Technical Data Sheet
TDS-296-01909

IEA™

Injection Epoxy Adhesive

Building & Transportation | Oil, Gas & Industrial | Offshore & Onshore | Water & Wastewater

PRODUCT DESCRIPTION

The CTech-LLC® IEA™ is a high-strength, non-shrink, epoxy-based adhesive formulated for bonding threaded rod and reinforcing bar hardware into drilled holes in concrete and masonry base materials and for post-installed reinforcing bar connections.
Applied in one single action the two component IEA™ injection adhesive will produce a cost effective, strong and chemical resistant fixing.

ADVANTAGES

- Pre-cured and no onsite impregnation product.
- Code listed under the IBC/IRC for URM per ICC-ES ESR-1772
- Meets or exceeds the requirements of ASTM C881 specification for Type I and IV, Grade 3, Class C
- Cure times — 24 hours at 65°F (18°C), 72 hours at 40°F (4°C)
- Easy hole-cleaning procedure — no power-brushing required
- Suitable for use in damp or wet anchor sites
- When properly mixed, adhesive will be a uniform gray color
- Available in 22 oz. cartridge for application versatility

TYPICAL USES

- Threaded rod anchoring and rebar doweling into concrete, masonry and URM (red brick)
- Pick-proof sealant around doors, windows and fixtures
- Paste-over for crack injection preparation
- Bonding hardened concrete to hardened concrete

CODES

ICC-ES ESR-1772 (unreinforced masonry); Florida FL15730.5; AASHTO M-235 and ASTM C881 (Type I and IV, Grade 3, Class C).

TEST CRITERIA

Anchors installed with IEA™ adhesive have been tested in accordance with ICC-ES.
Acceptance Criteria for Anchors in Unreinforced Masonry Elements (AC60)

TECHNICAL DATA

Property	Test Method	Result*
Consistency	ASTM C881	Passed, Non-sag
Glass transition temperature	ASTM E1356	155°F
Heat deflection temperature	ASTM D648	136°F (58°C)
Bond strength (moist cure)	ASTM C882	2,916 psi (2 d) 3,366 psi (14 d)
Water absorption	ASTM D570	0.10%
Compressive yield strength	ASTM D695	14,110 psi
Compressive modulus	ASTM D695	612,970 psi (7 d)
Shore D Durometer	ASTM D2240	84
Gel time	ASTM C881	60 min
VOC	ASTM D2369	3 g/L

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

CURE SCHEDULE

Base Material Temperature		Gel Time	Cure Time
°F	°C	Min	hr
50	10	75	72
60	16	60	48
70	21	45	24
90	32	35	24
110	43	20	24

Note: For water-saturated concrete (including damp and water-filled holes), the cure times must be doubled.

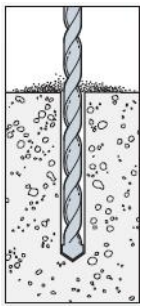
In-Service Temperature Sensitivity

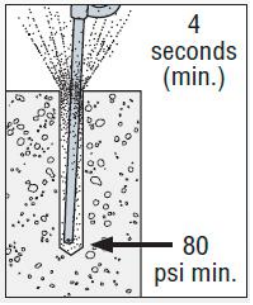
Base Material Temperature		Percent Allowable Load
°F	°C	
40	4	100%
70	21	100%
110	43	100%
135	57	75%
150	66	44%
180	82	20%

INSTALLATION PROCEDURE

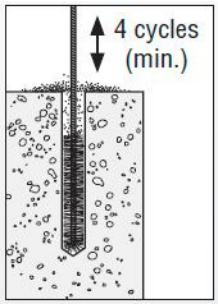
HOLE PREPARATION

- Drill: Drill hole to specified diameter and depth.
- Blow: Remove dust from hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle must reach the bottom of the hole.
- Brush: Clean with a nylon brush for a minimum of four cycles. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.
- Blow: Remove dust from hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle must reach the bottom of the hole.

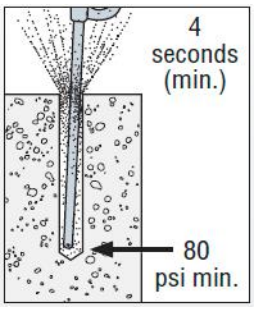

Drill



Blow



Brush

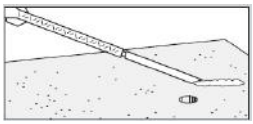


Blow

Cartridge Preparation

- Insert: Insert cartridge into dispensing tool.
- Dispense: Dispense adhesive to the side until properly mixed (uniform color).


Insert


Dispense

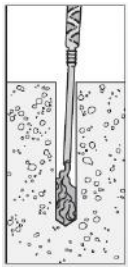
FILLING THE HOLE

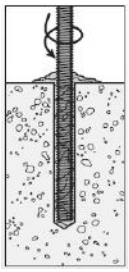
- *FOR SOLID BASE MATERIALS*

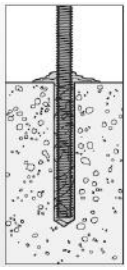
Fill: Fill hole completely full, starting from bottom of hole to prevent water pockets. Withdraw nozzle as hole fills up.

