



ACCEPTANCE CRITERIA FOR SHRINKAGE COMPENSATING DEVICES

AC316

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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.

This acceptance criteria has been issued to provide all interested parties with guidelines for demonstrating compliance with performance features of the applicable code(s) referenced in the acceptance criteria. The criteria was developed and adopted following public hearings conducted by the ICC-ES Evaluation Committee, and is effective on the date shown above. All reports issued or reissued on or after the effective date must comply with this criteria, while reports issued prior to this date may be in compliance with this criteria or with the previous edition. If the criteria is an updated version from the previous edition, a solid vertical line (|) in the margin within the criteria indicates a technical change, addition, or deletion from the previous edition. A deletion indicator (→) is provided in the margin where a paragraph has been deleted if the deletion involved a technical change. This criteria may be further revised as the need dictates.

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 set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria set forth in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria 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 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 if 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.

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1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for shrinkage compensating devices to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2003 *International Building Code*[®] (IBC), the 2003 *International Residential Code*[®] (IRC), the BOCA[®] *National Building Code/1999* (BNBC), the 1999 *Standard Building Code*[®] (SBC), and the 1997 *Uniform Building Code*[™] (UBC). Bases of recognition are IBC Section 104.11, IRC Section R104.11, BNBC Section 106.4, SBC Section 103.7, and UBC Section 104.2.8.

1.2 Scope: This criteria applies to shrinkage compensating devices used in conjunction with holddown and tension tie connectors of wood frame construction. The devices are installed as components of the restraint system, with the threaded anchor bolts or anchor rods passing through the axis of the devices to remove slack from the system. The purpose of the devices is to minimize clearances created between the holddown, tension tie connector, or plate washer and the anchor bolt/rod nut due to building settlement, or wood shrinkage (resulting from a reduction in moisture content), by a self-contained mechanism that allows the devices to move along its longitudinal axis.

1.3 Codes and Referenced Standards:

1.3.1 2003 *International Building Code*[®] (IBC), International Code Council, Inc.

1.3.2 2003 *International Residential Code*[®] (IRC), International Code Council, Inc.

1.3.3 BOCA[®] *National Building Code/1999* (BNBC).

1.3.4 1999 *Standard Building Code*[®] (SBC).

1.3.5 1997 *Uniform Building Code*[™] (UBC).

1.3.6 ASTM A 370-03a, Standard Test Methods and Definitions for Mechanical Testing of Steel Products, ASTM International.

1.4 Definitions:

1.4.1 Compression-controlled Shrinkage Compensating Device (CCSCD): A device, controlled by compression loading, used to compensate for localized wood shrinkage.

1.4.2 Tension-controlled Shrinkage Compensating Device (TCSCD): A device, controlled by tension loading, used to compensate for localized wood shrinkage.

1.4.3 Rated Shrinkage Compensation Capacity: The rated shrinkage compensation capacity is the maximum wood shrinkage, or settling (in any combination) a shrinkage compensating device can accommodate and still perform its intended function.

1.4.4 Proof Load: The proof load is the demonstrated axial compression or tension capacity at which a device will carry the design compression or tension load and still move to accommodate additional wood shrinkage after removal of the proof load. The proof load is equal to the allowable design load multiplied by a minimum of 1.1.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description: Complete information concerning dimensions, specifications, and the manufacturing process of the CCSCD or TCSCD device. The product specifications shall be included in the quality control documentation (as set forth in Section 5.0 of this criteria).

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

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

2.1.4 Field Preparation: A description of the methods of field-preparation of the CCSCD or TCSCD for installation.

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 CCSCD or TCSCD for tests under this criteria shall be in accordance with Section 3.2 of AC85.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 General: A minimum of three test specimens for each size of device to be included in the evaluation report shall be tested in accordance with Section 4.0. If the ultimate load for the three test specimens varies by more than 20 percent from the average, three additional specimens shall be tested.

The allowable compression or tension load shall be the lesser of:

1. The lowest ultimate load of three specimens divided by 3, or the average ultimate load of six specimens divided by 3.

2. The proof load divided by 1.1.

3. The load at which $\frac{1}{8}$ inch (3 mm) of deflection occurs. For ratchet-type devices, the load at which $\frac{1}{8}$ inch (3 mm) minus looseness exhibited (by tests or product description) of deflection occurs.

If the device is to be rated for dead load, then a dead load of three times the rated dead load shall be applied to the device during testing in accordance with Section 4.0.

