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ICC-ES Evaluation Report

ESR-1976*

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

REPORT HOLDER:

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EVALUATION SUBJECT:

ITW BUILDEX TEKS® SELF-DRILLING FASTENERS

1.0 EVALUATION SCOPE

Compliance with the following codes:

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

Property evaluated:

Structural

2.0 USES

The ITW Buildex TEKS® Self-drilling Fasteners described in this report are used in engineered or code-prescribed connections of cold-formed steel framing and of sheet steel sheathing to cold-formed steel framing.

3.0 DESCRIPTION

3.1 General:

ITW Buildex TEKS® Self-drilling Fasteners are self-drilling tapping screws complying with the material, process, and performance requirements of ASTM C1513. The screws have either a hex washer head (HWH), an HWH with serrations, or a Phillips® (Type II) pan head. The screws are fully threaded, except where noted in Table 1, and the screws' threads comply with ASME B18.6.4, and the screws' drill points and flutes are proprietary and are designated as TEKS/1, TEKS/2, TEKS/3, TEKS/4, TEKS/4.5, and TEKS/5. The screws have nominal sizes of No.10 (0.190 inch), No.12 (0.216 inch), and $^1/_4$ inch (0.250 inch), and lengths from $^1/_2$ inch to 8 inches (12.70 mm to 203.20 mm). See Figures 1 through 3 for depictions of the screws. Table 1 provides screw descriptions (size, tpi, length), nominal diameters, head style, head diameters, point styles, drilling capacity ranges, length of load-bearing area and coatings.

3.2 Material:

ITW Buildex TEKS® Self-drilling Fasteners are case-hardened from carbon steel conforming to ASTM A510, Grade 1018 to 1022, and are heat-treated and case-hardened to give them a hard outer surface necessary to cut internal threads in the joint material. Screws are coated with corrosion preventive coating identified as Climaseal®, or are plated with electrodeposited zinc (E-Zinc) complying with the minimum corrosion resistance requirements of ASTM F1941.

3.3 Cold-formed Steel:

Cold-formed steel material must comply with Section A2 of AISI S100.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Screw thread length and point style must be selected on the basis of thickness of the fastened material and thickness of the supporting steel, respectively, based on the length of load-bearing area (see Figure 4) and drilling capacity given in Table 1.

When tested for corrosion resistance in accordance with ASTM B117, the screws meet the minimum requirement listed in ASTM F1941, as required by ASTM C1513, with no white corrosion after three hours and no red rust after 12 hours.

4.1.2 Prescriptive Design: ITW Buildex TEKS Self-drilling Fasteners described in Section 3.1 are recognized for use where ASTM C1513 screws of the same size and head style/dimension are prescribed in the IRC and in the AISI standards referenced in IBC Section 2210.

4.1.3 Engineered Design: ITW Buildex TEKS® Self-drilling Fasteners are recognized for use in engineered connections of cold-formed steel construction. Design of the connection must comply with Section E4 of AISI S100 (AISI-NAS for the 2006 IBC), using the nominal and allowable fastener tension and shear strength for the screws, shown in Table 5. Allowable connection strength for use in Allowable Strength Design (ASD) for pull-out, pullover, and shear (bearing) capacity for common sheet steel thicknesses are provided in Tables 2, 3, and 4, respectively, based upon calculations in accordance with AISI S100 (AISI-NAS for the 2006 IBC). Instructions on how to calculate connection design strengths for use in Load Resistance Factor Design (LRFD) are found in the footnotes of these tables. The connection strength values are applicable to connections where the connected steel elements are in direct contact with one another. For

connections subject to tension, the least of the allowable pullout, pullover, and fastener tension strength found in Tables 2, 3 and 5, respectively, must be used for design. For connections subject to shear, the lesser of the fastener shear strength and allowable shear (bearing) found in Tables 4 and 5, respectively, must be used for design. Connections subject to combined tension and shear loading must be designed in accordance with Section E4.5 of AISI S100.

