

EINWOOD

2010 Technical information guide

Eco Mark label



Guaranteed free of glue,
chloride, and formaldehyde



WPC Corporation



What is EINWOOD®?

What is EINWOOD®?

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We disclaim responsibility for any damage caused by our products, or for the failure of the products themselves, as a result of failure to follow the instructions or through a failure to follow the instructions as defined in this document. Any non-respect of the instructions contained in this document will render the warranty null and void. The information contained herein is designed to provide guidelines for the purchaser. Local building codes and regulations must be followed and adhered to before, during, and after construction of any EINWOOD® installation. The content of this document is based on information available at December 2009. Changes due to technical modifications, etc., may be made without prior notice.



What is EINWOOD®?

Introduction

We have been developing wood plastic composite technology since the mid-1980's when the first generation Wood Plastic Composite product was developed. This original first generation product was similar to some of the "Conventional Wood Plastic Composite" 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 Composite, as well as those associated with natural wood. Among the advantages we cite the following:

- Similar to aluminum in its dimensional stability
- 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
- Stainable
- Looks and feels like natural wood
- Can be finished to resemble fine high quality furniture
- EINWOOD® can be extruded and injection moulded

EINWOOD® technology

Conventional Wood Plastic Composite

One of the biggest obstacles in manufacturing Wood Plastic Composite 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 Composite" 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 Plastic 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.

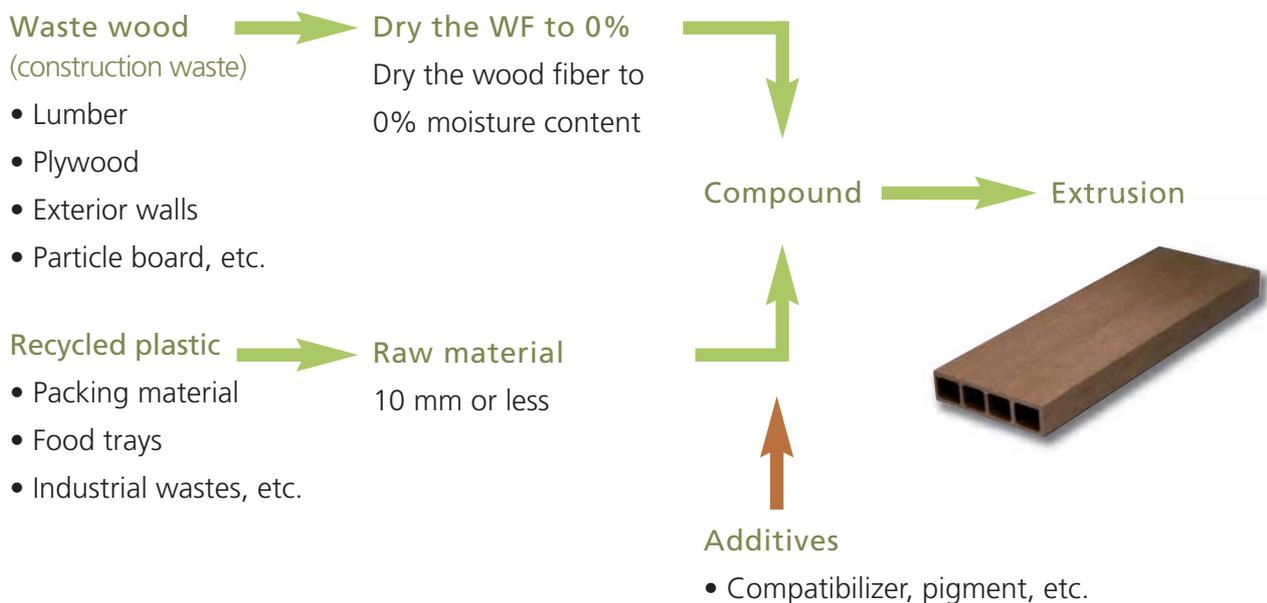
Creating a hardwood equivalent using EINWOOD® technology

After EINWOOD® has been extruded, it can then be sanded and finished like other natural wood products. WPC 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.



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Process Flow of manufacturing EINWOOD®

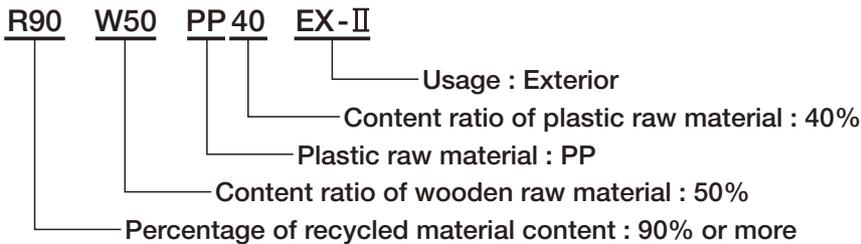


EINWOOD® Environmental Sustainability

Japanese Industrial Standard (JIS)

JIS A5741 Certification (environmental friendliness)

Made from recycled materials and itself recyclable, EINWOOD® is the one and only wood composite to have achieved the extremely challenging JIS A 5741 standard awarded by Japan's national laboratory qualifying recycled composite woods and plastics. This certification guarantees that the product is free of toxic substances potentially harmful to health. JISA5741 is the standard for WPC in regard to recycled material content, quality, safety performance and environmental friendliness.



ECO-MARK Label

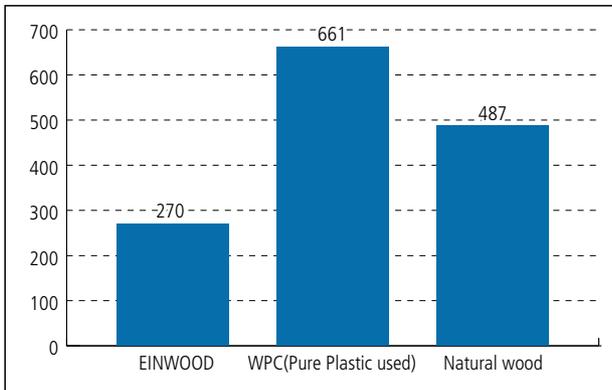
EINWOOD® products have also been awarded Eco-Mark status, a prestige label that is not easy to obtain. Eco-Mark certification guarantees that a product is 'eco-friendly' and is only awarded when it has met rigorous criteria as judged by a committee of academics, government members, consumer associations and industrial experts in their field. Eco-Mark is a label awarded by the Japan Environment Association (HYPERLINK "<http://www.ecomark.jp/english/>" "<http://www.ecomark.jp/english/>"), which guarantees that our products, for both interior and exterior applications, are totally harmless to human health and are composed of at least 80% raw materials of recycled origin (wood and polymers). As a result, the EINWOOD® range of products is completely free of chlorine, CFC or other solvents found in products such as PVC. The Japan Environment Association is a member of the Global Ecolabelling Network (HYPERLINK "<http://www.globalecolabelling.net/>" "<http://www.globalecolabelling.net/>) as well as the European Ecolabel scheme (HYPERLINK "http://ec.europa.eu/environment/ecolabel/index_en.htm" "http://ec.europa.eu/environment/ecolabel/index_en.htm).



