NDVK

NORSK DØR- OG VINDUSKONTROLL

Requirements for doors and windows

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Preface

This document - NDVK Requirements for doors and windows - summarizes the requirements for doors and windows as products. The requirements include:

- Performance requirements that are used as a basis for approval considering that the products must be suitable for use in heated buildings in Norway,
- Requirements for frame and casement materials and other components, and
- Requirements for production processes.

The content of the document is managed by the board of NDVK.

The previous revision of the document was in 2019, and this revision contains some major changes. Besides the change to a new template and graphic profile, the biggest changes in content are:

- Coinciding requirements with Nordic certification of laminated and possibly finger-jointed wooden items (Nordic Certified Scantlings – NCS),
- Adjustments for better compliance with other Nordic approval schemes, and

Part 1 Performance requirements

This part covers the requirements for windows and doors to be installed in buildings in Norway. Requirements for suitability for use are laid down in the Building Technical Regulations and apply based on the intended use of the building.

Requirements set in the Building Technical Regulations are formulated as function requirements, performance requirements or solution requirements. In many cases, it is not possible to find a property of windows or doors that corresponds directly to the requirement. In such cases, professional assessments based on experience are used as a basis.

The requirement for approval is considered good enough for most situations of use in Norway. Most use situations mean buildings that are not exposed to a lot of wind. Buildings with a view on a location exposed to the wind, tall buildings and special uses may require more detailed planning and stricter requirements than what is described in this document.

1.1 NVDK Basic requirements

All windows and doors to be listed in the certificate must satisfy NDVK Basic Requirements. The basic requirements cover basic requirements for energy efficiency and moisture protection in the Building Technical Regulations, which apply to all buildings in Norway.

1.1.1 Air permeability

Documentation of the air permeability is about ensuring sufficient tightness in the building and reducing infiltration heat loss.

Air permeability is documented by:

- Testing according to NS-EN 1026
- Classification according to NS-EN 12207

Type of claim	Classification/value				NDVK require ments:
Air permeability					
Class	**1**	**2**	**3**	**4**	**4**
Test pressure (Pa)	150	300	600	600	
Reference air permeability at 100 Pa ($m^3/(h \cdot m^2)$) or ($m^3/(h \cdot m)$)	50 or 12.5	27 or 6.75	9 or 2.25	3 or 0.75	

1.1.2 Water tightness

Documentation of water tightness is about ensuring sufficient tightness to avoid water leakages during precipitation and wind (driving rain).

Water tightness is documented by:

- Testing according to Method A or Method B according to NS-EN 1027
- Classification according to NS-EN 12208.

Method A is required for windows, window doors, sliding doors and possibly other external doors that are to be installed without protection against wind and weather.

Method B is used for external doors that are installed shielded with roof overhangs or roof sockets. A simple overlying water board is not considered sufficient shielding.

Products tested according to method B should have descriptions of required shielding and installation of the product such that declared performances are not compromised.

Type of claim	Classification/value										NDVK req.
Water tightness											
Method A: Unshielded											
Class	**1A**	**2A**	**3A**	**4A**	**5A**	**6A**	**7A**	**8A**	**9A**	**Exxx**	**9A***
Test pressure (Pa)	0	50	100	150	200	250	300	450	600	> 600	
Method B: Shielded											
Class	**1B**	**2B**	**3B**	**4B**	**5B**	**6B**	**7B**				**7A/7B****
Test pressure (Pa)	0	50	100	150	200	250	300				

* The requirement applies to windows, window doors, sliding doors and external doors installed without protection against wind and rain

** The requirement applies to external doors mounted shielded under roof sockets or roof overhangs

1.1.3 Thermal transmittance (U-value)

Documentation of thermal transmittance is about satisfying requirements for energy efficiency and sound energy use in buildings.

The U-value is documented by:

Numerical calculation according to *NS-EN ISO 10777-1 and -2 Thermal properties of windows, doors and shutters. Calculation of heat transfer coefficient,*

or

Testing according to *NS-EN ISO 12567-1 Thermal properties of doors and windows. Determination of heat transfer coefficient by heat flow device method. Part 1 Complete doors and windows,*

or

Simplified calculation or tabulation according to *NS-EN ISO 10777-1 Thermal properties of windows, doors and shutters Calculation of heat transfer coefficient Part 1: Simplified method.*

Type of claim	Classification/value	NDVK req.
Thermal transmittance		
U-value (W/(m ^{2}·K))	**Declared value**	**≤ 1.2**

1.1.4 Climate requirements

Norwegian building regulations require greenhouse gas (GHG) calculations for buildings. A GHG calculation is prepared based on a life cycle assessment of materials and products' GHG emissions in connection with production and manufacture.

GHG emissions from the production and manufacture of construction products are declared in an environmental product declaration (EPD) based on a life cycle assessment based on NS-EN 15804 and product category rules for windows and doors based on NPCR 014 or NS-EN 17213.

As of today, there is no requirement for construction products to have documentation of GHG emissions in their own name, but as the requirement for GHG calculations has been introduced, the certificate will state whether the product has such documentation or not.

1.2 Voluntary requirements

Voluntary requirements are requirements for properties that can be crucial in certain use cases and which can be included to demonstrate compliance for a specific use situation. An example is requirements for operating power in main entrance doors or doors in buildings with requirements for universal design.

Very few choose to include these characteristics in the certificate, but where it is listed, the characteristics will be followed up by the same requirement for regular testing as the basis for the basic requirements.

1.2.1 Resistance to wind load

Documentation of resistance to wind load is about documenting that wind forces do not cause deformations or movements in the product that reduce the performance of other tightness properties.

Requirements for resistance to wind load may be applicable in places exposed to the wind and for windows located higher than the 5th floor.

Resistance to wind load is documented by

- Testing according to NS-EN 12211
- Classification according to NS-EN 12210

Type of claim	**Classification/value**						**NDVK req.**
Resistance to wind load							
Class Test pressure (Pa)	**1** 400	**2** 800	**3** 1200	**4** 1600	**5** 2000	**Exxxx** > 2000	**C3**
Class Deflection of frame	**A** ≤ 1/150		**B** ≤ 1/200		**C** ≤ 1/300		

1.2.2 Impact resistance

Impact resistance must ensure that the window or door does not fall apart in the event of a collision. A window can fall apart such that glazing falls out of the casement, or the casement falls out of the frame. Doors can fall apart such that the door leaf falls off the hinges, or glazing falls out of the door leaf.

Impact resistance is related to testing safety glass (personal safety panes), but covers the entire product and not just the glazing.

Impact resistance is documented by:

- Testing according to NS-EN 13049

Type of claim	**Classification/value**					**NDVK req.**
Impact resistance						
Class Drop height (mm)	**1** 200	**2** 300	**3** 450	**4** 700	**5** 950	**1**

1.2.3 Operating forces

Operating forces for doors and windows includes two things: How much force is required to move the door leaf or the openable window frame, and how much force is required to operate twisters, levers and hasps.

Low operating force is important to ensure usability for all user groups. There is a requirement in the regulations for low operating force for the main entrance door and in buildings with a universal design.

1.2.3.1 Operating forces for windows and balcony doors

Operating forces for windows and side-hung balcony doors with espagnolets is documented by:

- Testing according to NS-EN 12046-1
- Classification according to NS-EN 13115

Type of claim	Classification/value		NDVK req.
Operating forces			
Class	**1**	**2**	**2**
Operating force for openable frame (N)	100	30	
Operating forces for fittings:			
Hand-operated fittings	100 N or 10 Nm	30 N or 5 Nm	
Finger operated fittings	50 N or 5 Nm	20 N or 2 Nm	

1.2.3.2 Operating forces for external pedestrian doors, sliding and window doors intended for pedestrian use

Operating forces for manually operated external doors is documented by:

- Testing according to NS-EN 12046-2
- Classification according to NS-EN 12217

Type of claim	Classification/value				NDVK req.
Operating forces					
Class	**1**	**2**	**3**	**4**	**3**
Operating force for door leaf (N)	75	50	25	10	
Hand operated twisters;					
Maximum twist, (Nm)	10	5	2.5	1	
Maximum force, (N)	100	50	25	10	
Finger operated twisters;					
Maximum twist, (Nm)	5	2.5	1.5	1	
Maximum force, (N)	20	10	6	4	

1.2.4 Mechanical strength

Mechanical strength determines the extent to which frames and casements can withstand mechanical loads from components in the window and or other applied loads.

