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TDS | 2046.1

PURE-EPOXY BIS-PE GEN3

EPOXY INJECTION ADHESIVE
POST INSTALLED REBAR CONNECTIONS

Pure-Epoxy GEN3

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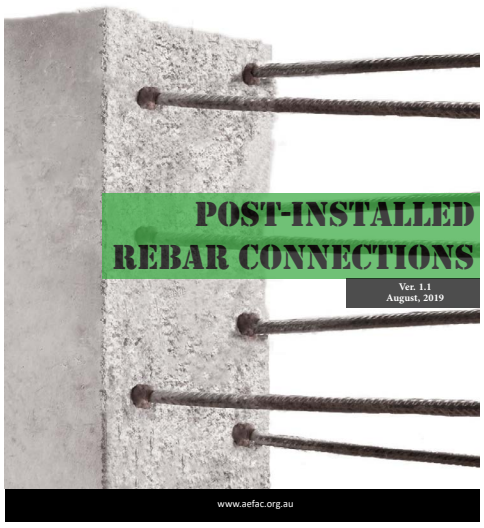
PURE-EPOXY BIS-PE GEN3

EPOXY INJECTION ADHESIVE POST INSTALLED REBAR CONNECTIONS

ETA ASSESSMENT (ETA-25/0455)

FEATURES

- For extreme loads
- Slow curing for more flexibility
- Fire rated
- Seismic assessed
- Styrene free
- Low VOC A+ rating
- Potable water approved



USE CONDITIONS

- Installation in reinforced and unreinforced concrete C16/20 to C50/60
- For post-installed rebar N10 to N32
- Hammer/compressed air drilled holes
- Diamond cored holes
- Hollow drill bits
- Dry or wet concrete (must not be installed in flooded holes)
- Overhead installation allowed
- 50 and 100 year design life

ADDITIONAL APPROVALS & TEST REPORTS

- ETA-25/0454
- ETA-25/0653

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TEMPERATURE RANGE

BIS-PE GEN3 injection mortar may be applied in the temperature ranges given below.
An elevated base material temperature leads to a reduction of the bond resistance.

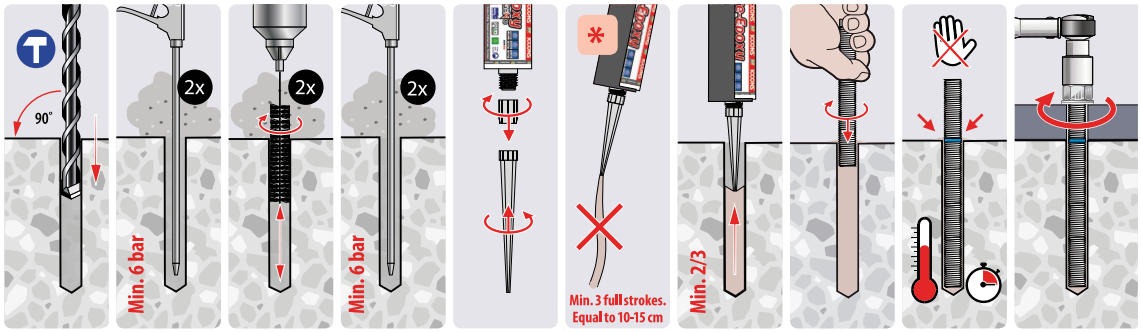
Max. long term base material temperature: Long term elevated base material temperatures are roughly constant over significant periods of time.

Max. short term base material temperature: Short term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Temperature Range	Temperature Base Material	Max. Long Term Base Material Temperature	Max. Short Term Base Material Temperature
Temp. Range	-40°C to +80°C	+50°C	+80°C

