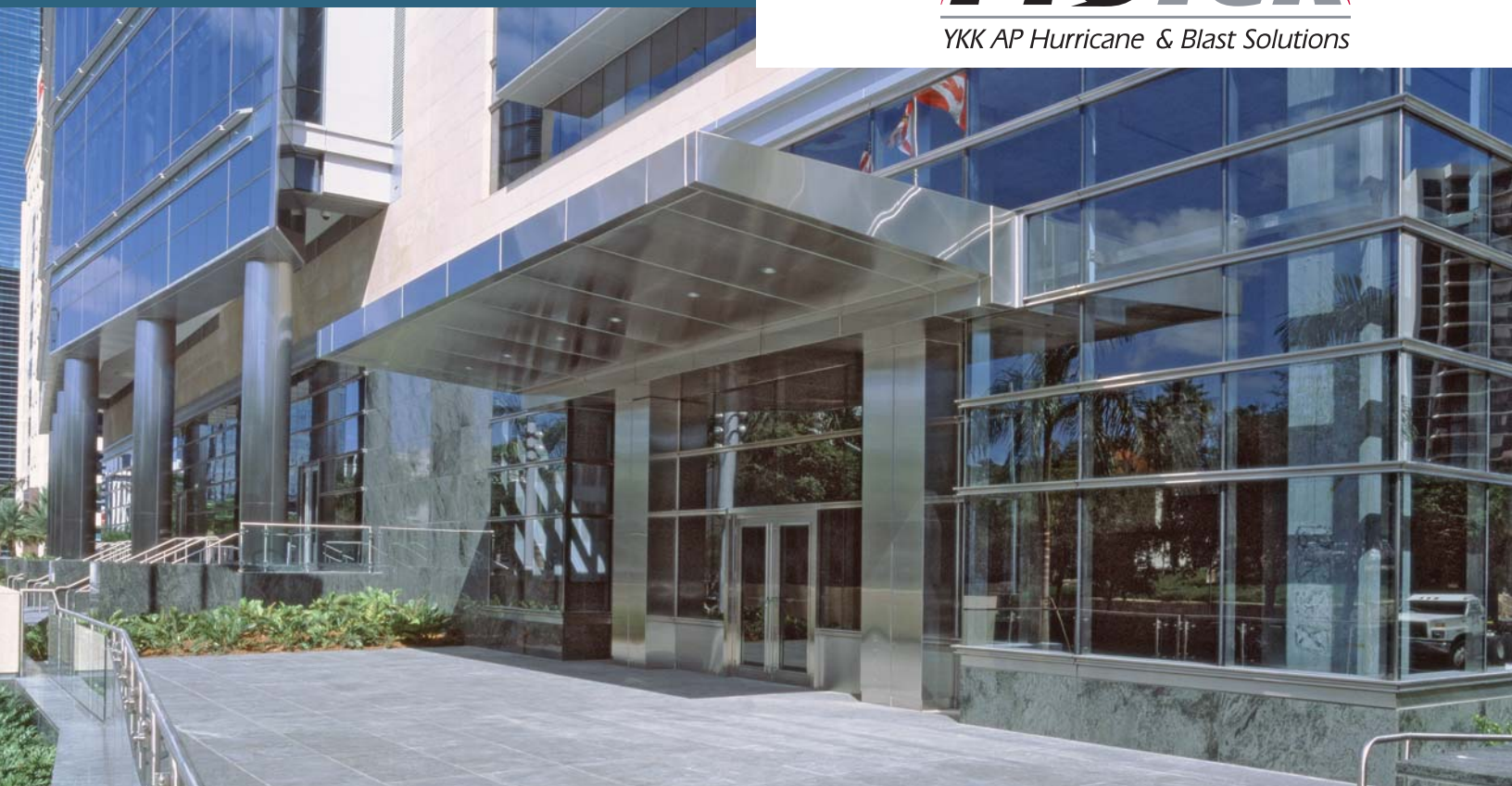




> Quality
Protects

Glazing Systems for Blast Mitigation

ProTek[®]
YKK AP Hurricane & Blast Solutions



Entrances | Storefronts | Curtain Walls | Sun Controls | Windows | Balcony Doors

**YKK
ap**[®] | Quality
inspires[®]

YKK AP's ProTek® Systems

Proven Performance for the Entire Building Envelope



Arena/Open Air Test

- ASTM F1642
- GSA-TS01-2003
- 6 PSI/41 PSI* MSC
- GSA Performance: Minimum 3B
- Contact YKK AP for Glazing Options

Entrance Doors

YKK AP Model 35H Swing Door

- Pairs up to 7'-0" x 8'-0"
- Maximum Security Lock
- Exit Device
- Dry Glaze Option for Blast Mitigation
- Wet Glazed for Blast & Hurricane Applications

Storefront

YKK AP YHS 50 TU

- 5'-0" x 8'-0" & 5'-0" x 2'-0" Lites of Glass
- Thermally Broken
- Dry Glaze Option for Blast Mitigation
- Wet Glazed for Blast & Hurricane Applications

Curtain Wall

YKK AP YHC 300 OG (Outside Glazed)

- 20' x 26' Wall Tested
 - Intermediate Anchors
 - Vertical Splice
