

MiTek®

Posi™-Joist

Technical Handbook

V 26.1

POSI™-JOIST TECHNICAL HANDBOOK 26.1 - MITEK BALTIC



POSI-JOIST.SE

Posi™-Joist

THE APPARENT SOLUTION FOR FLOOR AND RAFTER BEAMS WHEN EASY ACCESS FOR ELECTRICAL AND MVHR SYSTEMS IS NEEDED.

Please keep in mind that each project and design is unique and demands construction documents approved by a licensed construction engineer. MiTek cannot be held accountable for any errors in project planning, handling, or execution.



GLOSSARY

POSI™	General name of the family of Posi products and systems.
POSI™-STRUT	Steel web, a component found in all Posi products. A standard Posi-Strut is shaped as a V (full V) and can be split into two halves (half V). Abbreviation PS.
POSI™-JOIST	A manufactured joist used in floor applications (abbreviation PJ).
POSI™-RAFTER	A manufactured joist used as rafters in a roof (abbreviation PR).
POSI™ FLOOR SYSTEM	Basic, Min, Class B and Class A.
STRONGBACK	A reinforcement beam that runs perpendicular through the Posi-Joists.
CHASE OPENING	The open mid-section of a Posi-Joist divided by vertical timber webs.
NAIL PLATE	The steel plates used to connect the timber in a Posi-Joist.
END VERTICAL	The end piece of a Posi-Joist.
TOP CHORD	The top timber flange of a Posi-Joist.
BOTTOM CHORD	The bottom timber flange of a Posi-Joist.
NOGGIN	Short piece of timber used perpendicular between the joists in a floor system.
BOTTOM PLATE	Horizontal member providing support for load bearing wall or floor system.
TOP PLATE	Horizontal member at the top of a timber-framing wall.
LINTEL	Beam providing support for your joists.
BATTEN	Timber, usually no more than 50 mm in thickness and 63 mm in width.
STUD	Timber usually 34–63 mm thick and 70–125 mm wide.
CEILING STUD	Timber beam fixed on the sound profile 70x45 mm.
SOUNDPROFILE	MiTek Soundprofile 80, as shown in the image on page 33.

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AN INTRODUCTION TO POSI™-JOIST AND POSI™-RAFTER



AN OPEN JOIST SYSTEM – STEEL AND WOOD HYBRID

POSI™ COMPONENTS

ECONOMY

PERFORMANCE

FLEXIBILITY

Posi™-Joists – Parallel top and bottom timber chords (timber flanges), with pressed steel webs in a diagonal V pattern on one side and mirrored on the other side.

The web arrangement is symmetrical relative to a plane aligned with the length and depth of the top and bottom chords. The webs are always placed in pairs on the front and back faces of the joist to optimise capacity.

AN OPEN JOIST SYSTEM – STEEL AND WOOD HYBRID

Posi-Joist is a light-weight floor system combining the lightness of timber with the strength of the Posi-Strut steel web. Posi is also well suited for flat and pitched roofs then called Posi-Rafter.

Posi-Joist is a tested product with European technical approval, ETA-20/1169.

The Posi-Joist system gives you great architectural design freedom and easy installation. The system is lightweight, which makes installation quick and easy, even without a crane (note that Posi cassettes requires crane installation).

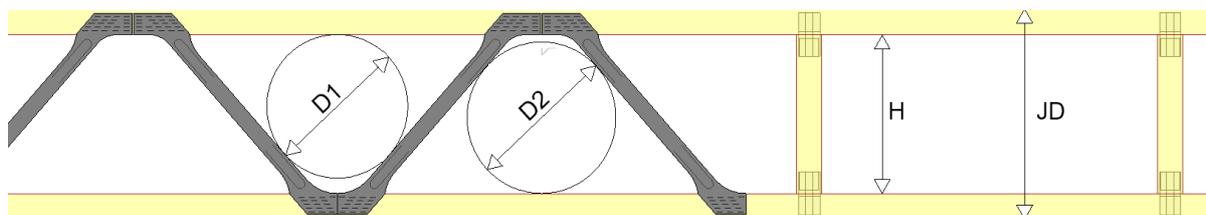


The open design contributes to the low weight of the beam, which simplifies assembly and subsequent installations.

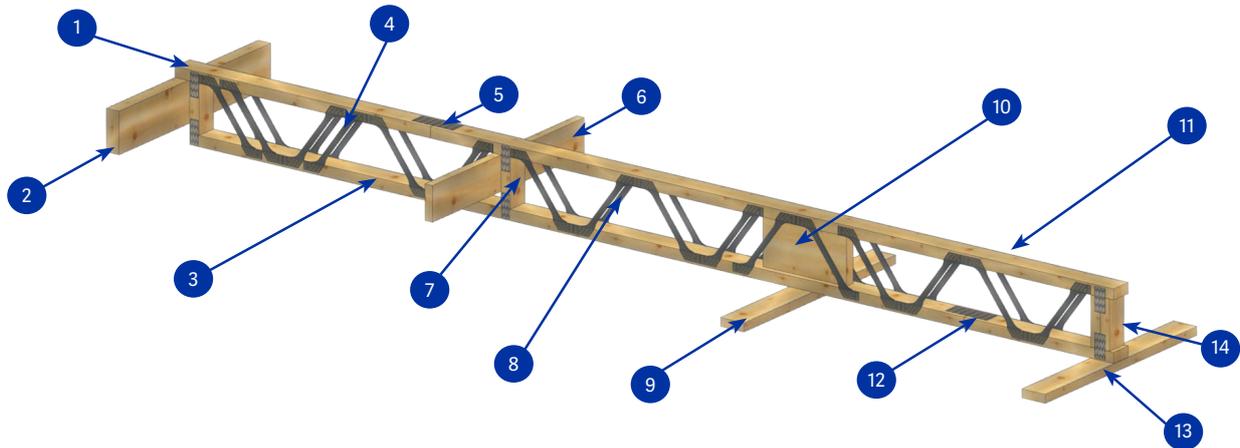
Posi beams are customised to the specific project. The height is adjusted in relation to the span, loads, services and insulation dimensions. Posi Joists can be specified in the following six depths.

POSI™-JOIST SPECIFICATIONS (BASED ON 45 MM TIMBER DEPTH)

Posi-Strut	D – Diameter between Posi-Struts (for service installations) H – Chase-opening height (for service installations)			JD – Joist Depth
PS8	D1 = 108 mm	D2 = 108 mm	H = 108 mm	198 mm
PS9	D1 = 131 mm	D2 = 131 mm	H = 131 mm	221 mm
PS10+	D1 = 159 mm	D2 = 159mm	H = 159 mm	249 mm
PS12	D1 = 210 mm	D2 = 210 mm	H = 210 mm	300 mm
PS14	D1 = 252 mm	D2 = 266 mm	H = 279 mm	369 mm
PS16	D1 = 270 mm	D2 = 292 mm	H = 327 mm	417 mm



POSI™ COMPONENTS



- | | |
|------------------------|-------------------|
| 1. Top Chord supported | |
| 2. Stud/wall plate | |
| 3. Bottom chord | 9. Counter batten |
| 4. Posi-Strut (half V) | 10. Scab |
| 5. Plated splice | 11. Top chord |
| 6. Strongback | 12. Plated splice |
| 7. Vertical web | 13. Support |
| 8. Posi-Strut (full V) | 14. End vertical |

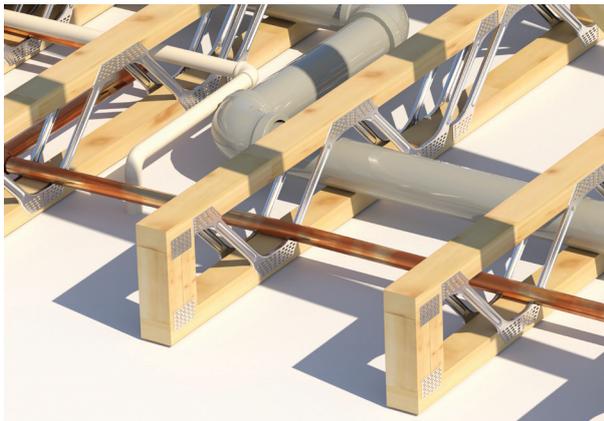
In a Posi-Joist, the shear forces are absorbed by the steel webs, Posi-Struts. To increase the shear capacity of the beams, double webs can be fitted where loads require it.

This can be calculated in the software MiTek PAMIR.

ECONOMY

The open system eliminates the need for drilling, milling, or creating other openings for ventilation, water, electricity, or other piping. This results in cost and time savings for installation and design calculations while maintaining the integrity of the floor/roof structure.

Posi producers manufacture Posi and its cassette system (see page 42) in a controlled factory environment, ensuring a stable humidity and temperature level, which results in guaranteed quality. Project-adapted, prefabricated Posi-Joists or cassettes are delivered ready for quick installation on site.



Easy pipework in the open system.



Increased flexibility for various services.



Posi-Joists are produced in the Posi-producer factories and delivered to the construction site customised to the specific project.

Performance

The Posi-Joist floor system has a large span in relation to its weight, vibration and deflection values, compared to many other types of floor systems. This combination delivers excellent sound and acoustic values. Sound class A is achievable using standard dry products.

Posi-Joists are very dimensionally stable and less affected by shrinkage than solid joists. The wide fixing surface makes floor laying very easy.

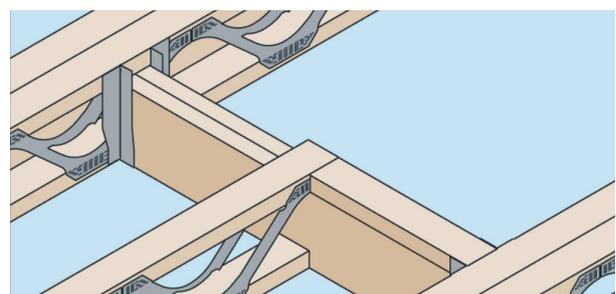


Posi manufacturing.

FLEXIBILITY

Posi-Joists are ideal for flooring and roofs. Design flexibility is inherent in the concept of the Posi-Joist. There are also options to choose solid insulation materials (insulation boards) or injected loose insulation.

Additionally, there are various suspension/fixing solutions to choose from, accommodating specific project conditions, materials, construction techniques, and environments. Connection details can be further explored in the design chapters on Posi-Joist and Posi-Rafter.



Top-hung joists are supported by noggins, without the need for additional hangers.

FLOOR SYSTEMS AND SPANS



THE FUTURE OF FLOOR SYSTEMS

POSI™-JOIST FOR GROUND FLOOR AND CRAWL SPACE

SPAN CHART

POSI-JOIST CALCULATOR

INCREASED FLEXIBILITY AND SPAN WITH TRIMMABLE BLOCKS

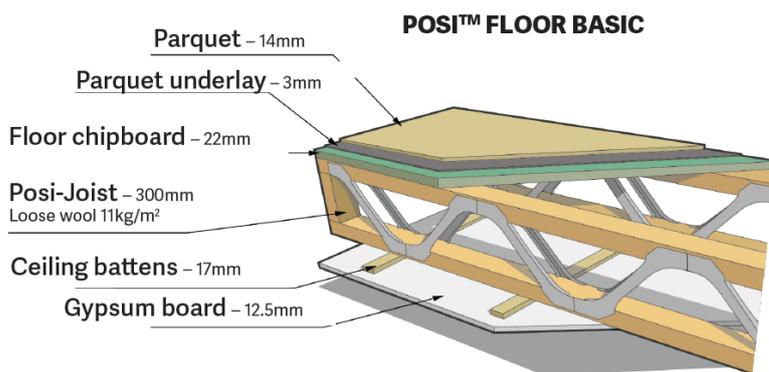
THE FUTURE OF FLOOR SYSTEMS

Acoustic, vibration, and deflection tests conducted in Sweden in 2020 have led to the development of four standard floor systems that cover all necessary floor solutions.

POSI™-Floor BASIC

Single-family dwelling / apartment

Parquet	14 mm
Parquet underlay	3 mm
Floor chipboard	22 mm
Posi-Joist PS12	300 mm
Ceiling battens 17x45	17 mm
Gypsum board	12,5 mm
Total floor weight	59 kg/m²
Thickness	368 mm



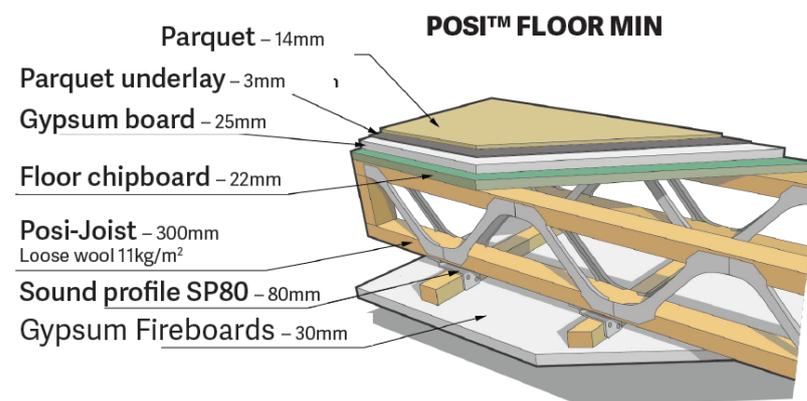
POSI™-Floor MIN

Minimum sound requirement (Swedish building regulations).