What is EINWOOD®?

Carbon Footprint

When we emphasize the earth friendliness of WPC, the traceability of the input materials should be highlighted, as well as the carbon foot print of the manufacturing process of material the product itself. Comparison tests are conducted to calculate the carbon footprint of EINWOOD® which uses recycled plastics,



with other brands of other WPC products that which use pure plastics. The calculation is done by Wood Plastic Recycled Composites Industrial Committee Japan, WG Research Feb 2008 (HYPERLINK "<http://www.wprc.info>" www.wprc.info) of which WPC Corporation is acting as a committee board member. The calculation result is shown :
LCCO2 (KG - CO₂) per decking 10m²

EINWOOD® Colours

Standard colour range

EINWOOD® is available in three standard colours:



Sandy Brown



Brown



Dark Brown

* 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.

EINWOOD® Product patents

Patents and Trade Mark : Please refer to wpc.corp.com



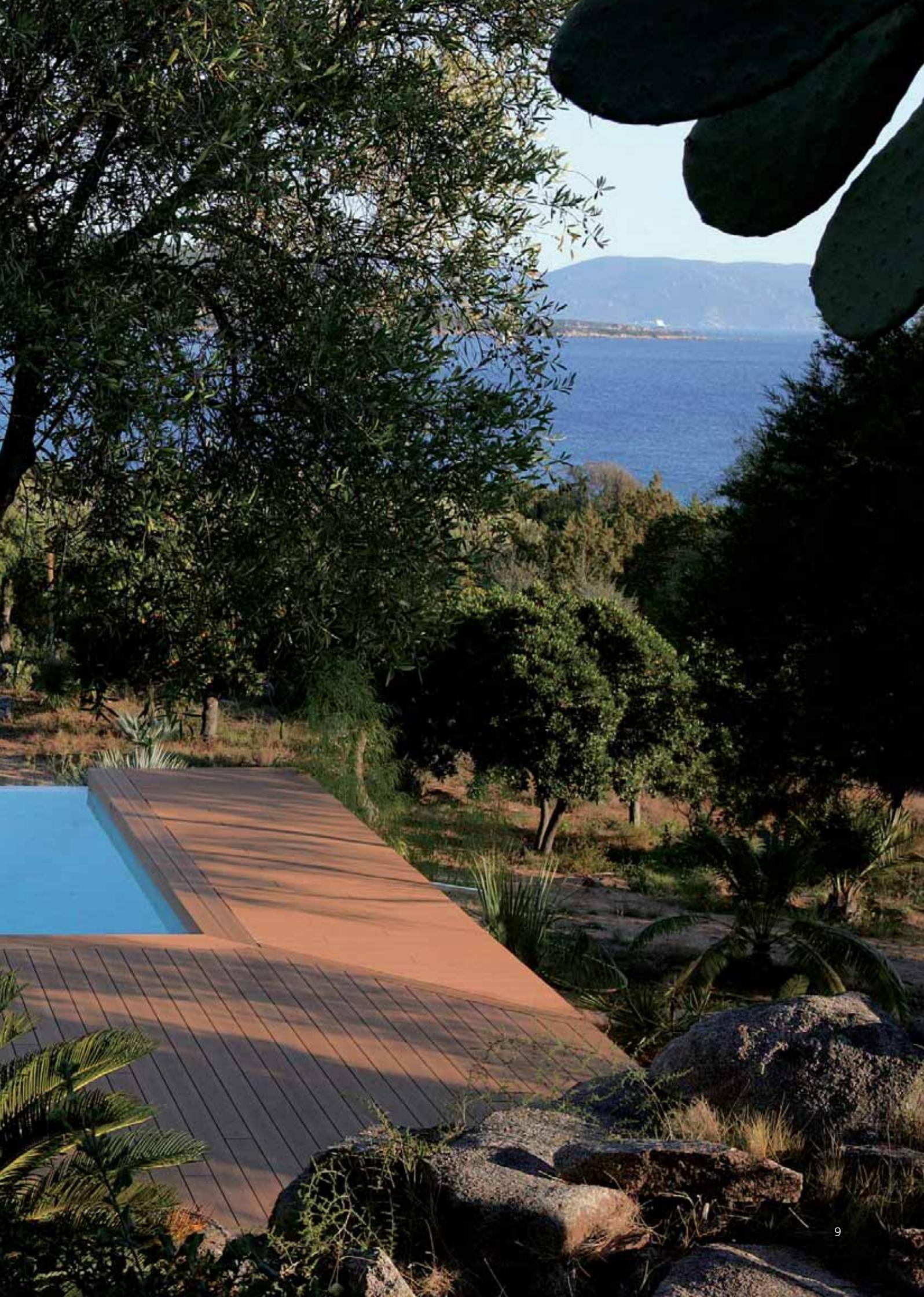


Table of basic physical properties

Item	Olefin (extraction)	Unit	Test method	Comparison with wood, etc.	JIS A 5741 (Wood and plastic recycled compound material) Reference value	Remarks	
Specific gravity	1,27	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	0,2	%	Conforms to JIS A 5905 (Fibre panel 6.8) (Submerge in 20°C water for 24 hours)	N/A	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)	N/A	3 or less	Rate of dimension change due to absorption Higher value signifies easier dimension change
Strength	Bending characteristics	32	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	4.0	MPa	Conforms to JIS K 7111 (Plastic - Test method for Charpy impact strength)	N/A	0.5 or more	Break and flex strength versus bending Higher value signifies better bending characteristics
Heat deformation temperature	Load deflection temperature	116	°C	Conforms to JIS K 7191-1(Plastic – Test method for load deflection temperature - Part 1: General Rule)	N/A	70 or more	Uses Method A.
Weatherability	Tensile strength change rate	-5	%	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)	N/A	-30 or more	Test time: 500 hours (Conforms to JIS A 5721)
	Elongation change rate	7	%		N/A	50 or less	
Volatile substance emission	Formaldehyde	Less than 0.1	mg/L	Conforms to JIS A 1460 (Construction board formaldehyde emission test method - Desiccator method)	N/A	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)	N/A	0.01 or less	
	Lead	Less than 0.005	mg/L		N/A	0.01 or less	
	Mercury	Less than 0.0005	mg/L		N/A	0.0005 or less	
	Selenium	Less than 0.002	mg/L		N/A	0.01 or less	
	Arsenic	Less than 0.01	mg/L		Conforms to JIS K 0400-61-10 (Water quality - Total arsenic quantity - silver diethyldithiocarbamate spectropotometric method)	N/A	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])	N/A		

