

# ACCEPTANCE CRITERIA FOR SELF-DRILLING TAPPING SCREWS USED TO ATTACH MISCELLANEOUS BUILDING MATERIALS TO STEEL BASE MATERIAL

AC500

Approved October 2017

## PREFACE

Evaluation reports issued by ICC Evaluation Service, LLC (ICC-ES), are based upon performance features of the International family of codes. (Some reports may also reference older code families such as the BOCA National Codes, the Standard Codes, and the Uniform Codes.) Section 104.11 of the *International Building Code*® reads as follows:

The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

This acceptance criteria has been issued to provide interested parties with guidelines for demonstrating compliance with performance features of the codes referenced in the criteria. The criteria was developed through a transparent process involving public hearings of the ICC-ES Evaluation Committee, and/or on-line postings where public comment was solicited.

New acceptance criteria will only have an “approved” date, which is the date the document was approved by the Evaluation Committee. When existing acceptance criteria are revised, the Evaluation Committee will decide whether the revised document should carry only an “approved” date, or an “approved” date combined with a “compliance” date. The compliance date is the date by which relevant evaluation reports must comply with the requirements of the criteria. See the ICC-ES web site for more information on compliance dates.

If this criteria is a revised edition, a solid vertical line (|) in the margin within the criteria indicates a change from the previous edition. A deletion indicator (→) is provided in the margin where any significant wording has been deleted.

ICC-ES may consider alternate criteria for report approval, provided the report applicant submits data demonstrating that the alternate criteria are at least equivalent to the criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. ICC-ES retains the right to refuse to issue or renew any evaluation report, if the applicable product, material, or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause injury or unreasonable damage.

*Acceptance criteria are developed for use solely by ICC-ES for purposes of issuing ICC-ES evaluation reports.*

# ACCEPTANCE CRITERIA FOR SELF-DRILLING TAPPING SCREWS USED TO ATTACH MISCELLANEOUS BUILDING MATERIALS TO STEEL BASE MATERIAL (AC500)

## 1.0 INTRODUCTION

**1.1 Purpose:** The purpose of this acceptance criteria is to establish requirements for self-drilling tapping screws used to attach miscellaneous building materials to steel base material to be recognized in an ICC Evaluation Service, LLC (ICC-ES), evaluation report under the 2015, 2012 and 2009 *International Building Code*® (IBC) and the 2015, 2012 and 2009 *International Residential Code*® (IRC). Bases of recognition are IBC Section 104.11 and IRC Section R104.11. The referenced standards in the code address determination of screw strengths and connection capacities for self-drilling tapping screws used in steel-to-steel connections. This criteria is intended to address determination of design values in accordance with these standards which can be used together with other design information to address IBC Section 1604.2, for screws used to attach building materials other than steel to the steel base material.

**1.2 Scope:** This acceptance criteria stipulates requirements for recognition of carbon steel self-drilling tapping screws (including dual-hardened screws), stainless steel self-drilling tapping screws or bi-metal self-drilling tapping screws used to attach miscellaneous building materials to steel base material. Screw characteristics that are addressed include the following:

1. Compliance with ASTM C1513.
2. Compliance with the report holder's specifications and minimum performance requirements.
3. Available screw tensile strength, shear strength and bending moment strength.
4. Available screw pull-out strength for installation in steel base material.
5. Applicable end distance, edge distance and spacing limitations for the attached building material.

### 1.3 Codes and Referenced Standards:

**1.3.1** 2015, 2012 and 2009 *International Building Code*® (IBC), International Code Council.

**1.3.2** 2015, 2012 and 2009 *International Residential Code*® (IRC), International Code Council.

**1.3.3** AISI S100-12, North American Specification for Design of Cold-Formed Steel Structural Members, American Iron and Steel Institute.

**1.3.4** AISI S200-12, North American Standard for Cold-Formed Steel Framing – General Provisions, American Iron and Steel Institute.

