



Industry Standard  
for

# Durability of uPVC Windows & Doors

## WG 45109.23-2025

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Part 1 - The weather resistance of  
material used in the manufacture  
of uPVC windows & doors.

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## INDUSTRY STANDARD for DURABILITY of uPVC WINDOWS & DOORS

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## 1.0 Introduction

All windows and doors, regardless of material, must comply with the New Zealand Building Code, for structural integrity, durability, weathertightness, energy, and safety. Often imported systems, windows, and/or raw materials are labelled as compliant with Standards from their country of origin and in many cases, these represent performance levels suitable for the NZ climate and building site on which they are to be used. The following Industry Standard is designed to provide an overview of the Building Code Clause that specifically relates to Durability and to assist with an understanding of compliance with Clause B2, when using uPVC windows and doors.

### The New Zealand Building Code

All building work in New Zealand must comply with the Building Code, even if it doesn't require a building consent. This ensures buildings are safe, healthy and durable for everyone who may use them.

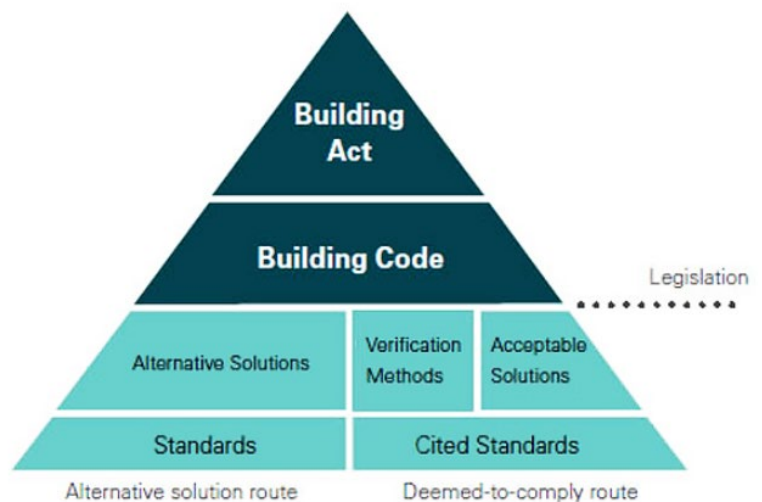
The Building Code sets clear expectations of the standards buildings should meet. It covers aspects such as structural stability, fire safety, access, moisture control, durability, services and facilities, and energy efficiency.

So, where does the NZ Building Code sit within the regulatory system?

The building regulatory system sets out a framework to promote good quality decisions being made during the building process. The legislation and regulation work together as the building regulatory system. The Building Code states, in general terms, how the completed building must perform in its intended use. It does not tell you how to do it. You can demonstrate Building Code compliance through different means.

One means of demonstrating compliance is to follow an Acceptable Solution or Verification Method. MBIE publishes Acceptable Solutions and Verification Methods, but it is not mandatory to use them.

However, for some products, such as uPVC windows and doors, the AS's and VM's do not clearly identify the requirements of the product in terms of its compliance with the NZBC.

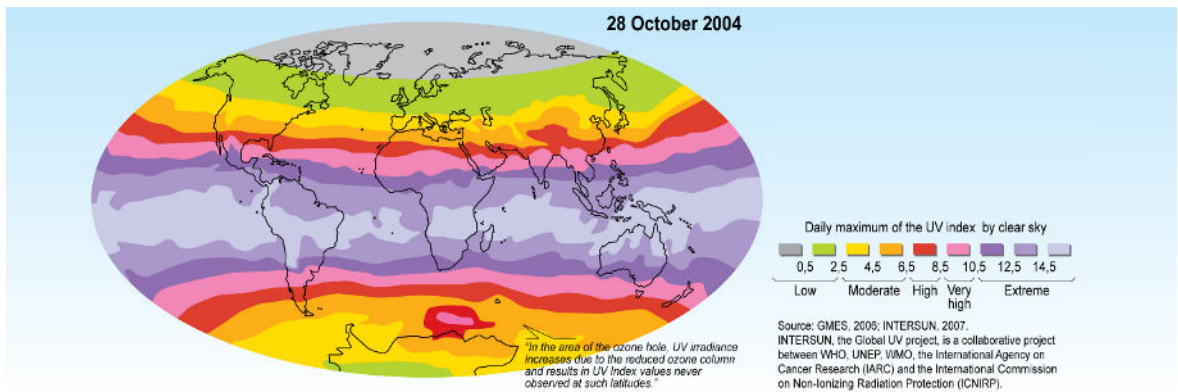


## 1.1 UV Radiation

The global solar UV index (UVI) is a simple measurement of the UV radiation level at the Earth’s surface. It has been designed to indicate the potential for adverse health effects and to encourage people to protect themselves. The higher the index value, the greater the potential for damage to the skin and eyes, and the less time it takes for harm to occur.

