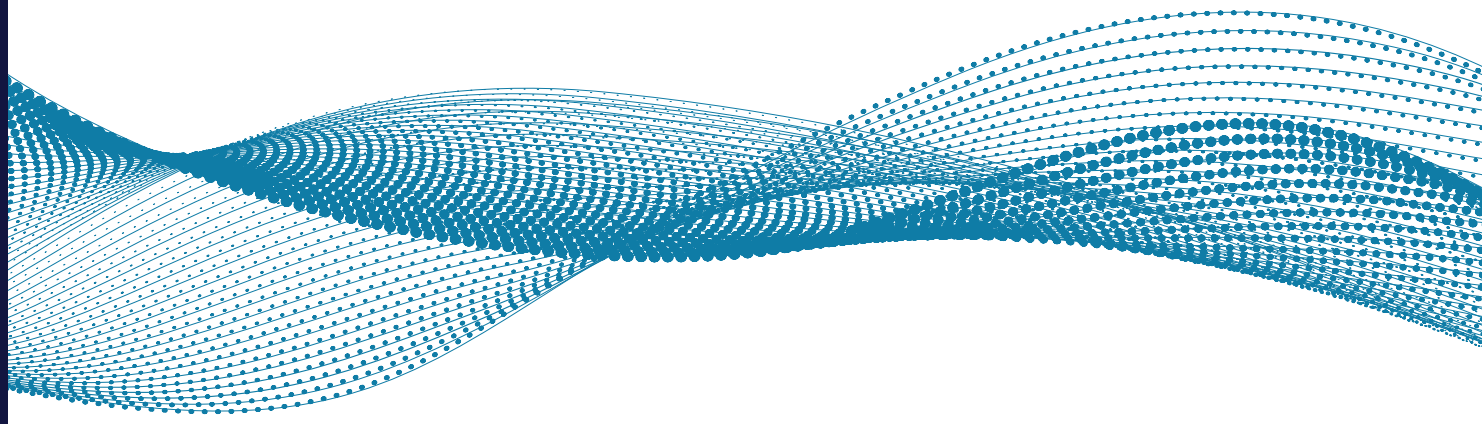
STANDARDS NEW ZEALAND
TE MANA TAUTIKANGA O AOTEAROA

SNZ TS 4211:2022

STANDARDS NEW ZEALAND TECHNICAL SPECIFICATION

Specification for the classification of windows

Superseding NZS 4211:2008



SNZ TS 4211:2022

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This technical specification was prepared by the P4211 Specification for Performance of Windows Committee. The membership of the committee was approved by the New Zealand Standards Executive and appointed by the New Zealand Standards Executive under the Standards and Accreditation Act 2015.

The committee consisted of representatives of the following nominating organisations:

BRANZ (Building Research Association of New Zealand)

Building Officials Institute of New Zealand (BOINZ)

Building System Performance (BSP)

Engineering New Zealand Te Ao Rangahau

International Accreditation New Zealand (IANZ)

Mott MacDonald New Zealand

New Zealand Institute of Building Surveyors (NZIBS)

New Zealand Joinery Manufacturers' Federation (NZJMF)

Window & Glass Association New Zealand (WGANZ)

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Figure 1 was adapted from BS EN 12207, with permission granted from BSI Standards Limited (BSI).

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Technical Specification

Specification for the classification of windows

Superseding NZS 4211:2008

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REFERENCED DOCUMENTS

Reference is made in this document to the following:

New Zealand standards

NZS 3604:2011	Timber-framed buildings
NZS 4121:2001	Design for access and mobility: Buildings and associated facilities
NZS 4223:- - - -	Glazing in buildings
Part 3:2016	Human impact safety requirements
Part 4:2008	Wind, dead, snow, and live actions
NZS ISO/IEC 17025:2018	General requirements for the competence of testing and calibration laboratories

Joint Australian/New Zealand standards

AS/NZS 1170:- - - -	Structural design actions
Part 2:2021	Wind actions
AS/NZS 4284:2008	Testing of building facades
AS/NZS 4420:- - - -	Windows, external glazed, timber and composite doors – Methods of test
Part 1:2016	Test sequence, sampling and test methods
AS/NZS 4505:2012	Garage doors and other large access doors
AS/NZS 4666:2012	Insulating glass units

Australian standards

AS 4285:2019	Rooflights

British standards

BS EN 12207:2016	Windows and doors. Air permeability. Classification

Other publications

BRANZ. *EM7 Performance of mid-rise cladding systems.* Version 3. BRANZ, 2020. Available at https://www.branz.co.nz/pubs/evaluation-methods/em7/

Carradine, D. M., Kumar, A., Fairclough, R., & Beattie, G. Serviceability fragility functions for New Zealand residential windows, *Bulletin of the New Zealand Society for Earthquake Engineering 53*(3):137-143.

Ministry of Business, Innovation and Employment (MBIE). *Verification methods E2, verification methods E2, VM1 and acceptable solutions E2/AS1, E2/AS2 and E2/AS3: For New Zealand Building Code clause E2 External moisture.* 3rd ed. MBIE, 2020. Available at https://www.building.govt.nz/

National Association of Steel-Framed Housing (NASH). *NASH standard – Part 2: Light steel framed buildings.* NASH, 2019. Available at www.nashnz.org.nz

Thurston, S. J. *Study report no. 54 – Report on racking resistance of long sheathed timber framed walls with openings.* Wellington: BRANZ, 1994.

Window & Glass Association NZ (WGANZ). *Trans-Tasman industry code of practice TT-ICP-002 NZ window and door hardware in housing and residential buildings product performance – Durability and corrosion resistance.* WGANZ, 2019. Available at https://www.wganz.org.nz/

Window & Glass Association NZ (WGANZ). *New Zealand industry code of practice NZ-ICP-003a window and door hardware in housing and residential buildings product performance – Structural strength.* WGANZ, 2019. Available at https://www.wganz.org.nz/

New Zealand legislation

Building Act 2004

Websites

www.branz.co.nz

www.building.govt.nz

www.legislation.govt.nz

www.nashnz.org.nz

www.wganz.org.nz

LATEST REVISIONS

The users of this technical specification should ensure that their copies of the above-mentioned New Zealand standards are the latest revisions. Amendments to referenced New Zealand and joint Australian/New Zealand standards can be found on www.standards.govt.nz.

REVIEW

Suggestions for improvement of this technical specification will be welcomed. They should be sent to the National Manager, Standards New Zealand, PO Box 1473, Wellington 6140.

FOREWORD

SNZ TS 4211 *Specification for the classification of windows* provides a methodology for classifying windows and exterior doors in accordance with their suitability for various design and building situations. It is intended for use by window suppliers, manufacturers, and designers. It establishes a basis for decisions about the likely performance of windows relative to their exposure, and for demonstrating compliance with the minimum requirements of the New Zealand Building Code.

SNZ TS 4211 is for use with discrete window and door units to be installed within the walls of buildings. It excludes the installation details at the window perimeter and excludes building facades and curtain walls. Requirements for glazing in buildings are excluded from SNZ TS 4211 but are given in the NZS 4223 series of standards. SNZ TS 4211 also does not cover durability, thermal, acoustic, or fire-rating performance requirements for windows.

SNZ TS 4211 supersedes NZS 4211:2008 *Specification for performance of windows*. Changes to the title, layout, and emphasis of the document reflect its role in providing a classification system for windows used in New Zealand buildings. This classification system ensures that appropriate windows can be manufactured and selected for the situations in which they will be used.

Windows for typical domestic New Zealand buildings remain classified by the building's wind zone. However, this technical specification's scope has been expanded to include windows for a wider range of building typologies. Classifications are available for windows used in buildings with facades verified using EM7 *Performance of mid-rise cladding systems* (BRANZ, version 3, June 2020), and for windows that achieve building-specific performance levels determined by the facade designer.

Classification of a window using SNZ TS 4211 still requires the performance testing of a representative specimen in a controlled test facility. The methods, parameters, and performance criteria for each test are prescribed within this technical specification either directly or by reference to other standards such as AS/NZS 4420.1 *Windows, external glazed, timber and composite doors – Methods of test – Part 1: Test sequence, sampling and test methods*, and AS/NZS 4284 *Testing of building facades*. Additional tests and performance criteria have been added for use where this technical specification has introduced additional classifications.

Other revisions include updating and rationalising the requirements for operating forces, and a more graduated system for classifying air permeability performance (adapted for New Zealand from BS EN 12207 *Windows and doors. Air permeability. Classification*) in the level of performance achieved by windows supplied in New Zealand for use in a wide range of building typologies and exposure conditions.

NOTES

Technical Specification

Specification for the classification of windows

1 GENERAL

1.1 Scope

1.1.1 Inclusions

This technical specification specifies requirements for the classification and associated testing of windows installed in the external walls of New Zealand buildings.

