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What Are Timber Connectors Used For?

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The types of metal connectors you work with play an important role in strengthening the structural integrity of a building or project. After all, even the strongest component is only as good as the connector used, once the connector starts failing, it's only a matter of time before the complete collapse of the structure.

One of the most important building accessories in the construction industry is timber connectors. They are designed to enhance performance in joining timber to steel and timber to timber connections. As such, it is of utmost importance for timber connectors to be manufactured from durable materials such as hot rolled mild steel or pre-galvanised steel.

It is not uncommon for carpenters and consultants to use stainless steel timber connectors for enhanced strength and extended durability. Timber connectors are used to help transfer loads by increasing the bearing area between the timber and the fasteners.

Depending on their place within a structure, timber connections and joints can be susceptible to degradation and decay due to a variety of reasons including fire and water damage, split or decayed timber, and chemical interactions between preservatives and wood. The most common type of degradation is indicated by red rust and white rust.

Over time these conditions can lead to complete structural failure since the connection gradually starts to weaken. For this reason it can be particularly challenging to look for the ideal timber connectors since it's never a straightforward decision. It may become important to carry out a timber survey to determine whether the timber is damp, rotting, structurally sound, and whether or not it is capable of dealing with existing or new loads. Timber examination is carried out under experienced consultants who know where to look and what things to search for.

The right places not only include the beam, but also the bearing sections that are usually embedded in the external wall, which is mostly susceptible to water damage. What follows in its wake is profound rust damage that may require significant structural repair.

A Look at the Different Types of Timber Connectors Used

Traditional structural timber connectors are divided into two main groups known as dowel types and metal connectors. They differ in the way they transfer forces between connected members. Metal fasteners have little to no fire resistance and are able to transfer and absorb heat very quickly. One common workaround is to use fire protection with plasterboard.

The only weakness of metal fasteners has to do with the timber itself. Metal fasteners are further divided into two sub categories, i) connectors with bolts and ii) metal plate fasteners. They are described in detail below.



Tooth Plate Timber Connector Double Sided Stainless Steel

i) Connectors with bolts

There are three popular types of bolted connectors, these are split ring connectors, toothed plate connectors, and shear plate connectors.

Split ring connectors consist of a single split-ring with washers, nut, and a bolt, and the ring itself maybe bevel sided or parallel formed. The former is easier to insert and carries greater load capacity. Split rings are formed with aluminium cast alloy, cast iron, or steel. They are circular and have diameters ranging from 60mm to 260mm; they are most commonly placed in pre-cut grooves produced by rotary cutters.

Split ring connectors are used in timber to timber connections that are laterally loaded. The split ring connector uses the embedding stresses for transferring the load from one timber member to another. It is essential to use precise boring and grooving for better performance and correct installation.

Shear Plate Connectors

Shear plate connectors consist of a single shear plate with washers, nut, and a bolt. Shear plates are formed from aluminium cast alloy, cast iron as split rings, or steel. They are circular in nature with diameters ranging from 60 mm to 260 mm. Shear plates are placed inside pre-cut grooved via rotary cutters.

Shear plate connectors are used in both timber to timber connections as well as steel to timber connections. They can be used as split rings in laterally loaded joints. They are installed ahead of the assembly of the structure although they are fully demountable. The strength of the connection depends on connector and timber dimensions, distances, density of the timber, and spacing. In some cases, the connection stiffness may depend on the timber density and connector diameter.

In shear plate connectors, the bolt is installed through bearing stresses between the bolt and the shear plate, once the load is transferred into the connector. The load is then transferred to the second shear plate or to a steel member.

The diameter of the shear plate must correspond to the bolt diameter in addition to a few a small amount of tolerance. This causes a considerable amount of initial slip in shear-plate connections.

Toothed Plate Connectors

Tooth plate timber connectors are secured with the use of powerful bolts. They are made from hot dipped galvanised mild steel or cold rolled uncoated low carbon narrow steel strips. They are commonly available in a range of sizes and shapes; with their diameters ranging from 38 mm to 165 mm. The glued laminated

members may use much larger connectors. The shape of toothed plate connectors is mostly circular, but oval and square shapes are also easily available.

In order to properly install them into the timber, the bolts of tooth plate connectors are tightened rigorously for proper grip. Both are installed with square or round washers of a size that is half the diameter of the connectors. The connector is not considered too stable for denser timbers due to the difficulty of pressing the teeth into them.

It is uncommon to use toothed plate connectors with wood based or timber panel product that have a density of more than 500 kg/m³.

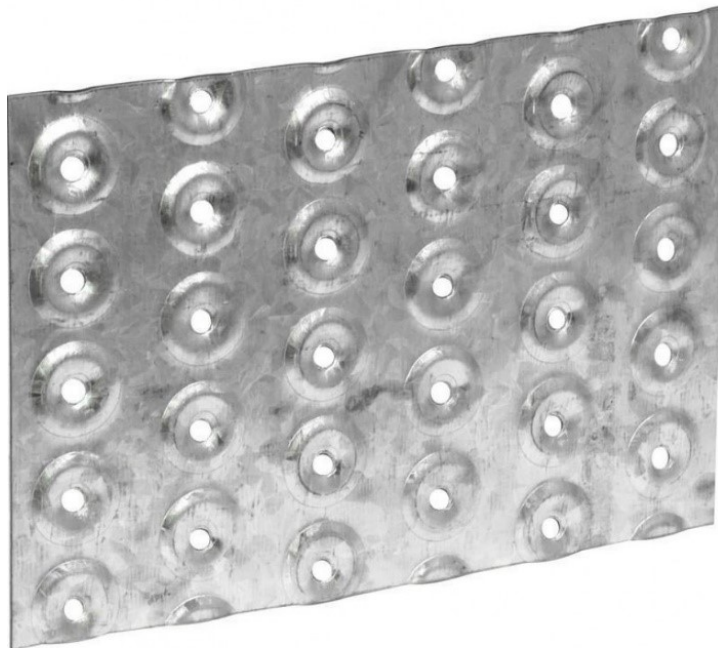
Dual sided toothed plate connectors are used in timber to timber connections that are laterally loaded. Single sided toothed connectors may be used in demountable timber joints and laterally loaded steel to timber connections.

