ULTRABOND 4CC

ADHESIVES TECHNOLOGY CORP. Concrete Solutions for Concrete Applications

TECH DATA SHEET

DESCRIPTION **Ultrabond 4CC is a high performance epoxy adhesive for anchoring and doweling applications in both Cracked and Un-Cracked concrete.**

PROPERTIES **TESTED IN ACCORDANCE TO ICC-ES AC-308**
Refer to ICC-ES ESR-3218 Evaluation Report

COLOR	
Part A	Opaque
Part B	Gray
Mixed	Concrete Gray
Mix Ratio	1 : 1

GENERAL USES and APPLICATIONS

- For anchoring threaded rods, bolts and fasteners into grout filled masonry, solid brick or either cracked or uncracked concrete
- Anchoring rebar dowels and smooth dowels into pavement/concrete
- Suitable for long term sustained loads and seismic bracing
- Can be used dry, water-saturated, water-filled and submerged applications with no load reductions
- Airport runways and taxi-way expansions, stadium seating, pallet racking
- Concrete traffic barriers to concrete bridge decks

ADVANTAGES and FEATURES **Ultrabond 4CC is a non-sag, high strength, moisture insensitive epoxy gel anchoring system. It is 100% solids with zero VOC content**

PACKAGING **Not available in Bulk sizes**

Package Size-Cartridge only	22 oz.
Part #	A22-4CC
Manual Dispensing Tool	TM22-HD
Pneumatic Dispensing Tool	TA22HD-N
Case Quantity	12
Pallet Quantity cases/units	48 / 576
Recommended Mixer Nozzle	T5814C

AVAILABILITY **ATC Ultrabond products are available through select distributors who can provide you with all your construction needs. Please contact ATC at (800) 892-1880 for a distributor near you.**

WEBSITE **www.ATC.ws**

SHELF LIFE / STORAGE **18 month shelf life when stored in unopened containers in dry conditions. Store between 40°F and 95°F.**

Independent ASTM C881 Technical Data			
Properties		**ASTM**	**70°F**
Working Time	minutes		15
Full Cure Time	hours		24
Compressive Yield Strength - psi	7 day	D695	10,344
Compressive Modulus – psi		D695	665,251
Tensile Strength psi		D638	4,355
Tensile Elongation - %		D638	7.56
Bond Strength – psi	2 day	C882	3,330
Bond Strength – psi	14 day	C882	3,330
Consistency or Viscosity		C881	Non-sag
Heat Deflection Temp		D648	143°F
Water Absorption - %		D570	0.036
Linear Coefficient of Shrinkage %		D2566	0.003
Volatile Organic Compounds (VOC)	mixed		0

STANDARDS and APPROVALS

Tested to ACI 318 Appendix D
ICC-ES AC-308 Evaluation Report ESR-3218
(Category 1 performance rating)
Meets 2009 IBC requirements
ASTM C881 Type I & IV, Grade 3, Class C
D.O.T Approvals: pending
Canada, Ontario MTO-DSM #9.30.25
FBC Florida Building Code FL#14373
Fire Resistance Performance: Tested
BS476

LEED: Certificate is available upon request

Manufactured In The U.S.A.  *Adhesives Technology Corp.*

APPLICATION TEMPERATURE **Substrate and ambient air temperature between 70°F and 110°F**

CONDITION PRODUCT **Product should be conditioned to at least 70°F prior to application**

COVERAGE **See Installation Instructions for Estimating and Usage Guide for anchoring/doweling.**

CHEMICAL RESISTANCE **A Chemical Resistance Chart for our Ultrabond, Miraclebond and Crackbond Epoxy products is available upon request. Contact a Sales Representative for details.**

LIMITATIONS & WARNINGS

- **Do not thin with solvents, as this will prevent cure**
- **Warm weather epoxy. Application temperature between 70°F and 110°F**

