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:

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 eleven models for the Wood-Knocker II+ inserts; eight fractional and three metric: 1/4-inch, 5/32-inch, 7/64-inch, 5/64-inch, 3/32-inch, 1/8-inch, M10, M10 & M12, and M12 corresponding to the sizes of the threaded rods or bolts used for the inserts.

There are eight models for the Pan-Knocker II+ inserts; five fractional and three metric: 1/4 & 5/32-inch multi, 1/4 & 3/8 & 1/2-inch multi, 3/8-inch, 5/8 & 1/2-inch multi, 1/2-inch, M10, M10 & M12 multi, and M12 corresponding to the sizes of the threaded rods or bolts used for the inserts.

There are ten models for the Bang-It+ inserts; seven fractional and three metric: 1/4-inch, 5/32 & 3/32-inch multi, 5/32-inch, 3/8 & 1/2-inch multi, 1/2-inch, 5/8-inch, 3/4-inch, 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. For inserts that can accept multiple rod or bolt sizes, applications designed to resist shear loads must use the largest diameter threaded rod or bolt.

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, Sections 1908 and 1909 of the 2012 IBC and Sections 1911 and 1912 of the 2009 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 consist of a steel internally threaded headed insert (body) 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 internally threaded headed insert (body), an outer spring, a plastic sleeve and a washer (base plate). The insert is illustrated in Figure 2 and Figure 6. The internally threaded insert and washer are manufactured from low carbon steel. 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 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 topside of the metal deck, and impacted 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 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 unstaed, the steel element must be considered brittle.

3.3 Concrete:

Normal-weight, sand-lightweight, and all-lightweight concrete must comply with 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 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 strength of anchors complying with the 2009 IBC and Section R301.1.3 of the 2009 IRC must be determined in accordance with ACI 318-08 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 318-11 D.3.3, as applicable.

Strength reduction factors, \( \phi \), 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. Strength reduction factors, \( \phi \), as given in ACI 318-11 D.4.4 must be used for load combinations calculated in accordance with ACI 318-11 Appendix C. An example calculation in accordance with the 2012 IBC is provided in Figure 9. The value of \( \Psi \) used in the calculations must be limited to a maximum of 10,000 psi (68.9 MPa), in accordance with ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable.

The pullout strength in tension is not decisive for design and does not need to be evaluated.

4.1.2 Requirements for Static Steel Strength in Tension: The nominal static steel strength in tension, \( N_{st} \), 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, \( N_{st,rod} \), as illustrated in Table 5 of this report. The lesser of \( \Psi N_{st,rod} \) in Table 5 or \( \phi N_{st,rod} \) 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, \( N_{bc} \), or \( N_{bcg} \), respectively, must be calculated in accordance with ACI 318-14 17.4.2 or ACI 318-11 D.5.2 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, \( N_{b} \), 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 \( N_{st} \) given in Tables 2A, 2B, 3A and 3B, and with \( k_{c} = 24 \). 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 \( \Psi_{c,N} = 1.25 \). 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 \( N_{bc} / N_{bco} \) in accordance with ACI 318-14 17.4.2.1 or ACI 318-11 D.5.2.1, as applicable, and \( c_{min} \) (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, \( N_{bd} \), must be 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, as applicable.

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 blowout strength is not required.

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, \( V_{st} \), of a single anchor must be taken as the threaded steel element strength,
For Bang-It+ anchors, the nominal static strength in shear, $V_{sa,deck}$, of a single Bang-It+ insert, in the lower flute or upper flute of the concrete filled steel deck assemblies, must be taken as the threaded steel element strength, $V_{sa,rod}$, given in Table 5 of this report. The lesser of $\phi V_{sa,rod}$ in Table 5 or $\phi V_{sa,insert,deck}$ 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 strength in shear, $V_{sa,deck}$, of a single Bang-It+ insert, in the lower flute or upper flute of concrete filled steel deck assemblies, must be taken 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 Breakout Strength in Shear: For Wood-Knocker II+ and Pan-Knocker II+ anchors, the nominal concrete breakout strength of a single anchor or group of anchors in shear, $V_{cp}$ or $V_{cp,g}$, 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 breakout strength, $V_{cbg}$, 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 Table 1. The value of $f_u$ 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 $h_u$ 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 $V_{cp,g}$, 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. Modifications to ACI 318-08 D.3.3 shall be applied under Section 1908.1.9 of the 2009 IBC. 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 breakout 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, $N_{sa}$, 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, $N_{sa,rod,eq}$, as given in Table 5, not to exceed the corresponding values of $N_{sa,insert,eq}$ in Table 2A or 2B 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 Wood-Knocker II+ anchors, the nominal steel strength in tension, $N_{sa}$, 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, $N_{sa,rod,eq}$, as given in Table 5, not to exceed the corresponding values of $N_{sa,insert,eq}$ in Table 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 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.

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, $V_{sa,rod,eq}$, given in Table 5 of this report, not to exceed the corresponding values of $V_{sa,insert,eq}$ in Table 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, $V_{sa,rod,eq}$, given in Table 5 of this report, not to exceed the corresponding values of $V_{sa,insert,eq}$ in Table 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 as applicable for cast-in bolts.
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 Figures 4A, 4B and 4C and shall have a minimum axial spacing along the flute in accordance with Table 3A or 3B.

