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Enhanced Performance Loads in Slab-to-Wall Moment Connections

Ancon®
RT KSN Anchors
Reinforcement Continuity System

New Zealand Edition

January 2022

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RT KSN Anchors

Safer, faster, simpler construction joints

Ancon RT KSN Anchors, in combination with Ancon RT parallel-threaded reinforcing bars, offer designers the opportunity to simplify concrete slab-to-wall construction joints, when compared to traditional methods.

RT KSN Anchors are cast into the concrete wall and, when the formwork and thread protection are removed, the reinforcing bars are simply screwed into the anchors. This is a quicker, easier and above all, safer solution. It eliminates the drilling of formwork or concrete and the dangers associated with projecting bars and on-site bar straightening. The system replaces cogged or hooked bar ends, thereby simplifying bar scheduling and minimises congestion in the wall. The rebate formed in the wall can also improve the quality of the joint.

In addition to their use in direct tensile applications, RT KSN Anchors have been independently tested in moment connections where they provide enhanced performance. See page 11 for further information.

RT KSN Anchors may also be suitable for other applications where a cast-in threaded insert is required.

Traditional slab-to-wall construction method.

Projecting reinforcing bars and congestion in the wall.

High performance RT KSN Anchor System

Bars are installed when required. No bending of bars. Less congestion in the wall.

Ancon RT KSN Anchors are designed to create an anchorage exceeding the tensile capacity of Grade 500E reinforcement bars to create a ductile failure mechanism as specified in NZS 3101:2006 - clause 17.5. Traditional threaded inserts are too short and normally can't meet the design requirement for reinforcement connections.

Contents

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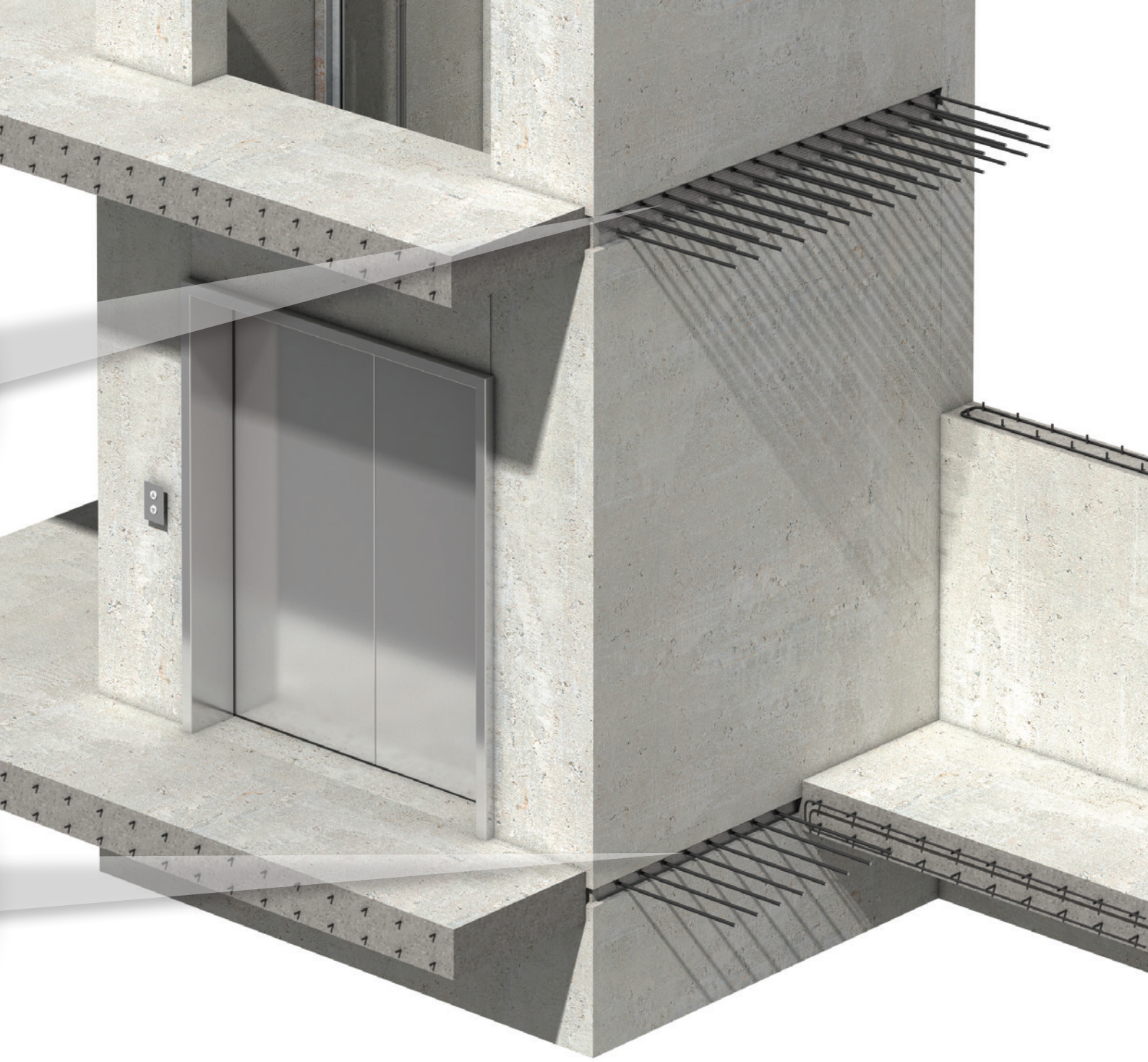


Eliminates risks associated with on-site bar straightening

Standard components for 'just-in-time' site delivery, direct from stock

Compatible with rebar up to 20mm diameter (bigger sizes available on request)

No drilling of formwork or concrete required

Reduces the dangers of exposed projecting rebars

Based on the design principles of NZS 3101

Certainty of performance provided by comprehensive test data

Replaces cogged or hooked bars to simplify bar scheduling

Visual check of correct bar engagement

Ancon RT thread minimises slip

Reusable rebate former available

Ancon RT KSN Anchors

Ancon RT KSN Anchors, in combination with RT parallel-threaded reinforcing bars, simplify concrete slab-to-wall construction joints when compared to traditional methods. This quicker, easier and above all, safer operation, eliminates the need for on-site bar straightening and the drilling of formwork or concrete. The system replaces cogged or hooked bar ends, thereby simplifying bar scheduling and minimising congestion in the wall.

System Design

The anchorage design for RT KSN anchors is covered by section 17 of NZS 3101:2006, and clause 8.6.11.1 which states anchorages must develop the upper characteristic breaking strength of the bar without damage to the concrete.

$N \leq \phi_s N_s \leq \phi_c N_c$ where $\phi_s = 0.8$, $\phi_c = 0.65$

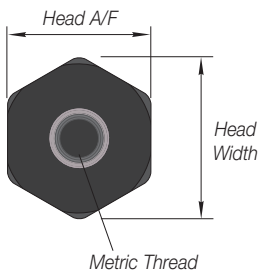
Associated References:

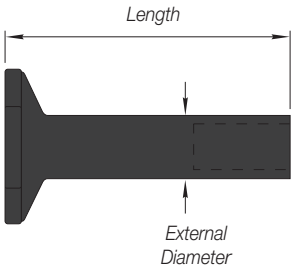
NZS 3101:2016 - clause C17.6.5: Anchors and Connections should be designed to suppress a brittle concrete pull-out failure, when approaching the ultimate limit state. As the concrete failure is recognised as a brittle failure, reinforcing bars around the RT KSN Anchors should be detailed in a way to reach required ductility level.

System Components

RT KSN Anchor

The RT KSN Anchor is machined from tough, high reliability, hot forged Cr-Mo alloy steel, with minimum 15% elongation, to form a blank that is subsequently hot forged to form the head. There are eight standard anchors in the RT KSN range to suit the requirements of most applications.





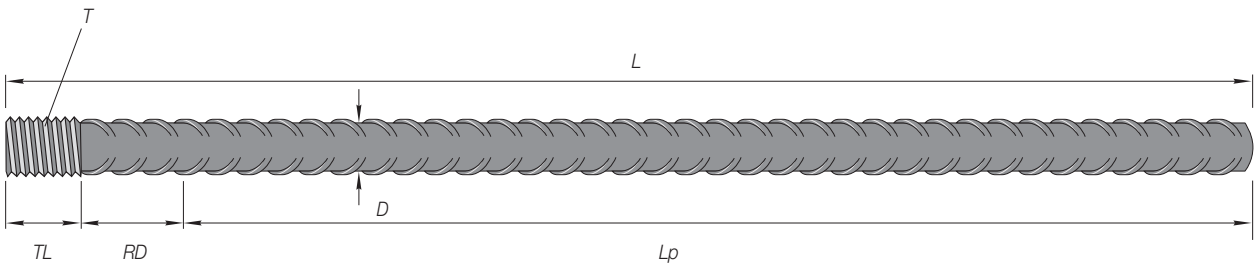
Minimum Wall Thickness

Anchor Part No.	Anchor Length mm	Min. Wall Thickness mm RT KSNBLOCK	Min. Wall Thickness mm RT KSNBOX
RTKSN12S	115	200	185
RTKSN12M	150	200	220
RTKSN16S	130	200	200
RTKSN16M	160	200	230
RTKSN16L	190	225	260
RTKSN20S	150	200	220
RTKSN20M	190	225	260
RTKSN20L	230	265	300

*Note. Wall thicknesses of less than 200mm are possible, but cannot be used with the enhanced loads available in slab/wall moment connections due to the limited moment capacity of the walls. The minimum wall thickness for RT KSN12S, RT KSN16S and RT KSN20S used in direct tension are **150mm**, **160mm** and **180mm** respectively, for anchors cast flush with the face of the concrete. Minimum thicknesses based on minimum 30mm cover.*

Ancon RT KSN Anchor Dimensions

Anchor Part No.	Anchor Length (mm)	Nominal External Diameter (mm)	Thread Dimension (mm)	Nominal Head Width (mm)	Nominal Head A/F (mm)
RTKSN12S	115	20	M13 x 1.75	46	40
RTKSN12M	150				
RTKSN16S	130	24	M17 x 2.5	61	53
RTKSN16M	160				
RTKSN16L	190				
RTKSN20S	150	30	M21 x 2.5	75	65
RTKSN20M	190				
RTKSN20L	230				



Ancon RT Starter Bars

Ancon RT KSN Anchors are designed for use with 12mm, 16mm and 20mm diameter grade 500E reinforcing bar, threaded with Ancon RT threads. The Ancon RT system produces a full strength joint. The end of each bar is cut square and pressed before a rolling sequence is engaged to thread the bar. For more information on the Ancon RT Coupler system please download the Ancon Reinforcing Bar Coupler brochure.