Airborne sound reduction	>52dB *)
Impact sound	<56dB *)

*) DnT,w,50hz. / LnT,w,50hz. SS-EN ISO 10140-2/3 16283-1/2

Parquet	14 mm
Parquet underlay	3 mm
Gypsum board	25 mm
Floor Chipboard	22 mm
Posi-Joist PS12	300 mm
MiTek Sound Profile 80	80 mm
Gypsum Fireboards 2x15	30 mm



Total floor weight	98 kg/m²
Thickness	474 mm

FLOOR SYSTEMS & SPANS

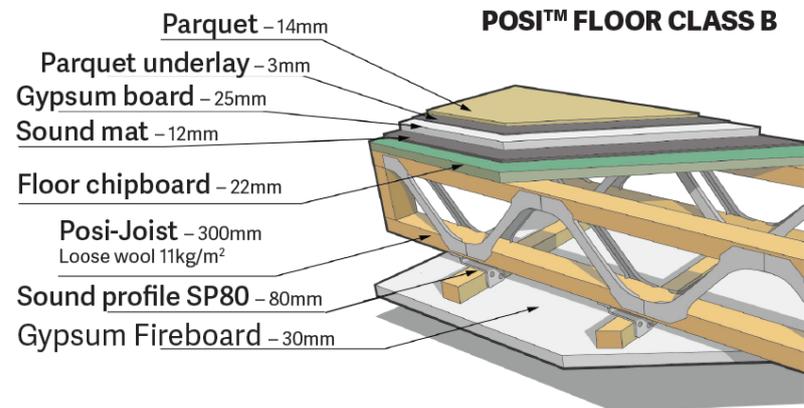
POSI™-Floor Class B

Airborne sound reduction **>56dB *)**

Impact sound **<52dB *)**

*) DnT,w,50hz. / LnT,w,50hz. SS-EN ISO 10140-2/3 16283-1/2

Parquet	14 mm
Parquet underlay	3 mm
Gypsum boards 2x12,5	25 mm
Sound mat dB4	12 mm
Floor chipboard	22 mm
Posi-Joist PS12, with loose mineral wool 11kg/m ²	300 mm
MiTek Sound profile	80 mm
Gypsum Fireboards	30 mm



Total floor weight **102 kg/m²**

Thickness **486 mm**

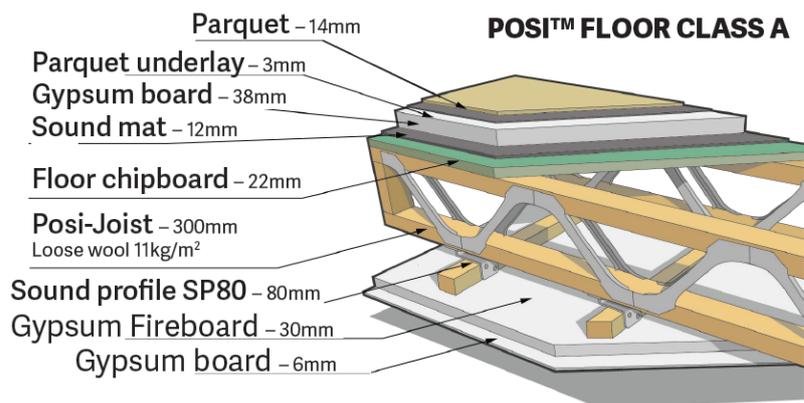
POSI™-Floor Class A

Airborne sound reduction **>60dB *)**

Impact sound **<48dB *)**

*) DnT,w,50hz. / LnT,w,50hz. SS-EN ISO 10140-2/3 16283-1/2

Parquet	14 mm
Parquet underlay	3 mm
Gypsum boards 3x12,5	38 mm
Sound mat dB4	12 mm
Floor chipboard	22 mm
Posi-Joist PS12, with loose mineral wool 11kg/m ²	300 mm
MiTek Sound profile	80 mm
Gypsum Fireboards	30 mm
Gypsum board	6 mm



Total floor weight **122 kg/m²**

Thickness **505 mm**

POSI™-JOIST FOR GROUND FLOOR AND CRAWL SPACE

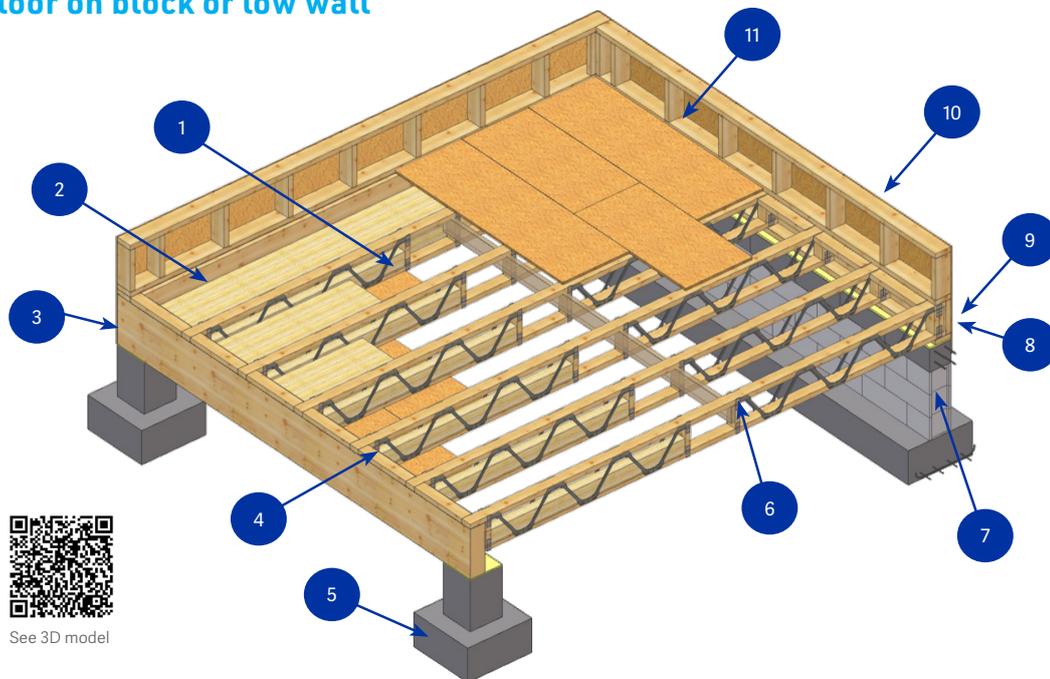
Posi-Joist can also be used at ground level. This floor is hung or stood at a frost-free distance, with e.g. :

- Concrete blocks
- Piles
- Crawl space
- Masonry low walls

ADVANTAGES

- Ideal solution for timber frame structures
- Possibility of prefabrication using floor cassettes
- Integration of ventilation screen and ducts
- Quick installation and easy handling
- Adaptable to all types of flooring

Posi™ floor on block or low wall



- | | | |
|----------------------|---|---------------|
| 1. Blind floor board | 6. Strongback | 10. Framing |
| 2. Insulation | 7. Masonry wall | 11. Chipboard |
| 3. Bottom plate | 8. Bottom plate insulation - vapour barrier | |
| 4. Filler | 9. Cover stud | |
| 5. Concrete block | | |

An outdoor-ventilated crawl space should follow the advice and instructions provided by the national wood industries principle sketches (ie. Svenskt trä for Sweden). A natural or mechanical ventilation must be installed for effective aeration of the crawl space.

SPAN CHART

The possible length of a Posi-Joist, i.e. the distance between two support points, depends, among other things, on:

Floor type:

→ e.g. Posi Floor BASIC, Posi Floor Min, Posi Floor Class A, etc. A complete floor weighs differently depending on the type.

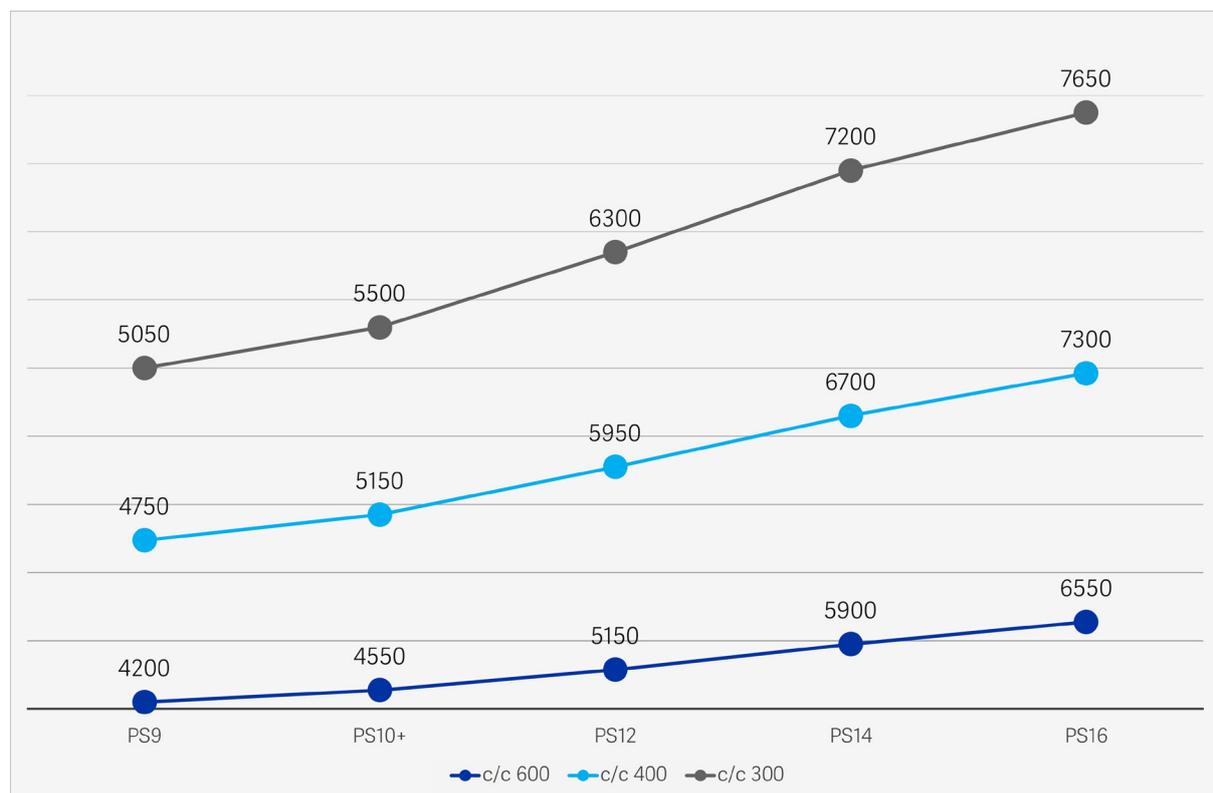
Spacing:

→ A smaller spacing between Posi-Joists will clear longer spans. Commonly used spacings are 600mm and 400mm.

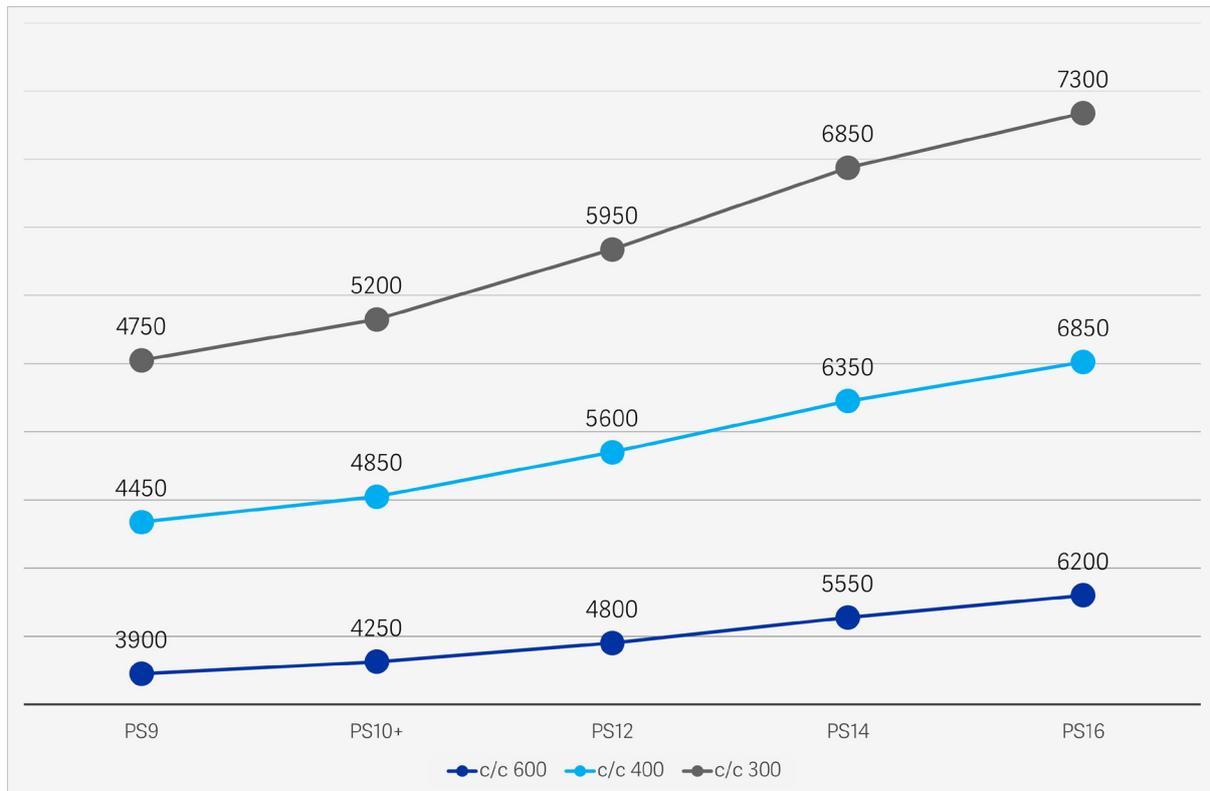
Posi-Strut:

→ The steel webs come in different sizes, where a larger size corresponds to a higher beam with a greater load-bearing capacity. Posi-Struts are available in the sizes PS8, PS9, PS10+, PS12, PS14 and PS16. However, PS8 is low and accommodates few installations, which means it is rarely used and is therefore omitted from the span tables below.

