



Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Walls for Buildings¹

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1. Scope

1.1 These test methods are designed to evaluate the shear stiffness, shear strength, and ductility of a wall assembly, including applicable shear connections and hold-down connectors, under quasi-static cyclic (reversed) load conditions.

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

1.3 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 2395 Test Methods for Specific Gravity of Wood and Wood-Based Materials²
- D 4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials²
- D 4444 Test Methods for Use and Calibration of Hand-Held Moisture Meters²
- E 564 Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings³
- E 575 Practice for Reporting Data from Structural Tests of Building Constructions, Connections, and Assemblies³
- E 631 Terminology of Building Constructions³
- E 1803 Test Methods for Determining Structural Capacities of Insulated Panels⁴

3. Terminology

3.1 For definitions of terms used in this standard, see Terminology E 631.

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.

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² Annual Book of ASTM Standards, Vol 04.10.

³ Annual Book of ASTM Standards, Vol 04.11.

⁴ Annual Book of ASTM Standards, Vol 04.12.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *ductility factor* (μ), n —the ratio of the ultimate displacement (Δ_u) and the yield displacement (Δ_{yield}).

3.2.2 *envelope curve* (see Fig. 1), n —the locus of extremities of the load-displacement hysteresis loops. Initial envelope curve contains the peak loads from the first cycle of each phase of the cyclic loading. Wall displacement in the positive direction produces a positive envelope curve; the negative wall displacement produces a negative envelope curve. The positive direction is based on outward movement of the hydraulic actuator. The negative direction is based on inward movement of the actuator.

3.2.3 *equivalent energy elastic-plastic (EEEP) curve* (see Fig. 2), n —an ideal elastic-plastic curve circumscribing an area equal to the area enclosed by the observed load-displacement curve or envelope curve between the origin, the ultimate displacement, and the displacement axis. The elastic portion of the EEEP curve contains the origin and has a slope equal to the elastic stiffness, k_e . The plastic portion is a horizontal line equal to P_{yield} determined by the following equation:

$$P_{yield} = \left(\Delta_u - \sqrt{\Delta_u^2 - \frac{2A}{k_e}} \right) k_e \quad (1)$$

where:

- P_{yield} = yield load (lbf or N);
- A = the area (lbf·in. or N·m) under the observed load-displacement curve or envelope curve from zero to ultimate displacement (Δ_u);
- k_e = elastic shear stiffness (lbf/in. or N/m) defined by the slope of the secant passing through the origin and a point on the observed load-displacement curve or envelope curve where the load equals $0.4 P_{peak}$.

3.2.4 *failure limit state*, n —the point in the load-displacement relationship corresponding to the last data point with the absolute load equal or greater than $0.8 P_{peak}$.

3.2.5 *failure load*, n — $0.8 P_{peak}$.

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

3.2.7 *limit state*, n —an event that marks the demarcation between two behavior states, at which time some structural behavior of the element or system is altered significantly.

