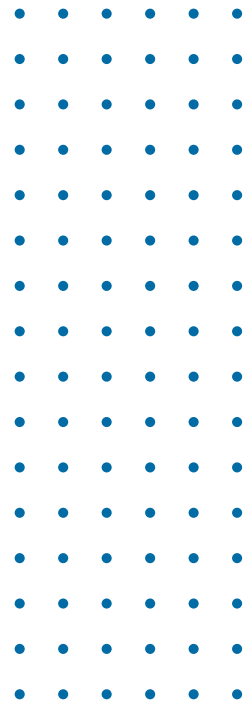


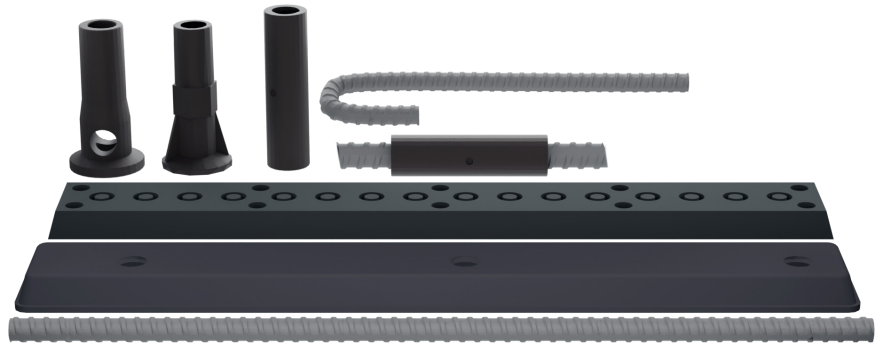
DESIGN GUIDE

PSA THREADBAR DESIGN GUIDE



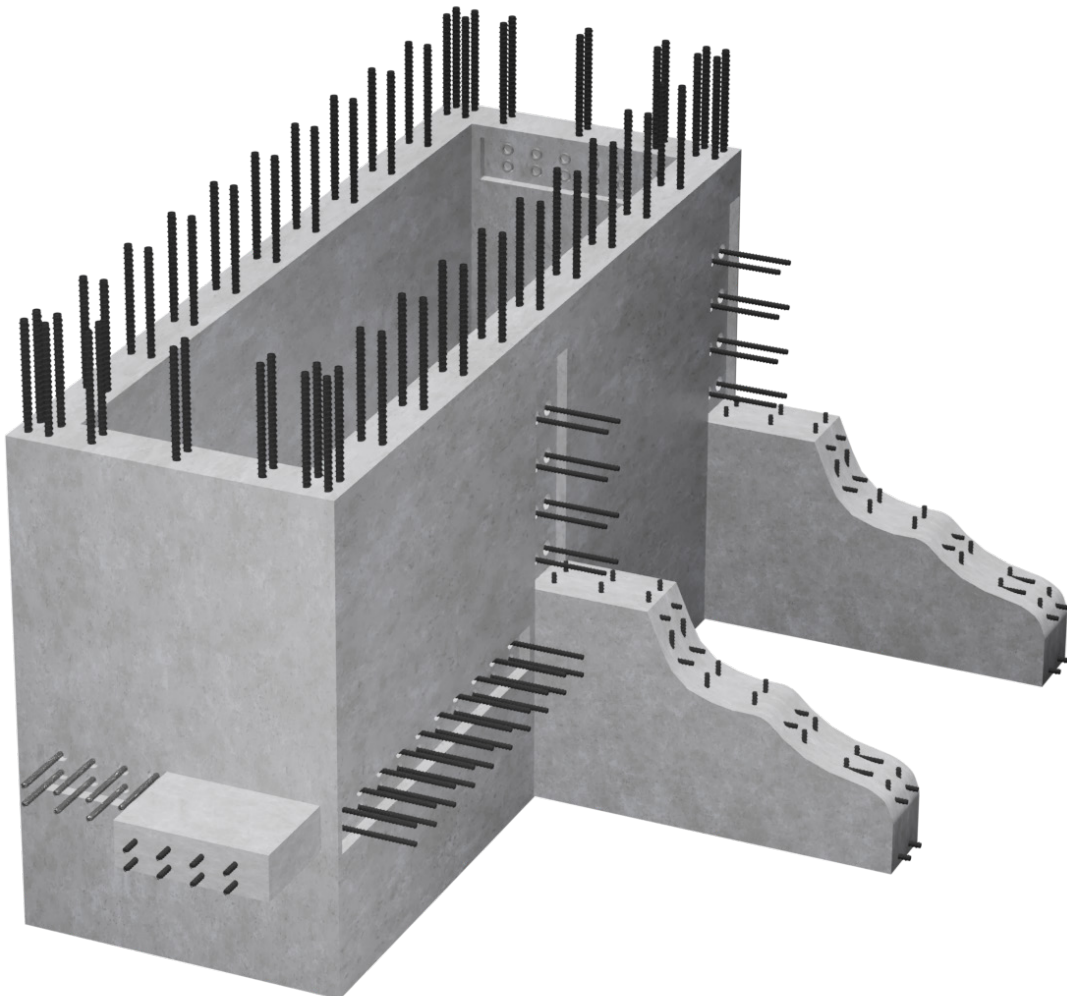


+ PSA THREADBAR - INTRODUCTION



PSA Threadbar system consists of 500 Grade fully left-hand threaded reinforcing bar and accessories compatible with the left-hand coarse thread. PSA Threadbar is engineered to create full strength connections in numerous applications of reinforced concrete structures. Most common applications of PSA Threadbar system are wall-wall connections wall-beam connections and wall-slab connections.

The system significantly increases the productivity and efficiency on site by reducing reinforcement congestion and by having compatible accessories that suit almost all applications.





FEATURES AND BENEFITS

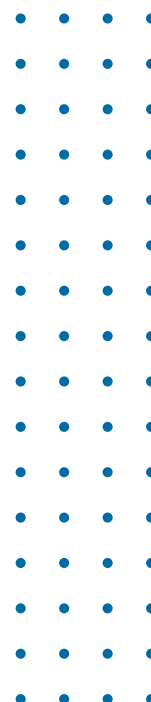
FEATURES

- + Conforms to relevant requirements of AS/NZS4671, AS3600 and AS3850.1
- + PSA Threadbar is certified by the Australasian Certification Authority for Reinforcing and Structural Steels Ltd (ACRS)
- + ISO 9001:2015 Accredited Mill Supply
- + ISO 14001:2015 Accredited Mill Supply
- + Approved by Transport and Main Roads (TMR)
- + System Diameters include 12mm, 16mm, 20mm, 25mm, 28mm, 32mm and 40mm (Contact PSA for larger sizes)
- + Grades include:
 - + 500/550 Grade (Left Hand thread)
 - + High Strength 670/800 Grade or 950/1050 Grade RH Thread (Not covered in this document, Contact PSA for more information)
- + Bars may be welded in accordance with AS/NZS 1554 part 3 and can be securely anchored.

BENEFITS

- + Fully threaded over its entire length, the PSA Threadbar can be cut at any point and connected with the corresponding PSA Threadbar Coupler or used with PSA Threadbar Inserts.
- + Coupler connection eliminates lap splicing and reduces reinforcement congestion.
- + Threadbar Insert connections eliminate the need for on-site bar re-bending and reduce associated risks.
- + The coarse thread provides an excellent bond to grout and is insensitive to grit damage.
- + There is no loss of strength, unlike cold cutting of threads.
- + The robust, coarse pitch thread ensures self-cleaning of the bar and fitting, simply assembled using hand screwing.
- + PSA Threadbar System is available in black steel finish or thermally diffused galvanized finish.

Note: Grade B500/B550 material manufactured by SAH to DIN 488-1 2009 – Reinforcing Steels - Part 1, has been assessed by ACRS against the requirements of AS/NZ 4671:2019 and is Approved as meeting the minimum requirements of AS/NZS 4671:2019 for Grade 500N, with the exceptions of product grade marking (as shown, below) and carbon equivalent (Ceq). This product is manufactured to a maximum Ceq from cast analysis of 0.49% (AS/NZS 4671:2019 = 0.44%, maximum). As such, some limited preheat may be required for bar diameters > 25mm in certain low energy input weld conditions. Refer AS/NZS 1554 Pt 3 for suitable guidelines.





PSA THREADBAR SYSTEM COMPONENTS

PSA THREADBAR

PSA Threadbar is a grade 500 Grade reinforcing bar with a unique left-hand coarse thread over its full length. Conforming to the requirements of AS/NZS 4671, it is also approved and certified by the Australasian Certification Authority for Reinforcing and Structural Steels Ltd (ACRS) for use in concrete structures.

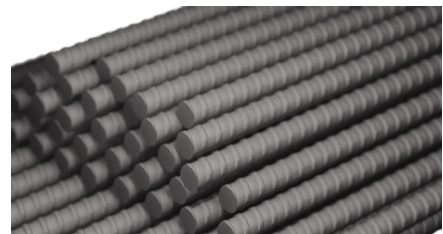
Fully threaded over its entire length, PSA Threadbar can be cut at any point and connected with the corresponding PSA Threadbar Coupler or used with PSA Threadbar Inserts. The unique left-hand thread eliminates the risk of being utilized with incompatible proprietary components. The coarse thread provides an excellent bond to grout and is insensitive to grit damage.

Significant efficiency increases can be achieved on-site as it can be simply assembled with components using hand screwing. While PSA Threadbar is available in standard starter bar lengths for diameters ranging from 12mm to 40mm, custom length bars can be supplied on request. Additionally, PSA offers bar processing services conforming to AS/NZS 4671 and AS 3600, enabling the supply of processed bars in any size or shape.

PSA THREADBAR PROPERTIES								
PART NO.	NOMINAL BAR DIAMETER	STEEL GRADE ULTIMATE	MIN. YIELD STRESS	MIN. ULTIMATE TENSILE STRENGTH	MIN. YIELD STRENGTH (TENSION)	MIN. SHEAR (.62MIN ULT)	CROSS-SECTION AREA	MASS
	(mm)	(MPa)	(MPa)	(kN)	(kN)	(kN)	(mm ²)	(kg/m)
PTB12	12	550	500	62.2	56.5	38.5	113	0.89
PTB16	16	550	500	110.6	100.5	68.5	201	1.58
PTB20	20	600	500	188.4	157	116.8	314	2.47
PTB25	25	550	500	270.1	245.5	167.4	491	3.85
PTB28	28	550	500	338.8	308	210.1	616	4.83
PTB32	32	550	500	442.2	402	274.2	804	6.31
PTB40	40	550	500	691.4	628.5	428.6	1257	9.86

Note: Modulus of Elasticity (E) for PSA Threadbar is $205 \times 10^3 \text{ N/mm}^2$ for all bar diameters.

PSA THREADBAR STARTER BARS				
PART NO.	NOMINAL BAR DIAMETER	LENGTH	MAX DIAMETER OVER THREADS	THREAD PITCH
	(mm)	(mm)	(mm)	(mm)
PSB12540	12	540	13	6
PSB16660	16	660	18	8
PSB20850	20	850	23	10
PSB251150	25	1150	28	12.5
PSB281280	28	1280	32	14
PSB321450	32	1450	36	16
PSB401800	40	1800	45	20



-  Contact PSA for custom bar lengths and shapes
-  All sizes of PSA Threadbar can be supplied in black and galvanized finish
-  Bar diameters 50mm and 63.5mm are available on request

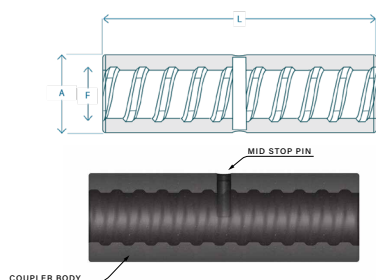


PSA THREADBAR COUPLERS

PSA offers a range of coupler sizes for the connection of two PSA Threadbars, assisting in eliminating splicing. These coupler connections are designed to achieve bar break, meaning they provide the full bar capacity through the coupler. A stop pin in the middle of the coupler ensures an equal screw-in length of both bars.

All PSA Threadbar coupler connections achieve 'bar break' failure in tension, as required by AS3600 Cl 13.2.6.

