

A GUIDE TO HUMAN IMPACT SAFETY REQUIREMENTS

NZS 4223:PART 3:1999

START HERE

SAFETY GLASS MEETS THE REQUIREMENTS OF EVERY SITUATION

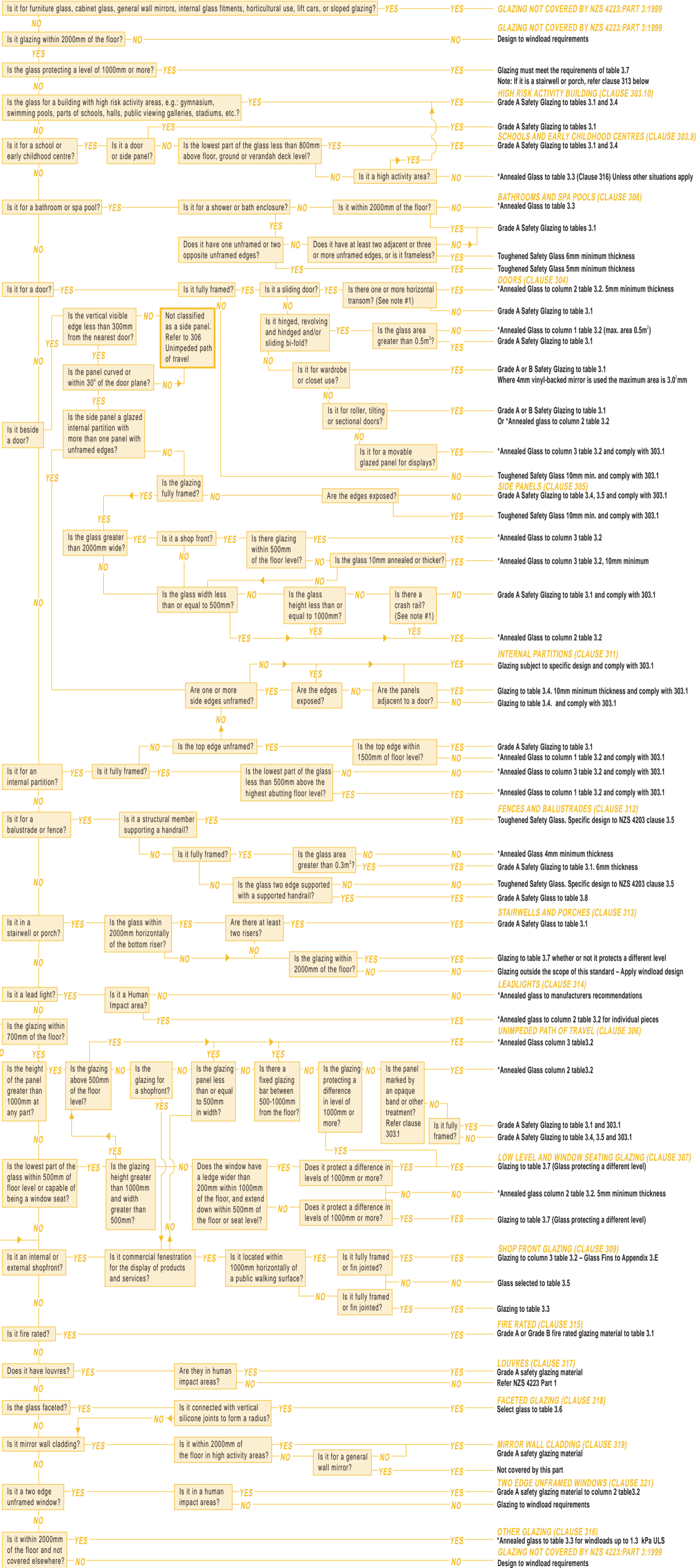


TABLE 3.1 (Abridged)
Maximum areas of safety glazing material for fully framed glazing

TYPE OF GLASS	THICKNESS GRADE A	MAXIMUM AREA m ²
TOUGHENED SAFETY GLASS	4mm	2.0
	5mm	3.0
	6mm	4.0
	8mm	6.0
	10mm	8.0
	12mm	10.0
LAMINATED SAFETY GLASS	6	3.0
	8	5.0
	10	7.0
	12	9.0