- 5'-0" x 8'-0" & 5'-0" x 2'-0" Lites of Glass
- Thermally Improved
- Dry Glaze Option for Blast Mitigation
- Wet Glazed for Blast & Hurricane Applications

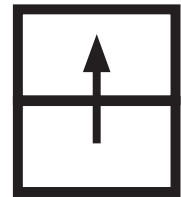
Fixed & Operable Windows



YOW 225 TUH

YKK AP YOW 225 TUH

- Outswing Casement
- Project Out Vents
- Fixed Lites
- Thermally Broken
- Wet Glazed Only



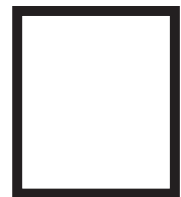
YVS 410 TUH

YKK AP YVS 410 TUH

- Single Hung
- Thermally Broken
- Wet Glazed Only

YKK AP YFW 400 TUH

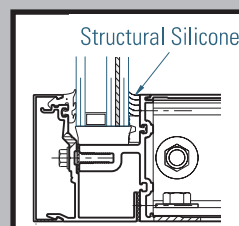
- Fixed Lites
- Thermally Broken
- Wet Glazed Only



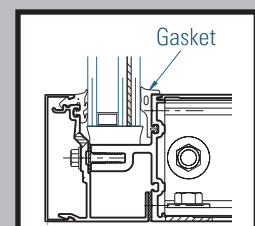
YFW 400 TUH

Dry Glazed Option

- Same level of proven performance
- Interior gasket replaces silicone seal to reduce material and labor cost



"Wet Glazed"
Interior Structural
Silicone Seal



"Dry Glazed"
Interior Gasket

Put YKK AP® On Your Security Team

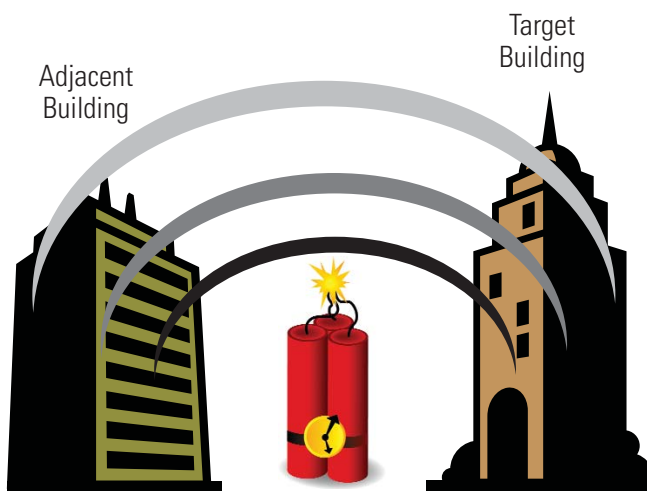
What Buildings Need Blast-mitigation Measures?

