

MILITARY SPECIFICATION

LOUDSPEAKER, PERMANENT MAGNET, BLASTPROOF

AND SUBMERSIBLE, NAVY TYPE 49546 ()

1 SCOPE

1.1 This specification covers a blastproof, submersible loudspeaker unit capable of reproducing audio signals, when operated in conjunction with Naval communications receiving sets and associated audio frequency amplifiers.

2 APPLICABLE DOCUMENTS

2.1 The following specifications, standards and drawings, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

QQ-S-571 - Solder: Lead Alloy, Tin Lead Alloy, and Tin Alloy; Flux Cored Ribbon and Wire, and Solid Form.

MILITARY

MIL-S-901 - Shockproof Equipment, Class HI(High-Impact), Shipboard Application, Tests for
MIL-C-915 - Cable, Cord and Wire, Electrical (Shipboard Use).
MIL-E-15090 - Enamel, Equipment, Light-Gray (Formula 111)
MIL-C-15328 - Coating, Pretreatment (Formula 117 for Metals).
MIL-C-21981 - Electronics Type Designations, Identification Plates and Markings; Requirements for

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-108 - Definitions of and Basic Requirement for Enclosures for Electric and Electronic Equipment.
MIL-STD-167 - Mechanical Vibrations of Shipboard Equipment.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.

DRAWINGS

BUREAU OF SHIPS

REC49041 - Loudspeaker, Navy Type 49546.

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

2.2 Other publications - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

NATIONAL BUREAU OF STANDARDS PUBLICATION

Handbook H28 - Screw Thread Standards for Federal Services

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.)

3. REQUIREMENTS

3.1 Preproduction sample. - Two preproduction samples shall be furnished for the tests of 4.2

3.2 Material and parts. - Material and parts shall be as specified on Drawing REC49041. Material and parts not specified shall be capable of withstanding the tests specified herein.

3.3 Salt spray. - The loudspeaker shall withstand the test specified in 4.4.6. Following the test, there shall be no evidence of corrosion or electrical or mechanical damage.

3.4 Application. - The loudspeaker shall be suitable for open bridge and other exterior installations and operation on Naval combatant ships of all types. This requirement predicates that the loudspeaker shall be capable of operating under conditions of shock, vibration, roll and pitch, gunblast, and wide ranges of ambient temperature and humidity incidental to such installations and use.

3.5 Design. - The loudspeaker unit specified herein shall be of the radial, reflex horn type.

3.5.1 Major parts - The loudspeaker unit shall include the following major parts:

- (a) Magnetic, blastproof driver unit complete with diaphragm-voice coil assembly.
- (b) Hermetically sealed matching input transformer.
- (c) Volume control.

3.6 Electrical requirements. -

3.6.1 Frequency range. - The loudspeaker shall be capable of reproducing, articulately and audibly, frequencies within the range of 200 to 5,000 cycles per second (c.p.s.). There shall be no serious resonance peaks of such amplitude as to materially affect the quality of response over the operating range or to cause rattling. The frequency response shall be within the limits shown on figure 1.

3.6.2 Power handling capacity. - The loudspeaker shall be capable of handling input power up to 10 watts. It shall also be capable of continuous operation at the specified maximum input level without producing rattles or causing deleterious effects to the windings of the voice coil or to any other parts of the loudspeaker. The maximum input level shall be considered to be 10 watts at 1000 c.p.s..

3.6.3 Input impedance. - A transformer, capable of handling 10 watts, shall be included in each unit which shall provide for changing the input impedance from 600 ohms to 1200, 1800, 2400, or 3000 ohms when the impedance is measured at 1000 c.p.s.. A tolerance of plus or minus 10 percent will be permitted on these impedance values.

3.6.4 Acoustical efficiency. - The acoustical efficiency of the loudspeaker shall be such that with an input of 1.00 watt to the voice coil with the frequency varied between 950 and 1300 c.p.s., the acoustical pressure shall average at least 10 dynes per square centimeter along the sound axis, at least 9 dynes per square centimeter 10 degrees off the axis, and at least 7 dynes per square centimeter 25 degrees off the axis. These values shall be based on pressure measurements on the sound axis made at a distance of 6 feet from the mouth of the loudspeaker and off-axis measurements made at four equally spaced points around the periphery of a circle whose plane is normal to the sound axis with the points of measurements 6 feet from the center of the loudspeaker mouth.

