Thermowood®

EXTERNAL CLADDING MANUAL

Finnforest

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1 Introduction to Finnforest ThermoWood®

1.1 Background

Heat treatment of wood was scientifically studied by Stamm and Hansen in the 1930s in Germany and by White in the 1940s in the United States. In the 1950s, Germans Bavendam, Runkel, and Buro continued research into the subject. Kollman and Schneider published their findings in the 1960s, and Rusche and Burmester in the 1970's. More recently, research work was carried out in Finland, France, and the Netherlands in the 1990s. The most comprehensive research work was conducted by VTT (Finnish State Research Center) in Finland.

ThermoWood is manufactured using a method developed by VTT. The wood material is heated to a temperature of at least 180 degrees Celsius while it is protected with steam. Besides providing protection, the steam also affects the chemical changes taking place in the wood. As a result of the treatment, environmentally friendly ThermoWood is created. Its colour darkens, it is more stable than normal wood in conditions of changing humidity, and its thermal insulation properties are improved. If carried out at a sufficiently high temperature, treatment also makes the wood resistant to decay.

1.2 The ThermoWood® Process

An industrial scale heat-treatment process for wood has been developed at VTT in co-operation with the Finnish wood product industry. The ThermoWood® process is licensed to the members of the Finnish ThermoWood Association. Finnforest ThermoWood® is available in two treatment classes Thermo-S (Scandinavian pine or spruce, heat treatment 190 ºC, internal use) and Thermo-D (Scandinavian pine, heat treatment 212 ºC, internal and external use).

The ThermoWood® process can be divided into three main phases:

- **Phase 1.** Temperature increase and high-temperature drying
  Using heat and steam, the kiln temperature is raised rapidly to a level of around 100 ºC. Thereafter, the temperature is increased steadily to 130 ºC, during which time the high-temperature drying takes place and the moisture content in the wood decreases to nearly zero.
- **Phase 2.** Heat treatment
  Once high-temperature drying has taken place, the temperature inside the kiln is increased to between 185 ºC and 215 ºC. When the target level has been reached, the temperature remains constant for 2–3 hours depending on the end-use application.
- **Phase 3.** Cooling and moisture conditioning
  The final stage is to lower the temperature by using water spray systems; when the temperature has reached 80–90 ºC, re-moisturising takes place to bring the wood moisture content to a useable level, 4–7%.

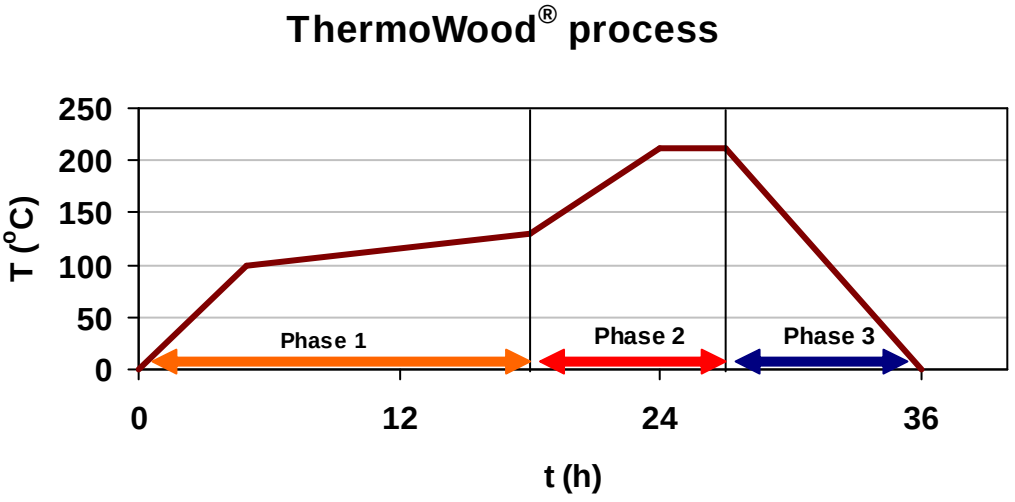


Figure 1. Diagram of the production process

2 Key properties of Finnforest ThermoWood®

Stability
Swelling and shrinkage of ThermoWood is only 50 % of the corresponding values of untreated Nordic pine and is in a similar range to teak. The internal stresses within the structure of timber are reduced in the heat treatment process. This reduces the potential for twist and warp. In addition there is a decrease in the equilibrium moisture content. There exists a linear correlation between water intake properties and dimensional stability of the material under changing moisture conditions.

Table 1. Dimensional changes of ThermoWood compared to untreated pine.

