DIVISION: 03 00 00—CONCRETE
Section: 03 15 19—Cast-In Concrete Anchors
Section: 03 16 00—Concrete Anchors

REPORT HOLDER:
DEWALT

EVALUATION SUBJECT:
WOOD-KNocker® II+ AND PAN-KNocker™ II+
CONCRETE INSERTS FOR FORMS AND BANG-IT®+
CONCRETE INSERTS FOR STEEL DECK IN CRACKED
AND UNCRACKED CONCRETE (DEWALT)

1.0 EVALUATION SCOPE

Compliance with the following codes:

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

For evaluation for compliance with the National Building Code of Canada® (NBCC), see listing report ELC-3657.

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see ESR-3657 LABC and LARC Supplement.

Properties evaluated:
Structural

2.0 USES

The Wood-Knocker II+ and Pan-Knocker II+ concrete inserts are used as anchorage to resist static, wind, and seismic tension and shear loads in cracked and uncracked normal-weight concrete, sand-lightweight, and all-lightweight concrete having a specified compressive strength, \( f'_c \), of 2,500 psi to 10,000 psi (17.2 MPa to 68.9 MPa).

The Bang-It+ steel deck concrete inserts are used to resist static, wind, and seismic tension and shear loads in the soffit of cracked and uncracked normal-weight concrete and sand-lightweight concrete on steel deck having a specified compressive strength, \( f'_c \), of 2,500 psi to 10,000 psi (17.2 MPa to 68.9 MPa).

There are sixteen models for the Wood-Knocker II+ inserts; thirteen fractional and three metric: \( \frac{1}{4} \)-inch, \( \frac{1}{4} \)-inch LP (low profile), \( \frac{1}{4} \) & \( \frac{1}{4} \)-inch multi LP (low profile), \( \frac{1}{2} \)-inch, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \)-inch, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \)-inch, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, M10, M10 & M12 multi, and M12 corresponding to the sizes of the threaded rods or bolts used for the inserts.

There are eleven models for the Pan-Knocker II+ inserts; eight fractional and three metric: \( \frac{1}{4} \) & \( \frac{1}{4} \)-inch multi LP (low profile), \( \frac{1}{4} \) & \( \frac{1}{2} \)-inch multi, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \)-inch, \( \frac{3}{8} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, M10, M10 & M12 multi, and M12 corresponding to the sizes of the threaded rods or bolts used for the inserts.

There are thirteen models for the Bang-It+ inserts; ten fractional and three metric: \( \frac{1}{4} \)-inch, \( \frac{1}{4} \) & \( \frac{1}{4} \)-inch multi, \( \frac{1}{4} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, \( \frac{3}{8} \) & \( \frac{3}{8} \)-inch multi, \( \frac{1}{2} \)-inch, \( \frac{1}{2} \) & \( \frac{1}{2} \)-inch multi, M10, M10 & M12 multi, and M12 corresponding to the sizes of the threaded rods or bolts used for the inserts.

Inserts denoted as ‘multi’ have an internal step thread and can accept more than one size of threaded rod or bolt, depending on the insert.

Reference to “inserts” in this report refers to the headed cast-in specialty anchorage products (Wood-Knocker II+, Pan-Knocker II+, and Bang-It+) used in concrete; reference to “steel elements” refers to threaded rods or bolts; reference to “anchors” in this report refers to the installed inserts in concrete with threaded rods or bolts.

The inserts are alternatives to cast-in anchors described in Section 1901.3 of the 2018 and 2015 IBC, and Sections 1908 and 1909 of the 2012 IBC. The anchors may be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 Wood-Knocker II+, Pan-Knocker II+ and Bang-It+ Inserts:

The Wood-Knocker II+ and Pan-Knocker II+ inserts are cast-in concrete form inserts. The inserts consists of a steel headed insert (body) which is internally threaded and an outer plastic sleeve. The Wood-Knocker II+ also has nails used to attach the insert to the inside surface of concrete formwork, and the Pan-Knocker II+ is attached to the form without nails (e.g. using screws). The inserts are illustrated in Figure 1A, 1B and Figure 6. The internally threaded inserts are manufactured from low carbon steel. The inserts have minimum 5 μm (0.002-inch) zinc plating, except for the plastic sleeve which is fabricated from polypropylene.

The Bang-It+ steel deck inserts are cast-in concrete inserts. The insert consists of a steel headed insert (body) which is internally threaded, an outer spring, a plastic

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The inserts are illustrated in Figure 2 and Figure 7. The internally threaded inserts are manufactured from low carbon steel. The base plates are manufactured from low carbon steel or polypropylene. The spring is manufactured from steel music wire. The Bang-It+ inserts have a minimum 5 μm (0.002-inch) zinc plating except for the plastic sleeve and base plate which is fabricated from polypropylene.

The anchor assembly is comprised of a Wood-Knocker II+, Pan-Knocker II+ or Bang-It+ insert with a threaded steel element (e.g. rod or bolt). The Wood-Knocker II+ insert is installed on the inside surface of wood formwork and the head driven down until it comes into contact with the plastic sleeve and the nails enter the form. The Pan-Knocker II+ insert is installed on the inside surface of formwork and attached to the form with the insert base (e.g. using screws). The Bang-It+ insert is installed in a predrilled hole in the top of the metal deck, impacted or pressed with sufficient force to compress the spring and drive the flared plastic fins of the sleeve completely through the hole. Concrete can then be cast over the inserts.

3.2 Steel Elements:

3.2.1 Threaded Steel Rods and Bolts: Threaded steel rods (all-thread) or bolts must be threaded on their embedded end in diameters as described in Table 5 of this report. Specifications for grades of common threaded rod or bolts, including the mechanical strength properties are described in Table 4 of this report. Carbon steel threaded rods or bolts may be furnished with a minimum 0.0002-inch-thick (5 μm) zinc plating.

3.2.2 Ductility: In accordance with ACI 318 D.1, in order for a steel anchor element to be considered ductile, the tested elongation must be at least 14 percent and the reduction of area must be at least 30 percent. Steel anchor elements with a tested elongation of less than 14 percent or a reduction of area less than 30 percent, or both, are considered brittle. Values for common steel threaded rod elements are provided in Tables 4 and 5 of this report. Where values are nonconforming or unstated, the steel anchor element must be considered brittle.

3.3 Concrete:

Normal-weight, sand-lightweight, and all-lightweight concrete must conform to Sections 1903 and 1905 of the IBC.

3.4 Steel Deck Panels:

Steel deck panels must be in accordance with the configuration in Figures 4A, 4B and 4C and have a minimum base steel thickness of 22 gage [0.034 inch (0.864 mm)]}. Steel must comply with ASTM A653/A653M SS Grade 33 minimum and have a minimum yield strength of 33,000 psi (228 MPa).

4.0 DESIGN AND INSTALLATION

4.1 Strength Design:

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

Design parameters provided in Tables 2, 3, and 5 of this report are based on the 2018 and 2015 IBC (ACI 318-14) and the 2012 IBC (ACI 318-11), as applicable, unless noted otherwise in Sections 4.1.1 through 4.1.12. The strength design of anchors must comply with ACI 318-14 17.3.1 or ACI 318-11 D.4.1, as applicable, except as required in ACI 318-14 17.2.3 or ACI 318 D.3.3, as applicable.

Strength reduction factors, φ, as given in ACI 318-14 17.3.3 and ACI 318-11 D.4.3, as applicable, for cast-in headed anchors, must be used for load combinations calculated in accordance with Section 1605.2 of the IBC, Section 5.3 of ACI 318-14 and Section 9.2 of ACI 318-11.

4.1.2 Requirements for Static Steel Strength in Tension: The nominal static steel strength in tension, Nsa, of a single anchor must be calculated in accordance with ACI 318-14 17.4.1 or ACI 318-11 Section D.5.1, as applicable, for the threaded steel element, Nsa,rod, as illustrated in Table 5 of this report. The lesser of Nsa,rod or Nsa,insert provided in Tables 2A, 2B, 3A and 3B shall be used as the steel strength in tension.

4.1.3 Requirements for Static Concrete Breakout Strength in Tension: For the Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ anchors, the nominal concrete breakout strength of a single anchor or group of anchors in tension, Ncb or Ncbg, respectively, must be calculated in accordance with ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable for cast-in headed bolts, with modifications as described in this section, and with Figures 3, 4A, 4B and 4C of this report, as applicable. The basic concrete breakout strength in tension, Ncb, must be calculated in accordance with ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable, using the values of href given in Tables 2A, 2B, 3A and 3B, and with kc = 24. The nominal concrete breakout strength in tension in regions where analysis indicates no cracking in accordance with ACI 318-14 17.4.2.6 or ACI 318-11 D.5.2.6, as applicable, must be calculated with ψc,N = 1.25. For the Bang-It+ inserts installed in the soffit of sand-lightweight or normal-weight concrete filled steel deck assemblies, the contribution of the steel deck strength must be ignored and the calculation of Aic/Aico in accordance with ACI 318-14 17.4.2.1 or ACI 318-11 D.5.2.1, as applicable, and ca,min (minimum edge distance) must be based on Figures 4A, 4B and 4C.

