

S7

**The ONLY fast cure
ICC-ES listed
adhesive for
water-filled holes
and submerged
concrete**



S7-10

S7-28

APPLICATIONS / USES

- Formulated and approved for use in water saturated concrete, water-filled holes, & submerged concrete.
- Can be installed in a variety of base material temperatures.
- Adheres threaded rod and reinforcing bar into solid concrete.

DESCRIPTION

Fast Curing Hybrid Epoxy Adhesive

The resin and hardening agent are completely mixed as they are dispensed from the dual cartridge through a static mixing nozzle, directly into the anchor hole. S7 can be used with threaded rod or rebar. It's the "go to" adhesive on the jobsite to cover installations in **ALL WEATHER CONDITIONS!**



Saturated - Concrete is wet, but there is no water standing in the hole



Water Filled - Concrete is wet and there is water standing in the hole



Submerged - Concrete is completely under water

ADVANTAGES

- All weather formula
- Works in damp holes and underwater applications
- Fast curing time, 30 minutes at 70°F
- ICC-ES Evaluation Report No. 2308
- NSF 61 Listed
- High flow nozzle reduces installation time
- Fast & easy dispensing, even 28 ounce cartridge can be hand dispensed
- Compatible with A7 installation tools & nozzles

Curing Times

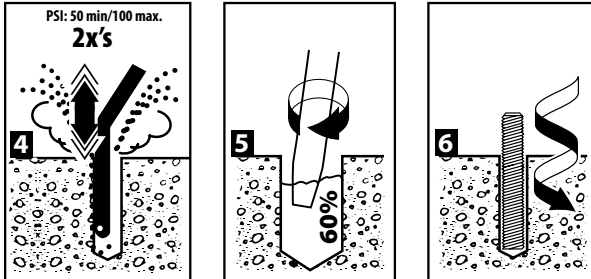
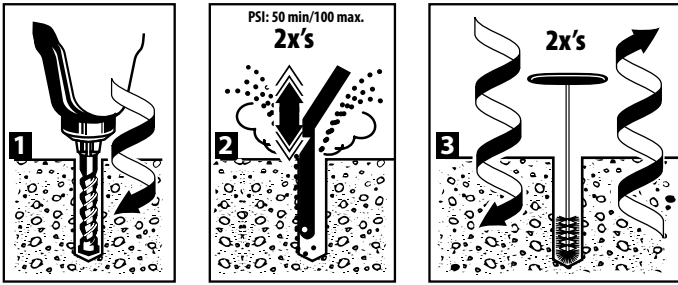


CONCRETE (F°)	ADHESIVE (F°)	GEL TIME	FULL CURE TIME
110	110	1 minute	30 minutes
90	90	2 minutes	30 minutes
70	70	4 minutes	30 minutes
50	50	6 minutes	45 minutes
30	30	14 minutes	2 hours
14	30	30 minutes	12 hours
0	40	18 minutes	24 hours

Spacing and Edge Distance

NOMINAL ANCHOR DIAMETER (IN.)	MINIMUM SPACING (IN.)	MINIMUM EDGE DISTANCE (IN.)
3/8	15/16	15/16
1/2	1-1/2	1-1/2
5/8	2-1/2	2-1/2
3/4	3	3
7/8	3-1/2	3-1/2
1	4	4
1-1/4	5	5

INSTALLATION STEPS



* Damp, submerged and underwater applications require 4x's air, 4x's brushing and 4x's air

APPROVALS/LISTINGS

ICC-ES ESR 2308 for Cracked, Uncracked, and all Seismic Zones
 Florida Building Code
 IBC 2006/2009 Compliant
 NSF/ANSI Standard 61
 ASTM C881 Type I, II, IV & V; Grade 3, Class A, B, & C with the exception of gel time (Class C only)

