WAUSAU

WINDOW AND WALL SYSTEMS

FLORIDA PRODUCT GUIDE

WINDOW AND CURTAIN WALL SYSTEMS ENGINEERED FOR PROTECTION AND SUSTAINABILITY

www.wausauwindow.com 1.877.678.2983

WELCOME

TO WAUSAU'S FLORIDA PRODUCT GUIDE

For decades, Wausau Window and Wall Systems® products have been addressing the unique needs of the Florida market, exceeding code requirements for hospitals, condominiums, office buildings and government buildings statewide.

From cost-competitive architectural windows to custom-engineered high-performance curtainwall, new construction to historically accurate renovation, sustainable designs to resilient protection – Wausau will help you achieve your design visions and construction goals, on time and within budget with support from our experienced technical team and a warranty of up to 10 years.

This book presents an overview of products carrying Florida Product Approval from the Florida Department of Business and Professional Regulation. Where specifically noted, products also may carry Notices of Acceptance (NOAs) by Miami-Dade County, Florida with the applicable expiration dates indicated.

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WAUSAU
WINDOW AND WALL
SYSTEMS

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CAN'T FIND IT?

For downloadable product details,

specifications, and product performance information,

visit Wausau Window and Wall Systems' website at

www.wausauwindow.com

SALT LAKE CITY PUBLIC SAFETY BUILDING
Salt Lake City, Utah
GSBS Architects

RIGHT. THE WAY YOU WANT IT.

A CAPABILITIES OVERVIEW

Celebrating more than 60 years of success and customer partnership, Wausau Metals was founded in 1956, and became Wausau Window and Wall Systems in 1999. Wausau is focused on windows and curtainwall for commercial and institutional construction applications, health care, government, office, education and high-rise residential. Working closely with architects, building owners and contractors to realize their vision for aesthetic beauty, sustainability and lasting value, Wausau strives to maintain the highest level of customer service, communication and overall satisfaction, and offers an industry-leading limited warranty of up to 10 years. Wausau is a business unit of Apogee Enterprises; APOG on the NASDAQ exchange.

RIGHT. THE WAY YOU WANT IT.

ON-TIME DELIVERY, DAMAGE-FREE SHIPMENTS

- Experienced project managers assigned to every project, from bidding through installation
- Critical path schedules developed and kept current through submission, approval and manufacturing
- Electronic document transfer, including extensive experience with collaboration software, such as Constructware® and Navisworks®
- Architectural and code authority support, and consultant relationships, help ensure prompt approval
- In-house custom color paint blending
- In-house video conferencing capability for project updates
- Engineering and manufacturing capacity to handle even the largest projects, and the most aggressive delivery schedules
- Fully-sequenced project break-outs, from applications engineering through shipment, coordinated with installation requirements
- Shipping on Wausau's fleet of trucks to minimize "common carrier" LTL delays and damage
- Advance notification of delivery method and time
- LEED® submission support - extruded aluminum framing contains recycled content averaging 70% or greater

CAPABLE MANUFACTURING, EFFECTIVE PACKAGING

- 380,000-square-foot Wausau Manufacturing Center certified as LEED®-Silver by the U.S. Green Building Council in 2009
- 100,000-square-foot Stratford (Wisconsin) Manufacturing Center supports Advantage by Wausau®
- Wireless factory floor "thin clients" for electronic information transfer, allowing instant status reporting and revisions
- Award-winning safety performance
- Automated dual-head sawing equipment, and five-axis CNC machining centers for close-tolerance cutting and machining of specialized work
- Overhead crane coverage throughout manufacturing areas for large, heavy units, facilitating speed of installation
- Flexible packaging to meet jobsite handling and distribution needs: crated, palletized, or packed with minimum dunnage
- Photo documentation of every outgoing load
- A 10-year culture of Six Sigma continuous quality improvement and Lean Manufacturing waste reduction

PRODUCT PERFORMANCE, EASE OF INSTALLATION

- Pre-bid design engineering to ensure proper product selection
- Revit® BIM modeling available for design and project execution
- Fully-staffed project engineering teams, with over 1000 years combined experience in design for ease of installation
- Wausau-guaranteed field measuring for custom-engineered window renovations with layout and installation support
- Licensed, registered professional engineers for in-house structural calculations
- Complete thermal performance analysis capabilities for U-Factor, condensation resistance, solar heat gain and daylighting
- A complete line of National Fenestration Ratings Council (NFRC)-labeled window products
- NFRC Component Modeling Approach (CMA)
- Approved Calculation Entity (ACE) modelers on-staff
- In-house, finite element, thermal modeling expertise
- Seismic design and analysis, including extensive State of California OSHPD experience
- Hurricane-impact testing and code interpretation support
- Design for blast hazard mitigation per GSA Security Design Criteria or Department of Defense Unified Facilities Criteria
- Acoustical performance optimization

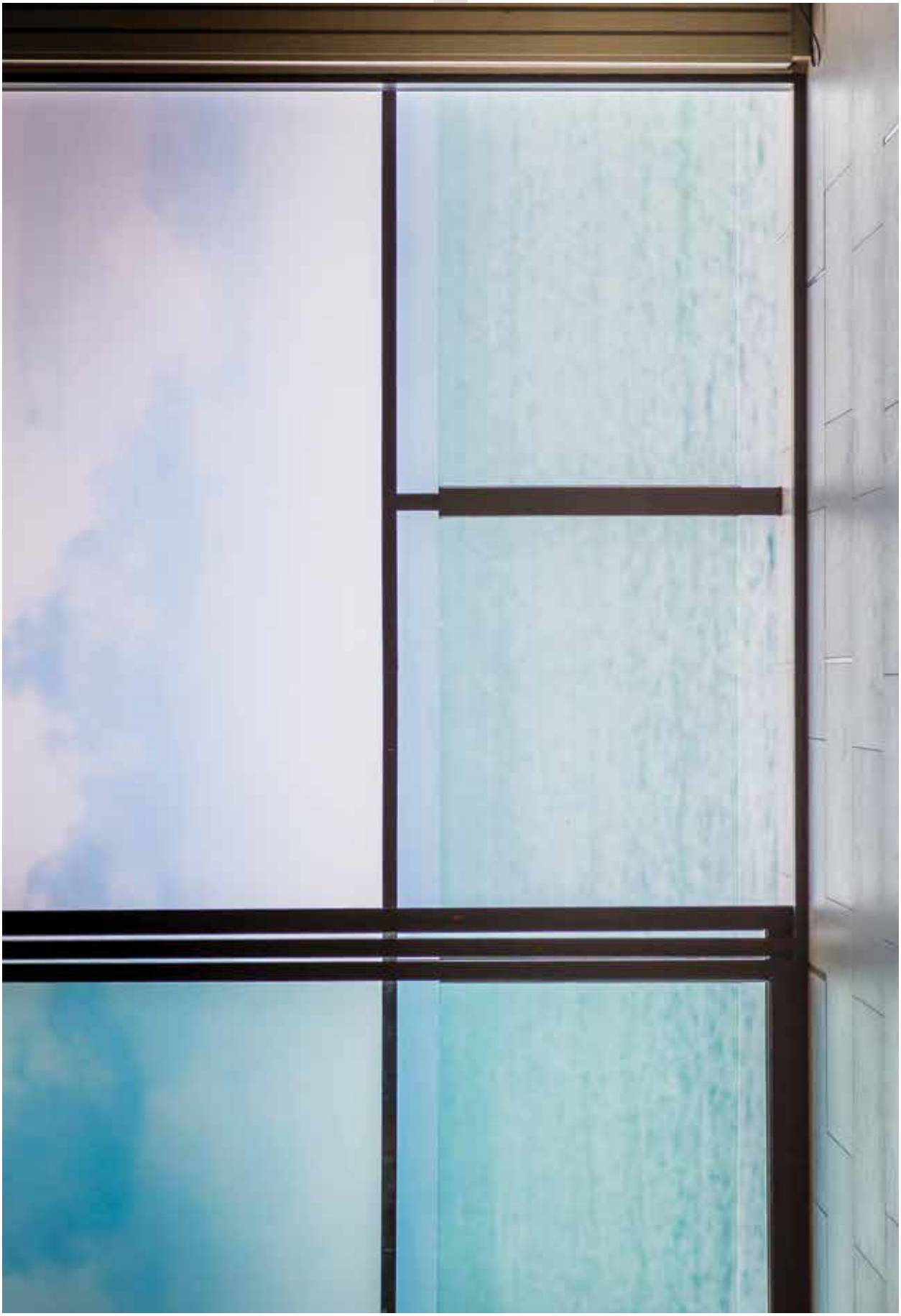
RIGHT. THE WAY YOU WANT IT.

OPERABLE AND FIXED WINDOWS, CURTAINWALL PRODUCTS

- All operable windows and terrace doors are AAMA Architectural (AW) Performance Class, including life-cycle testing for long-term durability
- Competitive standard casement, awning and hopper vent projected windows, pre-engineered for quick delivery through Advantage by Wausau
- Historically influenced renovation windows, panning and muntin grids
- Hurricane impact-tested, blast hazard mitigating, psychiatric and detention windows
- Integral between-glass blind options
- U-Factors as low as 0.21 BTU/hr.sqft.°F
- Thermal barrier unitized curtainwall systems to meet Model Energy Codes in any climate zone
- Unitized curtainwall anchors can be adjusted after hoist rigging removal, to minimize field labor
- Clear Story™ sun shades and light shelves enhance energy efficiency, and integrate seamlessly with Wausau wall systems
- Wausau SuperWall™ ships in three weeks, in any color
- Complementary storefront and entrance systems available

QUALITY ASSURANCE, UP TO 10-YEAR LIMITED WARRANTY

- Revision-controlled enterprise-wide quality assurance documentation, including SOPs, critical business practices, quality standards, records and logs
- Apogee sibling business unit, Linetec provides 100% of aluminum finishing and thermal barrier, for quick turn and highest quality
- Shear strength testing on polyamide thermal barriers ensures flexural stiffness and water resistance
- Frequent in-process material quality audits
- Compatibility and adhesion testing on every structural silicone glazed project
- Glazing details reviewed and approved by insulating glass fabricators
- Annual associate training and certification in critical sealing and glazing skills
- Production line inspection and water testing of glazed window products and sub-sills before shipment with complete records available to each project's building team
- Wausau offers an industry-leading limited warranty of up to 10-years with material and maintenance bonding available upon request



AMALIE ARENA
Tampa, Florida
Ellerbe Becket Architects (AECOM)

PROJECT PORTFOLIO

A SELECTION OF WAUSAU'S PROJECTS IN FLORIDA

For decades, Wausau Window and Wall Systems® products have been addressing the unique needs of the Florida market, meeting code requirements for hospitals, condominiums, office buildings and government buildings statewide. From INvent™ operable windows to INvision™ unitized curtainwall, Wausau systems are engineered for protection and sustainability, and are offered with complementary ClearStory™ sun control products for control of solar heat gain and natural daylight harvest.

CAPTAL REGIONAL MEDICAL CENTER
Tallahassee, Florida
Michael Graves and Associates

JACKSONVILLE AIRPORT
Jacksonville, Florida
Gresham Smith and Partners Architects

MULLET RESIDENCE
Gulf Breeze, Florida
Kruek & Sexton Architects

FLORIDA HOSPITAL WATERMAN
Tavares, Florida
RTKL Associates

PARRISH HOSPITAL
Titusville, Florida
Earl Swensson Associates

FLORIDA BUILDING CODE COMPLIANCE

WAUSAU FLORIDA

Whether the design goal is basic code compliance or a higher level of protection for property and occupants, Wausau's hurricane-impact windows, window wall, curtainwall and accessories rise to the challenge.

WIND SPEED MAPS

The 2010 and 2016 editions of the American Society of Civil Engineers ASCE-7 "Design Loads for Buildings and Other Structures," in conjunction with the International Building Code (IBC), establish design wind speeds for all building types. The schematic maps [at right] show the extent of hurricane-impact requirements cited in IBC-2012. Be sure to check local code and project specifications for requirements applicable to any particular site or project, consider more recent updates to Model Building Codes, and verify whether additional protection may be warranted for specific projects to meet higher expectations of building owners.

THE FLORIDA BUILDING CODE

The Florida Building Code (FBC) is updated periodically, and Wausau's commitment to the Florida market means our products will be expeditiously redesigned and tested to comply with the latest standards. The most-recently adopted codes require a higher level of protection for all essential facilities, and in High Velocity Hurricane Zones (HVHZ's) essential facilities require the most stringent "E" missile performance.

In this Florida Product Guide, you will find Wausau products that have been granted (or will soon be granted) Florida Product Approvals (FPAs) and/or Miami Dade Notices of Acceptance (NOAs). For certain projects, especially those employing custom unitized curtainwall, project-specific testing and acceptance is the preferred compliance path, and Wausau's engineering team stands ready to execute protocols in a timely manner, supporting the critical path schedules of fast-track construction projects.

HURRICANE-IMPACT TESTING

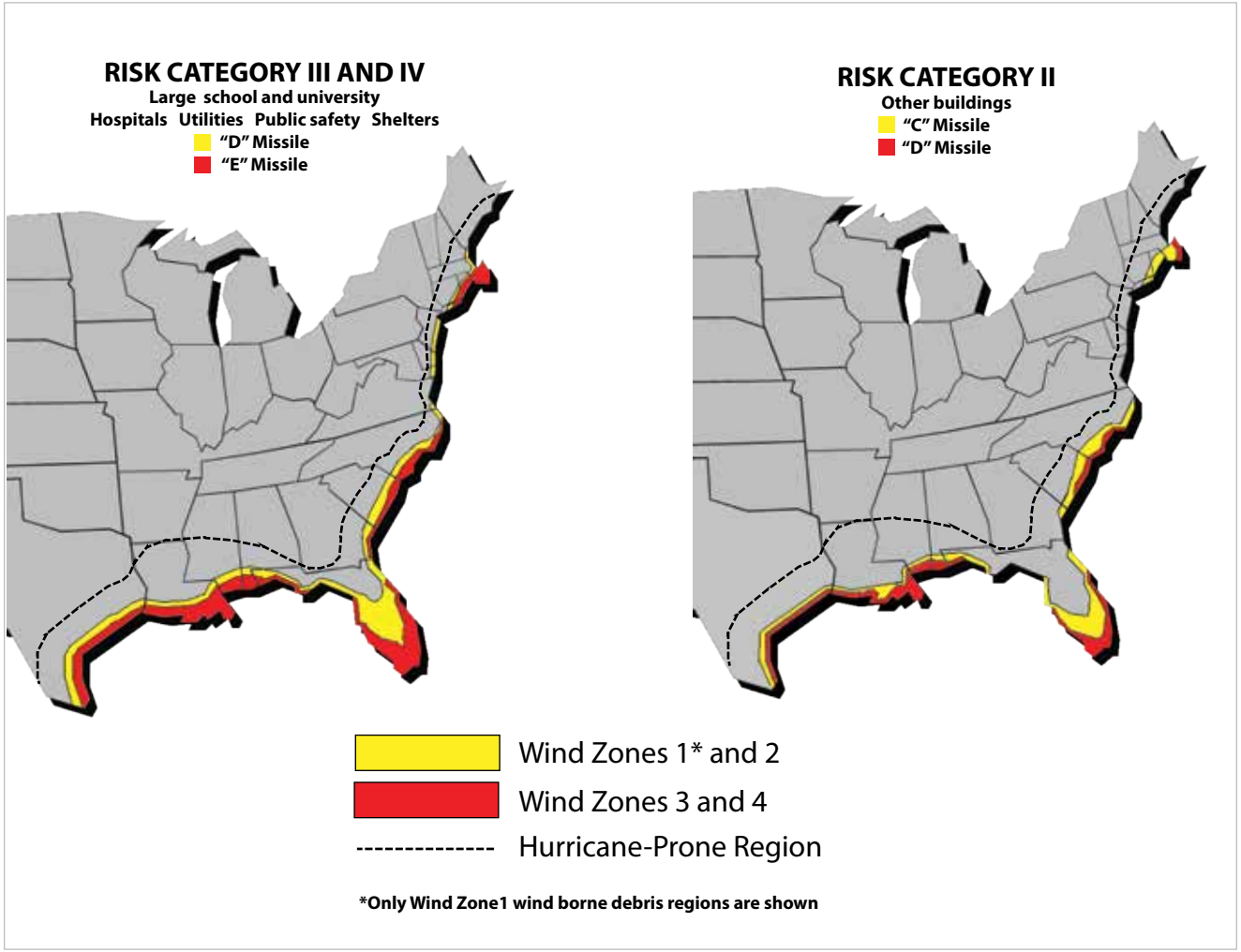
ASTM E1886 and ASTM E1996 define hurricane-impact testing protocols, as do the applicable Miami-Dade Testing Application Standards (TAS). ASTM and TAS testing procedures simulate large missile impact at lower floors utilizing large "D" missiles or "E" missiles. "D" missile air cannons fire a 9-pound, 2-inch by 4-inch wood stud at a velocity of 50 feet per second (fps). For "E" missile testing, velocity is increased to 80 fps. Some products are also tested for small "A" missile impact at upper floors, utilizing 2-gram steel balls fired at 130 fps. Impacts are followed by cyclical pressure testing.

Most Wausau products are "D" and/or "E" large missile-tested to comply with requirements both below and above 30-feet in height, without non-uniformity in glass appearance that can result from the use of different small missile glass. Laminated insulating glass meets new Florida Energy Code requirements statewide.

As noted, enhanced protection for essential facilities within HVHZ's call for hurricane impact-tested windows meeting the most stringent "E" missile performance requirements. Pre-engineered and pre-tested Wausau SuperWall™-HP hurricane stick curtainwall and INvent™ 3250i-HP-XLT, 4250i-HP-XLT and 3250-HP Series casement, projected and fixed windows rise to the challenge of enhanced protection, and are offered with a broad range of test-proven options and accessories.

BEYOND HURRICANE-IMPACT PERFORMANCE

Beyond Florida-specific testing requirements, Wausau's product portfolio includes a diverse collection of products offering the best in air infiltration and water penetration resistance, energy and condensation performance, noise attenuation, ADA accessibility, and even blast hazard mitigation. Wausau is committed to providing an engineered solution for your application, and often participates in design-assist programs, so please inquire with your local sales representative about local product approval, project specific testing, and custom design.


RISK CATEGORY III AND IV
Large school and university
Hospitals Utilities Public safety Shelters
"D" Missile
"E" Missile
RISK CATEGORY II
Other buildings
"C" Missile
"D" Missile
Wind Zones 1* and 2
Wind Zones 3 and 4
Hurricane-Prone Region
*Only Wind Zone1 wind borne debris regions are shown

BROADWAY RESEARCH BUILDING
Johns Hopkins University
Payette Associates

ACOUSTICS OF WINDOWS AND CURTAINWALL

TEST RESULTS SUMMARY

Some sounds are welcome, other sounds are not – a well-designed building envelope provides necessary attenuation, while maintaining views and a connection with the outdoors - even in a crowded city, near a major airport's flight path, or adjacent to a busy highway or rail line.

Wausau acoustic window and curtainwall systems can promote wellness, help occupants maintain focus on the task at hand, or simply allow a quiet night's sleep without compromising functionality or energy efficiency.

