ICC-ES Evaluation Report

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

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EVALUATION SUBJECT:

ITW RED HEAD EPCON S7 ADHESIVE ANCHORING SYSTEM FOR CRACKED AND UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009, 2006, 2003 and 2000 *International Building Code*® (IBC)
- 2009, 2006, 2003 and 2000 *International Residential Code*® (IRC)
- 1997 *Uniform Building Code*™ (UBC)

Property evaluated:

Structural

2.0 USES

The ITW Red Head EPCON S7 Adhesive Anchoring System is a post-installed anchorage system used to resist static, wind and seismic tension and shear loads when installed in cracked and uncracked normal-weight concrete having a specified compressive strength, f'_c, of 2500 psi to 8,500 psi (17.2 MPa to 58.6 MPa). The anchoring system is an alternative to anchors described in Sections 1911 and 1912 of the 2009 and 2006 IBC, Sections 1912 and 1913 of the 2003 and 2000 IBC, and Section 1923 of the UBC. The anchoring system may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the 2009, 2006 and 2003 IRC, and Section R301.1.2 of the 2000 IRC.

3.0 DESCRIPTION

3.1 General:

The ITW Red Head EPCON S7 Adhesive Anchoring System is a two-component, high-strength, fast-cure, structural adhesive, used with continuously threaded rods and deformed reinforcing bar installed in normal-weight concrete. The primary components of the ITW Red Head Epcon S7 Adhesive Anchoring System are shown in Figure 1 of this report.

Installation information and parameters are included with the adhesive packaging and are replicated in Figure 3 of this report.

3.2 Materials:

3.2.1 Adhesive: The Epcon S7 anchoring system is a two-part hybrid epoxy packaged in a dual-chamber cartridge at a volumetric ratio of 10:1. The cartridge is available in 28-ounce (side-by-side) and 10-ounce (coaxial) sizes. The components are dispensed through a static mixing nozzle which attaches to the cartridge. The original, unopened cartridge has a shelf life of 12 months, as indicated by the "best used by" date stamped onto the cartridge, when stored in a cool, dry, ventilated area and in accordance with Figure 3.

3.2.2 Hole Cleaning Equipment: Hole cleaning equipment consists of wire brushes, as shown in Figures 1 and 3, and a compressed air nozzle with extension.

3.2.3 Dispensing Tools: Epcon S7 adhesive must be dispensed with manual or pneumatic dispensing tools provided by ITW Red Head, as shown in Figure 1.

3.2.4 Anchor Elements:

3.2.4.1 Threaded Rods: The continuously threaded rods range from $^3/_8$ inch through $1^1/_4$ inches (9.5 mm through 31.75 mm) in diameter. Carbon steel threaded rods must comply with either ASTM A36 [minimum f_{uta} = 58,000 psi (400 MPa)] or ASTM A193, Grade B7 [minimum f_{uta} = 125,000 psi (860 MPa)]. Stainless steel threaded rods must comply with ASTM F593 (Alloy Type 300) [minimum f_{uta} = 75,000 psi (517 MPa)]. Table 1 notes steel properties for the threaded rods. Carbon steel threaded rods must be furnished with a minimum 0.0002-inch-thick (5 μm) zinc electroplated coating complying with ASTM B633 SC1 or must be hot-dipped galvanized complying with ASTM A153, Class C or D. Threaded steel rods must be straight and free from indentations or other defects along their length.

3.2.4.2 Steel Reinforcing Bars: Steel reinforcing bars are deformed reinforcing bars. Table 5 summarizes reinforcing bar size ranges and provides properties of common reinforcing bar types and grades. The embedded portions of reinforcing bars must be straight, and free of mill scale, rust, mud, oil, and other coatings that may impair the bond with the adhesive. Reinforcing bars must not be bent after installation, except as set forth in Section 7.3.2 of ACI 318 with the additional condition that the bars must be bent cold, and heating of reinforcing bars to facilitate field bending is not permitted.

3.2.4.3 Ductility: In accordance with ACI 318 Appendix D, for the steel element to be considered ductile, the

tensile elongation must be at least 14 percent and reduction of area must be at least 30 percent. Steel elements used for anchoring with an elongation of less than 14 percent or a reduction of area of less than 30 percent, or both, are considered brittle. Where values are nonconforming or unstated, the steel must be considered brittle. Threaded rods complying with ASTM A36 and A193 Grade B7 steel are considered to be ductile. The design professional must determine the ductility of the stainless steel rods in accordance with ACI 318 D.1.

3.2.5 Concrete: Concrete in which the adhesive anchors are to be installed must be normal-weight concrete with a minimum compressive strength at the time of anchor installation of 2,500 psi (17.2 MPa), but not less than that required by the applicable code, nor more than 8,500 psi (58.6 MPa). Concrete must comply with Sections 1903 and 1905 of the IBC and UBC.

4.0 DESIGN AND INSTALLATION

4.1 Strength Design:

4.1.1 General: The design strength of anchors under the 2009, 2003, and 2000 IBC, as well as Section R301.1.3 of the 2009 and 2003 IRC and Section 301.1.2 of the 2000 IRC, must be determined in accordance with ACI 318-08 Appendix D and this report.

The design strength of anchors under the 2006 IBC and 2006 IRC must be determined in accordance with ACI 318-05 Appendix D and this report.

The strength design of anchors must comply with ACI 318 D.4.1, except as required in ACI 318 D.3.3. A design example in accordance with the 2009 IBC is provided in Figure 2 of this report.

Design parameters are based on the 2009 IBC (ACI 318-08) unless noted otherwise in this report. Design parameters including strength reduction factors, ϕ, corresponding to each limit state and anchor steel, are provided in Tables 1 through 6. Strength reduction factors, ϕ, as described in ACI 318 Section D.4.4, must be used for load combinations calculated in accordance with Section 1605.2.1 of the IBC, Section 1612.2 of the UBC or Section 9.2 of ACI 318. Strength reduction factors, ϕ, as described in ACI 318 Section D.4.5, must be used for load combinations calculated in accordance with ACI 318 Appendix C or Section 1909.2 of the UBC.

The following section provides amendments to ACI 318 Appendix D as required for the strength design of adhesive anchors. In conformance with ACI 318, all equations are expressed in inch-pound units.

Modify ACI 318 D.4.1.2 as follows:

D.4.1.2—In Eq. (D-1) and (D-2), ϕN_n and ϕV_n are the lowest design strengths determined from all appropriate failure modes. ϕN_n is the lowest design strength in tension of an anchor or group of anchors as determined from consideration of ϕN_{sa}, either ϕN_a or ϕN_{ag}, and either ϕN_{cb} or ϕN_{cbg}. ϕV_n is the lowest design strength in shear of an anchor or a group of anchors as determined from consideration of ϕV_{sa}, either ϕV_{cb} or ϕV_{cbg}, and either ϕV_{cp} or ϕV_{cpg}. For adhesive anchors subject to tension resulting from sustained loading, refer to D.4.1.4 in this report for additional requirements.

Add ACI 318 D.4.1.4 as follows:

D.4.1.4—For adhesive anchors subjected to tension resulting from sustained loading, a supplementary check shall be performed using Eq. (D-1) whereby N_{ua} is determined from the sustained load alone, e.g., the dead load and that portion of the live load acting that may be considered as sustained and ϕN_n is determined as follows:

D.4.1.4.1—For single anchors, $\phi N_n = 0.75\phi N_{a0}$

D.4.1.4.2—For anchor groups, Eq. (D-1) shall be satisfied by taking $\phi N_n = 0.75\phi N_{a0}$ for that anchor in an anchor group that resists the highest tension load.

D.4.1.4.3—Where shear loads act concurrently with the sustained tension load, the interaction of tension and shear shall be analyzed in accordance with D.4.1.3.

Modify ACI 318 D.4.2.2 in accordance with the 2009 IBC Section 1908.1.10 as follows:

D.4.2.2—The concrete breakout strength requirements for anchors in tension shall be considered satisfied by the design procedure of D.5.2 provided Equation D-8 is not used for anchor embedments exceeding 25 inches. The concrete breakout strength requirements for anchors in shear with diameters not exceeding 2 inches shall be considered satisfied by the design procedure of D.6.2. For anchors in shear with diameters exceeding 2 inches, shear anchor reinforcement shall be provided in accordance with the procedures of D.6.2.9.

4.1.2 Static Steel Strength in Tension: The nominal strength of an anchor in tension as governed by the steel, N_{sa}, in accordance with ACI 318 D.5.1.2 and strength reduction factors, ϕ, in accordance with ACI 318 Section D.4.4 are given in Tables 1 and 4 of this report for the corresponding anchor steel.

