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October 1, 2009

**TO: PARTIES INTERESTED IN EVALUATION REPORTS ON TAPPING SCREW FASTENERS**

**SUBJECT: Proposed Revisions to the Acceptance Criteria for Tapping Screw Fasteners, Subject AC118-1009-R1 (EL/RK)**

Dear Madam or Sir:

Proposed revisions to the subject acceptance criteria, as presented in the enclosed criteria draft, are being posted on the ICC-ES web site to allow for public comment.

Currently, Sections 3.1.1.2, 3.1.2, 3.1.3.1, 3.1.3.2 and 3.1.4 of AC118 require the screws to have a corrosion-resistant treatment specified in ASTM F 1941 and to be tested in accordance with ASTM B 117 for a minimum 12-hour test period, without showing products of corrosion from either the coating (white corrosion) or from the base metal (red rust) at the end of the test period.

Prompted by the attached letter from industry, dated August 27, 2009, we have reviewed the code requirements, and find them to be as follows:

- Section 2210 of the 2006 *International Building Code*<sup>®</sup> (IBC) references the AISI Standard for Cold-Formed Steel Framing – General Provisions (AISI-General) and other AISI framing standards for provisions for cold-formed steel light-framed construction.
- Section D1 of AISI-General requires steel-to-steel screws and sheathing screws to comply with ASTM C 1513 or an approved alternate.
- Section 9.3 of ASTM C 1513-01 requires screws to have a corrosion-resistant treatment, and says that, “The screws shall meet a minimum requirement as listed in Specification F 1941 as tested in accordance with Practice B 117.”
- Table A1.1 of ASTM F 1941-00(2006) gives salt spray corrosion protection performance requirements. For the minimum zinc coating thickness, the first appearance of white corrosion must not occur in less than three hours, and the first appearance of red rust must not occur in less than 12 hours. Section 9.3 of ASTM F 1941 names ASTM B 117 as the applicable test method.

The attached proposed revisions to the criteria are based on the interpretation of the forgoing to mean that the fastener coatings do not need to be limited to those that comply with types of coatings or coating thicknesses specified in ASTM F 1941, provided the coatings show neither white corrosion after three hours, nor red rust after 12 hours of testing in accordance with ASTM B 117. ICC-ES staff seeks confirmation of the validity of this interpretation.

You are cordially invited to submit written comments, within 30 days of the date of this letter. Please use the comment form on the web site attaching any letters to the form. An explanation of the alternate criteria process can be found on our web site at [http://www.icc-es.org/Criteria\\_Development/alternative\\_criteria\\_process.shtml](http://www.icc-es.org/Criteria_Development/alternative_criteria_process.shtml).

All comments received in the 30-day comment period will be considered. During this same 30-day period, however, the draft criteria will be balloted to the Evaluation Committee. If the public comments raise major issues, generate controversy, or require the criteria to be substantially rewritten, then ICC-ES staff may decide to reballot the criteria; or place a revised draft on the web site for further public comment; or put the criteria on the agenda for a future Evaluation Committee meeting.

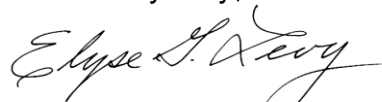
Correspondence received and a memo outlining staff's resolution of the comments in the correspondence will be posted on the web site shortly after the close of the comment period.

Your cooperation is requested in forwarding to the Los Angeles business/regional office all material directed to the Evaluation Committee. Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members. The committee reserves the right to refuse communications that do not comply with this request.

Newly approved acceptance criteria may involve test methods or test protocols that are not currently included in the scope of testing services offered by accredited testing laboratories. As noted in the ICC-ES Rules of Procedure for Evaluation Reports, the scope of the laboratory's accreditation must include the type of testing that is to be reported to ICC-ES. We encourage accredited laboratories to expand their scopes of accreditation to include testing under newly approved acceptance criteria. Please note that testing laboratories must be accredited by the International Accreditation Service (IAS) or by another accreditation body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. For further information, please contact IAS at (562) 699-0541, extension 3309, or send an e-mail to [pmccullen@iasonline.org](mailto:pmccullen@iasonline.org).