Insert: Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the hole.

Do not disturb: Do not disturb anchor until fully cured.


Fill


Insert


Do not disturb

IEA™ Design Information

IEA™ Allowable Tension Loads for Threaded Rod Anchors in Normal-Weight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength				Tension Load Based on Steel Strength		
					f'c ≥ 2,000 psi (13.8 MPa) Concrete		f'c ≥ 4,000 psi (27.6 MPa) Concrete		F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)
3/8 (9.5)	1/2	1 3/4 (44)	2 5/8 (67)	7 (178)	1,900 (8.5)	475 (2.1)	1,900 (8.5)	475 (2.1)	2,105 (9.4)	4,535 (20.2)	3,630 (16.1)
		3 1/2 (89)	5 1/4 (133)	18 (457)	10,613 (47.2)	2,655 (11.8)	10,613 (47.2)	2,655 (11.8)			
		4 1/2 (114)	6 3/4 (171)	18 (457)	10,613 (47.2)	2,655 (11.8)	10,613 (47.2)	2,655 (11.8)			
1/2 (12.7)	5/8	2 1/8 (54)	3 3/16 (81)	8 1/2 (216)	7,216 (32.1)	1,805 (8.0)	7,216 (32.1)	1,805 (8.0)	3,750 (16.7)	8,080 (35.9)	6,470 (28.8)
		4 1/4 (108)	6 3/8 (162)	17 (432)	17,700 (78.7)	4,425 (19.7)	18,400 (81.8)	4,600 (20.5)			
		6 (152)	9 (229)	24 (610)	18,556 (82.5)	4,640 (20.6)	18,556 (82.5)	4,640 (20.6)			
5/8 (15.9)	3/4	2 1/2 (64)	3 3/4 (95)	10 (254)	6,780 (30.2)	1,695 (7.5)	6,780 (30.2)	1,695 (7.5)	5,875 (26.1)	12,660 (56.3)	10,120 (45.0)
		3 3/4 (95)	5 5/8 (143)	15 (381)	------	4,190 (18.6)	------	4,875 (21.7)			
		5 (127)	7 1/2 (191)	20 (508)	26,700 (118.8)	6,680 (29.7)	32,200 (143.2)	8,050 (35.8)			
		7 3/16 (183)	10 7/8 (276)	28 3/4 (730)	------	7,515 (33.4)	------	8,200 (36.5)			
		9 3/8 (238)	14 1/8 (359)	37 1/2 (953)	33,402 (148.6)	8,350 (37.1)	33,402 (148.6)	8,350 (37.1)			
3/4 (19.1)	7/8	3 3/8 (86)	5 1/16 (129)	13 1/2 (343)	15,456 (68.8)	3,865 (17.2)	15,456 (68.8)	3,865 (17.2)	8,460 (37.6)	18,230 (81.1)	12,400 (55.2)
		5 1/16 (129)	7 5/8 (194)	20 1/4 (514)	—	7,195 (32.0)	—	7,245 (32.2)			
		6 3/4 (171)	10 1/8 (257)	27 (686)	42,100 (187.3)	10,525 (46.8)	42,480 (189.0)	10,620 (47.2)			
		9 (229)	13 1/2 (343)	36 (914)	—	11,220 (49.9)	—	11,265 (50.1)			
		11 1/4 (286)	16 7/8 (429)	45 (1,143)	47,634 (211.9)	11,910 (53.0)	47,634 (211.9)	11,910 (53.0)			
7/8 (22.2)	1	3 7/8 (98)	5 13/16 (148)	15 1/2 (394)	19,120 (85.1)	4,780 (21.3)	19,120 (85.1)	4,780 (21.3)	11,500 (51.2)	24,785 (110.2)	16,860 (75.0)
		5 13/16 (148)	8 3/4 (222)	23 1/4 (591)	—	8,535 (38.0)	—	9,250 (41.1)			
		7 3/4 (197)	11 5/8 (295)	31 (787)	49,160 (218.7)	12,290 (54.7)	54,880 (244.1)	13,720 (61.0)			
		10 7/16 (265)	15 5/8 (397)	41 3/4 (1,060)	—	14,480 (64.4)	—	15,195 (67.6)			
		13 1/8 (333)	19 5/8 (498)	52 1/2 (1,334)	66,679 (296.6)	16,670 (74.2)	66,679 (296.6)	16,670 (74.2)			