3.6.5 Volume control. - The loudspeaker shall be provided with a volume control having the following characteristics:

3.6.5.1 Minimum attenuation shall occur in the full clockwise position of the control.

3.6.5.2 Maximum attenuation shall occur in the full counter-clockwise position of the control and

shall be at least 30 decibels (db) below the audio output at the minimum attenuation position of the control, for all audio frequencies.

3.6.5.3 The attenuation with respect to shaft rotation shall be linear within plus or minus 6 db over approximately three-quarters of the range. The attenuation shall be spread over not less than 75 percent of the angular rotation of the control.

3.6.5.4 The volume control shall present a constant impedance to the source and to the load.

3.6.6 Distortion. - Distortion shall not exceed 10 percent r.m.s. when measured at the frequencies specified in 4.4.4.

3.6.7 Acoustical quality. - The loudspeaker shall withstand the acoustical quality test specified in 4.4.5.

3.6.8 Insulation resistance. - Insulation resistance shall be not less than 100 megohms when measured with a 500-volt source as specified in 4.4.6.

3.7 Mechanical details and construction. -

3.7.1 Dimensions. - The dimensions and external physical characteristics of the loudspeaker shall be in accordance with Drawing REC49041.

3.7.2 Weight. - The weight of the loudspeaker unit including transformer and volume control shall not exceed 10-1/2 pounds.

3.7.3 Mounting. - The loudspeaker shall be designed for mounting to any vertical surface, such as bulkheads, or to the overhead by the addition of a right angle bracket. It is not required that the contractor provide the right angle bracket.

3.7.4 Terminal tube entrance. - All terminal necessary for connection of the audio source to the attenuator pad shall be provided on the matching transformer. A cable clamp shall be provided on the interior of the mounting base to support all incoming audio lines. The entrance for the terminal tube shall be enclosed and protected against the entrance of moisture, and shall be so constructed as to permit ready access to the terminals for the connection of the leads. The terminals shall be suitable for the connection of conductors of Navy type TTHFWA-1-1/2 cable (0.030 diameter conductor) in accordance with Specification MIL-C-915. The terminal entrance shall be of approximately 1/16 inch wall thickness. The entrance wall shall permit drilling of up to a 3/4-inch diameter hole for attachment of an entering tube and at least 3/4-inch clearance between the wall and the internal parts shall be provided for attachment of the entering tube and fanning of leads. Entering tube and cable will be Government-furnished. Entrance of cable to the loudspeaker will be made along the surface of the wall to which the loudspeaker is mounted.

