Strength Design Performance Values in Accordance to CSA 23.3-14

ITW RED HEAD TAPCON+ SCREW ANCHOR

DESIGN INFORMATION TESTED TO ICC-ES AC193 AND ACI 355.2, DEFINED IN ICC ESR-3699

TAPCON+ DESIGN INFORMATION

PARAMETER	Symbol	Units	Nominal Anchor Diameter				
			1/4"		3/8"	1/2"	
Anchor outer diameter	$d_a[d_o]^2$	mm.	6.4		9.5	12.7	
Drill bit specification		in	1/4" Tapcon+ bit	1/4" ANSI bit	3/8" ANSI bit	1/2" ANSI bit	
Minimum specified yield strength	f_y	MPa	689		689	689	
Minimum specified ultimate strength	f_{uta}	MPa	862		862	862	
Effective tensile stress area	$A_{se,N}$ [A_{se}]^6	mm^2	30		63	119	
Effective shear stress area	$A_{se,V}$ [A_{se}]^6	mm^2	30		63	119	**CSA 23.3-14**
Resistance modification factor, tension, steel failure modes	R	–	0.70				D5.3
Resistance modification factor, shear, steel failure modes	R	–	0.65				D5.3
Resistance factor for steel anchors	Φs	–	0.85				8.4.3
Factored steel resistance, tension	N,sar	kN	15.5		32.4	61.2	D.6.1.2
Factored steel resistance, shear	V,sar	kN	14.4		30.1	56.8	D.7.1.2
Factored steel resistance, seismic shear	V,sar,eq	kN	9.5		24.3	41.9	
Effectiveness factor for uncracked concrete	k_{uncr}	–	10		11.25	12.5	D.6.2.2
Effectiveness factor for cracked concrete	k_{cr}	–	7				D.6.2.2
Modification factor for resistance in tension to account for uncracked concrete	$\Psi_{c,N}$	–	1				D.6.2.6
Anchor category	–	–	1	2	1		
Material resistance factor for concrete	Φc	–	0.65				8.4.2
Strength reduction factor for tension and shear, concrete failure modes	R	Cond. A	1.15	1.00	1.15		D.5.3c
	R	Cond. B	1.00	0.85	1.00		D.5.3c
Modification Factor for concrete density	λ	–	1				8.6.5
Factored pullout resistance in 20 MPa uncracked concrete	Npr, uncr	kN	6.6	5.6	Pullout does not control	Pullout does not control	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete	$N_{pr,cr}$	kN	2.7	2.3	5.4	Pullout does not control	D.6.3.3
Factored seismic pullout resistance in 20 MPa cracked concrete	$N_{pr,cr}$	kN	2.7	2.3	4.9	Pullout does not control	D.6.3.3

1. The data in this table was taken from ICC ESR-3699 and converted to be used in conjunction with the design provisions of CSA 23.3-14 or CSA 23.3-04, Chapter 8 and Annex D, as applicable.
2. Installation must comply with the manufacturers printed installation instructions and details described in the ICC ESR-3699 and this ITW Red Head catalog
3. The 1/4", 3/8", and 1/2" Tapcon+ carbon steel anchors are considered brittle steel elements
4. For all design cases, Ψc, N = 1. The appropriate effectiveness factor for cracked (kcr) or uncracked concrete (kuncr) must be used.
5. Condition B was assumed for the strength reduction factor for tension and shear (concrete failure modes). For cases where the presence of supplementary reinforcement in conformance with CSA 23.3-14 D.5.3 can be verified, the modification factor for condition A may be used
6. Where Pullout strength does not control anchor design, determine steel and concrete breakout capacities only.

