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Sound Level of Highway Truck Tires

**SAE Recommended Practice
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**Submitted for Recognition as
an American National Standard**

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SOUND LEVEL OF HIGHWAY TRUCK TIRES

1. **INTRODUCTION:** This SAE Recommended Practice establishes a test procedure for measuring the sound level produced by tires intended primarily for highway use on motor trucks, truck tractors, trailers and semitrailers, and buses. The procedure provides for the measurement of the sound generated by a set of test tires, mounted on the rear axle operated at 80 km/h (50 mph) and at maximum rated tire load.

Specifications for the instrumentation, the test site, and the operation of the test vehicle are set forth to minimize the effects of extraneous sound sources and to define the basis of reported sound levels.

Factors influencing sound level measurement and reference to sound levels are given in the Appendix.

2. **INSTRUMENTATION:** The following instrumentation shall be used for the measurements as required:
- 2.1 Sound level meter which satisfies the Type 1 or SIA requirements of American National Standard Specification for Sound Level Meters, S1.4-1983.
- 2.1.1 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 J184 FEB87, Qualifying a Sound Data Acquisition System, with slow response specified in place of fast response as applicable to paragraph 3.6 therein.
- 2.2 An acoustical calibrator, having an accuracy of ± 0.5 dB, for establishing the calibration of the sound level meter and associated instrumentation.
- 2.3 An anemometer having an accuracy of $\pm 10\%$ at 19 km/h (12 mph).

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3. TEST SITE:

- 3.1 The test site shall be located on a flat area which is free of reflecting surfaces (other than the ground), such as parked vehicles, trees, or buildings within 30 m (100 ft) of the measurement area.
- 3.2 The vehicle path shall be relatively smooth, semipolished, dry, Portland cement concrete which is free of extraneous surface material.
- 3.3 The microphone shall be located 15 m (50 ft) from the centerline of the vehicle path at a height of 1.2 m (4 ft) above the ground plane. The normal to the vehicle path from the microphone shall establish the microphone point on the vehicle path. See Fig. 1.

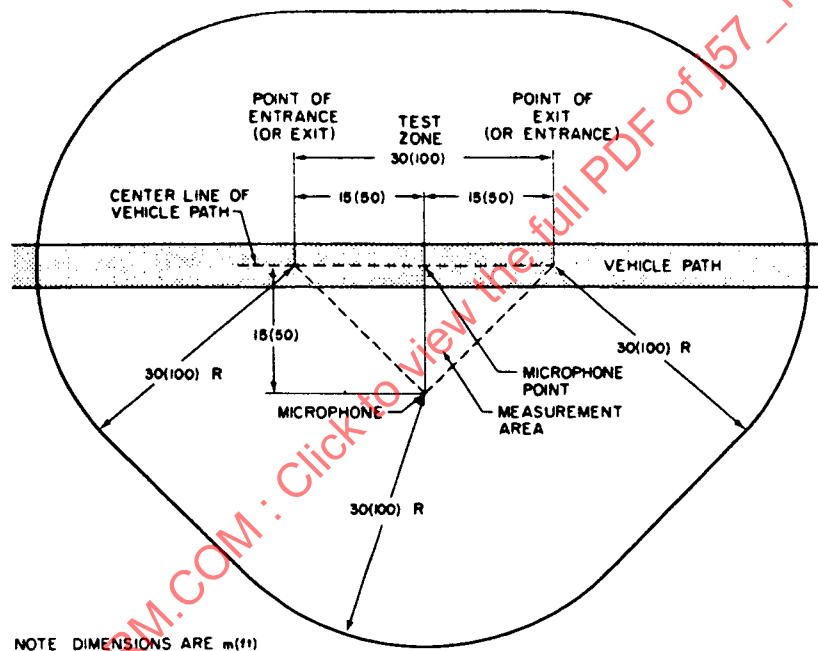


FIG. 1- TEST SITE (SEE PARAGRAPH 3). (VEHICLE MAY BE RUN IN EITHER DIRECTION)

- 3.4 The test zone extends 15 m (50 ft) on either side of the microphone point along the vehicle path. The measurement area is the triangular area formed by the point of entrance into the test zone, point of exit from the test zone, and the microphone.
- 3.5 The measurement area should be surfaced with concrete, asphalt, or similar hard material and, in any event, shall be free of snow, grass, soil, ashes, or other sound-absorbing materials.
- 3.6 The ambient sound level (including wind effects) at the test site shall be at least 10 dB below the level of the test vehicle operated in accordance with the test procedure.
- 3.7 The wind speed in the measurement area shall be less than 19 km/h (12 mph).

4 TEST VEHICLE:

- 4.1 The vehicle shall be a motor truck equipped with two axles (a nonpowered steering axle and a powered axle).
- 4.2 The vehicle shall have a platform, rack, or van body capable of retaining the loading or ballast. This body shall have an essentially flat and horizontal undersurface, and be mounted such that this surface has a $230 + 100$ mm ($9 + 4$ in) clearance with the tire fully loaded. This body shall be nominally 2440 mm (96 in) in width and extend a minimum of 910 mm (36 in) rearward of the rear (powered) axle centerline.
- 4.3 Mud flaps should be removed at the test site, if permissible.

