



Building & Landscape Products

NORWAY SPRUCE

Plato[®] WOOD

Sustainable inspiration

Plato's unique two stage thermal process dramatically improves the performance of abundant wood in an environmentally responsible way.

No chemicals are involved throughout the process, where a careful combination of temperature and pressure significantly upgrades the stability and natural durability of Norway spruce, while retaining important mechanical properties. This makes Plato[®]wood Norway spruce the perfect choice for projects seeking an environmental performance over a long worry-free service life.

Projects in its wide range of applications include cladding, rainscreens, decking, fencing and even ground and fresh water landscaping.

Directly from stock or machined to your specifications

Plato®WOOD Norway spruce is available as sawn, planed or round timber via a network of selected local distributors. Long and fixed lengths are held as standard stock items and sawn items can be machined into custom profiles for quick delivery.

Plato®WOOD can be stained, painted and fire retardant treated. Below you will find standard sections of Plato®WOOD Norway spruce. For any queries about Plato®WOOD please contact our national account managers or your local distributor.

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Overview of standard Plato®WOOD Norway spruce profiles

Platonium® Oslo

- Shiplap cladding, 18 x 139 mm
- Effective width 125 + 4 mm
- Lengths 3.60-5.10 m*



Platonium® Stockholm

- Featheredged cladding, 9/20 x 141 mm
- Effective width 125 + 4 mm
- Lengths 3.60-5.10 m*



Plato®WOOD Exloo

- Planed with round edges
- 18 x 140 mm
- Lengths 1.80-5.10 m*



Plato®WOOD T&G

- Planed with T&G blockhouse profile
- 27 x 140 and 32 x 140 mm
- Lengths 2.40-5.10 m*



Plato®WOOD Decking

- Planed with decking profile
- 27 x 140 mm
- Lengths 2.40-5.10 m*



Plato®WOOD Beam

- Planed with round edges
- 40 x 66 mm
- Lengths 2.40-5.10 m*



Plato®WOOD Post

- Planed with round edges
- 66 x 66 and 85 x 85 mm
- Lengths 2.10-3.00 m*



Plato®WOOD Norway spruce

- Rough sawn (incl. sticker marks)
- Different cross section sizes
- Lengths 1.80-5.40 m*
- Density approx. 420 kg/m³



Plato®WOOD Stakes

- Milled round wood with 4-cut point and crown
- Diameters 60-70-80-90-100-120 mm
- Lengths 2.00-2.50-3.00 m
- Shrinking and drying cracks are allowed



* Intermediate lengths going up per 30 cm, if available. Other lengths available upon request.

Standard assortment rough Plato®WOOD Norway spruce for Building and Landscape products

Pre treatment cross section (mm)	After treatment cross section (mm)	Advice cross section after machining (mm)
23 x 100 23 x 125 23 x 150 23 x 175 23 x 200	approx. 22 x 97 22 x 121 22 x 146 approx. 22 x 171 22 x 196	18 x 85 18 x 115 18 x 140 18 x 162 18 x 185
32 x 125 32 x 150 32 x 200	approx. 30 x 121 30 x 146 approx. 30 x 196	26 x 115 26 x 140 26 x 185
38 x 150	approx. 36 x 146	32 x 140

Thicker dimensions of Plato®WOOD Norway spruce are available (47, 50, 63, 75 and 100 mm). These boards can contain internal cracks and large knots. Knots can be live and/or cracked. Please read our instructions for product properties and the proper machining and processing of Plato®WOOD Norway spruce.

FSC, the mark for responsible forest management.
Plato International BV is certified according the rules of FSC Int., CoC no. SGS-COC-1035 and Plato®WOOD FSC certified products are available on request. © 1996 Forest Stewardship Council A.C.

