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DIVISION: 04—MASONRY
Section: 04081—Masonry Anchorage

REPORT HOLDER:

POWERS FASTENERS, INC.
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EVALUATION SUBJECT:

POWERS STANDARD SET POWER-FAST+ EPOXY (SIKADUR INJECTION GEL ANCHORFIX-4) ADHESIVE ANCHOR SYSTEM FOR UNREINFORCED MASONRY

ADDITIONAL LISTEE:

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1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2006 *International Building Code*® (2006 IBC)
- 2006 *International Residential Code*® (2006 IRC)
- 2006 *International Existing Building Code*® (IEBC)
- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)
- 1997 *Uniform Building Code*™ (UBC)
- 1997 *Uniform Code for Building Conservation*™ (UCBC)

Property evaluated:

Structural

2.0 USES

The Standard Set Power-Fast+ Epoxy (Sikadur Injection Gel AnchorFix-4) Adhesive Anchor System consists of a two-component structural epoxy adhesive and a screen tube or steel sleeve that is used to bond threaded steel rods or steel reinforcement in predrilled holes of unreinforced brick masonry. Anchors installed in unreinforced masonry with the Standard Set Power-Fast+ epoxy (Sikadur Injection Gel AnchorFix-4) adhesive are designed to resist short-term loads

imposed by wind or earthquake. The existing unreinforced brick walls must have a minimum thickness of 13 inches (330 mm [3 wythes of brick]). The anchor system is an alternative to cast-in-place anchors described in Section 2.12 of ACI 530-02 under the 2003 IBC or Section 2.1.4 of ACI 530-05 under the 2006 IBC, which are referenced in Section 2107 of the IBC, Section A 113.1 of the IEBC, Section A113.1 of the UCBC, and Section 2107.1.5 of the UBC. The anchor system may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 Materials:

3.1.1 Adhesive: The Standard Set Power-Fast+ epoxy (Sikadur Injection Gel AnchorFix-4) adhesive is a two-component epoxy that is packaged in equal-volume, dual plastic cartridges to keep the adhesive components separate and allow for multiple uses. The components are a base resin and a hardener that are mixed at a one-to-one ratio as they are dispensed through a disposable static-element mixing nozzle supplied by Powers Fasteners, Inc. (Sika Corporation supplies a similar static-element mixing nozzle for Sikadur Injection Gel AnchorFix-4.) The Power-Fast+ epoxy (Sikadur Injection Gel AnchorFix-4) adhesive is available in Standard Set formula. The maximum shelf life of the adhesive is two years when stored in a dry environment at temperatures between 40°F and 90°F (4.4°C and 32.2°C).

3.1.2 Steel Anchor Rods and Reinforcing Bars: Threaded steel rods are $\frac{3}{4}$ inch (19.1 mm) and $\frac{5}{8}$ inch (15.9 mm) in diameter and must comply with ASTM A 307. Deformed steel reinforcing bars range in size from No. 4 to No. 6 and must comply with ASTM A 615, A 616, A 617, or A 706 Grade 60.

3.2 Accessories:

Screen tubes consist of stainless steel wire mesh, open at one end and closed at the other end, in diameters and lengths as described in Section 4.1. Steel sleeves are manufactured from ASTM A 36 steel and are open at one end and closed at the other end with a plastic plug as described in Section 4.1.

4.0 DESIGN AND INSTALLATION

4.1 General:

Three types of anchor assemblies are available for retrofitting as Configuration A, Configuration B and Configuration C.

4.1.1 Configuration A: Configuration A is the anchor assembly resisting shear load where the outside face of the wall is inaccessible. Configuration A consists of a $\frac{3}{4}$ -inch-diameter (19.1 mm) ASTM A 307 threaded rod or a No. 6, No. 5 or No. 4 reinforcing bar and a $\frac{15}{16}$ -inch-diameter-by-8-inch-long (23.8 mm by 203 mm) wire mesh screen tube. Figure 1 shows details of an installed Configuration A.