ACOUSTIC PERFORMANCE OF WINDOWS AND CURTAINWALL

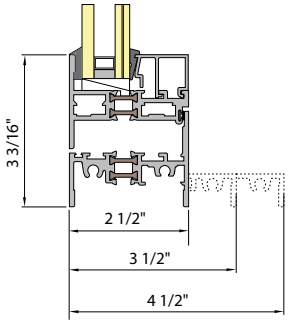
ACOUSTIC TEST RESULTS

SEALED INSULATING GLASS UNITS (IGU)

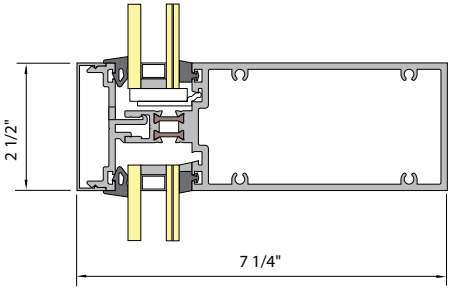
REPRESENTATIVE ACOUSTIC TEST RESULTS
Sealed Insulating Glass Units (IGUs)

Test Unit Description			Frame Size (Nominal)	Insulating Glass Dimensions (Nominal)			Overall Performance	
Glass Type	Product and Configuration	No of Lites	Width x Height (in.)	Exterior (in.)	Spacer(s) (in.)	Interior PVB thickness (in.)	STC	OITC
Projected Windows **INvent™ Product Family**								
Double IGUs	INvent Fixed over Project -Out	2	48 x 60	1/4	1/2	1/4	34	**28**
	INvent Fixed	1	48 x 60	1/4	7/16	5/16	36	**30**
	INvent XLT Fixed next to Casement	2	48 x 60	3/8	3/4	1/2 Lami 0.060	40	**33**
	INvent Fixed over Project -Out	2	60 x 48	1/4	1/2	5/16	39	**33**
	INvent XLT Fixed next to Casement	2	48 x 60	1/4	1/2	1/2 Lami 0.03"	41	**34**
	INvent Fixed next to Casement	2	60 x 48	1/4	1/2	5/16	39	**34**
	INvent Fixed next to Casement	2	60 x 48	5/16	5/8	7/16 Lami 0.060	41	**35**
Triple IGUs	INvent Fixed next to Casement	2	60 x 48	1/4	7/16 3/8	1/4 5/16	39	**31**
	INvent XLT Fixed next to Casement	2	60 x 48	1/4	7/16 3/8	1/4 5/16	40	**33**
Curtainwall and Window Wall **SuperWall™, HP-Wall and INvision™ Product Families**								
Double IGUs	SuperWall Captured Glazing	2	80 x 80	1/4	1/2	1/4	31	**26**
	INvision Unitized Captured Glazing	2	80 x 80	1/4	1/2	1/4	32	**26**
	INvision Unitized Structural Glazing	2	80 x 80	1/4	1/2	1/4	32	**26**
	SuperWall Captured Glazing	2	80 x 80	1/4	7/16	7/16 Lami 0.060	37	**31**
Triple IGUs	HP-Wall Captured Glazing	2	80 x 80	1/4	3/4 1/2	1/4 1/4	35	**26**
	HP-Wall Captured Glazing	2	80 x 80	1/4	5/8 5/8	1/4 1/4	35	**26**
	HP-Wall Captured Glazing	2	80 x 80	1/4	1/2 3/8	3/8 Lami 0.030	40	**32**

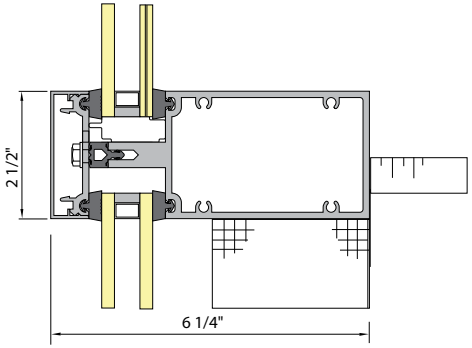
Test results may vary



2250i INvent
Laminated IGU



7250i-HR INvision
Laminated IGU



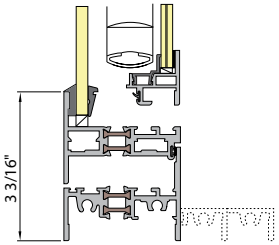
6250 SuperWall™
Laminated IGU

INTERIOR ACCESS DOORS

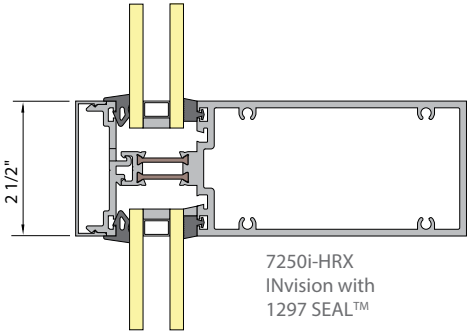
REPRESENTATIVE ACOUSTIC TEST RESULTS
Dual and Triple Glazing using Interior Access Doors

Test Unit Description			Frame Size (Nominal)	Glass Description and Dimensions (Nominal)			Overall Performance	
Glass Type	**Product and Configuration**	**No of Lites**	**Width x Height** (in.)	**Exterior** PVB thickness (in.)	**Air Space** (in.)	**Interior** PVB thickness (in.)	**STC**	**OITC**
Projected Windows **INvent™, Flagship and Psychiatric Product Families**								
Dual-Glazed with Access Doors	INvent XLT Fixed next to Casement	2	48 x 60	1/4	1-3/4	1/4	42	**30**
	2250 Series Fixed over Project-Out	2	48 x72	1/4	1-1/2	1/4	39	**31**
	2250 Series Fixed over Project-Out	2	48 x 72	1/4 Lami 0.030	1-1/2	1/4	41	**32**
	2250 Series Fixed over Project-Out	2	48 x 72	1/4 Lami 0.030	1-7/16	5/16 Lami 0.060	41	**32**
	2250 Series Fixed over Project-Out	2	48 x 72	3/8 Lami 0.030	1-3/8	1/4	43	**35**
	2250 Series Fixed over Project-Out	2	48 x 72	-1/2-1/4	3/4	1/4	40	**31**
	2250 Series Fixed over Project-Out	2	48 x 72	1/4 -1/2-1/4 IGU	3/4	5/16 Lami 0.060	41	**32**
Triple-Glazed with Access Doors	INvent XLT Fixed next to Casement	2	48 x 60	1/4 -1/2-1/4 IGU	1-1/8	1/4	43	**31**
	INvent XLT Fixed next to Casement	2	60 x 48	1/4 -5/16-Lami IGU	1-1/8	1/4	45	**34**
	4000i Fixed next to Casement	2	60 x 48	1/4 -1/2-1/4 IGU	2-1/2	1/4	47	**33**
	4000i-DT Psych Fixed next to Casement	2	60 x 48	1/4 -1/2-1/4 IGU	2-7/32	7/16 Lami 0.090	48	**37**
	4000i-DT Psych Fixed next to Casement	2	60 x 48	1/4 -1/2-1/4 IGU	2-7/32	1/2 Polycarbonate	49	**37**
Curtainwall and Window Wall **SuperWall™ Product Family**								
Triple Glazed with Access Doors	SuperWall Captured Glazing	2	80 x 80	1/4 1/4	2-7/16	1/4	45	**36**
	SuperWall Captured Glazing	2	80 x 80	1/4 1/4	2-1/8	7/16 Lami 0.060	46	**36**
	SuperWall Captured Glazing	2	80 x 80	1/4 1/4	5-1/16	1/4	44	**37**
	SuperWall Captured Glazing	2	80 x 80	1/4 1/4	6-1/2	7/16 Lami 0.060	53	**43**

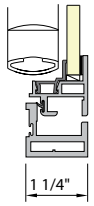
Test results may vary



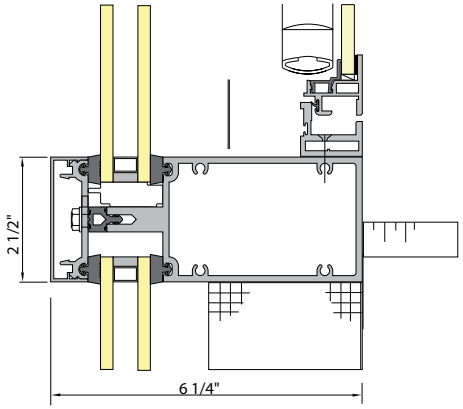
2250i INvent
Dual Glazed



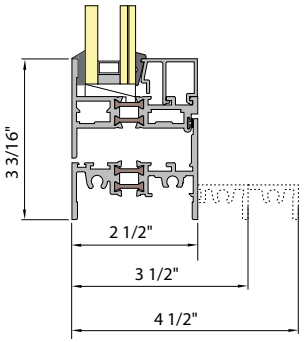
7250i-HRX
INvision with
1297 SEAL™



1297 SEAL™
Interior Accessory Window



6250 SuperWall™ with
1297 SEAL



ACOUSTIC PERFORMANCE OF WINDOWS AND CURTAINWALL

FREQUENTLY ASKED QUESTIONS (FAQS)

HOW ARE SOUNDS AND NOISE MEASURED?

The decibel (dB) is a logarithmic measure of sound pressure level. Because decibels are logarithmic, they cannot be added, subtracted or multiplied with ordinary arithmetic. Small differences of less than ±3 dB in sound pressure level or transmission loss are barely perceptible.

Pitch or frequency is expressed in Hertz (Hz) or cycles per second. Low-frequency noises carry much more energy than high-frequency sounds, and therefore, are more difficult to absorb. As a lightweight material, glass performs much better at higher frequencies.

Transmission Loss (TL) is a measure of a material's or assembly's sound attenuation at a specic frequency. For STC or OITC testing, a TL Curve is generated over the frequency range or spectrum that can be perceived by the human ear.

HOW ARE WINDOWS AND CURTAINWALL RATED FOR ACOUSTIC PERFORMANCE?

Sound Transmission Class (STC) is a single-number rating system for acoustical performance, developed primarily for the typical interior noise spectrum. STC is the most-commonly specied measure of acoustical performance - higher is better.

Outdoor-Indoor Transmission Class (OITC) is a single-number rating system for acoustical performance, developed primarily for the typical exterior noise spectrum. TLs are measured at somewhat lower frequencies than in STC testing. The formula to calculate OITC from TL test results is:

$$OITC = 100.14 - 10\log\Sigma_f 10((L_f - TL_f + A_f)/10)\ (dBA)$$

Where: L_f = reference source spectrum,
A_f = A-weighting adjustment, and
TL_f = specimen TL at each one-third octave frequency band

Acoustical consultants determine required performance levels by starting from exterior sound intensity data. This is a complex process, requiring consideration of the noise source (rail vs. traffic vs. aircraft), time-weighted exposure averages, and attenuation due to distance. Interior occupancy plays a major part in determining the required OITC rating or octave band transmission losses. Other laboratory test-based rating systems include Weighted Sound Reduction Index (Rw) and Exterior Wall Noise Rating (EWNR).

Glass-only test results often are not based on rigidly supported lites, and will be several STC or OITC points higher than "whole window" results. There is no dependable way to adjust these glass numbers to predict whole window performance reliably. Unlike thermal performance, there are no commercially available computer modeling tools that are capable of accurately predicting acoustical performance. Test-to-test variation can be considerable.

HOW CAN THE ACOUSTIC PERFORMANCE OF WINDOWS BE IMPROVED?

Improvement in acoustical performance is achieved by adding glazing mass, increasing air space and improving damping through the addition of a laminated interlayer. Of course, maintaining an air-tight assembly to reduce "flanking" noise is critical, especially at high frequency. Thin, heat-treated glass makeups with more than one lite laminated may introduce unexpected visual distortion, coating limitations or other design issues. Thin laminated glass is also subject to size limitations in fabrication.

Adding another layer of glass at the expense of air space is typically ineffective - A 1-1/2" triple insulating glass unit (IGU) will perform similarly to a 1-1/2" double IGU. Incremental improvement can sometimes be attained by "unbalancing" the insulated unit, e.g. using a 1/4" inner lite with a 5/16" outer lite. The location of laminated lites (interior or exterior) within the assembly makes no signicant difference in acoustical performance, nor does heat strengthening or tempering, however effects of changes in glass lite size and aspect ratio can be very significant.

The addition of sound-absorbing foam between the lites of a dual-glazed system can improve STC 1 to 2 points, but only if high-frequency noise transmission is the controlling factor in STC calculations.

For any given air-tight, rigidly supported, glass-air space combination; frame design makes little difference in acoustical performance. Air and argon in the space of an IGU perform the same.

OTHER QUESTIONS?

Contact Wausau's market managers at info@wausauwindow.com.

RENAISSANCE APARTMENTS
Shelton, Connecticut
TPG Architecture

ADA ACCESSIBILITY FOR WINDOWS

WAUSAU FLORIDA

In skilled nursing facilities, condominiums, apartments, hotels, classrooms and dormitories, help ensure that fresh air and a connection with the outdoors are made accessible to people with physical disabilities. Specify windows and window hardware capable of meeting the operating force and limited motion requirements of ICC/ANSI A117.1, even with heavy, laminated, hurricane, insulating glass.

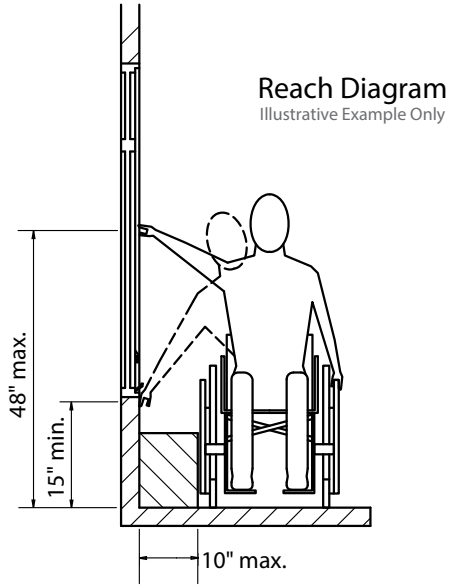
ADA ACCESSIBILITY FOR WINDOWS

OVERVIEW

Wausau's accessible projected windows are laboratory-proven capable of operating with one hand using a force of 5 pounds or less, to unlock, open, close and lock, without tight grasping, pinching or twisting of the wrist.

FEATURES

- AAMA Architectural AW-100 Performance Class
- No reductions in air, water or structural performance for lab testing of accessible vents
- Low U-Factors - Triple glazing available on the INvent family
- Between-glass blinds optional on the INvent family
- 1/8" wall thickness at hardware attachment points
- Recycled aluminum content averaging 70% or greater
- More than 30,000 finish colors, including two-color option
- Several muntin grid options for historical renovation
- 4250-Z Zero Sightline windows offer unobtrusive ventilation as curtainwall insert vents



Make sure operable windows are located and detailed in a way that meets the "reach" limitations of ICC/ANSI A117.1. One typical diagram is shown. Different height requirements apply to "obstructed" and "front" reach.

There are also physical limits on clearances and protrusions, as well as approach area and threshold height (for terrace doors and sliding glass doors).

AAMA Guide Specification "Accessibility: As indicated on architectural drawings, one operable window in each occupied space shall meet the operating force limits and motion restrictions of ICC/ANSI A117.1 Section 309.4, when tested by an AAMA-accredited lab in accordance with AAMA 513." [Specifiers Note: All code-required operable windows in a given occupied space may be required to meet these restrictions.]

LABORATORY-TESTED WAUSAU OPERABLE WINDOWS CAPEABLE OF ACCESSIBLE OPERATING FORCES AND MOTIONS (AS OF MAY 2013)

PRODUCT SERIES	VENT MODE	MAXIMUM VENT SIZE		MINIMUM VENT SIZE		HARDWARE PACKAGE(S) TESTED
		WIDTH (IN.)	HEIGHT (IN.)	WIDTH (IN.)	HEIGHT (IN.)	
INvent™ Family INvent INvent-XLT INvent Retro INvent-VX INvent.PLUS™	Project-Out Awning	60	36	25	28	Dual-arm roto with several handle choices Linear operation latches Concealed four-bar hinges
	Out-Swing Casement	36	60	22	32	Single-arm roto with several handle choices Linear operation keeper Exposed butt hinges or concealed four-bar hinges
	In-Swing Casement	36 40	60 80	27	32	Hand-operated Euro-style multi-point locking handle Exposed butt hinges No triple glazing on oversize
4250-Z Zero Sightline Insert Vents	Project-Out Awning	60 48	36 80	25	28	Dual-arm roto with several handle choices Linear operation latches Concealed four-bar hinges AW-50 rating on oversize 4250-Z awning vents
	Out-Swing Casement	36	60	22	32	Single-arm roto with several handle choices Linear operation latches Concealed four-bar hinges

1. Test results can vary. All size limits are sash dimension tip-to-tip. "Oversize" vent limits shown in gold font.
2. All testing based on AAMA 513, without air, water and structural allowances or reductions; but including sampling, test equipment and methodology qualifications.
3. Project-out awning vents cannot be hand-operated due to the requirement for hold-open friction. Out-swing casement vents cannot be hand-operated due to the requirement for one-hand operation. Roto operators can be provided for both of these vent types, with several optional accessible handle and knob choices.
4. Refer to “Frequently Asked Questions” for special disclaimers and qualififcation notes applying to accessibility.
5. Consult Wausau’s market managers for technical assistance if sizes required are outside of the ranges specified above.
6. The use of insect screens may limit accessibility options for certain vent modes and hardware packages. Controls for between-glass Venetian blinds may not be accessible in certain conditions.
7. All double and triple insulating glass (IG) units were tested with 6 mm glass lites, for flatness and available coating options.
8. Wausau is committed to continuous imporvement, as well as an ever-increasing breadth of accessible product offering. Consult Wausau market managers and info@wausauwindows.com for current information.

ADA ACCESSIBILITY FOR WINDOWS

FREQUENTLY ASKED QUESTIONS

IS THE AMERICANS WITH DISABILITIES ACT (ADA) A BUILDING CODE?

The ADA is a law, not a building code, specification nor test method. As such, it is missing many of the necessary technical requirements for compliance testing. Some of the government agencies that have promulgated regulations to help ensure compliance include; the U.S. Department of Justice's "ADA Standards for Accessible Design," the U.S. Access Board's "ADA and Architectural Barriers Act Accessibility Guidelines," and the U.S. Department of Housing and Urban Development's "U.S. Fair Housing Act." Other authorities also are requiring or recommending accessibility, including the Chicago Public Schools and Mayor's Office for People with Disabilities, university housing offices and the New York City Building Code. While detailed requirements vary, all reference ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities," in defining window operating forces and motions.

The AAMA 513 "Standard Laboratory Test Method for Determination of Forces and Motions Required to Activate Operable Parts of Operable Windows and Doors in Accessible Spaces" addresses the necessary window-specific provisions.

Remember, building codes represent only minimum requirements. Even if not required, accessible operating windows may be a very desirable feature of the occupied spaces being designed.

WHAT IS CONSIDERED AN ACCESSIBLE WINDOW BY AAMA, ADA AND ICC/ ANSI A117.1?

AAMA 513 defines "Accessible Window Units" as operable window assemblies, including frame, infill, hardware and all other appurtenances, required by project specifications and/ or applicable codes, to be, *"accessible to and usable by people with such physical disabilities as the inability to walk, difficulty walking, reliance on walking aids, blindness and visual impairment, deafness and hearing impairment, in coordination, reaching and manipulation disabilities, lack of stamina, difficulty interpreting and reacting to sensory information, and extremes of physical size."* (Portion in italics from ICC/ANSI A117.1.)

DO WINDOW MANUFACTURERS REPRESENT THEIR PRODUCTS AS "ADA" WINDOWS?

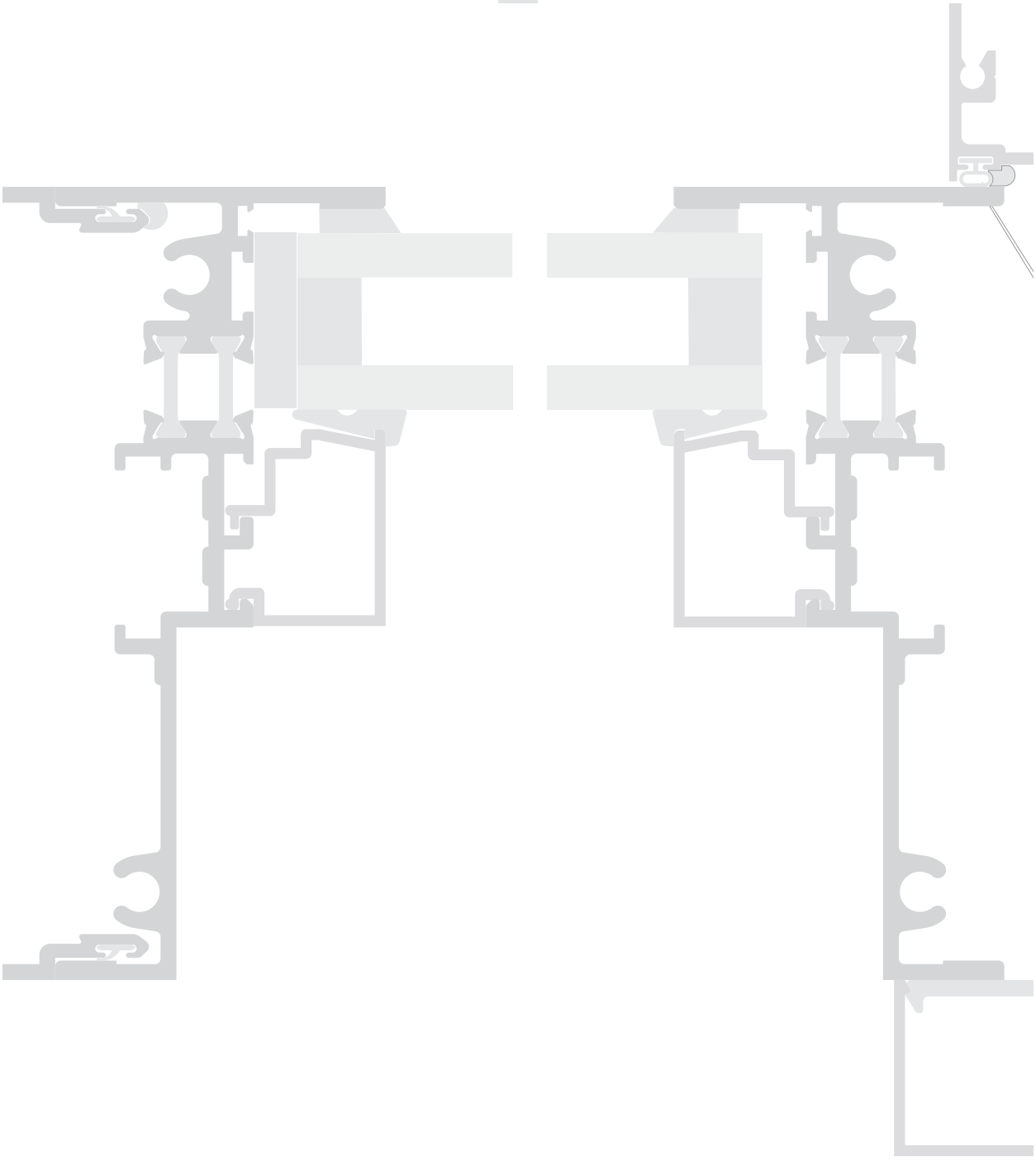
As noted in AAMA 513, "No test method provides sufficient basis for a manufacturer to represent an individual component, product or product line, as 'ADA-certified,' ADA-approved,' or 'ADA-compliant,' as the Americans with Disabilities Act makes no provisions for, nor outlines any requirements for, such certification, approval, or compliance verification." Wausau is careful to represent laboratory-tested products as capable of achieving accessible operating forces and motions, when properly installed and adjusted, without making any non-verifiable claims.

