



SURFACE VEHICLE RECOMMENDED PRACTICE

J2422™

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Superseding J2422 FEB2010

Cab Roof Strength Evaluation - Quasi-Static Loading Heavy Trucks

RATIONALE

In their 2015 report to Congress titled The Need for Additional Heavy Truck Crashworthiness Standards, the NHTSA stated, "The Agency has contacted SAE International and has asked them to reassess the SAE Recommended Practices in light of our study and recent motorcoach crashworthiness research." The Truck Crashworthiness Committee reviewed the NHTSA motorcoach research regarding its applicability to heavy-truck cabs. The committee determined that mechanical differences between vehicle construction, combined with differences in rollover crash characteristics, are too great to make the results directly applicable. Since it was issued in 1998, SAE J2422 has been well accepted worldwide, has demonstrated repeatable and reproducible results, and has led to stronger heavy-truck cab designs. Lacking any new, publicly available rollover crash data applicable to heavy trucks, this revision is limited to procedural clarifications where appropriate.

1. SCOPE

This SAE Recommended Practice describes the test procedures for conducting quasi-static cab roof strength tests for heavy-truck applications. Its purpose is to establish recommended test procedures that will standardize the procedure for heavy trucks. Descriptions of the test setup, test instrumentation, photographic/video coverage, and test fixtures are included.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J211-1 Instrumentation for Impact Test - Part 1 - Electronic Instrumentation

SAE J211-2 Instrumentation for Impact Test - Part 2 - Photographic Instrumentation

SAE J1516 Accommodation Tool Reference Point for Class B Vehicles

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For more information on this standard, visit https://www.sae.org/standards/content/J2422_202507/

Documents



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2.1.2 Code of Federal Regulations (CFR) Publications

Copies of these documents are available online at <https://www.ecfr.gov/>.

49 CFR Part 571.3 Definitions

2.1.3 European Union Publications

Available from European Commission, https://ec.europa.eu/info/index_en.

ECE Regulation 29 Uniform Provisions Concerning the Approval of Vehicles with Regard to the Protection of the Occupants of the Cab of a Commercial Vehicle.

3. DEFINITIONS

3.1 PLATEN

A structurally stiff, flat plate.

3.2 CAB MOUNT

The component or components used to connect and align the cab to the chassis frame rails.

3.3 STATIC STABILITY POSITION

The roll position at which a vehicle would be statically balanced on either left- or right-side wheels.

4. TEST CONFIGURATION

The cab roof strength test is designed to evaluate the resistance of a heavy-truck cab in 180-degree rollovers. The loading is divided into two phases: a dynamic pre-load that simulates the side loading on the upper cab as the vehicle rolls past 90 degrees, and a quasi-static roof loading that simulates the loading on the cab when the vehicle is inverted. Both phases are conducted on the same cab, attached to actual or simulated frame rails with its standard cab mounts. The loading is applied to the cab with a platen. The energy for the dynamic pre-load is generated from the inertia of the platen and the structure carrying it.

To assist with the description of the platen orientation and direction of motion, a reference system is defined for the cab and chassis relative to its original orientation on the vehicle. This is illustrated in Figure 1.

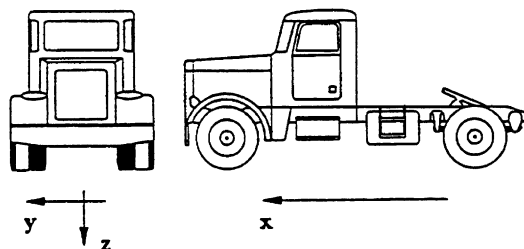


Figure 1 - Reference frame

5. DYNAMIC PRE-LOAD

In the dynamic pre-load, the platen impacts one side of the cab, with the cab mounted at an angle so that the platen initially contacts the upper portion of the cab. The platen is oriented vertically and aligned parallel to the chassis' longitudinal axis.

Either side of the cab may be loaded, depending on whether a driver side or passenger side leading rollover is to be simulated. The chassis of the test cab shall be affixed to the ground at a roll angle of 20 degrees. The longitudinal axis of the chassis shall be perpendicular to the direction of travel of the platen. The pre-load configuration is shown in Figure 2. The target speed of the platen and its supporting structure is computed as described in the following sections.

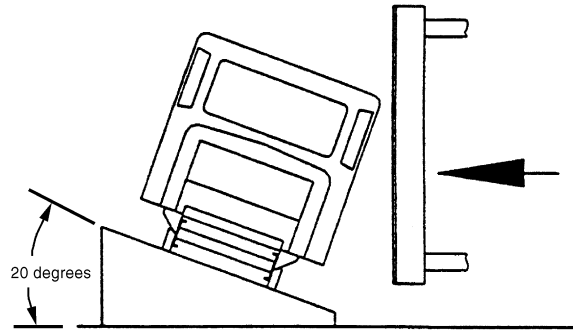


Figure 2 - Dynamic pre-load configuration

If the cab or its mounting is not symmetric, such that it may result in a strong or weak side, the weaker side of the assembly should be evaluated.

5.1 Pre-Load Energy Computation

The energy to pre-load the cab comes from the kinetic energy of the platen and its supporting structure. For the pre-load phase of the test, the target energy level is 1.6 times a reference energy level up to a maximum recommended target level of 17625.6 J (13000 ft-lb). The recommended maximum is based upon the limited testing performed to evaluate this test procedure and to produce cab damage consistent with rollover accidents. Manufacturers can, at their discretion, exceed this maximum. The reference energy level is an approximation of the kinetic energy developed when a vehicle is tipped from its static stability position to a rest position on its side. Both positions are illustrated in Figures 3 and 4. The calculation assumes that all the potential energy at the static stability position is converted to kinetic energy at the ground contact point. Basic dimensions, weight, and the center of gravity (cg) height of the vehicle are needed for this calculation. This computed energy level shall be used in the following sections in determining the platen impact speed.

$$TW_c = \frac{(TW_F + TW_R)}{2}$$

$$h_N = \sqrt{\left(\frac{TW_c}{2}\right)^2 + h_{cg}^2}$$

$$h_F = \frac{(TW_c + tw)}{2}$$

$$KE = mg*(h_N - h_F)$$

(Eq. 1)

$$TE = KE * 1.6$$

where:

TW_F = trackwidth of the front wheels

TW_R = trackwidth of the rear wheels; in the case of dual wheels, use the outermost wheels