The classification of as-manufactured windows relative to exposure categories is intended to facilitate the selection and specification of windows used in:

(a) Buildings for which the building wind zone is determined in accordance with NZS 3604 or *NASH standard – Part 2: Light steel framed buildings* and for which the weathertightness of the window installation in the cladding system is demonstrated using an acceptable solution or verification method for New Zealand Building Code (NZBC) clause E2 External moisture;

(b) Other buildings within the scope of NZS 3604 or *NASH standard – Part 2: Light steel framed buildings*, and for which the building wind zone is determined in accordance with those documents, for which the weathertightness of the window installation in the cladding system is demonstrated using an alternative solution for NZBC clause E2 External moisture;

(c) Buildings for which cladding wind pressures on the windows have been determined using AS/NZS 1170.2. For these buildings, the weathertightness of the window installation in the cladding system can be demonstrated using an acceptable solution, verification method, or alternative solution for NZBC clause E2 External moisture.

This technical specification covers performance in terms of exposure categories related to test pressures for wind and water penetration resistance, and in terms of air permeability. Additional tests are also required for operating force, torsional rigidity of opening panels, and behaviour following lateral displacement for some configurations and circumstances.

C1.1.1
The lateral displacement test provides an assessment of the resilience of the test specimen. It is not intended to be a full assessment of seismic performance and makes no assessment of performance in ultimate limit state (ULS) seismic events.

AS/NZS 4284 provides additional methods for undertaking seismic assessment of a facade.

While BRANZ's study report 54 (Thurston, 1994) showed that windows in timber-framed houses are likely to 'ride out' ULS seismic displacements without collapse or losing their structural integrity, more recent work (Carradine, et al., 2020) has identified that this risk cannot be ignored, since window systems in New Zealand have been shown to be susceptible to significant damage as evidenced in recent earthquakes. Hence, lateral displacement testing has been added to the suite of tests.

1.1.2 Exclusions

This technical specification specifically excludes:

(a) Skylights, rooflights, and roof windows;

(b) Interior windows and doors;

(c) Fixed louvres;

(d) Building facades (including curtain walls);

(e) Large access doors such as roller-shutter doors and grilles;

(f) Automatic entrance doors;

(g) Thermal and acoustic performance;

(h) The weathertightness of the window perimeter junction with the external wall or facade;

(i) Durability;

(j) Security performance.

C1.1.2
The performance of skylights, rooflights, and roof windows can be tested using AS 4285.

The performance of garage doors and large access doors can be tested using AS/NZS 4505.

Performance outcomes addressed by this technical specification are intended to be applied to fire windows installed in the external walls of buildings. However, this technical specification does not address their fire performance.

1.2 Objectives

This technical specification provides a method for determining the performance classification of production windows, based on testing of a representative specimen under simulated conditions of loading. It can be applied to windows that fit within the scope set out in 1.1 above. Tests include strength, rigidity, air infiltration, operation of opening panels, water penetration, and an optional in-plane lateral displacement of window and door systems. This technical specification does not include methods for determining durability, thermal, acoustic, or fire-rating performance.

1.3 Interpretation

For the purposes of this technical specification, the word 'shall' refers to requirements that are mandatory for compliance with the technical specification, while the word 'should' refers to practices that are advised or recommended.

The term 'normative' has been used in this technical specification to define the application of the appendix to which it applies. A 'normative' appendix is an integral part of the technical specification and contains requirements.

Clauses prefixed by 'C' are intended as comments on the corresponding mandatory clauses. They are not to be taken as the only or complete interpretation of the corresponding clause, nor should they be used for determining in any way the mandatory requirements of compliance within this technical specification.

1.4 Definitions

For the purposes of this technical specification, the following definitions shall apply:

Air permeability — The degree to which a test specimen allows the flow of air from either exterior to interior (infiltration) or from interior to exterior (exfiltration)

Collapse — When one or any combination of the following occurs during strength testing:

(a) Dislodgement or breaking of any glazing;

(b) Dislodgement of a frame or any part of a frame;

(c) Dislodgement of an opening panel from its 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 locking device, fastener, or supporting stay that allows an opening panel to open

Deflection	The amount of relative displacement of the structural components in a window. Deflection is typically not measured in the perimeter frame or the opening panel elements that are restrained by the perimeter frame. Deflection is usually measured in each of the unique full-height mullions, stiles, and/or interlockers, (normally the smallest or weakest one), and can be measured in transoms as well
Door	An opening panel of a size suitable for use as access through an external wall
Fixed glass	Glass fixed into a light that does not move within the window or door
Frame	The outer surrounding members of the window, commonly called 'head', 'sill', and 'jamb'. The frame could incorporate integral linings and facings
Friction restraint	A rotating or sliding frictional device holding a hinged, pivoted, or projected opening panel in a selected 'open' position and which is overcome by force during opening and closing. The term does not include any device, such as a stay nipped by a thumbscrew, in which the friction is manually released during window movement
Glazing	(a) The installation of glass in prepared openings in windows, opening panels, and the like; (b) Glass or plastic glazing sheet material for installation in a building
Hardware	The components necessary to operate, close, and/or lock an opening panel as designed. These can include – but are not limited to – hinges, pivots, stays, handles, locking mechanisms, and furniture
Louvre, fixed	A window unit comprising a series of fixed blades of glass or any other material
Louvre, operable	A window unit comprising a series of operable blades of glass or any other material
Mullion	An intermediate vertical member subdividing a window
Non-specific design	Design that does not require project-specific engineering calculation and design of structural actions and behaviour with project structural design work based on pre-calculated design options provided by standards such as NZS 3604 and *NASH standard – Part 2: Light steel framed buildings*

Panel	An assembly of parts, being glazing potentially contained by stile and rail members that can be opening or fixed NOTE – In the industry, the term 'sash' is sometimes used to describe what this technical specification refers to as a 'panel'.
Production window	A window intended for use in building work and classified in accordance with this technical specification based on testing of a representative specimen (or specimens)
Purpose-built collection or drainage area	A system that allows water to collect and/or be drained to the outside (at the end of testing) from sills or other framing members, or in cavities
Rail	A horizontal member of an opening panel other than an interlocker
Serviceability limit state (SLS)	A state that corresponds to conditions beyond which specified service criteria for a structure or structural element are no longer met. These criteria are based on the intended use and can include limits on deformation, vibratory response, degradation, weathertightness, or other physical aspects
Specific engineering design (SED)	Project-specific engineering calculations of structural parameters, such as a facade's wind pressures, deflections, and/or strength under structural loads
Stile	A vertical side member of an opening panel other than an interlocker
Structural member	An element – for example, a mullion, transom, interlocker, or stile – that performs the function of transferring a load to the perimeter frame or other structural member
Transom	An intermediate horizontal member subdividing a window
Ultimate limit state (ULS)	A state associated with collapse or other similar forms of structural failure. Such states generally correspond to the maximum load-carrying resistance of a structure, but in some cases, they can also correspond to the maximum applicable resistance, strains, or deformations of particular structural elements

Uncontrolled water	Water that penetrates through a test sample during the water testing is 'uncontrolled water' if it: (a) Moves beyond the joint where it entered; or (b) Is not contained in a purpose-built collection or drainage area. Examples that would not be considered 'uncontrolled water' are: (c) Minor splashing due to air infiltration within one minute after a change of applied air pressure; (d) Water which accumulates on gaskets, in sill tracks, and/or on thresholds and which drains to the exterior during or at the end of testing
Weathertightness	(a) Performance in respect to air infiltration, watertightness, and wind resistance; (b) The condition where external water has been prevented from entering and accumulating on the interior side of the cladding in amounts that can cause undue dampness or damage to the building elements NOTE – The correlation of real performance to test methods and parameters is empirical.
Window	A window or door of any type not excluded in 1.1.2
Window manufacturer or supplier	A person who, in relation to a production window, is a 'product manufacturer or supplier' as defined by, and with responsibilities under, section 14G of the Building Act 2004
Wind zone	Classification of the level of wind actions on a non-specific design building into one of five zones (L, M, H, VH and EH), using the methodology provided in NZS 3604 or *NASH standard – Part 2: Light steel framed buildings*

1.5 Abbreviations

Abbreviations have the following meanings:

EH	Extra high (wind zone)
H	High (wind zone)
IGU	Insulating glass unit
L	Low (wind zone)
l	Litres
M	Medium (wind zone)
m	Metres
N	Newtons
NZBC	New Zealand Building Code
Pa	Pascals
s	Seconds
SED	Specific engineering design
SLS	Serviceability limit state
ULS	Ultimate limit state
VH	Very high (wind zone)
WGANZ	Window & Glass Association New Zealand

1.6 Notations

This technical specification uses the following notations:

Q	Air permeability of the specimen
Q_A	Area averaged air permeability
Q_L	Opening joint averaged air permeability
p_n **(SLS)**	Serviceability limit state net cladding pressure acting on the window, derived using the methods in AS/NZS 1170.2
p_n **(ULS)**	Ultimate limit state net cladding pressure acting on the window, derived using the methods in AS/NZS 1170.2
p_{tp} **(SLS)**	Test pressure for serviceability limit states (serviceability testing)
p_{tp} **(ULS)**	Test pressures for ultimate limit states (strength testing)

2 CLASSIFICATION

2.1 Determination of exposure

Many of the minimum test performance requirements are determined relative to the anticipated wind pressure exposure of a window. This technical specification allows for the classification of windows that use a variety of pathways to establish wind exposure.