4.1.2 Configuration B: Configuration B is the anchor assembly resisting a combination of tension and shear loads where the outside face of the wall is not accessible. The anchor must be installed in the wall at an angle of $22\frac{1}{2}$ degrees to the horizontal. Configuration B consists of a $\frac{3}{4}$ -inch-diameter (19.1 mm) ASTM A 307 prebent threaded rod used with a $\frac{15}{16}$ -inch-by-13-inch-long (23.8 mm by 330 mm) wire mesh screen tube. The threaded rod must be embedded a minimum of 13 inches (330 mm) at the $22\frac{1}{2}$ -degree angle. Figure 2 shows details of an installed Configuration B.

4.1.3 Configuration C: Configuration C is the anchor assembly for tension and shear applications where the outside face of the wall is accessible. Configuration C consists of a $\frac{5}{8}$ -inch-diameter (15.9 mm) ASTM A 307 threaded rod, and a $\frac{13}{16}$ -inch-outside-diameter-by- $\frac{11}{16}$ -inch-inside-diameter-by-8-inch-long (20.6 mm by 17.5 mm by 203 mm) ASTM A 36 steel sleeve, a $\frac{15}{16}$ -inch-diameter-by-8-inch-long (23.8 mm by 203 mm) wire mesh screen tube, and an ASTM A 36 steel plate measuring 6 inches by 6 inches by $\frac{3}{8}$ inch thick (152 mm by 152 mm by 9.5 mm). The plate must be bolted to the opposite side of the wall with a nut complying with ASTM A 563. The steel sleeve has a plastic plug at one end to prevent leakage of adhesive during installation. Figure 3 shows details of an installed Configuration C.

4.2 Design:

Conditions of acceptance for threaded rods and reinforcing bars in unreinforced brick masonry are as follows:

4.2.1 Configuration A Threaded Rods or Steel Reinforcing Bars in Shear:

- Installation of Configuration A threaded rods and reinforcing bars intended to resist shear only must comply with Sections 4.1. and 4.3.
- The allowable shear load for the $\frac{3}{4}$ -inch-diameter (19.1 mm) threaded rod is 1,000 pounds (4450 N) as shown in Table 3. For the No. 6, No. 5 and No. 4 reinforcing bars, the allowable shear loads are 1,000, 750 and 500 pounds (4450, 3338 and 2225 N), respectively, as shown in Table 3. No adjustment for wind or earthquake loading is permitted with the above-noted loads.
- Allowable shear value is applicable only to anchors installed in walls where in-place shear tests indicate a minimum mortar strength of 50 psi (344.5 kPa) net.

4.2.2 Configuration B Threaded Rods and Configuration C Through-bolts in Tension and Shear:

- Installation of threaded rods and through-bolts must comply with Sections 4.1 and 4.3.
- Maximum allowable tension load for the $\frac{3}{4}$ -inch-diameter (19.1 mm) bent threaded rod (Configuration B) or the $\frac{5}{8}$ -inch-diameter (15.9 mm) through-bolt (Configuration C) is 1,200 pounds (5340 N), with no adjustment for wind or earthquake loading. Allowable loads are also shown in Table 3.
- The maximum allowable shear load for the $\frac{3}{4}$ -inch-diameter (19.1 mm) bent threaded rod is 1,000 pounds (4450 N), and for the $\frac{5}{8}$ -inch (15.9 mm) through-bolt it is 750 pounds (3338 N), with no adjustment for wind or earthquake loading permitted. Allowable loads are also shown in Table 3.
- For the $\frac{3}{4}$ -inch-diameter (19.1 mm) bent threaded rod or the $\frac{5}{8}$ -inch-diameter (15.9 mm) through-bolt subjected to

tension and shear, the allowable combined load must be determined using 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 allowable tension and shear is applicable only to anchors installed in walls where in-place shear tests indicate minimum mortar strength of 50 psi (344.5 kPa), net.

