

INCH-POUND

MIL-PRF-26542E
30 May 1997

SUPERSEDING
MIL-M-26542D
29 March 1985

PERFORMANCE SPECIFICATION

MICROPHONE, AND MICROPHONE ASSEMBLIES, DYNAMIC 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 the general requirements for moving coil, noise-canceling dynamic microphones. The products described herein are used in oxygen and gas-masks, and headset-microphones (boom-mounted and protective-shield mounted). These parts provide communications within moderate to high noise environments, at ground level and altitude, as specified, and meet established United States Air Force sensitivity standards (see 6.1).

1.2 Classification. Types of microphones shall be as follows:

- Type I - Boom mounted (including boom, cable and connector)
- Type II - Mask mounted (including bracket and cable assembly)

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 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 documents cited in section 3 and 4 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: 88 LOG/LGME, 4170 Hebble Creek Road, Building 280, Door 4, Wright Patterson AFB, OH 45433-5653 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-PRF-26542E

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-C-22442 - Cable assemblies, radio frequency (aircraft audio), general specification for.

(See supplement 1 for list of specification sheets.)

STANDARDS

DEPARTMENT OF DEFENSE

- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
- MIL-STD-810 - Environmental Test Methods and Engineering Guidelines.
- MIL-STD-1285 - Marking of Electrical and Electronic Parts.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Building 4D, Customer Service, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS

NAVY

- SK-N-864 - Simulated Gun Blast Producing Equipments

(Copies of specifications, standards, handbooks, 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.)

2.3 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI S1.10-1966 - American Standard Method for the Pressure Calibration of Laboratory Standard Pressure Microphone.

(Application for copies should be addressed to the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

MIL-PRF-26542E

MAGNETIC MATERIALS PRODUCERS ASSOCIATION (MMPA)

MMPA 0101 - Standard Specification for Permanent Magnet Materials.

(Application for copies should be addressed to Magnetic Materials Producers Association, 11 S. LaSalle Street, Suite 1400, Chicago, IL 60603.)

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

2.4 Order of precedence. In the event of a conflict between the text of this document, and the references cited herein (except for related associated specifications, specification sheets, or MS standards), 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 requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Microphones furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) before contract award (see 4.5 and 6.3).

3.3 Materials. All materials shall enable the parts to meet the performance requirements of this specification. Materials which have measurable changes in property due to aging shall not be used, such as ferrite magnets. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the specified requirements (see 3.1), and promotes economically advantageous life cycle costs.

3.3.1.1 Unacceptable materials. Natural rubber or natural rubber cement shall not be used in the microphone element. Rubber substitutes and plastic materials shall not be used as wedges and fillers.

3.3.2 Diaphragm material. The diaphragm material shall be metal or mylar, or material having equivalent or superior environmental and durability requirements in accordance with this specification.

3.3.3 Magnetic material. The magnetic material shall be in accordance with MMPA 0101.

3.4 Interface.

3.4.1 Cement. All cements shall be used in accordance with the manufacturer's or supplier's product specification sheet. Cements shall not corrode or otherwise degrade the properties of materials to which they are applied, nor to materials to which they are adjacent.

MIL-PRF-26542E

3.4.2 Color. The exterior of the microphone element shall be lusterless black, providing low contrast with operational clothing and gear.

3.4.3 Components. Components which are supplied with the complete assembly shall be as specified (see 3.1).

3.4.4 Cleanliness of air gap. There shall be no foreign material present in the air gap of the microphone element when viewed through a microscope having a magnification of at least fifteen.

3.4.5 Cord assemblies. Unless otherwise specified (see 3.1), cord assemblies shall meet the requirements of MIL-C-22442, to ensure interchangeability.

3.4.6 Weight. Weight shall be as specified (see 3.1).

3.5 Performance. Parameter applicability shall be as specified (see 3.1). Performance variations allowable following subjection to environmental exposures shall utilize the initial group 1 measurements as a reference. Performance variations are not cumulative with multiple environmental exposures. See 3.5.30.

3.5.1 Sensitivity at ground level (see 4.5.2.2). The sensitivity shall be as specified (see 3.1).

3.5.2 Sensitivity at altitude (see 4.5.2.3). When applicable, the sensitivity at the simulated altitude shall be as specified (see 3.1).

3.5.3 Frequency response at ground level (see 4.5.2.4). The frequency response of the microphone shall be within the frequency response limits specified (see 3.1).

3.5.4 Frequency response at altitude (see 4.5.2.5). When applicable, the frequency response at the simulated altitude shall be as specified (see 3.1).

3.5.5 Impedance (see 4.5.3). The impedance at any frequency over the specified frequency response range (see 3.1) shall not deviate from the impedance at 1,000 Hz by more than 10 percent, unless otherwise specified (see 3.1).

3.5.5.1 Impedance limits (see 4.5.3). The impedance at 1,000 Hz and at 20°C (68°F) shall be as specified (see 3.1).

3.5.6 Total harmonic distortion (see 4.5.4). Unless otherwise specified (see 3.1), the total harmonic distortion in the output of the microphone within the specified frequency response range (see 3.1) shall not exceed 6 percent with an input sound pressure of 114 dB relative to 20 micropascals.

3.5.7 Signal-to-acoustic noise (see 4.5.5). For the purpose of qualification, the noise cancellation characteristics shall be in accordance with 3.5.7.1. For the purpose of quality assurance, the noise immunity characteristics shall be in accordance with 3.5.7.1 or 3.5.7.2 at the manufacturer's option. The microphone shall discriminate in favor of speech signals and against acoustic noise.

3.5.7.1 Noise cancellation characteristics (see 4.5.5.1). The noise cancellation characteristic of the microphone shall be as specified (see 3.1).

3.5.7.2 Noise-immunity characteristic (see 4.5.5.2). Under standard conditions, the signal-to-noise ratio

shall be at least 15 dB in favor of the signal when measured in accordance with 4.5.5.2.

3.5.8 Effect of external magnetic field (see 4.5.6). The sensitivity of the microphone to an external 400 Hz magnetic field shall not be more than 25 percent of that of a coil consisting of 123 turns of No. 34 enameled wire closely wound in a single-layer solenoid upon a nonconductive, nonmagnetic mandrel 0.500 inch in diameter, placed in the same magnetic field.

