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DIVISION: 04—MASONRY
Section: 04081—Masonry Anchorage

REPORT HOLDER:

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EVALUATION SUBJECT:

POWERS POWER-FAST EPOXY ADHESIVE ANCHORING SYSTEM

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2006 *International Building Code*® (2006 IBC)
- 2006 *International Residential Code*® (2006 IRC)
- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)
- 2000 *International Building Code*® (2000 IBC)
- 2000 *International Residential Code*® (2000 IRC)
- 1997 *Uniform Building Code*™ (UBC)
- 1999 *Standard Building Code*® (SBC)

Properties evaluated:

Structural

2.0 USES

The anchoring system is an alternative to the cast-in-place anchors described in Section 2107.1 of the IBC and Section 2107 of the UBC. The anchors are permitted to be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 General:

The Power-Fast Adhesive Anchor System consists of an adhesive and threaded rods or steel reinforcing bars. The adhesive is available in a Standard Set formulation.

3.2 Materials:

3.2.1 Adhesive: The Power-Fast epoxy adhesive is a two-component structural epoxy that is packaged in equal-volume, dual plastic cartridges that separate the adhesive components and allow for multiple uses. The

components include a base resin and a hardener that are mixed in a 1-to-1 ratio as they are dispensed through a disposable static-element mixing nozzle (supplied by Powers Fasteners, Inc.). The Power-Fast epoxy adhesive is available in a Standard Set formulation. Cure times, as recommended by the manufacturer, are noted in Table 18. The minimum shelf life of the adhesives is two years when stored in a dry environment at temperatures between 40°F and 90°F (4.4°C to 32.2°C).

3.2.2 Screen Tube: Screen tubes consist of stainless steel mesh that is open at one end and closed at the other. The screen tube diameters correspond to the desired anchor diameter, and the tube length is based on required embedment depth.

3.2.3 Threaded Rods: Threaded rods shall have a diameter from $\frac{3}{8}$ inch to $\frac{5}{8}$ inches (9.5 to 15.9 mm) and shall be manufactured from carbon steel in compliance with ASTM A 36; ASTM A 307, Grade C; or ASTM A 193, Grade B7; or shall be stainless steel in compliance with ASTM F 593, Condition CW, Type 304 or 316. When anchors are used for exterior installations, zinc coating on threaded rods shall be either hot-dipped in accordance with ASTM A 153 with a Class C or D coating weight, or mechanically deposited in accordance with ASTM B 695 with a Class 65 coating having a minimum thickness of 2.1 mils (0.533 mm). Specification and installation requirements for the threaded rods are listed in Tables 2, 3 and 4.

3.2.4 Concrete Masonry Units: When prism tests are required, the concrete masonry must have a minimum compressive strength of 1,500 psi (9.58 MPa) at the time of anchor installation. Concrete masonry units may be lightweight, normal-weight, or heavyweight blocks, minimum Grade N, Type II, in accordance with UBC Standard 21-4 or ASTM C 90 (IBC or IRC).

Mortar must be minimum Type N in accordance with Section 2103.3 of the UBC, Section 2103.8 of the IBC, or Section R607 of the IRC. Grout shall comply with Section 2103.4 of the UBC, Section 2103.12 of the IBC, or Section R609.1.1 of the IRC, and shall have a minimum compressive strength of 2,000 psi (13.78 MPa).

4.0 DESIGN AND INSTALLATION

4.1 Design:

The allowable tension and shear loads for the anchors are noted in Tables 5 and 6. The anchor spacing and edge distance requirements are given in Tables 5 and 6 for concrete masonry. The allowable tension and shear loads for the adhesives must be adjusted for elevated temperatures in accordance with Figure 1. Allowable loads for anchors subjected to combined tension and shear forces are determined by the following equation:

$$(P_s / P_t) + (V_s / V_t) \leq 1$$

where:

P_s = Applied service tension load.

P_t = Service tension load.

V_s = Applied service shear load.

V_t = Service shear load.

The Power-Fast epoxy adhesive Standard Set formulation is permitted for dead, live, wind, or earthquake loads under the conditions described in Section 5.0.

