



Windows and external glazed doors in buildings



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The following are represented on Committee BD-021:

- Australasian Institute of Surface Finishing
 - Australian Building Codes Board
 - Australian Glass and Glazing Association
 - Australian Industry Group
 - Australian Institute of Building Surveyors
 - Australian Window Association
 - Building Research Association of New Zealand
 - CSIRO Materials Science and Engineering
 - Glass Association of New Zealand
 - Housing Industry Association
 - Master Builders Australia
 - Master Locksmiths Association of Australasia
 - National Association of Testing Authorities Australia
 - New Zealand Joinery Manufacturers Federation
 - Window and Door Industry Council
 - Window Association of New Zealand
-

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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Australian Standard[®]

Windows and external glazed doors in buildings

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee BD-021, Doors and Windows, to supersede, AS 2047—1999, *Windows in buildings*. After allowing sufficient time for adjustment (nominally 12 months from publication), the superseded document will be withdrawn.

This Standard incorporates Amendment No. 1 (February 2016) and Amendment No. 2 (June 2017). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide window designers and manufacturers with a generic requirement for windows in buildings, setting out the performance requirements and specifications in the design and manufacture of all windows, regardless of materials.

This edition differs from the previous edition as follows:

- (a) Hinged, pivot and bi-fold doors have been added to the scope of the Standard.
- (b) Wind pressures for housing, including cyclonic regions and corner conditions, have been updated to ensure alignment with AS 4055, *Wind loads for housing*.
- (c) The deflection/span ratio for housing and residential buildings has been changed to align with the new lower serviceability limit state wind pressures.
- (d) Additional guidance is given for the extrapolation of test results to larger size windows and the substitution of structural members and components.
- (e) Updated requirements for windows made from unplasticized PVC (uPVC).
- (f) The guide to wind pressures (Appendix A) has been revised to ensure alignment with AS 1170.2.
- (g) Appendix B (Environmental considerations) has been included to ensure alignment with current Standards.

In this Standard, statements expressed in mandatory terms in notes to tables and figures are deemed to be an integral part of the Standard.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard**Windows and external glazed doors in buildings**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements, materials, construction, installation and glazing for external—

- (a) windows;
- (b) sliding and swinging glazed doors, including French and bi-fold doors;
- (c) adjustable louvres;
- (d) shopfronts; and
- (e) window walls with one-piece framing elements.

NOTE: Window walls do not include curtain walls using stacked or vertically spliced framing systems, manufactured from any material and installed in external walls of all classes of buildings.

Throughout this Standard, the term ‘window(s)’ means window of any type, including louvre(s) and glazed door(s).

NOTES:

- 1 The window ratings or classifications differ from previous glass and window Standards due to the more accurate evaluation of the effect of wind conditions. They are based on either AS 1170.2, or the specific wind loading code developed for housing, AS 4055.
- 2 For information on wind loads applicable to windows covered by this Standard, see Appendix A.
- 3 Prefabricated bay windows that incorporate sloped glass are classified as windows in external walls.
- 4 For the performance specifications of building facades, see AS/NZS 4284. Conformance to the requirements of AS/NZS 4284 will be deemed to satisfy the requirements of this Standard, provided the windows have been tested to AS 4420.1 (operating force test).
- 5 The following are not covered by this Standard but should be checked with the National Construction Code (NCC) for compliance requirements:
 - (a) Internal doors.
 - (b) Revolving glazed doors.
 - (c) Fixed louvres.
 - (d) Skylights and roof lights and windows in other than the vertical plane.
 - (e) Windows in greenhouses and agricultural buildings.
 - (f) Frameless sliding and swinging doors.
 - (g) Windows constructed on site and architectural one-off windows, which are not design tested.
 - (h) Second-hand windows, re-used windows or recycled windows.
 - (i) Heritage windows for heritage buildings, as defined by the relevant State or Territory authority.