Wood samples	MC %	MC %	Dimensional Change % per 1 % MC change		Dimensional Change 50%RH → 90%RH %	
	50%RH	90%RH	Thickness	Width	Thickness	Width
ThermoWood	5 %	10 %	0.28	0.17	1.4 %	0.85 %
Pine Heartwood	10 %	20 %	0.31	0.19	3.1 %	1.9 %

E.g. Dimensional change of 118 mm wide ThermoWood cladding when 50%RH → 90%RH
ThermoWood MC change 5% (5%-->10%)
Width change (%) 5% x 0.17 = 0.85%
Width change in mm 0.0085 x 118 mm = 1 mm

Durability
Finnforest ThermoWood has improved durability due to the degradation of hemicelluloses (arabinose, galactose, xylose, mannose). This is the nutrition for rot-causing fungi and bacteria and in the absence for nourishment they are not able to occupy ThermoWood.

ThermoWood has high resistance to most decay fungi. Finnforest ThermoWood (Pine, Thermo-D) is classified as highly durable (class 1) in general service situations and hazard classes 1-3. If ThermoWood (Pine, Thermo-D) is used in direct contact with ground, risk of attack by fungi (Poria Placenta) is higher and the durability is in class 3.

Table 2. Service situations and hazard classes
Scandinavian Pine treated with the Thermo-D process can be considered suitable for usage in situations where hazard classes 1-3 (EN-335-2) apply.

General service situations and hazard classes given in EN 335-1 (Appendix 1):
- Hazard class 1 Above ground, covered (dry);
- Hazard class 2 Above ground, covered (risk of wetting);
- Hazard class 3 Above ground, not covered
In normal conditions external cladding is exposed to hazard class 2 or 3

ThermoWood is resistant to Longhorn beetles, Anobium punctatum and Lyctus Bruneus.

NB - ThermoWood is not resistant to the biological growth of algae on it's surface. These organisms get their nourishment from the surrounding air and do not cause structural damage. However they are considered in many cases to be an aesthetic problem. Their growth can be prevented by using surface treatments.

Service Life
BRE (Building Research Establishment Ltd, England) have reviewed evidence supplied by VTT and concluded that Finnforest ThermoWood (Pine, Thermo-D) gives durability equivalent to that required to provide a thirty year service life.

Density
ThermoWood density is 350 - 480 kg/m^3 when its moisture content is 6% (typical for RH = 65%, t = 20^{o}C conditions). Natural variation will occur between individual boards. Material density is approximately 10 % lower than the density of Nordic pine.

Nail & screw holding strength
Nail holding strength values for wire and improved nails for ThermoWood do not differ from the values of European redwood. However, screw holding strength is about 20 % less due to the altered state of the cell wall during the ThermoWood process.

Emissions
ThermoWood has a characteristic smell which is caused by the chemical changes that occur during heat treatment. The smell might not be appreciated by all, but several tests have shown that emissions are not harmful or dangerous. TVOC (Total Volatile Organic Compounds) values are significantly lower than those for untreated softwoods due to the evaporation of most of the terpenes during heat treatment process.

Fire performance
According to EN 13501 (SBI-test) Finnforest ThermoWood® is in reaction to fire class D like untreated softwood. It is possible to treat ThermoWood products further with fire protective treatments in order to achieve improved fire rating.

Thermal properties
Thermal conductivity of ThermoWood is reduced by 20-25% compared with normal softwoods. According to VTT tests the thermal conductivity λ_{10} of ThermoWood (D, pine) is 0.099 W/(m K). The corresponding value for untreated sawn timber is 0.12 W/(m K).

Colour
The colour of ThermoWood is affected by the treatment temperature and time; the higher the temperature the darker the appearance. As with all softwoods variances occur and are due to varying densities. When ThermoWood is exposed to UV-light, it will lose its colour and turn silver grey unless protected by a pigmented surface protection.

Moisture content
Finnforest ThermoWood® has moisture content of 5-7% (50%RH) when packed at production site. This level will change according to atmospheric conditions. The Equilibrium moisture content is only half of the corresponding value for untreated pine (Table 1).

Quality control
The external quality control for the Finnforest ThermoWood manufacturing process and quality system is done by SKH (Stichting Keuringsbureau Hout) a certification institute based in Holland. The quality system has been established to guarantee the consistent quality of the ThermoWood products. The external quality control is part of the product certification process. As an outcome of this process SKH has granted Finnforest ThermoWood, *Thermo-D pine* the right to use the KOMO® product certificate.

Environment
ThermoWood is manufactured from wood which is a renewable natural resource. Finnforest ThermoWood® has the right to use the PEFC-logo which ensures that the raw material is sourced from sustainable managed forests. Bioenergy is used in the manufacturing process and according to life cycle analysis ThermoWood has generally a low effect on the environmental load. There are no chemicals added to ThermoWood during the heat treatment process and it does not contain any toxic or harmful components. The volatile organic compound (VOC) emissions from ThermoWood are only a fraction of those from normal pine.

3 Products

3.1 Visual quality

Finnforest ThermoWood® is produced from European Redwood (Pinus Sylvestris). The raw material is specially selected and sawn from live knotted logs.