4.1.3 Static Concrete Breakout Strength in Tension: The nominal static concrete breakout strength of a single anchor or group of anchors in tension, N_{cb} or N_{cbg}, must be calculated in accordance with ACI 318 D.5.2 with the following addition:

D.5.2.10 (2009 IBC) or D 5.2.9 (2006 IBC) — The limiting concrete strength of adhesive anchors in tension must be calculated in accordance with D.5.2.1 to D.5.2.9 under the 2009 IBC or D.5.2.1 to D.5.2.8 under the 2006 IBC where the value for k_c used in Eq. (D-7) is as follows:

$k_{c,cr}$ = 17 where analysis indicates cracking at service load levels in the vicinity of the anchor (cracked concrete)

$k_{c,uncr}$ = 24 where analysis indicates no cracking at service load levels in the vicinity of the anchor (uncracked concrete)

The basic concrete breakout strength of a single anchor in tension, N_b, must be calculated in accordance with ACI 318 D.5.2.2 using the values of h_{ef}, $k_{c,cr}$, $k_{c,uncr}$ as described in this report. The modification factor λ shall be taken as 1.0. Anchors shall not be installed in lightweight concrete. The value of f'_c used for calculation must be limited to a maximum of 8,000 psi (55 MPa) in accordance with ACI 318 D.3.5.

4.1.4 Static Pullout Strength in Tension: In lieu of determining the nominal pullout strength in accordance with ACI 318 D.5.3, nominal bond strength in tension must be calculated in accordance with the following sections added to ACI 318:

D.5.3.7—The nominal bond strength of an adhesive anchor, N_a, or group of adhesive anchors, N_{ag}, in tension shall not exceed

(a) for a single anchor

$$N_a = \frac{A_{Na}}{A_{Na0}} \cdot \Psi_{ed,Na} \cdot \Psi_{p,Na} \cdot N_{a0} \qquad \textit{(D-16a)}$$

N_{a0} must be calculated according to equation (D-16f).

(b) for a group of anchors

$$N_{ag} = \frac{A_{Na}}{A_{Na0}} \cdot \Psi_{ed,Na} \cdot \Psi_{g,Na} \cdot \Psi_{ec,Na} \cdot \Psi_{p,Na} \cdot N_{a0} \qquad \textit{(D-16b)}$$

where:

A_{na} is the projected area of the failure surface for the single anchor or group of anchors that must be approximated as the base of the rectilinear geometrical figure that results from projecting the failure surface outward a distance, $c_{cr,Na}$ from the centerlines of the anchor, or in the case of a group of anchors, from a line through a row of adjacent anchors. A_{na} must not exceed nA_{na0} where n is the number of anchors in tension in the group. In ACI 318 Figures RD.5.2.1(a) and RD.5.2.1(b), the terms $1.5h_{ef}$ and $3.0h_{ef}$ must be replaced with $c_{cr,Na}$ and $s_{cr,Na}$, respectively.

A_{Na0} is the projected area of the failure surface of a single anchor without the influence of proximate edges in accordance with Eq. (D-16c):

$$A_{Na0} = \left(s_{cr,Na}\right)^2 \qquad \textit{(D-16c)}$$

with

$s_{cr,Na}$ = as given by Eq. (D-16d)

D.5.3.8—The critical spacing ($s_{cr,Na}$) and critical edge distance ($c_{cr,Na}$) shall be calculated as follows:

$$s_{cr,Na} = 20 \cdot d \cdot \sqrt{\frac{\tau_{\kappa,uncr}}{1{,}450}} \leq 3 \cdot h_{ef} \qquad \textit{(D-16d)}$$

$$c_{cr,Na} = \frac{s_{cr,Na}}{2} \qquad \textit{(D-16e)}$$

D.5.3.9—The basic strength of a single adhesive anchor in tension in cracked concrete shall not exceed:

$$N_{a0} = \tau_{k,cr} \cdot \pi \cdot d \cdot h_{ef} \qquad \textit{(D-16f)}$$

where $\tau_{k,cr}$ is the bond strength in cracked concrete

D.5.3.10—The modification factor for the influence of the failure surface of a group of adhesive anchors is

$$\Psi_{g,Na} = \Psi_{g,Na0} + \left[\left(\frac{s}{s_{cr,Na}}\right)^{0.5} \cdot \left(1 - \Psi_{g,Na0}\right)\right] \qquad \textit{(D-16g)}$$

where:

s = spacing of anchors (see Table 2 for s_{min} requirements)

$$\Psi_{g,Na0} = \sqrt{n} - \left[\left(\sqrt{n} - 1\right) \cdot \left(\frac{\tau_{k,cr}}{\tau_{k,max,cr}}\right)^{1.5}\right] \geq 1.0 \qquad \textit{(D-16h)}$$

where:

n = the number of tension-loaded adhesive anchors in a group.

$$\tau_{k,max,cr} = \frac{k_{c,cr}}{\pi \cdot d} \sqrt{h_{ef} \cdot f_c'} \qquad \textit{(D-16i)}$$

The value of f'_c must be limited to a maximum value of 8,000 psi (55 MPa) in accordance with ACI 318 D.3.5.

D.5.3.11—The modification factor for eccentrically loaded adhesive anchor groups is

$$\Psi_{ec,Na} = \frac{1}{1 + \frac{2e'_N}{s_{cr,Na}}} \leq 1.0 \qquad \textit{(D-16j)}$$

Eq. (D-16j) is valid for $e'_N \leq \frac{s}{2}$

If the loading on an anchor group is such that only certain anchors are in tension, only those anchors that are in tension shall be considered when determining the eccentricity, e'_N, for use in Eq. (D-16j).

In the case where eccentric loading exists about two orthogonal axes, the modification factor $\Psi_{ec,Na}$ shall be computed for each axis individually and the product of these factors used as $\Psi_{ec,Na}$ in Eq. (D-16b).

D.5.3.12—The modification factor for the edge effects for single adhesive anchors or anchor groups loaded in tension is:

for $c_{a,min} \geq c_{cr,Na}$

$$\Psi_{ed,Na} = 1.0 \qquad \textit{(D-16l)}$$

Or

for $c_{a,min} < c_{cr,Na}$

$$\Psi_{ed,Na} = \left(0.7 + 0.3 \cdot \frac{c_{a,min}}{c_{cr,Na}}\right) \leq 1.0 \qquad \textit{(D-16m)}$$

D.5.3.13—When an adhesive anchor or group of anchors is located in a region of a concrete member where analysis indicates no cracking at service load levels, the nominal strength, N_a or N_{ag}, of a single adhesive anchor or group of adhesive anchors shall be determined according to Eq. (D-16a) and Eq. (D-16b) with $\tau_{k,uncr}$ substituted for $\tau_{k,cr}$ in the calculation of the basic concrete breakout strength N_{ao}, in accordance with Eq. (D-16f). The factor $\Psi_{g,Nao}$ shall be calculated in accordance with Eq. (D-16h) whereby the value of $\tau_{k,max,uncr}$ shall be calculated in accordance with Eq. (D-16n) and substituted for $\tau_{k,max,cr}$.

$$\tau_{k,max,uncr} = \frac{k_{c,uncr}}{\pi \cdot d} \sqrt{h_{ef} \cdot f_c'} \qquad \textit{(D-16n)}$$

D.5.3.14—When an adhesive anchor or group of anchors is located in a region of a concrete member where analysis indicated that no cracking at service load levels, the modification factor $\Psi_{p,Na}$ shall be taken as:

$$\Psi_{p,Na} = 1.0 \text{ when } c_{a,min} \geq c_{ac} \qquad \textit{(D-16o)}$$

$$\Psi_{p,Na} = \frac{max|c_{a,min};c_{cr,Na}|}{c_{ac}} \text{ when } c_{a,min} < c_{ac} \qquad \textit{(D-16p)}$$

where c_{ac} must be determined in accordance with Section 4.1.10 of this report.

Additional information for the determination of nominal bond strength in tension is given in Section 4.1.8 of this report.

4.1.5 Static Steel Strength in Shear: The nominal static strength of an anchor in shear as governed by the steel, V_{sa}, in accordance with ACI 318 D.6.1.2 and the corresponding strength reduction factor, ϕ, are given in Tables 1 and 4 of this report for the corresponding anchor steel.

4.1.6 Static Concrete Breakout Strength in Shear: The nominal concrete breakout strength in shear, V_{cb} or V_{cbg}, must be calculated in accordance with ACI 318 D.6.2 based on information given in Table 2 and Table 5 of this report. The basic concrete breakout strength of a single anchor in shear, V_b, must be calculated in accordance with ACI 318 D.6.2.2 using the values of d and h_{ef} given in this report in lieu of d_a (2009 IBC), d_o (2006 IBC) and l_e, respectively. In no case shall l_e exceed 8d. The value of f'_c must be limited to a maximum value of 8,000 psi (55 MPa) in accordance with ACI 318 D.3.5.