Ancon RT starter bars are available in 1200mm lengths. Please contact us for other lengths.

Ancon RT Starter Bars - Standard Dimensions

Part No.	Anchor Ref.	Bar Diameter (D)	Thread Length (TL)	Rebate Depth* (RD)	Stock Length (L)
RTTHB121200	RTKSN12	12mm	17mm	36mm	1200mm
RTTHB161200	RTKSN16	16mm	20mm	36mm	1200mm
RTTHB201200	RTKSN20	20mm	25mm	36mm	1200mm

*Note: Custom bar lengths are available on request.*Rebate depth (RD) based on application with RT KSN Anchor Box - RT KSN Anchor Block, Nailing Plate and applications allow for shorter rebates.*

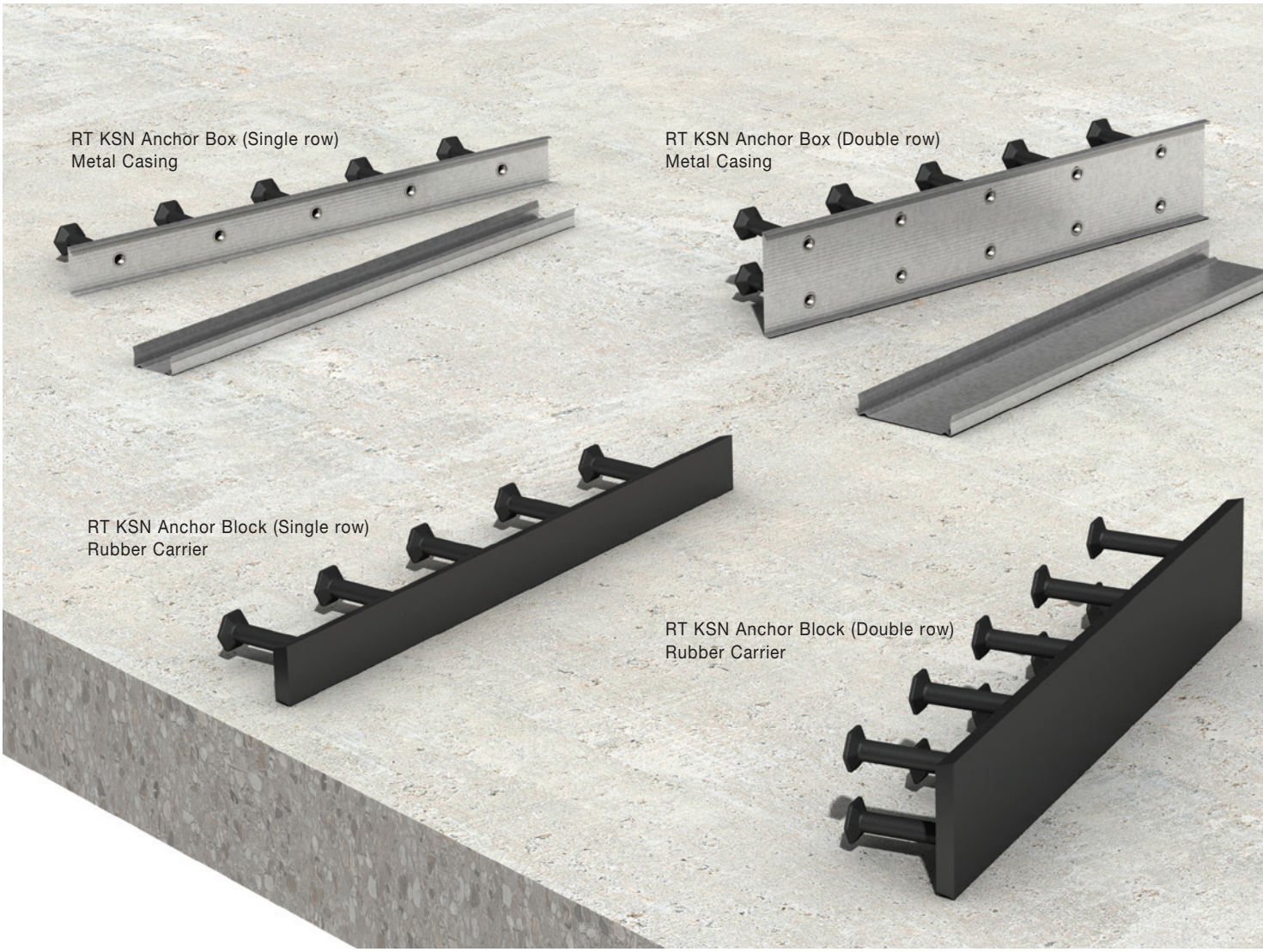
Reinforcement Characteristic Yield Load

Bar Diameter	Yield Load (kN)
12	56.5
16	100.5
20	157.0

Ancon RT KSN Anchors

Installation Methods

For maximum versatility, we provide a number of installation methods for the RT KSN Anchor. Since trouble free installation and optimum performance requires clean threads, each system provides thread protection to exclude contamination.



Additional Embedment Given

Installation Method	Additional Embedment
RT KSN Anchor Block	5mm
Individual Nailing Plate	8mm
RT KSN Anchor Box	36mm*

Specifying / Ordering

An Ancon RT KSN Anchor System is specified and ordered using the following identification method:

Anchor Ref. / Installation method / Box width / Anchor arrangement / No of anchors / Box length / Anchor spacing

e.g. RT KSN12L - RT KSNBOX - 150 - AA - 3 - 600 @200

This is the reference for RTKSN12L anchors in a metal casing, 150mm wide, with a double row of anchors, 3 anchors per row, in a 600mm long unit with an anchor spacing of 200mm.

RT KSN Anchor with Individual Nailing Plate

RT KSN Anchor System Options

RT KSN Anchor Box

A galvanised steel casing can be supplied with RT KSN Anchors installed at the specified design spacing. The unit is sealed at each end to prevent the ingress of concrete. Upon removal of the formwork, the casing remains embedded in the wall with the cover in place to prevent thread contamination. The cover is removed to install the threaded bars and the rebate formed by the boxes is filled with concrete when the adjoining slab is poured. This method provides RT KSN Anchors with an additional 36mm of embedment making it the highest load capacity installation method available, and suitable for moment connections.

RT KSN Anchor Block

This is a reusable plastic mould that is provided with mountings for the RT KSN Anchors at the specified design spacing. The blocks are loaded with RT KSN Anchors and fixed to the formwork where required. The block protects the internal threads of the anchors until it is removed, so should be left in position until this time. Once removed, the block may be equipped with RT KSN Anchors ready for use on the next set of formwork or may be retained for use on future projects. The block provides the RT KSN Anchor with 5mm of additional embedment by offsetting it from the formwork face. This offset and surrounding rebate increases the capacity and makes this installation method suitable for moment connections.

RT KSN Anchor with Individual Nailing Plate

Individual Nailing Plates may be used to place RT KSN Anchors singularly or in groups to provide anchor points for starter bars. They are also useful for placing anchors in lines where wide centres or congestion precludes the use of other installation methods, though care must be taken to ensure correct placement. The Individual Nailing Plate provides the Ancon RT KSN Anchor with an additional embedment of 8mm however it is unsuitable for moment connections.

Information for Specifying and Ordering

Anchor Part No.	Installation Method	Unit Widths	Anchor Arrangement and Number of Anchors	Unit Lengths
RTKSN12S RTKSN12M RTKSN16S RTKSN16M RTKSN16L RTKSN20S RTKSN20M RTKSN20L	RT KSNBOX RT KSNBLOCK	RT KSN Box available widths = 85, 120, 150, 190, 220mm RT KSN Block available widths = 90, 200mm	A = Single row AA = Double row (AA units are only available in system widths of 120mm and above) Number of anchors per row	RT KSN Box = 600, 800, 1000, 1200mm RT KSN Block = 600, 800, 1000, 1200mm

Specification Clause

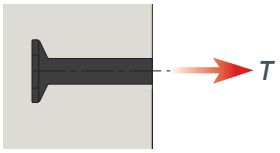
Headed Anchors shall be Ancon RT KSN Anchors as manufactured by Leviat.
Reinforcement shall be Ancon RT Threaded Starter Bars as manufactured by Leviat.

Ancon RT KSN Anchors

System Performance

The performance of RT KSN Anchors is presented for two load applications and is based on comprehensive test data.

Direct tensile concrete characteristic loads



The direct pull-out strength of anchors embedded in concrete has been the subject of extensive research over many years. To determine the direct pull strength of RT KSN Anchors, we commissioned a test programme at the Heriot Watt University, UK. The test results and subsequent analysis aligned closely with the Concrete Capacity Design (CCD) method.

The direct pull-out strength is based on a model with a break out prism angle of approximately 35 degrees. See Fig A.

NZS 3101:2006 - clause 17.5.7.2 requires cast-in fixings to be designed in accordance with the Concrete Capacity Design (CCD) method. The concrete characteristic tensile load N_{cb} is determined from the formula, $N_{cb}=k_{cr}\cdot f'_c{}^{0.5}\cdot h_{eff}{}^{1.5}$

Where:

N_{cb} is the characteristic tensile strength of a single anchor remote from edge effects (kN)

f'_c is the characteristic concrete cylinder compressive strength (MPa)

h_{eff} is the effective embedment depth of the anchor (mm)

k_{cr} is an empirical coefficient determined from tests (k_{cr} = 12.5 for non-cracked concrete).

To achieve the maximum anchor load, the required minimum spacing is three times the depth of the anchor h_{eff}.

The design strength is calculated by multiplying the ultimate capacity from NZS 3101 with a reduction factor of $ø_c$= 0.65 in accordance with NZS 3101:2006 - clause 17.5.6.4

$N^0_{Rd,c}= ø_c\ N_{cb}$

The direct tensile design capacity is provided in the tables on page 15.

Anchor Spacings

Although RT KSN Anchors are able to provide an anchor that is equal to or greater than the characteristic yield strength of the reinforcing bars, this is dependent on their arrangement. The capacity of the anchors is reduced when the proximity of adjacent anchors or concrete edges affect the development of the full cone, as illustrated in Fig B.

Load data for reduced anchor spacing is printed in the tables on pages 15 to 23.