Figure 2. Finnforest ThermoWood® appearance

3.2 Finnforest ThermoWood® Product Profiles

Finnforest ThermoWood® external cladding product range is presented below. The product range is consistent of standard profiles which are kept in stock and have short delivery times and customized profiles which are specially tailored according to customer needs. The customized profiles are not available in stock and therefore the delivery time is longer. Other special profiles are available by order.

Finnforest ThermoWood® Stock Profiles	Standard Profile codes	Dimension mm	Cover Width mm	Running meters/m^2
	Profile 1	21 x 118	108	9.3
	Profile 2	21 x 118	108	9.3
	Profile 4	21 x 118	108	9.3

All Finnforest ThermoWood® standard profiles have textured surface. Planed surface is available by order.

Finnforest ThermoWood® Customized Profiles	Customer Profile codes	Dimension mm	Cover Width mm	Running meters/m^2
	Profile 3	21 x 118	106	9.5
	Profile 7	21 x 142	128	7.9
	Profile 9	21 x 142	130	7.7

Profiles 3 and 9 have textured surface. Profile 7 has planed surface.

Finnforest ThermoWood® Corner Strips and Battens	Dimension mm
	42 x 42 32 x 42 21 x 92

Finnforest ThermoWood® corner strips and battens have textured surface on two sides and planed surface on two sides.

3.3 Types of cladding

Standard profile 2 and profile 7 are most appropriate for horizontal cladding as the slope shoulder will effectively channel water away from the up stand. Standard profile 1 can be used for both horizontal and vertical cladding. Horizontal tongued and grooved boards should always be installed tongue uppermost. Standard profiles 1 and 4 are recommended for vertical applications. Customized profiles 3 and 9 are suitable for horizontal applications.

Horizontal or vertical applications for Standard profile 1
Vertical applications only for Standard profile 4
Horizontal applications only for Standard profile 2 and for profiles 3, 7 and 9

4 General design

The purpose of ThermoWood cladding is to provide a waterproof design which gives long service life and low maintenance costs. These instructions are offered as general recommendations. They do not provide structural design. The compatibility of these guidelines to the specific structure should be verified from local norms and regulations on case by case basis. In short the basic principles for the installation of ThermoWood cladding may be summarized below.

1. Take into account the surrounding buildings, local vegetation and ground as well as the territorial claims when designing the cladding.
2. Always incorporate a drained and ventilated cavity between the ThermoWood cladding and external walls whether they are of timber frame or masonry construction. This will allow airflow and moisture management behind the ThermoWood cladding and will reduce the potential for mould growth on the inside faces of external walls.
3. The drained and ventilated cavity should extend from the lower edge to the upper edge of the wall and be open from both edges to allow vertical circulation of air (figures 6 and 7).
4. Make sure that water flows away from the cladding boards and structure and that sufficient ventilation is provided to allow the cladding boards to dry.
5. Chamfer all horizontal surfaces.
6. Make sure that appropriate flashings are applied at intersections between cladding boards, windows and doors, horizontal trim and at roof/cladding intersections. Flashings should be installed so that they direct water away from the cladding boards.
7. Install gutters so that water flows away from the cladding boards and structure.
8. Ensure that the cladding and structure is protected from indirect wetting, as a result of splashing off the ground, by stopping any wood cladding minimum 200 mm above ground level. Install eaves to roof edges to prevent direct wetting.
9. Do not plant bushes or other plants in direct contact with the cladding.
10. Always seal the end grains of cladding boards when installed. Especially if cladding boards are to be finished with a low build stain or opaque paint system. End sealing reduces the potential of any moisture ingress.

It is important to avoid direct contact between ThermoWood and porous or wetted non porous surfaces. This is particularly important where the end grain is exposed because it is very absorbent. End grain protection can be provided by either a damp proof membrane or flashing. Vertical boards should always be kept clear of any flashings below by at least 10 mm and their performance can be enhanced by chamfering the bottom edges which improves the ability of the board to discharge rain water to the ground. Also have the top edges well protected. Horizontal boards should stop short of any vertical members by 8 mm to allow ventilation to the end grain of the surfaces. Butt joints between cladding boards are installed without a gap.

4.1 Battens

For the purpose of allowing efficient ventilation behind the ThermoWood cladding, the cavity behind the cladding should not be less than 19 mm wide. The width of the ventilation gap is determined by the size of battens necessary to fix the boards.

Vertical ThermoWood battens of thickness 21 mm x 92 mm are suitable if fixed to timber frame walls and are coincident with wall studs. If 32 x 42 or 42 x 42 mm ThermoWood battens are used, it will be necessary to double batten the position where cladding boards meet i.e. produce an 84mm surface to fix to.