Please submit all comments using the form on the web site. Attach any letters to the comment form. If you have any questions (not comments), please contact the undersigned at (800) 423-6587, extension 4315, or Russ Krivchuk, Senior Staff Engineer, at extension 3231. You may also reach us by e-mail at [es@icc-es.org](mailto:es@icc-es.org).

Yours very truly,



Elyse G. Levy, S.E.  
Senior Staff Engineer

EL/jw:raf

Enclosures

cc: Evaluation Committee

Kurt Stochlia, Vice President  
ICC Evaluation Service, Inc.  
Los Angeles Business/Regional Office  
5360 Workman Mill Road  
Whittier, CA 90601

August 27, 2009

Subject: Public Comment on AC118 for May 2008 hearing

Dear Mr. Stochlia:

The undersigned screw fastener manufacturers would like to formally request a modification to ICC-ES AC118 (Acceptance Criteria for Tapping Screw Fasteners).

It has been brought to our attention that Section 3.1.1.2 of AC118 can be misinterpreted as requiring a tested fastener to be an ASTM F 1941 specified coating and that the fasteners show no signs of red rust or white corrosion after 12 hours. Both of these interpretations go against the intended purpose of this section, which was simply to ensure the fasteners met the requirements of Section 9.3 of ASTM C 1513. This section states the following.

*"The screws shall meet a minimum requirement as listed in Specification F 1941 as tested in accordance with Practice B 117."*

ASTM C 1513 clearly states that the coating shall meet the minimum requirements listed in ASTM F 1941 and not that the coating must actually be one of the coatings specified in ASTM F 1941.

Furthermore, it clearly states that the coating must meet the minimum requirements of ASTM F 1941 when tested according to ASTM B 117, which is not 12 hours for both white corrosion and red rust, but simply 3 hours for white corrosion and 12 hours for red rust. The wording found in Section 3.1.1.2 of AC118 seems to be an attempt at restating the wording found in Section 6.2 of ASTM F 1941, which states the following.

*"6.2 Corrosion Resistance—Coated fasteners, when tested by continuous exposure to neutral salt spray in accordance with 9.3, shall show neither corrosion products of coatings (white corrosion) nor basis metal corrosion products (red rust) at the end of the test period."*

In the case of AC118 Section 3.1.1.2, the test period for red rust was already predetermined as the minimum requirement of 12 hours, so 12 hours was inserted into the language. Unfortunately, this causes some confusion as one might interpret the language as requiring 12 hours no white corrosion as well, which makes little sense and is not the intent.

Because white corrosion is not possible with many proprietary coatings, it actually makes sense to simply use the red rust requirement only when evaluating screw coatings.

Therefore, our recommended language for Section 3.1.1.2 would be as follows.



*"3.1.1.2 IBC: Fasteners shall be self-drilling or self-piercing tapping screws complying with ASTM C 1513. Tapping screws shall comply with SAE J78 or ANSI/ASME B18.6.4, whichever is more restrictive, when the screw size is not covered under ASTM C 1513. Tapping screws shall have a corrosion-resistant treatment that meets the minimum ASTM B 117 requirement as listed in ASTM F 1941. Coated screws shall not show products of corrosion from the base metal (red rust) at the end of a 12-hour test period when tested in accordance with ASTM B 117."*

We hope the above discussion, along with our agreement will persuade ICC-ES to make this necessary change to AC118. If more dialogue on AC118 is required, please contact Drew Liechti at (918) 872-5805 and he will organize a conference call with the group at a mutually convenient date and time.

Thank you for your consideration.

Regards,

Andrew T. Liechti, P.E.  
Technical Services Engineer  
Hilti, Inc.

Edward Sutt  
Manager of Engineering,  
Fastener Development  
Simpson Strong-Tie Co., Inc.