For the most current approvals/listings visit:
www.itw-redhead.com

APPLICATIONS



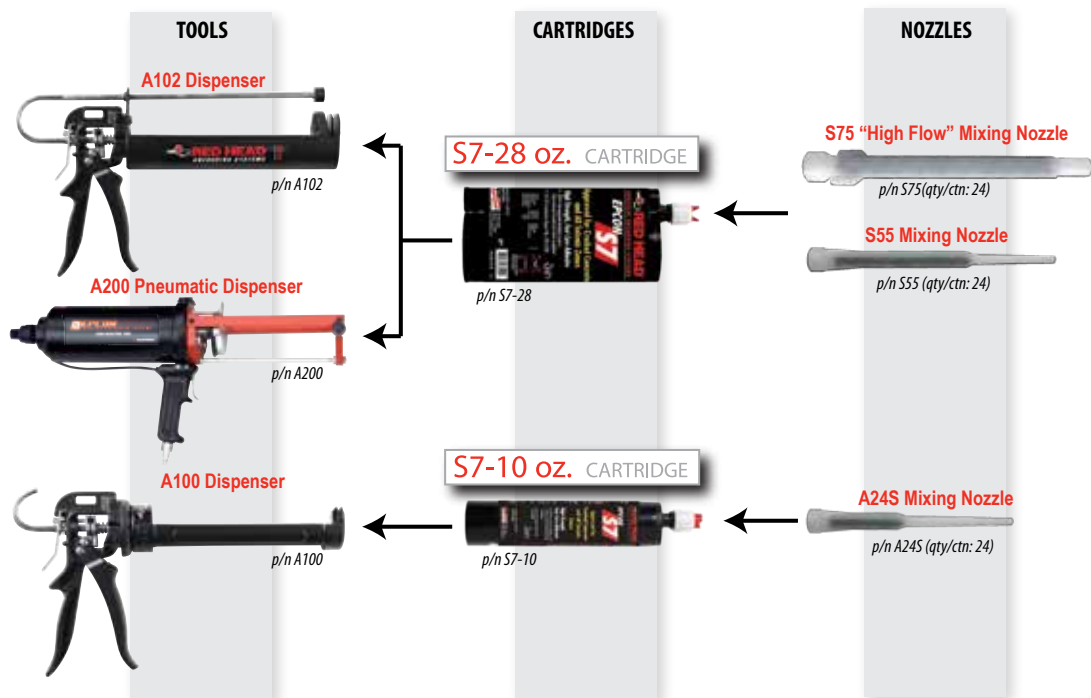
Water Treatment Facilities

The fast dispensing, fast curing properties of S7 make it ideal for repetitive installation processes.









Subway /Tunnel Systems

S7 dispenses so quickly and rebar inserts so easily that contractors find installed costs are lower than many other products including grout for doweling.



S7-28 fl. oz. Ordering Information

PART NUMBER	DESCRIPTION	BOX QTY	PART NUMBER	DESCRIPTION	BOX QTY
 S7-28	28 Fluid Ounce Cartridge S7	4	 A102	Hand Dispenser for S7-28	1
 S55	Mixing Nozzle for S7-28 Cartridge Nozzle diameter fits holes for 3/8" diameter & larger anchors (overall length of nozzle 10")	24	 A200	Pneumatic Dispenser for S7-28	1
 S75	High Flow Mixing Nozzle for S7-28 Cartridge Nozzle diameter fits holes for 5/8" diameter & larger anchors (overall length of nozzle 9-1/4")	24			
 S75EXT	High Flow Mixing Nozzle Extension for S75 (overall length of extension 9-1/4")	24			

ESTIMATING TABLE

S7

28 Fluid Ounce Cartridge

Number of Anchoring Installations per Cartridge* Using Reinforcing Bar with S7 Adhesive in Solid Concrete

