Product Submittal/Substitution Request

TO:

PROJECT:

PROJECT LOCATION:

SPECIFIED ITEM:

Section | Page | Paragraph | Description

PRODUCT SUBMIT TAL / SUBSTITUTION REQUESTED:

DEWALT® Engineered By Powers® DEWALT Deck Insert(tm)+ (DDI(tm)+) -

The attached submittal package includes the product description, specifications, drawings, and performance data for use in the evaluation of the request.

SUBMITTED BY:

Name: Signature:

Company:

Address:

Date: Telephone: Fax:

FOR USE BY THE ARCHITECT AND/OR ENGINEER

☐ **Approved** ☐ **Approved as Noted** ☐ **Not Approved**

(If not approved, please briefly explain why the product was not accepted.)

By: Date:

Remarks:

Questions or inquiries? Contact us at engineering@powers.com, or call 1.800.524.3244

DEWALT® DEWALT Deck Insert(tm)+ (DDI(tm)+) Submittal Section:

Product Pages:

- General Information
- Installation Instructions
- Design Tables
- Ordering Information

Code Reports & Agency Listings:

- ICC–ES Approval: ESR–3958 (Cracked And Uncracked Concrete–Filled Steel Decks)
- Underwriters Laboratories: File No. EX1289

GENERAL INFORMATION

DDI™+ (DECK INSERT)

Threaded Insert for Metal Deck

PRODUCT DESCRIPTION

The DDI+ (Deck Insert) is a concrete insert designed for installation in concrete-filled metal deck assemblies (i.e. “pan-deck”, “Q-deck”) applications. After installation, the threaded male hanger of the insert protrudes below the surface of the deck. The DDI+ comes in sizes ranging from 3/8" to 7/8" in diameter. The threaded bolt offers adjustability for precise height requirements and guarantees the minimum embedment depth. The longer "T" brace enables a variety of installation locations in across the deck.

GENERAL APPLICATIONS AND USES

- Seismic Loading and Cracked Concrete
- Hanging Pipe and Sprinkler Systems
- HVAC Ductwork and Strut Channels
- Suspending Trapeze and Cable Trays
- Mechanical Unit Overhead Utilities
- Conduit and Lighting System

FEATURE AND BENEFITS

+ Fast and simple to install, low installed cost
+ Pre-mounted self drilling screws for convenient installation
+ Fine-tuned thread length for guaranteed minimum embedment
+ Lengthened "T" brace for more flexible installation positions

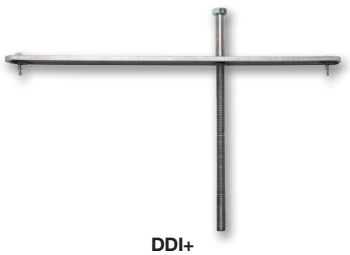
APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3958 for concrete. Approved for seismic and wind loading
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes.
- FM Approvals (Factory Mutual) – File No. J.I. 3059197

GUIDE SPECIFICATIONS

CSI Divisions: 03 15 19 - Cast-In Concrete Anchors and 03 16 00 - Concrete Anchors. Concrete inserts shall be DDI+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



DDI+

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

Plain and zinc plated carbon steel

ANCHOR SIZE RANGE

- 3/8" diameter through 7/8" diameter

SUITABLE BASE MATERIALS

- Concrete or lightweight concrete over metal deck

TENSION ZONE CRACKED CONCRETE

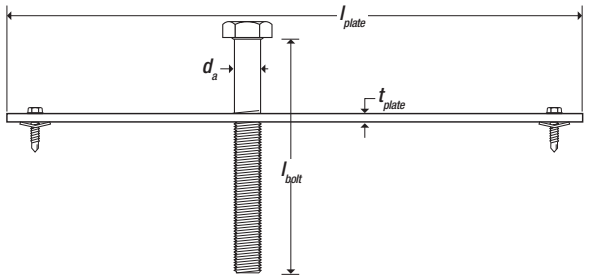
SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-3958
CONCRETE

DDA
DeWALT DESIGN ASSIST™

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Metal Plate	ASTM A1011 Carbon Steel or equivalent (plain)
Hex Head Bolt	ASTM A307 Grade A (zinc plated)



DDI+ Insert Detail

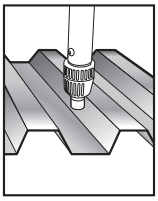
INSTALLATION SPECIFICATIONS

Dimension		Notation	Nominal Anchor Size				
			3/8"	1/2"	5/8"	3/4"	7/8"
Typical Drill Bit Diameter for Deck		in.	7/16 or 1/2	9/16 or 5/8	11/16 or 3/4	13/16 or 7/8	15/16 or 1
Overall Length of Metal Plate		in.	12	12	12	12	12
Approximate Width of Metal Plate		in.	1-1/4	1-1/4	1-1/4	2	2
Approximate Thickness of Metal Plate		in.	3/16	3/16	3/16	3/8	3/8
Bolt Thread Size (UNC)		in.	3/8-16	1/2-13	5/8-11	3/4-10	7/8-9
Length of Hex Head Bolt		in.	8	8	8	8	8
Effective Embedment Depth		in.	1-1/2	1-3/4	2	2-1/8	2-1/16
Nominal Embedment Depth		in.	1-3/4	2	2-3/8	2-5/8	2-5/8
Approx. Thread Projection (through 3-inch-deep deck)	Over Upper Flute	in.	6-1/4	6	5-5/8	5-3/8	5-3/8
	Over Lower Flute		3-1/4	3	2-5/8	2-3/8	2-3/8

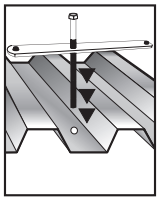
Dimension	Size	Point Style	Drill Range	RPM (Max)
Self-Drilling Screw	8-18	#2	18 Gage Max	2500

INSTALLATION INSTRUCTIONS

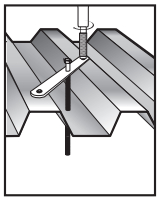
Cut (e.g. drill/punch) a hole in the steel deck to the hole size required by the threaded bolt of the insert.



Place the threaded bolt of the insert through the hole in the steel deck.



The metal plate of the insert must be on the top of the deck flutes. The metal plate can (optionally) be secured to the deck using the pre-assembled size drilling screws.



REFERENCE DATA (ASD)

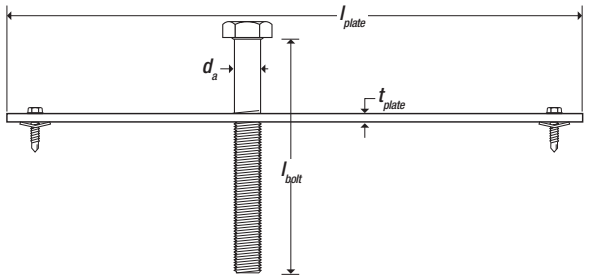
Ultimate and Allowable Load Capacities for DDI+ (Deck Insert) Installed in the Soffit of Sand-lightweight or Normal Weight Concrete over Metal Deck Floor and Roof Assemblies[1,2,3,4]

Nominal Anchor Diameter in.	Nominal Embed. Depth h_{nom} (in.)	Min. Concrete Topping Thickness (in.)	Min. Insert Spacing (in.)	Min. End Distance (in.)	Normal-weight or Sand-lightweight concrete, f'c ≥ 3,000 psi											
					3-7/8" or 4-1/2" Wide Deck											
					Installed Over Upper Flute				Installed Over Flute Incline				Installed Over Lower Flute			
					Ultimate Load		Allowable Load		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/8	1-3/4	2	4-1/2	9	3,420	1,985	1,140	660	5,230	1,985	1,745	660	5,230	2,610	1,745	870
1/2	2	2-1/2	5-1/4	10-1/2	4,310	4,205	1,435	1,400	6,235	4,205	2,080	1,400	6,235	5,155	2,080	1,720
5/8	2-3/8	3-1/4	6	12	5,265	6,450	1,755	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275
3/4	2-5/8	3-1/4	6-3/8	12-3/4	5,770	6,450	1,925	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275
7/8	2-5/8	3-1/4	6-3/8	12-3/4	5,770	6,450	1,925	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0
2. Nominal embedment depth is measured from the bottom of the insert plate to the top of the insert bolt head.
3. Insert spacing and end distances are measured from the centerline of the insert bolt head.
4. Shear loads may be applied in any direction. For inserts installed over the upper flute, if the shear load is parallel to the flute the tabulated allowable load values may be increased by 20 percent (multiplied by 1.2)

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Metal Plate	ASTM A1011 Carbon Steel or equivalent (plain)
Hex Head Bolt	ASTM A307 Grade A (zinc plated)



DDI+ Insert Detail

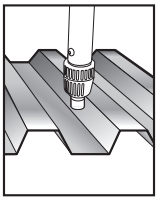
INSTALLATION SPECIFICATIONS

Dimension		Notation	Nominal Anchor Size				
			3/8"	1/2"	5/8"	3/4"	7/8"
Typical Drill Bit Diameter for Deck		in.	7/16 or 1/2	9/16 or 5/8	11/16 or 3/4	13/16 or 7/8	15/16 or 1
Overall Length of Metal Plate		in.	12	12	12	12	12
Approximate Width of Metal Plate		in.	1-1/4	1-1/4	1-1/4	2	2
Approximate Thickness of Metal Plate		in.	3/16	3/16	3/16	3/8	3/8
Bolt Thread Size (UNC)		in.	3/8-16	1/2-13	5/8-11	3/4-10	7/8-9
Length of Hex Head Bolt		in.	8	8	8	8	8
Effective Embedment Depth		in.	1-1/2	1-3/4	2	2-1/8	2-1/16
Nominal Embedment Depth		in.	1-3/4	2	2-3/8	2-5/8	2-5/8
Approx. Thread Projection (through 3-inch-deep deck)	Over Upper Flute	in.	6-1/4	6	5-5/8	5-3/8	5-3/8
	Over Lower Flute		3-1/4	3	2-5/8	2-3/8	2-3/8

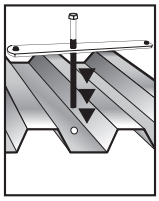
Dimension	Size	Point Style	Drill Range	RPM (Max)
Self-Drilling Screw	8-18	#2	18 Gage Max	2500

INSTALLATION INSTRUCTIONS

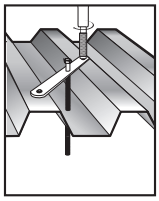
Cut (e.g. drill/punch) a hole in the steel deck to the hole size required by the threaded bolt of the insert.



