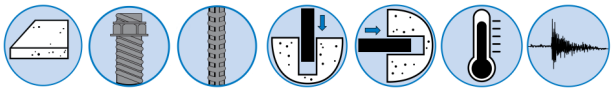
ULTRABOND® 1



Product Description

ULTRABOND® 1 is a two-component, 1:1 mix ratio, structural anchoring epoxy system offering exceptional strength in anchoring and doweling applications. A smooth pump-friendly formulation is available in multiple bulk sizes. It may be used in temperatures between 40 °F to 110 °F (4 °C to 43 °C). ULTRABOND 1 in cartridges has been tested in accordance with ASTM E488-96 and ASTM E1512-01 for its capability to resist static, dynamic, seismic and wind loads in uncracked concrete for both threaded rod and rebar.

General Uses & Applications

- Anchoring threaded rods, bolts and rebar dowels into uncracked concrete
- Short and long term tensile anchoring, including wind, seismic and shear forces in accordance with allowable stress design (ASD)
- Grouting dowel bars and tie bars for full depth concrete pavement repairs
- Bonding agent for fresh to hardened concrete, and hardened to hardened concrete

Advantages & Features

- Evaluated by National Transportation Product Evaluation Program (NTPEP)
- LEED® EQc4.1 Credit: Low emitting materials - adhesives and sealants; LEED (Leadership in Energy and Environmental Design) is the most widely used green building rating system in the world
- Available in numerous cartridge sizes and in bulk
- Moisture insensitive allowing installation and curing in damp environments
- Withstands freeze-thaw conditions
- Little or no odor
- High modulus
- In-service temperature range between 35 °F (2 °C) and 180 °F (82 °C)

STANDARDS & APPROVALS

AASHTO M235 / ASTM C881-15
Type I, II, IV & V Grade 3 Class A, B & C

(See ATC website for current Department of Transportation approvals throughout the United States)

Availability: Adhesives Technology Corp. (ATC) products are available online and through select distributors providing all your construction needs. Please contact ATC for a distributor near you or visit www.atcepoxy.com for online purchasing options or to search for a distributor by zip code.

Color & Ratio: Part A (Resin) White: Part B (Hardener) Black, Mixed: Concrete Gray, Mix Ratio: 1:1

Storage & Shelf Life: 28 months when stored in unopened containers in dry conditions. Store between 40 °F (4 °C) and 95 °F (35 °C).

Installation & Estimation: Manufacturer's Printed Installation Instructions (MPII) are available within this Technical Data Sheet (TDS). Due to occasional updates and revisions, always verify the most current MPII usage. In order to achieve maximum results, proper installation is imperative. An estimating guide for product usage may be found at www.atcepoxy.com.

Clean-Up: Clean uncured materials from tools and equipment with mild solvents. Cured material can only be removed mechanically.

Limitations & Warnings:

- Do not thin with solvents, as this may affect cure
- Not recommended for any overhead application where there may be a sustained tensile load
- For anchoring applications, concrete must be a minimum of 21 days old prior to anchor installation
- Performance characteristics, such as seismic and long term load resistance, were tested in accordance with ASTM E488 -96 (2003) & E1512-01 (2015) provisions and not that of ACI 355.4, and are therefore not applicable in the concrete tension zone - always consult with a design professional prior to use to ensure product applicability
- Smooth bulk formulation has not been tested to ASTM E488 or ASTM E1512

Safety: Please refer to the Safety Data Sheet (SDS) for ULTRABOND 1. Call ATC for more information at 1 -800-892-1880.

Specification: Anchoring adhesive shall be a two-component, 1:1 ratio, solvent free epoxy system supplied in pre-measured containers. The epoxy must meet the requirements of C881 specification for Type I, II, IV, and V, Grade 3 Class A, B & C. After a 7 day cure and at a temperature of 75 °F (24 °C), the anchoring adhesive shall have a compressive yield strength of 11,410 psi (78.7 MPa) per ASTM D695. The anchoring adhesive shall have a heat deflection temperature of 132 °F (56 °C) per ASTM D648. The anchoring adhesive shall be ULTRABOND 1 from Adhesives Technology Corp., Pompano Beach, Florida. Anchors shall be installed per the Manufacturer's Printed Installation Instructions (MPII) for ULTRABOND 1 anchoring system.

