Tenn™ FASTENING SYSTEMS

TENN PK WEDGE ANCHORS

Torque-Controlled Expansion Anchors

ADVANTAGES

- Drill-hole diameter equals thread diameter, therefore insitu fastening is possible, i.e. the anchor hole may be drilled and PK Wedge Anchor inserted through the clearance hole in the attachment.
- Alignment problems eliminated.
- No need for prior marking out of drill-holes in concrete.

Providing a secure, heavy-duty insitu anchorage for attachments to concrete, Tenn PK Wedge Anchors give complete support in shear for a stronger fastening against dynamic side loads, and are specifically designed for quick and ready installation.

Comprising a high strength steel bolt with a tough expansion collar, PK Wedge Anchors are set by torque and are suitable for either preset or through-fix installations. To ensure a durable, high performance anchorage with high pull-out values, the collar is specifically designed to give controlled expansion within the base material

- High clamping loads.
- PK Anchor does not depend on bottom of hole to expand and therefore may be used in overdrilled holes.
- No special setting tools required.
- Smaller drill-hole diameter than any other expansion anchor.
- Available in 4 versions:
  1. Carbon steel, zinc plated
  2. Carbon steel, hot-dip galvanized
  3. Stainless steel, Grade 304 (A2)
  4. Stainless steel, Grade 316 (A4).

Typical Applications

- Highway guard rail posts
- Scaffolding brackets
- Industrial doors and gates
- Curtainwall brackets
- Stainless steel anchoring in water supply and sewerage projects

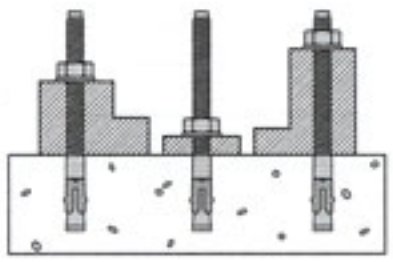
DESCRIPTION

Tenn PK Wedge Anchor is a steel stud bolt with a nut and a washer on one end. The other end has a uniformly tapered mandrel around which an expansion collar is fitted. When the nut is tightened, the sleeve slightly expands and engages the wall of the hole preventing the anchor from turning in the hole. With further tightening, the tapered mandrel travels up the sleeve forcing it to expand and grip the sides of the hole.

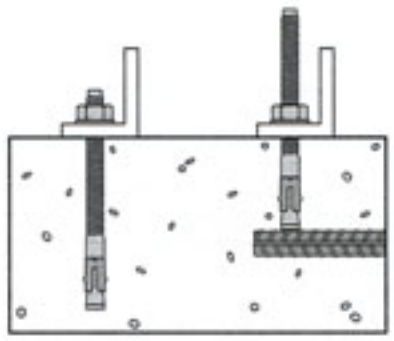
Features of PK Wedge Anchor

1. Extra long thread
2. Expansion collar designed to clinch wall of drill-hole to prevent turning during setting
3. High taper base permits re-expansion when re-tightening is necessary

PK ANCHOR'S LONG THREAD ADVANTAGE



Long thread accommodates various material thicknesses at the same embedment. One anchor length saves installation time and money.



Long thread feature overcomes subsurface obstruction problems.

