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SAE J1096 FEB87

Measurement of Exterior Sound Levels for Heavy Trucks Under Stationary Conditions

SAE Recommended Practice
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Submitted for Recognition as
an American National Standard

SAE The Engineering Society For Advancing Mobility Land Sea Air and Space
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HIGHWAY VEHICLE PRACTICE

Submitted for recognition as an American National Standard

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MEASUREMENT OF EXTERIOR SOUND LEVELS FOR HEAVY TRUCKS UNDER STATIONARY CONDITIONS

1. INTRODUCTION: This SAE Recommended Practice establishes the test procedure, environment, and instrumentation for determining the maximum exterior sound level of highway motor trucks and truck tractors over 4540 kg (10 000 lbs) gross vehicle weight rating (GVWR) with governed engines under stationary vehicle conditions. The basic procedure involves a full throttle engine acceleration and a closed throttle deceleration with the engine inertia as the load.

2. INSTRUMENTATION: The following instrumentation shall be used, where applicable, for the measurement required.

2.1 A sound level meter which satisfies the Type 1 or S1A requirements of American National Standard Specification for Sound Level Meters, ANSI S1.4-1983 & S1.4A-1985.

2.2 As an alternative to making direct measurements using a sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or a graphic level recorder or other indicating instrument, providing the system meets the requirements of SAE Recommended Practice J184 FEB87, Qualifying a Sound Data Acquisition System.

2.3 A sound level calibrator, accurate to ±0.5 decibel (dB) (see paragraph 5.3.3).

2.4 A windscreen may be used. The windscreen shall not affect the microphone response more than +1 dB for frequencies of 20 - 4000 Hz or ±1-1/2 dB for frequencies of 4000 - 10 000 Hz (see paragraph 5.1).

2.5 An engine-speed tachometer.

3. TEST SITE: The following test site requirements shall be considered necessary to perform effective measurements for this stationary procedure.

3.1 A suitable test site shall consist of a flat open space free of large reflecting surfaces, such as parked vehicles, signboards, buildings, or hillsides, located within 30 m (100 ft) of either the vehicle or the microphone. See Fig. 1.

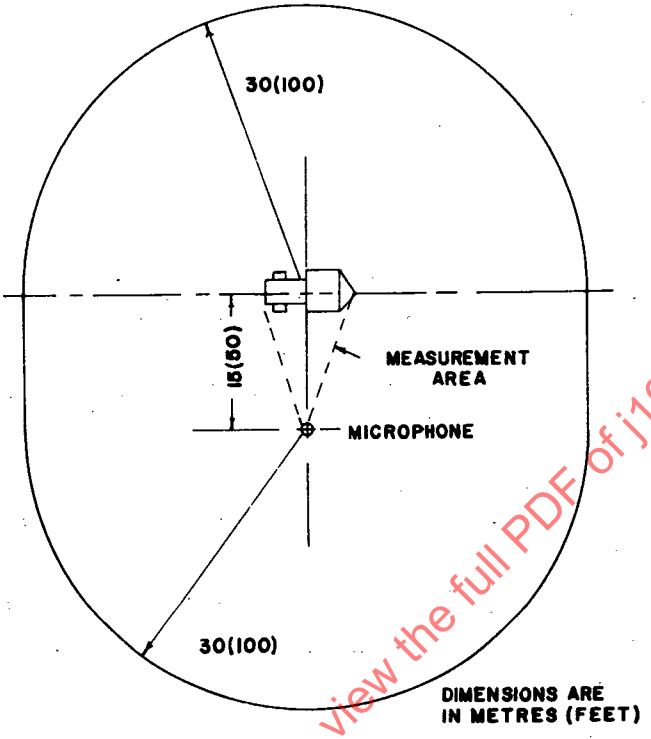

FIG. 1 - TEST SITE CONFIGURATION

3.2 The measurement area (defined as shown in Fig. 1, including the area under the test vehicle) shall be surfaced with concrete, asphalt, or similar hard non-porous material, and shall be free of snow, grass, soil, ashes, or other sound-absorbing materials. Trailers or semi-trailers are to be neglected when determining the measurement area.