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1.2 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

AS

1231	Aluminium and aluminium alloys—Anodic oxidation coatings
1288	Glass in buildings—Selection and installation
1604	Specification for preservative treatment
1604.1	Part 1: Sawn and round timber
1720	Timber structures
1720.2	Part 2: Timber properties
1789	Electroplated zinc (electrogalvanized) coatings on ferrous articles (batch process)
1874	Aluminium and aluminium alloys—Ingots and castings
2331	Methods of test for metallic and related coatings
2331.3.1	Part 3.1: Corrosion and related property tests—Neutral salt spray test (NSS test)
2754	Adhesives for timber and timber products
2754.2	Part 2: Polymer emulsion adhesives
3715	Metal finishing—Thermoset powder coatings for architectural applications of aluminium and aluminium alloys
4055	Wind loads for housing
4145	Locksets and hardware for doors and windows (series)
4291	Mechanical properties of fasteners made of carbon steel and alloy steel
4291.1	Part 1: Bolts, screws and studs

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4773	Masonry in small buildings
4773.2	Part 2: Construction
AS/NZS	
1080	Timber—Methods of test
1080.1	Part 1: Moisture content
1167	Welding and brazing—Filler metals
1167.2	Part 2: Filler metal for welding
1170	Structural design actions
1170.2	Part 2: Wind actions
1580	Paints and related materials—Methods of test
1580.481.1.3	Part 481.1.3: Coatings—Exposed to weathering—Degree of dirt collection
1580.601.3	Part 601.3: Colour—Methods of colour measurement
1665	Welding of aluminium structures
1734	Aluminium and aluminium alloys—Flat sheet, coiled sheet and plate

A2	AS/NZS	
	1865	Aluminium and aluminium alloys—Drawn wire, rod, bar and strip
	1866	Aluminium and aluminium alloys—Extruded rod, bar, solid and hollow shapes
	2098	Methods of test for veneer and plywood
	2098.2	Part 2: Bond quality of plywood (chisel test)
	2904	Damp-proof courses and flashings
	4420	Windows, external glazed, timber and composite doors—Methods of test
	4420.1	Part 1: Test sequence, sampling and test methods
	4491	Timber—Glossary of terms in timber related Standards
	ISO	
	179	Plastics—Determination of Charpy impact properties
	179-2	Part 2: Instrumented impact test
	AAMA	
	303	Voluntary Specification for Rigid Polyvinyl Chloride (PVC) Exterior Profiles
	613	Voluntary Performance Requirements and Test Procedures for Organic Coatings on Plastic Profiles
	615	Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Plastic Profiles
	2603	Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
	2604	Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
	2605	Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
	ABCB	
	NCC	National Construction Code
	BS	
	4842	Specification for liquid organic coatings for application to aluminium alloy extrusions, sheet and preformed sections for external architectural purposes, and for the finish on aluminium alloy extrusions, sheet and preformed sections coated with liquid organic coatings
	BS EN	
	513	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors. Determination of the resistance to artificial weathering
	12608	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors. Classification, requirements and test methods
	ASTM	
	D4216	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly(Vinyl Chloride) (CPVC) Building Products Compounds
	G151	Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources

ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
D4726	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors
RAL-GZ 716/1	Quality and Test Requirements for Plastic Window Profile Systems

1.3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 4491 and those below apply.

1.3.1 Air conditioning

For the purpose of energy efficiency, a service that actively cools or heats a space within a building in order to provide a suitable environment for the building occupants, but does not include process needs, such as temperature or humidity control, as occurs in cold rooms and hot rooms.

1.3.2 Air infiltration

The flow of air through a window or door that aids in determining the acoustic and thermal performance.

NOTE: Products with a low airflow rate will perform better for noise and energy; therefore, they should provide a higher comfort level than those with a high flow rate.

1.3.3 Architectural one-off window

A window designed to suit one specific installation in a building.

NOTE: The sections and components used to make the window should be unique to that installation.

1.3.4 Curtain wall

A non-loadbearing wall of metal sections, glass and infill panels, which is carried directly by the structure of a building.