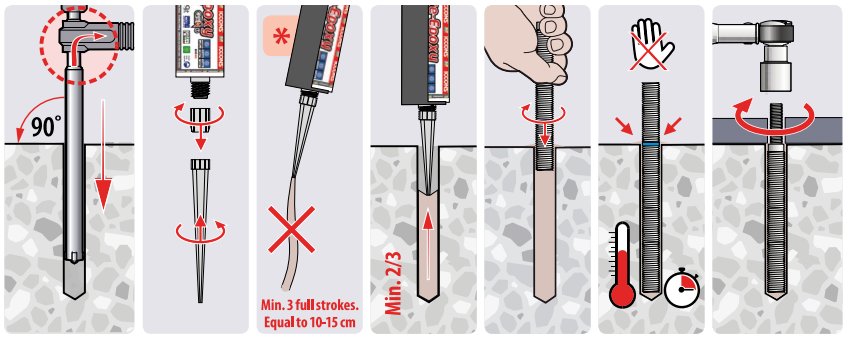
INSTALLATION PROCEDURES

HAMMER DRILLING

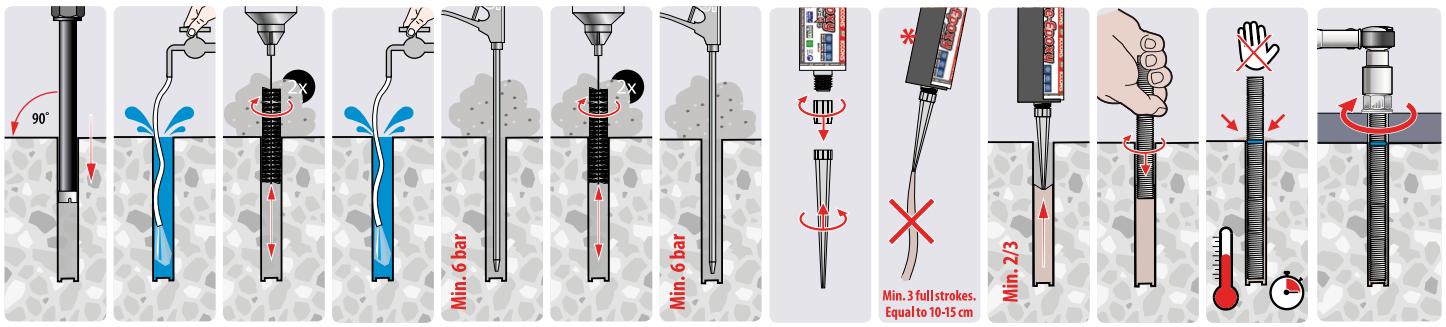


* Squeeze out separately a minimum of 3 full strokes (Equal to 10-15 cm) until the mortar shows a consistent colour.

HOLLOW DRILLING



DIAMOND DRILLING



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CURING TIMES[1]

Temperature[2] °C	0 to +4	+5 to +9	+10 to +14	+15 to +19	+20 to +24	+25 to +34	+35 to +39	+40
Processing Working Time	80 min	80 min	60 min	40 min	30 min	12 min	8 min	8 min
Curing Time Dry Holes	144 h	48 h	28 h	18 h	12 h	9 h	6 h	4 h
Curing Time Wet Holes	288 h	96 h	56 h	36 h	24 h	18 h	12 h	8 h

[1] Cartridge Temperature must be between +5°C and +40°C.
[2] Concrete Temperature

MATERIAL PROPERTIES

BIS-PE GEN3 injection mortar may be applied in cracked and non-cracked concrete, lightweight-concrete, aerated-concrete and natural stone (Attention! natural stone can discolour, this shall be checked in advance.). In the table below the physical properties of the BIS-PE GEN3 are listed.

Properties	Test Method	Result
Compressive strength	EN 196-1	122 N / mm²
Flexural strength	EN 196-1	66.0 N / mm²
Axial tensile strength	DIN EN	44.2 N / mm²
E modulus	DIN EN	6,300 N / mm²
Elongation at fracture	DIN EN	1 %
Degree of shrinkage	DIN 52450	≤ 1.4 %
Hardness Shore A	DIN EN	99.4
Hardness Shore D	DIN EN	86.1
Density		≤ 1.5 kg / dm³
Thermal conductivity	DIN EN 993-15	0.50 W/mK
Heat capacity	DIN EN 993-15	1,350 J/kgK
Electrical resistance	DIN IEC 93	$8.0 \cdot 10^{12}$ Ω

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CHEMICAL RESISTANCE CONT.

The resistance of the BIS-PE GEN3 injection mortar to chemical substances is given in the table below. The data in this table are applicable to brief periods of chemical contact with full cured adhesive (e.g. temporary contact with adhesive during a spill).

Chemical Agent	Concentration	Resistant	Not Resistant
Acetic acid	40		✖
Acetone 10	10		✖
Ammonia, aqueous solution	5	✔	
Aniline 100		✔	
Beer 100		✔	
Benzine (kp 100-140°F)	100	✔	
Benzene	100		✖
Boric Acid, aqueous solution		✔	
Calcium carbonate, suspended in water	All	✔	
Calcium chloride, suspended in water		✔	
Calcium hydroxide, suspended in water		✔	
Carbon tetrachloride	100	✔	
Caustic soda (Sodium hydroxide)	40	✔	
Citric acid	All	✔	
Chlorine	All	✔	
Diesel oil	100	✔	
Ethyl alcohol, aqueous solution	50		✖
Formaldehyde, aqueous solution	30	✔	
Formic acid (Methanoic acid)	100		✖
Formic acid (Methanoic acid)	10	✔	
Freon		✔	
Fuel Oil		✔	
Gasoline (premium grade)	100	✔	
Glycol (Ethylene glycol)		✔	
Hydrogen peroxide	30		✖
Hydrochloric acid (Muriatic Acid) Conc.			✖
Isopropyl alcohol	100		✖
Lactic acid	All		✖

Chemical resistance table cont. next page

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CHEMICAL RESISTANCE CONT.