Properties for mechanical strength are closely related to properties for bearing capacity for safety fittings and operating force.

When testing mechanical strength, the operating force must also be measured both before and after to ensure that requirements for operating force are met even after heavy mechanical load.

1.2.4.1 Mechanical strength for windows

Mechanical strength for windows is documented by:

- Testing of vertical load according to NS-EN 14608
- Testing of static twisting according to NS-EN 14609
- Classification according to NS-EN 13115

Type of claim	**Classification/value**				**NDVK req.**
Mechanical strength					
Class	**1**	**2**	**3**	**4**	**2**
Torsion (vertical load) (N)	200	400	600	800	
Static twist (N)	200	250	300	350	

1.2.4.2 Mechanical strength for exterior doors

Mechanical strength for external doors is documented by:

- Classification according to NS-EN 1192
- Testing of vertical load according to NS-EN 947
- Testing of static twisting according to NS-EN 948
- Testing of soft, heavy impacts according to NS-EN 949
- Testing of hard, heavy impacts according to NS-EN 950

Type of claim	Classification/value				NDVK req.
Mechanical strength					
Class	**1**	**2**	**3**	**4**	**3**
Vertical load (N)	400	600	800	1000	
Static twist (N)	200	250	300	350	
Soft and heavy shocks (J)	30	60	120	180	
Hard Shocks (J)	1.5	3	5	8	

1.2.5 Resistance to repeated opening and closing

Resistance to repeated opening and closing will safeguard the usability of a window or door over time. Windows and doors are among the few movable building parts, and must have permanent fittings and components if they are to be light and easy to use over many years.

Doors are most exposed to wear and tear, and there are therefore stricter requirements for external doors and window doors than for windows.

Resistance to repeated opening and closing is documented by:

- Testing according to NS-EN 1191
- Classification according to NS-EN 12400

Type of claim	Classification/value				NDVK req.
Repeated opening and closing					
Class	**1**	**2**	**3**	**4**	**3***
Number of cycles	5,000	10,000	20,000	50,000	**4****

* The requirement applies to windows

** The requirement applies to window doors, sliding doors and external doors

1.2.6 Behaviour between different climates

Behaviour between different climates is about how well an external door or window is secured against movements and deformations caused by different climatic conditions on each side of the door. This is most relevant for external doors, and requirements for windows are not included here.

Behaviour between different climates for external doors is documented by:

- Testing according to NS-EN 1121
- Classification according to NS-EN 12219

Type of claim	**Classification/value**			**NDVK req.**
Behaviour between different climates				
Class	**1**	**2**	**3**	**2**
Permitted deformation	≤4 mm	≤4 mm	≤2 mm	
Test climate	(x)*	(x)*	(x)*	

***** Climate a, b, c, d or e used during testing must be described

1.2.7 Burglar resistance

Burglar resistance is about ensuring that windows and doors cannot be opened by force to secure people or valuables.

For "normal" doors and windows, burglar resistance largely depends on which solution is chosen for locks and fittings. For the higher classes, there are also requirements for the construction of door leaves, glass, etc.

Burglar resistance requirements normally apply to windows on floors where the height difference to ground level on the outside of the window is up to 6.6 m, and all window doors and external doors with direct access to the door from the outside.

Burglar resistance is documented by:

- Static load testing according to NS-EN 1628
- Dynamic load testing according to NS-EN 1629
- Testing of manual tests according to NS-EN 1630

- Classification according to NS-EN 1627

Type of claim	**Classification/value**						**NDVK req.**
Burglar resistance							
Class	**RC1**	**RC2**	**RC3**	**RC4**	**RC5**	**RC6**	**RC2**

1.3 Other requirements

Other requirements are requirements for suitability for use which include properties that are not certified or checked through the NDVK either because certification is required (fire) or because they may be decisive in certain use situations and which can be included to give approval against a specific use situation. An example is requirements for Operating forces in main entrance doors or doors in buildings with requirements for universal design.

Very few of them have these characteristics in the certificate, but where it is listed, the characteristics will be followed up by the same requirement for regular testing as the basis for the basic requirements.

Other requirements include properties that are essential to have documented in given situations of use, but where the property must either be handled through an imposed certification scheme (such as fire properties) or, but which will not apply to all buildings in Norway. This is typically sound insulation, wind load resistance or burglary protection.

1.3.1 Fire properties

Reaction to fire is different than fire resistance. Reaction to fire is about how easily materials ignite, how they burn and whether there is a risk of burning droplets etc. The property is relevant for skylights, but is not used for windows mounted in external walls or external doors.

Fire-classified products with requirements for *fire resistance* (EI 15, EI $_2$ 30, etc.) are not checked by NDVK, but have their own fire certificates - so-called AVCP certificate in System 1 or Certificate of conformity for expected performance. CE marking of fire-classified (openable) products must be based on NS-EN 16034 and NS-EN 14351-1.

Fire properties are documented by:

- Testing according to relevant parts in the NS-EN 13501 series
- Classification according to NS-EN 13501-1

Fire resistance is required for windows facing the escape route and doors to and in the escape route. This must be planned separately in each individual case.

1.3.2 Ability to release

Ability to release is about how easy it is to open the door in an emergency. This is most relevant for doors to and in the escape route and is controlled to a large extent by the choice of fittings.

1.3.3 Height and width of external pedestrian doorsets and window doors

The height and width of external pedestrian doorsets and French windows must ensure sufficient free width for passenger traffic through the doorway.

Minimum clear width and height are required in the Building Technical Regulations. Clear height is clearly defined, but due to different measuring rules for how clear width should be declared and measured in a finished building, there is no clear way to formulate a limit value for the width.

Clear height and width are documented by measuring in accordance with NS-EN 12519.

NDVK does not control this property.

1.3.4 Load-bearing capacity for safety devices

Load-bearing capacity for safety devices is about ensuring that window casements do not open or loosen in the event of a collision so that people can fall out. Safety devices are devices that restrain the window casement from opening beyond an restricted, open ventilation position.

The load-bearing capacity must be documented by calculation or testing in accordance with the requirements of the Building Technical Regulations.

The property is not controlled by NDVK.

1.3.5 Radiation properties

Radiation properties are about how much light and solar heat escapes through a window.

The light transmission says something about how much daylight is allowed in. A high light transmission lets in a lot of light.

The solar factor, or g-value, says something about how much infrared heat radiation (solar heat) is allowed in. A low solar factor means high damping.

Light transmission and solar factor are documented by:

- Testing according to NS-EN 410
- Calculation of solar factor according to 52022-1 and possibly NS-EN 52022-3

Calculation according to the NS-EN 52022 series goes to solar shading and includes more solutions than just the glass.

1.3.6 Acoustic performance

Acoustic performance (sound insulation) is about reducing the amount of airborne noise that propagates through a window. There is no requirement for sound insulation for windows and doors alone. Sound insulation requirements follow from planning in each individual project.

The sound insulation is measured for both deep and bright tones, but a weighted sound reduction number, R_w , is calculated based on the measurements to be able to characterize the performance with a single number.

In addition, so-called spectrum corrections are determined which are used to "adapt" the performance to a specific usage situation. In sound insulation from "normal" noise, industry noise etc., the spectrum adaptation term C is used, and for traffic noise, the spectrum adaptation term C_{tr} is used.

Replacing windows is among the very first noise measures that are carried out on existing buildings if, for example, a new road is built.

Sound insulation is documented by:

- Testing according to NS-EN ISO 10140-2
- Assessment according to NS-EN ISO 717-1

Assessment here means calculation of weighted sound reduction figures and spectrum corrections.

