

ICC-ES Evaluation Report

ESR-1799

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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**REPORT HOLDER:****ITW RAMSET**
700 HIGH GROVE BOULEVARD
GLENDALE HEIGHTS, ILLINOIS 60139
www.ramset.com
techsupport@ramset.com**ADDITIONAL LISTEE:****ITW BRANDS - DUO-FAST**
955 NATIONAL PARKWAY
SCHAUMBURG, ILLINOIS 60173
brandscs@itwbrands.com**EVALUATION SUBJECT:****RAMSET AND DUO-FAST POWER-DRIVEN FASTENERS,
POWER POINT FASTENERS AND ANGLE CLIP
FASTENERS****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)*

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

Property evaluated:

Structural

2.0 USES

Ramset and Duo-Fast 1500, 1600 W and 3300 Series fasteners and SP Series Power Point fasteners are used for general fastening of building components to normal-weight concrete, structural lightweight concrete, and structural lightweight concrete filled steel deck panels and steel substrates, as noted in this report. The fasteners are used as alternatives to cast-in-place anchors described in IBC Sections 1911 and 1912 and to the bolts used to attach to steel, described in IBC Section 2204.2. The fasteners may also be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

Ramset and Duo-Fast SDC and SPC Angle Clip fasteners are used for fastening of building components to normal-weight concrete and structural lightweight concrete filled steel deck panels. The Angle Clip fasteners are used as alternatives to cast-in-place anchors described in IBC Sections 1911 and 1912; and may also be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION**3.1 General:**

The fasteners are power-driven fasteners, which are fasteners that are installed using a power-driven fastening system. Power-driven fastening systems are systems that use explosive powder, gas combustion, compressed air or other gas to embed the fastener into base materials.

3.2 Ramset and Duo-Fast 1500, 1600 W and 3300 Series Fasteners:

The smooth-shank 1500 and 3300 series fasteners are manufactured from steel complying with ASTM A 510, Grades 1060 or 1062, and austempered to a Rockwell "C" core hardness of 52 to 56. The knurled-shank 1500 series fasteners are manufactured from steel complying with ASTM A 510, Grade 1060 or 1062, and austempered to a Rockwell "C" core hardness of 54 to 56. The 1600 W series fasteners are manufactured from ASTM A 510, Grades 1060 or 1062, steel and austempered to Rockwell "C" core hardness of 52 to 56 for smooth-shank fasteners and 54 to 56 for knurled-shank fasteners. Except for the 1600 series fasteners, the ITW Ramset fasteners have an approximate head diameter of 0.3 inch (7.6 mm). The 1600 series fasteners have $\frac{1}{4}$ -20 (6.4 mm - 7.87 threads/cm) threads on the end of the fasteners to be used with a nut and washer. All of the fasteners have a zinc-plated finish, except for the smooth-shank 1506B and 1508B fasteners which have a black oxide finish instead of zinc. The 1506B and 1508B fasteners are limited to installation in normal-weight concrete.

The nominal diameter of the shanks of the fasteners is as noted in Tables 1 through 4 of this report. The tables also indicate whether the shanks are straight or have a stepped shank, and indicate whether the shanks are smooth or knurled. The 1500, 1600W and 3300 series fasteners are available in lengths to achieve embedment depths as noted in the tables of this report.

3.3 Power Point Fasteners:

Ramset and Duo-Fast SP Series Power Point fasteners are straight or stepped shank series fasteners manufactured from ASTM A 510, Grade 1060 or 1062, steel austempered to a Rockwell "C" hardness of 55 to 56.

The SP Series fasteners have a head diameter of 0.3 inch (7.62 mm). Fasteners having nominal shank lengths of $\frac{7}{8}$ inch (22 mm) and less have a smooth, straight, nominally 0.150-inch-diameter (3.81 mm) shank. Fasteners having a nominal shank length of 1 inch (25.4 mm) or longer have a smooth, stepped shank with a nominally 0.150-inch (3.81 mm) diameter at the tapered end and a nominally 0.180-inch (4.57 mm) diameter at the headed end. The SP Series Power Point fasteners have a zinc-plated finish.

