



EVALUATION REPORT

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Report No. 401
December, 1988

Filing Category: FASTENERS—Concrete and Masonry Anchors

HILTI HVA ADHESIVE CONCRETE ANCHORS
HILTI, INC.
 5400 SOUTH 122 EAST AVENUE
 TULSA, OKLAHOMA 74145

I. Subject: Hilti HVA Adhesive Concrete Anchors.

II. Description: The Hilti HVA concrete anchors are stud-type adhesive anchors for use in regular-weight concrete having a minimum compressive strength of 2000 psi or structural lightweight concrete having a minimum compressive strength of 3000 psi. The system includes a threaded rod or steel reinforcement dowels and a sealed glass tube. The threaded rod consists of zinc-plated SAE 1018 steel, a nut and washer. The threaded rod is identified as "HAS." The rod is available in 3/8-, 1/2-, 5/8-, 3/4-, 7/8- and 1-inch threaded sizes. The steel dowels consist of No. 3, No. 4, No. 5, No. 6, No. 7 and No. 8, Grade 40 or Grade 60 reinforcement bars. Inside the tube of resin there is a smaller tube containing quartz sand which has been coated with a hardening agent. The tube of resin identified as "HBP" contains an unsaturated polyester resin. The tube of resin identified as "HEA" contains a vinyl ester resin.

Installation: The anchor is installed into a predrilled hole in concrete that has been cleaned, using either a brush and a stream of water, or a brush and compressed air. The hole diameter is slightly larger than the tube of resin. The depth of the hole should be sufficient to allow the tube of resin to be inserted flush with the surface of the concrete. The HAS or dowel is then inserted into an adapter which is attached to a rotary hammer by means of a connecting shaft. The beveled end is placed on top of the tube of resin and the combination of the rotation and the hammering action pulverizes and mixes the contents of the tube of resin. After the stud is driven to the bottom of the hole, the drill should be immediately stopped.

See Figure No. 2 for additional installation details.

The chuck may be released and the rotary hammer disengaged. Care should be taken to ensure that the anchor bond is not disturbed for an initial cure period of ten minutes. The resin must be allowed to cure, before applying a load, at the temperature and for the time periods noted in Tables Nos. I-A and I-B. The resin and the quartz sand combine to form an adhesive mixture which bonds the rod to the wall of the hole. The HAS rod must be embedded up to the minimum embedment ring, which is marked on the rod.

Dimensions and installation criteria are noted in Table No. II.

Finding No. 7 indicates that adhesive anchors cannot be used to resist pullout forces in overhead and wall installations. This restriction is necessary solely because the adhesive used with anchors is temperature sensitive.

During a fire, failure could occur at approximately 170°F. Anchors can be satisfactorily installed in walls and ceilings, provided proper consideration is given to fire conditions. The remaining installation details are unchanged. Allowable tension and shear values are tabulated in Tables Nos. I through VIII. Allowable load values are influenced by the environment in which the anchor is used. The allowable values given in Tables Nos. I through VIII must be adjusted in accordance with Figures Nos. 1 and 3 with the anchors are installed in locations where the concrete temperature may exceed 68°F.

Identification: The anchors are identified in the field by labels on the packaging indicating the manufacturer's name, product name and the anchor size. The HBP and HEA capsules are marked individually as to size and the threaded rod has an "H" stamped on top.

III. Evidence Submitted: Descriptive data, results of tension and shear tests and results of dynamic tests.

Findings

IV. Findings: That the HVA Adhesive Concrete Anchors described in this report comply with the 1985 Uniform Building Code, subject to the following conditions:

1. Allowable shear and tension load do not exceed the values set forth in Tables Nos. III through VIII.
2. The anchor sizes, minimum embedment depths, minimum spacing, edge and end distances conform to Table No. II.
3. Allowable loads for anchors subjected to combined shear and tension forces are determined by the ratio of the actual shear to the allowable shear plus the ratio of the actual tension to the allowable tension not exceeding 1.00.
4. Calculations and details showing that the anchors comply with this report and that the concrete slab or footing is capable of resisting the applied loads must be submitted to the local building official for approval.
5. Special inspection in accordance with Section 306 (a) 12 of the code must be provided for all anchor installations.
6. The anchors cannot be used to support fire-resistive construction.
7. The anchors cannot be used to resist pullout forces in overhead and wall installations, unless proper consideration is given to fire conditions.

