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Steering Control Systems—Laboratory Test Procedure Heavy Trucks

1. **Scope**—This SAE Recommended Practice describes a laboratory test procedure for evaluating the characteristics of heavy truck steering control systems under simulated driver impact conditions. The test procedure employs a torso-shaped body block that is impacted against the steering wheel.

2. **References**

2.1 **Applicable Publications**—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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

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

SAE CRP-9—Heavy Truck Crashworthiness (Testing and Analysis for Recommended Practice Development), November 1996

3. **Items to be Determined**

3.1 Impact velocity of the body block.

3.2 Resultant force during the impact.

4. **Test Equipment for Instrumentation**

4.1 **Body Block**—The complete body block shall have the following characteristics:

4.1.1 **SPRING RATE**—107-143 kg/cm (600-800 lb/in), when the chest is loaded by a 10.0 cm wide by 38.0 cm long (4 in by 15 in) beam, 90 deg to the longitudinal axis of the body block, and parallel to the backing plate (Figure 1). The center of the beam is placed 45.7 ± 0.63 cm (18.0 ± 0.25 in) from the top of the head, centered laterally, and preloaded to 2.26 kg (5 lb) including the weight of the beam, to establish baseline penetration. Test speed is 25.0 ± 5 cm/minute (10 ± 2 in/minute). The load is measured when the beam has moved 12.7 cm (0.50 in) into the body block from the baseline and the spring rate is obtained by doubling this load.

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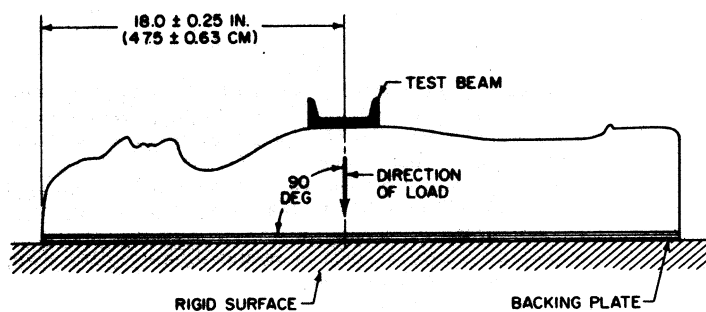


FIGURE 1—TEST BEAM LOCATION

- 4.1.2 WEIGHT—The body block shall weight $33.97 +2.26 -0$ kg ($75 +5 -0$ lb).
- 4.1.3 BODY BLOCK CENTER OF GRAVITY—The center of gravity of the complete body block shall be 55.12 ± 0.63 cm (21.7 ± 0.25 in) from the top of the head.
- 4.1.4 MOMENT OF INERTIA—The moment of inertia around the lateral axis through the center of gravity of the complete body block shall be 23 ± 2.3 cm $\cdot$ kg sec 2 (20 ± 2 in $\cdot$ lb sec 2).
- 4.1.5 Configuration of the body block is shown in Figures. 2-4.

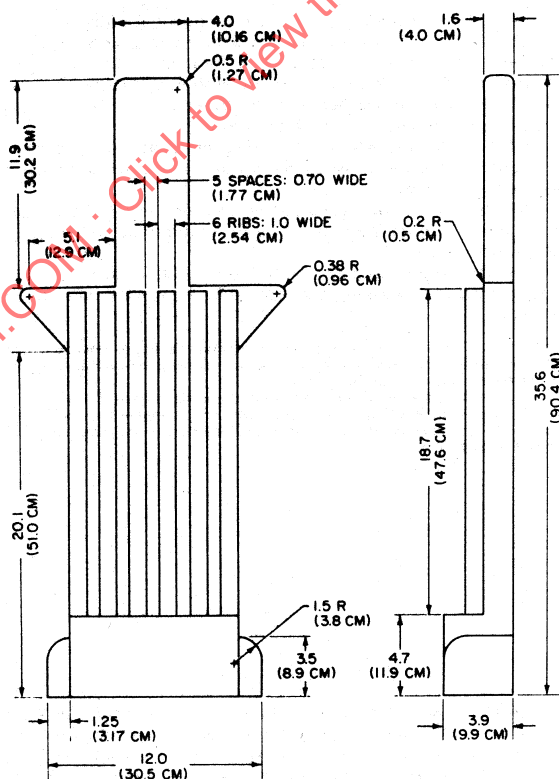


FIGURE 2—MOLD INSERT

Diagram illustrating the components and dimensions of a backboard assembly for a human torso model.