4.2 Installation:

4.2.1 General: Anchors shall be installed in accordance with the manufacturer's published installation instructions and the requirements of this report. The anchors shall not be installed until the concrete or concrete masonry has reached its minimum design compressive strength. Anchor holes are predrilled into concrete or masonry substrates at a predetermined depth, using a rotary hammer drill with a carbide-tipped drill bit that complies with ANSI B212.15-1994. The anchor hole must be cleaned of dust and debris using compressed air and a nylon brush. Holes are permitted to be dry or damp, but standing water shall be removed. The hole diameter, embedment depth, spacing, edge distance, and concrete shall comply with the requirements of this report.

4.2.2 Installation in Grouted Concrete Masonry: The Power-Fast epoxy adhesive is injected into the hole from a static-element mixing nozzle, starting at the bottom, until the hole is approximately one-half full. The threaded rod or reinforcing bar is inserted into the hole, while rotating, to the required embedment depth. See Figures 2, 3 and 4 for installation details concerning permitted anchor location in concrete masonry substrates. The anchors must be allowed to cure in accordance with Table 7 prior to application of the design load.

4.2.3 Installation in Hollow Concrete Masonry: A rotary drill or rotary hammer drill set in rotation-only mode is used to drill the holes. The Power-Fast epoxy adhesive is injected into a screen tube until the tube is completely full. The screen tube is then inserted into the predrilled hole. A threaded rod is inserted to the bottom of the epoxy-filled screen tube, while rotating, to ensure complete coating of the rod. See Figures 2, 3 and 4 for installation details concerning permitted anchor location in concrete masonry substrates. The anchors must be allowed to cure in accordance with Table 7 prior to application of the design load.

4.3 Special Inspection:

Adhesive anchor installations require special inspection in accordance with IBC Section 1704 or UBC Section 1701. Special inspection in accordance with Section 1704 of the IBC shall be provided for installations under the IRC. The code official shall receive a report, from an approved special inspector, that includes the following details:

1. Adhesive anchor description, including the adhesive product name and expiration date; and anchor bolt or rod material, grade, diameter, length and cleanliness.
2. Hole description, including verification of drill bit compliance with ANSI B212.15-1994, hole depth and cleanliness.
3. Installation description, including verification in accordance with Section 2105.3 of the IBC or Section 2105.3.5 of the UBC for concrete masonry compressive strength, installation temperature and verification of anchor

installation and location (spacing and edge distance) in accordance with the published installation instructions and this report.

5.0 CONDITIONS OF USE

The Power-Fast Epoxy Adhesive Anchor System described in this report complies with those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The adhesive shall be identified and the anchors shall be installed in accordance with the manufacturer's installation instructions and this report.
- 5.2 Anchors are installed in holes predrilled into concrete masonry using a carbide-tipped drill bit manufactured within the range of maximum and minimum drill tip dimensions of ANSI B212.15-1994.
- 5.3 Calculations showing that the applied loads comply with this report shall be submitted to the building official for review and acceptance.
- 5.4 Special inspection in accordance with Section 4.3 of this report shall be provided for all anchor installations.
- 5.5 The Power-Fast epoxy adhesive anchor is permitted to be used only in grouted concrete masonry. The Power-Fast epoxy adhesive, Standard Set, is permitted to resist dead loads, live loads, and short-term loads such as those resulting from wind or earthquake in accordance with Sections 5.6, 5.7 and 5.8.
- 5.6 **Grouted Masonry under the 2006 IBC, 2006 IRC, 2003 IBC or 2003 IRC:** The adhesive anchors described in the evaluation report are capable of resisting seismic and wind loads. When using the basic load combinations in accordance with 2006 and 2003 IBC Section 1605.3.1, allowable loads are not permitted to be increased for seismic or wind loading. When using the alternative basic load combinations in 2006 and 2003 IBC Section 1605.3.2 that include seismic or wind loads, the allowable shear and tension loads for anchors are permitted to be increased by 33¹/₃ percent, or the alternative basic load combinations may be reduced by a factor of 0.75.
- 5.7 **Grouted Masonry under the 2000 IBC or 2000 IRC:** When using the basic load combinations in accordance with IBC Section 1605.3.1.1, allowable loads are not permitted to be increased for seismic or wind loading. When using the alternative basic load combinations in IBC Section 1605.3.2 that include seismic or wind loads, the allowable shear and tension loads for anchors are permitted to be increased by 33¹/₃ percent, or the alternative basic load combinations may be reduced by a factor of 0.75.
- 5.8 **Grouted Masonry under the UBC:** When using the basic load combinations in accordance with UBC Section 1612.3.1, allowable loads are not permitted to be increased for wind or seismic loading. When using the alternative basic load combinations in UBC Section 1612.3.2 that include wind or seismic loads, the allowable shear and tension loads for anchors are permitted to be increased by 33¹/₃ percent.
- 5.9 **Fire-resistance-rated Construction:** Anchors are not permitted to support fire-resistance-rated construction. Where not otherwise prohibited by the code, anchors are permitted for installation in fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:
 - Anchors are used to resist wind or seismic forces only.