NOTE: Curtain walls are extensively used in modern high-rise office buildings.

1.3.5 Deflection

The amount of relative displacement of the structural components in a window.

NOTE: The amount of deflection is controlled for several reasons, such as the appearance of movement to the end user, the rigidity of joint and sealing of those joints, and the adequate support of glass to prevent premature failure.

1.3.6 Door

A sash of a size suitable for use as access through walls.

1.3.7 Exposed site

A site where one or more of the following AS 4055 site conditions are met:

- (a) Terrain category TC2 or less.
- (b) Topographic class T3 or greater.
- (c) No shielding.

NOTE: Any site other than defined above is considered non-exposed.

1.3.8 Fenestration

The arrangement of windows and other openings on the external walls of buildings, especially the facade.

1.3.9 Fin

A piece of glass positioned to provide lateral support.

1.3.10 Fixing

Any item that is used to secure members of a window assembly to each other, secure an item of hardware to a window member or secure a completed window assembly into the building structure.

1.3.11 Flashing

An impervious membrane installed in such a manner as to prevent ingress of water into the building.

NOTE: Flashing includes a waterproof strip barrier around an opening in a wall, at a roof junction or at a roof penetration to prevent the ingress of water to the inner parts of a building. In some instances the flashing can act as a damp-proof course.

1.3.12 Frame

That part of a window assembly surrounding the sashes or fixed glazing, manufactured from timber, metal, glass, or other durable material or combination of materials, such as glass fins and structural sealant forming part of the assembly of a glazed panel and supporting the full length of all the edges of the glass.

NOTE: Butt-jointed glass panels that are not in the same plane may be deemed to satisfy the requirements for frames.

1.3.13 Frameless (panels)

Without framed edges.

1.3.14 Glass

A hard, brittle, amorphous substance produced by fusion and usually consisting of mutually dissolved silica or silicates that also contain soda and lime, and may be transparent, translucent or opaque.

1.3.15 Glazing

One of the following:

- (a) The securing of glass in prepared openings in windows, door panels, partitions and the like.
- (b) Glass or plastics glazing sheet material for installation into a building.

1.3.16 Glazing bar

A member that is added to a standard window construction to change the appearance of the window.

NOTE: The glass is individually glazed. The bar may also be clipped or stuck onto both faces of the glass. Also known as colonial bars or federation bars.

1.3.17 Glazing gasket

Plastic or synthetic rubber members, used between the glass and the frame or the glass and the bead.

1.3.18 Hardware

Equipment used in the opening, operating, closing, locking and stopping of windows.

1.3.19 Head

The top horizontal framing member of a window assembly.

1.3.20 Jamb

A vertical side-framing member.

1.3.21 Light

See window light.

1.3.22 Louvre

A window unit comprising a series of blades of glass or other material lapping each other.

1.3.23 Meeting stiles

Vertical intermediate sash members that meet when the window is closed such that they combine to act in unison.

1.3.24 Meeting rails

Horizontal intermediate sash members that meet when the window is closed such that they combine to act in unison.

1.3.25 Mullion

A vertical intermediate framing member of a window frame or opening that is jointed into the head and sill, and separates the lights.

1.3.26 Multi-light window

A window incorporating more than one opening or fixed light, or both, within one perimeter frame, as low lights, high lights or side lights.

1.3.27 Panel wall

A non-loadbearing window wall forming an infill between columns or within a frame and wholly supported at each storey by a beam, slab or structural projection.

1.3.28 Pascal (Pa)

The pressure or stress that arises when a force of one newton is applied uniformly over an area of one square metre.

1.3.29 Reveal lining

The lining attached to the window unit frame, which is used to position and mount the window to the structure.

1.3.30 Sash

The separate frame, to a window or door, carrying the glass, which may be fixed (inoperable) or movable (operable).

1.3.31 Section

An extruded or profiled member.

1.3.32 Sill

The bottom horizontal framing member of a window assembly.

1.3.33 Stile

A vertical side member of a sash.

