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Static Testing – an economical method that employs the conventional static testing methods used to test fenestration products.

Shock Tube Testing – a moderate cost method that uses a compressed gas charge to achieve the positive pressure of an explosion but that usually lacks negative phase effects.

Arena Testing – the most realistic and costly method, this test uses an actual explosive charge positioned at the projected standoff distance producing both the positive and negative phase blast effects.

Shock Tube and Arena test methods both include the use of a number zoned “witness chamber” to help measure the effects of debris entering the room as a result of the blast. The performance of the glazing system is then determined and given a Performance Condition or Hazard Rating relative to the testing standards.

Within seconds buildings can be fatally damaged and landscapes can change. Increasing the safety of building occupants and preserving human life by protecting persons within or near a target building is the primary goal of blast mitigation.

Kawneer provides a single source solution to the growing need for blast mitigation products. From curtain walls and entrances to windows and storefront framing systems, our array of ultra thermal, blast resistant products extend beyond industry-leading performance, offering occupants higher levels of protection. Our products represent a full range of fenestration solutions designed and independently tested to meet stringent federal requirements as outlined by the Department of Defense (DoD) and Interagency Security Committee (ISC)/General Services Administration (GSA) as well as testing standards for Blast Performance as set forth in ASTM F 1642 Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.

Kawneer is dedicated to providing architects and glaziers products and systems that help them achieve design goals that shape the lives of occupants. Whether new construction or retrofit applications, Kawneer provides solutions that deliver added defense against damage and devastation and protect what’s inside. After all, it’s what’s on the inside that matters the most.

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Threats against our national security – people and property – are ever-present in today’s global society. As architects, you have the unique ability to safeguard human lives.
Kawneer is committed to working with architects, building owners, structural engineers, consultants and/or general contractors to evaluate blast resistant projects and works to ensure that our range of products and systems meet or exceed security criteria and federal regulations.

Developing high-performing blast mitigation solutions involves several interdependent steps to ensure the effectiveness of the products and how they will safeguard the people in and near the buildings they are used for.

**Threat Assessment** is used to determine the estimated size and nature of the potential explosive device as well as the “standoff distance,” or the distance from the anticipated detonation point to the buildings. This is the first step to any blast mitigation project and is evaluated by a third-party consultant. During the process questions like, “what is the likelihood of an attack?” or “how close can a vehicle or cannon get to the building?” are asked. Risk analysis software, site surveys and blast consultants often provide the answers to those questions and more. However, the method is critical for this step to be carried out and communicated to the design team as this lays the foundation for the project design.

After the initial Threat Assessment, Blast Resistance can be measured by several test methods designed to simulate the effects of an explosion.

Building blast resistance requirements, known as Blast Mitigation Standard (BMS), are driven by the size of the explosive device and distance to the target. The BMS is typically expressed in pounds per square inch of reflected pressure and psi-msec of impulse. Barring these elements, the BMS is incomplete and the building is likely to be inadequately protected. During this process, the Building and Wall Assessment/Reinforcement is evaluated, addressing design and product options as well as the blast resistance of the products, attachment methods. The evaluation and assessment must look at the products as a system and examine how various elements work together. Key points to consider include:

- The glass can break but cannot send flying shards into the room.
- The glass lite must stay in the frame along with all interior window components.
- The frame must remain anchored to the wall.
- The wall must resist the load and retain the frame.

Depending on building construction methods, materials and construction, a variety of wall anchoring options are offered:

- Basic Trim and Clip – usually suitable for low blast load applications.
- Expansion anchors and adhesive anchors.
- High-performance CINTEC™ grout-filled anchors, which are particularly effective in retrofit applications where the need to tie together unrelated construction elements or deep anchoring is necessary to support high blast loads.

Highly skilled glazing contractors and window installers are paramount to the overall process and are critical to ensuring proper anchorage and craftsmanship. These teams work closely with project designers, consultants and engineers to create safe spaces that help protect building occupants and those nearby.

**ASTM INTERNATIONAL STANDARDS**

Similar to the ISC/GSA performance, ASTM International’s ASTM F 1642-04 “Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading” establishes a testing method that evaluates levels of protection. These criteria require that glazed window products meet performance levels that correspond to specific levels of protection.