Wind exposure shall be determined using methods derived from:

(a) NZS 3604 or *NASH standard – Part 2: Light steel framed buildings* wind zones;

(b) The test pressures used in BRANZ's evaluation method EM7 (BRANZ EM7);

(c) AS/NZS 1170.2.

C2.1
In 2.1 (a), the approaches for determining wind zones relate to methods in documents cited as 'acceptable solutions' for claddings of domestic houses which have scope and geometric constraints for exposure calculations. Exposure ratings derived from wind zones are only intended for windows in buildings that fall within those constraints.

Wind pressures determined using AS/NZS 1170.2, including pressures acting on the corners of buildings, won't always correlate to the pressures derived from wind zones. For situations with unusual exposure conditions, it is recommended that designers use the AS/NZS 1170.2 methodologies.

2.2 Classification

2.2.1 Overview

The classification of windows in accordance with this technical specification establishes:

(a) Exposure rating;

(b) Air permeability performance;

(c) Minimum torsional strength and operating force characteristics for opening panels.

For a window to be classified, the mandatory tests applicable to the type of classification shall have been completed. There are two types of classification covered by this technical specification:

(d) 2022 – classification includes the range of mandatory and applicable tests listed in Table 3;

(e) 2022(A) – classification as (d) above, and also includes additional tests relating to BRANZ EM7.

Tests for each type of classification are listed in Table 3.

2.2.2 Exposure rating

The exposure rating is selected according to Table 1, which allows various exposure determination pathways, and shows the available exposure categories and the specific

minimum test parameters p_{tp} (SLS) and p_{tp} (ULS) used in this technical specification for each.

For a window to obtain a particular exposure rating, tests undertaken to the parameters applicable to that exposure category shall show that the window attains or exceeds the performance requirements of 6.1, 6.6, and 6.8 and, if applicable, 6.7.

C2.2.2
Users will not necessarily be working in the direction of 'exposure, parameters, testing'. The alternative would be to work in the other direction and determine a window's exposure category from test results.

Table 1 – Exposure rating

Approach to exposure determination	Exposure rating	p_{tp} (SLS) (Pa)[a]	p_{tp} (ULS) (Pa)[a]
NZS 3604 *NASH standard – Part 2: Light steel framed buildings*	L	± 510	± 720
	M	± 680	± 960
	H	± 970	± 1360
	VH	± 1250	± 1760
	EH	± 1515	± 2130
EM7	EM7	+ 2250/– 2750	+ 3200/– 3950
NZS 1170.2	SED (test report #)	Serviceability limit state net cladding pressures[b] p_n (SLS)	Ultimate limit state net cladding pressures[b] p_n (ULS)

[a] p_{tp} (ULS) = test pressures for ultimate limit states (strength testing).
p_{tp} (SLS) = test pressure for serviceability limit states (serviceability testing).

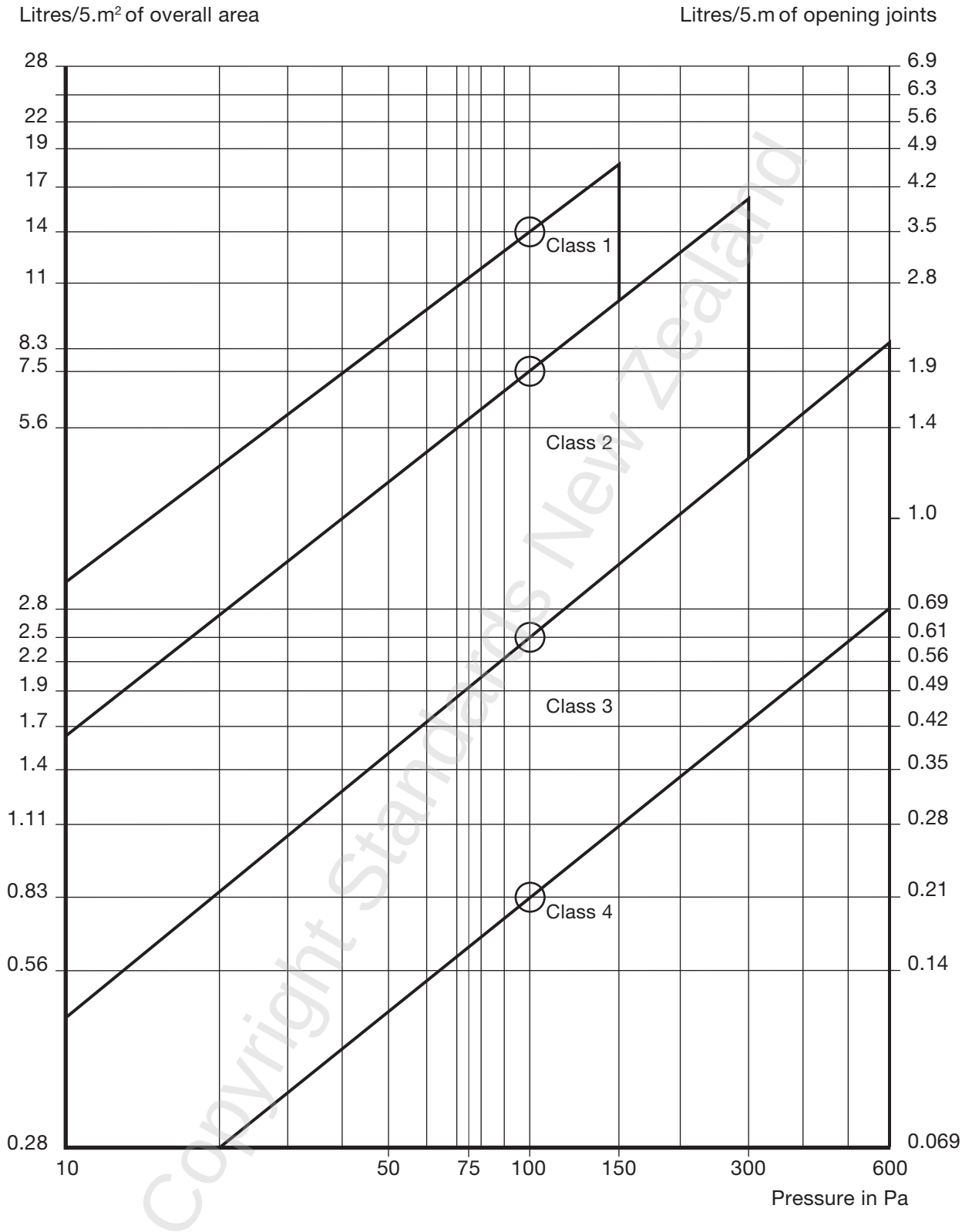
[b] SED parameters are net positive and negative limit state cladding pressures acting on the window, including local pressure coefficients.

2.2.3 Air permeability

The air permeability class describes the air permeability of the window in accordance with Figure 1, which defines a range of classes from 1 to 4 and shows the applicable air permeability parameters for each.

For a window to obtain a particular air permeability class, tests shall demonstrate that it attains or exceeds the performance requirements for that class. Tests are undertaken at two different pressure settings (in both the positive and negative directions) and are assessed in relation to the window's total area as well as the total length of opening joints (if any). The assessment that produces the worst result (lowest class number) shall determine the window's air permeability class.

C2.2.3
Users will not necessarily be working in the direction 'allowable air permeability, parameters, testing'. The alternative would be to work in the other direction and determine a window's air permeability class from test results.



(adapted from BS EN 12207)

Figure 1 – Air permeability class

The higher the air permeability class, the better the performance. To be in the relevant air permeability class in Figure 1, the product must have air permeability of less than the relevant four numbers shown on the graph and listed in Table 2 at *both* 75 Pa and 150 Pa, and for *both* the length of the joint and the area of the window.

In other words, to be in class 1, the product must have air permeability of less than:

(a) 11.4 litres per second per square metre of window (l/s.m²) at 75 Pa *and* air permeability of less than 18.3 l/s.m² at 150 Pa (left-hand axis); and

(b) 2.86 litres per second per metre of opening joint length (l/s.m) at 75 Pa, *and* less than 4.57 l/s.m at 150 Pa.