3.5.9 Stray magnetic field (see 4.5.7). Unless otherwise specified (see 3.1), the stray magnetic field of the microphone shall cause no more than a 5 degree deflection of a magnetic compass at a distance of 12 inches.

3.5.10 Linearity (see 4.5.8). The output of the microphone shall be a linear function of the sound pressure input to the microphone in the range of inputs from 74 dB to 114 dB inclusive, relative to 20 micropascals at any frequency within the specified frequency response range (see 3.1). A 20 dB increment in acoustic input shall yield a 20 dB \pm 1 dB increment in the voltage output.

3.5.11 Talk-out (see 4.5.9). There shall be no subjective difference in the output of the microphone by talking into the front and the back sound ports with equal loudness and with lips touching the moisture-barrier guard.

3.5.12 Dielectric withstanding voltage (see 4.5.10). The product shall operate safely at its rated voltage, and withstand momentary overpotentials due to switching, surges, and other similar phenomena. It shall be capable of withstanding a voltage higher than its rated voltage, for a prolonged period of time, between mutually insulated portions of the product and between insulated portions and ground. This shall not result in either arcing or breakdown of insulation. Following such exposure, the impedance shall change not more than 1 ohm or 5 percent from the initial measured value, whichever is greater.

3.5.13 Interchangeability (see 4.5.11). Like units, assemblies, subassemblies, and replaceable parts shall be electrically and mechanically interchangeable. Design tolerances shall permit parts, subassemblies and assemblies to be used without regard to the source of supply or manufacturer.

3.5.14 Thermal shock (see 4.5.12). The product shall resist degradation in performance due to exposure to extremes of high and low temperatures, and to the shock of alternate exposures to these extremes, such as would be experienced when parts are transferred to and from heated shelters in arctic areas. Following such exposure, the product shall exhibit the following performance:

Visual examination:	No evidence of physical damage which would cause a malfunction.
Sensitivity and frequency response:	No more than \pm 3 dB variation at any frequency.
Impedance:	No more than \pm 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.15 Humidity (see 4.5.13). The product shall resist degradation in performance due to exposure to extremes of a warm, humid atmosphere, resisting such defects as corrosion, biological growth, material property changes due to moisture penetration, and effects of condensation. Following such exposure, the product shall exhibit the following performance:

Visual examination:	No evidence of physical damage which would cause a malfunction.
---------------------	---

MIL-PRF-26542E

Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.
Impedance: No more than ± 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.16 Drop (see 4.5.14). The product shall resist degradation in performance due to dropping from field-typical heights onto hard surfaces, such as would occur due to a drop from a cockpit-level or aircraft door-level height onto concrete pavement. Following exposure to such repeated dropping, the product shall exhibit the following performance:

Visual examination: No evidence of physical damage which would cause a malfunction.
Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.
Impedance: No more than ± 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.17 Pressure equalization (see 4.5.15). Provisions shall be made to equalize the pressure between the ambient outside the microphone element and the interior of the microphone element including the space enclosed by the moisture barrier, such that the product is able to withstand exposure to repeated, alternating extremes of pressure. Following such exposure, the product shall exhibit the following performance:

Visual examination: No evidence of physical damage which would cause a malfunction.
Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.
Impedance: No more than ± 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.18 Explosive decompression (see 4.5.16). The stability of the diaphragm material and the concentricity of the voice coil and air gap shall not be affected by explosive decompression when specified (see 3.1). Following exposure to such conditions, the product shall exhibit the following performance:

Visual examination: No evidence of physical damage which would cause a malfunction.
Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.
Impedance: No more than ± 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.19 Salt fog (see 4.5.17). The microphone shall be capable of operation in salt atmosphere as encountered in coastal areas. Prolonged periods of exposure to salt sea atmosphere shall not result in visible evidence of corrosion on any equipment surfaces. Following exposure to an extreme salt atmosphere, the product shall exhibit the following performance:

Visual examination: No evidence of physical damage which would cause a malfunction.
Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.
Impedance: No more than ± 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.20 Vibration (see 4.5.18). The product shall resist failure and degradation in performance due to repeated, excessive vibration. Following such exposure, the product shall exhibit the following performance:

MIL-PRF-26542E

Visual examination: No evidence of physical damage which would cause a malfunction.

Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.

Impedance: No more than ± 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.21 Bounce (see 4.5.19). The product shall resist degradation in performance due to hard-floor bouncing and part-to-part bumping, such as would occur during poorly-secured transport either in cargo aircraft or combat vehicles traversing rough terrain over long distances. Following such exposure, the product shall exhibit the following performance:

Visual examination: No evidence of physical damage which would cause a malfunction.

Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.

Impedance: No more than ± 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.22 Altitude, nonoperating (see 4.5.20). The product shall withstand, and operate in, low-pressure environments, and withstand rapid pressure changes, such as would occur during air shipment of the product in cargo aircraft, or when stored at high ground elevations, or when exposed to explosive (rapid) decompression as a result of aircraft damage. Following such exposure, the product shall exhibit the following performance:

Visual examination: No evidence of physical damage which would cause a malfunction.

Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.

Impedance: No more than ± 1 ohm or 5 percent variation from initial reading, whichever is greater.

3.5.23 Moisture barrier (see 4.5.21). A moisture barrier shall be provided, when specified (see 3.1), as part of the microphone element. The moisture barrier shall serve as both a breathblast shield and as a shield to prevent entrance of moisture into the microphone element. The moisture barrier shall be so sealed to the case that it shall withstand an internal pressure of one-quarter pound per square inch without leaking.

3.5.24 Immersion (see 4.5.22). The product shall resist degradations in performance due to immersion in fresh water for prolonged periods of time. Following such exposure, the product shall exhibit the following performance:

Sensitivity and frequency response: No more than ± 3 dB variation at any frequency when referenced to the initial response.

3.5.25 Fungus (see 4.5.23). The product shall be constructed of fungus-inert materials, and shall not exhibit any degradation in performance due to prolonged exposure to fungus-producing conditions. Following such exposure, the product shall exhibit the following performance:

Visual examination: No evidence of physical damage which would cause a malfunction, and no visible fungus or corrosion.

MIL-PRF-26542E

3.5.26 Gun blast (see 4.5.24). The equipment shall meet the requirements of 3.5.3 with no more than a 3 dB change in frequency response following thirty rounds of blast at a peak pressure of 9.5 pounds per square inch (psi) as provided in accordance with SK-N-864 equipment procedures, when specified (see 3.1).