Michael Gong, Ph.D.  
Senior Project Engineer  
ITW Buildex

Doug Holmberg  
Grabber Construction  
Products Division, JWA

Gregg Melvin  
Senior Applications Engineer  
Elco® Construction Products, LLC

cc: Michael Beaton



## **PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR TAPPING SCREW FASTENERS**

**AC118**

**Proposed October 2009**

**Previously approved May 2008, February 2008, October 2007, December 2006,  
June 2005, July 1996, June 2004**

### **PREFACE**

Evaluation reports issued by ICC Evaluation Service, Inc. (ICC-ES), are based upon performance features of the International family of codes and other widely adopted code families, including the Uniform Codes, the BOCA National Codes, and the SBCCI Standard 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.

Similar provisions are contained in the Uniform Codes, the National Codes, and the Standard Codes.

ICC-ES may consider alternate criteria, provided the report applicant submits valid data demonstrating that the alternate criteria are at least equivalent to the criteria proposed in this document, and otherwise meet the applicable performance requirements of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria proposed in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise meet the applicable performance requirements of the codes, ICC-ES retains the right to refuse to issue or renew an evaluation report, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

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

# PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR TAPPING SCREW FASTENERS

## 1.0 INTRODUCTION

**1.1 Purpose:** The purpose of this acceptance criteria is to establish requirements for tapping screw fasteners to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2006 *International Building Code*® (IBC), the 2006 *International Residential Code*® (IRC), and the 1997 *Uniform Building Code*™ (UBC).

**1.2 Scope:** This criteria provides a basis for:

**1.2.1** Evaluating the material, dimensional, and performance properties of self-drilling, self-piercing, thread-cutting, and thread-forming tapping screws.

**1.2.2** Determining the allowable [design] shear and tension strength values for tapping screws used in cold-formed sheet steel-to-steel connections as described in Section E4 of AISI-NAS or Section 2218 (item 3) of the UBC.

**1.2.3** Recognizing tapping screws for use in cold-formed steel framed lateral-force-resisting assemblies described in Section 2210.5 of the IBC and Chapter 22, Division VIII, of the UBC.

**1.2.4** Recognizing tapping screws for use in prescriptive cold-formed steel connections as described in Section 2210 of the IBC and Sections R505, R603, and R804 of the IRC.

**1.2.5** Recognizing tapping screws for attaching gypsum panel products to cold-formed steel framing members as described in Sections 2210.4 and 2508 of the IBC, Section R702.3 of the IRC, and Sections 2502 and 2511 of the UBC.

## 1.3 Codes and Reference Standards:

**1.3.1** 2006 *International Building Code*® (IBC), International Code Council.

**1.3.2** 2006 *International Residential Code*® (IRC), International Code Council.

**1.3.3** 1997 *Uniform Building Code*™ (UBC).

**1.3.4** ANSI/ASME B18.6.4, 1998, Standard Specification for Thread Forming and Thread-Cutting Screws, ASME International.

**1.3.5** SAE J78—(1998), Steel Self-drilling Tapping Screws, Society of Automotive Engineers.

**1.3.6** ASTM B 117-07, Standard Practice for Operating Salt Spray (Fog) Apparatus, ASTM International.

**1.3.7** ASTM B 633-07, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel, ASTM International.

**1.3.8** ASTM C 954-00, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness, ASTM International.

**1.3.9** ASTM C 1002-01, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs, ASTM International.

**1.3.10** ASTM C 1513-01, Standard Specifications for Tapping Screws, ASTM International.

~~**1.3.11** ASTM F1941-00(2006), Standard Specification for Electrodeposited Coatings on Threaded Fasteners [Unified Inch Screw Threads (UN/UNR)], ASTM International.~~

**1.3.12** AISI Specification for Design of Cold-formed Steel Structural Members, 1996 edition, American Iron and Steel Institute.

**1.3.13** AISI-NAS, 2001 North American Specification for Design of Cold-formed Steel Structural Members, including 2004 Supplement, American Iron and Steel Institute.

**1.3.14** AISI TS-4-02, Standard Test Method for Determining the Tensile and Shear Strength of Screws, Part VI, AISI Manual, 2002, Cold-Formed Steel Design, American Iron and Steel Institute.

**1.3.15** AISI TS-5-02, Test Methods for Mechanically Fastened Cold-Formed Steel Connections, Part VI, AISI Manual, 2002, Cold-Formed Steel Design, American Iron and Steel Institute.