4.1.7 Static Concrete Pryout Strength in Shear: In lieu of determining the nominal pryout strength in accordance with ACI 318 D.6.3.1, nominal pryout strength in shear must be calculated in accordance with the following sections added to ACI 318 Appendix D:

D.6.3.2—The nominal pryout strength of an adhesive anchor or group of adhesive anchors shall not exceed:

(a) for a single adhesive anchor

$$V_{cp} = min \mid k_{cp} \cdot N_a;\ k_{cp} \cdot N_{cb} \mid \qquad \textit{(D-30a)}$$

(b) for a group of adhesive anchors

$$V_{cpg} = min\left|k_{cp} \cdot N_{ag};\ k_{cp} \cdot N_{cbg}\right| \quad \text{(D-30b)}$$

where

k_{cp} *= 1.0 for* $h_{ef} < 2.5$ *in. (64 mm)*

k_{cp} *= 2.0 for* $h_{ef} \geq 2.5$ *in. (64 mm)*

N_a *shall be calculated in accordance with Eq. (D-16a)*

N_{ag} *shall be calculated in accordance with Eq. (D-16b)*

N_{cb},N_{cbg} *are determined in accordance with D.5.2.*

4.1.8 Bond Strength Determination: Bond strength values are a function of the concrete condition (cracked, uncracked), installation conditions (dry, water-saturated, etc.), and special inspection level. Strength reduction factors for bond strength, ϕ, listed in Table 3 and Table 6 are utilized for anchors installed in dry, saturated, water-filled or submerged hole conditions, in accordance with the level of inspection provided (periodic or continuous), as applicable.

4.1.9 Minimum Member Thickness, h_{min}, Minimum Anchor Spacing, s_{min}, and Minimum Edge Distance, c_{min}: In lieu of ACI 318 D.8.3, values of c_{min} and s_{min}, as given in Table 2 and Table 5 of this report, must be used. In lieu of ACI 318 D.8.5, minimum member thicknesses h_{min} as given in Table 2 and Table 5 of this report must be used. In determining minimum edge distance, c_{min}, the following section must be added to ACI 318:

D.8.8—*For adhesive anchors that will remain untorqued, the minimum edge distance shall be based on the minimum cover requirements of reinforcement in 7.7. For adhesive anchors that will be torqued, the minimum edge distance (c_{min}) and spacing (s_{min}) noted in Table 2 and Table 5 of this report shall be used.*

4.1.10 Critical Edge Distance c_{ac}: In lieu of ACI 318 D.8.6, c_{ac} must be determined as follows:

$$\frac{c_{ac}}{h_{ef}} = \left(\frac{\tau_{k,uncr}}{1160}\right)^{0.4} \cdot max\left[3.1\text{-}0.7\frac{h}{h_{ef}};1.4\right] \quad \text{Eq. (4-1)}$$

where $\tau_{k,uncr}$ is the characteristic bond strength in uncracked concrete, h is the member thickness, and h_{ef} is the embedment depth.

$\tau_{k,uncr}$ *need not be taken as greater than:*

$$\tau_{k,uncr} = \frac{k_{uncr}\sqrt{h_{ef} f'_c}}{\pi \cdot d}$$

4.1.11 Requirements for Seismic Design: For structures assigned to Seismic Design Category C, D, E or F under the IBC or IRC, or Seismic Zones 2B, 3, or 4 under the UBC, the design strength of an adhesive anchor must be performed in accordance with ACI 318 D.3.3, and must be modified in accordance with Section 1908.1.9 of the 2009 IBC or Section 1908.1.16 of the 2006 IBC. For brittle steel elements, the anchor strength must be adjusted in accordance with ACI 318-08 D.3.3.5 or D.3.3.6 or ACI 318-05 D.3.3.5. The nominal steel shear strength, V_{sa}, must be adjusted by the factor $\alpha_{V,seis}$ given in Table 1 and Table 4 of this report. The nominal bond strength, $\tau_{k,cr}$, must be adjusted by $\alpha_{N,seis}$ given in Table 3 and Table 6 of this report.

4.1.12 Interaction of Tensile and Shear Forces: For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318 D.7.

4.2 Allowable Stress Design:

4.2.1 General: For anchors designed using load combinations in accordance with IBC Section 1605.3 or UBC Section 1612.3 (Allowable Stress Design), allowable loads shall be established using Eq. (4-2) or Eq. (4-3):

$$T_{allowable,ASD} = \frac{\phi N_n}{\alpha} \quad \text{Eq. (4-2)}$$

and

$$V_{allowable,ASD} = \frac{\phi V_n}{\alpha} \quad \text{Eq. (4-3)}$$

where

$T_{allowable,ASD}$ = Allowable tension load (lbf or kN)

$V_{allowable,ASD}$ = Allowable shear load (lbf or kN)

ϕN_n = Lowest design strength of an anchor or anchor group in tension as determined in accordance with ACI 318 Appendix D with amendments in this report and 2009 IBC Sections 1908.1.9 and 1908.1.10 or 2006 IBC Section 1908.1.16, as applicable.

ϕV_n = Lowest design strength of an anchor or anchor group in shear as determined in accordance with ACI 318 Appendix D with amendments in this report and 2009 IBC Sections 1908.1.9 and 1908.1.10 or 2006 IBC Section 1908.1.16, as applicable.

α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, α must include all applicable factors to account for non-ductile failure modes and required over-strength.

Limits on edge distance, anchor spacing and member thickness described in this report must apply.

Example calculations for derivation of $T_{allowable,ASD}$ are provided in Figure 2 and Table 7.

4.2.2 Interaction of tensile and shear forces: In lieu of ACI 318 D.7.1, D.7.2 and D.7.3, interaction must be calculated as follows:

For shear loads $V \leq 0.2V_{allowable,ASD}$, the full allowable load in tension shall be permitted.

For tension loads $T \leq 0.2T_{allowable,ASD}$, the full allowable load in shear shall be permitted.

For all other cases:

$$\frac{T}{T_{allowable,ASD}} + \frac{V}{V_{allowable,ASD}} \leq 1.2 \quad \text{Eq. (4-4)}$$

4.3 Installation:

4.3.1 General: The anchors must be installed in accordance with the ITW Red Head published installation instructions (Figure 3), the plans and specifications approved by the code official, and the requirements of this report. The nozzles, brushes, hole plugs, and dispensing tools supplied by ITW Red Head must be used along with the adhesive cartridge. See Figure 3 for brush and hole plug specifications, gel times, and cure times.

The anchors must be installed in locations where the maximum short-term and long-term concrete temperatures comply with temperature ranges A, B and C as noted in Table 3 and Table 6.

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

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

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

The concrete temperature must not exceed the maximum long-term concrete temperature for the applicable temperature range during the service life of the anchor. Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of daily cycling. Long-term concrete temperatures are roughly constant over significant periods of time. The footnotes to Table 3 and Table 6 provide additional information regarding short-term and long-term concrete temperature.

The adhesive anchoring system may be used for floor (vertically down), wall (horizontal) and overhead applications. Overhead applications are limited to use with the $^3/_8$-inch- (9.5 mm) through $^1/_2$-inch-diameter (12 mm) threaded rods and reinforcing bars, assembled with a Red Head hole plug. Horizontal applications installed at a concrete or adhesive temperature above 70°F (21°C) require the use of a Red Head hole plug with the threaded rod or reinforcing bar.

4.4 Special Inspection:

4.4.1 General: Installations may be made under continuous special inspection or periodic special inspection, as determined by the registered design professional. Table 3 and Table 6 of this report provide strength reduction factors, ϕ, corresponding to the type of inspection provided.

4.4.2 Continuous Special Inspection: Installations made under continuous special inspection with an on-site proof loading program must be performed in accordance with Sections 1704.4 and 1704.15 of the 2009 IBC, Sections 1704.4 and 1704.13 of the 2006, 2003 and 2000 IBC, and Section 1701.5 of the UBC, whereby continuous special inspection is defined in Section 1702.1 of the IBC, Section 1701.6.2 of the UBC, and this report. The special inspector must be on the jobsite continuously during anchor installation to verify anchor type, adhesive expiration date, anchor dimensions, concrete type, concrete compressive strength, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete thickness, anchor embedment, tightening torque, and adherence to the manufacturers printed installation instructions.