SPECIFICATION **Anchor adhesive shall be a two component, 1:1 ratio system supplied in a pre-measured side by side cartridge and dispensed through a static mixing nozzle supplied by the manufacturer. The adhesive must have a minimum heat deflection temperature of 143°F per ASTM D648. The adhesive must have a minimum ultimate tension load value of 13,476 lbs when tested using 1/2-inch threaded rod in 9/16 diameter hole at a minimum embedment depth of 4-1/2" in 4,000 psi concrete. The shelf life must be a minimum of 18 months. The adhesive shall be Adhesives Technology Corporation Ultrabond 4CC that has been tested in accordance to ICC-ES AC-308.**

INSTALLATION INSTRUCTIONS **For complete Installation Instructions and Technical data for Ultrabond 4CC refer to our Website, www.atc.ws or call ATC for more information at 1-800-892-1880.**

SURFACE PREPARATION **All surfaces must be sound and clean before product application. All dust, dirt, oil, wax, grease or any other contaminant must be removed with solvent or other means. Unsound and loose concrete must also be removed by grinding or sanding. Smooth surface must be roughened with sand paper or wire brush before application. Use pressurized air to blow away dust and dirt.**

CLEAN UP **Clean tools and equipment with solvent such as acetone, MEK or toluene before product hardens.**

SAFETY **Please refer to the MSDS for Ultrabond 4CC published on our Website, www.atc.ws or call ATC for more information at 1-800-892-1880.**

WARRANTY All warranties of the product listed herein, in the corresponding ATC catalog, and in any other current literature, expressed or implied, including warranties of merchantability and fitness for a particular purpose are specifically and expressly excluded with the following exception: At its sole discretion, ATC will repair or replace any product which it considers to be defective in material or workmanship, excepting normal wear and tear within sixty (60) days from the date of purchase from ATC. ATC shall not be liable for any injury, loss or damage, direct, indirect, incidental or consequential or arising out of misuse of, negligence, accident or inability to use any ATC product.

INDEX OF ESTIMATING CHARTS & LOAD TABLES

Ultrabond 4CC Cure Schedule			
Temperature		Working	Full Cure
°C	°F	Time (minutes)	Time (hours)
43°C	110°F	9	24
32°C	90°F	9	24
20°C	70°F	15	24

ALLOWABLE STRESS DESIGN PERFORMANCE VALUES

ALLOWABLE TENSION LOADS FOR THREADED ROD INSTALLED IN CONCRETE BASED ON BOND[1,2,3]

Threaded Rod Diameter (in.)	Based on Bond Strength			2000 psi Normal Weight Concrete		4000 psi Normal Weight Concrete	
	Hole Diameter (in.)	Minimum Embedment Depth (in.)	Max Torque After cure (ft.-lbs.)	Ultimate Tension Load (lbs.)	Allowable Tension Load (lbs.)	Ultimate Tension Load (lbs.)	Allowable Tension Load (lbs.)
3/8	7/16	3-3/8 4-1/2	9	5,060 6,465	1,265 1,616	8,396 10,490	2,092 2,622
1/2	9/16	4-1/2 6 7 1/2	16	10,484 12,392 N/A	3,004 3,098 N/A	13,476 19,166 20,572	3,369 4,791 5,140
5/8	11/16 or 3/4	5-5/8 7-1/2 9 3/8	47	14,634 20,182 N/A	3,659 5,046 N/A	20,880 27,939 32,249	5,220 6,985 8,060
3/4	13/16 or 7/8	6-3/4 9 11 1/4	90	18,966 25,988 N/A	4,742 6,497 N/A	29,019 43,812 47,927	7,255 10, 057 11,980
1	1-1/16 or 1-1/8	9 12 15	170	43,804 45,351 N/A	10,951 11,338 N/A	53,531 64,022 82,547	11,209 15,923 20,630

[1]Use the lower of either the load based on bond, or allowable steel strength value, for design load.
[2]Linear interpolation may be used for intermediate spacing and edge distances
[3]Allowable Loads based on 2000 IBC Allowable Stress Design. (ICC-ES AC-58)

ALLOWABLE SHEAR LOADS FOR THREADED ROD INSTALLED IN CONCRETE BASED ON BOND[1,2]

