



## SOUND LEVEL MEASUREMENTS AT THE OPERATOR STATION FOR AGRICULTURAL AND CONSTRUCTION EQUIPMENT—SAE J919a

### SAE Recommended Practice

Report of Construction and Industrial Machinery Technical Committee approved May 1966 and last revised by Vehicle Sound Level Committee April 1971.

**1. Introduction**—This SAE Recommended Practice sets forth the instrumentation and procedure to be used in measuring sound levels at the operator station for agricultural and construction equipment, including mobile outdoor industrial equipment.

#### 2. Instrumentation

2.1 A sound level meter which meets the requirements of International Electrotechnical Commission Publications (IEC) 179, Precision Sound Level Meters, and American National Standard ANSI S1.4—1961, General Purpose Sound Level Meters.

2.2 As an alternative to making direct measurements using a sound level meter and octave band analyzer, a microphone or sound level meter may be used with a magnetic tape recorder and/or a graphic level recorder or indicating meter, providing the system meets the requirements of SAE J184.

2.3 A sound level calibrator (see paragraph 4.2.4).

2.4 A calibrated windscreen (see paragraph 4.3).

2.5 A set of octave bandpass filters which meets the Class II requirements of ANSI S1.11—1966, Octave, Half-Octave, and Third-Octave Band Filter Sets.

2.6 An engine speed indicator (accurate within  $\pm 1\%$  or  $\pm 10$  rpm, whichever is greater).

2.7 An anemometer.

#### 3. Procedure

##### 3.1 Test Site

3.1.1 The test area shall consist of a flat open space free of large reflecting surfaces such as a signboard, building, or hillside located within 50 ft of the equipment.

3.1.2 For certification tests on rubber-tired vehicles, the test site shall be paved. For certification tests on tracked or steel-wheeled vehicles, the test site surface shall be smooth, hard packed dirt. In either case, the surface shall be free of acoustically absorptive materials such as snow or grass.

3.1.3 For job site tests, topographical conditions may not be fully controllable, but should conform as closely as practicable to conditions stated in paragraphs 3.1.1 and 3.1.2 and be described in detail.

##### 3.2 Environment and Equipment Conditions

3.2.1 No person other than the vehicle operator shall be in the operator station area on vehicles with or without a cab. Bystanders may have an appreciable influence on instrumentation readings if such persons are in the vicinity of the equipment or the microphone.

3.2.2 The ambient sound level (including wind effects) due to sources other than equipment being measured shall be at least 10 dB(A) lower than the level of the tested equipment at the microphone location for the A weighted sound level readings. If octave band measurements are being taken, the ambient sound pressure level from other sources shall be at least 10 dB lower in each octave band.

3.2.3 The microphone shall be located as follows:

(a) On the middle line of the vehicle operator's normal seated position measure upward 28 in. from the seat reference point along a straight line tangent to the predominant front surface to the seat back.

(b) Forward 6 in. horizontally from the point location in paragraph 3.2.3(a).

(c) Right 10 in. horizontally from the point location in paragraph 3.2.3(b).

The seat reference point is defined as the point where the middle lines of the seat and backrest intersect. These middle lines shall be tangents to the predominant surfaces of the seat cushion and the seat back. The seat reference point is based on an undeflected cushion. Where the seat is of the buttock-pan type, with no back, consider the "back" to be a vertical plane, tangent to the rear of the pan. If more details are desired on the operator's seat dimensions, SAE J898 and 899

may be referred to for specific details. These dimensions take into consideration "operator slump" and "cushion deflection."

Adjustable seats shall be placed at the midpoint of their ranges for the calculation of this microphone location point. If the seat cushion is directly attached to a movable suspension system, then the range of travel shall be determined and the midpoint location be used to determine the seat reference point location relative to the vehicle. During the test the adjustable seats may be adjusted to suit the individual operator, providing that his final position for the test with the vehicle stationary places his right ear 6 in. ( $\pm 1$  in.) to the left of the microphone. The ear shall also be in a horizontal plane ( $\pm 1$  in.) with reference to the microphone location.

The dimensions of the vehicle operator should be as close as practical to the 50th percentile male. The operator's eye location dimension for a sitting clothed male (reference SAE J833) shall fall inside the 5th percentile to the 95th percentile male range.

3.2.4 When the test vehicle has a cab, measurements are to be taken with windows, doors, and vents in a fully closed position and all cab accessories turned on (except radio). If the vehicle does not have air conditioning, then the test shall also be run with windows, doors, and vents in a fully open position and all accessories turned off.

3.2.5 The vehicle shall be at a stabilized operating temperature during the test and must not be operated in a manner such that the break-in procedure specified by the manufacturer is violated.

3.3 Stationary Certification Tests—Measurements shall be made under the following conditions:

3.3.1 Maximum attainable governed engine speed at no load. Vehicles that have major noise generating machinery, such as an elevating scraper, combine, or field cutter, shall have this machinery in operation during the test.

3.3.2 Maximum attainable governed engine speed at torque converter stall conditions (make this test where possible).

3.3.3 Maximum power take-off load at rated engine speed (make this test where possible).

##### 3.4 Moving Test

3.4.1 For a moving certification test, the vehicle shall be operated in an intermediate forward gear over the surface specified in paragraph 3.1.2. The engine shall be operated at full governed control setting loaded with any combination of rolling resistance, blading, drag load, or vehicle brakes to obtain rated engine speed. Intermediate is intended to mean the third gear ratio for machines with five or six gear ratios, fourth gear ratio for machines with seven or eight gear ratios, etc. (Gear ratio refers to overall gear reductions.) Hydrostatic or electric drive equipment will be operated at approximately one-half their maximum ground speed. If the condition of rated engine speed at load cannot be obtained due to stall (for instance, as on some loaders), the equipment shall be operated in the same intermediate gear ratio at maximum obtainable speed and no load. Equipment that has major noise generating machinery, such as elevating scraper or combine, shall have this machinery in operation during these tests.

3.4.2 For job site tests, the vehicle shall be operated over a path of travel and in a manner most typical of its application on that job. When this type of test is requested, the conditions of operation and test site description shall be specified in detail so that the conditions that may have an effect on the level of the measurements are quite self-evident.

3.4.3 The above prescribed operating conditions will normally result in noise levels representative of the vehicle and shall be used in the noise level evaluation of the vehicle. However, if other operating conditions are found to produce appreciably greater noise levels, then they shall be measured and recorded for reference purposes only.

##### 3.5 Data Collection