



# SURFACE VEHICLE RECOMMENDED PRACTICE

J2424™

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## Free Motion Headform Impact Tests of Heavy Truck Cab Interiors

### RATIONALE

This revision to the recommended practice aligns the impact speed with FMVSS 201 when heavy trucks are equipped with a dynamically deployed upper interior head protection system.

#### 1. SCOPE

This SAE Recommended Practice describes the test procedures for conducting free-motion headform testing of heavy truck cab interior surfaces and components. A description of the test setup, instrumentation, impact configuration, target locations, and data reduction is 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](http://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 J1727	Calculation Guidelines for Impact Testing
CRP-013	Heavy Truck Crashworthiness - Phase III

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### 2.1.2 Code of Federal Regulations (CFR) Publications

Available from United States Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, [www.gpo.gov](http://www.gpo.gov).

49 CFR Part 571.201 Occupant Protection in Interior Impacts

49 CFR Part 572 Anthropomorphic Test Devices

### 2.1.3 NHTSA Publications

Available from National Highway Traffic Safety Administration, 1200 New Jersey Avenue, SE, Washington, DC 20590, Tel: 1-888-327-4236, <https://www.nhtsa.gov/>.

TP-201U-02 Laboratory Test Procedure for FMVSS 201: Occupant Protection in Interior Impact, Upper Interior Head Impact Protection

## 3. TEST SETUP

### 3.1 Free-Motion Headform

The free-motion headform is a 4.54-kg modified Hybrid III dummy head with the nose removed that conforms to the specifications of 49 CFR 572 subpart L.

### 3.2 Impact Zone

The free-motion headform is impacted with the interior components such that impact occurs within the forehead impact zone. This impact zone consists of a 100 mm (4 inches) by 125 mm (5 inches) rectangular area on the forehead of the free-motion headform, as described in the latest version of TP-201U.

### 3.3 Test Temperature Conditions

The free-motion headform must be within the temperature range of 19 to 26 °C (66 to 78 °F) at any relative humidity between 10% and 70%. The free-motion headform must be soaked in an ambient air environment in the specified range for a minimum of 4 hours prior to the test.

## 4. INSTRUMENTATION

The instrumentation requires measurement of time, three accelerations, and the time when the headform contact occurs. All measurements should be recorded, filtered, and processed according to the most recent versions of SAE J211-1 and SAE J1727.

### 4.1 Accelerometers

Three accelerometers shall be installed in the head cavity to measure orthogonal accelerations ( $a_x$ ,  $a_y$ , and  $a_z$ ) at the center of gravity of the free-motion headform. The three accelerometers shall be mounted in an orthogonal array, and the intersection of the planes containing the sensitive axes of the three sensors will be the origin of the array. Each data channel will be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables and must conform to the requirements of the most recent version of SAE J211-1 with data class 1000 for head acceleration data.

### 4.2 Event Time

A system that identifies the precise instant of headform contact will be incorporated with the time reference signal. The system should not affect the response of the free-motion headform impact with the interior component.

## 5. IMPACT CONFIGURATION

Any means of propelling the headform can be used as long as the impactor design is capable of impacting the selected target at the specified speeds. The impactor must be able to launch the headform from inside the vehicle at the desired approach angle. At the time of launch, the midsagittal plane of the headform is vertical and the headform upright. The headform shall travel freely through the air, without rotation, along a velocity vector perpendicular to the headform's skull cap plate, not less than 25 mm (1 inch) before making contact with the vehicle target. The free-motion headform **MUST** travel in free flight at least 25 mm (1 inch) prior to impact. The forehead impact zone must contact the target circle at the time of initial contact. A single test vehicle may be impacted multiple times subject to the following:

- a. Impacts within 300 mm (12 inches) of a prior impact may not occur less than 30 minutes apart.
- b. No impacts may occur within 150 mm (6 inches) of any other impact.
- c. The distance between impacts is measured from the center of the target circles along the vehicle interior surface.
- d. Allow at least 3 hours between successive impacts on the same headform.

## 6. IMPACT SPEED

For vehicles equipped with a dynamically deployed upper interior head protection system, any target location over any point inside the area measured along the contour of the vehicle interior within 50 mm (2.0 inches) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface shall be impacted by the free-motion headform at any speed up to and including 19 km/h (12 mph) with the system undeployed. This includes mounting and inflation components but excludes any cover or covers.

All other target locations shall be impacted at any speed up to and including 24 km/h (15 mph).

## 7. TARGET LOCATIONS

It is recommended that targets be chosen on the following interior components. Target locations that are covered by a dynamically deployed upper interior head protection system during crash scenarios that would lead to head contact may be evaluated with the deployed system in place. Target locations that are covered by airbags during crash scenarios that would lead to head contact may be evaluated with a deployed airbag in place.

- a. Roof side rail
- b. Front header
- c. Rear header
- d. Cab roof
- e. Dashboard or instrument panel
- f. Steering wheel rim
- g. Steering wheel hub
- h. A - Pillar
- i. B - Pillar
- j. Upper seat belt anchor for torso belt
- k. Other cab-dependent contact surfaces to which the head is exposed