**1.3.5** AISI S904-13, Standard Test Method for Determining the Tensile and Shear Strength of Screws, American Iron and Steel Institute.

**1.3.6** AISI S905-13, Test Standard for Cold-Formed Steel Connections, American Iron and Steel Institute.

**1.3.7** ASME B18.6.4-1998, Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series), The American Society of Mechanical Engineers.

**1.3.8** ASTM A370-12, Standard Test Methods and Definitions for Mechanical Testing of Steel Products, ASTM International.

**1.3.9** ASTM A1040-10(2015), Standard Guide for Specifying Harmonized Standard Grade Compositions for Wrought Carbon, Low-Alloy, and Alloy Steels, ASTM International.

**1.3.10** ASTM A510-13, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel, ASTM International.

**1.3.11** ASTM B117-07, Standard Practice for Operating Salt Spray (Fog) Apparatus, ASTM International.

**1.3.12** ASTM C1513-13, Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections, ASTM International.

**1.3.13** ASTM F1575-17, Standard Test Method for Determining Bending Yield Moment of Nails, ASTM International.

**1.3.14** SAE J78 1998-05, Steel Self-Drilling Tapping Screws, SAE International.

**1.4 Definitions:** The following definitions are applicable within the context of this acceptance criteria:

**1.4.1 Allowable Strength:** Allowable strength is the nominal strength divided by the safety factor. Allowable strength is used in Allowable Strength Design (ASD).

**1.4.2 Available Strength:** Available strength is the allowable strength or design strength, as applicable.

**1.4.3 Base steel thickness:** The base steel thickness is the thickness of the steel, exclusive of all coatings.

**1.4.4 Bi-metal screw:** A screw which is manufactured from two different metals which are joined together at the manufacturing facility. For example, a screw with a stainless steel body fused to a hardened carbon steel drilling tip.

**1.4.5 Design Strength:** Design strength is the nominal strength multiplied by the resistance factor. Design strength is used in Load and Resistance Factor Design (LRFD).

**1.4.6 Dual-hardened screw:** Screws which have a relatively high hardness at the drilling point and lead threads, compared to the hardness of the remainder of the screw. These screws are typically used where the higher hardness is needed for drilling purposes, while the lower hardness at the load-bearing portion of the screw is intended to prevent hydrogen-assisted stress corrosion cracking.

**1.4.7 Fastener family:** A group of screw products which are the same in all respects except for the screw length.

**1.4.8 Fastener class:** A group of screw products from the same manufacturer which have the same raw material specifications and manufacturing processes. Screws within the fastener class can differ in diameter, head style and length, but have similar thread design.

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**1.4.9 Load-bearing portion of screw:** The portion of the screw that is intended to be embedded in the connected materials after installation. This is typically the nominal screw length minus the minimum required protrusion past the back side of the supporting material

**1.4.10 Minimum required protrusion past the back side of the supporting material:** This is the dimension from the tip of the screw to the start of the load-bearing portion of the screw. For carbon steel and stainless steel screws this is the dimension which will allow three full (unslotted) threads to protrude past the back side of the supporting material. For dual hardened or bi-metal screws, this shall not be less than the dimension from the tip of the screw to the location where the screw has the lower hardness.

**1.4.11 Nominal Bending Moment Strength:** The nominal bending moment strength is the maximum bending moment determined in accordance with ASTM F1575.

**1.4.12 Nominal Screw Strength:** Nominal screw strength (shear or tension) is the average test strength of the screw, without the resistance factor or safety factor applied.

**1.4.13 Nominal Pull-out Strength:** Average pull-out test strength adjusted by the reduction factor determined in accordance with Section 4.4, as applicable, without any safety factor or resistance factor applied.

**1.4.14 Proprietary Screws:** Screws that do not comply with ASTM C1513.

**1.4.15 Self-drilling Tapping Screws:** See Section 3.2.9 of ASTM C1513.

## 2.0 BASIC INFORMATION

**2.1 General:** The following information shall be submitted:

### 2.1.1 Screws:

**2.1.1.1** A description of the intended end use of the screws, including the types of materials that will be attached to the supporting steel, and the scope of recognition sought.