Fig A. Full Tensile Cone

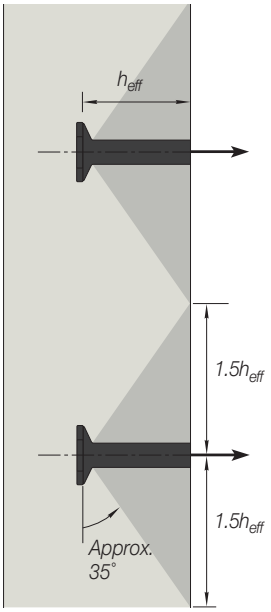
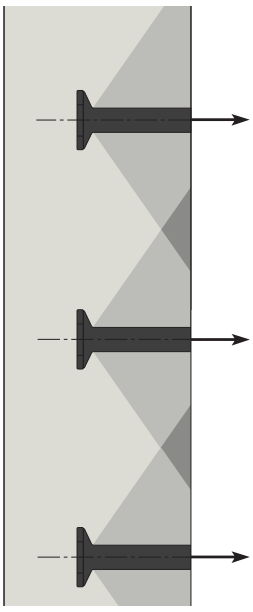
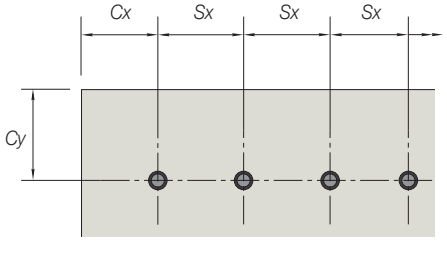


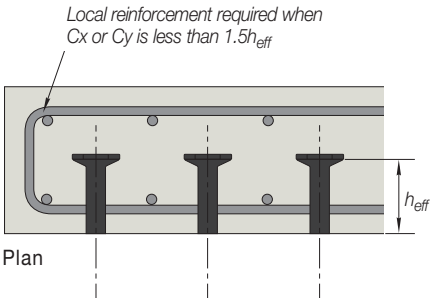
Fig B. Reduced Spacings



The tables on pages 15 to 23 assume that the close edge distances Cx and Cy are catered for by either (1) ensuring Cx and Cy are equal to or greater than 1.5 x h_{eff} or (2) local reinforcement is provided (see page 24). In addition, where moment connections are used, the top of the wall shall be at least three times the effective embedment of the anchor (h_{eff}) measured from the centre line of the anchor. If these conditions cannot be met, please contact us.



Elevation



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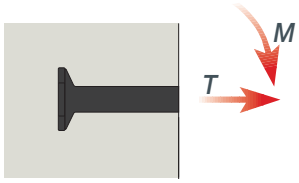
Tensile concrete characteristic loads in slab-to-wall moment connections



From the tests conducted to determine the direct pull-out capacities of RT KSN Anchors (see page 10), we identified a potential increase in anchor performance when the compression part of the moment couple lies within the pull-out cone.

Although design procedures for the direct pull-out strength of cast-in anchors are well established, existing procedures do not cover anchors within moment resisting connections, such as slab-to-wall applications. Therefore, we commissioned a further test programme with the Heriot Watt University to determine the degree of enhancement in concrete cone pull-out capacity in typical slab-to-wall connections.

These tests verified that there is enhancement in concrete cone capacity, when the pull-out failure surface is modified by the presence of an adjacent compression force forming part of the couple. The enhancement is strongly influenced by the ratio depth of embedment of the head of the anchor to the effective depth of the anchor in the slab h_{eff}/d.

An empirical expression has been derived for the strength of RT KSN Anchors where the concrete cone failure is modified by an adjacent compression reaction. Load data for RT KSN Anchors in moment resisting slab-to-wall connections is provided in the tables on pages 16 to 23. These enhanced performance figures were quantified by our test programme and subsequent design procedure and are therefore specific to the range of Ancon RT KSN Anchors.

The tests used RT KSN Anchors in the arrangement shown in Fig. 1. The design procedures derived enabled us to calculate pull-out loads for RT KSN Anchors when they are located in the paired arrangement used in the tests and in a single line at the mid-depth of a slab (shown in Fig. 2). Fig. 1 and Fig. 2 illustrate how the full pull-out cone is modified by an adjacent compression zone in both applications.

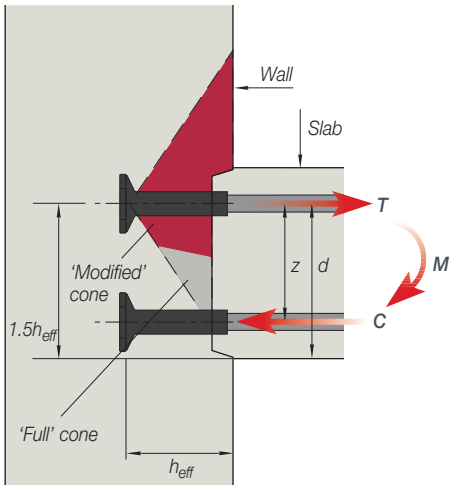


Fig 1. Idealised modified concrete failure. Paired arrangement used in testing.

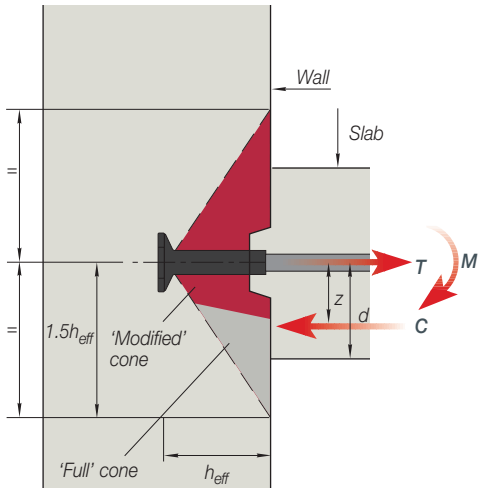


Fig 2. Idealised modified concrete failure. Single line of Anchors is shown.

Notes on the design tables for slab-to-wall moment connections

The load tables on pages 16 to 23 are applicable provided the following conditions are met.

- *The concrete characteristic pull-out loads are applicable for Ancon RT KSN anchor range, sizes 12mm to 20mm with anchor effective embedment between 109mm and 260mm.*
- *The structural concrete compressive strength shall be in the range N32/40 to N50/60. The letter N denotes normal weight concrete; the first figure, 32 is the minimum characteristic cylinder strength/ the second figure, 40 is the minimum characteristic cube strength.*
- *The design tables assume the concrete in which the RT KSN anchor is embedded is un-cracked. This in general would be the normal case for anchors embedded in walls.*
- *The minimum wall thickness shall be 200mm.*
- *Where other forms of loading give rise to cracks which intersect the failure surface, the design tables may over estimate the load capacity, e.g. seismic.*
- *The design tables assume no close edges, see pages 10 and 24.*
- *The design procedure assumes that the top of the wall is at least 3 times the effective embedment of the anchor (h_{eff}) measured from the centre line of the anchor.*
- *Provided the wall/slab connection comprises at least 5 RT KSN anchors, $\psi_{S,N}$, the edge distance reduction factor may be taken as 1.0 where the edge distances are ≥ $1.5h_{eff}$ or where local reinforcement is provided. If these conditions are not met, please contact us for further information.*
- *Analysis of the structure should be based on the assumption of linear elastic behaviour.*
- *Redistribution of elastic bending moments shall only be used if the greater of $\Sigma R_{d,c}$ and $\Sigma R_{d,s} \geq 1.25 \Sigma R_{d,y}$ this restriction is to ensure the anchor has sufficient capacity to develop strains in excess of those required for yield of the reinforcement.*
- *The shear capacity of the joint must be checked at all times. In tests with continuity bars at the top and bottom zones of the slab, no distress was evident that related to vertical shear in the plane of the wall, so it is unlikely vertical shear will be a problem. However, should the shear capacity be exceeded, then the designer may consider the use of debonded shear connectors.*
  The use of KeyBox metal casings approximately 85mm high x 36mm deep is considered a suitable alternative key. The effective wall depth to be used in the calculation of joint shear resistance is limited to 175mm or the anchor embedment, whichever is the greater.

Ancon RT KSN Anchors

Load Table Guidance

The RT KSN Anchor capacities on pages 15 to 23 are provided as design capacities N_{Rd}, which are taken as the minimum of the design capacities of the steel and concrete.

Design Examples

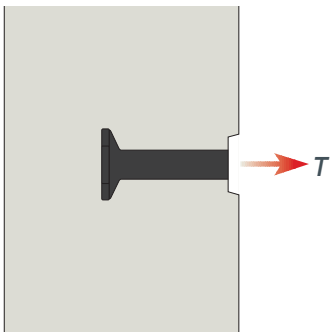
A)

Load condition:	**Direct tensile load**
Wall depth:	180 mm
Wall concrete:	32MPa
Minimum cover:	25mm
Tension applied:	165kN/m
Starter bar size and spacing:	N16@200
Assuming anchors at 200mm c/c:	N_{Ed} = 165 x 0.200 = 33kN per anchor

From the table on page 15 and by considering the anchor length and cover, the following anchors are suitable:

RT KSN16S@-RT KSNBLOCK 200c/c	Anchor design resistance N_{Rd}=34.8 kN
RT KSN16S@-Nailing Plate 200c/c	Anchor design resistance N_{Rd}=35.2 kN

The values in the table are not in bold which means that the **anchors are limited by the concrete design resistance,** thus supplementary reinforcement is required to ensure ductility of the connection.



B)

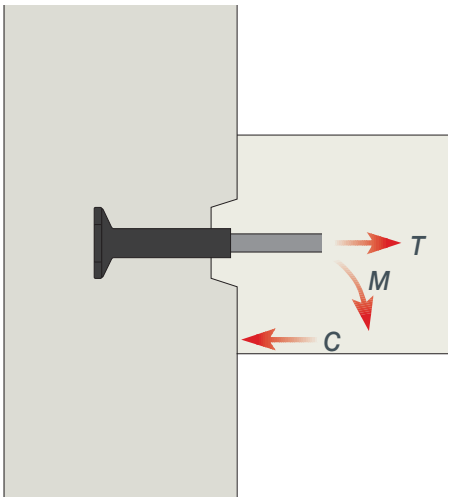
Load condition:	**Moment connection**
Anchor:	RT KSN16M x 160mm long
Method of fixture:	RT KSNBLOCK
Anchor effective embedment:	159mm
Anchor spacing:	200mm
Concrete:	32MPa
Slab depth:	250mm
Wall depth:	200mm
Anchor reinforcement location:	Mid slab depth

From the table on page 22 the anchor design resistance N_{Rd} is 80.4 kN

The value in the table is in bold which means that the **anchor design resistance is limited by the reinforcing bar yield capacity.** Therefore, the anchor is suitable for full elastic design.