REBAR	DRILL HOLE DIA. INCHES	EMBEDMENT DEPTH IN INCHES (mm)														
		1 (25.4)	2 (50.8)	3 (76.2)	4 (101.6)	5 (127.0)	6 (152.4)	7 (177.8)	8 (203.2)	9 (228.6)	10 (254.0)	11 (279.4)	12 (304.8)	13 (330.2)	14 (355.6)	15 (381.0)
# 3	7/16	662.5	331.3	220.8	165.6	132.5	110.4	94.6	82.8	73.6	66.3	60.2	55.2	51.0	47.3	44.2
# 4	5/8	373.0	186.5	124.3	93.2	74.6	62.2	53.3	46.6	41.4	37.3	33.9	31.1	28.7	26.6	24.9
# 5	3/4	286.1	143.0	95.4	71.5	57.2	47.7	40.9	35.8	31.8	28.6	26.0	23.8	22.0	20.4	19.1
# 6	7/8	231.0	115.5	77.0	57.7	46.2	38.5	33.3	28.8	25.7	23.1	21.0	19.2	17.8	16.5	15.4
# 7	1	213.4	106.7	71.1	53.3	42.7	35.6	30.5	26.7	23.7	21.3	19.4	17.8	16.4	15.2	14.2
# 8	1-1/8	177.3	88.6	59.1	44.3	35.5	29.5	25.3	22.2	19.7	17.7	16.1	14.8	13.6	12.7	11.8
# 9	1-1/4	102.8	51.4	34.3	25.7	20.6	17.1	14.7	12.8	11.4	10.3	9.3	8.6	7.9	7.3	6.9
# 10	1-3/8	84.1	42.0	28.0	21.0	16.8	14.0	12.0	10.5	9.3	8.4	7.6	7.0	6.5	6.0	5.6
# 11	1-3/4	51.4	25.7	17.1	12.8	10.3	8.6	7.3	6.4	5.7	5.1	4.7	4.3	4.0	3.7	3.4

* The number of anchoring installations is based upon calculations of hole volumes using ANSI tolerance carbide tipped drill bits, the nominal areas of the reinforcing bars and the stress areas of the threaded rods. These estimates do not account for waste.

ESTIMATING TABLE

CLAMPING FORCE PROVIDED ON PAGE 26

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28 Fluid Ounce Cartridge

Number of Anchoring Installations per Cartridge* Using Threaded Rod with S7 Adhesive in Solid Concrete

ROD In. (mm)	DRILL HOLE DIA. INCHES	EMBEDMENT DEPTH IN INCHES (mm)														
		1 (25.4)	2 (50.8)	3 (76.2)	4 (101.6)	5 (127.0)	6 (152.4)	7 (177.8)	8 (203.2)	9 (228.6)	10 (254.0)	11 (279.4)	12 (304.8)	13 (330.2)	14 (355.6)	15 (381.0)
1/4 (6.4)	5/16	915.5	457.7	305.2	228.9	183.1	152.8	130.8	114.4	101.7	91.5	83.2	76.3	70.4	65.4	61.0
3/8 (9.5)	7/16	530.0	265.0	176.7	132.5	106.0	88.3	75.7	66.3	58.9	53.0	48.2	44.2	40.8	37.9	35.3
1/2 (12.7)	9/16	381.4	190.7	127.1	95.4	76.3	63.6	54.5	47.7	42.4	38.1	34.7	31.8	29.3	27.2	25.4
5/8 (15.9)	11/16	273.6	136.8	91.2	68.4	54.7	45.6	39.1	34.2	30.4	27.4	24.9	22.8	21.0	19.5	18.2
	3/4	195.6	97.8	65.1	48.8	39.0	32.5	27.9	24.4	21.7	19.5	17.7	16.3	15.0	13.9	13.0
3/4 (19.1)	13/16	192.9	96.5	64.3	48.2	38.6	32.2	27.6	24.1	21.4	19.3	17.5	16.1	14.8	13.8	12.9
	7/8	154.4	77.2	51.5	38.6	30.9	25.7	22.1	19.3	17.2	15.4	14.0	12.9	11.9	11.0	10.3
7/8 (22.2)	15/16	185.1	92.6	61.7	46.3	37.0	30.9	26.8	23.1	20.6	18.5	16.8	15.4	14.2	13.2	12.3
	1	128.0	64.0	42.8	32.0	25.6	21.4	18.3	16.0	14.2	12.8	11.6	10.7	9.9	9.2	8.5
1 (25.4)	1-1/16	158.3	79.2	52.8	39.6	31.7	26.4	22.6	19.8	17.6	15.8	14.4	13.2	12.2	11.3	10.6
	1-1/8	105.2	52.6	35.2	26.3	21.1	17.6	15.0	13.2	11.7	10.5	9.6	8.8	8.1	7.6	7.0
1-1/4 (31.8)	1-5/16	101.3	50.7	33.8	25.3	20.3	16.9	14.5	12.7	11.3	10.1	9.2	8.4	7.8	7.2	6.8
	1-3/8	80.0	40.0	26.6	20.0	15.9	13.3	11.4	10.0	8.9	8.0	7.2	6.6	6.1	5.7	5.3

* The number of anchoring installations is based upon calculations of hole volumes using ANSI tolerance carbide tipped drill bits, the nominal areas of the reinforcing bars and the stress areas of the threaded rods. These estimates do not account for waste.