3.5.27 Microphone bracket leakage (see 4.5.25). Type II microphones which have brackets that can result in loss of integrity of the mask when installed shall exhibit no more than the specified (see 3.1) leakage at the mask/bracket interface.

3.5.28 Boom finish (see 4.5.26). The boom finish shall adhere completely to the underlying metal, without flaking, peeling or otherwise leaving the surface to which it is applied, excepting the surface of the ball-joint.

3.5.29 Boom operating force (see 4.5.27). The microphone boom shall provide firm positioning of the microphone element, and shall not require undue exertion for adjustment, and shall prevent inadvertent slippage of the adjusted position during use.

3.5.30 Detrimental effect of storage. Parts accepted by the government are transported to, and stored for indefinite periods of time in, depot locations having a wide range of temperature extremes. Product shall be constructed so as to withstand the effects of government storage, such as cold- and hot-temperature storage, and standard commercial transport, such that there is no more than 1 dB of deviation from the specified performance range after having been exposed to such storage.

3.6 Marking. Microphones shall be marked for identification in accordance with MIL-STD-1285, as specified (see 3.1).

3.7 Workmanship. The microphone shall be processed in such a manner as to comply with the following. After fabrication, parts and assembled equipment shall be cleaned of smudges; loose, spattered, or excess solder; weld metal; metal chips and mold release agents; or any other foreign material which might detract from the intended operation, function, or appearance of the equipment. Screws, nuts and bolts shall show no evidence of cross threading, mutilation, or detrimental or hazardous burrs, and shall be firmly secured. Bearing assemblies shall be free of rust, discoloration, and imperfections of ground, honed, or lapped surfaces. Contacting surfaces shall be free of tool marks, gouge marks, nicks, or other surface-type defects. There shall be no detrimental interference, binding, or galling. Wires and cables shall be positioned or protected to avoid contact with rough or irregular surfaces and sharp edges and to avoid damage to conductors or adjacent parts. Shielding on wires and cables shall be secured in a manner that will prevent it from contacting or shorting exposed current-carrying parts. The ends of the shielding or braid shall be secured to prevent fraying.

4. VERIFICATION

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

- a. Qualification inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, microphones shall be tested under the following conditions: Temperature: Room ambient, +15°C (+59°F) to +35°C (+95°F); Pressure: Normal atmospheric; Humidity: Room ambient up to 90 percent relative humidity.

MIL-PRF-26542E

Magnetic field measurements shall be made in a location substantially free from stray magnetic disturbances. No mechanical vibrations can be present. All measurements shall be made at such a sound pressure level that the harmonic distortion or the noise produced in the test microphone by the air pumped through the orifice of the artificial voice at low frequencies shall be sufficiently small so as not to introduce a significant measurement error. All acoustical measurements shall be made relative to 20 micropascals (0.0002 dynes/cm²). All acoustical testing shall be made in a free field environment.

4.3 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

4.3.1 Sample size. Six microphones shall be subjected to qualification inspection. If Group IV or Group V tests are specified, three additional units shall be required for each of these tests.

4.3.2 Inspection routine. The sample shall be subjected to the inspections specified in table I, in the order shown, unless otherwise specified (see 3.1). All sample units shall be subjected to the inspections of group I. The sample shall then be divided equally into two groups; one shall be subjected to the group II inspections, and the other shall be subjected to group III inspections. If Group IV or Group V tests are specified, three additional units shall be necessary for each test.

4.3.3 Failures. Failures in excess of those allowed in table I shall be cause for refusal to grant qualification approval.

4.3.4 Verification of qualification. Every 24 months the manufacturer shall provide verification of qualification to the qualifying activity. Continuation of qualification is based on meeting the following requirements.

- a. The design of the microphone has not changed.
- b. Group A and group B inspections.
- c. Periodic group C inspection.

MIL-PRF-26542E

TABLE I. Qualification inspection.

Inspection	Requirement paragraph	Test paragraph	Number of sample units to be tested	Number of failures
<u>Group I</u>				
Visual and mechanical inspection	3.1, 3.3, 3.4, 3.6, and 3.7	4.5.1	6	0
Sensitivity at ground level	3.5.1	4.5.2.2	6	0
Sensitivity at altitude	3.5.2	4.5.2.3	6	0
Frequency response at ground level . .	3.5.3	4.5.2.4	6	0
Frequency response at altitude	3.5.4	4.5.2.5	6	0
Impedance	3.5.5	4.5.3	6	0
Impedance limits	3.5.5.1	4.5.3	6	0
Distortion	3.5.6	4.5.4	6	0
Noise cancellation characteristics	3.5.7.1	4.5.5.1	6	0
Effect of external magnetic field	3.5.8	4.5.6	6	0
Stray magnetic field	3.5.9	4.5.7	6	0
Linearity	3.5.10	4.5.8	6	0
Talk-out	3.5.11	4.5.9	6	0
Dielectric withstanding voltage	3.5.12	4.5.10	6	0
Interchangeability	3.5.13	4.5.11	6	0
<u>Group II</u>				
Thermal shock	3.5.14	4.5.12	3	0
Humidity	3.5.15	4.5.13	3	0
Drop	3.5.16	4.5.14	3	0
Pressure equalization	3.5.17	4.5.15	3	0
Explosive decompression	3.5.18	4.5.16	3	0
Salt fog	3.5.19	4.5.17	3	0
<u>Group III</u>				
Vibration	3.5.20	4.5.18	3	0
Bounce	3.5.21	4.5.19	3	0
Altitude (nonoperating)	3.5.22	4.5.20	3	0
Moisture barrier	3.5.23	4.5.21	3	0
Immersion	3.5.24	4.5.22	3	0
<u>Group IV</u>				
Fungus	3.5.25	4.5.23	3	0
<u>Group V</u>				
Gun blast	3.5.26	4.5.24	3	0
Microphone bracket leakage	3.5.27	4.5.25	3	0
Boom finish	3.5.28	4.5.26	3	0
Boom operating force	3.5.29	4.5.27	3	0

4.4 Conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A and group B inspections.

4.4.1.2 Group A inspection. Group A inspection shall consist of the inspections specified (see 3.1).

4.4.1.2.1 Sampling plan. A sample of parts shall be randomly selected in accordance with table II. If one or more defects are found, the lot shall be rescreened and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected in accordance with table II. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification. Reinspected lots shall be clearly identified.