An estimate of the design moment capacity per metre width (where the lever arm l_a = 0.85 x d_{eff} & d_{eff} = 100mm) (80.4 X 0.10 x 0.85) x (1000/200) = 34.2kNm per metre.

In cases where the anchor will be located to provide a mid slab connection, the joint design is generally considered as a pinned joint.



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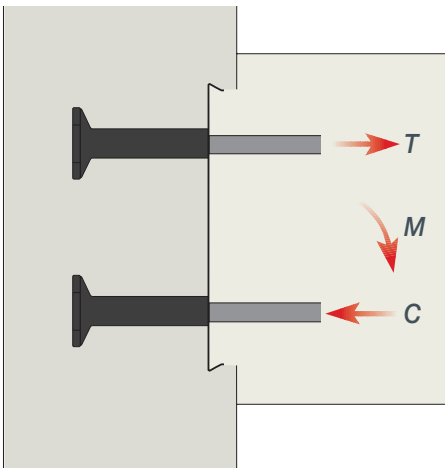
C)

Load condition:	**Moment connection**
Anchor:	RT KSN16M x 160mm long
Method of fixture:	RT KSNBOX casing 36mm deep
Anchor effective embedment:	190mm
Anchor spacing:	200mm
Concrete:	32MPa
Slab depth:	225mm
Wall depth:	250mm
Anchor reinforcement location:	Top and bottom of slab
Cover:	25mm to top main steel

From the table on page 16 the anchor design resistance N_{Rd} is 80.4 kN.

The value in the table is in bold which means that the **anchor design resistance is limited by the reinforcing bar yield capacity.** Therefore, the anchor is suitable for full elastic design.

An estimate of the design moment capacity per metre width (where the lever arm l_a = 0.85 x d_{eff} & d_{eff} = 192mm) (80.4 X 0.192 x 0.85) x (1000/200) = 65.6kNm per metre.

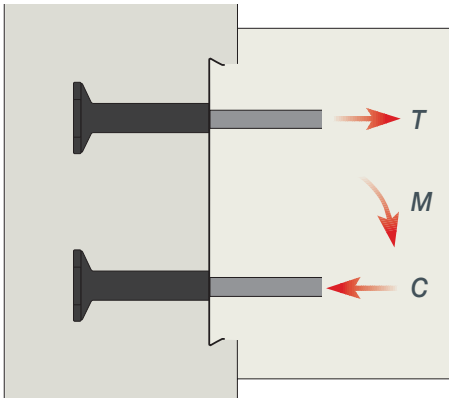


D)

Load condition:	**Moment connection**
Anchor:	RT KSN20S x 150mm long
Method of fixture:	RT KSNBOX casing 36mm deep
Anchor effective embedment:	180mm
Anchor spacing:	250mm
Concrete:	32MPa
Slab depth:	250mm
Wall depth:	300mm
Anchor reinforcement location:	Top and bottom of slab
Cover:	25mm to top main steel

From the table on page 17 the anchor design resistance N_{Rd} is 96.7 kN.

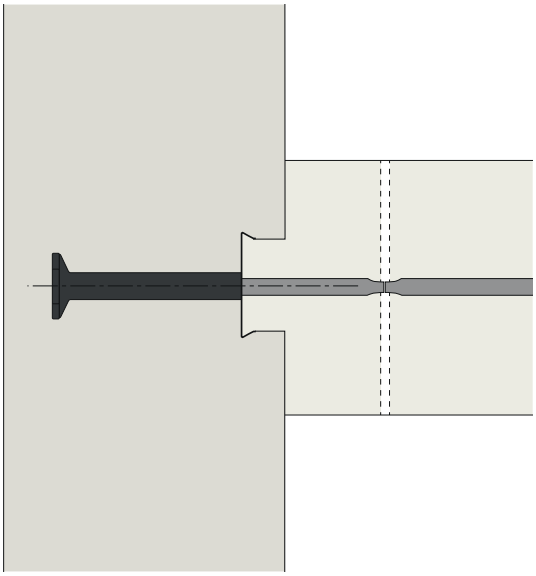
The value in the table is not in bold which means that the **anchor is limited by the concrete design resistance,** thus supplementary reinforcement is required to ensure ductility of the connection.
An estimate of the design moment capacity per metre width (where the lever arm l_a = 0.85 x d_{eff} & d_{eff} = 215mm) (96.7 X 0.215 x 0.85) x (1000/250) = 70.6kNm per metre.



Ancon RT KSN Anchors

Direct Tensile Concrete Characteristic Load Data

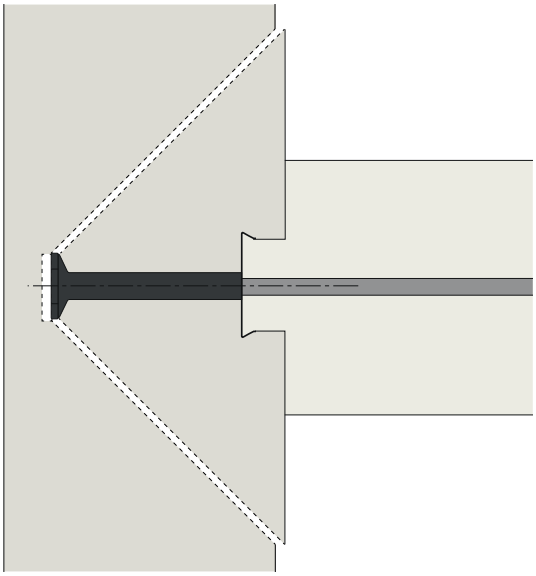
Failure modes related to headed anchors in slab/wall connections:



Yielding of reinforcement bar

Reinforcement yielding is the desired failure mode for reinforcement continuity systems. This failure mode provides the ductility that is required in the connection zone. Ancon RT KSN Anchors in combination with Ancon RT Threaded Starter bars ensure that the connection strength exceeds the strength of the Grade 500E bar.

Metric threaded bars that are often used in these applications will fail in the threaded connection zone of the bar and thus provide lower capacities and less ductility.



Concrete cone failure of the concrete surrounding the headed anchor

A tension failure in the concrete surrounding the headed anchor should be avoided as the concrete failure is considered a brittle failure mode. Ancon RT KSN Anchors are available in multiple lengths. It is recommended to always use the longest possible anchor for each condition and the maximum anchor length that fits in the wall section.

Threaded Inserts that are traditionally used for these connections have a reduced length and their concrete capacity will normally not suffice for the concrete breakout strength to exceed the capacity of the connected reinforcement bar.

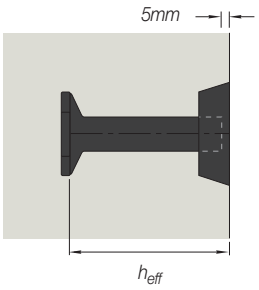
Mode of Failure

By increasing the embedment depth, the capacity of the RT KSN Anchor can be improved. The tables on pages 15 to 23 provide the tensile design resistance load of each anchor for the four installation methods. **Bold** figures indicate performance equal to or greater than reinforcement design resistance load $N_{Rd,s}$, where $N_{Rd,s} = N_{ks} \times 0.8$. If a ductile behaviour is required but the anchor arrangement does not provide a ductile failure mode, such behaviour can be obtained with some additional reinforcement.

$N_{Rd,s}$ = reinforcement design resistance load
N_{ks} = reinforcement characteristic load
0.8 = material reduction factor for reinforcement

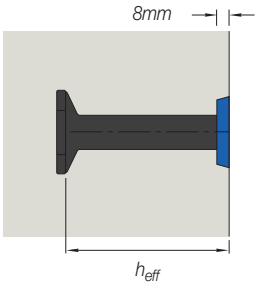
Effective embedment depth h_{eff} =
Anchor Length – Head Thickness (6mm) +
Additional Embedment

RT KSN Anchor Block (Additional 5mm Embedment)



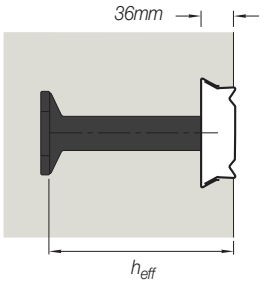
Anchor Ref.	Metric Thread (mm)	Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Anchor - Direct Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
					150	200	250	300	350	400	450
RT KSN12S	M13	12	115	114	24.5	32.7	40.9	**45.2**	**45.2**	**45.2**	**45.2**
RT KSN12M	M13	12	150	149	28.1	37.4	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
RT KSN16S	M17	16	130	129	26.1	34.8*	43.5	52.2	60.9	64.6	67.3
RT KSN16M	M17	16	160	159	29.0	38.6	48.3	58.0	67.6	74.2	**80.4**
RT KSN16L	M17	16	190	189	31.6	42.1	52.7	63.2	73.7	**80.4**	**80.4**
RT KSN20S	M21	20	150	149	28.1	37.4	46.8	56.1	65.5	71.8	83.6
RT KSN20M	M21	20	190	189	31.6	42.1	52.7	63.2	73.7	80.9	94.8
RT KSN20L	M21	20	230	229	34.8	46.4	58.0	69.6	81.1	89.0	104.3

RT KSN Anchors with Individual Nailing Plate (Additional 8mm Embedment)



RT KSN12S	M13	12	115	117	24.9	33.1	41.4	**45.2**	**45.2**	**45.2**	**45.2**
RT KSN12M	M13	12	150	152	28.3	37.8	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
RT KSN16S	M17	16	130	132	26.4	35.2*	44.0	52.8	61.6	66.9	69.7
RT KSN16M	M17	16	160	162	29.3	39.0	48.8	58.5	68.3	74.9	**80.4**
RT KSN16L	M17	16	190	192	31.8	42.5	53.1	63.7	74.3	**80.4**	**80.4**
RT KSN20S	M21	20	150	152	28.3	37.8	47.2	56.7	66.1	72.5	85.0
RT KSN20M	M21	20	190	192	31.8	42.5	53.1	63.7	74.3	81.5	95.5
RT KSN20L	M21	20	230	232	35.0	46.7	58.3	70.0	81.7	89.6	105.0

RT KSN Anchor Box (Additional 36mm Embedment)