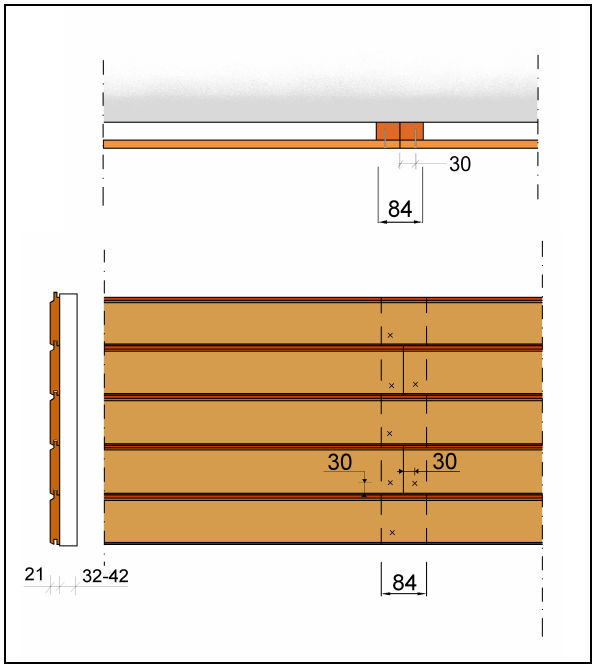


Figure 3. Where joints occur the batten width should be a minimum of 84 mm.
Nail fixing should be at least 30 mm from the ends and edges of the boards. Boards under 120 mm can be fixed with one nail. The nail should be placed to the lower part of the board

Timber Frame Walls

When designing horizontal ThermoWood cladding, the battens must be coincident with the timber studs and these are usually at 600 mm centres.

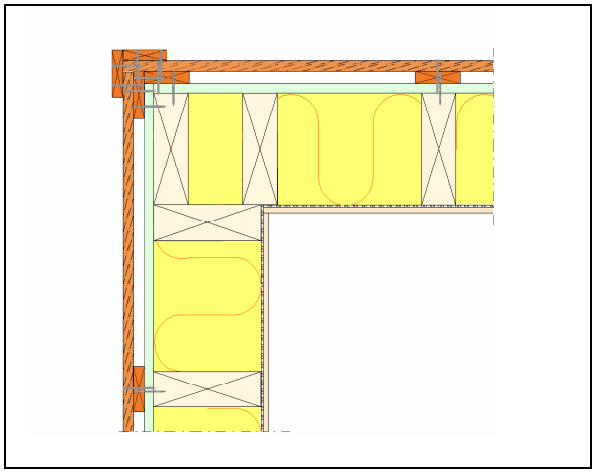


Figure 4. The battens must be coincident with studs when fixing to timber frame wall
The schematic drawing does not provide structural design!

When timber cladding is exposed on elevations of taller buildings or when battens are not fixed coincident with timber studs increased thickness of battens is recommended. This ensures that cladding is fixed robustly to the building.

Masonry Walls

When timber cladding is fixed to masonry building increased thickness of battens is recommended. To avoid driving nails into masonry walls battens should be thick enough to provide the necessary penetration of the fixing. When using improved nails (e.g. annular ring shank) the batten should be a minimum thickness of 32 mm.

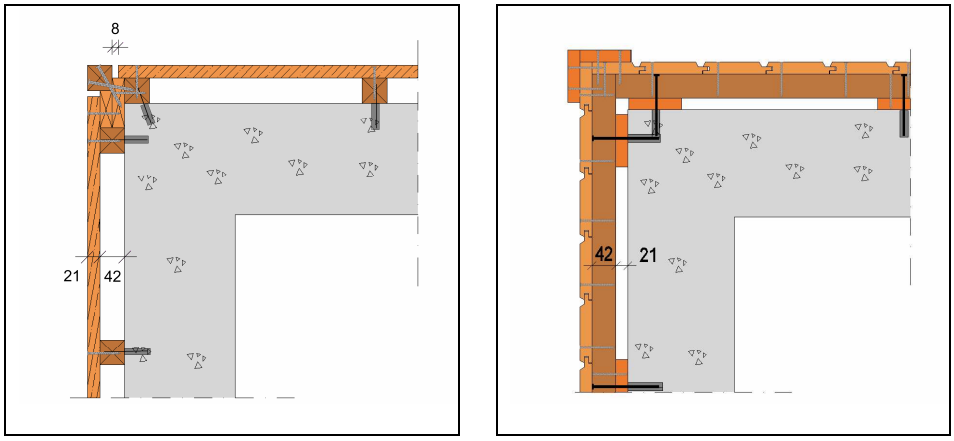


Figure 5. Battens should be thick enough to avoid driving the board fixing nails into masonry.

4.2 Maintaining a drained and ventilated cavity

If vertical boards are fixed to horizontal battens it will be necessary to introduce vertical counter battens behind the horizontal battens to provide drainage and air circulation. If the horizontal battens are to be fixed to counter battens, the counter battens must be of sufficient thickness and follow the guidance detailed above. If board-on-board cladding is used it is not necessary to provide counter-battens. In this case it is preferable if the horizontal battens are chamfered on the top edge to shed any water outwards.

To avoid infestation by insects any openings at the top or bottom of close jointed boards should be protected by an insect mesh.

