EINWOOD®

Product information guide

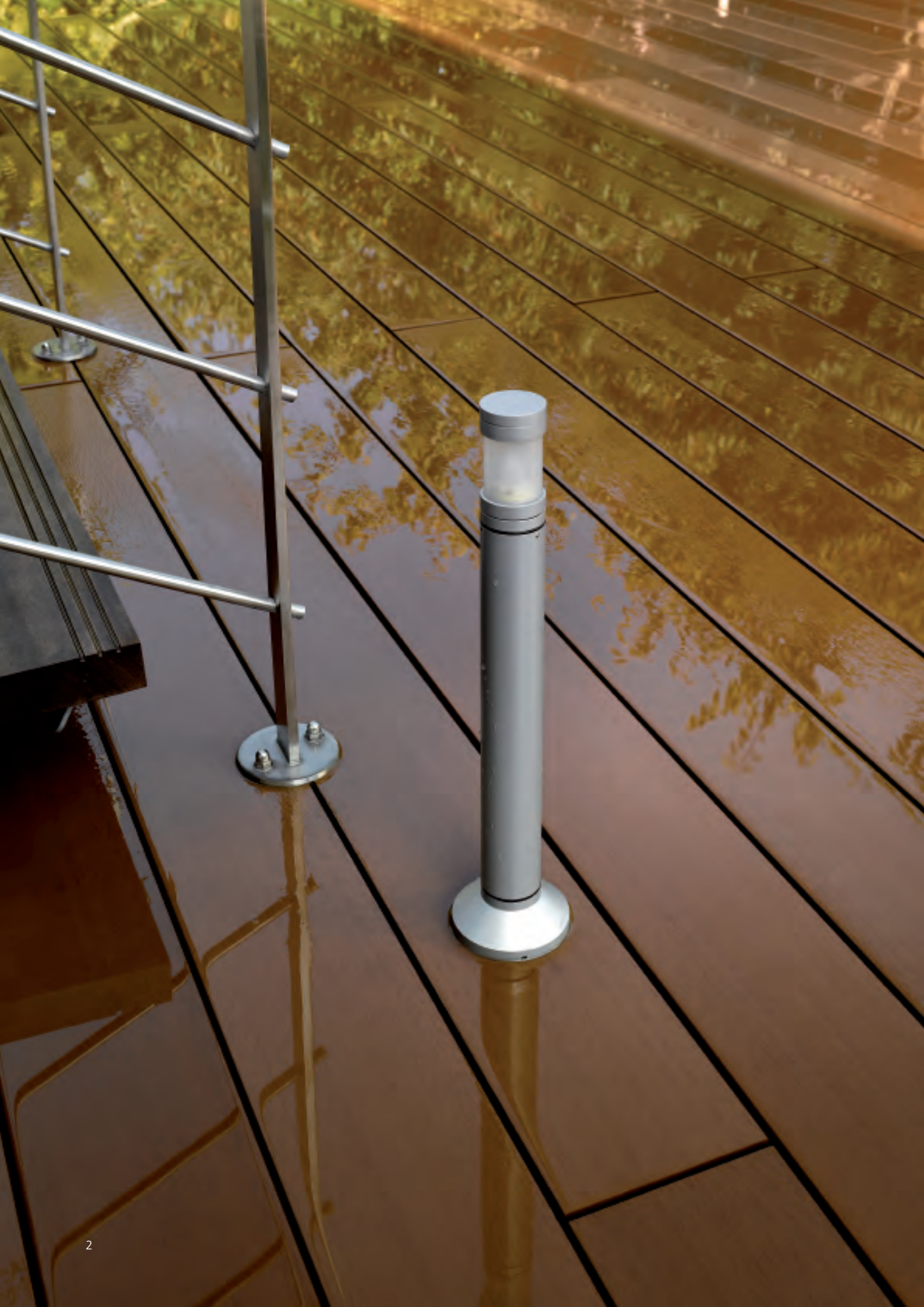
Eco Mark label

Guaranteed free of glue, chloride, and formaldehyde

Geobois naturalelements

What is Einwood®?

Einwood® products are distributed under the following brand names in Europe: **Geolam® and Exalam®**.



What is Einwood®?

We have been developing wood-fibre plastic composites since the mid-1980's when the first generation wood composite product was developed. This original first generation product was similar to some of the "Conventional Wood Plastic Composites" currently on the market in North America today. We worked to enhance this first generation product and made it available to the public through a preliminary licensing venture in 1992. Our licensees now manufacture these products for many different indoor and outdoor applications in homes and professional interiors all over the world. They are used for flooring, mouldings, cabinetry, and many other interior applications.

As a first generation product, it still had some limitations. The strength, dimensional stability, natural appearance, water absorption and durability were still considered to limit the product's overall potential. This led to the latest version of Einwood® being developed. Einwood® provides the solution to all the problems associated with conventional Wood Plastic Composites, as well as those associcated with natural wood. Among the advantages we will cite the following:

- Similar to aluminum in its dimensional stability
- Heat resistant up to 120° C (248°F)
- Retains water resistance and flexural strength properties when subjected to repeated testing at temperatures of -30°C (-22°F)
- Screw-holding power is three times greater than that of natural wood
- Does not deteriorate when exposed to intense ultraviolet rays
- Superior flexural strength
- Absorbs less than 3% moisture after 30 days submersion in water
- Paintable and stainable
- Looks and feels like natural wood
- Can be finished to ressemble fine high quality furniture
- Einwood® can be extruded and injection moulded
- Can be produced using PVC, PE, PP, ABS, PS

Einwood® technology

Conventional Wood Plastic

One of the biggest obstacles in manufacturing Wood Plastic Composites is the removal of moisture from the wood fibres used in the manufacturing process. Wood and petroleum-based thermoplastics will not adhere to one other naturally, and especially if the wood contains any moisture. "Conventional Wood Plastic" products do not address this issue. Typically, in these processes, wood flour is dried to 0.5%-3% moisture content. The wood is then added to an extruder along with the plastic. The two compounds are mixed in the extruder and pushed out through a die. Since the two products are not physically attracted to each other, and above all because of the moisture content, the products only co-exist and never completely bond to each other. Furthermore, wood acid can be created from this moisture, which can cause further problems in an extruder. The resulting product's strength, water absorption ability, and many other physical characteristics may be adversely affected. This is why we take great care to control which wood fibres are used and treated in our manufacturing site, and why we never use conventional wood flour.

We reduce the moisture content of the wood fibres used to 0%

Our approach to manufacturing Wood Plastic Composites is very different to the one generally applied in the North American marketplace. We recognized at an early stage the problems that can occur if any moisture is present in the wood flour, and this is why we developed a process that eliminates 100% of the moisture content found in the wood fibres used to make Einwood®.

We patented a process based on a system similar to a PVC compounding system in which wood fibres are added to a high intensity mixer. The fibres are dried in the high intensity mixer through a friction process incorporating a special mixer blade design. Once the moisture has been driven out of the wood, a thermoplastic is added along with a special reinforcing agent. The plastic is then literally beat into the pores or tracheids of the wood, this being only possible due to the fact that the wood does not contain any moisture. This is the significant part of the process, as the plastic is fully integrated or embedded in the tracheids of the wood to create a single, matrix-like material. This is why Einwood® is physically stronger and more stable in terms of its dimensions than any other wood-fibre composite product. Furthermore, since the wood actually surrounds the plastic, the finished product looks and feels like natural wood.

This natural wood-like look and feel is also made possible because of the high wood content of the compound. Wood fibres are mixed with thermoplastics at an 8:1 volume ratio of wood to plastic (55% wood / 45% polypropylene by weight). Since the majority of the compound is wood, the product naturally takes on the characteristics of a real hardwood.