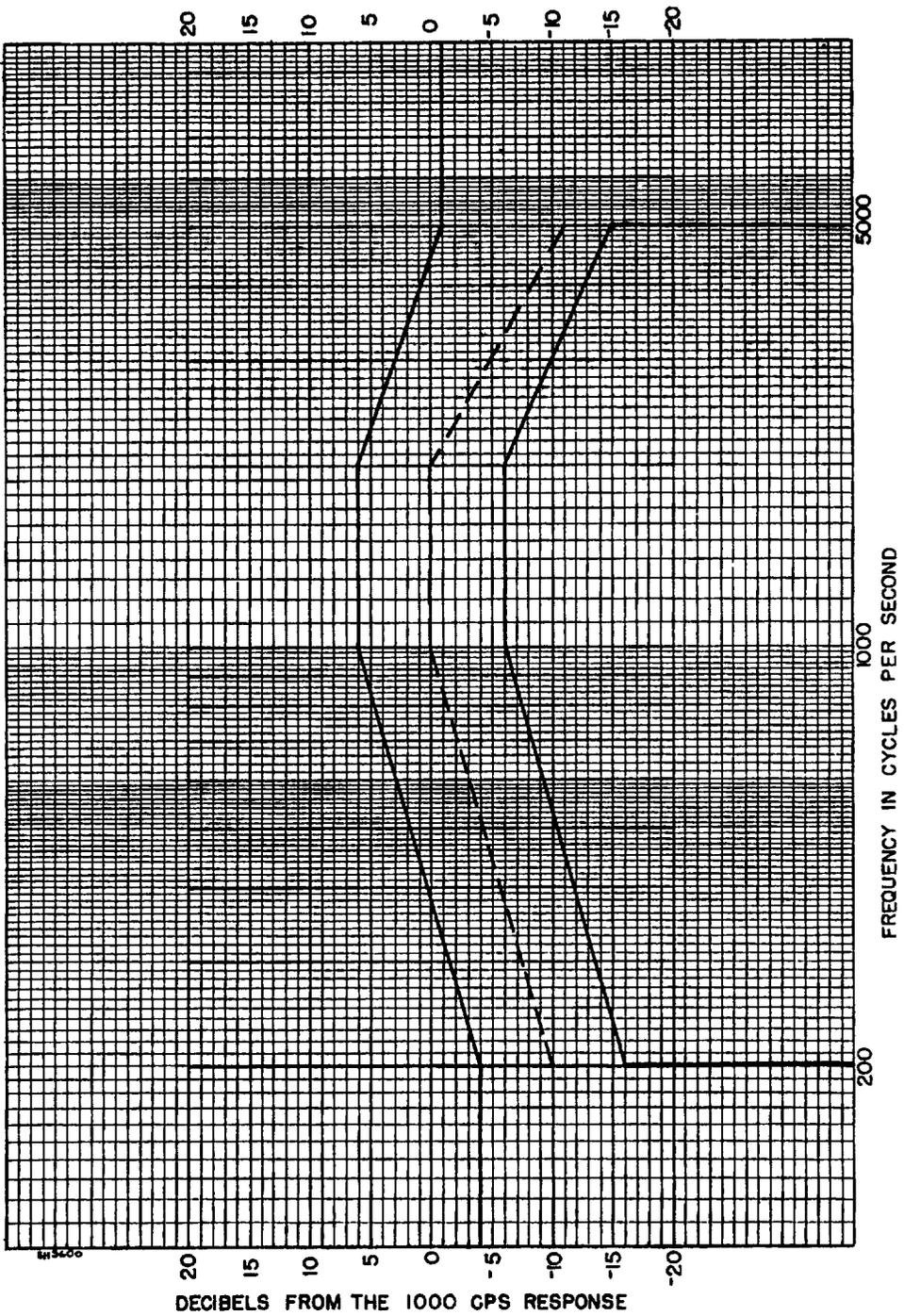


Figure 1 - Limits for loudspeaker frequency response

3.7.5 Volume control adjustment. - The volume control shall be recessed so that the shaft shall be flush with the enclosure surfaces. Provision shall be made for screwdriver adjustment of the volume control through an opening in the loudspeaker housing. The volume control opening shall be so constructed as to maintain the watertight security of the complete loudspeaker unit

3.7.6 Finish. - The loudspeaker shall be thoroughly cleaned and covered with a protective coating in accordance with Specification MIL-C-15328. This shall be followed by two coats of high quality semi-gloss alkyd enamel. The color shall be light gray, and shall match the standard chip of formula III of Specification MIL-E-15090.

3.7.7 Terminal screws. - All screws employed as parts of terminals for securing cable leads or other similar applications shall be of the "captive" type. Staking or "upsetting" the ends of the threaded shanks of such screws will be considered as meeting these requirements.

3.7.8 Threaded parts - All threaded parts shall be in accordance with Handbook H28, and shall have the specified fit after plating or other coatings (see 3.2).

3.7.9 Solder. - Solder shall be solid or rosin flux cored in accordance composition SN60 of Specification QQ-S-571.

3.8 Operating conditions. - The loudspeaker unit shall be designed for intermittent or continuous operation, without damage, under the adverse conditions normally encountered in installations exposed to the weather aboard Naval combatant ships, and shall be capable of normal operation after prolonged periods of storage and transportation from one location to another. Such operation shall predicate satisfactory performance within the limits permitted herein and under these specified conditions:

3.8.1 Submergence. - There shall be no degradation of the acoustical characteristics after the loudspeaker has been subjected to the submergence tests of 4.4.8.

3.8.2 Temperature cycling. - The loudspeaker shall not be damaged nor the operational performance degraded, when restored to the operating temperature range after being exposed for long periods in the non-operating temperature range of minus 62° to plus 70°C. (see 4.4.10).

3.8.3 Shock and vibration. - The loudspeaker shall be designed to withstand the mechanical shocks and vibrations normally encountered aboard ship. The loudspeaker shall successfully withstand the tests of 4.4.9.

