

# ICC-ES Evaluation Report

**ESR-2249**

Reissued April 1, 2011

This report is subject to renewal in two years.

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**DIVISION: 03 00 00—CONCRETE**

Section: 03 16 00—Concrete Anchors

**DIVISION: 06 00 00—WOOD, PLASTICS AND  
COMPOSITES**

 Section: 06 05 23—Wood, Plastic, and Composite  
Fastenings

**DIVISION: 09 00 00—FINISHES**

Section: 09 22 16.23—Fasteners

**REPORT HOLDER:**

**POWERS FASTENERS, INC.**  
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**EVALUATION SUBJECT:**
**POWERS TRAK-IT C4 FASTENERS**
**ADDITIONAL LISTEE:**

**MAX COMPANY, LTD.**  
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 CHOU-KU, TOKYO  
 JAPAN  
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**1.0 EVALUATION SCOPE**
**Compliance with the following codes:**

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

\*Codes indicated with an asterisk are addressed in Section 8.0.

**Property evaluated:**

Structural

**2.0 USES**

Powers Trak-It C4 fasteners are used to attach building elements, such as wood and steel, to uncracked, normal-weight and structural sand-lightweight concrete, and metal decks with structural sand-lightweight concrete fill. The fasteners are alternatives to the cast-in-place anchors described in IBC Sections 1911 and 1912 for placement in concrete. The fasteners may be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

**3.0 DESCRIPTION**
**3.1 Trak-It C4 Fasteners:**

Powers Trak-It C4 fasteners are manufactured from steel complying with ASTM A 510, Grade 1060, and austempered to a Rockwell C51-55 core hardness.

The Trak-It C4 fasteners are also sold by Max Company, Ltd., and are labeled as Powerlite. The Trak-It C4 fasteners are illustrated in Figure 1.

**3.1.1 Tapered Shank Fasteners:** The tapered shank fasteners have a 0.137-inch (3.5 mm) nominal shank diameter and a 0.25-inch (6.4 mm) head diameter. The fasteners are supplied collated into plastic strips or as single fasteners with premounted vinyl flutes. The fasteners are zinc-plated in accordance with ASTM B 695, Class 65.

**3.1.2 Straight Shank Fasteners:** The straight shank fasteners have a 0.145-inch (3.7 mm) nominal shank diameter and a 0.25-inch (6.4 mm) head diameter. The fasteners are supplied collated into plastic strips and have a minimum 0.0002-inch (5 µm) zinc plating per ASTM B 633.

**3.1.3 Stepped Shank Fasteners:** The stepped shank fasteners have shank diameters of 0.145 inch (3.7 mm) and 0.102 inch (2.6 mm), and a 0.25-inch (6.4 mm) head diameter. The fasteners are supplied collated into plastic strips and have a minimum 0.0002-inch (5 µm) zinc plating per ASTM B 633.

**3.2 Normal-weight Concrete:**

Normal-weight concrete must be of stone-aggregate and comply with Section 1905 of the IBC or Section 402.2 of the IRC, as applicable. The minimum concrete compressive strength at the time of fastener installation is noted in Tables 1 and 2.

**3.3 Structural Lightweight Concrete:**

Structural lightweight concrete must be sand-lightweight and must comply with Section 1905 of the IBC. The minimum concrete compressive strength at the time of fastener installation is noted in Tables 3 and 4.

### 3.4 Steel Deck:

Steel deck properties must be as described in the footnotes of Table 3 and Table 4, and Figure 2, of this report.

## 4.0 DESIGN AND INSTALLATION

### 4.1 Design:

**4.1.1 General:** The allowable tension and shear loads for Powers Trak-It C4 fasteners installed in accordance with this report are shown in Tables 1 through 4.

The allowable tension and shear loads with required embedment depths, for fasteners installed in normal-weight concrete, are shown in Tables 1 and 2. The allowable tension and shear loads for fasteners installed in structural sand-lightweight concrete and structural sand-lightweight concrete over steel deck are shown in Tables 3 and 4.

