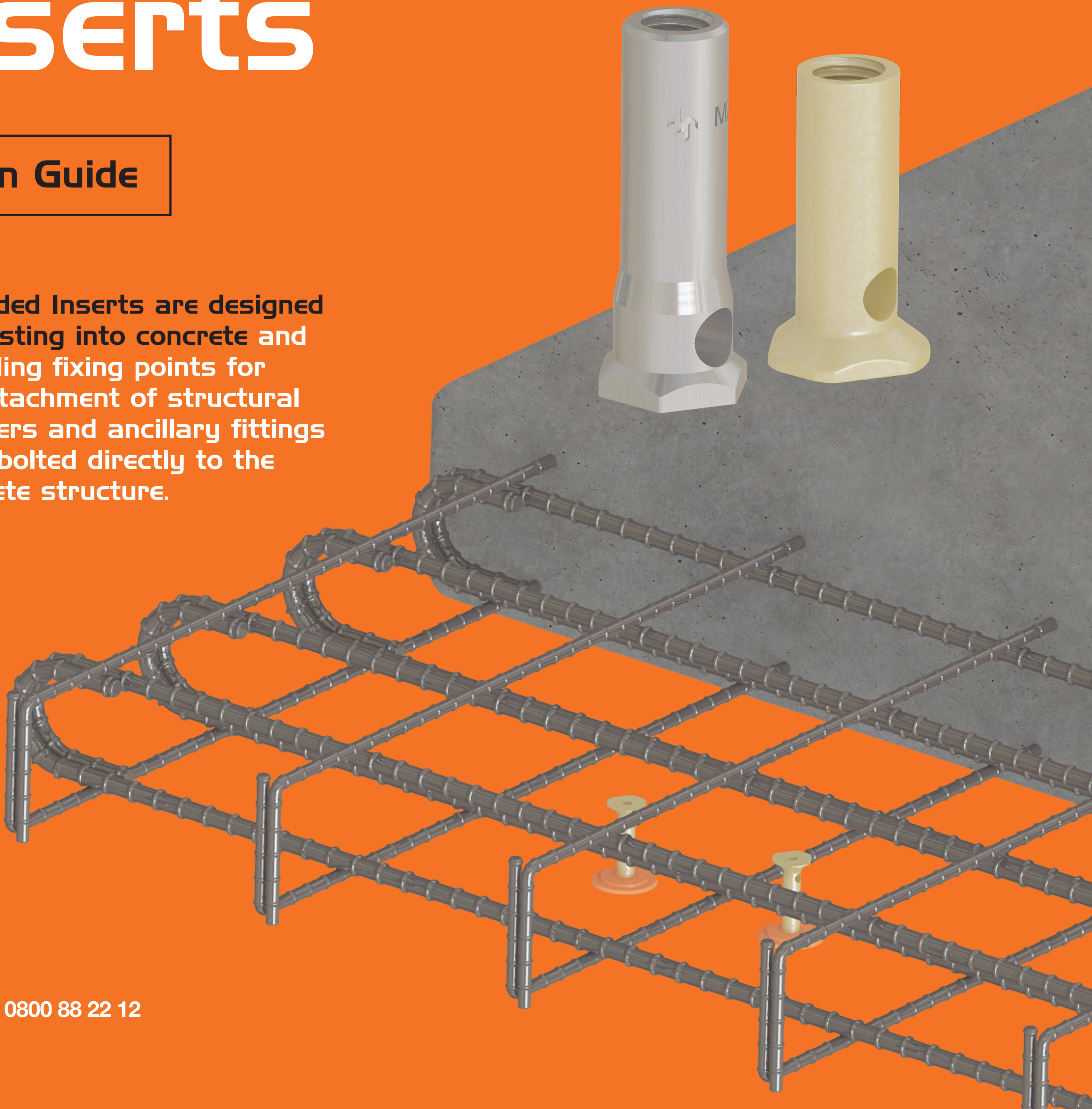
December | 2023 NZ

Metric Threaded Inserts

Design Guide

Threaded Inserts are designed for casting into concrete and providing fixing points for the attachment of structural members and ancillary fittings to be bolted directly to the concrete structure.



Welcome to reid™

Reid™ has been supplying quality engineered products to the New Zealand precast and construction industries for the last 25 years and we have built a position of market leadership in the supply of cast-in components to the concrete construction sector.

Reid™ introduced the revolutionary SwiftLift system, involving robust cast-in anchors and safe, quick release clutches. This unique system greatly increased safety and efficiency in the transportation and placement of large concrete components such as wall panels, stairs, beams and pipes. Reid innovation continued with the development of the ReidBar™ system - ReidBar™ Couplers, Grout Sleeves and Inserts that are used with ReidBar™ - continuously threaded Grade 500E reinforcing steel produced in Australia and New Zealand.

These products are now widely used to enable fast, easy and efficient reinforcement connections on major construction projects throughout all markets. Reid's ongoing commitment to innovation and investment in better products, systems and services was further strengthened when the business became a part of the global ITW Group in 2004. This gives Reid™ people access to significant technology and business resources worldwide, the benefits of which flow to our customers.In partnership with another ITW group member – Ramset, we can deliver lifting, connection, anchorage and fixing solutions for anything built from concrete.

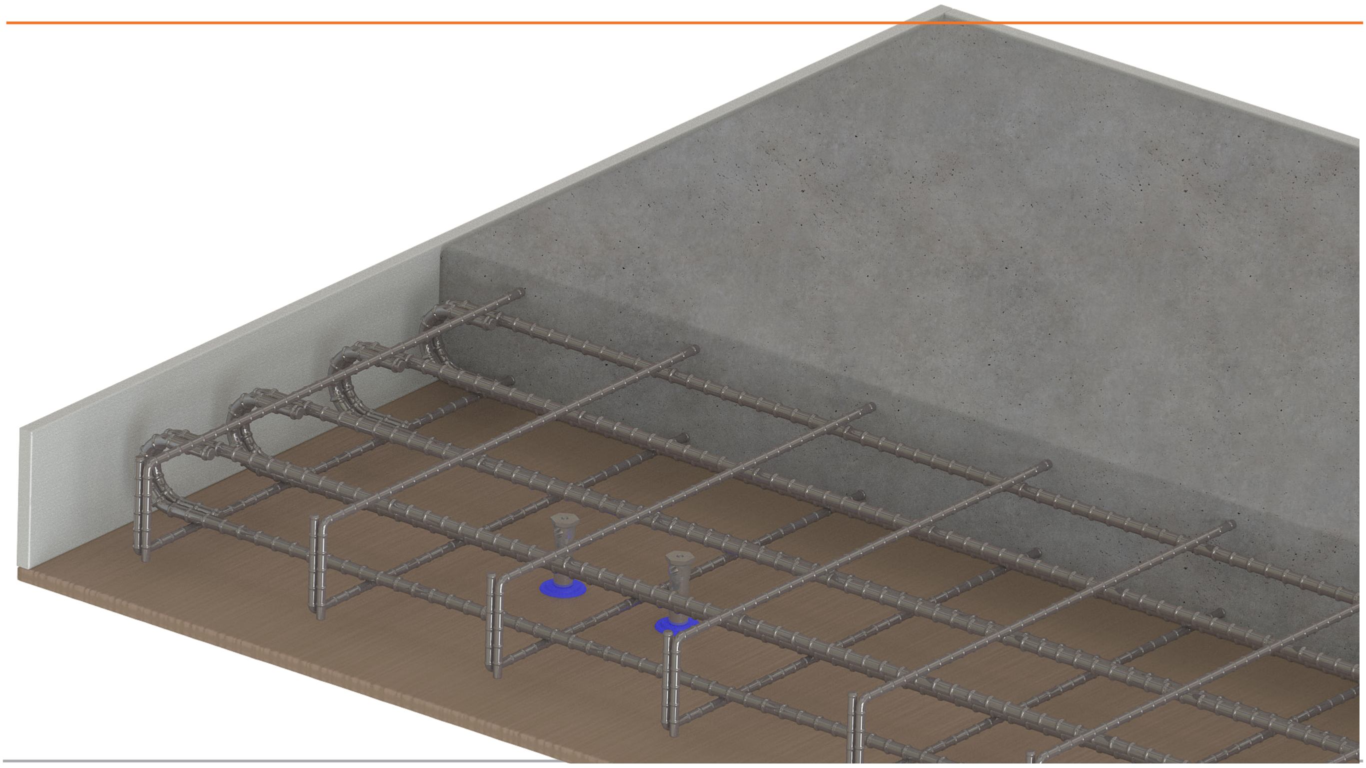
At Reid™, we aim to be much more than just a supplier of components to the concrete construction industry. We work in partnership with our customers in all facets of planning, preparation, design, engineering, forming, production, rigging, lifting, anchoring and bracing... all critical stages in the safe and efficient manufacture and placement of concrete elements.

Our products help handle the physical load, whilst our professional support services help lift the risk load – each Reid™ design comes backed by the strength of ITW and our absolute commitment to delivering your project faster, safer, more efficiently.This design guide is a practical demonstration of that commitment – we hope you find it useful.

Reid™ Provides:

- **Technical representation in all cities and regional areas**
- **Extensive technical data and support available**
- **Strict quality control systems**
- **Products designed in New Zealand to meet New Zealand Standards**
- **Products tested in New Zealand building materials**
- **Stand behind our product range and performance data**

Contents



1.1 Threaded Insert Overview

CHARTERED VERIFIED ENGINEER

Threaded Inserts are designed for casting into concrete and providing fixing points for the attachment of structural members and ancillary fittings to be bolted directly to the concrete structure. Reid supply a range of threaded inserts from M10 to M24 in zinc, hot dipped galvanised and 316 Stainless Steel finishes.