The proof loading program must be established by the registered design professional. As a minimum, the following requirements must be addressed in the proof loading program:

1. Frequency of proof loading based on anchor type, diameter, and embedment.
2. Proof loads by anchor type, diameter, embedment, and location.
3. Acceptable displacements at proof load.
4. Remedial action in the event of a failure to achieve proof load, or excessive displacement.

Unless otherwise directed by the registered design professional, proof loads must be applied as confined tension tests. Proof load levels must not exceed the lesser of 50 percent of expected peak load based on adhesive bond strength, or 80 percent of the anchor yield strength. The proof load shall be maintained at the required load level for a minimum of 10 seconds.

4.4.3 Periodic Special Inspection: Periodic special inspection must be performed where required in accordance with Sections 1704.4 and 1704.15 of the 2009 IBC or Section 1704.13 of the 2006, 2003 and 2000 IBC, whereby periodic special inspection is defined in Section 1702.1 of the IBC and this report. The special inspector must be on the jobsite initially during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete thickness, anchor embedment, and tightening torque. The special inspector must verify the initial installations of each type and size of adhesive anchor by construction personnel on the site. Subsequent installations of the same anchor type and size by the same construction personnel are permitted to be performed in the absence of the special inspector. Any change in the anchor product being installed or the personnel performing the installation requires an initial inspection. For ongoing installations over an extended period, the special inspector must make regular inspections to confirm correct handling and installation of the product.

Continuous special inspection is required for all cases where anchors installed overhead (vertical up) are designed to resist sustained tension loads.

Under the IBC, additional requirements as set forth in Sections 1705, 1706, or 1707 must be observed, where applicable.

4.5 Compliance with NSF/ANSI Standard 61:

The Epcon S7 Adhesive Anchor System complies with the requirements of NSF/ANSI Standard 61, as referenced in Section 605 of the 2009 and 2006 *International Plumbing Code*® (IPC), and is certified for use as an anchoring adhesive for installing threaded rods less than or equal to 1.3 inches (33 mm) in diameter in concrete for water treatment applications. An NSF/ANSI Standard 61 listing is provided by NSF International.

5.0 CONDITIONS OF USE

The ITW Red Head EPCON S7 Adhesive Anchoring System 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 The Epcon S7 Adhesive must be installed in accordance with the manufacturer's published installation instructions, as included with the adhesive packaging and reproduced in Figure 3 of this report.

5.2 The anchors must be installed in cracked and uncracked normal-weight concrete having a specified compressive strength of f'_c = 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

5.3 The values of f'_c used for calculation purposes must not exceed 8,000 psi (55 MPa).

5.4 Anchors must be installed in holes predrilled into concrete using a carbide-tipped masonry drill bit manufactured within the range of the maximum and minimum drill-tip dimensions of ANSI B212.15-1994.

5.5 Loads applied to the anchors must be adjusted in accordance with Section 1605.2 of the IBC or Section 1612.2 or 1909.2 of the UBC for strength design, and in accordance with Section 1605.3 of the IBC or Section 1612.3 of the UBC for allowable stress design.

5.6 Epcon S7 adhesive anchors are recognized for use in resisting short- and long-term loads, including wind and earthquake loads, subject to the conditions of this report.

5.7 In structures assigned to Seismic Design Category C, D, E or F under the IBC or IRC, anchor strength must comply with the requirements of 2009 IBC Section 1908.1.9 or 2006 IBC Section 1908.1.16.

5.8 Epcon S7 adhesive anchors are permitted to be installed in concrete that is cracked or that may be expected to crack during the service life of the anchor, subject to the conditions of this report.

5.9 Strength design values must be established in accordance with Section 4.1 of this report.

5.10 Allowable stress design values must be established in accordance with Section 4.2 of this report.

5.11 Minimum anchor spacing and edge distance, as well as minimum member thickness, must comply with the values given in this report.

5.12 Prior to anchor installation, calculations and details demonstrating compliance with this report must be submitted to the code official. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.13 Anchors are not permitted to support fire-resistive construction. Where not otherwise prohibited by the code, anchors are permitted for installation in fire-resistive construction provided 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-resistive envelope or a fire-resistive membrane, are protected by approved fire-resistive materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

5.14 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of adhesive anchors subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under such conditions is beyond the scope of this report.

5.15 Use of zinc-plated carbon steel threaded rods is limited to dry, interior locations.

5.16 Use of hot-dipped galvanized carbon steel threaded rods, with coating complying with ASTM A153 Class C or D, and stainless steel threaded rods is permitted for exterior exposure or damp environments.

5.17 Steel anchoring materials in contact with preservative-treated and fire-retardant-treated wood must be of zinc-coated carbon steel or stainless steel. The minimum coating weights for zinc-coated steel must comply with ASTM A153 Class C or D.

5.18 Special inspection must be provided in accordance with Section 4.4 of this report.

5.19 Anchors may be installed in dry holes, saturated holes, water-filled holes or submerged holes, subject to the conditions of this report.

5.20 Epcon S7 adhesive anchors may be used to resist tension and shear forces in wall, floor and overhead installations only if installation is into concrete with a temperature between 14°F and 110°F. Overhead applications are limited to use with $^{3}/_{8}$-inch- through $^{1}/_{2}$-inch-diameter (9.5 mm through12 mm) threaded rods and reinforcing bars, assembled with a Red Head hole plug. Horizontal applications installed at a concrete temperature above 70°F (21°C) require the use of a Red Head hole plug with the threaded rod or reinforcing bar.

5.21 Epcon S7 adhesive is manufactured in the U.S.A. under a quality control program with inspections by PFS Corporation (AA-652).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Post-installed Adhesive Anchors in Concrete Elements (AC308), dated February 2012.

7.0 IDENTIFICATION

The ITW Red Head adhesive is identified by labels on the adhesive cartridges bearing the adhesive manufacturer's name (ITW Red Head) and address (Addison, Illinois), the product name (EPCON S7), best-used-by expiration date, the evaluation report number (ESR-2308), and the name of the inspection agency (PFS Corporation).

TABLE 1—STEEL DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT THREADED ROD [(1)]

CHARACTERISTIC		SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
				$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_4$
Threaded rod effective cross-sectional area		A_{se}	inch²	0.078	0.142	0.226	0.335	0.462	0.606	0.969
Carbon Steel A36	Nominal steel strength in tension	N_{sa}	lb	4,500	8,230	13,110	19,400	26,780	35,130	56,210
	Nominal steel strength in shear	V_{sa}	lb	2,250	4,940	7,870	11,640	16,070	21,080	33,730
	Strength reduction factor for tension, steel failure mode	ϕ	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75
	Strength reduction factor for shear, steel failure mode[1]	ϕ	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Carbon Steel A193 B7	Nominal steel strength in tension	N_{sa}	lb	9,690	17,740	28,250	41,810	57,710	75,710	121,140
	Nominal steel strength in shear	V_{sa}	lb	4,485	10,640	16,950	25,090	34,630	45,430	72,680
	Strength reduction factor for tension, steel failure mode	ϕ	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75
	Strength reduction factor for shear, steel failure mode[1]	ϕ	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Stainless Steel F593	Nominal steel strength in tension	N_{sa}	lb	5,810	10,640	16,950	25,090	34,630	45,430	72,680
	Nominal steel strength in shear	V_{sa}	lb	2,905	6,390	10,170	15,050	20,780	27,260	43,610
	Strength reduction factor for tension, steel failure mode[1]	ϕ	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength reduction factor for shear, steel failure mode	ϕ	-	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.70	0.70	0.70	0.70	0.70

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1ft-lbf = 1.356 N-M, 1 psi = 0.006895 MPa.

[1]The tabulated value of ϕ applies when the load combinations of Section 1605.2.1 of the IBC, Section 1612.2.1 of the UBC, or ACI 318 Section 9.2 are used. If the load combinations of Section 1909.2 of the UBC or ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5.

TABLE 2—CONCRETE BREAKOUT DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT THREADED ROD [(1)]

CHARACTERISTIC	SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
			$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_4$
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24	24	24	24	24
Effectiveness factor for cracked concrete	k_{cr}	-	17	17	17	17	17	17	17
Minimum concrete thickness	h_{min}	in.	$h_{ef} + 1^1/_4$		$h_{ef} + 2d_o$				
Anchor embedment depth - minimum	$h_{ef,min}$	in.	$2^3/_8$	$2^3/_4$	$3^1/_8$	$3^1/_2$	$3^1/_2$	4	5
Minimum spacing	s_{min}	in.	$^{15}/_{16}$	$1^1/_2$	$2^1/_2$	3	$3^1/_2$	4	5
Minimum edge distance	c_{min}	in.	$^{15}/_{16}$	$1^1/_2$	$2^1/_2$	3	$3^1/_2$	4	5
Critical edge distance	c_{ac}	in.	See Section 4.1.10 of this report						
Strength reduction factor for tension, concrete failure mode[1]	ϕ	Cond. B	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Strength reduction factor for shear, concrete failure mode[1]	ϕ	Cond. B	0.70	0.70	0.70	0.70	0.70	0.70	0.70

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1ft-lbf = 1.356 N-M, 1 psi = 0.006895 MPa.