The resistance of the BIS-PE GEN3 injection mortar to chemical substances is given in the table below. The data in this table are applicable to brief periods of chemical contact with full cured adhesive (e.g. temporary contact with adhesive during a spill).

Chemical Agent	Concentration	Resistant	Not Resistant
Laitance		✔	
Linseed oil	100	✔	
Lubricating oil	100	✔	
Magnesium chloride, aqueous solution	All	✔	
Methanol	100		✖
Motor oil (SAE 20 W-50)	100	✔	
Nitric acid	10		✖
Oleic acid	100	✔	
Perchloroethylene	100	✔	
Petroleum	100	✔	
Phenol, aqueous solution (Carbonic acid)	8		✖
Phosphoric acid	85	✔	
Phosphoric acid	10	✔	
Potash lye (potassium hydroxide, 10% and 40% solutions)		✔	
Potassium carbonate, aqueous solution	All	✔	
Potassium chlorite, aqueous solution	All	✔	
Potassium nitrate, aqueous solution	All	✔	
Sodium carbonate, aqueous solution	All	✔	
Sodium chloride, aqueous solution	All	✔	
Sodium phosphate, aqueous solution	All	✔	
Sodium silicate	All	✔	
Sulfuric acid	30		✖
Tartaric acid	All	✔	
Tetrachloroethylene	100	✔	
Toluene			✖
Turpentine	100	✔	
Trichloroethylene	100		✖

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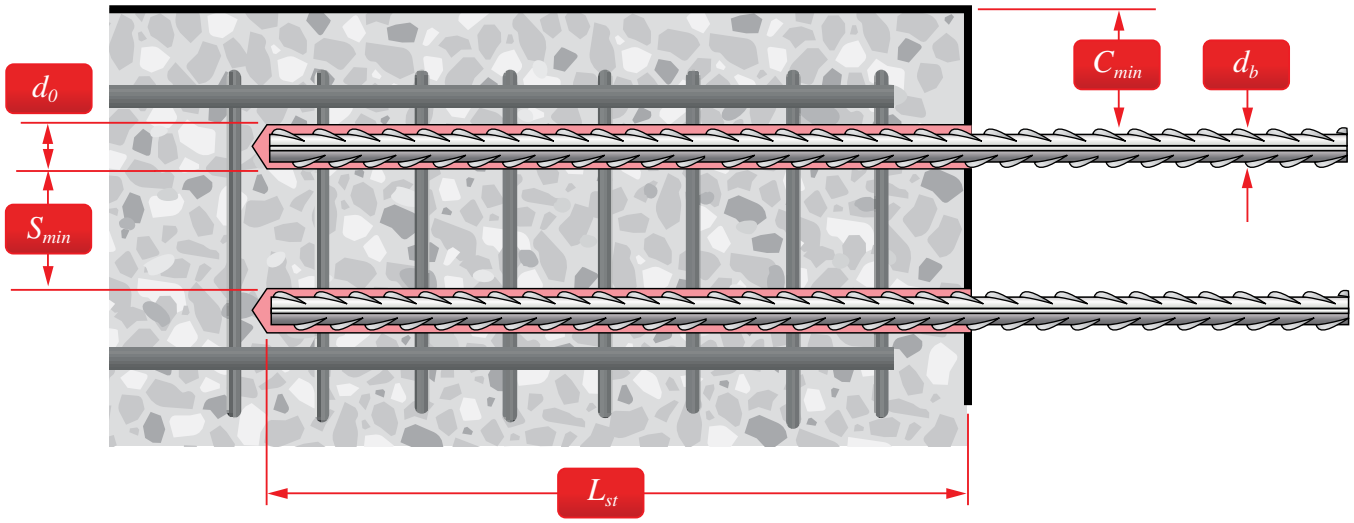
DESIGN OF POST-INSTALLED REBAR CONNECTIONS



DESIGN GUIDELINES FOR POST-INSTALLED REBAR CONNECTIONS.

This document provides the design provisions and load tables for Post-installed Rebar Connections designed in accordance with AS3600 Section 13.1.2 and AEFAC technical note - TN08 Post Installed Rebar Connections Version 1.1, August 2019. To ensure post installed rebar performance is similar to that of cast-in rebar as outlined in AS3600 only adhesive systems that are prequalified according to EAD 330087 shall be used. The embedment length of post-installed rebars should not be less than the development length obtained from equation (A) as highlighted below and in AS 3600 13.1.2.2.

The development length ($L_{sy.t}$) to develop the characteristic yield strength of a rebar (f_{sy}) in tension is given by equation (A).