Sales points, instructions, on-line documentation, a project overview, and more information can be found on www.platoewood.com

Instructions Plato[®] WOOD Cladding Systems

e.g. for Platonium[®] Afara, Oslo, Stockholm, and Westminster

Transport and storage

- To prevent damages packaging, transport and storage of Platonium[®] cladding boards should be done with care. For instance, the distance between the forks of a forklift should be sufficient (ca. 1.5 m) when big and/or long packages (5.1-6.0 m) are transported.
- Packages should be stored dry, clean and flat. Use sufficient strikes and the strikes must be located straight above each other when two or more packages are placed on top of each other. Storage should not result in a negative impact on the properties and quality of the Platonium[®] cladding boards. This also concerns storage on the building place.

Fastening

- Platonium[®] Norway spruce cladding boards (Oslo and Stockholm) are planed with the sapwood site as the (visual) top site. This is done because of the possible occurrence of raising grain between early wood and late wood at the heart site of the board.
- Fastening of Platonium[®] cladding boards should be done according the appropriate standards and/or directives. Important items are:
 1. The cross section end should be coated with an appropriate compound.
 2. The heart-to-heart distance of the under construction (e.g. Plato[®]WOOD 40x66 mm beams) should be maximal 600 mm.
 3. Ventilation behind the cladding boards should be sufficient, both for horizontal and vertical cladding. This includes also ventilation at the bottom and top site of the cladding!
 4. An expansion distance of at least 4 mm should be used between the individual cladding boards. The cladding boards should be fastened with an open distance of 5-10 mm between the cross section ends of the individual boards (especially when long length's are applied).
 5. Stainless steel ring nails of stainless steel wood screws should be used to fasten Platonium[®] cladding boards (A2- or A4-quality). The minimal attach length of a ring nail is 2,5x the thickness of the cladding board and the minimal attach length of a screw is 2x the thickness of the cladding board. Pre-drilling or the use of a screw with a special cutting point is recommendable, especially at the cross section end.
 6. The first ring nail of screw must be placed minimal 20 mm and maximal 25 mm from the board end.
 7. Fasten the cladding board against the under construction with one ring nail or screw per beam per fastening place. The place where the ring nail or screw is fastened is minimal 2 x the thickness until maximal 3 x the thickness of the boards, counted from the lower part of the board.
 8. Nail- and/or screw holes should be closed with an appropriate compound, if a film forming coating system is used. The ground layer must be repaired until the original layer thickness.

Coating

- Plato[®]WOOD can be applied without a coating system. The surface will be weathered on a natural way due to the influence of sun light, rain and wind. This does not affect the durability of the wood, but the wood surface will be grey after a while. During the first period of weathering the wood surface might be a bit spotty and dark coloured (especially when wet). This might be intensified through the adhesion of dirt and aerosols on the wood surface.
- Use appropriate coating systems which are allowed in your country.

- Apply the instructions of the coating producer. Important items are:
 1. The moisture content of the Platonium® cladding boards should be similar to the moisture content when applied in service conditions.
 2. The wood surface should be dry, clean and free of fatty compounds before the coating system is applied.
 3. A **covering film forming coating system** should be applied on all (four) sites with a minimal dry primer layer thickness of 80 µm (in minimal two layers of ca. 40 µm per layer). Cross section ends must be closed with an appropriate compound, keeping the moisture regulation similar to the painted surface. Do not wait too long coating the wood surface with the top layer. The primer layer might be discolouring slightly after some time. Please follow the instructions of the coating producer.
 4. Preferably do not use (semi)transparent film forming coatings for Platonium® cladding boards. If such a system is used, please use a system with a good quality UV-absorber (pigmented) and a anti sapstain fungicide. A transparent alkyd based coating system must be used in this case.
 5. Platonium® cladding boards can be painted with the regular non-film forming coating systems (covering and/or semi-transparent), e.g. stains and oils.
 6. If the Platonium® cladding boards are painted after fastening on the facade, only non-film forming coating systems can be used, e.g. stains or oils. It is always better to paint all (four) sites of the boards before fastening.
 7. Apply the maintenance schedule according the instructions of the coating producer.

Specific items which are of importance when coating Platonium® cladding boards:

- Natural defects (e.g. cracks in knots) on the surface of Platonium® Norway spruce cladding boards (e.g. Oslo) should be repaired with an appropriate compound when a (covering) film forming coating system is used. The surface should be repaired after the first primer layer and before the second primer layer is applied.

