



WAUSAU

WINDOW AND WALL
SYSTEMS

WWW.WAUSAUWINDOW.COM

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ACOUSTIC PERFORMANCE

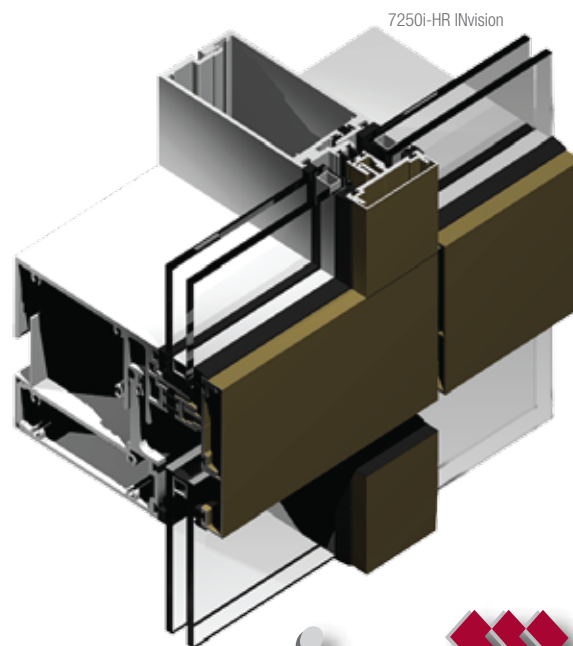
OF WINDOWS AND CURTAINWALL



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.

WHETHER THE DESIGN GOAL IS BASIC CODE COMPLIANCE OR A
HIGHER LEVEL OF COMFORT FOR OCCUPANTS, WAUSAU'S
 WINDOW AND CURTAINWALL SYSTEMS HELP ENSURE PEACE AND QUIET.



INvent (pictured below)
 INvent -XLT
 INvent Retro
 INvent Simulated Double-Hung
 INvent.PLUS™
 INvent -HP Hurricane
 INvent -BHM Blast Hazard



CODES AND REGULATIONS

New York City closely regulates zoning changes on sites that are subject to environmental factors, including unacceptable noise levels. Extensive study has shown Outdoor-Indoor Transmission Class (OITC) to be the appropriate measurement parameter in defining requirements for windows and curtainwall.

Noise Attenuation Requirements - Residential Dwellings and Community Facilities					
New York City Department of Environmental Protection					
June 2012					
Vehicular Noise Level	$70 < L_{10} \leq 73$	$73 < L_{10} \leq 76$	$76 < L_{10} \leq 78$	$78 < L_{10} \leq 80$	$80 < L_{10}$
Required Attenuation	(I) 28 dBA	(II) 31 dBA	(III) 33 dBA	(IV) 35 dBA	$36 + (L_{10} - 80)$ dBA
Required attenuation applies to composite window-wall assemblies based on OITC values of individual components. Vision areas usually represent the controlling value. Commercial office spaces and meeting rooms require attenuation 5 dBA less in each category. Alternative ventilation may be required, since attenuation necessitates operating windows in the closed position. L_{10} represents the sound pressure level that is exceeded for 10% of the measurement period.					

California Title 24 requires buildings that provide habitable space be designed to ensure that interior noise levels do not exceed 45 dBA, if sited where day-night average sound level (L_{dn}) is more than 60 dB. For these applications, window and curtainwall performance must be considered in expert acoustical analysis during permitting.

Befitting the therapeutic environment, LEED® for Healthcare awards up to two points for EQ Credit 2: "Acoustic Environment: Exterior Noise, Acoustical Finishes and Room Noise Levels" after rigorous determination of exterior noise levels, acoustic design of the total building envelope, and measurement of "as-built" sound pressure levels. LEED for Schools EQ Prerequisite 3: "Minimum Acoustical Performance" can be met by complying with American National Standards Institute's Standard S12.60-2002.

Other acoustical requirements may apply to buildings of various occupancies under the jurisdiction of the International Green Building Code, the U.S. Department of Housing and Urban Development, or the U.S. Federal Aviation Administration, among other authorities.