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 \( \gamma_{CP,N} = 1.0 \) in accordance with ACI 318-14 17.4.2.5 or ACI 318-11 D.5.2.5, as applicable.

4.1.12 Sand-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 \( \lambda_a \) or \( \lambda \), respectively, for concrete breakout strength must be taken as 0.85 for sand-lightweight or 0.75 for all-lightweight according to ACI 318-14 17.2.6 (2018 and 2015 IBC), ACI 318-11 D.3.6 (2012 IBC) or ACI 318-08 D.3.4 (2009 IBC).

For Bang-It+ anchors in the soffit of sand-lightweight concrete-filled steel deck, \( \lambda_a \) or \( \lambda \) 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:

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

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

where:

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

\( V_{allowable,ASD} \) = 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 2016 or 2015 IBC Section 1905.1.8, ACI 318-11, -08 Appendix D, and 2009 IBC Section 1908.1.9, 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, -08 Appendix D, and 2009 IBC Section 1908.1.9, 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 6 through 9. The values presented in Tables 6 through 9 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, -08 D.7, as applicable, as follows:

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

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

For all other cases:

\[
\frac{T_{applied}}{T_{allowable,ASD}} + \frac{V_{applied}}{V_{allowable,ASD}} \leq 1.2
\]

Due to the projection of the internally-threaded end of the Bang-It+ insert when installed in concrete filled steel deck assemblies (approximately 3/8-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, -08 D.7 as applicable.

4.3 Installation:

For the Wood-Knocker II+ and Pan-Knocker II+ inserts, installation parameters are provided in Table 2A or 2B and in Figures 3 and 7. 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 inserts 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 Table 3A or 3B and in Figures 4A, 4B, 4C and 7. A hole must be made in the steel deck using a step-drill, hole saw, deck punch or equivalent in accordance with the following hole diameters: 1/8-inch or 3/8-inch (21 mm or 22 mm) bit diameter for Bang-It+ inserts up through 1/2-inch nominal diameter, and 1 1/8-inch or 1 1/4-inch (30 mm or 32 mm) bit diameter for Bang-It+ inserts with 5/8-inch or 3/4-inch nominal 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+ metal base plate may be screwed 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 plastic thread protector nozzle until contact is made with the inner steel barrel. 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 plastic sleeve must be cut and trimmed to the surface of the insert 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.
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 conditions of this report, where applicable.

5.1 Specially printed inserts are limited to dry interior locations.

5.2 Specially printed inserts are limited to dry interior locations.

5.3 Specially printed inserts must be installed in accordance with the manufacturer’s printed instructions and this report. In case of conflict, this report governs.

5.4 Specially printed 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 Specially printed 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 II+ inserts.

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 \( (f < f_i) \), subject to the conditions of this report.

5.12 Specialty inserts may be used to resist long-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 member 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 specific size 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
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<tr>
<td>Side-face Blowout</td>
<td>$V_{sa}, V_{sbg}, V_{sp}, V_{scp}$ Table 2A and 2B</td>
<td>Table 2A and 2B</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**CONCRETE TYPE** | **CONCRETE STATE** | **INSERT / STEEL ELEMENT NOMINAL SIZE** | **SEISMIC DESIGN CATEGORIES**
--- | --- | --- | ---
Normal-weight and lightweight | Cracked | $\frac{1}{4}"$, $\frac{5}{32}"$, M10, M12, $\frac{1}{2}"$, $\frac{9}{32}"$, $\frac{7}{32}"$ | A through F |
Uncracked | $\frac{1}{4}"$, $\frac{1}{2}"$, M10, M12, $\frac{3}{8}"$, $\frac{7}{32}"$, $\frac{7}{32}"$ | A and B |

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

<sup>1</sup>Reference 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, pryout and side-face blowout, as applicable) and design assumptions. The pullout strength in tension is not decisive for design and does not need to be evaluated.

<sup>2</sup>See Section 4.1.8 for requirements for seismic design, where applicable.
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 ASSEMBLIES

FIGURE 4B—BANG-IT+ INSERTS INSTALLED IN SOFFIT OF CONCRETE-FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES

FIGURE 4C—BANG-IT+ INSERTS INSTALLED IN SOFFIT OF CONCRETE-FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES

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. Upper flute installations require a minimum 3” concrete topping thickness from the top of the upper flute. Inserts in upper flute may be installed anywhere across upper flute.

2Axial spacing for Bang-It+ inserts along the lower flute length shall be minimum 3.00.

3Upper flute Bang-It+ 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 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 edge distance of 1/8-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 edge distance of 3/8-inch is also satisfied.

6Lower flute installations of Figure 4B with flute widths greater than 13/8-inch are permitted.

7Lower flute installations of Figure 4B in flute depths greater than 1 1/2-inch are permitted provided the minimum edge distance of 3/8-inch is met and 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 2 3/8-inch).

