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ESR-4110

Issued 11/2018
This report is subject to renewal 11/2019.

DIVISION: 03 00 00—CONCRETE
SECTION: 03 16 00—CONCRETE ANCHORS
DIVISION: 04 00 00—MASONRY
SECTION: 04 05 19.16—MASONRY ANCHORS
DIVISION: 05 00 00—METALS
SECTION: 05 05 23—METAL FASTENINGS

REPORT HOLDER:

AEROSMITH FASTENING SYSTEMS

EVALUATION SUBJECT:

AEROSMITH 2193HP POWERPIN® FASTENERS

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DIVISION: 05 00 00—METALS
Section: 05 05 23—Metal Fastenings

REPORT HOLDER:

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EVALUATION SUBJECT:

AEROSMITH 2193HP POWERPIN® FASTENERS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012, 2009, and 2006 *International Building Code®* (IBC)
- 2018, 2015, 2012, 2009, and 2006 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

Aerosmith 2193HP PowerPin® power-driven fasteners are used for general fastening of building components, such as cold-formed steel framing members, to uncracked normalweight concrete, sand-lightweight concrete, steel decks filled with sand-lightweight concrete, concrete masonry units (CMUs) and steel base materials. The fasteners are used as alternatives to the cast-in-place concrete anchors described in IBC Section 1901.3 (2012 IBC Section 1908; 2009 and 2006 IBC Section 1911) for placement in concrete; the embedded anchors described in Section 8.1.3 of TMS 402 referenced in Section 2107 of the IBC (Section 2.1.4 of TMS 402-11, -08, and -05, referenced in Section 2107 of the 2012, 2009 and 2006 IBC, respectively); and to the welds and bolts used to attach to steel, described in IBC Sections 2204.1 and 2204.2, respectively. For structures regulated under the IRC, the fasteners may also be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 Aerosmith 2193HP PowerPin® Fasteners:

The fasteners are manufactured from steel complying with ASTM A510, grades 1060 or 1062, and austempered to a Rockwell "C" core hardness of 52-56. All fasteners have a straight, smooth shank with a diameter of 0.109 inch (2.77 mm), and a head diameter of 0.25 inch (6.4 mm). The minimum effective length of the fastener is 0.03 inch (0.762 mm) less than the nominal fastener length. Fasteners for installation into concrete have either a black oxide or a zinc-plated finish. Fasteners for installation into steel and concrete masonry have a zinc-plated finish. The fasteners are supplied in collated strips. See Figure 2.

3.2 Substrate Materials:

3.2.1 Concrete: Normalweight and sand-lightweight concrete must comply with IBC Chapter 19 or IRC Section R402.2, as applicable. The minimum concrete compressive strength at the time of fastener installation must be as noted in the applicable allowable load table.

3.2.2 Steel Deck Panels: Steel deck panels must conform to a code-referenced material standard, with the minimum thickness and minimum yield strength and tensile strength noted in Table 2. See Figure 1 for panel configuration requirements.

3.2.3 Concrete Masonry: Concrete masonry units (CMUs) must be minimum 8-inch-thick (203 mm), normalweight blocks conforming to ASTM C90. Mortar must be minimum Type S mortar complying with the ASTM C270. The masonry wall must have a minimum compressive strength, f'_m of 1,800 psi (12.41 MPa).

3.2.4 Structural Steel: Structural steel used in supports must comply with the minimum strength requirements of ASTM A36, and must have a thickness as noted in Table 4.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Selection of fasteners must take into consideration the applicable base material and the length of the fastener. The minimum fastener length must be determined as follows:

- Unless otherwise noted, for installation into concrete, concrete-filled steel deck panels, concrete masonry and steel base materials, the minimum effective shank length must equal or exceed the sum of the thickness of the attached material and the minimum embedment depth (penetration) shown in the applicable tables in this report.
- For installation through steel base materials, the minimum effective shank length must equal or exceed the sum of the following: the thickness of the attached

material, the thickness of the base material and the required point penetration shown in Table 4.

4.1.2 Allowable Loads: The most critical applied loads, excluding seismic load effects, resulting from the load combinations in IBC Section 1605.3.1 or 1605.3.2, must not exceed the allowable loads described in this section. For fasteners which are subjected to seismic loads, see Section 4.1.5 for additional information. The allowable shear and tension (pullout) values in Tables 1 through 4 are for use in allowable stress design (ASD). The allowable loads apply to the interaction between the fasteners and the specified base materials only, and limit states such as pull-over and lateral bearing, which are governed by the properties of attached materials, are outside the scope of this report. Design of the connection to the attached material must comply with the applicable requirements of the IBC. The stress increases and load reductions described in Section 1605.3.2 of the IBC are not allowed.