S7-10 fl. oz. Ordering Information

PART NUMBER	DESCRIPTION	BOX QTY
 S7-10	10 Fluid Ounce Cartridge S7 with nozzle	6
 A24S	Additional Mixing Nozzle for S7-10 Cartridge Nozzle diameter fits holes for 3/8" diameter & larger anchors (overall length of nozzle 7-3/8")	24
 A100	Hand Dispenser for S7-10 (26:1 Thrust Ratio)	1

Refer to page 49 for ordering information on brushes, hole plugs, and extension tubing for deep holes.

PACKAGING

1. Disposable, self-contained cartridge system capable of dispensing both components in the proper mixing ratio
2. Components dispensed through a static mixing nozzle that thoroughly mixes the material and places the material at the base of the pre-drilled hole
3. Cartridge markings: Include manufacturer's name, batch number and best-used-by date, mix ratio by volume, ANSI hazard classification, and appropriate ANSI handling precautions

SUGGESTED SPECIFICATIONS

HYBRID EPOXY ADHESIVE:

Fast Cure HYBRID EPOXY ADHESIVE: USA Made, ARRA Certified

1. Two component hybrid epoxy adhesive, non-sag paste, moisture insensitive when cured, dark gray in color, fast cure time.
2. Meets NSF Standard 61, certified for use in conjunction with drinking water systems.
3. Works in wet, damp, submerged holes.
4. Shelf life: Best if used within 15 months.
5. All weather cure time (45 min. at 50°F).
6. Dispenses easier and faster.
7. Dispenses and cures faster in cold weather, but works in hot weather.
8. For use in 0°F concrete with 40°F adhesive.
9. Formula for use in solid materials.
11. Quick insertion time = less labor cost.

ESTIMATING TABLES

S7 10 Fluid Ounce Cartridge

Number of Anchoring Installations per Cartridge* Using Reinforcing Bar and Threaded Rod with S7 Adhesive in Solid Concrete

REBAR	DRILL HOLE DIA. INCHES	EMBEDMENT DEPTH IN INCHES (mm)			
		2 (50.8)	4 (101.6)	6 (152.4)	8 (203.2)
# 3	7/16	110	55	37	27
# 4	5/8	63	31	20	14
# 5	3/4	48	24	16	11
# 6	7/8	39	18	13	9
# 7	1	35	18	11	9
# 8	1-1/8	29	14	9	7

* The number of anchoring installations is based upon calculations of hole volumes using ANSI tolerance carbide tipped drill bits, the nominal areas of the reinforcing bars and the stress areas of the threaded rods. These estimates do not account for waste.

ROD In (mm)	DRILL HOLE DIA. INCHES	EMBEDMENT DEPTH IN INCHES (mm)				
		2 (50.8)	4 (101.6)	6 (152.4)	8 (203.2)	10 (254.0)
3/8 (9.5)	7/16	88	44	28	22	18
1/2 (12.7)	9/16	65	31	22	16	13
5/8 (15.9)	11/16	46	22	14	11	9
	3/4	33	16	11	7	6.5
3/4 (19.1)	13/16	33	16	11	7	7
	7/8	26	13	9	7	5
7/8 (22.2)	15/16	31	14	11	7	6
	1	22	11	7	5	4.5
1 (25.4)	1-1/16	26	13	9	7	5.5
	1-1/8	18	9	5	3	3.5