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ORDERING INFORMATION

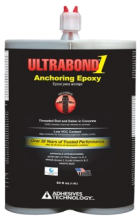
TABLE 1: ULTRABOND 1 Adhesive Packaging, Dispensing Tools and Mixing Nozzles[1,2]

Package Size	8.6 fl. oz. (254 ml) Cartridge	21.2 fl. oz. (627 ml) Cartridge	53 fl. oz. (1.6 L) Cartridge	10 Gallon (38 L) Kit	100 Gallon (379 L) Kit
Part #	A9-1	A22-1N[3]	A53-1N[3]	B5G-1S-A B5G-1S-B	B50G-1S-A B50G-1S-B
Recommended Mixing Nozzle	T12			T34HF[4]	
Manual Dispensing Tool	TM9HD	TM22HD	N/A		
Pneumatic Dispensing Tool	N/A	TA22HD-N	TA53HD-A	Pump[5]	
Case Qty.	12		6	1	
Pallet Qty.	1,116	432	252	12 kits	2 kits
Pallet Weight (lb.)	1,190	985	1,260	1,720	2,797
SDS Brush Adaptor	BR-SDS				
Brush Extension	BR-EXT				
Nozzle Extension Tubing	TUBE916-EXT				
Retention Wedge	WEDGE				

1. Each cartridge is packaged with one mixing nozzle.
2. Call for bulk packaging availability and lead times.
3. For projects with hole diameters greater than 3/4 inch, the T3412CT may be used on A22-1N.
4. T3412CT mixing nozzle may be used as an alternate nozzle.
5. For bulk dispensing pumps, contact ATC for recommended manufacturers.


A9-1


A22-1N


A53-1N


B5G-1S-A B5G-1S-B


T12 Nozzle


T34HF Nozzle

Brush Extension
BR-EXT


Manual Brush Handle

Large Wire Brush
(see Table 3 part #'s)


Retention Wedge
WEDGE

Small Wire Brush
(see Table 3 part #'s)


Nozzle Extension Tubing
TUBE916-EXT


TM9HD


TM22HD

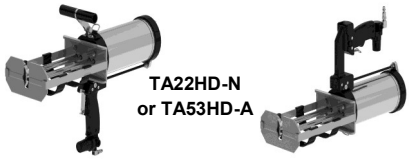

TA22HD-N
or TA53HD-A
One tool, dual grip configurations

TABLE 2: Milwaukee Vacuum Drill Components[1]

Part #	Drill Type	Drill Bit Size in.	Overall Length in.	Useable Length in.
48-20-2102	SDS+	7/16	13	7-7/8
48-20-2106		1/2	13	7-7/8
48-20-2110		9/16	14	9-1/2
48-20-2114		5/8	14	9-1/2
48-20-2118		3/4	14	9-1/2
48-20-2152	SDS-MAX	5/8	23	15-3/4
48-20-2156		3/4	23	15-3/4
48-20-2160		7/8	23	15-3/4
48-20-2164		1	25	17-1/2
48-20-2168		1-1/8	35	27
48-20-2172		1-3/8	35	27
8960-20	8 Gallon Dust Extractor Vacuum			

1. Vacuum drill accessories available from Milwaukee distributors nationwide.

TABLE 3: ULTRABOND 1 Installation Parameters and Brushes

Threaded Rod in.	Rebar	Drill Bit Diameter in.	Maximum Installation Torque ft-lbs. (N-m)	Brush Part #	Brush Length in.
3/8	----	7/16	15 (20)	B716	6
----	#3	1/2	----	B12	
1/2	----	9/16	30 (41)	B916	
----	#4	5/8	----	B58	
5/8	#5	3/4	60 (82)	B34	
3/4	#6	7/8	105 (142)	B78	
7/8	#7	1	125 (170)	B100	9
1	#8	1 1/8	165 (224)	B118	
----	#10	1 1/2	----	B112	

