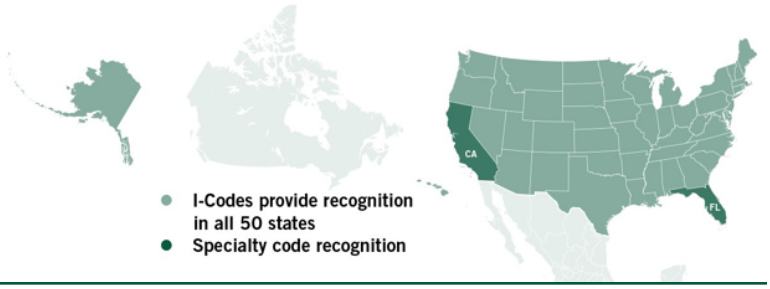
ICC EVALUATION SERVICE

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# ICC-ES Evaluation Report
# ESR-4340

*Reissued December 2022*

*This report is subject to renewal December 2023.*

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

**DIVISION: 05 00 00—METALS**
**Section: 05 05 19—Post-Installed Concrete Anchors**

**REPORT HOLDER:**

**THE HILLMAN GROUP**

**ADDITIONAL LISTEES:**

**ALL POINTS SCREW, BOLT & SPECIALTY CO.**

**THE HILLMAN GROUP OF CANADA**

**EVALUATION SUBJECT:**

**POWER-PRO CONCRETE SCREW ANCHORS**

## 1.0 EVALUATION SCOPE

**Compliance with the following codes:**

- 2018, 2015, and 2012 *International Building Code®* (IBC)
- 2018, 2015, and 2012 *International Residential Code®* (IRC)

**Properties evaluated:**

- Structural
- Nonstructural

## 2.0 USES

The Power-Pro concrete screw anchors are used as anchorage to resist static, wind and seismic (Seismic Design Categories A and B only) tension and shear loads in uncracked normal-weight or lightweight concrete having a specified compressive strength, $f'_c$, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

The Power-Pro concrete screw anchors $^3/_{16}$-, ¼- and $^5/_{16}$-inch (4.8, 6.4 and 7.9 mm) diameters with $1^3/_4$-inch (44 mm) nominal embedment are to be used in single anchor applications or in group anchorages when designed according to ACI 318-14 Chapter 17 or ACI 318-11 Appendix D and Sections 4.1 and 4.2 of this report, as applicable.

The Power-Pro concrete screw anchors $^3/_{16}$- and ¼-inch (4.8 and 6.4mm) diameters with $1^1/_4$-inch (32 mm) nominal embedment are to be used for redundant applications, where multiple anchors support linear elements (e.g., ductwork), when designed according to Section 4.3 of this report. In redundant applications, the anchors can be used in cracked and uncracked concrete having a specified compressive strength, $f'_c$, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

The Power-Pro concrete screw anchors are an alternative to cast-in-place anchors described in Section 1901.3 of the 2018 and 2015 IBC and Sections 1908 and 1909 of the 2012 IBC. The anchors 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 Power-Pro Concrete Screw Anchors:

The Power-Pro concrete screw anchors are manufactured from carbon steel, are given a supplementary hardening process and have a corrosion inhibiting coating system available in several colors. The anchors are available with a hex washer head or a flat countersunk head with a star recess. Available nominal diameters are $^3/_{16}$-, ¼- and $^5/_{16}$-inch (4.8, 6.4 and 7.9 mm) with various lengths.

Product names for the report holder and the additional listees are presented in the following table:

| COMPANY NAME | PRODUCT NAME |
|---|---|
| The Hillman Group | Power Pro® Concrete Screw Anchor |
| The Hillman Group | Hillman Solid Set™ |
| All Points Screw, Bolt & Specialty Co. | All Points Solid Set™ |
| The Hillman Group of Canada | Pro-Fast Concrete Screw Anchor |

The Power-Pro concrete screw anchor with different head styles are illustrated in Figure 1.

### 3.2 Concrete:

Normal-weight and lightweight concrete must comply with Sections 1903 and 1905 of the IBC.

## 4.0 DESIGN AND INSTALLATION

### 4.1 Strength Design (Structural):

**4.1.1 General:** Design strength of anchors complying with 2018 and 2015 IBC, as well as Section R301.1.3 of the 2018 and 2015 IRC must be determined in accordance with ACI 318-14 Chapter 17 and this report.

Design strength of anchors complying with the 2012 IBC and Section R301.1.3 of the 2012 IRC, must be determined in accordance with ACI 318-11 Appendix D and this report.

Design parameters and references to ACI 318 are based on the 2018 and 2015 IBC (ACI 318-14) and 2012 IBC (ACI 318-11) unless noted otherwise in Sections 4.1.2 through 4.1.11 of this report.

The strength design must comply with ACI 318-14 17.3.1 or ACI 318-11 D.4.1, except as required in ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable.

Strength reduction factors, $\phi$, as given in ACI 318-14 17.3.3 or ACI 318-11 Section D.4.3, as applicable, and noted in Tables 3 and 4 must be used for load combinations calculated in accordance with Section 1605.2 of the IBC and Section 5.3 of ACI 318-14 or Section 9.2 of ACI 318-11, as applicable. Strength reduction factors, $\phi$, as given in ACI 318-11 D.4.4 must be used for load combinations set forth in ACI 318-11 Appendix C.

The value of $f'_c$ used in the calculations must be limited to a maximum of 8,000 psi (55.2 MPa), in accordance with ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable.

**4.1.2 Requirements for Static Steel Strength in Tension, $N_{sa}$:** The nominal static steel strength of a single anchor in tension is calculated in accordance with ACI 318-14 17.4.1.2 or ACI 318-11 D.5.1.2, as applicable. The $N_{sa}$ values of a single anchor are given in Table 3 of this report. Strength reduction factors, $\phi$, corresponding to brittle steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable, and provided in Table 3, must be used.