1.3.7 Release of dangerous substances

A declaration of dangerous substances means that the manufacturer guarantees that no substances dangerous to health or the environment are used in the production of the window. This is normally taken care of by other schemes in Norway than the declaration of the performance declaration.

1.3.8 Ventilation

There is no requirement for ventilation in windows, but for ventilation of buildings. In measures on existing buildings, ventilation through slit valves or in the window will be important, while in new buildings ventilation takes place with balanced ventilation with heat recovery.

As a product characteristic, ventilation refers to how much air can escape through slits or other ventilation valves in the window. Window ventilation with open windows is not part of the requirement or feature.

Ventilation and air exchange are calculated on the basis of the characteristics of the slit valve mounted in the window, and no general limit value can be set for approval.

For windows with a slatted valve, it can also be interesting to know how much air leaks there is through the slatted valve in the closed state. This was required in the past, but is currently omitted because the solution with ventilation through slit valves is little used.

The property is determined on the basis of measured airflow property (K) and airflow exponent (n) at various standardized pressure differences (Δp).

1.3.9 Bullet and explosion resistance

Resistance to bullets and/or explosion resistance are properties that are relevant for what are called safety windows or doors where the purpose is to secure people's lives and health more than just values.

1.3.9.1 Bullet resistance

Bullet resistance is about securing people's lives and health against bullets from firearms that are fired at a window or a door.

Resistance to projectiles is documented by:

- Testing according to NS-EN 1523
- Classification according to NS-EN 1522

1.3.9.2 Explosion resistance

Explosion resistance is about securing people's lives and health or valuables against intentional or unintentional explosions.

Explosion resistance is documented for shock tubes and (free) range testing by:

- Shock tube test according to NS-EN 13124-1
- Range test according to NS-EN 13124-2
- Classification for shock tube test according to NS-EN 13123-1
- Classification for range test according to NS-EN 13123-2

Part 2 Requirements for frame and casement materials

Part 2 describes basic requirements for the material used in the frame, casement and door leaf. As of today, this includes wood and plastic (PVC).

2.1 Common requirements

The requirements include materials for use in frames and casements in windows, window doors and external doors. Materials for other components such as glass, sealing strips, fittings etc. are dealt with in Part 3.

2.1.1 Definitions

Several definitions are taken from the book *Nordic quality language from the softwood industry - softwood* (ISBN 87-7756-568-1) Despite the fact that the book is about wood, the definitions below are also valid for materials other than wood.

Term	Definition
Visible parts	Parts and surfaces visible in the room or on the outside when the product is installed and is in the closed position. Example: Interior side of frames, casements, door leaves
Hidden parts	Parts and surfaces that are not visible in the room or on the outside when the product is installed and are in the closed position, but which come into view when the product is in the open position.
Hidden parts	Parts and surfaces that are not visible in the room or on the outside in either the open or closed position of the installed product.
Weather-exposed surface	Defined in NS-EN 14220:2006 as: - External visible parts - The outermost 15 mm on external hidden parts measured from the external edge - Rebate platform in bottom frame - Glazing beads

2.1.2 Dimensioning and securing

With large openable window fields, there may be a risk of functional problems. Large window fields require that special attention be paid to the dimensioning of frame and/or frame profiles. Examples of properties that must be taken into account are:

- Dimension of frame/frame
- Profile cross-section or design
- Holding strength for fittings
- Strength and function for fittings and hinges
- Number and type of closing points

Large window fields mean windows where one or more of the following conditions are exceeded :

Criterion	Wood	Plastic (PVC)
Area of window	1.7 m2	1.7 m2
Longest side edge	1.5 m	1.5 m
Ratio between longest and shortest side edge	3	3

2.1.3 Requirement for documentation

The Norwegian Regulations on Documentation of Construction Products (Byggevareforskriften - DOK) is Norway's implementation of the European Construction Products Regulation (CPR).

Construction products that are to be traded on the Norwegian market and installed in construction must have the following documentation according to the Building Technical Regulations and the Construction Products Regulations:

- CE marking of products with a reference to the Declaration of Performance
- Declaration of Performance
- Installation manual
- Safety information (where applicable)

- User manual (documentation for management, operation and maintenance – "FDV")

All documentation must be available in a Scandinavian language for legal marketing and use and be attached to each delivery and/or be made accessible on the manufacturer's web site.

Installation manuals must show how the product is to be installed in an external wall to ensure that the performances of the product is not derogated or compromised.

Safety information applies to products that contain health and environmentally dangerous substances where handling and/or use of the product can lead to exposure to such substances.

FDV documentation (user manuals) must contain information on:

- What materials and components the product consists of,
- Expected maintenance of components,
- How products should be cleaned, and
- Information on repair, dismantling and disposal of the product.

2.2 Requirements for frames and casements made of wood

The requirements include wood and components of wood-based material for use in windows, window doors, air hatches and external doors. Products with external cladding in aluminium, plastic or other material are also covered by these rules.

Frames and casements must be made of solid wood or laminated scantlings. Wood-based boards are only applicable for door leaves, fillings in (window) doors, etc

Wood is a natural material with a natural variation in quality, and which will never be 100% homogeneous. Annual rings, Knots, cracks, insect attacks, fungi, rot etc. are considered "material defects" and create this variation. Acceptance of material defects is described in 2.2.4.

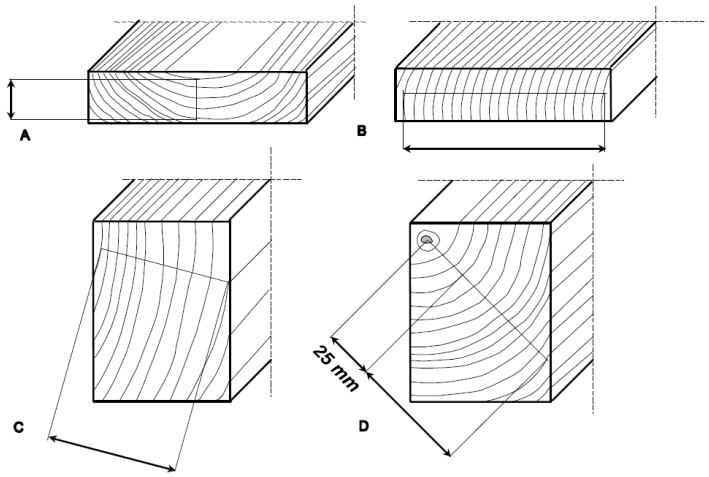
The requirements in this chapter apply to finished surface-treated frame and casement profiles and must ensure good resistance to rot, mold and blue rot, as well as good mechanical strength.

The requirements are based on NS-EN 13307-1 *Timber blanks and semi-finished profiles for non-structural uses - Part 1: Requirements* and are primarily intended for spruce and pine, but may also apply to other types of wood in relevant contexts.

Material quality is normally checked upon receipt. The quality control log is checked during annual NDVK inspection.

2.2.1 General requirements for wood

Requirements for wood – solid wood or laminated scantlings – in finished windows, window doors, air hatches and external doors are set out in the table below.

Property	Requirements/description
Slope of grain	At most 1:10
Growth rate (width of annual rings)	 Average ring width ≤ 4,0 mm calculated along the largest possible length of the cross-section across the rings (A, B, C or D). No single annual ring shall exceed 6,0 mm. Where the margin is visible, the innermost 25 mm is not counted (D). In laminated constructions, the requirement for average annual ring width in middle parts is ≤ 5,0 mm. See also 2.2.2.
Moisture content	Relative humidity 12% ± 3% humidity must be measured in accordance with *Nordic quality language from the wood industry - softwood* , and must be in the same order of magnitude in all parts of the window/door. 95% of the measurement results from the test pieces must lie within the framework of permitted deviations of 3%. The humidity must not at any time be lower than 9.0% or higher than 15.0% for spruce and pine.
Bowing/ cupping	Maximum 2 mm/m (length) for flat bends and edge hooks. The requirement does not apply to laminated scantlings (see 2.2.2)
Twisting	Maximum 2 mm/dm (width)/m (length). The requirement does not apply to laminated scantlings (see 2.2.2)
Checks	Permitted scope and size for cracks is given in 2.2.4.1.
Knots	The permitted number and size of knots is given in 2.2.4.2.
Other material defects	Non-permissible material defects are given in 0.

