FIELD TESTING OF WINDOWS AND FAÇADE ELEMENTS USING CERTIFIED TESTING PROCEDURES

FOR

WINDOW AND GLASS ASSOCIATION OF NEW ZEALAND

These Test Methods are Issued Under the Authority Of:

Mr. Robert Campion

Technical Manager

WINDOW AND GLASS ASSOCIATION OF NEW ZEALAND

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General

There are occasions when on-site testing of the weathertightness of a window or façade element installation is required. These tests may be part of building Quality Assurance programmes, verification of remedial work on installation detailing, or diagnostic tests to trace observed water penetration through recently installed fenestration products.
Most products supplied to building sites will either have had prototype testing on near identical component systems carried out by the manufacturer or have been designed based on engineering information and established performance criteria. However as most commercial building sites are not identical, the installation details of fenestration elements will be specific to the particular site. As the prototype testing of facades is an expensive undertaking, such testing is usually only carried out where the system or products have no performance history, and it is necessary to demonstrate that the specific criteria of structural performance air infiltration and water penetration at defined wind loads is achieved.
Where established fenestration systems are being used in different arrangements from the original prototype tests, the structural aspects of the design can be verified by engineering calculation, but there may be questions concerning equivalent weatherability performance that need to be considered. If the installation detailing is significantly different to that of the original prototype or there are concerns by the specifiers that require additional verification of the fenestration installation, site testing should be considered. While this is an additional cost to the project, these costs may well be an insurance against subsequent remedial work on weathertightness problems, after the building contract is completed.
To avoid specifiers and building contractors developing site testing procedures that may be non-standard and therefore not able to be certified within existing NZS ISO/IEC 17025 accredited laboratory testing protocols, WGANZ has developed two test procedures that can be specified for on-site weathertightness verification and quality assurance and that can be incorporated into existing IANZ accredited laboratory test schedules. These two testing procedures are based on long established testing methods developed by the American Architectural Manufacturers Association (AAMA) for site testing of fenestration elements and their installation. The two tests procedures are:

AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems",

AAMA 502 Voluntary Specification for Field Testing of Newly Installed Fenestration Products.

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All	1	Issue of Controlled Document	01.07.2018	R Campion

Members of the Window and Glass Association in New Zealand have for many years valued the ready availability of the many technical support documents published by the AAMA. Many of our members have utilised the standardised field testing procedure that is covered by AAMA 501.2 with the purchase of the recommended nozzle and making up and using the equipment in accordance with the procedure. More recently there have been moves on a number of building projects to undertake a more detailed evaluation of water tightness performance, using an internal enclosure similar to that covered by AAMA 502 – 12.

AAMA 501.2 - 15 "Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems".

The purpose of the test procedure is to provide a quality assurance and diagnostic field water check method for installed fenestration elements including storefronts, curtain walls, and sloped glazing systems. This field test procedure is intended to evaluate those joints, gaskets and sealant details in the glazing which are designed to remain permanently closed and water tight. The procedure is not intended to test the rated or specified water performance representative of a wind driven rain event, nor is it appropriate for testing operable components such as operable windows and doors.

The WGANZ procedure based on AAMA 502-12 is the proper test method for field water penetration resistance testing of operable windows and doors.

A copy of the Window and Glass Association Test procedure based on AAMA 501.2 is shown in Appendix B

AAMA 502 – 12 "Voluntary Specification for Field Testing of Newly Installed Fenestration Products"

