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Legacy report on the 1997 Uniform Building Code™

DIVISION: 04—MASONRY
Section: 04081—Masonry Anchorage

EPCON ACRYLIC 7 ADHESIVE ANCHORING SYSTEMS

ITW RAMSET/RED HEAD
1300 NORTH MICHAEL DRIVE
WOOD DALE, ILLINOIS 60191

1.0 SUBJECT

Epcon A7 Adhesive Anchors and Maxima 7 Capsule Anchors.

2.0 DESCRIPTION

2.1 Epcon A7 Adhesive:

2.1.1 General: Epcon A7 is a stud-type adhesive designed for anchoring and doweling in concrete masonry units with threaded rod and reinforcing bar.

2.1.2 Materials:

2.1.2.1 Epcon A7: Epcon A7 is a methyl methacrylate adhesive packaged in either a 5-ounce (150 mL), 8-ounce (235 mL) or a 28-ounce (825 mL) cartridge. The dual-component cartridges, assembled with a 10:1 ratio of adhesive to activator, are used with manual or pneumatic dispensing tools and plastic mixing nozzles to ensure proper mixing of the two components. Epcon A7 cartridges have an 18-month shelf life when stored at temperatures of -40°F to 80°F (-40°C to 26.7°C). The adhesive may be used with threaded steel rods that are 3/8, 1/2, 5/8, 3/4, 7/8, 1 or 1 1/4 inches (9.5, 12.7, 15.9, 19.1, 22, 25.4 or 31.7 mm) in diameter. Steel rods must conform to either ASTM A 307 [Fu = 60,000 psi (415 MPa), minimum]; ASTM A 193, Grade B7 [Fu = 125,000 psi (860 MPa), minimum]; or ASTM F 593, Grade F 593A, Alloy Type 304 [Fu = 115,000 psi (795 MPa), minimum]. Epcon A7 may also be installed with deformed reinforcement bars ranging in size from No. 3 to No. 11 and conforming to ASTM A 615, A 616, A 617 or A 706 (minimum Grade 60).

2.1.2.2 Umbrella Inserts: The plastic Umbrella Inserts consist of a white spring assembly positioned inside of an orange, slotted conical body. The spring assembly allows the insert to adapt to the wall thickness of the concrete masonry; the body, which is placed in the void behind the wall, holds the adhesive in place. The length of the umbrella body is 2 inches (51 mm). The total length of rod required for each anchor is equal to the length of rod in the umbrella body [2 inches (51 mm)] plus the wall thickness plus the length of rod projecting from wall. The umbrella inserts are to be utilized only with 3/8-inch-diameter (9.5 mm) threaded rod.

The plated, carbon steel Umbrella Sleeve, used in conjunction with the plastic Umbrella Insert, is internally threaded to accept a 3/8-inch-diameter (9.5 mm) threaded rod. The total length of the sleeve is 3 inches (76 mm). The 1 1/4-inch (31.7 mm) length at the open end of the sleeve is vertically grooved on the outside surface, and has an enlarged outside diameter that is positioned inside the wall face shell during installation. The remaining 1 3/4 inches (44.5 mm) of exterior length is horizontally threaded. The total length of rod required for each anchor is equal to the length of rod in the umbrella sleeve [approximately 1 inch (25.4 mm)] plus the length of rod projecting from the wall.

2.1.2.3 Stubby Screens: The Stubby Screens consist of stainless steel screen tubing that is open at one end and closed at the other end. The 1 1/4-inch (31.7 mm) lengths at the open ends of the screens are enlarged and positioned inside the wall face shell during installation. The 1/2-inch-diameter (12.7 mm) Stubby Screen has a total length of 3 1/2 inches (89 mm) and the 5/8-inch-diameter (15.9 mm) Stubby Screen has a total length of 4 1/2 inches (114 mm).

2.1.3 Design: Allowable static loads for anchors installed in accordance with this report are shown in Tables 4 and 5. These values must be adjusted for in-service temperatures in accordance with Figure 1, and for spacing and edge distance effects in accordance with the footnotes to the tables. Allowable loads for anchors subject to combined shear and tension forces are determined by the following equation:

Concrete: (Ps/Pt)^5/3 + (Vs/Vt)^5/3 ≤ 1

Masonry: (Ps/Pt) + (Vs/Vt) ≤ 1

where:

- Ps = Applied service tension load.
Pt = Service tension load.
Vs = Applied service shear load.
Vt = Service shear load.