Allowable loads for fasteners subjected to combined shear and tension forces are determined by the following formula:

$$(P_s/P_t) + (V_s/V_t) \leq 1$$

where:

$P_s$  = Applied service tension load, pounds (kg).

$P_t$  = Allowable tension load, pounds (kg).

$V_s$  = Applied service shear load, pounds (kg).

$V_t$  = Allowable shear load, pounds (kg).

**4.1.2 Wood to Concrete:** Reference lateral design values for nails, with diameters less than or equal to the diameter of the Trak-It C4 fasteners, and with penetration into the main member of 10D, determined in accordance with Part 11 and/or Table 11N of ANSI/AF&PA NDS, are applicable to the Trak-It C4 fasteners. The wood element is the side member. The fastener bending yield strength is allowed to be taken as the value noted in the footnotes to Table 11N of the ANSI/AF&PA NDS, based on the diameter of the Trak-It C4 fasteners.

### 4.2 Installation:

Fasteners must be installed in accordance with this report and the manufacturer's published installation instructions. The fasteners must not be installed until the base material has reached the minimum designated concrete compressive strength. The minimum embedment depth, fastener spacing, edge distance and base material must comply with the requirements of this report.

## 5.0 CONDITIONS OF USE

The Powers Trak-It C4 fasteners described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The fasteners must be identified and installed in accordance with this report and the manufacturer's instructions. In the event of a conflict between the instructions in this report and the manufacturer's instructions, this report governs.
- 5.2 Allowable tension and shear values must comply with Section 4.1 of this report. Calculations demonstrating that the applied loads are less than the allowable loads described in this report must be submitted to the code official for approval. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is constructed.

5.3 Fasteners must be installed in concrete with a minimum thickness of three times the fastener penetration.

5.4 Allowable tension and shear values are as noted in Section 4.1. The stress increases described in Section 1605.3.2 of the IBC are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.

5.5 The use of fasteners is limited to installation in uncracked concrete. Cracking occurs when  $f_t > f_r$  due to service loads or deformations.

5.6 The use of the fasteners in this report is limited to installation in dry, interior environments.

5.7 Use of the fasteners to resist earthquake loads is outside the scope of this report, except when used with architectural, electrical and mechanical components described in Section 13.1.4 of ASCE/SEI 7 as exempt from seismic design requirements.

## 6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven into Concrete, Steel, and Masonry Elements (AC70), dated February 2011.

## 7.0 IDENTIFICATION

The Powers Trak-It C4 fasteners are identified by a "P" stamped onto the head of the drive pin. Packages bear the company name (Powers Fasteners, Inc., or Max Co., Ltd.) and information that includes the fastener shank type, length and diameter, and the evaluation report number (ESR-2249).

## 8.0 OTHER CODES

### 8.1 Evaluation Scope:

In addition to the 2009 IBC and the 2009 IRC referenced in Section 1.0, the products in this report were evaluated for compliance with the requirements of the following codes:

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

### 8.2 Uses:

The Trak-It C4 fasteners are used to connect materials as described in Section 2.0. The fasteners are alternatives to the cast-in-place anchors described in 2006 IBC Sections 1911 and 1912; 2003 IBC Sections 1912 and 1913 and UBC Section 1923.1 for placement in concrete. The fasteners may be used where an engineered design is submitted in accordance with 2006 and 2003 IRC Section R301.1.3.

### 8.3 Description:

**8.3.1 Fasteners:** See Section 3.1.

**8.3.2 Concrete:** See Sections 3.2 and 3.3. Under the UBC, concrete must conform to Section 1903.

**8.3.3 Steel Deck:** See Section 3.4.

### 8.4 Design and Installation:

#### 8.4.1 Design:

**8.4.1.1 General:** See Section 4.1 and Conditions of Use 8.5.1 and 8.5.2.

**8.4.1.2 Wood to Concrete:** See Section 4.1.1. Reference lateral design values for fasteners determined in accordance with Section 4.1.2 (2006 IBC), Part 11 of ANSI/AF&PA NDS (2003 IBC and IRC) or UBC Section 2318.3, as applicable, are applicable to the Trak-It C4 fasteners of equal or greater diameters.