CAN ACCESSIBLE WINDOWS BE EXPECTED TO PERFORM THE SAME AS STANDARD OPERABLE WINDOWS?

Gaining the leverage for easy operation may require special location of roto-operators, which then offer a limited opening for ventilation. Also, as noted in AAMA 513, “For accessible units, certain 'reductions' in air infiltration, and water resistance performance requirements shall be permitted, when compared to conventional requirements, given the desirability of minimizing operating forces." Air infiltration 1.5 times the maximum air infiltration specified in AAMA/WDMA/CSA 101/I.S.2/A440, for the type and class tested is allowed, but can be no greater than 1.0 l/s/m^2 (0.2 cfm/ft^2) at 75 Pa (1.57 psf). Water Resistance is conducted at 20% of inward acting design pressure for the project for AW Class, but not less than 390 Pa (8 psf). Design Wind Pressure is based on project requirements, or a minimum of 1920 Pa (40 psf) for AW products (whichever is greater). In lab testing of Wausau products, no reductions were necessary.

IS SPECIAL CARE REQUIRED IN THE INSTALLATION AND ADJUSTMENT OF ACCESSIBLE WINDOW UNITS?

Yes - These products will require additional care in installation, final adjustment and maintenance, to achieve and maintain compliance. Plumb, square and level installation is critical. Building settlement can affect operating forces and necessitate post-installation adjustment.



ADVANTAGE BY WAUSAU

ACCELERATED LEAD TIME, COMPETITIVE PRICING

Driven by state-of-the-art computer configuration tools, the Advantage by Wausau process provides subcontractors with competitively priced, pre-engineered Wausau products, available on an accelerated delivery schedule, and backed with an industry-leading warranty of up to 10 years. The Advantage by Wausau process allows for local control of scope of work, project management and approval, and is facilitated by Wausau's knowledgeable team and comprehensive engineering support tools.

ADVANTAGE BY WAUSAU®

ACCELERATED LEAD TIME, COMPETITIVE PRICING

Advantage by Wausau® offers pre-engineered standard products for competitive pricing and quick delivery

Design and submission engineering support tools help ensure prompt approval of your shop drawings and calculations - available online 24/7

Advantage Wall Products makes it easy to provide a complete, coordinated wall system, offering aluminum brake metal and panels formed to your specifications - finished to match

- AutoCAD® .DWG details
- Up-to-date test reports
- Wind load charts
- Guide specifications
- Standard NFRC thermal models
- Samples
- Anchorage recommendations
- Installation instructions
- LEED® submission templates

HURRICANE IMPACT WINDOWS

FIXED, PROJECTED AND CASEMENT

Wausau Invent™ hurricane impact resistant fixed, projected and casement window series.

3250i-HP AND 4250i-HP INVENT™ XLT

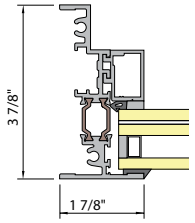
HIGH-PERFORMANCE PROJECTED AND FIXED

FL 17603 FL17604 FL17657 FL17658

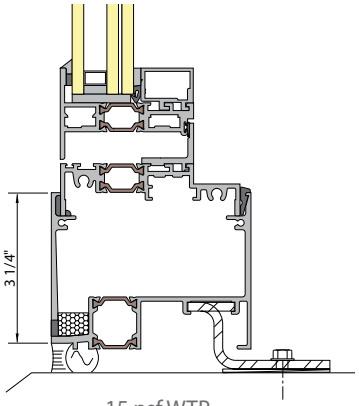
LIMITED UP TO 10 YEAR WARRANTY

HURRICANE-IMPACT RESISTANT FIXED AND OPERABLE WINDOWS

- 3-7/8" (3250i) and 4-7/8" (4250i) frame depth
- 24mm XLT polyamide thermal barrier
- AAMA AW-100 Architectural Performance Class
- Fixed, project-in or project-out casement, project-out awning or project-in hopper
- Integral blinds with access doors available ("D" missile only)
- 0.125" extrusion wall thickness
- Conventional hardware or multi-lock option
- Large "D" missile impact tested for basic protection in Wind Zones 1-4
- "E" missile impact tested for essential facilities' enhaced protection in Wind Zones 3-4
- Tested with receptors and steel strap anchors to address varying substrate configurations



3250i-HP-XLT
Fixed



15 psf WTP
3250i-HP-XLT INvent
Sill Starter

ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.10 cfm/sqft at 6.24 psf	15 psf	0.34 to 0.64 BTU/hr.sqft.°F	46 to 65	31 to 24

Test results may vary - Thermal and acoustical performance cited with non-hurricane-impact resistant glass.

TEST SUMMARY

WAUSAU INVENT™ 3250i AND 4250i HP-XLT SERIES HURRICANE WINDOWS

CONFIGURATION OR OPTION	"D" MISSLE TESTED MIAMI-DADE TAS PROTOCOLS	"E" MISSLE TESTED MIAMI-DADE TAS PROTOCOLS
Risk Category II Buildings	Wind Zones 1, 2, 3 and 4	Not Required
Risk Category III and IV Buildings	Wind Zones 1 and 2	Wind Zones 3 and 4
Design Wind Pressure	80 psf (ASD)	100 psf (ASD)
Glass and Glazing Types 1/4 fully tempered (FT) or heat strengthened (HS) exterior	G1 or G2 : Wet-glazed 1-5/16" IG 1/4" FT or HS exterior 1/2" air space 9/16" SentryGlas® Laminated	G5 or G6 : Wet-glazed 1-7/16" IG 1/4" FT or HS exterior 1/2" air space 11/16" SentryGlas® Laminated
	G3 or G4 : Dry-glazed 1-5/16" IG 1/4" FT or HS exterior 1/2" air space 9/16" SentryGlas® Laminated	G7 or G8 : Dry-glazed 1-7/16" IG 1/4" FT or HS exterior 1/2" air space 11/16" SentryGlas® Laminated
	Triple-glazed G1 or G2 exterior 5/8" or 1" blinds Interior access door	Not available
	Triple-glazed G1 or G2 exterior 5/8" or 1" blinds Interior access door	Not available
OVERALL WINDOW SYSTEM		
Frame Depth	3-7/8" or 4-7/8"	3-7/8" or 4-7/8"
Meeting Rails	2-7/8"	2-7/8"
Self-stacking mullions	Available	Available
PROJECT - OUT CASEMENT VENTS		
Maximum Vent Size (Width x Height)	36" x 60"	36" x 60"
Locks	Linear operation multi-lock or cam handles	Linear operation multi-lock or cam handles
Hinges	Butt hinges or stainless steel (SS) four-bar friction hinges	Butt hinges or SS four-bar friction hinges
Notice of Acceptance (NOA) Miami-Dade County, Florida	#13-0917.05 Expires April 2023	#13-0917.05 Expires April 2023
PROJECT - OUT AWNING VENTS		
Maximum Vent Size (Width x Height)	60" x 36"	60" x 36"
Maximum Fixed-Over-Awning (punched opening only)	60" x 84"	60" x 84"
Locks	Linear operation multi-lock or cam handles	Linear operation multi-lock or cam handles
Hinges	SS four-bar friction hinges	SS four-bar friction hinges
Notice of Acceptance (NOA) Miami-Dade County, Florida	#13-0917.07 Expires April 2023	#13-0917.07 Expires April 2023
PROJECT - IN CASEMENT VENTS		
Maximum Vent Size (Width x Height)	36" x 60"	36" x 60"
Locks	Linear operation or Euro multi-lock or cam handles	Linear operation or Euro multi-lock or cam handles
Hinges	Butt hinges or SS four-bar friction hinges	Butt hinges or SS four-bar friction hinges
Notice of Acceptance (NOA) Miami-Dade County, Florida	#13-0917.04 Expires April 2023	#13-0917.04 Expires April 2023

CONTINUED

CONFIGURATION OR OPTION	"D" MISSLE TESTED MIAMI-DADE TAS PROTOCOLS	"E" MISSLE TESTED MIAMI-DADE TAS PROTOCOLS
PROJECT - IN HOPPER VENTS		
Maximum Vent Size (Width x Height)	60" x 36"	Not available
Maximum Fixed-Over-Awning (punched opening only)	60" x 84"	
Locks	Cam handles	
Hinges	SS four-bar friction hinges	
Notice of Acceptance (NOA) Miami-Dade County, Florida	#13-0917.08 Expires April 2023	
FIXED WINDOWS		
Maximum Fixed Lite Size (Width x Height) also see table below	45-3/8" x 69-3/8" Glass Size 48" x 72" Window Dimension	45-3/8" x 69-3/8" Glass Size 48" x 72" Window Dimension
Interior and Exterior Glazing	Interior or Exterior	Interior or Exterior
Notice of Acceptance (NOA) Miami-Dade County, Florida	#13-0917.06 Expires April 2023	#13-0917.06 Expires April 2023
ANCHORS AND ACCESSORIES FOR ALL WINDOW TYPES		
Receptors and Starters	Receptors directly anchored to substrate or with steel strap anchors	45-3/8" x 69-3/8" Glass Size 48" x 72" Window Dimension
Anchors	Steel strap anchors	Interior or Exterior
Screens	Wickets of hinged screens required	Wickets of hinged screens required
Between-Glass Blinds	5/8" or 1" blinds	5/8" or 1" blinds

*Risk Category II buildings require only C missle protection in Wind Zones 1 and 2.
Grid muntins and beveled glazing rebated are not available on INvent HP-XLT series windows.

STACK MULLIONS AND INTEGRAL IMPOSTS

LENGTH	DESIGN LOAD CAPACITY (PSF)									
	IMPOSTS	STACKS	IMPOSTS	STACKS	IMPOSTS	STACKS	IMPOSTS	STACKS	IMPOSTS	STACKS
54	100	100	100	100	100	100	100	100	100	100
60	100	100	100	100	100	100	100	100		
66	100	100	100	100	100	100				
72	100	100	96.3	100	87.7	92.1				
WIDTH	36		42		48		54		60	

3250-HP

3 ½" HURRICANE FIXED AND PROJECT-IN CASEMENT

FL 13605 FL13608

HURRICANE WINDOWS

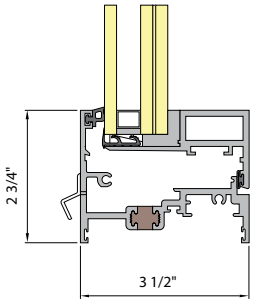
Wausau's AAMA AW-120 rated 3250-HP Hurricane windows have been the product of choice for dozens of hospitals in hurricane-prone regions, and are Miami Dade Product Control Approved:

Fixed window, large missile
Notice of Acceptance (NOA) #12-0416.07
Miami-Dade County, Florida, 25Apr17

Fixed window, small missile
Notice of Acceptance (NOA) #12-0416.09
Miami-Dade County, Florida, 25Apr17

Casement window, large missile
Notice of Acceptance (NOA) #12-0416.06
Miami-Dade County, Florida, 25Apr17

Casement window, small missile
Notice of Acceptance (NOA) #12-0416.08
Miami-Dade County, Florida, 25Apr17

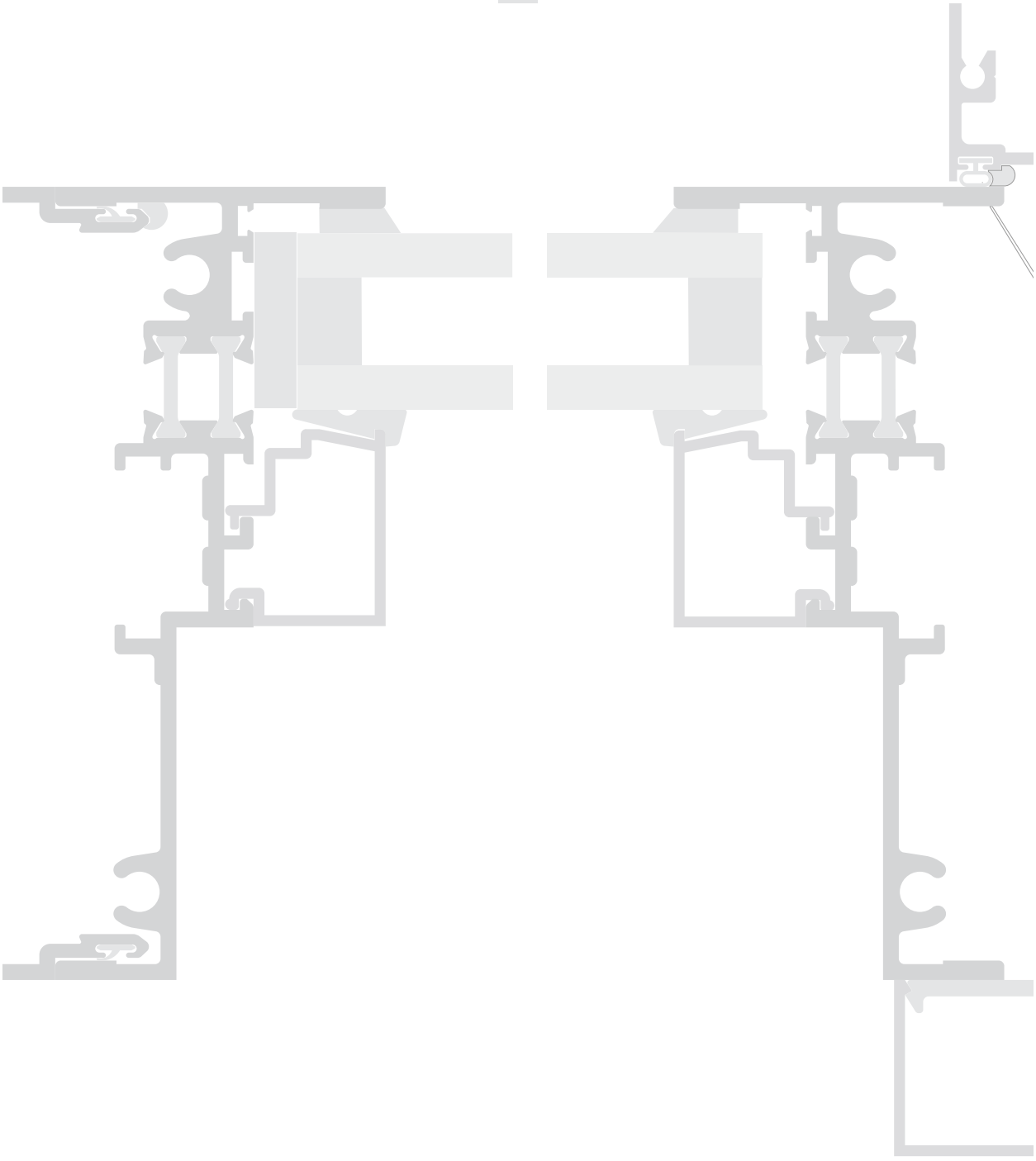


3250-HP
Hurricane

MIAMI-DADE PRODUCT CONTROL APPROVAL
WAUSAU 3250-HP LARGE MISSILE IMPACT-RESISTANT FIXED WINDOWS

Short Dimension	DESIGN LOAD CAPACITY (POSITIVE AND NEGATIVE PSF)											
	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
30"	80.0	90.0	80.0	90.0	80.0	90.0	80.0	90.0	80.0	90.0	80.0	90.0
36"	80.0	90.0	80.0	90.0	80.0	90.0	80.0	90.0	80.0	90.0		
42"	80.0	90.0	80.0	90.0	80.0	90.0	80.0	90.0				
49"	80.0	90.0	80.0	90.0	80.0	90.0						
54"	72.6	81.7	72.6	81.7								
59"	66.4	74.7										
Long Dimension	59"		65"		72"		84"		98"		117"	

1. All window dimensions are frame dimensions +/- 1/2"
2. Sizes listed are maximum allowable at load indicated. If no load is listed for a given size, the size exceeds allowable and is not acceptable.
3. Casement size maximum is 4'-0" wide by 6'-0" high with allowable design pressures of +80 psf and -90 psf.



NON-IMPACT WINDOWS

FIXED, PROJECTED AND CASEMENT

Standard high-performance fixed, projected and casement windows and window wall, interior accessory windows, products for behavioral care, as well as historical renovation.

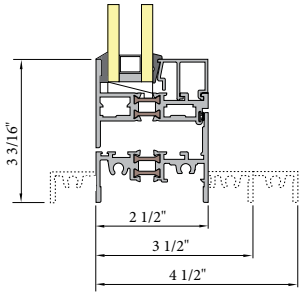
2250i, 3250i, 4250i INVENT™

2 ½", 3 ½" AND 4 ½" THERMAL PROJECTED

FL 14040 FL14046 FL14064 FL14091

WAUSAU'S STANDARD HIGH-PERFORMANCE PROJECTED WINDOW PRODUCT LINE

- 2-1/2", 3-1/2" and 4-1/2" frame depth with polyamide thermal barrier
- AAMA AW-100 Architectural Performance Class
- Fixed, project-in hopper, project-out awning, or casement
- Integral blinds with access doors available
- 1/8" wall thickness at hardware attachments
- Multi-lock hardware option for improved accessibility
- High recycled aluminum content, choice of 30,000 finish colors, including two-color option



ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.10 cfm/sqft at 6.24 psf	15 psf	0.34 to 0.64 BTU/hr.sqft.°F	46 to 65	31 to 42 26 to 37

Test results may vary

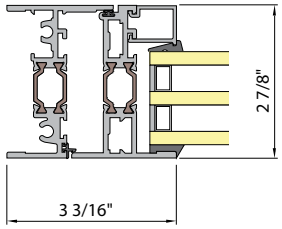
2250i, 3250i, 4250i INVENT™ XLT

ENHANCED THERMAL PROJECTED AND FIXED

FL 14040 FL14046 FL14064 FL14091

SUPERIOR ENERGY EFFICIENCY AND CONDENSATION RESISTANCE

- 2-7/8", 3-7/8" and 4-7/8" frame depth
- XLT option features extra-wide polyamide thermal barrier
- AW-100 rating - accepts triple glazing
- Glazed-in muntin grid option for historical renovation



2250i-XLT

ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.10 cfm/sqft at 6.24 psf	15 psf	0.21 to 0.60 BTU/hr.sqft.°F	59 to 68	31 to 42 26 to 37

Production line sampling, with inspection and water testing prior to shipment, helps ensure real-world performance equal to the laboratory.