4.1.4 Requirements for Static Side-Face Blowout Strength in Tension: For the Wood-Knocker II+ and Pan-Knocker II+ anchors, the nominal side-face blowout strength of a headed insert, Nsb, calculated in accordance with ACI 318-14 17.4.4.1 or ACI 318-11 D.5.4.1, as applicable, for the cast-in headed insert, in cracked and uncracked concrete, is not decisive for design and is not required to be calculated.

For the Bang-It+ anchors installed in the soffit of sand-lightweight or normal-weight concrete on steel deck floor and roof assemblies as shown in Figures 4A, 4B and 4C, calculation of the concrete side-face blowout strength is not decisive for design and is not required to be calculated.

4.1.5 Requirements for Static Steel Strength in Shear: For Wood-Knocker II+ and Pan-Knocker II+ anchors, the nominal static steel strength in shear, Vsa, of a single...
anchor must be taken as the threaded steel element strength, $V_{sa,rot}$, given in Table 5 of this report. The lesser of $\sqrt[\phi]{V_{sa,rot}}$ in Table 5 or $\sqrt[\phi]{V_{sa,insert}}$ in Table 2A or 2B shall be used as the steel strength in shear, and must be used in lieu of the values derived by calculation from ACI 318-14 Eq. 17.5.1.2a or 17.5.1.2b; or ACI 318-11 Eq. D-28 or D-29, as applicable.

For Bang-It+ anchors, the nominal static steel strength in shear, $V_{sa,deck}$, of a single Bang-It+ insert, in the lower flute and upper flute of concrete filled steel deck assemblies, must be taken as the threaded steel element strength, $V_{sa,rot}$, given in Table 5 of this report. The lesser of $\sqrt[\phi]{V_{sa,rot}}$ in Table 5 or $\sqrt[\phi]{V_{sa,insert,deck}}$ in Table 3A or 3B shall be used as the steel strength in shear, and must be used in lieu of the values derived by calculation from ACI 318-14 Eq. 17.5.1.2a or 17.5.1.2b; or ACI 318-11 Eq. D-28 or D-29, as applicable.

4.1.6 Requirements for Static Concrete Pryout Strength in Shear: For Wood-Knocker II+ and Pan-Knocker II+ anchors, the nominal concrete pryout strength of a single anchor or group of anchors in shear, $V_{cb}$ or $V_{cag}$, respectively, must be calculated in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable. The basic concrete pryout strength, $V_{cb}$, must be calculated in accordance with ACI 318-14 17.5.2.2 or ACI 318-11 D.6.2.2, as applicable, based on the values provided in Tables 3A and 3B. The value of $t_{f}$ 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 $8d_{s}$.

For the Bang-It+ anchors installed in the soffit of sand-lightweight or normal-weight concrete on steel deck floor and roof assemblies, as shown in Figures 4A, 4B and 4C, the breakout strength in shear need not be calculated.

4.1.7 Requirements for Static Concrete Pryout Strength in Shear: For Wood-Knocker II+ and Pan-Knocker II+ anchors, the nominal concrete pryout strength of a single anchor or group of anchors, $V_{cp}$ or $V_{cag}$, respectively, must be calculated in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable.

For the Bang-It+ anchors installed in the soffit of sand-lightweight or normal-weight concrete filled steel deck assemblies, as shown in Figures 4A, 4B and 4C, calculation of the concrete pry-out strength in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, is not required.

4.1.8 Requirements for Seismic Design:

4.1.8.1 General: For load combinations including seismic, the design must be performed in accordance with ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable. Modifications to ACI 318-14 17.2.3 shall be applied under Section 1905.1.8 of the 2018 or 2015 IBC. For the 2012 IBC, Section 1905.1.9 shall be omitted. The anchors may be installed in Seismic Design Categories A through F of the IBC.

For Wood-Knocker II+ and Pan-Knocker II+ anchors, the nominal concrete breakout strength and nominal concrete side-face blowout strength for anchors in tension; and the nominal concrete breakout strength and pryout strength in shear, must be calculated in accordance with ACI 318-14 17.4 and 17.5 or ACI 318-11 D.5 and D.6, as applicable.

For Bang-It+ anchors, the nominal concrete breakout strength for anchors in tension must be calculated in accordance with ACI 318-14 17.4 or ACI 318-11 D.5, as applicable.

4.1.8.2 Seismic Tension: For Wood-Knocker II+ and Pan-Knocker II+ anchors, the nominal steel strength in tension, $N_{sa,rod}$, of a single anchor must be calculated in accordance with ACI 318-14 17.4.1 or ACI 318-11 D.5.1, as applicable, for the threaded steel element, $N_{sa,rot,eq}$, as given in Table 5, not to exceed the corresponding values of $N_{sa,insert,eq}$ in Tables 2A or 2B of this report; the nominal concrete breakout strength for anchors in tension must be calculated in accordance with ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, as described in Section 4.1.3 of this report; the nominal concrete side-face blowout strength must be calculated in accordance with ACI 318-14 17.4.4.1 and 17.4.4.2 or ACI 318-11 D.5.4.1 and D.5.4.2, as applicable, and Section 4.1.4 of this report.

For Bang-It+ anchors, the nominal steel strength in tension, $N_{sa,rod}$, of a single anchor must be calculated in accordance with ACI 318-14 17.4.1 or ACI 318-11 D.5.1, as applicable, for the threaded steel element, $N_{sa,rot,eq}$, as given in Table 5, not to exceed the corresponding values of $N_{sa,insert,eq}$ in Tables 3A or 3B of this report; the nominal concrete breakout strength for anchors in tension must be calculated in accordance with ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, as described in Section 4.1.3 of this report; the nominal concrete pullout strength calculations in accordance with ACI 318-14 17.4.3.1 and 17.4.3.4 or ACI 318-11 D.5.3.1 and D.5.3.4, as applicable, are not required.

4.1.8.3 Seismic Shear: For Wood-Knocker II+ and Pan-Knocker II+ anchors, the nominal concrete breakout strength and pryout strength in shear must be calculated in accordance with ACI 318-14 17.5.2 and 17.5.3 or ACI 318-11 D.6.2 and D.6.3, as applicable, as described in Sections 4.1.6 and 4.1.7 of this report. In accordance with ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable, the nominal steel strength for seismic loads, $V_{sa,eq}$, must be taken as the threaded steel element strength, $V_{sa,rot,eq}$, given in Table 5 of this report, not to exceed the corresponding values of $V_{sa,insert,eq}$, in Tables 2A or 2B.

For Bang-It+ anchors, the nominal concrete breakout strength and pryout strength in shear, calculations in accordance with ACI 318-14 17.5.2 and 17.5.3 or ACI 318-11 D.6.2 and D.6.3, as applicable, as described in Sections 4.1.6 and 4.1.7 of this report, are not required. In accordance with ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable, the nominal steel strength for seismic loads, $V_{sa,eq}$, must be taken as the threaded steel element strength, $V_{sa,rot,eq}$, given in Table 5 of this report, not to exceed the corresponding values of $V_{sa,insert,eq,deck}$, in Tables 3A or 3B, for lower flute or upper flute of the concrete filled steel deck assembly, as applicable.

4.1.9 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.

Due to the projection of the internally-threaded end of the Bang-It+ insert when installed in concrete filled steel deck assemblies (approximately 3/4-inch), for anchors or groups of anchors that are subject to the effects of combined tension and shear forces, the design engineer must verify the validity of the interaction equation in ACI 318-14 17.6 or ACI 318-11 D.7, as applicable.

4.1.10 Requirements for Minimum Member Thickness, Minimum Anchor Spacing and Minimum Edge Distance: Requirements on headed cast-in specialty anchor edge distance, spacing, member thickness, and
concrete strength must be in accordance with the requirements in ACI 318-14 or ACI 318-11, as applicable, for cast-in bolts and the information in Tables 1A and 1B, as applicable.

For Bang-It+ anchors installed in the soffit of sand-lightweight or normal-weight concrete over profile steel deck floor and roof assemblies, the anchors must be installed in accordance with Tables 1A and 1C, as applicable, as well as Figures 4A, 4B and 4C, as applicable.

4.1.11 Requirements for Critical Edge Distance: The critical edge distance, c_{ec}, must be calculated in accordance with ACI 318-14 17.7.2 or ACI 318-11 D.8.2, as applicable. The modification factor \( \alpha \) for concrete breakout strength must be taken as 0.85 for sand-lightweight or 0.75 as applicable. The modification factor \( \lambda \) for concrete, the modification factor \( \phi \) for LGBT anchors in sand-lightweight or all-lightweight concrete, and \( \phi \) for concrete breakout strength must be in accordance with ACI 318-14 17.4.2.5 or ACI 318-11 D.5.2.5, as applicable.

