SEPA GROUP

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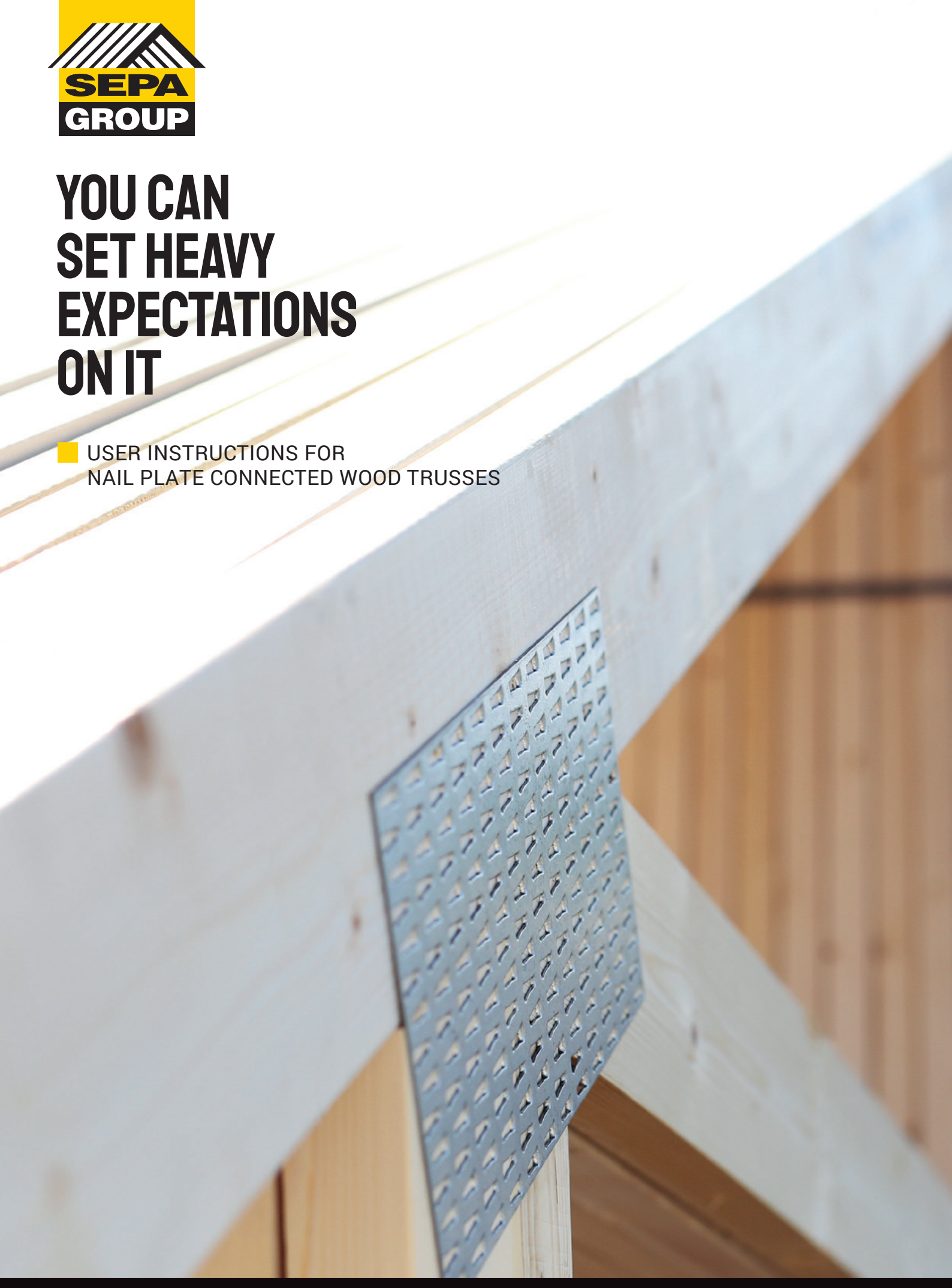
USER INSTRUCTIONS FOR
NAIL PLATE CONNECTED WOOD TRUSSES