Continue on next page

IEA™ Allowable Tension Loads for Threaded Rod Anchors in Normal-Weight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength				Tension Load Based on Steel Strength		
					f'c ≥ 2,000 psi (13.8 MPa) Concrete		f'c ≥ 4,000 psi (27.6 MPa) Concrete		F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)
1 (25.4)	1 1/8	4 1/2 (114)	6 3/4 (171)	18 (457)	20,076 (89.3)	5,020 (22.3)	20,076 (89.3)	5,020 (22.3)	15,025 (66.8)	32,380 (144.0)	22,020 (97.9)
		6 3/4 (171)	10 1/8 (257)	27 (686)	—	10,020 (44.6)	—	10,640 (47.3)			
		9 (229)	13 1/2 (343)	36 (914)	60,060 (267.2)	15,015 (66.8)	65,020 (289.2)	16,255 (72.3)			
		12 (305)	18 (457)	48 (1,219)	—	17,810 (79.2)	—	18,430 (82.0)			
		15 (381)	22 1/2 (572)	60 (1,524)	82,401 (366.5)	20,600 (91.6)	82,401 (366.5)	20,600 (91.6)			
1 1/8 (28.6)	1 1/4	5 1/8 (130)	7 3/4 (197)	20 1/2 (521)	27,560 (122.6)	6,890 (30.6)	27,560 (122.6)	6,890 (30.6)	19,025 (84.6)	41,000 (182.4)	27,880 (124.0)
		7 5/8 (194)	11 1/2 (292)	30 1/2 (775)	—	12,105 (53.8)	—	12,500 (55.6)			
		10 1/8 (257)	15 1/4 (387)	40 1/2 (1,029)	69,200 (307.8)	17,300 (77.0)	72,340 (321.8)	18,085 (80.4)			
		13 1/2 (343)	20 1/4 (514)	54 (1,372)	—	21,380 (95.1)	—	21,770 (96.8)			
		16 7/8 (429)	25 3/8 (645)	67 1/2 (1,715)	101,820 (452.9)	25,455 (113.2)	101,820 (452.9)	25,455 (113.2)			
1 1/4 (31.8)	1 3/8	5 5/8 (143)	8 7/16 (214)	22 1/2 (572)	35,858 (159.5)	8,965 (39.9)	35,858 (159.5)	8,965 (39.9)	23,490 (104.5)	50,620 (225.2)	34,425 (153.1)
		8 7/16 (214)	12 3/4 (324)	33 3/4 (857)	—	14,115 (62.8)	—	14,115 (62.8)			
		11 1/4 (286)	16 7/8 (429)	45 (1,143)	77,045 (342.7)	19,260 (85.7)	77,045 (342.7)	19,260 (85.7)			
		15 (381)	22 1/2 (572)	60 (1,524)	—	24,965 (111.0)	—	24,965 (111.0)			
		18 3/4 (476)	28 1/8 (714)	75 (1,905)	122,681 (545.7)	30,670 (136.4)	122,681 (545.7)	30,670 (136.4)			

1- Allowable load must be the lesser of the bond or steel strength.
2- The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3- Refer to allowable load-adjustment factors for spacing and edge distance
4- Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5- Allowable load based on bond strength may be interpolated for concrete compressive strengths between 2,000 psi and 4,000 psi.

IEA™ Allowable Shear Loads for Threaded Rod Anchors in Normal-Weight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength f'c ≥ 2,000 psi (13.8 MPa) Concrete		Tension Load Based on Steel Strength		
							F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)
3/8 (9.5)	1/2	1 3/4 (44)	5 1/4 (133)	2 5/8 (67)	4,573 (20.3)	1,145 (5.1)	1,085 (4.8)	2,340 (10.4)	1,870 (8.3)
		3 1/2 (89)		5 1/4	6,935 (30.8)	1,735 (7.7)			
		4 1/2 (114)		(133)	—	1,735 (7.7)			
1/2 (12.7)	5/8	2 1/8 (54)	6 3/8 (162)	3 1/4 (83)	7,001 (31.1)	1,750 (7.8	1,930 (8.6)	4,160 (18.5)	3,330 (14.8)
		4 1/4 (108)		6 3/8 (162)	11,116 (49.4)	2,780 (12.4)			
		6 (152)		6 3/8 (162)	—	2,780 (12.4)			
5/8 (15.9)	3/4	2 1/2 (64)	7 1/2 (191)	3 3/4 (95)	14,427 (64.2)	3,605 (16.0)	3,025 (13.5)	6,520 (29.0)	5,220 (23.2)
		5 (127)		7 1/2 (191)	19,501 (86.7)	4,875 (21.7)			
		9 3/8 (238)		7 1/2 (191)	—	4,875 (21.7)			
3/4 (19.1)	7/8	3 3/8 (86)	10 1/8 (257)	5 1/8 (130)	21,180 (94.2)	5,295 (23.6)	4,360 (19.4)	9,390 (41.8)	6,385 (28.4)
		6 3/4 (171)		10 1/8 (257)	25,244 (112.3)	6,310 (28.1)			
		11 1/4 (286)		10 1/8 (257)	—	6,310 (28.1)			
7/8 (22.2)	1	3 7/8 (98)	11 5/8 (295)	5 7/8 (149)	28,333 (126.0)	7,085 (31.5)	5,925 (26.4)	12,770 (56.8)	8,685 (38.6)
		7 3/4 (197)		11 5/8 (295)	33,533 (149.2)	8,385 (37.3)			
		13 1/8 (333)		11 5/8 (295)	—	8,385 (37.3)			
1 (25.4)	1 1/8	4 1/2 (114)	13 1/2 (343)	6 3/4 (171)	30,520 (135.8)	7,630 (33.9)	7,740 (34.4)	16,680 (74.2)	11,345 (50.5)
		9 (229)		13 1/2 (343)	50,187 (223.2)	12,545 (55.8)			
		15 (381)		13 1/2 (343)	—	12,545 (55.8)			
1 1/8 (28.6)	1 1/4	5 1/8 (130)	16 7/8 (429)	8 1/2 (216)	52,130 (231.9)	13,035 (58.0)	9,800 (43.6)	21,125 (94.0)	14,365 (63.9)
		10 1/8 (257)		16 7/8 (429)	66,383 (295.3)	16,595 (73.8)			
		16 7/8 (429)		16 7/8 (429)	—	16,595 (73.8)			
1 1/4 (31.8)	1 3/8	5 5/8 (143)	16 7/8 (429)	8 1/2(216)	52,130 (231.9)	13,035 (58.0)	12,100 (53.8)	26,075 (116.0)	17,730 (78.9)
		11 1/4 (286)		16 7/8 (429)	66,383 (295.3)	16,595 (73.8)			
		18 3/4 (476)		16 7/8 (429)	—	16,595 (73.8)			