Table 2 – Threshold values for air permeability classes

	l/s.m²		l/s.m	
	@ 75 Pa	@ 150 Pa	@ 75 Pa	@ 150 Pa
Class 1	11.4	18.3	2.86	4.57
Class 2	6.17	9.88	1.54	2.47
Class 3	2.06	3.29	0.514	0.823
Class 4	0.685	1.10	0.171	0.274
NOTE – Values are given to three significant figures in order to define the class boundaries. However, this level of accuracy will not necessarily be achieved in the test booth.				

2.3 Application to production windows

2.3.1 Use and rating of smaller- or larger-size production windows

Where a production window is not of the same size as the specimen, 2.3.1.1, 2.3.1.2, or 2.3.1.3 shall apply.

2.3.1.1 Smaller sizes

Production windows that are smaller (either shorter or narrower or both) than a tested specimen of the same construction shall have the same air permeability class as the tested specimen, and either:

(a) The same exposure rating as the tested specimen; or

(b) A higher exposure rating than the tested specimen if all of the following requirements are met:

(i) The tested specimen's test results achieved the performance required for the higher exposure rating in the water penetration test, and

(ii) Calculations of deflection and stress for all structural members show that should a specimen corresponding to the configuration of the production window be subjected to the wind test pressures p_{tp} (SLS) in Table 1 for the higher exposure rating, then that specimen would achieve the performance requirements of 6.1. Calculations shall use the actual test data for the structural members, and shall be performed and certified by a suitably qualified person who can provide substantiating documentation, and

(iii) The specimen's test results achieved the performance required for the higher exposure rating in the ultimate strength test.

2.3.1.2 Larger sizes

Production windows that are larger (either taller or wider or both) than a tested specimen of the same construction shall have the same air permeability class and the same, or lower, exposure rating as the tested specimen if all of the following requirements are met:

(a) The dimensions of the production window are not more than 10% larger than those of the tested specimen in both the horizontal and vertical directions, and the total area of the production window is not more than 15% larger than the total area of the tested specimen. This applies to any element within the production window. See Figure 2;

(b) Calculations of deflection and stress for all structural members show that should a specimen corresponding to the configuration of the production window be subjected to the wind test pressures p_{tp} (SLS) in Table 1 for the exposure rating, then that specimen would achieve the performance requirements of 6.1. Calculations shall use the actual test data for the structural members, and shall be performed and certified by a suitably qualified person who can provide substantiating documentation;

(c) If the production window assembly contains one or more opening panels that move out of plane, then those panels shall have been tested at the larger size in accordance with 5.8, and shall comply with 6.9;

(d) Where the window assembly contains one or more sliding opening panels that are larger in size than the tested specimen's, then:

(i) The production window shall use the same rolling hardware that was used in the test specimen, and the weight of the opening panel in the production window shall not exceed the weight rating of that rolling hardware, and

(ii) The operating force determined during the test shall be multiplied by the ratio of the production window panel area to the test specimen panel area, and the result taken as the panel operating force for the purposes of assessing compliance of the panel with 6.2.

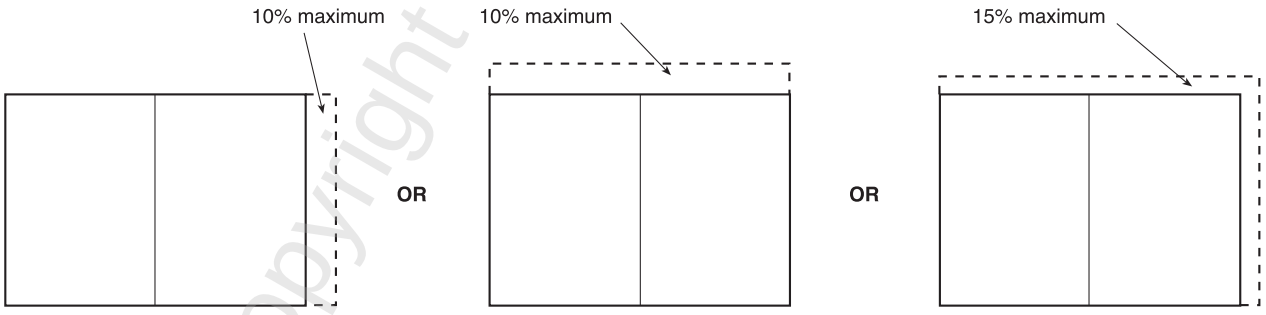


Figure 2 – Allowable dimensional increase

C2.3.1.2

When classifying a production window that is larger than the tested specimen, care should be taken to ensure its adequacy in all aspects of the chosen classification.

Provided internal or external stiffeners do not interfere with the window's systems for the management of air or water, air permeability and water penetration test results from unstiffened systems can be used for stiffened systems, within the limit of the system deflection prescribed in 6.1.

Internal stiffeners can:

(a) Allow the rotation or partial buckling of hollow sections surrounding them;

(b) Increase the loads on structural connections;

(c) Affect the air permeability and water penetration of the system, given the fixing of the stiffeners, altered deflection of the members, and changed connection with seals.

2.3.1.3 Wider sizes formed from multiple panels repeating horizontally

Production windows that are wider (but not taller) than a tested specimen and which consist solely of multiple panels repeating horizontally, with neither couplings nor mullions, shall have the same air permeability class and the same exposure rating as the tested specimen, if all of the following conditions are met:

(a) The test specimen included all panel and frame details and junctions used in the production window; and

(b) The test specimen included at least three panels of the full width and height to be used in the production window; and

(c) The test specimen included the same number of tracks used in the production window and, where the number of tracks in the specimen exceeded the number of panels, the tracks without panels faced the weathering side of the specimen; and

(d) The test specimen included all joining details required in the assembly of the outer frame; and

(e) The production window is not part of a coupled assembly.

C2.3.1.3

This clause allows the classification of production windows consisting of multiple sliding or bi-folding panels when the production window is wider than the test booth.

2.3.1.3 (b) prevents the increase in size allowed by 2.3.1.2 being used in conjunction with this clause.

2.3.1.3 (c) prevents testing of a specimen with some tracks protected by panels where those tracks could be exposed to the weather on a production window with more panels.

2.3.2 Use and rating of coupling systems

Coupling is the joining of two or more assemblies together horizontally or vertically.

Where an assembly is made of repeated adjoining modules, at least two modules, including coupling mechanisms where used, shall have been tested.

The individual modules comprising the assembly need only have been tested once, provided the sealing and closing systems are identical.

Where an assembly consists of both horizontal and vertical coupling mechanisms, these shall both have been included in the same test specimen.

A successful test result shall be sufficient to indicate that larger assemblies created by the addition of identical adjoining modules will comply.

Likewise, an opening panel need only be tested once, provided the sealing and closing systems are identical.

Where structural couplings have been tested to this technical specification, further testing of these same couplings in other configurations shall not be required, provided the calculations for deflection and stress show that these will remain within the requirements of 6.1 and 6.8 for the new configuration, based on actual test data for these couplings, and provided the calculations are performed and certified by a suitably qualified person who can provide substantiating documentation.

C2.3.2
To ensure adequacy in all aspects of the chosen classification, care should be taken when classifying a coupled window assembly larger than the tested specimen.

The use of multiple couplers should be carefully considered and limited to ensure the effects of material expansion do not compromise the overall function of the assembly. The differential movement of components forming the assembly can cause the failure of jointing mechanisms not designed to accommodate this movement.

The use of multiple couplers in both horizontal and vertical directions in an assembly can exacerbate this issue.

2.3.3 Hardware

Hardware used in production windows can vary from the tested specimen so long as any difference (such as functionality, materials, or configuration) can be shown not to adversely impact the ability of the window to achieve the performance requirements. See Appendix A for further information.

2.4 Labelling

Each production window shall be supplied with labelling on the frame, placed by the window manufacturer or supplier, stating:

(a) The window manufacturer or supplier's name or brand name;

(b) The number of this technical specification, TS 4211, and type of classification, 2022 or 2022(A);

(c) The exposure rating, and the test report number where the exposure rating is SED;

(d) The air permeability class (1 to 4). For production windows with a 2022(A) classification, the label shall state the air permeability class determined from air permeability test 2.

The labelling shall be attached to a framework member using a durable affixed label or other durable method, have lettering not less than 2 mm high, and be located so that it will be readable after installation of the window.

