SAE International™ SURFACE VEHICLE STANDARD

SAE J1051 REAF. DEC2002

Issued 1974-01
Reaffirmed 2002-12

Superseding J1051 SEP1993

# Force-Deflection Measurements of Cushioned Components of Seats for Off-Road Work Machines



***1. Scope***—This SAE Standard provides a method to obtain consistent force-deflection data of finished (or unfinished, when specified) cushioned components of seats for off-road work machines as listed in SAE J1116. This data may be helpful in maintaining seat comfort characteristics and quality control. There is no intent to establish any acceptance criteria.

## *2. References*

**2.1 Applicable Publications**—The following publication forms a part of this standard to the extent specified herein. The latest issue of SAE publications shall apply.

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

SAE J1116—Categories of Off-Road Work Machines
SAE TSB 002—Preparation of SAE Technical Reports
SAE REPORT—Format Guidelines for the Electronic Capture of SAE Documents, June 1992

## *3. Technical Requirements*

### 3.1 Test Apparatus

3.1.1 A 200 mm diameter, rigid, flat or curved indentor (Figure 1 and Figure 2) or a 50 mm diameter, rigid, flat indentor (Figure 1). The indentor force shall be applied through a rigid joint or a swivel joint capable of accommodating the angle of the top surface of the test specimen.

3.1.2 A platform capable of positioning the top surface of the test specimen parallel to and centered with the rigid joint indentor and not to restrict the breathing or normal deformation of the specimen tested (Figure 3). The indentor with the swivel joint may be preferred for tapered or irregular shaped cushions or for a fixed platform (Figure 4).

3.1.3 An apparatus capable of applying forces and measuring the deflection of the indentor into the specimen.



**TO PLACE A DOCUMENT ORDER:**
**Tel: 877-606-7323 (inside USA and Canada)**
**Tel: 724-776-4970 (outside USA)**
**Fax: 724-776-0790**
**Email: custsvc@sae.org**
**SAE WEB ADDRESS: http://www.sae.org**