Place the threaded bolt of the insert through the hole in the steel deck.



The metal plate of the insert must be on the top of the deck flutes. The metal plate can (optionally) be secured to the deck using the pre-assembled size drilling screws.



REFERENCE DATA (ASD)

Ultimate and Allowable Load Capacities for DDI+ (Deck Insert) Installed in the Soffit of Sand-lightweight or Normal Weight Concrete over Metal Deck Floor and Roof Assemblies[1,2,3,4]

Nominal Anchor Diameter in.	Nominal Embed. Depth h_{nom} (in.)	Min. Concrete Topping Thickness (in.)	Min. Insert Spacing (in.)	Min. End Distance (in.)	Normal-weight or Sand-lightweight concrete, f'c ≥ 3,000 psi											
					3-7/8" or 4-1/2" Wide Deck											
					Installed Over Upper Flute				Installed Over Flute Incline				Installed Over Lower Flute			
					Ultimate Load		Allowable Load		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/8	1-3/4	2	4-1/2	9	3,420	1,985	1,140	660	5,230	1,985	1,745	660	5,230	2,610	1,745	870
1/2	2	2-1/2	5-1/4	10-1/2	4,310	4,205	1,435	1,400	6,235	4,205	2,080	1,400	6,235	5,155	2,080	1,720
5/8	2-3/8	3-1/4	6	12	5,265	6,450	1,755	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275
3/4	2-5/8	3-1/4	6-3/8	12-3/4	5,770	6,450	1,925	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275
7/8	2-5/8	3-1/4	6-3/8	12-3/4	5,770	6,450	1,925	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0
2. Nominal embedment depth is measured from the bottom of the insert plate to the top of the insert bolt head.
3. Insert spacing and end distances are measured from the centerline of the insert bolt head.
4. Shear loads may be applied in any direction. For inserts installed over the upper flute, if the shear load is parallel to the flute the tabulated allowable load values may be increased by 20 percent (multiplied by 1.2)

STRENGTH DESIGN (SD)

CODE LISTED ICC-ES ESR-3958

DDI+ Insert Installation Information and Supplemental Information[1,2]

Design Information		Symbol	Units	3/8-inch	1/2-inch	5/8-inch
Nominal bolt diameter		d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Length of insert bolt		ℓ_{bolt}	in (mm)	8 (203)	8 (203)	8 (203)
Typical drill bit diameter		d_{bit}	in.	7/16 or 1/2	9/16 or 5/8	11/16 or 3/4
Nominal overall length of insert plate		ℓ_{plate}	in.² (mm²)	12 (305)	12 (305)	12 (305)
Nominal width of insert plate		W_{plate}	in.² (mm²)	1-1/4 (32)	1-1/4 (32)	1-1/4 (32)
Approximate thickness of insert plate		t_{plate}	in. (mm)	3/16 (4.8)	3/16 (4.8)	3/16 (4.8)
Minimum nominal embedment depth	Over upper flute	$h_{nom\ (upperflute)}$	in. (mm)	1-3/4 (45)	2 (51)	2-3/8 (60)
	Over flute incline	$h_{nom\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{nom\ (lowerflute)}$	in. (mm)			
Minimum effective embedment depth	Over upper flute	$h_{ef\ (upperflute)}$	in. (mm)	1.50 (38)	1.75 (45)	2.00 (51)
	Over flute incline	$h_{ef\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{ef\ (lowerflute)}$	in. (mm)			
Minimum concrete member thickness (topping thickness)	Over upper flute	$h_{min\ (upperflute)}$	in. (mm)	2 (51)	2-1/2 (64)	3-1/4 (83)
	Over flute incline	$h_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{min\ (lowerflute)}$	in. (mm)			
Minimum flute edge distance (insert bolt)	Over upper flute	$c_{min,deck\ (upperflute)}$	in. (mm)	N/A	N/A	N/A
	Over flute incline	$c_{min,deck\ (upperincline)}$	in. (mm)			
	Over lower flute	$c_{min,deck\ (lowerflute)}$	in. (mm)	See Figure 3C	See Figure 3C	See Figure 3C
Minimum spacing distance (bolt spacing, center-to-center)	Over upper flute	$s_{min\ (upperflute)}$	in. (mm)	4-1/2 (114)	5-1/4 (133)	6 (152)
	Over flute incline	$s_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$s_{min\ (lowerflute)}$	in. (mm)			
Minimum deck end distance	Over upper flute	$c_{min\ (upperflute)}$	in. (mm)	Specified cover requirements for reinforcement in accordance with ACI 318-14 17.7.2 or ACI 318-11 7.7, as applicable.		
	Over flute incline	$c_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$c_{min\ (lowerflute)}$	in. (mm)			
Effective tensile stress area (insert bolt)		A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)	0.226 (146)
Insert head net bearing area		A_{brg}	in.² (mm²)	0.17 (110)	0.28 (181)	0.45 (290)
Minimum specified ultimate strength		f_{uta}	psi (N/mm²)	60,000 (400)		
Minimum specified yield strength		f_{ya}	psi (N/mm²)	36,000 (248)		

For SI: 1 inch = 25.4 mm, 1 ft-lb = 1.356 N-m

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable,
2. For installation detail for inserts in concrete-filled steel deck assemblies, see Figures A, B and C (i.e. over upper flute, over flute incline, over lower flute).

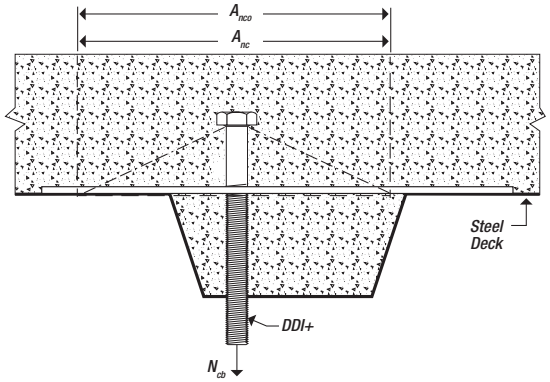
CODE LISTED
ICC-ES ESR-3958

DDI+ Insert Design Information[1,2,3,4,5,6]

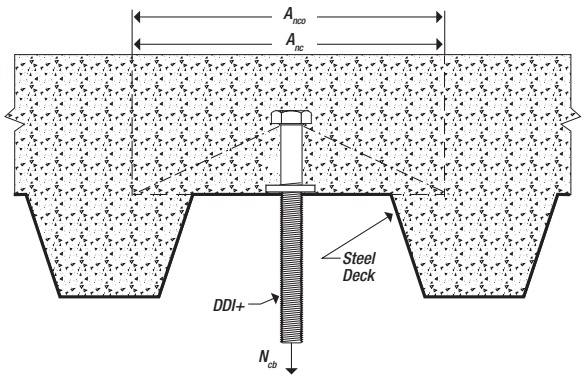
Design Information		Symbol	Units	3/8-inch	1/2-inch	5/8-inch
Insert O.D. (nominal bolt diameter)		d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Insert head net bearing area		A_{brg}	in² (mm²)	0.17 (110)	0.28 (181)	0.45 (290)
Effective tensile stress area		A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)	0.226 (146)
Effective embedment depth	Over upper flute	h_{ef} (upperflute)	in. (mm)	1.50 (38)	1.75 (45)	2.00 (51)
	Over flute incline	h_{ef} (fluteincline)	in. (mm)			
	Over lower flute	h_{ef} (lowerflute)	in. (mm)			
Minimum concrete member thickness (topping thickness over upper flute)		h_{min}	in. (mm)	2.00 (51)	2.50 (64)	3.25 (83)
Minimum spacing and edge distance		s_{min}, c_{min}	in. (mm)	See Installation Information Table and Figures A, B and C		
Effectiveness factor for cracked concrete		k_c	- (SI)	24 (10)		
Modification factor for tension strength in uncracked concrete		$\Psi_{C,N}$	-	1.25		
According to Figures A, B or C	Nominal tension strength of single insert as governed by steel strength	$N_{sa,insert}$	lb (kN)	4,650 (20.7)	8,520 (37.9)	13,560 (60.3)
	Nominal tension strength of single insert as governed by steel strength, seismic	$N_{sa,insert,eq}$	lb (kN)			
According to Figure A (over upper flute)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (upperflute)	lb (kN)	2,280 (10.1)	4,260 (18.9)	7,245 (32.2)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (upperflute)	lb (kN)	1,825 (8.1)	3,410 (15.2)	
According to Figure B (over flute incline)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (fluteincline)	lb (kN)	1,310 (5.8)	3,410 (15.2)	5,240 (23.3)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (fluteincline)	lb (kN)	1,045 (4.6)	2,860 (12.7)	
According to Figure C (over lower flute)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (lowerflute)	lb (kN)	2,280 (10.1)	4,260 (18.9)	5,735 (25.5)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (lowerflute)	lb (kN)	2,015 (9.0)	3,410 (15.2)	

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.