3.2 Materials: Mill certificates shall be provided for the specific heat or lot of material used to produce the load-carrying components of the shrinkage compensating devices subjected to the load tests of this acceptance criteria. As an alternative, the mechanical properties of the components may be determined by testing in accordance with ASTM A 370 of materials taken from the load-tested devices. If actual yield and tensile strengths of the steel exceed specified values by more than 7 ksi, the allowable load from tests in Section 3.1 shall be reduced by the percentage over that specified.

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3.3 Test Requirements: The CCSCD shall be tested in accordance with Section 4.1. The TCSCD shall be tested in accordance with Section 4.2.

4.0 TEST METHODS

4.1 Load Tests for CCSCD:

4.1.1 General: Each load test specimen shall consist of a CCSCD, rod, nut, washer (if specified by the evaluation report applicant for use with the device), and support plate, assembled as shown in Figure 1, with the load applied to the CCSCD in a manner consistent with its intended installation. The steel support shall have a slope of 2 degrees from level where the device is supported. Displacement measuring devices with an accuracy of at least 0.001 inch (0.0254 mm) shall be used to measure both positive and negative vertical movement. Preloading of the device shall not be permitted. The rate of loading shall be reported in the test report and shall be a uniform rate of between 0.03 and 0.11 inch (0.8 and 2.5 mm) per minute. Test results shall be reported in both tabular form and by means of a graph of load versus deflection.

4.1.2 Test Procedure: The load test shall be conducted in three phases.

4.1.2.1 Phase 1: The load shall be applied to the specimen with the specimen's initial height (length) being equal to the manufacturer's specified installation height (length). A minimum of ten load and deflection measurements shall be recorded at approximately equal intervals between zero and the proof load of 110 percent of the rated allowable compression load.

Prior to Phase 2, the applied load shall be removed and the load application ram retracted until the device self-expands $\frac{1}{2}$ of the rated expansion capacity. The load and deflection at this point shall be reported in the test report.

4.1.2.2 Phase 2: The load shall be applied to the specimen with a minimum of ten load and deflection measurements recorded at approximately equal intervals up to an applied load of 110 percent of the rated allowable compression load.

Prior to Phase 2, the applied load shall be removed and the load application ram retracted until the device self-expands to 100 percent of its rated expansion capacity. Deflection at this point shall be reported in the test report.

4.1.2.3 Phase 3: The load shall be applied to the specimen with a minimum of ten load and deflection measurements recorded at approximately equal intervals prior to failure of the device. Failure is defined as the inflection point on the curve where the load-deflection curve is nonlinear.

4.2 Load Tests for TCSCD: Each axial tension load test specimen shall consist of a TCSCD, rod, washer (if specified by the evaluation report applicant for use with the device), and support plate, assembled as shown in Figure 2, with the tension load applied to the threaded rod. The steel support shall have a slope of 2 degrees from level where the device is supported. Displacement measuring devices with an accuracy of at least 0.001 inch (0.0254 mm) shall be used to measure positive and negative movement along the axis of the TCSCD.

The rate of loading shall be reported in the test report and shall be a uniform rate of between 0.03 and 0.11 inch (0.8

and 2.5 mm) per minute. Test results shall be reported in both tabular form and by means of a graph of load versus deflection.

4.3 Test Procedure: The axial tension load test shall be conducted in four phases.

4.3.1 Phase 1: The axial tension load shall be applied to the specimen with initial height (length) of the rod above the support plate measured and established as the reference height. The reference height shall be measured with a load of approximately 100 pounds (445 N) on the threaded rod. A minimum of five load and deflection measurements shall be recorded at approximately equal intervals between zero and the proof load of 110 percent of the rated allowable tension load.

4.3.2 Phase 2: The applied tension load shall be removed and the load application ram reversed until the reference height (established above) increases by one thread pitch of the threaded rod above the support plate. The ram shall be reversed and the rod loaded to approximately 100 pounds (445 N) and the displacement measuring device readings recorded. The difference between this reading and the original reference height is the ratcheting distance provided by the TCSCD.

4.3.3 Phase 3: The applied tension load shall be removed and the load application ram reversed until the reference height established increases by a total of two thread pitches of the threaded rod above the support plate. The ram shall be reversed and the rod loaded to approximately 100 pounds (445 N) and the displacement measuring device readings recorded. The difference between this reading and the original reference height is the ratcheting distance provided by the TCSCD. The axial tension shall now be applied to the specimen up to proof load and deflection measured with the displacement measuring device readings. A minimum of ten load and deflection measurements shall be recorded at approximately equal intervals between zero and the proof load of 110 percent of the rated allowable tension load.