3.8.4 Service blastproof and gun blastproof. - The loudspeaker shall be service blastproof and gun blastproof as follows:

3.8.4.1 Service blastproof. - The loudspeaker shall be capable of being exposed, and shall not be damaged during the exposure to ten service charge blasts of a 5-inch, 25- or 38-caliber gun. The unit shall be elevated at least 6 feet above the ground and located 21-1/2 feet for the 25-caliber gun or 25 feet for the 38-caliber gun, from the gun muzzle in the plane through the muzzle perpendicular to the gun axis, and shall be oriented to face the gun muzzle

3.8.4.2 Gun blastproof. - The loudspeaker shall not be damaged when exposed (in addition to the service blasts of 3.8.4.1) to thirty service charge blasts of a 5-inch, 25- or 38-caliber gun. The unit shall be located as specified in 3.8.4.1, except that the distance from the muzzle shall be 12 feet for the 25-caliber gun, or 14 feet for the 38-caliber gun

3.9 Nomenclature and serial numbers - Nomenclature and serial numbers should be requested in accordance with the procedures outlined in Specification MIL-E-21981.

3.10 Identification plates - Identification plates shall be in accordance with Drawing REC49041.

3.11 Workmanship. - Workmanship shall be such that the finished product shall meet all of the requirements of this specification

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. 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.

4.2 Preproduction inspection. - Two preproduction samples shall be made and assembled by the manufacturer with tools and methods that, as far as practicable, are the same as those which will be used for quantity production of the product. The manufacture of the loudspeaker for a Government contract, prior to approval of the preproduction sample, shall be at the manufacturer's risk.

4.2.1 The preproduction samples shall be subjected to the examination and tests specified in table I.

Table I - Preproduction inspection.

Tests	Requirement paragraph	Test paragraph
Visual, dimensional and mechanical examination	3.5, 3.5.1., 3.7.1 to 3.7.8, incl., and 3.10	4.4.2
Input impedance	3.6.3	4.4.3
Insulation resistance	3.6.7	4.4.6
Frequency range	3.6.1	4.4.3
Power handling	3.6.2	4.4.3
Volume control	3.6.5.1, 3.6.5.2, 3.6.5.3 and 3.6.5.4	4.4.3
Acoustical efficiency	3.6.4	4.4.3
Distortion	3.6.6	4.4.4
Salt spray	3.3	4.4.7
Non-operating temperature	3.8.2	4.4.10
Shock and vibration	3.8.3	4.4.9
Service and gun-blast	3.8.4, 3.8.4.1, 3.8.4.2	4.4.11
Submergence	3.8.1	4.4.8

4.3 Sampling for acceptance inspection. -

4.3.1 Lot. - All loudspeakers offered for delivery at one time shall be considered a lot for purposes of sampling and inspection.

4.3.2 Acceptance inspection. - Acceptance inspection shall consist of the examination and tests specified in 4.3.2.1, 4.3.2.2, and 4.3.3.3. The samples shall be subjected to the tests in the order shown.

4.3.2.1 Each loudspeaker shall be subjected to the acoustical quality test specified in 4.4.5. If any loudspeaker fails this test it shall be rejected.

4.3.2.2 Group A examination and tests. - Group A examination and tests shall consist of those specified in table II. Sampling shall be in accordance with Standard MIL-STD-105, inspection level II. The Acceptable Quality Level (A. Q. L.) shall be 1.5 percent.

Table II - Group A inspection.

Tests	Requirement paragraph	Test paragraph
Visual, dimensional and mechanical examination	3.5, 3.5.1, 3.7.1 to 3.7.8 incl., and 3.10	4.4.2
Volume control	3.6.5.1	4.4.3
Input impedance	3.6.3	4.4.3
Insulation resistance	3.6.8	4.4.6

4.3.3.3 Group B tests. - The group B tests shall consist of those specified in table III. Samples shall be in accordance with level L-6 of the table for small sample inspection of Standard MIL-STD-105. The A. Q. L. shall be 2.5 percent.

Table III - Group B tests.

Tests	Requirement paragraph	Test paragraph
Frequency range	3.6.1	4.4.3
Power handling	3.6.2	4.4.3
Volume control	3.6.5.2 and 3.6.5.3	4.4.3
Acoustical efficiency	3.6.4	4.4.3
Distortion	3.6.6	4.4.4

4.4 Test procedures. -

4.4.1 Test conditions. - Unless otherwise specified herein, all measurements and tests shall be made at room ambient temperature, pressure, and humidity.

4.4.2 Visual, dimensional, and mechanical examination. - Loudspeakers shall be examined visually, dimensionally, and mechanically to determine conformance with this specification.