An important aspect of the AAMA 502 - 12 test is that the field test is conducted at 2/3 of the water penetration test pressure specified for that site location. Normally under NZS 4211 and AS/NZS 4284, as well as the Australian window standard AS 2047, the Static Water penetration test is conducted at 30% of the positive Serviceability wind pressure, an empirical relationship developed and substantiated by site service performance for many years. This relationship simulates through a 15 minute test at a constant pressure equal to 30% of the specified positive serviceability wind pressure, a water penetration performance equivalent to the actual pressure from the highly variable wind gust velocity that may on statistically infrequent occasions reach the serviceability wind speed.
AS/NZS 1170.0 Appendix B 'Use of Data for Design' has in section B3 'Prototype Testing' Table B1 which sets out values of Variability Constant k1 to allow for variability of the property being evaluated. When prototype tests are undertaken with only a single sample, such as is usual with window and façade testing to NZS 4211 and AS/NZS 4284, the table indicates that the target value should be increased by the variability factor k1. Experience suggests that the variability of a property such as watertightness would have a variability of at least 10%, which for a single prototype test requires a k1 factor of 1.46. As both NZS 4211 and AS/NZS 4284 define the water penetration test pressure as 30% of the positive serviceability wind pressure for a single prototype test, the implication is that the unfactored requirement would be 1/1.46 or just over 2/3 of the defined NZS 4211 and AS/NZS 4284 specification test pressures.
In addition, as the AAMA note in their test procedure, the field installation conditions also influence the product performance. Products tested in the laboratory are perfectly plumb, level and square in a precision opening. Field test specimens, although installed within acceptable industry tolerances, are rarely perfectly plumb, level and square. Shipping, handling, acts of subsequent trades, aging and other environmental conditions all may have an adverse effect upon the performance of the installed specimen.
A 1/3 reduction of the test pressure for field testing as specified is an appropriate adjustment for the differences between the single prototype laboratory test and the general range of similar products following installation, subject to a field test procedure.
While the AAMA 502 - 12 test procedure allows for either an external enclosure positively pressurized or an internal enclosure negatively pressurized, the practicalities of mounting an external enclosure with adequate fastenings into the building cladding against the positive pressure force generally precludes this method. It should be noted that as the internal enclosure will be under negative pressure, the resulting suction will draw the temporary enclosure onto the existing window perimeter without the need for substantial structural attachment and corresponding minimisation of damage to internal linings and fixtures.
The only variation to AAMA 502 - 12 is the requirement for the water spray to comply with the ASTM 1105 requirement for a minimum coverage of 3.4 l/min.m^2 and instead specifies the NZS 4211 and AS/NZS 4284 minimum rate of 3.0 l/min.m^2

A copy of the Window and Glass Association Test Procedure for Field Testing of Newly Installed Windows and Doors Generally in accordance with AAMA 502 – 12 is shown in Appendix C

Short Form Specifications

To facilitate specifiers calling up the Field test procedures, draft Short Form Specifications are attached. As the cost of undertaking these Field tests will need to be covered within any contractual supply from manufacturers or installers, it is important that provision for any Field test is signalled by specifiers, during contract negotiations, with the necessary details of number, selection, sampling site access, responsibility, testing agency etc covered by the specification.
A copy of the Window and Glass Association Short Form Specification for the “WGANZ Procedure for Field Testing of Newly Installed Windows and Doors." is shown in Appendix A

APPENDIX A

WGANZ Short Form Specification for Field Testing

To simplify the writing of field testing specifications for fenestration products, WGANZ has prepared the following "Short Form Specification" for use by architects/specifiers. It may be used by merely inserting the following paragraph(s) into the project specifications. Please note that Specifier Notes in italics are not to be inserted into the project specifications.

Short Form Field Testing Specification

1. Newly installed fenestration product(s) shall be field tested in accordance with WGANZ Procedure for Field Testing of Newly Installed Windows and Doors."

> *SPECIFIER NOTE 1: See WGANZ Procedure for a description of the test method "Field Testing of Newly Installed Windows and Doors generally in accordance with AAMA 502" for water penetration resistance field testing of fenestration product specimens during construction and prior to building occupancy.*

2. All testing shall be performed by an NZS ISO/IEC 17025 accredited testing laboratory registered for such tests.

3. Test three (unless otherwise specified) of the fenestration product specimens after the products have been completely installed for water penetration resistance as specified.