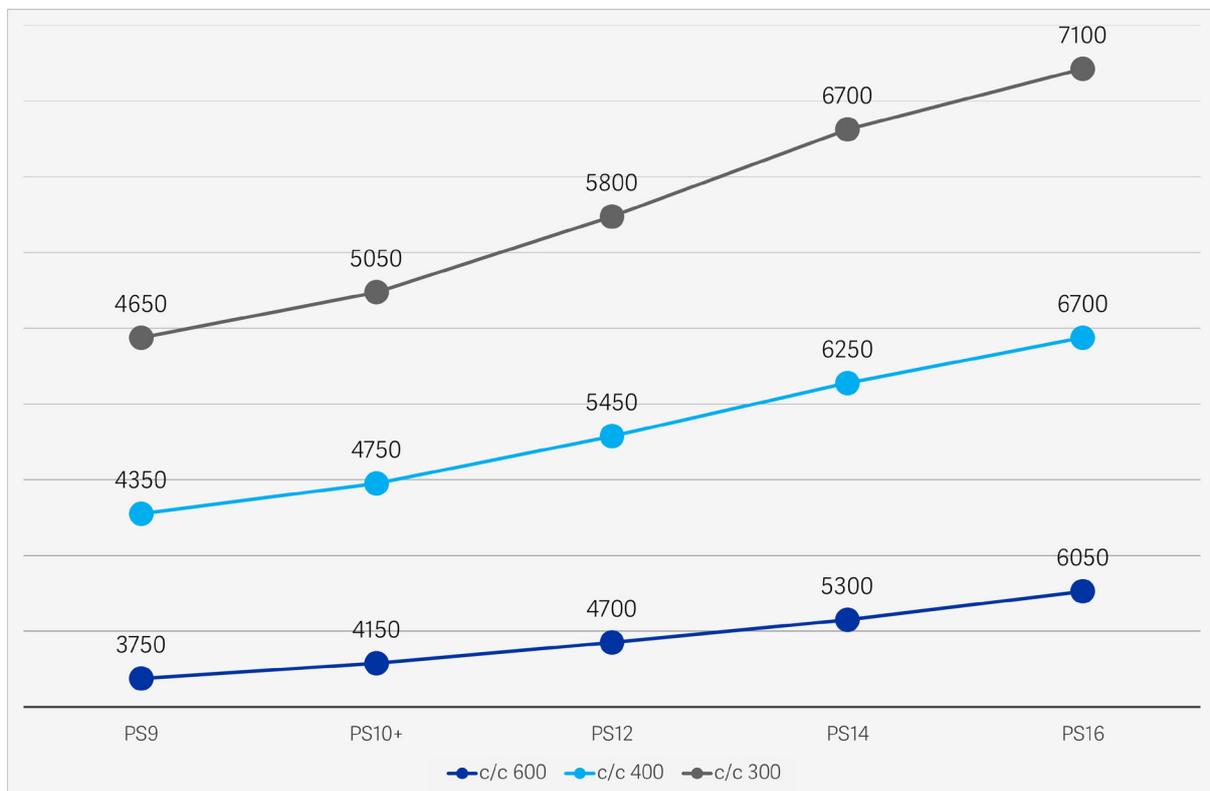
POSI™-FLOOR BASIC, APPROX. 60 KG/M² (SINGLE FAMILY DWELLING)



POSI-FLOOR MIN, APPROX. 100 KG/M²



POSI-FLOOR CLASS A, APPROX. 122 KG/M²



POSI CALCULATOR

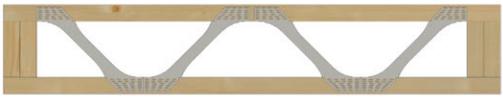
For additional information and examples of different spans, you can also use our online calculator:

MiTek

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[KONTAKTI](#)
[JAUNUMI](#)

Posi™-Kalkulators

Projekta tips
Starpstāvu pārsegums



Konfigurācija
Biroju ēka_Mini_AP

Slodzes dati

- Gridas pastāvīgā slodze: 500 kN/m²
- Griestu pastāvīgā slodze: 500 kN/m²
- Lietderīgā slodze grīdai: 3000 kN/m²
- Starpsiena: 500 kN/m²

Laidums (mm)
3000

(2000 - 5700)

Maksimālais augstums (mm)
300

(221 - 417)

MEKLĒT

Results

Rādīt 5 ▼ ierakstus

Posi size	Joist Depth (mm)	Timber Width (mm)	Spacing (mm)	Span (m)	Deflection Value (mm)
▶ PS9	221	95 x 45	600	3.000	7.1
▶ PS9	221	95 x 45	400	3.000	5
▶ PS10	249	95 x 45	600	3.000	6.5
▶ PS10	249	95 x 45	400	3.000	4.1
▶ PS12	300	95 x 45	600	3.000	5.2

Atlasīti 1 līdz 5 no 6 ierakstiem

Pirmā
Iepriekšējā
1
2
Nākošā
Pedējā

Ja jūsu prasības pārsniedz pieejamās standarta konfigurācijas vai nepieciešama papildu informācija specifikācijai, lūdzu, sazinieties ar mūsu projektēšanas komandu pa tālruni support.baltic@mii.com.

Lūdzu, nemieta vērā, ka mūsu Posi-kalkulators ir indikatīvs rīks, un visi dati ir jāapstiprina pie izvēlēta ražotāja. Noklikšķiniet uz pogas "Atrast ražotāju" zemāk, lai atrastu ražotājus savā reģionā.

You can find the Posi calculator on MiTek's website; see the following link:
<https://www.mitekba.lt/posi-calculator/>.

INCREASED FLEXIBILITY AND SPAN WITH TRIMMABLE BLOCKS



Trimmable blocks will help you achieve on-site adjustability with Posi-Joists, providing flexibility.

These trimmable blocks can also be used to create stiffer Posi-Joists, capable of handling larger spans.

Trimmable blocks also enable volume production with more efficient production times and economics.



POSI™-JOIST DESIGN



CONSTRUCTION DETAILS

STRONGBACKS

DESIGN

FIRE

Posi-Joists are designed using our software MiTek Pamir, and to optimise the performance of the joist, the designer can choose from several different design features.

CONSTRUCTION DETAILS

The Posi-Joist can be adapted to a wide range of conditions to optimise on-site assembly.

Timber Frame Wall

The best support for a Posi-Joist in an intermediate floor

application is to have it hung from its top chord. This will give you the best conditions for longer spans, minimal vibrations and better sound and acoustic insulation (as verified by sound testing 2020).

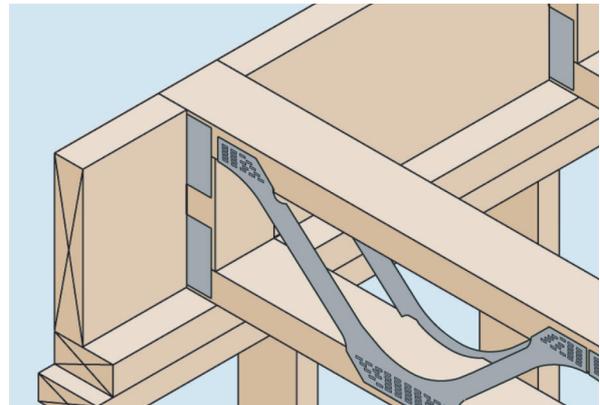
As the images to the right show, this will also eliminate any need for mounting profiles. The chord inset should be >45mm.

Please observe that a gap is needed between the last noggin and the wall, so that the Posi-Joist hangs freely.

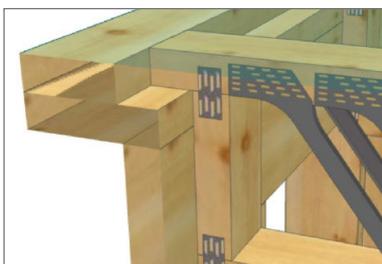
A Posi-Joist supported by a timber frame wall can also be placed with the bottom chord directly on a horizontal stud or top plate, as shown below.



Posi-Joist resting on a horizontal beam connected to the wall. For a safe installation process, angle brackets have been used to fasten the Posi-Joists to the wall. Make sure not to damage existing nail plates.



Posi-Joist with bottom chord resting on a top plate.



Posi-Joist top chord with an 45mm inset resting on the wall plate.



Top-chord-supported Posi-Joist resting on on a face-mounted lintel.



Top-chord-supported Posi-Joist resting on double LVL beams.

POSI-JOIST DESIGN

Masonry wall

Posi-Joists can also be built into masonry walls, as illustrated in the images to the right.

This method of construction meets the thermal and air leakage requirements of Swedish Building regulations, provided that the perimeter of the Posi-Joist is sealed in accordance with the building designer's specification.

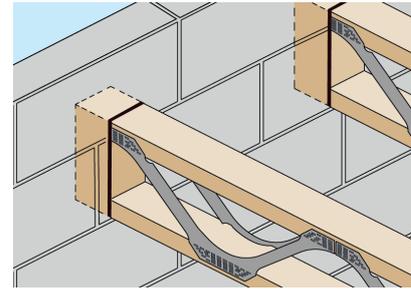
Alternative proprietary built-in constructions may be used, provided that they have been demonstrated by third-party tests to meet or exceed the air leakage performance of the construction and comply with the energy requirements.

Posi-Joists can be supported in masonry hangers at an external masonry wall. This method of construction meets the thermal and air leakage requirements of Building Regulations, provided that the building designer's specifications are respected.

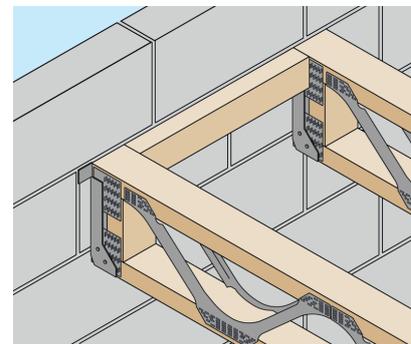
Ensure that lateral restraint to the wall is checked; noggins may be required. See the image to the right. Only use an approved hanger.

Steel beam

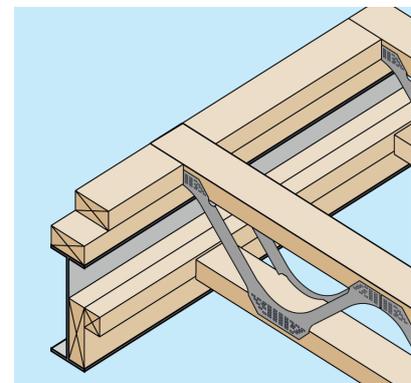
The Posi-Joist is suspended from a steel beam in the same manner as it is from a wall. For example, the Posi-Joist can be hung with the top chord resting on top of the steel beam. Fixing can also be achieved by installing horizontal timber members within the steel beam, on which the Posi-Joist can hang or be secured with hangers. See example images below.



The Posi-Joist is sealed and insulated in accordance with the designer's specification that meets the energy requirements.



Posi-Joists fixed with hangers and noggins according to designer's specification.



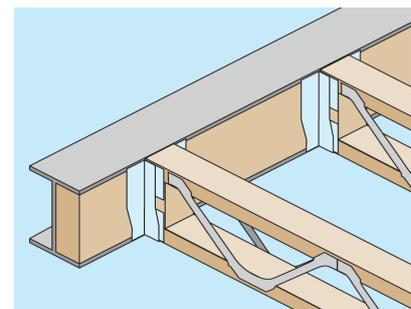
Fixing to steel beam. Top-chord resting on timber studs on top of the steel beam.



Top-chord-supported Posi-Joist on a steel beam.



Posi-Joist hung on steel beam, with no need for hangers.



Fixing to steel beam, with hangers.

STRONGBACKS

Strongbacks should be used for spans over four metres.

A solid timber member running perpendicular to the Posi-Joists and connected to them will provide effective load sharing from adjacent joists, significantly increasing the floor's transverse stiffness and improving its vibrational performance

Strongbacks can be fitted as one long member or shorter ones overlapped on each side of the vertical timber web. For more installation information, see the chapter "Posi-Joist On Site" (page 29) under the "Strongbacks" heading.

An acceptable floor structure takes into account both static and dynamic criteria. Deflection,



Strongback bracing is installed for spans exceeding four metres

elasticity and vibrations are properties that are important for perceived quality and must be dimensioned correctly.



Overlapping strongbacks.

DESIGN

MiTek Pamir is the software used to calculate a Posi-Joist floor system according to the Eurocode and your country's national annex.

The designer is responsible for the design and the design checks. Consideration must be given to the existing loadings, which include, for example, dead load, imposed loads and additional loads, all of which can be applied in Pamir. Please get in touch with our design office for calculation services and software support.

