

WINDOW WALL PRODUCTS AND APPLICATIONS



WAUSAU

WINDOW AND WALL
SYSTEMS



Franklin Tower Residences . Philadelphia, Pennsylvania . Gensler . PMC Property Group



Leverage the unique characteristics of window wall for your next mid-rise or high-rise residential, mixed-use or dormitory project. Wausau offers a full line of windows, curtainwall systems and storefront designed specifically for use in window wall applications.

Wausau's experienced technical design team optimizes structural integrity, weather-ability, energy efficiency, noise attenuation and aesthetics, to deliver time-tested products backed by a well-deserved 65-year reputation for reliability and workmanship.

WINDOW WALL VERSUS CURTAINWALL

A GUIDE TO PRODUCT SELECTION

The North American Fenestration Standard AAMA/WDMA/CSA 101/I.S.2/A440-17 (NAFS) defines “curtainwall” and “window wall” as:

Curtainwall: “A non-load bearing exterior wall cladding which is hung to the exterior of the building, usually spanning from floor to floor. *NOTE: Curtainwall can be factory-glazed or designed to accommodate field fabrication and glazing, including optional structural glazing - Anchorage is typically at verticals only.*”

Window Wall: “A non-load-bearing fenestration system provided in combination assemblies and composite units, including transparent vision panels and/or opaque glass or metal panels, which span from the top of a floor slab to the underside of the next higher floor slab. *NOTE: Window walls are available with separate or integral slab edge covers and can be fabricated from windows or curtain wall or storefront systems. Primary provision for anchorage occurs at head and sill conditions. Receptor systems can be designed as a part of drainage and movement accommodation provisions.*”

Window wall “rests” on the floor below, and expands in the same direction as interior finishes, for easy interfaces at door openings and balcony slabs. Shear walls and changes in sill height are straightforward. Window wall can be installed in any sequence.

Unitized curtainwall “hangs” from the floor above, and expands in the opposite direction of interior finishes. Challenging interfaces at door openings and balcony slabs are created. Shear walls and changes in sill height can be complex. Unitized curtainwall is best-installed in a sequential manner from the bottom of the wall upwards.

Window wall can be designed to look as much - or as little - like curtainwall as desired. Performance criteria are similar. The most significant technical differences are evident in the installation features of each product type, as shown below.

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Installation Feature	Unitized Curtainwall	Window Wall
Anchor quantity	One per mullion per floor	Two per mullion per floor*
Anchor location	Face- or top-of-slab	Top- and underside-of-slab*
Anchor type	Embed or masonry anchor	Embed or masonry anchor
Floor-to-floor span	Up to ~25 feet	Up to ~12 feet*
Installed from:	Interior or exterior	Interior or exterior
Sealed from:	Interior or exterior	Interior or exterior
Sequence	Bottom-up*	As required
Discontinuities	Special detailing required*	No special detailing required
Hoist bay leave outs	Special detailing required*	No special detailing required
Balcony/door integration	Differential movement issues	Consistent movement*
Vent integration	Requires frame inserts*	Integral vent frames
Perimeter fire and smoke	Safing and smoke seal	Slabs provide separation*