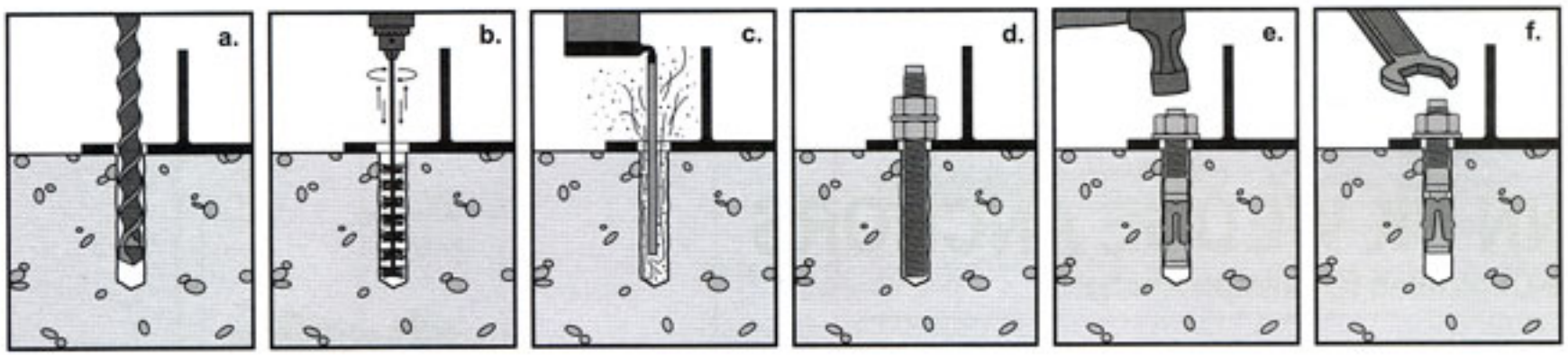
PK Wedge Anchor Material Properties

Quality	Ultimate Tensile Strength	Yield Stress
	f_t, N/mm^2	f_y, N/mm^2
Carbon Steel 5.8	500	400
Stainless Steel 304 (A2)		
≤ M16	700	450
≥ M20	500	250
316 (A4)		
≤ M16	700	450
≥ M20	500	250

Tensile Breaking Loads

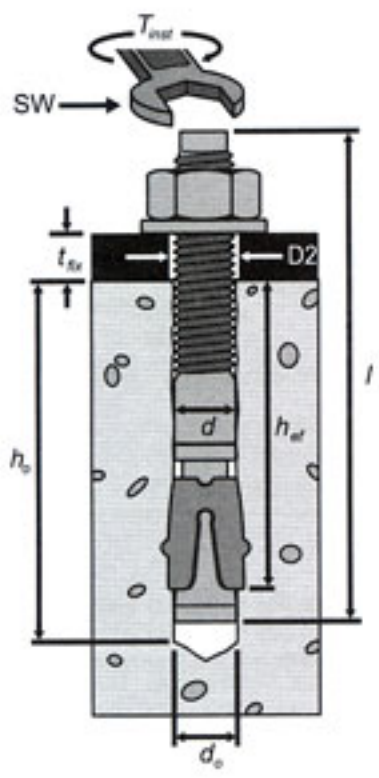
PK Wedge Anchor Size	Tensile Stress Area	Minimum Breaking Loads		
		Carbon Steel	Stainless Steel	
		5.8	304	316
d, mm	A_s, mm^2	N_u, kN	N_u, kN	N_u, kN
M6	20.1	10.1	14.1	14.1
M8	36.6	18.3	25.6	25.6
M10	58.0	29.0	40.6	40.6
M12	84.3	42.2	59.0	59.0
M16	157.0	78.5	109.9	109.9
M20	245.0	122.5	171.5	171.5
M24	353.0	176.5	176.5	176.5

INSTALLATION PROCEDURE



a. Drill hole to correct diameter and depth.
b. Brush side of hole to loosen dust.
c. Extract dust with a vacuum cleaner or blow out with compressed air
d. Check for fit and depth.
e. Tap in Tenn PK Wedge Anchor.
f. Expand anchor: to apply pre-load, tighten nut to bring surfaces into intimate contact; mark position of nut on the attachment, then further tighten nut an additional 1/3 to 1/2 turn from mark.