[1]The tabulated value of ϕ applies when the load combinations of Section 1605.2.1 of the IBC, Section 1612.2.1 of the UBC, or ACI 318 Section 9.2 are used and the requirements of ACI 318 D.4.4(c) for Condition B are met. If the load combinations of Section 1909.2 of the UBC or ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5 for Condition B.

TABLE 3—S7 ADHESIVE ANCHOR BOND STRENGTH DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT THREADED ROD [1,6]

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	$\tau_{k,uncr}$	psi	1,735	1,735	1,735	1,735	1,735	1,735	1,333
	Characteristic Bond Strength for Cracked Concrete	$\tau_{k,cr}$	psi	652	726	726	785	785	785	443
Temperature Range B[3]	Characteristic Bond Strength for Uncracked Concrete	$\tau_{k,uncr}$	psi	1,611	1,611	1,611	1,611	1,611	1,611	1,238
	Characteristic Bond Strength for Cracked Concrete	$\tau_{k,cr}$	psi	652	726	726	785	785	785	412
Temperature Range C[4,5]	Characteristic Bond Strength for Uncracked Concrete	$\tau_{k,uncr}$	psi	1,544	1,544	1,544	1,544	1,544	1,544	1,186
	Characteristic Bond Strength for Cracked Concrete	$\tau_{k,cr}$	psi	625	696	696	752	752	752	394
Continuous Inspection	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	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						

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1ft-lbf = 1.356 N-M, 1 psi = 0.006895 MPa.

[1]Bond strength values correspond to concrete compressive strengths ranging from 2,500 psi to 8,000 psi.
[2]Temperature range A: Maximum short term temperature of 110°F and maximum long term temperature of 70°F.
[3]Temperature range B: Maximum short term temperature of 130°F and maximum long term temperature of 110°F.
[4]Temperature range C: Maximum short term temperature of 176°F and maximum long term temperature of 110°F.
[5]For 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.
[6]For 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 $\alpha_{N,seis}$.

TABLE 4—STEEL DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT REINFORCING BARS [(1)]

CHARACTERISTIC		SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
				No. 3	**No. 4**	**No. 5**	**No. 6**	**No. 7**	**No. 8**	**No. 10**
Nominal bar diameter		d	in.	$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_4$
Reinforcing bar effective cross-sectional area		A_{se}	inch²	0.11	0.2	0.31	0.44	0.6	0.79	1.27
ASTM 615 Grade 60	Nominal steel strength in tension	N_{sa}	lb	9,900	18,000	27,900	39,600	54,000	71,100	114,300
	Nominal steel strength in shear	V_{sa}	lb	5,940	10,800	16,740	23,760	32,400	42,660	68,580
	Strength reduction factor for tension, steel failure mode	ϕ	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength reduction factor for shear, steel failure mode[1]	ϕ	-	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.91	0.91	0.91	0.90	0.90	0.71	0.71

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1ft-lbf = 1.356 N-M, 1 psi = 0.006895 MPa.

[1]The tabulated value of ϕ applies when the load combinations of Section 1605.2.1 of the IBC, Section 1612.2.1 of the UBC, or ACI 318 Section 9.2 are used. If the load combinations of Section 1909.2 of the UBC or ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5 (b).

TABLE 5—CONCRETE BREAKOUT DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT REINFORCING BARS [(1,2)]

CHARACTERISTIC	SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
			No. 3	**No. 4**	**No. 5**	**No. 6**	**No. 7**	**No. 8**	**No. 10**
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24	24	24	24	24
Effectiveness factor for cracked concrete	k_{cr}	-	17	17	17	17	17	17	17
Minimum concrete thickness	h_{min}	in.	$h_{ef} + 1^1/_4$		$h_{ef} + 2d_o$				
Anchor embedment depth - minimum	$h_{ef,min}$	in.	$2^3/_8$	$2^3/_4$	$3^1/_8$	$3^1/_2$	$3^1/_2$	4	5
Minimum spacing	s_{min}	in.	$^{15}/_{16}$	$1^1/_2$	$2^1/_2$	3	$3^1/_2$	4	5
Minimum edge distance	c_{min}	in.	$^{15}/_{16}$	$1^1/_2$	$2^1/_2$	3	$3^1/_2$	4	5
Critical edge distance	c_{ac}	in.	See Section 4.1.10 of this report						
Strength reduction factor for tension, concrete failure mode[1]	ϕ	Cond. B	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Strength reduction factor for shear, concrete failure mode[1]	ϕ	Cond. B	0.70	0.70	0.70	0.70	0.70	0.70	0.70

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1ft-lbf = 1.356 N-M, 1 psi = 0.006895 MPa.

[1]The tabulated value of ϕ applies when the load combinations of Section 1605.2.1 of the IBC, Section 1612.2.1 of the UBC, or ACI 318 Section 9.2 are used and the requirements of ACI 318 D.4.4(c) for Condition B are met. If the load combinations of Section 1909.2 of the UBC or ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5 for Condition B.
[2]The value of f'_c used for calculation must be limited to maximum 8,000 psi (55 MPa) in accordance with ACI 318 D.3.5.

TABLE 6—S7 ADHESIVE ANCHOR BOND STRENGTH DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT REINFORCING STEEL [1,6]

CHARACTERISTIC		SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
				No. 3	**No. 4**	**No. 5**	**No. 6**	**No. 7**	**No. 8**	**No. 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[2]	Characteristic Bond Strength for Uncracked Concrete	$\tau_{k,uncr}$	psi	1,184	1,184	1,184	1,184	1,184	1,184	1,026
	Characteristic Bond Strength for Cracked Concrete	$\tau_{k,cr}$	psi	506	552	563	608	608	608	601
Temperature Range B[3]	Characteristic Bond Strength for Uncracked Concrete	$\tau_{k,uncr}$	psi	1,100	1,100	1,100	1,100	1,100	1,100	953
	Characteristic Bond Strength for Cracked Concrete	$\tau_{k,cr}$	psi	506	552	563	608	608	608	559
Temperature Range C[4,5]	Characteristic Bond Strength for Uncracked Concrete	$\tau_{k,uncr}$	psi	1,054	1,054	1,054	1,054	1,054	1,054	913
	Characteristic Bond Strength for Cracked Concrete	$\tau_{k,cr}$	psi	484	528	539	583	583	583	535
Continuous Inspection	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	$\phi_{sub,aci}$	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Periodic Inspection	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						

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1ft-lbf = 1.356 N-M, 1 psi = 0.006895 MPa.

[1]Bond strength values correspond to concrete compressive strengths ranging from 2,500 psi to 8,000 psi.
[2]Temperature range A: Maximum short term temperature of 110°F and maximum long term temperature of 70°F.
[3]Temperature range B: Maximum short term temperature of 130°F and maximum long term temperature of 110°F.
[4]Temperature range C: Maximum short term temperature of 176°F and maximum long term temperature of 110°F.
[5]For 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.
[6]For 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 $\alpha_{N,seis}$.

FIGURE 1—ITW RED HEAD S7 ADHESIVE CARTRIDGES, DISPENSING TOOLS, MIXING NOZZLES, HOLE CLEANING BRUSHES AND HOLE PLUGS

TABLE 7—EXAMPLE EPCON S7 ADHESIVE ALLOWABLE STRESS DESIGN VALUES (ASD) FOR ILLUSTRATIVE PURPOSES

Anchor Diameter (d)	Min/Max Embedment Depth, h_{ef} (in)	Char. Bond Strength $\tau_{k,uncr}$ (psi)	Allowable Tension Load (lb) 2500psi- 8000psi	Controlling Failure Mode
3/8	2 3/8	1,735	1,929	Concrete
	7 1/2		2,280	Steel
1/2	2 3/4		2,403	Concrete
	10		4,171	Steel
5/8	3 1/8		2,911	Concrete
	12 1/2		6,644	Steel
3/4	3 1/2		3,451	Concrete
	15		9,831	Steel
7/8	3 1/2		3,451	Concrete
	17 1/2		13,571	Steel
1	4		4,216	Concrete
	20		17,802	Steel
1 1/4	5	1,333	5892	Concrete
	25		28,485	Steel

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1ft-lbf = 1.356 N-M, 1 psi = 0.006895 MPa.

