MILITARY SPECIFICATION

LOUDSPEAKERS, PERMANENT MAGNET,

(UNENCASED, 2.5-, 3-, 4-, 5-, 6-, 8-, 10-,
AND 12-INCH DIAMETER CONES),

GENERAL SPECIFICATION FOR

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 shall be of the types and applicable ratings specified (see 3.1), and shall include round, square, and pincushion.

2. APPLICABLE DOCUMENTS

2.1 Government specifications and standards. Unless otherwise specified, the following specifications and standards, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

L-P-513	-	Plastic Sheet and Insulation Sheet, Electrical (Laminated, Thermosetting, Paper-Base, Phenolic-Resin).
NN-P-71	-	Pallet, Material Handling, Wood, Stringer Construction, 2 Way and 4 Way.
QQ-C-502	-	Copper Rods and Shapes; and Flat Products with Finished Edges (Flat Wire, Strips, and Bars).
QQ-C-576	-	Copper Flat Products with Slit, Slit and Edge-Rolled, Sheared, Sawed, or Machined Edges (Plate, Bar, Sheet, and Strip).
QQ-S-781	-	Strapping, Steel, and Seals.
QQ-Z-325	-	Zinc Coating, Electrodeposited, Requirements for.
PPP-B-566	-	Box, Folding, Paperboard.
PPP-B-585	-	Boxes, Wood, Wirebound.
PPP-B-601	-	Boxes, Wood, Cleated-Plywood.
PPP-B-621	-	Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-B-676	-	Boxes, Setup.

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MIL-P-116	-	Preservation, Methods of.
MIL-L-13078	-	Loudspeaker, Dynamic (LS-112( )/U, LS-116( )/U, LS-148( )/U, LS-160( )/U, LS-179( )/U, LS-181( )/U) and Loudspeaker Assembly (LS-154( )/U and LS-206( )/U).
MIL-F-14072	-	Finishes for Ground Electronic Equipment.
MIL-P-15047	-	Plastic Sheets, Laminated Thermosetting, Nylon Fabric Base, Phenolic-Resin.

(See supplement 1 for list of associated specifications.)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Communications Research and Development Command, ATTN: DRDCO-PED-CH-DM, Fort Monmouth, NJ 07703 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

STANDARDS

FEDERAL

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

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MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking For Shipment and Storage.
MIL-STD-147 - Palletized Unit Loads.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-831 - Test Reports, Preparation of.
MIL-STD-1285 - Marking of Electrical and Electronic Parts
MIL-STD-45662 - Calibration Systems Requirements.

(Copies of specifications, standards, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

Standard 233 - Phasing of Receiver Loudspeaker.
RS-278 - Mounting Dimensions for Loudspeakers.
RS-299 - Moving Coil Loudspeakers for Radio Receivers.

(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, N.W., Washington, D.C. 20006.)

(Industry association specifications and standards are generally a ilable for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

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. The test report shall conform to MIL-STD-831.

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 quaranty of the acceptance of the finished product.

3.3.1 Laminated plastic (thermosetting). Laminated plastic material used for terminal strips shall conform to type PBE or PBE-P of L-P-513 or type NPG of MIL-P-15047.

3.3.2 Metals. Metals shall be of a corrosion-resisting type, or shall be plated or treated in accordance with QQ-Z-325, type II, unless otherwise specified (see 3.1).

3.3.3 Copper. Copper shall conform to QQ-C-502 or QQ-C-576. 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-F-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.

3.4 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 with 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. 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) (see 3.1) shall be in accordance with EIA Standard RS-278.

3.5 Performance characteristics.

3.5.1 Voice coil polarity. 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. When measured as specified in 4.6.4, the voice coil impedance shall be as specified (see 3.1).

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 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 octave.

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).

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). 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 military part number (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 military part number is specified (see 3.1), the manufacturer's part number may also be included provided it does not interfere with required markings. Markings shall remain legible after all tests.

3.5.14.1 Military part number. The military part number 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:

M	10911/1-	01
Military designator	Specification sheet number	Dash number

3.5.14.2 Terminal board marking. The positive terminal shall be marked in accordance with EIA Standard RS-233. The mark shall be visible with the terminal board mounted in place.

3.5.15 Workmanship. 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. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 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 MIL-STD-45662.

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

a. First article inspection (see 4.4).
b. Quality 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.

4.5 Quality 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 I. First article inspection.

Inspection	Requirement paragraph	Method paragraph	Number of sample units to be inspected	Acceptable number of defectives permitted
Group I				
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		
Group II				
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		
Group III				
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		

TABLE II. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph	AQL (percent defective)	
			Major	Minor
Group I				
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	1.0	4.0
Voice coil polarity	3.5.1	4.6.2	1.0	---
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 plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be as specified in table II. Major and minor defects shall be as defined in table V.

4.5.1.2.2 Rejected lots. If an inspection lot is rejected, the manufacturer may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots and shall be clearly identified as reinspected 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 plan. The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S-4. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection. The AQL shall be 4.0 percent defective.

4.5.1.3.2 Rejected lots. If an inspection lot is rejected, the manufacturer may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected 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
Subgroup 1				
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		
Subgroup 2				
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 inspections may be reinstituted; however, final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.3 Inspection of packaging. The sampling and inspection of the preservation and interior pack marking shall be in accordance with the group A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129.