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MATERIAL SPECIFICATION

ATC has tested and recommends Milwaukee Tool's OSHA compliant, commercially available dust extraction products for use in combination with ULTRABOND 1 installations in dry concrete (see Table 2 for details). When used in accordance with the manufacturer's instructions, and in conjunction with ULTRABOND 1, these Vacuum Drill Bits along with the Dust Extractor with HEPA filter as specified by Milwaukee Tool, can completely replace the traditional blow-brush-blow cleaning method used to install threaded rod or rebar (see Installation Instructions (MPII) for more detail). **Important:** Prior to injecting the adhesive, the hole must always be clean, either by using self-cleaning vacuum bits or by using the blow-brush-blow cleaning method with a traditional hammer drill bit and dust shroud. Only vacuuming out a hole drilled with a standard masonry bit is NOT acceptable and will yield lower performance than published for the anchoring/doweling adhesive. For more information, see Respirable Crystalline Silica White Paper at www.atcepoxy.com.

Milwaukee Tool Dust Extraction System

TABLE 4: ULTRABOND 1 performance to **ASTM C881-15**[1,2,3]

Property	Cure Time	ASTM Standard	Units	Sample Conditioning Temperature		
				Class A	Class B	Class C
				38 °F (3) °C	50 °F (10) °C	75 °F (24) °C
Gel Time - 60 Gram Mass[4]	----	C881	min	38	20	14
Pot Life[5,6]				13		
Consistency or Viscosity			----	Non-sag		
Compressive Yield Strength	7 day	D695	psi (MPa)	10,860 (74.9)	10,490 (72.3)	11,410 (78.7)
Compressive Modulus			psi (MPa)	209,000 (1,441)	211,000 (1,455)	244,000 (1,682)
Bond Strength	2 day	C882	psi (MPa)	2,850 (19.7)	3,300 (22.8)	3,580 (24.7)
	14 day		psi (MPa)	2,790 (19.2)	4,090 (28.2)	3,940 (27.2)
Tensile Strength	7 day	D412	psi (MPa)	3,330 (23.0)		
Tensile Modulus			psi (MPa)	1,554,000 (10,714)		
Elongation			%	0.2		
Shear Strength	7 day	D4027	psi (MPa)	1,316 (9.1)		
Lap Shear Strength		D1002	psi (MPa)	1,240 (8.5)		
Heat Deflection Temperature		D648	°F (°C)	132 (55.6)		
Water Absorption	14 day	D570	%	0.53		
Linear Coefficient of Shrinkage	----	D2566		0.002		
Surface Resistivity 1/4 in. Thickness	7 day	D257	----	Greater than 10^{12} ohms / square		
Volume Resistivity 1/4 in. Thickness				1.26 x 10^{14} inch / square		

1. Results based on testing conducted on a representative lot(s) of product. Average results will vary according to the tolerances of the given property.
2. Full cure is listed above to obtain the given properties for each product characteristic.
3. Results may vary due to environmental factors such as temperature, moisture and type of substrate.
4. Gel time may be lower than the minimum required for ASTM C881.
5. Property not referenced in ASTM C881.
6. Pot life is measured as the workable and applicable time of 1.0 gallon (3.8 L) when mixed at 75 °F (24 °C).

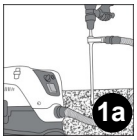
TABLE 5: ULTRABOND 1 **CURE SCHEDULE**[1,2,3]

Base Material Temperature °F (°C)	Working Time	Full Cure Time
40 (4)	36 min	72 hr
75 (24)	20 min	24 hr
110 (43)	12 min	18 hr

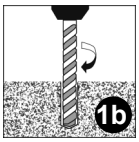
1. Working and full cure times are approximate, may be linearly interpolated between listed temperatures and are based on cartridge/nozzle system performance.
2. Application Temperature: Substrate and ambient air temperature should be between 40 - 110 °F (4 - 43 °C).
3. When ambient or base material temperature falls below 70 °F (21 °C), condition the adhesive to 70 - 75 °F (21 - 24 °C) prior to use.

INSTALLATION INSTRUCTIONS (MPII)

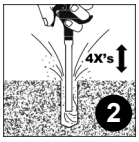
Drilling and Cleaning



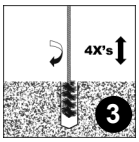
Recommended Dust Extractor System for drilling into dry concrete - Attach appropriate size drill bit to the Dust Extractor Vacuum System (see Table 2). The drill bit should conform to ANSI B212.15 and be the appropriate size for the anchor diameter to be installed. Drill the hole to the specified embedment depth. **Skip to Step 5 if using Dust Extractor System.**



Traditional Drilling Method for dry and damp concrete - Using a rotary hammer drill, and a bit which conforms to ANSI B212.15 and is the appropriate size for the anchor diameter to be installed, drill the hole to the specified embedment depth. **CAUTION:** Always wear appropriate personal protection equipment (PPE) for eyes, ears and skin and avoid inhalation of dust during the drilling and cleaning process. Refer to the Safety Data Sheet (SDS) for details prior to proceeding.