1.3.34 Structural members

The elements, including mullions, transoms, meeting rails and meeting stiles, that perform the function of transferring loads to the perimeter frame.

NOTE: Glazing bars, awning and casement sash stiles and rails are not considered structural members for housing; however, they are considered structural members for residential and commercial buildings.

1.3.35 Suitably qualified person

A person nominated by the window systems designer or supplier to have the skills, experience or qualifications to assess and determine compliance with this Standard.

1.3.36 Swinging glazed doors

A swinging door with more than 30% of the door area glazed, and includes hinged, swinging, single, two leaf or multi-leaf doors.

1.3.37 Transom

A horizontal intermediate framing member of a window assembly.

1.3.38 Water containment element

A section incorporating a drainage system that collects water and directs it to flow to the outside of the window.

1.3.39 Weather seal

A material included in a window assembly to reduce the air infiltration or improve resistance to water penetration.

1.3.40 Window assembly

A complete unit comprising a frame, couplings, sashes, glazing infill panels and hardware.

1.3.41 Window light

A single panel or glazing in a window assembly.

1.3.42 Window rating

A classification system providing for windows to be tested to determine their level of performance for strength and weatherproofness.

NOTE: Window ratings for housing are expressed in wind classification terms (see Table 2.1), and window ratings for buildings other than housing are expressed in limit state design wind pressure terms.

1.3.43 Window wall

A series of multi-light windows generally spanning from floor to ceiling, and often continuous horizontally.

1.3.44 Windows constructed on site

Unframed fixed panel windows constructed on site where glazing is fixed into the preformed rebates in the building structure.

SECTION 2 PERFORMANCE

2.1 GENERAL

2.1.1 Performance criteria

This Section details performance criteria for window assemblies that are classified by a rating system for housing, and by design wind pressures for residential and commercial buildings.

NOTES:

- 1 The performance levels of windows given in this Section are the result of many years of testing units in laboratories and the evaluation of building sites after high winds and cyclones in various regions of Australia.
- 2 The window ratings or classifications differ from previous glass and window Standards due to the more accurate evaluation of the effect of these wind conditions. They are based on either AS/NZS 1170.2, or the specific wind loading code developed for housing (i.e. AS 4055).
- 3 For guidance on design wind pressure, see Appendix A.
- 4 For environmental effects that should be considered, see Appendix B.
- 5 AS 1428.1 has specific requirements for door handles and related hardware and accessories and specifies operating forces, which are lower than those specified in Table 2.2.
- 6 Door sills that meet the requirements of AS 1428.1 might not meet the minimum water penetration requirements of this Standard. In such situations, the building design should be such that it provides sufficient protection to avoid the ingress of water.
- 7 AS 4299 applies to planning and design of residential accommodation, and is intended for reference by designers and specifiers in the preparation of their documentation and by members of the general public considering adaptable housing for their particular needs.
- 8 A guide to the weatherproofing of external doors is provided in AS 4299. The guidance given in AS 4299 may not meet the minimum water penetration requirements of this Standard (AS 2047).

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2.1.2 Generic timber windows

Generic timber windows shall comply with the requirements of Appendix F.

NOTES:

- 1 The objective of including the generic timber windows in the Standard, as an acceptable alternative to individual testing of specific fabricator products, is to enable small joineries to manufacture windows to the generic detail shown in Appendix F.
- 2 For guidance on test results of generic windows, see Appendix G.

2.2 ATMOSPHERIC ENVIRONMENTS

Materials shall be compatible with the atmospheric conditions of the site.

NOTE: Corrosion and weathering of materials used in window assemblies can occur in atmospheric environments where the materials are incompatible with the environment and other window assembly materials, and with other building materials.

2.3 WINDOW PERFORMANCE

2.3.1 Housing

2.3.1.1 General

In this Standard, housing is defined as Class 1 buildings and Class 10 buildings, as described in the National Construction Code (NCC), and is governed by the limitations specified in AS 4055, except that windows in Class 10 buildings are not required to pass the air infiltration and water penetration requirements of this Standard.