In countries close to the equator, the UVI can be as much as 20 (Chile, Argentina, and Peru). Summertime values in northern latitudes rarely exceed 8. The UV levels in Aotearoa New Zealand are not excessively high by global standards and generally sits within the Very high range, 8.5 and 10.5.

Figure 1 – Global UVI



Historically, a consultation between uPVC manufacturers, the Window Association, and NIWA agreed that the a ‘severe climate’ classification was appropriate for New Zealand. EN 12608 classifies a ‘severe climate’ (in Europe) per Table 1 below.

Table 1 — Classification of climatic zones in Europe

	Moderate climate M	Severe climate S
Annual total solar energy <sup>a</sup> on horizontal surface	< 5 GJ/m <sup>2</sup>	≥ 5 GJ/m <sup>2</sup>
Average of the daily maximum temperature <sup>a</sup> of the warmest month per year	and < 22 °C	or ≥ 22 °C
<sup>a</sup> Values measured according the specifications of the World Meteorological Organisation (WMO).		

*Note - Profiles designed for use in a ‘Moderate Climate’ may not be used in climate is classified as ‘Severe’.*

Similar to the EN 12608 requirement, the VCA’s (Vinyl Council Australia) Industry Code of Practice requirement has been developed to ensure the uPVC material is correctly formulated for the country it is to be used within and to provide an appropriate service life.

## 2.0 NZBC Clause B2 - Durability

Clause B2 of the Building Code provides the Durability requirements for building elements and nominates that external windows must demonstrate an expected durability of not less than 15 years, regardless of material.

Compliance can be demonstrated through one of three methods, set out in B2/VM1.

- i. Verification of durability based on '**In-service history**' requires that the manufacture submit evidence including, length of service, environment of use, intensity of use, any reaction with adjacent materials, limitations in performance, degree of degradation, and any changes in formulation, for consideration by the Building Consent Authority.
- ii. Verification of durability based on '**Laboratory testing**' requires that the manufacture submit evidence of successful performance in a laboratory test, accompanied by an assessment of the tests performed, their relevance to field and service conditions, and in particular, types of degradation mechanisms likely to be induced by testing, the degradation mechanisms likely in service, details of methods of assessment, variability of results, and the relevance of the test to the building element under study, for consideration by the Building Consent Authority.
- iii. Verification of durability based on '**Comparable performance of similar building elements**' requires that the manufacture submit evidence for consideration by the Building Consent Authority. A building element may be considered as similar to another building element with proven performance, if both are subject to the same controls for composition and overall performance. Examples of such controls are Approved Documents or Standards.  
Where a direct comparison is not possible, the building element shall be independently assessed to determine the degree of similarity. Assessment shall take into account but not be limited to, the products composition, the method and quality assurance of manufacture, degradation mechanisms, local environment, conditions of use, maintenance requirements, and performance in use.

To be acceptable, any opinion in support of the assessed durability for a building element shall clearly identify the conditions of use and the environment under which that durability will be achieved. If the building element can be reasonably expected to be used in circumstances which will reduce the durability, any limitations in use shall be clearly identified and evaluated.

Circumstances which need to be considered include, but are not limited to, Maintenance required to achieve the required durability (e.g. painting, cleaning, replacing high wear items such as washers), Installation details of the total system (e.g. fixings, flashings, jointing materials), Compatibility with other materials (e.g. galvanic corrosion, plasticiser migration), Locality or macroclimatic effects (e.g. coastal or thermal areas, wet or damp ground conditions), Microclimatic effects (e.g. sheltered areas

on buildings such as eaves), External environment influences (e.g. local industrial operations such as fertiliser works), and Internal environment (e.g. swimming pools, chemical processing areas, sauna rooms).

### 2.1 Weathering Tests

The focus of uPVC durability has historically revolved around the ability of the material to remain adequately resistant to weathering under New Zealand's UV conditions.

If compliance with Clause B2 through the '**Laboratory testing**' method is to be used, in lieu of the availability of specific NZ Standards, there are International Standards that define the classification and test methods for uPVC profiles used in the manufacture of windows and doors. Testing typically consists of exposing the surface of the profile to amounts of solar radiation and then assessing the surface for uniformity of colour, changes in visual appearance, and any cracking, peeling, flaking etc. The standards referred to most commonly, are as follows,

**EN 12608:2003** Unplasticised polyvinylchloride (uPVC) profiles for the fabrication of windows and doors - Classification, requirements and test methods.

