U.S. ARMY

HEL STANDARD S-1-63B

(Supersedes HEL Standard S-1-63A, June 1964)

MAXIMUM NOISE LEVEL

FOR ARMY MATERIEL COMMAND EQUIPMENT

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ABERDEEN PROVING GROUND,
MARYLAND

HEL Standard S-1-63B
(Supersedes HEL
Standard S-1-63A, June 1964)

MAXIMUM NOISE LEVEL FOR ARMY MATERIEL COMMAND EQUIPMENT

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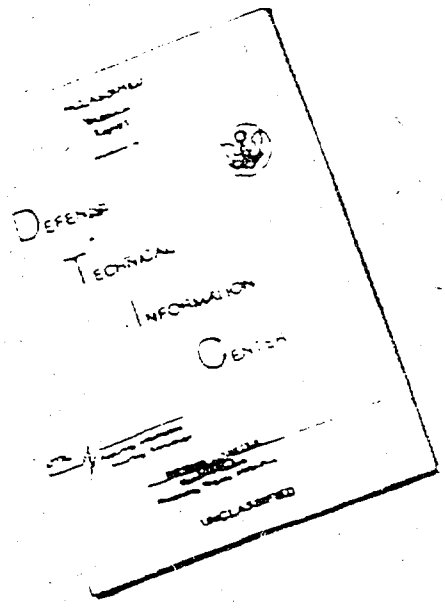

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I. INTRODUCTION

1. The data contained within this standard reflect the official position of the U.S. Army Human Engineering Laboratories and supersede all other data from these laboratories pertaining to the subject of this standard.

2. Human Engineering Laboratories (HEL) standards are issued for use by the major subordinate commands of the Army Materiel Command (AMC) in the area of human factors engineering.

3. HEL standards provide guidance to the major subordinate commands of AMC for the inclusion of human factors engineering requirements in research and development or procurement contractual documents.

4. HEL standards will serve as the basis for a human factors engineering evaluation by the Human Engineering Laboratories in accordance with AMCR 10-4.

II. SCOPE

1. This standard establishes the maximum noise level permitted at personnel occupied spaces of equipment designed, developed or procured by AMC.

2. This standard establishes the testing requirements for determining conformance to the maximum noise level permitted.

3. This standard is not intended for application as an industrial standard. Its use shall be limited to military equipment.

4. This standard is not to be considered as a hearing damage risk criterion.

III. APPLICABLE DOCUMENTS

1. The documents cited in this section form a part of this standard to the extent specified herein.

a. ASA Z24.10-1953 Octave-Band Filter Set for the Analysis of Noise and Other Sounds

b. ASA S1.1-1960 Acoustical Terminology

c. ASA S1.6-1960 Preferred Frequencies for Acoustical Measurements

d. ASA S1.4-1961 General Purpose Sound Level Meters

2. Applications for copies of these documents should be addressed to:

American Standards Association
10 East 40th Street, New York 16, New York

VI. DEFINITIONS

1. Definitions of acoustical terms that do not appear in this section are in accordance with ASA S1.1-1960.

2. Decibel (dB) Reference Level is 0.0002 microbar.

3. Impulse Noise is a non-periodic variation in atmospheric pressure which may completely be described by its pressure vs time history. It has a positive pressure envelope duration of less than 1,000 milliseconds and a peak to root mean square value greater than 10 dB.

4. Positive Peak Sound Pressure Level is the highest instantaneous pressure achieved (expressed in dB or in PSI).

5. Positive Pressure Duration is the time required for the pressure wave to rise to its first positive peak and to return momentarily to ambient.

6. Positive Pressure Envelope Duration is the time required for the ressure wave to rise to its highest positive peak and to decrease to and remain) dB below this highest peak.

7. Small Arms - all arms, including automatic weapons, up to and including aliber .60 and shotguns.

8. Steady State Noise is a periodic or random variation in atmospheric ressure at audible frequencies which has a positive pressure envelope duration ı excess of 1,000 milliseconds.

. GENERAL REQUIREMENTS

1. Equipment operating, training, or maintenance tasks shall not require ersonnel to be exposed to noise that exceed the levels specified in Table 1 or and Figure 1.

2. Noise reduction principles and techniques shall be applied to the equip-ıent to achieve a minimum noise level at personnel occupied spaces.