Einwood® is made from a mix of waste wood discarded from construction sites or industrial plants that has been crushed into fiber, and discarded plastics that have been recycled and crushed into flakes. This mix is then heat-treated so it can be melted and moulded. The main raw material is therefore a new, environmentally friendly, 100% recycled material. The moulding method used is extrusion moulding. Since Einwood® is not subject to corrosion or termite damage, it is better suited than natural wood to outdoor applications, and is widely used for decks, pergolas, fences, and other outdoor landscaping features, as well as general construction materials.

What is Einwood®?

Extruding Einwood®

Once the Einwood® compound has been created, the product can be extruded in a similar way to other profile extrusion processes. The Einwood® process utilizes conical twin screw extruders and requires a special screw and die design. The screw and die design are essential to the process, as they are responsible for the product's superb physical characteristics, as well as its natural wood-like feel.

Creating a hardwood equivalent using Einwood® technology

After Einwood® has been extruded, it can then be sanded and finished like other natural wood products. WPCC has also patented a process to add wood grain to the product, and the result is a product that looks exactly like natural wood. Furthermore, Einwood® graining technology can be used to emulate almost any species of wood.

Label Eco Mark 09137002

Process Flow of manufacturing Einwood®

Waste wood
(construction waste)
- Lumber
- Plywood
- Exterior walls
- Particle board, etc.

Recycled plastic
- Packing material
- Food trays
- Industrial wastes, etc.

Dry the WF to 0%
Dry the wood fiber to 0% moisture content

Raw material
10 mm or less

Compound → **Extrusion**

Additives
- Compatibilizer, pigment, etc.

Einwood® product patents and certifications

Patents (as of March 2008)

COUNTRY	PAT NUMBER
NORWAY	31743
AUSTRIA	407747
UK	2286360
BRAZIL	9500563-3
INDIA	187451
INDIA	187460
BELGIUM	667375
FRANCE	667375
GERMANY	69524893.6
ITALY	0667375
CANADA	2135267
RUSSIA	2154573
JAPAN	3768559
JAPAN PATENT	133139

Trade Mark (Einwood®)

EU	3342318
AUSTRALIA	975387
SINGAPORE	T03/14426
MALAYSIA	200312313
RUSSIA	310158

Design right

JAPAN DESIGN RIGHT	2007-537
JAPAN DESIGN RIGHT	1317707
CANADA DESIGN RIGHT	120293
HONG KONG DESIGN RIGHT	0701177.2
E U DESIGN RIGHT	721865
U S DESIGN RIGHT	29/288,756
KOREA DESIGN RIGHT	30/20070028501
SWISS DESIGN RIGHT	133882
MONACO DESIGN RIGHT	1102A

Eco Mark Certification

Certification N° 07123069 (awarded October 2007)

The Japan Environment Association certifies products that contribute to environmental preservation, and provides a logo that can be displayed on the product. This logo is attached to products that can be seen to help protect the environment, and expresses a "let's defend the Earth and the environment" feeling with the aim of promoting the development of eco-friendly products.

Einwood® products used extensively to design private and public exteriors (decks, pergolas, fences, and gates) have successfully obtained certification as products contributing to environmental preservation under Product Category No.123 "Construction product using recycled material" adopted in April 2002.

New JIS Mark Wood and Plastic Recycled Compound (WPRC) product certification

Certification N° TC0307021 (awarded April 2007)

Some Einwood® licensees are the first in the wood and plastic recycled compound material industry to obtain the new JIS level certification "JIS A 5741 Wood and Plastic Recycled Compound Material" publicly announced by the Japan Testing Center for Construction Materials in April 2006.

Colours

Standard colour range

Einwood® is available in three standard colours:

Teak

Rosewood

Ebony

* Due to the impossibility of reproducing exact colours when going to print, the colour samples shown here may vary from the actual product.

* Wood fibre that is processed from thinned and waste wood, as well as regenerated recycled plastic are used as raw materials for Einwood®. Please be aware, therefore, that shades of colour may vary somewhat between manufacturing batches.

Table of basic physical properties

Item		Olefin (extraction)	Unit	Test method	Comparison with wood, etc.	JIS A 5741 (Wood and plastic recycled compound material) Reference value	Remarks
Specific gravity		1,25	g/cm^3	Conforms to JIS K 7112 (Measurement method for plastic to non-foam plastic density and ratio [Method A (displace in water)] 6.1)	1.5 (Same for all wood types)	0.8 to 1.5	Weight ratio per unit of volume Higher value signifies heavier weight
Water absorption	Absorption rate	1,3	%	Conforms to JIS A 5905 (Fibre panel 6.8) (Submerge in 20°C water for 24 hours)	0	10 or less	Rate of weight change due to absorption Higher value signifies easier water absorbance
	Length change rate	Lengthwise: 0.001 Widthwise: 0.1	%	Conforms to JIS A 5905 (Fibre panel 6.10) (Submerge in 20°C water for 24 hours)	0	3 or less	Rate of dimension change due to absorption Higher value signifies easier dimension change
Strength	Bending characteristics	20	MPa	Conforms to JIS K 7171 (Plastic - Test method for bending characteristics) Span 16x	48 (Western red cedar)0	20 or more	Break and flex strength versus bending Higher value signifies better bending characteristics
	Impact strength	3.6	MPa	Conforms to JIS K 7111 (Plastic - Test method for Charpy impact strength)	0	0.5 or more	Break and flex strength versus bending Higher value signifies better bending characteristics
Heat deformation temperature	Load deflection temperature	78,9	℃	Conforms to JIS K 7191-1(Plastic – Test method for load deflection temperature - Part 1: General Rule)	0	70 or more	Uses Method A.
Weather-ability	Tensile strength change rate	-8	%	Test method: Conforms to JIS K 7350-2 (Plastic – Exposure test method using test chamber light source - Part 2: Xenon arc light source) Evaluation method: Conforms to JIS A 5721 (Plastic deck material)	0	-30 or more	Test time: 500 hours (Conforms to JIS A 5721)
	Elongation change rate	12	%		0	50 or less	
Volatile substance emission	Formalde-hyde	Less than 0.1	mg/L	Conforms to JIS A 1460 (Construction board formal-dehyde emission test method - Desiccator method)	0	Average value at 0.3 or less, and maximum value at 0.4 or less	
Toxic substance elution	Cadmium	Less than 0.001	mg/L	Conforms to JIS K 6743 (Hard polyvinyl pipe couplings for water systems)	0	0.01 or less	
	Lead	Less than 0.005	mg/L		0	0.01 or less	
	Mercury	Less than 0.0005	mg/L		0	0.0005 or less	
	Selenium	Less than 0.002	mg/L		0	0.01 or less	
	Arsenic	Less than 0.01	mg/L	Conforms to JIS K 0400-61-10 (Water quality - Total arsenic quantity - silver diethyldithiocarba-mate spectropotometric method)	0	0.01 or less	
	Hexavalent chromium	Less than 0.05	mg/L	Conforms to JIS K 0400-61-20 (Water quality - Arsenic quantity - Atomic absorption method [Hydride generation method])			

Table of basic physical properties

Item		Olefin (extraction)	Unit	Test method	Comparison with wood, etc.	JIS A 5741 (Wood and plastic recycled compound material) Reference value	Remarks
Product bending Young's modulus		3000	MPa	Conforms to JIS K 7171 (Plastic - Test method for bend characteristics) Span 16x	6409 (Western red cedar)	0	Rigidity to bending Higher value signifies harder to bend
Coefficient of linear expansion (Lengthwise)		5.0×10 -5	0	Caliper method	Iron 1.2 Aluminum 2.4 Natural wood 0.3 (Fibre direction)	0	Larger rate of expansion due to change in temperature means greater expansion with change in temperature
Coefficient of linear expansion (Widthwise)		7.0×10 -5	0	Caliper method		0	Larger rate of expansion due to change in temperature means greater expansion with change in temperature
Rate of dimension change due to moisture absorption	Lengthwise	0.26	%	Caliper method	0	0	Larger maximum rate of dimension change due to moisture absorption when used outdoors means easier changes in dimension
	Widthwise	0.73	%	Caliper method	0	0	Larger maximum rate of dimension change due to moisture absorption when used outdoors means easier changes in dimension
C.S.R. (Slip resistance)		0.78	0	In dry conditions	0.79 (Western red cedar)	0	Shoes 0.4 to 0.9, Stockings/slippers 0.35 to 0.9, Barefoot 0.45 to 0.9 *1
Mould resistance		0.7	%	Wood material rot resistance test Japan Wood Preserving Association, Standard No.3 Average weight loss ratio for 2 types of mould	Wood 32%	0	Mould: Fomitopsis palustris, Trametes versicolor
Termite resistance		0.6	%	Termite resistance effectiveness test Japan Wood Preserving Association, Standard No.11 Weight loss ratio	Wood 28%	0	Coptotermes termite

** 1 From guide standards in the Tokyo Metropolitan Town Creation Ordinance and Facility Development Manual*

Tested profiles were manufactured using the Einwood® Composite technology.