- Anchors that support gravity load-bearing structural elements are within a fire-resistance-rated envelope or a fire-resistance-rated membrane, or protected by approved fire-resistance-rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

5.10 Adhesive anchors may be used to resist tension and shear forces in overhead or wall installations only if consideration is given to the effects of elevated temperature conditions on anchor performance. Figure 1 describes load reduction factors for elevated temperatures.

5.11 Since an ICC-ES acceptance criteria for evaluating the performance of adhesive anchors subjected to shock loads is unavailable at this time, the use of these adhesive anchors under these conditions is beyond the scope of this report.

5.12 Anchors are limited to interior use, except that installation, in severe, moderate, or negligible exterior weathering locations, in accordance with Figure 21-1-1 of UBC Standard 21-1 or Figure 1 of ASTM C 62-97a (IBC or IRC), is permitted when stainless steel or zinc coated threaded rods are installed.

5.13 Anchors are permitted in dry-hole and damp-hole installations.

5.14 Where the evaluation report does not include the edition of any referenced standard, the applicable edition of the referenced standard is as specified in the code (UBC, SBC or IBC) that is applicable to the specific building project.

5.15 The adhesive is manufactured for Powers Fasteners, Inc., under a quality control program with inspections by CEL Consulting (AA-639).

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Adhesive Anchors in Masonry Elements (AC58), dated December 2006, including the following optional tests: static tension and shear tests (Test Series 5, 6, 7, 9, 13, 14), creep, dampness (Test Series 19), freezing and thawing (Test Series 20), and seismic (Test Series 21).

6.2 A quality control manual.

7.0 IDENTIFICATION

The adhesives shall be identified on the packaging with the Powers Fasteners name, the product name (Power-Fast Adhesive), the formulation type (Standard Set), the batch number, the expiration date, and the evaluation report number (ESR-1531).

TABLE 1—APPLICATION DESCRIPTIONS

BASE MATERIAL	ADHESIVE	ANCHOR MATERIAL	SPECIFICATION DATA	LOAD DATA
Hollow concrete masonry	Power-Fast	Threaded rod with screen tubes	Tables 3 & 4	Table 5
Grouted concrete masonry	Power-Fast	Threaded rod	Tables 3 & 4	Table 6

TABLE 2—SPECIFICATIONS FOR INSTALLATION OF THREADED RODS WITH POWER-FAST EPOXY ADHESIVE

PROPERTY	THREADED ROD DIAMETER (<i>d</i>)		
	3/8 inch	1/2 inch	5/8 inch
A_{nom} = Nominal area of threaded rod (inch ²)	0.1105	0.1963	0.3068
A_{se} = Tensile stress area of rod (inch ²)	0.0775	0.1419	0.2260
d_{bit} = Nominal bit diameter (inch) Grout	7/16	9/16	3/4
d_{bit} = Nominal bit diameter (inch) Hollow	—	5/8	3/4

For SI: 1 inch = 25.4 mm, 1 ft.-lb. = 1.35 N-m, 1 inch² = 645.2 mm².

TABLE 3—SPECIFICATIONS FOR MATERIAL PROPERTIES OF THREADED ROD AND REINFORCING BAR

THREADED ROD				
Steel Description (General)	Steel Specification (ASTM)	Rod Diameters (inch)	Minimum Yield Strength f_y (ksi)	Minimum Ultimate Strength f_u (ksi)
Standard carbon rod	A 36	All	36.0	58.0
	A 307, Grade C	3/8 thru 4	36.0	58.0
High strength carbon rod	A 193 Grade B7	3/8 thru 2-1/2	105.0	120.0
Stainless rod (Type 304 / 316 SS)	F 593, Condition CW	3/8 thru 5/8	65.0	100.0
		3/4 thru 1-1/2	45.0	85.0

For SI: 1 inch = 25.4 mm, 1 ksi = 6.89 MPa.

