Performance, Test, and Application Criteria for Electrically Operated Backup Alarm Devices - SAE J994b

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SAE RECOMMENDED PRACTICE
APPROVED MAY 1974

PERFORMANCE, TEST, AND APPLICATION CRITERIA FOR ELECTRICALLY OPERATED BACKUP ALARM DEVICES—SAE J994b

SAE Recommended Practice

Report of Construction and Industrial Machinery Technical Committee and Vehicle Noise Committee approved July 1967 and last revised by latter May 1974.

1. Scope—This SAE Recommended Practice establishes the following criteria for electrically operated backup alarm devices on mobile construction and industrial machinery:

(a) Backup alarm device performance requirements.
(b) Measurement technique for alarm performance requirements.
(c) Laboratory environmental tests.
(d) Alarm activation on the vehicle.

2. Backup Alarm System—The backup alarm system (complete system) for purposes of this recommended practice consists of an alarm, alarm control circuitry, and an actuating switch (refer to Fig. 1).

3. Backup Alarm Performance Requirements—The performance requirements apply at ambient temperature of 77 ±20°F (25 ±11°C) and at normal operating voltage of a 14 or 28 V battery system unless otherwise stated and measured as in paragraphs 4.2-4.3.27.

3.1 The predominant sound frequency of the alarm shall fall within the frequency range of 700-2800 Hz.

3.2 The cycles of sound level pulsations from the alarm shall be of the order of 1-2/s. The duration of the "on" and "off" intervals shall be approximately equal in length.

3.3 The sound level of the alarm shall be measured according to paragraph 4.2 and shall be any of the following with tolerances as stated in paragraphs 3.4, 3.5, and 3.6.

Type A—112 dB(A)
Type B—107 dB(A)
Type C— 97 dB(A)
Type D— 87 dB(A)
Type E— 77 dB(A)

3.4 The sound level shall meet the design type or types specified and not vary from the values in paragraph 3.3 by more than ±4 dB with a normal system voltage of 14 or 28 V.

3.5 The sound level shall not vary more than ±8 dB from the values given in paragraph 3.3 for both extremes of the operating voltage range of 9.8-18.2 V and 19.6-36.4 V for 14 and 28 V systems, respectively.

3.6 The sound level shall not vary more than ±8 dB from a baseline measurement (determined as specified in paragraph 4.3) at −40 ±5°F (−40 ±3°C) and 165 ±5°F (74 ±3°C) when the alarm is in the appropriate environment chamber.

4. Laboratory Measurement Technique

4.1 Instrumentation and Test Facilities

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

4.1.2 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 indicating meter, providing the system meets the requirements of SAE J184.

4.1.3 A filter set which meets the Class II octave band requirements of ANSI S1.11—1966 (R1971), Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets.

4.1.4 A sound level calibrator.
4.1.5 A temperature measuring system.
4.1.6 A voltage measuring system.
4.1.7 Vibration appartus.
4.1.8 Environmental chamber.
4.1.9 Dust chamber.
4.1.10 Rain, steam, and corrosion chamber.

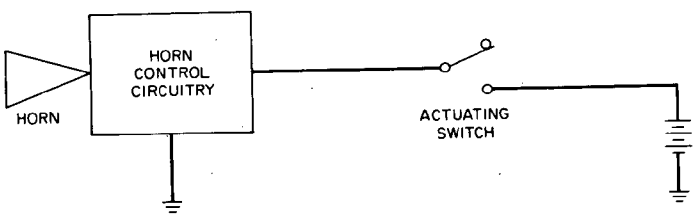

FIG. 1—BACKUP ALARM SYSTEM SCHEMATIC

4.2 Measurements

4.2.1 The alarm device and a microphone shall be located in a free field 4 ft (1.2 m) above a horizontal reflecting plane or laboratory equivalent, with the microphone 4 ft (1.2 m) from the alarm's horn along its 0 deg axis. For determination of the sound levels in the appropriate environmental chamber for the extreme temperature tests, see paragraph 4.2.5. (A free field is defined as an area with no vertical reflecting surface within 50 ft (15.2 m). A horizontal reflecting plane is defined as the finished concrete in a laboratory or the equivalent when conducting testing in the field.)

4.2.2 The sound level, due to all sources other than the alarm device, shall be at least 10 dB lower than the sound level of the alarm.

4.2.3 The sound level meter shall be set for fast response or equivalent and A-weighting network to check sound level.

4.2.4 The predominant sound level output shall be checked with an octave band filter set to determine that the frequency is within acceptable limits.

4.2.5 The sound level shall be determined and recorded for the backup alarm (type A, B, C, D, or E) when it is actuated in the environmental test chamber at 77 ±20°F (25 ±11°C) and at extreme temperature as specified in paragraph 3.6.