> *SPECIFIER NOTE 2: The number of specimens to be selected for testing on a project should be determined after careful consideration of the following factors:*
>
> *• What will be the cost impact of the quantity and location of specimens selected for testing?*
>
> *• Selecting a large number of specimens on a small project (fewer than 50 fenestration products) is normally not cost effective, and as few as one specimen may provide the information needed.*
>
> *• On all projects, regardless of size, the specifier should determine how many specimens are required in order to establish a reasonable measure of quality for the entire project ASTM E 122 provides guidance on how to establish the number of test specimens in order to estimate a measure of quality of a production lot with prescribed precision.*

• The specifier must carefully balance the cost of specimen or specimen preparation, as well as the cost of testing and the restoration of the project surrounding components and finishes to their original condition, before determining the number and location of specimens to be tested. On larger projects, a formal cost-benefit analysis is appropriate.
On smaller projects, the specifier should avoid a situation where the cost of testing and building restoration approaches the cost of the fenestration products. If any of the tested fenestration products fail to comply with the project requirements, consideration should be given to the selection and testing of additional products.

• If water penetration is observed and the source of the leakage cannot be determined, a forensic evaluation using the procedures outlined in AAMA 511 shall be performed while maintaining the test pressures and methods defined in "Field Testing of Newly Installed Windows and Doors generally in accordance with AAMA 502"

4. Water penetration resistance tests shall be conducted at a static test pressure of ……..Pa No water penetration shall occur as defined in clause 4.5 of "WGANZ Procedure for Field Testing of Newly Installed Windows and Doors."

SPECIFIER NOTE 3: When selecting static water test pressure to be tested at the job site, in no case shall the specified test pressure exceed 2/3 of the tested or rated laboratory performance (see Section 4.3.2 for default performance requirements).

APPENDIX B

WINDOW AND GLASS ASSOCIATION OF NEW ZEALAND QUALITY ASSURANCE AND DIAGNOSTIC WATER LEAKAGE FIELD CHECK OF INSTALLED FENESTRATION ELEMENTS IN ACCORDANCE WITH AAMA 501.2

1 - General

1.1 The detailed test method outlined in this procedure is based on AAMA 501.2 – 15 “Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems”, using an external controlled pressure water spray nozzle.

1.2 The purpose of the test procedure is to provide a quality assurance and diagnostic field water check method for installed fenestration elements including storefronts, curtain walls, and sloped glazing systems. This field test procedure is intended to evaluate those joints, gaskets and sealant details in the glazing which are designed to remain permanently closed and water tight. The procedure is not intended to test the rated or specified water performance representative of a wind driven rain event.

1.3 This field test method is not appropriate for testing operable components such as operable windows and doors. The WGANZ procedure based on AAMA 502- 12 is the proper test method for field water penetration resistance testing of operable windows and doors.

2 - Equipment Requirement

2.1 The test shall be conducted using a Type B-25, #6.030 brass nozzle with a 1/2" FPT as manufactured by Monarch Manufacturing Works, Inc./Newton Tool & Mfg. Company, 500 Pedricktown Road, Swedesboro, NJ 08085.The nozzle shall be connected to a hose [19 mm (3/4 in) diameter is suggested] and shall be provided with a control valve and a pressure gauge between the valve and the nozzle.

2.2 A suitable water pump to augment mains water pressure where necessary to achieve the required 205 to 240kPa (30 to 35psi) pressure at the nozzle inlet.

2.2 The pressure gauge shall be calibrated at a maximum of 6 monthly intervals

4 - Procedure

4.1 Turn on water supply valve (and booster pump if required) and adjust water pressure to the required 205 to 240kPa (30 to 35psi) with the control valve.

4.2 The designated test area shall be divided into and evaluated in 1.5m sections of the framing and joint. The nozzle shall be held at a distance of 305mm (1ft) ±25mm (1in) from the location under test. Each 1.5 m section of test area shall be evaluated for a period of 5 minutes by slowly moving the nozzle back and forth over the test section while maintaining the nozzle perpendicular to the plane of the wall.

> ***NOTE:*** *It is recommended that a gauge rod be attached to the end of the nozzle to ensure that the specified distance from the joint under test is maintained.*

4.3 Working from the exterior, the wall test section shall be selectively wetted progressing from the lowest horizontal framing member, then the adjacent framing intersections, then the adjacent vertical framing members, etc. During the test, an observer on the indoor side of the wall, using a flashlight if necessary, shall check for any water leakage and shall note where it occurs.

4.4 If no water leakage occurs during the five minute test, the next 1.5m of framing shall be wetted for five minutes, and testing continued in this manner until the entire test area is tested.