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USER INSTRUCTIONS FOR NAIL PLATE CONNECTED WOOD TRUSSES

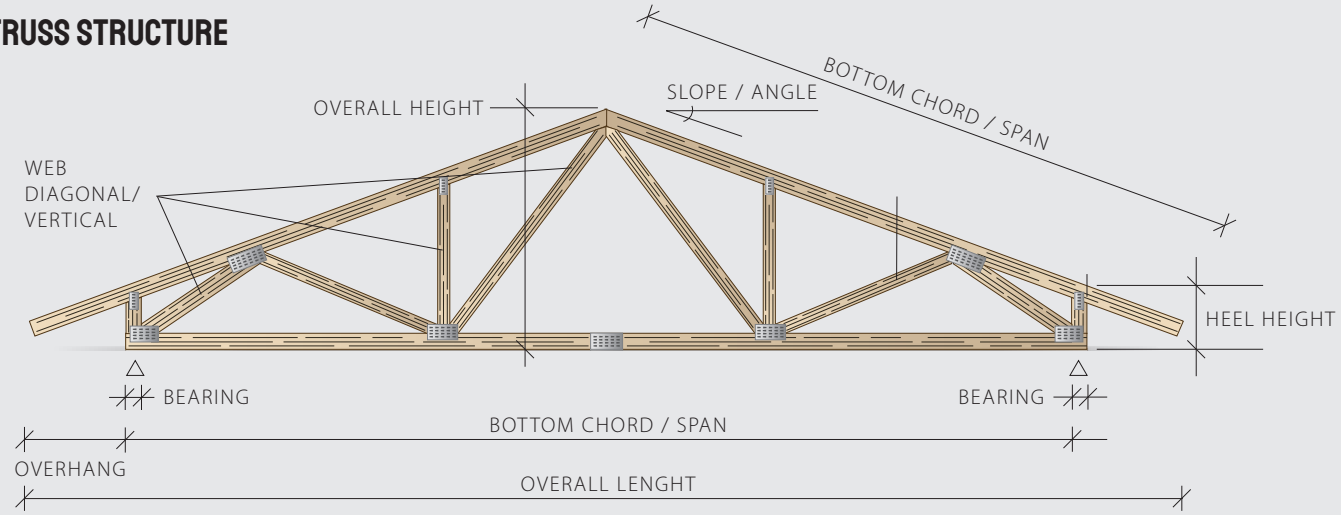
NOTE

You will find the truss structure installation inspection form is at the end of this document.

Nail plate connected wood trusses must be handled, installed, affixed and braced in accordance with the approved plans of the **chief structural design engineer** or, at the very least, following the general principles of these support instructions.

The **foreman in charge** is responsible for ensuring compliance with the plans and bracing instructions. The foreman in charge must complete the attached **installation inspection form,** which will be annexed to the construction work inspection document (Land Use and Building Act (MRL) §150, Land Use and Building Decree (MRA) §77, Finnish Building Regulations (RakMk) A1 7.1 – 7.2).

TRUSS STRUCTURE



A nail plate connected wood truss is a self-supporting timber construction, built from planed / dimensioned sawn timber and strength graded. Truss structures are manufactured in specialist factories, under independent supervision. Kiwa Sertifiointi Oy is a quality inspection company for truss structures, approved by the Finnish Ministry of the Environment. The CE-marked roof truss structures within the scope of inspection of Kiwa Sertifiointi Oy will be given a CE stamp, which displays the inspection company's, in this case Kiwa Sertifiointi Oy, identifying code (0416) as well as the factory code (Keitele factory 4688), as issued by the inspection company; also the harmonised Standard EN 14250 on truss construction; structural plan number; and the week and year of construction. In some exceptional circumstances, the truss structure may also be furnished with a national FI-marking, an example of which is shown below.

KEITELE FACTORY

	CE **0416-CPR-4688 EN 14250:2010**	structural plan no.	week/yr
e.g.	CE **0416-CPR-4688 EN 14250:2010**	123456:10:	01/19
	FI **NR 3072**	structural plan no.	week/yr

USER INSTRUCTIONS FOR NAIL PLATE CONNECTED WOOD TRUSSES

I. RECEIVED INSPECTION

The delivery of nail plate connected trusses includes truss construction plans, strength calculations and user instructions for truss structures. The chief structural engineer of the construction project will verify that the standards set out in the truss construction plans are appropriate for the project. The chief structural engineer will then forward the approved plans to the Building Inspection Authorities, in accordance with the Building Licence Regulations. Together with the trusses, the building site will receive a so-called 'site-series' of truss photos, in a yellow plastic bag (jobsitebag).

The chief structural design engineer of the building will draw a plan for the affixing of the nail plate connected trusses to other structures, and for the total bracing of the final structure. The chief structural design engineer must ensure that the plans for any separately designed structures, parts or systems form a fully-functional entity (e.g. overall stability of the building)/ Finnish Building Regulations (RakMk) A2 3.2.2.

a.) On receipt of the plans at the construction site, at least the following issues must be verified:

- External measures of the truss structure and bracing locations
- Truss support spacing (support spacing of the truss structures)
- Bottom section bracing material and the length of the support areas
- Spacing of the top chord sheathing, also in respect of roof elevations and two-piece truss structures, which coincide with the top-runner
- Inner members to be braced against buckling (see section 7)
- On-site assembly or reinforcement, such as the joining of two-piece truss structures, reinforcement of long open eaves, or reinforcement of a braced section with bearing pressure shoes
- Structure of intermediate floors, if any (vs. the floor structure anticipated in the truss structure vibration planning stage)
- Any potential point load or load resulting from other structures, equipment, etc. as well as operational load, if not included in the plans.

Any deviations should be reported to the chief structural design engineer, who, if necessary, will contact the truss plate engineer.

b.) On receipt of the delivery, it must be verified that that the quantity of the truss structures accords with the purchase contract, the plan number of the truss structures accords with the construction plan number, and that no damage has been incurred to the trusses during transit. In the event of any shortage or damage, the manufacturer of the truss structures should be contacted without a delay in order that they may take further action. Deviation is acceptable in truss structures' extreme measures, joint locations and truss plate positioning within the manufacturing tolerance limits, set out in section 10.

2. STORAGE

Nail plate connected trusses must be stored at the construction site on a horizontal platform, in a vertical or horizontal position, which will prevent the formation of permanent deflections. In order to obviate mechanical damage, the warehouse should be situated in a traffic-free zone.