**8.4.2 Installation:** See Section 4.2.

**8.5 Conditions of Use:**

See Section 5.0 and the following:

**8.5.1** Allowable tension and shear values are as noted in Tables 1 through 4. The stress increases and load reductions described in Section 1605.3 of the 2006 and 2003 IBC and the stress increases described in UBC Section 1612.3.2, are not allowed for wind

loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.

**8.5.2** Except for fasteners used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7-05 (2006 IBC) or Section 9.6.1 of ASCE/SEI 7-02 (2003 IBC and IRC) as exempt from seismic design requirements, use of fasteners to resist earthquake loads is outside the scope of this report.

**8.6 Evidence Submitted:**

See Section 6.0.

**8.7 Identification:**

See Section 7.0.

**TABLE 1—ALLOWABLE TENSION VALUES FOR TRAK-IT C4 FASTENERS INSTALLED IN NORMAL WEIGHT CONCRETE<sup>1,2,3,4</sup>**

SHANK TYPE	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	ALLOWABLE TENSION LOAD (lbf)	
					f'c = 2,500 psi	f'c = 3,000 psi
Straight	0.145	<sup>3</sup> / <sub>4</sub>	4	3	65	70
Straight	0.145	<sup>7</sup> / <sub>8</sub>	4	3	125	135
Step	0.145	<sup>3</sup> / <sub>4</sub>	4	3	80	85
Step	0.145	1	4	3	125	135
Taper	0.137	<sup>3</sup> / <sub>4</sub>	4	1 <sup>3</sup> / <sub>4</sub>	80	85
Taper	0.137	1	4	1 <sup>3</sup> / <sub>4</sub>	90	100

For **SI**: 1 lbf = 4.48 N, 1 inch = 25.4 mm, 1 psi = 6.895 kPa.

<sup>1</sup>Fasteners must not be driven until the concrete has reached the tabulated compressive strength.

<sup>2</sup>Concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

<sup>3</sup>The tabulated allowable load values are for the fastener only. Wood or steel members connected to the steel substrate must be investigated in accordance with accepted design criteria.

<sup>4</sup>The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.

**TABLE 2—ALLOWABLE SHEAR VALUES FOR TRAK-IT C4 FASTENERS INSTALLED IN NORMAL WEIGHT CONCRETE<sup>1,2,3,4</sup>**

SHANK TYPE	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	ALLOWABLE SHEAR LOAD (lbf)	
					f'c = 2,500 psi	f'c = 3,000 psi
Straight	0.145	<sup>3</sup> / <sub>4</sub>	4	3	105	110
Straight	0.145	<sup>7</sup> / <sub>8</sub>	4	3	105	110
Step	0.145	<sup>3</sup> / <sub>4</sub>	4	3	215	235
Step	0.145	1	4	3	245	265
Taper	0.137	<sup>3</sup> / <sub>4</sub>	4	1 <sup>3</sup> / <sub>4</sub>	90	95
Taper	0.137	1	4	1 <sup>3</sup> / <sub>4</sub>	70	75

For **SI**: 1 lbf = 4.48 N, 1 inch = 25.4 mm, 1 psi = 6.895 kPa.

<sup>1</sup>Fasteners must not be driven until the concrete has reached the tabulated compressive strength.

<sup>2</sup>Concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

<sup>3</sup>The tabulated allowable load values are for the fastener only. Wood or steel members connected to the steel substrate must be investigated in accordance with accepted design criteria.

<sup>4</sup>The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.

**TABLE 3—ALLOWABLE TENSION VALUES FOR TRAK-IT C4 FASTENERS INSTALLED IN STRUCTURAL SAND-LIGHTWEIGHT CONCRETE AND STRUCTURAL SAND-LIGHTWEIGHT CONCRETE OVER STEEL DECK<sup>1,2,3,4,5</sup>**

SHANK TYPE	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	LOCATION	ALLOWABLE TENSION (lbf) f'c = 3000 psi
Straight	0.145	3/4	4	3	Top	115
				1 1/8	Lower Flute	80
					Upper Flute	110

For SI: 1 lbf = 4.48 N, 1 inch = 25.4 mm, 1 psi = 6.895 kPa.