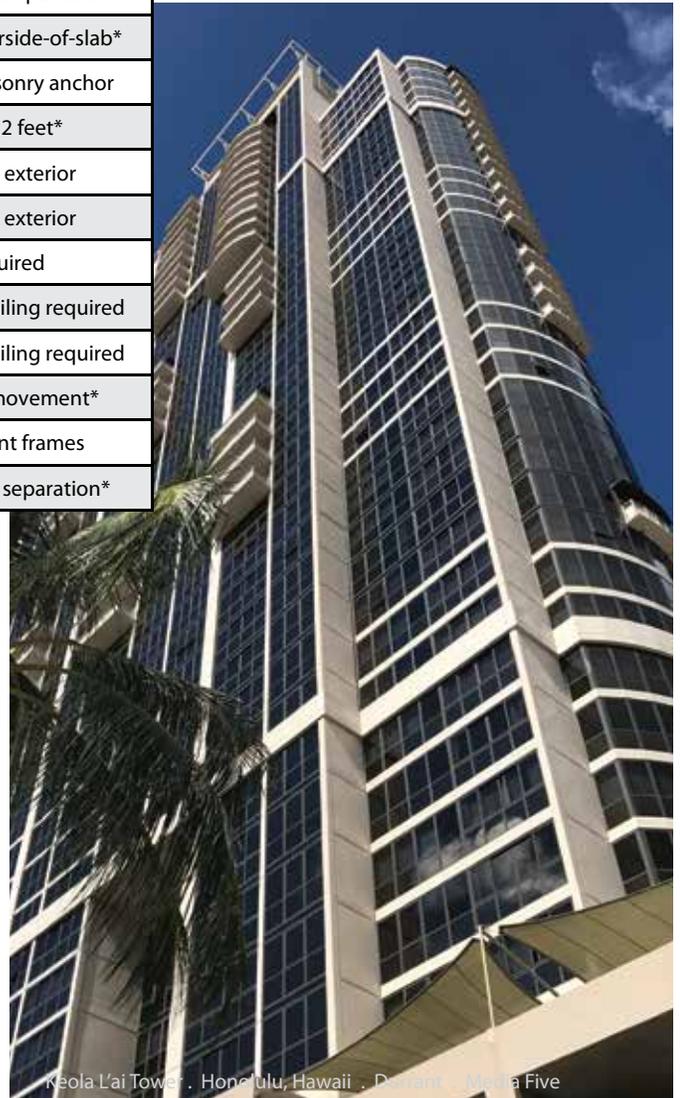
*Indicates installation features of SOTA HYBRID-WALL®

Window wall made from **window** systems - like Wausau’s INvent™ product family - looks more “residential,” with expressed interior glazing beads, and framing sightlines interrupted by offsets. Optional beveled or profiled glazing rebates are available, while vents are integrated into system framing. Structural silicone glazing (SSG) is generally unavailable

Window wall made from unitized **curtainwall** - like Wausau’s INvision™ product family - looks more “commercial,” with rectilinear mullion profiles interior and exterior, and glazed-in insert vents. “Chicken head” starters are used at slab conditions. SSG is optional.

Window wall made from **storefront** is generally suitable only for one- or two-story buildings.

For more information, request an online or in-person presentation of the Wausau AIA CES program, “Window Wall or Curtainwall - Selecting the Right System.”



Keola L'ai Tower . Honolulu, Hawaii . D. Grant . Media Five

SLAB COVERS

DESIGN FLEXIBILITY

Window wall slab covers may be fabricated from aluminum extrusions, formed aluminum sheet (pictured), rain screen metal panels, terra cotta or even glass. Customized configurations can reflect the creativity and imagination of the design professional. In certain climates, slab edges of steel or concrete may be left exposed for aesthetic effect, or to match balcony structure.

While sometimes post-installed from the building exterior, slab covers are most-often erected from the building interior, in sequence, floor-by-floor. Covers can extend above the slab for aesthetic effect or reduced U-Factor.

Window wall is more dependent on field sealing than unitized curtainwall. Window wall receptor systems are typically sealed at the interior and exterior at the head and sill. This creates four continuous lines of perimeter sealant at each floor slab. However, in most cases these sealant joints are concealed by interior and exterior trim, and are not subject to severe weathering or wear. In this way, the sealant's service life is extended.