In a vertical storage position (image 1a), the truss structures must be stored on bed timber positioned under the support points, bundled together and steadied against collapsing. In horizontal storage (image 1b) bed timber should be positioned adequately close together (< 2m). Where several truss bundles are stacked on top of the other, the ledge should be vertically aligned with the bed timber.

Bed timber must be at a sufficient height (approx. 0.5 m), so that no part of the truss structures are in contact with the ground or snow, and provision should be made for air circulation under the protective cover. During storage, truss structures should be protected against rain with a waterproof covering, which must also withstand strong wind conditions. During the installation period, truss structures may not be stored without protection against rain for more than 2 weeks.

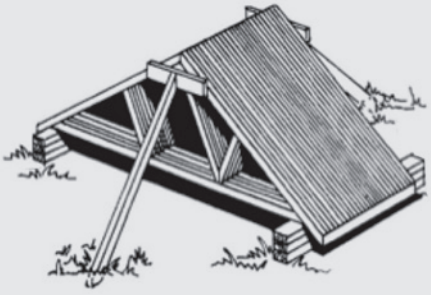


IMAGE 1A. VERTICAL STORAGE

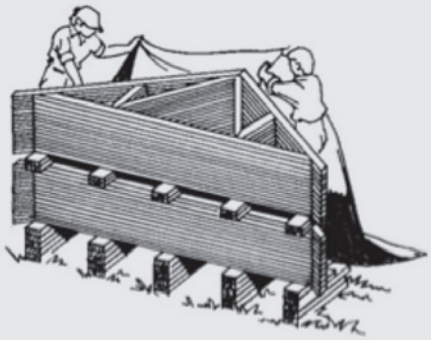


IMAGE 1B. HORIZONTAL STORAGE

3. HANDLING AND HOISTING

Nail plate connected trusses have been designed to function in a vertical position, and must be handled and moved vertically. A truss structure moved horizontally will be subjected to stress, which has not been taken into account in its design. The most common handling damage consists of the detachment of the nail plates from timber, and member fracture.

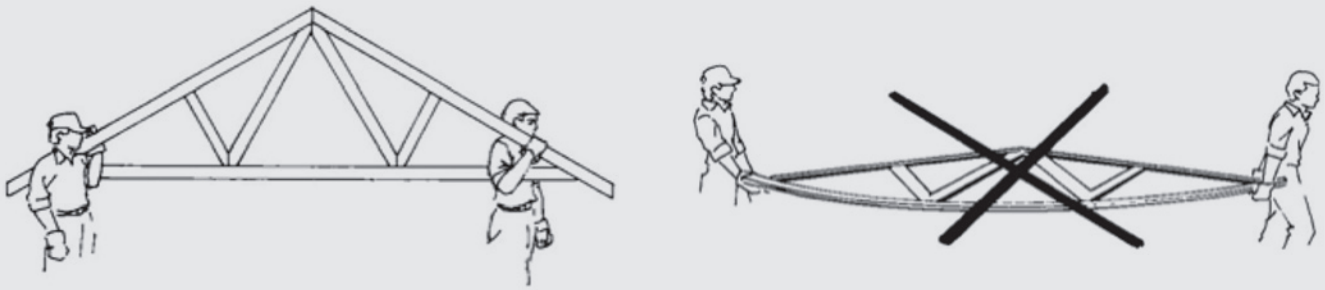


IMAGE 2. HANDLING TRUSS STRUCTURES

Truss structures may be lifted from the delivery vehicle or site storage either as a bundle or one-by-one, directly onto the supporting walls. In hoisting, at least two hoist points are required, where the interval between the points is approximately half of the structure's length. Only symmetrical ridge trusses of 7 m or under (W) may be hoisted from the apex joint alone.

When hoisting long structures, a lifting girder with adequate lateral stiffness should be used, along with three or more hoisting points. Images 3-5 show the recommended hoisting methods, depending on the length of the structure.

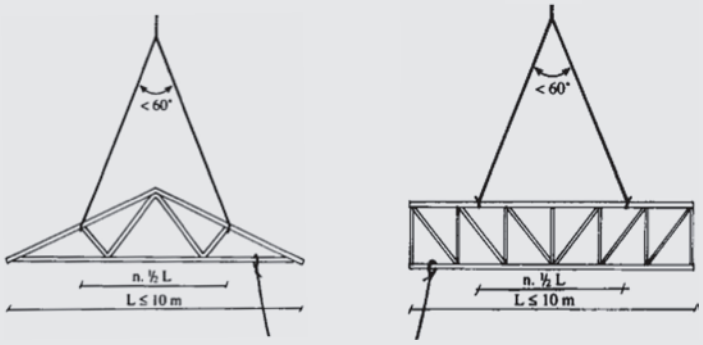


IMAGE 3. TWO-POINT HOISTING WITHOUT GIRDER

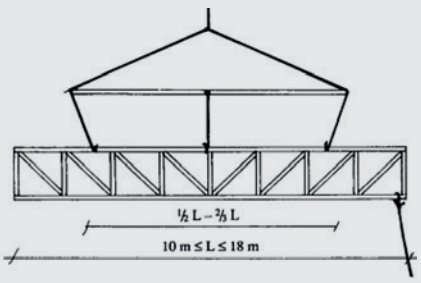


IMAGE 4. THREE-POINT HOISTING WITH GIRDER FOR WIDTHS 10m–18m.