FIRE

Simulations and calculations on Posi flooring of the Sound Mini class have been carried out by Jörgen Thor at the third-party company Brandskyddslaget. He concluded that the fire resistance class REI60 is not only met but exceeded if the bottom chord is protected with 2x15 mm fire-resistant plasterboards.

Any ventilation ducts should be further protected to prevent the addition of extra heat. Ceiling penetrations and edges shall have an appropriate fire resistance seal. More information can be found in the subheading "Fire resistance" on page 39.

POSI™-RAFTER DESIGN



POSI-RAFTER

POSI-ATTIC

Posi™-Rafters are designed using our software MiTek Pamir. This chapter highlights several construction details specific to roof applications.

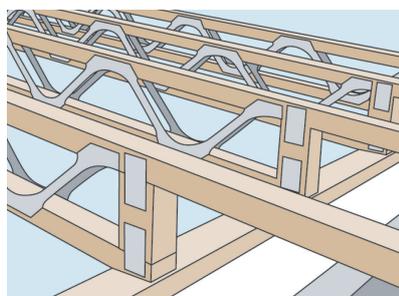
POSI™-RAFTER

Posi-Rafters, like Posi-Joists, are parallel wooden chords with steel webs mounted between them. They have been used in roof applications in other European countries for a long time. Posi-Rafters are customised to the specific project, produced in a factory environment and transported to site as single beams, or roof cassettes, which allows for quick on-site assembly.

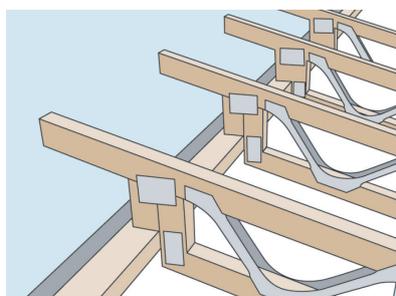
Posi-Rafters are suitable for both flat and pitched roofs. They also contribute to a better U-value due to the avoidance of the thermal bridges that occur with solid wood.

As Posi-Struts are available in several different heights, there are many opportunities for optimisation and adaptation to the specific project. Expensive fittings and fasteners can also be minimised in many cases with the help of smart detail solutions.

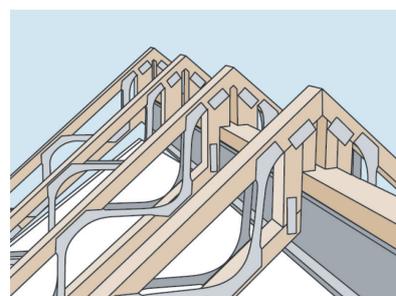
Below are a few details that can be used to simplify the installation of Posi-Rafters.



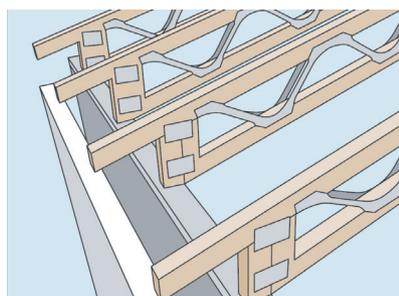
Chamfered bottom chord to avoid notching wall-plate



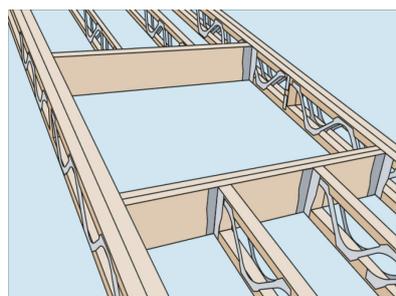
Plated end detail with support on wall plate



Posi-Rafters with support on a ridge-steel beam



Plated end detail with support on wall plate.



Solid timber as an opening binder.

POSI-RAFTER DESIGN



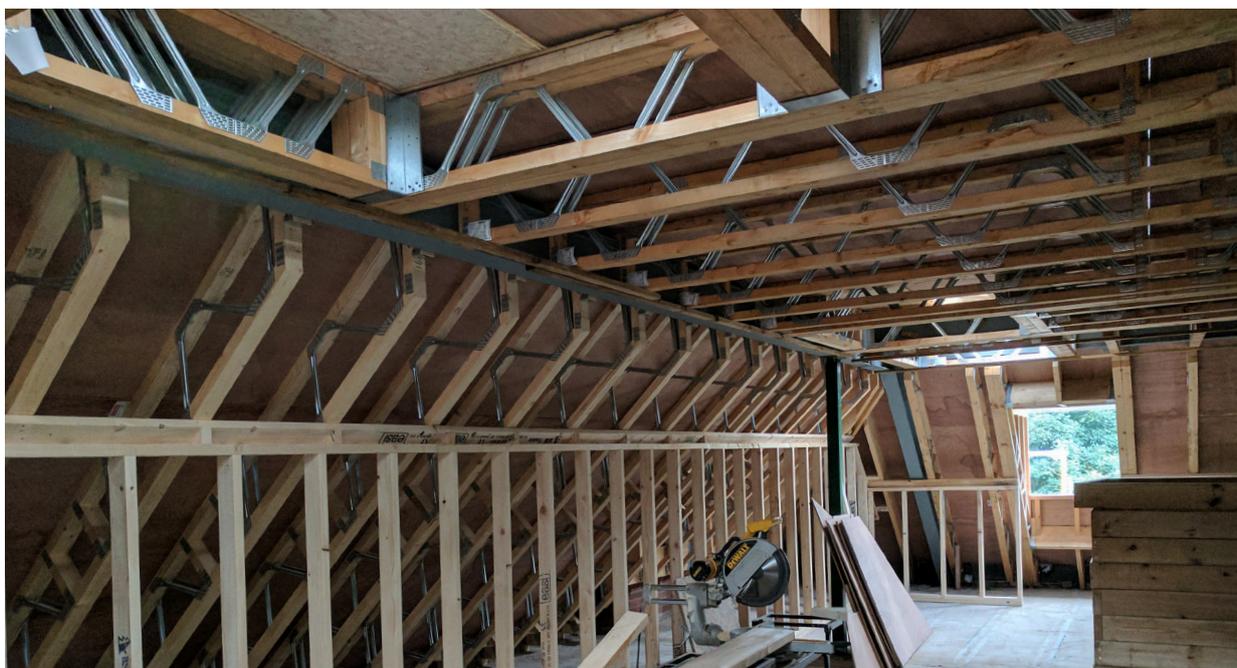
Posi-Joist for vaulted ceiling with support on ridge-steel beam.



The Posi system used in roof construction: Posi-Rafter

POSI™-ATTIC

Posi-Attic combines the advantages of the Posi-Joist system with the advantages of a regular Attic frame. This solution makes the on-site-attic-floor installation easy, while also allowing subsequent installations to be hidden in the joists without further impact on them.



Plated end detail with wall plate support.



Posi-Attic erection on site.

POSI™-JOIST ON SITE



SITE HANDLING AND STORAGE

RECEIVING DELIVERY

LABELLING

STRONGBACKS

STORAGE

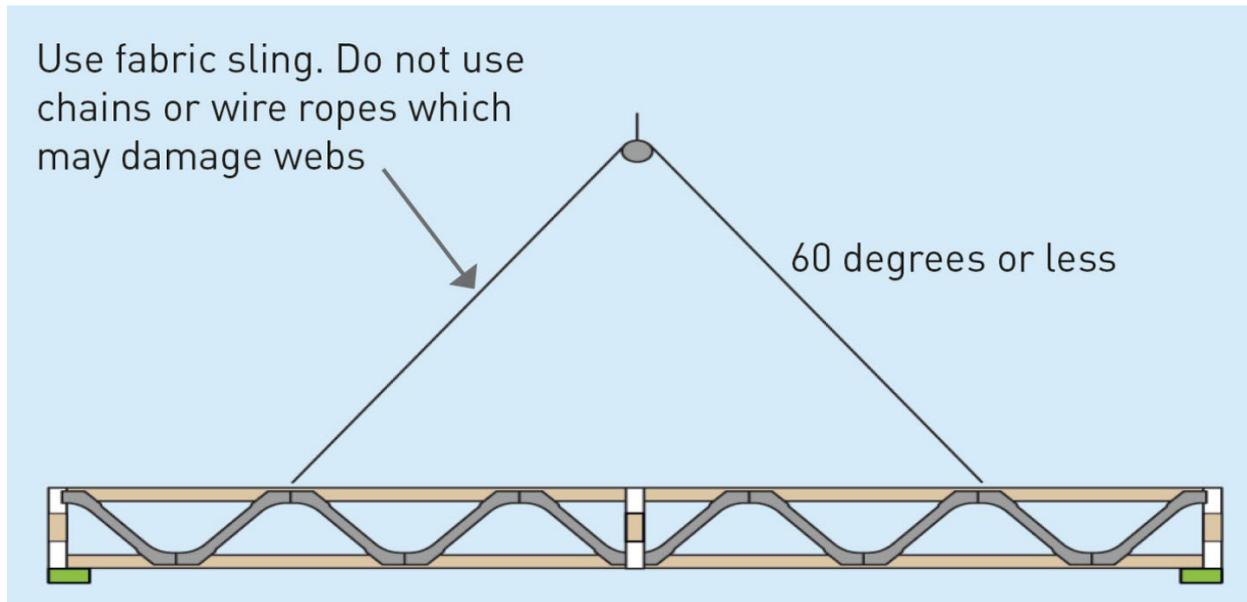
DOS AND DON'TS

SITE HANDLING AND STORAGE

Lifting and moving Posi-Joists should be done with a fabric sling (not with chains or wire ropes).

When loading or offloading with a crane, slings

should always be attached to the timber flanges and not to the metal webs, to avoid buckling (ETA 20/1169: 3.8.3).



Slings should be attached at panel points closest to the quarter points of the Posi-Joists as shown above. The angle between the two slings shall be 60° or less.

RECEIVING DELIVERY

Make sure that the Posi-Joists have been clearly marked and labelled by the manufacturer, and that you have corresponding layout drawings and installation instructions.

ETA 20/1169: 3.8.2.1 states that it is the manufacturer's responsibility to ensure that

the specific markings/instructions for installation are provided to the purchaser.

For larger projects, deliveries are made in the correct erection order to avoid confusion.

POSI-JOIST ON SITE

LABELLING

Labelling is usually done on the left side of the top chord and >20 cm from the end to avoid it being covered by walls. A corresponding labelling is also done on the layout drawing to prevent misdirection.

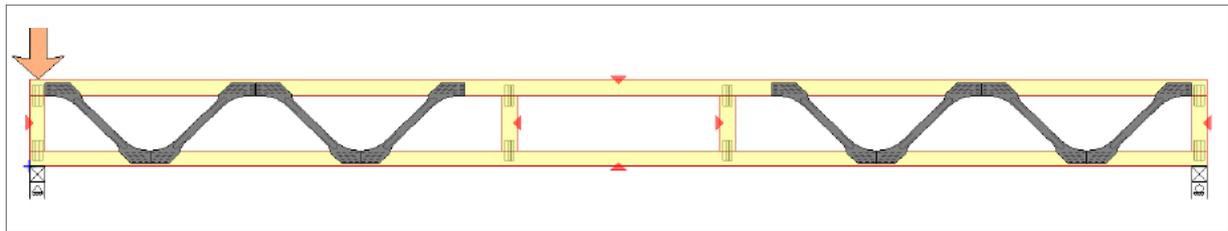


Orange marking on the top left side of the Posi-Joist, together with labelling.



Example of a Posi-Joist layout drawing from Pamir.

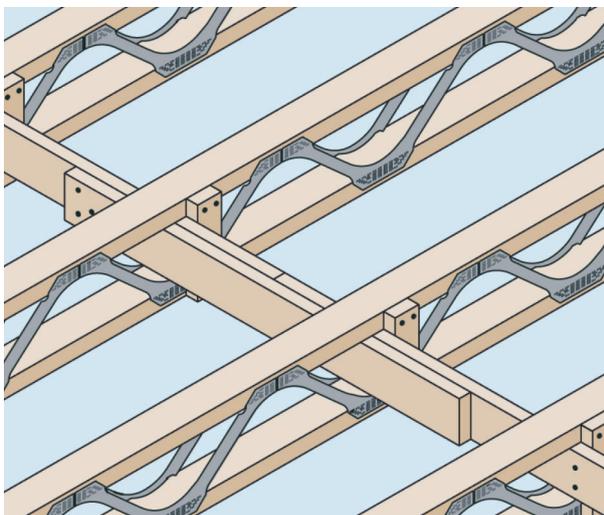
TOP LEFT SIDE MARKED WITH ORANGE PAINT



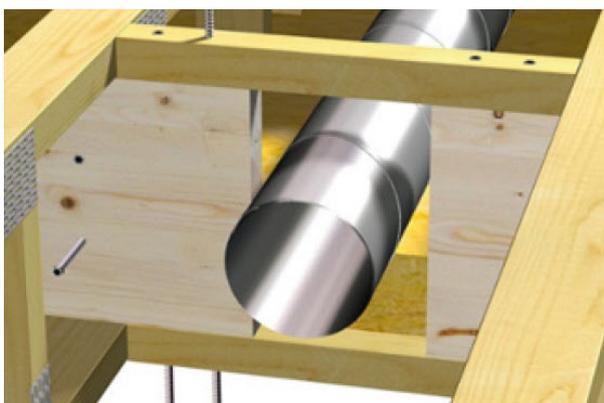
Example of clear instruction on the Posi-Joist drawing.



Strongbacks fitted on either side of the vertical timber web.



Strongbacks spliced and connected to surface-mounted vertical noggins



Strongback reinforcement.