EN 12608 sets out the requirements of uPVC profiles in order to classify the climates in which they can be used. There are a number of classifications, climate zone (Moderate or Severe), resistance to impact (Class I or II), and wall thickness of main profiles (Class A, B, C). However, **Annex C** describes the calculation method for the radiation dose and exposure time used for artificial weathering.

**EN 513:2018** Plastics - polyvinylchloride (PVC) based profiles - Determination of the resistance to artificial weathering.

The bulk of EN 513 refers to the xenon arc test apparatus and method. However, **Annex A** is used to determine the changes in colour and variations of properties after exposure to radiation. The annex makes reference to a number of other standards in order to determine these changes.

**ASTM D4726-09** Standard specification for rigid polyvinylchloride (PVC) exterior profiles used for assembled windows and doors.

D4726 is the American Standard Test Method for testing and measuring the weatherability of PVC profiles and is similar to a combined version of the two European standards above.

### 3.0 Industry Standard – Resistance to weathering

In order to assess the durability of uPVC profiles and their ability to demonstrate compliance with this Industry Standard requires two sets of sample profiles from the product range be tested as follows,

- i) one sample set of profiles taken from the product range shall undergo an **accelerated weathering** test, in accordance with **Section 3.1**, and
- ii) a second set shall undergo a two-year **natural outdoor weathering** test, in accordance with **Section 3.2**.

**NOTE:** *The standard shall apply to both virgin and recycled uPVC profiles. Re-testing is required anytime the material formula is modified, whether it is recycled or virgin. Typically, the recycled content of uPVC profiles are only used on the internal parts of the sections, so are not exposed to UV light. If in doubt seek reassurance from your supplier.*

#### 3.1 Accelerated laboratory weathering

A sample set of uPVC extruded profiles are required to meet the performance requirements of an Accelerated Laboratory Weathering Resistance test. The sample set shall be exposed under either,

- a) EN 12608 severe climatic conditions (Climate S), or
  - b) ASTM G151 and G154 methodology adapted for this Industry Standard,
- to the equivalent of 15 GJ/m<sup>2</sup> radiation in accordance with EN 513 or ASTM G154.

##### 3.1.1 Performance Requirements for Test B Accelerated Laboratory Weathering

Upon completion of the natural weathering test identified in Section 3.1, uPVC profiles that have met the performance requirements given here shall be deemed compliant with this Industry Standard.

The uPVC compound in extruded section shall maintain uniform colour and be free of any surface or structural changes, such as peeling, chipping, cracking, flaking, or pitting following testing.

##### 3.1.2 Colour Change Evaluation

After an exposure in accordance with the test conditions mentioned above, the change in colour between the unexposed and exposed test specimens, expressed as  $\Delta E^*$  shall be  $\leq 5$  and  $\Delta b^*$  shall be  $\leq 33$ , in accordance with EN 513.

The uPVC compound in the extruded section shall maintain uniform colour and be free of any visual surface or structural changes, such as peeling, chipping, cracking, flaking, or pitting following testing.

Upon completion of the Accelerated Laboratory Weathering Resistance test, uPVC profiles tested that have met the performance requirements given here shall be deemed compliant with this Industry Standard.

The 'Colour Change Evaluation' shall apply to external surfaces only.

### 3.2 Natural outdoor weathering resistance

A second sample set of uPVC extruded profiles will be subject to a two-year natural outdoor weathering test at Allunga Exposure Laboratory's Townsville site in Queensland. The natural weathering test follows ASTM D4726 methodology adapted for Australian climatic conditions.

***NOTE:** Profiles tested at an accredited natural weathering laboratory in the US Arizona climate for 2 years and meeting the colour change requirements stipulated below will qualify for compliance under this Industry Code of Practice.*

Following completion of the test, the change in colour of the sample shall be measured in accordance with EN 513 (see 3.2.1 and 3.2.2 below).

#### 3.2.1 Performance requirements for natural weathering test

Upon completion of the natural weathering test identified in Section 3.2, uPVC profiles that have met the performance requirements given here shall be deemed compliant with this Industry Standard.

The uPVC compound in extruded section shall maintain uniform colour and be free of any surface or structural changes, such as peeling, chipping, cracking, flaking, or pitting following testing.

#### 3.2.2 Colour Change Evaluation

After an exposure in accordance with the test conditions mentioned above, the change in colour between the unexposed Sample set A and exposed Sample set B, expressed as  $\Delta E^*$  shall be  $\leq 5$  and  $\Delta b^*$  shall be  $\leq 3$  (the limit to the change in colour applies in both directions of the colour spectrum), in accordance with EN 513.