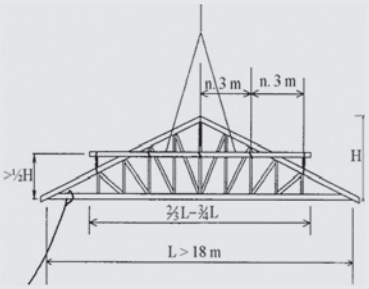


IMAGE 5. FIVE-POINT HOISTING WITH GIRDER FOR WIDTHS > 18m.
A girder has been placed half-way through the height of the truss construction, with adjustable hoisting points lengthwise. The truss construction is attached to the girder.

4. INSTALLATION TOLERANCES

The vertical alignment of truss structures and the lateral alignment of the chords must meet the tolerance requirements shown in images 6 and 7. After installation, the lateral curve of the inner member may not exceed 15 mm. The plumb and lateral alignment of the truss structures must be inspected before the installation of final diagonal bracing.

Nail plate connected truss bracing must be positioned only in the areas shown in the truss' structural plan. It is not permitted to use support points other than those set out in the plans. With asymmetrically supported truss constructions, it is particularly important to take care that the trusses are installed the right way round, in accordance with the drawings, i.e. the support points are positioned correctly in relation to the inner members.

All support lengths must meet the minimum values set out in the truss structure plan. The structural design engineer should verify the upper course bearing pressure capacity, where the upper course extension is positioned less than 100 mm from the support point.

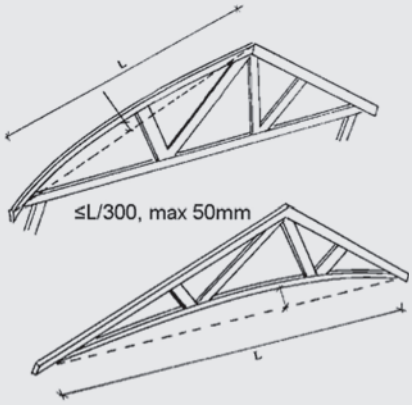


IMAGE 6. INSTALLATION TOLERANCE OF CHORDS

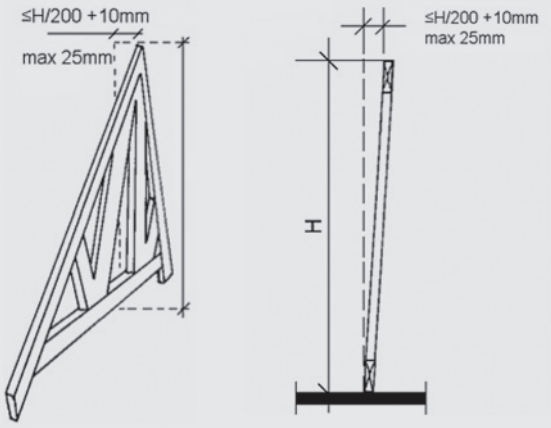


IMAGE 7. VERTICAL TOLERANCE

A truss structure or its member must not be sheared off, notched or pierced, unless so permitted in the structural plan. ≤

In the event that any changes are made to the positioning of supports, or it is necessary to shear off or notch the truss structure, the Sepa truss design engineer should be notified before installation in order to check whether a different replacement structure is needed. If the current structure can be modified on site, the design engineer will draft a modification plan.

5. INSTALLATION AND TEMPORARY BRACING

Unless otherwise set out in the truss construction or structural plans, these instructions should be adhered to when installing, affixing and bracing truss structures. **The bracing and stiffening of the entity that consists of truss structures is always carried out according to a separate plan, which has been approved by the chief structural design engineer (see section 9).**

Temporary bracing during the installation period should be sufficient to hold the truss structures in place, taking into account loads such as wind or building materials lifted on top of the supporting brackets, for which allowance has been made in the plans. A suitable support method is diagonal bracing, which can be constructed on site. Another possible bracing method uses horizontal trusses and horizontal trestles, which can also be used for total bracing of the structure. The installation of horizontal trusses and horizontal trestles is carried out as indicated in the bracing plan, and should be taken into account when placing the order for trusses.

Collapse of supports is prevented by applying temporary crosswise diagonal bracing (X-bracing) at least to the outer supports of the section (see image 8). X-bracing is nailed to the nearest vertical members, with the horizontal distance between the top ends not exceeding 2.5 m. Diagonal bracing is applied to both ends of the truss structure section and, if the length of the section exceeds 15 m, intermediate bracing is affixed so that the interval between X-bracing lengthwise, linear with the construction, is no more than 10 m. The minimum dimension of the panels used for diagonal bracing should be 22x100, nailed at least 2n2,8x75/joint. The maximum nail dimensions permitted in the truss structure plan should be used for bracing against buckling also during installation.

