ULTRABOND® ASF-2000

Fast Cure Doweling Adhesive

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Product Description

ULTRABOND® ASF-2000 is a domestically manufactured, two-component styrene-free, acrylic adhesive used for anchoring and doweling applications in uncracked concrete with threaded rod and rebar. It is suitable for use in temperatures between 5 °F and 110 °F (-15 °C to 43 °C).

General Uses & Applications

- Adhering dowel bars and tie bars for full depth concrete repairs
- Short-term tensile anchoring and shear loading conditions in accordance with allowable stress design (ASD)
- For use in wet or damp environments
- Bonding agent for fresh concrete to hardened concrete and hardened to hardened concrete

Advantages & Features

- Ultra-fast 30 minute full cure time at 75 °F (24 °C) in dry concrete
- Cures down to 5 °F (-15 °C) - see Table 5
- Wide service temperature range between -40 °F to 176 °F (-40 °C to 80 °C)
- Fast mortar repair for precast panels and other concrete surfaces
- High bond strength with fast cure times
- Easily dispensable even at low temperatures
- Made in the USA
- Styrene-free
- Non-sag
- Low odor

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

Color & Ratio: Part A (Resin) Gray: Part B (Hardener) White, Mixed Ratio: 10:1 by volume, Mixed Color - Gray

Storage & Shelf Life: 18 months when stored in unopened containers in dry conditions between 41 °F (5° C) and 75 °F (24 °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 and use the most current instructions. In order to achieve maximum results, proper installation is imperative. An estimating guide for product usage may be found on the product's estimation guide.

Clean-Up: Always wear appropriate personal protective equipment such as safety glasses and gloves. Clean uncured materials from tools and equipment using a mild solvent, such as CRACKBOND® INDUSTRIAL CITRUS CLEANER from Adhesives Technology Corp. Cured material may only be removed mechanically using a sander or grinder. Collect with absorbent material. Flush area with water. Dispose of in accordance with local, state and federal disposal regulations.

Limitations & Warnings:

- Do not thin with solvents, as this may affect cure
- For anchoring applications, concrete should be a minimum of 21 days old prior to anchor installation per ACI 355.4
- Not recommended for any application where there may be a sustained tensile load, including overhead applications
- Always consult with the Engineer of Record, or a design professional, prior to use to ensure product applicability

Safety: Please refer to the Safety Data Sheet (SDS) for ULTRABOND ASF-2000. Call ATC for more information at 1-800-892-1880.

Specification: Adhesive shall be a two component, 10:1 ratio by volume, non-sag system supplied in pre-measured cartridges. Adhesive must meet the requirements of AASHTO M235 / ASTM C881 Type I, II, IV & V Grade 3 Class A, B & C. Adhesive shall have a minimum compressive yield strength of 10,760 psi (74.2 MPa) and a minimum compressive modulus of 512,000 psi (3,530 MPa) at 73 °F (23 °C) after a 7 day cure per ASTM D695. Shelf life shall be a minimum of 18 months. Adhesive shall be ULTRABOND ASF-2000 from Adhesives Technology Corp., Pompano Beach, Florida.

STANDARDS & APPROVALS

AASHTO M235 / ASTM C881-20
Type I, II, IV & V Grade 3 Class A, B & C

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

Revision 3.0

Fast Cure Doweling Adhesive

Ordering Information

TABLE 1: ULTRABOND ASF-2000 Adhesive Packaging, Dispensing Tools and Accessories[1]

Package Size	28 fl. oz. (828 ml) Cartridge
Part #	A28-ASF2000
Recommended Mixing Nozzle	T12
Manual Dispensing Tool	TM28HD
Battery Dispensing Tool	TB28HD-A
Pneumatic Dispensing Tool	TA28HD-A
Case Qty.	8
Pallet Qty.	384
SDS Brush Adaptor	BR-SDS
Brush Extension	BR-EXT
Nozzle Extension Tubing	TUBE916-EXT

1. Each cartridge is packaged with one mixing nozzle.

A28-ASF2000

TM28HD

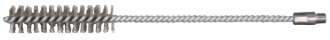

TB28HD-A


TA28HD-A


Small Wire Brush


Manual Brush Handle (included with Wire Brush)


Nozzle Extension Tubing TUBE916-EXT


Large Wire Brush


SDS Drill Brush Attachmet BR-SDS

Brush Extension BR-EXT


10 in. (254 mm) Small Nozzle T12

Ordering Information

In order to reduce the risk of respirable crystalline silica, ULTRABOND ASF-2000 has been tested and approved for use in conjunction with Milwaukee Tool's OSHA compliant, commercially available dust extraction products in dry concrete (see Table 2 for details). When used in accordance with the manufacturer's instructions, and in conjunction with ULTRABOND ASF-2000, 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 (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/resources.