1. Concrete must have a compressive strength f 'c of 3,000 psi (20.7 MPa) minimum.
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 the Idealization of Concrete Filled Steel Decks Figure.
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 shall be taken as 0.75 for tension and 0.65 for shear; values correspond to ductile 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.
4. Insert O.D. is the nominal bolt diameter of the insert.
5. Minimum spacing distance between anchors and minimum edge distances for cast-in headed DDI+ inserts shall be in accordance with the Installation Information Table, Design Information Table, Figures A, B and C and noted provisions.
6. Shear loads for concrete inserts in concrete-filled steel deck assemblies may be applied in any direction (i.e. over upper flute, over flute incline, over lower flute).



Idealization of Steel Deck Profile (over lower flute or over flute incline)



Idealization of Steel Deck Profile (over upper flute)

Idealization of Concrete Filled Steel Decks for Determination of Concrete Breakout Strength in Accordance with ACI 318

Tension and Shear Design Strengths for DDI+ Inserts Installed in Uncracked Lightweight Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Insert O.D. (Nominal Bolt Diameter) (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi					
		Upper Flute (Figure A)		Flute Incline (Figure B)		Lower Flute (Figure C)	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	1-3/4	1,795	1,480	1,795	850	1,795	1,480
1/2	1-3/4	2,265	2,770	2,265	2,215	2,265	2,770
5/8	1-3/4	2,765	4,710	2,765	3,405	2,765	3,730

□ - Anchor Pullout/Pryout Strength Controls ▣ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths for DDI+ Inserts Installed in Cracked Lightweight Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Insert O.D. (Nominal Bolt Diameter) (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi					
		Upper Flute (Figure A)		Flute Incline (Figure B)		Lower Flute (Figure C)	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	1-3/4	1,435	1,480	1,435	850	1,435	1,480
1/2	1-3/4	1,810	2,770	1,810	2,215	1,810	2,770
5/8	1-3/4	2,210	4,710	2,210	3,405	2,210	3,730

□ - Anchor Pullout/Pryout Strength Controls ▣ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

1- Tabular values are provided for illustration and are applicable for single anchors installed in sand-lightweight concrete with minimum member thickness (topping thickness), $h_a = h_{min}$, and with the following conditions:
- For Upper Flute and Flute Incline: c_{a1} is greater than or equal to the critical edge distance, c_{ac}
- For Lower Flute: c_{a1} is equal to the minimum lower flute edge distance

2- Calculations were performed following methodology in ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode listed (e.g. For Tension: steel strength, concrete breakout strength, or pullout strength; For Shear: steel strength). Furthermore, the capacities for concrete breakout strength in tension are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information table. Please also reference the installation specifications for additional information.

3- Strength reduction factors (ø) for the inserts are based on ACI 318-14 17.3.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 governed by steel strength of the insert are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements.

4- Tabular values are permitted for short-term static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Chapter 17 and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.

Figure A

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Upper Flute)[1,2,3]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)

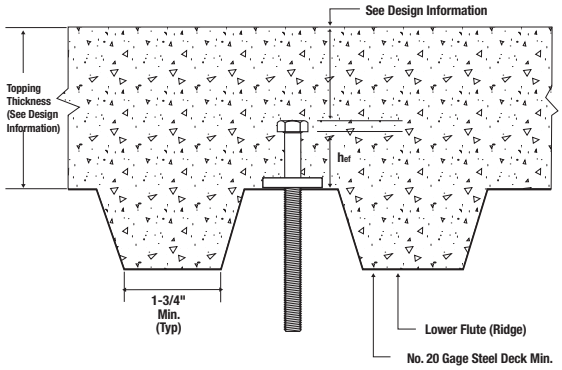


Figure B

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Flute Incline)[1,2,4]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)

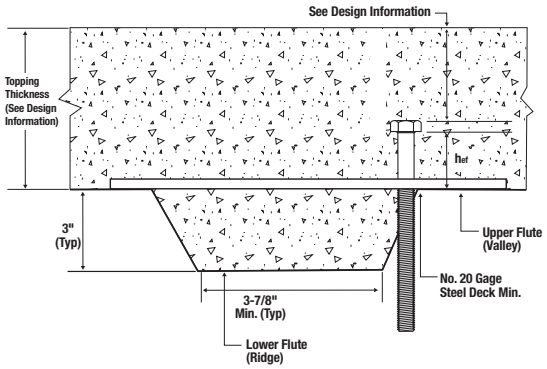
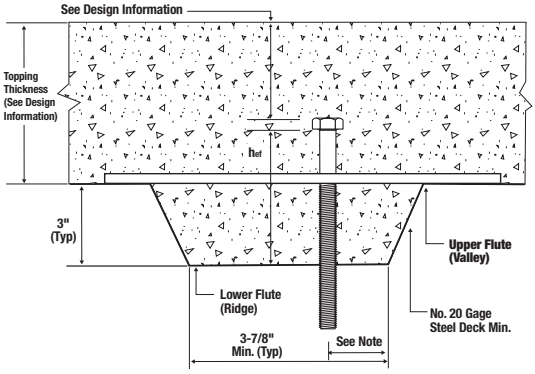


Figure C

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Lower Flute)[1,2,5]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)

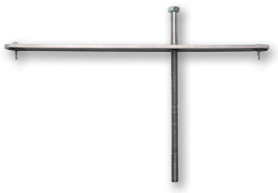


1. Installations require a minimum concrete member topping thickness from the top of the upper flute as given in the Design Information Table.
2. Inserts may be placed on the upper flute of the steel deck assembly; they may be installed anywhere across upper flute as follows:
   (Figure A) - Placed over the upper flute with threaded bolt installed through the upper flute or;
   (Figure B) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the inclined section or;
   (Figure C) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the lower flute.
3. Inserts over the upper flute with threaded bolt installed through the upper flute may be placed in any location and orientation that meets the minimum deck end distance requirements (see Design Information Table). The minimum deck end distance is measured from deck end to the centerline of the insert bolt.
4. Inserts over the upper flute spanning the lower flute with threaded bolt installed through the inclined section may be placed in any location and orientation that meets the minimum deck end distance requirements (see Design Information Table). The minimum deck end distance is measured from deck end to the centerline of the insert bolt.
5. Inserts over the upper flute spanning the lower flute with threaded bolt installed through the lower flute may be placed in any location that meets the minimum deck end distance and minimum lower flute edge distance requirements. The minimum deck end distance is measured from deck end to the centerline of the insert bolt. For lower flute widths of 3-7/8-inch, a maximum 1-inch centerline bolt 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 15/16 -inch is also satisfied.

ORDERING INFORMATION

DDI+ (Deck Insert)

Cat. No.	Anchor Size	Rod/Anchor Dia.	Typical Drill Diameter	Box Qty.
PFM2511100	3/8" Metal Deck Insert	3/8"	7/16" or 1/2"	20
PFM2511110	1/2" Metal Deck Insert	1/2"	9/16" or 5/8"	20
PFM2511120	5/8" Metal Deck Insert	5/8"	11/16" or 3/4"	20
PFM2511130	3/4" Metal Deck Insert	3/4"	13/16" or 7/8"	12
PFM2511140	7/8" Metal Deck Insert	7/8"	15/16" or 1"	12



Rod Coupling Nuts - Zinc

Cat. No.	Description	Rod/Anchor Dia.	Hex Diameter	Box Qty.	Ctn. Qty.
030007	3/8"-16 x 1/2" x 1-1/8"	3/8"	1/2"	100	1000
030009	1/2"-13 x 5/8" x 1-1/4"	1/2"	5/8"	50	500
030010	5/8"-13 x 13/16" x 2-1/8"	5/8"	13/16"	25	250
030011	3/4"-13 x 1" x 2-1/4"	3/4"	1"	25	250
030012	7/8"-13 x 1-1/4" x 2-1/2"	7/8"	1-1/4"	10	100

Figure A

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Upper Flute)[1,2,3]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)