FINISH OPTIONS

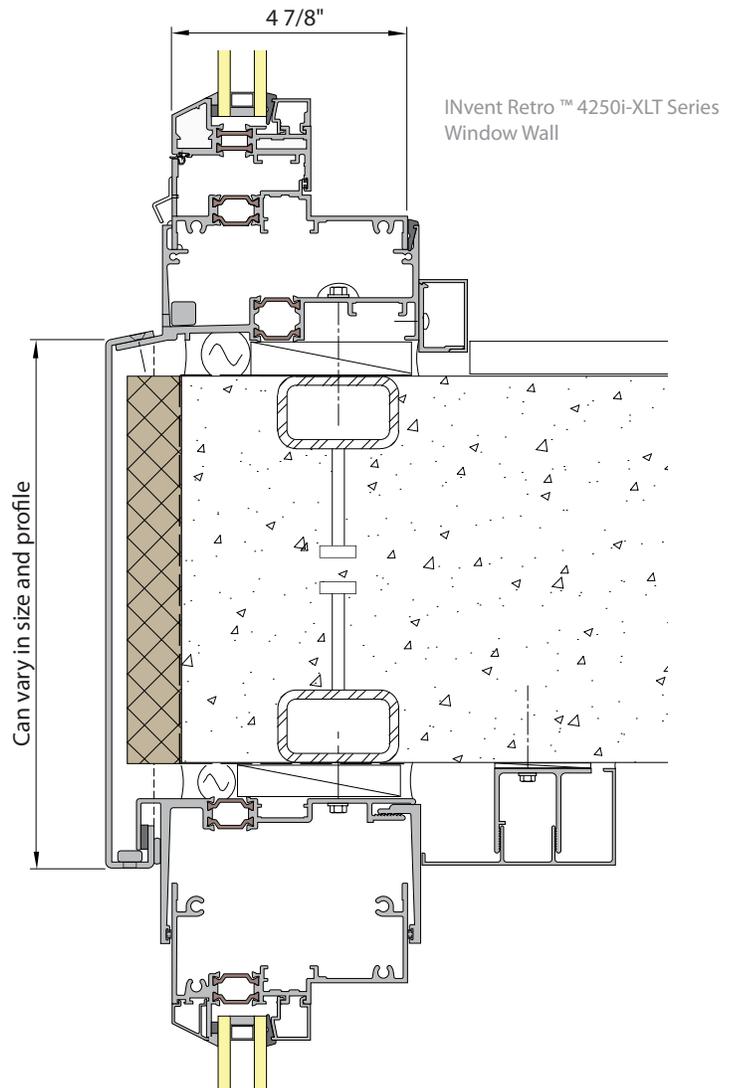
ANODIC OR ORGANIC

Custom colors are no problem, whether your project is large or small. Apogee sibling business unit Linetec, also based in Wausau, Wisconsin, is the nation's largest independent high-performance architectural metals finishing company. Linetec's in-house blending capabilities and Hunter Labs spectrophotometer help Wausau respond to most sample requests in days.

Linetec's services include Kynar 500® / Hylar 5000® coatings (Duranar, Fluoron, 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 Technoform polyamide thermal strut insertion, as well as poured-and-debridged polyurethane utilizing Azo-Brading™.



Visuline™ 4250i-V Series
Window Wall



THE INVENT™ PRODUCT FAMILY

FIXED AND OPERABLE ARCHITECTURAL WINDOW WALL

For window wall made from window systems, the Wausau INvent product family provides a **proven chassis** with the breadth of options necessary to meet the needs of design professionals nationwide. All INvent Series products are available in a variety of frame depths to optimize span versus wind load resistance, and are tested to meet stringent AAMA Architectural Window AW 100 Performance Class requirements. Fixed window wall is available with integral-frame operable vents; project-out (awning), project-in (hopper), in-swing casement or out-swing casement. Simulated double hung options are available in many Series. Polyamide thermal barriers are durable, energy-efficient and allow for different colors or finishes on interior and exterior frame surfaces.

- INvent** Wausau's flagship operable window line, using 14.7 mm polyamide thermal barrier
- INvent -XLT** Energy-efficient 24.0 mm polyamide thermal barrier, perfect for triple glazing
- INvent Retro™** Beveled, ogee, cove or square glazing rebates to echo the look of putty-glazed steel windows
- INvent -HP and -BHM** Hurricane impact-tested and blast hazard-mitigating fixed and operable windows
- INvent.PLUS™** European benchmark thermal performance, designed for US architectural preferences
- Custom Window™** Historically accurate products for tax credit-eligible National Register of Historic Places properties - Featuring true divided lite (TDL) muntins for high-fidelity replication

Receptors are vital components of window wall systems for movement accommodation, drainage, membrane interface and ease of installation. The INvent product family draws on a vast library of internally consistent and interchangeable high-performance head, sill and jamb receptors. Panning, anchors, sun shades and trim choices round out the accessory product offering.

Wausau designs and cuts more than 400 new extrusion profiles annually, to meet **project-specific customization** needs. The Wausau applications engineering team brings over 1000 years of combined experience to bear on unique design challenges.