RT KSN12S	M13	12	115	145	27.7	36.9	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
RT KSN12M	M13	12	150	180	30.8	41.1	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
RT KSN16S	M17	16	130	160	29.1	38.8	48.4	58.1	67.8	74.4	**80.4**
RT KSN16M	M17	16	160	190	31.7	42.2	52.8	63.4	73.9	**80.4**	**80.4**
RT KSN16L	M17	16	190	220	34.1	45.4	56.8	68.2	79.5	**80.4**	**80.4**
RT KSN20S	M21	20	150	180	30.8	41.1	51.4	61.7	71.9	78.9	92.5
RT KSN20M	M21	20	190	220	34.1	45.4	56.8	68.2	79.5	87.3	102.3
RT KSN20L	M21	20	230	260	37.1	49.4	61.8	74.1	86.5	94.9	111.2

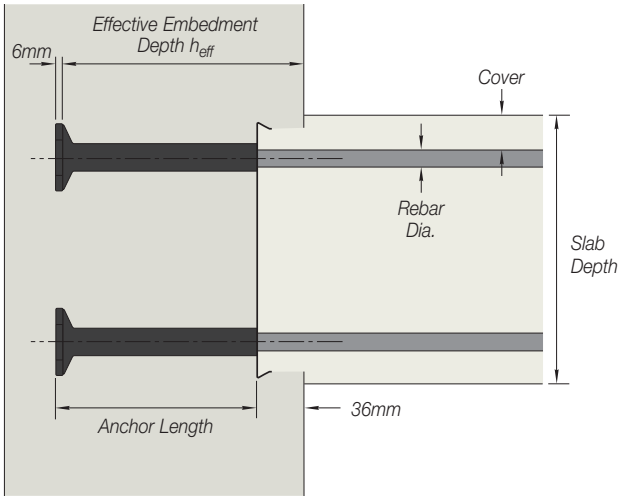
** Design example, see page 12*

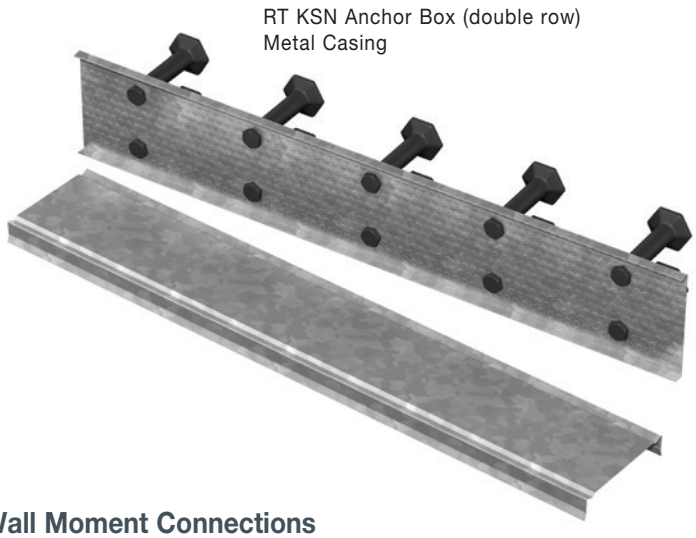
Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centreline.*

Bold *figures indicate performance equal or greater than reinforcement design resistance.*

Ancon RT KSN Anchors

RT KSN Anchor Box (Additional Embedment 36mm)
Moment Connection - Two layers of starter bars with 25mm cover





Tensile Concrete Characteristic Loads in Slab-to-Wall Moment Connections

Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Slab Depth (mm)	Anchor - Enhanced Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN12S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
12	115	145	175	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			200	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			225	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			250	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			275	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			300	40.8	40.8	40.8	41.5	**45.2**	**45.2**	**45.2**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN12M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
12	150	180	175	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			200	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			225	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			250	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			275	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			300	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN16S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	130	160	175	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	72.7	75.0	75.0	75.0	75.0	75.0	75.0
			275	64.3	64.3	64.3	64.3	64.3	64.3	64.3
			300	55.7	55.7	55.7	55.7	55.7	55.7	58.1
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN16M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	160	190	175	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	79.2	**80.4**	**80.4***	**80.4**	**80.4**	**80.4**	**80.4**
			250	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			300	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**

** Design example, see page 13*

Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centreline.*
Bold *figures indicate performance equal or greater than reinforcement design resistance.*
The above tables are based on 25mm cover to the top main steel. For other cover please contact us.

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Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Slab Depth (mm)	Anchor - Enhanced Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN16L				150	175	200	225	250	275	300
16	190	220	175	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			300	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN20S				150	175	200	225	250	275	300
20	150	180	175	77.1	89.9	102.8	115.6	**125.7**	**125.7**	**125.7**
			200	77.1	89.9	102.8	115.6	**125.7**	**125.7**	**125.7**
			225	77.1	89.9	102.8	115.6	122.8	122.8	122.8
			250	77.1	89.9	102.8	104.8	104.8*	104.8	104.8
			275	77.1	89.9	90.5	90.5	90.5	90.5	90.5
			300	77.1	78.9	78.9	78.9	78.9	78.9	78.9
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN20M				150	175	200	225	250	275	300
20	190	220	175	85.2	99.4	113.6	125.7	**125.7**	**125.7**	**125.7**
			200	85.2	99.4	113.6	125.7	**125.7**	**125.7**	**125.7**
			225	85.2	99.4	113.6	125.7	**125.7**	**125.7**	**125.7**
			250	85.2	99.4	113.6	125.7	**125.7**	**125.7**	**125.7**
			275	85.2	99.4	113.6	125.7	**125.7**	**125.7**	**125.7**
			300	85.2	99.4	113.6	125.7	**125.7**	**125.7**	**125.7**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN20L				150	175	200	225	250	275	300
20	230	260	175	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			200	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			225	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			250	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			275	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			300	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**

** Design example, see page 13*

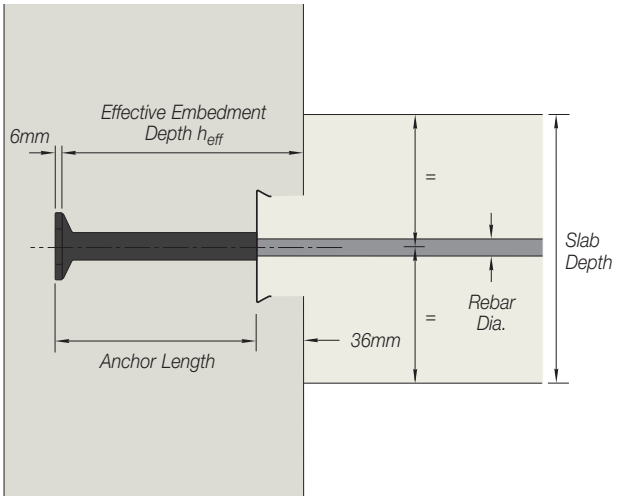
Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centreline.*

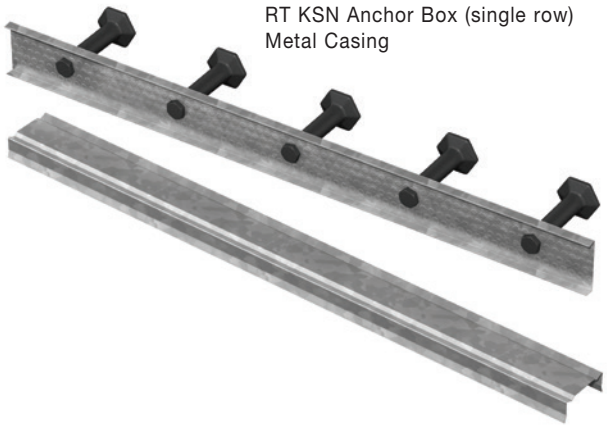
Bold *figures indicate performance equal or greater than reinforcement design resistance.*

The above tables are based on 25mm cover to the top main steel. For other cover please contact us.

Ancon RT KSN Anchors

RT KSN Anchor Box (Additional Embedment 36mm)
Moment Connection - Starter bars located mid depth of slab





RT KSN Anchor Box (single row)
Metal Casing

Tensile Concrete Characteristic Loads in Slab-to-Wall Moment Connections

Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Slab Depth (mm)	Anchor - Enhanced Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN12S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
12	115	145	175	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			200	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			225	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			250	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			275	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			300	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN12M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
12	150	180	175	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			200	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			225	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			250	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			275	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			300	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN16S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	130	160	175	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			300	72.7	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN16M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	160	190	175	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			300	79.2	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**

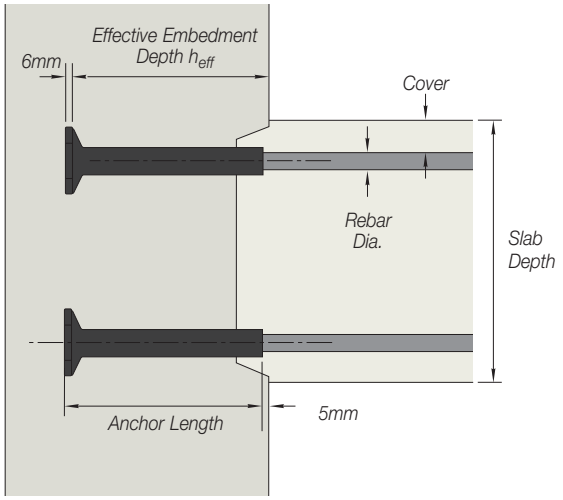
Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centreline.*
Bold *figures indicate performance equal or greater than reinforcement design resistance.*

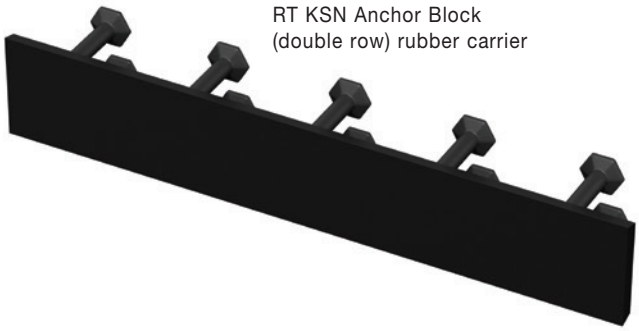
Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Slab Depth (mm)	Anchor - Enhanced Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN16L				150	175	200	225	250	275	300
16	190	220	175	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			300	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN20S				150	175	200	225	250	275	300
20	150	180	175	77.1	89.9	102.8	115.6	**125.7**	**125.7**	**125.7**
			200	77.1	89.9	102.8	115.6	**125.7**	**125.7**	**125.7**
			225	77.1	89.9	102.8	115.6	**125.7**	**125.7**	**125.7**
			250	77.1	89.9	102.8	115.6	**125.7**	**125.7**	**125.7**
			275	77.1	89.9	102.8	115.6	**125.7**	**125.7**	**125.7**
			300	77.1	89.9	102.8	115.6	**125.7**	**125.7**	**125.7**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN20M				150	175	200	225	250	275	300
20	190	220	175	85.2	99.4	113.6	**125.7**	**125.7**	**125.7**	**125.7**
			200	85.2	99.4	113.6	**125.7**	**125.7**	**125.7**	**125.7**
			225	85.2	99.4	113.6	**125.7**	**125.7**	**125.7**	**125.7**
			250	85.2	99.4	113.6	**125.7**	**125.7**	**125.7**	**125.7**
			275	85.2	99.4	113.6	**125.7**	**125.7**	**125.7**	**125.7**
			300	85.2	99.4	113.6	**125.7**	**125.7**	**125.7**	**125.7**
				Horizontal Spacing (mm)						
RT KSN Anchor Box with RT KSN20L				150	175	200	225	250	275	300
20	230	260	175	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			200	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			225	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			250	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			275	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**
			300	92.6	108.1	123.5	**125.7**	**125.7**	**125.7**	**125.7**

Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centreline.*
Bold *figures indicate performance equal or greater than reinforcement design resistance.*

Ancon RT KSN Anchors

RT KSN Anchor Block (Additional Embedment 5mm)
Moment Connection - Starter bars with 25mm cover





RT KSN Anchor Block
(double row) rubber carrier

Tensile Concrete Characteristic Loads in Slab-to-Wall Moment Connections

Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Slab Depth (mm)	Anchor - Enhanced Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN12S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
12	115	145	175	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			200	39.8	39.8	39.8	39.8	40.9	45.0	**45.2**
			225	32.5	32.5	32.7	36.8	40.9	45.0	**45.2**
			250	26.9	28.6	32.7	36.8	40.9	45.0	**45.2**
			275	24.5	28.6	32.7	36.8	40.9	45.0	**45.2**
			300	24.5	28.6	32.7	36.8	40.9	45.0	**45.2**
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN12M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
12	150	180	175	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			200	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			225	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			250	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			275	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			300	44.4	44.4	44.4	44.4	**45.2**	**45.2**	**45.2**
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN16S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	130	129	175	65.3	71.6	71.6	71.6	71.6	71.6	71.6
			200	57.8	57.8	57.8	57.8	57.8	57.8	57.8
			225	47.7	47.7	47.7	47.7	47.7	47.9	52.2
			250	39.8	39.8	39.8	39.8	43.5	47.9	52.2
			275	33.6	33.6	34.8	39.2	43.5	47.9	52.2
			300	28.6	30.5	34.8	39.2	43.5	47.9	52.2
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN16M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	160	159	175	72.4	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	72.4	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	72.4	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	72.4	73.6	73.6	73.6	73.6	73.6	77.3
			275	63.2	63.2	63.2	63.2	63.2	63.2	77.3
			300	54.7	54.7	54.7	54.7	54.7	58.0	77.3

Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centerline.*
Bold *figures indicate performance equal or greater than reinforcement design resistance.*
The above tables are based on 25mm cover to the top main steel. For other cover please contact us.

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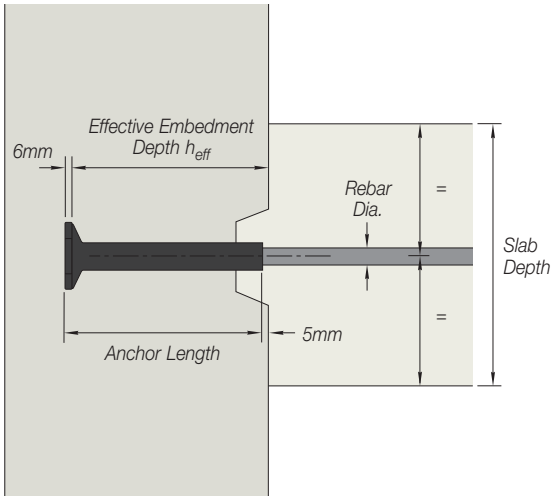
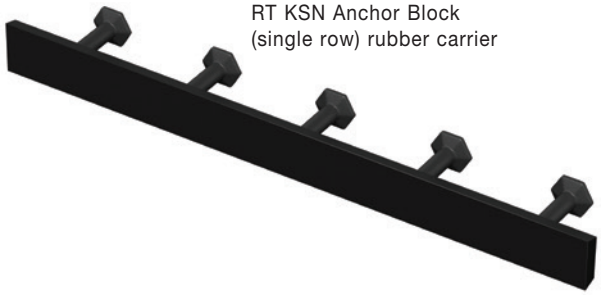
Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Slab Depth (mm)	Anchor - Enhanced Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN16L				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	190	189	175	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			300	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN20S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
20	150	149	175	70.1	81.8	93.5	104.5	104.5	104.5	104.5
			200	70.1	81.8	86.8	86.8	86.8	86.8	86.8
			225	70.1	72.2	72.2	72.2	72.2	72.2	72.2
			250	61.0	61.0	61.0	61.0	61.0	61.0	61.0
			275	52.1	52.1	52.1	52.1	52.1	52.1	56.1
			300	44.9	44.9	44.9	44.9	46.8	51.4	56.1
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN20M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
20	190	189	175	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
			200	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
			225	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
			250	79.0	92.1	105.3	118.5	120.2	120.2	120.2
			275	79.0	92.1	104.1	104.1	104.1	104.1	104.1
			300	79.0	91.0	91.0	91.0	91.0	91.0	91.0
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN20L				**150**	**175**	**200**	**225**	**250**	**275**	**300**
20	230	229	175	86.9	101.4	115.9	**125.7**	**125.7**	**125.7**	**125.7**
			200	86.9	101.4	115.9	**125.7**	**125.7**	**125.7**	**125.7**
			225	86.9	101.4	115.9	**125.7**	**125.7**	**125.7**	**125.7**
			250	86.9	101.4	115.9	**125.7**	**125.7**	**125.7**	**125.7**
			275	86.9	101.4	115.9	**125.7**	**125.7**	**125.7**	**125.7**
			300	86.9	101.4	115.9	**125.7**	**125.7**	**125.7**	**125.7**

Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centerline.*
Bold *figures indicate performance equal or greater than reinforcement design resistance.*
The above tables are based on 25mm cover to the top main steel. For other cover please contact us.

Ancon RT KSN Anchors

RT KSN Anchor Block (Additional Embedment 5mm)
Moment Connection - Starter bars located mid depth of slab





RT KSN Anchor Block
(single row) rubber carrier

Tensile Concrete Characteristic Loads in Slab-to-Wall Moment Connections

Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Slab Depth (mm)	Anchor - Enhanced Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN12S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
12	115	114	175	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			200	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			225	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			250	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			275	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			300	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN12M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
12	150	149	175	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			200	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			225	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			250	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			275	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
			300	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**	**45.2**
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN16S				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	130	129	175	65.3	76.1	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	65.3	76.1	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	65.3	76.1	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	65.3	76.1	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	65.3	74.6	74.6	74.6	74.6	74.6	74.6
			300	65.3	66.7	66.7	66.7	66.7	66.7	66.7
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN16M				**150**	**175**	**200**	**225**	**250**	**275**	**300**
16	160	159	175	72.4	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	72.4	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	72.4	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	72.4	**80.4***	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	72.4	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			300	72.4	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**

** Design example, see page 12*

Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centerline.*
Bold *figures indicate performance equal or greater than reinforcement design resistance*

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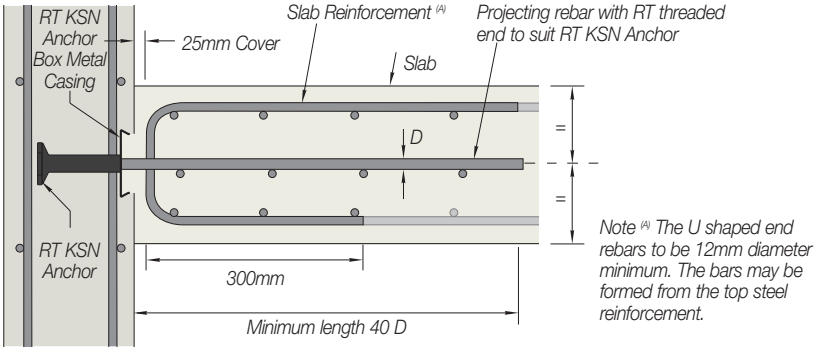
Rebar Dia. (mm)	Anchor Length (mm)	Embedment Depth h_{eff} (mm)	Slab Depth (mm)	Anchor - Enhanced Tensile Resistance Load N_{Rd} (kN) 32MPa Concrete at Various Anchor Spacing						
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN16L				150	175	200	225	250	275	300
16	190	189	175	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			200	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			225	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			250	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			275	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
			300	79.0	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**	**80.4**
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN20S				150	175	200	225	250	275	300
20	150	149	175	70.1	81.8	93.5	104.5	104.5	104.5	104.5
			200	70.1	81.8	93.5	104.5	104.5	104.5	104.5
			225	70.1	81.8	93.5	104.5	104.5	104.5	104.5
			250	70.1	81.8	93.5	104.5	104.5	104.5	104.5
			275	70.1	81.8	93.5	104.5	104.5	104.5	104.5
			300	70.1	81.8	93.5	99.5	99.5	99.5	99.5
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN20M				150	175	200	225	250	275	300
20	190	189	175	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
			200	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
			225	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
			250	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
			275	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
			300	79.0	92.1	105.3	118.5	**125.7**	**125.7**	**125.7**
				Horizontal Spacing (mm)						
RT KSN Anchor Block with RT KSN20L				150	175	200	225	250	275	300
20	230	229	175	86.9	101.4	115.9	**125.2**	**125.7**	**125.7**	**125.7**
			200	86.9	101.4	115.9	**125.2**	**125.7**	**125.7**	**125.7**
			225	86.9	101.4	115.9	**125.2**	**125.7**	**125.7**	**125.7**
			250	86.9	101.4	115.9	**125.2**	**125.7**	**125.7**	**125.7**
			275	86.9	101.4	115.9	**125.2**	**125.7**	**125.7**	**125.7**
			300	86.9	101.4	115.9	**125.2**	**125.7**	**125.7**	**125.7**

Notes: *All edges assumed to be at least 1.5 x h_{eff} from anchor centerline.*
Bold *figures indicate performance equal or greater than reinforcement design resistance.*

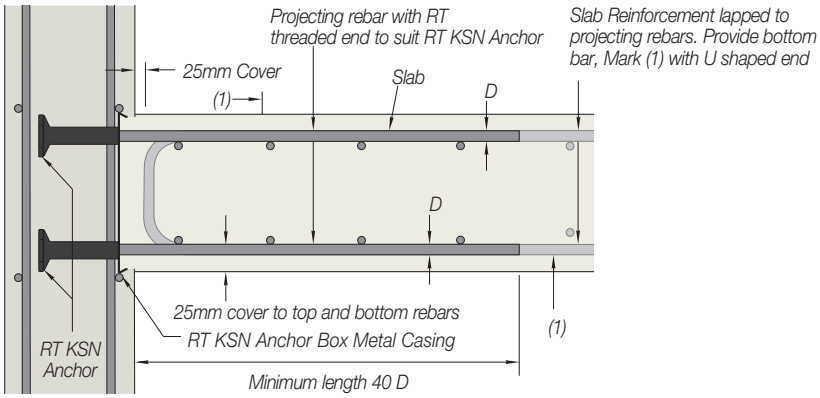
Reinforcement Details

Correct detailing of reinforcement in accordance with appropriate design codes and the recommendations provided here will ensure Ancon RT KSN Anchors attain the designed performance.