2.3.1.2 Window ratings

The following shall apply:

- (a) Window assemblies shall be rated in accordance with Table 2.1 and by achieving the test results detailed in Clauses 2.3.1.3 to 2.3.1.7 to the appropriate test in AS/NZS 4420.1.
- (b) The supporting members shall have sufficient thickness of material and strength to ensure the performance of the window-operating hardware.

Windows and doors with 25% or more of the width of a single panel or pane within 1200 mm of the building edge shall be classified as corner windows and doors.

NOTE: Appendix C nominates window ratings or design wind pressures for each window and door assembly.

TABLE 2.1
WINDOW RATINGS FOR HOUSING

Window rating	Serviceability pressure, Pa	
	General	Corner windows
N1	400	600
N2	400	600
N3	600	800
N4	800	1200
N5	1200	1800
N6	1600	2500
C1	600	800
C2	800	1200
C3	1200	1800
C4	1600	2500

NOTE: The pressures are as per AS 4055, rounded to the nearest 100 Pa.

2.3.1.3 Deflection/span ratio

Window assemblies for housing shall be subjected to the deflection test in accordance with AS/NZS 4420.1. The test pressure shall be the serviceability wind pressure as specified in Table 2.1. No structural members in a completely assembled and glazed window shall deflect by an amount greater than the following, when tested at the serviceability design wind pressure:

- (a) Span/250 for windows and sliding doors.
- (b) Span/100 for doors other than sliding.

NOTE: Glazing bars, awning, and casement sash stiles and rails are not members that require deflection tests; however, they should comply with the ultimate strength test requirements.

2.3.1.4 Operating force

Windows for housing shall be subjected to the operating force test in accordance with AS/NZS 4420.1. The test force shall be not greater than the value for windows given in Table 2.2.

TABLE 2.2
OPERATING FORCE FOR TEST

Product and movement type	Initiate N	Maintain N
Horizontal sliding window	110	90
Vertical sliding window	200	160
Horizontal sliding door (see Note 1)	180	110
Swinging door (see Note 2)	60	20
Projecting sashes (no operator)	160	80

NOTES:

- 1 For multiple sliding panel door configuration (e.g. stacking doors), each panel shall be measured independently and the highest figures adopted for the total product.
- 2 For multiple swinging panel configurations (e.g. bi-fold doors and windows), the initiating force is the force measured perpendicular to the opening direction.

2.3.1.5 Air infiltration

Windows for Class 1 buildings shall be subjected to the air infiltration test in accordance with AS/NZS 4420.1 under the test pressure specified in Table 2.3. The air infiltration shall not exceed the value given in Table 2.3.

TABLE 2.3
MAXIMUM AIR INFILTRATION

Air infiltration level	Pressure direction	Maximum air infiltration, L/s m ²
		Test pressure, 75 Pa
Low	Positive and negative	1.0
High	Positive	5.0

2.3.1.6 Water penetration

Windows for Class 1 buildings shall be subjected to the water penetration resistance test in accordance with AS/NZS 4420.1, under the test pressures specified in Table 2.4 in the positive direction only. During and at the completion of the test there shall have been no penetration of uncontrolled water. Uncontrolled water is defined as—

- (a) water that is not contained in a purpose-built drainage area;
- (b) water that wets or is likely to wet insulation, fixtures and finishes, reveal linings or window furnishings beyond the window frame; or
- (c) water that lies on transoms, rails, sills, etc., which has no designed means of escape to the outside of the product by way of the drainage system.

Acceptable water penetration is not deemed a failure if—

- (i) minor splashing occurs due to air infiltration, within 1 min after change of pressure;
- (ii) minor, intermittent leakage on the indoor side of openable sashes, which is contained on sash gaskets, sill tracks and thresholds that are part of a drainage system that allows water to flow to the outside of the product at cessation of the test (constant streams and regular dripping would be regarded as failure); or

- (iii) water running down the indoor face of louvres, which is completely contained within a purpose-built drainage area.

