EXPERIENCE . DESIGN AND ANALYSIS . PRODUCTS . TESTING . WARRANTY

As windows and curtainwall encounter the extreme pressure released by an explosive mass, all elements of the assembly **WORK TOGETHER**. modern, blast-mitigating assemblies are intended to be flexible and **ABSORB BLAST ENERGY**, creating elegant, quiet, daylight-filled, environmentally-responsible, and safe buildings.

BLAST
HAZARD MITIGATION

WAUSAU
WINDOW AND WALL SYSTEMS

U.S. GREEN BUILDING COUNCIL MEMBER

EXPERIENCE . DESIGN AND ANALYSIS

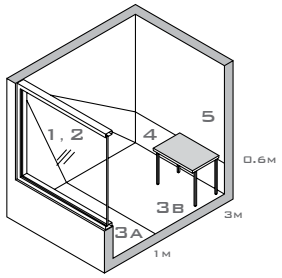
With years of experience on dozens of major blast projects nationwide, Wausau can interpret the lexicon of blast hazard mitigation, and design for safety and cost-effectiveness. Blast hardened re-cladding of an existing building, hazard-mitigating replacement windows, or a modern all-glass facade for a new building, Wausau has the technical expertise to **TAKE THE LEAD** from inception to timely completion.

GSA-ISC

General Services Administration Inter-Agency Security Committee
"Security Design Criteria for New Federal Office Buildings or Major Modernizations"

Performance Condition	Protection Level	Hazard Level	Description of Window Glazing Response
1	Safe	None	No glazing breakage or visible damage.
2	Very High	None	Glazing cracks. Dusting of fragments.
3a	High	Very Low	Glazing cracks. Fragments on floor within 1m of window.
3b	High	Low	Glazing cracks. Fragments on floor within 3m of window.
4	Medium	Medium	Glazing cracks. Fragments impact lower 0.6m of wall.
5	Low	High	System fails catastrophically.

IMPORTANT NOTE: Determination of peak pressure, impulse, and Performance Condition (to include Hazard Condition and Protection Level) is the responsibility of the Owner's security/blast consultant; not the window/curtainwall manufacturer or installer. Design parameters typically range from 4 psi peak and 28 psi-msec impulse, to 10 psi peak and 89 psi-msec impulse.



DoD - UFC

GUIDE SPECIFICATION Blast Hazard Mitigation Design Requirements

1. Department of Defense (DoD) Unified Facilities Criteria

a. All calculations must be prepared by a Registered Structural Engineer directly contracted by, or in the employ of, the manufacturer or glazing subcontractor, and address specific requirements of this project, including all framing materials to be furnished as part of this contract. Calculations from other projects, non-representative test results on other systems, or other qualitative analysis will not be acceptable in lieu of project-specific calculations.

b. Blast Loading: A multiple of equivalent three-second duration design load, based on ASTM F 2248, shall be used for framing and connection design, in accord with Department of Defense (DoD) Unified Facilities Criteria UFC 4-010-01 "Minimum Anti-Terrorism Standards for Buildings" 9 February 2012, Change 1, 1 October 2013

c. Applicable Level of Protection shall be _____. [Specify "Very Low" or "Low"]

d. Standoff Distance shall be ___ feet. [Specify distance – IMPORTANT NOTE: Standoff Distance must be greater than 43 feet for Charge Weight I, or 23 feet for Charge Weight II, otherwise this Wausau Guide Specification is inapplicable.]

e. Charge Weight ___ [Specify I or II]

(IMPORTANT NOTE: Determination of applicable Level of Protection, Stand-Off Distance and Charge Weight is the responsibility of the Owner's security/blast consultant; not the window manufacturer or installer.)

f. Refer to Section 08 80 00 for glass design, analysis, and selection requirements in accord with DoD UFC 4-010-01, ASTM F 2248 and ASTM E 1300.

g. Framing Deflection: Limit deflection of frame members, in a direction normal to the wall, to 1/60 of the supported glazing edge dimension, at two times the glazing load resistance.

h. Glass Support: Comply with glass bite and structural silicone joint width requirements of DoD UFC 4-010-01.

i. For structural silicone glazed systems, joint width must be one to two times the thickness of the glass to which it is adhered.

i. For monolithic glass, structural silicone shall be applied to both faces.

ii. For insulating glass units, structural silicone shall be applied to the inboard face.

j. For systems that do not utilize structural silicone:

i. Provide glass bite no less than four times the inboard glass thickness, and

ii. Provide dynamic analysis indicating adequacy of glass bite across the full range of unit size variation, validated by shock tube or open arena testing at a laboratory accredited specifically for blast testing.