This report is subject to re-examination in one year.

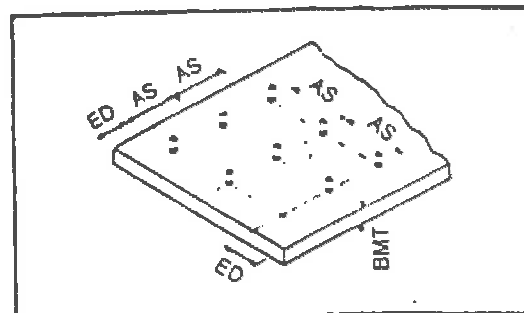
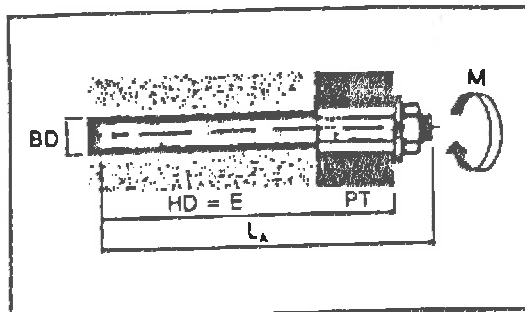
TABLE NO. I-A
HBP TUBE

RECOMMENDED HARDENING TIME FOR THE RESIN (DEPENDENT ON AMBIENT TEMPERATURE)	
Above 68°F.	10 min.
50°F. to 68°F.	20 min.
32°F. to 50°F.	1 hr.
Below 32°F.	5 hr.

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TABLE NO. II
HVA SPECIFICATIONS AND INSTALLATION DETAILS



Details		Anchor size	HVA 3/8"	HVA 1/2"	HVA 3/4"	HVA 1"	HVA 1 1/4"	HVA 1 1/2"		
BD	bit diameter (inches)		11/32	9/16	11/16	7/8	1	1 1/8		
HD = E	min. depth of embedment = capsule length		3 1/2	4 1/4	5	6 3/8	6 3/8	8 1/4		
PT	max. thickness fastened (inches)		1	1 1/2	1 3/4	2	2 1/4	2 3/4		
LA	anchor length (inches)		5 1/8	6 1/2	7 3/8	9 3/8	10	12		
Tensile Stress Area (in ²)			0.078	0.142	0.226	0.334	0.462	0.606		
M	max. tightening torque (ft. lbs.)	HAS S.S.	18	30	75	150	175	235		
		HAS Std.	18	35	80	160	200	330		
		HAS-Super								
Drill bit size			TE-C-15/32-12	TE-D-9/16-12	TE-D-11/16-12	TE-F-7/8-13	FE-F-1-13	TE-F-1 1/8-17		
*BMT	minimum base material thickness (inches)		5 1/2	6 1/4	7 1/8	8 1/2	8 1/2	10 1/2		
DISTANCE BETWEEN ANCHORS A AND DISTANCE FROM EDGE R (inches) ²										
		LOAD DIRECTED TOWARD EDGE			LOAD NOT DIRECTED TOWARD EDGE					
Anchor Type		AS, ED, 1	AS min.	AS	ED	ED min.	ED	ED	ED min.	ED
HVA		1E	0.5 E	0.7	1.5 E	0.5 E	0.5	1.5 E	0.5 E	0.6

*Base material: Concrete with a minimum nominal compressive strength as noted in this report.