PSA THREADBAR COUPLER PROPERTIES						
PART NO. Standard Coupler	PART NO. No-Mid-Stop Coupler	DESCRIPTION	BODY LENGTH	BODY DIAMETER	NOMINAL THREAD	SUITS BAR
			L (mm)	A (mm)	F (mm)	
PTC12	PTC12-NMS	12mm PSA Threadbar Coupler	60	22	12	PTB12
PTC16	PTC16-NMS	16mm PSA Threadbar Coupler	90	32	16	PTB16
PTC20	PTC20-NMS	20mm PSA Threadbar Coupler	105	36	20	PTB20
PTC25	PTC25-NMS	25mm PSA Threadbar Coupler	115	40	25	PTB25
PTC28	PTC28-NMS	28mm PSA Threadbar Coupler	125	45	28	PTB28
PTC32	PTC32-NMS	32mm PSA Threadbar Coupler	140	52	32	PTB32
PTC40	PTC40-NMS	40mm PSA Threadbar Coupler	160	65	40	PTB40



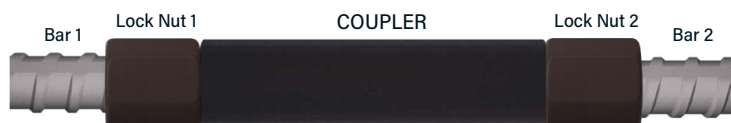
PSA THREADBAR COUPLERS - STANDARD CONNECTION

PSA Threadbar Coupler connection is a solution for achieving full-strength reinforcement bar joints in a wide range of applications. Its installation requires that at least one of the bars can be freely rotated to fully engage it into the coupler.



TYPE C CONNECTION

The Type C is intended for reinforcement bar applications in which neither bar can be freely rotated during installation. This condition typically occurs when Bar 1 is already cast-in and Bar 2 is bent or when large -diameter bars are used, making unrestricted rotation impractical due to their weight and geometry. PSA offers No-Mid-Stop couplers for type C connections to allow rotating the coupler all the way on the first bar. Two lock nuts are required per connection to ensure bars are firmly secured against the coupler. Please refer to the installation guide on page 8 for more details.



- •
- •

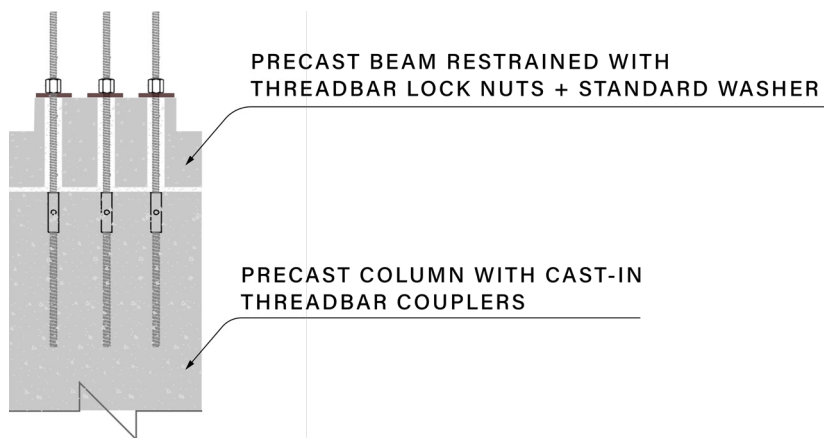
+ PSA THREADBAR LOCK NUTS

PSA Threadbar lock nuts can be used to reduce the slip of coupler connections. When PSA Threadbar couplers are used in conjunction with lock nuts, effective slip at a tensile stress of 300MPa will be less than 0.1mm, as required by AS3600 for applications where control of cracking or vertical deflection are relevant serviceability design criteria.



Typical coupler connection with lock nuts

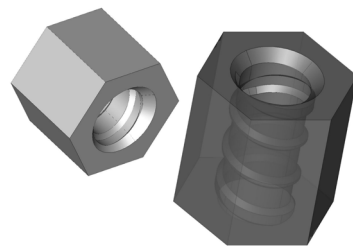
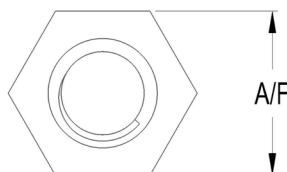
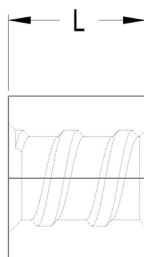
PSA Threadbar lock nuts can also be used to temporarily or permanently restrain precast elements.



Typical temporary restraint connection with lock nuts

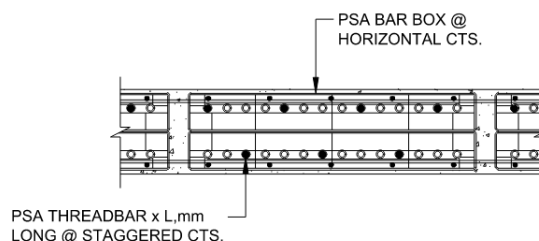
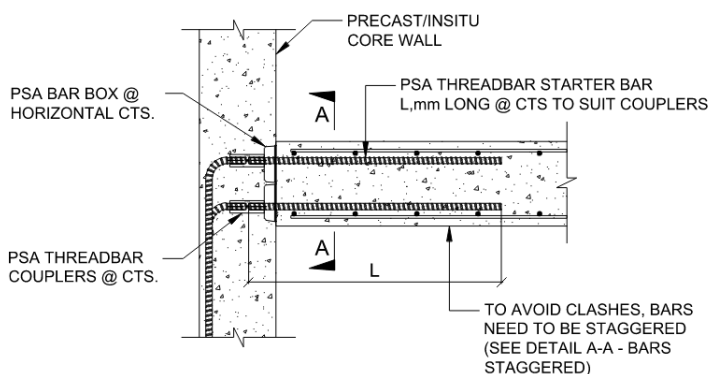
PSA THREADBAR LOCK NUTS: DIMENSIONS

PART NO.	DESCRIPTION	BODY LENGTH	ACROSS FLATS	SUITS BAR
		L (mm)	A/F (mm)	
TBLN16	16mm PSA Threadbar Lock Nut	30	32	PTB16
TBHN20	20mm PSA Threadbar Hex Nut	35	41	PTB20
TBHN25	25mm PSA Threadbar Hex Nut	41	46	PTB25
TBHN28	28mm PSA Threadbar Hex Nut	45	51	PTB28
TBHN32	32mm PSA Threadbar Hex Nut	54	61	PTB32
TBHN40	40mm PSA Threadbar Hex Nut	64	70	PTB40

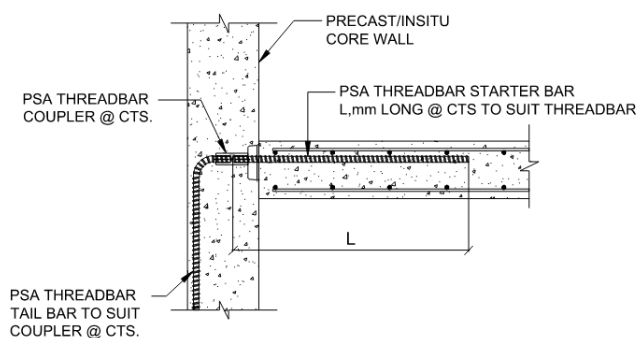
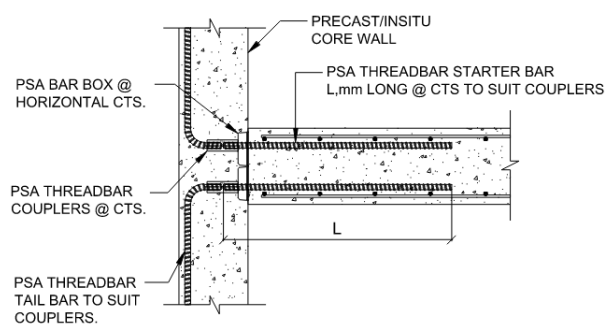
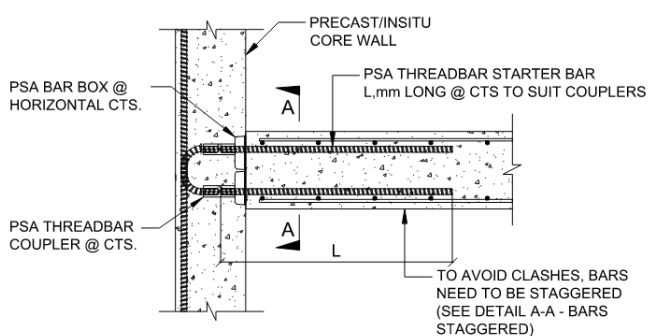


**PSA Threadbar Lock Nuts are rated to 90% of the bar's yield load. If full-strength nuts are required for your application, please reach out to PSA.*

PSA THREADBAR COUPLERS - TYPICAL APPLICATIONS



SECTION A-A
BARS STAGGERED



TYPICAL SLAB/WALL CONNECTION DETAIL
PSA THREADBAR COUPLER WITH PSA BAR BOX, 1 LAYER OF REINFORCEMENT

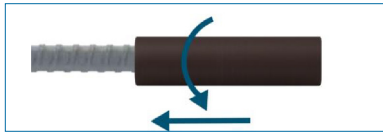
Please contact technical@psa.com.au to receive a full set of CAD details.



+ INSTALLATION

INSTALLATION OF A PSA THREADBAR COUPLER CONNECTION

PSA Threadbar Coupler connection is a solution for achieving full-strength reinforcement bar joints in a wide range of applications. Its installation requires that the second bar (Bar 2) can be freely rotated to fully engage it into the coupler.



STEP 1

If the first bar is not already supplied with a coupler installed, screw the coupler on the bar (Note the left-hand thread). Tighten by wrench to ensure the bar is firmly seated against the middle stop.

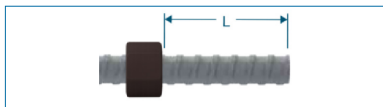


STEP 2

Screw the second bar into the coupler by rotating the bar (Note the left-hand thread). Tighten by wrench to ensure the bar is firmly seated against the middle stop.

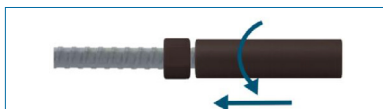
INSTALLATION OF A PSA THREADBAR COUPLER CONNECTION WITH LOCK NUTS

If specified by the design engineers, the Threadbar Coupler system can be installed using Lock nuts. The installation requires that the second bar (Bar 2) can be freely rotated to fully engage it into the coupler.



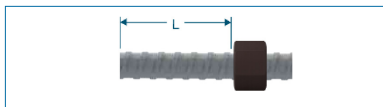
STEP 1

Screw the Lock nut on Bar 1 (Note the left-hand thread), ensure the projected length L is greater than the half of the coupler length, follow the product dimensions on page 5.



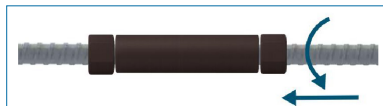
STEP 2

Screw the coupler on the bar (Note the left-hand thread). Tighten by wrench to ensure the bar is firmly seated against the middle stop.



STEP 3

Screw the Lock nut on Bar 2 (Note the left-hand thread), ensure the projected length L is greater than the half of the coupler length, follow the product dimensions on page 5.



STEP 4

Screw the second bar into the coupler by rotating the bar (Note the left-hand thread). Tighten by wrench to ensure the bar is firmly seated against the middle stop.

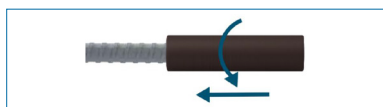


STEP 5

Tighten the lock nuts against the coupler on both sides using a wrench (Note the left-hand thread).

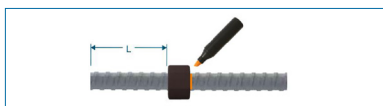
INSTALLATION OF A PSA TYPE C THREADBAR COUPLER CONNECTION

The system is intended for reinforcement bar applications in which neither bar can be freely rotated during installation. This condition typically occurs when Bar 1 is already cast-in and Bar 2 is bent or when large -diameter bars are used, making unrestricted rotation impractical due to their weight and geometry.



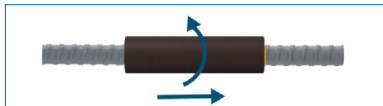
STEP 1

Screw the lock nut followed by the No-Mid-Stop Coupler onto bar 1 (Note the left-hand thread). The bar end should be flush with the open end of the coupler.



STEP 2

Screw the lock nut on Bar 2 (Note the left-hand thread), ensure the projected length L is equal to the half of the coupler length, follow the product dimensions on page 5. Mark the lock nut location.