Threaded Rod Diameter (in.)	Hole Diameter (in.)	Minimum Embedment Depth (in.)	Max Torque After cure (ft.-lbs.)	2000 psi Normal Weight Concrete		4000 psi Normal Weight Concrete	
				Ultimate Shear Load (lbs.)	Allowable Shear Load (lbs.)	Ultimate Shear Load (lbs.)	Allowable Shear Load (lbs.)
3/8	7/16	3-3/8	9	6,227	1,557	6,227	1,557
1/2	9/16	4-1/2	16	12,016	3,004	12,016	3,004
5/8	11/16 or 3/4	5-5/8	47	17,547	4,387	17,547	4,387
3/4	13/16 or 7/8	6-3/4	90	24,918	6,230	24,918	6,230
1	1-1/16 or 1-1/8	9	170	43,648	10,912	43,648	10,912

[1]Use the lower of either the load based on bond, or allowable steel strength value, for design load.
[2]Allowable Loads based on 2000 IBC Allowable Stress Design. (ICC-ES AC-58)

ALLOWABLE THREADED ROD STEEL STRENGTH[1]

Threaded Rod Size (in.)	Allowable Tension loads Based on Steel Strength Design			Allowable Shear loads Based on Steel Strength Design		
	ASTM A307 GRADE C (lbs.)	ASTM A193 GRADE B7 (lbs.)	304/316 SS (lbs.)	ASTM A307 GRADE C (lbs.)	ASTM A193 GRADE B7 (lbs.)	304/316 SS (lbs.)
3/8	2,080	4,340	3,645	1,040	2,170	1,995
1/2	3,730	7,780	6,480	1,870	3,895	3,585
5/8	5,870	12,230	10,125	2,940	6,125	5,635
3/4	8,490	17,690	12,390	4,250	8,855	7,440
7/8	11,337	24,060	16,865	5,781	12,105	10,170
1	15,180	31,620	22,030	7,590	15,810	13,285
1 ¼	23,137	49,101	34,425	11,797	26,080	17,735

[1]Use the lower of either the load based on bond, or allowable steel strength value, for design load.

ALLOWABLE LOADS FOR REBAR INSTALLED IN CONCRETE BASED ON BOND[1,2,3]

Rebar Size	Hole Diameter (in.)	Minimum Embedment Depth (in.)	2,000 psi Concrete		4,000 psi Concrete	
			Ultimate Tension Load (lbs.)	Allowable Tension Load (lbs.)	Ultimate Tension Load (lbs.)	Allowable Tension Load (lbs.)
#3	1/2	3-3/8 4-1/2	7,480 ---	1,870 ---	8,090 10,488	2,022 2,622
#4	5/8	4-1/2 6	--- 11,235	--- 2,808	14,471 20,396	3,617 5,099
#5	3/4	5-5/8 7-1/2	--- 18,108	--- 4,527	21,273 31,863	5,318 7,965
#6	7/8	6-3/4 9	--- 29,338	--- 7,334	27,677 47,879	6,919 11,969
#7	1-1/8	7-7/8 10-1/2	--- ---	--- ---	43,905 52,046	10,976 13,011
#8	1-1/4	9 12	--- 48,000	--- 12,000	55,676 77,358	13,919 19,339
#9	1-3/8	10-1/8 13-1/2	--- ---	--- ---	62,443 71,959	15,610 17,989
#10	1-1/2	11-1/4 15	--- ---	--- ---	70,165 78,545	17,541 19,636

[1]Use the lower of either the load based on bond, or allowable steel strength value, for design load.
[2]Allowable Loads based on 2000 IBC Allowable Stress Design. (ICC-ES AC-58)
[3]SHEAR DATA: Provided the distance from the rebar to the edge of the concrete member exceeds 1.25 times the embedment depth of the rebar, calculate the ultimate shear load for the rebar anchorage as 60% of the ultimate tensile strength of the rebar.

ALLOWABLE REBAR STEEL STRENGTH[1]

Rebar Size	Allowable Steel Strength		Ultimate Tensile and Yield Strength Grade 60 Rebar	
	Tension Load (lbs.)	Shear Loads (lbs.)	Minimum Yield Strength	Minimum Ultimate Tensile Strength
#3	2,650	1,700	6,600	9,900
#4	4,710	3,060	12,000	18,000
#5	7,365	4,740	18,600	27,900
#6	10,605	6,730	26,400	39,600
#7	14,430	9,180	36,000	54,000
#8	18,850	12,085	47,400	71,100
#9	23,856	15,307	60,000	90,000
#10	30,410	18,898	76,200	114,300

[1]Use the lower of either the load based on bond, or allowable steel strength value, for design load.

