

INCH-POUND
MIL-DTL-10911E
w/AMENDMENT 1
13 May 2015
SUPERSEDING
MIL-DTL-10911E
20 November 2012

DETAIL SPECIFICATION

LOUDSPEAKERS, PERMANENT MAGNET,
(UNENCASED, 2.5-, 3-, 4-, 5-, 6-, 8-, 10-,
AND 12-INCH DIAMETER CONES),
GENERAL SPECIFICATION FOR

Inactive for new design after 30 March 1999.

This specification is approved for use by all Departments
and Agencies of the Department of Defense.

1 SCOPE

1.1 Scope. This specification covers unencased, permanent magnet loudspeaker units, having 2.5, 3, 4, 5, 6, 8, 10, and 12 - inch diameter cones and intended for general purpose use.

1.2 Classification. Loudspeaker units covered by this specification should all be of the types and applicable ratings specified (see 3.1), to include round, square, and pincushion.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Since Navy-EC is the Navy custodian for this document, all Navy review activities should forward their comments directly to DLA Land and Maritime. Beneficial comments, recommendations, additions, deletions, clarifications, etc., and any data that may improve this document should be sent to: DLA-CC, DLA Land and Maritime, ATTN: VAI, P.O. Box 3990, Columbus, Ohio 43218-3990 or emailed to sound@dsccl.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.



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FEDERAL STANDARDS

FED-STD-H28 - Screw-Thread Standards for Federal Services.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-10911/8 - Loudspeakers , Permanent Magnet, (Unencased, 4-Inch Diameter Cone).
MIL-DTL-14072 - Finishes for Ground Based Electronic Equipment.
MIL-I-24768/9 - Insulation, Plastic, Laminated, Thermosetting, Nylon-Fabric-Base, Phenolic-Resin (NPG)

(See supplement 1 for list of specification sheets)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-1285 - Marking of Electrical and Electronic Parts.

(Copies of these documents are available online at <http://quicksearch.dla.mil>.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, these issues of the documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM B152/B152M - Copper Sheet, Strip, Plate, and Rolled Bar.
ASTM B187/B187M - Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes.
ASTM B272 - Copper Flat Products with Finished (Rolled or Drawn)Edges (Flat Wire and Strip).
ASTM B633 - Zinc on Iron and Steel, Electrodeposited Coatings of.
ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

(Copies of these documents are available online at <http://www.astm.org>.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 10012 - Measurement Management Systems - Requirements for Measurement Processes and Measuring Equipment
ISO 17025 - General Requirements for the Competence of Testing and Calibration Laboratories

(Copies of these documents are available online at <http://www.iso.ch>.)

NCSL INTERNATIONAL

NCSL Z540.3 - Requirements for the Calibration of Measuring and Test Equipment - To Purchase Call 1-800-854-7179 USA/Canada or 303-397-7956 Worldwide

(Copies of these documents are available online at <http://www.ncsli.org>.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations, unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 First article. Loudspeakers furnished under this specification shall be products which have been tested and have passed the first article inspection specified in 4.4.

3.2.1 First article test report. For information on preparation of test report requirements, see 6.4.

3.3 Material. Material shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the loudspeakers to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.3.1 Laminated plastic (thermosetting). Laminated plastic material used for terminal strips shall conform to type XXX, XXXP, or XXXPC of ASTM D709 or type NPG of MIL-I-24768/9.

3.3.2 Metals. Metals shall be of a corrosion-resisting type, or shall be plated or treated in accordance with ASTM B633, type III, unless otherwise specified (see 3.1).

3.3.3 Copper. Copper shall conform to ASTM B187/B187M, ASTM B272, or ASTM B152/B152M. These specifications do not pertain to the materials of the voice coil.

3.3.4 Dissimilar metals. There shall be no intermetallic contact of dissimilar metals. Where it is necessary that any combination of dissimilar metals be assembled, an interposing material shall be used which is compatible to each metal. Compatibility of intermetallic contacting surfaces is defined in MIL-DTL-14072.

