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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Practice for Accelerometer Use in Vehicles for Tire Testing[1]

This standard is issued under the fixed designation F 811; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers guidelines for using accelerometers in test vehicles to evaluate dynamic accelerations resulting from various maneuvers such as braking, accelerating, or cornering.

1.2 This practice is applicable to accelerometers that are rigidly attached to the body of the test vehicle or stabilized to the earth-fixed axis system by means of a gyroscope.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautions are given in Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*

F 538 Terminology Relating to the Characteristics and Performance of Tires[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *accelerometer, n*—an instrument that senses inertial reaction to measure linear or angular acceleration. **F 538**

3.1.1.1 *Discussion*—For additional information on accelerometers, refer to the *Handbook of Transducers for Electronic Measuring Systems.*[3]

3.1.2 *bandwidth, [1/T], n*—the range of frequencies within which certain performance characteristics occur; specific limits normally apply. **F 538**

3.1.3 *g, n*—a unit of acceleration where 1 *g* is equal to the acceleration of gravity, 9.8 m/s^2(32.2 ft/s^2). **F 538**

3.1.4 *gyro-stabilized accelerometer, n*—a precision vertical gyroscope fitted with one to three accelerometers to provide orthogonal measurements referenced to the earth-fixed axis system. **F 538**

3.1.5 *servo accelerometer, n*—an accelerometer containing servo mechanisms, electronics, and a seismic element to sense inertial reaction. **F 538**

3.1.6 *strain gage accelerometer, n*—an accelerometer using strain gages to sense the motion of the seismic element. **F 538**

4. Significance and Use

4.1 The measured accelerometer output can be used to calculate traction properties of combined tire-vehicle systems in the operation of passenger cars, light trucks, and heavy trucks through use of applicable methods of testing.

4.2 This practice is intended to achieve uniformity in test vehicle accelerometer use and in accelerometer signal processing. Through such usage, a basis for meaningful comparisons of test results from different sources will be obtained.

4.3 This practice is not applicable to accelerometers used in destructive testing, such as vehicle crash tests or vehicle vibration measurements.

5. Apparatus

5.1 *Body-Mounted Accelerometer*—An accelerometer shall be used to measure vehicle accelerations in any of the three primary vehicle axes (use x, y, z as illustrated in Fig. 1) and shall have the following specifications:

5.1.1 *Range*—The full-scale range of the accelerometer shall be at least ±1.0 g and not more than± 5.0 g for units used in the x and y axes, and at least ±2.0 g and not more than ±5.0 g for units used in the z axis.

5.1.2 *Accuracy*—The static and dynamic accuracies of the accelerometer shall be ±0.25 % of full scale including linearity, hysteresis, and repeatability.

5.1.3 *Bandwidth*—The frequency response of the complete system shall be from DC to a minimum of 20 Hz. The output shall not vary more than ±2 % of the static output over this frequency range.

5.1.4 *Temperature*—The operating temperature range shall be, as a minimum, between 23 and 66°C (−10 and 150°F) with a temperature sensitivity of less than 0.054 %/°C (0.03 %/°F).

5.1.5 *Cross-Axis Sensitivity*—The measured output shall not be affected by more than 1 % of the accelerations acting perpendicular to the measurement axis.

5.2 *Gyro-Stabilized Accelerometer*—Accelerometers that are attached to a gyro-stabilized platform for the purpose of

[1] This practice is under the jurisdiction of ASTM Committee F-9 on Tires and is the direct responsibility of Subcommittee F09.10 on Equipment, Facilities, and Calibration.

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[2] *Annual Book of ASTM Standards*, Vol 09.02.

[3] Norton, H. N., *Handbook of Transducers for Electronic Measuring Systems*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1969, pp. 93–141.