SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J34 JUL2011

Issued 1973-04
Revised 2011-07

Superseding J34 SEP2010

(R) Exterior Sound Level Measurement Procedure for Recreational Motorboats

RATIONALE

This revision includes provisions for monitoring tests as well as type tests. Monitoring tests are particularly necessary in those jurisdictions where manufacturer certification of compliance with recreational motorboat sound level regulations is not required prior to sale. Consequently, monitoring tests are a necessary and important addition to this SAE Recommended Practice.

1. SCOPE

This SAE Recommended Practice establishes the procedure for measuring the maximum exterior sound level of recreational motorboats while being operated under a variety of operating conditions. It is intended as a guide toward standard practice and is subject to change to keep pace with experience and technical advances.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 IEC Publication

Available from International Electrotechnical Commission, 3,rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland, http://www.iec.ch

IEC Standard 61672-1 Specifications

IEC Standard 60942 Specifications for Sound Level Calibrators

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1970 Shoreline Sound Level Measurement Procedure for Recreational Motorboats

SAE J 2005 Stationary Sound Level Measurement Procedure for Recreational Motorboats

2.2.2 ASA Publications

Available from Acoustical Society of America, http://asa.aip.org, or from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI S1.1 Acoustical Terminology

ANSI S1.13 Measurement of Sound Pressure Levels in Air

2.2.3 ISO Publications

Available from International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211, Geneve 20, Switzerland/Suisse or from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 14509 Measurement of Airborne Sound Emitted by Powered Recreational Craft

ISO 8665 Small craft -- Marine propulsion reciprocating internal combustion engines -- Power measurements and declarations

2.2.4 IEC Publications

Available from International Electrotechnical Commission, 3,rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland, http://www.iec.ch

IEC Standard 61672-1 Specifications

IEC Standard 60942 Specification for Sound Level Calibrators

2.2.5 National Marine Manufacturers Association Test Report

Available from NMMA Engineering Standards Department, 231 S. LaSalle Street, Suite 2050, Chicago, IL 60604, Tel. 312-946-6213, www.nmma.org.

DOC0722010 Powerboat Sound Level Engineering Report. October 16, 1987

3. INSTRUMENTATION

The following instrumentation shall be used for the measurement required.

3.1 For Type Testing a sound level meter which meets IEC Standard 61672-1 Type 1 Specifications for Sound Level Meters.

3.2 For Monitoring Tests a sound level meter which meets IEC Standard 61672-1 Type 1 or Type 2 Specifications for Sound Level Meters.

3.3 A microphone windscreen that does not affect the overall reading by more than ±0.5 dB(A).

3.4 A sound level calibrator which meets IEC Standard 60942 specification for Sound Level Calibrators

3.5 A wind speed anemometer.

3.6 An engine speed tachometer.

3.7 A calibrated speedometer or radar gun

3.8 A range finder.

4. TERMS, DEFINITIONS AND ABBREVIATIONS

4.1 Type Testing

Type testing is performed to prove that the operational sound level of a boat, or an outboard motor while using a standard boat or a stern drive with integral exhaust system complies with sound specifications or prescribed limits.

4.1.1 Standard Boat Specifications for Outboard Motor Type Tests

Any series production boat with a V-hull shape meeting the dimensional and weight characteristics given in Table 1 may be used as a standard boat.

TABLE 1 - STANDARD BOAT SPECIFICATIONS

Declared Propeller Shaft Power (According to ISO 8665) of the Outboard Motor Under Test (kW)	Length of Hull According to ISO 8666 m/ft	Weight Without Engine kg/lb
P < 6	3.8/12.5	135/297
6 ≤ P < 25	4.2/13.8	220/484
25 ≤ P < 55	4.7/15.4	400/880
55 ≤ P < 115	5.5/18.0	800/1760
115 ≤ P < 150	6.2/20.3	1100/2420
P ≥ 150	7.5/24.6	1650/3630

A variation of ±20% is allowed in the dimensional characteristics and a variation of ±25% is allowed in the weight of the craft. In addition the craft shall have no covers over the outboard motor or unusual extensions behind the transom which could affect the sound level.