STEP 3

Locate the second bar centrally against the open end of the coupler and rotate the coupler on the second bar (Note the left-hand thread), continue till the coupler is firmly secure against the lock nut on Bar 2. Ensure the lock nuts position by checking the mark on the bar.



STEP 4

Tighten both lock nuts against the coupler using a wrench (Note the left-hand thread).



PSA THREADBAR INSERTS

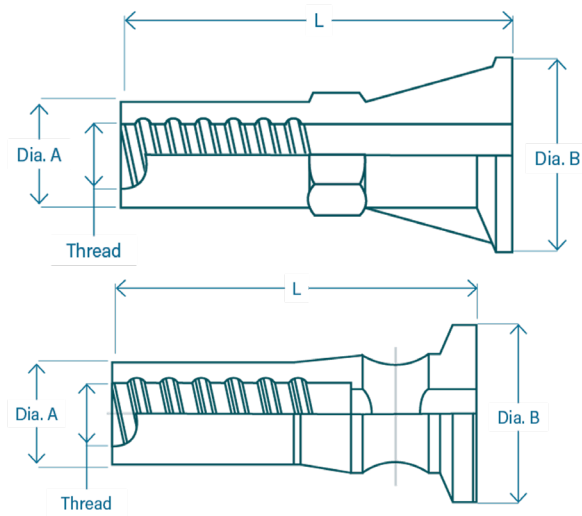
PSA Threadbar Inserts provide a simple, efficient, and effective solution for wall-slab connections in both precast and in-situ applications. This system eliminates the numerous inefficiencies and complications associated with traditional cogged or hooked bar wall-slab connections.

PSA Threadbar Inserts are designed to achieve a concrete pull-out capacity that exceeds the yield capacity of grade 500N reinforcing bar, resulting in a ductile failure mode as required by AS3600 – Cl 19.3.

FEATURES AND BENEFITS

-  PSA Threadbar Inserts are available for bar diameters: 12mm, 16mm, 20mm, 25mm, 28mm, and 32mm.
-  Easy installation to jump forms and other types of formwork, with three available installation options:
 -  Plastic locator plates
 -  Single-use plastic bar boxes (pre-assembled with Threadbar Inserts)
 -  Reusable polyurethane rebate boards
-  No drilling through formwork required.
-  Eliminate on-site bar re-bending and associated risks.
-  Coarse pitch thread allows for simple assembly by hand screwing.
-  All capacity data is based on recognized third-party testing and calculations according to AS3600, AS3850, and AS5216.

- •
- •



**Threadbar Insert
(PTIxx)**



**Threadbar Rebate
Insert (PTIxxR)**

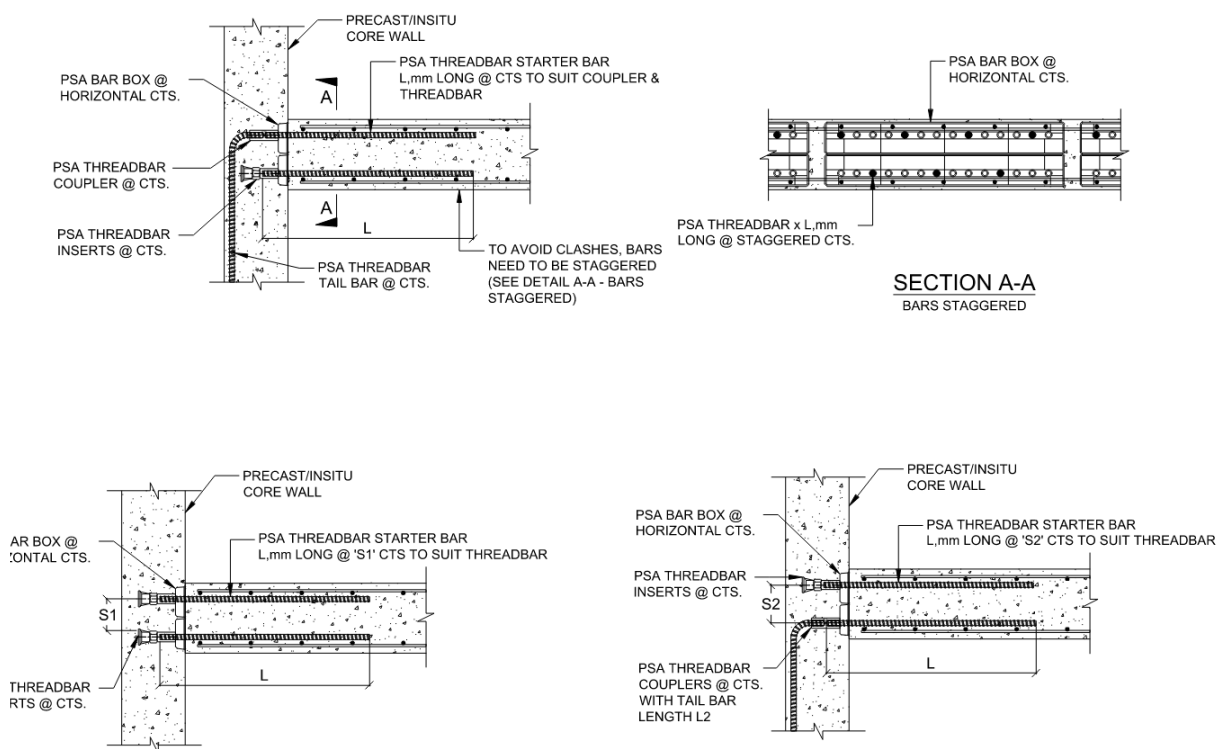
NOTE: PTI12R and PTI16R are designed to be used with at least a 30mm recess to achieve similar concrete resistance as standard 'PSA Threadbar Inserts' installed with nailing plates. It is recommended that the 'PSA Threadbar Inserts for Rebates' are installed with a N12 x 300mm long cross bar.

PSA THREADBAR INSERT RANGE

PART NO.	DESCRIPTION	THREAD (mm)	BODY LENGTH	BODY DIAMETER	FOOT DIAMETER	THREAD DEPTH	SUITS BAR
			L (mm)	A (mm)	B (mm)	(mm)	
PTI12R	12mm PSA Threadbar Insert for Rebates	12	78	22	39	50	PTB12
PTI12	12mm PSA Threadbar Insert	12	100	22	38	50	PTB12
PTI16R	16mm PSA Threadbar Insert for Rebates	16	96	30	51	54	PTB16
PTI16	16mm PSA Threadbar Insert	16	118	30	50	50	PTB16
PTI16L	16mm PSA Threadbar Insert - Long	16	160	30	50	50	PTB16
PTI20	20mm PSA Threadbar Insert	20	148	35	64	60	PTB20
PTI20L	20mm PSA Threadbar Insert - Long	20	190	35	64	60	PTB20
PTI25	25mm PSA Threadbar Insert	25	191	43	80	78	PTB25
PTI28	28mm PSA Threadbar Insert	28	200	46	96	85	PTB28
PTI32	32mm PSA Threadbar Insert	32	210	55	101	102	PTB32



PSA THREADBAR INSERTS - TYPICAL APPLICATIONS

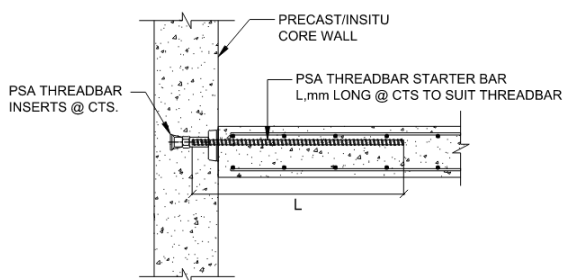


TYPICAL SLAB/WALL CONNECTION DETAIL

PSA PTI INSERT WITH PSA BAR BOX, 2 LAYERS OF REINFORCEMENT

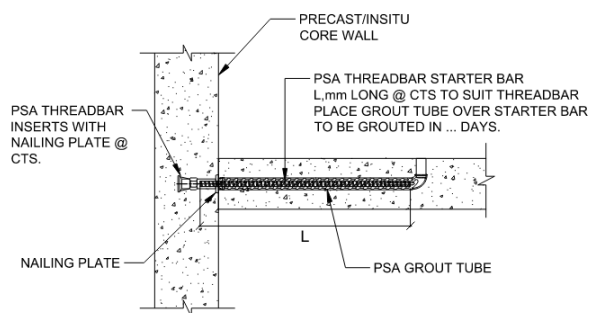
TYPICAL SLAB/WALL CONNECTION DETAIL

PSA PTI INSERT AND COUPLER WITH PSA BAR BOX, 2 LAYERS OF REINFORCEMENT



TYPICAL SLAB/WALL CONNECTION DETAIL

PSA PTI INSERT WITH PSA BAR BOX, 1 LAYER OF REINFORCEMENT



TYPICAL SLAB/WALL CONNECTION DETAIL FOR TEMPORARY MOVEMENT JOINT

PSA PTI INSERT WITH NAILING PLATE, 1 LAYER OF REINFORCEMENT

Please contact technical@psa.com.au to receive a full set of CAD details.

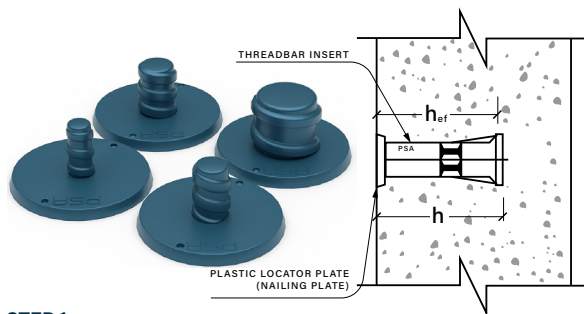
- •
- •

INSTALLATION OPTIONS

PSA offers three installation solutions for Threadbar Inserts to cater varying project requirements and site conditions. Each installation method has their unique advantages and limitations.

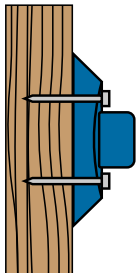
PLASTIC LOCATOR PLATES

Plastic locator plates(nailing plates) can be used to install singular or multiple Threadbar Inserts on to timber or steel formworks and recess formers.



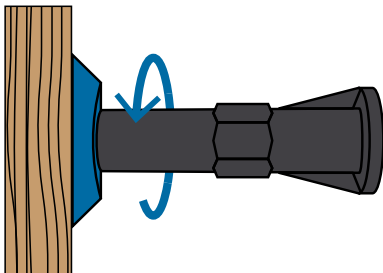
STEP 1

Install the nailing plates on to formwork using a nail at the center or two nails on the plate



STEP 2

Screw on the Threadbar Insert to the nailing plate firmly



STEP 3

Once the reinforcement and formworking is finished, carry out the concrete pour ensuring adequate compaction around Threadbar Inserts

STEP 4

Once formwork is stripped, hand screw the Threadbar into Threadbar Insert until the bar hits the bottom of the Insert

CRITICAL DIMENSIONS - 8mm RECESSED			
PART NO.	TOTAL EMBEDMENT DEPTH (h)	EFFECTIVE EMBEDMENT DEPTH (h _{ef})	MINIMUM PANEL THICKNESS
	(mm)	(mm)	
PTI12R *	Minimum 30mm recess required		
PTI12	108	101	150
PTI16R *	Minimum 30mm recess required		
PTI16	126	117	160
PTI16L	168	159	200
PTI20	156	146	190
PTI20L	198	188	230
PTI25	199	190	230
PTI28	208	199	240
PTI32	218	208	250

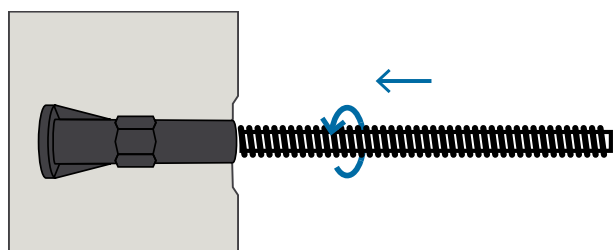
* PTI12R and PTI16R are designed to be used with at least a 30mm recess to achieve similar concrete resistance as standard 'PSA Threadbar Inserts' installed with nailing plates. It is recommended that the 'PSA Threadbar Inserts for Rebates' are installed with a N12 x 300mm long cross bar.