The required water penetration level shall be based on the location of the building and the amount of shielding protection provided by the design of the building.

NOTES:

- 1 If the building is in an exposed site and is likely to be subjected to driving rain, the exposed level of water penetration resistance should be specified in the design.
- 2 If the window is protected from driving rain by elements of the building such as a wide veranda, a lower level of water penetration resistance may be specified in the design as part of an alternative solution.

TABLE 2.4
WATER PENETRATION RESISTANCE
TEST PRESSURES

Rating	Non-exposed Pa	Exposed Pa
N1, N2	150	200
N3, C1	150	300
N4, C2	200	300
N5, C3	300	450
N6, C4	450	600

2.3.1.7 *Ultimate strength*

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Windows for housing shall not collapse when subjected to the ultimate strength test in accordance with AS/NZS 4420.1. ‘Collapse’ shall mean any one, or any combination, of the following:

- (a) Failure or dislodgment of any glazing.
- (b) Dislodgment of a frame or any part of a frame.
- (c) Removal of a light, either with or without its framing sash, from a frame.
- (d) Loss of support of a frame, such as when it is unstable in its opening in the building structure.
- (e) Failure of any sash, locking device, fastener or supporting stay, allowing an opening light to open.

The test pressure shall be not less than the value given in Table 2.5.

Windows and doors with 25% or more of the width of a single panel or pane within 1200 mm of the building edge shall be classified as corner windows and doors.

TABLE 2.5
ULTIMATE STRENGTH TEST PRESSURES

Window rating	Ultimate limit state pressure, Pa	
	General	Corner windows
N1	600	900
N2	900	1300
N3	1400	2000
N4	2000	3000
N5	3000	4500
N6	4000	6000
C1	1800	2700
C2	2700	4000
C3	4000	5900
C4	5300	8000

NOTE: The pressures are as per AS 4055, rounded to the nearest 100 Pa.

2.3.2 Residential and commercial buildings

2.3.2.1 General

This Clause covers residential buildings of Class 2, Class 3 and Class 4, commercial buildings of Classes 5, 6, 7, 8 and 9, as described in the NCC, and Class 1 and 10 buildings outside the limitations specified in AS 4055.

A2 | Window assemblies shall achieve the test results detailed in Clauses 2.3.2.3 to 2.3.2.7 to the appropriate test in AS/NZS 4420.1.

2.3.2.2 Design wind pressures

The design wind pressures for serviceability limit state and ultimate limit state shall be determined in accordance with AS/NZS 1170.2. All local pressure factors and internal pressure coefficients relevant to the location of the window on the building shall be considered.

NOTES:

- 1 For guidance on design wind pressure, see Appendix A.
- 2 Appendix C nominates window ratings or design wind pressures for each window and door assembly.

2.3.2.3 Deflection/span ratio

A2 | Windows shall be subjected to the deflection test in accordance with AS/NZS 4420.1. The test pressure shall be the serviceability limit state wind pressure determined in Clause 2.3.2.2. No structural members in a completely assembled and glazed window shall deflect by an amount greater than span/250 for windows and sliding doors, and span/100 for all other doors.

2.3.2.4 Operating force test

A2 | Windows shall be subjected to the operating force test in accordance with AS/NZS 4420.1. The test force shall be not greater than the value given in Table 2.2.

2.3.2.5 Air infiltration

A2 | Windows shall be subjected to the air infiltration test in accordance with AS/NZS 4420.1. The air infiltration shall not exceed the amount given in Table 2.3.

2.3.2.6 *Water penetration*

- A2 | Windows shall be subjected to the water penetration resistance test in accordance with AS/NZS 4420.1. The test pressure shall be calculated as 30% of the positive serviceability limit state wind pressure, as determined in Clause 2.3.2.2, but not less than 150 Pa, and in positive direction only. During the test, there shall be no penetration of uncontrolled water, as specified in Clause 2.3.1.6.

