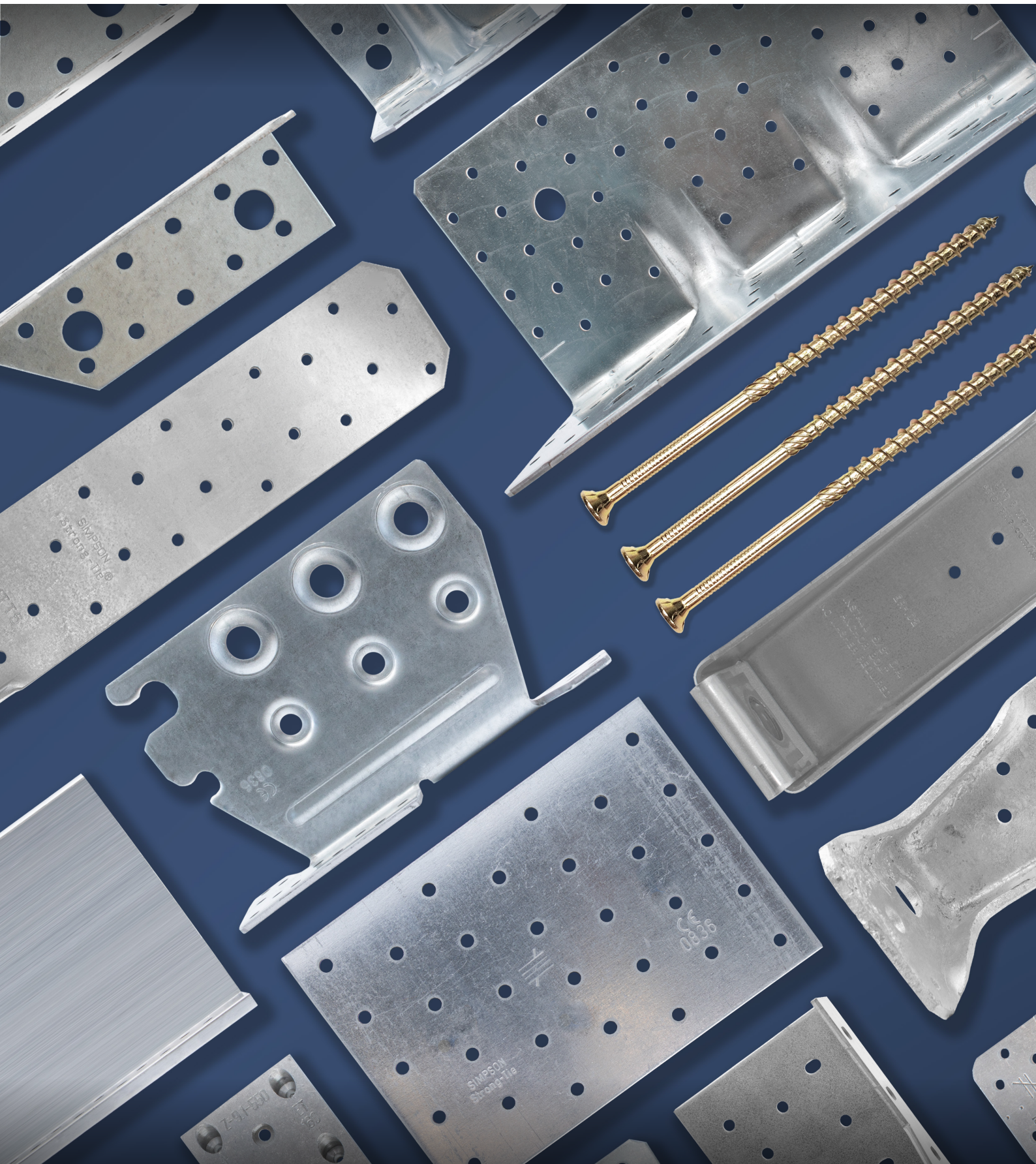
Connectors and Fasteners for

CLT Construction

C-CLT-EU-2020 | strongtie.eu

SIMPSON Strong-Tie®



Strength Beyond Steel

Our products are engineered to stand the test of time. So are our relationships. For over 60 years, Simpson Strong-Tie® has focused on creating connectors that perform under the toughest of conditions, helping you build safer, stronger homes and structures. With more than 1,000 product solutions, we're proud to offer the widest connector range in Europe.

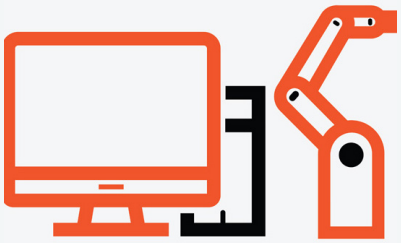
CE & Guarantees

All of our products meet the Construction Products Regulations and those that are required to achieve CE Marking are tested to guarantee that they comply.

Technical Support

Our Technical Support team is on hand to answer your questions and provide some sound installation advice, from making sure you have the most suitable product, to the best ways to go about installing them.

Design & Manufacture



We regularly work with house builders and designers to develop our range of structural connector solutions, considering every aspect of their use to meet your ever-changing needs.

Ease of installation, performance characteristics and life-span are the fundamental principles that make up our design DNA.

Stock & Delivery

We maintain 200 different product families spanning over 5,000 product lines. We will continue supporting them for as long as you need them.

From our distribution centres in Tamworth and Dublin, we do everything we can to make sure you get your delivery in full, and on time - to your premises or direct to site.

Research & Development

We continuously invest in research and product development to ensure that our product solutions are efficient, easy to use and meet the needs of construction professionals.

Our Technical team design, develop and test new product solutions.

Plans & Drawings

We know that architects, designers, and contractors need very detailed technical information about our products, so we provide drawings and technical information free on our website.

These include CAD and BIM drawings, as well as DWG 2D and 3D, SAT files and performance data sheets.

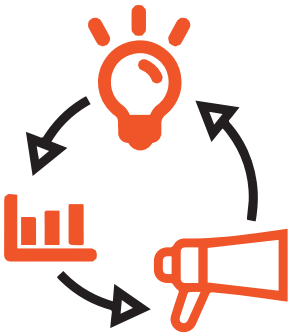
Software

We offer free software solutions to help you choose the right connector or fastener.

Connector Selector enables you to quickly and easily identify the connectors or fastenings you will need, based on your dimensions, purpose and performance requirements.

Anchor Designer offers a quick calculation for anchor fixings into cracked and non cracked concrete.

Marketing Support



Our in-house marketing team is on hand to provide a wide range of product images and resources for you to use in-store or online, including catalogues, posters, displays and promotions, product data and product installation and feature videos.

Custom Manufacturing

Every construction project comes with its own set of challenges, sometimes unexpected and quite often unique.

Our engineering and production teams provide a design and manufacture service for ‘one off’ connectors, based on plans provided by you.

Your unique connector is produced using state-of-the-art equipment and is ready to send - often within one working day.

Quality Testing

We build quality and innovation into everything we make and everything we do.

Made using the best quality steels, all of our “No Equal” products and connectors undergo rigorous quality testing, to ensure that they meet safety regulations, and exceed our customers’ needs and expectations.

No Equal

This is our ‘No Equal’ commitment.

The difference between us and everybody else.

www.strongtie.eu

Alphabetical index

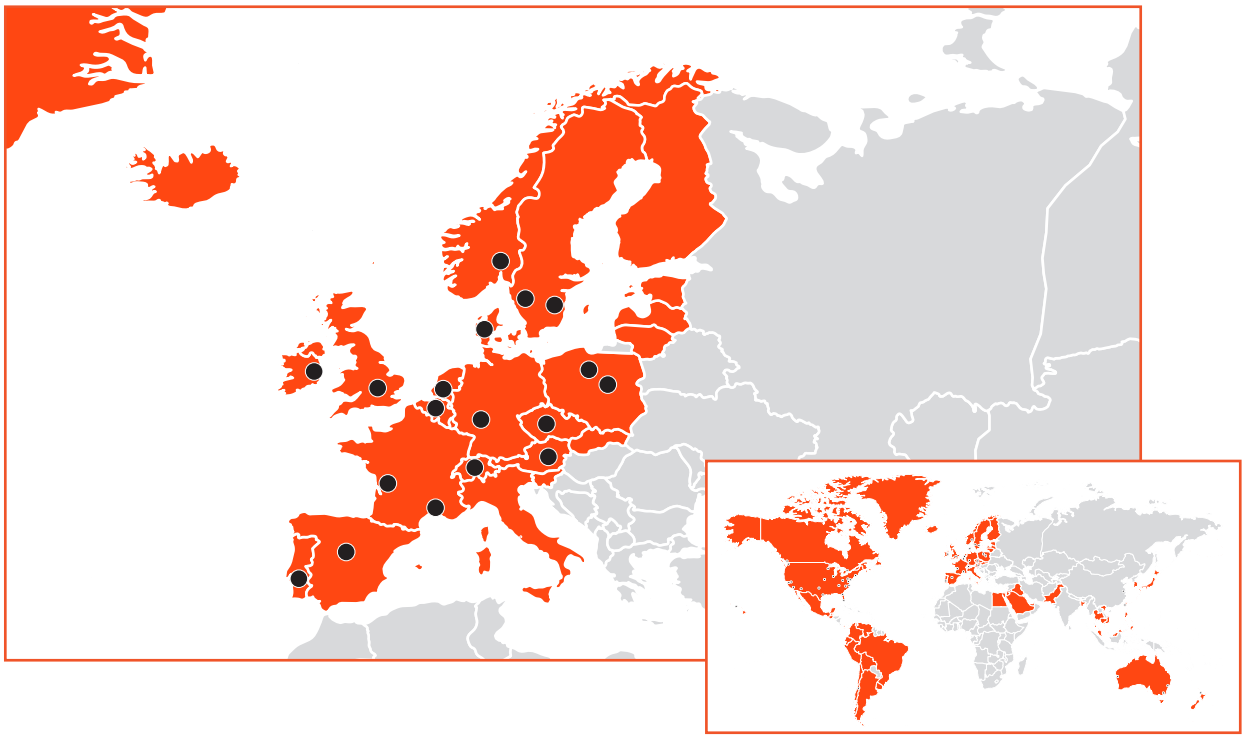
In addition to the products listed in this catalogue, we have additional products on our website, strongtie.eu.

Subject Index

Company information

For more than 60 years, Simpson Strong-Tie® has focused on creating structural products that help people build safer and stronger homes and buildings. A leader in structural systems research and technology, Simpson Strong-Tie® is one of the largest suppliers of structural building products in the world. Our commitment to product development, engineering, testing and training is evident in the consistent quality and delivery of our products and services.

For more information, visit the company's website at **strongtie.eu**.



Factories, offices, or warehouses in Australia, Austria, Belgium Canada, Chile, China, Czech Republic, Denmark, France, Germany, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Taiwan, UK and USA

Distribution in Australia, Canada, Chile, Western Europe, part of Eastern Europe, Middle East, Egypt, Japan, Korea and other Asian countries, Mexico, New Zealand, UK, part of South America and USA

European Manufacturing

Beyond precision engineering and rigorous testing, our European based manufacturing facilities are what enable us to deliver products to the highest industry standard. We invest in - and invent - fabrication technology that can bring our designs to life, and ultimately provide your projects strength, speed and success.

Contents

The Simpson Strong-Tie Company Inc.

“No Equal” Pledge Includes:

- Quality products value-engineered for the lowest installed cost at the highest-rated performance levels
- Most thoroughly tested and evaluated products in the industry
- Strategically located manufacturing and warehouse facilities
- National code agency listings
- Largest number of patented connectors in the industry
- European locations with an international sales team
- In-house R&D and tool and die professionals
- In-house product testing and quality control engineers

Quality Policy

We help people build safer structures economically. We do this by designing, engineering and manufacturing “No Equal” structural connectors and other related products that meet or exceed our customers’ needs and expectations.

Everyone is responsible for product quality and is committed to ensuring the effectiveness of the Quality Management System. Simpson Strong-Tie® is an ISO 9001 registered company. ISO 9001 is an internationally recognised quality management system standard, which lets our customers know that they can count on the consistent quality of Simpson Strong-Tie’s products and services.

Karen Colonias
President,
Chief Executive Officer

Testing Laboratory Accreditation

The Andris Peterson European Test Laboratory, located in the UK in Tamworth, Staffordshire, is the first manufacturer's facility to achieve third party accreditation to the international standard BS EN ISO/IEC 17025.

The world-class facility now conducts around 10,000 product tests annually and has recently benefited from a significant investment, which will enable double productivity. The fact that we extensively test our products give you the reassurance that they will perform in the toughest conditions. We strive to ensure that our products are compliant with the latest European requirements for construction products.

We Are ISO 9001-2008 Registered

Simpson Strong-Tie is an ISO 9001-2015 registered company. ISO 9001-2015 is an internationally-recognized quality assurance system which lets our domestic and international customers know that they can count on the consistent quality of Simpson Strong-Tie® products and services.

ISO 14001

Our Swedish, French (St. Gemme la Pleine) and UK facilities are ISO 14001 certified. This standard states the requirements for an environmental management system, and applies to the environmental aspects over which our company has control and can be expected to have an influence.

OHSAS 18001

Our Tamworth, UK facility is OHSAS 18001 certified. This certification reflects an internationally applied British Standard for occupational health and safety management systems.

To learn more about these certifications and organizations, please visit ISO.org, ICCSafe.org and bsigroup.com.

STORA ENSO: CLT

General Information

About Simpson Strong-Tie

Guaranteed Performance

The fact that we extensively test our connectors gives you the reassurance that they will perform in the toughest conditions. We strive to ensure that our products are compliant with the latest European requirements for construction products.

The quality and variety of our product lines gives engineers and builders more freedom to design flexibly, while offering reliable and proven performance. In addition, customers can count on our specialized local technical support centers with experienced field representatives and tailored training programmes.

The characteristic values published within this document have been determined from test values in accordance with EN14358 for use with Limit State Design methods. Corresponding deflection limits are published, where appropriate, which indicates the amount of slip in the connection when the stated characteristic load is applied.

What are our connectors made from?

Unless otherwise stated the connectors listed in this document are manufactured from S250GD carbon steel with a pre-galvanised coating of 275 g/m^2, in accordance with EN 10346.

SSH Screw

SIMPSON STRONG-TIE WORKS ALONGSIDE:

STRUCTURAL TIMBER ASSOCIATION – Building solutions in timber

registered LABC

TRA

Treteknisk

InnoBYG – Innovationsnetværket for bæredygtigt BYGGERI

TRÆ Information

SVENSKT TRÄ

TEKNOLOGISK INSTITUT

CLT FRANCE – L'INDUSTRIE BOIS CONSTRUCTION

APIBOIS

SCIBO

SNBL

FCBA – INSTITUT TECHNOLOGIQUE

SYMOB

cisma – Syndicat des équipements pour Construction

UNION INDUSTRIELS CONSTRUCTEURS BOIS

EDONI – Echanges des DOnnées Normalisées Informatisées

afcobois – Syndicat Français de la Construction Bois

About Simpson Strong-Tie

Quality testing

Our ultra modern laboratories constantly test new and existing products as part of our determination to provide the best connectors and anchoring solutions. We subject our products to the most rigorous strength, pull-out and fire-resistance tests. It gives you the reassurance that they will perform reliably in the toughest conditions, as well as providing key information for installing our solutions to ensure the best performance.

Accreditations and warranties

When it comes to quality and safety, we are determined to lead by example. We select the best steel and ensure that our products comply with the latest European requirements for construction products. Check out our product pages for the corresponding technical approval numbers. They can be viewed and downloaded from www.strongtie.eu.

Research and development

We continue to invest heavily in research and development to produce new high-performance solutions that are easier to use and geared towards the needs of professional users.

Technical support

The quality and variety of our product lines give engineers and builders more freedom to design. You can count on our dedicated team of engineering consultants for support and guidance with your projects and construction issues. We have technical hotlines in all our offices and can be contacted every working day during working hours.

Technical information and drawings

Designers, engineers, project managers and architects need access to highly detailed technical information and 3D drawings of our products. CAD drawings and documentation can be downloaded for free in several formats (DWG 2D and 3D, SAT, etc.).

For more information:

www.strongtie.eu

What is CLT?

Wood is clearly a material for the future, as evidenced by its growing popularity in the construction industry. During the 1990s, wood engineers in Austria and Germany achieved a breakthrough with a new construction system known as CLT (cross-laminated timber). Nowadays, CLT is widely used across Europe and is beginning to gain traction in the United States.

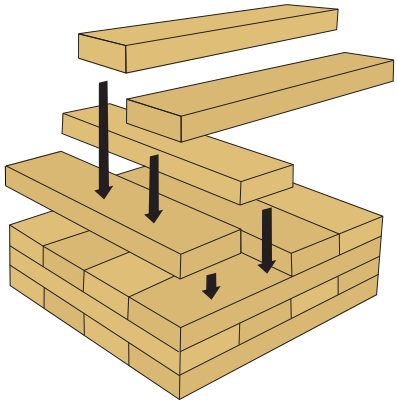
CLT panels are favoured for residential and public-access buildings, but they can also be used in all types of construction projects, ranging from individual houses to high-rise buildings.

Stadthaus, an eight-storey residential building in London, is one of the most iconic constructions made from CLT. Cross-laminated timber is also used in engineered structures, such as Canada's 160-metre Mistissini Bridge, and all types of small residential buildings.

Stadthaus, Murray Grove. Image provided by KLH UK.

Manufacturing secrets

CLT is made from gluing perpendicular layers of solid timber boards together. Each layer is rotated by 90° in relation to the previous layer to improve the panel's performance. The number of layers varies and depends on the application (generally between three and eight layers). Panels can be made in sizes up to 20 metres in length and 4 metres in height. Their thickness tends to vary between 60 mm and 320 mm.



A versatile material

Creating panels with perpendicular layers not only ensures excellent mechanical strength, but also guarantees high dimensional stability. These two qualities give architects and building planners considerable freedom with their designs.

CLT can easily be incorporated into hybrid construction projects, such as timber-concrete and timber-metal, and is also suited to projects combining different construction systems, whether posts, beams, or timber frames.

Advantages of using CLT

- Environmentally-friendly construction material
- Healthy and comfortable indoor climate
- Maximum architectural freedom
- Easy planning of individual homes and residential buildings
- Effective use of the available land area through slim-line modules
- Superior mechanical performance
- Short building times, dry construction and quick occupation
- High precision with numerically controlled cutting
- Prefabricated elements delivered straight to the construction site
- Lightweight panels compared to masonry and concrete elements
- Technically endorsed construction product featuring the CE marking

Calculation of capacities

Characteristic values

$$R_d = \frac{R_k \times k_{mod}}{\gamma_M}$$

When selecting a product, it is very often necessary to check that its resistance is higher than the loads that will be applied.

k_{mod} values according to EN 1995-1-1						
Material	Service class	Actions				
		Permanent	Long term	Medium term	Short term	Instantaneous
Solid wood	1	0,6	0,7	0,8	0,9	1,1
	2	0,6	0,7	0,8	0,9	1,1
	3	0,5	0,55	0,65	0,7	0,9

The design strength (R_d) of a product is obtained from the characteristic value R_k (published in the tables in this catalogue and on our website) by multiplying it with the factors K_{mod} of γ_M.

The characteristic values are expressed in kilo Newtons (kN) and dimensions in millimetres (mm) unless otherwise specified.

The k_{mod} factor given in the table above (extract from Eurocode 5 § 3.1.4) depends on the load duration class, the service class and the type of material used.

Partial factor for the connection in question (γ_M):

- In England, 1,30 for connections
- In Denmark, 1,35 for connections
- In Germany, 1,30 for connections
- In Norway, 1,30 for connections
- In Sweden, 1,30 for connections
- In France, 1,3 for connections
- In Spain, 1,35 for connections
- In Belgium, 1,3 for connections
- In Portugal, 1,3 for connections

For further information, please refer to your Eurocode National Annexes.

The characteristic values given in the product pages are the resistances corresponding to a specific application. Other applications (other fasteners, other fixing quantities, force direction, etc.) are very often available and covered by the ETAs, in which case we would advise you to refer to the corresponding ETA.

Change of density

The resistance R_k given in the tables corresponds to the use of CLT comprising C24 graded timber as required for structural applications.
For higher grade timbers, the tabulated values remain unchanged. For lower grade timbers, the tabulated values must be multiplied by the k_{dens} factor calculated according to the formula below:

$$k_{dens} = (\varrho k / 350)$$

Where:
350 kg/m³: characteristic density of the C24 graded timber according to EN 338
ϱk: characteristic density of the timber used according to EN 338

Load combination

In case of load combination, the formulas given for each product family must be verified.

$$\left(\frac{F_1}{R_1}\right)^2 + \left(\frac{F_3}{R_3}\right)^2 + \left(\frac{F_4}{R_4}\right)^2 \leq 1$$

Downward + lateral + tensile:

$$\left(\frac{F_2}{R_2}\right)^2 + \left(\frac{F_3}{R_3}\right)^2 + \left(\frac{F_4}{R_4}\right)^2 \leq 1$$

Upward + lateral + tensile:

Stiffness

In this document, the assembly stiffness is given for certain products. This value can be used to check the displacement induced in the SLS and confirm that the chosen connector is compatible with the intended application.
The stiffness data given in the product pages are the stiffness values corresponding to a specific application.

Fixing to a rigid substrate

The values given for a rigid substrate (steel or concrete) apply as long as the anchor systems are capable of withstanding the forces. Plugs must often be checked separately, since a number of factors can influence their strength (distance from the edge, centre spacings, quality of the concrete, etc.). In addition, the forces that must be taken into account for the plug on some products are greater than the forces that must be taken into account for the connector due to the lever arm.
To determine which forces should be prioritised, refer to our ETAs. When it comes to the actual verification, the Anchor Designer© software is available for free from www.strongtie.eu.

Corrosion information

Understanding the corrosion issue

Many environments and materials can cause corrosion, including ocean salt air, fire retardants, fumes, fertilizers, preservative-treated wood, de-icing salts, dissimilar metals and more. Metal connectors, fasteners and anchors could corrode and lose load-carrying capacity when installed in corrosive environments or when installed in contact with corrosive materials.

When corrosion is caused by airborne solutions (ocean air, swimming halls, spray from a salt-treated street in winter, etc.) the metal parts can be in environments that are directly exposed to rain. They can be covered by a roof or inside the ventilated area of a facade.

The many variables present in a building environment make it impossible to accurately predict if, or when, corrosion will begin or reach a critical level. This relative uncertainty makes it crucial that specifiers and users are knowledgeable of the potential risks and select a product suitable for the intended use. It is also prudent that regular maintenance and periodic inspections are performed, especially for outdoor applications.

It is common to see some corrosion in outdoor applications. Even stainless steel can corrode. The presence of some kinds of corrosion, e.g. white rust on zinc, does not mean that load capacity has been affected or that failure is imminent. If significant corrosion, e.g. red rust, is apparent or suspected, then a qualified engineer or inspector should inspect the framing members, fasteners and connectors. Replacement or cleansing of affected components may be appropriate. Red rust corrosion of steels will mostly carry on increasing and will cause major damage at an advanced stage.

Galvanic corrosion

Galvanic corrosion (also known as bimetallic corrosion, dissimilar metal corrosion or contact corrosion) may occur when dissimilar metals (e.g. galvanised mild steel and stainless steel) are in contact in a corrosive electrolyte (e.g. water containing salt, acid, etc.). When a galvanic couple forms, one of the metals in the couple becomes the anode and corrodes faster than it would all by itself, while the other becomes the cathode and corrodes slower than it would alone. For galvanic corrosion to occur, three conditions must be present:

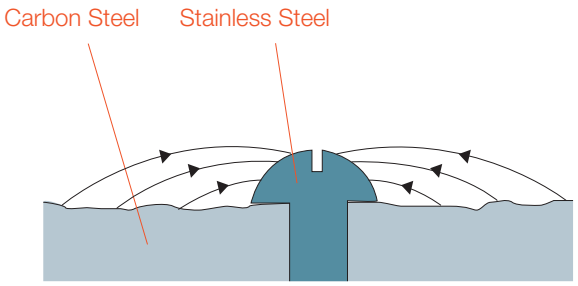
1. Electrochemically dissimilar metals must be present,
2. These metals must be in electrical contact,
3. The metals must be exposed to an electrolyte.

The relative nobility of a material can be predicted by measuring its corrosion potential. The well-known galvanic series, (see below) lists the relative nobility of certain materials in seawater. A small anode/cathode area ratio is highly undesirable. In this case, the galvanic current is concentrated onto a small anodic area. Rapid thickness loss of the dissolving anode tends to occur under these conditions. Adverse area ratios are likely to occur with fasteners at joints.

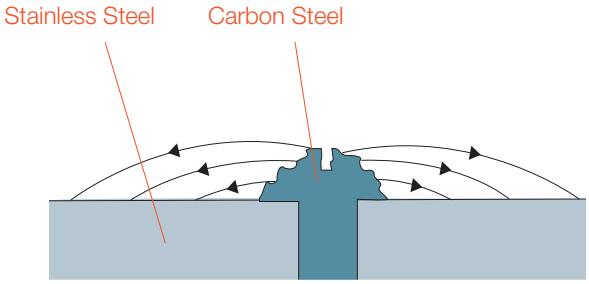
Galvanic Series of Metals

Corroded end (Anode)
Magnesium, Magnesium alloys and Zinc
Aluminium, Cadium, Iron and Steel
Lead, Tin, Nickel and Ni-Cr alloy
Brasses, Copper and Cu-Ni alloys
Nickel
Stainless Steels
Protected end (Cathode)

Carbon steel fasteners used with stainless steel connectors should be avoided because the ratio of the area between the stainless steel to carbon steel is small and the fasteners will be subject to aggressive attack, thus greater corrosion. Conversely, the rate of attack of a carbon steel connector secured by a stainless steel fastener is much slower. Prevention of bimetallic corrosion is possible by excluding an electrolyte from the connection by painting or taping over the joint. Alternatively, the two metals should be isolated from each other by painting each contact surface or using a non-metallic isolation material, typically nylon, neoprene or Teflon washers, pads, gaskets or bushes depending upon the particular application.



Large ANODE (Carbon Steel) area, small CATHODE (stainless steel fastener) area showing no attack on the fasteners and relatively insignificant attack of carbon steel.



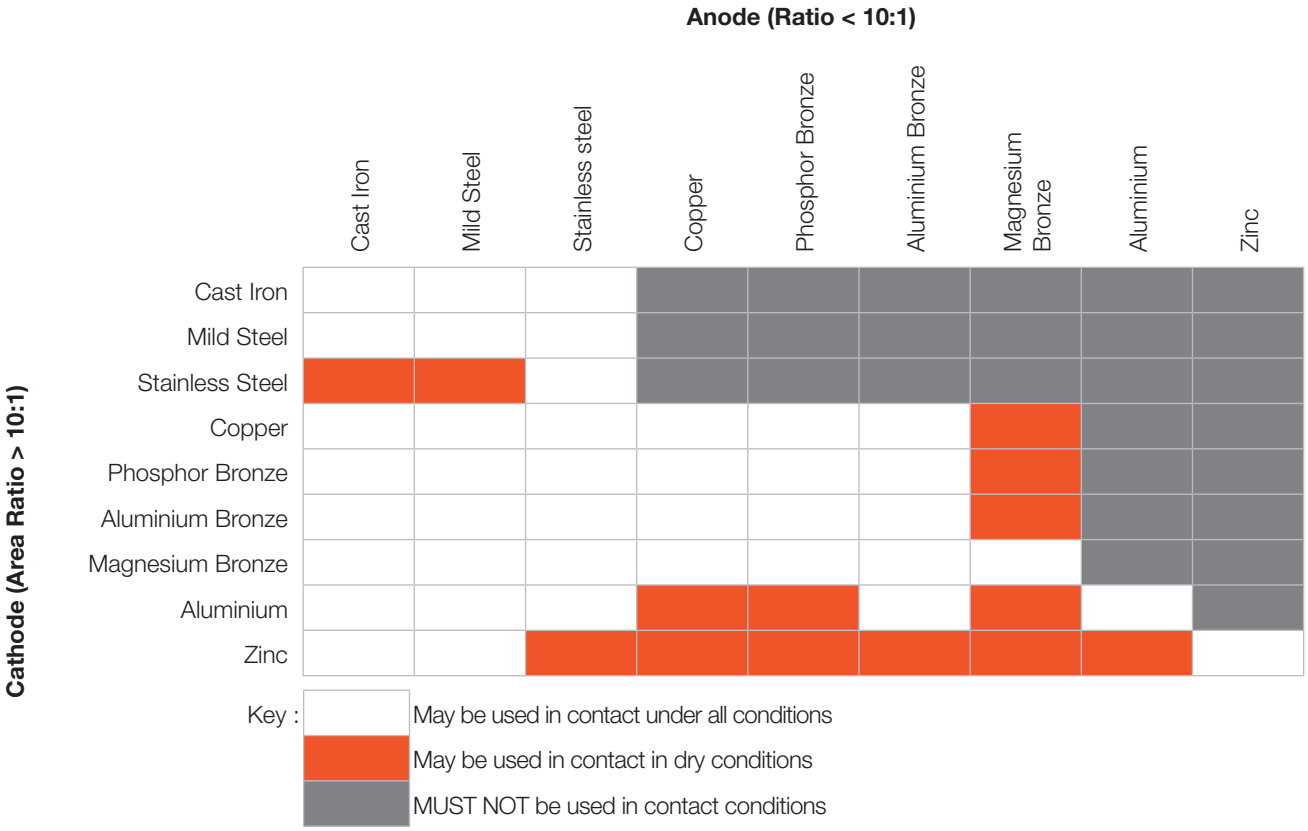
Large Cathode (Stainless Steel) area, small ANODE (carbon steel fastener) area showing no attack on the stainless steel and relatively increased attack of the fastener.

Corrosion information

The table below provides details of general materials that may be used together in certain instances, also depending on area ratio as previously discussed.

It is sometimes hard to give general statements on certain materials (e.g. Aluminium) as the appearance of certain ingredients in the certain alloy (e.g. Copper) has a major impact on the corrosion resistance in presence of certain electrolytes (e.g. de-icing salt). In addition, the post treatment (e.g. Eloxation) makes a big difference on the corrosion resistance.

Good to know: When low-alloy steels in high moisture atmospheres are in contact even with small carbon steel particles, bimetallic corrosion can cause a nucleus for a stainless steel corrosion. This might happen e.g. when stainless fasteners are processed with non-stainless tools.



Service classes according to Eurocode 5: Definition of the service classes environment are given within the EN1995-1-1

Service Class	Description	Examples
1 	Moisture content in the materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 65% for a few weeks per year.	Warm roof, intermediate floors, timber frame walls - internal and party walls.
2 	Moisture content in the materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 85% for a few weeks per year.	Cold roof, ground floors, timber frame walls - external walls where member is protected from direct wetting.
3 	Climatic conditions leading to higher moisture contents than in service class 2.	External uses - fully exposed.

Acoustic performance

Nowadays, acoustic comfort is an important criterion during the construction design process. All sorts of sounds can penetrate the building and are transmitted through the walls and structure. Choosing the right acoustic solutions is key to avoiding this phenomenon. Although wood boasts a wealth of qualities (the ultimate environmentally-friendly material, insulating properties and an effective mechanical strength-to-weight ratio), its relatively low mass reduces the structure's acoustic performance. For example, all rigid contacts help to transmit sound throughout the building.

Improving the acoustic performance of certain structures represents a major challenge for designers and engineers. This issue is especially apparent with CLT structures, since some designs may call for certain timber elements to be left exposed for aesthetic reasons, meaning that there is no system to "absorb" the sound. Similarly, since timber is not a hollow material, any vibrations at the end of a CLT panel will spread across the rest of the panel and also into any adjacent panels that have not been insulated against vibrations.

That is why Simpson Strong-Tie has developed the ABAI angle bracket for connecting CLT walls and floors without transferring any sound and vibrations through the fasteners. This product is generally used in combination with an acoustic isolating strip between the wall and floor elements.

In Europe, the Building Acoustic Performance Regulation of 30 June 1999 defines such insulation levels as nT,w ≤ 58 dB and DnT,w ≥ 53 dB.

Design example

The acoustic solution proposed by Simpson Strong-Tie comprises an **ABAI** angle bracket and a soundproofing strip. The design calculation is shown below:

- This example is based on a CLT apartment wall. The wall is 95 mm thick, 2.8 m high and 5.0 m long. The room volume is 50 m^3.
- The vertical loads are g_k = 22 kN/m and q_k = 19 kN/m.
- The horizontal loads are F2 = q_k = 6.1 kN at the top of the wall and F5 = qk = 0.5 kN/m at the bottom.
- France's Building Acoustic Performance Regulation of 30 June 1999 defines such insulation levels as $L'_{nT,w} \leq 58$ dB and $D_{nT,w} \geq 53$ dB.
- The chosen acoustic insulator is a strip with a working interval between 15 kN/m and 35 kN/m.

The type of insulator depends on the load to be supported:

$$(g_k + 30\% \times q_k) \times \frac{100\ mm}{95\ mm} = (22 + 0.3 \times 19) \times \frac{100}{95} = 29.2\ kN/m$$

$$29.2\ kN/m \leq 35\ kN/m \rightarrow Ok$$

$$Deformation = \frac{Calculated\ linear\ load - min\ linear\ load}{Max\ linear\ load - min\ linear\ load}$$

$$\times\ (max\ deformation - min\ deformation) + min\ deformation$$

$$Deformation = \frac{29.2\ kN/m - 15\ kN/m}{35\ kN/m - 15\ kN/m} \times (1.3\ mm - 0.5\ mm) + 0.5\ mm = 1.1\ mm$$

$$1.1\ mm \leq 1.3\ mm \rightarrow OK$$

The ABAI bracket's capacity can be checked with the following formula:

$$\sqrt{\left(\frac{F_{1.d}}{R_{1.d}}\right)^2 + \left(\frac{F_{2/3.d}}{R_{2/3.d}}\right)^2 + \left(\frac{F_{4/5.d}}{R_{4/5.d}}\right)^2} \leq 1$$

Acoustic performance

Force F1 at the top of the wall can be found with the following equation:

$$-\left(Q_k \times H \times 6 \times \frac{6}{L^2}\right) + g_k = 0$$

$$-\left(6.1\ kN \times 2.8\ m \times \frac{6}{5\ m^2}\right) + 22\ kN/m = 17.9\ kN/m > 0$$

Since the force at the top of the wall is greater than 0, there are no tensile forces. Therefore, $F_1 = 0$.

The horizontal forces are determined as follows:

$$F_{2.d} = \frac{Q_k}{L} \times B \times 1.5 = \frac{6.1\ \text{kN}}{5\ \text{m}} \times 0.5\ \text{m} \times 1.5 = 0.92\ \text{kN}$$

$$F_{5.d} = q_k \times B \times 1.5 = 0.5\ \text{kN/m} \times 0.5\ \text{m} \times 1.5 = 0.38\ \text{kN}$$

The design strength of the brackets is calculated as follows:

$$R_{2.d} = R_{2.k} \times \frac{k_{mod}}{\gamma_M} = 1.4\ \text{kN} \times \frac{0.9}{1.3} = 0.97\ \text{kN}$$

$$R_{2.d} = R_{2.k} \times \frac{k_{mod}}{\gamma_M} = 1.6\ \text{kN} \times \frac{0.9}{1.3} = 1.11\ \text{kN}$$

Therefore:

$$\sqrt{\left(\frac{0.92\ \text{kN}}{0.97\ \text{kN}}\right)^2 + \left(\frac{0.38\ \text{kN}}{1.11\ \text{kN}}\right)^2} = 1 \leq 1 \rightarrow \text{The bracket is suitable}$$

Now that the load data have been verified, the acoustic insulation can be checked. In the catalogue "Deckenkonstruktionen für den mehrgeschossigen Holzbau" issued by the Austrian Timber Research Institute, various wall/floor configurations are provided along with the corresponding insulation.

Seismic activity and timber constructions

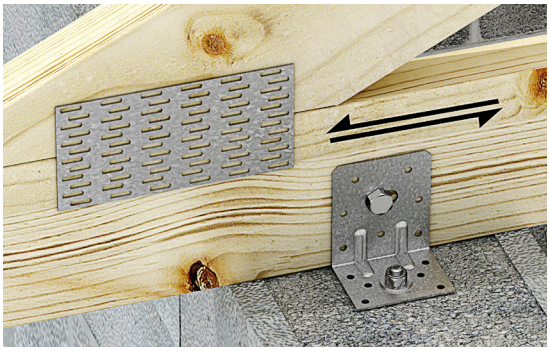
Evidence suggests that the use of timber for construction in seismic areas dates back to at least 10,000 years. Many of the buildings that still stand today provide clear evidence that timber and the associated construction systems are well suited to the forces and stresses caused by seismic events.

Until recently, Europe had experienced very few destructive earthquakes, unlike Japan and the United States, which have played a major role in understanding and developing a scientific approach towards assembly and connection methods in timber constructions.

The types of connectors used, and their materials, have undergone significant changes over the last few decades. Efforts were therefore needed to create an array of design calculations and regulations to understand the systemic behaviour of timber constructions.

1. Background

The whole process of designing timber structures in seismic areas is a complex issue and goes far beyond the metal connectors used.



E5 bracket – used as a truss connector

1.1. Simpson Strong-Tie® connectors

The three-dimensional metal connectors used for timber constructions that have been CE certified according to ETAG 015 and EN 14545 are not specifically tested in seismic conditions.

However, there are fixing accessories, such as anchors, that can be classed as C1 or C2 according to ETAG 001.

When it comes to designing dissipative zones for the connectors and a continuous load transfer, Eurocode 8 specifies two approaches: distribution and dissipation. Where the behaviour factor q is considered to be greater than 1.5, cyclic tests according to EN 12512 can be carried out to determine the dissipative properties of a connector or part of the structure.

1.2. Seismic design: first tests in France

The first cyclic tests on E5 angle brackets were carried out by the FCBA laboratory in Bordeaux in 2005. The data gathered during testing were instrumental in incorporating E5 brackets into the SISBAT and SISMOB research projects aimed at analysing the behaviour of timber buildings during seismic events.

The tests performed during the research projects demonstrated that these brackets and the associated construction methods were capable of withstanding seismic stresses according to the French Regulation of 1 April 2011.

Simpson Strong-Tie continued taking part in test programmes during the Woodrise Congress in 2017.

Seismic testing during Woodrise 2017

1.3. R&D laboratories and research

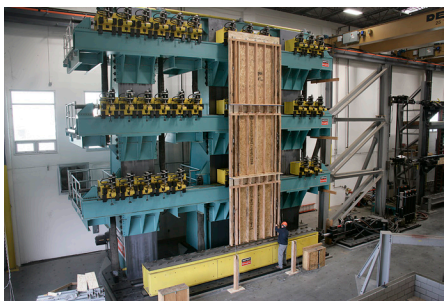
Simpson Strong-Tie® has spent several decades investing in internal test equipment and campaigns to improve the development of connectors, anchors and fasteners in seismic conditions. The vast majority of our products are tested in-house during development.