8Inserts in the lower flute of Figure 4C may be installed with a maximum 1 3/16-inch offset in either direction from the center of the flute.
TABLE 2A—WOOD KNOCKER II+ AND PAN-KNOCKER II+ SINGLE THREAD INSERT DESIGN INFORMATION1,2,3,4,6

<table>
<thead>
<tr>
<th>DESIGN INFORMATION</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>1/4-inch</th>
<th>3/8-inch</th>
<th>1/2-inch</th>
<th>M10</th>
<th>M12</th>
<th>3/8-inch</th>
<th>3/4-inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert O.D. (outside diameter of the headed insert body)</td>
<td>d_h</td>
<td>in. (mm)</td>
<td>0.7 (18)</td>
<td>1.0 (25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insert head net bearing area</td>
<td>A_f</td>
<td>in² (mm²)</td>
<td>1.20 (762)</td>
<td>1.30 (839)</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>1.75 (45)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum member thickness</td>
<td>h_min</td>
<td>in. (mm)</td>
<td>3.5 (89)</td>
<td>3.5 (89)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum spacing and edge distances</td>
<td>s_min, c_min</td>
<td>-</td>
<td>See ACI 318 Section D.8.1 and D.8.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Effectiveness factor for cracked concrete
K_c = \frac{1}{24} (SI) = 1.25

Nominal tension strength of single insert as governed by steel strength
N_{s,b,insert} (lb (kN)) = 3,545 (15.8) 0.70 (40.1) 9,005 (40.1) 12,685 (56.4)

Nominal tension strength of single insert as governed by steel strength, seismic
N_{s,b,insert,eq} (lb (kN)) = 3,545 (15.8) 0.70 (40.1) 9,005 (40.1) 12,685 (56.4)

Nominal steel shear strength of single insert
V_{s,a,insert} (lb) = 1,775 (7.9) 9,005 (31.9) 9,005 (31.9)

Nominal steel shear strength of single insert, seismic
V_{s,a,insert,eq} (lb) = 1,775 (7.9) 9,005 (31.9) 9,005 (31.9)

For SI: 1 inch = 25.4 mm, 1 pound = 0.00445 kN, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

TABLE 2B—WOOD KNOCKER II+ AND PAN-KNOCKER II+ MULTI THREAD INSERT DESIGN INFORMATION1,2,3,4,6

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert O.D. (outside diameter of the headed insert body)</td>
<td>d_h</td>
<td>in. (mm)</td>
<td>1.890 (47.5)</td>
<td>9,005 (40.1)</td>
<td>7,670 (34.1)</td>
<td>9,005 (40.1)</td>
</tr>
<tr>
<td>Insert head net bearing area</td>
<td>A_f</td>
<td>in² (mm²)</td>
<td>1.890 (47.5)</td>
<td>9,005 (40.1)</td>
<td>7,670 (34.1)</td>
<td>9,005 (40.1)</td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>h_ef</td>
<td>in. (mm)</td>
<td>1.75 (45)</td>
<td>1.75 (45)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum member thickness</td>
<td>h_min</td>
<td>in. (mm)</td>
<td>3.5 (89)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum spacing and edge distances</td>
<td>s_min, c_min</td>
<td>-</td>
<td>See ACI 318 Section D.8.1 and D.8.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Effectiveness factor for cracked concrete
K_c = \frac{1}{24} (SI) = 1.25

Nominal tension strength of single insert as governed by steel strength
N_{s,b,insert} (lb (kN)) = 1,890 (47.5) 9,005 (40.1) 7,670 (34.1) 9,005 (40.1) 9,005 (40.1) 9,005 (40.1)

Nominal tension strength of single insert as governed by steel strength, seismic
N_{s,b,insert,eq} (lb (kN)) = 1,890 (47.5) 9,005 (40.1) 7,670 (34.1) 9,005 (40.1) 9,005 (40.1) 9,005 (40.1)

Nominal steel shear strength of single insert
V_{s,a,insert} (lb) = 7,180 (31.9) 7,180 (31.9) 7,180 (31.9)

Nominal steel shear strength of single insert, seismic
V_{s,a,insert,eq} (lb) = 7,180 (31.9) 7,180 (31.9) 7,180 (31.9)

For SI: 1 inch = 25.4 mm, 1 pound = 0.00445 kN, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

Footnotes for Table 2A and 2B:

1Concrete must have a compressive strength f'_c of 2,500 psi minimum. Installation must comply with Sections 4.1.10 and 4.3, and Figure 3 of this report.
2Design 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.
3Strength 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 shall be taken as 0.65 for tension and 0.60 for shear; values correspond to brittle steel elements. The value of φ 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 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318 Appendix C are used, the appropriate value of φ must be determined in accordance with ACI 318-11 D.4.4.
4Minimum spacing 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.
5Only the largest size of threaded rod or bolt for multi inserts (e.g. 1/2-inch diameter for 3/8- & 1/2-inch insert) must be used for applications resisting shear loads.
6The 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—BANG-IT+ SINGLE THREAD INSERT DESIGN INFORMATION¹,²,³,⁴,⁵,⁶,⁷