4.1.12 Lightweight Concrete: For ACI 318-14, 318-11 and 318-08, when the Wood-Knocker II+ and Pan-Knocker II+ anchors are used in sand-lightweight or all-lightweight concrete, the modification factor \( \lambda \) for concrete breakout strength must be taken as 0.85 for sand-lightweight or 0.75 for all-lightweight concrete according to ACI 318-14 17.2.6 (2018 and 2015 IBC), or ACI 318-11 D.3.6 (2012 IBC).

For Bang-It+ anchors in the soffit of sand-lightweight concrete-filled steel deck, \( \lambda \) shall be taken as 0.85 and applied to the concrete breakout strength in tension only as applicable. Values are shown in Table 3A or 3B and installation details are shown in Figures 4A, 4B and 4C.

4.2 Allowable Stress Design (ASD):

4.2.1 General: Design values for use with allowable stress design (working stress design) load combinations calculated in accordance with Section 1605.3 of the IBC, must be established as follows:

\[
T_{\text{allowable, ASD}} = \frac{\phi N_n}{\alpha}
\]

\[
V_{\text{allowable, ASD}} = \frac{\phi V_n}{\alpha}
\]

where:

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

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

\( \phi N_n \) = Lowest design strength of an anchor or anchor group in tension as determined in accordance with ACI 318-14 Chapter 17 and 2018 or 2015 IBC Section 1905.1.8, and ACI 318-11 Appendix D, as applicable (lbf or N). 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 or 2015 IBC Section 1905.1.8, ACI 318-11 Appendix D, as applicable (lbf or N). 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 non-ductile failure modes and required over-strength.

The requirements for member thickness, edge distance and spacing, described in this report, must apply. Examples of allowable stress design values for tension and shear for illustrative purposes are shown in Tables 6A, 6B, 7A, and 7B. The values presented in Tables 6A, 6B, 7A, and 7B are only valid when all of the conditions given in the footnotes to the respective tables are applicable.

4.2.2 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, as follows:

For shear loads \( V_{\text{applied}} \leq 0.2 V_{\text{allowable, ASD}} \), the full allowable load in tension must be permitted.

For tension loads \( T_{\text{applied}} \leq 0.2 T_{\text{allowable, ASD}} \), the full allowable load in shear must be permitted.

For all other cases:

\[
\frac{T_{\text{applied}}}{T_{\text{allowable, ASD}}} + \frac{V_{\text{applied}}}{V_{\text{allowable, ASD}}} \leq 1.2 \quad (\text{Eq-1})
\]

Due to the projection of the internally-threaded end of the Bang-It+ insert when installed in concrete filled steel deck assemblies (approximately 3/4-inch), for anchors or groups of anchors that are subject to the effects of combined tension and shear forces, the design engineer must verify the validity of the interaction equation in ACI 318-14 17.6 or ACI 318-11 D.7 as applicable.

4.3 Installation:

For the Wood-Knocker II+ and Pan-Knocker II+ inserts, installation parameters are provided in Tables 1A or 1B and in Figures 3 and 8. For the Wood-Knocker II+, the head of the insert must be impacted with sufficient force until it comes into contact with the plastic sleeve and the nails enter the form completely. For the Pan-Knocker II+, the base of the insert must be attached to the form using screws or other means to secure the insert. From beneath the deck, following the concrete pour and form removal, a threaded rod or bolt element must be screwed into the internal threads of the steel body until fully seated in the inserts. The threaded steel rod or bolt element must have a minimum thread engagement equal to one steel element diameter.

For the Bang-It+ inserts, installation parameters are provided in Tables 1A and 1C and in Figures 4A, 4B, 4C and 8. A hole must be made in the steel deck using a step-drill, hole saw, deck punch or equivalent in accordance with Tables 1A or 1C, as applicable. For multi inserts the hole size correlates to the largest internal thread diameter. The Bang-It+ plastic sleeve must be placed in the hole, and following this, the head of the insert must be impacted with sufficient force to compress the outer spring and drive the flared plastic fins of the sleeve completely through the hole in the steel deck. The Bang-It+ base plate may also be attached to the deck for additional stability (optional). Before or after Bang-It+ insertion in deck, a threaded rod or bolt element must be inserted through the perforated nozzle on the end of the plastic sleeve until contact is made with the internally threaded steel body. The threaded rod or bolt element must then be screwed into the Bang-It+ internal threads. The rod or bolt must be turned until fully seated in the insert, which will result in a thread engagement equal to a minimum of one rod diameter. The end of the plastic sleeve must be cut, trimmed, or otherwise removed to the surface of the internally threaded steel body following the concrete pour if the insert is
intended to resist shear loads. Bang-It+ inserts are permitted to be installed in either the upper or lower flute of the steel deck.

Installation of Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ inserts must be in accordance with this evaluation report and the manufacturer’s printed installation instruction (MPII) as provided in Figure 8 of this report. In the event of a conflict between this report and the MPII, this report governs.

4.4 Special Inspection:
Periodic special inspection is required in accordance with Section 1705.1.1 and Table 1705.3 of the 2018, 2015 or 2012 IBC, as applicable. The special inspector must make periodic inspections during installation of the headed cast-in specialty inserts to verify insert type, insert dimensions, concrete type, concrete compressive strength, insert spacing, edge distances, concrete member thickness, insert embedment, threaded rod fully seated into insert, and adherence to the manufacturer’s printed installation instructions. 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 Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ concrete anchors described in this report are acceptable alternatives to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Specialty inserts are limited to dry interior locations.
5.2 Specialty insert sizes, dimensions, minimum embedment depths, and other installation parameters are as set forth in this report.
5.3 Specialty inserts must be installed in accordance with the manufacturer’s printed instructions and this report. In case of conflict, this report governs.
5.4 Specialty inserts must be limited to use in cracked and uncracked normal-weight concrete, sand-lightweight concrete and all-lightweight concrete having a specified compressive strength, $f_{c}$, of 2,500 psi to 10,000 psi (17.2 MPa to 68.9 MPa) for the Wood-Knocker inserts, and in cracked and uncracked normal-weight or sand-lightweight concrete filled steel deck assemblies having a specified compressive strength, $f_{c}$, of 2,500 psi to 10,000 psi (17.2 MPa to 68.9 MPa) for the Bang-It+ inserts.
5.5 The values of $f_{c}$ used for calculation purposes must not exceed 10,000 psi (68.9 MPa).
5.6 Strength design values must be established in accordance with Section 4.1 of this report.
5.7 Allowable design values are established in accordance with Section 4.2.
5.8 Specialty insert spacing and edge distance as well as minimum member thickness must comply with ACI 318-17 17.7 or ACI 318-11 Section D.8, as applicable, for cast-in-place headed anchors.
5.9 Prior to 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.

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

5.11 Specialty inserts may be installed in regions of concrete where analysis indicates cracking may occur ($f_{c} > f_{t}$), subject to the conditions of this report.

5.12 Specialty inserts may be used to resist short-term loading due to wind or seismic forces in locations designated as Seismic Design Categories A through F of the IBC, subject to the conditions of this report.

5.13 Where not otherwise prohibited in the code, Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ inserts are permitted for use with fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:
- Headed cast-in specialty inserts 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.
- Headed cast-in specialty inserts are used to resist wind or seismic forces only.
- Headed cast-in specialty inserts are used to support nonstructural elements.

5.14 Use of zinc-coated carbon steel anchors is limited to dry, interior locations.
5.15 Special inspection must be provided in accordance with Section 4.4.
5.16 Specialty inserts 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 Headed Cast-in Specialty Inserts in Concrete (AC446), dated August 2018; and quality control documentation.

7.0 IDENTIFICATION
7.1 The inserts are identified by packaging labeled with the insert size, lot number, company name, insert name, and evaluation report number (ESR-3657). The inserts have the letters DEWALT or the product name, as applicable, and the nominal size(s) embossed atop the head of the insert, visible prior to installation for verification.

7.2 The report holder’s contact information is the following:

DEWALT
701 EAST JOPPA ROAD
TOWSON, MARYLAND 21286
(800) 524-3244
www.DEWALT.com
anchors@DEWALT.com
### TABLE A—DESIGN USE AND REPORT TABLE INDEX

<table>
<thead>
<tr>
<th>Design Strength</th>
<th>Wood-Knocker II+ Inserts</th>
<th>Pan-Knocker II+ Inserts</th>
<th>Bang-it+ Steel Deck Inserts</th>
<th>Threaded Steel Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel $N_{sa}$, $V_{sa}$</td>
<td>Table 2A and 2B</td>
<td>Table 2A and 2B</td>
<td>Table 3A and 3B</td>
<td>Table 5</td>
</tr>
<tr>
<td>Concrete $N_{ca}$, $V_{ca}$</td>
<td>Table 2A and 2B</td>
<td>Table 2A and 2B</td>
<td>Table 3A and 3B</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concrete Type</th>
<th>Concrete State</th>
<th>Insert / Steel Element Nominal Size</th>
<th>Seismic Design Categories2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal-weight and lightweight</td>
<td>Cracked</td>
<td>$\frac{1}{4}''$, $\frac{3}{8}''$, M10, M12, $\frac{1}{2}''$, $\frac{5}{8}''$, $\frac{3}{4}''$</td>
<td>A through F</td>
</tr>
<tr>
<td></td>
<td>Uncracked</td>
<td>$\frac{1}{4}''$, $\frac{3}{8}''$, M10, M12, $\frac{1}{2}''$, $\frac{5}{8}''$, $\frac{3}{4}''$</td>
<td>A and B</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm. For pound-inch units: 1 mm = 0.03937 inch.