4.5 For this water leakage field check, water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces, that is not contained or drained back to the exterior, or that can cause damage to adjacent materials or finishes. Water contained within drained flashings, gutters, and sills is not considered water leakage. The collection of up to 15ml (1/2oz) of water in a five minute test period on top of an interior stop or stool integral with the system shall not be considered water leakage.

4.6 If water leakage occurs and the source of the leakage cannot be identified, the following sequence shall be followed:

4.6.1 After allowing the wall to dry completely and working downward from the top of the area to be checked, all joints, gaskets and framing within this area shall be completely and tightly covered, on the outdoor side, with a water proof adhesive masking tape. If necessary, use small amounts of sealant where the tape wraps around the framing corners and joints to ensure that the masking is complete and waterproof.

4.6.2 Starting at the bottom of the prepared area, the masking tape shall be removed from the lowest horizontal framing for a distance of not more than 1.5m from one end of the frame, including the joint intersection or corner at the end. This exposed length shall be subjected to the nozzle spray as directed in Section 4.1.

4.6.3 If no water leakage occurs during the five minute test period, this length of framing shall be considered satisfactory and shall remain uncovered. If leakage has occurred at any point, the framing shall be re-taped at such points to prevent further leakage of these points during the subsequent checking of joints and framing adjacent to or above them.

4.6.4 This process shall then be repeated on all framing, gaskets and joint intersections within the designated area, using increments of exposed framing length not exceeding 1.5 mm and always working upward on the wall.

5 - Remedial Work and Re-Checking

5.1 Wherever water leakage has occurred, the framing shall be made watertight in a manner acceptable to the specifier and/or owner's representative. Remedial work involving the use of curing-type compounds shall be allowed to set before it is re-checked for leakage.

5.2 After all necessary remedial work has been completed and the required curing time, if any, has elapsed, all repaired framing sections shall again be checked, following the same procedure as before (Section 4). Should leakage still be found, further remedial measures shall be taken, and checking shall be repeated until all framing in the designated area is found to be satisfactory.

6 - Reporting

6.1 A report of the Field test shall be prepared by the testing technician and shall contain the following information:

- Location of testing site
- Identification of testing agency and name of technician performing the tests
- Description and location of the façade elements under test
- Date and weather conditions during test period
- Description of extent and source of any water leakage on internal face of test samples
- Signature of testing technician and date of test report.

6.2 The test report shall include a compliance statement indicating that the tests were conducted in accordance with this method or completely describe any deviation. Also state whether or not the results indicate compliance with the field testing specification requirements for the project.

APPENDIX C

WINDOW AND GLASS ASSOCIATION OF NEW ZEALAND
PROCEDURE FOR FIELD TESTING NEWLY INSTALLED WINDOWS AND DOORS GENERALLY IN ACCORDANCE WITH AAMA 502 – 12

1 - General

1.1 The detailed test method outlined in this procedure is based on AAMA 502 – 12 "Voluntary Specification for Field Testing of Newly Installed Fenestration Products", using an internal enclosure and negative pressure (suction) applied to the internal face.

1.2 The test procedure varies from the AAMA 502-08 requirement for the water spray to comply with the ASTM 1105 requirement for a minimum coverage of 3.4l/min.m^2 and instead specifies the NZS 4211 minimum rate of 3.0l/min.m^2.

1.3 The test procedure requires either the specified positive Serviceability Design Wind pressure for the site for the determination of the default water penetration test pressure in accordance with NZS 4211: 2008 or the specified water penetration test pressures for the installation being tested.

1.4 In accordance with the AAMA 502 – 12 procedure, actual test pressures are 2/3 of the specification test pressures in 1.3 above.

2 - Equipment Requirement

2.1 An electrically powered fan or commercial vacuum machine to provide the negative pressure (suction). A suitable speed control or adjustable bleed in the hose connection from a commercial cleaner is necessary as the negative pressure (suction) at full operating speed is substantially in excess of the range of test pressures and may also damage both the window or door under test, as well as the temporary enclosure.