Table values represent actual measurements, and should not be construed as guaranteed or design values.
Comparison values are values from the Wood Materials Handbook.
Values may change at any time because of changes in composition specifications due to technological modifications.

Rot resistance

In Standard Test No.3, the Japan Wood Preserving Association determined that Einwood® achieves a weight loss of less than 2% from the common moulds (*Fomitopsis palustris* and *Trametes versicolor*) the most commonly known wood rotting agents, and so effectively to be rot-resistant. So although Einwood® consists of more than 50% wood material by weight, it does not suffer from the rot often seen in other wood-based materials, and is unaffected by the main problem with using wood as a building material for outdoor structures.

Test Results

Fomitopsis palustris

Sample	Weight loss (%)		
	Min. – Max.	Ave.	Standard deviation
Einwood®	0.9 ~ 1.8	1.5	0.3
Beech sapwood	21.8 ~ 32.3	26.7	3.4

Trametes versicolor

Sample	Weight loss (%)		
	Min. – Max.	Ave.	Standard deviation
Einwood®	0.0 ~ 0.0	0.0	0.0
Beech sapwood	32.4 ~ 46.0	37.0	5.0

Note: Tests both repeated nine times.
Tested profiles were manufactured using the Einwood® Composite technology by Misawa home.

Einwood® performance

Termite resistance

In Standard Test No. 11, the Japan Wood Preserving Association determined that Einwood® achieves a weight loss of less than 5%. In a damage test using the most pestiferous termite, the *Coptotermes* termite, Einwood® successfully avoided all damage. This result was due to the molecular compatibility of Einwood®, a mix of wood fibres and plastic flakes.

Test Results

Coptotermes termite

Sample	Weight loss (%)	Termite mortality rate (%)		
	Min. – Max.	Ave.	Min. – Max.	Ave.
Einwood®	0.4 ~ 0.9	0.6	16 ~ 14	20
Japanese red cedar sapwood	24.8 ~ 30.2	28.2	9 ~ 17	14

Note: Tests both repeated nine times.
Tested profiles were manufactured using the Einwood® Composite technology by Misawa home.

Safety

When a Ministry of Health, Labour and Welfare testing procedure normally applied to food containers was applied to Einwood, no traces of copper, chromium, or other toxic heavy metal elutions were detected. In addition, the results of an indoor air pollutant emission velocity measurement of Einwood® conducted at the Japan Testing Center for Construction Materials confirmed emissions lower than the standard for Type 3 formaldehyde emissions in building materials (F) (minimum limit of determination 0.005 mg/m2h or less) regulated in the amended Building Standards Law Enforcement Ordinance. Moreover, no traces of toluene, xylene, styrene, ethylbenzene, or other toxic chemical substances were detected.

Slip resistance

Slip resistance on Einwood® decks exhibits the same level of performance as conventional natural wood decks.

Exterior (deck) slip resistance test results

Material	Test surface conditions	C.S.R.measurement	
		Max.	Min.
Einwood® (Olefin-extruded deck)	Dry	0.78	0.65
	Wet	0.75	0.64
	Water + Sand	0.53	0.51
Western red cedar	Dry	0.79	
	Wet	0.73	
	Water + Sand	0.53	
Interlocking	-	0.50	

**C.S.R. is an evaluation method based on human slip sensations.*
**In the Facility Development Manual under the Town-Planning Regulations to Promote Welfare in Tokyo, the following C.S.R. values are laid down as guidance standards.*
Walking in shoes 0.4 to 0.9
Walking in stockings/slippers 0.35 to 0.9
Walking barefoot 0.45 to 0.9
Walking on sloped area 0.5 to 0.9
Tested profiles were manufactured using the Einwood® Composite technology by Misawa home.

Flammability

Einwood® is not considered to be a non-flammable material under the Building Standards Law. Therefore, because Einwood® does not exhibit non-combustible or non-flammable performance due to the properties of its waste wood and recycled plastic chip (olefin) raw materials, it may be advisable to use a flame-resistant backing or a steel or aluminum core material when necessary. Since it will burn in the same manner as natural wood under the same conditions, practice due caution for the handling of flames nearby.

Cigarette Burn Test Results

While a cigarette burn does not cause a fire, it does leave a charred mark on the product surface.

Einwood® (Using Polypropylene)

Natural wood

Weatherability

Einwood® exhibits less color fading than natural wood after years of service.

The color change may vary depending on the surrounding environment and the location of the installation; however, most colours fade slightly within 3-6 months of installation, and then no change will be seen after that. Fading is only at the surface, and will not affect the physical characteristics of the product.

Change over time as recorded by a sunshine weathering meter

Teak

reference | 500 hours | 1000 hours | 1500 hours | 2000 hours | 3000 hours

Rosewood

** The sunshine weather meter is an accelerated weather tester that exposes the test sample to strong ultraviolet rays and water, and creates a high humidity environment, to facilitate observation of changes over time. A period of 500 hours in the sunshine weather meter is considered to be approximately equivalent to one year of aging (varies depending on the region and sunshine conditions).*

** Due to print issues, the color may vary slightly from the actual sample.*

** Tested profiles were manufactured using the Einwood® Composite technology.*

** The appearance of the wood surface may be altered slightly if you use the sanding method.*

Einwood® performance

Maintenance

Oil or coffee spills

Wood fibre is exposed on the surface to give a woody feel to Einwood®. This means that oil may stick to the surface. If oil stains are difficult to eliminate, use acetone, xylene or methanol and wipe in the lengthwise direction to remove. If the stains prove impossible to remove, after trying to wipe the surface clean, wrap a piece of sand paper (40-60) around a wood block and sand in a lengthwise direction.

General Stains

Dilute a small amount of kitchen detergent with water and use a cloth to wipe in a lengthwise direction. Afterwards, wipe off the detergent and the stain (that has hopefully separated from the surface) with a wet cloth.

Red Wine

Following a wine spillage, wipe it off before it dries with a wet cloth soaked in ordinary household detergent. If the stain cannot be removed, continue to wipe the surface for a while, and then wrap sand paper (40-60) around a supporting wood block and sand in a lengthwise direction.

** The appearance of the wood surface may be altered slightly if you use the sanding method.*

Design criteria for installations

Basic design

Einwood® is a "Wood plastic composite" made from wood fibres and plastic resin. It provides a new class of material offering the richness of the texture of wood and many advantageous features of resin such as non-decomposability. To preserve these benefits, Einwood® must be machined and stored differently from regular lumber. General instructions and specification values regarding the handling of Einwood® are given below.

Standard design values

For a strength calculation to obtain the basic physical properties, use the values in the table below.
For the cross-section area, section modulus, and geometrical moment of inertia used in the strength calculation for parts and materials, use the set values for each part and material (see the appended sheet).