3.4 Angle Clip Fasteners:

Ramset and Duo-Fast SDC and SPC Angle Clip Fasteners are preassembled, power-actuated fasteners with a steel clip angle.

SDC 100 and SDC 125 fasteners have 1500 series, smooth, straight shank fasteners, described in Section 3.2 of this report, with shank lengths of 1 inch and $1\frac{1}{4}$ inches (25.4 and 31.7 mm), respectively. The clip angles have a 120-degree angle between the legs of the clip and are manufactured from $\frac{3}{4}$ -inch-wide steel strips conforming to ASTM A 635, Grade 1010, having a minimum yield strength of 33,000 psi (227 kPa) and a base-metal thickness of 0.074 inch (1.88 mm). One leg of the clip is $\frac{29}{32}$ inch long (23 mm) and the opposite leg is $\frac{3}{4}$ inch long (19.1 mm). The fasteners are assembled through dimples formed in a horizontal leg of the clip angle.

SPC 78 and SPC 114 fasteners have SP series Power Point smooth, straight shank fasteners, described in Section 3.3 of this report, with shank length of $\frac{7}{8}$ inch and $1\frac{1}{4}$ inches (22 and 31.7 mm), respectively. The clip angles have a 90-degree angle between the legs of the clips and are manufactured from $\frac{3}{4}$ -inch-wide (19.1 mm), No. 14 gage [0.0747 inch (1.90 mm) base-metal thickness], steel strips conforming to ASTM A 635, Grades 1010 or AISI 1020, steel having a minimum yield strength of 33 ksi (228 MPa) and a base-metal thickness of 0.074 inch (1.88 mm). One leg of the clip is 1 inch long (25.4 mm) and the opposite leg is $\frac{3}{4}$ inch long (19.1 mm). The fasteners are assembled through the clip with an eyelet manufactured from 5052-0 grade aluminum having a thickness of 0.032 inch (0.81 mm).

3.5 Substrate Materials:

3.5.1 Steel: Structural steel used in supports must comply with the minimum strength requirements of ASTM A 36 or ASTM A 572 Grade 50, and must have thicknesses as noted in Table 3 or 4, respectively.

3.5.2 Normal-weight Concrete: Normal-weight concrete must be stone-aggregate and comply with IBC Section 1905 or IRC Section R402.2, as applicable. The minimum concrete compressive strength at the time of fastener installation is noted in Tables 1 and 5.

3.5.3 Lightweight Concrete: Lightweight concrete must be sand-lightweight complying with IBC Section 1905. The minimum concrete compressive strength at the time of fastener installation is noted in Tables 2 and 6.

3.5.4 Steel Deck Panels: Steel deck panels must have a minimum 0.035-inch (0.889 mm) base-metal thickness and conform to the applicable material standard, with a minimum yield strength of 49.5 ksi (341 MPa). See Figure 1 for panel configuration requirements.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: The allowable shear and tension (pullout) values in the tables of this report are for use in allowable stress design, and are for fasteners driven into the

materials specified in the tables. The stress increases and load reductions described in IBC Section 1605.3, shall not be allowed for wind loads acting alone or combined with vertical loads. No adjustment shall be allowed for vertical loads acting alone. Seismic load resistance is outside the scope of this report, except for fasteners used under the IBC and IRC for attachment of architectural, electrical and mechanical components as described in the exceptions to Section 13.1.4 of ASCE/SEI 7.

The allowable shear and tension values for the fasteners and SP Series Power Point fasteners driven into normal-weight concrete are shown in Table 1 of this report. Allowable shear and tension values for these fasteners driven into structural lightweight concrete with or without a metal deck are shown in Table 2 of this report. Allowable shear and tension values for these fasteners driven into steel are shown in Tables 3 and 4 of this report.

The allowable shear and tension values for the angle clip fasteners installed in normal-weight concrete are shown in Table 5 of this report. Allowable shear and tension values for the angle clip fasteners installed through steel deck panels and into the structural lightweight concrete fill of the metal steel deck panel are shown in Table 6 of this report.