2.2.2 Laminated and/or finger jointed scantlings

Laminated scantlings used for frame and casement profiles made up of two or more parts glued together lengthwise. Finger jointing of parts in the longitudinal direction is permitted.

The requirements in this section apply to glued components that the manufacturer makes themselves and glued components that the manufacturer buys from another supplier. The requirements are in accordance with common Nordic regulations:

Nordic Certified Scantlings, Certification of laminated blanks for use in door and window production. Technical requirements and manufacturing procedures for process and production control .

Logo for Nordic Certified Scantlings.

https://nordicscantlings.com

2.2.2.1 Purchase of scantlings

When purchasing ready-made laminated scantlings, the quality for finger jointed scantlings shall be classified as "General performance" for laminated and finger jointed scantlings and "High performance" for only finger jointed scantlings.

The purchase of laminated scantlings from an NCS-certified manufacturer does not normally require any quality control beyond normal reception control at the door/window manufacturer.

The purchase of laminated blanks *without* NCS certification requires that the door/window manufacturer can provide documentation from the laminate supplier that laminated/ finger -jointed blanks have been produced in accordance with the NCS regulations and requirements for the work description in the next point.

2.2.2.2 Requirements for the production process for laminated/finger jointed scantlings

The requirements for the production process for laminated/finger jointed items are fully described in the NCS regulations.

Adhesives used for lamination and finger jointing must comply with the requirements in 3.1on Adhesives and adhesive compounds and the NCS regulations.

The production process includes:

- Control of the wood material (see section 2.2.1)
    - Width of annual rings, wood moisture, heart wood, density (dependent on customer requirements)
- Finger jointing of scantlings
    - Finger geometry, application of glue, density, bending stiffness
- Planing of scantlings
    - Parallel planes, thickness accuracy, surface quality
- Lamination/gluing
    - Application of glue, mixing of glue and hardener, application pressure, pressure duration, testing of glue joint of finished products
- Final control of finished laminated scantlings

Profiling and processing must take place in accordance with the NCS regulations with regard to dimensions, time between processing and gluing and quality of the finished component.

General requirements for gluing are described in point 3.1. Otherwise, the requirements for gluing and glue in the NCS regulations apply.

Quality of gluing and adhesive strength must be tested and documented in accordance with the table below.

Glue type	Reference	Test
Thermoplastic, Type D3 or D4	NS-EN 204	NS-EN 14257[1] NS-EN 14080, Appendix C, method C[2,3]
Heat curing, Type C3	NS-EN 12765	NS-EN 14080, Appendix C, method C[2,3]
Heat setting, Type C4	NS-EN 12765	NS-EN 14080, Appendix C, method B (or A)
Phenolic and amino plastics, Type I	NS-EN 301	
EPI (emulsion-polymerized isocyanate)	NS-EN 16254	
One-component polyurethane (PUR)	NS-EN 15425	
Two-component polyurethane (PUR)	- [1]	

[1] Previous testing of adhesive strength according to WATT 91 at 80 °C
[2] Max delamination 20%
[3] Alternatively, delamination testing for type D3 and C3 can be replaced by shear testing in accordance with NS-EN 14080, Appendix D

2.2.3 Wood fibre boards

Wood fibreboards such as Medium Density Fibreboard (MDF) or High Density Fibreboard (HDF) are used in door leaves or tight panels in window doors. Wood fibreboards can swell if they are exposed to moisture, so surface treatment of the boards is important. MDF boards must not be used on the outside.

Wood fibreboards must be produced and manufactured with CE marking in accordance with NS-EN 13986.

Requirements for wood fibreboards are summarized in the tables below.

Requirements for wood fibre boards (HDF)

Test standard	Property	Requirements	
		Limit value	Tolerance
NS-EN 323	Density	≥ 850 kg/m ^{3}	± 5%
NS-EN 317	Thickness swelling (24h)	≤ 14%	
NS-EN 318	Dimensional change, length / width	≤ 0.4%	
NS-EN 318	Dimensional change, thickness	≤ 6%	
NS-EN 319	Transverse tensile strength	≥ 1.5 N/mm ^{2}	
NS-EN 1087-1	Transverse tensile strength after boiling test V100	≥ 0.15 N/mm ^{2}	
NS-EN 717-1	Emission of formaldehyde to air	E1	
–	Moisture content upon receipt	≤ 8%	

Requirements for wood fibre boards (MDF)

Test standard	Property	Requirements	
		Limit value	Tolerance
NS-EN 323	Density	≥ 650 kg/m ^{3}	± 5%
NS-EN 317	Thickness swelling (24h)	≤ 10%	
NS-EN 318	Dimensional change, length / width	≤ 0.40%	
NS-EN 318	Dimensional change, thickness	≤ 7%	
NS-EN 319	Transverse tensile strength	≥ 1.50 N/mm ^{2}	
NS-EN 1087-1	Transverse tensile strength after boiling test V100	≥ 0.15 N/mm ^{2}	
NS-EN 717-1	Emission of formaldehyde to air	E1	

2.2.4 Material defects

2.2.4.1 Checks (radial cracks)

Product part	Requirements for cracks
Weather-exposed surfaces Visible parts and inside of frame/frame Door leaf	Only microchecks[1] are permitted
Hidden parts of frame Glass rebate	Length up to 200 mm: Check < 2 mm width Length up to 300 mm: Check < 1,5 mm width
Hidden parts of the frame (wall side)	Checks are accepted along the entire length of the frame, but must not be deeper than half the thickness of the profile or be the connections along the entire length of the profile

[1] Micro checks are hair-thin checks that are difficult to detect before the surface treatment.

2.2.4.2 Knots

Requirements for the occurrence, number and size of Knots are given in the tables below.

The following requirements and rules apply to Knots in general:

- Knot diameter must be measured across the fiber direction.
- The minimum distance between Knots is 2 times the diameter of the Knot.
- Loose, dry Knots are not permitted.

Other measurement rules; refer to the book: " Nordic quality language for the wood industry - softwood"

Knots in windows, window doors and air hatches. Permitted sizes and number (per m)

Knot type or -size	Permitted number, type or proportion of knots per meter length				
	Frame	Sash Casement Mullion Transom	Glazing bars and beads	Threshold	Panel surface
Max knot diameter measured in relation to the component's side dimensions	50% of visible part (NS-EN 942)	–	–	–	–
Diam. 40 mm	≤ 1	–	–	–	–
Diam. 30 mm	≤ 1	≤ 1	–	–	–
Diam. 20 mm	≤ 2	≤ 2	–	–	–
Diam. 10 mm	≤ 5	≤ 5	–	≤ 2	Unlimited
Sprigs of pearl	Unlimited	Unlimited	≤ 2	≤ 2	Unlimited
Of the above, the following number of fixed dry knots (excluding pearl knots) is permitted	6 pcs/10 mm	–	–	–	–
Corner Knots	–	–	–	Not permitted in visible corners	Not allowed
Leaf Knots	–	–	–	–	Not allowed

Knots in external pedestrian doorsets. Permitted sizes and number (per m)

	Frame	**Stiles/rails** **Muntin**	**Glazing bars and beads**	**Threshold**	**Door leaf**
Max Knot diameter measured in relation to the component's side dimensions	50% of visible part (NS-EN 942)		–	–	In veneer, the number and size can be unlimited
Diam. 40 mm	≤ 1	Not allowed	Not allowed	Not allowed	Not allowed
Diam. 30 mm	≤ 1	≤ 1	Not allowed	Not allowed	Not allowed
Diam. 20 mm	≤ 2	≤ 2	Not allowed	Not allowed	Not allowed
Diam. 10 mm	≤ 5	≤ 5	Not allowed	≤ 2	Unlimited
Sprigs of pearl	Unlimited	Unlimited	≤ 2	≤ 2	Unlimited
Corner Knots	–	Not allowed	Not allowed	Not allowed in visible corners	–
Leaf Knots	–	Not allowed	–	–	–

2.2.4.3 Other material defects

Other material defects include bluewood, mold, rot, insect attacks, marl drains, quail ends and bullwood, as well as damage from storage and handling.