<table>
<thead>
<tr>
<th>DESIGN INFORMATION</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>3/8-inch</th>
<th>1/2-inch</th>
<th>M10</th>
<th>M12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert O.D. (outside diameter of the headed insert body)</td>
<td>dₐ₀</td>
<td>in.</td>
<td>(mm)</td>
<td>0.7</td>
<td>(18)</td>
<td>1.0</td>
</tr>
<tr>
<td>Insert head net bearing area</td>
<td>Aₜₐ₀</td>
<td>in²</td>
<td>(mm²)</td>
<td>1.20</td>
<td>(762)</td>
<td>1.30</td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>hₑ</td>
<td>in.</td>
<td>(mm)</td>
<td>1.75</td>
<td>(45)</td>
<td>1.75</td>
</tr>
<tr>
<td>Minimum member thickness</td>
<td>fₚₑ₀</td>
<td>-</td>
<td>-</td>
<td>See Figures 4A, 4B and 4C as applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum spacing and edge distances</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Upper flute</td>
<td>sₐ₀ , cₐ₀</td>
<td>-</td>
<td>-</td>
<td>See ACI 318 Section D.8.1 and D.8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower flute</td>
<td>sₐ₀ , cₐ₀</td>
<td>-</td>
<td>-</td>
<td>See Figures 4A, 4B and 4C as applicable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Effective factor for cracked concrete | kₑ | (SI) | 24 |
Modification factor for tension strength in uncracked concrete | Ψₑ₀₂₀ | - | 1.25 |

According to Figures 4A or, 4B & 4C
Nominal tension strength of single insert as governed by steel strength | Nₑ₀₂₀ | lb | (kN) | 3.955 | (17.6) | 9,480 | (42.2) | 9,850 | (43.8) | 11,985 | (53.3) |
Nominal tension strength of single insert as governed by steel strength, seismic | Nₑ₀₂₀,eq | lb | (kN) | 3.955 | (17.6) | 9,480 | (42.2) | 9,850 | (43.8) | 11,985 | (53.3) |

According to Figure 4A
Nominal steel shear strength of single insert in the soffit of concrete on steel deck | Vₑ₀₂₀,insert,deck | lb | (kN) | 1,980 | (8.8) | 2,280 | (10.1) | 3,075 | (13.7) |

According to Figures 4B & 4C
Nominal steel shear strength of single insert as governed by steel strength, seismic | Nₑ₀₂₀,eq,deck | lb | (kN) | 1,980 | (8.8) | 2,280 | (10.1) | 2,695 | (12.0) |

For SI: 1 inch = 25.4 mm, 1 pound = 4.45 N, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

TABLE 3B—BANG-IT+ MULTI THREAD INSERT DESIGN INFORMATION¹,²,³,⁴,⁵,⁶,⁷

<table>
<thead>
<tr>
<th>DESIGN INFORMATION</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>3/8-inch</th>
<th>1/2-inch</th>
<th>M10 &amp; M12 Multi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert O.D. (outside diameter of the headed insert body)</td>
<td>dₐ₀</td>
<td>in.</td>
<td>(mm)</td>
<td>0.7</td>
<td>(18)</td>
</tr>
<tr>
<td>Insert head net bearing area</td>
<td>Aₜₐ₀</td>
<td>in²</td>
<td>(mm²)</td>
<td>1.20</td>
<td>(762)</td>
</tr>
<tr>
<td>Effective embedment depth</td>
<td>hₑ</td>
<td>in.</td>
<td>(mm)</td>
<td>1.75</td>
<td>(45)</td>
</tr>
<tr>
<td>Minimum member thickness</td>
<td>fₚₑ₀</td>
<td>-</td>
<td>-</td>
<td>See Figures 4A, 4B and 4C as applicable</td>
<td></td>
</tr>
<tr>
<td>Minimum spacing and edge distances</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Upper flute</td>
<td>sₐ₀ , cₐ₀</td>
<td>-</td>
<td>-</td>
<td>See ACI 318 Section D.8.1 and D.8.2</td>
<td></td>
</tr>
<tr>
<td>Lower flute</td>
<td>sₐ₀ , cₐ₀</td>
<td>-</td>
<td>-</td>
<td>See Figures 4A, 4B and 4C as applicable</td>
<td></td>
</tr>
</tbody>
</table>

Effective factor for cracked concrete | kₑ | (SI) | 24 |
Modification factor for tension strength in uncracked concrete | Ψₑ₀₂₀ | - | 1.25 |

According to Figures 4A or, 4B & 4C
Nominal tension strength of single insert as governed by steel strength | Nₑ₀₂₀ | lb | (kN) | 1,965 | (8.7) | 9,480 | (42.2) | 9,480 | (42.2) | 9,850 | (43.8) | 9,850 | (43.8) |
Nominal tension strength of single insert as governed by steel strength, seismic | Nₑ₀₂₀,eq | lb | (kN) | 1,965 | (8.7) | 9,480 | (42.2) | 9,480 | (42.2) | 9,850 | (43.8) | 9,850 | (43.8) |

According to Figure 4A
Nominal steel shear strength of single insert in the soffit of concrete on steel deck | Vₑ₀₂₀,insert,deck | lb | (kN) | - | - | 2,280 | (10.2) | - | - | 2,280 | (10.2) |
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic | Vₑ₀₂₀,eq,deck | lb | (kN) | - | - | 2,280 | (10.2) | - | - | 2,280 | (10.2) |