3. The degree or extent of application of noise reduction principles and chniques to equipment shall be determined by the procuring activity.

4. Noise reduction shall not be accomplished by specifying ear protective evices as mandatory for use by system personnel unless:

a. The cost of reducing the noise level to or below the noise levels stated herein is prohibitive.

b. Systems effectiveness is degraded by reducing the noise level to or below the noise levels of this standard.

5. The provisions of paragraph 4 (Section V) shall be determined by the rocuring activity.

VI. STEADY STATE NOISE REQUIREMENTS

1. An octave-band analysis of the steady state noise produced by the equipment shall be made. The analysis may be made using the commercial frequencies (ASA Z24.10-1953) and their respective noise levels (Table 1) or the preferred frequencies (ASA S1.6-1960) and their respective noise levels (Table 2).

TABLE 1

Maximum Steady State Noise Level for Army Materiel Command Equipment

(Commercial Frequencies [ASA Z24.10-1953])

Octave Band Limits (cps)	Center Frequency (cps)	Noise Level (dB)
37.5 - 75	53	120
75 - 150	106	115
150 - 300	212	109
300 - 600	425	101
600 - 1200	850	93
1200 - 2400	1700	89
2400 - 4800	3400	89
4800 - 9600	6800	91

TABLE 2

Maximum Steady State Noise Level for Army Materiel Command Equipment

(Preferred Frequencies [ASA S1.6-1960])

Octave Band Limits (cps)	Center Frequency (cps)	Noise Level (dB)
44 - 87	63	119
87 - 175	125	114
175 - 350	250	107
350 - 700	500	99
700 - 1400	1000	91
1400 - 2800	2000	89
2800 - 5600	4000	89
5600 - 11200	8000	91

2. A steady state noise level reading at each octave band shall be letermined for the following situations and combinations thereof; to be taken at he head position of:

a. Each operator position under all normal operating conditions.

b. Each instructor and trainee position where training is conducted.

c. Each maintenance personnel position where maintenance is conducted with the equipment operating.

d. Note: Personnel will not be used in these positions during the measurement program unless it is essential to the conduct of the test.

3. Where personnel other than an operator, instructor or maintenance man may be present in or on the equipment, readings shall be made at representative positions occupied by these personnel in accordance with the conditions expressed in paragraph 2 (Section VI).

4. The sound level meter and microphone used to measure the noise level, including calibration requirements for each, shall be in accordance with ASA S1.4-1961. The octave band analyzer used shall meet the requirements of ASA Z24.10-1953.

5. When pure tones, or narrow bands of noise, are present in any octave band, the sound pressure level of that octave band shall be reduced from the level shown in Tables 1 or 2, by 5 dB for frequencies above 1,000 cps and 10 dB for the frequencies below 1,000 cps.

6. Where the steady state noise level exceeds that specified in Tables 1 or 2, the distance from the source at which the noise level is equal to or below that specified in Tables 1 or 2 shall be determined.

7. At the discretion of the procuring activity, provision shall be made for operation of the equipment from the distance at which the noise level is equal to or below that specified in Tables 1 or 2.

8. When the noise level of the item of equipment exceeds that specified in Tables 1 or 2, the equipment shall be conspicuously marked as follows: "Warning, ear protection required within ___ feet when equipment is operating." The number of feet specified in the warning will be the result of measurements made in response to paragraph 6 (Section VI).

9. The warning marking specified in paragraph 8 (Section VI) shall be legible from the distance determined in paragraph 6 (Section VI).

10. Where the equipment steady state noise level exceeds the limits of Tables 1 or 2, training, operating, and maintenance manuals, both preliminary and final, will cite the warning and distance stated in paragraph 8 (Section VI).

VII. IMPULSE NOISE REQUIREMENTS

1. The impulse noise limits expressed in Figure 1 are the criteria of acceptability for small arms. Other weapons which fall within the limits of Figure 1 are acceptable. Weapons larger than small arms that do not meet the limits of Figure 1 must be reviewed for adequacy on an individual basis.

2. To be acceptable, positive peak sound pressure level vs. positive pressure duration shall be below limit "A" of Figure 1 and positive peak sound pressure level vs. positive pressure envelope duration shall be below limit "B".

3. Where positive peak sound pressure level measurements are made in pounds per square inch (PSI) Figure 2 shall be used for conversion to dB.