## 1.4 Definitions:

**1.4.1 Allowable Strength:** Allowable strength is the nominal strength divided by the safety factor.

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

**1.4.3 Connection:** A connection is a combination of structural elements and joints used to transmit forces between two or more members.

**1.4.4 Design Strength:** Design strength is the resistance factor multiplied by the nominal strength.

**1.4.5 Joint:** A joint is an area where two or more ends, surfaces, or edges are attached, and is categorized by type of fastener and method of force transfer.

**1.4.6 Nominal Strength:** Nominal strength is the strength of the screw or connection, without the resistance factor or safety factor applied, to resist the load effects determined in accordance with the code.

**1.4.7 Tapping Screws:** Tapping screws are externally threaded fasteners with the ability to “tap” their own internal mating threads when installed. Tapping screws are high-strength, one-piece, one-side-installation fasteners. (Reference Section 3.2.12 of ASTM C 1513.)

**1.4.8 Self-drilling Tapping Screws:** Self-drilling tapping screws are externally threaded fasteners with the ability to drill their own hole and form or cut their own internal mating threads, into which they are driven without breaking during assembly. (Reference Section 3.2.9 of ASTM C 1513.)

**1.4.9 Self-piercing Tapping Screws:** Self-piercing tapping screws are externally threaded fasteners with the ability to self-pierce metallic material 33 mils (0.84 mm), or less,, form a sleeve by extruding metallic material and “tap”

## PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR TAPPING SCREW FASTENERS

their own mating threads when driven. Self-piercing screws have a sharp-point with a point angle not more than 30 degrees. (Reference Section 3.2.10 of ASTM C 1513.)

**1.4.10 Thread-cutting Tapping Screws:** Thread-cutting tapping screws are for application in materials where disruptive internal stresses are undesirable or where excessive driving torques are encountered with thread-forming screws. (Reference Section 1.3.2 of ASME B18.6.4.)

**1.4.11 Thread-forming Tapping Screws:** Thread-forming tapping screws are for application in materials where large internal stresses are permissible, or desirable, to increase resistance to loosening. (Reference Section 1.3.1 of ASME B18.6.4.)

### 2.0 BASIC INFORMATION

**2.1 General:** The following information shall be submitted and shall be included in the submitted test reports:

#### 2.1.1 Screws:

**2.1.1.1** Type and description of screw fasteners.

**2.1.1.2** Screw fastener specifications, such as ASTM C 954, ASTM C 1002, ASTM C 1513, or SAE J78, as applicable. Any deviations from the applicable specification or standard shall be noted, along with the intended end use of the fastener.

**2.1.1.3** Drawings and details noting dimensions, including tolerances for each screw size, configuration, and head and point type, and noting material specifications including case and core hardness, and protective coatings.

**2.1.1.4** Head markings used on each screw fastener, when practical.

**2.1.1.5** Installation instructions, including description of the recommended tool, and of the recommended tool operation, such as speed and torque, during installation.

**2.1.2 Cold-formed Steel:** Steel description, including material specification, and measured yield strength, tensile strength and minimum uncoated steel thickness for the tested cold-formed steel connections.

**2.2 Packaging and Identification:** The method of packaging and identifying the screw fasteners shall be reported. 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 type, the evaluation report holder's name, the ASTM designation (when applicable), and the ICC-ES evaluation report number. Each screw fastener head marking or manufacturer's logo shall be reported.

**2.3 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.

**2.4 Test Reports:** Test reports shall comply with AC85 and the report requirements in the applicable test standard.

#### 2.5 Product Sampling:

**2.5.1** Sampling of the screw fasteners for tests under

this criteria shall comply with Section 3.2 of AC85.

**2.5.2** Where the tested fasteners are prototypes, the fasteners shall be representative of later production, and shall be proven to be identical, within specified tolerance limits, to production fasteners by confirming dimensions, material, and performance requirements set forth in the applicable specification or standard.