Truss structures should be tied to each other from the top edge at intervals of no more than 2.5m, ensuring that the support lines coincide with diagonal bracing. The bracing interval of the bottom chords is 4m maximum, and spaced sheathing should be affixed to any end frames and partition walls. Diagonal bracing is affixed between the spaced sheathing of the top and bottom chords, as shown in images 9 and 10, at both ends of the construction, in the minimum. For truss sections exceeding 15 m, intermediate bracing must be used, as shown. Bracing during installation requires panels of 22x100 mm in the minimum, to be nailed at all chord points, with at least two 2,8x75 nails.

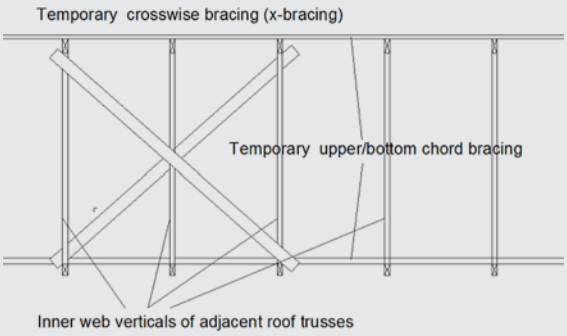


IMAGE 8. DIAGONAL BRACING DURING INSTALLATION. THE DISTANCE BETWEEN X-BRACING IN THE DIRECTION OF THE SUPPORT IS A MAXIMUM OF 2.5 m.

If the bracing of the truss section is carried out in accordance with the structural plan, using the horizontal truss structure (see images at section 9), intermediate vertical bracing will usually only be required by the ridge and the supports. When truss trestles are affixed vertically between trusses, in conjunction with a horizontal truss structure, this eliminates the need for diagonal bracing during the installation period. The first supports, horizontal trusses and trestles may be bundled up on the ground and the complete braced element hoisted onto the roof.

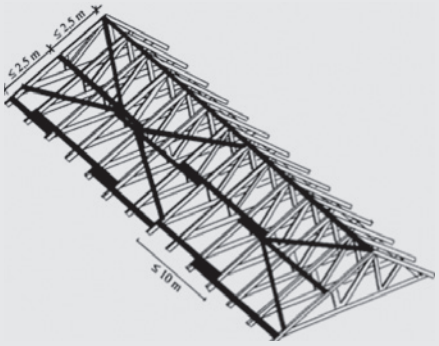


IMAGE 9. TOP CHORD BRACING DURING INSTALLATION.

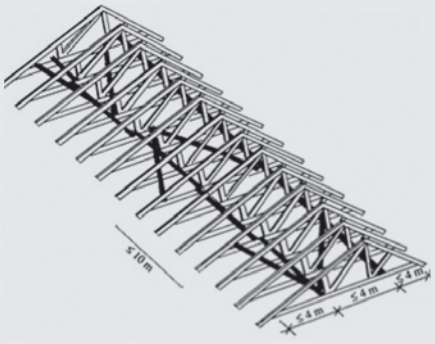


IMAGE10. BOTTOM CHORD BRACING DURING INSTALLATION.

6. PLATE STRENGTHENING

The strengthening of nail plate connected trusses may be undertaken only at points identified in the drawings. Allowance for sagging must be made between non-loadbearing partition walls and the bottom chord (see image 11). Allowance for sagging should be at least A/150, with A representing distance of the connection point from the nearest truss structure support.

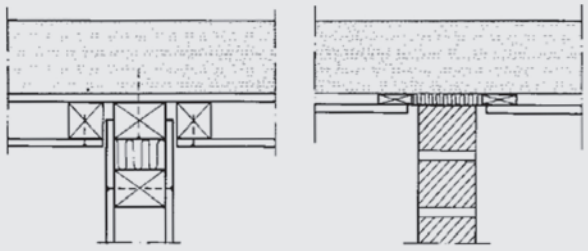


IMAGE 11. SAGGING ALLOWANCE BETWEEN
THE SUPPORTING WALL AND TRUSS.

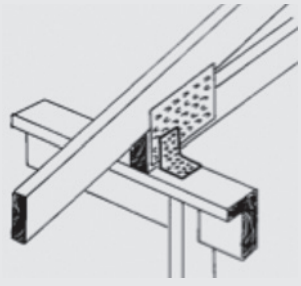


IMAGE 12. PLATE STRENGTHENED WITH AN ANGLE BRACKET

Plate strengthening is carried out in accordance with the structural plan. Normally, factory-made angle brackets (e.g. BMF90) are used and fastened with so-called anchor nails. Joining should be carried out using the angle brackets set out in the plan and nails, which can be obtained from a hardware store. As a norm, angle brackets are affixed with the longer leg upwards. Where a truss plate has been fastened in the area to be strengthened, nails can be driven through the truss plate, if necessary, by pre-drilling the plate (see image 12).

The bearing pressure capacity of both the truss structure and bottom support can be improved with bearing pressure shoes or bearing pressure brackets. This requires a separate plan by the truss structure design engineer. In such a case, the necessary bearing pressure fasteners and nails will be included in the truss structure delivery.

Slant nailing must not be used for plate strengthening purposes since it may result in chord fracture, and the chord will then be incapable of withstanding bearing pressure. Slant nailing may be used only when so indicated in the structural plan. Slant nailing is only possible in intermediate bracing, which does not contain a chord extension and the truss plate extends to the bottom of the chord.