AS = spacing to obtain max. load

AS_{min} = shortest distance between anchors when both anchors influence the failure load in tension or shear.

ED = distance from edge to obtain max. load

ED_{min} = shortest distance from edge when there is an influence on the failure in tension or shear

fAS = load factor of safe working load (or failure load) when using ED_{min} and AS_{min}

fED = load factor when using ED_{min} and AS_{min}

E = recommended min. depth of embedment.

¹The nominal hole diameter is equivalent to the normal Hilti carbide tip drill bit diameter.

²Example: HVA 3/8 anchors spaced 3 inches apart (loaded in tension) required spacing for full design load (stone aggregate concrete).

AS = 1.0E = 1.0 × 5 inches = 5 inches
 minimum required spacing and corresponding load factor
 AS_{min} = 0.5E = .5 × 5 inches = 2.5 inches
 which corresponds to a load factor fAS = .7 × 3900 = 2730 lbs.
 Interpolating 5 inches—3900 lbs.
 2.5 inches—2730 lbs. } 3 inches—2965 lbs.

The application of load factors is cumulative

Example: Load factor for Anchor No. 1:
 f = fED₁ × fED₂ × fAS₁ × fAS₂ × fAS₃

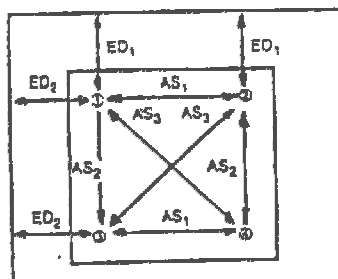
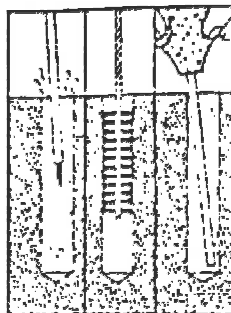
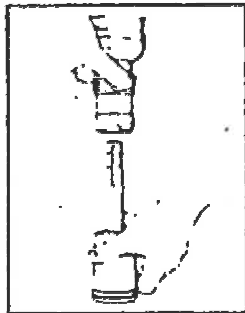


FIGURE NO. 2—INSTALLATION DETAILS FOR THE REINFORCEMENT DOWELS

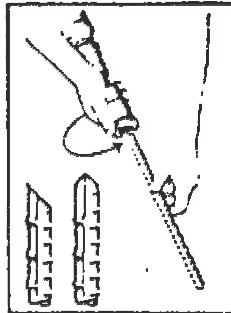


1 Drill the hole to the required hole depth.

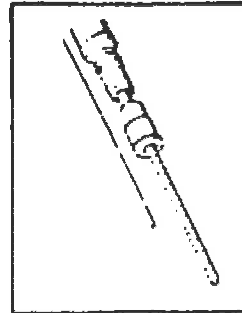
IMPORTANT: Clear out dust and fragments, preferably using a jet of water or compressed air and a wire brush (The damp hole does not influence the holding value!)



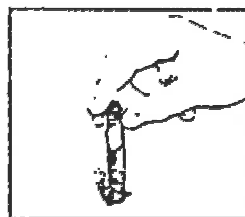
2. Insert shank of rebar tool into drill chuck. Switch drill to hammer with rotation mode



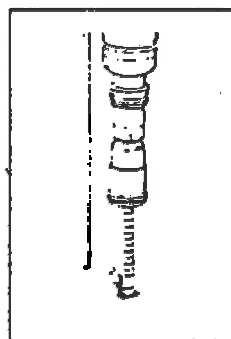
3 Rotate knurled locking sieve and insert appropriate diameter rebar. End of rebar being inserted into base material must have a 45° or chisel point (90°).