3.3.5 Gaskets. The rim gasket material shall be such that it shall meet the environmental tests of this specification. The rim gaskets shall not shrink, thicken, warp, or become loosened after it has been subjected to the environmental tests.

3.3.6 Pure tin (see 6.8). The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of loudspeaker components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass.

3.5.3 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Design and construction. Loudspeakers shall be of the design, construction, and physical dimensions specified (see 3.1).

3.4.1 Threaded parts. All threaded parts shall be in accordance with FED-STD-H28. Where practical, all threads shall conform to the coarse-thread series. The fine-thread series shall be used only for applications that might show a definite advantage through their use. Where a special diameter-pitch combination is required, the thread shall be of American National Form and of any pitch between 16 and 36 which is used in the fine-thread series.

3.4.2 Riveting of aluminum parts. Rivets shall be used where practicable in preference to other means of securing aluminum structural parts. The thickness of countersunk metal which accepts the heads of flush rivets shall be not less than the height of the rivet heads. The distance from the centers of the rivet holes to the edges of the material in which the holes are formed shall be at least 1-1/2 times the rivet diameter. After riveting, the joints shall be tight, the joined parts shall not be damaged, and the rivet heads shall be seated and tight against their bearing surfaces.

3.4.3 Terminal board (see 3.3.6). The terminal board for the voice coil wire lead terminations shall be of laminated plastic and shall provide two solder-type terminals to permit soldering two No. 20 AWG wires on each terminal. Terminals shall be copper or copper-base alloy and unless otherwise specified (see 3.1), shall be hot tin dipped or treated with any other surface treatment suitable for easy soldering.

3.4.4 Mounting dimensions. Mounting dimensions of loudspeakers as limited by their individual configuration (round, square or pincushion) shall be in accordance with the specification sheet (see 3.1). For more information, see 6.6.

3.5 Performance characteristics.

3.5.1 Voice coil polarity (see 3.5.14.2). When loudspeakers are tested as specified in 4.6.2, the positive terminal shall check positive.

3.5.2 Dielectric withstanding voltage. When loudspeakers are tested as specified in 4.6.3, there shall be no arcing or breakdown of the voice coil insulation.

3.5.3 Voice coil impedance (see 6.7). When measured as specified in 4.6.4, the voice coil impedance shall be as specified (see 3.1). For the 1 (one) remaining MIL-DTL-10911/8 specification sheet, the Standard Loudspeaker Rating Impedance shall be 4.0 ohms.

3.5.4 Acoustic quality. When loudspeakers are tested as specified in 4.6.5, there shall be no buzzing, rattling, or other spurious sounds which will degrade the quality of reproduced speech or music in the acoustic output.

3.5.5 Frequency response. When loudspeakers are tested as specified in 4.6.6, the response in decibels (dB) relative to 20 micropascal's (μ PA) or 0.0002 dynes per square centimeter shall be not less than the value specified for each applicable frequency range (see 3.1). The response at any frequency within the applicable frequency range shall not vary from the established average for the range by more than ± 5 dB, except that peaks or dips greater than this value are permissible providing the base of such peaks or dips shall not exceed 0.1 octaves.

3.5.6 Harmonic distortion. When tested as specified in 4.6.7, the total harmonic distortion in the acoustic output of the loudspeaker shall not exceed 5 percent unless otherwise specified (see 3.1).

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3.5.7 Cold resistance. When loudspeakers are tested as specified in 4.6.8, the acoustic quality shall be as specified in 3.5.4 during the test. After the test, the response and harmonic distortion shall be as specified in 3.5.5 and 3.5.6, respectively, and there shall be no damage to the loudspeaker.

3.5.8 Heat resistance. When loudspeakers are tested as specified in 4.6.9, the acoustic quality shall be as specified in 3.5.4 during the test. After the test, the response and harmonic distortion shall be as specified in 3.5.5 and 3.5.6, respectively, and there shall be no damage to the loudspeaker.

3.5.9 Moisture resistance. When loudspeakers are tested as specified in 4.6.10, the response and harmonic distortion shall be as specified in 3.5.5 and 3.5.6, respectively. The loudspeaker shall show no evidence of mechanical or electrical failures. There shall be no signs of peeling or flaking of the painted finish or corroding of the metallic parts. There shall be no evidence of cone deformation.