4.3 Upper edge and lower edge details

The drained and ventilated cavity should be open from both lower and upper edges to allow vertical circulation of air. The recommendation for upper edge and lower edge details are presented in figures 6 and 7. Take into account the surroundings, local vegetation, ground and climate as well as the territorial requirements and conditions when designing the details.

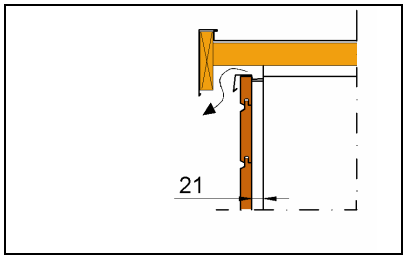


Figure 6. Upper edge detail showing ventilation gap above top board.

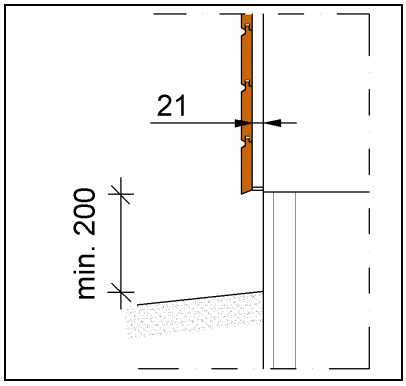


Figure 7. Lower edge detail showing 200mm gap between lower edge and the ground. Note the chamfered bottom edge allowing water run off. The drained and ventilated cavity should be open from both lower and upper edges to allow vertical circulation of air.

5 Installation

5.1 Fixings

It is recommended to use a nail gun with a facility to adjust the pressure. The nail should penetrate so that the head sits flush with the cladding surface (See figure 8). Typically 2.1 or 2.5 is the recommended nail thickness when using an airgun and improved nails. The use of improved nails (e.g. annular ring shank) is recommended to improve nail holding strength and to be able to use thinner nails to avoid splitting. For standard nail, nail length should be 2.5 times and for improved nail 2 times the thickness of the cladding board being fixed.

When nailing pay attention to the following:

1. Using a hammer increases the risk of splitting due to hammer contact with the wood.
2. Do not nail on knots
3. If screws are to be used, pilot drilling is always recommended.
4. Secret nailing with single nails should be avoided for tongue and grooved ThermoWood boards because of the risk of the tongue splitting although the risk of splitting can be reduced by drilling pilot holes.
5. Nail fixing should be at least 30 mm from the ends and edges of the boards. Always apply the edge and end distance rules to avoid splitting. If forced to fix under the recommended edge and end distances always drill nail holes before fixing to prevent splitting. Nails should preferably be located as close as possible to the quarter points in the board width although the actual position of the fixings may be determined by the board profile.
6. It is important that where boards are overlapped or in a board-on-board pattern the nails fixing the outer boards do not penetrate the inner boards. Overlap between outer end inner boards on board-on-board cladding should be 20 mm.
7. Cladding boards 120 mm wide or above should be double nailed. Boards under 120 mm can be fixed with one nail. The nail should be placed to the lower part of the board. In conditions where cladding boards are exposed to heavy wind loading boards 100mm wide and above should be double nailed.
8. Where boards are butt-jointed the junction should always occur over battens. If 42 mm wide battens are used, it will be necessary to double batten the position where cladding boards meet to assure that nail fixing is at least 30 mm from the end of the board (figure 3).

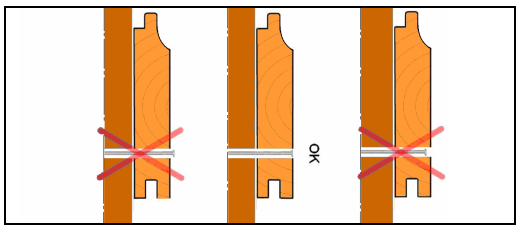


Figure 8. Schematic drawing on the correct nail penetration depth

Nail types

Stainless steel nails should be used to fix Finnforest ThermoWood®. Mild steel and even plated nails can deteriorate when exposed to moisture and stain the area around the nail head. A less visible lower gauge nail can be used but lower pull through strength should be noted and additional fixings will be required. “Lost-head”, “small head” or “siding nails” are suitable for ThermoWood but “round-head” nails offer greater holding power.

5.2 Nailing Positions

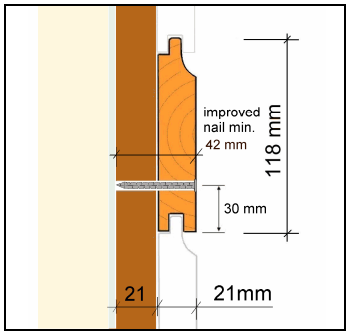


Figure 9. One nail 30mm from the bottom edge is sufficient for the 118mm profile boards.

6 Surface treatment

Finnforest ThermoWood® is a durable product that will last for many years without applying surface treatments. The natural effect of weathering and exposure to sunlight can however cause fading, surface cracking and the potential for algae growth.