Allowable loads for fasteners installed into concrete and subjected to combined shear and tension loads are permitted to be calculated by the following equation:

$$\left(\frac{P_s}{P_t}\right) + \left(\frac{V_s}{V_t}\right) \leq 1.0$$

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: Lateral design values shall be determined in accordance with Part II of the ANSI/AF&PA NDS, with Ramset fasteners of equal or greater diameters. The wood element is the side member. The fastener bending yield strength shall be the value noted in the NDS, based on fastener diameter.

4.2 Installation:

A low-velocity, powder-actuated fastening tool, recommended by ITW Ramset or ITW Brands - Duo-Fast, must be used to install the fasteners. The fastening procedures must comply with the fastener manufacturer's published installation instructions. The fasteners must be installed with the fastener penetration, spacing and edge distances specified in this report. Except as noted in Figure 1 of this report, concrete must have a thickness of at least three times the fastener penetration. Installation is limited to dry, interior environments.

For fasteners installed into concrete, the fasteners must not be driven until the concrete has reached the designated compressive strength.

5.0 CONDITIONS OF USE

The ITW Ramset and ITW Brands - Duo-Fast power-actuated 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 ITW Ramset or ITW Brands - Duo-Fast published installation instructions. In the event of a conflict between this report and the published installation instructions, this report governs.
- 5.3 Allowable loads must comply with Section 4.1 of this report. The stress increases and load reductions described in IBC Section 1605.3 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 Calculations demonstrating that the applied loads are less than the maximum allowable loads described in this report 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 in concrete, except where noted otherwise in this report.
- 5.6 Seismic load resistance is outside the scope of this report, except as noted in Section 4.1.1 of this report.
- 5.7 Use is limited to uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.
- 5.8 Installation is limited to dry interior environments.
- 5.9 Use of the fasteners in contact with preservative-treated or fire-retardant-treated wood is outside the scope of this report.

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 2010.

7.0 IDENTIFICATION

The containers of the fasteners shall be labeled with the company name (ITW Ramset or ITW Brands - Duo-Fast); the fastener product name, length, catalog number, and quantity; the evaluation report number (ESR-1799); and the manufacturing date. In addition, the ITW Ramset fasteners, except for the 1600 W series, are identified by the letter "R" stamped into the fastener head while the ITW Brands - DUO-FAST fasteners, except for the 1600 W series, have a semi-circle stamped on the fastener head. See Figure 2.

8.0 OTHER CODES

8.1 Evaluation Scope:

In addition to the codes referenced in Section 1.0, the products described 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)

8.2 Uses:

Ramset and Duo-Fast 1500, 1600 W and 3300 Series fasteners and SP Series Power Point fasteners are used for general fastening of building components to normal-weight concrete, structural lightweight concrete, and structural lightweight concrete filled steel deck panels and steel substrates, as noted in this report. The fasteners are used as alternatives to cast-in-place anchors described in 2006 IBC Sections 1911 and 1912 and to the bolts used to attach to steel, described in 2006 IBC Section 2204.2. The fasteners may also be used where an engineered design is submitted in accordance with 2006 IRC Section R301.1.3.

Ramset and Duo-Fast SDC and SPC Angle Clip fasteners are used for fastening of building components to normal-weight concrete and structural lightweight concrete filled steel deck panels. The Angle Clip fasteners are used as alternatives to cast-in-place anchors described in 2006 IBC Sections 1911 and 1912; and may also be used where an engineered design is submitted in accordance with 2006 IRC Section R301.1.3.

8.3 Description:

See Section 3.0.

8.4 Design and Installation:

See Section 4.0.

8.5 Conditions of Use:

See Section 5.0.

8.6 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.

8.7 Identification:

See Section 7.0.