Pre-engineered products such as threaded inserts, require customised application / engineering to devise and deliver the best results for each project. Ultimately this produces value-added solutions for our customer's needs and inherently better engineering.

The following design information is intended to provide guidance to qualified structural engineers or other suitably skilled persons in the design of cast-in anchors and allows the designer to determine load carrying capacities based on actual application and installation conditions. With the aid of this guide, you have the option to design your cast-in solution independently, or you can easily seek the necessary support from our team of engineers or technical sales professionals. We're always here to help.

NZS 3101 Compliant

Did you know?

Extensive research, development and testing are invested in Reid™ products. This provides designers with the complete performance capabilities of the Reid range of Cast-In Metric Threaded Inserts.

The performance data contained in this Design Guide relates only to the Reid range of Cast-In Metric Threaded Inserts. Our superior steel grade and manufacturing tolerances are key factors in producing our excellent products.

Generic products may appear similar physically, but their actual performance is heavily influenced by the steel grade and manufacturing tolerances used.

TESTED TO LOCAL CONDITIONS

Using The Design Guide

1.2 Using The Design Guide

1.21 STRENGTH LIMIT STATE DESIGN

The Simplified Design Approach to achieve strength limit state design, originally first published by our sister company Ramset, has proven to be a simple and effective method to allow for rapid selection of a suitable anchor through systematic analysis, ensuring that it will meet the required design criteria under strength limit state principles.

1.22 DEVELOPING PULLOUT OF A CONCRETE CONE

The potential to develop a full pullout cone of concrete is assumed in determining the pullout capacity of an insert. Capacity is then modified for factors such as bolt steel strength, concrete strength, spacing to other inserts, or concrete edges that prevent full development of a concrete cone. Tables are provided in the Strength Limit State section of the design guide to calculate these reductions.

1.23 REINFORCEMENT

Reinforcement in the concrete around a threaded insert can affect the concrete pullout and shear capacity. Unless it is specifically designed to work with the insert and enhance its capacity in that situation, reinforcement should always be disregarded when assessing the capacity of the insert during design. For this reason, the design tables provide loadings for inserts in unreinforced concrete without the addition of a hanger bar.

1.24 FORMULAE

Reid traditionally have applied pullout formulae for threaded inserts that have been well established and proven to reliably predict concrete pullout based on the strength of the concrete, location of the insert and the embedment depth. For the new 2023 Design Guide however, we have modified our formula to be consistent in concept with the Concrete Capacity Design (CCD) approach of embedded anchor design that NZS3101 section 17 is modelled on. The CCD approach has its origins in pullout capacity being a function of the square root of the concrete strength whereas the previous Reid pullout formula used concrete strength to the power of two thirds. For the design of the concrete shear capacity we have used NZS3101 section 17 as the basis of design.

1.25 PREVIOUS DOCUMENTATION

The change in formula will supersede any previously published Threaded Insert information from Reid or Ramset. All prior information from Reid or Ramset should be discarded as it is out of date with the publication of this design guide.

1.26 FEEDBACK

We endeavour to provide an accurate and clear document. However, if the information is not clear, inaccurate or you feel that it is misleading, please do not hesitate to contact us to discuss your concerns. We welcome industry feedback.

TIMS Product Overview

Reid™ Metric Threaded Inserts (TIMS)

Reid™ Threaded Metric Inserts (TIMS) are cast into concrete to provide fixing points for attachments and structural members. The TIM is the original Reid design with a large foot at the base of the insert (see nominal dimensions).

All TIMS with the exception of the TIM20x120 have a hole through the shaft to accept a cross bar for situations where full pullout capacity of the TIM is required ie thin concrete sections or where the TIM is close to an edge.

Features and Benefits

Advantages

- Easy and simple to use
- Improved security and reliability for slip free anchorage
- No cross bar required to develop rated capacity
- Resists dynamic loading
- Plastic nail plates simplify installation and minimise fouling during the concrete pour

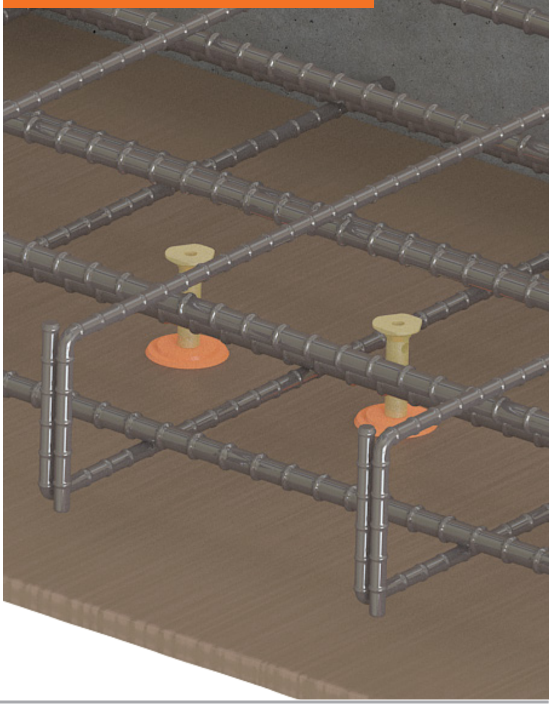
Versatile Applications

- Medium to heavy duty applications
- Use in near or far face applications with our range of accessories
- May be used with small rebar for fixing to mesh
- Used to provide Structural, building service & temporary connections.
- Curtain wall and panel facades
- Temporary precast panel bracing points

Finishes & Material

- High grade carbon steel
- Gold passivated zinc coating to AS1789:2003 recommended for internal applications
- Hot Dip Galvanised, recommended for external applications

Application Example



Performance Details (TIMS)

Reduced characteristic ultimate bolt shear capacity ϕV_{S2} (kN), $\phi = 0.8$

Bolt Size	Suitable Threaded Insert Product Code	Area of Root of thread (mm^2)	Shear, V_{s2} (kN) Steel Grade of Bolt	
			4.6	8.8
M10	**TIM10X40G**	52.3	9.8	20.0
M12	**TIM12X50G**	76.2	14.4	29.3
M16	**TIM16X75G**	144	27.4	56.1
M20	**TIM20X75G / TIM20X120G**	225	43.0	88.3
M24	**TIM24X100G**	324	62.0	127.2

Performance Details (TIMS)

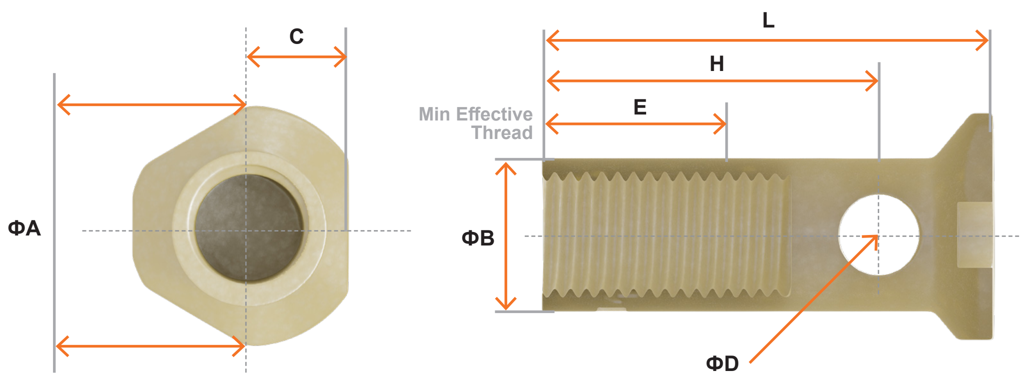
Site Installation and Performance Details Reid™ TIMS in Uncracked and Unreinforced Concrete

Bolt Size	Product Code	Installation Details			Optimum Dimensions*		Reduced characterisitc capacity						
		Cross hole Dia, [mm]	Tightening Torque, T [Nm]	Insert Length (L)	Edge Distance or half distance to another anchor e_c [mm]	Substrate Thickness b_m [mm]	Shear of Grade 8.8 Bolt (No edge Distance) ϕV_{s2} [kN]	Shear, ϕV_{uc}(kN)** towards edge based on optimum dimensions e_c and b_m			Tension, ϕN_{uc} [kN]**		
								Concrete Compressive Strength, f'c			Concrete Compressive Strength, f'c		
								20MPa	30MPa	40MPa	20MPa	30MPa	40MPa
M10	**TIM10X40G**	9	17	40	60	50	20.0	5.3	6.5	7.5	7.9	9.6	11.1
	*****with nail plate**							5.6	6.8	7.9	10.6	13.0	15.0
M12	**TIM12X50G**	9.5	30	50	75	65	29.3	8.0	9.8	11.3	11.4	13.9	16.1
	*****with nail plate**							8.2	10.1	11.7	14.4	17.6	20.3
M16	**TIM16X75G**	11.6	75	75	115	95	56.1	17.9	21.9	25.2	21.8	26.6	30.8
	*****with nail plate**							18.2	22.3	25.8	25.5	31.2	36.1
M20	**TIM20X75G**	15.5	144	75	115	95	88.3	19.1	23.4	27.0	21.3	26.0	30.1
	*****with nail plate**							19.1	23.4	27.0	25.0	30.6	35.4
M20	**TIM20X120G**	N/A	144	120	180	150	88.3	37.3	45.7	52.8	44.8	54.8	63.3
	*****with nail plate**							37.3	45.7	52.8	49.6	60.8	70.2
M24	**TIM24X100G**	20.5	250	100	150	125	127.2	28.4	34.8	40.2	33.6	41.2	47.6
	*****with nail plate**							28.4	34.8	40.2	38.0	46.5	53.7