Construction of Plato[®]WOOD Terrace Planking

Preparation

Plato[®]WOOD terrace planking can be constructed on ground or on pavement. It is of importance that the foundation is flat. Ground can be dugged (ca. 10 cm deep) to 'sink' the planking in the ground. Put a bottom layer of (dark) root cloth on the ground to prevent growth of weeds. Root cloth is not necessary when the planking is placed on pavement.

The under construction

Put an under construction on the root cloth or pavement consisting several Plato[®]WOOD beams (40x66 mm or 66x66 mm). Each beam must be placed on several tiles or clinkers and must be free from the ground. Do not put the tiles/clinkers too far from each other (ca. 50 cm) to prevent bending of the beams. The heart-to-heart distance of the beams should be maximal 500 mm. Add a gravel layer between the beams to put the root cloth out of sight and to obtain a firm placement of the beams. In this case it should be useful to stabilize the beams by nailing a board at the beginning and end the beams. The stabilizing boards can be removed after the first Plato[®]WOOD planks are fastened. It is not necessary to apply tiles/clinkers when the planking is placed on pavement.



Assembling of the planking

Put the Plato[®]WOOD planks (27x140 mm) at right angles to or under an angle on the under construction layer. Put the individual planks not against each other but use a distance of ca. 1-1,5 cm to allow sufficient ventilation. Apply a distance of 1-1,5 cm between the cross section ends of two boards. Preferably, seal the cross section ends with an appropriate compound. Preferably, the crossing of a plank should be 5 cm (with a maximum of 10 cm). The planks must be fastened with sunked stainless steel particle board screws \varnothing 5 x 60 mm (A2- or A4-quality). Pre-drilling the boards and beams (\varnothing 5 mm) is recommended and if possible the screws should be sunked in the groove of the plank. The Plato[®]WOOD terrace planking boards should be fastened on the under construction beams in the outer two grooves, i.e. with two screws per fastening place.

Maintenance

The surface of Plato[®]WOOD terrace planking shall be weathered (grey) on a natural way due to the influence of sun light, rain and wind. In dark and moist conditions formation of alga on the wood surface is possible. This can be removed with special cleaning compounds and/or with a high pressure squirt.

Note: natural defects such as knots and resin pockets are still present in Plato[®]WOOD terrace planking.

Natural durability of Plato® wood Use class 3 applications

The determination of the natural durability of wood is described in the European standard EN 350-1¹. Lab and semi-practice or service tests are used to determine the natural durability as specified in the EN 350-1, e.g. EN 113 (kolleflask test), ENV 807 (stake test) and EN 252 (graveyard test). Based on the results of these test methods a wood species can be classified in a certain durability class (see table 1). However, this classification and the associated service life expectation concerns durability in ground contact (use class 4).

Table 1. Durability classes of solid wood

	Durability class	Expected service life in ground contact*
1	Very durable	25 years and longer
2	Durable	15-25 years
3	moderate durable	10-15 years
4	Low durable	5-10 years
5	Not durable	Less than 5 years

* in a temperate climate

A classification of the natural durability for other applications or use classes is not (yet) determined. At European level methods have been developed to determine the durability of wood for other applications or use classes. Examples are the L-joint test (EN 330), lap-joint test and the double layer test, test methods to determine the natural durability of wood in use class 3 applications (e.g. cladding, window frames, outer doors). Furthermore, existing test methods can be modified making them suitable to determine the so called application specific durability of a wood species. In the case of the EN 113 (Kolleflaktest) only those fungi are selected which are known to be hazardous for a specific application. Fungal species which are not hazardous are not used for that specific EN 113 test. In this way the natural durability of a wood species is related to the intended application.

The determination of the durability of wood for a specific application based on accelerated lab tests such as the EN 113 are however indicative. A long lasting semi-practice test and practical experience, obtained by monitoring several projects, must give final inconclusive about the resistance of a wood species against fungal decay and the expected service life.