EQUATION (A)

$$L_{sy.t} = \frac{(0.5 k_1 k_3 f_{sy} d_b)}{k_2 \sqrt{f_c'}} \geq 0.058\, f_{sy}\, k_1\, d_b$$

Where,

k_1 = 1.3 for rebar with more than 300mm of concrete cover

= 1.0 otherwise

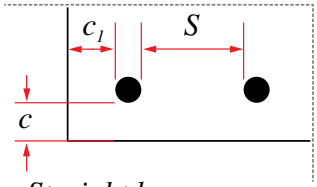
k_2 = $(132 - d_b) / 100$

k_3 = $1 - \frac{0.15(c_d - d_b)}{d_b}$

(within the limits $0.7 \leq k_3 \leq 1.0$)

c_d = Minimum of clear cover on each side and half of clear spacing between rebars

f_c' ≤ 65MPa



Straight bars

c_d = min $(S/2, c_1, c)$

Note: Equation A is valid for cracked and uncracked concrete if no additional requirement is provided in product ETA.

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DEVELOPMENT LENGTH TO DEVELOP LESS THAN YIELD STRENGTH (L_{st})

Where it may be necessary to achieve a development length that develops a tensile stress (σ_{st}) less than yield due to design parameters or base material restrictions, the Development Length (L_{st}) for post-installed rebar shall be designed according to equation (B) below.

EQUATION (B)

$$L_{st} = L_{sy.t} \frac{\sigma_{st}}{f_{sy}}$$

The development length (L_{st}) calculated from equation (B) should be greater than $12d_b$ or other provisions as specified in AS 3600.

The reduced nominal capacity of the post-installed rebar (N_{st}) can be calculated from equation (C) or (D) below.

EQUATION (C)

$$N_{st} = A_s \sigma_{st}$$

EQUATION (D)

$$N_{st} = A_s f_{sy} \frac{L_{st}}{L_{sy.t}}$$

Where,

$$A_s = \frac{\pi d_b^2}{4}$$

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CONCRETE COVER & SPACING OF REBAR

Provisions for adequate concrete cover (C_{min}) are highlighted in EAD 330087 and in table A below. Where a drilling guide is used factors are reduced accordingly.

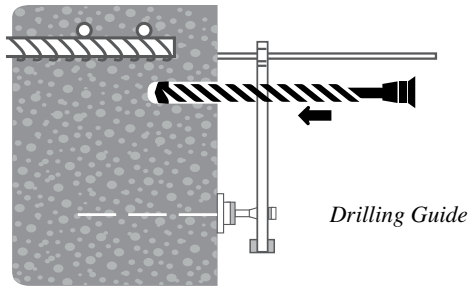
MINIMUM CONCRETE COVER (C_{min})

TABLE A

Drilling Method	Rebar ø [mm]	Without Drilling Aid	With Drilling Aid
Hammer Drilling (HD), Hammer Drilling with hollow drill (HDB)	<25	30mm + 0.06·L_v ≥ 2ø	30mm + 0.02·L_v ≥ 2ø
	≥25	40mm + 0.06·L_v ≥ 2ø	40mm + 0.02·L_v ≥ 2ø
Diamond Drilling (DD)	<25	Drilling rig used as aid	30mm + 0.02·L_v ≥ 2ø
	≥25	Drilling rig used as aid	40mm + 0.02·L_v ≥ 2ø
Compressed Air Drilling (CD)	<25	50mm + 0.08·L_v	50mm + 0.02·L_v
	≥25	60mm + 0.08·L_v ≥ 2ø	60mm + 0.02·L_v ≥ 2ø

MINIMUM (CLEAR) SPACING BETWEEN POST-INSTALLED REBARS (S_{min}) IS;

$$s_{min} = 40mm \geq 4\ d_b$$



DESIGN VALUES OF ULTIMATE BOND RESISTANCE f_{bd} IN N/mm^2

Rebar	Concrete Class						
	C20	C25	C32	C35	C40	C45	C50
Ø10 - 32 mm	2.3	2.7	3.2	3.4	3.7	4.0	4.3

Important: Information contained in this documents shall be read in conjunction with the provisions and guidelines set out in;

- AS 3600 (Concrete Structures)
- AEFAC Technical Note (Post Installed Rebar Connections) Version 1.1 August 2019 -TN08
- EAD 330087 (Systems for Post-Installed rebar connections with mortar)
- Product ETA in accordance with EAD 330087

For splicing of reinforcement please follow guidelines highlighted in AS3600 section 13.2.

