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## EVALUATION REPORT

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### ITW RAMSET/RED HEAD SELF-DRILLING, TRUBOLT WEDGE, AND MULTI-SET II CONCRETE ANCHORS

ITW RAMSET/RED HEAD  
1300 NORTH MICHAEL DRIVE  
WOOD DALE, ILLINOIS 60191

#### 1.0 SUBJECT

ITW Ramset/Red Head Self-Drilling, Trubolt Wedge, and Multi-Set II Concrete Anchors.

#### 2.0 DESCRIPTION

##### 2.1 ITW Ramset/Red Head Self-Drilling Anchor:

**2.1.1 General:** The ITW Ramset/Red Head anchor is a self-drilling concrete expansion shell anchor with a single cone expander. Both elements are made from heat-treated steel. The steel for the body conforms to AISI C-12L1 4, and the steel for the plug conforms to AISI C-1010. The anchor has eight sharp teeth at one end and is threaded internally at the other end. The outer surface of the tubular shell at the toothed end has annular broaching grooves and four milled slits. At its threaded end, the anchor is provided with an unthreaded chucking cone that has an annular break-off groove at its base for flush mounting. Anchor shell and expander cone are electrodeposit zinc and chromate-plated.

**2.1.2 Installation:** Embedment, spacing, edge distance, and concrete requirements are shown in Tables 1 and 2. The anchors are installed by a Model 747 Roto-Stop Hammer, by air or electric impact hammer, or by hand. The anchor is used as a drill in forming the hole in normal-weight concrete. After the hole is formed, the anchor must be removed and the hole thoroughly cleaned. The hole depth is regulated by the drill chuck. A Red Head plug must be set into the bottom of the anchor prior to insertion in the hole. The concrete anchor must be driven over the plug, to cause expansion of the anchor in the hole. The chucking end of the anchor is broken off with a hammer blow. Verification that the anchor has been installed properly is evidenced by the fact that the anchor does not project above the surface of the concrete and the red plug is visible at the bottom of the hole.

##### 2.2 ITW Ramset/Red Head Trubolt Wedge Anchor:

**2.2.1 General:** The Trubolt Wedge anchor is a stud bolt type of drop-in anchor. The anchors are cold-formed or machined from zinc-plated and chromate-dipped carbon steel, hot-dipped galvanized carbon steel or stainless steel. Steel used to produce the anchors complies with AISI C-1015 to AISI C-1022 and AISI C-1213 carbon steels, Type 304 or Type 316 stainless steels. Hot-dipped galvanizing complies with ASTM 153 Class C requirements. The expander sleeves are fabricated from stainless steel or carbon steel meeting the require-

ments of Type 302 or AISI C-1010, respectively. Cold-formed anchor studs are available only for the 1/4-inch-, 3/8-inch-, 1/2-inch-, 5/8-inch- and 3/4-inch-diameter (6.4, 9.5, 12.7, 15.9 and 19.1 mm) wedge anchors. The anchor stud is threaded at its upper end and has a straight cylindrical section reduced in diameter, around which the expander sleeve is formed. A straight-tapered section enlarging to a cylindrical base acts to increase the diameter of the expander ring as the stud is tightened in the concrete hold. The expander ring, which is formed around the stud bolt, consists of a split-ring element with a "coined" groove at each end. The expander ring is designed to engage the walls of the concrete hold as the tapered portion of the stud is forced upward against its interior.

**2.2.2 Installation:** Embedment, spacing, edge distance, and concrete requirements are shown in Tables 3, 4, 5 and 10. Holes must be predrilled in normal-weight or lightweight concrete with carbide-tipped masonry drill bits manufactured within the range of the maximum and minimum drill tip dimensions of ANSI B212.15-1994. The anchors must be installed in holes the same nominal size as the anchor size, with a greater depth than the length of embedment desired, but no less than the minimum embedment. The hole must be cleaned out prior to installation of the anchor. The anchor must be tapped into the hole to the embedment depth desired, but no less than the minimum embedment. A standard hexagonal nut and washer must be used over the material being fastened and the nut tightened until the minimum installation torque, as indicated in Tables 3 and 10, is reached.