The values in Tables 2, 3, and 4 are based on a minimum spacing between the center of fasteners of three times the diameter of the screws, and a minimum distance from the center of a fastener to the edge of any connected part of 1.5 times the diameter of the screws. Minimum edge distance when connecting cold-formed framing members must be three times the diameter of the screw, in accordance with Section D1.5 of AISI S200 (AISI-General for 2006 IBC). Under the 2009 and 2006 IBC, when the distance to the end of the connected part is parallel to the line of the applied force, the allowable connection shear strength determined in accordance with Section E4.3.2 of Appendix A of AISI S100 must be considered. Connected members must be checked for rupture in accordance with Section E5 of AISI S100-07/S2-10.

4.2 Installation:

Installation of ITW Buildex TEKS® Self-drilling Fasteners must be in accordance with the manufacturer's published installation instructions and this report. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

The screws must be installed perpendicular to the work surface, using a screw driving tool. The installation speed for $^1/_4$-inch TEKS/3, $^1/_4$-inch TEKS/5, and #12 TEKS/5 screws should not exceed 1,800 rpm; the installation speed for all other screws should not exceed 2,500 rpm. The screw must penetrate through the supporting steel with a minimum of three threads protruding past the back side of the supporting steel.

5.0 CONDITIONS OF USE

The ITW Buildex TEKS® Self-drilling 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 Fasteners must be installed in accordance with the manufacturer's published installation instructions and this report. In the event of a conflict between this report and the manufacturer's published installation instructions, this report governs.

5.2 The utilization of the nominal strength values contained in this evaluation report, for the design of cold-formed steel diaphragms, is outside the scope of this report.

5.3 The allowable load values (ASD) specified in Section 4.1 for screws or for screw connections are not permitted to be increased for short-duration loads, such as wind or earthquake loads.

5.4 Drawings and calculations verifying compliance with this report and the applicable code must be submitted to the code official for approval. The drawings and calculations are to be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Tapping Screw Fasteners (AC118), dated June 2012.

7.0 IDENTIFICATION

ITW Buildex TEKS® Self-drilling Fastener heads are marked with "BX" as shown in Figures 1 through 3. Each box of fasteners has a label bearing the company name (ITW Buildex), fastener description (model, point type, diameter and length), lot number, and the evaluation report number (ESR-1976).

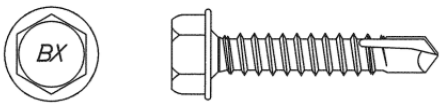

FIGURE 1—HEX WASHER HEAD (HWH)

FIGURE 2—HWH WITH SERRATIONS

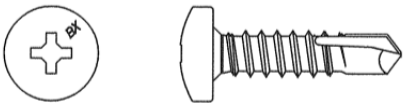

FIGURE 3—PHILLIPS PAN HEAD

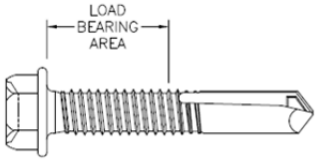

FIGURE 4—LENGTH OF LOAD-BEARING AREA

TABLE 1—TESK® SELF-DRILLING TAPPING SCREWS[1]