So, natural durability requirements for wood species are necessary depending on the application and the expected hazards in this application. In table 2 a definition is given for use class 1-3, including a sub-division for use class 3, and the relation to the durability class (= durability class of a wood species applicable in the use class). Applications of timber in use class 3 relate in particular to joinery such as window frames, outer doors and cladding. Beside durability demands can also be required to other material properties such as dimensional stability, strength, coating and glueing properties, and fire resistance.

¹ Durability of wood and wood-based products - Natural durability of solid wood - Part 1: Guide to the principles of testing and classification of the natural durability of wood

Table 2. Definition of the use class and the relation to the durability class

Definition use class						Risk	Durability class ²
Use class	Temperature	Relative humidity	Water contact	Sun/UV	Remarks		
1	10-25	30-65	None	Geen	Always inside	-	1-5
2	10-30	30-80	Accidental	Accidental	Humid rooms inside, exterior (completely) protected	-	1-5
3.1	10-35	30-90	Limited	Limited	Exterior (partly) protected (e.g. cladding)	+/-	1-4
3.2	10-35	30-95	Limited	Frequent	Standard exterior application (e.g. window frames, outer doors and cladding)	+	1-4 ³
3.3	10-35	30-95	Permanent	High	exterior application with high risk in design (e.g. decking)	++	1-2

Results of several lab tests performed by independent research institutes⁴, show an indication of the natural durability of Plato[®]WOOD against fungal decay. It appears that the resistance against fungal decay is significantly increased after the Plato treatment. In general, this improvement is at least two durability classes, depending on the wood species, dramatically increasing the expected service life. According the British standard BS 8417 the expected service life will be twice as high after the Plato treatment, which means 30 years for applications in use class 3 (in stead of 15 years or less for untreated wood).

It is however always important to process, fasten and maintain the timber product properly (see our instructions which can be downloaded on our website www.platowood.nl, the Centrum Hout Instruction for claddings, the Dutch KVT directive, etc). For instance, a cladding should be fastened with sufficient ventilation behind the cladding. The coating of a cladding (e.g. oil, stain, lacquer) should be maintained on a regular basis as well, including cleaning, repair and reapply. On this way the timber performs better and the expected service life can increase to 50 years.

Since 2001 wood products of Plato International are applied in a large variety of building projects. Are you interested and do you want to visit a project, go to our website www.platowood.nl. There you will find an overview of a large number of projects including the associated information.

² The durability class is determined according to the EN 113 kolleflask test including the following fungi: *C. puteana*, *P. placenta*, *C. versicolor* (hardwood and softwood), *G. trabeum* (softwood) en *D. expansa* (hardwood).

³ For durability class 3 and 4 appropriate actions should be taken, which guarantee a high resistance against decay or preventing the timber against long term moistening.

⁴ Stichting Houtresearch SHR Wageningen, Agricultural University Wageningen, Ghent University, and Institut für Holztechnologie Dresden,

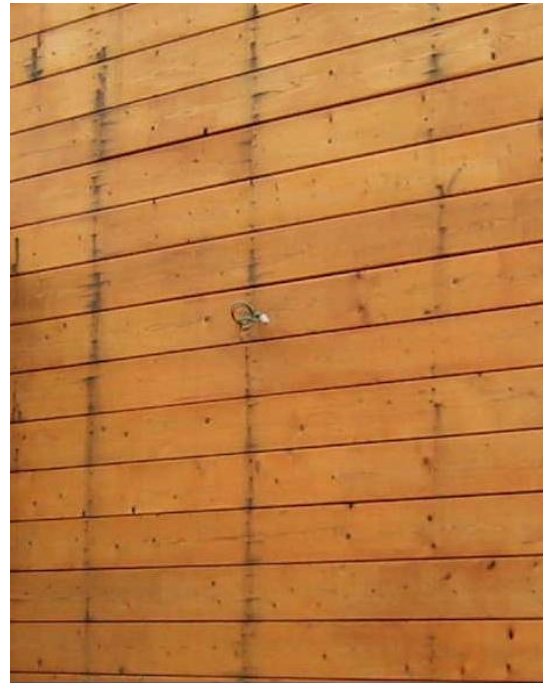
Corrosion

Fastening devices (e.g. ring nails, wood screws, staples) and metalwork which is used in combination with Plato® Wood must be resistant against corrosion. This concerns all exterior applications, e.g. cladding, garden wood, sound barriers, water works, etc.