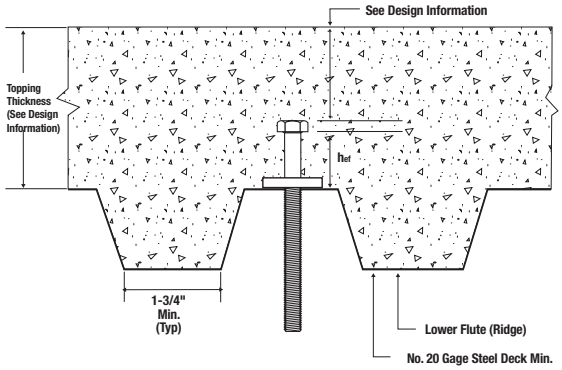


Figure B

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Flute Incline)[1,2,4]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)

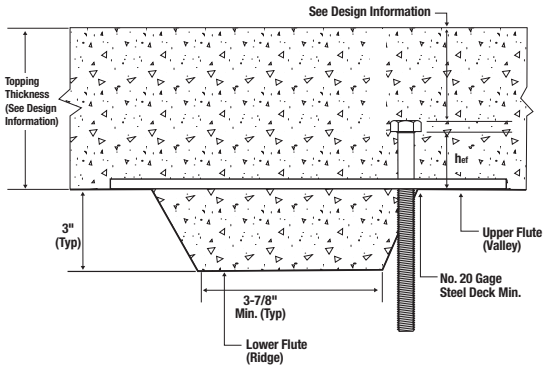
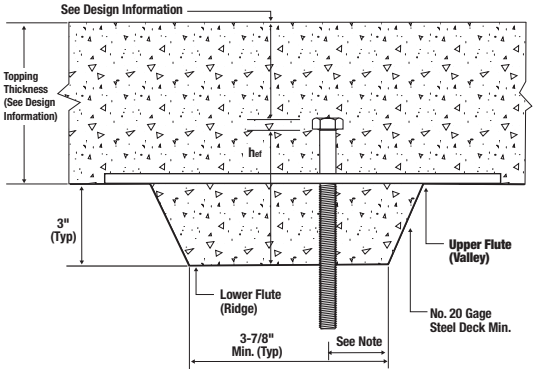


Figure C

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Lower Flute)[1,2,5]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)



1. Installations require a minimum concrete member topping thickness from the top of the upper flute as given in the Design Information Table.
2. Inserts may be placed on the upper flute of the steel deck assembly; they may be installed anywhere across upper flute as follows:
   (Figure A) - Placed over the upper flute with threaded bolt installed through the upper flute or;
   (Figure B) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the inclined section or;
   (Figure C) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the lower flute.
3. Inserts over the upper flute with threaded bolt installed through the upper flute may be placed in any location and orientation that meets the minimum deck end distance requirements (see Design Information Table). The minimum deck end distance is measured from deck end to the centerline of the insert bolt.
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5. Inserts over the upper flute spanning the lower flute with threaded bolt installed through the lower flute may be placed in any location that meets the minimum deck end distance and minimum lower flute edge distance requirements. The minimum deck end distance is measured from deck end to the centerline of the insert bolt. For lower flute widths of 3-7/8-inch, a maximum 1-inch centerline bolt 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 15/16 -inch is also satisfied.

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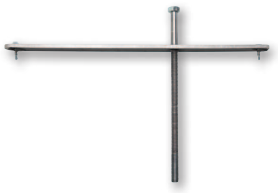

Rod Coupling Nuts - Zinc

Cat. No.	Description	Rod/Anchor Dia.	Hex Diameter	Box Qty.	Ctn. Qty.
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030010	5/8"-13 x 13/16" x 2-1/8"	5/8"	13/16"	25	250
030011	3/4"-13 x 1" x 2-1/4"	3/4"	1"	25	250
030012	7/8"-13 x 1-1/4" x 2-1/2"	7/8"	1-1/4"	10	100

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ESR-3958

Reissued 12/2018
This report is subject to renewal 12/2019.

DIVISION: 03 00 00—CONCRETE
SECTION: 03 15 19—CAST-IN CONCRETE ANCHORS
SECTION: 03 16 00—CONCRETE ANCHORS

REPORT HOLDER:

DEWALT

EVALUATION SUBJECT:

DDI+™ HEADED CAST-IN SPECIALTY INSERTS FOR CRACKED AND UNCRACKED CONCRETE-FILLED STEEL DECKS (DEWALT)

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ESR-3958

Reissued December 2018

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

REPORT HOLDER:

DEWALT

EVALUATION SUBJECT:

DDI+™ HEADED CAST-IN SPECIALTY INSERTS FOR CRACKED AND UNCRACKED CONCRETE-FILLED STEEL DECKS (DEWALT)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012, and 2009 *International Building Code*® (IBC)
- 2018, 2015, 2012, and 2009 *International Residential Code*® (IRC)

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see ESR-3958 LABC and LARC Supplement.

Property evaluated:

Structural

2.0 USES

The DEWALT DDI+ inserts are headed cast-in specialty inserts cast in concrete filled metal deck used as anchorage 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 3,000 psi to 10,000 psi (20.7 MPa to 68.9 MPa) to resist static, wind, and seismic tension and shear loads.

There are three models for the DDI+ inserts; $^3/_8$-inch, $^1/_2$-inch, and $^5/_8$-inch, corresponding to the sizes of the threaded bolts used in the inserts.

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 inserts may be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 DDI+ Inserts:

The DDI+ steel deck inserts are cast-in concrete inserts. The insert consists of an internally threaded steel base plate and a threaded bolt. The insert is illustrated in Figures 1A and 1B. The steel plates are manufactured from low carbon steel. The threaded bolts comply with the geometrical requirements of ACI 318 (-14, -11, -08) for cast-in headed bolts, are manufactured from carbon steel, and have a minimum 5 µm (0.002-inch) zinc plating.

The DDI+ insert is installed through a predrilled hole in the topside of the metal deck. The insert can optionally be attached to the metal deck using pre-mounted self-drilling screws on the steel plate. Concrete can then be cast over the insert.

3.2 Concrete:

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

3.3 Steel Deck Panels:

Steel deck panels must be in accordance with the configuration in Figures 3A, 3B and 3C and have a minimum base steel thickness of 20 gage [0.034 inch (0.864 mm)]. Steel must comply with ASTM A653/A653M SS Grade 50 minimum and have a minimum yield strength of 50,000 psi (345 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 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 1 and 2 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. Strength reduction factors, ϕ, as given in ACI 318-11 D.4.4 must be used for load combinations calculated in accordance with ACI 318-11 Appendix C. The value of f'_c 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.

4.1.2 Requirements for Static Steel Strength in Tension: The nominal static 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 Section D.5.1, as applicable. $N_{sa,insert}$ provided in Table 2 must be used as the steel strength in tension.

4.1.3 Requirements for Static Concrete Breakout Strength in Tension: For the DDI+ insert, the nominal concrete breakout strength of a single anchor or group of anchors in tension, N_{cb} or N_{cbg}, 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 3A, 3B, 3C, and 4 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 h_{ef} given in Table 2, 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 DDI+ 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 A_{Nc} / A_{Nco} in accordance with ACI 318-14 17.4.2.1 or ACI 318-11 D.5.2.1, as applicable, and $c_{a,min}$ (minimum edge distance) must be based on Figures 3C and 4, as applicable.

4.1.4 Requirements for Static Side-Face Blowout Strength in Tension: For the DDI+ inserts installed in the soffit of sand-lightweight or normal-weight concrete on steel deck floor and roof assemblies as shown in Figures 3A, 3B and 3C, calculation of the concrete side blowout strength is not required.

4.1.5 Requirements for Static Pullout Strength in Tension: The pullout strength of a single anchor or a group of anchors, shall be calculated in accordance with ACI 318-14 17.4.3 or ACI 318-11 D.5.3, as applicable, in cracked and uncracked concrete, $N_{p,cr}$ and $N_{p,uncr}$.

4.1.6 Requirements for Static Steel Strength in Shear: For the DDI+ inserts, the nominal static steel strength in shear, $V_{sa,deck}$, of a single insert, in concrete filled steel deck assemblies, must be taken as the insert strength, $V_{sa,insert}$ in Table 2, 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.

4.1.7 Requirements for Static Concrete Breakout Strength in Shear: For the DDI+ inserts installed in the soffit of sand-lightweight or normal-weight concrete on steel deck floor and roof assemblies, as shown in Figures 3A, 3B and 3C, the breakout strength in shear need not be calculated.

4.1.8 Requirements for Static Concrete Pryout Strength in Shear: For the DDI+ inserts installed in the soffit of sand-lightweight or normal-weight concrete filled steel deck assemblies, as shown in Figures 3A, 3B and 3C, 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.

4.1.9 Requirements for Seismic Design:

4.1.9.1 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 and 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 DDI+ inserts, the nominal concrete breakout strength for anchors in tension; and the nominal concrete breakout strength in the upper flute of concrete filled steel deck assemblies for anchors 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.

4.1.9.2 Seismic Tension: For DDI+ inserts, 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 insert using the values of $N_{sa,insert,eq}$ in Table 2 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; and the nominal concrete pullout strength must be calculated 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, and as described in Section 4.1.5 of this report, as applicable.

4.1.9.3 Seismic Shear: For DDI+ inserts, 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 4.1.7 and 4.1.8 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 insert strength, $V_{sa,insert,deck,eq}$, given in Table 2 of this report.

4.1.10 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 DDI+ inserts when installed in the inclined section of concrete filled steel deck assemblies, 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.