The Murano · Philadelphia, Pennsylvania · Solomon Cordwell Buenz and Associates

INvent 2250i Series
Copper Anodized
Out-Swing Casement



Custom WIn dow 8300i
Historical Floating Vent
Window Wall with TDL
Muntins



INvent.PLUS 2250i-XP
Fixed and Project-In
Hopper Vent



The INVISION™ PRODUCT FAMILY

UNITIZED WINDOW WALL

For window wall made from curtainwall systems, the Wausau INvision product family provides a **proven chassis** with the breadth of options necessary to meet the needs of design professionals nationwide. All rain screen pressure-equalized INvision Series window wall products interface seamlessly with INvision unitized curtainwall, and are available in a variety of frame depths to optimize span versus wind load resistance, tested to meet the most stringent industry standards. Captured, two-sided or four-sided structural silicone glazing is available. Fixed window wall is available with Wausau 4250-Z Series zero-sightline operable vent inerts, in project-out (awning), or out-swing casement styles. Polyamide thermal barriers are durable, energy-efficient and allow for different colors or finishes on interior and exterior frame surfaces.

- 6250i-HR** A slim 2-1/2" face width unitized wall system, using 14.7 mm polyamide thermal barrier
- 6250i-HRX** A 2-1/2" face width unitized wall system, using energy-efficient 24.0 mm polyamide thermal barrier
- 7250-UW** A robust 3" face width thermally-improved unitized wall system for seismic zones
- 7250i-UW** 3" face width unitized wall system with two-level thermal barrier
- 8000i-BHM** Blast hazard-mitigating unitized window wall

Receptors are vital components of window wall systems for movement accommodation, drainage, membrane interface and ease of installation. The INvision product family draws on a vast library of internally consistent and interchangeable high-performance head, sill and jamb receptors. Anchors, sun shades and trim choices round out the accessory offering.

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CHOOSING BETWEEN STICK and UNITIZED WALL SYSTEMS		
Selection Criteria	Stick Wall	Unitized Wall
Project Size	Small	Large
Wall Configuration	Complex <small>(Many changes in plane)</small>	Repetitive <small>(Large expanses of flat wall)</small>
Joint Pattern	Random	Uniform horizontal sill line
Inter-story Movements	Very limited	Inter-locking frames <small>(Accommodate movements)</small>
Quality Control <small>Sealing and Glazing</small>	Subject to site variables <small>(Both environment and equipment)</small>	Factory conditions
Modification	Can be cut-to-fit	Pre-engineered
Field Labor Duration	Slow <small>(Many parts to track and assemble)</small>	Fast <small>(Often setting 75 sqft or more per unit)</small>
Access and Safety	Exterior access required	Set from the interior <small>(Exterior optional)</small>



INvision 6250i-HRX Sill Starter



INvision 7250i-UW Vertical Mullion

INVISION™ 950-SG

THERMAL UNITIZED WINDOW WALL

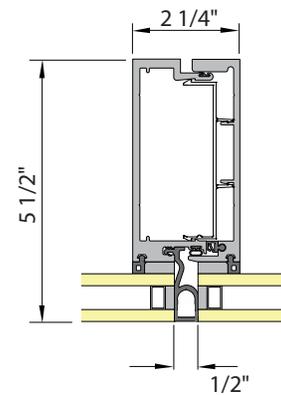
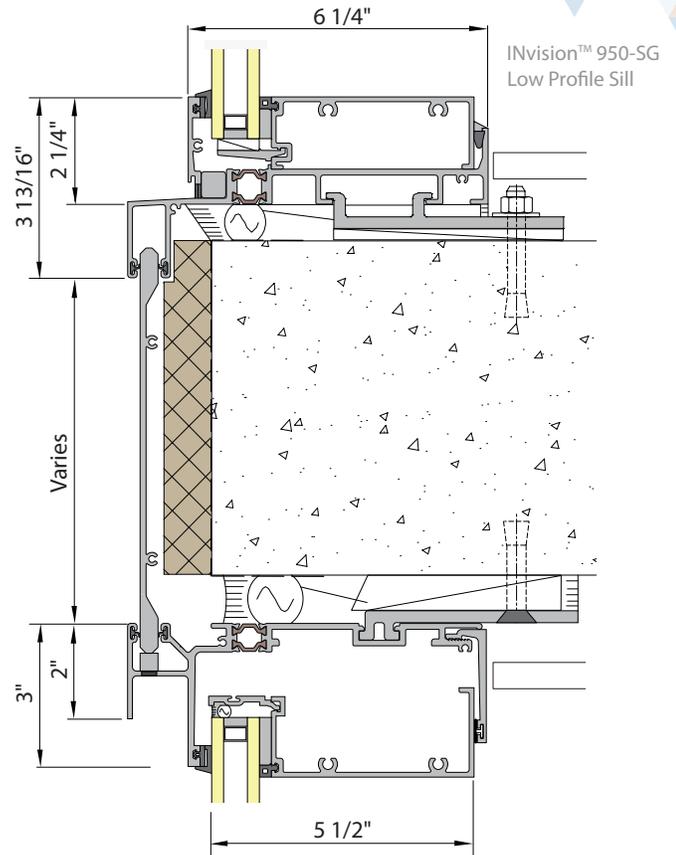
The newest addition to the Wausau INvision product family, 950-SG Series is an economical window wall system for low- and mid-rise buildings, where factory assembly and glazing is preferred. Complete AAMA 501 testing - including lateral drift and interstory movement accommodation - helps ensure long-term performance.

