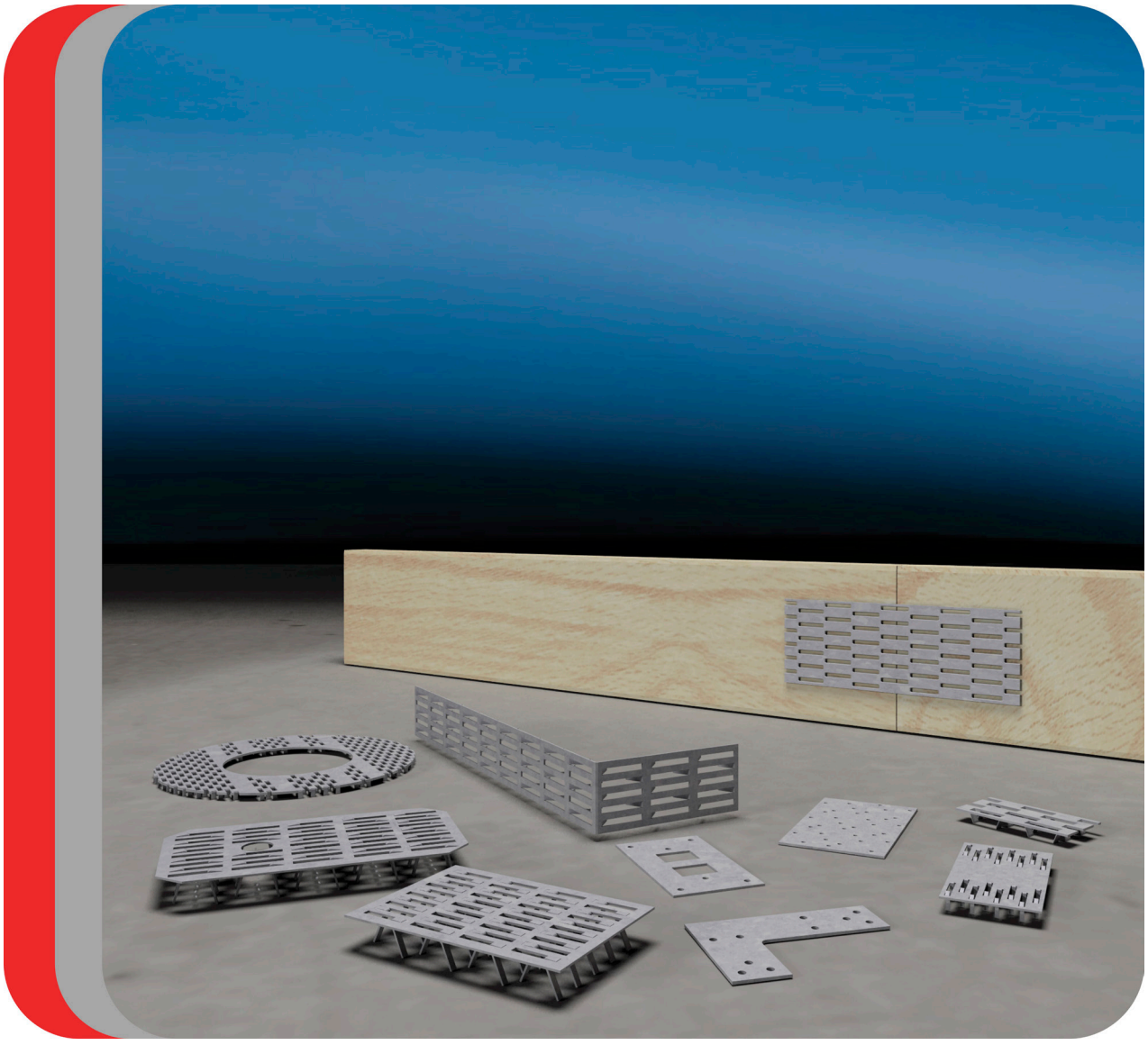
Pryda Timber Connectors

Nailplates Guide

September 2016



A complete guide to the design, specifications and installation of Pryda Nailplates

ESSENTIAL NOTES – PRYDA PRODUCT GUIDES

INTRODUCTION

The information in this Product Guide is provided for use in Australia by architects, engineers, building designers, builders and others. It is based upon the following criteria:

1. **No Substitution**: The products covered by or recommended in this guide must not be substituted with other products.

2. **Design Capacity Basis**: See Codes & Standards following.

3. **Supporting Constructions**: Constructions using Pryda products must be built in accordance with the NCC (BCA) or an appropriate Australian Standard. *Note: This includes appropriate corrosion protection- See Corrosion Protection following.*

4. **Correct Installation**: Installation of Pryda products must be strictly in accordance with the instructions in this guide.

5. **Current Guide Version Used**: The current version of this guide, including any amendments or additions, must be used. Users are advised to check the Pryda website, www.pryda.com.au, on a regular basis for the most current design guides.

CODES & STANDARDS

Product design capacities in this guide have been derived from:

(a) Results of laboratory tests carried out by or for Pryda Australia

(b) Engineering computations in accordance with the relevant Australian Standards, ie:

- AS1720.1-2010 Timber Structures. Part 1: Design Methods.
- AS/NZS1170 series Structural Design Actions.
- AS4055-2006 Wind Loads for Housing.

Design capacities tabulated in this guide apply directly for **Category 1** joints. For all other joints, reduce design capacities by using the factors as specified in *General Notes* (if applicable). Design capacities are related to the **Joint Group** of the timber as defined in AS1720 and AS1684. If the Joint Group of timber members joined together varies, the lower group must be assumed for design, for example, JD5 is lower than JD4.