Allowable shear and tension values for Aerosmith 2193HP PowerPin® fasteners driven into uncracked normalweight concrete are shown in Table 1. Allowable shear and tension values for fasteners driven into sand-lightweight concrete, with or without metal deck, are shown in Table 2. Allowable shear and tension values for fasteners driven into concrete masonry are shown in Table 3. Allowable shear and tension values for fasteners driven into steel are shown in Table 4.

4.1.3 Combined Loading: For fasteners subjected to both shear and tension loads, compliance with the following interaction equation must be verified:

$$(p/P_a) + (v/V_a) \leq 1$$

where:

p = Actual applied tension load on fastener, lbf (N).

P_a = Allowable tension load for the fastener, lbf (N).

v = Actual applied shear load on fastener, lbf (N).

V_a = Allowable shear load for the fastener, lbf (N).

4.1.4 Steel-to-steel Connections: When the fasteners are used in connections of two steel elements in accordance with Section J5 of AISI S100-16 (Section E5 of AISI S100-12 for the 2015, 2012, 2009, and 2006 IBC), connection capacity must be determined in accordance with Sections 4.1.4.1 and 4.1.4.2, as applicable.

4.1.4.1 Connection Strength - Tension: To determine tensile connection strength in accordance with Section J5.2 of AISI S100-16 (Section E5.2 of AISI S100-12), the fastener tension strength, pull-out strength and pull-over strength must be known. These characteristics must be determined as follows:

- **PAF Tensile Strength:** The allowable fastener tension strengths must be calculated in accordance with Section J5.2.1 of AISI S100-16 (Section E5.2.1 of AISI S100-12) using a value of 260,000 psi for F_{uh}.
- **Pull-out Strength:** See Table 4 for available pull-out strength.
- **Pull-over Strength:** The available pull-over strengths must be calculated in accordance with Section J5.2.3 of AISI S100-16 (Section E5.2.3 of AISI S100-12).

4.1.4.2 Connection Strength - Shear: To determine shear connection strength in accordance with Section J5.3 of AISI S100-16 (Section E5.3 of AISI S100-12), the fastener shear strength, bearing and tilting strength, pull-out strength in shear, net section rupture strength and shear strength limited by edge distance must be known. These characteristics must be determined as follows:

- **PAF Shear Strength:** The allowable fastener shear strengths must be calculated in accordance with Section J5.3.1 of AISI S100-16 (Section E5.3.1 of AISI S100-12) using a value of 260,000 psi for F_{uh}.
- **Bearing and Tilting Strength:** The available bearing and tilting strengths must be calculated in accordance with Section J5.3.2 of AISI S100-16 (Section E5.3.2 of AISI S100-12).
- **Pull-out Strength in Shear:** The available pull-out strength in shear must be the applicable allowable shear strength from Table 4, or must be calculated in accordance with Section J5.3.3 of AISI S100-16 (Section E5.3.3 of AISI S100-12).
- **Net Section Rupture Strength and Shear Strength Limited by Edge Distance:** The net section rupture strength must be determined in accordance with Section J5.3.4 of AISI S100-16 (Section E5.3.4 of AISI S100-12) and the shear strength limited by edge distance must be determined in accordance with Section J5.3.5 of AISI S100-16 (Section E5.3.5 of AISI S100-12).

4.1.5 Seismic Considerations: The fasteners are recognized for use when subjected to seismic loads as follows:

1. The Aerosmith 2193HP PowerPin® fasteners may be used for attachment of nonstructural components listed in Section 13.1.4 of ASCE 7, which are exempt from the requirements of ASCE 7.
2. Concrete base materials: The fasteners installed in concrete may be used to support acoustical tile or lay-in panel suspended ceiling systems, distributed systems and distribution systems where the service load on any individual fastener does not exceed the lesser of 90 lbf (400 N) or the published allowable load shown in Tables 1 and 2, as applicable.
3. Steel base materials: The fasteners installed in steel may be used where the service load on any individual fastener does not exceed the lesser of 250 lbf (1112 N) or the published allowable load shown in Table 4.
4. Interior, nonstructural walls: For interior, nonstructural walls that are not subject to sustained tension loads and are not a bracing application, the power-driven fasteners described in Section 3.1 may be used to attach steel tracks to concrete or steel in all Seismic Design Categories. In Seismic Design Categories D, E and F, the allowable shear load due to transverse pressure must be no more than 90 pounds (400 N) when attaching to concrete; or 250 pounds (1,112 N) when attaching to steel. Substantiating calculations are submitted addressing the fastener-to-base material capacity and the fastener-to-attached material capacity. Interior nonstructural walls are limited to locations where bearing walls, shear walls or braced walls are not required by the approved plans. The design load on the fastener must not exceed the allowable load shown in Tables 1, 2 and 4, as applicable.