In an effort to gain a clearer insight into how connectors behave during seismic events, the Group acquired a host of cyclic test systems in the mid-1990s. Research focused on both connector behaviour and the systems with the aim of understanding how parts and components affect the behaviour of the systems and ratifying the regulatory options.

1.3.1. Tyrel Gilb Research Laboratory in Stockton, California

This laboratory was built in 2003 to test full-scale structures subjected to seismic events. Featuring an investment of close to $10 million, this laboratory simulates earthquakes according to the curves recorded during real seismic activity.

Buildings with up to three storeys can be tested, thereby allowing engineers to analyse the behaviour of the ground floor and intermediate floor. Specific loads can be applied to simulate the weight of several storeys. The laboratory team is led by Steve Pryor, who has been developing research activities for Simpson Strong-Tie since 1997. He is a recognised expert in seismic timber design. He actively takes part in international programmes, including the NEES in Japan in 2009, which involved testing a seven-storey building.

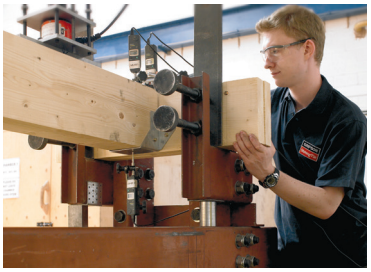


Test of a full-size three-storey building. Simpson Strong-Tie - Tyrel Gilb Laboratory in Stockton

Seismic activity and timber constructions

1.3.2. Andris Peterson Laboratory in Tamworth, UK

This laboratory was created in 1997 to support the development of connectors in Europe. The laboratory now focuses exclusively on timber connectors and fasteners, and already has the necessary equipment for carrying out cyclic tests.



Connectors, panel anchors, the Steel Strong-Wall™ and the system developed for Europe and France in particular are tested in this laboratory. This ensures that products are compliant with all applicable regulations, the supply of specific wood species to the target markets and interactivity with the design teams based in different countries.

1.4. New builds and renovations

Seismic design generally tends to apply to new builds that need to satisfy regulatory obligations. Discrepancies may arise between the recommended products and the solutions actually implemented due to a lack of knowledge.

The issues often reported are caused by the use of fasteners (nails or screws) that fail to conform to quality specifications (lack of certification) or generally the required quantities. The repercussions in the event of an earthquake could be the early slip of a connector leading to a critical deformation in the building's stability. You are advised to check this particular point.

Reinforcement of the connection with the foundation

Furthermore, a whole range of buildings has been built in accordance with the PS92 standards, which were highly concise for timber constructions, or the Eurocodes and the new seismic zoning regulations enacted in France on 1 May 2011.

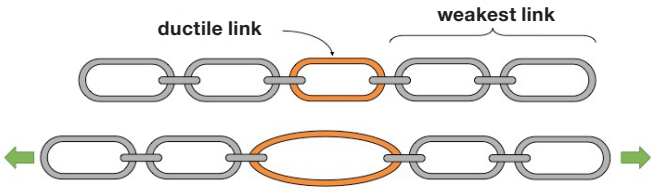
The existing timber structure can easily be reinforced to withstand the stresses and forces laid down by the new regulations. Generally speaking, standard connectors and the associated fasteners are sufficient to achieve these objectives. A thorough inspection is recommended of the design and the execution of the metal connector zones considered to be dissipative, regardless of whether the structure is a new build or renovation.

2. Specific features of connectors

Connectors play an important role in enabling buildings to withstand seismic stresses and forces. Depending on the type of structure, it must fulfil a specific function:

Transfer the forces (distribution) or dissipate the energy (dissipation).

In all cases, it is important to use the connector so as to create a continuous load path.



Principle of conception

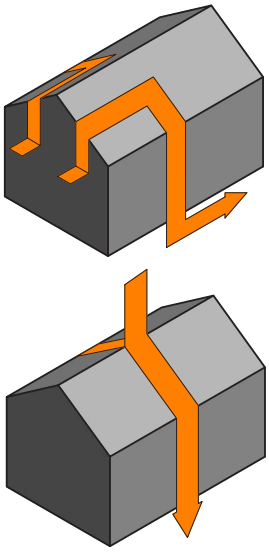
The structure must be designed in such a way that fragile elements are sufficiently resistant, so that any ductile elements flex before the fragile elements break.

2.1. Continuous load path

In terms of the application directions, seismic forces are often considered to be similar to wind forces. However, wind forces are exerted against the outer surfaces, whereas seismic forces are caused by the movement of the foundations, which displaces the mass constituting the structure. This means that all the rooms in the structure are required to move and not just the outer surfaces. In addition, the quick change in direction during an earthquake means that parts of the building may be required to displace several centimetres before returning to their initial position.

Seismic forces (both horizontal and vertical) depend on the mass of the element that displaces during the earthquake. Consequently, these forces occur in both the roof structure and the floors / walls. They increase as they get closer to the ground, since they tend to build up over time.

One of the key points in seismic design is to ensure that all forces are transferred to the building's foundations. To do so, you must create what is known as a continuous load path. This is a set of components that ensure that the forces are transferred to the foundations as directly as possible.



Connectors are partly important, since they will create a link between the different masses

in movement and ensure that the resulting forces are exerted downwards.

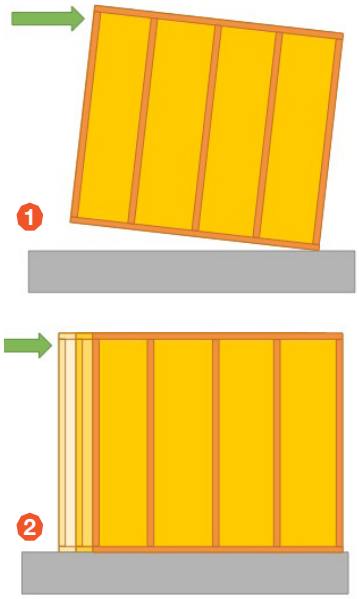
Seismic activity and timber constructions

2.2. Distribution

There are two possibilities for connectors: the first is called Distribution. In this case, the structure is fairly ductile. The aim is to use connectors to transfer the forces. In this scenario, they act as the weakest link.

This is typically the case with a timber frame house. This type of structure is quite flexible due to the many fixings between the sheathing, studs and rails. In some cases, sheathing may be required on both sides of the timber frame wall panel.

The connector is then responsible for preventing two phenomena that could occur: sliding and overturning.



Phenomena to be avoided: overturning 1, sliding 2

There are several solutions to overcome this problem, such as anchoring the timber frame, using a continuous tie-down system (currently unavailable in Europe) or implementing a Steel StrongWall™ stability wall. Each solution addresses

a specific need and offers different distribution performance levels.

For example, timber frame anchors are suitable for low seismic loads. This type of connector is fixed to the ends of the walls to prevent uplift. They can be reinforced with anchor plugs or pre-grouted rods for earthquake-prone areas (certification: C2 for anchors) to resist the shear forces along the sole plate. Timber frame anchors should not be too flexible, otherwise the studs could be wrenched away from the sole plate.

Where anchors are fitted to the external face of the walls, their behaviour varies according to whether the anchor is fixed to the sheathing or directly to the stud. The maximum load is reduced when timber frame anchors are fixed to the sheathing, but ductility and equivalent viscous damping are slightly improved.

Similarly, the length of the fasteners and the fact that fixings are asymmetric may cause early failure in the studs.

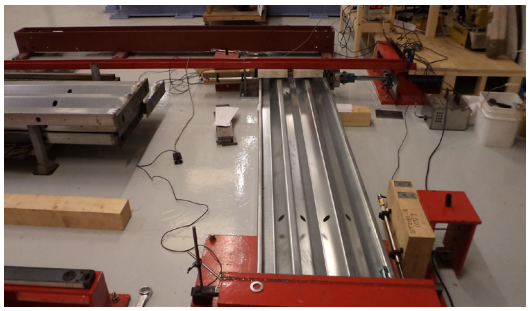
If fasteners are too short in comparison to the thickness of the stud (length of the fastener less than half the thickness of the stud), tensile failure may occur. To avoid this phenomenon, it may be worthwhile using longer fasteners or adding structural screws to the other side of the timber element.

The second solution for distribution is to use a Strong-Wall™.

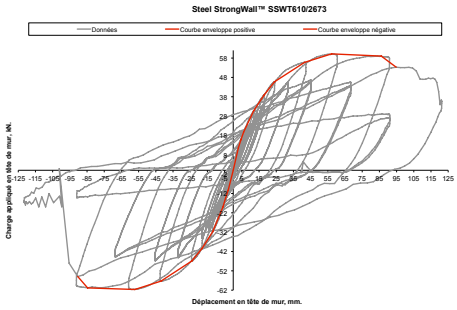
Example of a timber frame construction with Steel Strong-Wall™

This product is especially suited to situations where space is at a premium and timber frame walls are unable to withstand the forces. The low footprint and rigid design of the Steel Strong-Wall™ system are invaluable in such cases.

Steel Strong-Wall™ panels have been subjected to cyclic testing and have demonstrated effective behaviour, meaning that they can be used to withstand seismic forces. **Their behaviour factor is equivalent to a timber frame wall (q=3).**



If this type of solution is chosen, the concrete foundation is a critical element, meaning that special care must be taken, since high forces may be exerted on the anchors (> 60 kN in tensile).



Steel Strong-Wall™ panels subjected to cyclic loading

It is important to remember that the walls are only part of the structure. The load path must be ensured in all the structural members and also between members. Fixing bands or retaining brackets may need to be added to the horizontal diaphragms or roof structure, so that forces are quickly transferred through all the elements within the structure.

Seismic activity and timber constructions

2.3. Dissipation

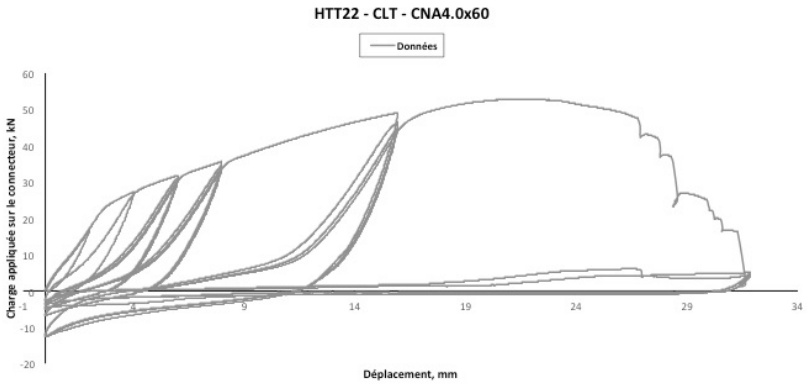
The other possibility is dissipation. This case is required if the structure is sufficiently rigid. The connector acts as a fuse in the structure and therefore represents the ductile link in the chain. This is the principle chosen for CLT structures. CLT elements are rigid enough to transfer the forces, but they lack flexibility. This is where the connector comes into play. However, using ductile connectors in this type of structure is not enough to guarantee effective performance. Other parameters, such as the dimension ratio of the panels, also have an effect on design performance.

As with the timber frame, it may be worthwhile using specialised products for each force direction. That is why an effective solution is the combined use of wall anchors (HTT22E) and structural angle brackets (ABR255). HTT22E anchors absorb the uplift forces and are fitted at each end of the panel. AE116 structural brackets are placed at regular intervals along the panels and absorb the shear forces.

Other more versatile brackets, such as ABR100, can be used for their good performance in both force directions.

3. Conclusion

It is important to ensure the continuous force path when designing for buildings for earthquake resistance. Care must also be taken to ensure that all connection points are resistant enough to prevent the structure from partially or fully collapsing. With timber frame structures, connections can easily be made with the standard products that are already used for wind resistance. Whether standard tie straps or Steel Strong-Wall™, an end-to-end range of connectors is available in the market to address this particular issue (dissipation or distribution).



Steel StrongWall™ panels subjected to cyclic loading

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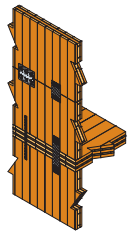
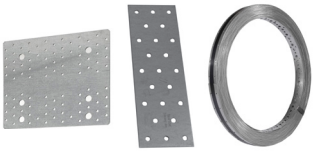
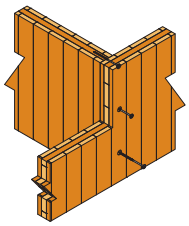
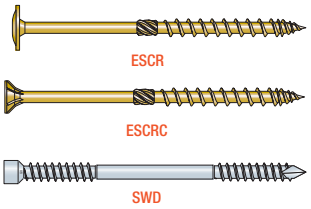
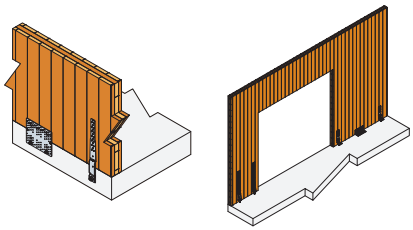
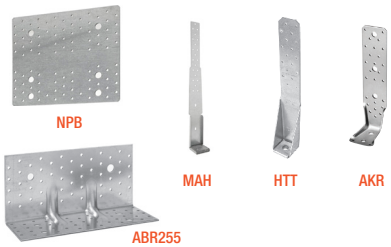
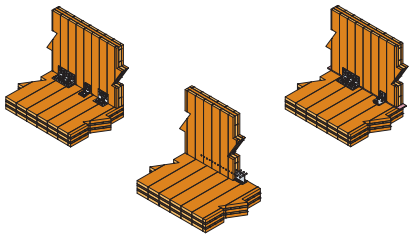
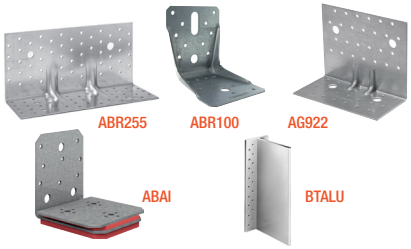
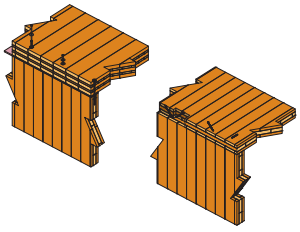
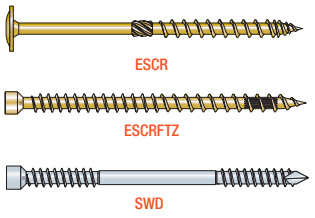
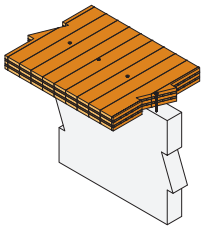
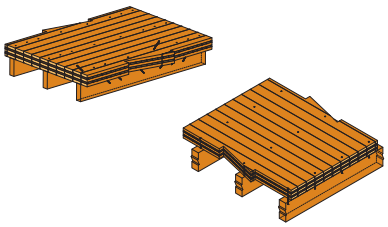
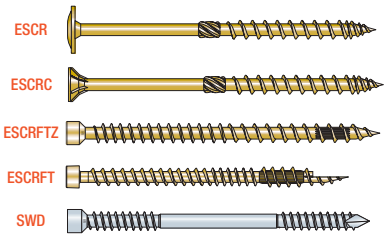
Different CLT Configurations

Configuration summary and recommended products

Configurations	Applications	Recommended products	Page
	2.1 – Wall-to-wall connection	 NPB NP BAN	26
	2.2 – T-connection between two walls	 ESCR ESCRC SWD	27
	2.3 – CLT wall on a concrete floor	 NPB MAH HTT AKR ABR255	28
	2.4 – CLT wall on a CLT floor	 ABR255 ABR100 AG922 ABAI BTALU	29
	2.5 – CLT floor on a CLT wall	 ESCR ESCRFTZ SWD	30
	2.6 – CLT floor on a concrete wall	 WA-RL	31
	2.7 – CLT floor on timber joists	 ESCR ESCRC ESCRFTZ ESCRFT SWD	32

Configuration summary and recommended products

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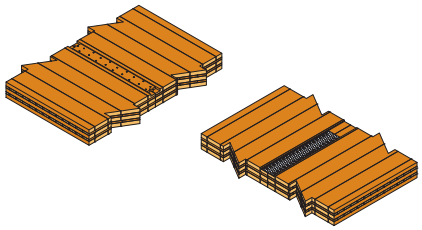
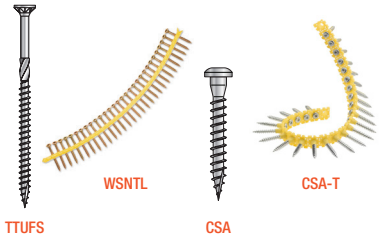
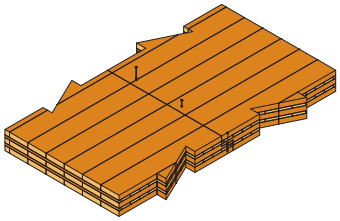
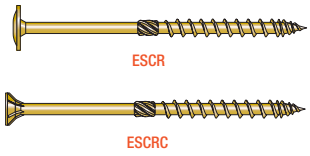
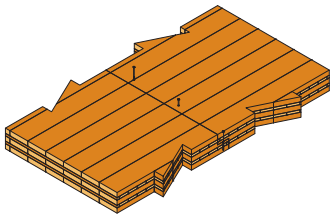
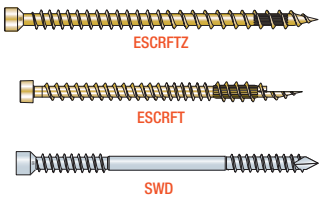
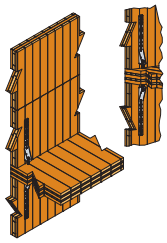
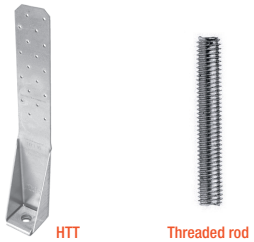
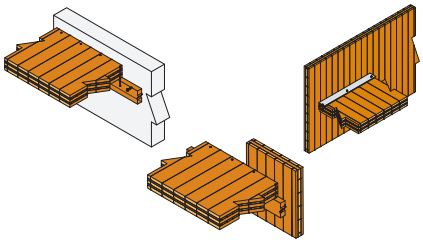
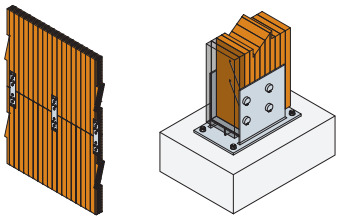
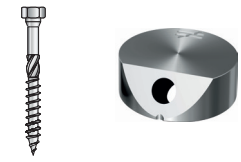
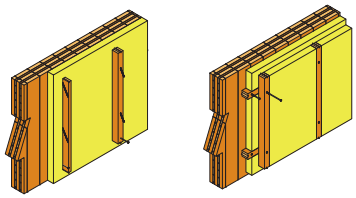
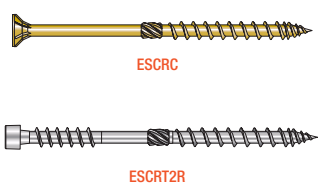
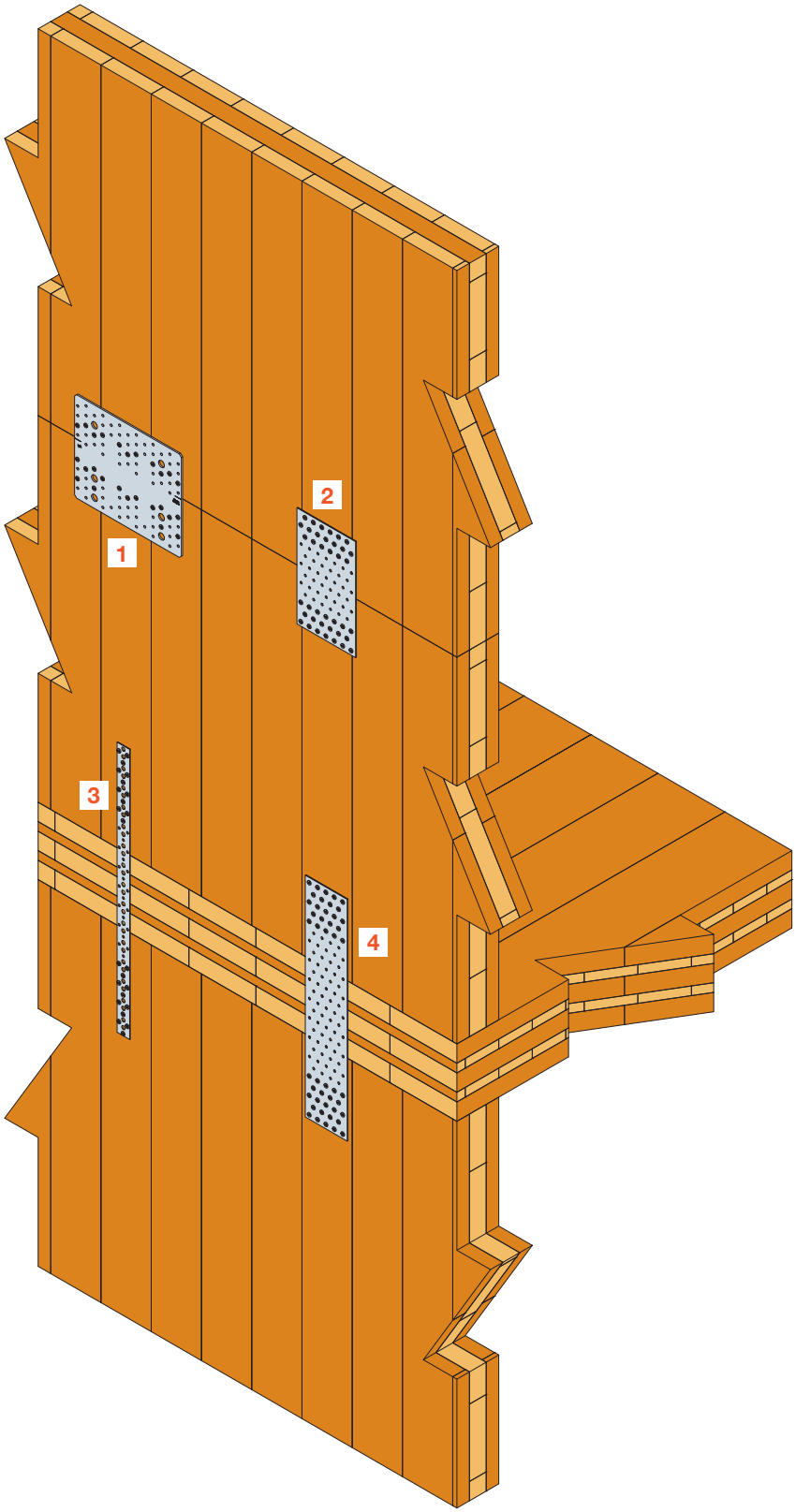
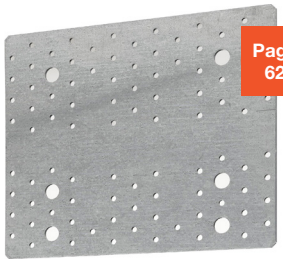
	**2.8.1 – CLT floor on a CLT floor** Wooden tongues or nail plates		33
	**2.8.2 – CLT floor on a CLT floor** Halved joint		34
	**2.8.3 – CLT floor on a CLT floor** Skewed screws		35
	**2.9 – Force transfer between two walls**		36
	**2.10 – Fixing a CLT floor to a wall plate**		37
	**2.11 – Connector brackets**		38
	**2.12 – CLT building envelope**		39

2.1 – Wall-to-wall connection

There are different ways to join CLT walls on top of other CLT walls. One solution is to use nail plates to withstand the forces and prevent any uplift. Simpson Strong-Tie offers various solutions, such as **NPB255** nail plates, **NP** nail plates, **NP-X** nail plates and **BAN** fixing bands.





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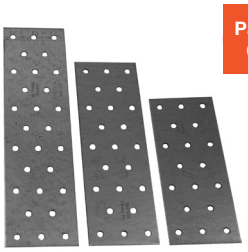
1 NPB - Nail plate for CLT



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2 NP - Nail plate

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3 BAN - Fixing band

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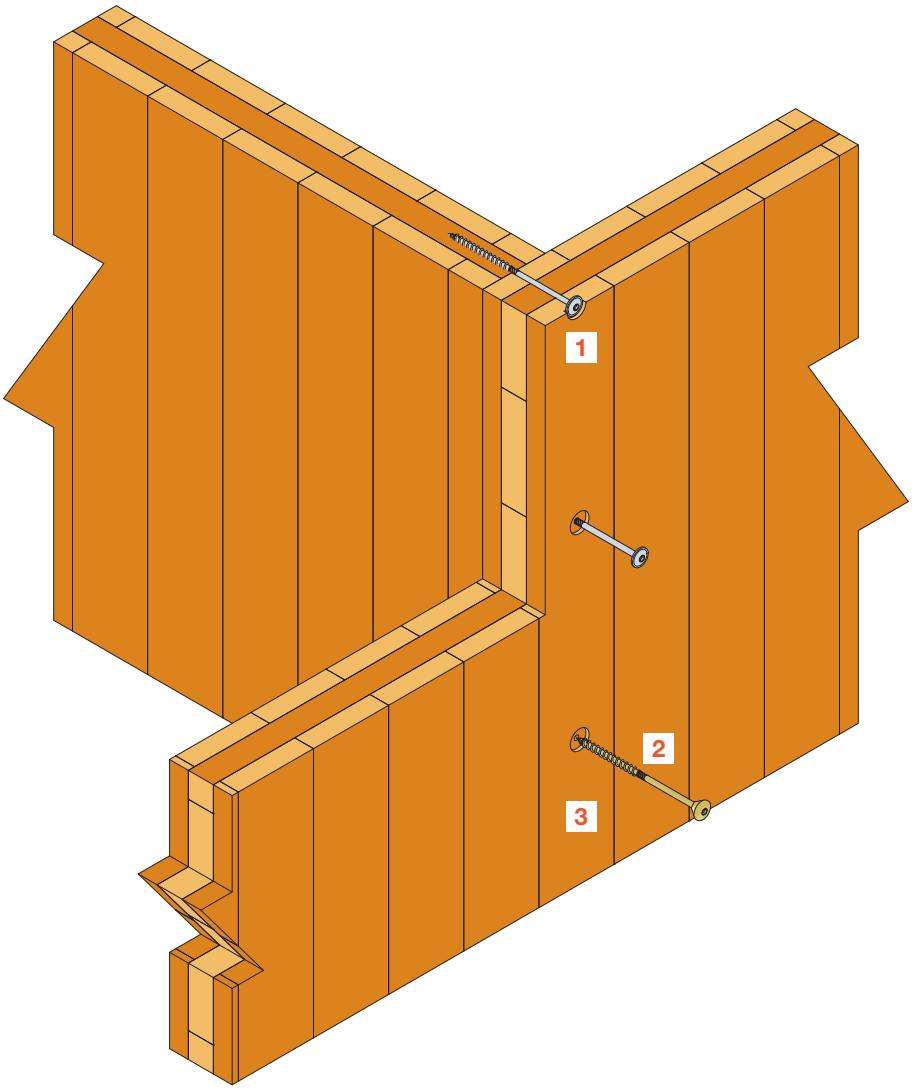
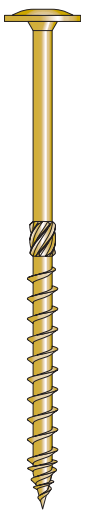
4 NP-X - Special nail plate

2.2 – T-connection between two walls

Part threaded screws are recommended for joining two walls at a T-connection. The screws ensure that panels are fastened tightly together, while offering good load-bearing performance. **ESCR** part threaded washer head screws, **ESCRC** part threaded countersunk head screws and **SWD** double threaded screws are especially suited to this type of configuration.





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1 ESCR - Washer head structural timber screw

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2 ESCRC - Countersunk head structural timber screw

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3 SWD - Double threaded structural timber screw

2.3 – CLT wall on a concrete floor

When the outer face of the CLT wall is aligned with the edge of the slab, the wall can be fixed with **NPB** nail plates or **MAH** hold downs (fig. 1). In all other cases, **ABR** and **AG** brackets can be used, as well as **AKRX3L** and **HTT** hold down brackets (fig. 2).

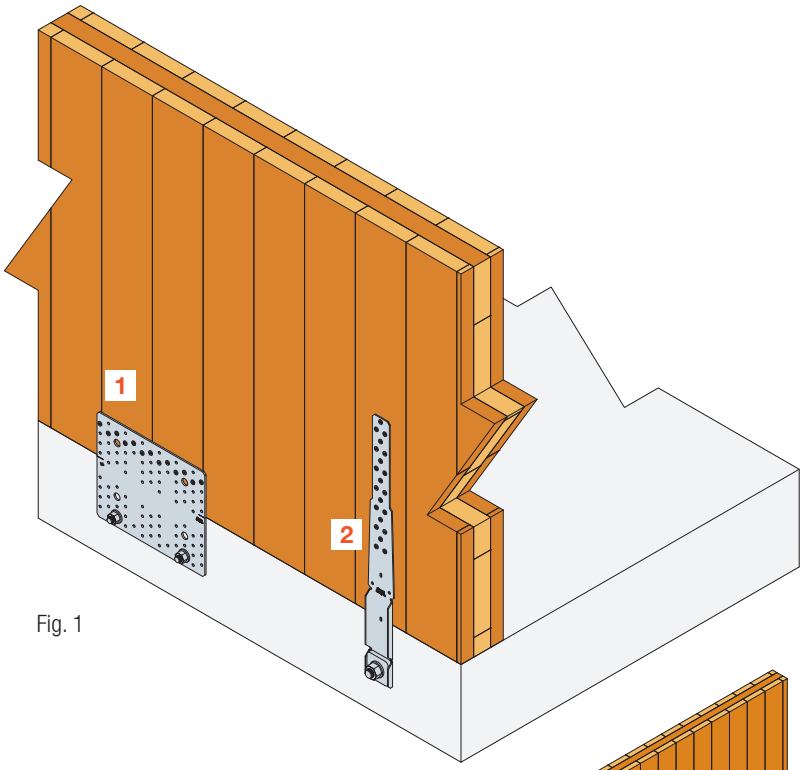


Fig. 1

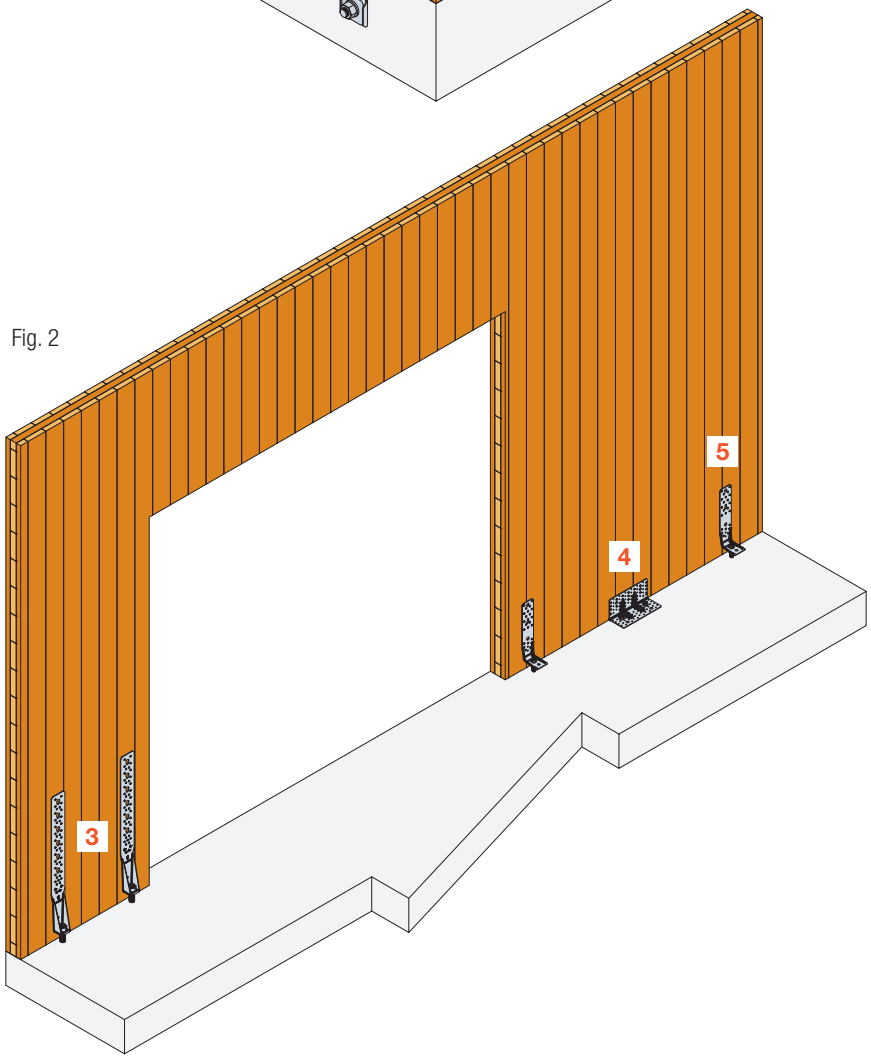
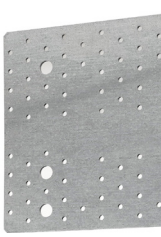


Fig. 2



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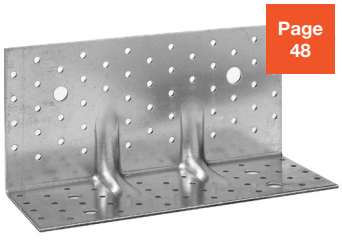
1 NPB - Nail plate for CLT

Page 44

2 MAH - Multi-purpose hold down for studs

Page 42

3 HTT - Hold down for timber frame studs



Page 48

4 ABR255 - Reinforced hold down bracket

Page 43

5 AKR - Reinforced angle bracket for timber frames

2.4 – CLT wall on a CLT floor

When joining a CLT wall to a CLT floor, a conventional solution is to use such brackets as **ABR255, ABR100 and AG922** (fig. 1). An acoustic resilient strip may be required to reduce sound. In this case, remember to use an appropriate connector, such as the **ABR255** with a SIT acoustic isolating strip or the **ABAI** acoustic angle bracket, to prevent sound transmission (fig. 2). Another solution is to use **BTALU** concealed beam hangers. In this particular case, simply cut a slot in the wall and insert the dowels to ensure a good connection (fig. 3).

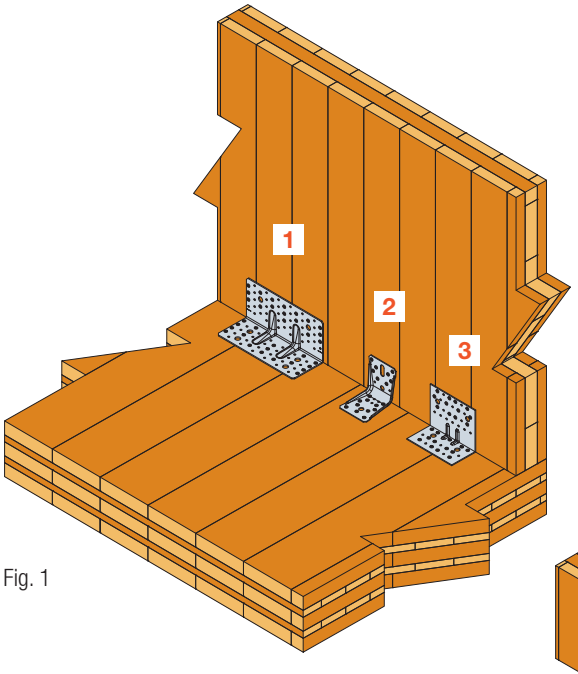


Fig. 1

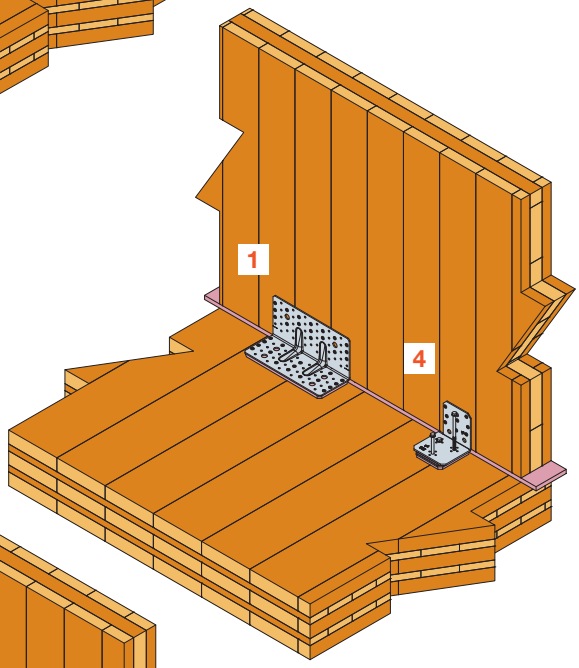


Fig. 2

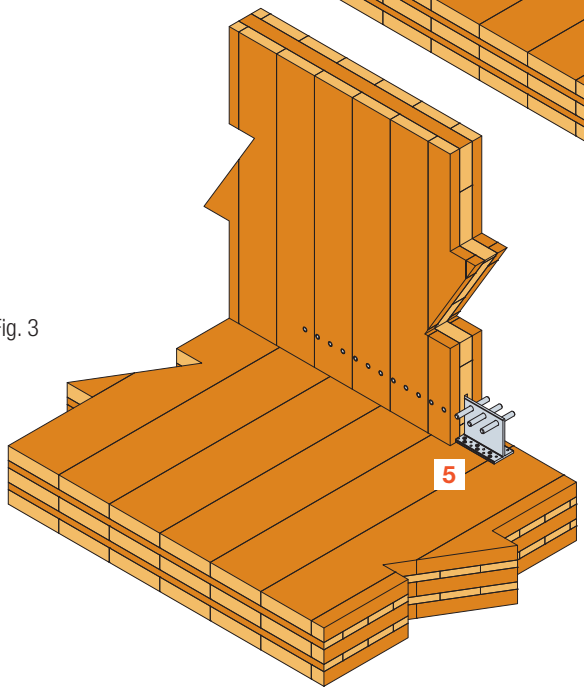
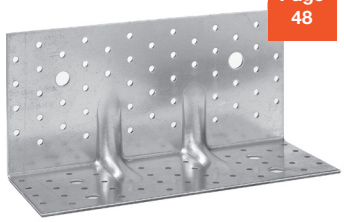


Fig. 3



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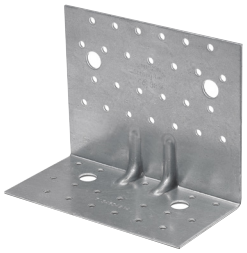
1 ABR255 - Reinforced hold down bracket

Page 55

2 ABR100 - Reinforced angle bracket



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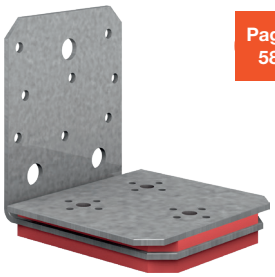
3 AG922 - Reinforced angle bracket



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4 ABAI - Acoustic angle bracket

Page 68

5 BTALU - Concealed beam hanger - Aluminium

2.5 – CLT floor on a CLT wall

When a CLT floor needs to be fixed to the top of a CLT wall, the easiest method is to use **ESCR** or **ESCRC** part threaded screws (fig. 1). If looking to achieve the best acoustic performance, the use of a **SITW** acoustic washer is required. To support higher shear forces, **ESCRFTZ** fully threaded screws or **SWD** double threaded screws should preferably be used at an angle (fig. 2).

