TECHNOTES

Meeting Window and Door Building Code Requirements

ICC
INTERNATIONAL CODE COUNCIL

IBC
COMMERCIAL
INTERNATIONAL BUILDING CODE

IRC
RESIDENTIAL
INTERNATIONAL RESIDENTIAL CODE

IECC
ENERGY
INTERNATIONAL ENERGY CONSERVATION CODE

The intent of this Technote is to provide an overview of applicable window and door building code requirements referenced in the International Building Code (IBC), International Residential Code (IRC), and International Energy Conservation Code (IECC). We start with a basic explanation of the Wind Design Criteria and Estimating Design Pressure requirements for a project, which is applicable to both residential and commercial building codes. Following that the Technote is broken into separate sections for residential, commercial, and energy conservation. Please note that this Technote is provided for educational purposes, and it is the responsibility of the Project Architect, General Contractor, and Pella Distributor to refer to state and local building codes or discuss code requirements with a local building code official to confirm specific project requirements. Be advised that local building code restrictions can be more stringent than the IRC, IBC, and IECC.

Wind Design Criteria and Estimating Design Pressure (IBC and IRC)

Both residential and commercial building codes require that window and door products and their mullions meet a buildings structural design pressure (DP) requirements (per ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures), and a buildings design pressure requirements are to be confirmed by the Project Design Professional or a local building code official. Estimating design pressure and mullion reinforcement requirements for projects is a service commonly provided by Pella Architectural Solutions (PAS); however, for those so trained or more ambitious the following ***link*** takes you to the Sales Tools in PERL where a design pressure and mullion calculator is available for use.

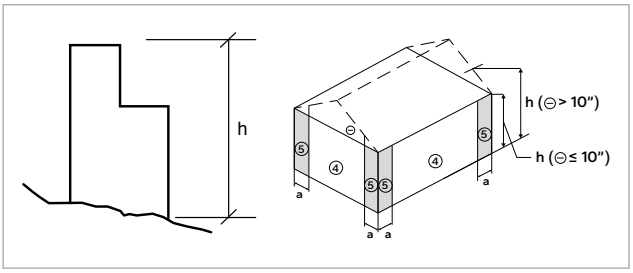
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Note the following when establishing design pressure requirements for a project:

- The Wind Design Criteria for estimating design pressure on a project is commonly found on the first page(s) of the structural Drawings on a project and should be used when available. The Wind Design Criteria found in the structural Drawings will generally include Risk Category, Design Wind Speed, and Exposure Category at a minimum. If this criteria is unavailable there are tabs in the design pressure and mullion calculator that provide descriptions of each for reference.
- The Design Pressure requirements for windows and doors on a project are the Allowable Stress Design pressures, which are obtained by multiplying the Ultimate design pressure by 0.6 per the building code and align with WDMA/AAMA standards and the NAFS performance rating system (See Figure 1 below).

Design Pressure Calculation

State	ASCE 7-16	
Building Code (By State)	ASCE 7-16	–
Mean Roof Height – h (ft.)	59.0	
Risk Category	IV	
Design Wind Speed (MPH)	121 (Ult.)	94 (ASD)
Exposure Category	B	
Topographical Factor	1	
Wind Zone Classification	Not Applicable	
Ground Elevation & Ke Factor	738 ft.	0.974



Components and Cladding Design Pressures (PSF)				
Square Feet	Ultimate		Allowable (ASD)	
	Zone 4	Zone 5	Zone 4	Zone 5
10	+31.0/-33.6	+31.0/-41.7	+18.6/-20.2	+18.6/-25.0
20	+29.6/-32.2	+29.6/-38.9	+17.8/-19.3	+17.8/-23.3
50	+27.7/-30.4	+27.7/-35.1	+16.6/-18.2	+16.6/-21.1
100	+26.3/-29.0	+26.3/-32.3	+15.8/-17.4	+15.8/-19.4
200	+24.9/-27.6	+24.9/-29.4	+15.0/-16.5	+15.0/-17.6

The proposed windows and doors comply with the design pressures shown unless noted otherwise. Allowable Stress Design (ASD) pressures were obtained by multiplying the Ultimate design pressures (ULT.) by 0.6 per IBC section 1609. ASD pressures align with wDMA/AAMA standards and the NAFS performance rating system. Please confirm these design pressures with the structural engineer or building official.