**4.1.3 Requirements for Static Concrete Breakout Strength in Tension, $N_{cb}$ or $N_{cbg}$:** The nominal concrete breakout strengths of a single anchor or a group of anchors in tension, $N_{cb}$ and $N_{cbg}$, respectively, must be calculated in accordance with ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, with modifications as described in this section. The nominal concrete breakout strength in tension in regions of concrete where analysis indicates no cracking at service loads in accordance with ACI 318-14 17.4.2.6 or ACI 318-11 D.5.2.6, as applicable, must be calculated using the values of $k_{uncr}$ as given in Table 3 of this report with $\psi_{c,N}$ = 1.0.

**4.1.4 Requirements for Static Pullout Strength in Tension, $N_{pn}$:** The nominal pullout strength of a single anchor in accordance with ACI 318-14 17.4.3.1 and 17.4.3.2 or ACI 318-11 D.5.3.1 and D.5.3.2, respectively, as applicable, in uncracked concrete, $N_{p,uncr}$, is given in Table 3 of this report. In lieu of ACI 318-14 17.4.3.6 or ACI 318-11 D.5.3.6, as applicable, $\psi_{c,P}$ = 1.0 for all design cases. The nominal pullout strength can be adjusted by calculation according to Eq-1:

$$N_{p,f'_c} = N_{p,uncr}\left(\frac{f'_c}{2{,}500}\right)^n \quad \text{(lb,psi)} \qquad \text{(Eq-1)}$$

$$N_{p,f'_c} = N_{p,uncr}\left(\frac{f'_c}{17.2}\right)^n \quad \text{(N, MPa)}$$

where $f'_c$ is the specified compressive strength and $n$ is the factor defining the influence of concrete strength on the pullout strength. See Table 3 for $n$ factor for applicable diameters.

**4.1.5 Requirements for Static Steel Shear Capacity, $V_{sa}$:** The nominal steel strength in shear, $V_{sa}$, of a single anchor in accordance with ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable, is given in Table 4 of this report and must be used in lieu of the values derived by calculation from ACI 318-14 Eq. 17.5.1.2b or ACI 318-11 Eq. D-29, as applicable. The strength reduction factor, $\phi$, corresponding to brittle steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable, and provided in Table 4, must be used.

**4.1.6 Requirements for Static Concrete Breakout Strength of Anchor in Shear, $V_{cb}$ or $V_{cbg}$:** The nominal concrete breakout strength of a single anchor or group of anchors in shear, $V_{cb}$ or $V_{cbg}$, respectively, must be calculated in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, with modifications as described in this section. The basic concrete breakout strength of a single anchor in shear, $V_b$, must be calculated in accordance with ACI 318-14 17.5.2.2 or ACI 318-11 D.6.2.2, as applicable, using the value of $\ell_e$ and $d_a$ given in Table 4 of this report. The value of $l_e$ used in ACI 318-14 Eq. 17.5.2.2a or ACI 318-11 Eq. D-33, as applicable, must be taken as no greater than the lesser of $h_{ef}$ or $8d_a$.

**4.1.7 Requirements for Static Concrete Pryout Strength of Anchor in Shear, $V_{cp}$ or $V_{cpg}$:** Static nominal concrete pryout strengths of a single anchor or a group of anchors, $V_{cp}$ and $V_{cpg}$, respectively, must be calculated in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, modified by using the value of $k_{cp}$ provided in Table 4 and the value of $N_{cb}$ or $N_{cbg}$ as calculated in Section 4.1.3 of this report.

**4.1.8 Requirements for 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 318-14 17.6 or ACI 318-11 D.7, as applicable.

**4.1.9 Requirements for Critical Edge Distance, $c_{ac}$:** In applications where $c < c_{ac}$ and supplemental reinforcement to control splitting of the concrete is not present, the concrete breakout strength in tension for uncracked concrete, calculated according to ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, must be further multiplied by the factor $\psi_{cp,N}$ given by Eq-2:

$$\psi_{cp,N} = \frac{c}{c_{ac}} \qquad \text{(Eq-2)}$$

where the factor $\psi_{cp,N}$ need not be taken as less than $1.5h_{ef}/c_{ac}$.

For all other cases, $\Psi_{cp,N} = 1.0$. In lieu of ACI 318-14 17.7.6 or ACI 318-11 D.8.6, as applicable, the values for the critical edge distance, $c_{ac}$, must be taken from Table 3.

**4.1.10 Requirements for Minimum Member Thickness, Minimum Anchor Spacing, and Minimum Edge Distance:** In lieu of ACI 318-14 17.7.1 and 17.7.3 or ACI 318-11 D.8.1 and D.8.3, respectively, as applicable, values of $s_{min}$ and $c_{min}$ must comply with Tables 3 and 4 of this report. In lieu of ACI 318-14 17.7.5 or ACI 318-11 D.8.5, as applicable, minimum member thicknesses, $h_{min}$, must comply with Table 2 of this report.

**4.1.11 Lightweight Concrete:** For the use of anchors in lightweight concrete, the modification factor $\lambda_a$ equal to 0.8λ is applied to all values of $\sqrt{f'_c}$ affecting $N_n$ and $V_n$.

For ACI 318-14 (2018 and 2015 IBC) and ACI 318-11 (2012 IBC), λ shall be determined in accordance with the corresponding version of ACI 318.