Pigmented translucent stain gives protection against UV-light (i.e. graying of the surface) and retains the natural ThermoWood appearance. The most commonly used are translucent stains with brown pigment close to the original ThermoWood colour. The finish is usually slightly darker than ThermoWood natural colour.

Choose wood finish recommended for softwoods and for exterior use. Use either translucent or opaque wood stains. Different treatments will have different maintenance intervals. The more pigment used the longer the maintenance free period. See paint manufacturer instructions. Exterior wood stains perform generally better on textured sawn surfaces than on smoothly planed ones.

It is recommended to apply one coat of finish before installation and apply secondary coats once the boards are in situ. Sealing of end grain is very important. It will reduce the potential for any moisture ingress and possible end staining around the end grain.

The finish should be applied on ThermoWood in accordance with the recommendations of the paint manufacturer, with strict attention given to proper coverage instructions, temperature and weather conditions at the time of painting and other specific requirements. Surface must be clean and dry when treated.

Examples of Paint Manufacturers Recommendations

	Translucent	Opaque
Akzo Nobel	2 coats Sadolin Supercoat	2 coats Sadolin Superdec
or	Sikkens Cetol; 1 coat BL21, 2 coats BL31	2 coats Sikkens Cetol BL

6.1 Maintenance

The environment and climate have a crucial impact on the service life of surface treatment. UV-light and moisture are the major factors affecting surface treatment. This could mean south facing elevations needing more regular maintenance than those facing north. In addition buildings exposed to sea air may require more maintenance than those inland due to the abrasive factor of the wind blowing in from the sea.

To ensure maximum performance of coating and avoiding damages, the surfaces should be cleaned and checked annually. If defects occur it is usually a sign of a structural weakness, which should be repaired immediately. Mechanical damages require instant repair.

Annual inspection is advisable in order to avoid possible serious damages.
Always refer to the paint manufacturer's specific instructions of maintenance.

Maintenance check list for ThermoWood Cladding

A. Fixings of cladding boards and trims
Fix loosen cladding boards and trims. Replace any damaged boards.
B. Dirt on the surface
Wash down according to paint manufacturer instructions to remove contamination from weathering and any loose particles.
C. Coating and need for repaint
Loose paint material should be removed by sanding or scraping. Brush down to remove dust from the surface. Surface treatment with one or more coats. Use the same translucent wood stain or opaque wood stain as used before. Always follow paint manufacturer instructions.
D. Rain damage
Clean any accumulation of leaves and trash from the gutters so that the water flows freely through them. Repair any leaks where water can get behind the cladding boards and cause deterioration. Make sure that water does not stand on horizontal surfaces (chamfering of horizontal surfaces and bottom edges).
E. Flashings
Any flashing that does not direct water away from the siding, or allows water to penetrate into the wall, must be corrected. Improperly installed flashing may leakage.

7 General working with ThermoWood products

ThermoWood cuts like untreated pine. However due to the dry nature of ThermoWood, the saw dust is lighter and finer.

Because of the more brittle nature of ThermoWood, care should be taken not to apply unnecessary impact stresses as these can result in splitting and damage.

8 Health & Safety

There is no major difference in health and safety aspects of ThermoWood compared to normal softwood species. There are still two detectable differences: the smell of the material and the dust produced when processing ThermoWood.

ThermoWood has a smoke-like smell, which arises from chemical compounds called furfurals. The volatile organic compound (VOC) emissions from ThermoWood are only a fraction of those from normal pine.

There are no toxic or harmful components in ThermoWood, but if wood splinters penetrate the skin they should be removed as soon as possible.

ThermoWood dust has smaller particle size than normal softwoods. It is comparable to MDF (although lower density) or hardwood dust. Dust can cause problems for people suffering from asthma. Because of the reasons mentioned above one has to pay special attention to the dust removal system. If dust extraction systems are not available, dust masks should be used.

9 Handling & Storage

When in storage ThermoWood should be laid flat with sufficient support to eliminate bowing (recommended distance of 600mm between supports). To minimise the potential for degradation store ThermoWood out of ground contact and in dry conditions

Where gluing and/or surface treatment is taking place, material should be acclimatised to the moisture content and temperature as required by the manufacturer’s recommendations.

9.1 Waste Handling

ThermoWood is a natural wood product and has had no chemicals additives. When not glued or painted ThermoWood waste can be handled as any other untreated wood waste.

Appendix 1

Hazard Classifications

European Standard for the assessment of Hazard classes: Application to solid wood (source EN 335–1, EN 335–2)

Hazard class 1
Where wood is under cover, fully protected from weather and not exposed to wetting.

In this environment the moisture content of solid wood is such that the risk of attack by surface moulds or by staining or wood destroying fungi is insignificant, that is the wood shall have a moisture content of maximum 20% in any part for practically the whole of its service life. However, attack by wood boring insects, including termites, is possible although the frequency and importance of the insect risk depends on the geographic region.