4.3 Data Acquisition—All data measurements will be taken during a minimum test period of 1 min operation at ambient temperature of 77 ±20°F (25 ±11°C) and normal battery system voltage of 14 or 28 V, unless either temperature or voltage is stated otherwise. The data must be correlated with performance requirements where specified. If requirements are not met at any step in testing, a decision will be necessary to determine if testing should be continued.

4.3.1 Measure and record the predominant sound frequency of the alarm. Correlate data with performance requirements in paragraph 3.1.

4.3.2 Measure and record the rate of cyclic sound level pulsations from the alarm. Correlate data with performance requirements in paragraph 3.2.

4.3.3 Measure and record the sound level of the alarm. Correlate the data with performance requirements and tolerance from paragraph 3.4.

4.3.4 Measure and record the sound level change between extremes of the operating voltage range between 9.8-18.2 V and 19.6-36.4 V for 14 or 28 V systems, respectively. Correlate the data with performance requirements and tolerance specified in paragraph 3.5.

4.3.5 Perform the vibration tests as specified in paragraphs 5.1 through 5.1.3.

4.3.6 Repeat paragraphs 4.3.3 and 4.3.4.
4.3.7 Perform rain tests as specified in paragraph 5.2.
4.3.8 Repeat paragraphs 4.3.3 and 4.3.4.
4.3.9 Perform corrosion test as specified in paragraph 5.3.
4.3.10 Repeat paragraphs 4.3.3 and 4.3.4.
4.3.11 Perform steam test as specified in paragraph 5.4.
4.3.12 Repeat paragraphs 4.3.3 and 4.3.4.
4.3.13 Perform dust test as specified in paragraph 5.5.
4.3.14 Repeat paragraphs 4.3.3 and 4.3.4.

4.3.15 Measure and record the sound level of the alarm in the environmental chamber to obtain the baseline data as specified in paragraph 4.3.

4.3.16 Measure and record the sound level of the alarm in the environmental chamber at −40 ±5°F (−40 ±3°C) after the complete system has been at this temperature for at least 1 h immediately prior to this test. The sound level should be within ±8 dB of the baseline data measured in paragraph 4.3.15.

4.3.17 Measure and record the sound level of the alarm in the environmental chamber at −40 ±5°F (−40 ±3°C) for both extremes of the operating voltage range between 9.8-18.2 V and 19.6-36.4 V for 14 or 28 V systems, respectively, after the complete system has been at the above temperature for at least 1 h immediately prior to the test. No specified sound level is required, but the alarm is to be operational and register a reading on the meter above the existing ambient sound level.

4.3.18 Operate the complete system at −40 ±5°F (−40 ±3°C) in the environmental chamber for 15,000 sound pulsation cycles as

specified in paragraphs 5.6 and 5.6.1.

4.3.19 Repeat paragraphs 4.3.16 and 4.3.17.

4.3.20 Repeat paragraph 4.3.15 for the environmental chamber to be used for the high temperature evaluation.

4.3.21 Measure and record the sound level of the alarm in the environmental chamber at 165 ±5°F (74 ±3°C) after the complete system has been at this temperature for 1 h immediately prior to this test. The sound level should be within ±8 dB of that measured in paragraph 4.3.20.

4.3.22 Measure and record the sound level of the alarm in the environmental chamber at 165 ±5°F (74 ±3°C) at both extremes of the operating range between 9.8-18.2 V and 19.6-36.4 V for 14 or 28 V systems, respectively, after the complete system has been at the above temperature for 1 h immediately prior to the test. No specified sound level is required, but the alarm is to be operational and register a reading on the meter above the existing ambient sound level.

4.3.23 Operate the complete system at 165 ±5°F (74 ±3°C) in the environmental chamber for 15,000 sound pulsation cycles as specified in paragraphs 5.6 and 5.6.2.

4.3.24 Repeat paragraphs 4.3.21 and 4.3.22.

4.3.25 Repeat paragraphs 4.3.3 and 4.3.4.

4.3.26 Operate the complete system for 470,000 sound pulsation cycles as specified in paragraphs 5.6 and 5.6.3.

4.3.27 Repeat paragraphs 4.3.1, 4.3.2, 4.3.3, and 4.3.4.

5. Laboratory Environmental Tests—Sound level output shall be measured during a minimum test period of 1 min according to the requirements of paragraphs 3.4, 3.5, and 3.6 in the sequence under paragraph 4.3. The unit shall then be examined. Any unit showing evidence of material physical weakness, displacement, or ruptured parts shall be considered to have failed. The environmental tests are listed in the recommended test sequence.