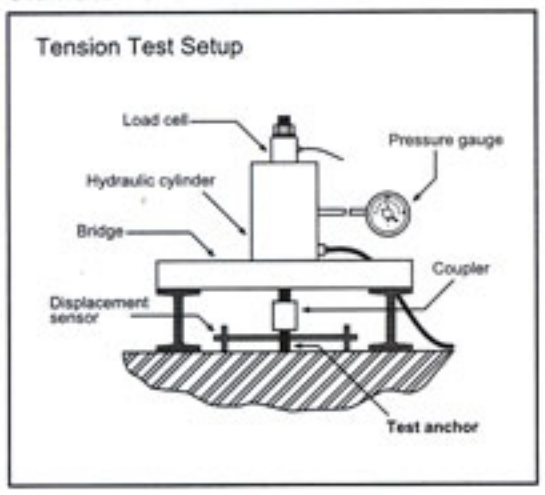
INSTALLATION DATA



Type	Anchor Size d, mm	Anchor Length l, mm	Maximum Attachment Thickness t_{fix}, mm	Drill-Hole Diameter d_o, mm	Minimum Drill-Hole Depth h_o, mm	Tightening Torque T_{inst}, Nm	Wrench Size SW, mm	Clearance Hole Diameter D2, mm
PK 06065	M6	65	20	6	55	4.5	10	7
PK 06100	M6	100	55	6	55	4.5	10	7
PK 08080	M8	80	25	8	55	11	13	9
PK 08105	M8	105	50	8	55	11	13	9
PK 10080	M10	80	15	10	65	22	17	11
PK 10100	M10	100	35	10	65	22	17	11
PK 10120	M10	120	55	10	65	22	17	11
PK 12080	M12	80	10	12	70	39	19	13
PK 12100	M12	100	30	12	70	39	19	13
PK 12120	M12	120	50	12	70	39	19	13
PK 12150	M12	150	80	12	70	39	19	13
PK 16100	M16	100	12	16	80	94	24	18
PK 16125	M16	125	37	16	80	94	24	18
PK 16140	M16	140	50	16	80	94	24	18
PK 16180	M16	180	90	16	80	94	24	18
PK 16220	M16	220	130	16	80	94	24	18
PK 20125	M20	125	20	20	100	185	30	22
PK 20140	M20	140	40	20	100	185	30	22
PK 20160	M20	160	60	20	100	185	30	22
PK 24180	M24	180	45	24	135	318	36	26

TEST DATA

Ultimate Failure Loads



Failure modes

*Pull-out failure
**Concrete-cone failure

^Lateral concrete-cone failure
^^Steel failure

All tests were conducted in accordance with ASTM E-488-96 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements" in 25 N/mm^2 unreinforced concrete. Edge effect, concrete strength and rebar location, if any, will affect anchorage performance.

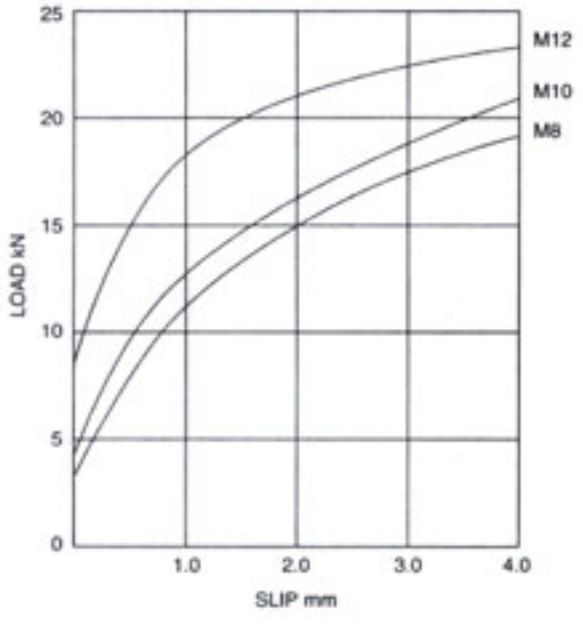
PK Wedge Anchor Size d, mm	Drill-Hole Diameter d_o, mm	Average Ultimate Pull-out Loads, N_u (kN) Embedment Depth, h_{ef} 35 mm	45 mm	55 mm	65 mm	75 mm	90 mm	110 mm	130 mm
M6	6	7.2*	7.5*	-	-	-	-	-	-
M8	8	-	10.3*	11.9**	-	-	-	-	-
M10	10	-	12.7*	15.0**	18.0**	-	-	-	-
M12	12	-	14.5*	18.5**	22.4**	28.6**	-	-	-
M16	16	-	-	22.4**	25.3**	30.5**	36.0**	-	-
M20	20	-	-	-	-	37.1**	44.4**	49.7**	-
M24	24	-	-	-	-	-	-	65.8**	74.8**