PERFORMANCE TABLE

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Hybrid Epoxy Adhesive

Adhesive Anchor Bond Strength for Threaded Rod^{1,6,7}

CHARACTERISTIC		SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Anchor embedment depth - minimum		h_{ef}	in	2-3/8	2-3/4	3-1/8	3-1/2	3-1/2	4	5
Anchor embedment depth - maximum		h_{ef}	in	7-1/2	10	12-1/2	15	17-1/2	20	25
Temperature Range A ²	Characteristic Bond Strength for Uncracked Concrete	$t_{k,unscr}$	psi	1,735	1,735	1,735	1,735	1,735	1,735	1,333
	Characteristic Bond Strength for Cracked Concrete	$t_{k,cr}$	psi	652	726	726	785	785	785	443
Temperature Range B ³	Characteristic Bond Strength for Uncracked Concrete	$t_{k,unscr}$	psi	1,611	1,611	1,611	1,611	1,611	1,611	1,238
	Characteristic Bond Strength for Cracked Concrete	$t_{k,cr}$	psi	652	726	726	785	785	785	412
Temperature Range C ^{4,5}	Characteristic Bond Strength for Uncracked Concrete	$t_{k,unscr}$	psi	1,544	1,544	1,544	1,544	1,544	1,544	1,186
	Characteristic Bond Strength for Cracked Concrete	$t_{k,cr}$	psi	625	696	696	752	752	752	394

¹Bond strength values correspond to concrete compressive strengths ranging from 2,500psi to 8,000psi

²Temperature range A: Maximum short term temperature of 110°F and maximum long term temperature of 70°F

³Temperature range B: Maximum short term temperature of 130°F and maximum long term temperature of 110°F

⁴Temperature range C: Maximum short term temperature of 176°F and maximum long term temperature of 110°F

⁵For load combinations consisting of only short-term loads, such as wind or seismic loads, bond strengths may be increased by 4% for Temperature Range C

⁶Reference Table 6 for Bond Strength Reduction Factors (table on pg. 27)

⁷Per ICC-ES ESR-2308, calculate steel, concrete breakout, and bond strength, determine the controlling resistance strength in tension.

PERFORMANCE TABLE

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Hybrid Epoxy Adhesive

Adhesive Anchor Bond Strength for Reinforcing Bar^{1,7,8}

CHARACTERISTIC		SYMBOL	UNITS	Reinforcing Bar						
				#3	#4	#5	#6	#7	#8	#10
Anchor embedment depth - minimum		h_{ef}	in	2-3/8	2-3/4	3-1/8	3-1/2	3-1/2	4	5
Anchor embedment depth - maximum		h_{ef}	in	7-1/2	10	12-1/2	15	17-1/2	20	25
Temperature Range A ³	Characteristic Bond Strength for Uncracked Concrete	$t_{k,unscr}$	psi	1,184	1,184	1,184	1,184	1,184	1,184	1,026
	Characteristic Bond Strength for Cracked Concrete	$t_{k,cr}$	psi	506	552	563	608	608	608	601
Temperature Range B ⁴	Characteristic Bond Strength for Uncracked Concrete	$t_{k,unscr}$	psi	1,100	1,100	1,100	1,100	1,100	1,100	953
	Characteristic Bond Strength for Cracked Concrete	$t_{k,cr}$	psi	506	552	563	608	608	608	559
Temperature Range C ^{5,6}	Characteristic Bond Strength for Uncracked Concrete	$t_{k,unscr}$	psi	1,054	1,054	1,054	1,054	1,054	1,054	913
	Characteristic Bond Strength for Cracked Concrete	$t_{k,cr}$	psi	484	528	539	583	583	583	535

¹Bond strength values correspond to concrete compressive strengths ranging from 2,500psi to 8,000psi

²Per ASTM A615 Grade 60

³Temperature range A: Maximum short term temperature of 110°F and maximum long term temperature of 70°F

⁴Temperature range B: Maximum short term temperature of 130°F and maximum long term temperature of 110°F

⁵Temperature range C: Maximum short term temperature of 176°F and maximum long term temperature of 110°F

⁶For load combinations consisting of only short-term loads, such as wind or seismic loads, bond strengths may be increased by 4% for Temperature Range C

⁷Reference bond strength reduction factors (table on pg 27)

⁸Per ICC-ES ESR-2308, calculate steel, concrete breakout, and bond strength, determine the controlling resistance strength in tension.