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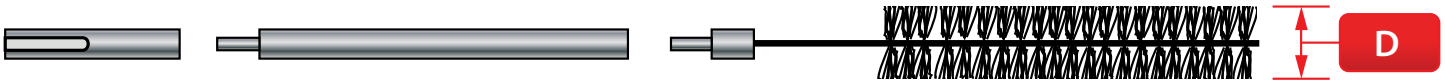
INSTALLATION DIMENSIONS

Rebar Size	d_b		Ø10	Ø12	Ø16	Ø20	Ø24	Ø28	Ø32
Hole Diameter	d_o	[mm]	14	16	20	25	32	35	40
Min. Anchoring Length	$12d_b$	[mm]	120	144	192	240	288	336	384
Max. Embedment Depth	L_{max}	[mm]	1000	1200	1600	2000	2000	2000	2000
Min. (clear) Spacing	S_{min}	[mm]	40	48	64	80	96	112	128
Required Volume per cm Embedment Depth	V_s	[ml/cm]	0.90	1.06	1.36	2.12	3.76	4.16	5.43



STEEL BRUSH & PISTON PLUG DIMENSIONS

Rebar Size	d_b		Ø10	Ø12	Ø16	Ø20	Ø24	Ø28	Ø32
Brush Diameter	D	[mm]	16	18	22	27	34	37	41.5
Min. Brush Diameter	D_{min}	[mm]	14.5	16.5	20.5	25.5	32.5	35.5	40.5
Piston Plug	#	-	14	16	20	25	32	35	40

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STRESS DEVELOPMENT IN REINFORCEMENT

DEVELOPMENT LENGTH FOR POST-INSTALLED REINFORCEMENT IN TENSION IN ACCORDANCE WITH AS3600 (CLAUSE 13.1.2)

Rebar designation			N10	N12	N16	N20	N24	N28	N32
Diameter of rebar	d_b	(mm)	10	12	16	20	24	28	32
Drill hole size	d_o	(mm)	14	16	20	25	32	35	37
Cross Sectional Area of Rebar	A_s	(mm^2)	79	113	201	314	452	616	804
Yield Strength of Rebar (D500N)		(kN)	39.5	56.5	100.5	157	226	308	402
12 x d_b(min.)		(mm)	120	144	192	240	288	336	384
$0.058\ f_{sy}\ k_1\ d_b$		(mm)	290	348	464	580	696	812	928
$\frac{(0.5k_1\ k_3\ f_{sy}\ d_b)}{k_2\ \sqrt{f_c'}}$	f'c =20	(mm)	389	475	655	849	1056	1279	1521
	f'c =32	(mm)	308	376	518	671	835	1011	1202

ASSUMPTIONS IN ACCORDANCE WITH AS3600 SECTION 13.1.2

Rebar designation			N10	N12	N16	N20	N24	N28	N32
k_1			1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_2			1.22	1.20	1.16	1.12	1.08	1.04	1.00
k_3			0.85	0.85	0.85	0.85	0.85	0.85	0.85
c (Clear cover to concrete edge)*		(mm)	20	24	32	40	48	56	64
s (Clear spacing b/w bars)		(mm)	40	48	64	80	96	112	128
s min.			40	48	64	80	96	112	128

* c clear cover shall be the greater of the c value above and the value highlighted in table A (page 10) which is based on drilling process.

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L_{st} DEVELOPMENT LENGTH LESS THAN YIELD - AS3600 (FOR C_d=2 x d_b) K_3=0.85, 20MPa

	Reinforcing Bar Capacity (kN)						
L_{st} (mm)	N10	N12	N16	N20	N24	N28	N32
120	12.2						
145	14.7	17.3					
200	20.3	23.8	30.7				
240	24.3	28.6	36.8	44.4			
300	30.4	35.7	46.0	55.5	64.3		
340	34.5	40.5	52.2	63.0	72.8	81.8	
389	39.5	46.3	59.7	72.0	83.3	93.6	102.9
440		52.4	67.5	81.5	94.3	105.9	116.4
475		56.5	72.9	87.9	101.8	114.3	125.6
540			82.8	100.0	115.7	130.0	142.8
620			95.1	114.8	132.8	149.2	164.0
655			100.5	121.3	140.3	157.7	173.2
700				129.6	150.0	168.5	185.1
740				137.0	158.5	178.1	195.7
800				148.1	171.4	192.6	211.6
849				157.0	181.9	204.3	224.6
990					212.1	238.3	261.9
1056					226.0	254.2	279.3
1100						264.8	290.9
1279						308.0	338.3
1400							370.3
1521							402.0
Length to develop yield $L_{sy,t}$ (mm)	389	475	655	849	1056	1279	1521