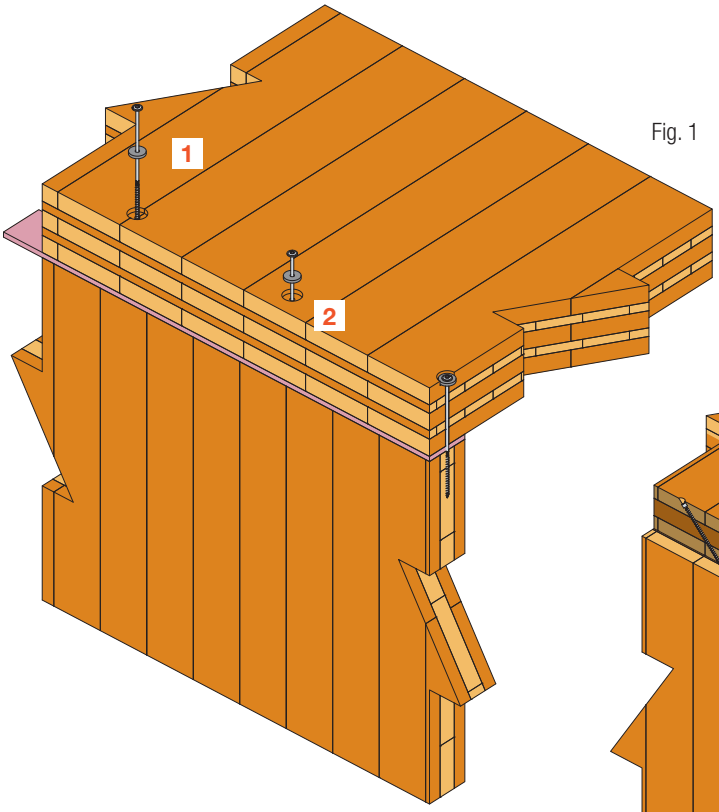


Fig. 1

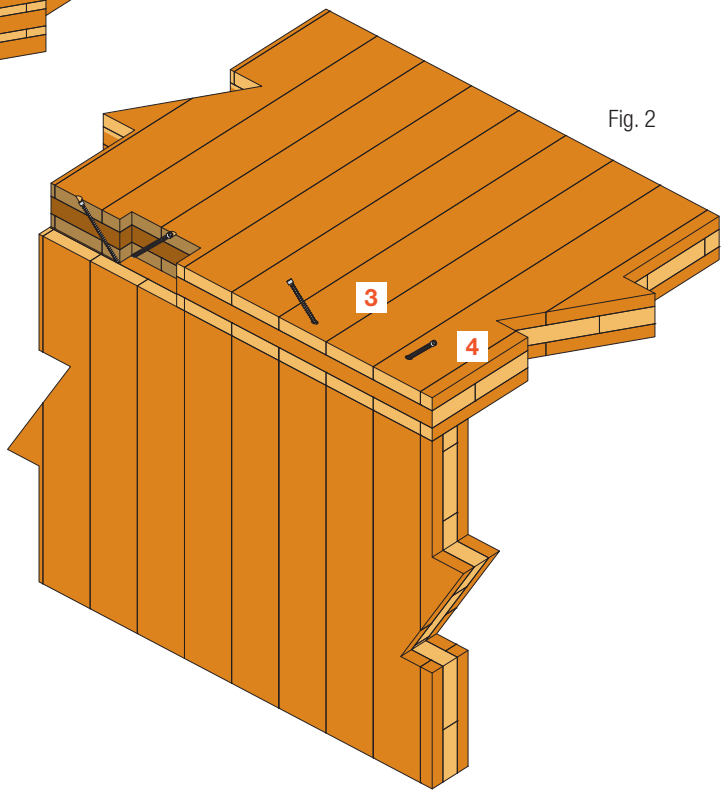
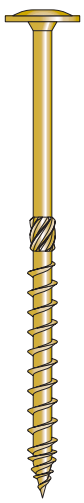


Fig. 2



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1 ESCR - Washer head structural timber screw

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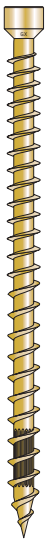
2 SITW - Acoustic washer



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3 ESCRFTZ - Fully threaded structural timber screw

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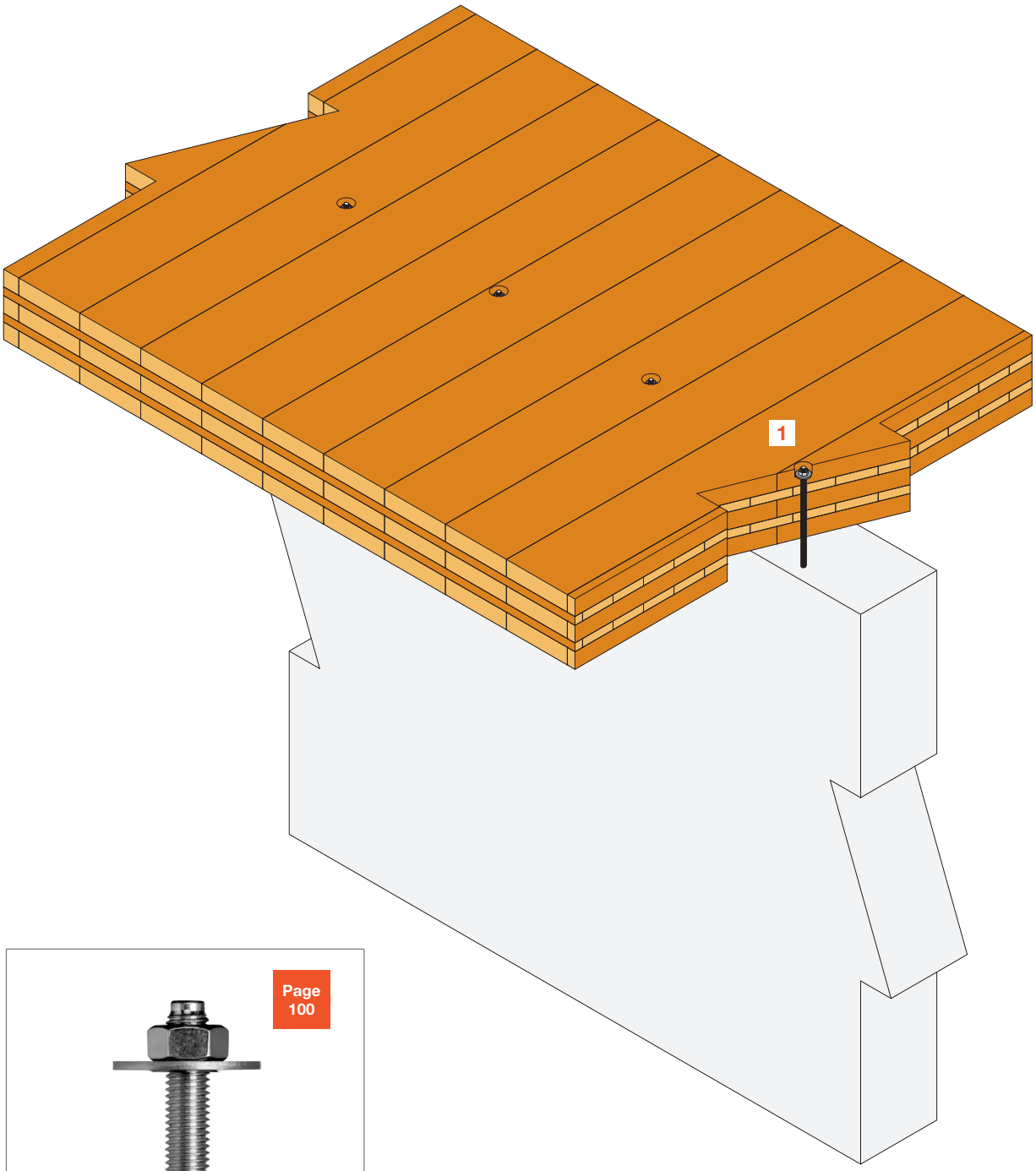
4 SWD - Double threaded structural timber screw

2.6 – CLT floor on a concrete wall

A CLT floor is fixed to a concrete wall using a throughbolt. A wide washer must be used to avoid punching through the panel. **WA-RL** throughbolts are perfectly suited to this type of application.



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1 WA-RL - Throughbolt with wide washer

2.7 – CLT floor on joists

When CLT panels are laid on timber joists, they must be secured with screws: either part threaded screws **(ESCR, ESCRC)**, double threaded screws **(SWD)** or fully threaded screws **(ESCRFTZ)** (fig. 1). Using fully threaded screws reduces the number of fixings, but the screws must then be driven in at an angle (fig. 2).

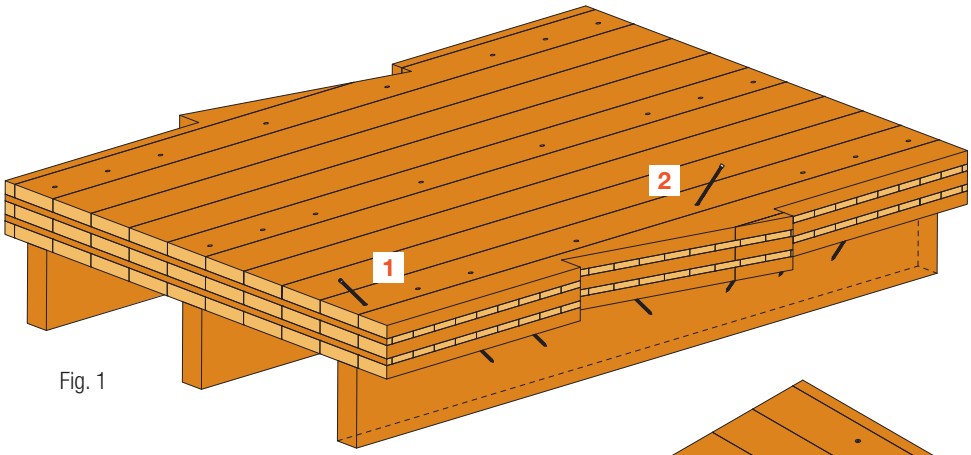


Fig. 1

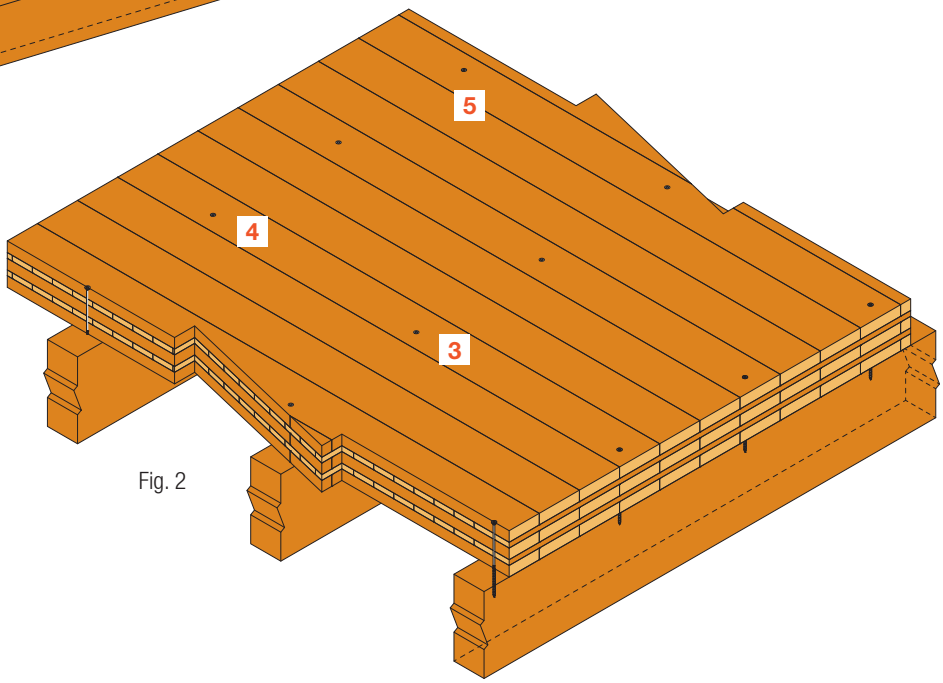


Fig. 2

Fully threaded

Page 82

1 ESCRFT - Fully threaded structural timber screw

Page 82

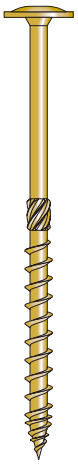
2 ESCRFTZ - Fully threaded structural timber screw

Double threaded

Page 89

3 SWD - Double threaded structural timber screw

Part threaded



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4 ESCR - Washer head structural timber screw

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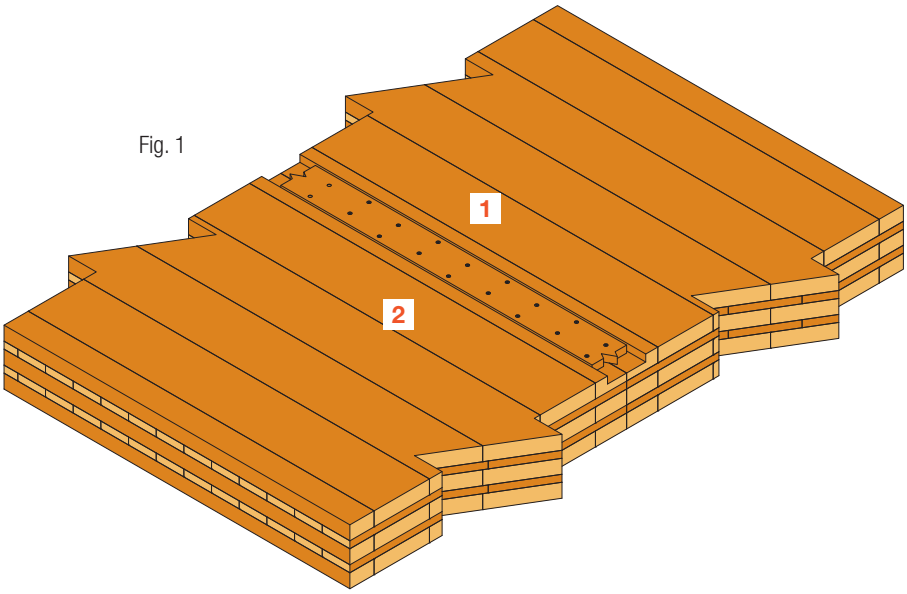
5 ESCRC - Countersunk head structural timber screw

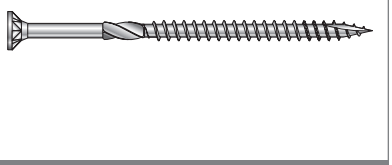
2.8.1 – CLT floor on a CLT floor Wooden tongues or plates

Several methods are available for joining two CLT panels in the same plane. One solution is to use plywood or OSB tongues, which are then fixed with the appropriate screws.

Since installation times are a key factor when erecting CLT buildings, it is important to use a mechanised screwing system. In addition to the **TTUFS** loose screws (part threaded countersunk head screws), Simpson Strong-Tie proposes **WSNTL** collated screws that can be used with the Quik Drive system for fast installation (fig. 1).

Fig. 1





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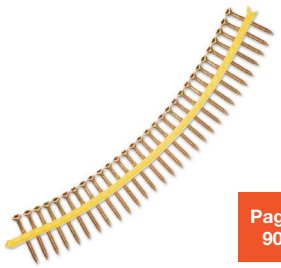
1 TTUFS - Countersunk head timber screw



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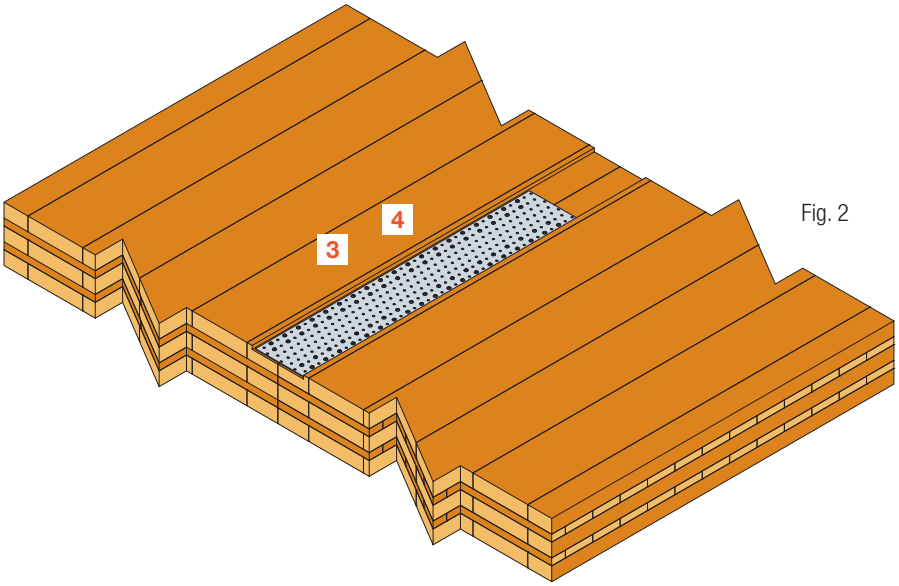
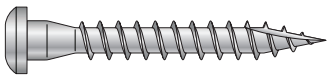
2 WSNTL - Timber frame screw

The wooden tongue can be replaced with a perforated plate fixed with **CSA** screws. This method reduces the number of screws for the same load or increases the load-bearing capacity with the same number of screws. CSA screws are available loose **(CSA)** and collated **(CSA-T)**.
For example, at least 30% less screws can be used compared to **WSNTL** screws. Compared to TTUFS loose screws, the saving is at least 20%. Simpson Strong-Tie can also supply custom-sized perforated plates (fig. 2).

Fig. 2





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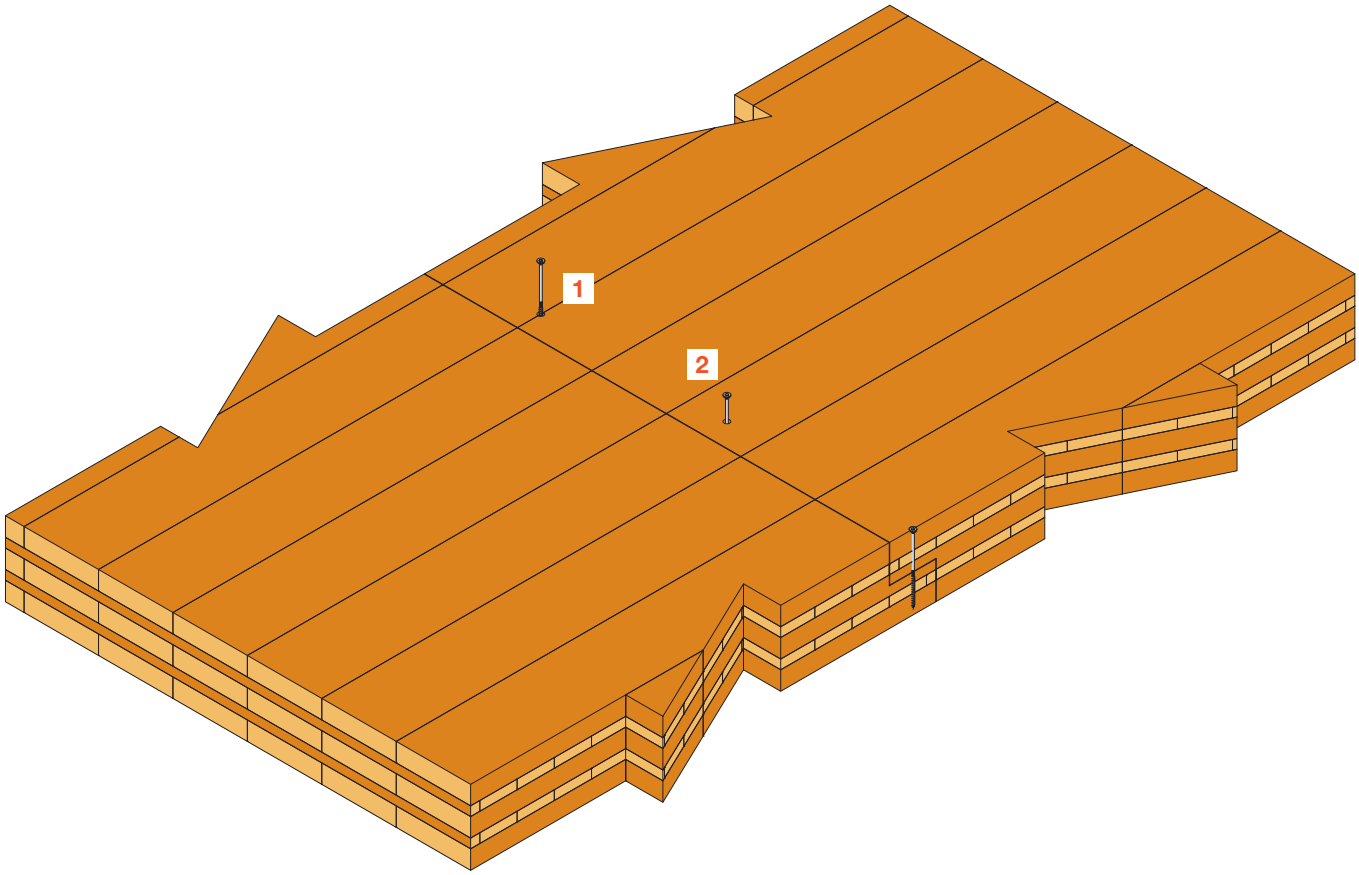
3 CSA - Connector screws

Page 96

4 CSA-T - Collated connector screws

2.8.2 – CLT floor on a CLT floor Halved joint

A second solution is available for joining two CLT floors together, namely a halved joint.
Preferably use part threaded screws **(ESCR or ESCRC)** to keep both panels butted tightly together.

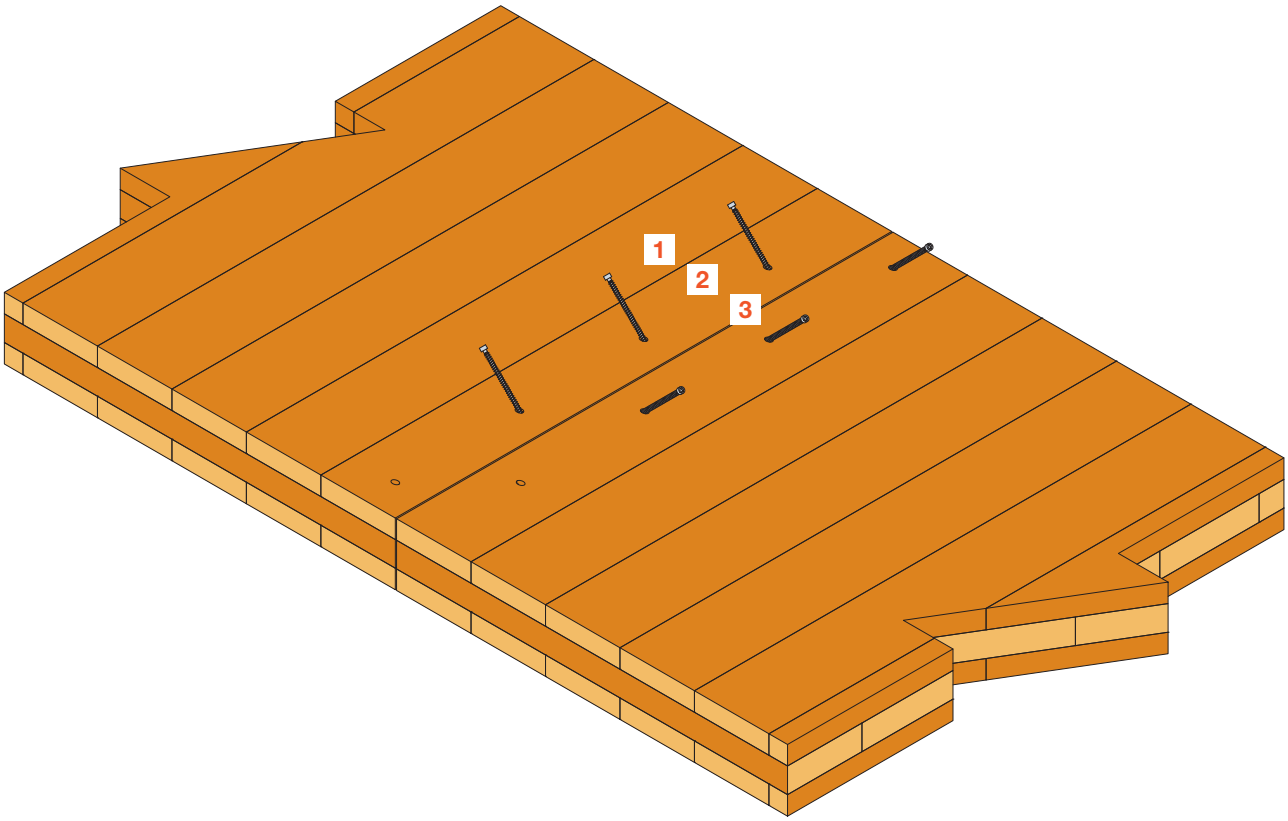


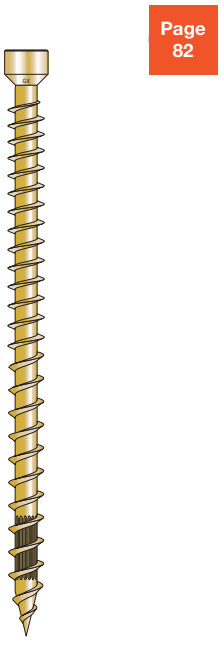
1 ESCR - Washer head structural timber screw

2 ESCRC - Countersunk head structural timber screw

2.8.3 – CLT floor on a CLT floor Skewed screws

The last solution for joining two CLT floors together involves using pairs of skewed screws. In this case, you are advised to choose fully threaded screws **(ESCRFT or ESCRFTZ)** or double threaded screws **(SWD)** to improve the load-bearing capacity.





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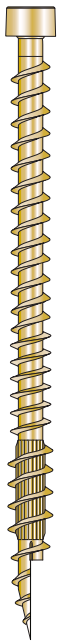
1 ESCRFT - Fully threaded cylinder head structural timber screw



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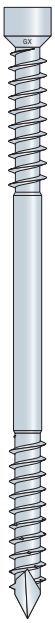
2 ESCRFTZ - Fully threaded cylinder head structural timber screw



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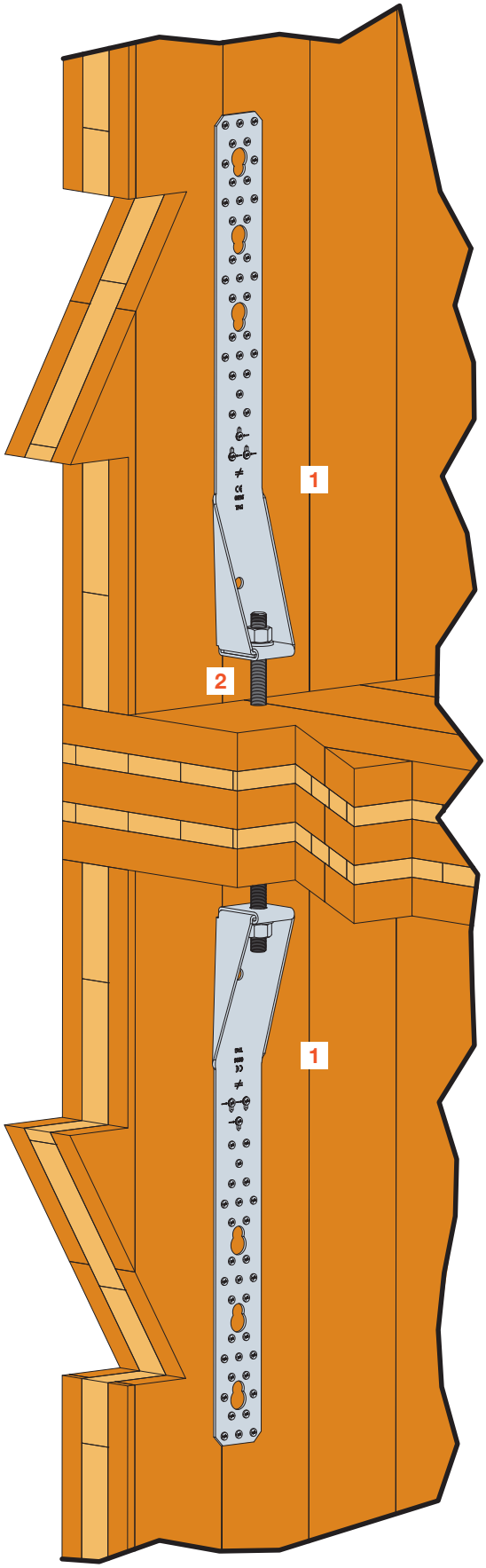
3 SWD - Double threaded structural timber screw

2.9 – Force transfer between two walls

Forces can be transferred from one CLT wall to another wall, even in the presence of an intermediate floor.
To do so, use timber panel connectors, such as **HTT**, which are connected together using threaded rods.



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1 HTT - Hold down for timber frame studs

2 Threaded rod

2.10 – Fixing a CLT floor to a wall plate

This application raises two question marks: how do you fix the wall plate and how do you fix the floor to the wall plate?
The substrate determines how the wall plate is fixed:

- Concrete substrate: preferably use throughbolts with a wide washer, such as **WA-RL** (fig. 1).
- Timber substrate: preferably use timber screws, such as **ESCR, ESCRC, ESCRFTC, ESCRFTZ and SWD** (fig. 2).

There are two separate ways to fix the floor to the wall plate:

- Timber wall plate: fix the floor with **ESCR** or **ESCRC** screws (fig. 1 or 2).
- Steel wall plate: fix the floor with **SSH** screws (fig. 3).

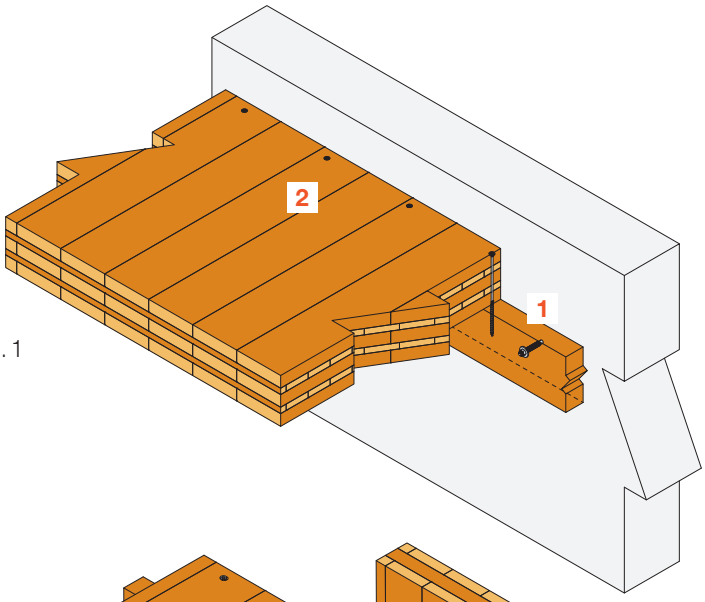


Fig. 1

1 WA-RL - Throughbolt with wide washer

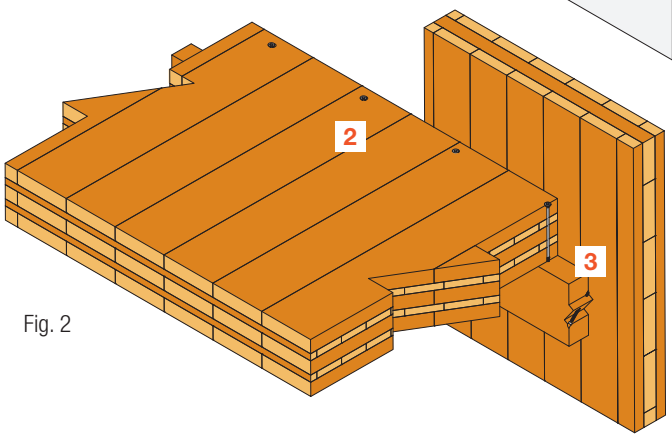


Fig. 2

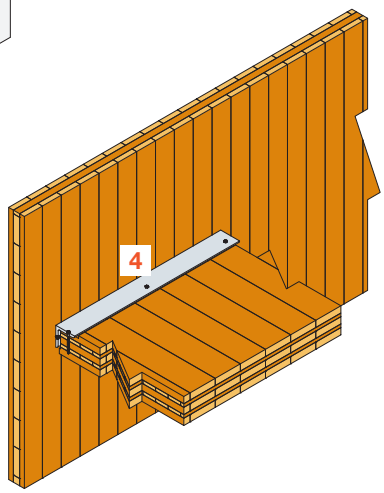
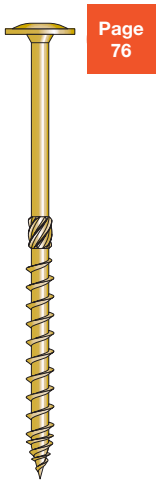


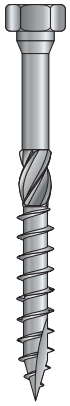
Fig. 3

Part threaded



2 ESCR

2 ESCRC



4 SSH

Double threaded

3 SWD

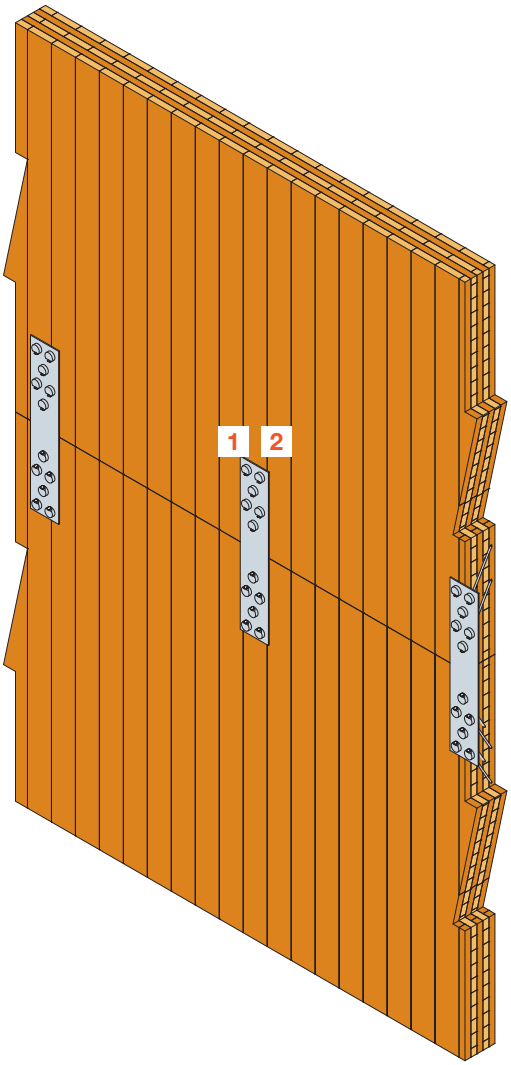
Fully threaded

3 ESCRFT

3 ESCRFTZ

2.11 – Connector brackets

If there are no standard connectors for the required assembly, connector brackets can be made to specification.
These brackets are fixed with **SSH** screws or **ZYKLOP**™ angled washers and screws.



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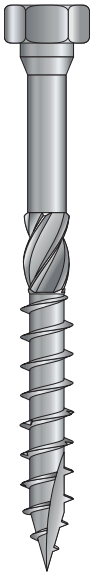
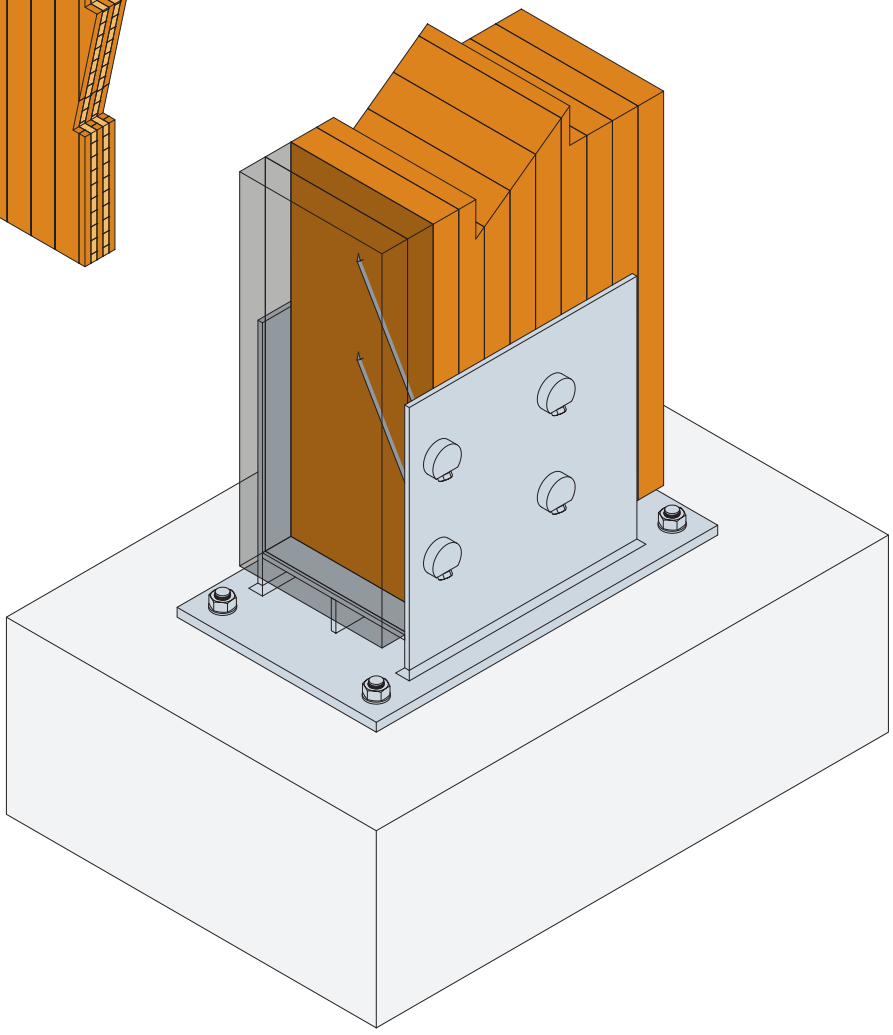


1 SSH - Hex head structural timber screw



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2 ZYKLOP™ - Angled washer with long screws

2.12 – CLT building envelope

When fitting external wall insulation to a CLT building, simply fix a timber frame directly to the CLT with **ESCRC** screws. In some cases, a secondary timber frame may be required, which is also fixed with countersunk head screws (fig. 1).