Outboard motors shall be installed on the boat per the manufacturers' instructions. Additional damping or absorbing materials are not permitted.

4.1.2 Standard Boat Specifications for Stern Drives with Integral Exhaust Type Tests

Any series production boat with a V-hull shape meeting the dimensional and weight characteristics given in Table 2 may be used as a standard boat.

TABLE 2 - STANDARD BOAT SPECIFICATIONS FOR SPARK IGNITION ENGINES

Declared Propeller Shaft Power (According to ISO 8665) of the Stern Drive with Integral Exhaust System kW	Length of Hull According to ISO 8666 m/ft	Weight With Engine kg/lb
P > 78	5.0/16.4	700/1540
78 ≤ P < 115	5.8/19.0	1600/3520
115 ≤ P < 159	7.0/23.0	1900/4180
159 ≤ P < 226	7.7/25.3	2200/4840
P ≥ 226	8.7/28.5	2600/5720

A variation of ±20% is allowed in the dimensional characteristics and a variation of ±25% is allowed in the weight of the craft. Stern drives with integral exhaust shall be installed in the boat per the manufacturers instructions. In addition the engine cover shall not have non-series absorbing or damping materials and the boat shall not be fitted with unusual extensions or materials on or behind the transom which could affect the sound level.

4.2 Monitoring Test

Monitoring tests are performed to determine if the operational sound level of a recreational motorboat complies with regulated sound level limits. Monitoring tests are used primarily in those jurisdictions where there are no sound level certification requirements prior to the sale of boats to the general public. Monitoring tests are also performed to ensure that a boat/motor/exhaust system have not been modified subsequent to prior testing.

4.3 Maximum AS-Weighted Sound Pressure Level for Recreational Motorboats

L_{pasmax} - The maximum sound pressure level (SPL) of a passing recreational motorboat under specified operating conditions measured with “A” frequency weighting and with “S” slow time weighting according to IEC 61672-1.

5. TYPE TESTING PROCEDURE

5.1 Measurement Site

A suitable site is the shore of a body of water or a dock projecting out from the shore into the body of water. If the measurement is made from a dock the dock shall be of open construction so that it presents a minimum of reflecting surfaces. The area around the microphone and boat being measured shall be free of large obstructions or reflective surfaces, such as buildings, high embankments, sea walls, hills, large piers, or breakwaters, etc. for a minimum distance of 30 m (100 ft). Three markers (buoys or posts) shall be placed in line, 50 m (165 ft) apart, to mark the course the boat is to follow while being tested. The site should be set up similar to that shown in Figure 1.

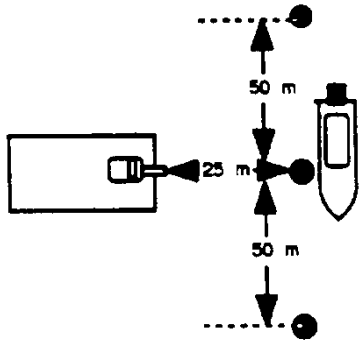

FIGURE 1 - TYPE TEST MEASUREMENT SITE DIAGRAM

5.2 Boat Operation

5.2.1 The boat shall be operated with an equivalent two-person load (150 kg ± 40 kg) except for boats intended for single person operation (PWC included).

5.2.2 The propeller/impeller shall be selected such that at level trim the full throttle engine speed falls within ±4% of the mid-point of the full throttle specified engine speed as recommended by the manufacturer.

5.2.3 The boat shall pass all three markers within a distance of 3 m (10 ft) maximum on a straight course at full throttle with the engine operating at the midpoint of the manufacturer's recommended full throttle rpm range or 70 km/h+0/-3 km (43.5 mph+0/-2mph) if the boat's full throttle speed exceeds 70 km/h (43.5 mph).

5.2.4 For boats with motors or drive systems which are equipped with adjustable trim, the trim angle shall be adjusted so that the propeller thrust is parallel to the plane of the hull.