EINWOOD® performance

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	4060	MPa	Conforms to JIS K 7171 (Plastic - Test method for bend characteristics) Span 16x	6409 (Western red cedar)	–	Rigidity to bending Higher value signifies harder to bend	
Coefficient of linear expansion (Lengthwise)	3.6×10^{-5}	o	Caliper method	Iron 1.2 Aluminum 2.4 Natural wood 0.3 (Fibre direction)	–	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}	o	Caliper method	N/A	–	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	N/A	–	Larger maximum rate of dimension change due to moisture absorption when used outdoors means easier changes in dimension
	Widthwise	0.73	%	Caliper method	N/A	–	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	o	In dry conditions	0.79 (Western red cedar)	–	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%	–	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%	–	Coptotermes termite	

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

Tested profiles (EW16) 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 is 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.

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.

EINWOOD® performance

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.

Volatile Substance emission(Formaldehyde)	Less than 0.1	mg/L	JIS A1460
Toxic substance elution			
Cadmium	Less than 0,01	mg/L	JIS K6743
Lead	Less than 0.01		JIS K6743
Mercury	Less than 0.0005		JIS K6743
Selenium	Less than 0.01		JIS K6743
Arsenic	Less than 0.01		JIS K0400
Hexavalent Chromium	Less than 0.05		JIS K0400

Weatherability

EINWOOD® exhibits less colour fading than natural wood after years of service. The colour 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

Sandy Brown



Brown

* 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 colour 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.

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, caution is needed when in close proximity to open flame.

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





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)	2,000MPa
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	$\delta = PL^3 / 48EI$
	Equal load	$\delta = 5\omega L^4 / 384EI$
Cantilever support	Concentrated load	$\delta = PL^3 / 3EI$
	Equal load	$\delta = \omega L^4 / 8EI$

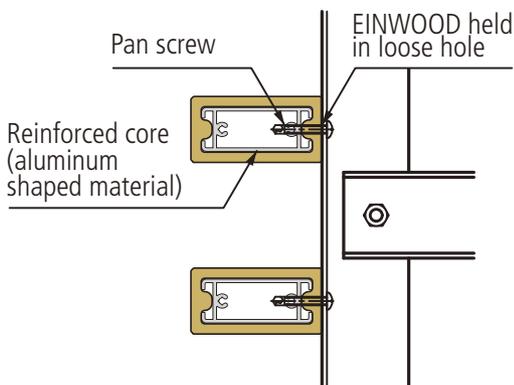
Joint Design

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.

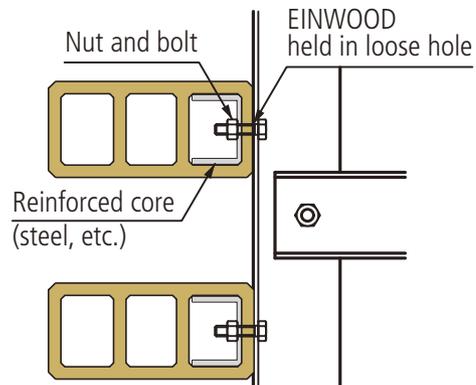
Joint example (fixed with screws)

- Reinforced core (aluminum etc.) fixed with screws.



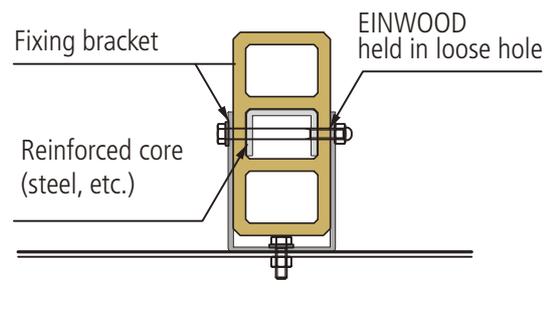
Joint example (fixed with bolts)

- 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 effect 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	3.6×10^{-5} *
	Widthwise	7.0×10^{-5}

* Compared to wood, direct sunlight causes EINWOOD's surface temperature to rise more. If used in the Kyusyu(south part of Japan) area during mid summer with temperature 35C in sunny weather, the surface temperature will rise to more than 60C.

How to calculate the amount of expansion due to humidity

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	0.46% *
	Widthwise	0.73%

* If the board were submerged in water for 365 days at a temperature of 23°, the saturation point would be reached after 290 days, and the expansion associated with this absorption of water would be of the order of 0.46%, and so 4.6 mm per linear metre of board.

For boards 3 metres long, always leave a minimum space of 14mm between two boards placed end-to-end