The other solution involves using screws for the sarking to avoid horizontal studs. **ESCRT2R** screws are perfectly suited to this configuration (fig. 2).

Note: Cladding brackets are not allowed to be used for fixing external wall insulation to a CLT building.

Fig. 1

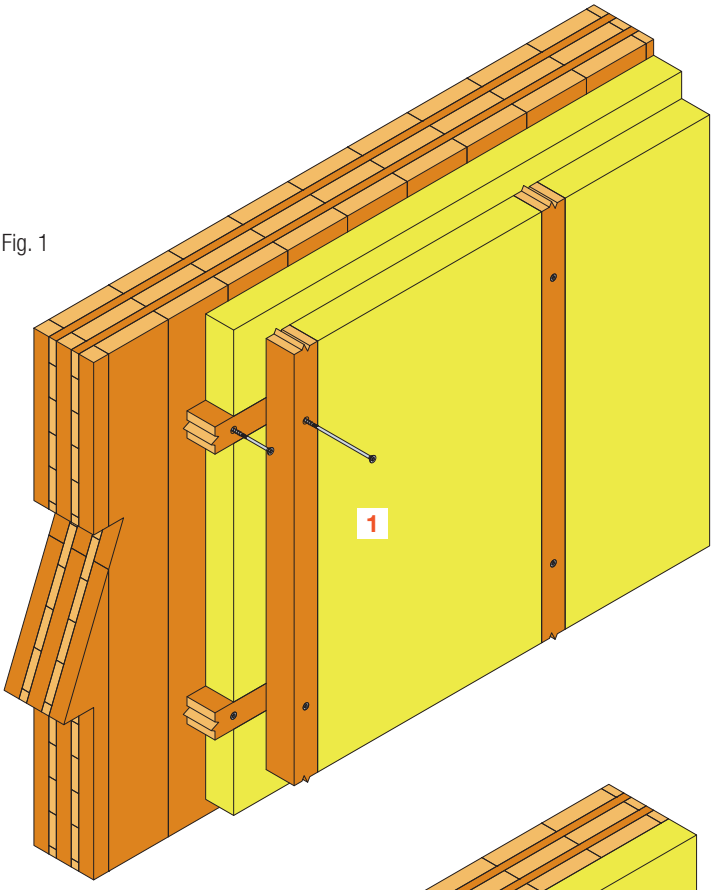
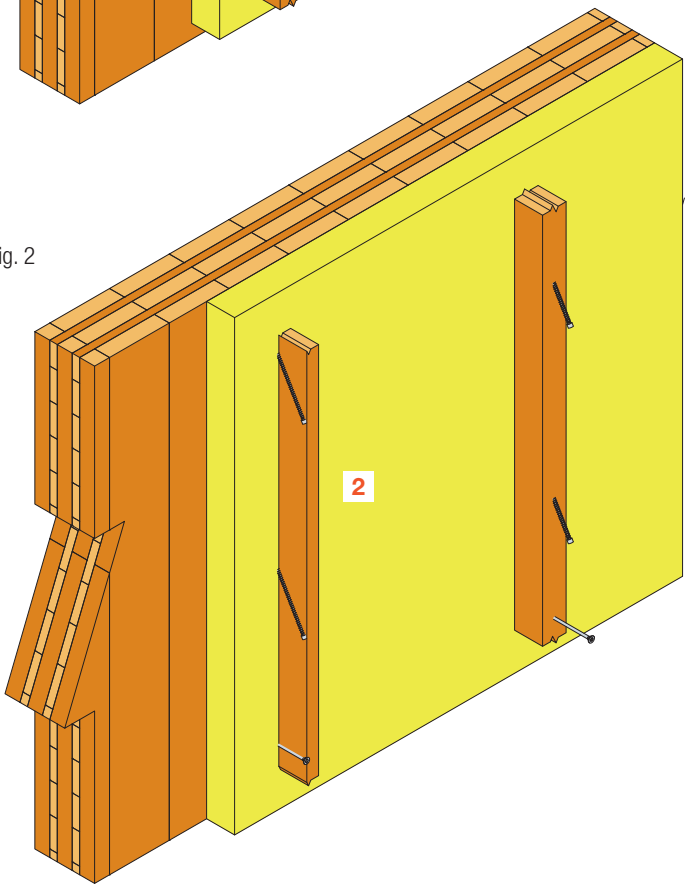


Fig. 2



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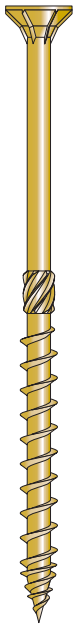

1 ESCRC - Countersunk structural timber screw

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2 ESCRT2R - Twin thread cylinder head screw

PIVETEAU: HEXAPLI

Hold Downs

Hold down for timber frame studs **HTT**

HTT5 HTT22E HTT31

HTT hold downs for timber panels are folded parts that are optimised to withstand uplift forces. They can be used individually or in pairs. They are especially suitable for CLT structures.
The tongue enveloping the two sides at the bottom significantly increases the load-bearing capacity.

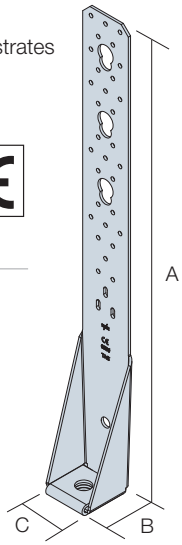
Advantages:

- High uplift resistance: ideal for connections to concrete substrates

Z275 20 µm

SC 2

ETA-06/0285



Dimensions

Model No.	Dimensions [mm]								Qty Holes Flange A [mm]			Qty Holes Flange B [mm]		
	A	B	C	D	E	F	G	t	ø4.7	ø5	ø21	ø17.5	ø18	ø26
HTT5	404	62	90	2,5	33	-	-	2,8	26	-	-	1	-	-
HTT22E	558	60	63	12,5	33	80	352	3	-	31	3	-	1	-
HTT31	785	60	90	12	33	80	340	3	-	41	6	-	-	1

Characteristic values

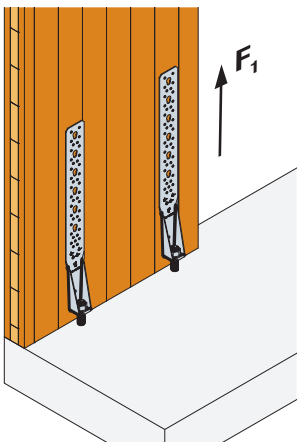
Model No.	Fasteners		Characteristic values [kN]						
	Flange A	Flange B	Tensile $R_{1,k}$					$R_{1,k}$ (+US50/50/8)	
	Qty	Qty	CNA4,0x50	CNA4,0x60	CSA5,0x50	CSA5,0x80	6 ZYKT69 + 4 CSA	CNA4,0x50	CNA4,0x60
HTT5	18	1 M16	min (24,7; 43/k_{mod})	min (31,0; 43/k_{mod})	-	-	-	24,7	34,2
HTT22E	26	1 M16	min (42,3; 57,5/k_{mod})	min (53,1; 57,5/k_{mod})	min (59,1; 57,5/k_{mod})	min (78,7; 57,5/k_{mod})	-	min (42,3; 57,5/k_{mod})	min (53,1; 57,5/k_{mod})
HTT31	45	1 M24	-	-	min (85,7; 85,1/k_{mod})	min (143; 85,1/k_{mod})	min (93,8;78,3/k_{mod})	-	-

This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285.

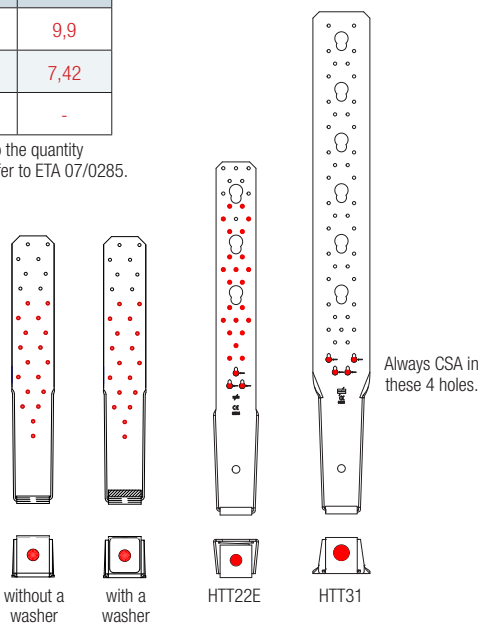
Stiffness

Model No.	Fasteners		Stiffness – C24 graded timber on concrete [kN/mm]						
	Flange A	Flange B	Tensile $R_{1,k}$					$R_{1,k}$ (+US50/50/8)	
	Qty	Qty	CNA4,0x50	CNA4,0x60	CSA5,0x50	CSA5,0x80	6 ZYKT69 + 4 CSA	CNA4,0x50	CNA4,0x60
HTT5	18	1 M16	4,45	4,78	-	-	-	9,28	9,9
HTT22E	26	1 M16	5,08	5,7	6,89	7,2	-	6,59	7,42
HTT31	45	1 M24	-	-	-	24,3	17,1	-	-

This table provides the characteristic values for the stiffness of the connection where the number of fasteners corresponds to the quantity specified in the table of characteristic values For the stiffness values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285.



Other nailing patterns are available in the ETA:



Reinforced angle bracket for timber frames **AKR**

The AKRX3 reinforced angle brackets for timber frames build on the existing range of reinforced brackets offering significant tensile strength. These brackets are recommended for withstanding uplift forces at the timber panel base.
They are capable of supporting forces in all directions ($R_{1,k}$, $R_{2,k}$, $R_{4,k}$, $R_{5,k}$).

Advantages:

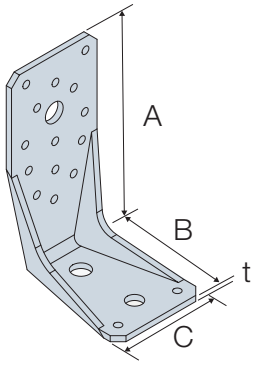
- Anchors the timber frame wall solidly to the ground (recommended in seismic zones)
- Engineered to withstand tensile forces

Z275 20 µm | SC 2 | ETA CE

ETA-07/0285

Dimensions

Model No.	Dimensions [mm]				Drill holes [mm]				
	A	B	C	Thickness	Flange A		Flange B		
					Nails	Bolts	Nails	Bolts	Obround
AKR95X3L	95	85	65	3	9 Ø5	-	2 Ø5	1 Ø11	1 Ø13,5x25
AKR135X3L	135	85	65	3	14 Ø5	1 Ø13,5	2 Ø5	1 Ø11	1 Ø13,5x25
AKR285X3L	285	85	65	3	26 Ø5	3 Ø13,5	2 Ø5	1 Ø11	1 Ø13,5x25



Characteristic values

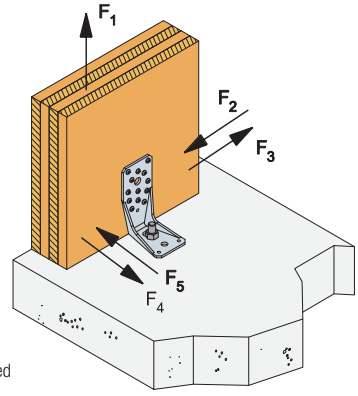
Model No.	Fasteners		Characteristic values [kN]			
	Flange A	Flange B	Tensile $R_{1,k}$		$R_{2,k}$	
	Qty	Qty	CNA4,0x50	CNA4,0x60	CNA4,0x50	CNA4,0x60
AKR95X3L	5	1 Ø12	min (5,7; 12,5/k_{mod} + 2,6)	min (6,8; 12,5/k_{mod} + 3,3)	2,0	2,3
AKR135X3L	8	1 Ø12	min (10,5; 12,5/k_{mod} + 1,7)	min (12,4; 12,5/k_{mod} + 2,2)	3,1	3,6
AKR285X3L	22	1 Ø12	min (20,1; 12,5/k_{mod} + 1,7)	min (24,4; 12,5/k_{mod} + 2,2)	2,8	3,5

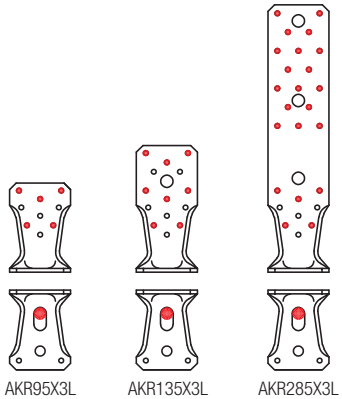
This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285. $R_{4,k}$ and $R_{5,k}$ are provided in ETA 07/0285.

Stiffness

Model No.	Fasteners		Stiffness – C24 graded timber on concrete [kN/mm]			
	Flange A	Flange B	$k_{ser,R}$		$k_{ser,R}$	
	Qty	Qty	CNA4,0x50	CNA4,0x60	CNA4,0x50	CNA4,0x60
AKR95X3L	5	1 Ø12	0,8	0,95	0,28	0,32
AKR135X3L	8	1 Ø12	1,46	1,72	0,43	0,50
AKR285X3L	22	1 Ø12	2,78	3,38	0,39	0,48

This table provides the characteristic values for the stiffness of the connection where the number of fasteners corresponds to the quantity specified in the table of characteristic values. For the stiffness values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285.





Related products

CSA | CNA | LMAS / AT-HP

Multi-purpose hold down for studs **MAH**

The MAH485/2 hold down for timber frame studs and its washer are recommended for reinforcing timber frame walls subjected to uplift forces.

Advantages:

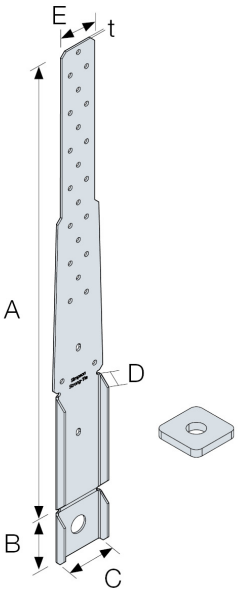
- Narrow anchor for use with 45mm wide timber frame studs
- The double configuration anchors the timber frame wall solidly into a parapet wall or concrete slab (recommended in seismic zones)
- Reinforces the stud/sole plate connection by preventing uplift: energy in the panel is dissipated through the stitching
- Washer supplied and pre-mounted on the bracket

Z275 20 µm | SC 2 | ETA | CE

ETA-06/0285

Dimensions

Model No.	Dimensions [mm]						Drill holes [mm]	
	A	B	C	D	E	Thickness	ø5	ø18
MAH485/2	484	53	55	12	40	3	23	1



Characteristic values

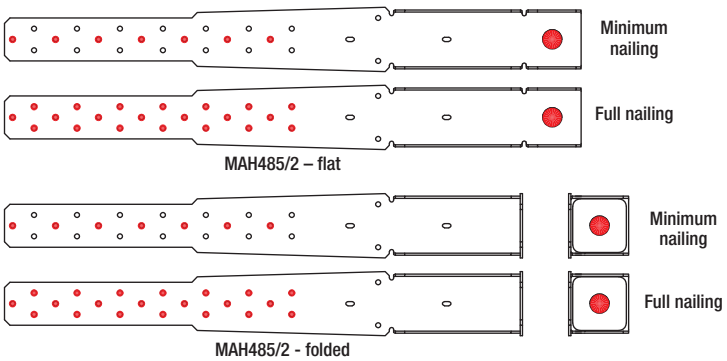
Model No.	Fasteners		Characteristic values – C24 graded timber on concrete [kN]			
	Flange A	Flange B	$R_{1,k}$			
	Qty	Qty	CNA4,0x50	CNA4,0x60	CNA5,0x40	CNA5,0x50
MAH485/2 – flat	7	1 Ø16	min (11,6; 18,7/k_{mod})	min (12,3; 18,7/k_{mod})	min (11,7; 18,7/k_{mod})	min (13,7; 18,7/k_{mod})
MAH485/2 – folded	7	1 Ø16	min (11,6; 24,6/k_{mod})	min (12,3; 24,6/k_{mod})	min (11,7; 18,7/k_{mod})	min (13,7; 18,7/k_{mod})
MAH485/2 – flat	21	1 Ø16	min (29,5; 18,7/k_{mod})	min (31,4; 18,7/k_{mod})	min (29,9; 18,7/k_{mod})	min (34,9; 18,7/k_{mod})
MAH485/2 – folded	21	1 Ø16	min (29,5; 24,6/k_{mod})	min (31,4; 24,6/k_{mod})	min (29,9; 18,7/k_{mod})	min (34,9; 18,7/k_{mod})

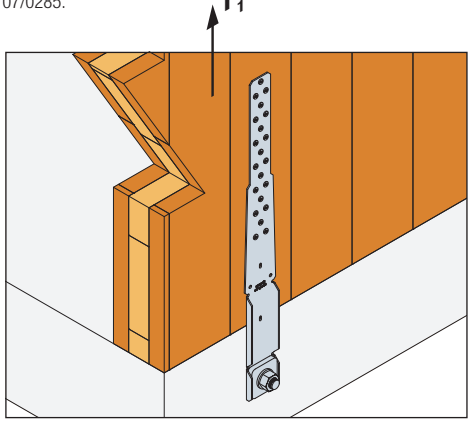
This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285. $R_{4,k}$ and $R_{5,k}$ are provided in ETA 07/0285.

Stiffness

Model No.	Fasteners		Stiffness – C24 graded timber on concrete [kN/mm]			
	Flange A	Flange B	$k_{ser,R1}$			
	Qty	Qty	CNA4,0x50	CNA4,0x60	CNA5,0x40	CNA5,0x50
MAH485/2 – flat	n	1 Ø16	0,165*n+1,862	-	-	0,223*n+2,524
MAH485/2 – folded	n	1 Ø16	0,214*n+2,417	-	-	0,286*n+3,242

This table provides the characteristic values for the stiffness of the connection where the number of fasteners corresponds to the quantity specified in the table of characteristic values. For the stiffness values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285.





Related products

CSA

CNA

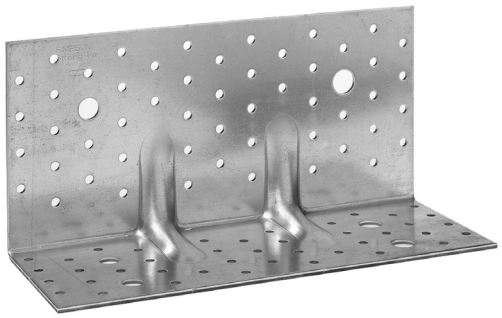
LMAS / AT-HP


Find more information on
our website
www.strongtie.eu

SIMPSON Strong-Tie®

Structural Angle Brackets

Structural angle bracket **ABR255**



These brackets have been especially developed for fixing CLT panels to timber or concrete. These highly versatile brackets are particularly resistant to shear loads due to their enhanced geometrical design.

Advantages:

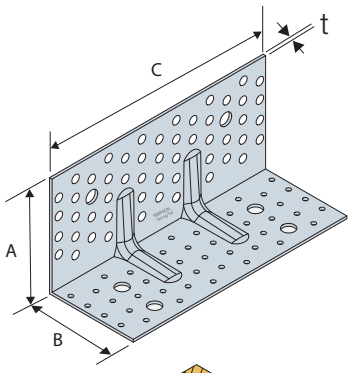
- Highly versatile
- Superior performance for forces in horizontal (F_2/F_3) and vertical directions (F_1)
- It is possible to use SIT as interim layer for soundproofing

Z275 20 µm

ETA-06/0106

Dimensions

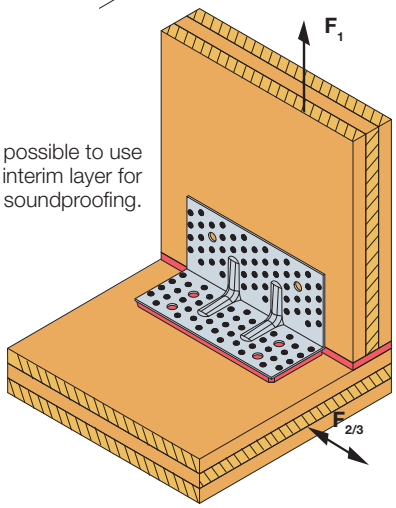
Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
ABR255	120	100	255	3	52 Ø 5	2 Ø 14	41 Ø 5	4 Ø 14



Characteristic values

Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
ABR255	24 CNA4,0x60	21 CNA4,0x60	min (18,1/$k_{mod}^{0,4}$; 26,2/k_{mod})	31,4
CLT/rigid substrate connection - Fixing with one angle bracket				
ABR255	17 CNA4,0x60	2 Ø12	min (27,3; 22/k_{mod})	min (26,5; 57,6/k_{mod})
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
ABR255	2 SSH12x80	4 SSH12x80	13,4	18,4

This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity. For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.
The F_4 and F_5 values are also given in ETA 06/0106.

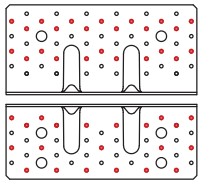


It is possible to use **SIT** as interim layer for soundproofing.

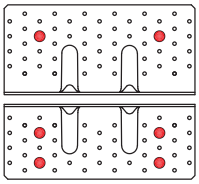
Stiffness

Model No.	Fasteners		Stiffness [kN/mm]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
ABR255	24 CNA4,0x60	21 CNA4,0x60	8,9	4,3
CLT/rigid substrate connection - Fixing with one angle bracket				
ABR255	17 CNA4,0x60	2 Ø12	4,5	4,8
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
ABR255	2 SSH12x80	4 SSH12x80	1,84	2,7

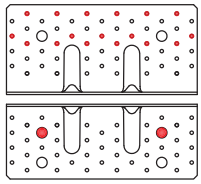
This table provides the characteristic values for the stiffness of the connection where the number of fasteners corresponds to the quantity specified in the table of characteristic values For the stiffness values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285.



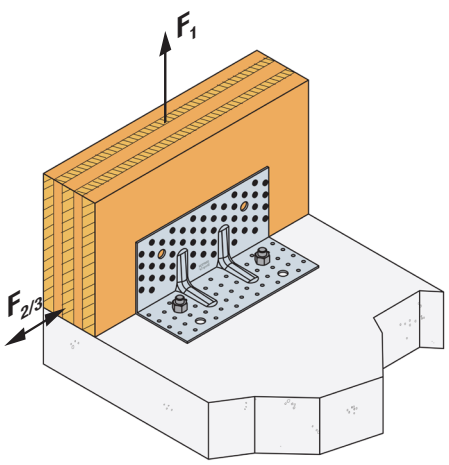
CLT/CLT fixing with CNA nails

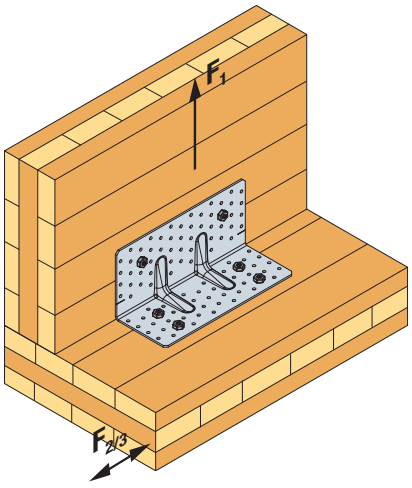


CLT/CLT fixing with SSH screws



CLT/Rigid substrate fixing with CNA nails and M12 bolts





Structural angle bracket **ABR255SO**

These brackets have been especially developed for fixing CLT panels to timber or concrete. These highly versatile brackets are particularly resistant to shear loads due to their enhanced geometrical design.

Advantages:

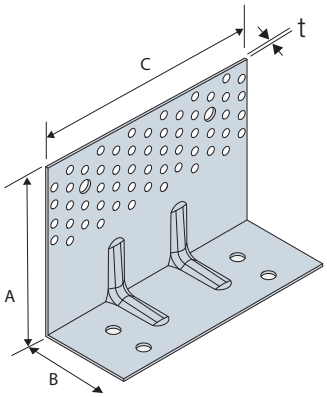
- Highly versatile
- Superior performance for forces in horizontal (F_2/F_3) and vertical directions (F_1)

Z275 20 µm | SC 2 | ETA CE

ETA-06/0106

Dimensions

Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
ABR255SO	197	100	255	3	56 Ø 5	2 Ø 14		4 Ø 14



Characteristic values

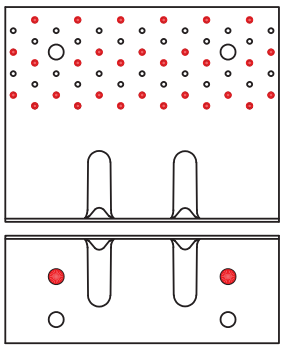
Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/rigid substrate connection - Fixing with one angle bracket				
ABR255SO	30 CSA5,0x50	2 Ø12	22,9/k_{mod}	35,3

This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.
The F_4 and F_5 values are also given in ETA 06/0106.

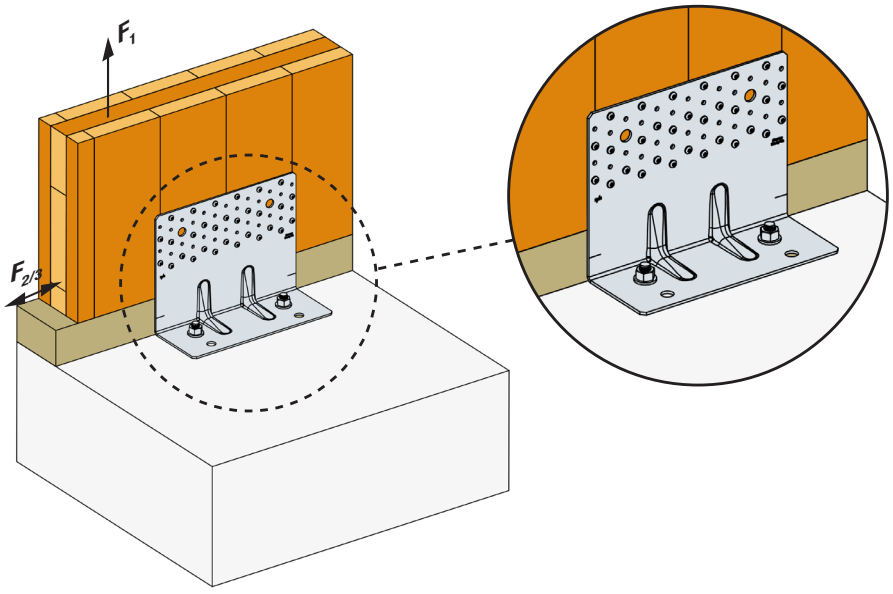
Stiffness

Model No.	Fasteners		Stiffness [kN/mm]
	Flange A	Flange B	Tensile ($R_{1,k}$)
CLT/rigid substrate connection - Fixing with one angle bracket			
ABR255SO	30 CSA5,0x50	2 Ø12	3,9

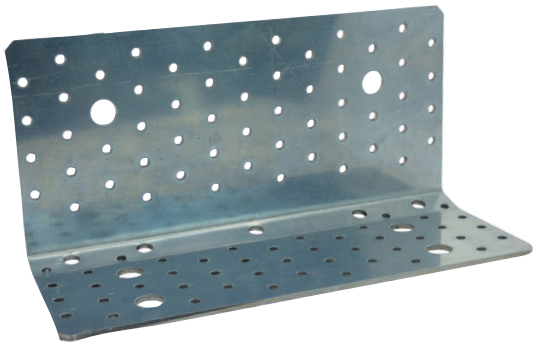
This table provides the characteristic values for the stiffness of the connection where the number of fasteners corresponds to the quantity specified in the table of characteristic values. For the stiffness values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285.



Nailing pattern
CLT/Rigid substrate
fixing with CSA screws and M12 bolts



Structural angle bracket **AB255HD**



These brackets have been especially developed for fixing CLT panels to timber or concrete. These highly versatile brackets are particularly resistant to shear loads due to their enhanced geometrical design.

Advantages:

- Highly versatile
- Superior performance for forces in horizontal (F_2/F_3) and vertical directions (F_1)

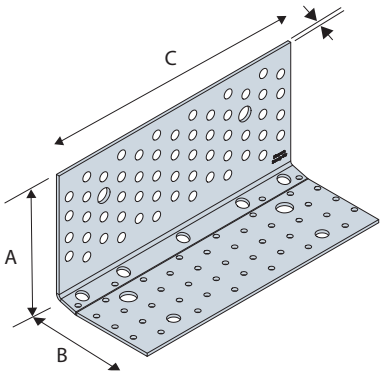
Z275 20 µm

SC 2

ETA-06/0106

Dimensions

Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
AB255HD	123	100	255	3	56 Ø 5	2 Ø 14	41 Ø 5	4 Ø 14



Characteristic values

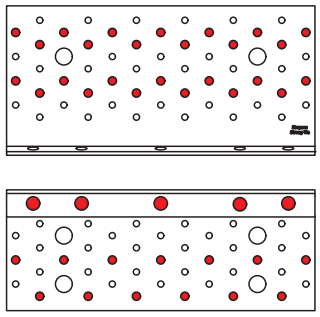
Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
AB255HD	26 CSA5,0x50	5 ESCRFTC8,0x160 + 13 CSA5,0x50	min (59 ; 56/k_{mod})	46,0

This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.
The F_4 and F_5 values are also given in ETA 06/0106.

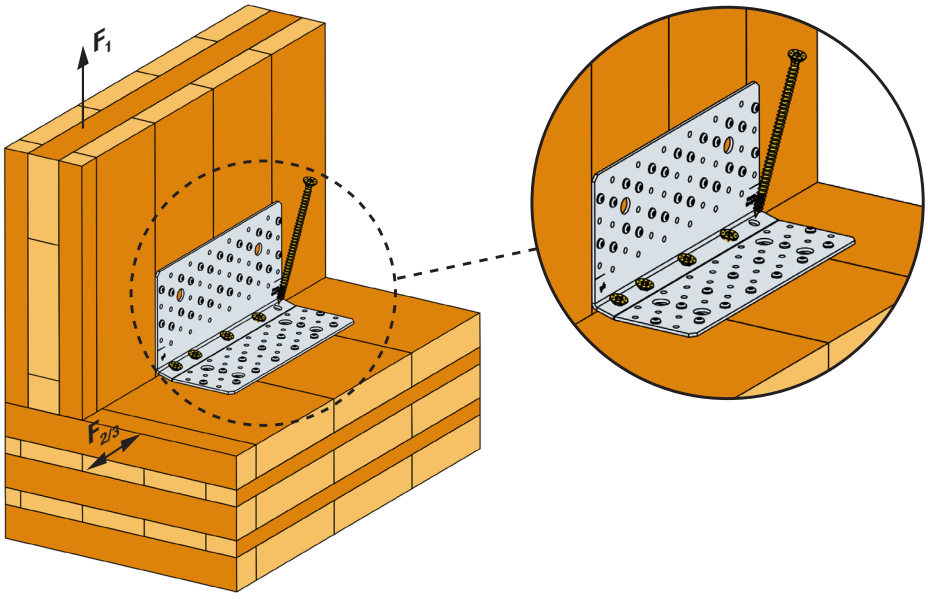
Stiffness

Model No.	Fasteners		Stiffness [kN/mm]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
AB255HD	26 CSA5,0x50	5 ESCRFTC8,0x160 + 13 CSA5,0x50	12,2	16,0

This table provides the characteristic values for the stiffness of the connection where the number of fasteners corresponds to the quantity specified in the table of characteristic values. For the stiffness values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285.



Nailing pattern
CLT/CLT
fixing with CSA and ESCRFTC screws



Structural angle bracket **AB255SSH**

AB255SH structural angle brackets are suitable for installing CLT elements on wood using the only the SSH structural screws.

Advantages:

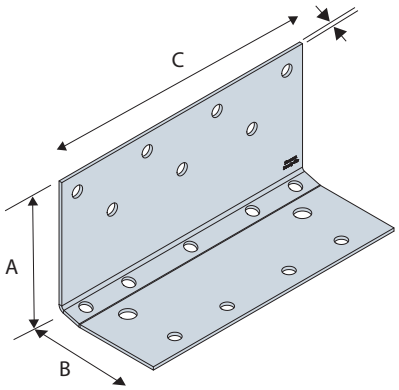
- Highly versatile
- Superior performance for forces in horizontal (F_2/F_3) and vertical directions (F_1)

Z275 20 µm | SC 2 | ETA | CE

ETA-06/0106

Dimensions

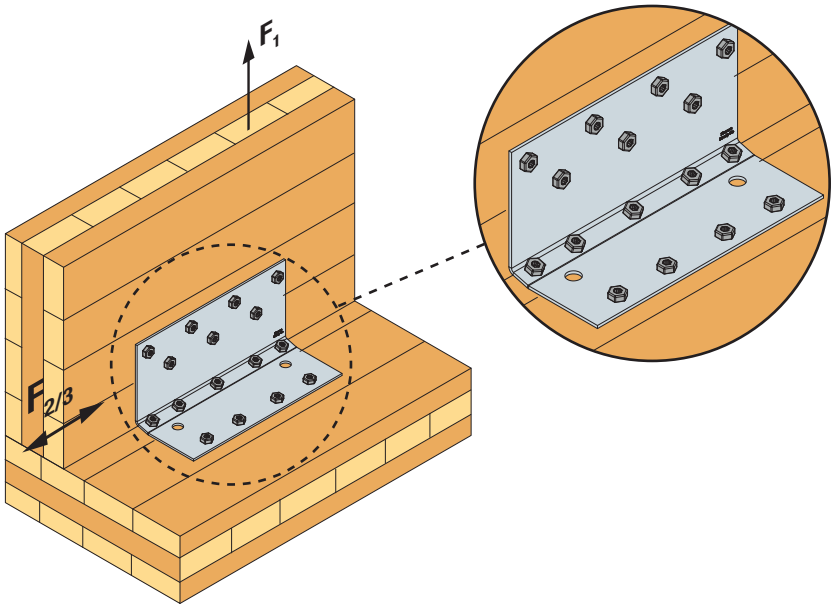
Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
AB255SSH	123	100	255	3,0	7 Ø 10	-	9 Ø 10	2 Ø14

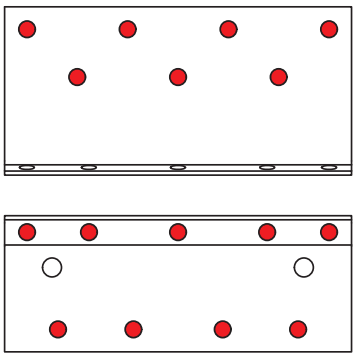


Characteristic values

Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
AB255SSH	7 SSH10,0x120	9 SSH10,0x120	42,6	42,6
AB255SSH	7 SSH10,0x160	9 SSH10,0x160	56,2	48,5

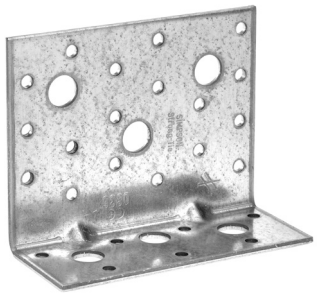
This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.
The F_4 and F_5 values are also given in ETA 06/0106.





Nailing pattern
CLT/CLT
fixing with SSH screws

Structural angle bracket **AE116**



Thanks to its extra-wide design, the AE116 angle bracket is especially suited to withstanding lateral loads. It can be used on both timber and rigid substrates. For installation on rigid substrate remember to use US40/40/10G or US40/50/10G washers.

Advantages:

- High shear resistance
- Versatile

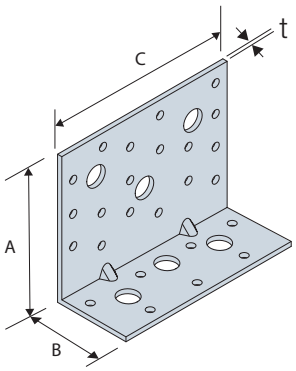
Z275 20 µm

SC 2

ETA-06/0106

Dimensions

Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
AE116	90	48	116	3	18 Ø 5	3 Ø 13	7 Ø 5	3 Ø 13



Characteristic values

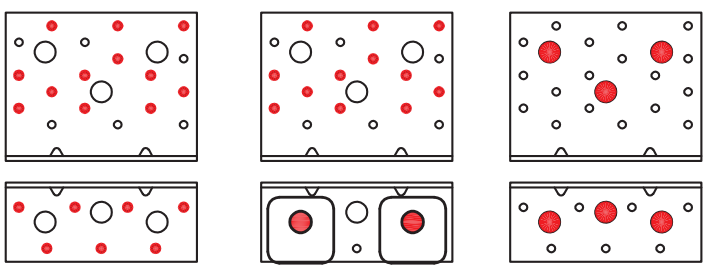
Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
AE116	12 CNA4,0x50	7 CNA4,050	3,8	9,9
CLT/rigid substrate connection - Fixing with one angle bracket				
AE116	12 CNA4,0x50	2 M12	12,6	13,3
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
AE116	3 SSH 12x80	3 SSH12x80	16,5	14,7

This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.

Stiffness

Model No.	Fasteners		Stiffness [kN/mm]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
AE116	12 CNA4,0x50	7 CNA4,0x50	1,37	1,92
CLT/rigid substrate connection - Fixing with one angle bracket				
AE116	12 CNA4,0x50	2 M12	5,5	4,9
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
AE116	3 SSH12x80	3 SSH12x80	1,88	2,36

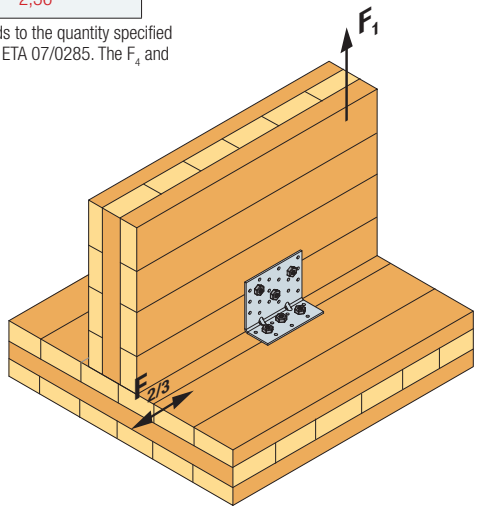
This table provides the characteristic values for the stiffness of the connection where the number of fasteners corresponds to the quantity specified in the table of characteristic values. For the stiffness values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285. The F_4 and F_5 values are also given in ETA 06/0106.



CLT/CLT
fixing with CNA nails

CLT/Rigid substrate
fixing with CNA nails and M12 bolts
and US washer

CLT/CLT
fixing with SSH screws



Reinforced wide angle bracket **AG922**

Thanks to its extra-wide design, the AG922 angle bracket is especially suited to withstanding lateral loads. It can be used on both timber and rigid substrates.