Item	Value
Young's Bending modulus (E)	3,000MPa
Bending stress σ	
Allowed short-term stress	10MPa (1/2 of bending strength)
Allowed long-term stress	5MPa (1/4 of bending strength)

** If compression strength, shear strength, or other items not listed in the physical properties above are necessary, perform real-size confirmation tests for these items as well.*

Support span design considerations

To determine support spans for the structure fixing the Einwood® material in place, use the following formula to confirm the deflection δ.
To set the values used for deflection δ according to utilization, take into consideration the material's own weight, the load placed on the material, creep, etc.

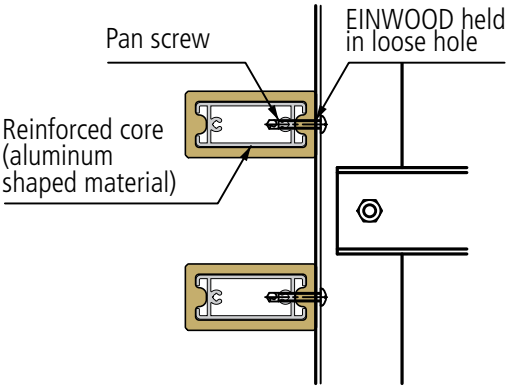
	Load conditions	Formula
Double-sided support	Concentrated load	$\delta = PL3 / 48EI$
	Equal load	$\delta = 5\omega L4 / 384EI$
Cantilever support	Concentrated load	$\delta = PL3 / 3EI$
	Equal load	$\delta = \omega L4 / 8EI$

Joint Design

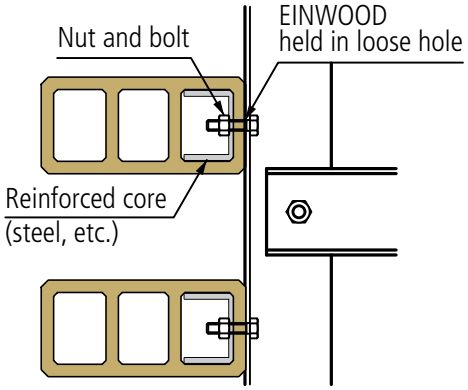
When designing the joint, avoid fittings that use Einwood® materials to strengthen the joint (that rely on Einwood® material for long-term strength). For structural joints, always use fittings that join two reinforced core materials (steel, etc.), or clamp Einwood® in between.

If using fittings held in place by Einwood® materials (that rely on Einwood® materials for strength), perform a real-size strength test to confirm the performance.

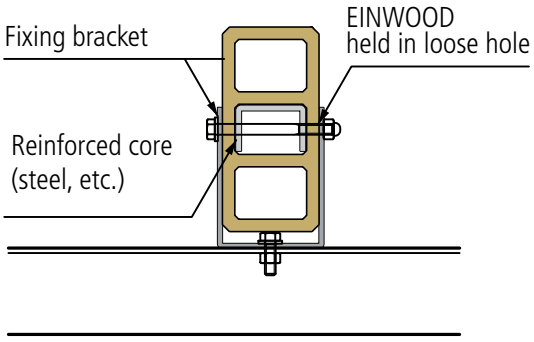
Joint example (fixed with screws)
• Reinforced core (aluminum etc.) fixed with screws.



Joint example (fixed with bolts)
• Reinforced core (settle C channel, etc.) fixed with nut and bolt.



Joint example
EINWOOD clamped between backing materials (steel, etc.) and metal washers, etc., and fixed with nut and bolt.



Design criteria for installations

Designing to accommodate expansion of materials

Since wood fibres and plastic resin are the main components of Einwood®, it has a very slight moisture absorption capacity. This means its water content can change depending on the water or humidity present, leading to material expansion. In addition, some linear expansion or contraction can occur because of local temperature differentials, as these affect the resin used as one of the raw materials. It is important to understand the characteristics of the component materials of Einwood®, and to ensure appropriate levels of clearance are left to allow for changes that will almost certainly take place following installation. Failure to allow clearance could lead to deformation or cracks due to dimensional changes.

How to calculate the amount of expansion due to temperature Changes

Einwood® can expand with changes in temperature. Use the expansion values as calculated below to create a design with suitable clearances.

Expansion [mm] = [Einwood® coefficient of thermal expansion] x
(Temperature difference) [°C] x (Material length) [mm]

	Item	Value
Coefficient of linear expansion	Lengthwise	5.0×10^{-5}
	Widthwise	7.0×10^{-5}

Installed in a standard environment, Einwood® will absorb moisture up to the level of the usual moisture content of wood that has been air-dried, regardless of the location or utilization. While the amount of expansion will vary slightly depending on the cross-section shape (surface area) and on the surrounding environment, use the expansion values as calculated below to create a design with suitable clearances.

Expansion value [mm] = [Rate of Einwood® dimension change] x (Material length) [mm]

How to calculate probable expansion due to humidity.

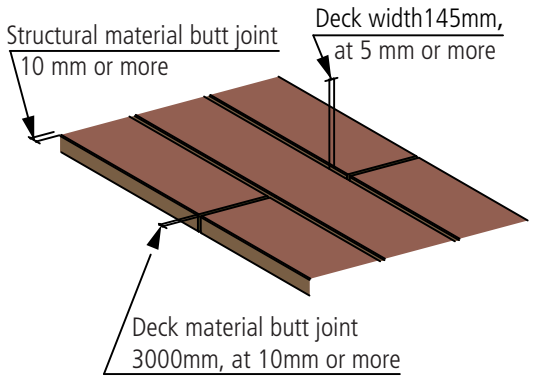
	Item	Value
Rate of dimension change (Maximum expansion in material dimensions)	Lengthwise	0.26%
	Widthwise	0.73%

Einwood® can be expected to undergo dimension changes at the expansion values shown above. As a result, your design will need to incorporate sufficient clearances to allow for the total expansion in each utilization and part caused by temperature and humidity changes as calculated from the above.

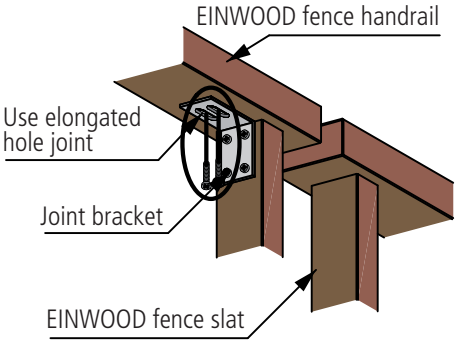
However, if screwed to a backing or structural material using screws with a suitable pitch, the expansion between the fixing points can be suppressed to a certain degree. (A suitable pitch will be one that is appropriate for the Einwood® cross-section and utilization concerned.)

Expansion and distortion can also be countered using the methods shown in the figure below.

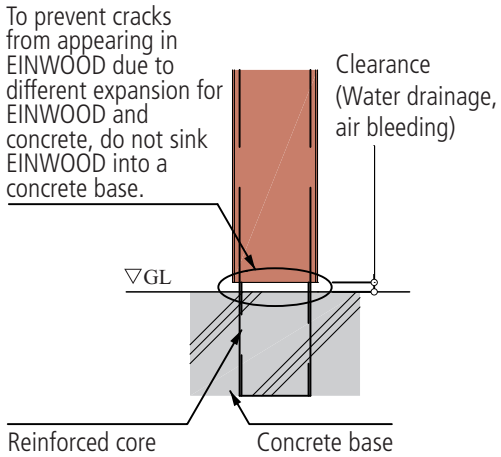
Deck fitting example



Fence fitting example



Column fitting example



Because Einwood® has a hollow cross-section, installing it where conditions differ between front and back surfaces (for example where the front surface is heated by scorching sunshine while the back surface has no ventilation and is always damp) could lead to warping or twisting. In such cases, use a design that allows suitable clearance for expansion, and boards that are reinforced in their hollow section, in order to prevent warping and distortion.