Building Length (ft.)	80.0
Building Width (ft.)	54.0
Building Height (ft.)	59.0
Wall Zone 5 - a (ft.)	5.4

Figure 1: Example of design pressure calculation where filling in the table on the left results in estimated Component and Cladding Design Pressure requirements for a project in the table on the right (use Allowable Stress Design estimated pressures highlighted in yellow above).

Note: Window and door products with AAMA/WDMA/NAFS certified performance ratings are recognized by the IRC and IBC. The Performance Grade (PG) component of certified ratings represent the overall air, water, and structural performance of a product. When a product is not certified for performance then it is required by code that it be engineered to meet the minimum design pressure (DP) requirements of the building. This includes a deflection criteria for the edge of glass at L/175, which is a bending requirement involving glass thickness or strength in compliance with ASTM E 330.

Limited Opening, Fall Protection, Egress, and Safety Glazing Design Parameters for Residential Construction
(Single Family Homes, Duplexes, and Town Homes)

IRC RESIDENTIAL
INTERNATIONAL RESIDENTIAL CODE

Minimum window sill heights:

Window sills more than 6 feet above exterior grade:

- 24" minimum window sill height above finished floor

Exception: Windows with 4" limited opening devices or window guards

Window fall protection (Window Opening Control Devices & limited opening devices):

Required when all of the following conditions occur:

- Window is operable
- Top of window sill is less than 24" above finished floor
- Top of window sill is more than 72" above finished grade

Note: The Pella limited opening device cannot be installed in a window opening that is required for emergency escape or rescue.

Window requirements for meeting egress in sleeping rooms:

- 20" minimum clear opening width
- 24" minimum clear opening height
- 5.7 square feet above grade
- 5.0 square feet at or below grade
- 44" maximum sill height
- Operate without special tools or knowledge

Exception: Replacement windows are exempt from meeting egress requirements provided there is no change in the occupancy, and the replacement windows are the manufacturers largest size that will fit in the existing window opening and is the same operating style as the existing window or one that provides an equal or greater opening area than the existing window that it replaces.

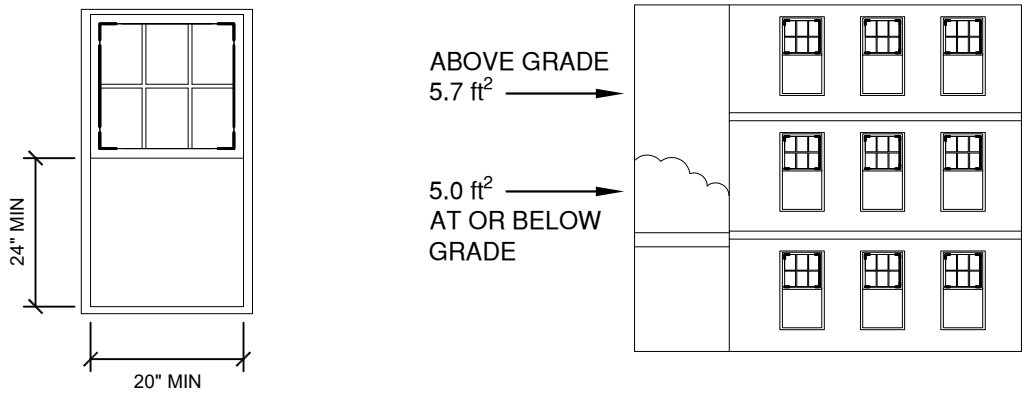


Figure 2: Window egress dimensional requirements

Safety glazing is required for the following conditions:

Glazing in all swinging and sliding doors,

Glazing in windows within a 24” arc of doorways that is less than 60” above finished floor level,

Glazing in windows that meet ALL of the following criteria:

- Glass area is greater than 9 square feet
- Bottom edge of glazing is within 18” of finished floor level
- Top edge of glazing is greater than 36” above finished floor level
- There is a walking surface within 36”

Glazing within 60" of wet areas such as a shower, bathtub, sauna, pool, etc..