* Where these minimum dimensions are not achievable, please use the simplified strength limit state design process to verify capacity
**For conversion to Working Load Limit (FOS = 3), MULTIPLY ϕN_{uc} x 0.51 for Tension
**For conversion to Working Load Limit (FOS = 3), MULTIPLY ϕV_{uc} x 0.51 for Shear towards edge
**For conversion to Working Load Limit (FOS = 2.5), MULTIPLY ϕV_{s2} x 0.50 for Shear of Gr 8.8 Bolt
*** Nail Plate set insert 8mm deeper into concrete

Nominal Dimensions (TIMS)

Product Codes and Nominal Dimensions Reid Threaded Insert (TIM)



Reid™ Metric Threaded Inserts - Nominal Dimensions (mm)

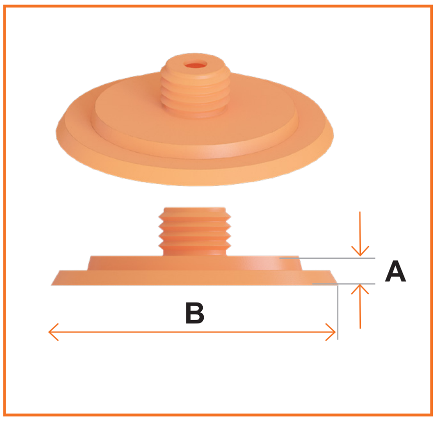
Metric Threaded Inserts	Insert Length, L [mm]	ΦA	ΦB	C	ΦD	E [min]	H	Thread / Pitch
TIM10X40G	40	25	16	10.6	9	14	25	M10x1.5P
***with nail plate**	48							
TIM12X50G	50	28	17	11	9	20	37	M12x1.75P
***with nail plate**	58							
TIM16X75 / TIM16X75G	75	39	22	16.6	11	35	55	M16x2P
***with nail plate**	83							
TIM20X75 / TIM20X75G	75	53	30	23.5	15.5	32	55	M20x2.5P
***with nail plate**	83							
TIM20X120G	120	50	30	N/A	N/A	35	N/A	M20x2.5P
***with nail plate**	128							
TIM24X100G	100	60	38	26	20	45	76	M24x3P
***with nail plate**	108							

* Nail Plate set insert 8mm deeper into concrete

Metric Threaded Insert Nailing Plates

Product Codes for Metric Nail Plates to suit Reid Threaded Inserts

Product Code	Description	Depth of Nail Plate (mm) (A)	Diameter of Nail Plate (mm) (B)
NP10	Metric Nail Plate M10	8mm	63mm
NP12	Metric Nail Plate M12	8mm	63mm
NP16	Metric Nail Plate M16	8mm	63mm
NP20	Metric Nail Plate M20	8mm	63mm
NP24	Metric Nail Plate M24	8mm	63mm



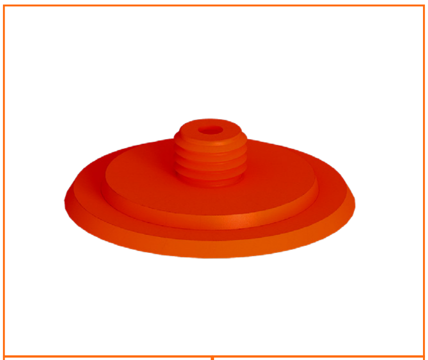
Metric Plastic Glue On Nail Plates

Glue on nailing plates are used to attach ferrules to steel formwork or casting beds, where screwing or drilling is not desired. Designed to be used with Reid Double Sided Spots, they have a recess on the bottom side that allows for easy removal after the panel has been lifted.

Product Code	To Suit	Pack Qty
GP12	M12	100
NP16GLUE	M16	100
GP20	M20	100
GP24	M24	100

Double Sided Spots to Suit:

Product Code	Diam Pack	Pack Qty
NPSPOT	58mm	100



Material Properties (TIMS)

Engineering Properties Reid™ Threaded Insert (TIMS)

Size	Product Code	Min.stress area of anchor, A_s (mm²)	Bearing area of head of insert, A_{brg}, (mm²)	Carbon Steel *	
				Yeild Strength f_y (MPa)	UTS, f_u (MPa)
M10	**TIM10X40G**	65.0	237.4	240	400
M12	**TIM12X50G**	81.4	247.5	240	400
M16	**TIM16X75G**	127.8	696.4	240	400
M20	**TIM20X75G**	263.4	1350.6	240	400
M20	**TIM20X120G**	263.4	1350.6	370**	600**
M24	**TIM24X100G**	410.8	1450.5	240	400

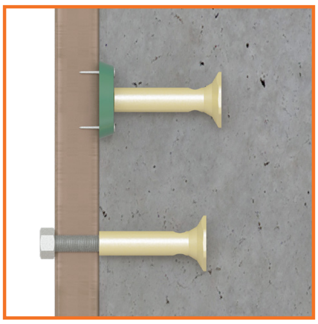
* Mechanical Properties of Carbon Steel for all sizes except TIM20x120.
** Mechanical Properties of TIMx120 is based on SG IRON QT 600-3.

Installation Instructions (TIMS)

- Either insert a positioning bolt through the mould wall or boxing and thread the insert onto the bolt until flush with the wall, or thread the insert onto a nail plate and fix this to the mould.
- If required, pass a rebar of the correct diameter and length through the cross-hole in the insert and tie to the reinforcement to prevent it moving during pouring and vibration of the concrete.
- When the concrete has cured, remove the bolt and mould. If a nailing plate has been used leave it screwed into the insert until immediately before use to help protect the internal thread.

Limitations

- Reid™ Threaded Inserts MUST NOT be used for lifting. Contact your local Reid™ Engineer or sales person for advice on lifting designs & products.
- Structural capacity is dependent upon the load capacity required, or the diameter of the fixing bolt selected.
- Remember the practical aspect: small diameter inserts are much more prone to fouling and thread damage than larger inserts. For most applications it is preferable to use inserts of M12 diameter or greater.



1. Nailing plate or bolted to formwork

2. Fixing to steel casting bed with glue-on nailing plate

3. “Puddled” into wet concrete

4. Templated onto face of panel

TCM Product Overview

Reid™ 316 Stainless Steel Metric Threaded Inserts (TCM)

The Reid™ Stainless Steel Metric Threaded Inserts (TCM) are manufactured from premium grade 316 Stainless Steel and suit medium to heavy duty structural applications. Noticably different from the TIMS, this threaded insert has an Elephant Foot™.

All TCMs have a hole through the shaft to accept a cross bar for situations where full pullout capacity of the TCMs is required. ie thin concrete sections or where the TCM is close to an edge.

Features and Benefits

Advantages

- Easy and simple to use
- Improved security and reliability for slip free anchorage
- No cross bar required to develop rated capacity
- Resists dynamic loading
- Plastic nail plates simplify installation and minimise fouling during the concrete pour

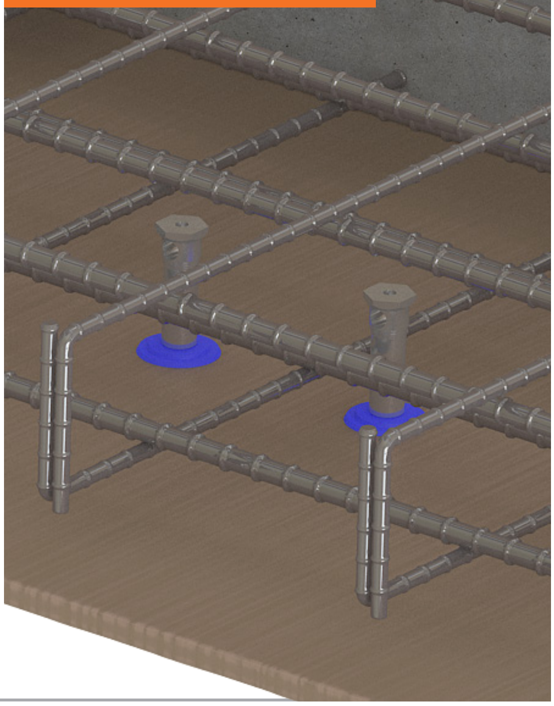
Versatile Applications

- Suitable for use in corrosive areas where durability is required such as salt spray zones
- Use in near or far face applications with our range of accessories
- May be used with small rebar for fixing to mesh
- Used to provide Structural, building service & temporary connections.
- Curtain wall and panel facades
- Temporary precast panel bracing points

Finishes

- AISI 316 Stainless Steel suitable for marine or corrosive environments

Application Example



Performance Details (TCM)

Reduced characteristic ultimate bolt shear capacity ϕV_{S2} (kN), $\phi = 0.8$

Bolt Size	Suitable Threaded Insert Product Code	Area of Root of thread (mm^2)	Shear, V_{s2} (kN)
			Steel Grade of Bolt
			AISI 316 Stainless Steel
M10	**FE10045SS**	52.3	16.8
M12	**FE12055SS**	76.2	24.7
M16	**FE16070SS**	144	47.4
M20	**FF20095SS**	225	74.5

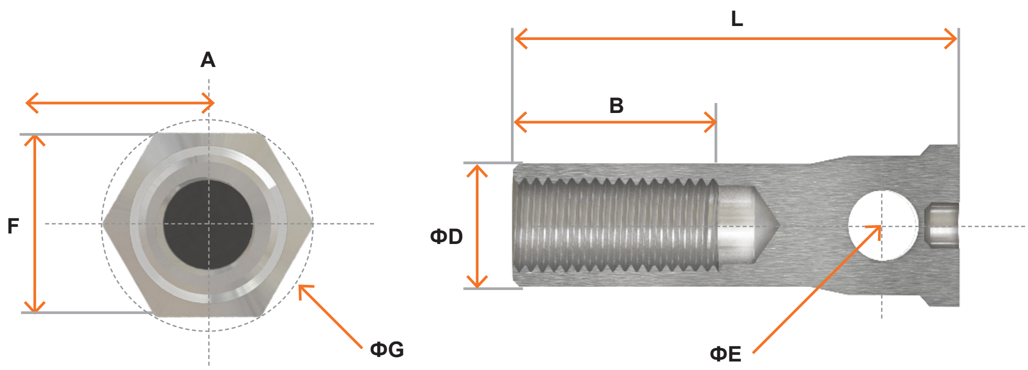
Site Installation and Performance Details
316 Stainless Steel FE in Uncracked and Unreinforced Concrete