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>Description</th>
<th>Fragments</th>
<th>Witness Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Break</td>
<td>Glazing is allowed to break and there is no visible damage to the framing system</td>
<td>1m to 3m</td>
<td>None</td>
</tr>
<tr>
<td>No Glass</td>
<td>Glazing fractures but is fully retained in the facility test frame or glazing system frame and the near rear surface is untreated</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Minimal Hazard</td>
<td>Glazing fractures and the total length of tears in the glazing plus the total length of fallout from the edge of the frame is less than 20% of the glazing sight perimeter</td>
<td>&lt; 10 in. in total length</td>
<td>Three or less perforations from glazing slivers and no fragment indents</td>
</tr>
<tr>
<td>Very Low Hazard</td>
<td>Glazing fractures at a distance of one (1) meter of the original location</td>
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<td>Low Hazard</td>
<td>Glazing fractures generally fall between one (1) meter and three (3) meters</td>
<td>&lt; 5 perforations 50 cm below the bottom of the specimen and none of the perforations penetrate through the full thickness of the witness panel</td>
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<tr>
<td>High Hazard</td>
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**Performance Condition**

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<tr>
<th>Protection Level</th>
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<th>Window Glazing Responses</th>
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<tr>
<td>Safe</td>
<td>None</td>
<td>Glazing does not break. No visible damage to glazing or frame.</td>
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<tr>
<td>Very High</td>
<td>None</td>
<td>Glazing cracks but is retained by the frame. Dusting or very small fragments near sill or on floor acceptable.</td>
</tr>
<tr>
<td>High</td>
<td>Very Low</td>
<td>Glazing cracks. Fragments enter space and land on floor no further than 3.3 ft. from the window.</td>
</tr>
<tr>
<td>Medium</td>
<td>Medium</td>
<td>Glazing cracks. Fragments enter space and land on floor and impact a vertical witness panel at a distance of no more than 10 ft. from the window at a height no greater than 2 ft. above the floor.</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>Glazing cracks and window system fails catastrophically. Fragments enter space impacting a vertical witness panel at a distance of no more than 10 ft. from the window at a height greater than 2 ft. above the floor.</td>
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**Glazing and Glazing Systems Subject to Airblast Loading**

GSI Security Criteria and General Services Administration (GSA) as well as ASTM International Standards.
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Enhanced by our vertically integrated manufacturing process, Kawneer offers a single source for blast resistant windows, entrances, curtain walls and framing – both non-thermal and thermally broken.

Our comprehensive offering of solutions, allow architects to design for the whole building. Our products conform to the range of government standards and beyond DoD, ISC/GSA and DOS criteria as well as custom blast mitigation standards.

Blast resistant products are comprised of laminated glass infill within standard or ultra thermal aluminum frames anchored to the surrounding building. Air blast pressures, impulses, and/or durations often vary project-to-project.

The products also meet applicable North American performance standards for air, structural, condensation, thermal and sound transmission.

ULTRA THERMAL BLAST RESISTANT

Curtain Walls

Storefront Framing

Windows

Entrances

CURTAIN WALLS

With versatile features, proven performance and a range of fabrication options, Kawneer’s ultra-thermal and non-thermal curtain walls set the standards.

STOREFRONT FRAMING

Delivering the ultimate in occupant safety and comfort, our versatile, ultra-thermal storefront framing systems have options for single span storefronts, low- to mid-rise ribbon window and punched openings, and are ideal for a range of applications.

WINDOWS

Available in a range of configurations for increased design flexibility. Options include Fixed and Operable, Single Hung, Casement, Projected and Sliding.

ENTRANCES

Providing extra strength for high traffic applications where codes require impact resistance, blast mitigation protection or high thermal performance.

It’s what’s on the inside that matters most.

Excellence in innovation, world-class engineering, proven quality and performance combined with the most comprehensive portfolio of products have established Kawneer and Traco as leading manufacturers of aluminum products and systems for commercial applications. We believe that buildings can influence their occupants and strive to help designers not only achieve their creative goals, but make buildings that are healthy and safe. Protecting what’s inside is critical and with the highest level of protection – blast and thermal – Kawneer’s blast mitigation products stand ready to accomplish this objective.
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