Design criteria for installations

Designing to allow for water drainage

While Einwood® is resistant to rotting in damp conditions, if it is soaked in water or if water is allowed to collect inside the hollow cell, and the structure suffers exposure to water over a long period of time, the moisture content of the wood fibre (which at the outset is zero) will increase, and this could in turn lead to further water absorption. The result could be that the material expands at well-over the normal rate of dimension change, with warping, cracking, or splitting.

We recommend therefore avoiding design applications that involve submersion in water or burial in soil, or utilisations in conditions that are constantly damp. In addition, use designs that allow for water drainage to compensate for the effects of rainfall or the evacuation of household water.

Air ventilation and water drip holes

Where a structure is sealed with an end cap, air trapped in the hollow section may expand and cause the structure to deform. To prevent this, make air ventilation holes (8-10mm) at 900mm intervals in each hollow section.

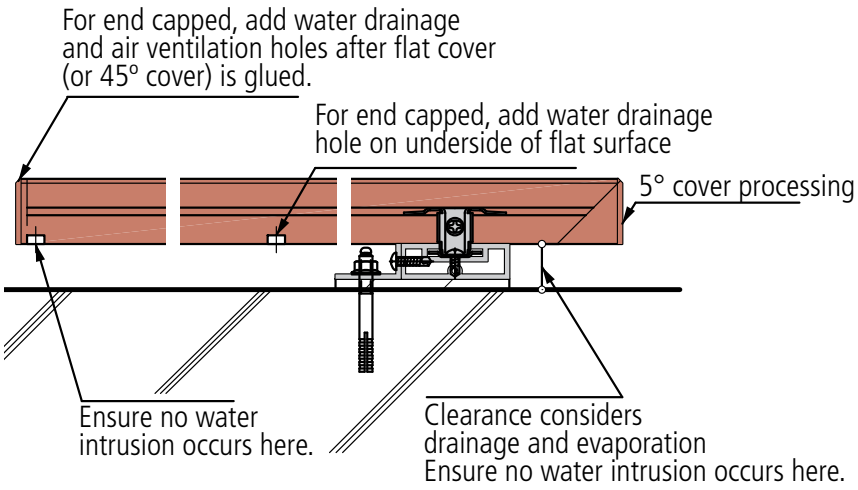
Depending on the prevailing conditions, water from dew or other sources may become trapped in the hollow section. To prevent this, make water drip holes (8-10mm) at 900mm intervals in each hollow section.

Ventilation

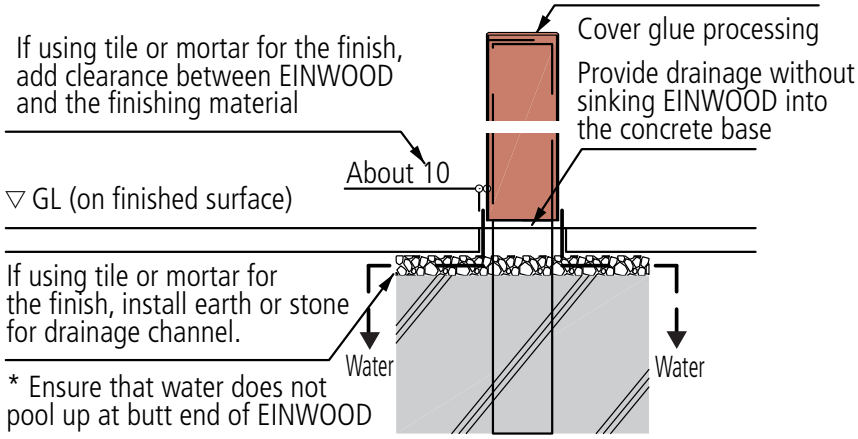
We suggest 100mm minimum clearance from the bottom of the deck joist to the ground when installing a low ground-level deck, and ensure two sides are left open to ensure adequate ventilation. This minimizes the possibility of uncontrolled expansion and contraction, warping, and mould or mildew growth from dirt with high humidity under the deck.

Important note: Einwood® must always be installed with the correct end gap allowances, and directly on joists. Do not attach Einwood® to any solid surface or watertight system such as sheathing, waterproof membranes, concrete, roof system, or patios.

Example of horizontal use (end capped)
• Install a water drainage and air ventilation hole.
Example of vertical use (cantilever cover)



Example of vertical use (cantilever cover)
• Do not block one side (non-cover side),
to ensure water drainage and air bleeding.



Precautions when fitting a butt end cover

The end cap will be somewhat larger than the structure it is to cover. After installation, sand the sides and chamfer to fit.

Use our recommended types of screws and glue when installing cap material.

Recommended glue: made by 3M (EPX Glue (Name of Product: DP8010 Clear)

When capping the ends, take care to avoid completely sealing up the hollow section or preventing water from draining out.

- For a capped end, fit so that the butt end surface is not blocked on the opposite side.

- When both ends are capped, take care to prevent water from infiltrating, and always create a hole (φ10 or more) for water drainage and air bleeding. Where appropriate, make a cover to fit over a 45° cut.

Precautions to take when fitting

Tools

When using Einwood®, standard tools used on wood for hole punching, chamfering and cutting can all be used.

Cutting

Cutting a board cross-section in a longitudinal (lengthwise) direction may cause deformation of the board, and so should be avoided at all costs.

Chips of Einwood® contain recycled plastic, and therefore do not decompose fully. Dispose of end-cuts as though they were non-burnable.

Hammering

When hammering Einwood®, protect the impact point with a piece of wood or use a rubber hammer, etc.

Screwing

Be sure to position fixing screws at least 20-25mm from the edges of the board or other material (in both the length and width directions).

Design criteria for installations

Deck design

When designing a deck using Einwood®, be sure your design complies with the following conditions.

Deck dimensions:

Maximum dimension of one unit of Einwood® deck material is L = 4,200mm. If your installation requires lengths of more than the maximum dimension, join two or more units together. (Recommended dimension L = 3,000mm or less.)

Gapping:

Width-to-width gap: The minimum required width-to-width gapping is 5mm to ensure good drainage and ventilation.

Abutting gap:

Minimum gap required of 10 mm (3,000mm length board) for decking abutting a building or structure wall.

End-to-end gap:

The End-to-end gap will vary according to the temperature difference before and after construction, or the humidity of the location. To ensure that your deck will look great year after year, as a general rule, allow an end-to-end gap of more than 10mm when using 3m lengths of board.

Joist span:

If using Einwood® 30mm profiles as the decking material, set the joist pitch to 600mm or less.

*Please do not hesitate to consult us at the design stage of your project, as the ideal pitch dimensions may vary depending on the intended utilisation.

For load-bearing applications such as hot tubs, planters, etc. consult a local building engineer or inspector for span recommendations.

Deck	Distribution load	Joist span
T 22 × W145 mm (Geolam Duo)	450kgf/m2	Maximum 450mm
T 30 × W145 mm (Geolam Qualita)	450kgf/m2	Maximum 600mm

T = Thickness

The joist spans are based on a deflection limit of L/300.

Fastening

• Always screw board from the top (rather that from the underside)

• It is best to pre-drill and countersink all holes before screwing the boards into place.

• Use stainless, galvanized and ceramic-coated screws.

• Be sure to position fixing screws at least 20-25mm from the edges of the board or other material (in both the length and width directions). If butt joints are necessary, butt boards together at their ends. When using an electric screwdriver, use a weak torque setting for screwing. Do not over-tighten to prevent the board from splitting.

• Excessive tightening may cause the screw to lose friction and slip. In this case, use a larger screw of the next size up.

• The screw must be fixed vertically to the surface of part.

• Two screws should be used on every joist. With the first board in place align the next board alongside it.