NOTE: Remove any standing water from hole prior to beginning the cleaning process. If removal of standing water is not possible, please contact ATC for application specific installation instructions. Using oil free compressed air with a minimum pressure of 80 psi (5.5 bar), insert the air wand to the bottom of the drilled hole and blow out the debris with an up/down motion for a minimum of 4 seconds/cycles (4X).

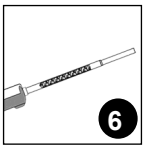


Select the correct wire brush size for the drilled hole diameter (see Table 3), making sure that the brush is long enough to reach the bottom of the drilled hole. Reaching the bottom of the hole, brush in an up/down and twisting motion for 4 cycles (4X). **CAUTION:** The brush should contact the walls of the hole. If it does not, the brush is either too worn or small and should be replaced with a new brush of the correct diameter.

Blow the hole out once more to remove brush debris using oil free compressed air with a minimum pressure of 80 psi (5.5 bar). Insert the air wand to the bottom of the drilled hole and blow out the debris with an up/down motion for a minimum of 4 seconds/cycles (4X). Visually inspect the hole to confirm it is clean. **NOTE:** If installation will be delayed for any reason, cover cleaned holes to prevent contamination.

Cartridge Preparation

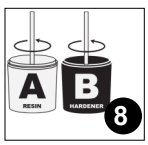
CAUTION: Check the expiration date on the cartridge to ensure it is not expired. **Do not use expired product!** Remove the protective cap from the adhesive cartridge and insert the cartridge into the recommended dispensing tool. Before attaching mixing nozzle, balance the cartridge by dispensing a small amount of material until both components are flowing evenly. For a cleaner environment, hand mix the two components and let cure prior to disposal in accordance with local regulations.



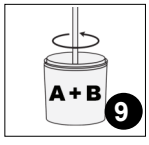
Only after the cartridge has been balanced, screw on the proper Adhesives Technology mixing nozzle to the cartridge (see Table 1). Do not modify mixing nozzle and confirm that internal mixing element is in place prior to dispensing adhesive. Take note of the air and base material temperatures and review the working/full cure time chart (see Table 5) prior to starting the injection process.

Dispense the initial amount of material from the mixing nozzle onto a disposable surface until the product is a uniform gray color with no streaks, as adhesive must be properly mixed in order to perform as published. Dispose of the initial amount of adhesive according to local regulations prior to injection into the drill hole. **CAUTION:** When changing cartridges, never re-use nozzles. A new nozzle should be used with each new cartridge and steps 5-7 should be repeated accordingly.

Bulk Preparation



CAUTION: Check the expiration date on each container to ensure it is not expired. **Do not use expired product!** Epoxy materials may separate. This is normal and may be expected when stored over a period of time. Mix only the amount of material that can be used before the pot life expires (see Table 4). Thoroughly mix Part B Hardener prior to pouring and mixing the two components together. **GALLON Packaging (B10G & B100G):** Pour Part A Resin and Part B Hardener equally at a 1:1 ratio into a third container, adding Part A first then Part B. Mix thoroughly.



Mix thoroughly with a low speed drill (400 – 600 rpm) with a mix paddle attachment (i.e. Jiffy Mixer). **CAUTION:** mixing the epoxy on high speed may cause air bubbles which may cause application problems. Keep the paddle speed on low and the mix paddle below the surface of the material to avoid entrapping air. Carefully scrape the sides and the bottom of the container while mixing. Proper mixing will take 2 – 3 minutes and when well mixed the material will be uniform in color and free of streaks or lumps. **NOTE:** Due to the high viscosity/non-sag consistency of this product, a bulk dispensing pump should be used to ensure mixed epoxy is placed to the deepest end of anchor hole and that threaded rod/rebar is fully encapsulated.