PRODUCT BRAND	**LOGO**	**TS 4211**	**2022**	**AIR CLASS**	**2**
		RATING	**VH**		

Example 1 – Type of classification TS 4211:2022,
exposure rating VH, air permeability class 2

PRODUCT BRAND	**LOGO**	**TS 4211**	**2022(A)**	**AIR CLASS**	**3**
		RATING	**EM7**		

Example 2 – Type of classification TS 4211:2022(A),
exposure rating EM7, air permeability class 3

PRODUCT BRAND	**LOGO**	**TS 4211**	**2022**	**AIR CLASS**	**2**
		RATING	**SED Test #**		

Example 3 – Type of classification TS 4211:2022,
exposure rating SED (test report number to be added by
window manufacturer or supplier), air permeability class 2

Figure 3 – Examples of complying labels for marking a window

C2.4
Exposure ratings of low (L), medium (M), high (H), very high (VH), and extra high (EH) are derived from wind zones determined using the version of NZS 3604 current at the time this technical specification was published.

2.5 Reporting

Each test report supporting the classification of production windows in accordance with this technical specification shall contain the following information:

(a) Test report number;

(b) Date of test;

(c) Laboratory details, including accreditation endorsement;

(d) Details of the author or test technician, or both;

(e) Window supplier or manufacturer's details;

(f) Customer's details (if different from the window supplier or manufacturer's);

(g) Summary of test results;

(h) Test specimen classifications;

(i) The documentation that was made available to the test laboratory in accordance with 3.2.2;

(j) A list of any modifications to the test specimen made after testing started;

(k) The installation and perimeter details, clearly defined in the test report drawings;

(l) Test details, including which tests were performed, the sequence in which they were performed, test settings, the record of observations including photos, and the test results.

If data from a previous test are being used, then the test report for the new specimen shall clearly identify which data were used and the test report reference.

3 SPECIMEN PREPARATION

3.1 Test facilities

All testing shall be performed by an NZS ISO/IEC 17025 accredited testing laboratory registered for such tests, under the authority of a currently accredited test technician.

3.2 Test specimen

3.2.1 Requirements for test specimen

Prepare the test specimen in accordance with AS/NZS 4420.1.

Except where 2.3 applies, the test specimen, with components, shall be representative both in size and configuration of one of the following:

(a) The largest standard assembly of the product type;

(b) The largest assembly of the product type to be used on the specific building project.

The specimen shall be glazed with the thinnest allowable insulating glass unit or units (IGUs), or thinnest allowable intended glazing material.

The designation 'product type' is used to help distinguish between operation methods of the window and associated materials and components (for example, awnings, casements, or slidings).

The test specimen assembly's materials and components shall be of the same type and size and shall have identical methods of construction as those to be used in production, except where stay tables, or the like, are used as allowed in 5.2.

NOTE – In the case of a timber specimen, the manufacturer could present the specimen in a finished state (that is, painted or stained), subject to the notation on the test report.

C3.2.1

Examples of specimen configurations typically tested for compliance with historic versions of NZS 4211 are given in Appendix B to provide a level of direction to a window manufacturer or supplier who is deciding what should, could or possibly will be tested.

The thinnest glazing is used in the specimen to have the least impact on the structural performance.

The thinnest allowable insulating glass unit (IGU) is made up of the thinnest glass panes and appropriately sized spacer(s).

Appendix C provides information on the impacts that glazing selection may have on torsional rigidity tests.

The test specimen should comprise components most likely to be used in normal manufacture – in other words, double glazing, seals, and hardware. The hardware used for the test specimen should be sufficiently robust to meet the minimum requirements of the New Zealand Building Code. See Appendix A.

3.2.2 Documentation of test specimen

Technical drawings and any other relevant information shall be made available to the test laboratory before the test specimen is installed. Documents shall include:

(a) Expected classifications(s) or wind pressure capacity of the test specimen assembly, if known, in accordance with this technical specification;

(b) An assembly drawing showing the test specimen's elevations and sections;

(c) Details uniquely identifying all parts comprising the window system, including all gaskets, weather seals, joint sealants, and hardware;

(d) Details of the test specimen's support fixing;

(e) Details of drainage including drainage hole dimensions, spacing, and location;

(f) Glazing materials, including glass type and thickness;

(g) A statement certifying that these documents accurately represent the test specimen in all respects;

(h) The date that the statement was generated.

3.3 Installation of test specimen

The installation of the test specimen shall be as follows:

(a) The test specimen shall be closed and locked and supported around the outside, except that in the case of the operating force test, it is not applicable to lock the window;

(b) The perimeter of the test specimen shall be sealed against air and water penetration;

(c) Operable test specimens shall be tested for operation with five cycles of opening, closing, and locking prior to the testing;

(d) Where there are differences from the documentation provided with the test specimen, details of the test specimen's mounting and fixing shall be noted on the respective drawing and included in the test report.

C3.3
For the purposes of this technical specification, the perimeter referred to in 3.3 (b) is considered as the exterior interface between the test specimen and the external wall of the test booth.

The perimeter of the test specimen can be tested for air and water penetration using AS/NZS 4284 or E2/VM1.

4 SEQUENCE OF TESTS

4.1 Sequence of measurements and tests

The sequence for testing a single specimen shall be determined using Table 3.

Table 3 – Sequence of measurements and tests

Test	Type of classification			
	2022		2022(A)	
	Sequence #	Application	Sequence #	Application
Deflection of structural members	1	Mandatory	1	Mandatory
Operating force	2	If required by 6.2	2	If required by 6.2
Air permeability	3	Mandatory	3	Mandatory
In-plane lateral displacement	-	Not applicable	4	Mandatory
Air permeability – 2	-	Not applicable	5	Mandatory
Water penetration – Static	4	Mandatory	6	Mandatory
Water penetration – Cyclic	-	Not applicable	7	Mandatory
Ultimate strength test	5	Mandatory	8	Mandatory
Torsional rigidity test	6	If required by 6.9	9	If required by 6.9

To determine the test sequence for each specimen, the type of classification being sought – 2022 or 2022(A) – shall be established as per 2.2.

For each classification type, there are mandatory tests as well as some additional tests that could be applicable depending on the configuration of the test specimen. Tests are to be performed in numerical sequence as nominated in Table 3.

NOTE – The term ‘if required’ refers to the test specimen’s configuration and not the client’s instruction or test operator’s discretion.

5 TEST METHODS

5.1 Deflection of structural members test

Structural members of the specimen shall be tested in accordance with AS/NZS 4420.1 section 3.

5.2 Operating force test

5.2.1 General

Sliding and bi-folding panels in a specimen shall be tested in accordance with AS/NZS 4420.1 section 4, subject to (a), (b), and (c) below. For multiple sliding panel configurations where the first panel provides access for people regardless of whether additional panels are opened, a test is only required for that panel.

Projecting and pivoting panels shall be tested in accordance with (a), (b), and (c) below.

Hinged panels, panels with a restricted opening device, and uncontrolled bi-folding panels do not require an operating force test, except where they include a closing control mechanism.

(a) The operating forces shall be applied under still air conditions, in both opening and closing directions, and for both initiating and sustaining movement at each position.

(b) Measurements shall be taken at the following positions, with the average of three readings recorded for each position:

  (i) In the opening direction:
  – Fully closed, but unfastened
  – Approximately 33% open
  – Approximately 67% open

  (ii) In the closing direction:
  – Approximately 33% closed
  – Approximately 67% closed;

(c) The force shall be applied to the fastener or handle in the direction of motion. If there is no fastener or handle, the force shall be applied midway between the slides or pivots and to the member most likely to be gripped by a user.

C5.2.1
This technical specification elaborates on the provisions of AS/NZS 4420.1 section 4. Test provisions for multiple sliding panel door configurations, and for hinged panels (including uncontrolled bi-folding panels), are aligned to matters covered by the performance requirements of this technical specification. Provisions for the testing of opening and closing forces for projected and pivoted panels are also included.

Testing in still air conditions ensures that operating force measurements are not influenced by pressures resulting from wind or other air movement within the test environment.

5.2.2 Opening panels that differ from the test specimen

A new operating force test is required to determine compliance of any opening panel that differs from the original tested specimen through one or both of the following:

(a) A change to a seal type;

(b) A change in the hardware used, unless a separate confirmation is provided indicating that the replacement hardware is appropriate for the size and configuration of the opening panel.

5.3 Air permeability test

The specimen shall be tested for air permeability in accordance with AS/NZS 4420.1.

5.4 In-plane lateral displacement

The specimen shall be displaced laterally according to the method set out in 8.9 of AS/NZS 4284.

5.5 Water penetration resistance test – Static pressure

The specimen shall be tested in accordance with AS/NZS 4420.1 section 6.

Where testing is continued beyond the initial 15-minute period, additional pressure increments shall be for 10-minute intervals.

Spray nozzle layout shall comply with Appendix D.

5.6 Water penetration resistance test – Cyclic pressure

The specimen shall be tested to the cyclic water test methods of 8.6 of AS/NZS 4284.

5.7 Ultimate strength test

The specimen shall be tested in accordance with AS/NZS 4420.1 section 7.