PSA THREADBAR LOCATOR PLATE - SCREW ON

PART NO.	PLATE THICKNESS	COMPATIBLE WITH
LTLP12	8mm	PTI12R, PTI12
LTLP16	8mm	PTI16R, PTI16, PTI16L
LTLP20	8mm	PTI20, PTI20L
LTLP25	8mm	PTI25
LTLP28	8mm	PTI28
LTLP32	8mm	PTI32

PSA THREADBAR LOCATOR PLATE - PUSH ON

PART NO.	PLATE THICKNESS	COMPATIBLE WITH
PLP12	5mm	PTI12R, PTI12
PLP16	5mm	PTI16R, PTI16, PTI16L





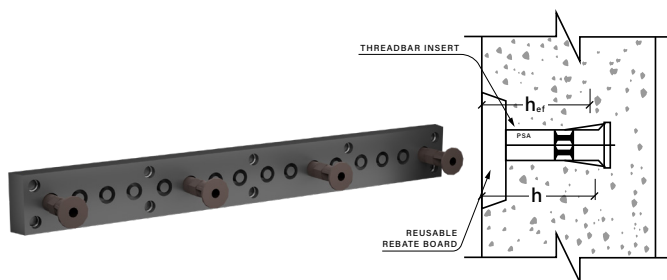
RE-USEABLE POLYURETHANE REBATE BOARDS

Reusable rebate boards are the ideal solution when using Threadbar Inserts for slab-wall connections in jump form systems. The rebate board features a series of slots to accommodate a single size of Threadbar Inserts at various spacing configurations. Threadbar Inserts can easily be pushed into these slots prior to the wall concrete pour.

Additionally, rebate boards are equipped with screw holes for installation onto formwork and M20 threaded bolt slots for jacking bolts used during stripping.

ADVANTAGES

- + Customisable to suit various sizes and arrangements
- + Re-usable for multiple levels and projects
- + Fast and easy installation onto rolling shutters/jump forms
- + Remains in jump form when each level is typical
- + No need for bending of bars unlike pull out box connections
- + Suitable for 12mm, 16mm and 20mm Threadbar Inserts



CRITICAL DIMENSIONS - 14mm RECESSED

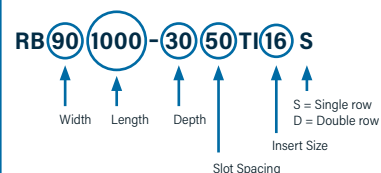
PART NO.	TOTAL EMBEDMENT DEPTH (h)	EFFECTIVE EMBEDMENT DEPTH (h_{eff})	MINIMUM PANEL THICKNESS
	(mm)	(mm)	(mm)
PTI12R *	Minimum 30mm recess required		
PTI12	114	107	150
PTI16R *	Minimum 30mm recess required		
PTI16	132	123	175
PTI16L	174	165	210
PTI20	162	152	200
PTI20L	204	194	240
PTI25	Not recommended		
PTI28	Not recommended		
PTI32	Not recommended		

* PTI12R and PTI16R are designed to be used with at least a 30mm recess to achieve similar concrete resistance as standard 'PSA Threadbar Inserts' installed with nailing plates. It is recommended that the 'PSA Threadbar Inserts for Rebates' are installed with a N12 x 300mm long cross bar.

ITEM NOMENCLATURE FOR PLACING ORDERS

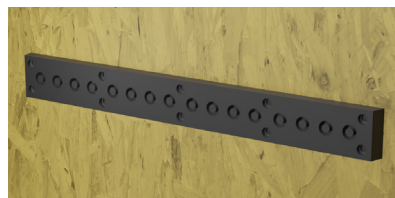
Ex: RB901000-3050TI16S

90 wide x 1000 long x 30 deep
Polyurethane Rebate Board – Slots
at 50mm Centres – To Suit PTI16 PSA
Threadbar Inserts



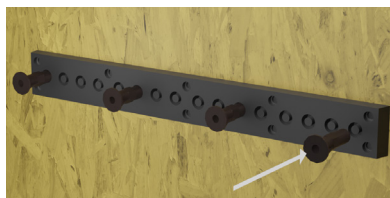
STEP 1

Install the rebate board on to the formwork with nails in pre-drilled holes. Use screws instead of nails, if rebate board needs to stay on the formwork when stripping.



STEP 2

Push the Threadbar inserts firmly into the slots in Rebate board at required spacings. Cover the un-used slots with tape or grease to prevent slurry getting in.



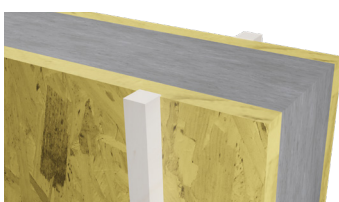
STEP 3

Install the wall reinforcement and ready formwork for concrete pour.



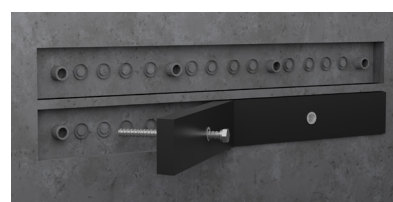
STEP 4

Complete concrete pour ensuring adequate compaction is done around the Threadbar inserts.



STEP 5

Strip the formwork and use M20 bolts in the provided slots to push the rebate board out. Rebate board will come out with the formwork if screws were used for fixing.



- •
- •

SINGLE-USE PLASTIC BAR BOXES(PRE-ASSEMBLED WITH THREADBAR INSERTS)

Single-use Bar Boxes pre-assembled with PSA Threadbar Inserts provide means to an efficient onsite installation.

Threadbar Inserts are assembled on to the bar boxes using disposable plastic bolts. Starter bars can be screwed into the Threadbar inserts once the bolts are taken out post-pour.

ADVANTAGES

- + Facilitates 30mm recess for slab connections
- + Plastic housing and cap prevents concrete slurry leakage
- + Delivered to site fully assembled and ready for installation
- + Fast and easy installation onto formwork or reinforcement cage
- + Fast and easy post pour stripping
- + Available in a wide range of insert sizes and spacings
- + No need for bending of bars unlike pull out box connections
- + In-expensive sacrificial boxes
- + PSA Bar Boxes can be cut and sealed where needed

CRITICAL DIMENSIONS - 30mm RECESSED

PART NO.	TOTAL EMBEDMENT DEPTH (h)	EFFECTIVE EMBEDMENT DEPTH (h_{ef})	MINIMUM PANEL THICKNESS
	(mm)	(mm)	(mm)
PTI12R *	108	101	150
PTI12	130	123	160
PTI16R *	126	117	160
PTI16	148	139	180
PTI16L	190	181	220
PTI20	178	168	210
PTI20L	220	210	250
PTI25	221	212	260
PTI28	230	221	260
PTI32	240	230	270

ITEM NOMENCLATURE FOR SPECIFICATION

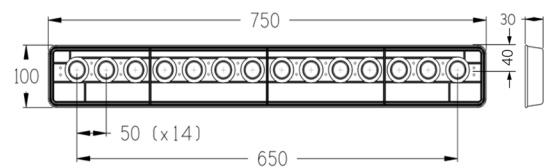
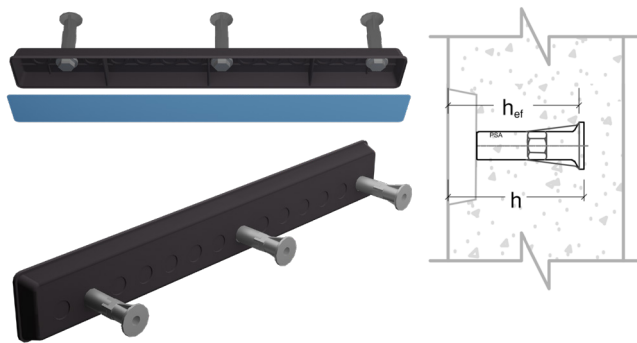
Ex: BB16TI3-300

Bar box with 3 x PTI16 assembled @300 spacing

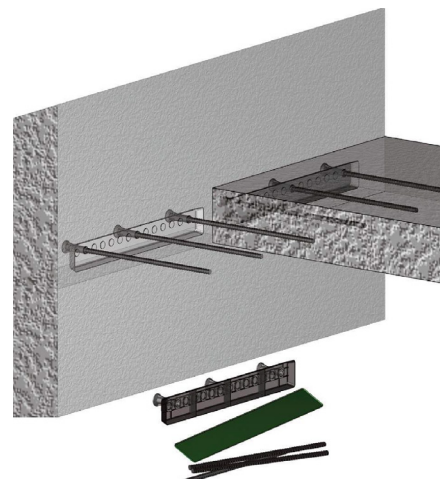
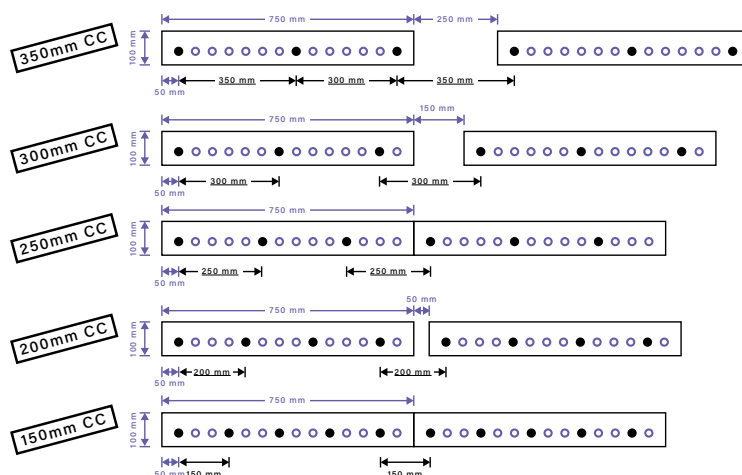
BB(16)TI(3)-300 ← Spacing

*Insert Size No. of Inserts in a single bar box

*Use R.L. after Insert size for Rebate and Long Insert versions



PSA BAR BOX INSTALLATION FOR DIFFERENT SPACING APPLICATIONS





PSA BAR BOX INSTALLATION GUIDE

STEP 1

Ensure the pre-assemble bar box matches the requirements on the drawings. Refer page 13 for more info on spacing arrangements. Install the pre-assembled bar box on to the formwork with nails.



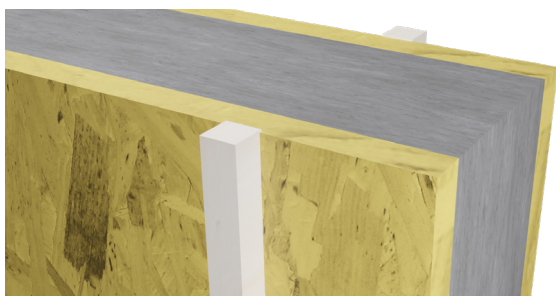
STEP 2

Install the wall reinforcement and ready formwork for concrete pour.



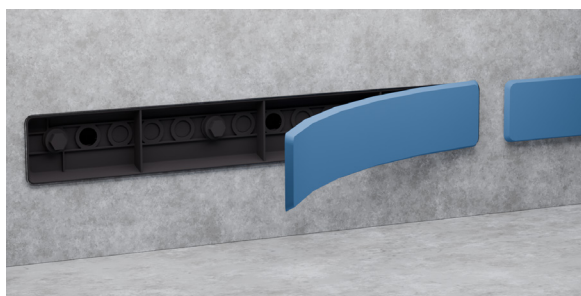
STEP 3

Complete concrete pour ensuring adequate compaction is done around the Threadbar inserts.



STEP 4

Strip the formwork and remove the box lid.



STEP 5

Remove the disposable HDPE bolts using a rattle gun and strip the box out.



STEP 6

Hand screw the starter bar in to the Threadbar Insert.



- •
- •

+ WALL-SLAB CONNECTIONS

CONNECTION DESIGN

Connections with PSA Threadbar Inserts need to be designed to conform AS3600 Clause 19.3.1

Above clause requires connections to yield prior to ultimate failure in the event of overload, thus achieving a ductile failure mode. Hence, all connections should satisfy below;

$$N^* \leq \phi_s N_s \leq \phi_c N_c$$

N^* = Tensile load

$\phi_s = 0.85$

N_s = Threadbar yield capacity

$\phi_c = 0.6$

N_c = Threadbar Insert concrete capacity

PSA in conjunction with Swinburne University of Technology, conducted pullout testing on PSA Threadbar Inserts to assess failure modes and determine the characteristic concrete tensile capacity of the Inserts. Through analysing the outcomes of the test program, it was concluded that the performance of the Threadbar Inserts aligned with the design methods outlined in AS3850.1 Appendix B and this methodology can be adopted to calculate modified capacities for various Insert arrangements.