3.5.10 Vibration. When loudspeakers are tested as specified in 4.6.11, the response and harmonic distortion shall be as in 3.5.4 or as specified in 3.5.5 and 3.5.6, respectively. There shall be no loosening or deformation of parts or other damage to the loudspeaker.

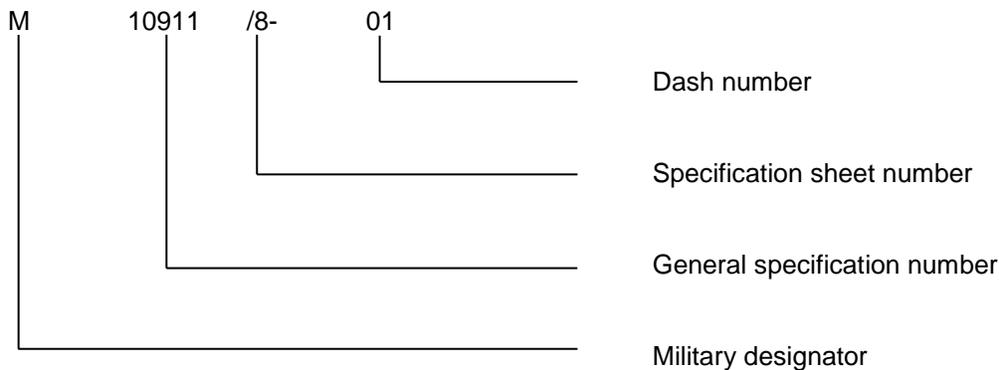
3.5.11 Endurance. After loudspeakers are tested as specified in 4.6.12, the response and harmonic distortion shall be as specified in 3.5.5 and 3.5.6, respectively, and there shall be no damage to the loudspeaker.

3.5.12 Solderability (when specified, see 3.1 and 3.3.6). When loudspeakers are tested as specified in 4.6.13, the dipped portion of the terminals shall conform to the solid lug termination criteria of method 208 of MIL-STD-202.

3.5.13 Shock (specified pulse) (when specified, see 3.1). When loudspeakers are tested as specified in 4.6.14, the acoustic quality, frequency response, and harmonic distortion shall be as specified in 3.5.4, 3.5.5, and 3.5.6, respectively, and there shall be no loosening or deformation of parts or other visible damage.

3.5.14 Marking. Loudspeakers shall be permanently and legibly marked in accordance with MIL-STD-1285 with the type number (see 3.1) or Part or Identifying Number (PIN) (when specified, see 3.1), and the manufacturer's name or symbol. When specified (see 3.1), the date code shall also be included. When a PIN is specified (see 3.1), the manufacturer's part number may also be included provided it does not interfere with the required markings. Markings shall remain legible after all tests.

3.5.14.1 Part or Identifying Number (PIN). The PIN shall consist of the letter "M", the basic number of the specification sheet, and an assigned dash number (see 3.1) as shown in the following example:



3.5.14.2 Terminal board marking. The positive terminal shall be marked in accordance with the following information (see 6.5). The mark shall be visible with the terminal board mounted in place.

Color	Impedance (Ohms)	Color	Impedance (Ohms)
White	3.2	Brown	11.0
Violet	4.0	Yellow	16.0
Pink	5.6	Black	23.0
Orange	6.5	Green	32.0
Red	8.0	Blue	45.0

When the loudspeaker is viewed from the back, with the voice coil terminals at the bottom, the right-hand terminal shall be coded with a + mark or color dot. This is to be considered the “positive” terminal. Where the voice coil terminals are spaced 180 degrees apart or are not clearly identifiable as right and left, the coded terminal shall be considered the “positive” terminal.

NOTE: A loudspeaker shall generate a positive voltage at the “positive” coded terminal, when the diaphragm is moved away from the magnet. The diaphragm will also move away from the magnet with the application of a positive voltage to the “positive” coded terminal.