4.3 Installation:

One-inch-diameter (25.4 mm) holes must be drilled using standard carbide-tipped masonry drill bits complying with ANSI Specification B212.15-1994. A rotary drill, or a rotary hammer drill set on "rotation only," must be used to drill the holes. Holes for the Configuration B anchors (Figure 2) must be drilled 13 inches (330 mm) deep at a $22\frac{1}{2}$ -degree angle. Holes for the Configuration A anchors (Figure 1) and the Configuration C anchors (Figure 3) must be drilled perpendicular to the wall. For Configuration A anchors, the holes must be drilled 8 inches (203 mm) deep. The holes must be cleaned using a nylon brush and a jet of compressed air. An extension nozzle must be used to reach the bottom of the hole with compressed air. Screen tubes must be completely filled with the adhesive and then placed into the drilled holes. A $\frac{3}{4}$ -inch-diameter (19.1 mm) threaded rod or No. 6 rebar for the Configuration A and B anchors, and steel sleeves for the Configuration C anchors, must be slowly pushed into the screen tube, while being rotated continuously. The adhesive must be allowed to cure for the full curing times listed in Table 1 before anchors are loaded. Minimum curing time refers to that period of cure after which hardware may be placed and nuts tightened. Care must be taken not to overtighten nuts or induce tension in bolts. Design loads may not be applied until the full curing time has transpired.

For the Configuration C anchor, a 1-inch-diameter (25.4 mm), 8-inch-deep (203 mm) hole must be drilled and cleaned as noted above. A $\frac{7}{8}$ -inch-outside-diameter (22 mm) steel sleeve must be pushed into an adhesive-filled screen in a manner similar to the installation of the rod. After curing of the adhesive, a $\frac{5}{8}$ -inch-diameter (15.9 mm) hole must be drilled through the sleeve and through the remainder of the masonry wall. Drilling must be continued until the entire wall is penetrated. The $\frac{5}{8}$ -inch-diameter (15.9 mm) rod must be inserted and fitted with a plate and nut to complete the through-bolted anchor connection. Figure 3 illustrates the installation.

4.4 Field Tests:

- Tests for in-place mortar shear strength of the building must be done in accordance with Section A106.3.3 of the IEBC or Section A106.3.3 of the UCBC.
- Anchors resisting tension forces or a combination of tension and shear forces must be tested in accordance with Section 107.4 of the IEBC and the UCBC. The test report must include:
 - Test location(s)
 - Brick/mortar condition
 - Bolt movement/elongation
 - Embedment depth and masonry wall thickness

5. Applied load, loading procedure, load increments and rate of loading
6. Mode of failure
7. Photographs of test equipment and typical failure loads

The Standard Set Power-Fast+ epoxy (Sikadur Injection Gel AnchorFix-4) adhesive anchors are intended to resist only short-term loads imposed by wind or earthquake. The anchors must be approved by the registered design professional and installed under special inspection in accordance with Section 4.5 of this report. The edge distance and vertical and horizontal spacings for the three types of anchor assemblies described in Section 4.1 must comply with Table 2.

4.5 Special Inspections:

4.5.1 IBC and IRC: Continuous special inspection must be done in accordance with Section 1704.5 of the IBC.

4.5.2 IEBC: Periodic inspection and direct-tension test and calibrated torque wrench tests must be done in accordance with Section 107.4 of the IEBC. In lieu of testing and periodic inspection, the IEBC permits continuous special inspection during installation of bolts resisting tension forces or shear forces only.

4.5.3 UBC: Continuous special inspection must be done in accordance with Section 1701.5.7 of the UBC.

4.5.4 UCBC: Periodic inspection, direct-tension tests, and calibrated torque wrench tests must be done in accordance with Section 107.4 of the UCBC. In lieu of testing and periodic inspections, the UCBC permits continuous special inspection during installation of bolts resisting shear forces only.