4.4.1.3 Group B inspection. Group B inspection shall consist of the inspections specified (see 3.1) and shall be made on sample units which have been subjected to and have passed the group A inspection.

4.4.1.3.1 Sampling plan. A sample of parts shall be randomly selected in accordance with table II. If one or more defects are found, the lot shall be rescreened and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected in accordance with table II. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification. Reinspected lots shall be clearly identified.

TABLE II. Group A and B, zero defect sampling plan.

Lot size	Sample size
2 to 8	100 percent
9 to 15	13
16 to 25	13
26 to 50	13
51 to 90	13
91 to 150	13
151 to 280	20
281 to 500	29
501 to 1,200	34
1,201 to 3,200	42
3,201 to 10,000	50

4.4.2 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.4.2.1.4), delivery of products which have passed group A and group B shall not be delayed pending the results of these inspections.

4.4.2.1 Group C inspection. Group C inspection shall consist of the inspections specified (see 3.1) in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed the group A and group B inspection.

MIL-PRF-26542E

4.4.2.1.1 Sampling plan. Group C inspection shall be performed once each 6 months on six sample units selected at random without regard to their quality from units produced during the period. The sample shall be divided equally into two groups and subjected to the tests of group II and group III as specified (see 3.1).

4.4.2.1.2 Disposition of sample units. Samples which have been subjected to Group C inspection shall not be delivered on the contract.

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

4.4.2.1.4 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and 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 materials and processes, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the qualifying activity, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspections, or the inspection which the original sample failed, at the option of the qualifying activity). Group A and group B inspections may be reinstated; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful.

4.5 Methods of inspection.

4.5.1 Visual and mechanical inspection. Microphones shall be examined to verify that the materials, interface, design, construction, physical dimensions, markings, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4, 3.6, and 3.7).

4.5.2 Sensitivity and frequency response.

4.5.2.1 General. Unless otherwise specified (see 3.1), the test fixture shall hold the microphone in such a way that with the moisture barrier guard in place, the sound port is .25 inch from and coaxial with the opening in the artificial voice. For the purpose of this specification, all sensitivity data shall use an input sound pressure level (SPL) of 28 dynes/cm² (103 dB SPL re20μPa). The response of the microphone shall be measured by means of a suitable ac voltmeter and with an applied sound pressure level of 103 dB re 20 μPa and shall be related back to 74 dB SPL re20μPa. The driver unit used to obtain the desired SPL shall be Bruel and Kjaer Artificial Voice Type 4227 or equivalent and shall have been previously calibrated by means of a condenser microphone such as W.E. 640 AA, or equivalent, (calibrated in accordance with ANSI S1.10).

4.5.2.1.1 Test fixtures. The fixtures used to position the calibrating microphone or the test microphone element with respect to the sound source shall be designed to minimize any possible error in acoustical measurements owing to vibration, sound transmitted from the voice tube, unstable positioning of microphone elements, reflections from fixtures or environment (such as the interior of an altitude chamber), and ambient noise. No baffles shall be used near the sound sensitive parts of the microphone elements.

4.5.2.2 Sensitivity at ground level (see 3.5.1). The sensitivity shall be determined by the voltage developed by the microphone across a resistive load (as specified, see 3.1) at 1,000 Hz. The output voltage developed by the microphone shall be measured on an electronic voltmeter. Measurements shall be made

at ground level.

4.5.2.3 Sensitivity at altitude (see 3.5.2). On microphones which are used in high altitude conditions, the sensitivity shall be measured as specified in 4.5.2.2, except the measurements shall be made at a simulated altitude of 25,000 feet, unless otherwise specified (see 3.1).

4.5.2.4 Frequency response at ground level (see 3.5.3). The output voltage of the microphone shall be measured across a resistive load (as specified, see 3.1) over the frequency response range. The moisture barrier shall be in place during the test.

4.5.2.5 Frequency response at altitude (see 3.5.4). The frequency response shall be measured as specified in 4.5.2.4, except the recordings shall be made at a simulated altitude of 25,000 feet, unless otherwise specified (see 3.1).

4.5.3 Impedance (see 3.5.5 and 3.5.5.1). A constant acoustic input at 1 kHz shall be applied to the microphone and the open circuit voltage V_0 at the microphone output shall be measured. A calibrated variable resistor shall then be connected across the microphone output terminals. The variable resistor shall then be adjusted until the voltage across it is $V_0/2$. The resistance of the variable resistor shall then be recorded as the microphone impedance.

4.5.4 Distortion (see 3.5.6). The total harmonic distortion of the microphone shall be measured by means of a distortion analyzer of the wave analyzer or total harmonic distortion type; or, at the option of the contractor, the total harmonic distortion may be determined by the following formula:

$$\text{Percent harmonic distortion} = 100 \times \sqrt{\frac{E_2^2 + E_3^2 + \dots + E_n^2}{E_1^2 + E_2^2 + E_3^2 + \dots + E_n^2}}$$

Where $E_1, E_2, E_3, \dots, E_n$ are the output voltages of fundamental frequency and the second, third, and higher harmonics, respectively, developed across a resistive termination equal to the source impedance. In performing harmonic distortion measurements, precautions shall be taken to ensure that the sound pressure at the "nontalking" port has a level not less than 15 dB below the sound pressure level at the "talking" port. Unless otherwise specified (see 3.1), the measurement shall be made over the frequency range of 200 Hz to 6,000 Hz with an acoustic input having a pressure level of 114 dB relative to 20 micropascals at the talking port.

4.5.5 Signal-to-noise (see 3.5.7). For the purpose of qualification, the noise-cancellation characteristics shall be determined with the test procedures outlined in 4.5.5.1 through 4.5.5.1.3.2, inclusive. For the purpose of quality assurance, the noise-immunity characteristics shall be determined using the test procedures outlined in 4.5.5.1 through 4.5.5.1.3.2, inclusive or 4.5.5.2 through 4.5.5.2.2, inclusive at the option of the manufacturer.

