

ICC-ES Evaluation Report

ESR-1995*

Reissued January 1, 2010

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DIVISION: 03—CONCRETE

Section: 03151—Concrete Anchoring

DIVISION: 05—METALS

Section: 05090—Metal Fastenings

DIVISION: 06—WOOD AND PLASTICS

Section: 06090—Wood and Plastic Fastenings

DIVISION: 09—FINISHES

Section: 09051—Fasteners

REPORT HOLDER:
POWERS FASTENERS, INC.

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EVALUATION SUBJECT:
POWERS 8 mm HEAD SPIRAL CSI PIN and 10 mm HEAD DRIVE PIN POWER-DRIVEN FASTENERS
ADDITIONAL LISTEE:
MAX CO., LTD.

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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

The Powers 8 mm Head Spiral CSI Pin power-driven fasteners are used to attach building elements, such as wood and light gage steel members, to uncracked, normal-weight concrete and steel base materials. The 10 mm Head Drive Pin power-driven fasteners are used to attach building elements, such as wood and light gage steel, to uncracked, normal-weight and structural sand-lightweight concrete, steel decks with structural sand-lightweight concrete fill and steel base materials. The fasteners are alternatives to the cast-in-place anchors described in IBC Sections 1911 and 1912 for placement in concrete. They are also alternatives to standard bolts used to attach materials to structural steel described in IBC Section 2204.2. The fasteners may be used under the IRC where an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION
3.1 Fasteners:

Powers 8 mm Head Spiral CSI Pin and 10 mm Head Drive Pin power-driven fasteners are manufactured from carbon steel complying with the manufacturer's quality documentation.

3.1.1 8 mm Head Spiral CSI Pin: The fasteners are power-driven pins manufactured from carbon steel conforming to ASTM A 510, Grade 1060, and austempered to a Rockwell C nominal core hardness of 51 to 55. The fasteners are zinc-plated in accordance with ASTM B 695, Class 5, Type 1, with a minimum coating thickness of 0.0002 inch (0.005 mm), and have spiral shanks. The fasteners have a head diameter of 8 millimeters (0.32 inch) and a shank diameter of 0.157 inch (4.0 mm) and are available in lengths ranging from $\frac{5}{8}$ inch to $2\frac{7}{8}$ inches (15.9 to 73 mm). The fasteners are available in boxes of individual pins or in collated strips. See Table 1 for a list of recognized fasteners.

3.1.2 10 mm Head Drive Pin: The fasteners are power-driven pins manufactured from carbon steel conforming to ASTM A 510, Grade 1060, and austempered to a Rockwell C nominal core hardness of 53-55. The fasteners are zinc-plated in accordance with ASTM B 695, Class 5, Type 1, with a minimum coating thickness of 0.0002 inch (0.005 mm), and have smooth shanks. The fasteners have a head diameter of 10 millimeters (0.39 inch) and a shank diameter of 0.177 inch (4.5 mm) and are available in lengths ranging from $\frac{3}{4}$ inch to $3\frac{1}{4}$ inches (19 to 82 mm). See Table 1 for a list of recognized fasteners. The 10 mm Head Drive Pin fasteners are also sold by Max Company, Ltd., and are labeled as Powerlite 10 mm Head Drive Pins.

*Corrected January 2010

3.2 Substrate Materials:

3.2.1 Concrete: Uncracked normal-weight and structural sand-lightweight concrete must conform to Chapter 19 of the IBC or Section R402.2 of the IRC, as applicable. The minimum concrete compressive strength at the time of fastener installation is noted in the tables of this report.

3.2.2 Steel: Structural steel must comply with ASTM A 36 or ASTM A 572, Grade 50, as shown in the tables in this report, and must have a minimum thickness of $\frac{3}{16}$ inch (4.8 mm). Steel deck properties and configurations must be as described in the footnotes to Table 4.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: The allowable shear and tension service loads for the fasteners installed in normal-weight concrete, structural sand-lightweight concrete, structural sand-lightweight concrete filled steel deck, and steel base materials can be found in Tables 2 through 6.

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. Except for fasteners used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7, use of fasteners to resist earthquake loads is beyond the scope of this report.

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 (N).
- P_t = Allowable service tension load, pounds (N).
- V_s = Applied service shear load, pounds (N).
- V_t = Allowable service shear load, pounds (N).

4.1.2 Wood to Steel or Concrete: Reference lateral design values for nails with diameters equal to or less than the diameter of the 8 mm Head Spiral CSI Pin or the 10 mm Head Drive Pin as applicable, and penetration into the main member of 10 times the shank diameter, determined in accordance with Part 11 and Table 11N of ANSI/AF&PA NDS, are applicable to the 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 shank diameter of the fasteners.