Bolt Size	Product Code	Installation Details			Optimum Dimensions*		Reduced characterisitc capacity						
		Cross hole Dia, [mm]	Tightening Torque, T [Nm]	Insert Length (L)	Edge Distance or half distance to another anchor e_c [mm]	Substrate Thickness b_m [mm]	Shear For AISI 316 SS Bolt (No edge Distance) ϕV_{s2} [kN]	Shear, ϕV_{uc}(kN)** towards edge based on optimum dimensions e_c and b_m			Tension, ϕN_{uc} [kN]**		
								Concrete Compressive Strength, f'c			Concrete Compressive Strength, f'c		
								20MPa	30MPa	40MPa	20MPa	30MPa	40MPa
M10	**FE10045SS**	8.4	17	45	60	50	16.8	5.5	6.7	7.7	9.5	11.6	13.4
	*****with nail plate**							5.7	7.0	8.0	12.5	15.3	17.7
M12	**FE12055SS**	8.4	30	55	75	65	24.7	8.1	10.0	11.5	13.3	16.2	18.7
	*****with nail plate**							8.4	10.3	11.9	16.5	20.2	23.3
M16	**FE16070SS**	11	75	70	100	85	47.4	13.9	17.0	19.6	19.5	23.9	27.6
	*****with nail plate**							14.2	17.4	20.1	23.1	28.3	32.7
M20	**FE20095SS**	14.1	144	95	135	115	74.5	23.9	29.2	33.7	31.0	38.0	43.8
	*****with nail plate**							24.2	29.7	34.3	35.3	43.2	49.9

* Where these minimum dimensions are not achievable, please use the simplified strength limit state design process to verify capacity
**For conversion to Working Load Limit (FOS = 3), MULTIPLY ϕN_{uc} x 0.51 for Tension
**For conversion to Working Load Limit (FOS = 3), MULTIPLY ϕV_{uc} x 0.51 for Shear towards edge
**For conversion to Working Load Limit (FOS = 2.5), MULTIPLY ϕV_{s2} x 0.50 for Shear of AISI 316 SS Bolt
*** Nail Plate set insert 8mm deeper into concrete

Nominal Dimensions (TCM)

Product Codes and Nominal Dimensions Reid Threaded Insert (TCM)

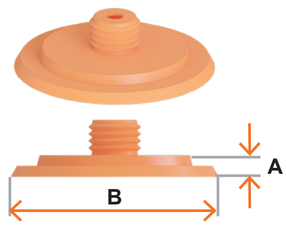


REID METRIC THREADED INSERTS - NOMINAL DIMENSIONS [mm]								
REID Metric Threaded Inserts	Insert Length, L [mm]	A	B	ΦD	ΦE	F	ΦG	Thread / Pitch
FE10045SS	45	M10	20	16	8.4	19.0-19.3	20.9	M10x1.5P
***with nail plate**	53							
FE12055SS	55	M12	25	17	8.4	22.0-22.3	24.4	M12x1.75P
***with nail plate**	63							
FE16070SS	70	M16	32	22	14.5	31.8	35.0	M16x2P
***with nail plate**	78							
FE20095SS	95	M20	38	26	14.5	34.5	37.0	M20x2.5P
***with nail plate**	103							

* Nail Plate set insert 8mm deeper into concrete

Product Codes for Metric Nail Plates to suit Reid Threaded Inserts

Product Codes	Description	Depth of Nail Plate (mm) (A)	Diameter of Nail Plate (mm) (B)
NP10	Metric Nail Plate M10	8	63
NP12	Metric Nail Plate M12	8	63
NP16	Metric Nail Plate M16	8	63
NP20	Metric Nail Plate M20	8	63
NP24	Metric Nail Plate M24	8	63



Note: 'Stick-on' nail plates available to suit most sizes. Refer to 'Metric Plastic Glue-On Nail Plate' table on Page 10 for further details.

Material Properties (TCM)

Engineering Properties Reid Threaded Insert (TCM)

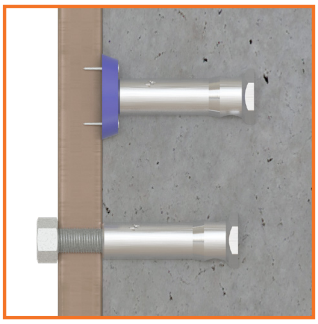
Bolt Size	Product Code	Min.stress area of anchor, A_s (mm^2)	AISI 316 Stainless Steel	
			Yield strength, f_y (MPa)	UTS, f_u (MPa)
M10	**FE10045SS**	71.3	450	700
M12	**FE12055SS**	88.3	450	700
M16	**FE16070SS**	158.0	450	600
M20	**FE20095SS**	242.0	450	600

Installation Instructions (TCM)

- Either insert a positioning bolt through the mould wall or boxing and thread the insert onto the bolt until flush with the wall, or thread the insert onto a nail plate and fix this to the mould.
- If required, pass a rebar of the correct diameter and length through the cross-hole in the insert and tie to the reinforcement to prevent it moving during pouring and vibration of the concrete.
- When the concrete has cured, remove the bolt and mould. If a nailing plate has been used leave it screwed into the insert until immediately before use to help protect the internal thread.

Limitations

- Reid Threaded Inserts MUST NOT be used for lifting. Contact your local Reid Engineer or sales person for advice on lifting designs & products.
- Structural capacity is dependent upon the load capacity required, or the diameter of the fixing bolt selected.
- Remember the practical aspect: small diameter inserts are much more prone to fouling and thread damage than larger inserts. For most applications it is preferable to use inserts of M12 diameter or greater.



1. Nailing plate or bolted to formwork

2. Fixing to steel casting bed with glue-on nailing plate

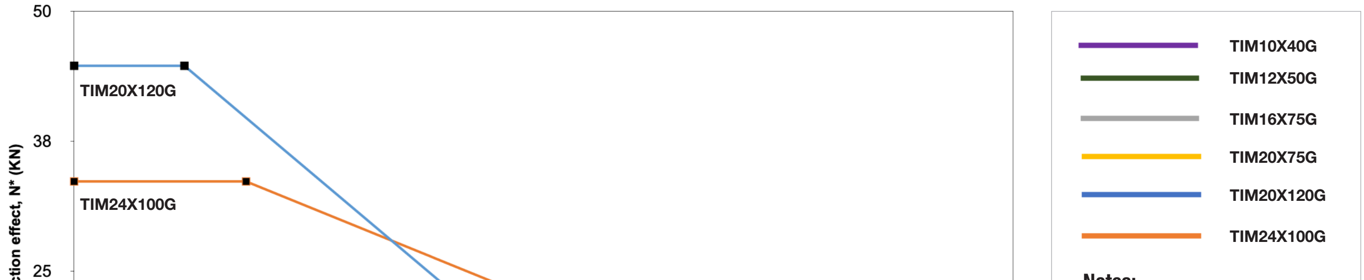
3. "Puddled" into wet concrete

4. Templated onto face of panel

Strength Limit State Design

Step I. Select Anchor to be Evaluated

Table 1A-1 Indicative combined loading with no edge or spacing effects, e_m (mm) (TIM)



Notes:

1. Tension limited by the lesser of steel capacity and concrete cone capacity. No edge ors spacing effects.
2. Shear limited by the TIM capcity
3. f_c = 20 MPa
4. Without Nail Plate

Table 1A-2 Indicative combined loading with no edge or spacing effects, e_m (mm) (TCM 316SS)

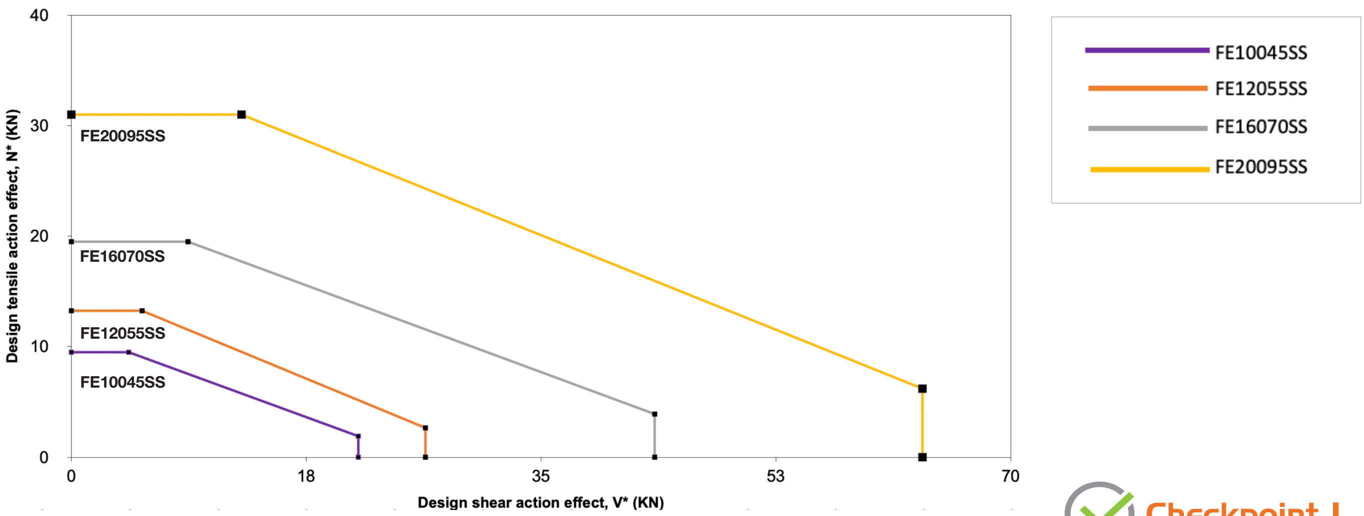


Table 1A Absolute minimum edge distance and half of anchor spacing values, e_m (mm)

