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ACCEPTANCE CRITERIA FOR CONNECTORS USED WITH COLD-FORMED STEEL STRUCTURAL MEMBERS

AC261

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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 technical change from the previous edition. A deletion indicator (→) is provided in the margin where wording has been deleted if the deletion involved a technical change.

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.

NOTE: The Preface for ICC-ES acceptance criteria was revised in July 2011 to reflect changes in policy.

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

ACCEPTANCE CRITERIA FOR CONNECTORS USED WITH COLD-FORMED STEEL STRUCTURAL MEMBERS (AC261)

1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for connectors used with cold-formed steel structural members to be recognized in an ICC Evaluation Service, LLC. (ICC-ES), evaluation report under the 2009 *International Building Code*® (IBC), and the 2009 *International Residential Code*® (IRC). Bases of recognition are IBC Section 104.11 and IRC Section 104.11. See Appendix A of this criteria for requirements for connectors used with cold-formed steel structural members to be recognized in an ICC-ES evaluation report under the 2006 IBC and the 2006 IRC.

1.2 Scope: This criteria establishes test procedures for qualifying steel connectors used with cold-formed steel structural members where the composition or configuration of elements, assemblies, connections, or details of cold-formed steel structural members is such that calculation of their structural capacities cannot be made in accordance with the provisions of the code.

1.3 Codes and Reference Standards: Where standards are referenced in this criteria, these standards shall be applied consistently with the code upon which compliance is based.

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

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

1.3.3 AISI-S100-2007, North American Specification for the Design of Cold-formed Steel Structural Members, 2007 Edition, American Iron and Steel Institute.

1.3.4 AISI (2008) Cold-Formed Steel Design Manual, Part VI, Test Procedures, American Iron and Steel Institute.

1.3.5 ASTM A 90-09, Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM International.

1.3.6 ASTM A 370-10, Standard Test Methods and Definitions for Mechanical Testing of Steel Products, ASTM International.

1.3.7 ASTM A 924-07, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by Hot-Dip Process, ASTM International.

1.3.8 ASTM D 1761-06, Test Method for Mechanical Fasteners in Wood, ASTM International.

1.3.9 ASTM E 4-10, Practices for Force Verification of Testing Machines, ASTM International.

1.4 Definitions:

1.4.1 ASD: Allowable Stress Design, herein referred to as Allowable Strength Design.

1.4.2 Coefficient of Variation (COV): COV is the ratio of the standard deviation, σ, to the mean, μ.

1.4.3 Connection: Combination of structural elements and joints used to transmit forces between two or more members.

1.4.4 Connector: Device using one or more connections to transmit forces between a cold-formed steel structural member and its support.

1.4.5 Fastener: Bolts, screws, power-driven pins or nails, clinches, or other mechanical fasteners conforming to a nationally recognized standard or an ICC-ES acceptance criteria.

1.4.6 Joint: An area where two or more ends, surfaces, or edges of structural elements are attached, and can be categorized by the type of fastener or weld used and the method of force transfer

1.4.7 LRFD: Load and Resistance Factor Design.

1.4.8 Nominal Strength, R_n: The capacity of the structure or component to resist the effects of loads, as determined in accordance with this criteria using specified material strengths and dimensions.

1.4.9 R_s: Adjustment factor (refer to Section 4.2 for its application).

1.4.10 Welded Joint: A welded joint consisting of arc welds or resistance welds conforming to AISI-S100.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description: Complete information concerning material specifications, thickness, size and the manufacturing process.

2.1.2 Installation Instructions: Installation details and limitations, and fastening requirements.

2.1.3 Packaging and Identification: A description of the method of packaging and field identification of the connectors. Identification provisions shall include the evaluation report number.

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. In addition, the test report shall contain the following:

2.3.1 A description of the connector, members, and fasteners tested, including a sketch or drawing of the connector showing the pertinent dimensions and material specifications.

2.3.2 A description of the test specimens, including a description of the mechanical properties of the steel elements being connected and the connector, and a description of the connection of the tested assembly. Described properties shall include the measured yield stress, tensile strength, and uncoated base-metal steel thickness.