DIRECT TENSILE CONNECTIONS

When headed inserts are subjected to direct tensile loads, concrete failure typically occurs in a cone type failure mode. AS3850.1 Appendix B provide guidelines to determine concrete capacities based on this failure mode. Concrete cone capacity of a headed insert heavily depend on the concrete compressive strength, effective embedment depth, edge distance and spacing restrictions. Extensive research have been conducted to establish the relationship of these factors with concrete cone capacity. Those relationships in combination with the tested capacities were used to determine capacities of PSA Threadbar Inserts in various Insert arrangements.

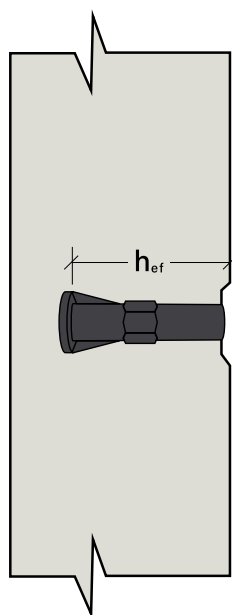
Refer to the design capacity tables in page 18 for capacities relating to various Insert arrangements. All concrete design capacities presented in this document includes a reduction factor $\phi_c = 0.6$ in accordance with AS3600 Clause 19.3.1, unless noted otherwise.

Concrete design capacities exceeding the yield capacity of reinforcement bar are highlighted in green in the design capacity tables. In applications where capacity of the connection is limited by the concrete design capacity, supplementary reinforcement is required to achieve a ductile connection.

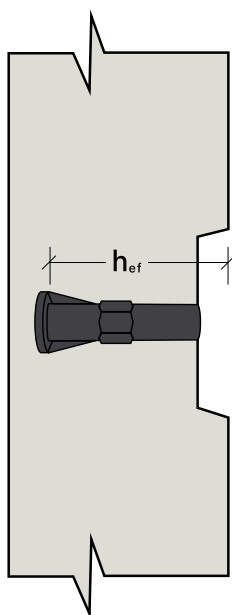
Refer to page 26 for supplementary reinforcement design.

All concrete capacities published in this document relate to concrete compressive strength of 40MPa. To calculate the design capacity values for other common concrete compressive strengths, multiply the relevant design capacity value by A_c factor given in the table below.

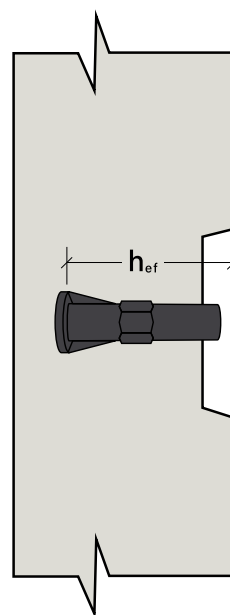
CONCRETE COMPRESSIVE STRENGTH EFFECT					
f'_c (MPa)	20	25	32	40	50
A_c	0.71	0.79	0.89	1	1.12



Direct tensile load on Threadbar Inserts installed with nailing plates



Direct tensile load on Threadbar Inserts installed with bar box



Direct tensile load on Threadbar Inserts installed with rebate boards





DIRECT TENSILE CONCRETE CAPACITY DATA

THREADBAR INSERTS INSTALLED WITH NAILING PLATE - 8MM RECESSED														
PART NO.	BAR DIA. (mm)	EFFECTIVE DEPTH (mm)	DESIGN TENSION CAPACITY BASED ON THE TEST RESULTS @ 40 MPA [KN]											
			ANCHOR SPACING C/C (mm)											
			150	200	250	300	350	400	450	500	550	600	650	700
PTI12	12	101	32.2	42.9	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
PTI16	16	117	34.7	46.3	57.8	69.4	81.0	81.3	81.3	81.3	81.3	81.3	81.3	81.3
PTI16L	16	159	49.6	66.2	82.7	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
PTI20	20	146	47.5	63.4	79.2	95.1	110.9	126.8	133.5	133.5	133.5	133.5	133.5	133.5
PTI20L	20	188	59.4	79.2	99.0	118.8	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
PTI25	25	190	59.7	79.6	99.5	119.4	139.3	159.2	179.1	199.0	208.6	208.6	208.6	208.6
PTI28	28	199	61.6	82.2	102.7	123.3	143.8	164.3	184.9	205.4	226.0	244.8	244.8	244.8
PTI32	32	208	65.2	87.0	108.7	130.5	152.2	174.0	195.7	217.4	239.2	260.9	271.0	271.0

THREADBAR INSERTS INSTALLED WITH REBATE BOARD- 14MM RECESSED														
PART NO.	BAR DIA. (mm)	EFFECTIVE DEPTH (mm)	DESIGN TENSION CAPACITY BASED ON THE TEST RESULTS @ 40 MPA [KN]											
			ANCHOR SPACING C/C (mm)											
			150	200	250	300	350	400	450	500	550	600	650	700
PTI12	12	107	33.1	44.2	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
PTI16	16	123	35.6	47.4	59.3	71.2	83.0	85.5	85.5	85.5	85.5	85.5	85.5	85.5
PTI16L	16	165	50.5	67.4	84.2	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
PTI20	20	152	48.5	64.7	80.8	97.0	113.2	129.3	133.5	133.5	133.5	133.5	133.5	133.5
PTI20L	20	194	60.3	80.4	100.5	120.7	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
PTI25	25	196	60.6	80.9	101.1	121.3	141.5	161.7	181.9	202.1	208.6	208.6	208.6	208.6
PTI28	28	205	62.6	83.4	104.3	125.1	146.0	166.8	187.7	208.5	229.4	250.2	256.0	256.0
PTI32	32	214	66.2	88.2	110.3	132.3	154.4	176.5	198.5	220.6	242.6	264.7	282.8	282.8

THREADBAR INSERTS INSTALLED WITH BAR BOX- 30MM RECESSED														
PART NO.	BAR DIA. (mm)	EFFECTIVE DEPTH (mm)	DESIGN TENSION CAPACITY BASED ON THE TEST RESULTS @ 40 MPA [KN]											
			ANCHOR SPACING C/C (mm)											
			150	200	250	300	350	400	450	500	550	600	650	700
PTI12R	12	101	32.2	42.9	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
PTI12	12	123	35.5	47.4	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
PTI16R	16	117	34.7	46.3	57.8	69.4	81.0	81.3	81.3	81.3	81.3	81.3	81.3	81.3
PTI16	16	139	37.8	50.4	63.0	75.6	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
PTI16L	16	181	52.9	70.6	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
PTI20	20	168	51.0	68.0	85.0	102.0	119.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5
PTI20L	20	210	62.8	83.7	104.6	125.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
PTI25	25	212	63.1	84.1	105.1	126.1	147.2	168.2	189.2	208.6	208.6	208.6	208.6	208.6
PTI28	28	221	65.0	86.6	108.3	129.9	151.6	173.2	194.9	216.5	238.2	259.8	261.7	261.7
PTI32	32	230	68.6	91.5	114.3	137.2	160.1	182.9	205.8	228.7	251.5	274.4	297.3	315.2

- + All published capacities are determined based on third party testing, guidelines in AS3600, AS3850.1 and AS5216
- + Displayed design values include material safety factor of 0.85 for Steel and 0.6 for concrete
- + Green background indicates ductile failure of the reinforcement bar
- + Minimum edge distance shall be 1.5 x Embedment depth of the Insert
- + All capacities are based on the assumption that concrete is un-cracked where the Inserts are embedded
- + Where bar yield cannot be achieved, supplementary reinforcement may provide close to Inserts to achieve ductile failure
- + The highlighted cell in red is used in the shear calculation example on page 25
- + For any other design conditions, contact PSA technical team, technical@psa.com.au.

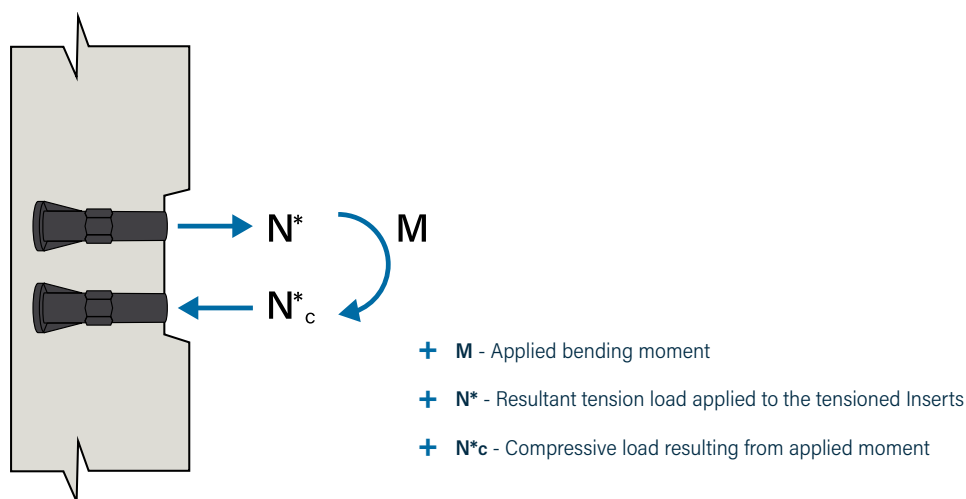
MOMENT CONNECTIONS

When PSA Threadbar Inserts are used for slab-wall moment connections, Insert subjected to tensile load resulting from the applied moment, could achieve an enhanced concrete cone capacity due to the adjacent compression load resulting from the moment.

Enhancement effect on concrete cone capacity can be quantified using the ψ_{MN} factor given in Clause 7.2.1.4(7) of EN1992-4 and Clause 6.2.3.7 of AS5216. Both standards provide similar instructions for calculating the enhancement effect and hence considered in the design capacities presented in pages 20 to 22 in this document.

Ensure below condition are met prior to adopting the moment connection design capacities of PSA Threadbar Inserts for design applications.

- + Edge distance to the Insert shall exceed $1.5 \times h_{ef}$
- + $N^*_c/N^* > 0.8$
- + Moment capacity of the wall shall be adequate to resist the applied bending moment
- + Concrete cover of slab main reinforcement is assumed to be 30mm. Contact PSA for applications with different concrete cover values.
- + Lever arm of the moment is assumed to be $0.85 \times$ Effective depth of the slab
- + All capacities are based on the assumption that concrete is un-cracked where the Inserts are embedded
- + Values highlighted in green exceed the corresponding reinforcing bar yield load
- + Capacity reduction factor(ϕ) of 0.6 included in all design capacity values



All concrete capacities published in this document relate to concrete compressive strength of 40MPa. To calculate the design capacity values for other common concrete compressive strengths, multiply the relevant design capacity value by A_c factor given in the table below.