DEFINITIONS

Special terms used in this guide are as defined in Australian Standards, including:

Design Capacity: The maximum Limit State Design load (aka "action") which the product can safely support under the specified load condition, eg, 1.2G + 1.5Q (dead+roof live). *See General Notes for details (if applicable).*

Joint Group: Classification of a timber according to its fastener-holding capacity. *See General Notes for details (if applicable)*

CORROSION PROTECTION

Most Pryda products are manufactured using Z275 light-gauge steel, having zinc coating of 275 gsm (total weight). This protection is adequate only for INTERNAL applications in most corrosive environments, except areas that are classified as heavy industrial or those subject to high humidity (eg, enclosed swimming pools). Under these circumstances, seek advice from experts as special protection will be required. *Note: INTERNAL areas are those within the building envelope that are kept permanently dry*.

AS1684.2-2010 and AS1684.3-2010, *Australian Standards for Residential Timber Frame Construction* stipulate a minimum Z275 steel for all sheet metal products used in an internal environment.

In areas outside the building envelope that are exposed to repeated wetting (EXTERNAL areas), Pryda's stainless steel products or equivalent should be considered. Some alternatives include hot dip galvanised or powder coated steel, which are not supplied by Pryda. For more detailed information, read Pryda's Technical Update on *Corrosion Resistance of Pryda Products* or contact a Pryda office.

PRODUCT CERTIFICATION

Pryda Australia warrants:

- Products in this guide are free from defects in the material and manufacturing
- Design capacities are in accordance with test results or current, relevant Australian Standards and the Building Code of Australia.
- Pryda products are structurally adequate provided they are designed, installed and used completely in accordance with this guide.

This warranty applies only to:

- Products in this guide.
- Products used in the specified applications and not damaged after manufacture and supply.
- Joints free from wood splitting, decay or other timber defects at the joint or within 150 mm of the joint.

INSTRUCTIONS FOR INSTALLATION

These notes are provided to ensure proper installation.

1. All fasteners used must be manufactured by reputable companies and be of structural quality.
2. Connectors must not be installed on timber which is split before or during installation. If the timber is likely to split as fasteners are driven, fastener holes must be pre-drilled.
3. Do not overload the joints during construction or in service.
4. Hole diameter for bolts in seasoned timber must not be more than 1.0 mm larger than the bolt diameter to achieve a snug-tight connection. Specified washers must be installed against the timber face.
5. Use proper safety equipment and due care in installing these connectors.
6. Any gaps in joints between the timber members must not exceed 3 mm.
7. Do not over-tighten screws.

Pryda
Nailplates Guide

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Product Information Updates
Information contained in this product guide is subject to change.
The latest updates are available from www.pryda.com.au.

GENERAL NOTES

Timber Joint Groups

Joint groups for some common timber are tabulated below. A more comprehensive table is given in AS1720.1: 2010.

Timbers	Strength Group		Joint Group	
	Dry	Green	Dry	Green
Oregon (Douglas fir) – America	SD5	S5	JD4	J4
Oregon from elsewhere	SD6	S6	JD5	J5
Radiata pine, heart-excluded	SD6	NA	JD4	NA
Radiata pine, heart-in	SD6	NA	JD5	NA
Slash pine	SD5	S5	JD3	J3
Ash type hardwoods from Vic, NSW highlands & Tas	SD4	S4	JD3	J3
Non-Ash type hardwoods from Qld & NSW	SD3	S3	JD2	J2

Note on **Engineered Timbers**: Most standard LVLs are assigned a JD4 joint group, and some JD3. Seek advice from the relevant LVL manufacturer for confirmation.

Design Load Cases

Following is a description of the combined load cases adopted in this design guide. These load cases are in compliance with AS/NZS1170.0:2002 – Structural design actions Part 0:General principles.

Load Case	Description
1.35G	Permanent Action (*or Dead Load*) only
1.2G + 1.5Qr	Permanent and Roof Imposed Actions (*or Dead & Roof Live*)
1.2G + 1.5Qf	Permanent and Floor Imposed Actions (*or Dead & Floor Live*)
1.2G + Wd	Permanent and Wind Down Actions (*or Dead & Wind down*)
Wind Uplift (0.9G – Wup)	Permanent and Wind Up Actions (*or Dead & Wind up*)

Design Loads & Capacities

The tabulated capacities are for Category 1 joints as described in Table 2.2 of AS1720.1:2010. For joints in other Categories, reduce design capacities by using the following factors:

- Category 2 Joints: **0.94**
- Category 3 Joints: **0.88**

Category 1 joints are defined in Table 2.2 AS1720.1:2010 as structural joints for houses for which failure would be unlikely to affect an area of 25 sqm OR joints for secondary elements in structures other than houses.

Material Thickness

All material thicknesses referred to in this guide are the total coated thickness. This includes the zinc coating thickness, which is typically around 0.04mm for Z275 steel.

Machine Driven Nail Use

Where appropriate, 32 x 2.3 mm Duo-Fast C SHEG (ie, screw hardened electro galvanized) machine driven nails (code D40810) or equivalent may be used instead of the specified 35 x 3.15 mm Pryda Timber Connector Nails to fix Pryda connectors provided that:

- 20% more nails are used (eg, 5 instead of 4, 4 instead of 3, 3 instead of 2) or alternatively, design capacities are to be reduced by 20% where the same number of nails are used.
- Machine driven nails are driven at nail spacings and edge distances similar to the hole pattern but these nails are not driven into the holes.