Advantages:

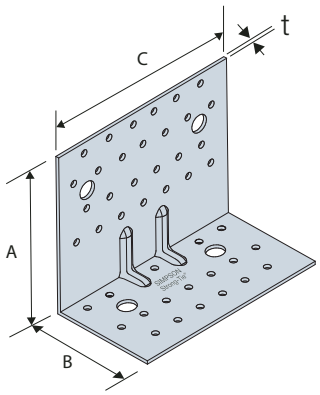
- High resistance to lateral loads
- Superior rigidity
- Can be fixed to a concrete substrate with a single anchor

Z275 20 µm | SC 2 | ETA CE

ETA-06/0106

Dimensions

Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
AG922	150	121	79	2.5	26 Ø 5	2 Ø 13	18 Ø 5	2 Ø 13



Characteristic values

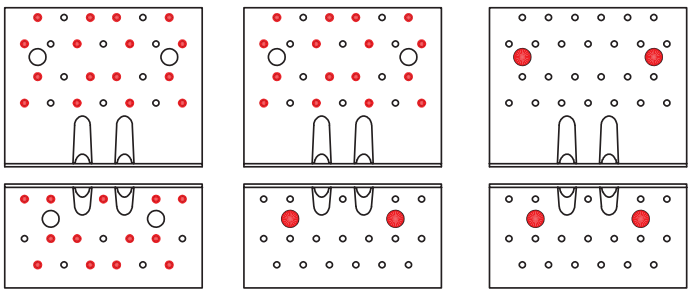
Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
AG922	16 CNA4,0x50	13 CNA4,0x50	9,2	14,7
CLT/rigid substrate connection - Fixing with one angle bracket				
AG922	16 CNA4,0x50	2 Ø12	15,3	24,1
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
AG922	2 SSH12x80	2 SSH12x80	11,5	11,5

This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.

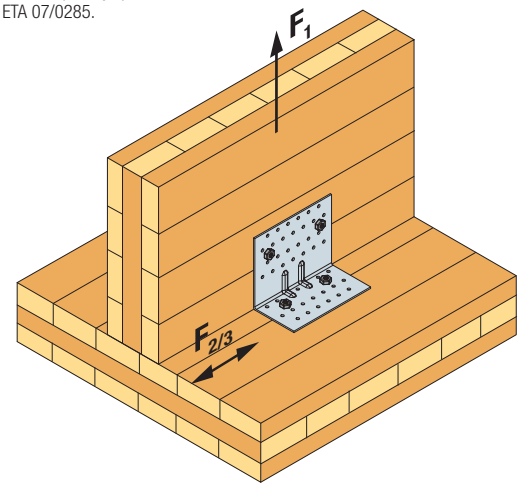
Stiffness

Model No.	Fasteners		Stiffness [kN/mm]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
AG922	16 CNA4,0x50	13 CNA4,0x50	2,75	2,07
CLT/rigid substrate connection - Fixing with one angle bracket				
AG922	16 CNA4,0x50	2 Ø12	2,8	3,27
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
AG922	2 SSH12x80	2 SSH12x80	1,42	1,6

This table provides the characteristic values for the stiffness of the connection where the number of fasteners corresponds to the quantity specified in the table of characteristic values. For the stiffness values that apply in other cases (quantity / type of fastener), refer to ETA 07/0285.



CLT/CLT fixing with CNA nails | CLT/Rigid substrate fixing with CNA nails and M12 bolts | CLT/CLT fixing with SSH screws



Structural angle bracket **E20/3**

E20/3 reinforced angle brackets are especially versatile and can be used on both timber and rigid substrates.
The major central reinforcement delivers excellent performance, particularly on rigid substrates.

Advantages:

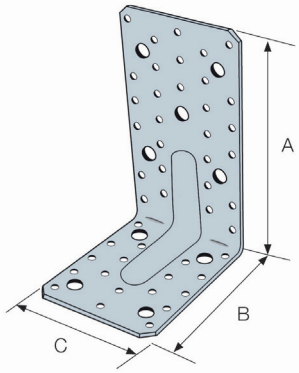
- Highly resistant to tensile and shear forces
- Suitable for a wide range of applications
- Withstands forces in different directions (F_1, $F_{2/3}$)

Z275 20 µm | SC 2 | ETA CE

ETA-06/0106

Dimensions

Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
E20/3	170	113	95	3	24 Ø5	5 Ø11	16 Ø5	4 Ø11



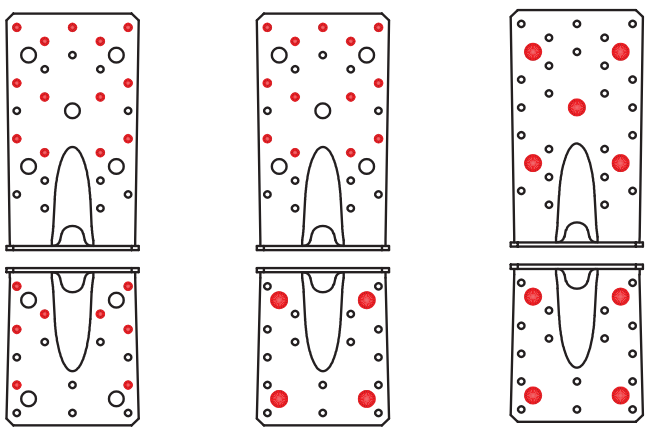
Characteristic values

Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
E20/3	13 CNA4,0x50	8 CNA4,0x50	4,3	7,8
CLT/rigid substrate connection - Fixing with one angle bracket				
E20/3	13 CNA4,0x50	4 Ø10	20,0	14,5
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
E20/3	5 SSH10x80	4 SSH10x80	14,5	13,0

This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.
The F_4 and F_5 values are also given in ETA 06/0106.

Stiffness

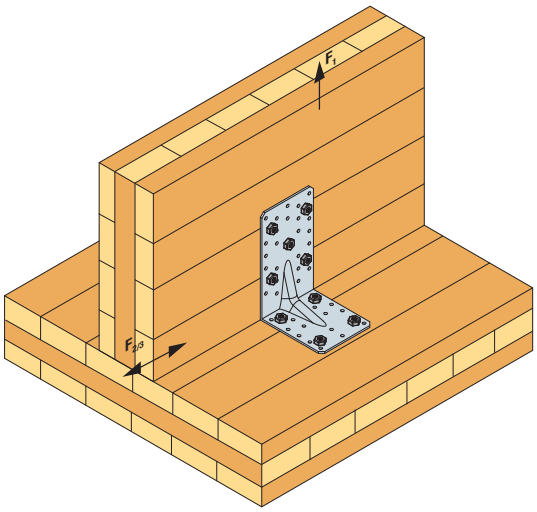
Model No.	Fasteners		Stiffness [kN/mm]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
E20/3	5 SSH10x80	4 SSH10x80	2,54	1,97



CLT/CLT
fixing with CNA nails

CLT/Rigid substrate
fixing with CNA nails and M12 bolts

CLT/CLT
fixing with SSH screws



Structural angle bracket **ABR100**

ABR100 reinforced angle brackets are especially versatile and can be used on both timber and rigid substrates. The side reinforcements allow the anchor plug to be positioned closer to the fold and thereby ensure good load-bearing capacity on the rigid substrate.

Advantages:

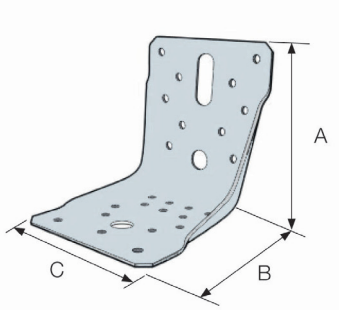
- Superior rigidity
- Versatile
- Withstands forces in different directions (F_1, $F_{2/3}$, F_4 and F_5)

Z275 20 µm | SC 2 | ETA CE

ETA-06/0106

Dimensions

Model No.	Dimensions [mm]				Qty Holes Flange A			Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Obround	Screws or nails	Bolts
ABR100	100	100	90	2	10 Ø 5	1 Ø 12	1 Ø 12x32	14 Ø 5	1 Ø 12



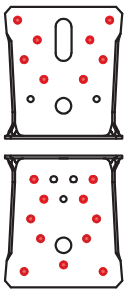
Characteristic values

Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
ABR100	8 CNA4,0x50	11 CNA4,0x50	7,9	8,7
CLT/rigid substrate connection - Fixing with one angle bracket				
ABR100	1 Ø10	5 CNA4,0x50	8,3	4,1
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
ABR100	2 SSH10x40	1 SSH10x40	2,6	1,4
CLT/rigid substrate connection - Connector screws - Fixing with one angle bracket				
ABR100	1 Ø10	1 SSH10x40	2,8	2,0

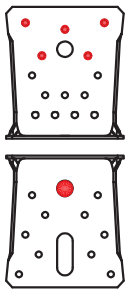
The F_4 and F_5 values are given in ETA 06/0106.

Model No.	Fasteners		Stiffness [kN/mm]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
ABR100	8 CNA4,0x50	11 CNA4,0x50	2,6	0,9
CLT/rigid substrate connection - Fixing with one angle bracket				
ABR100	1 Ø10	5 CNA4,0x50	9,2	1,5
CLT/CLT connection - Connector screws - Fixing with one angle bracket				
ABR100	2 SSH10x40	1 SSH10x40	0,56	0,19
CLT/rigid substrate connection - Connector screws - Fixing with one angle bracket				
ABR100	1 Ø10	1 SSH10x40	0,68	0,22

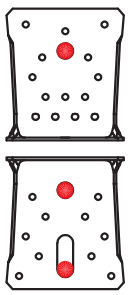
The F_4 and F_5 values are given in ETA 06/0106.



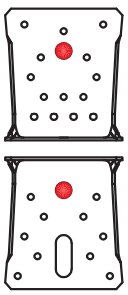
CLT/CLT fixing with CNA nails



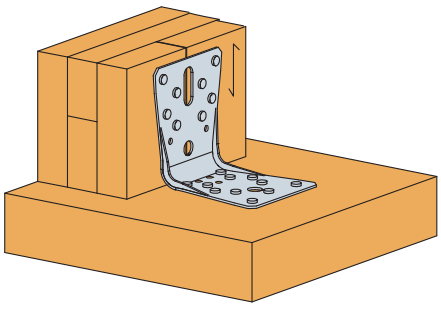
CLT/CLT fixing with CNA nails and M10 bolt

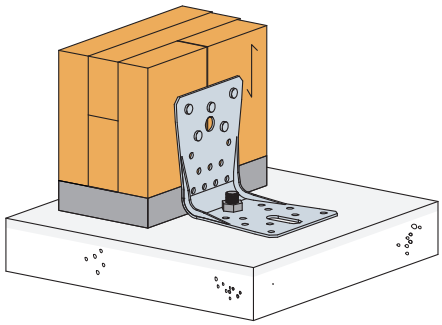


CLT/CLT fixing with SSH screws

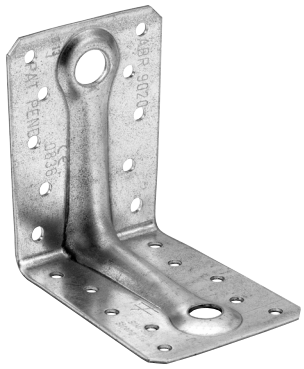


CLT/Rigid substrate fixing with SSH screw and M12 bolt





Structural angle bracket **ABR9020**



The ABR9020 reinforced angle bracket is especially versatile.

Advantages:

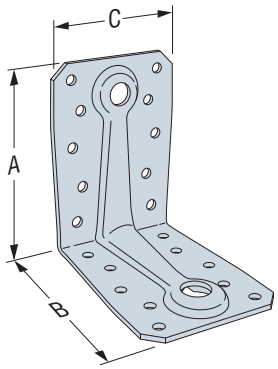
- Superior rigidity
- Versatile
- Withstands forces in different directions (F_1, $F_{2/3}$, F_4 and F_5)

Z275 20 µm | SC 2 | ETA | CE

ETA-06/0106

Dimensions

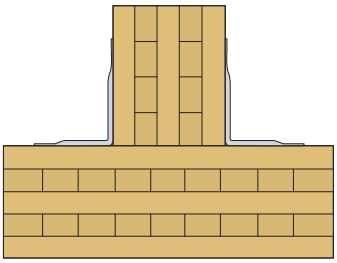
Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
ABR9020	90	90	65	2.5	10 Ø 5	1 Ø 11	10 Ø 5	1 Ø 11

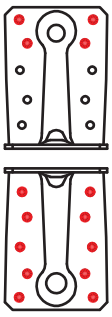


Characteristic values

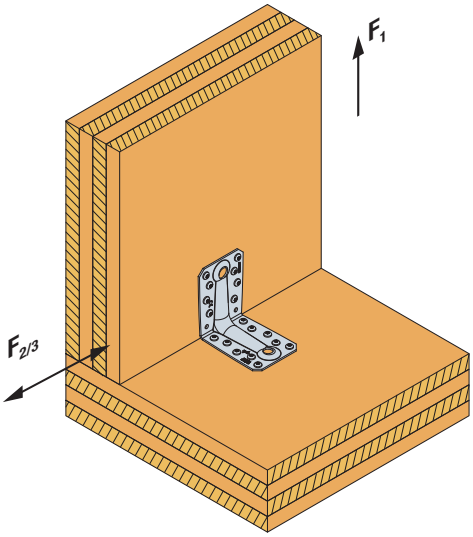
Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/CLT connection - Fixing with one angle bracket				
ABR9020	4 CNA4,0x50	10 CNA4,0x50	9,0	2,0

This table provides the characteristic values for the connection where the number of fasteners corresponds to the quantity specified in the table.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.





CLT/CLT
fixing with CNA nails



Structural angle brackets **AB90** / **AB105**

AB90

AB105

AB90 and AB105 angle brackets are especially versatile and can be used on timber substrates.

Advantages:

- Versatile
- Withstands forces in different directions (F_1, $F_{2/3}$, $F_{4/5}$)

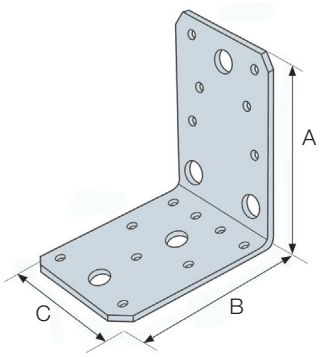
Z275 20 µm

SC 2

ETA-06/0106

Dimensions

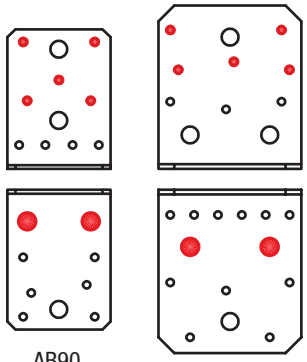
Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Bolts	Screws or nails	Bolts
AB90	88	88	65	2.5	6 Ø5	3 Ø11	9 Ø5	2 Ø11
AB105	103	103	90	3	8 Ø5	3 Ø11	11 Ø5	3 Ø11



Characteristic values

Model No.	Fasteners		Characteristic values [kN]	
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)
CLT/rigid substrate connection - Fixing with one angle bracket				
AB90	5 CNA4,0x50	2 Ø10	2,7/k_{mod}	3,1
AB105	5 CNA4,0x50	2 Ø10	min (8,8 ; 5,6/k_{mod})	3,2

This table provides the characteristic values for the connection where the number of fasteners corresponds to the specified quantity.
For the values that apply in other cases (quantity / type of fastener), refer to ETA 06/0106.
The F_4 and F_5 values are also given in ETA 06/0106.



AB90

AB105

CLT/Rigid substrate fixing with CNA nails and M10 bolts

Acoustic angle bracket **ABAI**

The ABAI acoustic angle bracket breaks new ground by combining the qualities of a conventional angle bracket with the SIT acoustic isolating strip. It can be used to join CLT wall and floor members together, while guaranteeing acoustic insulation between the elements.

Advantages:

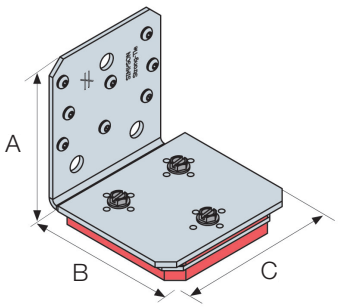
- Reduced sound transfer between structural components
- Improved draught sealing when used with 12mm insulating strips beneath the external walls
- Fast installation

Z275 20 µm | SC 2 | ETA CE

ETA-06/0106

Dimensions

Model No.	Dimensions [mm]				Qty Holes Flange A		Qty Holes Flange B	
	A	B	C	Thickness	Screws or nails	Screws	Screws or nails	Screws
ABAI105	111	103	90	3	8 Ø 5	3 Ø 11	-	3 Ø 7



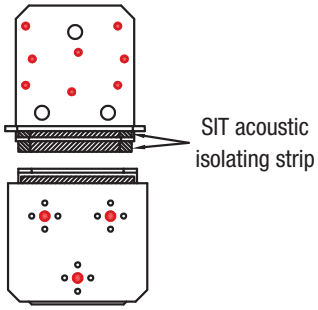
Characteristic values

Model No.	Fasteners		Characteristic values [kN]			
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)	Transverse force ($R_{4,k}$)	Transverse force ($R_{5,k}$)
CLT/CLT connection - Fixing with one angle bracket						
ABAI105	8 CNA4,0x60	3 SDS25600	$2,0/k_{mod}$	$2,0/k_{mod}$	$3,3/k_{mod}$	$2,3/k_{mod}$

This table provides the characteristic values that correspond to values that are restricted to a low level of deformation. Therefore, they are effective at screening out vibrations and can be used for SLS calculations.

Model No.	Fasteners		Characteristic values [kN]			
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)	Transverse force ($R_{4,k}$)	Transverse force ($R_{5,k}$)
CLT/CLT connection - Fixing with one angle bracket						
ABAI105	8 CNA4,0x60	3 SDS25600	7,9	5,9	7,3	5,4

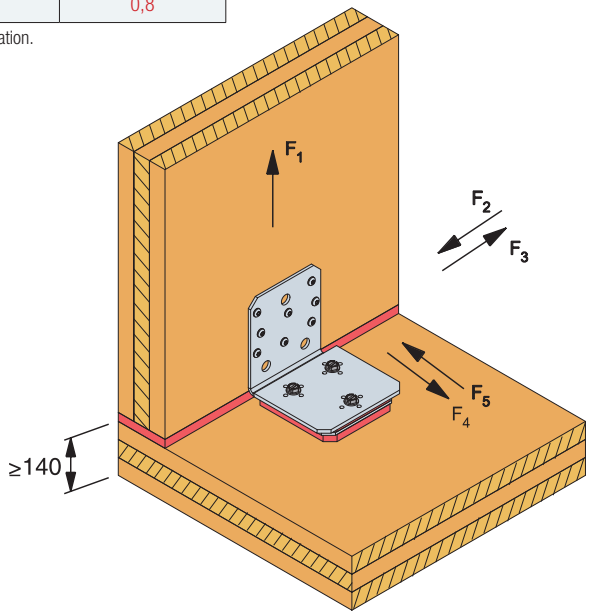
This table provides the ultimate characteristic values. When used for sizing, filtration cannot be ensured, but these values can be used for ULS calculations according to EN 1995-1-1.



Stiffness

Model No.	Fasteners		Stiffness [kN/mm]			
	Flange A	Flange B	Tensile ($R_{1,k}$)	Shear ($R_{2,k} = R_{3,k}$)	Transverse force ($R_{4,k}$)	Transverse force ($R_{5,k}$)
CLT/CLT connection - Fixing with one angle bracket						
ABAI105	8 CNA4,0x60	3 SDS25600	0,8	0,68	1,16	0,8

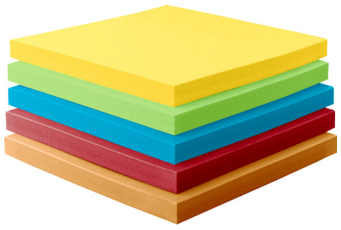
This table provides the characteristic values that correspond to values that are restricted to a low level of deformation. Therefore, they are effective at screening out vibrations.



Related products

For correct installation use the **MOABAI** installation tool

Acoustic isolating strip **SIT**



SIT acoustic isolating strips are recommended for CLT buildings that are required to deliver superior acoustic performance. They guarantee acoustic insulation between timber walls and floors. The choice of the strip's density depends on the weight of the wall.

Advantages:

- Absorbs vibrations
- Can be used in humid environments
- Estimated service life of 50 years
- Improved draught sealing

Dimensions

	75	150	350	750	1500	
Item code	**SIT75-100**	**SIT150-100**	**SIT350-100**	**SIT750-100**	**SIT1500-100**	
Colour	yellow	green	blue	red	orange	
Static pressure [N/mm²] (1)	0,075	0,15	0,35	0,75	1,5	
Dynamic pressure [N/mm²] (1)	0,12	0,25	0,5	1,2	2	
Peak pressure [N/mm²] (1)	2	3	4	6	8	
Mechanical loss factor (2)	0,06	0,03	0,03	0,04	0,05	DIN 53513 (3)
Static E-modulus [N/mm²] (2)	0,63	1,25	2,53	5,21	9,21	DIN 53513 (3)
Dynamic E-modulus [N/mm²] (2)	0,92	1,65	3,25	8,88	16,66	DIN 53513 (3)
Static shear modulus [N/mm²] (2)	0,16	0,22	0,35	0,8	1,15	DIN 53513 (3)
Dynamic shear modulus [N/mm²] (2)	0,27	0,35	0,52	1,22	1,69	DIN 53513 (3)
Compressive strength at 10% deformation [N/mm²]	0,083	0,16	0,32	0,59	0,94	
Permanent deformation after compression [%]	< 5	< 5	< 5	< 6	< 8	DIN ISO 1856
Tensile strength [N/mm²]	> 1,5	> 2,0	> 3,5	> 5,0	> 7,0	DIN 53455-6-4
Elongation at break [%]	> 500	> 500	> 500	> 500	> 500	DIN 53455-6-4
Tear resistance [N/mm]	> 1,6	> 2,1	> 2,5	> 4,3	> 5,6	DIN ISO 34-1/A
Rebound elasticity [%]	70	70	70	70	70	DIN EN ISO 8307
Volume resistivity [Ω·cm]	> 1011	> 1011	> 1011	> 1011	> 1011	DIN IEC 93
Thermal conductivity [W/(m·K)]	0,06	0,075	0,09	0,1	0,11	DIN 52612-1
Operating temperature [°C]	-30 to +70					
Extreme temperature [°C]	120					
Flammability	Class E / EN 13501-1					EN ISO 11925-1

(1) Values apply for a shape factor of q = 3
(2) Measured by the upper limit of the static performance sector
(3) Measurements performed in accordance with the model indicated in the applicable standard

Acoustic isolating washer SITW

SITW washers are combined with SIT isolating strips to create a high-performance system in CLT buildings that are required to deliver superior acoustic performance. The isolating washer is fitted between a metal washer and the CLT when assembling with screws, which prevents vibrations from spreading through the fastenings.

Advantages:

- Reduced sound transfer between structural components
- Improved draught sealing

Dimensions

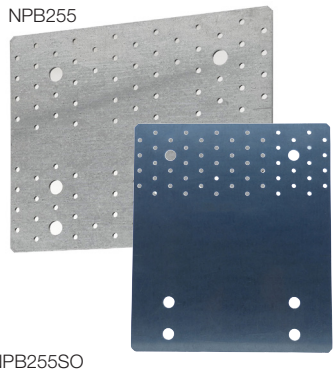
Model No.	Screw diameter [mm]	Washer dimensions [mm]				Pilot holes [mm]	
		Inner diameter	Outer diameter	Thickness	Tolerance	Inner diameter	Outer diameter
SITW-M0608	6 and 8	8.5	34	6	0.5	8 or 10	35
SITW-M1012	10 and 12	12.5	49	6	0.5	12 or 14	50

Simply drill pilot holes in the first CLT panel to avoid transferring vibrations through the flat part of the screw.

SIMPSON Strong-Tie®

Nail Plates and Fixing Bands

Nail plate for CLT **NPB**



The NPB255 nail plate has been especially developed for fixing CLT panels to timber or concrete substrates. This highly versatile plate features a marking line to help align both parts to be joined.

Advantages:

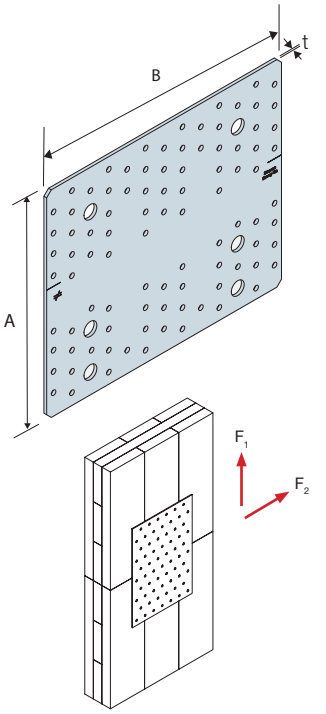
- Ideal for use with CLT buildings
- Easy installation with a marking line for aligning both parts to be joined
- Highly versatile: can be fixed to timber and concrete substrates
- Superior performance for forces in horizontal (F_2/F_3) and vertical directions (F_1)

Z275 20 µm | SC 2 | CE

EN14545

Dimensions

Model No.	Dimensions [mm]			Drill holes	
	A	B	t	Screws or nails	Bolts
NPB255	214	255	3	52 Ø 5 + 2 Ø14	41 Ø 5 + 4 Ø14
NPB255SO	294	255	3	52 Ø 5 + 2 Ø14	4 Ø14



Characteristic values

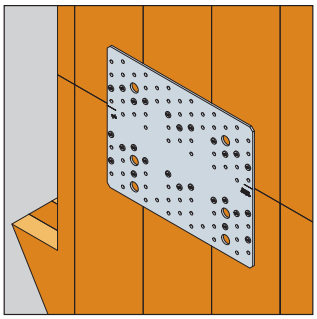
Model No.	Fasteners			Characteristic values – C24 graded timber on C24 graded timber [kN] - 1 NPB255							
	Nailing pattern	Flange A	Flange B	$R_{1,k}$				$R_{2,k}$			
		Qty	Qty	CNA4,0x35	CNA4,0x50	CNA4,0x60	CSA5,0x50	CNA4,0x35	CNA4,0x50	CNA4,0x60	CSA5,0x50
NPB255	1	11	15	17,9	23,9	26,0	27,6	15,6	20,8	22,6	24,0
	2	13	15	21,2	28,3	30,7	32,6	14,5	19,4	21,0	22,3
	3	30	34	-	-	-	-	-	-	-	44,0
	4	11	2 Ø12	17,9	23,9	26,0	27,6	17,1	22,8	24,8	26,3
	5	13	2 Ø12	21,2	28,3	30,7	32,6	16,7	22,3	24,2	25,7
NPB255SO	6	26	2 Ø12	42,4	56,6	61,4	65,3	16,1	21,5	23,3	24,8

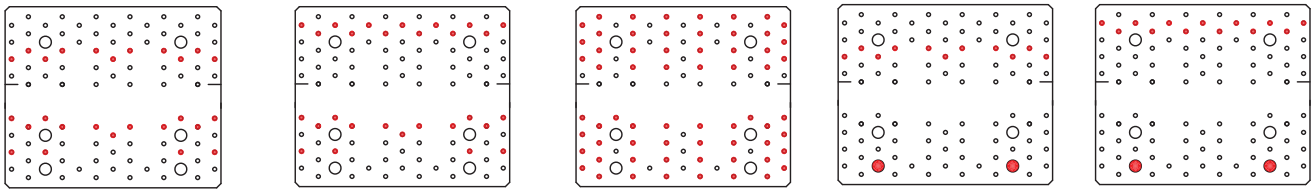
This table provides the characteristic values for the connection where the number of fasteners corresponds to the quantity specified in the table.
For the values that apply in other cases (quantity / type of fastener), please contact the technical services department.

Stiffness

Model No.	Fasteners			Stiffness – C24 graded timber on C24 graded timber [kN/mm] - 1 NPB255							
	Nailing pattern	Flange A	Flange B	$k_{ser,R1}$				$k_{ser,R2}$			
		Qty	Qty	CNA4,0x35	CNA4,0x50	CNA4,0x60	CSA5,0x50	CNA4,0x35	CNA4,0x50	CNA4,0x60	CSA5,0x50
NPB255	1	11	15	1,87	2,50	2,71	6,29	1,42	1,89	2,05	4,76
	2	13	15	2 ,21	2,95	3,20	7,44	1,04	1,38	1,50	3,49
	3	30	34	-	-	-	-	-	-	-	5,68
	4	11	2 Ø12	2,51	3,35	3,64	5,96	2,28	3,04	3,30	5,41
	5	13	2 Ø12	2,96	3,96	4,30	7,05	1,83	2,45	2,66	4,36
NPB255SO	6	26	2 Ø12	-							

This table provides the characteristic values for the connection where the number of fasteners corresponds to the quantity specified in the table.
For the values that apply in other cases (quantity / type of fastener), please contact the technical services department.





1 2 3 4 5

Nail plate **NP**

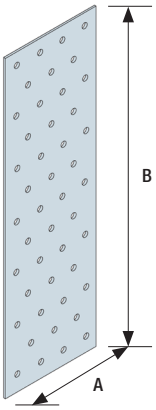
NP nail plates are suited to a wide range of applications, especially for butt joints, post & beam connections, CLT panel assemblies and connections where nail plates need to be folded on site.

Advantages:

- Suitable for a wide range of applications
- Can be folded on site

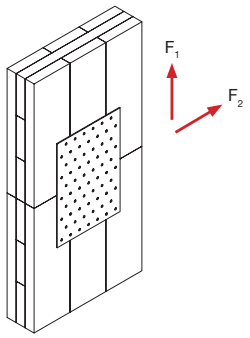
Z275 20 µm | SC 2 | CE

EN14545



Dimensions

Model No.	Fasteners			Drill holes		Maximum characteristic values tolerated under tensile load $R_{1.st}$ [kN]
	A	B	Thickness	Qty	Diameter	
NP20/40/120	40	120	2	9	Ø5	17,8
NP20/60/160	60	160	2	20	Ø5	26,7
NP20/60/200	60	200	2	25	Ø5	26,7
NP20/80/160	80	160	2	28	Ø5	35,6
NP20/80/200	80	200	2	35	Ø5	35,6
NP20/80/240	80	240	2	42	Ø5	35,6
NP20/100/160	100	160	2	36	Ø5	44,6
NP20/100/200	100	200	2	45	Ø5	44,6
NP20/100/240	100	240	2	54	Ø5	44,6
NP20/120/160	120	160	2	44	Ø5	53,5
NP20/120/240	120	240	2	66	Ø5	53,5
NP20/120/300	120	300	2	83	Ø5	53,5
NP20/140/200	140	200	2	65	Ø5	62,4
NP20/140/240	140	240	2	78	Ø5	62,4



The maximum characteristic value tolerated under tensile load corresponds to the plate's maximum tensile strength. The fasteners must be checked separately using EN 1995-1-1. The characteristic resistance of an NP nail plate assembly under tensile load $R_{l.k}$ is:

$$R_{l.k} = min\ (R_{1.st} / k_{mod};\ R_{upper};\ R_{lower})$$

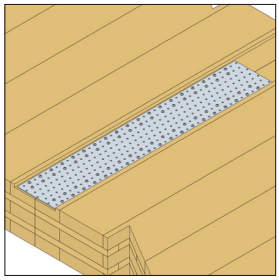
Where:

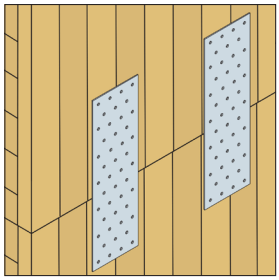
$R_{1.st}$: the maximum characteristic value tolerated under tensile load as specified in the table above.
R_{upper}: the resistance of the group of fasteners in the upper wall
R_{lower}: the resistance of the group of fasteners in the lower wall

$$R_{upper} = n_{ef.upper} \times R_{lat.k}$$
$$R_{lower} = n_{ef.lower} \times R_{lat.k}$$

Where:

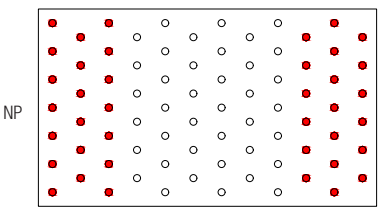
$n_{ef.upper}$: the effective number of fasteners in the upper wall
$n_{ef.lower}$: the effective number of fasteners in the lower wall
$R_{lat.k}$: the strength of the chosen fastener





Example: NP20/140/240 joining two CLT walls. The aim is to determine the plate's load-bearing capacity when subjected to tensile forces. The nailing pattern shown below is used. The following table provides the characteristic strength values ($k_{mod} = 1.1$).

Model No.	Fasteners			
	CNA4,0x35	CNA4,0x60	CSA5,0x40	CSA5,0x50
NP20/140/240	31,5	44,8	42,7	50,5

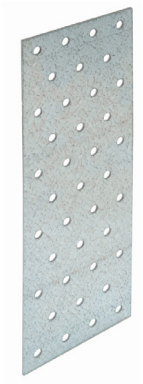


Related products


CSA


CNA

Custom-designed nail plate **NP-X**



NP-X nail plates are made to your specifications. Therefore, they can be produced in the required dimensions to fit your project requirements. They can be used to join two CLT slab elements with a metal tongue instead of a plywood or OSB tongue.

Advantages:

- Suitable for a wide range of applications
- Can be folded on site

Z275 20 µm

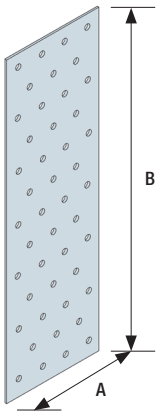
SC 2

EN14545

Dimensions

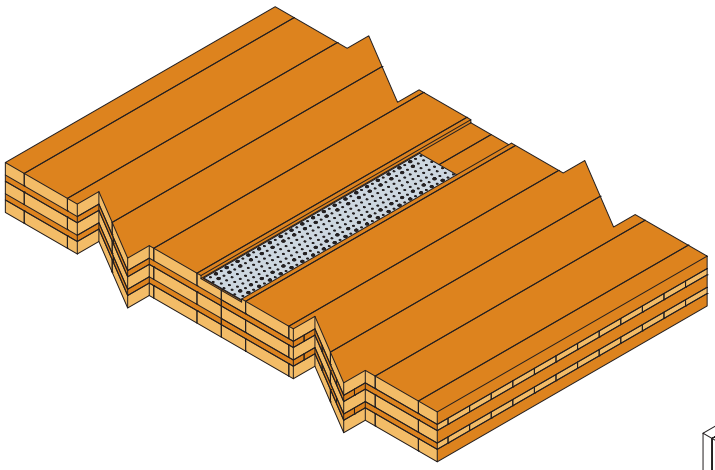
Model No.	Dimensions [mm]			Drill holes	
	A	B	Thickness	Qty	Diameter
NP-X	X	Y	2	n	Ø5

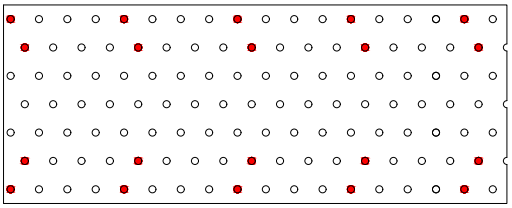
"X" and "Y" are custom dimensions. The number of drill holes "n" depends on the size of the plate.

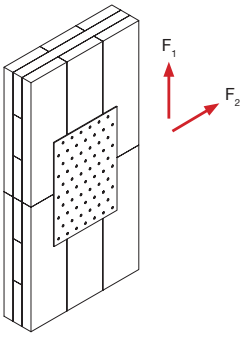


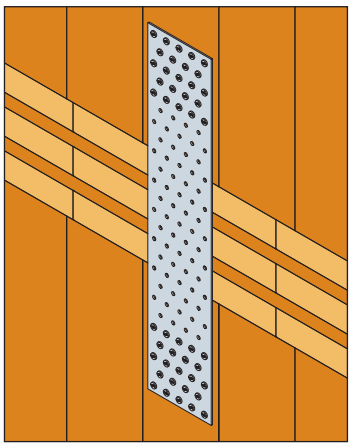
Example: NP/X where A = 500 mm and B = 140 mm for use as a tongue.
The following nailing plan can be used to enhance the fixing. It can be used to maximise fastenings and achieve an effective number of fastenings "nef" equal to the number of fastenings "n", even with CSA screws. The spacing between screws in the same grain is greater than 14xd.

When associated with CSA-T collated screws, steel tongues are capable of absorbing up to an extra 30% of the forces with the equivalent number of fastenings compared to plywood or OSB tongues. This solution reduces the number of fastenings and therefore saves time at the construction site.









Fixing band **BAN**

BAN09

BAN

BAN fixing bands are suited to a wide range of applications, especially for butt joints, post & beam connections, CLT panel assemblies and connections where nail plates need to be folded on site.

Advantages:

- Flexible installation
- Resistance to uplift forces

Z275 20 µm

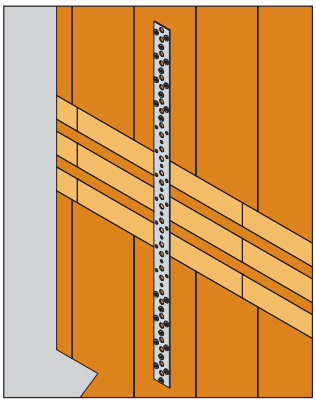
SC 2

CE

EN14545

Dimensions

Model No.	Dimensions			Drill holes [mm]	Maximum characteristic values tolerated $R_{1.st}$ [kN]
	Width [mm]	Length [m]	Thickness [mm]	Round	
BAN094025	40	25 m	0,9	Ø5	17,8
BAN102003	20	3 m	1,0	Ø5	4,0
BAN102010	20	10 m	1,0	Ø5	4,0
BAN102010S	20	10 m	1,0	Ø5	4,0
BAN102025	20	25 m	1,0	Ø5	4,0
BAN152010	20	10 m	1,5	Ø5	6,0
BAN152025	20	25 m	1,5	Ø5	6,0



The maximum characteristic value tolerated under tensile load corresponds to the plate's maximum tensile strength.
The fasteners must be checked separately using EN 1995-1-1. The characteristic resistance of an BAN fixing band assembly under tensile load $R_{1.k}$ is: $R_{1.k} = min\ (R_{1.st};\ R_{upper};\ R_{lower})$

Where:
$R_{1.st}$: the maximum characteristic value tolerated under tensile load as specified in the table above.
R_{upper}: the resistance of the group of fasteners in the upper wall R_{lower}: the resistance of the group of fasteners in the lower wall

$R_{upper} = n_{ef.upper} \times R_{lat.k}$ $R_{lower} = n_{ef.lower} \times R_{lat.k}$

Where:
$n_{ef.upper}$: the effective number of fasteners in the upper wall $n_{ef.lower}$: the effective number of fasteners in the lower wall
$R_{lat.k}$: the strength of the chosen fastener

Example: BAN094025 joining two CLT walls with an intermediate floor. The aim is to determine the fixing band's load-bearing capacity when subjected to tensile forces. The nailing pattern shown below is used. The following table provides the characteristic strength values.

SCHILLIGER: PMC

Concealed Connectors

Aluminium concealed beam hanger **BTALU**

This aluminium hanger can be used to create a completely invisible connection for large section beams. It can also be used at the base of a wall for a completely concealed assembly, where it resists against uplift and lateral forces. The BTALU connector is supplied in bars of 1,180 mm.
It can be cut according to requirements. The drill holes for the dowels are made at the same time as those in the timber.