2250i, 3250i, 4250i INVENT RETRO™ XLT

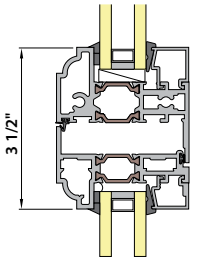
HISTORICALLY INFLUENCED PROJECTED AND FIXED

FL 14040 FL14046 FL14064 FL14091

FEATURES

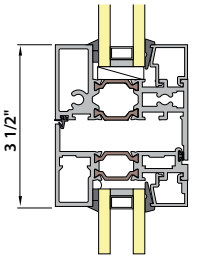
- 2-7/8", 3-7/8" and 4-7/8" frame depth
- 18mm and 24mm XLT polyamide thermal barriers
- AAMA AW-100 Architectural Performance Class
- Optional equal sightlines at vents and fixed lites
- Triple glazing and integral blinds available
- Grid muntins or true divided lite (pictured)
- Optional decorative cove glazing beads (pictured)
- Optional multi-lock hardware for improved accessibility
- Innovative, French casement available (pictured) for Juliet balconies, terraces, or ground floor use

Ogee

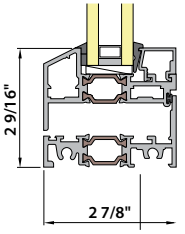


Meeting Rails

Square

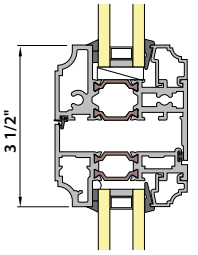


Bevel

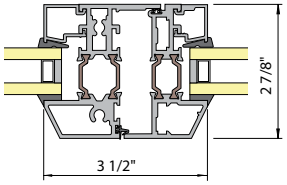


2250i Sill

Cove



Profiled bead



2250i Retro -XLT

ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.10 cfm/sqft at 6.24 psf	15 psf	0.39 to 0.64 BTU/hr.sqft.°F	46 to 65	31 to 42 26 to 37

Test results may vary

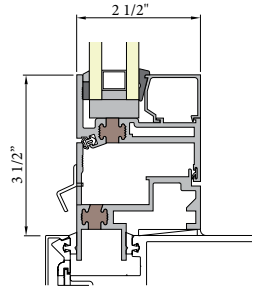
2250 INSERT VENTS

2 ½" THERMAL CURTAINWALL INSERT VENTS

FL 14040 FL14046 FL14091

FEATURES

- 2 1/2" frame depth with polyurethane thermal barrier
- AAMA AW-70 Architectural Class rated
- Project-in hopper, project-out awning or casement vents available
- Mitered and corner-blocked tubular vents
- 0.125" principal wall thickness



2250, 3250 AND 4250

2 ½", 3 ½" AND 4 ½" THERMAL PROJECTED AND FIXED

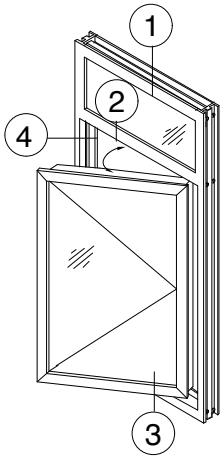
FL 14040 FL14046 FL14091

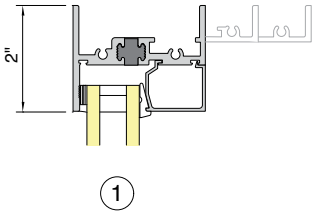
FEATURES

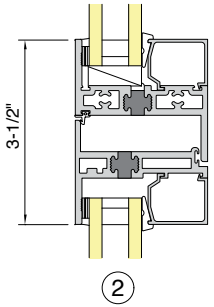
- 2-1/2", 3-1/2", and 4-1/2" frame depths with polyurethane thermal barrier
- AAMA AW-70 Performance Class
- Fixed, project-out awning, project-in hopper or casement
- Flush vent construction reduces collection of dust and debris
- Side-stacking, self-mating, mullions for ease of installation
- Corner-blocked and crimped sash construction for durability
- 1/8" principal wall thickness
- Available as curtainwall insert vents
- NFRC-labeled
- Offered through Advantage by Wausau
- Covered by Wausau's Standard Limited Warranty of up to 10 years

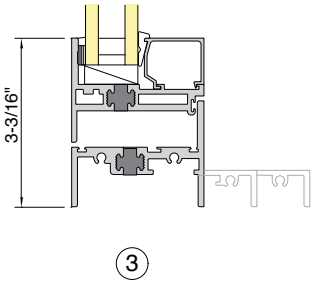
OPTIONS

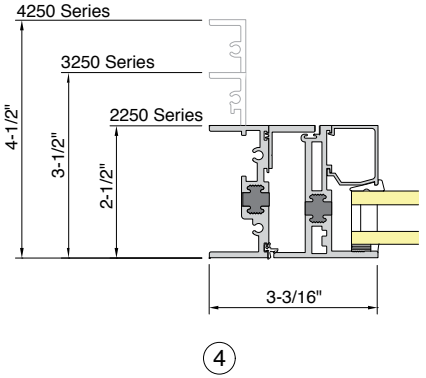
- 4250-OS Offset Series framing provides a 1" exterior glass plane recess
- Occupant or custodial hardware options
- Dual- or triple-glazed option with hinged or lift-out access panels
- Optional, integral between-glass blinds with 5/8" or 1" aluminum slats
- Glazing options for spandrel glass and panels
- Twist-in or heavy-duty slide-in steel anchors
- Broad selection of renovation panning systems and "T" mullions
- Head, sill and jamb receptors available
- More than 30,000 color choices, in liquid and powder-coat paints, applied with 100% VOC-capture processes
- Frosty matte VOC-free anodize ideal for recycled aluminum
- Patina-free copper anodize available











2250 awning vent
Triple-glazed with access door

THERMAL PERFORMANCE SUMMARY

	OPERATOR TYPE	NFRC			AAMA 1503	
		TESTED U-FACTOR	RANGE OF MODELED U-FACTOR	SHGC	TESTED U-FACTOR	CONDENSATION RESISTANCE FACTOR (CRF)
		BTU/HR.SQFT.°F			BTU/HR.SQFT.°F	
2250	Fixed	0.33 (1)	0.33 to 0.54	0.33 to 0.62	0.57 (1)	57 Frame 78 Glass
	Project-Out Casement	0.46 (1)	0.47 to 0.62	0.27 to 0.49	0.48 (1)	50 Frame 57 Glass
2250 DUAL-GLAZED	Project-In Casement	N/A			0.62 (3)	44 Frame 60 Glass
2250 TRIPLE-GLAZED	Project-In Casement	N/A			0.43 (2)	49 Frame 74 Glass
4250-OS OFFSET DUAL-GLAZED	Project-Out Casement	N/A			0.61 (2)	45 Frame 69 Glass

Please contact Wausau for configurations not listed

Glass Type Tested:
(1) Viracon VE1-2M, argon fill, SS warm edge
(2) LOF Energy Advantage no argon or warm edge
(3) Uncoated clear glass

Modeled performance data range is based on various glass configurations. Contact Wausau for project-specific thermal performance modeling.

Performance can vary with hardware package and glazing selected.

ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.10 cfm/sqft at 6.24 psf	12 psf	0.33 to 0.62 BTU/hr.sqft.°F	46 to 65	33 to 47 28 to 40

Test results may vary

4000 AND 4000i-DT

4" HOSPITAL AND BEHAVIORAL CARE WINDOWS

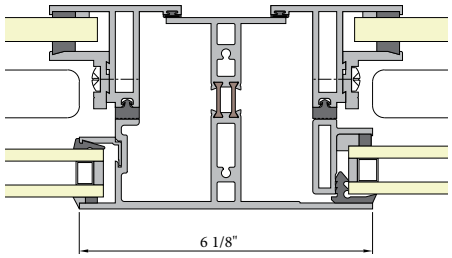
*FL21579

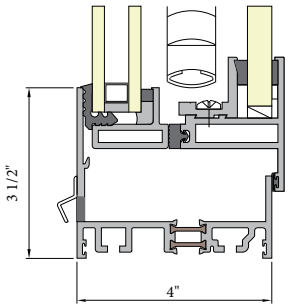
OVERVIEW

4000i-DT Series behavioral care windows help ensure security by resisting interior human impact, while helping establish a home-like and safe therapeutic environment. This time-tested design has been used for construction and renovation projects in 16 states and D.C.

Appropriate minimum requirements for interior human impact performance and hardware design depend on application, occupancy and level of supervision, as well as other project-specific parameters. Consultation with on-site medical and security staff is encouraged, with special consideration given to pass/fail criteria.

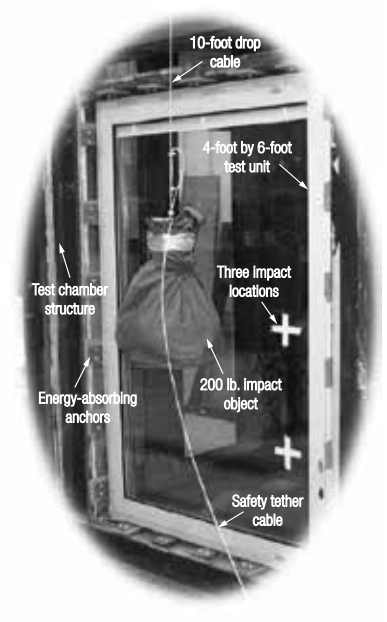
Standard 4000i Series hospital windows with between-glass blinds can be upgraded with behavioral care interior access doors at a later date, for adaptive reuse of patient rooms.





FEATURES

- 4" frame depth with polyamide thermal barrier
- AAMA AW-120 Architectural Performance Class
- Resists interior, human impacts up to 2000 ft-lbs of energy
- Fixed; side-hinged, in-swing casement; top-hinged, in-swing; or hopper vent
- Low U-Factors allow broad expanses of vision glass to meet Model Energy Codes
- 15 psf static and cyclical water resistance
- Equal sightline at vents and fixed lites
- 1/8" principal wall thickness
- No vent joinery exposed to the exterior
- Integral between-glass blinds with 5/8" or 1" aluminum slats
- Concealed, extruded aluminum, butt hinges with stainless steel pins
- Tamper-resistant locking hardware and interior glazing materials
- Recycled aluminum framing



Human Impact "Drop Test" Apparatus

ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.10 cfm/sqft at 6.24 psf	15 psf	0.34 to 0.39 BTU/hr.sqft.°F	57 to 60	40 to 44 (est.)

Test results may vary

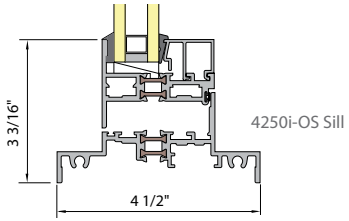
4250i-OS INVENT™

4 ½" OFFSET THERMAL PROJECTED AND FIXED

FL 14040 FL14046 FL14064 FL14091

OVERVIEW

The 1-inch exterior offset between framing and glass in the Wausau 4250i-OS INvent™ Series provides visual interest and texture, while maintaining the industry-leading performance and breadth of options available in the INvent family of products.



FEATURES

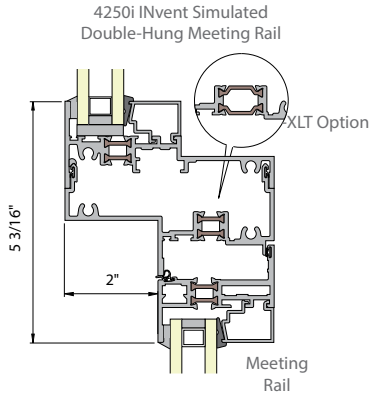
- 4½" frame depth with polyamide thermal barrier
- AAMA AW-100 Performance Class
- Fixed, project-out awning, project-in hopper or casement
- Glass plane recessed 1 ¼" from exterior face
- Dual- or triple-glazed option with hinged or lift-out access panels
- 5/8" or 1" between-glass Venetian blinds available
- Slide-in heavy duty steel anchors
- 1/8" principal wall thickness
- Multi-lock hardware option for improved accessibility
- Head, sill and jamb receptors available
- Broad selection of renovation panning
- Offered through Advantage by Wausau
- NFRC-labeled
- High recycled content aluminum framing
- Blast Hazard Mitigation option for Unified Facilities Criteria or Interagency Security Committee blast hazard mitigation

ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.10 cfm/sqft at 6.24 psf	15 psf	0.40 to 0.64 BTU/hr.sqft.°F	46 to 50	31 to 42

4250i SIMULATED DOUBLE-HUNG

OVERVIEW

Projected windows with offset glass planes to replicate existing double-hung sash, but with the ease of operation, durability and low air infiltration of compression seals Wausau Window and Wall Systems 4250i and 4250i-XLT INvent simulated double-hung windows are ideal for historical renovation.



FEATURES

- 2" glass offset replicates existing single- and double-hung windows AAMA AW-100 Architectural Performance Class
- 4 1/2" frame depth with polyamide thermal barrier (4 7/8" depth for -XLT frame option)
- Maximum upper daylight opening, or “matching sightline” frames available
- Fixed; in- or out-swing casement; top-hinged, awning or hopper vents (pictured)
- Uses architecturally flat 6mm glass thickness without balance weight limits 15 psf static and cyclical water resistance - 0.10 cfm/sqft air infiltration
- Low U-Factors allow broad expanses of vision glass to meet Model Energy Codes
- Easy-to-operate compression seals - no sliding seals to stick or disengage
- 1/8" principal wall thickness
- Butt hinges or concealed four-bar friction hinges - No balances to maintain or replace
- High recycled content aluminum framing and LEED® support services

OPTIONS

- Triple glazing optional
- Optional integral between-glass blinds with 5/8" or 1" aluminum slats
- Extra-wide thermal barrier at -XLT option for energy savings and condensation resistance
- Dual-color frame finishes
  Glazed-in muntin grids (-XLT)
- Slide-in steel anchors
- Panning systems with “T” mullions for renovation
- Head, jamb and sill receptors with “H” mullions for bays
- Hurricane impact and blast hazard mitigating optional designs
- Over 30,000 color choices, in ultra-low VOC paints or VOC-free anodize finishes
- Frosty matte eco-friendly anodize is ideal for recycled aluminum - patina-free copper anodize available

TYPE	ALLOWABLE AIR	WATER	NFRC U-FACTOR BTU/hr.sqft.°F	CRF_F	STC OITC
4250i Fixed Upper	0.10 cfm/sqft at 6.24 psf	15 psf	0.37 to 0.58	56 to 61	32 to 43
4250i Vent Lower			0.50 to 0.56	46 to 51	
4250i-XLT Fixed Upper			0.23 to 0.55	59 to 71	
4250i-XLT Fixed Lower			0.35 to 0.60	49 to 61	

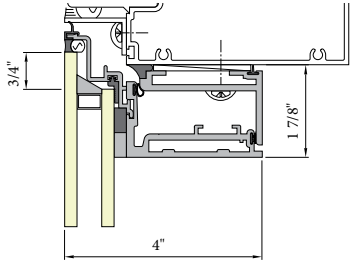
4250-Z

4" ZERO SIGHTLINE INSERT VENTS – MULTI-LOCK

FL14046

4250-Z

- Available for two- or four-side structural glazed curtainwall of varying face widths
- Multi-point locking system for single handle operation
- Concealed stainless steel four-bar friction hinges only
- Project-out awning or project-out casement only
- Mitered frame construction, corner-blocked tubular vents
- Factory silicone glazed for “no sag” performance in large vent sizes
- 1/8” principal wall thickness
- High recycled content aluminum framing



Interior View

Exterior View

SERIES	TYPE	MAXIMUM SIZE	AAMA CLASS gateway size	WATER	NFRC U-FACTOR	CRF_F
4250-Z Multi-Lock	Awning	6’-0” x 5’-6” vent	AW 90	15 psf	0.39 to 0.72 BTU/hr.sqft.°F	67 to 68
	Casement	5’-0” x 3’-0” vent	AW 100			

Project-specific test results may vary

SEAL™ 1297, 2187-DT, 2500

INTERIOR ACCESSORY WINDOWS

FEATURES

- Minimal frame depth to fit within existing window frame openings
- Also used as a curtainwall and storefront add-on for integral blinds or enhanced performance
- Side-hinged access doors with custodial locks
- 5/8" or 1" between-glass Venetian blinds available, with slip-clutch tilt control knob and concealed raise-lower controls
- Mitered frame construction, corner-blocked tubular vents
- Dual-glazed 2500 Series I.C.U. observation windows
- Drop tested 2187-DT Series accepts psychiatric glazing, ideal for adaptive re-use
- Offered through Advantage by Wausau
- Wausau extruded aluminum frames contain recycled content averaging 70% or greater
- Covered by Wausau's Standard Limited Warranty of up to 10 years

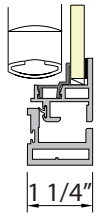
1297 SEAL

2187-DT SEAL

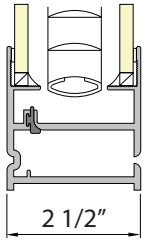
2500 SEAL
I.C.U. Observation

OPTIONS

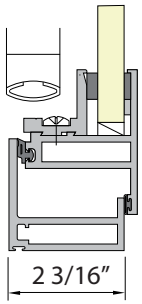
- Hinged or lift-out access panels
- Available with or without optional, integral between-glass blinds
- Glazing options for laminated glass or polycarbonate
- More than 30,000 color choices, in liquid and powder-coat paints, applied with 100% VOC-capture processes
- Frosty matte VOC-free anodize ideal for recycled aluminum
- Patina-free copper anodize available



1297 SEAL



2500 SEAL I.C.U. Observation



2187-DT SEAL Psychiatric

U-FACTORS
1297 SERIES SEAL INTERIOR ACCESSORY WINDOWS

EXTERIOR GLASS TYPE	NORMAL AIR SPACE (IN.)	ESTIMATED CENTER-OF-GLASS U-FACTOR		
		INTERIOR GLASS TYPE		
		1/4" UNCOATED (ANNEALED CHEAT-TREATED)	1/4" PYROLITIC LO-E (FACING AIR SPACE)	7/16"LAMINATED
1/4" Uncoated (annealed cheat-treated)	2 1/2"	0.49	0.37	0.47
	5"	0.49	0.37	0.47
1" Insulating Glass	2 1/2"	0.31	0.25	0.30
	5"	0.31	0.25	0.30

All estimates calculated using WINDOWS 6.0 software.
Results will change with exterior glass and frame type, as well as airspace and wall cavity conditions.
Test results may vary. Refer to standard Wausau disclaimers and qualifications.

ACOUSTIC PERFORMANCE
1297 SERIES SEAL INTERIOR ACCESSORY WINDOWS

EXTERIOR GLASS TYPE	NORMAL AIR SPACE (IN.)	ESTIMATED ACOUSTIC PERFORMANCE SOUND TRANSMISSION CLASS (STC) AND OUTDOOR-INDOOR TRANSMISSION CLASS (OITC)			
		INTERIOR GLASS TYPE			
		1/4" UNCOATED OF LO-E (ANNEALED CHEAT-TREATED)		7/16"LAMINATED	
		STC	OITC	STC	OITC
1/4" Uncoated (annealed cheat-treated)	2 1/2"	40	31	44	33
	5"	42	33	46	35
1" Insulating Glass	2 1/2"	45	36	48	37
	5"	48	37	50	39

All estimates calculated using WINDOWS 6.0 software.
Results will change with exterior glass and frame type, as well as airspace and wall cavity conditions.
Test results may vary. Refer to standard Wausau disclaimers and qualifications.

Estimated performance values are NOT test results. As noted, actual performance will vary.
Validation may require project-specific testing, adding cost and impacting schedule.

SEAL™ 1297, 2187-DT, 2500

INTERIOR ACCESSORY WINDOWS

SPECIFICATION

SEAL 1297 SERIES

[NOTE: WAUSAU recommends that a representative sample of SEAL Series interior accessory windows be provided in situ, at least one seasonal cycle prior to installation.

This will allow building occupants, facility staff and the design team an opportunity to gauge the effectiveness of interior accessory windows, and verify the suitability of operation, maintenance, existing glass type(s), and surrounding conditions. Internal fogging and thermal stress in existing annealed glass are of particular concern. Refer to Wausau's standard disclaimers for limitations and qualifications.]

AIR INFILTRATION AND EXFILTRATION

With all purposeful vent holes plugged, neither air infiltration nor exfiltration shall exceed 0.3 cfm per square foot at 6.24 psf pressure differential when tested in accord with ASTM E283.

MATERIALS

Aluminum framing members shall be extruded aluminum billet, 6063-T5 or -T6 alloy meeting the requirements of ASTM B221. Principal window frame and access panel members will be a minimum 0.093" in thickness at glazing legs, hardware mounting webs and section flanges. Extruded or formed trim components will be a minimum 0.060" in thickness. Frame depth 1-¼" minimum.

COMPONENTS

All steel hardware components including attachment fasteners to be 300 Series stainless steel. Extruded aluminum components 6063-T5 or -T6. Locking handles, bases and strikes to be die cast, white bronze or stainless steel. Thermo-plastic or thermo-set plastic caps, housings and other components to be injection-molded nylon, extruded PVC or other suitable compound. Hardware to be custodial-operated and include concealed hinge pins and blocks, concealed locks, retainer clips and lift blocks. All sealants shall comply with applicable provisions of AAMA 800 and/or Federal Specifications FS-TT-001 and -002. Frame joinery sealants shall be suitable for application specified and as tested and approved by the window manufacturer. Provide glass and glazing in accordance with Section 08 80 00.

INTEGRAL VENETIAN BLINDS

Integral Venetian blinds shall employ 5/8" or 1" (select one) wide aluminum slat blinds. Blind color shall be selected from standard color chart. Blind to be integrally mounted between the dual glazing. Tilt-control knob will be located on the operable face and incorporate a "slip clutch" feature. Raise and lower pull cords will be located between glass for access only when glazed access panel is opened.