1- Allowable load must be the lesser of the bond or steel strength.
2- The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3- Refer to allowable load-adjustment factors for spacing and edge distance
4- Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.

IEA™ Allowable Tension Loads for Rebar Dowels in Normal-Weight Concrete

Rebar Size No. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength				Tension Load Based on Steel Strength
					f'c ≥ 2,000 psi (13.8 MPa) Concrete		f'c ≥ 4,000 psi (27.6 MPa) Concrete		ASTM A615 Grade 60 Rebar
					Ultimate lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)
#4 (12.7)	5/8	4 1/4 (108)	6 3/8 (162)	17 (432)	16,480 (73.3)	4,120 (18.3)	18,320 (81.5)	4,580 (20.4)	4800 (21.4)
		6 (152)	9 (229)	24 (610)	19,360 (86.1)	4,840 (21.5)	—	4,840 (21.5)	
#5 (15.9)	3/4	5 (127)	7 1/2 (191)	20 (508)	24,600 (109.4)	6,150 (27.4)	26,040 (115.8)	6,510 (29.0)	7440 (33.1)
		9 3/8 (238)	14 1/8 (359)	37 1/2 (953)	48,380 (215.2)	12,095 (53.8)	48,380 (215.2	12,095 (53.8)	
#6 (19.1)	7/8	6 3/4 (171)	10 1/8 (257	27 (686)	38,380 (170.7)	9,595 (42.7)	40,500 (180.2)	10,125 (45.0)	10560 (47.0)
		11 1/4 (286)	16 7/8 (429)	45 (1,143)	65,020 (289.2)	16,255 (72.3)	65,020 (289.2	16,255 (72.3)	
#7 (22.2)	1	7 3/4 (197)	11 5/8 (295)	31 (787)	47,760 (212.4)	11,940 (53.1)	47,760 (212.4)	11,940 (53.1)	14400 (64.1)
		13 1/8 (333)	19 5/8 (498)	52 1/2 (1,334)	81,560 (362.8)	20,390 (90.7)	81,560 (362.8	20,390 (90.7)	
#8 (25.4)	1 1/8	9 (229)	13 1/2 (343)	36 (914)	53,680 (238.8)	13,420 (59.7)	53,680 (238.8	13,420 (59.7)	18960 (84.3)
		15 (381)	22 1/2 (572)	60 (1,524)	94,240 (419.2)	23,560 (104.8)	94,240 (419.2)	23,560 (104.8)	
#9 (28.6)	1 1/4	10 1/8 (257)	15 1/4 (387)	40 1/2 (1,029)	53,680 (238.8)	13,420 (59.7)	53,680 (238.8)	13,420 (59.7)	24000 (106.8)
		16 7/8 (429)	25 3/8 (645)	67 1/2 (1,715)	111,460 (495.8)	27,865 (123.9)	111,460 (495.8)	27,865 (123.9)	
#10 (31.8)	1 1/2	11 1/4 (286)	16 7/8 (429)	45 (1,143)	76,000 (338.1)	19,000 (84.5)	76,000 (338.1)	19,000 (84.5)	30480 (135.6)
		18 3/4 (476)	28 (711)	75 (1,905)	125,840 (559.8)	31,460 (139.9)	125,840 (559.8)	31,460 (139.9)	
#11 (34.9)	1 5/8	12 3/8 (314)	18 5/8 (473)	49 1/2 (1,257)	87,500 (389.2)	21,875 (97.3)	87,500 (389.2	21,875 (97.3)	37440 (166.5)
		20 5/8 (524)	28 (711)	82 1/2 (2,096)	132,080 (587.5)	33,020 (146.9)	132,080 (587.5)	33,020 (146.9)	

1. Allowable load must be the lesser of the bond or steel strength.
2. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Allowable load based on bond strength may be interpolated for concrete compressive strengths between 2,000 psi and 4,000 psi.