DESCRIPTION (nom. size-tpi x length)	NOMINAL DIAMETER (inch)	HEAD STYLE	HEAD DIAMETER (inch)	DRILL POINT	DRILLING CAPACITY[3] (in.)		LENGTH OF LOAD BEARING AREA[4] (inch)	COATING
					Min.	Max.		
10-16 x 3/4"	0.190	HWH	0.400	TEKS/1	0.018	0.095	0.220	Climaseal
12-14 x 3/4"	0.216	HWH	0.415	TEKS/1	0.018	0.095	0.205	Climaseal
1/4-14 x 7/8"	0.250	HWH	0.415	TEKS/1	0.018	0.095	0.380	Climaseal
10-16 x 1/2"	0.190	Pan	0.365	TEKS/3	0.036	0.175	0.150	Climaseal
10-16 x 5/8"	0.190	Pan	0.365	TEKS/3	0.036	0.175	0.200	Climaseal
10-16 x 3/4"	0.190	Pan	0.365	TEKS/3	0.036	0.175	0.325	Climaseal
10-16 x 1/2"	0.190	HWH	0.400	TEKS/3	0.036	0.175	0.150	Climaseal
10-16 x 5/8"	0.190	HWH	0.400	TEKS/3	0.036	0.175	0.200	Climaseal
10-16 x 3/4"	0.190	HWH	0.400	TEKS/3	0.036	0.175	0.325	Climaseal
10-16 x 1"	0.190	HWH	0.400	TEKS/3	0.036	0.175	0.575	Climaseal
10-16 x 1"	0.190	Pan	0.365	TEKS/3	0.036	0.175	0.575	Climaseal
10-16 x 1 1/4"	0.190	HWH	0.400	TEKS/3	0.036	0.175	0.825	Climaseal
10-16 x 1 1/2"	0.190	HWH	0.400	TEKS/3	0.036	0.175	1.075	Climaseal
10-16 x 3/4"	0.190	HWH[2]	0.435	TEKS/3	0.036	0.175	0.323	E-Zinc
12-14 x 3/4"	0.216	HWH	0.415	TEKS/3	0.036	0.210	0.270	Climaseal
12-14 x 1"	0.216	HWH	0.415	TEKS/3	0.036	0.210	0.520	Climaseal
12-14 x 1 1/4"	0.216	HWH	0.415	TEKS/2	0.036	0.210	0.550	Climaseal
12-14 x 1 1/2"	0.216	HWH	0.415	TEKS/2	0.036	0.210	0.800	Climaseal
12-14 x 2"	0.216	HWH	0.415	TEKS/3	0.036	0.210	1.450	Climaseal
12-14 x 2 1/2"	0.216	HWH	0.415	TEKS/3	0.036	0.210	1.950	Climaseal
12-14 x 3"	0.216	HWH	0.415	TEKS/3	0.036	0.210	2.450	Climaseal
12-14 x 4"	0.216	HWH	0.415	TEKS/3	0.036	0.210	3.450	Climaseal
1/4-14 x 3/4"	0.250	HWH	0.500	TEKS/3	0.036	0.210	0.210	Climaseal
1/4-14 x 1"	0.250	HWH	0.500	TEKS/3	0.036	0.210	0.400	Climaseal
1/4-14 x 1 1/4"	0.250	HWH	0.500	TEKS/3	0.036	0.210	0.650	Climaseal
1/4-14 x 1 1/2"	0.250	HWH	0.500	TEKS/3	0.036	0.210	0.900	Climaseal
1/4-14 x 2"	0.250	HWH	0.500	TEKS/3	0.036	0.210	1.400	Climaseal
1/4-14 x 2 1/2"	0.250	HWH	0.500	TEKS/3	0.036	0.210	1.900	Climaseal
1/4-14 x 3"	0.250	HWH	0.500	TEKS/3	0.036	0.210	2.400	Climaseal
1/4-14 x 4"	0.250	HWH	0.500	TEKS/3	0.036	0.210	3.400	Climaseal
1/4-14 x 3/4"	0.250	HWH[2]	0.610	TEKS/3	0.036	0.210	0.250	Climaseal
1/4-14 x 1"	0.250	HWH[2]	0.610	TEKS/3	0.036	0.210	0.500	Climaseal
12-24 x 7/8"	0.216	HWH	0.415	TEKS/4	0.125	0.250	0.325	Climaseal
12-24 x 1 1/4"	0.216	HWH	0.415	TEKS/4.5	0.125	0.375	0.575	Climaseal
12-24 x 1 1/4"	0.216	HWH	0.415	TEKS/5	0.125	0.500	0.375	Climaseal
12-24 x 1 1/2"	0.216	HWH	0.415	TEKS/5	0.125	0.500	0.625	Climaseal
12-24 x 2"	0.216	HWH	0.415	TEKS/5	0.125	0.500	1.125	Climaseal
1/4-28 x 3"	0.250	HWH	0.415	TEKS/5	0.125	0.500	2.150	Climaseal
1/4-28 x 4"	0.250	HWH	0.415	TEKS/5	0.125	0.500	3.150	Climaseal
1/4-28 x 5"[5]	0.250	HWH	0.605	TEKS/5	0.125	0.500	4.150	Climaseal
1/4-28 x 6"[5]	0.250	HWH	0.605	TEKS/5	0.125	0.500	5.150	Climaseal
1/4-28 x 8"[5]	0.250	HWH	0.605	TEKS/5	0.125	0.500	7.150	Climaseal