No exterior unit wet sealing is required by 950-SG's structural silicone-glazed, pressure-equalized, rain screen design. Polyamide thermal barriers are durable, energy-efficient and allow for different colors or finishes on interior and exterior frame surfaces.

Fixed window wall is available with Wausau 4250-Z Series zero-sightline operable vent inerts, in project-out (awning), or out-swing casement styles.

Receptor choices include captured "can" starters at head and sill, concealed "chicken head" sill starters, or starters incorporating integral slab cover receivers (pictured). Through-frame anchorage, slide-in extruded anchors, sun shade brackets and trim choices round out the accessory offering.

Wausau designs and cuts more than 400 new extrusion profiles annually, to meet **project-specific customization** needs. The Wausau applications engineering team brings 1000 years of combined experience to bear on unique design challenges.



Vantage Oak Park . Chicago, Illinois . Gensler

in.vision™
...unitized wall from Wausau...

WAUSAU SUPERWALL™ and HP-WALL™

FIELD-GLAZED WINDOW WALL

For more than 40 years, designers and subcontractors have trusted SuperWall systems for smooth, quick installation and worry-free, test-verified performance. Easy-to-fabricate screw-spline Wausau SuperWall can ship as fast **in any color** as it can in standard anodized finishes. Four complete systems in 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. The SuperWall product family includes a variety of exterior accent covers for aesthetic effect or solar heat gain reduction.

SuperWall A 2-1/2" or 3" face-width pressure wall system, using 9.5 mm EPDM thermal separators

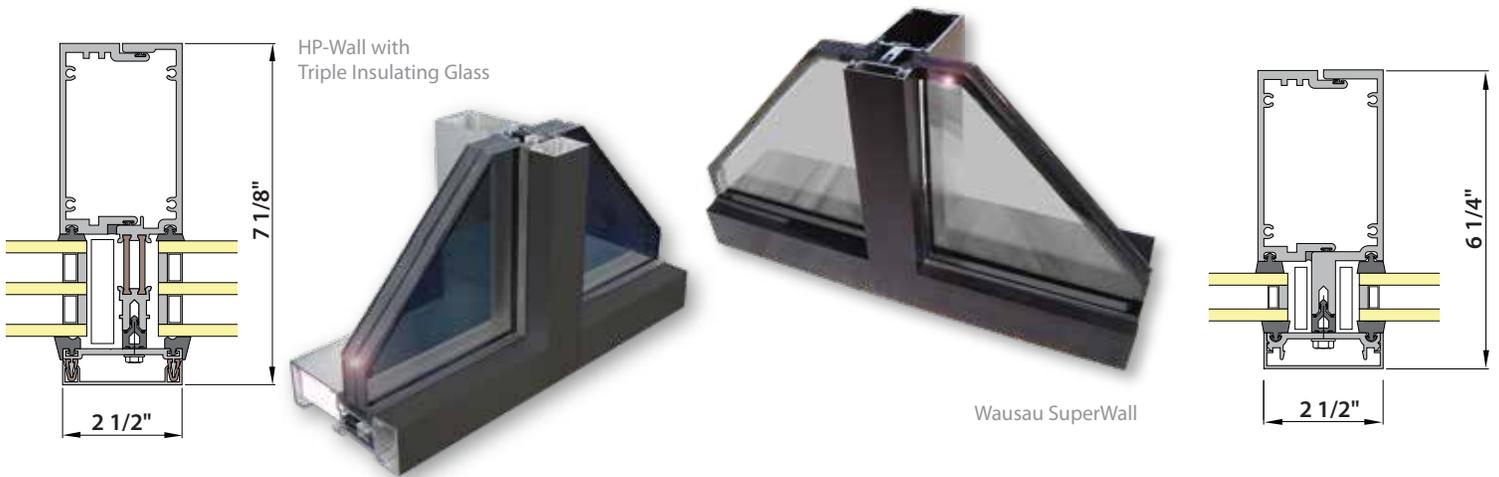
SuperWall -XLT Composite fiberglass pressure plates improve U-Factor and condensation resistance