Milwaukee Tool Dust Extraction System

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 ASF-2000 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	#3	7/16	7 (10)	B716	6
1/2	#4	9/16	25 (34)	B916	
5/8	#5	3/4	50 (68)	B34	
3/4	#6	7/8	85 (115)	B78	
7/8	#7	1	115 (156)	B100	9
1	#8	1 1/8	145 (197)	B118	

Material Specifications

TABLE 4: ULTRABOND ASF-2000 performance to **ASTM C881-20**[1,2,3]

Property	Cure Time	ASTM Standard	Units	Sample Conditioning Temperature			
				Class A	Class B	Optional	Class C
				5 °F (-15) °C	50 °F (10) °C	73 °F (23) °C	110 °F (43) °C
Gel Time - 60 Gram Mass[4]	----	C881	min	20	11	6	3
Consistency or Viscosity	----	C881	----	----	Non-sag		
Compressive Yield Strength	7 day	D695	psi (MPa)	12,790 (88.2)	10,940 (75.4)	10,760 (74.2)	10,970 (75.6)
Compressive Modulus			psi (MPa)	608,300 (4,194)	608,300 (4,194)	512,000 (3,530)	617,900 (4,260)
Bond Strength Hardened to Hardened Concrete	2 day	C882	psi (MPa)	2,750 (19.0)	3,060 (21.1)	2,580 (17.8)	2,790 (19.2)
	14 day		psi (MPa)	3,050 (21.0)	3,810 (26.3)	2,630 (18.1)	3,280 (22.6)
Bond Strength Fresh Concrete to Hardened Concrete			psi (MPa)	1,900 (13.1)			
Tensile Strength[5]	7 day	D638	psi (MPa)	2,190 (15.1)			
Tensile Elongation[5]			%	0.5			
Heat Deflection Temperature	7 day	D648	°F (°C)	143 (61.8)			
Water Absorption	24 hr	D570	%	0.25			
Linear Coefficient of Shrinkage	48 hr	D2566	%	0.004			

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 time 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. Optional testing for ASTM C881 Grade 3.

TABLE 5: ULTRABOND ASF-2000 **CURE SCHEDULE**[1,2,3,4,5]

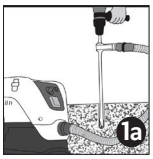
Temperature Range °F (°C)	Working Time	Full Cure Time
5 (-15)	40 min	24 hr
20 (-7)	30 min	3 hr
40 (4)	15 min	1.5 hr
75 (24)	6 min	30 min
110 (43)	3 min	15 min

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 temperature should be from 5 - 110 °F (-15 - 43 °C).
3. When ambient or base material temperature falls below 60 °F (15 °C), condition the adhesive to 75 °F (24 °C) prior to use.
4. For installations above 95°F (35 °C), condition the adhesive to 75 °F (24 °C) prior to use.
5. Cure time doubles in damp conditions.

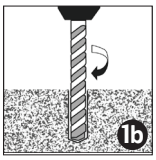
Fast Cure Doweling Adhesive

Installation Instructions

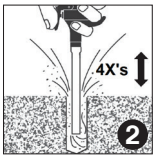
Drilling and Cleaning



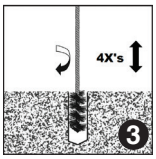
Recommended Dust Extractor System for drilling into dry concrete - Attach appropriate size drill bit to the Dust Extractor Vacuum System - see Table 2. The drill bit should conform to ANSI B212.15 and be the appropriate size for the anchor diameter to be installed. Drill the hole to the specified embedment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



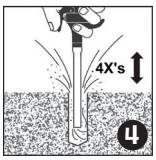
Traditional Drilling Method for dry and damp concrete - Using a rotary hammer drill, and a bit which conforms to ANSI B212.15 and is the appropriate size for the anchor diameter to be installed, drill the hole to the specified embedment depth. **CAUTION**: Always wear appropriate personal protection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



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 each cycle (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.