4.1.11 Requirements for Minimum Member Thickness, Minimum Anchor Spacing and Minimum Edge Distance: For DDI+ inserts 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 3A, 3B and 3C and shall have a minimum axial spacing along the flute in accordance with Table 1.

4.1.12 Requirements for Critical Edge Distance: The critical edge distance, c_{ac}, must be calculated in accordance with ACI 318-14 17.7.2 or ACI 318-11 D.8.2, as applicable. The modification factor $\Psi_{cp,N}$ = 1.0 in accordance with ACI 318-14 17.4.2.5 or ACI 318-11 D.5.2.5, as applicable.

4.1.13 Sand-lightweight Concrete: For DDI+ inserts in the soffit of sand-lightweight concrete-filled steel deck, λ shall be taken as 0.85 and applied to the concrete breakout strength in tension, as applicable.

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).

ϕN_n = Lowest design strength of an anchor or anchor group in tension as determined in accordance with ACI 318-14 Chapter 17 and 2018 and 2015 IBC Section 1905.1.8, ACI 318-11, -08 Appendix D, and 2009 IBC Section 1908.1.9, as applicable (lbf or N).

ϕV_n = Lowest design strength of an anchor or anchor group in shear as determined in accordance with ACI 318-14 Chapter 17 and 2018 and 2015 IBC Section 1905.1.8, ACI 318-11, -08 Appendix D, and 2009 IBC Section 1908.1.9, as applicable (lbf or N).

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

The requirements for member thickness, edge distance and spacing, described in this report, must apply.

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 tension 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:

$$\frac{T_{applied}}{T_{allowable,ASD}} + \frac{V_{applied}}{V_{allowable,ASD}} \leq 1.2 \qquad \text{(Eq-1)}$$

Due to the projection of DDI+ inserts when installed in the inclined section of concrete filled steel deck assemblies, 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 DDI+ inserts, installation parameters are provided in Table 1 and in Figures 3A, 3B and 3C. 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: $^{7}/_{16}$-inch or $^{1}/_{2}$-inch (11 mm or 12 mm) diameter [for DDI+ $^{3}/_{8}$-inch], $^{9}/_{16}$-inch or $^{5}/_{8}$-inch (14 mm to 16 mm) diameter [for DDI+ $^{1}/_{2}$-inch], and $^{11}/_{16}$-inch or $^{3}/_{4}$-inch (17 mm to 19 mm) [for DDI+ $^{5}/_{8}$-inch]. The insert bolt must be placed in the hole. The insert can optionally be attached to the metal deck using pre-mounted self-drilling screws on the steel plate. Concrete can then be cast over the insert.

Installation of DDI+ inserts must be in accordance with this evaluation report and the manufacturer's printed installation instructions (MPII) as provided in Figure 1 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, or Section 1704.15 and Table 1704.4 of the 2009 IBC, as applicable. The special inspector must make periodic inspections during installation of the cast-in specialty inserts to verify insert type, insert dimensions, concrete type, concrete compressive strength, insert spacing, edge distances, concrete member thickness, insert embedment, 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 DDI+ headed cast-in specialty inserts in concrete 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 insert sizes, dimensions, minimum embedment depths, and other installation parameters are as set forth in this report.

5.2 Specialty inserts must be installed in accordance with the manufacturer's printed installation instructions and this report. In case of conflict, this report governs.

5.3 Specialty inserts must be limited to use in cracked and uncracked normal-weight or sand-lightweight concrete filled steel deck assemblies having a specified compressive strength, f'_c, of 3,000 psi to 10,000 psi (20.7 MPa to 68.9 MPa) for the DDI+ inserts.

5.4 The concrete shall have attained its minimum design strength prior to installation of the anchors.

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

5.6 Allowable design values are established in accordance with Section 4.2.

5.7 Specialty insert spacing and edge distance as well as minimum member thickness must comply with ACI 318 Section D.8 for cast-in-place headed anchors.

5.8 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.

5.9 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.

5.10 Specialty inserts may be installed in regions of concrete where analysis indicates cracking may occur ($f_t > f_r$), subject to the conditions of this report.

5.11 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.

5.12 Where not otherwise prohibited in the code, the 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.

5.13 Use of zinc-coated carbon steel anchors is limited to dry, interior locations.

5.14 Special inspection must be provided in accordance with Section 4.4.

5.15 Specialty inserts are manufactured under an approved quality-control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Headed Cast-in Specialty Inserts in Concrete (AC446), dated August 2018.

6.2 Geometrical documentation of the threaded bolts.

6.3 Quality control documentation.

7.0 IDENTIFICATION

7.1 The inserts are identified by packaging labeled with the insert size, lot number, company name (DEWALT), and insert name (DDI+) as set forth in Section 3.1 of this report, and evaluation report number (ESR-3958). The inserts have the letters DDI+ and the specific size embossed atop the plate 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

DESIGN STRENGTH[1]				DDI+ STEEL DECK INSERTS
Failure Mode		Tension	Shear	
Steel		N_{sa}	V_{sa}	Table 2
Concrete	Breakout	N_{cb}, N_{cbg}	-	Table 2
		-	V_{cb}, V_{cbg}	Not applicable
	Side-face Blowout	N_{sb}	-	Not applicable
	Pryout	-	V_{cp}, V_{cpg}	Not applicable
Pullout		N_{pn}	-	ACI 318-14 17.4.3 or ACI 318-11 D.5.3

CONCRETE TYPE	CONCRETE STATE	INSERT NOMINAL SIZE	SEISMIC DESIGN CATEGORIES[2]
Normal-weight and lightweight	Cracked	$^3/_8$", $^1/_2$", $^5/_8$"	A through F
	Uncracked	$^3/_8$", $^1/_2$", $^5/_8$"	A through F

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

[1]Reference ACI 318-14 17.3.1.1 or ACI 318-11 D.4.1.1, as applicable. The controlling strength governs from all appropriate failure modes (i.e. steel, concrete breakout, concrete pryout and side-face blowout, as applicable) and design assumptions. The side-face blowout strength in tension, and the breakout strength and pryout strength in shear, are not decisive for design and do not need to be evaluated.
[2]See Section 4.1.9 for requirements for seismic design, where applicable.

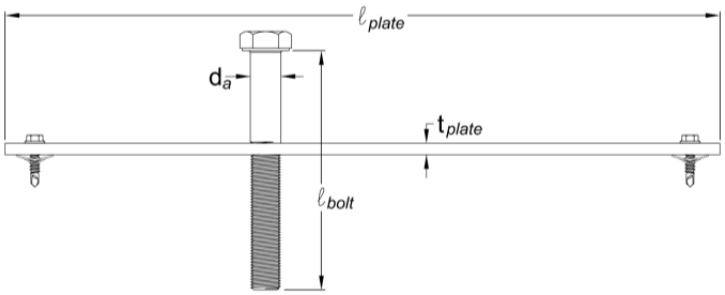


FIGURE 1A—DDI+ INSERT DETAIL

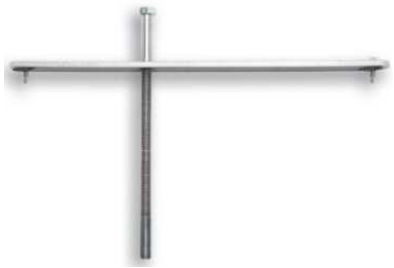


FIGURE 1B—DDI+ DECK INSERT

TABLE 1—DDI+ INSERT INSTALLATION INFORMATION AND SUPPLEMENTAL INFORMATION[1,2]

