

ICC-ES Evaluation Report

ESR-3453



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DIVISION: 03 00 00— CONCRETE Section: 03 16 00— Concrete Anchors DIVISION: 05 00 00— METALS Section: 05 05 23— Metal Fastenings DIVISION: 09 00 00— FINISHES Section: 09 22 16.23— Fasteners	REPORT HOLDER: AEROSMITH FASTENING SYSTEMS 	EVALUATION SUBJECT: AEROSMITH 5000 SERIES FASTENERS	
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1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, 2009 and 2006 [International Building Code® \(IBC\)](#)
- 2015, 2012, 2009 and 2006 [International Residential Code® \(IRC\)](#)

Property evaluated:

- Structural

2.0 USES

Aerosmith 5000 Series fasteners are power-actuated fasteners (PAFs) used for fastening of building components to normalweight concrete, sand-lightweight concrete, sand-lightweight concrete filled steel deck panels and structural steel substrates. The fasteners are used as alternatives to cast-in-place anchors described in 2015 IBC Section 1901.3 (2012 IBC Section 1908; 2009 and 2006 IBC Section 1911) for placement in concrete and to the welds and bolts used to attach to steel, described in IBC Sections 2204.1 and 2204.2. 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 General:

See [Table 1](#) in this report for recognized fastener designations, shank descriptions, fastener dimensions, coating information and applicable base materials. The fasteners are available in various lengths to achieve embedment depths as noted [Tables 2](#) through [5](#).

3.2 Aerosmith 5000 Series Fasteners:

The 5000 Series fasteners are manufactured from steel complying with ASTM A510, Grade 1060 or 1062, and austempered to a Rockwell “C” core hardness of 52 to 56.

The 5000 Series fasteners have a nominal shank diameter of 0.145 inch (3.7 mm) and a nominal head diameter of 0.300 inch (7.6 mm). All of the 5000 Series fasteners have a zinc-plated finish.

3.3 Substrate Materials:

3.3.1 Structural Steel: Structural steel used in supports must comply with the minimum strength requirements of ASTM A36 and must have thicknesses as noted in [Table 5](#).

3.3.2 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.

3.3.3 Steel Deck Panels: Steel deck panels must conform to a code-referenced material standard, with the minimum thickness and minimum yield strength and specified tensile strength noted in [Table 4](#). See [Figure 1](#) for panel configuration requirements.

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 and steel base materials, the minimum effective shank length shown in [Table 1](#) must equal or exceed the sum of the thickness of the attached material and the minimum embedment depth (penetration) shown in [Tables 2, 3](#) and [4](#), as applicable.
- For installation through steel base materials, the minimum effective shank length shown in [Table 1](#) 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 5](#).

4.1.2 Allowable Loads: The applicable allowable shear and tension load tables for the Aerosmith 5000 Series fasteners driven into different base materials may be determined by referencing [Table 1](#). 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 the tables of this report 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. When designing the connection of wood members to the base material, the bending yield strength of the PAFs can be assumed to be the same as that of a nail with the same shank diameter. The stress increases and load reductions described in IBC Section 1605.3 are not allowed.

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 Aerosmith 5000 Series fasteners listed in [Table 5](#) are used in connections of two steel elements in accordance with Section E5 of AISI S100-12, 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 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 E5.2.1 of AISI S100-12 using a value of 260,000 psi for F_{uh} .
- **Pull-out Strength:** See [Table 5](#) for available pull-out strengths.

- **Pull-over Strength:** The available pull-over strengths must be calculated in accordance with Section E5.2.3 of AISI S100-12.

4.1.4.2 Connection Strength - Shear: To determine shear connection strength in accordance with 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 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 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 5](#) or must be calculated in accordance with 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 E5.3.4 of AISI S100-12 and the shear strength limited by edge distance must be determined in accordance with 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 5000 Series 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 base materials 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 in [Tables 2, 3 and 4](#), 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 5](#).
4. Interior, Nonstructural Walls: For interior, nonstructural walls that are not subject to sustained tension loads and are not a bracing application, the PAFs described in Section 3.0 may be used to attach steel track 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 2 through 5](#), as applicable.

4.2 Installation:

4.2.1 General: The fasteners must be installed in accordance with this report and the Aerosmith Fastening Systems installation instructions. A copy of these instructions must be available on the jobsite at all times during installation.

A pneumatic fastening tool, recommended by Aerosmith Fastening Systems, must be used to install the fasteners. The fastener penetration, spacing and edge distances must be as noted in the tables of this report. For fasteners installed into concrete, the fasteners must not be driven until the concrete has reached the designated compressive strength.

4.2.2 Use with Treated Lumber: The Aerosmith 5000 Series fasteners described in [Table 1](#) may be used in contact with fire-retardant-treated wood in dry, interior locations only, in accordance with 2015 IBC Section 2304.10.5.4 (2012 and 2009 IBC Section 2304.9.5.4) and Aerosmith's recommendations. Use of fasteners in contact with preservative-treated wood or fire-retardant-treated wood in exterior applications is outside the scope of this report.