##### 2.3 ITW Ramset/Red Head Multi-Set II Anchor:

**2.3.1 General:** The Multi-Set anchors are designed to be installed in a predrilled hole equal to the anchor diameter. The anchor consists of a shell formed from carbon steel meeting the minimum requirements of AISI C-1213 and an expansion plug formed from carbon steel meeting the minimum requirements of AISI C-1010. The expansion end is divided into four equal segments by radial slots. The expansion plug is preassembled and is cylindrical in cross section.

**2.3.2 Installation:** Embedment, spacing, edge distance, and concrete requirements are shown in Tables 6, 7 and 9. Holes must be predrilled in normal-weight or lightweight concrete with carbide-tipped masonry drill bits manufactured within the range of the maximum and minimum drill tip dimensions of ANSI B212.15-1994. The anchors must be installed in predrilled holes, the hole depth and diameter for each anchor size being listed in Tables 6, 7 and 9. After the hole is drilled, it is cleared of all cuttings. The anchor is set by installing the expansion shell and then driving the cone expander with a setting tool provided with each anchor size. When the

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cone expander is driven down into the anchor, the legs of the shell expand.

**2.4 Design:**

Allowable static loads are as set forth in Tables 1, 3, 6, 9 and 10. Allowable loads for anchors subjected to combined shear and tension forces are determined by the following equation:

$$(P_s/P_t)^{5/3} + (V_s/V_t)^{5/3} \leq 1$$

where:

$P_s$  = Applied service tension load.

$P_t$  = Allowable service tension load.

$V_s$  = Applied service shear load.

$V_t$  = Allowable service shear load.

The anchors cannot be subjected to vibratory loads. Sources of such loads include, for example, reciprocating engines, crane loads and moving loads due to vehicles.

**2.5 Special Inspection:**

When special inspection is required, compliance with Section 1701.5.2 of the code is necessary. The special inspector must be on the jobsite continuously during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, hole dimensions, anchor spacings, edge distances, slab thickness, anchor embedment and tightening torque.

**2.6 Identification:**

The concrete anchors are identified by their dimensional characteristics, the anchor size, and by the length code stamped on the anchor. The conical-shaped expander plugs are colored red. See Figure 1 for additional details. Length codes are in Table 8. Packages are identified with the anchor type and size, the manufacturer's name and address, and the name of the quality control agency, PFS Corporation.

**3.0 EVIDENCE SUBMITTED**

Data complying with the ICBO ES Acceptance Criteria for Expansion Anchors in Concrete and Masonry Elements (AC01), dated January 1999.

**4.0 FINDINGS**

That the ITW Ramset/Red Head fasteners described in this report comply with the 1997 *Uniform Building Code*<sup>TM</sup>, subject to the following conditions:

- 4.1 Anchor sizes, dimensions and installation are as set forth in this report.
- 4.2 Allowable shear and tension loads are as set forth in Section 2.4.
- 4.3 Calculations justifying that the applied loads comply with this report are submitted to the building official for approval.
- 4.4 Special inspection is provided as set forth in Section 2.5.
- 4.5 Anchors are limited to installation in uncracked concrete, which is concrete subjected to tensile stresses not exceeding 170 psi (1.2 MPa) as induced by external loads, deformations and interior exposures.
- 4.6 Anchors are limited to nonfire-resistive construction unless appropriate data is submitted to demonstrate anchor performance is maintained in fire-resistive situations.
- 4.7 Anchors are manufactured at Highway 12, Michigan City, Indiana, with inspections by PFS Corporation (NER-QA251).
- 4.8 Use of electroplated or mechanically plated carbon steel anchors is limited to dry, interior locations. Use of hot-dipped galvanized carbon steel is permitted in exterior-exposure or damp environments.
- 4.9 Except for ITW Ramset/Red Head Carbon Steel and Stainless Steel Trubolt Wedge anchors embedded in normal-weight concrete, as noted in Table 3, use of anchors in resisting earthquake or wind loads is beyond the scope of this report.
- 4.10 The anchors are not subjected to vibratory loads, such as those encountered by supports for reciprocating engines, crane loads and moving loads due to vehicles.

This report is subject to re-examination in two years.