3.5.15 Workmanship (see [table V](#)). Loudspeakers and all components shall be processed in such a manner as to be uniform in quality and shall be free from defects that will affect life, serviceability, or appearance. Loudspeakers shall provide satisfactory performance and shall not adversely affect the performance of any other component of the public address set or other system in which the loudspeaker is intended to be used, when interconnected with and operated as a part of that equipment.

4. VERIFICATION

4.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ISO 10012, ISO 17025, and NCSL Z540.3.

4.2 Classification of inspections. The inspections specified herein are classified as follows:

- a. First article inspection (see [4.4](#)).
- b. Conformance inspection (see [4.5](#)).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the “GENERAL REQUIREMENTS” of MIL-STD-202.

4.4 First article inspection. First article inspection shall be performed by the contractor, after award of contract and prior to production, at a location acceptable to the Government. First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. First article approval is valid only on the contract or purchase order under which it is granted, unless extended by the Government to other contracts or purchase orders (see [6.3](#)).

4.4.1 Sample size. Six loudspeakers shall be subjected to first article inspection.

4.4.2 Inspection routine. The sample shall be subjected to the inspections specified in [table I](#) in the order shown. All sample units shall be subjected to the inspection of group I. The sample shall then be divided equally into 2 groups of 3 units each and subjected to the inspection for their particular group.

4.4.3 Failures. Failures in excess of those allowed in [table I](#) shall be cause for refusal to grant first article approval.

TABLE I. First article inspection.

Inspection	Requirement paragraph	Method paragraph	Number of sample units to be inspected	Acceptable number of defectives permitted
<u>Group I</u>				
Visual and mechanical inspection	3.1, 3.3 thru 3.3.5, 3.4 thru 3.4.4, 3.5.12 and 3.5.13	4.6.1	6	None
Voice coil polarity	3.5.1	4.6.2		
Dielectric withstanding voltage	3.5.2	4.6.3		
Voice coil impedance	3.5.3	4.6.4		
Acoustic quality	3.5.4	4.6.5		
Frequency response	3.5.5	4.6.6		
Harmonic distortion	3.5.6	4.6.7		
<u>Group II</u>				
Cold resistance	3.5.7	4.6.8	3	One
Heat resistance	3.5.8	4.6.9		
Moisture resistance	3.5.9	4.6.10		
Solderability (when specified, see 3.1)	3.5.12	4.6.13		
<u>Group III</u>				
Vibration	3.5.10	4.6.11	3	One
Endurance	3.5.11	4.6.12		
Shock (specified pulse) (when specified, 3.1)	3.5.13	4.6.14		

4.5 Conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection.

4.5.1.1 Inspection lot. An inspection lot shall consist of all loudspeakers of the same type produced under essentially the same conditions, and offered for inspection at one time.

4.5.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in [table II](#) in the order shown.

TABLE II. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph
<u>Group I</u>		
Visual and mechanical inspection	3.1, 3.3 thru 3.3.5 3.4 thru 3.4.4 3.5.12 and 3.5.13	4.6.1
Voice coil polarity	3.5.1	4.6.2
Dielectric withstanding voltage	3.5.2	4.6.3
Voice coil impedance	3.5.3	4.6.4
Acoustic quality	3.5.4	4.6.5

4.5.1.2.1 Sampling tests. Unless otherwise specified, one (1) Loudspeaker shall be selected at random from each number of 100 or fraction thereof on the order. The selected Loudspeaker and its component parts shall be subjected to all the sampling tests listed in [table II](#), and to any other tests deemed necessary by mutual agreement of the procuring activity and the contractor to determine conformance to the requirements of this specification.

4.5.1.2.2 Rejection and retest. When one or more items fail to meet the specification, acceptance of all items will be withheld until the extent and cause of failure are determined. After corrections have been made, all necessary tests shall be repeated. Such lots shall be separate from new lots and shall be clearly identified as re-inspected lots.

4.5.1.3 Group B inspection. Group B inspection shall consist of the inspections specified in [table III](#) and shall be made on sample units which have been subjected to and have passed the group A inspection.