2.3.3 Data on the load-deflection curve and the maximum observed load shall be noted.

2.3.4 The test report or a separate engineering analysis report shall derive the Allowable Strength Design (ASD) load and the Load and Resistance Factor Design (LRFD) load.

2.3.5 Type and location of failure and a description of the general behavior of the specimen.

2.3.6 Laboratory personnel shall witness or verify the proper construction of the test assembly in accordance with Section 3.3 of AC85.

2.4 Product Sampling: Sampling of the connectors for tests under this criteria shall comply with Section 3.2 of AC85. Sampling of connectors fabricated with welding, not connectors attached with welds, shall comply with Section 3.1 of AC85.

3.0 LOAD TEST REQUIREMENTS

3.1 A qualification test plan shall be submitted to ICC-ES for each type of connector prior to commencement of testing. AISI S905-08 (Test Methods for Mechanically Fastened Cold-Formed Steel Connections) can be used as a guide. Alternatively, test protocols specified in ASTM D 1761 or the ICC-ES Acceptance Criteria for Joist Hangers and Similar Devices (AC13) are permitted to be adapted for testing steel connectors, provided a qualification test plan is submitted prior to commencement of testing. The test plan shall specify the test setup, as well as any additional tests identified as applicable for special features of the connector. The test plan shall be a complete document, and shall include a description of the test methods; load rates, drawings and sketches; sampling methodology; product range variables; and the service limit states. A $^1/_8$-inch (3.2 mm) deflection limit shall be used, unless a different serviceability limit state associated with static deflection can be justified for a connector.

3.2 Test specimens shall consist of a connection consisting of a cold-formed steel structural member, a connector, and a supporting member representative of field conditions. During the test, applied load and corresponding deflection of the connector is recorded to provide load-deflection data.

3.3 A testing machine that is capable of operation at a constant rate of motion of the movable crosshead or a constant rate of loading, and a measuring device that is calibrated in accordance with ASTM E 4, shall be used. In lieu of a test machine, either a hydraulic or pneumatic cylinder may be used to apply the load. When a cylinder is used, a calibrated load cell shall be used to measure the applied load to within ±1 percent.

3.4 All steel materials shall have a specified minimum yield stress and a specified minimum tensile strength, which shall be verified by using ASTM A 370 test procedures.

3.5 The uncoated base-metal thickness of the steel from which the tested connectors are formed shall be measured or calculated. When the base-metal thickness is calculated by converting the coating weight to a coating thickness and subtracting it from the overall measured thickness, coating weight tests shall be performed in accordance with the requirements of ASTM A 90 or ASTM A 924. The following relationship to estimate the coating thickness from the coating weight (mass) is permitted to be used: 1 oz/ft^2 coating weight = 1.7 mils coating thickness (7.14 g/m^2 coating mass = 1 µm coating thickness).

3.6 The specimen shall be loaded such that the load is applied with reference to the intended application of the connector.

3.7 An initial load, or preload, is permitted to be applied to the connector to seat the assembly. This preload shall not exceed 10 percent of the average ultimate load.

3.8 Load shall be applied at either a uniform crosshead rate between 0.03 and 0.10 inch (0.8 to 2.5 mm) per minute, or at a rate of loading that will result from approximately this machine head rate. The rate of loading shall be reported with the test data.

3.9 Evaluation of the test results shall be made on the basis of the average value of the test data as determined in accordance with Section 3.6. 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

3.10 Load-deflection characteristics of the connector shall be determined. The deflection in question is the relative movement between the supported cold-formed steel member and the supporting structural member in the direction of the applied load. Deflections shall be recorded up to the deflection limit state predetermined in the qualification plan required in Section 3.1 to the nearest 0.001 inch at a sufficient number of load levels to permit the establishment of a load-deflection curve. At least eight readings shall be taken prior to reaching the deflection limit state.