CONCRETE COMPRESSIVE STRENGTH EFFECT						
f'_c (MPa)	20	25	32	40	50	
A_c	0.71	0.79	0.89	1	1.12	



THREADBAR INSERTS INSTALLED WITH NAILING PLATE - 8MM RECESSED													
SLAB THICKNESS (mm)	PART NO.	BAR DIA-METRE (mm)	EFFEC-TIVE DEPTH (mm)	DESIGN TENSION CAPACITY @40MPa [kN]									
				ANCHOR SPACING C/C (mm)									
				150	200	250	300	350	400	450	500	550	600
175	PTI12	12	101	39.2	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	117	46.4	61.9	77.3	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	159	75.0	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	146	70.2	93.5	116.9	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	188	94.6	126.1	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	190	95.8	1278	159.7	191.6	208.6	208.6	208.6	208.6	208.6	208.6
	PTI28	28	199	100.2	133.6	167.0	200.4	233.9	261.7	261.7	261.7	261.7	261.7
	PTI32	32	208	107.5	143.3	179.2	215.0	250.9	286.7	322.5	341.8	341.8	341.8
200	PTI12	12	101	34.7	46.2	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	117	42.2	56.3	70.3	84.4	85.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	159	70.6	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	146	65.5	87.4	109.2	131.1	133.5	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	188	90.1	120.2	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	190	91.4	121.8	152.3	182.7	208.6	208.6	208.6	208.6	208.6	208.6
	PTI28	28	199	95.8	1278	159.7	191.7	223.6	255.5	261.7	261.7	261.7	261.7
	PTI32	32	208	103.1	137.4	171.8	206.1	240.5	274.8	309.2	341.8	341.8	341.8
225	PTI12	12	101	32.2	42.9	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	117	38.0	50.7	63.3	76.0	85.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	159	66.2	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	146	60.9	81.2	101.6	121.9	133.5	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	188	85.7	114.2	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	190	86.9	115.9	144.9	173.8	202.8	208.6	208.6	208.6	208.6	208.6
	PTI28	28	199	91.4	121.9	152.4	182.9	213.3	243.8	261.7	261.7	261.7	261.7
	PTI32	32	208	98.6	131.5	164.4	197.2	230.1	263.0	295.8	328.7	341.8	341.8
250	PTI12	12	101	32.2	42.9	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	117	34.7	46.3	57.8	69.4	81.0	81.3	81.3	81.3	81.3	81.3
	PTI16L	16	159	61.8	82.4	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	146	56.3	75.1	93.9	112.6	131.4	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	188	81.2	108.2	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	190	82.5	109.9	137.4	164.9	192.4	208.6	208.6	208.6	208.6	208.6
	PTI28	28	199	87.0	116.0	145.1	174.1	203.1	232.1	261.1	261.7	261.7	261.7
	PTI32	32	208	94.2	125.5	156.9	188.3	219.7	251.1	282.5	313.9	341.8	341.8
275	PTI12	12	101	32.2	42.9	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	117	34.7	46.3	57.8	69.4	81.0	81.3	81.3	81.3	81.3	81.3
	PTI16L	16	159	57.4	76.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	146	51.7	68.9	86.2	103.4	120.7	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	188	76.7	102.3	127.9	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	190	78.0	104.0	130.0	156.0	182.0	208.0	208.6	208.6	208.6	208.6
	PTI28	28	199	82.6	110.2	137.7	165.3	192.8	220.4	247.9	261.7	261.7	261.7
	PTI32	32	208	89.7	119.6	149.5	179.4	209.3	239.2	269.1	299.0	328.9	341.8
300	PTI12	12	101	32.2	42.9	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	117	34.7	46.3	57.8	69.4	81.0	81.3	81.3	81.3	81.3	81.3
	PTI16L	16	159	52.9	70.6	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	146	47.5	63.4	79.2	95.1	110.9	126.8	133.5	133.5	133.5	133.5
	PTI20L	20	188	72.2	96.3	120.4	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	190	73.6	98.1	122.6	147.1	171.6	196.2	208.6	208.6	208.6	208.6
	PTI28	28	199	78.2	104.3	130.4	156.5	182.6	208.6	234.7	260.8	261.7	261.7
	PTI32	32	208	85.3	113.7	142.1	170.5	198.9	227.4	255.8	284.2	312.6	341.1

- + All published capacities are determined based on third party testing, guidelines in AS3600, AS3850.1 and AS5216
- + Displayed design values include material safety factor of 0.85 for Steel and 0.6 for concrete
- + Green background indicates ductile failure of the reinforcement bar
- + Minimum edge distance shall be 1.5 x Embedment depth of the Insert
- + All capacities are based on the assumption that concrete is un-cracked where the Inserts are embedded
- + Where bar yield cannot be achieved, supplementary reinforcement may provide close to Inserts to achieve ductile failure
- + The highlighted cell in red is used in the shear calculation example on page 25
- + For any other design conditions, contact PSA technical team, technical@psa.com.au.



THREADBAR INSERTS INSTALLED WITH REBATE BOARD - 14MM RECESSED

SLAB THICKNESS (mm)	PART NO.	BAR DIA-METRE (mm)	EFFECTIVE DEPTH (mm)	DESIGN TENSION CAPACITY @40MPa [kN]									
				ANCHOR SPACING C/C (mm)									
				150	200	250	300	350	400	450	500	550	600
175	PTI12	12	107	38.3	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	123	45.2	60.3	75.3	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	165	73.1	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	152	68.3	91.1	113.9	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	194	92.4	123.2	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	196	93.6	124.8	156.0	187.2	208.6	208.6	208.6	208.6	208.6	208.6
	PTI28	28	205	97.9	130.6	163.2	195.9	228.5	261.2	261.7	261.7	261.7	261.7
	PTI32	32	214	105.1	140.2	175.2	210.2	245.3	280.3	315.4	341.8	341.8	341.8
200	PTI12	12	107	34.3	45.7	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	123	41.4	55.2	69.0	82.8	85.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	165	69.0	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	152	64.1	85.4	106.8	128.2	133.5	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	194	88.2	117.6	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	196	89.4	119.2	149.0	178.8	208.6	208.6	208.6	208.6	208.6	208.6
	PTI28	28	205	93.8	125.1	156.3	187.6	218.9	250.1	261.7	261.7	261.7	261.7
	PTI32	32	214	100.9	134.6	168.2	201.8	235.5	269.1	302.7	336.4	341.8	341.8
225	PTI12	12	107	30.4	40.5	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	123	37.6	50.1	62.7	75.2	85.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	165	64.9	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	152	59.8	79.8	99.7	119.6	133.5	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	194	84.0	112.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	196	85.2	113.6	142.0	170.4	198.8	208.6	208.6	208.6	208.6	208.6
	PTI28	28	205	89.7	119.5	149.4	179.3	209.2	239.1	261.7	261.7	261.7	261.7
	PTI32	32	214	96.7	128.9	161.2	193.4	225.7	257.9	290.1	322.4	341.8	341.8
250	PTI12	12	107	30.4	40.5	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	123	33.8	45.1	56.3	67.6	78.9	83.2	83.2	83.2	83.2	83.2
	PTI16L	16	165	60.8	81.1	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	152	55.6	74.1	92.6	111.1	129.7	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	194	79.8	106.4	133.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	196	81.0	108.0	135.1	162.1	189.1	208.6	208.6	208.6	208.6	208.6
	PTI28	28	205	85.5	114.0	142.5	171.0	199.5	228.0	256.5	261.7	261.7	261.7
	PTI32	32	214	92.5	123.3	154.2	185.0	215.9	246.7	277.5	308.4	339.2	341.8
275	PTI12	12	107	30.4	40.5	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	123	33.0	44.0	55.0	66.0	77.0	81.3	81.3	81.3	81.3	81.3
	PTI16L	16	165	56.7	75.6	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	152	51.3	68.4	85.5	102.6	119.7	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	194	75.6	100.8	126.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	196	76.8	102.5	128.1	153.7	179.3	204.9	208.6	208.6	208.6	208.6
	PTI28	28	205	81.4	108.5	135.6	162.7	189.9	217.0	244.1	261.7	261.7	261.7
	PTI32	32	214	88.3	117.7	147.2	176.6	206.0	235.5	264.9	294.4	323.8	341.8
300	PTI12	12	107	30.4	40.5	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16	16	123	33.0	44.0	55.0	66.0	77.0	81.3	81.3	81.3	81.3	81.3
	PTI16L	16	165	52.6	70.2	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	152	47.1	62.7	78.4	94.1	109.8	125.5	133.5	133.5	133.5	133.5
	PTI20L	20	194	71.4	95.2	119.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	196	72.7	96.9	121.1	145.3	169.6	193.8	208.6	208.6	208.6	208.6
	PTI28	28	205	77.2	103.0	128.7	154.5	180.2	205.9	231.7	257.4	261.7	261.7
	PTI32	32	214	84.1	112.1	140.2	168.2	196.2	224.3	252.3	280.3	308.4	336.4

- + All published capacities are determined based on third party testing, guidelines in AS3600, AS3850.1 and AS5216
- + Displayed design values include material safety factor of 0.85 for Steel and 0.6 for concrete
- + Green background indicates ductile failure of the reinforcement bar
- + Minimum edge distance shall be 1.5 x Embedment depth of the Insert
- + All capacities are based on the assumption that concrete is un-cracked where the Inserts are embedded
- + Where bar yield cannot be achieved, supplementary reinforcement may provide close to Inserts to achieve ductile failure
- + For any other design conditions, contact PSA technical team, technical@psa.com.au.



THREADBAR INSERTS INSTALLED WITH BAR BOX - 30MM RECESSED													
SLAB THICKNESS (mm)	PART NO.	BAR DIA-METRE (mm)	EFFECTIVE DEPTH (mm)	DESIGN TENSION CAPACITY @40MPa [kN]									
				ANCHOR SPACING C/C (mm)									
				150	200	250	300	350	400	450	500	550	600
175	PTI12R	12	101	271	361	451	481	481	481	481	481	481	481
	PTI12	12	123	35.9	47.8	481	481	481	481	481	481	481	481
	PTI16R	16	117	34.0	45.3	56.6	67.9	79.2	79.5	79.5	79.5	79.5	79.5
	PTI16	16	139	42.1	56.2	70.2	84.2	85.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	181	68.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	168	63.8	85.1	106.3	127.6	133.5	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	210	87.0	116.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	212	88.1	117.4	146.8	176.1	205.5	208.6	208.6	208.6	208.6	208.6
	PTI28	28	221	92.3	123.1	153.8	184.6	215.4	246.1	261.7	261.7	261.7	261.7
200	PTI32	32	230	99.2	132.3	165.3	198.4	231.5	264.5	297.6	330.7	341.8	341.8
	PTI12R	12	101	23.9	31.9	39.9	47.9	481	481	481	481	481	481
	PTI12	12	123	32.8	43.8	481	481	481	481	481	481	481	481
	PTI16R	16	117	30.9	41.2	51.5	61.8	72.1	72.3	72.3	72.3	72.3	72.3
	PTI16	16	139	39.1	52.2	65.2	78.3	85.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	181	65.1	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	168	60.3	80.4	100.5	120.6	133.5	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	210	83.4	111.2	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	212	84.5	112.7	140.8	169.0	197.1	208.6	208.6	208.6	208.6	208.6
225	PTI28	28	221	88.7	118.3	147.9	177.5	207.0	236.6	261.7	261.7	261.7	261.7
	PTI32	32	230	95.6	127.4	159.3	191.1	223.0	254.8	286.7	318.5	341.8	341.8
	PTI12R	12	101	22.2	29.6	37.1	44.5	44.8	44.8	44.8	44.8	44.8	44.8
	PTI12	12	123	29.8	39.7	48.1	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16R	16	117	27.8	37.1	46.4	55.6	64.9	65.1	65.1	65.1	65.1	65.1
	PTI16	16	139	36.2	48.2	60.3	72.3	84.4	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	181	61.7	82.2	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	168	56.8	75.8	94.7	113.7	132.6	133.5	133.5	133.5	133.5	133.5
	PTI20L	20	210	79.8	106.4	133.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5
250	PTI25	25	212	80.9	107.9	134.9	161.8	188.8	208.6	208.6	208.6	208.6	208.6
	PTI28	28	221	85.2	113.6	142.0	170.3	198.7	227.1	255.5	261.7	261.7	261.7
	PTI32	32	230	91.9	122.6	153.2	183.9	214.5	245.1	275.8	306.4	337.1	341.8
	PTI12R	12	101	22.2	29.6	37.1	44.5	44.8	44.8	44.8	44.8	44.8	44.8
	PTI12	12	123	26.7	35.6	44.5	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16R	16	117	25.4	33.9	42.3	50.8	59.3	59.5	59.5	59.5	59.5	59.5
	PTI16	16	139	33.2	44.3	55.3	66.4	77.5	85.5	85.5	85.5	85.5	85.5
	PTI16L	16	181	58.3	77.7	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	168	53.4	71.1	88.9	106.7	124.5	133.5	133.5	133.5	133.5	133.5
275	PTI20L	20	210	76.2	101.6	127.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	212	77.3	103.1	128.9	154.7	180.5	206.2	208.6	208.6	208.6	208.6
	PTI28	28	221	81.6	108.8	136.0	163.2	190.4	217.6	244.8	261.7	261.7	261.7
	PTI32	32	230	88.3	117.7	147.1	176.6	206.0	235.4	264.9	294.3	323.7	341.8
	PTI12R	12	101	22.2	29.6	37.1	44.5	44.8	44.8	44.8	44.8	44.8	44.8
	PTI12	12	123	26.4	35.2	44.0	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16R	16	117	25.4	33.9	42.3	50.8	59.3	59.5	59.5	59.5	59.5	59.5
	PTI16	16	139	30.2	40.3	50.4	60.4	70.5	80.6	84.1	84.1	84.1	84.1
	PTI16L	16	181	54.9	73.1	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
300	PTI20	20	168	49.9	66.5	83.1	99.7	116.4	133.0	133.5	133.5	133.5	133.5
	PTI20L	20	210	72.6	96.8	121.0	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	212	73.8	98.4	122.9	147.5	172.1	196.7	208.6	208.6	208.6	208.6
	PTI28	28	221	78.0	104.1	130.1	156.1	182.1	208.1	234.1	260.1	261.7	261.7
	PTI32	32	230	84.6	112.9	141.1	169.3	197.5	225.7	253.9	282.2	310.4	338.6
	PTI12R	12	101	22.2	29.6	37.1	44.5	44.8	44.8	44.8	44.8	44.8	44.8
	PTI12	12	123	26.4	35.2	44.0	48.1	48.1	48.1	48.1	48.1	48.1	48.1
	PTI16R	16	117	25.4	33.9	42.3	50.8	59.3	59.5	59.5	59.5	59.5	59.5
	PTI16	16	139	29.2	39.0	48.7	58.4	68.2	77.9	81.3	81.3	81.3	81.3
300	PTI16L	16	181	51.4	68.6	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5
	PTI20	20	168	46.4	61.9	77.3	92.8	108.2	123.7	133.5	133.5	133.5	133.5
	PTI20L	20	210	69.0	92.0	115.1	133.5	133.5	133.5	133.5	133.5	133.5	133.5
	PTI25	25	212	70.2	93.6	117.0	140.4	163.8	187.2	208.6	208.6	208.6	208.6
	PTI28	28	221	74.5	99.3	124.1	149.0	173.8	198.6	223.4	248.3	261.7	261.7
	PTI32	32	230	81.0	108.0	135.0	162.0	189.0	216.0	243.0	270.0	297.0	324.0
	PTI32	32	230	81.0	108.0	135.0	162.0	189.0	216.0	243.0	270.0	297.0	324.0