FABRICATION

Finish, fabricate, assemble, and factory-glaze frame and access panel members into complete windows under the responsibility of one manufacturer. Miter all corners and mechanically stake over a solid extruded aluminum corner block, set and sealed in epoxy; or miter and weld each corner. Provide two die cast concealed hinge pins, retained in injection-molded nylon hinge blocks at sill and spring steel hinge clips at head. Die cast or stainless steel Allen-keyed locks for custodial operation shall secure panel in closed position. Provide locks at maximum 40" spacing. Weather-stripping shall be bulb- or fin-type neoprene, EPDM, dual-durometer PVC, polypropylene, TPE, or other suitable material as approved by the window manufacturer. Miter, crowd, stake or join at corners.

WARRANTY

Products: Submit a written warranty, executed by the window manufacturer, for a period of up to 10 years from the date of manufacture, against defective materials or workmanship, including substantial non-compliance with applicable specification requirements and industry standards, which result in premature failure of the windows, finish, factory-glazed glass, or parts, outside of normal wear. In the event that windows or components are found defective, manufacturer will repair or provide replacements without charge at manufacturer's option. Warranty for all components must be direct from the manufacturer (non pass-through) and non pro-rated for the entire term. Warranty must be assignable to the non-residential owner, and transferable to subsequent owners through its length.

NON-IMPACT TERRACE AND PATIO DOORS

WAUSAU FLORIDA

Enjoy expansive views through large vision lites, while maximizing ease of operation and meeting the most stringent performance requirements. Wausau factory fabrication and glazing helps ensure trouble-free installation, with individual fixed and operable door units set plumb, square and level in continuous ribbons.

Choose inside-track CrossTrak™ sliding glass doors for use behind Juliet balconies, or outside-track doors with accessible thresholds. Any option can be operated by conventional or “lift and slide” hardware.

TD-4250i Series in-swing and out-swing terrace doors are ideally suited for high-rise residential, hotel, and dormitory projects. 4-1/2" frame depth integrates seamlessly with other Wausau window and curtainwall systems popular in these applications.

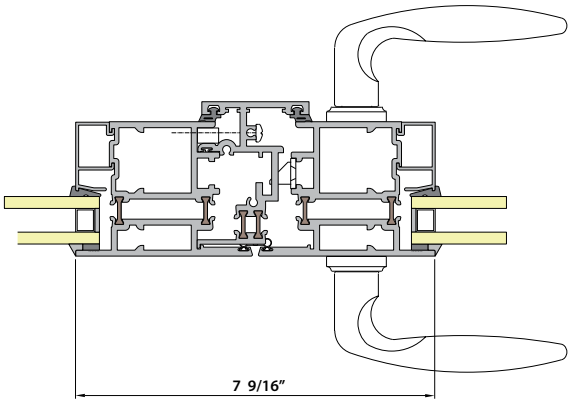
TD-4250i

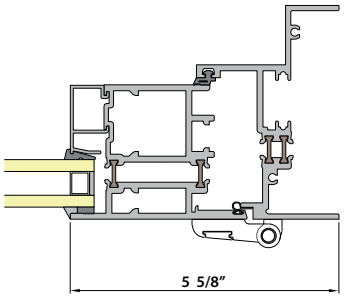
4 ½" THERMAL TERRACE DOOR

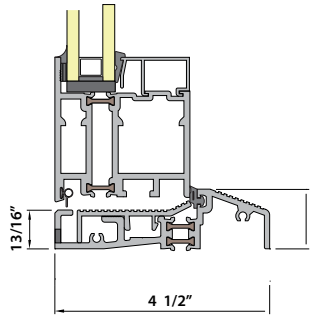
*FL Approval Coming Soon

IN-SWING AND OUT-SWING ARCHITECTURAL TERRACE DOORS

Wausau Window and Wall Systems® TD-4250i Series in-swing and out-swing terrace doors are ideally suited for high-rise residential, hotel and dormitory projects. 4-1/2" frame depth integrates seamlessly with other Wausau window and curtainwall systems popular in these applications.







Low-profile sill

ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.10 cfm/sqft at 6.24 psf	8 to 15 psf	0.48 to 0.63 BTU/hr.sqft.°F	58 to 61	32 to 38 28 to 29

Performance can vary with hardware package and glazing selected.

FEATURES

- 4-1/2" frame depth with polyamide thermal barrier
- AAMA AW-60 Performance Class for single doors - AW-50 Performance Class for double French doors
- 15 psf static water resistance for standard sills - low-profile sills range from 8 psf to 12 psf
- French door leaf sizes up to 4’-0” x 8’-0”
- Side-stacking, self-mating mullions for ease of installation
- Corner-blocked and crimped door leaf construction for durability - life cycle tested to AAMA 910-10 requirements
- 1/8” principal wall thickness
- Verona-style Euro handle with adjustable stainless steel multi-point locking, 90˚thumbturn locks on active leaf and concealed astragal shootbolts
- Designed for LCN 4040 closers - Standard operating force or improved accessibility
- NFRC-labeled
- Forced entry-resistance tested
- Offered through Advantage by Wausau
- Covered by Wausau’s Standard Limited Warranty of up to 10 years

OPTIONS

- Low-profile sills for improved accessibility
- Door sill kick plate
- Thumbturn locks with exterior keyed cylinder
- Integral transom lite insert framing
- Dual- or triple-glazed option with hinged or lift-out access panels
- Optional, integral between-glass blinds with 5/8” or 1” aluminum slats
- Heavy-duty slide-in steel anchors
- Two-color frame finish
- Head, sill and jamb receptors available
- More than 30,000 color choices, in liquid and powder-coat paints, applied with 100% VOC-capture processes
- Frosty matte VOC-free anodize ideal for recycled aluminum
- Patina-free copper anodize available

5250i-XLT CROSSTRAK™

5 7/8" THERMAL SLIDING GLASS DOOR

*FL Approval Coming Soon

FEATURES

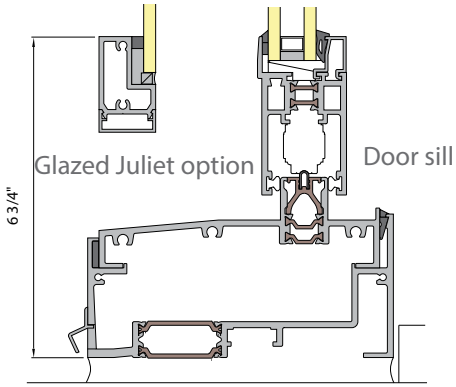
- 5-7/8" frame depth for high spans and wind loads; polyamide thermal barrier
- Extruded "palm tree" pull handles at meeting stiles
- Half-slide, end-slide, center-slide and center-open two-track configurations side-stack with INvent™ fixed lites
- Outside-track door panels for terrace and balcony access
- Inside-track panels for Juliet balconies (shown)
- Easy-to-install, rigidly square, pre-glazed fixed lites independent of door frames
- Snap-in polyamide insert and stainless steel roller track cross from fixed to sliding side
- AAMA Architectural Performance Class, life cycle tested for durability
- Less than 0.30 cfm/sqft air infiltration at 6.24 psf
- 8 to 12 psf water test pressure; static and dynamic
- Listed in the National Fenestration Ratings Council (NFRC) Certified Products Directory and/or CMA database

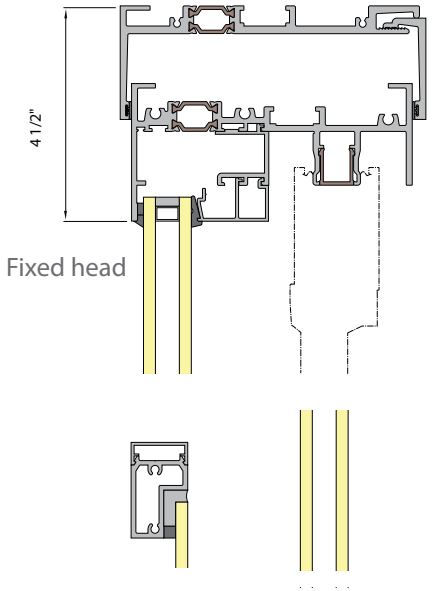
OPTIONS

- Conventional sliding glass door operation or Euro "lift and slide" operation for lower operating force and tigher air seals
- Low-profile sills for improved accessibility available on outside-track configurations
- AmesburyTruth Mammoth™ rollers for easier operation of conventional sliding glass doors
- Accepts insulating glass units up to 1-3/8" in thickness for improved acoustical performance
- Head, sill and jamb receptors available
- Interior or exterior-mounted insect screens
- Two-color frame finish
- More than 30,000 color choices, in liquid and powder-coat paints, applied with 100% VOC-capture processes
- Frosty matte VOC-free anodize is ideal for recycled aluminum
- Patina-free copper anodize available

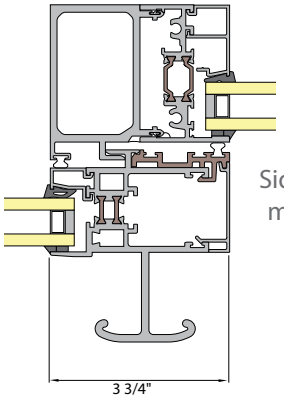
CrossTrak™

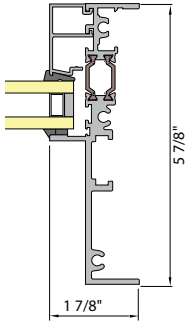
INSIDE TRACK

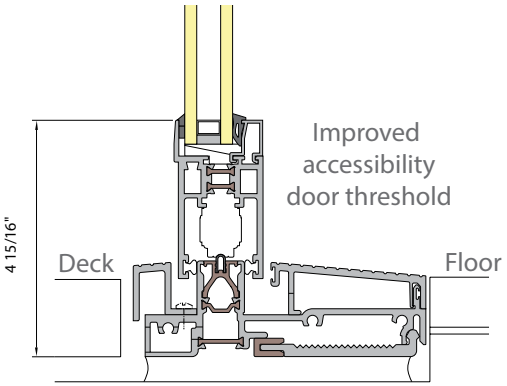


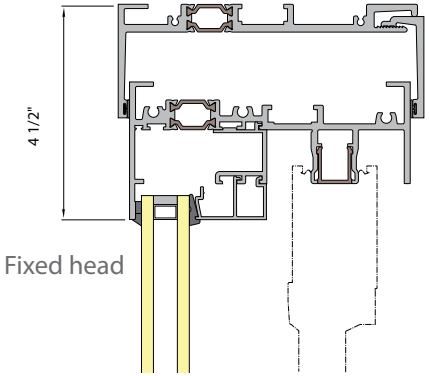


OUTSIDE TRACK









ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.30 cfm/sqft at 6.24 psf	8 psf Outside Track 12 psf Inside Track	0.39 to 0.55 BTU/hr.sqft.°F	60 to 67	31 to 39 26 to 33

Test results may vary. Acoustical test results based on INvent framing systems.

LOS ANGELES POLICE HEADQUARTERS
Roth Sheppard Architects

HURRICANE-IMPACT CURTAINWALL AND WINDOW WALL

WAUSAU FLORIDA

Wausau SuperWall™ is a time-tested, screw-spline, field-glazed curtainwall system for smooth, quick installation and worry-free, test-verified performance, used in low- and mid-rise buildings such as schools, hospitals, and offices. SuperWall™-HP has been hurricane-tested for both “D” and “E" missile impact.

The Wausau INvision™ family of unitized curtainwall and window wall products offers multiple options to help ensure the right match for your project. For hurricane-impact unitized curtainwall, project-specific testing and acceptance is usually the preferred compliance path, and Wausau’s engineering team stands ready to execute protocols in a timely manner, supporting the critical path schedules of fast-track construction projects.

All Wausau walls are NFRC-tested and CMA-listed, and backed by full AAMA 501 testing for air, water and structural integrity, including racking, jacking and thermal cycling.

7250i-UW INVISION™

7 ¼" THERMAL UNITIZED CURTAINWALL

*FL Approval via project-specific testing

OVERVIEW

Wausau Window and Wall Systems® 7250-UW and 7250i-UW Series unitized curtainwall systems are designed for the needs of institutional applications nationwide - including health care and university buildings.

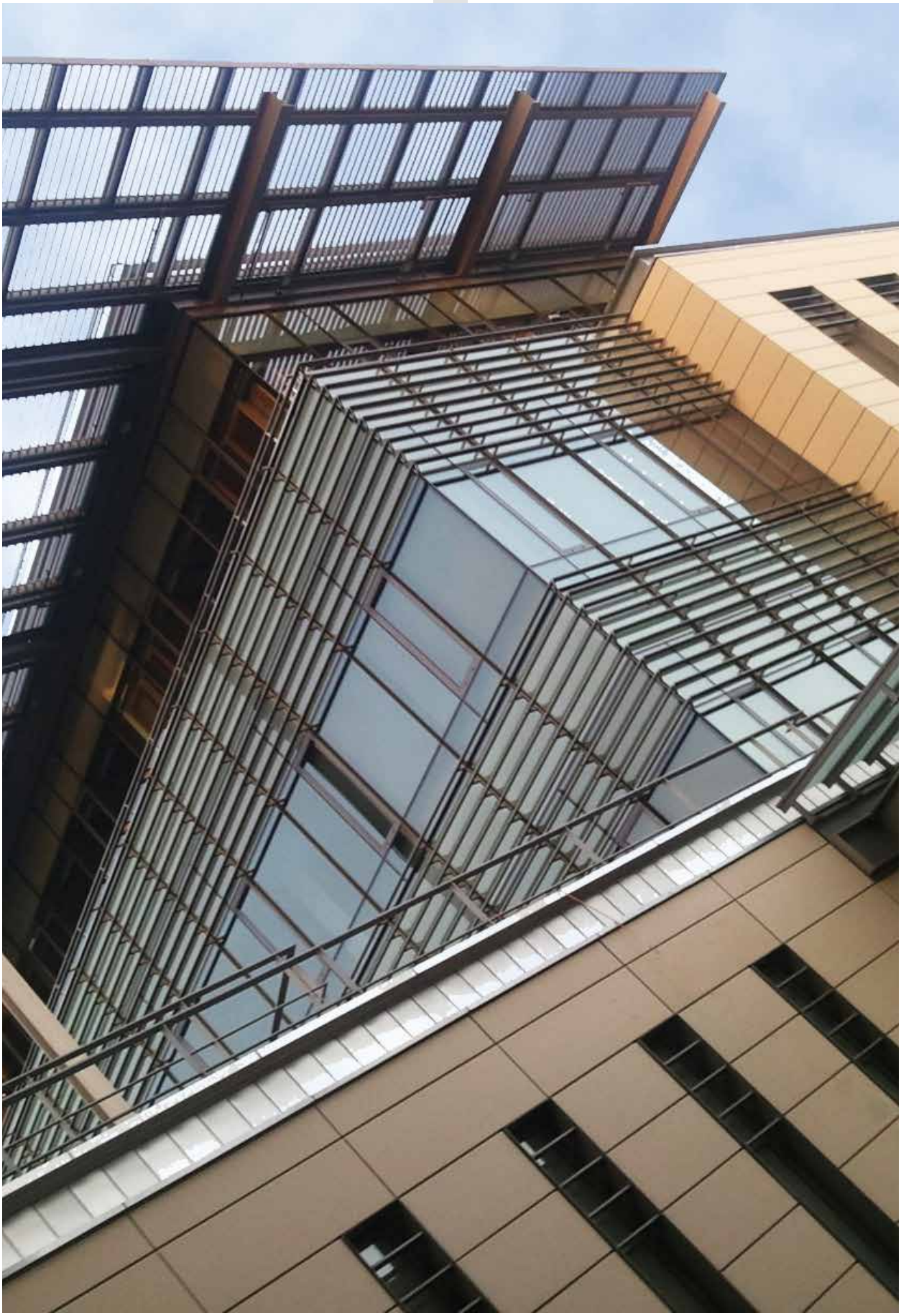
Maximizing performance and minimizing installation time, factory-glazed 7250-UW and 7250i-UW can incorporate polyamide frame thermal barriers for energy efficiency and condensation resistance, as well as zero sightline operating vents for natural ventilation.

7250i-UW features a 3" face width for adequate structural silicone joint width in high wind load zones, and a 7-1/4" frame depth for typical institutional buildings' floor-to-floor spans. Each unit, typically one lite wide by one floor tall, comes equipped with picking and alignment provisions for safe, efficient handling from the interior or exterior.

Edge-of-slab and top-of-slab anchor base options work in tandem with cast-in-place Halfen® embeds to speed layout. Jack-bolt anchors allow for full three-way adjustment "off the rig," optimizing hoisting and handling. Only one unit-to-unit splice, a translucent silicone sheet, needs to be field-sealed.

FEATURES

- 3" face width unitized wall designed for high spans, seismic movement and energy efficiency
- Narrow 3" mullion sightlines - 7-1/4" frame depth
- Engineered to meet typical institutional buildings' span and wind load requirements
- Interlocking frame design and 3" face accommodates seismic, live load and thermal movements
- Two-level thermal barrier frames (7250i-UW) or thermally improved with polyamide clips (7250-UW)
- Two lines of defense against air and water infiltration - compartmentalized and pressure-equalized rain screen design
- Pressure-equalized rain screen design
- Glazing and sealing in a controlled factory environment
- Low U-Factors allow broad expanses of vision glass to meet Model Energy Codes
- NFRC- and CMA-certified thermal performance
- Accepts up to 11/16" total vertical movement
- Three-way adjustable anchors for ease of installation
- Extruded aluminum framing contains recycled content averaging 70% or greater



7250i-UW INVISION™

7 ¼" THERMAL UNITIZED CURTAINWALL

*FL Approval via project-specific testing

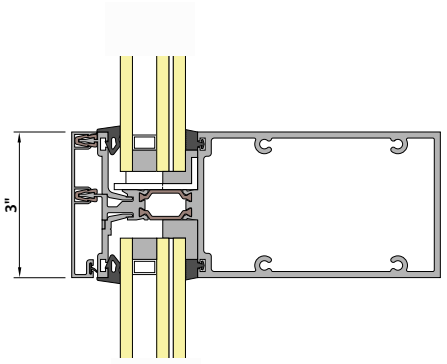
OPTIONS

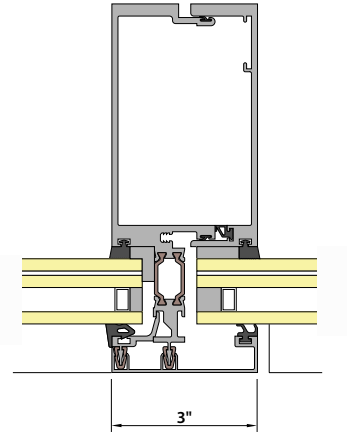
- Captured, two-side or four-side structural glazed - with or without fins at structural glazing
- Matching inside and outside 90-degree corners
- Zero sightline multi-lock insert vents for easily accessible natural ventilation
- Exterior sun shades to block solar heat gain
- Interior light shelves for natural daylight harvest
- Dual-color frame finishes
- Shadow boxes and backpans at spandrels
- Various exterior accent trim covers available
- Blast hazard-mitigating 8000i-BHM and 8000i-BHM Series curtainwall systems

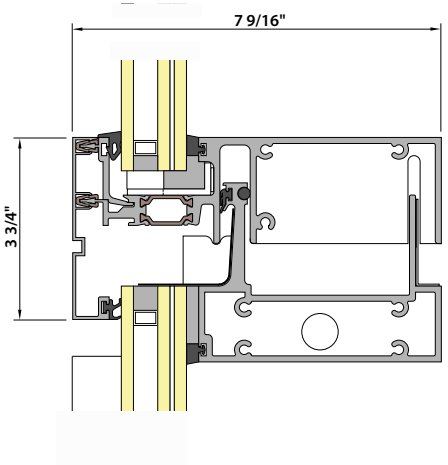
7250-UW Series may be finished in dual colors to match the building's interior and exterior design, with a color palette of more than 30,000 choices.

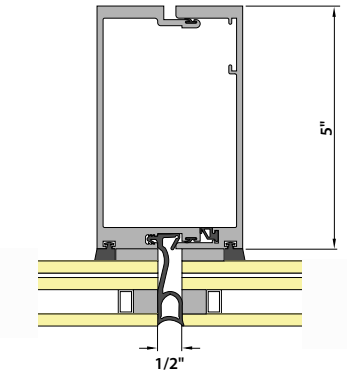
Liquid and powder paints are applied with 100% VOC-capture processes.