**TABLE 1—ITW RAMSET/RED HEAD SELF-DRILLING ANCHOR ALLOWABLE SHEAR AND TENSION VALUES (pounds)<sup>1,3,4</sup>**

BOLT DIAMETER (inch)	ANCHOR DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH (inches)	$f'_c = 2,000 \text{ psi}$			$f'_c = 4,000 \text{ psi}$		
			Tension		Shear	Tension		Shear
			With Special Inspection <sup>2</sup>	Without Special Inspection		With Special Inspection <sup>2</sup>	Without Special Inspection	
1/4	7/16	1 3/32	415	210	295	650	325	365
3/8	9/16	1 7/32	785	395	770	1,035	520	650
1/2	1 1/16	2 1/32	1,150	575	920	1,555	775	930
5/8	2 7/32	2 15/32	1,510	755	1,605	2,485	1,240	1,755
3/4	1	3 1/4	1,985	995	2,495	3,165	1,585	2,575

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

<sup>1</sup>The tabulated shear and tensile values are for anchors installed in normal-weight concrete having the designated ultimate compressive strength at the time of installation. Values have been tabulated for both ASTM A 307 and A 449 bolts installed with the device.

<sup>2</sup>These tension values are applicable only when the anchors are installed with special inspection as set forth in Section 2.5.

<sup>3</sup>The minimum concrete thickness is 1 1/2 times the embedment depth, or the embedment depth plus three times the anchor diameter, whichever is greater.

<sup>4</sup>The anchors are illustrated as follows:



TABLE 2—RECOMMENDED SPACING AND EDGE DISTANCE REQUIREMENTS FOR ITW RAMSET/RED HEAD SELF-DRILLING ANCHOR<sup>1</sup>

BOLT DIAMETER (inch)	ANCHOR DIAMETER (inch)	MIN. EMBEDMENT DEPTH (inches)	DESCRIPTION			
			Edge Distance Required to Obtain Max. Working Load (inches)	Min. Allowable Edge Distance (inches) Load Factor Applied = 0.85 for Tension = 0.75 for Shear	Spacing Required to Obtain Max. Working Load (inches)	Min. Allowable Spacing Between Anchors (inches) Load Factor Applied = 0.95 for Tension = 0.70 for Shear
1/4	7/16	1 <sup>3</sup> / <sub>32</sub>	1 <sup>15</sup> / <sub>16</sub>	1	3 <sup>7</sup> / <sub>8</sub>	1 <sup>15</sup> / <sub>16</sub>
3/8	9/16	1 <sup>7</sup> / <sub>32</sub>	2 <sup>11</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	5 <sup>3</sup> / <sub>8</sub>	2 <sup>11</sup> / <sub>16</sub>
1/2	11/16	2 <sup>1</sup> / <sub>32</sub>	3 <sup>9</sup> / <sub>16</sub>	1 <sup>13</sup> / <sub>16</sub>	7 <sup>1</sup> / <sub>8</sub>	3 <sup>9</sup> / <sub>16</sub>
5/8	27/32	2 <sup>15</sup> / <sub>32</sub>	4 <sup>3</sup> / <sub>8</sub>	2 <sup>3</sup> / <sub>16</sub>	8 <sup>11</sup> / <sub>16</sub>	4 <sup>3</sup> / <sub>8</sub>
3/4	1	3 <sup>1</sup> / <sub>4</sub>	5 <sup>11</sup> / <sub>16</sub>	2 <sup>7</sup> / <sub>8</sub>	11 <sup>3</sup> / <sub>8</sub>	5 <sup>11</sup> / <sub>16</sub>

For SI: 1 inch = 25.4 mm.

<sup>1</sup>Linear interpolation may be used for intermediate spacing and edge distances.

