SURFACE VEHICLE RECOMMENDED PRACTICE

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Emergency Vehicle Sirens

RATIONALE

This document was revised to address the harmonization and revision of ANSI S1.4 to IEC 61672.

FOREWORD

Data obtained from measurements of siren performance depend on not only the characteristics of the siren tested, but additionally on the test procedures and the characteristics of the measurement instrumentation and test environment. These additional factors must be well defined and controlled to obtain reliable data. Detailed test methods are described here, which include specifications for a laboratory environment, to minimize the measurement uncertainty and obtain accurate and reproducible measurement results. Such results are necessary to qualify the performance of all sirens as equally as practicable. Requirements have been established based on the laboratory-measured performance of sirens that have been effective in emergency service.

Whether a person will hear, recognize, and react quickly enough to the warning sounds produced by a siren during an emergency depends on many factors, in addition to the sound pressure level (SPL) it produces in a controlled test environment. Reflection, scattering, and attenuation caused by objects such as buildings, trees, road surfaces, and vehicles contribute to sound propagation losses. Absorption of sound by the atmosphere itself also results in losses. Windows, soundproofing, and other materials that are part of a vehicle further decrease sound levels. Background noises also interfere with the audibility of acoustical signals, an effect called masking. Siren sounds are masked by traffic and community noise, and noise produced by car stereos, air conditioning, wind, and rain. There are also variations in how well different people can detect, identify, and localize sounds, which are partly due to their ability to hear as a function of frequency. Finally, how effectively someone can react to a detected sound depends on the proximity and speed of the emergency vehicle, the speed of their vehicle, and their reflexes.

Emergency vehicle sirens do not produce sounds that are loud enough to warn effectively in all circumstances. A report prepared for the U.S. Department of Transportation by Bolt, Beranek, and Newman, Inc., concluded that the sound levels produced by sirens would have to be increased greatly, to the point where these levels would be intolerable to the community, to be loud enough to warn effectively in all ordinary circumstances. There is no assurance that all other motorists will always hear, recognize, or react quickly enough to the warning sounds produced by a siren to take appropriate action. It is necessary for emergency vehicle operators to watch for the reaction of other motorists to the siren and be prepared to maneuver accordingly. Sirens have been effective in calling for the right-of-way by an emergency vehicle, but must always be used in conjunction with effective visual warning devices and operated only by properly trained personnel who are aware of the limitations noted here.

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There is an additional concern for emergency vehicle operators and others exposed to siren noise. Sounds produced by emergency vehicle sirens are loud enough to increase the risk of temporary or permanent hearing loss. Appendix A contains information regarding occupational hearing loss and exposure to siren noise.

Appendix B is a data sheet that includes Tables B1 through B5C and descriptive statements for use when documenting test results. It outlines the data that must be recorded when performing the measurements specified in this document, except for the data acquired from the additional acoustical test for siren systems with a large speaker or a large speaker array. Those data are outlined in the data sheet provided in Appendix C.

Appendix D contains information regarding an Excel workbook that is available to reduce the data acquired during the additional acoustical test for siren systems with a large speaker or a large speaker array according to the data reduction procedures described in 5.11.3.

1. SCOPE

This SAE Recommended Practice provides laboratory test procedures, requirements, and guidelines for electronic siren systems with a single loudspeaker, and electromechanical sirens for use on authorized emergency vehicles, which call for the right-of-way. Test procedures and performance requirements for individual system components are not included in this version. Results obtained for a siren system with a speaker array that is greater than 0.5 m in any dimension shall apply to the system only when the array is in the same spatial configuration as tested (i.e., the same speaker separation and orientation).

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 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J336	Sound Level for Truck Cab Interior
SAE J575	Test Methods and Equipment for Lighting Devices for Use on Vehicles Less than 2032 mm in Overall Width
SAE J759	Lighting Identification Code
SAE J994	Alarm - Backup - Electric Laboratory Performance Testing
SAE J1113-21	Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Part 21: Immunity to Electromagnetic Fields, 30 MHz to 18 GHz, Absorber-Lined Chamber

2.1.2 ANSI Accredited Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ANSI/ASA S1.1-2013	Acoustical Terminology
ANSI/ASA S1.4-2014/Part 1	American National Standard Electroacoustics - Sound Level Meters - Part 1: Specifications
ANSI/ASA S1.4-2014/Part 2	American National Standard Electroacoustics - Sound Level Meters - Part 2: Pattern Evaluation Tests

ANSI/ASA S1.4-2014/Part 3	American National Standard Electroacoustics - Sound Level Meters - Part 3: Periodic Tests
ANSI S1.15-1997/Part 1 (R2016)	Measurement Microphones - Part 1: Specifications for Laboratory Standard Microphones
ANSI S1.40-2006 (R2016)	Specifications and Verification Procedures for Sound Calibrators
ANSI S1.42-2001 (R2016)	Design Response of Weighting Networks for Acoustical Measurement

2.1.3 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

IEC 61094-1 (2000-07)	Measurement Microphones - Part 1: Specifications for Laboratory Standard Microphones
IEC 61094-4 (1995-11)	Measurement Microphones - Part 4: Specifications for Working Standard Microphones
IEC 61672-1 (2013-09)	Electroacoustics - Sound Level Meters - Part 1: Specifications
IEC 61672-2 (2013-09)	Electroacoustics - Sound Level Meters - Part 2: Pattern Evaluation Tests
IEC 61672-3 (2013-09)	Electroacoustics - Sound Level Meters - Part 3: Periodic Tests
CISPR 25:2016	Vehicles, Boats and Internal Combustion Engines - Radio Disturbance Characteristics - Limits and Methods of Measurement for the Protection of On-Board Receivers

2.1.4 DOT Publications

Available from the National Technical Information Service, Springfield, VA 22161.

Effectiveness of Audible Warning Devices on Emergency Vehicles. Report No. DOT-TSC-OST- 77-38. R.C. Potter, S.A. Fidell, M.M. Myles, and D.N. Keast. Work performed by Bolt, Beranek, and Newman, Inc., for the U.S. Department of Transportation, Washington, DC 20590; August 1977.

2.1.5 Other Publications

NIOSH publications available from NIOSH, Cincinnati, OH 45226.

Criteria for a Recommended Standard: Occupational Noise Exposure Revised Criteria 1998. DHHS (NIOSH) Publication No. 98-126. National Institute for Occupational Safety and Health, Cincinnati, OH 45226-1998; June 1998.

Health Hazard Evaluation Report HETA 81-059-1045, Newburgh Fire Department, Newburgh, New York, Tubbs, R.A., Flesch, J.P., National Institute for Occupational Safety and Health, Cincinnati, OH 45226-1998; February 1982.

Health Hazard Evaluation Report HETA 84-493-1583, General Services Administration, Washington, DC., Flesch, J.P., Tubbs, R.A., National Institute for Occupational Safety and Health, Cincinnati, OH 45226-1998; April 1985.

Hearing Protector Device Compendium. National Institute for Occupational Safety and Health, Cincinnati, OH 45226-1998. Available online at http://www.cdc.gov/niosh/topics/noise/hpcomp.html.

Preventing Occupational Hearing Loss - A Practical Guide. DHHS (NIOSH) Publication No. 96-110. National Institute for Occupational Safety and Health, Cincinnati, OH 45226-1998; October 1996.