4.2 Installation:

The fasteners must be installed with a power fastening tool in accordance with Aerosmith Fastening Systems' recommendations. The fastening procedures must comply with Aerosmith Fastening Systems' published installation instructions. These instructions must be available on the jobsite at all times during installation.

The fasteners must be installed with the fastener penetration, spacing and edge distances specified in this report. Concrete thickness must be a minimum of three

times the fastener penetration. Face shell thickness of CMUs must be a minimum of $1^1/_4$ inches (32 mm). Fasteners must not be installed into concrete until the concrete has reached the specified compressive strength. Installation is limited to dry, interior environments.

5.0 CONDITIONS OF USE

Aerosmith 2193HP PowerPin® 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 are manufactured and identified in accordance with this report.

5.2 Fastener installation complies with this report and the Aerosmith Fastening Systems' published installation instructions. In the event of conflict between this report and Aerosmith Fastening Systems' published installation instructions, the more restrictive requirements govern.

5.3 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.

5.4 For steel-to-steel connections that meet the applicability requirements of Section J5 of AISI S100-16 (Section E5 of AISI S100-12), calculations demonstrating that the available connection strength has been determined in accordance with Section J5 of AISI S100-16 (Section E5 of AISI S100-12) and Section 4.1.4 of this report, and equals to or exceeds the applied load, must be submitted to the code official. 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.

5.5 The minimum concrete thickness must be three times the fastener embedment.

5.6 See Section 4.1.5 for seismic considerations.

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

5.8 Use of fasteners is limited to dry, interior locations, which include exterior walls which are protected by an exterior wall envelope.

5.9 The Aerosmith 2193HP PowerPin® products addressed in this report are manufactured under a quality-control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Power-actuated Fasteners Driven into Concrete, Steel and Masonry Elements (AC70), dated February 2016 (editorially revised November 2017).

7.0 IDENTIFICATION

7.1 Containers of fasteners are identified with the company's name (Aerosmith Fastening Systems), the product name (Aerosmith 2193HP PowerPin® Fasteners), the fastener catalog number and length, quantity, the manufacturing date and the evaluation report number (ESR-4110). In addition, each fastener is identified by the logo symbol stamped into the fastener head as shown in Figure 3.

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

AEROSMITH FASTENING SYSTEMS
5621 DIVIDEND ROAD
INDIANAPOLIS, INDIANA 46241
(800) 528-8183
www.aerosmithfastening.com
info@aerosmithfastening.com

TABLE 1—ALLOWABLE TENSION AND SHEAR VALUES FOR AEROSMITH 2193HP POWERPIN® FASTENERS INSTALLED IN UNCRACKED NORMALWEIGHT CONCRETE[1]

FASTENER PART NUMBER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	ALLOWABLE LOADS (lbf)			
Concrete Compressive Strength:					2,500 psi		4,000 psi	
Load Direction:					Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)
2193HP	0.109	5/8	4	3 3/16	60	55	55	95
2193HP	0.109	3/4	4	3 3/16	60	80	55	115

For **SI:** 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1 psi = 6.895 kPa.

[1]The fasteners must not be driven until the concrete has reached the designated minimum compressive strength. Minimum concrete thickness is three times the fastener embedment into the concrete.

TABLE 2—ALLOWABLE TENSION AND SHEAR VALUES FOR AEROSMITH 2193HP POWERPIN® FASTENERS INSTALLED IN MINIMUM 3,000 psi SAND-LIGHTWEIGHT CONCRETE[1]

FASTENER PART NUMBER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE[3] (inches)	INSTALLED IN CONCRETE		INSTALLED THROUGH METAL DECK[4] (LOWER FLUTE)	
					Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)
2193HP	0.109	5/8	6	6	35	55	30	205
2193HP	0.109	3/4	6	6	80	100	40	235

For **SI:** 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1 psi = 6.895 kPa, 1 ksi = 6.895 Mpa.