CHARACTERISTIC		SYMBOL	UNITS	$^3/_8$-inch	$^1/_2$-inch	$^5/_8$-inch
Nominal bolt diameter		d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Overall length of insert bolt		ℓ_{bolt}	in. (mm)	8 (203)	8 (203)	8 (203)
Nominal overall length of insert plate		ℓ_{plate}	in (mm)	12 (305)	12 (305)	12 (305)
Nominal width of insert plate		w_{plate}	in (mm)	$1^1/_4$ (32)	$1^1/_4$ (32)	$1^1/_4$ (32)
Approximate thickness of insert plate		t_{plate}	in. (mm)	$^3/_{16}$ (4.8)	$^3/_{16}$ (4.8)	$^3/_{16}$ (4.8)
Minimum nominal embedment depth[3]	Over upper flute	$h_{nom\ (upperflute)}$	in. (mm)	$1^3/_4$ (45)	2 (51)	$2^3/_8$ (60)
	Over flute incline	$h_{nom\ (fluteincline)}$	in. (mm)			
	Over lower flute	$h_{nom\ (lowerflute)}$	in. (mm)			
Minimum effective embedment depth	Over upper flute	$h_{ef\ (upperflute)}$	in. (mm)	1.50 (38)	1.75 (45)	2.00 (51)
	Over flute incline	$h_{ef\ (fluteincline)}$	in. (mm)			
	Over lower flute	$h_{ef\ (lowerflute)}$	in. (mm)			
Minimum concrete member thickness (topping thickness)	Over upper flute	$h_{min\ (upperflute)}$	in. (mm)	2 (51)	$2^1/_2$ (64)	$3^1/_4$ (83)
	Over flute incline	$h_{min\ (fluteincline)}$	in. (mm)			
	Over lower flute	$h_{min\ (lowerflute)}$	in. (mm)			
Minimum flute edge distance (insert bolt)	Over upper flute	$c_{min,deck\ (upperflute)}$	in. (mm)	N/A	N/A	N/A
	Over flute incline	$c_{min,deck\ (fluteincline)}$	in. (mm)			
	Over lower flute	$c_{min,deck\ (lowerflute)}$	in. (mm)	See Figure 3C	See Figure 3C	See Figure 3C
Minimum spacing distance (bolt spacing, center-to-center)	Over upper flute	$s_{min\ (upperflute)}$	in. (mm)	$4^1/_2$ (114)	$5^1/_4$ (133)	6 (152)
	Over flute incline	$s_{min\ (fluteincline)}$	in. (mm)			
	Over lower flute	$s_{min\ (lowerflute)}$	in. (mm)			
Minimum deck end distance	Over upper flute	$c_{min\ (upperflute)}$	in. (mm)	Specified cover requirements for reinforcement in accordance with ACI 318-14 17.7.2 or ACI 318-11 7.7, as applicable.		
	Over flute incline	$c_{min\ (fluteincline)}$	in. (mm)			
	Over lower flute	$c_{min\ (lowerflute)}$	in. (mm)			
Effective tensile stress area		A_{se}	in.^{2} (mm^2)	0.078 (50)	0.142 (92)	0.226 (146)
Insert head net bearing area		A_{brg}	in^2 (mm^2)	0.17 (110)	0.28 (181)	0.45 (290)
Minimum specified ultimate strength		f_{uta}	psi (N/mm^2)	60,000 (400)		
Minimum specified yield strength		f_{ya}	psi (N/mm^2)	36,000 (248)		

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

N/A = Not Applicable.

[1]The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
[2]For installation detail for inserts in concrete-filled steel deck assemblies, see Figures 3A, 3B and 3C (i.e. over upper flute, over flute incline, over lower flute).
[3]Nominal emedment depth is taken from the bottom of the insert plate to the top of the insert bolt.

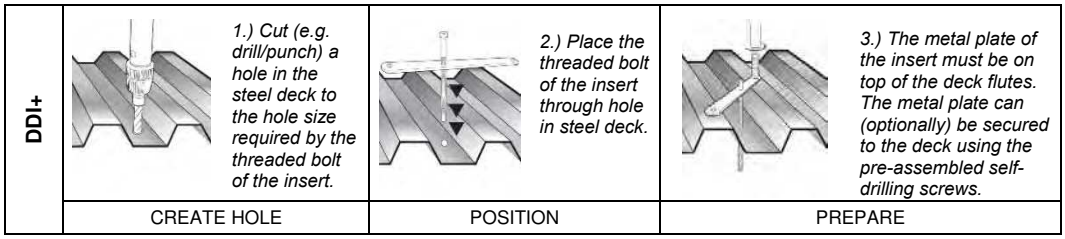


FIGURE 2—DDI+ CONCRETE INSERTS FOR STEEL DECK INSTALLATION INSTRUCTIONS

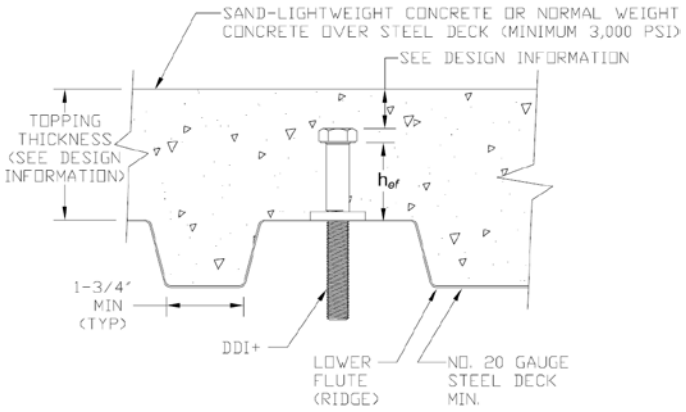


FIGURE 3A—DDI+ CONCRETE INSERTS INSTALLED THROUGH THE SOFFIT OF CONCRETE-FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES (OVER UPPER FLUTE)[1,2,3]

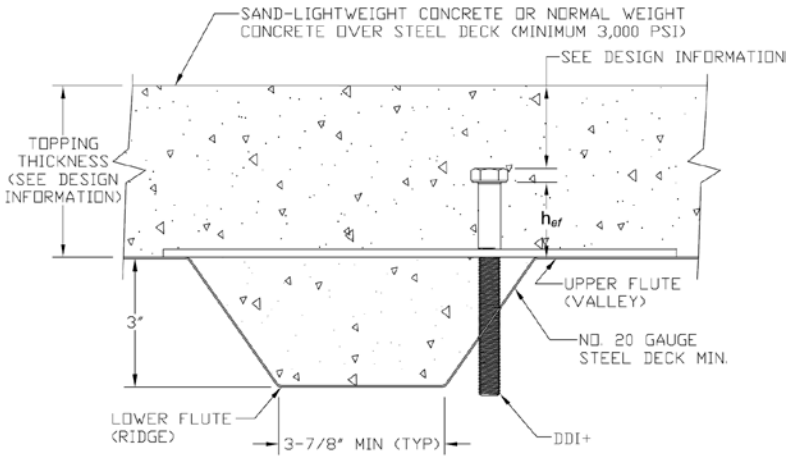


FIGURE 3B—DDI+ CONCRETE INSERTS INSTALLED THROUGH THE SOFFIT OF CONCRETE-FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES (OVER FLUTE INCLINE)[1,2,4]

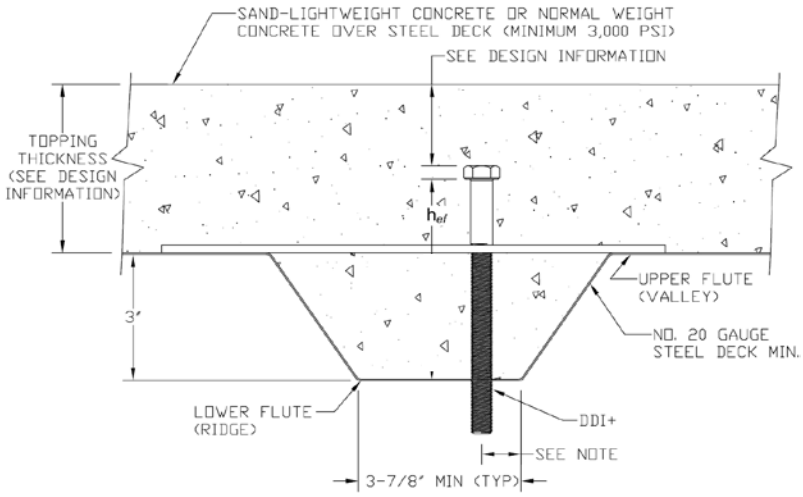


FIGURE 3C—DDI+ CONCRETE INSERTS INSTALLED THROUGH THE SOFFIT OF CONCRETE-FILLED STEEL DECK FLOOR AND ROOF ASSEMBLIES (OVER LOWER FLUTE)[1,2,5,6]

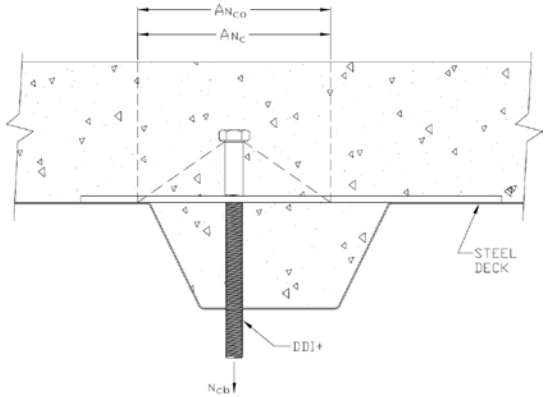
[1]Installations require a minimum concrete member topping thickness from the top of the upper flute as given in Table 2 of this report.
[2]Inserts may be placed on the upper flute of the steel deck assembly; they may be installed anywhere across upper flute in any orientation as follows:
(Figure 3A) - Placed over the upper flute with threaded bolt installed through the upper flute (with insert plate placed in any orientation or as pictured) or;
(Figure 3B) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the inclined section or;
(Figure 3C) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the lower flute.
[3]Figure 3A – Inserts over the upper flute with threaded bolt installed through the upper flute may be placed in any location and orientation that meets the minimum deck end distance requirements (see Table 2). The minimum deck end distance is measured from deck end to the centerline of the insert bolt.
[4]Figure 3B – Inserts over the upper flute spanning the lower flute with threaded bolt installed through the inclined section may be placed in any location and orientation that meets the minimum deck end distance requirements (see Table 2). The minimum deck end distance is measured from deck end to the centerline of the insert bolt. For insert bolts placed in locations with minimum lower flute edge distance less than as required in Figure 3C, values for Figure 3B can be used.
[5]Figure 3C – Inserts over the upper flute spanning the lower flute with threaded bolt installed through the lower flute may be placed in any location and orientation that meets the minimum deck end distance and minimum lower flute edge distance requirements. The minimum deck end distance is measured from deck end to the centerline of the insert bolt. The minimum lower flute edge distance is measured from the edge of the lower flute to the centerline of the insert bolt.
[6]Figure 3C – For lower flute widths of $3^{7}/_{8}$-inch, a maximum 1-inch centerline bolt 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 $^{15}/_{16}$-inch is also satisfied.