YKK AP pioneered hurricane impact-resistant glazing systems and is leading the development of blast mitigation systems. These systems are designed to help protect building occupants from flying glass shards, the leading cause of injury in a blast event.

Any building that may be a target of terrorist attacks will benefit from the use of YKK AP's ProTek® storefront, entrances, curtain wall, and window systems as an integral part of the building envelope.

Current guidelines mandate that new buildings for the Department of Defense and the majority of other new federal buildings be designed to afford the minimal level of protection from terrorist attacks. But any building near one of these facilities could also be at risk. As shown in the graphic below, a blast event is target-neutral. The destructive force of the blast radiates out from the point of detonation in all directions, so an unprotected building across the street from a targeted building may be as vulnerable, or more so, as the targeted building.

Explosions are Target Neutral

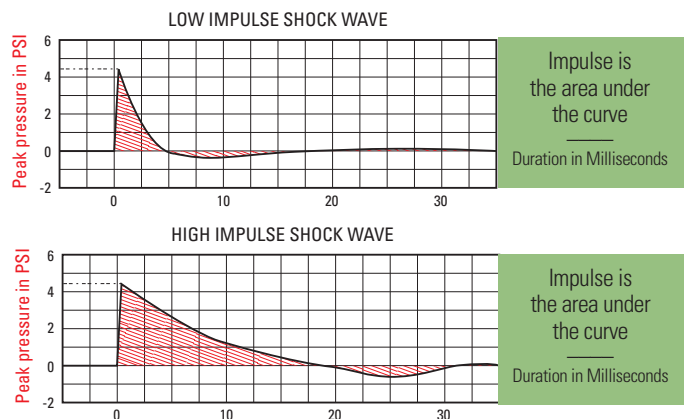


A bomb does not know what the target is. Energy from an explosion radiates out evenly, so the shock wave impacts everything in a circle of injury, and destruction. Even buildings that are not potential targets may need protection if they are in the proximity of potential targets.

Studies show that up to 80% of injuries in a blast are the direct result of flying glass debris. In the 1995 bombing of the Alfred P. Murrah Federal Building in Oklahoma City, glass broke in buildings more than 10 blocks away. Broken glass alone accounted for 69% of the injuries outside the targeted building.

How To Protect Your Buildings' Occupants From Blast-driven Glass Shards

The extent of damage caused by a blast is directly related to its peak pressure (measured in pounds per square inch) and its intensity, or impulse, which is a function of the blast's peak pressure and the duration (measured in milliseconds). A firecracker and a stick of TNT both generate high peak pressure, but the TNT blast causes much more damage because it has a much larger impulse. The blast duration of a large explosive device is about 41 milliseconds—roughly one-eighth of the time it takes for an eye to blink.



According to blast consultants, laminated glass is a very effective way to protect building occupants from injuries that result when the glass breaks and razor-like shards explode into the occupied space. Laminated glass may break from the force of the blast, but the interlayer that is bonded to the glass will prevent the majority of the glass shards from entering the



building. Products such as the family of YKK AP's ProTek® glazing systems are required to ensure that the sheet of laminated glass itself does not fly into the building.

Designing Buildings For Blast Mitigation

Buildings that are prominent potential targets require systems specifically designed to resist the destructive power of blast events with very high peak pressures and impulses. It is not necessary that all buildings be designed for this level of protection.

The Department of Defense (DoD) has issued the Unified Facilities Criteria (UFC) that prescribes the minimum design requirements for all DoD buildings. This guideline enables architects to specify windows and entrances that are designed to help protect building occupants from serious injury in the event of a terrorist attack, even if these systems have not been tested. The UFC requires laminated glass and mandates that the majority of the glass remain in the framing system even when broken by a blast event. An interior seal of structural silicone, or a one-inch glass bite, is a requisite of the UFC to anchor the glass to the framing system. Glazing systems may be designed without these prescriptive requirements, but testing in accordance ASTM F-1642 is then required to demonstrate

their ability to perform.