4.5.5.1 Noise-cancellation characteristics (see 3.5.7.1). The noise-cancellation characteristics of the microphone shall be determined by a comparison of the sensitivity and frequency-response characteristics to a "close" sound source with its sensitivity and frequency-response characteristics to a "distant" sound source.

4.5.5.1.1 Frequency-response and sensitivity to a "close" sound source for noise-immunity characteristics measurements. The frequency-response of the microphone at ground level shall be measured in accordance with 4.5.2.4. The sensitivity shall be measured in accordance with 4.5.2.2.

4.5.5.1.2 Frequency-response and sensitivity to a "distant" sound source for noise cancellation characteristics measurements. The frequency-response characteristics and sensitivity to a "distant" sound source shall be determined by measuring the voltage output of the microphone developed across a resistive load (see 3.1) when the microphone is placed in a calibrated sound field at least 1 meter minimum from a sound source in an anechoic chamber.

4.5.5.1.2.1 Calibration of the sound field. The sound field shall be calibrated at a point not less than 1 meter from the sound source by using a Western Electric 640-AA condenser microphone or an approved equivalent using the free field calibration of the calibrating microphone. The calibration of the condenser microphone 640-AA shall be in accordance with ANSI S1.10. The point where the calibration microphone is placed shall be known as the "calibration point".

4.5.5.1.2.2 Sensitivity to a "distant" sound source. The sensitivity of the microphone to a distant sound source at the calibration point shall be established by measuring the voltage developed by the microphone across a resistive load (see 3.1) and referred to a sound pressure of 74 dB relative to 20 micropascals at 1,000 Hz. The sensitivity measurement shall be made twice, in each case with the cylindrical axis of the microphone element normal to the axis of the sound source. In the first measurement, called "sensitivity A", the talking port of the microphone shall point away from the sound source. In the second measurement, called "sensitivity B", the talking port shall point toward the sound source. In each measurement, the microphone shall be adjusted about the cylindrical axis of the microphone element to obtain maximum outputs.

4.5.5.1.2.3 Frequency-response to a "distant" sound source. The frequency-response of the microphone at the calibration point shall be established by measuring the voltage developed by the microphone across a resistive load (see 3.1) as a continuous function of frequency from 200 Hz to 6,000 Hz, referred to a sound field of constant sound pressure as determined with the standard condenser microphone. Two frequency-response curves shall be made; in each case with the cylindrical axis of the microphone element normal to the axis of the sound source. The frequency response obtained with the talking port of the microphone pointing away from the sound source shall be known as a "distant response A" and that obtained with the talking port pointing toward the sound source shall be known as "distant response B".

4.5.5.1.3 Formation of noise cancellation characteristics.

4.5.5.1.3.1 Plotting of data. The close frequency-response characteristics obtained herein shall be plotted on semi-logarithmic coordinate paper with the length of a 10 to 1 frequency interval along the abscissa equal to the length of 30 dB along the ordinate. The "distant response A" shall be plotted on the same coordinates with the point on the curve at 1,000 Hz located below the point on the close response curve at 1,000 Hz by the number of dB equivalent to the ratio of the close sensitivity in volts at 1,000 Hz to the "distant sensitivity" in volts at 1,000 Hz, i.e.,

$$\text{Number of dB} = 20 \log_{10} \left(\frac{\text{Close sensitivity at 1 kHz}}{\text{Distant sensitivity at 1 kHz}} \right)$$

The same procedure shall be followed with "distant response B" and "distant sensitivity B". A fourth curve shall be obtained by averaging the ordinates of "distant response A" and "distant response B" at each point

between 200 Hz and 6 kHz and called the "average distant response curve".

4.5.5.1.3.2 Construction of "difference curves". The three curves, "distant response A", "distant response B", and "average distant response", shall be individually subtracted from the close response curve, and the differences plotted. These shall be called, respectively, "difference curve A", "difference curve B", and "average difference curve".

4.5.5.2 Noise-immunity characteristics (see 3.5.7.2). When mounted in the test fixture illustrated on figure 1 and figure 2 with the talking port of the microphone .25 inch from the mouth of the signal speaker, the noise spectrum shall be applied from the "noise source" and the microphone output measured. The noise spectrum shall be removed and the signal spectrum shall be applied from the "signal source" and the microphone output measured. The signal-to-noise ratio shall be the quotient of these measured values.

4.5.5.2.1 Noise source. By means of a suitable test apparatus and circuit (see figure 1 and figure 2), provision shall be made for the production of the noise spectrum, table III, at a rms sound pressure of 115 dB above a reference level of 20 micropascals as measured at the microphone diaphragm. The noise source shall be a loudspeaker capable of producing a sound pressure of 115 dB above a reference level of 20 micropascals at the rear as well as the front of the microphone and the loudspeaker shall be located as far away from the microphone as practicable. The calibrating microphone shall be mounted in the test rig, in the box, .25 inch from the mouth of the signal speaker which shall be short-circuited during adjustments of the noise spectrum.

TABLE III. Noise spectrum.