5.1 Vibration Test—A sample unit (complete system), as mounted on the supports supplied, shall be bolted to the table of the vibration test machine and the test conducted as follows with the alarm in operation:

5.1.1 Resonance Search—Determine and record the resonant frequencies of the test item for each position (x-y-z axis) by slowly varying the frequency of applied vibration through 10-500 Hz with sufficient amplitude to excite the item. Resonance of components is determined by visual observation, strain-gaging of components, observing signal interruptions of the electronic circuit, or a combination of these. See Fig. 2.

5.1.2 Resonance Dwell—Vibrate the test item for 30 min at a 10*g* (peak to peak) level at the most severe resonant frequency and at no more than three other significant resonant frequencies (if they were

TEST SCHEDULE

EQUIPMENT	APPLICABLE TESTS: RESONANCE SEARCH	RESONANCE DWELL	SINUSOIDAL CYCLING	TEST TIME SCHEDULE (PER AXIS): DWELL TIME AT EACH RESONANCE	SINUSOIDAL CYCLING TIME	SWEEP TIME 27-500-27 CPS
VEHICLE AND TRACTOR	X	X	X	30 MIN	3 H-LESS DWELL TIME	15 MIN

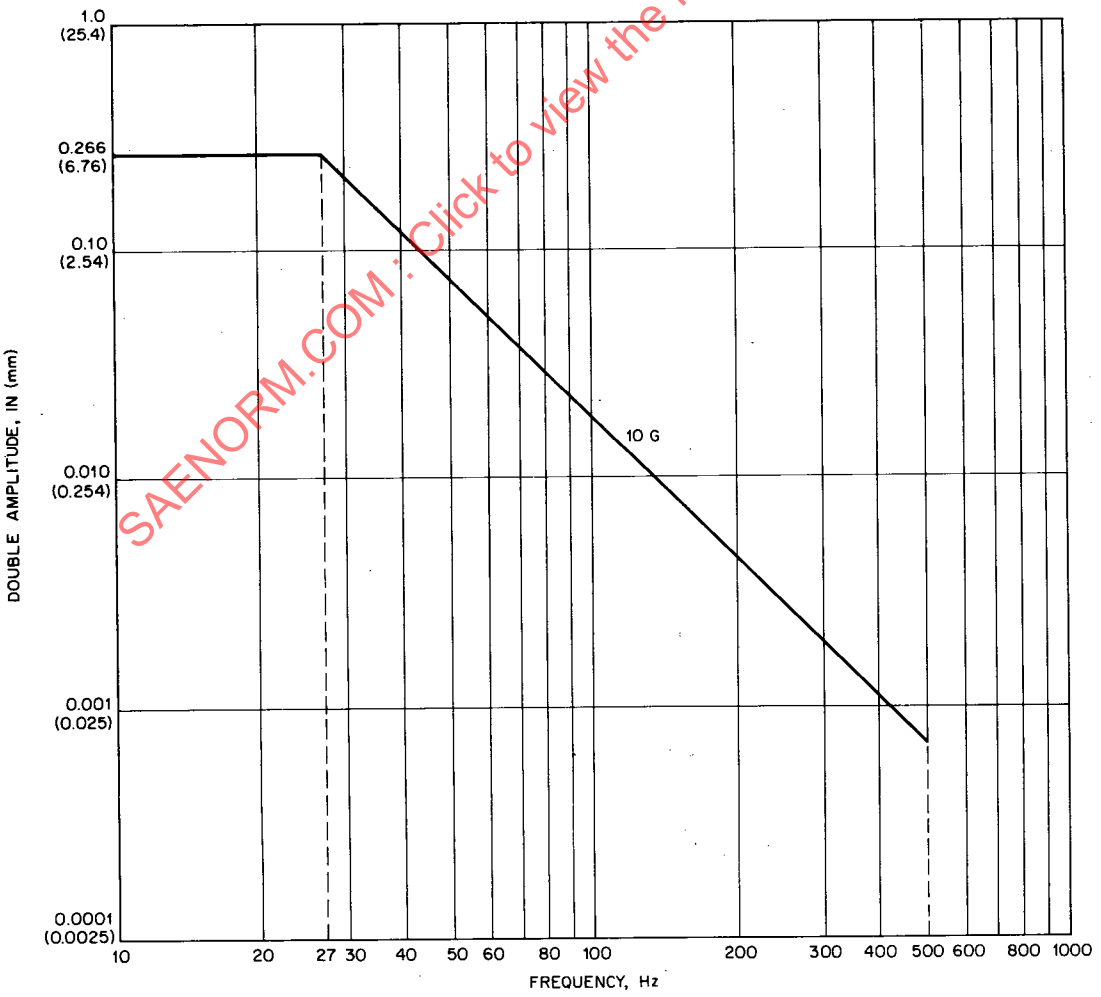

FIG. 2—VIBRATION TEST