COMBINATION LOADS TENSION and SHEAR REDUCTION CALCULATIONS

Allowable loads for anchors under both tension and shear loading at the same time (combination loading) will be lower than the allowable loads for anchors subjected to 100% tension or 100% shear. Use the following equation to evaluate anchors in combination loading conditions.

$$\left(\frac{Na}{Ns}\right) + \left(\frac{Va}{Vs}\right) \leq 1$$

Na = Applied Service Tension Load **Va = Applied Service Shear Load**

Ns = Allowable Tension Load **Vs = Allowable Shear Load**

EDGE DISTANCE LOAD FACTORS SUMMARY[1,2]

Distance From Edge of Concrete	Load Factor
Critical Edge Distance – Tension 1.25 x Anchor Embedment	100% Tension Load
Minimum Edge Distance – Tension 0.50 x Anchor Embedment	70% Tension Load
Critical Edge Distance – Shear 1.25 x Anchor Embedment	100% Shear Load
Minimum Edge Distance – Shear 0.30 x Anchor Embedment	30% Shear Load

SPACING DISTANCE LOAD FACTORS SUMMARY[1,2]

Distance From Another Anchor	Load Factor
Critical Spacing – Tension 1.50 x Anchor Embedment	100% Tension Load
Minimum Spacing – Tension 0.75 x Anchor Embedment	75% Tension Load
Critical Spacing – Shear 1.50 x Anchor Embedment	100% Shear Load
Minimum Spacing – Shear 0.50 x Anchor Embedment	30% Shear Load

1. Use linear interpolation for load factors at edge distances or spacing distances between critical and minimum.
2. Anchors are affected by multiple combination of spacing and/or edge distance loading and direction of the loading. Use the product of tension and shear loading factors in design.

Manufactured In The U.S.A. *Adhesives Technology Corp.*

STRENGTH DESIGN PERFORMANCE VALUES

CONCRETE BREAKOUT DESIGN INFORMATION[1,2]

CHARACTERISTIC	SYMBOL	UNITS	Threaded Rod Diameter d(inch)						
			3/8	1/2	5/8	3/4	7/8	1	1 1/4
Effectiveness factor for uncracked concrete	$K_{c,uncr}$	---	24	24	24	24	24	24	24
Effectiveness factor for Cracked concrete	$K_{c,cr}$	---	17	17	17	17	17	17	17
Minimum Concrete Thickness[2]	h_{min}	in.	h_{ef} + 1 ¼"			h_{ef} + 2d_0			
Anchor embedment depth - Minimum	$h_{ef,min}$	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 1/2	4	5
Anchor embedment depth – Maximum	$h_{ef,max}$	in.	3 3/8	4 1/2	5 5/8	6 3/4	7 7/8	9	11 ¼
Minimum Spacing	S_{min}	in.	15/16	1	2 1/2	6	3 1/2	4	5
Minimum Edge Distance	C_{min}	in.	15/16	1	2 1/2	6	3 1/2	4	5
Critical Edge Distance	C_{ac}	in.	See Section 4.1.10 of the ESR-3218 Report						
Strength reduction factor for Tension, concrete failure mode[1]	Ø	Cond. B	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Strength reduction factor for Shear, concrete failure mode[1]	Ø	Cond. B	0.70	0.70	0.70	0.70	0.70	0.70	0.70

For SI: 1 inch = 25.4mm, 1 lbf = 4.45N.

[1] The tabulated value of Ø applies when the load combinations of Section 1605.2.1 of the IBC, Section 1612.2.1 of the UBC, ACI 318 Section 9.2 are used and the requirements of ACI 318 D.4.4© for Condition B are met. If the load combinations of Section 1909.2 of the UBC or ACI 318 Appendix C are used, the appropriate value of Ø must be determined in accordance with ACI 318 D.4.5 for Condition B.