TABLE 1—ALLOWABLE TENSION AND SHEAR VALUES FOR FASTENERS INSTALLED IN NORMAL-WEIGHT CONCRETE^{1,2,3,4} (pounds)

PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	SHANK DESCRIPTION	MINIMUM EMBEDMENT DEPTH (inches)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	CONCRETE COMPRESSIVE STRENGTH (psi)					
						2000 psi		4000 psi		6000 psi	
						Tension	Shear	Tension	Shear	Tension	Shear
1500 and 1600 W	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	—	—
SP	0.150	Smooth-straight	3/4	5.1	3.2	—	—	150	105	81	82
SP	0.150/0.180	Smooth-stepped	1	5.1	3.5	154	200	243	175	189	210
			1 1/4			207	230	298	218	305	
			1 1/2			—	—	384	391	239	594
3300	0.180	Smooth-straight	1	5.1	3.5	196	100	255	284	—	—
			1 1/4			241	329	294	373	—	—
			1 1/2			254	379	419	501	—	—

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

¹The fasteners shall not be driven until the concrete has reached the designated minimum compressive strength. Concrete aggregate shall comply with ASTM C 33. Minimum concrete thickness is three times the fastener embedment into the concrete.

²The allowable shear and tension values are only for the fasteners in the concrete. Members connected to the concrete shall be investigated in accordance with accepted design criteria.

³The stress increases and load reductions described in IBC Section 1605.3, are not allowed for wind loads acting alone or when combined with vertical loads. No adjustment is allowed for vertical loads acting alone.

⁴Seismic load resistance is outside the scope of this report, except as noted in Section 4.1.1 of this report.

TABLE 2—ALLOWABLE TENSION AND SHEAR VALUES FOR FASTENERS INSTALLED IN MINIMUM 3000 psi SAND-LIGHTWEIGHT CONCRETE^{1,2,3,4} (pounds)

PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	SHANK DESCRIPTION	MINIMUM EMBEDMENT DEPTH (inches)	MINIMUM SPACING (inches)	FASTENER INSTALLED THROUGH LOWER FLUTE OR METAL DECK INTO CONCRETE ^{5,6}		FASTENER INSTALLED INTO CONCRETE		
					Tension	Shear	Minimum Edge Distance (inches)	Tension	Shear
1500	0.145	Smooth-straight	3/4	4	76	260	3.2	167	179
			1		134	265		200	228
			1 1/4		157	269		333	400
			1 1/2		233	346		391	410
SP	0.150/0.180	Smooth-stepped	1	4	119	336	3.5	226	250
			1 1/4		175	372		329	377
			1 1/2		179	426		406	380

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

¹The fasteners shall not be driven until the concrete has reached the designated minimum compressive strength. Concrete aggregate shall comply with ASTM C 330. Minimum concrete thickness shall be three times the fastener embedment into the concrete.

²The allowable shear and tension values are only for the fasteners in the concrete. Members connected to the concrete shall be investigated in accordance with accepted design criteria.

³The stress increases and load reductions described in IBC Section 1605.3, are not allowed for wind loads acting alone or when combined with vertical loads. No adjustment is allowed for vertical loads acting alone.

⁴Seismic load resistance is outside the scope of this report, except as noted in Section 4.1.1 of this report.

⁵For fasteners installed through metal deck, the fastener shall be installed through the lower flutes of the metal deck with a minimum edge distance of 1 1/8 inches from the edge of the metal deck web and 4 inches from the end of the deck. See Figure 1 of this report.

⁶The steel deck shall have a minimum base-metal thickness of 0.035 inch and have a minimum yield strength of 49.5 ksi.

TABLE 3—ALLOWABLE TENSION AND SHEAR VALUES FOR FASTENERS INSTALLED IN ASTM A 36 STEEL^{1,2,3,4} (pounds)

PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	TYPE OF SHANK	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	STEEL THICKNESS (inch)									
					³ / ₁₆		¹ / ₄		³ / ₈		¹ / ₂		³ / ₄	
					Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
1500 and 1600W	0.145	Smooth	1	¹ / ₂	81	373	181	273	397	489	243 ⁵	277 ⁵	—	—
1500K and 1600 WK	0.145	Knurled	1	¹ / ₂	296	636	584	659	680	730	253 ⁵	293 ⁵	—	—
SP	0.150	Smooth	1	¹ / ₂	385	662	445	477	393	574	948	597	234 ⁵	356 ⁵
3300	0.180	Smooth	1	¹ / ₂	281	580	385	507	460	644	641	684		

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

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

²The allowable tension and shear values are only for the fasteners in the steel. Members connected to the steel shall be investigated in accordance with accepted design criteria.