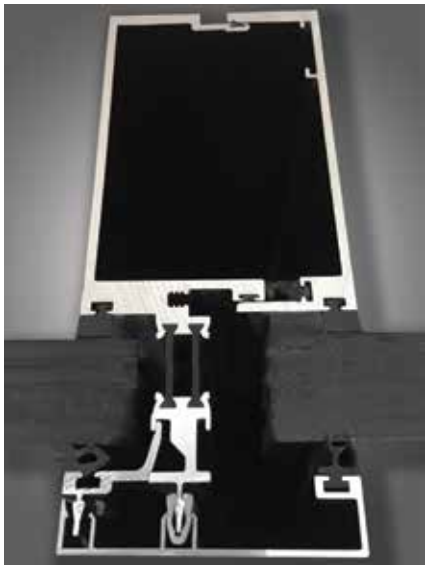
The frosty matte finish of VOC-free anodize is ideal for projects specifying Wausau's aluminum framing with recycled content. Patina-free copper anodize available.











ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.06 cfm/sqft at 6.24 psf	15 psf	0.29 to 0.63 BTU/hr.sqft.°F	73 to 77	32 to 34 26

Test results may vary

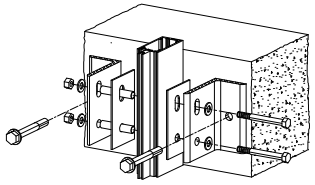
SUPERWALL-HP™

HURRICANE STICK CURTAINWALL

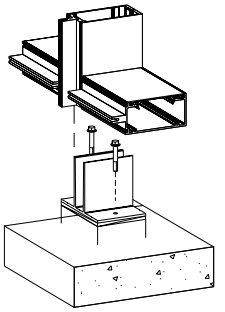
*FL Approval Coming Soon

OVERVIEW

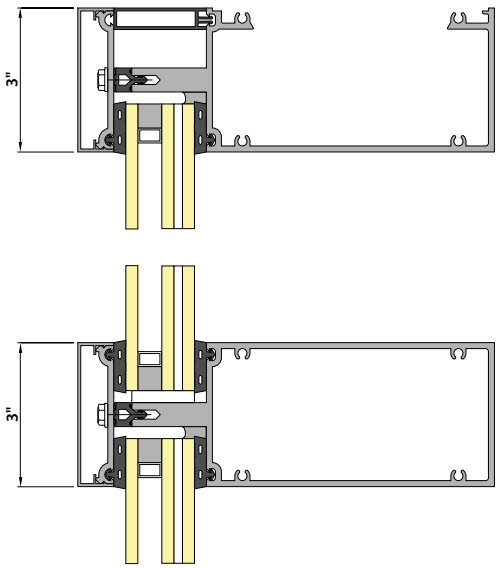
For more than 30 years, contractors and designers have trusted Wausau SuperWall™ screw-spline, field-glazed curtainwall systems for smooth, quick installation and worry-free, test-verified performance. The new SuperWall™-HP addition to the SuperWall™ family has been hurricane-tested for both "D" and "E" missile impact. When you need it fast and you need it right, Wausau's SuperWall™ systems are ideally suited to meet the accelerated pace of construction timelines for low- and mid-rise buildings such as schools, hospitals and offices.

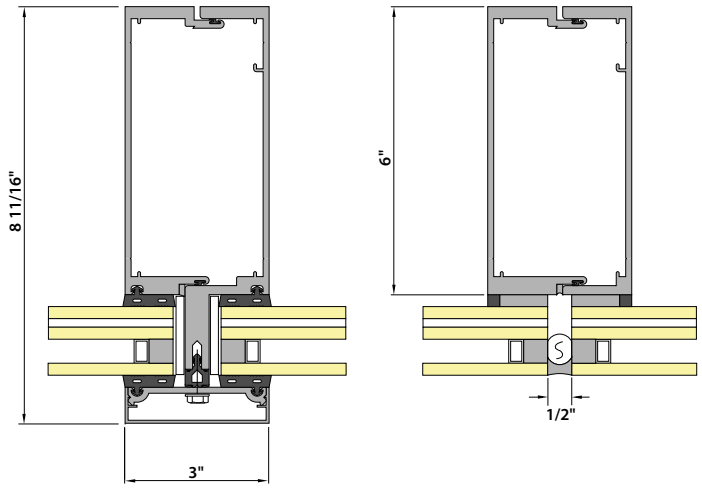


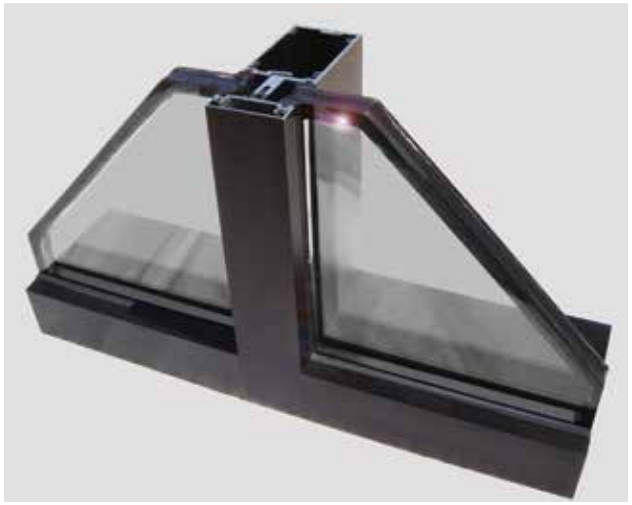
Slab edge anchor

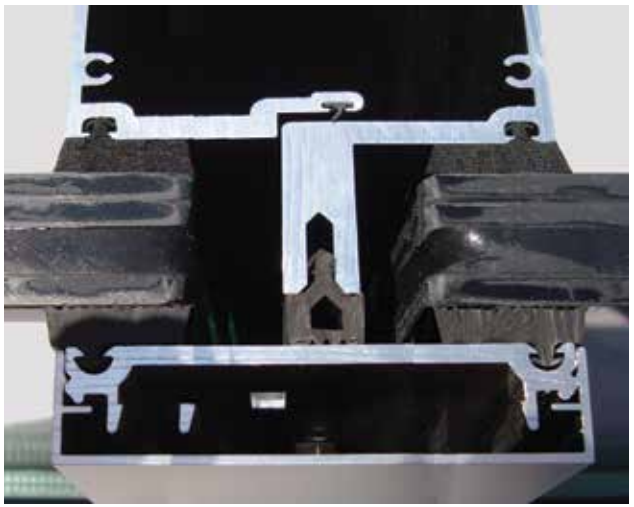


Perimeter "T" anchor









ZUCKERBERG SAN FRANCISCO GENERAL HOSPITAL AND TRAUMA CENTER
Fong and Chan Architects

NON-IMPACT CURTAINWALL AND WINDOW WALL

WAUSAU FLORIDA

Wausau SuperWall™ is a time-tested, screw-spline, field-glazed curtainwall system for smooth, quick installation and worry-free, test-verified performance, used in low- and mid-rise buildings such as schools, hospitals, and offices.

The Wausau INvision™ family of unitized curtainwall and window wall products offers multiple options to help ensure the right match for your project.

All Wausau walls are NFRC-tested and CMA-listed, and backed by full AAMA 501 testing for air, water and structural integrity, including racking, jacking and thermal cycling.

5250i AND 6250i-HR AND HRX INVISION™

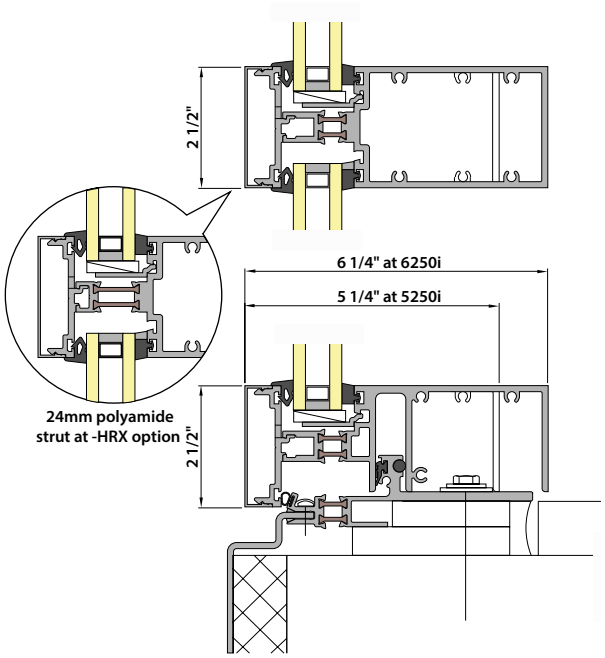
5 ¼" AND 6 ¼" THERMAL UNITIZED WINDOW WALL

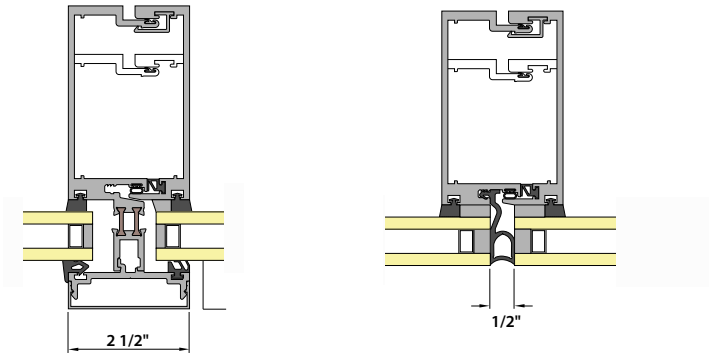
*FL Approval via project-specific testing

OVERVIEW

Available in 5-1/4" and 6-1/4" frame depth, 2-1/2" face width INvision –HR window walls feature an 18 mm polyamide thermal barrier. By definition, window wall spans from the top of the floor slab to the underside of the next higher floor slab. Receptor systems can be designed as a part of drainage and movement accommodation provisions.

INvision window wall systems can be designed to look as much, or as little, like curtainwall as is aesthetically desirable, through creative detailing of slab edge covers, and units can be installed in any sequence. Window wall systems often are provided with integral operable vents. In the closed position, Wausau's 4250-Z Zero Sightline vents are almost indistinguishable from adjacent fixed lites.


2 1/2"
6 1/4" at 6250i
5 1/4" at 5250i
24mm polyamide
strut at -HRX option
2 1/2"


2 1/2"

1/2"

6250i AND 7250i-HR AND HRX INVISION™

6 ¼" AND 7 ¼" THERMAL UNITIZED CURTAINWALL

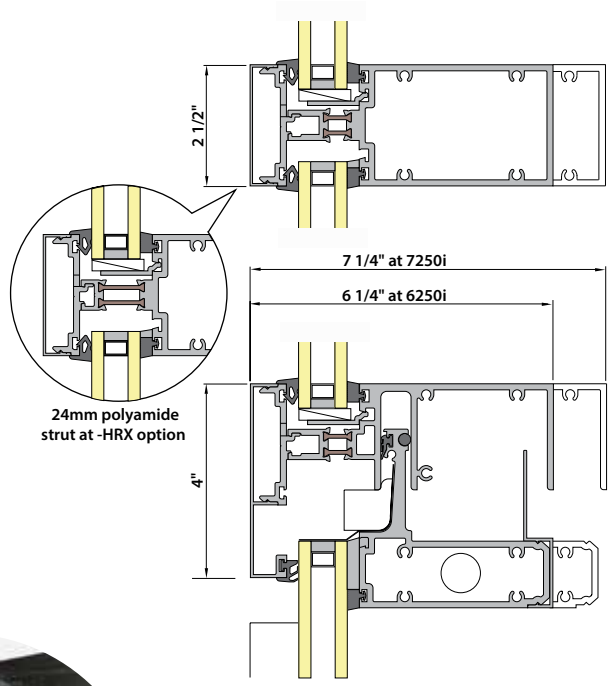
*FL Approval via project-specific testing

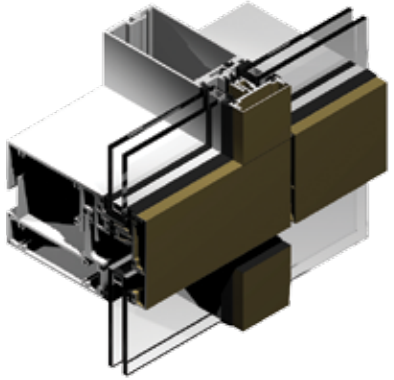
OVERVIEW

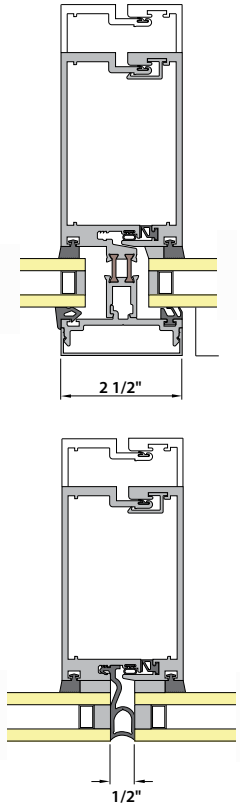
Available in 6-1/4" and 7-1/4" frame depth, 2-1/2" face width INvision –HRX window walls feature an 18 mm polyamide thermal barrier. Each factory-glazed unit, typically one lite wide by one floor tall, comes equipped with picking and alignment provisions for safe, efficient handling from the interior or exterior.

Edge-of-slab and top-of-slab anchor base options work in tandem with cast-in-place Halfen® embeds to speed layout. Jack-bolt anchors allow for full three-way adjustment "off the rig," optimizing hoisting and handling. Only one unit-to-unit splice, a translucent silicone sheet, needs to be field-sealed.

Curtainwall systems often are provided with integral operable vents. In the closed position, Wausau's 4250-Z Zero Sightline vents are almost indistinguishable from adjacent fixed lites.







CHOOSING BETWEEN STICK AND UNITIZED CURTAIN WALL SYSTEMS

SELECTION CRITERIA	STICK WALL	UNITIZED CURTAIN WALL
PROJECT SIZE	Small	Large
WALL CONFIGURATION	Complex Many changes in plane, e.g. soffits, corners, etc.	Monolithic Large expanses of flat wall
JOINT PATTERN	Random	Uniform horizontal sill line
GLAZING	Field	Factory
INTERSTORY MOVEMENTS	Very limited	Inter-locking frames take movements
QUALITY CONTROL	Subject to site variables Both environment and equipment	Controlled factory conditions
MODIFICATION	Can be cut to fit in the field	Pre-engineered
SEALING	Subject to site variables	Minimal field sealing
FIELD LABOR COST	High Many parts to track and assemble	Low Often setting 75 sqft or more
FIELD LABOR DURATION	Slow	Fast Up to 50 units per day reported
ACCESS AND SAFETY	Exterior access required	Set from the interior

CLEARSTORY™ SUN CONTROL

PRE-ENGINEERED SUN SHADES AND LIGHT SHELVES

OVERVIEW

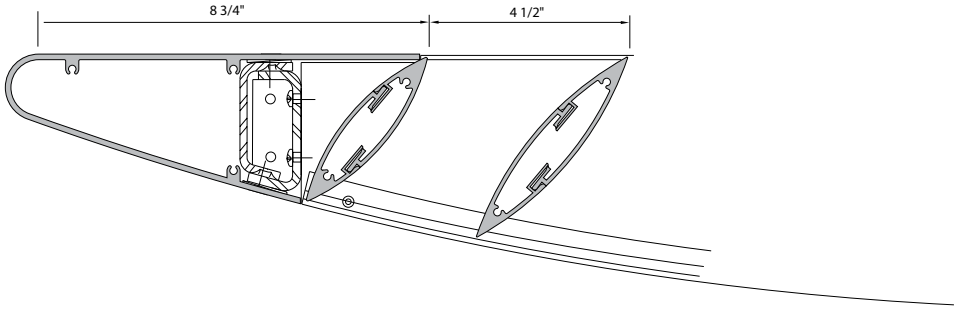
- Natural daylight harvest, solar heat gain control and striking visual effect.
- Seamlessly integrated into windows or curtainwall

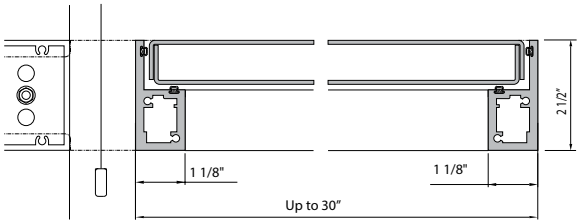
INTERIOR LIGHT SHELVES

- Redirect south daylight off ceiling surfaces so light penetrates deeper
- Control glare at high solar altitudes
- Diffuse, reflective, upper surfaces maximize light - lower surfaces match decor
- A variety of pre-engineered configurations - flush, articulated, aerofoil, and contoured
- Light shelves can work in combination with sun shades for maximum daylight harvest
- Shelf depth up to 30", to match transom height
- Optional easy-to-clean removable infill panels
- Not intended as a shelf or step

EXTERIOR SUN SHADES

- Control solar heat gain and harvest natural daylight to meet sustainable design goals
- Increase Projection Factor (PF) and decrease solar cut-off angles
- A variety of pre-engineered configurations - extruded blades, perforated sheet, “catwalk” grids or solid shading
- Modular design and integral alignment features for ease of installation
- Thermally improved mullion attachments
- Laser- or water-jet, precision-cut, factory-attached end caps
- Vertical sun shades available for east and west facades





SUPERWALL™

THERMAL CURTAINWALL IN VARIOUS SYSTEM DEPTHS

FL21569

OVERVIEW

For more than 30 years, contractors and designers have trusted SuperWall™ systems for smooth, quick installation and worry-free, test-verified performance. Standard, easy-to-fabricate SuperWall - in any color finish.

When you need it fast and you need it right, Wausau's SuperWall systems are ideally suited to meet the accelerated pace of construction timelines for low- and mid-rise buildings such as schools, hospitals, and offices.

Five complete systems in 4-3/4", 6-1/4", 7-1/4", 8-1/4" and 10-1/4" frame depths to efficiently address almost any span/load requirement - all systems' components are internally consistent and interchangeable.

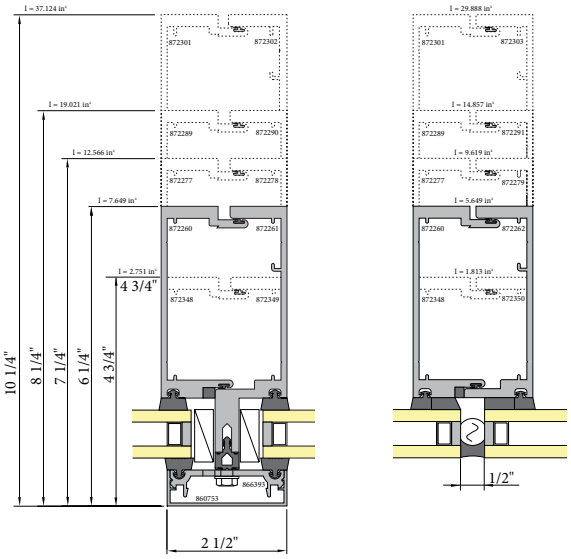
FEATURES

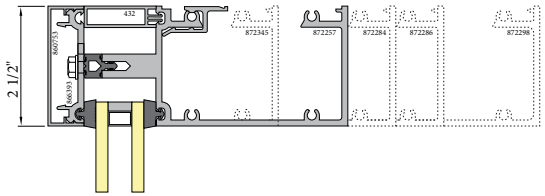
- 2 ½" exterior sightline - accent covers available
- Captured or vertical structural glazed
- Full 1/8" extrusion wall thickness
- EPDM gaskets; silicone setting blocks
- 3/8" wide thermal separator for energy efficiency
- Easy-to-install "ladder frame" screw-spline construction
- Less than 0.06 cfm/sqft air infiltration at 6.24 psf
- 15 psf water test pressure; static and dynamic
- Listed in the National Fenestration Ratings Council (NFRC) Certified Products Directory and CMA database

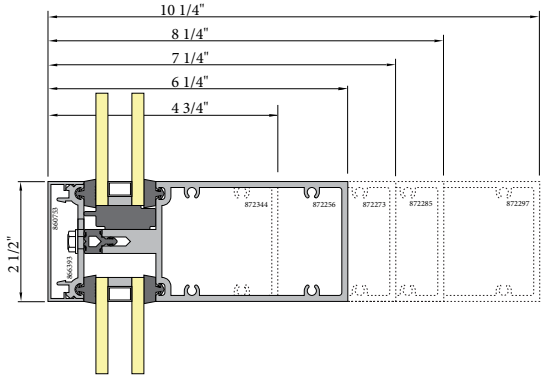
THERMAL PERFORMANCE SUMMARY

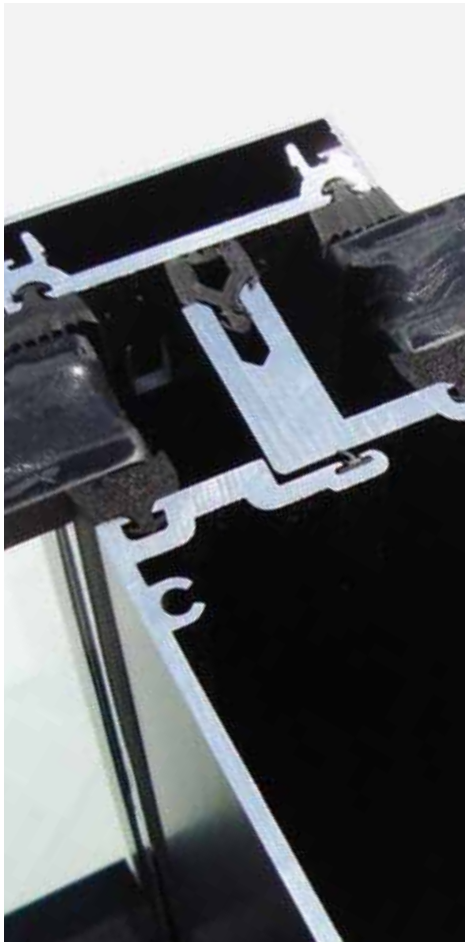
	NFRC U-FACTOR BTU/HR-FT2-°F		SHGC RANGE	AAMA U-FACTOR BTU/HR-FT2-°F	CRF
	TESTED	MODELED RANGE		TESTED	
6250 SUPERWALL ALUMINUM PP (CAPTURED GLAZING)	0.38	0.35 to 0.57	0.34 to 0.65	0.40	68 Frame 67 Glass
6250 SUPERWALL COMPOSITE PP (CAPTURED GLAZING)	0.34	0.34 to 0.54	0.34 to 0.65	0.35	73 Frame 69 Glass

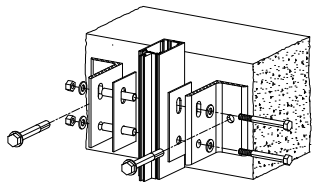
Unless noted, tested performance data listed is based on Viracon 1" overall VE1-2M insulating glass (Low-E on surface #2), 1/2" argon with stainless steel spacer. Modeled NFRC performance data range listed is based on various clear substrate glass configurations, with validation test per NFRC requirements. Contact Wausau for project-specific thermal performance modeling.