IEA™ Allowable Shear Loads for Rebar Dowels in Normal-Weight Concrete

Rebar Size No. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength f'c ≥ 2,000 psi (13.8 MPa) Concrete		Tension Load Based on Steel Strength ASTM A615 Grade 60 Rebar
					Ultimate lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)
#4 (12.7)	5/8	4 1/4 (108)	6 3/8 (162)	6 3/8 (162)	15,156 (67.4)	3,790 (16.9)	3060 (13.6)
		6 (152)			15,156 (67.4)	3,790 (16.9)	
#5 (15.9)	3/4	5 (127)	7 1/2 (191)	7 1/2 (191)	24,245 (107.8)	6,060 (27.0)	4740 (21.1)
		9 3/8 (238)			24,245 (107.8)	6,060 (27.0)	
#6 (19.1)	7/8	6 3/4 (171)	10 1/8 (257)	10 1/8 (257)	33,195 (147.7)	8,300 (36.9)	6730 (29.9)
		11 1/4 (286)			33,195 (147.7)	8,300 (36.9)	
#7 (22.2)	1	7 3/4 (197)	11 5/8 (295)	11 5/8 (295)	47,017 (209.1)	11,755 (52.3)	9180 (40.8)
		13 1/8 (333)			47,017 (209.1)	11,755 (52.3)	
#8 (25.4)	1 1/8	9 (229)	13 1/2 (343)	13 1/2 (343)	58,880 (261.9)	14,720 (65.5)	12085 (53.8)
		15 (381)			58,880 (261.9)	14,720 (65.5)	
#9 (28.6)	1 1/4	10 1/8 (257)	15 1/4 (387)	15 1/4 (387)	58,880 (261.9)	14,720 (65.5)	15300 (68.1)
		16 7/8 (429)			58,880 (261.9)	14,720 (65.5)	
#10 (31.8)	1 1/2	11 1/4 (286)	16 7/8 (429)	16 7/8 (429)	65,840 (292.9)	16,460 (73.2)	19430 (86.4)
		18 3/4 (476)			65,840 (292.9)	16,460 (73.2)	
#11 (34.9)	1 5/8	12 3/8 (314)	18 5/8 (473)	18 5/8 (473)	81,400 (362.1)	20,350 (90.5)	23.870 (106.2)
		20 5/8 (524)			81,400 (362.1)	20,350 (90.5)	

1. Allowable load must be the lesser of the bond or steel strength.
2. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance .
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.

IEA™ Allowable Load Adjustment Factors in Normal-Weight Concrete: Edge Distance, Tension and Shear Load

How to use these charts:

- The following tables are for reduced edge distance.
- Locate the anchor size to be used for either a tension and/or shear load application.
- Locate the embedment (E) at which the anchor is to be installed.
- Locate the edge distance (c_{act}) at which the anchor is to be installed.
- The load-adjustment factor (fc) is the intersection of the row and column.
- Multiply the allowable load by the applicable load-adjustment factor.
- Reduction factors for multiple edges are multiplied together.
- Adjustment factors do not apply to allowable steel strength values.
- Adjustment factors are to be applied to allowable tension / shear load based on bond strength values only.

- Note That:

E = Embedment depth (inches).

c_{act} = actual edge distance at which anchor is installed (inches).

c_{cr} = critical edge distance for 100% load (inches).

c_{min} = minimum edge distance for reduced load (inches).

f_c = adjustment factor for allowable load at actual edge distance.

f_{ccr} = adjustment factor for allowable load at critical edge distance. f_{ccr} is always = 1.00.

f_{cmin} = adjustment factor for allowable load at minimum edge distance.

$fc = f_{cmin} + [(1 - f_{cmin}) (c_{act} - c_{min}) / (c_{cr} - c_{min})]$.

Edge Distance Tension (fc)

Edge Dist. c_{act} (in.)	Dia.	3/8			1/2			5/8			3/4		
	Rebar					#4			#5			#6	
	E	13/4	31/2	41/2	21/8	41/4	6	21/2	5	93/8	33/8	63/4	111/4
	c_{cr}	25/8	51/4	63/4	31/4	63/8	9	33/4	71/2	141/8	51/8	101/8	167/8
	c_{min}	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4
	f_{cmin}	0.65	0.65	0.69	0.65	0.65	0.59	0.48	0.48	0.64	0.48	0.48	0.57
13/4		0.65	0.65	0.69	0.65	0.65	0.59	0.48	0.48	0.64	0.48	0.48	0.57
2		0.75	0.68	0.71	0.71	0.67	0.60	0.55	0.50	0.65	0.52	0.50	0.58
3		1.00	0.78	0.77	0.95	0.74	0.66	0.81	0.59	0.68	0.68	0.56	0.61
4			0.88	0.83	1.00	0.82	0.72	1.00	0.68	0.71	0.83	0.62	0.63
5			0.98	0.89		0.90	0.77		0.77	0.73	0.99	0.68	0.66
6			1.00	0.95		0.97	0.83		0.86	0.76	1.00	0.74	0.69
7				1.00		1.00	0.89		0.95	0.79		0.81	0.72
8							0.94		1.00	0.82		0.87	0.75
9							1.00			0.85		0.93	0.78
10										0.88		0.99	0.80
11										0.91		1.00	0.83
12										0.94			0.86
14										1.00			0.92
16													0.98
17													1.00

Edge Distance Tension (fc) (continued)