C5.7
There could be occasions during the ULS test when the desired test pressure cannot be readily achieved. In this case, it is acceptable for any openings to be covered with flexible, airtight material to provide sufficient airtightness for the duration of that part of the test, provided this does not contribute any structural support to the window.

5.8 Torsional rigidity

A specimen opening panel shall be supported in its normal attitude, then subjected to a force perpendicular to the plane of the opening panel.

The test shall be conducted as follows:

(a) The test apparatus described in Appendix E shall be used;

(b) The opening panel to be tested shall be mounted vertically and clamped at three corners so that these corners cannot move out of plane;

(c) The two corner clamps closest to the free corner shall each use a pair of rigid metal strips 5 mm wide, secured approximately parallel to each other, one on each side of the opening panel. The centre line of each strip shall be aligned along the corner joint of the stiles and rails of the opening panel. The third clamp shall securely hold the corner most remote from the free corner;

(d) The fourth corner shall be subjected to a force at right angles to the opening panel, applied and progressively increased in increments of 10 ± 0.1 N at 1-minute intervals up to the maximum specified in 6.9;

(e) The opening panel shall be tested in both inward and outward directions.

6 PERFORMANCE REQUIREMENTS

6.1 Deflection of structural members

The maximum deflection due to bending of any structural member, measured relative to the ends of the member, shall not exceed the span divided by 200, unless a smaller value of allowable deflection is specified.

The maximum deflection of any structural member shall not exceed 20 mm, unless a smaller value of allowable deflection is specified.

Undertake separate tests to both the positive and negative p_{tp} (SLS) pressures, established as per 2.2.2 and Table 1.

6.2 Operating force test

The test force shall be no greater than the values for opening panels given in Table 4.

Table 4 – Maximum operating force for panels

Function	Horizontal sliding panel	Vertical sliding panel	All other opening panels
To initiate movement	135 N	180 N	100 N
To sustain movement	100 N	150 N	100 N

An open, vertically sliding opening panel shall not move when an upward or downward vertical force of less than 10 N is applied.

Where friction restraints alone are relied on to control a pivoting or projecting panel when open, the friction restraints shall provide sufficient restraint to prevent the window from moving when subjected to a force in newtons equal to 35 times the opening panel area in square metres.

There are no operating force requirements for hinged panels, panels with a restricted opening device, or uncontrolled bi-folding panels unless they include a closing control mechanism.

C6.2
The operating forces required by this technical specification are not intended to apply to situations where people with disabilities will operate the panels. NZS 4121 contains provisions for operating forces of door panels for use by people with disabilities – for example, door panels that are part of an accessible route.

6.3 Air permeability test 1

The air permeability class (from 1 to 4) shall be determined by establishing the air permeability of the test specimen in relation to the overall area of the test specimen and, where applicable, the length of opening joints in the test specimen.

First determine the air permeability of the specimen (Q) in l/s (litres per second) at pressure differentials of + 75 Pa, – 75 Pa, + 150 Pa, and – 150 Pa.

Then for each test pressure, determine the area averaged permeability (Q_A) by dividing the air permeability (Q) by the total area of the test specimen. This calculation will result in four data points.

If the specimen contains opening joints, determine the opening joint averaged permeability (Q_L) by dividing the air permeability (Q) by the total length of opening joints in the test specimen. This calculation will result in four data points.

Plot the first four data points on Figure 1 using the left-hand y axis for the area averaged results. For test specimens containing opening joints, plot the next four data points for the opening joint averaged results using the right-hand y axis.

The air permeability class is the lowest-numbered (least-favourable) class indicated by any of the plotted data points.

For windows to have an exposure rating of EM7, the specimen shall achieve a class 4 performance in this test, and at least a class 3 performance in air permeability test 2.

C6.3
This method is similar to that used in BS EN 12207, thus allowing international comparison of performance.

The 'non-air-conditioned' rating from NZS 4211:2008 falls within class 2, and the 'air-conditioned' rating falls within class 3.

6.4 In-plane lateral displacement

The specimen shall be displaced laterally in accordance with EM7 section 4. Requirements for EM7 lateral displacement are not less than the specimen height divided by 200 in each direction parallel to the window plane.

6.5 Air permeability test 2

Repeat the air permeability test 1 process and determine the air permeability class using all of the steps in 6.3.

The window shall not be classified 2022(A) if the specimen performance reduces by more than one class or reduces below class 2.

For windows to have an exposure rating of EM7, the specimen shall achieve at least a class 3 performance in this test and achieve a class 4 performance in air permeability test 1.

The 2022(A) classification requires air permeability test 2 results to be displayed on the label.

6.6 Water penetration test pressures – Static

Undertake tests at the minimum positive pressures shown in Table 5.

Table 5 – Water penetration test pressures – Static

Exposure label	Water test pressure (Pa)
L:2011	155
M:2011	205
H:2011	290
VH:2011	375
EH:2011	455
EM7:2020	675
SED	p_{tp} (SLS) × 0.3

Water penetration shall be assessed by visual observation. The specimen shall not show uncontrolled water.

Observations of the internal surface of the specimen shall be carried out throughout the water spray operation and for 5 minutes after the water spray has stopped and there is zero air pressure differential on the specimen.

C6.6
The pressures used for the water penetration tests are not intended to represent actual pressures during rainstorms. They are an empirically derived set of test pressures which have been found to correlate well with observed performance during in-service wind and rain events.

6.7 Water penetration test pressures – Cyclic

Undertake tests to EM7 section 4 parameters, as shown in Table 6.

Water penetration shall be assessed by visual observation. The specimen shall not show uncontrolled water.

Observations of the internal surface of the specimen shall be carried out throughout the water spray operation and for 5 minutes after the water spray has stopped and there is zero air pressure differential on the specimen.

Table 6 – Water penetration test pressures – Cyclic

Test stages	Water test pressure (Pa)
Stage 1	337 – 675
Stage 2	450 – 900
Stage 3	675 – 1350

6.8 Ultimate strength test

Undertake separate tests to 100% of both the positive and negative p_{tp} (ULS) pressures, established as per 2.2.1 and Table 1.

The specimen shall not collapse when it is tested to the test pressures.

6.9 Torsional rigidity test

The maximum deflection of an opening panel shall not exceed 0.025 times the length of the shortest of two members joined at the point of load, or 30 mm (whichever is the lesser), when loaded with a force of 40 N.

All projecting opening panels used in a specimen shall be tested to the requirements of this section, unless identical in construction to, and of the same size or smaller than, a previously tested panel.

C6.9
If using data from a previous test, then the test report for the new specimen shall include reference to the test from which the data were extracted.

Appendix C provides information on the impacts that glazing selection may have on torsional rigidity tests.

APPENDIX A – HARDWARE

(Informative)

The term 'hardware' includes those components necessary to operate, close, or lock (or any combination thereof) an opening panel as designed. These components might include, but are not limited to, hinges, pivots, stays, handles, locking mechanisms, and furniture.

The hardware used in the construction of operable windows and doors comes in a variety of types, styles, and levels of quality. Clause 2.5 requires test reports to include clear and accurate identification of each item of hardware used in any test specimen and for these to be noted on the test drawings, with type, brand, model, part number, and any modifications made prior to or during testing noted in 2.5 (j).

Hardware should be installed so that the operating opening panel remains attached to the window frame. Sharp edges should not protrude.

The hardware should have a tested level of performance for the most severe exposure rating in which the window is to be used.

The following codes of practice from the Window & Glass Association of New Zealand (WGANZ) are examples of test standards that could help demonstrate hardware performance:

(a) WGANZ TT-ICP-002 NZ;

(b) WGANZ NZ-ICP-003a.

APPENDIX B – TYPICAL CONFIGURATIONS AND STRUCTURAL MEMBERS

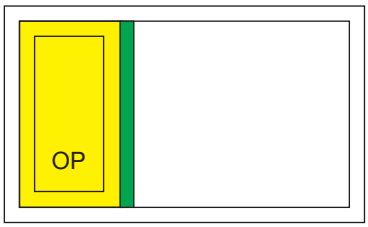
(Informative)

The following figures provide examples of window and door configurations typically tested for compliance with historic versions of NZS 4211. The intent of this technical specification, as described in 4.1, is that when testing a prototype, the test specimen should replicate the largest size of any particular configuration and/or system type. Not all possible configurations can be included in this appendix, nor indeed conceived, so the following figures simply provide a level of direction when deciding what should, could or will possibly be tested.

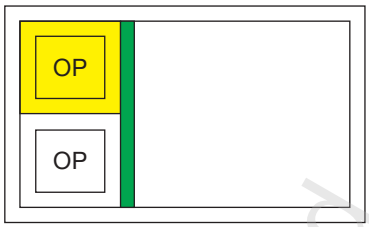
Sizes have been specifically excluded from the following figures. The manufacturer should decide what size a particular test specimen should be, based on its design and intended market. Clause 2.3 allows production windows to differ in size from the specimen, within the limits prescribed.