L_{st} DEVELOPMENT LENGTH LESS THAN YIELD - AS3600 (FOR C_d=2 x d_b) K_3=0.85, 32MPa

	Reinforcing Bar Capacity (kN)						
L_{st} (mm)	N10	N12	N16	N20	N24	N28	N32
120	15.4						
145	18.6	21.8					
200	25.7	30.1	38.8				
240	30.8	36.1	46.6	56.2			
308	39.5	46.4	59.8	72.1	83.5		
340		51.2	66.0	79.6	92.1	103.5	
376		56.5	73.0	88.1	101.9	114.5	
440			85.4	103.0	119.2	134.0	147.2
475			92.2	111.2	128.7	144.6	158.9
518			100.5	121.3	140.4	157.7	173.3
620				145.2	168.0	188.8	207.4
671				157.0	181.8	204.3	224.5
700					189.7	213.1	234.2
740					200.5	225.3	247.6
800					216.8	243.6	267.7
835					226.0	254.2	279.4
990						301.4	331.2
1011						308.0	338.2
1100							368.0
1150							384.8
1202							402.0
Length to develop yield $L_{sy,t}$ (mm)	308	376	518	671	835	1011	1202

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STRESS DEVELOPMENT IN REINFORCEMENT

DEVELOPMENT LENGTH FOR POST-INSTALLED REINFORCEMENT IN TENSION IN ACCORDANCE WITH AS3600 (CLAUSE 13.1.2)

Rebar designation			N10	N12	N16	N20	N24	N28	N32
Diameter of rebar	d_b	(mm)	10	12	16	20	24	28	32
Drill hole size	d_o	(mm)	14	16	20	25	32	35	37
Cross Sectional Area of Rebar	A_s	(mm^2)	79	113	201	314	452	616	804
Yield Strength of Rebar (D500N)		(kN)	39.5	56.5	100.5	157	226	308	402
12 x d_b(min.)		(mm)	120	144	192	240	288	336	384
$0.058\ f_{sy}\ k_1\ d_b$		(mm)	290	348	464	580	696	812	928
$\frac{(0.5k_1\ k_3\ f_{sy}\ d_b)}{k_2\ \sqrt{f_c'}}$	f'c =40	(mm)	275	336	463	600	747	905	1075
	f'c =50	(mm)	246	301	415	537	668	809	962

ASSUMPTIONS IN ACCORDANCE WITH AS3600 SECTION 13.1.2

Rebar designation			N10	N12	N16	N20	N24	N28	N32
k_1			1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_2			1.22	1.20	1.16	1.12	1.08	1.04	1.00
k_3			0.85	0.85	0.85	0.85	0.85	0.85	0.85
c (Clear cover to concrete edge)*		(mm)	20	24	32	40	48	56	64
s (Clear spacing b/w bars)		(mm)	40	48	64	80	96	112	128
s min.			40	48	64	80	96	112	128

* c clear cover shall be the greater of the c value above and the value highlighted in table A (page 10) which is based on drilling process.

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L_{st} DEVELOPMENT LENGTH LESS THAN YIELD - AS3600 (FOR C_d=2 x d_b) K_3=0.85, 40MPa

	Reinforcing Bar Capacity (kN)						
L_{st} (mm)	N10	N12	N16	N20	N24	N28	N32
120	16.3						
145	19.8	23.6					
200	27.2	32.5	43.3				
240	32.7	39.0	52.0	62.8			
290	39.5	47.1	62.8	75.9	87.9		
348		56.5	75.4	91.1	105.4	118.5	
390			84.5	102.1	118.2	132.8	145.9
440			95.3	115.2	133.3	149.8	164.6
464			100.5	121.5	140.6	157.9	173.6
520				136.2	157.6	177.0	194.5
600				157.0	181.8	204.2	224.4
650					196.9	221.3	243.1
700					212.1	238.3	261.8
747					226.0	254.3	279.4
800						272.3	299.2
850						289.3	317.9
905						308.0	338.5
950							355.4
1075							402.0
Length to develop yield $L_{sy,t}$ (mm)	290	348	464	600	747	905	1075

L_{st} DEVELOPMENT LENGTH LESS THAN YIELD - AS3600 (FOR C_d=2 x d_b) K_3=0.85, 50MPa

	Reinforcing Bar Capacity (kN)						
L_{st} (mm)	N10	N12	N16	N20	N24	N28	N32
120	16.3						
145	19.8	23.6					
200	27.2	32.5	43.3				
240	32.7	39.0	52.0	65.0			
290	39.5	47.1	62.8	78.6	94.3		
348		56.5	75.4	94.3	113.1	132.0	
390			84.5	105.6	126.8	147.9	163.1
440			95.3	119.2	143.0	166.9	184.0
464			100.5	125.7	150.8	176.0	194.0
520				140.8	169.0	197.2	217.5
580				157.0	188.5	219.9	242.6
650					211.3	246.5	271.8
696					226.0	263.9	291.1
747						283.3	312.4
812						308.0	339.6
850							355.5
905							378.5
962							402.0
Length to develop yield $L_{sy,t}$ (mm)	290	348	464	580	696	812	962

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STRESS DEVELOPMENT IN REINFORCEMENT