TABLE 3—ITW RAMSET/RED HEAD TRUBOLT WEDGE ANCHOR ALLOWABLE SHEAR AND TENSION VALUES (pounds)<sup>1,2,4,5,6</sup>

ANCHOR DIAMETER (inches)	INSTALLATION TORQUE (lbf · ft)	EMBEDMENT DEPTH (inches)	f <sub>c</sub> = 2,000 psi			f <sub>c</sub> = 4,000 psi			f <sub>c</sub> = 6,000 psi		
			Tension		Shear	Tension		Shear	Tension		Shear
			With Special Inspection <sup>3</sup>	Without Special Inspection		With Special Inspection	Without Special Inspection		With Special Inspection	Without Special Inspection	
1/4	8	1 <sup>1</sup> / <sub>8</sub>	295	150	350	445	225	350	475	240	350
		1 <sup>5</sup> / <sub>16</sub>	525	265	420	825	410	420	825	410	420
		2 <sup>1</sup> / <sub>8</sub>	565	280		825	410		825	410	
3/8	25	1 <sup>1</sup> / <sub>2</sub>	420	210	580	560	280	655	710	355	790
		3	870	435	1,000	1,485	740	1,035	1,530	765	1,125
		4	1,200	600		1,485	740		1,530	765	
1/2	55	2 <sup>1</sup> / <sub>4</sub>	1,165	580	1,190	1,275	640	1,190	1,760	880	1,760
		4 <sup>1</sup> / <sub>8</sub>	1,165	580	1,810	2,410	1,205	1,810	2,705	1,355	2,040
		6	1,335	665		2,410	1,205		2,705	1,355	
5/8	90	2 <sup>3</sup> / <sub>4</sub>	1,645	820	1,780	1,795	900	1,780	2,430	1,215	2,405
		5 <sup>1</sup> / <sub>8</sub>	1,645	820	2,400	3,730	1,865	2,975	4,095	2,045	3,130
		7 <sup>1</sup> / <sub>2</sub>	1,765	880		3,755	1,880		4,095	2,045	
3/4	175	3 <sup>1</sup> / <sub>4</sub>	1,780	890	2,530	2,710	1,355	3,430	3,325	1,665	3,995
		6 <sup>5</sup> / <sub>8</sub>	2,745	1,375	5,080	4,425	2,210	5,935	5,065	2,530	5,935
		10	2,745	1,375		4,470	2,235		5,895	2,950	
7/8	250	3 <sup>3</sup> / <sub>4</sub>	2,380	1,190	3,290	3,685	1,840	4,145	4,355	2,180	4,790
		6 <sup>1</sup> / <sub>4</sub>	3,665	1,835	5,220	5,235	2,620	7,200	6,090	3,045	7,200
		8	3,665	1,835		5,580	2,790		6,090	3,045	
1	300	4 <sup>1</sup> / <sub>2</sub>	3,485	1,745	4,020	5,045	2,520	5,705	5,295	2,650	6,120
		7 <sup>3</sup> / <sub>8</sub>	3,650	1,825	7,170	5,995	3,000	9,485	8,315	4,160	9,520
		9 <sup>1</sup> / <sub>2</sub>	4,675	2,340		6,635	3,315		8,315	4,160	
1 <sup>1</sup> / <sub>4</sub>	500	5 <sup>1</sup> / <sub>2</sub>	4,535	2,270	5,820	6,595	3,300	7,365	8,410	4,205	8,445
		8	6,835	3,413	8,770	10,825	5,410	11,065	11,385	5,695	12,640
		10	9,035	4,515		11,385	5,695		14,075	7,040	

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf · ft = 1.355 818 N · m, 1 lbf = 4.45 N.

<sup>1</sup>The tabulated shear and tensile values are for anchors installed in stone-aggregate concrete having the designated ultimate compressive strength at the time of installation.

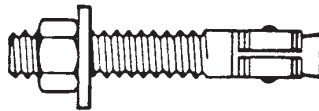
<sup>2</sup>The holes are drilled with bits complying with ANSI B212.15-1994. The bit diameter equals the anchor diameter.

<sup>3</sup>These tension values are applicable only when the anchors are installed with special inspection as set forth in Section 2.5.

<sup>4</sup>The minimum concrete thickness is 1<sup>1</sup>/<sub>2</sub> times the embedment depth, or the embedment depth plus three times the anchor diameter, whichever is greater.

<sup>5</sup>Allowable static loads may be increased one-third for earthquake or wind resistance in accordance with Section 1612.3.3 of the code. No further increase is allowed.

<sup>6</sup>The anchors are illustrated as follows:



**TABLE 4—RECOMMENDED SPACING AND EDGE DISTANCE REQUIREMENTS FOR TENSION LOADS FOR ITW RAMSET/RED HEAD TRUBOLT WEDGE ANCHORS<sup>1</sup>**