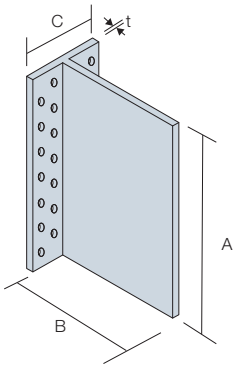
Advantages:
- 1200mm bar to be cut according to the height of the supported beam
- Possibility of supporting beams up to a height of 900 mm
- 30-minute fire-resistance rating according to certain recommendations. Refer to our fire resistance documentation on the Internet

R 30 | ALU | SC 2 | ETA | CE

ETA-07/0245

Dimensions

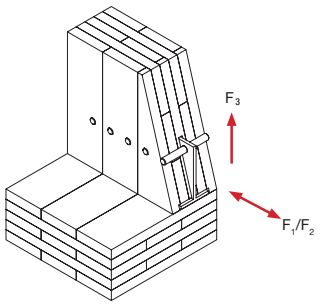
Model No.	Dimensions [mm]				Qty Holes Flange A
	A	B	C	t	Screws or nails
BTALU1200	1180	109	62	6	Ø 5

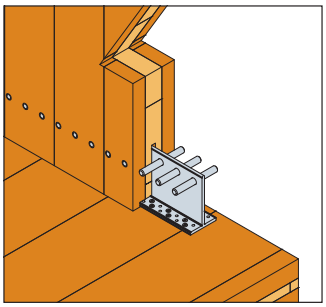


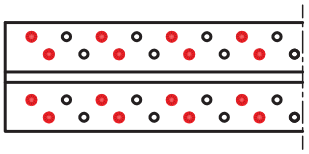
Characteristic values

Model No.	Fasteners				Characteristic values [kN]						
	Flange A (nails)		Flange B (nails)		$R_{1,k}$						$R_{3,k}$
	Qty	Type	Qty	Type	CNA4,0x50						
					60	80	100	120	140	160	
BTALU1200/120	12	CNA4,0x50	3	STD12	14,7	15,5	16,6	17,9	19,4	20,7	5,9
BTALU1200/160	16	CNA4,0x50	4	STD12	23,2	24,4	26	27,9	30	32	7,8
BTALU1200/200	20	CNA4,0x50	5	STD12	32,4	34,1	36,2	38,7	41,2	43,4	14,7
BTALU1200/240	24	CNA4,0x50	6	STD12	42,1	44,3	46,8	49,7	52,3	53,2	12
BTALU1200/280	28	CNA4,0x50	7	STD12	52	54,7	57,5	60,5	62	62	14
BTALU1200/320	32	CNA4,0x50	8	STD12	61,8	65,1	68,1	70,7	70,9	70,9	16
BTALU1200/360	36	CNA4,0x50	9	STD12	71,7	75,5	78,5	79,8	79,8	79,8	18
BTALU1200/400	40	CNA4,0x50	10	STD12	81,4	85,7	88,4	88,6	88,6	88,6	20
BTALU1200/440	44	CNA4,0x50	11	STD12	91	95,8	97,5	97,5	97,5	97,5	22
BTALU1200/480	48	CNA4,0x50	12	STD12	100	106	106	106	106	106	24
BTALU1200/520	52	CNA4,0x50	12	STD12	106	111	115	115	115	115	26
BTALU1200/560	56	CNA4,0x50	12	STD12	110	116	120	124	124	124	27
BTALU1200/600	60	CNA4,0x50	12	STD12	114	120	125	131	133	133	29

This table provides the characteristic values when the connector is used at the base of a CLT panel.
For other fixings (supporting or supported) or dimensions, refer to ETA 07/0245.







Nailing pattern for CLT

Related products

CNA

CSA

STD

Concealed beam hanger **BTC**

The BTC concealed beam hanger is a discreet connector used for fixing to a rigid substrate. The number of dowels and anchors can be chosen freely according to the load applied. The BTC hanger withstands forces in the three directions. Consequently, out-of-plane purlin assemblies can easily be performed in complete safety.

Advantages:

- Concealed assembly
- Connection to concrete
- Can be used for narrow supported beams
- Can be used for sloping configurations

Areas of application:

- Joists
- Purlins
- Supporting beams
- Sloping configuration up toan angle of 45°

R 60 | Z275 20 µm | SC 2 | ETA CE

ETA-07/0245

Dimensions

Model No.	Beam dimensions [mm]	Dimensions [mm]					Drill holes on supporting beam	Drill holes on supported beam
	Height Min.	A	B	C	t1	t2	Ø14	Ø13
BTC120-B	160	120	128	96	3	6	2	3
BTC160-B	200	160	128	96	3	6	4	4
BTC200-B	240	200	128	96	3	6	4	5
BTC240-B	280	240	128	96	3	6	4	6
BTC280-B	320	280	128	96	3	6	6	7
BTC320-B	360	320	128	96	3	6	6	8
BTC360-B	400	360	128	96	3	6	6	9
BTC400-B	440	400	128	96	3	6	8	10
BTC440-B	480	440	128	96	3	6	8	11
BTC480-B	520	480	128	96	3	6	8	12
BTC520-B	560	520	128	96	3	6	8	13
BTC560-B	600	560	128	96	3	6	8	14
BTC600-B	640	600	128	96	3	6	8	15

Characteristic values - Timber joist on rigid substrate - $R_{1,k}$ and $R_{2,k}$

Model No.	Fasteners				Characteristic values – C24 graded timber [kN]											
	Supporting member		Supported member		R1,k						R2,k					
					Dowel length [mm]						Dowel length [mm]					
	Quantity	Type	Quantity	Type	80	100	120	140	160	180	80	100	120	140	160	180
BTC120-B	2	Ø 12	3	STD12	11,5	12,7	14,2	15,8	17,2	17,2	-	-	-	-	-	-
BTC160-B	4	Ø 12	4	STD12	18,5	20,4	22,8	25,3	27,8	27,8	11,5	12,7	14,2	15,8	17,2	17,2
BTC200-B	4	Ø 12	5	STD12	26,7	29,4	32,7	36,4	40,3	40,3	18,5	20,4	22,8	25,3	27,8	28,7
BTC240-B	4	Ø 12	6	STD12	35,8	39,4	43,8	48,6	53,8	54,3	26,7	29,4	32,7	36,4	40,3	40,3
BTC280-B	6	Ø 12	7	STD12	45,6	50,1	55,6	61,7	68,3	69,4	35,8	39,4	43,8	48,6	53,8	54,3
BTC320-B	6	Ø 12	8	STD12	56	61,4	68,1	75,5	83,4	85,5	45,6	50,1	55,6	61,7	68,3	69,4
BTC360-B	6	Ø 12	9	STD12	66,8	73,1	80,9	89,6	99	102,2	56	61,4	68,1	75,5	83,4	85,5
BTC400-B	8	Ø 12	10	STD12	77,9	85,1	94	104,1	114,8	119,5	66,8	73,1	80,9	89,6	99	102,2
BTC440-B	8	Ø 12	11	STD12	89,1	97,2	107,3	118,7	130,9	133,3	77,9	85,1	94	104,1	114,8	119,5
BTC480-B	8	Ø 12	12	STD12	100,5	109,5	120,7	133,4	147	147	89,1	97,2	107,3	118,7	130,9	133,3
BTC520-B	8	Ø 12	12	STD12	100,5	109,5	120,7	133,4	147	147	100,5	109,5	120,7	133,4	147	147
BTC560-B	8	Ø 12	12	STD12	100,5	109,5	120,7	133,4	147	147	100,5	109,5	120,7	133,4	147	147
BTC600-B	8	Ø 12	12	STD12	100,5	109,5	120,7	133,4	147	147	100,5	109,5	120,7	133,4	147	147

Concealed beam hanger **BTC**

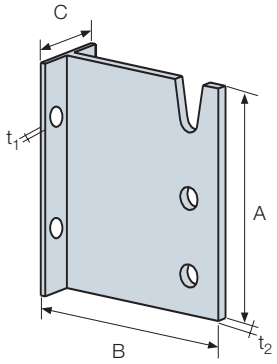
For combined loads:

$$\sum \left(\frac{F_{i,d}}{R_{i,d}} \right)^2 \leq 1$$

Value $R_{2,k}$ is calculated as $R_{2,k} = R_{1,k}$ x (number of dowels - 1) / (number of dowels).

The upper dowel is not considered for the uplift capacities, since it is placed in an open hole.

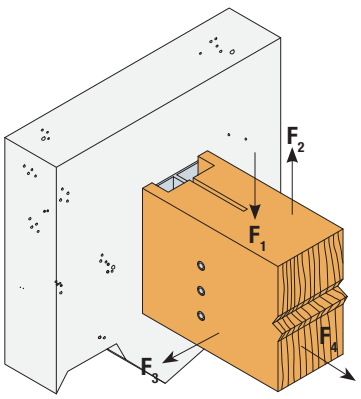
The strength and number of anchors must be checked according to the ETA and the type of substrate.
The number of anchors specified in the table above is the maximum.
If the strength of the anchors is going to play a decisive role, it must be taken into account for the connection.

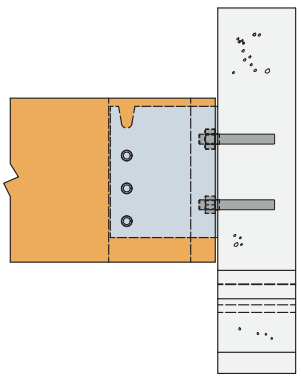


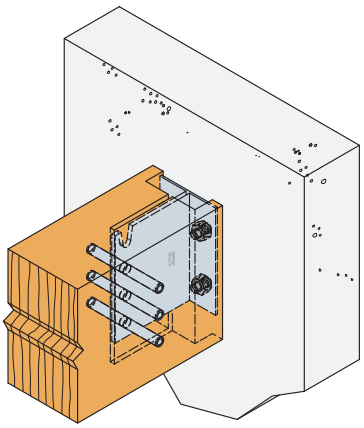
Characteristic values - Timber joist on rigid substrate - $R_{3,k}$ and $R_{4,k}$

Model No.	Fasteners				Characteristic values – C24 graded timber [kN]							Fasteners				Characteristic values – C24 graded timber [kN]
	Supporting member		Supported member		$R_{3,k}$ Dowel length [mm]							Supporting member		Supported member		
	Quantity	Type	Quantity	Type	60	80	100	120	140	160	180	Quantity	Type	Quantity	Type	$R_{4,k}$
BTC120-B	2	Ø 12	3	STD12	2,6	2,9	3,5	4	4,5	5,2	5,3	2	Ø 12	3	STD12	6,7/kmod
BTC160-B	4	Ø 12	4	STD12	3,2	3,9	4,4	5	5,9	6,5	7	4	Ø 12	4	STD12	13,4/kmod
BTC200-B	4	Ø 12	5	STD12	4	4,9	5,5	6,3	7,2	7,8	8,8	4	Ø 12	5	STD12	13,4/kmod
BTC240-B	4	Ø 12	6	STD12	4,8	5,7	6,6	7,5	8,4	9,1	10,4	4	Ø 12	6	STD12	13,4/kmod
BTC280-B	6	Ø 12	7	STD12	5,6	6,5	7,6	8,7	9,6	10,4	11,9	6	Ø 12	7	STD12	20,1/kmod
BTC320-B	6	Ø 12	8	STD12	6,4	7,3	8,6	9,7	10,8	11,8	13,4	6	Ø 12	8	STD12	20,1/kmod
BTC360-B	6	Ø 12	9	STD12	7,2	8,1	9,5	10,8	12	13,2	14,9	6	Ø 12	9	STD12	20,1/kmod
BTC400-B	8	Ø 12	10	STD12	8	8,9	10,5	11,9	13,2	14,7	16,4	8	Ø 12	10	STD12	26,8/kmod
BTC440-B	8	Ø 12	11	STD12	8,8	9,7	11,4	13	14,4	16,1	17,8	8	Ø 12	11	STD12	26,8/kmod
BTC480-B	8	Ø 12	12	STD12	9,6	10,6	12,4	14,1	15,6	17,6	19,3	8	Ø 12	12	STD12	26,8/kmod
BTC520-B	8	Ø 12	12	STD12	10,4	11,4	13,3	15,1	16,8	19,1	20,8	8	Ø 12	12	STD12	26,8/kmod
BTC560-B	8	Ø 12	12	STD12	11,2	12,3	14,3	16,2	18	20,5	22,3	8	Ø 12	12	STD12	26,8/kmod
BTC600-B	8	Ø 12	12	STD12	12	13,2	15,2	17,3	19,2	22	23,8	8	Ø 12	12	STD12	26,8/kmod

The strength and number of anchors must be checked according to the ETA and the type of substrate.
The number of anchors specified in the table above is the maximum.
If the strength of the anchors is going to play a decisive role, it must be taken into account for the connection.







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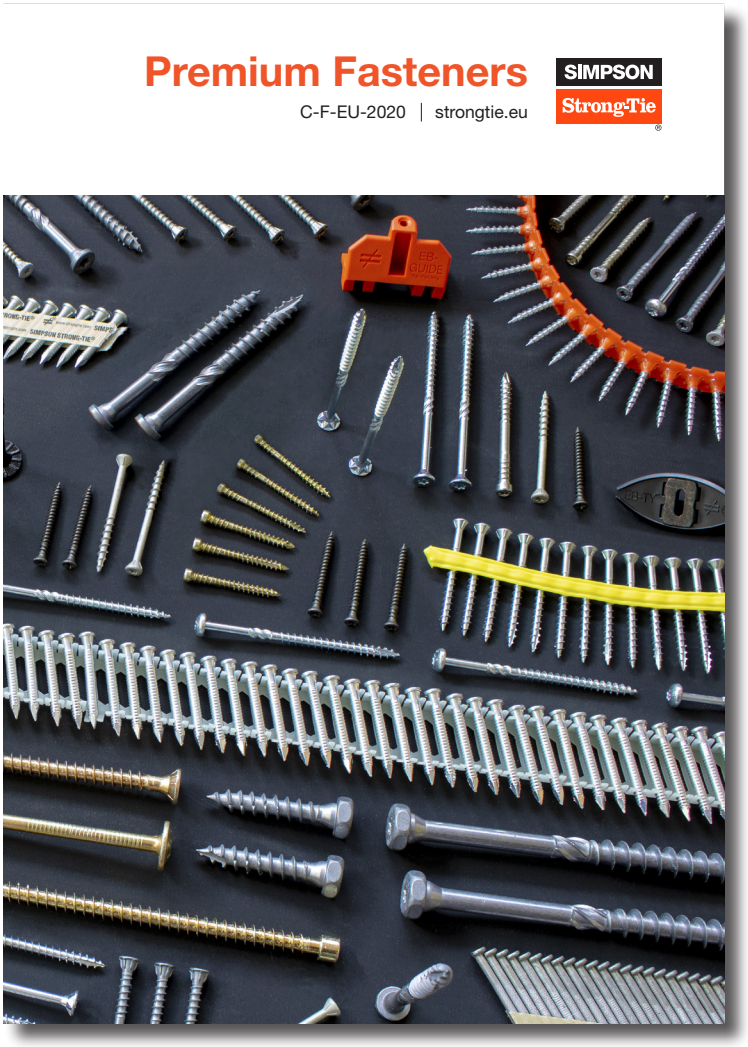

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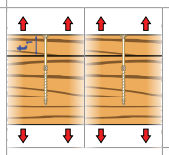
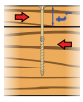
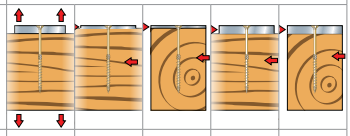
Screws and Nails for CLT

Understanding screw resistance

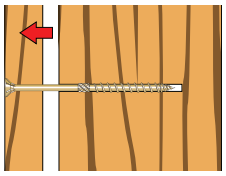
Instructions for using the Simpson Strong-Tie tables

		C24 graded timber/timber					
	Thread length						
		Axial $R_{ax.k}$		Shear parallel to the grain $R_{v.0°.k}$ according to t_1			
Item no.	L_g	t_1	$R_{ax.k}$	35	40	45	...
ESCRC5,0x50	30	20	1,46	-	-	-	...
ESCRC5,0x60	30	30	1,46	1,48	-	-	...
ESCRC5,0x70	37	33	1,46	1,67	-	-	...
ESCRC5,0x80	37	43	1,46	1,67	1,67	1,67	...

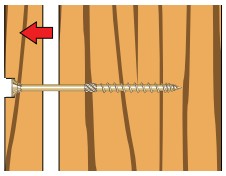
	C24 graded timber/timber			Steel/C24 graded timber				
								
	Shear perpendicular to the grain $R_{v.90°.k}$ according to t_1			$R_{ax.st.k}$	$R_{v.0.st.k}$	$R_{v.90.st.k}$	$R_{v.0.st.k}$	$R_{v.90.st.k}$
Item no.	35	40	...	Axial[1]	Shear thin plate[2]		Shear thick plate[3]	
ESCRC5,0x50	-	-	,,,	2,04	1,81	1,81	2,35	2,35
ESCRC5,0x60	1,48	-	,,,	2,04	1,81	1,81	2,35	2,35
ESCRC5,0x70	1,67	-	,,,	2,52	1,93	1,93	2,47	2,47
ESCRC5,0x80	1,67	1,67	1,67	2,52	1,93	1,93	2,47	2,47

1 2 2 3

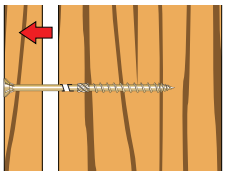
1 The timber/timber tensile strength $R_{ax.k}$ includes the following resistances:



1: thread pull-out



2: head pull-through



3: steel under tensile load

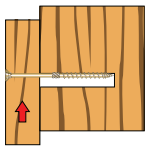
These resistances are valid for:
- A timber thickness beneath the head less than or equal to the value t1 displayed in the adjacent column.
- Screw in the lateral faces of the CLT with an angle from 45 to 90° between the screw axis and the grain of the timber.
- Screw in the strips of the CLT with an angle from 0 to 45° between the screw axis and the grain of the timber. A reduction factor dependent on the angle applies to the axial strength (refer to ETA 13/0796).

All tensile strengths are given for C24 graded timber. If using a material of a different density and if failure mode 3 is not design critical (which is the case for all timber-to-timber assemblies), the tensile strength can be multiplied by the following factor:

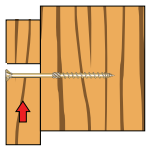
$$K_{dens} = (\rho/350)^{0.8}$$

Where:
350 kg/m³: characteristic density of the C24 graded timber according to EN 338
ρ_K: characteristic density of the timber used according to EN 338
For fastening screws (part threaded), dimension t_1 corresponds to the maximum thickness for which the thread is fully inserted pointside in the timber, which ensures effective tightening during installation.

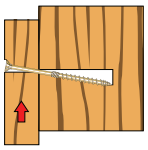
2 The timber/timber shear strength $R_{v.\alpha.k}$ includes the following resistances:



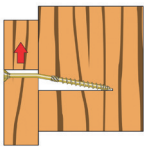
1: compression timber 2



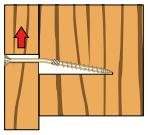
2: compression timber 1



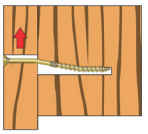
3: double compression



4: plastic swivel - timber 1



5: plastic swivel - timber 2



6: double plastic swivel

Shear strengths are provided for several timber thicknesses beneath the screw head t_1 and for the following configurations:
- Screw in the lateral faces of the CLT with an angle from 45 to 90° between the screw axis and the grain of the timber. Local bearing strength fh.k is calculated according to EN 1995-1-1:2004+A2:2014.
- Screw in the strips of the CLT with an angle from 0 to 45° between the screw axis and the grain of the timber. Local bearing strength fh.k is calculated according to the report entitled "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" by Univ.-Prof. Dr.-Ing Han Joachim Blass & Dipl.-Ing. Thomas Uibel.

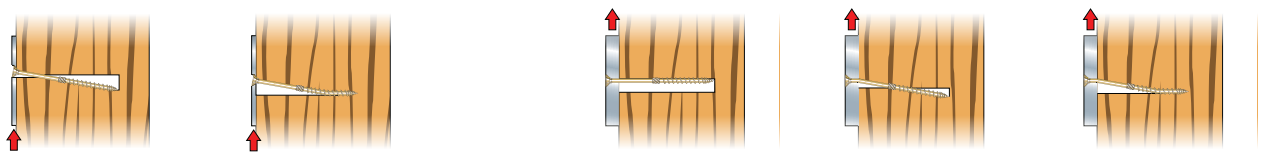
All tensile strengths are given for C24 graded timber. The minimum distances and spacings are calculated according to the above report. Note that the calculated strengths and minimum spacings according to the above report apply with or without pilot holes.

In case of part threaded screws, the strengths only apply to configurations where the thread does not exceed more than 5 mm into the timber element beneath the screw head to ensure the best possible fastening.
Clause (2) of Part 8.3.1.2 in EN 1995-1-1:204+A2:2014 on the pointside penetration depth does not apply to this calculation.

Understanding screw resistance

❸ The steel/timber shear strength $R_{v.\alpha.k}$ includes the following resistances:

Thin steel $t_{st} \leq 0.5\ d$ | Thick steel $t_{st} \geq d$



1: timber compression | 2: plastic swivel | 3: timber compression | 4: plastic swivel | 5: double plastic swivel

Shear strengths are provided for thick steel (t_{st} = d) and thin steel (t_{st} = 0.5xd). For the following configurations:
The strength values for intermediate steel thicknesses can be obtained by interpolating the values for thick and thin steel plates.
Local bearing strength fh.k and the minimum distances/spacings are calculated in the same way as the timber/timber shear strength values seen earlier, according to EN1995-1-1:2004+A2:2014 and the report entitled "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" by Univ.-Prof. Dr.-Ing Han Joachim Blass & Dipl.-Ing. Thomas Uibel.
Note that the calculated strengths and minimum spacings according to the above report apply with or without pilot holes.

These resistances are valid for C24 graded timber and higher.

All design calculations conform to EN 1995-1-1:2004+A2:2014 & the associated ETAs and DoPs for the screws.

For more information or for other screwed assembly configurations:

The SOLID WOOD web-based tool is available at www.strongtie.eu.

The technical services department is ready to answer your questions.

Characteristic values / Design values

The values provided in these tables are the characteristic strengths R_k according to Eurocode 5 (EN 1995-1-1:2005 + A1:2008 + A2:2014).
The corresponding design strength $R_{d.i}$ can be obtained with the following formula:

$$R_d = \frac{R_k \times k_{mod}}{\gamma_M}$$

Where:
$k_{mod.i}$: modification factor associated with the load duration, service class and material used (refer to Table 3.1 in Eurocode 5)
γ_m: partial factor for material properties
This design value should be compared with the corresponding weighted stress.

However, standard practice is to compare a characteristic weighted stress (the worst case scenario is the easiest to identify) directly against the characteristic strength. The following can then be verified:

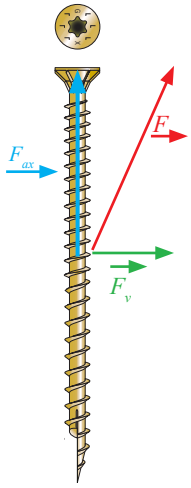
$$max\left(\frac{F_{d,i} \times \gamma_M}{k_{mod.i}}\right) \leq R_k$$

Combined or oblique stresses

If a screw or group of screws is subjected to axial and lateral forces at the same time (case of oblique stresses), the following combination must be verified:

$$\left(\frac{F_{ax.d.i}}{R_{ax.d.i}}\right)^2 + \left(\frac{F_{v.d.i}}{R_{v.d.i}}\right)^2 \leq 1$$

$F_{ax.d.i}$ and $F_{v.d.i}$ correspond to the projected oblique stresses respectively according to the screw axis and perpendicular to the screw axis.



Effective number

The strength $R_{k.n}$ of a group of screws can be calculated by multiplying the strength of a single screw by n_{eff}:

$$R_{k.n} = n_{eff}\, x\, R_k$$

Axially loaded screw:

$n_{eff} = n^{0.9}$

n	2	3	4	5	6
n_{eff}	1,87	2,69	3,48	4,26	5,02

Screws subject to shear loading:
TTUFS, ESCR/C/HRD d=5 and 6

On the same wood grain: $n_{eff} = n^{keff}$
Staggered arrangement of 1xd: $n_{eff} = n$
Perpendicular to the grain: $n_{eff} = n$

Spacing	k_{eff}
$a_1 \geq 14d$	1,0
$a_1 = 10d$	0,85
$a_1 = 7d$	0,7
$a_1 = 4d$	0,5

Screws subject to shear loading:
ESCR/C/HRD/FTC/FTZ/FT d ≥ 8

On the same wood grain: $n_{eff} = min\left\{n^{0.9} \times \sqrt[4]{\frac{a_1}{13d}}\right\}^n$

Perpendicular to the grain: $n_{eff} = n$

Structural timber screws for CLT

ESCR Structural Washer Head **WOOD** Screw

ESCR is a washer head structural screw designed for load-bearing wood structures. The ESCR screw has a milling thread to allow for smooth driving of the shank. The large washer head gives high head pull-through resistance while allowing the wood members to close up firmly.

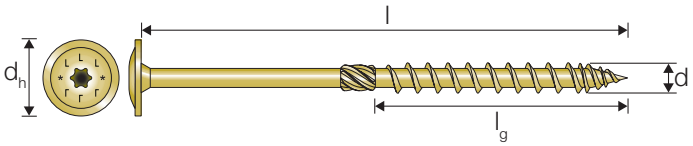
Features:

- No pre-drilling required
- High withdrawal resistance
- Milling thread allows smooth driving
- Washer head

Application:

- Solid wood, glulam, wood derivatives for timber framing
- OSB floors on I-beam and solid wood joists
- Battens for fixing external insulation

ETA-13/0796



ESCR Yellow Zinc Plated

Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCR6.0X60	6,0	60	14,0	36	T-30	100
ESCR6.0X80	6,0	80	14,0	48	T-30	100
ESCR6.0X100	6,0	100	14,0	48	T-30	100
ESCR6.0X120	6,0	120	14,0	64	T-30	100
ESCR6.0X140	6,0	140	14,0	64	T-30	100
ESCR6.0X160	6,0	160	14,0	64	T-30	100
ESCR6.0X180	6,0	180	14,0	64	T-30	100
ESCR6.0X200	6,0	200	14,0	64	T-30	100
ESCR8.0X80	8,0	80	20,0	54	T-40	50
ESCR8.0X100	8,0	100	20,0	54	T-40	50
ESCR8.0X120	8,0	120	20,0	54	T-40	50
ESCR8.0X140	8,0	140	20,0	84	T-40	50
ESCR8.0X160	8,0	160	20,0	84	T-40	50
ESCR8.0X180	8,0	180	20,0	100	T-40	50
ESCR8.0X200	8,0	200	20,0	100	T-40	50
ESCR8.0X220	8,0	220	20,0	100	T-40	50
ESCR8.0X240	8,0	240	20,0	100	T-40	50
ESCR8.0X260	8,0	260	20,0	100	T-40	50
ESCR8.0X280	8,0	280	20,0	100	T-40	50
ESCR8.0X300	8,0	300	20,0	100	T-40	50
ESCR8.0X320	8,0	320	20,0	100	T-40	50
ESCR8.0X340	8,0	340	20,0	100	T-40	50
ESCR8.0X360	8,0	360	20,0	100	T-40	50
ESCR8.0x380	8,0	380	20,0	100	T-40	50
ESCR8.0X400	8,0	400	20,0	100	T-40	50

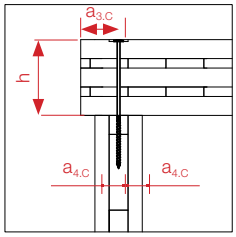
Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCR10.0X100	10,0	100	25,0	60	T-50	25
ESCR10.0X120	10,0	120	25,0	60	T-50	25
ESCR10.0X140	10,0	140	25,0	60	T-50	25
ESCR10.0X160	10,0	160	25,0	100	T-50	25
ESCR10.0X180	10,0	180	25,0	100	T-50	25
ESCR10.0X200	10,0	200	25,0	100	T-50	25
ESCR10.0X220	10,0	220	25,0	100	T-50	25
ESCR10.0X240	10,0	240	25,0	100	T-50	25
ESCR10.0X260	10,0	260	25,0	100	T-50	25
ESCR10.0X280	10,0	280	25,0	100	T-50	25
ESCR10.0X300	10,0	300	25,0	100	T-50	25
ESCR10.0X320	10,0	320	25,0	100	T-50	25
ESCR10.0X340	10,0	340	25,0	100	T-50	25
ESCR10.0X360	10,0	360	25,0	100	T-50	25
ESCR10.0X380	10,0	380	25,0	100	T-50	25
ESCR10.0X400	10,0	400	25,0	100	T-50	25

Structural timber screws for CLT

Design parameters

Model No.	Characteristic yield moment $M_{y,k}$ [Nmm]	Characteristic withdrawal parameter $f_{ax,k,90°}$ [N/mm²]	Characteristic head pull-through parameter $f_{head,k}$ [N/mm²]	Characteristic tensile capacity $f_{tens,k}$ [kN]
ESCR6…	10.100	13,0	16,7	12,8
ESCR8…	22.600	10,7	17,6	22,7
ESCR10…	33.000	9,5	15,2	33,2

Panels joined at right angles with screws



Model No.	Characteristic shear strength $R_{v,k}$ according to panel thickness h:								
	120	140	160	180	200	220	240	280	300
ESCR6,0X180	1,34								
ESCR6,0X200	1,48	1,34							
ESCR8,0X220	2,79								
ESCR8,0X240	2,79	2,79							
ESCR8,0X260	2,79	2,79	2,79						
ESCR8,0X280	2,79	2,79	2,79	2,79					
ESCR8,0X300	2,79	2,79	2,79	2,79	2,79				
ESCR8,0X320	2,79	2,79	2,79	2,79	2,79	2,79			
ESCR8,0X340	2,79	2,79	2,79	2,79	2,79	2,79	2,79		
ESCR8,0X360	2,79	2,79	2,79	2,79	2,79	2,79	2,79	2,79	
ESCR8,0X380	2,79	2,79	2,79	2,79	2,79	2,79	2,79	2,79	2,79
ESCR8,0X400	2,79	2,79	2,79	2,79	2,79	2,79	2,79	2,79	2,79
ESCR10,0X220	3,63								
ESCR10,0X240	3,63	3,63							
ESCR10,0X260	3,63	3,63	3,63						
ESCR10,0X280	3,63	3,63	3,63	3,63					
ESCR10,0X300	3,63	3,63	3,63	3,63	3,63				
ESCR10,0X320	3,63	3,63	3,63	3,63	3,63	3,63			
ESCR10,0X340	3,63	3,63	3,63	3,63	3,63	3,63	3,63		
ESCR10,0X360	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63	
ESCR10,0X380	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63
ESCR10,0X400	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63

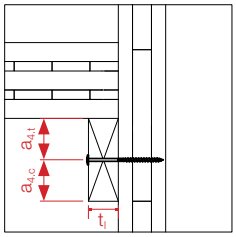
Minimum distance for screws under shear forces[1]

Model No.	a_1	$a_{3.c}$	$a_{4.c}$
ESCR6…	60	36	30
ESCR8…	80	48	40
ESCR10…	100	60	50

[1] According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" and ETA 13/0796.

Structural timber screws for CLT

Fixing a wall plate to a panel with screws



Model No.	Timber wall plate/C24 timber stud							
	Characteristic shear strength $R_{v,90-90,k}$ according to wall plate thickness t_1							
	35	40	45	60	75	80	90	≥ 100
ESCR6,0X80	2,57	-	-	-	-	-	-	-
ESCR6,0X100	2,57	2,60	2,60	-	-	-	-	-
ESCR6,0X120	2,57	2,60	2,60	2,60	-	-	-	-
ESCR6,0X140	2,57	2,60	2,60	2,60	2,60	2,60	-	-
ESCR6,0X160	2,57	2,60	2,60	2,60	2,60	2,60	2,60	2,60
ESCR8,0X100	3,70	3,89	4,10	-	-	-	-	-
ESCR8,0X120	3,70	3,89	4,10	4,35	-	-	-	-
ESCR8,0X140	4,31	4,50	4,70	4,91	-	-	-	-
ESCR8,0X160	4,31	4,50	4,70	4,96	4,96	4,91	-	-
ESCR8,0X180	4,31	4,50	4,70	4,96	4,96	4,96	-	-
ESCR8,0X200	4,31	4,50	4,70	4,96	4,96	4,96	4,96	4,96
ESCR10,0X120	-	4,86	5,10	5,67	-	-	-	-
ESCR10,0X140	-	4,86	5,10	5,67	5,67	5,67	-	-
ESCR10,0X160	-	5,81	6,05	6,62	-	-	-	-
ESCR10,0X180	-	5,81	6,05	6,62	6,62	6,62	-	-
ESCR10,0X200	-	5,81	6,05	6,62	6,62	6,62	6,62	6,62

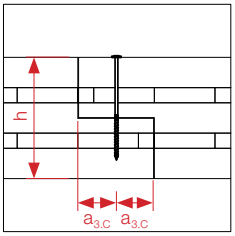
Minimum distance for screws under shear forces[1]

Model No.	$a_{1,90°}$	$a_{2,90°}$	$a_{4,t,90°}$	$a_{4,c,90°}$
ESCR6…	24	24	42	18
ESCR8…	32	32	32	24
ESCR10…	40	40	40	30

[1] According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" and ETA 13/0796.

Structural timber screws for CLT

Panel assembly with a halved joint and screws at 90°



Model No.		Characteristic shear strength
	h_{min}	$R_{v,k}$
ESCR6,0X100	110	2,6
ESCR6,0X120	130	2,6
ESCR6,0X140	150	2,6
ESCR6,0X160	170	2,6
ESCR6,0X180	190	2,6
ESCR6,0X200	210	2,6
ESCR8,0X100	110	3,92
ESCR8,0X120	130	4,09
ESCR8,0X140	168	4,69
ESCR8,0X160	170	4,69
ESCR8,0X180	200	4,69
ESCR8,0X200	210	4,69
ESCR8,0X220	230	4,69
ESCR8,0X240	250	4,69
ESCR8,0X260	270	4,69
ESCR8,0X280	290	4,69
ESCR8,0X300	310	4,69
ESCR8,0X320	330	4,69
ESCR10,0X100	120	4,86
ESCR10,0X120	130	5,3
ESCR10,0X140	150	5,3
ESCR10,0X160	200	6,25
ESCR10,0X180	200	6,25
ESCR10,0X200	210	6,25
ESCR10,0X220	230	6,25
ESCR10,0X240	250	6,25
ESCR10,0X260	270	6,25
ESCR10,0X280	290	6,25
ESCR10,0X300	310	6,25
ESCR10,0X320	330	6,25

Minimum distance for screws under shear forces[1]

Model No.	a_1	$a_{3,c}$
ESCR6…	24	36
ESCR8…	32	48
ESCR10…	40	60

[1] According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" and ETA 13/0796.

ESCRC Structural Countersunk **WOOD** Screw

ESCRC is a countersunk structural screw designed for load-bearing wood structures. The ESCRC screw has a milling thread to allow for smooth driving of the shank. The countersunk head gives a flush fitting while allowing the wood members to close up firmly.

Features:

- No pre-drilling required
- High withdrawal resistance
- Milling thread allows smooth driving
- Countersunk head

Application:

- Solid wood, glulam, wood derivatives for timber framing
- OSB floors on I-beams and solid wood joists
- Battens for fixing external insulation

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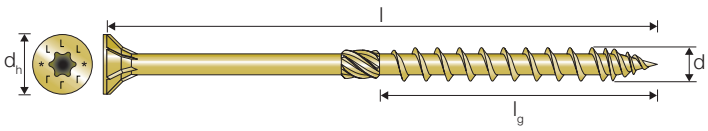


ESCRC Yellow Zinc Plated

Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCRC5.0X50	5,0	50	10,0	30	T-25	250
ESCRC5.0X60	5,0	60	10,0	30	T-25	250
ESCRC5.0X70	5,0	70	10,0	37	T-25	200
ESCRC5.0X80	5,0	80	10,0	37	T-25	200
ESCRC5.0X90	5,0	90	10,0	55	T-25	200
ESCRC6.0X60	6,0	60	12,0	60	T-30	200
ESCRC6.0X70	6,0	70	12,0	36	T-30	200
ESCRC6.0X80	6,0	80	12,0	48	T-30	100
ESCRC6.0X90	6,0	90	12,0	48	T-30	100
ESCRC6.0X100	6,0	100	12,0	48	T-30	100
ESCRC6.0X120	6,0	120	12,0	64	T-30	100
ESCRC6.0X130	6,0	130	12,0	64	T-30	100
ESCRC6.0X140	6,0	140	12,0	64	T-30	100
ESCRC6.0X150	6,0	150	12,0	64	T-30	100
ESCRC6.0X160	6,0	160	12,0	64	T-30	100
ESCRC6.0X180	6,0	180	12,0	64	T-30	100
ESCRC6.0X200	6,0	200	12,0	64	T-30	100
ESCRC6.0X220	6,0	220	12,0	64	T-30	100
ESCRC6.0X240	6,0	240	12,0	64	T-30	100
ESCRC6.0X260	6,0	260	12,0	64	T-30	100
ESCRC6.0X280	6,0	280	12,0	64	T-30	100
ESCRC6.0X300	6,0	300	12,0	64	T-30	100
ESCRC8.0X80	8,0	80	15,0	54	T-40	50
ESCRC8.0X100	8,0	100	15,0	54	T-40	50
ESCRC8.0X120	8,0	120	15,0	54	T-40	50
ESCRC8.0X140	8,0	140	15,0	84	T-40	50
ESCRC8.0X160	8,0	160	15,0	84	T-40	50

Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCRC8.0X180	8,0	180	15,0	100	T-40	50
ESCRC8.0X200	8,0	200	15,0	100	T-40	50
ESCRC8.0X220	8,0	220	15,0	100	T-40	50
ESCRC8.0X240	8,0	240	15,0	100	T-40	50
ESCRC8.0X260	8,0	260	15,0	100	T-40	50
ESCRC8.0X280	8,0	280	15,0	100	T-40	50
ESCRC8.0X300	8,0	300	15,0	100	T-40	50
ESCRC8.0X320	8,0	320	15,0	100	T-40	50
ESCRC8.0X340	8,0	340	15,0	100	T-40	50
ESCRC8.0X360	8,0	360	15,0	100	T-40	50
ESCRC8.0X380	8,0	380	15,0	100	T-40	50
ESCRC8.0X400	8,0	400	15,0	100	T-40	50
ESCRC10.0X120	10,0	120	18,5	60	T-40	50
ESCRC10.0X140	10,0	140	18,5	60	T-40	50
ESCRC10.0X160	10,0	160	18,5	100	T-40	50
ESCRC10.0X180	10,0	180	18,5	100	T-40	50
ESCRC10.0X200	10,0	200	18,5	100	T-40	50
ESCRC10.0X220	10,0	220	18,5	100	T-40	50
ESCRC10.0X240	10,0	240	18,5	100	T-40	50
ESCRC10.0X260	10,0	260	18,5	100	T-40	50
ESCRC10.0X280	10,0	280	18,5	100	T-40	50
ESCRC10.0X300	10,0	300	18,5	100	T-40	50
ESCRC10.0X320	10,0	320	18,5	100	T-40	50
ESCRC10.0X340	10,0	340	18,5	100	T-40	50
ESCRC10.0X360	10,0	360	18,5	100	T-40	50
ESCRC10.0X380	10,0	380	18,5	100	T-40	50
ESCRC10.0X400	10,0	400	18,5	100	T-40	50

Design parameters

Model No.	Characteristic yield moment – $M_{y,k}$ [Nmm]	Characteristic withdrawal parameter $f_{ax,k,90°}$ [N/mm²]	Characteristic head pull-through parameter $f_{head,k}$ [N/mm²]	Characteristic tensile capacity $f_{tens,k}$ [kN]
ESCRC8…	22.600	10,7	12,4	22,7
ESCRC10…	33.000	9,5	12,2	33,2

ESCRFTC Structural Fully Threaded Countersunk **WOOD** Screw

The ETA approved ESCRFTC is a fully threaded structural screw designed for load-bearing wood structures.