1Reference ACI 318-14 17.3.1.1 or ACI 318-11 D.4.1.1, as applicable. The controlling strength is decisive from all appropriate failure modes (i.e. steel, concrete, and pryout, as applicable) and design assumptions. The pullout strength in tension and side-face blowout strength in tension is not decisive for design and does not need to be evaluated.

2See Section 4.1.8 for requirements for seismic design, where applicable.

---

**FIGURE 1A**—WOOD-KNocker II+ CAST-IN-PLACE INSERTS FOR FORM POUR CONCRETE

Before Setting (head plate and nails starting in initial position)

& After Setting (head plate in down position, nails into form)

**FIGURE 1B**—PAN-KNocker II+ CAST-IN-PLACE INSERTS FOR FORM POUR CONCRETE

‘No Nail’ version of Wood-Knocker II+ (head plate in down position)

**FIGURE 2**—BANG-IT+ CAST-IN-PLACE INSERTS FOR CONCRETE FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES
### Table 1A—Installation Specifications for Single Thread Concrete Inserts

<table>
<thead>
<tr>
<th>Single Thread Insert Dimensions</th>
<th>Symbol</th>
<th>Units</th>
<th>Wood-Knocker II+ and Pan-Knocker II+ Nominal Insert / Anchor Size</th>
<th>Bang-IT+ Nominal Insert / Anchor Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>( \frac{1}{4} ) ( \frac{3}{8} ) inch Multi / LP</td>
<td>( \frac{1}{4} ) ( \frac{3}{8} ) inch Multi / LP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( \frac{1}{4} ) ( \frac{3}{8} ) inch Multi</td>
<td>( \frac{1}{4} ) ( \frac{3}{8} ) inch Multi</td>
</tr>
<tr>
<td>Outside diameter of the steel insert body</td>
<td>( d_a )</td>
<td>in. (mm)</td>
<td>0.5 (13)</td>
<td>0.7 (18)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0 (25)</td>
<td>0.7 (18)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0 (25)</td>
<td>1.75 (45)</td>
</tr>
<tr>
<td>Insert head plate diameter</td>
<td>( d_{hp} )</td>
<td>in. (mm)</td>
<td>1.30 (33)</td>
<td>1.50 (38)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.75 (45)</td>
<td>1.50 (38)</td>
</tr>
<tr>
<td>Plastic sleeve diameter</td>
<td>( d_s )</td>
<td>in. (mm)</td>
<td>2 (51)</td>
<td>2-3/8 (60)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3-1/2 (89)</td>
<td>3-1/2 (89)</td>
</tr>
<tr>
<td>Suggested hole size in deck</td>
<td>( d_{hole} )</td>
<td>in. (mm)</td>
<td>Not applicable</td>
<td>7/8 (22)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1-1/4 (32)</td>
<td>1-1/4 (32)</td>
</tr>
<tr>
<td>Base plate width</td>
<td>( w_b )</td>
<td>in. (mm)</td>
<td>Not applicable</td>
<td>1-1/2 (38)</td>
</tr>
<tr>
<td>Nominal embedment depth</td>
<td>( h_{nom} )</td>
<td>in. (mm)</td>
<td>1-1/2 (38)</td>
<td>2 (51)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1-1/2 (38)</td>
<td>2 (51)</td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>( h_{ef} )</td>
<td>in. (mm)</td>
<td>1.50 (38)</td>
<td>1.75 (45)</td>
</tr>
<tr>
<td>Minimum member thickness</td>
<td>( h_{min} )</td>
<td>in. (mm)</td>
<td>2-1/2 (64)</td>
<td>3-1/2 (89)</td>
</tr>
<tr>
<td>Minimum spacing distance</td>
<td>( s_{min} )</td>
<td>in. (mm)</td>
<td>4( d_a )</td>
<td>3( h_{ef} ) for lower flute locations; 4( d_a ) for upper flute locations</td>
</tr>
<tr>
<td>Minimum edge distance</td>
<td>( c_{min} )</td>
<td>in. (mm)</td>
<td>0.5( d_{hp} ) + 3/4 (19)</td>
<td>See Figures 4A, 4B and 4C, as applicable</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm. For pound-inch unit: 1 mm = 0.03937 inches.

### Table 1B—Installation Specifications for Multi Thread Wood Knocker II+ and Pan-Knocker II+ Inserts

<table>
<thead>
<tr>
<th>Multi Thread Insert Dimensions</th>
<th>Symbol</th>
<th>Units</th>
<th>Nominal Insert / Anchor Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>( \frac{1}{4} ) ( \frac{3}{8} ) inch Multi / LP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( \frac{1}{4} ) ( \frac{3}{8} ) inch Multi</td>
</tr>
<tr>
<td>Outside diameter of the steel insert body</td>
<td>( d_a )</td>
<td>in. (mm)</td>
<td>0.5 (13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0 (25)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.75 (45)</td>
</tr>
<tr>
<td>Insert head plate diameter</td>
<td>( d_{hp} )</td>
<td>in. (mm)</td>
<td>1.30 (33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.75 (45)</td>
</tr>
<tr>
<td>Plastic sleeve diameter</td>
<td>( d_s )</td>
<td>in. (mm)</td>
<td>2 (51)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3-1/2 (89)</td>
</tr>
<tr>
<td>Minimum member thickness</td>
<td>( h_{min} )</td>
<td>in. (mm)</td>
<td>2-1/2 (64)</td>
</tr>
<tr>
<td>Minimum spacing distance</td>
<td>( s_{min} )</td>
<td>in. (mm)</td>
<td>4( d_a )</td>
</tr>
<tr>
<td>Minimum edge distance</td>
<td>( c_{min} )</td>
<td>in. (mm)</td>
<td>0.5( d_{hp} ) + 3/4 (19)</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm. For pound-inch unit: 1 mm = 0.03937 inches.

### Table 1C—Installation Specifications for Multi Thread Bang-IT+ Inserts

<table>
<thead>
<tr>
<th>Multi Thread Insert Dimensions</th>
<th>Symbol</th>
<th>Units</th>
<th>Nominal Insert / Anchor Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>( \frac{1}{4} ) ( \frac{3}{8} ) inch Multi / LP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( \frac{1}{4} ) ( \frac{3}{8} ) inch Multi</td>
</tr>
<tr>
<td>Outside diameter of the steel insert body</td>
<td>( d_a )</td>
<td>in. (mm)</td>
<td>0.7 (18)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.75 (45)</td>
</tr>
<tr>
<td>Insert head plate diameter</td>
<td>( d_{hp} )</td>
<td>in. (mm)</td>
<td>1.50 (38)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1-7/32 (31)</td>
</tr>
<tr>
<td>Plastic sleeve diameter</td>
<td>( d_s )</td>
<td>in. (mm)</td>
<td>27/32 (89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 (51)</td>
</tr>
<tr>
<td>Suggested hole size in deck</td>
<td>( d_{hole} )</td>
<td>in. (mm)</td>
<td>7/8 (22)</td>
</tr>
<tr>
<td>Base plate width</td>
<td>( w_b )</td>
<td>in. (mm)</td>
<td>1-1/2 (38)</td>
</tr>
<tr>
<td>Nominal embedment depth</td>
<td>( h_{nom} )</td>
<td>in. (mm)</td>
<td>2 (51)</td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>( h_{ef} )</td>
<td>in. (mm)</td>
<td>1.75 (45)</td>
</tr>
<tr>
<td>Minimum member thickness</td>
<td>( h_{min} )</td>
<td>in. (mm)</td>
<td>See Figures 4A, 4B and 4C, as applicable</td>
</tr>
<tr>
<td>Minimum spacing distance</td>
<td>( s_{min} )</td>
<td>in. (mm)</td>
<td>3( h_{ef} ) for lower flute locations; 4( d_a ) for upper flute locations</td>
</tr>
<tr>
<td>Minimum edge distance</td>
<td>( c_{min} )</td>
<td>in. (mm)</td>
<td>See Figures 4A, 4B and 4C for lower flute edge distances; otherwise use 0.5( d_{hp} ) + 3/4 (19)</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm. For pound-inch unit: 1 mm = 0.03937 inches.