PERFORMANCE TABLE

S7 Hybrid Epoxy Adhesive Bond Strength Reduction Factors for Threaded Rod & Reinforcing Bars^{1,2}

CHARACTERISTIC		SYMBOL	NOMINAL ROD DIAMETER (inch)						
			#3 3/8	#4 1/2	#5 5/8	#6 3/4	#7 7/8	#8 1	#10 1-1/4
Continuous Inspection ³	Strength Reduction Factor - Dry Concrete	$\Phi_{dry, ci}$	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength Reduction Factor - Saturated Concrete	$\Phi_{sat, ci}$	0.55	0.55	0.55	0.65	0.65	0.65	0.65
	Strength Reduction Factor - Water-Filled Holes	$\Phi_{wf, ci}$	0.55	0.55	0.55	0.65	0.65	0.65	0.65
	Strength Reduction Factor - Submerged Concrete	$\Phi_{sub, ci}$	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Periodic Inspection ³	Strength Reduction Factor - Dry Concrete	$\Phi_{dry, pi}$	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength Reduction Factor - Saturated Concrete	$\Phi_{sat, pi}$	0.45	0.45	0.45	0.65	0.65	0.65	0.65
	Strength Reduction Factor - Water-Filled Holes	$\Phi_{wf, pi}$	0.45	0.45	0.45	0.65	0.65	0.65	0.65
	Strength Reduction Factor - Submerged Concrete	$\Phi_{sub, pi}$	0.55	0.55	0.55	0.65	0.65	0.65	0.65
Reduction factor for seismic tension		$\alpha_{N,seis}$	0.800						

¹ Φ reduction factors must be applied to calculated adhesive design loads

²For 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 $\alpha_{N,seis}$

³Inspections per 2009 IBC Section 1702.1

PERFORMANCE TABLE

S7 Hybrid Epoxy Adhesive Threaded Rod Strength Design Tension Load Estimation Table^{1,2}

THREADED ROD DIAMETER	EFFECTIVE EMBEDMENT DEPTH (IN)	TEMPERATURE RANGE A ³		TEMPERATURE RANGE C ⁴	
		UNCRACKED CONCRETE	CRACKED CONCRETE	UNCRACKED CONCRETE	CRACKED CONCRETE
3/8"	2-3/8	3,155	1,186	2,808	1,137
	3-3/8	4,484	1,685	3,990	1,615
	7-1/2	7,265	3,745	7,265	3,590
1/2"	2-3/4	4,499	2,038	4,335	1,954
	4-1/2	7,972	3,336	7,094	3,198
	10	13,303	7,413	13,303	7,106
5/8"	3-1/8	5,450	2,896	5,450	2,776
	5-5/8	12,456	5,212	11,084	4,997
	12-1/2	21,188	11,582	21,188	11,104
3/4"	3-1/2	6,460	4,208	6,460	4,031
	6-3/4	17,303	8,115	15,962	7,774
	15	31,356	18,034	31,356	17,276
7/8"	3-1/2	6,460	4,576	6,460	4,576
	7-7/8	21,804	11,046	21,725	10,581
	17-1/2	43,287	24,546	43,287	23,514
1"	4	7,893	5,591	7,893	5,591
	9	26,639	14,427	26,639	13,820
	20	56,788	32,060	56,788	30,712
1-1/4"	5	11,031	5,654	11,031	5,029
	11-1/4	37,229	12,721	34,057	11,314
	25	85,064	28,269	75,683	25,143

¹These load values are for the purposes of estimation only and should not be used in design

²Assuming single anchor with no edge or spacing distances, environmental factors that would reduce the load. Design loads include their respective Φ reduction factor from ACI 318 Appendix D, Condition B.