5.0 CONDITIONS OF USE

The Powers Power-Fast+ Standard Set Epoxy (Sikadur Injection Gel AnchorFix-4) Adhesive Anchor System for Unreinforced Masonry, described in this report, complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Use and installation must be as set forth in this report and the manufacturer's instructions. In case of conflict, this report governs.
- 5.2 Calculations and details must be submitted to the code official for approval.
- 5.3 Special inspection must be in accordance with Section 4.5 of this report.
- 5.4 Use of the anchors must be approved by the registered design professional.
- 5.5 Anchors must be limited to resisting transient (wind or seismic) loads only.
- 5.6 Anchors must be installed in holes predrilled with a carbide-tipped masonry drill complying with ANSI B94.15-1994.
- 5.7 Adhesives are manufactured by Sika Corporation, in Marion, Ohio, under a quality control program with inspections by CEL Consulting, Inc.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Unreinforced Masonry Anchors (AC60), dated April 2005 (editorially revised May 2007).

7.0 IDENTIFICATION

Power-Fast+ Standard Set Epoxy (Sikadur Injection Gel AnchorFix-4) adhesive cartridges are identified by a label displaying the product name and the manufacturer's name (Powers Fasteners, Inc., and Sika Corporation) and address, lot number traceable to a production date, expiration date, description of product, and the evaluation report number (ESR-1617). Accessories are identified by a label displaying the product name and the manufacturer's name (Powers Fasteners, Inc.) and address.

**TABLE 1—MANUFACTURER’S RECOMMENDED GEL AND CURING TIMES
FOR STANDARD SET POWER-FAST+ EPOXY ADHESIVE (SIKADUR INJECTION GEL ANCHORFIX-4)**

BASE MATERIAL TEMPERATURE	MAXIMUM GEL TIME ¹ (minutes)	MINIMUM CURING TIME ² (hours)	FULL CURING TIME ³ (hours)
40°F (4.4°C)	60	16	48
60°F (15.6°C)	45	7	36
75°F (23.9°C)	35	6	24
90°F (32.2°C)	20	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.

**TABLE 2—SPACING AND EDGE DISTANCE REQUIREMENTS FOR STANDARD SET POWER-FAST+ EPOXY
(SIKADUR INJECTION GEL ANCHORFIX-4) ADHESIVE INSTALLED IN UNREINFORCED BRICK MASONRY**

ANCHOR DESCRIPTION	MINIMUM VERTICAL SPACING (inches)	MINIMUM HORIZONTAL SPACING (inches)	MINIMUM EDGE DISTANCE (inches)
Shear anchor Configuration A (see Figure 1)	16	16	24
22 ¹ / ₂ ° combination anchor Configuration B (see Figure 2)	16	16	24
Through-bolt anchor Configuration C (see Figure 3)	16	24	16

For SI: 1 inch = 25.4 mm.

**TABLE 3—ALLOWABLE LOAD CAPACITIES FOR THREADED RODS AND REINFORCING BARS
FOR STANDARD SET POWER-FAST+ EPOXY (SIKADUR INJECTION GEL ANCHORFIX-4)
INSTALLED IN UNREINFORCED BRICK MASONRY^{1,2}**