Note: Extreme care must be taken when using machine driven nails as the prevailing installation practices tend to inhibit compliance with the above requirements.

Some of other pneumatic coil screw hardened nails considered equivalent to D40810 are Paslode 32 x 2.5 mm (B25110), Duo-Fast 32 x 2.5 mm (D41060), Paslode 40 x 2.5 mm (B25125) and Duo-Fast 40 x 2.6 mm (D42360).

CONNECTOR PLATE

The Versatile Timber Connector for Timber Construction

Features

Pryda Connector Plate is a quick, simple, economical and easy to use connector for jointing timber wall plates normally jointed by more time consuming conventional methods. The square slots allow for skew nailing when required.

Specification

Material	Steel is 0.8 mm, G300-Z275 Galvanised
Dimension	110 mm x 60 mm x 0.8 mm
Product Code	CPPQ
Packing	100 per carton, no nails.

For maximum efficiency, use three 35 x 3.15 mm galvanised **Pryda Timber Connector Nails** each side of the joint.

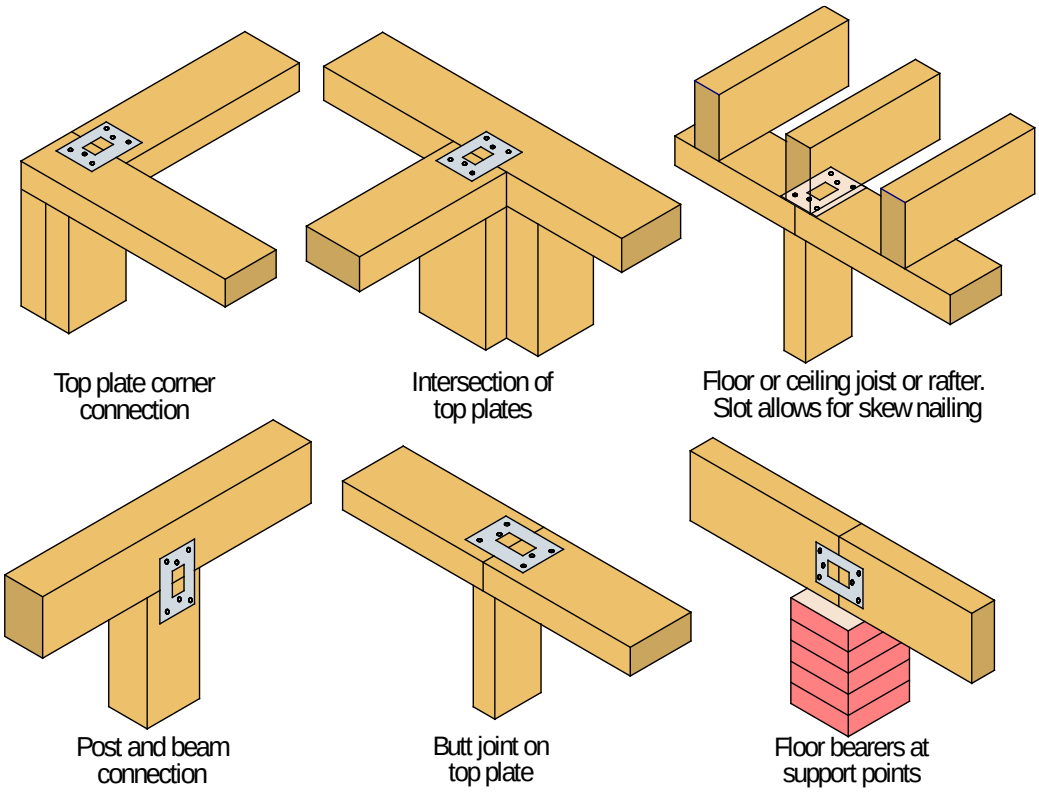
Design Capacities

Limit State Design capacities per **Pryda Connector Plate** are tabulated below for fixing with three 35 x 3.15 mm galvanised **Pryda Timber Connector Nails** each side of the joint and loads applied parallel to the length of the plate.

Joint Group	Design Capacity (ΦN_j) (kN) for Wind load case
JD3	4.0
JD4	2.8
JD5	2.4
J3	2.8
J4	2.4

Note: This capacity applies directly to all Category 1 joints. For all other joints, i.e Category 2 or 3 joints as per AS1720.1:2010), multiply these capacities by 0.94 or 0.88 respectively. See General Notes in page 4 for details.

Applications



CORNER PLATE

Galvanised Bracket for Right Angle Joints

Features

The **Pryda Corner Plate** is especially designed for jointing corner timbers in light framing applications such as gate frames, and also a wide range of other uses including wall frames, tops of pergola beams, furniture framing etc.

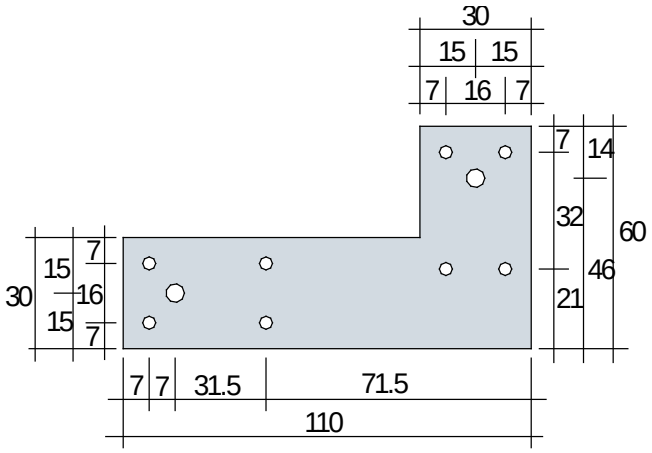
Suitable for use as either left or right hand and either the vertical or horizontal position.