2.2 An externally mounted water spray grid to provide a minimum coverage of 3.0l/min.m^2 with a calibrated water flow rate meter. At many sites and particularly where the test is being undertaken on multi-storey installations, a pressure booster pump may be required to augment the existing mains pressure.

2.3 A suitable 3 x 3 spray grid, based on 9 x B1/8HH-6SQ nozzles at 800mm centres covers an area of approximately 2.4m x 2.4m, and requires a minimum flow of 17.3l/min. A similar 0 - 22l/min flow meter to that used on current accredited permanent test facilities is recommended and can be similarly calibrated.

2.4 A calibrated manometer connected to a hose tail set into the acrylic sheet forming the internal enclosure, to measure the applied negative differential pressure (suction).

3 - Installation

3.1 Construct a temporary timber framed enclosure on the internal face of the window or door under test, with the perimeter framing having a sealed joint onto the perimeter support framing of the installation under test. The temporary framing must be supported only from the outer edges of the window frame or perimeter and must be sufficiently rigid to prevent any contact with the door or window under test when the negative pressure (suction) is applied to the internally positioned enclosure.

3.2 Seal all joints between the timber framing and the perimeter of the window with duct tape or removable foam tape seal. Where internal finishes have been completed care must be exercised to use only sealing methods that can be subsequently removed without damage to internal linings and paintwork. It should be noted that as the internal enclosure will be under negative pressure, the resulting suction will draw the temporary enclosure onto the existing window perimeter without the need for substantial structural attachment.

3.3 Fasten transparent acrylic sheeting onto the internal face of the enclosure framing using foam sealant tape on perimeter edges to minimise air leakage. The thickness will depend on the required test pressure and the spacing of any intermediate framing support.

3.4 Position a suitable opening through the transparent acrylic sheeting to provide the connection to the flexible hose from the equipment providing the negative pressure (suction), i.e. fan or commercial cleaning machine.

3.5 Position the external water spray grid at the distance calculated from the water spray nozzle pattern selected. Using the suggested 3 x 3 water spray grid in 2.3 above requires the spray nozzles to be approximately 700mm from the face of the window or door under test.

3.6 Insert a hose tail through the acrylic sheet and connect the calibrated manometer with an appropriately sized flexible hose.

4 - Water Penetration Test

4.1 Turn on water supply valve (and booster pump if required) and adjust water flow rate with flow meter adjusting valve in accordance with the spray grid spacing to achieve a minimum application rate of 3.0l/min.m^2.
Using the suggested 3 x 3 water spray grid in 2.3 above covers a net 5.76m^2, and therefore, requires a minimum flow rate of 17.3l/min.

4.2 Continue the application of water onto the exterior surface of the window or door under test for a period of five minutes without the application of any pressure differential.

4.3 Apply the calculated negative differential air pressure of 2/3 the original water penetration test specification for a period of 15 minutes.

4.4 Reduce the applied differential air pressure to zero and turn off the water sprays.

4.5 Record any water appearing on the internal face of the test specimen, stating the source and extent of the penetration, during the time at pressure and for the following five minutes. Water penetration attributable to the surrounding condition shall be defined as the presence of uncontrolled water that did not originate from the fenestration product or the joint between the fenestration product specimen and the wall/roof. Water penetration attributable to the fenestration product specimen shall be defined as the penetration of uncontrolled water beyond a plane parallel to the innermost edges of the product and that indisputably originates from the fenestration product. Water penetration attributable to the perimeter joint shall be defined as uncontrolled water that indisputably originates at the joint.

4.6 Reposition the external water spray grid if the window or door being subjected to the field test is larger than the initial effective water spray coverage and repeat 4.1 – 4.5 above.

5 - Reporting

5.1 A report of the Field test shall be prepared by the testing technician and shall contain the following information:

- Location of testing site
- Identification of testing agency and name of technician performing the tests
- Description and location of the window(s) or door(s) under test
- Date and weather conditions during test period
- Specified serviceability wind pressure and test pressure used
- Description of extent and source of any water penetration on internal face of test sample and surrounding enclosure
- Signature of testing technician and date of test report.

5.2 The testing technician shall be able to provide appropriate certificates of calibration for the manometer and water flow meter used in the reported tests.