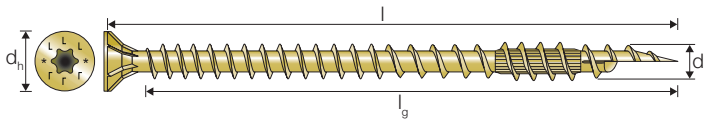
Features:

- No pre-drilling required
- High withdrawal resistance
- Fully threaded
- Countersunk head

Application:

- Bracket/timber and timber/timber connections
- Reinforcements
- Battens for fixing external insulation

ETA-13/0796



ESCRFTC Yellow Zinc Plated

Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCRFTC8.0X120	8,0	120	15,0	110	T-40	60
ESCRFTC8.0X140	8,0	140	15,0	130	T-40	60
ESCRFTC8.0X160	8,0	160	15,0	150	T-40	50
ESCRFTC8.0X180	8,0	180	15,0	170	T-40	50
ESCRFTC8.0X200	8,0	200	15,0	190	T-40	50
ESCRFTC8.0X220	8,0	220	15,0	210	T-40	50
ESCRFTC8.0X240	8,0	240	15,0	230	T-40	50
ESCRFTC8.0X260	8,0	260	15,0	250	T-40	50
ESCRFTC8.0X280	8,0	280	15,0	270	T-40	50
ESCRFTC8.0X300	8,0	300	15,0	290	T-40	50
ESCRFTC8.0X350	8,0	350	15,0	340	T-40	50
ESCRFTC8.0X400	8,0	400	15,0	390	T-40	50
ESCRFTC8.0X450	8,0	450	15,0	427	T-40	50
ESCRFTC10.0X120	10,0	120	18,5	108	T-50	50
ESCRFTC10,0X160	10,0	160	18,5	148	T-50	50
ESCRFTC10.0X180	10,0	180	18,5	168	T-50	50
ESCRFTC10.0X200	10,0	200	18,5	188	T-50	50
ESCRFTC10.0X220	10,0	220	18,5	208	T-50	50
ESCRFTC10.0X240	10,0	240	18,5	228	T-50	50
ESCRFTC10.0X260	10,0	260	18,5	248	T-50	50
ESCRFTC10.0X280	10,0	280	18,5	268	T-50	50
ESCRFTC10.0X300	10,0	300	18,5	288	T-50	50
ESCRFTC10.0X350	10,0	350	18,5	338	T-50	50
ESCRFTC10.0X400	10,0	400	18,5	388	T-50	50
ESCRFTC10.0X450	10,0	450	18,5	426	T-50	50

Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCRFTC12.0X200	10,0	200	20,0	180	T-50	25
ESCRFTC12.0X220	12,0	220	20,0	200	T-50	25
ESCRFTC12.0X240	12,0	240	20,0	220	T-50	25
ESCRFTC12.0X260	12,0	260	20,0	240	T-50	25
ESCRFTC12.0X280	12,0	280	20,0	260	T-50	25
ESCRFTC12.0X300	12,0	300	20,0	280	T-50	25
ESCRFTC12.0X350	12,0	350	20,0	330	T-50	25
ESCRFTC12.0X400	12,0	400	20,0	380	T-50	25
ESCRFTC12.0X450	12,0	450	20,0	430	T-50	25
ESCRFTC12.0X500	12,0	500	20,0	480	T-50	25
ESCRFTC12.0X600	12,0	600	20,0	580	T-50	25

Design parameters

Model No.	Characteristic yield moment $M_{y,k}$ [Nmm]	Characteristic withdrawal parameter $f_{ax,k,90°}$ [N/mm²]	Characteristic head pull-through parameter $f_{head,k}$ [N/mm²]	Characteristic tensile capacity $f_{tens,k}$ [$f_{tens,k}$] [kN]
ESCRFTC8...	20.300	13,1	12,4	24,1
ESCRFTC10...	36.700	12,5	12,2	40
ESCRFTC12...	48.500	11,2	10,3	46,7

Structural timber screws for CLT

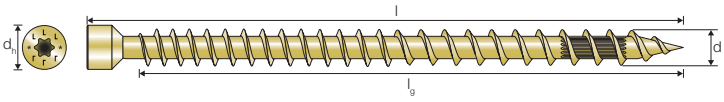
ESCRFTZ / ESCRFT Structural Fully Threaded Cylinder Head **WOOD** Screw

The ETA approved ESCRFTZ and ESCRFT are fully threaded cylinder head structural screws designed for load-bearing wood structures.

Features:
- No pre-drilling required
- High withdrawal resistance
- Fully threaded
- Cylinder head

Application:
- Timber-to-timber connections, reinforcements, glulam, CLT, wood-based panels
- Ideal for applications where pairs of screws are driven in at angles

ETA-13/0796



ESCRFTZ Yellow Zinc Plated

Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCRFTZ8.0X120	8,0	120	10,2	110	T-40	50
ESCRFTZ8.0X140	8,0	140	10,2	130	T-40	50
ESCRFTZ8.0X160	8,0	160	10,2	150	T-40	50
ESCRFTZ8.0X180	8,0	180	10,2	170	T-40	50
ESCRFTZ8.0X200	8,0	200	10,2	190	T-40	50
ESCRFTZ8.0X220	8,0	220	10,2	210	T-40	50
ESCRFTZ8.0X240	8,0	240	10,2	230	T-40	50
ESCRFTZ8.0X260	8,0	260	10,2	250	T-40	50
ESCRFTZ8.0X280	8,0	280	10,2	270	T-40	50
ESCRFTZ8.0X300	8,0	300	10,2	290	T-40	50
ESCRFTZ8.0X350	8,0	350	10,2	340	T-40	50
ESCRFTZ8.0X400	8,0	400	10,2	390	T-40	50

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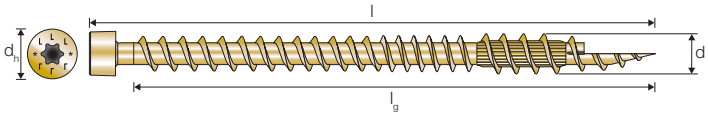


ESCRFT Yellow Zinc Plated

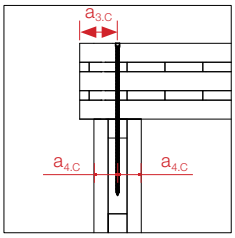
Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCRFT10.0X450	10,0	450	13,4	426	T-50	25
ESCRFT10.0X500	10,0	500	13,4	476	T-50	25
ESCRFT10.0X600	10,0	600	13,4	576	T-50	25
ESCRFT10.0X800	10,0	800	13,4	776	T-50	15
ESCRFT10.0X1000	10,0	1000	13,4	976	T-50	15

Design parameters

Model No.	Characteristic yield moment $M_{y,k}$ [Nmm]	Characteristic withdrawal parameter $f_{ax,k,90°}$ [N/mm²]	Characteristic head pull-through parameter $f_{head,k}$ [N/mm²]	Characteristic tensile capacity $f_{tens,k}$ [$f_{tens,k}$] [kN]
ESCRFTZ8…	20.300	13,1	-	24,1
ESCRFT10…	36.700	12,5	-	40

Structural timber screws for CLT

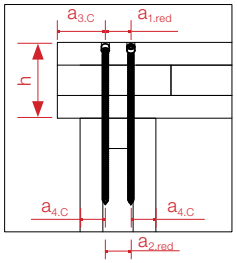
Panels joined at right angles with screws

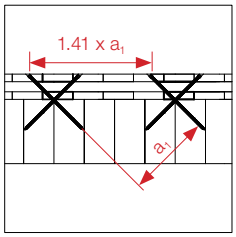


Model No.	Characteristic shear strength $R_{v.k}$ according to panel thickness R:								
	120	140	160	180	200	220	240	280	300
ESCRFTZ8,0X160	1,81								
ESCRFTZ8,0X180	2,26	1,81							
ESCRFTZ8,0X200	2,79	2,26	1,81						
ESCRFTZ8,0X220	2,96	2,79	2,26	1,81					
ESCRFTZ8,0X240	3,05	2,96	2,79	2,26	1,81				
ESCRFTZ8,0X400	3,05	3,22	3,4	3,57	3,75	3,66	3,49	3,31	3,14
ESCRFT10,0x450	4	4,21	4,41	4,62	4,83	5,04	5,18	4,98	4,77
ESCRFT10,0x500	4	4,21	4,41	4,62	4,83	5,04	5,25	5,46	5,29
ESCRFT10,0x600	4	4,21	4,41	4,62	4,83	5,04	5,25	5,46	5,66
ESCRFT10,0x800	4	4,21	4,41	4,62	4,83	5,04	5,25	5,46	5,66
ESCRFT10,0x1000	4,01	4,22	4,42	4,63	4,84	5,05	5,26	5,47	5,67

	Minimum distance for screws under shear forces[1]		
Model No.	a_1	$a_{3.c}$	$a_{4.c}$
ESCRFTZ8…	80	48	40
ESCRFTZ10…	100	60	50

Panels joined at right angles by skew screwing





Model No.	Minimum CLT thickness	Characteristic strength (pull-out/buckling) $R_{v.k.pair} = \min(R_{w.k.pair}; R_{buck.k.pair})$ 1 pair	
	h_{min}	$R_{w.k.pair}$	$R_{buck.k.pair}$
ESCRFTZ8,0X180	74	11,86	5,92 + 13,99 /k_{mod}
ESCRFTZ8,0X200	81	13,34	6,66 + 13,99 /k_{mod}
ESCRFTZ8,0X220	88	14,82	7,41 + 13,99 /k_{mod}
ESCRFTZ8,0X240	95	16,3	8,15 + 13,99 /k_{mod}
ESCRFTZ8,0X260	102	17,79	8,89 + 13,99 /k_{mod}
ESCRFTZ8,0X280	109	19,27	9,63 + 13,99 /k_{mod}
ESCRFTZ8,0X300	117	20,75	10,37 + 13,99 /k_{mod}

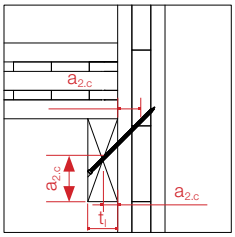
Minimum distance for screws under tensile forces

Model No.	a_1	$a_{1.red}$	$a_{2.red}$	$a_{3.c}$	$a_{4.c}$
ESCRFTZ8…	40	32	20	48	40
ESCRFT10…	50	40	25	60	50

[1] According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" and ETA 13/0796.

Structural timber screws for CLT

Fixing a wall plate to a panel with screws at 45°

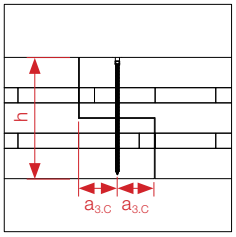


Model No.	Minimum wall plate thickness t_1	Characteristic capacity $R_{v.45.k}$
ESCRFTZ8,0X180	64	5,93
ESCRFTZ8,0X200	71	6,67
ESCRFTZ8,0X220	78	7,41
ESCRFTZ8,0X240	85	8,15

Minimum distance for angled screwing

Model No.	a_1	t_L	$a_{2.c}$
ESCRFTZ8…	50	64	32

Panel assembly with a halved joint and screws at 90°



Model No.	Minimum panel thickness	Characteristic shear strength
	h_{min}	$R_{v.k}$
ESCRFTZ8,0X120	130	4,09
ESCRFTZ8,0X140	150	4,35
ESCRFTZ8,0X160	170	4,61
ESCRFTZ8,0X180	190	4,87
ESCRFTZ8,0X200	210	5,14
ESCRFTZ8,0X220	230	5,4
ESCRFTZ8,0X240	250	5,56

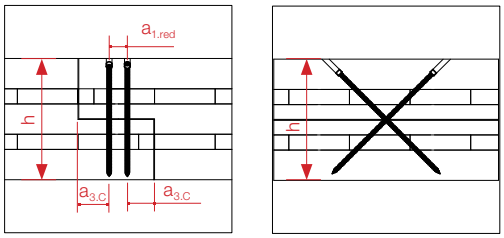
Minimum distance for screws under shear forces[1]

Model No.	a_1	$a_{3.c}$
ESCRFTZ8…	32	48

[1] According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" and ETA 13/0796.

Structural timber screws for CLT

Panel assembly with a halved joint and skew screwing



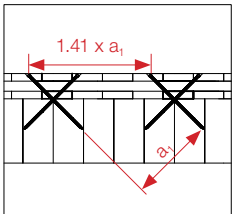
	Minimum CLT thickness	Characteristic strength (pull-out/buckling)	
		$R_{v.k.pair} = min (R_{w.k.pair}; R_{buck.k.pair})$	
		1 pair	
Model No.	h_{min}	$R_{w.k.pair}$	$R_{buck.k.pair}$
ESCRFTZ8,0X180	132	11,86	5,92 + 13,99 /k_{mod}
ESCRFTZ8,0X200	146	13,34	6,66 + 13,99 /k_{mod}
ESCRFTZ8,0X220	161	14,82	7,41 + 13,99 /k_{mod}
ESCRFTZ8,0X240	175	16,3	8,15 + 13,99 /k_{mod}
ESCRFTZ8,0X260	189	17,79	8,89 + 13,99 /k_{mod}
ESCRFTZ8,0X280	203	19,27	9,63 + 13,99 /k_{mod}
ESCRFTZ8,0X300	217	20,75	10,37 + 13,99 /k_{mod}

Minimum distance for screws under shear forces[1]

Model No.	a_1	$a_{1.red}$	$a_{3.c}$
ESCRFTZ8…	40	32	48

[1] According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" and ETA 13/0796.

Panel assembly with skew screwing



Model No.	h_{min}	$R_{v.k}$ per screw
ESCRFTZ8,0X180	132	4,87
ESCRFTZ8,0X200	146	5,14
ESCRFTZ8,0X220	161	5,4
ESCRFTZ8,0X240	175	5,56
ESCRFTZ8,0X260	189	5,56
ESCRFTZ8,0X280	203	5,56
ESCRFTZ8,0X300	217	5,56
ESCRFTZ8,0X350	252	5,56
ESCRFTZ8,0X400	288	5,56

Minimum distance for screws under shear forces [1]

Model No.	a_1	$a_{1\ red}$	a_3 c
ESCRFTZ8…	40		

[1] According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz" and ETA 13/0796.

Structural timber screws for CLT

TTUFS Countersunk **WOOD** Screw

Suitable for interior use, the TTUFS screw has a serrated thread to reduce the resistance when driving. It has a type 17 point which prevents wood splitting. 80mm or longer variants have an additional milling thread to further reduce the resistance.

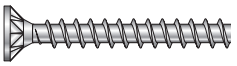
Features:

- 6 lobe drive
- Prismatic countersunk head design ensures a flush finish
- Type 17 point
- Serrated thread

Application:

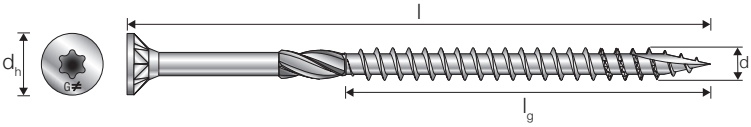
- Wood to wood

FT =
Full Thread



PT =
Partial Thread

PTM =
Partial Thread with Milling thread



TTUFS Electro Galvanised

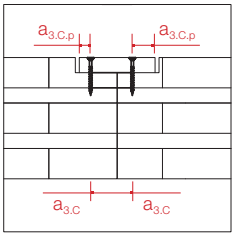
Model No.	Item code	Dimensions [mm]				Thread	Bit	
		d	l	d_h	l_g			
TTUFS4.5x25	74434	4,5	25	8,4	20	FT	T-20	200
TTUFS4.5x30	74435	4,5	30	8,4	25	FT	T-20	200
TTUFS4.5x35	74436	4,5	35	8,4	30	FT	T-20	200
TTUFS4.5x40	74437	4,5	40	8,4	35	FT	T-20	200
TTUFS4.5x45	74438	4,5	45	8,4	29	PT	T-20	200
TTUFS4.5x50	74439	4,5	50	8,4	30	PT	T-20	200
TTUFS4.5x60	74440	4,5	60	8,4	35	PT	T-20	200
TTUFS4.5x70	74441	4,5	70	8,4	40	PT	T-20	100
TTUFS4.5x80	74442	4,5	80	8,4	50	PTM	T-20	100
TTUFS5.0x30	74373	5,0	30	9,5	25	FT	T-25	200
TTUFS5.0x40	74374	5,0	40	9,5	35	FT	T-25	200
TTUFS5.0x50	74375	5,0	50	9,5	30	PT	T-25	200
TTUFS5.0x60	74376	5,0	60	9,5	35	PT	T-25	200
TTUFS5.0x70	74377	5,0	70	9,5	40	PT	T-25	100
TTUFS5.0x80	74378	5,0	80	9,5	40	PTM	T-25	100
TTUFS5.0x90	74379	5,0	90	9,5	45	PTM	T-25	100
TTUFS5.0x100	74443	5,0	100	9,5	60	PTM	T-25	100
TTUFS5.0x120	74372	5,0	120	9,5	60	PTM	T-25	100
TTUFS6.0x40	74455	6,0	40	11,6	34	FT	T-30	200
TTUFS6.0x50	74457	6,0	50	11,6	30	PT	T-30	200
TTUFS6.0x60	74458	6,0	60	11,6	35	PT	T-30	200
TTUFS6.0x70	74459	6,0	70	11,6	40	PT	T-30	100
TTUFS6.0x80	74460	6,0	80	11,6	40	PTM	T-30	100
TTUFS6.0x90	74461	6,0	90	11,6	45	PTM	T-30	100
TTUFS6.0x100	74380	6,0	100	11,6	60	PTM	T-30	100
TTUFS6.0x120	74451	6,0	120	11,6	70	PTM	T-30	100
TTUFS6.0x140	74452	6,0	140	11,6	70	PTM	T-30	100
TTUFS6.0x160	74453	6,0	160	11,6	70	PTM	T-30	100
TTUFS6.0x180	74454	6,0	180	11,6	70	PTM	T-30	100

Structural timber screws for CLT

Design parameters

Model No.	Characteristic yield moment $M_{y,k}$ [Nmm]	Characteristic withdrawal parameter $f_{ax,k,90°}$ [N/mm²]	Characteristic head pull-through parameter $f_{head,k}$ [N/mm²]	Characteristic tensile capacity $f_{tens,k}$ [$f_{tens,k}$] [kN]
TTUFS4,5…	5,452	19.2	16.8	7.6
TTUFS5…	7,602	13.2	18.2	9.3
TTUFS6…	12,281	17.2	20.3	12.4

Panel assembly with a tongue



Model No.	Panel (OSB, wood fibre $\rho_k \geq 380$ kg/m³) / C24 graded timber according to the tongue thickness t_p:			Plywood ($\rho_k \geq 490$ kg/m³) / C24 graded timber according to the tongue thickness t_p:			
	18	22	25	18	22	25	30
	$R_{v.90.k.18}$	$R_{v.90.k.22}$	$R_{v.90.k.25}$	$R_{v.90.k.18}$	$R_{v.90.k.22}$	$R_{v.90.k.25}$	$R_{v.90.k.30}$
TTUFS4,5X45	0,94	0,97	0,92	0,93	0,94	0,91	-
TTUFS4,5X50	1,3	1,05	1,03	0,97	1,03	1,02	0,91
TTUFS4,5X60	1,3	1,43	1,53	1,36	1,47	1,18	1,14
TTUFS4,5X70	1,3	1,43	1,53	1,36	1,47	1,56	1,59
TTUFS4,5X80	1,3	1,43	1,53	1,36	1,47	1,56	1,59
TTUFS5,0X50	1,57	1,15	1,18	1,14	1,15	1,17	1,09
TTUFS5,0X60	1,57	1,69	1,8	1,68	1,8	1,36	1,34
TTUFS5,0X70	1,57	1,69	1,8	1,68	1,8	1,89	1,5
TTUFS5,0X80	1,57	1,69	1,8	1,68	1,8	1,89	2,03
TTUFS5,0X90	1,57	1,69	1,8	1,68	1,8	1,89	2,03
TTUFS6,0X50	1,32	1,29	1,31	1,36	1,33	1,35	-
TTUFS6,0X60	2,13	2,24	1,57	2,35	1,57	1,6	1,62
TTUFS6,0X70	2,13	2,24	2,34	2,35	2,47	2,56	1,85
TTUFS6,0X80	2,13	2,24	2,34	2,35	2,47	2,56	2,75
TTUFS6,0X90	2,13	2,24	2,34	2,35	2,47	2,56	2,75

Minimum shear distances (1)

Model No.	Angle between the force and the fibre = 0°			
	a_1	a_2	$a_{3.c}$	$a_{3.c.p}$
TTUFS4,5…	18	18	28	14
TTUFS5…	20	20	30	15
TTUFS6…	24	24	36	18

(1) According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz".

Structural timber screws for CLT

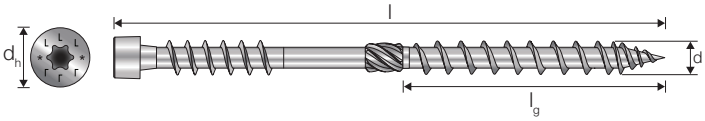
ESCRT2R Structural Roof Insulation **WOOD** Screw

The ETA approved ESCRT2R screw is the ideal fixing option for roof insulation. The screw can absorb shear and compressive forces and by doing so, the insulation material is pressed significantly less to the background, thereby improving the insulation performance.

Features:
- 6 lobe drive
- Milling thread
- Coarse thread

Application:
- Fixing of top roof insulation to wood

ETA-13/0796



ESCRT2R Electro Galvanised

Model No.	Dimensions [mm]				Bit	
	d	l	d_h	l_g		
ESCRT2R8.0X240	8,0	240	10,2	84	T-40	50
ESCRT2R8.0X260	8,0	260	10,2	100	T-40	50
ESCRT2R8.0X280	8,0	280	10,2	100	T-40	50
ESCRT2R8.0X300	8,0	300	10,2	100	T-40	50
ESCRT2R8.0X320	8,0	320	10,2	100	T-40	50
ESCRT2R8.0X340	8,0	340	10,2	100	T-40	50
ESCRT2R8.0X360	8,0	360	10,2	100	T-40	50
ESCRT2R8.0X400	8,0	400	10,2	100	T-40	50
ESCRT2R8.0X450	8,0	450	10,2	100	T-40	50

Design parameters

Model No.	Characteristic yield moment $M_{y,k}$ [Nmm]	Characteristic withdrawal parameter $f_{ax,k,90°}$ [N/mm²]	Characteristic head pull-through parameter $f_{head,k}$ [N/mm²]	Characteristic tensile capacity $f_{tens,k}$ [$f_{tens,k}$] [kN]
ESCRT2R8…	22.600	10,7	12,4	22,7

Insulation thickness

Model No.	Maximum insulation thickness [mm]
ESCRT2R8,0X240	125
ESCRT2R8,0X260	143
ESCRT2R8,0X280	160
ESCRT2R8,0X300	177
ESCRT2R8,0X320	195
ESCRT2R8,0X340	212
ESCRT2R8,0X360	229
ESCRT2R8,0X400	264
ESCRT2R8,0X450	307

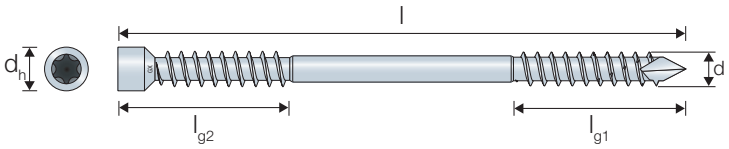
Maximum insulation thickness when a 30-mm counter-batten is used at a 60° angle between the screw axis and counter-batten
To determine the maximum spacings and the quantity of screws, contact our technical services department

SWD Structural Double Threaded **WOOD** Screw

SWD is a construction screw designed to connect two wood members together. The small cap-style head and double thread creates a flexible, hidden assembly with high strength. The differentiated thread pitch creates a clamp effect, reducing the risk of gaps between the wood pieces.

Features:
- Cap-style head
- Double threaded
- Chisel point

Application:
- Wood to wood



SWD Protec®+ Coating

Model No.	Item code	Dimensions [mm]					Bit	
		d	l	d_h	l_{g1}	l_{g2}		
SWD6.5X65	75425	6,5	65	8	28	21,5	T-30	50
SWD6.5X90	75426	6,5	90	8	40	33,5	T-30	50
SWD6.5X130	75427	6,5	130	8	40	33,5	T-30	50
SWD6.5X160	75428	6,5	160	8	65	58,5	T-30	50
SWD6.5X190	75429	6,5	190	8	80	73,5	T-30	50
SWD6.5X220	75430	6,5	220	10	95	88,5	T-30	50
SWD8.0X90	75431	8,0	90	10	40	31,5	T-40	50
SWD8.0X130	75432	8,0	130	10	40	31,5	T-40	50
SWD8.0X160	75433	8,0	160	10	65	56,5	T-40	50
SWD8.0X190	75434	8,0	190	10	80	71,5	T-40	50
SWD8.0X220	75435	8,0	220	10	95	86,5	T-40	50
SWD8.0X245	75436	8,0	245	10	107,5	99	T-40	50
SWD8.0X275	75437	8,0	275	10	107,5	99	T-40	50
SWD8.0X300	75438	8,0	300	10	135	126,5	T-40	50
SWD8.0X330	75439	8,0	330	10	135	126,5	T-40	50

Characteristic properties

Model No.	Yield moment $M_{y,k}$ [Nmm]	Withdrawal parameter $f_{ax,k,90°}$ [N/mm²]	Head pull-through parameter $f_{head,k}$ [N/mm²]	Tensile capacity $f_{tens,k}$ [$f_{tens,k}$] [kN]
SWD6.5...	14,5	13	29,4	14,3
SWD8.0...	31,2	14,2	38,8	21,9

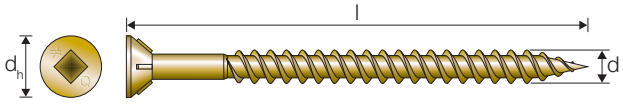
Structural timber screws for CLT

WSNTL **WOOD FLOORING** Screw, Twin Lead Thread

WSNTL is a ribbed head screw with a sharp point and twin lead thread, suitable for wood to wood applications such as flooring.

- Wood to wood applications
- Sharp point with twin lead thread
- Bit (BIT3SE) included

Compatible with Quik Drive® systems



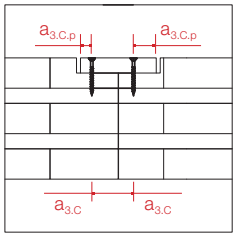
WSNTL Electro Galvanised

Model No.	d	l	d_h	d_1	l_G	Qty per strip	QDPRO64E	QDPRO76SE	QDPRO76SKE
WSNTL44E	4,6	44	8,4	3,1	30,5	30	✓	✓	✓
WSNTL51E	4,6	51	8,4	3,1	38	30	✓	✓	✓
WSNTL64E	4,6	64	8,4	3,1	51	30	✓	✓	✓
WSNTL76E	4,6	76	8,4	3,1	55	30		✓	✓

Design parameters

Model No.	Characteristic yield moment $M_{y,k}$ [Nmm]	Characteristic withdrawal parameter $f_{ax,k,90°}$ [N/mm²]	Characteristic head pull-through parameter $f_{head,k}$ [N/mm²]	Characteristic tensile capacity $f_{tens,k}$ [$f_{tens,k}$] [kN]
WSNTL44E	5.000	9,4	15,7	6,7
WSNTL51E	5.000	9,4	15,7	6,7
WSNTL64E	5.000	9,4	15,7	6,7
WSNTL76E	5.000	9,4	15,7	6,7

Panel assembly with a tongue



Model No.	Panel (OSB, wood fibre $\rho_k \geq 380$ kg/m³) / C24 graded timber according to the tongue thickness t_p:			Plywood ($\rho_k \geq 490$ kg/m³) / C24 graded timber according to the tongue thickness t_p:			
	18	22	25	18	22	25	30
	$R_{v.90.k.18}$	$R_{v.90.k.22}$	$R_{v.90.k.25}$	$R_{v.90.k.18}$	$R_{v.90.k.22}$	$R_{v.90.k.25}$	$R_{v.90.k.30}$
WSNTL44E	0,93	0,94	0,86	0,94	0,94	0,86	-
WSNTL51E	0,93	1,02	1,02	0,94	1,02	1,02	0,88
WSNTL64E	1,23	1,32	1,02	1,31	1,02	1,02	1,02
WSNTL76E	1,23	1,32	1,32	1,31	1,38	1,38	1,02

Minimum shear distances (1)

Model No.	Angle between the force and the fibre = 0°			
	a_1	a_2	$a_{3.c}$	$a_{3.c.p}$
WSNTL4,6…	18	18	28	14

(1) According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz".

SSH Hexagon Head **CONNECTOR** Screw

SSH is used together with connectors where high load capability is required. The conical shape under the head makes a perfect fitting to the connector hole, creating a firm assembly. Suitable for exterior use. The cut point type 17 prevents cracking, and the milling thread and serrated thread reduce the insertion torque. SSH has both 6 lobe drive and a hexagonal head, enabling mounting both with bits or with sleeves.

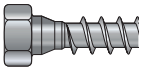
Features:

- Hex head with integrated 6 lobe drive
- Conical shape under the head for maximum fit in connector holes
- No predrilling required
- Milling thread
- Serrated coarse thread
- Type 17 point

Application:

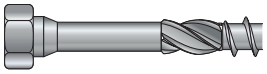
- Connectors to CLT

FT = Full Thread

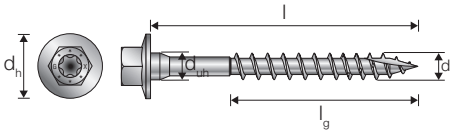


PT = Partial Thread

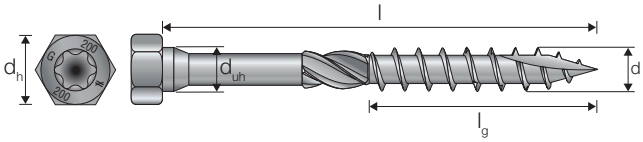
PTM = Partial Thread with Milling thread



6.0mm screws:



8-12.0mm screws:



SSH Impreg®+ Coating

Model No.	Item code	Dimensions [mm]				Thread	Bit	
		d / d_{uh}	l	d_h	l_g			
SSH6.0X40	75128	6,0	40	10	23	PT	T-30 / SW-10	100
SSH6.0X50	75129	6,0	50	10	33	PT	T-30 / SW-10	100
SSH6.0X60	75130	6,0	60	10	42	PT	T-30 / SW-10	100
SSH6.0X75	75131	6,0	75	10	42	PTM	T-30 / SW-10	100
SSH6.0X90	75132	6,0	90	10	42	PTM	T-30 / SW-10	100
SSH6.0X120	75133	6,0	120	10	75	PTM	T-30 / SW-10	100
SSH8.0X40	75134	8,0	40	13	Full thread	FT	T-40 / SW-13	50
SSH8.0X50	75135	8,0	50	13	Full thread	FT	T-40 / SW-13	50
SSH8.0X60	75136	8,0	60	13	42	PT	T-40 / SW-13	50
SSH8.0X80	75137	8,0	80	13	42	PTM	T-40 / SW-13	50
SSH8.0X90	75138	8,0	90	13	42	PTM	T-40 / SW-13	50
SSH8.0X100	75139	8,0	100	13	55	PTM	T-40 / SW-13	50
SSH8.0X120	75140	8,0	120	13	85	PTM	T-40 / SW-13	50
SSH8.0X140	75141	8,0	140	13	85	PTM	T-40 / SW-13	50
SSH8.0X160	75142	8,0	160	13	110	PTM	T-40 / SW-13	50
SSH8.0X180	75143	8,0	180	13	110	PTM	T-40 / SW-13	50
SSH8.0X200	75144	8,0	200	13	110	PTM	T-40 / SW-13	50
SSH8.0X240	75145	8,0	240	13	110	PTM	T-40 / SW-13	50
SSH8.0X260	75146	8,0	260	13	110	PTM	T-40 / SW-13	50
SSH8.0X280	75147	8,0	280	13	110	PTM	T-40 / SW-13	50
SSH8.0X300	75148	8,0	300	13	110	PTM	T-40 / SW-13	50
SSH10.0X40	75149	10,0	40	15	Full thread	FT	T-40 / SW-15	50
SSH10.0X50	75150	10,0	50	15	Full thread	FT	T-40 / SW-15	50
SSH10.0X60	75151	10,0	60	15	42	PT	T-40 / SW-15	50
SSH10.0X80	75152	10,0	80	15	42	PTM	T-40 / SW-15	50
SSH10.0X90	75153	10,0	90	15	42	PTM	T-40 / SW-15	50
SSH10.0X100	75154	10,0	100	15	55	PTM	T-40 / SW-15	50
SSH10.0X120	75155	10,0	120	15	85	PTM	T-40 / SW-15	50

Continues on next page.

Connector screws for CLT

SSH Impreg®+ Coating

Model No.	Item code	Dimensions [mm]				Thread	Bit	
		d / d_{uh}	l	d_h	l_g			
SSH10.0X140	75156	10,0	140	15	85	PTM	T-40 / SW-15	50
SSH10.0X160	75157	10,0	160	15	110	PTM	T-40 / SW-15	50
SSH10.0X180	75158	10,0	180	15	110	PTM	T-40 / SW-15	50
SSH10.0X200	75159	10,0	200	15	110	PTM	T-40 / SW-15	50
SSH10.0X240	75160	10,0	240	15	125	PTM	T-40 / SW-15	50
SSH10.0X280	75161	10,0	280	15	125	PTM	T-40 / SW-15	50
SSH12.0X60	75162	12,0	60	17	Full thread	FT	T-40 / SW-17	25
SSH12.0X80	75163	12,0	80	17	42	PTM	T-40 / SW-17	25
SSH12.0X90	75164	12,0	90	17	42	PTM	T-40 / SW-17	25
SSH12.0X100	75165	12,0	100	17	55	PTM	T-40 / SW-17	25
SSH12.0X120	75166	12,0	120	17	85	PTM	T-40 / SW-17	25
SSH12.0X140	75167	12,0	140	17	85	PTM	T-40 / SW-17	25
SSH12.0X160	75168	12,0	160	17	110	PTM	T-40 / SW-17	25
SSH12.0X180	75169	12,0	180	17	110	PTM	T-40 / SW-17	25
SSH12.0X200	75170	12,0	200	17	110	PTM	T-40 / SW-17	25

Characteristic properties

Model No.	Product characteristic properties				
	Characteristic Yield Moment – $M_{y,k}$ [Nm]	Characteristic withdrawal parameter - $f_{ax,k,90°}$ [N/mm²]	Characteristic head pull-through parameter - $f_{head,k}$ [N/mm²]	Characteristic tensile capacity - $f_{tens,k}$ [kN]	Torsional ratio
SSH6.0....	12,5	16,9	31,8	12,8	2,5
SSH8.0....	29,5	15,6	22,0	23,2	3,1
SSH10.0....	50,3	13,2	20,1	32,0	3,4
SSH12.0....	67,1	12,1	18,5	39,6	3,0

Minimum distance for screws under shear forces[(1)]

Model No.	Angle between load axis and grain = 0°						Angle between load axis and grain = 90°					
	$a_{1.0°}$	$a_{2.0°}$	$a_{3.t.0°}$	$a_{3.c.0°}$	$a_{4.t.0°}$	$a_{4.c.0°}$	$a_{1.90°}$	$a_{2.90°}$	$a_{3.t.90°}$	$a_{3.c.90°}$	$a_{4.t.90°}$	$a_{4.c.90°}$
SSH6.0....	30	24	80	24	18	18	24	24	80	42	24	18
SSH8.0....	40	32	80	32	24	24	32	32	80	56	56	24
SSH10.0....	50	40	80	40	30	30	40	40	80	70	40	30
SSH12.0....	60	48	84	48	36	36	48	48	84	84	48	36

[(1)] a_1 and a_2 can be multiplied by 0,85 for panel/timber assembly, and by 0,7 for steel/timber assembly.