3.3 The microphone shall be located 15 m (50 ft) from the centerline of the vehicle and 1.2 m (4 ft) above the ground plane as shown in Fig. 1. The microphone shall be located on a line perpendicular to the vehicle centerline and in line with the rear of the cab.

3.4 Because bystanders have an appreciable influence on meter response when they are in the vicinity of the vehicle or microphone, not more than one person, other than the observer reading the meter, shall be within 15 m (50 ft) of the vehicle or instrument, and that person shall be directly behind the observer reading the meter, on a line through the microphone and the observer.

3.5 The ambient sound level (including wind effects) coming from sources other than the vehicle being measured shall be at least 10 dB lower than the level of the tested vehicle.

4. PROCEDURE:

4.1 The vehicle shall be tested in a stationary position with maximum engine acceleration and deceleration with no external load applied.

4.1.1 The engine governor and throttle delay (if one is installed) shall be set to the manufacturer's specifications.

4.1.2 The vehicle engine coolant temperature shall be raised to the normal operating range.

4.1.3 The vehicle shall be positioned at the test site as shown in Fig. 1, with the main transmission in neutral and the clutch engaged.

4.1.4 The engine shall be accelerated, by rapidly establishing full throttle, from a low idle condition to the maximum governed speed. After the engine speed has been stabilized (3-5 s), the engine shall be decelerated at closed throttle to low idle speed.

4.2 Measurements:

4.2.1 The sound level meter shall be set for fast response and the A-weighting network. Equivalent settings shall be used with other instruments.

4.2.2 The meter shall be observed during the entire engine acceleration-deceleration cycle. The applicable reading shall be the highest sound level obtained during this cycle. Unrelated peaks due to extraneous ambient noises should be ignored.

4.2.3 The sound level for each side of the vehicle shall be the average of the first two highest readings which are within 1 dB of each other. Report the sound level for the side of the vehicle with the highest average value.

5. GENERAL COMMENTS:

5.1 Measurements shall be made only when wind speed is below 19 km/h (12 mph). The microphone windscreen may be used to minimize effects of wind gusts and other changes in wind speed. See paragraph 3.5.

5.2 It is strongly recommended that persons technically trained and experienced in the current techniques of sound measurement select the equipment and conduct the tests.

5.3 Proper use of all test instrumentation is essential to obtain valid measurements. Operating manuals or other literature furnished by the manufacturer should be referred to for both recommended operation of the instrument and precautions to be observed. Specific items to be considered are:

5.3.1 The effects of ambient weather conditions on the performance of all instruments (for example, temperature, humidity, and barometric pressure).

5.3.2 The effects of proper signal levels, terminating impedances, and cable lengths on multi-instrument measurement systems.

5.3.3 Proper acoustical calibration, to include the influence of extension cables, etc.

5.4 Field calibration shall be made immediately before and after each test sequence. Internal calibration means are acceptable for field use, provided that external calibration is accomplished immediately before or after field use.

5.5 The sound level of a vehicle with a diesel engine may be dependent on the fuel's cetane level. A diesel fuel with a cetane number between 42-50 is recommended. In vehicles with gasoline-fueled engines, a fuel grade consistent with the engine manufacturer's recommendations should be used.

6. REFERENCES:

6.1 SAE J184 FEB87, Qualifying a Sound Data Acquisition System.

6.2 ANSI S1.4-1983 & S1.4A-1985, Specification for Sound Level Meters.

ANSI documents are available from the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

APPENDIX

The Department of Transportation/Bureau of Motor Carrier Safety exterior noise regulation for commercial vehicles has a stationary test procedure (Title 40, Part 325, Subpart E) that is similar to this SAE test procedure.

The intent of the two test procedures and the resultant sound levels are in general the same. However, there are procedural differences that can result in different measured sound levels. The Department of Transportation/Bureau of Motor Carrier Safety test procedure allows for a greater deviation from ideal test conditions than this SAE test procedure.

ISO 5130-1982 Acoustics - Measurements of Noise Emitted by Stationary Road Vehicles - Survey Method, is an International Standard for the determination of noise emitted by stationary road vehicles in use, the noise being measured in close proximity to the exhaust outlet. The ISO 5130 test method is not similar to this SAE test procedure.