Specification

Material	Steel is 1.6 mm, G300-Z275 Galvanised
Product Code	CPL
Packing	150 per carton

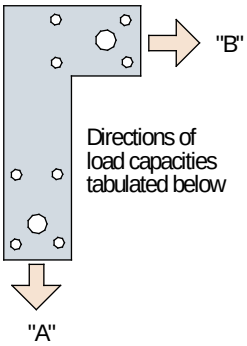
Note: The use of galvanised Pryda Timber Connector Nails 35 x 3.15 mm is recommended.

Dimensions



Design Capacities

Limit State Design capacities per **Pryda Corner Plate** are tabulated below for fixing with four galvanised 35 x 3.15 mm **Pryda Timber Connector Nails** each side of the joint.



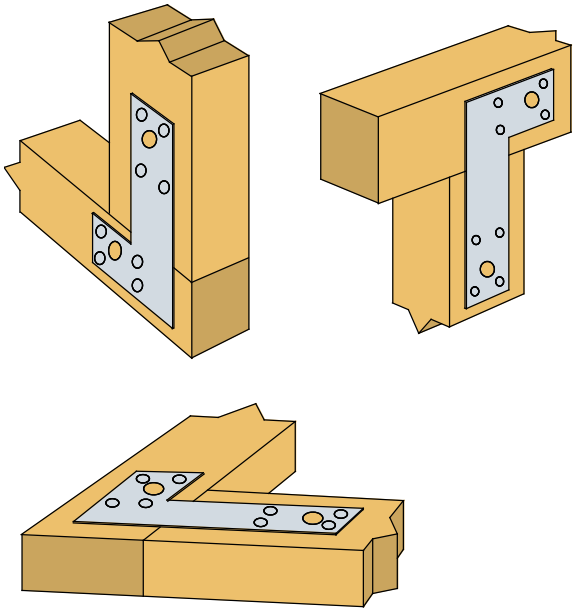
Load direction A

Joint Group	Design Capacity (ΦN_j) (kN) for Wind load case
JD3	5.3
JD4	3.8
JD5	3.2
J3	3.8
J4	3.2

Notes:

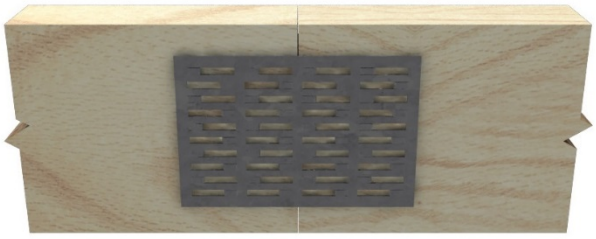
1. For **Load Direction B**, use 60% of the above capacities.
2. This capacity applies directly to all Category 1 joints. For all other joints, i.e Category 2 or 3 joints as per AS1720.1:2010), multiply these capacities by 0.94 or 0.88 respectively. See General Notes in page 4 for details.

Applications



KNUCKLE NAILPLATES – STANDARD & SPECIAL

Hammer Fixed, Easy to Use Nailplates for Many Applications



Features

Pryda Knuckle Nailplates are galvanised steel connectors with in-built, bent-up "knuckle" nails. These plates are ideal for many structural and non-structural timber jointing and timber protection uses. Applied simply by hammering in the "knuckle nails", these plates are used by tradesmen, home owners, frame and box manufactures, electricity supply authorities and builders. Special pressing equipment is not necessary.

Among the many uses of **Knuckle Nailplates** (see Applications following), the most common are:

- Jointing of wall frames together on-site.
- On-site splicing of timber beams.
- Reinforcement of corners of boxes and bins.
- Reinforcement of bolted joints (eg, Cable Truss).
- Truss manufacture in areas with low labour costs.

Generally, **Knuckle Nailplates**:

- Provide a **strong, economical and easy-to-use means of jointing timber** together.
- **Protect timber from damage** as they:
  - **Resist splitting** due to drying of the timber, nailing near ends or other causes eg: **Bin Straps.**
  - **Resist the effects of impact loads** such as from fork lift tyne strikes.
  - Dissipate electricity current surges in cross arms over a larger area (eg, **Shunt plates**).
- **Distribute concentrated loads over a wider area, e**g, they increase the strength of bolted joints.
- **Hold joints together,** preventing or restricting the separation of nailed joints such as in boxes and crates, eg, **Bin Straps**.

As well as the standard flat plate will all nail columns punched, **Knuckle Nailplates** can be manufactured:

(a) With columns of nails omitted for greater steel strength or for inclusion of a bolt hole.

(b) Bent at right angles with the nails outside (external angle) or inside (internal angle).

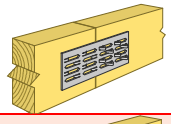
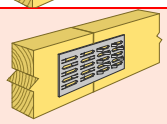
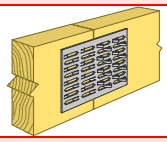
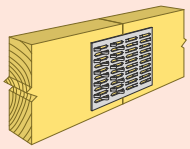
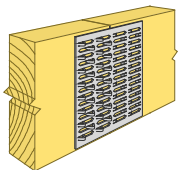
(c) In coils or bar stock which allow customers to cut off the lengths they require

Description

Knuckle Nailplates are available in a wide standard range as tabulated opposite. Larger sizes are available on request. Other forms of this plate could be developed given sufficient demand for the product.