Footnotes for Tables 1A, 1B and 1C:

1 Inserts have internal thread size designations for coarse threads matching the nominal rod / anchor size.
FIGURE 3—WOOD-KNOCKER II+ OR PAN KNOCKER II+ INSERTS INSTALLED IN FORM POUR CONCRETE FLOOR AND ROOF ASSEMBLIES

FIGURE 4A—BANG-IT+ INSERTS INSTALLED IN SOFFIT OF CONCRETE-FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES1,2,3,4

FIGURE 4B—BANG-IT+ INSERTS INSTALLED IN SOFFIT OF CONCRETE-FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES1,2,3,5,6,7

FIGURE 4C—BANG-IT+ INSERTS INSTALLED IN SOFFIT OF CONCRETE-FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES1,2,3,8,9

1Inserts may be placed in the upper flute or lower flute of the steel deck assembly. Inserts in the lower flute require a minimum 1.5" of concrete topping thickness (min. thick in Figures) from the top of the upper flute, except for the 3/8 & 1/2 & 5/8-inch multi insert and 5/8 & 3/4-inch multi insert which require a minimum of 2" of concrete topping thickness. Upper flute installations require a minimum 3" concrete topping thickness from the top of the upper flute.

2Axial spacing for inserts along the upper flute length shall be 4

3Upper flute inserts are not subject to steel deck dimension limitations, or the minimum steel deck gauge limitations.

4Inserts in the lower flute of Figure 4A may be installed with a maximum 11/8-inch offset in either direction from the center of the flute. The offset distance may be increased for flute widths greater than those shown provided the minimum lower flute edge distance of 11/8-inch is also satisfied.

5Inserts in the lower flute of Figure 4B may be installed with a maximum 1/8-inch offset in either direction from the center of the flute. The offset distance may be increased for flute widths greater than those shown provided the minimum lower flute width is increased proportionally (e.g. applicable to a lower flute depth of 2-inch with a minimum lower flute width of 21/4-inch).

6Lower flute installations of Figure 4B in flute depths greater than 11/4-inch are permitted.

7Lower flute installations of Figure 4B in flute depths greater than 11/8-inch are permitted provided the minimum edge distance of 11/8-inch is also satisfied.

8Inserts in the lower flute of Figure 4C may be installed with a maximum 13/16-inch offset in either direction from the center of the flute.

9Inserts in upper flute may be installed anywhere across upper flute provided minimum edge distances are maintained; see Table 1A and 1C as applicable.
TABLE 2A—DESIGN INFORMATION FOR WOOD KNOCKER II+ AND PAN-KNOCKER II+ SINGLE THREAD INSERTS1,3,4,5

<table>
<thead>
<tr>
<th>DESIGN INFORMATION / INSERT PROPERTY</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside diameter of the steel insert body</td>
<td>$d_s$</td>
<td>in. (mm)</td>
<td>0.5 (13)</td>
<td>0.7 (18)</td>
<td>1.0 (25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insert head plate net bearing area</td>
<td>$A_{beg}$</td>
<td>in² (mm²)</td>
<td>1.25 (32)</td>
<td>1.75 (45)</td>
<td>3.0 (64)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>$h_{ef}$</td>
<td>in. (mm)</td>
<td>1.75 (45)</td>
<td>2.25 (57)</td>
<td>-1.00 (25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STEEL STRENGTH IN TENSION (ACI 318-14 17.4.1 or ACI 318-11 Section D.5.1)

Steel strength in tension of single insert

$N_{as,insert}$ (lb) 3,545 (15.8) 6,475 (29.4) 18,005 (15.3)

Steel strength in tension of single insert, seismic

$N_{as,insert,eq}$ (lb) 3,545 (15.8) 6,475 (29.4) 18,005 (15.3)

Reduction factor, steel strength in tension

$f = 0.65 (0.65) (0.65) (0.65)$

CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)

Effectiveness factor for cracked concrete $k_C = -24$ (for SI use a value of 10)

Modification factor for uncracked concrete $\psi_{C,N} = -1.25$

Reduction factor, concrete strength in tension

$\phi = -0.70 (0.70) (0.70) (0.70)$

STEEL STRENGTH IN SHEAR (ACI 318-14 17.5.1 or ACI 318-11 Section D.6.1)

Steel strength in shear of single insert

$V_{as,insert}$ (lb) 985 (4.4) 2,835 (12.8) 4,155 (18.8)

Steel strength in shear of single insert, seismic

$V_{as,insert,eq}$ (lb) 985 (4.4) 2,835 (12.8) 4,155 (18.8)

Reduction factor, steel strength in shear

$\phi = -0.70 (0.70) (0.70) (0.70)$

CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-14 17.5.2 or ACI 318-11 D.6.2) AND PRYOUT STRENGTH IN SHEAR (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)

Load bearing length of insert $\ell_e$ in. (mm) 1.75 (45) -

Reduction factor, concrete strength in shear

$\phi = -0.70 (0.70) (0.70) (0.70)$

Coefficient for pryout strength $k_{op}$ - - - -

Reduction factor, pryout strength in shear $\phi = -0.70 (0.70) (0.70) (0.70)$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004445 kN, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

TABLE 2B—DESIGN INFORMATION FOR WOOD KNOCKER II+ AND PAN-KNOCKER II+ MULTI THREAD INSERTS1,3,4,5

<table>
<thead>
<tr>
<th>DESIGN INFORMATION / INSERT PROPERTY</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
<th>Multi (LP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside diameter of the steel insert body</td>
<td>$d_s$</td>
<td>in. (mm)</td>
<td>0.5 (13)</td>
<td>0.7 (18)</td>
<td>1.0 (25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insert head plate net bearing area</td>
<td>$A_{beg}$</td>
<td>in² (mm²)</td>
<td>1.25 (32)</td>
<td>1.75 (45)</td>
<td>3.0 (64)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>$h_{ef}$</td>
<td>in. (mm)</td>
<td>1.75 (45)</td>
<td>2.25 (57)</td>
<td>-1.00 (25)</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

STEEL STRENGTH IN TENSION (ACI 318-14 17.4.1 or ACI 318-11 Section D.5.1)

Steel strength in tension of single insert

$N_{as,insert}$ (lb) 3,545 (15.8) 6,475 (29.4) 18,005 (15.3)

Steel strength in tension of single insert, seismic

$N_{as,insert,eq}$ (lb) 3,545 (15.8) 6,475 (29.4) 18,005 (15.3)

Reduction factor, steel strength in tension

$f = 0.65 (0.65) (0.65) (0.65)$

CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)

Effectiveness factor for cracked concrete $k_C = -24$ (for SI use a value of 10)

Modification factor for uncracked concrete $\psi_{C,N} = -1.25$

Reduction factor, concrete strength in tension

$\phi = -0.70 (0.70) (0.70) (0.70)$

STEEL STRENGTH IN SHEAR (ACI 318-14 17.5.1 or ACI 318-11 Section D.6.1)

Steel strength in shear of single insert

$V_{as,insert}$ (lb) 985 (4.4) 2,835 (12.8) 4,155 (18.8)

Steel strength in shear of single insert, seismic

$V_{as,insert,eq}$ (lb) 985 (4.4) 2,835 (12.8) 4,155 (18.8)

Reduction factor, steel strength in shear

$\phi = -0.70 (0.70) (0.70) (0.70)$

CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-14 17.5.2 or ACI 318-11 D.6.2) AND PRYOUT STRENGTH IN SHEAR (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)

Load bearing length of insert $\ell_e$ in. (mm) 1.75 (45) -

Reduction factor, concrete strength in shear

$\phi = -0.70 (0.70) (0.70) (0.70)$

Coefficient for pryout strength $k_{op}$ - - - -

Reduction factor, pryout strength in shear $\phi = -0.70 (0.70) (0.70) (0.70)$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004445 kN, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

Footnotes for Table 2A and 2B:

1 Concrete must have a compressive strength of 2,500 psi minimum. Installation must comply with Sections 4.1.10 and 4.3, and Figure 3 of this report.

2 Design of headed cast-in specialty inserts shall be in accordance with the provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, for cast-in-headed anchors. Concrete breakout strength must also be in accordance with Figure 3.

3 Strength reduction factors for the inserts shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for cast-in-headed anchors. Strength reduction factors for load combinations in accordance with ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, governed by steel strength of the insert are as tabulated. Strength reduction values correspond to brittle steel elements; see Section 3.2.2 of this report. The value of $f$ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3, or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318 Appendix C are used, the appropriate value of $f$ must be determined in accordance with ACI 318-14 4.4.

4 Minimum spacing distance between anchors and minimum edge distance for cast-in-headed Wood Knocker II+ and Pan-Knocker II+ anchors shall be in accordance with ACI 318-14 17.7 or ACI 318-11 D.8, as applicable; see installation tables for additional details.