**2.1.1.2** A description of the screw fasteners, including brand name, head markings, model number, head style, drive type, nominal dimensions and point style. Representative figures of the screws shall be submitted for inclusion in the evaluation report.

**2.1.1.3** Product drawings showing the general shape of the fastener (head style, full or partial thread, spacing of threads, point type, etc.) and the specified dimensions, including tolerances, for each screw size; raw material specifications; final product specifications, including case and core hardness, ductility, and torsional strength, as applicable; and specifications for protective coatings.

**2.1.2 Steel Base Material:** A description of the steel material intended for use with the screws, including base steel thickness, ASTM specification, type and grade, as applicable, coating requirements, minimum yield and tensile strengths and product description (deck panel, framing member, etc.).

**2.1.3 Installation Instructions:** Installation details and limitations including the following: description of the recommended installation tool, and of the recommended tool operation, such as speed and torque, during installation; intended spacing, edge and end distances; applicable exposure conditions; drilling capacity recommended by the applicant and minimum required protrusion past the back side of the supporting member for each screw.

**2.1.4 Packaging and Identification:** A description of the method of packaging and field identification of the screws. The identifying information on each box or package of fasteners shall include the screw brand name and model number, nominal screw size (number, fraction or decimal equivalent), nominal screw length (fraction or decimal equivalent), point style, the evaluation report holder's name, and the ICC-ES evaluation report number. Figures depicting the head marking(s) on the screw and the report holder's logo, if applicable, shall be submitted for inclusion in the evaluation report.

**2.2 Testing Laboratories:** Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of the ICC-ES Rules of Procedure for Evaluation Reports.

**2.3 Test Reports:** Test reports shall comply with AC85.

**2.4 Product Sampling:** Sampling of the screws for tests under this criteria shall comply with Section 3.2 of AC85.

**2.5 Qualification Test Plan:** A qualification test plan shall be submitted to and approved by ICC-ES staff prior to any testing being conducted.

## 3.0 TEST AND PERFORMANCE REQUIREMENTS

**3.1 Screws That Comply with ASTM C1513:** Screws shall be recognized as meeting the intent of ASTM C1513 when the requirements shown in Table 1 are met. Where Table 1 indicates that third-party testing is required, a minimum of three replicate samples shall be tested for each fastener family. If any of the samples do not meet the specifications, an additional three samples shall be tested and the average results must comply with the specifications.

**3.2 Proprietary Screws:** Proprietary screws shall comply with Sections 3.2.1 through 3.2.3.

**3.2.1 Compliance with Proprietary Specifications:** Screws shall be tested to determine compliance with the applicant's specifications. A minimum of three replicate samples shall be tested for each fastener family, to determine compliance with dimensional specifications; mechanical properties, such as hardness and torsional strength; and other specified characteristics such as case depth. If any of the samples do not meet the specifications, an additional three samples shall be tested and the average results must comply with the specifications

**3.2.2 Corrosion Resistance:** Carbon steel screws and the carbon steel portions of bi-metal screws shall have a corrosion-resistant coating. Carbon steel screws and bi-metal screws with carbon steel shall be tested in accordance with ASTM B117 for a minimum 12-hour test period. Screws shall not show products of corrosion from

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the coating (white corrosion) after three hours, and shall not show corrosion from the base metal (red rust) visible to the unaided eye at normal reading distance at the end of the test period, except when present at the edges of the tested fastener. The testing laboratory shall determine compliance with these conditions of acceptance.

**3.2.3 Drill Hole Size and Drilling Capacity:** For screws where pull-out strength is determined by calculation, as allowed by Section 3.5.1, the screws shall be tested to confirm compliance with the drill hole size requirements shown in Table 1. All proprietary screws shall be tested to verify the maximum drilling capacity, as required in Table 1.