Electrochemical or wet corrosion can occur when Plato® Hout and/or the fastening devices are getting wet¹. This can corrode the metal of the fastening devices, resulting in spots around de fastening points (see picture).

In time these spots will be less visible due to weathering of the wood surface.

In order to prevent corrosion stainless steel fastening devices should be used, e.g. A2- or A4-quality steel. Near a marine environment preferably use fastening devices of A4-quality.



If non-stainless steel fastening devices are used and spots are occurring on the wood surface, it might be possible to remove them by sanding the wood surface or treatment with for instance oxalic acid or ammonia-hydrogen peroxide². Furthermore, one should prevent the development of new spots, for instance by coating the wood surface or replacing the fastening devices by A2- of A4-quality steel.

NB. The surface of aluminium, copper, lead and zinc can also corrode (e.g. a gutter). These metals produce a protection layer on the metal surface preventing further corrosion. Therefore, spots around such metals might be limited.

¹ (Plato®) Wood contains organic acids. These organic acids are the main cause for the occurrence of corrosion of metal fastening devices in wood.

² Please notice your personal safety and try such treatments first on a small place out of sight.

PLATO[®] Wood Norway spruce for Structural Timber

The Plato[®] process is a heat treatment method developed to improve the dimension stability and durability of wood. The Plato[®] process consists of a dry and wet process stage executed at relatively high temperatures (160-180°C). This results in a chemical modification of the main wood components (especially lignin and hemicelluloses) affecting the mechanical properties of wood. Below some important effects of the Plato[®] process on the mechanical properties of defect free Norway spruce specimen are given:

- the density decreases after treatment (ca. 10%), due to a lower moisture content (ca. 6-7% at 65% RH) and the evaporation of organic compounds (extractives and reaction components);
- a limited reduction of the bending strength (5-10%);
- a limited increase of the modulus of elasticity (0-10%);
- the (janka) hardness is either not changed or slightly increased (0-5%);
- a limited increase of the compression strength (0-5%);
- a clear decrease of the tensile strength (30-50%);
- values of the impact strength are within the range given by the literature, but in the lower segment of this range;
- a decrease of the screw tensile strength (ca. 10% for a 40x66 mm beam). Pre-drilling or the use of a screw with a special cutting point is recommendable, especially at the cross section end (to prevent splitting).

Defect free specimen versus the practice situation

During the development of the Plato[®] process defect free specimens were used to determine inherent, wood based properties. These tests were mainly performed for comparison reasons, e.g. to determine the effect of different process conditions. Characteristic strength values which are used in calculations for construction timber, are based on tests with a representative amount of large specimens including defects if present. These tests are necessary to determine the effect of natural wood defects, such as knots, slope of grain, fissures and rot, on the mechanical properties of wood. In general the density, bending strength and modulus of elasticity are used as test parameters. Based on the test results wood can be classified in strength-quality classes (NEN-EN 338¹ Structural timber - Strength classes). Furthermore, the variation in the strength properties, the kind and duration of stresses during the application, and incidental overloads should be taken into account when a construction is designed. The influence of moisture and long term loadings should be taken into account by using a modification factor in the calculation.

¹ In the European standard NEN-EN 338 (Construction timber - Strength class) a table is shown with the strength class classification including the characteristic strength values, for softwood C14 until C40. A timber species population can be classified in a certain strength class when the characteristic values of the bending strength, modulus of elasticity parallel to the fibre direction, and density are equal or higher than the values given in this table.

According a 3-point bending test (DIN 52186) the mechanical properties of several populations of Plato®Wood Norway spruce beams are determined. Based on the bending strength, the modulus of elasticity and the density Plato®Wood Norway spruce beams can be classified as strength class C18 (NEN-EN 338). Below an example is shown of a population of Plato®Wood Norway spruce beams (63x200 mm).