5 The strengths shown in the table are for inserts only. Design professional is responsible for checking threaded rod or bolt strength in tension, shear, and combined tension and shear, as applicable. See Table 5 for steel design information for common threaded rod elements.
TABLE 3A—DESIGN INFORMATION FOR BANG-IT+ SINGLE THREAD INSERTS

<table>
<thead>
<tr>
<th>DESIGN INFORMATION / INSERT PROPERTY</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>$\frac{1}{4}$-inch</th>
<th>$\frac{3}{8}$-inch</th>
<th>M10</th>
<th>M12</th>
<th>$\frac{1}{2}$-inch</th>
<th>$\frac{3}{4}$-inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside diameter of the steel insert body</td>
<td>$d_s$</td>
<td>in. (mm)</td>
<td>0.70</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insert head net bearing area</td>
<td>$A_{og}$</td>
<td>in$^2$ (mm$^2$)</td>
<td>1.20</td>
<td>1.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>$h_{te}$</td>
<td>in. (mm)</td>
<td>1.75</td>
<td>1.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STEEL STRENGTH IN TENSION (ACI 318-14 17.4.1 or ACI 318-11 Section D.5.1)

A Nominal tension strength of single insert as governed by steel strength $N_{a,insert}$ in kN (lb)

B Steel strength in tension of single insert as governed by steel strength, seismic $N_{a,insert,eq}$ in kN (lb)

Reduction factor, steel strength in tension $\phi$

CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)

Effectiveness factor for cracked concrete $k_c$

Reduction factor, concrete strength in tension $\psi$

TABLE 3B—DESIGN INFORMATION FOR BANG-IT+ MULTI THREAD INSERTS

<table>
<thead>
<tr>
<th>DESIGN INFORMATION / INSERT PROPERTY</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>$\frac{1}{4}$ &amp; $\frac{3}{8}$-inch</th>
<th>$\frac{1}{2}$ &amp; $\frac{5}{8}$-inch</th>
<th>$\frac{1}{2}$ &amp; $\frac{3}{4}$-inch</th>
<th>$\frac{1}{2}$ &amp; $\frac{5}{8}$-inch</th>
<th>M10 &amp; M12</th>
<th>M12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside diameter of the steel insert body</td>
<td>$d_s$</td>
<td>in. (mm)</td>
<td>0.70</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insert head plate net bearing area</td>
<td>$A_{og}$</td>
<td>in$^2$ (mm$^2$)</td>
<td>1.20</td>
<td>1.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>$h_{te}$</td>
<td>in. (mm)</td>
<td>1.75</td>
<td>2.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STEEL STRENGTH IN SHEAR (ACI 318-14 17.4.1.2 or ACI 318-11 Section D.5.1)

A Steel strength in shear of single insert, headed anchor $V_{s,a,insert,eq}$ in kN (lb)

B Steel strength in shear of single insert, headed anchor $V_{s,a,insert,eq}$ in kN (lb)

Reduction factor, steel strength in shear $\phi$

CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)

Effectiveness factor for cracked concrete $k_c$

Reduction factor, concrete strength in shear $\psi$

TABLE 3C—DESIGN INFORMATION FOR BANG-IT+ MULTI THREAD INSERTS

<table>
<thead>
<tr>
<th>DESIGN INFORMATION / INSERT PROPERTY</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>$\frac{1}{4}$ &amp; $\frac{3}{8}$-inch</th>
<th>$\frac{1}{2}$ &amp; $\frac{5}{8}$-inch</th>
<th>$\frac{1}{2}$ &amp; $\frac{3}{4}$-inch</th>
<th>$\frac{1}{2}$ &amp; $\frac{5}{8}$-inch</th>
<th>M10 &amp; M12</th>
<th>M12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside diameter of the steel insert body</td>
<td>$d_s$</td>
<td>in. (mm)</td>
<td>0.70</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insert head plate net bearing area</td>
<td>$A_{og}$</td>
<td>in$^2$ (mm$^2$)</td>
<td>1.20</td>
<td>1.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>$h_{te}$</td>
<td>in. (mm)</td>
<td>1.75</td>
<td>2.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STEEL STRENGTH IN SHEAR (ACI 318-14 17.4.1.2 or ACI 318-11 Section D.5.1)

A Steel strength in shear of single insert, headed anchor $V_{s,a,insert,eq}$ in kN (lb)

B Steel strength in shear of single insert, headed anchor $V_{s,a,insert,eq}$ in kN (lb)

Reduction factor, steel strength in shear $\phi$

CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)

Effectiveness factor for cracked concrete $k_c$

Reduction factor, concrete strength in shear $\psi$

Footnotes:
1. Concrete must have a compressive strength $f'_{cu}$ of 2,500 psi minimum. Installation must comply with Sections 4.1.10 and 4.3, and Figure 3 of this report.
2. Design of headed cast-in-slab inserts shall be in accordance with the provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, for cast-in headed anchors. Concrete breakout strength must also be in accordance with Figures 4A, 4B and 4C, as applicable.
3. Strength reduction factors for the inserts shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for cast-in headed anchors. Strength reduction factors for load combinations in accordance with ACI 318-14 17.3.3 or ACI 318-11 9.2, as applicable, governed by steel strength of the insert are tabulated above. Strength reduction values correspond to brittle steel elements; see Section 3.2.2 of this report for details. The values of $\phi$ apply when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. 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.
4. Minimum spacing distance between anchors and minimum edge distances for cast-in headed Bang-It+ anchors shall be in accordance with Figures 4A, 4B or 4C, as applicable, and noted provisions.
5. The strengths shown in the tables are for inserts only. Design professional is responsible for checking threaded rod strength in tension, shear, and combined tension and shear, as applicable. See Table 5 for steel design information for common threaded rod elements.
6. The tabulated insert strength values are applicable to installations in the lower flute or upper flute of the steel deck profiles; see Figures 4A, 4B and 4C.
TABLE 4—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON CARBON STEEL THREADED ROD ELEMENTS

<table>
<thead>
<tr>
<th>THREADED ROD SPECIFICATION</th>
<th>UNITS</th>
<th>MIN. SPECIFIED ULTIMATE STRENGTH, $f_{ut}$</th>
<th>MIN. SPECIFIED YIELD STRENGTH, $f_{y}$ 0.2 PERCENT OFFSET, $f_{y0.2}$</th>
<th>$f_{y}/f_{yt}$</th>
<th>ELONGATION MINIMUM PERCENT</th>
<th>REDUCTION OF AREA MIN. PERCENT</th>
<th>RELATED NUT SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASTM A36/A36M</td>
<td>psi (MPa)</td>
<td>58,000 (400)</td>
<td>36,000 (248)</td>
<td>1.61</td>
<td>23</td>
<td>40 (50 for A36)</td>
<td>ASTM A194 / A563 Grade A</td>
</tr>
<tr>
<td>ISO 898-1* Class 4.6</td>
<td>MPa (psi)</td>
<td>400 (58,000)</td>
<td>240 (34,800)</td>
<td>1.67</td>
<td>22</td>
<td>5</td>
<td>ISO 4032 Grade 4</td>
</tr>
<tr>
<td>ISO 898-1* Class 8.8</td>
<td>MPa (psi)</td>
<td>800 (116,000)</td>
<td>640 (92,800)</td>
<td>1.25</td>
<td>12</td>
<td>5</td>
<td>ISO 4032 Grade 8</td>
</tr>
<tr>
<td>ASTM A193/A193M* Grade B7</td>
<td>psi (MPa)</td>
<td>125,000 (860)</td>
<td>105,000 (720)</td>
<td>1.19</td>
<td>16</td>
<td>50</td>
<td>ASTM A194 / A563 Grade DH</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 psi = 0.006897 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1Inserts may be used in conjunction with all grades of continuously threaded carbon steel threads (all-thread) that comply with code reference standards and that have thread characteristics comparable to ANSI B1.1 UNC Coarse Thread Series or ANSI B1.13M Profile Metric Coarse Thread Series. Tabulated values correspond to anchor diameters included in this report. See Section 3.2.2 of this report for ductility of steel anchor elements.


3Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.

4Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs.

5Based on 2-inch (50 mm) gauge length except ASTM A193, which are based on a gauge length of 4d.

6Minimum percent reduction of area not reported in the referenced standard.

7Where nuts are applicable, nuts of other grades and style having specified proof load stress greater than the specified grade and style are also suitable.