4.0 PERFORMANCE REQUIREMENTS

4.1 The Allowable Strength Design (ASD) capacity of the connector shall be derived from the nominal connector strength divided by a safety factor, Ω. The Load and Resistance Factor Design (LRFD) capacity of a connector shall be derived from the nominal connector strength multiplied by a resistance factor, φ. The Ω or φ shall be as prescribed by Section F1 of the AISI-S100. The following variables for the Equations Chapter F of AISI-S100. shall be used, unless data justifying other variables are submitted.

β_o = Target reliability index = 3.5

M_M = Mean value of the material factor = 1.1

V_M = COV of the material factor = 0.10

V_F = COV of the fabrication factor = 0.15

4.2 If the yield stress of the steel from which the tested connectors or cold-formed steel structural members forming the connection are formed is larger than the specified minimum value, the test results shall be calibrated to the specified minimum yield stress of the steel which the manufacturer intends to use by the following adjustment factor, R_S:

$$R_S = \left(\frac{F_y\,(spec)}{F_y\,(tested)}\right) \times \left(\frac{t(spec)}{t(tested)}\right) \quad \leq 1.0 \qquad (4\text{-}1)$$

where:

R_s = Adjustment factor.

$F_y(spec)$ = Specified minimum yield stress of the steel, ksi (MPa).

F_y(*tested*) = Measured yield stress of the steel, ksi (MPa).

t(design) = Design base steel thickness, inch (mm).

t(*tested*) = Measured base steel thickness, inch (mm).

If the failure mode is dependent on the tensile strength, a similar adjustment shall be made on the basis of tensile strength instead of yield.

4.3 If the thickness of the steel, from which the critical cold-formed elements of tested connectors are made, is greater than the design thickness by more than 5 percent, the test results shall be reduced by the ratio of the design thickness of the connector to the measured thickness as shown in Equation 4-1.

4.4 In addition to establishing the strength of the connector in accordance with Sections 4.1 through 4.3, a service load limit shall be established. Regardless of whether an ASD capacity or LRFD capacity is established, the service limit load shall be based on the ASD load combinations. The service load limit of the connector shall be the average load at which the deflection of the connector parallel to the application of the test load reaches the deflection service limit specified in Section 3.1.

5.0 QUALITY CONTROL

5.1 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted for each facility manufacturing or labeling products that are recognized in the ICC-ES evaluation report.

5.2 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).

5.3 An annual inspection shall be conducted at each manufacturing facility in accordance with AC304.

5.4 Factory-fabricated welded connectors shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by the International Accreditation Service (IAS), or otherwise acceptable to ICC-ES.

5.5 A qualifying inspection shall be conducted at each manufacturing facility when required by the ICC-ES Acceptance Criteria for Inspections and Inspection Agencies (AC304).

6.0 EVALUATION REPORT RECOGNITION

The evaluation report shall include the following information:

6.1 Connector description, including physical and dimensional properties and material specifications.

6.2 Fastener description, including physical and dimensional properties and material specifications.

6.3 Cold-formed structural member properties.

6.4 The ASD allowable strength for the connector, which shall be the lowest of the following:

6.4.1 The average load at the deflection service limit specified in Section 3.1. (See Section 4.4.)

6.4.2 The nominal strength of the connector determined in accordance with Section 3.9 divided by the safety factor, Ω, referenced in Section 4.1.

6.4.3 The allowable strength of the fasteners or welds used to attach the connector to the structural members.

6.5 For Load and Resistance Factor Design (LRFD), both the following values shall be published: (1) The service limit load at ASD from Section 6.5.1; and (2) the lowest strength value from Section 6.5.2 and Section 6.5.3.

6.5.1 The average load at the deflection service limit specified in Section 3.1. (See Section 4.4.)

6.5.2 The nominal strength of the connector determined in accordance with Section 3.9 multiplied by the resistance factor, φ, referenced in Section 4.1.

