

FIRE-RATED GLASS DOES DOUBLE DUTY TO CREATE

# SAFE AND SECURE BUILDINGS

By Diana San Diego



Photos courtesy of SAFTIFIRST

**Ballistic and one-way reflective glass in the control rooms at Plaquemines Parish Detention Center in Davant, La.**

**IT'S AN UNFORTUNATE SIGN OF THE TIMES.** Increasingly, architects need to incorporate measures to deter, delay and protect people and property from human aggressors. Fortification of buildings once appealed largely to the State Department, the Department of Defense and prisons, but that is no longer the case.

Today, interest in built-in security has expanded to schools, local government facilities, courthouses, storefronts, airports and homes. Their challenge is to find ways to balance security measures with other design constraints such as fire protection, daylighting and aesthetics to build inviting, safe environments. New glazing and framing systems offer helpful, attractive tools that can meet security, fire protection and design goals all at the same time.

Adding glass enhances a sense of openness and improves energy efficiency, but windows and doors can be the most vulnerable portion of a building. Innovations by glazing manufacturers have produced glazing assembly options that perform double-duty by not only resisting forced entry, bullets or blasts but also protect buildings and occupants from fire, radiant heat and impact while providing aesthetic and environmental benefits associated with the use of glass. The use of fire-resistant, attack-resistant glass and frame assemblies or curtain walls allow designers to add transparency to entryways, exit corridors and exteriors while keeping the building and its occupants safe and secure.

## CATEGORIES OF SECURITY GLAZING TEST STANDARDS

Glazing products fall into three basic categories of security test standards: forced entry, ballistic, and bomb-blast. Here is a list of security test standards that helps determine which glazing assembly is appropriate for an application.

### RESISTS FORCED ENTRY

- ASTM F 1915, *Glazing for Detention Facilities* – Grades glazing based on time and a sequence of blunt and sharp impacts
- CDCR 860, *Standard for Security Glazing Products* – Designates Classes A-E and requires three impact tests: sledge, axe and hammer, and torch
- ASTM F 1233, *Standard Test Method for Security Glazing Materials and Systems* – Tests for blunt impacts, sharp impacts, thermal attacks, and chemical attacks and assesses impact types of Levels 1-5
- ASTM F 1592, *Standard Test Methods for Detention Hollow Metal Vision Systems* – Framing test for physical attacks in corrections facilities (does not include high-powered rifles, explosives, sawing, etc.)

### RESISTS BULLETS

- UL 752, *Standard for Bullet Resisting Equipment* – Grades glazing of Levels 1-8 and tests a product's ability to resist bullet penetration and flying glass fragments

- NIJ 0108.01, *Ballistic Resistant Protective Materials Test*

### RESISTS BOMB BLASTS

- ASTM F1642, *Bomb Blast Resistant Glazing*
- ASTM F2248, *3-Second Duration Design Load for Blast Resistant Glazing*
- ASTM F2912-11, *Glazing Systems Subject to Airblast Loadings*
- GSA/ISC TS01-2003, *Explosive Testing of Window Systems* – Defines protection Levels 1, 2, 3a, 3b, 4, and 5
- ISO 16933, *Explosion-Resistant Security Glazing*– Pertains to vehicle bombs and hand-carried satchel bombs
- ISO 16934, *Explosion-Resistant Security Glazing*– Designed to test glass for resistance to high-explosive detonations

### FIRE-RESISTIVE AND SECURITY-RATED GLAZING

When the glazing application requires protection from both fire and forced entry, earlier versions of fire-rated security glazing accepted by the industry used wired glass and polycarbonate, assuming that the wired glass would prevent the spread of fire and the polycarbonate would resist penetration from sustained attack. Because the wires in glass were deemed an obstruction to clear views and were aesthetically unappealing, fire- and security-rated glazing was replaced with laminated ceramic glass in one frame to meet fire-rated requirements, and polycarbonate in another frame to meet forced entry requirements.