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

[1] Screw dimensions comply with ASME B18.6.4 (nom. size = nominal screw size, tip = threads per inch, length = inches).
[2] HWH with serrations.
[3] Drilling capacity refers to the minimum and maximum total allowable thicknesses of material the fastener is designed to drill through, including any space between the layers.
[4] Length of load-bearing area is the total screw length minus the length from the screw point to the third full thread. See Figure 4.
[5] Partially threaded.

TABLE 2—ALLOWABLE TENSILE PULL-OUT LOADS (P_{NOT}/Ω), pounds-force[1, 2, 3, 4, 5]

Steel F_u = 45 ksi, Applied Factor of Safety, Ω=3.0												
Screw Designation	**Nominal Diameter (in.)**	**Design Thickness of Member Not in Contact with the Screw Head (in)**										
		0.018	**0.024**	**0.030**	**0.036**	**0.048**	**0.060**	**0.075**	**0.105**	**0.125**	**0.187**	**0.250**
10-16	0.190	44	58	73	87	116	145	182	254	303	[6]	[6]
12-14, 12-24	0.216	50	66	83	99	132	165	207	289	344	515	689
$^1/_4$-14, $^1/_4$-28	0.250	57	77	96	115	153	191	239	335	398	596	797

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.89 MPa.

[1]For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.
[2]ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.
[3]The allowable pull-out capacity for other member thickness can be determined by interpolating within the table.
[4]To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.
[5]For F_u = 58 ksi, multiply values by 1.29; for F_u = 65 ksi, multiply values by 1.44.
[6]Outside drilling capacity limits.

TABLE 3—ALLOWABLE TENSILE PULL-OVER LOADS (P_{NOV}/Ω), pounds-force[1, 2, 3, 4, 5]

Steel Fu = 45 ksi, Applied Factor of Safety, Ω=3.0													
Screw Designation	**Nominal Diameter (in.)**	**Head or Integral Washer Diameter (in.)**	**Design Thickness of Member in Contact with the Screw Head (in)**										
			0.018	**0.024**	**0.030**	**0.036**	**0.048**	**0.060**	**0.075**	**0.105**	0.125	0.187	0.250
Hex Washer Head (HWH)													
10-16	0.190	0.400	162	216	270	324	432	540	675	945	1125	[6]	[6]
12-14, 12-24	0.216	0.415	168	224	280	336	448	560	700	980	1167	1746	2334
$^1/_4$-14, $^1/_4$-28	0.250	0.500	203	270	338	405	540	675	844	1181	1406	2104	2813
HWH with Serrations													
10-16	0.190	0.435	176	235	294	352	470	587	734	1028	1223	[6]	[6]
$^1/_4$-14	0.250	0.610	203	270	338	405	540	675	844	1181	1406	2104	[6]
Phillips Pan Head													
10-16	0.190	0.365	148	197	246	296	394	493	616	862	1027	[6]	[6]

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.89 MPa.

[1]For tension connections, the lower of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively must be used for design.
[2]ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.
[3]The allowable pull-over capacity for other member thickness can be determined by interpolating within the table.
[4]To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.
[5]For Fu = 58 ksi, multiply values by 1.29; for Fu = 65 ksi, multiply values by 1.44.
[6]Outside drilling capacity limits.