PK Wedge Anchor Size d, mm	Drill-Hole Diameter d_o, mm	Average Ultimate Shear Loads, V_u (kN) Embedment Depth, h_{ef} 35 mm	45 mm	55 mm	65 mm	75 mm	90 mm	110 mm	130 mm
M6	6	7.3^	7.9^^	-	-	-	-	-	-
M8	8	-	12.0^	14.9^	-	-	-	-	-
M10	10	-	-	18.8^	27.3^	-	-	-	-
M12	12	-	-	22.5^	31.4^	32.8^	-	-	-
M16	16	-	-	-	-	45.9^	55.3^	-	-
M20	20	-	-	-	-	-	67.4^	66.0^	-
M24	24	-	-	-	-	-	-	75.3^	89.1^

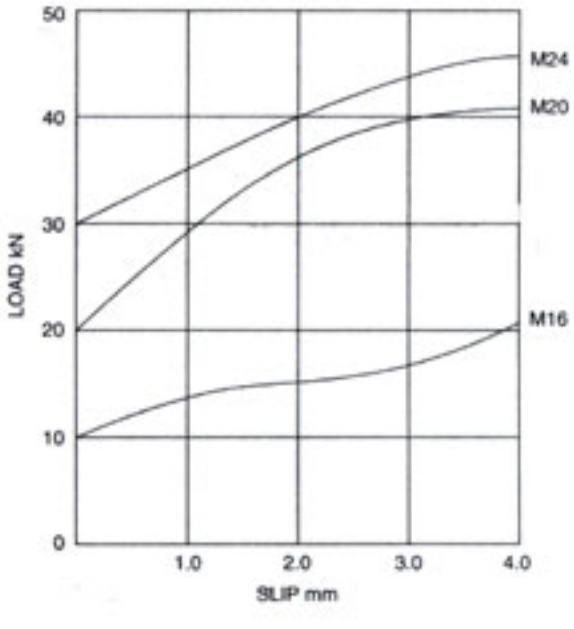
TYPICAL LOAD vs. DISPLACEMENT GRAPHS FOR TENN PK WEDGE ANCHORS

Graphs 1 & 2 show direct pull-out load vs. slip in 25 N/mm^2 concrete.
Graph 3 shows 90° shear load vs. slip in 25 N/mm^2 concrete.

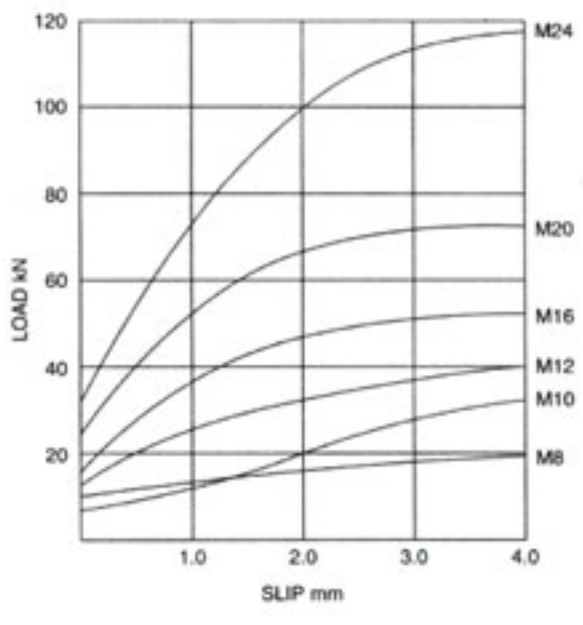
Graph 1



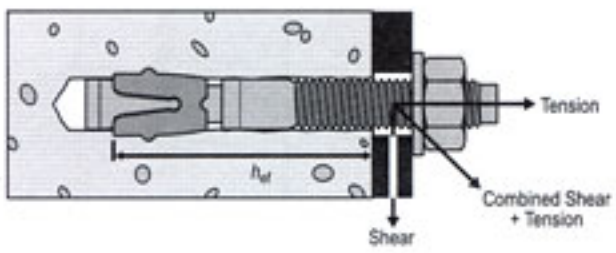
Graph 2



Graph 3



SAFE WORKING LOADS



Safe Working Load Reduction Tables

Spacing. Critical Spacing s_{cr} is the least anchor-to-anchor spacing at which the safe working loads
listed in Table 1 are applicable.

Minimum spacing s_{min} is the absolute minimum anchor-to-anchor spacing permitted.