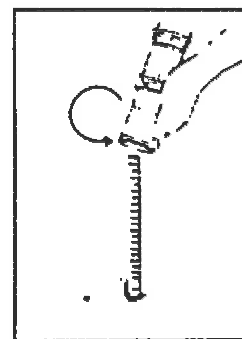
4 Set drill depth gauge or mark rebar to determine bottom of hole



5. Insert appropriate diameter HBP adhesive cartridge) into pre-drilled hole in base material.



6. Place chisel pointed end of rebar on top of HBP cartridge and switch on drill. Drive rebar to bottom of hole.



7 Once the rebar reaches the bottom of the hole the drill should be switched off. To release rebar setting tool, rotate knurled locking sieve and remove tool from rebar. Care should be taken not to disturb the installed rebar when removing the rebar tool.

FIGURE NO. 3
CONCRETE TEMPERATURE SENSITIVITY LOAD FACTOR FOR HEA ANCHORS

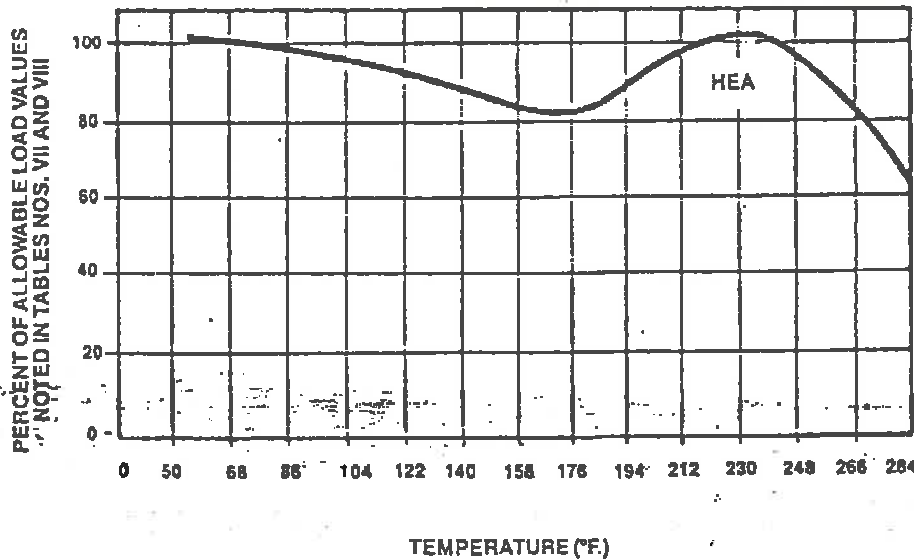


TABLE NO. VII—
ALLOWABLE TENSILE LOADS IN STONE AGGREGATE CONCRETE FOR THREADED RODS WITH HEA RESIN^{1,2,4,5,7}
(Pounds)

ANCHOR DIAMETER (Inches)	EMBEDMENT DEPTH (Inches)	BASED ON BOND STRENGTH ³				ANCHOR ROD STEEL STRENGTH ⁶		
		2000 PSI CONCRETE	3000 PSI CONCRETE	4000 PSI CONCRETE	6000 PSI CONCRETE	HAS STD. (SAE 1018)	HAS SUPER (SAE 4140)	HAS SS (304 SS)
						A307	A325	
1/8	3 1/2	1,885	2,075	2,270	2,655	1,550	3,410	1,240
	5 1/4	2,825	3,115	3,405	3,985			
	7	3,765	4,150	4,535	5,310			
1/4	4 1/4	2,500	2,810	3,120	3,740	2,840	6,245	2,270
	6 1/8	3,745	4,210	4,675	5,605			
	8 1/2	4,995	5,615	6,235	7,475			
3/8	5	3,860	4,305	4,755	5,645	4,520	9,945	3,615
	7 1/2	5,790	6,460	7,130	8,465			
	10	7,725	8,615	9,505	11,285			
1/2	6 3/8	5,395	6,100	6,810	8,220	6,680	14,695	5,345
	10	8,095	9,150	10,210	12,330			
	13 1/4	10,790	12,205	13,615	16,435			
5/8	6 3/8	6,350	7,180	8,015	9,680	9,240	20,330	7,390
	10	9,525	10,770	12,020	14,520			
	13 1/4	12,695	14,360	16,025	19,355			
1	8 1/4	9,040	10,280	11,520	13,995	12,120	26,665	9,695
	12 3/8	13,560	15,420	17,275	20,995			
	16 1/2	18,080	20,560	23,035	27,995			
1 1/4	12	19,230	21,770	24,315	29,405	19,380	42,635	15,505
	18	27,525	29,860	32,190	36,855			