Hazard class 2
Where wood is under cover and fully protected from the weather but where high environmental humidity can lead to occasional but not persistent wetting.

In this environment the moisture content of solid wood occasionally exceeds 20% either in the whole or only in part of the component and thus allows attack by wood destroying fungi. For timber whose use includes a decorative function, discolouration can also occur as a result of the growth of surface moulds and staining fungi.

Hazard class 3
Where wood is not covered and is not in contact with ground. It is either continually exposed to the weather or is protected from the weather but subject to frequent wetting.

In this environment solid wood can be expected to have a moisture content above 20% frequently, and thus it will often be liable to attack by wood destroying fungi. For timber whose use includes a decorative function, discolouration can occur as a result of the growth of surface moulds and staining fungi.

Hazard class 4
Where wood or wood-based product is in contact with the ground or fresh water and is permanently exposed to wetting.

In this environment solid wood can have a moisture content above 20% permanently and is liable to attack by wood destroying fungi. Termite can be a problem in certain geographic regions. Additionally, the above ground (or above water) portion of certain components, for example fence posts, may be attacked by wood-boring beetles.

Hazard class 5
Where wood is permanently exposed to salt water.

In normal conditions external cladding is exposed to hazard class 2 or 3

Appendix 2

Exemples of
The UK-Specific General Recommendations and Installation Instructions

These instructions are offered as general recommendations. They do not provide structural design. The compatibility of these guidelines to the specific structure should be verified from local norms and regulations on case by case basis.

Battens

The following rules of thumb regarding the batten sizes should be followed:

- When using improved nails (e.g. annular ring shank) a batten twice the thickness of the board is adequate. Vertical ThermoWood battens of thickness 21 mm x 92 mm are suitable if fixed to timber frame walls and are coincident with wall studs.
- When using standard nails the battens should be at least 2.5 times the thickness of the boards to be fixed. Vertical ThermoWood battens of thickness 21 mm are suitable if fixed to timber frame walls and are coincident with wall studs.
- If 42 x 42 mm battens are used, it will be necessary to double batten the position where cladding boards meet i.e. produce an 84mm surface to fix to.

When timber cladding is exposed on elevations of taller buildings or when battens are not fixed coincident with timber studs or when timber cladding is fixed to masonry building increased thickness of battens is recommended. This ensures that cladding is fixed robustly to the building.

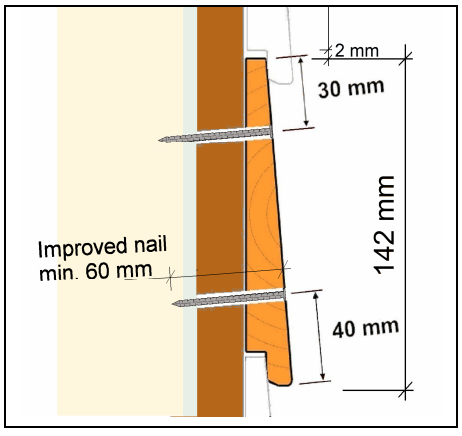
- When using standard nails the batten of thickness 50 mm is suitable.
- When using improved nails (e.g. annular ring shank) the batten should be a minimum thickness of 42 mm.

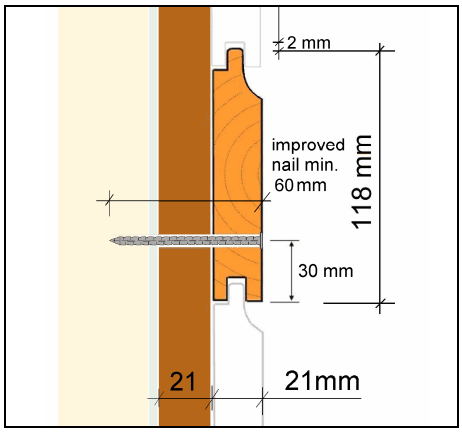
Openings

Most areas of timber cladding will either contain openings for windows or doors, or be contained within a dimensional framework determined by areas of glazing or a regular pattern of windows. Ideally any openings should be in multiples of the chosen board width to avoid the need to notch or split boards. Having to notch or split boards around openings can lead to poor appearance. It is also important to consider the flashing, sills and dpc's around any openings to ensure that any water is drained away to the outside of the wall.

Fixings and nail length

The use of improved nails (annular ring shank nails) is recommended to improve nail holding strength and to be able to use thinner nails to avoid splitting. For standard nails, nail penetration into battens should be 2.5x the thickness of the board being fixed. For improved nails (e.g. ring shank nails) nail penetration into the batten should be 2x thickness of the board.