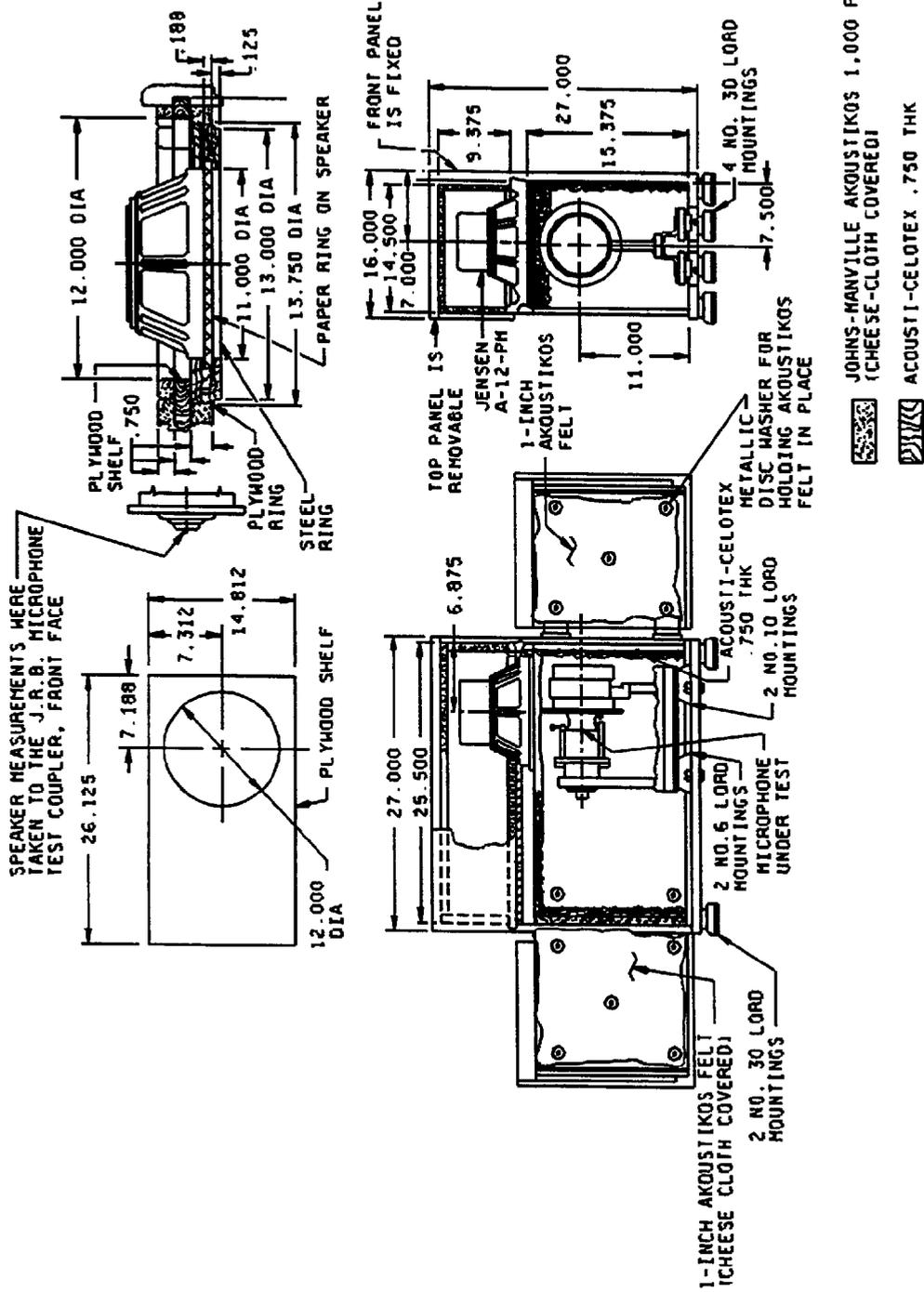
Frequency in Hz	Sound pressure in dB relative to sound pressure at 130 Hz
40	0
70	0
130	0
300	-5
600	-9
1,000	-13
2,000	-17
3,000	-19
4,000	-21

4.5.5.2.2 Signal source. By means of a suitable test apparatus and circuit (see figure 1 and figure 2), provision shall also be made for the production of the following signal spectrum, table IV, at a rms sound pressure of 115 dB above a referenced level of 20 micropascals. The signal source shall be the driver unit. The calibrating microphone shall be positioned .25 inch directly in front of the driver unit.

TABLE IV. Signal spectrum.

Frequency in Hz	Sound pressure in dB relative to sound pressure at 130 Hz
130	0
300	+7
600	+8
1,000	+5
2,000	-3
3,000	-7
4,000	-9

4.5.6 Effect of external magnetic field (see 3.5.8). The sensitivity of the microphone to an external ac magnetic field shall be measured by comparing the induced open-circuit voltage across the terminals of the microphone when placed in a 400 Hz magnetic field with the induced open-circuit voltage across the terminals of a calibrating coil of known sensitivity placed in the same magnetic field.



NOTES:

1. Dimensions are in inches. Tolerance is 10%, unless otherwise specified.
2. Equivalent alternatives are allowed to the following: Lord mountings, Akoustikos felt, Acousti-Celotex, J.R.B microphone, Jensen speaker.

FIGURE 1. Signal-to-noise test chamber.

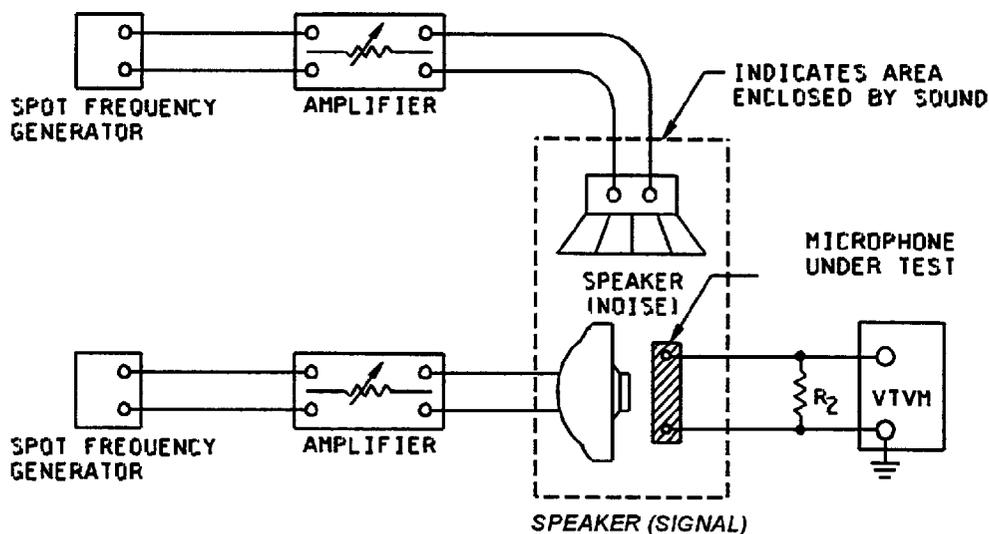


FIGURE 2. Signal-to-noise apparatus setup.

4.5.6.1 Field coil. The magnetic field for this test may be produced by a coil of 700 ± 10 turns of No. 18 enameled wire 6 ± 0.50 inches by 6 ± 0.50 inches in cross section or 6 ± 0.50 inches in diameter and winding length of 10 ± 0.50 inches.

4.5.6.2 Calibrating coil. The calibrating coil shall consist of a single-layer solenoid, wound with 123 ± 10 turns of No. 34 enameled wire on a nonconductive, nonmagnetic mandrel 0.5 in ± 0.010 in diameter.