- ¹The tabulated tensile values are for anchors installed in stone aggregate concrete having the minimum designated ultimate compressive strength at time of installation.
- ²The HEA adhesive experiences a reduction in tensile capacity with increased concrete temperature. The load factors noted in Figure No. 3 must be applied to the values noted in the above table when the anchors are installed in locations where the concrete temperature may exceed 68°F.
- ³Anchor rod allowable loads are governed by the tensile strength of the steel.
- ⁴The allowable load values may be increased 33 1/3 percent for duration of loading, such as seismic or wind.
- ⁵Spacing of the anchors shall be in accordance with the requirements noted in Table No. II.
- ⁶Special inspection in accordance with Section 306 (a) 12 of the code must be provided for all anchor installations.
- ⁷Allowable load should be the lesser of bond or steel strength.

TABLE NO. VIII—
ALLOWABLE TENSILE STRENGTH VALUES IN STONE AGGREGATE CONCRETE FOR REINFORCEMENT DOWELS WITH HEA RESIN^{1,2,4,5,7}
(Pounds)

REBAR EMBEDMENT SIZE	DEPTH (Inches)	BASED ON BOND STRENGTH ³				STEEL STRENGTH ⁶	
		2000 PSI	3000 PSI	4000 PSI	6000 PSI	GRADE 40	GRADE 60
No. 3	3 1/2	1,580	1,790	1,995	2,405	2,200	2,640
	5 1/4	2,370	2,680	2,990	3,610		
	7	3,160	3,575	3,985	4,810		
No. 4	4 1/4	2,420	2,745	3,070	3,715	4,000	4,800
	6 3/8	3,630	4,115	4,600	5,570		
	8 1/2	4,840	5,490	6,135	7,430		
No. 5	5	3,750	4,230	4,710	5,665	6,200	7,440
	7 1/2	5,625	6,345	7,060	8,495		
	10	7,500	8,455	9,415	11,330		
No. 6	6 3/8	5,255	6,065	6,870	8,485	8,800	10,560
	10	7,885	9,095	10,305	12,725		
	13 1/4	10,510	12,125	13,740	16,965		
No. 7	6 3/8	5,915	6,820	7,730	9,545	12,000	14,400
	10	8,870	10,230	11,590	14,315		
	13 1/4	11,825	13,640	15,455	19,085		
No. 8	8 1/4	8,910	10,125	11,340	13,770	15,800	18,960
	12 3/8	13,365	15,190	17,010	20,655		
	16 1/2	17,820	20,250	22,680	27,540		
No. 9	8 1/4	12,055	13,705	15,360	18,660	20,000	24,000
	12 3/8	18,080	20,560	23,035	27,995		
No. 10	12	15,835	17,980	20,125	24,410	25,400	30,480
	18	19,795	22,515	25,235	30,680		

- ¹The tabulated bond strength values are for dowels installed in stone aggregate concrete having the minimum designated ultimate compressive strength (f'_c) at time of installation.
- ²The HEA adhesive experiences a reduction in bond strength capacity with increased concrete temperature. The load factors noted in Figure No. 3 must be applied to the values noted in the above table when the dowels are installed in locations where the concrete temperature may exceed 68°F.
- ³The allowable bond strength may be increased 33 1/3 percent for duration of loading, such as seismic or wind.
- ⁴Spacing of the dowels and distance from edge shall be in accordance with the requirements noted in Table No. II.
- ⁵Allowable load should be the lesser of bond or rebar strength.
- ⁶Steel strength based on Uniform Building Code (1985), Sec. 2626 (d).
- ⁷Special inspection in accordance with Section 306 (a) 12 of the code must be provided for all anchor installations.
- ⁸See Figure No. 2 for additional installation details.