Other material defects can be accepted in some cases, but are usually not allowed. See the table below.

Material defect	Type of error
Blue rot/bluing	Permitted to a limited extent: • Untreated: Not allowed on visible pages • Treated: Allowed for full-coverage treatment
Mold	Not allowed
Rot	Not allowed
Insect infestation	Not allowed
Pith	Not allowed on visible or hidden parts Not permitted in connection with external corners and tap connections Margin branches with length ≤ 150 mmare otherwise permitted on hidden parts
Pitch pockets (resin pockets)	Not allowed on visible or hidden parts Can be accepted in glass rebates or on hidden parts if it does not weaken the construction or lead to leaks
Fatwood (resinous pinewood)	Not allowed
Waney edge	Not allowed on visible or hidden parts
Storage damage	Water damage: Not permitted

2.2.4.4 Correction of material defects

Some material defects can be repaired and improved with good results. The most common repair methods are wood plugs or various forms of repair compound, putty or hot-melt adhesive.

Plugging must not occur on weather-exposed surfaces in the bottom frame or horizontal casement, nor the lower 300 mm of the jamb/vertical casement.

Note that repairs with wood plugs are considered as knots, and that requirements for the size and number of knots must be satisfied after plugging.

For plugging of surfaces in general, the following applies:

- The wood quality of the plug shall be the same as for the frame/casement, that is: plugging of heart wood shall be done with heart wood plugs
- The grain of the plug must be parallel to the grain of the wooden profile
- Plugs in surfaces not exposed to the weather must be glued with adhesives that, at least, meet the requirements for Bonding Class 1 (see section 3.1)
- Plugs in weather exposed surfaces must be glued with adhesives that, at least, meet the requirements for Bonding Class 2 (see section 3.1)
- The moisture content in the plug must be the same as the wood moisture in the frame/frame profile with a tolerance of +0/–2%.
- Plugging of plugs or overlapping plugs are not permitted

For round plugs in particular, the following also applies:

- Diameter ≤ 30 mm
- The drilling depth must be > 5 mm below the finished profile of the plug and repair compound
- At least 2/3 of the plug diameter must be firmly attached after processing

For boat plugs in particular, the following also applies:

- Boat spars with several "keels" can be used
- Plugging must be done with suitable equipment for milling grooves, gluing and pressing

When gluing plugs, the adhesive shall be applied on one face and at the bottom and on each side in such way that the gap between the plug and hole/groove wall is completely filled with glue.

Repair compound, putty or hot-melt adhesive can be used to repair defects in non-weather-exposed surfaces. Repair compound and putty must be sanded down to a smooth surface.

2.2.5 Wood protection and surface treatment

As a biological material, wood is particularly susceptible to fungi, rot and other biological degradation. Products made of wood must be given sufficient protection against various degradation processes as described in point 3.2.

Surfaces in frames and wooden frames that must be protected are:

- Surfaces from the inner rebate upstand to the outer face of the frame for outward opening products
- Weather exposed surfaces for inward opening products

Door leaves must be provided with sufficient protection against moisture absorption and moisture transport, which can impair function and properties.

Wood protection and/or other treatment/priming must be applied as soon as possible after processing to ensure satisfactory chemical bonding of the substrate. Further surface treatment must be carried out in line with the supplier's instructions.

Current methods for wood protection are:

- Biocidal preservatives (vacuum, dip, flow-coat)
- Heartwood proportion over 90% in combination with other wood protection,
- Modified wood

Furthermore, the surface treatment system must be compatible with the selected wood protection .

2.2.5.1 Wood preservatives

Wood preservatives provides protection against fungus and rot by adding a biocide-based preservatives agent to the surface of the wood. This is the most common form of preservatives for doors and windows.

Wood preservatives is usually applied in one of the following ways:

- **Vacuum:** The preservative is applied in closed facilities that use pressure to increase penetration of the preservative into the component.
- **Flowcoat -/spray:** The preservative is sprayed/showered on the components in closed facilities.
- **Dipping:** The preservative is applied by dipping the components manually or in closed facilities.

It is particularly important that the end grain is given sufficient penetration of the preservative. In practice, this means preservatives corresponding to class NP3 according to NS-EN 351-1.

Products that are delivered with wood protection, but *without further surface treatment*, shall be marked, and conditions and limitations relating to exposure to dangerous substances when handling the product, further surface treatment and warranty obligations must be clearly stated in the documentation as mentioned in point 3.2.1.

2.2.5.2 Heartwood proportion over 90% in combination with other wood protection

Heartwood has natural protection against fungus and rot through a high resin content. Heartwood content can provide protection against biological degradation alone or together with other wood protection.

Where heartwood content is included as part of wood protection, the heartwood content must be controlled and logged when receiving material.

The two accepted forms of wood wood protection in combination with heart wood is:

- **Biocidal free wood preservatives:** Danish System 2ØKO and similar protective systems are permitted in combination with at least 90% heartwood content. It is particularly important that end grain is given sufficient preservatives. In practice, this means preservatives corresponding to class NP3 according to NS-EN 351-1.
- **Biocidal surface treatment:** The wood protection is included in the surface treatment (sealer or paint) and does not require further preservation or impregnation of the wood. It is particularly important that the end grain is treated with suffienct surface treatment.

The supplier's instructions must be followed regardless of which preservatives system is used.

2.2.5.3 Modified wood

Modification of wood often takes place through a chemical process that changes the fiber and/or pore structure of the wood.

Common systems for modified wood are:

- Acetylation. The wood is pressure impregnated with an acetic anhydride which chemically changes the structure of the cells in the wood.
- Furfurylation . The wood is impregnated with furfuryl alcohol before it is heat treated. The process forms a polymer that binds to the cells in the wood and prevents moisture from penetrating the wood.

2.2.5.4 Surface treatment

Wood protection does not normally provide sufficient protection alone over time against moisture absorption in the wood. Other surface treatment is therefore necessary in most cases. This particularly applies to end grain in cut surfaces and glue joints.

Special production without surface treatment (sealer/paint) shall not be marked with the NDVK Membership Label.

Pre-treatment may be necessary to ensure sufficient adhesion to the substrate. Any pre-treatment with primer or sealer must be suitable for the purpose and adapted to the rest of the surface treatment system.

Weather-exposed end grain in frames and casements must be given sufficient surface treatment to prevent moisture from penetrating the end grain.

The surface treatment must comply with EN 927-1 and the dry film thickness must be a minimum of 80 μm.

External wooden glazing bars must have treated end grain.

The external surface treatment must be open to diffusion to ensure the wood has sufficient drying opportunities.

Door leaves made of wood-based materials must normally have a moisture barrier to prevent moisture absorption and transport in the door leaf as a result of different climates on each side of the door leaf. Moisture absorption and transport can impair the function and properties of the door leaf.

2.2.5.5 Visual quality of finished surface treatment

The tables below summarize quality requirements for finished surface treatment. As of today, there is no common industry standard for assessing finished surface treatment.