4.5.6.3 Measurement procedure. Excite the field coil with 250 ± 10 mA of 400 Hz ac current. Connect the microphone to a Ballantine Electronic Voltmeter Model 300A, or its equivalent. Closely twist the leads from the microphone to the voltmeter. Orient the microphone in the center of the field coil for maximum output voltage and record this value. Then substitute the calibration coil for maximum output voltage in that portion of the field coil previously occupied by the microphone and record the output voltage.

4.5.7 Stray magnetic field (see 3.5.9). The stray magnetic field of the microphone shall be determined, using a Keuffel and Esser Type No. 5600 compass, or its equivalent. The motor of the microphone shall be placed with its geometric center 12 ± 0.50 in (unless otherwise specified (see 3.1)) from the pivot point of the compass needle and on the perpendicular bisector of the needle in the plane of rotation of the needle. The microphone shall be oriented in all directions and the maximum deflection of the compass observed. This test shall be made in a location substantially free from stray magnetic disturbances.

4.5.8 Linearity (see 3.5.10). The output voltage developed by the microphone across a resistive load (as specified, see 3.1) shall be measured at any four frequencies between 700 Hz and 4,000 Hz with an input sound pressure of 74 dB, 94 dB and 114 dB, relative to 20 micropascals, respectively. In performing linearity measurements, precautions shall be taken to ensure that the sound pressure at the "nontalking" port has a level not less than 15 dB below the sound pressure level at the "talking" port.

4.5.9 Talk-out (see 3.5.11). Each microphone shall be given a talk-out test. The tester shall talk separately into the front and back sound ports of the microphone with equal loudness and with lips touching the moisture barrier guard. The tester shall wear a good quality headset which is connected to the microphone through a suitable amplifier and shall listen to his own voice to determine if there is a difference in sound level when he is talking into the front or back sound port of the microphone and to ensure that the microphone is functioning in a satisfactory manner. The amplifier used in this test shall not contain automatic gain control or other circuits that will compensate for low microphone output.

4.5.10 Dielectric withstanding voltage (see 3.5.12). The product shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply:

- a. Test voltage: 250 volts.
- b. Nature of potential: 60 Hz ac.
- c. Points of application: Between one terminal and all metallic surfaces of the bracket.

4.5.11 Interchangeability (see 3.5.13). All mechanical dimensions shall be gauged or measured to determine conformance to the physical interchangeability requirement of 3.5.13. When a dimension is not within the specified or design limits, it shall be considered a major defect.

4.5.12 Thermal shock (see 3.5.14). The equipment shall be tested in accordance with method 107 of MIL-STD-202. The following details shall apply:

- a. Special mounting: The microphone element shall be mounted on the boom.
- b. Test condition letter; A.
- c. Measurements before and after test: Visual examination, frequency response at ground level, and impedance at 1,000 Hz.

4.5.13 Humidity (see 3.5.15). The equipment shall be tested in accordance with method 507 of MIL-STD-810. The following details shall apply:

- a. Procedure I.
- b. Measurements after test: Within 1 hour after the test, the frequency response at ground level shall be measured and the impedance at 1,000 Hz shall be determined; the microphone shall then be examined for evidence of damage.

4.5.14 Drop (see 3.5.16). The equipment shall be dropped 12 times at random from a height of 6 feet onto concrete faced with .125 inch thick asphalt tile.

4.5.15 Pressure equalization (see 3.5.17). The microphone element to be tested shall be placed within the test chamber and the absolute internal pressure of the chamber reduced to 3.44 inches of mercury (corresponding to an altitude of 50,000 feet above sea level) and the microphone element shall be allowed to remain at atmospheric pressure limit for 5 minutes. The rate of change of pressure shall correspond to approximately 50,000 feet per minute. The microphone element shall be subjected to 3 each pressure cycles. After 1 hour, the impedance at 1,000 Hz, sensitivity, and response-frequency characteristics of the

microphone element shall be measured. A mechanical inspection shall be made before and upon completion of the test.

4.5.16 Explosive decompression (see 3.5.18). The microphone element to be tested shall be subjected to 10 consecutive explosive decompressions from an altitude of 8,000 feet to an altitude of 35,000 feet (corresponding to pressures of 22.2 inches of mercury and 7.04 inches of mercury respectively). Each complete decompression or change of pressure shall take place in 0.1 second or less. After 1 hour, the impedance of 1,000 Hz, sensitivity and response-frequency characteristics of the microphone element shall be measured. A mechanical inspection shall be made before and upon completion of the test.

4.5.17 Salt fog (see 3.5.19). The equipment shall be tested in accordance with method 509 of MIL-STD-810. The following details shall apply:

- a. No operation is required while in the chamber.
- b. Physical and mechanical examination: Failure criteria shall be limited to corrosion of finishes and metal. Such corrosion shall be defined as any visible degradation of microphone surfaces that can be attributed to flaky, pitted, blistered, or otherwise loosened finish on the metal surface.
- c. Measurements after test: Frequency response and impedance.

4.5.18 Vibration (see 3.5.20). The equipment shall be tested in accordance with method 201 of MIL-STD-202. The equipment shall be mounted in a horizontal position, and shall be vibrated in a direction perpendicular to the plane of the microphone for a period of 5 hours.

4.5.19 Bounce (see 3.5.21). The product shall be tested in accordance with MIL-STD-810, method 514.4 ("Vibration"), Procedure III ("Loose cargo transport"). The test shall simulate conditions in which the part is transported as unsecured cargo on a military-transport vehicle traversing irregular surfaces, having the freedom to bounce, scuff or collide with other items of cargo or with the sides of the vehicle. This test is considered to exceed the conditions of commercial transport during initial product delivery to the government. The following test exceptions and details apply:

- a. Test apparatus. The specified typical package tester, or equivalent, shall be used, having a base of plywood and individual test chamber(s) with walls of plywood (no roof), forming a 6X6 inch test area(s), where the base has been secured with bolts or six-penny nails (tops of heads at, or slightly below the surface). The bed of the package tester shall move in a circular path in a vertical plane to the axes of the shafts.
- b. Test procedure. The specified package tester shall be operated at not less than 1-inch double amplitude and 284 rpm, for a total time of 3 hours. At each ½ hour interval, the test item shall be turned so as to rest on a different face, so that at the end of the 3-hour period the item has rested on each of its six faces (top, bottom, sides, ends).