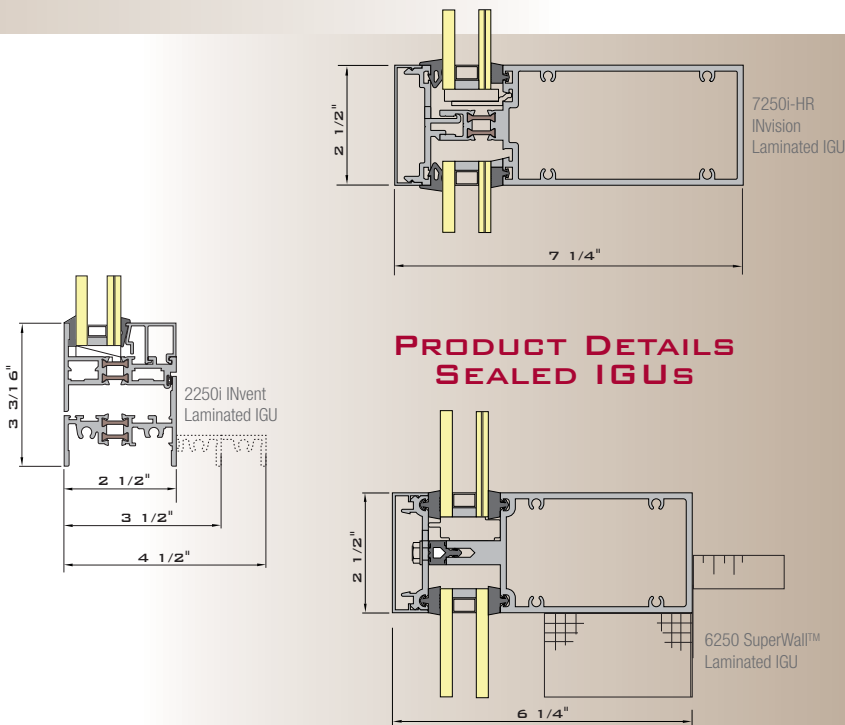
SEALED INSULATING GLASS UNITS

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	1/4 Lami 3/8 Lami 0.030	40	32

Test results may vary

Disclaimer: Due to test-to-test variations, Wausau typically bases proposals on the acceptance of existing test reports as proof of compliance to acoustical performance specifications for previously tested frame/glass combinations. Wausau can make no acoustical performance guarantees relative to results of project-specific testing if required. Neither can Wausau can make guarantees regarding acoustical performance of untested frame/glass combinations. Refer to FAQs herein for further clarification.

ACOUSTIC TEST RESULTS



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Download details, specifications and product performance information.

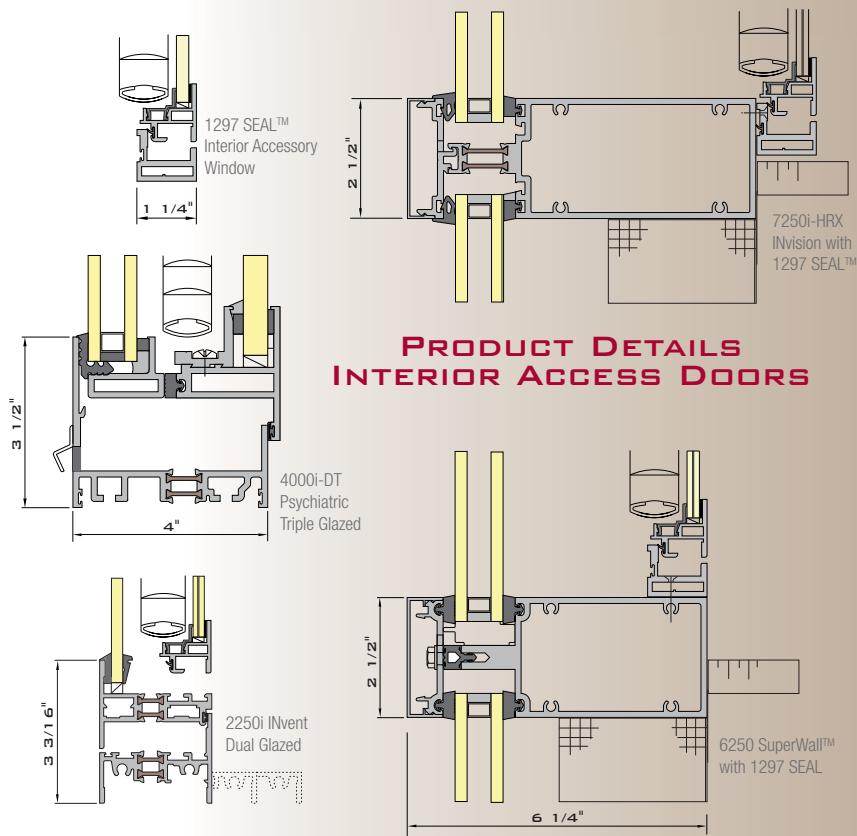
INTERIOR ACCESS DOORS

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 x 72	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
Triple Glazed with Access Doors	2250 Series Fixed over Project-Out	2	48 x 72	1/4 -1/2- 1/4 IGU	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
	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- 7/16L 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



ST RESULTS



PRODUCT DETAILS
INTERIOR ACCESS DOORS



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 specific frequency. For STC or OITC testing, a Transmission Loss 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 specified 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:

$$\text{OITC} = 100.14 - 10 \log \sum_i 10^{((L_i - TL_i + A_i)/10)} \text{ (dBA)}$$

Where: L_i = reference source spectrum,
 A_i = A-weighting adjustment, and
 TL_i = 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).

ACOUSTIC FAQs

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 significant 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.

Wausau's extruded aluminum frames contain recycled content averaging 70% or greater.



WAUSAU

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