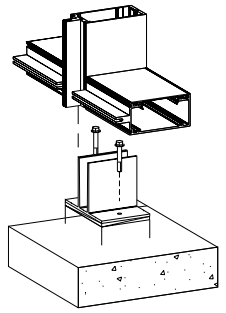








Slab edge anchor



Perimeter "T" anchor

SUPERWALL™ SSG

FOUR-SIDE STRUCTURALLY GLAZED IN VARIOUS SYSTEM DEPTHS

FL15258

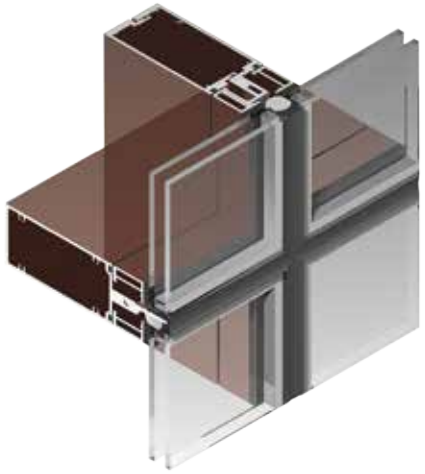
OVERVIEW

For more than 30 years, contractors and designers have trusted SuperWall™ systems for smooth, quick installation and worry-free, test-verified performance.

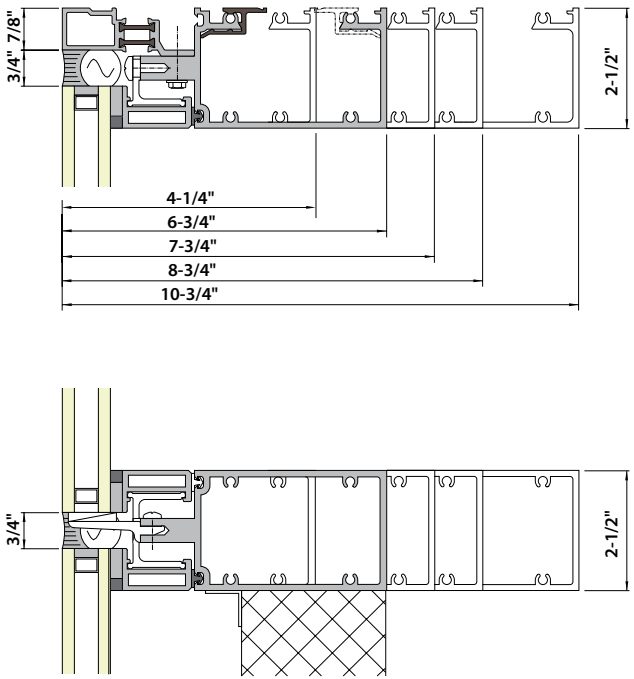
Wausau's standard, easy-to-fabricate SuperWall series now includes a four-side silicone-glazed system - SuperWall SSG - to create dramatic entrance atria - sleek, modern, reflective glass facades - or open, transparent, low-rise envelope solutions.

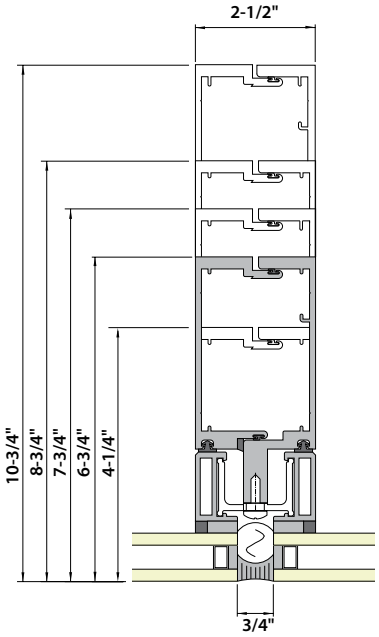
FEATURES

- 6-3/4", 7-3/4", 8-3/4", or 10-3/4" frame depth (with 1" glass)
- Narrow 2-1/2" mullions maximize daylight opening
- Carrier frames glazed in a factory-controlled environment
- Accepts standard, structural silicone insulating glass units - economical and fast replacements available
- Grid frames are factory-fabricated and shipped knocked-down (KD) for field assembly
- Interlocking mullions accept reinforcing for free-span atrium applications
- Matching 2-1/2" inside and outside 90º corner mullions
- Field face-sealed
- Low U-Factors allow broad expanses of vision glass to meet Model Energy Codes
- "F" and "T" perimeter anchors
- Exterior accent trim available
- Zero sightline vent inserts
- ClearStory™ exterior sun shades and interior light shelves available
- Wausau's extruded aluminum frames contain recycled content averaging 70% or greater



Designer Note: The use of clear glass in four-side silicone-glazed wall systems can make insulating glass unit construction, as well as glazing materials, visible under certain exterior lighting conditions. Review samples carefully during glass selection.





ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.06 cfm/sqft at 6.24 psf	15 psf	0.37 to 0.55 BTU/hr.sqft.°F	70 to 74	31 to 34 26

Test results may vary

HURRICANE-IMPACT STOREFRONT AND ENTRANCES

WAUSAU FLORIDA

Wausau's ForceFront Storm™ framing and entrances - a full line of impact-resistant framing systems - have been large-missile-tested by ATI Intertek, a highly respected and well-known industry leader, and have been granted Florida Product Approvals (FPAs) for use in HVHZs.

ForceFront entrance doors and storefronts protect building occupants and possessions from wind-borne projectiles and wind-driven rain. Combined with window and curtainwall systems under Wausau's single-source responsibility, these systems offer consistent color, coordination of deliveries, and strength of manufacturer's warranty.

E 44000 FORCEFRONT™ STORM

THERMAL CURTAINWALL IN VARIOUS SYSTEM DEPTHS

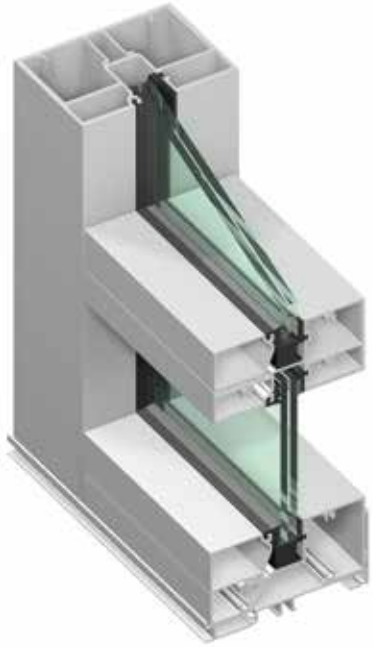
FL16766 FL16767

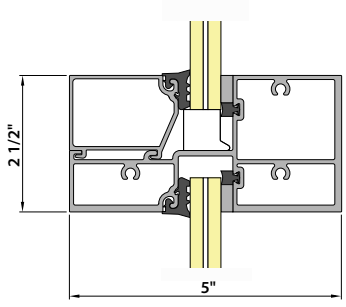
OVERVIEW

Tubelite E44000 Series Framing is a 2-1/2" by 5" flush-glazed storefront system for use on first floor, single-span applications in impact building code areas. This impact resistant screw-spline framing is designed to be glazed with 9/16" laminated glass positioned in the center of the frame. E44000 meets the requirements of HVHZ Wind Zone 4 - large missile impact [ASTM E1886-05/1996-09 TAS 201].

ForceFront Medium Stile Entrance Doors compliment the E44000 storefront system providing a complete impact resistant system that's easy to fabricate and install. These doors meet the requirements of Wind Zone 3 – large missile impact [ASTM E1886-05/1996-09] and passed the forced entry test [AAMA 1304-02].

E44000 is available with Tubelite's high recycled aluminum content of EcoLuminum®, and both the storefront and doors with the environmentally friendly anodizing and painting of Linetec.





FORCEFRONT™ STORM DOORS

MEDIUM STILE ENTRANCE DOORS FL16766

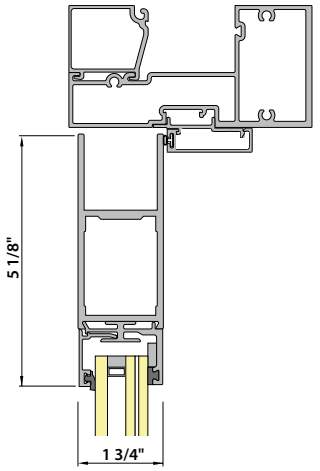
OVERVIEW

Tubelite ForceFront Medium Stile impact resistant entrance doors are rated for Wind Zone 2 – large and small missile impact [ASTM E1886-05/1996-09] and passed the forced entry test [AAMA 1304-02].

These 4" Medium Stile doors are glazed with 1-1/16" thick laminated insulated glass and are wet glazed on the interior side. Transom glass in all door frames are wet glazed.

Door frames are non-thermal, and are available with options for heavy-wall extrusions and steel reinforcing where required. Thresholds are equipped with bulb weatherseal gaskets and are ADA accessible.

Hinging hardware options include heavy-duty mortised butts and continuous gear hinges. Locking types can be concealed vertical rod panics or deadlocks.



CHERRY CAPITAL AIRPORT
Traverse City, Michigan
Reynolds, Smith and Hills Architects

NON-IMPACT STOREFRONT AND ENTRANCES

WAUSAU FLORIDA

Wausau's storefront and entrance systems are used all across America for single source responsibility. Combined with window and curtainwall, these systems offer consistent color, coordination of deliveries and strength of manufacturer's warranty. Wausau supports your sustainable design goals with energy-efficient, durable designs and high recycled content aluminum framing. Design and submission engineering support tools - like AutoCAD® .DWG details, test reports, samples, anchorage recommendations and installation instructions - help ensure prompt approval of your shop drawings and calculations; all available 24/7 at www.wausauwindow.com

T14000

2" X 4 ½" THERMAL AND NON-THERMAL STOREFRONT

FL16766

OVERVIEW

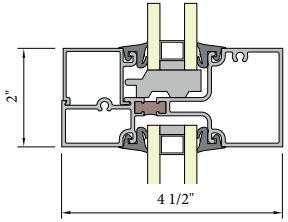
Glass or panels can be positioned to the inboard (I) or outboard (O) side of the 4-1/2" depth frame to achieve the look you imagine. Typical glass thickness is 1", and can be installed from the outside or inside of the building. Special glazing pocket reducers allow the use of 1/4" infill thicknesses, too.

14000 I/O Series Multiplane Storefront Framing thermal barrier insulates exterior surfaces from the interior to minimize temperature transfer. This provides industry accepted performance for CRF and Uc (conduction).

Using the same design, assembly and accessories as the 14000 center glazed system allows combining inboard, outboard and center planes of glass in the same elevation with the same great performance.

FEATURES

- 2" face width, 4 ½" frame depth
- Glass positioned in the center, front or back of the frame (14000 I/O)
- Dry glazed from the exterior, internally drained
- 0.075" frame extrusion wall thickness
- Adapters available for 1/4" glass
- For low- to mid-rise applications - ideal for entrance sidelites and transoms
- Insert vents, exterior sun shades and interior light shelves available
- Extruded aluminum contains recycled content averaging 70% or greater



ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.06 cfm/sqft at 6.24 psf	10 to 12 psf	0.60 to 0.63 BTU/hr.sqft.°F	53 to 56	32 26

Test results may vary


Gates

T14650

2" X 6 ½" THERMAL STOREFRONT FL16766

OVERVIEW

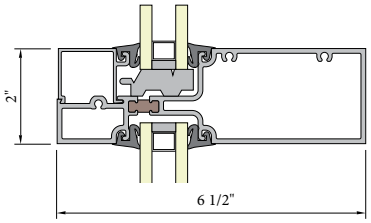
For optimal strength and thermal performance, use Wausau's 14000 Series Storefront Framing, a flush-glazed system for use on storefront and low-rise applications. Framing is available in standard thermally improved or non-thermal members with 2" by 4 1/2" profiles and a 1/2" bite for use with glass or panels up to 1" thick. Extra-heavy intermediate verticals are available for high performance against strong windloads.

Reduce project labor costs with the flexibility of inside or outside glazing. Members can be assembled using screw spline or clip joinery, and framing is compatible with Wausau Narrow, Medium and Wide Stile Doors.

Our 14000 Series Storefront products are subjected to thorough testing by an independent laboratory, ensuring that you get the highest quality storefront framing products that the industry has to offer.

FEATURES

- 2" face width, 6 ½" frame depth
- Glass positioned in the center, front or back of the frame (14000 I/O)
- Dry glazed from the exterior, internally drained
- 0.090" frame extrusion wall thickness
- Adapters available for 1/4" glass
- For low- to mid-rise applications - ideal for entrance sidelites and transoms
- Insert vents, exterior sun shades and interior light shelves available
- Extruded aluminum contains recycled content averaging 70% or greater



ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.06 cfm/sqft at 6.24 psf	10 to 12 psf	0.60 to 0.63 BTU/hr.sqft.°F	53 to 56	32 26

Test results may vary

STANDARD ALUMINUM ENTRANCES

NARROW, MEDIUM AND WIDE STILE

FL15766 FL15767

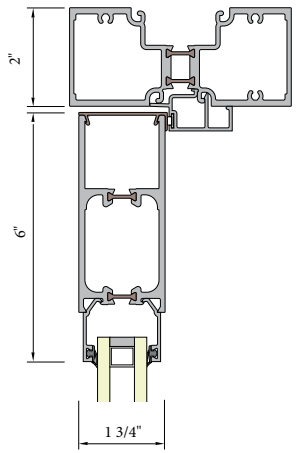
OVERVIEW

Wausau's range of standard aluminum entrances are designed for use in commercial, retail and institutional applications. Standard doors have exterior installation of glass or panels with the option of 4", 7 1/2" or 1" bottom rails for ADA compliance. The smooth design of Wausau's door hardware features a convenient pull handle and push bar with lock location 36" above the finished floor. Stock doors and frames are anodized with clear or dark bronze finishes, and readily available for quick delivery.

The strength and flexibility of steel tie-rod construction is what holds it all together and makes our doors endure. Tie-rod assembly is as durable as welded corner construction, but superior in many ways. Wausau doors can be modified, disassembled or resized right in the field. No other door design offers you this much strength and flexibility.

FEATURES

- 0.125" thick extrusions standard - 0.188" thick extrusions at monumental entrances
- Glazing adapters for 1" insulating glass
- Therml=Block™ entrances feature polyamide thermal barrier strips
- Dual-color finish option
- Custom door hardware applications available
- Extruded aluminum contains recycled content averaging 70% or greater


2"
6"
1 3/4"

200 STICK WALL

2" FACE CURTAINWALL IN VARIOUS DEPTHS

FL16767

OVERVIEW

The 200 series is an economical curtainwall system with a wide range of low- to mid-rise applications including atriums and clerestory. This exterior glazed pressure bar system with 2" face dimension is ideal for curving and compatible with all Tubelite entrances.

Snap-on cover finishes, available in a variety of colors, allow for contrasting interior and exterior finishes on exposed framing. Silicone glazed verticals can be selected to provide a sleek uninterrupted surface.

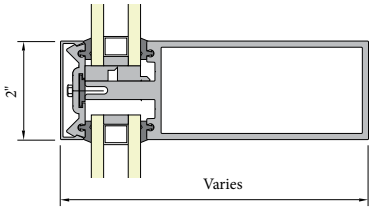
Both our 200 and 400 Series Curtainwall systems are subjected to rigorous testing by an independent agency, ensuring that you get the highest quality curtainwall products that the industry has to offer.

FEATURES

- 2" face width - frame depths up to 8"
- Continuous thermal isolators
- Exterior snap-on covers allow for different interior and exterior finishes
- Captured, vertical or horizontal structural glazed
- Insert vents, exterior sun shades and interior light shelves available
- Extruded aluminum contains recycled content averaging 70% or greater

ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.06 cfm/sqft at 6.24 psf	15 psf	0.66 to 0.67 BTU/hr.sqft.°F	66 to 68	32 26

Test results may vary


2"
Varies

400 STICK WALL

2 ½" FACE CURTAINWALL IN VARIOUS DEPTHS

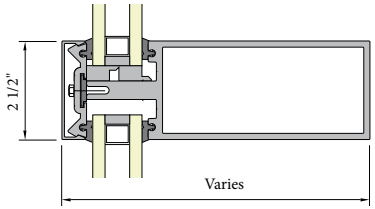
FL16767

OVERVIEW

Designed for low- and mid-rise applications, the durable framework of the 400 Series provides exceptional structural performance reducing the need for steel reinforcing. This system has a sightline of 2-1/2" and the strength of variable-depth backmembers from 4" to 8". An exterior screw-applied pressure bar secures the glass. Snap-on covers, available in a wide range of colors, allow for different finishes on interior and exterior exposed surfaces. Silicone glazed verticals are available for a seamless appearance.