Invisible fasteners

Using invisible fasteners for deck installations is recommended for a more professional finish. Refer to the instructions that follow to set up your installation process to include hidden fasteners.

1) Once the first board is in place, start fastening with the hidden fastener and Always screw board from the top (rather that from the underside).

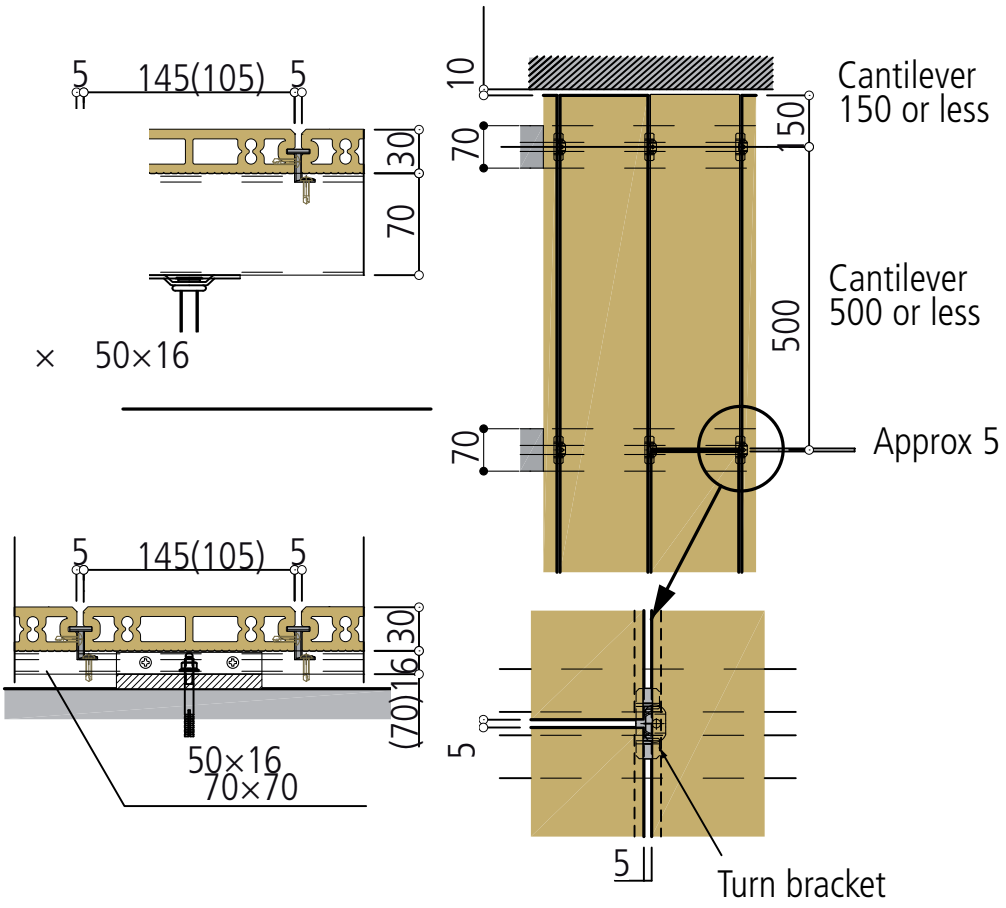
2) Do not over tighten the hidden fastener: when installed properly, the hidden fastener should sit flush with the joist.

3) With a rubber hammer, tap the next board so it fits tightly under the installed hidden fastener. Make sure the board remains tightly wedged against the hidden fastener before installing the next series of hidden fasteners.

Design criteria for installations

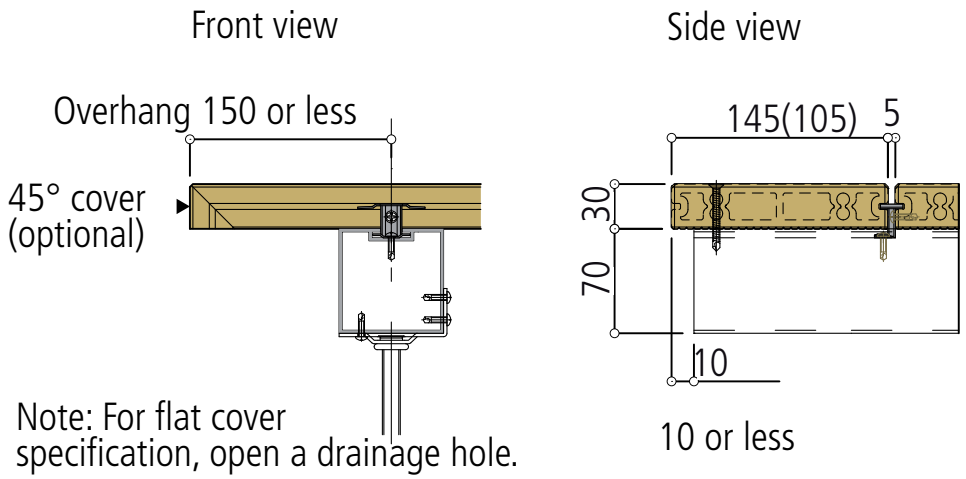
Decking board and joist installation (Units: mm)

Cross-section diagram Plan view

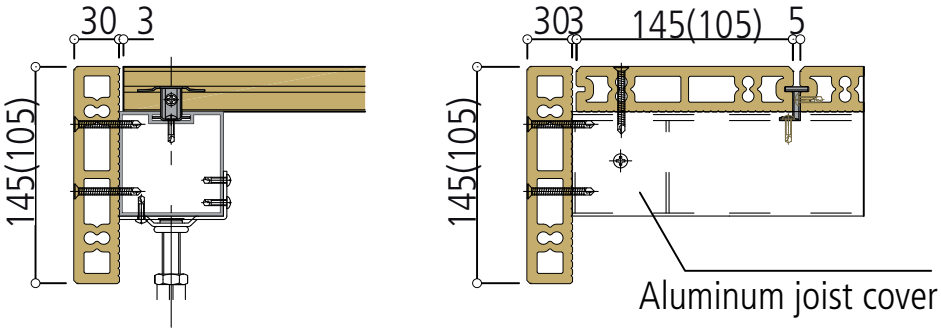


Fitting decking board edges

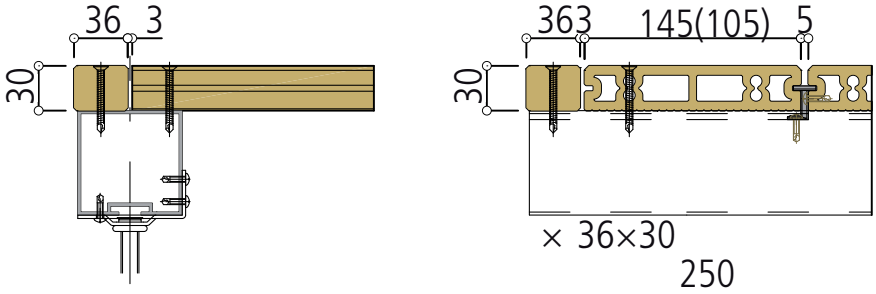
Butt end cover specification



End rail fitting (1)



End rail fitting (2)