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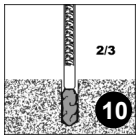
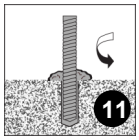
INSTALLATION INSTRUCTIONS (MPII)

Installation and Curing (Vertical Down and Horizontal)



NOTE: The engineering drawings must be followed. For any applications not covered by this document, or if there are any installation questions, please contact Adhesives Technology Corp. Insert the mixing nozzle to the bottom of the hole and fill from the bottom to the top approximately two-thirds full, being careful not to withdraw the nozzle too quickly as this may trap air in the adhesive. **NOTE:** When using a pneumatic dispensing tool, ensure that pressure is set at 90 psi (6.2 bar) maximum.



Do not disturb, torque or apply any load to the installed anchor until the specified full cure time has passed. The amount of time needed to reach full cure is base material temperature dependent - refer to Table 5 for appropriate full cure time.

Prior to inserting the threaded rod or rebar into the hole, make sure it is clean and free of oil and dirt and that the necessary embedment depth is marked on the anchor element. Insert the anchor element into the hole while turning 1-2 rotations prior to the anchor reaching the bottom of the hole. Excess adhesive should be visible on all sides of the fully installed anchor. For horizontal installations, wedges should be used to center and support the anchor while the adhesive is curing. **CAUTION:** Use extra care with deep embedment or high temperature installations to ensure that the working time has not elapsed prior to the anchor being fully installed.

TABLE 6: ULTRABOND 1 **IN-SERVICE CHART**[1]

Base Material Temperature °F (°C)	Allowable Load Capacity Reduction Factor
35 (2)	1.00
70 (21)	1.00
110 (43)	0.91
135 (57)	0.80
150 (66)	0.80
180 (82)	0.66

1. Reduction factors may be linearly interpolated between listed temperatures.

TABLE 7: ULTRABOND 1 ultimate and allowable **TENSION** loads for **THREADED ROD** in normal-weight concrete[1,2,3]

Threaded Rod Diameter in.	Nominal Drill Bit Diameter in.	Embedment Depth in. (mm)	Tension Load Based on Bond Strength/Concrete Capacity				Allowable Tension Load Based on Steel Strength[4]		
			$f'_c \geq 2{,}000$ psi (13.8 MPa)[5]		$f'_c \geq 4{,}000$ psi (27.6 MPa)[5]				
			Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	ASTM F1554 Grade 36 lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
3/8	7/16	3 3/8 (86)	9,248 (41.1)	2,312 (10.3)	9,248 (41.1)	2,312 (10.3)	2,114 (9.4)	4,556 (20.3)	3,645 (16.2)
1/2	9/16	4 1/2 (114)	17,076 (76.0)	4,269 (19.0)	22,328 (99.3)	5,582 (24.8)	3,758 (16.7)	8,099 (36.0)	6,480 (28.8)
5/8	3/4	5 5/8 (143)	23,865 (106.2)	5,966 (26.5)	29,950 (133.2)	7,488 (33.3)	5,872 (26.1)	12,655 (56.3)	10,124 (45.0)
3/4	7/8	6 3/4 (171)	31,371 (139.5)	7,843 (34.9)	39,278 (174.7)	9,820 (43.7)	8,456 (37.6)	18,224 (81.1)	12,392 (55.1)
7/8	1	7 7/8 (200)	39,532 (175.8)	9,883 (44.0)	53,862 (239.6)	13,466 (59.9)	11,509 (51.2)	24,804 (110.3)	16,867 (75.0)
1	1 1/8	9 (229)	48,299 (214.8)	12,075 (53.7)	62,697 (278.9)	15,674 (69.7)	15,033 (66.9)	32,398 (144.1)	22,030 (98.0)
1 1/4	1 3/8	11 1/4 (286)	67,500 (300.3)	16,875 (75.1)	88,594 (394.1)	22,149 (98.5)	23,488 (104.5)	50,621 (225.2)	34,423 (153.1)

1. Allowable bond strength/concrete capacity was calculated using a safety factor of 4.0.
2. Load adjustment factors for edge distance, spacing distance and in-service temperature should be applied if applicable.
3. The lower value of either the adjusted allowable bond strength/concrete capacity or steel strength should be used as the allowable tension value for design.
4. Allowable steel strengths calculated in accordance with AISC Manual of Steel Construction: Tensile = $0.33*F_u*A_{nom}$.
5. Linear interpolation may be used for intermediate concrete compressive strengths.