According to Figures 4B & 4C
Nominal steel shear strength of single insert in the soffit of concrete on steel deck | Vₑ₀₂₀,insert,deck | lb | (kN) | - | - | 2,080 | (9.3) | - | - | 2,080 | (9.3) |
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic | Vₑ₀₂₀,eq,deck | lb | (kN) | - | - | 2,080 | (9.3) | - | - | 2,080 | (9.3) |

For SI: 1 inch = 25.4 mm, 1 pound = 4.45 N, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

Footnotes for Table 3A and 3B:
¹Concrete must have a compressive strength f'; of 2,500 psi minimum. Installation must comply with Sections 4.1.10 and 4.3, and Figure 3 of this report.
²Design 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 Figures 4A, 4B and 4C, as applicable.
³Strength 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 shall be taken as 0.65 for tension and 0.60 for shear; values correspond to brittle steel elements. The value of Φ 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 17.3.3 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 Φ must be determined in accordance with ACI 318-11 D.4.4.
⁴Minimum 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.
⁵Only the largest size of threaded rod or bolt for multi inserts (e.g. 3/8-inch diameter for 3/8-inch & 1/2-inch insert) must be used for applications resisting shear loads.
⁶The strengths shown in the table 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.
⁷The 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>THREAD Rod SPECIFICATION</th>
<th>UNITS</th>
<th>MIN. SPECIFIED ULTIMATE STRENGTH, ( f_{ut} )</th>
<th>MIN. SPECIFIED YIELD STRENGTH, ( f_{ys} )</th>
<th>( \frac{f_{ut} - f_{ys}}{f_{ys}} )</th>
<th>MINIMUM REDUCTION OF AREA, ( % )</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>
</tr>
<tr>
<td>ASTM A36/A36M and F1554</td>
<td>Grade 36</td>
<td>58,000 (400)</td>
<td>30,000 (248)</td>
<td>1.61</td>
<td>23</td>
<td>40 (50 for A36)</td>
</tr>
<tr>
<td>ISO 898-1(^{1}) Class 4.6</td>
<td>MPa (psi)</td>
<td>400 (58000)</td>
<td>240 (34800)</td>
<td>1.67</td>
<td>22</td>
<td>45</td>
</tr>
<tr>
<td>ASTM F1554(^{4})</td>
<td>Grade 105</td>
<td>125,000 (862)</td>
<td>105,000 (724)</td>
<td>1.19</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>ASTM A193/A193M(^{7})</td>
<td>Grade B7</td>
<td>125,000 (860)</td>
<td>105,000 (720)</td>
<td>1.19</td>
<td>16</td>
<td>50</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 psi = 0.00689 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. May be used in conjunction with all grades of continuously threaded carbon steels (all-thread) that comply with code reference standards and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series or ANSI B1.13M M Profile Metric Coarse Thread Series.

2. Tabled values correspond to anchor diameters included in this report. See Section 3.2.2 of the report for ductility of steel anchor elements.

3. Strength 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 steel strength of ductile steel elements shall be taken as 0.75 for tension and 0.65 for shear. The value of \( \phi \) 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 17.3.3 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 5—STEEL DESIGN INFORMATION FOR COMMON THREAD Rod ELEMENTS USED WITH CONCRETE INSERTS

<table>
<thead>
<tr>
<th>DESIGN INFORMATION</th>
<th>SYMBOL</th>
<th>UNITS</th>
<th>V(_{4})-inch</th>
<th>( \frac{1}{2})-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>Threaded rod nominal outside diameter</td>
<td>( d_{rod} )</td>
<td>in.</td>
<td>0.250</td>
<td>0.375</td>
<td>0.394</td>
<td>0.472</td>
<td>0.500</td>
<td>0.625</td>
</tr>
<tr>
<td>Threaded rod effective cross-sectional area</td>
<td>( A_{se} )</td>
<td>in(^{2})</td>
<td>0.032</td>
<td>0.078</td>
<td>0.090</td>
<td>0.131</td>
<td>0.142</td>
<td>0.226</td>
</tr>
<tr>
<td>Nominal tension strength of threaded rod</td>
<td>( N_{u,rod,A36} )</td>
<td>lb (kN)</td>
<td>1,855</td>
<td>4,525</td>
<td>5,220</td>
<td>7,600</td>
<td>8,235</td>
<td>13,110</td>
</tr>
<tr>
<td>Nominal tension strength of threaded rod as governed by steel strength, seismic</td>
<td>( N_{u,rod,A36} )</td>
<td>lb (kN)</td>
<td>1,855</td>
<td>4,525</td>
<td>5,220</td>
<td>7,600</td>
<td>8,235</td>
<td>13,110</td>
</tr>
<tr>
<td>Nominal tension strength of threaded rod as governed by steel strength, seismic</td>
<td>( N_{u,rod,B7} )</td>
<td>lb (kN)</td>
<td>4,000</td>
<td>9,750</td>
<td>11,250</td>
<td>16,375</td>
<td>17,750</td>
<td>28,250</td>
</tr>
<tr>
<td>Nominal tension strength of threaded rod as governed by steel strength, seismic</td>
<td>( N_{u,rod,B7} )</td>
<td>lb (kN)</td>
<td>4,000</td>
<td>9,750</td>
<td>11,250</td>
<td>16,375</td>
<td>17,750</td>
<td>28,250</td>
</tr>
<tr>
<td>Nominal shear strength of threaded rod as governed by steel strength</td>
<td>( V_{u,rod,A36} )</td>
<td>lb (kN)</td>
<td>1,105</td>
<td>2,695</td>
<td>3,130</td>
<td>4,560</td>
<td>4,940</td>
<td>7,860</td>
</tr>
<tr>
<td>Nominal shear strength of threaded rod as governed by steel strength, seismic</td>
<td>( V_{u,rod,A36} )</td>
<td>lb (kN)</td>
<td>1,105</td>
<td>2,695</td>
<td>3,130</td>
<td>4,560</td>
<td>4,940</td>
<td>7,860</td>
</tr>
<tr>
<td>Nominal shear strength of threaded rod as governed by steel strength, seismic</td>
<td>( V_{u,rod,B7} )</td>
<td>lb (kN)</td>
<td>2,385</td>
<td>5,815</td>
<td>6,750</td>
<td>9,825</td>
<td>10,640</td>
<td>16,950</td>
</tr>
<tr>
<td>Nominal shear strength of threaded rod as governed by steel strength, seismic</td>
<td>( V_{u,rod,B7} )</td>
<td>lb (kN)</td>
<td>2,385</td>
<td>5,815</td>
<td>6,750</td>
<td>9,825</td>
<td>10,640</td>
<td>16,950</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 pound = 0.4448 kN, 1 inch\(^2\) = 645.2 mm\(^2\). For pound-inch units: 1 mm = 0.03937 inches.