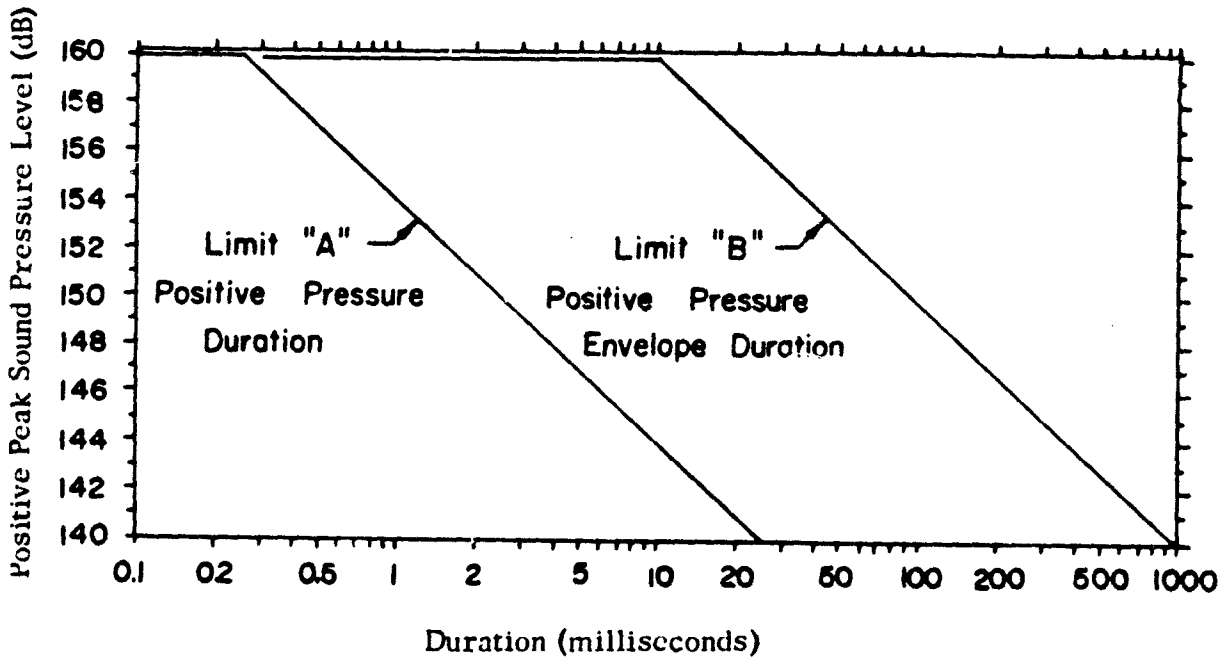

Fig. 1. Maximum Acceptable Impulse Noise Parameters for Army Materiel Command Small Arms

4. For measurement purposes, shoulder fired or hand-held weapons will be mounted with the barrel at least 40 inches above and parallel to the ground and with no large reflecting surfaces, including personnel, closer than 30 inches to the muzzle or the transducer. All other weapons will be measured in the physical position and in the system location from which they are normally fired.

5. Three pressure vs time histories shall be made of the impulse noise produced by the firing of three rounds, one round at a time.

6. The average of the three pressure vs time history measurements will be determined. The average of the three measurements will be sufficient if the positive peak sound pressure level does not vary more than $\pm$ 1 dB. Ten measurements will be averaged if this tolerance is exceeded.

7. Pressure vs time histories shall be obtained using an oscilloscope and a transducer possessing the following minimum requirements:

a. Amplitude distortion - less than 1.5 dB at the pressure being measured.

b. Ringing and overshoot - less than 1.5 dB at the pressure being measured.

c. Rise time - 10 microseconds or less at the pressure being measured.

8. Two of the three pressure vs time history measurements shall be made as follows: one at an oscilloscope sweep speed of 50 microseconds/cm and one at 1 millisecond/cm sweep speed.

9. The transducer shall be placed at the point, relative to the weapon, where the left ear of a right handed shooter or operator would be positioned.