TABLE 8: ULTRABOND 1 ultimate and allowable **SHEAR** loads for **THREADED ROD** in normal-weight concrete[1,2,3]

Threaded Rod Diameter in.	Nominal Drill Bit Diameter in.	Embedment Depth in. (mm)	Shear Load Based on Bond Strength/Concrete Capacity		Allowable Shear Load Based on Steel Strength[4]		
			$f'_c \geq 2{,}000$ psi (13.8 MPa)		ASTM F1554 Grade 36 lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
			Ultimate lbs. (kN)	Allowable lbs. (kN)			
3/8	7/16	3 3/8 (86)	7,189 (32.0)	1,797 (8.0)	1,089 (4.8)	2,347 (10.4)	1,878 (8.4)
1/2	9/16	4 1/2 (114)	12,863 (57.2)	3,216 (14.3)	1,936 (8.6)	4,172 (18.6)	3,338 (14.8)
5/8	3/4	5 5/8 (143)	22,855 (101.7)	5,714 (25.4)	3,025 (13.5)	6,519 (29.0)	5,216 (23.2)
3/4	7/8	6 3/4 (171)	32,304 (143.7)	8,076 (35.9)	4,356 (19.4)	9,388 (41.8)	6,384 (28.4)
7/8	1	7 7/8 (200)	36,214 (161.1)	9,054 (40.3)	5,929 (26.4)	12,778 (56.8)	8,689 (38.7)
1	1 1/8	9 (229)	52,151 (232.0)	13,038 (58.0)	7,744 (34.4)	16,690 (74.2)	11,349 (50.5)
1 1/4	1 3/8	11 1/4 (286)	69,011 (307.0)	17,253 (76.7)	12,100 (53.8)	26,078 (116.0)	17,733 (78.9)

1. Allowable bond strength/concrete capacity was calculated using a safety factor of 4.0.
2. Load adjustment factors for edge distance, spacing distance and in-service temperature should be applied if applicable.
3. The lower value of either the adjusted allowable bond strength/concrete capacity or steel strength should be used as the allowable shear value for design.
4. Allowable steel strengths calculated in accordance with AISC Manual of Steel Construction: Shear = $0.17*F_u*A_{nom}$.

TABLE 9: ULTRABOND 1 ultimate and allowable **TENSION & SHEAR** loads for **REBAR** in normal-weight concrete[1,2,3]

Rebar Size	Nominal Drill Bit Diameter in.	E9:edment Depth in. (mm)	Tension Load Based on Bond Strength/Concrete Capacity		Shear Load Based on Bond Strength/Concrete Capacity		Allowable Load Based on Steel Strength[4]			
			$f'_c \geq 2{,}000$ psi (13.8 MPa)		$f'_c \geq 2{,}000$ psi (13.8 MPa)		Tension		Shear	
			Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	ASTM A615 Grade 60 lbs. (kN)	ASTM A615 Grade 75 lbs. (kN)	ASTM A615 Grade 60 lbs. (kN)	ASTM A615 Grade 75 lbs. (kN)
#4	5/8	4 1/2 (114)	17,076 (76.0)	4,269 (19.0)	11,240 (50.0)	2,810 (12.5)	4,800 (21.4)	6,000 (26.7)	3,060 (13.6)	3,400 (15.1)
#5	3/4	5 5/8 (143)	23,865 (106.2)	5,966 (26.5)	21,024 (93.5)	5,256 (23.4)	7,440 (33.1)	9,300 (41.4)	4,743 (21.1)	5,270 (23.4)
#6	7/8	6 3/4 (171)	31,371 (139.5)	7,843 (34.9)	32,288 (143.6)	8,072 (35.9)	10,560 (47.0)	13,200 (58.7)	6,732 (29.9)	7,480 (33.3)
#7[5]	1	7 7/8 (200)	39,835 (177.2)	9,959 (44.3)	35,434 (157.6)	8,859 (39.4)	14,400 (64.1)	18,000 (80.1)	9,180 (40.8)	10,200 (45.4)
#8	1 1/8	9 (229)	48,299 (214.8)	12,075 (53.7)	38,580 (171.6)	9,645 (42.9)	18,960 (84.3)	23,700 (105.4)	12,087 (53.8)	13,430 (59.7)