5.0 CONDITIONS OF USE:

The Aerosmith Fastening Systems Brand 5000 Series 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 manufactured and identified in accordance with this report.
- 5.2 Fastener installation complies with this report and Aerosmith Fastening Systems published installation instructions. In the event of a conflict between this report and the published installation instructions, the more restrictive requirements govern.
- 5.3 Calculations demonstrating that the applied loads are less than the maximum allowable loads described in Section 4.1.1 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.
- 5.4 For steel-to-steel connections that meet the applicability requirements of Section E5 of AISI S100-12, calculations demonstrating that the available connection strength has been determined in accordance with 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 Refer to Section 4.1.5 for seismic considerations.
- 5.6 The minimum concrete thickness must be three times the fastener embedment in concrete, except where noted otherwise in this report.
- 5.7 The use of fasteners is limited to uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.
- 5.8 Installation must be limited to dry interior environments, which include exterior walls which are protected by an exterior wall envelope.
- 5.9 Refer to Section 4.2.2 regarding the use of fasteners in contact with preservative-treated or fire-retardant-treated wood.
- 5.10 The Aerosmith 5000 Series fasteners 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.

7.0 IDENTIFICATION

- 7.1 The containers of the fasteners are labeled with the company name (Aerosmith Fastening Systems); the fastener product name, length, catalog number, and quantity; the evaluation report number (ESR-3453); and the manufacturing date. In addition, the fasteners are identified by marking on the head of each fastener, as shown in [Figure 2](#).
- 7.2 The report holder's contact information is the following:

AEROSMITH FASTENING SYSTEMS
5621 DIVIDEND ROAD
INDIANAPOLIS, INDIANA 46241
(317) 243-5959
www.aerosmithfastening.com

TABLE 1—FASTENER DESCRIPTIONS AND APPLICATIONS

FASTENER DESIGNATIONS ¹	SHANK TYPE	SHANK DIAMETER (inch)	HEAD DIAMETER (inch)	MAXIMUM POINT LENGTH (inch)	MINIMUM EFFECTIVE SHANK LENGTH (inch)	FASTENER COATING	APPLICABLE BASE MATERIAL	APPLICABLE LOAD TABLES
5253 5323 5383 5503 5633	Smooth, straight	0.145	0.300	0.280	Designated shank length minus 0.03 inch	Zinc	Concrete	2, 3
							Conc.-filled deck	4
							Steel	5

For SI: 1 inch = 25.4 mm.

¹Only the first numbers, which correspond to specific product lengths are shown. Additional letters and numbers included in the fastener designation to indicate applicable Aerosmith tool, quantity in package, etc., are not shown.

TABLE 2—ALLOWABLE TENSION AND SHEAR VALUES FOR FASTENERS INSTALLED IN NORMALWEIGHT CONCRETE¹

PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	SHANK DESCRIPTION	MINIMUM EMBEDMENT DEPTH (inches)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	ALLOWABLE LOADS (lbf)			
Concrete Compressive Strength:						2500 psi		4000 psi	
Load Direction:						Tension	Shear	Tension	Shear
5000 ²	0.145	Smooth-straight	3/4	5.1	3.2	50	66	100	104
			1			152	166	157	182
			1 1/4			159	265	179	267
			1 1/2			154	340	209	342

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 6.89 kPa.

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

²See [Table 1](#) for specific applicable fasteners.

TABLE 3—ALLOWABLE TENSION AND SHEAR VALUES FOR FASTENERS INSTALLED IN MINIMUM 3000 psi SAND-LIGHTWEIGHT CONCRETE¹

PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	SHANK DESCRIPTION	MINIMUM EMBEDMENT DEPTH (inches)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	ALLOWABLE LOADS (lbf)	
						Tension	Shear
5000 ²	0.145	Smooth-straight	3/4	4	3.2	167	179
			1			200	228
			1 1/4			333	400
			1 1/2			391	410

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 6.89 kPa.

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

²See [Table 1](#) for specific applicable fasteners.

**TABLE 4—ALLOWABLE TENSION AND SHEAR VALUES FOR FASTENERS
INSTALLED THROUGH METAL DECK INTO MINIMUM 3000 psi SAND-LIGHTWEIGHT CONCRETE¹**

PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	SHANK DESCRIPTION	MINIMUM EMBEDMENT DEPTH (inches)	MINIMUM SPACING (inches)	ALLOWABLE LOADS (lbf)	
Deck Type:					3-INCH DEEP W TYPE STEEL DECK ^{2,3}	
Fastener Location:					Lower Flute	
Load Direction:					Tension	Shear
5000 ⁴	0.145	Smooth-straight	³ / ₄	4	76	260
			1		134	265
			1 ¹ / ₄		157	269
			1 ¹ / ₂		233	346

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 6.89 kPa.