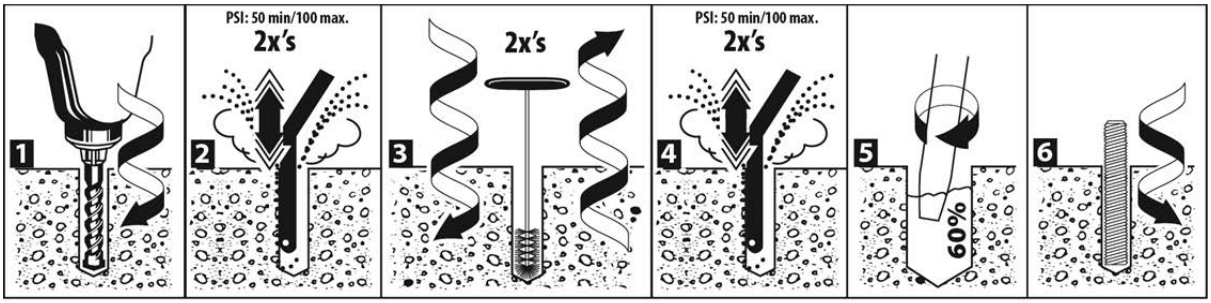
This table was developed based on the following conditions:
[1]Single anchor with static tension only, A36 threaded rod
[2]Vertical downward installation direction
[3]Inspection regimen = Periodic
[4]Installation temperature = 70°F to 110°F
[5]Long term temperature = 70°F
[6]Short term temperature = 110°F
[7]Dry hole condition (carbide drilled hole)
[8]Embedment = hef (min/max for each diameter)
[9]Concrete determined to remain uncracked for the life of the anchorage
[10]Load combinations from ACI 318 Section 9.2 (no seismic loading)
[11]30% dead load and 70% live load, controlling load combination 1.2D + 1.6L
[12]Calculation of weighted average for α = 0.3*1.2 + 0.7*1.6 = 1.48
[13]f'_c = 2,500 psi (normal weight concrete)
[14]$c_{a1} = c_{a2} \geq c_{ac}$
[15]$h \geq h_{min}$

Illustrative Procedure to Calculate Allowable Stress Design Tension Value:
Epcon S7 Adhesive Anchor ½-inch diameter, using an embedment of $4^1/_2$-inches, assuming the conditions given in Table 7.

	PROCEDURE		CALCULATION
Step 1	Calculate steel strength of a single anchor in tension per ACI 318 D 5.1.2, Table 1 of this report	ϕN_{sa}	$= \phi N_{sa}$ = 0.75*8,230 **= 6,173 lbs steel strength**
Step 2	Calculate concrete breakout strength of a single anchor in tension per ACI 318 D 5.2.2, Table 2 of this report	N_b	$= k_{uncr} \lambda \sqrt{f`_c}\ h_{ef}^{1.5}$ $= 24*1.0*\sqrt{2,500}*4.5^{1.5}$ = 11,455 lbs
		ϕN_{cb}	$= \phi A_{NC}/A_{NC0}\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N} N_b$ = 0.65*1.0*1.0*1.0*1.0*11,455 = 0.65*11,455 **= 7,446 lbs concrete breakout strength**
Step 3	Calculate bond strength of a single anchor in tension per Equations D-16a, D-16f and Table 3 of this report	N_{ao}	$= \tau_{k,cr}\ \pi d h_{ef}$ = 1,735*3.14*0.5*4.5 = 12,258 lbs
		ϕN_{ao}	$= \phi A_{Na}/A_{Na0}\ \psi_{ed,Na}\ \psi_{c,Na}\ N_{ao}$ = 0.65*1.0*1.0*1.0*1.0*11,092 = 0.65*12,258 **= 7,968 lbs bond strength**
Step 4	Determine controlling resistance strength in tension per ACI 318 D 4.1.1 and D 4.1.2		**= 6,173 lbs controlling resistance (steel)**
Step 5	Calculate allowable stress design conversion factor for loading condition per ACI 318 Section 9.2:	α	= 1.2*D* + 1.6*L* = 1.2(0.3) + 1.6(0.7) **= 1.48**
Step 6	Calculate allowable stress design value per Section 4.2 of this report	$T_{allowable,ASD}$	$= \phi N_n / \alpha$ = 6,173/ 1.48 **= 4,171 lbs allowable stress design**

FIGURE 2—EXAMPLE DESIGN CALCULATION

EPCON S7 ADHESIVE ANCHOR INSTALLATION INSTRUCTIONS



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

1) ▪ Use a rotary hammer drill or pneumatic air drilling machine with a drill bit complying to ANSI B212.15-1994 tolerance requirements. Drill hole to the required embedment depth. See attached table for drill bit specifications and min/maximum embedment depths.
▪ Floor/wall installations may be used with maximum $1^{1}/_{4}$" diameter rods/rebar, which are oil, rust and scale free.
▪ Overhead installations may be used with maximum $^{1}/_{2}$" diameter rods/rebar, which are oil, rust and scale free.
▪ Per construction specification, adhere to minimum spacing, minimum edge distance, and minimum member thickness.

2) ▪ For dry holes, oscillate a clean air nozzle in and out of the dry hole two times, for a total of two seconds, starting at the bottom of the hole with contaminant-free compressed air, exhausting hole until visually clean (i.e., no dust, debris, etc.)
▪ For damp, submerged, and underwater applications, oscillate a clean air nozzle in and out of the damp, water-filled or submerged hole four times, for a total of four seconds, starting at the bottom of the hole with contaminant-free compressed air, exhausting hole until visually clean (i.e., no dust, debris, etc.)
▪ If required, use an extension on the end of the air nozzle to reach the bottom of the hole.

3) ▪ Select an appropriately sized Red Head brush for the anchor diameter. Brush must be checked for wear before use. See attached table for brush specifications, including minimum diameter.
▪ Insert the brush into the hole with a clockwise motion. For every ½" forward advancement, complete one full turn until bottom of hole is reached. For faster and more suitable cleaning, attach the brush to a drill.
▪ Using a clockwise motion, for every full turn of the brush, pull the brush ½" out of the hole.
▪ For dry holes, twist/spin the brush two times in/out of the hole.
▪ For damp, submerged and underwater applications, twist/spin the brush four times in/out of the hole.
▪ If required, use a wire brush extension (part nos. ESDS-38 or EHAN-38) to reach the bottom of the hole.
▪ Air clean the dust off the brush to prevent clogging of the brush.

4) ▪ For dry holes, oscillate a clean air nozzle in and out of the dry hole two times, for a total of two seconds, starting at the bottom of the hole with contaminant-free compressed air, exhausting hole until visually clean (i.e., no dust, debris, etc.)
▪ For damp, submerged and underwater applications, oscillate a clean air nozzle in and out of the damp, water-filled or submerged hole four times, for a total of four seconds, starting at the bottom of the hole with contaminant-free compressed air, exhausting hole until visually clean (i.e., no dust, debris, etc.)

5) ▪ Review the Material Safety Data Sheet (MSDS) before use.
▪ Check the "best used by" date on the cartridge and that the cartridge has been stored in temperatures between 40°F and 90°F.
▪ Review the gel time/cure time chart, based on the temperature at time of installation, in order to determine tool, cartridge and nozzle requirements.
▪ Assemble the Red Head supplied cartridge and nozzle. Do not modify or remove mixing elements in nozzle.
▪ Place the assembly into a hand injection tool or a pneumatic injection tool.
▪ Dispense mixed adhesive outside of hole until uniform color is achieved.
▪ During installations, concrete must be between 14°F and 110°F, or artificially maintained. For concrete temperatures of 14°F to 30°F, adhesive must be maintained at a minimum 30°F during installation.
▪ Insert the nozzle to the bottom of the hole and inject the adhesive at an angle, leaving the nozzle tip always slightly below the fill level. If nozzle does not reach the bottom of the hole, use extension tubing positioned on the end of nozzle.
▪ In a slow circular direction, work the adhesive into the sides of the hole, filling slowly to ensure proper adhesive distribution, until the hole is approximately 60% filled.
▪ For holes that contain water, keep injecting the adhesive below the water in order to displace the water upward.