6.5.3 The design strength of the fasteners or welds used to attach the connector to the structural members

6.6 Figure of the connector showing a typical installation and load direction. ■

APPENDIX A—REQUIREMENTS UNDER THE 2006 *INTERNATIONAL BUILDING CODE*® AND THE 2006 *INTERNATIONAL RESIDENTIAL CODE*®

NOTE: Appendix A is the October 2004 (editorially revised January 2008) version of AC261, for the 2006 International Codes.

A1.0 INTRODUCTION

A1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for connectors used with cold-formed steel structural members to be recognized in an ICC Evaluation Service, LLC (ICC-ES), evaluation report under the 2006 *International Building Code*® (IBC) and the 2006 *International Residential Code*® (IRC). Bases of recognition are IBC Section 104.11 and IRC Section 104.11.

A1.2 Scope: This criteria establishes test procedures for qualifying steel connectors used with cold-formed steel structural members where the composition or configuration of elements, assemblies, connections, or details of cold-formed steel structural members is such that calculation of their structural capacities cannot be made in accordance with the provisions of the code.

A1.3 Codes and Referenced Standards: Where standards are referenced in this criteria, these standards shall be applied consistently with the code upon which compliance is based.

A1.3.1 2006 *International Building Code*® (IBC), International Code Council.

A1.3.2 2006 *International Residential Code*® (IRC), International Code Council.

A1.3.3 AISI-NAS-01 (AISI-NAS), North American Specification for the Design of Cold-formed Steel Structural Members, 2001 Edition, including 2004 Supplement, American Iron and Steel Institute.

A1.3.4 AISI (2002) Cold-Formed Steel Design Manual, Part VI, Test Procedures, American Iron and Steel Institute.

A1.3.5 ASTM A 90-01, Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM International.

A1.3.6 ASTM A 370-02ε^1, Standard Test Methods and Definitions for Mechanical Testing of Steel Products, ASTM International.

A1.3.7 ASTM A 924-04, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by Hot-Dip Process, ASTM International.

A1.3.8 ASTM D 1761-88(2000), Test Method for Mechanical Fasteners in Wood, ASTM International.

A1.3.9 ASTM E 4-02, Practices for Force Verification of Testing Machines, ASTM International.

A1.4 Definitions:

A1.4.1 ASD: Allowable Stress Design, herein referred to as Allowable Strength Design.

A1.4.2 Coefficient of Variation (COV): COV is the ratio of the standard deviation, σ, to the mean, μ.

A1.3.3 Connection: Combination of structural elements and joints used to transmit forces between two or more members.

A1.3.4 Connector: Device using one or more connections to transmit forces between a cold-formed steel structural member and its support.

A1.3.5 Fastener: Bolts, screws, power-driven pins or nails, clinches, or other mechanical fasteners conforming to a nationally recognized standard or an ICC-ES acceptance criteria.

A1.3.6 Joint: An area where two or more ends, surfaces, or edges of structural elements are attached, and can be categorized by the type of fastener or weld used and the method of force transfer

A1.3.7 LRFD: Load and Resistance Factor Design.

A1.3.8 Nominal Strength, R_n: The capacity of the structure or component to resist the effects of loads, as determined in accordance with this criteria using specified material strengths and dimensions.

A1.3.9 R_s: Adjustment factor (refer to Section 4.2 for its application).

A1.3.10 Welded Joint: A welded joint consisting of arc welds or resistance welds conforming to AISI-NAS.

A1.3.11 Yield Point: F_y, used for design (commonly known as yield stress or strength).

A2.0 BASIC INFORMATION

A2.1 General: The following information shall be submitted:

A2.1.1 Product Description: Complete information concerning material specifications, thickness, size and the manufacturing process.

A2.1.2 Installation Instructions: Installation details and limitations, and fastening requirements.

A2.1.3 Packaging and Identification: A description of the method of packaging and field identification of the connectors. Identification provisions shall include the evaluation report number.

A2.2 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.

A2.3 Test Reports: Test reports shall comply with AC85. In addition, the test report shall contain the following:

A2.3.1 A description of the connector, members, and fasteners tested, including a sketch or drawing of the connector showing the pertinent dimensions and material specifications.