Anchors are not permitted to be subjected to vibratory loads such as those encountered by supports for reciprocating engines, crane loads and moving loads due to vehicles. Anchors are permitted for live load, dead load, earthquake load and wind load applications, except as noted in the tables.

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2.1.4 Installation:

2.1.4.1 Installation in Grout-filled Concrete Masonry Walls:

Anchors are installed in grout-filled concrete masonry walls as specified in Table 5. Installation requirements are tabulated for various threaded rod sizes in Table 2. The minimum installation temperature is 0°F (−18°C); the adhesives may be placed without warming. Holes are drilled to predetermined depths using rotary hammer drills and carbide-tipped drill bits that comply with ANSI B212.15-1994. For installations in grouted concrete masonry, holes must be into the face of masonry units only and are not permitted in mortar joints. Holes must be cleaned from the bottom with forced air. A wire brush is used to remove dust and slurry from the hole, and this is followed by another cleaning with forced air. A mixing nozzle is attached to the Epcon A7 cartridge to ensure proper mixing of the adhesive from the dual-component system. Before application, the adhesive is pumped out of the nozzle until the material achieves a uniform dark-gray color. Dry and damp holes are filled approximately one-half full with the mixed adhesive, and the threaded rods or reinforcement bars are inserted, with a rotating motion, to the bottom of the hole. Water-containing holes are filled approximately one-half full with the mixed adhesive, and the threaded rods or reinforcement bars are inserted, with a rotating motion, to the bottom of the hole. The adhesive shall cure in accordance with Table 1 before the placement of attachments.

2.1.4.2 Installation in Hollow Concrete Masonry Walls:

Anchors are installed in hollow concrete masonry walls using ITW Ramset/Red Head Umbrella Inserts or Stainless Steel Stubby Screens, as specified in Table 4 and shown in Figure 2. The minimum installation temperature is 0°F (−18°C); the adhesives may be placed without warming. Installation requirements are tabulated for various threaded rod sizes in Table 2. Umbrella Inserts must be installed in the hollow cells, at least 3 inches (76 mm) from vertical joints and at least 2 inches (51 mm) from solid webs of masonry units. Stubby Screens may be installed in either the hollow or the solid portions of the masonry units. Holes are drilled to predetermined depths using rotary hammer drills and carbide-tipped drill bits that comply with ANSI B212.15-1994. Holes must be into the face of masonry units only and are not permitted in mortar joints. Holes must be cleaned from the bottom with forced air. A wire brush is used to remove dust and slurry from the hole, and this is followed by another cleaning with forced air.

For the installation of the Umbrella Insert, the umbrella is placed on the insertion tool and is then fully expanded over the hold pin. The assembly is inserted into the hole and the tool is disengaged from the umbrella. A mixing nozzle, with a $\frac{3}{8}$ -inch (3.2 mm) hole plug placed about $\frac{1}{8}$ inch (9.5 mm) from the nozzle tip, is attached to the Epcon A7 cartridge. Before application, the adhesive is pumped out of the nozzle until the material achieves a uniform dark-gray color. Approximately 1½ ounces (44 mL) of adhesive is then injected into the umbrella. The threaded rod, with a centering ring or the internally threaded sleeve, is inserted into the hole with a slow, twisting motion. The adhesive shall cure in accordance with Table 1 before the placement of attachments.

For the installation of the Stubby Screens, a mixing nozzle is attached to the Epcon A7 cartridge to ensure proper mixing of the adhesive from the dual-component system. Before application, the adhesive is pumped out of the nozzle until the material achieves a uniform dark-gray color. The nozzle is then inserted to the bottom of the screen, and the screen is filled completely with adhesive. The filled screen is inserted into the hole until it is below the wall surface. While the tab of the screen is held against the surface of the wall, the threaded rod

is inserted into the screen with a rotating motion. The screen is pulled flush to the wall surface and the adhesive is allowed to cure in accordance with Table 1 before the placement of attachments.