**3.3 Drilling Capacity in Attached Building Material (Optional):** The ability of a screw to self-drill through the attached building material into the supporting steel material may be addressed in the evaluation report. The attached material shall be described by type (wood, gypsum board, etc.) and maximum intended thickness, strength and/or density, as applicable. Drilling capacity shall be verified by a third-party laboratory. A minimum of 10 screws from each fastener family shall be drilled through the connected building material into the maximum intended thickness of the supporting steel. The edge and end distances and spacing in both the attached building material and the steel base material shall be the minimums that are to be addressed in the evaluation report. The screws shall be considered to have passed the test if the drill point and lead threads have penetrated through the steel and there is no cracking, splitting, or other damage to the attached building material after installation of the screws.

### 3.4 Screw Strengths:

**3.4.1 Shear and Tensile Strength:** Screw shear and tensile strength shall be tested in accordance with AISI S904. A minimum of three replicate screws of each type shall be tested. When deviation of any individual test result from the average value exceeds  $\pm 15$  percent, additional replicate screws shall be tested until the deviation of any individual test result from the average value obtained from all the tests does not exceed  $\pm 15$  percent, or until at least three additional tests have been conducted. In the case of dual-hardened screws or bi-metal screws, the hardened tip or stainless steel tip of the screw, as applicable, shall be beyond the shear load plane being tested. The available screw shear and tensile strengths shall be determined in accordance with Sections F1.1(c) and F1.2 of AISI S100, but the safety factor,  $\Omega$ , and resistance factor,  $\Phi$ , need not be more severe than 3.0 and 0.50, respectively.

**3.4.2 Bending Moment Strength (Optional):** The nominal bending moment strength for a fastener shall be the maximum bending moment determined in accordance with ASTM F1575. A minimum of 15 specimens shall be tested. For partially threaded fasteners, the test load shall be applied at the transition from threaded shank to smooth shank. The available bending moment strengths shall be determined in accordance with Sections F1.1(c) and F1.2 of AISI S100.

### 3.5 Pull-out Strength:

**3.5.1 Determined by Calculation:** For screws which comply with the material, thread design, case depth,

hardness, ductility, torsional strength and drill hole size requirements of Table 1, available pull-out strength may be determined in accordance with Sections E4 and E4.4.1 of AISI S100.

**3.5.2 Determined by Rational Analysis with Confirmatory Testing:** Pull-out capacities for screws which do not meet the applicability requirements of Section 3.5.1 may be calculated using a design methodology which is validated by testing selected configurations. Confirmatory testing shall be in accordance with Section 4.0. Analysis requirements are addressed in Sections A1.2(b) and F1.1(b) of AISI S100. When this approach is taken, a testing and analysis plan must be submitted to ICC-ES prior to testing.

**3.5.3 Determined by Testing:** Except as allowed in Section 3.5.1 or 3.5.2, pull-out strength shall be determined by testing. Testing shall be in accordance with Section 4.0. Test results shall be adjusted in accordance with Section 4.4 and available strengths shall be determined in accordance with Sections F1.1(c) and F1.2 of AISI S100.

## 4.0 TESTING REQUIREMENTS

**4.1 Test Method:** Pull-out testing shall be in compliance with AISI S905. Steel base material shall be representative of the material to be recognized in the evaluation report.

**4.2 Number of Specimens:** As a minimum, a series of three identical tests shall be performed for each combination of variables that affect pull-out performance, provided deviation of any individual test result from the average value does not exceed  $\pm 15$  percent. If such a deviation from the average value exceeds  $\pm 15$  percent, more tests of the same kind shall be conducted until the deviation of any individual test result from the average value obtained from all the tests does not exceed  $\pm 15$  percent, or until at least three additional tests have been conducted. No test result shall be eliminated unless a rationale for its exclusion is given.

**4.3 Component Assessment:** The base steel thickness, yield strength, and tensile strength of the steel test members shall be established from coupon tests in accordance with Section 8.2 of AISI S905. Base steel thickness shall be no more than 10 percent greater than specified. The mechanical properties shall comply with the material specification that is to be recognized in the evaluation report.