Components and Dimensions:

- PLYWOOD BACKBOARD**: The main support structure.
- SCOTCH FILAMENT TAPE NO. 89B 1, OR 4 IN. WIDE (2.5 OR 10.2 CM)**: Tape used for securing the assembly.
- TAPE**: Specific application of the Scotch Filament Tape.
- LEATHER VEST**: Worn by the model.
- RUBBER-LIKE MATERIAL TAPED AND STRAPPED TO BACKBOARD**: Material used for securing the model.
- HOLLOW**: A cavity in the assembly.
- 2x4's (5x10 CM)**: Structural supports.
- 2x6 BASEPLATE (5x15 CM)**: The base of the assembly.
- BODY BLOCK REFERENCE LINE**: A line indicating the position of the body block.
- ALSO METAL BAND**: An additional band used for securing.
- SECTION A-A (SECTION ROTATED 90 DEG COUNTER-CLOCKWISE)**: A cross-sectional view of the assembly.
- Dimensions for Section A-A**:
 - 0.7 (1.77 CM)
 - 1.0 (2.54 CM)
 - 1.0 (2.54 CM)
- Overall Dimensions**:
 - 33.0 (83.8 CM)

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4.2 Instrumentation—Any system of instrumentation that will provide data from which the items in Section 3 can be determined is acceptable. The peak resultant force may be measured by mounting a 3-axis load cell between the steering wheel and column or may be calculated from unidirectional accelerometers mounted on the body block. All measurements should be recorded and filtered according to the most recent version of SAE J211.

4.3 Any test equipment is satisfactory which can produce the minimum body block-to-steering wheel impact velocity of 24 km/h (15 mph) and which insures the body block is moving parallel to the vehicle horizontal reference, with translational (not rotational) motion, in side view at impact. (See Figure 5.) The direction of impact velocity, in the plan view, is parallel to the longitudinal vehicle axis.

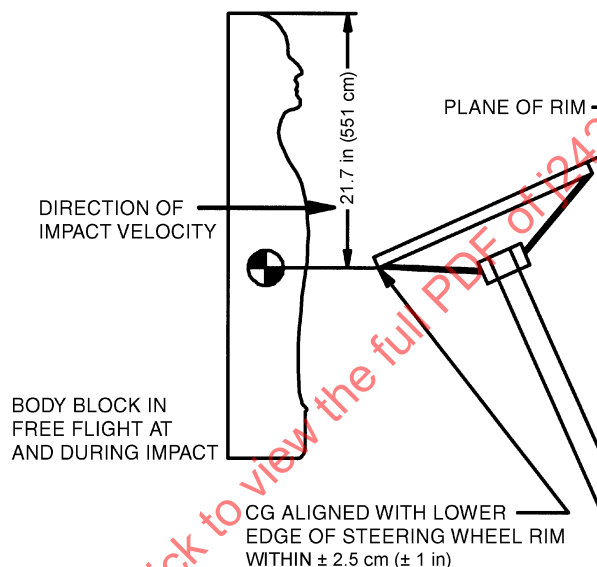


FIGURE 5—STEERING WHEEL/BODY BLOCK IMPACT CONFIGURATION

4.4 The steering wheel shall be mounted in the actual vehicle, vehicle buck, or on a fixture that is at least as rigid as the actual vehicle mounting.

4.5 If a load cell is used, it must be mounted between the column and the steering wheel.

5. Test Procedure

5.1 It is recommended that the steering wheel be turned so that its most rigid spoke is aligned with the direction of the impact velocity thus producing the worst-case force on the body block.

5.2 In the case of an adjustable steering wheel, the test will be made with the wheel adjusted to the manufacturer's design position. Other positions may be tested based on engineering judgement.

5.3 The body block at impact is positioned as shown in Figure 5. The body block is centered laterally in relation to the steering wheel hub. The vertical relationship between the steering wheel and the body block shall be such that the center of gravity of the body block is at the same level as the lower edge of the steering wheel rim, within ± 25 mm (± 1 in).