2.1.5 Special Considerations: The anchors may be used within fire-resistive construction, provided the anchors only resist wind and/or seismic forces. The anchors can be satisfactorily installed in walls and ceilings, provided proper consideration is given to fire-exposure conditions.

2.2 Special Inspection:

Adhesive anchor installations require special inspection in accordance with Section 1701 of the code. The special inspector records compliance of the drill bit with ANSI B212.15-1994; hole depth and cleanliness; product description, including product name, rod diameter and length; adhesive expiration date; and verification of anchor installation in accordance with the manufacturer's published instructions and this report.

2.3 Identification:

The Epcon A7 Adhesive Anchors are identified by labels on the packaging indicating the manufacturer's name (ITW Ramset/Red Head), product name, material type, serial number traceable to production date, and evaluation report number (ER-5560). The Umbrella Inserts and Sleeves are identified by labels on the packaging indicating the manufacturer's name (ITW Ramset/RedHead), product name (Epcon Umbrella Inserts, or Epcon Umbrella Flush Sleeves) and product part number [HBU-38 (for inserts), HBU-FS (for sleeves)]. The Stubby Screens are identified by labels on the packaging indicating the manufacturer's name (ITW Ramset/RedHead), product name (Epcon System Screens) and product part number (HB12-312, or HB58-412).

3.0 EVIDENCE SUBMITTED

Data in accordance with the Acceptance Criteria for Adhesive Anchors in Concrete and Masonry Elements (AC58), dated January 1999, including reports of creep, seismic, freeze-thaw, in-service temperature, and damp/wet hole tests.

4.0 FINDINGS

That the ITW Ramset/Red Head Epcon A7 Adhesive Anchors described in this report comply with the 1997 Uniform Building Code™, subject to the following conditions:

- 4.1 The anchors are installed in accordance with the manufacturer's instructions and this report.
- 4.2 Anchors used to resist seismic loads in masonry are outside the scope of this report.
- 4.3 The anchors may be installed in damp or water-filled holes.
- 4.4 The anchors may be installed in severe, moderate or negligible exterior weathering locations, in accordance with Figure 21-1-1 of UBC Standard 21-1, when stainless steel rods are utilized.
- 4.5 Anchors are installed in holes and substrates predrilled with a carbide-tipped masonry drill bit manufactured within the range of the maximum and minimum drill-tip dimensions of ANSI B212.15-1994 for the values set forth in this evaluation report.
- 4.6 Special inspection in accordance with Section 2.2 is provided for all anchor installations.
- 4.7 Calculations and details showing compliance with this report must be submitted to the local building official for approval.

- 4.8 Anchors are not used in conjunction with fire-resistive construction, except as noted in Section 2.1.5.
- 4.9 Anchors are not used to resist tension forces in wall installations unless special consideration is given to fire-exposure conditions.
- 4.10 Anchors are not subjected to vibratory or shock loads, such as those encountered by supports for reciprocating engines or crane rails.
- 4.11 Anchors are limited to installation in uncracked masonry. Cracking occurs when $f_t > f_r$ due to service loads or deformations.
- 4.12 Epcon A7 Adhesive is manufactured at a plant in Danvers, Massachusetts. Quality control inspections are done by PFS Corporation (AA-652).
- This report is subject to re-examination in one year.

TABLE 1—MANUFACTURER'S RECOMMENDED CURE TIMES FOR EPCON A7 ADHESIVE ANCHORS

MINIMUM CONCRETE TEMPERATURE	INITIAL SET TIME ¹	CURE TIME ²
0	4 hours	24 hours
20	35 minutes	6 hours
40	15 minutes	75 minutes
60	7 minutes	35 minutes
80	5.5 minutes	30 minutes
100	5 minutes	25 minutes
120	4 minutes	20 minutes

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

¹Anchors must be undisturbed during the initial set time.

²Cure time is the time required for the anchor to reach allowable tensile and shear load capacities.