Product Code	TIM10X40G FE10045SS	TIM12X50G FE12055SS	TIM16X75G FE16070SS	TIM20X75G FE20095SS	TIM20X120G	TIM24X100G
e_m, mm	30	36	48	60	85	72

Checkpoint I

Anchor Size, Absolute Minima Compliance Achieved

Step 2. Verify Concrete Tensile Capacity ϕN_{URC} (per anchor)

Table 2A Reduced characteristic ultimate concrete tensile capacity, ϕN_{uc} (kN), φ = 0.65, f'c = 20 MPa

Product Code	TIM10X40G	TIM12X50G	TIM16X75G	TIM20X75G	TIM20X120G	TIM24X100G
ϕN_{uc} [kN]	7.9	11.4	21.8	21.3	44.8	33.6
with nail plate	10.6	14.4	25.5	25.0	49.6	38.0

Product Code	FE10045SS	FE12055SS	FE16070SS	FE20095SS
ϕN_{uc} [kN]	9.5	13.3	19.5	31.0
with nail plate	12.5	16.5	23.1	35.3

Table 2B-1 Cracked concrete effect, tension, ψ_{ncr}

Product Code	TIM10X40G	TIM12X50G	TIM16X75G	TIM20X75G	TIM20X120G	TIM24X100G
ψ_{ncr}	0.8					

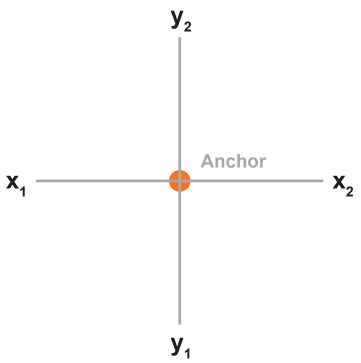
Product Code	FE10045SS	FE12055SS	FE16070SS	FE20095SS
ψ_{ncr}	0.8			

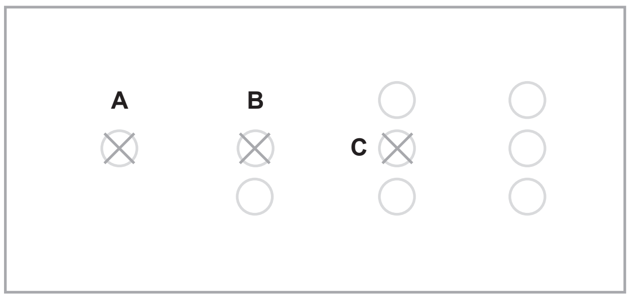
Table 2B-1 Note: For Non-cracked concrete ψ_{ncr} = 1.0

Table 2B-2 Concrete compresive strength effect, tension, ψ_{nc}

f'c [MPa]	15	20	25	30	40	50
ψ_{nc}	0.87	1	1.12	1.22	1.41	1.58

Diagram 2 Edge and spacing effect, tension, $x = \phi x_1 * \phi x_2 * \phi y_1 * \phi y_2 *$





Apply edge and spacing reduction factors as appropriate to the anchor location

Examples

Anchor →	A		B		C	
Factor	Type	Table	Type	Table	Type	Table
ϕx_1	Edge	2c	Spacing	2d	Spacing	2d
ϕx_2	Spacing	2d	Spacing	2d	Spacing	2d
ϕy_1	Edge	2c	Spacing	2d	Spacing	2d
ϕy_2	Edge	2c	Edge	2c	Spacing	2d

If edge distance to anchor greater than 1.5 times effective depth then reduction factor = 1.0.
If anchor spacing greater than 3 times efective depth then reduction factor = 1.0.

Table 2C Edge distance reduction factor ϕ_{ex} and ϕ_{ey}

Product Code	Anchor Edge Distance, e (mm)									
	30	40	50	60	70	85	100	125	150	>200
TIM10X40G *with nail plate	0.74 0.69	0.84 0.77	0.95 0.85	1.00 0.94	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
TIM12X50G *with nail plate		0.75 0.71	0.83 0.77	0.92 0.84	1.00 0.91	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
TIM16X75G *with nail plate			0.70 0.67	0.74 0.72	0.79 0.76	0.87 0.83	0.96 0.90	1.00 1.00	1.00 1.00	1.00 1.00
TIM20X75G *with nail plate			0.70 0.68	0.75 0.72	0.80 0.76	0.88 0.83	0.97 0.91	1.00 1.00	1.00 1.00	1.00 1.00
TIM20X120G *with nail plate						0.71 0.69	0.75 0.73	0.83 0.81	0.92 0.88	1.00 1.00
TIM24X100G *with nail plate					0.71 0.69	0.76 0.74	0.82 0.79	0.92 0.88	1.00 0.98	1.00 1.00
316 Stainless Steel Inserts (TCM)										
FE100145SS *with nail plate	0.71 0.67	0.79 0.73	0.88 0.81	1.00 0.97	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
FE12055SS *with nail plate		0.72 0.69	0.79 0.75	0.87 0.81	0.95 0.87	1.00 0.97	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
FE16070SS *with nail plate			0.72 0.69	0.77 0.73	0.82 0.78	0.91 0.86	1.00 0.94	1.00 1.00	1.00 1.00	1.00 1.00
FE20095SS *with nail plate			0.65 0.64	0.68 0.67	0.72 0.70	0.78 0.75	0.84 0.81	0.95 0.91	1.00 1.00	1.00 1.00

Table 2D Anchor spacing distance reduction factor ϕ_{sx} and ϕ_{sy}

Product Code	Anchor spacing, a (mm)													
	30	40	50	60	70	85	100	125	150	200	250	300	350	>400
TIM10X40G *with nail plate	0.64 0.61	0.69 0.65	0.73 0.69	0.78 0.73	0.82 0.77	0.89 0.82	0.96 0.88	1.00 0.97	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
TIM12X50G *with nail plate		0.64 0.62	0.68 0.65	0.72 0.69	0.75 0.72	0.81 0.76	0.86 0.81	0.95 0.89	1.00 0.96	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
TIM16X75G *with nail plate			0.62 0.61	0.64 0.63	0.67 0.65	0.70 0.68	0.74 0.71	0.80 0.77	0.86 0.82	0.98 0.93	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
TIM20X75G *with nail plate			0.62 0.61	0.64 0.63	0.67 0.65	0.70 0.68	0.74 0.71	0.80 0.77	0.86 0.82	0.98 0.93	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
TIM20X120G *with nail plate						0.62 0.62	0.64 0.64	0.68 0.67	0.72 0.70	0.76 0.74	0.85 0.82	0.94 0.90	0.10 0.99	1.00 1.00
TIM24X100G *with nail plate					0.62 0.61	0.65 0.64	0.68 0.66	0.72 0.70	0.76 0.74	0.85 0.82	0.94 0.90	0.10 0.99	1.00 1.00	1.00 1.00

316 Stainless Steel Threaded Inserts (TCM)

Product Code	30	40	50	60	70	85	100	125	150	200	250	300	350	>400
FE100145SS *with nail plate	0.62 0.60	0.66 0.64	0.70 0.67	0.74 0.70	0.78 0.74	0.85 0.79	0.91 0.84	1.00 0.93	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
FE12055SS *with nail plate		0.63 0.61	0.66 0.64	0.70 0.67	0.73 0.70	0.78 0.74	9.83 0.78	0.91 0.85	0.99 0.92	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
FE16070SS *with nail plate			0.63 0.61	0.65 0.64	0.68 0.66	0.71 0.69	0.75 0.73	0.82 0.78	0.88 0.84	1.00 0.95	1.00 1.00	1.00 1.00	1.00 1.00	1.00 1.00
FE20095SS *with nail plate			0.59 0.59	0.61 0.60	0.63 0.62	0.66 0.64	0.68 0.67	0.73 0.71	0.77 0.76	0.87 0.84	0.96 0.93	1.00 1.00	1.00 1.00	1.00 1.00

Verify Concrete Tension Capacity

Computation 2E Complete the table and determine, X as the product of the factors

Factor	Type	Table	Value
ϕx_1			
ϕx_2			
ϕy_1			
ϕy_2			
Factor X product of factors			

Checkpoint 2

Determine the reduced ultimate concrete tensile capacity of the anchor situation ϕN_{urc}

$\phi N_{urc} = \phi N_{uc} * \psi_{ncr} * \psi_{nc} * X$

Step 3. Verify Steel Tensile Capacity, ϕN_{us} (kN) (per anchor)

Table 3A Reduced characteristic ultimate anchor steel capacity, ϕN_{us} (kN), $\phi = 0.75$