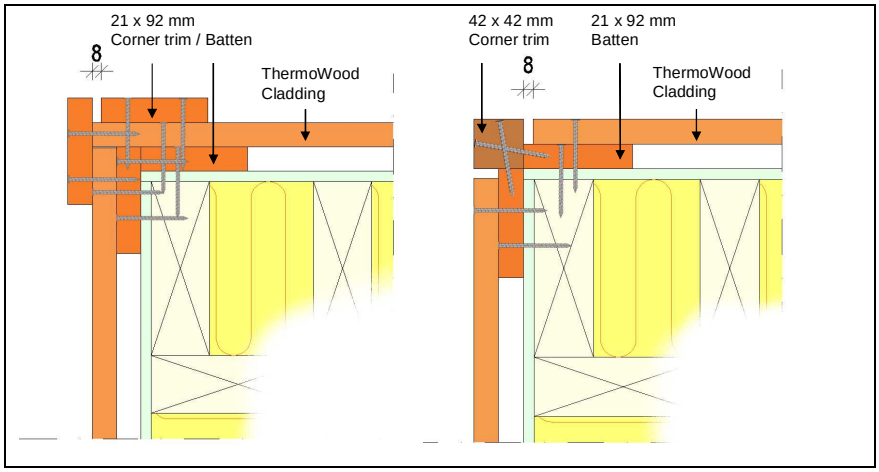


Corner Details

The same corner details can be followed when installing cladding to a masonry wall. Always use thicker battens 42 mm when fixing cladding to a masonry wall.

External Corners for Horizontal Cladding - Timber Frame Wall

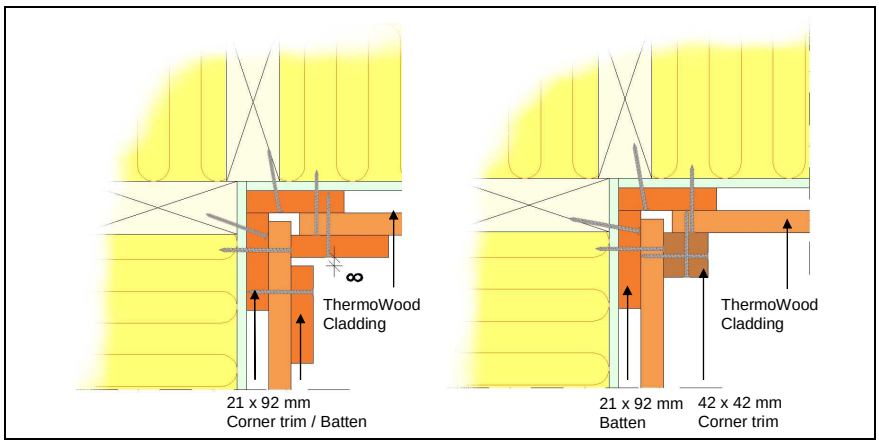
Option 1 **Option 2**



Outer corners for horizontal cladding.
Battens at max. 600mm centres.
Leave 8mm expansion gap between end of cladding board and corner trim.

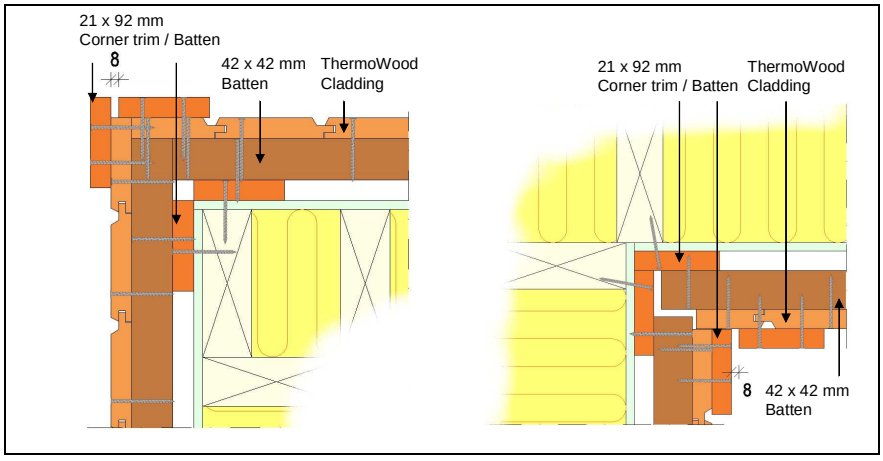
Internal Corners for Horizontal Cladding - Timber Frame Wall

Option 1 **Option 2**



Internal corners for horizontal cladding

External and Internal Corners for Vertical Cladding - Timber Frame Wall



External and Internal corner detail for vertical cladding.
Showing batten and trim detail using 21x92 mm and 42x42 mm ThermoWood.

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For further information please contact Finnforest sales and distribution network www.finnforest.com.

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Finnforest reserves the right to change the range without notice.

Finnforest is the largest wood products industry corporation in Europe. Its annual turnover is close to 2 billion euros and the number of employees is 8 000. Finnforest is a core business of the Metsäliitto Group. Finnforest serves in over 20 countries. Finnforest offers wood-based product and service solutions to its customers in the construction, industrial, distribution and retailing segments.
In Scandinavia the operations are the responsibility of Moelven.
More information: www.finnforest.com and www.moelven.com.

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