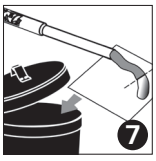


Blow the hole out once more to remove brush debris using oil free compressed air with a minimum pressure of 80 psi (5.5 bar). Insert the air wand to the bottom of the drilled hole and blow out the debris with an up/down motion for a minimum of 4 seconds/cycles (4X). Visually inspect the hole to confirm 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 to the cartridge, it is necessary to balance the cartridge by dispensing a small amount of material until both components are flowing evenly. For a cleaner environment, hand mix the two waste components and let cure prior to disposal in accordance with local regulations.

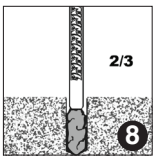
After the cartridge has been prepared, screw on the proper ATC mixing nozzle to the cartridge - see Table 1. Do not modify mixing nozzle. Confirm that internal mixing element is in place prior to dispensing the adhesive. Take note of the air and base material temperatures and review the working/full cure time chart prior to starting the injection process - see Table 5.



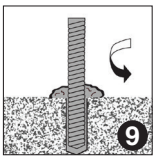
Dispense and waste enough material to ensure uniform gray color before injecting into hole. **NOTE**: The adhesive **must** be properly mixed in order to perform as published. **CAUTION:** When changing cartridges, never re-use nozzles. A new nozzle should be used with each new cartridge and steps 5 - 7 should be repeated accordingly. **NOTE:** Due to the fast cure time of ULTRABOND ASF-2000, if a delay in work occurs and the cartridge has not been fully dispensed, remove the old mixing nozzle and any partially cured or hardened material that may have formed in the neck of the cartridge prior to installing a new nozzle, then repeat steps 6 & 7.

Installation Instructions

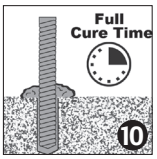
Installation and Curing (Vertical Down and Horizontal)



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. Use extension tubing - see Table 1, as necessary to ensure that adhesive is injected at the bottom of the hole first. **NOTE**: When using a pneumatic dispensing tool, ensure that pressure is set at 90 psi (6.2 bar) maximum.



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.



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 and moisture dependent - refer to Table 5 for appropriate full cure time.

Technical Data

ASD Allowable Stress Design

TABLE 6: ULTRABOND ASF-2000 ultimate and allowable **TENSION & SHEAR** loads for **THREADED ROD** in normal-weight concrete[1,2]

Threaded Rod Diameter in.	Nominal Drill Bit Diameter in.	Embedment Depth in. (mm)	Tension Load Based on Bond Strength/ Concrete Capacity		Allowable Loads Based on Steel Strength[3]					
			f'^{c} ≥ 4,000 psi (27.5 MPa)		Tension			Shear		
			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)	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)	7,127 (31.7)	1,782 (7.9)	2,114 (9.4)	4,556 (20.3)	3,645 (16.2)	1,089 (4.8)	2,347 (10.4)	1,878 (8.4)
1/2	9/16	4 1/2 (114)	13,273 (59.0)	3,318 (14.8)	3,758 (16.7)	8,099 (36.0)	6,480 (28.8)	1,936 (8.6)	4,172 (18.6)	3,338 (14.8)
5/8	3/4	5 5/8 (143)	16,800 (74.7)	4,200 (18.7)	5,872 (26.1)	12,655 (56.3)	10,124 (45.0)	3,025 (13.5)	6,519 (29.0)	5,216 (23.2)
3/4	7/8	6 3/4 (171)	22,231 (98.9)	5,558 (24.7)	8,456 (37.6)	18,224 (81.1)	12,392 (55.1)	4,356 (19.4)	9,388 (41.8)	6,384 (28.4)
7/8[4]	1	7 7/8 (200)	32,174 (143.1)	8,043 (35.8)	11,509 (51.2)	24,804 (110.3)	16,867 (75.0)	5,929 (26.4)	12,778 (56.8)	8,689 (38.7)
1	1 1/8	9 (229)	41,474 (184.5)	10,369 (46.1)	15,033 (66.9)	32,398 (144.1)	22,030 (98.0)	7,744 (34.4)	16,690 (74.2)	11,349 (50.5)