The General Services Administration (GSA), which manages over 9,000 federal facilities, also requires a minimum level of protection for building occupants from injuries resulting from a blast event. The GSA has published guidelines for glazing systems and their performance may be modeled with special computer programs or with actual testing in accordance with GSA-TS01.

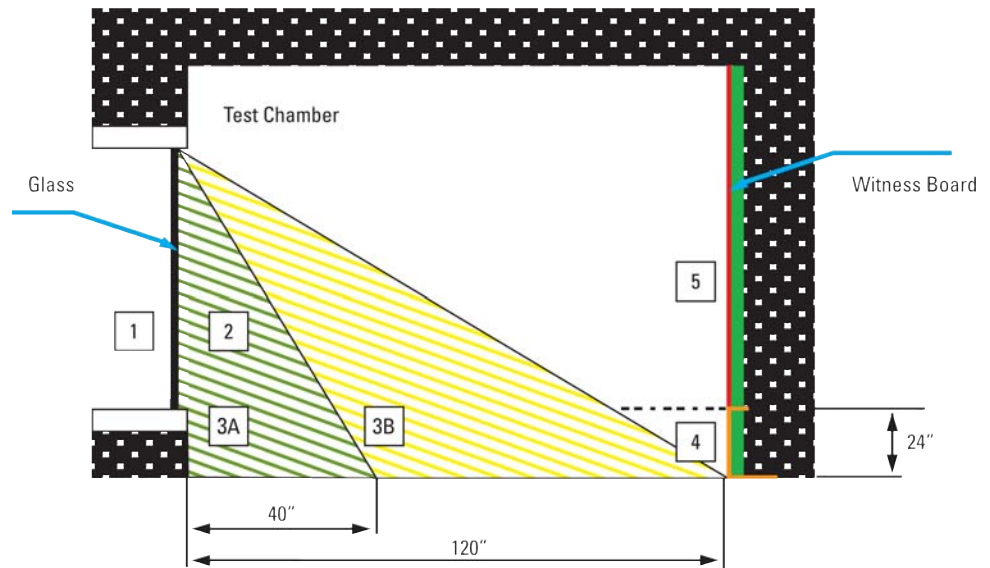
The American Architectural Manufacturers Association (AAMA) has published a voluntary design guideline, AAMA 510, in recognition that buildings in the private sector may need to be designed to protect occupants from blast events due to their proximity to a government building or a perceived threat. AAMA 510-06 requires glazing systems to be evaluated through dynamic analysis, using government-approved software, or to be tested in accordance with ASTM F-1642 or GSA-TS01.

The DoD, GSA, and AAMA rate the level of protection that a glazing system provides to building occupants based on its ability to mitigate injuries from flying glass. The diagram and table on the next page define performance levels of protection.

Proven Performance

Blast mitigation systems are another milestone in YKK AP's history of innovation. As we began developing these products, we turned to our family of ProTek® systems because many of them already

DoD, GSA,
and AAMA
Performance
Levels of Protection



GSA & AAMA			DoD	Description of Window Glazing Response
Performance Condition	Level of Protection	Hazard Level	Level of Protection	
1	Safe	None	High	Glazing does not break. No visible damage to glazing or frame.
2	Very High	None	Medium	Glazing cracks, but is retained in the frame. Dusting or very small fragments near sill or on the floor acceptable.
3A	High	Very Low	Low	Glazing cracks. Fragments enter space and land on floor no further than 3.3 feet from the window.
3B	High	Low		Glazing cracks. Fragments enter space and land on floor no further than 10 feet from the window.
4	Medium	Medium	Very Low	Glazing cracks. Fragments enter space and land on floor and impact a vertical witness panel at a distance of no more than 120 inches from the window at a height no greater than 24 inches above the floor.
5	Low	High	Below Anti-Terrorism (AT) standards	Glazing cracks and window system fails catastrophically. Fragments enter space impacting a vertical witness panel at a distance of no more than 120 inches from the window and at a height greater than 24 inches above the floor.

met the prescriptive standards of the UFC.