4.2 Installation:

4.2.1 General: The Powers 8 mm Head Spiral CSI Pin and 10 mm Head Drive Pin power-driven fasteners must be installed in accordance with this report and the manufacturer's published installation instructions. A copy of the instructions must be available on the jobsite at all times during installation. Installation is limited to dry, interior locations.

Fastener placement requires the use of a low-velocity powder-actuated tool used in accordance with Powers published installation instructions.

4.2.2 Fastening to Concrete: Fasteners must be driven into the concrete after the concrete attains the specified compressive strength. Minimum spacing between

fasteners must be $5\frac{1}{2}$ inches (140 mm) on center and minimum edge distance must be $3\frac{1}{2}$ inches (89 mm). Unless noted otherwise in this report, concrete thickness must be a minimum of three times the embedment depth of the fastener.

4.2.3 Fastening to Structural Lightweight Concrete Filled Steel Deck: Concrete thickness above the top of the deck must be a minimum of $3\frac{1}{4}$ inches (83 mm). When fasteners are installed in the lower flutes, the distance from the flute edge must be a minimum of $1\frac{1}{8}$ inches (29 mm). See Figure 1.

4.2.4 Fastening to Steel: When installed in steel, minimum spacing between fasteners must be 1 inch (25.4 mm) and minimum edge distance must be 0.5 inch (12.7 mm).

5.0 CONDITIONS OF USE

The Powers 8 mm Head Spiral CSI Pin and 10 mm Head Drive Pin power-driven 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 published installation instructions. In the event of conflict between this report and the manufacturer's published installation instructions, this report governs.
- 5.2** 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 to be constructed.
- 5.3** 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.
- 5.4** Except for fasteners used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7, use of fasteners to resist earthquake loads is beyond the scope of this report.
- 5.5** Use of fasteners is limited to dry, interior locations.
- 5.6** The use of fasteners is limited to installation in uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.
- 5.7** Use of fasteners in contact with preservative-treated or fire-retardant-treated wood is not permitted.

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 October 2006.

7.0 IDENTIFICATION

Each fastener is identified by a "P" stamped onto the head of the fastener, as shown in Figure 2. Each package of fasteners is labeled with the report holder or listee name (Powers Fasteners, Inc., or Max Co., Ltd.), as applicable and the fastener catalog number, length and diameter, and evaluation report number (ESR-1995).

8.0 OTHER CODES

8.1 Scope:

In addition to the 2009 IBC and IRC, 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 Powers 8 mm Head Spiral CSI Pin and 10 mm Head Drive Pin power-driven 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. They are also alternatives to bolts used to attach materials to structural steel. 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 Substrate Materials:

8.3.2.1 Concrete: See Section 3.2.1. Under the UBC, concrete must conform to Section 1903.

8.3.2.2 Steel Substrates: See Section 3.2.2.

8.4 Design and Installation:

8.4.1 Design: See Section 4.1. 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. Except for fasteners used with architectural,

electrical and mechanical components as described in Section 9.6.1 of ASCE/SEI 7-02 (2003 IBC and 2003 IRC) or Section 13.1.4 of ASCE/SEI 7 (2006 IBC and 2006 IRC), use of fasteners to resist earthquake loads is outside the scope of this report.

8.4.1.1 Wood to Steel or Concrete: See Section 4.1.1. Reference lateral design values for fasteners determined in accordance with Part 11 of ANSI/AF&PA NDS (2006 & 2003 IBC and 2006 & 2003 IRC) or Section 2318.3 of the UBC, as applicable, are applicable to the 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 2 through 6. The stress increases and load reductions described in Section 1605.3 of the 2003 and 2006 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 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 9.6.1 of ASCE/SEI 7-02 (2003 IBC and IRC) or Section 13.1.4 of ASCE/SEI 7 (2006 IBC and IRC), as applicable, 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—RECOGNIZED FASTENERS

CATALOG NUMBER	SHANK TYPE	SHANK DIAMETER (inch)	SHANK LENGTH (inches)
8 mm Head Spiral CSI Pins			
50201	Spiral	0.157	$\frac{5}{8}$
50203	Spiral	0.157	$\frac{3}{4}$
50204	Spiral	0.157	$\frac{7}{8}$
50205	Spiral	0.157	1
50208	Spiral	0.157	$1\frac{1}{4}$
50207	Spiral	0.157	$1\frac{1}{2}$
50217	Spiral	0.157	$1\frac{5}{8}$
50209	Spiral	0.157	2
50211	Spiral	0.157	$2\frac{7}{8}$
10 mm Head Drive Pins¹			
50850	Smooth	0.177	1
50852	Smooth	0.177	$1\frac{1}{4}$
50854	Smooth	0.177	$1\frac{5}{8}$
50856	Smooth	0.177	2
50858	Smooth	0.177	$2\frac{1}{2}$
50860	Smooth	0.177	$2\frac{7}{8}$
50862	Smooth	0.177	$3\frac{1}{4}$

For SI: 1 inch = 25.4 mm.