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

2. Strength 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 steel strength of ductile steel elements shall be taken as 0.75 for tension and 0.65 for shear. The value of \( \phi \) 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 17.3.3 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.

---

For the idealization of Steel Deck Profile (e.g. see Figures 4A and 4C) and STEEL DECK INSERT.

---

FIGURE 5—IDEALIZATION OF CONCRETE FILLED STEEL DECKS FOR DETERMINATION OF CONCRETE BREAKOUT STRENGTH IN ACCORDANCE WITH ACI 318.
Shear loads may be applied in any direction.

Assuming no edge distance influence (ca1 ≥ 1.5hν) and no side-face blowout in tension.

Values are for Condition B where supplementary reinforcement in accordance with ACI 318-14 17.7 or ACI 318-11 D.8, as applicable.

TABLE 6—EXAMPLE ASD ALLOWABLE SHEAR DESIGN VALUES FOR ILLUSTRATIVE PURPOSES1,2,3,4,5,6,7,8,9

<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>
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<tr>
<td>2,500</td>
<td>A36</td>
<td>940</td>
<td>1,555</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
<td>1,640</td>
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<tr>
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<td>A193, Grade B7</td>
<td>1,555</td>
<td>1,555</td>
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<td>1,640</td>
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<td>1,640</td>
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<tr>
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<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
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</tr>
<tr>
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</tr>
<tr>
<td>4,000</td>
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<td>940</td>
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<td>2,080</td>
<td>2,080</td>
<td>2,080</td>
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<tr>
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<td>2,080</td>
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<td>2,545</td>
<td>2,545</td>
<td>2,545</td>
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<td>2,545</td>
</tr>
<tr>
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<td>2,295</td>
<td>2,545</td>
<td>2,545</td>
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<td>2,545</td>
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<tr>
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<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>1,555</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
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<td>2,940</td>
</tr>
<tr>
<td>10,000</td>
<td>A36</td>
<td>940</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
</tr>
<tr>
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<td>A193, Grade B7</td>
<td>1,555</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</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 6 are applicable only when all of the following design assumptions are followed:
1. Concrete compressive strength, f′c, given for normal weight concrete.
2. Single anchors with static tension load with installation in accordance to 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. Concrete compressive strength, f′c, given for normal weight concrete.
6. Concrete determined to remain uncracked for the life of the anchorage.
7. Load combinations from ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, (no seismic loading).
8. Calculation of the weighted average for α = 1.2*0.3 + 1.6*0.7 = 1.48.
9. Single anchors with static tension load with installation in accordance with Figure 3.