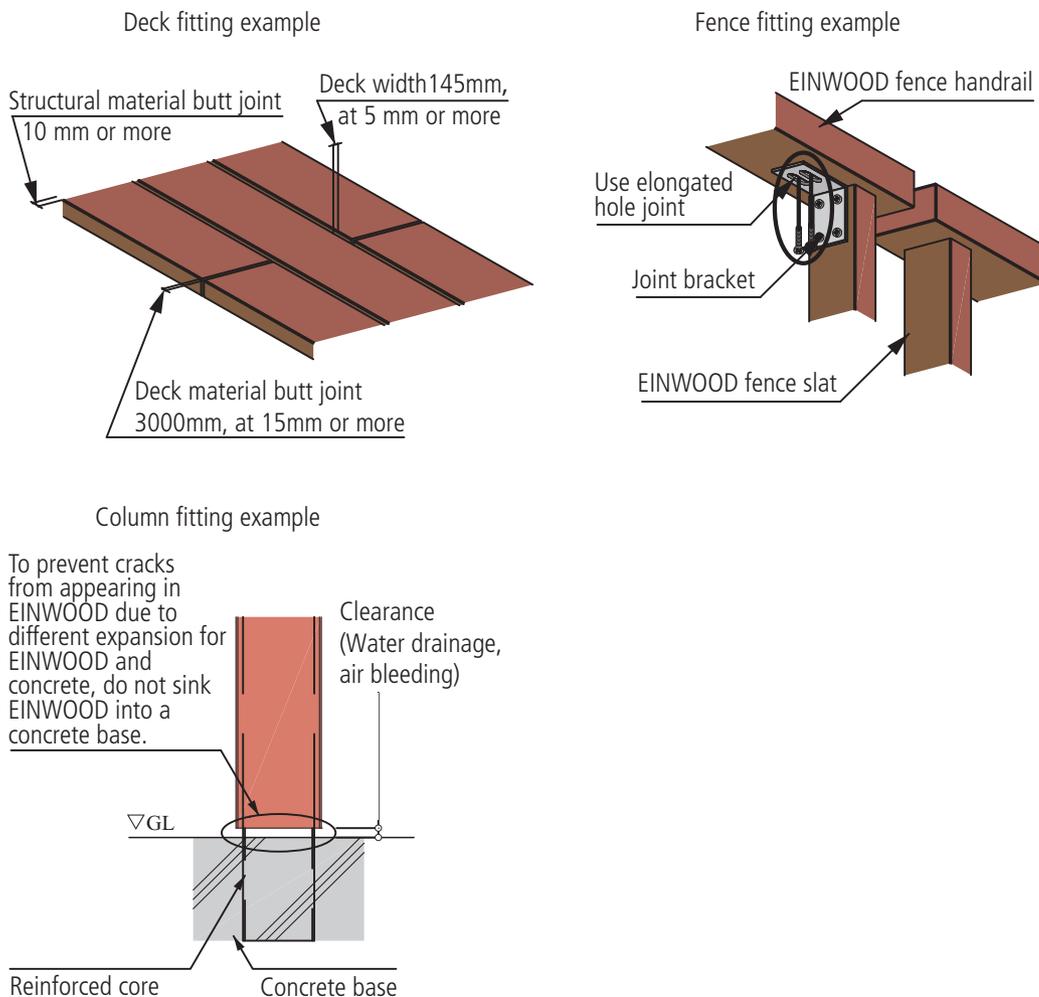
Depending on the total length of your deck or terrace (the cumulative length of boards placed end-to-end) and the difference between the extremes of temperature that might be encountered in their life-time in the immediate environment and the temperature on the day of installation, the end gaps given in the expansion due to temperature changes and humidity must be respected. If in doubt, use an end gap of at least 5mm per linear metre of decking (cumulative length of the boards).

Expansion and distortion

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.



Because EINWOOD® hollow profile 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

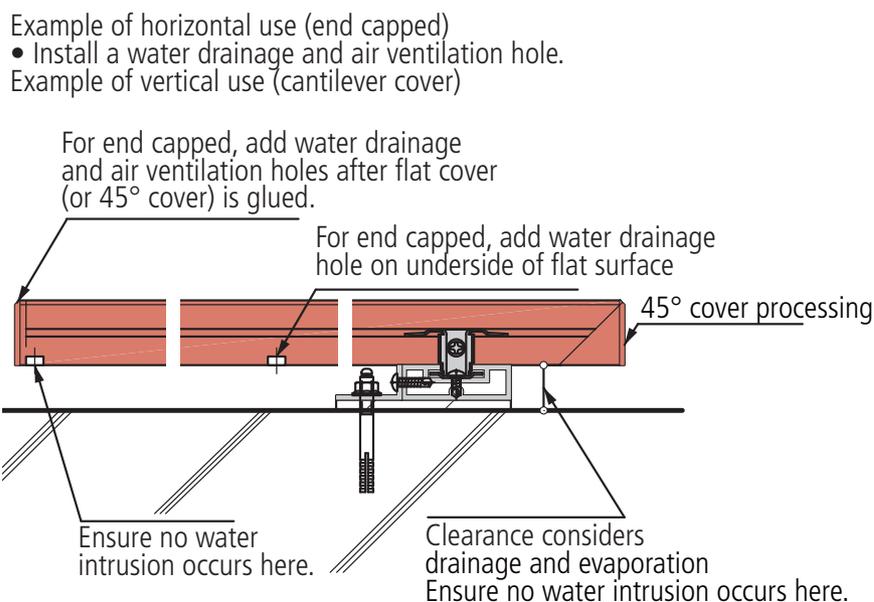
Where a structure is sealed with an end cap, air trapped in the hollow section may expand and cause the structure to deform. To prevent this, make air ventilation holes (8-10mm) at 900mm intervals in each hollow section.

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.

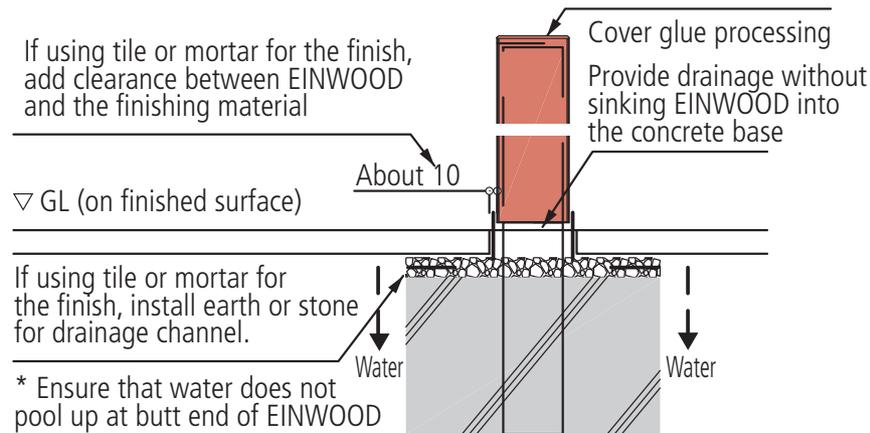
Ventilation

We suggest 120mm 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. Drainage of the ground beneath the decking must be to a high standard.

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 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 ($\varnothing 10$ 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.)

Ground types below the terrace:

Draining surface such as beaten earth or gravel:

Check that the ground beneath the terrace is stable and well-drained. The distance between the upper surface of boards and the ground – at all points - should not be less than 15cm (i.e. with 12cm empty space left at all points beneath the board,).