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ITW RED HEAD TAPCON+ SCREW ANCHOR

TAPCON+ INSTALLATION INFORMATION

PARAMETER	SYMBOL	UNITS	Nominal Anchor Diameter				
			1/4"	3/8"	1/2"		
Head Style	-	-	Hex Head	Hex Head	Hex Head		
Anchor Outer Diameter (Shank)	$d_a[d_o]^2$	mm. (in.)	6.4 (0.25)	9.7 (0.38)	12.7 (0.50)		
Nominal carbide bit diameter	d_{bit}	in.	1/4" Tapcon+ or 1/4" ANSI Bit	3/8" ANSI Bit	1/2" ANSI Bit		
Minimum base plate clearance hole diameter	d_h	mm. (in.)	9.7 (0.38)	12.7 (0.50)	16.0 (0.63)		
Effective embedment depth	h_{ef}	mm. (in.)	36.8 (1.45)	45.2 (1.78)	33.5 (1.32)	55.1 (2.17)	76.7 (3.02)
Minimum nominal embedment depth	h_{nom}	mm. (in.)	50.8 (2)	63.5 (2-1/2)	50.8 (2)	76.2 (3)	101.6 (4)
Minimum hole depth	h_o	mm. (in.)	57.2 (2-1/4)	69.9 (2-3/4)	57.2 (2-1/4)	82.6 (3-1/4)	108 (4-1/4)
Minimum concrete member thickness	h_{min}	mm. (in.)	101.6 (4)	101.6 (4)	101.6 (4)	152.4 (6)	
Critical edge distance	c_{ac}	mm. (in.)	63.5 (2-1/2)	114.3 (4-1/2)	76.2 (3)	101.6 (4)	127.0 (5)
Minimum anchor spacing	s_{min}	mm. (in.)	76.2 (3)	76.2 (3)	76.2 (3)	88.9 (3-1/2)	76.2 (3)
Minimum edge distance	c_{min}	mm. (in.)	38.1 (1-1/2)	38.1 (1-1/2)	63.5 (2-1/2)	44.5 (1-3/4)	63.5 (2-1/2)
Maximum installation torque	$T_{inst, max}$	ft-lb	20	50	70		
Maximum installation torque	$T_{impact, max}$	ft-lb	115	200	345		

1. Use ANSI carbide tipped hammer drill bits made in accordance with ANSI B212.15-1994 to install anchors.
2. Tinst, max applies to installations using a calibrated torque wrench

FACTORED STEEL RESISTANCE FOR TAPCON+ CARBON STEEL ANCHORS

Nominal Anchor Diameter	Effective Emb. Depth mm. (in.)	Tensile, kN (lbf)	Shear, kN (lbf)	Seismic shear, kN (lbf)
1/4	37 (1-4/9)	15.5 (3495)	14.4 (3245)	9.5 (2145)
3/8	45 (1-7/9)	32.4 (7290)	30.1 (6770)	24.3 (5460)
1/2	34 (1-1/3)	61.2 (13760)	56.8 (12775)	41.9 (9425)
	55 (2-1/6)			
	77 (3)			

1. The 1/4", 3/8", and 1/2" Tapcon+ carbon steel anchors are considered brittle steel elements
2. Tension values calculated according to Clause D6.1.2 in CSA A23.3-14 Annex D
3. Shear values calculated according to Clause D7.1.2 in CSA A23.3-14 Annex D
4. Seismic shear was calculated by reducing Vsar based on correlation between Vsa and Veq from the ICC ESR-3699

Strength Design Performance Values in Accordance to CSA 23.3-14

ITW RED HEAD TAPCON+ SCREW ANCHOR

FACTORED CONCRETE BREAKOUT/PULLOUT, TENSION kN (lbf)