7. BRACING AGAINST BUCKLING OF INNER MEMBERS

Any inner members to be braced against buckling are indicated both on the truss' structural plan (see image 13a) and on the truss structure itself (see image 13b). Any marked members must be braced on site, parallel to the building. It is imperative to brace inner members against buckling, failing which, the load bearing capacity of the truss structure could be only a fraction of that intended (see image 13c).

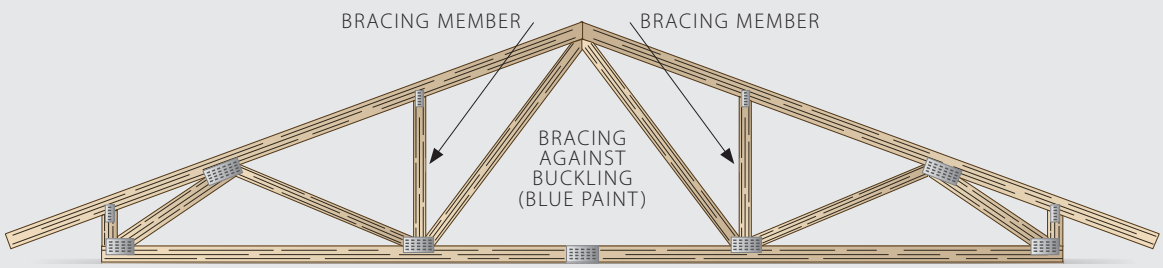


IMAGE 13A. MEMBERS TO BE BRACED AGAINST BUCKLING ARE MARKED WITH AN ARROW AND IN WRITING IN THE TRUSS DRAWING.

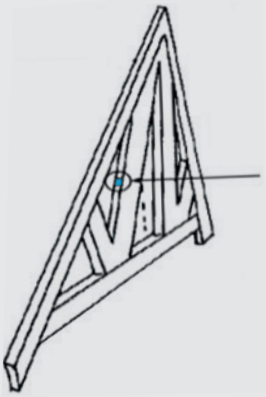


IMAGE 13B. MEMBERS TO BE BRACED AGAINST BUCKLING ARE MARKED WITH BLUE PAINT ON THE SIDE OF THE MEMBER.

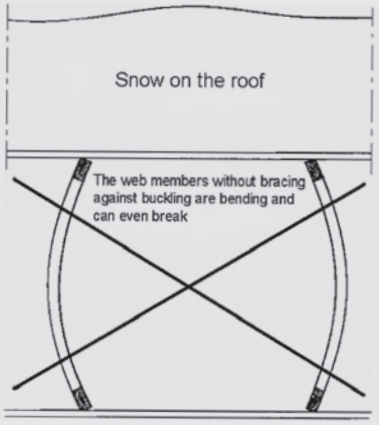


IMAGE 13C. A TRUSS STRUCTURE CANNOT WITHSTAND THE PLANNED LOAD IF INNER MEMBERS ARE NOT BRACED AGAINST BUCKLING.

Bracing against buckling is realised in the manner indicated in the truss' structural plan. **Where the truss structure plan makes reference to bracing against buckling in accordance with the bracing instructions, the bracing of inner members is carried out following the general instructions in image 14.**

If it is necessary to brace the inner members in more than one point, or if the calculated compression force of the member to be braced against buckling is Nd > 15 kN, then the general instructions shown in image 14 are inadequate. In such a case, bracing should be carried out as indicated in the truss structure plan or its attachment.

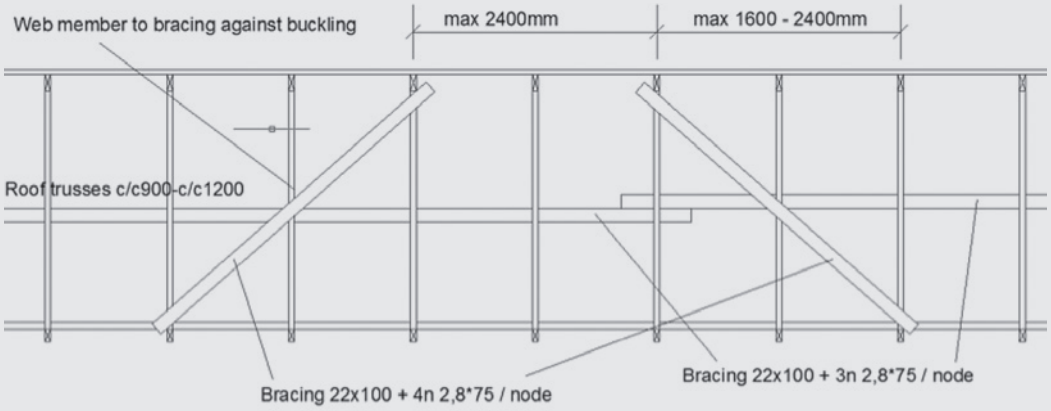


IMAGE 14. GENERAL INSTRUCTIONS FOR BRACING AN INNER MEMBER AGAINST BUCKLING.

