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Measurement of Light Vehicle Exhaust Sound Level Under Stationary Conditions—SAE J1169

SAE Recommended Practice
Approved January 1977

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MEASUREMENT OF LIGHT VEHICLE EXHAUST SOUND LEVEL UNDER STATIONARY CONDITIONS—SAE J1169 SAE Recommended Practice

Report of Vehicle Sound Level Committee approved January 1977. Rationale statement available.

1. Scope—This SAE Recommended Practice establishes the test procedure, environment, and instrumentation to be used for measuring the exhaust sound level for passenger cars and light trucks under stationary conditions.

This sound level measurement procedure has been developed as a guide for governmental agencies establishing vehicle in-service sound level limitations and enforcement measurement procedures. It is directed at the assessment of vehicle exhaust noise and is not designed to determine maximum vehicle sound levels.

2. Instrumentation—The following instrumentation shall be used:

2.1 A sound level meter meeting the Type 1, S1A, 2, or S2A requirements of American National Standard Specification For Sound Level Meters, S1.4-1971 (See paragraph 7.4).

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 magnetic tape recorder and/or a graphic level recorder or indicating instrument, provided the system meets the requirements of SAE Recommended Practice J184, Qualifying a Sound Data Acquisition System.

2.2 A sound level calibrator, accurate to ± 0.5 dB.

2.3 A windscreen, which if used shall be of a type recommended by the sound level meter manufacturer.

2.4 A calibrated engine speed measuring device, accurate to ± 100 rpm at 3000 rpm.

3. Test Environment

3.1 A suitable test site shall be out-of-doors and shall consist of a level concrete, asphalt, or similar hard material flat surface, free from snow, grass, loose soil, ashes, or other sound absorbing material. It shall be an open space free from large reflecting surfaces, such as parked vehicles, buildings, billboards, trees, shrubbery, parallel walls, people, etc., within 3 m (10 ft) radius from the microphone location and any point on the vehicle.

3.2 As an alternative to outside testing a large semi-anechoic chamber may be used.

3.3 The ambient sound level (including wind effects) from sources other than the vehicle being tested shall be at least 10 dB below that produced by the test vehicle.

4. Microphone Orientation

4.1 The microphone of the sound level meter shall be located at a distance of 0.5 m (20 in) from the reference point on the outlet pipe (refer to Fig. 1) and at an angle of 45 deg (+0, -10 deg) to the flow axis of the pipe termination. (Refer to Fig. 2.) The microphone shall be at the height of the reference point, but not less than 0.2 m (8 in) from the ground. The axis of maximum sensitivity of the microphone shall lie in a plane parallel to the ground and shall be directed toward the exhaust outlet. (Refer to paragraphs 4.2 and 4.4.)

4.1.1 If two microphone locations are possible, the location furthest laterally from the vehicle centerline shall be used.

4.1.2 If the flow axis of the outlet pipe is at 90 deg to the vehicle centerline, the microphone shall be located at the point, determined in accordance with paragraph 4.1, which is furthest from the engine.

4.2 For exhaust outlets located under the vehicle body, the microphone shall be located a minimum of 0.2 m (8 in) from the nearest part of the vehicle, at a point closest to, but not less than 0.5 m from, the exhaust outlet, and at a height of 0.2 m (8 in) above the ground, and not in line with exhaust flow. The angularity requirement of paragraph 4.1 may not be met in some cases. (Refer to Fig. 2.)

4.3 If a vehicle has two or more exhaust outlets spaced less than 0.3 m (12 in) apart and connected to a single silencer, only one measurement shall be made. The microphone shall be located relative to the outlet furthest from the vehicle centerline, or, when such outlet does not exist, to the outlet which is the highest above the ground.

4.4 Instrument manufacturer's specification for orientation of the microphone relative to the source of sound and the location of the observer relative to the meter shall be followed. The microphone should be mounted on a stand for stable location.

5. Procedure

5.1 The engine of the vehicle under test shall be at normal operating temperature during the test.

5.2 The engine hood or compartment cover shall be closed.

5.3 The vehicle air conditioner shall be turned off.

5.4 With the vehicle transmission in neutral or park position (parking brake applied for safety), the engine speed shall be slowly increased from idle speed to 3000 rpm, held constant at this speed for sufficient time to obtain a sound level meter reading, and then slowly decreased to idle speed.

6. Measurements

6.1 The sound level meter shall be set for slow dynamic response and for the A-weighting network.

6.2 Measurements shall be made at each exhaust outlet, using the microphone positions described in paragraphs 4.1, 4.2, and 4.3.

6.3 The sound level meter shall be observed during the constant engine speed operation of the vehicle, as described in paragraph 5.4. The recorded reading shall be the highest sound level observed.

6.4 The tests shall be repeated at each exhaust outlet until two measurements are obtained which are within 2 dB of each other. The reported sound level for a given outlet shall be the average of the two highest measurements which are within 2 dB of each other. For vehicles equipped with multiple exhaust outlets, the sound level reported shall be for the exhaust outlet having the highest sound level.

7. General Comments

7.1 It is essential that technically qualified personnel select equipment and that tests be conducted only by persons trained in the techniques of sound measurement.

7.2 Instrument manufacturer's recommended calibration practice shall be followed. External acoustic calibration shall be performed immediately before and after each period of field use, and at intervals during use not exceeding one h.

7.3 It should be recognized that variations in measured sound levels may occur due to variations in test sites, atmospheric conditions, test equipment differences, and operator skill. These variations should not exceed 2 dB.

7.4 Although both Type 1 and Type 2 sound level meters may be used with this procedure, it is suggested that a Type 1 instrument be considered to incorporate superior crest factor capability and lesser overall tolerance which can result in more accurate measurements.

7.5 Caution should be exercised when measuring rear engine vehicles because engine and cooling fan noise may prevent accurate measurement of exhaust noise.

8. Reference Material—Suggested reference material is as follows:

8.1 ANSI S1.2-1962, (R1971) Method for the Physical Measurement of Sound.

8.2 ANSI S1.4-1971, Specification for Sound Level Meters.

Application for copies of these documents should be addressed to the American National Standards Institute, 1430 Broadway, New York, New York 10018

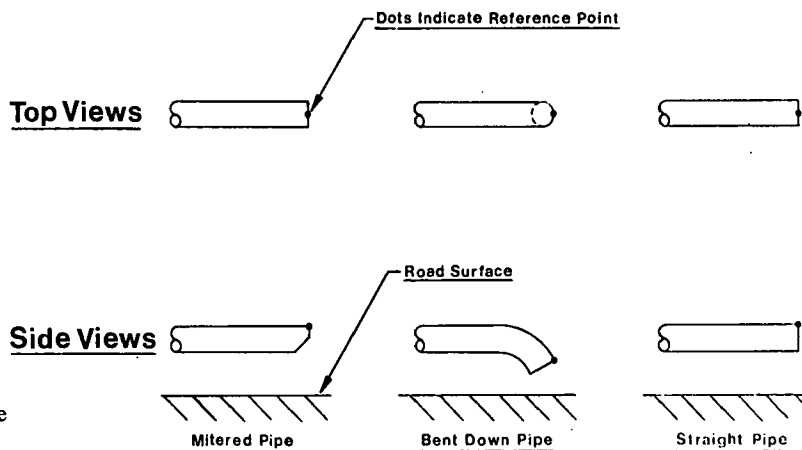


FIG. 1—OUTLET PIPE DETAILS