[2] d_o represents the nominal drill hole diameter.

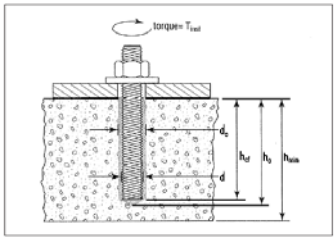
STEEL DESIGN INFORMATION FOR THREADED ROD[1]

Characteristic		Symbol	Units	Anchor Nominal Rod Diameter (d) 3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
Threaded rod effective cross-sectional area		A_{se}	$Inch^2$	0.078	0.142	0.226	0.335	0.462	0.606	0.969
ASTM Carbon Steel A36	Strength reduction factor for tension, steel failure mode.[1]	Φ	--	0.75	0.75	0.75	0.75	0.75	0.75	0.75
	Strength reduction factor for shear, steel failure mode.[1]	Φ	--	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Nominal steel strength in tension	N_{sa}	lb	4,500	8,230	13,110	19,400	26,780	35,130	56,210
	Nominal steel strength in shear	V_{sa}	lb	2,250	4,940	7,870	11,640	16,070	21,080	33,730
	Reduction factor for seismic shear	$av_{,seis}$	--	0.70	0.70	0.70	0.70	0.70	0.70	0.70
ASTM Carbon Steel A193 B7	Strength reduction factor for tension, steel failure mode. [1]	Φ	--	0.75	0.75	0.75	0.75	0.75	0.75	0.75
	Strength reduction factor for shear, steel failure mode. [1]	Φ	--	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Nominal steel strength in tension	N_{sa}	lb	9,690	17,740	28,250	41,810	57,710	75,710	121,140
	Nominal steel strength in shear	V_{sa}	lb	4,845	10,640	16,950	25,090	34,630	45,430	72,680
	Reduction factor for seismic shear	$av_{,seis}$		0.70	0.70	0.70	0.70	0.70	0.70	0.70
ASTM Stainless Steel F593	Strength reduction factor for tension, steel failure mode. [1]	Φ	--	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength reduction factor for shear, steel failure mode. [1]	Φ	--	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	Nominal steel strength in tension	N_{sa}	lb	5,810	10,640	16,950	25,090	34,630	45,430	72,680
	Nominal steel strength in shear	V_{sa}	lb	2,905	6,390	10,170	15,050	20,780	27,260	43,610
	Reduction factor for seismic shear	$av_{,seis}$		0.70	0.70	0.70	0.70	0.70	0.70	0.70

For **SI**: 1 inch=25.4mm, 1 lbf=4.45N.

[1] The value of Φ will apply when the load combinations of Section 1605.2.1 of the IBC, section 1612.2.1 of the UBC, or ACI 318 section 9.2 are used as set forth in ACI D 4.4. If the load combinations of Section 1901.2 of the UBC or ACI 318 Appendix C are used, the appropriate value of Φ must be determined in accordance with ACI 318 D 4.5.

ANCHOR INSTALLATION



BRUSH SPECIFICATIONS

Part #	(d) Anchor Diameter (in.)	(d_r) Rebar	(d_o) Drill bit Diameter (in.)	($d_{brush}\Phi$) Brush Diameter (in.)	(d_{brush}) Minimum brush diameter (in)
HB038	3/8	# 3	7/16	5/8	0.563
HB012	1/2	♦	9/16	3/4	0.675
HB058	5/8	# 5	3/4	1	0.900
HB034	3/4	#6	7/8	1-1/4	1.125
HB078	7/8	♦	1	1-1/2	1.350
HB010	1	#7	1-1/8	1-5/8	1.463
HB125	1-1/4	♦	1-3/8	1-3/4	1.575

For SI: 1 inch= 25.4mm ♦Available with lead time.