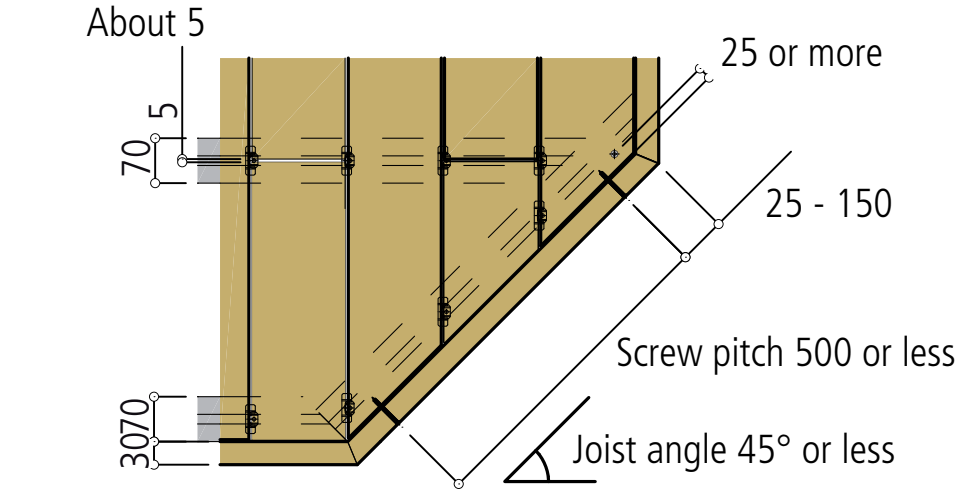


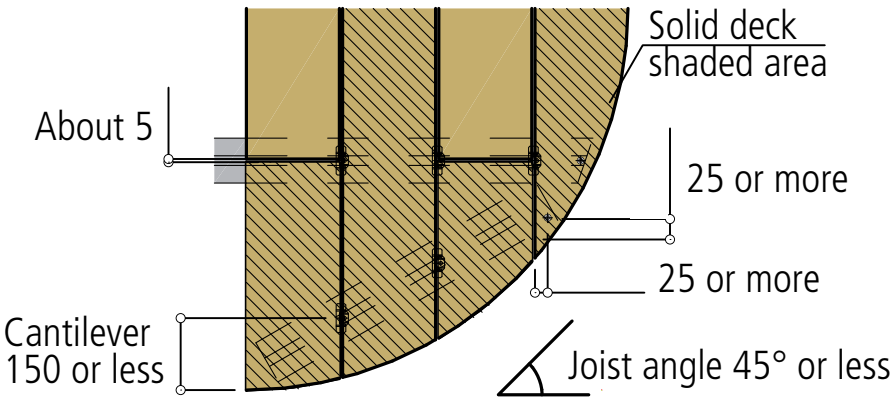
* If using a 36 x 30 end railing, joist pitch is 250 mm or less

Design criteria for installations

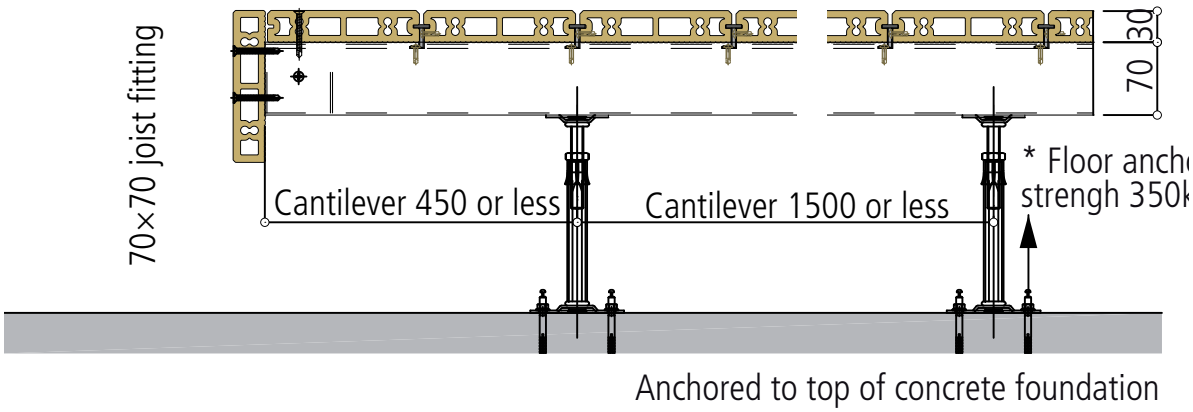
Cantilever installation (Units: mm)

Corner installations (unit: mm)

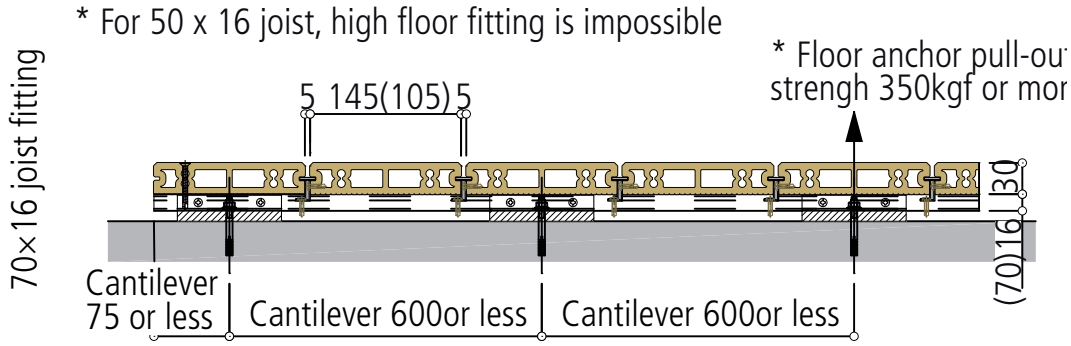




Joist/post installation (Units: mm)



Anchored to top of concrete foundation



Design criteria for installations

Louver design

When designing a louvered installation using Einwood®, make sure you comply with the following design criteria.

Design criteria

Confirm performance requirements and calculate the required strengths, and then select the cross-section to be used, the reinforced core specifications, and the fixing design.

- Wind load resistance design: When installing in high places, or in locations adjoining an empty void in a building, calculate the wind load for the region or height to determine the louver material strength requirement, the louver material pitch, the louver material joint strength, and the number of fixing locations.

Strength design:

When a fall prevention function is required, calculate the expected load in order to determine the louver material strength requirements, the louver material pitch, the louver material fixing strength, and the number of fixing locations.

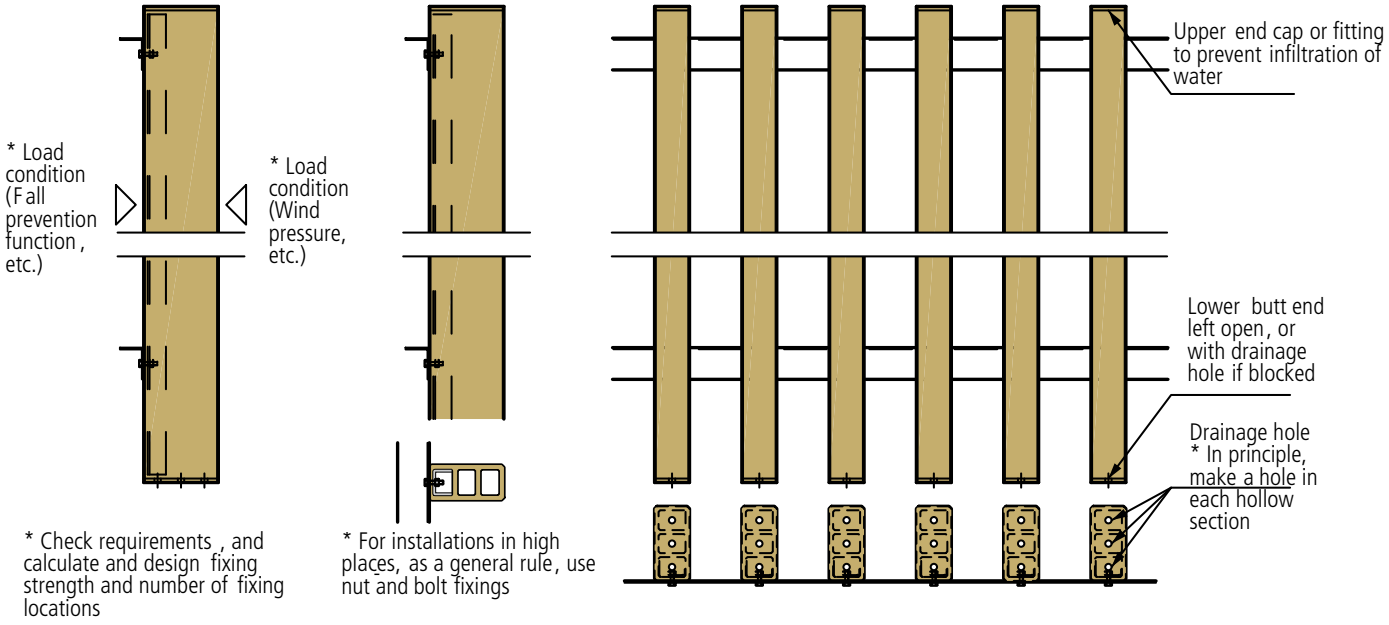
*In principle, the louver material strength is the strength of the reinforced core (Einwood® itself being the decorative covering material), and the installation should be designed so that the structure is joined to the reinforced core.