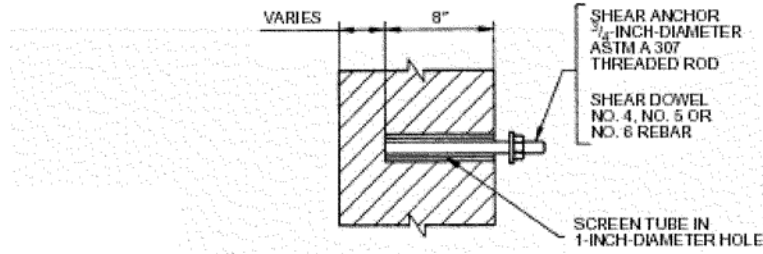
SHEAR ANCHOR – CONFIGURATION A (FIGURE 1)					
Anchor Rod Dia. (inch) or Rebar Size	Minimum Embedment (inches)	Minimum Wall Thickness (inches)	Allowable Tension Load (pounds)	Allowable Shear Load ³ (pounds)	Test Torque (foot-pounds)
³ / ₄	8	13	-	1,000	60
No. 4	8	13	-	500	40
No. 5	8	13	-	750	50
No. 6	8	13	-	1,000	60
22 ¹ / ₂ ° COMBINATION ANCHOR – CONFIGURATION B (FIGURE 2)					
Anchor Rod Dia. (inch)	Minimum Embedment	Minimum Wall Thickness (inches)	Allowable Tension Load ³ (pounds)	Allowable Shear Load ³ (pounds)	Test Torque (foot-pounds)
³ / ₄	Within 1 inch of opposite wall surface	13	1,200	1,000	60
THROUGH-BOLT ANCHOR – CONFIGURATION C (FIGURE 3)					
Anchor Rod Dia. (inch)	Minimum Steel Sleeve Embedment	Minimum Wall Thickness (inches)	Allowable Tension Load ³ (pounds)	Allowable Shear Load ³ (pounds)	Test Torque (foot-pounds)
⁵ / ₈	8 inches from interior wall surface	13	1,200	750	50

For SI: 1 inch = 25 mm, 1 lbf = 4.45 N, 1 foot-pound = 1.356 N-m, 1 psi = 6.89 Pa.

¹Allowable load values are applicable only to anchors where in-place shear tests indicate minimum mortar strength of 50 psi, net.

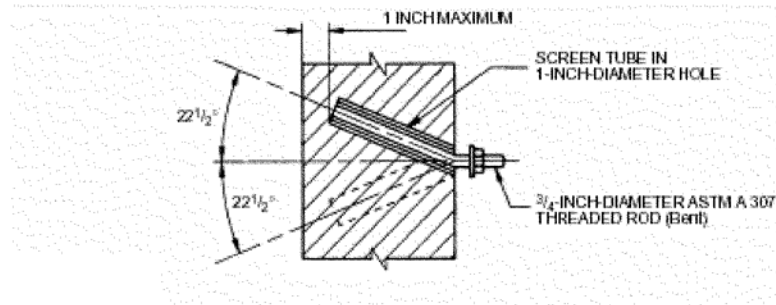
²No increase for lateral loading is permitted, such as loading induced by wind or earthquake.

³Anchors must be tested in accordance with Section 4.4.



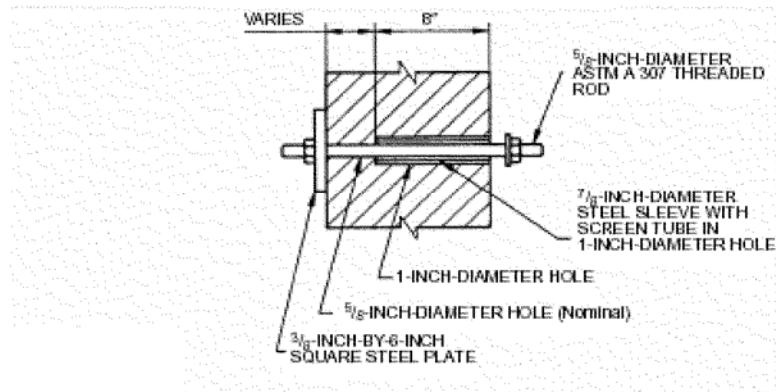
For SI: 1 inch = 25.4 mm.

FIGURE 1—CONFIGURATION A (SHEAR ANCHOR OR DOWEL)



For SI: 1 inch = 25.4 mm.

FIGURE 2—CONFIGURATION B (22¹/₂-DEGREE COMBINATION ANCHOR)



For SI: 1 inch = 25.4 mm.

FIGURE 3—CONFIGURATION C (THROUGH-BOLT ANCHOR)