The steel used is **1.0 mm thick, ZincForm® G300 Z275** or equivalent. Product codes for non-special plates refer to the number of columns of nails and the number of rows. Eg, A 4R8 has 4 rows and 8 columns.

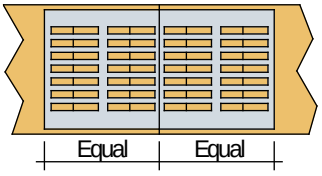
Product details

Diagram	Product Code	Size (mm)	Packaging	
			Merchant Pack	Trade Pack
	**R4 Nailplates**	33 wide x		
	TP4R4	127		133
	TP6R4	190		89
	**R5 Nailplates**	38 wide x		
	MP4R5	127	100	
	MP6R5	190	66	
	**R8 Nailplates**	67 wide x		
	MP4R8	127	66	
	MP6R8	190	44	
	MP8R8	254	33	
	**R10 Nailplates**	76 wide x		
	MP2R10	63	100	
	TP3R10	95		66
	MP4R10	127	50	
	MP6R10	190	33	
	MP8R10	254	26	
	**R16 Nailplates**	134 wide x		
	MP4R16	127	33	
	MP6R16	190	22	
	MP8R16	254	16	

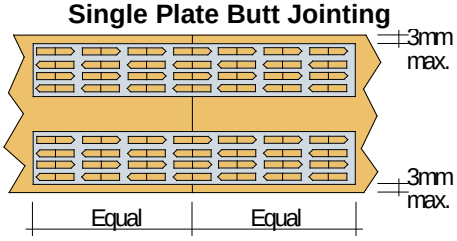
Note: Merchant packs are individually barcoded.

Knuckle Nailplates – Standard & Special continued:

Diagram	Product Code	Size (mm)	Packaging
	**Bin Straps** 8N5B1	64x190x44	75
	**Shunt Plates** 5N10	88 x 159 with hole	80



Single Plate Butt Jointing



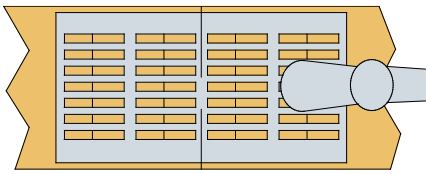
Double Plate Butt Jointing

Properties

Design Capacities for **Pryda Knuckle Nailplates** have been established from standard laboratory tests in accordance with *AS 1649-2001 Timber – Methods of test for mechanical fasteners and connectors – Basic working loads and characteristic strengths.* Loads are related to the standard joint groups for timber defined in AS 1720.1 - 2010 in Pryda's Timber Data. Also read General Notes in page 4.

Installation

Knuckle Nailplates are installed simply by hammering on the knuckles of all nails in each plate. It is recommended that the hammer be parallel to the length of the nails (see diagram below) to ensure full penetration of the nails.



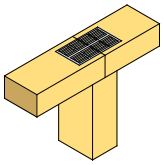
Hammer Parallel to Nails

A natural arc or dovetail effect is created by the nails as they penetrate into the timber. This provides positive resistance to nail withdrawal.

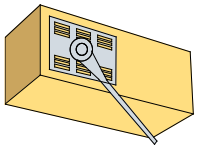
For butt jointing, **Knuckle Nailplates** are installed symmetrically over the joint, ie, with an equal length on each side (3 mm tolerance). For timber up to 150 mm wide, one plate is fixed onto each face; for wider timber, two plates are used, fixed at 3 mm maximum from each edge.

Applications

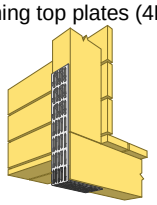
Some of the many applications of **Knuckle Nailplates** are illustrated below:



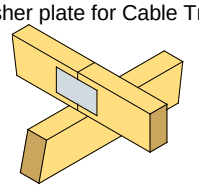
Joining top plates (4R8)



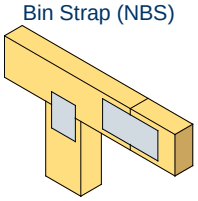
Washer plate for Cable Truss



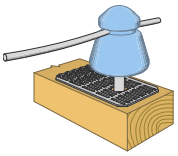
Bin Strap (NBS)



Purlin or Joist Splice (4R5)



End Jointing
(4R16, 6R10)



Shunt Plate
(5N10)

Knuckle Nailplates – Standard & Special continued:

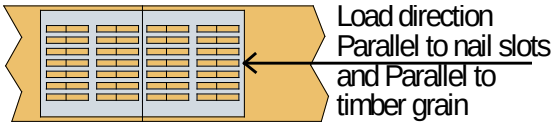
Design Capacities

Limit State Design capacities per single **Pryda Knuckle Nail** are:

Load Direction	Design Dead Load Capacity ϕN_j (N) per Nail for Timber Joint Group:						
	Green Timber			Dry Timber			
	J4	J3	J2	JD5	JD4	JD3	JD2
Parallel	185	230	280	185	230	280	280
Perp.	70	80	95	70	80	95	95

Notes:

1. *Parallel* in the above table applies to the case where the load is applied parallel to the nail slots in the plate and also parallel to the timber grain (see diagram below). *Perpendicular* applies where the load direction is not as defined for *Parallel.*