The strength of the connection depends on the timber and connection dimensions and the bolt's load carrying capacity. Connection stiffness depends on timber density and connector diameter. For small connector diameters, mild steel bolts of up to 65 mm can do the job just fine.

Large washers may be required to press the connector teeth into the timber. This is because the high perpendicular stresses to the grain can crush the timber. Toothed plate connectors with high strength bolts may be replaced with mild steel bolts permanently using washers for timber frames.

In a dual sided toothed plate connection, the load is transferred from timber to timber by embedding stresses into the connector's teeth, through the plate and into the teeth on the opposite side.

Joint slip is virtually negligible in the designing of toothed plate connector. This isn't the case in one sided connections where the load is transferred into the toothed plate and into the steel member or second toothed plate via shear in the bolt. The diameter of holes in toothed plate connectors corresponds to the bolt diameter in addition to a small tolerance that causes initial slip.



Metal Plate Fastener

ii) Metal plate fasteners

Metal plate fasteners are divided into two subcategories, 3D plates and 2D plates.

Three Dimensional (3D) Plates

3D plates are manufactured by bending nail plates into convenient shapes. Popular 3D plates include brace anchors, truss clips, and joist hangers. Manufacturers commonly give a range of off-the-shelf components for custom use.

In 2D metal plates, the load is transferred into the plate teeth from the timber member, then into the steel plate from the teeth, before going to the joint interface, before finally making its way to the teeth in the other member. Typical connections involve two such plates on opposite faces of the members. The 2D metal plates must be installed carefully given how easy it is to damage components during installation.

Two Dimensional (3D) Plates

3D plates are nail plates or punched metal plates that can be used to join two or more timbers having the same thickness in the same place. The plates are mostly assembled in factory prefabrication than on site. 2D plates are most commonly used for in-plane joints such as trussed rafters. Their most common thickness is around 1 mm.



Timber Joist Hanger Galvanised

2. Types of Joist Hangers

Joist hangers can be used to connect joists without cutting holes in timber elements or holes in walls. They can strengthen load bearing connections and use face mount attachments to fasten joists to ledger beams and boards. The most common types of joist hangers available are single, double, triple, left and right orientation hangers for different uses.

Carpenters and builders alike place extreme importance in selecting and installing appropriate joist hangers. There are many kinds of joist hangers, including mini joist hangers, face fix joist hangers, long leg joist hangers, concealed flange hangers, masonry joist hangers, and welded masonry joist hangers.

i) Masonry Joist hangers

These hangers are used in applications where masonry walls meet with the timber floor. They eliminate the need for extensive laborious work that goes into drilling holes in the wall. They can be used to connect joists to supporting beams and masonry and build new block work or brick work.

ii) Joist Hangers with Long Legs

Long legged joist hangers are quick and easy to use. They work by wrapping around three sides of a wooden support truss or wooden beam, secured with screws or strong nails to keep the application in place. If installed properly, long leg joist hangers can last a long time and prove to be extremely durable, even if the wood shrinks, twists, ages, and expands.

iii) Mini Joist Hangers

These are mostly utilised for light duty application such as ceiling joists, trimmers, studs, smaller timbers, and decking. Mini joist hangers are used for widths of up to 78 mm and depth of up to 100 mm.

iv) Heavy Duty Joist Hangers

These joist hangers are designed for applications where strength plays a vital role or where access to the top of the steel or timber is not available. They can be bolted or nailed. Heavy duty hangers can support two ply trusses on supporting timber, heavily loaded timber beams, and girded trusses.

v) I-Joist Hangers

These hangers are used for fixing I-Joists to ledger boards and to the face of timber beams and are incredibly cost effective. They are used to avoid rotational in column based constructions to ensure optimal structural performance. I-Joists are primarily available as top fix and face fix variations, some of them come with locators for easy fixing.

vi) Concealed Joist Hangers

These hangers are used in areas where it is impossible or extremely laborious to a standard joist hanger's side flange. Concealed joist hangers are useful in applications that involve the attachment of rim joists at the edges of the ledger board. Concealed joist hangers can be secured into place without the need to nail into the lumber's end grain.

Concealed hangers can be used to improve the aesthetics of exposed stair stringers while providing a strong connection.



Metal Heavy Duty Strap

3. Types of Restraint Straps and Bands

Restraint straps and branding are commonly used to provide horizontal restraint and vertical restraint against uplift forces and wind pressure. They consolidate and reinforce connections between structural elements of a structure. The most common types of restraint straps are their light and heavy duty versions. They are primarily produced from stainless steel and galvanised mild steel.

i) Light Duty Restraint Straps

These restraint straps are used for vertical applications such as holding down wall plates to masonry. They can be made from galvanised straps or stainless steel straps.

ii) Heavy Duty Restraint Straps

They are suitable for horizontal restraint applications such as tying timber floors and roofs into masonry walls. These restraint straps are available as stainless steel or galvanised straps.

iii) Fixing Bands

These highly versatile, strong, and flexible steel bands are easy to cut and bend, making them suitable for a large range of tasks that involve supporting, strapping, and securing purposes. Fixing bands include pre-

punched holes for screws, bolts, and nail, and are primarily available in galvanised finish for outdoor use. They can be plastic coated for additional protection from corrosion.

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