Edge Dist. c_{act} (in.)	Dia.	7/8			1			1 1/8			1 1/4				
	Rebar		#7			#8			#9			#10		#11	
	E	3 7/8	7 3/4	13 1/8	4 1/2	9	15	5 1/8	10 1/8	16 7/8	5 5/8	11 1/4	18 3/4	12 3/8	20 5/8
	c_{cr}	5 7/8	11 5/8	19 5/8	6 3/4	13 1/2	22 1/2	7 3/4	15 1/4	25 3/8	8 1/2	16 7/8	28 1/8	28 1/8	28 1/8
	c_{min}	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
	f_{cmin}	0.48	0.48	0.52	0.48	0.48	0.47	0.58	0.58	0.51	0.58	0.58	0.51	0.58	0.51
1 3/4		0.48	0.48	0.52	0.48	0.48	0.47								
2 3/4		0.61	0.53	0.55	0.58	0.52	0.50	0.58	0.58	0.51	0.58	0.58	0.51	0.58	0.51
4		0.77	0.60	0.58	0.71	0.58	0.53	0.69	0.62	0.54	0.67	0.62	0.53	0.61	0.53
6		1.00	0.70	0.63	0.92	0.67	0.58	0.85	0.69	0.58	0.82	0.68	0.57	0.67	0.57
8			0.81	0.69	1.00	0.76	0.63	1.00	0.76	0.62	0.97	0.74	0.61	0.72	0.61
10			0.91	0.74		0.85	0.68		0.82	0.67	1.00	0.80	0.65	0.77	0.65
12			1.00	0.80		0.93	0.73		0.89	0.71		0.86	0.69	0.82	0.69
14				0.85		1.00	0.78		0.96	0.75		0.91	0.73	0.88	0.73
16				0.90			0.83		1.00	0.80		0.97	0.77	0.93	0.77
18				0.96			0.89			0.84		1.00	0.80	0.98	0.81
20				1.00			0.94			0.88			0.84	1.00	0.84
24							1.00			0.97			0.92		0.92
28										1.00			1.00		1.00

Edge Distance Shear (fc)

Edge Dist. c_{act} (in.)	Dia.	3/8			1/2			1/2	5/8			5/8		3/4		3/4	
	Rebar						#4				#5					#6	
	E	1 3/4	3 1/2	4 1/2	2 1/8	4 1/4	4 1/4	6	2 1/2	5	5	9 3/8	3 3/8	6 3/4	6 3/4	11 1/4	
	c_{cr}	5 1/4	5 1/4	5 1/4	6 3/8	6 3/8	6 3/8	6 3/8	7 1/2	7 1/2	7 1/2	7 1/2	10 1/8	10 1/8	10 1/8	10 1/8	
	c_{min}	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	
	f_{cmin}	0.49	0.32	0.35	0.37	0.20	0.25	0.24	0.18	0.15	0.21	0.19	0.16	0.16	0.18	0.15	
1 3/4		0.49	0.32	0.35	0.37	0.20	0.25	0.24	0.18	0.15	0.21	0.19	0.16	0.16	0.18	0.15	
2		0.53	0.37	0.40	0.40	0.24	0.29	0.28	0.22	0.19	0.24	0.23	0.19	0.19	0.20	0.18	
3		0.67	0.56	0.58	0.54	0.42	0.45	0.45	0.36	0.33	0.38	0.37	0.29	0.29	0.30	0.28	
4		0.82	0.76	0.77	0.68	0.59	0.61	0.61	0.50	0.48	0.52	0.51	0.39	0.39	0.40	0.38	
5		0.96	0.95	0.95	0.81	0.76	0.78	0.77	0.64	0.63	0.66	0.65	0.49	0.49	0.50	0.48	
6		1.00	1.00	1.00	0.95	0.94	0.94	0.94	0.79	0.78	0.79	0.79	0.59	0.59	0.60	0.58	
7					1.00	1.00	1.00	1.00	0.93	0.93	0.93	0.93	0.69	0.69	0.69	0.68	
8									1.00	1.00	1.00	1.00	0.79	0.79	0.79	0.78	
9													0.89	0.89	0.89	0.89	
10													0.99	0.99	0.99	0.99	
11													1.00	1.00	1.00	1.00	

Edge Distance Shear (fc) (continued)