TYPE OF GLASS	THICKNESS GRADE B	MAXIMUM AREA m ²
WIRED SAFETY GLASS	6mm	1.5

TABLE 3.2 (Abridged)
Maximum areas of annealed glass for fully framed glazing

THICKNESS	COLUMN 1 HIGH RISK	COLUMN 2 MEDIUM RISK	COLUMN 3 LOW RISK
3mm	0.05m ²	0.1m ²	0.3m ²
4mm	0.2	0.3	1.1
5mm	0.5	1.2	2.2
6mm	0.9	2.1	3.3
8mm	1.8	3.2	4.5
10mm	2.7	4.4	6.0
12mm	4.5	6.3	8.0
15mm	6.3	8.2	10.0
19mm	8.5	10.3	12.0

TABLE 3.3 (Abridged)
Maximum areas of annealed glass for fully framed glazing

THICKNESS	FULLY FRAMED Max Area m ² (at 1.3kPa)
3mm	0.5
4mm	2.0
5mm	3.3
6mm	4.6
8mm	7.0
10mm	9.5
12mm	12.0
15mm	16.0
19mm	16.0

Maximum areas based on a 1.3kPa ULS face loading. Use windload design charts for wind pressures over 1.3kPa

TABLE 3.4 - Internal partitions with unframed side edges

HEIGHT OF GLASS (span) (m)	TYPE OF GLASS	MINIMUM STANDARD NOMINAL THICKNESS (mm)	MAXIMUM NUMBER OF VERTICAL BUTT JOINTS PER OPENING	MAXIMUM NUMBER OF INDIVIDUAL GLASS PANELS PER OPENING	MAXIMUM INDIVIDUAL PANEL WIDTH (mm)
≤ 1.3	Annealed	5*	2	3	1000
	Annealed	6*	No Limit	No Limit	No Limit
	Toughened†	4	2	3	1000
	Toughened†	5	No Limit	No Limit	No Limit
	Laminated‡	6	2	3	1000
	Laminated‡	8	No Limit	No Limit	No Limit
> 1.3 ≤ 2.0	Annealed	6*	1	2	1200
	Annealed	8*	2	3	1000
	Annealed	10	2	3	1200
	Toughened†	6	2	3	1000
	Toughened†	8	No Limit	No Limit	No Limit
	Toughened†	10	2	3	1000
	Laminated‡	6	2	3	1000
	Laminated‡	8	2	3	1200
	Laminated‡	10	No Limit	No Limit	No Limit
	Laminated‡	12	No Limit	No Limit	No Limit
> 2.0 ≤ 2.6	Annealed	8*	1	2	1200
	Annealed	10	2	3	1000
	Annealed	12	2	3	1200
	Toughened†	8	No Limit	No Limit	No Limit
	Toughened†	10	No Limit	No Limit	No Limit
	Toughened†	12	No Limit	No Limit	No Limit
	Laminated‡	8	1	2	1200
	Laminated‡	10	2	3	1200
	Laminated‡	12	No Limit	No Limit	No Limit
	Laminated‡	12	No Limit	No Limit	No Limit
> 2.6 ≤ 3.0	Annealed	10	1	2	1200
	Annealed	12	2	3	1000
	Toughened†	10	No Limit	No Limit	No Limit
	Toughened†	12	No Limit	No Limit	No Limit
	Laminated‡	10	2	3	1000
	Laminated‡	12	2	3	1200

* Minimum 10mm for side panels (refer 305.1.3).
† Safety glazing material Grade A to AS/NZS 2208 (refer Appendix 3.B).
‡ Based on total glass thickness only (interlayer thickness not included and should be added).
NOTE -
(1) Heights above 3.0m require specific design.
(2) Adequate edgecover is required to retain the glass under load (refer 303.2, and tables 25 & 27 of NZS 4223: Part 1).
(3) Safety glass design is based on a maximum 0.45 kPa ULS pressure.
(4) Refer to 303.4 for a definition of unframed edges.