HVA Allowable Bond Strength/Steel Strength (lbs) for Threaded Anchor Rods

Anchor Diameter (In.)	Embed. Depth (In.)	Adhesive Capsule(s) Required	1Bond Strength Allowable Tensile Loads				Anchor Rod Allowable Loads					
			2000 psi Conc.	3000 psi Conc.	4000 psi Conc.	6000 psi Conc.	HAS Std. (SAE 1018)		HAS Super (SAE 4140)		HAS SS (304 SS)	
							2Tensile	2Shear	2Tensile	2Shear	Tensile	Shear
3/8	3 1/2	1 - 3/8 x 3 1/2	2010	2210	2420	2850	1560	1070	3250	1900	2600	1850
	5 1/4	2 - 3/8 x 3 1/2	3010	3320	3630	4250						
	7	2 - 3/8 x 3 1/2	4010	4425	4840	5665						
1/2	4 1/4	1 - 1/2 x 4 1/4	2660	2990	3330	3990	2840	2090	5920	3270	4730	3600
	6 3/8	1 - 1/2 x 4 1/4 & 1 - 3/8 x 3 1/2	4000	4490	4990	5980						
	8 1/2	2 - 1/2 x 4 1/4	5330	5990	6650	7970						
5/8	5	1 - 5/8 x 5	4120	4590	5070	6020	4520	3000	9420	5632	7530	5050
	7 1/2	1 - 5/8 x 5 & 1 - 1/2 x 4 1/4	6180	6890	7600	9030						
	10	2 - 5/8 x 5	8240	9190	10140	12040						
3/4	6 5/8	1 - 3/4 x 6 5/8	5750	6510	7260	8770	6680	4800	13920	7650	9460	7270
	10	1 - 3/4 x 6 5/8 & 1 - 1/2 x 4 1/4	8630	9760	10890	13150						
	13 1/4	2 - 3/4 x 6 5/8	11510	13020	14520	17530						
7/8	6 5/8	1 - 7/8 x 6 5/8	6770	7660	8550	10320	9240	6350	19250	10780	—	—
	10	2 - 3/4 x 6 5/8	10160	11490	12820	15490						
	13 1/4	2 - 7/8 x 6 5/8	13540	15320	17090	20650						
1	8 1/4	1 - 1 x 8 1/4	9640	10960	12290	14930	12120	7630	25250	13760	—	—
	12 3/8	2 - 7/8 x 6 5/8	14460	16450	18430	22390						
	16 1/2	2 - 1 x 8 1/4	19280	21930	24570	29860						
1 1/4	12	1 - 1 1/4 x 12	20510	23220	25940	31370	19380	13070	40375	21530	—	—
	15	1 - 1 1/4 x 12 & 1 - 1 x 8 1/4	24935	27535	30140	35340						
	18	1 - 1 1/4 x 12 & 2 - 1 x 8 1/4	29360	31850	34340	39310						

1 Allowable tensile loads (AWL) for bond strength are based upon the following formula:

$$AWL = \frac{\bar{F}_T \cdot 2 S_x}{3} \text{ WITH } S_x = (C.V.) F_T; C.V. = 10\%$$

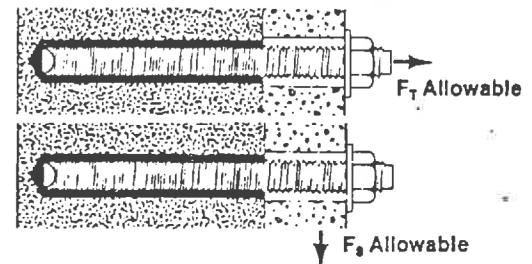
F_T determined by actual test results

2 Allowable tensile load for anchor rods is based upon allowable stress = .33 F_u Acting upon the tensile stress area of the rods. Per AISC Section 1.5