**4.2 Allowable Stress Design (ASD, Structural):**

**4.2.1 General**: Design values for use with allowable stress design (working stress design) load combinations in accordance with Section 1605.3 of the IBC are required. These are calculated using Eq-3 and Eq-4 as follows:

$$T_{allowable,\ ASD} = \Phi N_n / \alpha \quad \text{(Eq-3)}$$

and

$$V_{allowable,\ ASD} = \Phi V_n / \alpha \quad \text{(Eq-4)}$$

where:

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

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

$\Phi N_n$ = Lowest design strength of an anchor or anchor group in tension as determined in accordance with ACI 318-14 Chapter 17 and 2018 and 2015 IBC Section 1905.1.8, ACI 318-11 Appendix D and Section 4.1 of this report, as applicable (lbf or kN). For the 2012 IBC, Section 1905.1.9 shall be omitted

$\Phi V_n$ = Lowest design strength of an anchor or anchor group in shear as determined in accordance with ACI 318-14 Chapter 17 and 2018 and 2015 IBC Section 1905.1.8, ACI 318-11 Appendix D and Section 4.1 of this report, as applicable (lbf or kN). For the 2012 IBC, Section 1905.1.9 shall be omitted.

$\alpha$ = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, $\alpha$ must include all applicable factors to account for nonductile failure modes and required overstrength.

Limits on edge distance, anchor spacing and member thickness as given in Section 4.1.10 of this report must apply.

**4.2.2 Interaction of Tensile and Shear Forces:** The interaction must be calculated and consistent with ACI 318-14 17.6 or ACI 318-11 D.7 as follows:

If $T_{applied} \leq 0.2T_{allowable,ASD}$, then the full allowable strength in shear, $V_{allowable,ASD}$, must be permitted.

If $V_{applied} \leq 0.2V_{allowable,ASD}$, then the full allowable strength in tension, $T_{allowable,ASD}$, must be permitted.

For all other cases:

$$\frac{T_{applied}}{T_{allowable,ASD}} + \frac{V_{applied}}{V_{allowable,ASD}} \leq 1.2 \quad \text{(Eq-5)}$$

**4.3 Redundant fastening Design (Nonstructural)**

**4.3.1 General:** For an anchoring system designed with redundancy, the load maintained by an anchor that experiences failure or excessive deflection must be transmitted to neighboring anchors without significant consequences to the item being attached or remaining resistance of the anchoring system. In addition to the requirements for anchors, the item being attached must be able to resist the forces acting on it assuming one of the fixing points is not carrying load. It is assumed that by adhering to and specifying the limits shown for $n_1$, $n_2$ and $n_3$, illustrated in Figures 4 and 5 of this report, redundancy is satisfied, where $n_1$ is the total number of anchorage points supporting the linear element, $n_2$ is the number of anchors per anchorage point and $n_3$ is the factored design load, $N_{ua}$ or $V_{ua}$, or a combination of both on an anchorage point based on the critical load combination from IBC Section 1605.2 or ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2.

For redundant fastening, the Power-Pro concrete screw anchors $^3/_{16}$- and ¼-inch (4.8 and 6.4 mm) diameters with $1^1/_4$-inch (32 mm) nominal embedment are used to resist tension and shear loads, or any combination thereof, in accordance with Section 2.0 of this report and with the following limitations:

- Applications must be limited to the support of nonstructural elements.
- Single anchor point applications are prohibited.
- Anchor design must be limited to structures assigned to IBC Seismic Design category A or B only.
- The specified concrete compressive strength $f'_c$ used for calculation purpose must be equal 2,500 psi (17.2 MPa).

**4.3.2 Strength Design:** For redundant applications of anchors in concrete loaded in tension and shear, the following equations must be satisfied:

$$\phi_{ra}F_{ra} \geq N_{ua} \quad \text{(Eq-6)}$$

$$\phi_{ra}F_{ra} \geq V_{ua} \quad \text{(Eq-7)}$$

where:

$F_{ra}$ = the characteristic strength (resistance) for the anchors in Table 5 of this report (lb or kN)

$N_{ua}$ = factored tensile force applied at each anchorage point (lb or kN)

$V_{ua}$ = factored shear force applied at each anchorage point (lbf or kN)

Corresponding strength reduction factors for redundant applications, $\Phi_{ra}$, are given in Table 5. $F_{ra}$ is independent of load direction and applicable for cracked and uncracked concrete. For combined tension and shear loading of redundant applications, the following equation must be satisfied:

$$\phi_{ra}F_{ra} \geq \sqrt{(N_{ua})^2 + (V_{ua})^2} \quad \text{(Eq-8)}$$

For redundant applications of anchors installed in lightweight concrete, the design strength $\Phi_{ra}F_{ra}$ in Eq-6, Eq-7 and Eq-8 must be further multiplied by the modification factor, $\lambda_a$, as applicable. See Section 4.1.11 of this report.

**4.3.3 Allowable Stress Design (ASD):** Design values for redundant applications of anchors for use with Allowable Stress Design must be calculated in accordance with Section 4.3.2 of this report and Eq-9:

$$R_{allowable,ASD} = \frac{\phi_{ra}F_{ra}}{\alpha} \quad \text{(Eq-9)}$$

where $R_{allowable,ASD}$ is the allowable load (lbf or kN) for redundant applications and where $\alpha$ is the conversion factor calculated as a weighted average of the load factors for the controlling load combination. The conversion factor, $\alpha$, is equal to 1.4 assuming dead load only.

**4.3.4 Requirements for Minimum Member Thickness, Critical Edge Distance, Minimum Anchor Spacing and Minimum Edge Distance:** The values of $c_{min}$, $c_{ac}$, $s_{min}$ and $h_{min}$ must comply with Table 5 of this report.

**4.4 Installation:**

Installation parameters are provided in Table 1, Table 2 and in Figure 2. The manufacturer's printed installation instructions (MPII) are reproduced in Figure 3. Anchor locations must comply with this report and the plans and specifications approved by the code official. Power-Pro concrete screw anchors must be installed in accordance with the manufacturer's published installation instructions and this report. In case of conflict, this report governs. Holes must be predrilled in concrete with a Power-Pro carbide-tipped drill bit supplied by the manufacturer and a rotary-hammer drill. The hole must be drilled $^1/_4$ inch (6.4 mm) deeper than the embedment depth and cleaned out of any dust or debris. The anchors must then be installed through the attachment into the hole, to the specified nominal embedment depth, using an impact driver with a maximum torque of 1885 in-lbs.