Edge Dist. c_{act} (in.)	Dia.	7/8			7/8	1			1	1 1/8			1 1/4				
	Rebar			#7				#8			#9			#10		#11	
	E	3 7/8	7 3/4	7 3/4	13 1/8	4 1/2	9	9	15	5 1/8	10 1/8	16 7/8	5 5/8	11 1/4	18 3/4	12 3/8	20 5/8
	c_{cr}	11 5/8	11 5/8	11 5/8	11 5/8	13 1/2	13 1/2	13 1/2	13 1/2	15 1/4	15 1/4	15 1/4	16 7/8	16 7/8	16 7/8	18 5/8	18 5/8
	c_{min}	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
	f_{cmin}	0.14	0.13	0.14	0.10	0.14	0.10	0.12	0.10	0.17	0.16	0.12	0.17	0.16	0.12	0.16	0.12
1 3/4		0.14	0.13	0.14	0.10	0.14	0.10	0.12	0.10								
2 3/4		0.23	0.22	0.23	0.19	0.21	0.18	0.19	0.18	0.17	0.16	0.12	0.17	0.16	0.12	0.16	0.12
3		0.25	0.24	0.25	0.21	0.23	0.20	0.21	0.20	0.19	0.18	0.14	0.18	0.17	0.14	0.17	0.13
4		0.34	0.33	0.34	0.31	0.30	0.27	0.29	0.27	0.25	0.24	0.21	0.24	0.23	0.20	0.23	0.19
5		0.42	0.42	0.42	0.40	0.38	0.35	0.36	0.35	0.32	0.31	0.28	0.30	0.29	0.26	0.28	0.24
6		0.51	0.50	0.51	0.49	0.45	0.43	0.44	0.43	0.39	0.38	0.35	0.36	0.35	0.32	0.33	0.30
7		0.60	0.59	0.60	0.58	0.52	0.50	0.51	0.50	0.45	0.45	0.42	0.42	0.41	0.38	0.38	0.36
8		0.68	0.68	0.68	0.67	0.60	0.58	0.59	0.58	0.52	0.51	0.49	0.48	0.47	0.45	0.44	0.41
9		0.77	0.77	0.77	0.76	0.67	0.66	0.66	0.66	0.59	0.58	0.56	0.54	0.53	0.51	0.49	0.47
10		0.86	0.86	0.86	0.85	0.74	0.73	0.74	0.73	0.65	0.65	0.63	0.60	0.59	0.57	0.54	0.52
11		0.95	0.94	0.95	0.94	0.82	0.81	0.81	0.81	0.72	0.71	0.70	0.65	0.65	0.63	0.60	0.58
12		1.00	1.00	1.00	1.00	0.89	0.89	0.89	0.89	0.78	0.78	0.77	0.71	0.71	0.70	0.65	0.63
13						0.96	0.96	0.96	0.96	0.85	0.85	0.84	0.77	0.77	0.76	0.70	0.69
14						1.00	1.00	1.00	1.00	0.92	0.92	0.91	0.83	0.83	0.82	0.76	0.74
15										0.98	0.98	0.98	0.89	0.89	0.88	0.81	0.80
16										1.00	1.00	1.00	0.95	0.95	0.95	0.86	0.85
17													1.00	1.00	1.00	0.91	0.91
18 5/8																1.00	1.00

IAA™ Allowable Load Adjustment Factors in Normal-Weight Concrete: Spacing, Tension and Shear Load

How to use these charts:

- The following tables are for reduced *Spacing.*
- Locate the anchor size to be used for either a tension and/or shear load application.
- Locate the embedment (E) at which the anchor is to be installed.
- Locate the spacing (s_{act}) at which the anchor is to be installed.
- The load-adjustment factor (f_s) is the intersection of the row and column.
- Multiply the allowable load by the applicable load-adjustment factor.
- Reduction factors for multiple spacings are multiplied together.
- Adjustment factors do not apply to allowable steel strength values.
- Adjustment factors are to be applied to allowable tension / shear load based on bond strength values only.
- Note That:

E = Embedment depth (inches).
S_{act} = actual spacing distance at which anchor is installed (inches).
S_{cr} = critical space distance for 100% load (inches).
S_{min} = minimum spacing distance for reduced load (inches).
F_s = adjustment factor for allowable load at actual spacing distance.
F_{scr} = adjustment factor for allowable load at critical spacing distance.
F_{scr} is always = 1.00.
f_{smin} = adjustment factor for allowable load at minimum spacing distance.
$F_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

Spacing Tension (f_s)

s_{act} (in.)	Dia.	3/8			1/2			5/8			3/4		
	Rebar					#4			#5			#6	
	E	13/4	31/2	41/2	21/8	41/4	6	21/2	5	93/8	33/8	63/4	111/4
	s_{cr}	7	14	18	81/2	17	24	10	20	371/2	131/2	27	45
	s_{min}	7/8	13/4	21/4	11/8	21/8	3	11/4	21/2	43/4	13/4	33/8	55/8
	f_{smin}	0.52	0.89	0.90	0.52	0.89	0.90	0.52	0.89	0.90	0.52	0.89	0.90
7/8		0.52											
1		0.53											
2		0.61	0.89		0.58			0.56			0.53		
4		0.76	0.91	0.91	0.71	0.90	0.90	0.67	0.90		0.61	0.89	
6		0.92	0.93	0.92	0.84	0.92	0.91	0.78	0.91	0.90	0.69	0.90	0.90
8		1.00	0.95	0.94	0.97	0.93	0.92	0.89	0.92	0.91	0.78	0.91	0.91
10			0.96	0.95	1.00	0.95	0.93	1.00	0.94	0.92	0.86	0.92	0.91
12			0.98	0.96		0.96	0.94		0.95	0.92	0.94	0.93	0.92
14			1.00	0.97		0.98	0.95		0.96	0.93	1.02	0.94	0.92
16				0.99		0.99	0.96		0.97	0.93		0.95	0.93
18				1.00		1.00	0.97		0.99	0.94		0.96	0.93
20							0.98		1.00	0.95		0.97	0.94
24							1.00			0.96		0.99	0.95
28										0.97		1.00	0.96
32										0.98			0.97
36										1.00			0.98
40										1.00			0.99
45													1.00