Manufactured In The U.S.A.  *Adhesives Technology Corp.*

ADHESIVE ANCHOR BOND STRENGTH DESIGN INFORMATION[1,2,3,4,5,6]

CHARACTERISTICS		Symbol	Units	Nominal Rod Diameter (d)						
				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
Anchor Embedment Depth (minimum)		$h_{ef,min}$	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 1/2	4	5
Anchor Embedment Depth (maximum)		$h_{ef,max}$	in.	3 3/8	4 1/2	5 5/8	6 3/4	7 7/8	9	11 1/4
Temperature Range A [2,4,5] Bond Strength—Uncracked Concrete		$\tau_{k,uncr}$	psi	1,620	1,620	1,620	1,620	1,620	1,620	1,620
Temperature Range A [2,4,5] Bond Strength—Cracked Concrete		$\tau_{k,cr}$	psi	665	785	785	785	785	785	785
Temperature Range B [3,4,5] Bond Strength—Uncracked Concrete		$\tau_{k,uncr}$	psi	1,245	1,245	1,245	1,245	1,245	1,245	1,245
Temperature Range B [3,4,5] Bond Strength—Cracked Concrete		$\tau_{k,cr}$	psi	510	605	605	605	605	605	605
Continuous Inspection	Dry Concrete-- Strength Reduction Factor	$\Phi_{dry,ci}$	--	0.65	0.65	0.65	0.65	0.55	0.55	0.55
	Saturated Concrete Strength Reduction Factor	$\Phi_{sat,ci}$	--	0.65	0.65	0.65	0.65	0.55	0.55	0.55
	Water Filled Holes Strength Reduction Factor	$\Phi_{wf,ci}$	--	0.65	0.65	0.65	0.65	0.55	0.55	0.55
	Submerged Concrete Strength Reduction Factor	$\Phi_{sub,ci}$	--	0.65	0.65	0.65	0.65	0.55	0.55	0.55
Periodic Inspection	Dry Concrete-- Strength Reduction Factor	$\Phi_{dry,ci}$	--	0.55	0.55	0.55	0.55	0.45	0.45	0.45
	Saturated Concrete Strength Reduction Factor	$\Phi_{sat,ci}$	--	0.55	0.55	0.55	0.55	0.45	0.45	0.45
	Water Filled Holes Strength Reduction Factor	$\Phi_{wf,ci}$	--	0.55	0.55	0.55	0.55	0.45	0.45	0.45
	Submerged Concrete Strength Reduction Factor	$\Phi_{sub,ci}$	--	0.55	0.55	0.55	0.55	0.45	0.45	0.45
Reduction factor for seismic tension		$\Phi_{N,seis}$	--	0.80						

For **SI**: 1 inch=25.4mm, 1 lbf=4.45N. 1 ft-lbf = 1.356 N-M 1 psi = 0.006895 MPa.

[1] Bond strength values correspond to concrete compressive strength range 2,500 to 8,500 psi.

[2] Temperature Range A: Maximum short term temperature of 110°F and Maximum long term temperature of 70°F

[3] Temperature Range B: Maximum short term temperature of 110°F and Maximum long term temperature of 110°F

[4] Short term elevated concrete temperatures are those that occur over brief interval, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.

[5] For load combinations consisting of only short-term loads, such as wind or seismic loads, bond strengths may be increased by 5% FOR Temperature Range A and by 36% for Temperature Range B.

[6] For structures assigned to IBC or IRC Seismic Design Category C, D, E or F, or UBC Seismic Zone 2B, 3 or 4, bond strength values must be multiplied by $av_{,seis}$

TYPICAL ALLOWABLE STRESS DESIGN CALCULATION, ASD, USING LOW STRENGTH CARBON STEEL (A36) THREADED ROD INSTALLED IN f'c = 2,500 PSI – 8,000 PSI UNCRACKED CONCRETE WITH ULTRABOND 4CC ADHESIVE SYSTEM[1]