DEVELOPMENT LENGTH FOR POST-INSTALLED REINFORCEMENT IN TENSION IN ACCORDANCE WITH AS3600 (CLAUSE 13.1.2)

Rebar designation			N10	N12	N16	N20	N24	N28	N32
Diameter of rebar	d_b	(mm)	10	12	16	20	24	28	32
Drill hole size	d_o	(mm)	14	16	20	25	32	35	37
Cross Sectional Area of Rebar	A_s	(mm^2)	79	113	201	314	452	616	804
Yield Strength of Rebar (D500N)		(kN)	39.5	56.5	100.5	157	226	308	402
12 x d_b(min.)		(mm)	120	144	192	240	288	336	384
$0.058\ f_{sy}\ k_1\ d_b$		(mm)	290	348	464	580	696	812	928
$\frac{(0.5 k_1 k_3 f_{sy} d_b)}{k_2 \sqrt{f_c'}}$	f'c =20	(mm)	321	391	540	699	870	1054	1252
	f'c =32	(mm)	254	309	427	552	687	833	990

ASSUMPTIONS IN ACCORDANCE WITH AS3600 SECTION 13.1.2

Rebar designation			N10	N12	N16	N20	N24	N28	N32
k_1			1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_2			1.22	1.20	1.16	1.12	1.08	1.04	1.00
k_3			0.7	0.7	0.7	0.7	0.7	0.7	0.7
c (Clear cover to concrete edge)*		(mm)	30	36	48	60	72	84	96
s (Clear spacing b/w bars)		(mm)	60	72	96	120	144	168	192
s min.			40	48	64	80	96	112	128

* c clear cover shall be the greater of the c value above and the value highlighted in table A (page 10) which is based on drilling process.

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L_{st} DEVELOPMENT LENGTH LESS THAN YIELD - AS3600 (FOR $C_d \geq 3 \times d_b$) K_3=0.7, 20MPa

	Reinforcing Bar Capacity (kN)						
L_{st} (mm)	N10	N12	N16	N20	N24	N28	N32
120	14.7						
145	17.8	21.0					
200	24.5	28.9	37.3				
240	29.4	34.7	44.7	54.0			
321	39.5	46.4	59.8	72.2	83.5		
340		49.1	63.3	76.4	88.5	99.4	
391		56.5	72.8	87.9	101.7	114.3	125.6
440			82.0	98.9	114.5	128.6	141.3
500			93.1	112.4	130.1	146.1	160.6
540			100.5	121.3	140.4	157.7	173.3
620				139.4	161.3	181.2	199.1
680				152.9	176.9	198.7	218.4
699				157.0	181.7	204.2	224.3
740					192.5	216.3	237.7
800					208.1	233.8	256.9
870					226.0	253.9	279.0
990						289.3	318.0
1054						308.0	338.4
1100							353.3
1150							369.4
1252							402.0
Length to develop yield $L_{sy,t}$ (mm)	321	391	540	699	870	1054	1252

L_{st} DEVELOPMENT LENGTH LESS THAN YIELD - AS3600 (FOR $C_d \geq 3 \times d_b$) K_3=0.7, 32MPa

	Reinforcing Bar Capacity (kN)						
L_{st} (mm)	N10	N12	N16	N20	N24	N28	N32
120	16.3						
150	20.3	24.4					
200	27.1	32.5	43.3				
290	39.5	47.1	62.8	78.6			
300		48.8	65.0	81.3	97.5		
320		52.0	69.3	86.7	104.0		
348		56.5	75.4	94.3	113.1	128.7	
400			86.7	108.3	130.0	147.9	162.5
464			100.5	125.7	150.8	171.5	188.5
500				135.4	162.5	184.8	203.1
540				146.3	175.5	199.6	219.4
580				157.0	188.5	214.4	235.6
620					201.5	229.2	251.9
696					226.0	257.3	282.8
700						258.8	284.4
740						273.6	300.6
800						295.8	325.0
833						308.0	338.4
990							402.0
Length to develop yield $L_{sy,t}$ (mm)	290	348	464	580	696	833	990

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STRESS DEVELOPMENT IN REINFORCEMENT

DEVELOPMENT LENGTH FOR POST-INSTALLED REINFORCEMENT IN TENSION IN ACCORDANCE WITH AS3600 (CLAUSE 13.1.2)

Rebar designation			N10	N12	N16	N20	N24	N28	N32
Diameter of rebar	d_b	(mm)	10	12	16	20	24	28	32
Drill hole size	d_o	(mm)	14	16	20	25	32	35	37
Cross Sectional Area of Rebar	A_s	(mm^2)	79	113	201	314	452	616	804
Yield Strength of Rebar (D500N)		(kN)	39.5	56.5	100.5	157	226	308	402
12 x d_b(min.)		(mm)	120	144	192	240	288	336	384
$0.058\ f_{sy}\ k_1\ d_b$		(mm)	290	348	464	580	696	812	928
$\frac{(0.5 k_1 k_3 f_{sy} d_b)}{k_2 \sqrt{f_c'}}$	f'c =40	(mm)	227	277	382	494	615	745	885
	f'c =50	(mm)	203	247	341	442	550	666	792