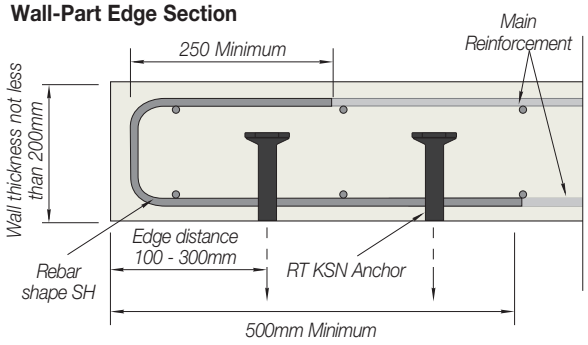
Mid Slab Anchor Connection



Top and Bottom Slab Anchor Connection

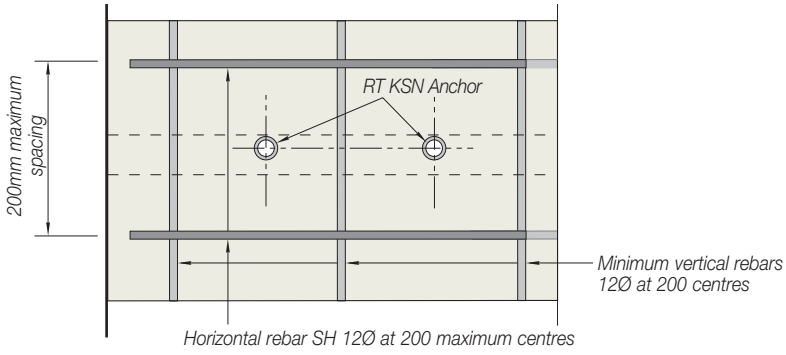


Wall-Part Edge Section



Reinforcement: *Minimum edge reinforcement, 12mm diameter Grade 500E*
The main reinforcement can be detailed to incorporate the above shape noted as rebar SH

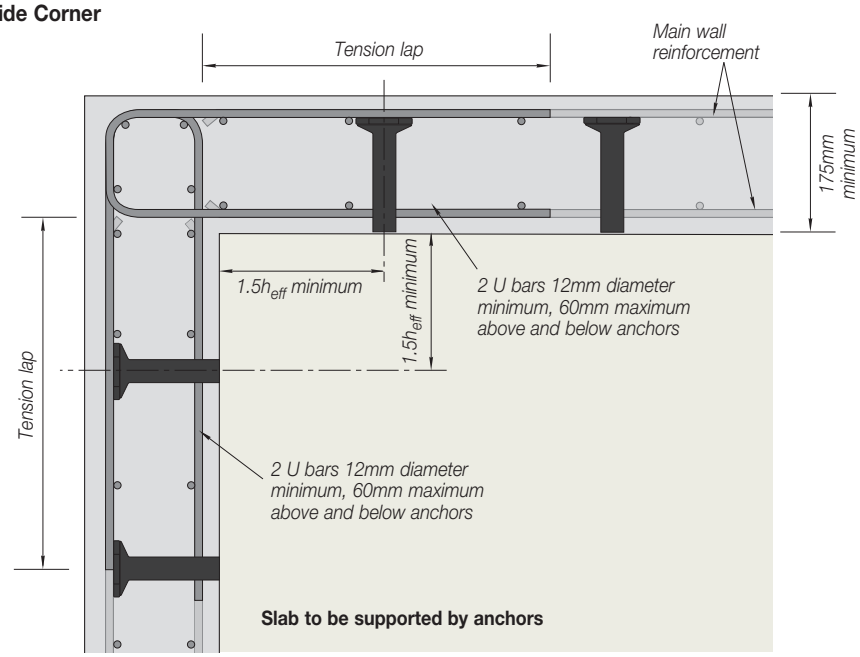
Wall-Part Edge Elevation



RT KSN Corner Guidance

RT KSN Anchors may be used to connect slabs to walls at corners as long as certain conditions are met.

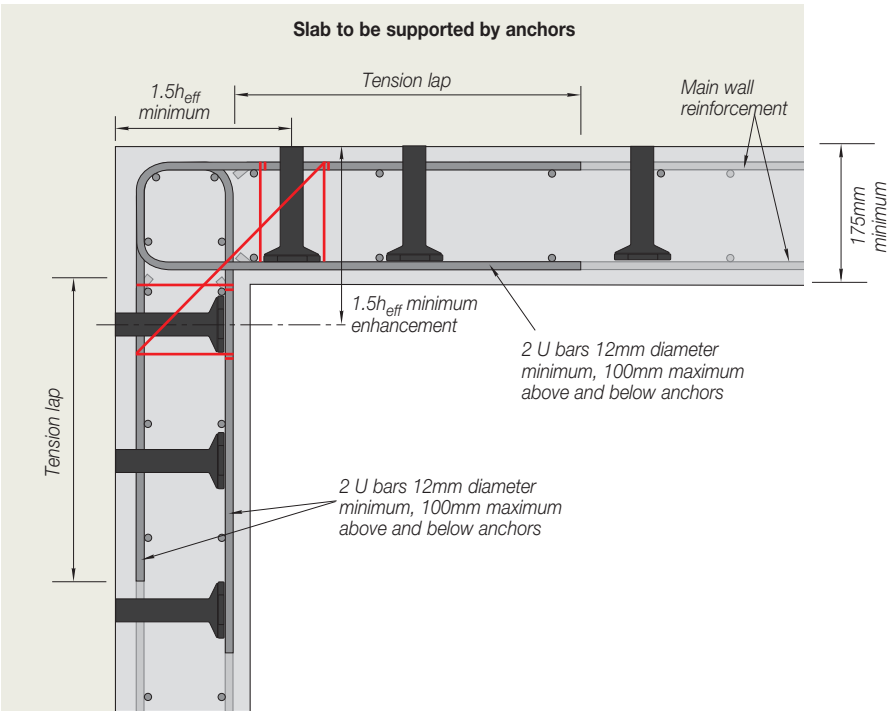
Inside Corner



Recommendations:

- Additional U-shaped rebars are to be provided above and below the corner anchors
- Careful attention to detailing of the anchors at corner locations is required to avoid the possibility of a clash of the continuity bars

Re-entrant Corner



Recommendations:

- Additional U-shaped rebars are to be provided above and below the corner anchors
- For high moments a special detail may be required, for example links and diagonal bars (shown red)
- Anchors at the re-entrant corner will have to resist higher loads than the current anchors due to the larger area of slab supported and therefore need to be designed for the specific loads applied to them

Ancon RT KSN Anchors

Guidance Regarding Ductility Requirement

NZS 3101:2016 - clause C17.6.5: Anchors and connections should be designed to suppress a brittle concrete pull-out failure, when approaching the ultimate limit state. As the concrete failure is recognised as a brittle failure, reinforcing bars around the RT KSN Anchors should be detailed in a way to reach required ductility level.

The design of slab-wall connections should not be made in isolation but should be as part of a structural system. Ductility requirements of such a connection will depend on the robustness requirements of the structure of which it is part and the strategy chosen to achieve global robustness.

Fixings shall be designed to yield before ultimate failure in the event of overload (NZS 3101:2016 - clause C17.6.5). In addition, when the structure is designed to earthquake requirements connections shall have sufficient ductility to preclude non-ductile failure.

To achieve such ductility, adding supplementary reinforcement is recommended. The supplementary reinforcing bars shall be designed to take the RT KSN Anchor design loads.

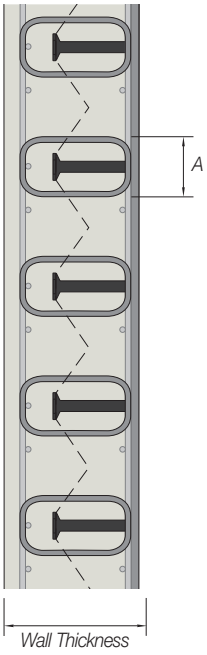
NZS 3101:2016 - section 8 provides guidance on supplementary reinforcement around anchors. The provided strength by supplementary reinforcement shall be based on development length and related tensile stress in the reinforcing bar (σ_{st}) not exceeding yield strength of the bar.

The supplementary reinforcing bar can be positioned directly next to the RT KSN Anchor or within a distance of up to 0.75 h_{eff}. The portion of the supplementary reinforcing bar located in the concrete failure cone may have the minimum length of,

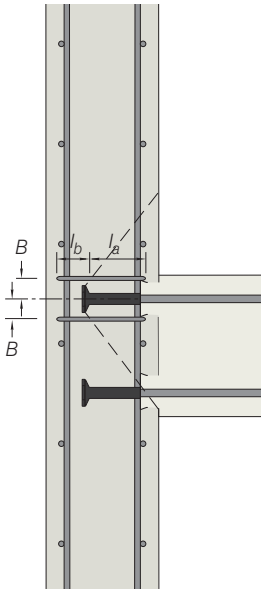
- $l_a \geq 4d_b$ for bends, hooks or loops
- $l_a \geq 10d_b$ for straight bars

where d_b is the reinforcing bar diameter.

As the supplementary reinforcing bar engages only after the concrete cracks, the development length inside and outside of the concrete failure cone can be calculated by following the crack pattern. According to the CCD method, the angle between crack direction and the anchor is around 55°.