A2.3.2 A description of the test specimens, including a description of the mechanical properties of the steel elements being connected and the connector, and a description of the connection of the tested assembly. Described properties shall include the measured yield point, tensile strength, and uncoated base-metal steel thickness.

A2.3.3 Data on the load-deflection curve and the maximum observed load shall be noted.

A2.3.4 The test report or a separate engineering analysis report shall derive the Allowable Strength Design

(ASD) load and the Load and Resistance Factor Design (LRFD) load.

A2.3.5 Type and location of failure and a description of the general behavior of the specimen.

A2.3.6 Laboratory personnel shall witness or verify the proper construction of the test assembly in accordance with Section 3.3 of AC85.

A2.4 Product Sampling: Sampling of the connectors for tests under this criteria shall comply with Section 3.2 of AC85. Sampling of connectors fabricated with welding, not connectors attached with welds, shall comply with Section 3.1 of AC85.

A3.0 LOAD TEST REQUIREMENTS

A3.1 A qualification test plan shall be submitted to ICC-ES for each type of connector prior to commencement of testing. AISI TS-5-02 (Test Methods for Mechanically Fastened Cold-Formed Steel Connections) can be used as a guide. Alternatively, test protocols specified in ASTM D 1761 or the ICC-ES Acceptance Criteria for Joist Hangers and Similar Devices (AC13) are permitted to be adapted for testing steel connectors, provided a qualification test plan is submitted prior to commencement of testing. The test plan shall specify the test setup, as well as any additional tests identified as applicable for special features of the connector. The test plan shall be a complete document, and shall include a description of the test methods; load rates, drawings and sketches; sampling methodology; product range variables; and the service limit states. A $^1/_8$-inch (3.2 mm) deflection limit shall be used, unless a different serviceability limit state associated with static deflection can be justified for a connector.

A3.2 Test specimens shall consist of a connection consisting of a cold-formed steel structural member, a connector, and a supporting member representative of field conditions. During the test, applied load and corresponding deflection of the connector is recorded to provide load-deflection data.

A3.3 A testing machine that is capable of operation at a constant rate of motion of the movable crosshead or a constant rate of loading, and a measuring device that is calibrated in accordance with ASTM E 4, shall be used. In lieu of a test machine, either a hydraulic or pneumatic cylinder may be used to apply the load. When a cylinder is used, a calibrated load cell shall be used to measure the applied load to within ±1 percent.

A3.4 All steel materials shall have a specified minimum yield point and a specified minimum tensile strength, which shall be verified by using ASTM A 370 test procedures.

A.3.5 The uncoated base-metal thickness of the steel from which the tested connectors are formed shall be measured or calculated. When the base-metal thickness is calculated by converting the coating weight to a coating thickness and subtracting it from the overall measured thickness, coating weight tests shall be performed in accordance with the requirements of ASTM A 90 or ASTM A 924. The following relationship to estimate the coating thickness from the coating weight (mass) is permitted to be used: 1 oz/ft^2 coating weight = 1.7 mils coating thickness (7.14 g/m^2 coating mass = 1 µm coating thickness).

A3.6 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 ±15 percent. If such a deviation from the average value exceeds ±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 ±15 percent, or until at least three additional tests have been conducted.

A3.7 The specimen shall be loaded such that the load is applied with reference to the intended application of the connector.

A3.8 An initial load, or preload, is permitted to be applied to the connector to seat the assembly. This preload shall not exceed 10 percent of the average ultimate load.

A3.9 Load shall be applied at either a uniform crosshead rate between 0.03 and 0.10 inch (0.8 to 2.5 mm) per minute, or at a rate of loading that will result from approximately this machine head rate. The rate of loading shall be reported with the test data.

A3.10 Evaluation of the test results shall be made on the basis of the average value of the test data as determined in accordance with Section A3.6. 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.