8. CHORD BRACING

The truss structure plan sets out the chords to be braced and the appropriate spacing of the sheathing. All top chords must be braced against buckling (including the horizontal sections of the top chords of any high, sheared-off truss structure supports). Some bottom chord sections may also need bracing against buckling. Bracing against buckling may be carried out with spaced sheathing, affixed either onto the top or bottom of the chord, solid boarding or plates.

When spaced sheathing is used for bracing the chords against buckling, the spacing must not exceed the values set out in the truss structure plan. Some types of roofing may withstand wider spacing than those indicated in the truss structure plan, in which case additional sheathing should be affixed to the top chords to prevent buckling. The minimum nailing requirement for bracing, using threaded nails and with sheathing spaced at a maximum of K400mm, is as follows:

- **SHEATHING THICKNESS 25-32 MM => 2N2,5X60 FOR EVERY CHORD,**
- **SHEATHING THICKNESS 38-48 MM => 2N2,8X75 FOR EVERY CHORD.**

Solid boarding (e.g. panels, tongue-and-groove or timber planking of felt roofing) is adequate to brace a chord against buckling, provided that the boards are fastened to every chord with a minimum of two nails. Extension of adjacent boards is not permitted over the same chord or space between supports.

Rigid boards, affixed directly onto chords, are also well-suited for bracing the chords against buckling. For instance, chipboard and plywood, with a minimum thickness of 8 mm, have sufficient strength and rigidity. Spacing between the nails on the board should be < 150 mm. Porous fibre boards, gypsum boards or Luja-boards are not recommended for bracing chords against buckling, due to insufficient strength and fragility.

Where an elevation batten is used between the chord and the bracing, the elevation batten (bxh, 48x22-32) should be nailed as follows (or, if machine-nailed, the equivalent):

- **BATTEN THICKNESS 22–32 MM => N2,8X75 K300**

9. TOTAL BRACING OF CHORDS

NOTE! The total bracing of a truss structure is always carried out in accordance with a separate structural plan, as approved by the structural design engineer of the construction.

Cross-bracing of the top chords alone will not brace the roof. By bracing the roof, the bracing capacity of the truss structures and external horizontal loads, such as wind, will be transferred to the supporting vertical structures. Alternative bracing methods consist of:

- Horizontal trusses and wind trestles (see images 15 and 16),
- Horizontal trusses and diagonal bracing built on site,
- Diagonal bracing along with the bracing of the top beam and bottom chord,
- Board bracing (profiled metal roofing, panelled-up top chord level).

In addition to the bracing of the roof, the supporting/bracing wall lines require diagonal bracing to transfer loads from the top chord level to the upper section of the wall. For this purpose, factory-made truss trestles, the height of which corresponds with the support height, can be placed between the truss supports. With slate roofing, the top chord level must always be separately braced – spaced sheathing does not constitute a bracing structure. Equally, solidly planked/ tongue-and-groove planked felt roofs must contain separate bracing structures. Generally, profiled metal roofing with a span below 12 m has an adequate bracing capacity, but utilisation of the roofing as a bracing structure will require substantially denser fastening than recommended by the manufacturer for wind suction loads. The affixing of metal roofing that is be used for bracing will be determined by the chief structural design engineer. Machine-jointed, smooth metal roofing has no bracing qualities. Horizontal truss structures are quick to install and normally more economical than horizontal roof trusses built on site. Especially when working with long trusses and slate roofing, it is worthwhile undertaking total bracing of the roof with a horizontal truss structure and truss trestles, which can be ordered and delivered together with the regular truss structure supports.

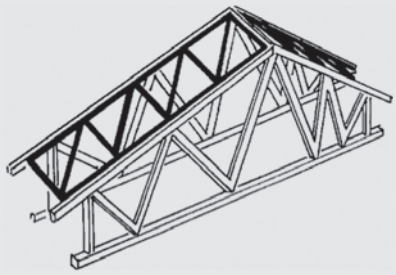


IMAGE 15. WIND TRUSSES USED FOR ROOF BRACING.

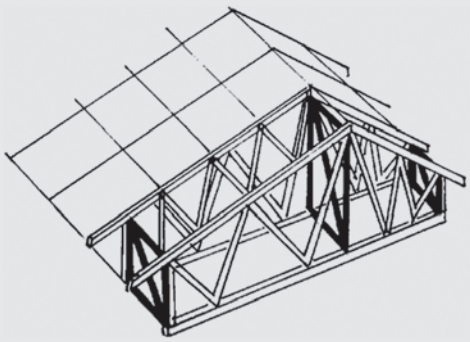


IMAGE 16. VERTICALLY INSTALLED TRUSS TRESTLES.

10. MANUFACTURING TOLERANCES

Truss structures meet the requirements of Product Standard SFS-EN 14250, covering truss structures. Manufacturing plants within the scope of Kiwa Sertifiointi Oy's quality control apply the following manufacturing tolerances: The length of the structure may deviate from the drawing measurements by ± 10 mm, where the length of the truss structure is a maximum of 10 m. Where the length of the truss structure is L > 10 m, longitudinal tolerance is ± L/1000. The length of truss structure supports of the same series may not vary from one another by more than 10 mm. Structure height may deviate by ± 10 mm.

The positioning of joints may deviate from the drawing by ± 20 mm. The positioning tolerance of truss structures has been set out in the truss structure plan.