TABLE 5—DESIGN STEEL INFORMATION FOR COMMON THREADED ROD ELEMENTS USED WITH CONCRETE INSERTS

<table>
<thead>
<tr>
<th>DESIGN INFORMATION</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>1/4-inch</th>
<th>3/8-inch</th>
<th>M10</th>
<th>M12</th>
<th>5/8-inch</th>
<th>3/4-inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threaded rod nominal outside diameter</td>
<td>$d_{rod}$</td>
<td>in. (mm)</td>
<td>0.250 (6.4)</td>
<td>0.375 (9.5)</td>
<td>0.394 (10)</td>
<td>0.472 (12)</td>
<td>0.500 (12.7)</td>
<td>0.625 (15.9)</td>
</tr>
<tr>
<td>Threaded rod effective cross-sectional area</td>
<td>$A_{rod}$</td>
<td>in$^2$ (mm$^2$)</td>
<td>0.032 (21)</td>
<td>0.078 (50)</td>
<td>0.090 (58)</td>
<td>0.131 (85)</td>
<td>0.142 (92)</td>
<td>0.226 (146)</td>
</tr>
<tr>
<td>Steel strength in tension of threaded rod</td>
<td>$N_{s,rod,A36}$</td>
<td>lb (kN)</td>
<td>1,855 (8.2)</td>
<td>4,525 (20.0)</td>
<td>5,220 (23.2)</td>
<td>7,600 (33.8)</td>
<td>8,235 (36.6)</td>
<td>13,110 (58.3)</td>
</tr>
<tr>
<td>Steel strength in tension of threaded rod, seismic</td>
<td>$N_{s,rod,eq,A36}$</td>
<td>lb (kN)</td>
<td>1,855 (8.2)</td>
<td>4,525 (20.0)</td>
<td>5,220 (23.2)</td>
<td>7,600 (33.8)</td>
<td>8,235 (36.6)</td>
<td>13,110 (58.3)</td>
</tr>
<tr>
<td>Steel strength in tension of threaded rod</td>
<td>$N_{s,rod,B7}$</td>
<td>lb (kN)</td>
<td>4,000 (17.7)</td>
<td>9,750 (43.1)</td>
<td>11,250 (50.1)</td>
<td>16,375 (72.9)</td>
<td>17,750 (76.9)</td>
<td>28,250 (125.7)</td>
</tr>
<tr>
<td>Steel strength in tension of threaded rod, seismic</td>
<td>$N_{s,rod,eq,B7}$</td>
<td>lb (kN)</td>
<td>4,000 (17.7)</td>
<td>9,750 (43.1)</td>
<td>11,250 (50.1)</td>
<td>16,375 (72.9)</td>
<td>17,750 (76.9)</td>
<td>28,250 (125.7)</td>
</tr>
<tr>
<td>Reduction factor, steel strength in tension</td>
<td>$\phi$</td>
<td>-</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel strength in shear of threaded rod</td>
<td>$V_{s,rod,A36}$</td>
<td>lb (kN)</td>
<td>1,105 (4.9)</td>
<td>2,695 (12.0)</td>
<td>3,130 (13.9)</td>
<td>4,560 (20.3)</td>
<td>4,940 (22.0)</td>
<td>7,860 (35.0)</td>
</tr>
<tr>
<td>Steel strength in shear of threaded rod, seismic</td>
<td>$V_{s,rod,eq,A36}$</td>
<td>lb (kN)</td>
<td>780 (3.5)</td>
<td>1,900 (8.4)</td>
<td>2,190 (9.7)</td>
<td>3,190 (14.2)</td>
<td>3,460 (15.4)</td>
<td>5,505 (24.5)</td>
</tr>
<tr>
<td>Steel strength in shear of threaded rod</td>
<td>$V_{s,rod,B7}$</td>
<td>lb (kN)</td>
<td>2,385 (10.6)</td>
<td>5,815 (25.9)</td>
<td>6,750 (30.0)</td>
<td>9,825 (43.7)</td>
<td>10,840 (47.9)</td>
<td>16,950 (75.4)</td>
</tr>
<tr>
<td>Steel strength in shear of threaded rod, seismic</td>
<td>$V_{s,rod,eq,B7}$</td>
<td>lb (kN)</td>
<td>1,680 (7.5)</td>
<td>4,095 (18.2)</td>
<td>4,725 (21.0)</td>
<td>6,890 (30.6)</td>
<td>7,455 (34.2)</td>
<td>11,865 (52.8)</td>
</tr>
<tr>
<td>Reduction factor, steel strength in shear</td>
<td>$\phi$</td>
<td>-</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 pound = 0.00445 kN, 1 in$^2$ = 645.2 mm$^2$. For pound-inch units: 1 mm = 0.03937 inches.

1Values provided for steel element material types, or equivalent, based on minimum specified strengths; $N_{s,rod}$ and $V_{s,rod}$ calculated in accordance with ACI 318-14 Eq. 17.5.1.2a and Eq. 17.5.1.2b or ACI 318-11 Eq. D-28 and Eq. D-29, respectively, as applicable. $V_{s,rod}$ must be taken as 0.7 $V_{s,rod}$.

2$N_{s,rod}$ shall be the lower of the $\phi N_{s,rod}$ or $\phi V_{s,rot}$ for static steel strength in tension; for seismic loading $\phi N_{s,rod}$ shall be the lower of the $\phi N_{s,rod}$ or $\phi V_{s,rot}$, where $\phi$ is the reduction factor.

3$N_{s,rod}$ shall be the lower of the $\phi N_{s,rod}$ or $\phi V_{s,rot}$ for static steel strength in tension; for seismic loading $\phi V_{s,rot}$ shall be the lower of the $\phi V_{s,rot}$ or $\phi V_{s,rot}$, where $\phi$ is the reduction factor.

4Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for steel elements. Strength reduction factors for load combinations in accordance with ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, governed by the steel strength of steel elements are tabulated above. Strength reduction values correspond to ductile steel elements; see Section 3.2.2 of this report for details.

The value of $\phi$ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. 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.
### TABLE 6A—EXAMPLE ASD ALLOWABLE TENSION DESIGN VALUES FOR ILLUSTRATIVE PURPOSES\(^1\),\(^2\),\(^3\),\(^4\),\(^5\),\(^6\),\(^7\),\(^8\),\(^9\),\(^10\),\(^11\)

<table>
<thead>
<tr>
<th>CONCRETE STRENGTH ((f_{c}'))</th>
<th>THREADED ROD SPECIFICATION (ASTM)</th>
<th>1/4-INCH LP (lbs)</th>
<th>1/4-INCH LP (lbs)</th>
<th>1/4-INCH (lbs)</th>
<th>1/4-INCH (lbs)</th>
<th>M10 (lbs)</th>
<th>M12 (lbs)</th>
<th>5/8-INCH (lbs)</th>
<th>5/8-INCH (lbs)</th>
<th>3/4-INCH (lbs)</th>
<th>3/4-INCH (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,500 A36</td>
<td>A193, Grade B7</td>
<td>940</td>
<td>990</td>
<td>940</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
</tr>
<tr>
<td>3,000 A36</td>
<td>A193, Grade B7</td>
<td>1,085</td>
<td>1,085</td>
<td>1,085</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
</tr>
<tr>
<td>4,000 A36</td>
<td>A193, Grade B7</td>
<td>1,255</td>
<td>1,255</td>
<td>1,255</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
</tr>
<tr>
<td>6,000 A36</td>
<td>A193, Grade B7</td>
<td>1,555</td>
<td>1,775</td>
<td>1,555</td>
<td>2,645</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>3,285</td>
<td>3,285</td>
<td>3,285</td>
</tr>
<tr>
<td>8,000 A36</td>
<td>A193, Grade B7</td>
<td>1,775</td>
<td>1,775</td>
<td>1,775</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>3,285</td>
<td>3,285</td>
<td>3,285</td>
</tr>
</tbody>
</table>

For SI: 1 pound = 4.45 N. For pound-inch unit: 1 inch = 25.4 mm.

### TABLE 6B—EXAMPLE ASD ALLOWABLE SHEAR DESIGN VALUE FOR ILLUSTRATIVE PURPOSES\(^1\),\(^2\),\(^3\),\(^4\),\(^5\),\(^6\),\(^8\),\(^9\),\(^10\),\(^11\)

<table>
<thead>
<tr>
<th>CONCRETE STRENGTH ((f_{c}'))</th>
<th>THREADED ROD SPECIFICATION (ASTM)</th>
<th>1/4-INCH LP (lbs)</th>
<th>1/4-INCH LP (lbs)</th>
<th>1/4-INCH (lbs)</th>
<th>1/4-INCH (lbs)</th>
<th>M10 (lbs)</th>
<th>M12 (lbs)</th>
<th>5/8-INCH (lbs)</th>
<th>5/8-INCH (lbs)</th>
<th>3/4-INCH (lbs)</th>
<th>3/4-INCH (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,500 A36</td>
<td>A193, Grade B7</td>
<td>400</td>
<td>485</td>
<td>1,185</td>
<td>1,375</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
</tr>
<tr>
<td>3,000 A36</td>
<td>A193, Grade B7</td>
<td>400</td>
<td>720</td>
<td>1,185</td>
<td>1,375</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
</tr>
<tr>
<td>4,000 A36</td>
<td>A193, Grade B7</td>
<td>400</td>
<td>485</td>
<td>1,185</td>
<td>1,375</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
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<tr>
<td>6,000 A36</td>
<td>A193, Grade B7</td>
<td>400</td>
<td>485</td>
<td>1,185</td>
<td>1,375</td>
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<td>8,000 A36</td>
<td>A193, Grade B7</td>
<td>400</td>
<td>720</td>
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<tr>
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<td>A193, Grade B7</td>
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<td>485</td>
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<td>1,375</td>
<td>2,170</td>
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<td>2,170</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
</tr>
</tbody>
</table>

For SI: 1 pound = 4.45 N. For pound-inch unit: 1 inch = 25.4 mm.