ASSUMPTIONS IN ACCORDANCE WITH AS3600 SECTION 13.1.2

Rebar designation			N10	N12	N16	N20	N24	N28	N32
k_1			1.0	1.0	1.0	1.0	1.0	1.0	1.0
k_2			1.22	1.20	1.16	1.12	1.08	1.04	1.00
k_3			0.7	0.7	0.7	0.7	0.7	0.7	0.7
c (Clear cover to concrete edge)*		(mm)	30	36	48	60	72	84	96
s (Clear spacing b/w bars)		(mm)	60	72	96	120	144	168	192
s min.			40	48	64	80	96	112	128

* c clear cover shall be the greater of the c value above and the value highlighted in table A (page 10) which is based on drilling process.

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L_{st} DEVELOPMENT LENGTH LESS THAN YIELD - AS3600 (FOR $C_d \geq 3 \times d_b$) K_3=0.7, 40MPa

	Reinforcing Bar Capacity (kN)						
L_{st} (mm)	N10	N12	N16	N20	N24	N28	N32
120	16.3						
150	20.3	24.4					
200	27.1	32.5	43.3				
290	39.5	47.1	62.8	78.6			
300		48.8	65.0	81.3	97.5	113.8	
320		52.0	69.3	86.7	104.0	121.3	138.7
348		56.5	75.4	94.3	113.1	132.0	150.8
400			86.7	108.3	130.0	151.7	173.4
464			100.5	125.7	150.8	176.0	201.1
500				135.4	162.5	189.6	216.7
540				146.3	175.5	204.8	234.0
580				157.0	188.5	219.9	251.4
620					201.5	235.1	268.7
696					226.0	263.9	301.6
700						265.4	303.4
740						280.6	320.7
812						308.0	351.9
833							361.0
928							402.0
Length to develop yield $L_{sy,t}$ (mm)	290	348	464	580	696	812	928

L_{st} DEVELOPMENT LENGTH LESS THAN YIELD - AS3600 (FOR $C_d \geq 3 \times d_b$) K_3=0.7, 50MPa

	Reinforcing Bar Capacity (kN)						
L_{st} (mm)	N10	N12	N16	N20	N24	N28	N32
120	16.3						
150	20.3	24.4					
200	27.1	32.5	43.3				
290	39.5	47.1	62.8	78.6			
300		48.8	65.0	81.3	97.5	113.8	
320		52.0	69.3	86.7	104.0	121.3	138.7
348		56.5	75.4	94.3	113.1	132.0	150.8
400			86.7	108.3	130.0	151.7	173.4
464			100.5	125.7	150.8	176.0	201.1
500				135.4	162.5	189.6	216.7
540				146.3	175.5	204.8	234.0
580				157.0	188.5	219.9	251.4
620					201.5	235.1	268.7
696					226.0	263.9	301.6
700						265.4	303.4
740						280.6	320.7
812						308.0	351.9
833							361.0
928							402.0
Length to develop yield $L_{sy,t}$ (mm)	290	348	464	580	696	812	928

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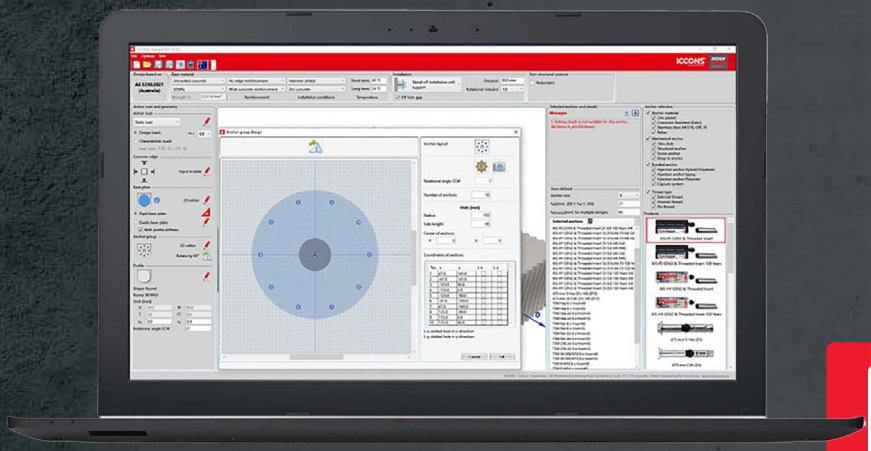

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