Perpendicular applies where the load direction is not as defined for *Parallel.*

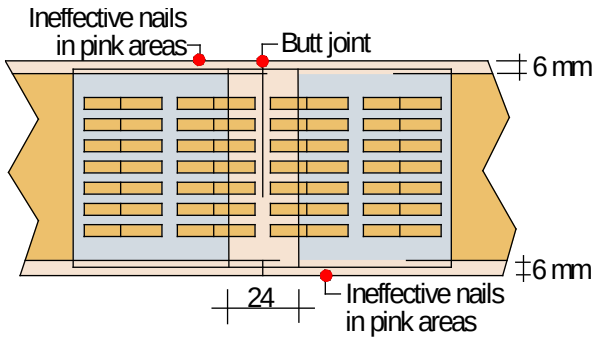
2. The above capacities are given in Newtons for a single knuckle nail, adopting a capacity factor (ϕ) of 0.85 and load durartion factor (k1) of 0.57, applicable to permanent loads.

3. To calculate the number of teeth per plate, multiply the first figure in the plate code by the second, eg:

- for 4R8, teeth = 4x8 = 32
- for 8R16, teeth = 8x16 = 128

On an area basis, there are conservatively, 3.5 nails per 1000 mm² of plate area.

In timber joint design, nails within 12 mm of ends or within 6 mm of edges are regarded as not effective. As the nail rows in these plates are 32 mm apart, all nails are effective in **Knuckle Nailplates** fixed symmetrical over the joint (3 mm tolerance).



Ineffective Nail Areas in Joints

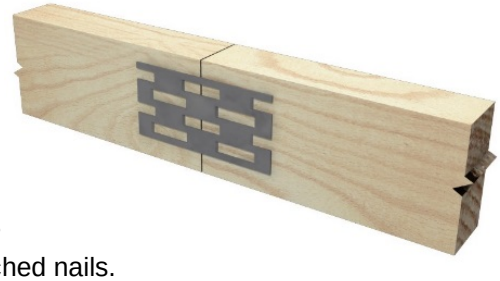
Steel Strength

Property	Design Capacity, ϕN_j (N/mm) per Pair of Plates	
	Longitudinal	Lateral
Tension	350	132
Shear	84	170

The Design Capacities for Steel Strength includes a capacity reduction factor ϕ = 0.90

MININAIL

A pre-punched, mini nailplate for joining or connecting timber

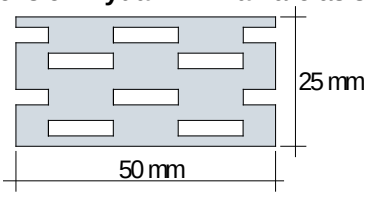


Features

- Pre-punched nails.
- Sharp tooth profile- penetrates readily into hardwoods and softwoods.
- Can be used as a mini joiner for narrow timber or for fixing fabric/foil to timber.
- Suitable for both trade use (eg, furniture manufacture) or handyperson application.
- Manufactured from 1.0 mm G300-Z275 Galvanised steel.

Dimensions

The dimensions of **Pryda Mini Nail** are as shown below:



Specification

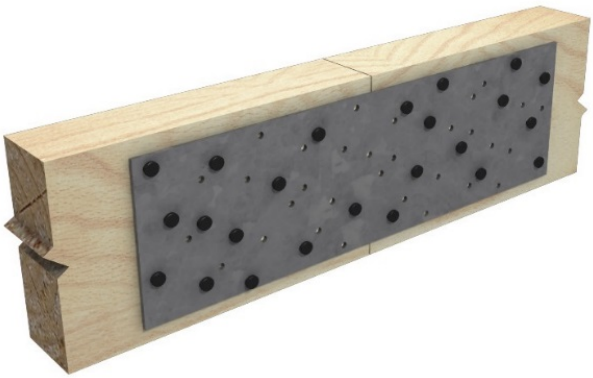
Packing	Cartons 500
	Merchant Packs of 7 x 30
Code	2C1S (Bulk)
	MP2C1S (Merchant Pack)

Applications

Pryda Mininail is used for simple butt joints of timber of small sizes and for applications such as in furniture.

NAIL-ON PLATES

Heavy Duty Pre-Punched Plates



Features

Pryda Nail-on Plates are flat, galvanised or stainless steel plates which are nail-fixed to timber to form various types of joints. Their medium to high load capacities and wide range of sizes makes them ideally suited for on-site work, including:

- Joining trusses on-site that have been made in parts in the factory.
- Fixing trusses to poles.
- Any heavy duty timber connection where a **Knuckle nailplate** will not suffice.
- Joining beams.
- Repair work over existing fixings.

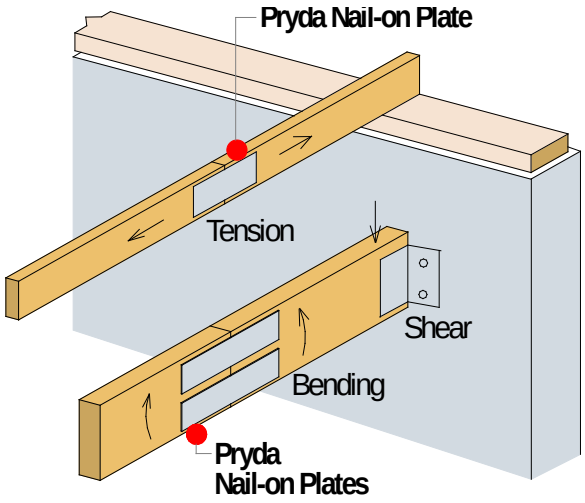
Pre-bent forms of **Nail-on Plates** are also available for use as cleats and brackets.