³Temperature Range A (long term temperature 70°F, short term temperature 110°F)

⁴Temperature Range C (long term temperature 110°F, short term temperature 176°F)

⁵Concrete compressive strength of 4,000 psi

⁶For periodic and continuous inspection with dry concrete

⁷Steel tensile strength of 125,000 psi (ASTM A193 Grade B7)

KEY	CONCRETE ⁵	ADHESIVE ⁶	STEEL ⁷
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PERFORMANCE TABLE

S7 Hybrid Epoxy Adhesive

Reinforcing Bar Strength Design Tension Load Estimation Table^{1,2}

REBAR	EFFECTIVE EMBEDMENT DEPTH (IN)	TEMPERATURE RANGE A ³		TEMPERATURE RANGE C ⁴	
		UNCRACKED CONCRETE	CRACKED CONCRETE	UNCRACKED CONCRETE	CRACKED CONCRETE
#3	2-3/8	2,153	920	1,917	880
	3-3/8	3,060	1,308	2,724	1,251
	7-1/2	6,800	2,906	6,053	2,780
#4	2-3/4	3,324	1,550	2,959	1,483
	4-1/2	5,440	2,536	4,843	2,426
	10	12,089	5,636	10,762	5,391
#5	3-1/8	4,722	2,245	4,204	2,150
	5-5/8	8,500	4,042	7,567	3,869
	12-1/2	18,889	8,982	16,815	8,599
#6	3-1/2	6,347	3,259	5,650	3,125
	6-3/4	12,240	6,285	10,896	6,027
	15	27,200	13,968	24,213	13,393
#7	3-1/2	6,460	3,802	6,460	3,646
	7-7/8	16,660	8,555	14,831	8,203
	17-1/2	37,022	19,011	32,957	18,230
#8	4	7,893	4,966	7,893	4,762
	9	21,760	11,174	19,371	10,715
	20	48,355	24,831	43,046	23,810
#10	5	11,031	7,670	11,031	6,828
	11-1/4	29,463	17,258	26,218	15,363
	25	65,473	38,352	58,262	34,140

¹These load values are for the purposes of estimation only and should not be used in design

²Assuming single anchor with no edge or spacing distances, environmental factors that would reduce the load

Design loads include their respective) reduction factors from ACI 318 Appendix D, Condition B

³Temperature Range A (long-term temperature 70°F, short-term temperature 110°F)

⁴Temperature range C (long-term temperature 110°F, short-term temperature 176°F)

⁵Concrete compressive strength of 4,000 psi

⁶For periodic and continuous inspection with dry concrete

⁷ASTM A615 Grade 60 rebar

KEY	CONCRETE ⁵	ADHESIVE ⁶	STEEL ⁷
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PERFORMANCE TABLE

S7 Hybrid Epoxy Adhesive

Strength Design Tension and Shear Load Estimation Table^{1, 2, 3}

NOMINAL THREADED ROD ANCHOR DIAMETER	EFFECTIVE EMBEDMENT DEPTH (IN)	DESIGN TENSION ΦN _t (LBS.)	DESIGN SHEAR ΦV _n (LBS.)
3/8"	2-3/8	3,155	3,398
	3-3/8	4,484	3,778
	7-1/2	7,265	3,778
1/2"	2-3/4	4,499	6,918
	4-1/2	7,972	6,918
	10	13,303	6,918
5/8"	3-1/8	5,450	11,018
	5-5/8	12,456	11,018
	12-1/2	21,188	11,018
3/4"	3-1/2	6,460	13,915
	6-3/4	17,303	16,305
	15	31,356	16,305
7/8"	3-1/2	6,460	13,915
	7-7/8	21,804	22,509
	17-1/2	43,287	22,509
1"	4	7,893	17,000
	9	26,639	29,530
	20	56,788	29,530
1-1/4"	5	11,031	23,759
	11-1/4	37,229	47,244
	25	85,064	47,244

¹These load values are for the purposes of estimation only and should not be used in design

²Assuming single anchor with no edge or spacing distances, environmental factors that would reduce the load

Design loads include their respective) reduction factors from ACI 318 Appendix D, Condition B

³Temperature Range A (long-term temperature 70°F, short-term temperature 110°F)

⁴Concrete compressive strength of 4,000 psi

⁵For periodic and continuous inspection with dry concrete

⁶Steel tensile strength of 125,000 psi (ASTM A193 Grade B7)

KEY	CONCRETE ⁴	ADHESIVE ⁵	STEEL ⁶
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