**4.5 Special Inspection:**

Special inspection is required in accordance with Section 1705.1.1 and Table 1705.3 of the 2018, 2015 and 2012 IBC, as applicable. The special inspector must make periodic inspections during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, hole dimensions, anchor spacing, edge distances, concrete thickness, anchor embedment, drill bit type and size, hole cleaning procedures, installation torque, and adherence to the manufacturer's published installation instructions and the conditions of this report (in case of conflict, this report governs). The special inspector must be present as often as required in accordance with the "statement of special inspection." Under the IBC, additional requirements as set forth in Sections 1705, 1706 and 1707 must be observed, where applicable.

## 5.0 CONDITIONS OF USE

The Power-Pro concrete screw anchors described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

**5.1** Anchor sizes, dimensions, and other installation parameters are as set forth in this report.

**5.2** The anchors must be installed in accordance with Figure 3 and this report. In case of conflicts, this report governs**.**

**5.3** The Power-Pro concrete screw anchors $^3/_{16}$-, and ¼-inch (4.8, and 6.4 mm) diameters with $1^1/_4$-inch (32 mm) nominal embedment may only be installed in cracked or uncracked, normal-weight or lightweight concrete having a specified compressive strength, $f'_c$, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa). The Power-Pro concrete screw anchors $^3/_{16}$-, ¼- and $^5/_{16}$-inch (4.8, 6.4 and 7.9 mm) diameters with $1^3/_4$-inch (44 mm) nominal embedment may only be installed in uncracked, normal-weight or lightweight concrete having a specified compressive strength, $f'_c$, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

**5.4** The values of $f'_c$ used for calculation purposes must not exceed 8,000 psi (55.2 MPa); for redundant fastenings (nonstructural) the values of $f'_c$ used for calculation purpose must equal 2,500 psi (17.2 MPa).

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

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

**5.7** Redundant fastening design values must be established in accordance with Section 4.3 of this report.

**5.8** Anchor spacing, edge distance, and minimum member thickness must comply with Tables 2, 3, 4 and 5 of this report.

**5.9** Prior to installation, calculations and details justifying that the applied loads demonstrate compliance with this report must be submitted to the code official for approval. 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.

**5.10** Since ICC-ES acceptance criteria for evaluating data to determine the performance of expansion 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.

**5.11** The Power-Pro concrete screw anchors $^3/_{16}$-and ¼-inch (4.8and 6.4 mm) diameters with $1^1/_4$-inch (32 mm) nominal embedment may be installed in regions of concrete where cracking has occurred or where analysis indicates cracking may occur ($f_t > f_r$), subject to the conditions of this report.

**5.12** Use of Power-Pro concrete screw anchors to resist seismic forces in structures assigned to Seismic Design Category C, D, E or F is beyond the scope of this report. Anchors may be used to resist short-term loading due to wind or seismic forces (Seismic Design Category A and B), subject to the conditions of this report**.**

**5.13** Where not otherwise prohibited in the code, Power-Pro concrete screw anchors are permitted for use with fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:

- Anchors are used to resist wind or seismic forces only.
- Anchors that support a fire-resistance-rated envelope or a fire-resistance-rated membrane are protected by approved fire-resistance-rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

**5.14** For redundant applications, the ability of the fixed element to transfer loads to adjacent anchors must be justified to the satisfaction of the code official by the design professional.

**5.15** Anchors have been evaluated for reliability against brittle failure and found to be not significantly sensitive to stress-induced hydrogen embrittlement.

**5.16** Use of anchors is limited to dry, interior locations.

**5.17** See ESR-4357 for installations in which Power-Pro concrete screw anchors are used in contact with treated wood.

**5.18** Special inspections are provided in accordance with Section 4.5 of this report.

**5.19** Anchors are manufactured under an approved quality-control program with inspections by ICC-ES.

## 6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC193), dated October 2017, which incorporates requirements in ACI 355.2-07; and quality-control documentation.

## 7.0 IDENTIFICATION

**7.1** The Power-Pro concrete screw anchors are identified in cartons bearing labels that provide the manufacturer name and the name of the product (Power-Pro concrete screw anchor); screw description (type, length, and shank diameter); the company name as set forth in Section 3.0 of this report, and the evaluation report number (ESR-4340). A length identification code letter is stamped on the head of the anchor. See the length identification system indicated in Table 1 of this report.

**7.2** The report holder's contact information is the following:

**THE HILLMAN GROUP INC.**
**10590 HAMILTON AVENUE**
**CINCINNATI, OHIO 45231**
**info@hillmangroup.com**

**7.3** The Additional Listees' contact information is the following:

**ALL POINTS SCREW, BOLT & SPECIALTY CO.**
**1590 N.W. 27TH AVENUE, #9**
**POMPANO BEACH, FLORIDA 33069**
**info@allpointsscrew.com**

**THE HILLMAN GROUP OF CANADA**
**900 PASSMORE AVENUE**
**TORONTO, ONTARIO M1X 0C6**
**CANADA**
**farhad.lajewardi@hillmangroup.com**

**TABLE 1—LENGTH IDENTIFICATION SYSTEM**

| LENGTH ID MARKING ON ANCHOR HEAD | | # | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length of anchor (inches) | From | 1 | 1 1/2 | 2 | 2 1/2 | 3 | 3 1/2 | 4 | 4 1/2 | 5 | 5 1/2 | 6 |
| | Up to, but not including | 1 1/2 | 2 | 2 1/2 | 3 | 3 1/2 | 4 | 4 1/2 | 5 | 5 1/2 | 6 | 6 1/2 |

For **SI:** 1 inch = 25.4 mm.