¹Also sold by Max Co., Ltd. as Powerlite 10 mm Head Drive Pin.

TABLE 2—ALLOWABLE LOADS FOR FASTENERS INSTALLED IN NORMAL-WEIGHT CONCRETE (lbf)^{1,2,3,4,5}

FASTENER DESCRIPTION	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inches)	MINIMUM CONCRETE COMPRESSIVE STRENGTH, <i>f_c</i>			
			2,500 psi		4,500 psi	
			Tension	Shear	Tension	Shear
8mm Head Spiral CSI Pin	0.157	$\frac{3}{4}$	120	170	–	–
		$1\frac{1}{4}$	310	385	–	–
10 mm Head Drive Pin	0.177	$\frac{3}{4}$	70	95	70	100
		$1\frac{1}{4}$	215	210	160	170

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

¹The fasteners must not be driven until the concrete has reached the minimum designated compressive strength.

²Concrete thickness must be a minimum of three times the embedment depth.

³The allowable tension and shear values are for the fasteners only. Steel or wood members connected to the concrete must be investigated for compliance with the applicable code.

⁴Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.5.2 of this report.

⁵The stress increases described in Section 1605.3.2 of the IBC, and Section 1612.3.2 of the UBC, are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.

TABLE 3—ALLOWABLE LOADS FOR FASTENERS INSTALLED IN STRUCTURAL SAND-LIGHTWEIGHT CONCRETE WITH *f_c* = 3,000 psi (lbf)^{1,2,3,4,5}

FASTENER DESCRIPTION	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inches)	TENSION	SHEAR
10 mm Head Drive Pin	0.177	$1\frac{1}{4}$	195	205
		$1\frac{5}{8}$	410	395

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

¹The fasteners must not be driven until the concrete has reached the minimum designated compressive strength.

²Concrete thickness must be a minimum of three times the embedment depth.

³The allowable tension and shear values are for the fasteners only. Steel or wood members connected to the concrete must be investigated for compliance with the applicable code.

⁴Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.5.2 of this report.

⁵The stress increases described in Section 1605.3.2 of the IBC, and Section 1612.3.2 of the UBC, are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.

TABLE 4—ALLOWABLE LOADS FOR FASTENERS INSTALLED THROUGH STEEL DECK INTO STRUCTURAL SAND-LIGHTWEIGHT CONCRETE WITH $f_c = 3,000$ psi (lbf)^{1,2,3,5,6}

FASTENER DESCRIPTION	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inches)	INSTALLATION IN UPPER FLUTE		INSTALLATION IN LOWER FLUTE ⁴		
			Tension	Shear	Tension	Shear Towards the Free Edge	Shear Parallel to the Free Edge
10 mm Head Drive Pin	0.177	1 ¹ / ₄	285	425	145	270	315
		1 ⁵ / ₈	315	485	170	280	315

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

¹The fasteners must not be driven until the concrete has reached the minimum designated compressive strength.

²The allowable tension and shear values are for the fasteners only. Steel or wood members connected to the concrete must be investigated for compliance with the applicable code.

³The tabulated allowable load values are applicable to fasteners installed through the underside of a steel deck into structural sand-lightweight concrete. The steel deck must have a minimum base-metal thickness of 0.034 inch, and a yield strength of 40 ksi, and must conform to dimensions shown in Figure 1. Structural lightweight concrete fill depth must be a minimum of 3¹/₄ inches above the deck.

⁴For fasteners installed into the lower flute of the deck, the minimum edge distance is 1¹/₈ inches from the edge of the deck rib.

⁵Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.5.2 of this report.

⁶The stress increases described in Section 1605.3.2 of the IBC and Section 1612.3.2 of the UBC, are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.

TABLE 5—ALLOWABLE LOADS FOR FASTENERS INSTALLED IN ASTM A 36 STEEL (lbf)^{1,2,4,5}

FASTENER DESCRIPTION	SHANK DIAMETER (inch)	MINIMUM STEEL THICKNESS (inch)							
		³ / ₁₆		¹ / ₄		³ / ₈		¹ / ₂ ³	
		Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
8mm Head Spiral CSI Pin	0.157	–	–	735	535	615	495	535	565
10 mm Head Drive Pin	0.177	95	545	150	545	245	755	640	600

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

¹The allowable tension and shear values are for the fasteners only. Steel or wood members connected to the steel must be investigated for compliance with the applicable code.