TABLE 4—ALLOWABLE LOAD CAPACITIES FOR THREADED ROD BASED ON STEEL STRENGTH^{1,2}

ROD DIAMETER (inch)	THREADED ROD							
	Tension (pounds)				Shear (pounds)			
	Steel Specification				Steel Specification			
	ASTM A 36	ASTM A 307, Gr. C	ASTM A 193, Gr. B7	ASTM F 593 304 / 316 SS	ASTM A 36	ASTM A 307, Gr. C	ASTM A 193, Gr. B7	ASTM F 593 304 / 316 SS
3/8	2,115	2,115	4,375	3,630	1,090	1,090	2,255	1,870
1/2	3,755	3,755	7,775	6,470	1,940	1,940	4,005	3,330
5/8	5,870	5,870	12,150	10,130	3,025	3,025	6,260	5,210
3/4	8,455	8,455	17,495	12,400	4,355	4,355	9,010	6,390
7/8	11,510	11,510	23,810	16,860	5,930	5,930	12,265	8,680
1	15,035	15,035	31,100	22,020	7,745	7,745	16,020	11,340
1-1/4	23,485	23,485	48,560	34,420	12,100	12,100	25,035	17,730

For SI: 1 inch = 25.4 mm, 1 lbf = 4.48 N.

¹The tabulated allowable load capacities for steel strength are provided for reference. These values must be compared with the corresponding allowable bond strength capacities for the Power-Fast adhesive anchors, diameter to diameter. Allowable design load must be the lesser of allowable steel strength as shown above and the allowable bond capacities as shown in Tables 7 through 11, and 13 through 17.

²Steel strength values for threaded rod are based on the equations:

$$T = 0.33 f_u A_{nom}$$

$$V = 0.17 f_u A_{nom}$$

where:

T = Allowable tension load (pounds).

V = Allowable shear load (pounds).

f_u = Minimum specified ultimate strength of threaded rod (psi). Refer to Table 4 for values.

A_{nom} = Nominal cross-sectional area of threaded rod (square inches). Refer to Table 2 for values.

TABLE 5—ALLOWABLE TENSION AND SHEAR LOAD CAPACITIES FOR POWER-FAST EPOXY ADHESIVE INSTALLED WITH THREADED ROD AND SCREEN TUBES IN HOLLOW CONCRETE MASONRY UNITS^{1,2,3,4,5,6}

ROD DIA. (inch)	DRILL BIT DIAMETER (inch)	MINIMUM EMBED. (inches)	MIN. EDGE DISTANCE (inches)	MIN. END DISTANCE (inches)	TENSION LOAD (pounds)		SHEAR LOAD (pounds)	
					Standard Set		Standard Set	
					UBC SBC	IBC IRC	UBC SBC	IBC IRC
1/2	5/8	3 1/2	3 3/4	3 3/4	135	110	315	255
5/8	3/4	3 1/2	3 3/4	3 3/4	135	110	375	300

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.48 N.

¹ Tabulated load values are for anchors installed in minimum 8-inch wide, Type II, Grade N, lightweight, medium weight, or normal weight concrete masonry units conforming to UBC Standard 21-4 or ASTM C 90.

² Allowable load must be the lesser of allowable bond capacity or allowable steel strength as shown in Table 5. For Standard Set Power-Fast epoxy adhesive the allowable loads based on bond strength are calculated using an applied safety factor of 5.0. The tabulated allowable loads may be increased by 25% for installations under the UBC and SBC.

³ Anchors may be installed at any location in the face shell. A maximum of one anchor per cell is allowed.

⁴ Embedment depth is the minimum screen tube length as measured from the outside face of the masonry unit.

⁵ Anchors must be installed in accordance with Section 4.2 and special inspection must be provided for installations in accordance with Section 4.3.

⁶ Allowable load values must be adjusted for increased base material temperatures in accordance with Figure 1.

