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DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

DIVISION: 05—METALS
Section: 05090—Metal Fastening

REPORT HOLDER:

ITW RAMSET
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EVALUATION SUBJECT:

RAMSET POWER-DRIVEN FASTENERS, POWER POINT FASTENERS AND ANGLE CLIP FASTENERS

1.0 EVALUATION SCOPE

Compliance with the following codes:

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

Properties evaluated:

Structural

2.0 USES

Ramset 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 decks and steel substrates, as noted in this report. Ramset SDC and SPC Angle Clip fasteners are used for fastening of building components to normal-weight concrete and structural lightweight concrete filled steel decks.

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 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 are 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 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 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 Concrete:

Normal-weight and structural lightweight concrete shall conform to IBC and UBC Sections 1903 and 1905.

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, and the stress increases described in UBC Section 1612.3, 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 7-05, Minimum Design Loads for Buildings and Other Structures (American Society of Civil Engineers/Structural Engineering Institute).

The allowable shear and tension values for Ramset 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 metal decks and into the structural lightweight concrete fill of the metal deck 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:

$$\left(\frac{P_s}{P_t}\right) + \left(\frac{V_s}{V_t}\right) \leq 1$$

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-05 (IBC) or Part 12 of the ANSI/NFoPA NDS-91 (UBC), as applicable, 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-05 or NDS-91, as applicable, based on fastener diameter.

4.2 Installation:

A low-velocity, powder-actuated fastening tool, recommended by ITW Ramset, shall be used to install the fasteners. The fastening procedures shall comply with the fastener manufacturer's published installation instructions. The fasteners shall be installed with the fastener penetration, spacing and edge distances specified in this report. Except as noted in Figure 1 of this report, concrete shall 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 shall not be driven until the concrete has reached the designated compressive strength.

5.0 CONDITIONS OF USE

The ITW Ramset 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 shall be manufactured and identified in accordance with this report.
- 5.2 Fasteners shall be installed in accordance with this report and ITW Ramset instructions. In the event of a conflict between this report and the ITW Ramset instructions, this report shall govern.
- 5.3 Allowable loads shall be in accordance with Section 4.1 of this report. Calculations demonstrating that the applied loads are less than the maximum allowable loads described in this report shall be submitted to the code official. The calculations shall 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 The minimum concrete thickness shall be three times the fastener embedment in concrete, except where noted otherwise in this report.
- 5.5 Seismic load resistance is outside the scope of this report, except as noted in Section 4.1.1 of this report.
- 5.6 Use is limited to uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.
- 5.7 Installation is limited to dry interior environments.
- 5.8 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 October 2006.

7.0 IDENTIFICATION

The containers of the fasteners shall be labeled with the ITW Ramset company name; the fastener product name, length, catalog number, and quantity; the evaluation report number (ESR-1799); and the manufacturing date and lot number. In addition, all of the fasteners, except the 1600 W series fasteners, shall be identified by the letter "R" stamped into the fastener head.

**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	$\frac{3}{4}$	5.1	3.2	50	66	100	104	—	—
			1			152	166	157	182	—	—
			$1\frac{1}{4}$			159	265	179	267	—	—
			$1\frac{1}{2}$			154	340	209	342	—	—
SP	0.150	Smooth-straight	$\frac{3}{4}$	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
			$1\frac{1}{4}$			207	230	298	218	213	305
			$1\frac{1}{2}$			—	—	384	391	239	594
3300	0.180	Smooth-straight	1	5.1	3.5	196	100	255	284	—	—
			$1\frac{1}{4}$			241	329	294	373	—	—
			$1\frac{1}{2}$			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, and the stress increases described in UBC Section 1612.3, 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
STRUCTURAL 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	$\frac{3}{4}$	4	76	260	3.2	167	179
			1		134	265		200	228
			$1\frac{1}{4}$		157	269		333	400
			$1\frac{1}{2}$		233	346		391	410
SP	0.150/0.180	Smooth-stepped	1	4	119	336	3.5	226	250
			$1\frac{1}{4}$		175	372		329	377
			$1\frac{1}{2}$		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, and the stress increases described in UBC Section 1612.3, 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 $1\frac{1}{8}$ 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, and the stress increases described in UBC Section 1612.3, 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, and the stress increases described in UBC Section 1612.3, 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	$\frac{7}{8}$	4	3.2	115	120	—	—
SDC125	0.145	$1\frac{1}{8}$	4	3.2	130	167	—	—
SPC78	0.150	$\frac{3}{4}$	5.1	3.2	155	188	150	153
SPC114	0.150/0.180	$1\frac{1}{8}$	5	$3\frac{1}{2}$	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, and the stress increases described in UBC Section 1612.3, 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 STRUCTURAL LIGHTWEIGHT CONCRETE FILLED METAL DECK^{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	$\frac{7}{8}$	67	237	104	310
SDC125	0.145	$1\frac{1}{8}$	94	276	106	319
SPC78	0.150	$\frac{7}{8}$	59	202	84	324
SPC114	0.150/0.180	$1\frac{1}{8}$	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.

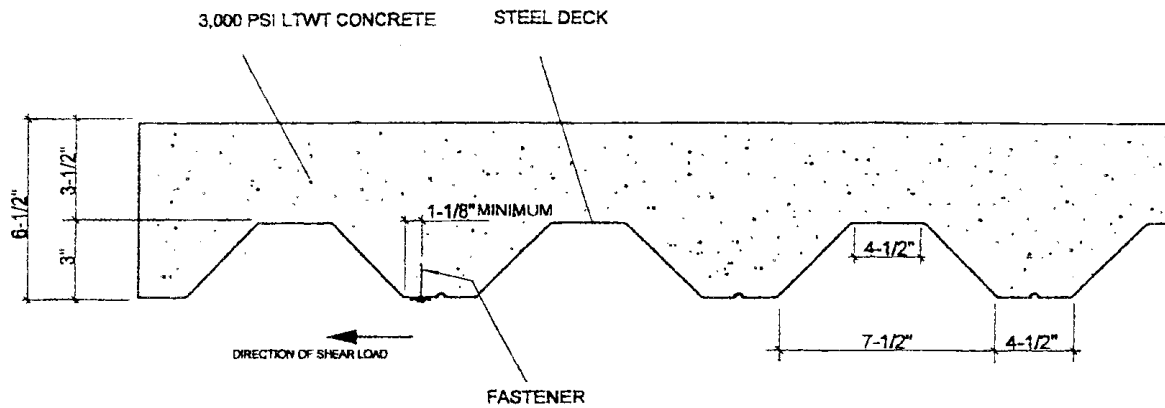
²The allowable shear and tension values are only for the fastener attachment to the concrete.

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

⁴The steel deck 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, and the stress increases described in UBC Section 1612.3, 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