³The stress increases and load reductions described in IBC Section 1605.3, are not allowed for wind loads acting alone or when combined with vertical loads. No adjustment is allowed for vertical loads acting alone.

⁴Seismic load resistance is outside the scope of this report, except as noted in Section 4.1.1 of this report.

⁵Fastener penetration into steel is a minimum of ⁷/₁₆ inch.

TABLE 4—ALLOWABLE LOADS FOR FASTENERS INSTALLED IN ASTM A 572, GRADE 50, STEEL^{1,2,3,4} (pounds)

PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	TYPE OF SHANK	MINIMUM SPACING (inch)	MINIMUM EDGE DISTANCE (inch)	STEEL THICKNESS (inch)									
					³ / ₁₆		¹ / ₄		³ / ₈		¹ / ₂		³ / ₄	
					Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
1500K and 1600WK	0.145	Knurled	1	1/2	260	499	579	725	383 ⁵	595 ⁵	—	—	—	—
SP	0.150	Smooth	1	¹ / ₂	356	569	554	637	604	602	814 ⁷	820 ⁷	243 ⁶	381 ⁶

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

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

²The allowable tension and shear values are only for the fasteners in the steel. Members connected to the steel shall be investigated in accordance with accepted design criteria.

³The stress increases and load reductions described in IBC Section 1605.3, are not allowed for wind loads acting alone or when combined with vertical loads. No adjustment is allowed for vertical loads acting alone.

⁴Seismic load resistance is outside the scope of this report, except as noted in Section 4.1.1 of this report.

⁵Fastener penetration into the steel is a minimum of ³/₈ inch.

⁶Fastener penetration into the steel is a minimum of ⁷/₁₆ inch.

⁷Fastener penetration into the steel is a minimum of ¹/₂ inch.

TABLE 5—ALLOWABLE TENSION AND SHEAR VALUES FOR ANGLE CLIP FASTENERS INSTALLED IN NORMAL-WEIGHT CONCRETE^{1,2,3,4} (pounds)

PART NUMBER	NOMINAL SHANK DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH (inches)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	MINIMUM CONCRETE COMPRESSIVE STRENGTH			
					4000 psi		6000 psi	
					Tension	Shear	Tension	Shear
SDC100	0.145	⁷ / ₈	4	3.2	115	120	—	—
SDC125	0.145	¹ / ₈	4	3.2	130	167	—	—
SPC78	0.150	³ / ₄	5.1	3.2	155	188	150	153
SPC114	0.150/0.180	¹ / ₈	5	³ / ₂	127	226	169	300

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

¹The fasteners shall not be driven until the concrete has reached the designated minimum compressive strength. Concrete aggregate shall comply with ASTM C 33. Minimum concrete thickness is three times the fastener embedment into the concrete.

²The allowable shear and tension values are only for the fastener in the concrete.

³The stress increases and load reductions described in IBC Section 1605.3, are not allowed for wind loads acting alone or when combined with vertical loads. No adjustment is allowed for vertical loads acting alone.

⁴Seismic load resistance is outside the scope of this report, except as noted in Section 4.1.1 of this report.

**TABLE 6—ALLOWABLE TENSION AND SHEAR VALUES FOR ANGLE CLIP FASTENERS
INSTALLED IN MINIMUM 3000 psi SAND-LIGHTWEIGHT CONCRETE FILLED STEEL DECK PANEL^{1,2,3,4,5,6} (pounds)**

PART NUMBER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH (inches)	FASTENER INSTALLATION LOCATION AND LOADING CONDITION			
			Lower Flute Tension	Lower Flute Shear	Upper Flute Tension	Upper Flute Shear
SDC100	0.145	7/8	67	237	104	310
SDC125	0.145	1 1/8	94	276	106	319
SPC78	0.150	7/8	59	202	84	324
SPC114	0.150/0.180	1 1/8	157	272	180	334

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

¹The fasteners shall not be driven until the concrete has reached the designated minimum compressive strength. Concrete aggregate shall comply with ASTM C 330. Minimum concrete thickness is three times the fastener embedment into the concrete.