STRONGBACKS

Strongbacks should be used for spans over four metres. A solid timber member is connected perpendicularly to all Posi-Joists, providing an effective load distribution system between adjacent joists.

This greatly increases the floor's transverse stiffness and improves its vibration performance. Experience shows that, due to working angles, it is easier to install the strongbacks before all Posi-Joists are in place.

The strongbacks can be laid alternately on each side of the vertical webs, as shown in the bottom most image below or spliced as shown in the illustration to the right.

They should be fixed with two wood screws from the side and two wood screws from above (screw dimension: 5/6x90). The bracing is fitted against the top chord of the Posi-Joists. The illustration to the right depicts a solution with stabilisers (vertical noggins) fixed to the face of the Posi-Joist, as no vertical webs are available as fixing points for the strongback. Strongbacks can be reinforced (shown in the image below) if a split is needed for pipework.

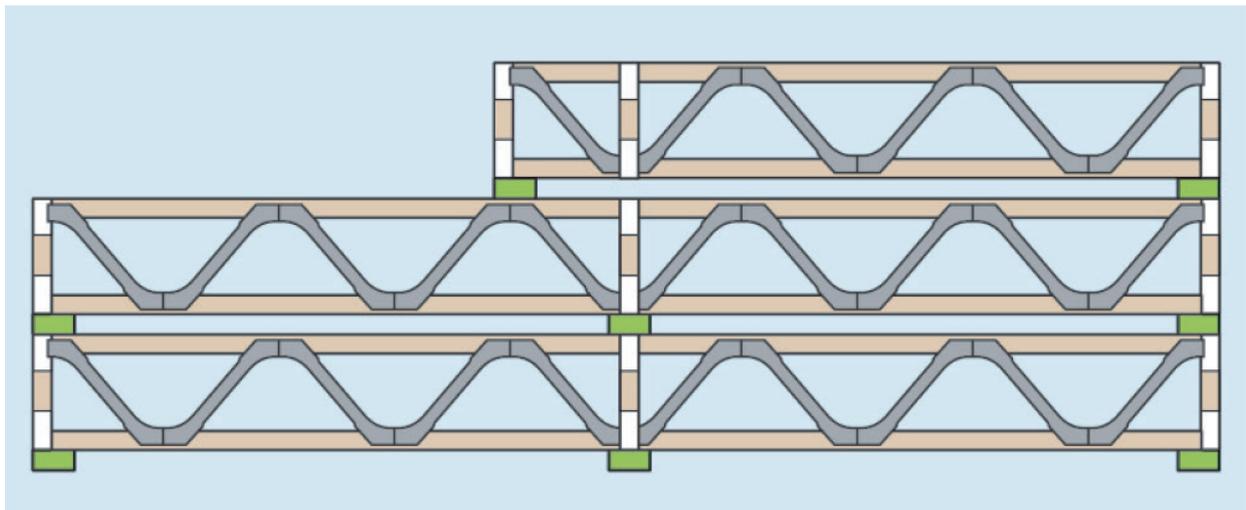
STORAGE

Storage on site should be for a limited period of time prior to erection of the Posi-Joists.

Posi-Joists should either be stored vertically or on the flat on a plane surface. If stored vertically there should be intermediate bearers at node points not within the bay of a joist, as shown below.

If stored in a flat position, sufficient bearings should be provided to prevent excessive lateral bending.

Special precautions should be taken when stacking floor cassettes to prevent the stack lozenging in storage.



Bearers at node points.

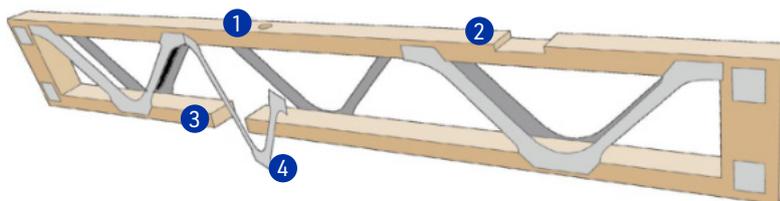
DOS AND DON'TS



- Store as shown in handling and storage section
- Use the open web feature for services
- Lift the Posi-Joists in a vertical position
- Protect the Posi-Joists from inclement weather – rain, moisture and direct sunlight



1. DON'T Drill holes in the timber
2. DON'T Cut notches in the timber
3. DON'T Cut through the timber chords
4. DON'T Cut or remove the metal webs



Make sure you INFORM all professions with access to the construction site.

TESTING AND RESULTS



SOUND AND ACOUSTICS IN POSI-JOIST FLOORS

POSI-JOIST FLOOR CASSETTE

VIBRATION AND DEFLECTION TESTING RESULTS

FIRE RESISTANCE

STEWARDSHIP

The aim is to verify, through laboratory and field tests, system solutions that fulfil Scandinavian legal requirements for sound classes in buildings. It is carried out by following the test regulations SS-EN ISO 10140-2 and -3, using only dry standard products together with MiTek's own range.

SOUND AND ACOUSTICS IN POSI™-JOIST FLOORS

MiTek Sweden has conducted thorough sound tests for both airborne and impact sound in laboratory and field environments, with the purpose of testing, measuring and verifying multi-storey environments.

Vibration/deflection testing, as well as testing using a washing machine spin cycle, have been conducted, all with excellent results using standard dry products.

Delphine Bard, professor of acoustics at Lund University, establishes that a total floor thickness of approximately 500mm is required to achieve Swedish Sound Class A with a lightweight floor system. This is unavoidable unless you are prepared to use specialised components or pour a concrete layer on your lightweight Posi-Joist floor.

Sound and Strongbacks

Spans over four metres need strongback bracing. More strongbacks also contribute to better impact sound and vibration properties. Posi-Joist flooring with strongbacks also offers a more comfortable walking surface.

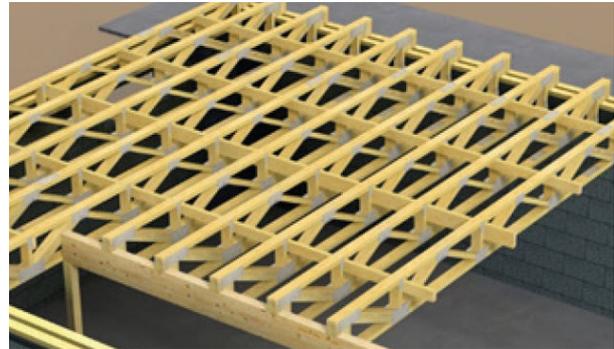
Using two strongbacks instead of one on a Posi-Joist floor with a span of five metres can improve the impact sound value by up to 1 dB.

Suspended ceilings

A suspended ceiling offers improved sound properties, and even impact sound values can be reduced by several decibels. It is also easier with the installation of recessed lighting and wiring in the ceiling. Note that holes can affect airborne sound and should therefore be insulated/sealed.

Additional support battens can be mounted between the ceiling battens (see image below). It will hold the insulation fabric in place and prevent it from transmitting vibrations. They also add additional stiffness to the floor structure, similar to the strongbacks.

To prevent airborne sound from penetrating, the joint between the suspended ceiling and side walls, they should be sealed appropriately, e.g. with elastic sealant or silicone.



Norway have been utilising multiple strongbacks to improve vibration and noise characteristics for years.



A sound profile mounted in this way has been shown after tests to provide the best vibration damping, according to measurements with the *Japanese ball*. Note that if the batten is mounted on the other side of the sound profile (two-sided contact), the vibration damping will not be as effective, although it also fulfils the sound requirements.

** The Japanese Impact Ball is the test that best simulates sound/acoustics from walking sounds of unclad feet, running/jumping children, etc.*



The arrow points to the support batten fitted between the suspended ceiling battens.

TESTING & RESULTS

Wall connection

The connection between the wall and floor is crucial in terms of both airborne and impact sound. The best conditions for longer spans, minimal vibrations and better sound and acoustic insulation are achieved when Posi-Joists are suspended from their top chord. It is also essential that there is a horizontal gap of approximately 1.5 mm between the Posi-Joists and the wall to prevent them from rubbing against each other.

For the higher sound classifications, vibration dampers are also recommended between the wall stud/beam and the Posi-Joist contact surface.

In our tests, we have allowed the Posi-Joist top chord to rest on 25 mm Vibradyn (vibration dampers) without any other form of fastening. Even for Posi-Joist cassettes, it has been shown that the best sound values are achieved when the cassette is lifted into place with 25 mm vibration dampers between the cassette and the wall, without fastening with wood screws or other fasteners.

Insulation in the floor structure

We have conducted tests with various insulation materials, including rock wool, recycled cellulose, wood shavings, and recycled fibreglass. Tests have shown that recycled fibreglass provides slightly poorer airborne sound insulation compared to the other three variants.

Injected loose wool insulation is ideal for use in Posi-Joist joist floors, as it can be easily distributed throughout the joist floor before closing it with decking material. It can also be injected from the side, bottom or top through temporary openings that are then closed and sealed.



The image shows a vibration damper glued to the upper frame of the Posi-Joist.



Loose-wool insulation can easily cover all spaces in the Posi-Joist floor structure.



Insulation with loose wool can be done at the factory for a cassette, or at the construction site.

TESTING & RESULTS

POSI™-JOIST FLOOR CASSETTE

The construction industry is increasingly moving towards off-site construction, where housing components are made in a controlled factory environment. Our Posi-Joist floor cassette plays a crucial role in advancing off-site construction.

For the tests we conducted in 2020, the floors were constructed on site.

In 2021, we focused on developing a cassette system that can be delivered directly from the factory, with only the floor covering needing to be installed on site.

In October 2021, cassettes were built in a factory environment in Sölvesborg, 97% complete (compared to the full construction height). An essential part of the testing was ease of handling, lifting, safety and transport. It turns out that even a floor that is 97% completed can be handled with both vertical and horizontal lifting.

The floor, which was 97% complete, already met the requirements for Swedish Sound Class B before it was shipped from the factory.

The cassettes were transported to the Science Centre at Lund University for testing and evaluation. The results show that our four Posi-Joist systems meet the requirements with flying colours, even for cassette manufacturing, transport and on-site assembly.



A Posi-Joist floor cassette is lifted into place by crane.



Insulation boards are installed within the Posi-Joists, and the cassette is then filled with loose wool at the cassette assembly stage in the factory.



Lifting and moving Posi-Joist cassettes in the factory.

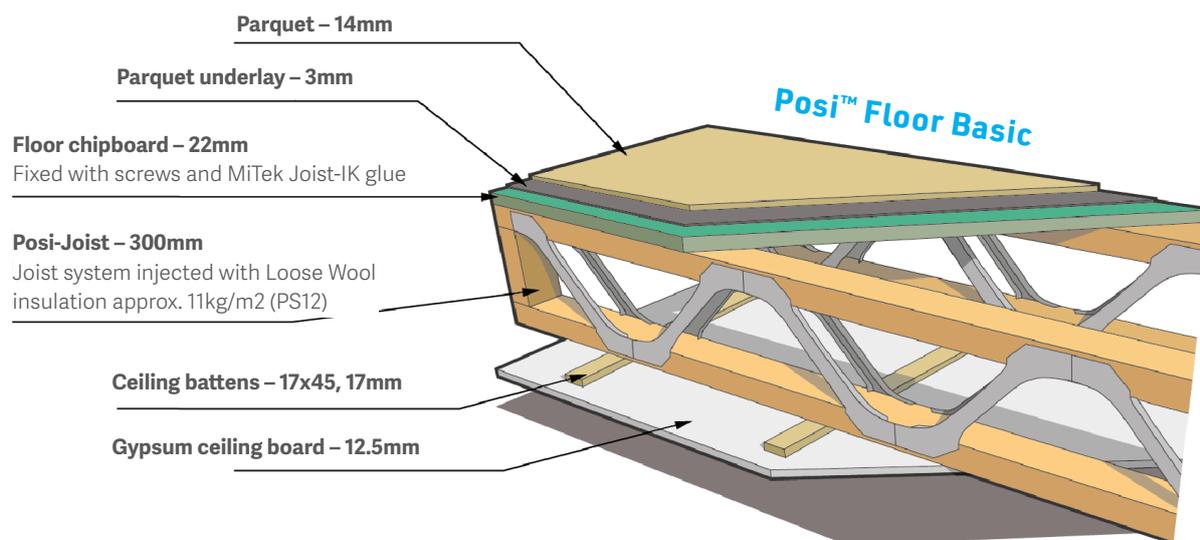


Lifting and moving Posi-Joist cassettes with a crane.