YKK AP conducted voluntary open air/arena blast tests in accordance with ASTM F-1642 at an independent test laboratory at a peak pressure and impulse level compliant with the UFC and the majority of the GSA requirements. These open air tests enable YKK AP to validate the enhanced performance levels of several of our ProTek® Systems to help lower project costs while providing the same level of protection. Testing applications with an interior structural silicone seal (wet glazed) and with gaskets on both the interior and exterior (dry glazed) clearly demonstrated the ability of both approaches to help protect building occupants. A 26'-0" tall curtain wall mockup was also tested to determine the effect of a blast on the intermediate anchors and vertical splices. Through all of the testing, the YKK AP ProTek systems consistently

met or exceeded government requirements by delivering a minimum 3b level of performance.



Specify YKK AP's ProTek®

YKK AP is proud to offer a full line of systems designed to help protect buildings and occupants from both natural and man-made threats. Please see the back of this brochure for a complete listing of YKK AP ProTek systems and contact one of our sales representatives for additional information.

YKK AP's ProTek® Glazing Systems

	System ⁽¹⁾	Standards				Comments
		ASTM F1642 ⁽²⁾		GSA TS01-03		
		(Wet Glazed)	(Dry Glazed)	(Wet Glazed)	(Dry Glazed)	
Entrances & Storefronts	Model 35H	No Break	Low Hazard	1	1	6psi/41psi-ms
	YHS 50 TU	Minimal Hazard	Low Hazard	3b	3b	6psi/41psi-ms
	YES 45 TU	—	Low Hazard	—	3b	4psi/28psi-ms
	YHS 50 FS	Meets UFC 4-010-01 prescriptive standard in accordance with 2007 revisions	Meets UFC 4-010-01 prescriptive standard in accordance with 2007 revisions	Must be analyzed using dynamic analysis by a blast consultant	Must be analyzed using dynamic analysis by a blast consultant	—
	YHS 50 FI	—	—	—	—	—
Curtain Walls	YHC 300 OG Monolithic	Low Hazard	Low Hazard	3b	3b	6psi/41psi-ms
	YHC 300 OG Insulating	—	No Hazard	—	2	4psi/28psi-ms
	YHC 300 SSG Monolithic	Meets UFC 4-010-01 prescriptive standard in accordance with 2007 revisions	—	Must be analyzed using dynamic analysis by a blast consultant	—	—
	YHC 300 SSG Insulating	—	—	—	—	—
	YHC 300 IG Monolithic	Meets UFC 4-010-01 prescriptive standard in accordance with 2007 revisions	—	Must be analyzed using dynamic analysis by a blast consultant	—	—
	YHC 300 IG Insulating	—	—	—	—	—
Windows	YOW 225 TUH Insulating					
	Casement Out	Minimal Hazard	—	2	—	6psi/41psi-ms
	Fixed/Project Out	Minimal Hazard	—	2	—	6psi/41psi-ms
	Fixed/Fixed	Minimal Hazard	—	2	—	6psi/41psi-ms
	YFW 400 TUH Insulating					
	Fixed	Minimal Hazard	—	2	—	6psi/41psi-ms
	YVS 410 TUH Insulating					
	Single Hung	Minimal Hazard	—	3b	—	6psi/41psi-ms

Product performance must be validated on a per project basis using approved engineering programs such as Wingard and SBEDS.

⁽¹⁾—Contact YKK AP for glazing requirements.

⁽²⁾—Tested in accordance with ASTM F 1642 for compliance with UFC 4-010-01.

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