1. Allowable bond strength/concrete capacity was calculated using a safety factor of 4.0.
2. The lower value of either the allowable bond strength/concrete capacity or steel strength should be used as the allowable tension value for design.
3. Allowable steel strengths calculated in accordance with AISC Manual of Steel Construction: Tensile = $0.33*F_u*A_{nom}$., Shear = $0.17*F_u*A_{nom}$
4. Values for bond strength of 7/8 in. rebar were linearly interpolated from 3/4 in. & 1 in. data.

TABLE 7: ULTRABOND ASF-2000 ultimate and allowable **TENSION & SHEAR** loads for **REBAR** in normal-weight concrete[1,2]

Rebar Size	Nominal Drill Bit Diameter in.	Embedment Depth in. (mm)	Tension Load Based on Bond Strength/ Concrete Capacity		Allowable Loads Based on Steel Strength[3]			
			f'_c ≥ 4,000 psi (27.5 MPa)		Tension		Shear	
			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)
#3	7/16	3 3/8 (86)	9,723 (43.3)	2,431 (10.8)	2640 (11.7)	3300 (14.7)	1683 (7.5)	1870 (8.3)
#4	9/16	4 1/2 (114)	14,830 (66.0)	3,708 (16.5)	4,800 (21.4)	6,000 (26.7)	3,060 (13.6)	3,400 (15.1)
#5	3/4	5 5/8 (143)	19,838 (88.2)	4,960 (22.1)	7,440 (33.1)	9,300 (41.4)	4,743 (21.1)	5,270 (23.4)
#6	7/8	6 3/4 (171)	28,762 (127.9)	7,191 (32.0)	10,560 (47.0)	13,200 (58.7)	6,732 (29.9)	7,480 (33.3)
#7[4]	1	7 7/8 (200)	33,598 (149.5)	8,400 (37.4)	14,400 (64.1)	18,000 (80.1)	9,180 (40.8)	10,200 (45.4)
#8	1 1/8	9 (229)	39,623 (176.3)	9,906 (44.1)	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. 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.
3. Allowable steel strengths calculated in accordance with AISC Manual of Steel Construction: Tensile = $(F_y*A_{nom})/2.5$, Shear = $0.17*F_u*A_{nom}$
4. Values for bond strength of #7 rebar were linearly interpolated from #6 & #8 data.

Revision 3.0

Technical Data

ASD Allowable Stress Design

TABLE 8: ULTRABOND ASF-2000 reduction factors for **EDGE DISTANCE** in **TENSION**[1,2]

Diameter	in.	3/8	1/2	5/8	3/4	7/8	1
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)
Critical Edge Distance	in. (mm)	4 1/2 (114)	5 7/8 (149)	7 3/8 (187)	8 7/8 (225)	10 1/4 (260)	11 3/4 (298)
Min. Edge Distance	in. (mm)	2 1/4 (57)	2 7/8 (73)	3 5/8 (92)	4 1/4 (108)	5 (127)	5 7/8 (149)
Edge Distance		Allowable Load Capacity Reduction Factor					
in.	(mm)						
2 1/4	(57.2)	0.63					
2 7/8	(73.0)	0.73	0.63				
3 5/8	(92.1)	0.86	0.72	0.63			
4	(101.6)	0.92	0.77	0.67			
4 1/4	(108.0)	0.96	0.80	0.69	0.63		
4 1/2	(114.3)	1.00	0.83	0.72	0.65		
5	(127.0)		0.89	0.77	0.69	0.63	
5 7/8	(149.2)		1.00	0.85	0.76	0.69	0.63
6 1/2	(165.1)			0.91	0.81	0.74	0.67
7 3/8	(187.3)			1.00	0.88	0.80	0.72
7 3/4	(196.9)				0.91	0.82	0.75
8 1/4	(209.6)				0.95	0.86	0.78
8 7/8	(225.4)				1.00	0.90	0.82
9 1/4	(235.0)					0.93	0.84
9 3/4	(247.7)					0.96	0.87
10 1/4	(260.4)					1.00	0.91
10 3/4	(273.1)						0.94
11 1/4	(285.8)						0.97
11 3/4	(298.5)						1.00