k. Provide project-specific calculations indicating adequacy of anchorage. Static analysis of dry-glazed systems not permitted.

l. Connections and Anchors: All frame-to-frame connections and connections to the building, shall be designed using ASTM F2248 under the assumption that the glazing must fail before the frame members and their connections. To ensure this, connections shall be designed to at least the following levels:

i. Two times the glass load resistance, if the maximum airblast pressure is greater than one-half the glass load resistance, or

ii. The glass load resistance, if the maximum airblast pressure is less than one-half the glass load resistance.

iii. Allowable stresses shall be as published by AISC, ACI, AISI or the manufacturer, for the respective materials used in each component.

iv. Geometry and connection configuration shall be taken into account in calculation of loads on connections and anchors.

m. Other Loads: In addition to blast loads, all components must be designed to satisfy applicable code requirements for adequate glass support, wind and gravity loads.

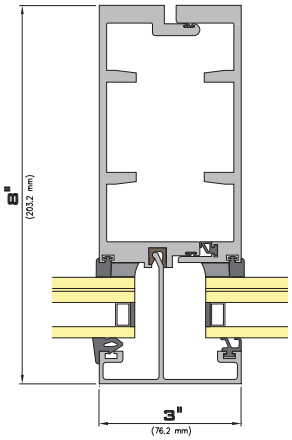
n. Shock tube or open arena testing, at a laboratory accredited specifically for blast testing, may be acceptable in lieu of static or dynamic analysis, if sizes and configurations tested comply fully with the limitations of USACE/NAVFAC/AFCESA/NASA UFGS-08 51 13 "Unified Facilities Guide Specification."

Refer to Wausau Window and Wall Systems BHM product guide specifications for complete technical information, limitations and qualifications.

Blast Hazard Mitigating (BHM)

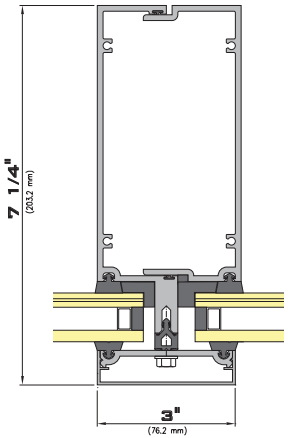
PRODUCTS

8000 - BHM
INVISION™ UNITIZED



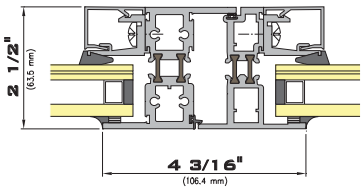
- Blast performance up to 33 psi peak pressure, 81 psi-msec impulse
- Interlocking frame design accommodates seismic, live load and thermal building movements
- Thermally improved; polyamide thermal barrier optional
- Structural silicone glazing and sealing in a controlled factory environment
- Accepts up to 3/4" total vertical movement
- Exterior sun shades and interior light shelves

BHM SUPERWALL™



- Blast performance up to 33 psi peak pressure, 81 psi-msec impulse
- Several frame depths including cladding for steel tubes
- 3" exterior sight line
- Captured or vertical structural glazed
- Screw-spline construction
- Exterior sun shades and interior light shelves
- BHM zero-sightline vents and terrace doors available

INVENT™ 2250i - BHM
FACTORY GLAZED



- Blast performance up to 33 psi peak pressure, 81 psi-msec impulse
- AAMA AW-100 air, water and structural performance
- 1/8" principal wall thickness
- Fixed, project-out awning, hopper, project-out or project-in casement
- Polyamide thermal barrier
- Integrally extruded anchor leg, slide-in anchors or receptors
- Also available in 3 1/2" and 4 1/2"