TABLE III. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph
Frequency response	3.5.5	4.6.6
Harmonic distortion	3.5.6	4.6.7

4.5.1.3.1 Sampling tests. Unless otherwise specified, the selected Loudspeaker and its component parts shall be subjected to all the sampling tests listed in [table III](#), and to any other tests deemed necessary by mutual agreement of the procuring activity and the contractor to determine conformance to the requirements of this specification.

4.5.1.3.2 Rejection and retest. When one or more items fail to meet the specification, acceptance of all items will be withheld until the extent and cause of failure are determined. After corrections have been made, all necessary tests shall be repeated. Such lots shall be separate from new lots, and shall be clearly identified as re-inspected lots.

4.5.1.3.3 Disposition of sample units. Sample units which have passed all the group B inspection may be delivered on the contract or purchase order, if the lot is accepted and the sample units are still within specified electrical and acoustical tolerances.

4.5.2 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see [4.5.2.1.4](#)), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of these periodic inspections.

4.5.2.1 Group C inspection. Group C inspection shall consist of the inspections specified in [table IV](#) in the order shown. Group C inspection shall be performed on sample units selected from inspection lots which have passed groups A and B inspection. At the option of the manufacturer all group C units may be tested at one time.

4.5.2.1.1 Sampling plan. Every 30 days 6 sample units shall be inspected. These sample units shall be selected from units produced during that period or each 1,000 units, whichever occurs first. The sample shall be divided equally into two groups and subjected to the tests of subgroups 1 and 2 of [table IV](#).

TABLE IV. Group C inspection.

Inspection	Requirement paragraph	Method paragraph	Number of sample units to be inspected	Acceptable number of defectives permitted
<u>Subgroup 1</u>				
Cold resistance	3.5.7	4.6.8	3	0
Heat resistance	3.5.8	4.6.9		
Moisture resistance	3.5.9	4.6.10		
Solderability (when specified, see 3.1)	3.5.12	4.6.13		
<u>Subgroup 2</u>				
Vibration	3.5.10	4.6.11	3	0
Endurance	3.5.11	4.6.12		
Shock (specified pulse) (when specified, see 3.1)	3.5.13	4.6.14		

4.5.2.1.2 Failures. If one or more sample units fail to pass group C inspection, the sample shall be considered to have failed.

4.5.2.1.3 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract or purchase order.

4.5.2.1.4 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Groups A and B may be reinstated; however, final acceptance shall be withheld until the group C re-inspection has shown that the corrective action was successful. In the event of failure after re-inspection, information concerning the failure and corrective action taken shall be furnished to the responsible inspection activity.

4.6 Methods of inspection and test.

4.6.1 Visual and mechanical inspection (see [table V](#)). Loudspeakers shall be examined to verify that the materials, designs, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see [3.1](#), [3.3](#), [3.4](#), [3.5.12](#) and [3.5.13](#)).

TABLE V. Classification of defects for visual and mechanical inspection.