Surface treatment of windows, window doors and outer door frames

Property	Transparent surface treatment	Opaque surface treatment		
		Within sealing strip	Outdoor, weather-exposed surfaces Bottom frame Side frame on opening page	Outdoors, not exposed surfaces
Knot discoloration	Not relevant	Knot sealing shall be used on items with knots. See the manufacturer's warranty conditions.		
Fillers and hot-melt glue	Hot-melt glue is permitted if the color matches well	Allowed to be visible when sanded down to a smooth surface.		
Visible grain structure	Not relevant	To be accepted.		
Color variations	Not relevant		Allowed to a small extent	Allowed
Surface roughness	The surface should feel smooth, but wood structure can be felt.		Some roughness is allowed. The surface should be rougher than the inside.	
Seeping	Not allowed		Allowed at one location per product	Allowed
Orange-peel texture	Not allowed			
Stickiness	Not allowed			

Surface treatment of outer door leaves. The requirements apply to both the inside and outside of the door leaf

Property	Transparent surface treatment		Opaque surface treatment		
	Veneered	Solid wood, frame wood , paneled	Veneered	Solid wood, frame wood , paneled	MDF/HDF
Knot discoloration	Not relevant		Knot sealing shall be used on items with knots. See the manufacturer's warranty conditions.		
Plugs	Not relevant		Not allowed		
Fillers and hot melt glue	Hot -melt glue is permitted provided there is a good color match.		Allowed to be visible when sanded down to a smooth surface.		
Visible grain structure	Not relevant		To be accepted.		To be accepted for panels, decorative moldings and profile milling
Color variations	Not relevant		Allowed to a small extent		
Surface roughness	Smooth				
Seeping	Not allowed				
Orange-peel texture	Not allowed				
Stickiness	Not allowed				

2.2.6 Workmanship requirements

2.2.6.1 Profiling

Horizontal surfaces that can be reached by rainwater must be profiled with a slope of at least 1:8 towards the outside to ensure that water running off.

2.2.6.2 Requirements for glued connections and corner connections

Corner connections are, according to experience, a weak point for leaks in finished windows. Leaks through corner connections in frames are also hidden and lead the water out into the rest of the outer wall.

To ensure tight corner connections over time, corner connections must be glued. The glue must fill the entire gap in the joint. The glue used must have good adhesion, also for finished surface-treated components.

Joint compound is recommended to be used in addition to glue to ensure sufficient sealing of the groove for the glass gasket and/or sealing strip, as well as of the corner connection as a whole.

There are no specific requirements for how to assemble corner joints, but a requirement for quality control through a periodic testing (blue stain test) of corner joints as described in

2.3 Requirements for frames and casements made of plastic (PVC)

The requirements include plastic material and the profile system used in windows, window doors, air hatches and external doors made of plastic. Plastic normally means PVC.

Frames and casements are made from plastic profiles that are often produced by a separate profile supplier. Requirements are placed on the profile supplier and the quality of the plastic profiles.

Plastic materials not used for the frame and casement, such as gaskets or other components, are not covered by the requirements in this section, but are dealt with under Part 3.

Weak points for plastic windows are normally attachment points for fittings, points for attachment to the wall and glue joints .

Material defects are normally due to uneven colour, stripes or other defects associated with the extrusion of the profile.

2.3.1 Plastic materials and profile system

Manufacturers of plastic doors and windows are responsible for obtaining the necessary documentation from their profile supplier(s), and must demonstrate compliance between purchased plastic profiles and the requirements for profiles set out in this document during inspection visits.

Plastic materials and profile systems for door and window production must satisfy the requirements of NS-EN 12608-1. This also applies to products with recycled plastic raw material.

2.3.1.1 Requirements for profile supplier

Production of plastic profiles for door and window production is not subject to requirements for external production control.

NDVK therefore requires that profile suppliers who supply to manufacturers of doors and/or windows must have a quality management system in accordance with the ISO 9000 series that covers the entire production of profiles for doors and/or windows.

2.3.1.2 Requirements for plastic materials

Plastic materials used for the production of profiles for doors and/or windows must be suitable for the purpose and satisfy Norwegian requirements for the absence of substances dangerous to health and the environment.

Examples are lead, cadmium, chlorinated or brominated paraffins, phthalates, polybrominated diphenyl ethers (PBDE), and organotin compounds.

2.3.1.3 Requirements for profile system

Profiles in PVC for door and window production must meet requirements in NS-EN 12608-1 *Unplasticized PVC profiles (PVC-U) for the production of windows and doors — Classification, requirements and test methods — Part 1: Uncoated PVC-U profiles with light colored surface* .

Profiles of polyvinyl chloride without plasticizer (PVC-U) for the production of doors and windows. Classification, requirements and test methods .

The profiles must have performances that satisfy the requirements in the tables below.

Requirements for PVC profiles for the production of doors and windows

Property	Test standard	Requirement
Impact resistance	EN 12608-1	Class II
Climate resistance	EN 12608-1	Class M (or S)
Profile thickness	EN 12608-1	Class A
Resistance to falling load	EN 477	Damage to the wall for only one of the test objects
Dimensional stability after heating to 150 ° C	EN 478	No defects
Dimensional stability in heat	EN 479	Dimensional change ± 2%
Weather resistance	EN 513	Requirements for maximum change of impact strength and color given in NS-EN 12608-1
Weldability	EN 514	Minimum voltage level requirements given in NS-EN 12608-1

As minimum documentation for meeting the requirements, the window/door manufacturer's data sheet must be attached to the profile supplier's specifications for the profile material.

Profiles used for door and window production must have reinforcement/reinforcement in accordance with the table below. Requirements for reinforcement/reinforcement apply based on the size of the finished product and the need for attachment points for mounting the product.

Requirements for reinforcement/reinforcement in PVC profiles

Profile type and color	Requirements for reinforcement/reinforcement
Dyed-in-the-grain, light (white or light gray)	In accordance with the profile provider's terms
Light colored profiles with a dark outer surface	In accordance with the profile provider's terms
Dyed-in-the-grain, dark	Always

If it has been approved/prescribed by the profile supplier, reinforcement/reinforcement of the frame and/or frame can be replaced by "full gluing " of the insulating glass pane to the frame or casement in accordance with the profile supplier's instructions.

Stiffening profiles must either have a perfect adaptation to the plastic profile or it must be fixed with screws on non-visible surfaces. The distance between the screws must not exceed 250mm and be placed a maximum of 60mm from the ends of the profile. If the profile supplier prescribes a different distance between the screws, these must be observed.

2.3.2 Material defects

On visible surfaces, edges and corners, it must not be possible to observe accidental marks or other traces from tools or traces from handling during production, packaging and storage.

2.3.3 Workmanship requirements

2.3.3.1 Requirements for finished frame/frame

Horizontal surfaces that can be reached by rainwater shall have a profile with a slope of at least 1:8 towards the outside to ensure that the water runs off.

Bottom pieces on frames and casements must also be made with drainage holes that lead any rain and/or condensation water inside the profiles to the outdoors. The smallest dimension of the drainage holes must be Ø8mm or a gap of 5x20mm. The number of drain holes and their location must be such that all water is led away. The drainage holes must under no circumstances be connected to cavities with inserted reinforcement/reinforcement.

Touchable corners (corners facing out) on frames must not be so pointed and/or sharp that it feels uncomfortable to touch them. The edge in the butt seam for the sealing strip must not be >0.5mm.

When the product's external dimensions are determined, sufficient consideration must be given to the plastic material's temperature movements. This applies in particular to products that have dark colours, are wide or where several products are built together side by side. Measurement tolerances are shown in the table below.

Measure	**Nominal length L**	**Tolerance**
Outer frame dimensions	L < 2 m	± 2 mm
	L > 2 m	± 3 mm
Frame size	–	± 2 mm

When the profiles are inspected at a distance of 1.5m or more, the visual impression must not be disturbed by scratches, tensile marks or other visual surface defects.

2.3.3.2 Requirements for corner connections, welding and gluing

Corner joints on frames and casements must be joined by welding. Posts and pilot holes can be counter-profiled and fixed with fittings that have been developed for the profile system.

The corner connections and/or connections between frame components and post/loose wood must be absolutely tight against air and water ingress.

The strength of the welded corner connections must be documented at least annually by accredited testing using the compression/bending test method as specified in NS-EN 514 with a breaking load (F) of at least 2.5 kN .

Accredited testing can take place every other year if the manufacturer himself carries out regular and documented testing as described above.

The door/window manufacturer's product data sheet must describe the method used for joining the corner joints. For example, the profile supplier's guidelines for temperature, time and pressure during contact with the welding mirror and during compression after welding must be disclosed.

