

**ACOUSTICS — MEASUREMENT OF AIRBORNE NOISE EMITTED BY
EARTHMOVING MACHINERY — METHOD FOR DETERMINING COMPLIANCE
WITH LIMITS FOR EXTERIOR NOISE — STATIONARY TEST CONDITION**

This document is equivalent to ISO document 6393, except for minor reorganization of paragraphs 1 through 4.

Foreword—This Document has not changed other than to put it into the new SAE Technical Standards board Format.

This SAE Standard is a special test code for specific types of earthmoving machinery. It is an extension of SAE J2101/ISO 4872 which contains the general requirements for construction equipment.

Specific requirements are provided in this special test code to enable the sound power emission in a stationary test condition to be determined in a manner which is repeatable. Attachments (bucket, dozer, etc.) for the manufacturer's production version shall be fitted since this is the configuration most likely to exist when the machine is in actual use.

This document will enable compliance with noise limits to be determined. It can also be used for evaluation purposes in noise reduction investigations.

An additional special test code is given in SAE J2103/ISO 6394. This other special test code shall be used to determine the noise emitted by earthmoving machinery, with the machine in a stationary condition, measured at the operator's position in terms of the equivalent continuous A-weighted sound pressure level.

- 1. Scope**—This SAE Standard describes a method for determining the exterior noise emitted by earthmoving machinery in terms of the A-weighted sound power level while the machine is in a stationary test condition. At six positions on a hemispherical surface, the equivalent continuous A-weighted sound pressure levels are measured. The A-weighted sound power level of the machinery is calculated from the measured values.

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2. References

2.1 Applicable Publications—The following publications form a part of this specification 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 J2101/ISO 4872—Acoustics—Measurement of airborne noise emitted by construction equipment intended for outdoor use—Method for determining compliance with noise limits.

SAE J2103/ISO 6394—Acoustics—Measurement of airborne noise emitted by earthmoving machinery—Operator's position—Stationary testing condition

2.1.2 IEC PUBLICATION—Available from International Electrotechnical Commission, 3, rue de Verambe, P.O. Box 131, 1211 Geneva 20, Switzerland.

IEC Publication 651—Sound level meters

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

ISO 1585—Road vehicles—Engines test code—Net power

ISO 6165—Earthmoving machinery—Basic types—Vocabulary

3. Definitions—For the purposes of this document, the definitions given in ISO 4872 and the following definitions apply.

3.1 Equivalent Continuous A-Weighted Sound Pressure Level, $L_{pAeq,T}$ —The A-weighted sound pressure level averaged on an energy basis over the whole measurement period.

3.2 A-Weighted Sound Power Level, L_{WA} —The A-weighted sound power level using equivalent continuous A-weighted sound pressure levels averaged over the measurement surface and averaged on an energy basis over the whole measurement period.

4. Field of Application—This document is applicable to the following specific types of earthmoving machinery (see also Appendix A): Excavators (hydraulic or rope operated), crawler and wheel tractors with dozer equipment, and crawler and wheel loaders.

5. Instrumentation

5.1 General—For the purposes of this document, the instrumentation specified in SAE J2101/ISO 4872 applies. An additional requirement relating to the microphone is given in 5.2.

5.2 Microphone—A condenser microphone or the equivalent in accuracy, stability and frequency response shall be used. The external diameter of the microphone shall not exceed 13 mm so as to reduce possible directivity errors. The microphone and its associated cable shall be chosen so that the combined sensitivity does not change significantly over the temperature range encountered during the measurements.

6. Test Environment

6.1 General—For the purposes of this document, the test environment specified in SAE J2101/ISO 4872, clause 4 and Appendix/Annex A, applies. Additional requirements are given in 6.2 to 6.6.

Humidity, air temperature, barometric pressure, vibration, and stray magnetic fields shall be within the limits specified by the manufacturer of the instrumentation.

- 6.2 Test Site and Environmental Correction, K**—For test sites which consist of a hard, flat ground surface, such as asphalt or concrete, and with no sound-reflecting obstacles within a distance from the source equal to three times the greatest distance from the source center to the lower measurement positions, it may be assumed that the environmental correction, K, is less than or equal to 0.5 dB and is, therefore, negligible and can be disregarded.
- 6.3 Test Site Surface**—Three types of test site surface are allowed. The choice is optional and the test site surface or surfaces selected shall be reported as specified in Sections 11 and 12. The test site surfaces are outlined in 6.3.1 to 6.3.3.
- 6.3.1 HARD REFLECTING PLANE (TEST SITE SURFACE A)**—The test area bordered by the microphones shall consist of concrete or sealed asphalt that has not incurred any extensive surface deterioration.
- 6.3.2 SAND (TEST SITE SURFACE B)**—The test area bordered by the microphones shall consist of humid sand of grain size up to 2 mm. The minimum depth of the sand shall be 0.3 m for the working location of the machine. The remainder of the test site should have a minimum depth of 0.05 m. If 0.3 m is not sufficient depth for track penetration, the depth shall be increased accordingly.
- 6.3.3 COMPACTED EARTH (TEST SITE SURFACE C)**—The test area bordered by the microphones shall consist of compacted earth that is slightly moist and will permit track or wheel lug penetration. The moisture content shall be low enough so that the material does not stick or pack in the track system or in the wheel lugs. The material shall be free of stones greater than 25 mm in diameter and the proportion of sand, gravel, or crushed rock should not exceed 50%. The soil may be clay or loam.
- 6.4 Background Noise**—Background noise at each measurement position shall be at least 10 dB lower than the noise emitted by the machine.
- 6.5 Climatic Conditions**—When precipitation, i.e., rain, snow, or hail, is falling or when the ground surface is covered with snow, it is recommended that measurements should not be carried out.
- 6.6 Signal Devices**—Any signal devices, such as forward warning horn or backup alarm, shall not be activated during this test.
- 7. Measurement of Equivalent Continuous A-Weighted Sound Pressure Levels**
- 7.1 Size of Measurement Surface**—The measurement surface to be used for the test shall be a hemisphere. The radius of the hemisphere shall be determined by the basic length, L, of the machine (see Figure 1, Figure 2, and Figure 3). The basic length encloses the main body of the machine and excludes major attachments, such as dozer blades, buckets, and boom.
- The radius shall be as follows:
- 4 m when the basic length, L, of the machine to be tested is less than 1.5 m.
 - 10 m when the basic length, L, of the machine to be tested is greater than 1.5 m but less than 4 m.
 - 16 m when the basic length, L, of the machine to be tested is greater than 4 m.