			Concrete Compressive Strength (Uncracked)					Concrete Compressive Strength (Cracked)				
Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Nominal Embedment Depth mm. (in.)	20 MPa (2900)	25 MPa (3625)	30 MPa (4350)	40 MPa (5800)	50 MPa (7250)	20 MPa (2900)	25 MPa (3625)	30 MPa (4350)	40 MPa (5800)	50 MPa (7250)
1/4	37 (1-4/9)	51 (2)	5.6 (1250)	6.2 (1395)	6.8 (1530)	7.9 (1765)	8.8 (1975)	2.3 (510)	2.5 (570)	2.8 (625)	3.2 (720)	3.6 (805)
3/8	45 (1-7/9)	64 (2-1/2)	9.9 (2235)	11.1 (2500)	12.2 (2735)	14.1 (3160)	15.7 (3535)	5.4 (1215)	6.0 (1360)	6.6 (1490)	7.6 (1720)	8.6 (1920)
1/2	34 (1-1/3)	51 (2)	7.1 (1585)	7.9 (1775)	8.6 (1940)	10.0 (2245)	11.2 (2505)	4.0 (890)	4.4 (995)	4.8 (1090)	5.6 (1255)	6.2 (1405)
	55 (2-1/6)	76 (3)	14.9 (3345)	16.6 (3735)	18.2 (4095)	21.0 (4725)	23.5 (5285)	8.3 (1870)	9.3 (2095)	10.2 (2295)	11.8 (2645)	13.2 (2960)
	77 (3)	102 (4)	24.4 (5490)	27.3 (6135)	29.9 (6720)	34.5 (7760)	38.6 (8675)	13.7 (3075)	15.3 (3435)	16.7 (3765)	19.3 (4345)	21.6 (4860)

1. Linear interpolation between embedment depths and concrete compressive strength is not permitted.
2. Single anchor with no spacing, edge distance, and concrete thickness factors included. Apply these factor according to project condition and compare to steel values to determine anchor strength for design.
3. Tabular values are for normal weight concrete only. For different concrete densities, apply modification factors according to CSA 23.3-14 8.6.5
4. Tabular values are for static loads only. For seismic tension refer to section 4.1.8 of the ICC ESR-3699.
5. Values are for Condition B in conformance with CSA 23.3-14 D.5.3
6. ANSI carbide bit drilling was assumed for all diameters. If using a 1/4" Tapcon+ drill bit, cracked and uncracked pullout of 1/4" Tapcon+ can be multiplied by 1.18

FACTORED CONCRETE PRYOUT/STEEL, RESISTANCE, SHEAR kN (lbf)

			Concrete Compressive Strength (Uncracked)					Concrete Compressive Strength (Cracked)				
Nominal Anchor Diameter (in.)	Effective Embedment Depth mm. (in.)	Nominal Embedment Depth mm. (in.)	20 MPa (2900)	25 MPa (3625)	30 MPa (4350)	40 MPa (5800)	50 MPa (7250)	20 MPa (2900)	25 MPa (3625)	30 MPa (4350)	40 MPa (5800)	50 MPa (7250)
1/4	37 (1-4/9)	51 (2)	5.5 (1240)	6.2 (1395)	6.8 (1530)	7.8 (1755)	8.7 (1965)	2.3 (870)	4.3 (970)	4.7 (1065)	5.5 (1230)	6.1 (1375)
3/8	45 (1-7/9)	64 (2-1/2)	9.9 (2235)	11.1 (2500)	12.2 (2735)	14.1 (3160)	15.7 (3535)	6.2 (1390)	6.9 (1555)	7.6 (1705)	8.7 (1965)	9.5 (2200)
1/2	34 (1-1/3)	51 (2)	7.1 (1585)	7.9 (1775)	8.6 (1940)	10.0 (2245)	11.2 (2505)	4.0 (890)	4.4 (995)	4.8 (1090)	5.6 (1255)	6.2 (1405)
	55 (2-1/6)	76 (3)	14.9 (3345)	16.6 (3735)	18.2 (4095)	21.0 (4725)	23.5 (5285)	8.3 (1870)	9.3 (2095)	10.2 (2295)	11.8 (2645)	13.2 (2960)
	77 (3)	102 (4)	48.8 (10975)	54.6 (12270)	56.8 (12775)	56.8 (12775)	56.8 (12775)	27.3 (6145)	30.6 (6870)	33.5 (7530)	38.7 (8695)	43.2 (9720)

1. Linear interpolation between embedment depths and concrete compressive strength is not permitted.
2. Single anchor with no spacing, edge distance, and concrete thickness factors included. Apply these factor according to project condition and compare to steel strength values to determine anchor strength for design.
3. Tabular values are for normal weight concrete only. For different concrete densities, apply modification factors according to CSA 23.3-14 8.6.5
4. Tabular values are for static loads only. For seismic shear compare values in this table with steel strength values.
5. Values are for Condition B in conformance with CSA 23.3-14 D.5.3