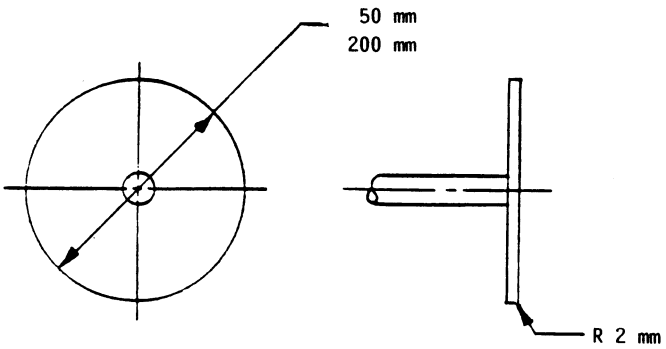


FIGURE 1—FLAT INDENTOR

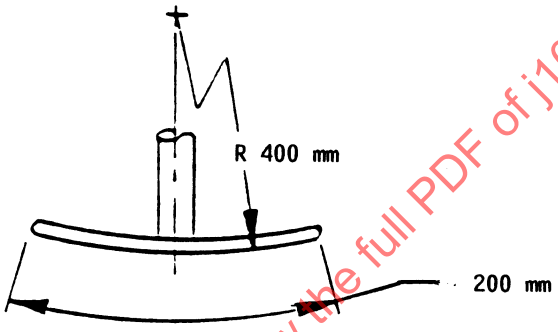


FIGURE 2—CURVED INDENTOR

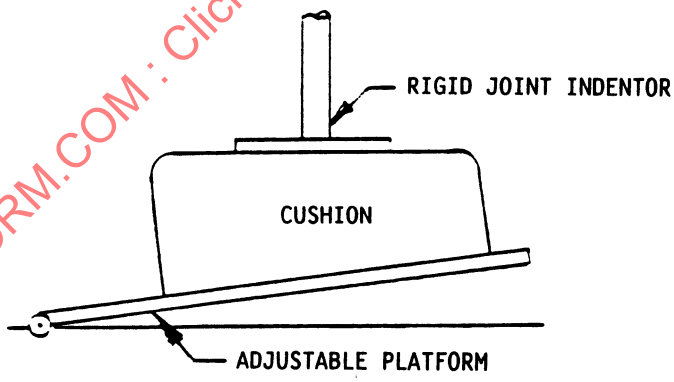


FIGURE 3—ADJUSTABLE PLATFORM

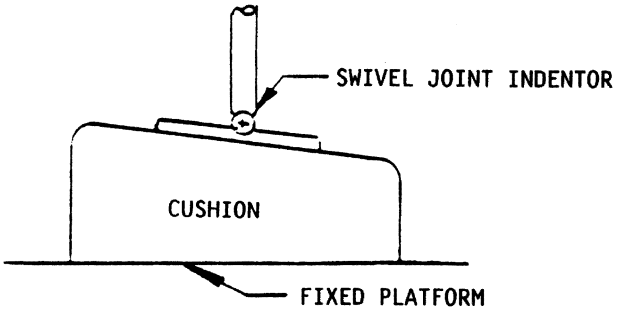


FIGURE 4—SWIVEL JOINT INDENTOR



### 3.2 Procedure

3.2.1 TEST SPECIMEN—The test specimen shall consist of a seat cushion, back cushion, or other components in an unused condition (with packaging or protective bag removed).

3.2.2 TEST CONDITIONS—The specimen shall be conditioned, undeflected, and undistorted at 22 °C ± 2.8 °C and relative humidity of 50% ± 2% for at least 12 h before being tested. The tests shall be performed 96 h or more after the manufacture of the raw materials used in the test specimen (foam, elastic components other than metal, etc.). In case of a question, refer to the applicable SAE or ASTM specification (if available) for the particular material.

3.2.3 PERCENT DEFLECTION—Percent Deflections are determined using the cushion material and cover without the supporting structure (base).

3.2.4 TEST METHOD

*3.2.4.1* *Mount Specimen*—Mount the specimen with the top surface parallel to and centered with the indentor, unless otherwise specified by mutual agreement of the manufacturer and the customers. The 200 mm diameter curved or flat indentor shall be used on seat and back cushions unless otherwise specified. A light muslin of a quality comparable to a grade described as a weave of 48 threads per inch and density of 190 g/m$^2$ is allowed to prevent marking of the component. In the case of components with unusual shapes or contours, location for placement, and the size of the indentor is to be agreed upon by the manufacturer and customer and shall allow a minimum of 80% of the indentor area to be in contact when the initial zeroing force of 3.2.3.3 is applied. (Example: Smaller diameter or curved indentor for curved backrest—see Figure 2.)

*3.2.4.2* *Preflex*—Preflex the test specimen three times by compressing and releasing the force at a rate of 100 mm/min. The specimen shall be compressed as follows:

a. Seat Cushion: 1335 N
b. Back Cushion: 665 N
c. Other Components: Compress to 20% of original thickness

Allow 10 min ± 5 min for the specimen to stabilize after preflexing before continuing the test.

*3.2.4.3* *Zero the Deflection Scale*—Apply a force of 45 N to the 200 mm diameter indentor or 10 N to the 50 mm diameter indentor and set the deflection scale to zero.

*3.2.4.4* *Force-Deflection Application*—For the 200 mm indentor, apply an incremental force (no greater than 220 N) slowly to minimize shock. Allow 1 min for the specimen to stabilize, then measure the deflection. Continue this incremental procedure without removing the preceding force until the maximum force of 1335 N for the seat cushion and 665 N for the back cushion is reached. For the 50 mm indentor or thin cushions, incremental deflection versus force may be more desirable. When incremental deflection is used, the specimen shall be compressed to not less than 20% of its original thickness. When the maximum force is 45 N or less the indentor diameter should be increased if possible.

*3.2.4.5* *Force-Deflection Removal*—After reaching maximum force, reduce the force slowly (minimize shock) in 220 N maximum increments, allowing 1 min for the test specimen to stabilize before measuring deflection at each increment.

*3.2.4.6* *Return Time*—Deflect the cushion to 25% ± 2.5% of undeflected condition and hold for 1 min. Release the load in 0.5 s or less and record the time taken to return to the undeflected condition.

### 3.3 Data Required

3.3.1 Description of the test specimen (Manufacturer's name, number, etc.).

3.3.2 Diameter and curvature of the indentor.

3.3.3 Deviations on special test conditions.

3.3.4 Location of the indentor on the test specimen.

3.3.5 Record all force-deflection data taken during the application and removal of the force on the test specimen.

3.3.6 Plot the force on the Y-axis versus deflection on the x-axis.



PREPARED BY THE SAE HUMAN FACTORS TECHNICAL
COMMITTEE SC4—OPERATOR SEATING AND RIDE