Waterproof flooring such as concrete screed, raft foundations, paving or terrace with damp course

Check that the ground beneath the terrace is stable and well-drained. Raise and chock the joists so any running water can drain freely and rapidly. Check there are no obstructions to water draining such as earth or other plants. Always ensure that the distance between the upper surface of the boards and the ground is not less at any point than 15 cm (i.e. 12 cm of empty space beneath the boards).

Deck structure:

The decking structure may be in treated wood, hardwood, or metal. As is the case for all composite woods, EINWOOD® should never be used to provide structural support. When using joists and beams in treated wood, we recommend fitting a plastic or bituminous strip over the joists in order to protect the structure, and to prevent creaking.

- Take care never to obstruct the free circulation of air under fitted boards. For decking that is flush with a lawn, or for a deck with a border or wall around it, it is vital to leave a clear gap of at least 12cm and two sides open to the air, in order to allow a natural level of ventilation to operate. Note that failure to comply with these conditions will render your Guarantee null and void.
- Always use joists with a minimum width of 50 mm, and a minimum height of 50 mm. The choice of the type and section of the joist will depend on its function, and the loads the terrace must bear.
- Fixing joists to a structure and fixing boards to joists: in order to prevent boards from lifting, CLIPLAM should be used to secure each board individually. Each board needs to be securely screwed down to the surface, or screwed at its extremity and at all points of contact with crossbeams or joists.

Invisible fasteners (Cliplam):

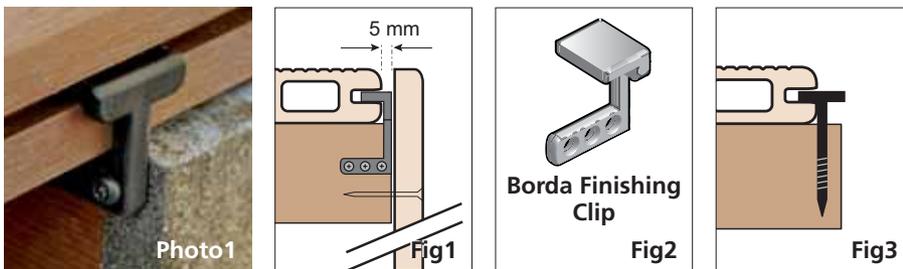
Never screw boards down, but always use CLIPLAM for fixing. CLIPLAM weatherproof clips enable rapid installation. Easily removable and discrete, they enable three-way expansion (lateral, longitudinal and widthways) of boards, while at the same time they allow the structure size to vary as the wood or metallic structures 'work' over time. The use of the clips prolongs the lifespan of your deck, and automatically maintains the minimum 5mm spacing required between boards. See www.cliplam.com.

Stainless steel screws:

These self-drilling screws are in A2 stainless steel, and are coated with a black outer surface layer. This anti-oxidation layer offers additional protection against corrosion, and also lubricates the screw to enable fixing without pre-drilling for most wood or aluminium battens or joists. They have a narrow head, and must have minimum dimensions of 4 x 40mm, with a flat screw-head, maximum diameter 6mm, to ensure the boards are not damaged when they are fitted, and to enable the tool to be inserted in the clip while holding the latter steady.

Installing boards around the edges of the deck:

Use CLIPLAM finishing clips (Fig1, Fig2, Photo1) or collar screws (Fig3). Do not screw into the board.



Gapping

EINWOOD decks must be gapped, both end to end and width to width. Gapping is necessary to facilitate proper draining and for the thermal expansion and contraction of your EINWODD decks.

``Remember, all WPC will expand or contract``

Width-to-width gap:

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 15mm 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 x W145 mm (EW16)	450kgf/m ²	Maximum 450mm
T 30 x W145 mm (EW20)	450kgf/m ²	Maximum 600mm

T = Thickness

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

Overhang

The length of overhang decks must be within maximum of 50mm. The end decks must be fixed.

Other remarks

- A slope of 1% is recommended to enable water to run-off the boards freely. Ensuring this slope is maintained, and good ventilation, will prevent water stains from forming.
- Each board end must be supported by a joist, and must be secured with 2 clips at each joist. If an overhang cannot be avoided, it should not exceed 5 cm.
- A minimum of 3 contact points and 6 clips are required per board, whatever the length of the latter. Any board less than 50 cms long should be supported by an additional joist, centred between the two other joists, and held by clips.
- Diagonal installations (boards placed at 45°): avoid damaging the flange running along the lower edge of the groove so the board cannot lift of its own accord. It is vital to provide maximum support at the end of the board by doubling up on both joists and clips.
- For mitre cuts, or layouts where boards are placed at right angles to one another.

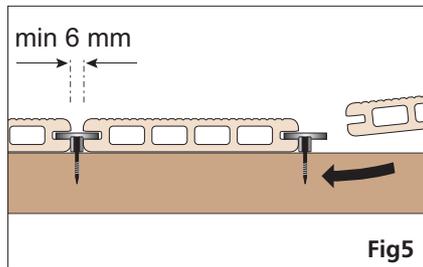
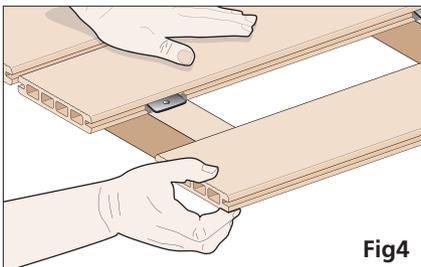
Remember to allow adequate play between boards to allow for expansion.

Fixing the decking boards:

Boards can be installed so that either the sanded side or grooved side is visible. The smooth surface is easier to clean, and just as anti-slip as the grooved side. Pre-screw the clips being sure to keep the drilling axis vertical. Simply hold the clip between your index finger and second finger as shown in (Photo2) so the clip doesn't move while screwing it in or use an off cut of decking profile to help support the drill in its vertical position (Photo3). Never screw all the way in.



Once the board is in place, place the next board at an angle in order to slide it in under the clips (Fig4 and 5). If necessary, use a rubber hammer to knock the board into place. Once all boards are fitted, check the expansion spaces (Photo4, Photo5) and screw all the clips home (Fig6) taking care, meanwhile, not to pierce the clip itself (put the drill into lowest gear, and proceed at minimum speed). The screwhead must on no account be screwed right down into the clip, but should remain flush with its sides.