3 Values are based upon tests performed at minimum embedment and the following formula:

$$\text{allowable shear load} = \frac{\bar{F}_S \cdot 2 S_x}{3} \quad \bar{F}_S \text{ determined by testing}$$

$S_x = (C.V.) \bar{F}_S; C.V. = 10\%$



HVA Ultimate Bond Strength/Steel Strength (lbs) for Threaded Anchor Rods

Anchor Diameter (In.)	Embed. Depth (In.)	Adhesive Capsule(s) Required	HEA ULTIMATE Bond Strength (lbs)				Steel Strength (lbs) ¹								
			Concrete Strength				HAS Std. (SAE 1018)			HAS Super (SAE 4140)			HAS SS (304 SS) ²		
			2000 psi	3000 psi	4000 psi	6000 psi	Yield Strength	Tensile Strength	Shear Strength	Yield Strength	Tensile Strength	Shear Strength	Yield Strength	Tensile Strength	Shear Strength
3/8	3 1/2	1 - 3/8 x 3 1/2	7530	8300	9070	10620	2810	4680	4015	8190	9750	7120	5070	7800	6930
	5 1/4	2 - 3/8 x 3 1/2	11290	12450	13610	15930									
	7	2 - 3/8 x 3 1/2	15050	16600	18140	21240									
1/2	4 1/4	1 - 1/2 x 4 1/4	9990	11230	12470	14950	5110	8520	7850	14910	17750	12280	9230	14200	13490
	6 3/8	1 - 1/2 x 4 1/4 & 1 - 3/8 x 3 1/2	14980	16840	18700	22420									
	8 1/2	2 - 1/2 x 4 1/4	19980	22460	24930	29890									
5/8	5	1 - 5/8 x 5	15440	17220	19010	22570	8140	13560	11240	23730	28250	21120	14690	22600	18950
	7 1/2	1 - 5/8 x 5 & 1 - 1/2 x 4 1/4	23160	25840	28510	33860									
	10	2 - 5/8 x 5	30890	34450	38010	45140									
3/4	6 5/8	1 - 3/4 x 6 5/8	21580	24400	27230	32870	12020	20040	18010	35070	41750	28700	15030	28390	27250
	10	1 - 3/4 x 6 5/8 & 1 - 1/2 x 4 1/4	32370	36600	40840	49310									
	13 1/4	2 - 3/4 x 6 5/8	43160	48810	54450	65740									
7/8	6 5/8	1 - 7/8 x 6 5/8	25390	28720	32050	38710	16630	27720	23805	48510	57750	40410	20790	39270	—
	10	2 - 3/4 x 6 5/8	38090	43080	48080	58070									
	13 1/4	2 - 7/8 x 6 5/8	50780	57440	64100	77420									
1	8 1/4	1 - 1 x 8 1/4	36160	41110	46070	55980	21820	36360	28615	63630	75750	51590	27270	51510	—
	12 3/8	2 - 7/8 x 6 5/8	54230	61670	69100	83970									
	16 1/2	2 - 1 x 8 1/4	72310	82230	92140	111970									
1 1/4	12	1 - 1 1/4 x 12	76910	87080	97260	117620	34880	58140	49000	101745	121125	80740	43605	82365	—
	15	1 - 1 1/4 x 12 & 2 - 1 x 8 1/4	93505	103255	113025	132525									
	18	1 - 1 1/4 x 12 & 1 - 1 x 8 1/4	110100	119430	128780	147420									

1. Steel strength based on tensile stress area of standard UNC thread.
2. Use lower value of either bond or steel strength
3. 7/8-1 1/4 HAS SS only available through special order.