**TABLE 2—INSTALLATION INFORMATION FOR POWER-PRO CONCRETE SCREW ANCHOR[1]**

| ANCHOR INFORMATION | SYMBOL | UNITS | NOMINAL ANCHOR DIAMETER (inch) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 3/16 | | 1/4 | | 5/16 | |
| Outside Diameter | $d_a$ | in. (mm) | 3/16 (4.8) | | 1/4 (6.4) | | 5/16 (7.9) | |
| Drill Bit Specification | $d_{bit}$ | in. (mm) | 5/32 (4.0) Power-Pro Bit | | 3/16 (4.8) Power-Pro Bit | | 1/4 (6.4) Power-Pro Bit | |
| Installation Torque | $T_{inst}$ | ft-lbf (N-m) | Not applicable | | | | | |
| Nominal Embedment Depth | $h_{nom}$ | in. (mm) | 1 1/4 (32) | 1 3/4 (44) | 1 1/4 (32) | 1 3/4 (44) | 1 1/4 (32) | 1 3/4 (44) |
| Effective Embedment Depth | $h_{ef}$ | in. (mm) | 0.80 (20) | 1.22 (31) | 0.79 (20) | 1.22 (31) | 0.82 (21) | 1.25 (32) |
| Minimum Hole Depth | $h_{hole}$ | in. (mm) | 1 1/2 (38) | 2 (51) | 1 1/2 (38) | 2 (51) | 1 1/2 (38) | 2 (51) |
| Minimum Concrete Thickness | $h_{min}$ | in. (mm) | 3 1/4 (83) | | | | | |

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

[1] The information presented in this table must be used in conjunction with the design requirements of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable. See Figure 2 for location of dimensions.

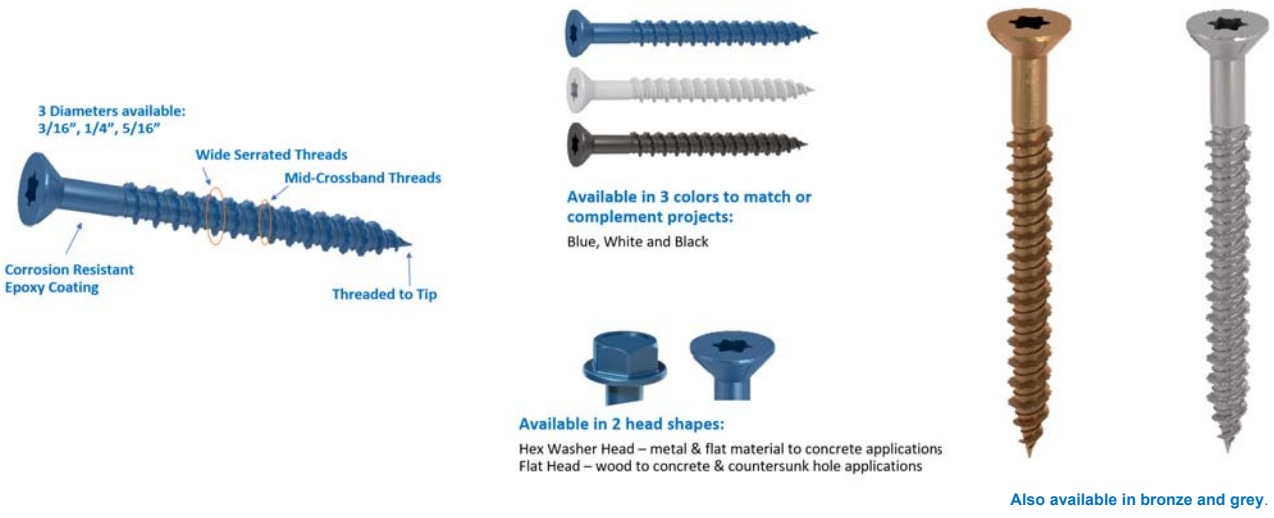



**FIGURE 1—POWER-PRO SCREW ANCHOR**

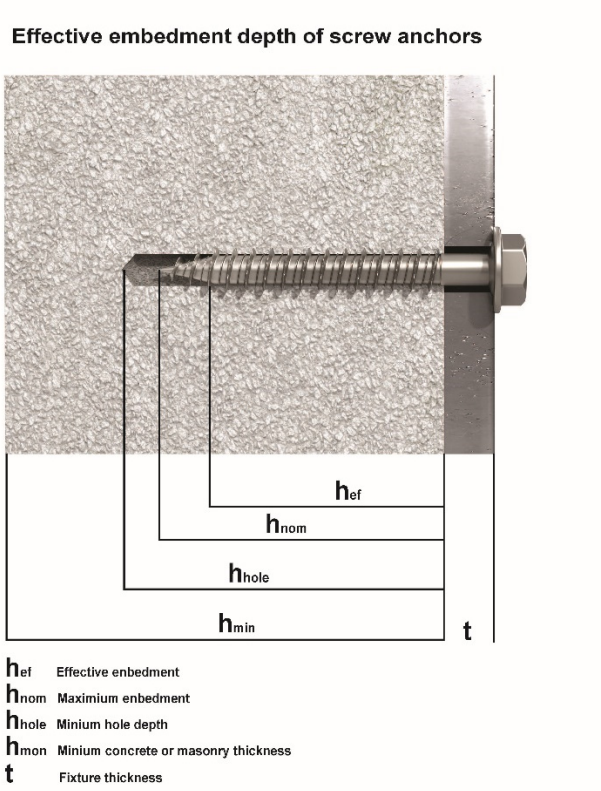
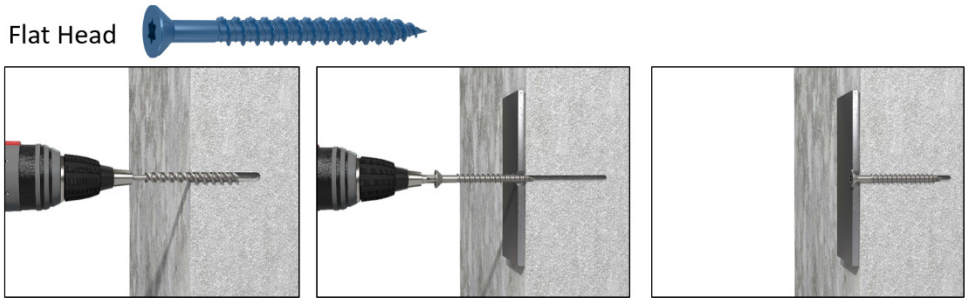