4.3.4 Phase 4: The threaded rod shall be loaded to ultimate failure of either the threaded rod or the TCSCD. The load shall be recorded at failure.

Failure is defined as the inflection point on the curve where the load-deflection curve is nonlinear.

4.4 Long-term Performance: Documentation showing how the CCSCD or TCSCD will be protected from moisture and contamination during construction, or data demonstrating that exposure to moisture and contamination during construction will have no long-term adverse effects on the device, shall be submitted.

5.0 QUALITY CONTROL

5.1 A quality control manual complying with the ICC-ES Acceptance Criteria for Quality Control Manuals (AC10) shall be submitted.

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

6.0 EVALUATION REPORT RECOGNITION

The evaluation report shall include:

1. The allowable load for each CCSCD or TCSCD.

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- 2. The allowable dead load for each CCSCD or TCSCD.
- 3. The maximum permitted expansion of the CCSCD or TCSCD and the maximum permitted expansion at the completion of installation.■

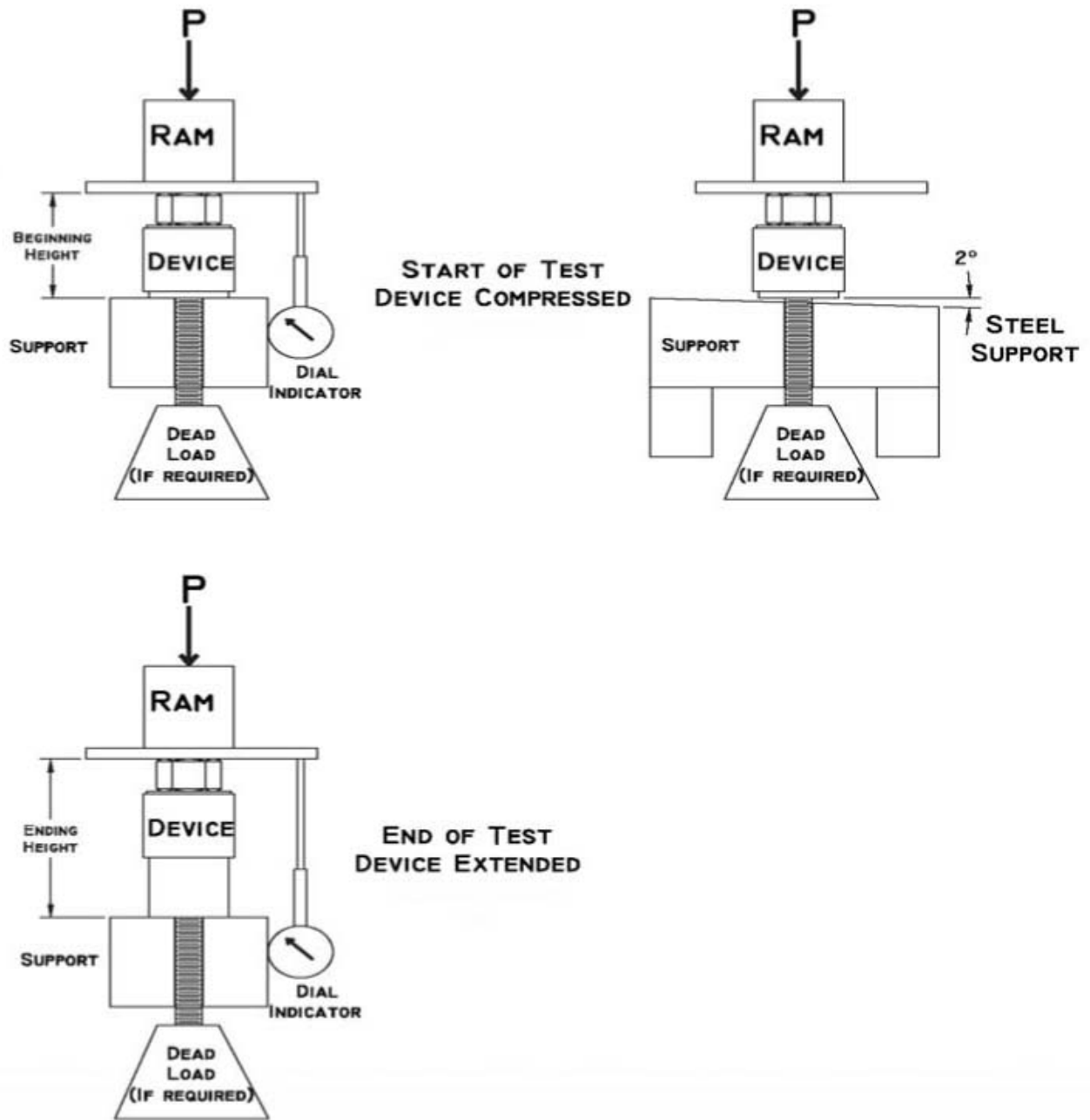


FIGURE 1—COMPRESSION TESTING

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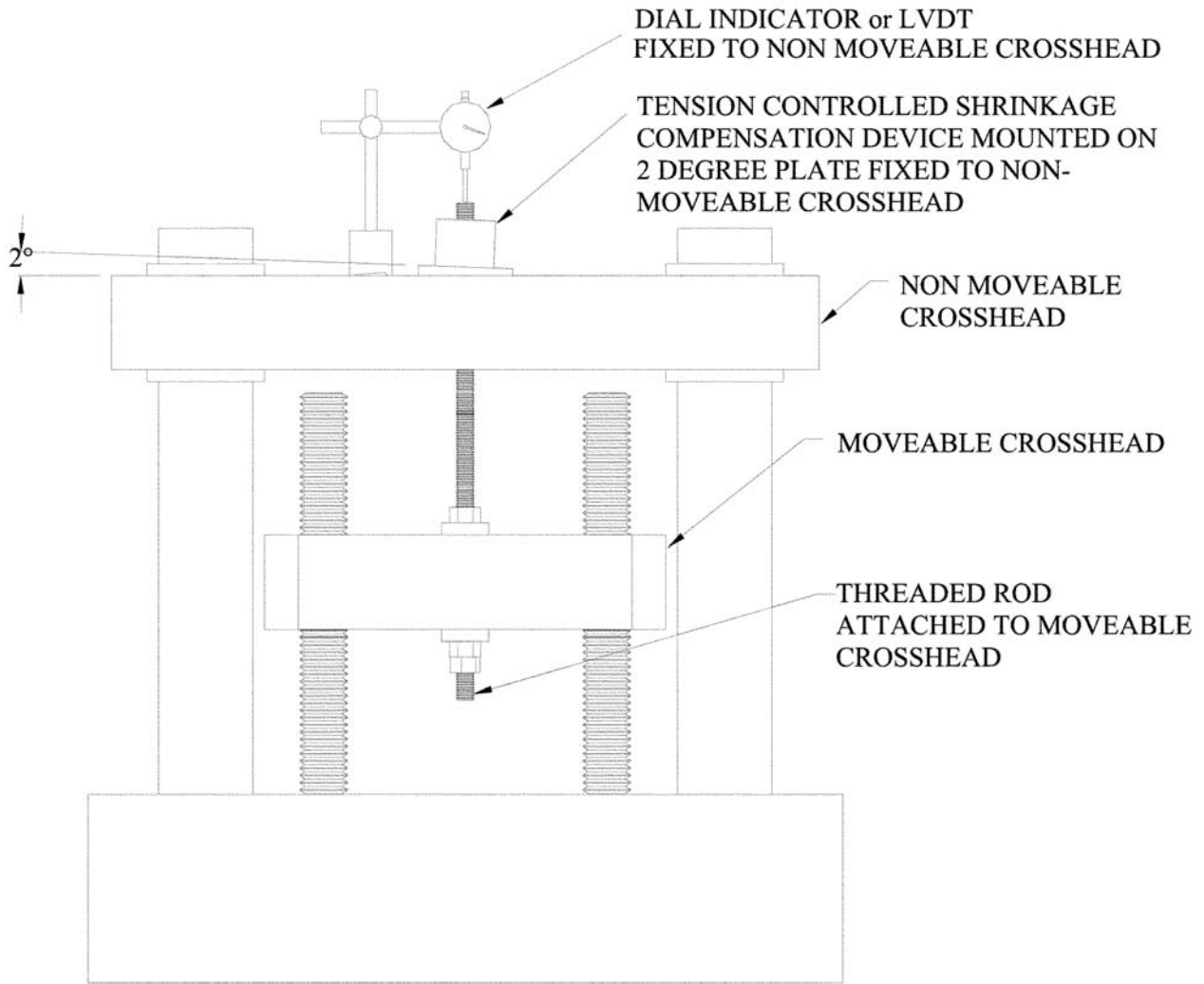


FIGURE 2—TENSION TESTING MACHINE