10. Transducers shall be oriented at an angle to prevent a pressure increase due to reflection on the transducer face.

Given: 1 psi = 6.895×10^4 dynes/cm^2 and

$$db = 20 \log_{10}\left(\frac{p}{0.0002\ d/cm^2}\right).$$

then

$$db = 20 \log_{10}\left(\frac{psi \cdot 6.895 \times 10^4}{2 \times 10^{-4}}\right) = 20 \log_{10} (psi \cdot 3.4475 \times 10^8).$$

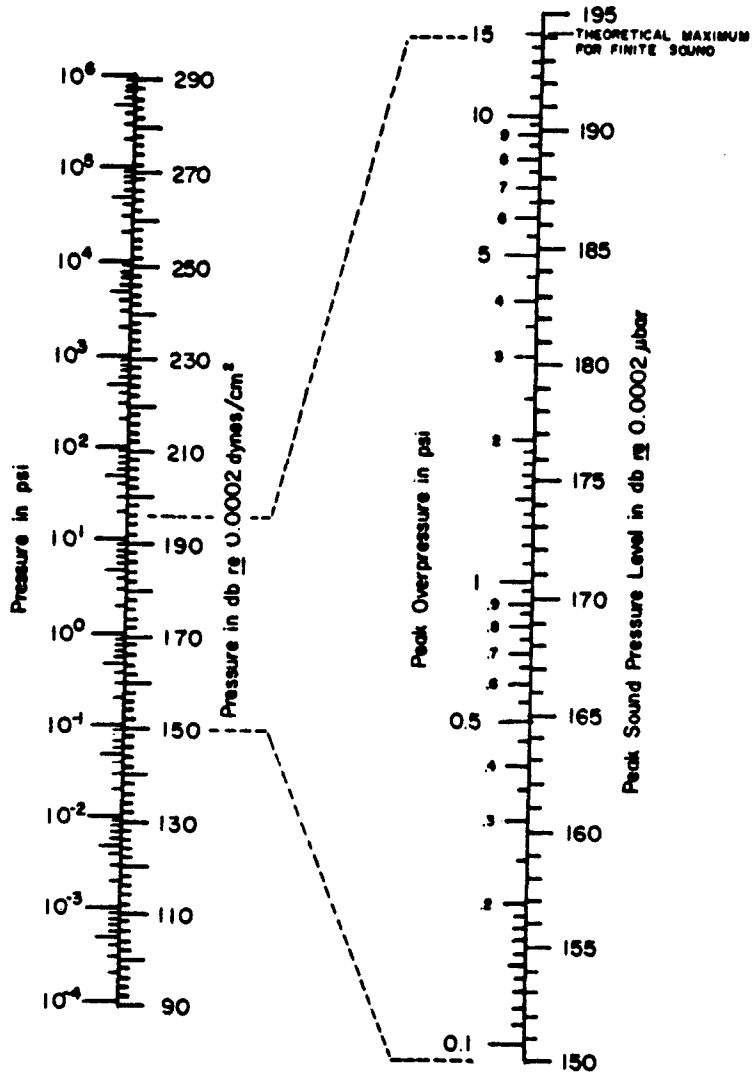

Fig. 2. Conversion of Pounds Per Square Inch to Decibels

VIII. COMMUNICATIONS

1. Where continuous person to person (non-electrically aided) communication of information is a system requirement, the steady state noise levels should not exceed those expressed in Tables 3 or 4.

2. Measurements shall be made in accordance with the requirements of Section VI paragraphs 1, 2a, 2d and 4.

TABLE 3

Maximum Steady State Noise Level for Non-Electrically Aided Person to Person Communication

(Commercial Frequencies ASA Z24.10-1953)

Octave Band Limits (cps)	Center Frequency (cps)	Noise Level (dB)
37.5 - 75	53	79
75 - 150	106	73
150 - 300	212	68
300 - 600	425	64
600 - 1200	850	62
1200 - 2400	1700	60
2400 - 4800	3400	58
4800 - 9600	6800	57

TABLE 4

Maximum Steady State Noise Level for Non-Electrically Aided Person to Person Communications

(Preferred Frequencies ASA S1.6-1960)

Octave Band Limits (cps)	Center Frequency (cps)	Noise Level (dB)
44 - 87	63	77
87 - 175	125	72
175 - 350	250	67
350 - 700	500	63
700 - 1400	1000	61
1400 - 2800	2000	59
2800 - 5600	4000	58
5600 - 11200	8000	57

IX. NOTE

1. Technical guidance concerning the provisions contained in this standard may be obtained from:

Acoustical Research Branch
Engineering Research Laboratory
U.S. Army Human Engineering Laboratories
Aberdeen Proving Ground, Maryland