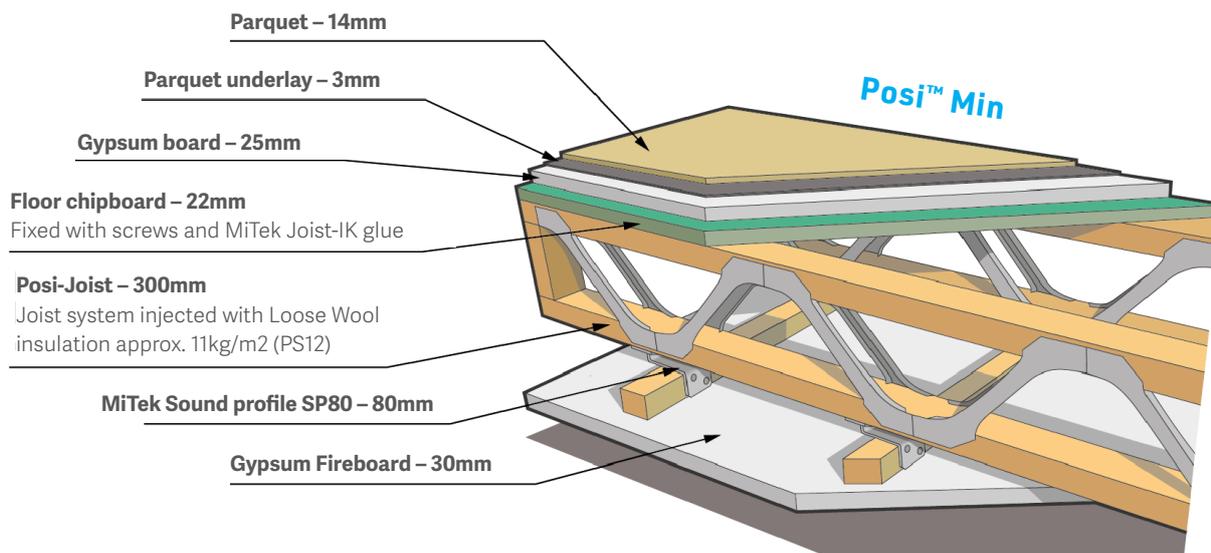
VIBRATION AND DEFLECTION TESTING RESULTS

All lab testing have been done at Lund University and field test are performed together with the company Granholmen Träteknik located in Piteå, Sweden.

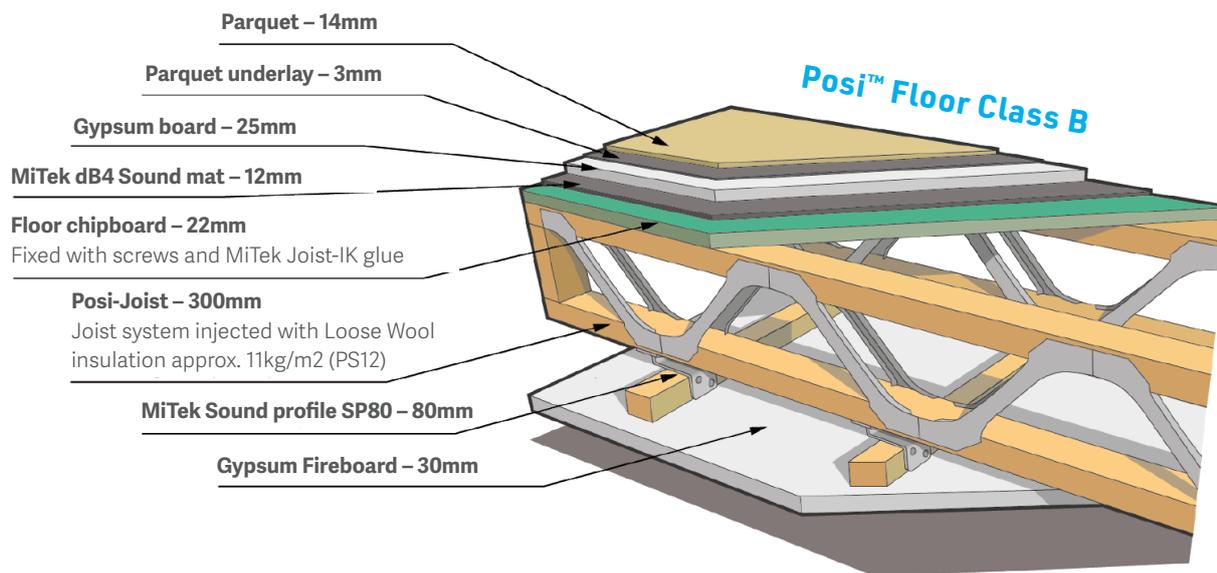
Below is a summary of the materials used and the airborne sound reduction and structure-borne sound measured for floor systems Mini, Class B and Class A.



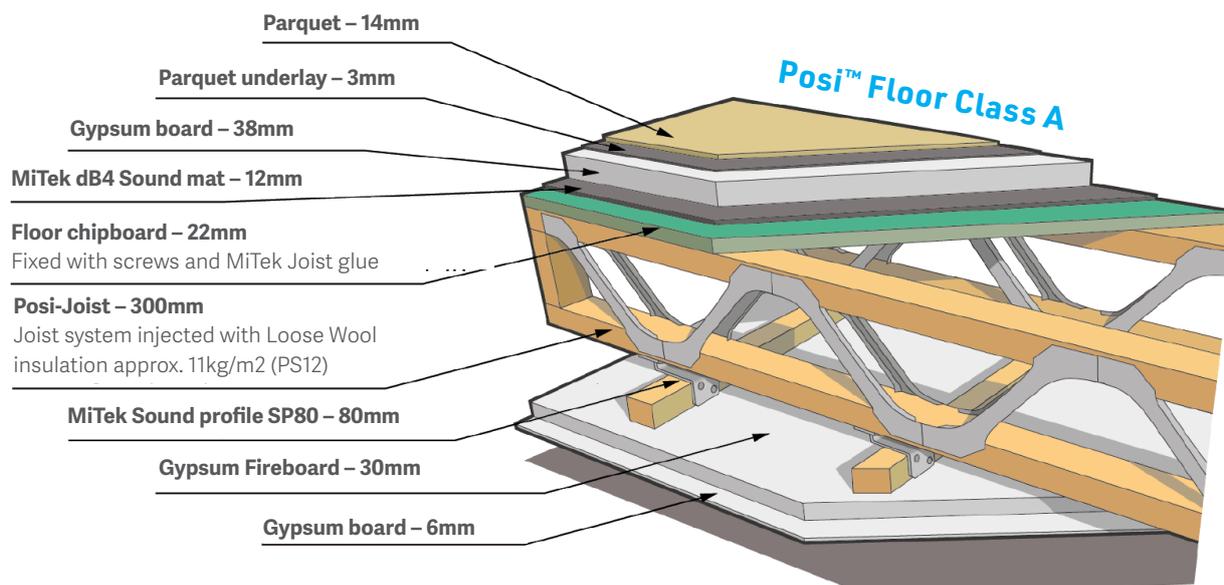
1	Parquet 14mm	14mm oak click-lock	(Kährs)
2	Parquet underlay	3mm, 1.2 m	(Prof)
3	Floor chipboard	P6 22 mm	(Forestia)
	→ Glue MiTek JOIST-ik d4	approx. 0.5 l/m ²	(MiTek)
	→ Screw	4.2x55, c/c=200 mm	
4	Posi-Joist	PS12, 300mm, c/c=600	(MiTek)
	→ Loose wool	approx. 11 kg/m ² , SHT1	(Paroc)
	→ Geo textile	2.7 m, XMS090	(Paroc)
5	Ceiling battens	17x45	
6	Gypsum board	12.5 mm, GN	(Gyproc)
	→ Screw	QS25mm, c/c=400	(Gyproc)



1	Parquet	14mm oak click-lock	(Kährs)
2	Parquet underlay	3mm, 1.2 m	(Prof)
3	Gypsum board	12.5 mm, GG 13 VPL	(Gyproc)
4	Floor chipboard	P6 22 mm	(Forestia)
	→ Glue MiTek JOIST-iK d4	approx. 0.5 l/m ²	(MiTek)
	→ Screw	4.2x55, c/c=200 mm	
5	Posi-Joist	PS12, 300mm, c/c=600	(MiTek)
	→ Loose wool	approx. 0.5 l/m ²	(Paroc)
	→ Geo textile	4.2x55, c/c=200 mm	(Paroc)
6	MiTek Soundprofile 80	c/c=600	(MiTek)
7	Gypsum Fireboard	15 mm, Protect F	(Gyproc)
	→ Screw	QS25 mm, c/c=400	(Gyproc)
8	Gypsum Fireboard	15 mm, Protect F	(Gyproc)
	→ Screw	QS41 mm, c/c=400	(Gyproc)
Airborne sound reduction		>52dB	DnT,w,50
Structure-borne sound		<56dB	LnT,w,50



1	Parquet	14mm oak click-lock	(Kährs)
2	Parquet underlay	3mm, 1.2 m	(Prof)
3	Gypsum board	12.5 mm, GG 13 VPL	(Gyproc)
4	Sound mat MiTek dB4	12 mm	(Aprobo)
5	Floor chipboard	P6 22 mm	(Forestia)
	→ Glue MiTek JOIST-ik d4	approx. 0.5 l/m ²	(MiTek)
	→ Screw	4.2x55, c/c=200 mm	
6	Posi-Joist	PS12, 300mm, c/c=600	(MiTek)
	→ Loose wool	approx: 11 kg/m ² , SHT1	(Paroc)
	→ Geo textile	2.7m, XMS090	(Paroc)
7	MiTek Soundprofile 80	c/c=600	(MiTek)
8	Gypsum Fireboard	15 mm, Protect F	(Gyproc)
	→ Screw	QS25 mm, c/c=400	(Gyproc)
9	Gypsum Fireboard	15 mm, Protect F	(Gyproc)
	→ Screw	QS41mm, c/c=400	(Gyproc)
	Airborne sound reduction	>60dB	DnT,w,50
	Structure-borne sound	<48dB	LnT,w,50



1	Parquet	14mm oak click-lock	(Kährs)
2	Parquet underlay	3mm, 1.2 m	(Prof)
3	Gypsum board	12.5 mm, GG 13 VPL	(Gyproc)
4	Sound mat MiTek dB4	12.5 mm, GG 13 VPL	(Aprobo)
5	Floor chipboard	P6 22 mm	(Forestia)
	→ Glue MiTek JOIST-iK d4	approx. 0.5 l/m ²	(MiTek)
	→ Screw	4.2x55, c/c=200 mm	
6	Posi-Joist	PS12, 300mm, c/c=600	(MiTek)
	→ Loose wool	approx. 0.5 l/m ²	
	→ Geo textile	4.2x55, c/c=200 mm	
7	MiTek Soundprofile 80	c/c=600	(MiTek)
8	Gypsum Fireboard	15 mm, Protect F	(Gyproc)
	→ Screw	QS25 mm, c/c=400	(Gyproc)
9	Gypsum Fireboard	15 mm, Protect F	(Gyproc)
	→ Screw	QS41 mm, c/c=400	(Gyproc)
10	Gypsum Fireboard	6 mm, GSE 6	(Gyproc)
	→ Screw	QD76mm, c/c=400	(Gyproc)
Airborne sound reduction		>60dB	DnT,w,50
Structure-borne sound		<48dB	LnT,w,50

Results of the washing machine vibration test

Three configurations of vibration tests using a washing machine were conducted – without a foot, with a vibration-reducing foot, and with a vibration-reducing foot on a plasterboard substrate with an elastic layer. One sensor for measuring vibration reduction was placed on top of the washing machine, and a second sensor was placed on the floor beneath the washing machine. The results are presented in the table below.

FoHMS:2014	1/3 Octave band [Hz]									LAeq/ LCeq	Required (Min.) LAeq/LCeq
	40	50	63	80	100	125	160	200			
	56	49	43	42	40	38	36	34	32		
Configuration											
Without a foot (1400 rpm)	62	56	62	65	59	50	45	43	43	46/82	30/50
With a vibration-reducing foot (1400 rpm)	59	54	61	55	47	43	44	41	36	38/83	
With a foot, plaster board and elastic layer (1400 rpm)	51	57	44	55	53	55	51	42	26	40/68	
Without a foot (1200 rpm)	50	51	46	63	55	55	43	45	28	42/68	

FIRE RESISTANCE

Fire resistance requirements in Sweden depend on the building class and the activity class to which the building belongs. The most common Swedish homes often have building class 2 or 3 – moderate or low protection requirements – and are in activity class 3.

Based on the building class, each structural element in a building can be assigned a fire resistance class. The following designations are commonly used in such classification systems:

- R** Load-bearing capacity
- E** Integrity
- I** Insulation

R, RE, E, EI and REI are usually accompanied by a number indicating the number of minutes the structural element must withstand a standard fire.

Standard 45 mm thick structural timber typically requires protection with plasterboard and other resistant materials to prevent it from completely charring during the period when it is required to

provide fire protection. A Posi-Joist with chords made of 45 mm thick timber therefore needs to be protected against fire when used in buildings with fire requirements.