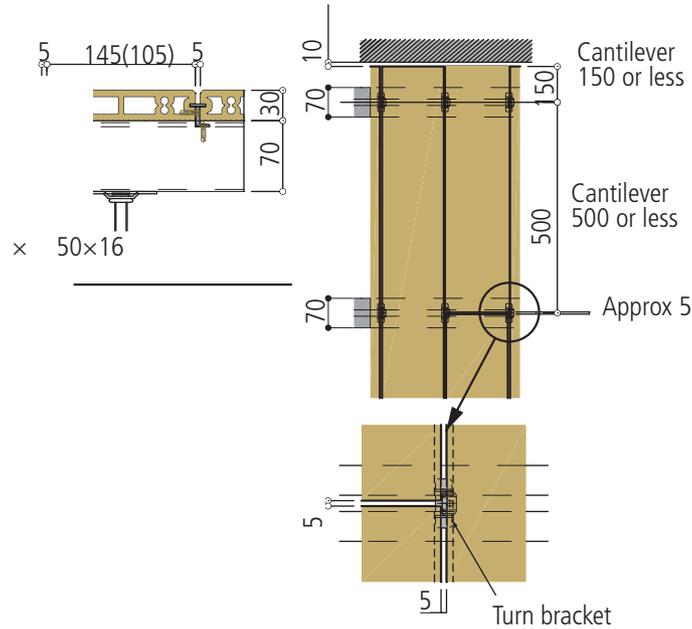
Butt Joint: You must use double joists for every butt joint. EINWOOD cannot be cantilevered on the butt-joint.



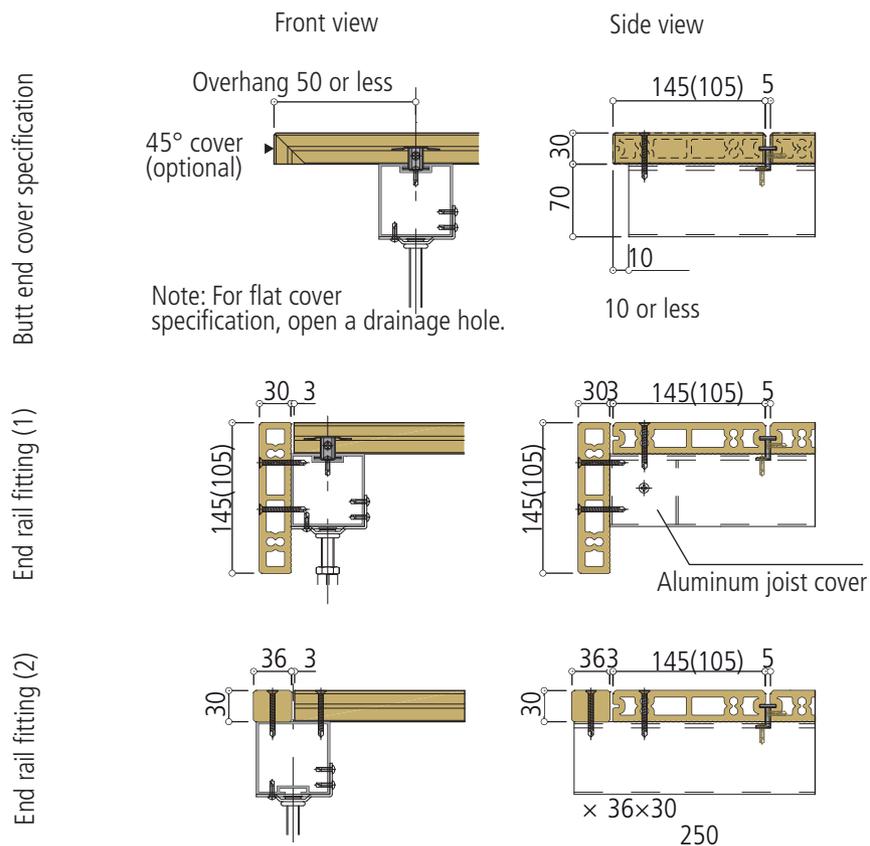
Design criteria for installations

Decking board and joist installation (Units: mm)

Cross-section diagram Plan view



Fitting decking board edges

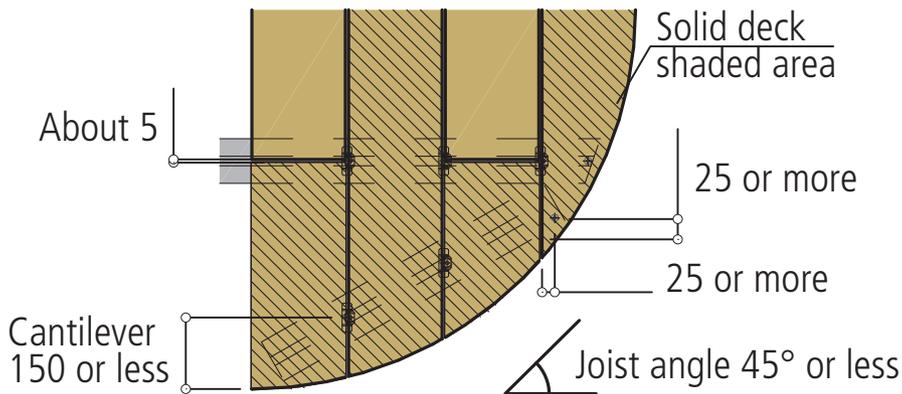
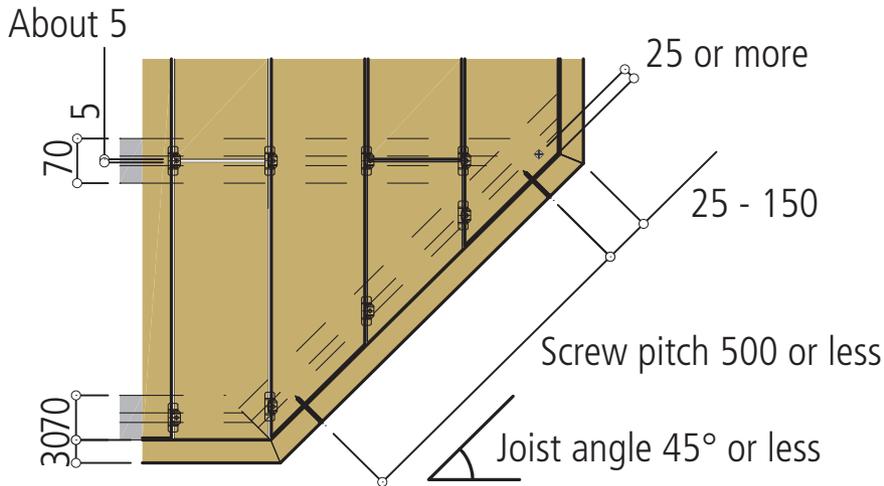