If spaced less than s_{cr}, the anchor's safe working load must be reduced. Refer to Table 2 for reduction factors.

Edge Distance. Critical Edge Distance c_{cr} is the minimum anchor-to-edge distance at which the safe working loads listed in Table 1 are applicable.

Edge distance c_{min} is the absolute minimum edge distance permitted.

For an edge distance less than c_{cr}, the anchor's safe working load must be reduced. Refer to Table 3 for reduction factors.

Net Safe Working Loads

Net safe working loads for Tenn PK Wedge Anchors are obtained by multiplying the safe working loads by one or more load reduction factors found in Tables 2 and 3.

In the case where three or more anchors are used, spacing reduction factors must be multiplied together. Where two or more edge distances affect performance, edge reduction factors must be multiplied together.

If two or more anchors in a group are affected by both reduced spacing and reduced edge distances, the edge and spacing reduction factors must be multiplied together.

See calculation example overleaf.

Table 1. Safe Working Loads in C20/25 Concrete

PK Wedge Anchor Size d, mm	Drill-Hole Diameter d_o, mm	Effective Embedment Depth h_{ef}, mm	Minimum Concrete Thickness h, mm	Critical Spacing s_{cr}, mm	Critical Edge Distance c_{cr}, mm	Safe Working Loads, SWL	
						Tension kN	Shear kN
M6	6	35	75	90	70	1.8	2.0
M8	8	45	90	115	90	2.6	3.1
M10	10	55	100	140	110	3.8	4.7
M12	12	65	120	165	130	5.6	7.9
M16	16	90	150	225	180	9.0	13.8
M20	20	110	180	275	220	12.4	16.5
M24	24	130	200	325	260	18.7	22.3

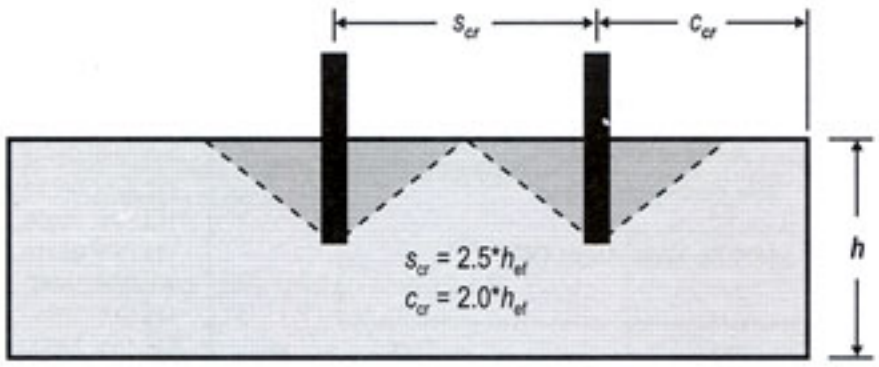


Table 2.
Load Reduction Factors for Reduced Centre-To-Centre Spacing - Tension and Shear Loading

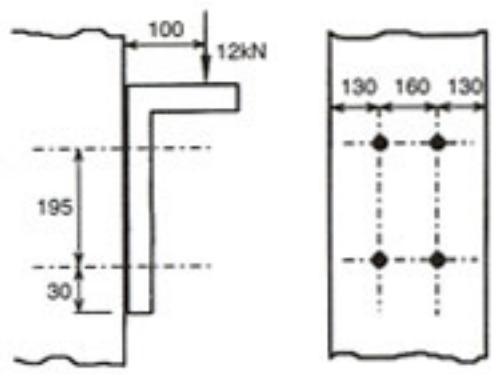
PK Wedge Anchor Size d, mm	M6	M8	M10	M12	M16	M20	M24
Critical Spacing s_{cr}, mm	90	115	140	165	225	275	325
Min. Spacing s_{min}, mm	60	80	95	115	160	195	230
Actual Spacing s, mm	Reduction Factors ψs for reduced centre-to centre spacing						
60	0.70						
80	0.90	0.70					
90	1.00	0.79					
95		0.83	0.70				
115		1.00	0.83	0.70			
130			0.93	0.79			
140			1.00	0.85			
160				0.97	0.70		
165				1.00	0.72		
195					0.86	0.70	
225					1.00	0.81	
230						0.83	0.70
275						1.00	0.84
325							1.00