Glazing with a bottom edge that is less than 36" above a stair tread or ramp.

Glazing less than 36" above finished floor and within 60" of top of bottom landing of stair.

Exception 1: Not required at windows with a horizontal safety rail installed 34" to 38" above finished floor and is not in a wet area, above a stair tread or ramp, or adjacent a stair landing.

Exception 2: Where access through the door is to a closet or storage area three feet or less in depth.

Note: Both tempered and laminated glazing qualify as safety glazing. Dual pane impact glazing is not considered safety glazing unless the non-laminated pane is tempered.

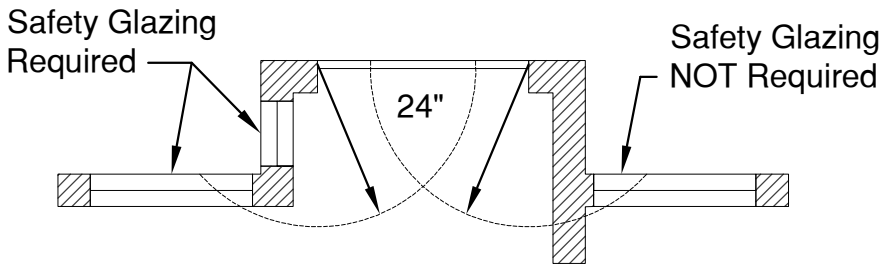


Figure 3: Safety glazing requirements for windows adjacent door openings

Accessibility, Fall Protection, Egress, and Safety Glazing Design Parameters for Commercial Construction

IBC
COMMERCIAL
INTERNATIONAL BUILDING CODE

Public access hinge door accessibility requirements:

Public access doors are required to be out-swing.

Clear opening dimension:

- 32" minimum width at 90 degree
- 80" minimum height

Threshold height :

- 1/2" max. with no greater than 1/4" edges beveled at 1:2 max. slope

Bottom rail height of 10" minimum with a smooth surface full width on the push side.

Hinged and sliding door accessibility requirements:

Clear opening dimension:

- 32" minimum width (at 90 degree for hinged doors)
- 80" minimum height

Threshold height:

- 1/2" maximum on hinged doors
- 3/4" maximum on sliding doors

Type A occupancy

- Minimum clear opening width and height shown above
- Maximum sill height shown above
- Maximum operating force of 5 lbs
- Hardware that meets accessibility requirements for ease of use
- Hardware reach height 34" min. and 48" max. above finished floor

Type B occupancy

- Minimum clear opening width and height shown above
- Maximum sill height shown above

See *Door Solutions for Accessibility Technote* for additional information.

Maneuvering clearance at doors with accessibility requirements:

Accessible doors require minimum clearances for maneuvering or making an approach to operate a door in a wheelchair (see Figure 4).