* If using a 36 x 30 end railing, joist pitch is 250 mm or less

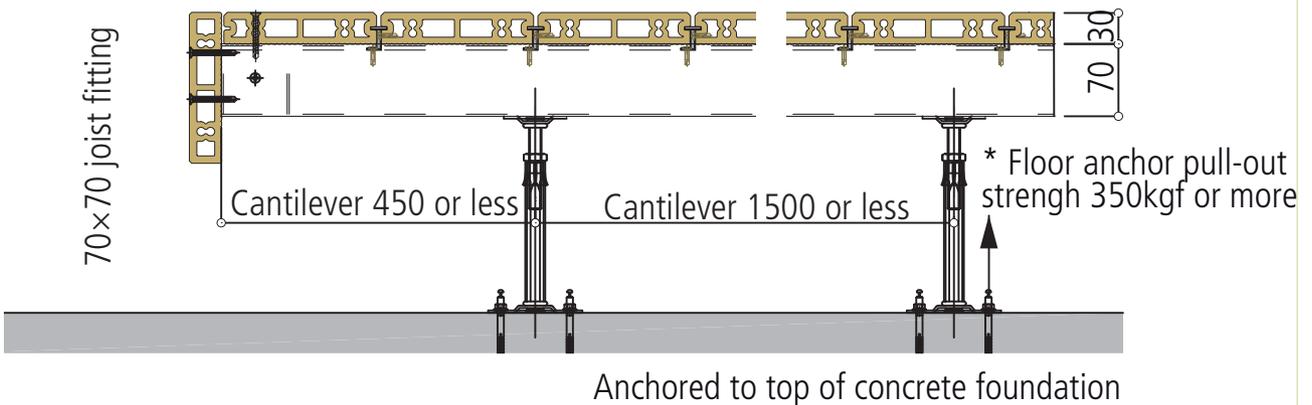
Design criteria for installations

Cantilever installation (Units: mm)

Corner installations (unit: mm)



Joist/post installation (Units: mm)



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:

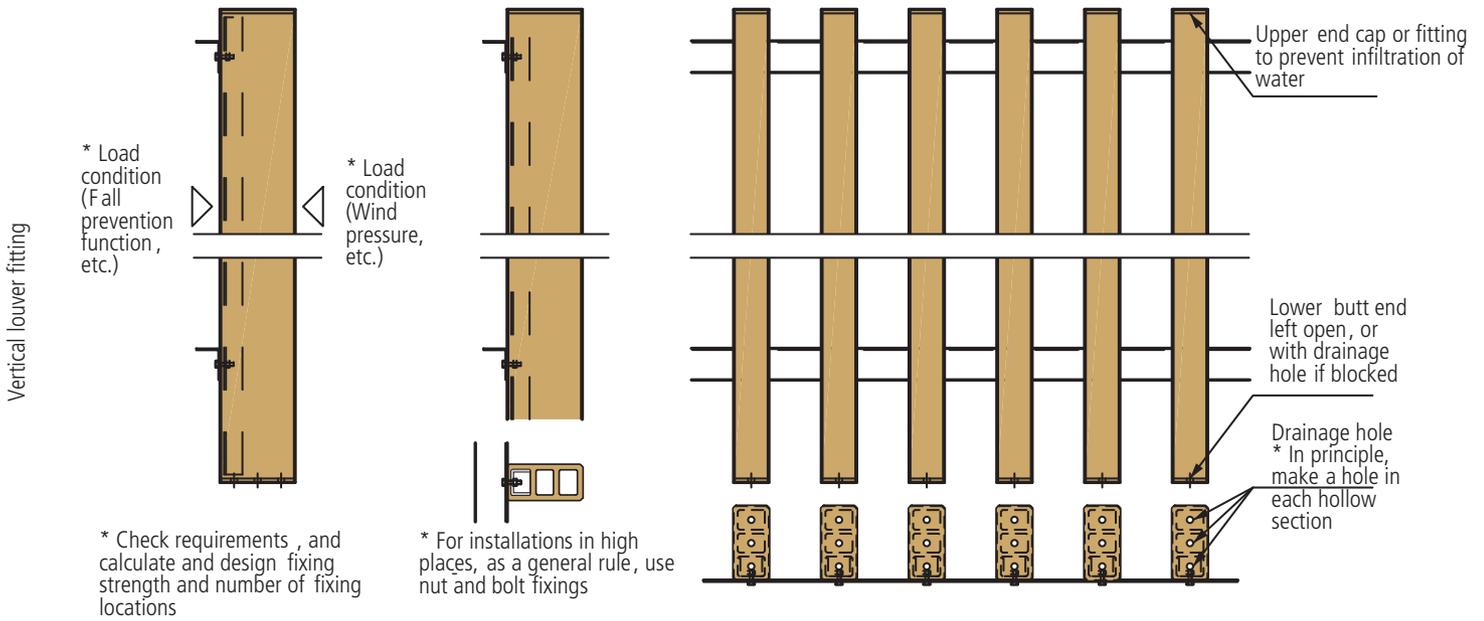
When a fall prevention function is required, calculate the expected load in order to determine the louver material strength requirements, the louver material pitch, the louver material fixing strength, and the number of fixing locations.