TABLE 4—ALLOWABLE SHEAR (BEARING) CAPACITY (P_{NS}/Ω), pounds-force[1, 2, 3, 4, 5]

Steel Fu = 45 ksi, Applied Factor of Safety, Ω=3.0												
Screw Designation	**Nominal Diameter (in.)**	**Design Thickness of Member Not in Contact with the Screw Head (in)**	**Design Thickness of Member in Contact with the Screw Head (in)**									
			0.018	**0.024**	**0.030**	**0.036**	**0.048**	**0.060**	**0.075**	**0.105**	**0.125**	**0.187**	**0.250**
10-16	0.190	0.018	66	66	66	66	66	66	66	66	66		
		0.024	102	102	102	102	102	102	102	102	102		
		0.030	111	143	143	143	143	143	143	143	143		
		0.036	120	152	185	188	188	188	188	188	188		
		0.048	139	168	199	228	289	289	289	289	289		
		0.060	139	185	213	239	327	404	404	404	404		
		0.075	139	185	231	251	337	427	564	564	564		
		0.105	139	185	231	277	356	436	570	808	808		
		0.125	139	185	231	277	369	442	571	808	962		
12-14 12-24	0.216	0.018	71	71	71	71	71	71	71	71	71	71	71
		0.024	109	109	109	109	109	109	109	109	109	109	109
		0.030	125	152	152	152	152	152	152	152	152	152	152
		0.036	136	170	205	200	200	200	200	200	200	200	200
		0.048	157	190	223	253	308	308	308	308	308	308	308
		0.060	157	210	240	266	362	430	430	430	430	430	430
		0.075	157	210	262	282	375	468	601	601	601	601	601
		0.105	157	210	262	315	402	483	624	919	919	919	919
		0.125	157	210	262	315	420	494	629	919	1094	1094	1094
		0.187	157	210	262	315	420	525	642	919	1094	1636	1636
		0.250	157	210	262	315	420	525	656	919	1094	1636	2187
$^1/_4$-14 $^1/_4$-28[6]	0.250	0.018	76	76	76	76	76	76	76	76	76	76	76
		0.024	117	117	117	117	117	117	117	117	117	117	117
		0.030	142	164	164	164	164	164	164	164	164	164	164
		0.036	156	193	215	215	215	215	215	215	215	215	215
		0.048	182	218	253	283	331	331	331	331	331	331	331
		0.060	182	243	276	300	406	463	463	463	463	463	463
		0.075	182	243	304	322	424	521	647	647	647	647	647
		0.105	182	243	304	365	461	544	694	1063	1063	1063	1063
		0.125	182	243	304	365	486	560	703	1063	1266	1266	1266
		0.187	182	243	304	365	486	608	731	1063	1266	1893	1893
		0.250	182	243	304	365	486	608	759	1063	1266	1893	2531

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.89 MPa.

[1]The lower of the allowable shear (bearing) and the allowable fastener shear strength found in Tables 4 and 5, respectively, must be used for design.
[2]ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.
[3]The allowable bearing capacity for other member thickness can be determined by interpolating within the table.
[4]To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.
[5]For F_u = 58 ksi, multiply values by 1.29; for F_u = 65 ksi, multiply values by 1.44.
[6]Shear values do not apply to 5, 6 and 8-inch-long $^1/_4$-28 screws, due to the fact that they are not fully threaded.

TABLE 5—FASTENER STRENGTH OF SCREWS[1, 2, 3, 4, 5]

SCREW DESIGNATION	**DIAMETER (in.)**	**ALLOWABLE FASTENER STRENGTH**		**NOMINAL FASTENER STRENGTH**	
		Tensile, P_{ts}/Ω (lb)	**Shear, P_{ss}/Ω (lb)**	**Tensile, P_{ts} (lb)**	**Shear, P_{ss} (lb)**
10-16	0.190	885	573	2654	1718
12-14	0.216	1184	724	3551	2171
12-24	0.216	1583	885	4750	2654
$^1/_4$-14	0.250	1605	990	4816	2970
$^1/_4$-28	0.250	1922	1308	5767	3925

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.89 MPa.

[1]For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.
[2]For shear connection, the lower of the allowable shear (bearing) and the allowable fastener shear strength found in Table 4 and 5, respectively, must be used for design.
[3]See Section 4.1 for fastener spacing and end distance requirements.
[4]Nominal strengths are based on laboratory tests;
[5]To calculate LRFD values, multiply nominal strength values by the LRFD Φ factor of 0.5.