### 3.0 TEST AND PERFORMANCE REQUIREMENTS

**3.1 Mechanical Performance and Physical Property Requirements for Tapping Screws Based on End-use Applications:** Different sections of the code require tapping screws to comply with different standards, such as ASTM C 954, ASTM C 1002, ASTM C 1513, or SAE J78, depending upon the end use of the screws. The purpose of this section (Section 3.1) is to clarify which test standard is applicable for the end-use application described in the codes. Reports of testing shall be submitted to establish compliance with Sections 3.1.1 through 3.1.4, as applicable. Sample size for testing in accordance with the applicable tapping screw standard shall comply with Table 1. Sample size for tests conducted by the manufacturer is established under the manufacturer's quality program. Screw type attributes that need to be considered include nominal size (number, fraction or decimal equivalent), threads per inch, nominal length (fraction or decimal equivalent), point type, material, and protective finish.

#### 3.1.1 Prescriptive Steel-to-steel Connections in Accordance with the IRC and IBC:

**3.1.1.1 IRC:** Fasteners shall be self-drilling tapping screws conforming to SAE J 78 and shall have a Type II coating in accordance with ASTM B 633 or a coating shown to have equivalent or better corrosion resistance when tested in accordance with Section 10.3 of ASTM B 633.

**3.1.1.2 IBC:** Fasteners shall be self-drilling or self-piercing tapping screws complying with ASTM C 1513. Tapping screws shall comply with SAE J78 or ANSI/ASME B18.6.4, whichever is more restrictive, when the screw size is not covered under ASTM C 1513. Tapping screws shall have a corrosion-resistant treatment specified in ASTM F 4944 and shall be tested in accordance with ASTM B 117 for a minimum 12-hour test period. Coated screws shall not show products of corrosion from the coating (white corrosion) after three hours, and shall not show corrosion from either the coating (white corrosion) or the base metal (red rust) at the end of the test period.

**3.1.2 Engineered Steel-to-steel Connections in Accordance with Section E4 of AISI-NAS or Section 2218 of the UBC:** Fasteners shall be thread-forming or thread-cutting tapping screws, with or without a self-drilling point, and shall comply with both ASTM C 1513 and ASME B18.6.4. The screws shall have a corrosion-resistant treatment specified in ASTM F 4944 and shall be tested in accordance with ASTM B 117 for a minimum 12-hour test period. Coated screws shall not show products of corrosion from the coating (white corrosion) after three hours, and shall not show corrosion from either coatings (white corrosion) or from the base metal (red rust) at the end of the test period.

#### 3.1.3 Shear Walls in Accordance with the IBC and UBC:

**3.1.3.1 Wood Structural Panel Sheathing:**

## PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR TAPPING SCREW FASTENERS

Fasteners used to attach wood-based structural-use panels to cold-formed steel wall framing members and to provide resistance to lateral loads in the plane of the wall, as described in Section 2210.5 of the IBC and Sections 2219 and 2220 of the UBC, shall be either No. 8, flat-head, self-drilling or self-piercing tapping screws with a minimum head diameter of 0.285 inch (7.24 mm) or No. 10, flat-head, self-drilling or self-piercing tapping screws with a minimum head diameter of 0.333 inch (8.46 mm) complying with ASTM C 1513. The flat-head, self-drilling tapping screws shall have a corrosion-resistant treatment ~~specified in ASTM F 1944~~ and shall be tested in accordance with ASTM B 117 for a minimum 12-hour test period. ~~Coated~~ Screws shall not show products of corrosion from the coating (white corrosion) after three hours, and shall not show corrosion from either coatings (white corrosion) or from the base metal (red rust) at the end of the test period.

**3.1.3.2 Sheet Steel Sheathing:** Fasteners used to attach sheet steel to cold-formed steel wall framing members and to provide resistance to lateral loads in the plane of the wall, as described in Section 2210.5 of the IBC, shall be self-drilling or self-piercing tapping screws complying with ASTM C 1513. Tapping screws shall comply with SAE J78 or ANSI/ASME B18.6.4, whichever is more restrictive, when the screw size is not covered under ASTM C 1513. Tapping screws shall have a corrosion-resistant treatment ~~specified in ASTM F 1944~~ and shall be tested in accordance with ASTM B 117 for a minimum 12-hour test period. ~~Coated~~ Screws shall not show products of corrosion from the coating (white corrosion) after three hours, and shall not show corrosion from either the coating (white corrosion) or the base metal (red rust) at the end of the test period.