Table 3.
Load Reduction Factors for Reduced Edge Distances - Tension and Shear Loading

PK Wedge Anchor Size d, mm	M6	M8	M10	M12	M16	M20	M24
Critical Edge Dist. c_{cr}, mm	70	90	110	130	180	220	260
Min. Edge Distance c_{min}, mm	35	45	55	65	90	110	130
Actual Edge Dist. c, mm	Reduction Factors ψc for reduced edge distance						
35	0.70						
45	0.79	0.70					
55	0.87	0.77	0.70				
65	0.96	0.83	0.75	0.70			
70	1.00	0.87	0.78	0.72			
80		0.93	0.84	0.77			
90		1.00	0.89	0.82	0.70		
110			1.00	0.91	0.77	0.70	
120				0.95	0.80	0.72	
130				1.00	0.83	0.75	0.70
180					1.00	0.89	0.82
220						1.00	0.91
240							0.95
260							1.00

Calculation example

Check the load carrying capacity of the 4 nos of M16 x 140 Tenn PK Wedge Anchors used the following attachment:



Concrete : Uncracked concrete, compressive strength > 30 N/mm²
Concrete thickness : 250 mm
Thickness of attachment : 12mm

Design loads:
1. A tension load of 3.1 kN is applied on each bolt on top row
2. Shear load applied on each of the four bolts: 3.0 kN

Pre-adjusted safe working loads for M16 PK Wedge Anchor:

Tension : 10.4 kN
Shear : 13.8 kN

Spacing and edge distance criteria for M16 PK Wedge Anchor:

Critical spacing s_{cr}	**= 225 mm**
Minimum spacing s_{min}	**= 160 mm**
Critical edge distance c_{cr}	**= 180 mm**
Minimum spacing s_{min}	**= 90 mm**

Each top anchor is affected by proximity to two anchors and one edge. (Spacing effects of anchors on the diagonal can be ignored.) Therefore safe working loads have to be adjusted using load reduction factors.

		Reduction factors ψ Tensile	Shear
Actual spacing $s1$	**= 160 mm**	**0.70**	**0.70**
Actual spacing $s2$	**= 195 mm**	**0.86**	**0.86**
Actual edge distance c	**= 130 mm**	**0.83**	**0.83**

Calculation:

Reduced safe working tension load = SWL * $\psi s1$ * $\psi s2$ * ψc
= 9.0 * 0.70 * 0.86 * 0.83
= 4.5 kN **(O.K.)**

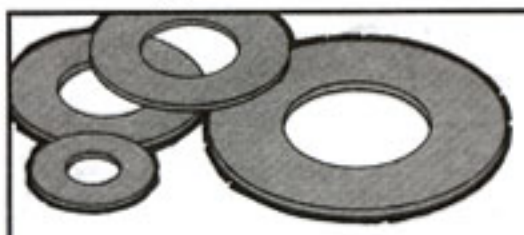
Reduced safe working shear load = SWL * $\psi s1$ * $\psi s2$ * ψc
= 13.8 * 0.70 * 0.86 * 0.83
= 6.9 kN **(O.K.)**

Check combined shear and tension interaction:

$$\frac{\text{Applied tension load}}{\text{Safe working tension load}} + \frac{\text{Actual shear load}}{\text{Safe working shear load}} \leq 1.4$$

$$= \frac{3.1}{4.5} + \frac{3.0}{6.9} = 1.1 \quad \textbf{(< 1.4) Therefore: OK}$$

Tenn Isolating Washers for Stainless Steel Anchors

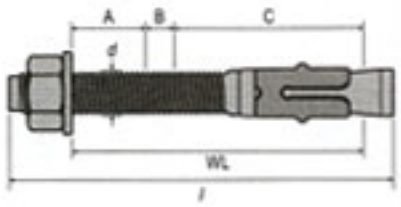


Special non-electrically conductive nylon washers to prevent galvanic corrosion

TIW.M6
TIW.M8
TIW.M10
TIW.M12
TIW.M16
TIW.M20
TIW.M24

How to select the correct length Tenn PK Wedge Anchor

Select an anchor with sufficient working length WL to accommodate A+B+C (mm)