The 'Colour Change Evaluation' shall apply to external surfaces only.

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### 3.3 Compliance

There are two types of 'Compliance' with this industry standard, as described below, and in Figure 2.

#### 3.3.1 Interim Compliance

'Interim Compliance' will be granted to profiles that have met the performance requirements of the testing specified in Section 3.1, and a two-year natural outdoor weathering test has commenced, and will be valid for a period of 30 months from the date of the issuing of the test certificate.

#### 3.3.2 Full Compliance

'Full Compliance' will be granted to profiles that have met the performance requirements of the testing specified in Section 3.2.

#### 3.3.3 Compliance with Other Standards

Manufacturer/suppliers who can provide either interim or full accreditation in accordance with the VCA's (Vinyl Council Australia) Industry Code of Practice, will be acknowledged as compliant with this standard.

There are a range of tests available from a range of sources, that might be offered up in lieu of those discussed above, EN, AAMA, VCA, Hallmark. For tests other than those discussed above, discuss these with your supplier and ask them to demonstrate how they compare.

#### 3.3.4 Advice of Compliance

The current state of a manufacturer/suppliers Compliance will be hosted on the Window and Glass Association New Zealand's website.

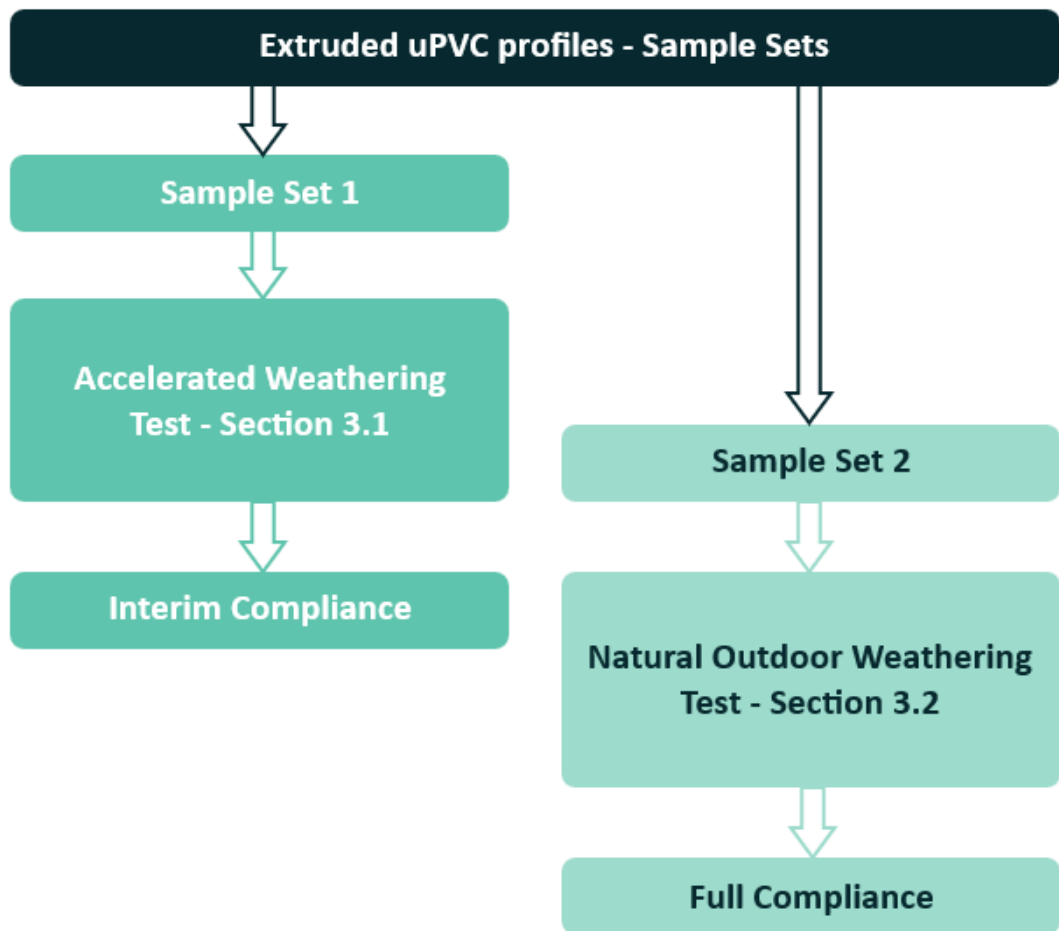


Figure 2 - Test flow chart

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