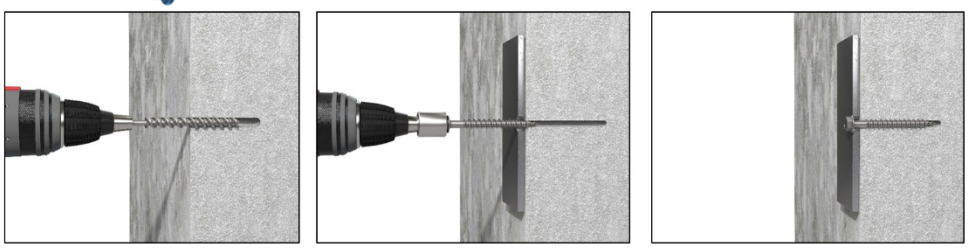

**FIGURE 2—POWER-PRO SCREW ANCHOR (INSTALLED)**

## Power Pro Concrete Screw Installation Instructions

Flat Head



Hex Head



1) Use appropriate size Power Pro drill bit and a hammer drill for best results.
2) Drill the hole ¼" deeper than embedment depth and remove dust from hole with suction or forced air.
3) Disable hammer mode on drill and set to rotary only. Place hex driver or star bit into drill.
4) Drive anchor through fixture and into hole until seated at the proper embedment. Do not overdrive.

**FIGURE 3—INSTALLATION INSTRUCTIONS (MPII) FOR POWER-PRO CONCRETE SCREW ANCHOR**

**TABLE 3—TENSION STRENGTH DESIGN INFORMATION FOR POWER-PRO SCREW ANCHORS[1]**

| CHARACTERISTIC | SYMBOL | UNITS | NOMINAL ANCHOR DIAMETER (inch) | | |
|---|---|---|---|---|---|
| | | | $^3/_{16}$ | $^1/_4$ | $^5/_{16}$ |
| Anchor Category | 1, 2 or 3 | - | 1 | 1 | 1 |
| Nominal Embedment Depth | $h_{nom}$ | in. (mm) | $1^3/_4$ (44) | | |
| Critical Edge Distance | $c_{ac}$ | in. (mm) | 3 (76) | | |
| Minimum Edge Distance | $c_{min}$ | in. (mm) | $1^3/_4$ (44) | | |
| Minimum Spacing | $s_{min}$ | in. (mm) | 1 (25) | | |
| **Steel Strength in Tension (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)** | | | | | |
| Minimum Specified Yield Strength | $f_{ya}$ | psi (N/mm²) | 100,000 (689) | | |
| Minimum Specified Tensile Strength | $f_{uta}$ | psi (N/mm²) | 125,000 (862) | | |
| Effective Tensile Stress Area | $A_{se}$ | in² (mm²) | 0.0165 (11) | 0.0284 (18) | 0.0471 (30) |
| Steel Strength in Tension | $N_{sa}$ | lbf (kN) | 2,065 (9.18) | 3,545 (15.76) | 5,890 (26.21) |
| Strength Reduction Factor-Steel Failure[2] | $\Phi_{sa}$ | - | 0.65 | | |
| **Concrete Breakout Strength in Tension (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)** | | | | | |
| Effective Embedment Depth | $h_{ef}$ | in. (mm) | 1.22 (31) | | |
| Effectiveness Factor-Uncracked Concrete | $k_{uncr}$ | - | 24 | | |
| Strength Reduction Factor-Concrete Breakout Failure[3] | $\Phi_{cb}$ | - | 0.65 | | |
| Modification Factor for Concrete[4] | $\Psi_{c,N}$ | - | 1.0 | | |
| **Pull-Out Strength in Tension (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)** | | | | | |
| Pull-Out Resistance Uncracked Concrete ($f'_c$ = 2,500 psi)[5] | $N_{pn,uncr}$ | lbf (kN) | 1,410 (6.29) | 1,550 (6.90) | 1,390 (6.19) |
| Normalization Exponent, Uncracked Concrete | n | - | 0.05 | 0.41 | 0.39 |
| Strength Reduction Factor-Pullout Failure[3] | $\Phi_p$ | - | 0.65 | | |
| **Axial stiffness** | | | | | |
| Axial stiffness in service load range in uncracked concrete | $\beta$ | lb/in (N/mm) | 126,895 (22,206) | 239,095 (41,841) | 290,275 (50,798) |

For **SI:** 1 inch = 25.4mm, 1lbf = 4.45N, 1 lb/in = 0.175 N/mm, 1 psi = 0.00689 MPa = 0.00689 N/mm², 1 in² = 645 mm², 1 lb/in = 0.175 N/mm.

[1]The information presented in this table must be used in conjunction with the design requirements of ACI 318-14 Chapter 17 or ACI 318 Appendix D, as applicable.

[2]The tabulated value of $\Phi_{sa}$ applies when the load combinations of Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of $\phi$ must be determined in accordance with ACI 318-11 D.4.4.The anchors are brittle steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.