**4.4 Reduction Factor:** If the measured tensile strength and/or thickness of the steel sheet used in the testing is greater than what will be specified in the evaluation report, the test results shall be adjusted downward by a factor,  $R_s$ , defined as follows:

$$R_s = \left( \frac{F_{u-specified}}{F_{u-tested}} \leq 1.0 \right) \times \left( \frac{t_{specified}}{t_{tested}} \leq 1.0 \right) \quad \text{Eq. 4.1}$$

where:

$R_s$  = Reduction factor.

$F_{u-specified}$  = Minimum steel tensile strength to be specified in the evaluation report, ksi (MPa).

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$F_{u-tested}$  = Measured tensile strength of the steel, ksi (MPa).

$t_{specified}$  = Steel thickness to be specified in the evaluation report, inch (mm).

$t_{tested}$  = Measured steel thickness, inch (mm).

### 5.0 QUALITY CONTROL

**5.1** The products shall be manufactured under an approved quality control program with annual inspections by ICC-ES or by a properly accredited inspection agency that has a contractual relationship with ICC-ES.

**5.2** Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted. The quality documentation shall include technical drawings for each fastener and the specifications required by Section 2.1.1.3. The quality documentation shall address how the fastener strengths recognized in the evaluation report are verified on an ongoing basis.

**5.3** A qualifying inspection shall be conducted at each manufacturing facility in accordance with the requirements of the ICC-ES Acceptance Criteria for Inspections and Inspection Agencies (AC304).

### 6.0 EVALUATION REPORT RECOGNITION

**6.1** The following descriptive information shall be included in the evaluation report:

**6.1.1** A description of the fastener class, including material specifications, basic manufacturing process (such as how carbon steel points are joined or fused to stainless steel bodies, for bi-metal screws), finished fastener mechanical properties, such as hardness, and coatings, as applicable.

**6.1.2** A description of each fastener family within the fastener class including the size (e.g. #8, #10, etc.), nominal screw diameter, threads per inch (tpi), head style and head diameter or integral washer diameter, as applicable, drive type, point style, drilling capacity and minimum required protrusion of the point for each fastener family.

**6.1.3** A description of the material properties and thicknesses of the steel base material for which pull-out capacities are given.

**6.1.4** Figures depicting the screws and the head markings.

**6.2** The following design information shall be included in the evaluation report:

**6.2.1** A description of the types of building materials that are intended to be attached to the steel base material.

**6.2.2** The available tensile and shear strengths of the screws (ASD and LRFD), or the nominal tensile and shear strengths of the screws with applicable safety factor(s),  $\Omega$ , and resistance factor(s),  $\Phi$ . The available bending moment strength, or the nominal bending moment strength of the screws with applicable safety factor(s),  $\Omega$ , and resistance factor(s),  $\Phi$ , if applicable data has been provided.

**6.2.3** The available pull-out strengths for the screws.

**6.2.4** The following statements:

**6.2.4.1** The design values in this report are intended to aid the designer in meeting the requirements of IBC Section 1604.2.

**6.2.4.2** Determination of the suitability of a particular screw recognized in this report for the specific application is the responsibility of the registered design professional and is outside of the scope of this report.

**6.2.4.3** The registered design professional is responsible for determining the available strengths for the connection, considering all applicable limit states such as pull-over or pull-through, tilting and bearing, etc., and for considering serviceability issues, such as fastener slip.

**6.2.4.4** The registered design professional is responsible for determining the required spacing, edge distance and end distance for the fasteners, based on the characteristics of the steel base material and the attached building material.

**6.3** The following installation information shall be included in the evaluation report:

**6.3.1** "Screw length must be adequate to accommodate the thickness of the connected building material, the thickness of the steel base material and the minimum required protrusion past the back side of the supporting steel base material. The minimum required protrusion dimensions are shown in Table (applicable table number)."