Defect type	Classification	
	Major	Minor
Dimensions	Dimensions not as specified	---
Materials and finish	Material not as specified. Wrong or incomplete finish. Large amounts of flaking, peeling, or chipping of finish	Scratches, cuts, abrasions, etc., causing exposure of base metal, or relatively small amounts of flaking, peeling or chipping.
Parts	Missing parts. Inoperative, improperly assembled, or defective parts which could cause the loudspeaker to fail in service. Wrong parts.	Defective parts which would reduce efficiency of use, but not cause failure in service. Cracks or chipped surfaces having no effect on the functioning, assembly, maintenance, or life of the loudspeaker.
Marking	Marking missing, illegible, or incorrect.	Markings dirty or smudged, but legible.
Foreign objects	Any metallic foreign object, nor firmly attached ^{1/} , which could cause a short circuit, or acoustical malfunctioning of the loudspeaker.	Any metallic or nonmetallic foreign object which affects appearance but which could not cause acoustical malfunctioning of the loudspeaker.
Soldering	Improper wrap-Less than 1/2 turn. Unsoldered joint-Solder not applied where intended. Insufficient solder-Minimum dimension of solder bridge less than twice the diameter of the wire or less than 3/32 inch, whichever is greater. Entire area of contact between wire and terminal not joined by solder bridge. Cold solder joint-Chalky appearance, lacks metallic luster, presents rough "pile-up" appearance; movement of wire or solder upon pick application. Rosin joint-Presence of excess rosin' relative movement of wire or solder upon pick application. Insulation in terminal hole-Solder over insulation; no appearance of visible wire contour.	Improper wrap-1/2 turn or more, but less than one turn. Excess solder-Build-up solder on joint greater than necessary for good soldering, usually resulting in obliteration of wire contour. Cold solder joint-Chalky appearance, lacks metallic luster, presents rough "pile-up" appearance; no relative action between wire and solder upon pick application.
Wiring	Broken strands-More than 20 percent; except in a 7-strand conductor, more than 2 broken strands. Insulation burned, abraded, pinched, or deteriorated between two or more conductors, resulting in a potential short circuit. Taut wire-Wire exhibits no slack and subsequent breakage may occur due to stress on terminal or part. Insulation frayed to the extent that a potential short circuit exists.	Broken strands-20 percent or less. In a 7-strand conductor, 2 broken strands. Insulation burned, abraded, pinched, or deteriorated, with exposure of bare wire, but short circuit not possible. Taut wire-Slight stress on conductor, but no possibility of subsequent breakage.

^{1/} Foreign objects that cannot be dislodged by the moderate application of pressure with a pick or spudger shall be considered to be firmly attached.

4.6.2 Voice coil polarity (see 3.5.1 and 3.5.14.2). The voice coil polarity shall be determined as specified in herein. A loudspeaker shall generate a positive voltage at the "positive" coded terminal, when the diaphragm is moved away from the magnet. The diaphragm will also move away from the magnet with the application of a positive voltage to the "positive" coded terminal.

4.6.3 Dielectric withstanding voltage (see 3.5.2). Loudspeakers shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply:

- a. Magnitude of test voltage – 115 ± 5 volts, unless otherwise specified (see 3.1).
- b. Nature of potential – 60 Hz, ac.
- c. Points of application – The test voltage shall be applied between one of the voice coil terminals and the loudspeaker frame; simultaneously, the voice coil shall be excited with a constant voltage having an rms value to provide rated power (see 3.1) at 600 Hz.

4.6.4 Voice coil impedance (see 3.5.3 and 6.7). The voice coil impedance shall be determined as specified herein. Loudspeaker impedance " Z_S " is complex impedance, usually varying considerably with frequency. In order to facilitate system design, a single value of loudspeaker rating impedance " R_{SR} " shall be used. For the remaining MIL-DTL-10911/8 specification sheet, the Standard Loudspeaker Rating Impedance shall be 4.0 ohms. The rating impedance " R_{SR} " shall be 1.15 times the direct current (d. c.) resistance " R_S " of the voice coil, measured at the terminals at 25 degrees C ambient temperature, unless stated otherwise. For more information on voice coil impedance, see 6.7

4.6.5 Acoustic quality (see 3.5.4). A constant voltage having an rms value to provide 60 percent of rated power (see 3.1) shall be applied to the voice coil terminals, and the frequency shall be varied continuously from the lower end to the higher end of the frequency response range, and back to the lower end. The acoustic output shall be checked for buzzing, rattling, or other spurious sounds.

4.6.6 Frequency response (see 3.5.5). The loudspeaker shall be mounted in a rigid enclosure or baffle as specified (see 3.1). A calibrated condenser microphone and amplifier shall be placed on the axis of the loudspeaker. The distance from the microphone to the loudspeaker shall be 3 feet. A constant voltage having an rms value to provide 60 percent of the rated power (see 3.1) of the loudspeaker shall be applied to the voice coil terminals, and the frequency shall be varied continuously from 75 to 7,000 Hz. The acoustic output shall be recorded on a direct-writing strip graph chart using an automatic plotter or curve tracer with a minimum writing speed of 10 inches per second and a maximum chart speed of 30 inches per minute; or at the option of the manufacturer, point-to-point measurements shall be made every 50 Hz from 100 to 300 Hz; every 100 Hz from 300 to 1,000 Hz; every 500 Hz from 1,000 to 4,000 Hz; and every 1,000 Hz from 4,000 to 13,000 Hz with the data recorded and a graph drawn. After the frequency response curve is recorded on the machine or on a hand drawn graph, the peaks and dips shall be observed.