A. Thickness of attachment
B. Depth of air space or non-structural layer
*C. Embedment depth (minimum 4*d)*

RANGE

Product ID	Anchor Dimensions *d* x *l* x WL, mm	Price Each (RM)
	Tenn PK Wedge Anchors, 5.8 Carbon Steel, Zinc Plated	
112.PK 06065	M6 x 65 x 53	0.55
112.PK 06100	M6 x 100 x 88	0.80
112.PK 08080	M8 x 80 x 66	0.90
112.PK 08105	M8 x 105 x 91	1.00
112.PK 10060	M10 x 60 x 42	1.20
112.PK 10080	M10 x 80 x 62	1.40
112.PK 10100	M10 x 100 x 82	1.60
112.PK 10120	M10 x 120 x 102	1.80
112.PK 10150	M10 x 150 x 132	2.10
112.PK 12080	M12 x 80 x 58	1.95
112.PK 12100	M12 x 100 x 78	2.20
112.PK 12120	M12 x 120 x 98	2.45
112.PK 12150	M12 x 150 x 128	2.90
112.PK 12180	M12 x 180 x 158	3.50
112.PK 16100	M16 x 100 x 73	4.15
112.PK 16140	M16 x 140 x 113	4.90
112.PK 16180	M16 x 180 x 153	5.90
112.PK 16220	M16 x 220 x 193	6.90
112.PK 20125	M20 x 125 x 92	7.30
112.PK 20140	M20 x 140 x 107	7.80
112.PK 20160	M20 x 160 x 127	8.60
112.PK 24180	M24 x 180 x 141	19.50
	Tenn PK Wedge Anchors, 5.8 Carbon Steel, Hot-Dip Galvanized	
112.HPK 12100	M12 x 100 x 78	2.30
112.HPK 12120	M12 x 120 x 98	2.60
112.HPK 16125	M16 x 125 x 98	4.35
112.HPK 16140	M16 x 140 x 113	5.10
	Tenn PK Wedge Anchors, Gr.304 (A2) Stainless Steel	
112.SPK 06065.A2	M6 x 65 x 53	1.50
112.SPK 06085.A2	M6 x 85 x 73	1.80
112.SPK 08090.A2	M8 x 90 x 76	2.90
112.SPK 08110.A2	M8 x 110 x 92	3.85
112.SPK 10060.A2	M10 x 60 x 42	3.90
112.SPK 10090.A2	M10 x 90 x 72	5.00
112.SPK 12080.A2	M12 x 80 x 58	6.95
112.SPK 12110.A2	M12 x 110 x 88	8.45
112.SPK 16110.A2	M16 x 110 x 83	14.70
112.SPK 16145.A2	M16 x 145 x 118	19.10
112.SPK 20160.A2	M20 x 160 x 127	33.00
	Tenn PK Wedge Anchors, Gr.316 (A4) Stainless Steel	
112.SPK 08100.A4	M8 x 100 x 86	5.10
112.SPK 10080.A4	M10 x 80 x 62	7.10
112.SPK 10125.A4	M10 x 125 x 107	9.65
112.SPK 10150.A4	M10 x 150 x 132	11.00
112.SPK 12080.A4	M12 x 80 x 58	10.45
112.SPK 12125.A4	M12 x 125 x 103	13.90

TENN HOLDINGS SDN. BHD. (341107-M)

Head Office
59 Jalan PBS 14/2
Taman Perindustrian Bukit Serdang
43300 Seri Kembangan, Selangor
Tel: 03-8941 3413
Fax: 03-8941 3412

Kuala Lumpur
29 Lorong 6C/91
Taman Shamelin-Perkasa
56100 Cheras
Tel: 03-9200 4113
Fax: 03-9283 5822

Pahang
A41 Jalan Seri Setali 1,
Off Jalan Air Putih
25000 Kuantan
Tel : 09-551 6436, 013-983 1688
Fax: 09-551 5934

Sabah
7-0 Lorong Medan Inanam 1
6th Mile Jalan Tuaran
88450 Inanam, Kota Kinabalu
Tel : 088-432 228, 088-438 880
Fax: 088-436 660

Email: tennlcf@streamyx.com