[3]The tabulated value of $\phi_{cb}$ and $\phi_{cp}$ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of $\phi$ must be determined in accordance with ACI 318-11 D.4.4(c) for Condition B.

[4]For all design cases use $\Psi_{c,N}$ = 1.0. The effectiveness factor for uncracked concrete ($k_{uncr}$) must be used.

[5]The characteristic pull-out resistance for greater than 2,500 psi concrete compressive strengths may be increased by multiplying the tabular value by $(f'_c / 2{,}500)^n$.

**TABLE 4—SHEAR STRENGTH DESIGN INFORMATION FOR POWER-PRO SCREW ANCHORS[1]**

| CHARACTERISTIC | SYMBOL | UNITS | NOMINAL ANCHOR DIAMETER (inch) | | |
|---|---|---|---|---|---|
| | | | $^3/_{16}$ | $^1/_4$ | $^5/_{16}$ |
| Anchor Category | 1, 2 or 3 | - | 1 | 1 | 1 |
| Nominal Embedment Depth | $h_{nom}$ | in. (mm) | $1^3/_4$ (44) | | |
| Critical Edge Distance | $c_{ac}$ | in. (mm) | 3 (76) | | |
| Minimum Edge Distance | $c_{min}$ | in. (mm) | $1^3/_4$ (44) | | |
| Minimum Spacing | $s_{min}$ | in. (mm) | 1 (25) | | |
| **Steel Strength in Shear (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)** | | | | | |
| Minimum Specified Yield Strength | $f_{ya}$ | psi (N/mm²) | 100,000 (689) | | |
| Minimum Specified Tensile Strength | $f_{uta}$ | psi (N/mm²) | 125,000 (862) | | |
| Effective Shear Stress Area | $A_{se}$ | in² (mm²) | 0.0165 (11) | 0.0284 (18) | 0.0471 (30) |
| Steel strength in shear - static | $V_{sa}$ | lbf (kN) | 650 (2.9) | 1,115 (5.0) | 2,005 (8.9) |
| Strength Reduction Factor-Steel Failure[2] | $\Phi_{sa}$ | - | 0.60 | | |
| **Concrete Breakout Strength in Shear (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)** | | | | | |
| Nominal Diameter | $d_0$ | in. (mm) | $^3/_{16}$ (4.8) | $^1/_4$ (6.4) | $^5/_{16}$ (7.9) |
| Load Bearing Length of Anchor in Shear ($h_{ef}$ or $8d_o$, whichever is less) | $l_e$ | in. (mm) | 1.22 (31) | | |
| Strength Reduction Factor-Concrete Breakout Failure[3] | $\Phi_{cb}$ | - | 0.70 | | |
| **Concrete Pryout Strength in Shear (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)** | | | | | |
| Coefficient for Pryout Strength | $k_{cp}$ | - | 1.0 | | |
| Strength Reduction Factor-Concrete Pryout Failure[3] | $\Phi_{cp}$ | - | 0.7 | | |

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45 N, 1 psi = 0.00689 MPa = 0.00689 N/mm², 1 in² = 645 mm².

[1]The information presented in this table must be used in conjunction with the design requirements of ACI 318-14 Chapter 17 or ACI 318 Appendix D, as applicable.

[2]The tabulated value of $\Phi_{sa}$ applies when the load combinations of Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of $\phi$ must be determined in accordance with ACI 318-11 D.4.4.The anchors are brittle steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.

[3]The tabulated value of $\phi_{cb}$ and $\phi_{cp}$ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of $\phi$ must be determined in accordance with ACI 318-11 D.4.4(c) for Condition B.

**A redundant system is achieved by specifying and limiting the following variables:**

***$n_1$*** **= the total number of anchorage points supporting the linear element**

***$n_2$*** **= the number of anchors per anchorage point**

***$n_3$*** **= factored load at each anchorage point using the load combinations from IBC Section 1605.2 or ACI 318 Section 9.2**