5. TIRES:

- 5.1 Tires used for dual installations shall be dual mounted (four tires) on the rear axle for testing. Tires used in single installations (wide base) shall be mounted singly. A tire used as both duals and singles may require test at both dual and single mounting. The sound level reported must be identified as to type of mounting.
- 5.2 The tires shall be inflated to the maximum pressure and loaded to the maximum load specified by the Tire and Rim Association for continuous operation at highway speeds exceeding 80 km/h (50 mph).
 - 5.2.1 If local load limits will not permit full rated load, the test may be conducted at the local load limit with inflation pressure reduced to provide a tire deflection equal to the maximum load and inflation pressure, provided the load is not less than 75% of the maximum rated load.

As an alternative, the pressure in the tires can be adjusted to correspond to the actual load following the appropriate load/pressure table in the Tire and Rim Association Yearbook. Because the choice of procedure may cause small differences in level, such levels shall not be reported unless they are identified with the percent load used.
- 5.3 Quiet tires are recommended for use on the front axle.

6. PROCEDURE:

- 6.1 The test vehicle shall be operated in such a manner (such as coasting) that the sound level due to the engine and other mechanical sources is minimized throughout the test zone. The vehicle speed at the microphone point shall be 80 km/h (50 mph).
- 6.2 The sound level meter shall be set for slow dynamic response and the A-weighting network. The observer shall record the highest level attained during each pass of the test vehicle, excluding readings where known acoustical interferences have occurred.
 - 6.2.1 Alternatively, each pass of the test vehicle may be recorded on magnetic tape and subsequently analyzed with a sound level meter and/or graphic level recorder.

- 6.3 There shall be at least three measurements. The number of measurements shall equal or exceed the range in decibels of the levels obtained.
- 6.4 The sound level reported shall be the average of the two highest readings which are within 2 dB of each other.

7. GENERAL COMMENTS:

- 7.1 It is recommended that technically competent personnel select the equipment to be used for the test measurements and that these tests be conducted only by persons familiar with the current techniques of sound measurement.
- 7.2 All instrumentation should be operated according to the practices recommended in the operating manuals or other literature provided by the manufacturer. All stated precautions should be observed. Some specific items for consideration are:
- 7.2.1 Specifications for orientation of the microphone relative to the ground plane and the source of sound should be adhered to. (Assume that the sound source is located at the microphone point.)
- 7.2.2 Proper signal levels, terminating impedances, and cable lengths should be maintained on all multi-instrument measurement systems.
- 7.2.3 The effect of extension cables and other components should be taken into account in the calibration procedure.
- 7.2.4 The position of the observer relative to the microphone should be as recommended.
- 7.3 Instrument manufacturer's recommended calibration procedure and schedule for individual instruments should be employed. Field calibrations should be made immediately before and after testing each set of tires.
- 7.4 Not more than one person, other than the observer reading the meter, shall be within 15 m (50 ft) of the vehicle path or the microphone, and that person shall be directly behind the observer reading the meter, on a line through the microphone and the observer.
- 7.5 The sound level of the tires being tested is valid only when the sound level of the vehicle equipped with quiet tires is at least 10 dB below that of the vehicle equipped with test tires. The sound levels obtained with this procedure may be used for a relative ranking of the test tires, if the sound level of the vehicle equipped with the quietest tires available is 3-10 dB lower than when equipped with the tires being tested.

8. REFERENCE MATERIAL:

- 8.1 SAE J184 FEB87, Qualifying a Sound Data Acquisition System
- 8.2 SAE Publication SP-373, Truck Tire Noise
- 8.3 G. R. Thurman, "Effect of Road Surface and Bed Clearance on Truck Tire Noise." Paper 740607 presented at SAE West Coast Meeting, Anaheim, California, August 1974

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

8.5 Tire and Rim Association Yearbook

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

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APPENDIX

- A1. An A-weighted sound level not exceeding 85 dB, determined in accordance with this recommended practice, is consistent with present best current practice for cross ribbed tires in normal states of wear. It is general experience that the sound level of unworn tires is significantly less than that of worn tires.
- A2. Road surfaces are known to significantly affect the sound levels generated by highway truck tires. Rib type tires generally produce lower sound levels on smooth surfaces than on surfaces having a textured finish such as that brushed in during construction. Differences as great as 5 dB have been observed between sound levels obtained on very smooth and coarse concrete surfaces for tires producing relatively low levels of sound. For cross-ribbed tires, however, generated sound levels have been found to not differ by more than approximately 1 dB for given tire types on a variety of Portland cement concrete surfaces judged to be relatively smooth. For these reasons, the vehicle path description in paragraph 3.2 is sufficient to provide for reproducible sound levels for cross-ribbed tires, within the expected accuracy of such measurements (+1 dB), and to provide surface-dependent relative sound levels for rib type tires.
- A3. Persistence of tire sounds after the passage of the vehicle and the tonal components of these sounds are properties of certain types of tires which tend to occur concurrently. Both are factors that direct attention to the sound, and are important determinants of the acceptability of the sound.

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