TABLE 2—SPECIFICATIONS FOR INSTALLATION OF THREADED RODS IN NORMAL-WEIGHT CONCRETE WITH EPCON A7 ADHESIVE AND EPCON MAXIMA 7 CAPSULES¹

PROPERTY	THREADED ROD DIAMETER						
	$\frac{3}{8}$ inch	$\frac{1}{2}$ inch	$\frac{5}{8}$ inch	$\frac{3}{4}$ inch	$\frac{7}{8}$ inch	1 inch	$1\frac{1}{4}$ inches
A_s = Tensile stress area of rod (inch ²)	0.0775	0.142	0.226	0.334	0.462	0.606	0.969
A_B = Nominal area of rod (inch ²)	0.1042	0.1867	0.2935	0.4246	0.5798	0.7589	1.19
Epcon A7 Adhesive BD = Nominal bit diameter (inch)	$\frac{7}{16}$	$\frac{9}{16}$	$\frac{11}{16}$ or $\frac{3}{4}$	$\frac{13}{16}$ or $\frac{7}{8}$	$\frac{15}{16}$ or 1	$1\frac{1}{16}$ or $1\frac{1}{8}$	$1\frac{5}{16}$ or $1\frac{3}{8}$
Epcon Maxima 7 Capsules BD = Nominal bit diameter (inch)	$\frac{7}{16}$	$\frac{9}{16}$	$\frac{11}{16}$	1	—	$1\frac{1}{8}$	—
T = Maximum tightening torque (ft.-lbf.)	18	25	80	160	220	330	450

For SI: 1 inch = 25.4 mm, 1 ft.-lbf = 1.36 N-m, 1 inch² = 645.16 mm².

¹Rod threads must conform to ANSI B1.1-74.

TABLE 3—ALLOWABLE TENSION AND SHEAR LOADS FOR THREADED ROD BASED ON STEEL STRENGTH¹

THREADED ROD DIAMETER (inches)	TENSION (lbf)			SHEAR (lbf)		
	Grade of Steel			Grade of Steel		
	A 307	A 193 Grade B 7	F 593 SS 304	A 307	A 193 Grade B 7	F 593 SS 304
$\frac{3}{8}$	2,080	4,340	3,995	1,040	2,170	1,995
$\frac{1}{2}$	3,730	7,780	7,155	1,870	3,895	3,585
$\frac{5}{8}$	5,870	12,230	11,250	2,940	6,125	5,635
$\frac{3}{4}$	8,490	17,690	14,860	4,250	8,855	7,440
$\frac{7}{8}$	11,600	24,170	22,240	5,800	12,080	11,110
1	15,180	31,620	26,560	7,590	15,810	13,285
$1\frac{1}{4}$	23,800	49,580	34,670	11,900	24,790	18,840

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

¹Tabulated allowable loads are based on the strength of the steel. These values must be compared to the allowable loads for the anchors, based on the Epcon A7 Adhesive bond strengths. The lesser of the value shown above and in Tables 4 and 5 in this evaluation report for the bond strength of the anchors must be used for the allowable value of the threaded bar installed with Epcon A7 Adhesive.

TABLE 4—ALLOWABLE TENSION AND SHEAR LOADS FOR THREADED RODS INSTALLED IN A HOLLOW CONCRETE MASONRY WALL WITH EPCON A7 ADHESIVE^{1,4,5,6,7,8,9,10}

ANCHOR DIAMETER (inch)	INSTALLATION DEVICE	BIT DIAMETER (inch)	ANCHOR LENGTH/ EMBEDMENT DEPTH (inches)	CRITICAL EDGE DISTANCE, s_{cr} (inches)	CRITICAL SPACING, s_{cr} (inches)	TENSILE LOAD BASED ON MASONRY AND BOND STRENGTH (lbf)	SHEAR LOAD BASED ON MASONRY AND BOND STRENGTH (lbf)
$\frac{3}{8}$	Umbrella Insert ²	$\frac{3}{4}$	$3\frac{3}{4}$	12	8	900	800
$\frac{1}{2}$	Stubby Screen ³	$\frac{5}{8}$	$3\frac{1}{2}$	12	8	615	1,115
$\frac{5}{8}$	Stubby Screen ³	$\frac{3}{4}$	$4\frac{1}{2}$	12	8	620	1,260

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

¹Allowable load values are based on masonry construction consisting of 8-inch-wide, Grade N, lightweight, medium-weight, or normal-weight masonry units conforming to ASTM C 90 and UBC Standard 21-4. Mortar must be Type M or S prepared in accordance with Section 2103 of the code and UBC Standard 21-15. The specified compressive strength of masonry, f'_m , at 28 days must be a minimum of 1,500 psi.