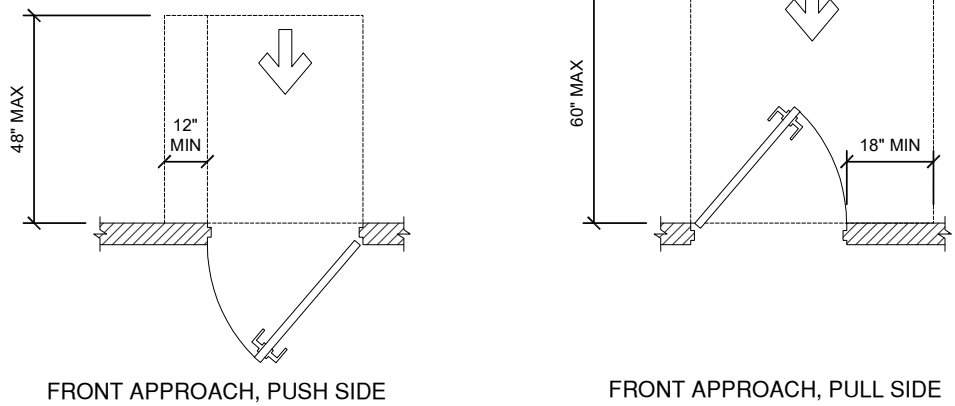


Figure 4: Maneuvering Clearance

Window accessibility requirements:
Hardware

- Maximum operating force of 5 lbs
- Hardware that meets accessibility requirements for ease of use or is operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.
- Unobstructed maximum reach height of 48" above finished floor (see Figure 5).
- Obstructed high reach areas or where a clear floor space allows a parallel approach (see Figures 6 & 7).

See *Window Solutions for Accessibility Technote* for additional information.