Specification

Size: Size range is shown in **Design Capacities** table.
Steel: 1.0 mm G300-Z275 galvanised steel
0.9 mm in stainless steel

Product codes below are made up from: Width/Length.

Thickness:	**1.0 mm thick**
75 mm width sizes:	NPA75/125, NPA75/190, NPA75/250, NPA75/315, NPA75/380
100 mm width	NPA100/190
150 mm width	NPA150/250, NPA150/315
Packing:	Approx. 1.2 square metre per carton



Installation

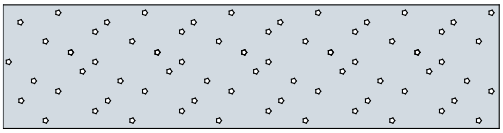
Use only 35 x 3.15 mm galvanised **Pryda Timber Connector Nails** or equivalent nails with these connectors. Stainless steel nails must be used with stainless steel **Nail-on plates**.

Number of Nail Holes per Plate

Plate Width	Plate Length (mm)					
	50	**125**	**190**	**250**	**315**	**380**
75		24	36	48	60	72
100			48			
150				96	120	

Note: Nail density is approx. one nail per 400 mm^2

Nails must be driven into all holes (ie, all holes filled), except for holes within 60 mm of timber ends and 15 mm of timber edges, to achieve the full Design Capacities – see **Design Capacities for a Typical Splice Joint** .

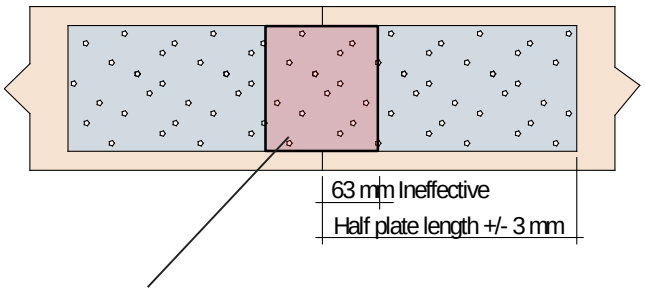


Nail-On Plates continued:

Design Capacities for a Typical Splice Joint

Limit State Design capacities for **Pryda Nail-on Plates** per pair of plates are as tabulated below with conditions:

- All nail holes filled except within 60 mm of timber ends.
- Minimum edge distance to nail centre = 5D = 16 mm.
- Minimum edge distance plate to timber edge = 5 mm.
- Loading case = 1.2G+1.5Qr (Roof Live + Dead Load).
- Nails within 60 mm of butt joint are neglected.
- Positioning tolerance along plate length = 3 mm.



Nails in this ineffective region (close to end-grain of timber) must be avoided to prevent splitting.

Plate Width (mm)	Minimum Timber Width (mm)	Design Capacity ϕN_j (kN) for a pair of plates in JD4 timber (1.2G+1.5Qr)							
		Plate Length (mm)						Steel Capacities	
		50	125	190	250	315	380	Max Tension	Max Shear
75 x 1.0	90		N/S	6.4	12.8	19.2	24.4	**35.2**	**21.2**
100 x 1.0	120			9.0				**46.0**	**27.6**
150 x 1.0	170				26.0	40.0		**70.2**	**42.5**

Notes

1. These design capacities apply directly for Category 1 joints as described in Table 2.2 of AS1720.1:2010. For Category 2 and Category 3 joints, multiply these capacities by 0.94 and 0.88 respectively.

2. The nail capacities (ϕNj) given in the table above is capable of resisting a resultant design force arising from an axial tension and shear forces (i.e vector sum of the axial tension and shear forces).

3. The design capacities tabulated above apply directly to joints on JD4 timber for 1.2G+1.5Qr load case using k_1 = 0.77. For other load cases and timber joint groups, multiply these capacities by the load factors given below.
   The resultant capacity must not exceed the maximum Steel Tension and Steel Shear values tabulated above.

4. 'N/S' in the above table signifies that the plate is not suitable for a splice joint connection, due to ineffectiveness of nails resulting from end-distance violations.

5. The duration factor (k1) for wind load case in the table below is taken as 1.14, as specified in Table 2.3 of AS1720.1:2010.

6. **Pryda WTF12-35 screws** may be substituted for Pryda Timber Connector nails. To achieve equivalent capacity, use 2 screws for every 5 nails (in JD4 or JD3) or 2 screws for every 4 nails (in JD5) The end/edge distance and spacing requirements for screws are different to nails and therefore should be specified by the designer.

Load Case:	1.35G	1.2G + 1.5Qf	1.2G + Wd or 0.9G - Wu
Factor:	0.74	0.90	1.48

Joint group:	J4	J3	J2	JD5	JD3	JD2
Multiplier:	0.62	0.88	1.24	0.83	1.4	1.8

POLE CATS

Pryda Pole Cats are anti-split nailplates for timber poles and posts. Available in four sizes, from 150 mm to 300 mm diameter.

Most have a central hole to allow pole inspection. They are applied by hammering.