TABLE 6—ALLOWABLE TENSION AND SHEAR LOAD CAPACITIES FOR POWER-FAST EPOXY ADHESIVE INSTALLED WITH THREADED ROD IN GROUT-FILLED CONCRETE MASONRY^{1,2,3,4,5,6}

ANCHOR INSTALLED THROUGH FACE SHELL (See Figure 2)								
ROD DIA. (inch)	DRILL BIT DIAMETER (inch)	MINIMUM EMBED. (inches)	MIN. EDGE DISTANCE (inches)	MIN. END DISTANCE (inches)	TENSION LOAD (pounds)		SHEAR LOAD (pounds) ⁷	
					Standard Set		Standard Set	
					UBC SBC	IBC IRC	UBC SBC	IBC IRC
3/8	7/16	3 1/2	3 3/4	12	1,095	875	1,210	970
			12	12	1,160	930	1,255	1,005
1/2	9/16	4 1/4	3 3/4	12	1,630	1,305	1,710	1,370
			12	12	1,980	1,585	2,020	1,615
5/8	3/4	5	3 3/4	12	1,880	1,505	1,710	1,370
			12	12	2,225	1,780	2,425	1,940
ANCHOR INSTALLED IN JOINT (See Figure 3)								
ROD DIA. (inch)	DRILL BIT DIAMETER (inch)	MINIMUM EMBED. (inches)	MIN. EDGE DISTANCE (inches)	MIN. END DISTANCE (inches)	TENSION LOAD (pounds)		SHEAR LOAD (pounds) ⁸	
					Standard Set		Standard Set	
					UBC SBC	IBC IRC	UBC SBC	IBC IRC
3/8	7/16	3 1/2	8	16	1,280	1,025	1,285	1,030
1/2	9/16	4 1/4	8	16	1,655	1,325	2,285	1,830
5/8	3/4	5	8	16	2,160	1,730	2,860	2,290
ANCHOR INSTALLED IN CELL OPENING (TOP OF WALL) FOR SILL PLATE AND OTHER ATTACHMENTS (See Figure 4)								
ROD DIA. (inch)	DRILL BIT DIAMETER (inch)	MINIMUM EMBED. (inches)	MIN. EDGE DISTANCE (inches)	MIN. END DISTANCE (inches)	TENSION LOAD (pounds)			
					Standard Set			
					UBC / SBC		IBC / IRC	
1/2	9/16	4 1/4	1 3/4	10 3/4	1,200		960	
5/8	3/4	5	1 3/4	10 3/4	1,390		1,115	
ROD DIA. (inch)	DRILL BIT DIAMETER (inch)	MINIMUM EMBED. (inches)	MIN. EDGE DISTANCE (inches)	MIN. END DISTANCE (inches)	SHEAR LOAD (pounds)			
					Parallel to the Edge		Towards the Edge	
					Standard Set			
					UBC SBC	IBC IRC	UBC SBC	IBC IRC
1/2	9/16	4 1/4	1 3/4	10 3/4	810	650	315	255
5/8	3/4	5	1 3/4	10 3/4	810	650	400	320

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.48 N.

¹ Tabulated load values are for anchors installed in minimum 8-inch wide, Type II, Grade N, lightweight, medium weight, or normal weight concrete masonry units conforming to UBC Standard 21-4 or ASTM C 90. Masonry prism compressive strength tested in accordance with ASTM E 447 (UBC Standard 21-17), must be at least 1500 psi at the time of anchor installation. The masonry units must be fully grouted with grout complying with UBC Section 2103.4 or IBC Section 2103.7. Mortar must be minimum Type N prepared in accordance with Section 2103.3 of the UBC and UBC Standard 21-15, or IBC Section 2103.7.

² Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased for the duration of the load in accordance with Section 5.0 of this report.

(Continued)

TABLE 6—ALLOWABLE TENSION AND SHEAR LOAD CAPACITIES FOR POWER-FAST EPOXY ADHESIVE INSTALLED WITH THREADED ROD IN GROUT-FILLED CONCRETE MASONRY^{1,2,3,4,5,6} (Continued)

³Allowable load must be the lesser of allowable bond strength or allowable steel strength as shown in Table 5. For Standard Set Power-Fast epoxy adhesive the allowable loads based on bond strength are calculated using an applied safety factor of 5.0 for the IBC and IRC. The tabulated allowable loads for the Standard Set Power-Fast epoxy adhesive are increased by 25 percent for installations under the UBC and SBC.

⁴Anchors must be installed in accordance with Section 4.2 and special inspection must be provided for installations in accordance with Section 4.3.

