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29 C.F.R. § 1928.53

Protective enclosures for wheel-type agricultural tractors—test procedures and performance requirements.

(a) *Purpose.* The purpose of this section is to establish the test and performance requirements for a protective enclosure designed for wheel-type agricultural tractors to minimize the frequency and severity of operator injury resulting from accidental upset. General requirements for the protection of operators are specified in 29 CFR 1928.51.

(b) *Types of tests.* All protective enclosures for wheel-type agricultural tractors shall be of a model that has been tested as follows:

(1) *Laboratory test.* A laboratory energy-absorption test, either static or dynamic, under repeatable and controlled loading, to permit analysis of the protective enclosure for compliance with the performance requirements of this standard; and

(2) *Field-upset test.* A field-upset test under controlled conditions, both to the side and rear, to verify the effectiveness of the protective system under actual dynamic conditions. This test may be omitted when:

(i) The analysis of the protective-frame static-energy absorption test results indicates that both *FER*is and *FER*ir (as defined in paragraph (d)(2)(ii) of this section) exceed 1.15; or

(ii) The analysis of the protective-frame dynamic-energy absorption test results indicates that the frame can withstand an impact 15 percent greater than the impact it is required to withstand for the tractor weight as shown in Figure C-7.

(c) *Description.* A protective enclosure is a structure comprising a frame and/or enclosure mounted to the tractor. A typical enclosure is shown in Figure C-12.

(d) *Test procedures*—(1) *General.* (i) The tractor weight used shall be that of the heaviest tractor model on which the protective enclosure is to be used.

(ii) Each test required under this section shall be performed on a protective enclosure with new structural members. Mounting connections of the same design shall be used during each test.

(iii) Instantaneous deflection shall be measured and recorded for each segment of the test; see paragraph (e)(1)(i) of this section for permissible deflections.

(iv) The seat-reference point ("*SRP*") in Figure C-14 is that point where the vertical line that is tangent to the most forward point at the longitudinal seat centerline of the seat back, and the horizontal line that is tangent to the highest point of the seat cushion, intersect in the longitudinal seat section. The seat-reference point shall be determined with the seat unloaded and adjusted to the highest and most rearward position provided for seated operations of the tractor.

(v) When the centerline of the seat is off the longitudinal center, the protective-enclosure loading shall be on the side with least space between the centerline of the seat and the protective enclosure.

(vi) Low-temperature characteristics of the protective enclosure or its material shall be demonstrated as specified in paragraph (e)(1)(ii) of this section.

(vii) Rear input energy tests (static, dynamic, or field-upset) need not be performed on enclosures mounted to tractors having four driven wheels and more than one-half their unballasted weight on the front wheels.

(viii) Accuracy table:

Measurements	Accuracy
Deflection of the enclosure, in. (mm)	±5 percent of the deflection measured.
Vertical weight, pounds (kg)	±5 percent of the weight measured.
Force applied to the enclosure, pounds force (newtons)	±5 percent of the force measured.
Dimensions of the critical zone, in. (mm)	±0.5 in. (12.5 mm).

(ix) When movable or normally removable portions of the enclosure add to structural strength, they shall be placed in configurations that contribute least to structural strength during the test.

(2) *Static test procedure.* (i) The following test conditions shall be met:

(A) The laboratory mounting base shall be the tractor chassis for which the protective enclosure is designed, or its equivalent; and