1. Allowable bond strength/concrete capacity was calculated using a safety factor of 4.0.
2. Load adjustment factors for edge distance, spacing distance and in-service temperature should be applied if applicable.
3. The lower value of either the adjusted allowable bond strength/concrete capacity or steel strength should be used as the allowable tension or shear value for design.
4. Allowable steel strengths calculated in accordance with AISC Manual of Steel Construction: Tensile = $(F_y*A_{nom})/2.5$, Shear = $0.17*F_u*A_{nom}$.
5. Values for bond strength of #7 rebar were linearly interpolated from #6 & #8 data.

TABLE 10: ULTRABOND 1 reduction factors for **EDGE DISTANCE** in **TENSION**[1,2]

Diameter	in.	3/8	1/2	5/8	3/4	7/8	1	1 1/4
Embedment Depth	in. (mm)	3 3/8 (86)	4 1/2 (114)	5 5/8 (143)	6 3/4 (171)	7 7/8 (200)	9 (229)	11 1/4 (286)
Critical Edge Distance	in. (mm)	5 1/4 (133)	6 3/4 (171)	8 1/2 (216)	10 1/4 (260)	11 3/4 (298)	13 1/2 (343)	17 (432)
Min. Edge Distance	in. (mm)	1 3/4 (44)	2 1/4 (57)	2 3/4 (70)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 3/4 (146)
Edge Distance		Allowable Load Capacity Reduction Factor						
in.	(mm)							
1 3/4	(44.5)	0.63						
2 1/4	(57.2)	0.68	0.64					
2 3/4	(69.9)	0.73	0.68	0.66				
3	(76.2)	0.76	0.70	0.67				
3 1/2	(88.9)	0.81	0.74	0.70	0.67			
4	(101.6)	0.87	0.78	0.73	0.70	0.71		
4 1/2	(114.3)	0.92	0.82	0.76	0.72	0.73	0.74	
5	(127.0)	0.97	0.86	0.79	0.75	0.75	0.75	
5 1/4	(133.4)	1.00	0.88	0.81	0.76	0.75	0.76	
5 3/4	(146.1)		0.92	0.84	0.78	0.77	0.78	0.77
6 1/4	(158.8)		0.96	0.87	0.81	0.79	0.79	0.78
6 3/4	(171.5)		1.00	0.90	0.83	0.81	0.81	0.79
7 1/2	(190.5)			0.94	0.87	0.84	0.83	0.81
8 1/2	(215.9)			1.00	0.92	0.88	0.86	0.83
9 1/2	(241.3)				0.96	0.92	0.88	0.85
10 1/4	(260.4)				1.00	0.94	0.91	0.86
11	(279.4)					0.97	0.93	0.88
11 3/4	(298.5)					1.00	0.95	0.89
12 1/2	(317.5)						0.97	0.91
13 1/2	(342.9)						1.00	0.93
15	(381.0)							0.96
16	(406.4)							0.98
17	(431.8)							1.00

1. Minimum slab thickness equals 1.5 x embedment depth.
2. Linear interpolation may be used for intermediate edge distances.

TABLE 11: ULTRABOND 1 reduction factors for **EDGE DISTANCE** in **SHEAR**[1,2]