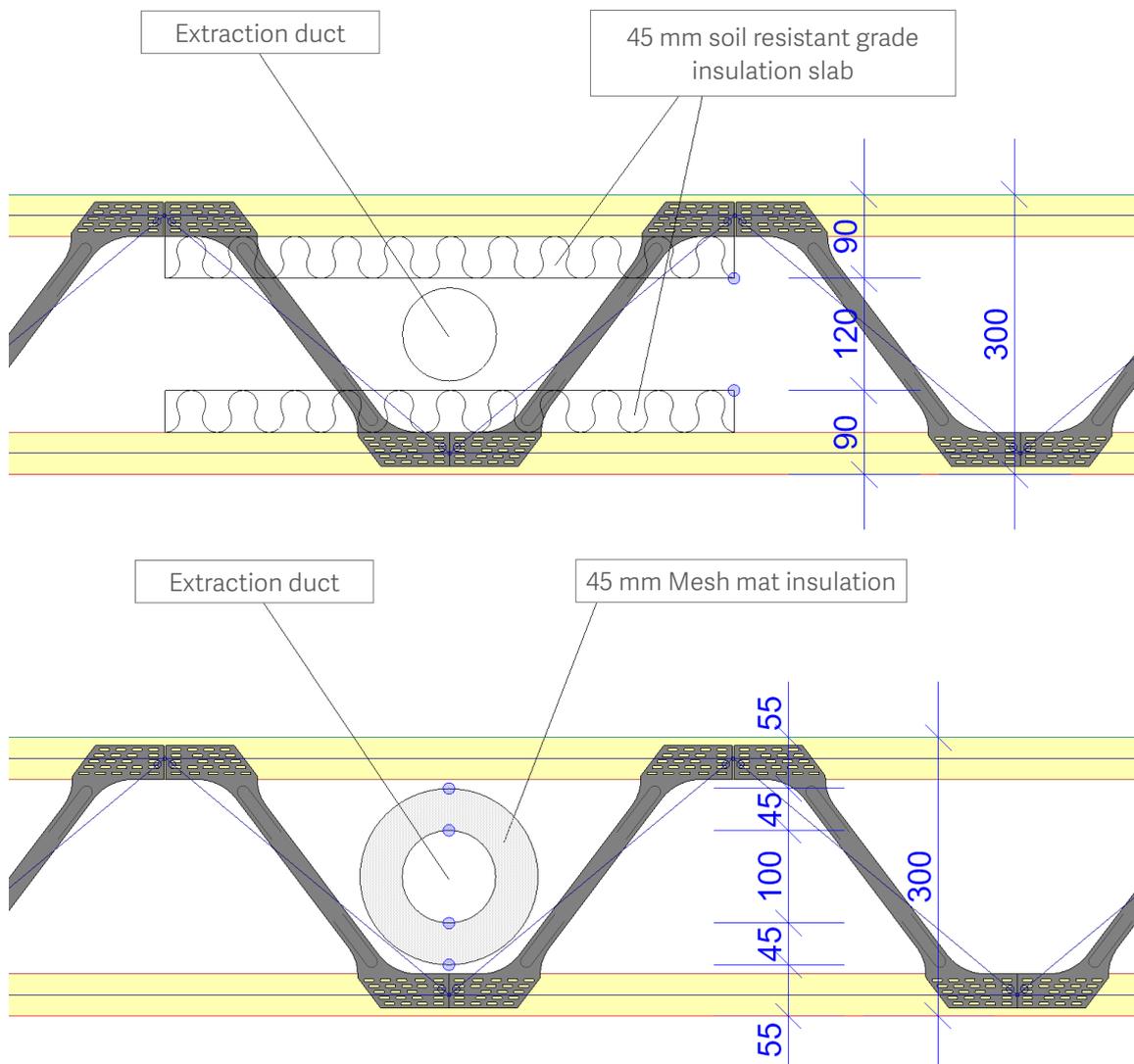
Jörgen Thor, Doctor of Technology at Brandskyddslaget, has conducted simulations and calculations on a Posi floor of class Min (see image on page 36) and found that the joist construction, protected from below with 2 x 15 mm fire-resistant plasterboard, meets the fire technical class REI60 by a wide margin.

The spaces between each floor joist are filled with loose rock wool insulation. Fire tests have also been conducted in England and France, demonstrating that 2 x 15 mm fire-resistant plasterboard provides adequate protection to meet REI 60 requirements. These tests also demonstrate the importance of preventing fire from entering the floor structure. Therefore, all types of roof perforations, such as holes for recessed lighting fixtures, should be sealed with fire-resistant foam or an equivalent material.

TESTING & RESULTS

The significant advantage of Posi-Joists is that installations in the floor structure are easy to carry out. Ventilation ducts in the floor structure can pose some fire safety challenges that require specific measures to be taken. For example, exhaust air ducts can add additional heat to the floor structure, which increases the charring of the wood. Therefore, further protection may be needed, which means that the design of Posi-Joists needs to be considered early in the design phase. Simulations with a Posi floor structure of class Min and an exhaust air duct built into the floor structure show that the sub-frame chars excessively, making it unable to withstand R60.

To achieve R60 on a joist system with an exhaust air duct, the top and bottom chords of the Posi-Joist must therefore be protected where the duct passes through the joist. This can be achieved with a 45 mm ground insulation board of approximately 150 kg/m³ or a 45 mm thick rock wool mesh mat intended for fire insulation of ventilation ducts, see images below. Depending on the size of the exhaust air duct, a taller Posi-Joist may need to be selected to accommodate both the extra insulation and the duct.



STEWARDSHIP

MiTek recognises the importance of both short and long term environmental protection and is committed to operating its business responsibly and in compliance with all legal requirements relating to the design, manufacture and sales of MiTek products.

We take seriously our responsibility to our people, our customers, our resources, and our world.

MiTek has prepared Environmental Product Declaration (EPD) documentation for its products.



EPD for
Nail plates
produced
in Sweden



EPD for
Posi™-
Struts

MiTek's Posi-Joist components are:



POSI™ MANUFACTURERS



- 1 OU Vessmont**
 Tammi tee 48c 76901 Tallinn
 +372 650 8600
info@puitmetalltala.com
- 2 OU Tenter**
 Meistri 12, Tallinn, Estonia
 +372 5120800
sales@tenter.ee
- 3 OU Alusehitus**
 Näki tee 20, Laane küla, Kambja vald,
 Tartumaa, 61703
 +372 5414 8101
alusehitus@alusehitus.ee
- 4 OU AMV Grupp**
 Kuusisoo tee 9, Tila küla, Tartu vald 60532
 +372 5247 478
info@amvgrupp.ee
- 5 SIA Dakstina Jumti**
 Vizbulu iela 8, Mandegās,
 Skultes p Limbažu nov.
 +37126449979
dakstina.jumti@inbox.lv
- 6 SIA RG Development**
 Rudzu iela 25, Stopinu pag., Ropazu nov.,
 LV-2130 Dreilini
 +37126319720
info@alpinesip.lv
- 7 UAB Santomartis**
 Plunges r., sav., Nausodzio sen., Varkaliu k.,
 Pušies g. 30, LT-90104
 +37067872705
tomassantomartis@gmail.com
- 8 UAB Domonas**
 Gamyklos g. 11, Gargždai Lietuva
 +372 650 8600
ekosantvaros.gediminas@gmail.com

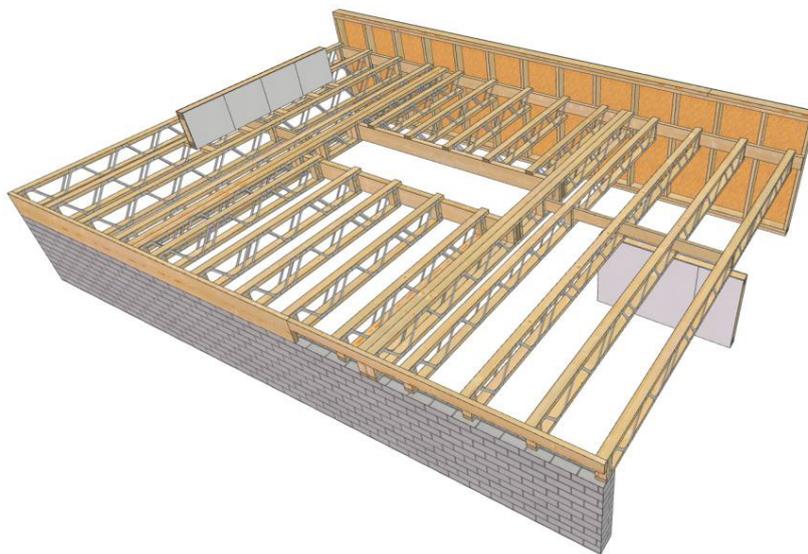
APPENDIX 1: POSI™ DETAILS

Scan the QR code or click the link below the code to view the model in MiTek 3D for each example.

MiTek 3D is a web-based 3D viewer that allows you to zoom and rotate for a closer view of each detail.

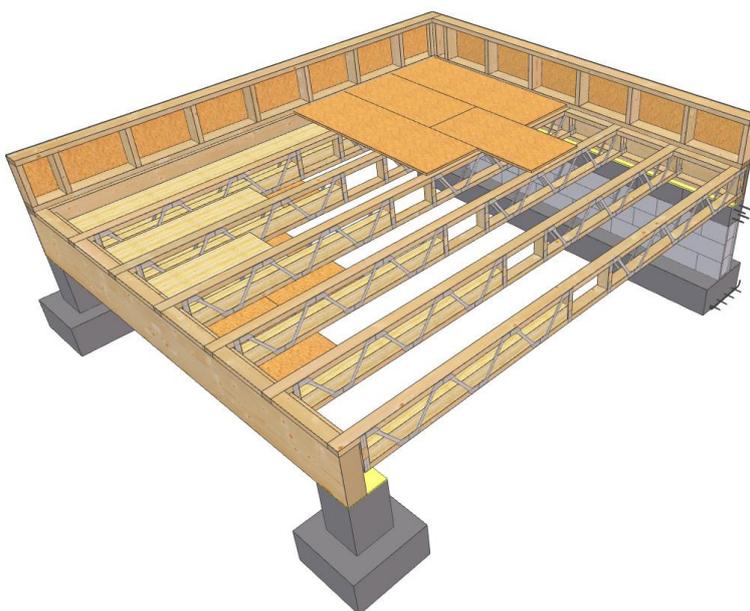
A – POSI™-JOIST FLOOR SOLUTIONS

1. FLOOR OVERVIEW PART ONE.



[View in MiTek 3D](#)

2. FLOOR OVERVIEW PART TWO.



[View in MiTek 3D](#)

3. EXAMPLES (FROM LEFT TO RIGHT):

- Wall plate support
- Internal block reinforcement
- Strongback
- Recessed and concealed steel beam
- Support on glulam beam



[View in MiTek 3D](#)

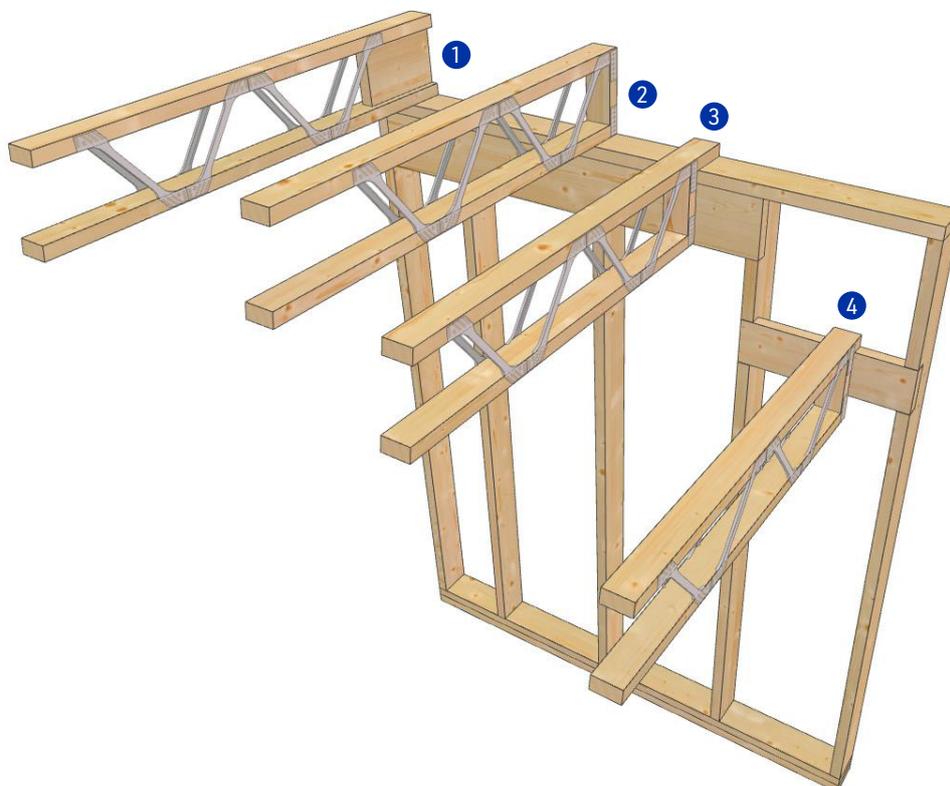


4. POSI END VARIATIONS (FROM LEFT TO RIGHT):

1. Block, bottom chord supported
2. End vertical, bottom chord supported
3. End vertical, top chord supported on top plate
4. End vertical, top chord supported on lintel

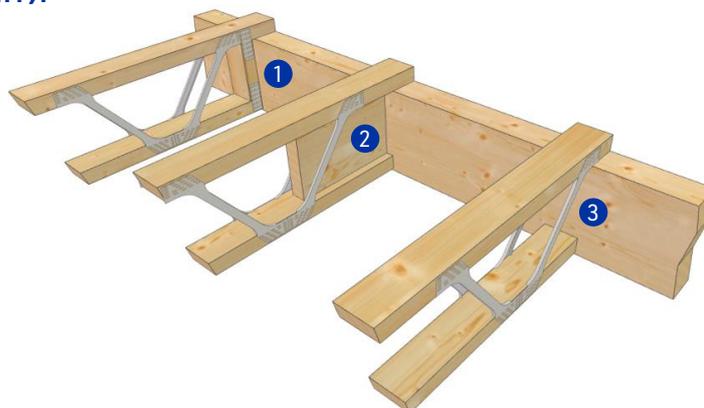


[View in MiTek 3D](#)