APPENDIX: Nail plate connected truss structure installation inspection form

Sepa Oy designs, manufactures and delivers nail plate trusses. We aim to be the leading manufacturer of nail plate structures in Finland. Our goal is to reach this aim though developing the quality of our operations, products and services.

In addition to various types of roof trusses, we also manufacture Posi joists, fire-safe trusses, house frames, bridge moulds, noise barriers and weather-protection shelters. Our customers include Finland's largest manufacturers of prefab houses, infra builders, construction companies, wholesale companies and private customers.

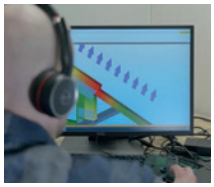
Being the market leader in our industry in Finland makes us very proud and provides us with the challenge of driving ourselves forward in our daily work.

Our goal is to remain worthy of your trust also in the years to come. We stick to our tried and tested methods of doing things, but we also focus on constant improvement. In our line of work, persistent, environmentally responsible development work is at the core of our operations: *"We can rely on this in so many aspects"*.

The cornerstones of our top-notch operations are our skilled and motivated personnel, our own design department and the most modern production equipment.

QUALITY

To ensure quality and operations, we have in place a quality system that complies with the SFS-EN ISO 9001 and an environmental system that complies with the SFS-EN ISO 14001standard. On a national level, our products and functionality are monitored through inspections carried out by Kiwa Sertifiointi Oy, as an indication of which all our SEPA products are NR-stamped and CE-marked.







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NAIL PLATE CONNECTED TRUSS STRUCTURE INSTALLATION INSPECTION FORM

This form must be completed and signed by the foreman in charge. The form must be attached to the building inspection documents and presented to the Building Inspection Authorities.

BUILDING TYPE: _____ **ADDRESS:** _____

LICENCE NUMBER: _____ _____

BUILDER: SEPA OY, TEL. 020 762 8700

KEITELE CE **0416-CPR-4688 EN 14250:2010**

NAIL PLATE CONNECTED TRUSS STRUCTURES CONTAINED WITHIN THE BUILDING:

Work no.:_____	Truss code:_____	Quantity :_____
Work no.:_____	Truss code:_____	Quantity :_____
Work no.:_____	Truss code:_____	Quantity :_____
Work no.:_____	Truss code:_____	Quantity :_____
Work no.:_____	Truss code:_____	Quantity :_____
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RECEIVING INSPECTION

- ☐ Structural plans for the truss construction project, as approved by the chief structural design engineer, have been received on site and forwarded to the Building Inspection Authorities.
- ☐ Truss structure bracing instructions are contained on site.
- ☐ The truss structures are furnished with the appropriate markings, and the delivery quantity accords with the plans.
- ☐ The truss structures have not been damaged during delivery

STORAGE AND HANDLING

- ☐ Storage and weather-shielding on site has been realised in compliance with the principles of the bracing instructions or any other specific instructions given by the manufacturer of the trusses.
- ☐ Bracing instructions have been complied with in the handling and hoisting of trusses on site.

INSTALLATION TOLERANCES

- ☐ Chord installation tolerances and vertical alignment tolerances do not exceed the maximum values set out in the bracing instructions.
- ☐ All support lengths meet the minimum values set out in the truss' structural plans.
- ☐ Truss structures have not been pierced, notched or sheared off without the structural design engineer's authorisation.

INSTALLATION AND TEMPORARY BRACING

- ☐ To prevent collapsing, temporary diagonal bracing has been erected, following either the chief structural design engineer's plan or with X-bracing, in accordance with the bracing instructions.
- ☐ Temporary bracing of the top and bottom chords has been realised, in accordance with the chief structural design engineer's plan or the bracing instructions.
- ☐ Bracing of truss structures has been executed in accordance with the construction plan or the truss' structural plan.
- ☐ Allowance for sagging has been made between non-loadbearing walls and the truss structure, in accordance with the bracing instructions.
- ☐ The bracing of any special truss structures (e.g. so-called scissors trusses) has been carried out following a separate structural plan/truss structure design engineer's plan.

BRACING AGAINST BUCKLING OF INNER MEMBERS AND CHORD SUPPORT

- ☐ All members have been braced against buckling, as marked in the truss' structural plans and structures, in accordance with the plan or the general bracing instructions.
- ☐ All chords that require lateral bracing have been braced, applying the maximum sheathing spacing (or panels or solid boarding) stated in the truss' structural plans.
- ☐ With nailed joints, thickness of the nails and edge distance correspond with the structural design plan.

TOTAL BRACING OF THE ROOF KOKONAISJÄYKISTYS

- ☐ A structural plan for total bracing, approved by the chief structural design engineer, is contained on site.
- ☐ Total bracing of the roof has been carried out in compliance with the above-mentioned plan.

NOTE! For long truss structures, where the span exceeds 16 m, an unprompted inspection by an expert or third party is recommended both during installation and on completion. An inspection may be performed by a truss design engineer or timber structure design engineer, with AA qualification (FISE). The report of the expert or third party inspector should be annexed to this form. Where necessary, the Building Inspection Authorities may require a third party inspection Land Use and Building Act (MRL) s.4, §151.

PLACE AND DATE

FOREMAN IN CHARGE

PRINT NAME