4.6 Methods of inspection and test.

4.6.1 Visual and mechanical inspection. 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).

4.6.2 Voice coil polarity (see 3.5.1). The voice coil polarity shall be determined as specified in EIA standard RS-233.

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, not firmly attached 1/, which could cause a short circuit, or acoustical malfunctioning of the loudspeaker. Any nonmetallic foreign object such as insulation, dirt, or phenolic chips which could cause 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, abrased, 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, abrased, 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.

4.6.3 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). The voice coil impedance shall be determined as specified in EIA Standard RS-299.

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 may be made. When applicable, the 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 ±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:

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

where P_1 is the pressure amplitude of the fundamental and P_2, P_3, 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°F (or -80 -5, +0°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°F (or -65 -5, +0°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°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°C and 50 ±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 loudspeaker 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 a value which will not coincide with any major resonant frequency of the loudspeaker:

Hz		
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 Preservation. Preservation shall be level A or C, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Loudspeakers shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Loudspeakers shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. Contact preservatives shall not be used.

5.1.1.4 Unit packs. Unless otherwise specified in the contract (see 6.2), loudspeakers shall be individually unit packed in accordance with the submethods of MIL-P-116 specified herein insuring compliance with the applicable requirements of that specification.

5.1.1.4.1 Loudspeakers, 2 1/2 to 6 inches in diameter. These loudspeakers shall be preserved in accordance with IA-15. The container shall conform to PPP-B-566, PPP-B-676 or PPP-B-636.

5.1.1.4.2 Loudspeakers, 8 to 12 inches in diameter. These loudspeakers shall be preserved in accordance with IA-14. The unit container shall conform to PPP-B-636, class weather resistant.

5.1.1.5 Intermediate packs. Intermediate packs are not required.

5.1.2 Level C. The level C preservation for loudspeakers shall conform to the MIL-STD-794 requirements for this level.

5.2 Packing. Packing shall be level A, B or C, as specified (see 6.2).

5.2.1 Level A. The packaged loudspeakers shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. The requirements for box closure, waterproofing and reinforcing shall be in accordance with method V of the PPP-B-636 appendix.

5.2.2 Level B. The packaged loudspeakers shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto.

5.2.3 Level C. The level C packing for loudspeakers shall conform to the MIL-STD-794 requirements for this level.

5.2.4 Unitized loads. Unitized loads, commensurate with the level of packing specified in the contract or order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

5.2.4.1 Level A. Loudspeakers, packed as specified in 5.2.1, shall be unitized on pallets in conformance with MIL-STD-147, load type I, with a fiberboard cap (storage aid 4) positioned over the load.

5.2.4.2 Level B. Loudspeakers, packed as specified in 5.2.2, shall be unitized as specified in 5.2.4.1 except that the fiberboard caps shall be class domestic.

5.2.4.3 Level C. Loudspeakers, packed as specified in 5.2.3, shall be unitized as specified in MIL-STD-794 except that conformance to MIL-STD-147 is not required.

5.3 Marking. In addition to any special or other identification marking required by the contract (see 6.2), each unit and exterior container and unitized load shall be marked in accordance with MIL-STD-129. For air shipment the containers shall be marked in accordance with the MIL-STD-129 special marking requirements for magnetized materials.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2 and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Packaging inspection. The inspection of these packaging requirements shall be in accordance with 4.5.3.

5.4.3 Army acquisitions.

5.4.3.1 Level A and Level B packing. For level A packing the fiberboard containers shall not be banded but shall be placed in a close fitting box conforming to PPP-B-601, overseas type; PPP-B-621, class 2, style 4 or PPP-B-585, class 3, style 2 or 3. Closure and strapping shall be in accordance with applicable container specification except that metal strapping shall conform to QQ-S-781, type I, finish A. When the gross weight exceeds 200 pounds or the container length and width is 48 x 24 inches or more and the weight exceeds 100 pounds, 3 x 4 inch skids (laid flat) shall be applied in accordance with the requirements of the container specification. If not described in the container specification, the skids shall be applied in a manner which will adequately support the item and facilitate the use of material handling equipment. For level B packing, fiberboard boxes shall be weather resistant as specified in level A and the containers shall be banded (see 5.2.1 and 5.2.2).

5.4.3.2 Level A and B unitization. For level A and B unitization, softwood pallets conforming to NN-P-71, type IV, size 2 shall be used. Weather resistant fiberboard caps shall also be used for level B unitization. The loads for both levels shall be bonded to the pallets by strapping conforming to QQ-S-781, type I, finish A or shrink film (see 5.2.4.1 and 5.2.4.2).

6. NOTES

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 (SigC) 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. Levels of preservation and packing required (see 5.1 and 5.2).
d. Method of preservation, if other than specified (see 5.1.1.4.1 and 5.1.1.4.2).
e. If special or other identification marking is required (see 5.3).

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 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - CR
Navy - EC
Air Force - 85

Review activities:
Army - ER
Navy - OS, SH
Air Force - 13, 11
DLA - ES

User activities:
Army - AT, AV, ME, MI, AR
Navy - AS, MC
Air Force - 17

Agent:
DLA - ES

Preparing activity:
Army - CR

(Project 5965-0176)

☆U.S. GOVERNMENT PRINTING OFFICE: 1982-605-034/5525