²Fasteners must be driven to obtain the minimum embedment with the point of the fastener point penetrating through the steel base material.

³For steel thicknesses greater than ¹/₂ inch, the fasteners must be embedded a minimum of 0.50 inch.

⁴Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.5.2 of this report.

⁵The stress increases described in Section 1605.3.2 of the IBC and Section 1612.3.2 of the UBC, are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.

TABLE 6—ALLOWABLE LOADS FOR FASTENERS INSTALLED IN ASTM A 572 GRADE 50 STEEL (lbf)^{1,2,4,5}

FASTENER DESCRIPTION	SHANK DIAMETER (inch)	MINIMUM STEEL THICKNESS (inch)							
		³ / ₁₆		¹ / ₄		³ / ₈		¹ / ₂ ³	
		Tension	Shear	Tension	Tension	Tension	Shear	Tension	Shear
8mm Head Spiral CSI Pin	0.157	–	–	795	580	660	535	580	610
10 mm Head Drive Pin	0.177	215	650	295	735	355	785	–	–

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

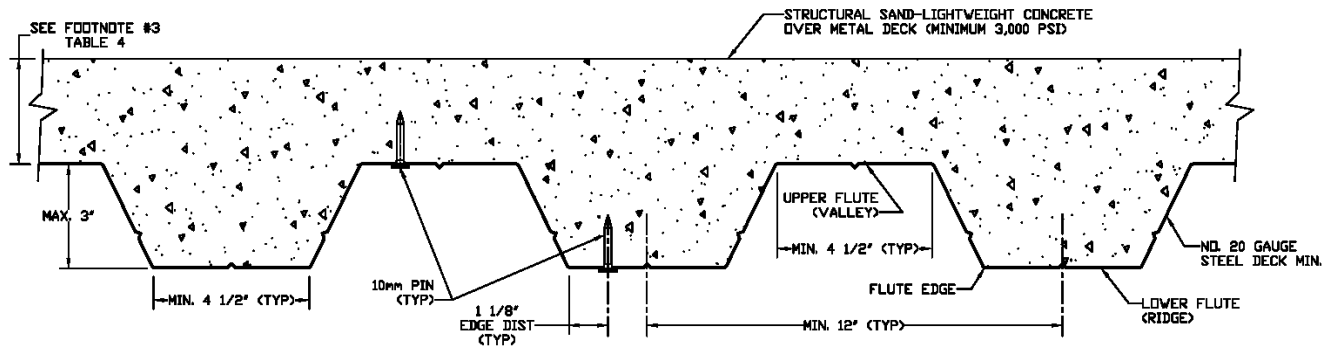
¹The allowable tension and shear values are for the fasteners only. Steel or wood members connected to the steel must be investigated for compliance with the applicable code.

²Fasteners must be driven to obtain the minimum embedment with the point of the fastener point penetrating through the steel base material.

³For steel thicknesses greater than ¹/₂ inch, the fasteners must be embedded a minimum of 0.50 inch.

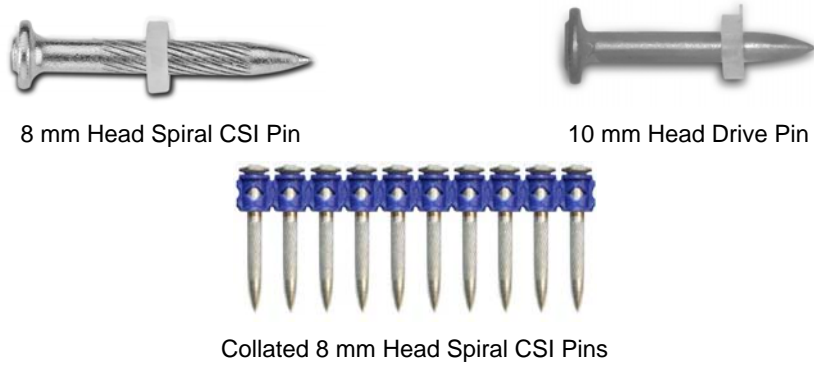
⁴Earthquake load resistance is outside the scope of this report, except as noted in Sections 5.4 and 8.5.2 of this report.

⁵The stress increases described in Section 1605.3.2 of the IBC and Section 1612.3.2 of the UBC, are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.



For SI: 1 inch = 25.4 mm.

FIGURE 1—FASTENER INSTALLATION LOCATION IN COMPOSITE DECK



8 mm Head Spiral CSI Pin

10 mm Head Drive Pin

Collated 8 mm Head Spiral CSI Pins

FIGURE 2—FASTENER TYPES