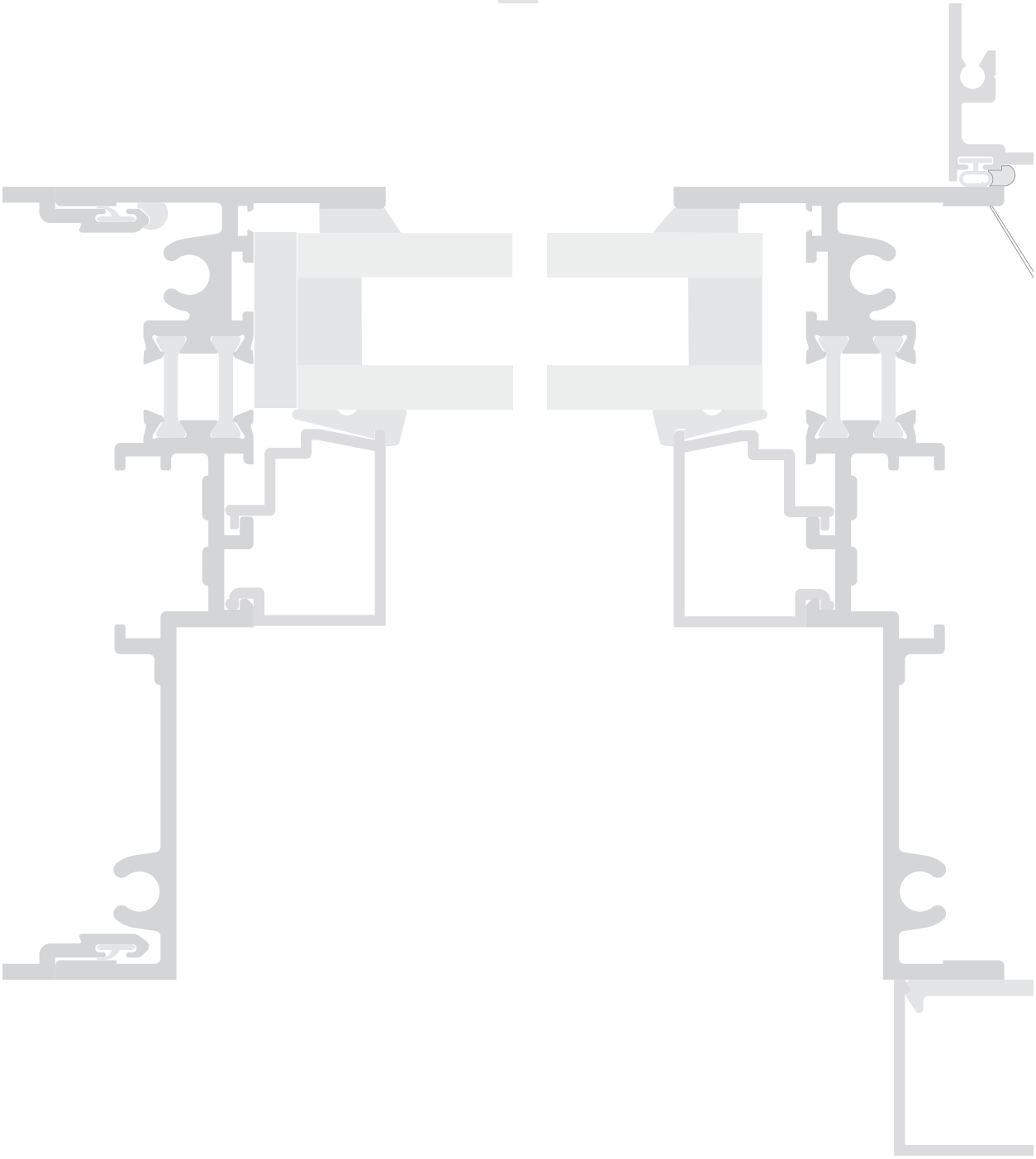
FEATURES

- 2 ½" face width - Frame depths up to 8"
- Continuous thermal isolators
- Exterior snap-on covers allow for different interior and exterior finishes
- Captured, vertical or horizontal structural glazed
- Insert vents, exterior sun shades and interior light shelves available
- Extruded aluminum contains recycled content averaging 70% or greater



ALLOWABLE AIR	WATER	NFRC U-FACTOR	CRF_F	STC OITC
0.06 cfm/sqft at 6.24 psf	15 psf	0.66 to 0.67 BTU/hr.sqft.°F	66 to 68	32 OITC 26

Test results may vary



PANNING, TRIM, MUNTINS AND SCREENS

WAUSAU FLORIDA

Each Wausau product family is available with a consistent group of accessories, coordinated and color-matched with windows and curtainwall, designed to minimize installation time, and help ensure field quality control.

PANNING

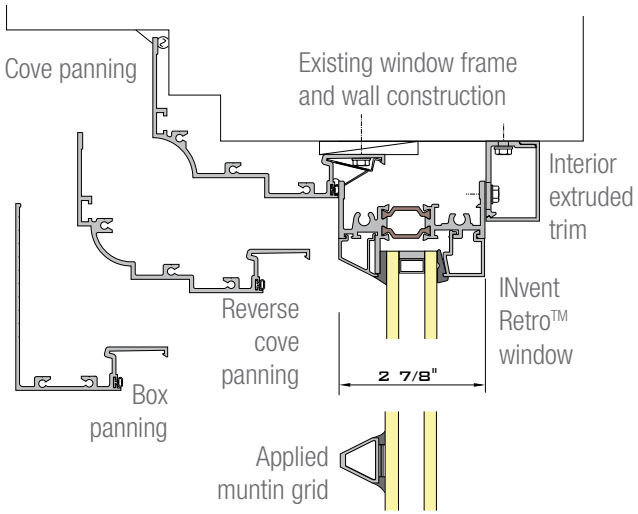
OVERVIEW

When replacing windows, removal of existing operable sash only, leaving frames in place, speeds installation and minimizes disruption. Extruded aluminum exterior “panning” prepares the opening, and extruded interior trim provides clean, finished appearance for occupants.

WINDOW REPLACEMENT PANNING AND MUNTIN GRIDS

Removal of existing operable sash only, leaving frames in place, speeds installation and minimizes disruption. Extruded aluminum “panning” prepares the opening.

Muntins are available as true divided lites, snap-in grids, glazed-in grids, silicone-applied or between-glass muntins.


Cove panning
Existing window frame
and wall construction
Interior
extruded
trim
INvent
Retro™
window
Reverse
cove
panning
2 7/8"
Box
panning
Applied
muntin grid

TRIM

OVERVIEW

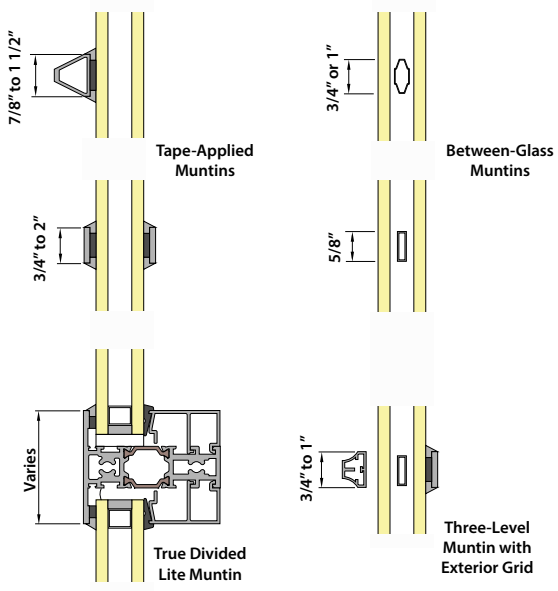
Trim includes receptors, anchors, caulk backers, extruded exterior sills or interior stools, as well as formed aluminum “brake metal” panels, column covers and closures. Wausau sizable inventory of pre-engineered trim designs helps ensure the right match for your project’s performance or installation needs.


8737
SCIENCE CENTER

MUNTINS

OVERVIEW

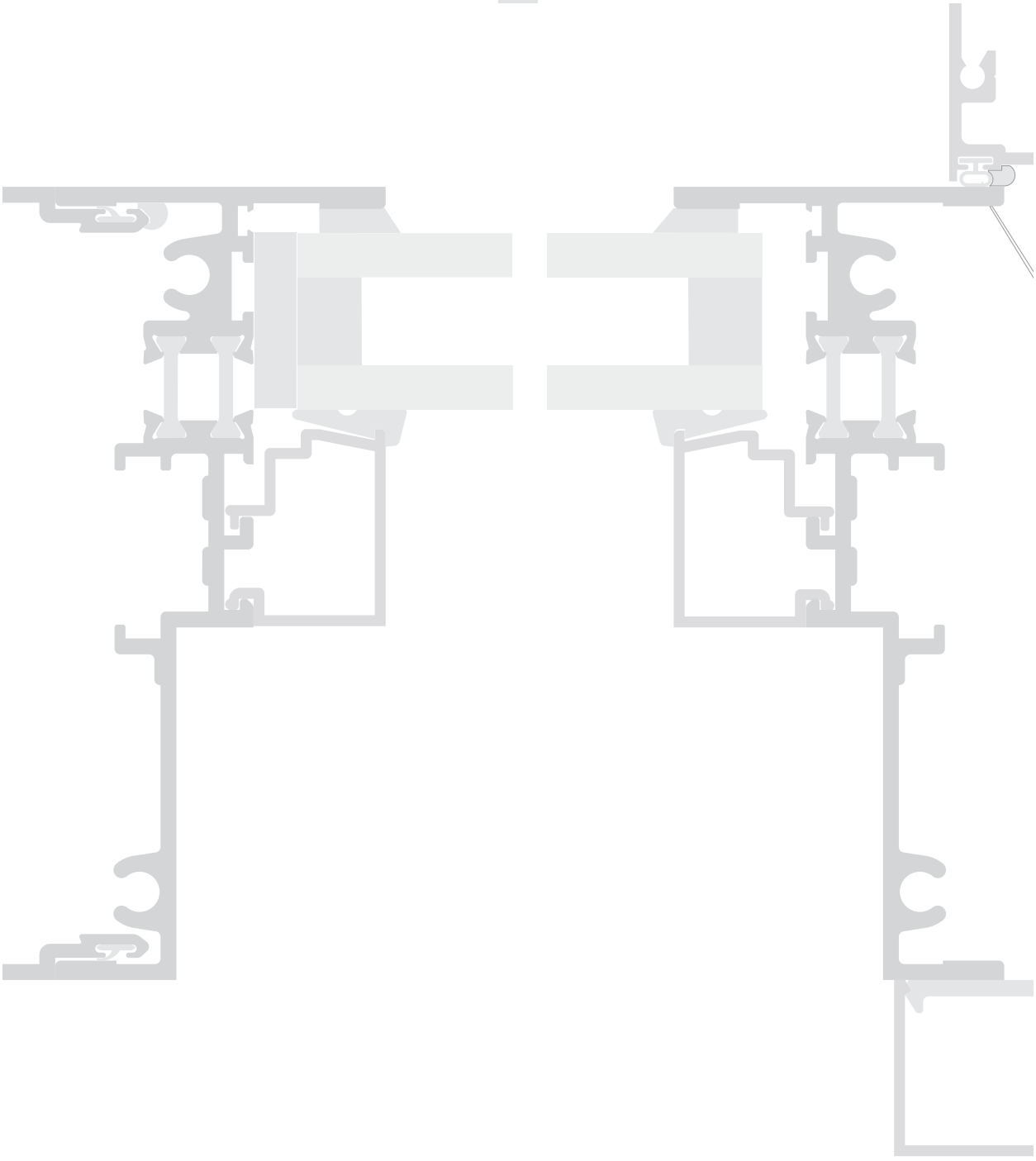
Muntins are available as true divided lites, snap-in grids, glazed-in grids, silicone-applied or between-glass, in a variety of shapes, sizes and spacings.



SCREENS

OVERVIEW

Aluminum or fiberglass mesh insect screens are interior- or exterior-mounted depending on direction of opening and window type, and can be fitted with sliding or hinged wicket doors for access to locking cam handles when necessary. A number of vandalism- and tamper-resistant options are available, including powder-coated stainless steel mesh. All Wausau screen frames are fabricated from extruded aluminum for crisp appearance and durability.



HARDWARE

WAUSAU FLORIDA

HARDWARE

EURO-STYLE LOCKING HANDLE

CAM HANDLE

RING CAM HANDLE

LIFT AND SLIDE LOCKING HANDLE

LINEAR OPERATION KEEPER LATCH

TERRACE DOOR VERONA HANDLE SET

SIGNATURE HANDLE

ROTO OPERATOR

BUTT HINGE

FOUR-BAR HINGE

FRICTION ADJUSTER

ACCESS DOOR LOCK AND TILT CONTROL

CONCEALED LOCK AND STRIKE

HURRICANE AND BLAST LOCKING PAWL

LIMITED OPENING DEVICE

MAMMOTH ROLLER

FINISHES

WAUSAU FLORIDA

FINISHES

WAUSAU PRODUCTS

OVERVIEW

Custom colors are no problem at Wausau, whether your job is large or small. Linetec's blending capabilities along with their Hunter Labs spectrophotometer let us respond to most requests in days, not weeks.

Wausau's Apogee sibling business unit, Linetec is the nation's largest independent high-performance architectural metals finishing company.

Linetec's services include Kynar 500® / Hylar 5000® coatings (Duranar, Fluropon, Trinar, Acroflur), baked enamel (Acrobond), and anodizing for extrusions, aluminum windows, curtainwall, storefront, entrance systems and architectural components.

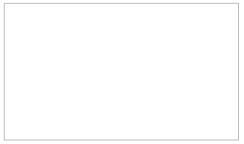
Beyond finishing Linetec offers thermal improvement services, including Azo-Brading™, stretch forming and wood grain finishes.

Linetec is also a registered AIA/CES provider. For more information, including color charts and green finishing information, visit www.linetec.com.

Please also view our Linetec Anodize and Linetec Paint Color Charts.

New from Wausau: Copper Anodize finish - The elegance of copper without the patina.

LINETEC STANDARD AND PREMIERE PAINT COLOR SELECTION


Bone White
LT609

Ivory
LT611

Sandstone
LT607

Burnt Sun
LT612


Sierra Tan
LT621


Beige
LT603


Light Seawolf Beige
LT614


Dove Gray
LT615


Slate Gray
LT604


Charcoal Gray
LT605


Patina Green
LT616


Dark Ivy
LT617


Hartford Green
LT606


Military Blue
LT610


Interslate Blue
LT623


Colonial Red
LT622


Boysenberry
LT608


Sage Brown
LT620


Quaker Bronze
LT602


Black
LT601

PREMIERE COLORS


Carnival Red II
LT728


Classic Copper
LT727


Champagne Pearl
LT728


Pewter
LT729


Silver
LT730

FINISHES

LINETEC ANODIZE-COLOR SELECTION

ANODIZING

Anodizing is the process of electrochemically accelerating and controlling the oxidation of an aluminum substrate, creating an extremely hard, durable and aesthetically pleasing coating on the aluminum. Architectural anodize finishes are limited to certain colors, however, their hardness and scratch-resistance far surpass that of paint coatings.

QUALITY

Our automated system controls and monitors your product through the entire anodizing process. It tracks all apsects of the process including tank sequecing, voltage, current, time and temperature, ensuring the most consistent anodize finish available.

CARE AND CLEANING

Anodized material has an extremely hard surface that is colorfast and mar resistant. An anodized finish should be cleaned using mild soap solutions to retain its original beauty. The cleaning solution should be applied with a soft cloth or alkaline cleaners. To avoid damage to the finish, anodized aluminum should be placed into walls after mortar has cured. Any uncured masonry product that is not immediately removed from the anodized aluminum will destroy the finish, sometimes beyond repair.

Linetec anodized finishes meet the AAMA 611 specification.

COPPER ANODIZED FINISH

- Bright copper color on aluminum components, with no patina over time
- Visually interesting depth and specularity in an all-natural finish
- Ideal for Southwestern- or historically-influenced design pallettes
- Three-step electrolytically-deposited AAMA 611 A44 Architectural Class I durability and warranty
- Superior abrasion resistance
- Matte finish non-caustic acid etching with no VOCs generated
- Available on extrusions with recycled content averaging 70% or greater
- No clear coat or periodic lacquer treatments required
- No run-off stains or galvanic corrosion from copper ions
- Can be applied to aluminum sheet or extrusions up to 24'
- No limits on shapes or quantities
- Like all Linetec anodized finishes, superior process control helps ensure industry-leading color consistency
- Economical and quick - no custom color-matching required

NON-CAUSTIC ANODIZED FINISH

Non-caustic anodizing improves surface quality, resulting in an aesthetically appealing, "frostier," matte finish, especially when finishing "secondary" extrusion billet.

All of Wausau's products are now fabricated using aluminum extrusions exclusively from secondary billet, containing recycled content averaging 70% or greater.

Non-caustic acid etch anodizing produces only one-tenth of the sludge of the traditional caustic etch process, sending 90% less waste to the landfill.

FINISHES

ANTIMICROBIAL PROTECTION

24/7 PROTECTION

Antimicrobial protection is infused into select Wausau 70% PVDF-based fluoropolymer product finishes provided by Linetec, helping to inhibit the growth of stain- and odor-causing bacteria that may affect the surface of the coating. It protects product finishes from microorganisms such as bacteria that may cause odor and deterioration of the physical properties of the coating.

WHERE IT'S USED

The antimicrobial product protection offered by Linetec in its finishes works continuously to help prevent the growth of damaging stain- and odor-causing bacteria on the coating of aluminum surfaces for such facilities as hospitals, schools or anywhere the growth of such microorganisms is a concern.

HOW IT WORKS

When moisture is present, the ion exchange mechanism in the antimicrobial finish is activated and silver cations are released. The released silver acts on odor-causing bacteria by disrupting metabolism and reproduction.

LASTING PERFORMANCE BACKED BY AN INDUSTRY LEADER

Utilizing the latest technology in antimicrobial PVDF-based finishes that meet stringent AAMA 2605 specifications, Linetec provides Wausau products with extra protection that exceeds that of other conventional finishes.

HOW TO SPECIFY

Call for, "PVDF-based, AAMA 2605, fluoropolymer finish containing minimum 70% Kynar® resin, three-coat system with antimicrobial protection, [insert paint color code]."

WIND LOAD CHART

WAUSAU FLORIDA

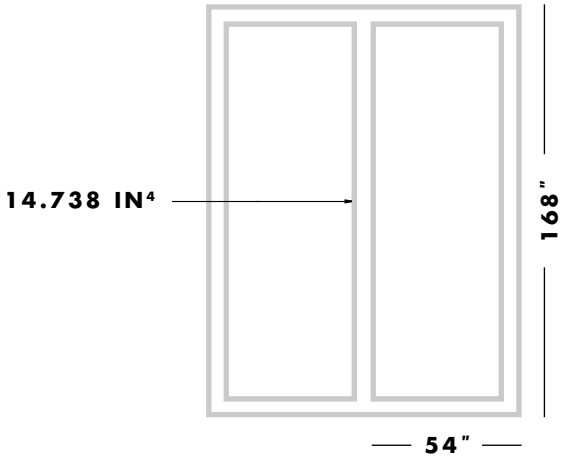
WIND LOAD CHART

Factors are for one psf windload. Multiply this factor by the actual windload to obtain a required "I" value.

Example:

To determine the "I" value for 54" mullion width, 168" mullion height, at 36 psf windload:

CALCULATE: (0.4094)* (36 PSF) = 14.738 IN⁴



Notes:

Trapezoidal loading used to mullions 84" or less.

Mullions over 168" are designed for L/240 + 1/4" allowable deflection. Mullions under 168" are designed for L/175 allowable deflection.
Based on E=10,000,000 psi (Aluminum)

ARCHTECTURAL WINDOWS AND WALLS - ALL SERIES
I-VALUE REQUIRED (IN4)

MULLION SPACING

MULLION HEIGHT INCHES	24	30	36	42	48	54	60	66	72
42	0.0025	0.0028	0.0031	0.0032	0.0036	0.0041	0.0045	0.0050	0.0054
48	0.0038	0.0045	0.005	0.0053	0.0054	0.0060	0.0067	0.0074	0.0081
54	0.0055	0.0066	0.0074	0.0081	0.0085	0.0086	0.0096	0.0105	0.0115
60	0.0077	0.0093	0.0106	0.0117	0.0125	0.0130	0.0131	0.0144	0.0158
66	0.0103	0.0125	0.0145	0.0161	0.0175	0.0184	0.0190	0.0192	0.0210
72	0.0136	0.0165	0.0192	0.0215	0.0235	0.0251	0.0263	0.0270	0.0272
78	0.0173	0.0212	0.0248	0.028	0.0308	0.0331	0.035	0.0364	0.0372
84	0.0218	0.0267	0.0313	0.0356	0.0393	0.0426	0.0454	0.0476	0.0491
90	0.0277	0.0346	0.0415	0.0484	0.0554	0.0623	0.0692	0.0761	0.0831
96	0.0336	0.0420	0.0504	0.0588	0.0672	0.0756	0.0840	0.0924	0.1008
102	0.0403	0.0504	0.0605	0.0705	0.0806	0.0907	0.1008	0.1108	0.1209
108	0.0478	0.0598	0.0718	0.0837	0.0957	0.1076	0.1196	0.1316	0.1435
114	0.0563	0.0703	0.0844	0.0985	0.1125	0.1266	0.1407	0.1547	0.1688
120	0.0656	0.082	0.0984	0.1148	0.1313	0.1477	0.1641	0.1805	0.1969
132	0.0873	0.1092	0.1310	0.1529	0.1747	0.1965	0.2184	0.2402	0.2620
144	0.1134	0.1418	0.1701	0.1985	0.2268	0.2552	0.2855	0.3319	0.3402
156	0.1428	0.1785	0.21425	0.2499	0.2856	0.3213	0.3570	0.3927	0.4284
168	0.1820	0.2275	0.2730	0.3184	0.3639	0.4094	0.4549	0.5004	0.5459
180	0.2278	0.2848	0.3417	0.3987	0.4556	0.5126	0.5695	0.6265	0.6834
192	0.2809	0.3511	0.4213	0.4915	0.5617	0.6320	0.7022	0.7724	0.8426
204	0.3417	0.4271	0.5125	0.5979	0.6834	0.7688	0.8542	0.9596	1.0250t
216	0.4108	0.5135	0.6162	0.7189	0.8216	0.9242	1.0269	0.1296	1.2323
228	0.4887	0.6109	0.7331	0.8552	0.9774	1.0996	1.2218	1.3439	1.4661
240	0.5760	0.7200	0.8640	1.0080	1.1520	1.2960	1.4400	1.5840	1.7280