⁵Allowable load values must be adjusted for increased base material temperatures in accordance with Figure 1.

⁶Embedment depth is measured from the outside surface of the concrete masonry unit.

⁷Allowable shear loads for anchor installations into the face shell may be applied in any direction provided the anchor location is a minimum of 12 inches from the edge and end of a masonry wall. For anchor installations with an edge distance less than 12 inches the allowable shear loads may be applied in any direction except upward vertically.

⁸Allowable shear loads for anchor installations into the joint may be applied in any direction provided the anchor location is a minimum of 16 inches from the edge and end of a masonry wall. For anchor installations with an edge distance less than 16 inches the allowable shear loads may be applied in any direction except upward vertically.

TABLE 7—MANUFACTURER’S RECOMMENDED CURE TIME FOR POWER-FAST EPOXY ADHESIVE

BASE MATERIAL TEMPERATURE (°F)	MAXIMUM GEL TIME ¹ (minutes)	MINIMUM CURING TIME ² (hours)	FULL CURING TIME ³ (hours)
	Standard Set	Standard Set	Standard Set
40	30	16	48
60	20	7	36
75	15	6	24
90	10	4	24

For SI: $t^{\circ}\text{C} = \frac{5}{9}(t^{\circ}\text{F} - 32)$.

¹The gel time is the maximum time during which the epoxy can be dispensed before it begins to set.

²Anchors must not be disturbed before the minimum curing time occurs. When the minimum cure time is achieved, the fixture can be positioned.

³The full curing time is the minimum time required for the epoxy to achieve its load capacities.