- + All published capacities are determined based on third party testing, guidelines in AS3600, AS3850.1 and AS5216
- + Displayed design values include material safety factor of 0.85 for Steel and 0.6 for concrete
- + Green background indicates ductile failure of the reinforcement bar
- + Minimum edge distance shall be 1.5 x Embedment depth of the Insert

- + All capacities are based on the assumption that concrete is un-cracked where the Inserts are embedded
- + Where bar yield cannot be achieved, supplementary reinforcement may provide close to Inserts to achieve ductile failure
- + For any other design conditions, contact PSA technical team, technical@psa.com.au.



+ PSA THREADBAR INSERT SHEAR CAPACITY GUIDE

When designing wall-slab connections using PSA Threadbar Inserts under shear loading, it is essential to consider the following critical failure modes. The shear capacity of the joint shall be verified by the designer. Ignoring any contribution from shear keys or interface roughening, the design shear resistance of the connection shall be taken as the minimum of the following governing mechanisms*:

- + Concrete Pry-Out capacity, evaluated using the Concrete Capacity Design (CCD) method
- + Steel Shear Capacity of the Threadbar
- + Concrete Edge Capacity

CHECK 1: PRY-OUT CAPACITY

When there is no edge distance, the concrete shear capacity is always limited to the concrete pry-out capacity, calculated as follows,

$$\phi V_{u,cp} = k_{cp} \cdot \phi N_{u,c}$$

ϕ = Capacity reduction factor to concrete

$V_{u,cp}$ = Characteristic pry-out shear capacity

k_{cp} = Pry-out factor = 2 for $h_{ef} \geq 65\text{mm}$

$\phi N_{u,c}$ = Design concrete pull out capacity

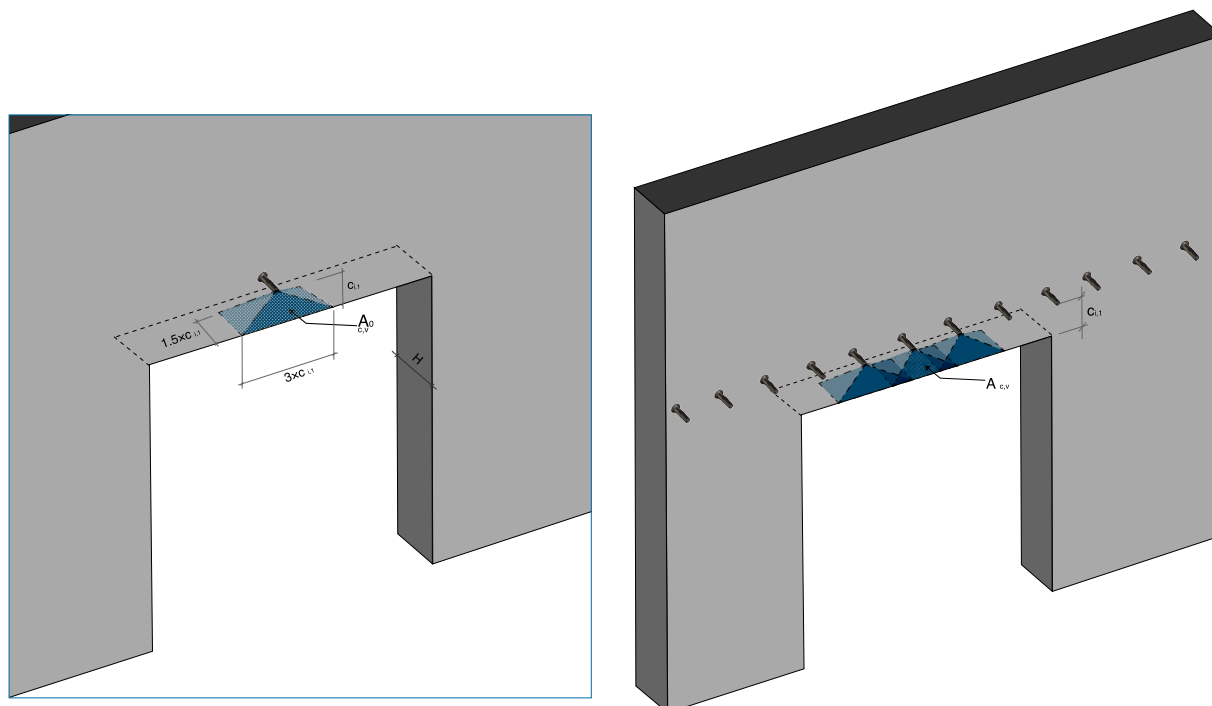
CHECK 2: STEEL SHEAR CAPACITY OF THE THREADBAR

The ultimate shear capacity of each Threadbar size is provided the PSA THREADBAR PROPERTIES table on page 4.

CHECK 3: CONCRETE EDGE BREAKOUT CAPACITY

In general applications, this is only applicable if there is an opening/edge close to the insert and in the direction of the applied load.

Normally this conditions occur if there is an opening under the slab to wall connection point.



-
-

In accordance with AS 3600 Clause 19.3.3, cast-in inserts may be designed using AS 3850.1 Appendix B (CCD method) as a recognised design approach.

The reduced characteristic shear resistance for a Threadbar Insert that does not include supplementary reinforcement shall correspond to the following:

$$\phi V_{uc} = \phi V_{u,c,\beta}^0 \frac{A_{c,v}}{A_{c,v}^0} \psi_{s,v} \psi_{h,v}$$

ϕ = Capacity reduction factor for concrete failure

V_{uc} = Characteristic shear capacity of a single Threadbar Insert including the effects from edge distance, spacing etc

$V_{u,c,\beta}^0$ = Unrestricted shear capacity of a single Threadbar Insert

$A_{c,v}$ = Actual area of concrete cone at the lateral concrete surface for shear failure

$A_{c,v}^0$ = Idealized area of concrete cone at the lateral concrete surface for shear failure

$\psi_{s,v}$ = Factor accounting for the disturbance of the distribution of stresses for shear failure

$\psi_{h,v}$ = Factor accounting for the effect of element thickness on shear failure

INSERT	REDUCED ULTIMATE SHEAR CAPACITY IN EDGE BREAKOUT FAILURE @40MPa - $\phi V_{u,c}^0$ (kN)						
	EDGE DISTANCE TOWARDS LOADING DIRECTION - $C_{i,1}$ (mm)						
	100	150	200	250	300	350	400
Part No.	100	150	200	250	300	350	400
PTI12	19.2	32.2	46.9	63.1	80.5	99.1	118.8
PTI16	21.1	34.9	50.3	67.3	85.5	104.9	125.4
PTI16L	22.7	37.2	53.4	71.0	89.8	109.9	131.1
PTI20	23.0	37.5	53.8	71.5	90.5	110.7	132.0
PTI20L	24.7	39.9	56.8	75.1	94.7	115.6	137.5
PTI25	26.0	41.7	59.1	77.9	98.0	119.3	141.7
PTI28	26.8	42.8	60.5	79.6	100.0	121.6	144.3
PTI32	28.4	45.0	63.2	82.9	103.9	126.1	149.4

- + All above capacities are determined based on guidelines in AS3850.1 Appendix B.
- + Capacity reduction factor(ϕ) of 0.6 included in all capacity figures
- + The concrete member thickness H is considered $1.5 \times c_{i,1}$ or above, for other conditions use AS3850.1 Appendix B guidelines
- + The edge distance measured perpendicular to the load direction ($c_{i,2}$) is considered greater than $1.5 \times c_{i,1}$
- + All capacities assume that concrete is un-cracked where the Inserts are embedded.
- + The highlighted cell in red is used in the shear calculation example on page 25

The table below shows the reduction in the edge break out capacity due to the inserts spacing.

EDGE DISTANCE $C_{i,1}$ (MM)	SPACING REDUCTION FACTOR FOR A GROUP OF INSERTS INSTALLED WITH BAR BOX						
	SPACING C/C (mm)						
	200	250	300	350	400	450	500
100	0.67	0.83	1.00	1.00	1.00	1.00	1.00
150	0.44	0.56	0.67	0.78	0.89	1.00	1.00
200	0.33	0.42	0.50	0.58	0.67	0.75	0.83
250	0.27	0.33	0.40	0.47	0.53	0.60	0.67
300	0.22	0.28	0.33	0.39	0.44	0.50	0.56
350	0.19	0.24	0.29	0.33	0.38	0.43	0.48
400	0.17	0.21	0.25	0.29	0.31	0.38	0.42

All concrete capacities published in this document relate to concrete compressive strength of 40MPa. To calculate the design capacity values for other common concrete compressive strengths, multiply the relevant design capacity value by A_c factor given in the table below.

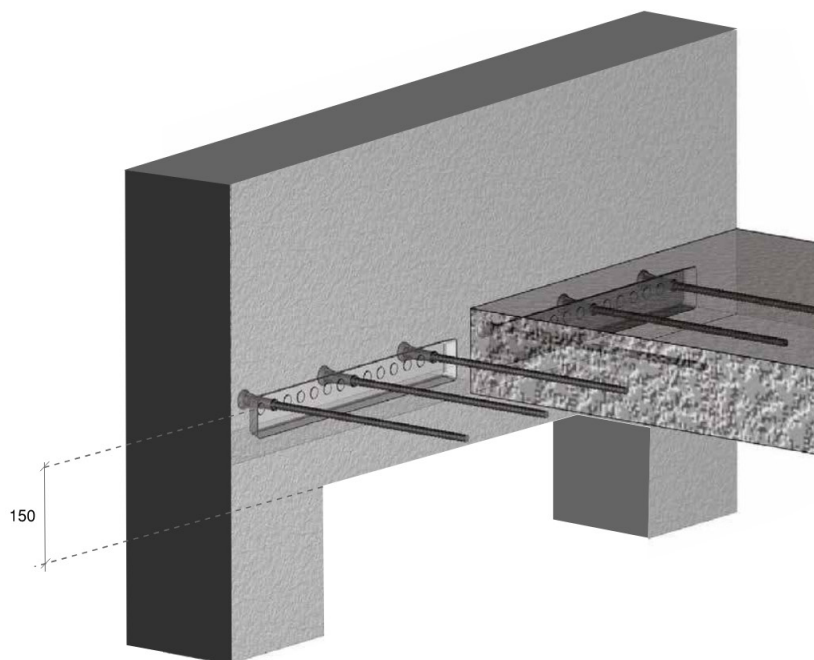
CONCRETE COMPRESSIVE STRENGTH EFFECT						
f'_c (MPa)	20	25	32	40	50	
A_c	0.71	0.79	0.89	1.00	1.12	

- + For any other design conditions, contact PSA technical team, technical@psa.com.au.