5.3 Measurements

5.3.1 The microphone shall be placed 25 m (82.5 ft) from the line determined by the three markers, normal to the line and opposite the center marker. It shall be positioned 3.5 m ± 0.5 m (11.5 ft ± 1.6 ft) above the water, and, if mounted on a solid surface, shall be positioned at least 1.2 m (4.0 ft) above that surface. The microphone shall be placed within ±0.5 m (1.6 ft) of the edge of the surface above which it is mounted.

5.3.2 The meter shall be set for slow response and the A-weighting network.

5.3.3 The observer reading the meter shall not be closer than arm's length from the microphone and no other person shall be in such a position so as to affect the sound field.

5.3.4 The meter shall be observed during the entire pass-by with the boat passing within 0.5 to 1 m (~1 to 3 ft) on the far side of all three markers. The applicable reading shall be the highest sound level measured during the pass-by provided that the ambient sound level is at least 10 dB lower than the maximum AS-weighted sound pressure level of the boat being measured.

A measurement shall be invalid if changes in the ambient sound level affect the applicable reading.

Ambient sound level includes wind effects, noise from boats other than the one being measured, wave action, boat wakes, and other extraneous noises. Peak readings due to hull slaps which create intermittent sound levels shall be disregarded.

5.3.5 Measurements shall be made only when the wind speed is below 19 km/h (13 mph).

5.3.6 The observer shall record the applicable reading and the ambient sound levels taken immediately before and immediately after the applicable reading.

5.3.7 At least two measurements shall be made for each side of the boat. The sound level for each side of the boat shall be the average of the first two readings for each side which are within 1 dB of each other. The sound level reported shall be that of the louder side of the boat.

If readings are required to be given at the 15 m (50 ft) distance it is permissible to add 2.6 dB to the sound levels recorded during the above tests at the 25 m (82.5 ft) distance.

6. MONITORING TEST PROCEDURE

6.1 Measurement Site

6.1.1 A suitable measurement site is the shore of a body of water or a dock projecting out from the shore into the body of water or anywhere in the water or inland from the water's edge or anywhere on a body of water in a boat of open construction (cabin-style boats are prohibited). If the measurement is taken from a boat the sound level meter shall be held at arm's length over the side of the boat while pointing in the general direction of the boat being measured.

6.1.2 The area around the microphone shall be free of large obstructions or reflective surfaces, such as buildings, high embankments, sea walls, hills, or any large vertical reflective body, etc., for a minimum distance of 3 m (10 ft).

6.2 Boat Operation

6.2.1 The boat may be operating in any mode other than the stationary mode during testing.

6.3 Measurements

6.3.1 The sound level meter may be either hand-held or mounted on a tripod. The surface beneath the sound level meter is unspecified (sand, grass, water, etc.). The vertical distance between the sound level meter and the underlying surface shall be any distance equal to or greater than 0.91 m (3 ft).

6.3.2 The microphone shall be pointed in the general location of the monitored boat. The person reading the meter shall not be closer than arm's length from the microphone and no other person shall be in such a position so as to affect the sound field.

6.3.3 The distance from the microphone to the boat shall be determined with a range finder. To determine if the operational sound level of the measured boat complies with regulated sound level limits apply Equation 1 - illustrated graphically in Appendix A:

$$L = 16.7 * \log_{10} (d_2/d_1) \quad \text{(Eq. 1)}$$

where:

d_2 = distance from the microphone to the measured boat

d_1 = distance at which the noise ordinance within the local jurisdiction has been lawfully established

6.3.4 The AS-weighted ambient sound level shall be at least 6 dB below the maximum AS-weighted sound pressure level during passage of the boat being monitored. The reading shall then be corrected as specified in Table 1.

TABLE 1

Difference in the Maximum Sound Pressure Level of the Boat and the Ambient Sound Pressure Level	Correction in dB to be Applied to the Maximum Sound Pressure Level of the Boat
≥10	0
6 to 9	-1

6.3.5 The observer shall record the applicable reading and the ambient sound levels taken before and after the applicable reading.

6.4 Test Report – See Appendix B

7. GENERAL REQUIREMENTS

7.1 The measurements shall be conducted only by persons qualified by training to perform these measurements.

7.2 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.

7.3 Proper acoustical calibration shall comprise the complete measurement system including extension cables, etc. Field calibration shall be performed before and after each test sequence.

