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Superseding J1013 AUG1992

Measurement of Whole Body Vibration of the Seated Operator of Off-Highway Work Machines

1. Scope—This SAE Standard defines a method for the measurement of the whole body vibration to which the seated operator of off-highway self-propelled work machines is exposed while performing an actual or simulated operation. It applies to vibration transmitted to the operator through the seat. There are no equivalent ISO Standards.

1.1 Application—In the main body of this document, conditions are defined for measuring and recording while body vibration of the seated operator of off-highway self-propelled work machines. The specification of instruments, analytic methods, and description of site and operating conditions allows the measurements to be made and reported with an acceptable precision. The procedure includes means of weighting the vibration level at different frequencies as specified in ISO 2631. A standard format for reporting spectral data is recommended.

The definitions, instruments, and analytic methods also apply to simulated tests for operator vibration as performed in laboratories.

This procedure is a measuring method only and is not intended for the evaluation or selection of seating systems.

1.2 Rationale—Superseded by ISO 2631.

2. References

2.1 Applicable Publications—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, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J711 MAR91—Tire Selection Tables for Agricultural Tractors of Future Design

SAE J751 APR86—Off-Road Tire and Rim Classification - Construction Machines

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2.1.2 ANSI AND ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI S2.2-1959 (R-1990)—Methods for Calibration of Shock and Vibration Pickups

ISO 2631-1:1985—Evaluation of human exposure to whole body vibration—Part 1: General requirements

ISO 2041-1975—Vibration and shock vocabulary

ISO 5008-1979(E)—Agriculture wheeled tractors and field machinery—Measurement of whole-body vibration of the operator

2.1.3 IRIG PUBLICATION—Available from Secretariat, Range Commanders Council, Attn: STEWS-SA-R, White Sands Missile Range, New Mexico 88002.

IRIG Document 106—Inter Range Instrumentation Group. Magnetic Tape Recorder Reproducer Standards

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

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

SAE HS J6a—Ride and Vibration Data Manual

2.2.2 ANSI PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI S1.11-1986—Specifications for Octave Band and Fractional Octave Band Analog and Digital Filters

ANSI S2.4-1976 (R-1990)—Method for Specifying the Characteristics of Auxiliary Equipment for Shock and Vibration Measurement

3. **Definitions**

3.1 Whole Body Vibration—As used in this document, this term means vibration transmitted to the body as a whole through the buttocks of a seated operator.

3.2 Operator Seat—Specifically for the purposes of this document, that portion of the machine provided for the purpose of supporting the buttocks of the seated operator, including the seat suspension system.

3.3 Frequency Analysis—Process of arriving at a quantitative description of the amplitude of a vibration as a function of frequency.

3.4 Measurement Interval—The time interval over which vibration data for analysis is obtained.

3.5 Average Ground Speed—Ratio of the distance traveled during the measurement interval to the length of the measurement interval.

Other terminology used in this recommendation is in accordance with ISO 2041.

4. **Letter Symbols**

a - instantaneous acceleration

a_f - rms value of 1/3 octave acceleration having center frequency f

a_w - frequency weighted acceleration signal

a_{wf} - weighted rms acceleration calculated as described in 6.4.1, 6.4.2, or 6.4.3

B_e - resolution bandwidth of a frequency analysis, Hz

f - frequency

rms - root-mean-square

T - analysis time duration, seconds
 m/s^2 - acceleration units, meters per second squared
 Hz - hertz, standard notation for frequency, cycles per second
 W_f - frequency dependent, dimensionless weighting factor
 G - acceleration of gravity, by international agreement equal to $9.80665 m/s^2$ at sea level
 PSD - Power Spectral Density expressed as mean square acceleration per unit bandwidth $(m/s^2)^2 Hz$

5. **Vibration Measurement Axes**—The vibration shall be measured along three mutually perpendicular axes, passing through a point on the interface between the operator and the seat. These axes are substantially vertical, longitudinal, and lateral (a_z , a_x , and a_y) with respect to the orientation of the seated operator and are defined in Figure 1. The operator should sit in a typical upright position and should keep both hands in a normal position for operating the controls as suggested by Figure 1. The seat shall be adjusted per manufacturer's instructions.

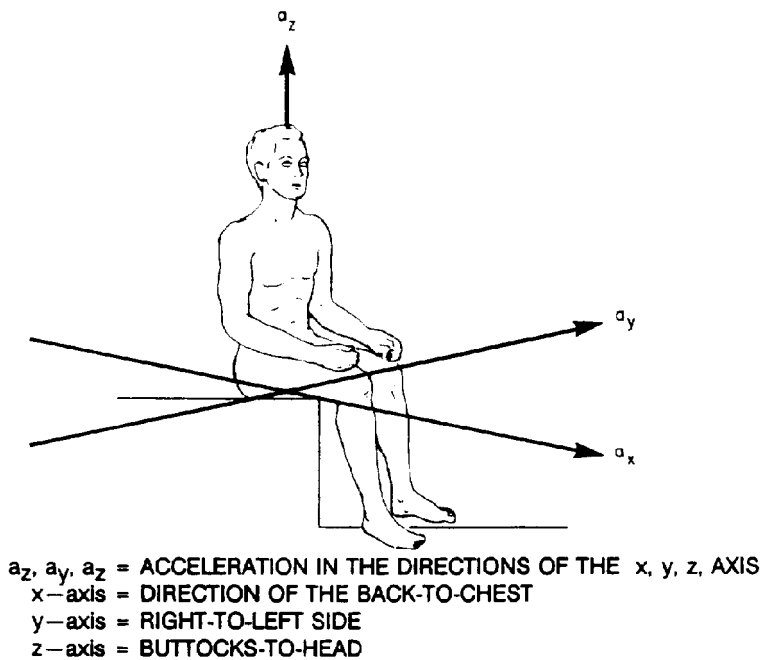


FIGURE 1—MEASUREMENT AXES