TABLE 3.5 - Shopfronts with unframed side edges

HEIGHT OF GLASS (span) (m)	TYPE OF GLASS	MINIMUM STANDARD NOMINAL THICKNESS (mm)	MAXIMUM NUMBER OF VERTICAL BUTT JOINTS PER OPENING	MAXIMUM NUMBER OF INDIVIDUAL GLASS PANELS PER OPENING	MAXIMUM INDIVIDUAL PANEL WIDTH (mm)
≤ 1.3	Annealed	8	1	2	1200
	Annealed	10	No Limit	No Limit	No Limit
	Toughened*	6	2	3	1200
	Toughened*	8	No Limit	No Limit	No Limit
	Laminated*†	8	2	3	1200
	Laminated*†	10	No Limit	No Limit	No Limit
> 1.3 ≤ 2.0	Annealed	8	1	2	1200
	Annealed	10	2	3	1000
	Annealed	12	2	3	1200
	Toughened*	8	2	3	1200
	Toughened*	10	No Limit	No Limit	No Limit
	Toughened*	12	No Limit	No Limit	No Limit
> 2.0 ≤ 2.6	Annealed	10	1	2	1200
	Annealed	12	2	3	1000
	Toughened*	8	1	2	1500
	Toughened*	10	2	3	1200
	Toughened*	12	No Limit	No Limit	No Limit
	Laminated*†	10	1	2	1200
> 2.6 ≤ 3.0	Annealed	12	1	2	1200
	Toughened*	10	1	2	1500
	Toughened*	12	2	3	1200
	Toughened*	15	No Limit	No Limit	No Limit
	Laminated*†	12	1	2	1200
	Laminated*†	12	2	3	1200

* Safety glazing material Grade A to AS/NZS 2208 (refer Appendix 3.B).
† Based on total glass thickness only (interlayer thickness not included and should be added).
NOTE -
(1) Heights above 3.0m require specific design.
(2) Adequate edgecover is required to retain the glass under load (refer 303.2, and tables 25 & 27 of NZS 4223: Part 1).
(3) Safety glass design is based on a maximum 1.1 kPa ULS pressure. For pressures over 1.1 kPa specific design is required.
(4) Refer to 303.4 for a definition of unframed edges.

TABLE 3.6 - Faceted glazing

Maximum height	Maximum radius	Minimum glass thickness and type for ULS wind pressure				
		Internal glazing 0.45 kPa	External glazing wind area			
			Low 0.51 to 0.65 kPa	Medium 0.66 to 0.85 kPa	High 0.86 to 1.2 kPa	Very High 1.21 to 1.55 kPa
Up to 1.3m	2m 3m 4m	5mm T, 6mm, A 6mm A, L, T 6mm A, L, T	5mm T, 6mm A, L 6mm A, L, T 8mm A, L, T	6mm A, L, T 8mm A, L, T 10mm A, L, T	8mm A, L, T 10mm A, L, T 12mm A, L, T	10mm A, L, 8mmT 12mm A, L, 8mmT 12mm A, L, 8mmT
Up to 1.3m	Over 4m	6mm A 8mm L 5mm T	8mm A 8mm L 5mm T	8mm A 8mm L 6mm T	10mm A 10mm L 8mm T	12mm A 12mm L 8mm T
1.31m to 2m	2m 3m 4m	5mm T, 6mm, A, L 6mm A, L, T 8mm A, L, T	5mm T, 6mm A, L 6mm L, T 8mm A, L, T	6mm A, L, T 8mm A, L, T 10mm A, L, T	8mm A, L, T 10mm A, L, T 12mm A, L, T	10mm A, L, T 15mm A, L, 8mmT 15mm A, L, 8mmT
1.31m to 2m	Over 4m	10mm A 10mm L 8mm T	10mm A 12mm L 8mm T	12mm A 12mm L 8mm T	15mm A SD 10mm T	15mm A SD 12mm T
2.1m to 2.6m	2m 3m 4m	6mm A, L, T 6mm A, L, T 8mm A, L, T	6mm A, L, T 6mm A, L, T 8mm A, L, T	6mm L, T 8mm A, L, T 10mm A, L, T	8mm A, L, T 10mm A, L, T 12mm A, L, T	10mm A, L, T 15mm A, L, T 15mm A, L, T
2.1m to 2.6m	Over 4m	12mm A 8mm T 12mm L	15mm A 10mm T SD	15mm A 12mm T SD	19mm A 12mm T SD	SD 15 mm T SD
Over 2.6m	Any radius	SD	SD	SD	SD	SD