ANCHOR DIAMETER (inches)	EMBEDMENT DEPTH (inches)	DESCRIPTION			
		Edge Distance Required to Obtain Max. Working Load (inches)	Min. Allowable Edge Distance (inches) Load Factor Applied = 0.65	Spacing Required to Obtain Max. Working Load (inches)	Min. Allowable Spacing Between Anchors (inches) Load Factor Applied = 0.70
1/4	1 1/8	2	1	3 15/16	2
	1 5/16	1 5/16	1	3 7/8	1 5/16
3/8	2 1/8	1 5/8	13/16	3 3/16	1 5/8
	1 1/2	2 5/8	1 5/16	5 1/4	2 5/8
1/2	3	3	1 1/2	6	3
	4	3	1 1/2	6	3
5/8	2 1/4	3 15/16	2	7 7/8	3 15/16
	4 1/8	3 1/8	1 9/16	6 3/16	3 1/8
3/4	6	4 1/2	2 1/4	9	4 1/2
	2 3/4	4 13/16	2 7/16	9 5/8	4 13/16
7/8	5 1/8	3 7/8	1 5/16	7 11/16	3 7/8
	7 1/2	5 5/8	2 13/16	11 1/4	5 5/8
1	3 1/4	5 11/16	2 7/8	11 3/8	5 11/16
	6 5/8	7 1/2	2 1/2	9 15/16	5
1 1/4	10	7 1/2	3 3/4	15	7 1/2
	3 3/4	6 9/16	3 5/16	13 1/8	6 9/16
1	6 1/4	6 1/4	3 1/8	12 1/2	6 1/4
	8	6	3	12	6
1 1/4	4 1/2	7 7/8	3 15/16	15 3/4	7 7/8
	7 3/8	7 3/8	3 11/16	14 3/4	7 3/8
1 1/4	9 1/2	7 1/8	3 9/16	14 1/4	7 1/8
	5 1/2	9 5/8	4 13/16	19 1/4	9 5/8
1 1/4	8	8	4	16	8
	10	7 1/2	3 3/4	15	7 1/2

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

<sup>1</sup>Linear interpolation may be used for intermediate spacing and edge distances.

<sup>2</sup>Spacings and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete in accordance with Table 10.

**TABLE 5—RECOMMENDED SPACING AND EDGE DISTANCE REQUIREMENTS FOR SHEAR LOADS FOR ITW RAMSET/RED HEAD TRUBOLT WEDGE ANCHORS<sup>1</sup>**

ANCHOR DIAMETER (inches)	EMBEDMENT DEPTH (inches)	DESCRIPTION				
		(E) Edge Distance Required to Obtain Max. Working Load (inches) (See Figure 2)	(E1) Min. Edge Distance at Which the Load Factor Applied = 0.60 (inches) (See Figure 2)	(E2) Min. Edge Distance at Which the Load Factor Applied = 0.20 (inches) (See Figure 2)	Spacing Required to Obtain Max. Working Load (inches)	Min. Allowable Spacing Between Anchors (inches) Load Factor Applied = 0.40
1/4	1 1/8	2	1 5/16	N/A	3 15/16	2
	1 5/16	1 5/16	1	N/A	3 7/8	1 5/16
3/8	1 1/2	2 5/8	1 3/4	N/A	5 1/4	2 5/8
	3	3 3/4	3	1 1/2	6	3
1/2	2 1/4	3 15/16	2 9/16	N/A	7 7/8	3 15/16
	4 1/8	5 3/16	3 1/8	1 9/16	6 3/16	3 1/8
5/8	2 3/4	4 13/16	3 1/8	N/A	9 5/8	4 13/16
	5 1/8	6 7/16	3 7/8	1 15/16	7 11/16	3 7/8
3/4	3 1/4	5 11/16	3 3/4	N/A	11 3/8	5 11/16
	6 5/8	8 5/16	5	2 1/2	9 15/16	5
7/8	3 3/4	6 9/16	4 5/16	N/A	13 1/8	6 9/16
	6 1/4	8 1/2	6 1/4	3 1/8	12 1/2	6 1/4
1	4 1/2	7 7/8	5 1/8	N/A	15 3/4	7 7/8
	7 3/8	10 1/16	7 3/8	3 11/16	14 3/4	7 3/8
1 1/4	5 1/2	9 5/8	6 1/4	N/A	19 1/4	9 5/8
	8	11 7/16	8	4	16	8

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

N/A = Not applicable.

<sup>1</sup>Linear interpolation may be used for intermediate spacing and edge distances.

<sup>2</sup>Spacings and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete in accordance with Table 10.