NOTE: When testing a window for water penetration, where insulation is removed in order to observe the indoor side of the window, the manufacturer should supply drawings indicating its intended location in order that the result can be determined.

2.3.2.7 *Ultimate strength*

- A2 | Windows shall not collapse when subjected to the ultimate strength test in accordance with AS/NZS 4420.1. 'Collapse' shall be as specified in Clause 2.3.1.7.

The test pressure shall be not less than the ultimate limit state wind pressure determined in accordance with AS/NZS 1170.2. All local pressure factors and internal pressure coefficients relevant to the location of the window on the building shall be considered.

2.3.3 **Window energy rating**

Calculation of the total system overall heat transfer coefficient (U-value), the total system solar heat gain coefficient (SHGC) and the visible transmittance (T_{vis}) shall be required for the total system of the window assembly.

NOTES:

- 1 The energy efficiency performance of windows may be calculated using the technical protocols and procedures of the Australian Fenestration Rating Council (AFRC).
- 2 It is important that all buildings be efficient in their use of energy for heating and cooling. A major path of heat flow into and out of buildings is through the windows; therefore, significant savings can be made by using energy-efficient windows.
- 3 The energy ratings do not have any pass or fail criteria. The energy ratings are used to measure the performance of the window, and provide data for use by other building energy rating schemes.
- 4 Physical laboratory testing to evaluate the U-value may be performed.

2.4 **VERIFICATION OF SMALLER OR LARGER SIZE PRODUCTS**

- A2 | AS/NZS 4420.1 generally requires the test sample window to be representative in both size and shape of the largest standard assembly in the product range as specified by the manufacturer. Where the supplied products are not the same size as those verified by testing, one of the following shall apply:

- (a) Smaller size products (shorter, narrower or both) which have the same construction (fenestration, sections and components) as a tested product shall assume the same rating, provided they are in no way less favourably disposed and are glazed in compliance with AS 1288.
- (b) Smaller size products as described in Item (a) shall be rated at a higher design wind pressure rating than the tested products, provided the calculations of deflection and stress for all structural members to arrive at the higher rating are certified using the actual test data for the structural members, and provided they are in no way less favourably disposed and are glazed in compliance with AS 1288. The calculations shall be performed by a suitably qualified person who can provide substantiating documentation.

Where a higher rating is determined by calculation for a smaller size window assembly, the maximum water penetration rating that may be used is that which the tested product has achieved.

- A2 | (c) A larger size product (either taller or wider) which has identical construction (fenestration, sections and hardware) as a tested product in accordance with AS/NZS 4420.1 shall assume the same or lower performance as the tested product, provided it complies with one of the following:
- (i) The area of the window assembly is not greater than 10% in either the horizontal or vertical direction, and not greater than 15% of the total area of the tested product. This shall apply to any element within the assembly, as shown in Figure 2.2.
 - (ii) The area of an adjustable louvre assembly or frameless sash is not greater than 10% in the vertical direction only.

Loads on the hardware shall not be exceeded.

Where the window assembly contains movable multiple window lights, sashes, panels or leafs, the calculation of maximum area shall be also applied proportionally to each of the window lights, sashes, panels or leafs.

Where the above limits are exceeded, the following applies:

- (A) The calculations of deflection and stress for all structural members to arrive at the rating shall be certified using the actual test data for the structural members and the calculations shall be performed by a suitably qualified person capable of providing substantiating documentation.
- (B) If a sliding sash is increased in size, the operating force determined during the test shall be multiplied by the ratio of the area to determine if it still complies with the requirements at the increased size.

NOTES:

- 1 Appendix C nominates window ratings or design wind pressures for each window and door assembly.
- 2 A product may only be given a higher rating than a tested product if the tested product has satisfied the water penetration and air infiltration requirements of the higher rating.
- 3 It is recommended that windows be initially tested to determine their maximum rating of resistance to water penetration, so as to allow for the possibility of extrapolating the rating of a smaller product to a higher value at a later date.