Arrows and lines indicating opening direction are examples only.

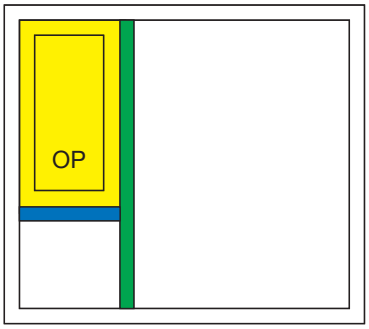
The figures indicate which elements of the configuration shall be tested.



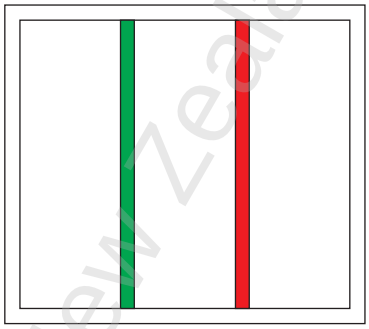
Window with full-height panel



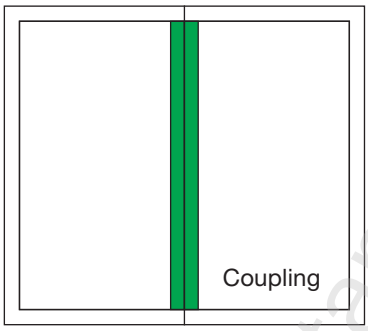
Window with transomless panel



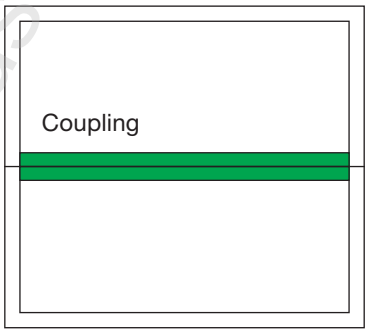
Window with transom or panel



Fixed window



Vertical coupling



Horizontal coupling

Key

OP Opening panel

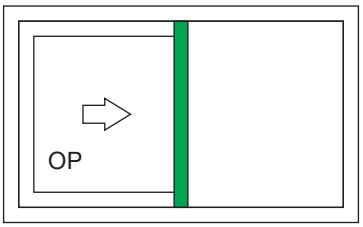
Indicative of a structural member as defined in 4.1, which would be tested in accordance with 5.1.

If identical to another structural member in the same test specimen, then testing as per 5.1 is not required.

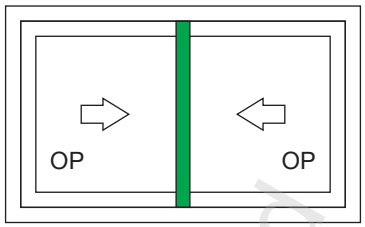
Similar to a structural member and testing in accordance with 5.1 is often omitted unless the member length exceeds 1.0 m.

A panel, for which deflection testing as per 5.1 is not required. However, torsional testing of the panel assembly is required in accordance with 5.8.

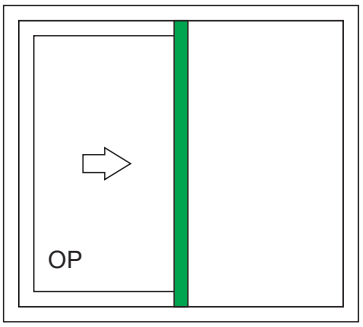
Figure B1 – Configuration examples – Windows



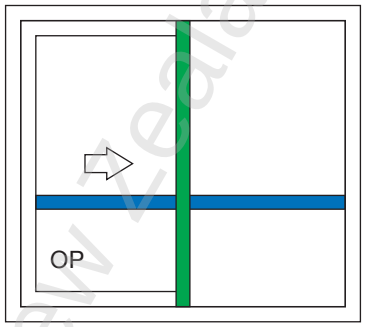
Sliding window



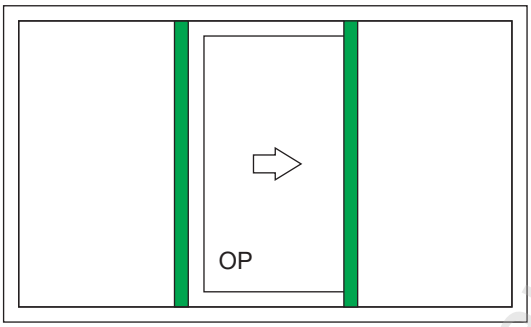
Opposing sliding window



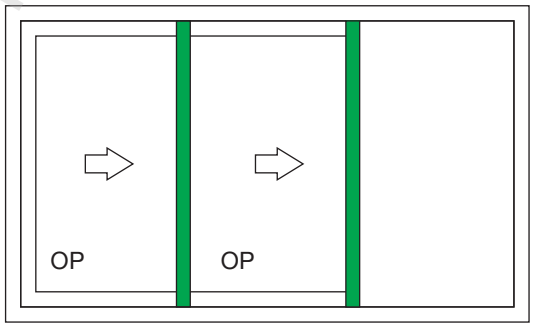
Sliding door



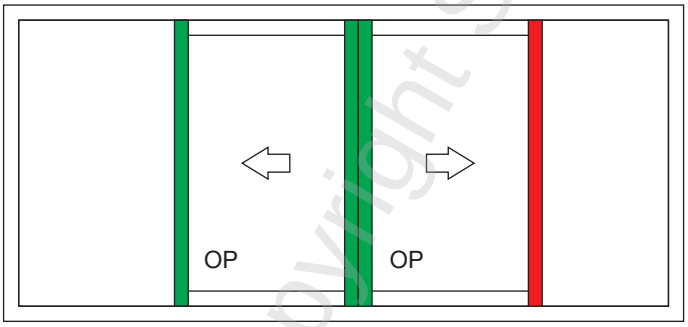
Sliding door with vision rails



Sliding door with sidelight



Stacking sliding door



Bi-parting sliding door

Key

OP Opening panel

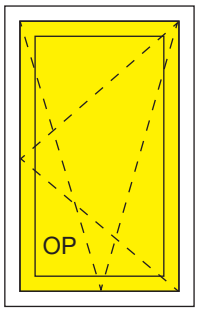
Indicative of a structural member as defined in 4.1, which would be tested in accordance with 5.1.

If identical to another structural member in the same test specimen, then testing as per 5.1 is not required.

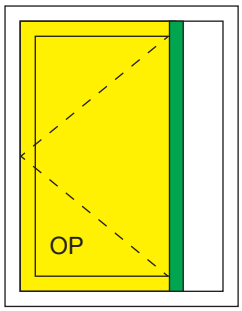
Similar to a structural member and testing in accordance with 5.1 is often omitted unless the member length exceeds 1.0 m.

A panel, for which deflection testing as per 5.1 is not required. However, torsional testing of the panel assembly is required in accordance with 5.8.

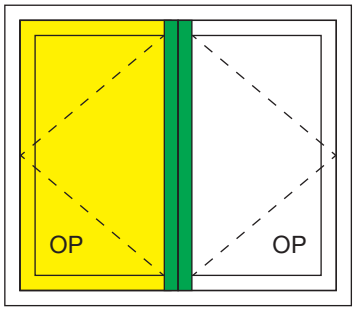
Figure B2 – Configuration examples – Sliding



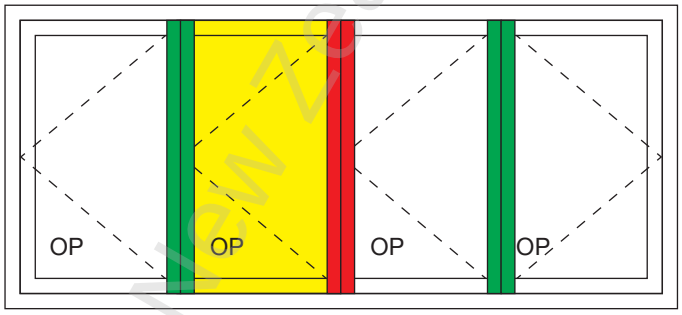
Hinged door



Hinged door and sidelight



French door



Bi-folding door

Key

OP Opening panel

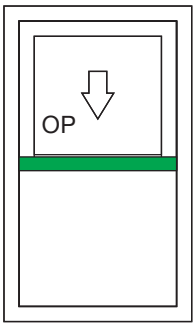
Indicative of a structural member as defined in 4.1, which would be tested in accordance with 5.1.

If identical to another structural member in the same test specimen, then testing as per 5.1 is not required.

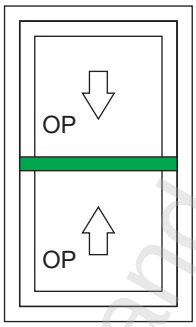
Similar to a structural member and testing in accordance with 5.1 is often omitted unless the member length exceeds 1.0 m.