*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

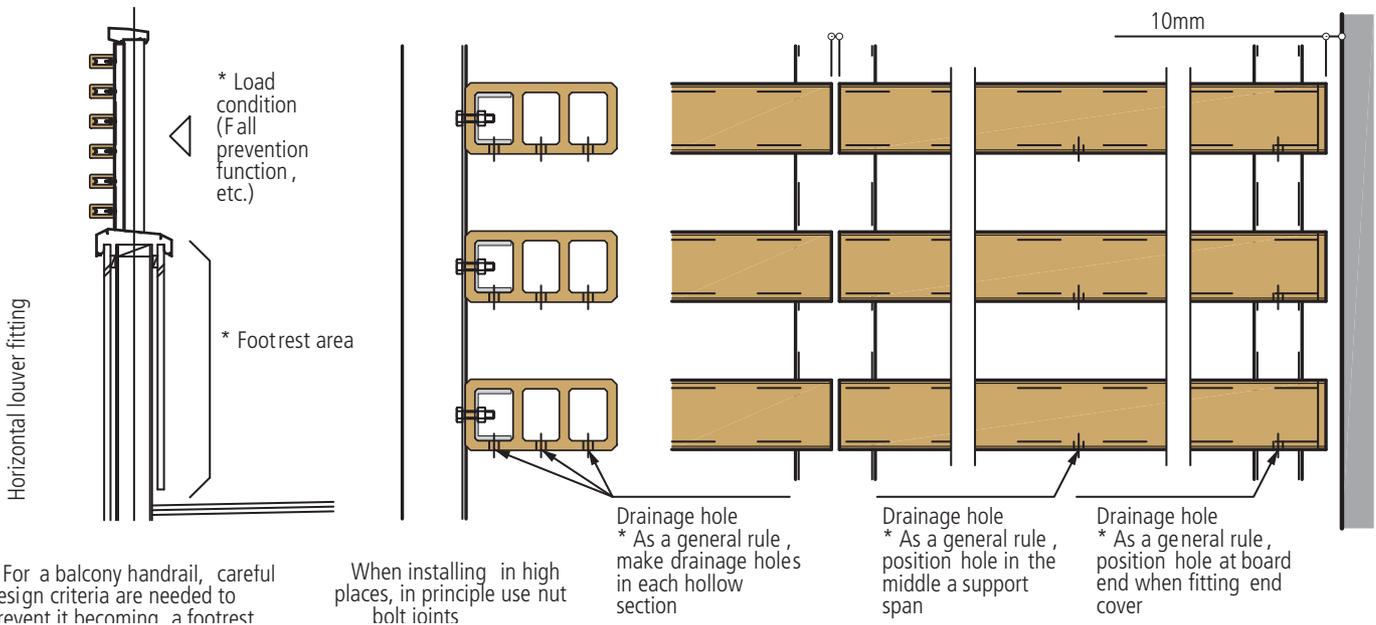
For all the different types of fittings, make sure your design complies with the fitting examples. (Page29)

Fitting examples



Gap of 10mm or more at louver joints

Gap of 10mm or more at joining point with building or fixed structure



EINWOOD® performance

Maintenance

The following are guides to maintaining the appearance and longevity of EINWOOD®.

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.*





Technical specifications for various EINWOOD® profile sections

No.	Cross-section diagram	Size	Cross-section	weight per meter	Cross-section secondary moment		Cross-section coefficient		JIS A5741 Certification	ECOMARK Certification
		(mm)	(mm ²)		Ix(mm ⁴)	Iy(mm ⁴)	Zx(mm ³)	Zy(mm ³)		
EW16		145x22	1887	2.40	111,600	3,666,000	10,000	50,560	TC 08 07 161	07 137 003
EW18		170x21	3477	2.99	127,300	8,128,000	12,000	96,620	N/A	07 137 003
EW19		145x30B	2365	3.00	267,100	4,690,000	17,590	64,690	TC 03 07 021	02 123 011
EW20		145x30S	2479	3.15	269,900	5,066,000	17,820	69,870	TC 03 07 021	02 123 011
EW21		145x30	4,263	5.41	318,100	7,305,000	21,060	100,800	TC 08 07 161	07 137 003
EW22		145x30M	4312	5.48	318,100	7,544,000	21,070	104,000	TC 08 07 161	07 137 003
EW23		105x30M	3123	3.97	230,500	2,866,000	15,260	54,580	TC 08 07 161	07 137 003
EW24		105x30	3072	3.90	230,000	2,739,000	15,230	52,160	TC 08 07 161	07 137 003
EW25		105x30B	1921	2.44	198,500	1,968,000	13,120	37,490	TC 03 07 021	02 123 011
EW26		105x30S	1878	2.39	197,500	2,054,000	13,030	39,120	TC 03 07 021	02 123 011
EW27		90x90B	1916	2.43	2,268,000	-	50,400	-	TC 03 07 021	02 123 011
EW28		145x60	3070	3.90	1,519,000	7,103,000	50,640	97,950	TC 03 07 021	02 123 011
EW29		45x45	930	1.18	239,600	-	10,650	-	TC 08 07 161	07 137 003
EW30		145x25	3542	4.50	184,300	6,035,000	14,640	83,240	TC 08 07 161	07 137 003
EW30F		145x25F	3542	3.05	184,300	6,035,000	14,640	83,240	N/A	07 137 003
EW31		120x120A	4216	5.35	6,667,000	-	111,100	-	TC 03 07 021	02 123 011
EW32		120x120B	2601	3.30	5,584,000	-	90,370	-	TC 03 07 021	02 123 011
EW33		94x44	1626	2.07	423,400	1,418,000	19,250	30,160	TC 03 07 021	02 123 011
EW34		145x72.5	3268	4.15	2,396,000	6,726,000	66,110	92,770	TC 03 07 021	02 123 011
EW35		220x36B	2720	3.45	561,300	12,770,000	31,180	116,100	TC 03 07 021	02 123 011
EW36		452x101	11640	14.78	18,390,000	225,100,000	364,100	995,700	TC 03 07 021	02 123 011
EW37		D56	767	0.97	253,700	-	9,061	-	TC 03 07 021	02 123 011
EW38		D86	1714	2.18	1,322,000	-	30,740	-	TC 03 07 021	02 123 011
EW39		D40	492	0.62	79,150	-	3,957	-	TC 08 07 161	07 137 003
EW40		145x9	1,303	1.65	8,774	2,277,000	1,950	31,400	TC 08 07 161	07 137 003
EW41		D30	291	0.37	26,020	-	1,735	-	TC 08 07 161	07 137 003
EW42		145x36B	2731	3.47	441,100	5,768,000	24,500	79,570	TC 03 07 021	02 123 011
EW43		138x20	1,660	2.11	76,870	2,810,000	7,687	40,720	TC 08 07 161	07 137 003
EW44		147x6	882	1.12	2,646	1,589,000	882	21,610	TC 08 07 161	07 137 003
EW46		181x35	2,383	3.03	425,500	7,039,000	24,320	77,770	TC 08 07 161	07 137 003
EW47		105x52.5	1,802	2.29	660,900	2,275,000	25,180	43,320	TC 08 07 161	07 137 003
EW48		60x30	733	0.93	89,230	325,800	5,948	10,860	TC 08 07 161	07 137 003
EW49		156x20	1676	2.13	87,040	3,774,000	8,572	48,380	TC 08 07 161	07 137 003
EW50		146x60	2663	3.38	1,392,000	4,921,000	46,140	67,410	TC 08 07 161	07 137 003
EW51		D35	417	0.53	49,380	-	2,822	-	TC 08 07 161	07 137 003

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