Diameter	in.	3/8	1/2	5/8	3/4	7/8	1	1 1/4
Embedment Depth	in. (mm)	3 3/8 (86)	4 1/2 (114)	5 5/8 (143)	6 3/4 (171)	7 7/8 (200)	9 (229)	11 1/4 (286)
Critical Edge Distance	in. (mm)	5 1/4 (133)	6 3/4 (171)	8 1/2 (216)	10 1/4 (260)	11 3/4 (298)	13 1/2 (343)	17 (432)
Min. Edge Distance	in. (mm)	1 3/4 (44)	2 1/4 (57)	2 3/4 (70)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 3/4 (146)
Edge Distance		Allowable Load Capacity Reduction Factor						
in.	(mm)							
1 3/4	(44.5)	0.31						
2 1/4	(57.2)	0.41	0.29					
2 3/4	(69.9)	0.51	0.37	0.28				
3	(76.2)	0.56	0.41	0.31				
3 1/2	(88.9)	0.66	0.49	0.37	0.26			
4	(101.6)	0.75	0.57	0.44	0.32	0.26		
4 1/2	(114.3)	0.85	0.65	0.50	0.37	0.31	0.26	
5	(127.0)	0.95	0.73	0.56	0.43	0.35	0.30	
5 1/4	(133.4)	1.00	0.76	0.59	0.45	0.38	0.32	
5 3/4	(146.1)		0.84	0.65	0.51	0.43	0.36	0.25
6 1/4	(158.8)		0.92	0.72	0.56	0.47	0.40	0.29
6 3/4	(171.5)		1.00	0.78	0.62	0.52	0.44	0.32
7 1/2	(190.5)			0.87	0.70	0.59	0.50	0.37
8 1/2	(215.9)			1.00	0.81	0.69	0.59	0.44
9 1/2	(241.3)				0.92	0.78	0.67	0.50
10 1/4	(260.4)				1.00	0.86	0.73	0.55
11	(279.4)					0.93	0.79	0.60
11 3/4	(298.5)					1.00	0.86	0.65
12 1/2	(317.5)						0.92	0.70
13 1/2	(342.9)						1.00	0.77
15	(381.0)							0.87
16	(406.4)							0.93
17	(431.8)							1.00

1. Minimum slab thickness equals 1.5 x embedment depth.
2. Linear interpolation may be used for intermediate edge distances.

TABLE 12: ULTRABOND 1 reduction factors for **SPACING DISTANCE** in **TENSION**[1,2]

Diameter	**in.**	**3/8**	**1/2**	**5/8**	**3/4**	**7/8**	**1**	**1 1/4**
Embedment Depth	**in.**	**3 3/8**	**4 1/2**	**5 5/8**	**6 3/4**	**7 7/8**	**9**	**11 1/4**
	(mm)	(86)	(114)	(143)	(171)	(200)	(229)	(286)
Critical Spacing Distance	**in.**	**6**	**7 7/8**	**9 7/8**	**11 7/8**	**13 7/8**	**15 3/4**	**19 3/4**
	(mm)	(152)	(200)	(251)	(302)	(352)	(400)	(502)
Min. Spacing Distance	**in.**	**1 3/4**	**2 1/4**	**2 3/4**	**3 3/8**	**4**	**4 1/2**	**5 5/8**
	(mm)	(44)	(57)	(70)	(86)	(102)	(114)	(143)
Spacing Distance		**Allowable Load Capacity Reduction Factor**						
in.	**(mm)**							
1 3/4	(44.5)	0.69						
2 1/4	(57.2)	0.73	0.69					
2 3/4	(69.9)	0.76	0.72	0.69				
3	(76.2)	0.78	0.73	0.70				
3 3/8	(85.7)	0.81	0.75	0.72	0.69			
4	(101.6)	0.85	0.79	0.74	0.71	0.69		
4 1/2	(114.3)	0.89	0.81	0.77	0.73	0.71	0.69	
5 5/8	(142.9)	0.97	0.88	0.82	0.77	0.74	0.72	0.69
6	(152.4)	1.00	0.90	0.83	0.79	0.75	0.73	0.70
6 1/2	(165.1)		0.92	0.85	0.80	0.77	0.75	0.71
7 1/4	(184.2)		0.97	0.89	0.83	0.79	0.77	0.73
7 7/8	(200.0)		1.00	0.91	0.85	0.81	0.78	0.74
8 1/2	(215.9)			0.94	0.88	0.83	0.80	0.75
9 7/8	(250.8)			1.00	0.93	0.87	0.84	0.78
10 1/2	(266.7)				0.95	0.89	0.86	0.80
11 7/8	(301.6)				1.00	0.94	0.89	0.83
12 1/2	(317.5)					0.96	0.91	0.84
13 7/8	(352.4)					1.00	0.95	0.87
14 1/2	(368.3)						0.97	0.88
15 3/4	(400.1)						1.00	0.91
17	(431.8)							0.94
18 1/2	(469.9)							0.97
19 3/4	(501.7)							1.00

1. Minimum slab thickness equals 1.5 x embedment depth.
2. Linear interpolation may be used for intermediate spacing distances.