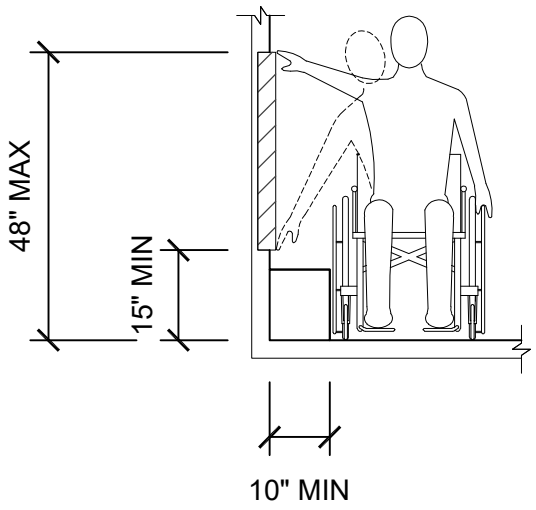


Figure 5: Unobstructed Side Reach

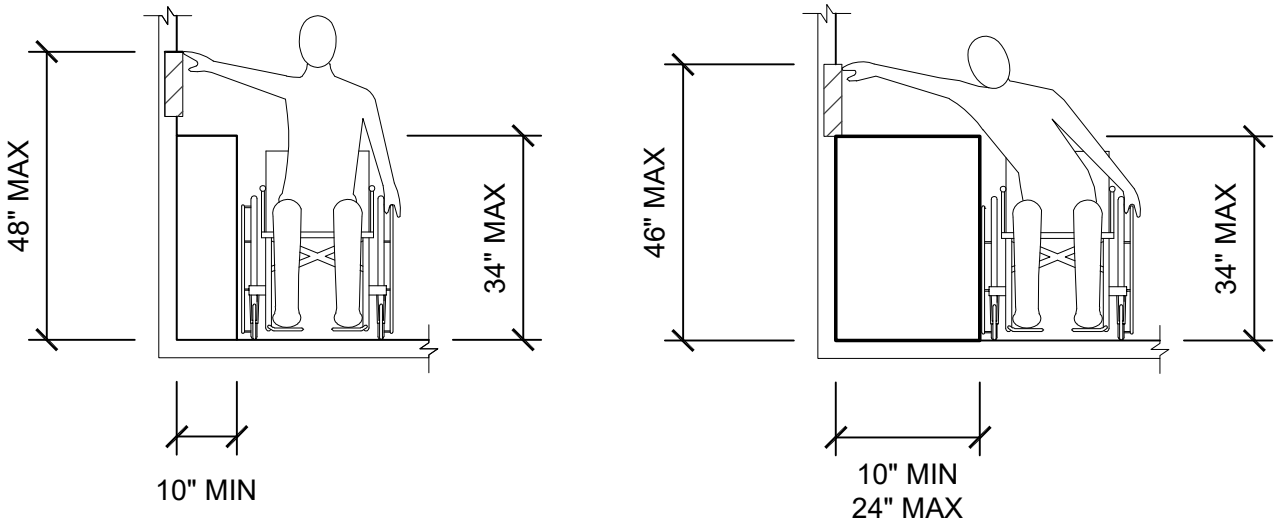


Figure 6: Obstructed High Side Reach

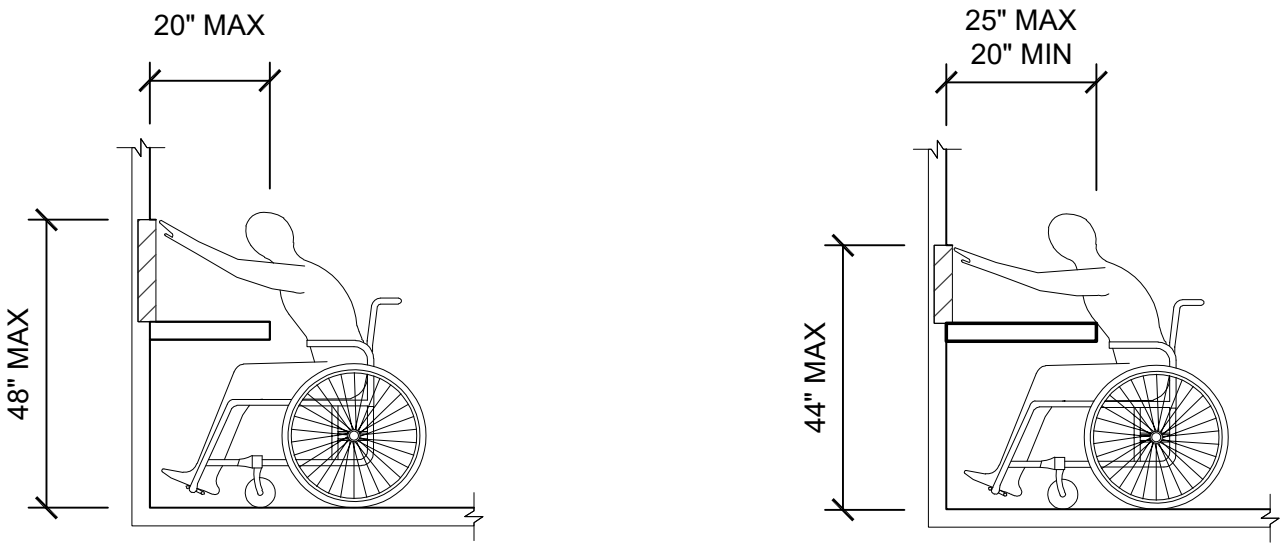


Figure 7: Obstructed High Forward Reach

Window fall protection requirements:

Required when all of the following conditions occur:

- Window is operable
- Top of window sill is less than 36” above finished floor (24” prior to 2012 IBC)
- Top of window sill is more than 72” above finished grade

Note: The Pella limited opening device cannot be installed in a window opening that is required for emergency escape or rescue.

Window requirements for meeting egress:

Egress - 20” minimum clear opening width

- 24” minimum clear opening height
- 5.7 square feet above grade
- 5.0 square feet at or below grade
- 44” maximum sill height
- Operate without special tools or knowledge

Exception 1: Not required in buildings with fire suppression or sprinkler systems

Exception 2: Replacement windows are exempt from meeting egress requirements provided there is no change in occupancy, and the replacement windows are the manufacturers largest size that will fit in the existing window opening and is the same operating style as the existing window or one that provides an equal or greater opening area than the existing window that it replaces.