Anchor Diameter (d)	Embedment Depth, h_{ef} (in) (min.max)	*Characteristic Bond Strength τ_{uncr} (psi)	Controlling Failure Mode	Allowable Tension Load (lbs) 2500 psi --- 8000 psi
3/8	2 3/8	1.620	Bond	1,684
	3-3/8	1.620	Steel	2,280
1/2	2 3/4	1.620	Concrete	2,403
	4-1/2	1.620	Steel	4,171
5/8	3 1/8	1.620	Concrete	2,911
	5-5/8	1.620	Steel	6,643
3/4	3 1/2	1.620	Concrete	3,451
	6-3/4	1.620	Concrete	9,242
7/8	3-1/2	1.620	Concrete	3,451
	7-7/8	1.620	Bond	10,663
1	4	1.620	Concrete	4,216
	9	1.620	Bond	13,927
1-1/4	5	1.620	Concrete	5,892
	11-1/4	1.620	Concrete	19,887

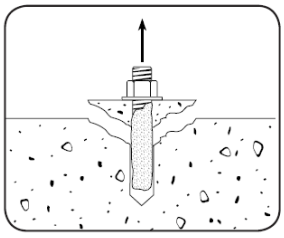
[1] To Achieve the values in this table all condition listed below have to be met. This table is an example based on the conditions set forth below.

For SI: 1 inch= 25.4mm, 1lbf= 4.45N, 1ft-lbf= 1.356N-M, 1 psi=0.006895 MPa

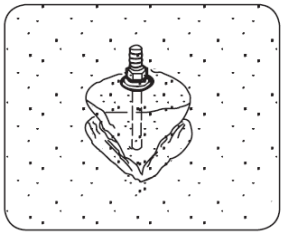
This table was developed based on the following conditions:
1 Single anchor with static tension only, A36 threaded rod
2 Vertical downward installation direction
3 Inspection regimen = Periodic
4 Installation temperature = 70°F to 110°F
5 Long term temperature = 70°F
6 Short term temperature = 110°F
7 Dry hole condition (carbide drilled hole)
8 Embedment = h_{ef} (min/max for each diameter)
9 Concrete determined to remain uncracked for the life of the anchorage
10 Load combinations from ACI 318 Section 9.2 (no seismic loading)
11 30% dead load and 70% live load, controlling load combination 1.2D + 1.6L
12 Calculation of weighted average for _ = 0.3*1.2 + 0.7*1.6 = 1.48

Controlling Modes

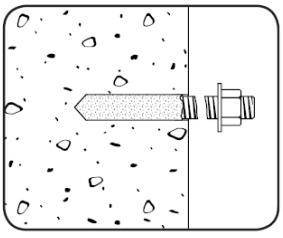
Bond



Concrete



Steel



Illustrative Procedure to Calculate Allowable Stress Design Tension Values: ATC Ultrabond 4CC, ½" anchor diameter, embedment depth of 4-1/2" assuming the conditions in Table above (Page 10).

Procedure to calculate allowable tension load for Strength Design:

Example: 1/2" diameter anchor with embedment depth of 4-1/2" installed in 4,000 psi concrete

1. Calculate steel strength – tension (A36 steel)

$$\Phi N_{sa} = 0.75 * 8{,}230 = \mathbf{6{,}173\ lbs}$$

2. Calculate concrete breakout strength – tension

$\Phi N_b = (\Phi A_{NC}/A_{NCo}) * k_{uncr} * \sqrt{f'_c} * h_{ef}^{1.5} = 0.65*24*\sqrt{2{,}500} * 4\text{-}1/2^{1.5} =$ **7,446 lbs** per ACI 218 D5.2

Normalize load for 4,000 psi concrete $7{,}446 * \sqrt{\frac{4{,}000}{2{,}500}} =$ **9,418 lbs**

3. Calculate bond strength – tension

$$\Phi * d * \pi * h_{ef} * \tau_{k,uncr} = 0.55 * 1/2 * 3.1415 * 4\text{-}1/2 * 1{,}620 = \mathbf{6{,}298\ lbs}$$

4. Determine load combination & conversion factor
   – Assume 30% dead load & 70% live load using load combination

$$\alpha = 1.2D + 1.6L = 1.2(0.3) + 1.6(0.7) = \mathbf{1.48}$$

5. Controlling strength is **6,173 lbs** (steel) – lowest load value amongst bond, concrete and steel controlling modes. Divide by the load combination conversion factor, 1.48, to obtain allowable tension load.

$$6{,}173 / 1.48 = \mathbf{4{,}171\ lbs}\ \text{(steel)}$$