Spacing Tension (f_s) (continued)

s_{act} (in.)	Dia.	7/8			1			11/8			11/4				
	Rebar		#7			#8			#9			#10		#11	
	E	37/8	73/4	131/8	41/2	9	15	51/8	101/8	167/8	55/8	111/4	183/4	123/8	205/8
	s_{cr}	151/2	31	521/2	18	36	60	201/2	401/2	671/2	221/2	45	75	491/2	821/2
	s_{min}	2	37/8	65/8	21/4	41/2	71/2	25/8	51/8	81/2	27/8	55/8	93/8	61/4	103/8
	f_{smin}	0.52	0.89	0.90	0.52	0.89	0.90	0.52	0.89	0.90	0.52	0.89	0.90	0.89	0.90
2		0.52													
3		0.56			0.54			0.53			0.52				
4		0.59	0.89		0.57			0.56			0.55				
5		0.63	0.89		0.60	0.89		0.58			0.57				
6		0.66	0.90		0.63	0.90		0.61	0.89		0.60	0.89			
8		0.73	0.91	0.90	0.70	0.90	0.90	0.66	0.90		0.65	0.90		0.89	
10		0.80	0.91	0.91	0.76	0.91	0.90	0.72	0.91	0.90	0.69	0.90	0.90	0.90	
12		0.88	0.92	0.91	0.82	0.92	0.91	0.77	0.91	0.91	0.74	0.91	0.90	0.90	0.90
14		0.95	0.93	0.92	0.88	0.92	0.91	0.83	0.92	0.91	0.79	0.91	0.91	0.91	0.91
16		1.00	0.94	0.92	0.94	0.93	0.92	0.88	0.92	0.91	0.84	0.92	0.91	0.91	0.91
20			0.96	0.93	1.00	0.94	0.92	0.99	0.94	0.92	0.94	0.93	0.92	0.92	0.91
24			0.97	0.94		0.96	0.93	1.00	0.95	0.93	1.00	0.94	0.92	0.94	0.92
28			0.99	0.95		0.97	0.94		0.96	0.93		0.95	0.93	0.95	0.92
32			1.00	0.96		0.99	0.95		0.97	0.94		0.96	0.93	0.96	0.93
36				0.96		1.00	0.95		0.99	0.95		0.97	0.94	0.97	0.94
40				0.97			0.96		1.00	0.95		0.99	0.95	0.98	0.94
50				0.99			0.98			0.97		1.00	0.96	1.00	0.95
60				1.00			1.00			0.99			0.98		0.97
70										1.00			0.99		0.98
75													1.00		0.99
821/2															1.00

Spacing Shear (f_s)

s_{act} (in.)	Dia.	3/8		1/2		5/8		3/4		7/8		1		1 1/8		1 1/4		
	Rebar				#4		#5		#6		#7		#8		#9		#10	#11
	E	1 3/4	3 1/2	2 1/8	4 1/4	2 1/2	5	3 3/8	6 3/4	3 7/8	7 3/4	4 1/2	9	5 1/8	10 1/8	5 5/8	11 1/4	12 3/8
	s_{cr}	2 5/8	5 1/4	3 1/4	6 3/8	3 3/4	7 1/2	5 1/8	10 1/8	5 7/8	11 5/8	6 3/4	13 1/2	7 3/4	15 1/4	8 1/2	16 7/8	18 5/8
	s_{min}	7/8	1 3/4	1 1/8	2 1/8	1 1/4	2 1/2	1 3/4	3 3/8	2	3 7/8	2 1/4	4 1/2	2 5/8	5 1/8	2 7/8	5 5/8	6 1/4
	f_{smin}	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.83
7/8		0.90																
1		0.91																
1 1/2		0.94		0.92		0.91												
2		0.96	0.84	0.94		0.93		0.91		0.90								
2 1/2		0.99	0.87	0.96	0.85	0.95	0.83	0.92		0.91		0.91						
3		1.00	0.89	0.99	0.87	0.97	0.85	0.94		0.93		0.92		0.91		0.90		
3 1/2			0.92	1.00	0.89	0.99	0.86	0.95	0.83	0.94		0.93		0.92		0.91		
4			0.94		0.91	1.00	0.88	0.97	0.85	0.95	0.83	0.94		0.93		0.92		
5			0.99		0.95		0.92	1.00	0.87	0.98	0.85	0.96	0.84	0.95		0.94		
6			1.00		0.99		0.95		0.90	1.00	0.88	0.98	0.86	0.97	0.84	0.96	0.84	
7					1.00		0.98		0.92		0.90	1.00	0.88	0.99	0.86	0.97	0.85	0.84
8							1.00		0.95		0.92		0.90	1.00	0.88	0.99	0.87	0.85
9									0.97		0.94		0.92		0.90	1.00	0.88	0.87
10									1.00		0.96		0.93		0.91		0.90	0.88
12											1.00		0.97		0.95		0.93	0.91
14													1.00		0.98		0.96	0.94
16															1.00		0.99	0.96
17																	1.00	0.98
18 5/8																		1.00

CTech-LLC®
CYTEC's Composite Technology
technical@ctech-llc.com
info@ctech-llc.com
www.CTech-LLC.com