TABLE 2—DDI+ INSERT DESIGN INFORMATION[1,2,3,4,5,6]

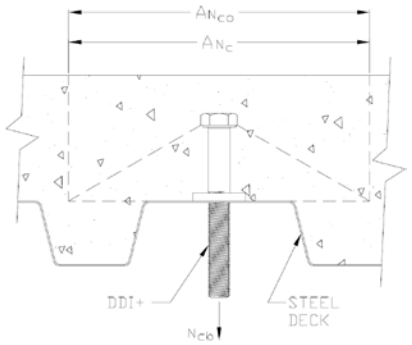
DESIGN INFORMATION		SYMBOL	UNITS	$^3/_8$-inch	$^1/_2$-inch	$^5/_8$-inch
Insert O.D. (nominal bolt diameter)		d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Insert head net bearing area		A_{brg}	in^2 (mm^2)	0.17 (110)	0.28 (181)	0.45 (290)
Effective tensile stress area		A_{se}	in.^{2} (mm^2)	0.078 (50)	0.142 (92)	0.226 (146)
Effective embedment depth	Over upper flute	$h_{ef\ (upperflute)}$	in. (mm)	1.50 (38)	1.75 (45)	2.00 (51)
	Over flute incline	$h_{ef\ (fluteincline)}$	in. (mm)			
	Over lower flute	$h_{ef\ (lowerflute)}$	in. (mm)			
Minimum concrete member thickness (topping thickness over upper flute)		h_{min}	in. (mm)	2.00 (51)	2.50 (64)	3.25 (83)
Minimum spacing and edge distance		s_{min}, c_{min}	in. (mm)	See Table 1 and Figures 3A, 3B and 3C		
Effectiveness factor for cracked concrete		k_c	- (SI)	24 (10)		
Modification factor for tension strength in uncracked concrete		$\Psi_{C,N}$	-	1.25		
According to Figures 3A, 3B or 3C	Nominal tension strength of single insert as governed by steel strength	$N_{sa,insert}$	lb (kN)	4,650 (20.7)	8,520 (37.9)	13,560 (60.3)
	Nominal tension strength of single insert as governed by steel strength, seismic	$N_{sa,insert,eq}$	lb (kN)			
According to Figure 3A (over upper flute)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck\ (upperflute)}$	lb (kN)	2,280 (10.1)	4,260 (18.9)	7,245 (32.2)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq\ (upperflute)}$	lb (kN)	1,825 (8.1)	3,410 (15.2)	
According to Figure 3B (over flute incline)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck\ (fluteincline)}$	lb (kN)	1,310 (5.8)	3,410 (15.2)	5,240 (23.3)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq\ (fluteincline)}$	lb (kN)	1,045 (4.6)	2,860 (12.7)	
According to Figure 3C (over lower flute)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck\ (lowerflute)}$	lb (kN)	2,280 (10.1)	4,260 (18.9)	5,735 (25.5)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq\ (lowerflute)}$	lb (kN)	2,015 (9.0)	3,410 (15.2)	

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.

[1]Concrete must have a compressive strength f'_c of 3,000 psi (20.7 MPa) minimum. Installation must comply with Sections 4.1.11 and 4.3 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 4.
[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 shall be taken as 0.75 for tension and 0.65 for shear; values correspond to ductile 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.
[4]Insert O.D. is the nominal bolt diameter of the insert.
[5]Minimum spacing distance between anchors and minimum edge distances for cast-in headed DDI+ inserts shall be in accordance with Tables 1 and 2, Figures 3A, 3B and 3C and noted provisions.
[6]Shear loads for concrete inserts in concrete-filled steel deck assemblies may be applied in any direction (i.e. over upper flute, over flute incline, over lower flute).



Idealization of Steel Deck Profile
(over lower flute or over flute incline)



Idealization of Steel Deck Profile
(over upper flute)

FIGURE 4—IDEALIZATION OF CONCRETE FILLED STEEL DECKS FOR DETERMINATION OF CONCRETE BREAKOUT STRENGTH IN ACCORDANCE WITH ACI 318

ICC-ES Evaluation Report

ESR-3958 LABC and LARC Supplement

Reissued December 2018

This report is subject to renewal December 2019.

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

REPORT HOLDER:

DEWALT

EVALUATION SUBJECT:

DDI+™ HEADED CAST-IN SPECIALTY INSERTS FOR CRACKED AND UNCRACKED CONCRETE-FILLED STEEL DECKS (DEWALT)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that DDI+™ Headed Cast-In Specialty Inserts for Cracked and Uncracked Concrete-Filled Steel Decks, described in ICC-ES master evaluation report ESR-3958, have also been evaluated for compliance with the codes noted below as adopted by 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 DDI+™ Headed Cast-In Specialty Inserts for Cracked and Uncracked Concrete-Filled Steel Decks, described in Sections 2.0 through 7.0 of the master evaluation report ESR-3958, comply with LABC Chapter 19, and LARC, and are subjected to the conditions of use described in this report.

3.0 CONDITIONS OF USE

The DDI+™ Headed Cast-In Specialty Inserts for Cracked and Uncracked Concrete-Filled Steel Decks described in this evaluation report must comply with all of the following conditions:

- All applicable sections in the master evaluation report ESR-3958.
- The design, installation, conditions of use and labeling of the inserts are in accordance with the 2015 *International Building Code®* (2015 IBC) provisions noted in the master evaluation report ESR-3958.
- 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 inserts to the concrete. The connection between the inserts and the connected members shall be checked for capacity (which may govern).

This supplement expires concurrently with the master report, reissued December 2018.

VFXT.EX1289 - HANGERS, PIPE

Hangers, Pipe

See General Information for Hangers, Pipe

DEWALT, INC EX1289
701 East Joppa Rd
Towson, MD 21286 USA
For Installation in Wood:

Model Designation	Hanger Type	Rod Size	Nominal Pipe Size	Comments
HangerMate+ PFM2251100	Self-Threading Anchor	3/8	3	For vertical installation into the bottom of a wood timber or joist. Min. 1-1/2 in. wood thickness
HangerMate+ PFM2251150	Self-Threading Anchor	3/8	4	For vertical installation into the bottom of a wood timber or joist. Min. 1-1/2 in. wood thickness
HangerMate+ PFM2251200	Self-Threading Anchor	3/8	3	For vertical installation into the bottom of a wood timber or joist. Min. 1-1/2 in. wood thickness
HangerMate+ PFM2251250	Self-Threading Anchor	3/8 .	3	For vertical installation into the bottom of a wood timber or joist. Min. 1-1/2 in. wood thickness
HangerMate+ PFM2251350 (Step Thread)	Self-Threading Anchor	3/8, 1/2	3	For vertical installation into the bottom of a wood timber or joist. Min. 1-1/2 in. wood thickness
HangerMate+ PFM2261100	Self-Threading Anchor	3/8	3	For Horizontal installation into the side of a wood timber or joist. Min. 1-1/2 in. wood thickness.
HangerMate+ PFM2261150	Self-Threading Anchor	3/8	4	For Horizontal installation into the side of a wood timber or joist. Min. 1-1/2 in. wood thickness.

For Installation in Steel:

Model Designation	Hanger Type	Rod Size, in.	Nominal Pipe Size	Comments
Vertigo 7154	Self-Drilling Anchor	3/8	4	For vertical installation into steel. Min. 0.06 in. steel thickness.
Vertigo 7158	Self-Drilling Anchor	3/8	4	For vertical installation into steel. Min. 0.06 in. steel thickness.
Vertigo 7160	Self-Drilling Anchor	3/8	Up to 4	For vertical installation into steel. Min. 0.06 in. steel thickness.
Vertigo 7161	Self-Drilling Anchor	1/2	Up to 8	For vertical installation into steel. Min. 0.25 in. steel thickness.
Vertigo 7184	Self-Drilling Anchor	3/8	4	For horizontal installation into steel. Min. 0.06 in. steel thickness.
Vertigo 7186	Self-Drilling Anchor	3/8	4	For horizontal installation into steel. Min. 0.06 in. steel thickness.
Vertigo 7188	Self-Drilling Anchor	3/8	4	For horizontal installation into steel. Min. 0.06 in. steel thickness.
Vertigo 7201	Self-Drilling Anchor	3/8	4	For horizontal installation into steel. Min. 0.06 in. steel thickness.