6) ▪ For floor (vertical down) installations, the anchor rod/rebar must be marked with the required embedment depth.
▪ For wall (horizontal) installations with concrete or adhesive at or below 70°F, the anchor rod/rebar must be marked with the required embedment depth.
▪ For wall (horizontal) installations with concrete or adhesive over 70°F, the anchor rod/rebar must be marked with the required embedment depth and assembled with a Red Head hole plug positioned on the rod/rebar at the required embedment depth.
▪ For overhead installations, the anchor rod/rebar must be marked with the required embedment depth and assembled with a Red Head hole plug (part nos. E038 or E012) positioned on the rod/rebar at the required embedment depth.
▪ Immediately insert the rod/rebar assembly to the required embedment depth, using a slow rotating motion to ensure proper adhesive distribution.
▪ After installing the anchor, the gap between the rod and the concrete must be completely filled with adhesive. The adhesive must fill voids, crevices and uniformly coat the rod and concrete.
▪ After installation, do not disturb the anchor until the full cure time has elapsed.
▪ Adhesive must be fully cured before applying any load or torque.

FIGURE 3—ITW RED HEAD S7 ADHESIVE INSTALLATION INSTRUCTIONS

SPECIFICATIONS FOR INSTALLATION OF EPCON S7 ADHESIVE ANCHORS IN CONCRETE

FOR INSTALLATION USING U.S. CUSTOMARY UNIT THREADED ROD

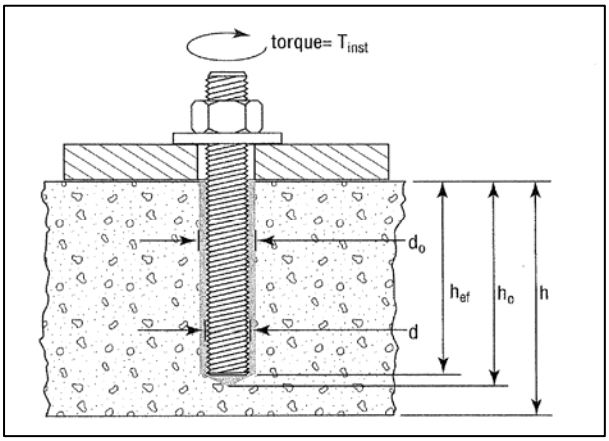
CHARACTERISTIC	SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
			$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_4$
Nominal carbide bit diameter	-	in.	$^7/_{16}$	$^9/_{16}$	$^3/_4$	$^7/_8$	1	$1^1/_8$	$1^3/_8$
Anchor embedment depth - minimum	$h_{ef,\,min}$	in.	$2^3/_8$	$2^3/_4$	$3^1/_8$	$3^1/_2$	$3^1/_2$	4	5
Anchor embedment depth - maximum	$h_{ef,\,max}$	in.	$7^1/_2$	10	$12^1/_2$	15	$17^1/_2$	20	25
Minimum spacing	s_{min}	in.	$^{15}/_{16}$	$1^1/_2$	$2^1/_2$	3	$3^1/_2$	4	5
Minimum edge distance	c_{min}	in.	$^{15}/_{16}$	$1^1/_2$	$2^1/_2$	3	$3^1/_2$	4	5
Minimum concrete thickness	h_{min}	in.	$h_{ef} + 1^1/_4$		$h_{ef} + 2d_o$				
Maximum tightening torque for pretension clamping	T_{inst}	ft lb	9	16	47	70	90	110	370

FOR INSTALLATION USING U.S. CUSTOMARY UNIT REINFORCING BARS

CHARACTERISTIC	SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
			No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 10
Nominal carbide bit diameter	-	in.	$^7/_{16}$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_8$	$1^3/_8$
Anchor embedment depth - minimum	$h_{ef,\,min}$	in.	$2^3/_8$	$2^3/_4$	$3^1/_8$	$3^1/_2$	$3^1/_2$	4	5
Anchor embedment depth - maximum	$h_{ef,\,max}$	in.	$7^1/_2$	10	$12^1/_2$	15	$17^1/_2$	20	25
Minimum spacing	s_{min}	in.	$^{15}/_{16}$	$1^1/_2$	$2^1/_2$	3	$3^1/_2$	4	5
Minimum edge distance	c_{min}	in.	$^{15}/_{16}$	$1^1/_2$	$2^1/_2$	3	$3^1/_2$	4	5
Minimum concrete thickness	h_{min}	in.	$h_{ef} + 1^1/_4$		$h_{ef} + 2d_o$				

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1ft-lbf = 1.356N-m, 1psi = 0.006895MPa.

ANCHOR INSTALLATION



BRUSH & HOLE PLUG SPECIFICATIONS

Anchor diameter (in) **(d)**	Brush color	Brush Part No.	Minimum brush diameter (in)	Hole Plug Part No.
$^3/_8$	Grey	SB038	0.563	E038
$^1/_2$	Brown	SB012	0.675	E012
$^5/_8$	Green	SB058	0.900	E058
$^3/_4$	Yellow	SB034	1.125	E034
$^7/_8$	Red	SB078	1.350	E078
1	Purple	SB010	1.463	E010
$1^1/_4$	Blue	SB125	1.575	E114

CURE TIMES AND GEL TIMES FOR EPCON S7 ADHESIVE

Concrete Temperature (°F)[1,2]	Gel Time[3]	Cure Time[4]
90	2 minutes	30 minutes
70	4 minutes	30 minutes
50	6 minutes	45 minutes
30	14 minutes	2 hours
14	30 minutes	12 hours

For **SI:** t° (°F-32) X .555 = °C.

[1]Adhesive must be installed in concrete temperatures within the noted range or artificially maintained at the noted temperature.
[2] For concrete temperatures between 14°F and 30°F, adhesive must be maintained at a minimum of 30°F during installation.
[3]Gel time is the maximum time from the end of mixing to when the insertion of the anchor into the adhesive shall be completed and is based upon the adhesive and concrete temperatures noted.
[4]Cure time is the minimum time from the end of gel time to when the anchor maybe torque or loaded. Anchors are to be undisturbed during the cure time.

FIGURE 3—ITW RED HEAD S7 ADHESIVE INSTALLATION INSTRUCTIONS (Continued)

ICC-ES Evaluation Report

ESR-2308 FBC Supplement

Reissued May 1, 2013
This report is subject to renewal May 1, 2014.

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

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EVALUATION SUBJECT:

ITW RED HEAD EPCON S7 ADHESIVE ANCHORING SYSTEM FOR CRACKED AND UNCRACKED CONCRETE

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the ITW Red Head Epcon S7 Adhesive Anchoring System for Cracked and Uncracked Concrete, recognized in ICC-ES master evaluation report ESR-2308, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2010 *Florida Building Code—Building*
- 2010 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The ITW Red Head Epcon S7 Adhesive Anchoring System for Cracked and Uncracked Concrete**,** described in Sections 2.0 through 7.0 of the master evaluation report ESR-2308, complies with the 2010 *Florida Building Code—Building* and the 2010 *Florida Building Code—Residential*, provided the design and installation are in accordance with the *International Building Code®* (IBC) provisions noted in the master report.

Exception: The modifications to ACI 318 as shown in 2009 IBC Sections 1908.1.9 and 1908.1.10, and as noted in 2009 IBC Section 1912.1, do not apply to the 2010 *Florida Building Code*.

Use of the ITW Red Head Epcon S7 Adhesive Anchoring System for Cracked and Uncracked Concrete with stainless steel threaded rod materials has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the 2010 *Florida Building Code—Building* and the 2010 *Florida Building Code—Residential*.

For products falling under Florida Rule 9N-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report reissued on May 1, 2013.

ICC-ES VAR Environmental Report

VAR-1033

Issued July 1, 2012

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EVALUATION SUBJECT:

ITW RED HEAD EPCON S7 ADHESIVE ANCHORING SYSTEM FOR CRACKED AND UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following environmental criteria:

- ICC-ES Environmental Criteria for Determination of Volatile Organic Compound (VOC) Content and Emissions of Adhesives and Sealants (EC105), dated March 1, 2012.
- ICC-ES Evaluation Guideline for Determination of Regionally Extracted, Harvested or Manufactured Materials or Products (EG104), dated October 1, 2008.