**6.3.2** Minimum edge distance, end distance and spacing of the screws in the steel base material shall be addressed. The requirements of AISI S100 or S200 shall be followed as applicable.

**6.3.3 When drilling capacity in the attached building material is not addressed:** "The screw point style must be selected on the basis of the qualified drilling capacity, which is shown in Table (applicable table number). The tabulated drilling capacity refers to the thickness of the supporting steel member. Evaluation of the ability of the screw to self-drill through the attached building material is outside the scope of this report. The required edge distance, end distance and spacing for the attached building material is also outside the scope of this report."

**6.3.4 When drilling capacity in the attached building material is addressed in accordance with Section 3.3:** "The screw point style must be selected on the basis of the required drilling capacity." The maximum thickness of the applicable attached building material combined with the maximum thickness of steel base material that the screws can be self-drilled through shall be addressed in the report. The minimum edge distance, end distance and spacing for the attached building material shall also be addressed.

**6.4** The following conditions of use shall be included in the evaluation report:

**6.4.1** The screws have only been evaluated for fastener strength, quality control and pull-out strength. Evaluation of other applicable limit states for connections of building materials to the steel base material is outside the scope of this report.

**6.4.2** Design of the connection of attached material to the steel base material, taking into account the properties of the attached material, must comply with the

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applicable requirements of the IBC, and be justified to the satisfaction of the code official.

**6.4.3** The screws may be used in structures regulated under the IRC when an engineered design is submitted for review in accordance with IBC Section R301.1.3.■

**TABLE 1—QUALIFICATION REQUIREMENTS FOR ASTM C1513 SCREWS**

TABLE 1—QUALIFICATION REQUIREMENTS FOR ASTM C1513 SCREWS												
ASTM C1513 Requirement	AC500 Requirement								Verification Requirements			
Material	Carbon steel wire complying with ASTM A510 (or similar national standard for carbon steel wire), minimum grade of 1018 per Table 2 of ASTM A1040 for long product (defined in ASTM A1040).								Manufacturer's specifications			
Head Styles and Head Dimensions	Applicable <b>head styles</b> include Bugle, Wafer, Hex Washer, Modified Truss <sup>1</sup> , Pan, Pan Framing and Pancake, as shown in Fig. 1 of ASTM C1513.									Manufacturer's specifications		
	Requirements for <b>head dimensions</b> are as follows:											
	Nominal Size	Basic Screw Diameter (inch)	Hex Washer Head		Pan, Pan Framing, Pancake Head		Bugle, Wafer Head (inch)					
			Min. Washer Dia. (inch)	Min. Washer Thickness (inch)	Min. Head Diameter (inch)	Min. Head Height (inch)	Min. Head Dia. (inch)					
			6	0.138	0.302	0.015	0.256	0.087	0.238			
			8	0.164	0.322	0.019	0.306	0.105	0.285			
	10	0.190	0.384	0.019	0.357	0.122	0.333					
	12	0.216	0.398	0.022	0.407	0.139	0.380					
	1/4	0.250	0.480	0.030	0.473	0.162	0.442					
Ref.: ASME B18.6.4												
<sup>1</sup> Modified Truss Head screws are typically used for attaching lath to CFS, and required head diameter is governed by other code requirements.												
Thread Dimensions	Nominal Size	Basic Screw Diameter (inch)	Coarse (spaced) Threads				Fine Threads		Threads per inch			
			Major diameter (inch)		Minor Diameter (inch)		Major diameter (inch)					
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
			6	0.138	0.135	0.139	0.099	0.104	0.1326	0.1380	10	20
			8	0.164	0.161	0.166	0.116	0.122	0.1586	0.1640	12	20
	10	0.190	0.183	0.189	0.135	0.141	0.1834	0.1900	12	24		
	12	0.216	0.209	0.215	0.157	0.164	0.2094	0.2160	14	24		
1/4	0.250	0.246	0.240	0.185	0.192	0.2428	0.2500	14	28			
Ref.: SAE J78, ASTM C1513-13									Manufacturer's specifications.  Third-party laboratory verification of compliance with manufacturer's specifications for one length of each screw size.			
Total Case Depth	Nominal Size	Basic Screw Diameter (inch)	Total Case Depth (inch)									
			Min.	Max.								
			6	0.138						0.002	0.007	
			8	0.164						0.004	0.009	
			10	0.190						0.004	0.009	
	12	0.216	0.004	0.009								
	1/4	0.250	0.005	0.011								
Ref.: SAE J78, ASTM C1513-13												