PCAT150	150 mm diameter
PCAT200	200 mm diameter
PCAT250	250 mm diameter
PCAT300	300 mm diameter

See: **Sales data.**

STRAP NAILS

A toothed steel nailplate for speedy construction of timber

Features

Pryda Strap Nails are a range of nailplates with pre-punched **Claw** nails at each end. These connectors are:

- **Designed for fast construction jointing of timber frames using a hammer.**
- **Suitable for all timbers** as the sharp, twisted form of **Claw nails** penetrates into timber ranging from the lightest softwoods to the densest hardwoods.
- **Time-saving and therefore, cost-saving.**

Specification & Dimensions

All Strap Nails except SN4C and MPSN4C have their nails perpendicular to plate length.

The steel used is 1.0 mm Zincform G300-Z275 or equivalent. G300 is the steel grade;

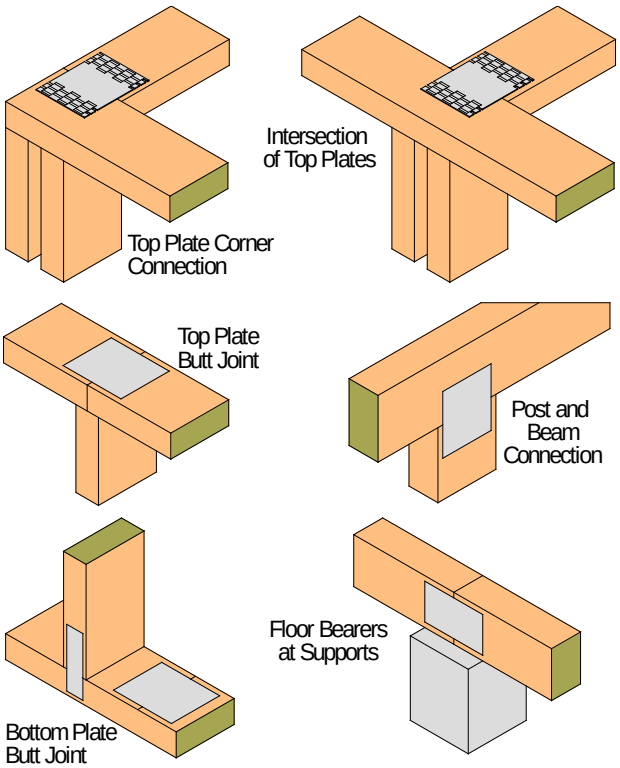
Pryda Strap Nails are available in a range of sizes and quantities to suit timber from 25 to 120 mm wide as follows:

Product Code	Size (mm)	Packed
Carton Packs		
SN5	50 x 100	100
Bulk Packs		
SN5B	50 x 100	300
Merchant Packs*		
MPSN2	25 x 100	180
MPSN4C	38 x 90	75
MPSN5	50 x 100	75
MPSN7	75 x 100	50

Notes:
1. Size is width x length.
2. * Individually bar-coded.

Applications

Some typical applications of **Pryda Strap Nail** are shown below:

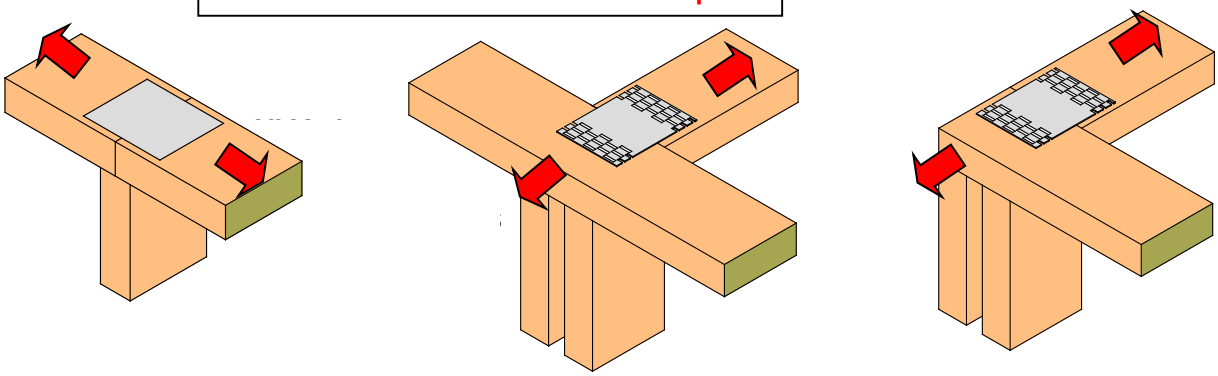


Design Capacities

DESIGN WIND LOAD CAPACITIES FOR STRAP NAILS – LOAD ALONG PLATE

Product Code	Width mm	Steel Cap. kN	Nail Dirn. To Load	Teeth Each End	Design Capacity ϕN_j per Strap Nail (kN) for Timber Joint Group:						
					J4	J3	J2	JD5	JD4	JD3	JD2
MPSN2	25	2.9	Perp.	10	1.4	2.2	2.9	2.2	2.6	2.9	2.9
SN5, SN5B	50	5.7	Perp.	16	2.4	3.6	4.6	3.4	4.0	4.6	5.7

LOADING ALONG THE PLATE - Examples



Notes

1. These design capacities apply directly for Category 1 joints as described in Table 2.2 of AS1720.1:2010. For Category 2 and Category 3 joints, multiply these capacities by 0.94 and 0.88 respectively.

2. The above capacities are given for the wind load case. For other load cases, decrease capacities by multiplying with the corresponding factor tabulated below.

Load Case:	1.35G	1.2G + 1.5Qf	1.2G + 1.5Qr
Factor:	0.50	0.60	0.68