[1]The fasteners must not be driven until the concrete has reached the designated minimum compressive strength. Minimum concrete thickness is three times the fastener embedment into the concrete.
[2]For fasteners installed through steel deck, the fastener must be installed through the lower flutes of the steel deck and into minimum 3,000 psi sand-lightweight concrete, with minimum edge distances of 1 1/8 inches from the edge of the steel deck and 4 inches from the end of the deck. See Figure 1.
[3]The allowable values are applicable to fasteners installed through the underside of a steel deck at the ribs and into minimum 3,000 psi sand-lightweight concrete. See Figure 1. The steel deck must have a minimum base-metal thickness of 0.034 inch and conform to ASTM A653 SS Grade 40, or higher. For ASTM A653 SS Grade 33 deck with a yield strength of 33 ksi, the tabulated shear values must be multiplied by 0.68. For steel decks having a yield strength of 38 ksi, tabulated shear values must be multiplied by 0.78.

TABLE 3—ALLOWABLE TENSION AND SHEAR VALUES FOR AEROSMITH 2193HP POWERPIN® FASTENERS INSTALLED IN CONCRETE MASONRY UNITS (CMUs)[1,2,6]

FASTENER PART NUMBER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING[4] (inches)	MINIMUM EDGE DISTANCE[5] (inches)	ALLOWABLE LOADS (lbf) FOR HOLLOW CMU (ANY LOCATION)[6]	
					Tension (lbf)	Shear (lbf)
2193HP	0.109	5/8	6	5	35	50

For **SI:** 1 lbf = 4.448 N, 1 inch = 25.4 mm.

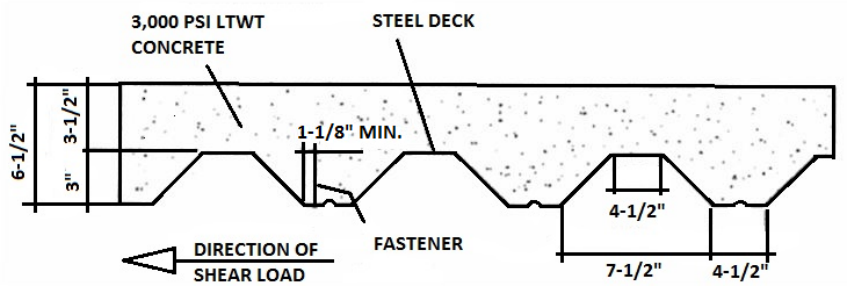
[1]See section 3.2.3 for CMU and mortar requirements.
[2] Face shell thickness of the CMUs must be a minimum of 1 1/4 inches.
[3]Applies to fasteners installed along the bed joint.
[4]Minimum distance from the edge of the wall.
[5]Fastener installed into face shell of CMU must be located a minimum of 1 inch from the mortar joints, center web and end web of the CMUs.
[6]No more than one fastener may be installed in an individual CMU cell.

TABLE 4—ALLOWABLE TENSION AND SHEAR VALUES FOR AEROSMITH 2193HP POWERPIN® FASTENERS INSTALLED IN ASTM A36 STEEL

FASTENER PART NUMBER	SHANK DIAMETER (inch)	MINIMUM SPACING (inch)	MINIMUM EDGE DISTANCE (inch)	STEEL THICKNESS (inch)					
				3/16[2]		1/4[2]		3/8[3]	
				Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)
2193HP	0.109	1	1/2	195	292	223	278	181	186

For **SI:** 1 lbf = 4.448 N, 1 inch = 25.4 mm.

[1]Fasteners installed in 3/16- and 1/4-inch-thick steel must penetrate the steel such that the shank pierces the steel and protrudes 0.16 and 0.10 inch, respectively.
[2]Fasteners must have 0.32-inch fastener penetration when installed into 3/8-inch-thick steel. For steel-to-steel connections designed in accordance with Section 4.1.4, the tabulated allowable tension load may be increased by a factor of 1.25, and the design tension strength may be taken as the tabulated allowable tension load multiplied by a factor of 2.0.



SECTION – COMPOSITE DECK – NO SCALE

For **SI:** 1 inch = 25.4 mm.

FIGURE 1—AEROSMITH 2193HP POWERPIN® FASTENER INSTALLATION LOCATION IN COMPOSITE DECK

FIGURE 2—AEROSMITH 2193HP POWERPIN® FASTENER

FIGURE 3—AEROSMITH 2193HP POWERPIN® FASTENER HEAD STAMP