Safety glazing is required for the following conditions:

Glazing in all swinging and sliding doors,

Glazing in windows within a 24” arc of doorways that is less than 60” above finished floor level,

Glazing in windows that meet ALL of the following criteria:

- Glass area is greater than 9 square feet
- Bottom edge of glazing is within 18” of finished floor level
- Top edge of glazing is greater than 36” above finished floor level
- There is a walking surface within 36”

Glazing within 60" of wet areas such as a shower, bathtub, sauna, pool, etc..

Glazing with a bottom edge that is less than 36" above a stair tread or ramp.

Glazing less than 36" above finished floor and within 60" of top of bottom landing of stair.

Exception 1: Not required at windows with a horizontal safety rail installed 34" to 38" above finished floor and is not in a wet area, above a stair tread or ramp, or adjacent a stair landing.

Exception 2: Not required where access through the door is to a closet or storage area three feet or less in depth.

IECC
ENERGY
INTERNATIONAL ENERGY CONSERVATION CODE

IECC Maximum allowable U-Factors & Solar Heat Gain Coefficient (SHGC) ratings:

The International Energy Conservation Code developed by the International Code Council (ICC) is a model building code that sets minimum energy efficiency standards including U-Factor and SHGC ratings for windows and doors in new construction by region (see Figure 8).

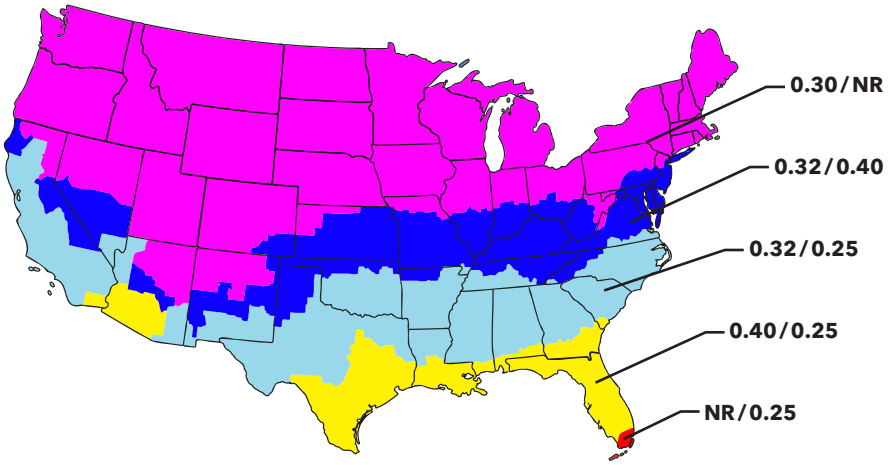
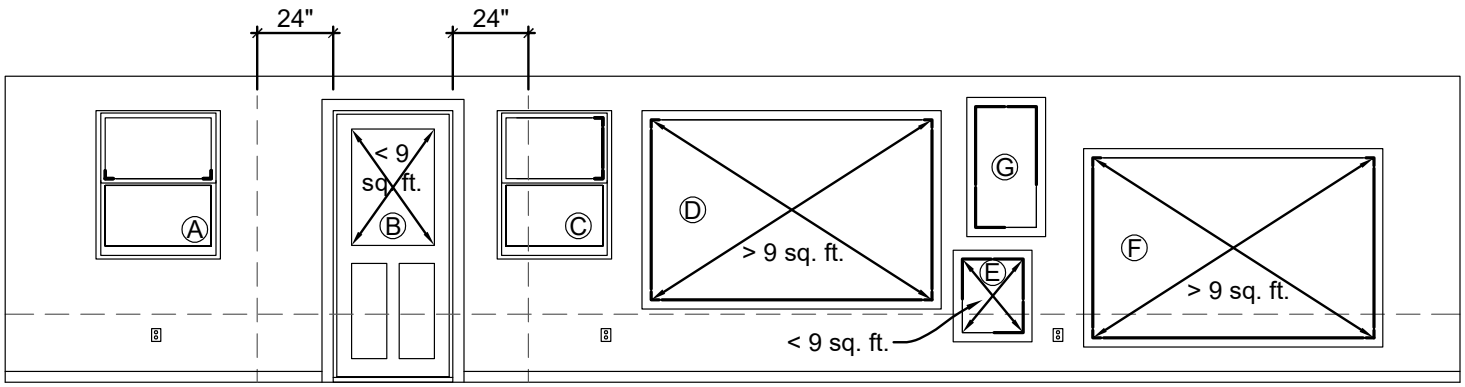