Horizontal Section
Plan View



Vertical Section
Side View

Anchor Ref.	Bar Diameter (mm)	Anchor Length (mm)	Min. Wall Thickness w. RT KSNBOX (mm)	Link Diameter (mm)	Dimension A (mm)	Dimension B (mm)
RT KSN12S	12	115	185	12	120	90
RT KSN12M	12	150	220	12	120	110
RT KSN16S	16	130	200	16	120	90
RT KSN16M	16	160	230	16	120	115
RT KSN16L	16	190	260	12	120	140
RT KSN20S	20	150	220	16	135	105
RT KSN20M	20	190	260	16	135	140
RT KSN20L	20	230	300	12	135	165

Guidance on Shear Checks

The shear capacity of the joint (vertical shear at the interface and horizontal shear in the wall) must be checked by the designer. Tests undertaken with top and bottom anchors have shown no sign of distress due to shear at the interface, however suitability must be checked by the designer. Ignoring the shear key effect, the shear capacity is the minimum of the following:

- Concrete pry-out capacity calculated by CCD method
- Steel shear capacity of the starter bar
- Dowel bending capacity
- Shear friction capacity

For example, for RT KSN16S @ 200 with RT KSN Anchor Box metal casing and slab thickness of 250mm the shear capacity can be calculated as below:

- Concrete shear pry-out calculated by CCD method (according to NZS 3101)

$N_{Rd,c}$ = 38.8 kN

$V_{Rd,c} = 2 \times N_{Rd,c}$ = 77.6 kN

• Steel shear capacity of the starter bar (NZS 3404)

$V_{Rd,s} = ø_s \times 0.62 \times A_s \times f_y$

Capacity reduction factor=0.8 (NZS 3404, Table 3.3)

$V_{Rd,s}$ = 0.8 × 0.62 × 201.06 mm^2 × 500MPa

= 49.86 kN **• Dowel bending capacity (EC-3 and EC-4) assuming 1mm gap**

$V_{Rd,D} = \text{Min}\,(V_{pl,RD}, V_{Rd,1})$

Where **(EN 1993-1-1 Eq. 6.18)**

$V_{pl,RD} = A_v\,(f_y / \sqrt{3}) / \gamma_{M0}$

= 53 kN

and

$V_{Rd,1} = 2M_{pl,\,Rd} / (f + a)$

$M_{pl,Rd} = W_{pl}\, f_y\, \gamma_{M0}$ = 310 kNmm

$a = V_{Rd1} / (øf_{cd,\,sup})$ = 27.07mm

$V_{Rd,1}$ = 22.11kN

Therefore

$V_{Rd,D}$ = 22.1kN

• Shear friction capacity (EC-2) **(EN 1992-1-1 - Clause 6.2.5)**

$V_{Rdi} = c\, f_{ctd} + \mu\, \sigma_n + \rho\, f_{yd}\,(\mu \sin\alpha + \cos\alpha) \leq 0.5\, v\, f_{cd}$

μ = 0.6

c = 0.35

σ_n = 0

α = 90

f_{ctd} = 1.38

$\rho\, f_{yd}$ = 1.088 (the f_{yd} is replaced by the tensile capacity from table on page 14,

ρ = interface area = 250* 1000)

Therefore

V_{Rdi} = 1.13 MPa

Provided shear resistance per anchor (lever arm = 125)

V_{Rd} = 28.4 kN

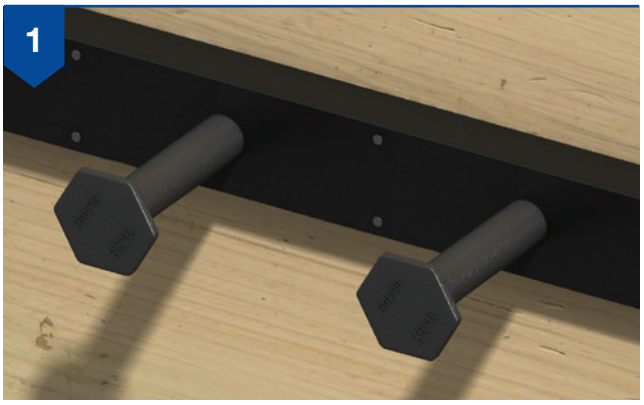
Shear capacity of RT KSN16S @ 200 with RT KSN Anchor Box for 250 slab with 32MPa concrete is the minimum value of above calculated values which is 22.1kN per anchor or 110.5kN per metre.

For advice please contact Leviat.

Ancon RT KSN Anchors

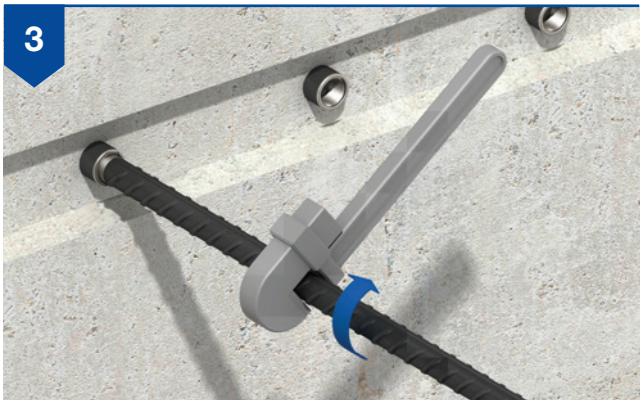
Installation Guidance

Re-Useable RT KSN Anchor Block



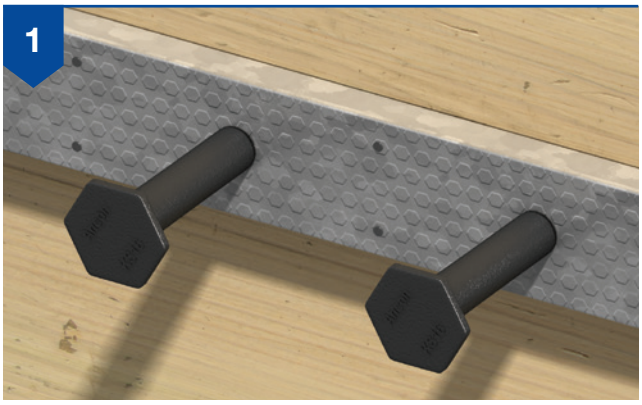
RT KSN Anchors are inserted into the Ancon RT KSN Anchor Block. The unit is then nailed to the formwork. The wall reinforcement is installed to which the anchors are tied. The concrete is cast and once it reaches sufficient strength, the formwork is removed.

When a connection is required, the Ancon RT KSN Anchor Block is removed and retained for future use.



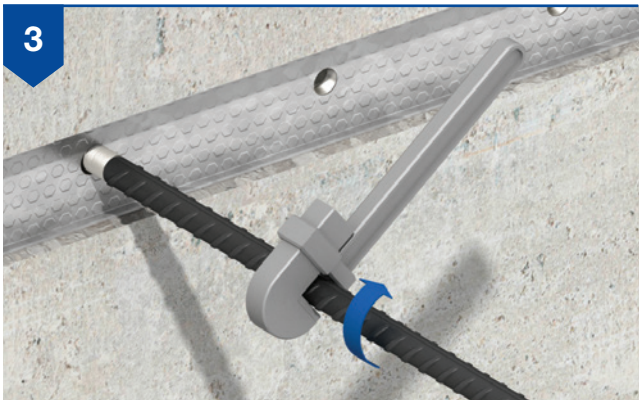
The RT parallel threaded reinforcing bar is rotated into the RT KSN Anchor and tightened using a wrench. No more than 2mm of thread should be left exposed on the bar. Fix the slab reinforcement and pour the concrete to complete the installation.

RT KSN Anchor Box



Nail the metal casing to the formwork. The wall reinforcement is installed to which the anchors are tied. The concrete is cast and once it reaches sufficient strength, the formwork is removed to reveal the steel cover.

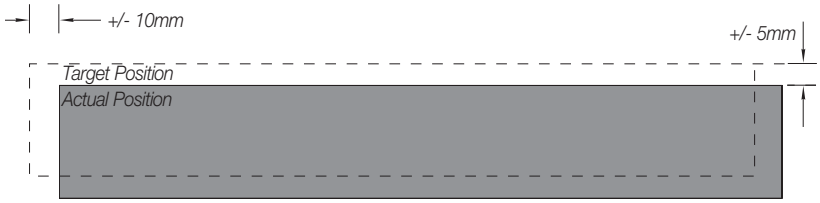
When a connection is required, the cover is removed and the bolts which held the Anchors to the casing prior to installation are removed to reveal the threads.



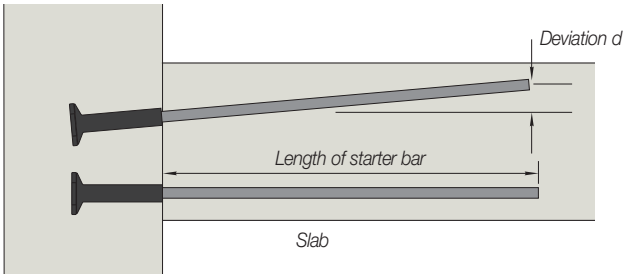
The RT parallel threaded reinforcing bar is rotated into the RT KSN Anchor and tightened using a wrench. No more than 2mm of thread should be left exposed on the bar. Fix the slab reinforcement and pour the concrete to complete the installation.

Installation Tolerances

In order to ensure adequate cover to the starter bar and to comply with the design, it is important that the RT KSN Anchor is set to the correct position and fixed to prevent any movement during concreting. The installation tolerances for the Ancon RT KSN Anchor Block and Ancon RT KSN Anchor Box are shown below.

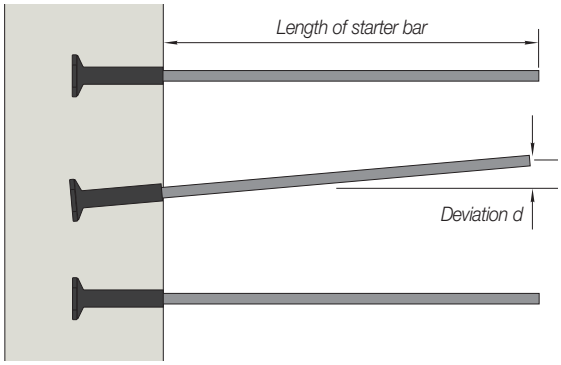


RT KSN Anchor Box and Anchor Block Deviation Allowances



Vertical Transverse Section Alignment of Anchor
Side View

Allowable vertical deviation: d=-5, +10mm where a positive value indicates the amount the cover increases and a negative value indicates the amount the cover decreases.



Horizontal Transverse Section Alignment of Anchor
Plan View

Allowable horizontal deviation: d=10% of the specified spacing or 15mm, whichever is greater.

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