SuperWall -BHM Verified systems to meet your projects' protective glazing requirements

SuperWall -SSG Four-side silicone structurally-glazed cassettes create dramatic entrance atria - sleek, modern, reflective glass facades - or open, transparent, low-rise envelope solutions

HP-Wall Multi-level thermal separation for the best in energy efficiency - Perfect for triple glazing

When you need it fast and you need it right, Wausau's SuperWall systems are ideally suited to meet accelerated construction timelines for low- and mid-rise buildings.

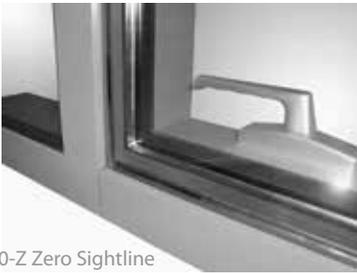


OPERABLE WINDOWS AND INSERT VENTS FOR NATURAL VENTILATION

Operable windows can be part of an effective natural ventilation strategy, when applied using the recommendations in the Carbon Trust “Good Practice Guide 237” and ASHRAE 62.1, or as required by code. Wausau structurally glazed, operable window products such as INvent™ Series 4250i-VX, Visuline™ Series, and Zero-Sightline Series can provide “no-sag” performance even for oversized vents. When residents prefer to open their windows for natural ventilation, projected windows are easier to open than sliding or hung windows, and eliminate counter-balances, requiring continual maintenance, especially in large sizes with heavy glass.

Awning vents and out-swing casement windows should be used on upper floors of high-rise buildings only in conjunction with robust limited opening devices. Project-in hoppers and in-swing casements, also fitted with limited opening devices, are usually a better choice for high-rise applications, but are unavailable as zero-sightline vent inserts. FGIA is developing an open vent test method to help ensure vent safety, even if facility managers’ monitoring systems fail to alert occupants that windows have been unintentionally left unlatched in a wind event. Operable windows used for cleaning access to exterior glass surfaces may be required by local code to incorporate drop-tested window washer belt anchors.

For more information on operable window selection and specification, check out the online Wausau AIA CES program, “Window Selection for Sustainability and Long-Term Performance.”



4250-Z Zero Sightline
Awning Vent



INvent Retro
Copper Anodized
Awning Vent



INvent -XLT
Awning Vent



ADA ACCESSIBILITY FOR OPERABLE WINDOWS

Help ensure that fresh air and a connection with the outdoors are made accessible to people with physical disabilities, by specifying windows and window hardware meeting the operating force and limited motion requirements of ICC/ANSI A117.1. Wausau’s accessible projected windows are laboratory-proven capable of operating with one hand using a force of five pounds or less, to unlock, open, close, and lock, without tight grasping, pinching or twisting of the wrist, when tested in accordance with AAMA 513, “Standard Laboratory Test Method for Determination of Forces and Motions Required to Activate Operable Parts of Windows and Doors in Accessible Spaces.”