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

TABLE 9: ULTRABOND ASF-2000 reduction factors for **EDGE DISTANCE** in **SHEAR**[1,2]

Diameter	in.	3/8	1/2	5/8	3/4	7/8	1
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)
Critical Edge Distance	in. (mm)	3 3/4 (95)	5 (127)	6 1/4 (159)	7 1/2 (191)	8 3/4 (222)	10 (254)
Min. Edge Distance	in. (mm)	2 (51)	2 1/2 (64)	3 1/4 (83)	3 3/4 (95)	4 3/8 (111)	5 (127)
Edge Distance		Allowable Load Capacity Reduction Factor					
in.	(mm)						
2	(50.8)	0.25					
2 1/2	(63.5)	0.46	0.25				
2 3/4	(69.9)	0.57	0.33				
3 1/4	(82.6)	0.79	0.48	0.25			
3 1/2	(88.9)	0.89	0.55	0.31			
3 3/4	(95.3)	1.00	0.63	0.38	0.25		
4	(101.6)		0.70	0.44	0.30		
4 3/8	(111.1)		0.81	0.53	0.38	0.25	
4 3/4	(120.7)		0.93	0.63	0.45	0.31	
5	(127.0)		1.00	0.69	0.50	0.36	0.25
5 1/2	(139.7)			0.81	0.60	0.44	0.33
6	(152.4)			0.94	0.70	0.53	0.40
6 1/4	(158.8)			1.00	0.75	0.57	0.44
7	(177.8)				0.90	0.70	0.55
7 1/2	(190.5)				1.00	0.79	0.63
8	(203.2)					0.87	0.70
8 3/4	(222.3)					1.00	0.81
9 1/4	(235.0)						0.89
10	(254.0)						1.00

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

Technical Data

ASD Allowable Stress Design

TABLE 10: ULTRABOND ASF-2000 reduction factors for **SPACING** in **TENSION**[1,2]

Diameter	in.	3/8	1/2	5/8	3/4	7/8	1
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)
Critical Spacing Distance	in. (mm)	8 7/8 (225)	11 3/4 (298)	14 5/8 (371)	17 5/8 (448)	20 1/2 (521)	23 1/2 (597)
Min. Spacing Distance	in. (mm)	2 1/4 (57)	3 (76)	3 5/8 (92)	4 3/8 (111)	5 1/8 (130)	5 3/4 (146)
Spacing Distance		Allowable Load Capacity Reduction Factor					
in.	(mm)						
2 1/4	(57.2)	0.63					
3	(76.2)	0.67	0.63				
3 1/4	(82.6)	0.69	0.64				
3 5/8	(92.1)	0.71	0.66	0.63			
4	(101.6)	0.73	0.67	0.64			
4 3/8	(111.1)	0.75	0.69	0.66	0.63		
5 1/8	(130.2)	0.79	0.72	0.68	0.65	0.63	
5 3/4	(146.1)	0.83	0.75	0.70	0.67	0.65	0.63
6 3/4	(171.5)	0.88	0.79	0.74	0.70	0.67	0.65
7 3/4	(196.9)	0.94	0.83	0.77	0.72	0.69	0.67
8 7/8	(225.4)	1.00	0.88	0.81	0.76	0.72	0.70
10 1/4	(260.4)		0.94	0.85	0.79	0.75	0.72
11 3/4	(298.5)		1.00	0.90	0.84	0.79	0.76
13	(330.2)			0.95	0.87	0.82	0.78
14 5/8	(371.5)			1.00	0.92	0.86	0.82
16 1/4	(412.8)				0.96	0.90	0.85
17 5/8	(447.7)				1.00	0.93	0.88
19	(482.6)					0.96	0.91
20 1/2	(520.7)					1.00	0.94
22	(558.8)						0.97
23 1/2	(596.9)						1.00

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