Welding equipment, procedure and quality control are checked at an annual control visit.

Stiffening profiles must either have a perfect adaptation to the plastic profile or be fixed with screws in hidden or hidden surfaces. Fixing must follow the profile supplier's guidelines with regard to distance to profile ends and between screws. Where such guidelines do not exist, the distance between the screws must not exceed 250 mm and the distance to the ends of the profile must not exceed 60 mm.

Additional profiles, such as water logs , can be glued to the frame profile in accordance with the profile supplier's instructions for gluing.

2.3.3.3 Requirements for surface treatment

PVC profiles are normally supplied fully coloured, but painted or foiled profiles are permitted under certain conditions.

Visible and hidden surfaces must appear with a uniform color and degree of gloss.

Paint must be applied in accordance with the profile supplier's conditions. Application should preferably take place in industrial facilities.

Foiling can be carried out in accordance with the profile supplier's conditions.

The door/window manufacturer must state whether the product is through-dyed, painted or foiled in the product data sheet and FDV documentation. In the description of necessary cleaning, the FDV documentation must include both which products can be used and which should be avoided.

2.3.3.4 Requirements for attachment points and fittings

Hinges or other fittings with a corresponding load must be attached with screws that have fastening through at least two layers of material. Two layers of material can be two layers of plastic or one layer of plastic and one metal insert.

Other fastening methods, for example screw cams, can be used if equivalent strength and stability as shown can be documented.

If, during production of the product, holes are drilled for mounting the product in the wall, the hole distance must be in accordance with the manufacturer's installation description. Installation description must also be sent with all deliveries.

Part 3 Requirements for other components

Part 3 describes basic requirements for other components in windows and doors. This includes glue, surface treatment, insulating glass panes, locks and fittings, sealing strips and gaskets, putty and joint sealing, external cladding materials and other components.

3.1 Glue and glue joints

3.1.1 General requirements for glue and gluing

All glue used to join frame and/or frame components must have documented and approved strength and durability properties. The documentation must be issued by an accredited testing laboratory.

All gluing must follow the glue supplier's instructions with regard to

- Mixing ratio for multi-component adhesives,
- Application amount, speed and one- or two-sided application,
- Open time (time from application until the surfaces are joined),
- Closed time (time from folding until press pressure is applied),
- Press time (the time the press pressure is on), and
- Press pressure and temperature.

Requirements for adhesive joints are particularly important for wooden windows and doors where gluing is the primary means of fastening between the components in frames and casements. In addition to providing strength and stiffness, the glue must prevent moisture from penetrating the joint and causing moisture and/or rot damage in the frame/frame.

For frames and casements made of plastic materials, welding is primarily used, but gluing can be used for some secondary frame and casement components.

3.1.2 Bonding Classes and requirements for glue

Definitions of glue joints and requirements for glue in the two Bonding Classes are in accordance with the NCS regulations. Adhesive joints are placed either in adhesive

joint class 1 or 2 depending on the area of use. The glue used must be approved for the glue joint class .

3.1.2.1 Bonding Class 1 (C1)

Bondings in Bonding Class 1 (C1) are not exposed to weather. For short periods, however, wood moisture and temperature in wood near the bonding can exceed, respectively, 20% and 50 °C.

A distinction is made between moderate and high moisture load for Bonding Class 1 and whether the bonding is exposed to indoor or outdoor climate.

Moisture load	Indoors	Outdoors
Moderate	Frequent, short-term exposure to running water or condensation, and/or heavy exposure to high humidity	Not exposed to weather influences
High	Frequent, prolonged exposure to running water or condensation	Exposed to the effects of the weather, but protected with "adequate surface protection", cf. definition of adhesive joint class 2

3.1.2.2 Bonding Class 2 (C2)

Bondings in Bonding Class 2 (C2) may be exposed. Wood humidity and temperature in the wood near the bonding can exceed, respectively, 20% and 50 °C for longer periods.

Bondings that are perpendicular to the pane or door plane and can be seen on the surface belong to Bonding Class 2 regardless of other surface treatment.

If bondings in Bonding Class 2 are protected against weathering with external cladding in plastic, aluminium, etc., the glue joint is placed in Bonding Class 1 with a high moisture load.

3.1.2.3 Approved glue types

Approved adhesive types for Bonding Class C1 and C2 are shown in the table below.

Glue type	Reference	Bonding Class
Thermoplastic, Type D3	NS-EN 204	C1 (Moderate)
Heat curing, Type C3	NS-EN 12765	C1 (Moderate)
Thermoplastic, Type D4	NS-EN 204	C1 (High)
Heat setting, Type C4	NS-EN 12765	C1 (High) C2
Phenolic and amino plastics, Type I	NS-EN 301	C2
EPI (emulsion-polymerized isocyanate)	NS-EN 16254	C2
One-component polyurethane (PUR)	NS-EN 15425	C2
Two-component polyurethane (PUR)	- [1]	C2

[1] There is no separate standard for approval of two-component PUR. Standard NS-EN 15425 is used as a starting point

3.2 Surface treatment

3.2.1 Generally

It is not a requirement that products be delivered with one specified surface treatment, but there is a requirement that finished products be delivered with a surface with sufficient protection against degradation processes such as:

- biodegradation,
- UV radiation,
- leaching of plasticizers , and
- corrosion.

Products made of wood are particularly susceptible to biological degradation, and requirements for the protection of frames and casements made of wood are described under section 2.2.5. Products made of wood must withstand limited exposure to water

and a humid environment without the wood moisture exceeding 18% or other properties deteriorating. For frames and window frames made of wood, a form of surface treatment is normally used, but for door leaves, full-covering sheets of laminate etc. are also applicable. See point 0.

Plastic products often have no surface treatment beyond the plastic material itself. For such products, the properties of the plastic material control the resistance to degradation as mentioned above. See point 2.3.

3.2.2 Requirements for surface treatment

Surface treatment normally takes place using various chemical products. The supplier's instructions for the use and combination of individual products or product systems must always be followed.

Complete surface treatment normally includes:

- Priming, pretreatment and possible preservatives,
- Painting, lacquering or other covering surface treatment, as well as
- Any final treatment.

All visible and hidden surfaces must be surface treated. However, it is permitted that limited areas on hidden surfaces can be delivered untreated.

3.2.3 Documentation of surface treatment

The manufacturer must state what kind of surface treatment the product is supplied with in the following documentation:

- Product data sheet/technical data sheet,
- FDV documentation, and
- Marketing materials (where relevant)

If products are delivered with something other than the manufacturer's standard surface treatment, for example untreated wooden windows, wooden windows only treated with preservatives liquid, painted plastic windows etc., special information must be given about any changes in:

- Warranty times and conditions (especially rot guarantee and aesthetic quality),
- Requirements for further surface treatment, cleaning and/or maintenance, and
- Risk of exposure to health and environmentally dangerous substances when handling the product.

The latter only applies to wooden windows that are delivered with preservatives, but without further surface treatment.

3.3 Insulating glass units (IGU)

Insulating glass panes must be manufactured, manufactured and CE marked in accordance with the EN 1279 series.

The glass must be installed and used in accordance with the supplier's instructions.

Where there are no installation instructions from the manufacturer, EN 12488 must be used as the basis for installation. For external doors, a simplified glass assembly is accepted in accordance with SINTEF Building design guide 533.202.

Safety glass, fire glass and other functional glass must be marked in accordance with their own standards.

3.4 Additional cladding in other materials

Wooden windows are often supplied with outer cladding in metal or plastic. Aluminum cladding is the most common.

Such cladding must be on the outside and have a drained and ventilated cavity between the cladding and frame or casement profile. The cavity must be at least 5 mm. Gaskets must be used to prevent moisture from entering behind the cladding along weather-exposed edges. Drainage and ventilation must therefore take place along the outside of the frame.

For horizontal surfaces that can be reached by water from precipitation, and for construction details where condensation water can collect, the requirements for profile design in accordance with 2.2.6.1.