TABLE 7—EXAMPLE ASD ALLOWABLE TENSION DESIGN VALUES FOR ILLUSTRATIVE PURPOSES1,2,3,4,5,6,7,8,9

<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>
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<tbody>
<tr>
<td>2,500</td>
<td>A36</td>
<td>490</td>
<td>1,195</td>
<td>1,375</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>720</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</td>
<td>A36</td>
<td>490</td>
<td>1,195</td>
<td>1,375</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>720</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</td>
<td>A36</td>
<td>490</td>
<td>1,195</td>
<td>1,375</td>
<td>2,005</td>
<td>2,005</td>
<td>2,005</td>
<td>2,005</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>720</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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<td>6,000</td>
<td>A36</td>
<td>490</td>
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<td>1,375</td>
<td>2,005</td>
<td>2,005</td>
<td>2,005</td>
<td>2,005</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>720</td>
<td>2,545</td>
<td>2,545</td>
<td>2,545</td>
<td>2,545</td>
<td>2,545</td>
<td>2,545</td>
</tr>
<tr>
<td>8,000</td>
<td>A36</td>
<td>490</td>
<td>1,195</td>
<td>1,375</td>
<td>2,005</td>
<td>2,005</td>
<td>2,005</td>
<td>2,005</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>720</td>
<td>2,910</td>
<td>2,910</td>
<td>2,910</td>
<td>2,910</td>
<td>2,910</td>
<td>2,910</td>
</tr>
<tr>
<td>10,000</td>
<td>A36</td>
<td>490</td>
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<td>1,375</td>
<td>2,005</td>
<td>2,005</td>
<td>2,005</td>
<td>2,005</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>720</td>
<td>2,910</td>
<td>2,910</td>
<td>2,910</td>
<td>2,910</td>
<td>2,910</td>
<td>2,910</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 7 are applicable only when all of 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. 90% dead load and 70% live load, controlling load combination 1.2D + 1.6 L.
6. Calculation of the weighted average for α = 1.2*0.3 + 1.6*0.7 = 1.48.
7. Assumining no edge distance influence (ca1 ≥ 1.5hν) or corner distance influence (ca2 ≥ 1.5ca1).
8. Shear loads may be applied in any direction.
9. h ≥ hmin according to ACI 318-14 17.7 or ACI 318-11 D.8, as applicable.
10. 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.

![FIGURE 6—WOOD-KNOCKER II+ AND PAN-KNOCKER II+ CONCRETE INSERTS FOR FORMS](image-url)
For SI: 1 pound = 4.45 N. For pound-inch unit: 1 inch = 25.4 mm.

Illustrative Allowable Stress Design Values in Table 8 are applicable only when all of the following design assumptions are followed:

1. Concrete compressive strength, f_c, given for sand-light weight concrete.
2. Single anchors: static tension load with installation in upper and lower flute locations in concrete-filled steel deck in accordance with Figures 4A, Figure 4B, or Figure 4C, as applicable, and noted provisions.
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 5.7.2, as applicable (no seismic loading).
5. 90% dead load and 10% live load, controlling load combination 1.2D + 1.6 L.
6. Calculations of the weighted average for \( \sqrt{f_{ck}} \) = 1.0075 ± 1.075 or 1.125-inch (see Figure 4A).
7. For lower flute Bang-It+ anchors, the near edge distance, \( c_{min} \), is 0.75-inch (see Figure 4B).
8. For lower flute Bang-It+ anchors, the near edge distance, \( c_{min} \), is 0.75-inch (see Figure 4C).

\( f'c, \) Concretes compressive strength
**TABLE 9—EXAMPLE ASD ALLOWABLE SHEAR DESIGN VALUE FOR ILLUSTRATIVE PURPOSES**

<table>
<thead>
<tr>
<th>CONCRETE STRENGTH (f′c, ksi)</th>
<th>THREADED ROD SPECIFICATION (ASTM)</th>
<th>[1/8]-INCH (lbs)</th>
<th>[1/4]-INCH (lbs)</th>
<th>M10 (lbs)</th>
<th>M12 (lbs)</th>
<th>[1/2]-INCH (lbs)</th>
<th>[3/4]-INCH (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A36</td>
<td>Upper</td>
<td>Lower</td>
<td>Upper</td>
<td>Lower</td>
<td>Upper</td>
<td>Lower</td>
</tr>
<tr>
<td>2,500 to 10,000</td>
<td></td>
<td>490</td>
<td>490</td>
<td>925</td>
<td>925</td>
<td>925</td>
<td>925</td>
</tr>
<tr>
<td></td>
<td>A193, Grade B7</td>
<td>800</td>
<td>800</td>
<td>925</td>
<td>925</td>
<td>925</td>
<td>925</td>
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<td></td>
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<td>730</td>
<td>730</td>
<td>845</td>
<td>845</td>
<td>845</td>
<td>845</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 9 are applicable only when all of the following design assumptions are followed:

- Concrete compressive strength, \(f_{c}^\prime\), given for sand-light weight concrete.
- Single anchors: static shear load with installation in upper and lower flute locations in concrete-filled steel deck in accordance with Figures 4A, 4B or 4C, as applicable, and noted provisions.
- Concrete determined to remain uncracked for the life of the anchorage.
- Load combinations from ACI 318-14 5.3 or ACI 318-11 9.2, as applicable (no seismic loading).
- 30% dead load and 70% live load, controlling load combination 1.2D + 1.6L.
- Calculation of the weighted average for \(\alpha = 1.2(0.3 + 1.6(0.7) = 1.48\).
- Assuming no edge distance \((c_{1} \geq 1.5\alpha, c_{2} \geq 1.5\alpha, c_{1})\) for upper flute anchors.
- Shear loads may be applied in any direction.
- \(h \geq h_{m}\) according to ACI 318-14 17.7 or ACI 318-11 D.8, as applicable.
- 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.

**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)**

**WOOD-KNOCKER II+**

1. Position insert on formwork, plastic down.
2. Drive insert down until head contacts plastic.
3. After formwork removal, remove nails as necessary (e.g. flush mounted fixture).
4. Push through plastic center (thread seal) and thread steel element (rod/bolt) into the insert. Attach fixture as applicable (e.g. seismic brace).

**PAN-KNOCKER II+**

1. Position insert on formwork, plastic down.
2. Mount / secure insert to formwork (e.g. using screws).
3. After formwork removal, remove screws as necessary (e.g. flush mounted fixture).
4. Push through plastic center (thread seal) and thread steel element (rod/bolt) into the insert. Attach fixture as applicable (e.g. seismic brace).