5. END VARIATIONS ON TOP CHORD SUPPORTED POSI-JOIST (FROM LEFT TO RIGHT):

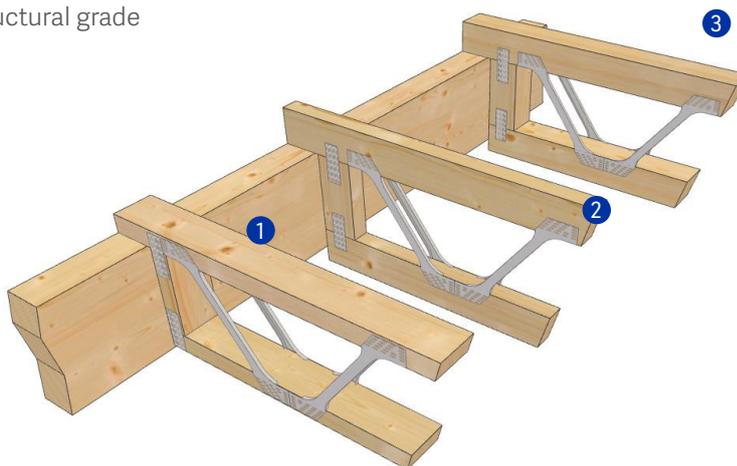
1. End vertical
2. Built-in block
3. Open ended



[View in MiTek 3D](#)

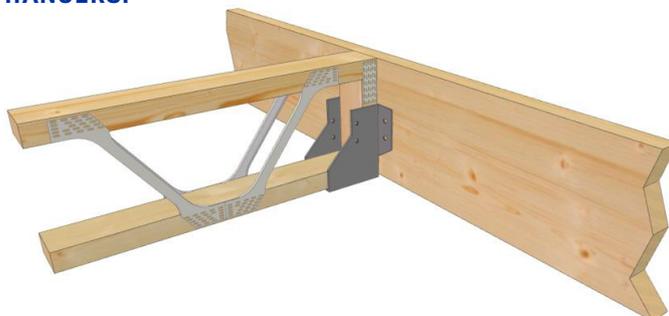
6. POSI IS FLEXIBLE AND CAN BE PRESSED WITH, FOR EXAMPLE:

1. Flatwise structural grade timber
2. Edgewise structural grade timber
3. 90x90 glulam



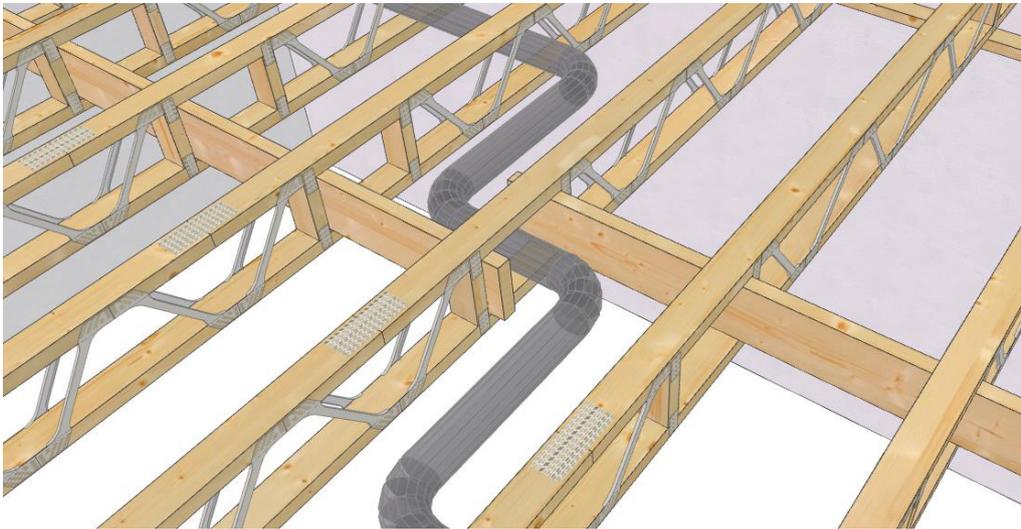
[View in MiTek 3D](#)

7. POSI SUSPENDED BY HANGERS.



[View in MiTek 3D](#)

8. SPLIT STRONGBACKS WITH PASSING SERVICES.



[View in MiTek 3D](#)

9. STRONGBACK REINFORCEMENT WITH PASSING SERVICES.



[View in MiTek 3D](#)

B - POSI-RAFTER, ROOF SOLUTIONS

1. POSI-RAFTER WITH FLATWISE-TIMBER CHORDS.



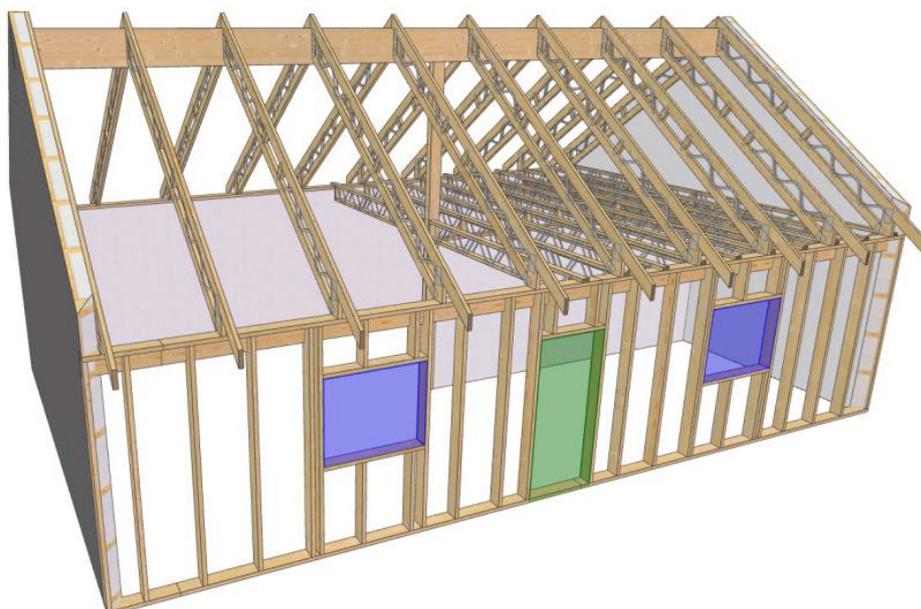
[View in MiTek 3D](#)



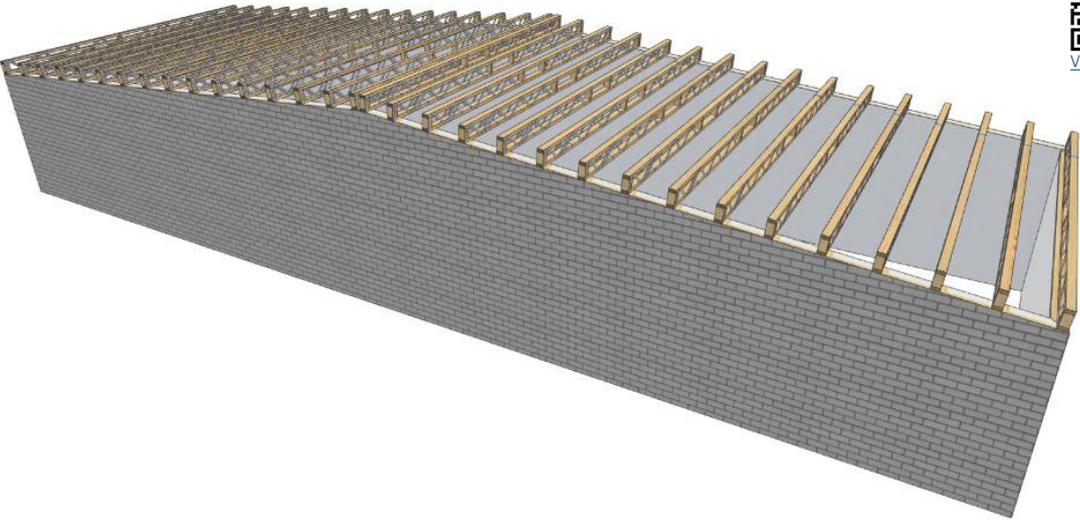
2. POSI-RAFTER WITH EDGEWISE-TIMBER CHORDS.



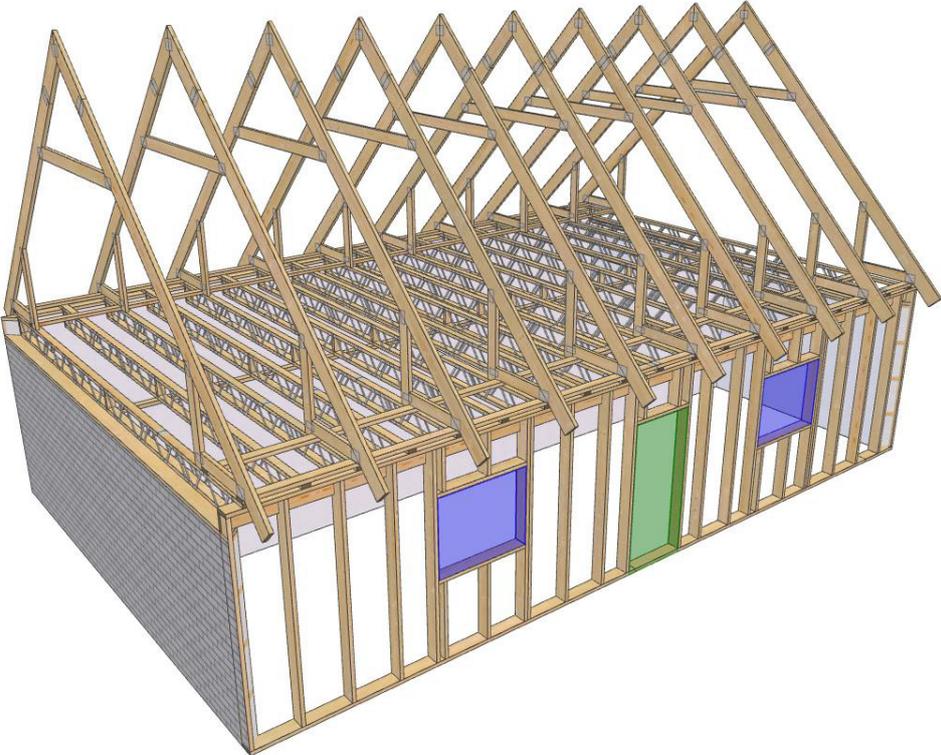
[View in MiTek 3D](#)



3. POSI-RAFTER ON LOW-PITCHED ROOFS.

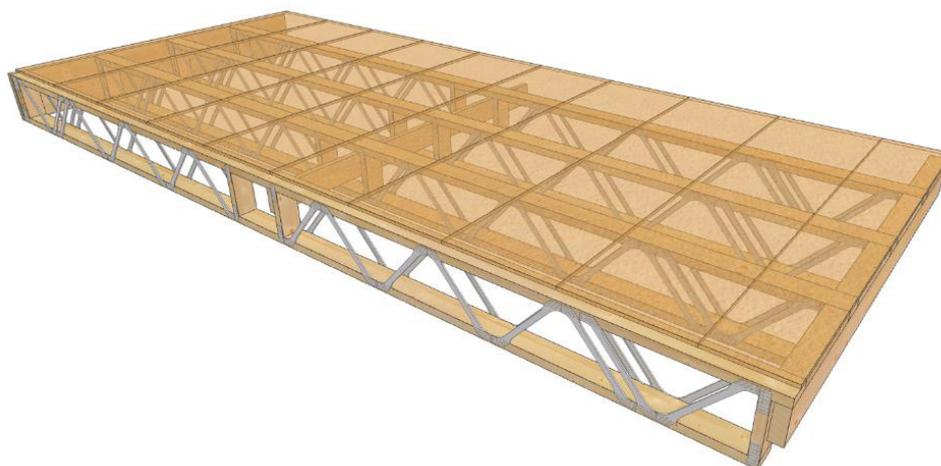


4. POSI-JOIST IN COMBINATION WITH ATTIC FRAME.



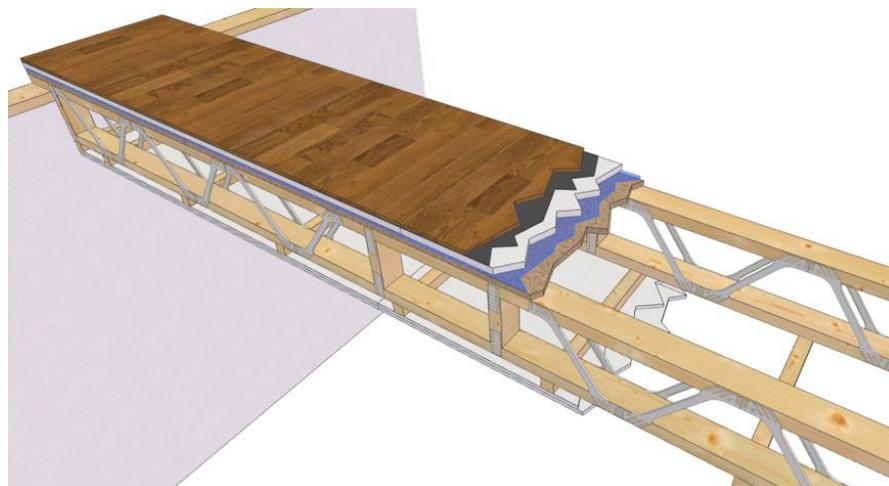
C – POSI CASSETTES

1. POSI-JOIST CASSETTE.



[View in MiTek 3D](#)

2. CASSETTES CAN BE BUILT WITH MULTIPLE LAYERS.



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3. STRONGBACKS FOR JOINING TWO CASSETTES.