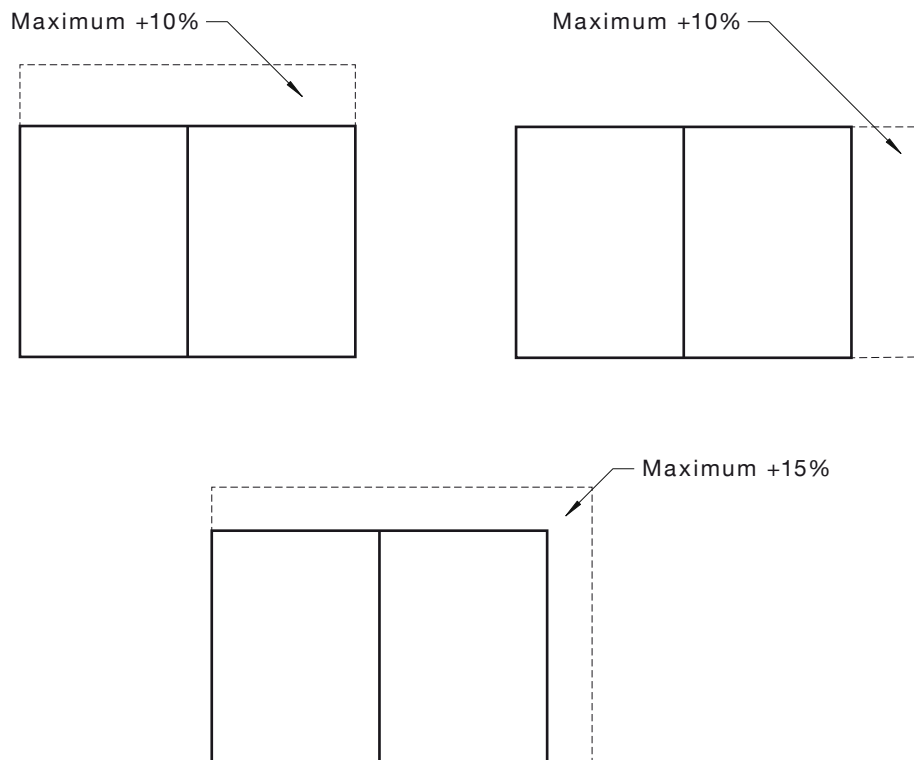


FIGURE 2.2 LARGER SIZE ASSEMBLIES

2.5 USE AND RATING OF WINDOW COUPLING SYSTEMS

Where window structural couplings have been tested in windows to this Standard, further testing of these same couplings in other configurations is not deemed necessary, provided—

- (a) the calculations for deflection and stress are based on actual test data for these couplings; and
- (b) they are in no way less favourably disposed and are glazed to comply with AS 1288.

NOTE: Coupling is the joining of two or more assemblies together, which meets the same performance criteria as for the window.

2.6 SUBSTITUTION

Substitution of structural or water containment elements of a window shall be allowed in a given window configuration where the performance of such elements has been tested and shown to comply with the requirements of this Standard.

The use of such test data to verify individual configuration options shall be conditional upon the following:

- (a) The referenced test data is of like and no more favourable application or configuration of the element.
- (b) The application of any element is not more than 10% greater in length than that verifiable by the referenced test data.
- (c) A design record is kept detailing the test references and methodology used.

For adjustable louvre systems, the substitution of material types (e.g. glass, aluminium or timber) and the size of the blades (102 mm, 130 mm or 152 mm) shall not be allowed without testing to AS/NZS 4420.1.

Substitution of structural or water containment elements shall be allowed where such an element differs only by minor aesthetic variation to a tested element.

A2 |

Such substitution shall be conditional upon the following:

- (i) The structural strength of the member is greater than or equal to the tested element, demonstrated by the element's moment of inertia.
- (ii) All functional details of the element, including the seal positions, clearances, fixings and interrelations with other window elements, are identical to the tested element.