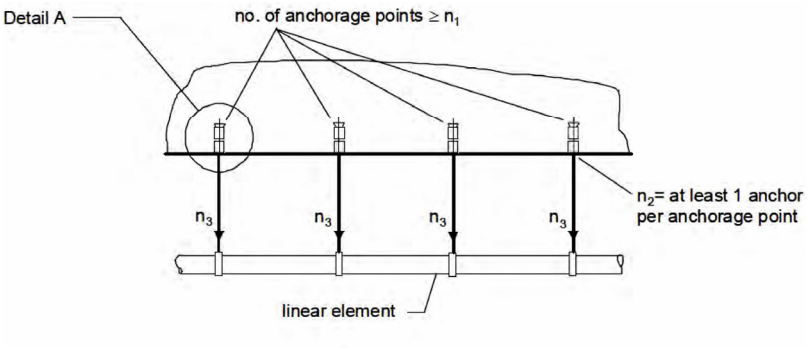



**FIGURE 4—REDUNDANT FASTENING APPLICATION REQUIREMENTS FOR STRENGTH DESIGN OF TYPICAL FIXTURES**

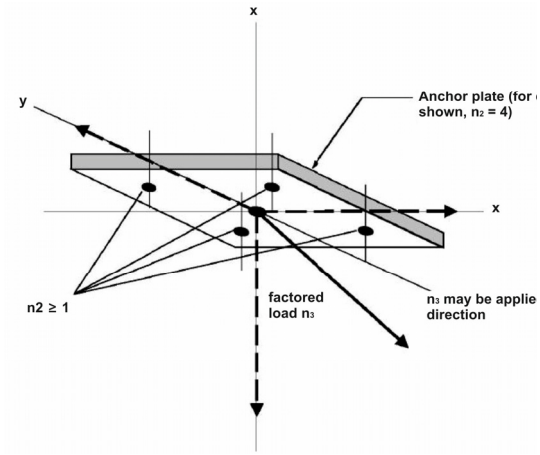



**FIGURE 5—DETAIL A; ANCHORAGE POINT**

**TABLE 5—INFORMATION FOR POWER-PRO CONCRETE SCREW ANCHORS IN REDUNDANT APPLICATIONS[1,2,5]**

| PROPERTIES AND SETTING INFORMATION | SYMBOL | UNITS | NOMINAL ANCHOR SIZE | | | |
|---|---|---|---|---|---|---|
| | | | $^3/_{16}$ | | $^1/_4$ | |
| Anchor category | 1, 2 or 3 | - | 3 | | 2 | |
| Nominal anchor diameter | $d_a$ | in (mm) | 3/16 | | 1/4 | |
| Nominal drill bit diameter | $d_{bit}$ | in. (mm) | 5/32 | | 3/16 | |
| Installation Torque | $T_{inst}$ | ft-lbf (N-m) | - | | - | |
| Minimum nominal embedment depth | $h_{nom}$ | in. (mm) | 1 1/4 | | 1 1/4 | |
| Effective embedment depth | $h_{ef}$ | in. (mm) | 0.80 | | 0.79 | |
| Minimum member thickness | $h_{min}$ | in. (mm) | 3 | | 3 | |
| Minimum edge distance | $c_{min}$=$c_{ac}$ | in. (mm) | 4 | | 4 | |
| Minimum anchor spacing | $s_{min}$ | in. (mm) | 8 | | 8 | |
| Minimum hole depth | $h_{hole}$ | in. (mm) | 1 1/2 | | 1 1/2 | |
| CHARACTERISTIC STRENGTH (RESISTANCE) INSTALLED IN NORMAL-WEIGHT CONCRETE[4] | | | | | | |
| Resistance at each anchorage point, cracked or uncracked concrete (2,500 psi) | $F_{ra}$ | lb (kN) | Number of anchorage points | | | |
| | | | $n_1 \geq 4$ | $n_1 \geq 3$ | $n_1 \geq 4$ | $n_1 \geq 3$ |
| | | | 608 | 450 | 675 | 450 |
| Strength reduction factor[3] | $\Phi_{ra}$ | - | 0.45 | | 0.55 | |

For **SI:** 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN

[1]The data in this table is intended to be used with Strength Design provisions of Section 4.3 of this report; loads are independent of direction and may be applied in tension, shear or any combination thereof.
[2]Installation must comply with published installation instructions and this report.
[3]All values of $\Phi$ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2.
[4]Anchors are permitted to be used in lightweight concrete providing the design strength $\Phi_r F_{ra}$ is multiplied by the modification factor, $\lambda_a$, as applicable. See Section 4.1.11 of this report.
[5]For Allowable Stress Design, see Section 4.3.3 of this report.

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

**DIVISION: 05 00 00—METALS**
**Section: 05 05 19—Post-Installed Concrete Anchors**

**REPORT HOLDER:**

**THE HILLMAN GROUP**

**EVALUATION SUBJECT:**

**POWER-PRO CONCRETE SCREW ANCHORS**

## 1.0 REPORT PURPOSE AND SCOPE

**Purpose:**

The purpose of this evaluation report supplement is to indicate that the Power-Pro concrete screw anchors, described in ICC-ES evaluation report ESR-4340, have also been evaluated for compliance with the codes noted below.

**Applicable code editions:**

- 2019 *California Building Code*® (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2019 *California Residential Code*® (CRC)

## 2.0 CONCLUSIONS

### 2.1 CBC:

The Power-Pro concrete screw anchors, described in Sections 2.0 through 7.0 of the evaluation report ESR-4340, comply with CBC Chapter 19, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapter 16, 17 and 19, as applicable.

#### 2.1.1 OSHPD:

The applicable OSHPD Sections of the CBC are beyond the scope of this supplement.

#### 2.1.2 DSA:

The applicable DSA Sections of the CBC are beyond the scope of this supplement.

### 2.2 CRC:

The Power-Pro concrete screw anchors, described in Sections 2.0 through 7.0 of the evaluation report ESR-4340, comply with CRC Chapter 3, provided the design and installation are in accordance with the 2018 *International Residential Code*® (IRC) provisions noted in the evaluation report and the additional requirements of CRC Chapter 3.

This supplement expires concurrently with the evaluation report, reissued December 2022.

# ICC-ES Evaluation Report

# ESR-4340 FBC Supplement

*Reissued December 2022*

*This report is subject to renewal December 2023.*

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

**DIVISION: 05 00 00—METALS**
**Section: 05 05 19—Post-Installed Concrete Anchors**

**REPORT HOLDER:**

**THE HILLMAN GROUP**

**EVALUATION SUBJECT:**

**POWER-PRO CONCRETE SCREW ANCHORS**

## 1.0 REPORT PURPOSE AND SCOPE

**Purpose:**

The purpose of this evaluation report supplement is to indicate that Power-Pro concrete screw, described in ICC-ES evaluation report ESR-4340, have also been evaluated for compliance with the codes noted below.

**Applicable code editions:**

- 2020 and 2017 *Florida Building Code—Building*
- 2020 and 2017 *Florida Building Code—Residential*

## 2.0 CONCLUSIONS

The Power-Pro concrete screw anchors, described in Sections 2.0 through 7.0 of ICC-ES evaluation report ESR-4340, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design requirements are determined in accordance with the *Florida Building Code—Building* or the *Florida Building Code—Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-4340 for the 2018 and 2015 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—Residential,* as applicable.

Use of the Power-Pro concrete screw anchors has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential*, with the following condition:

a) For connections subject to uplift, the connection must be designed for no less than 700 pounds (3114 N).

For products falling under Florida Rule 61G20-3, 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 evaluation report, reissued December 2022.