4.4.3 Electrical tests. - Tests shall be conducted to determine conformance with the requirements of 3.6.1 to 3.6.5, inclusive.

4.4.4 Distortion. - The distortion test shall be performed on the loudspeaker. A constant voltage having a r.m.s. value to provide rated power at 1000 c.p.s. shall be applied to the loudspeaker, and the measurements shall be made at 200 and 5000 c.p.s.

4.4.5 Acoustical quality - The acoustical quality test shall be performed on each loudspeaker. A constant voltage having an r. m. s. value to provide rated power at 1000 c.p.s. shall be applied to the 600-ohm input terminals, and the frequency varied continuously from 200 to 5000 c.p.s. During this test, there shall be no buzzing, rattling, or other spurious sounds in the acoustic output of the loudspeaker which will degrade the quality of reproduced speech.

4.4.6 Insulation resistance. - The voice coil shall be disconnected from the circuit before the insulation resistance of the loudspeaker is measured. The insulation resistance shall be measured between all circuit conductors and metal parts of the loudspeaker. The insulation resistance shall in no case be less than 100 megohms as measured with a 500-volt source

4.4.7 Salt spray test - The loudspeaker shall be subjected to a salt spray test as specified in method 101, condition A of Standard MIL-STD-202. Following this test, the unit shall meet the requirements of 3.3

4.4.8 Submergence. - The loudspeaker shall be subjected to the 15-foot submergence test in accordance with Standard MIL-STD-108.

4.4.9 Shock and vibration. - The loudspeaker shall be subjected to the type A, grade 1 test of Specification MIL-S-901, while mounted on a figure 4A adapter, and the type I vibration test of Standard MIL-STD-167.

4.4.10 Non-operating temperature. - The loudspeaker shall be subjected to the following non-operating temperature cycle to determine conformance to 3.8.2

- (a) With the loudspeaker set up for test in a temperature-controlled room, reduce room temperature to minus 62°C. and hold to within 0°-5°C. of that temperature for at least 3 days
- (b) Increase room temperature to plus 70°C and maintain that temperature within $\pm 3^\circ\text{C}$. for at least 4 hours.
- (c) Reduce room temperature to 25° $\pm 2^\circ\text{C}$. and maintain that temperature for at least 4 hours.

4.4.11 Service and gunblast tests. - The loudspeaker shall be subjected to the service and gunblasts specified in 3.7.4. When required (see 6.1) these tests will be performed upon units furnished by the manufacturer

4.4.12 Design tests. - The bureau or agency concerned may authorize modifications of these tests as

may be necessary to suit this design and to guard against any weaknesses noted in the preliminary or preproduction model(s) being reflected in production units.

5. PREPARATION FOR DELIVERY

5.1 Domestic shipment and early installation. -

5.1.1 Loudspeaker -

5.1.1.1 Preservation and packaging. - Loudspeakers shall be packaged to provide adequate protection against damage during shipment and handling from the supply source to the using activity until early installation.

5.1.1.2 Packing - Loudspeakers packaged as specified shall be packed in a manner which will be acceptable by common carrier, and will afford protection against physical or mechanical damage during direct shipment from the supply source to the using activity for early installation. The shipping container shall comply with the carrier's rules and regulations applicable to the mode of transportation

5.1.1.3 Marking - In addition to any special marking required by the contract or order, shipment marking information shall be provided on interior packages and shipping containers in accordance with the contractor's commercial practice. The marking information shall include the stock number, nomenclature, contract or purchase number, contractor's name, and destination.

5.2 Domestic shipment and storage or overseas shipment. - The requirements and levels of preservation, packaging, packing, and marking for shipment shall be specified by the procuring activity (see 6.1).

(5.2.1) The following provides various levels of protection during domestic shipment and storage or overseas shipment, which may be required when procurement is made

5.2.1.1 Preservation and packaging, packing, and marking. - Loudspeakers shall be preserved and packaged by level A or C, packed by level A or B, and marked in accordance with Specification MIL-E-17555.)

6. NOTES

6.1 Ordering data. - Procurement documents should specify the following

- (a) Title, number, and date of this specification

- (b) Whether service and gunblast tests are required (see 4.4.11).
- (c) Preservation and packaging, packing or marking requirements if other than those required by 5.1 (see 5.2).

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Preparing activity:
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