A3.11 Load-deflection characteristics of the connector shall be determined. The deflection in question is the relative movement between the supported cold-formed steel member and the supporting structural member in the direction of the applied load. Deflections shall be recorded up to the deflection limit state predetermined in the qualification plan required in Section A3.1 to the nearest 0.001 inch at a sufficient number of load levels to permit the establishment of a load-deflection curve. At least eight readings shall be taken prior to reaching the deflection limit state.

A4.0 PERFORMANCE REQUIREMENTS

A4.1 The Allowable Strength Design (ASD) load of the connector shall be derived from the nominal connector strength divided by a safety factor, Ω. The Load and the Resistance Factor Design (LRFD) load of a connector shall be derived from the nominal connector strength multiplied by a resistance factor, φ. The Ω or φ shall be as prescribed by Section F1 of the AISI-NAS-01. The following variables for the equations in Chapter F of AISI-NAS-01 shall be used, unless data justifying other variables are submitted.

β_o = Target reliability index = 3.5

M_M = Mean value of the material factor = 1.1

V_M = COV of the material factor = 0.10

V_F = COV of the fabrication factor = 0.15

A4.2 If the yield point of the steel from which the tested connectors or cold-formed steel structural members forming the connection are formed is larger than the specified minimum value, the test results shall be calibrated to the specified minimum yield point of the steel

which the manufacturer intends to use by the following adjustment factor, R_s:

$$R_S = \left(\frac{F_y\,(spec)}{F_y\,(tested)}\right) \times \left(\frac{t(spec)}{t(tested)}\right) \quad \leq 1.0 \qquad \text{(A4-1)}$$

where:

R_s = Adjustment factor.

$F_y(spec)$ = Specified yield point of the steel, psi (Pa).

$F_y(tested)$ = Measured yield point of the steel, psi (Pa). thickness, inch (mm).

$t(tested)$ = Measured st

$t(spec)$ = Specified steel eel thickness, inch (mm).

A similar adjustment shall be made on the basis of tensile strength instead of yield strength where the tensile strength is a critical factor. The factor that results in the greatest reduction shall be used.

A4.3 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 Equation A4-1.

A4.4 The service limit load shall be based on the ASD load combinations and shall be applicable to both ASD and LRFD. The service load of the connector shall be the average load at which the deflection of the connector parallel to the application of the test load reaches the deflection service limit specified in Section A3.1.

A5.0 QUALITY CONTROL

A5.1 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted for each facility manufacturing or labeling products that are recognized in the ICC-ES evaluation report.

A5.2 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 (A304).

A5.3 An annual inspection shall be conducted at each manufacturing facility in accordance with AC304.

A5.4 Factory-fabricated welded connectors shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by the International Accreditation Service (IAS), or otherwise acceptable to ICC-ES.

A5.5 A qualifying inspection shall be conducted at each manufacturing facility when required by the ICC-ES Acceptance Criteria for Inspections and Inspection Agencies (AC304).

A6.0 EVALUATION REPORT RECOGNITION

The evaluation report shall include the following information:

A6.1 Connector description, including physical and dimensional properties and material specifications.

A6.2 Fastener description, including physical and dimensional properties and material specifications.

A6.3 Cold-formed structural member properties.

A6.4 Allowable Strength Design (ASD) load for the connector, which shall be the lowest of the following:

A6.4.1 The average load at the deflection service limit specified in Section A3.1.

A6.4.2 The nominal strength of the connector determined in accordance with Section A3.10 divided by the safety factor, Ω, referenced in Section A4.1.

A6.4.3 The allowable strength of the fasteners or welds used to attach the connector to the structural members.

A6.5 For Load and Resistance Factor Design (LRFD), both the following values shall be published: (1) The service limit load at ASD from Section A6.5.1; and (2) the lowest strength value from Section A6.5.2 and Section A6.5.3. of the following:

A6.5.1 The average load at the deflection service limit specified in Section A3.1.

A6.5.2 The nominal strength of the connector determined in accordance with Section A3.10 multiplied by the resistance factor, φ, referenced in Section A4.1.

A6.5.3 The design strength of the fasteners or welds used to attach the connector to the structural members.

A6.6 Figure of the connector showing a typical installation and load direction.