Illustrative Allowable Stress Design Values in Table 6A and 6B are applicable only when the following design assumptions are followed:

1. Concrete compressive strength, \(f_{c}'\), given for normal weight concrete.
2. Single anchors with static shear load with installation in accordance with Figure 3.
3. Concrete determined to remain uncracked for the life of the anchorage.
4. Load combinations from ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, (no seismic loading).
5. 30% dead load and 70% live load, controlling load combination 1.2D + 1.6 L.
6. Calculation of the weighted average for \(\alpha = 1.2*0.3 + 1.6*0.7 = 1.48\).
7. Assuming no edge distance influence (\(ca_1 \geq 1.5hef\)) and no side-face blowout in tension.
8. Assuming no edge distance (\(ca_1 \geq hef\)) or corner distance influence (\(ca_2 \geq 1.5ca_1\)) in shear.
9. Shear loads may be applied in any direction.
10. \(h \geq h_{min}\) according to ACI 318-14 17.7 or ACI 318-11D.8, as applicable.
11. Values are for Condition B where supplementary reinforcement in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, is not provided.
### TABLE 7A—Example ASD Allowable Tension Design Values for Illustrative Purposes1,2,3,4,5,6,7,8,10,11

<table>
<thead>
<tr>
<th>CONCRETE STRENGTH (f'c)</th>
<th>THREADED ROD SPECIFICATION (ASTM)</th>
<th>1/4-INCH (lbs)</th>
<th>3/8-INCH (lbs)</th>
<th>M10 (lbs)</th>
<th>M12 (lbs)</th>
<th>1/2-INCH (lbs)</th>
<th>5/8-INCH (lbs)</th>
<th>3/4-INCH (lbs)</th>
<th>1-1/4-INCH (lbs)</th>
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<tbody>
<tr>
<td></td>
<td>A36</td>
<td>940</td>
<td>830</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
</tr>
<tr>
<td></td>
<td>A36</td>
<td>940</td>
<td>940</td>
<td>1,765</td>
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<td>1,765</td>
<td>1,765</td>
<td>1,765</td>
<td>1,765</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>1,765</td>
<td>1,765</td>
<td>1,765</td>
<td>1,765</td>
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<td>1,765</td>
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</tr>
<tr>
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<td>A36</td>
<td>940</td>
<td>940</td>
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</tr>
<tr>
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<td>2,500</td>
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</tr>
</tbody>
</table>

For SI: 1 pound = 4.45 N. For pound-inch unit: 1 inch = 25.4 mm.

### TABLE 7B—Example ASD Allowable Shear Design Value for Illustrative Purposes1,2,3,4,5,6,7,8,10,11

<table>
<thead>
<tr>
<th>CONCRETE STRENGTH (f'c)</th>
<th>THREADED ROD SPECIFICATION (ASTM)</th>
<th>1/4-INCH (lbs)</th>
<th>3/8-INCH (lbs)</th>
<th>M10 (lbs)</th>
<th>M12 (lbs)</th>
<th>1/2-INCH (lbs)</th>
<th>5/8-INCH (lbs)</th>
<th>3/4-INCH (lbs)</th>
<th>1-1/4-INCH (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A36</td>
<td>940</td>
<td>830</td>
<td>1,395</td>
<td>1,395</td>
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<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
<td>1,395</td>
</tr>
</tbody>
</table>

Illustrative Allowable Stress Design Values in Tables 7A and 7B are applicable only when all of the following design assumptions are followed:

1Concrete compressive strength, f'c, given for sand-light weight concrete.
2Single anchors; static tension load with installation in upper and lower flange locations in concrete-filled steel deck in accordance with Figures 4A, 4B, or 4C, as applicable, and noted provisions.
3Concrete determinations to remain uncracked for the life of the anchorage.
4Load combinations from ACI 318-14 5.3 or ACI 318-11 9.2, as applicable (no seismic loading).
5Values are for Condition B where supplementary reinforcement in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, is not provided.
6Assuming no edge distance with 0.75-inch for lower flute anchors in shear. Load bearings may be applied in any direction.
7For lower flute anchors in accordance with Figure 4A, the near edge distance, c_{min}, is 1.25-inch. For lower flute anchors in accordance with Figure 4B, the near edge distance, c_{min}, is 0.75-inch. For lower flute anchors in accordance with Figure 4C, the near edge distance, c_{min}, is 0.75-inch.
**BANG-IT+ SINGLE THREAD INSERTS**

- 1/4-inch Brown
- 3/8-inch or M10 Green
- 5/8-inch or M12 Yellow
- 3/4-inch Red
- 1-inch Purple

**BANG-IT+ MULTI THREAD INSERTS**

- 1/4 & 1/2-inch White
- 3/8- & 1/2-inch or M10 & M12 Aqua
- 5/8- & 3/4-inch or M10 & M12 Gray
- 3/8 & 1/2- & 5/8-inch Orange
- 5/8 & 3/4-inch Black

**FIGURE 7—BANG-IT+ INSERTS FOR CONCRETE-FILLED STEEL DECKS**

<table>
<thead>
<tr>
<th>WOOD-KNOCKER II+</th>
<th>1.) Position insert on formwork, plastic down.</th>
<th>2.) Drive insert down until head contacts plastic.</th>
<th>3.) After formwork removal, remove nails as necessary (e.g. flush mounted fixtures).</th>
<th>4.) Push through plastic center (thread seal) and thread steel element (rod/bolt) into the insert. Attach fixture as applicable (e.g. seismic brace).</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITION</td>
<td>DRIVE</td>
<td>PREPARE</td>
<td>ATTACH</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PAN-KNOCKER II+</th>
<th>1.) Position insert on formwork, plastic down.</th>
<th>2.) Mount / secure insert to formwork (e.g. using screws).</th>
<th>3.) After formwork removal, remove screws as necessary (e.g. flush mounted fixtures).</th>
<th>4.) Push through plastic center (thread seal) and thread steel element (rod/bolt) into the insert. Attach fixture as applicable (e.g. seismic brace).</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITION</td>
<td>MOUNT</td>
<td>PREPARE</td>
<td>ATTACH</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BANG-IT+</th>
<th>1.) Cut (e.g. drill/punch) a hole in the steel deck to the hole size required by the insert.</th>
<th>2.) Place the plastic sleeve of the insert through hole in steel deck.</th>
<th>3.) Step on or impact the insert head to engage. Optionally, base plate of insert can also be attached to steel deck (e.g. using screws).</th>
<th>4.) Install threaded steel element (rod/bolt) into the insert. Trim away/remove plastic sleeve as necessary for shear loading; attach fixture as applicable (e.g. seismic brace).</th>
</tr>
</thead>
<tbody>
<tr>
<td>CREATE HOLE</td>
<td>POSITION</td>
<td>MOUNT</td>
<td>ATTACH</td>
<td></td>
</tr>
</tbody>
</table>

**FIGURE 8—WOOD KNOCKER II+ AND PAN-KNOCKER II+ CONCRETE INSERTS FOR FORMS AND BANG-IT+ CONCRETE INSERTS FOR STEEL DECK, MANUFACTURER PRINTED INSTALLATION INSTRUCTIONS (MPII)**
1.0 REPORT PURPOSE AND SCOPE

Purpose:
The purpose of this evaluation report supplement is to indicate that the DEWALT Wood-Knocker II+ and Pan-Knocker II+ concrete inserts for forms and Bang-It+ concrete inserts for steel deck in cracked and uncracked concrete, described in ICC-ES evaluation report ESR-3657, has also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2020 City of Los Angeles Building Code (LABC)
- 2020 City of Los Angeles Residential Code (LARC)

2.0 CONCLUSIONS

The DEWALT Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ inserts in cracked and uncracked concrete, described in Sections 2.0 through 7.0 of the evaluation report ESR-3657, comply with LABC Chapter 19, and the LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The DEWALT Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ inserts described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-3657.
- The design, installation, conditions of use and labeling of the DEWALT Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ inserts are in accordance with the 2018 International Building Code® (IBC) provisions noted in the evaluation report ESR-3657.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.
- The allowable and strength design values listed in the evaluation report and tables are for the connection of the headed cast-in specialty inserts to the concrete. The connection between the headed cast-in specialty inserts and the connected members shall be checked for capacity (which may govern).
- For use in wall anchorage assemblies to flexible diaphragm applications, anchors shall be designed per the requirements of City of Los Angeles Information Bulletin P/BC 2020-071.

This supplement expires concurrently with the evaluation report, reissued December 2019 and revised August 2020.
1.0 REPORT PURPOSE AND SCOPE

Purpose:
The purpose of this evaluation report supplement is to indicate that the DEWALT Wood-Knocker II+ and Pan-Knocker II+ concrete inserts for forms and Bang-It+ concrete inserts for steel deck in cracked and uncracked concrete, recognized in ICC-ES evaluation report ESR-3657, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2017 Florida Building Code—Building
- 2017 Florida Building Code—Residential

2.0 CONCLUSIONS

The DEWALT Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ inserts in cracked and uncracked Concrete, described in Sections 2.0 through 7.0 of the evaluation report ESR-3657, comply with the Florida Building Code—Building and the Florida Building Code—Residential, when designed and installed in accordance with the 2015 International Building Code® provisions noted in the evaluation report.

Use of the Wood-Knocker II+, Pan-Knocker II+, and Bang-It+ inserts in cracked and uncracked Concrete for compliance with the High-Velocity Hurricane Zone Provisions of the Florida Building Code—Building and Florida Building Code—Residential, has not been evaluated and is outside the scope of this supplement.

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 evaluation report, reissued December 2019 and revised August 2020.