Greenpoint Landing . Brooklyn, New York . Handel Architects

CROSSTRAK™ SLIDING DOORS, TERRACE DOORS and ENTRANCES

INTEGRATED SOLUTIONS

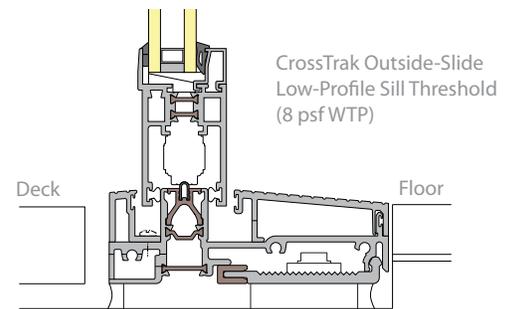
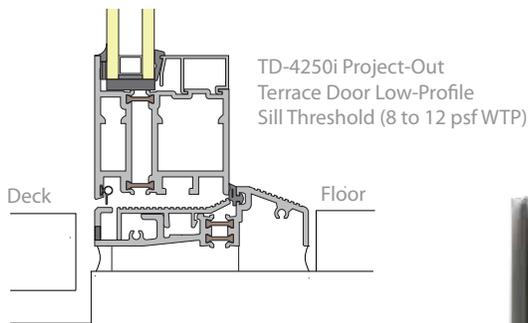
CrossTrak™ Euro lift-and-slide or conventional sliding glass doors move in the plane of the wall, and are designed for high-rise air, water and structural performance, meeting stringent AAMA AW Performance Class requirements. Polyamide thermal barriers improve energy efficiency and facilitate two-color finishing. Two-track designs offer an open area of up to 50%, and are available as inside-slide for Juliet balconies (pictured) or outside-slide using low-profile improved-access sill detailing for easier passage. Water test pressure (WTP) varies with configuration.

Wausau **TD-4250i Series Terrace Doors** are side-hinged, and designed for high-rise air, water and structural performance. Single leaf and French astragal options are available, all meeting AAMA AW Performance Class requirements. Improved-access sill threshold detailing complies with ANSI A117.1 and the Fair Housing Act.

Ask for integrated balcony doors that are side-stacking with window wall systems, for matching runs of framing and accessories, single source responsibility, one warranty and one finisher, as well as one set of shop drawings and calculations for review and coordination.

Storefront doors, like the unique Wausau **EN-8300i Series Historical Entrances** with true divided lite muntins, or standard medium stile doors, meet most designers' size expectations and are durable and adjustable, accepting a broad range of hardware. However, performance of aluminum entrances is suitable only for low-rise applications, and they are properly used only where well-protected from the elements.

Door closers are always a good idea on swinging doors, in case of unexpected wind gusts on doors left unlocked or unlatched in severe weather events. For more information check out the online Wausau AIA CES program, *"Balcony Door Systems."*



TD-4250i Project-In Terrace Door

CrossTrak Inside-Slide XO Lift-and Slide Door with Glazed Juliet Rail

EN-8300i Historical Entrance Door

Standard Medium Stile Entrance Door



With properly designed building conditions and correct installation, improved access sill component profiles will meet ADA accessibility criteria per Fair Housing Act Regulations, 24 CFR 100.205 Chapter 4, "Thresholds and Accessibility Routes at Exterior Doors." However, Wausau makes no claim relative to ANSI A117.1 compliance of the total door installation, including but not limited to, clear width, hardware, approach area, reach, force(s), motion, etc. It is the sole responsibility of the building's Architect or Engineer of Record to verify compliance of the total installation. Wausau takes no responsibility for acceptance by authorities having jurisdiction.

STOREFRONT SYSTEMS LOW-RISE FIELD-GLAZED

Storefront systems may be an option for budget-conscious low-rise window wall projects with modest performance requirements, and where exterior access for periodic maintenance is expected.

Wausau teams up with Apogee sibling business unit Tubelite, based in Walker, Michigan, to jointly offer fast delivery of attractive, easy-to-install, durable storefront and entrances.

Tubelite offers a variety of tools for easy-to-estimate projects, a full but streamlined product line, and delivery on "Damage-Free-Guarantee" company trucks.

Tubelite 14000 Series
Storefront Framing



2400 Market Street . Philadelphia, Pennsylvania . Gensler

WAUSAU CLEARSTORY™ SUN SHADES

Control solar heat gain to meet sustainable design goals, increasing Projection Factor and decreasing solar cut-off angles while adding visual interest.

Wausau offers a variety of pre-engineered configurations - extended snap-on covers, extruded blades, perforated sheet, "catwalk" grids or solid shading. Modular design and integral alignment features facilitate ease of installation. Vertical sun shades are available for East and West facades.

Optima Camelview Village . Scottsdale, Arizona . David C. Hovey



ENERGY EFFICIENCY

U-FACTOR AND CONDENSATION RESISTANCE

Energy-efficiency is a key design criteria for all buildings, whether utilizing window wall or curtainwall. There is little inherent difference in energy efficiency between window wall systems and unitized curtainwall systems, all other things being equal. However, thermal performance varies considerably based on glass selection, thermal barrier design features, air leakage and the potential for thermal bridging.