**3.1.3.3 Gypsum Board Panel Sheathing:** Fasteners used to attach gypsum board to cold-formed steel wall framing members and to provide resistance to lateral loads in the plane of the wall, as described in 2210.5 of the IBC and Sections 2219 and 2220 of the UBC, shall be self-drilling tapping screws complying with ASTM C 954, or self-piercing tapping screws complying with ASTM C 1002.

**3.1.4 Wood Structural Panel Diaphragms in Accordance with the IBC:** Fasteners used to attach wood-based structural-use panels to roof or floor cold-formed steel framing members as described in Section 2210.5 of the IBC for structural diaphragms, shall be minimum No. 8 (when framing members have a designation thickness of 54 mils or less) or No. 10 (when framing members have a designation thickness greater than 54 mils) flat-head, self-drilling or self-piercing tapping screws complying with ASTM C 1513. The flat-head self-drilling tapping screws shall have a corrosion-resistant treatment ~~specified in ASTM F 1944~~ and shall be tested in accordance with ASTM B 117 for a minimum 12-hour test period. ~~Coated~~ Screws shall not show products of corrosion from the coating (white corrosion) after three hours, and shall not show corrosion from either coatings (white corrosion) or from the base metal (red rust) at the end of the test period.

### 3.2 Tapping Screw Available Strength:

**3.2.1 General:** Tapping screws designed to transmit design forces acting on steel-to-steel connections described in Section 1.2.2 of this criteria shall comply with this section.

### 3.2.2 Shear and Tension Strength of Tapping

**Screws:** Each type and size (diameter) of tapping screw shall be tested in accordance with Sections 4.1 and 4.2 of this criteria. The available tensile and shear strengths (IBC) and capacities (UBC) of each screw type shall be determined in accordance with the following:

**3.2.2.1 Analysis—IBC:** The available shear and tension strength of the screw shall be in accordance with Section E4.3.3 (Shear in Screws) and E4.4.3 (Tension in Screws), respectively, of AISI-NAS.

**3.2.2.2 Analysis—UBC:** The allowable shear capacity,  $P_{as}$ , and allowable tension capacity,  $P_{at}$ , of the screw shall be determined in accordance with Sections E6.3.2 (Shear in Screws) and E6.4.3 (Tension in Screws), respectively, as described in Amendment 3 in Section 2218 of the UBC, using a safety factor of 3.0.

### 3.3 Available Strength Values of Tapping Screw Connections:

**3.3.1 Connection Strength Analysis—IBC:** Available strength of screw connections shall be the lesser of the following:

**3.3.1.1** Available strength value of the tapping screw determined in accordance with Section 3.2.2.1 of this criteria.

**3.3.1.2** The calculated available strength value of a screw connection determined in accordance with Sections E4.3, E4.4, and E4.5 of AISI-NAS using a safety factor,  $\Omega$ , equal to 3.0, or a resistance factor,  $\phi$ , equal to 0.50 as described in Section E4 of AISI-NAS.

**3.3.2 Connection Strength Analysis—UBC:** Allowable strength of screw connections shall be the lesser of the following:

**3.3.2.1** Allowable capacity value of the tapping screw determined in accordance with Section 3.2.2.2 of this criteria.

**3.3.2.1.1** The shear capacity of the tapping screw shall be at least 125 percent of the nominal shear strength of the connection,  $P_{ns}$ , calculated in accordance with Section E6.3.1 (Connection Shear) as described in Amendment 3 in Section 2218 of the UBC.

**3.3.2.1.2** The tension capacity of the tapping screw shall be at least 125 percent of the nominal pull-out force,  $P_{not}$ , and of the nominal pull-over force,  $P_{nov}$ , of the connection calculated in accordance with Section E6.4.1 (Pull-out) and Section E6.4.2 (Pull-over) of the connection as described in Amendment 3 in Section 2218 of the UBC.