TABLE 6—ITW RAMSET/RED HEAD MULTI-SET II ANCHOR ALLOWABLE SHEAR AND TENSION VALUES (pounds)<sup>1,2,4,5</sup>

BOLT DIAMETER (inch)	ANCHOR DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH (inches)	$f'_c = 2,000$ psi			$f'_c = 4,000$ psi			$f'_c = 6,000$ psi		
			Tension		Shear	Tension		Shear	Tension		Shear
			With Special Inspection <sup>3</sup>	Without Special Inspection		With Special Inspection <sup>3</sup>	Without Special Inspection		With Special Inspection <sup>3</sup>	Without Special Inspection	
1/4	3/8	1	420	210	270	590	295	300	745	375	325
3/8	1/2	1 5/8	745	375	790	950	475	625	1,560	780	465
1/2	5/8	2	825	415	1,145	1,460	730	875	2,075	1,035	600
5/8	7/8	2 1/2	1,375	685	1,860	2,160	1,080	1,385	2,755	1,375	910
3/4	1	3 3/16	2,070	1,035	2,620	2,370	1,185	1,920	3,065	1,530	1,215

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

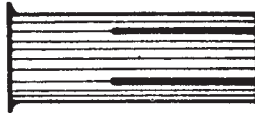
<sup>1</sup>The tabulated shear and tensile values are for anchors installed in stone-aggregate concrete having the designated ultimate compressive strength at the time of installation. Values have been tabulated for both ASTM A 307 and A 449 bolts installed with the device.

<sup>2</sup>The holes are drilled with bits complying with ANSI B212.15-1994. The bit diameter equals the anchor diameter.

<sup>3</sup>These tension values are applicable only when the anchors are installed with special inspection as set forth in Section 2.5.

<sup>4</sup>The minimum concrete thickness is 1 1/2 times the embedment depth, or the embedment depth plus three times the anchor diameter, whichever is greater.

<sup>5</sup>The anchors are illustrated as follows:

TABLE 7—RECOMMENDED SPACING AND EDGE DISTANCE REQUIREMENTS FOR ITW RAMSET/RED HEAD MULTI-SET II ANCHOR<sup>1</sup>

BOLT DIAMETER (inch)	ANCHOR DIAMETER (inch)	MIN. EMBEDMENT DEPTH (inches)	DESCRIPTION			
			Edge Distance Required to Obtain Max. Working Load (inches)	Min. Allowable Edge Distance (inches) Load Factor Applied = 0.80 for Tension = 0.70 for Shear	Spacing Required to Obtain Max. Working Load (inches)	Min. Allowable Spacing Between Anchors (inches) Load Factor Applied = 0.80 for Tension = 0.55 for Shear
1/4	3/8	1	1 3/4	7/8	3 1/2	1 3/4
3/8	1/2	1 5/8	2 7/8	1 7/16	5 11/16	2 7/8
1/2	5/8	2	3 1/2	1 3/4	7	3 1/2
5/8	7/8	2 1/2	4 3/8	2 3/16	8 3/4	4 3/8
3/4	1	3 3/16	5 5/8	2 13/16	11 3/16	5 5/8

For SI: 1 inch = 25.4 mm.

<sup>1</sup>Linear interpolation may be used for intermediate spacing and edge distances.

<sup>2</sup>Spacings and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete in accordance with Table 9.

TABLE 8—LENGTH IDENTIFICATION CODES

CODE		LENGTH OF ANCHOR		CODE		LENGTH OF ANCHOR	
		(inches)	(mm)			(inches)	(mm)
A	Black	1 1/2 < 2	38 < 51	N	8 < 8 1/2	203 < 216	
B	White	2 < 2 1/2	51 < 63	O	8 1/2 < 9	216 < 229	
C	Red	2 1/2 < 3	63 < 76	P	9 < 9 1/2	229 < 241	
D	Green	3 < 3 1/2	76 < 89	Q	9 1/2 < 10	241 < 254	
E	Yellow	3 1/2 < 4	89 < 102	R	10 < 11	254 < 267	
F	Blue	4 < 4 1/2	102 < 114	S	11 < 12	267 < 305	
G	Purple	4 1/2 < 5	114 < 127	T	12 < 13	305 < 330	
H	Brown	5 < 5 1/2	127 < 140	U	13 < 14	330 < 366	
I	Orange	5 1/2 < 6	140 < 152	V	14 < 15	366 < 381	
J	N/A	6 < 6 1/2	152 < 165	W	15 < 16	381 < 406	
K	N/A	6 1/2 < 7	165 < 178	X	16 < 17	406 < 432	
L	N/A	7 < 7 1/2	178 < 191	Y	17 < 18	432 < 457	
M	N/A	7 1/2 < 8	191 < 203	Z	18 < 19	457 < 483	