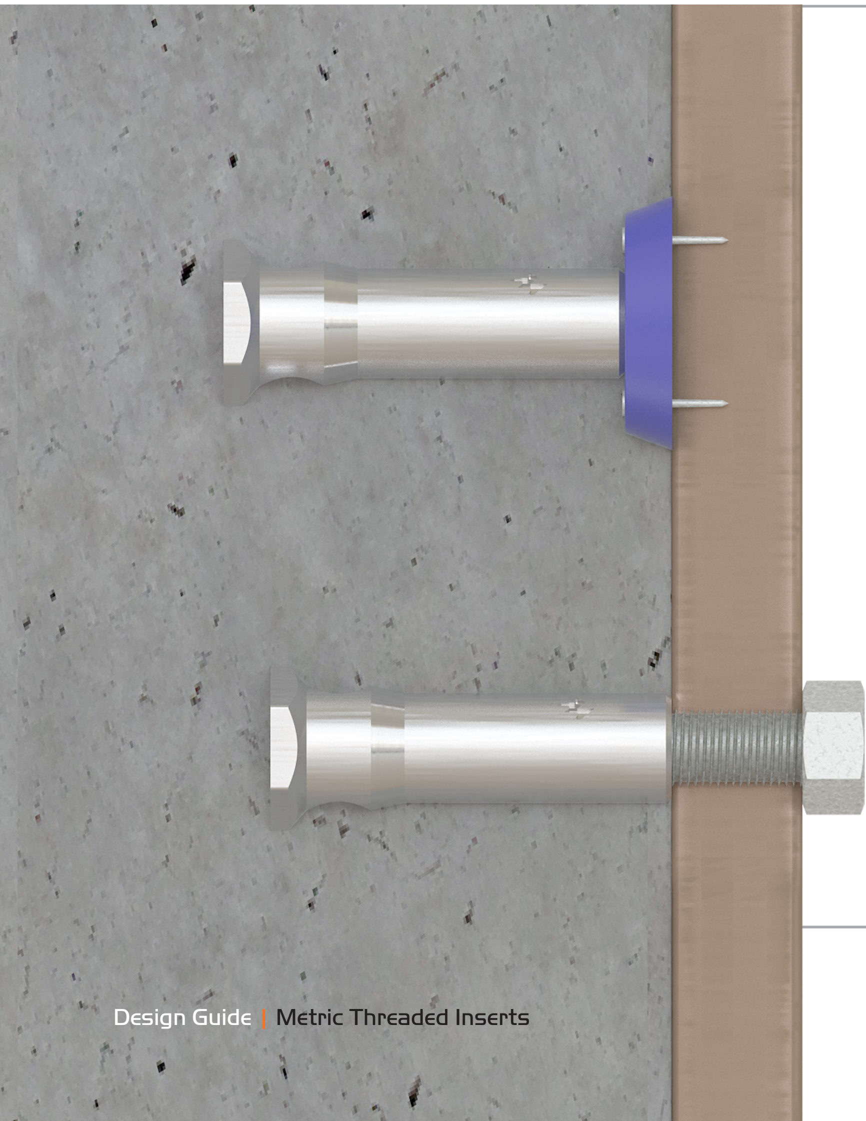
Product Code	TIM10X40G	TIM12X50G	TIM16X75G	TIM20X75G	TIM20X120G	TIM24X100G
ϕN_{us} [kN]	19.5	24.4	38.3	79.0	79.0	123.2

Product Code	FE10045SS	FE12055SS	FE16070SS	FE20095SS
ϕN_{us} [kN]	37.3	46.3	71.1	108.9

Table 3B Reduced characteristic ultimate bolt tensile capacity, ϕN_{TF} (kN), $\phi_n = 0.8$

Bolt Size	M10		M12		M16		M20		M24	
ϕNTF (kN)	G4.6	G8.8	G4.6	G8.8	G4.6	G8.8	G4.6	G8.8	G4.6	G8.8
	18.6	38.5	27	56	50.2	104.2	78.4	162.7	112.8	234.4

Bolt Size AISI 316 SS	M10	M12	M16	M20
ϕN_{TF} [kN]	32.5	47.2	87.9	137.2



Verify Steel Tension Capacity

Step 3 Establish the reduced characteristic bolt tensile capacity, from the literature of the specified bolt manufacturer. Table 3B details the nominal expected capacities of bolts manufactured to ISO standards.

Checkpoint 3

Design reduced ultimate tensile capacity, ϕN_{ur} (kN)

ϕN_{ur} = Minimum of ϕN_{urc}, ϕN_{US}, ϕN_{TF}

Check $N^* / \phi N_{ur} \leq 1$,

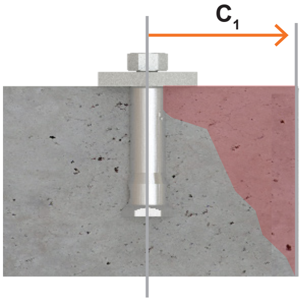
If not satisfied return to Step 1

Step 4. Verify Concrete Shear Capacity (per anchor) Perpendicular to Edge, ϕV_{CB} (kN), ϕ = 0.65

Anchor Shear Capacity (reference NZS3101 Section 17)

Table 4A Reduced basic concrete breakout strength in Shear, per anchor ϕV_B (kN), for single anchor ϕ = 0.65 f_c = 20MPa

Product Code	c1 - distance from the centre of resistance of an anchor to the edge of the concrete in the direction which the load is											
	30	35	40	50	60	85	100	200	300	400	500	≥ 600
TIM10X40G *with nail plate	1.9 2.0	2.4 2.5	2.9 3.0	4.1 4.2	5.3 5.6	9.0 9.4	11.5 12.0	32.5 33.8	59.7 62.1	91.9 95.7	128.4 133.7	168.8 175.7
TIM12X50G *with nail plate		2.5 2.6	3.1 3.2	4.3 4.5	5.7 5.9	9.6 9.9	12.3 12.7	34.7 35.9	63.8 65.9	98.3 101.5	137.4 141.8	180.6 186.4
TIM16X75G *with nail plate				5.1 5.2	6.7 6.9	11.3 11.6	14.5 14.8	40.9 41.8	75.2 76.8	115.8 118.3	161.9 165.4	212.8 217.4
TIM20X75G *with nail plate					7.2 5.4	12.1 9.1	15.5 11.6	43.7 32.7	80.4 60.1	123.7 92.5	172.9 129.3	227.3 170.0
TIM20X120G *with nail plate						12.1 12.1	15.5 15.5	43.7 43.7	80.4 80.4	123.7 123.7	172.9 172.9	227.3 227.3
TIM24X100G *with nail plate						12.1 12.1	15.5 15.5	43.7 43.7	80.4 80.4	123.7 123.7	172.9 172.9	227.3 227.3
316 Stainless Steel Threaded Inserts (TCM)												
FE100145SS *with nail plate	1.9 2.0	2.4 2.5	3.0 3.1	4.2 4.3	5.5 5.7	9.2 9.6	11.8 12.2	33.3 34.6	61.3 63.5	94.3 97.7	131.8 136.6	173.3 179.6
FE12055SS *with nail plate		2.6 2.7	3.2 3.3	4.4 4.6	5.8 6.0	9.8 10.1	12.5 12.9	35.5 36.5	65.2 67.1	100.3 100.3	140.2 144.4	184.3 189.8
FE16070SS *with nail plate			3.5 3.6	4.9 5.0	6.4 6.6	10.9 11.1	13.9 14.2	39.2 40.1	72.0 73.7	110.9 113.5	155.0 158.6	203.8 208.5
FE20095SS *with nail plate					7.1 7.2	11.9 12.1	15.2 15.4	43.0 43.7	79.1 80.2	121.7 123.5	170.1 172.6	223.6 226.9



DIA 4A. Verify Concrete Strength in Shear

Table 4B-1 Cracked concrete effect, shear, ψ_{vcr}

Product Code	TIM-10X40G	TIM-12X50G	TIM-16X75G	TIM-20X75G	TIM-20X120G	TIM-24X100G
ψ_{vcr}	0.7					

Product Code	FE10045SS	FE12055SS	FE16070SS	FE20095SS
ψ_{vcr}	0.7			

Note: For Non-cracked concrete ψ_{vcr} =1

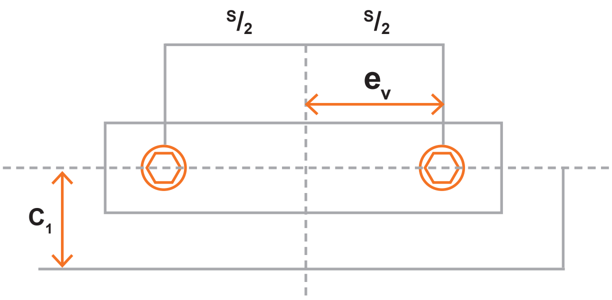
Table 4B-2 Concrete compresive strength effect, shear, ψ_{vc}

f'c [MPa]	15	20	25	≥ 30
ψ_{ncr}	0.87	1	1.12	1.22

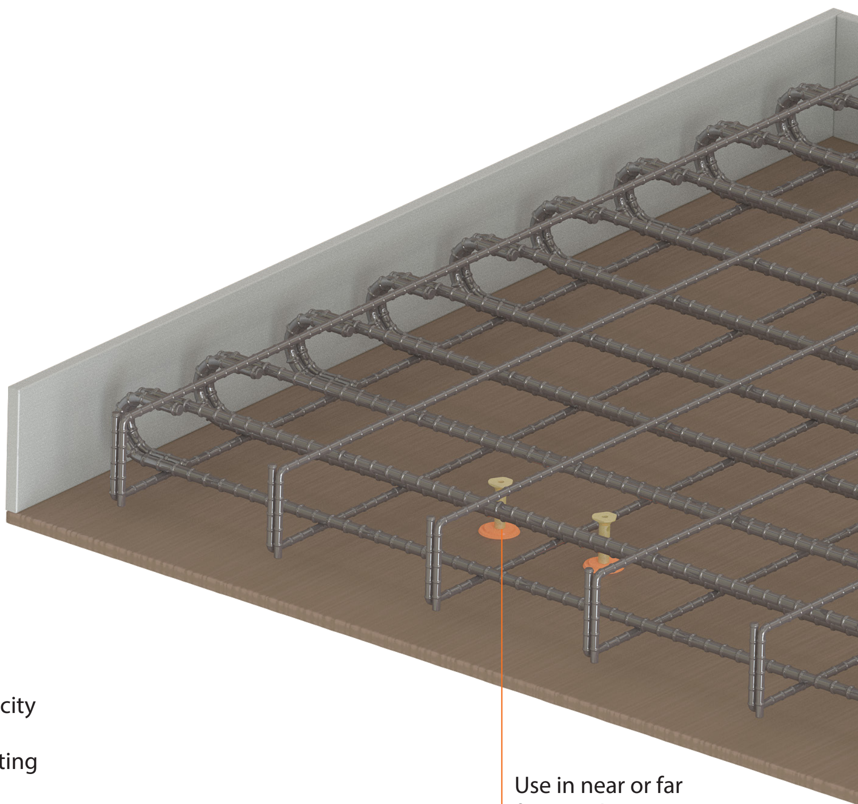
Table 4C Modification factor for anchor groups, Ψ_5 if e_v<half of centre-to-centre spacing, s)

