Designation: E2126 – 25

Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings[1]

This standard is issued under the fixed designation E2126; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods cover the evaluation of the shear stiffness, shear strength, and ductility of the vertical elements of lateral force resisting systems, including applicable shear connections and hold-down connections, under quasi-static cyclic (reversed) load conditions.

1.2 These test methods are intended for specimens constructed from wood or metal framing braced with solid sheathing or other methods or structural insulated panels.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2395 Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials

D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials

D7438 Practice for Field Calibration and Application of Hand-Held Moisture Meters

E72 Test Methods of Conducting Strength Tests of Panels for Building Construction

E564 Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings

E575 Practice for Reporting Data from Structural Tests of Building Constructions, Elements, Connections, and Assemblies

E631 Terminology of Building Constructions

2.2 *ISO Standard:*[3]

ISO 16670 Timber Structures—Joints Made with Mechanical Fasteners—Quasi-static Reversed-cyclic Test Method

2.3 *Other Standards:*

ANSI/AWC NDS[4] National Design Specification[4] for Wood Construction

CSA O86 Engineering Design in Wood[5]

3. Terminology

3.1 For definitions of terms used in this standard, see Terminology E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *ductility ratio, cyclic (D), n*—the ratio of the ultimate displacement (Δ_u) and the yield displacement (Δ_{yield}) of a specimen observed in cyclic test.

3.2.2 *elastic shear stiffness (K_e)* (see 9.1.4, Fig. 1), *n*—the resistance to deformation of a specimen in the elastic range before the first major event (FME) is achieved, which can be expressed as a slope measured by the ratio of the resisted shear load to the corresponding displacement.

[1] These test methods are under the jurisdiction of ASTM Committee E06 on Performance of Buildings and are the direct responsibility of Subcommittee E06.11 on Horizontal and Vertical Structures/Structural Performance of Completed Structures.

Current edition approved Aug. 1, 2025. Published August 2025. Originally approved in 2001. Last previous edition approved in 2019 as E2126 – 19. DOI: 10.1520/E2126-25.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

[4] A registered trademark of and available from American Wood Council, 222 Catoctin Circle SE, Suite 201, Leesburg, VA 20175, https://www.awc.org.

[5] Available from CSA Group, 178 Rexdale Blvd. Toronto, ON Canada M9W 1R3, Canada, http://www.csagroup.org.