TABLE 9—ITW RAMSET/RED HEAD MULTI-SET II ANCHOR ALLOWABLE SHEAR AND TENSION VALUES (pounds)<sup>1,2,4</sup>

BOLT DIAMETER (inch)	ANCHOR DIAMETER (inch)	MINIMUM EMBEDMENT DEPTHS (inches) <sup>3</sup>	LIGHTWEIGHT CONCRETE <i>f'c</i> = 3,000 psi			LOWER FLUTE OF STEEL DECK WITH LIGHTWEIGHT CONCRETE FILL <i>f'c</i> = 3,000 psi		
			Tension		Shear	Tension		Shear
			With Special Inspection <sup>3</sup>	Without Special Inspection		With Special Inspection	Without Special Inspection	
3/8	1/2	1 <sup>9</sup> / <sub>16</sub>	965	482	1,105	835	417	1,105
1/2	5/8	2	1,020	510	1,410	800	400	1,235
5/8	7/8	2 <sup>1</sup> / <sub>2</sub>	1,570	785	2,610	1,490	745	1,460
3/4	1	3 <sup>3</sup> / <sub>16</sub>	2,750	1,375	3,945	2,045	1,022	2,280

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

<sup>1</sup>The tabulated shear and tensile values are for anchors installed in structural lightweight concrete having the designated ultimate compressive strength at the time of installation. Values have been tabulated for both ASTM A 307 and A 449 bolts installed with the device.

<sup>2</sup>The holes are drilled with bits complying with ANSI B212.15-1994. The bit diameter equals the anchor diameter.

<sup>3</sup>These tension values are applicable only when the anchors are installed with special inspection as set forth in Section 2.5.

<sup>4</sup>Installation details are in Figure 3. Spacing and edge distances are in Table 7 as modified by Footnote 2.

TABLE 10—ITW RAMSET/RED HEAD TRUBOLT WEDGE ANCHOR ALLOWABLE SHEAR AND TENSION VALUES (pounds)<sup>1,2,4</sup>

ANCHOR DIAMETER (inch)	INSTALL TORQUE (ft.-lb.)	MINIMUM EMBEDMENT DEPTHS (inches) <sup>3</sup>	LIGHTWEIGHT CONCRETE <i>f'c</i> = 3,000 psi			LOWER FLUTE OF STEEL DECK WITH LIGHTWEIGHT CONCRETE FILL <i>f'c</i> = 3,000 psi		
			Tension		Shear	Tension		Shear
			With Special <sup>3</sup> Inspection	Without Special Inspection		With Special Inspection	Without Special Inspection	
3/8	25	1 <sup>1</sup> / <sub>2</sub>	530	265	930	475	237	790
		3	735	367	1,060	710	355	1,000
1/2	55	2 <sup>1</sup> / <sub>4</sub>	900	450	1,760	850	425	1,345
		3	1,180	590	1,655	1,120	560	1,655
		4	N/A	N/A	1,730	1,200	600	1,610
5/8	90	3	1,500	750	2,310	1,180	590	1,375
		5	1,490	745	2,320	1,645	822	2,285
3/4	175	3 <sup>1</sup> / <sub>4</sub>	1,790	895	3,150	1,460	730	2,220
		5 <sup>1</sup> / <sub>4</sub>	2,225	1,112	3,980	1,760	880	N/A

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

N/A = Not applicable.

<sup>1</sup>The tabulated shear and tensile values are for anchors installed in structural lightweight concrete having the designated compressive strength at the time of installation.

<sup>2</sup>The holes are drilled with bits complying with ANSI B212.15-1994. The bit diameter equals the anchor diameter.

<sup>3</sup>These tension values are applicable only when the anchors are installed with special inspection as set forth in Section 2.5.

<sup>4</sup>Installation details are in Figure 3. Spacing and edge distances are in Tables 4 and 5 as modified by Footnote 2.

