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Exterior Sound Level Measurement Procedure for Pleasure Motorboats

SAE Recommended Practice
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an American National Standard

The Engineering Society For Advancing Mobility Land Sea Air and Space®
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SPECIALIZED VEHICLE PRACTICE

an American National Standard

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EXTERIOR SOUND LEVEL MEASUREMENT PROCEDURE FOR PLEASURE MOTORBOATS

1. SCOPE:

This SAE Recommended Practice establishes the procedure for measuring the maximum exterior sound level for pleasure motorboats under 20 m (65 ft) in length, and describes the instrumentation, test site, and boat operation, for determining the sound level.

2. INSTRUMENTATION:

The following instrumentation shall be used for the measurement required:

2.1 A precision sound level meter which meets the Type 1 requirements of ANSI S1.4-1971, Specification for Sound Level Meters.

2.1.1 The microphone shall be used with an acceptable foam wind screen. To be acceptable the wind screen shall not affect the overall reading by more than ±0.5 dB(A) for the sound source that is being measured. (See paragraph 4.4.)

2.2 A sound level calibrator (See paragraph 4.3).

2.3 A wind speed anemometer.

2.4 An engine speed tachometer.

3. PROCEDURE:

3.1 Test Site: A suitable test site is a flat calm body of water, large enough to allow full speed pass-bys. The area around the microphone and boat shall be free of large obstructions, such as buildings, boats, hills, large piers or breakwater, etc. for a minimum distance of 30 m (100 ft). Three markers (buoys or posts) will be placed in line, 15 m (50 ft) apart, to mark the course the boat is to follow while being tested.

3.1.1 The background sound level (including wind effects) shall be at least 10 dB lower than the measured level of the boat being tested.

3.2 Boat Operation:

3.2.1 The boat shall pass all three markers on a straight course at wide-open throttle with the engine operating at the midpoint of the manufacturers recommended full throttle rpm range. (See companion document for further information.)

3.2.2 The engine speed tolerance shall be +100 rpm if this falls in the recommended full-throttle speed range. If a single top speed rpm is recommended, the tolerance shall be +0, -100 rpm.

3.2.3 Boats which are sold with the power units installed (for example, inboards, and stern drives) shall be tested in this combination. Outboard motorboats shall be tested with a motor or motors for which the boat is rated, since sound level is dependent upon boat design and construction.

3.3 Measurements:

3.3.1 The microphone shall be placed 25 m (82 ft) from the line determined by the three markers, normal to the line and opposite the center marker. It shall also be placed 1.2 - 1.5 m (4 - 5 ft) above the water, and no closer than 0.6 m (2 ft) from the surface of the dock or platform on which the microphone stands. It shall be placed as near to the end of the dock as possible or overhanging the end of the dock.

3.3.2 The meter shall be set for fast response and the A-weighting network.

3.3.3 The meter shall be observed while the boat is passing within 0.5 - 1 m (approximately 1 - 3 ft) on the far side of all three markers. The applicable reading shall be the highest sound level obtained for the run rounded to the nearest 0.5 dB. At least two measurements shall be made for each side of the boat. All values shall be recorded.

3.3.4 The sound level for each side of the boat shall be the average of the first two readings which are within 1 dB of each other rounded out to the nearest 0.5 dB. Care should be taken to avoid higher than normal readings which may be the result of unusual boat motion due to waves and wakes. The sound level reported shall be that of the loudest side of the boat.

4. GENERAL REQUIREMENTS:

4.1 It is strongly recommended that technically trained personnel select the equipment, and that the tests be conducted only by qualified persons trained in the current techniques of sound measurements.

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

4.2.1 The type of microphone and its orientation relative to the source of noise.

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

4.2.3 Proper signal levels, terminating impedances, and cable lengths on multi-instrument measurement systems.

4.3 Proper acoustical calibration of the complete measurement system shall be performed immediately before and after each field use. Field calibration, which may be accomplished by either external or internal calibration means, shall be made immediately before and after each test sequence, provided that system acoustical calibration is performed immediately before and after field use.

4.4 Measurements shall be made only when the wind speed is below 19 km/h (12 mph). A wind screen shall be used at all times to minimize wind effects.

4.5 Because bystanders may have an appreciable influence on meter response when they are in the vicinity of the microphone, no person shall be within 1 m of the microphone. Not more than one person other than the observer reading the meter shall be within 15 m (50 ft) of the microphone, and that person shall be directly behind the observer reading the meter, on a line through the microphone and the observer.

5. REFERENCES:

Suggested reference material is as follows:

5.1 ANSI S1.1-1960 Acoustical Terminology

5.2 ANSI S1.4-1971 Specification for Sound Level Meters

5.3 ANSI S1.2-1962 Physical Measurement of Sound

5.4 ANSI S1.13-1971 Methods for the Measurement of Sound Pressure Levels

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

APPENDIX

This procedure is based on wide-open throttle operation at 25 m from the shoreline. Motorboats seldom are operated in this manner, therefore, the procedure yields an overestimate of the typical sound level at the shoreline. Under actual operating conditions the sound level created by any motorboat will depend on the manner in which the boat is operated, the distance from the motorboat to the listener, hull and structural design of the boat, water conditions, atmospheric attenuation of the sound, etc. (See companion document for further information.)

The phi (Ø) symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.