**3.3.2.2** The calculated allowable shear and tension force values of a screw connection determined in accordance with Sections E6.3 (Shear) and E6.4 (Tension), respectively, as described in Amendment 3 in Section 2218 of the UBC, using a safety factor,  $\Omega$ , equal to 3.0.

### 3.4 Empirically Derived Available Strength Values of Tapping Screw Connections (Alternate to Section 3.3):

**3.4.1 General:** The available strength values of particular screw connections empirically derived in accordance with this section (Section 3.4) are not required to be compared to the available strength connection values calculated in accordance with Sections 3.3.1 (IBC) or 3.3.2 (UBC) of this criteria.

## PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR TAPPING SCREW FASTENERS

**3.4.2 Connection Testing:** Reports of connection testing in accordance with Sections 4.1 and 4.3 of this criteria shall be submitted when empirically derived available strength values for particular connection applications are sought for recognition in an evaluation report.

**3.4.3 Connection Strength Analysis—IBC:** Available strength of a particular screw connection shall be the lesser of the following:

**3.4.3.1** Available strength values of the tapping screw determined in accordance with Section 3.2.2.1 of this criteria.

**3.4.3.2** The allowable [design] strengths of the particular connection based on the tested values in conjunction with the safety factor,  $\Omega$ , and resistance factor,  $\phi$ , from Section F1 of AISI-NAS.

**3.4.4 Connection Strength Analysis—UBC:** Allowable strength values of the tapping screw shall be determined in accordance with Section 3.2.2.2 of this criteria, and the following:

**3.4.4.1** The shear capacity of the screw, determined per Section 3.2.2.2 of this criteria, shall be at least 125 percent of the shear test results from connection testing conducted per Section 3.4.2 of this criteria.

**3.4.4.2** The tension capacity of the tapping screw shall be at least 125 percent of the pull-out and pull-over force test results from the connection testing conducted per Section 3.4.2 of this criteria.

### 4.0 TEST METHODS

**4.1 General:** As a minimum, a series of three identical tests shall be performed for each combination of variables that affect the performance of the connector, 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 can be given. The average value of all tests made shall be regarded as the nominal strength,  $R_n$ , for the series of the tests. The nominal strength,  $R_n$ , and the coefficient of variation,  $V_p$ , of the test results shall be determined by statistical analysis.

**4.2 Fastener Testing:** Tension and shear testing of screws shall comply with TS-4. Steel plates or shapes used in the tests shall comply with TS-4. Reporting shall comply with Section 4 of TS-4.

### 4.3 Connection Testing:

**4.3.1** Tension (pull-over and pull-out) and shear test specimen setup and dimensions and load application shall comply with TS-5. Steel plates or shapes used in the tests shall comply with TS-5, and be representative of connected steel material that is to be recognized in the evaluation report. Reporting shall comply with Section 10 of TS-5.

**4.3.2** If the tensile strength of the steel from which the tested steel structural members forming the connection are formed is greater than the specified minimum value, the test results shall be calibrated to the specified minimum tensile strength of the steel which the manufacturer intends to use, by the following adjustment factor,  $R_s$ :

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

w  
here:

$R_s$  = Adjustment factor.

$F_{u(\text{specified})}$  = Specified tensile strength of the steel, psi (Pa).

$F_{u(\text{tested})}$  = Measured tensile strength of the steel, psi (Pa).

$t_{(\text{specified})}$  = Specified steel thickness, inch (mm).

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

If the thickness of the steel, from which the critical cold-formed elements of tested connectors are made, is greater than the specified (design) thickness by more than 5 percent, the test results shall be reduced by the ratio of the specified (design) thickness of the connector to the measured thickness, as shown in the formula above.

### 5.0 QUALITY CONTROL

**5.1** Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted.

**5.2** Third-party follow-up inspections are not required under this acceptance criteria.

**5.3** Ongoing quality control tests shall be conducted in accordance with the standards upon which the screws have been qualified and shall meet the conditions of acceptance noted in the appropriate section of the standard as it relates to the type of fastener. Sampling size for quality control tests shall be consistent with accepted procedures for quality control sampling.