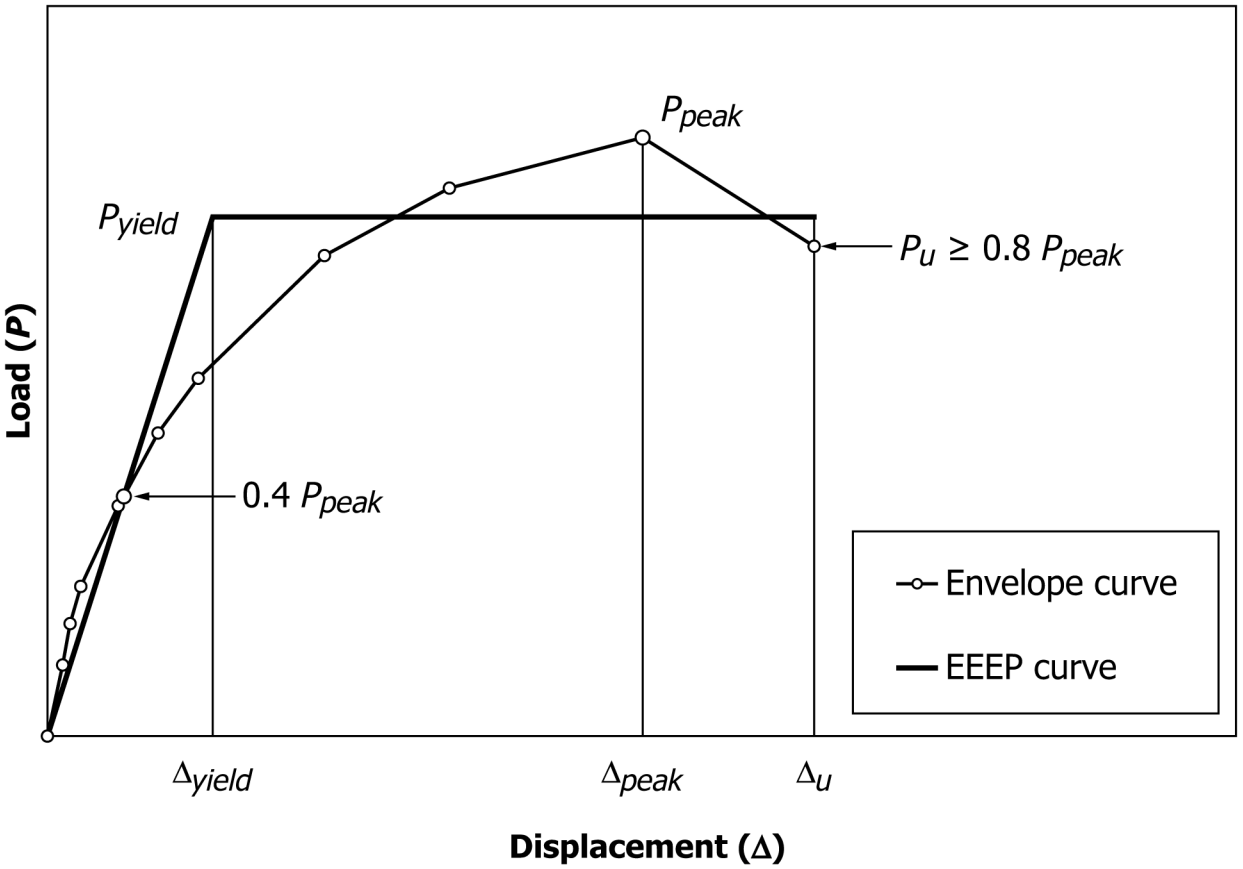

FIG. 1 Performance Parameters of Specimen: (A) Last Point at $P_u \geq 0.8\ P_{peak}$

3.2.3 *envelope curve* (see Fig. 2), *n*—the locus of extremities of the load-displacement hysteresis loops, which contains the peak loads from the first cycle of each phase of the cyclic loading and neglects points on the hysteresis loops where the absolute value of the displacement at the peak load is less than that in the previous phase.

3.2.3.1 *Discussion*—Specimen displacement in the positive direction produces a positive envelope curve; the negative specimen displacement produces a negative envelope curve. The positive direction is based on outward movement of the hydraulic actuator.

3.2.4 *envelope curve, average* (see Fig. 3), *n*—envelope curve obtained by averaging the absolute values of load and displacement of the corresponding positive and the negative envelope points for each cycle.

3.2.4.1 *Discussion*—For a monotonic test, the measured load-displacement curve is used as the average envelope curve for analysis purposes.

3.2.5 *equivalent energy elastic-plastic (EEEP) curve* (see 9.1.4, Fig. 1), *n*—an ideal elastic-plastic curve circumscribing an area equal to the area enclosed by the envelope curve between the origin, the ultimate displacement, and the displacement axis.

3.2.5.1 *Discussion*—For monotonic tests, the observed load-displacement curve is used to calculate the EEEP curve.

3.2.6 *failure limit state, n*—the point on the envelope curve corresponding to the last data point with the absolute load equal to or greater than $|0.8\ P_{peak}|$, as illustrated in Fig. 1.

3.2.7 *failure load (P_u), n*—the load corresponding to the failure limit state.

3.2.8 *first major event (FME), n*—the first significant limit state to occur (see *limit state*).

3.2.9 *limit state, n*—an event that demarks the two behavior states, at which time some structural behavior of the specimen is altered significantly.

3.2.10 *specimen, n*—the vertical element of the lateral force resisting system to be tested.

3.2.10.1 *Discussion*—Examples of specimens are walls, structural insulated panels, portal frames, etc. A specimen can be a single element or an entire line of resistance within a lateral force resisting system.

3.2.11 *stabilized response, n*—load resistance that differs not more than 5 % between two successive cycles at the same amplitude.

3.2.12 *strength limit state* (see Fig. 1), *n*—the point on the envelope curve corresponding to the maximum absolute displacement Δ_{peak} at the maximum absolute load (P_{peak}) resisted by the specimen.