**BANG-IT+**

1. Cut (e.g. drill/punch) a hole in the steel deck to the hole size required by the insert.
2. Place the plastic sleeve of the insert through hole in steel deck.
3. Step on or impact the insert head to engage. Optionally, base plate of insert can also be screwed to steel deck.
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).
Given:
One 3/4" Bang-it+ insert with ASTM A36 rod installed in the lower flute of steel deck
Steel deck in accordance with Figure 4C of this report (3/4" min. flute width)
Anchor is 1/3" offset from center of flute (1/3" from close edge, 3/4" from far edge)
Sand-lightweight concrete with
compressive strength: (f') = 3,000 psi
No supplemental reinforcement:
(Condition B per ACI 318-11 D.4.3 c)
Assume cracked concrete and no seismic

Calculation in accordance with ACI 318-14, ACI 318-11 and this report:

**Step 1.** Verify minimum member thickness, spacing and edge distance:
- $h_s = 5.0$ in. (2" topping thickness)
- $h_{df} = 1.75$ in.
- $c_{cs} = C_{cs,min} = 0.75$ in.
- $c_{cs} \geq 1.5h_{df}$ (taken as 1.5h_{df})

**Step 2.** Calculate steel strength of the anchor in tension:
- Calculate $\phi N_{Rd,insert}$ and $\phi N_{Rd,rod}$ and determine the controlling steel strength in tension

**Step 2a.** Calculate steel strength of the insert in tension: $\phi N_{Rd,insert} = 0.65 \times 9,480$ lbs. = 6,160 lbs.

**Step 2b.** Calculate steel strength of the threaded rod in tension: $\phi N_{Rd,ASD} = 0.75 \times 4,525$ lbs. = 3,395 lbs.

**Step 2c.** $\phi N_{Rd,ASD} < \phi N_{Rd,insert}$: threaded rod capacity controls steel strength in tension

**Step 3.** Calculate concrete breakout strength of the anchor in tension:
- $N_{cb} = \frac{A_{nc}}{A_{nc}} \cdot \psi_{cb} \cdot \psi_{cm} \cdot \psi_{cb,n} \cdot N_c$

**Step 3a.** Calculate $A_{nc}$ and $A_{nc}$
- $A_{nc} = 39h_{df} = 9 \times (1.75)^2 = 27.6$ in.²
- $A_{nc} = (c_{cs} + 1.5h_{df}) = (c_{cs} + 1.5h_{df}) = (0.75 + 2.625)(2.625 + 2.625) = 17.7$ in.²

**Step 3b.** Calculate $\psi_{cb,n}$ = 1.0 if $c_{cs, min} \geq 1.5h_{df}$; $\psi_{cb,n} = 0.7 + 0.3 \frac{c_{cs,min}}{1.5h_{df}}$ if $c_{cs, min} < 1.5h_{df}$
- $c_{cs, min} = 0.75$ in. < 1.5h_{df}; $\psi_{cb,n} = 0.7 + 0.3(0.75/2.625) = 0.79$

**Step 3c.** Calculate $\psi_{cb,n} = 1.0$ (for cracked concrete)

**Step 3d.** $\phi N_{cb,n} = 1.0$ (for cast-in anchors)

**Step 3f.** Calculate $N_c = k_c A_{nc} \sqrt{\frac{1}{f_c} h_{df}^{1.5}} = 24(0.85)\sqrt{3,000} \times 1.75^{1.5} = 2,587$ lbs.

**Step 3g.** Calculate concrete breakout capacity = $\psi N_{cb} = 0.70 \times 310 = 917$ lbs.

**Step 4.** Calculate nominal pullout strength of a single anchor in tension: $N/A$ (not applicable)

**Step 5.** Calculate nominal side-face blowout strength of the anchor: $N/A$ (not applicable)

**Step 6.** Determine the controlling resistance strength of the anchor in tension:
- $\phi N_{Rd, min}$ = $\phi N_{Rd,insert}$ = $\phi N_{Rd,ASD}$ = $\phi N_{cb} = 917$ lbs.

**Step 7.** Calculate allowable stress design conversion factor for loading condition:
- Assume controlling load combination: 1.2D + 1.6L; 30% Dead Load, 70% Live Load
- $\alpha = 1.2(0.3) + 1.6(0.7) = 1.48$

**Step 8.** Calculate allowable stress design value:
- $T_{allowable, ASD} = \frac{\phi N_{Rd}}{\alpha} = \frac{917}{1.48} = 620$ lbs.

**FIGURE 9—EXAMPLE STRENGTH DESIGN CALCULATION FOR TENSION CAPACITY OF BANG-IT+ ANCHOR IN CONCRETE-FILLED STEEL DECK ASSEMBLY**
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 master 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:
- 2017 City of Los Angeles Building Code (LABC)
- 2017 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 master evaluation report ESR-3657, comply with LABC Chapter 19, and 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 must comply with all of the following conditions:
- All applicable sections in the master 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 2015 International Building Code® (2015 IBC) provisions noted in the master 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 master 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).

This supplement expires concurrently with the evaluation report, reissued December 2019.
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 master 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 master 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.