e_v-distance between the point of shear application and the centroid of the group of anchors resisting the shear in direction of the applied shear	C_1 - distance from the centre of resistance of an anchor to the edge of the concrete in the direction which the load is											
	#	30	35	40	50	60	85	100	200	300	400	500	600
	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	40	0.53	0.57	0.60	0.65	0.69	0.76	0.79	0.88	0.92	0.94	0.95	0.96
	80	0.36	0.40	0.43	0.48	0.53	0.61	0.65	0.79	0.85	0.88	0.90	0.92
	120	0.27	0.30	0.33	0.38	0.43	0.52	0.56	0.71	0.79	0.83	0.86	0.88
	160	0.22	0.25	0.27	0.32	0.36	0.44	0.48	0.65	0.74	0.79	0.82	0.85
	200	0.18	0.21	0.23	0.27	0.31	0.39	0.43	0.60	0.69	0.75	0.79	0.82
	240	0.16	0.18	0.20	0.24	0.27	0.35	0.38	0.56	0.65	0.71	0.76	0.79
	280	0.14	0.16	0.18	0.21	0.24	0.31	0.35	0.52	0.62	0.68	0.73	0.76
	320	0.12	0.14	0.16	0.19	0.22	0.28	0.32	0.48	0.58	0.65	0.70	0.74

Diagram 4C Distance half of centre-to-centre spacing



A cross hole through the shaft is provided to accept a cross bar for situations where full pullout capacity of the fitting is required (eg: thin concrete sections or where the fiting is close to an edge)



Use in near or far face applications with our range of accessories

Table 4D Modification factor for anchor groups, edge distance, Ψ_6

c_2 - minimum edge distance or half of anchor spacing perpendicular to c_1, mm		c_1 - distance from the centre of resistance of an anchor to the edge of the concrete in the direction which the load is											
		30	35	40	50	60	85	100	200	300	400	500	≥ 600
	30	0.90	0.87	0.85	0.82	0.80	0.77	0.76	0.73	0.72	0.72	0.71	0.71
	35	0.93	0.90	0.88	0.84	0.82	0.78	0.77	0.74	0.72	0.72	0.71	0.71
	40	0.97	0.93	0.90	0.86	9.83	0.79	0.78	0.74	0.73	0.72	0.72	0.71
	50	1.00	0.99	0.95	0.90	0.87	0.82	0.90	0.75	0.73	0.73	0.72	0.72
	60		1.00	1.00	0.94	0.90	0.84	0.82	0.76	0.74	0.73	0.72	0.72
	70			1.00	0.98	0.93	0.86	0.84	0.77	0.75	0.74	0.73	0.72
	100				1.00	1.00	0.94	0.90	0.80	0.77	0.75	0.74	0.73
	200						1.00	1.00	0.90	0.83	0.80	0.78	0.77
	300								1.00	0.90	0.85	0.82	0.80
	450									1.00	0.94	0.88	0.85
	600										1.00	0.94	0.90
	750											1.00	0.95
	1000												1.00

Diagram 4D Distance from the centre of resistance to the edge

$C_2 < 1.5 \times c_1$

DIA 4D. Distance from the centre of resistance to the edge

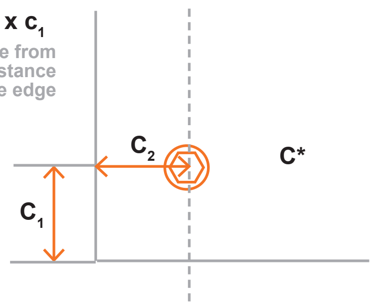


Table 4E Calculate the projected concrete failure area of anchor in shear when not limited by edge distance $A_{v0} = 4.5c_1^2$

c_1	30	35	40	50	60	70	100	200	300	400	500	600
A_{v0} ($\times 10^4$)	0.4	0.6	0.7	1.1	1.6	2.2	4.5	18.0	40.5	72.0	112.5	162.0

Table 4F Calculate $1.5c_1$

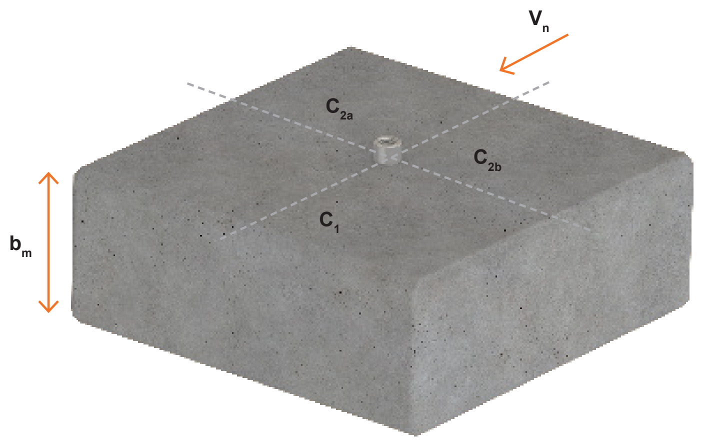
c_1	30	35	40	50	60	70	100	200	300	400	500	600
$1.5c_1$	45	52.5	60	75	90	105	150	300	450	600	750	900

Computation 4H Calculate the project concrete failure area of anchor in shear

$A_V = (c_{2a} + c_{2b})*b_m$, $(c_{2a}, c_{2b}, b_m \leq 1.5c_1)$

c_{2a}, c_{2b} = Edge distance or half of anchor spacing perpendicular to the loading direction (but less than $1.5c_1$).

b_m = Substrate Thickness (but less than $1.5c_1$)



Checkpoint 4

Design Concrete Breakout Strength shear load towards edge of a single anchor, φV_{CB}

$\phi V_{CB} = \phi V_B * \psi_{vcr} * \psi_{vc} * \psi_5 * \psi_{6A} * \psi_{6B} * A_V / A_{V0}$

For when shear load direction is parralel to edge (i.e load angle = 180°) of a singular anchor, MULTIPLY ϕV_{CB} x 2

Step 5. Verify Shear Strength of Steel ϕV_s (kN)

Table 5A Reduced characteristic ultimate anchor steel shear capacity, ϕV_{s1} (kN), ϕ =0.65

Product Code	TIM10X40G	TIM12X50G	TIM16X75G	TIM20X75G	TIM20X120G	TIM24X100G
ϕV_{s1} [kN]	10.1	12.7	19.9	41.1	41.1	64.1

Product Code	FE10045SS	FE12055SS	FE16070SS	FE20095SS
ϕV_{s1} [kN]	21.0	26.1	40.0	61.3

Table 5B Reduced characteristic ultimate bolt steel shear capacity, ϕV_{s2} (kN), ϕ =0.80

Zinc Bolt Size	M10		M12		M16		M20		M24	
ϕV_{s2} [kN]	G4.6	G8.8	G4.6	G8.8	G4.6	G8.8	G4.6	G8.8	G4.6	G8.8
	9.8	20.0	14.4	29.3	27.4	56.1	43.0	88.3	62.0	127.2

AISI 316 SS Bolt Size	M10	M12	M16	M20
ϕV_{s2} [kN]	16.8	24.7	47.4	74.5

Step 6. Verify Concrete Pry-Out Strength In Shear, ϕV_{cp} (Kn), ϕ = 0.65

Table 6A Co-efficient of pry out strength
h = length of insert (mm) plus 8mm for nail plate if used

h	<65mm	≥65mm
k_{cp}	1.0	2.0

Checkpoint 5

Concrete Pry-Out Strength in Shear

$\phi V_{cp} = k_{cp} * \phi N_{urc}$

Checkpoint 6

Design Reduced Ultimate Concrete Shear Capacity Perpendicular to an Edge, ϕV_{ur}