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

²The fastener must be installed through the lower flutes of the metal deck with a minimum edge distance of 1¹/₈ inches from the edge of the steel deck web and 4 inches from the end of the deck. Concrete thickness above the deck must be a minimum of 3¹/₂ inches. See [Figure 1](#) of this report.

³The steel deck must be configured as shown in [Figure 1](#), have a minimum base-metal thickness of 0.035 inch, and have a minimum yield strength of 50 ksi and a minimum tensile strength of 65 ksi.

⁴See [Table 1](#) for specific applicable fasteners.

TABLE 5—ALLOWABLE TENSION AND SHEAR VALUES FOR FASTENERS INSTALLED IN ASTM A36 STEEL¹

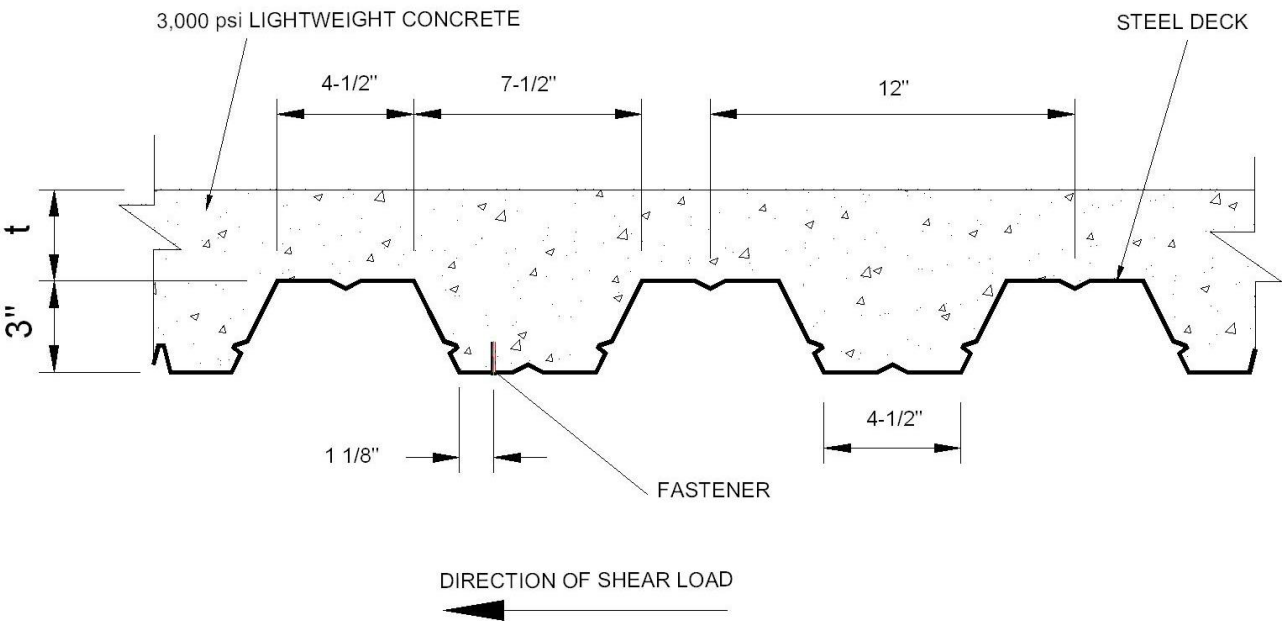
PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	TYPE OF SHANK	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	ALLOWABLE LOADS (lbf)							
Steel Thickness (inch):					³ / ₁₆		¹ / ₄		³ / ₈		¹ / ₂	
Load Direction:					Tension ³	Shear	Tension ³	Shear	Tension	Shear	Tension	Shear
5000	0.145	Smooth	1	¹ / ₂	81	373	181	273	397	489	243 ²	277 ²

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.45 N.

¹Except where noted otherwise in this table, the allowable load values shown are for fastenings that have the entire pointed end of the fastener driven through the steel plate.

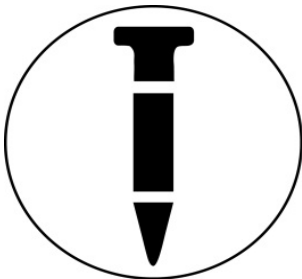
²Fastener penetration into steel must be a minimum of ⁷/₁₆ inch.

³For steel-to-steel connections designed in accordance with Section 4.1.4, the tabulated allowable load may be increased by a factor of 1.25, and the design strength may be taken as the tabulated allowable load multiplied by a factor of 2.0.



For SI: 1 inch = 25.4 mm. See [Table 4](#). $t = 3\frac{1}{2}$ "

FIGURE 1—FASTENER INSTALLATION LOCATION IN SAND-LIGHTWEIGHT CONCRETE FILLED 3-INCH-DEEP STEEL DECK



AEROSMITH 5000 SERIES HEAD STAMP

FIGURE 2—FASTENER MARKING