Following the test, the part shall be inspected for failure-mode defects, and the sensitivity, frequency response and impedance shall be measured as specified (see 4.5.2, 4.5.3)

4.5.20 Altitude, nonoperating (see 3.5.22). The equipment shall be tested in accordance with method 500, procedure I, of MIL-STD-810. The frequency response shall be measured at 300 Hz, 600 Hz, 1,000 Hz, 2,000 Hz, and 3,500 Hz. When operated at step 4, the response shall not vary more than 3 dB.

MIL-PRF-26542E

4.5.21 Moisture barrier seal (see 3.5.23). The microphone element shall be immersed in water and pressure of plus one-quarter pound per square inch shall be applied to the pressure-equalization hole to determine whether there are any leaks through the microphone element and around the moisture barrier seal.

4.5.22 Immersion (see 3.5.24). The microphone shall be immersed to a depth of 3 feet in fresh water at room temperature for a period not less than 2 hours. Upon completion, remove the unit. Shake excess water from the microphone. Frequency response shall be measured and checked within 1 hour for compliance with paragraph 3.5.3.

4.5.23 Fungus (see 3.5.25). The contractor shall certify that the materials used meet the requirements for fungus-inert materials per MIL-STD-454, or test in accordance with method 508 of MIL-STD-810. The following details shall apply:

- a. The complete assembly shall be tested.
- b. Within 1 hour after the test the components shall be examined for evidence of physical damage.

4.5.24 Gun blast (see 3.5.26). Mount the microphone under test on the carriage of the simulated gun blast producing equipment in accordance with U.S. Navy Sketch SK-N-864 with the front edge of the element in the test plane and with its axis coincident with that of the explosion chamber. Subject the element to 30 rounds of blast at a peak pressure of 9.5 psi.

4.5.25 Microphone bracket leakage (see 3.5.27). Unless otherwise specified (see 3.1), type II microphone bracket leakage shall be determined utilizing the apparatus shown on figure 3. Connect the flowmeter to the vacuum source and into the test fixture. Remove the front plate of the bracket and insert the bracket into the gasket, install plate, and fasten securely. The contact area between the gasket and the fixture shall be coated with petrolatum jelly to ensure proper sealing of the gasket and the test fixture. With the vacuum adjusted to simulate 50,000 feet, slowly apply the suction by opening the stop valve, check that the gasket is properly seated, and allow the test fixture cavity to stabilize. The ball indicator in the flowmeter should rise initially and start dropping as the test chamber reaches stabilization. When the ball is completely stabilized, take the reading of where the center of the ball sits on the scale. Then refer to the calibration chart supplied with the flow meter to determine the rate of leakage in ML/MIN. Repeat testing procedure for 80,000 feet. The gasket shall simulate the mask-type as specified (see 3.1).

4.5.26 Boom finish (see 3.5.28). After finish has been applied, the part shall be wiped with a clean, white cloth. There shall be no indication of residue of any kind on the cloth. Time between application of the finish (or other finishing treatments to it), and this test, is optional.

4.5.27 Boom operating force (see 3.5.29). The boom shall be positioned such that the non-microphone end is fixed, and the microphone end is holding a weight of 100 g. Under such loading, the microphone end of the boom shall not move. The weight shall be replaced with a 250 g weight. Under such loading, the microphone end of the boom shall move smoothly and slowly downward.

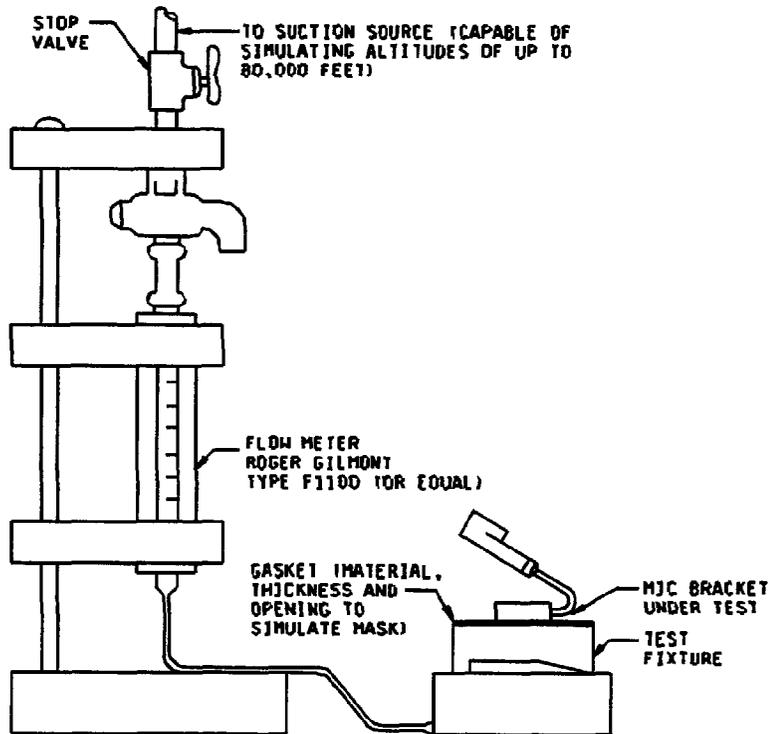


FIGURE 3. Type II microphone bracket leakage tester.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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. Microphones are intended to be used as specified (see 3.1). The sensitivity requirements for these products were developed in conjunction with the Air Force Materiel Command, Human Systems Center, Armstrong Laboratory, Biological Acoustics and Biocommunications branch (AL/CFBA), Wright-Patterson AFB, OH.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of the specification and applicable specification sheet.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2)
- c. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in the Qualified Products List (QPL) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from USAF 88LOG/LGME Bd 280 Door 4, 4170 Hebble Creek Road, Wright-Patterson AFB, OH 45433-5653.

6.4 Subject term (key work) listing.

Boom
Bracket
Coil
Dynamic
Headset
Mask
Noise-canceling

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:

Army - CR
Navy - EC
Air Force - 85

Preparing activity:

Air Force - 85

Review activities:

Army - AR, AT, AV, ME
Navy - AS, OS
Air Force - 99
DLA - ES

(Project 5965-0238)