ϕV_{ur} = MINIMUM OF ϕV_{CB} , ϕV_{S1} , ϕV_{S2} , ϕV_{cp}

If not satisfied return to Step I

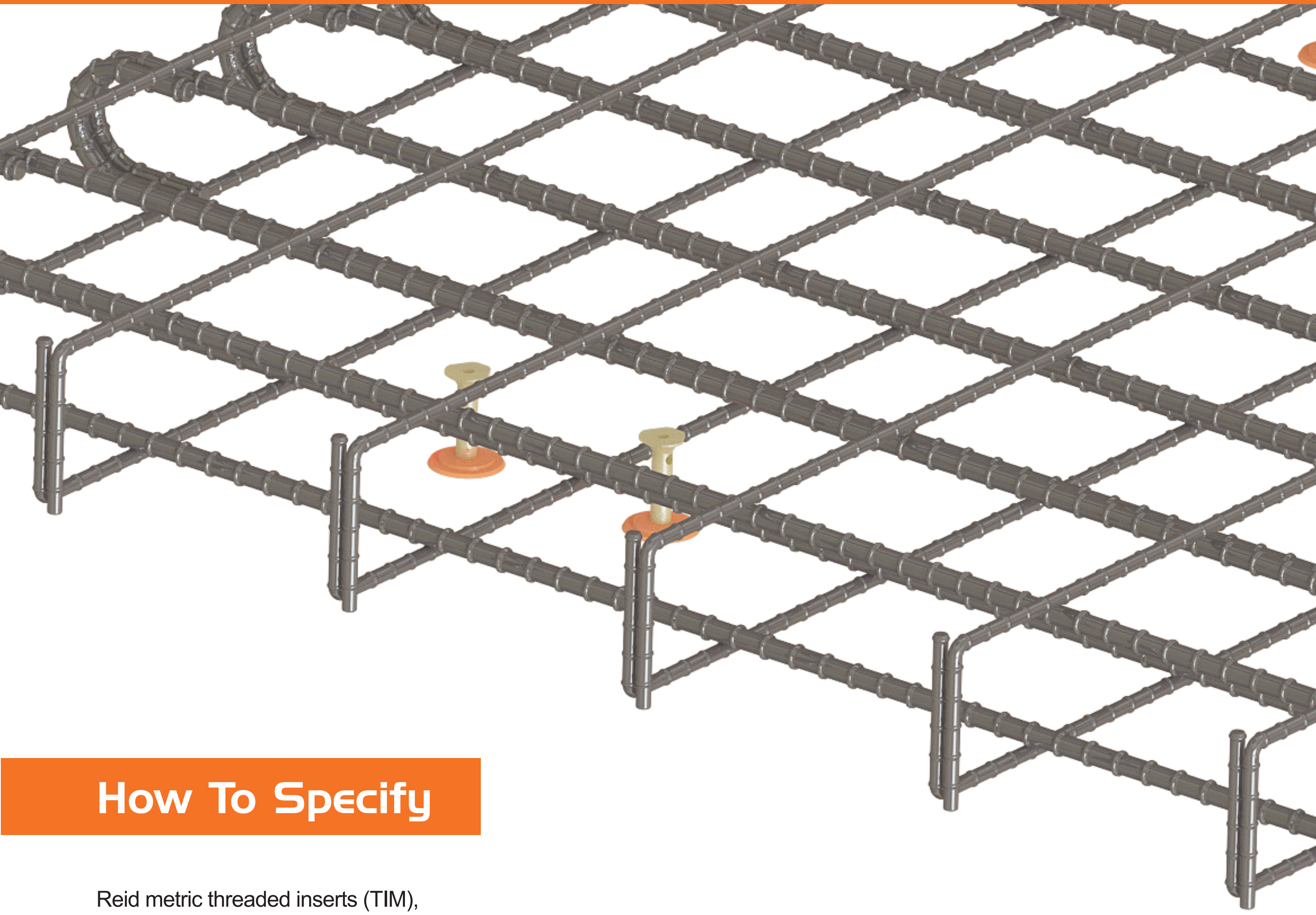
Step 7. Combined Loading & Specification

Checkpoint 7

Check

$N^*/\phi N_{ur} + V^*/\phi V_{ur} \leq 1.2$,

If not satisfied return to Step I



How To Specify

Reid metric threaded inserts (TIM),
(TIM size x length) (part number), (finish) with a (bolt grade) bolt.

Reid 316 stainless steel elephant foot™ metric threaded inserts
(fe size x length) (part number) with a (bolt grade) bolt.

Example

Reid Metric Threaded Insert 16mm x 75mm long.
TIM16X75G, Galvanised Finish With a Grade 4.6 Bolt.
To Be Installed In Accordance With Reid Technical Data Sheet.

Project	
Design	
Location	
Project ID	
Design by	
Date	
Checked	

Sketch

Inputs

N* & V* are the **per anchor** load demand.
Check both external and internal anchors for suitability.

Tensile design action effect	N*		kN
Shear design action effect	V*		kN
Substrate thickness	b_m		mm
Concrete compressive strength	f'_c		MPa

STEP 1 SELECT ANCHOR TO BE EVALUATED

Table 1a: Find the interaction of N* and V* values

Anchor Type ______

Table 1a: Absolute minima, edge distance and half of anchor spacing.

e_m ______

Check for compliance with absolute minima tick ☐

Checkpoint 1:

Anchor size selected? tick ☐

Comply with absolute minima? tick ☐

STEP 2 VERIFY CONCRETE TENSILE CAPACITY

Table 2a:	Concrete tensile capacity	ϕN_{UC}		kN
Table 2b:	Concrete compressive strength effect	ψ_{nc}		

Table 2c and /or 2d: Edge distance and anchor spacing reduction factors

Factor	Type	Table	Value
ϕx_1			
ϕx_2			
ϕy_1			
ϕy_2			

Step 2a: Cracked concrete reduction factor ψ_{CR} ______

Checkpoint 2:
Calculate: $\phi N_{URC} = \phi N_{UC} * \psi_{nc} * \phi x_1 * \phi x_2 * \phi y_1 * \phi y_2 * \psi_{CR}$ ______ kN

STEP 3 VERIFY STEEL TENSILE CAPACITY

Table 3a:	Anchor steel capacity	ϕN_{US}		kN
Table 3b:	Bolt steel capacity	ϕN_{TF}		kN

Checkpoint 3:
ϕN_{UR} = minimum of ϕN_{URC}[1], ϕN_{US}[2], ϕN_{TF}[3] = ______ kN

$N^* / \phi N_{UR} \leq 1.0$? ______ / ______ = ______ tick ☐

If not satisfied, return to step 1.

Tensile Design Completed

STEP 4 VERIFY CONCRETE SHEAR CAPACITY

Table 4a:	Concrete shear capacity	ϕV_B		kN
Table 4b:	Concrete compressive strength effect	ψ_{VC}		
Table 4c:	Anchor group factor	ψ_5		
Table 4d:	Edge distance factor	ψ_{6A}		
		ψ_{6B}		
Table 4e	Concrete crack failure	ψ_7		
Table 4f	Projected failure area when not limited by edge distance	A_{V0}		mm²

Step 4g Projected concrete failure area of anchor A_V

Edge distance / Half of anchor spacing, mm	Original value, A	Table 4g, $1.5c_1$, B	Calc value, min (A,B)
c_{2a}			
c_{2b}			
b_m			
$A_V = (c_{2a} + c_{2b}) * b_m$			

Checkpoint 4: Calculate

$\phi V_{CB} = \Phi V_B * \psi_{VC} * \psi_5 * \psi_{6A} * \psi_{6B} * \psi_7 * A_V / A_{V0}$ ______ kN [4]

STEP 5 VERIFY STEEL SHEAR STRENGTH ϕV_s

Table 5a:	Steel shear capacity	ϕV_{s1}		kN [5]
Table 5b:	Bolt shear capacity	ϕV_{s2}		kN [6]

STEP 6 VERIFY CONCRETE PRY-OUT STRENGTH IN SHEAR ϕV_{CP} (PER ANCHOR)

Table 6a: Pry-out co-efficient k_{cp} ______

Checkpoint 5:

Calculate $\phi V_{CP} = 0.75/0.6 * k_{cp} * \phi N_{URC} * \psi_{VC}$ ______ kN [7]

Checkpoint 6:

ϕV_{UR} = Minimum of ϕV_{CB}[4], ΦV_{S1}[5], ΦV_{S2}[6], ΦV_{CP}[7] = ______ kN

$V^* / \phi V_{ur} \leq 1.0$? ______ / ______ = ______

STEP 7 COMBINED LOADING & SPECIFICATION

Checkpoint 7:
$N_* / \phi N_{UR} + V^* / \phi V_{UR} \leq 1.2$?
______ / ______ + ______ / ______ = ______ tick ☐

If not satisfied, return to step

SPECIFY: ______________________________

Product Compliance

Compliance statement

Reid™ Metric Threaded Inserts comply with the New Zealand Building Code clauses identified below.

Compliance details: NZBC

NZBC Clause	Criteria	Compliance Status
B1.3.1	'Buildings, building elements and sitework shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during construction or alteration and throughout their lives.'	✓
B1.3.2	'Buildings, building elements and sitework shall have a low probability of causing loss of amenity through undue deformation, vibratory response, degradation, or other physical characteristics throughout their lives, or during construction or alteration when the building is in use.'	✓
B1.3.3 (a), (b), (d), (e), (f), (g), (h), (j), (q)	'Account shall be taken of all physical conditions likely to affect the stability of buildings, building elements and sitework, including: (a) Self weight, (b) Imposed gravity loads arising from use . . . (d) Earth pressure, (e) Water and other liquids, (f) Earthquake, (g) Snow, (h) Wind . . . (j) Impact . . . (q) Time dependent effects including creep and shrinkage.	✓
B1.3.4	'Due allowance shall be made for: (a) The consequences of failure, (b) The intended use of the building, (c) Effects of uncertainties resulting from construction activities, or the sequence in which construction activities occur, (d) Variation in the properties of materials and the characteristics of the site, and (e) Accuracy limitations inherent in the methods used to predict the stability of buildings.'	✓
B2.3.1	'Building elements must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the specified intended life of the building, if stated, or: (a) The life of the building, being not less than 50 years, if (i) Those building elements . . . Provide structural stability to the building, or (ii) Those building elements are difficult to access or replace, or (iii) Failure of those building elements to comply with the building code would go undetected during both normal use and maintenance of the building.'	✓
B2.3.2	B2.3.2 Individual building elements which are components of a building system and are difficult to access or replace must either: (a) All have the same durability, or (b) Be installed in a manner that permits the replacement of building elements of lesser durability without removing building elements that have greater durability and are not specifically designed for removal and replacement.	✓

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