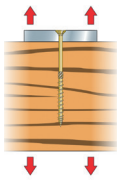
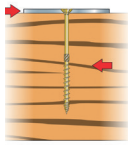
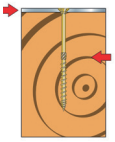
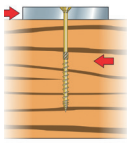
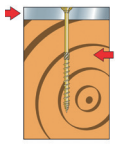
Minimum distance for screws under tensile forces

Model No.	a_1	a_2	$a_{1,CG}$	$a_{2,CG}$	$a_{2,red*}$
SSH6.0....	42	30	60	24	-
SSH8.0....	56	40	80	32	-
SSH10.0....	70	50	100	40	-
SSH12.0....	84	60	120	48	-

* Valid if the applied spacings comply with $a_1 x a_2 \geq 25d^2$
Calculation according to EN1995-1-1:2004+A2:2014

Connector screws for CLT

Characteristic values for steel-to-CLT connections

	Steel / C24 CLT				
					
	Axial (1)	Thin plate shear (2)		Thick plate shear (3)	
Model No.	$R_{ax.st.k}$	$R_{v.0.st.k}$	$R_{v.90.st.k}$	$R_{v.0.st.k}$	$R_{v.90.st.k}$
SSH6.0x40	2,33	1,70	1,70	2,72	2,72
SSH6.0x50	3,35	2,15	2,15	3,34	3,34
SSH6.0x60	4,26	2,60	2,60	3,79	3,79
SSH6.0x75	4,26	2,99	2,99	3,79	3,79
SSH6.0x90	4,26	2,99	2,99	3,79	3,79
SSH6.0x120	7,61	3,83	3,83	4,62	4,62
SSH8.0X40	3,99	2,26	2,26	4,29	4,29
SSH8.0X50	5,24	2,87	2,87	5,00	5,00
SSH8.0x60	5,24	3,48	3,48	5,48	5,48
SSH8.0X80	5,24	4,69	4,69	6,18	6,18
SSH8.0x90	5,24	4,75	4,75	6,18	6,18
SSH8.0x100	6,86	5,16	5,16	6,58	6,58
SSH8.0x120	10,61	6,09	6,09	7,52	7,52
SSH8.0x140	10,61	6,09	6,09	7,52	7,52
SSH8.0x160	13,73	6,87	6,87	8,30	8,30
SSH8.0x180	13,73	6,87	6,87	8,30	8,30
SSH8.0x200	13,73	6,87	6,87	8,30	8,30
SSH8.0x240	13,73	6,87	6,87	8,30	8,30
SSH8.0x260	13,73	6,87	6,87	8,30	8,30
SSH8.0x280	13,73	6,87	6,87	8,30	8,30
SSH8.0x300	13,73	6,87	6,87	8,30	8,30
SSH10.0x40	3,99	2,26	2,26	4,29	4,29
SSH10.0x50	5,54	3,40	2,34	6,19	5,13
SSH10.0x60	5,54	4,13	2,84	6,68	5,41
SSH10.0x80	5,54	6,31	4,85	8,36	6,98
SSH10.0x90	5,54	6,31	4,35	8,36	6,55
SSH10.0x100	7,26	6,74	4,85	8,78	7,41
SSH10.0x120	11,22	7,73	5,86	9,77	8,59
SSH10.0x140	11,22	7,73	6,86	9,77	8,59
SSH10.0x160	14,52	8,56	7,72	10,60	9,41
SSH10.0x180	14,52	8,56	7,72	10,60	9,41
SSH10.0x200	14,52	8,56	7,72	10,60	9,41
SSH10.0x240	16,50	9,05	8,18	11,09	9,91
SSH10.0x280	16,50	9,05	8,18	11,09	9,91
SSH12.0x60	6,97	4,41	3,02	7,72	6,33
SSH12.0x80	6,97	5,98	4,10	8,90	7,03
SSH12.0x90	6,97	6,76	4,63	9,57	7,44
SSH12.0x100	7,99	7,55	5,17	10,34	8,14
SSH12.0x120	12,34	8,98	6,24	11,43	9,99
SSH12.0x140	12,34	8,98	7,31	11,43	9,99
SSH12.0x160	15,97	9,89	8,39	12,33	10,89
SSH12.0x180	15,97	9,89	8,87	12,33	10,89
SSH12.0x200	15,97	9,89	8,87	12,33	10,89

(1) With a plate thickness ≤ d
(2) Thin plate: thickness ≤ 0.5 x d
(3) Thick plate: thickness ≥ d
In case of intermediate thicknesses, the strength can be obtained through interpolation.

Connector screws for CLT

ZYKLOP™ **Angled Washer** with Long Screws

Using the ZYKLOP™ system with a screw angled at 30°, 45 or 60° guarantees high sliding resistance and increases the rigidity of the timber-metal assembly. When combined with a steel plate, ZYKLOP™ effectively transfers the sheet metal stresses to the timber element.

Features:

- Discreet and aesthetic finish for the assembly
- Reduction in the sheet metal thickness between 50 and 80%: no need for extra thicknesses or machining
- Can be fitted to the side or end of the timber member
- Supplied with screws

Application:

- High-load assemblies, lifting, reinforcements, nodes, etc.
- Embedded and joined elements to solid wood, glulam, CLT, LVL and wood-based panels
- Fixing of a timber beam to a steel framework

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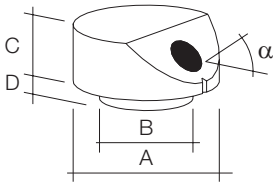
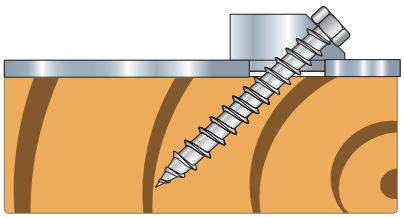
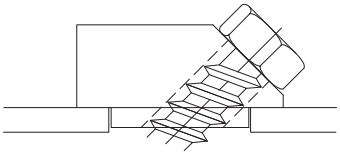


Dimensions

Model No.	ZYKLOP™ connector dimensions						SST screw		Suggested steel thickness limit**	Type of drilling template
	A	B	C	D	Slope α [°]	X*	α x L	Thread length	t_{gr}	
ZYK10	32	20	11,5	1,9	30	16	6x200	192	3	BZYK6
ZYK11	25	16	10	1,9	45	11	6x200	192	6	BZYK6
ZYK12	20	12	7,5	1,9	60	8	6x200	192	10	BZYK6
ZYK40	45	27	14	2,9	30	23	8x300	290	5	BZYK8
ZYK41	30	20	12	2,9	45	14	8x300	290	8	BZYK8
ZYK42	25	16	9,5	2,5	60	10	8x300	290	9	BZYK8
ZYK70	50	30	16,5	3,4	30	26	10x400	388	5	BZYK10
ZYK71	35	24	15	3,4	45	16	10x400	388	8	BZYK10
ZYK72	30	20	11	2,9	60	11	10x400	388	12	BZYK10
ZYKT39	25	16	7,4	14	30	14	6x200	192	3	BZYK6
ZYKT69	30	20	7,5	14	30	17	8x300	290	4	BZYK8
ZYKT99	35	20	7,5	19	30	16	10x400	388	5	BZYK10

* Length of the screw that passes through the ZYKLOP™ washer, to be subtracted from the screw length to determine the effective length of the thread when calculating resistance.
** tgr = limit thickness of the sheet metal up to which the hole can simply be drilled in the plate with a diameter of B+0.1/1 mm. For greater thicknesses, an additional notch must be made in the metal to allow the body of the angled screw to pass through.





Connector screws for CLT

Screw strength parameters

Model No.	Withdrawal parameter [N/mm]		$R_{t,u,k}$ [kN]
	Side of the timber member $r_{ax,k,\alpha}$	End of the timber member $r_{ax,k,\alpha}$	
ZYK10	62,1	81	12,5
ZYK11	81	81	12,5
ZYK12	81	62,1	12,5
ZYK40	66,9	87,2	23,5
ZYK41	87,2	87,2	23,5
ZYK42	87,2	66,9	23,5
ZYK70	88,2	115	33
ZYK71	115	115	33
ZYK72	115	88,2	33
ZYKT39	62,1	81	12,5
ZYKT69	66,9	87,2	23,5
ZYKT99	88,2	115	33

ZYKLOP™ connector strength parameters

Model No.	ZYKLOP™ fitted to the side of the beam				ZYKLOP™ fitted to the end of the beam			
	Maximum strength* and associated sheet metal thickness		Minimum sheet metal thickness t_{st} and associated strength		Maximum strength* and associated sheet metal thickness		Minimum sheet metal thickness t_{st} and associated strength	
	Max. $R_{k,ZYK}$ [kN]	Min. t_{st} [mm]	Min. t_{st} [mm]	$R_{k,ZYK}$ [kN]	Max. $R_{k,ZYK}$ [kN]	Min. t_{st} [mm]	Min. t_{st} [mm]	$R_{k,ZYK}$ [kN]
ZYK10	10,8	2	2	10,8	10,8	2	2	10,8
ZYK11	8,8	4	2	4,6	8,8	2	2	8,8
ZYK12	6,3	4,5	2	2,6	6,3	2	2	6,3
ZYK40	20,4	3	3	20,4	20,4	3	3	20,4
ZYK41	16,6	5,5	3	7,8	16,6	3	3	16,6
ZYK42	11,8	6,5	2,5	3,8	11,8	3,5	2,5	9
ZYK70	28,6	3,5	3,5	28,6	28,6	3,5	3,5	28,6
ZYK71	23,3	7	3,5	10,5	23,3	3,5	3,5	23,3
ZYK72	16,5	7,5	3	5,3	16,5	4	3	12,7
ZYKT39	10,8	2,5	1,5	7,7	10,8	1,5	1,5	10,8
ZYKT69	20,4	4	2	10,8	20,4	2	2	20,4
ZYKT99	28,6	5	2	13,4	28,6	2	2	28,6

* These are the maximum load values that must not be exceeded, even for thicker sheet metal plates.
Intermediate values may be interpolated linearly.

The load capacity of a ZYKLOP™ connector is determined as follows:

$$R_d = \min \begin{cases} R_{k,ZYK} \times n \times k_{mod}/\gamma_m \\ R_{ax,screw,d} \times \cos a \times n_{ef} \end{cases}$$

Where:

$$R_{ax,screw,d} = \min \begin{cases} r_{ax,k,\alpha} \times l_{ef} \times k_{mod}/\gamma_m \\ R_{t,u,k}/\gamma_m \end{cases}$$

It must be demonstrated:

$$\frac{F_{i,d}}{R_{i,d}} \leq 1$$

n: Quantity of ZYKLOP™ connectors on a sheet metal plate anchored to the same part.
For n > 1: $n_{ef} = n^{0.9}$; for n = 1 and $l_{ef} \geq 20$ x d: $n_{ef} = 0.5$
For β > 0, you must also prove: $F_{ax,\,screw,\,d} / R_{ax,\,screw,\,d} \leq 1$

Connector screws for CLT

CSA **CONNECTOR** Screw

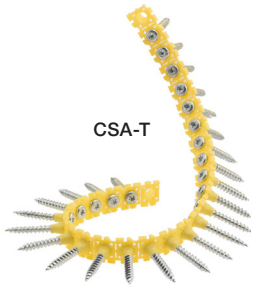
CSA connector screw is developed for mounting of Simpson Strong-Tie connectors to wood, in order to obtain the published load bearing capacities. The conical shape under the head secures fully contact to the connector which increases the transfer of force. A fixed connection with larger cross-bearing capacity than for standard screws is obtained. The 6 lobe recess helps to fix the screw during insertion.

Features:

- 6 lobe drive
- Conical shape under the head for maximum fit in connector holes
- Type 17 point

Application:

- Connectors to wood



Compatible with Quik Drive® systems - see page 106

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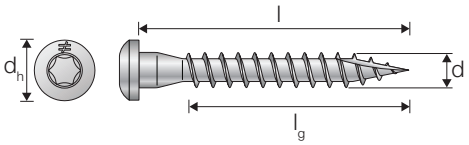


CSA Electro Galvanised

Model No.	d	l	d_h	d_1	l_g	Characteristic values – C24 graded timber according to ETA 04/0013 [kN]				QDPR050E
						$R_{lat.k}$	$R_{ax.k}$			
CSA5,0X25	4,8	25	8,3	3,1	19	1,49	1,38	T-20	250	
CSA5,0X35	4,8	35	8,3	3,1	29	1,99	2,11	T-20	250	
CSA5,0X40	4,8	40	8,3	3,1	34	2,25	2,47	T-20	250	
CSA5,0X50	4,8	50	8,3	3,1	44	2,63	3,2	T-20	250	
CSA5,0X80-DE	4,8	80	8,3	3,1	74	3,5	5,38	T-20	250	
CSA5,0X35T*	5,0	35	8,3	3,1	29	1,99	2,11	T-20	1,500	✓
CSA5,0X40T*	5,0	40	8,3	3,1	34	2,25	2,47	T-20	1,000	✓
CSA5,0X50T*	5,0	50	8,3	3,1	34	2,63	3,2	T-20	1,000	✓

*Collated screws for Quik Drive systems.

Minimum shear distances (1)

Model No.	Angle between the force and the fibre = 0°						Angle between the force and the fibre = 90°					
	$a_{1.0°}$	$a_{2.0°}$	$a_{3.t.0°}$	$a_{3.c.0°}$	$a_{4.t.0°}$	$a_{4.c.0°}$	$a_{1.90°}$	$a_{2.90°}$	$a_{3.t.90°}$	$a_{3.c.90°}$	$a_{4.t.90°}$	$a_{4.c.90°}$
CSA5,0…	20	12,5	30	30	30	12,5	20	12,5	30	30	30	12,5

(1) According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz".

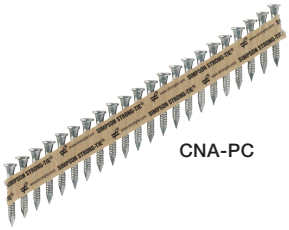
Connector nails for CLT

CNA **CONNECTOR** Nail

Annular ring-shank connector nails are recommended for structural assemblies and installation of Simpson Strong-Tie connectors to wood, in order to obtain the published load bearing capacities.

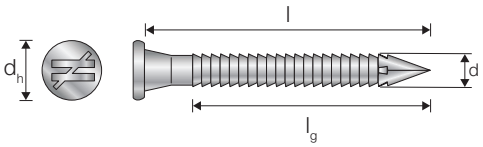
Features:
- Conical shape under the head for maximum fit with connectors
- Annular ring thread

Application:
- Connectors to wood



Compatible with 34° pneumatic nailers

ETA-04/0013



CNA Electro Galvanised

Model No.	d	l	d_h	h_t	Characteristic values [kN]		
					$R_{lat,k}$	$R_{ax,k}$	
CNA4,0X35	4,0	35	8,0	1,5	1,66	0,61	250
CNA4,0X40	4,0	40	8,0	1,5	1,85	0,74	250
CNA4,0X50	4,0	50	8,0	1,5	2,22	0,98	250
CNA4,0X60	4,0	60	8,0	1,5	2,36	1,23	250
CNA4,0X75	4,0	75	8,0	1,5	2,5	1,45	250
CNA4,0X35PC34*	4,0	35	8,0	1,5	1,66	0,61	1,500
CNA4,0X40PC34*	4,0	40	8,0	1,5	1,85	0,74	1,500
CNA4,0x50PC34*	4,0	50	8,0	1,5	2,22	0,98	1,000
CNA4,0x60PC34*	4,0	60	8,0	1,5	2,36	1,23	1,000

*Collated nails 34°

Minimum shear distances (1)

Model No.	Angle between the force and the fibre = 0°						Angle between the force and the fibre = 90°					
	$a_{1.0°}$	$a_{2.0°}$	$a_{3.t.0°}$	$a_{3.c.0°}$	$a_{4.t.0°}$	$a_{4.c.0°}$	$a_{1.90°}$	$a_{2.90°}$	$a_{3.t.90°}$	$a_{3.c.90°}$	$a_{4.t.90°}$	$a_{4.c.90°}$
CNA4,0xL	24	12	40	24	12	12	12	12	28	24	28	12

(1) According to the technical report by Univ.-Prof. Dr.-Ing. Hans Joachim Blass and Dipl.-Ing Thomas Uibel. "Bemessungsvorschläge für Verbindungsmittel in Brettsperrholz".

EGOIN: EGO-CLT

SIMPSON Strong-Tie®

Mechanical and Chemical Anchor Systems

Throughbolt with wide washer **WA-RL**

Throughbolts are expansion fastening systems for medium loads. The wide washer increases the peel force of the head on a timber element.

Advantages:

- Low spacings and edge distance
- Quick and easy installation: pre-mounted nut and washer; reduced anchor depth; thread Ø = drilling Ø
- Protected thread during installation: reinforced striking point

ETA-11/0080

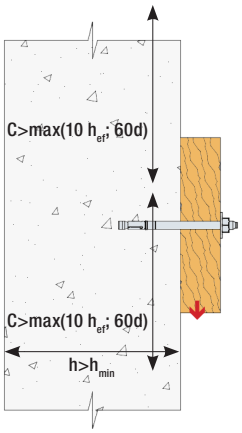
Dimensions

Model No.	Thread diameter [mm]	Length [L] [mm]	Max. fixture thickness [tfix] [mm]	Thread length [F] [mm]	Ø max. fixture hole [df] [mm]	Effective embedment depth [hef] [mm]	Ø drilled hole [d0] [mm]	Min. depth of drilling hole [h1] [mm]	Box contents [parts]
WA10123RL	10	123	50	60	12	50	10	70	50
WA10173RL	10	173	100	80	12	50	10	70	50
WA12149RL	12	149	50	100	14	65	12	90	25
WA12199RL	12	199	100	110	14	65	12	90	25

Shear design values – timber-to-timber connections

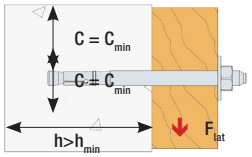
The following two tables provide the design values for WA-RL throughbolts according to the CLT thickness.
Case 1: no edge effect (c > 600 mm) or no interaction between the anchors (s > sc). Concrete thickness h > hmin.

Model No.	Panel thickness	V_{Rd} [kN]				
		k_{mod} = 0.6	k_{mod} = 0.7	k_{mod} = 0.8	k_{mod} = 0.9	k_{mod} = 1.1
WA10123RL	45 mm	3,6	4,2	4,8	5,4	6,6
WA10173RL	≥ 60 mm	4,1	4,8	5,8	6,1	7,5
WA12149RL	45 mm	4,1	4,8	5,5	6,2	7,5
WA12199RL	≥ 60 mm	5,5	6,4	7,3	8,2	10,1



Case 2: edge distance (c = cmin), no interaction between the anchors (s > scr). Concrete thickness h > hmin.

Model No.	Panel thickness	V_{Rd} [kN]				
		k_{mod} = 0.6	k_{mod} = 0.7	k_{mod} = 0.8	k_{mod} = 0.9	k_{mod} = 1.1
WA10123RL	45 mm	3,6	4,2	4,7	4,7	4,7
WA10173RL	≥ 60 mm	4,1	4,7	4,7	4,7	4,7
WA12149RL	45 mm	4,1	4,8	5,5	6,2	7,5
WA12199RL	≥ 60 mm	5,5	6,4	7,3	8	8



Throughbolt with wide washer **WA-RL**

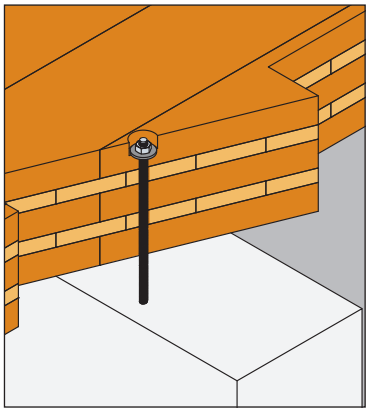
Design value - plate fixing to a concrete substrate

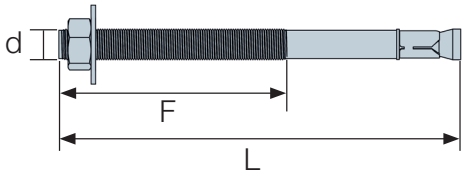
Model No.	Non-cracked concrete (3)								
	Tensile - N_{Rd} (1) [kN]				Shear - V_{Rd} (1-2) [kN]				Bending moment M_{Rd} [Nm]
	C20/25	C30/37	C40/50	C50/60	C20/25	C30/37	C40/50	C50/60	
WA10123RL	10,7	13	15	16,5	11,9	13,6	13,6	13,6	38
WA10173RL	10,7	13	15	16,5	11,9	13,6	13,6	13,6	38
WA12149RL	17,6	21,5	24,9	27,3	20	20	20	20	66
WA12199RL	17,6	21,5	24,9	27,3	20	20	20	20	66

1. The published loads are calculated according to the partial safety factors in the ETAs. These loads are calculated for non-reinforced concrete and standard reinforced concrete, with rebars spaced at s ≥ 15 cm (all diameters) or s ≥ 10 cm if their diameter is less than or equal to 10 mm.
2. Shear loads are specified for a single anchor without taking account of the distance from the edge of the slab. For anchors near the edges (c ≤ max [10 hef; 60d]), concrete edge failure must be verified in accordance with ETAG 001, Annex C, Design Method A.
3. Concrete is considered to be non-cracked when the tensile stress within the concrete is equal to σL + σR ≤ 0. In the absence of a detailed verification, σR = 3 N/mm² can be assumed (σL corresponds to the tensile stress within the concrete as a result of external loads, including forces on the anchors).

Installation

Torquing draws the cone end of the stud into the expansion clip. The clip's segments break and open against the sidewalls of the hole, thereby developing a frictional grip against the substrate.
The result is an expansion anchor by torque-controlled screwing without any special tools required.





Simpson Strong-Tie disclaims all liability for any incidents caused by an installation other than in accordance with the instructions provided.
Designers are expected to use their experience and judgement when defining the design and installation requirements.

Installation data

Model No.	Minimum spacing distance [s_{min}] [mm]	Min edge distance [c_{min}] [mm]	Characteristic spacing distance [$s_{cr,N}$] [mm]	Characteristic edge distance [$c_{cr,N}$] [mm]	Minimum substrate thickness [h_{min}] [mm]
WA10123RL	50	50	150	75	100
WA10173RL	50	50	150	75	100
WA12149RL	70	70	195	98	130
WA12199RL	70	70	195	98	130

Note: a version is available with a conventional washer for fixing steel elements. Refer to WA.

High-performance multi-material resin **AT-HP**

AT-HP is a styrene-free high-performance multi-material methacrylate resin designed for the high-performance fixing of threaded rods or rebar into concrete.

Advantages:

- High adherence value for concrete and masonry
- Good behaviour in damp and/or wet drill holes
- Fire-resistant

ETA-19/0265

Model No.	Colour	Contents [ml]	Weight [kg]	Quantity per box [parts]
ATHP300G	Grey	320	0.58	12
ATHP420G	Grey	420	0.83	12

Assembly data

Model No.	Drill Ø [d_0] [mm]	Max. Ø fixture hole [d_f] [mm]	Drill depth [h_0=h_{ef}=8d] [mm]	Anchor depth [h_0=h_{ef}=12d] [mm]	Width across flats [SW]	Installation torque [T_{inst}] [Nm]
AT-HP + M8	10	9	64	96	13	10
AT-HP + M10	12	12	80	120	17	20
AT-HP + M12	14	14	96	144	19	30
AT-HP + M16	18	18	128	192	24	60
AT-HP + M20	22	22	160	240	30	90
AT-HP + M24	28	26	192	288	36	140

Design values - Non-cracked concrete - plate fixing to a concrete substrate

Model No.	Design values - Non-cracked concrete		
	Tensile - N_{Rd} [kN]	Shear - V_{Rd} [kN]	Bending moment - M_{Rd} [Nm]
	Non-cracked concrete C20/25	Non-cracked concrete C20/25	
AT-HP + M8	12	7,2	15,2
AT-HP + M10	19,3	12	29,6
AT-HP + M12	28	16,8	52,8
AT-HP + M16	51,4	31,2	133,6
AT-HP + M20	75,4	48,8	260,8
AT-HP + M24	101,3	70,4	448,8

High-performance multi-material resin **AT-HP**

Installation data

Model No.	Minimum spacing distance [s_{min}] [mm]	Minimum edge distance [c_{min}] [mm]	Characteristic spacing distance [$s_{cr,N}$] [mm]	Characteristic edge distance [$c_{cr,N}$] [mm]	Minimum substrate thickness h_{ef}=8d [h_{min}] [mm]
AT-HP + M8	40	40	192	96	100
AT-HP + M10	50	50	240	120	110
AT-HP + M12	60	60	288	144	126
AT-HP + M16	80	80	384	192	158
AT-HP + M20	100	100	480	240	190
AT-HP + M24	120	120	576	288	222

Related Products

Quik Drive® connector screw system **QDBPC50E**

Teflon® tool for fixing our hangers and angle brackets to timber frames. Compatible with Quik Drive collated screws, such as CSA-T.

Advantages:

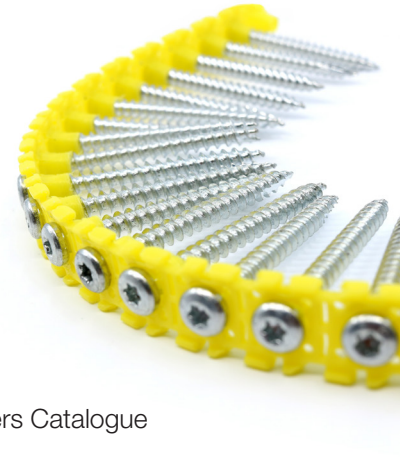
- Possible 360° rotation on the adapter or extension
- Easily clips to the screwdriver and extension
- Specific loading system with our flexible strip

Areas of application:

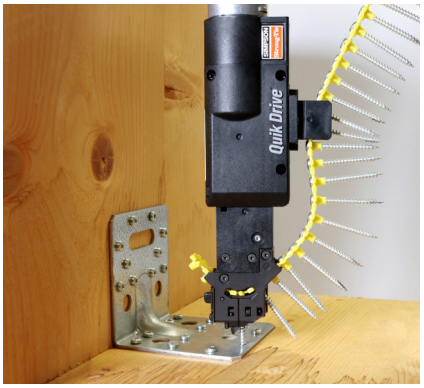
- Connections for assembling timber frames

Kit contents:		QDBPC50E	Compatible screws
Attachment	QDBPC50E	✓	CSA-T CSA-ST
Mandrel	MANDREL 128E	✓	
Spare bits	BITLTX20E (x1)	✓	

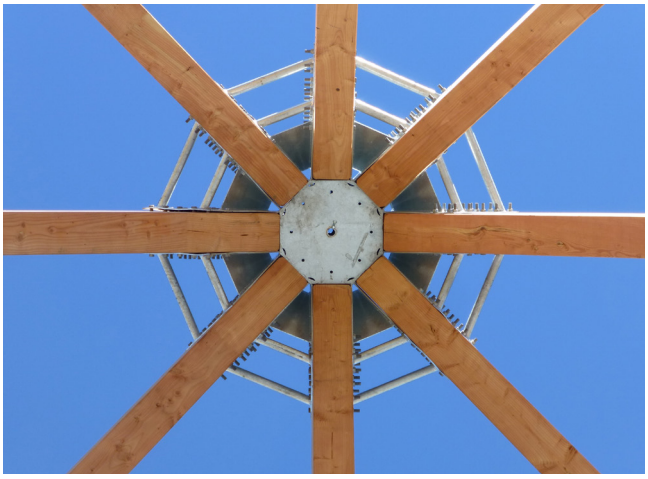
QDBPC50E



For more information on Quik Drive, please see our Quik Drive or Premium Fastners Catalogue on our website in our resources section at **www.strongtie.eu**



Bespoke designs



An unrivalled service

At Simpson Strong–Tie our team of specialists can help you design the connectors you might need.
After receiving your blueprints or sketches (endorsed by an engineering consultancy if necessary), we produce all your custom-designed metal connectors.

Since 1 January 2019, Simpson Strong-Tie's process for manufacturing special parts has been certified to EN 1090-2. This European standard specifies the technical requirements for the execution of steel and stainless steel structures.

CE
EN 1090-2
EXC1 / EXC2 / EXC3

A specialist service…

Our "Special" service involves support and guidance from an engineer and two technicians for your projects. Irrespective of your needs, we can fulfil all your requirements as part of our special production service, while drawing strength from the superior quality of our production facilities.
For all your bespoke connector and metalwork needs, place your trust in the expertise and quality of Simpson Strong-Tie.

Made to specifications

With Simpson Strong-Tie's made-to-order service, you can expect a wealth of recognised advantages:

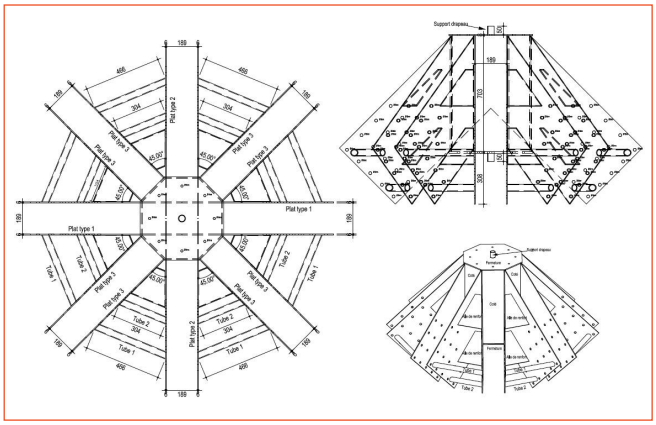
- **Cost analysis based on your drawings and sketches**
- **Customised parts**
  Each part can be identified via an engraved reference number.
- **Expertise in using production machinery:**
  Bespoke parts are designed and created by a specific production service.
  - Plasma and laser cutting (flat/tube)
  - Deep drawing press
  - Stamping
  - Folding
  - Manual TIG/MIG welding or automated welding for mass production runs
- **Expert knowledge of our certified and qualified welders**
- **Use of standard and special steel grades and stainless steel**
  Thicknesses can exceed 20mm.
- **A choice of finishes for your parts**
  Galvanisation, zinc alloy electroplating, bichromate, epoxy, rust inhibition, intumescent paint, passivation (stainless steel), and much more.
- **Provision of technical notes and material traceability records**
  On request, we can provide technical notes for the parts to be manufactured and material traceability records, and factory inspection certificates.

Your custom parts:
You design, we produce!

From the drawing board...
to delivery at the project site

From start to finish, you have access to a single point of contact for the special and standard parts to be delivered to your worksite.
Take advantage of an end-to-end support service for manufacturing your parts!

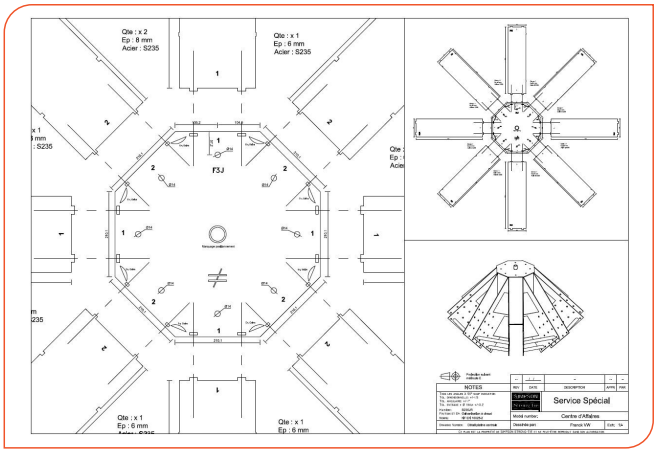
1 Receipt of the quotation request and drawings
Send your request to our techincal department:
(Contact your local technical team).



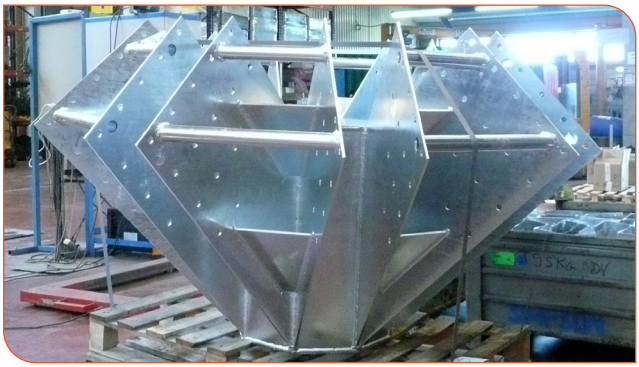
2 Economic project assessment and issuing of a proposal
At this stage, the special products department analyses the project's economic aspects and can also provide a technical study on request.

3 Validation of the order

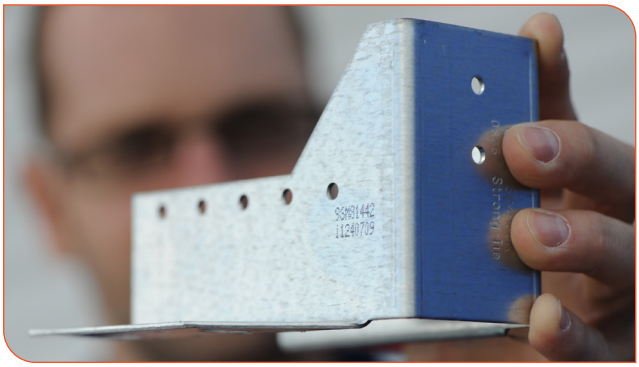
4 Creation of production plans



5 Manufacture of special parts

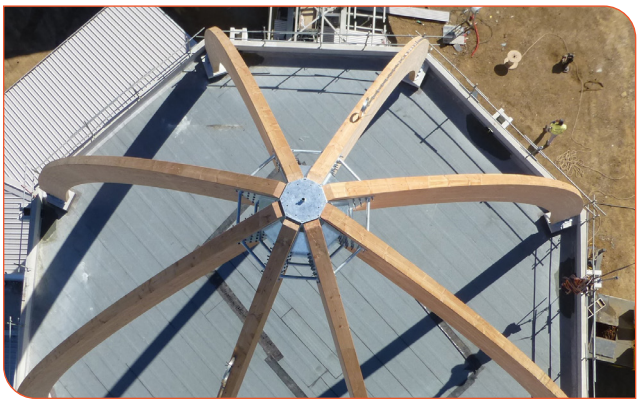


6 Production inspections



Quality control procedures are carried out at each step when manufacturing your special parts.

7 Delivery of the finished products to the required location, whether your workshop or straight to the construction site.



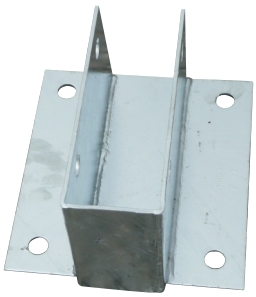
During the initial stages of the project, you can hone your requirements by discussing them with our technicians.

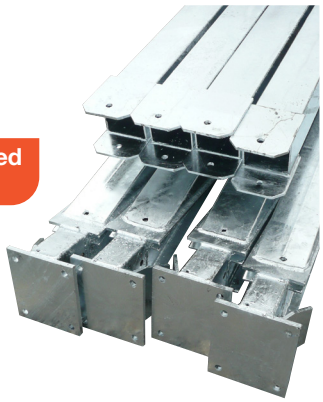
Special products and modified products

What is a special product?

Special products are the result of a specific design process. They are intended for a given project, they meet non-standard requirements and they are produced in our production facilities. Consequently, non-standard products cannot be CE marked in accordance with regulations.

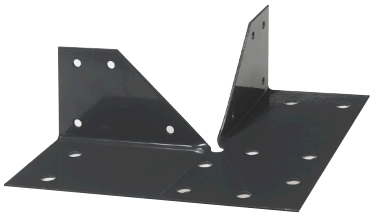
Mechanically-welded parts





Specific folds

Bespoke finishes

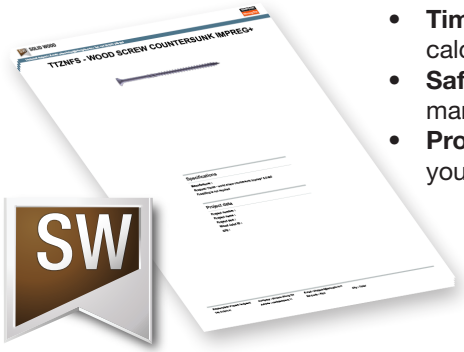


Special products and modified products:
Special products are designed by the customer and are manufactured by Simpson Strong-Tie according to the customer's specifications. Simpson Strong-Tie cannot and does not make any recommendations regarding the suitability of the special products for their use.
Any product modified by the designer or the user is under the sole responsibility of the person who recommended or carried out such a modification. Designers must provide the necessary installation instructions. Simpson Strong-Tie® cannot be held responsible for such modifications or for the consequences of their implementation.

Notes

Solid Wood The professional structural fastening solutions software

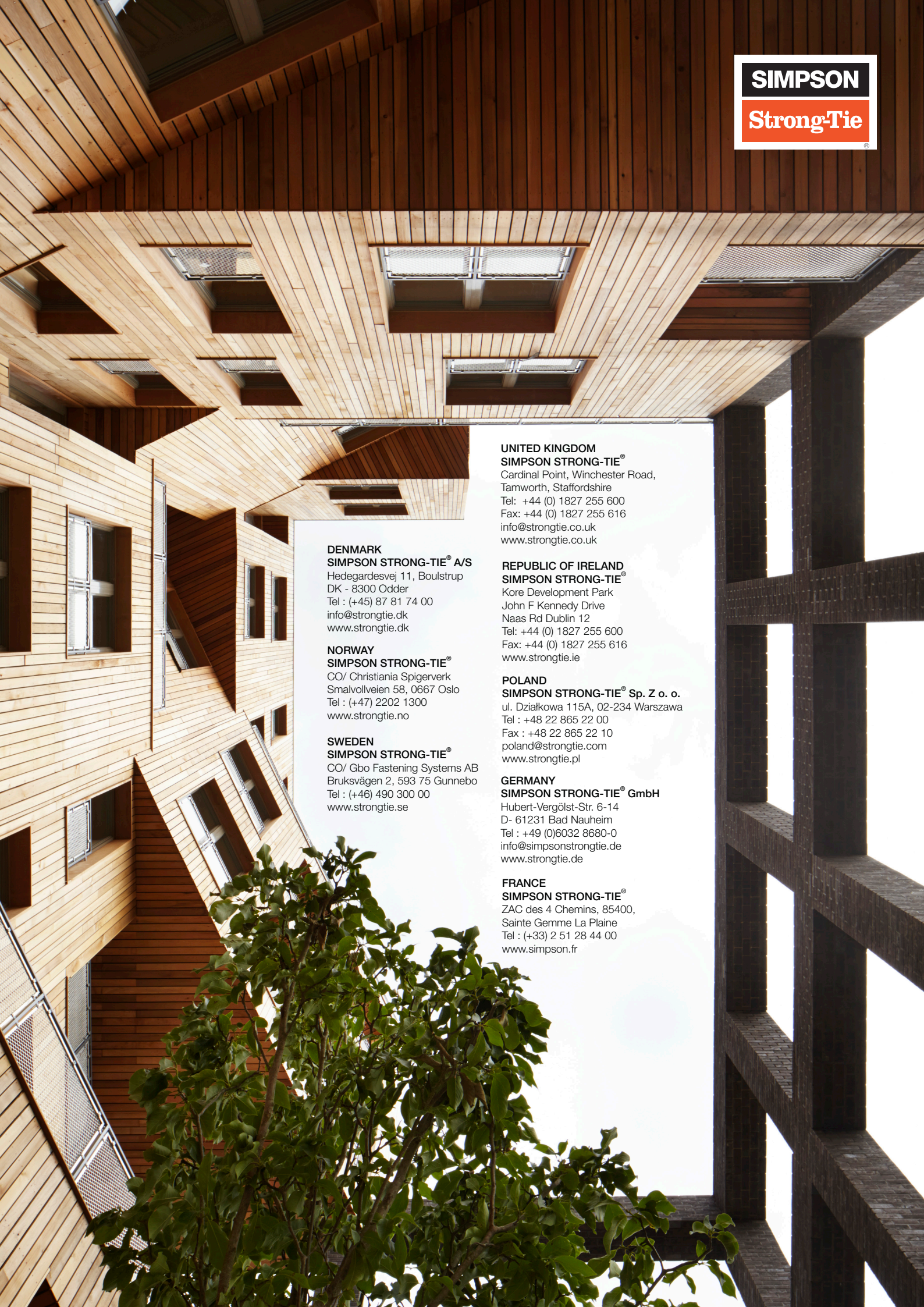
In just four simple steps, Solid Wood helps you to calculate and find fastening solutions suitable for your timber connections according to Eurocode 5 (EN 1995-1-1). The specifications can be printed and used as documentation in your projects.



- **Time saving** - Quicker and easier than doing manual calculations
- **Safety** - Removes your doubt in the precision of your manual calculations
- **Product guide** - Helps you find the correct product for your application

The software generates a PDF-report that can be used as documentation for the project.

SIMPSON Strong-Tie®



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