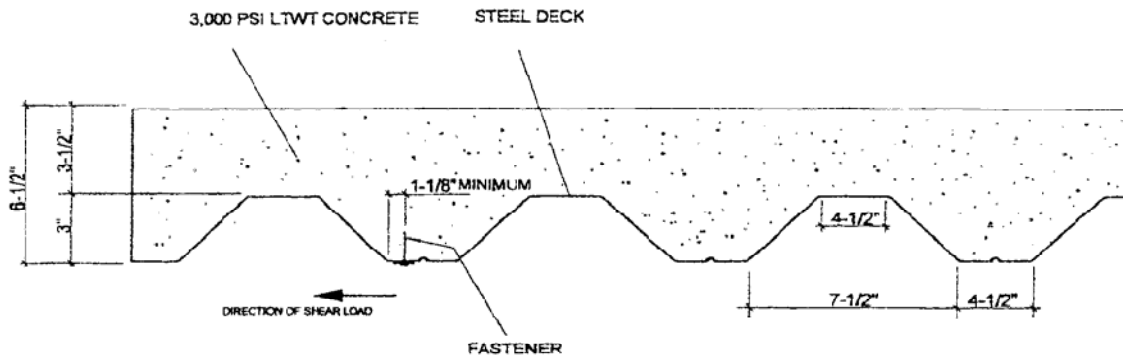
²The allowable shear and tension values are only for the fastener attachment to the concrete.

³The fasteners shall be installed through the metal deck panel and into the concrete at the upper or lower flute as designated in the table. The fastener must be a minimum of 1 1/8 inches from the edge of the deck panel web and 4 inches from the end of the deck panel. The minimum fastener spacing is 4 inches.

⁴The steel deck panel shall have a minimum base-metal thickness of 0.035 inch and a minimum yield strength of 49.5 ksi.

⁵The stress increases and load reductions described in IBC Section 1605.3, are not allowed for wind loads acting alone or when combined with vertical loads. No adjustment is allowed for vertical loads acting alone.

⁶Seismic load resistance is outside the scope of this report, except as noted in Section 4.1.1 of this report.



For SI: 1 inch = 25.4 mm.

SECTION – COMPOSITE DECK – NO SCALE

FIGURE 1—FASTENER INSTALLATION LOCATION IN COMPOSITE DECK

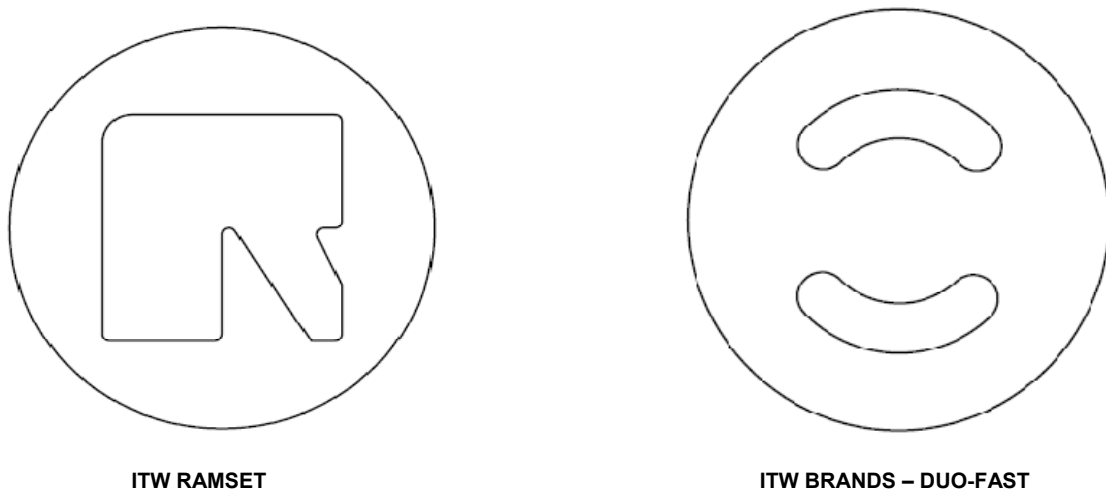


FIGURE 2—FASTENER MARKING