²Umbrella Inserts are installed through the face shell of the masonry unit and into the hollow cell portion of the unit only. Anchor installations are not permitted in mortar joints. See Figure 2 for anchor installation.

³Stubby Screens are installed through the face shell of the masonry unit and into both hollow and solid portions of the unit. Anchor installations are not permitted in mortar joints. See Figure 2 for anchor installation.

⁴The allowable tension load must be the lesser of the tabulated bond strength and the allowable steel strength shown in Table 3. The allowable load capacities may be increased for duration of load in accordance with Section 1612.3.3 of the code. Resistance to earthquake loads is beyond the scope of this report.

⁵Adhesive anchors experience a reduction in load capacity with increased ambient temperatures. See Figure 1 for load-reduction factor.

⁶Special inspection in accordance with Section 2 must be provided for all anchor installations.

⁷Sections 2.1.3 through 2.1.5 contain special considerations for anchor load conditions.

⁸Bond strength loads are based on a safety factor of 4.0.

⁹Displacement under tabulated allowable loads is $\frac{1}{8}$ inch or less.

¹⁰The tabulated values are for anchors installed at the critical edge distances (c_{cr}) and critical spacings (s_{cr}). Critical edge distance is the least edge distance at which the tabulated allowable load capacity of an anchor is applicable without applying a load-reduction factor. Critical spacing is the least anchor spacing distance at which the tabulated allowable load capacity of an anchor is applicable such that the anchor is not influenced by neighboring anchors.

TABLE 5—ALLOWABLE TENSION AND SHEAR LOADS FOR THREADED RODS INSTALLED IN A GROUT-FILLED CONCRETE MASONRY WALL WITH EPCON A7^{1,2,3,4,5,6,7,8,9}

ANCHOR DIAMETER (inch)	BIT DIAMETER (inch)	EMBEDMENT DEPTH, h_v (inches)	CRITICAL EDGE DISTANCE, c_{cr} (inches)	CRITICAL SPACING, s_{cr} (inches)	TENSILE LOAD BASED ON MASONRY AND BOND STRENGTH (lbf)	SHEAR LOAD BASED ON MASONRY AND BOND STRENGTH (lbf)
$\frac{1}{2}$	$\frac{5}{8}$	$4\frac{1}{4}$	12	8	1,290	2,125
$\frac{5}{8}$	$\frac{3}{4}$	5	12	8	1,580	2,710
$\frac{3}{4}$	$\frac{7}{8}$	$6\frac{5}{8}$	12	8	2,725	4,265

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

¹Allowable load values are based on masonry construction consisting of 8-inch-wide, Grade N, lightweight, medium-weight, or normal-weight masonry units conforming to ASTM C 90 and UBC Standard 21-4. Mortar must be prepared in accordance with Section 2103 of the code and UBC Standard 21-15. Grout must have a minimum compressive strength of 2,000 psi and must meet the coarse grout proportion limits specified in Table 21-B of the code. Grout must be prepared in accordance with Section 2103 of the code and UBC Standard 21-19. The specified compressive strength of masonry, f'_m , at 28 days must be a minimum of 1,500 psi.

²Anchor installations are not permitted in mortar joints.

³The allowable tension load must be the lesser of the tabulated bond strength and the allowable steel strength shown in Table 3. The allowable shear capacities may be increased for duration of load in accordance with Section 1612.3.3 of the code. Resistance to earthquake loads is beyond the scope of this report.

⁴Adhesive anchors experience a reduction in load capacity with increased ambient temperatures. See Figure 1 for load-reduction factor.

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⁹The tabulated values are for anchors installed at the critical edge distances (c_{cr}) and critical spacings (s_{cr}). Critical edge distance is the least edge distance at which the tabulated allowable load capacity of an anchor is applicable without applying a load reduction factor. Critical spacing is the least anchor spacing distance at which the tabulated allowable load capacity of an anchor is applicable such that the anchor is not influenced by neighboring anchors.