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**TABLE 1—QUALIFICATION REQUIREMENTS FOR ASTM C1513 SCREWS (continued)**

TABLE 1—QUALIFICATION REQUIREMENTS FOR ASTM C1513 SCREWS (continued)																															
ASTM C1513 Requirement	AC500 Requirement					Verification Requirements																									
Minimum Hardness	Case: Rockwell C50 (Vickers 515) Core: Rockwell C32 (Vickers 320)					Manufacturer's specifications.  Third-party laboratory verification of compliance with manufacturer's specifications for one length of each screw size.																									
Ductility	5° bend test with testing and conditions of acceptance in accordance with Section 4.3 of SAE J78.																														
Torsional Strength	<table><tr><th rowspan="2">Nominal Size</th><th rowspan="2">Basic Screw Diameter (inch)</th><th colspan="2">Minimum Torsional Load (lbf-in.)</th></tr><tr><th>Coarse (spaced) Threads</th><th>Fine Threads</th></tr><tr><td>6</td><td>0.138</td><td>24</td><td>24</td></tr><tr><td>8</td><td>0.164</td><td>42</td><td>48</td></tr><tr><td>10</td><td>0.190</td><td>61</td><td>65</td></tr><tr><td>12</td><td>0.216</td><td>92</td><td>100</td></tr><tr><td>1/4</td><td>0.250</td><td>150</td><td>156</td></tr></table>				Nominal Size		Basic Screw Diameter (inch)	Minimum Torsional Load (lbf-in.)		Coarse (spaced) Threads	Fine Threads	6	0.138	24	24	8	0.164	42	48	10	0.190	61	65	12	0.216	92	100	1/4	0.250	150	156
	Nominal Size	Basic Screw Diameter (inch)	Minimum Torsional Load (lbf-in.)																												
			Coarse (spaced) Threads	Fine Threads																											
	6	0.138	24	24																											
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	10	0.190	61	65																											
	12	0.216	92	100																											
1/4	0.250	150	156																												
Ref.: ASTM C1513-13 Testing shall be in accordance with Section 5.1.1 of SAE J78.																															
Drill Hole Size	Testing and condition of acceptance shall be in accordance with Section 5.4 of SAE J78:					Third-party laboratory verification for each combination of nominal size and drill point design.																									
Drill Drive	Plate: Carbon steel, base steel thickness 0.062 through 0.068 inch, minimum ASTM A653 SS Grade 33					Manufacturer's specifications.																									
	Nominal Size	Basic Screw Diameter (inch)	Maximum Axial Loading (lbf)		Maximum Time to Drill and Form Thread, (sec)		Recommended Tool Speed (rpm)																								
			Screws with phosphate coating or zinc coating up to 0.0003 inch thick	Screws with zinc coating over 0.0003 inch thick																											
	6	0.138	30	35	2.5		2500																								
	8	0.164	30	35	3.0		2500																								
	10	0.190	35	40	3.5		2500																								
	12	0.216	45	50	4.0		1800																								
1/4	0.250	45	50	5.0	1800																										
Ref.: ASTM C1513-13																															
Drill Capacity	Minimum and maximum to be recommended by manufacturer.					Maximum drilling capacity shall be verified by third party testing, using steel complying with ASTM A653 SS Grade 33, minimum.																									
Corrosion-resistant treatment	See Section 3.2.2.					Third-party laboratory verification.																									

For SI: 1 inch = 25.4 mm; 1 lbf = 4.45 N; 1 lbf-in. = 0.113 N-m