Compliance eligibility with the applicable sections of the following codes, standards and other reference documents:

- 2012 *International Green Construction* Code™ (IgCC) (see Table 3 for details)
- *International Green Construction Code*™, Public Version 2.0 (IgCC PV2.0) (see Table 4 for details)
- 2008 *National Green Building Standard*™ (ICC 700) (see Table 5 for details)
- ANSI/ASHRAE/USGBC/IES Standard 189.1-2009, Standard for the Design of High-Performance Buildings (Except Low-Rise Residential Buildings) (see Table 6 for details)
- LEED® 2009 for New Construction and Major Renovations (see Table 7 for details)
- LEED® 2009 for Schools New Construction and Major Renovations (see Table 8 for details)
- ANSI/GBI 01-2010, Green Building Assessment Protocol for Commercial Construction (see Table 9 for details)
- CSI GreenFormat™ (see Table 10 for details)

2.0 USES

The ITW Red Head EPCON S7 Adhesive Anchoring System is a post-installed anchorage system used to resist static, wind and seismic tension and shear loads when installed in cracked and uncracked normal-weight concrete having a specified compressive strength, *f'c*, of 2500 psi to 8,500 psi (17.2 MPa to 58.6 MPa). The anchoring system is an alternative to anchors described in Sections 1911 and 1912 of the 2009 and 2006 *International Building Code*® (IBC), Sections 1912 and 1913 of the 2003 and 2000 IBC, and Section 1923 of the 1997 *Uniform Building Code*™ (UBC). The anchoring system may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the 2009, 2006 and 2003 *International Residential Code*® (IRC), and Section R301.1.2 of the 2000 IRC. Refer to ICC-ES report ESR-2308 for detailed information.

3.0 DESCRIPTION

The ITW Red Head EPCON S7 Adhesive Anchoring System is a two-component, high-strength, fast-cure, structural adhesive, used with continuously threaded rods and deformed reinforcing bars installed in normal-weight concrete. The primary components of the ITW Red Head EPCON S7 Adhesive Anchoring System consist of hole-cleaning equipment, dispensing tools, anchor elements (threaded rods or steel reinforcing bars) and adhesive.

The EPCON S7 anchoring system adhesive is a two-part hybrid epoxy packaged in a dual-chamber cartridge at a volumetric ratio of 10:1. The cartridge is available in 28-ounce (side-by-side) and 10-ounce (coaxial) sizes. The components are dispensed through a static mixing nozzle, which attaches to the cartridge.

The adhesive has VOC emission levels as set forth in Table 1 of this report.

4.0 CONDITIONS

4.1 Code Compliance:

See ICC-ES ESR-2308 for compliance of the anchoring system with IBC, IRC and UBC code requirements.

4.2 Codes, Standards and Green Rating Systems Eligibility:

The information presented in Tables 3 through 10 of this report provides a matrix of areas of evaluation and corresponding limitations and/or additional project-specific requirements, and offers benefits to individuals who are assessing eligibility for compliance.

The final interpretation of the specific requirements of the code rests with the Authority Having Jurisdiction.

Compliance for items noted as "Verified Attribute" is subject to any conditions noted in the tables. Decisions on compliance for those items noted as "Eligible for Points" in Tables 3 through 10 rest with the user of this report, and those items are subject to the conditions noted. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report.

5.0 BASIS OF EVALUATION

The information in this report, including the "Verified Attribute," is based upon supporting documentation in conformance to the requirements set forth in the ICC-ES Environmental Criteria EC105. (Evaluation applies to 2012 IgCC Section 806.2; IgCC PV2.0 Section 806.2; ASHRAE Standard 189.1 Sections 8.4.2.1 and 8.5.2; ICC 700 Section 901.9; LEED NC Credit IEQ4.1; LEED Schools Credit IEQ4.1; and ANSI/GBI 01-2010 Table 12.2.1-A.)

6.0 IDENTIFICATION

The ITW Red Head EPCON S7 anchoring system adhesive is identified by labels on the adhesive cartridges bearing the adhesive manufacturer's name (ITW Red Head) and location (Addison, Illinois), the product name (EPCON S7), and the VAR Environmental Report number (VAR-1033).

TABLE 1—VOC EMISSION SUMMARY

PRODUCT NAME	VOC EMISSIONS[1]		METHOD OF DETERMINATION
Epcon S7 Adhesive	Individual VOCs	≤ 1/2 CREL[2]	CPDH/EHLB/Standard Method V1.1 (private office and classroom scenarios)
	Formaldehyde	BQL[3]	

Notes:

[1]Based on both private office and standard classroom scenarios with usage of four anchor adhesives for each scenario.
[2]Chronic Reference Exposure Level (CREL)
[3]Below quantifiable limit of 2 µg/m^3

TABLE 2—RAW MATERIAL COMPONENT SOURCE LOCATIONS[1,2]

RAW MATERIAL SOURCE LOCATION[3]	DISTANCE FROM POINT OF MANUFACTURE (MILES)[4]
Pensacola, FL	933
West Chester, PA	758
Rock Hill, SC	800
Kennesaw, GA	715
Waterford, NY	848
Wallingford, CT	908
Fairmount, GA	686
Bridgewater, MA	1018
Wheeling, IL	11
DeLisle, MS	923
Piffard, NY	607
Wheeling, IL	11
Gonzales, TX	1180
Sandusky, OH	313

Notes:

[1]The raw material source location is provided for informational purposes. Determination of compliance with regional or indigenous material requirements of any particular code, standard or rating system is left to the user of the report for any particular project.
[2]The raw material source locations listed in Table 2 account for 100% of the raw materials used to manufacture the EPCON S7 anchoring system.
[3]The actual street addresses of the raw material source locations are proprietary. The actual locations are on file and have been verified by ICC-ES.
[4]The distances are measured in a straight line from point-to-point and assume mode of transportation to be by motor vehicle.

TABLES 3 THROUGH 10

Section Number	Section Intent	Possible Points	Requirements/Conditions Of Use To Determine Compliance	Finding
TABLE 3—SUMMARY OF AREA OF ELIGIBILITY WITH THE 2012 *INTERNATIONAL GREEN CONSTRUCTION CODE*				
806.2	Material Emissions and Pollutant Control—Adhesives and sealants	N/A	A minimum of 85 percent by weight or volume, of specific categories of site-applied adhesives and sealants used on the interior side of the building envelope shall comply with the VOC emission limits in Table 806.2(2)	●
TABLE 4—SUMMARY OF AREA OF ELIGIBILITY WITH THE *INTERNATIONAL GREEN CONSTRUCTION CODE*, PV2.0				
806.2	Material Emissions and Pollutant Control—Adhesives and sealants	N/A	A minimum of 85 percent by weight or volume, of specific categories of site-applied adhesives and sealants used on the interior side of the building envelope shall comply with the VOC emission limits in Table 806.2(2)	●
TABLE 5—SUMMARY OF AREA OF ELIGIBILITY WITH 2009 ASHRAE STANDARD 189.1				
8.4.2.1.1	Adhesives and Sealants—VOC Emission Requirements	Prescriptive	VOC emissions shall be determined in accordance with CA/DHS/EHLB/R-174 (which has been revised to CDPH/EHLB/Standard Method V1.1 (February 2010))	●
8.5.2	Materials—Emissions	Performance	Emissions of all materials listed in the section shall be modeled for VOC concentrations in accordance with CA/DHS/EHLB/R-174 (which has been revised to CDPH/EHLB/Standard Method V1.1 (February 2010))	○
TABLE 6—SUMMARY OF AREA OF ELIGIBILITY WITH ICC 700-2008				
901.9	Interior low-VOC adhesives and sealants	5	A minimum of 85 percent of site-applied products used within the interior of the building are in accordance with CDPH 01350 (aka CA/DHS/EHLB/R-174 (which has been revised to be CDPH/EHLB/Standard Method V1.1 (February 2010)), as certified by a third party program	●
TABLE 7—SUMMARY OF AREA OF ELIGIBILITY WITH LEED 2009 FOR NEW CONSTRUCTION				
IEQ4.1	Low Emitting Materials—Adhesives and Sealants	1	All adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following requirements as applicable to the project scope 1: Multipurpose construction adhesives must comply with SCAQMD Rule #1168 and have a VOC content of no greater than 70 g/L; however, the provisions of LEED for Schools IEQ4.1 are recognized as an alternate compliance path.	●
TABLE 8—SUMMARY OF AREA OF ELIGIBILITY WITH LEED 2009 FOR SCHOOLS				
IEQ4.1	Low Emitting Materials—Adhesives and Sealants	1	All adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (aka CA/DHS/EHLB/R-174 (which has been revised to be CDPH/EHLB/Standard Method V1.1 (February 2010))	●
TABLE 9—SUMMARY OF AREA OF ELIGIBILITY WITH 2010 ANSI/GBI 01				
12.2.1-A	Source Control of Indoor Pollutants—Volatile Organic Compounds	1 min. 3 max.	Multipurpose construction adhesives shall comply with VOC emission limits in Table 12.2.1-A as determined in accordance with CA/DHS/EHLB/R-174 (which has been revised to be CDPH/EHLB/Standard Method V1.1 (February 2010))	●
TABLE 10—SUMMARY OF AREA OF ELIGIBILITY WITH CSI GREENFORMAT™				
2.3.6	Emissions	N/A	This category relates to LEED rating system points. For specifics, see the GreenFormat-LEED Relationships Table.	●
●	= Verified attribute			