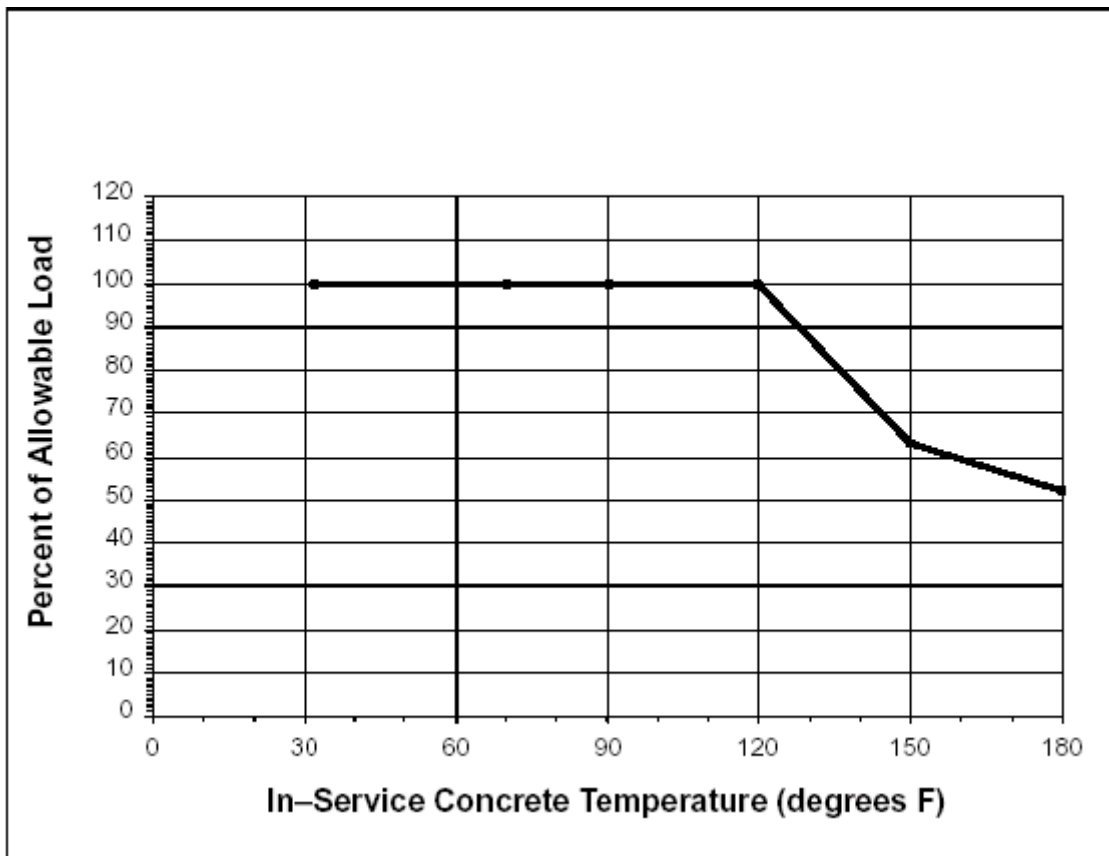
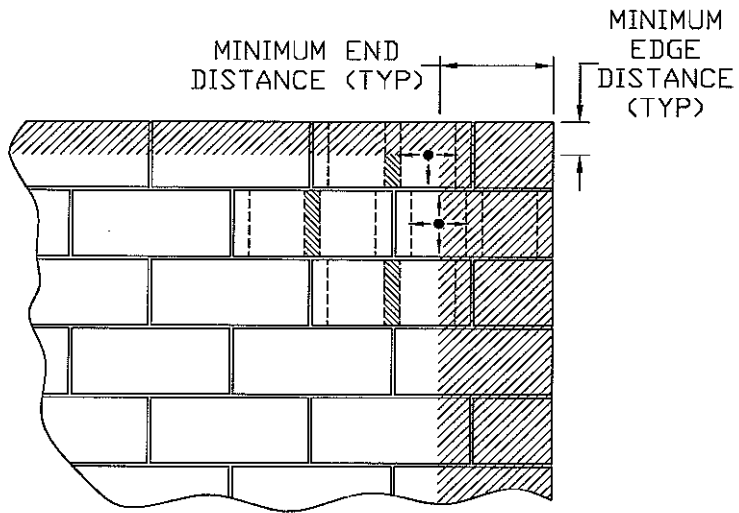
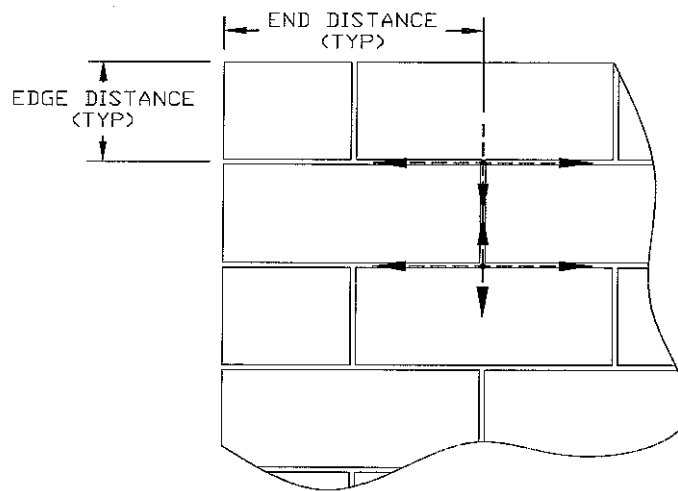


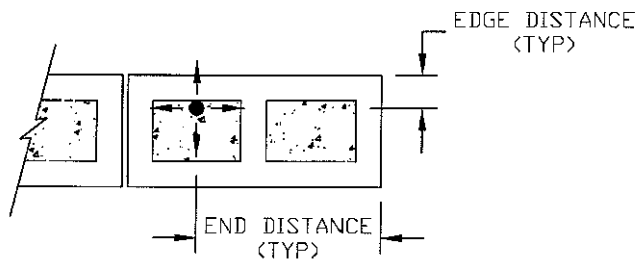
FIGURE 1—ALLOWABLE LOAD BOND STRENGTH REDUCTION BASED ON IN-SERVICE TEMPERATURE FOR THE POWER-FAST EPOXY ADHESIVE



**FIGURE 2—ANCHOR INSTALLED IN THE FACE SHELL
(ANCHOR INSTALLATION IS RESTRICTED TO NON-SHADED AREAS)
(ALLOWABLE SHEAR LOAD DIRECTION SHOWN BY ARROWS)**



**FIGURE 3—ANCHOR INSTALLED IN THE JOINT
(ALLOWABLE SHEAR LOAD DIRECTION SHOWN BY ARROWS)**



**FIGURE 4—ANCHOR INSTALLED IN THE CELL OPENING
(ALLOWABLE SHEAR LOAD DIRECTION SHOWN BY ARROWS)**