	Density kg/m ³	Bending strength N/mm ²	Modulus of elasticity N/mm ²
Mean	388	9324	33.1
Stdev	40.7	1684	6.9
5%-value	327	7155	21.7
Minimal	321	6423	19.7
Maximal	488	12907	41.6
Strength class	(C18)	C18	C18

specimen amount: 45; lay up width: 125 mm; lay up length: 1100 mm;
specimen sizes: 59x125x1400 mm

Remarks:

1. It is recommended to investigate which stresses are of importance in a construction and how large these stresses can be when Plato®Wood Norway spruce is used. The use of Plato®Wood Norway spruce should be adjusted on these stresses. Not only the mechanical properties of Plato®Wood are of importance but also the fastening devices and metal works. Please read the machining and corrosion documentation of Plato®Wood.
2. It is recommended not to use Plato®Wood for (heavy) load bearing and/or spanning constructions without a professional advice.

Mechanical and physical properties of Plato[®] Wood Norway spruce*				
Defect free specimen		Plato[®] Wood		Untreated**
		Mean	Stdev	
Density (65% RH)	kg/m3	421	40	460 (12% EMC)
Equilibrium moisture content				
- 65% RH	%	5.9	0.12	13.0 (60%RV)
- 90% RH	%	9.8	0.21	19.5
Shrinkage (wet -> 65% RH)				
- radial	%	1.0	0.06	1.9
- tangential	%	1.8	0.20	4.5
Bending strength (EN 408)	N/mm2	79	19	77
Modulus of elasticity (EN 408)	N/mm2	10514	2665	10800
Janka hardness (ASTM D143)				
- radial	N	1905	38	1570
- tangential	N	1990	119	
- Perpendicular	N	3444	371	2650
Impact strength*** (DIN 52 189)	KJ/m2	21	16	52

* SHR-report 2.793-1w en 2.793-2w (2003),

** Literature (Houtvademecum)

*** SHR report 98.252 (1998)

Note:

It is recommended to investigate which stresses are of importance in a construction and how large these stresses can be when Plato[®] Wood Norway spruce is used. The use of Plato[®] Wood Norway spruce should be adjusted on these stresses. Not only the mechanical properties of Plato[®] Wood are of importance but also the fastening devices and metal works. For the calculation of a construction we advise to use the characteristic values of C16 or C18 according the EN 338. It is recommended not to use Plato[®] Wood for (heavy) load bearing and/or spanning constructions without a professional advice. Please also read the Plato[®] Wood documentation on structural timber, machining and corrosion.

Product properties PlatoWood Fraké

		Fraké*		Literature**
		PLATO	Non-treated	
Physical properties				
Density	kg/m3	438	484	531
Stdev	kg/m3	19	21	
Moisture content	%	5.1	14.7	
Equilibrium moisture content 60% RH	%			13
Equilibrium moisture content 65% RH	%	5.1	14.7	
Equilibrium moisture content 90% RH	%	9.5	17.5	18
Equilibrium moisture content 95% RH	%	11.5	20.4	
Radial shrinkage saturated -> 65% RH	%	0.8	1.0	1.5
Tangential shrinkage saturated -> 65% RH	%	1.1	1.8	2.8
Radial shrinkage 65% RH -> ovendry	%	1.4	2.5	
Tangential shrinkage 65% RH -> ovendry	%	1.9	2.9	
Radial shrinkage saturated -> ovendry	%	2.2	3.5	3.3
Tangential shrinkage saturated -> ovendry	%	2.9	4.8	5.5
Mechanical properties				
Moisture content before testing	%	5.1	14.7	12
Bending strength (MOR)	N/mm2	67.2	65.5	80
Stdev	N/mm2	10.3	6.9	
Modulus of elasticity (MOE)	N/mm2	11064	10712	10300
Stdev	N/mm2	498	1045	
Durability				
Kolleflask test		Ongoing***	Ongoing***	4

* 4 boards tested (the treated and non-treated boards were matched)

** Houtvademeccum, S.I. Winselius, ten Hagen & Stam uitgevers Den Haag, ISBN 90 440 02171

*** The first EN 113 test has started recently, results are expected in June 2007