A panel, for which deflection testing as per 5.1 is not required. However, torsional testing of the panel assembly is required in accordance with 5.8.

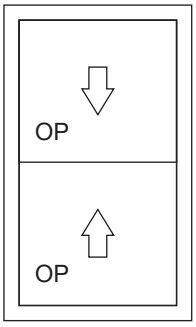
Figure B3 – Configuration examples – Hinged and bi-folding



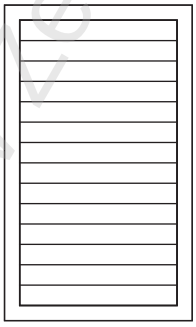
Vertical sliding window



Double-hung window



Frameless double-hung window



Louvre

Key

OP Opening panel

Indicative of a structural member as defined in 4.1, which would be tested in accordance with 5.1.

If identical to another structural member in the same test specimen, then testing as per 5.1 is not required.

Similar to a structural member and testing in accordance with 5.1 is often omitted unless the member length exceeds 1.0 m.

A panel, for which deflection testing as per 5.1 is not required. However, torsional testing of the panel assembly is required in accordance with 5.8.

Figure B4 – Configuration examples – Miscellaneous

APPENDIX C – IMPACTS ON TORSIONAL RIGIDITY TESTS

(Informative)

Glazing (including glazing gaskets, tapes, or sealants used to fix, retain, and support the glazing) provides some torsional rigidity to opening panels, so it does matter what glazing is used in the test. The option of testing the torsional rigidity of a window opening panel without any glazing at all was considered for a past edition, but it was deemed inappropriate to set performance levels without further research. While it is expected that the specimen will be tested with the thinnest (weakest) glazing system possible, as noted in 3.2.2, in some situations testing a specific glazing thickness, typical glazing system, or IGU configuration could be more relevant to a particular project.

If it is permitted by NZS 4223 that the window system will be used with single glazing, then this should be used in the test. Where a window system will not be used with single glazing, the thinnest (weakest) IGU allowed by NZS 4223.3 would typically be used in the test.

While it is expected that glazing installed in window assemblies for testing should comply with NZS 4223, there could be situations where plastic panes (or panes made from another material) are appropriate for testing. This should be clearly noted in the test report. Also, the panes should comply with any applicable material standards as well as any applicable human impact requirements.

APPENDIX D – SPRAY NOZZLE LAYOUT

(Normative)

D1

As the majority of the specimen is subjected to surface water run-off rather than water spray droplet impact, the crucial factor is the surface water coverage, not the droplet size. The following layout provides a means of achieving this.

D2

To test the water penetration of windows, spray the face of the windows completely and continuously. A typical spray nozzle layout for water application is shown in Figure D1.

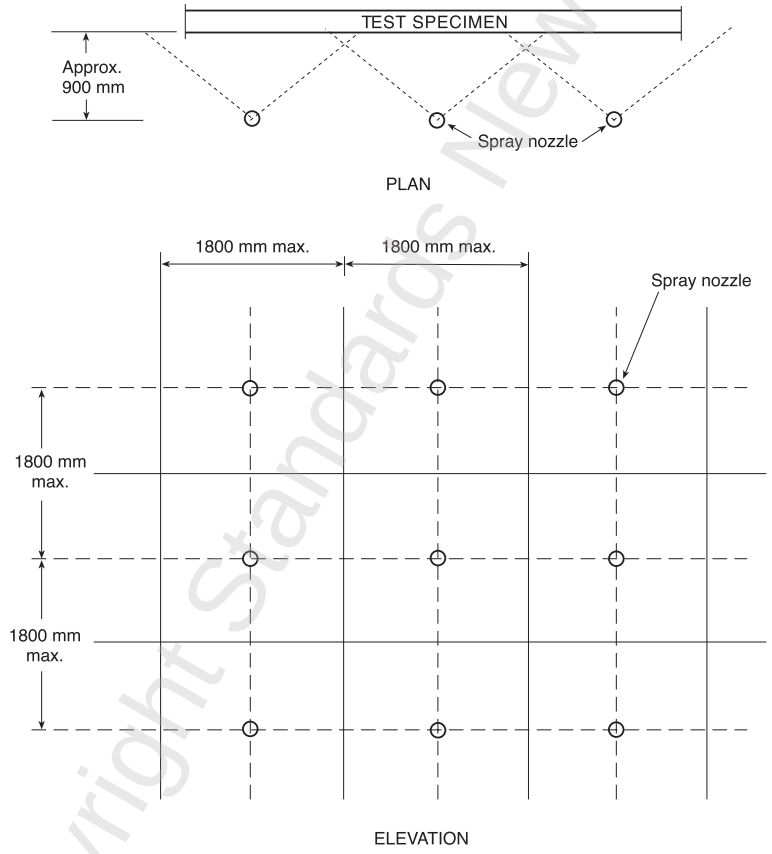


Figure D1 – Spray nozzle layout for water application

D3

Spray nozzles shall provide complete coverage of the top of the specimen. They can be a solid-cone type giving a spray angle of between about 90° and 100°, with a predominantly large droplet size (50% greater than 2 mm diameter). The top horizontal row of nozzles should be positioned at a level within ± 100 mm of the top of the test specimen.

NOTE – A Spraying Systems 1/4HH-14WSQ nozzle is an example of an acceptable square-pattern, solid-cone type that provides a suitable droplet size and coverage of between 1.5 m^2 and 2.0 m^2.

APPENDIX E – TORSIONAL TEST RIG

(Normative)

The following apparatus is required:

(a) A mounting frame, such as the example shown in Figure E1, of a size to fit the test specimen;

(b) A displacement-measuring device capable of measuring displacements to an accuracy of better than ± 0.5 mm;

(c) A set of weights or a digital force scale with a maximum reading capability calibrated to a traceable standard in increments of 10 N to an accuracy of better than ± 0.1 N;

(d) A system for applying force to a corner of the opening panel.

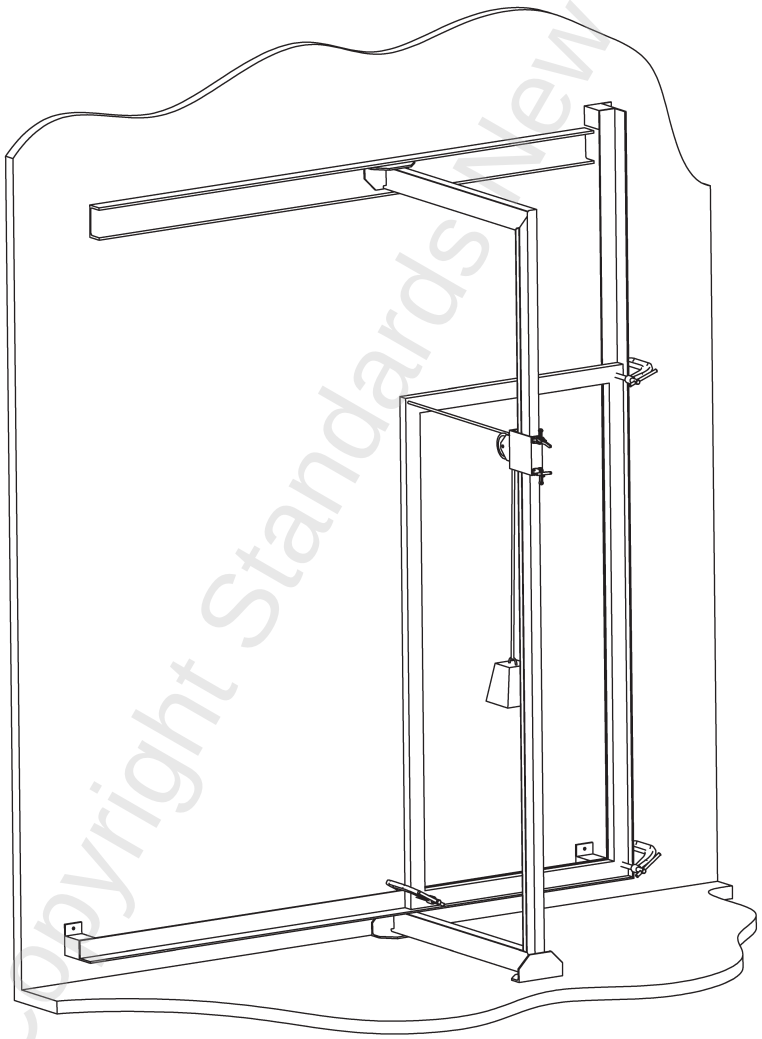


Figure E1 – Example of a torsional test rig assembly

NOTES

Approved by the New Zealand Standards Executive on 9 September 2022 to be a New Zealand technical specification.

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The following references relate to this standard:

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