4.6.7 Harmonic distortion (see 3.5.6). Loudspeakers shall be tested by one of the two methods specified in 4.6.7.1 or 4.6.7.2 at the option of the manufacturer. Mount loudspeaker in enclosure or baffle (see 3.1). A constant voltage having an rms value to provide rated power (see 3.1) to the loudspeaker voice coil at 1,000 Hz shall be applied to the voice coil terminals at discrete frequencies of 200, 2,000 and 4,000 Hz \pm 10 percent and the harmonic distortion in the acoustic output of the loudspeaker at each frequency shall be determined by using a sound wave analyzer.

4.6.7.1 Distortion analyzer method. The total harmonic distortion shall be determined by a Hewlett Packard distortion Analyzer, Model 330C, or equal.

4.6.7.2 Sound wave analyzer method. The harmonic distortion in the acoustic output of the loudspeaker at each frequency shall be determined by using a sound wave analyzer, and the following formula:

$$\text{Percent rms distortion} = \frac{\sqrt{P_2^2 + P_3^2 + \dots + P_N^2}}{\sqrt{P_1^2 + P_2^2 + P_3^2 + \dots + P_N^2}} \times 100$$

where P_1 is the pressure amplitude of the fundamental and $P_2, P_3, \text{ etc.},$ are the pressure amplitudes of the harmonic components in the output.

4.6.8 Cold resistance (see 3.5.7). The loudspeaker unit shall be placed in a cold chamber and maintained at a temperature of -65, -5, +0 degrees F (or -80, -5, +0 degrees F, when specified, see 3.1) for 24 hours. The temperature of the chamber shall then be raised to and stabilized at -40, -5, +0 degrees F (or -65, -5, +0 degrees F, when specified, see 3.1) and the acoustic quality of the loudspeaker determined in accordance with 4.6.5 while at that temperature. The temperature of the loudspeaker shall then be raised to room ambient conditions and the response and harmonic distortion determined in accordance with 4.6.6 and 4.6.7, respectively, and the loudspeaker inspected for damage.

4.6.9 Heat resistance (see 3.5.8). The loudspeaker unit shall be placed in a heat chamber and maintained at a temperature of +160, +5, -0 degrees F for a period of 24 hours. The acoustic quality of the loudspeaker shall be determined in accordance with 4.6.5 while at that temperature. The temperature of the loudspeaker shall then be reduced to room ambient conditions and the response and harmonic distortion determined in accordance with 4.6.6 and 4.6.7, respectively, and the loudspeaker inspected for damage.

4.6.10 Moisture resistance (see 3.5.9). Loudspeakers shall be tested in accordance with method 106 of MIL-STD-202. The following details shall apply:

- a. Mounting – Any convenient mounting with the edge of the cone exposed and parallel with the vertical plane.
- b. Polarizing voltage – Not applicable.
- c. Step 7b – Not applicable.
- d. Final measurements – At the completion of the tenth cycle and following a 24-hour period at 25 ± 5 percent relative humidity, the loudspeakers shall be tested for frequency response and harmonic distortion in accordance with 4.6.6 and 4.6.7, respectively, and inspected for loose or deformed parts or other damage.
- e. Upon completion of the test, loudspeakers shall be subjected to the dielectric withstanding voltage test as specified in 4.6.3.

4.6.11 Vibration (see 3.5.10). The loudspeakers shall be tested in accordance with method 201 of MIL-STD-202 or as specified (see 3.1). The following details shall apply:

- a. Mounting – The loudspeaker shall be rigidly mounted by the mounting holes in a rigid enclosure or baffle, as specified (see 3.1).
- b. Measurements – At the completion of the test, the loudspeaker shall be tested for response and harmonic distortion in accordance with 4.6.6 and 4.6.7, respectively, and inspected for loose, broken, or deformed parts.