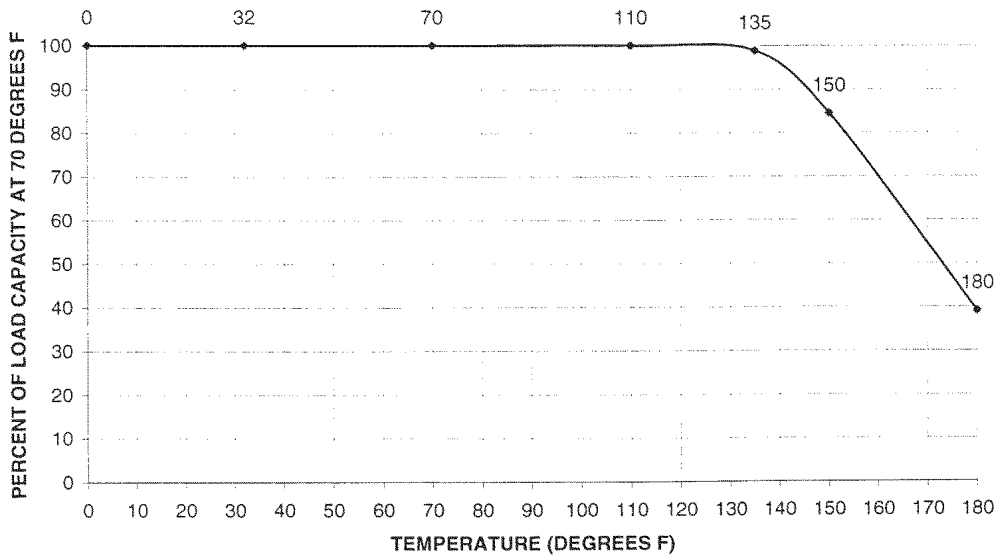


FIGURE 1—CHANGE IN LOAD CAPACITY OF EPCON A7 WITH TEMPERATURE VARIATION

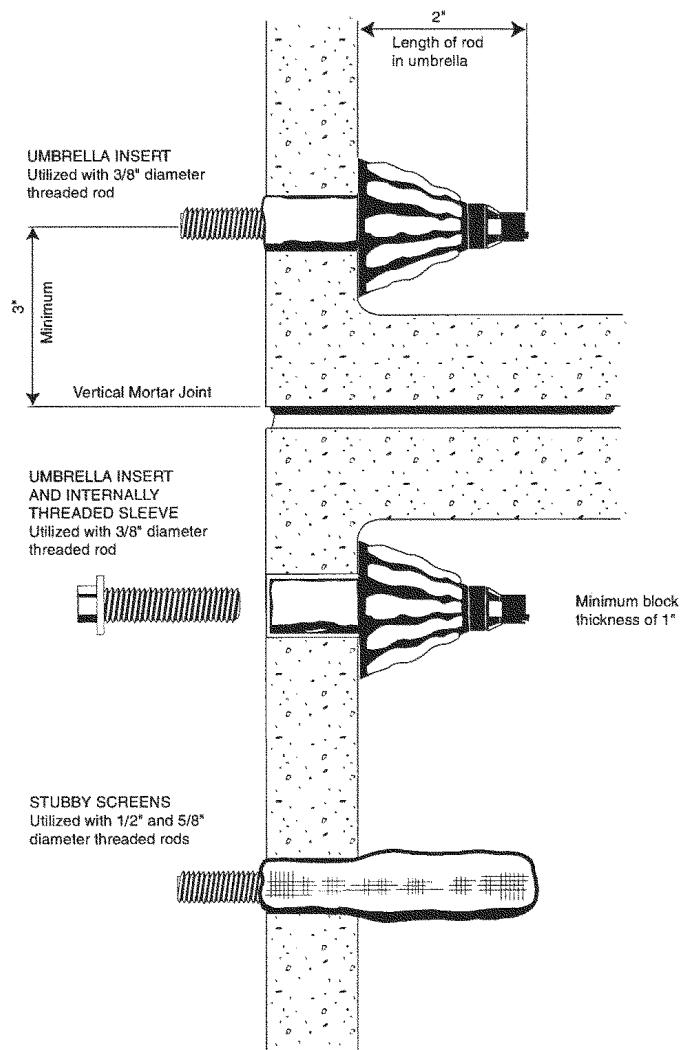


FIGURE 2—HOLLOW BLOCK FASTENING WITH EPCON A7 ADHESIVE