Figure 8: IECC Maximum U-Factor/SHGC Map

NR = No Requirement

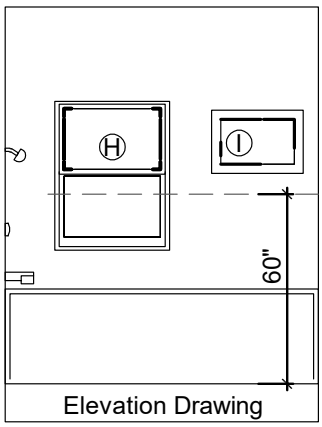
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Example of the application of building code requirements for safety glazing:

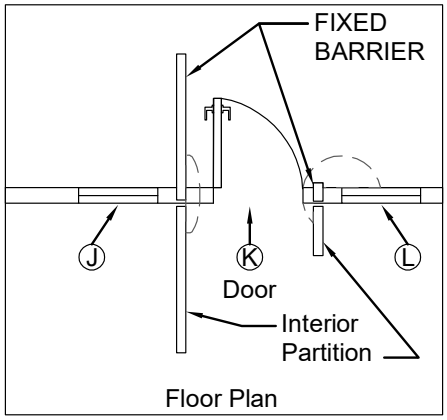


Observation	Difference between both	Reason for safety glass
Window A & C same size and height A.F.F.	Window A does not require safety glass. Window C required.	Within 24" of exterior door.
Window D & F same size, different heights.	Window D does not require safety glass. Window F required.	Both > 9 sq. ft. & < 18" A.F.F.
Window E & F are same height A.F.F. , but < 18".	Window E does not require safety glass. Window F required.	> 9 sq. ft.
Glass B & G are same size, < 9 sq.ft. & > 18" A.F.F.	One is a window & one is for a door. Glass B required.	All doors require safety glass.
Window A & H same size & same height A.F.F.	Window A does not require safety glass. Window H required.	In tub area and < 60" A.F.F.
Window H & I in tub area.	Window I does not require safety glass. Window H required.	< 60" above floor in tub.
Window J & L same size & < 24" from door.	Window J does not require safety glass. Window L required.	Within 24" radius & no fixed barrier.
Window N & O same size and height A.F.F.	Window O does not require safety glass. Window N required.	Within 60" of floor landing.
Window M & N & O same size. Window M higher A.F.F.	Window O does not require safety glass. Window M & N required.	Within 60" of floor landing of steps.

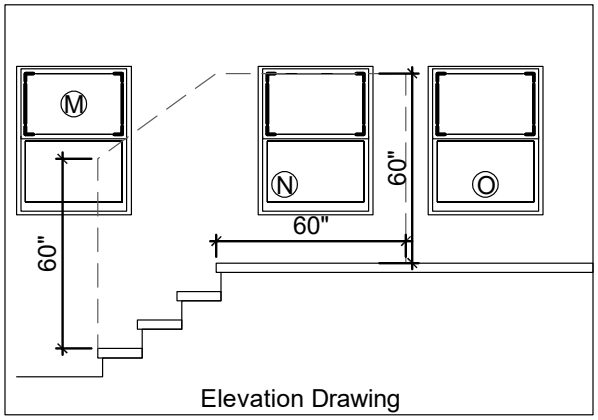
Note: If window M or H where to be a single-hung and not a double-hung such that the top sash were fixed, only the lower sash would require safety glass.



Elevation Drawing



Floor Plan



Elevation Drawing

Key A.F.F = Above Finished Floor > = Greater then < = Less then