KEY - A = Annealed Glass
L = Laminated Safety Glass
T = Toughened Safety Glass
SD = Specific Design required

NOTE - The maximum glass size may be restricted by the maximum allowable area according to sections 306, 307 and 310

TABLE 3.7 - Glazing protecting a difference in level in any building

Ceiling	Floor or seat level	Diagram	Requirements
HOUSEHOLD UNITS			Safety glazing material to table 3.1 or annealed glass to column 1 of table 3.2
ALL OTHER BUILDINGS §			Safety glazing material to table 3.1 or annealed glass to column 2 of table 3.2
			Selected glass thickness by reference to wind design charts in Part 4. Table 3.3 of this Part is the minimum requirement.‡

* Crash rails should be designed to discourage people from sitting on them.
† If a transom is fitted, the upper panel can be type C.
‡ Refer also to section 307.
§ For high-risk activity areas, refer to 303.10. For stairwells, refer to section 313.

NOTE -
(1) Thickness of glazing materials shall also be checked for wind loading.
(2) Glazing materials shall be contained in accordance with 303.2.
(3) For opening windows - refer to Clause F4/AS1 of the NZBC for window opening restrictions not related to this Part.

TABLE 3.8 - Unframed or partly framed balustrades and fences

Horizontal pressure ULS (Pa)	Maximum glass span* (m)				Maximum glass span† (m)				Horizontal pressure SLS (Pa)	
	Laminated safety glass‡ (mm)				Toughened Safety Glass (mm)					
	6	8	10	12	6	8	10	12		
Residential buildings and swimming pools	1200	0.88	1.16	1.44	1.71	1.24	1.65	2.08	2.50	750
Other buildings and public areas of residential buildings	1600	0.76	1.00	1.24	1.48	1.13	1.50	1.89	2.28	1000
Theatres, cinemas, assembly hall, stadiums etc.	2400	0.62	0.82	1.01	1.21	1.00	1.31	1.65	2.00	1500

* For laminated safety glass the governing horizontal pressures are Ultimate Limit State from NZS 4203 table 3.5.1 and include the ULS load factor.
† For toughened safety glass the governing horizontal pressures are Serviceability Limit State from NZS 4203 table 3.5.1 and spans are based on a glass deflection limit of Span/60 for these loads.
‡ The interlayer thickness is not included and should be added to obtain nominal thickness.

CLAUSE 303.1 - Manifestation (Making glass visible)

Where transparent glazing material may be mistaken for a doorway or an unimpeded path of travel, (as defined in 306), the presence of glazing shall be made apparent either by the provision of an opaque band complying with 303.1.2 and 303.1.3 across the full width of the glazed opening or by a motif or other decorative treatment (e.g. colonial bars). Where motifs or other decorative treatments are proposed, they shall provide similar levels of manifestation (when viewed from both sides) to the opaque band. Such markings are not a substitute for the use of safety glazing where this is required by this Part.

303.1.2
Where an opaque band is provided for manifestation, it shall be not less than 20 mm in height and located so that the vertical distance from the floor level is:
(a) Not less than 700 mm to the upper edge of the band;
(b) Not more than 1000 mm to the lower edge of the band.

303.1.3
The band shall be readily apparent. This may be achieved either by ensuring that the band contrasts with the background or by increasing the width of the band.
NOTE - A broken line or patterns are acceptable forms of warning bands.

303.1.4
A band or marking is not required where any one of the following applies:
(a) The height of the glass panel is no greater than 1000 mm at any part;
(b) The width of the glass panel is no greater than 500 at any part (includes individual panels in faceted glazing, refer 31B);
(c) There is no glazing within 500mm of the floor level;
(d) The glass panel is provided with at least one fixed glazing bar, firmly attached to the styles to locate and protect each face of the glass. At least one glazing bar shall be located with its upper edge not less than 500mm, and its bottom edge not more than 1000mm, above the floor level. The glazing bar shall have a face width not less than 40mm.
(e) Where safety glazing material is used in housing.

NOTE - Commercial glazing must meet the requirements of NZBC Clause F2 and therefore 303.1. Glazing in housing does not need to meet the requirements of 303.1.

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