Self-Drills	S (bolt size)
Trubolt Wedge Anchors	WS-Carbon Steel (anchor size × length)
Multi-Set II	RM-Carbon Steel (bolt size)

FIGURE 1—IDENTIFICATION SYMBOLS FOR THE VARIOUS ANCHORS

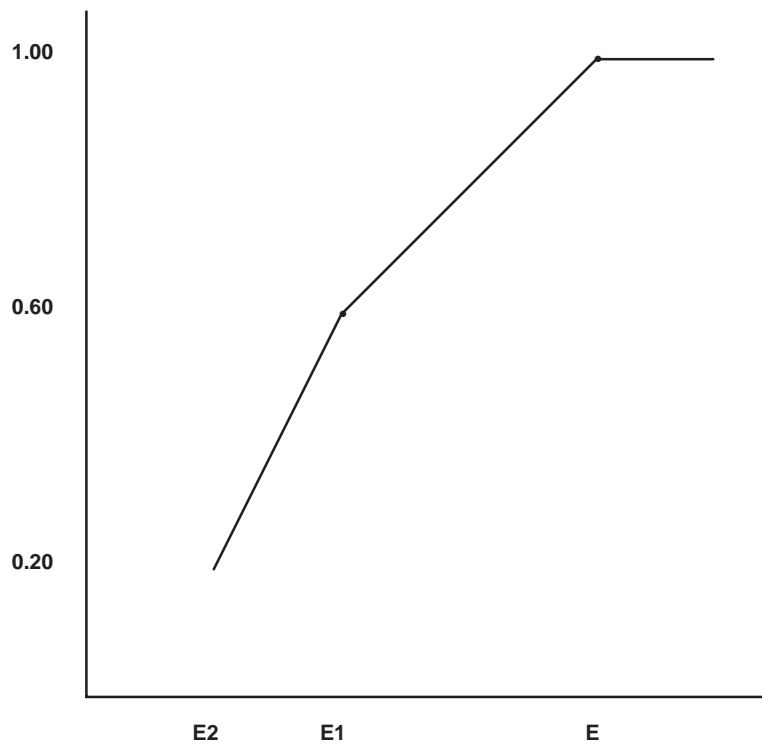
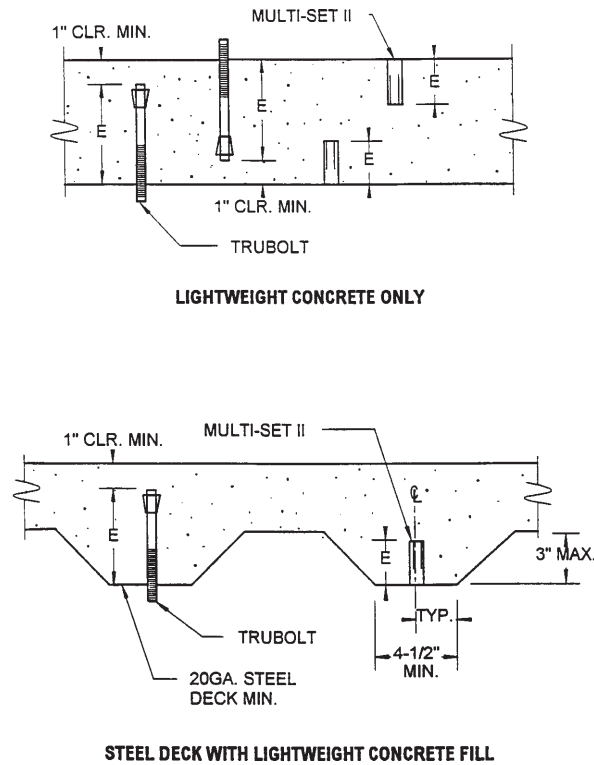


FIGURE 2—LOAD FACTORS FOR TRUBOLT WEDGE ANCHOR SHEAR LOADS AT REDUCED EDGE DISTANCES (See also Table 5)



E = DEPTH OF EMBEDMENT

For SI: 1 inch = 25.4 mm.

FIGURE 3—TRUBOLT AND MULTI-SET II ANCHORS IN LIGHTWEIGHT CONCRETE ( $f'_c = 3,000$  psi) AND STEEL DECK WITH LIGHTWEIGHT CONCRETE FILL ( $f'_c = 3,000$  psi)