Frame and casement profiles in wood must have sufficient protection against degradation processes as described in point 2.2.5. In practice, it is required that the profiles are surface treated before the cladding or fastening elements for the cladding are installed.

The outer covering must have sufficient corrosion protection. For metal profiles, the same requirements for corrosion protection apply as for locks and fittings. Steel details must be stainless or insulated from aluminum parts to avoid galvanic corrosion.

Other solutions can be accepted for individual cases with special approval.

3.5 Lock and fittings

Locks and fittings must be adapted to the product and intended use in terms of load-bearing capacity, wear resistance and corrosion protection.

Locks and fittings that are exposed to the external climate must at least be delivered with corrosion class 3 in accordance with NS-EN 1670. Fittings that are used within sealing strips may have corrosion class 1 in normally dry rooms.

In the product data sheet, FDV documentation and marketing, the manufacturer must highlight the type of lock and fittings supplied with the product. Information must be given about any reservations related to benefits as described in the first paragraph.

3.6 Sealants and gaskets

Sealants include

- sealing strips,
- gaskets,
- Putty,
- Joint compounds, and
- Joint tape.

The sealants must be suitable for the intended use of the product. This means that the sealants must have sufficient resistance against aging and deterioration of properties as a result of influences that occur during the lifetime of the window. The supplier's instructions for durability must always be followed.

For sealing strips and gaskets , the following properties are important to maintain over a long period of time:

- temperature stability,
- work area,
- Compression, and
- Sentence properties.

Putty, sealants and joint tapes are elastic materials that must absorb movements from mechanical loads and temperature and moisture movements in the substrate and between various components in the window. These sealants must be sufficiently elastic so that other components are not damaged, and durable enough so that the elastic properties are maintained over time.

Annex A Wet stain testing of corner joints

Purpose of testing

The corner joints of windows are well known to be weak spots of doors and windows. Leakage of rainwater through the corner joints of the frame can result in concealed moisture damages to the building, and the leak is hard to detect.

NDVK therefore require manufacturers to control the quality of the corner joints of window and door frames through regular wet stain testing. The test is performed for each unique type of frame profile the manufacturer produce.

The test is destructive, which means that the tested frame is destroyed as a part of the test.

Frequency of testing

The manufacturer shall at least every 14 days (2 weeks) perform a wet stain test for a randomly selected frame of each frame type. For small production volumes, the frequency can be lowered to 1 test per 100 produced units of each frame type, but not less frequent than every 28 days (4 weeks). The production volume is the total number of units for each frame type, and not just the units manufactured for the Norwegian market.

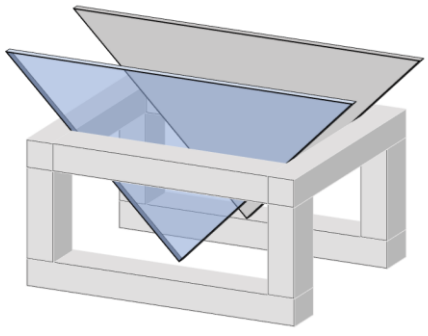


Figure 1. Possible test apparatus. To boards/sheets are clamped on each side of a frame corner joint. The frame-sheet setup is mounted in a rack such that the corner points directly downward. A tray is placed underneath to reveal leakages.

Test setup

The test is performed for a randomly selected fully produced frame. The frame is mounted in a test rig and a standard staining fluid is added. A fully produced frame is profiled, glued, pressed and surface treated. For fixed light frames, the IGU should not be installed.

Test apparatus

The test apparatus consists of two sheets/boards clamped to the inside and outside of the frame and a rack for supporting the frame/sheets/boards. Make sure the clamping does not create an obstacle to place the clamped frame into the rack correctly. Each sheet/board shall be equipped with gaskets to ensure adequate tightness.

Staining fluid

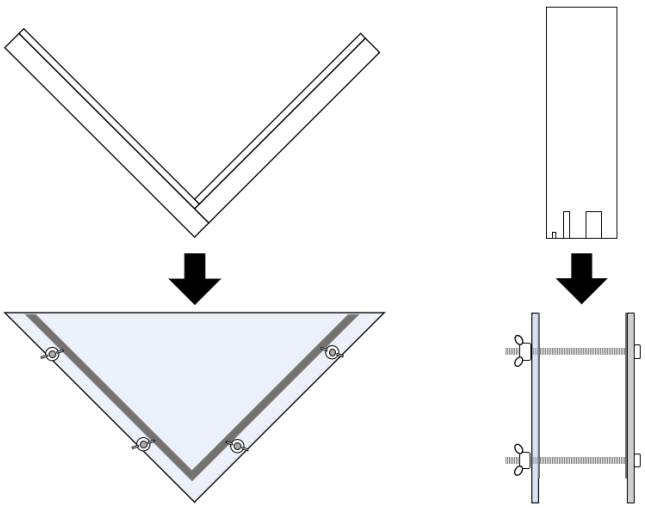
To ensure equal and stable conditions, a standard stain fluid should be used to normalise the hardness of the water and the surface tension.

The staining fluid shall be mixed according to the following recipe:

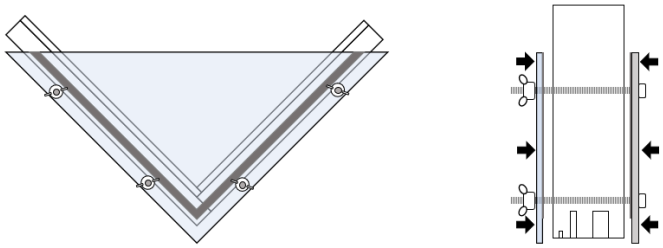
- 50 parts regular tap water
- 50 parts ethanole based disinfectant (95 %)
- 3–5 parts blue (or black) ink
- 3 drops of regular dishwasher soap

Testing procedure (figures on the next page)

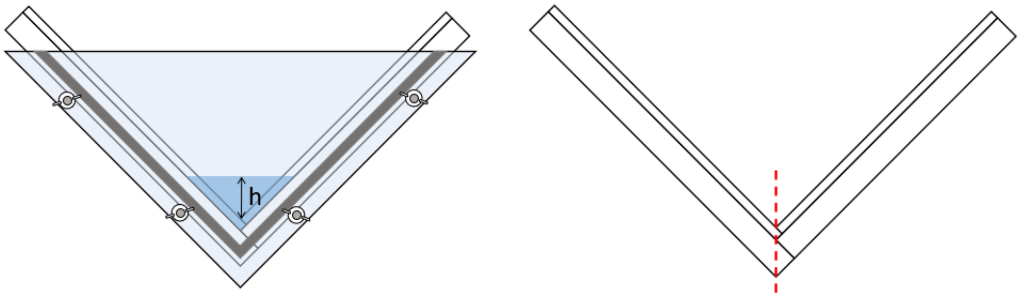
1. Place the frame with a 45 degree angle between the sheets/boards in the test rig such that the corner of the sill and jamb points directly downward.
2. Clamp the sheets/boards of the test rig to the frame.
3. Fill staining fluid into the tray such that the depth is 60 mm measured from the top of the rebate (see figure next page).
4. Leave the test for at least 45 min before the fluid is emptied. The fluid may be reused if stored properly.
5. Air dry the frame without extra use of heat, fans etc. until all moisture has evaporated from the surface.
6. Cut the corner joint diagonally with a saw such that all mortises and tenons are cut and the glue between the mortise and tenon is visible.
7. The test is passed if the cut surface shows no sign of color penetration along the glue surfaces.
8. Log the result of the test.



Step 1. Place the frame with a 45 degree angle between the sheets/boards in the test rig such that the corner of the sill and jamb points directly downward.



Step 2. Clamp the sheets/boards of the test rig to the frame. Make sure the clamping makes a tight seal between the gaskets of the sheets/boards and the frame.



Step 3 (left). Fill staining fluid into the tray until the depth from the rebate to the surface is at least h = 60 mm.

Step 6 (right). Cut the corner joint diagonally with a saw such that all mortises and tenons are cut and the glue between the mortise and tenon is visible.