- High recycled content aluminum framing

INVISION - BHM
UNITIZED CURTAINWALL

GSA FEDERAL BUILDING RE-CLADDING
DES MOINES, IOWA

BHM SUPERWALL
CURTAINWALL

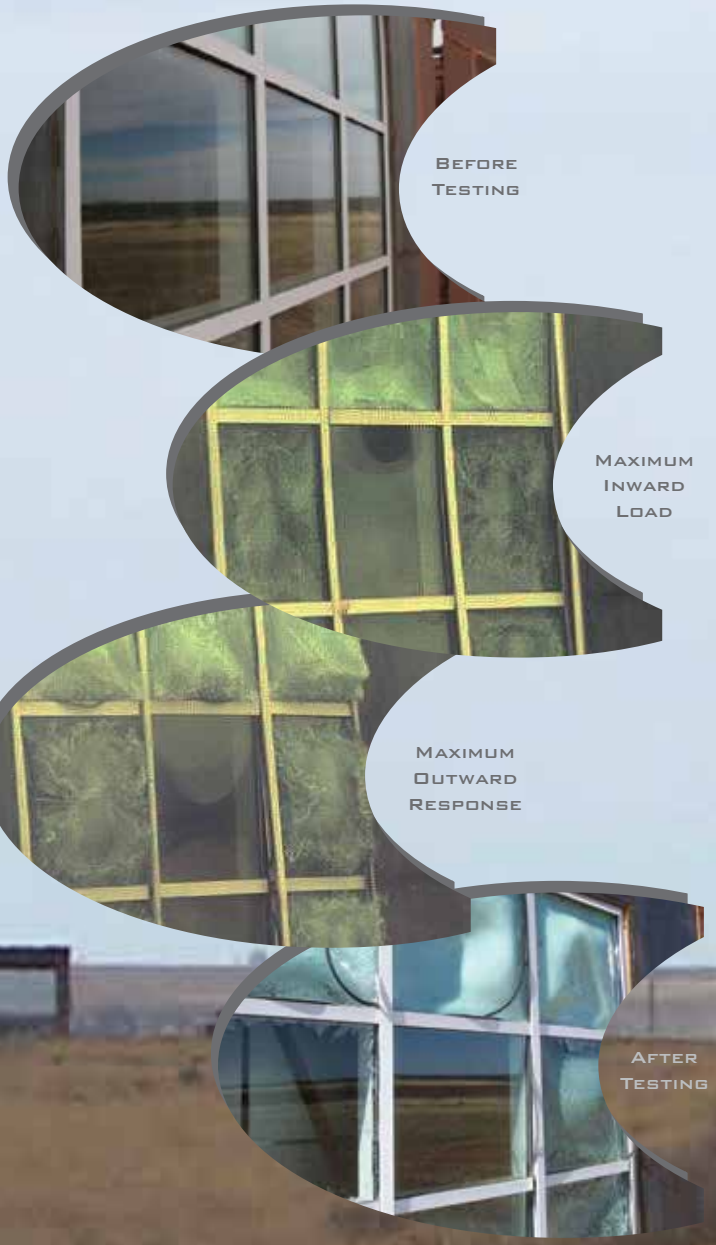
RICHMOND FEDERAL COURTHOUSE
RICHMOND, VIRGINIA

INVENT - BHM
WINDOWS

TESTING

8000i - BHM Full Scale Open Arena Blast Test

Testing is used to validate inelastic dynamic analysis.

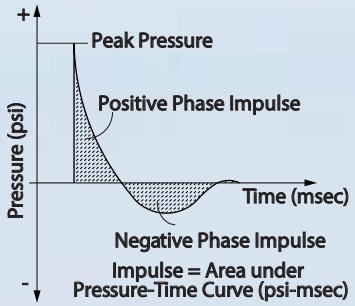


WARRANTY

For more than 50 years, Wausau has worked closely with architects, building owners and contractors to realize their vision for

AESTHETICS, SUSTAINABILITY AND LASTING VALUE,

while striving to maintain the highest level of customer service, communication and overall satisfaction.



WAUSAU WINDOW and WALL SYSTEMS Full Scale Open Arena Blast Test Results	
Description	
Testing Laboratory	HTL, LLC
Test Method(s)	ASTM F1642 and GSA-TS01-2003
System Tested	8000 -BHM Series Curtainwall
Performance Class	10 psi – 89 psi-msec
Overall Size	120" high x 143-5/8" wide per ASTM 510-06
Location	Lynn County, Texas
Test Date and Time	4:00 PM CDT, March 10, 2009
Ambient Temperature and RH	81°F, 16% RH
Weather Conditions	Mostly Cloudy, winds 10-15 mph
Explosive Charge	
Charge Type	ANFO (Ammonium Nitrate Fuel Oil)
Charge Weight	850 lbs
Standoff Distance	129 ft
Summary of Results	
Reflected Blast Wave Peak Pressure	11.23 psi (exceeds Performance Class)
Positive Phase Impulse	90.62 psi-msec (exceeds Performance Class)
Hazard Rating/Performance Condition	
GSA Performance Condition	3b
ASTM	Very Low Hazard
UFC Level of Protection	Low (Refer to Page 2)

WAUSAU
WINDOW AND WALL SYSTEMS

Visit www.wausauwindow.com for guide specifications, testing video clips, and complete product information.

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