### 6.0 EVALUATION REPORT RECOGNITION

**6.1** The following statement shall appear in the Conditions of Use section in the product evaluation report "Fasteners are 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."

**6.2** The evaluation report shall note the allowable [design] shear and tension strength values for tapping screws used in cold-formed sheet steel-to-steel connections determined in accordance with Section 3.2.2 of this criteria.

**6.3** The evaluation report shall note that the allowable load values (ASD) for screws or for screw connections are not permitted to be increased for short-duration loads, such as wind or earthquake loads.

**6.4** For screws qualified in accordance with Section 3.3, the evaluation report shall include a statement that the available connection strength shall be in accordance with Section E4 of AISI-NAS.

**6.5** For connections qualified in accordance with Section 3.4, the evaluation report shall include the following:

**6.5.1.1** A statement indicating that the most restrictive of fastener tensile strength, pull-out from the supporting material or pull-over of the supported material governs.

**6.5.1.2** A statement indicating that the more

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restrictive of fastener shear strength and bearing and tilting capacity of the connected steel, including minimum end and edge distances, governs.

**6.5.1.3** Description of the specific tested connections, including physical and dimensional properties and material specifications.

**6.6** The evaluation report shall include a description of the screw fasteners, including the screw series, model, size, threads per inch (tpi), point number or type, head type, head

diameter, minor and major shank diameter, overall length, thread length, and drill point length.

**6.7** The evaluation report shall note that screw fasteners are limited to dry, interior applications unless coatings or other corrosion-resistant materials are used to provide specific higher levels of corrosion resistance. The coating, material or required corrosion resistance shall be noted on the construction documents. ■

**TABLE 1—SAMPLE SIZE FOR THIRD-PARTY AND MANUFACTURING LOCATION QUALIFICATION TESTS SPECIFIED IN SCREW STANDARDS REFERENCED IN SECTION 3.1 OF THIS CRITERIA**

CHARACTERISTIC	THIRD- PARTY QUALIFICATION TEST SAMPLE SIZE	MANUFACTURING LOCATION QUALIFICATION TEST SAMPLE SIZE
Proper Seating Test, Section 6.2.1.1 of ASTM C 954; Section 12.6.3 of ASTM C 1002	-	Per ASTM C 954 Section 9
Assembly Tension, Section 6.2.1.2 of ASTM C954	5	Per ASTM C 954 Section 9
Case Depth	5	Per ASTM C 1513 Section 10
Chemistry <sup>2</sup>	-	-
Corrosion Resistance (salt-spray testing)	5	Per ASTM C 1513 Section 10
Drill Capacity	-	Per ASTM C 1513 Section 10
Drill Drive	-	Per ASTM C 1513 Section 10
Drill Hole Size, Section 5.4 of SAE J78	-	Per ASTM C 1513 Section 10
Ductility	5	Per ASTM C 1513 Section 10
Hardness	5 <sup>3</sup>	Per ASTM C 1513 Section 10
Hydrogen Embrittlement	-	Per ASTM C 1513 Section 10
Plating/Coating Thickness <sup>4</sup>	-	Per ASTM C 1513 Section 10
Spin out (Section 6.1 of ASTM C 954)	-	Per ASTM C 954 Section 9
Torsional Strength	5	Per ASTM C 1513 Section 10
Dimensional Checks <sup>5</sup>	5	-

<sup>1</sup>This table relates to the sample sizes for tests required to verify compliance with the applicable sections of ASTM C 954, C 1002 and C 1513. Requirements for the purpose of quality control are in Section 5.3.

<sup>2</sup>A certified copy of the material's chemical or product analysis, which is traceable to the lot of test specimens, shall be furnished.

<sup>3</sup>Hardness ranges listed in Section 5.1.2 of ASTM C 954 are not for the final product. This test is not required for screws to be recognized for ASTM C 954 applications.

<sup>4</sup>If the plating/coating thickness test is performed as a qualification test in addition to the salt-spray test, the manufacturing location test that is used may be either the salt-spray test or the plating/coating thickness test.

<sup>5</sup>The average of five measurements of same dimension should be evaluated for conformance with manufacturer's drawing dimensions and tolerances.