For Installation in Concrete:

Model Designation	Hanger Type	Rod Size, in.	Nominal Pipe Size	Comments
Drive-In	Drive-In Anchor	3/8	Up to 4	—
Drive-In	Drive-In Anchor	1/2	5, 6, 7, 8	—
Lok Bolts	Sleeve Anchor	3/8	Up to 4	—
Lok Bolts	Sleeve Anchor	1/2	5, 6, 7, 8	—
Lok Bolts	Sleeve Anchor	5/8	10, 12	—
Dropin 6200	Expansion Anchor	3/8	Up to 4	—
Dropin 6200	Expansion Anchor	1/2	5, 6, 7, 8	—
Dropin 6200	Expansion Anchor	5/8	10, 12	—
Dropin 6200	Expansion Anchor	3/4, 20 mm	12	—
Dropin 6300	Expansion Anchor	3/8	Up to 4	—
Dropin 6300	Expansion Anchor	1/2	5, 6, 7, 8	—
Dropin 6300	Expansion Anchor	5/8	10, 12	—

Dropin 6300	Expansion Anchor	3/4, 20 mm	12	—
Power-Bolt 6900	Heavy Duty Sleeve Anchor	3/8	Up to 4	—
Power-Bolt 6900	Heavy Duty Sleeve Anchor	1/2	5, 6, 7, 8	—
Power-Bolt 6900	Heavy Duty Sleeve Anchor	5/8	10, 12	Series 6900
Power-Bolt 6900	Heavy Duty Sleeve Anchor	3/4, 20 mm	12	—
Power Stud 7200	Wedge Anchor	3/8	Up to 4	—
Power Stud 7200	Wedge Anchor	1/2	5, 6, 7, 8	—
Power Stud 7200	Wedge Anchor	5/8, 20 mm	10, 12	—
Power Stud 7200	Wedge Anchor	3/4, 20 mm	12	—
Power Stud 7200	Wedge Anchor	7/8, 20 mm	12	—
Power Stud 7300	Wedge Anchor	3/8	Up to 4	—
Power Stud 7300	Wedge Anchor	1/2	5, 6, 7, 8	—
Power Stud 7300	Wedge Anchor	5/8, 20 mm	10, 12	—
Power Stud 7300	Wedge Anchor	3/4	12	—
Power Stud 7300	Wedge Anchor	7/8	12	—
Power Stud 7400	Wedge Anchor	3/8, 20 mm	Up to 4	—
Power Stud 7400	Wedge Anchor	1/2, 20 mm	5, 6, 7, 8	—
Power Stud 7400	Wedge Anchor	5/8, 20 mm	10, 12	—
Power Stud 7400	Wedge Anchor	3/4, 20 mm	12	—

Power Stud 7600	Wedge Anchor	3/8, 20 mm	Up to 4	—
Power Stud 7600	Wedge Anchor	1/2	5, 6, 7, 8	—
Power Stud 7600	Wedge Anchor	5/8	10, 12	—
Power Stud 7600	Wedge Anchor	3/4	Up to 12	—
Power Stud 7600	Wedge Anchor	7/8	12	—
Power Stud 7700	Wedge Anchor	3/8	Up to 4	—
Power Stud 7700	Wedge Anchor	1/2, 20 mm	5, 6, 7, 8	—
Power Stud 7700	Wedge Anchor	5/8, 20 mm	10, 12	—
Power Stud 7700	Wedge Anchor	3/4, 20 mm	12	—
Power Stud 7700	Wedge Anchor	7/8, 20 mm	12	—
Power Stud 7800	Wedge Anchor	3/8, 20 mm	Up to 4	—
Power Stud 7800	Wedge Anchor	1/2, 20 mm	5, 6, 7, 8	—
Power Stud 7800	Wedge Anchor	5/8, 20 mm	10, 12	—
Power Stud 7800	Wedge Anchor	3/4, 20 mm	12	—
Power Stud 7800	Wedge Anchor	7/8, 20 mm	12	—
Hollow Set 9340	Expansion Anchor	3/8	Up to 4	—
Hollow Set 9350	Expansion Anchor	1/2	Up to 8	—
Hollow Set 9360	Expansion Anchor	5/8	Up to 12	—
SD1	Expansion Anchor	3/8	Up to 4	Lengths, in.: 3, 3-1/2, 3-3/4, 5, 7
SD1	Expansion Anchor	1/2	Up to 8	Lengths, in.: 3-3/4, 4-1/2, 5-1/2, 7, 8-1/2

SD1	Expansion Anchor	5/8	Up to 12	Lengths, in.: 5, 6, 7, 8-1/2, 10
SD2	Expansion Anchor	3/8	Up to 4	Lengths, in.: 3, 3-1/2, 3-3/4, 5
SD2	Expansion Anchor	5/8	Up to 12	Lengths, in.: 4-3/4, 5, 6, 7, 8-1/2
SD2	Expansion Anchor	3/4	Up to 12	Lengths, in.: 5-1/2, 6-1/4, 7, 8-1/2
Smart DI+	Expansion Anchor	3/8	Up to 4	—
Smart DI+	Expansion Anchor	1/2	Up to 8	—
Smart DI+	Expansion Anchor	5/8, 20 mm	Up to 12	—
Smart DI+	Expansion Anchor	3/4, 20 mm	Up to 12	—

Cast-in Place Concrete Installation:

Model Designation	Hanger Type	Rod Size, in.	Nominal Pipe Size	Comments
Bang-It+ 7542	Cast-in-place Concrete Insert	3/8	Up to 4	Intended for use in lightweight concrete with a min compressive strength of 3000 psi. Also suitable for use in air-handling spaces.
Bang-It+ 7543	Cast-in-place Concrete Insert	3/8	Up to 4	Intended for use in lightweight concrete with a min compressive strength of 3000 psi. The 1/2 in. rod size is for installation into the crest of metal decking supporting a concrete slab only. Also suitable for use in air-handling spaces.
Bang-It+ 7543	Cast-in-place Concrete Insert	1/2	Up to 8	Intended for use in lightweight concrete with a min compressive strength of 3000 psi. The 1/2 in. rod size is for installation into the crest of metal decking supporting a concrete slab only. Also suitable for use in air-handling spaces.
Bang-It+ 7544	Cast-in-place Concrete Insert	1/2	5, 6, 7, 8	Intended for use in lightweight concrete with a min compressive strength of 3000 psi. Model Bang-It in the 1/2 in. rod size is for installation into the crest of metal decking supporting a concrete slab only. Also suitable for use in air-handling spaces.
Wood-Knocker 7552	Cast-in-place Concrete Insert	3/8	Up to 4	Intended for use in concrete with a min compressive strength of 2900 psi. Also suitable for use in air-handling spaces.

Wood-Knocker 7554	Cast-in-place Concrete Insert	1/2	Up to 8	Intended for use in concrete with a min compressive strength of 2900 psi. Also suitable for use in air-handling spaces.
Wood-Knocker 7556	Cast-in-place Concrete Insert	5/8	Up to 8	Intended for use in concrete with a min compressive strength of 2900 psi. Also suitable for use in air-handling spaces.
Wood Knocker II PFM2521150	Cast-in-place concrete insert	3/8	Up to 4	Intended for use in concrete with a min compressive strength of 2900 psi. Also suitable for use in air-handling spaces.
Wood Knocker II P/N PFM2521200	Cast-in-place concrete insert	1/2	Up to 8	Intended for use in concrete with a min compressive strength of 2900 psi. Also suitable for use in air-handling spaces.
Wood Knocker II PFM2521250	Cast-in-place concrete insert	5/8	Up to 8	Intended for use in concrete with a min compressive strength of 2900 psi. Also suitable for use in air-handling spaces.
Wood Knocker II PFM2521350	Cast-in-place concrete insert	3/8, 1/2	Up to 8	Intended for use in concrete with a min compressive strength of 2900 psi. Also suitable for use in air-handling spaces.
DDI+	Cast-in-place Concrete Insert	3/8	4	—
DDI+	Cast-in-place Concrete Insert	1/2	8	—
DDI+	Cast-in-place Concrete Insert	5/8	12	—
DDI+	Cast-in-place Concrete Insert	3/4	12	—

DDI+	Cast-in-place Concrete Insert	7/8	12		—

Pipe hangers

For Installation into Steel

Model	Hanger Type	Min Steel Thkns, in.	Rod Size, in.	NPS*	Comments
PFM2231050	Self-drilling anchor	0.125	3/8	4	—
PFM2231100	Self-drilling anchor	0.125	3/8	4	—
PFM223110N	Self-drilling anchor	0.060	3/8	4	—
PFM2231200	Self-drilling anchor	0.125	3/8	4	—
PFM223120N	Self-drilling anchor	0.060	3/8	4	—
PFM2231150	Self-drilling anchor	0.125	3/8	4	—
PFM223115N	Self-drilling anchor	0.060	3/8	4	—
PFM2231250	Self-drilling anchor	0.125	3/8	4	—
PFM2231300	Self-drilling anchor	0.125	3/8	4	—
PFM224110N	Self-drilling anchor	0.060	3/8	4	—
PFM224115N	Self-drilling anchor	0.060	3/8	4	—
PFM224120N	Self-drilling anchor	0.060	3/8	4	—
PFM227110N	Self-drilling anchor	0.1046 (12 ga.)	3/8	4	Horizontal and Vertical Installation
PFM227120N	Self-drilling anchor	0.1046 (12 ga.)	3/8	4	Horizontal and Vertical Installation
PFM227130N	Self-drilling anchor	0.1046 (12 ga.)	3/8	4	Horizontal and Vertical Installation

For Installation into Wood

Model	Hanger Type	Min Wood Thkns, in.	Rod Size, in.	NPS*	Comments
PFM2271000	Self-threading anchor	1-1/2	3/8	4	Horizontal and Vertical Installation

* NPS = Nominal pipe size

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