Fitting conditions

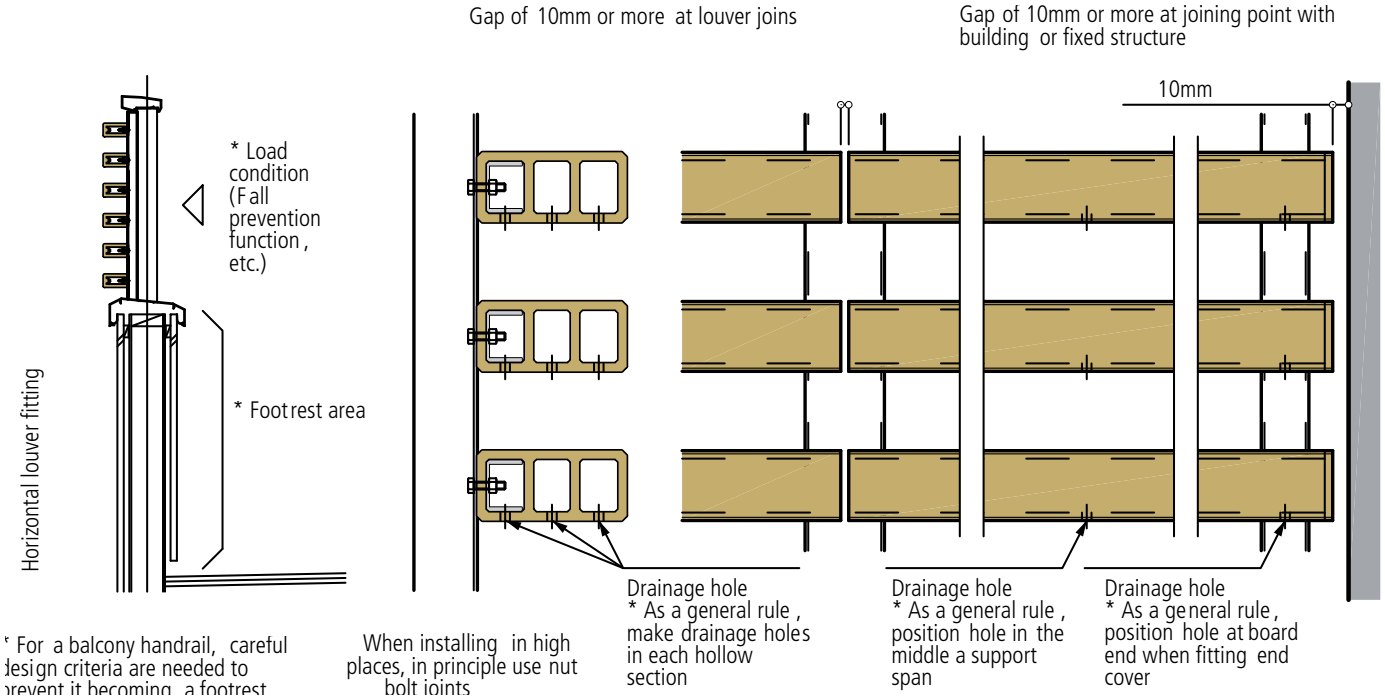
For all the different types of fittings, make sure your design complies with the following conditions.

Fitting examples

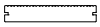
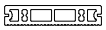
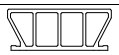
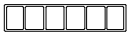
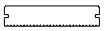
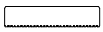
Vertical louver fitting



Horizontal louver fitting



Technical specifications for various Einwood® profile sections

Commercial Designation	Cross-section diagram	Size (mm)	Cross-section (mm^2)	weight per meter (kg/m)	Cross-section secondary moment Ix(mm^4)	Iy(mm^4)	Cross-section coefficient Zx(mm^3)	Zy(mm^3)
Optima		156x20	1676	2.13	87 040	3 774 000	8 572	48 380
Optima 2		138x20	1 660	2.11	76 870	2 810 000	7 687	40 720
Duo		145x22	1887	2.40	111 600	3 666 000	10 000	50 560
Robusta 1		145x25F	3542	3.05	184 300	6 035 000	14 640	83 240
Robusta S		145x25	3542	4.50	184 300	6 035 000	14 640	83 240
Qualita		145x30S	2479	3.15	269 900	5 066 000	17 820	69 870
Qualita 2		145x36B	2731	3.47	441 100	5 768 000	24 500	79 570
Ponto		105x30S	1878	2.39	197 500	2 054 000	13 030	39 120
Maxima		146x60	2663	3.38	1 392 000	4 921 000	46 140	67 410
Maxima 2		145x60	3070	3.90	1 519 000	7 103 000	50 640	97 950
Forte 1		94x44	1626	2.07	423 400	1 418 000	19 250	30 160
Forte 2		105x52.5	1 802	2.29	660 900	2 275 000	25 180	43 320
Forte 3		145x72.5	3268	4.15	2 396 000	6 726 000	66 110	92 770
Forte 4		452x101	11640	14.78	18 390 000	225 100 000	364 100	995 700
Integra 1		145x30	4 263	5.41	318 100	7 305 000	21 060	100 800
Integra 2		145x30M	4312	5.48	318 100	7 544 000	21 070	104 000
Integra 3		105x30M	3123	3.97	230 500	2 866 000	15 260	54 580
Integra 4		105x30	3072	3.90	230 000	2 739 000	15 230	52 160
Soleo 1		145x30B	2365	3.00	267 100	4 690 000	17 590	64 690
Soleo 2		105x30B	1921	2.44	198 500	1 968 000	13 120	37 490
Soleo 5		220x36B	2720	3.45	561 300	12 770 000	31 180	116 100
Soleo 6		181x35	2 383	3.03	425 500	7 039 000	24 320	77 770
Borda 1		145x9	1 303	1.65	8 774	2 277 000	1 950	31 400
Borda 2		145x30B	2365	3.00	267 100	4 690 000	17 590	64 690
Borda 3		147x6	882	1.12	2 646	1 589 000	882	21 610
Careo 1		45x45	930	1.18	239 600	-	10 650	-
Careo 5		120x120B	2601	3.30	5 584 000	-	90 370	-
Careo 6		120x120A	4216	5.35	6 667 000	-	111 100	-
Careo 7		90x90B	1916	2.43	2 268 000	-	50 400	-
Careo 8		60x30	733	0.93	89 230	325 800	5 948	10 860
Rondo 1		D40	492	0.62	79 150	-	3 957	-
Rondo 2		D35	417	0.53	49 380	-	2 822	-
Rondo 3		D86	1714	2.18	1 322 000	-	30 740	-
Rondo 4		D56	767	0.97	253 700	-	9 061	-
Rondo 5		D30	291	0.37	26 020	-	1 735	-

Changes in values due to technical modifications or other changes in specifications, etc., may be made without prior notice.

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