<sup>1</sup>Fasteners must not be driven until the concrete has reached the tabulated compressive strength.

<sup>2</sup>The steel deck must have a minimum base material thickness of 0.035 inch (0.89 mm), minimum yield strength, Fy, of 33 ksi, and conform to the profile shown in Figure 2.

<sup>3</sup>Concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

<sup>4</sup>The tabulated allowable load values are for the fastener only. Wood or steel members connected to the steel substrate must be investigated in accordance with accepted design criteria.

<sup>5</sup>The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.

**TABLE 4—ALLOWABLE SHEAR VALUES FOR TRAK-IT C4 FASTENERS INSTALLED IN STRUCTURAL SAND-LIGHTWEIGHT CONCRETE AND STRUCTURAL SAND-LIGHTWEIGHT CONCRETE OVER STEEL DECK<sup>1,2,3,4,5</sup>**

SHANK TYPE	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	LOCATION	ALLOWABLE SHEAR (lbf) f'c = 3000 psi
Straight	0.145	3/4	4	3	Top	165
				1 1/8	Lower Flute	200
					Upper Flute	220

For SI: 1 lbf = 4.48 N, 1 inch = 25.4 mm, 1 psi = 6.895 kPa.

<sup>1</sup>Fasteners must not be driven until the concrete has reached the tabulated compressive strength.

<sup>2</sup>The steel deck must have a minimum base material thickness of 0.035 inch (0.89 mm), minimum yield strength, Fy, of 33 ksi, and conform to the profile shown in Figure 2.

<sup>3</sup>Concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

<sup>4</sup>The tabulated allowable load values are for the fastener only. Wood or steel members connected to the steel substrate must be investigated in accordance with accepted design criteria.

<sup>5</sup>The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.



0.145-inch Diameter (3.7 mm) Straight Shank C4 Fasteners

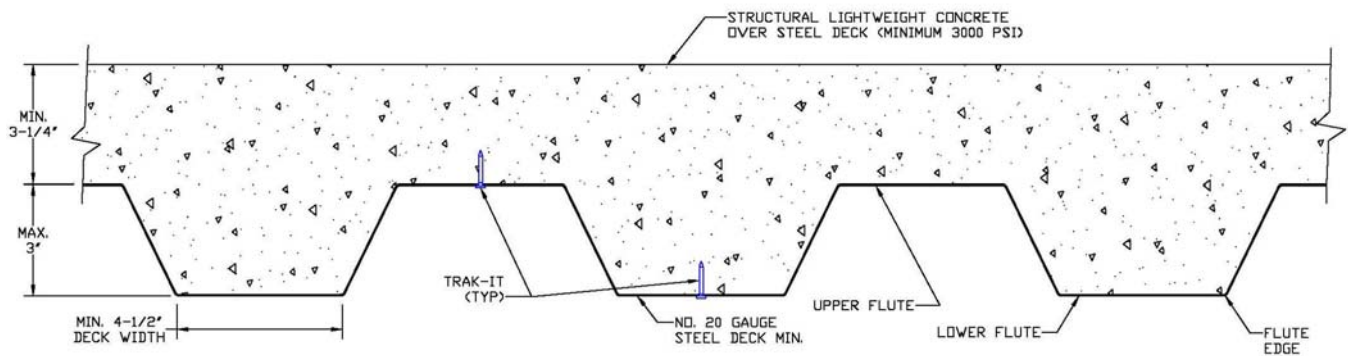


0.145-inch Diameter (3.7 mm) Step Shank C4 Fasteners



0.137-inch Diameter (3.5 mm) Taper Shank C4 Fasteners

**FIGURE 1—TRAK-IT C4 FASTENERS**



**FIGURE 2—FASTENER INSTALLATION LOCATION IN COMPOSITE DECK**