THERMAL PERFORMANCE – WINDOW WALL Sealed Double Insulating Glass Units (IGUs)				
System	Viracon Glass Type	Performance		
		U-Factor (BTU/hr.sqft.degF)	SHGC	VT
INvent™ 4250i –XLT Fixed	1/4" VNE1-63 exterior 1/2" VTS spacer 90% argon fill 1/4" clear interior (Captured glazing unless noted)	0.36	0.25	53%
INvent™ 4250i –XLT PI Vent		0.46	0.21	39%
INvision™ 6250i –HRX		0.33	0.25	54%
INvision™ 950 –SG		0.33	0.26	54%
4250-Z Zero Sightline Vent		0.40	0.25	50%
Terrace Door TD-4250i		0.49	0.20	38%
5250i CrossTrak™		0.41	0.23	38%

NOTES on THERMAL PERFORMANCE:

All thermal modeling should be considered ± 0.03 BTU/hr.sqft.degF per NFRC 100 validation testing criteria.

Overall system U-Factors given in BTU/hr.sqft.degF. NFRC 100 standard sizes used for window wall (79" x 79") and operable vents (24" x 59").

Condensation resistance varies with substrates in the high-rise residential "critical occupancy." (Refer to AAMA 515) No fourth-surface low-e options are given due to condensation concerns in this occupancy.

Archival test reports, CMA database frame assemblies, and project-specific modeling available from Wausau.



ACOUSTIC PERFORMANCE

STC AND OITC

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 wall 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.

REPRESENTATIVE ACOUSTIC TEST RESULTS – WINDOW WALL and CURTAINWALL Sealed Double Insulating Glass Units (IGUs)					
Nominal Glass Size	IGU Make-Up			Performance	
	Layer 1	Air Space	Layer 2	OITC	STC
37' x 78' Per ASTM E1425	1/4"	1/2"	1/4"	26	31
	5/16"	1"	1/4"	30	38
	5/16"	1/2"	3/8"	32	37
	1/4"	1/2"	7/16" laminated	32	39
	5/16"	1/2"	7/16" laminated	33	39
	1/4"	1/2"	9/16" laminated	33	39
	5/16"	1/2"	9/16" laminated	34	39

NOTES on ACOUSTIC TEST RESULTS:

All acoustic test results should be considered ± 2 dBA per ASTM E 90.

Tests were conducted on a variety of fixed and operable window wall framing systems. Framing type has no appreciable effect on OITC, if relatively airtight and providing rigid glass support.

Gas fill, heat treatment, interlayer type and nominal increase in sealed air space depth have little effect on OITC.

Expect improved performance if maximum non-laminated glass lite size is smaller than indicated, if access doors are added, and when using triple insulating glass.

Many more archival test reports available from Wausau.

THE WAUSAU VALUE PROPOSITION

CAPABILITY . CAPACITY . QUALITY

Wausau supports visionary design and accelerated construction timelines, within budget, backed by significant manufacturing capacity and an experienced in-house technical team, offering a standard limited warranty of up to 10 years.

BUILDING INFORMATION MODELING (BIM) AND RAPID PROTOTYPING

Wausau offers architects, engineers and designers Revit® models and 2-D drawings of its most popular window and curtainwall systems, available as easy downloads from each Wausau product's website landing page. Many product models are parametric, offering real-time size and configuration control. A "Revit® Guide" users' manual accompanies each download.

The Wausau website's unique "Download Cart" functionality allows users to bundle multiple file types and products into a compact ZIP file, and share with any email recipient. Available technical information includes:

DWG and PDF product details	DOC guide specifications	Revit® files
Product literature	Technical guides	Finishes
Project case studies	Warranty	Hardware

Hands-on evaluation of new extrusion die profiles and joinery is facilitated by Wausau's in-house 3-D printed rapid prototyping capabilities.



SUSTAINABILITY LEADING BY EXAMPLE

Wausau Window and Wall systems' primary manufacturing center (pictured below), was opened in September 2008, and has been certified Silver through the USGBC LEED® Green Building Rating System™. Wausau's products and services may contribute in a number of Credit Categories in "LEED v4.0 and v4.1 for Building Design and Construction:"

Integrative Process (IP)	Energy and Atmosphere (EA)	Materials and Resources (MR)
Indoor Environmental Quality (EQ)	Innovation and Design Process (ID)	



Wausau Manufacturing Center . Somerville Architects



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