With laminated ceramic already being expensive, having two types of glazing in two separate frames increased the material cost even further, as well as installation and maintenance costs, as condensation can occur between the two separate systems. Replacing wired glass with laminated ceramic didn't improve fire-rated performance either, as both types of glazing still allowed the passage of dangerous radiant heat.

The next generation of fire and forced entry glazing now includes clear, fire-resistive security glazing that meets ASTM E-119/UL 263/NFPA 251 with hose stream up to two hours for fire and



**Ballistic pair doors with cherry wood veneer at a private office in San Francisco, Calif.**



**A blast exterior wall opening at the VA Primary Care Annex in Tampa, Fla.**

ASTM F1915 Grades 1-4 and CDCR 860-14a for forced entry. It is available in dramatically larger sizes compared to the antiquated wired/ceramic glass and polycarbonate versions that did not provide both fire-resistive and security ratings in one complete listed assembly.

### **FIRE-RESISTIVE AND BALLISTIC-RATED ASSEMBLIES**

Ballistic or bullet-resistant glass is designed to prevent destruction, injury or death caused by assaults from handguns, shotguns or rifles. It does this in two ways. The first is to stop one or several rounds of bullets from penetrating the glass by laminating sheets of polycarbonate between two pieces of glass. The bullet fired may pierce the outside layer of the glass, but the polycarbonate will absorb the bullet's energy and stop it from exiting onto the other side.

The second layer is to protect against spalling, which occurs when shards of glass break away from the rear face (or protection side) from the bullet's impact. These shards of glass are dangerous because they can become projectiles themselves and cause significant injuries, damage or even death.

In situations or areas where fire protection is also needed, architects can now specify products in which fire and ballistic protection is combined in the same assembly.

### **FIRE-RESISTIVE AND BLAST-RATED ASSEMBLIES**

Demand for blast-resistant glazing continues to grow because of increased terrorist activity, as well as mandates from the General Services Administration (GSA) and the U.S. Departments of Defense and State, which require installation of protective glazing in new and renovated government buildings that meet certain threat criteria.

The objective is to minimize the hazards that might occur, such as flying glass and wall debris. In fact, blast mitigation technologies




were credited for saving many lives during the September 11 attack on the Pentagon. Blast hazard mitigation design for windows and fenestrations is particularly important because these façade components are typically the most vulnerable during an explosive blast. Approximately 75 percent of all damage and injury from bomb blasts can be attributed to flying and falling glass following the explosion.

However, there is a growing trend toward government buildings combining fire-resistive performance and blast resistance in one glazed assembly. For example, construction is currently under way for the new Fort Irwin Replacement Hospital in Southern California. This landmark project marks a significant milestone for the United States Department of Defense and features high-performance glazed assemblies that maximize daylight while still maintaining high levels of protection.

To help meet this goal, a two-hour fire-resistive, blast-resistant curtain wall adjacent to the non-fire-rated and blast-resistant portions of the building envelope is being used. The blast systems meet ASTM E 119/UL 263/NFPA 251 with hose stream up to two hours for fire and is designed in accordance with ASTM F2248, *Standard Practice for 3-Second Duration Design Loading for Blast Resistant Glazing*.


Selecting the most appropriate fire- and security-rated products involves considerations of threat, vulnerability and risk; the envelope design system; cost; daylighting needs; sustainability goals and other design objectives.


When designing these specialized facilities, it is always helpful to involve an experienced manufacturer early in the project to explore available options, assist in product selection, or even provide design assistance when needed. 



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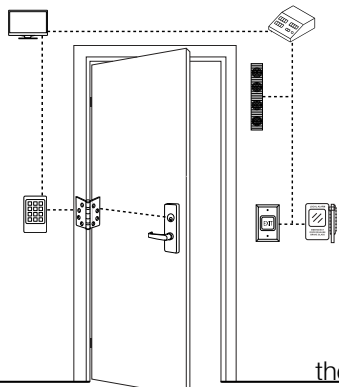


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