Design Example

One row of **BB16TI3-300*** is used to connect a slab to 300mm thick wall with 40MPa concrete. In some areas there are openings under the slab to wall connection line with 150mm edge distance as shown below.

*BB16TI3-350: BTI16 installed with Bar Box @300mm spacing - 3 BTI inserts per box



Shear capacity of the inserts in the areas with no opening:

In this case the concrete edge breakout is not considered as a possible failure mode. The only checks are as below,

Check 1: Pry-Out Capacity

$$\phi V_{ucp} = k_{cp} \cdot \phi N_{uc}$$

ϕN_{uc} : referring to the tensile capacity tables on page 18 = 75.6kN

$$\phi V_{ucp} = 2 \times 75.6 = 151.2 \text{ kN}$$

Check 2: Steel Shear Capacity of the Threadbar

Referring to the PSA THREADBAR PROPERTIES table on page 4, the ultimate shear capacity of PTB16 is 68.5kN.

$$\phi V_s = 0.8 \times 68.5 = \mathbf{54.8 \text{ kN}}$$

$$\phi V_s \text{ per metre} = 54.8 \times (1000/300) = 182.7 \text{ kN/m}$$

Therefore, the design capacity of anchors in shear where there is no opening under the slab is limited to the reinforcing bar shear capacity.

Shear capacity of the inserts in the areas with opening:

Referring to the capacity table on page 24, the design shear capacity of a single PTI16 with 150mm edge distance is 34.9kN.

The reduction factor for 150mm edge distance and 300mm spacing is 0.67, as per the table on page 24.

Therefore:

$$\phi V_{uc} = 0.67 \times 34.9 = 23.4$$

$$\phi V_{uc} \text{ per metre} = 23.4 \times (1000/300) = 78.0 \text{ kN/m}$$

- •
- •

SUPPLEMENTARY REINFORCEMENT DESIGN

This section provides general guidelines for designing supplementary reinforcement for PSA Threadbar Inserts. The recommendations below are provided for informational purposes only, and it is the responsibility of the design engineer to ensure compliance with relevant codes and standards for specific applications.

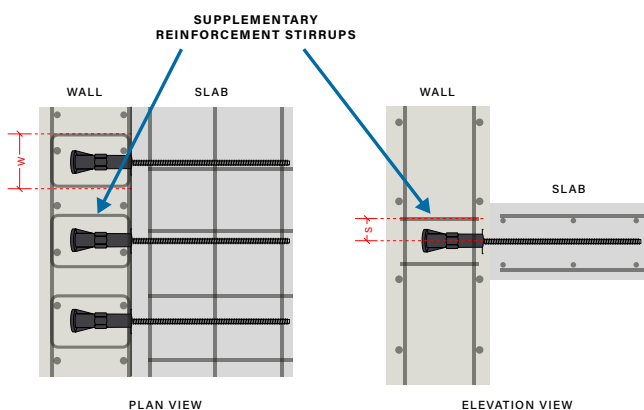
In accordance with AS 3600:2018, Clause 19.3.1(c), structural fixings must be designed to yield under overload conditions to prevent sudden or brittle failure. For structures that need to comply with seismic standards, Clause 14.4.2(b) specifies that connections must possess sufficient ductility and rotational capacity to avoid non-ductile failure under seismic loading conditions.

The design capacity values presented in the tables on pages 18, 20, 21 and 22 are applicable for slab-to-wall connection designs. It is crucial to note that only the configurations highlighted in 'Green' correspond to ductile failure modes. To meet ductility requirements, the provision of additional reinforcement around the Threadbar Inserts is strongly recommended.

AS 5216 - Design of Post-Installed and Cast-In Fastenings in Concrete provides guidance on detailing supplementary reinforcement around anchors. Key points from Section 5 are summarized below:

- When supplementary reinforcement is designed to resist the entire load applied to Threadbar Inserts, strength verification for concrete cone failure (tensile) and concrete edge failure (shear) is not required.
- Supplementary reinforcement can include straight bars, hooks, cogs, loops or surface reinforcement, and must be designed in accordance with AS 3600.
- Supplementary reinforcement must be deformed bar with a maximum diameter of 16mm.
- Strength verification is based on development length, with tensile stress not exceeding the yield strength of the bar.
- Reinforcement placement should be symmetrical around the Threadbar Insert, and reinforcement more than 0.75 times the effective embedment depth (h_{ef}) from the Insert is disregarded.
- If using hooks, cogs or loops for shear resistance, they must enclose or contact the Threadbar Insert shaft.
- Minimum anchorage length of supplementary reinforcement inside the concrete failure cone:
 - 4 x bar diameter for bends, hooks, or loops.
 - 10 x bar diameter for straight bars (with or without welded transverse bars).
- Outside the concrete failure cone, supplementary reinforcement must meet the development length (L_{st}) requirements of AS 3600.
- Surface reinforcement shall be provided to resist the forces determined from the strut-and-tie model.
- If supplementary reinforcement is not adequately lapped with reinforcement in the structural element, the tensile strength against concrete cone failure must consider the embedment length of the supplementary reinforcement outside the concrete failure cone.
- The supplementary reinforcement should enclose surface reinforcement where possible.

The following criteria should be considered when designing tensile supplementary reinforcement for PSA Threadbar Inserts, to satisfy point 5 and 7 above.



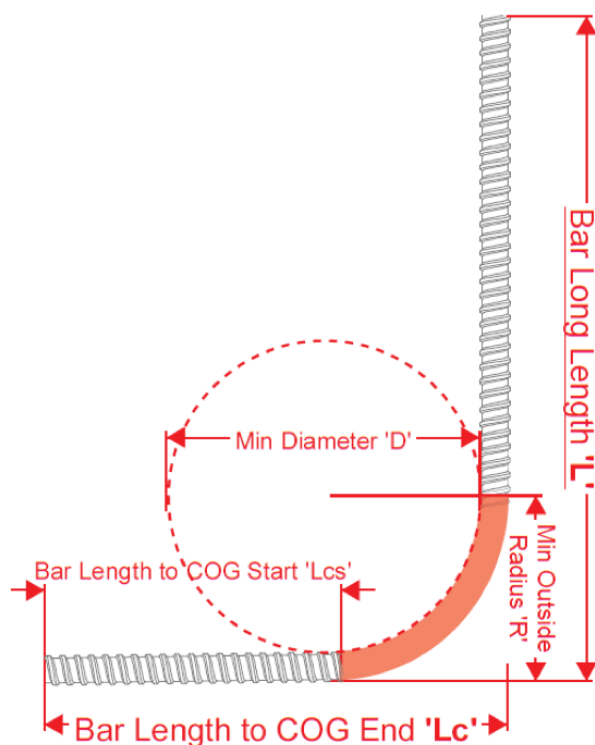
INSERT	MIN. STIRRUP DIA. (MM)	MIN. NO OF STIRRUPS	WIDTH OF STIRRUP (W)		OFFSET FROM INSERT (S)	
			MIN (mm)	MAX (mm)	MIN (mm)	MAX (mm)
PTI12R	10	2	80	140	40	70
PTI12	10	2	80	140	40	70
PTI16R	10	2	100	160	50	80
PTI16	10	2	100	160	50	80
PTI16L	10	2	100	220	50	110
PTI20	12	2	120	200	60	100
PTI20L	12	2	120	270	60	135
PTI25	16	2	140	270	70	135
PTI28	16	2	160	280	80	140
PTI32	16	2	170	300	85	150



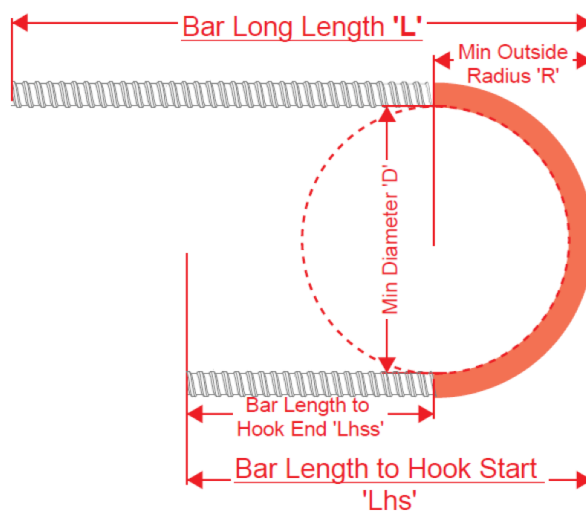
PSA THREADBAR PROCESSING

STANDARD BENDING GUIDE

90° BEND (COG)



180° BEND (HOOK)

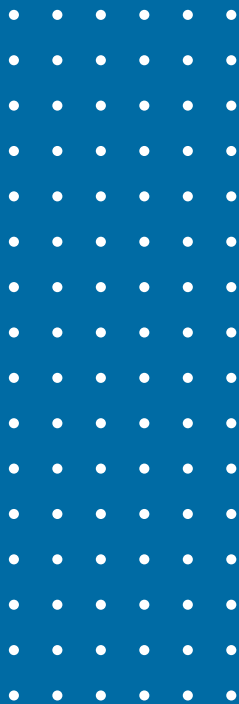


PSA THREADBAR STANDARD BENDING GUIDE

THREADBAR PART NO.	BAR SIZE (MM)	PIN DIAMETER D (MM)	OUTSIDE RADIUS R (MM)	900 BEND (COG)		1800 BEND (HOOK)	
				BAR LENGTH TO COG END (LC)	BAR LENGTH TO COG START (LCS)	BAR LENGTH TO HOOK END (LHS)	BAR LENGTH TO HOOK START (LHS)
				(MM)	(MM)	(MM)	(MM)
PTB12	12	60	42	170	128	115	70
PTB16	16	80	56	205	149	130	70
PTB20	20	100	70	245	175	150	80
PTB25	25	125	88	295	208	190	100
PTB28	28	140	98	345	247	210	112
PTB32	32	160	112	395	283	240	128
PTB40	40	200	140	490	350	300	160

NOTE

The above dimensions are the final physical dimensions. Cutting length need to consider bending processes and tolerances.
For coated or galvanised bars a larger pin diameter is used in accordance to AS 3600. Contact PSA for more info.



psa.com.au

MELBOURNE

PSA Victoria (Head Office)

T: (03) 9764 0031
E: vic@psa.com.au (General enquiries)
E: vic@psabracess.com.au (Brace hire)
1257 Ferntree Gully Rd, Scoresby VIC 3179

BRISBANE

PSA Queensland

T: (07) 3279 4555
E: qld@psa.com.au (General enquiries)
E: qld@psabracess.com.au (Brace hire)
136 Mica St, Carole Park QLD 4300

SYDNEY

PSA New South Wales

T: (02) 9756 2756
E: nsw@psa.com.au (General enquiries)
E: nsw@psabracess.com.au (Brace hire)
13-15 Penelope Cres, Arndell Park NSW 2148

PERTH

PSA Western Australia

T: (08) 9439 6405
E: wa@psa.com.au (General enquiries)
E: wa@psabracess.com.au (Brace hire)
9 Yeates Rd, Kwinana Beach WA 6167

TOWNSVILLE

PSA Queensland

T: 0408 339 836
E: qld@psa.com.au (General enquiries)
E: qld@psabracess.com.au (Brace hire)
27-31 Taryn Street, Mount St John QLD 4818

ADELAIDE

PSA South Australia

T: 0409 041 099
E: SA@psa.com.au (General enquiries)
E: SA@psabracess.com.au (Brace hire)
U1/17 Ceafield Rd, Para Hills West SA 5096

For technical questions please contact technical@psa.com.au



© Copyright 2026 Plastic Solutions Australia (PSA). All information contained in this document is provided in good faith and is accurate to the best of PSA's knowledge as of the date of publication. However, this information is subject to change without prior notice. The technical data, drawings, and recommendations provided herein are based on current knowledge and industry practices. PSA makes no representations or warranties, express or implied, regarding the suitability, accuracy, or completeness of the information for any specific application. It is the responsibility of appropriately qualified and competent professionals to assess the suitability of the information and interpret it accurately in the context of the specific project requirements and relevant local regulations. PSA shall not be liable for any direct, indirect, or consequential damages arising from the use or reliance on this information. PSA reserves the right to modify product designs, specifications, and details as part of its policy of continuous improvement and development.