4.6.12 Endurance (see 3.5.11). A constant voltage having an rms value to provide rated power ^{1/} (see 3.1) to the loudspeaker voice coil at 1,000 Hz shall be applied to the voice coil terminals continuously at each of four discrete frequencies for 12.5 hours at each selected frequency (50-hours total duration). One frequency shall be selected from each of the following frequency ranges, and shall be of the value which will not coincide with any major resonant frequency of the loudspeaker:

<u>Hertz</u>		
150	-	400
400	-	500
1,000	-	1,500
2,000	-	3,000

At the completion of the test, the loudspeaker shall be tested for response, in accordance with 4.6.6 and inspected for damage.

^{1/} Voltage having an rms value to provide rated power is defined as follows:

$$V_R = (P_R \times R_R)^{1/2}$$

where V_R = Voltage to provide rated power
 P_R = Rated power
 R_R = Rated impedance

4.6.13 Solderability (when specified, see 3.1) (see 3.5.12). Loudspeakers shall be tested in accordance with method 208 of MIL-STD-202. The following detail shall apply:

- a. Number of terminations of each part to be tested – Both terminals (one terminal of the six to be tested not passing the test shall constitute the allowable failure).

4.6.14 Shock (specified pulse) (when specified, see 3.1) (see 3.5.13). Loudspeakers shall be tested in accordance with method 213 of MIL-STD-202. The following details shall apply:

- a. Mounting means – As specified (see 3.1).
- b. Test condition – C.
- c. Measurements after test – Acoustic quality, frequency response, and harmonic distortion shall be measured as specified in 4.6.5, 4.6.6, and 4.6.7, respectively.

After the test, loudspeakers shall be visually inspected for evidence of loosening or deformation of parts or other damage.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. The loudspeakers covered by this specification are intended for use in cabinets, cases, panels, and so forth, as found in MIL-L-13078 and other similar equipment.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. Title, number, and date of the applicable specification sheet and the loudspeaker type (see 1.2 and 3.1).
- c. Packaging required (see 5.1).

6.3 First article inspection. Information pertaining to first article inspection of items covered by this specification should be obtained from the procuring activity, for the specific contracts involved.

6.4 First article test report (see 3.2.1). For information on preparation of the test report, see MIL-HDBK-831.

6.5 Terminal board marking (see 3.5.14.2). The requirements of EIA-233-A (Withdrawn) were absorbed into EIA-276-A. For more information, refer to "CEA EIA-276-A" (Withdrawn – 1980) titled "Acceptance Testing of Dynamic Loudspeakers", a copy of which is available from the Information Handling System (IHS), <http://www.ihs.com>. Electronic Industries Alliance (EIA) ceased operations in February 2011.

6.6 Mounting dimensions (see 3.4.4). For more information, refer to "CEA EIA-278-B" (Withdrawn) titled "Mounting Dimensions for Loudspeakers", a copy of which is available from the Information Handling System (IHS), <http://www.ihs.com>. Electronic Industries Alliance (EIA) ceased operations in February 2011.

6.7 Voice coil impedance (see 3.5.3 and 4.6.4). For more information, refer to "CEA EIA-299-A" (Withdrawn) titled "Loudspeakers, Dynamic, Magnetic Structures and Impedance", a copy of which is available from the Information Handling System (IHS), <http://www.ihs.com>. Electronic Industries Alliance (EIA) ceased operations in February 2011.

6.8 Tin whisker growth (see 3.3.6). The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.9 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website <http://www.epa.gov/osw/hazard/wastemin/priority.htm>. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see 3.2).

6.10 Subject term (key word) listing.

Acoustic quality
Acoustical
Analyzer, sound wave
Complex impedance
Distortion, harmonic
Mounting dimensions
Resonant frequency
Sound wave analyzer
Voice coil

6.11 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

CONCLUDING MATERIAL

Custodians:
Army – CR
Navy – EC
Air Force – 85
DLA - CC

Preparing activity:
DLA - CC

(Project 5965-2015-002)

Review activity:
Air Force – 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.