7.4 The use of the word “shall” in the procedure is to be understood to be mandatory. The use of the word “should” is to be understood as advisory. The use of the word “may” is to be understood as permissive.

8. NOTES

8.1 Marginal Indicia

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

PREPARED BY THE SAE MARINE TECHNICAL STEERING COMMITTEE

APPENDIX A

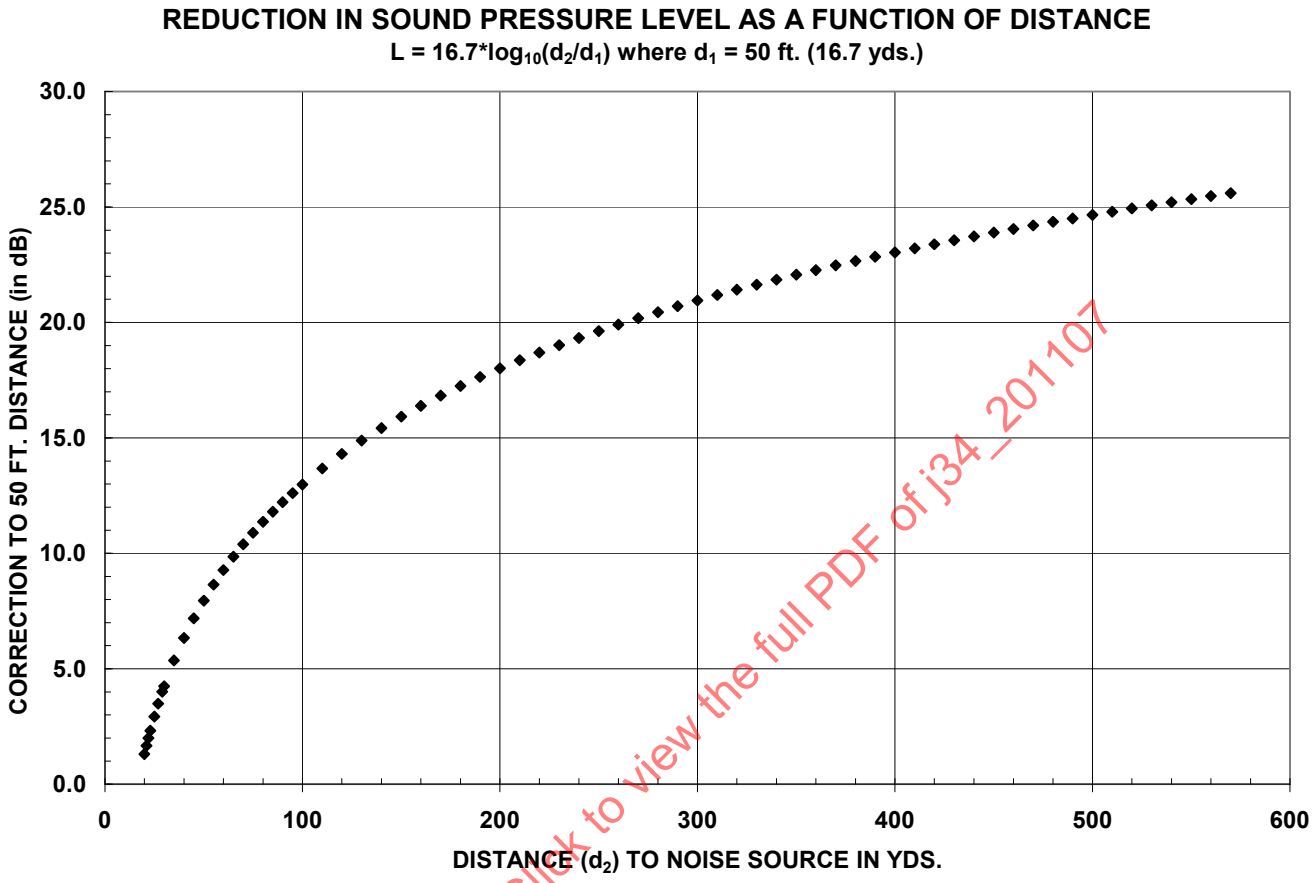

FIGURE A1